MEINBERG
FUNKUHREN

Technical Data

Operating Instructions

TCR509

Incl. Software TCRMON

Impressum

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Introduction

In the early 1950's the use of coded timing signals for correlation of data began to take on widespread importance. Especially the U.S space and missile programs were the forces behind the development of new time codes. The definition of time code formats was completely arbitrary and left to the individual ideas of each design engineer. Hundreds of different time codes were formed, some of which were standardized by the "Inter Range Instrumantetion Group" (IRIG) in the early 60´s.

Exept these IRIG-Timecodes other formats like NASA36, XR3, 2137 or AFNOR-NFS87500 are still in use. However TCR509 confines to the decoding of IRIG-Codes A133 and B123. A decoding of AFNOR-NFS87500 is available on special request.

Detailed information about IRIG- and other time codes can be found in the "Handbook of Time Code Formats", by Datum Inc., 1363 South State College Boulevard, Anaheim, California 92806-5790.

General

The board TCR509 was designed for the reception of the IRIG code formats A132/A133 and B122/B123, as well as the translation of these received IRIG codes into a serial telegram and a pulse telegram as transmitted by the german time code station DCF77. An automatic gain control allows the reception of signals within an amplitude range from 600mV to 8V (peak to peak). The potential free receiver input is terminated in 50Ohms. TCR509 provides two configurable serial ports (RS232, 1xRS485 on request), a PPS-Signal at TTL-Level, as well as four TTL and four potential free 20mA outputs which can be configured to issue either a PPS-Signal or a DCF77 telegram. A LED-Display indicating time, date and synchronization state is available on request.

Function

The received IRIG telegram is used for synchronization of software clock and buffered real time clock. Every received telegram is checked for its consistency. When detecting an invalid telegram, the software clock is switched into freewheeling mode. A crystal correction value, which is derived from IRIG in synchronous mode, is used to limit the deviation of the time base to about 1us/sec in freewheeling mode. Since IRIG codes do not supply a date information except the day of year, the buffered real time clock keeps a complete date. Every minute the validity of the RTCs date is checked by a day of year comparison. When detecting a mismatch between the day of year calculated from the RTCs date and that received in the IRIG-Telegram, the system clock is switched into freewheeling mode and the DCF simulation is suppressed, though the time base which is used for generating the PPS signal is still synchronized by IRIG. Initial Time and date can be set by a standard Meinberg telegram via serial port COM0. TCR509 can re-calculate **UTC** from received **IRIG-Time** if there are no time zone changeovers (such as daylight saving) performed in the IRIG telegram. Please see Chapter **TCRMON/UTC Offset** for more information.

ATTENTION !

IRIG-Telegrams do not contain any announcement bits for daylight saving changeovers or for the insertion of a leap second. Hence, daylight saving changeovers are performed by TCR509 with a delay of 1 second. In case of the insertion of a leap second, TCR509 switches into freewheling mode and resynchronizes after one minute.

Time Codes Supported (configurable by dip switch SW1-10)

a) A133: 1000pps, amplitude-modulated sinusoidal signal ,
10 kHz carrier frequency, BCD time of year, SBS time of day

b) B123: 100pps, amplitude-modulated sinusoidal signal,
1 kHz carrier frequency, BCD time of year, SBS time of day

a) A132: 1000pps, amplitude-modulated sinusoidal signal ,
10 kHz carrier frequency, BCD time of year

b) B122: 100pps, amplitude-modulated sinusoidal signal,
1 kHz carrier frequency, BCD time of year

Setting into operation

To obtain a correct operation of the TCR509, please pay attention to the following points.

Supply Voltage

The board only needs a single supply voltage of +5V. Source should be able to supply at least 200mA.

Input Signals

The IRIG-A/B signal must be applied to the SMB-Connector. The respective IRIG-Code is selectable by using the dip switch. Please use a shielded or a twisted pair cable.

Configuration of the Board

The time code type as well as the configuration of the serial ports and the pulse outputs can be selected by the dip switch SW1.

IRIG-Mode

The time code type is selected by dip switch SW1-10. Possible formats are A133 and B123. Other formats are available on request.

SW1-10	IRIG-Mode
off	IRIG-B
on	IRIG-A

Serial Port Configuration

Baudrate and framing for each of the both serial ports can be configured seperately by three dip switches.

SW1-1	SW1-2	Baudrate
off	off	19200
on	off	9600
off	on	4800
on	on	2400

Baudrate of serial port COM0

SW1-3	Datenformat
off	8N1
on	7E2

Framing of serial port COM0

SW1-5	SW1-6	Baudrate
off	off	19200
on	off	9600
off	on	4800
on	on	2400

Baudrate of serial port Com1

SW1-7	Datenformat
off	8N1
on	7E2

Framing of serial port COM1

Operating mode of the serial ports

Each of the two serial ports is configurable separately for two operating modes. If the 'per second' mode is selected, the TCR509 automatically issues a Meinberg standard time string at the beginnig of every new second. When selecting the 'on request' mode TCR509 issues a timestring at the beginning of the next second after the character '?' (ASCII-Code 3Fh) was received.

SW1-4	Mode
off	on request
on	once per sec.

Operating mode of serial port COM0

SW1-8	Mode
off	on request
on	once per sec.

Operating mode of serial portCOM1

Configuration of the TTL and 20mA current loop outputs

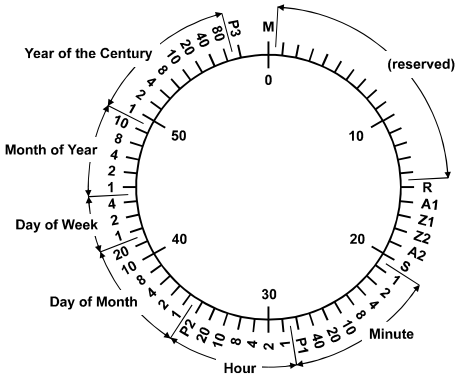
Dip switch SW1-9 selects the mode of the four TTL and current loop outputs.The PPS Signal (TTL) which is provided at VG-Connector (6a, 6c) is not affected from this setting. There you can always find a PPS signal.

SW1-9	Outputs
off	PPS
on	DCF-SIM

Operating mode of the TTL and current loop outputs

The DCF Simulation Mode

In DCF-Simulation mode the TTL and current loop outputs provide a time mark signal similar to the signals transmitted by the german VLF time code transmitter DCF77. Within one minute a complete time code frame is transmitted. Since there are no timezone and leap second announcements in the IRIG time code, these announcement flags (daylight saving flag, leap second flag) are neglected. The generated DCF telegram always contains the time information which is derived from the IRIG Signal and the system clock. When receiving a time code telegram containing a leap second (field sec. is 60) the DCF simulation is turned off for a minute. By this the re-synchronization of all clocks connected to the simulation outputs is enforced. The issued DCF time code frame contains a date information which is derived from the system clock. The validity of the system clock date is ensured by a 'day of year' comparison. In case of an invalid system clock date the DCF simulation is turned off. System clocks initial date can be set via COM0. In case of brown out or power failure a lithium battery guarantees the system clocks operation for at least ten years. (Option: Gold Cap buffering for 150 hours)



M	Start of Minute (0)
R	RF Transmission via secondary antenna (0)
A1	Announcement of a change in daylight saving
Z1, Z2	Time zone identification
	Z1,Z2 = 0,1: Daylight saving disabled
	Z1,Z2 = 1,0: Daylight saving enabled
A2	Announcement of a leap second
S	Start of time code information (1)
P1, P2, P3	Even parity bits

TIME_SYN Output

This TTL-Output, which is provided at the 64Pin VG Connector, turns high as soon as valid time code telegrams are received. Whenever a faulty telegram is detected or the reception fails completely (due to a broken wire e.g.) the TIME_SYN output turns low.

Updating the Firmware

Whenever it is necessarry to upgrade the on-board software, the new firmware can be downloaded using the serial port COM0.

If the /BOOT input, which is available on the 64 Pin VG-Connector, is pulled low during a power up reset, an internal bootstrap-loader is activated and waits for instructions from the serial port COM0. A loader program will be shipped together with the file containing the image of the new firmware. The current fimware is retained in the flash memory until the download program sends a command to erase the flash. So if the boot sequence was initiated erroneously, the program memory is not deleted accidently. The system is ready to go after the next power up.

Replacing the Lithium-Battery

The life time of the lithium battery on the board is at least 10 years. If the need arises to replace the battery, the following should be noted:

ATTENTION!
Danger of explosion in case of inadequate replacement of the lithium battery. Only identical batteries or batteries recommended by the manufacturer must be used for replacement. The waste battery must be disposed as proposed by the manufacturer of the battery.

Specifications

Signal Input:	potential free Impedance 50Ohms also available 600 Ohms
Amplitude:	abt. 600mV...8V peak to peak (Mark)
Supported Time Codes:	IRIG-A133 and IRIG-B123 AFNOR NFS 87-500 on request
PPS-Strobe Accuracy:	+/-5us referred to 'On Time'
Free running mode:	changeover to crystal time base, accuracy abt. 1e-6s/s if decoder was synchronized for at least 1h.
Backup Battery:	The internal hardware clock (RTC) is supplied from a backup battery in case of an operating voltage failure. The lifetime of the Lithium-Battery is at least 10 years.
Security of operation:	hardware watchdog generates a reset in case of brown out. Software watchdog generates reset in case of improper program execution
Initialization:	Initial time and date of hardware clock can be set by a Meinberg standard telegram via serial port COM0.
Pulse Outputs:	one PPS-Output, TTL Level, 200ms length, positive and inverted. four TTL pulse outputs, DCF-Simulation or positive PPS four 20mA current loop outputs, DCF-Simulation or positive PPS
Serial Ports:	two independent RS232 ports
Baud rates:	configurable : 2400Bd, 4800Bd ,9600B,19200Bd
Framing:	configurable: 7E2, 8N1

Serial modes:	per second or on request
Format of serial time string:	Meinberg Standard Telegram
Connectors:	64 Pin VG-Connector Coax RF-Connector (SMB)
Supply voltage:	+5V, abt. 200mA when option 'LED-Display' is installed
Dimensions:	Eurocard 100mm x 160 mm, 1,5mm Epoxy
Ambient Temperature:	0...50°C
Humidity:	max. 85%

CE Label

CE

This device conforms to the directive 89/336/EWG on the approximation of the laws of the Member States of the European Community relating to electromagnetc compatibility.

Format of the Meinberg Standard Time String

The Meinberg Standard Time String is a sequence of 32 ASCII characters starting with the STX (start-of-text) character and ending with the ETX (end-of-text) character. The format is:

<STX>D:*dd.mm.yy*;T:*w*;U:*hh.mm.ss*;*uvxy*<ETX>

The letters printed in *italics* are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

<STX> Start-Of-Text (ASCII code 02h)

dd.mm.yy the current date:

dd	day of month	(01..31)
mm	month	(01..12)
yy	year of the century	(00..99)

w the day of the week (1..7, 1 = Monday)

hh.mm.ss the current time:

hh	hours	(00..23)
mm	minutes	(00..59)
ss	seconds	(00..59, or 60 while leap second)

uv clock status characters:

u: '#' clock has not synchronized after reset
' ' (space, 20h) clock has synchronized after reset

v: different for DCF77 or GPS receivers:

'*' DCF77 clock currently runs on XTAL
GPS receiver has not checked its position

' ' (space, 20h) DCF77 clock is sync'd with transmitter
GPS receiver has determined its position

x time zone indicator:

'U'	UTC	Universal Time Coordinated, formerly GMT
' '	MEZ	European Standard Time, daylight saving disabled
'S'	MESZ	European Summertime, daylight saving enabled

y anouncement of discontinuity of time, enabled during last hour before discontinuity comes in effect:

'!' announcement of start or end of daylight saving time
'A' announcement of leap second insertion
' ' (space, 20h) nothing announced

<ETX> End-Of-Text (ASCII code 03h)

Rear Connector Pin Assignments

Name	Pin	Description
GND	32a+c	Ground
VCC in (+5V)	1a+c	+5V Supply Voltage
P_SEC out	6c	PPS-Signal, TTL-Level, length 200msec
/P_SEC out	6a	PPS-Signal, TTL-Pegel, length 200ms inverted
GEN_TTL1	28c	DCF-Simulation or PPS-Signal, TTL-Level
GEN_TTL2	27a	DCF-Simulation or PPS-Signal, TTL-Level
GEN_TTL3	28a	DCF-Simulation or PPS-Signal, TTL-Level
GEN_TTL4	27c	DCF-Simulation or PPS-Signal, TTL-Level
GEN_OPT1+	23c	DCF-Simulation or PPS-Signal, 20mA Collector
GEN_OPT1-	23a	DCF-Simulation or PPS-Signal, 20mA Emitter
GEN_OPT2+	21c	DCF-Simulation or PPS-Signal, 20mA Collector
GEN_OPT2-	21a	DCF-Simulation or PPS-Signal, 20mA Emitter
GEN_OPT3+	16c	DCF-Simulation or PPS-Signal, 20mA Collector
GEN_OPT3-	16a	DCF-Simulation or PPS-Signal, 20mA Emitter
GEN_OPT4+	17c	DCF-Simulation or PPS-Signal, 20mA Collector
GEN_OPT4-	17a	DCF-Simulation or PPS-Signal, 20mA Emitter
COM0 RxD in	26c	COM0 RS-232 Input
COM0 TxD out	30c	COM0 RS-232 Output
COM1 RxD in	29c	COM1 RS-232 Input
COM1 TxD out	24c	COM1 RS-232 Output
TIME_SYN	19c	synchronization signal, TTL-Level, active high
/BOOT	4a	Boot-Input, Starts the bootstrap-loader
Reserve	10c	Reserved I/O-Pin

Pin Assignment

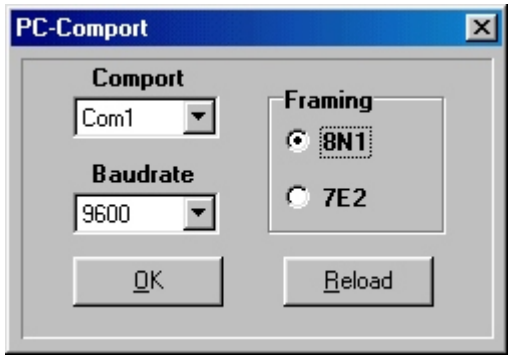
	a	c
1	VCC in (+5V)	VCC in (+5V)
2		
3		
4	/BOOT	
5		
6	/P_SEC	P_SEC
7		
8		
9		
10		Reserve
11		
12		
13		
14		
15		
16	GEN_OUT3-	GEN_OUT3+
17	GEN_OUT4-	GEN_OUT4+
18		
19		TIME_SYN
20		
21	GEN_OUT2-	GEN_OUT2+
22		
23	GEN_OUT1-	GEN_OUT1+
24		COM1 TxD
25		
26		COM0 TxD
27	GEN_TTL2	GEN_TTL4
28	GEN_TTL3	GEN_TTL1
29		COM1 RxD
30		COM0 RxD
31		
32	GND	GND

Diskette with Software TCRMON

The Program TCRMON.EXE

The program TCRMON was designed to monitor and control all functions of the Meinberg IRIG-Time Code Reader TCR509. TCRMON is executable in a Win9x and WinNT environment. To install TCRMON just start Setup.exe from the enclosed Disk and follow the instructions of the installation program.

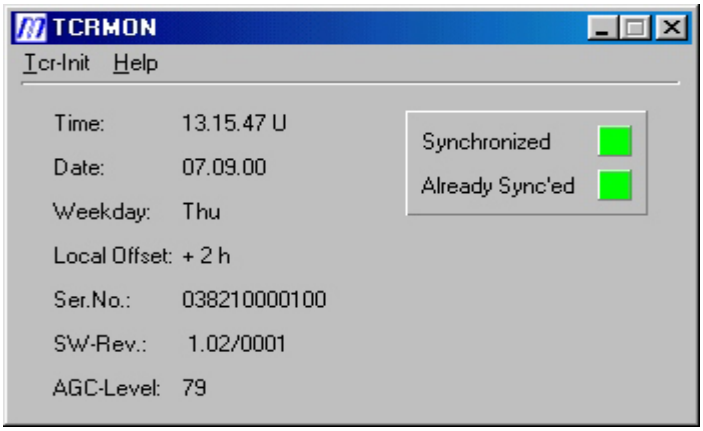
To obtain a connection between your PC and TCR509 connect the IRIG Readers serial port **COM0** to a free serial port of your host PC. Selected comport of your PC as well as used baudrate and framing can be adjusted by means of menu **TCR-Init/PC-Comport**. Furthermore the mode of TCRs serial port COM0 must be set to **STRING_PER_SEC.**



If the PC-Comport parameters have been changed accidently, the user can reload the old values by clicking the **RELOAD** button, as long as the **OK** button has not been pushed

The Main Window

The main window provides an overview of all essential data like time, date, etc.



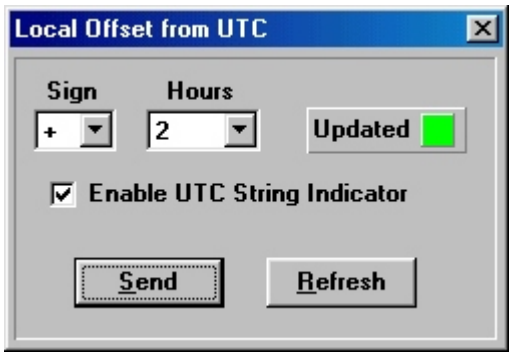
Time,Date,Weekday:	Show time, date and day of week. The displayed time is extended by a 'U' if the serial timestrings UTC-Timezone identifier is enabled.
Local Offset:	Shows the offset from local time to UTC
Ser. No.:	Displays the connected boards serial number
SW.Rev.:	Displays the connected boards firmware revision
AGC-Level:	Level of the TCR's automatic gain control. 0 correspons lowest, 255 highest gain.
Led Synchronized:	This field turns red if TCR509 is running in freewheeling mode. It turns green in synchronous mode.
Led Already Sync'ed:	Shows whether the timecode reader was able to synchronize after a power up reset (green)

Setting the TCRs Initial Time and Date

To set the TCR509's on board battery buffered real time clock, the submenu **Set Initial Time** which can be found in menu **TCR-Init** must be selected. Host PCs time and date are transferred into the IRIG-Receivers RTC, when the appearing pop up box is confirmed

Setting the local Offset from UTC

The Timecode receiver TCR509 is able to re-calculate UTC from the received IRIG-Time, on condition that there are timezone changeovers, such as daylight saving e.g., performed in the IRIG-Telegram. To carry out this re-calculation TCR509 needs to know the offset from local time to UTC. When selecting the topic **Local Offset** from the Menu **TCR-Init** the following window pops up.



The field **Sign** determines whether the local Offset is added or subtracted from UTC to obtain the local time. (ann.: this example shows the offset for central european summer - time). The value of the offset given in hours is entered in field **Hours**. In the example shown above, an offset of two hours is added to UTC to get the local time. Thus TCR509 will subtract two hours from the received IRIG Telegram to obtain UTC. Checkbox Enable UTC String Indicator selects whether the UTC Identifier shall appear in the issued timestrings. (s. Chapter **Format of Standard Meinberg Timestring**). When using a Meinberg-Driver to synchronize a PC, the correct UTC offset must be entered and the UTC identifier must be enabled.

Menu Help

This window shows information about the current release of TCRMON and the system ressources.