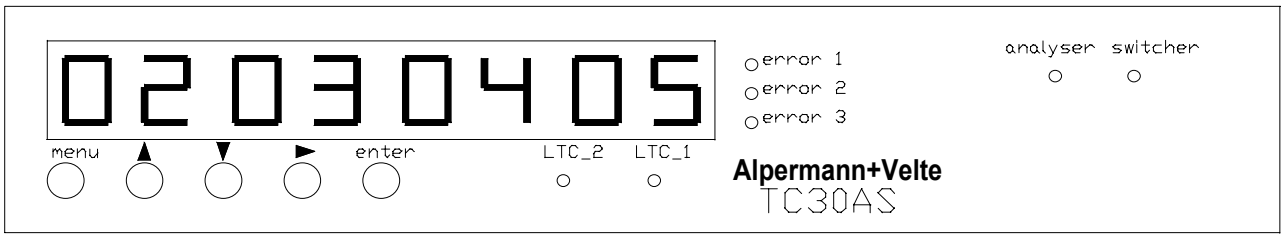
Installation & Operating Manual

Version 4.5

31.08.11

TC 30 AS

LTC Analyser and Changeover Unit



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CONTENT

A1 Safety Instructions

General rules: Only use the device as directed in a dry atmosphere. Treat the device with the same care as other studio devices. Please follow the advice in the following operator's manual.

Damages in transit: If the device shows obvious damages from transit the shipper in question must be notified and the dealer must be informed.

Positioning: Position device only where sufficient air circulation can be maintained. Extreme temperatures, dust, humidity, shocks and strong electromagnetic fields must be avoided.

Maintenance: Use a moist soft textured fabric cloth when cleaning the housing. Do not use polish or any other cleaning agents.

Repairs: This device does not require any extra maintenance. There are no user serviceable parts inside the device. Repairs should be sent to an authorized service partner**.**

EMC: The EMC regulations are observed only under the following condition: use high quality shielded cables at data inputs and outputs.

A2 Copyright

For further information please contact your local dealer or:

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A3 Certifications & Compliances

We,

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Otto-Hahn-Str. 42
D-42103 Wuppertal

herewith declare under our sole responsibility that the

TC 30 AS

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

1 Introducing TC 30 AS

TC 30 AS monitors two LTC sources. The standard version accepts LTC with frequency and frame rate = 25 (time code of television system PAL 625/50). Optionally the device can be adjusted to frame rate = 30 (time code of television system NTSC 525/50).

TC 30 AS consists of:

- Two balanced LTC inputs and one LTC output. LTC of two sources can be read and analysed; one source will be switched to output via relay.
- One input and two wired loop outputs for signals of a time & date reference (signals of a GPS or DCF77 receiver). These signals consist of a PPS (Pulse Per Second) and a serial data string with time & date information.
- One serial RS232 interface transmits status and error messages.
- Three relays indicating failures: Failure of LTC1, LTC2 or GPS/DCF77.
- 8-digit LED display showing reader data and status information.

TC 30 AS operates in an "**Analyser**" or in a "**Switcher**" operating mode.

Default mode = "**Analyser"**. The device monitors both the LTC input signals and the signals of a real-time reference (GPS/DCF77). There is a 1:2 distribution provided for the real-time reference signals. Failures and errors of the LTC time code will be detected and the LTC time addresses will be compared with the real-time reference. The unit decides which LTC source will be switched to the output. To realise a failure-proof, real-time coupled and genlocked LTC system, the following units are required: Two master time code generators (e.g. G 30 TM) generate a genlocked LTC (locked to a black-burst). A connected GPS/DCF77 receiver (connect loop outputs of TC 30 AS with e.g. G 30 TM) supplies time & date. In case one generator fails or generates a time different to the real-time, TC 30 AS will automatically switch to the other LTC input. In this mode all important data can be switched to the display.

TC 30 AS evaluates the kind of an error and reacts accordingly:

- Total failure of one LTC input: Changeover to the other source; indication of a failure at the main display and by an error LED; closing the error relay; incrementing an error counter; transmitting an error message via serial interface.
- LTC drop-out: Incrementing an error counter; transmitting an error message via serial interface.
- LTC not locked to the real-time reference: Incrementing an error counter and an "unlock" counter; transmitting an error message via serial interface.
- Failure of the real-time reference signals: Indication of a failure at the main display and by an error LED; closing the error relay; incrementing an error counter; transmitting an error message via serial interface.
- Jump of the real-time: Incrementing an error counter; transmitting an error message via serial interface.

During "**Switcher**" operating mode, the automatic changeover is disabled, but it is possible to do a changeover manually. This operating mode measures and displays the time difference of the LTC sources with an accuracy of +/- 0.1ms.

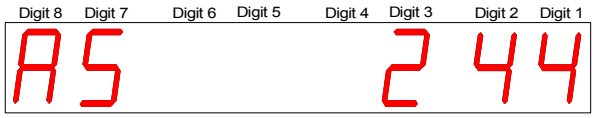
This mode also enables to remove a faulty **TC 30 AS** unit from the system without interrupting the LTC output line for more than one frame.

2 Functional Description

2.1 After Power-On

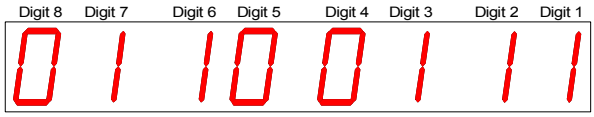
Without power, LTC_1 input is switched to output. All the three failure relays will close their contacts NO and COM, thus indicating a failure of the system.

After power has turned on, the display shows status messages in two steps. Example:



1st step:

Digits 8/7: "AS" indicates the type of the unit.
Digit 4: Indicates an option – if any.
Digit 3: RS232 interface: "2" = installed, "0" = not installed.
Digits 2/1: Firmware version.



2nd step: Indicates the configuration of the device:

Digit 8: Frame rate: 25=0, 24=1, 30=2, 30Drop=3, Auto=4.
Digit 7: RS232: no (=0), yes (=1).
Digit 6: Receiver for real-time signals (DCF77/GPS): no (=0), yes (=1).
Digit 5: Type of serial interface for real-time signals.
Digit 4: Type of serial protocol (0...4).
Digit 3: Second pulse (PPS): 0 = not used,
1 = rising edge – positive pulse,
2 = falling edge – negative pulse.
Digit 2: Special hardware configuration.
Digit 1: Special software configuration.

During these steps all LEDs will light up for test purposes.

There is a jumper inside (please refer to chapter "Locations of fuse and jumper Analyser/Switcher") which sets the main operating mode after power has turned on:

Jumper at position **"A" = Analyser**; jumper at position **"B" = Switcher**.

The current mode is indicated by the appropriate LED at the front. Switching the main operating mode manually is possible as well.

After power has turned on, the serial interface will be ready to send error messages automatically.

2.2 “Analyser” Operating Mode

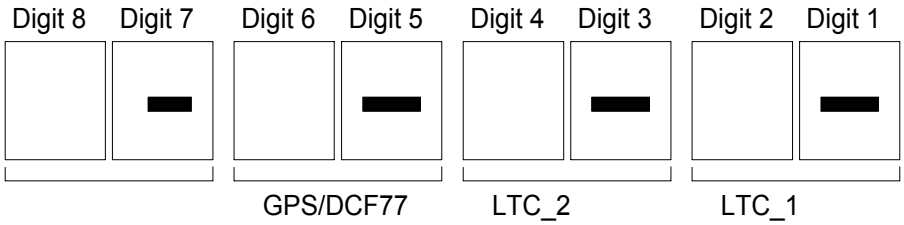
The LED **analyser** lights up.

LEDs **ltc_1** and **ltc_2** indicate which source currently is switched to the output. Automatic changeover occurs if the active source has a failure and the back-up source is without failures.

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 the real-time reference signals (GPS/DCF77).

There is more detailed information at the front display:



Digits 1/2: indicate failure of LTC_1,
Digits 3/4: indicate failure of LTC_2,
Digits 5/6: indicate failure of the real-time reference signals (GPS/DCF77).

The **hyphen –** means: “OK, no failure“. Any **digit** defines the failure by an hexadecimal number, whereas the bits have the following meaning:

Bit	**LTC Failure**	**GPS/DCF77 Failure**
Bit 0 = 1	Time-Out: There is no valid LTC for a period of 50 ms.	Time-Out: There are no valid signals for a period of 5 seconds.
Bit 1 = 1	LTC invalid time addresses or LTC in “reverse” direction.	Invalid data detected.
Bit 2 = 1	Time difference of LTC against the real-time reference (GPS/DCF77) >= 10 seconds – checked only if real-time reference signals are without errors.	Real-time reference indicates “unlock” since > 24 hours, the real-time reference operates in a free-running mode.

Utilizing the **menu** key, more data can be switched to the display and some functions can be executed. Keys ↑ and ↓ are used to select the next submenu, key → is used to select the items provided for this submenu. The **hyphen –** means: Pressing the **enter** key a function can be executed. Pressing key **menu** again will switch off the menu; the display returns to error indication as described above.

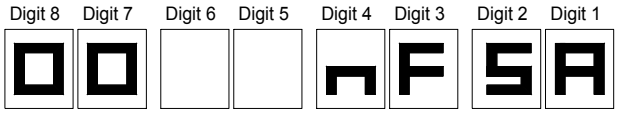
MENU of "Analyser" operating mode:

↑↓**vertical**	→ **horizontal**	
READ	→ **1**=	Time of LTC_1: HH:MM:SS:FF
	→ **2**=	Time of LTC_2: HH:MM:SS:FF
	→ **3**=	Time of real-time reference (GPS/DCF77): HH:MM:SS
	→ **4**=	Date of real-time reference (GPS/DCF77): Day.Month.Year
	→	Return to **READ**
ERROR	→ **1**=	LTC_1 failures since power-on or since last **reset.** 8-digits number, no overrun to "00 00 00 00" after "99 99 99 99".
	→ **2**=	LTC_2 failures, same as **1**.
	→ 3=	Real-time reference (GPS/DCF77) failures, same as **1**.
	→ **4**=	Sum of all failures = Sum of 1 + 2 + 3. Display same as **1**.
	→ **5**=	**reset -**. Press key **enter** to set *all* error counters to zero.
	→ **6**=	LTC_1 error, not counted as a failure. Example: A single time jump. Display same as **1**.
	→ **7**=	LTC_2 error, same as **6**.
	→ **8**=	Real-time reference (GPS/DCF77) errors, not counted as a failure.
	→	Return to **ERROR**
DIFF	→ **1**=	Time difference LTC_1 against real-time reference. Update once a second. Differences of > 4 frames are displayed in a HH:MM:SS:FF format. A decimal point at the right side indicates that the time of real-time reference is equal or ahead of LTC_1. Difference of < 5 frames are displayed for example: "17 2d FF 01". The digits most right (01) show the difference of frames; the digits left of "d" (17 2) show the difference within a frame in milliseconds (example: 17.2 ms). Relative accuracy ≈ 0.2 ms, absolute accuracy ≈ some milliseconds.
	→ **2**=	Time difference LTC_2 against real-time reference, same as **1**.
	→ **3**=	Time difference between LTC_1 and LTC_2: HH:MM:SS:FF format. A decimal point at the right side indicates that the time of LTC_2 is equal or ahead of LTC_1. A more accurate difference is calculated in the "Switcher" operating mode.
	→ **4**=	Maximum of time difference LTC_1 against real-time reference.
	→ **5**=	Maximum of time difference LTC_2 against real-time reference.
	→ **6**=	Maximum of time difference between LTC_1 and LTC_2.
	→	Return to **DIFF**

MENU of "Analyser" operating mode (continued):

↑↓**vertical** → **horizontal**

STATUS → **1**= Status of real-time reference (GPS/DCF77). Example:



Digits 8/7: 00 - 99 = Elapsed number of hours since last "lock" state. If > 00, the source currently operates in a free-running mode.

Digit 4: **-** = Source has locked once after power-on.
n = Source not locked after power-on.

Digit 3: **-** = Source currently "locked".
F = Source currently in free-running mode.

Digit 2: **-** = Standard time (no DST).
S = Daylight Saving Time (DST).
U = UTC.

Digit 1: **-** = No announcement of a time jump.
A = Announcement of a DST switching, one hour before start or end of DST.
L = Announcement of a leap second.

→ **2**= Time (HH:MM:SS) of last "lock" state. Time is counting upwards if source currently is in "lock" state. If this time is not counting, the source has lost its synchronization since this time. If no time is displayed, the source has not reached synchronization since power of TC 30 AS has been turned on.

→ **3**= Date (day/month/year) of last "lock" state. Same as status **2**.

→ **4**= Device status, see "1st step" at chapter "After Power-On".

→ **5**= Device configuration, see "2nd step" at chapter "After Power-On".

→ **6**= Status RS232:

Digit 1: Automatic mode for sending any message: 0 = off, 1 = on.

Digit 2: Automatic mode for sending messages, which indicate an error (no failure): 0 = off, 1 = on.

Digit 3: Automatic mode for sending messages, which indicates an error caused by a drift of LTC against the real-time reference: 0 = off, 1 = on.

→ Return to **STATUS**

MENU of "Analyser" operating mode (continued):

↑↓ **vertical**	→ **horizontal**	
ANALYSER	→ **1**=	**SELECT -**. Press key **enter** to switch to the "Switcher" operating mode.
	→	Return to **ANALYSER**
LOCK	→ **1**=	Drift of LTC_1 against the PPS of the real-time reference, and a 4-digit error counter which counts every time the drift exceeds 5 ms. Drift measurement is done only if there are no errors at LTC_1 and real-time reference signals, and if the time difference (shown at DIFF) is less than 5 frames. This measurement verifies that the LTC is locked to a real-time reference. The recommended real-time and time code system consists of an SPG, which receives a 10 MHz signal of a real-time reference for sync purposes. The black-burst of the SPG synchronizes the LTC generator. This way, everything is locked. The errors counter counts up to 9999. After counting an error, the drift will be set to 0 and – after some seconds – the measurement starts again. The three digits most left show the drift in steps of 100µs, e.g. a value of 032 means 3.2 ms. The four digits most right show the errors counter. If the drift measurement cannot be executed, a status is shown instead of the drift: 999 = Failure if real-time reference (GPS/DCF77). 888 = Failure of LTC_1. 777 = Difference > 4 frames, 666 = Drift > 1 frame.
	→ **2**=	Drift of LTC_2 against the PPS of the real-time reference, same as 1.
	→ **3**=	**reset -**. Press key **enter** to reset the error counters and to start a new measurement.

2.3 “Switcher” Operating Mode

The LED **switcher** lights up.

LEDs **ltc_1** and **ltc_2** indicate which source currently is switched to the output. 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 LTC’s sync words is measured accurately and displayed, range 0.0 ms - 50.9 ms approx. In case the difference exceeds this range “FFF” is displayed. A sign “+” indicates that source LTC_1 precedes source LTC_2, a sign “-“ v.v.

If 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 + 30.1 ms.
00- 004 ➔ LTC_2 precedes LTC_1 by 0.4 ms.

During **”Switcher“** operating mode there is **no automatic changeover**, no error will be indicated or counted, RS232 and the relays 1... 3 are without function.

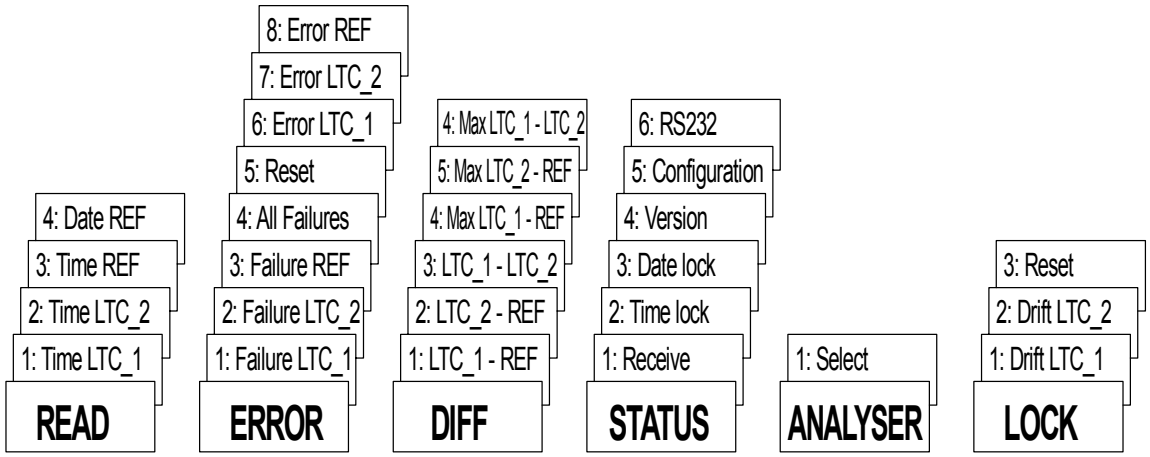
Having pressed the **menu** key two functions are available:

Press key → : Display shows **SELECT -**.
Press key **enter** to switch to the **”Analyser**“ operating mode.

Again key → : Display shows **1—2 -**.
Press key **enter** to manually force a changeover.

Manual changeover occurs synchronously: If LTC_1 and LTC_2 are synchronized to each other the changeover by relay will destroy one LTC frame of the output. If both sources are not synchronized there will be a “hard” changeover destroying one or two LTC frames of the output.

2.4 Menu, Overview



2.5 Error Indication by relays

This function is available in operating mode **"Analyser"** only.

The contacts of the three relays are wired to the DSUB 9P **GPI** – see chapter "Technical Data" for pinning.

Each relay may switch contact **COM** (common) to cut short **NC** (normally closed) or **NO** (normally open). At normal operation, the relay closes COM – NC, in case of any failure or in case of power-down the relay closes COM – NO. The relay indicates a failure 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 a failure is removed the relay will switch to normal position.

Relay 1	(NC1, COM1, NO1)	indicates failure of LTC_1.
Relay 2	(NC2, COM2, NO2	indicates failure of LTC_2.
Relay 3	(NC3, COM3, NO3	indicates failure of real-time reference (GPS/DCF77).

2.6 Error Indication by RS232 Serial Interface

This function is available in operating mode **"Analyser"** only.

The interface parameters are fixed to: 9600 baud, 1 stop bit, 8 data bits, 1 parity bit odd.

Messages indicating a failure consist of two bytes:

1st Byte = $41: Concerning LTC_1
$42: Concerning LTC_2
$43: Concerning real-time reference (GPS/DCF77)

2nd Byte = Message or status according to table below:

Bit	LTC Failure	GPS/DCF77 Failure
Bit 0 = 1	Time-Out: There is no valid LTC for a period of 50 ms.	Time-Out: There are no valid signals for a period of 5 seconds.
Bit 1 = 1	LTC invalid time addresses or LTC in "reverse" direction.	Invalid data detected.
Bit 2 = 1	Time difference of LTC against the real-time reference (GPS/DCF77) >= 10 seconds – checked only if real-time reference signals are without errors.	Real-time reference indicates "unlock" since > 24 hours, the real-time reference operates in a free-running mode.
Bit 3	= 0: LTC_1 switched to output. = 1: LTC_2 switched to output.	= 0: LTC_1 switched to output. = 1: LTC_2 switched to output.

This type of message will be sent every second until TC30AS receives an appropriate return.

Return message:

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

Any change of an error status will activate an error message again.

After power has turned on, TC 30 AS starts to transmit messages – with 2nd byte = $00 if there is no error.

Example: $41 $00 should be acknowledged by $C1 $00, then the message stops.

Errors which are not considered to be a failure will be indicated by a one byte message. There is no return provided for this type of message.

$51 = Drift LTC_1 against PPS >= 5ms.
$52 = Drift LTC_2 against PPS >= 5ms.
$61 = Error (no failure) LTC_1. For example: Single drop-out or time jump detected.
$62 = Error (no failure) LTC_2. For example: Single drop-out or time jump detected.
$63 = Error (no failure) GPS/DCF77. For example: Single time jump detected.

Sending any message can be stopped by a command. Sending messages $51/$52 and $61/$62/$63 can individually be stopped. Please refer to chapter "Remote Control by RS232 Serial Interface".

2.7 Remote Control by RS232 Serial Interface

The interface parameters are fixed to: 9600 baud, 1 stop bit, 8 data bits, 1 parity bit odd.

The following commands are provided to remote control the unit. A new command should not be sent before a return of the preceding command or request has been received.

Description	Command	TC 30 AS return
Reset of all failure/error counters	$A0 $00	$E0 $00
Disable messages	$A1 $00	$E1 $00
Enable messages	$A1 $01	$E1 $01
Disable messages about drift	$A2 $00	$E2 $00
Enable messages about drift	$A2 $01	$E2 $01
Initialize new drift measurement	$A2 $03	$E2 $03
Disable messages about errors (no failures)	$A3 $00	$E3 $00
Enable messages about errors (no failures)	$A3 $01	$E3 $01
Reset of error counters	$A3 $03	$E3 $03

Request of time data, date, counters, differences:

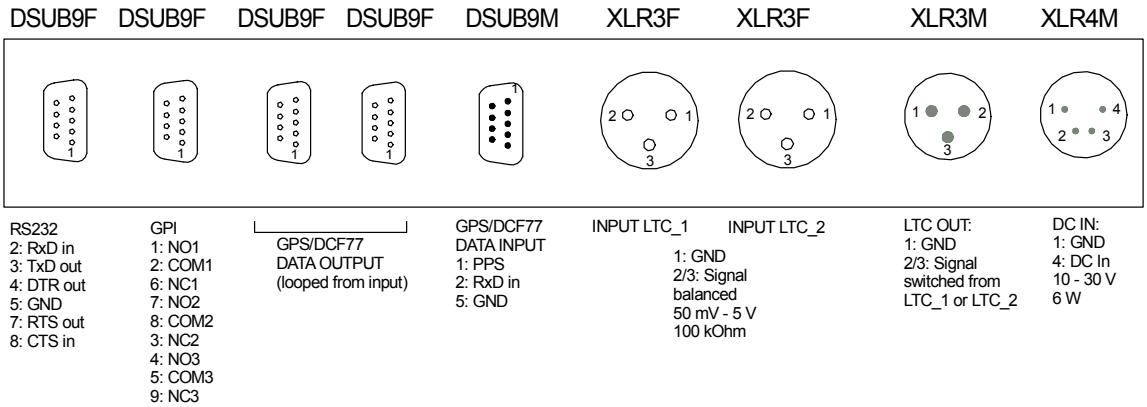
Description	Request	TC 30 AS return
LTC_1 Time	$91 $10	$D1 $10 $hours $minutes $seconds $frames
LTC_2 Time	$92 $10	$D2 $10 $hours $minutes $seconds $frames
Time of reference (GPS/DCF77)	$93 $10	$D3 $10 $hours $minutes $seconds $frames (frames = $03 = fixed offset)
Date of reference (GPS/DCF77)	$93 $20	$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 reference (GPS/DCF77)	$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 reference (GPS/DCF77)	$94 $07	$D4 $07 NNx10^6$ NNx10^4$ NNx10^2$ $NN

Differences:

Description	Request	TC 30 AS return
LTC_1 – reference (GPS/DCF)	$95 $01	$D5 $01 + 4 bytes corresponding to the digits 8...1 at TC 30 AS display
LTC_2 – reference (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 – PPS	$96 $01	$D6 $01 + 4 bytes corresponding to the digits 8...1 at TC 30 AS display (drift + error counter)
Drift LTC_2 – PPS	$96 $02	$D6 $02 + 4 bytes, see above

3 Technical Data

3.1 Connections at the Rear



Dimensions:	214 (W) x 43 (H) x 262 (D) mm
Weight:	1.5 kg approx.
Operating temperature:	5 °C to 40 °C
Ambient humidity:	35 % to 85 %
RS232:	9600/8/odd/1
LTC Input:	According to ANSI/SMPTE 12M-1-2008 Frequency: 20 - 32 frames/second

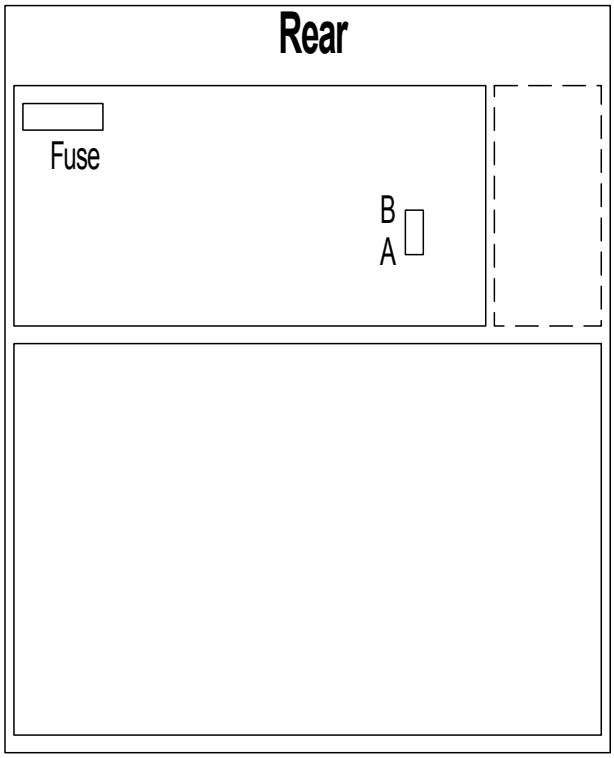
GPS/DCF77 DATA INPUT:

PPS:	logic input, rising edge = reference mark, Input Low: < 0.8 V Input High: 2 - 15 V
RxD:	Serial interface (RS232 or Low/High same as PPS). Standard format: 2400/7/E/2 Optional (e.g. for PZF 535): 4800/7/E/2

Specifications of the relays at GPI connector:

Maximum switchable power:	5 W
Max switchable current:	0.25 A
Maximum transportable current:	1 A
Maximum voltage:	75 V
Contact resistance:	200 mΩ

3.2 Locations of Fuse and Jumper “Analyser/Switcher”



4 Redundant System and Proceeding in case of a Failure

The system combining 2 x G 30 TM and 1 x TC 30 AS 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. G 30 TM_1), 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, TC 30 AS has to be set to „switcher" mode, and synchronous changeover will occur (one LTC frame will be destroyed). Then, TC 30 AS shall be switched back to „analyser" mode.

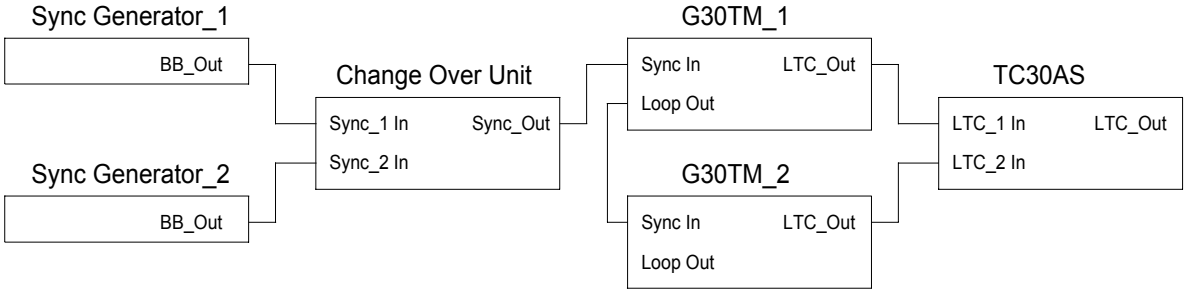


Diagram 1

The system can be enhanced to 2 x TC 30 AS if a faulty TC 30 AS 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. LTC_1 will supply its signal now via TC30AS_2.
2. Disconnect LTC_2 at TC30AS_1 and connect to LTC_2 of TC30AS_2.
3. Switch on TC30AS_2 and do a manual changeover to LTC_2.
4. Disconnect LTC_1 at TC30AS_1 and connect to LTC_1 of TC30AS_2. Now select "analyser" operating mode at TC30AS_2, now TC30AS_2 has fully replaced TC30AS_1.
5. Re-integrating TC30AS_1 into the system: If TC30AS_2 (still) loops LTC_2 to output, disconnect LTC_1 at TC30AS_2 and connect it to LTC_1 of TC30AS_1. Connect TC30AS_1 output to LTC_1 of TC30AS_2.
6. Switch on TC30AS_1.
7. Select „switcher" operating mode at TC30AS_2. Do a manual changeover to LTC_1.
8. Switch off TC30AS_2. LTC_2 at TC30AS_2now can be connected to LTC_2 of TC30AS_1.

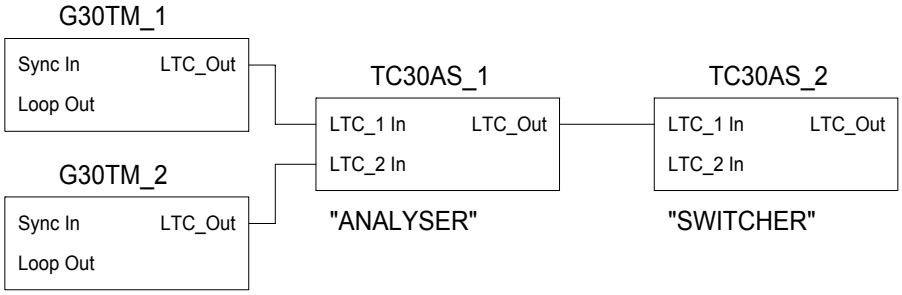


Diagram 2

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.