GEN170

Impressum

Meinberg Funkuhren GmbH & Co. KG
Lange Wand 9
D-31812 Bad Pyrmont

Telefon: +49 (0) 52 81 / 9309-0
Telefax: +49 (0) 52 81 / 9309-30

Internet: **http://www.meinberg.de**
Email: **info@meinberg.de**

17. November, 2008

Index

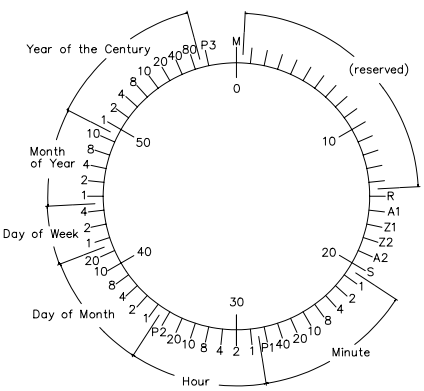
General Information about DCF77

The long wave transmitter DCF77 is installed in Mainflingen near Frankfurt/Germany and transmits the reference time of the Federal Republic of Germany. This is either the Central European Time (Mitteleuropäische Zeit, MEZ) or the Central European Summer Time (Mitteleuropäische Sommerzeit, MESZ). The transmitter is controlled by the atomic clock plant at the Federal Physical Technical Institute (PTB) in Braunschweig/ Germany and transmits the current time of day, date of month and day of week in coded second pulses. Once every minute the complete time information is available. The highly accurate 77.5 kHz carrier frequency of DCF77 is modulated in both amplitude and phase.

At the beginning of every second the amplitude of the carrier frequency is lowered by 75% for a period of 0.1 or 0.2 sec. The length of these time marks represent a binary coding scheme using the short time mark for logical zeroes and the long time mark for logical ones. The information on the current date and time as well as some parity and status bits can be decoded from the time marks of the 15th up to the 58th second every minute. The absence of any time mark at the 59th second of a minute signals that a new minute will begin with the next time mark.

The amplidude modulation can be easily decoded by a simple receiver circuit. However, decoding the phase modulation achieves much more accuracy but also requires much larger efforts including usage of correlation techniques.

Figure: Decoding Scheme



M	Start of Minute (0.1 sec)
R	RF Transmission via secondary antenna
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 (0.2 sec)
P1, P2, P3	Even parity bits

GEN170

GEN170 Overview

The time code generator GEN170 has been designed to generate all signals required to control or simulate a DCF77 compatible long wave transmitter, or provide the reference time for an NTP server:

- o 77.5 kHz carrier frequency
- o second marks to modulate the carrier's amplitude
- o PRN sequence and PRN window to modulate the carrier's phase
- o Pulse-per-Second (PPS) output

Additionally, an IRIG or AFNOR time code signal is generated, and a serial time string can be transmitted which includes the generated absolute date and time.

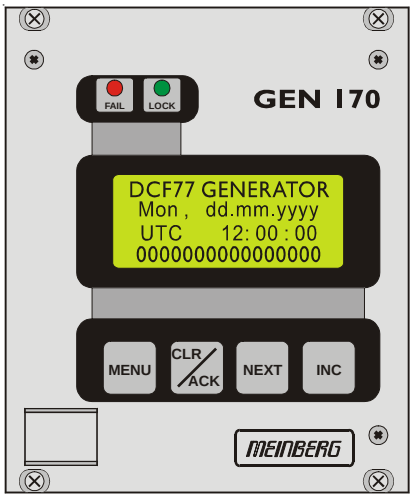
All signals are derived from a single 10 MHz reference frequency. That frequency can either be generated by a high quality on-board oscillator, or it can be supplied externally. The frequency source is selected by a jumper on the printed circuit board. The leading edge of the second marks can be synchronized by an external PPS input signal.

Internal date and time is always based on UTC (Universal Time, Coordinated; formerly GMT, Greenwich Mean Time). A configurable time offset can be applied to the UTC time base to compute a local standard time. Beginning and end of a period of daylight saving time can either be computed year by year based on a simple, configurable algorithm, or can be configured for the current year. GEN170 generates the proper changeover announcement flags as required by the DCF77 coding scheme.

Additionally, a date for insertion of a leap second can be configured. Actually, leap seconds are only inserted at UTC midnight. GEN170 automatically generates the coding sequences to announce the leap second as required for DCF77 and NTP, and also inserts the leap second correctly.

16 TTL level inputs are provided to configure the length of the AM marks transmitted in seconds 0 through 15 of a minute in DCF77 emulation. These second marks are reserved by the PTB and are igno*red by most DCF77 receivers.

The GEN170 Front Panel Layout



FAIL LED and LOCK LED

The red LED labeled FAIL is turned on after power-up and stays on until the current time has either been acknowledged via the ACK key in the front panel, or the time has been set via the serial interface. The green LOCK LED reflects the generated DCF77 compatible AM time marks.

LC Display

The 4 x 16 character LC display is used to show the system's time and status and let the user edit parameters. The keys described below let the user select the desired menu. The next chapter lists all available menus in detail. A quick reference of the available menus and submenus can be found at the end of this document.

MENU Key

This key lets the user step through several display menus showing specific data.

CLR/ACK Key

This key has to be used when parameters are to be modified. When this key is pressed the parameters that have been edited are saved in the battery buffered memory. If the menu is left without pressing CLR/ACK all changes are discarded.

NEXT Key

When editing parameters (LCD cursor is visible) this key moves the cursor to the next digit rsp. to the next parameter to be edited. If the current menu just displays data (cursor not visible) pressing this key switches to a submenu (if available).

INC Key

When editing parameters this key increments the digit or letter at the cursor position.

The Menus in Detail

Root Menu

The root menu is shown when the receiver has completed initialization after power-up. During power-down the current date and time are kept in a battery buffered on-board real time clock (RTC), so after power-up the initial calendar date and time should be fairly correct. However, the red FAIL LED is on and a message is displayed asking to acknowledge the initial time:

```
ACK TO CONFIRM
Mon,   dd.mm.yyyy
UTC    12:00:00
0000000000000000
```

Unless the initial time is acknowledged by either pressing the CLR/ACK key in the front panel or by setting the initial time via the RS-232 serial port the device stays in state “unsynchronized“. This is to prevent the device from starting to distribute a wrong time after power-up, which could otherwise happen due to interferences between an incoming PPS pulse and the second changeover of the built-in RTC chip.

Once the initial time has been acknowledged the main menu is displayed. The first line simply shows the module's function:

```
DCF77 GENERATOR
Mon,   dd.mm.yyyy
UTC    12:00:00
0000000000000000
```

The next two lines display the current day of week, date, the name of the time zone (just informational, as defined in the setup menu), and local time. The last line shows, from left to right, the input levels of the control lines for the AM second marks 0 through 15. If a '1' is displayed a long time mark is generated at the corresponding second of a minute, if a '0' is displayed, there will be a short mark at the corresponding second.

If the NEXT key is pressed in this menu, the display shows the module's firmware version:

```
Meinberg   GEN170

Rev. 1.01
```

Menu SETUP

From this menu, one of the configurable parameters can be selected using the NEXT key. When the CLR/ACK key is pressed, a submenu is displayed which lets the user view or modify the selected parameter. In each of these submenus the NEXT key lets the cursor move to the next digit or letter to be edited whereas the INC key increments the digit or letter under the cursor. If changes have been made, the CLR/ACK key must be pressed in order to save those changes in the battery buffered memory, otherwise all changes are discarded when the user presses the MENU key in order to return to the SETUP display.

SETUP INITIAL TIME

```
SETUP

SET INITIAL TIME
```

```
SET INITIAL TIME
      UTC
Date:      dd.mm.yyyy
Time:      12 : 00 : 00
```

Using this menu, GEN170's on-board real time clock can be set. When finally the CLR/ACK button is pressed the system date and time is set to the values shown in the display.

ADJUST SECONDS

If the system time differs by some seconds from an external reference time, this menu can be used to adjust the internal clock to the reference time. The second and third lines of the display show the system date and time, enabling the user to compare it to the external time. The last line includes the two fields SEC+ and SEC-. The NEXT key can be used to position the cursor on one of these fields. Each time the CLR/ACK key is pressed, the system time is adjusted by one second: If the cursor is positioned on the SEC+ field, the time is incremented by one second, otherwise it is decremented.

```
SETUP

ADJUST SECONDS
```

```
ADJUST SECONDS
Wed,   dd.mm.yyyy
 MEZ    12:00:00
SEC +          SEC -
```

SETUP TIME ZONE

This menu lets the user enter the names of the local time zone with daylight saving disabled and enabled, together with the zones' time offsets from UTC. The left part of the display shows the zone and offset if daylight saving is off whereas the right part shows name and offset if daylight saving is on. These parameters are used to convert UTC to local time, e.g. MEZ = UTC + 1h and MESZ = UTC + 2h for Central Europe. The zone names are just informational and shown in the LC display. The range of date daylight saving comes in effect can be entered using the next two topics of the setup menu.

```
SETUP

TIME ZONE
```

```
TIME ZONE
OFF<-DAYL SAV ->ON
MEZ                MESZ
+01:00h          +02:00h
```

SETUP DAYLIGHT SAV ON/OFF

The two topics let the user enter the range of date for daylight saving to be in effect. Concerning parameter input both topics are handled identically, so they are described together in this chapter. Beginning and end of daylight saving may either be defined by exact dates for a single year or using an algorithm which allows the device to recompute the effective dates year by year. The figures below show how to enter parameters in both cases. If the number of the year is displayed as wildcards ('*'), a day-of-week must be specified. Then, starting from the configured date, daylight saving changes the first day which matches the configured day-of-week. In the figure below March 25, 1996 is a Monday, so the next Sunday is March 31, 1996. If the number of the year is not displayed as wildcards then the complete date exactly determines the day daylight saving has to change (March 31, 1996 in the figures below), so the day-of-week doesn't need to be specified and therefore is displayed as wildcards.

```
SETUP

DAYLIGHT SAV ON
```

```
DAYLIGHT SAV ON
Date:        31.03.1996
Day of week:        ***
Time:          2 : 00 : 00
```

```
DAYLIGHT SAV ON
Date:        25.03.****
Day of week:       Sun
Time:          2 : 00 : 00
```

```
SETUP

DAYLIGHT SAV OFF
```

```
DAYLIGHT SAV OFF
Date:        27.10.1996
Day of week:        ***
Time:          3 : 00 : 00
```

```
DAYLIGHT SAV OFF
Date:        25.10.****
Day of week:       Sun
Time:          3 : 00 : 00
```

SETUP LEAP SECOND

This menu can be used to enter the date of a leap second insertion. In order to adjust the world wide time (UTC) to the earth rotation, the International Earth Rotation Service (IERS) announces when a leap second must be inserted into the UTC time scale. The IERS prefers to insert a leap second after 23:59:59 UTC on December, 31 or on June, 30, if necessary.

```
SETUP

LEAP SECOND
```

```
LEAP SECOND
UTC
Date:      dd.mm.yyyy
Time:        12.00.00
```

SETUP SERIAL PORT PARM

Using this topic the user can enter transmission speed and framing of the serial ports. Default parameters are:

COM0: 19200 baud, 8N1
COM1: 9600 baud, 8N1

```
SETUP

SERIAL PORT PARM
```

```
SERIAL PORT PARM
COM 0:  19200  8N1
COM 1:   9600  8N1
```

SETUP SER. STRING TYPE

This menu lets the user select the time string formats sent via the serial ports. As of this writing the GEN170 supports sending the Meinberg standard string only on both ports.

```
SETUP

SER. STRING TYPE
```

```
SER. STRING TYPE
COM 0:  Meinbg Std
COM 1:  Meinbg Std
```

SETUP SERIAL OUTPUT

This menu lets the user select the serial ports' mode of operation. COM0 transmits the current date and time using Meinberg's standard string. This string can be sent automatically once per second, once per minute or on request by ASCII '?' only.

```
SETUP
SER. OUTPUT
```

```
SER. OUTPUT
COM 0:  Per  Second
COM 1:  Per  Second
```

SETUP TIMECODE OUT

This menu lets the user configure the card's IRIG/AFNOR time code output. The CODE: parameter selects the desired code frame format (IRIG or AFNOR), and the TIME: parameter determines whether the transmitted code should carry UTC, or local time.

```
SETUP
TIMECODE OUT
```

```
TIMECODE OUT
CODE:  B002 + B122
TIME:  UTC
```

Since most time code formats do neither include the UTC offset of the transmitted time, nor a flag which reports the current DST status, the recommended setting is UTC in order to avoid unexpected time steps of the connected time code receivers.

```
TIMECODE OUT
CODE:  IEEE1344
TIME:  UTC EN_T
```

The IEEE1344 signal frame also contains a Time Figure Of Merit (TFOM) flag which reflects whether the time code generator is synchronized, or not. If the IEEE1344 code is selected then an additional parameter is displayed in the lower right corner which determines whether the TFOM flag reports the real current synchronization status (EN_T), or whether it always reports the generator was synchronized (DI_T). The latter setting can be useful in testing scenarios.

INIT USER PARMS

This menu lets the user reset all configurable parameters to default values. Before initialization is done, the user must press CLR/ACK once more to acknowledge.

```
SETUP

INIT USER PARMS
```

```
Are you sure ?
Press...
CLR/ACK  –> YES
   MENU  –> NO
```

Resetting Factory Defaults

If both the NEXT key and the INC key on the front panel are pressed while the system is powered up the battery buffered memory is cleared and user definable parameters are reset to factory defaults. The key should be held until the root menu is displayed on LCD.

Attention: If the GEN170 module is assembled as one part of a larger equipment then the default parameters may not be appropriate for the rest of the equipment. Please check the new settings and make sure they match the settings required for the complete system.

Firmware Updates

Whenever the on-board software must be upgraded or modified, the new firmware can be downloaded to the internal flash memory via the serial port COM0. There is no need to open the metal case and insert a new EPROM.

If the MENU key on the front panel is pressed while the system is powered up, a bootstrap-loader is activated and waits for instructions from the serial port COM0. The new firmware can be uploaded from any standard PC with serial interface. A loader program will be shipped together with the file containing the image of the new firmware.

The contents of the program memory will not be modified until the loader program has sent the command to erase the flash memory. So if the MENU key is pressed unintentionally while the system is powered up, the firmware will not be changed accidentally. After the next power-up the system will be ready to operate again.

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 (depending on clock type):

u: '#' GPS: clock is running free (without exact synchr.)
PZF: time frame not synchronized
DCF77: clock has not synchronized after reset

' ' (space, 20h)
GPS: clock is synchronous (base accuracy is reached)
PZF: time frame is synchronized
DCF77: clock has synchronized after reset

v: '*' GPS: receiver has not checked its position
PZF/DCF77: clock currently runs on XTAL

' ' (space, 20h)
GPS: receiver has determined its position
PZF/DCF77: clock is syncronized with transmitter

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

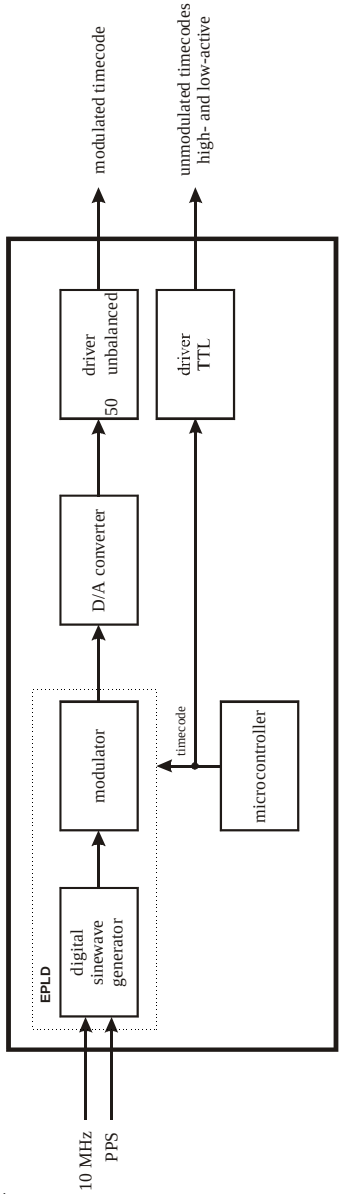
<ETX> End-Of-Text (ASCII code 03h)

Time code

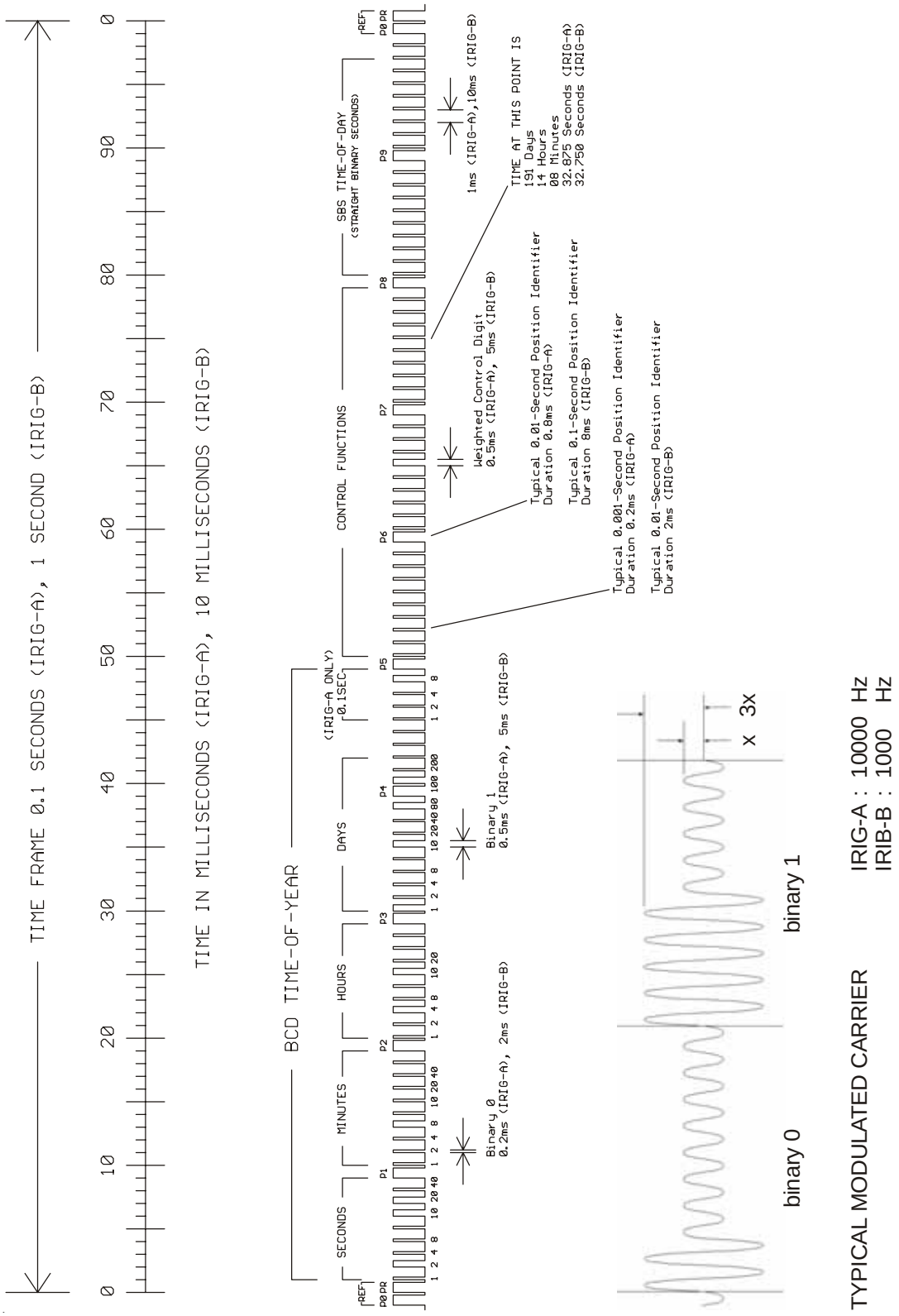
Principle of Operation

The Board GEN170 has been designed for the generation of IRIG, AFNOR and IEEE1344 standard time codes. Apart from the digitally generated amplitude-modulated code, it also provides the unmodulated DC-Level shift code. The modulated sine wave carrier and the board´s internal time pattern are derived from the radio clock´s disciplined oscillator.

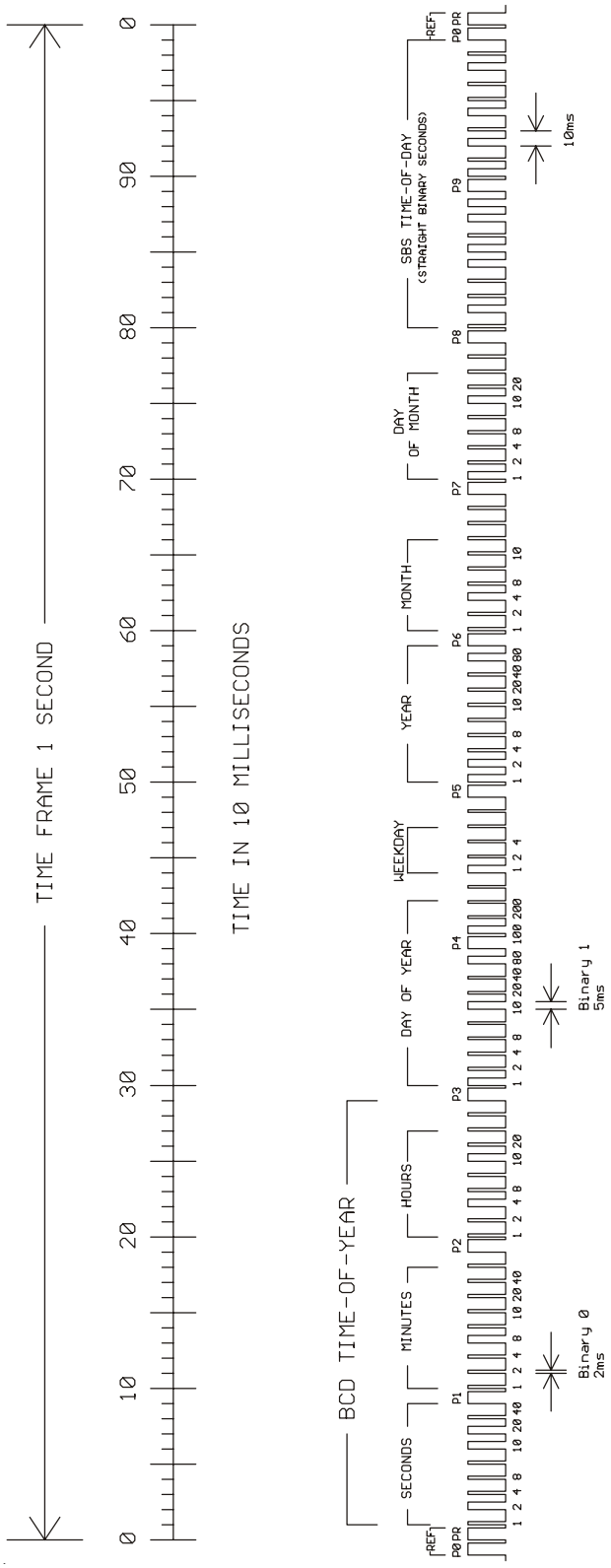
Block Diagram Time code



IRIG Standard Format



AFNOR Standard Format



Assignment of CF Segment in IEEE1344 mode

Bit No.	Designation	Description
49	Position Identifier P5	
50	Year BCD encoded 1	low nibble of BCD encoded year
51	Year BCD encoded 2	
52	Year BCD encoded 4	
53	Year BCD encoded 8	
54	empty, always zero	
55	Year BCD encoded 10	high nibble of BCD encoded year
56	Year BCD encoded 20	
57	Year BCD encoded 40	
58	Year BCD encoded 80	
59	Position Identifier P6	
60	LSP - Leap Second Pending	set up to 59s before LS insertion
61	LS - Leap Second	0 = add leap second, 1 = delete leap second [1.)]
62	DSP - Daylight Saving Pending	set up to 59s before daylight saving changeover
63	DST - Daylight Saving Time	set during daylight saving time
64	Timezone Offset Sign	sign of TZ offset 0 = '+', 1 = '-'
65	TZ Offset binary encoded 1	Offset from IRIG time to UTC time. Encoded IRIG time plus TZ Offset equals UTC at all times !
66	TZ Offset binary encoded 2	
67	TZ Offset binary encoded 4	
68	TZ Offset binary encoded 8	
69	Position Identifier P7	
70	TZ Offset 0.5 hour	set if additional half hour offset
71	TFOM Time figure of merit	time figure of merit represents approximated clock error. [2.)] 0x00 = clock locked 0x0F = clock failed
72	TFOM Time figure of merit	
73	TFOM Time figure of merit	
74	TFOM Time figure of merit	
75	PARITY	parity on all preceding bits incl. IRIG-B time

[1.)] current firmware does not support deletion of leap seconds

[2.)] TFOM is cleared, when clock is synchronized first after power up. *see chapter Selection of generated timecode*

Generated Time codes

Besides the amplitude modulated sine wave signal, the board also provides unmodulated DC-Level Shift TTL output in parallel. Thus six time codes are available.

a) B002: 100pps, PWM DC signal, no carrier
BCD time of year

b) B122: 100pps, AM sine wave signal, 1 kHz carrier frequency
BCD time of year

c) B003: 100pps, PWM DC signal, no carrier
BCD time of year, SBS time of day

d) B123: 100pps, AM sine wave signal, 1 kHz carrier frequency
BCD time of year, SBS time of day

e) B006: 100pps, PWM DC signal, no carrier
BCD time of year, year number (0...99)

f) B126: 100pps, AM sine wave signal, 1 kHz carrier frequency
BCD time of year, year number (0...99)

g) B007: 100pps, PWM DC signal, no carrier
BCD time of year, SBS time of day, year number (0...99)

h) B127: 100pps, AM sine wave signal, 1 kHz carrier frequency
BCD time of year, SBS time of day, year number (0...99)

i) AFNOR: Code according to NFS-87500, 100pps,
AM sine wave signal, 1kHz carrier frequency,
BCD time of year, complete date, SBS time-of-day,
Signal level according to NFS-87500

j) IEEE1344: Code according to IEEE1344-1995, 100pps,
AM sine wave signal, 1kHz carrier frequency,
BCD time-of-year, SBS time of day, IEEE1344
extensions for date, timezone, daylight-saving
and leap second in control functions (CF) segment.
see also table 'Assignment of CF segment in IEEE1344 mode'

Selection of Generated Time Code

The time code to be generated can be selected by Menu Setup TIMECODE OUT. DC-Level Shift Codes (PWM signal) B00x and modulated sine wave carrier B12x are always generated simultaneously. Both signals are provided at the VG64-Connector, i.e. if code B122 is selected also code B002 is available. This applies for the codes AFNOR NFS 87-500 and IEEE1344 as well.

The TFOM field in IEEE1344 code is set dependent on the 'already sync'ed' character ('#') which is sent in the serial time telegram. This character is set, whenever the preconnected clock was not able to synchronize after power up reset. The 'time figure of merit' (TFOM) field is set as follows.

Clock synchronized once after power up	:	TFOM = 0000
Clock <u>not</u> synchronized after power up	:	TFOM = 1111

For testing purposes the output of TFOM in IEEE1344 mode can be disabled. The segment is then set to all zeros.

Outputs

The module GEN170-TC provides modulated and unmodulated (DC-Level Shift) outputs. The format of the time codes is illustrated "IRIG-" and "AFNOR standardformat".

AM Sine Wave Output

The amplitude-modulated carrier is available at the VG connector pin 6a. The carrier frequency depends on the code and has a value of 1 kHz (IRIG-B). The signal amplitude is $3V_{pp}$ (MARK) and $1V_{pp}$ (SPACE) into 50 Ω. The encoding is made by the number of MARK amplitudes during ten carrier waves. The following agreements are valid:

a)	binary "0"	:	2 MARK amplitudes, 8 SPACE amplitudes
b)	binary "1"	:	5 MARK amplitudes, 5 SPACE amplitudes
c)	position-identifier	:	8 MARK amplitudes, 2 SPACE amplitudes

PWM DC Output

The pulse width modulated DC signals labeled "IRIG" and "AFNOR standard format" are coexistent to the modulated output and is available at the VG connector pin 13a with TTL level.

Technical Data

Outputs:

Unbalanced AM sine wave signal:	$3V_{PP}$ (MARK) / $1V_{PP}$ (SPACE) into 50Ω
PWM signal:	TTL (2,5V into 50Ω), active high

Technical Specifications GEN170

LC DISPLAY	:	4x16 character, menu selectable by push buttons	
INPUT SIGNALS	:	1 pps in	pulse per second (TTL level, leading edge)
		10 MHz in	reference frequency (Sine wave) (only if configured for external reference) amplitude V_{eff}: 1 V input impedance: 50 Ohm
OUTPUT SIGNALS	:	10 MHz	reference frequency (TTL level)
		77.5 kHz	carrier frequency (TTL-Pegel)
		AM	second mark (TTL level, active high)
		PZF	PRN sequence (TTL level)
		PZF_CLK	PRN clock (TTL level)
		PZF_WIN	PRN window (TTL level, active high)
		IRIG_AC	modulated IRIG sine wave output
		IRIG_DC	unmodulated IRIG output
		P_SEC	second pulse, duration 200ms (TTL level)
		PPM	minute pulse, duration 200ms (TTL level)
ACCURACY OF PULSES	:	better than ±100 nsec	
ACCURACY OF INTERNAL XTAL	:	1 day:	$\pm 1 \cdot 10^{-7}$
		1 year:	$\pm 5 \cdot 10^{-7}$
		drift with temparature:	$\pm 2 \cdot 10^{-7}$
SERIAL PORT	:	2 asynchronous serial port (RS-232)	
		transmission speed:	300 through 19200
		framing:	7N2, 7E1, 7E2, 8N1, 8N2, 8E1
		default setting:	19200, 8N1

POWER REQUIREMENTS	:	5 V ± 5% @ 300 mA
PHYSICAL DIMENSION	:	19" module in a closed 112mm high x 102mm wide closed aluminium case
FRONT PANEL	:	3U / 21HP (128mm high x 107mm wide), Aluminium
REAR EDGE CONNECTOR	:	according to DIN 41612, type C 64, rows a+c (male)
AMBIENT TEMPERATURE	:	0 ... 60° C
HUMIDITY	:	85% max.

Signal Description GEN170

Name	Pin	Function
GND	32a+c	Ground
VCC in (+5V)	1a+c	+5V supply
Vosc in (+5V)	2a+c	+5V supply
10 MHz out	12a	10 MHz frequency output (TTL level)
2.25MHz out	27c	2,25MHz frequency output (TTL level)
77.5 kHz out	11a	77.5 kHz frequency output (TTL level)
DCF out	8c	AM time marks (TTL level, active high)
PZF_CLK out	10a	PRN clock (TTL level)
PZF_WIN out	7c	PRN window (TTL level, active high)
PZF out	6c	PRN sequence (TTL level)
P_SEC out	14c	pulse once a second, duration 200ms (TTL level)
PPM out	8c	pulse once a minute, duration 200ms (TTL level)
IRIG_AC out	a6	Modulated IRIG sine wave output
IRIG_DC out	a7	Unmodulated IRIG output
10MHz in	4c	10MHz reference input $1V_{eff}$ into 50 Ohm
1 pps in	28c	sync. second (TTL, rising edge)
TTL_INxx in		control inputs for AM marks 0 through 15 (TTL) long AM mark if input is high
COMx TxD out		COMx RS-232 output
COMx RxD in		COMx RS-232 input
/RESET in/out	9c	RESET signal, Open Drain pulled up to +5V
(reserved)		reserved, do not connect

Rear Connector Pin Assignments GEN170

	a	c
1	VCC in (+5V)	VCC in (+5V)
2	Vosc in (+5V)	Vosc in (+5V)
3		
4		10 MHz in
5		
6	IRIG_AC out	PZF out
7	IRIG_DC out	PZF_WIN out
8	PPM	DCF out
9		/RESET in/out
10	PZF_CLK out	
11	77.5 kHz out	
12	10MHz out	
13	TTL_IN0 in	
14	TTL_IN1 in	P_SEC out
15	TTL_IN2 in	reserved 0
16	TTL_IN3 in	reserved 1
17	TTL_IN4 in	reserved 2
18	TTL_IN5 in	
19	TTL_IN6 in	reserved 3
20	TTL_IN7 in	
21	TTL_IN8 in	
22	TTL_IN9 in	
23	TTL_IN10 in	
24	TTL_IN11 in	COM1 TxD out
25	TTL_IN12 in	
26	TTL_IN13 in	COM0 TxD out
27	TTL_IN14 in	2,25MHz out
28	TTL_IN15 in	1 pps in
29		COM1 RxD in
30		COM0 RxD in
31		
32	GND	GND

GEN170 -E- 191108