TRANSMILLE 8700
OPERATION MANUAL

FREQUENCY SOURCE / MEASURE
GPS STANDARD

Warranty

Transmille guarantees this product to be free from defects in material and workmanship under normal user for a period of one (1) year from the date of shipment. This warranty does NOT cover any required re-calibration/adjustment or standard maintenance actions. This warranty extends only to the original end purchaser and does not apply to fuses, batteries, external cables or to the product if it has been modified, misused, altered or has been subjected to mishandling or misuse.

Transmille's obligation to warranty is limited to repair or replace the product after return to an authorized Transmille service centre within the warranty period and is subject to Transmille's investigation determining that the fault is not caused by misuse, alteration or through mishandling.

If failure occurs, send the product via pre-paid freight, to the service centre as informed by Transmille with a description of the fault only after receiving confirmation from Transmille. At Transmille's option, either repairs will be performed or a replacement unit of similar condition and age will be provided.

Transmille will return the product to the end customer or local distributor via pre-paid freight (with exception of any customs clearance fees).

Transmille accept no responsibility for damage during return shipping for warranty service.

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Temperature Performance	Storage : -5°C to + 60°C Operation : 0°Cto +50°C
Humidity Performance	Storage : <95%, non-condensing Operation : <80% to 30°C, <70% to 40°C, <40% to 60°C
Altitude	Storage / Transit : 12,000m (40,000ft) Maximum Operation : 3000m (10,000ft) Maximum
Dimensions	Width : 45cm / 17.7 in Length : 44cm / 17.3 in Height : 10cm / 3.9 in
Weight	8.5 kg 18.8 lbs
Connectors	Front Panel : 5 x BNC Rear Panel : 3 x BNC 1 x USB Receptacle 1 x GPIB Connector 1 x Female RS232 1 x RJ45 Socket 1 x IEC Mains Inlet
Line Power	Line Voltage Selectable : 110V / 230V Line Frequency : 50 to 60Hz Line Voltage Variation : -6% + 10%
Display Information	Type : 7.2” Full Colour LCD
Keyboard	Rubber Key
Fuses	Mains Inlet : 500 mA
Warranty Period	1 Year

DECLARATION OF CONFORMITY CE

Manufacturer's Name:	Transmille Ltd.
Manufacturer's Address:	Unit 4, Select Business Centre Lodge Road Staplehurst TN12 0QW

Declares, that the product

Product Name:	Frequency Source / Measure GPS Standard
Model Number:	8700
Product Options:	This declaration covers all options of the above product(s)

Conforms with the following European Directives:

The product herewith complies with the requirements of the Low Voltage Directive 73/73EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly

Conforms with the following product standards:

EMC
EN 61326-1:1997+A1:1998 • EN55011:1991 (Group 1 : Class A)

Standard	Limit
IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995	4kV CD, 8kV AD
IEC 61000-4-3:1995 / EN 61000-4-3:1995	3 V/m, 80-1000 MHz
IEC 61000-4-4:1995 / EN 61000-4-4:1995	0.5kV signal lines, 1kV power lines
IEC 61000-4-5:1995 / EN 61000-4-5:1995	0.5kV line-line, 1kV line-ground
IEC 61000-4-6:1996 / EN 61000-4-6:1996	3V, 0.15-80 MHz / cycle, 100%
IEC 61000-4-11:1994 / EN 61000-4-11:1994	Dips: 30% 10ms; 60% 100ms Interrupt > 95%@5000ms

Date : 01/03/2018

M.A. Bailey

Revision No: 1.00

Director

Introduction

The 8700 Frequency Source / Measure GPS Standard has been designed to able to calibrate all functions of modern hand held and bench frequency counters and signal sources. A high accuracy precision GPS reference frequency of up to 1 GHz is available, with outputs for A-B phase and variable levels for confirming trigger levels of modern counter-timer units

In addition, unlike other GPS references, the 8700 also adds the ability to measure frequencies of up to 1 GHz with high precision, removing the requirement for an additional instrument in your laboratory. Utilising the latest in GPS reference technology, the 8700 combines both frequency source and measurement into a single integrated solution.

A full colour 7.2” LCD screen provides the user with a comprehensive source / measure readout, with direct access to detailed settings and satellite signal information.

Main Features

- Precision 10MHz output synchronised to GPS reference enabling traceable frequency output anywhere in the world with no requirement for external calibration.
- Digitally divided frequency output from 1 Hz to 5 MHz in 1,2,5 steps internally disciplined to GPS referenced 10 MHz.
- 5V peak-peak square wave frequency output from 10 Hz to 2 MHz.
- Variable level sinewave output into 1 MΩ (1mV to 5V) or 50Ω (1mV to 2.5V) from 10Hz to 2MHz.
- High Frequency output from 10 MHz to 1.05 GHz internally disciplined to GPS.
- Frequency measurement from 1 Hz to 1 GHz, internally disciplined to GPS.
- A-B output for verifying phase meters with output from 0° to 359° at frequencies from 1 Hz to 50 kHz.
- A full colour 7.2” LCD screen ensures clear display of measurements, outputs and menu functions.

Preparing the Unit for Use

Initial Inspection

After shipment the standard should be inspected for any signs of external damage. Should external damage be found contact the carrier immediately. Do not connect a damaged instrument to the line power as this may result in internal damage. Please retain the original packaging; this should be used when returning the standard for service.

Ensure that all external calibration seals are intact and show no sign of tampering.

Positioning the Standard

The standard should be placed where access to both front and rear connections is not hampered. Transmille advise that at least 5cm clearance is allowed to the rear to allow the passing of power cables to the input is allowed.

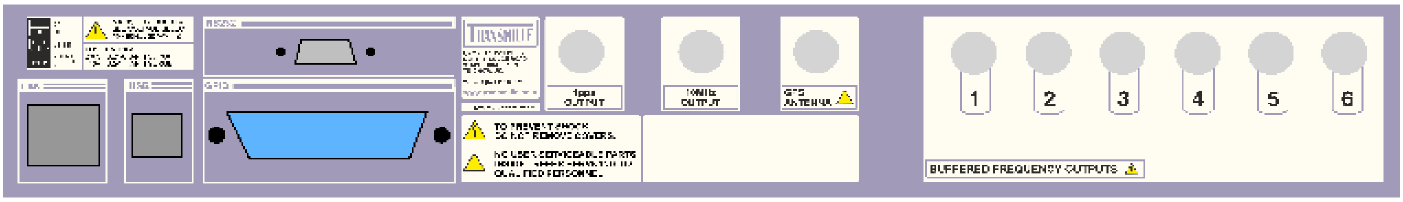
Positioning the Antenna

To operate correctly the 8700 requires a GPS antenna with full view of the sky to achieve a stable lock with GPS satellites.

A range of antennas with varying cable lengths are available for purchase from Transmille with magnetic backing to affixing to the exterior of buildings.

Although it may be possible to receive GPS lock with the antenna mounted internally (for example near a window) Transmille would advise that the antenna is fixed permanently outside to ensure a stable lock, especially in built up areas.

Connections are offered on the rear panel of the 8700 as below



On the rear USB, RS232, RJ45 and GPIB connectors can be used for controlling the instrument remotely. A BNC connector is provided for the GPS antenna input (labelled), 1 PPS output and dedicated 10 MHz out.

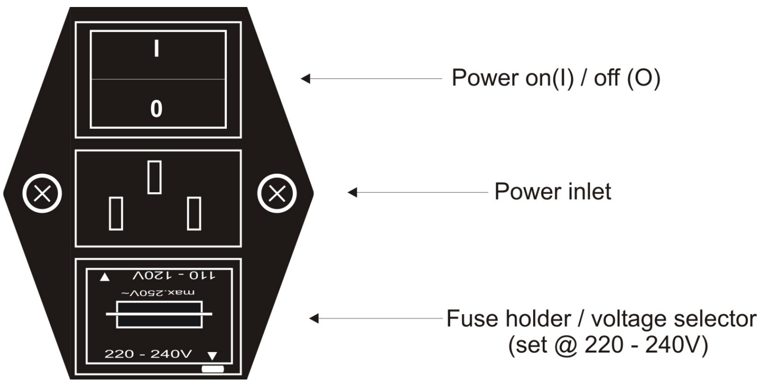
If specified, an option to have 5 additional buffered 10 MHz outputs will be provided each with independant BNC connectors

Due care should be taken to prevent damage to the internal pins of the BNC connectors by using only undamaged male BNC cables to connect.

Setting and checking the line voltage

The standard has been designed to work from either 110-120V or 220-240V line supply. The user should confirm that the correct voltage has been set prior to connecting power to the instrument. Connecting the instrument to the wrong power supply could cause damage to the instrument. To change the line voltage, remove the fuse / voltage selector housing from the rear of the unit, rotate through 180° and replace with he required voltage setting at the bottom of the housing.

The instrument is set for 110V operation when shipped to the USA, for all other regions the instrument is shipped set to 230V operation.



Powering up the Instrument

After connecting line power, the instrument can be switched on with the power switch on the rear of the instrument.

The front panel display will illuminate and the instrument will begin its start up sequence. This process takes approximately 15 seconds. After powering on, allow the unit to acquire a GPS fix, as identified on the front panel prior to use.Connecting to a computer

The 8700 is fitted with USB, RS232, GPIB and Ethernet interfaces for connecting to a computer. For best compatibility with ProCal, Transmille advise that the USB connection is used.

RS232 Interface

Baud Rate	9600
Parity	None
Data Bits	8
Stop Bits	1
Cable Type	Male to Female Serial Cable (9 pin D Type) Straight through pin connection (NOT Null Modem)
Software Driver	N/A - If used with Transmille USB to RS232 adapter FTDI drivers as provided should be installed

USB Interface

Cable Type	USB ‘A’ Type connector to USB ‘B’ Connector
Software Driver	FTDI USB Driver (supplied)

Ethernet Interface

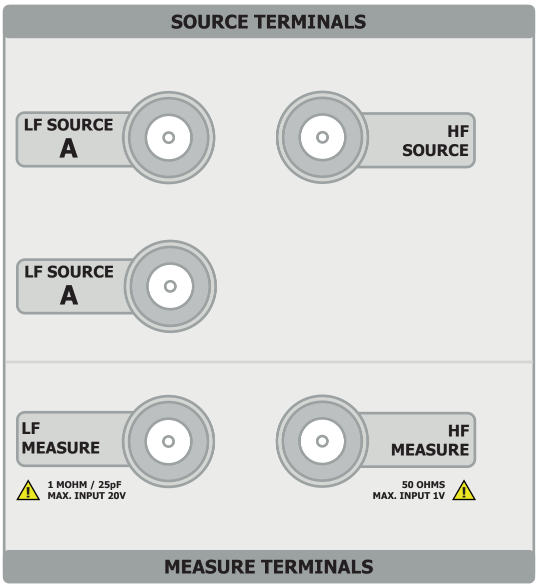
Configuration	Via optional configuration utility for computer
Cable Type	100BaseT Ethernet Cable (RJ45)
Software Driver	N/A

GPIB Interface

Configuration	Use config menu to set address Enter new GPIB Address (Valid range 0-30)
Cable Type	GPIB Interface Cable
Software Driver	National Instruments VISA or equivalent

Front Panel Connections

The 8700 features 5 BNC connectors on the front panel for simple connections to frequency counters and sources. 3 of the BNC connections are used for SOURCE, 2 of the connectors are used for MEASURE.



Output Connectors

Output connectors are provided for Low Frequency (up to 10 MHz) outputs A and B, and a dedicated output for the High Frequency (up to 1.05 GHz) output.

Only the active function will have an output present at the terminal, other terminals are disconnected while not in use.

Low Frequency output A is used for the primary 10 MHz output, Frequency Divider (1,2,5 sequence) and Variable level outputs (5V Square and Variable Sine Wave)

Low Frequency output B is only active when in Phase Offset mode.

Input Connectors

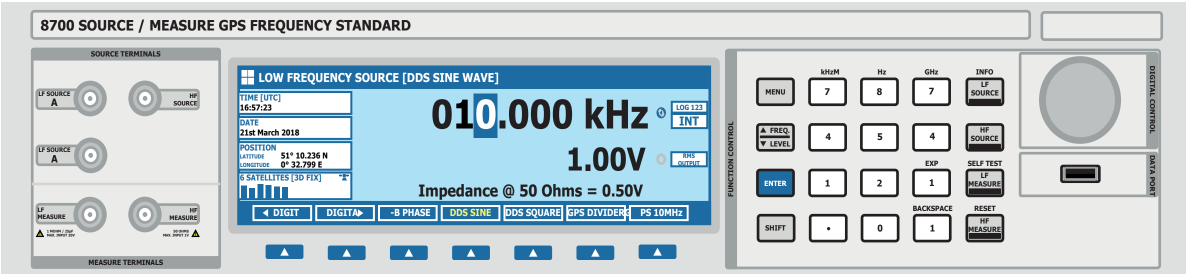
Input connectors are provided for both low frequency input (up to 10 MHz) and high frequency input (up to 1.05 GHz) via two BNC inputs.

Input Characteristics

The Low Frequency input has an input impedance of 1 MOhm, an input capacitance of 25pF and has a maximum input of 20V

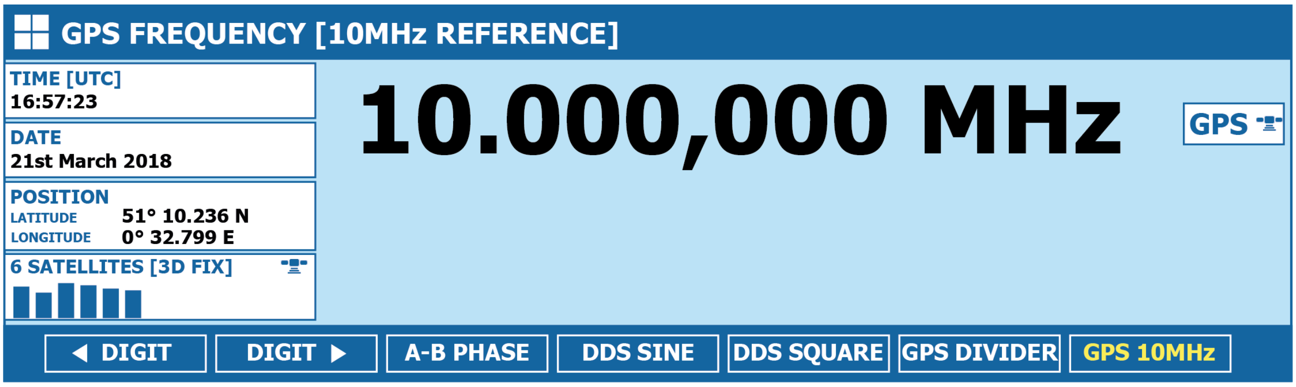
The High Frequency input has an input impedance of 50 Ohms, with a maximum input of 1V

Front Panel Controls

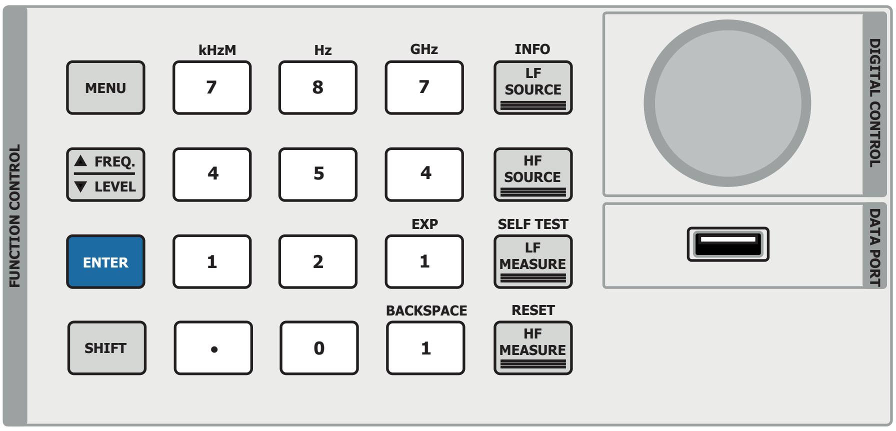


For ease of use, the front panel keyboard is separated into two sections.

A dynamic ‘softkey’ section under the display for function related modes of operation.



A function control section to access major function selection and value entry, including a digital control for easy increment / decrement of values.



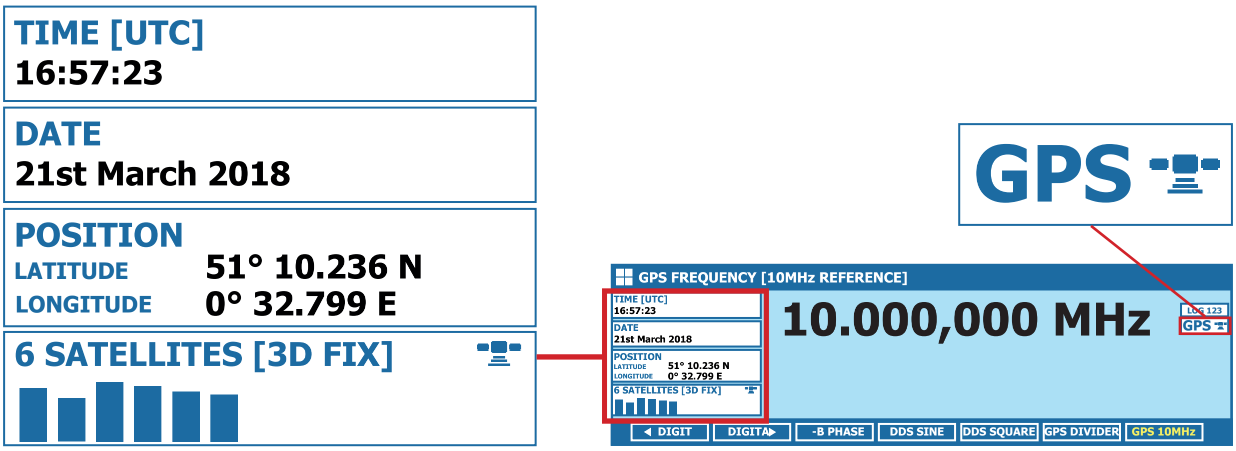
The main display of the 8700 is a full colour 7.2” LCD. This screen displays GPS signal data and either the current SOURCE or the MEASURE information depending upon the mode.

At the left hand side of the screen detailed GPS data is displayed if a signal fix has been successfully acheived. If GPS signal fix has not yet been acheived this section will display an ‘Awaiting GPS Signal’ indicator. GPS signal fix may take up to 20 minutes after installation, however should not appear during normal use.

If a GPS signal fix has been acheived the 10 MHz reference is disciplined to the GPS system

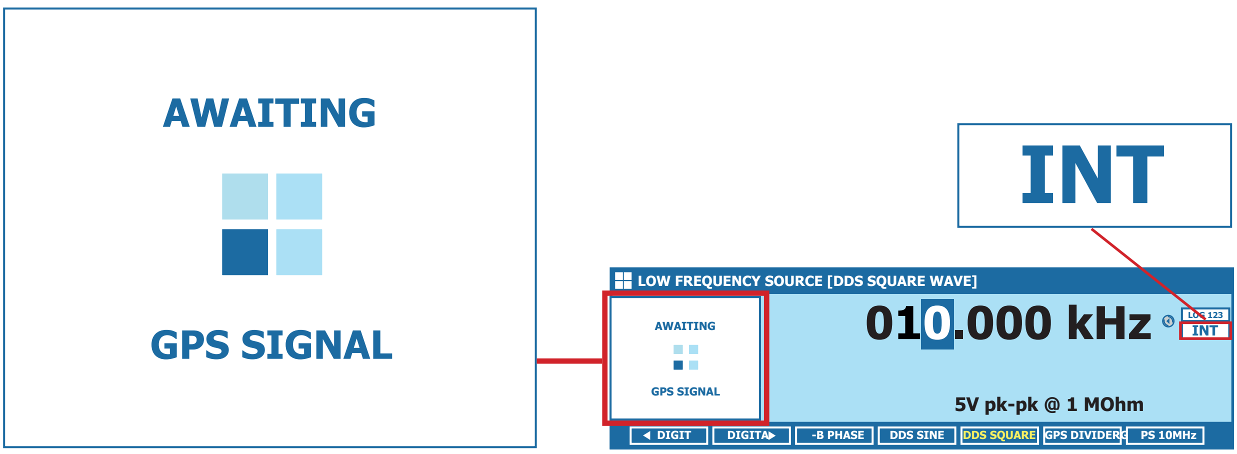
GPS signal fix achieved

GPS indicator denotes **GPS DERIVED** 10MHz reference in use



No GPS Fix

INT indicator denotes **INTERNAL 10MHz** reference in use



GPS FREQUENCY [10MHz REFERENCE]

The default start up state for the 8700 is for the 10 MHz reference frequency signal
This can also be selected using the GPS 10MHz softkey when in LF SOURCE mode.

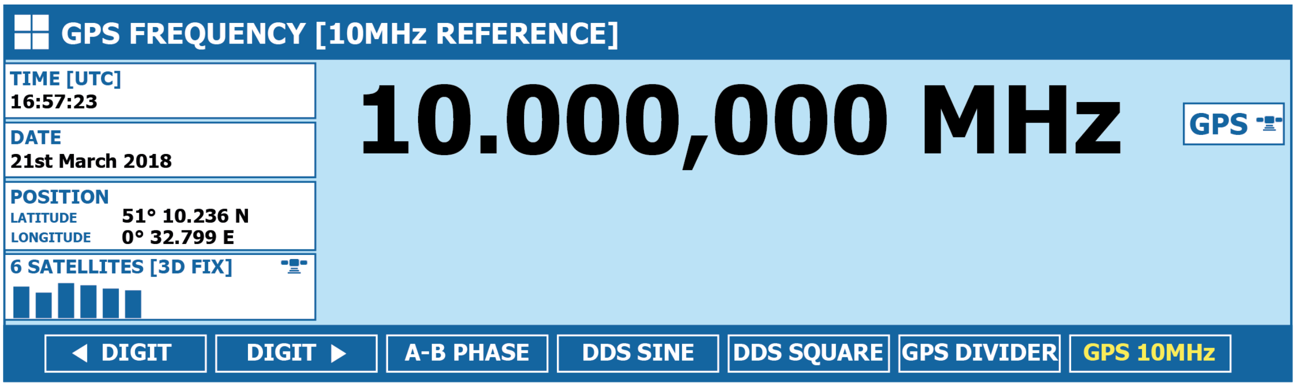
The function display in the title bar of the display will indicate
GPS FREQUENCY [10MHz Reference]

This output is disciplined to GPS and requires no calibration to maintain specifications as long as a GPS lock is achieved.

In this mode the Main Display will indicate 10 MHz, followed by either **INT** or **GPS**.

A display of **GPS** indicates that the unit is currently disciplined to GPS, a display of **INT** means that a fix has not been achieved and the 8700 is using the internal 10MHz reference.

The output for this function appears at the **LF Source A** Terminal

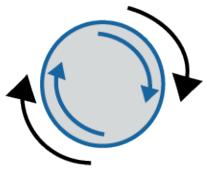


Pressing the GPS DIVIDER softkey when the unit is in LF SOURCE mode will set the 8700 to **GPS FREQUENCY [DIVIDER MODE]**. In this mode the output frequency can be varied in steps of 1, 2, 5 from 1 Hz to 5 MHz.

In this mode the Main Display will indicate 10 MHz, followed by either **INT** or **GPS**.

A display of **GPS** indicates that the unit is currently disciplined to GPS, a display of **INT** means that a fix has not been achieved and the 8700 is using the internal 10MHz reference.

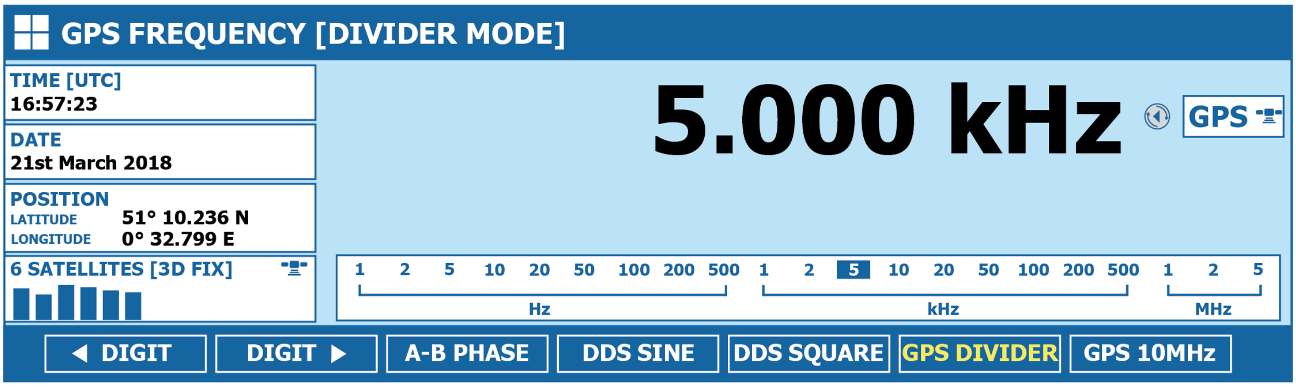
The output is varied using the digital control, rotating clockwise to INCREASE the frequency, and anti-clockwise to DECREASE the frequency.

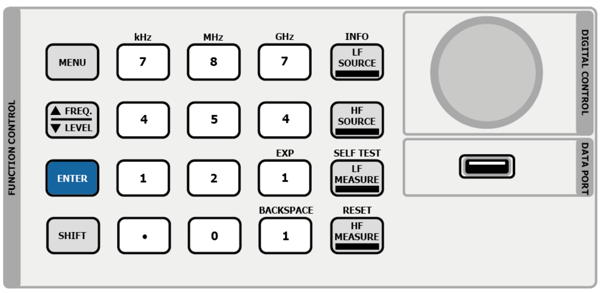


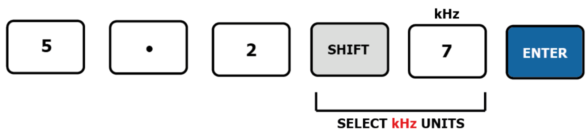
A convenient selection display panel shows the currently selected frequency from the values available in this mode.

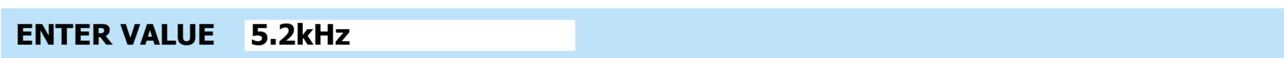
Direct digit entry is also possible using the numerical section of the keyboard, followed by pressing the ENTER key. Entries which are not valid will select the next available frequency (i.e. an entry of 300 Hz will select the 500 Hz output.

The output for this function appears at the **LF Source A** Terminal





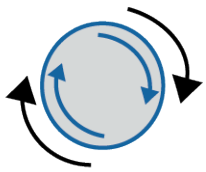




Pressing the DDS SQUARE softkey when the unit is in LF SOURCE mode will set the 8700 to **LOW FREQUENCY SOURCE [DDS SQUARE WAVE]**. In this mode the frequency can be varied from 10 Hz to 100 kHz in 1 Hz steps. The output is a fixed square wave with a peak to peak amplitude of 5V @ 1 MOhm.

In this mode the Main Display will indicate the current output frequency, followed by either **INT** or **GPS**. A display of **GPS** indicates that the unit is currently disciplined to GPS, a display of **INT** means that a fix has not been achieved.

The output is varied using the digital control, rotating clockwise to INCREASE the frequency, and anti-clockwise to DECREASE the frequency.

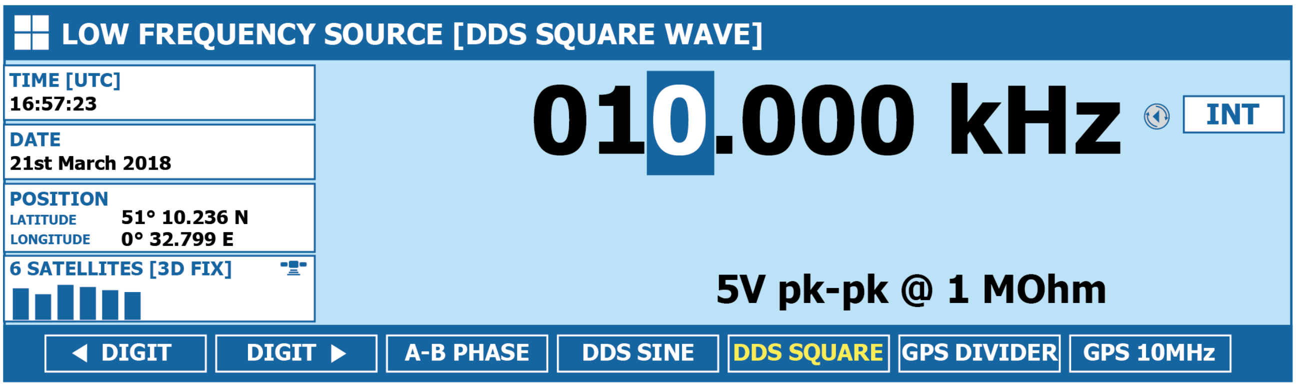


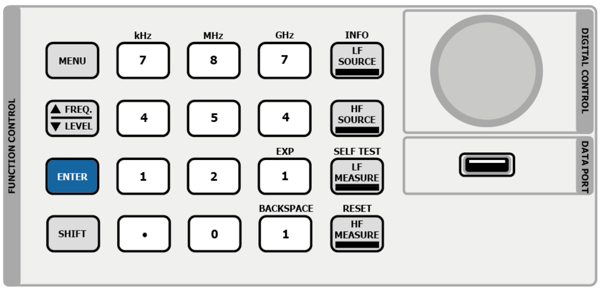
A specific digit can be selected by using the digit select buttons

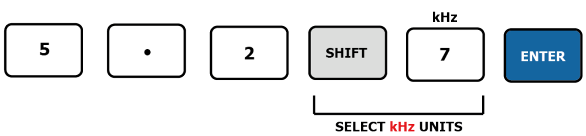
◀ DIGIT DIGIT ▶

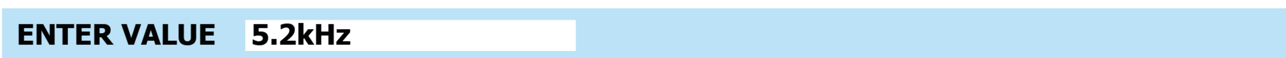
Direct digit entry is also possible using the numerical section of the keyboard, followed by pressing the ENTER key. Entries which are not valid will select the next available frequency (i.e. an entry of 300 Hz will select the 500 Hz output.

The output for this function appears at the **LF Source A** Terminal



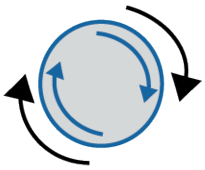






Pressing the DDS SINE softkey when the unit is in LF SOURCE mode will set the 8700 to **LOW FREQUENCY SOURCE [DDS SQUARE WAVE]**. In this mode the frequency can be varied from 10 Hz to 2 MHz in 1 Hz steps. The output is a variable level sine wave - RMS Output level is displayed with a primary display of 1 MOhm input impedance and a secondary display of a 50 Ohm input impedance. In this mode the Main Display will indicate the current output frequency, followed by **INT** indicating theis function is internally referenced.

The frequency output is varied using the digital control, rotating clockwise to INCREASE the frequency, and anti-clockwise to DECREASE the frequency.
A specific digit can be selected by using the digit select buttons



◀ DIGIT   DIGIT ▶

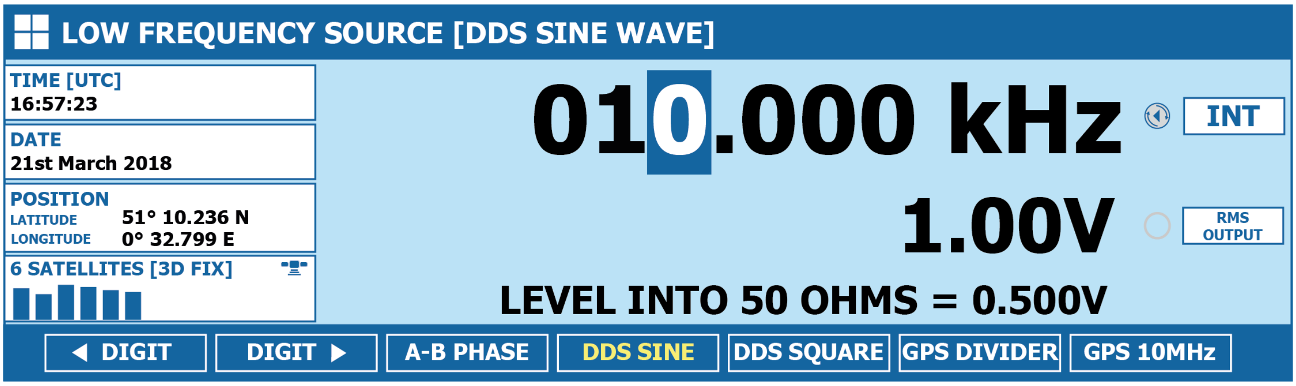
To toggle between the frequency and RMS output settings press

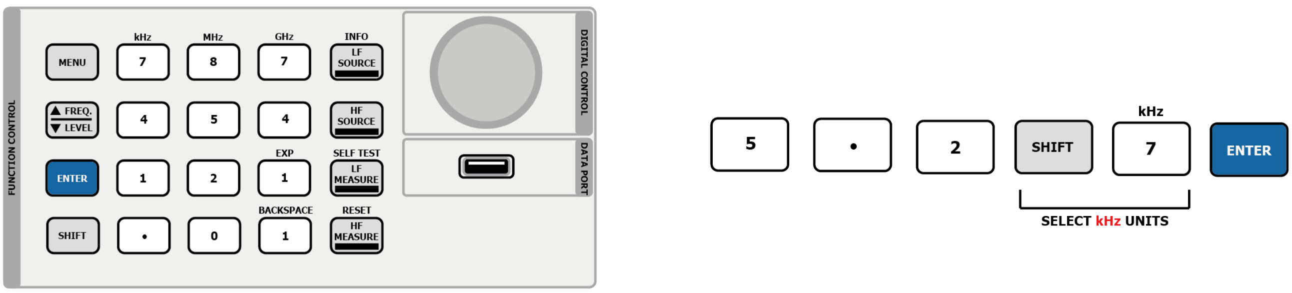
A marker will be displayed next to the active setting

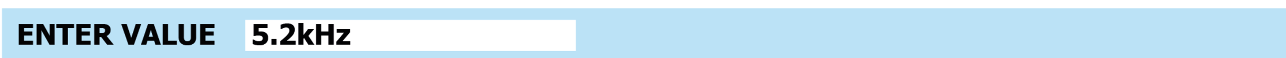
The RMS output is adjusted using the digital control, rotating clockwise to INCREASE the frequency, and anti-clockwise to DECREASE the frequency. A specific digit can be selected by using the digit select buttons ◀ DIGIT   DIGIT ▶

Direct digit entry is also possible using the numerical keys followed by pressing ENTER.

The output for this function appears at the **LF Source A** Terminal

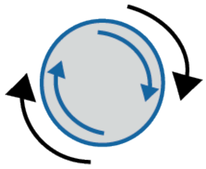


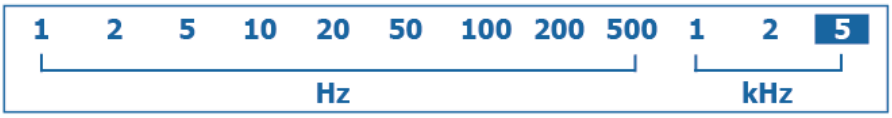




Pressing the GPS A-B PHASE softkey when the unit is in LF SOURCE mode will set the 8700 to **LOW FREQUENCY SOURCE [A-B PHASE]** mode. In this mode the output frequency can be varied in steps of 1, 2, 5 from 1 Hz to 5 kHz. In this mode the Main Display will indicate the current output frequency, followed by **INT** indicating theis function is internally referenced.

The output is varied using the digital control, rotating clockwise to INCREASE the frequency, and anti-clockwise to DECREASE the frequency. A convenient selection display panel shows the currently selected frequency from the values available in this mode.

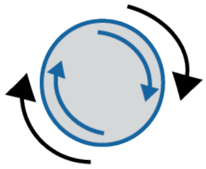




To toggle between the frequency and phase angle settings press

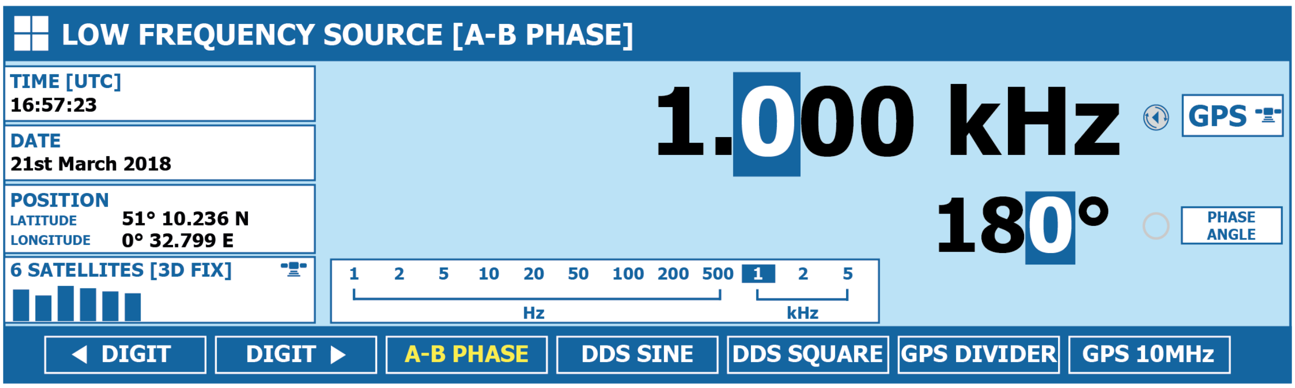
A marker will be displayed next to the active setting

The phase angle is adjusted using the digital control, rotating clockwise to INCREASE the frequency, and anti-clockwise to DECREASE the frequency. A specific digit can be selected by using the digit select buttons



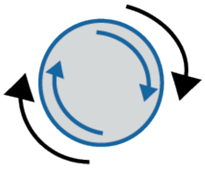
Direct digit entry is also possible using the numerical section of the keyboard, followed by pressing the ENTER key. Entries which are not valid will select the next available frequency (i.e. an entry of 300 Hz will select the 500 Hz output.

The output for this function appears at the **LF Source A** and **LF Source B** Terminals



Pressing the HF SOURCE function key will set the unit to **HIGH FREQUENCY SOURCE [VCO]** mode. In this mode the frequency can be varied from 5 MHz to 1.05 GHz in 1 Hz steps. The output is a variable level sine wave. In this mode the Main Display will indicate the current output frequency, followed by **INT** indicating theis function is internally referenced.

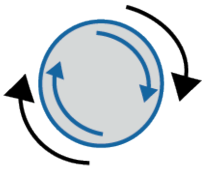
The frequency output is varied using the digital control, rotating clockwise to INCREASE the frequency, and anti-clockwise to DECREASE the frequency. A specific digit can be selected by using the digit select buttons



To toggle between the frequency and output level settings press

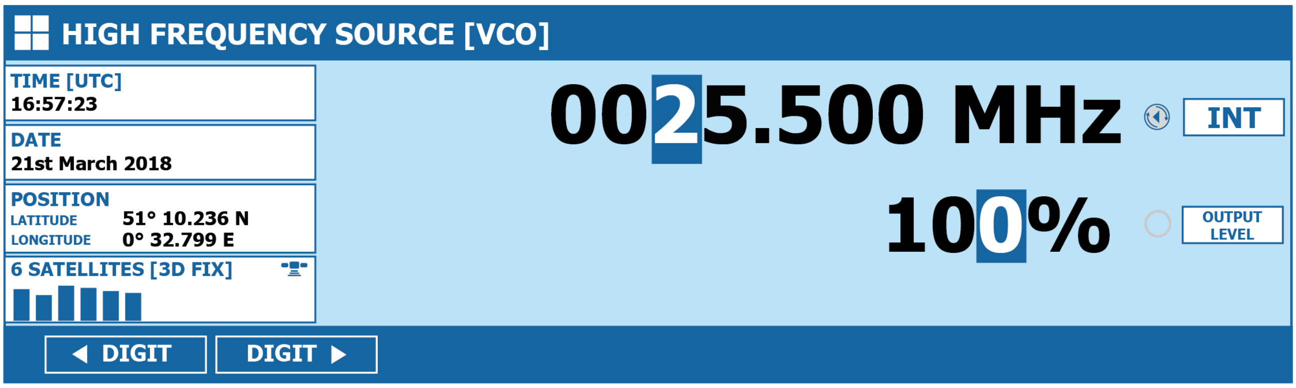
A marker will be displayed next to the active setting

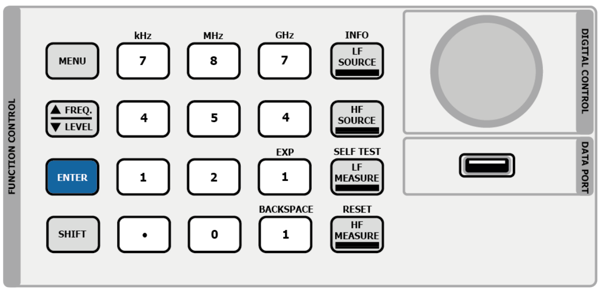
The output level is adjusted using the digital control, rotating clockwise to INCREASE the frequency, and anti-clockwise to DECREASE the frequency. A specific digit can be selected by using the digit select buttons

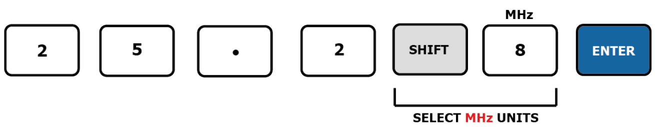


Direct digit entry is also possible using the numerical section of the keyboard, followed by pressing the ENTER key.

The output for this function appears at the **HF Source** Terminal





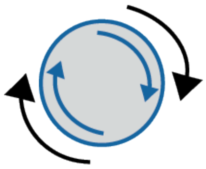


LF Measure

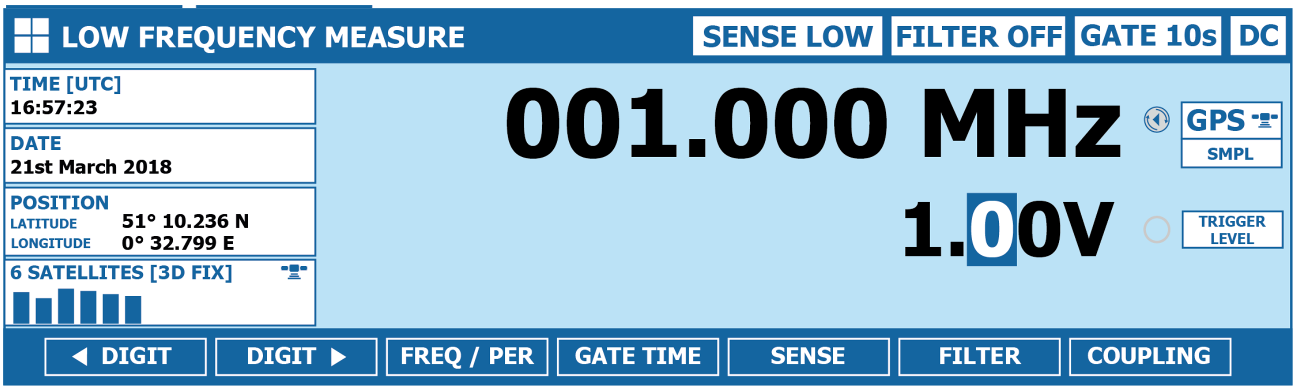
The 8700 incorporates a high resolution frequency counter that is internally disciplined to GPS, reducing the requirement for a separate piece of equipment and complicated wiring and interconnections.

Pressing the **LF MEASURE** function key will set the unit to low frequency measurement mode. In this mode the instrument measures the frequency of the signal connected to the LF Measure Input. The maximum input frequency is 10 MHz, and the maximum input voltage is 20 V. The input impedance of this input is 1 Mohm with a capacitive loading of 25pF

In this mode the Main Display will indicate the current measurement - a display of **GPS** indicates that the unit is currently disciplined to **GPS**, a display of **INT** means that a fix has not been achieved. The status bar shows the Sensitivity, Filter, Gate Time and Current Coupling Mode.



The trigger level is adjusted using the digital control, rotating clockwise to INCREASE the frequency, and anti-clockwise to DECREASE the value.
A specific digit can be selected by using the digit select buttons

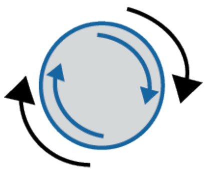


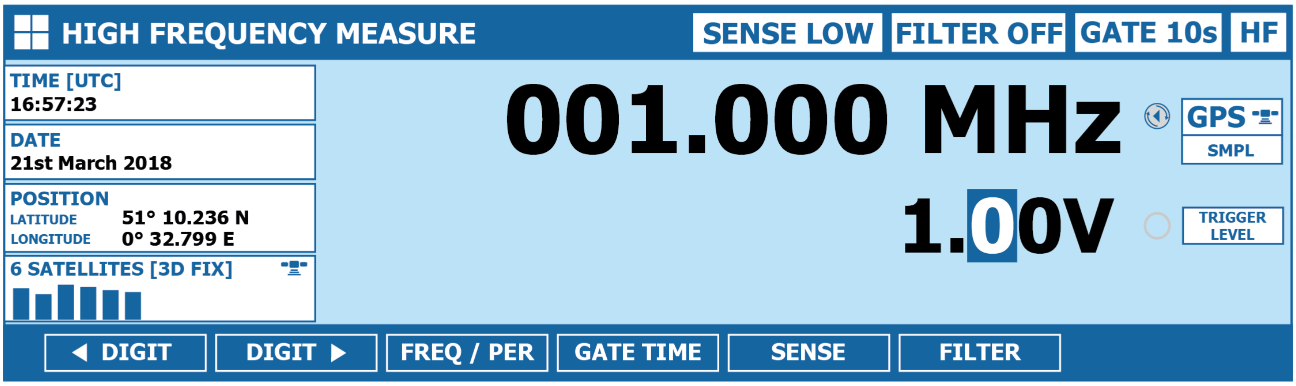
Pressing the **HF MEASURE** function key will set the unit to low frequency measurement mode. In this mode the instrument measures the frequency of the signal connected to the LF Measure Input. The maximum input frequency is 1.05 GHz, and the maximum input voltage is 1 V.

It is advised that this input is not used for measuring frequencies below 10 MHz and that the low frequency measurement mode should be used.

In this mode the Main Display will indicate the current measurement - a display of **GPS** indicates that the unit is currently disciplined to **GPS**, a display of **INT** means that a fix has not been achieved. The status bar shows the Sensitivity, Filter and Gate Time

The trigger level is adjusted using the digital control, rotating clockwise to INCREASE the frequency, and anti-clockwise to DECREASE the value.
A specific digit can be selected by using the digit select buttons





Frequency / Period Display Select

Pressing the **FREQ / PER** softkey will toggle the unit to Period Measurement. In this mode the instrument measures the frequency of the signal connected to the LF Measure Input and displays as period (seconds). To return to Frequency display simply press then **FREQ / PER** softkey again

Gate Time

The measurement gate allows the user to select the duration of the measurement. Higher gate times provide more resolution, however measurements will be slower to react to changes in frequency. The gate time is selectable from 0.1, 1 and 10 seconds by pressing the **GATE TIME** softkey on the front panel.

Sensitivity

The sensitivity mode sets the hysteresis level around the trigger level. When in high sensitivity mode the hysteresis around the trigger point is widened to enable the counter to trigger off of a wider range of levels. When in low sensitivity mode the hysteresis around the trigger point is narrowed to reduce the possibility of false triggering when distorted signals are being measured.

The sensitivity is set between HIGH and LOW by pressing the **SENSE** softkey.
The current sensitivity is displayed in the status bar.

High Frequency Filter

The High Frequency filter assists with noise when measuring frequencies below 400 Hz by placing a passive low pass filter in the internal signal chain to prevent high frequencies triggering the counter. To enable or disable the High Frequency filter press the **FILTER** softkey.

The current filter state is displayed in the status bar as OFF or ON depending on the present status of the filter.

AC/DC Coupling

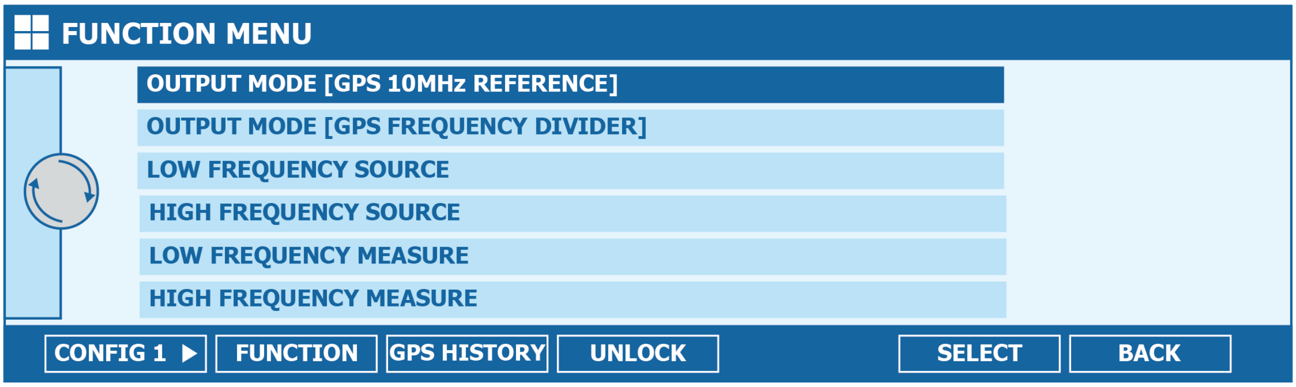
The AC / DC coupling setting enables the removal of the signals DC content
(in AC Coupling mode). AC Coupling helps to measure high frequency measurements by filtering any DC components and removing them from the measurement.

Note : Low frequency signals may be filtered if AC coupling is enabled. It is recommended that the DC Coupled mode is used in conjunction with the High Frequency filter when measuring low frequency signals.

Trigger Level

The trigger level sets a minimum input level at which the counter starts a measurement. For measurements where there is the potential for distortion setting the trigger level can ensure that only the peaks are captured and any incorrect counts caused by distortion on the waveform are ignored. The trigger level is set by selecting the TRIGGER LEVEL key and then adjusting via the digital control until a stable trigger is achieved.

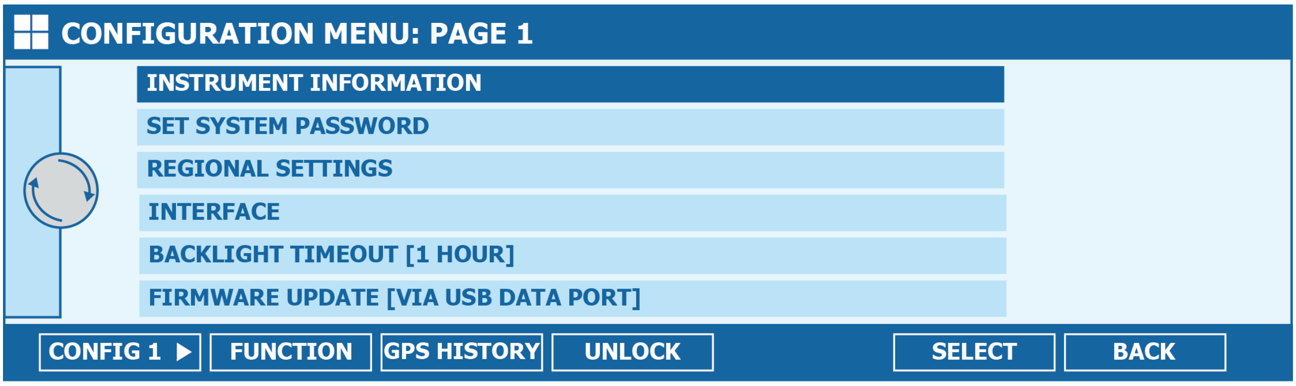
Pressing the **MENU** button will display the function menu :



Select a menu item using the **DIGITAL DIAL** to select the corresponding function - the menu will close after function selection automatically

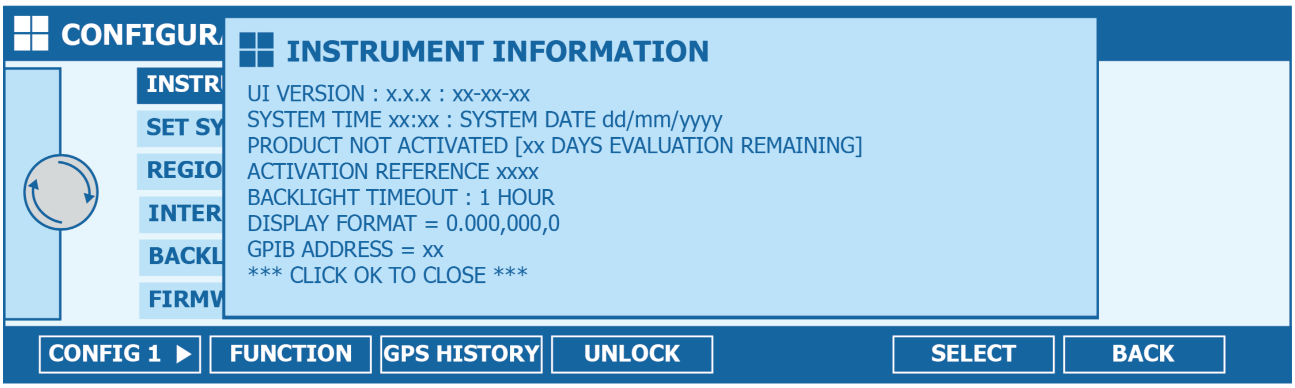
Config 1 [Page 1] Menu

Pressing the **CONFIG 1 >** softkey will display the config page 1 menu :

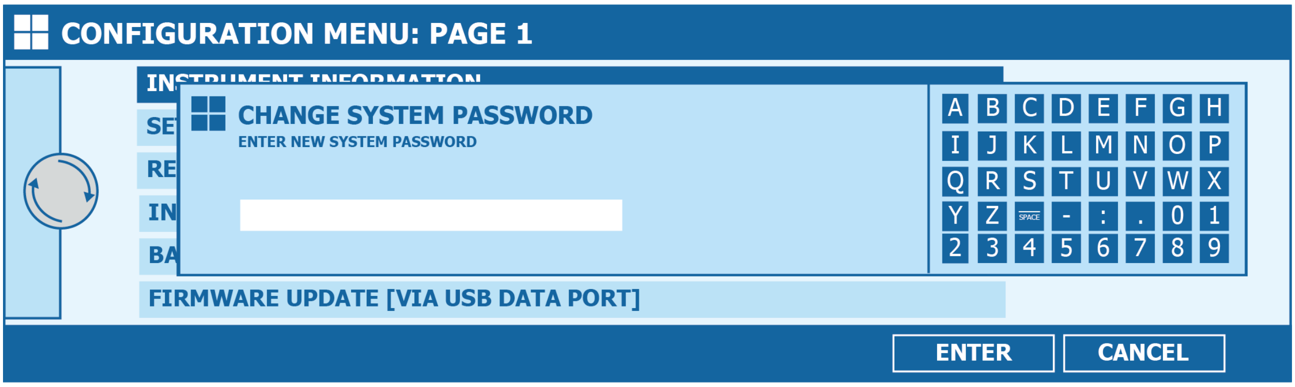


Instrument Information

Displays a summary of instrument settings as shown below :



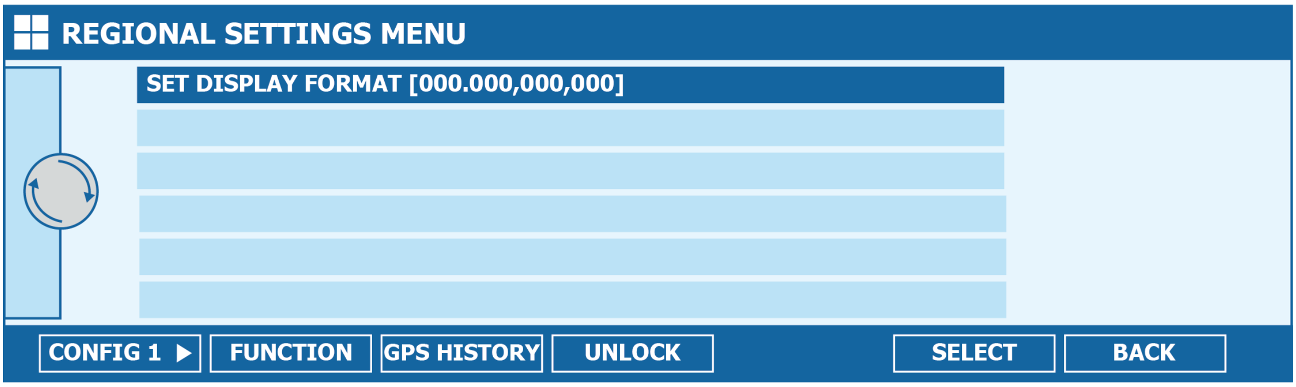
Allows the system password to be changed :

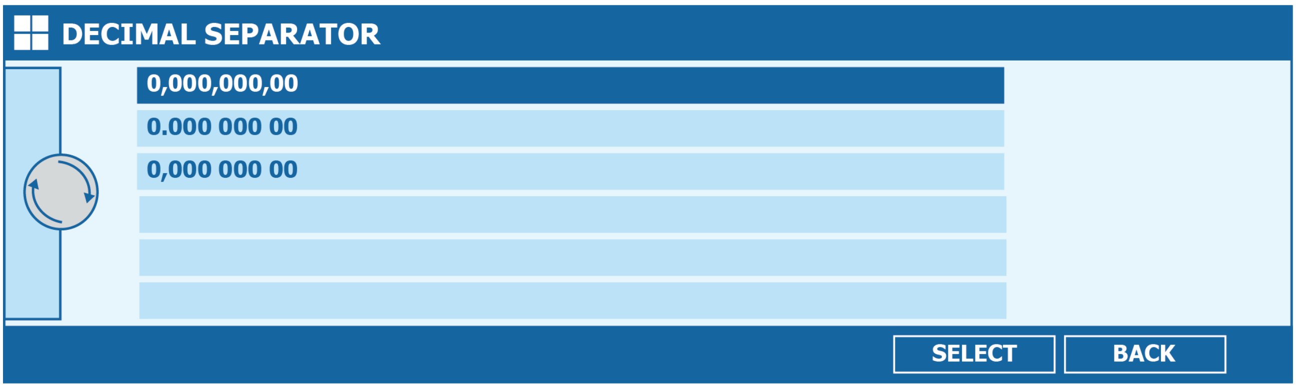


Use the digial dial to select from the on-screen keyboard or use the numeric keys as required.

Regional Settings

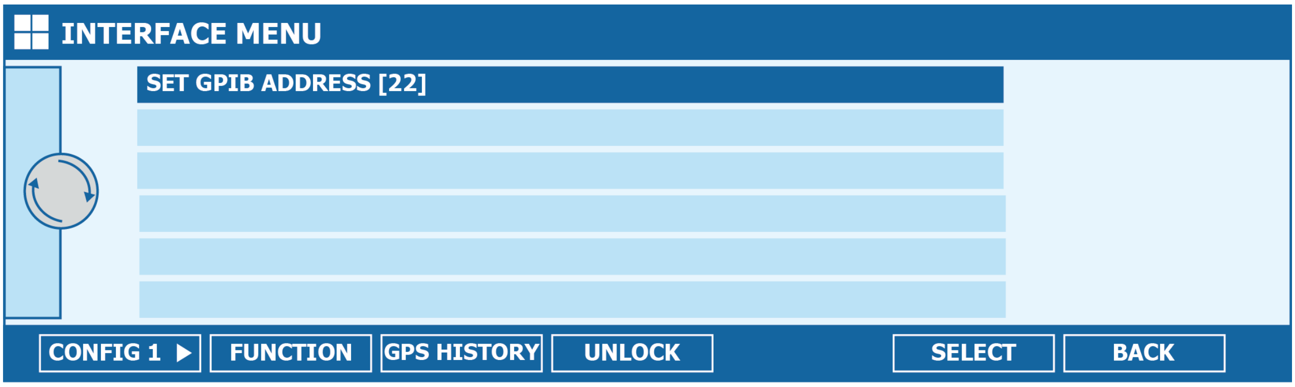
Select SET DISPLAY FORMAT to change the number separators to your preferred format :

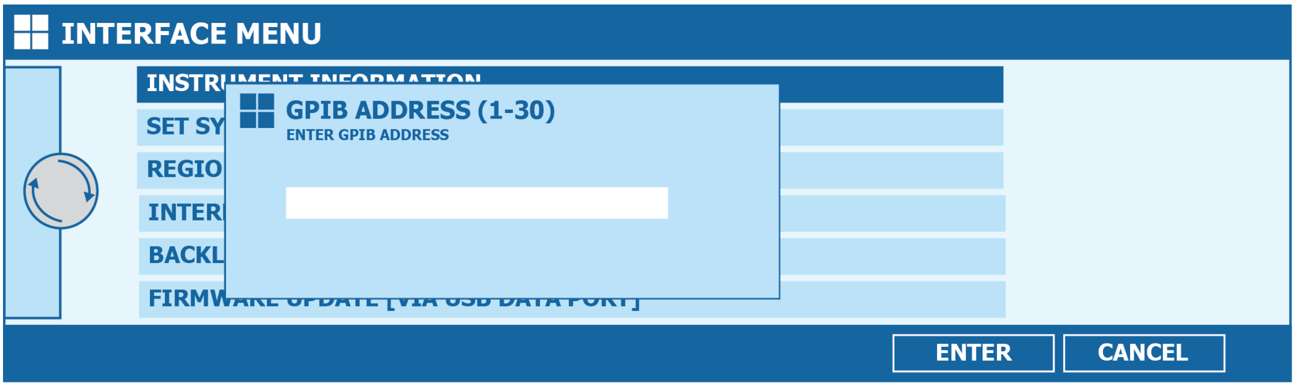




Interface

Select INTERFACE to set the GPIB address :

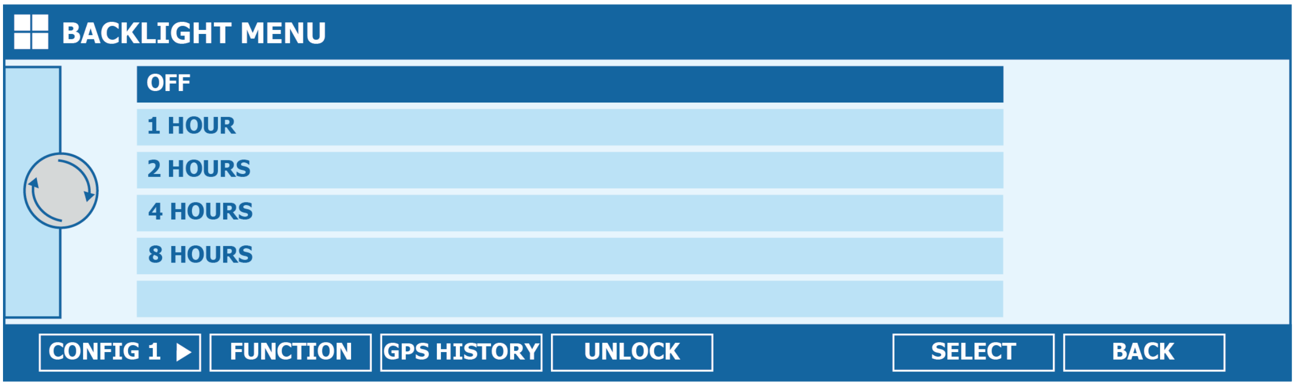




Enter the required GPIB address using the keypad, then select **ENTER** to save or **CANCEL** to abort.

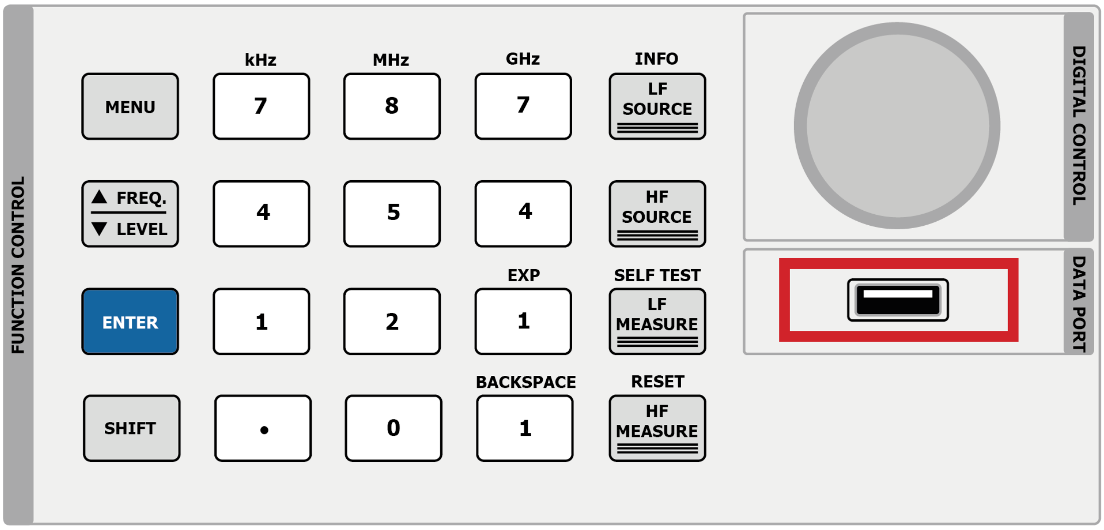
Backlight Timeout

Select BACKLIGHT TIMEOUT to change the timeout for the display backlight

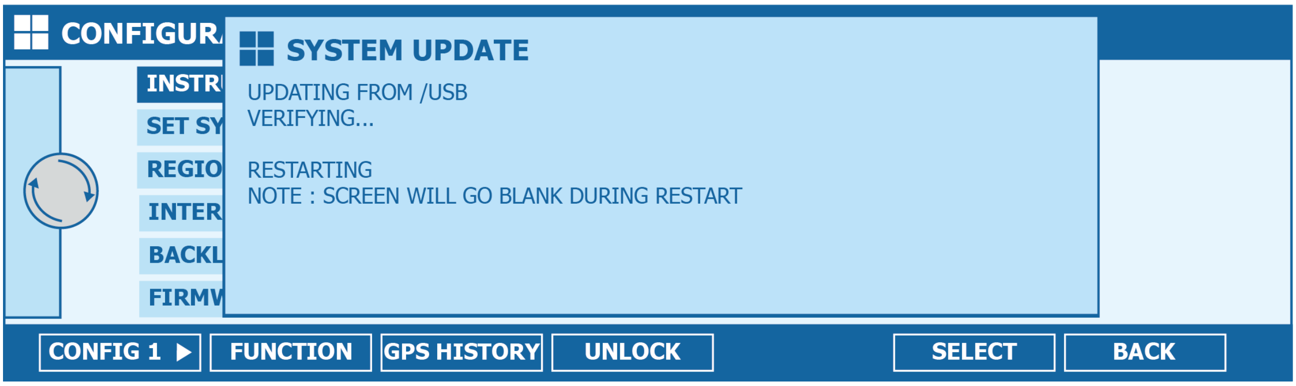


Select timeout setting using the digital dial then click **SELECT** to accept or **CANCEL** to abort.

To update the system firmware ensure the update is copied to a USB drive and inserted into the DATA PORT on the front panel of the 8700 before proceeding :



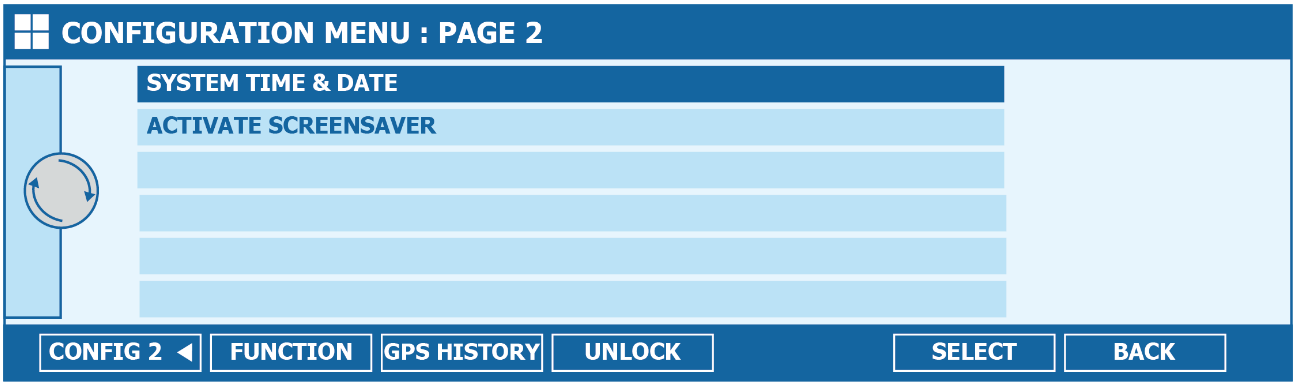
The update process will display as shown below:.



Once completed the user is prompted to **REMOVE** the **USB** drive -
the system will then restart ***after removal of the USB drive is detected***.

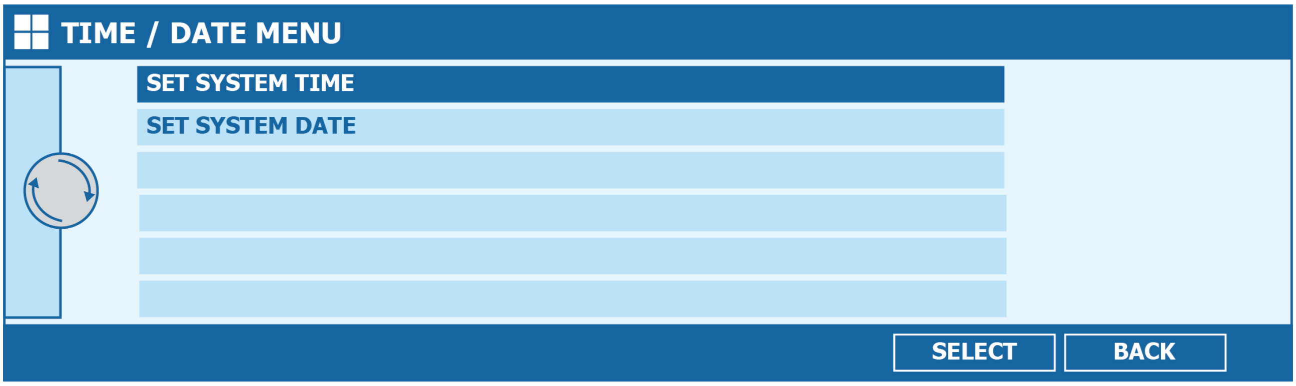
Config 2 [Page 2] Menu

Pressing the **CONFIG 1 >** softkey will select the **CONFIG 2 >** menu.
To return to the **CONFIG 1 >** menu, press the **CONFIG 2 >** softkey.

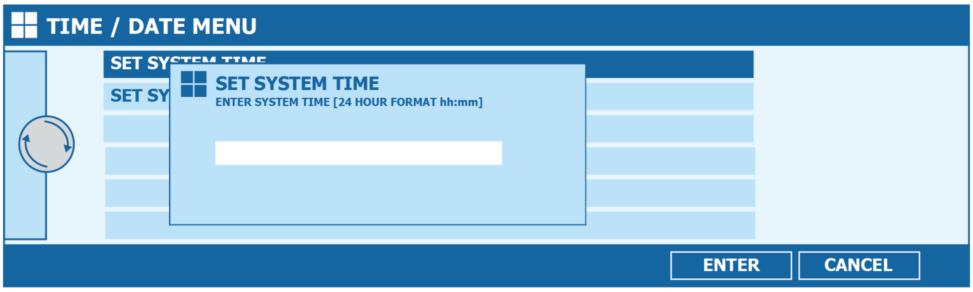


System Time & Date

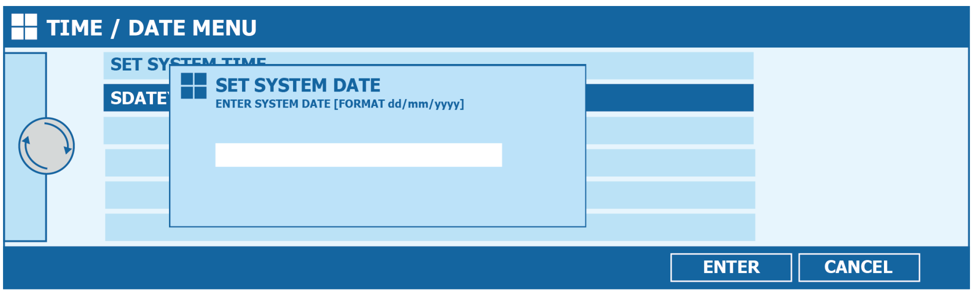
The system Time and / or Date can be updated using the following menus :



Selecting SET SYSTEM TIME allows the time to be set in 24 hour format (hh:mm) :

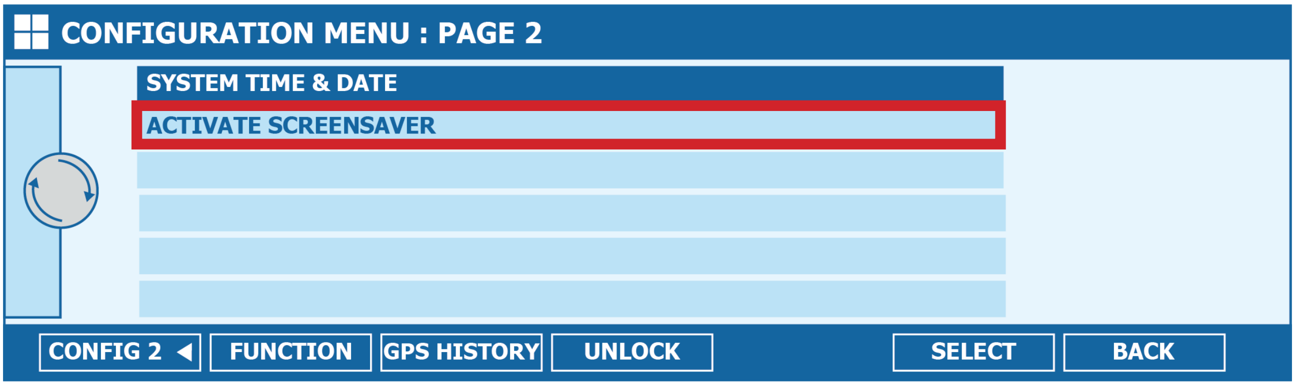


Selecting SET SYSTEM DATE allows the date to be set in the format dd/mm/yyyy :



To activate the screensaver immediately, select this menu item.

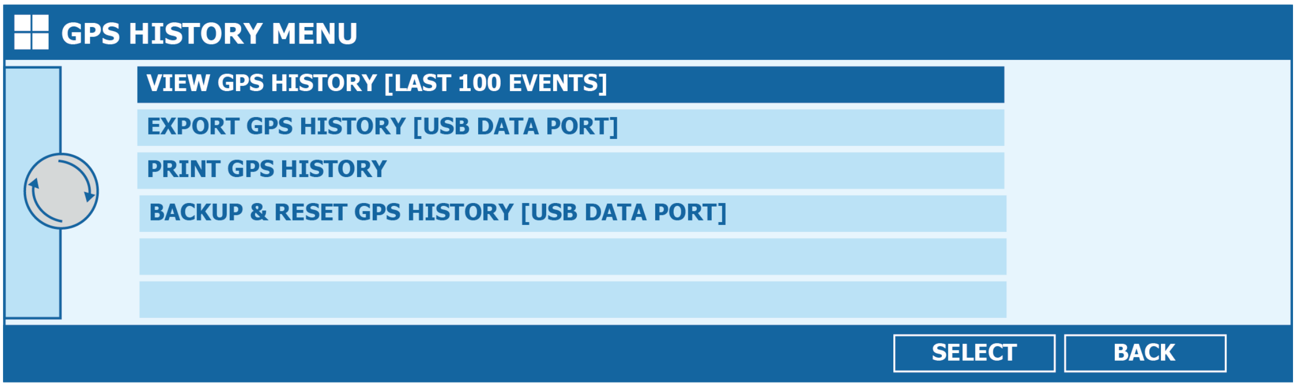
The menu will close automatically and display the main screen in screensave mode with dimmed backlight and low contract graphics.



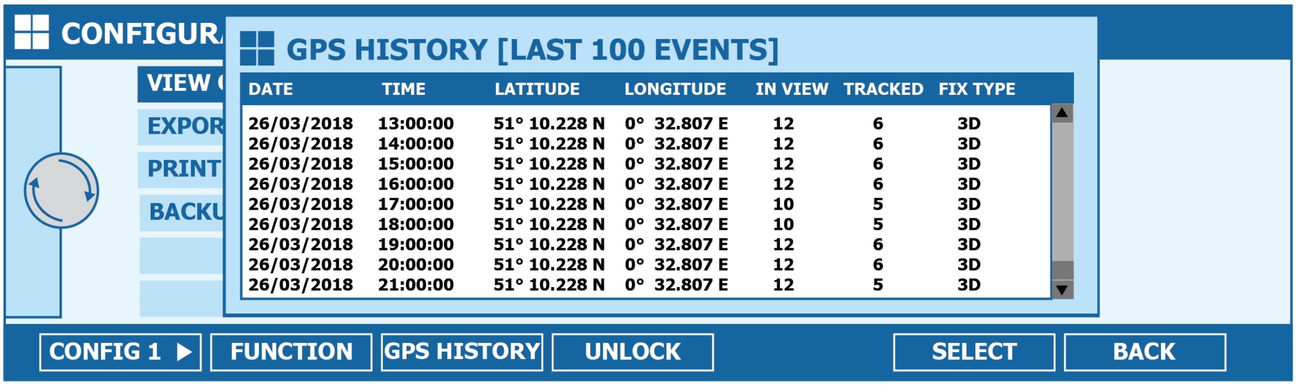
The GPS History functionality provides ***hourly*** logging of the GPS Status data, including the following data :

Date (ddmmyyyy)
Time (hh:mm:ss)
GPS Date (dd month yyyy)
GPS Time (hh:mm:ss)
Latitude
Longitude
Satellites In View
Satellites Tracked
Fix Type
Satellite Index Number
Satellite ID Number (1 to total In view)
Satellite Signal to Noise Ration (1 to total In view)

The information is recorded using internal flash memory and can also be downloaded as a comma delimited file to a USB drive using the data port.



Select the **VIEW GPS HISTORY [LAST 100 EVENTS]** to display a scrollable list of up to the **last 100 events** - use the digital dial to select up / down.



The displayed list shows the major GPS information as follows :

Date (dd/mm/yyyy)
Time (hh:mm:ss)
Latitude
Longitude
Satellites In View
Satellites Tracked
Fix Type

The data stored in memory includes additional data for the individual satellites as follows :

Satellite Index Number
Satellite ID Number (1 to total In view)
Satellite Signal to Noise Ration (1 to total In view)

This can be accessed by downloaded the GPS history data via the USB data port.

Export GPS History [USB Data Port]

The GPS history data can be exported to a datafile on an available USB drive.

Simply insert a USB drive into the front panel Data Port and select the
EXPORT GPS HISTORY DATA [USB DATA PORT] to begin.

Files will be automaticall created on the USB drive in an **8700_gps_history** folder

Data is stored in yearly log files named **8700_gps_history_yyyy.txt**, for example
8700_gps_history_2018.txt

Print GPS History

To print the current GPS history data, connect a PCL compatible printer to the Data Port
Hewlett Packard (HP) printers have been verified for his application and are recommended for best compatibility.

The printed list shows the major GPS information as follows :

Date (ddmmyyyy)
Time (hh:mm:ss)
Latitude
Longitude
Satellites In View
Satellites Tracked
Fix Type

The data stored in memory includes additional data for the individual satellites as follows :

Satellite Index Number
Satellite ID Number (1 to total In view)
Satellite Signal to Noise Ration (1 to total In view)

This can be accessed by downloaded the GPS history data via the USB data port.

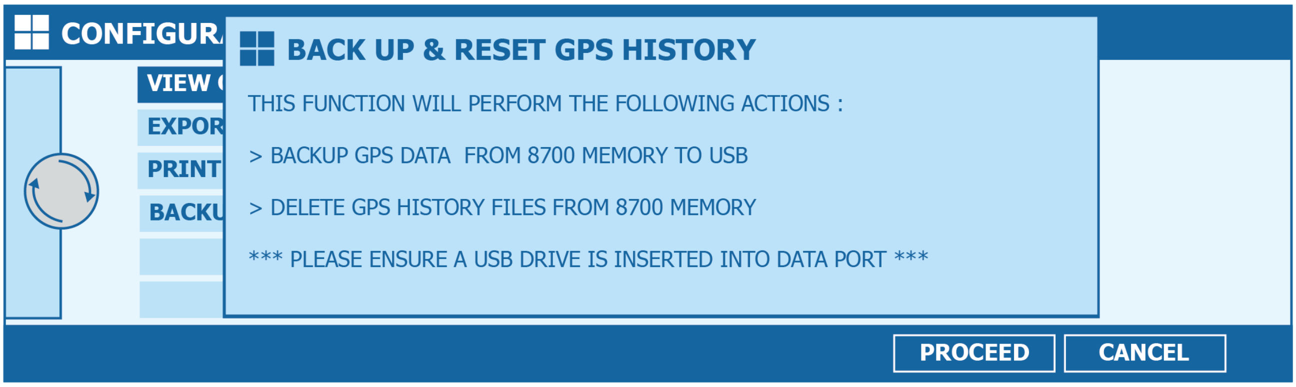
The GPS history data can be backed up to a USB drive to free space on internal memory.

The internal memory has capacity for approx. 10 years logging data,
but period backup and reset is recommended.

To start the backup and reset process, ensure a USB drive is inserted into the data port of the 8700.

Select BACKUP & RESET GPS HISTORY [USB DATA PORT] and a message will be displayed to ensure the user wishes to proceed.

Select the PROCEED to continue or CANCEl to abort



Remote Commands

Introduction

The 8700 is fitted with remote interfaces to enable automation. Automation not only improves throughput but also reduces errors due to operator error as the unit is configured by software

All commands must be terminated with a Carriage Return (ASCII Character 13) to be executed. All responses are terminated with a Carriage Return (ASCII Character 13), followed by a Line Feed (ASCII Character 10).

Programming Overview

The 8700 is controlled by a set of simple high level commands which can be used either individually or as part of a command sequence.   The basic structure is as follows :

{Command}{Data - Optional}<CR>

Where command is represented as {Command}, required data is represented as {Data} and the Carriage Return is represented by <CR>

Compound Commands

To simplify remote commands, multiple commands can be sent on a single line.
This can reduce the number of lines required in a program to configure the output/input state of the instrument.

To create a compound command a backslash ‘/’ should be inserted between each command/ data pair as below :

{Command}{Data}/{Command}{Data}/{Command}{Data}<CR>

An example of using this structure follows

SOURCE:LF:SINE/SOURCE:LF:SINE:LEVEL 2.5/SOURCE:LF:SINE:FREQ 1000<CR>

Where the DDS Sinewave output is being set to 2.5 volts at a frequency of 1 kHz.
These commands do not need additional delays added in code.

The 8700 standard will respond to any command with a fixed code beginning with a star (*). The codes are listed below

Response Code	Description
*0	Command Successful
*1	Unrecognised Command
*2	Invalid Range
*3	Invalid Frequency
*4	Output Error
*5	Calibration Factor Error
*6	Self Test Error
*7	Password Error
*8	Command Parameter Error

Frequency Source - 10 MHz Output

To set the GPS Frequency output (fixed frequency) send the following command

SOURCE:LF:REF<CR>

There are no data parameters to be send with this command

Frequency Source - 1Hz - 5MHz Divided Output

To set the 1 Hz - 5 MHz divider output, send the following command

SOURCE:LF:DIVIDER:FREQ {Data}<CR>

Followed by the desired frequency. Valid multipliers are k, M

For example, to set 5 kHz, send the following command

SOURCE:LF:DIVIDER:FREQ 5k<CR>

To query the current output, place a ? in the position of data.
The unit will respond with the current frequency in Hz

Frequency Source - Low Frequency 5V Pk-pk

To set the square wave low frequency output (Variable frequency),
send the following command

SOURCE:LF:SQUARE:FREQ {Data}<CR>

Followed by the desired frequency in Hz

For example, to set the square wave output at 500 Hz, send the following command

SOURCE:LF:SQUARE:FREQ 500<CR>

Frequency Source - Low Frequency Sine

To set the sine wave low frequency output (Variable Frequency and level),
send the following command

SOURCE:LF:SINE<CR>

This command will enter the sine wave output mode.

To set the frequency, send the following command

SOURCE:LF:SINE:FREQ {Data}<CR>

Where data is the desired frequency in Hz

To set the Level, send the following command

SOURCE:LF:SINE:LEVEL {Data}<CR>

Where data is the desired level in volts

For Example, to set the output to High Input impedance, at 5 kHz with an output of 1V send

SOURCE:LF:SINE/SOURCE:LF:SINE:FREQ 5000/SOURCE:LF:SINE:LEVEL 1<CR>

To set the sine wave low frequency output (Variable Frequency and level), send the following command

SOURCE:HF:SINE<CR>

This command will enter the sine wave output mode.

To set the frequency, send the following command

SOURCE:HF:SINE:FREQ {Data}<CR>

Where data is the desired frequency in Hz

To set the Level, send the following command

SOURCE:HF:SINE:LEVEL {Data}<CR>

Where data is the desired level in % of output

For Example, to set the output to 750 MHz, with a VCO level of 70

SOURCE:HF:SINE/SOURCE:HF:SINE:FREQ 750000000/SOURCE:HF:SINE:LEVEL 70<CR>

To set the A-B Relative Phase output, send the following command

SOURCE:LF:PHASE<CR>

This command will enter the A-B Relative Phase output mode

To set the frequency, send the following command

SOURCE:LF:PHASE:FREQ {Data}<CR>

Where data is the desired frequency in Hz

To set the phase error between the two outputs send the following command

SOURCE:LF:PHASE:ANGLE{Data}<CR>

Where data is the desired level in degrees

For Example, to set Phase Output, 2 kHz with a phase angle of 90 between output A and B

SOURCE:LF:PHASE/SOURCE:LF:PHASE:FREQ 2000/SOURCE:PHASE:ANGLE 90<CR>

LF Measurement

To set the low frequency measurement input, send the following command

MEASURE:LF<CR>

This will set the unit to Low Frequency measurement mode.

To receive the currently displayed measurement, read the response to the following command

READ?

The response will be returned in Hz with the same resolution as on the display

For example, if 1.0456 kHz is currently being measured with a gate time of 1s
the response will be

1045.60000

LF Measurement - Gate Time

To set the Gate time parameter, send the following command

MEASURE:LF:GATE {Data}<CR>

Where the gate time is specified in seconds (valid inputs 0.1, 1 and 10).

For example, to set the gate time to 1 second,

MEASURE:LF:GATE 1 <CR>

LF Measurement - Trigger Level

To set the Trigger Level parameter, send the following command

MEASURE:LF:TRIGGER {Data}<CR>

Where the trigger level is specified in volts

For example, to set the trigger level to 700mV,

MEASURE:LF:TRIGGER 0.7 <CR>

LF Measurement - Sensitivity

To set the measurement sensitivity parameter, send the following command

MEASURE:LF:SENSE {Data}<CR>

Where the sensitivity is set as either HIGH or LOW

For example, to set High Sensitivity mode :

MEASURE:LF:SENSE HIGH<CR>

LF Measurement - High Frequency Filter

To enable or disable the high frequency filter on the measurement input, send the following command

MEASURE:LF:FILTER {Data}<CR>

Where the filter is set to ON or OFF

For example, to turn the filter OFF send

MEASURE:LF:FILTER OFF<CR>

LF Measurement - AC / DC Coupling

To set the coupling mode for the measurement inputs, send the following command

MEASURE:LF:COUPLING {Data}<CR>

Where the coupling mode is specified as AC or DC

For example, to set AC Coupling

MEASURE:LF:COUPLING AC<CR>

LF Measurement - Frequeny / Period Display

To set period measurement mode, send the following command

MEASURE:MODE {Data}<CR>

Where the measurement mode is specified as **FREQUENCY** or **PERIOD**

Example : Set period display mode

MEASURE:MODE PERIOD<CR>

Example : Set frequency display mode

MEASURE:MODE FREQUENCY<CR>

HF Measurement - Gate Time

To set the Gate time parameter, send the following command

MEASURE:HF:GATE {Data}<CR>

Where the gate time is specified in seconds (valid inputs 0.1, 1 and 10).

For example, to set the gate time to 1 second,

MEASURE:HF:GATE 1 <CR>

HF Measurement - Trigger Level

To set the Trigger Level parameter, send the following command

MEASURE:HF:TRIGGER {Data}<CR>

Where the trigger level is specified in volts

For example, to set the trigger level to 700mV,

MEASURE:HF:TRIGGER 0.7 <CR>

HF Frequency Measurement - Sensitivity

To set the measurement sensitivity parameter, send the following command

MEASURE:HF:SENSE {Data}<CR>

Where the sensitivity is set as either HIGH or LOW

For example, to set High Sensitivity mode :

MEASURE:HF:SENSE HIGH<CR>

HF Measurement - High Frequency Filter

To enable or disable the high frequency filter on the measurement input,
send the following command

MEASURE:HF:FILTER {Data}<CR>

Where the filter is set to ON or OFF

For example, to turn the filter OFF send

MEASURE:HF:FILTER OFF<CR>

HF Measurement - AC / DC Coupling

To set the coupling mode for the measurement inputs, send the following command

MEASURE:HF:COUPLING {Data}<CR>

Where the coupling mode is specified as AC or DC

For example, to set AC Coupling

MEASURE:HF:COUPLING AC<CR>

HF Measurement - Gate Time

To set the Gate time parameter, send the following command

MEASURE:HF:GATE {Data}<CR>

Where the gate time is specified in seconds (valid inputs 0.1, 1 and 10).

For example, to set the gate time to 1 second,

MEASURE:HF:GATE 1 <CR>

HF Measurement - Trigger Level

To set the Trigger Level parameter, send the following command

MEASURE:HF:TRIGGER {Data}<CR>

Where the trigger level is specified in volts

For example, to set the trigger level to 700mV,

MEASURE:HF:TRIGGER 0.7 <CR>

HF Measurement - Sensitivity

To set the measurement sensitivity parameter, send the following command

MEASURE:HF:SENSE {Data}<CR>

Where the sensitivity is set as either HIGH or LOW

For example, to set High Sensitivity mode :

MEASURE:HF:SENSE HIGH<CR>

HF Measurement - High Frequency Filter

To enable or disable the high frequency filter on the measurement input, send the following command

MEASURE:HF:FILTER {Data}<CR>

Where the filter is set to ON or OFF

For example, to turn the filter OFF send

MEASURE:HF:FILTER OFF<CR>

LF Measurement - AC / DC Coupling

To set the coupling mode for the measurement inputs, send the following command

MEASURE:LF:COUPLING {Data}<CR>

Where the coupling mode is specified as AC or DC

For example, to set AC Coupling

MEASURE:LF:COUPLING AC<CR>

Frequency Measurement - Period

To set the Low Frequency period measurement input, send the following command

MEASURE:INPUT:PERIOD<CR>

This will set the unit to Period measurement mode.

To receive the currently displayed measurement, read the response to the following command

READ?

The response will be returned in seconds with the same resolution as on the display

For example, if 1.01ms is currently being measured with a gate time of 0.1s the response will be

0.001010000

GPS Status : Fix

To get the GPS fix data use the following command :

STATUS:GPS:FIX ?<CR>

Return data : **2D / 3D / None**

GPS Status : Number of Tracked Satellites

To get the GPS tracking data use the following command :

STATUS:GPS:TRACKING ?<CR>

Return data : **Number of satellites currently tracked**

GPS Status : Number of Tracked Satellites

To get the GPS tracking data use the following command :

STATUS:GPS:TRACKING ?<CR>

Return data : **Number of satellites currently tracked**

GPS Status : Location

To get the GPS tracking data use the following command :

STATUS:GPS:LOCATION ?<CR>

Return data : **Latitude / Longitude**

GPS Status : Date [UTC]

To get the GPS tracking data use the following command :

STATUS:GPS:DATE ?<CR>

Return data : **dd month yyyy (UTC Time)**

To get the GPS tracking data use the following command :

STATUS:GPS:TIME ?<CR>

Return data : **hh:mm:ss (UTC Time)**

Circuit Description

At a high level, the 8700 consists of a number of separate blocks (input circuit, output circuit, GPS Disciplined oscillator) which are all trained to a common 10 MHz signal generated by the GPS Disciplined oscillator.

Without GPS signal the 8700 allows an internal oscillator to run in hold over (no correction for short term,long term and temperature drift) to generate the internal (and external in 10 MHz output mode) clocking source for each element of the circuit to use.

When a GPS lock has been achieved a phase comparator adjusts the output of the oscillator to match the timing signal received from the GPS satellites.

As the oscillator is self disciplining the effects of short term, long term and temperature drift are compensated for through the lock to the GPS system. During normal operation the 8700 will not operate in holdover mode unless an antenna fault occurs so the unit can be assumed to be drift free and therefore not require external re-calibration.

However, for traceability purposes some accreditation bodies recommend an initial calibration by inter-comparison to a National Metrology Institute (NMI) or accredited calibration laboratory prior to installation to confirm that the GPS receiver is disciplining the oscillator correctly as well to confirm the stability of the output over time.

The long term performance of the 8700 is dependant upon the local environment (including antenna installation and temperature fluctuations). To evaluate these effects it is advised to confirm correct operation of the 8700 after installation by comparison against another frequency standard. A portable frequency standard or counter can be used for this operation.

Although the 8700 does not require periodic calibrations to maintain its specification, some accreditation bodies may wish to see proof of external traceability through periodic calibrations either by an NMI or another accredited laboratory. This can be performed either by sending the 8700 to the laboratory to have the 10 MHz output verified, or alternatively an external oscillator calibrated and compared against the output of the 8700. As the measurement circuitry is trained to the internal 10 MHz oscillator it is possible to compare the measurement of the external oscillator against the certified output to confirm correct operation of the 8700.

Further information on the traceability of GPS disciplined oscillators (GPSDO's) can be found by contacting Transmille at sales@transmille.com