

TCD26, TCD26-14, TCD46 AND TCD86

SMPTE – IRIG

TIME CODE

CLOCK – DATE – COUNTER

DISPLAY

(Series II)



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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 here in or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

See important *limited warranty* information at the end of this document.

TCD TIME CODE DISPLAY

Introduction

The TCD Series II is a series of versatile, multi-featured time code driven clock displays. These units decode and display SMPTE linear/longitudinal and IRIG-B time codes. *

SMPTE decoding supports 30 fps, 25 fps and 24 fps, NDF (non-drop frame). IRIG-B decoding supports the 1kHz modulated format (B1) and the unmodulated format (B0). Other features include:

- +12 to -11 hour time zone offsets
- Half hour offsets
- US/Canada daylight savings time adjustments
- World-wide /EU DST rules via serial port interface
- Retains time during loss of power and/or time code
- Automatic level adjustment to incoming time code signals
- Automatic detection of time code type and date encoding availability
- Programmable time and date when time code not present
- Programmable up/down timer/counter functions using serial interface or Masterclock, RC200 remote control

SMPTE

Defined by the Society of Motion Picture and Television Engineers. It is available in frame rates of 30, 25, and 24 frames second. The TCD time code clock display supports all three formats. * All formats of SMPTE time code decoded by the TCD use the full date information in the user bits as defined by Leitch Inc.

* The TCD Series II, does not support decoding of SMPTE drop-frame time code. Masterclock, Inc. does not provide products with, or support for, drop-frame capability.

IRIG-B

Defined by the Range Commanders Council, U.S. Army White Sands Missile Range. The format is used by military, government, power industry, and many other commercial and industrial applications. The TCD decodes IRIG-B in both a 1kHz modulated (IRIG-B1) and unmodulated (a.k.a pulse-width coded/DC level shifted) (IRIG-B0) format. All formats of IRIG-B time code decoded by the TCD use the time of year information BCD (binary coded decimal). All formats of IRIG-B time code decoded by the TCD also use the extended year/date and time zone information in the control functions (CF) as defined by the IEEE 1344 specification. SBS (Straight Binary Seconds) information is not decoded. Manchester format/encoding is not supported.

Operation

Operating Environment

The TCD series is not water or moisture proof, it is designed for indoor use in a controlled environment. Treat it as you would any other delicate electronic device and do not expose it to water, excessive heat or physical abuse. See the specifications sections for details of the environmental operation limits.

Configuration

Basic operation of the TCD series is configured via the **S1** and **S2** switch banks accessible on the back panel of the clock.

The **S1** switches configure fundamental operation mode:

<u>Function</u>	<u>S1-1</u>	<u>S1-2</u>
Time display	<i>OFF</i>	<i>OFF</i>
Date display	<i>OFF</i>	<i>ON</i>
Timer/counter	<i>ON</i>	<i>OFF</i>

Note: Fundamental operation mode cannot be switched during clock operation. A power on/off cycle is required to change these modes.

The **S2** switches configure modifiers to fundamental mode of operation:

S2 switches 1-4 configure the time zone (hour) offset:

<u>Hour offset</u>	<u>S2-1</u>	<u>S2-2</u>	<u>S2-3</u>	<u>S2-4</u>
0 hour offset	OFF	OFF	OFF	OFF
1 hour offset	ON	OFF	OFF	OFF
2 hour offset	OFF	ON	OFF	OFF
3 hour offset	ON	ON	OFF	OFF
4 hour offset	OFF	OFF	ON	OFF
5 hour offset	ON	OFF	ON	OFF
6 hour offset	OFF	ON	ON	OFF
7 hour offset	ON	ON	ON	OFF
8 hour offset	OFF	OFF	OFF	ON
9 hour offset	ON	OFF	OFF	ON
10 hour offset	OFF	ON	OFF	ON
11 hour offset	ON	ON	OFF	ON
12 hour offset	OFF	OFF	ON	ON

S2 switch 6 ON- applies an additional ½ hour to the offset specified by switch positions 1-4.

<u>Function</u>	<u>S2-6</u>
No ½ hour offset	OFF
Enable ½ hour offset	ON

S2 switch 5 configures positive/negative time zone (as set with S2 switch positions 1-4 & 6).

<u>Function</u>	<u>S2-5</u>
Time offset is positive	OFF
Time offset is negative	ON

S2 switch 7 configures daylight savings time adjustment option. (See *Daylight Savings Time*)

<u>Function</u>	<u>S2-7</u>
DST adjustment disabled	OFF
DST adjustment enabled	ON

S2 switches 8 and 9 configure brightness intensity of the clock display.

<u>Level</u>	<u>S2-8</u>	<u>S2-9</u>
Brightest	OFF	OFF
Intermediate (brighter)	ON	OFF
Intermediate (dimmer)	OFF	ON
Dimmest	ON	ON

S2 switch 10 configures time display format.

<u>Format</u>	<u>S2-10</u>
24-hour	OFF
12-hour	ON

S2 switch 11 configures date display format.

<u>Format</u>	<u>S2-11</u>
US (MM/DD/YY)	OFF
European (DD/MM/YY)	ON

S2-12 is reserved.

Note: All S2 switch functions may be changed dynamically during clock operation.

Default Configuration

A TCD ships from the factory with all S1 and S2 switches in the OFF position. This configuration results in the time displayed as: no time zone offset, no daylight saving time adjustment, and 24 hour display format.

Operation As A Time/Date Display

Insert the power cord or power supply into an appropriate AC source.

After application of power the TCD will go through an internal checkout. Time from the real-time clock backup will then be displayed until a time code signal is acquired. If time code has never been applied to the clock dashed lines will be displayed until time code is acquired or the operator programs a time.

Connect a source of SMPTE or IRIG-B time code to the input connector. The time should appear on the display within 120 seconds of application of time code. If the time code signal is lost or disconnected the TCD will continue to display time based on its internal reference until the time code signal is returned. If the clock is unable to achieve a time code lock see the section entitled *Troubleshooting Tips*.

The colons of the clock display will flash when the time or date displayed is not locked to time code. When time code is present and decoding properly the colons will remain steady-on. When operating in time/date display mode the operator may program time and date information into the clock at any time. However, when time and/or date information is available from the time code source it will always override any operator-programmed information. In some situations time code may be providing time but not date information. Under these circumstances the operator may still program time/date. Any programmed time will be ignored but programmed date will be retained. This feature facilitates use of the clock's daylight savings time function even when date information is not provided by time code.

If the TCD is configured for a 12-hour time display mode an AM/PM indicator will appear in the bottom right corner of the display during the PM hours.

Daylight Savings Time

When enabled the TCD will apply an extra hour of offset to the incoming time code during US/Canadian-defined daylight savings time. The TCD series II firmware version 2.0.8 or later uses the US/Canada DST standard where Daylight savings time begins on the second Sunday of March at 2:00AM and ends on the first Sunday of November at 2:00AM.

IMPORTANT: The incoming time code must have a date encoded in a format recognized by the TCD, or the correct date must be programmed into the TCD, for daylight savings time adjustments to be performed. For best reliability Masterclock, Inc. recommends a time code source that encodes full date information, such as the Masterclock, Inc. GPS200A master clock.

For SMPTE time codes date must be encoded to the Leitch specification. These specifications are also supported by Masterclock, Inc. master clock systems. IRIG-B date/year decoding is supported for the IEEE 1344 standard. The TCD will automatically detect a recognized date encoding format in time code.

Note: If your time code source is already making adjustments for daylight savings time do not enable this feature in the TCD.

Operation As A Timer/Counter

Note: an RC200 remote control may be used to control the timer/counter/clock functions of the TCD series II clock. With the RC200 it is not necessary to set the TCD series II clock into the timer/counter mode with the DIP switches; the mode selection of the RC200 provides this capability. See the RC200 user guide/manual for details on controlling one or multiple TCD Series II clocks.

Set the TCD series II clock to either counter or timer mode using the DIP switches.
Insert the power cord or power supply into an appropriate AC source.

After application of power the TCD will go through an internal checkout. A time value, which represents either the start or end of a timer/counter sequence, will then be displayed. If the clock has never before been used as a timer/counter a default time of 00:00:15 will be displayed and the clock will be in a count-down mode.

The count up/count down feature of the timer/counter mode is programmed by the operator. See the section entitled *Programming The Timer/Counter* for more information.

When programmed as a count-up timer/counter the end time will be displayed until the start event is

detected. The start event may occur based upon a start event pulse, a command issued via the RS232 serial port, or a command issued by the RC200. Upon start, the clock will revert to 00:00:00 then begin counting up to the programmed end time. When the end time is reached the display will flash twice then revert to the end time count waiting for the next start event.

When programmed as a count-down timer/counter the start time will be displayed until the start event is detected. Upon start, the clock will begin counting down to 00:00:00. When 00:00:00 is reached the display will flash twice then revert to zero and wait for the next start event.

A start event pulse is defined as providing a logic low to pin 1 of the DB-9 connector located on the back panel of the clock. This can be achieved by a momentary switch or relay closure to connect pin 1 to pin 5 (ground) of the DB-9 connector). The duration of the start closure should be at least 100ms and not more than 1000ms.

Programming /Configuring the TCD

Note: an RC200 remote control may be used to control the timer/counter/clock functions of the TCD series II clock. With the RC200 it is not necessary to set the TCD series II clock into the timer/counter mode with the DIP switches or using the following procedure;; the mode selection of the RC200 provides this capability. See the RC200 user guide/manual for details on controlling one or multiple TCD Series II clocks.

The TCD may be configured or setup using one of two methods: manually with the momentary push buttons located on the rear of the unit, or via software using the configuration port located on DB9 connector of the rear of the unit.

Programming the time and date manually is accomplished via the MODE, UP, and DOWN buttons located on the back panel of the clock. To actuate the MODE button always press then release. Pressing and holding the UP or DOWN buttons in configuration mode will incrementally increase the speed of the directional adjustment.

A start event pulse or trigger is defined as providing a logic low to the appropriate pin of the DB-9 connector located on the back panel of the clock. This can be achieved by a momentary switch or relay closure to connect the pin 1 to pin 5 (ground of the DB-9 connector). The duration of the start closure should be at least 100ms and not more than 1000ms.

Programming the TCD via software is accomplished by using the communications port(s) located on the DB9 connector on the rear of the unit. Brightness, offsets, TC identification, decoder status, real-time-clock status and other configuration features are also controllable or programmable via the built in RS-232 or RS485 port. See the downloads location of our webpage, www.masterclock.com, for a serial port protocol specification.

The communications/programming port is for setup/configuration and/or RC200 remote control only. The communications cable should be limited to 3m (meters) or less for the RS-232.

Pinouts for the DB9 connector are shown below

DB9 Pin Connections

Pin 1 – Counter/Timer Start	Pin 6 – N/C [or VDC _{out} to External Programmer/Comm (contact factory to request)]
Pin 2 – Serial receive RS232	Pin 7 – N/C
Pin 3 – Serial transmit RS232	Pin 8 – Serial transmit RS485
Pin 4 – N/C	Pin 9 – Serial receive RS485
Pin 5 – Ground/Common	

Pin 6 of the DB9 is normally a no connect (N/C) however, for special configuration/programming setups VDC out of +5VDC or +12VDC may be provided by jumpering pin 1,2 (+5VDC) or pin 2,3(+12VDC) on an internal header located on the circuit board. When connected as VDCout, pin 6 will be fused to 0.25A DC.

Caution: there are no user serviceable parts inside the TCD display. Please contact the factory during time of order if you require a special DC power pin 6 configuration, as there are no user serviceable parts inside the TCD display.

Programming - Time/Date Display Manually

When the clock is in time/date display mode the first press of the MODE button will enter configuration mode.

The first stage of configuration is for the date. The portion of the date currently available to be adjusted will be flashing. *The order of the month and day values displayed in configuration mode will depend upon the date presentation format switch (S2-11).* The UP and DOWN buttons will increment and decrement the flashing value. When the operator is done programming the currently selected value, or does not wish to change it, pressing the MODE button again will move on to the next value. When pressing the MODE button on the third value (year) configuration will switch to stage 2.

The second stage of configuration is for the time. The portion of the time currently available to be adjusted will be flashing. Time is programmed in the same manner as date. When pressing the MODE button on the third value (seconds) the programmed date/time values will “take” and the clock will resume ticking forward. Remember that time and/or date information in time code, when available, will always override operator-programmed information.

Programming - Timer/Counter Function Manually

When the clock is in timer/counter mode the first press of the MODE button will enter configuration mode.

The first stage of configuration is for the timer/counter direction. Only *uP* (up) or *dn* (down) may be selected. When pressing the MODE button again the configuration will switch to stage 2.

The second stage of configuration is for the time. If programming a count-up timer/counter you are programming the end time for the count sequence. If programming a count-down timer/counter you are programming the start time for the count sequence. The UP and DOWN buttons will increment and decrement the flashing value. When the operator is done programming the currently selected value, or does not wish to change it, pressing the MODE button again will move on to the next value. When pressing the MODE button on the third value (seconds) the programmed time will be stored then displayed and the timer/counter will then wait for the start event to begin.

Any time between 00:00:00 and 23:59:59 may be programmed. Date is not supported in timer/counter mode and therefore count up/down sequences may not span more than a 24-hour period.

Troubleshooting Tips

Problem: Clock is unable to “lock” to time code after 2 minutes.

Possible reasons/solutions:

1. Clock is not currently connected to time code source. Verify that all cables are properly connected.
2. There is a problem with the cabling between the clock and the time code source. Verify that all cables and connectors are working, in good condition, and that proper pinout connections have been observed.
3. There is a ground loop or other type of interference between the clock and the time code source. Verify that a common ground exists between the clock and the time code source. If the cabling distance between the time code source and clock is large you may want to consider inserting an audio distribution amplifier between the devices.
4. The signal level of the incoming time code is out of the range of the time code decoder’s circuitry. See the clock specification section for acceptable signal level ranges.
5. The signal level of the incoming time code is fluctuating or has changed. The signal level must be stable for the TCD to detect and decode the time code. Restart the TCD device to re-initiate the auto-detection of time code.
6. The time code being fed to the TCD is not a recognized format. Verify that your time code source is providing one of the time code formats that the TCD can decode.

Problem: Clock is not displaying the correct local time or date.

Possible reasons/solutions:

1. The time code source is not referenced to your local time zone. Possibly it is referenced to UTC (GMT) or other another time zone. Determine the time zone reference of your time code source then set the clock’s time zone offset accordingly to arrive at a correct displayed local time/date.
2. Your time code source and your TCD are both set with time zone and/or DST offsets. Determine the time zone reference of your time code source then set the clock’s time zone offset accordingly to arrive at a correct displayed local time/date.
3. Your time code source is not providing the time/date that you expect. Contact the individual responsible for the time code source for more information.

Problem: Clock did not properly negotiate the daylight time to standard time (or vice-versa) transition.

Possible reasons/solutions:

1. Your time code source is not providing date information and a valid date was never programmed into the TCD. Valid date information is required to provide the daylight savings time adjustment feature.
2. Your time code source provides the daylight savings time adjustment. The daylight savings time adjustment feature in the TCD should be disabled.
3. Your time code source or the TCD clock does not have the correct DST firmware installed.

If these troubleshooting tips do not solve your problem contact technical support.

SPECIFICATIONS

Input

Type:..... LTC (Longitudinal/Linear Time Code), forward running
Formats: SMPTE - 24, 25 or 30 fps NDF (Non Drop-Frame)
IRIG-B(1) 1kHz, amplitude modulated (3:1 mark to space ratio), BCD, CF *, no SBS
IRIG-B(0) pulse-width coded, DC level shifted , BCD, CF*, no SBS (reported as zero filled)
Level Range..... 1 to 16 Vpp
Impedance.....Typ. >10 K ohm
Connector..... BNC female

Date (SMPTE):..... Included in user bits per Leitch/Masterclock specification
Date/Year (IRIG-B):..... Included in control functions (CF) per IEEE 1344 specification

Configuration

Programming/Configuration Port Connector.....DB9 male.
Limit length of communication cable to 3meters maximum

DB9 Pin Connections

Pin 1 – Counter/Timer Start
Pin 2 – Serial receive RS232
Pin 3 – Serial transmit RS232
Pin 4 – N/C
Pin 5 – Ground/Common
Pin 6 – N/C [or VDC_{out} to External Programmer/Comm (fused to 0.25A @ 5V or 12VDC)]
Pin 7 – N/C
Pin 8 – Serial transmit RS485
Pin 9 – Serial receive RS485

Power Requirements

AC Input Voltage.....100 – 240 VAC
AC Input Frequency.....47 – 63 Hz
AC Input Connector –TCD26, 46, 86.....IEC male jack
AC Input Connector –TCD26-14.....ITT Cannon – 3 pin “K” (WK-C3-32SL)
DC Input Voltage..... 15 – 28 VDC
DC Input Connector.....2.1 mm male panel mt jack, center pin + (positive)
Use Switchcraft (S761K) screw-down, 2.1 mm female power plug.
Power Consumption. –TCD26, 26-14, 46..... < 10 Watts
Power Consumption. –TCD86..... < 40 Watts

Physical

Chassis-TCD-26R - L-19.0”/48.3cm H -3.5”/8.9cm D-6.5”/16.5cm
Chassis-TCD-26 -14 - L-13.65”/34.7cm H -3.47”/8.8cm D-6”/15.25cm
Chassis-TCD-46 – L-25.25”/64.1cm H – 7.625”/19.4cm D-4.25”/10.8cm
Chassis-TCD-86 - L-46.75”/119cm H – 12.25”/31cm D-4.5”/11cm
LED Characters - 6 each
TCD-26 - 2.25 in/5.7cm
TCD-26-14 – 2.25 in/5.7c m
TCD-46 – 4 in/10.2 cm
TCD-86 – 7 in/17.8 cm

WEIGHT


- TCD-26 - 4lbs./1.82 kg
- TCD-26-14 – 4lbs./1.82 kg
- TCD-46 – 7.7lbs./3.5kg
- TCD-86 – 26.3lbs./11.8kg

Power Supply Characteristics

Built in output power limiting, over voltage and short circuit protection.
 Input AC fuse protection – internal built in fuse designed to blow if a catastrophic failure occurs.

Caution: No user serviceable parts inside, contact factory for repair or replacement.

Battery.....**Maintenance Free** - Rechargeable Manganese Lithium Coin Cell, 3V, 17mAh Panasonic ML1220

MODEL	Battery
TCD26, TCD26-14 TCD46 TCD86	 3V,17 mAh, Coin Cell Rechargeable Manganese Lithium Panasonic ML1220/V1A





Operating/Storage Temperature & Humidity

- Operating Temperature 0 to +40°C
- Relative Humidity Up to 90% (non condensing @ 25°C)
- Storage Temperature -40 to +70° C
- Relative Humidity Up to 90% (non condensing @ 25°C)

OPTIONS – Special Order

RC200 remote control for counter/timer functions.

Compliance

	<p><u>Models: TCD26, TCD26-14, TCD46</u></p> <p>This equipment has been tested and found to comply with the radiated and line conducted limits for a Class B digital device. These limits are designed to provide reasonable protection against harmful interference in a commercial/residential installation.</p> <p>This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation</p>
	<p><u>Models: TCD26, TCD16-14, TCD46</u></p> <p>Electromagnetic Compatibility 89/336/EEC ; 92/31/EC ; 93/68/EEC ; 2004/108/EC <u>Tested and Conforms to the following EMC standards :</u> EN61000-3-2:2000 (Harmonic Current Emission) EN61000-3-3:1995 + A1:2001 (Voltage Fluctuations & Flicker) EN61000-4-2:2000, ,3,4,5,6,8,11 (ElectroStatic Discharge, RF Immunity, Fast Transient CM, Surge, RF Injection CM, Power Frequency Magnetic Field, Voltage Dips) EN61000-6-3:2001 (EMC Emissions –Generic Commercial) EN55022:1998+A1:2000 +A2:2003 CISPR22</p> <p>Low voltage directive 2006/95/EC <u>Tested and Conforms to the following Safety standards:</u> EN60950-1:2001 (Safety of Information Technology Equipment)</p>
	<p>Waste Electrical and Electronic Equipment Directive (WEEE) 2002/95/EC</p> <p>The TCD time display models are considered WEEE Category 9 (Monitoring and Control Instruments) Equipment as defined by the WEEE Directive and therefore fall within the scope of the WEEE Directive.</p> <p>For more information about Masterclock’s WEEE compliance and recycle program, please visit the Masterclock WEEE/RoHS website at: www.masterclock.com/rohs_compliance.php</p>
	<p>Restriction of the Use of Certain Hazardous Substances Directive 2002/95/EC</p> <p>The RoHS directive covers the same scope of electrical and electronic equipment that are under the WEEE directive, except that Category 8, Medical Devices, and Category 9, Monitoring and Control Instruments, which are under WEEE, are excluded from the RoHS directive.</p> <p>The time display products, <u>Models: TCD26, TCD26-14, TCD46, TCD86</u> fall under the category of Monitoring and Control Instruments Equipment (Category 9 as defined in Annex 1A of WEEE 2002/96/EC Directive) which is excluded from the RoHS directive 2002/95/EC (reference Article 2, paragraph 1) requirements.</p> <p><u>These products are manufactured using lead in the soldering process as allowed for items excluded from the RoHS directive. These units are RoHS Compliant only in that they are excluded from the RoHS directive under Category 9, Monitoring and Control Instruments.</u></p>

LIMITED WARRANTY

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

MC warrants the TCD-26R, TCD-26-14, TCD-46, and TCD-86 against defects in materials and workmanship for a period of one year 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 installation or 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.