AV - G 30 TM

Master Time Code Generator

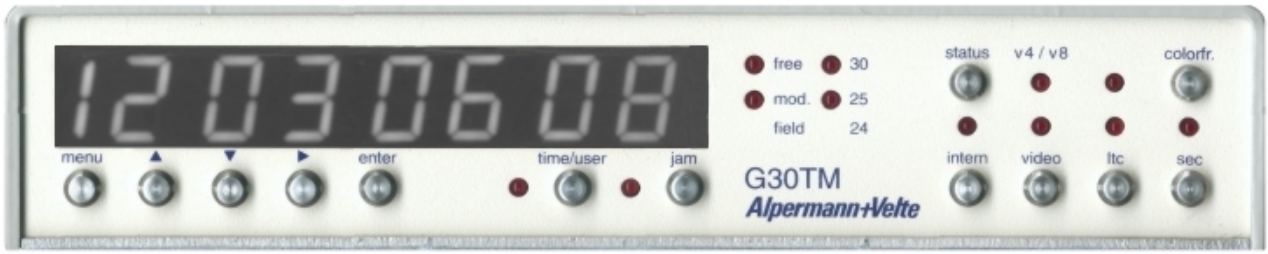


Table of Contents

1. Functions overview

G30TM generates a linear time code (LTC). Optional the vertical interval time code (VITC) module can be plugged. The frames can be adjusted to 24, 25, 30 or 30drop. G30TM generates time code according to the SMPTE standard ANSI/SMPTE 12M-1995 (revision of ANSI/SMPTE 12M-1986) for the television systems 625/50 (PAL) and 525/60 (NTSC).

Time and user information are displayed at the 8-digits front display. Time and user can be preset by key functions or (optional) by external LTC or by receiving real time from a DCF77 or GPS receiver.

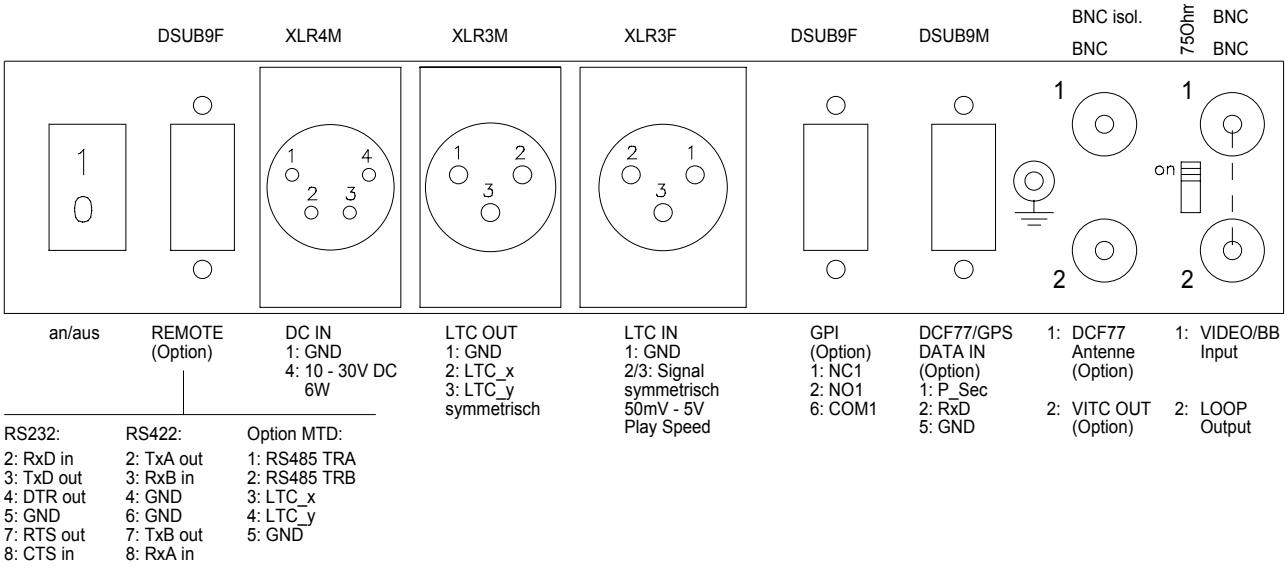
The LTC signal could be phase-locked to internal reference (x'tal, temperature compensated), to a television signal (video, black-burst), to an external LTC source or to a real time seconds pulse.

G30TM is designed to work in video studios and broadcast stations. External synchronising signals pass through special filters, so that any interferences do not affect the time code output. This ensures that the time code is permanently available, continuously up-counting, and without any disturbance even in case of a drop-out of the external synchronising signal. In addition G30TM makes a real time coupling possible. It supplies the information required for the adjustment of the sync pulse generator to be real time locked. The time and date information can be fed into G30TM by a DCF77 or GPS receiver.

The standard unit can be equipped with further optional modules:

- VITC generator: VITC data will be generated identical to the LTC data.
- Serial interface RS232 or RS422: to remote control G30TM and to transfer time and user information.
- Colour lock V4 or V8 (V8 using the colour identification flag at line 7 of a black burst signal).
- LTC reader (normal play speed): reads the 80-bits and the 112-bits code, for jam sync functions, for LTC regeneration, for external genlock, for conversion 112-bits to 80-bits.
- Built-in DCF77 receiver for real time application.
- External DCF77 or GPS receiver for real time application.
- Relay (GPI) for comparator events.
- Option MTD: master unit of the Time Timer Time Code System.

2. Connections at the rear and technical data



Dimensions:	214 (W) x 43 (H) x 262 (D) mm
Weight:	1.5kg approx.
Operating temperature:	5°C to 40°C
Admiss. ambient humidity:	35% to 85%
Power consumption:	without options: typ. 2.88W (e.g. 24V DC, 0.12A) with options REMOTE, LTC IN, colour framing, DCF77: typ. 6W (e.g. 24V DC, 0.25A)
LTC output amplitude:	to adjust manually in the range 35mVpp - 3Vpp
Stability of the frequency (sync=intern.):	approx. 3ppm, adjustable by pot
Option GPI:	relay points, switcher COM1-NC1 (Normally Closed) and COM1-NO1 (Normally Open) max. switchable power: 5W max. switchable current: 175V max. switching current: 0.25A max. transportable current: 1A

GPS/DCF77 DATA INPUT:

P_Sec:	logic signal, seconds clock = leading (positive) or falling (negative) edge according to selection in menu E CLOCK, MODE 1 input low: max. 0.8V input high: 2-15V
RxD:	serial interface (RS232 or low/high as P_Sec) format is fixed: 2400/7/E/2

LTC READER (optional):

Input level:	50mVpp - 5Vpp, balanced
LTC „direction“:	only „forward“, i.e. up-counting (except with MTD option)
Input frequency:	1500-3000 bits/second, i.e. approx.: 19-37 frames/second (80-bit code), 14-26 frames/second (112-bit code).
„Lock“ range with sync = LTC:	frame rate = 24: 24 frames/second +/- 1.4% frame rate = 25: 25 frames/second +/- 1.5% frame rate = 30: 30 frames/second +/- 1.8%

3. Short description of key functions

Key	Description
status	Display shows type of the unit, configuration and software revision (same steps as after power-on).
colorf.	Switching on/off the colour lock (optional).
intern	Select LTC reference = internal.
video	Select LTC reference = genlock to video/black burst.
ltc	Select LTC reference = external LTC source (optional).
sec	Select LTC reference = external real time seconds pulse (optional).
jam	Switching on/off the jam sync function: enables LTC reader and transfers the reader data to the generator according to the menu selections (option).
time/user	Switching the display to show time or user information.
menu	Switching on/off the menu lines.
↑ ↓ → **enter**	Keys to operate in the menu, see description of the menu.

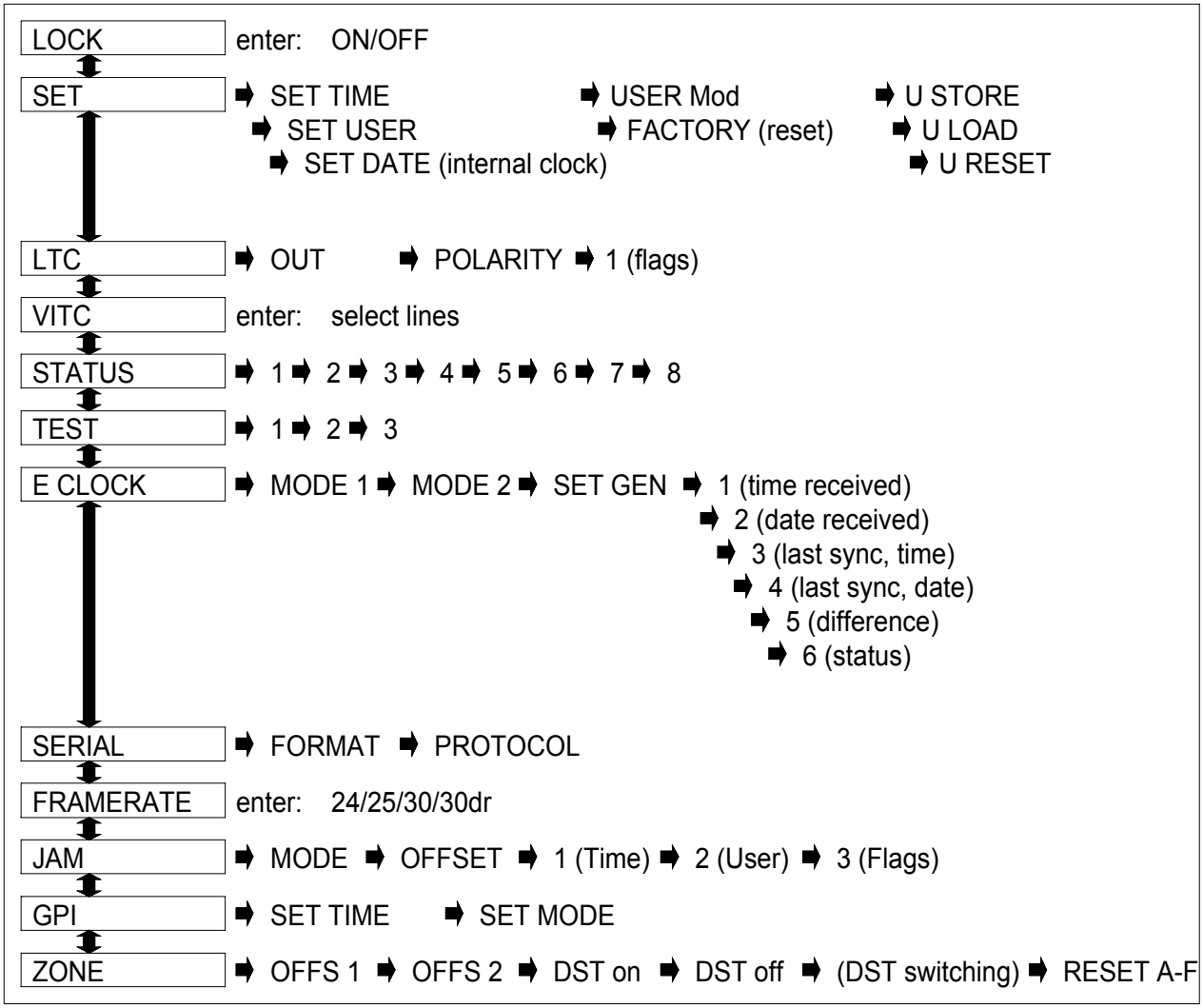
4. Short description of LEDs functions

LED	Description
free	While receiving DCF77/GPS data: LED lights up as long as the receiver is in the free-running mode. While receiving external DCF77/GPS data: LED lights up even if no serial data are received.
mod.	While receiving DCF77/GPS data: LED flashes every second if the DCF77 telegram can be received (version of built-in DCF77 receiver) or if there are serial data coming (GPS or DCF77 receiver externally connected).
field	Version of built-in DCF77 receiver: shows the field strength of the antenna signal.
30	Frame rate = 30 (and television system 525/60). LED lights = 30 non-drop mode, LED flashes = 30 drop frame compensation.
25	Frame rate = 25 (and television system 625/50).
24	Frame rate = 24 (settings for both television standards available).
v4/v8	Indicates the colour lock: lights up if the colour frame flag in the time code is set, that is V4 (4-field) lock is reached in the 525/60 system or V8 (8-field) lock is reached in the 625/50 system.
colorf.	Lights up if colour lock function is selected and V4 or V8 lock is reached. Flashes if colour lock function is selected and no colour lock is reached.
intern	Lights up if internal reference is selected. In case of synchronisation = **sec**: lights up during a coarse trim, i.e. frame 0 of the time code is more than 16ms apart from the real time seconds pulse.
video	Lights up if LTC is referenced to video/black burst. Flashes if the genlock signal is disturbed and the internal reference is currently selected. If the genlock signal returns to be ok the LED will light up again.
ltc	Lights up if the generator is locked to the external LTC signal. Flashes if the genlock is selected but not in lock, because the LTC is not readable or the frequency is not within the specified range. The internal reference is currently selected. If the genlock signal returns to be ok the LED will light up again
sec	Lights up if LTC is referenced to external real time seconds pulse. That only can be achieved if the seconds pulse is stable, i.e. the jitter must not exceed 1.2ms. LED flashes if the signal is disturbed or during a coarse or fine trim. The coarse trim will be indicated by LED **intern** as well. Fine trim means: frame 0 of the time code is not more than 16ms apart from the real time seconds pulse.
jam	Lights up if any jam sync function is selected and LTC can be read. Flashes continuously if any jam sync function is selected and no LTC can be read. Short flashes indicate reader errors because of drop-outs or incompatible frame rate.
time/user	Lights up display shows time of the time code. LED dark display shows user of the time code.

5. Menu overview

Using key **menu** further data can be switched to the display and some functions may be executed. With keys ↑ and ↓ the next „vertical„ line in the menu is reached, with key → all functions present at this vertical line can be reached. Key **enter** executes functions, starts set modes or stores settings.
Pressing key **menu** again the display returns to show the time or user data. Pressing this key during a set mode no new setting will be stored.

If there has been a change to any setting G30TM stores the new data into the non-volatile memory. The display shows **store** during that time, and no key stroke will be acknowledged.



5.1 LOCK

LOCK **off** = the key-lock function is not active.
on = key-lock function is active.
Key-lock function means that all keys except **status**, **menu** and **enter** are without function. So an unintentional key stroke do not lead to an unwanted function. Switch between ON and OFF with key **enter**.

5.2 SET

→ SET TIME:

Press key **enter** to enable the preset of a time value. The last preset value appears at the display. The flashing pair of digits can be set using keys **↑↓,** the next pair can be selected using key →. The allowed range will be 00-23 of the hours, 00-59 of the minutes and seconds, 00-23/24/29 of the frames - dependent on the frame rate. Press key **enter** to start the generator with the preset values and to quit the menu.
Note: during DCF77/GPS operation: the preset mode can be automatically switched off if there is actual a real time take-over, for example during the operating mode „transfer every second".

→ SET USER:

Press key **enter** to enable the preset of a user value. The last preset value appears at the display. The flashing digit can be set using keys **↑↓,** the next digit can be selected using key →. The allowed range will be 0-9 and A-F, i.e. a hexadecimal value. Press key **enter** to set the value in the generator and to quit the menu.
Please note the user mode:

- To enable setting function select *USER Mod* = *0 SET* (see below).
- When user mode is set = *1 DATE,* the user bits are used for the date (see 5.7) with the 6 least significant digits reserved for day, month and year of the internal clock, or the date resp. with DCF77/GPS reception. The two most significant digits will then be freely settable.
- With all other settings of the user mode (2..4) all user bits are reserved for other functions, setting data will be ignored.
- A jam sync function will overwrite the set user data.

→ SET DATE:

Press key **enter** to enable the setting of the date of the internal clock; first the current date is indicated. The flashing pair of digits may be changed pressing the keys ↑↓, the next pair of digits may be selected using the → key. Press **enter** key to take over the value and to quit the menu. Invalid inputs will not be accepted, i.e. pressing the **enter** key will not enable any function.
Please refer to chapter 12 for the functions of the internal clock.

→ USER Mod:

Press key **enter** to select different ways of using the user bits:

0 SET The user bits may be set freely, see **SET USER**.

1 TTT Only with option MTD: the G30TM will at the same time be the master unit of the MTD Time Timer Time Code System. Please refer to the appendix "Option MTD" and "Time Zone Management".

2 DATE The 6 digits of low significance are used for the date, in BCD format: day = „minutes", month = „seconds", year = „frames". The date is set by the internal clock or by the DCF77/GPS reception data, respectively. The year is coded in two digits. The 2 digits of high significance ("hours") may be set freely.

3 STATUS The 6 digits of low significance are used for the date (as with selection = 2); in addition, the 2 digits of high significance contain status information (also refer to chapter 12.4):

Bit(s) Digit 7 („units of hours"):

0 = 1 if the generated LTC time is synchronous to the DCF77/GPS time, i.e. the receiver has to be in sync for take-over.

1+2 = actual time zone:

bit 2	1	
0	0	= UTC
0	1	= CET
1	0	= CEST.

3 = 1 during announcement beginning/end of Daylight Savings Time, at the hour before the switch-over.

Bit(s) Digit 8 („tens of hours"):

0 = 1 during the announcement of a leap second.

1 Y2K flag: =1, if the two digits coded year is less 98, else it is = 0. See "*5 DATE-2*" as well.

2 not used, = 0.

3 not used, = 0.

4 *BBC* All user bits are used for the date, with a special format according to EBU Technical Information I29-1995 (BBC format). The date is BCD-coded and assigned to the user bits as follows:

Digit 1 (BG1)	reserved	bits = 0
Digit 2 (BG2)	units of the day	4 bits, lsb = bit 12
Digit 3 (BG3)	units of the month	4 bits, lsb = bit 20
Digit 4 (BG4)	tens of the day	2 bits, lsb = bit 28
	tens of the month	1 bit = bit 30, bit 31 = 0
Digit 5 (BG5)	reserved	bits = 0
Digit 6 (BG6)	units of the year	4 bits, lsb = bit 44
Digit 7 (BG7)	reserved	bits = 0
Digit 8 (BG8)	tens of the year	4 bits, lsb = bit 60

5 *DATE-2* All user bits are used for the date, in BCD format: day = „hours", month = „minutes", year = "seconds" and „frames". The date is set by the internal clock or by the DCF77/GPS reception data, respectively. The year is coded in four digits, valid from

1998 to 2097. The input of the date (for example by DCF77) may have the year only with two digits, so the following rule applies: with the two digits coded year < 98 the century will be 20, else 19. After power-on the unit starts with the date 1.1.1998.

6 *DATE-3* ... 9 *DATE-6*

There are more „date in user bits“ selections, similar to the selection „*2 DATE“*. The following table summarizes the selections:

2 *DATE*	0 0 D D M M Y Y
6 *DATE-3*	Y Y M M D D 0 0
7 *DATE-4*	0 0 Y Y M M D D
8 *DATE-5*	0 Y Y M M D D 0
9 *DATE-6*	D D M M Y Y 0 0

D D = day, M M = month, Y Y = year. The digits 0 0 may be set freely (**SET - USER**).

→ **FACTORY:**

Press key **enter** to enable a new start of G30TM with the factory settings - see chapter „Factory setting“. The display firstly shows **RESET ==**, a further press at **enter** will execute the reset. This set mode will be finished using key **menu**, ↑, ↓ or →.

→ **U STORE:** with MTD option only. Please refer to MTD option supplement.
→ **U LOAD:** with MTD option only. Please refer to MTD option supplement.
→ **U RESET:** with MTD option only. Please refer to MTD option supplement.

→ returns to **SET**

5.3 LTC

→ **OUT:** LTC output amplitude:
Pressing key **enter** enables the set mode, the present value (in mV) appears. Select a new value using keys ↑↓. Press key **enter** again to store this new setting and to quit the menu.

→ **POLARITY:**
Pressing key **enter** enables to change the mode of using the polarity correction bit of the LTC. Change the mode using keys ↑↓, the display shows **POLA on** or **POLA off**. Press key **enter** again to store this new setting and to quit the menu.
On means: the polarity of the sync word will be stabilised, the polarity correction bit will be put in a state so that every 80-bit word will contain an even number of logical zeros. The polarity correction bit will be bit no. 27 in the 525/60 system, no. 59 in the 625/50 system.

→ **1:** Displays the six flag bits of the generators LTC output. Each flag bit may have the value 0 or 1.
Digit 1 (units of frames) = Bit 10 of LTC
Digit 2 (tens of frames) = Bit 11 of LTC
Digit 3 (units of seconds) = Bit 27 of LTC
Digit 4 (tens of seconds) = Bit 43 of LTC
Digit 5 (units of minutes) = Bit 58 of LTC
Digit 6 (tens of minutes) = Bit 59 of LTC

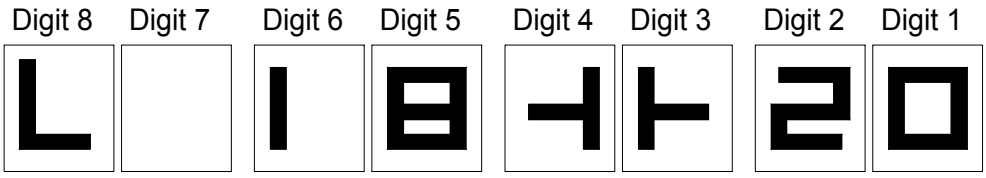
The definition of the flag bits according to ANSI/SMPTE 12M-1995:

bit number	frame rate = 30	frame rate = 25	frame rate = 24
10	drop flag	-	-
11	colour flag	colour flag	-
27	polarity	binary group BGF0	polarity
43	binary group BGF0	binary group BGF2	binary group BGF0
58	binary group BGF1	binary group BGF1	binary group BGF1
59	binary group BGF2	polarity	binary group BGF2

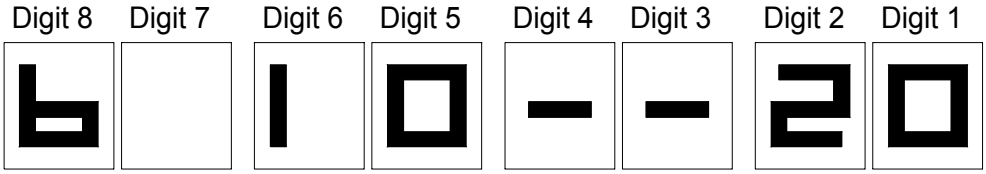
→ returns to **LTC**

5.4 VITC

Only if the VITC board is plugged:
Pressing key **enter** enables to set the VITC lines. The current setting appears. The display shows - if for example LINE mode and lines 18 and 20 is selected:



- or if BLOCK mode and all lines from 10 to 20 are selected:



The flashing digit(s) can be changed using keys ↑↓**,** the next digit can be selected using key →.

Digit 8 may be switched between **L** and **b**, simultaneously the digits 3 and 4 changes:
L = LINE mode, this means max. two lines can be selected for the VITC code insertion. Line 1 have to be <= line 2. If line 1 = line 2 only one VITC line will be selected.
b = BLOCK mode, this means a complete line range can be selected, defined by a starting line (line 1) and an ending line (line 2).

Line 1 or starting line is represented by digits 5-6, line 2 or ending line by digits 1-2. Allowed values are 6-22 in the 625/50 system (PAL) or 10-20 in the 525/60 system (NTSC).

Press key **enter** again to store the whole setting and to quit the menu.
Remember to press key **menu** to quit the menu if the current setting should not be changed.

5.5 STATUS

The display can be switched to show some internal registers and counters:

→ **1:** Internal registers: AWCNTR1 (digits 1-2)
AWCNTR2 (digits 3-4)
ARCNTR1 (digits 5-6)

→ **2:** Display shows efficiency of CPU and some hardware signals:
PORTA (digits 1-2)
PORTB (digits 3-4)
Index for a CPU efficiency (digits 5-6)

→ **3:** Display shows the current value of the internal reference timing:
A 6-digits hexadecimal value, which results after a decimal conversion and a multiplication by 125 in the period of the free-run frequency (in ns).

→ **4:** Display shows a 6-digits error counter (BCD):
Any disturbing event at the external genlock signal counts one up. Reset the counter by switching the synchronisation mode using keys **video**, **ltc** or **sec**.

→ **5:** Display shows a 6-digits error counter (BCD):
Missing of the external genlock signal counts one up. Reset the counter by switching the synchronisation mode using keys **video**, **ltc** or **sec**.

→ **6:** Display shows a 6-digits error counter (BCD):
An interference of the external genlock signal counts one up. Reset the counter by switching the synchronisation mode using keys **video**, **ltc** or **sec**.

→ **7:** Internal registers: SYNMISS (digits 1-2)
EXTTIM (digits 3-4)
CLKFLG+0E (digits 5-6): if sync mode = **sec**: number (hexadec.) x 4 = distance (ms) of frame 0 to P_Sec.

→ **8:** Internal registers: NOBYCMP (digits 1-2), values 0..9
SECCMP (digits 3-4)
RVGCOU (digits 5-6)

→ returns to **STATUS**

5.6 TEST

G30TM can measure and display some signals:

→ **1:** Timing delay between internal and external genlock signal.
The most significant two digits represent milliseconds. Accuracy = +/- 125ns.

→ **2:** Period of the external genlock signal (e.g. sync = **video**: period of the video signal; sync = **ltc**: period of the external LTC). Displays ms in the same way as at 1.

→ **3:** Timing delay between the seconds pulse and the 1. field sync signal.
Display in the same way as at 1 - except the least significant digit most right:
If no colour lock is selected this digit is blank.
In case of colour lock: digit shows the colour field sequence at the **real time** seconds 00, 04, 08... A number 0 identifies the fields 1-2, 1 = 3-4, 2 = 5-6, 3 = 7-8. For the 525/60 system a 0 means: a real time coupling can be achieved with no additional time code correction due to colour lock. For the 625/50 system same applies at number 3 in case of V8 colour lock and at number 1 in case of a V4 colour lock.

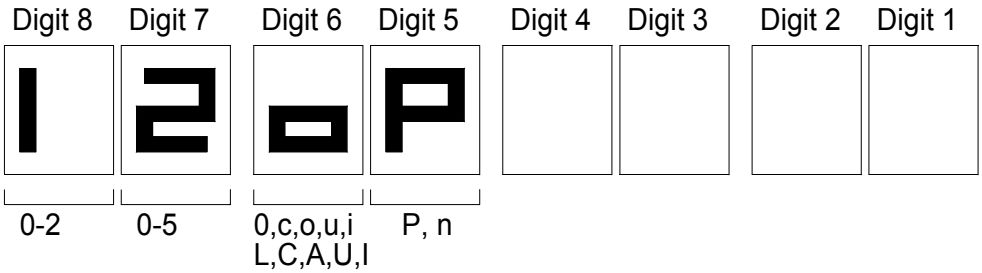
→ returns to **TEST**

5.7 E CLOCK

Displays data and selects the operating mode for „real time“ operation, i.e. with an external GPS or DCF77 receiver as well as with an internal clock.
At lines **Mode 1** and **Mode 2** pressing key **enter** enables to view and change the operating mode regarding the real time. The flashing digit(s) can be changed using keys ↑ ↓, the next digit can be selected using key →. Press key **enter** again to store the whole setting and to quit the menu.
Remember pressing key **menu** to quit the menu if the current setting should not be changed.

Please refer to chapter 12 for important informations on „real time“ operation and explanations of the settings in detail. Settings at menu line **ZONE** defines the time zone.

→ **Mode 1:** Verify and change the operating mode:



Digit 8 shows the power-on mode of G30TM.
0= no time or date setting after power-on, time code starts with 00:00:00:00.
1= setting time/date with the first received data (if the receiver clock is not synchronised, the time will be the one of the free running clock).
2= setting time/date not before the clock has synchronised. This setting is not available for all types of receiver.

Digit 7 shows the normal operation mode - please read chapter 12 carefully.
0= no automatic take-over of time/date - except see digit 6.
1= taking time/date every second.
2= taking time/date once a day at a pre-selected hour (→ **Mode 2**).
3= taking time/date once a week at a pre-selected hour (→ **Mode 2**).
4= taking time/date once a month at a pre-selected hour (→ **Mode 2**).
5= taking time/date once a year at a pre-selected hour (→ **Mode 2**).
If 2...5 has been selected, the „with sync only“ condition has to be selected additionally (→ Mode 2).
→ *Please notice chapter 12.3 as well!* ←

Digit 6 shows additionally to the choice at digit 7 (even if digit 7 = 0) a take-over at a change of the time zone and/or leap second, and will set the internal clock to an automatic Daylight Savings Time switching.
0= no take-over at a time zone change or leap second, automatic Daylight Savings Time switching of the internal clock = **off**.
c= take-over after time zone change has been announced and done by DCF77/GPS, automatic Daylight Savings Time switching of the internal clock = **off**, no take-over after leap second.
o= take-over after time zone change has been announced and done by DCF77/GPS, automatic Daylight Savings Time switching of the internal clock = **on**, no take-over after leap second.

u= the DCF77/GPS time is treated like UTC (without Daylight Savings Time switching), automatic Daylight Savings Time switching of the internal clock = **on**, the time zone is calculated as an offset to UTC, no take-over after leap second.

i= the DCF77/GPS time received has time zone = CET/CEST, but G30TM generates UTC. Automatic Daylight Savings Time switching of the internal clock = **off**, no take-over after leap second.

L= take-over of the DCF77/GPS time after a leap second has been announced and done, no take-over after change of time zone, automatic Daylight Savings Time switching of the internal clock = **off**.

C= as with **c**, but with take-over after leap second.

A= as with **o**, but with take-over after leap second.

U= as with **u**, but with take-over after leap second.

I= as with **i**, but with take-over after leap second.

→ *Please notice chapter 5.12, 12.3 and 12.4 as well!* ←

Digit 5 = choose the correct edge of the seconds pulse „P_Sec“:

P= positive (rising or leading) edge of the signal defines the seconds pulse.
Example: connecting GPS166, GPS167, DCF77 PZF535.

n= negative (falling) edge of the signal defines the seconds pulse.
Example: connecting DCF77 C51.

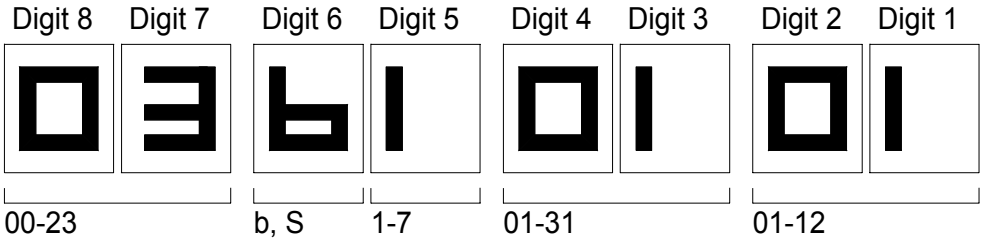
Digit 4 = without function.

Digit 3 = without function.

Digit 2 = without function.

Digit 1 = without function.

→ **Mode 2:** Verify and change the moment of taking the real time data according to the choice at Digit 7, **Mode 1**. The reference time +/- the selected offset (time zone) will be monitored to catch this moment of time.



Digits 8/7 show the hour of taking the data, range **00-23**. This hour will be relevant to the selection at Mode 1 with digit 7 = 2 or 3 or 4 or 5.

Digit 6 determines whether a take-over should only be made with actual synchronisation of the receiver (=**S**), or irrespective of this state, i.e. even with receiver in free running mode (=**b**). If **S** has been selected no take-over will be made if the receiver has not been synchronous during the entire hour. If **b** has been selected the take-over will be made within the first two seconds of the selected hour.

Digit 5 shows the day-of-week of taking the data, range **1-7**, 1 = Monday. This day will be relevant to the selection at Mode 1 with digit 7 = 3, i.e. once a week at this day at the pre-selected hour.

Digits 4/3 show the day of taking the data once a month, range **01-31**. This day will be relevant to the selection at Mode 1 with digit 7 = 4 or 5, i.e. once a month at this day at the pre-selected hour or once a year.

Digits 2/1 show the month of taking the data once a year, range **01-12**. This month will be relevant to the selection at Mode 1 with digit 7 = 5, i.e. once a year at the selected date and the pre-selected hour.

→ **SET GEN**:

Press key **enter** to manually set the time and - if selected - the date of the external clock (+ offset) to the generator.

→ **1:** Switches the display to show the time (+/- offset) of the external clock. This could serve to test the serial interface between the receiver clock and G30TM. Every second the time must update. A blank display indicates that there is no data connection to the receiver.

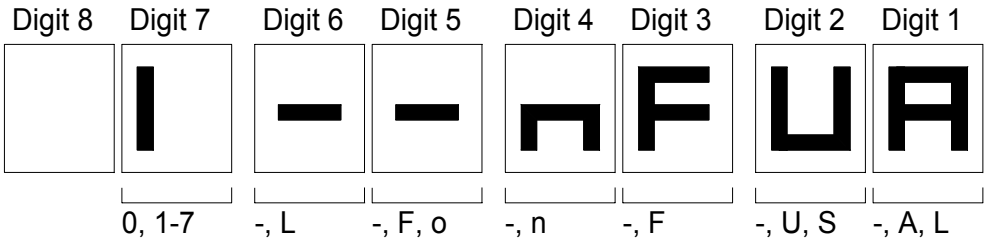
→ **2:** Switches the display to show the date (+/- offset) of the external clock. A blank display indicates that there is no data connection to the receiver.

→ **3:** Switches the display to show the time (hours:minutes:seconds) of the last synchronisation of the receiver clock. This time counts upwards if the receiver clock currently stays in sync. Otherwise this time stops, the receiver clock is in free run mode since the displayed time. Showing 00:00:00 means no synchronisation has been made since last power-on at G30TM, but a date has been stored. A blank display means that G30TM has not detected a synchronisation since the last reset.

→ **4:** Switches the display to show the date of the last synchronisation, see 3. The date is stored in a non-volatile memory, i.e. a control of the reception quality can be made if unit had been switched off only for a short time.

→ **5:** Switches the display to show the difference in time (hours:minutes:seconds) between the time of the LTC and the time of the external clock. In case the difference is >= one hour the display shows FF FF FF.

→ **6:** Switches the display to indicate the status of the GPS/DCF77 receiver:



Digit 7: **1-7** = current day-of-week, 1 = Monday.
0 = receiver does not transfer a day-of-week status.

Digit 6: **L** = the announcement of a leap second has been accepted.
- = no announcement of a leap second internal.

Digit 5: **F** = the announcement of switching off a Daylight Savings Time has been accepted.
o = the announcement of switching on a Daylight Savings Time has been accepted.
- = no announcement of a Daylight Savings Time change.

Digit 4: **-** = external clock receives GPS/DCF77 signals.
n = external clock cannot receive GPS/DCF77 signals.

Digit 3: **-** = external clock is in sync to GPS/DCF77 signals.
F = external clock is in free-running mode.

Digit 2: **-** = time zone CET.
S = time zone CEST.
U = time zone UTC.

Digit 1: **-** = no announcement of a time change-over.
A = announcement of a Daylight Savings Time change-over, one hour before the changing occurs.
L = announcement of a leap second, one hour before the changing occurs.

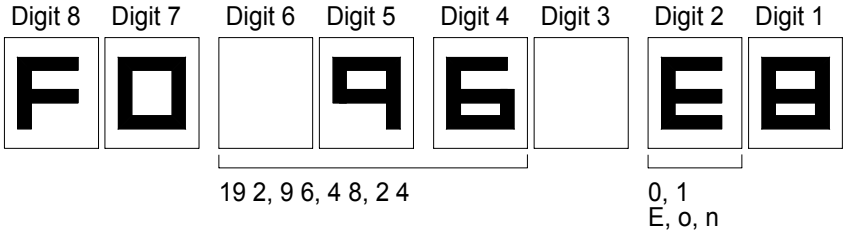
→ **7:** Display indicates day and month for the begin/end of the Daylight Savings Time. These moments of time are relevant for the internal clock and the automatic Daylight Savings Time switching, and are calculated using the set values (see **SET DLS**). Every time the number of the year changes these values will be calculated anew.
Example: 29 03 25 10 = 29th March start, 25th October ending of the Daylight Savings Time.

→ returns to **E CLOCK**

5.8 SERIAL

Only if the serial interface is plugged:

→ **Format:** Pressing key **enter** enables to select the baud rate and the data format. The display switches to (e.g.):



The flashing field can be changed using keys ↑↓, the next field can be selected using key →.

The first field (digits 4-6) indicates the baud rate:

2 4 = 2400
4 8 = 4800
9 6 = 9600
19 2 = 19200.

The second field (digit 2) indicates the use of the parity bit:

0 = parity bit fixed to 0.
1 = parity bit fixed to 1.
E = even parity bit.
o = odd parity bit.
n = no parity bit.

The third field (digit 1) indicates the number of data bits (fixed to 8).
The number of stop bits is fixed to 1.

Press key **enter** again to store the whole setting and to quit the menu.
Remember to press key **menu** to quit the menu if the current setting should not be changed.

→ **Protocol:** Enables to select different data protocols (not used with the standard unit). Chapter 11 describes the data protocol.

5.9 FRAME RATE

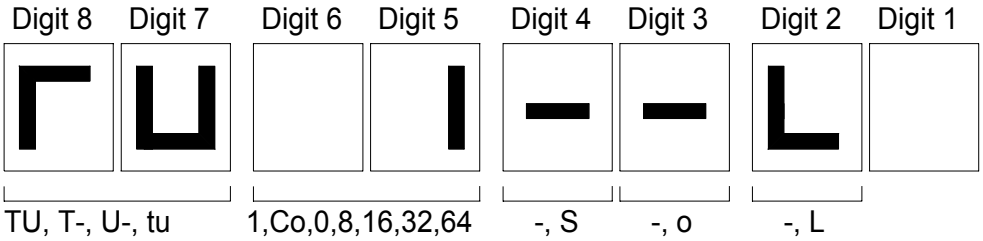
Select the frame rate:
Pressing key **enter** will display the current frame rate and enable a change. Using keys ↑↓ a selection between **24**, **25**, **30**, **30drop** could be done. Press key **enter** again to store the setting and to quit the set mode. The result is indicated by the LEDs as well.

Frame rate = 25 means television system 625/50. This is important regarding VITC, video synchronisation and some time code flag bits.
Frame rate = 30 means television system 525/60. This is important regarding VITC, video synchronisation and some time code flag bits.
Framerate = 24 will automatically switch off the colour lock mode. The internal parameters regarding the video system will be kept, i.e. if the frame rate was 25 before the systems parameter will be the one of the 625/50 system; if the frame rate was 30 before the systems parameter will be the one of the 525/60 system. According to ANSI/SMPTE 12M-1995 the time code flag bits in the 24-frame system should be the one of the 30-frame system.

5.10 JAM

Enables to select the jam sync functions and to display the data of the external LTC. The hardware reader module have to be plugged. For more descriptions see chapter „LTC reader for Jam Sync and external genlock (option)„. At line **Mode** and **OFFSET** pressing key **enter** enables to view and change the operating mode regarding the jam sync. The flashing digit(s) can be changed using keys ↑↓, the next digit can be selected using key → . Press key **enter** again to store the whole setting and to quit the menu.
Remember pressing key **menu** to quit the menu if the current setting should not be changed.

→ **Mode:** Verify and change the jam sync function:



Digits 8/7 indicate the transfer of time and/or user:
TU= time and user jam sync.
T- = only time jam sync, the user of the generator will be left unchanged.
-U = only user jam sync.
tu = cross jam sync: time of the reader LTC will be inserted as user data of the generator.

Digits 6/5 indicates the operating modes: one time jam sync, continuos jam sync, or jam sync with stop.
1 = one time jam sync. After data transfer the jam sync mode will be switched off automatically.
Co = continuos jam sync. In case no LTC can be read the generator will proceed to count upwards for all times.
00 = jam sync with stop. In case no LTC can be read the generator stops counting at once. All output frames contain same information. As soon as LTC can be read again the generator proceeds with the new readers data.
08..64 = jam sync with stop. Same as at **00**, but the generator stops only if there are no reader values for 8..64 frames, so the generator will bridge drop-outs.

Digit 4 indicates a stand-by operation: if the generator stops in a jam sync function, the output LTC can be completely suppressed.
- = no stand-by. If the generator stops LTC will be at the output with all frames having same information.
S = stand-by. If the generator stops the output will be completely quiet.

Digit 3 indicates, whether the offset function is active or not:
- = offset function is switched off.
o = offset function active, i.e. a hours:minutes:seconds:frames offset as selected at **OFFSET** will be added to the time of the reader LTC.

Digit 2 indicates, that the jam sync may be coupled with the genlock function. If sync = **ltc** is selected this function enables a data transfer only if the

generator is locked, i.e. the input LTC must have a frequency within the specified range. If any other synchronisation source is selected this function will not be active.
- = function is switched off.
L = function is switched on.

→ **OFFSET:** verify and change the jam sync offset.
This is a hours:minutes:seconds:frames value which will be added to the time of the reader, the result will be the data to transfer to the generator. The offset function can be switched on and off, see digit 3 of **MODE**. A minus offset - for example minus one frame - will be realised by setting the offset to 23:59:59:24 (if framerate = 25).
The allowed range will be 00-23 of the hours, 00-59 of the minutes and seconds, 00-23/24/29 of the frames - dependent on the frame rate. Press key **enter** to store a new setting and to quit the menu.

→ **1**: Displays hours:minutes:seconds:frames = time of the input LTC.
The reader is switched on during any active jam sync (key **jam**) or if sync = **ltc** is selected. The LTC frequency must lie within the specified range and the time data must have plausible values. This display serves for test purposes only, the values show the reader time without frame compensation or offset calculation.

→ **2**: Displays the user bits of the input LTC, same way as at display 1.

→ **3**: Displays the flag bits of the input LTC (digits 1..6, description see at menu **LTC**, display 1) together with an index of the input speed:
Digit 7 = 0: stop
Digit 7 = 1: slow
Digit 7 = 2: normal play speed
Digit 7 = 3: fast.

5.11 GPI

Settings of the relay function. Requires the corresponding hardware to be built-in. „GPI“ (General Purpose Interface) is a change-over relay. Normally, the contacts between COM1 and NO1 are opened, with trigger they are closed; the contacts between COM1 and NC1 are normally closed, with trigger they are opened.
A switch-over is made after a triggering pulse. The pulse, i.e. the duration of the trigger, may be set within a range between approx. 64ms - 1.28s (+0/-20ms). A trigger will be executed if GPI has been activated and a programmed reference time value has been reached either by the LTC generator, the time A (with „MTD“ option only) or by the time B (with „MTD“ option only).

→ **SET TIME:** Use **enter** key to input the reference value. A time may be set as hours:minutes:seconds, frames are expected as 00. The flashing field may be changed using keys ↑↓, to change to next field press key →. Press **enter** key to save the settings and to quit the menu. Pressing the **menu** key will quit the setting mode at any time without saving the settings made.

→ **SET MODE:** Use **enter** key to display and change the following programming:

1st field = **L**: trigger is made by the LTC generator time.
= **A**: trigger is made by the time A (only with „MTD“ option).
= **B**: trigger is made by the time B (only with „MTD“ option).

2nd field = **0-9**: pulse duration: 0 = 128ms, 1 = 256ms, .., 9 = 1280ms.
Tolerance: +0, -64ms.

3rd field = **on**: GPI enabled, trigger can be made.
= **off**: GPI disabled, no trigger.

The flashing field may be changed using keys ↑↓, to change to next field press key →. Press **enter** key to save the settings and to quit the menu. Pressing the **menu** key will quit the setting mode at any time without saving the settings made.

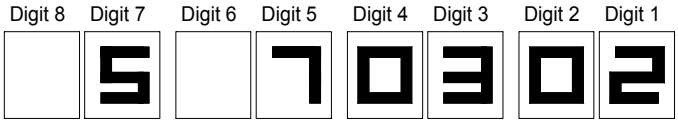
5.12 ZONE

The time zone of the internal clock (= time bits of the LTC) has to be defined, i.e. the offsets regarding the reference time and the moments of switching the Daylight Saving Time (**DST**). The reference time will be delivered from the built-in DCF77/GPS receiver or will be received by serial interface data.

→ **OFFS 1:** Having pressed key **enter** OFFSET 1 will be displayed and can be changed: hours, minutes and sign. The valid range is from -14:59 to +14:59. The sign **P** means plus, **-** means minus. OFFSET 1 will be added/subtracted to/from the reference time during normal time (no DST).

→ **OFFS 2:** Having pressed key **enter** OFFSET 2 will be displayed and can be changed: hours, minutes and sign. The valid range is from -14:59 to +14:59. The sign **P** means plus, **-** means minus. OFFSET 2 will be added/subtracted to/from the reference time during DST.

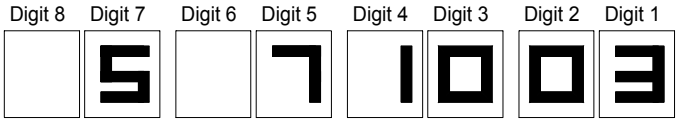
→ **DST on:** Having pressed key **enter** the moment of switching from normal time to DST will be displayed and can be changed:



Digits 1/2: hour, range 01 - 24.
Digits 3/4: month, range 01 - 12.
Digit 5: day of week, 1 = Monday ... 7 = Sunday.
Digit 7: week of month, 1 = first week ... 5 = last week.

Example: with the values above the switching occurs always at the last Sunday in March at 2 o' clock.
The programmed time should correspond to the time of the current time zone or local time = reference time +/- current offset.

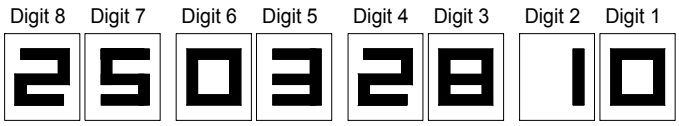
→ **DST off:** Having pressed key **enter** the moment of switching from DST to normal time will be displayed and can be changed:



Digits 1/2: hour, range 01 - 24.
Digits 3/4: month, range 01 - 12.
Digit 5: day of week, 1 = Monday ... 7 = Sunday.
Digit 7: week of month, 1 = first week ... 5 = last week.

Example: with the values above the switching occurs always at the last Sunday in October at 3 o' clock.
The programmed time should correspond to the time of the current time zone or local time = reference time +/- current offset.

→ **(DST switching):** Displays the date of switching within the current year. After having programmed **DST on** and **DST off** it is recommended to verify the date:



This example shows switching from normal time to DST at 25th of March and switching from DST to normal time at 28th of October.

→ **RESET A-F:** Available with option MTD: pressing key **enter** the time zones A ... F will be reset to a standard setting.

Some remarks to the time zone settings:

DST on/DST off:

This gives a formula to calculate the day. The time code generator executes these calculations for the current year and every time, the year or the parameter changes. The result can be checked at the menu line “DST switching”.
A hour = 00 is not valid. If there is any switching (yet not known) at 00, the day before and hour = 24 has to be selected. But basically the time code generator will not switch any date reverse during DST switching. OFFSET 1 and OFFSET 2 and their difference must be reasonable. The following example shows invalid data: OFFSET 1 = +02 and OFFSET 2 = -02 gives a difference of -04 at the moment of DST switching on! So at a switching hour 03 the time code generator will switch to hour 23, but will keep the day!

Reference input (GPS, DCF77) / time zone output suggestions:

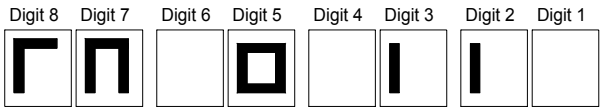
Reference input	**Time zone output and DST automatic**	**Mode: E CLOCK Mode 1 Digit 6**	**Offset 1 Offset 2**
without DST	without DST automatic off	0	Offset 1
without DST	with DST automatic on	u, U	intern clock at normal time: Offset 1 intern clock at DST: Offset 2
with DST	without DST automatic off	i, I	reference at normal time: Offset 1, reference at DST: Offset 2. DST switching parameter must correspond to the switching of the reference time.
with DST	with DST automatic off	0, c, C	Offset 1
with DST	with DST automatic on	o, A	Offset 1 (***1**)

(***1**) Only offset 1 will be added/subtracted to/from the reference input. But for the automatic DST switching offset 2 will be important. The switching generates a time jump equal to the difference between offset 2 and offset 1.
Example: output = input with CET/CEST (Central European Time): set offset 1 = 0 and offset 2 = 1.

6. After power-on

After switching on G30TM the data of the non-volatile memory will be tested. If the test fails the display shows **reset** and the factory values will be stored. If the test passes G30TM will be set into same state as before switching off.
After that the display shows status messages in two steps. At same time all LEDs illuminate for test purposes. Step 1 shows the hardware configuration, step 2 the software configuration.

Step 1 e.g.:

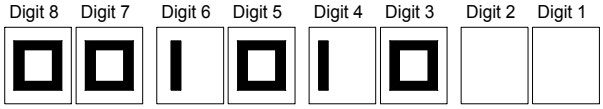


Digits 8 and 7 indicates the type of the unit: G30TM. With option MTD and selected user mode “1 TTT” the display shows “Tt” instead of “TM”.
Digit 5 shows if there are any modules plugged. The number shown is to be read as a hexadecimal number, with following meanings of the single bits:

Bit 0: =1, if VITC generator is plugged.
Bit 1: =1, if serial interface RS232 or RS422 is plugged.
Bit 2: =1, if colour lock module is plugged.
Bit 3: =1, if LTC reader module is plugged.

Digit 4 is blank.
Digits 3 and 2 shows the software revision (e.g. 1.1).
Digit 1 is blank in a standard unit. If there is a special sign this indicates a non-standard unit.

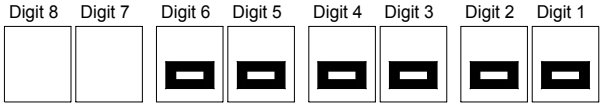
Step 2 e.g.:



Digit 8: =1, if the remote control via serial interface is basically enabled.
Digit 7: =1, if the LTC jam function is basically enabled.
Digit 6: =1, if GPS/DCF77 operation is basically enabled.
Digits 5..3 = blank if digit 6 = 0, else:

Digit 5: indicates the hardware communication method with the GPS/DCF77 receiver.
Digit 4: =0: no use of a real time seconds pulse.
=1: seconds pulse is used, rising edge.
=2: seconds pulse is used, falling edge.
Digit 3: indicates the communication protocol between G30TM and GPS/DCF77 receiver.

With option MTD the parameters of the time zones A ... F will be checked separately. The result of the check will be shown as step 3:



Digit 1 corresponds to time zone A, 2=B , 3=C, 4=D, 5=E, 6=F. „**o“** = parameters ok, „**n“** = parameter check failed, this time zone has been reset to standard values.

7. Synchronisation at „sec„

Press key **sec** to switch on this operating mode. It must be provided that an external clock (DCF77 or GPS receiver) transfers serial data (real time and date) as well as a seconds pulse. These signals are to connect at input GPS/DCF77 DATA. In an application using no television signal this operating mode enables a real time coupling and genlocking of the time code. The selected edge of the seconds pulse synchronises the time code, this may be the rising or the falling edge (see menu E CLOCK, Mode 1, Digit 5).

Having switched on this operating mode the LED **sec** will begin to flash. The generator is locked to internal reference, but this reference will be slightly adjusted to slowly reach the seconds pulse, that is the frame 0 of the time code must be phase-locked to the selected edge of the seconds pulse. This adjustment will again be switched on after a fail of the synchronisation caused by a jitter or a disturbance of the seconds pulse. This method varies the output frequency of the LTC a little bit but avoids a break in frames.

Using a stable seconds pulse with a jitter < 1.2ms the LED **sec** will light up after a while, this means a real phase-lock could be reached. During an adjustment the LED **intern** indicates the fine trim (LED extinguishes) and the coarse trim (LED lights up).
Fine trim means: frame 0 of the time code is more than 1.2ms but less than 16ms apart from the seconds pulse.
Coarse trim means: frame 0 of the time code is more or equal than 16ms apart from the seconds pulse.

Reaching a phase-locking is important for a correct timing of the real time data transfer. The time and date will come via a serial interface, but the seconds pulse is used as the timing reference to write these data into internal registers. There is a definite moment each time code frame where the generator takes these data out of the register to prepare the next frame. Having an unstable timing due to an unstable seconds pulse writing into the register may happen one time before, next time past this moment. This will result in generating a discontinuity in frames. Having reached a phase-locking the optimal timing is assured, i.e. a maximal jitter of +/- 16ms will be allowed. As long as LED **intern** lights up the data transfer is at a critical timing. For example having selected the operating mode „take time every second“ (see chapter ‘Receiving real time by DCF77 or GPS’) it is not guaranteed to generate a continuous time code. The timing is not critical if this LED does not light up. A short flash can be watched if for approx. 2 minutes the LED **sec** was flashing (seconds pulse has a jitter > 1.2ms) and G30TM shortly switches to coarse adjustment - but the frame 0 will be not more than 16ms apart from the seconds pulse.

At the beginning the seconds pulse may be apart from frame 0 at the most (1/2 second). In that case the fine adjustment will be reached only after several minutes. But with the first real time transfer - see chapter ‘Receiving real time by DCF77 or GPS’ - the fine adjustment will be reached quick. Please carefully refer to this chapter especially for the problem of time changes due to Daylight Savings Time and Leap Seconds.

8. LTC reader for Jam Sync and external genlock (option)

These functions require that the reader module is plugged. The status display indicates the presence of this module: read digit 5 of the display hexadecimal, then bit 3 must be set to 1. The status will be displayed after power-on or after pressing key **status**.

The input LTC must be connected at 3P XLRF **LTC IN**.

*Please note: With the „MTD" option and the user mode „TTT" enabled, the keys **ltc** and **jam** are without function, the LTC reader has a certain function (please refer to supplement for the MTD option).*

Pressing key **ltc** will switch on or off the external genlock. The LED lights up if the generator locks to the external LTC, the LED flashes if lock is not possible and the internal reference is selected. Lock can be reached only if the input frequency lies within the specified range. G30TM measures the frequency of the input LTC and adjusts the internal reference, so in case of a drop-out and switching to internal reference there are no disturbances at the output LTC.

Pressing key **jam** the jam sync will become active. The following operating modes can be programmed in the menu **JAM**, at **MODE:**

- Select an hours:minutes:seconds:frames offset to compensate or create a time delay between reader and generator time. The offset function can be switched on or off.
- The jam sync can operate as a One Time Jam Sync, as a Continuous Jam Sync, or as Jam Sync with Stop. Having accepted the first reader data the One Time Jam Sync will transfer these data to the generator, then the jam sync will be switched off automatically. In the Continuous Jam Sync mode the generator keeps on counting if there are no time code to read. The Jam Sync with Stop forces the generator to stop after a programmed number of frames if there are no time code to read (drop-out compensation) and if the jam sync is programmed to transfer data into the time of the generator.
- In case of a generator stop (Jam Sync with Stop): the LTC output can completely be suppressed (Stand-By function) or LTC can be generated having equal data in each frame.
- If the LTC genlock is selected (key **ltc**): it can be programmed that a data transfer from reader to generator only happens if the generator locks to the incoming LTC, so no Jam Sync at jog or shuttle frequencies will be allowed.

The jam sync can be programmed to transfer:

- Time and user data.
- Only time data, the user of the generator will be left unchanged.
- Only user data, the time will be counted up automatically.
- Time of the reader into the user of the generator = Cross Jam Sync. The functions offset and stop (with drop-out compensation) then operates on the user of the generator. The time of the reader will exactly appear in the user (with frame delay compensation), but to keep this accuracy in an evaluation a time code reader have to treat the user data as a time, so adding one frame.

Please note:

- A time jam sync will exactly regenerate the reader time by a frame compensation. A break of the reader time will appear at the generator time with three frames delay.
- A time jam sync prevents a real time jam sync, so if a jam sync becomes active it is not necessary to manually switch off the real time mode at menu **E CLOCK**. With the Cross

Jam Sync it is possible to have both: real time = time of the generator, reader time = user of the generator. It is equally possible to regenerate only the time of an external LTC and to carry in the user bits the date of the internal clock.

- To regenerate an external LTC with the function 1x jam sync, we recommend to switch off completely the „real time“ take-over, i.e. the automatic take-over and time change (see menu **E CLOCK**) as well as the employment of the user bits as date (see menu **SET** → **USER Mod**). In case a „real time“ automatism is still enabled, the time or the user bits could happen to be overwritten with the „real time“ again immediately after the 1x jam sync.

9. Colour lock (option)

This function requires that the colour lock module is plugged. The status display indicates the presence of this module: read digit 5 of the display hexadecimal, then bit 2 must be set to 1. The status will be displayed after power-on or after pressing key **status**.

Connect the colour signal at BNC **Video/BB Input**. Same signal is used for the video synchronisation of the generator.

Pressing key **colorf.** the colour lock mode can be switched on or off. The LED lights up if a 4-field or 8-field sequence has been detected, else this LED flashes. The colour lock mode requires a frame rate = 25 or 30/30drop and the synchronisation mode = **video**.

The LED **v4/v8** indicates the setting of the colour frame flag in the time code. For the television system 625/50 (PAL, frame rate = 25) the 8-field sequence has to be deduced, for the television system 525/60 (NTSC, frame rate = 30 or 30drop) the 4-field sequence has to be deduced.
The 8-field sequence requires an input signal with the PAL identification flag = a white pulse at line 7 of the first field. Without this white pulse the 4-field sequence will be deduced.

LED v4/v8	LED colorf.	colour lock
off	flashes	no
off	lights up	4-field (625/50)
on	lights up	8-field (625/50)
on	lights up	4-field (525/60)

Once having reached a colour lock it would be kept for over 10 seconds even if no field sequence can be deduced. If the video lock fails this time will be reduced to 5 seconds before the LED colorf. starts to flash.

If the colour lock is selected any time transferred to the generator (setting time by keys manually or by Jam Sync or by real time lock) will be checked and corrected to give the right address for the colour fields. So it is possible to regenerate an external time together with the colour lock addressing. In case of a stop during jam sync the colour lock will be switched off currently.

10. VITC generator (option)

This function requires that the VITC module is plugged. The status display (level 1) indicates the presence of this module: read digit 5 of the display hexadecimal, then bit 0 must be set to 1. The status will be displayed after power-on or after pressing key **status**.

VITC will be inserted in the signal at BNC connector **Video/BB Input**. The output of the signal + VITC will be at connector **VITC OUT**. The data of the VITC will be identical to the LTC. The mode of synchronisation has to be = **video**.

At menu **VITC** the lines can be selected. The allowed range is limited to 6-22 for the television system 625/50 (PAL, frame rate = 25) and 10-20 for the television system 525/60 (NTSC, frame rate = 30). It can be switched between block mode and 2-lines mode.

11. Serial interface (option)

This function requires that the serial interface module is plugged. The status display (level 1) indicates the presence of this module: read digit 5 of the display hexadecimal, then bit 1 must be set to 1. The status will be displayed after power-on or after pressing key **status**.

The serial interface enables to (partly) remote control the unit. The current time or user values of the generator can be requested. Connect the serial interface cable at the 9-pins DSUB at the rear (see „Connections at the rear and technical data“).

G30TM waits for commands or requests. The received or transmitted data string is arranged as follows:

Byte1	Byte2	Byte3	Byte 4	Byte n+2	Byte n+3
CMD1/DC	CMD2	DATA 1	DATA 2	DATA n	CHECK

CMD1 Command 1, specifies the command group: 0 = system control,
4 = data pre-set,
6 = data request.

DC data count, hexadecimal $0 - $F.
CMD2 command 2, specifies the command within the group.
DATA 1.. data bytes, as many as given by DC.
CHECK hexadecimal sum of bytes 1 to n+2 without carry.

- The data string has to be transmitted with no time gap between single bytes of more than 10ms.
- A new command should only be transmitted if the return of a preceding command has been received.
- Please note: the changes of settings done by serial interface commands will **not** be saved in the non-volatile memory as it is using key functions.

Table of commands

Command/Request (hexadecimal)					Return (hexadecimal)				
Description	CMD1 /DC	CMD2	DATA	CHECK	Description	CMD1 /DC	CMD2	DATA	CHECK
Device type request	$00	$11	-	$11	Device type	$12	$11	*1	$CHECK
Generator “Go“	$01	$86	$00	$87	ACK	$10	$01	-	$11
Generator “Stop“	$01	$86	$01	$88	ACK	$10	$01	-	$11
Pre-set time *7	$44	$04	*2	$CHECK	ACK	$10	$01	-	$11
Pre-set user *7	$44	$05	*3	$CHECK	ACK	$10	$01	-	$11
Pre-set date	$44	$06	*4	$CHECK	ACK	$10	$01	-	$11
Request time	$61	$0A	$01	$6C	Time	$74	$08	*2	$CHECK
Request user	$61	$0A	$10	$7B	User	$74	$09	*3	$CHECK
Request time+user	$61	$0A	$11	$7C	Time + user	$78	$08	*5	$CHECK
Request time+flag	$61	$0A	$02	$6D	Time + flag	$74	$08	*6	$CHECK
Request date	$61	$0A	$20	$8B	Date	$74	$09	*4	$CHECK

$CHECK hexadecimal sum of bytes 1 to n+2 without carry.
ACK acknowledge.
NAK in case of an error the unit may return NAK (= not acknowledge):
$11 $12 $ERROR $CHECK, with $ERROR = Bit 7: -
Bit 6: Framing
Bit 5: Overflow
Bit 4: Parity
Bit 3: -
Bit 2: Check
Bit 1: Data not plausible
Bit 0: Undefined command

*1 DATA 1: Bit 7 = 0
Bit 6 = 0
Bit 5 = 0 Bits 7..5 = device type
Bit 4
Bit 3: 1 = LTC reader module plugged, 0 = not plugged
Bit 2: 1 = Colour lock module plugged, 0 = not plugged
Bit 1: 1 = Interface module ok, 0 = not ok
Bit 0: 1 = VITC reader plugged, 0 = not plugged
DATA 2: BCD revision of firmware

*2 DATA 1 = BCD frames
DATA 2 = BCD seconds
DATA 3 = BCD minutes
DATA 4 = BCD hours

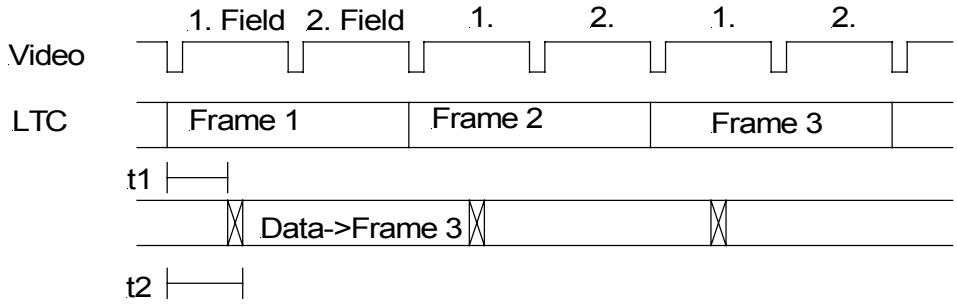
*3 DATA 1 = User digit 1/2
DATA 2 = User digit 3/4
DATA 3 = User digit 5/6
DATA 4 = User digit 7/8

*4 DATA 1 = BCD day
DATA 2 = BCD month
DATA 3 = BCD year (2-digits representation)
DATA 4: will be ignored in the pre-set command, at return = internal time zone:
$00 = UTC or not specified
$01 = no Daylight Savings Time
$02 = Daylight Saving Time

*5 DATA 1...4 = time (see *2), DATA 5-8 = user (see *3).

*6 „Flag“ indicates the first/second half of the frame, it is set to 1 at the first half (corresponding to the 1rst field during video synchronisation). It is send as bit 7 of DATA4, i.e. the MSB of the hours. It is recommended to choose the baud rate as high as possible to be able to resolve a half-frame. The value of “flag” in the return represents the moment at which the command has been received completely.

*7 Time and user can be pre-set every frame (every picture). The LTC generator accepts new data in the region t1 to t2 (t1/t2 = 10/13ms approx. at frame rate 25, 9/12ms approx. at frame rate 30), in case of video synchronisation this corresponds to lines 160 - 200 (625/50 PAL) or 140 - 190 (525/60 NTSC). For a frame accurate setting avoid a timing, at which the last command byte will be received in this region. For example to set the data of frame 3 the last byte of the command should be received as shown at the diagram.



12. Operating mode „real time“

The operating mode „real time“ is completely switched off if in menu **E CLOCK→MODE 1** the digits **8**, **7** and **6** have been set **= 0**, and in menu **SET→USER Mod = 0 SET** has been set!

12.1 Connecting or building-in a DCF77 or GPS receiver

This option can be offered in two configurations:

1. Built-in a DCF77 receiver in G30TM.

   At the rear of the housing the antenna is to connect at the insulated BNC. Three LEDs at the front of G30TM indicate the status of the receiver:

   LED free (red): Free-run mode, as long as this LED lights up the receiver is not synchronised to the antenna signal.

   LED mod. (green): Modulation, flashes every second to indicate the received time signal.

   LED field (green): Field strength of the antenna signal.

2. Connect an external receiver.

   Connect a serial interface at DSub DATA to transfer time and date every second. Two LEDs at the front of G30TM indicate the status of the serial data:

   LED free (red): Free-run mode, as long as this LED lights up the receiver is not synchronised to the antenna signal.

   LED mod. (green): Modulation, flashes every second if the data string will be accepted.

Please note for a correct installation of an antenna:
„**the antenna should be placed at the roof“**. Many problems did not arise if this is fulfilled. Especially concerning the DCF77 antenna:
Do not place the antenna near computers or any monitors. Both the status LEDs **mod.** and **field** serve to get an optimal installation. In the built-in version these LEDs are at the front of G30TM, in the external version these or similar LEDs are at the housing of the external receiver. In this case the LED **mod.** only indicates a serial data stream reaching G30TM.
Please carefully read the **operating manual of the receiver**. Having all units installed and switched on, the red LED must go out after some minutes. If not: try to place the antenna at a different place.

The GPS/DCF77 receiver is a clock by its own, which runs freely without receiving signals and keeps the clock running if power failed. The accuracy during this free run will at least be 10^{-5} (see receiver manual). Having reached a synchronisation once the clock is adjusted to the real time, and mostly it is sufficient to reach a synchronisation once or twice a day. G30TM supplies status information to monitor the receiver:

- Lighting of the **free** LED indicates synchronisation of the receiver.
- The display of menu **E CLOCK**, **6** indicates whether the receiver has executed synchronisation since power-on.
- In the menu **E CLOCK, 3** and **4** the unit indicates time and date of the last synchronous reception, independent of a time take-over into the time code. Then it can be evaluated whether an actually free-running receiver still runs with sufficient accuracy.

12.2 After power-on of G 30 TM

The G30TM has no own buffered clock to keep-on counting the time when the unit has been switched off. The time of the internal clock means the LTC time, the date means a start value = 01.01.98 (=1st of January, 1998). After power-on this clock may be set by data received from a DCF77/GPS receiver. With the G30TM connected to an external DCF77/GPS receiver, after a power-on the LTC output will be suppressed for approx. 17 seconds. During this time G30TM sets an optimum timing for a real time take-over to avoid the occurrence of an discontinuous LTC. If a real time take-over is made during this time, already the first LTC frame will be synchronous to the real time.

In the menu **E CLOCK**, **MODE 1** it can be programmed whether G30TM should set the clock after power-on, and if so: should the time received be synchronised to DCF77/GPS, or should also a free-running time be accepted. If G30TM and the receiver are powered on simultaneously, it will take some minutes (or up to any time) until the receiver will be synchronising. Having selected power-on mode = **2** (data take-over only with synchronisation of the receiver), the validity for the take-over is limited to 15 minutes after power-on, thus avoiding to have a time discontinuity at an undefined moment.

12.3 Time take-over during normal operation and time jumps

G30TM generates a “Real Time” time code and receives data from a reference clock (GPS or DCF77). Who will be the “master”? What happens after “wrong” or “correct” time jumps? There are different behaviours depending on the operating mode selected at menu **E CLOCK**.

“Wrong” time jumps:
In general only plausible time and plausible date received from the reference clock will be accepted. Wrong time jumps may be caused by an error of the serial interface or by wrong operation of the reference clock. The reference clock or G30TM may now be the “master”:

- Selecting the operating mode “ taking time/date every second” no further checks are provided, G30TM always follows the time of the reference clock.
- Switching off the automatic Daylight Savings Time switching of the internal clock, only a check of valid time counting sequence is done, thus the reference clock keeps to be the master.
- Switching on the automatic Daylight Savings Time switching of the internal clock, G30TM is meant to be the master. G30TM should always be fairly accurate to the Real Time, only a synchronisation regarding the seconds may happen. So a synchronisation to the reference clock only happens if the check of valid time counting sequence is passed and the hours and minutes are identical to the time of the internal clock. Exception: a time zone switching or a leap second has been announced and done by the reference clock.

“Correct” time jumps:
Because there are time changes due to **Daylight Savings Times** (twice a year) and due to **leap seconds** (one or two times a year) the time code will naturally transfer these changes as breaks - if the operating mode is selected to an automatic transfer of real time to time code. If time code is generated synchronous to the video, and the sync generator is not synchronised to the real time, a **frame jump** will be generated when the real time is taken over into the time code.

The matter of real time take-over can only be discussed with respect to further involved devices of the system. Problems may arise at systems which rely on a continuous time code. The time jumps are real, and an automatic real time take-over, which inevitably generates such time jumps, should only be activated if this will not cause any disturbances throughout the system. Therefore, the following conditions should be considered carefully:

1. The priority is to achieve an exact „real time„ of the time code.
2. The priority is to achieve a continuous time code without frame jumps.
3. Both objectives should be achieved.

To achieve objectives 1. and 2. the G30TM offer an automatic time take-over: the time will be set in the time code every second, every day, every week, every month, every year, after begin/end of the Daylight Savings Time, or after a leap second. A time take-over after begin/end of the Daylight Savings Time and after a leap second will only be made if an announcement has been made during the hour preceding the event. The take-over every day/month/year may be coupled with the synchronisation of the receiver.
Without a time take-over the accuracy of the time code with respect to the „real time" depends on the accuracy of the crystal (of G30TM or of the sync generator, respectively):

deviation of frames after one day	after 30 days	with an accuracy of
0.02	0.65	10^{-8}
0.2	6.5	10^{-7}
2	65	10^{-6}

To achieve objective 3, G30TM **must** be synchronised either to a stable seconds pulse of the receiver or - if time code has to be generated synchronous to the video - the sync generator has to be externally real time coupled via e.g. a 10 MHz clock to avoid frame jumps with a time take-over in the time code (please see chapters 7 and 13). The selection when the time take-over will take place (every second/day...) is then relevant only with a consideration of the time jumps with leap seconds or begin/end of the Daylight Savings Time:

- **Leap second**: only with the operating mode „every second" a leap second will be generated exactly (ahead), provided that the leap second has been announced. Please note: the insertion of leap seconds started with the 1st of January 1972. This insertion of leap seconds is made upon instruction of the IERS (International Earth Rotation Service), mostly at the change of year or in the mid of the year, as the last second of the 31st of December or the 30th of June, respectively in **UTC**, i.e. at the 1st of January at 1:00 o'clock **Central European time (CET)** or the 1st of July at 2:00 o'clock **Central European summer time (CEST)**. The leap second is the 60th second of an hour, and G30TM generates the leap second by repeating the 59th second, e.g. the proceeding for the summer is:

real time			time code of G30TM
1st July	1:59:59	CEST	1:59:59:23
			1:59:59:24
1st July	1:59:60	CEST ← leap second	1:59:59:00
			1:59:59:01
			etc.
			1:59:59:23
			1:59:59:24
1st July	2:00:00	CEST	2:00:00:00

- **Begin/end of Daylight Savings Time**: only with the operating mode „every second" or with enabled time zone automatics the change-over for Daylight Savings Time will be generated exactly (ahead). With the mode „every second" the change-over has to be

announced. Further pre-conditions for proper operation: OFFSET 1 and OFFSET 2 must be programmed correctly, in almost all cases the difference between 1 and 2 results in + or - one hour. G30TM will generate the following frame sequence for example:

Begin of Central European Summer Time:	Begin of Central European Time:
01:59:59:23	02:59:59:23
01:59:59:24	02:59:59:24
03:00:00:00	02:00:00:00
03:00:00:01	02:00:00:01
etc.	etc.

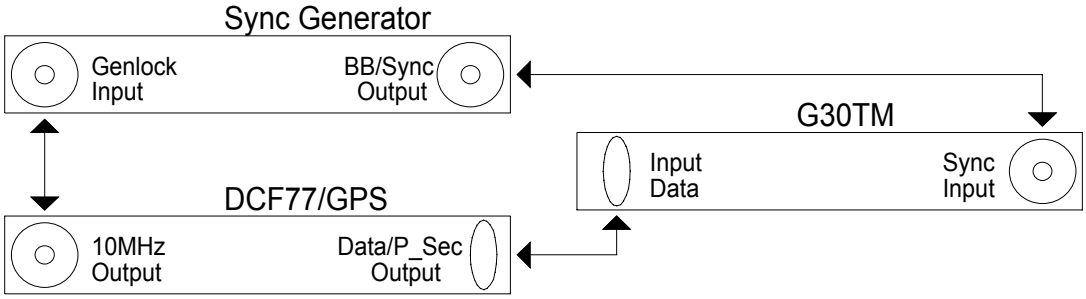
12.4 Internal clock, time zone automatics, status in the user bits

G30TM has an internal clock with date counter. The start value after power-on is 00:00:00:00 and 01.01.98. The clock may be set manually (SET TIME, SET DATE) or by accepting external reference time. The internal clock sets the time zone to normal time or DST (Daylight Saving Time). Begin and end of DST will be calculated from the input values day-of-week, week-of-month and month – valid from 01.01.98 until 31.12.2097, please see **ZONE**. The time zone will be calculated as well if a new date or a new hour has been set. The switching occurs with the next hour, following an announcement.
To select this time zone automatism, use menu **E CLOCK, MODE 1, Digit 6**.
With this automatism selected, the time zone switching will be made even in case of reference failure, so the time code output keeps correct. Another possibility is to receive **UTC** externally and then to generate any time zone (for example Central European Time (CET) with offset 1 = +01 and CEST with offset 2 = +02).

If date and status bits are transferred in the user bits (i.e. user mode = 3, please refer to chapter 5.2) external units (e.g. TC 60 CLS) will exactly receive the „real time“ and the time zones.
The date is the date of the internal clock.
The status bit Digit 7.0 (sync) will be set = 1 if the status received from a DCF77/GPS receiver indicates a current synchronisation to the antenna signal. This bit will be set for one minute’s time approximately; if no more synchronous take-over occurs, the bit will be reset = 0 to indicate, that the time code is in the free-running mode.
The status bits Digit 7.1 and Digit 7.2 indicate the current time zone of the internal clock. The time zone will be set = UTC if the DCF77/GPS receiver supplies UTC and G30TM has not been set to time zone automatism.
The status bit Digit 7.3 indicates the announcement of begin/end of Daylight Savings Time. When the time zone automatism has been set, it will be sent exactly one hour before the change-over occurs. Without this automatism selected, it will be sent after having been checked by the receiver (i.e. with a delay of 4.5 minutes approximately) – even if the time will not be taken over in the time code.
The status bit Digit 8.0 indicates the announcement of a leap second. This bit will be set only if it is received from the serial data of a DCF77/GPS receiver.

13. Video and time code locked to real time in 25-frame system

The best way to be genlocked and real time coupled is to genlock the sync generator to the real time. This will avoid breaks in frames. Some DCF77 or GPS receiver output a stable 10MHz frequency which could be connected to the genlock input of a sync generator. The stable seconds pulse which should be another output of the DCF77 or GPS receiver is to connect to the system as well. The following diagram shows a simple connection:



For just a „local“ application no special adjustment will be necessary:

- Select synchronisation = **video** at G30TM.
- Select the 10MHz genlock at the sync generator. Shows the sync generator „locked“?
- G30TM is able to measure the difference of seconds pulse to 1. field sync pulse: menu **TEST**, point **3**. This value has to be stable (ignore nanoseconds)!

After power-on and after every new sync mode selection (key **intern** or **video** ...) G30TM measures the timing between seconds pulse and sync pulse, then it adjusts to an optimal moment of taking the real time data, thus to avoid break in frames. The phase position of the sync pulse relative to the seconds pulse can vary between +/- 20ms, because the 10MHz genlock signal does not carry any phase information. So the LTC can be up to one frame constantly apart from the real time, in case of colour lock up to four frames. An optimal adjustment can only be reached having all units of the system in a stable state. Sometimes the GPS or DCF77 receiver needs a long time to be in lock, so it is recommended to supervise the adjustment after a power-down: switch on the menu and look at **STATUS**, point **8**. Digit 1 = NOBYCMP must show 0 or 9 for optimum, 4 or 5 are critical. The greater the difference to value 4 (in the range 0..9) the better. Correction can be made by switching on again the video synchronisation, i.e. press key **intern**, then key **video**.

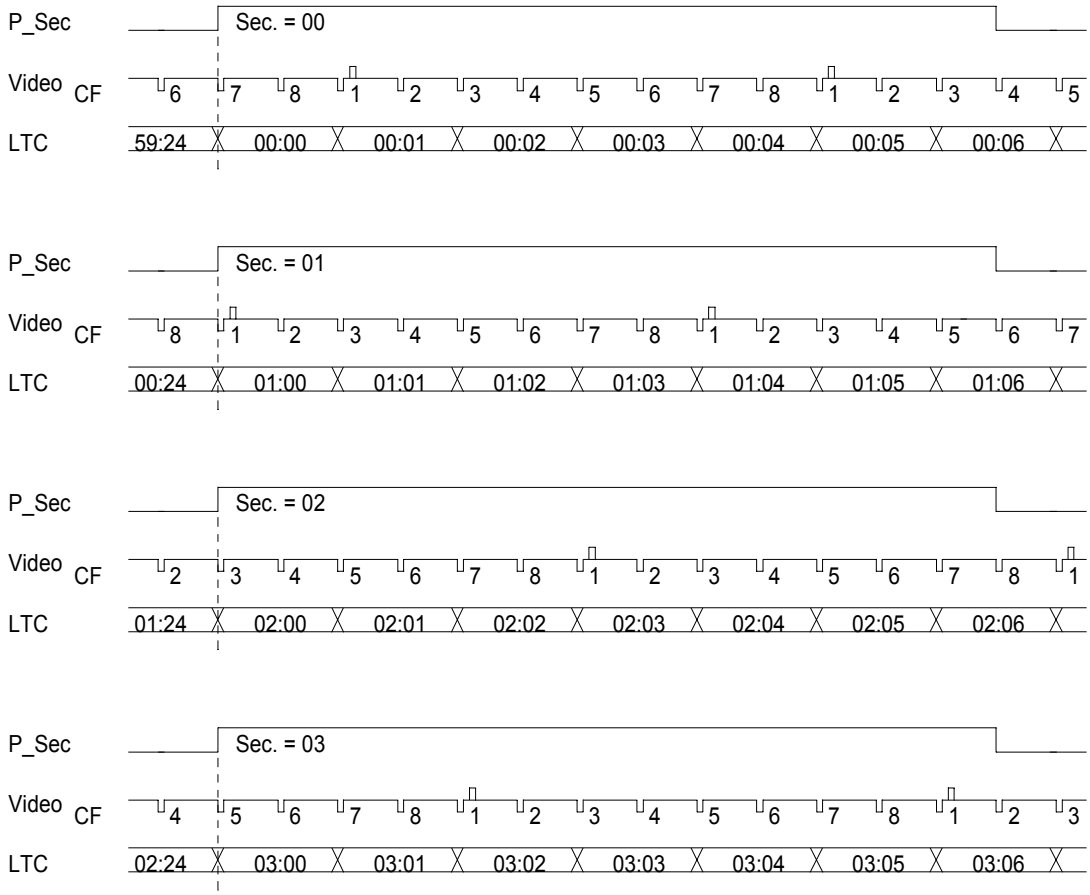
It can be reached having the LTC **absolutely** phase locked to the seconds pulse, so frame = 0 will exactly be at a new second. The LTC is locked to the video sync, so the sync generator has to be adjusted to the seconds pulse:

- Shift the sync signal output at your sync generator vertical (field-wise) and horizontal (line-wise) or even with finer steps. The test display at G30TM (**TEST**, point **3**) should show 00 00 00 0 (the first seven digits). In case of colour lock V4: the last digit must show 1. In case of colour lock V8: the last digit must show 3.
  Important: after this adjustment the video sync mode at G30TM must again be selected, i.e. press key **intern**, than key **video**.
  Please note: this adjustment has to be repeated every time the sync generator has been switched off or lost its 10MHz genlock signal!

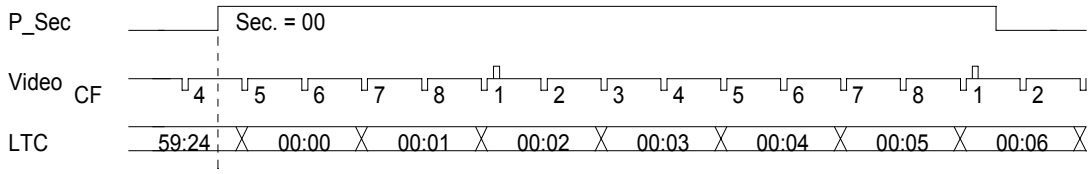
The following diagrams show timing examples:

Real time LTC of the video system 625/50

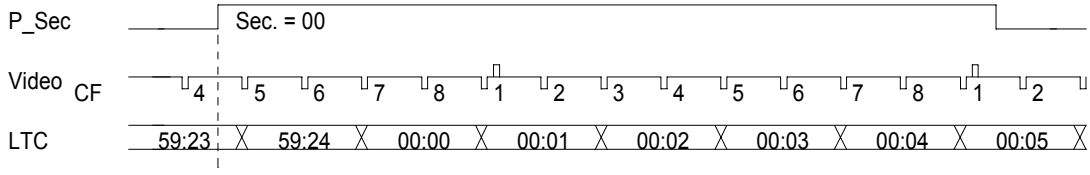
1. Perfect synchronisation = V1 + color burst locked to P_Sec, LTC with colorframing



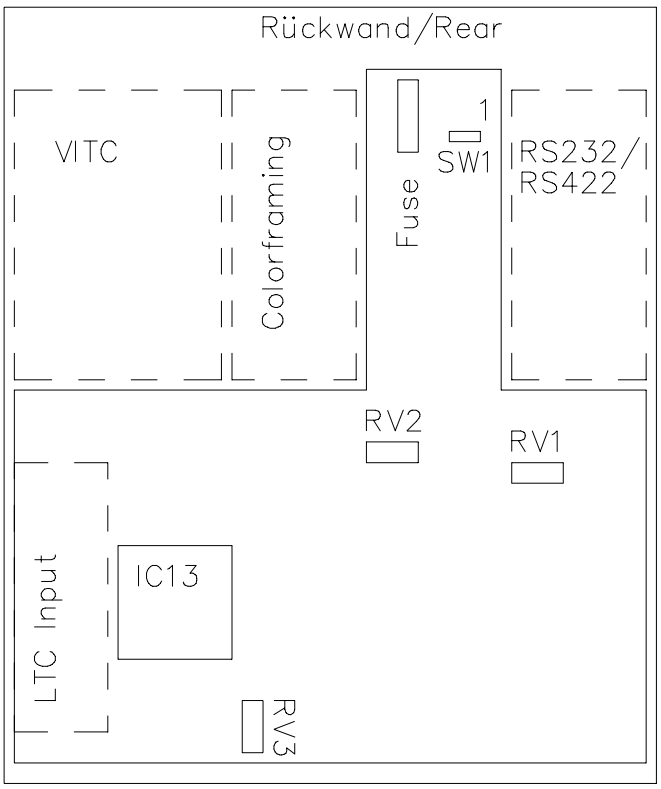
2. Only 10MHz genlock, LTC without colorframing, LTC deviation 0-1 frame



3. Only 10MHz genlock, LTC with colorframing, LTC deviation 0-4 frames



14. Placement of fuse, modules, SW1 and pots for adjustments



SW1: LTC output floating yes/no:
Position 1 (factory setting)
Pin1 of XLR LTC Out = GND, the LTC signals at pins 2 and 3 are inverse to each other and balanced relative to GND. The output amplitude between pins 1-2 and 1-3 is as displayed at menu. Do not cut short either pin 2 or pin 3 to GND.
Position 3
Pin 1 of XLR LTC Out = centre tapping of the output transformer, all pins are floating. Pin 1 should be connected to external GND to have a balanced LTC output. An unbalanced signal output can be reached at pin 3 by connecting pin 2 at GND (or v.v.) In this case the output amplitude is twice the value shown at menu. Pin 1 keeps not connected, it may not be connected to GND. GND of G30TM can be wired using the contact of the XLR housing.

RV1: Adjustment of the LTC output amplitude.

RV2: Adjustment of the rise and fall time of the LTC signal.

RV3: Adjustment of the internal oscillators frequency:
Using a stable external reference:
IC13.83 = 16MHz,
IC13.13 = 2MHz.
Using a stable video sync generator: select menu TEST, point 2: the value should be 40000000 for the 625/50 system.

15. Factory settings

At first delivery and after the function FACTORY RESET the standard unit will have the following settings:

Basically all is set to zero or switched off, except:

Frame rate	25
LTC output amplitude	1.5V
VITC	lines 18 and 20
Synchronisation	video
Mode „real time“	Parameter begin of Daylight Savings Time = 07-03. Parameter end of Daylight Savings Time = 07-10. Power-on mode = take time/date of the free-running clock. Running mode = take time/date once a day. Moment of data transfer: hour = 03, day-of-week = 1, day = 01, month = 01. User bits = mode 3: date + status (with the „MTD“ option: = mode 1: TTT). Time zone automatism selected. Last sync date = invalid. Seconds pulse = positive (rising) edge.
LTC reader, Jam Sync	Time + user jam sync. One time jam sync, not active. Function „jam sync coupled to lock„ selected.

16. General remarks

Specifications are subject to change without notice.

This unit contains maintenance-free parts only. Any repair should be done by qualified people only.
Avoid using this unit in extremely hot, cold or humid places, in places subject to vibrations, near appliances generating strong electro-magnetic fields.

In case of shipping damages please inform the common carrier and your dealer.

17. CE declaration of conformity

We,

Alpermann+Velte
Electronic Engineering GmbH
Otto-Hahn-Str. 42
D-42369 Wuppertal

declare under our sole responsibility that the unit

AV - G 30 TM

meets the intent of the following directives, standards and specifications:

89/336/EEC Electromagnetic Compatibility

EN 50081-1 Emissions
- EN 55022
- EN 55103-1

EN 50082-1 Immunity
- EN 55024
- EN 55103-2

The following preconditions have to be fulfilled:
- Only high-quality shielded cables have been used to connect data inputs/outputs.