Digital Instruments

EASYREF

Miniature Disciplined RF Generator

Rev 1.1

Dichiarazione di conformità **Declaration of conformity**	CE
La Ditta *The Company*	**DIGITAL INSTRUMENTS S.r.l.** **Via Parco degli Scout, 13** **20091 BRESSO (MI) ITALY**
Dichiara con la presente che il Prodotto *Herewith declares that the Product*	
Tipo / *Type*	**Miniature Disciplined RF Generator**
Modello / *Model*	**EASYREF**
Serial Number	**0010** /
Oggetto di questa dichiarazione è conforme ai seguenti standard o norme della Comunità Europea *Referred to by this declaration is in conformity with the following standards or normative documents of EC*	
Norme Europee Armonizzate *European Armonized Standards*	
CEI EN 61000-6-4:2007	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
CEI EN 61000-6-2:2006	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
CEI EN 55011	Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment
CEI EN 61000-4-2	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
CEI EN 61000-4-3:2007	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test
CEI EN 61000-4-4:2006	Electromagnetic compatibility (EMC) – Part 4-4:Testing and measurement techniques – Electrical fast transient/burst immunity test
CEI EN 61000-4-5:2007	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
CEI EN 61000-4-6	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
CEI EN 61000-4-8:1997+A1:2001	Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test
CEI EN 61000-4-11	Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests
CEI EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
Bresso, November 2008	**DIGITAL INSTRUMENTS S.r.l.** **Via Parco degli Scout, 13** **20091 BRESSO (MI) ITALY** *Marco Genova* *Quality Assurance Manager*

Istruzioni di sicurezza
Safety Instructions

Il dispositivo è stato progettato, costruito e collaudato in conformità alle normative richiamate nel Certificato di Conformità ed è stato rilasciato dal costruttore completamente testato secondo gli standard di sicurezza. Per mantenere questa condizione e assicurare la sicurezza d'uso, l'utente deve osservare tutte le istruzioni e segnalazioni di pericolo descritte in questo manuale.

This unit has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacurer's plant in a condition fully complying with safety standard. To maintain this condition and to ensure safe operation, the user must observe all the instructions and warnings given in this operating manual.

- **Prima di mettere in servizio il dispositivo, leggere attentamente ed integralmente le istruzioni per l'uso. Osservarle e seguirle in tutti i punti. Provvedere in modo che le istruzioni per l'uso siano sempre accessibili a tutti gli addetti.**

  Prior to switching on the unit, please read carefully the instructions on the manual. Keep this manual available for all every user of this equipment.

- **Il terminale PE sul dispositivo deve essere connesso al conduttore PE prima di eseguire qualsiasi altra connessione. L'installazione ed il cablaggio devono essere eseguiti da personale tecnico qualificato.**

  The PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made. Installation and cabling of the unit to be performed only by qualified technical personnel.

- **Lo strumento supporta alimentazione AC wide range da 95 Vac a 240 Vac e deve essere connesso tramite protezione con corrente nominale massima pari a 16A.**

  This unit may be operate from wide range AC supply networks from 95 Vac to 240 Vac fused with max. 16A.

- **Lo strumento supporta alimentazione DC wide range da 20 Vdc a 50 Vdc e deve essere connesso tramite protezione con corrente nominale massima pari a 5A. Il circuito di protezione contro l'inversione di polarità è implementato a bordo.**

  This unit may be operate from wide range DC supply networks from 20 Vdc to 50Vdc fused with max. 5A.Circuit against polarity inversion is also implemented.

  Le condizioni di sicurezza vanno testate ad ogni sostituzione. Ispezione visiva dei cavi, stato dell'isolamento, corrente di dispersione, stato del connettore PE e test funzionale.

  A safety test must be performed after each replacement of part. Visual inspections, PE conductor test, insulation resistance, leakage-current measurement, functional test.

- **Non interrompere il conduttore PE in nessun caso. Un interruzione del cavo PE rende l'apparato elettricamente pericoloso.**

  It is not permissible to interrupt PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit become electrically hazardous.

- **Ogni riparazione, manutenzione e sostituzione del dispositivo deve essere eseguita unicamente da personale autorizzato dalla Digital Instruments.**

  Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized Digital Instruments technical personnel.

- **Assicurarsi che ogni collegamento con dispositivi informatici sia eseguito secondo IEA950/EN60950**

  Ensure that the connections with information technology equipment comply with IEC950/EN60950

Simboli di sicurezza
Safety Symbols

Sono presenti sul dispositivo e nella documentazione simboli utilizzati per la segnalazione di segnalazione conformi alle specifiche IEC61010-1 II.

Safety-related symbols used on equipment and documentation comply with IEC 61010-1 II.

	• **SIMBOLO DIRECT CURRENT IEC 417, N°5031** Vdc may be used on rating labels
	• **SIMBOLO ALTERNATING CURRENT IEC 417, N°5032** For rating labels, the symbol is typically replaced by V and Hz as in 230V, 50Hz.
	• **SIMBOLO PROTECTIVE CONDUCTOR TERMINAL IEC 417, N°5019** This symbol is specifically reserved for the PROTECTIVE CONDUCTOR TERMINAL and no other. It is placed at the equipment earthing point and is mandatory for all grounded equipment
	• **SIMBOLO CAUTION ISO 3864, N°B.3.1** used to direct the user to the instruction manual where it is necessary to follow certain specified instructions where safety is involved.

Changelog

Rev.	Note	Data
1.0	First review	18/01/2008
1.1	Updated NTP Section	24/11/2012

EASYREF

Miniature Disciplined RF Generator

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Summary

This manual provides to the user of the apparatus ***EASYREF*** with all the information necessary for proper operation. The information include the normal installation procedures and any data on the maintenance and programming in order to facilitate interventions in the field.

EASYREF is a high stability Time & Frequency generator. The high stability is obtained by disciplining algorithms controlled by GPS receiver.

EASYREF in the standard version provides 10 MHz frequency reference and 1PPS time reference as well as Etrhernet interface for LAN synchronization by NTP protocol.

EASYREF is very flexible for all applications where high stability Time & frequence references are needed in very small size.

The unit is extremely compact (can be mounted on Omega DIN rail Equipment) and can be interfaced with a serial connection or with the Ethernet interface using SNMP (Simple Management Network protocol).

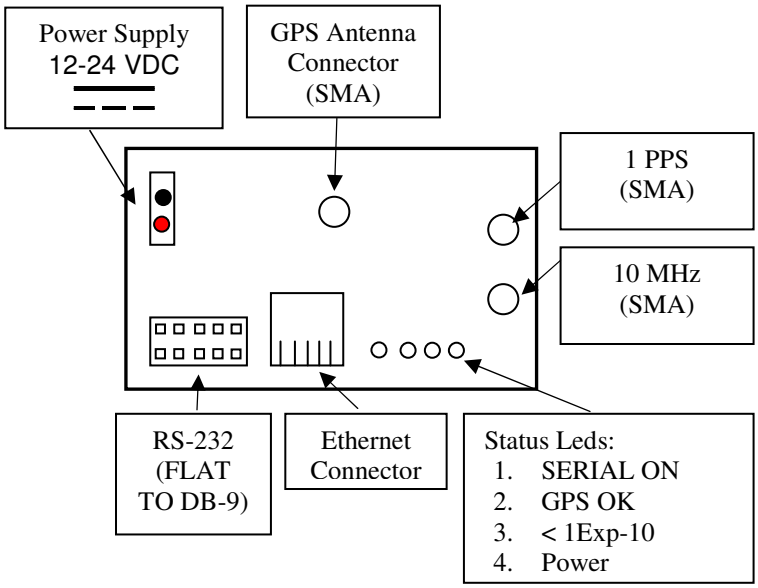
4 leds give immediate status information about power supply and synchronization.

Note

WARNING: Before connecting the power supply please review the rest of this manual about the operating instructions.

Front view

The front panel appears as shown in the following figure.



In order to power on the device a DC voltage 12-24V shall be applied on the power supply connector.

The device is able to work stand alone, with no user interaction.

The status is shown on the 4 leds:

POWER:

Stedy green when the device is powered on.

<1Exp-10:

Should light on green when the device is synchronized and has reached a stability better than $1x10^{-10}$

GPS OK:

Should blink green when the GPS antenna is connected and the GPS is tracking satellites.

SERIAL ON:

Should link on when a serial connection is present (it needs serial control lines to work)

Web Interface

The **EASYREF** is managed through the network using a common WEB browser by simply connecting to the associated IP address.

Network

IP Address

Allows to set up the IP address associated to the the specific network interface. To activate the changes, system needs to restart.

Gateway

Allows to set the gateway associated with specific network interface. To activate the changes, system needs to restart.

Netmask

Allows to set the netmask associated to specific network interface. To activate the changes, system needs to restart.

GPS

Positioning Mode (Data Mode)

Permits to set the way in which the GPS module should calculate its geographical position. If extract it from the information collected from the satellites or using the one given by the user.

The "Altitude Hold" mode may not be available on every GPS module.

Latitude (hold)

Permits to view/set the latitude of the GPS antenna.

In brackets is shown the hold value used in the *Position Hold* mode.

Longitude (hold)

Permits to view/set the longitude of the GPS antenna.

In brackets is shown the hold value used in the *Position Hold* mode.

Height

Permits to view/set the height of the GPS antenna.

Cable Delay

Permits to set the length of the antenna cable connected to the GPS module, so to compensate the delays introduced by the signal propagation.

Power 10 Mhz

Permette di impostare la potenza di uscita del segnale a 10 MHz del cassetto in maniera indipendente dall'altro.

Show Ch Status

Shows the status of the channels of the GPS receiver

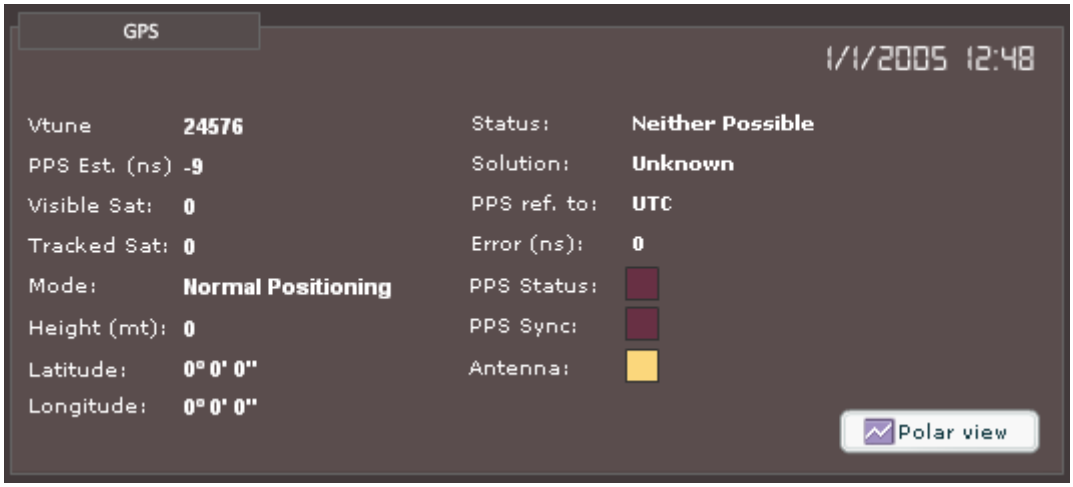
The snr, the elevation and the azimuth of the visible satellites are reported

In order to cycle between the various channels use the ↓ and ↑ keys.

Show Global Info

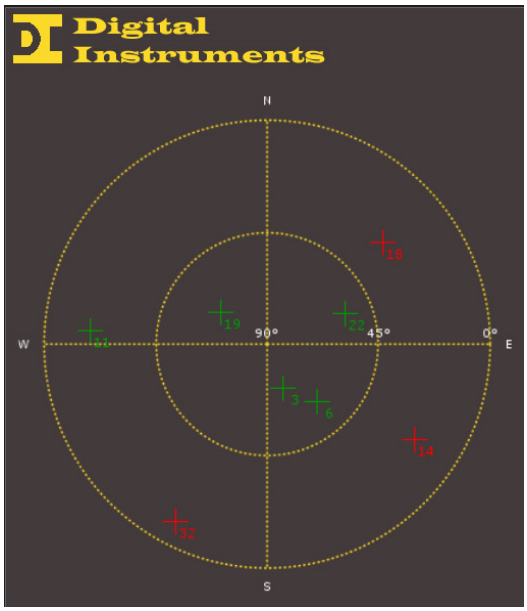
Shows some info about the GPS module:

Vtune value	→ shows the decimal value relative to the control voltage applied to the oscillator
GPS Accuracy	→ shows the accuracy in the reconstructed PPS from the GPS radio
Visibile Sats	→ shows the number of visible satellites
Tracked Sats	→ shows the number of tracked satellites
PPS Status	→ shows the status of the PPS signal
PPS Sync	→ shows the synchronization status
Antenna	→ shows the status of the antenna
Position	→ shows if the position is good or if there is any sort of error (e.g. due to some wrong position hold value)
Quality	→ shows the overall quality of the GPS signal received from the radio



Position Mode, Cable Delay, Latitude, *Longitude*, *Height* can be set from *Board Configuration*.

The satellite view can be opened by clicking on the Polar view button. In order to correctly see the view a Java Virtual Machine version 1.5 or above is needed and a few files must be copied on C: (jcommon-1.0.14.jar and jfreechart-1.0.11.jar).



Setup

Date & Time

Permits to view/set the date and time of the apparatus. Please note that it will be automatically updated by the GPS modules.

Timezone

Permits to set the timezone offset from UTC.

Clear Log

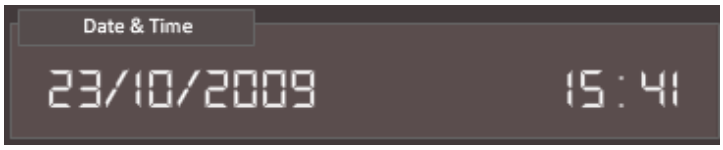
Clears the log file.

Restore Defaults

Restore the settings of the apparatus to their default state.

Reboot

Reboots the device.



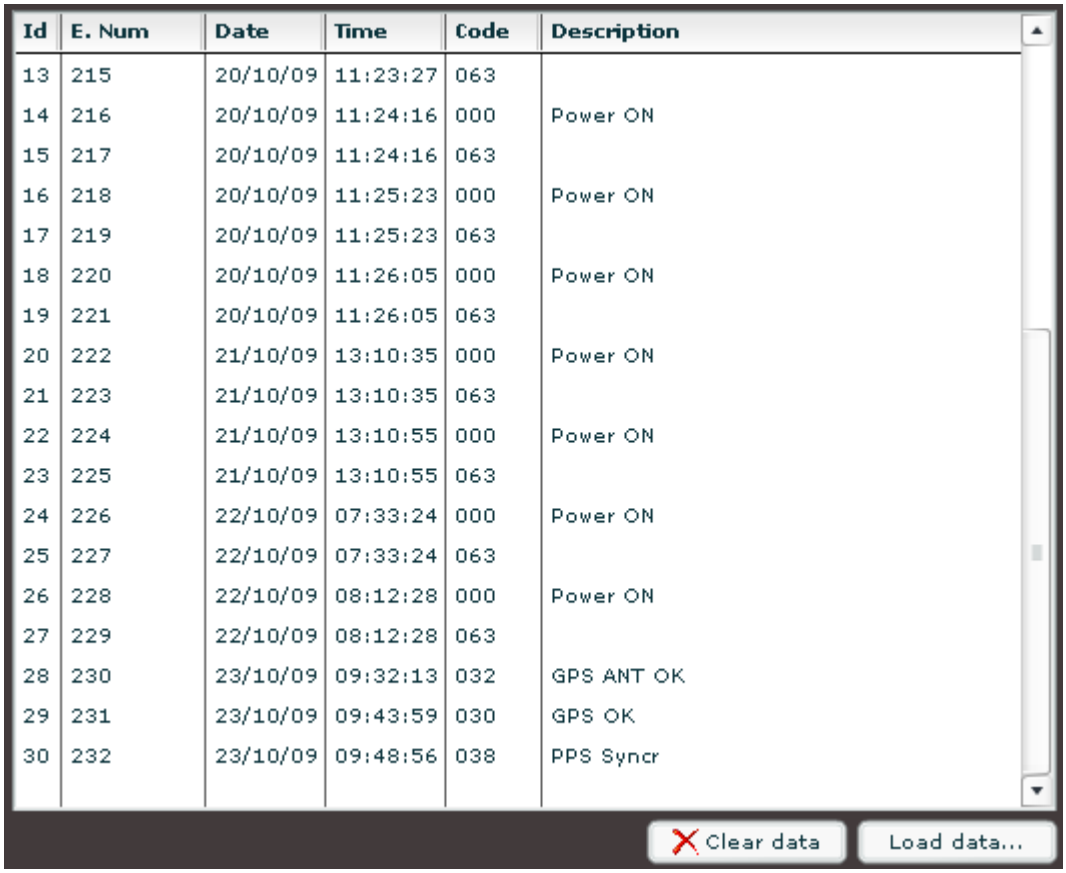
Event Log

From WEB it is possible to view the *Event log*, consisting of 100 events.
The log can be cleared or saved in csv format.

For each event date and time of when it happened are recorded.

CODE	EVENT	MEANING
Event Code 000	Power ON	→ Power on
Event Code 030	GPS OK	→ GPS signal present
Event Code 031	GPS KO	→ GPS signal absent
Event Code 032	GPS ANT OK	→ GPS antenna valid
Event Code 033	GPS ANT OC	→ GPS antenna over current
Event Code 034	GPS ANT UC	→ GPS antenna under current
Event Code 037	Vtune Probl	→ Vtune problem
Event Code 038	PPS Syncr	→ Synchronization completed

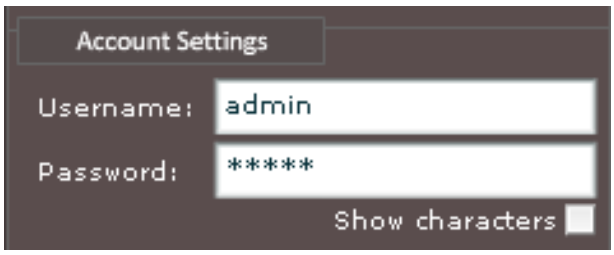
Events can be viewed from serial line or WEB interface.



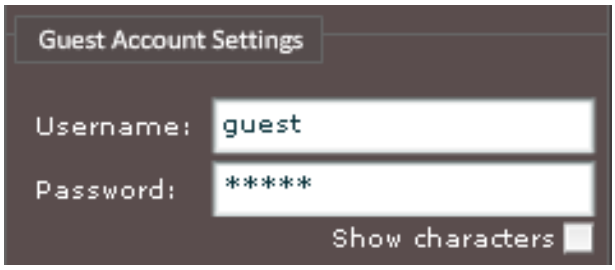
Id	E. Num	Date	Time	Code	Description
13	215	20/10/09	11:23:27	063	
14	216	20/10/09	11:24:16	000	Power ON
15	217	20/10/09	11:24:16	063	
16	218	20/10/09	11:25:23	000	Power ON
17	219	20/10/09	11:25:23	063	
18	220	20/10/09	11:26:05	000	Power ON
19	221	20/10/09	11:26:05	063	
20	222	21/10/09	13:10:35	000	Power ON
21	223	21/10/09	13:10:35	063	
22	224	21/10/09	13:10:55	000	Power ON
23	225	21/10/09	13:10:55	063	
24	226	22/10/09	07:33:24	000	Power ON
25	227	22/10/09	07:33:24	063	
26	228	22/10/09	08:12:28	000	Power ON
27	229	22/10/09	08:12:28	063	
28	230	23/10/09	09:32:13	032	GPS ANT OK
29	231	23/10/09	09:43:59	030	GPS OK
30	232	23/10/09	09:48:56	038	PPS Syncr

User Account

The main user is the administrator. He can change its own credentials in the *Account Settings* tab.



It is possible to create a read-only user that can view, but not modify the settings of the device.
The username and password for this particular guest account can be set by the administrator in the *Guest Account Settings* tabs.



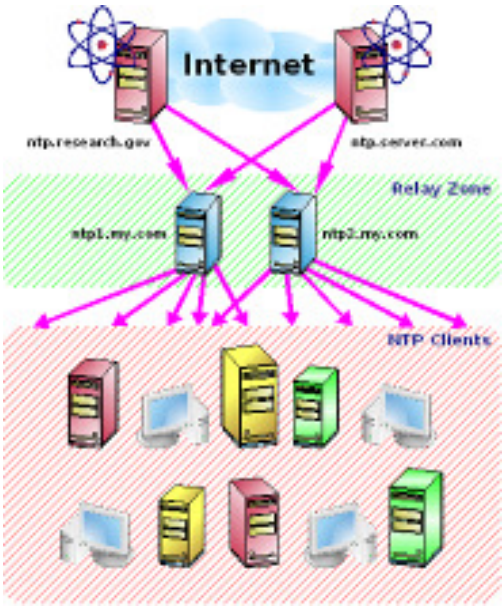
The default credentials are:

Administrator	→	**admin / admin**
Guest	→	**guest / guest**
SNMP	→	**public / public**

NTP

The NTP (Network Time Protocol) is a well-established standard for the synchronization of PCs and other devices on the Internet or an Intranet network.

The accuracy of the order of tens of milliseconds, can be considered adequate for most situations. Its flexibility and strength, thanks to the many servers widely available, make it a very smart choice for the time synchronization.

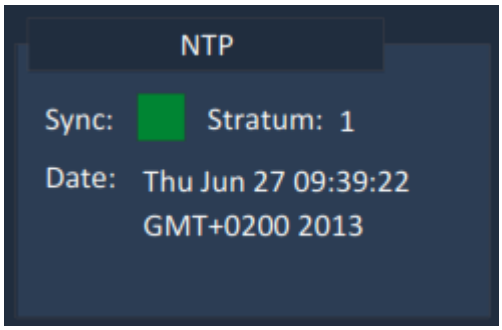


The device supports NTP server version 4 that distributes the synchronous time related to the GPS time reference.

There are no particular settings required to tune its functionality, but the device may require a hardware upgrade if you receive an error.

After a succesful sync the holdover status may lose 8 µs per day, so it may still be acceptable after months (supposing no power failure would happen in the meantime).

Is better to disable the muting setting on the GPS modules in order to keep the PPS active even after a long holdover.



Board Bring-Up

At the power on EASYREF will lock its internal PPS (pulse-per-second) to the UTC reference recovered from the GPS satellites.

The GPS OK led will blink once per second when a valid PPS is retrieved (antenna is connected and GPS satellites are being tracked).

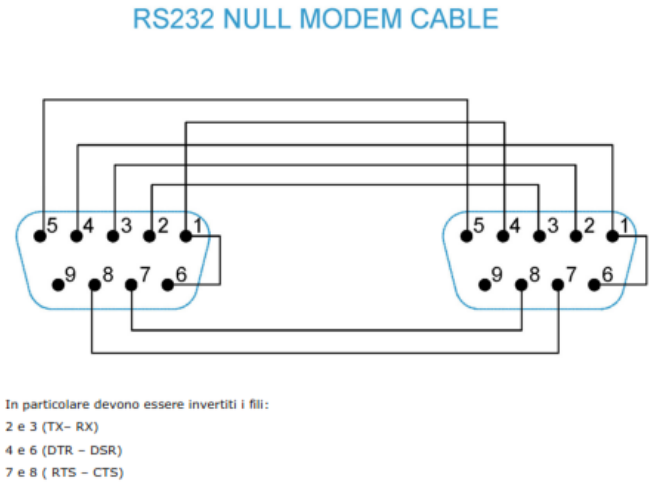
After having reached a sufficient precision ($1x10^{-10}$) the <1Exp-10 led will turn on.

At this point both the 10 MHz and the PPS signals may be considered valid and stable.

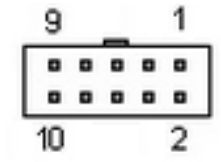
Usually from 5 to 10 minutes are sufficient to reach this situation.

Serial handling software

The device is provided with a serial port. It is possible to connect this console with a flat to DB9 connector and subsequently by using a null modem serial connector.



In particolare devono essere invertiti i fili:
2 e 3 (TX– RX)
4 e 6 (DTR – DSR)
7 e 8 (RTS – CTS)

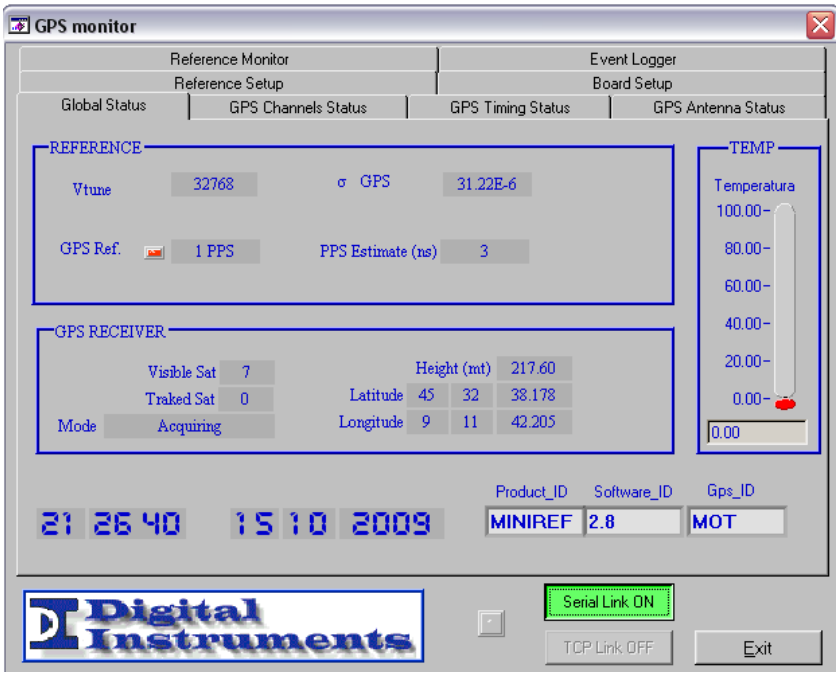


3 .. RX
4 .. RTS
6 .. CTS
5 .. TX
7 .. DTR
9 .. GND

EASYREF may be handled via software installed on a PC through the serial port in DCE-DCE configuration.

Follows an exhaustive description of the various windows and settings relative to the device.

Global Status Window



REFERENCE Panel:

Vtune: Numeric value of the Voltage Control Oscillator.
σ GPS: Last calculated value of short term stability compared to the GPS reference.
GPS Ref: Reference value set as a reference GPS.
PPS Estimate: Value of the error of reconstruction reference signal.

Riquadro TEMP:

Temperature: Internal temperature of the apparatus

GPS RECEIVER Panel:

Latitude: Latitude value.
Longitude: Longitude value.
Height: Height value.
Tracked Sat: Number of tracked satellites.
Visible Sat: Number of visible satellites.
Mode: Position mode status.

Reference Setup Window

Panel used for the of the operating parameters of the ***REFERENCE*** block input.

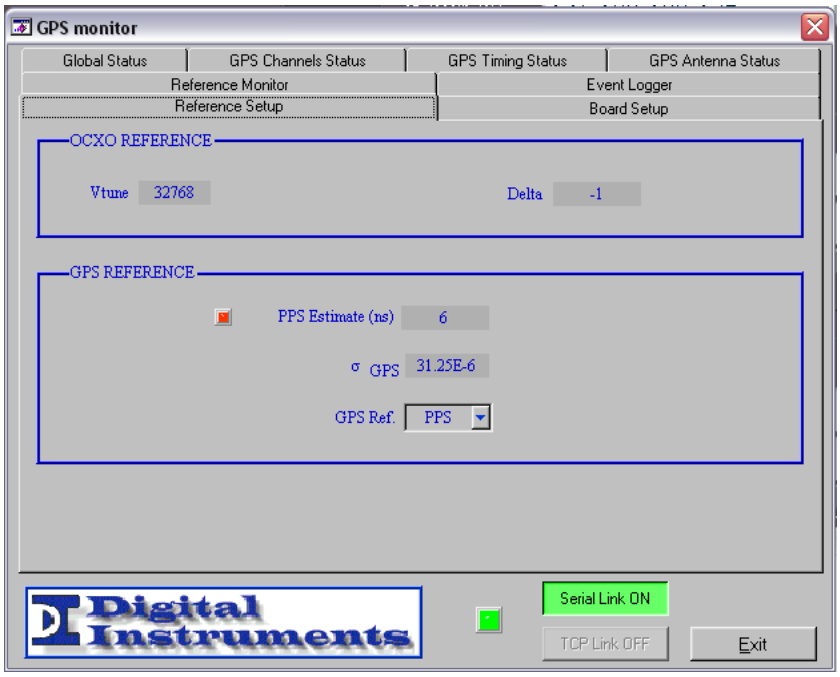
OCXO REFERENCE panel:

Settings related to the tuning of the high-stability oscillator:

Disciplined to: Preferential reference selection of internal oscillator report.
Switch Mode: Selection of the switching mode of the Preference reference in case of failure.
Vocxo: Numeric value of the Voltage Control Oscillator. (Read only)

GPS REFERENCE panel:

σ GPS: Last calculated value of short term stability compared to the GPS reference. (Read only)
GPS Ref: Selection of the value of the GPS reference. (Read only)
PPS Estimate: value of the reconstruction reference signal error. (Read only)



Board Setup Window

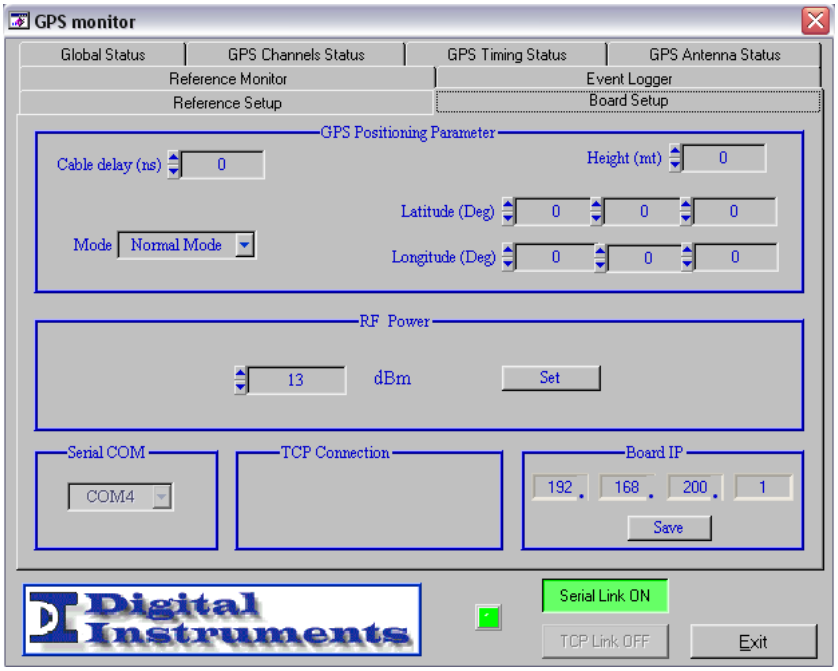
GPS Positioning Parameter Panel.

Mode: Mode of acquisition of the position of the GPS receiver.
Cable Delay: Delay expressed in nanoseconds introduced by the cable length.
Height: Altitude of the receiving antenna.
Latitude: Latitude of the receiving antenna.
Longitude: Longitude of the receiving antenna.

Serial COM panel:

COM: Settings concerning the PC serial port

Board IP panel:
IP Adress: IP address.



GPS Channels Status Window

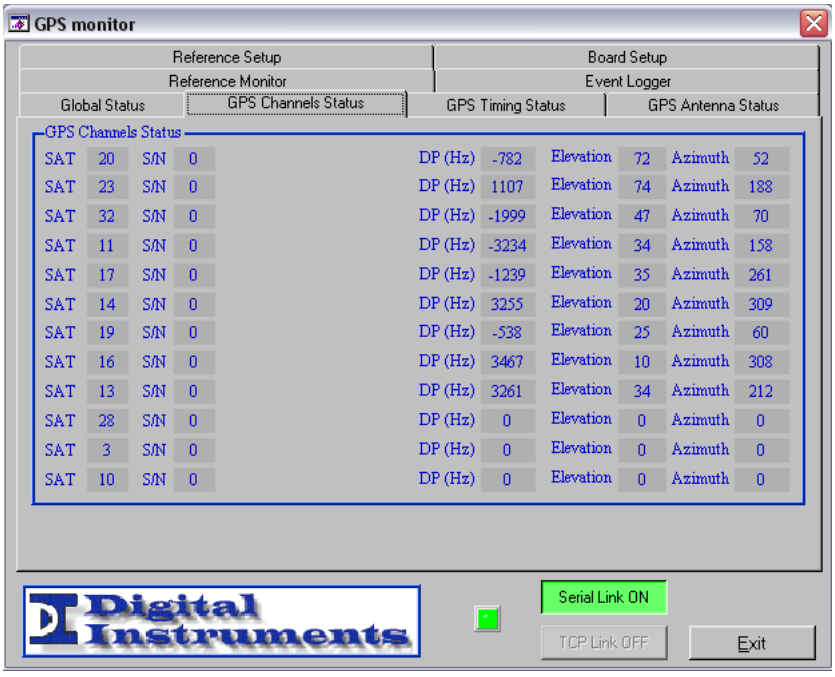
The next window contains all the informations about the status of the 12-channel GPS receiver.

Each channel shows the number of the satellites being tracked and the associated signal/noise ratio.

It also displays the specific parameters of the satellites including:

DP: frequency offset between the internal oscillator to the GPS receiver and the frequency value received from the specific satellite.

Elevation, Azimuth: orbital position of the specific satellite.

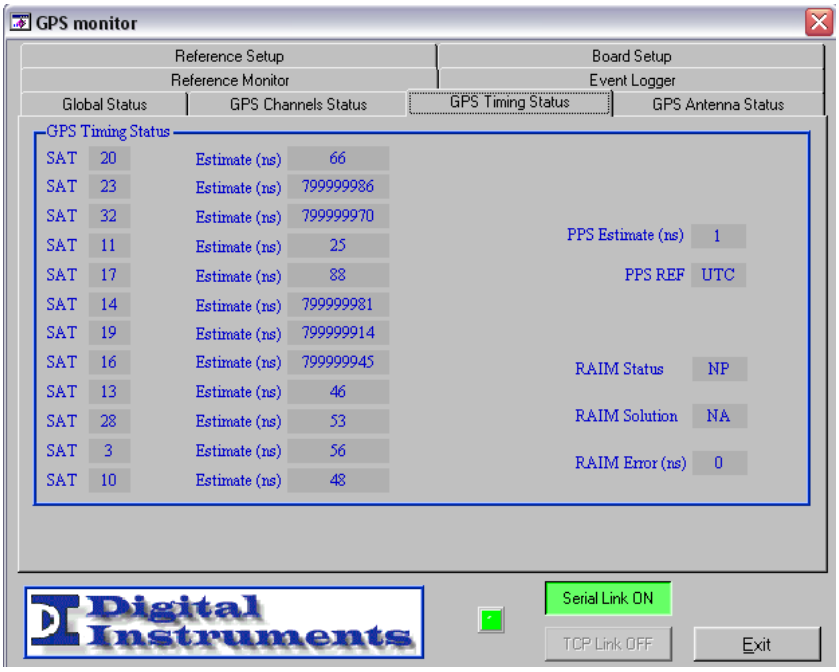


GPS Timing Status Windows

This window displays the reconstruction status of PPS synchronism for each of the 12 channels of the GPS receiver.

For each channel is displayed the attached satellite and the value expressed in nanoseconds of the position of sync compared to the value calculated from the ephemerides of the satellites tracked.
On the right side informations relating to the reconstruction algorithm of the synchronism are collected, and in particular:

RAIM Status: Assessment methods and syncs with error correction.
RAIM Solution: Solution of the calculation of regeneration synchronism established range
RAIM Limit: Range acceptable maximum beyond which the synchronism GPS becomes unacceptable.
RAIM Error: Value of mean square error.

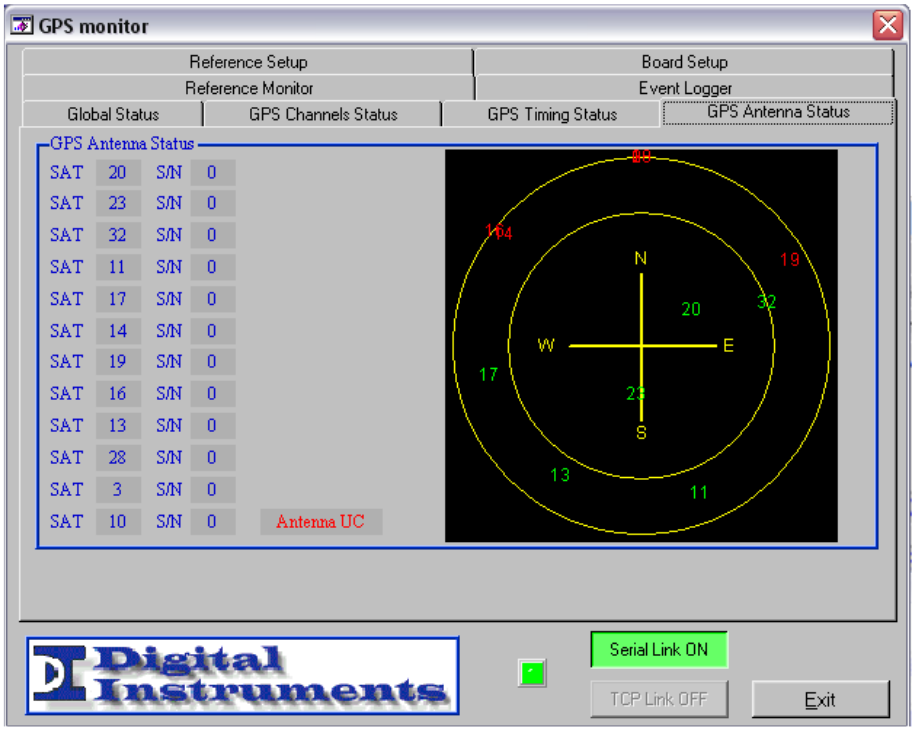


GPS Antenna Status Window

Panel for displaying the situation of visible satellites. Allows to view what the antenna "sees" looking at the sky. This view can be very useful in situations of blindness due to interference on GPS receiver channels.

In the bottom panel is also reported the status of the connection between the device and GPS antenna. In normal operation the display reads Antenna OK. Under abnormal conditions the following messages can be displayed: (in red)

Antenna UC: Inexistent connection (Under current)
Antenna OC: short-circuit connection (Over Current)



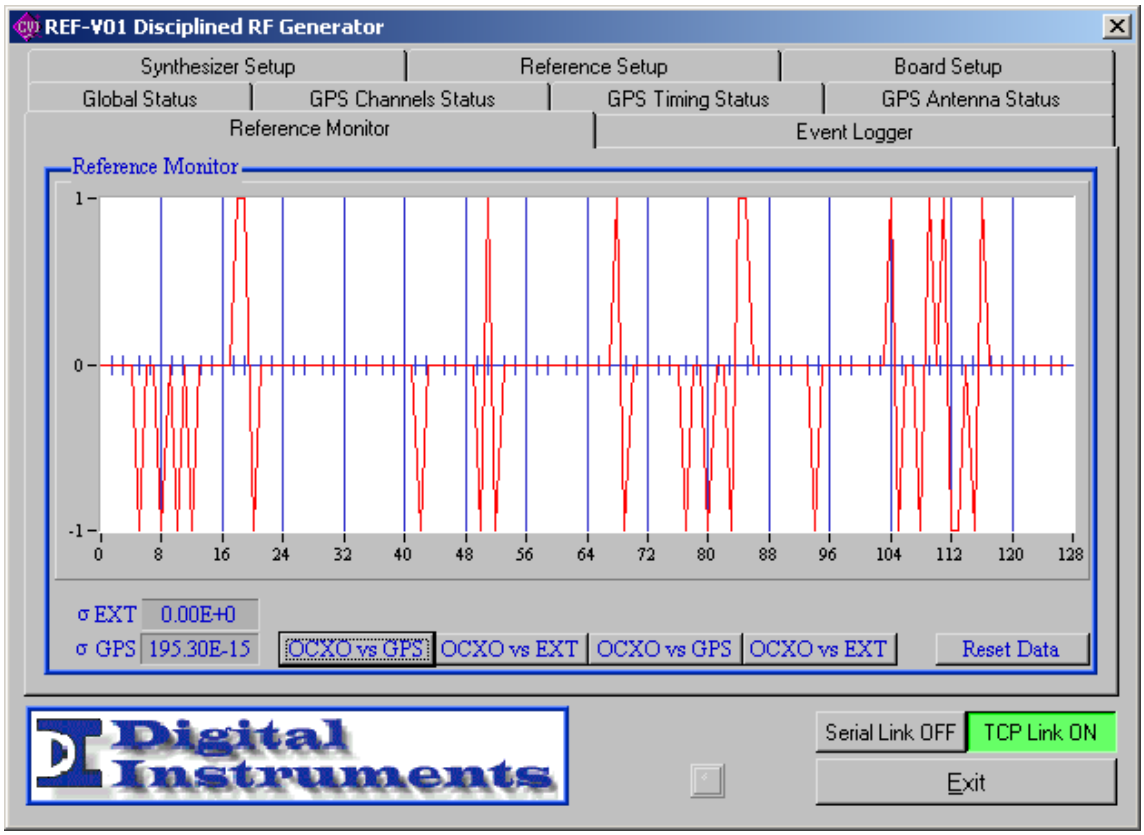
Reference Monitor Window.

Displays the offset value (expressed as difference) between the theoretical number of periods and the one effectively realized by the internal oscillator (OCXO) in a predetermined time interval (120 seconds).

The X axis shows the number of sequential sampling windows where the observation time for each window is 120 seconds, whilst the Y axis shows the number of period deviation from the theoretical value.

These charts are also produced both in absolute terms and in Δf/f terms.

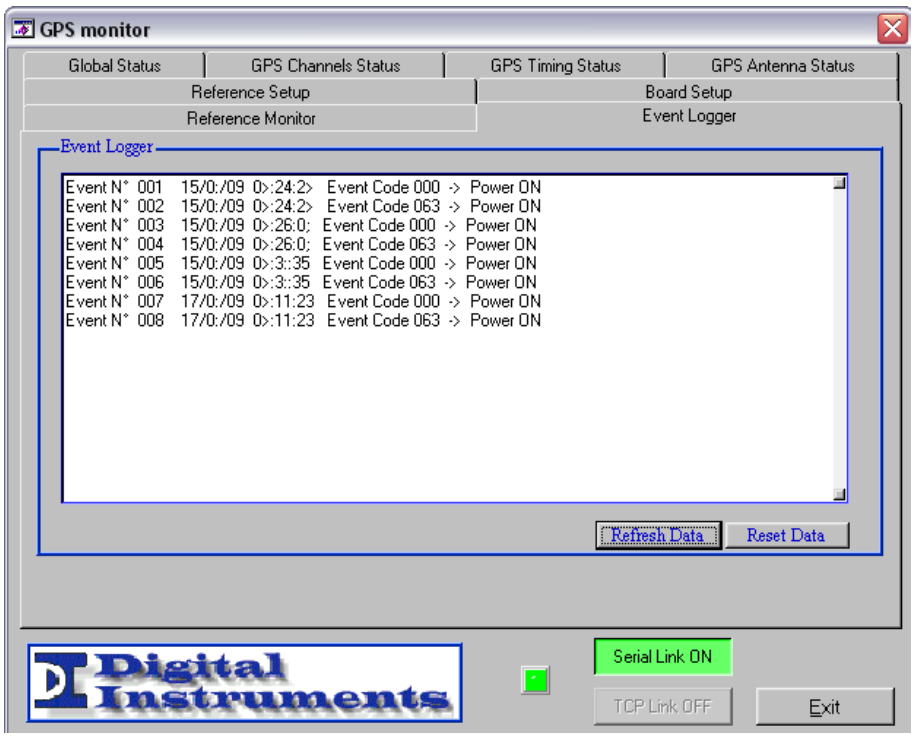
To be noted that in normal conditions there is a deviation between +1 and -1. This means that the system is perfectly locked.



NOTE: These charts should never be confused with the internal systems used for the calculation of the internal oscillator disciplining. These graphs in fact allow a rapid evaluation of the system and any abnormal conditions that can occur mainly on the external back-up signal.

Event Logger Window.

Window used to display the list of occurred events, the date and time of occurrence and their relative code



The two keys on the bottom allow to reset the internal buffer of the apparatus and to refresh the display.

Assistance

For support requests please download the form from the website:
http://www.digital-instruments.it/ita/assistenza.php

Compile it in its entirety by specifying as precisely as possible and giving as many details as possible about the type of fault detected.

You can then send the form to **riparazioni@digital-instruments.com**, via fax to **+39.02.66506103**, or enter it directly into the box when sending goods for repair.

You can also contact us at +39.02.66506250 Monday to Friday from 9 to 13 and from 14 to 17 (GMT+1 Time).

Technical Data

Frequency Reference

Signal	10 MHz sine wave
Spectral Purity	-70 dBc (harmonic)
	-75 dBc (non-harmonic)
Phase noise	-130 dBc at 1kHz
Output	1
Output level	13 dBm
Output impedance	50 Ω
Output connector	BNC
Stability	1e-12 daily average (OCXO locked to GPS on SA)
	1e-10 daily average (OCXO free run)

Time Reference

Signal	1 PPS, 100µs Duty, Rising Edge
Output	1
Output level	TTL 5 Vpp, Square wave
Output impedance	50 Ω
Output connector	BNC

GPS Section

Receiver	12 Channels L1 1575.42 MHz
Tracking	Correlation on 12 satellites
PPS accuracy	< 50 ns on SA
Antenna connector	TNC
Collection time	< 4 min

NTP Section

Protocol	NTP version 4
Role	Grandmaster clock source (GPS)
Stratum	1
Precision	< 10 ms

Signaling

Network connection	N° 1 Ethernet 10/100 interfaces, TCP/IP protocol
Signaling	N° 4 leds on front panel
Serial Connection	RS-232 connector FLAT +/- 15 kV (ESD)

Supply

Battery	12 Vdc < > 24 Vdc

Certifications CE

Sizes

Height	51 mm
Width	76 mm
Depth	102 mm
Weight	500 g

Accessories

1 x GPS Antenna
1 x 30 m Belden PRG 7 Cable
10 cm Cordon for battery supply
Handbook in English
Management Software