TRANSMILLE
SOLUTIONS IN CALIBRATION

TRANSMILLE 8600 FREQUENCY SOURCE / MEASURE GPS STANDARD

OPERATION MANUAL

TRANSMILLE 8600 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.

Contents

General Specifications

Temperature Performance	Storage : -5℃ to + 60℃ Operation : 0℃ to +50℃
Humidity Performance	Storage : <95%, non-condensing Operation : <80% to 30℃, <70% to 40℃, <40% to 60℃
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 : VFD Number of Lines (Main Display) : 1 Number of Lines (Secondary Display) : 2
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: 8600
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 : 02/03/2015

Revision No: 1.00

Director

8600 Frequency Source / Measure GPS Standard

Introduction

The 8600 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 8600 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 8600 combines both frequency source and measurement into a single integrated solution.

Dual VFD displays provide the user with a dedicated source/measure readout, with direct access to detailed settings and satellite Lock/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.
- Dual VFD Screens ensure 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

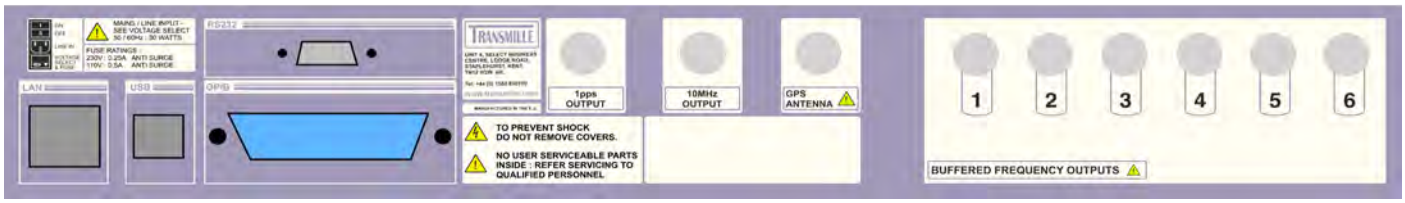
To operate correctly the 8600 requires a GPS antenna with full view of the sky to achieve a stable lock with GPS satellites.

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.

Rear Panel Connections

Connections are offered on the rear panel of the 8600 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), 1PPS output and dedicated 10 MHz out.

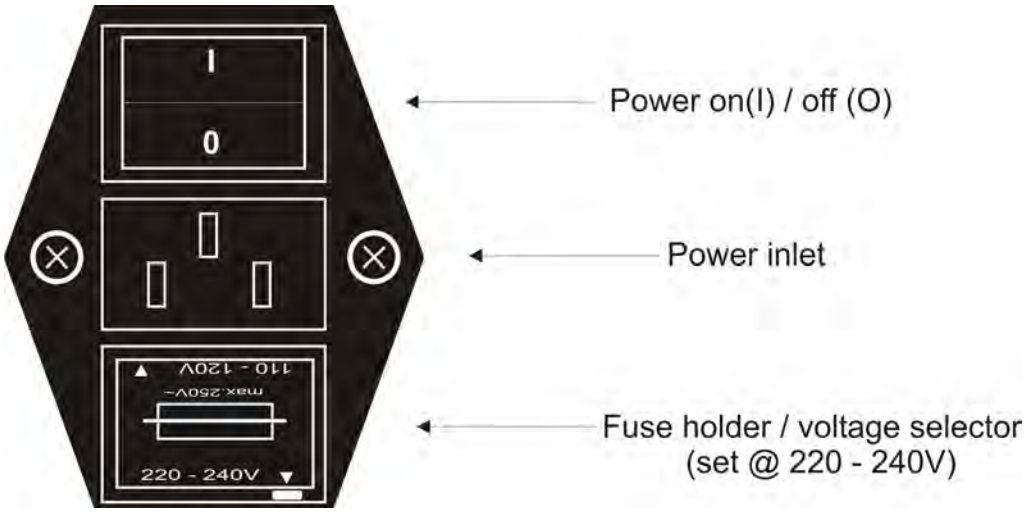
If specified, an option to have 6 additional buffered 10 MHz outputs will be provided each with independant BNC connectors

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 8600 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

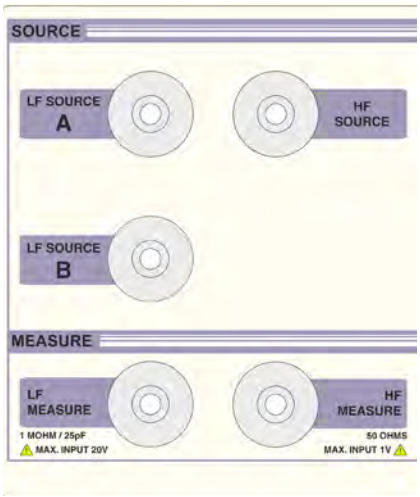
Configuration	Via optional configuration utility for computer
Cable Type	100Bast T Ethernet Cable (RJ45)
Software Driver	N/A

GPIB Interface

Configuration	Press MENU until GPIB Address : is displayed Enter new GPIB Address (Valid range 0-30) Press ENTER
Cable Type	GPIB Interface Cable
Software Driver	National Instruments VISA or equivalent

Front Panel Connections

The 8600 features 5 BNC connectors on the front panel for simple connections to frequency counters and sources. 3 of the BNC connections are used for OUTPUT, 2 of the connectors are used for INPUT.



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

Operation

Front Panel Controls

For ease of use, the front panel keyboard is separated into 3 sections. The first is OUTPUT functions and configuration, the second is MEASUREMENT functions and configuration, and then a general purpose keyboard for navigation and numerical entry.

The function of each key is described in detail throughout the operation manual. In summary, the block of 8 buttons on the left of the keyboard select FUNCTIONS, the center keys set CONFIGURATION or MENU functions and the right hand keys are for numerical entry.

The TOP row of keys in the left hand section control SOURCE functions, the BOTTOM row of keys in the left hand section control MEASURE functions

To assist the operator, the currently active function is highlighted in GREEN to provide immediate feedback at a glance.

Main Display

The main display of the 8600 is a bright single line VFD for enhanced readability. This screen displays either the current OUTPUT or the current MEASUREMENT depending upon the mode.

At the end of the screen there is an indicator to display the current state of the GPS Reference. If “Int” is displayed this indicates that no fix has been achieved to the GPS system. This is normal for the first 10 - 20 minutes after installation, however should not appear during normal use.

If “GPS” is displayed at the end of the screen this indicates that a good fix has been achieved and the 10 MHz reference is currently being disciplined to the GPS system

Status Display

The smaller status display is used to indicate the function, current status of user configurable parameters as well as menu functions.

The status display is split across 2 lines. In entry mode the bottom line shows the value that is being entered

Entering Values

Using the numerical section of the keyboard users can enter parameters for output / configuration directly into the unit.

After the desired function has been selected, use the numerical keyboard to enter the desired value. Appropriate units are automatically added.

To enter a multiplier, press the SHIFT key and then press the key with the appropriate multiplier above the key, for example for kHz press the SHIFT key, followed by 1

Clear, Backspace and decimal place keys have also been included as SHIFT functions.

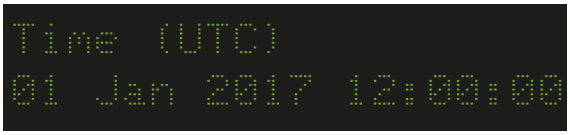
GPS Status

GPS Strength

To view the current GPS Signal strength and number of satellites currently locked, press the MENU key once. The following screen will be displayed on the status screen.

Time Display

Pressing the MENU key again will display the current date and time to UTC standards.



Location

Pressing the MENU key once more will display the current location in the following format :

Latitude: DD°mm.mmm H
Longitude : DDD°mm.mmm H

Where D denotes degrees, m denotes minutes and H is the hemisphere (North, South / East, West)

Output Functions

10 MHz Reference Frequency

The default start up state for the 8600 is for the 10 MHz reference frequency signal to be present on the Low Frequency (LF) A terminal. The status display will indicate **GPS 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.

Low Frequency Divided Output

Pressing the 1 Hz - 10 MHz key when the unit is in **10MHz Frequency Mode** will set the 8600 to **Frequency Divider Output Mode**. In this mode the output frequency can be varied in steps of 1, 2, 5 from 1 MHz to 5 MHz.

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.

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

Low Frequency Variable Output - Square Wave

Pressing the LF Mode key will set the unit to **DDS Square Wave Output Mode**. 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 into 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 smaller status display will indicate **DDS Square Wave 5V Pk-pk Output Mode**

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

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 LF Source A Terminal

Low Frequency Variable Output - Variable Sine

Pressing the LF Mode key again will set the unit to **DDS Sine Wave Output Mode**. 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 that can be configured for output into either a 1 MOhm input impedance or a 50 Ohm input impedance.

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 smaller status display will indicate **DDS Variable Sine** and the currently configured output impedance.

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

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

To vary the level, press the LEVEL key and then observe the current output on the smaller screen. The default in both output impedance modes is 1V. The output voltage is displayed as the RMS level. The output can be varied either with the digital control or through direct numerical entry.

Note : Outputs below 0.26V will be displayed in mV, outputs above will be displayed in V.

To change the output impedance, press the SHIFT key followed by the LEVEL key. The status display will update to indicate either **Hi Impd Output** or **50Ω Impd Output**.

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

High Frequency Variable Output

Pressing the LF Mode key again will set the unit to **High Frequency VCO Output 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 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 smaller status display will indicate **High Frequency VCO Output Mode.**

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

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

To adjust the level, press the LEVEL key and then adjust the level from 0 to 100%. The level can be adjusted via the digital control or via direct keyboard entry.

The output for this function appears at the HF Source Terminal

A → B Phase Reference Output

Pressing the A→B Ref key will set the unit to Phase Offset Mode. In this mode a phase error is generated between LF Output A and LF Output B to verify phase measurement functions of timer counter instruments.

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 smaller status display will indicate **A→B Phase Output** and the current phase error between the two outputs on the second line.

The output frequency can be varied by setting the unit to the Low Frequency Divided output mode, and then re-selecting **A→B Phase Reference Output** mode again.

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

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

Input Functions

In addition to the source functions, the 8600 combines a high resolution frequency counter that is internally disciplined to GPS reducing the requirement for separate pieces of equipment and complicated wiring and interconnections.

Gate Settings

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 DIGITS key on the front panel.

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 pressing the TRIGGER LEVEL key and then adjusting via the digital control until a stable trigger is achieved.

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 HIGH-LOW key. The current sensitivity is displayed in the status display.

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 HF FILTER key. The current filter state is displayed in the status display as Flt Off or Flt 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.

To switch between AC and DC coupled modes, press the AC/DC COUPLED key. The current state is displayed in the status display as AC for AC coupled, and DC for DC coupled.

Low Frequency Measurement

Pressing the LF Range 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 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, 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 smaller status display shows the Gate setting, Trigger level, Sensitivity, HF Filter state and the current coupling mode.

To set measurement parameters, refer to the previous sections which detail each setting.

Period Measurement

Pressing the Period Measure key will set 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). The maximum input frequency is 10 MHz, and the maximum input 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, 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 smaller status display shows the Gate setting, Trigger level, Sensitivity, HF Filter state and the current coupling mode.

To set measurement parameters, refer to the previous sections which detail each setting.

High Frequency Measurement

Pressing the HF Range key will set the unit to **High Frequency Measurement Mode**. In this mode the instrument measures the frequency of the signal connected to the HF Measure Input. The maximum input frequency is 1.05 GHz, and the maximum input 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, 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 smaller status display shows the Gate setting, Trigger level, Sensitivity, HF Filter state and the current coupling mode.

To set measurement parameters, refer to the previous sections which detail each setting.

Remote Commands

Introduction

The 8600 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 8600 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

DDS:SINE/DDS:LEVEL 2.5/F1000<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.

Response / Error Codes

The 8600 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 k5 Hz, 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 Impedance, send the following command

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

Where data is HIGH or LOW to set the correct impedance

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:IMPEDANCE HIGH/
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>

Frequency Source - A-B Relative Phase

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>

Frequency Measurement - Gate Time

To set the Gate time parameter, send the following command

MEASURE:CONFIGURE:GATE:TIME{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:CONFIGURE:GATE:TIME 1 <CR>

Frequency Measurement - Trigger Level

To set the Trigger Level parameter, send the following command

MEASURE:CONFIGURE:TRIGGER:LEVEL {Data}<CR>

Where the trigger level is specified in volts

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

MEASURE:CONFIGURE:TRIGGER:LEVEL 0.7 <CR>

Frequency Measurement - Sensitivity

To set the measurement sensitivity parameter, send the following command

MEASURE:CONFIGURE:SENSITIVITY:LEVEL {Data}<CR>

Where the sensitivity is set as either HIGH or LOW

For example, to set High Sensitivity mode :

MEASURE:CONFIGURE:SENSITIVITY:LEVEL HIGH<CR>

Frequency Measurement - High Frequency Filter

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

MEASURE:CONFIGURE:FILTER {Data}<CR>

Where the filter is set to ON or OFF

For example, to turn the filter OFF send

MEASURE:CONFIGURE:FILTER OFF<CR>

Frequency Measurement - AC / DC Coupling

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

MEASURE:CONFIGURE:COUPLING {Data}<CR>

Where the coupling mode is specified as AC or DC

For example, to set AC Coupling

MEASURE:CONFIGURE:COUPLING AC<CR>

Frequency Measurement - Low Frequency Input

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

MEASURE:INPUT:LOWFREQ<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

Frequency Measurement - High Frequency Input

To set the High Frequency measurement input, send the following command

MEASURE:INPUT:HIGHFREQ<CR>

This will set the unit to High 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 MHz is currently being measured with a gate time of 10s the response will be

1045600000

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

Query Current Function

To query the current function of the 8600, send the following command

FUNCTION?<CR>

The table below lists the responses and the corresponding function

Return Code	Function
1	10MHz Reference Output
2	1 Hz - 5 MHz Divider Output
3	Low Frequency 5V Peak to Peak
4	Low Frequency Variable Sine
5	High Frequency Output
6	A-B Relative Phase
7	Low Frequency Measurement
8	High Frequency Measurement
9	Period Measurement

Query GPS Status

To query the current GPS status of the 8600, send the following command :

STATUS:GPS:STATUS?<CR>

The table nelow lists the responses and the corresponding function

Return Code	Status
1	No Fix
2	2D Fix
3	3D Fix

Query Number of Satellites

To query the number of satellites that he 8600 is currently tracking, send the following command :

STATUS:GPS:TRACKING?<CR>

The current number of tracked satellites will be returned followed by <CR><LF>

Query Latitude and Longitude

To query the current latitude and longitude, send the following command :

STATUS:GPS:LOCATION?<CR>

The current latitude and longitude will be reported by the 8600 in degrees followed by minutes and the hemisphere

Query Date

To query the current date as received by GPS, send the following command :

STATUS:GPS:DATE?<CR>

The date will be returned as DD,MM,YYYY

Query Time

To query the current time as received by GPS, send the following command :

STATUS:GPS:TIME?<CR>

The tome will be returned in 24 hour formatt as HH:MM:SS

Theory of Operation

Circuit Description

At a high level, the 8600 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 8600 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.

Traceability

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 8600 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 8600 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 8600 after installation by comparison against another frequency standard. A portable frequency standard or counter can be used for this operation.

Although the 8600 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 8600 to the laboratory to have the 10 MHz output verified, or alternatively an external oscillator calibrated and compared against the output of the 8600. 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 8600.

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

ABOUT US

We truly believe in offering Solutions in Calibration, offering bespoke solutions for calibration laboratories and manufacturers across the globe. Our mission statement is not just a phrase, it is our design and support philosophy, offering support and advice that cannot be found elsewhere with a friendly atmosphere.

Transmille was founded in 1997 as a commercial calibration service, and soon after began to develop and manufacture a range of electrical calibration products and software to answer a growing requirement for solutions to common problems. Following this small beginning, Transmille has worked year on year to provide unique equipment and software to benefit calibration laboratories and manufacturers across the globe.

Ever since releasing the very first products Transmille have continued to innovate and develop new products for the metrology community, from world first products such as the 2100 Electrical Test Equipment calibrator, through to the worlds lowest cost multi product calibrator the 1000 series.

Transmille now produce over 600+ calibration instruments per year, shipping instruments to customers ranging from National Standards Laboratories and manufacturers through to small calibration test houses around the world.

An unrivalled commitment to quality and innovation drives Transmille forwards, with a dedicated design and support team in house with a combined experience of over 60 years in manufacture and design of electrical calibration products and software.

With local distributors across the globe, we can offer one to one personalised support, no matter how large or small the customer.

Unit 4, Select Business Centre,
Lodge Road, Staplehurst, Kent
TN12 0QW. United Kingdom

Main Office : +44 (0) 1580 890700
sales@transmille.com
www. transmille.com

Need technical support? Visit our online portal:
http://support.transmille.com

20 YEARS OF INNOVATION 1997 - 2017