HORITA TR-100
USER MANUAL

MULTI FRAME RATE
SMPTE TIME CODE READER
WITH LED DISPLAY

Doc. 073129-00
Rev. B

HORITA®

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1 GENERAL

The TR-100 is a versatile SMPTE Longitudinal/Linear SMPTE Time Code (LTC) reader with an LED display. The LED display characters are 0.8" high and are suitable for viewing across a room, while a brightness control allows adjustment of display intensity for use in various ambient light conditions.

The TR-100 can display time code or user bits, and also momentarily displays the frame rate when time code is first applied. The TR-100 provides both a MIDI time code output as well as a reshaped LTC output.

The TR-100 comes standard as a small desktop unit, but can be installed in a standard 19" rack using the HORITA S100EK Rackmount Ear kit. It can also be attached to a wall or other piece of equipment using the HORITA S100SK Wallmount Swivel Bracket kit.

2 FEATURES

- Reads LTC from 1/30th to 10 times play speed, forward and reverse.
- 0.8" high LED display characters with brightness control.
- Outputs 2V P-P reshaped LTC for passing on to other units.
- Outputs MIDI time code (MTC).
- MIDI TC output "flywheels" for up to 3 FRAMES of reading bad time code.
- Rear panel switches select time code or user bits for display and display of frames or not.
- Discrete LEDs indicate LTC code present and drop frame or non-drop frame time code.
- Reads 23.976/24 (film), 25 (PAL), 29.97 drop frame/non-drop frame (NTSC), and 30 FPS (frames-per-second) time codes and displays the frame rate of the code being read.
- Operates from +9V to +14V DC for portable use in the field. Includes a 9 volt AC adapter.
- Desktop sized TR-100 measures 8.75"W x 4.5"H x 4.5"D.

3 SMPTE TIME CODE

SMPTE (pronounced "semtee") is an acronym for the "Society of Motion Picture and Television Engineers". SMPTE adopts and sets standards for the motion picture and television industry and has adopted standards for longitudinal time code (LTC). LTC is commonly referred to as SMPTE time code, and works with (60/525) NTSC video at frame rates of 29.97 and 30 FPS (frames-per-second).

EBU time code is of the same basic format as SMPTE time code, but has a frame rate of 25 FPS to work with (50/625) PAL video. The SMPTE/EBU time code format is also used at a frame rate of 23.976/24 FPS for film work, and 30 FPS for other video and audio applications.

3.1 LTC – Longitudinal/Linear Time Code

Longitudinal time code is an electronic timing signal. It is audible and sounds much like a dial-up FAX machine when first receiving a fax. It is audible so that it can be recorded on the audio channel of a video recorder or recorded on an audio recorder, and was originally developed to assist in editing video played back from video tape recorders.

It is called longitudinal or linear time code because it was originally recorded along the length of a video tape by a stationary recording head as the video was being recorded as magnetic stripes on the rest of the tape by a spinning recording head. After recording, SMPTE time code enables video and audio recordings to be synchronized to each other during playback using specialized playback devices and software.

Instead of being just a continuously incrementing count, SMPTE time code identifies each frame of a television picture by counting in an hours, minutes, seconds and frame number format. It has a starting value of 00:00:00:00 and a maximum value after 24 hours of 23:59:59:29 (23 hours, 59 minutes, 59 seconds, and 29 frames) for the 29.97/30 FPS frame rate, a maximum value of 23:59:59:24 for 25 FPS frame rate, and a maximum of 23:59:59:23 for the 23.976/24 FPS frame rate.

The LTC signal itself is an 80-bit serial binary code that repeats once each video frame. Of these 80 bits, 32 are reserved for the time information. An additional 32-bits, known as user bits, are available for including miscellaneous information along with the time information. These user bits are organized as eight, 4-bit hexadecimal digits. A hexadecimal has a value of from 0 to 9 and then from A to F. The remaining 16 bits of time code form a special "sync" pattern which is used to locate and decode the time code and user bit information.

When a tape with time code is played back, the time code signal can be read by appropriate equipment to provide a precise frame and/or time identification for video editing, audio synchronizing, and other purposes.

Depending upon the capabilities of the playback machine, the TR-100 can read and decode LTC signals at speeds as slow as 1/30th times play speed up to speeds as high as 10 times play speed.

3.2 Drop Frame Time Code

Drop frame time code is a form of SMPTE code which is used when it is important that the time code time value also be an accurate representation of real time. Drop frame is not used for the 25 FPS EBU or 24 FPS film time code format.

U.S. color television standards were first developed to be compatible with earlier black and white television. This required a slight slowing down of the (then) standard black & white TV frame rate of 30 frames-per-second, down to 29.97 frames-per-second. Because it is this frame rate that increments the SMPTE time code numbers, the time code readout falls behind real clock time by about 108 frames per hour, or 3.6 seconds. 3.6 seconds is important to television broadcasters selling air time, so drop frame time code was developed to adjust for this error and make 29.97 FPS SMPTE time code time more closely match real time like 30 FPS time code would.

The technique for producing drop frame time code involves skipping ahead by two frame numbers on each new minute except on minutes 00, 10, 20 , 30, 40, and 50. Thus, except for these tens-of-minutes exceptions, drop frame time code advances from frame number 29 to frame number 02, skipping frame numbers 00 and 01 at the start of each new minute. This effectively causes the time display to catch up and match that of a real time clock.

Although drop frame time code is widely used in the broadcast industry, it is often avoided elsewhere due to problems in handling it by various video and audio editing and control equipment.

4 CONNECTING THE TR-100

4.1 Connecting Power

Included with your TR-100 is an AC power adapter that provides a 9 volt, 500 milliamperes DC output. This adapter is equipped with a miniature phone plug with the "+" (positive) voltage output connected to the front tip of the plug.

Insert the power plug into the "+9V DC" rear panel connector and plug the adapter into 110-120 volt, 60-Hz AC power.

WARNING:

ELECTRICALLY OPERATED PRODUCT

As with all electrical products, precautions should be observed during handling and use to prevent electrical shock.

NOTE:

Make sure the plug is inserted all the way into the power connector or else damage to the power adapter may result. Do not use an adapter of more than 9 volts at 500 milliamperes or damage to the TR-100 may result.

4.2 Connecting LTC In and Out

Figure 4-1 shows a basic hookup for the TR-100.

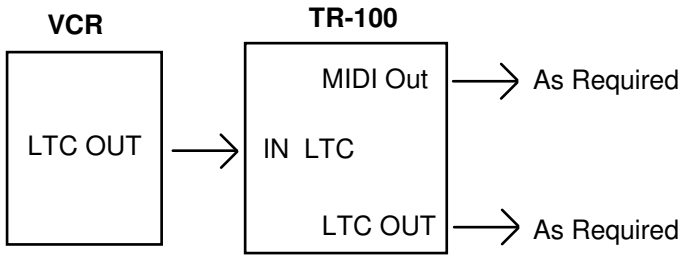

Figure 4-1, Basic TR-100 Hookup

Connect SMPTE LTC from its source to the RCA connector labeled LTC IN. Reshaped, 2V P-P LTC is available at the RCA connector labeled LTC OUT.

4.3 Connecting MIDI Out

Use a standard 5-pin DIN MIDI cable to connect the TR-100 MIDI time code output to your MIDI equipment as desired.

5 OPERATING THE TR-100

5.1 Controlling the Display

The TR-100 rear panel DATA switch allows the display of either time code or user bits.

The FRAMES switch allows the frame number display to be turned on or off. This only applies when displaying time code. When user bits are displayed, the FRAMES switch is disabled.

The BRIGHT knob controls the display brightness.

5.2 Display Description

The following paragraphs refer to Figure 5-1 when describing various aspects of the TR-100 display.

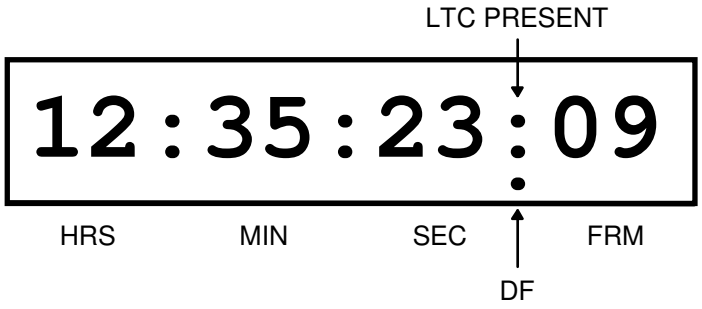

Figure 5-1, TR-100 LED Display

During display of the time code value, the top discrete LED for the colon between the seconds and frames digits "flashes" to indicate reading of time code as follows:

FLASH RATE	MEANING
Off	Indicates that an active LTC input to the TR-100 is not present.
Fast	Indicates LTC is being read at play speed and MIDI time code quarter frame messages are being output.
Slow	Indicates LTC is being read at search/shuttle speeds and that full frame MIDI time code messages are being output.
DF	DF LED is on whenever drop frame time code is being read. It is off for non-drop frame time code or when user bits are displayed.

5.3 MIDI Time Code Output

The TR-100 outputs quarter frame MIDI Time Code (MTC) messages when reading time code at play speed. Full frame MTC messages are output when the TR-100 is reading time code at speeds slower or faster speeds than play speed.

For reference, the complete MTC quarter frame message format is (in "hex"): F1- 0uf - F1-1tf - F1- 2us - F1- 3ts - F1 - 4um - F1 - 5tm - F1 - 6uh - F1 - 7th. Where "u" = units, "t" = tens, "f" = frames, "s" = seconds, "m" = minutes, "h" = hours. There are 16 bytes altogether, sent at a rate of 8 per frame, requiring 2 frame times to send all 16.

When the TR-100 initially acquires and starts reading time code, it first outputs a full frame MIDI time code message consisting of both time code and user bit values. After doing this, it continues to output full frame time code messages if not at play speed, or quarter frame time code messages if at play speed. For reference, the complete MTC full frame message format is (in "hex"): F0 - 7F - 7F - 01 - 01 - hr - mn - sc - fr - F7 for the time code value, and, for the user bit value: F0 - 7F - 7F - 01 - 02 - u1 - u2 - u3 - u4 - u5 - u6 - u7 - u8 - u9 - F7.

This TR-100 MTC output will "coast" or "flywheel" for up to 3 FRAMES should there be errors reading the input LTC.

5.4 Frame Rate Display

The TR-100 determines the frame rate by checking the frame number immediately preceding the reading of frame number zero (00). Frame number 23 precedes frame 00 when reading 23.976/24 FPS time code, frame number 24 precedes frame 00 for 25 FPS, and frame number 29 precedes frame 00 for 29.97/30 FPS.

Because 29.97 drop frame, 29.97 non-drop frame, and 30 FPS time codes all have frame number 29 preceding frame number 00, there is an ambiguity in determining the frame rate in this manner. So, in the TR-100, if the frame preceding frame 00 is 29 and the time code is not drop frame, then the TR-100 displays a frame rate of 30 FPS. If drop frame time code is being read, as indicated by a special "drop frame" bit in the time code itself, then the TR-100 displays "29" as the frame rate. and the "DF" LED on the display is illuminated.

Immediately after the frame rate is first determined, the 24, 25, 29, or 30 FPS frame rate value is displayed for one or two seconds in place of the time code frame number. After this time the frames digit reverts to displaying the normal changing frame value of the time code being read. The frame rate is not displayed again until a different frame rate is detected.

6 MAINTENANCE

6.1

1. Do not attempt to disassemble your TR-100 to clean it.

2. Clean your TR-100 using only a damp cloth.

3. NEVER use water or solvents such as alcohol, window cleaner, etc., to clean your TR-100

6.2 Service and Troubleshooting

If you suspect your TR-100 is not operating properly, check the following:

1. Check all cables for opens or shorts.

2. If using an AC power adapter different from the one supplied with the TR-100, make sure it supplies the TR-100 with at least 9 volts (maximum of 14 volts) when the TR-100 is switched on.

There are no internal adjustments in the TR-100. You may return your TR-100 to HORITA for service. Please contact HORITA first, either by phone or mail, before returning your unit.

7 SPECIFICATIONS

Power

Operation	9-to-14V DC, approx. 500 mA
AC Adapter	9 volt, 500 mA

Connectors

TC IN/TC OUT	RCA
POWER	3.5MM mini phone jack
MIDI	5 PIN DIN (FEMALE)

Switches And Controls

FRAMES ON/OFF	Toggle switch
DATA TC/UB	Toggle switch
POWER ON/OFF	Toggle switch
BRIGHT	Brightness adjustment

Environment

Operating	5°C to 40°C (41°F to 104°F)
Storage	-10°C to 60°C (14°F to 140°F)

Dimensions

8.75"W x 1.5"H x 4.5"D

Weight

Approximately 13 Oz. (shipping weight approximately 29 Oz. including power adapter)

Specifications subject to change without notice