

TimeLock Pro

Word Clock Interface Operation Manual

Declaration of Conformity

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herewith confirm that the product:

Type: Time Code Interface

Model: TimeLock Pro

meets the requirements of the council of the European communities as specified by the following norms (or normative documents)

CENLEC EN 50 081-1

CENLEC EN 50 082-1

CENLEC EN 55 014

CENLEC EN 55 022

DIN EN 60 950

relating to electromagnetic compatibility

(Council Directives 73/23/EEC and 89/336/EEC)



The CE symbol is awarded to high-quality appliances which comply with the European Directive 89/336/EEC or the EMVG (law relating to electromagnetic compatibility of appliances) and which offer the following significant benefits:

- Simultaneous and interference-free operation of adjoining appliances
- No unpermitted interference signals
- High resistance to electro-smog

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Introduction

Congratulations on the purchase of your TimeLock Pro!

TimeLock Pro is a powerful and flexible Synchronizer. You can use it to synchronize hardware devices and software programs that use different Time Code formats.

TimeLock Pro has the following main features:

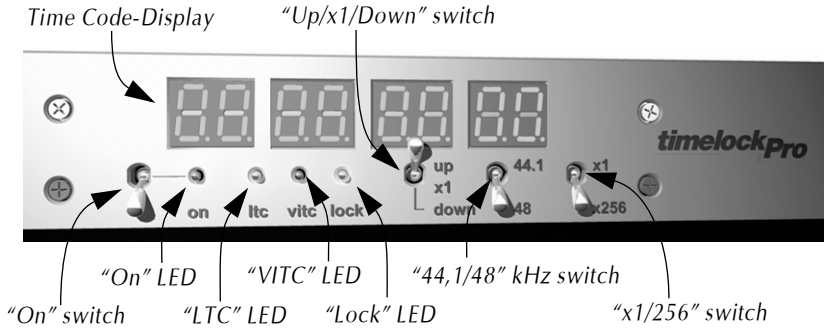
- Converts the input signal formats Video, VITC and/or LTC into Word Clock and/or MIDI Time Code (MTC).
Even consumer VCRs can be connected!
- The Word Clock sample rate can be switched between 44,1 and 48 kHz.
- A Pull-Up/Pull-Down Factor can be used to fit the Word Clock sample rate output to all usual frame rate / video standards.
- Varispeed – If controlled by an LTC Master Clock signal, TimeLock Pro tolerates a speed deviation of up to +/- 10% and outputs a corresponding Word Clock and/or MIDI Time Code signal.

Please read this manual to find out about all possibilities that TimeLock Pro has to offer.

Have fun using TimeLock Pro!

The Steinberg team

Front Panel



Time Code Display

The Time Code display has two modes: Time Code Mode and Status Mode.

- In Time Code Mode the display shows incoming LTC or VITC input as SMPTE time code.
- In Status Mode, the Frame Rate Format is shown on the left side of the display and the Pull-Up/Pull-Down Factor on the right.

The Frame Rate Format indicates the frame rate of the incoming time code or the frame rate of the incoming video signal.

The Pull-Up/Pull-Down Factor indicates the pull-up or pull-down that you have selected by setting the "Up/1x/Down" switch. Find more information on page 6 und page 11.

"On" Switch

Use this switch to turn the power to the TimeLock Pro on or off.

TimeLock Pro runs through a display test routine, each time it is powered up. During this routine, it shows the software version and the internal DIP switch settings.

The routine is described in detail on page 18.

“On” LED

This LED lights up to indicate that the built-in power supply functions properly.

“LTC” LED

If this LED lights up, TimeLock Pro receives a valid LTC signal.

“VITC” LED

When TimeLock Pro detects a valid VITC signal, this LED will light up.

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- Please note that the “VITC” LED will not light up, if TimeLock Pro detects a video signal *without* VITC.
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“Lock” LED

If this LED lights up, then the Clock output is locked to an incoming reference signal.

The incoming reference signal can be an LTC, VITC or a video signal.

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- If a pure video signal without any VITC is used as TimeLock Pro’s reference signal, then the unit will not output MIDI Time Code.
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“Up/x1/Down” Switch

- If this is set to “Up”, the Pull-Up Factor is applied to the 44.1 or 48 kHz Clock sample rate.
- Set the switch to the “x1” setting to leave the Clock sample rate at exactly 44.1 or 48 kHz.
- If this is set to “Down”, the Pull-Down Factor is applied to the 44.1 or 48 kHz Clock sample rate.

-
- Set this switch to “x1”, if you do not use any Pull-Up or Pull-Down sample rates. TimeLock Pro will then generate the standard 44.1 or 48 kHz Clock sample rates.
-

Whenever you change the setting of this switch, the Time Code Display will switch to Status Mode to display the new Pull-Up/Pull-Down Factor.

Pull-Ups and Pull-Downs are described in detail in the section “Pull-Up/Pull-Down Factor” on page 11.

“44.1/48” kHz Switch

You can use this switch to toggle the “x1/256” output clock rate between 44.1 kHz and 48 kHz.

The exact sample rate output also depends on the position of the “up/x1/down” switch, which is located just to the left of this switch.

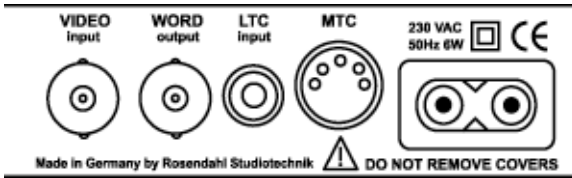
If you need to operate at exactly 44.1 kHz or 48 kHz, please set the “up/x1/down” switch to “x1”.

“x1/256” Switch

You can use this switch to determine, whether the signal output via the “Word Output” connector should have Word Clock or Digidesign's 256 Superclock format.

- If you have connected TimeLock Pro to Digidesign's 888 or 882 interfaces, set this switch to “256”
- Set the switch to “x1” when connecting the TimeLock Pro to any other Word Clock compatible digital audio device.

Back Panel



Video Input Connector

Use this BNC connector to feed any VITC or video signal into TimeLock Pro.

Possible source for this could be a VITC, a black burst or any composite video signal.

Even an unstable video source such as a consumer VCR can be used.

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- This input is terminated with a 75 Ohm resistor.
 - Never connect the same signal to other terminated video inputs (e.g. via a T piece)! This way you avoid double termination.
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- When a VITC or video signal is applied, the TimeLock Pro will lock to it and produce a low-jitter clock.
 - When a VITC signal is applied, the TimeLock Pro will additionally translate the VITC time code into MTC.
 - If the VITC format changes the Time Code Display will briefly switch to the Status Mode to indicate the new VITC format.

Word Output Connector

Depending on the setting of the “x1/256” switch, this BNC connector outputs a Word Clock or a Superclock.

-
- Neither the Word Clock or 256x Superclock should ever be daisy chained. One output can only properly drive one input.
 - The cable length for a word clock signal should be limited to 4,5 m (15 feet), for the Superclock it must be kept under 1 m (3 feet).
-

LTC Input Connector

This RCA connector accepts an unbalanced LTC time code signal.

The input circuit has a wide sensitivity range: -40 to +20 dBu. This allows reliable operation of the unit with nearly all LTC sources. When an LTC signal is applied, the TimeLock Pro will translate it to high-quality MTC and a low jitter Word Clock output.

If the LTC format changes, the Time Code Display will briefly switch to the Status Mode to indicate the new format. Find more information in the sections “Status Mode” on page 10 and “Using TimeLock Pro” on page 16.

MTC Output Connector

This 5-pin DIN connector outputs Midi Time Code (MTC). For reliable operation, we recommend that you only use shielded MIDI cables. Find more details about MIDI Time Code in the section “DIP 1-3 – The Midi Cue Mode” on page 19.

Mains input

Use the provided AC power cord to connect TimeLock Pro to an AC power outlet. Depending on which TimeLock Pro version you have, this must either be a 230 VAC/50Hz outlet or a 115 VAC, 60 Hz outlet.

Time Code Display

The Time Code display has two modes: Time Code Mode and Status Mode.

Time Code Mode

Time Code Mode is TimeLock Pro's normal display mode, whenever it receives time code.

In the Time Code Mode the display will then show incoming LTC or VITC in SMPTE time code format, thus providing you with the ability to monitor the incoming time code.

The time code is shown as hours, minutes, seconds and frames.

Status Mode

This display mode indicates both the Frame Rate Format and the Pull-Up/Pull-Down Factor.

- Frame Rate Format relates to the frame rate of the incoming time code, or the frame rate of the incoming video signal.
- The Pull-Up/Pull-Down Factor shows the pull-up/pull-down value that you have selected with the "up/x1/down" switch.

The display will remain in the Status Mode if...

...no LTC or VITC signal is present when the unit is powered up.

...a pure video signal without VITC is applied to TimeLock Pro.

In the following two instances the display will briefly switch into Status Mode before switching back to Time Code Mode:

- Whenever the format of the LTC or VITC input changes.
- Whenever the "up/x1/down" switch is toggled.

The latter is the easiest way to force TimeLock Pro to display the Status Mode information.

Pull-Up/Pull-Down Factor

Audio, video and film material following certain different standards can be synchronized by applying a Pull-Up/Pull-Down Factor.

Except for the conversion of movie film (24 frames per second) to PAL video (50 semi-frames per second) or NTSC video (ca. 59,94 semi-frames per second), applying a Pull-Up/Down is often only necessary in European Post Production if you synchronize audio material that follows the European standards and NTSC video material, or vice versa.

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- In contrast to the situation in the USA and in Japan, the Pull-Up/Pull-Down Factor does not play an important role in European Post Production. As a European TimeLock Pro-user, you will generally only use it if you have to synchronize audio and video where one or both parts originate from a country that uses the NTSC standard.
If this doesn't apply to you, then you should position the "Up/x1/Down" switch in its "x1" position and leave it there!
-

In contrast to the NTSC system for color video, both the PAL and the SECAM system use an integer frame rate (25 frames per second). In connection with a clock sample rate of 48 kHz or 41.1 kHz this always results in an integer relationship between one picture frame and the clock sample rate.

- At a clock sample rate of 48 kHz and 25 frame per second, one frame relates to 1920 samples. At 41.1 kHz and 25 fps the resulting value is 1644 samples. Applying a Pull-Up/Down is not necessary.

For technical and compatibility reasons (mains voltage frequency and compatibility to b/w TV), the NTSC format for color video data uses a frame rate of exactly 29,97002617 frame per second.

Synchronizing NTSC video and audio that uses one of the usual clock sample rates therefore often results in a non-integer relationship.

This problem can be solved by applying a Pull-Up/Pull-Down Factor to the clock sample frequency, which is then adjusted correspondingly.

In the Status Mode, the four rightmost digits of TimeLock Pro's display indicate the set Pull-Up/Pull-Down Factor.

The Pull-Up/Pull-Down Factor can be set by using the "up/x1/down" switch.

The set factor is applied to either the 44.1 kHz or the 48 kHz Word Clock sample rate.

The following table helps you to interpret the numbers.

Pull-Up/Pull-Down Factor	Description
1.000	No pull-up or pull-down. The clock sample rate is exactly 44.1 or 48 kHz.
1.041	PAL pull-up from 25 frames per second to 24 frames per second. The clock sample rate is increased by 4%.
0.960	PAL pull-down from 24 fps to 25 fps. The clock sample rate is decreased by 4%.
1.001	NTSC pull-up (1001/1000 or a 0.1% change in the clock sample rate)
0.999	NTSC pull-down (1000/1001 or a 0.1% change in the clock sample rate)

- Please remember that the Pull-Up/Pull-Down Factor works in conjunction with the "44.1/48" switch to determine the exact sample rate of the clock outputs.
-

Frame Rate Format

In Status Mode, the three left digits show the Frame Rate Format which carries various meaning depending on the signal types that are applied to TimeLock Pro.

No Input Signal

When the unit is powered up and neither the LTC nor the VITC connector receive any signal – i.e. TimeLock Pro does not lock to any reference signal – then the Frame Rate Format follows to the default standard. This is defined by the setting of internal DIP switch 8.

The following table shows the Pull-Up/Down Factors that you can set by using the “up/x1/down” switch.

Frame Rate Format shown in display	Default Standard	Pull-Up	Pull-Down
25	25 fps	1.041	0.960
30	30 fps	1.001	0.999

Video Input Signal without VITC

When a video signal without VITC is applied to the “Video input” connector, the Frame Rate Format shown in the display indicates the frame rate of the applied video signal.

The following table shows the Frame Rate Format displayed for each video standard and the Pull-Up/Down Factors that you can apply using the “up/x1/down” Switch.

Format shown	Video Standard	Pull-Up	Pull-Down
25	PAL/SECAM	1.041	0.960
29	NTSC	1.001	0.999

- If a pure video signal without any VITC is used as TimeLock Pro’s reference signal, then the unit will not output MIDI Time Code.

LTC Input Signal Only

When an LTC signal is applied to the “LTC input” connector, its time code format is shown in the display.

The table below this paragraph provides a summary of the displayed frame rate formats, their corresponding time code format names as well as the Pull-Up/Down Factors that you can apply by using the “up/x1/down” switch.

Format shown	Time Code Format	Pull-Up	Pull-Down
24	24 fps	1.041	0.960
25	25 fps	1.041	0.960
29d	29.97 fps drop Frame	1.001	0.999
30	29.97 fps non drop Frame*	1.001	0.999
30	30 fps	1.001	0.999

- Please note that TimeLock Pro detects 29.97 non drop frame format as 30 fps when 29.97 fps LTC is applied without any video signal. This will cause a pull down by 0.1%. This Pull-down can be corrected by setting the “Up/x1/Down” Switch to the Up position. This problem only occurs with 29.97 non drop format.

VITC Input Signal Only

When a pure VITC signal is applied to the “Video input” connector, then the Frame Rate Format shown in the display indicates the frame rate of the applied VITC signal.

The following table relates the Frame Rate Format shown with the VITC format and the Pull-Up/Down Factors that you can apply by setting the “up/x1/down” switch.

Format	VITC Format	Pull-Up	Pull-Down
25	PAL	1.041	0.960
29d	NTSC drop Frame	1.001	0.999
29.	NTSC non drop Frame	1.001	0.999

Simultaneous Video and LTC Input Signals

If TimeLock Pro simultaneously receives a video signal without VITC via its “Video input” connector and an LTC signal via its “LTC input” connector, then the display will show the time code format of the applied LTC signal.

The following table shows the Frame Rate Format displayed for each video standard and LTC format. The table also shows the Pull-Up/Down Factors that you can apply by using the “up/x1/down” switch.

Format shown	Video Standard	LTC Format	Pull-Up	Pull-Down
25	PAL	25 fps	1.041	0.960
29d	NTSC	29.97 fps drop	1.001	0.999
29.	NTSC	29.97 fps non drop	1.001	0.999

- Please note that the LTC format must match to the corresponding video standard!

Using TimeLock Pro

About Selecting Clock and Time Code Sources

- If there is only an LTC signal present, TimeLock Pro will use this as its positional and clock reference. This means that the word clock output is locked to the LTC input. The time code data of the LTC signal is furthermore translated into MIDI Time Code and is available at the MTC output.
- If TimeLock Pro simultaneously receives an LTC signal and a video signal, then it will use the LTC signal as its positional reference for the MTC output and the video signal as its clock reference for the word clock output.
- If a pure video signal without VITC is present, then TimeLock Pro uses this as its clock reference for the word clock output.
- If there is a VITC video signal present, then TimeLock Pro uses this video signal as its clock reference and the VITC as its positional reference.
- If VITC video and LTC are present at the same time, the video signal is used as the clock reference and the LTC is used as the positional reference. If the LTC signal falls out of range – e.g. because the source machine is stopped, jogged or shuttled – then TimeLock Pro will automatically switch to VITC for positional reference. As soon as the LTC is restored to play speed, TimeLock Pro will switch back to LTC as its source time code reference. At all times, the “LTC” and “VITC” LEDs on TimeLock Pro’s front panel indicate the currently used time code source. Automatically switching over is a special TimeLock Pro feature, as it ensures that the best possible time code sources is used at any time.

About Varispeed

Many digital audio systems are capable of Varispeed operation. If Varispeed is applied, the connected equipment will follow changes in the master clock speed up to a certain percentage value, typically $\pm 10\%$.

TimeLock Pro supports Varispeed operation when deriving the master clock from LTC.

- If the LTC changes gradually, the clock will follow the change to keep the connected digital audio equipment in sync. The deviation from the nominal playback speed that is tracked is limited to 10%. This is to prevent errors that occur in many digital audio workstations when this limit is exceeded.
 - If the LTC speed changes dramatically, e.g. when the LTC source machine stops or shuttles, then TimeLock Pro will not follow the change. In this case TimeLock Pro will continue to generate the clock signal at the sample rate that was used just before the LTC went out of range. In other words TimeLock Pro has a “sample rate memory”. This sample rate memory is used to dramatically reduce LTC lock-up time.
 - Once the LTC returns to a useful range, TimeLock Pro will re-lock again and gradually adjust the clock to match the new LTC speed.
 - Even when LTC disappears, TimeLock Pro will continue to generate a glitch-free clock signal. The unit remembers the last sample rate used and continues to freewheel at that rate.
-
- You may not want the clock signal to continue at the off-speed rate due to a previous off-pitch operation. To reset the TimeLock Pro clock signal to nominal frequency, turn the unit off or toggle the “Up/x1/Down” switch.
-

Internal DIP Switches

The TimeLock Pro unit has eight internal DIP switches to preset the Synchronizer.

Getting Information on the current DIP Switch Setting

To get the information how the eight internal switches are set, it is not necessary to open the unit. During TimeLock Pro's power-up routine its display shows the current settings in abbreviated form. Here's an example of what you might see:

Event:	The display shows this:
Display test	8.8.8.8 8.8.8.8.
The firmware version is displayed	SoFt 2.10
The MIDI Cue Mode (DIP 1 to 3) and the tolerated Drop Out-length (DIP 7) are displayed.	FuLL J8
The display remains in Status Mode for as long as no LTC or VITC signal arrives at the unit's inputs.	25 1.0 00

The current settings can be changed by altering the position of the DIP switches that reside within the unit. The following section describes the various switch settings and the resulting functionality.

DIP Switch settings and resulting Functions

The table below lists the DIP switch settings, the resulting functions and the abbreviations that are visible in the Time Code display.

DIP No.	Settings	Abbreviation	Function
1-2-3		MIDI Cue Mode
	0-0-0	oFF	No MTC output during jog or shuttle operation
	1-0-0	FuLL	MTC "Full" message
	0-1-0	Loc	MMC "Locate" command
	0-0-1	qFb	Quarter frame bursts
	1-0-1	qFb-2	Quarter frame bursts-2
7		Drop Out duration
	0	J8	8 frames
	1	J32	32 frames
8		Default standard
	0	25	Default standard 25 fps
	1	30	Default standard 30 fps

DIP 1-3 – The Midi Cue Mode

Midi Time Code is a standard that is used to translate SMPTE time code into MIDI messages. There are two basic types of messages, called "Quarter Frame" and "Full" message.

- The "Quarter Frame" message is used for normal running status at play speed.
- The "Full" message communicates a specific time for locating or cueing.

The Steinberg software Nuendo, for example, supports the "Quarter Frame" and the "Full" message. When using this program, you should therefore set MIDI Cue Mode to "Full".

Unfortunately, many devices that use MTC do not support the “Full” message. For this reason, TimeLock Pro supports a couple of other MIDI Cue Modes which can be used to frame-accurately locate or cue your sequencer or audio workstation to a master time code.

One of these methods to cue up a digital audio workstation (DAW) is the use of the MMC “Locate” command, if the slaved DAW supports MMC slave mode as well as MTC slave mode.

If this is the case, you can set TimeLock Pro’s MIDI Cue Mode to »Locate«. (e.g. if you use Digidesign ProTools 4.2, Roland VS-880, Fostex FD8 etc.) TimeLock Pro will then output an MMC locate command instead of the “Full” message.

Other recording software can be located by using a burst of several quarter frames. The Creamware Triple DAT Software, for example, works fine with TimeLock Pro’s MIDI Cue Mode “qFb-2”.

DIP 7 – Setting Drop Out Duration

The time code drop out correction bridges drop outs with a length of up to 8 frames. By using DIP switch 7 you can set this error correction to 32 frames. On the other hand, this will also cause a post-roll time of 32 frames, after the master time code has stopped.

DIP 8 – Setting the Standard Default

When you switch on TimeLock Pro, the default standard setting determines the time code standard that will be used. The available possibilities are listed in the table on the previous page.

Specifications

LTC input	RCA female, -40 to 20 dBu, 10k ohms 0,5 to 200% of playback speed, reverse and positional format auto-detection (24, 25, 30 drop, 30 fps)
Video input	BNC female, 75 ohms terminated PAL/NTSC Composite Sync reads VITC in lines 6 to 22
MIDI output	5-pin DIN, The Complete MIDI 1.0 MTC quarter frame and full messages MTC quarter bursts, MMC locate
Word output	BNC female, 75 ohms, TTL x1 or x256 sample rate, 42.336, 44.056, 44.100, 44.144, 45.937 kHz 46.080, 47.952, 48.000, 48.048, 50.000 kHz Lock range +/- 10% of nominal speed Clock jitter < 1 ns per audio frame Resolution 23 ppm
Power	Euro EN 60.320, 230 VAC, 50 Hz, 30 mA, (115 VAC, 60 Hz, 60 mA version also available)
LED Display	8 x HP 7503, 6mm (0,3") red
Dimensions	1U-19" rackmount kit
Weight	0,7 kg
