Time Signal Generator

TSG400

Version

P161.01

Serial number

XXXX-XXXX

Technical data

	value	**Condition**
Case dimension	290 x 260 x 75mm	W x L x H
Weight:	2,9 Kg	
Voltage:	115 / 230 V +-10%	Fuses: 250mA 230V 500mA 115V
Storage temperature	-20° - +50°C	
operating temperature	+10° - +40°C	
Humidity	0% - 90%	not condensing
output voltage	1.0µV – 9.00V eff.,	before 50 Ohm output resistor, in 7 decades, each is 3 digit adjustable
Deviation of output voltage	±2%	
Adjustment of output voltage via time signal	0% - 99% of carrier amplitude,	1% steps
Frequency	40.000 kHz 60.000 kHz 77.500 kHz	
Time pulse and frequency deviations	±0.5ppm equals ± 43ms/day	
Time pulse and frequency deviations	short term: ± 0.1ppm 1 day and > 1day: 0ppm	with connected GPS receiver after 30 minutes
Accuracy of modulation impulse length	±0.5ms	
Accuracy of impulse flank	±75µs	at the start of the second, in GPS operation
Time pulse and frequency change	-99.9ppm – 99.9ppm	0.1ppm steps
Data memory of backup battery	> 100 years	OFF time: >2days
field strength	lower limit: 1µV/m (or: higher value of field strength that is created at 1µV output voltage) upper limit: 9.00V/m (or: the lower value of field strength that is created at 9.00V output voltage	from 1 abbreviating antenna factor

Operation

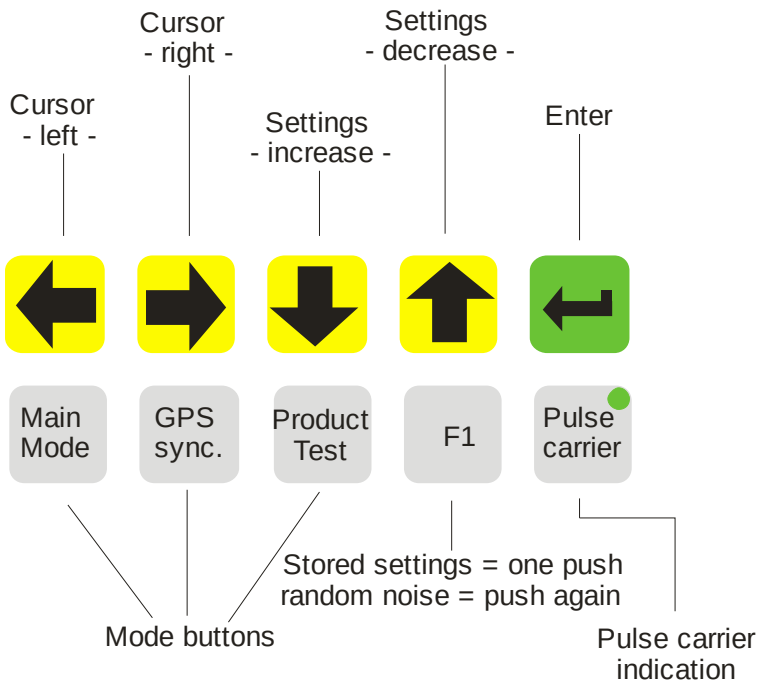
1. General

The TSG400 time signal generator simulates the time signals DCF, MSF, WWVB, HBG and JJY. Connection of the GPS receiver enables maintain free operation, since switch to DST is done automatically within the corresponding signals. Operation is done via buttons, display via four-line, illuminated LCD. In the main menu, all important parameters such as time, antenna factor, date, time signal and output voltage are easy to recognize and modify.

2. Button functions

After turning on the TSG400, always the main menu is shown in the display. The values that have to be adjusted can be chosen by using the buttons ⬅ and ➡ The chosen value is indicated by the cursor (underline). The cursor will only move to positions, where something can be adjusted. The actual adjustment of any values is done with the buttons ⬆ and ⬇

In some adjustments, by pushing ⬆ and ⬇ continuously (>1s), a fast mode can be activated. To enter a different mode, push the adequate button.



2.1 Button 

With this button, the cursor can be moved to its next position to the right.

If the last character in a line is reached, the cursor will move to the very left character in the next line. If no other line is available, the cursor will stay in its current position.

2.2 Button 

With this button, the cursor can be moved to its next position to the left.

If the last character in a line is reached, the cursor will move to the very right character in the next line. If no other line is available, the cursor will stay in its current position.

2.3 Button 

With the + button, a selected value can be increased

2.4 Button 

With the – button, a selected value can be decreased.

2.5 Button - 

With the  button, settings are confirmed. If this button is pushed, the chosen values are confirmed.

2.6 Button **F1**

With the F1 button, the sub menu STORED SETTINGS and RANDOM NOISE can be selected

2.7 Button **pulse/carrier**

This button has the same function in all modes. By pushing the button, following selection can be made with the generator:

Modulated output signal (normal condition: LED will flash once a second)
Non-modulated output signal (carrier frequency only: LED is in continuous operation and not flashing)
No output signal (carrier frequency OFF: LED is OFF)

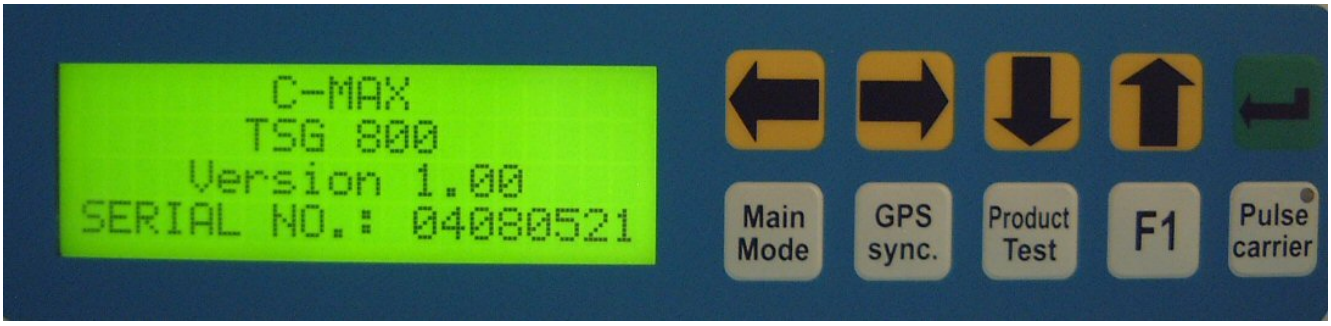
2.8 Buttons – **3 single mode buttons**

Each mode can be directly selected by pressing the corresponding button.

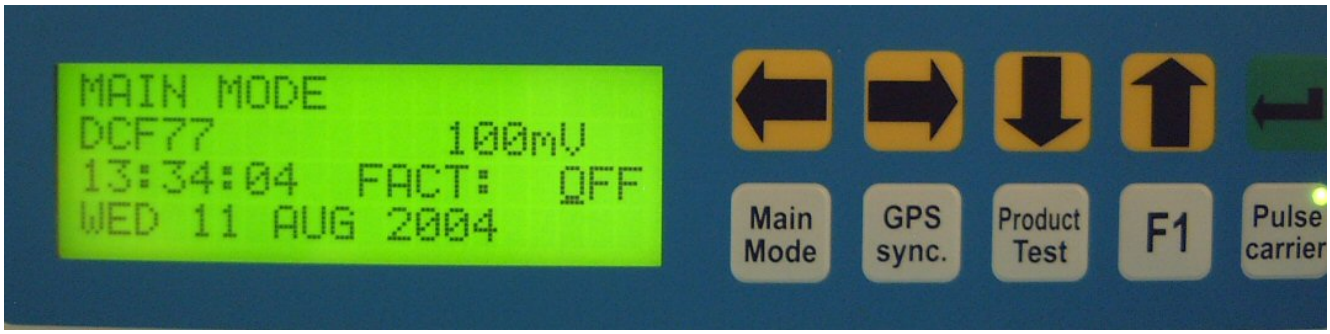
3.0 Operation

3.1 MAIN MODE

After Turning on the TSG400, following information will appear in the display:



After 5 seconds, it will automatically be switched to the MAIN MODE



In this mode, following adjustments can be done:
Protocol, output voltage/field strength, hours, minutes, seconds, antenna factor, day, date, month, year.

The icons in the upper right corner of the display are defined as following:

 = “Sync sec” activated

The adjustment of time and date in GPS operation is not recommended,
since all values will be re-adjusted to the actual ones if “Sync time” is activated.

Default values:

Protocol:	DCF77	Output voltage (field strength):	100 mV (/m)
Time:	Actual time	Antenna factor:	OFF
Date:	Actual date		

3.1.1 Adjustment of protocol

If the cursor is positioned onto any name of a time code transmitter, another transmitter can be chosen with the buttons ⬆ and ⬇. Standard settings for the chosen transmitter will be valid at this time.

3.1.2 Adjustment of output voltage and field strength

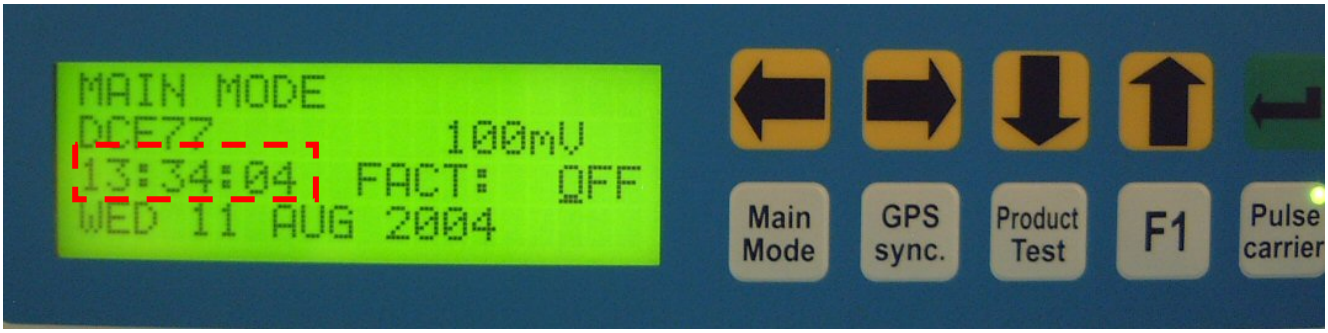
To place the cursor to the outpout voltage/field strength, use the ➡ button.

The cursor can be positioned onto the three possible digits for value adjustment or point onto the corresponding unit of the output voltage/field strength. The desired value can be adjusted with the ⬆ and ⬇ buttons. If the cursor is positioned onto the unit, the unit for output voltage /field strength can be increased or decreased with the ⬆ and ⬇ buttons.

Note: If any value other than 1 is adjusted for the antenna factor, the indication of the output voltage (µV) will change to indication of field strength (µV/m)

3.1.2 Adjustment of time

To place the cursor to the time, use the ➡ button.



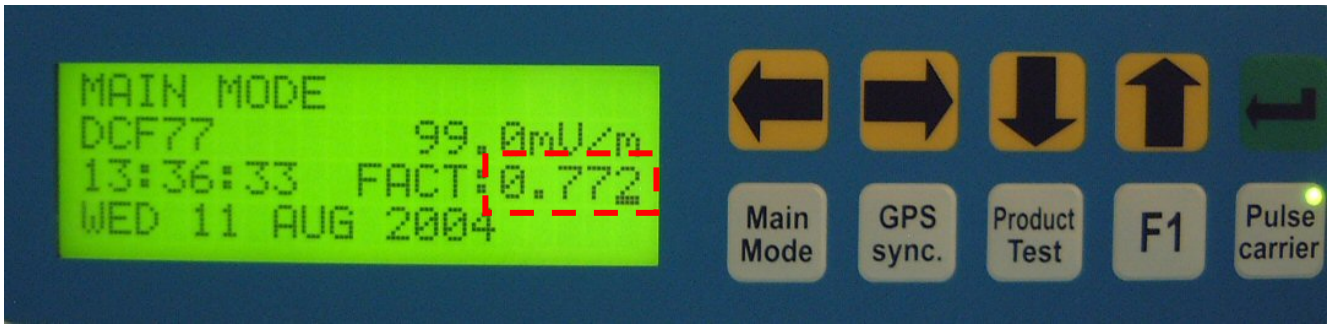
The cursor may be positioned onto hour, minute or second.

Hours and minutes can be increased or decreased with the buttons ⬆ and ⬇. If positioned onto seconds, the seconds can be set to 00 with the buttons ⬆ (minute will be increased) and ⬇. (only second set to 00 no chnage of the minute)

NOTE: If time cannot be adjusted, GPS SYNC is still activated. See “GPS sync.” to change to GPS OFF.

3.1.3 Adjustment of antenna factor

To place the cursor to the antenna factor, use the ➡ button.



To switch from OFF to any value, use the ⬇ button.

Then, the cursor can be positioned onto 4 possible digits for value adjustment of the antenna factor. The desired value can be adjusted with the ⬆ and ⬇ buttons.

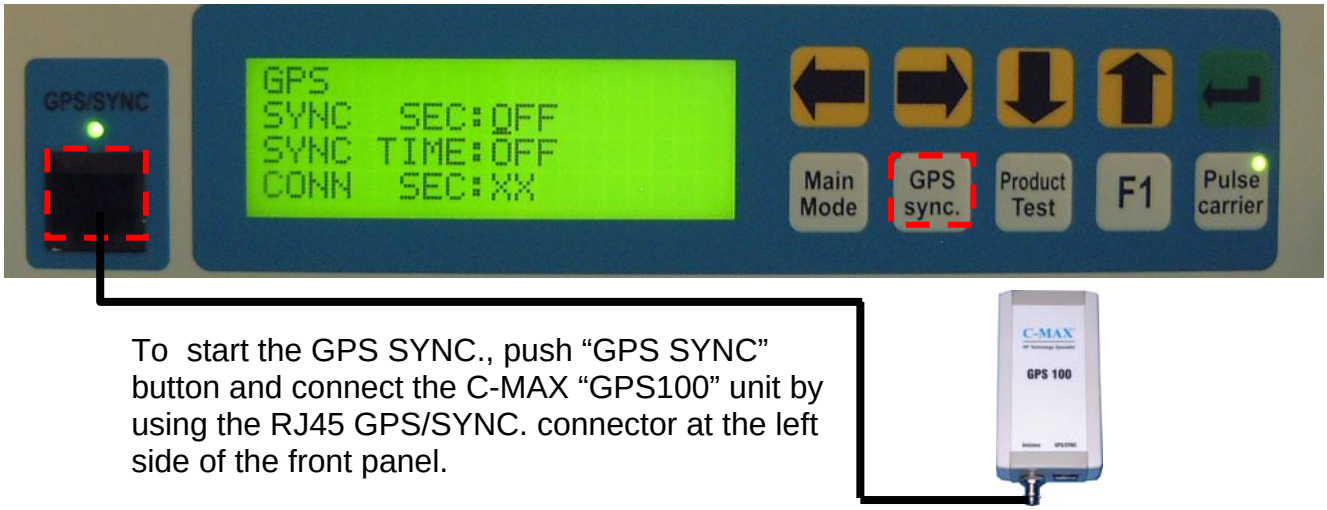
Note: If any value other than 1 is adjusted for the antenna factor, the indication of the output voltage (µV) will change to indication of field strength (µV/m)

3.1.4 Adjustment of date

To place the cursor to the date, use the ➡ button.

The cursor may be positioned onto date, month and year. The chosen value can be increased or decreased with the buttons ⬆ and ⬇. If a date has been chosen which is larger than the length of the displayed month, the date is automatically adjusted to the largest allowed value. The adjustment of the year is possible from 2000 up to 2099. The day-of-the-week is calculated automatically.

4. GPS SYNC.



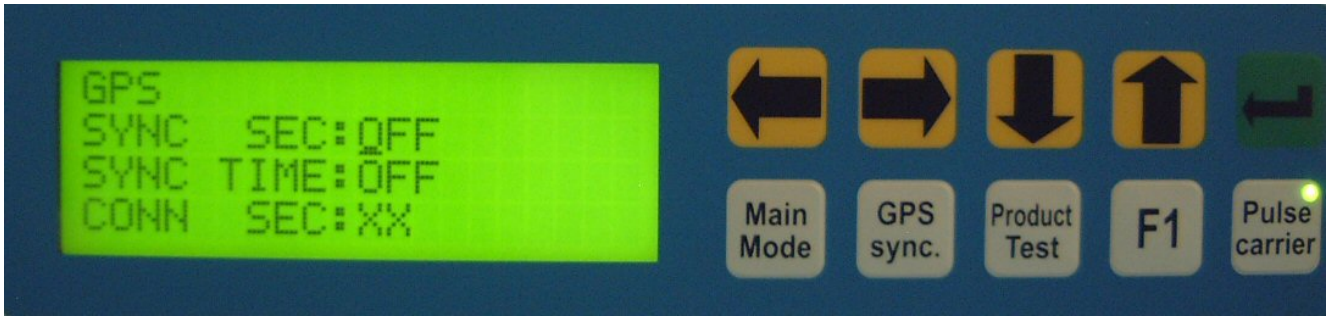
To start the GPS SYNC., push “GPS SYNC” button and connect the C-MAX “GPS100” unit by using the RJ45 GPS/SYNC. connector at the left side of the front panel.

The GPS mode will allow different operating options. Available are the options “Sync sec” and “Sync Time”. If “Sync sec” is set to ON, the change over of the second is adjusted exactly to the change over of the second of UTC time. If this feature has successfully finished, L will be displayed in the upper right corner of the display. If, in addition, “Sync Time” is set to ON, the time that is supplied by the GPS receiver will be calculated into local time (exception: WWVB) and be transmitted as time and date. The calculation will also take possible summer time settings into consideration. If the GPS receiver is connected, the recently transmitted values of the second will be displayed. If the GPS receiver is not connected XX will be displayed in the same position.

If “Sync Time” is chosen, “Sync sec” will be turned on automatically.

If “Sync sec” is activated, an automatic fine tuning of frequency and time pulse will be done in addition to adjustment of the second impulse to UTC.

A precision of ±0.1ppm will be accomplished after max. 30 minutes. If a highly deviating value has been adjusted previously, the display “locked” might appear and disappear in uneven periods.



NOTE:
Before disconnecting the RJ45 connector, the GPS SYNC must be switched OFF or the whole unit must be turned OFF.

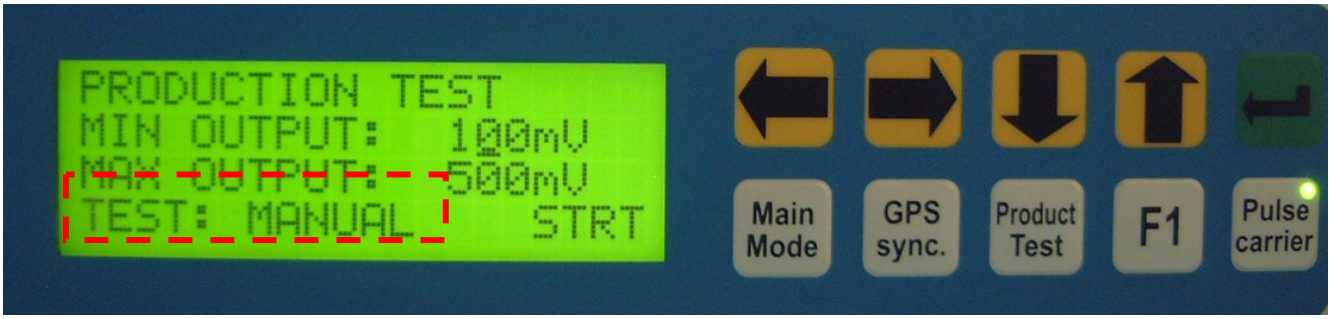
5. PRODUCTION TEST

To activate the PRODUCTION TEST MODE, the button PRODUCT TEST button must be pushed.

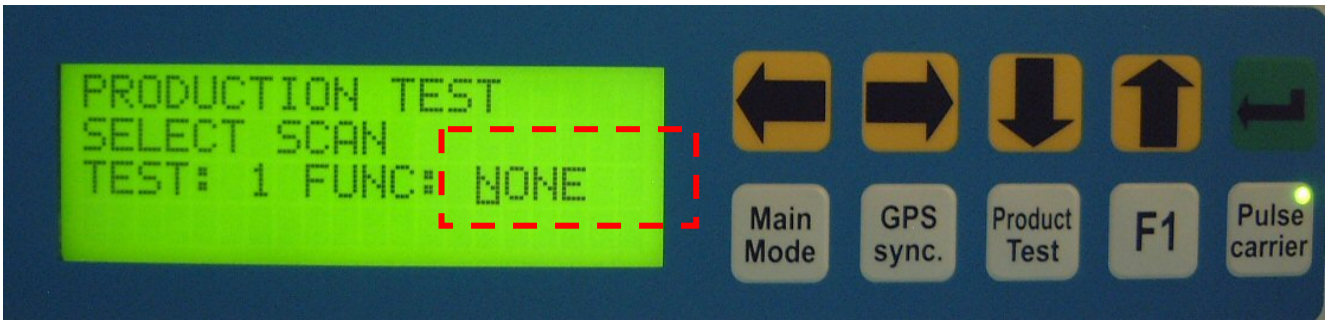
The test jig must be connected to the SUB25 parallel connector at the back side of the TSG800.

In the Production test main menu Following tests can be selected:

TEST:	MANUAL	SCAN	JJY-D	MSF	WWVB
	JJY60	JJY40	HBG	DCF77	

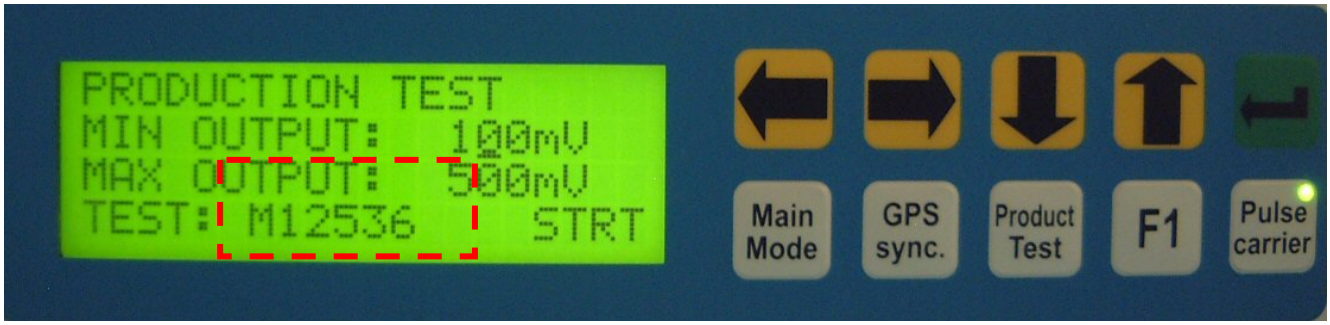


If MANUAL is selected and confirmed by the ↵ key following sub menu appear
With the ↑ and the ↓ the single protocol can be selected and and been confirmed by pressing the ↵ key. The next protocoll can be now selected: By using this MANUAL selection an own customised SCAN mode can be done.

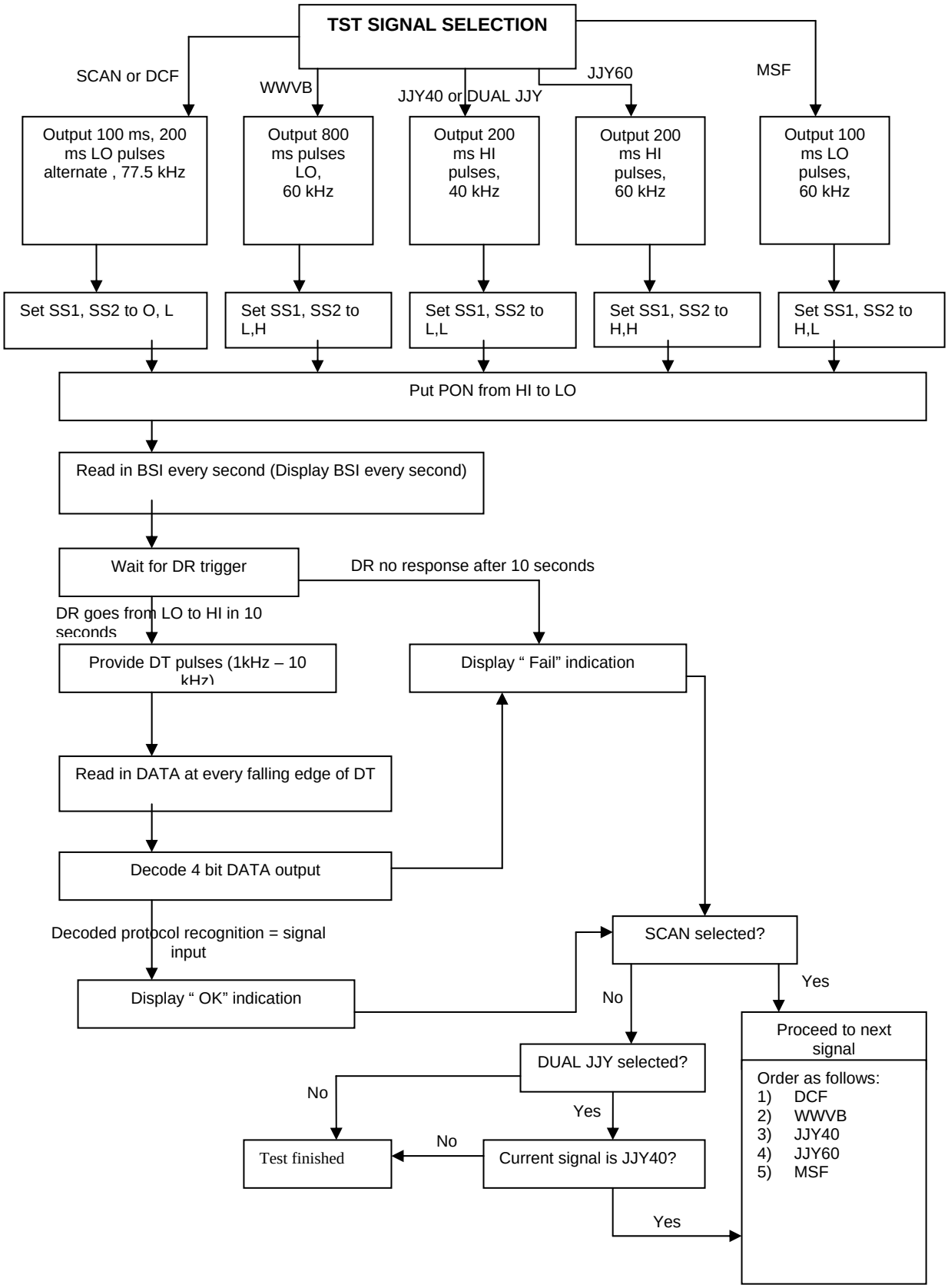


This mode will be stored and appear in future as M(up to 5 numbers)
Following are our internal protocoll sequence numbers:

1:	DCF77	2:	HBG	3:	JJY40
4:	JJY60	5:	WWVB	6:	MSF



In case that only 2,3 or 4 prtocolls should be used for the customized SCAN the other Functions must be filled up by selecting: NONE.


TST SIGNAL SELECTION
SCAN or DCF
WWVB
JJY40 or DUAL JJY
JJY60
MSF
Output 100 ms, 200 ms LO pulses alternate , 77.5 kHz
Output 800 ms pulses LO, 60 kHz
Output 200 ms HI pulses, 40 kHz
Output 200 ms HI pulses, 60 kHz
Output 100 ms LO pulses, 60 kHz
Set SS1, SS2 to O, L
Set SS1, SS2 to L,H
Set SS1, SS2 to L,L
Set SS1, SS2 to H,H
Set SS1, SS2 to H,L
Put PON from HI to LO
Read in BSI every second (Display BSI every second)
Wait for DR trigger
DR no response after 10 seconds
DR goes from LO to HI in 10 seconds
Provide DT pulses (1kHz – 10 kHz)
Display " Fail" indication
Read in DATA at every falling edge of DT
Decode 4 bit DATA output
Decoded protocol recognition = signal input
SCAN selected?
Yes
No
Display " OK" indication
Proceed to next signal
Order as follows:
1) DCF
2) WWVB
3) JJY40
4) JJY60
5) MSF
DUAL JJY selected?
No
Yes
Test finished
No
Current signal is JJY40?
Yes

ROUTINE:

1. Set output level to defined min. value
2. Output pulse as set in TST signal
3. Set SS1, SS2 to TST Signal (PON Reset first)
4. Wait for protocol recognition
5. Repeat for max. value

SCAN:

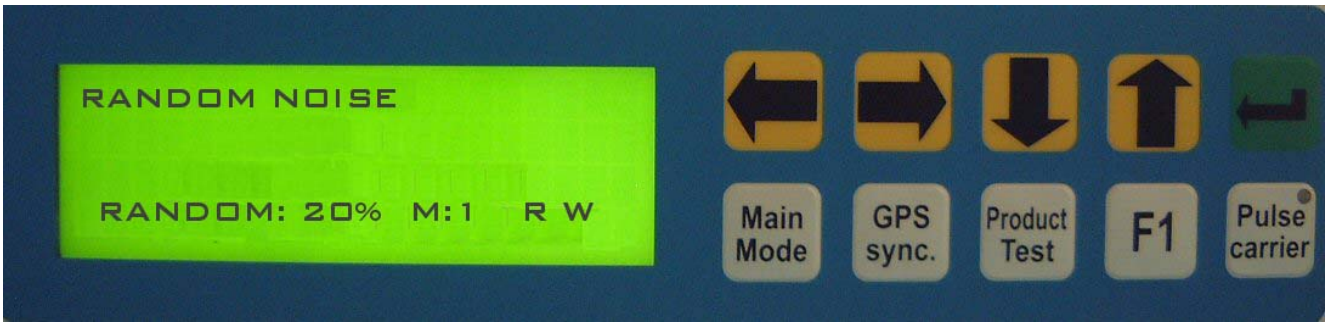
1. DCF
2. WWVB (MSF – WWVB)
3. JJY60
4. MSF
5. JJY40

6. STORED SETTINGS

To activate the STORED SETTINGS MODE, the button F1 must be pushed.

In this mode, up to 9 complete settings of the TSG800 which are deviating from the TSG800 standard settings, can be stored and/or recalled. This mode is activated by pushing the F1 button. After entering the mode, READ for storing a setting sequence or WRITE for transmitting a previously stored setting to the TSG800 can be chosen. In the bottom two lines, protocol, frequency, output voltage and antenna factor of the selected setting sequence are displayed.

To activate the RANDOM NOISE MODE, the button F1 must be pushed again.



To activate RANDOM NOISE, the cursor must be placed at Random noise – OFF. By pushing the ⬆ or ⬇ button, a percentage for the random noise is selected.

Maximum values of 0% (no noise) and 99% (maximum noise) can be adjusted. The percentage expresses the ratio of the maximum stochastic noise level toward the output voltage. Therefore, 99% means, that the noise level is nearly as big as the chosen output voltage. If output voltage is set >5V, the output voltage can be increased by additional noise enough for the limit within the output booster to be activated. Then neither the sinus form nor the adjusted voltage value will be kept. Error-free is ensured only if the sum of the output voltage and the noise level is <10V. In carrier switched off condition, this is not valid (button pulse/carrier). If the carrier has been switched off, the generator will only create the noise. If this noise is radiated via antenna, it will not lead to beats with possibly existing carrier on the same frequency.

The random noise pattern can be stored. Up to 10 different random noise patterns can be stored. To store it select the memory (M) no. (1-10) and then place the cursor below the W (write). To read out the data place the cursor after selecting the number under the R (read).

Random noise settings can be stored via “Stored settings” (F1) or via “Memory” function.

If noise is activated via F1 and the value is not equal 0, the antenna factor indication in the display is replaced by noise percentage indication. Instead of the antenna factor information, a symbol will be displayed in the upper right corner of the display to show that an antenna factor is set. The value for the noise can be changed by using the UP and DOWN button. If the value of the noise is adjusted to 0, it will automatically be switched OFF and instead the antenna factor will be displayed again. Only via F1 the noise can be activated again.

7. Summer time / winter time adjustment

In the protocols of DCF77, MSF and WWVB the switch from summer time to winter time and vice versa is intended. The switch is done automatically by the TSG800. Therefore, the TSG800 has to be turned on during the period of the switch over.

7.1 Switch in DCF

Base condition for accurate switch of time is, that the TSG800 is adjusted to the currently transmitted time. In order to switch to summer time, the TSG800 has to be adjusted previously to winter time. If the date is the last Sunday in March, at 01:00 the bit TCA is set as an indication for the change. At 02:00 the hours will be set to 03:00, the signal bit summer time / winter time will be set to summer time and the TCA bit will be deleted.

To switch to winter time, the TSG800 has to be adjusted previously to summer time. If the date is the last Sunday in October, at 02:00 the TCA bit is set for the switch over. At 03:00, the time is re-adjusted to 02:00, the signal bits will be set to winter time and the TCA bit will be deleted.

7.2 Switch in HBG

Base condition for accurate switch of time is, that the TSG800 is adjusted to the currently transmitted time. In order to switch to summer time, the TSG800 has to be adjusted previously to winter time. If the date is the last Sunday in March, at 01:00 the bit TCA is set as an indication for the change (see 3.3 and 3.3.1). At 02:00 the hours will be set to 03:00, the signal bit summer time / winter time will be set to summer time and the TCA bit will be deleted.

To switch to winter time, the TSG800 has to be adjusted previously to summer time. If the date is the last Sunday in October, at 02:00 the TCA bit is set for the switch over. At 03:00, the time is re-adjusted to 02:00, the signal bits will be set to winter time and the TCA bit will be deleted.

7.3 Switch in MSF

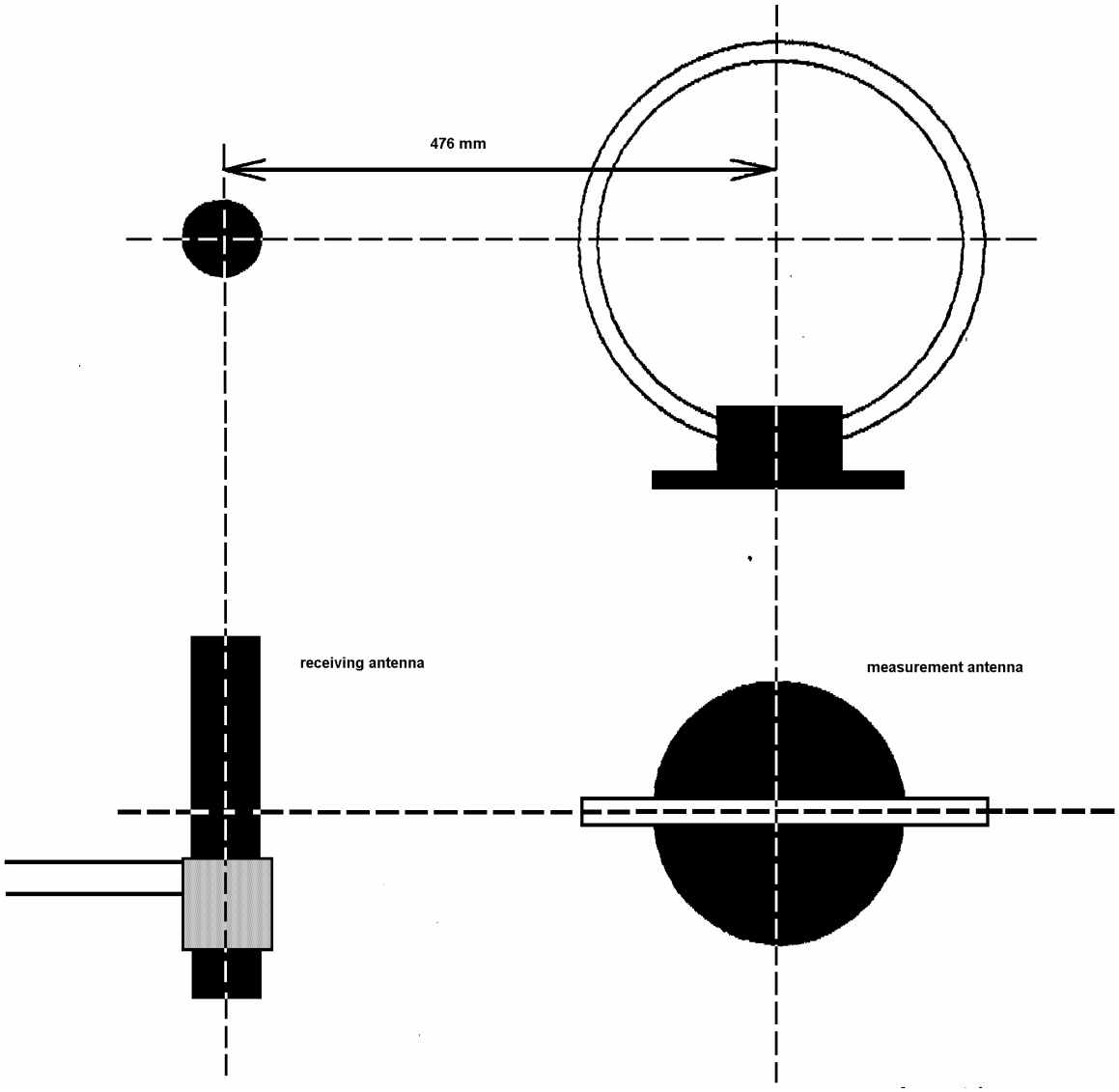
Base condition for accurate switch of time is, that the TSG800 is adjusted to the currently transmitted time. In order to switch to summer time, the TSG800 has to be adjusted previously to winter time. If the date is the last Sunday in March, at 00:00 the TCA bit is set as indication for the change (see 3.3 and 3.3.2). At 01:00 the hours will be set to 02:00, the summer time bit will be set within the protocol and the TCA bit will be deleted.

To switch to winter time, the TSG800 has to be adjusted previously to summer time. If the date is the last Sunday in October, at 01:00 the TCA bit is set for the switch over. At 02:00, the time is re-adjusted to 01:00, the signal bits will be set to winter time and the TCA bit will be deleted.

7.4 Switch in WWVB

Base condition for accurate switch of time is, that the TSG800 is adjusted to the currently transmitted time. In order to switch to summer time, the TSG800 has to be adjusted previously to winter time. If the date is the first Sunday in April, at first bit 57 will be set at 00:00 UTC time within the time protocol. With the set bit 57 and the not yet set bit 58 this day is marked as the day for the switch over from summer time to winter time. All watches and clocks must now do the change automatically, according to the corresponding point of time in their time zone. On the following Monday, the bit 58 will be set also. Then, the switch over is finished.

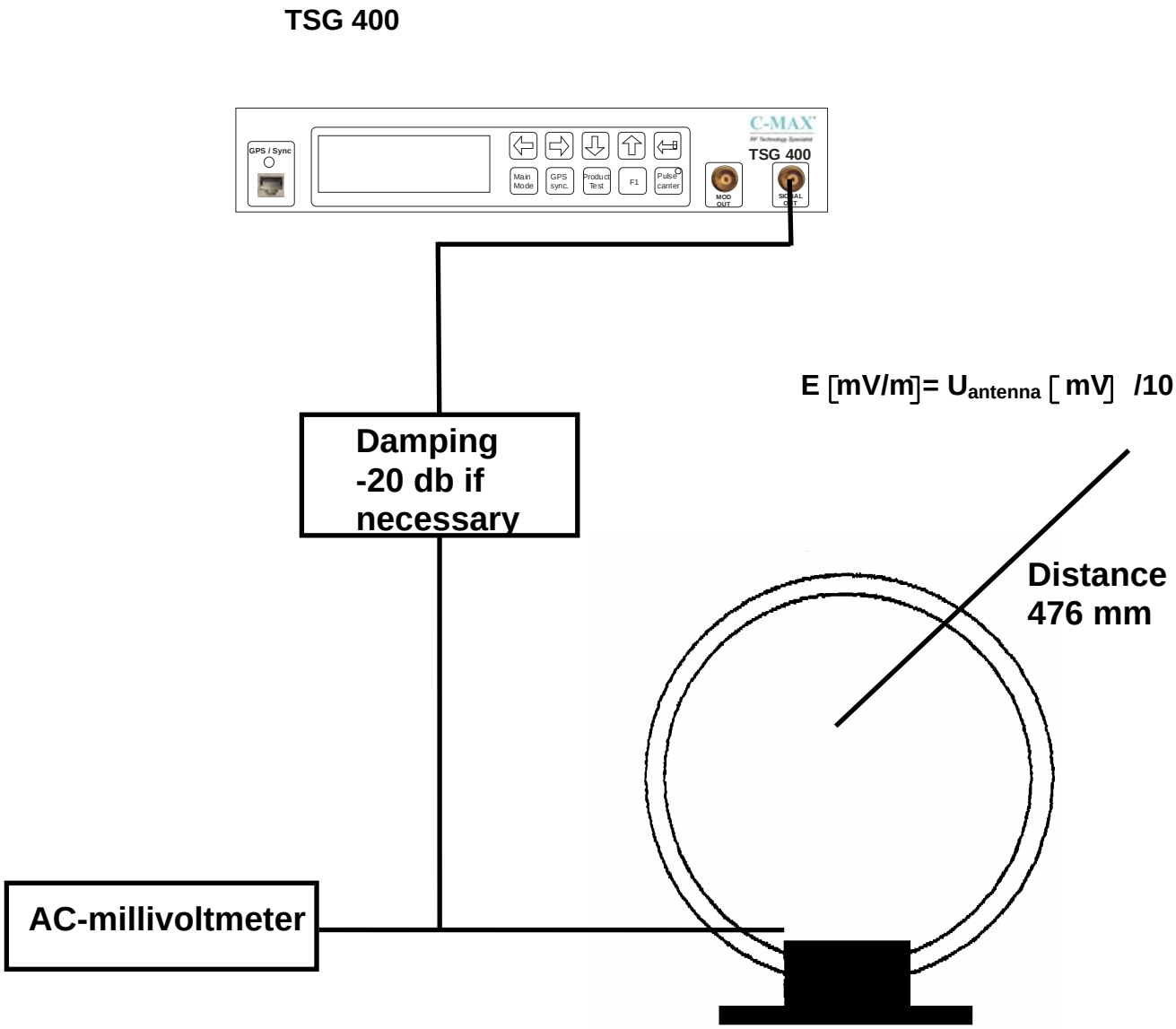
To switch to winter time, the TSG800 has to be adjusted previously to summer time. If the date is the last Sunday in October, at 00:00 UTC time the bit 57 is reset within the time protocol. Due to the reset bit 57 and the still set bit 58, this day is marked as the day for switch over from summer time to winter time. All watches and clocks must now do the change automatically, according to the corresponding point of time in their time zone. On the following Monday at 00:00 UTC time, bit 58 is also reset. Then, the switch over is finished.



Between the shown generator idle motion voltage G_{GEN} [V_S] and the receiving field power under restriction of the above measurement set up following relation exists.

$$E\ [V/m] = k*0{,}313 * U_{GEN}\ [V_S] *2 \qquad ; k=0{,}1m^{-1}$$

To increase the accuracy of the measurement we recommend to make the measurement in a shielded room and to adjust the antenna measurement with a separate voltage meter



When using the 4-loop-antenna, please refer to the corresponding antenna manual for detailed information.

TSG 400 – Hardware calibration

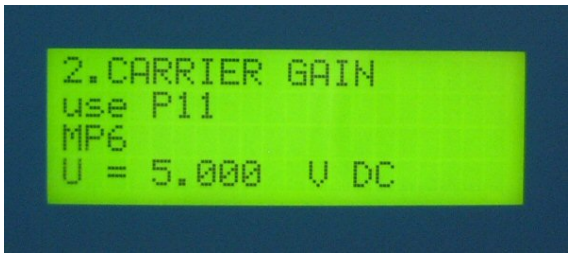
In this mode the base settings of the equipment can be adjusted.

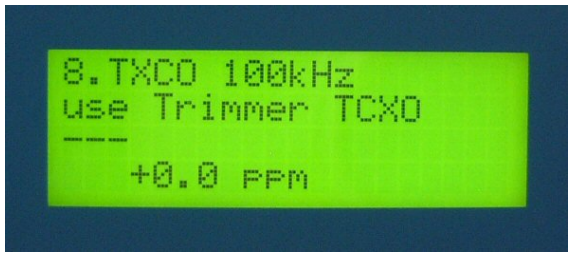
We recommend a re-calibration every 12 month. This calibration can be done in the C-MAX calibration facilty or in an other calibration facility using the calibration standards described in the attached “Calibration Certificate”.

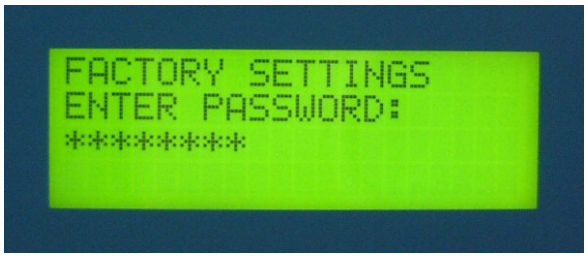
To allow an indipendent calibration facility to calibrate this unit we have put down the instruction below:

To activate the HARDWARE CALIBRATION MODE of the TSG400, the buttons ➡ and PULSE/CARRIER must be pushed >2 seconds.

The different settings for calibration can be selected with the ⬆ and ⬇ buttons. To exit the calibration mode, the TSG400 has to be turned off.







Note: Factory settings are accessible for manufacturer only via password.

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C-MAX Time Solutions GmbH

Carl-Zeiss-Str. 13
74078 Heilbronn

Tel.: +49-7066-900400
Fax: +49-7066-9004029
e-mail: contact@c-max-time.com

Data sheets can also be retrieved from our Internet homepage: www.c-max-time.com