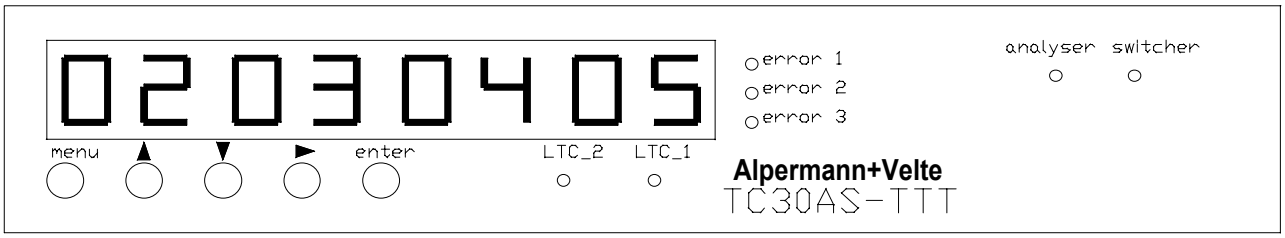
TC 30 AS - TTT

LTC Analysing/Switching Unit
of the Realtime-Timecode-Timer-System



Contents

Functions overview

TC30AS-TTT supervises two LTC sources of the television system 625/50, i.e. LTC with frequency and frame rate = **25**.

TC30AS-TTT consists of:

- Two LTC/RS485 inputs and one LTC/RS485 output plus one LTC master output. The LTC of two sources can be read and supervised, one LTC will be switched by relay to the outputs. The RS485 interface of the MTD timer system will be looped-through.
- One data input and two wired outputs to connect a GPS or a DCF77 receiver. The data contain time and date information as a serial protocol plus a seconds pulse.
- One serial interface RS232 to transmit error messages.
- Three relays to indicate error of LTC_1, LTC_2 or GPS/DCF77 data.
- An 8-digit display to show the reader data and status information, and status LEDs.

TC30AS-TTT operates as „**analyser**„ or as „**switcher**„.

The main function is to operate as an „**analyser**„, i.e. to supervise both the LTC inputs and the GPS/DCF77 data input. TC30AS-TTT has all the connections to built a system with two generators G30TM-TTT. In this system LTC and RS485 serial interface is distributed. Connecting the LTC/RS485 lines between TC30AS-TTT and both the units G30TM-TTT it is provided that:

- the LTC can be distributed and supervised;
- the RS485 data can be distributed. Both units G30TM-TTT will receive data, but the control signal DRV_SEL only enables one transmitter.

Besides the connectings at the rear TC30AS-TTT is identical to TC30AS, so from now on only TC30AS and G30TM will be named.

A connected GPS or DCF77 receiver (connect loop outputs of TC30AS to both units G30TM) supplies time and date. The LTC time data are compared to the GPS/DCF77 time and analysed to detect further errors. The unit decides which input will be switched to the output. In case one generator fails or generates no GPS/DCF77 time, TC30AS will automatically switch to the other LTC input. In the analyser mode all important data can be switched to display.
TC30AS evaluates the kind of error and reacts accordingly:

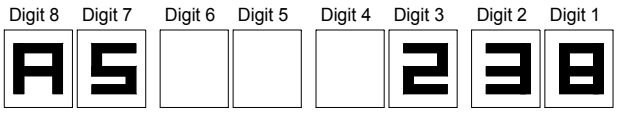
- LTC failure: switches to the other LTC source, shows a visible error message at the main display and by an error LED, the error relay switches, the error counter is incremented, an error message is output via serial interface.
- LTC frame error: the error counter is incremented, a message is output via serial interface.
- LTC not locked to GPS/DCF77: the error counter and the counter for lock error are incremented, a message is output via serial interface.
- GPS/DCF77 failure: shows a visible error message at the main display and by an error LED, the error relay switches, the error counter is incremented, an error message is output via serial interface.
- GPS/DCF77 time continuity error: the error counter is incremented, a message is output via serial interface.

In the „**switcher**„ mode the automatic change-over is disabled, but each source can be manually selected. The unit measures the difference of the two LTC sources with an accuracy of +/- 0.1ms. The mode also serves to remove a faulty TC30AS unit from the system without having an LTC dropout of > 1 frame.

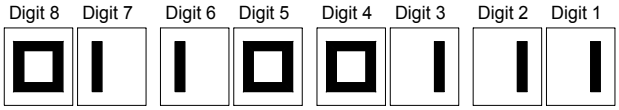
After power-on

Without power the input LTC_1 is switched to the output. The three failure relays will close the contacts NO and COM, thus indicating a failure of the system.

After power-on the display shows status messages in two steps:



1. step: Digits 8/7: „AS“ identifies the type of unit = TC30AS.
Digit 3: RS232-Modul: „2“ = built-in, „0“ = not built-in.
Digits 2/1: Revision of firmware.



2. step: Indicates the configuration of the software:
Digit 8: Frame rate: 25=0, 24=1, 30=2, 30 drop=3, auto=4
Digit 7: RS232 no (=0), yes (=1)
Digit 6: DCF77/GPS no (=0), yes (=1)
Digit 5: identifies the GPS/DCF77 hardware interface
Digit 4: GPS/DCF77 serial protocol (0..4)
Digit 3: seconds pulse: 0 = not used,
1 = leading edge (positive pulse),
2 = falling edge (negative pulse).
Digit 2: special hardware configuration
Digit 1: special software configuration

During these two steps all LEDs will be lit for test purposes.

Inside the unit a jumper (see chapter „Locations of fuse and jumper Analyser/Switcher) defines the operational mode after power-on:
position A = **analyser**, position B = **switcher**. The current mode is indicated by the appropriate LED at the front. Switching the modes is possible by keys as well.
After power-on the serial interface is ready to automatically output messages.

„Analyser„ operation

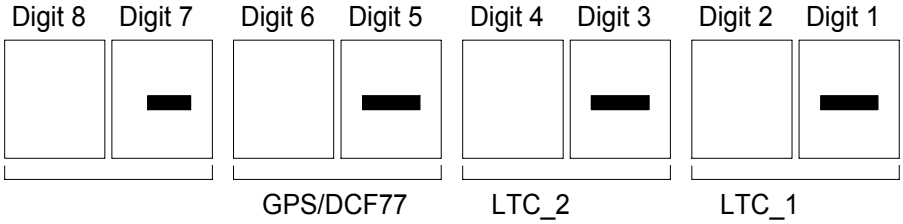
LED **analyser** lits.

LED **ltc_1** or **ltc_2** lits to indicate which source is switched to output. Switching-on-fault occurs if the current source is faulty and the other source without faults.

LEDs **error1**, **error2** and **error3** indicate active failures, at the same time the corresponding relay has switched from NC-COM to NO-COM:

error1 indicates failure of LTC_1,
error2 indicates failure of LTC_2,
error3 indicates failure of GPS/DCF77 data.

The front display shows the kind of failure:



Digits 1/2 indicate failure of LTC_1,
digits 3/4 indicate failure of LTC_1,
digits 5/6 indicate failure of GPS/DCF77.
If there is a hyphen '**-**' no failures are currently detected, else a hexadecimal number defines the failure. The bitwise meaning is:

Bits	**LTC failure**	**GPS/DCF77 failure**
Bit 0 = 1	Time-Out: 50ms without valid LTC.	Time-Out: 5 seconds without valid data.
Bit 1 = 1	LTC time not plausible or LTC „reverse".	Plausibility check failed.
Bit 2 = 1	Difference between LTC and GPS/-DCF77 time >= 10 seconds - difference check only if GPS/-DCF77 is without failure.	Receiver clock in free-running operation since > 24 hours - no antenna signal available.

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. A hyphen '**-**' indicates that a function can be executed pressing key **enter**.
Pressing key **menu** again the display returns to show the error status as described above.

MENU of „analyser„ operating mode**:**

↑↓ vertical → horizontal

READ → **1=** shows time of LTC_1: hours/minutes/seconds/frames

→ **2=** shows time of LTC_2: hours/minutes/seconds/frames

→ **3=** shows time of GPS/DCF77: hours/minutes/seconds

→ **4=** shows date of GPS/DCF77: day/month/year

→ returns to **READ**

ERROR → **1=** number of failures of LTC_1 (since power-on or **reset**), 8 digits BCD number, no rollover at 99 99 99 99.

→ **2=** number of failures of LTC_2, same as 1

→ **3=** number of failures of GPS/DCF77 data, same as 1

→ **4=** sum of all failures 1 + 2 + 3, display same as 1

→ **5= reset -**. Now pressing key **enter** will reset all error counters to zero.

→ **6=** error at LTC_1, without being a failure, for example a one frame drop-out. Display same as at 1.

→ **7=** error at LTC_2, same as at 6.

→ **8=** error at GPS/DCF77, without being a failure, for example a discontinuity in the time information.

→ returns to **ERROR**

DIFF → **1=** difference in time between LTC_1 and GPS/DCF77, calculated with every seconds pulse.
Given a difference of more than four frames the result is shown in the format hours/minutes/seconds/frames. A decimal point most right indicates, that the time of GPS/DCF77 is leading compared to LTC_1.
Given a difference of smaller than five frames the display shows e.g.: 17 2d FF 01. The digits most right (01) show the frames difference, the digits before d (17 2) show the smaller than one frame difference in ms (17.2ms). The relative accuracy is approx. 0.2ms, the absolute accuracy about some milliseconds.

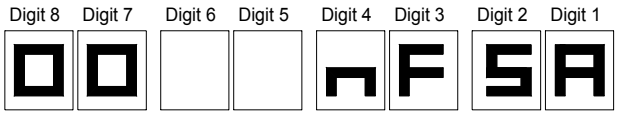
→ **2=** difference in time between LTC_2 and GPS/DCF77, same as 1.

→ **3=** difference in time between LTC_1 and LTC_2:
The format is hours/minutes/seconds/frames. A decimal point most right indicates, that the time of LTC_2 is leading compared to LTC_1.
A more precise measurement is done in the switcher operating mode.

→ returns to **DIFF**

MENU cont. of „analyser“ operating mode:
↑↓ vertical → horizontal

STATUS → **1**= shows the status of the GPS/DCF77 external clock, e.g.:



Digits 8/7: **00 - 99** = number of hours in free-running mode, i.e. no good quality of antenna signal available.
Digit 4: **-** = the clock receives GPS/DCF77 signals,
n = the clock cannot receive GPS/DCF77 signals.
Digit 3: **-** = the clock has synchronised to GPS/DCF77 time,
F = the clock runs internal locked (free-running mode).
Digit 2: **-** = no daylight saving time,
S = daylight saving time,
U = UTC.
Digit 1: **-** = no announcement of a time change-over,
A = announcement of a time change-over, one hour before switching on or off the daylight-saving-time.
L = announcement of a leap second.

→ **2**= shows the time (6 digits: hours/minutes/seconds) of the last synchronisation of the external clock. While digits 4 and 3 at status display 1 (see above) show bars (i.e. reception is o.k. and synchronous), this time will be counting upward every second. Otherwise this time stops, the receiver clock is in free run mode since the displayed time. Showing only bars means no synchronisation since power-on at TC30AS.

→ **3**= shows the date of the last synchronisation, same as status 2.

→ **4**= shows the type identification and software revision, see chapter „After power-on„.

→ **5**= shows the software configuration, see chapter „After power-on„.

→ **6**= RS232 status:
Digit 1 (units of frames): all messages shall be output automatically:
0 = off, 1 = on.
Digit 2 (tens of frames): messages indicating an error (not failure) shall be output automatically:
0 = off, 1 = on.
Digit 3 (units of seconds): messages indicating a faulty GPS/DCF77 lock shall be output automatically:
0 = off, 1 = on.

→ returns to **STATUS**

MENU cont. of „analyser“ operating mode:
↑↓ vertical → horizontal

ANALYSER → **1= SELECT -**. Pressing key **enter** the operating mode is changed to „switcher„.

→ returns to **ANALYSER**

LOCK → **1=** relative difference (drift) between LTC_1 and the seconds pulse (P_SEC) of the GPS/DCF77 system and a 4-digit error counter, which will count one error if drift >= 5ms.
This measurement will only be made if LTC_1 and GPS/DCF77 are o.k. and the absolute difference (see DIFF display) is less than 5 frames. This measurement serves to check whether the lock of the LTC to the seconds pulse or a 10MHz genlock of the clock generator (10MHz derived from the GPS/DCF77 signal), which synchronises the LTC via video, is working.
The error counter counts up to 9999 and then stops.
Following an error, the difference is set to zero, and after a few seconds the next measuring cycle starts.
The three most significant digits show the drift in steps of 100µs, i.e. a value of 032 means 3.2ms. The four right side digits show the error counter. If the above conditions required for measurement are not fulfilled, a status will be shown instead of the drift:
999 = GPS/DCF77 not o.k. (failure),
888 = LTC_1 not o.k. (failure),
777 = absolute difference > 4 frames,
666 = drift > 1 frame.

→ **2=** drift between LTC_2 and the seconds pulse, as in 1.

→ **3= reset -**. Press **enter** key to reset both error counters to zero and initiate new measurements.

„Switcher„ operation

LED **switcher** lits.
LED **ltc_1** or **ltc_2** lits to indicate which source is switched to output. The LEDs error1..3 are without function.
This operating mode measures the synchronisation of two LTC sources. TC30AS calculates the difference of the time information and displays the result as number of frames, range 00-99. In case the difference is more than 99 frames „FF„ is shown. At the same time the difference of the LTCs sync words is measured and displayed, range 0.0ms - 50.9ms approx. In case the difference lies not within this range „FFF„ is displayed. A sign „+„ indicates that source LTC_1 precedes source LTC_2, a sign „-„ v.v.
In case no measurement is possible (for example one source is missing) the display shows ***no no no no***.

Example:	***01+ 301***	LTC_1 precedes LTC_2 by one frame and +30.1ms.
	00- 004	LTC_2 precedes LTC_1 by -0.4ms

In the „switcher„ operating mode **no automatic change-over** occurs, no error status will be detected and indicated, the RS232 and the error relays are without function.

Pressing key **menu** two functions are available:

press key → :	Display shows ***SELECT -***. Press key **enter** to switch to „analyser„ operating mode.
again press key →:	Display shows ***1—2 -***. Press key **enter** to manually switch over to the other source of the LTC output than present selected.

The manual switching between the LTC sources is synchronous, i.e. if LTC_1 and LTC_2 are synchronous to each other, one LTC output frame will be destroyed through the switching of the relays. With no synchronous signals applied, the switching will be „hard“ and at a non-defined point of time, i.e. even two LTC frames may be destroyed.

Error indications by relays

This function is available in operating mode „analyser„ only.

The contacts of the three relays are found at D-SUB 9P **GPI**. Each relay may switch the contact **COM** (common) to cut short **NC** (normally closed) or **NO** (normally open). At normal operation the relay is switched to COM-NC, in case of any failure or in case of power-down of TC30AS the relay is switched to COM-NO. A failure is exactly at that time the display shows the failure. The state of each relay is indicated by the LEDs **error1**, **error2**, **error3**. If the cause of an failure is removed the relay will switch to normal position.
Relay 1 (NC1, COM1, NO1) switches in case of a failure of LTC_1.
Relay 2 (NC2, COM2, NO2) switches in case of a failure of LTC_2.
Relay 3 (NC3, COM3, NO3) switches in case of a failure of GPS/DCF77 data.

Error indications by serial interface RS232

This function is available in operating mode „analyser„ only.

The serial interface data format is fixed: 9600 baud, 1 stop, 8 data, 1 parity odd.

The **error messages** are two bytes long:

1. byte = $41: refers to LTC_1,
   $42: refers to LTC_2,
   $43: refers to GPS/DCF77.
2. byte = error message or status:

Bits	**LTC failure**	**GPS/DCF77 failure**
Bit 0 = 1	Time-Out: 50ms without valid LTC.	Time-Out: 5 seconds without valid data.
Bit 1 = 1	LTC time not plausible or LTC „reverse“.	Plausibility check failed.
Bit 2 = 1	Difference between LTC and GPS/-DCF77 time >= 10 seconds - difference check only if GPS/-DCF77 is without failure.	Receiver clock in free-running operation since > 24 hours - no antenna signal available.
Bit 3	= 0: LTC_1 is switched to output, = 1: LTC_2 is switched to output.	= 0: LTC_1 is switched to output, = 1: LTC_2 is switched to output.

The messages occur every second until each message will be acknowledged. The acknowledge should be:

1. byte = $C1, $C2, $C3 to acknowledge $41, $42, $43,
2. byte = identical to bits 0..2 of the 2. byte of the error message.

Any change of the error flags will again lead to send out a message.

After power-on the messages start (with 2. byte = $00 if all is o.k.).

Example: $41 $00 has to be acknowledged by $81 $00, then the message stops.

Other errors which are no failures will be sent in one byte. These messages need not to be acknowledged.

$51 = drift of LTC_1 to P_SEC >= 5 ms.
$52 = drift of LTC_2 to P_SEC >= 5ms.
$61 = error (no failure) of LTC_1, e.g. if TC30AS detects a frame jump or a drop-out.
$62 = error (no failure) of LTC_2, e.g. if TC30AS detects a frame jump or a drop-out.
$63 = error (no failure) of GPS/DCF77, e.g. if TC30AS detects a discontinuity in the time information.

The output of these messages can be stopped by sending an interface command, the output of the messages $51/$52 and $61/$62/$63 may be enabled or disabled individually (see „remote control...“).

Remote control by serial interface RS232

The serial interface data format is fixed: 9600 baud, 1 stop, 8 data, 1 parity odd.

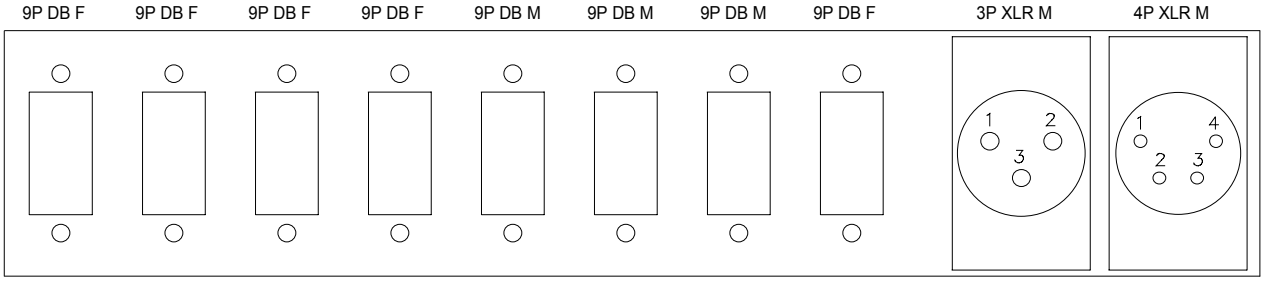
Sending interface commands TC30AS can be remote controlled. A new command should not be transmitted before the return of the preceding command or request has been received.

Command		TC30AS returns
Reset counter of failures/errors	$A0 $00	$E0 $00
Disable messages	$A1 $00	$E1 $00
Enable messages	$A1 $01	$E1 $01
Disable drift measurement errors	$A2 $00	$E2 $00
Enable drift measurement errors	$A2 $01	$E2 $01
Initialise new drift measurements	$A2 $03	$E2 $03
Disable error (no failure) messages	$A3 $00	$E3 $00
Enable error (no failure) messages	$A3 $01	$E3 $01
Reset error counter to zero	$A3 $03	$E3 $03

Request of time data, date, counters of failures/errors, differences:

Request		TC30AS returns
LTC_1 time	$91 $10	$D1 $10 $hours $minutes $seconds $frames
LTC_2 time	$92 $10	$D2 $10 $hours $minutes $seconds $frames
GPS/DCF77 time	$93 $10	$D3 $10 $hours $minutes $seconds $frames (GPS/DCF77 frames = $03 as a fixed offset)
GPS/DCF77 date	$93 $20	$D3 $20 $year $month $day $day of week
Failures LTC_1	$94 $01	$D4 $01 NNx10^6$ NNx10^4$ NNx10^2$ $NN
Failures LTC_2	$94 $02	$D4 $02 NNx10^6$ NNx10^4$ NNx10^2$ $NN
Failures GPS/DCF	$94 $03	$D4 $03 NNx10^6$ NNx10^4$ NNx10^2$ $NN
Sum of all failures	$94 $04	$D4 $04 NNx10^6$ NNx10^4$ NNx10^2$ $NN
Errors LTC_1	$94 $05	$D4 $05 NNx10^6$ NNx10^4$ NNx10^2$ $NN
Errors LTC_2	$94 $06	$D4 $06 NNx10^6$ NNx10^4$ NNx10^2$ $NN
Errors GPS/DCF77	$94 $07	$D4 $07 NNx10^6$ NNx10^4$ NNx10^2$ $NN
Differences:		
LTC_1 - GPS/DCF	$95 $01	$D5 $01 + 4 bytes as a mirror of the digits 8..1 at the display of TC30AS
LTC_2 - GPS/DCF	$95 $02	$D5 $02 + 4 bytes, see above
LTC_1 - LTC_2	$95 $03	$D5 $03 + 4 bytes, see above
Drift LTC_1-P_SEC	$96 $01	$D6 $01 + 4 bytes as a mirror of the digits 8..1 at the display of TC30AS (drift + error counter)
Drift LTC_2-P_SEC	$96 $02	$D6 $02 + 4 bytes, see above

Connections at the rear and technical data



RS232
2: RxD in
3: TxD out
4: DTR out
5: GND
7: RTS out
8: CTS in

GPI
1: NO1
2: COM1
6: NC1
7: NO2
8: COM2
3: NC2
4: NO3
5: COM3
9: NC3

GPS/DCF77
DATA OUTPUT
(wired loop)

GPS/DCF77
DATA INPUT
1: P_SEC
2: RxD
5: GND

IN1 IN2

LTC/RS485
1: RS485 TRA
2: RS485 TRB
3: LTC_x
4: LTC_y
5: GND
6: DRV_SEL

DATA OUT
LTC/RS485
1: RS485 TRA
2: RS485 TRB
3: LTC_x
4: LTC_y
5: GND

LTC OUT
1: GND
2: LTC_x
3: LTC_y
switched from
IN1 or IN2

DC IN
1: GND
4: 10-30 V DC
typ. 5.5W

Dimensions:	214 (W) x 43 (H) x 262 (D) mm
Weight:	1.5kg approx.
Operating temperature:	5°C to 40°C
Ambient humidity:	35% to 85%

RS232: data format 9600/8/odd/1

LTC input: 80 bit code according to ANSI/SMPTE 12M-1995
Frequency 20-32 frames/second

GPS/DCF77 DATA INPUT:

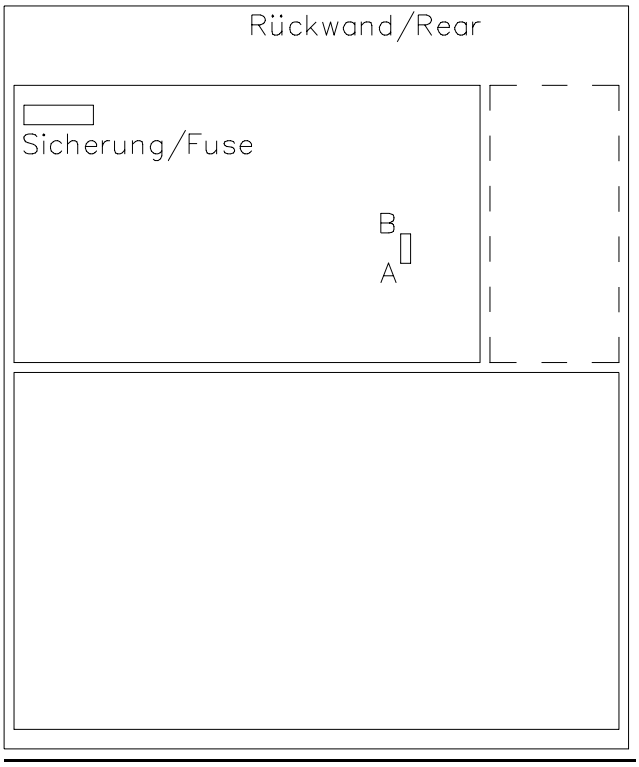
P_Sec: Logic signal, rising edge = seconds clock,
input Low: max. 0.8V
input High: 2-15V

RxD: Serial interface (RS232 or Low/High as P_Sec).
Format is fixed:
standard format: 2400/7/E/2,
alternatively (PZF 535): 4800/7/E/2

Technical data of the relays at connector GPI:

Switchable power:	max. 5W
Switchable current:	max .0.25A
Transportable current:	max. 1A
Voltage:	max. 75V
Contact resistance:	max. 200mΩ

Locations of fuse and jumper „analyser/switcher„



Failure-proof systems and proceeding in case of failure

The system combining 2x G30TM and 1x TC30AS ensures that even in case of failure of one of the units a valid signal will be supplied. Diagram 1 shows a typical system, connected with a failure-proof clock generator system. In case of failure of one of the generators (e.g. G30TM), this generator has to be replaced. During this time, the second generator will supply the signal. If then a switch back to e.g. LTC_1 should be made, TC30AS has to be set to „switcher“ mode, and synchronous switching-over will occur (one LTC frame will be destroyed). Then, TC30AS shall be switched back to „analyser“ mode.

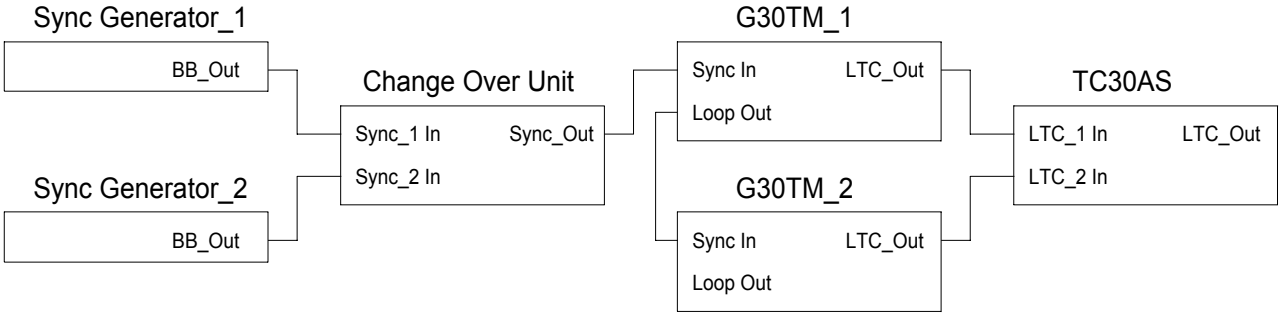


Diagram 1

The system can be enhanced to 2x TC30AS if a defect TC30AS unit shall be replaced without causing a considerable LTC dropout, or if the system shall remain failure-proof during the time of replacement.
Diagram 2 shows such system. During normal operation, TC30AS_2 is switched off, with internal configuration as „switcher“. If TC30AS_1 shall be replaced, please proceed as follows:

1. Switch off TC30AS_1, and LTC_1 will supply its signal now via TC30AS_2.
2. Switch LTC_2 to the second input of TC30AS_2.
3. Switch on TC30AS_2 and switch over to input LTC_2.
4. Remove LTC_1 from input of TC30AS_1 and connect it to input 1 of TC30AS_2. Now switch TC30AS_2 via keys to „analyser“ mode, so TC30AS_2 has now taken over the functions of TC30AS_1.
5. Re-integrating TC30AS_1 into the system: if TC30AS_1 is connected to input 2, remove LTC_1 and connect it to input 1 of TC30AS_1, and connect TC30AS_1 output to input 1 of TC30AS_2.
6. Switch on TC30AS1.
7. Switch TC30AS_2 to „switcher“ mode via keys, input 1 is switched to.
8. Switch off TC30AS_2, and now LTC_2 can be connected to input 2 of TC30AS_1.

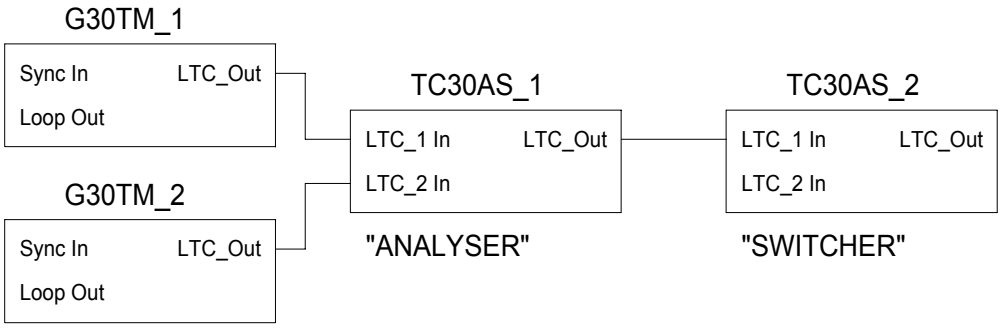
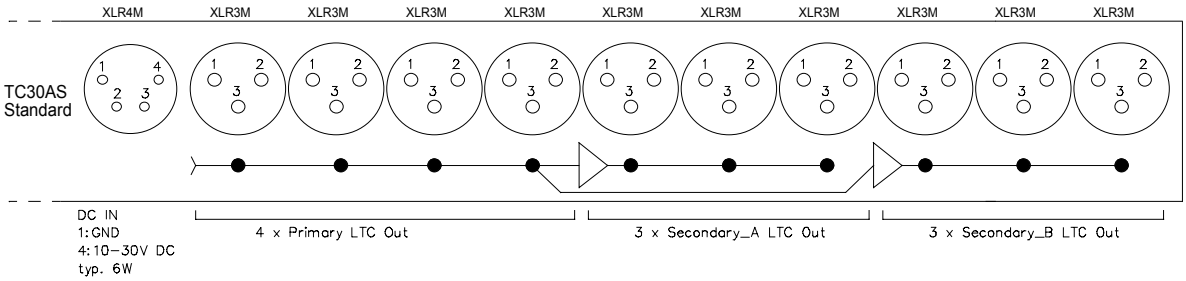


Diagram 2

The diagrams 1 and 2 show no connections to a GPS/DCF77 receiver, since there is no relevance for these examples whether the data connections are cut for a short time. The LTC generator as well as the sync generators would continue to supply their signals without any dropouts. It is up to the system operator to use the outputs of the error relays and of the serial data interface to detect a failure asap.

Optional: LTC distribution amplifier 4-3-3

With this option TC30AS gets 10 LTC outputs (XLR). The rear and some technical data will change:



LTC Out Primary:	Balanced. Level 35 mVpp to 3 Vpp (-27 dB to +12 dB approx.), selectable at G30TM menu.
LTC Out Secondary:	Balanced. Level 980 mVpp approx. (+2 dB). Can be reduced to 220 mVpp approx. (-11dB) by internal pot.
Dimensions:	19” format: 430 (W) x 43 (H) x 262 (D) mm
Weight:	3kg approx.

The 4-3-3 configuration combines the idea of failure proof system, the efficiency of the LTC output drivers and the use of up to 10 LTC connectors:

- Failure proof system (redundancy): The system combining 2 x G30TM and 1 x TC30AS ensures that even in case of failure of one of the units a valid signal will be supplied. This applies to the four primary outputs which are simply switched (by relay) to the four XLR connectors.
- Efficiency of the LTC output drivers: The 4-3-3 configuration uses the G30TM output driver (four Primary outputs) and two independent output drivers Secondary_A and Secondary_B, each drives three outputs. Each driver is of low impedance and could drive up to 100 LTC inputs, so there is no need to give each XLR connector a separate output driver.
- These 10 LTC outputs allow to realise different LTC distribution systems. The four Primary outputs are active even if TC30AS is switched off. The signal level is adjusted at the G30TM menu. The 2 x 3 Secondary outputs are active only as long as TC30AS keeps switched on. The signal level is fixed, but it may be altered by internal pot. A short at e.g. one of the Secondary_A outputs will have no influence at the Primary or Secondary_B outputs.

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 local dealer.

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

TC30AS-TTT

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.
- Housing has been connected to ground.