

TCI500
(formerly TCI232A)

UNIVERSAL TIME CODE

CONVERTER

&

INTERFACE



TABLE OF CONTENTS

DISCLAIMER	2
INTRODUCTION	3
FEATURES	3
Time Code Conversion	3
Time Zone/Daylight Savings Time Adjustment	3
RS-232 Serial Interface	4
Frame Rate Pulse	4
Date Support	4
INITIAL OPERATION	4
TIME CODE SOURCES Supported	5
Incoming Time Code / Source Select	5
Source Signal Level	5
Automatic Detection of TC Specifics	5
NORMAL OPERATION	5
SETUP AND CONFIGURATION VIA INTERNAL SWITCHES	5
Setup and I/O Options	5
Access to PC Board	5
FIGURE 1	7
TC Source Selection	7
TIME CODE GENERATION	7
Time code generation configuration	8
Step 1: Time Code Generator Selection	8
Step 2: Signal Output Selection	8
Short-Term Stability	8
Long-Term Stability	8
TIME ZONE/DAYLIGHT SAVINGS TIME ADJUSTMENTS	9
Time Zone Offset Selection	10
Daylight Savings Time Selection	10
Configuration Error	10
PULSE OUTPUT/RELAY CLOSURE CONFIGURATION	10
Pulse Output Configuration	11
Relay Closure Configuration	11
Pulse/Relay One Second Advance	11
Pulse/Relay Advance	11
Pulse Accuracy	11
Contact Closure Accuracy	11
PHYSICAL CONNECTIONS/CONFIGURATION	11
Simplified I/O Connections	12
Figure 2	12
9600/300 BAUD Output	13
Heathkit WWV Clock Emulation	13
PROBLEMS - TROUBLE SHOOTING	13
SPECIFICATIONS	15
FUNCTIONAL	15
HARDWARE	16

Operating Environment.....	16
TTL Level Outputs	16
Relay Contact Closure	16
Battery Operation.....	16
OPTIONS & Related hardware	17
Rack Mount.....	17
Time Code Reader Cards (PCI bus).....	17
Time Code Generator GPS200	17
BNC9 Adapter	17
LIMITED WARRANTY	18
Exclusions.....	18
Warranty Limitations	18
Exclusive Remedies	18
Hardware Service.....	18

DISCLAIMER

The information contained in this document is subject to change without notice.

Masterclock, Inc. (hereinafter MC) makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

MC shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

See limited warranty information starting on page 18.

INTRODUCTION

The TCI500 is a multipurpose TC (time code) converter and interface between various TCs and external systems.

The unit can:

- convert from / to various serial time codes
- insert time zone offsets into the output TC
- insert automatic daylight savings time adjustments when using certain TC sources that have date information encoded
- communicate to PCs & other systems via RS-232 bi-directionally, @ 9600 baud
- communicate to PCs & other systems via RS-232 simplex (single direction transmit), @ 300 baud using the Heathkit protocol
- provide a relay contact closure per – min – hour – day
- provide a TTL pulse output per – sec – min – hour – day
- provide a frame pulse related to the generated TC

FEATURES

Time Code Conversion

The TCI500 can decode any of the time code formats shown on the chart (INPUTS) and convert to/generate any of the time code formats shown (OUTPUTS).

TIME CODE FORMATS		OUTPUTS			
		SMPTE 30 fps	SMPTE 25 fps	SMPTE 24 fps	IRIG-B* IRIG-B(1)*
I N P U T S	SMPTE – 30 fps	•	•	•	•
	SMPTE – 25 fps	•	•	•	•
	SMPTE – 24 fps	•	•	•	•
	IRIG-B*	•	•	•	•
	IRIG-B(1)*	•	•	•	•

* The TCI500 accepts and generates both the 1 kHz modulated & unmodulated IRIG-B TC formats.

Time Zone/Daylight Savings Time Adjustment

Time zone offsets from –11.5 to +12 hours (in 30 minute increments) can be selected in all configurations. In addition, if date (month/day/year) information is available in the time code source, in a format recognized by the TCI500, daylight savings time adjustments can be made to

the US/Canada standard. Other daylight savings time offsets can be provided – contact factory for details & cost.

RS-232 Serial Interface

A native 9600 baud serial protocol is available to interrogate the TCI500 for time and operational status. Optionally, the serial interface can be configured for a 300 baud “Heathkit” serial output for Grass Valley switcher and other device synchronization.

Pulse Output/Relay Contact Closure

A pulse output, synchronized to the TC generator, is available and can be configured for pulse per second, hour, minute, or day operation. The pulse is positive going and 100ms wide.

A relay contact closure, synchronized to the TC generator, is available and can be configured for closure per minute, hour, or day operation.

Frame Rate Pulse

A frame rate TTL level pulse is available on pin 7 of the DB-9 output connector. The repetition rate of this pulse corresponds to the generated TC. It is 10 ms wide and the leading edge of the pulse is accurate to within approximately 200 u sec of the source TC. The leading edge of the pulse is synced to the “on time” point of the respective TCs – typically at the beginning of the data word. Repetition rates are:

SMPTE 30 fps	30 pps
SMPTE 25 fps (EBU)	25 pps
SMPTE 24 fps (Film)	24 pps
IRIG-B	1 pps

Date Support

Date processing is supported for most time code formats. The TCI500 supports Leitch-format date for decoding and generation of all SMPTE time code formats. IEEE 1344 date and related encoding is supported for decoding and generation of all IRIG-B formats.

INITIAL OPERATION

Setup for initial operation consists of:

- supplying a source of TC
- connecting a power source
- selecting the desired setup parameters with switches inside the case
- connecting to an external TC generator device

TIME CODE SOURCES SUPPORTED

One of the following sources of TC is required.

- SMPTE (30fps, 25fps, and 24fps)*
- IRIG- B (B0, unmodulated/pulse width modulated/dc level shift)
- IRIG –B (B1, 1kHz Amplitude Modulated)

*** Note: This device does not support SMPTE 30 fps drop-frame or drop frame applications**

Incoming Time Code / Source Select

There are two options for selecting incoming or source TC type – automatic & manual select. In the automatic mode the system will determine the TC format and adjust itself accordingly – the negative of this mode is that it will take up to 90 seconds for the unit to make the automatic determination. If the type of incoming TC is fixed then it is recommended that appropriate switches be set for the TC – this will significantly decrease the setup/calibration time for the unit.

Source Signal Level

Regardless of incoming TC configuration the TCI500 will attempt to automatically determine the appropriate gain for incoming TC signal level at startup. The input level of TC to the TCI500 should be in the range of –20 to +20 DBm (600 ohms). The unit will automatically calibrate to any input voltage level within this range. It may not be able to calibrate to voltages outside of this range.

Automatic Detection of TC Specifics

Frame rate will automatically be determined for supported SMPTE-format TCs. If date is encoded in incoming TC (in a format recognized by TCI500) it will be automatically detected.

NORMAL OPERATION

When power is first applied (without TC present) the front panel LED will flash twice and go out.

After power up (when TC is present) and after initialization, the LED will flash once each second in synchronization with the on-time mark of the generated TC.

Should TC be lost or become invalid the LED will go out.

SETUP AND CONFIGURATION VIA INTERNAL SWITCHES

SETUP AND I/O OPTIONS

Various setup parameters can be configured by setting switches inside the case.

Access to PC Board

In order to gain access to the setup and configuration switches it is necessary to remove the case from the TCI500 as follows:

First disconnect the power and other cables from the unit. Even though the highest voltage inside the TCI500 is 12-28VDC (which is generally not dangerous to touch), accidentally shorting a trace or wire inside the unit with power on could destroy or damage any one of the extremely sensitive electronic modules. **Accidentally shorting a wire or trace or subjecting the unit to a static discharge, even for a very small fraction of a second, can destroy these modules. Such damage is not covered by the warranty.**

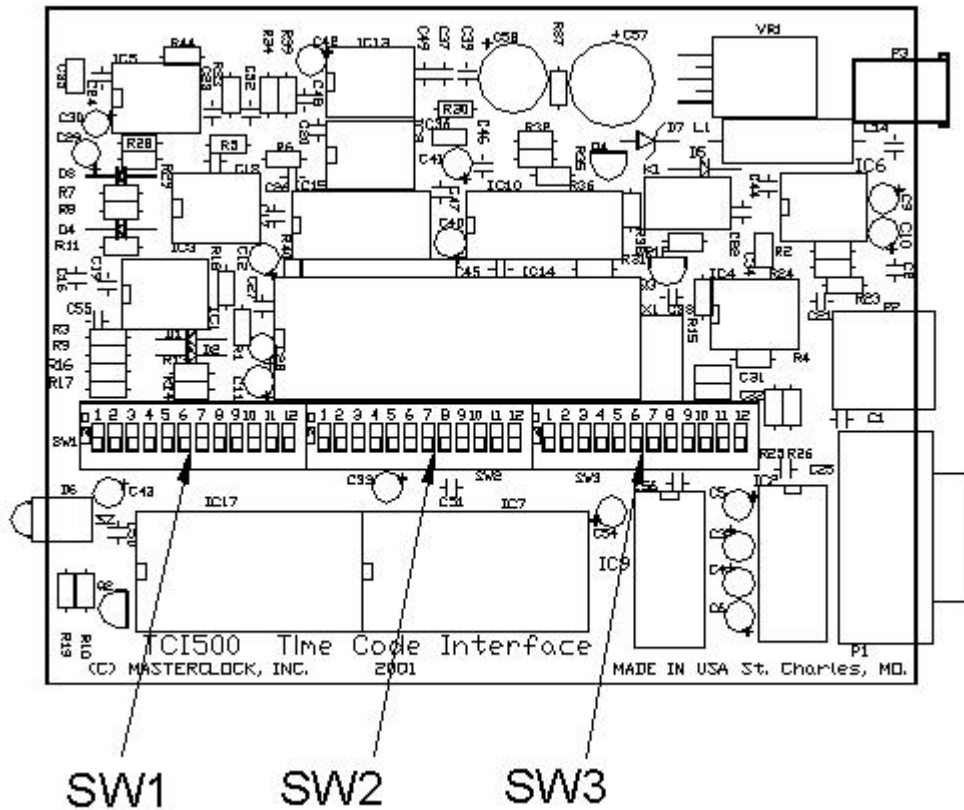
Remove the two Phillips screws on the rear panel (this is the end with the power socket, BNC, and DB-9 connectors). Holding the case of the unit in one hand, slide the rear panel assembly outward from the rear. The entire rear panel assembly and PC board will slide out.

As was mentioned above, the PC board is sensitive to any electrical signal including static discharge. Do not touch the PC board with any external wiring and, whenever possible, handle the unit by the rear panel or on the edge of the PC board as you would a Compact Disc. When not changing the switches, always keep the PC board installed in the case.

When reassembling the unit take care that the PC board is properly fitted into the slots in the base of the chassis. When properly inserted, the PC board and rear panel assembly will slide easily into the case, no force is necessary. The warranty does not cover damage caused to the unit while removing or reassembling the PC board.

Figure 1 shows the location of the configuration switches on the PC board.

FIGURE 1



TC source select can be configured via the SW1 switch bank.

TC Source Selection

<u>SW1-1</u>	<u>SW1-2</u>	<u>SW1-3</u>	<u>SW1-4</u>	<u>TC source selection</u>
OFF	OFF	OFF	OFF	Auto-detect (<i>default</i>)
ON	OFF	OFF	OFF	SMPTE (30, 25, or 24 fps) NDF
OFF	ON	OFF	OFF	IRIG-B(1) 1kHz modulated
ON	ON	OFF	OFF	IRIG-B(0) (unmodulated/pulse width mod/dc level shift)

TIME CODE GENERATION

The TCI500 can provide a conversion from any of the supported source TCs to any of the supported generate TCs. In all configurations the TCI500 supports time zone offsets, if desired, as part of the conversion. If date is available in the TC source a US/Canada daylight savings time

adjustment can be applied to the generated TC. If the generated TC supports date encoding, and date is available in the TC source, date will be supplied with generated time.

The TCI500 can generate any of the following TC formats:

- SMPTE (30fps, 25fps, and 24fps) NDF, non-drop frame.
- IRIG-B(0) /B(1)

Time code generation configuration

Step 1: Time Code Generator Selection

<u>SW1-5</u>	<u>SW1-6</u>	<u>SW1-7</u>	<u>SW1-8</u>	<u>TC generator type selection</u>
OFF	OFF	OFF	OFF	SMPTE (30 fps NDF) (<i>default</i>)
ON	OFF	OFF	OFF	Undefined
OFF	ON	OFF	OFF	SMPTE (EBU, 25 fps)
ON	ON	OFF	OFF	SMPTE (FILM , 24 fps)
OFF	OFF	ON	OFF	IRIG-B(0)/B(1)

Step 2: Signal Output Selection

<u>SW3-9</u>	<u>SW3-10</u>	<u>SW3-11</u>	<u>SW3-12</u>	<u>TC signal output selection*</u>
OFF	OFF	OFF	OFF	No signal output
ON	OFF	OFF	OFF	IRIG-B(0) (unmodulated/pulse-width mod/dc level shift)
OFF	OFF	ON	OFF	SMPTE (<i>default</i>)
OFF	OFF	OFF	ON	IRIG-B(1) 1kHz Amplitued Modulated

* Note: under no circumstances should more than one of SW3-9 – SW3-12 be switches ON at a given time.

Short-Term Stability

Upon startup the TC generator will synchronize itself to the source TC. The TCI500 will adjust to small frequency changes, drift, and oscillation in the TC source by applying small frequency adjustments to the generator, also called *slawing*. Interruptions of the TC source or large changes in the frequency of the TC source may cause the TCI500 to shut down the generator briefly allowing it to “jam sync” itself. Any jumps in the values of time data (or date if available) will also cause the generator to jam sync.

Long-Term Stability

The long-term accuracy and stability of the TCI500 generated TC is the same as that of the TC source. Any drift inherent in the TC source will also be mapped onto the generated TC.

TIME ZONE/DAYLIGHT SAVINGS TIME ADJUSTMENTS

The TCI500 can apply time zone offsets to the generated time code data. Offsets can be configured for -11.5 to +12 hours (in 30 minute increments). Any offsets specified will be relative to the time code source time zone encoding.

If date information is available in time code source and encoded in a format the TCI500 recognizes the daylight savings time adjustment option is available. When enabled this feature applies daylight savings time adjustments to generated time code during US/Canada-defined daylight time. The adjustment is calculated relative to the time code source reference after any TCI500-specified hour offset has been applied.

Time Zone Offset Selection

<u>SW2-1</u>	<u>SW2-2</u>	<u>SW2-3</u>	<u>SW2-4</u>	<u>Hour offset</u>
OFF	OFF	OFF	OFF	0 hour – no offset (<i>default</i>)
ON	OFF	OFF	OFF	1 hour
OFF	ON	OFF	OFF	2 hours
ON	ON	OFF	OFF	3 hours
OFF	OFF	ON	OFF	4 hours
ON	OFF	ON	OFF	5 hours
OFF	ON	ON	OFF	6 hours
ON	ON	ON	OFF	7 hours
OFF	OFF	OFF	ON	8 hours
ON	OFF	OFF	ON	9 hours
OFF	ON	OFF	ON	10 hours
ON	ON	OFF	ON	11 hours
OFF	OFF	ON	ON	12 hours

<u>SW2-5</u>	<u>Additional ½ Hour offset</u>
ON	Apply additional ½ hour offset
OFF	No ½ hour offset (<i>default</i>)

<u>SW1-12</u>	<u>Offset Direction from UTC</u>
ON	Specified offset is negative
OFF	Specified offset is positive (<i>default</i>)

Daylight Savings Time Selection

<u>SW2-6</u>	<u>Offset Direction</u>
ON	Enable Daylight Saving Time Adjustment*
OFF	No Daylight Saving Time Adjustment (<i>default</i>)

Configuration Error

* Note: if no date is detected in time code source and this option is enabled the TCI500 will revert to a non-operational state where the front-panel LED will blink rapidly. To correct the situation, disable daylight time adjustment or apply a time code signal that provides date encoding then restart the unit.

PULSE OUTPUT/RELAY CLOSURE CONFIGURATION

Pulse and relay closure timing and frequency is selected via the SW-2 switch bank.

Pulse Output Configuration

<u>SW2-7</u>	<u>SW2-8</u>	<u>Output Rate</u>
OFF	OFF	PPS (1 pulse per second)
OFF	ON	PPM (1 pulse per minute)
ON	OFF	PPH (1 pulse per hour)
ON	ON	PPD (1 pulse per day)

Relay Closure Configuration

<u>SW2-9</u>	<u>SW2-10</u>	<u>Closure Rate</u>
OFF	OFF	No relay closure
ON	OFF	CPM (1 closure per minute)
OFF	ON	CPH (1 closure per hour)
ON	ON	CPD (1 closure per day)

Pulse/Relay One Second Advance

<u>SW2-11</u>	<u>One Second Advance</u>
ON	Enable pulse/relay closure one second advance
OFF	No pulse/relay closure advancement (<i>default</i>)

Pulse/Relay Advance

By default pulse/relay closure will occur at XX:XX:59.9 of the selected period. Timing of pulse output and relay closure can be advanced so as to occur at the 58.9 sec point of the selected period by setting SW2-11 in the on position.

Pulse Accuracy

Time is valid at the leading edge of the pulse and is accurate to within < 1 ms of the on-time mark of generated time code.

Contact Closure Accuracy

Time is accurate and valid at the end of the contact closure (when the contact opens) and is accurate to within approximately 1 ms of the on-time mark of generated time code.

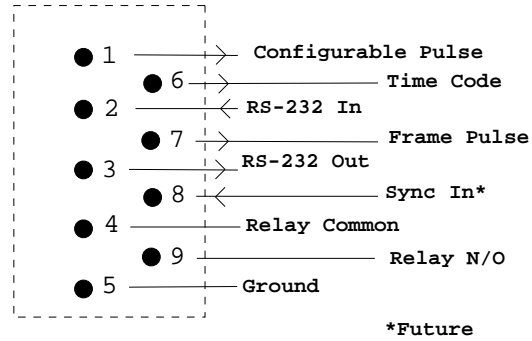
PHYSICAL CONNECTIONS/CONFIGURATION

All I/O functions are available on P1 at all times in addition to the TC. If only the time code output is used, a DB9 to BNC adapter is available from MC (part no. BNC-9). Contact the factory for ordering information.. To simultaneously use some combination of functions a custom I/O cable will be necessary. Such cables can be fabricated locally by an electronic technician or on a custom basis by MC.

SIMPLIFIED I/O CONNECTIONS

FIGURE 2

**SIMPLIFIED I/O
P1 - DB-9**



Input Connections

Connect the TC to the BNC connector on the rear of the TCI500. The BNC input is isolated from chassis ground, is balanced, and has an input impedance of > 100K ohm.

Time Code Interconnect Cable

Time Code is an audio signal similar to that of a modem. It can be routed over shielded audio wire, unshielded wire such as telephone wire or, if desired, over inexpensive RG-58/59 coaxial cable.

Time Code Signal Level

The input level of TC to the TCI500 should be in the range of -20 to +20 DB (600 ohms). The unit will automatically calibrate to any input voltage level within this range. Levels outside this range may not be decoded by the TCI500.

Output Connections

All outputs of the TCI500 are available on the DB-9 connector on the rear of the unit.

IBM 9 Pin Serial Port Compatible

The RS-232 pin out configuration is the same as is used on IBM compatible 9 pin serial ports, i.e. pin 2 receive, pin 3 transmit and pin 5 ground. A standard DB-9 male to DB-25 adapter can be used to connect most 25 pin serial cables. A null-modem interface cable will be required to communicate with most PC's.

9600/300 BAUD OUTPUT

SW1-9,10 & 11 sets the communications speed for the serial port. In the off position the serial port operates bi-directionally at 9600 baud. With SW1-9 on & 10 & 11 in the off position it operates in a 300 baud simplex output mode. See details of the output format in the following section entitled *Serial Protocol Specification*.

Heathkit WWV Clock Emulation

Grass Valley switchers and some other types of systems can accept a TC input from Heathkit WWV Clocks via RS-232 at 300 bits per second, 8 data bits, 1 stop bit, no parity. The expected format is:

HH:MM:SS.T MM/DD/YY<CR>

HH=hour, MM=minute, SS=second, T=tenths of second followed by five spaces followed by MM=month, DD=day, YY=year (0-99) followed by a carriage return.

With SW1-9 on & 10 & 11 in the off position (Auto Output @ 300 baud) the Heathkit format message will be sent once per second at the valid start of the first frame of that second. The tenths of second field will always contain '0' (ASCII value 48). If no date is detected in the incoming time code, the MM/DD/YY fields will be padded with the character '0' (ASCII value 48). The Grass Valley switcher may not accept the serial message without the date included.

PROBLEMS - TROUBLE SHOOTING

All TCI500 units are checked for proper operation before shipment and unless physical damage is found, the unit is probably functional.

If you have problems getting the unit to work:

- double check all input and output connections
- verify configuration switch settings
- make sure that power is applied and the front panel LED is showing the startup sequence when first activated

- verify that a valid TC is connected
- verify that the TC input level is in range
- allow up to 1 minute (typical) – 3 minutes for the autodetection circuit to acquire the TC input

If the unit does not work even after the above precautions have been noted contact the factory.

SPECIFICATIONS

FUNCTIONAL

Time Code Input

Format:.....Selectable
Level:.....-20 - +20dBm (600 ohm)
Impedance:..... > 100K ohm
Connector:.....BNC male

Time Code Output

Connector:.....DB-9 male
SMPTE:.....Approx.- 1.25 Vpp (0 db/600 Ω)
Impedance:.....< 50 ohm

IRIG-B(1) – modulated:.....Approx.- 5Vpp
Impedance:.....< 50 ohm

IRIG-B:.....Approx.- 5Vpp
Impedance:.....< 50 ohm

Type.....Longitudinal/Linear Time Code (LTC), forward running

SMPTE/EBU/Film24/25/30 fps, NDF (Non Drop Frame)
Date encoding (User Bits)to Leitch/Masterclock Encoding

NOTE: Using time code generators providing SMPTE drop frame (DF) time code may cause undesirable operation. Use only (NDF) linear/longitudinal time code.

NOTE: Using time code generators with date encoding or other data in the user bit fields other than to the Leitch/Masterclock date encoding may cause undesirable operation.

IRIG-B0 (unmodulated/pulse width modulated)

B000BCD, CF to IEEE-1344 or zero filled, No SBS or zero filled
B001BCD, CF to IEEE-1344, No SBS (zero filled)
B002BCD, No CF (zero filled), No SBS (zero filled)
B003BCD, No CF (zero filled), No SBS or zero filled.

IRIG-B1 (Amplitude Modulated, 1kHz)

B120BCD, CF to IEEE-1344 or zero filled, No SBS or zero filled
B121BCD, CF to IEEE-1344, No SBS (zero filled)
B122BCD, No CF (zero filled), No SBS (zero filled)
B123BCD, No CF (zero filled), No SBS or zero filled.

NOTE: Unit does not read the optional SBS information, this information will be ignored/treated as zero filled.

NOTE: Unit does not read CF, except to IEEE-1344 specification for date/year encoding .(see tcr1000.sdk for details)

NOTE: Using time code generators providing CF information that is not to IEEE-1344 or using SBS information may cause undesirable operation.

Time Code Output Accuracy

Latency from incoming TC.< +/-500 μ sec

HARDWARE

Operating Environment

The TCI500 is not water or moisture proof. Treat it as you would any other delicate electronic device and do not expose it to water, moisture, excessive heat or physical abuse.

TTL Level Outputs

The configurable and frame rate pulse outputs of the TCI500 are high impedance TTL level signals and are not designed to drive relays and other low impedance devices directly. Connecting such devices, including shorting the output pin, and causing more than approximately 2 ma of current to flow, could damage the unit. Such damage is not covered by warranty. Pulse is positive going, 100ms wide.

Relay Contact Closure

The absolute maximum contact rating is .5 Amp at 24 VDC. Nominal current should not exceed 200 ma. Connecting high current loads and exceeding the recommended rating could damage the relay and traces on the PC board. Such damage is not covered by warranty.

Power Supply Requirements

Input voltage12 VDC (9-28 VDC)
Input power connector2 mm male plug
Power consumption.....approximately 200 ma (2.4 W)

Battery Operation

If desired the unit can be operated from a 12 VDC power source (9-15 VDC range). Observe voltage polarity - printed on the rear panel. Center pin is positive, outer ring is ground/DC return.

Physical

Size:1.5 x 4.1 x 5.5 in. (3.8 x 10.4 x 14 cm)
Weight.....17 oz. (480 gr.)

Operating Temperature

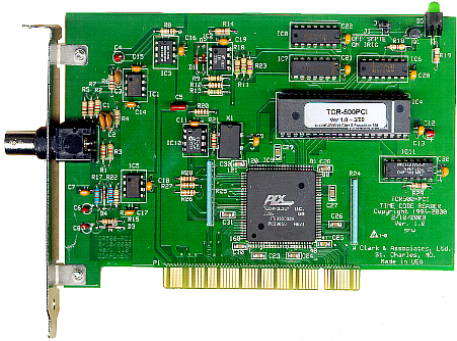
Temperature0 to +60 °

OPTIONS & RELATED HARDWARE

RACK MOUNT



TIME CODE READER CARDS (PCI BUS)

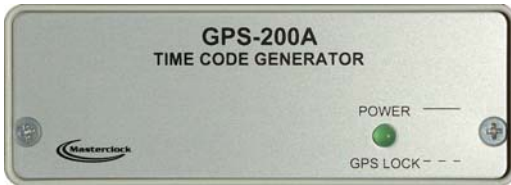


TCR500-PCI



TCR1000

TIME CODE GENERATOR GPS200



BNC9 ADAPTER



LIMITED WARRANTY

This Masterclock, Inc. (hereinafter MC) product warranty extends to the original purchaser.

MC warrants the TCI500 against defects in materials and workmanship for a period of five years from date of sale. If MC receives notice of such defects during the warranty period, MC will, at its option, either repair or replace products which prove to be defective.

Should MC be unable to repair or replace the product within a reasonable amount of time, the customer's alternate remedy shall be a refund of the purchase price upon return of the product to MC. This warranty gives the customer specific legal rights. Other rights, which vary from state to state or province to province, may be available.

EXCLUSIONS

The above warranty shall not apply to defects resulting from improper or inadequate maintenance by the customer, customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product or improper site preparation and maintenance (if applicable).

WARRANTY LIMITATIONS

MC MAKES NO OTHER WARRANTY, EITHER EXPRESSED OR IMPLIED, WITH RESPECT TO THIS PRODUCT. MC SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

In any state or province which does not allow the foregoing disclaimer, any implied warranty of merchantability or fitness for a particular purpose imposed by law in those states or provinces is limited to the one-year duration of the written warranty.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL MC BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

In any state or province which does not allow the foregoing exclusion or limitation of incidental or consequential damages, the customer may have other remedies.

HARDWARE SERVICE

You may return your TCI500 to MC for repair either under warrant or on a time & material basis. Please contact the factory for return authorization before returning the unit. When you return your TCI500 for service, you must prepay all shipping charges, duty, and taxes. For international returns please contact the factory.