PROFESSIONAL TIMING

START CLOCK HL 930

WITH INTERGRATED GPS TIMEBASE CONTROL

OPERATING INSTRUCTIONS

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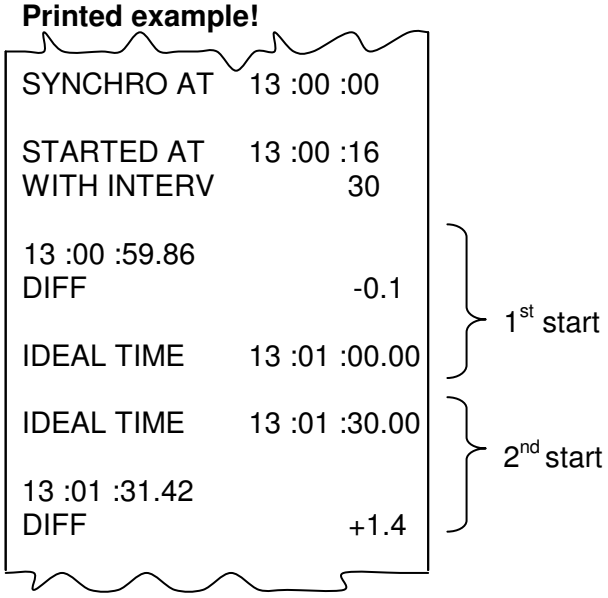
I. START CLOCK DESCRIPTION

There are many new innovative features on this Start Clock that uses a special 3-motor analogue movement developed entirely by TAG Heuer

- The operation of the start clock is based on a microprocessor that checks the exact position and alignment of the clock hands every minute to ensure a total precision and reliability of the Official Time.
- Initial manual or continuous automatic setting and maintenance of the exact time-of-day via GPS time signals.
- Digital "Countdown" display for every start accompanied with acoustic "beeps" as well as color changes of a rotating disk that indicates valid start periods (red, green and yellow available depending on sport regulations).
- Complete control by the operator of start interval changes during the competition.
- START / STOP function for start processes.
- An Input for timing signals (from start gates or photocells) allows the HL 930 to take and memorize every start time in sequential order.
- An RS 232 serial data port can be used to connect a dedicated printer (such as our Printer HL 200) to immediately print in hard copy all recorded start times as they happen. The differences between the start times and the ideal times generated by the Start Clock are also printed.

Printed example!

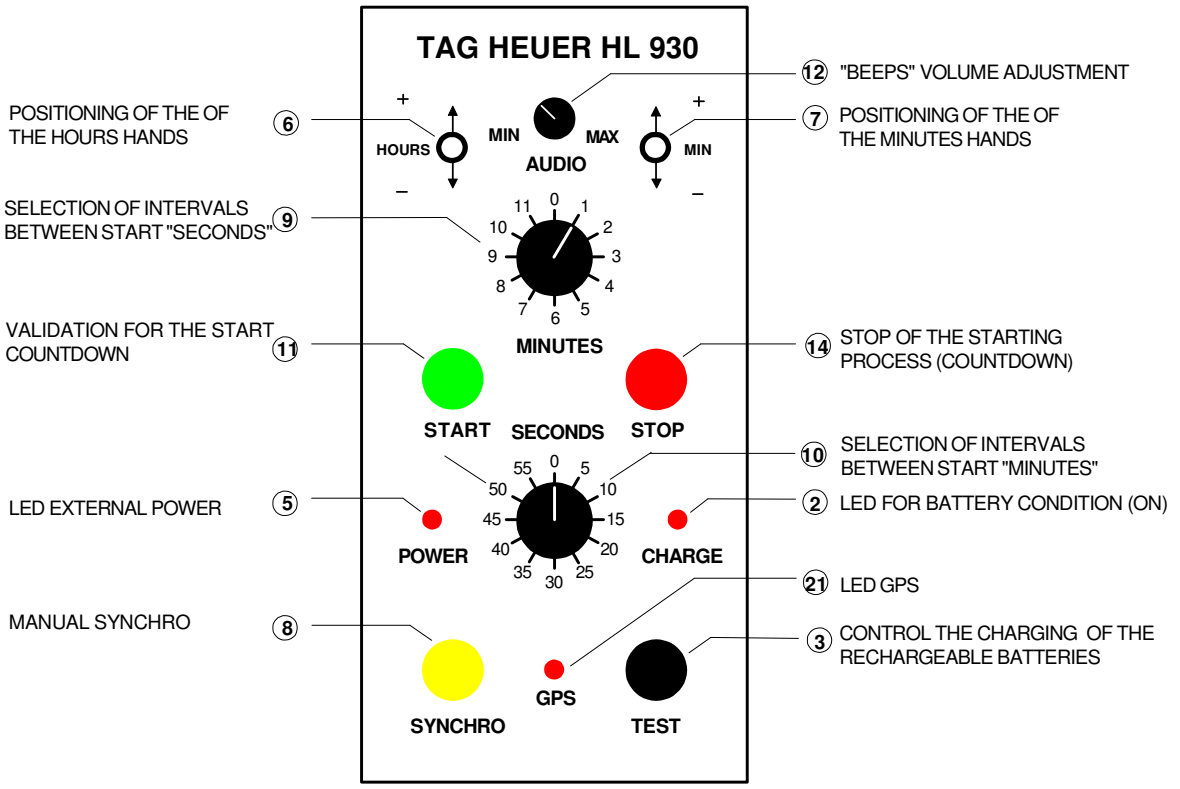


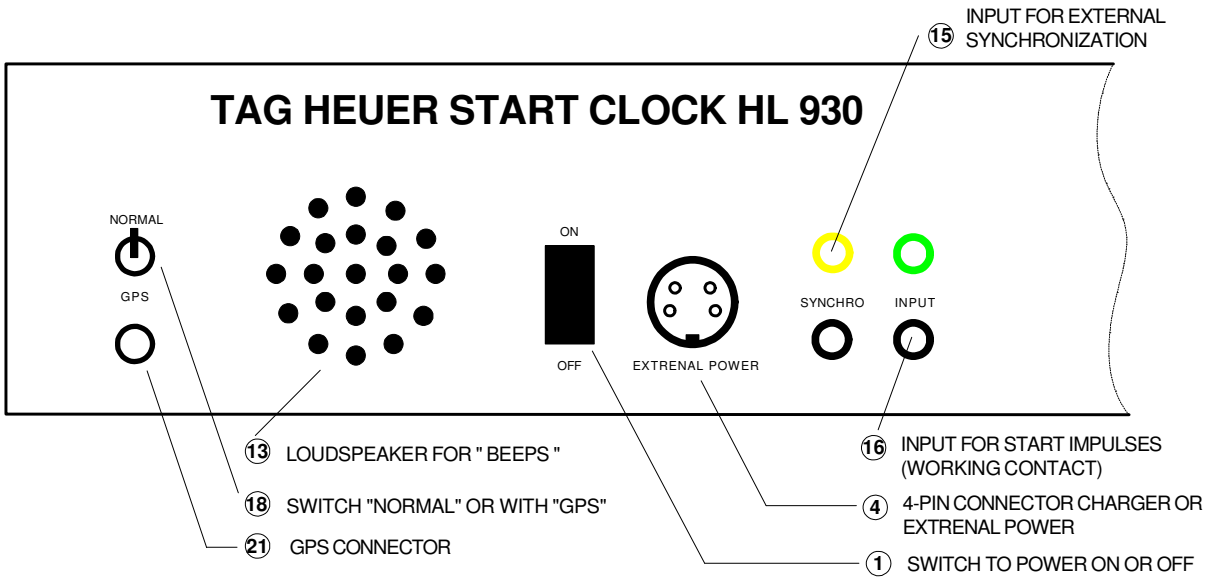
- The bidirectional RS 232 data port also serves as a way to send control commands to adjust operating parameters of the HL 930 start clock.
- A supplementary output provides control signals for signal lights or additional loud speaker.
- Rechargeable batteries assure excellent operational duration down to – 25° C.
- The start clock can be fixed on a support-post using the support HL 930-4 or on a tripod (HL 5R or HL6).

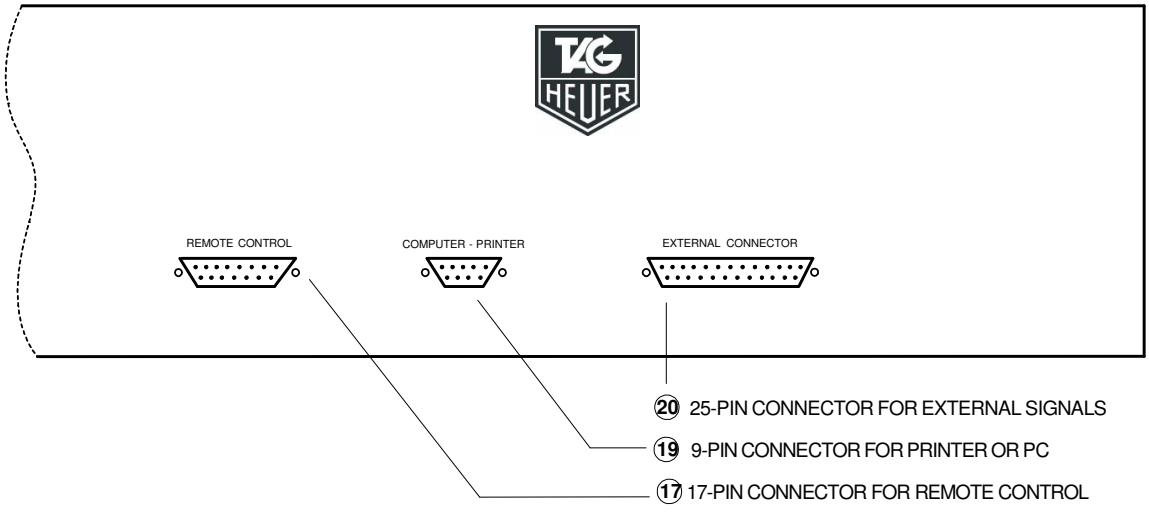
Option

- Remote Control (ref. HL 930-1).

I. START CLOCK DESCRIPTION







II. START CLOCK MODE

1	**ON**	Switch to power ON or OFF the start clock
2	**CHARGE**	LED for battery condition LED flashes when battery is discharged (see autonomy)
3	**TEST**	Control key for the charging of the batteries
4	**POWER**	4-pin connector for the charger or for external power (12V battery) (12 ÷ 24 VDC, see pin-out)
5	**POWER**	LED indicates presence of external power
6	**HOURS**	Switch for the positioning of the hours hand. (Forwards **+** / Backwards **-**)
7	**MINUTES**	Switch for the positioning of the minutes hand. (Forwards **+** / Backwards **-**)
8	**SYNCHRO**	Manual button to trigger initial synchronization
9	**MINUTES**	Selection of intervals between Starts "MINUTES" (From 0 to 11 minutes)
10	**SECONDS**	Selection of intervals between Starts "SECONDS" (From 0 to 55 seconds)
11	**START**	Validation key to engage the count-down sequence for selected Starts
12	**AUDIO**	"BEEPS" volume adjustment
13		Loudspeaker for “BEEPS” Start
14	**STOP**	Key to stop the selected Start sequence (count-down)
15	**SYNCHRO**	Input for external synchronization (normally-open working contact)
16	**INPUT**	Input for start impulses generated by a sensor (normally-open working contact)
17	**REMOTE CONTROL**	15 pin connector for the remote control (ref. HL 930-1)
18	**NORMAL** / **RS 232**	Switch for NORMAL or GPS mode **-** NORMAL : Programming of the start clock parameters Times printed on hard copy (on printer HL 200) Download of memorized times **-** GPS : Operation in GPS mode
19	**COMPUTER** / **PRINTER**	**-** 9-pin connector for a printer to a PC
20	**EXT. CONNECTOR**	25-pin connector for external signals. **-** Control for external starting lights (5 lights-Type F1) **-** Control for external lights RED – YELLOW – GREEN (same as the disk). **-** Audio line (for external louof dspeaker) **-** TOP OF SECOND / TOP OF MINUTES / TOP OF ZERO (TOP OF THE START SIGNAL)
21	**GPS**	**Connector for GPS antenna**

III. OPERATING INSTRUCTIONS

Be sure that the programmed parameters of your start clock are appropriate to the desired application. (See chapter V “START CLOCK PROGRAMMING”)

1 Automatic setting of the time-of-day via GPS reception.

- The GPS antenna must be installed outdoors in a clearly open place with an unobstructed view of the sky in order to correctly receive the satellite signals generated by GPS systems.
- The antenna must be fixed horizontally on its magnetized base and ideally on a solid support or a metal square in order to guarantee a good mechanical resistance
- Carefully connect the GPS antenna cable in the socket (21) located under the Start Clock
- Set the switch (18) in GPS mode.
- Switch on the Start Clock (1).
- The hands will rotate and stop to be positioned "at zero" (on12 o’clock).
- The minutes hand is then used to indicate the difference at your time zone compared to the GMT time used by the GPS system satellites. This variation can be modified by using the switch of the minutes (7).
- The horizontal segment in the middle of the left digit starts to flash and the right digit indicates the number of satellites identified. A fix of at least 3 satellittes is required and may take some minutes to engage.
- After approximately 2 minutes, the hands will rotate to the official GPS time-of-day, and the Start Clock will automatically start running.

2 Manual setting for the synchronization of the time-of-day (without GPS)

- Switch (18) on Normal
- Power ON by the switch (1) "ON"). Switch (18) on NORMAL
- The clock hands will move to “zero" (on12 o’clock).
- In the meantime the digits indicate “88”.
- The rotating disk does one rotation and stops on the RED position.
- The light “CHARGE” is on and should not flash (see autonomy).

Note: If it is necessary to switch OFF the Start clock, you should wait at least 5 seconds before switching it ON again.

Setting of the hands at the desired time:

- Hours with the switch **(6)** Forwards **+** or Backwards **-**
- Minutes with the switch **(7)** Forwards **+** or Backwards **-**

! WARNING ! The Start Clock HL 930 runs on the 24 hours clock

When the hands are in position "zero", the represented time is 12h00

- To synchronize it at 9h00 for example, it is necessary to move the hours hand back to 9
- To synchronize it at 21h00, it is necessary to turn hours hand forward to 9
- This detail is obligatory when the start clock is to be used with the printer (HL 200) or the computer to download the memorized times

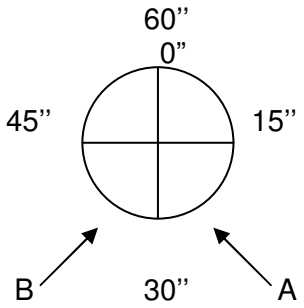
3 Synchronization at the exact time-of-day

- Manually, by pressing on the contact **(8)** SYNCHRO (Starting time).
- With the Input **(15)** SYNCHRO (yellow and black ”banana plugs”) for a synchronization with several start clocks in parallel or other timing devices. Respect the polarities, Yellow = impulse / Black = Ground (If other devices from other brands have to be synchronized we recommend the use of our impulse distributors HL 553).
- Set the timing devices at the time-of-day corresponding to the start clock + 1 minute. Thus, at the next “TOP minute” all devices will be synchronized at the selected time via output pulse generated by the Start Clock.
- Verify that all the devices are well synchronized.
- Block the timing inputs of the devices / Disconnect the timing devices.

4.0 Control of start intervals

- Select the interval with the MINUTES (9) and SECONDS (10) switches)
- Intervals can be selected in a range from 10” to 11’ 55” in steps of 5”
- To activate the selected countdown interval, you must press the START (11) button during the 15 seconds period which precedes the start of the programmed countdown.
- When properly activated, as you press on the START button, the colored disk will perfom 1 rotation (Starts validation).

Examples: *(for the 1st start at time ”0”)*



A. Press START between 15” and 30” if the programmed countdown is 30”.
B. Press START between 30"and 45" if the programmed countdown is 15".

4.1 Expected visual Countdowns based on selected Start Intervals:

(For details, see chapter **V** ”START CLOCK PROGRAMMING”)

The visual countdown digits will generate different countdown intervals based on the start intervals selected. Below are a few examples of the what to expect

5” for intervals of 10 seconds.
10” for intervals of 15 seconds.
15” for intervals of 20 to 55 seconds.
30” for intervals of 1 minute and more.

4.2 Change of start intervals during the race.

(See chapter **V** ”START CLOCK PROGRAMMING”)

The change to a different start interval must be done BEFORE the last competitior on the current start interval has departed.

Example:

Start Intervals programmed at 30" until 12h 06’ 00’’

New interval to program at 15" from 12h 06’ 00’’

The interval should be changed between 12h 05’ 30’’
and 12h 06’ 00’’

4.3 Stop of the starting process (Race interruption for ex.)

- Press STOP (14) for a minimum of 2 seconds minimum
  (Blanking of the display and rotating disk to the RED position will occurr)

- New starts can be decided as you wish respecting the previous rules

5 Do not forget to adjust the audio volume (12)

1 x “BEEP“ at 10” from the start.
5 x "BEEPS" for the last 5 seconds with a high-pitched BEEP for the start.

6 The 3 colors rotating disk (red green and yellow) allows to visualize valid start periods.

Ski The disk is RED between starts.
The disk becomes GREEN 5 seconds before the ideal starting time and return to RED after 5 seconds.

Rally The disk is RED between starts.
The disk becomes YELLOW 5 seconds before the ideal starting time (Attention, start) and GREEN for start validation when the display indicates 0.
The disk returns to the RED position after 5 seconds.

7 Mounting

- The start clock can be mounted on a tripod 3/8” (standard camera thread), mounting ball, or support. Contact your agent.
- We recommend the use of a high quality tripod to assure stability.
- In case of strong wind, we recommend to secure or stabilize the tripod with additional weight fixed on the base.

8 ! WARNING !

- **Do not clean the plexiglas with a dry or dirty cloth.**
  You must clean it with a clean wet cloth and a mild cleaning product (Soap and water).

9 HL 930 complete set includes:

- 1 transport case (HL 930-7)
- 1 GPS antenna
- 1 charger 110 / 220 VAC (Type of plug to be confirmed USA / Europe) (HL 930-3)
- 1 programming software “HL 930 Controler”
- 1 operating instructions

10 Option:

Printer MARTEL HL 200 for the printing of the ideal time (TOP minute) and real starting times with difference between these two values.

IV. AUTONOMY AND CHARGING OF THE START CLOCK HL 930

The HL 930 has an excellent operating autonomy on the internal batteries.

Of course, autonomy depends on the state and on the maintenance of the rechargeable batteries.
With well-charged and maintained batteries we can guarantee the following values with 1 Start per minute and maximum Loudspeaker volume.

24 hours at 20° C
15 hours at 0° C
10 hours at –20° C
8 hours at –30° C

- The LED CHARGE (2) flashes when the rechargeable battery is partially discharged (~50%).
- At this moment, we recommend to use an external power supply or to recharge the Start clock.
- You can control the state of charge of the battery by pressing TEST (3) during 5 seconds.
- If the LED (2) is not flashing, it means that the start clock batteries are guaranteed for several hours.
- When the LED (2) is flashing, the key TEST should not be used.
- In extreme cases and as the start clock approaches inoperability, as an additional security feature you can save the start timing when the capacity of the battery is very low.
  - The two digits display will indicate “LO”, the rotating disk and the start “BEEPS” will stop working.
  - The official time of the start clock will continue to be correct carry during ~1 hour.

Use and functions of the charger

- Connect the charger HL 930-3 to a normal household ac current receptacle
- Connect the charger to the power input jack (4)
- **RED LED Flashing very fast** ⇒ The red LED is flashing faster than one flash per second. **Batteries are totally DIS-CHARGED**
- **RED LED ON** ⇒ The LED is continually red **Batteries are CHARGING**
- **RED LED Flashing** ⇒ The red LED is flashing every second. **Batteries are totally CHARGED**

Important notes:

- **Never leave the start clock discharged for a long period.** At the beginning, it is however advised to **discharge and recharge the start clock 3 to 4 times to fully access the rechargeable batteries capacity**.
- The charger can also be used as an external power supply when the start clock is working, in-so-far as they are not completely discharged.
- **!! WARNING !!** If the start clock is OFF, the LED CHARGE (2) is not active when you plug the charger. The charger LED to note is on the external power supply itself.
- **For safety reason, during internal battery refill, it is imperative that the Clock HL930 is switched OFF.**
  It is recommended to refill the battery at ambient temperature (20°)

V. START CLOCK PROGRAMMING

CHANGE OF THE START CLOCK PARAMETERS USING THE PROGRAM "HL 930 CONTROLER"

1. **Connect your PC to the start clock HL 930 using the "COMPUTER"** (19) **plug.**

2. **Switch RS 232** (18) **on "NORMAL" position.**

3. **Start the PC and launch the "HL 930 CONTROLER ".**

4. **Turn on the HL 930** (1)**.**

Short description of window "HL 930 CONTROLER"

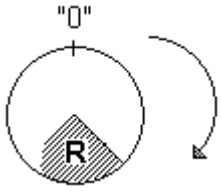
- SERIAL PORT : Choice of the serial port (COM X)
- COLOR DISK : Choice of the 3 colors rotating disk for the starting process.
  RED: Prohibited starts.
  YELLOW: Warning start (if desired).
  GREEN: Authorized starts.
- COUNT DOWN : Setting of the count down (30,15 sec…) of the digits.
- ACCOUSTIC SIGNAL : AUDIO starting signals (BEEPS).
- GET STARTS : Download of the memorized starting times in the HL 930.
- GPS TIME : Only for HL 930-GPS. Adjustment of the time-of-day compared to GMT.
- FILE : Download of the variable parameters in the start clock HL 930. Click on "SAVE PARAMETERS TO CLOCK".
- COMMAND STATUS : Download or connection with the PC confirmation.
  YELLOW: HL 930 is not connected.
  RED: "NACK" Datas not transferred.
  GREEN: "ACK". OK. Datas transferred.

5. **Click on SERIAL PORT** and to select COM1 (or other). The start clock answers "CONNECTED...".

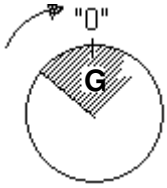
6. **Click on COLOR DISK** to program the visual periods of the 3 colors disk.

! REFER TO THE IDEAL STARTING TIME "0"

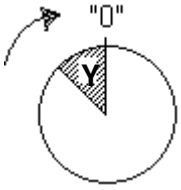
RED : Insert the desired number between "0" and the red color start.



Green : Insert the desired number of seconds between the green color start and “0”.



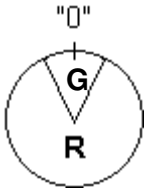
YELLOW : Insert the desired number of seconds between the yellow color start and “0”.



Save parameters by clicking on FILE and SAVE PARAMETERS TO THE CLOCK.

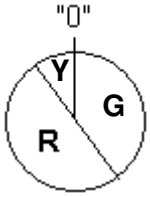
Examples:

SKI : The disk is red between starts. The disk becomes green 5 seconds before the ideal start time and turns back in red position 5 second after.



RED: 05 sec. GREEN: 05 sec. YELLOW: 00 sec.

RALLY : The disk is red between starts. The disk becomes yellow 5 seconds before the ideal start time and green at “0”. The disk turns back in red position 20 seconds after.



RED: 20 sec. GREEN: 00 sec. YELLOW: 05 sec.

7 **Click on COUNT DOWN** for a timing countdown from 01 to 59 seconds.

Examples:

- For starts each minute, a countdown from 30 seconds is sufficient.
- For starts each 30 seconds, a countdown of 15 seconds for the ski and 10 seconds for the rally are advised.

Important rule:

If the count down is programmed with a higher value than the desired intervals, the start clock will always begin the new countdown 5 seconds after the ideal start time of the last competitor (Especially for the rally, it is necessary to take this rule into account because the starts are possible at intervals of 20 seconds).

Save parameters by clicking on FILE and SAVE PARAMETERS TO CLOCK.

8 **Click on ACCOUSTIC SIGNAL** to program the wished "BEEPS" sequence before starts.

Generally, we use:
1 BEEP, 10" before the start (SINGLE BEEP 10 seconds).
5 BEEPS for the last 5 seconds before the start (CONTINUOUS BEEP 5 seconds).

Save parameters by clicking on FILE and SAVE PARAMETERS TO CLOCK.

To confirm the parameters while clicking on FILE and SAVE PARAMETERS TO CLOCK.

9 **Click on GET STARTS** when you wish to download the memorized ideal and real starting times in the start clock HL 930.

Of course, this operation has relevance only if the start clock HL 930 were used with a starting accessory sensor (photocell, starting gate) on the input (16) during operation.

The delivered precision is the one used in rally which mean the 1/100 of seconds with the calculated difference compared to the ideal start time at the 1/10 of seconds. For a use at the 1/1000 of seconds, contact your agent.

10 **Click on TIME MEASURE** to set the precision of the printed times.

11 **Click on GPS TIME** to adjust the local time with the GMT time.
This function is available only with a start clock HL 930 with integrated GPS.

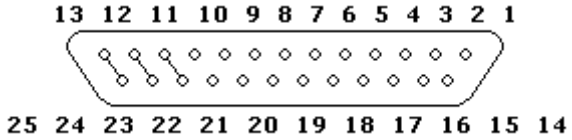
12 **PROTOCOL HL 930**

Available on: **www.tagheuer-timing.com**, under the “Operating instructions and protocol” headline.

When all the start clock parameters are configured. Carry out the time-of-day synchronization (chapter II and III)

VI. 25 PIN EXTERNAL CONNECTOR

Pin description



1 : lamp 1 command
2 : lamp 2 command
3 : lamp 3 command
4 : lamp 4 command
5 : lamp 5 command

6 : external GND (mass of the signals on pins 1, 2, 3, 4, 5, 14, 15, 16, 17, 18, 19)

7 : START input
8 : STOP input

9 : AUDIO LINE output

10 : SYNCHRO input

11 : Activation of the red, yellow and green lamp commands (activation = ponted to pin 23)

12 : Activation of the lamps 1, 2, 3, 4 and 5 commands (activation = ponted to pin 24)

13 : Activation of the TOP MINUTE, TOP SECOND and TOP "0" commands (activation = ponted to pin 25)

14 : lamp RED command
15 : lamp YELLOW command
16 : lamp GREEN command

17 : TOP SECOND output
18 : TOP MINUTE output
19 : TOP "0" output

20 : internal GND (mass of the signals on pins 7, 8, 9, 10)
21 : idem
23 : idem
24 : idem
25 : idem

VII. TECHNICAL SPECIFICATIONS

General

- The Start Clock HL 930 is world-renowned
- 3 separate stepping motors make up this sophisticated movement to control the hours, minutes and seconds hands.
- An integrated GPS receiver ensures the exact synchronization to the official time-of-day at your location.
- In addition to the analogue movement, two seven-segment numeric indicators visually countdown the remaining seconds to each start interval.
- Further, another indicator comprised of a rotating red, green and yellow disk provides information on start validity.
- An acoustic signal rounds out the battery of indicators that serve this start clock

Start Intervals

- From 10 seconds to 11 min 55 sec in 5 second increments

Time Setting

- From internal GPS or manually

Time Base

- 16 MHz Thermocompensated Quartz Crystal
- +/– 0,5 ppm at 20° C
- +/– 2,5 ppm from –30° to 75° C

Outputs

- 1 RS 232 Data output /9'600 bds for Printer or CP (program differents setting of the Start Clock)
- 25 Pin Connector with multiple outputs of timing signals for lights, additional audio systems or other visual indicators

Inputs

- GPS Antenna Connector
- Timing Impulses
- SYNCRHO and TOP MINUTE signal synchronize other Timing Devices (CP520)
- Remote Control

Temperature Range

- 25° C to + 75° C (without heating)

Power Supply

- Internal : 12V DC rechargeable battery
- External : 12-18V DC source

Autonomy

- 18 hours at 20° C
- 8 hours at – 20° C

Housing

- Hot lacquered black aluminum case
- Delivered with its tranport case, charger, GPS antenna and setting software.

Dimensions/Weight

- 6kg alone (11,5 kg with transport case).
- 320 x 500 x 115 mm
- Clock face diameter : 270 mm
- digits height : 110 mm

VIII. IMPORTANT REMARKS

GMT = UTC TIME (Coordinated Universal Time)

The time-of-day which is provided by the GPS (Atomic Time-of-day) differs from 13 seconds (since 2001) of the UTC time. This information is transmited every 12.5 minutes by the satellites. However, this information remains in the “almanac” (memory) of the GPS which allows a fast synchronization.

If the Start Clock battery is completely discharged, the “almanac” (memory) is lost. In this case, the Start Clock can be synchronized with an error of 13 seconds. This is an absolute error.

If a timing requires an absolute correct time-of-day (for example several Start Clocks) and that the battery was completely discharged, the following protocol must be followed to restore the precision of the GPS receiver:

- Charge the accumulators
- Switch on the Start Clock (POWER ON)
- Wait for the automatic synchronization via GPS
- Wait more than 13 minutes
- Switch off the Start Clock (POWER OFF)
- Switch on again the Start Clock (POWER ON)
- The following synchronization will be at the correct in the absolute.