



# GPS-DS

RF Disciplined Generator

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Rev 2.3

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**Dichiarazione di conformità**  
**Declaration of conformity**

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* **RF Disciplined Generator with Backup**

Modello / *Model* **GPS-DS-8**

Serial Number **0050 /**

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, March 2009

**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 manufacturer'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 IEC950/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.*

	<ul style="list-style-type: none"> <li>• <b>SIMBOLO DIRECT CURRENT IEC 417, N°5031</b> Vdc may be used on rating labels</li> </ul>
	<ul style="list-style-type: none"> <li>• <b>SIMBOLO ALTERNATING CURRENT IEC 417, N°5032</b> For rating labels, the symbol is typically replaced by V and Hz as in 230V, 50Hz.</li> </ul>
	<ul style="list-style-type: none"> <li>• <b>SIMBOLO PROTECTIVE CONDUCTOR TERMINAL IEC 417, N°5019</b> 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</li> </ul>
	<ul style="list-style-type: none"> <li>• <b>SIMBOLO CAUTION ISO 3864, N°B.3.1</b> used to direct the user to the instruction manual where it is necessary to follow certain specified instructions where safety is involved.</li> </ul>

## Changelog

Rev.	Note	Data
1.0	First review	29/01/2010
2.0	Added appendix	04/04/2011
2.1	Updated CE certification	10/02/2012
2.2	Added events and SNMP features	08/07/2013
2.3	Fixed typo in electrical specifications	19/07/2013

# GPS-DS

## RF Disciplined Generator with Backup

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## Summary

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

**GPS-DS** is a high-stability Time and Frequency reference generator composed by two independent transport systems, implemented in two separate removable modules, providing 8 output signals of Time (PPS) and frequency (10 MHz).

**GPS-DS** is really reliable since the two generator modules are completely autonomous and independent, each one being equipped with its own supply and amplification chain, both for the 10 MHz and the PPS signals.

The switching unit is completely passive and the choice of the output module is done through high reliable electro-mechanical relays.

Each one of the 8 10MHz and PPS outputs, coming from the two distinct GPS modules, is constantly monitored by the switching logic in order to switch in case of failures.

Upon the detection of an anomaly of the currently selected module, other than some electrical notifications and SNMP trap generation, a switch may be immediatly carried on, based on the switching settings.

**It is extremely important to note that the settings on which the switching logic is based is completely user defined.**

The user may in fact choose to switch upon the missing of only one of the eight 10 MHz or PPS signals, of all of them or based on the GPS radio or antenna status.

**GPS-DS** is particularly simple to be operated, installed and maintained. Every function can be accessed locally, via an LCD display and a keyboard, or remotely, via WEB or SNMP protocol.

**GPS-DS** provides the user with info on its own status via 7 dry contacts placed on the back.

**GPS-DS** is completely adherent to the SNMP protocol, that provides every information inherent to the electrical status of the device and of the two modules.

**GPS-DS** is provided of redundant power supply.

**GPS-DS** is fabricated in 19'' 1U size for rack mounting.

### *Note*

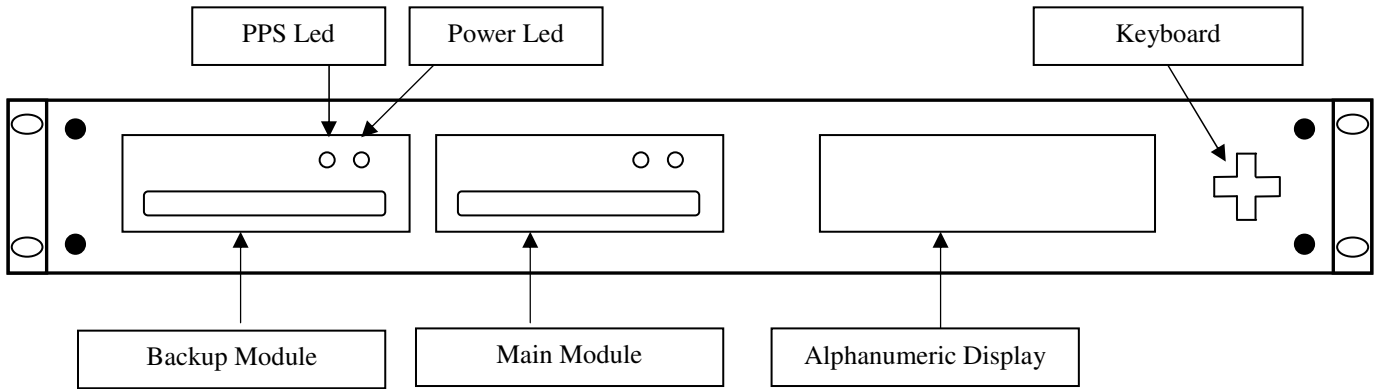
*This document may contain confidential and or reserved material of property of Digital Instruments s.r.l. It cannot be reproduced, used or shown to third parties for any other scope than the intended one.*

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

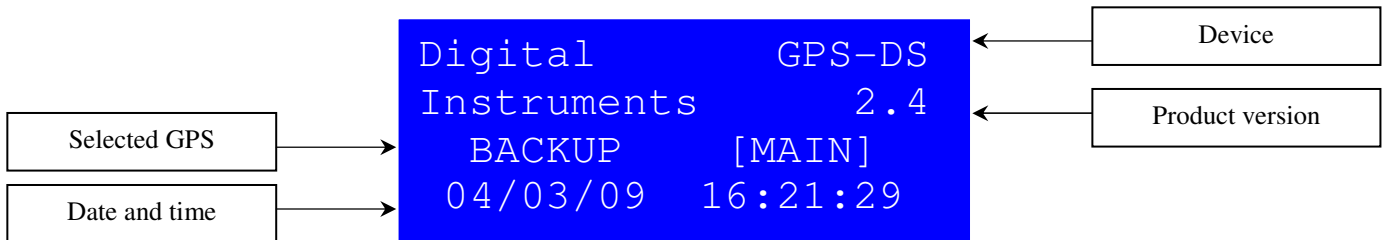
### Front view

The front panel appears as shown in the following figure.

On the left side there are the two removable modules, whilst on the right can be found an alphanumeric 20x4 display and a keyboard.



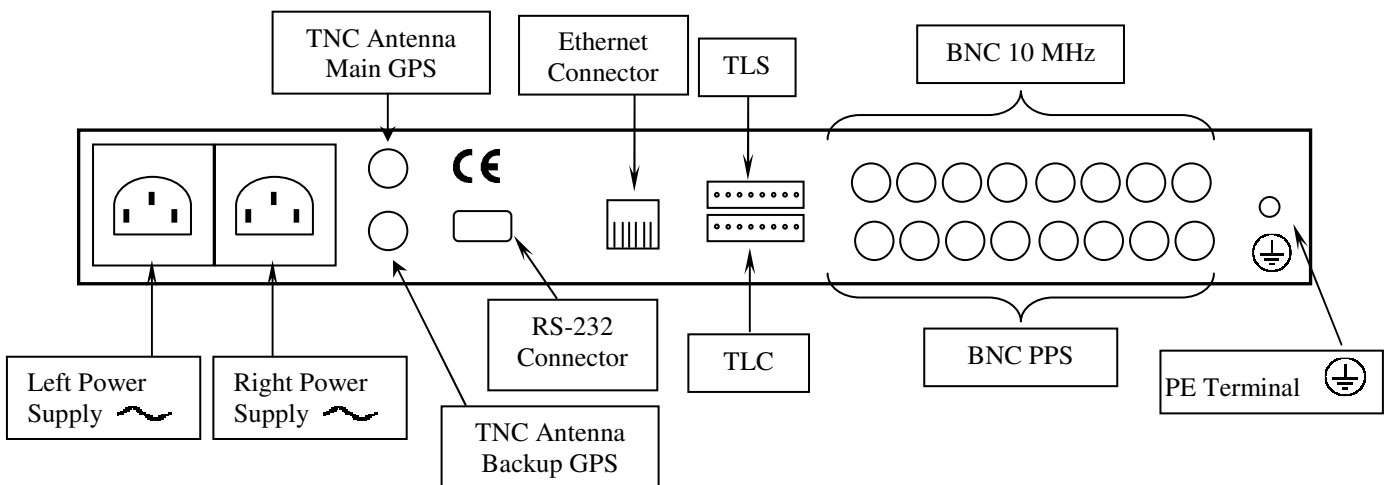
When operating, the display shows some info like the ones depicted in the following figure:



By pushing the right keyboard button it's possible to enter the main menu of the **GPS-DS**.

### Rear view

In the following figure is depicted the back of the apparatus **GPS-DS** with the position of connectors.



**The GPS-DS does not provide any supply switch.**

## Connectors details

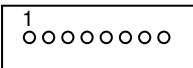
### TLS connectors (Telesignals)



The 8 poles TLS connector provides the following information on the various pins (from left to right):

- PIN 1: Common contact
- PIN 2: Closed contact → Right power supply provided
- PIN 3: Closed contact → Left power supply provided
- PIN 4: Closed contact → Main GPS module present and synchronized
- PIN 5: Closed contact → Backup GPS module present and synchronized
- PIN 6: Closed contact → Automatic switch
- PIN 7: Closed contact → Main GPS module selected
- PIN 8: Closed contact → TBD

### TLC connector (Telecontrols)



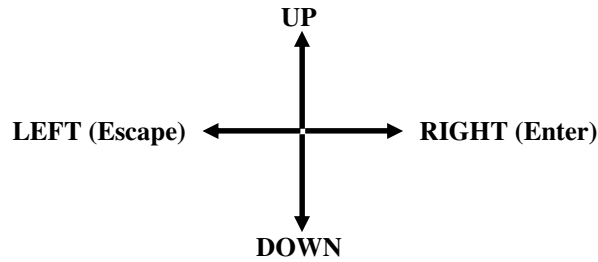
The 8 poles TLC connector provides the following commands on the various pins (from left to right):

- PIN 1-2: Powered → Manual switch
- PIN 3-4: Powered → Automatic switch
- PIN 5-6: Powered → Switch on the main GPS module
- PIN 7-8: Powered → Switch on the backup GPS module



## Graph Menu

The graph menu can be navigated with the pressing of the four direction provided by the keyboard.



To enter the first level from level zero (**ROOT**) is enough to press the **RIGHT** key, that works as **Enter** key. At this point all the first level menus are visible in a cyclic loop with the pressing of the **UP** and **DOWN** keys. The currently selected menu is recognized by an arrow placed on its left side. It is possible to enter it by pressing the **RIGHT** key.

```
Setup  
→ Mode Menu  
Network  
Settings
```

By entering a menu is possible to view all of its associated submenus by pressing the **UP** and **DOWN** keys. The **RIGHT** key permits, once again, to enter the selected submenu in the view mode. By pressing **RIGHT** again is possible to modify the value of the parameter (an arrow indicates the modify mode). **RIGHT (Enter)** confirms the choice, whilst **LEFT (Escape)** discards it.

```
Mode Menu  
Local/Remote  
→ Local
```

**The changing of parameters from front panel is only supported in local mode.**

From the level 0 (**ROOT**) it is possible to change the contrast of the LCD screen by pushing the **UP** and **DOWN** keys.

In the following table the whole graph is shown, with the associated permitted values for each parameter.

Front Panel Menu		Values
Mode Menu	Local/Remote	Local, Remote
Network	IP Address	0.0.0.0 ÷ 255.255.255.255
	Gateway	0.0.0.0 ÷ 255.255.255.255
	Netmask	0.0.0.0 ÷ 255.255.255.255
	MAC Address	00:00:00:00:00:00 ÷ ff:ff:ff:ff:ff:ff
	Trap Dest	0.0.0.0 ÷ 255.255.255.255
Switch	Main/Backup	Main, Backup
	Manual/Auto	Manual, Auto
	Gate	Min: 0 ÷ 5 Vrms Max: 0 ÷ 5 Vrms
	Policy	Switch & Block, Switch & Free, Switch & Pref
	Switchover	Main: 0 ÷ 3600 s Backup: 0 ÷ 3600 s
	Conditions	Clock: None, Any, All PPS: None, Any, All Antenna: No, Yes Serial: No, Yes
Power GPS	Power 10 MHz	-2 ÷ 16 dBm
Status	Board	FW/HW version of the board
	GPS	FW/HW version of the GPS modules
	Clock Main	8 values, O, ?, ! 0 ÷ 5 Vrms
	Clock Backup	8 values, O, ?, ! 0 ÷ 5 Vrms
	PPS Main	8 values → O, !
	PPS Backup	8 values → O, !
	TLC	4 values → 0, 1
	TLS	7 values → 0, 1
	Supply	AC L: On, Off AC R: On, Off
GPS Main	Positioning Mode	Normal Position, Position Hold, Altitude Hold, Autosite Survey
	Latitude	-89° 59' 59'' ÷ 89° 59' 59''
	Longitude	-179° 59' 59'' ÷ 179° 59' 59''
	Height	0 ÷ 18000 mt
	Cable Delay	0 ÷ 10000 ns
	Holdover	0 ÷ 999999 s
	T-RAIM Alarm	300 ÷ 1000000 ns
	Restore Defaults	Restore
	Power 10 MHz	-2 ÷ 16 dBm
	PPS Mute	Off, On
	Show Statistics	min QF, max holdover, max PPS distance
	Show Ch Status	Ch, S/N, Elevation, Azimuth
Show Global Info	Visible Sats, Tracked Sats, PPS Status, GPS Accuracy, Antenna Status, Position Status, Quality	
GPS Backup	Positioning Mode	Normal Position, Position Hold, Altitude Hold, Autosite Survey
	Latitude	-89° 59' 59'' ÷ 89° 59' 59''
	Longitude	-179° 59' 59'' ÷ 179° 59' 59''

	Height	0 ÷ 18000 mt
	Cable Delay	0 ÷ 10000 ns
	Holdover	0 ÷ 999999 s
	T-RAIM Alarm	300 ÷ 1000000 ns
	Restore Defaults	Restore
	Power 10 MHz	-2 ÷ 16 dBm
	PPS Mute	Off, On
	Show Statistics	min QF, max holdover, max PPS distance
	Show Ch Status	Ch, S/N, Elevation, Azimuth
	Show Global Info	Visible Sats, Tracked Sats, PPS Status, GPS Accuracy, Antenna Status, Position Status, Quality
	Setup	Date & Time
Timezone		-12 ÷ 12
Clear Log		Clear
Restore Defaults		Restore
Reboot		Reboot

## WEB Interface

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

### Mode Menu

#### Local/Remote

In local mode is only possible to modify operative parameters from the front panel display. In remote mode it can be done from WEB, SNMP and REMOTE CONTROLS.

In the WEB interface this value is visible in the *Remote Mode Status* field. When *Disabled* is shown no operation can be made to change the operative status of the apparatus.

Please note that the value of this parameter can only be changed by the front panel.



### 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.

#### MAC Address

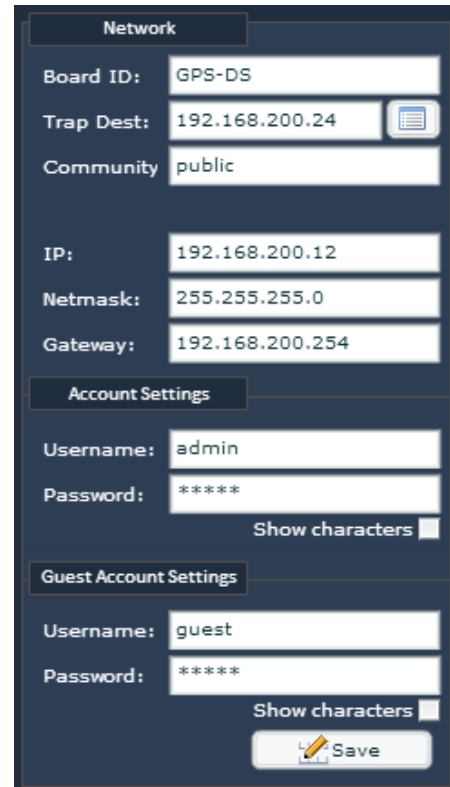
Show the MAC address of the ethernet interface. This value is generated based on the IP address and may not be changed.

#### Trap Dest

Allows to configure the destination server of the traps related to the events.

In the WEB interface these settings can be changed in the *Board Configuration* section.

In this section is also possible to change the *Board ID* field (to customize the name of the board), to change the SNMP community string and to filter the trap events that have to be sent.

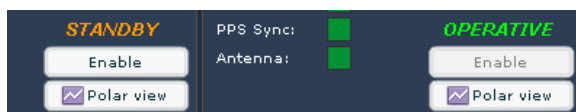


### Switch

#### Main/Backup

Allows to choose which module to use for generating the signals. The switch is permitted only when the switching mode is in manual.

In order to change module from the WEB interface is sufficient to move in the *GPS status* section and click on the *Enable* button of the module to activate.



*Manual/Auto*

Allows to change how to switch between GPS modules.

*Gate*

Allows to change the minimum and maximum threshold (in Vrms) to trigger alarms on the 10 MHz outputs.

*Policy*

Shows the currently selected policy for the automatic switching. For further details in this subject please refer to the *Switching policies* section.

*Holdover*

Described later in the *GPS Main* section.

*Switchover*

Permits to set the time to wait before switching from the main GPS module to the backup and vice versa. For further details on the subject please refer to the *Switchover* section.

*Conditions*

Permits to choose which kind of events may cause a switch. The section *Switching conditions* describes in details the various options and their meaning.

**Power GPS**

*Power 10 MHz*

Allows to simultaneously change the output power of both the GPS modules.

These variables can be set through the WEB interface in the *GPS Configuration* panel.

The screenshot shows a 'Configuration' panel with several sections:

- 10MHz Output Power:** main: 13 dBm, backup: 13 dBm
- Cable Delay:** main: 0 ns, backup: 0 ns
- PPS Mute:** main: On, backup: On
- Holdover:** main: 7200 sec, backup: 7200 sec
- Autoswitch Treshold:** min: 0.6 Vrms, max: 1.2 Vrms
- Reset:** Main GPS, Backup GPS buttons
- Switchover:** main»backup: 30 sec, backup»main: 30 sec
- Switch Policy:** choose: Switch and Free
- Switch Mode:** manual, automatic (selected)
- Position Mode:** main: Normal Positioning, backup: Normal Positioning
- TI RAIM Alarm:** main: 500 ns, backup: 500 ns
- Switch Conditions:** Clock: Any, PPS: Any, Antenna: Yes, Serial: Yes

**Status**

*Board*

Displays the name of the device and the corresponding software release. The *ID* field cannot be customized by the user and is used to track the device.

The screenshot shows a 'Board Info' panel with the following information:

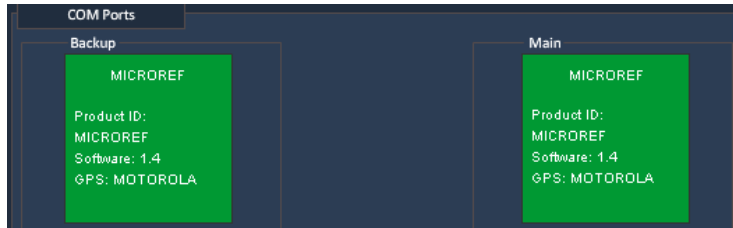
- ID: GPSDS1
- Name: GPS-DS
- Version: 1.8

These informations are displayed in the *Board Info* panel of the main page of the WEB interface.

**GPS**

Shows the presence/absence of the GPS modules and their software version.

It is shown in the *COM Ports* section of the WEB interface.



**Clock Main**

Shows the status of the 10 MHz outputs of the main GPS module.

- ! → error (short circuit, no signal)
- O → OK (cable plugged and closed on a 50 Ω termination)
- ? → warning (cable unplugged or not close on a 50 Ω termination)

By pressing ↓ is possible to go to the next menu where the measured values in Vrms are shown.

**Clock Backup**

Please refer to “Clock Main”.

**PPS Main**

Shows the presence of the PPS outputs.

- ! → error (short circuit, no signal)
- O → OK (PPS signal present)

**PPS Backup**

Please refer to “PPS Main”.

These values are reported in the WEB interface under *GPS status*. The errors (!) are coloured in red, the warnings (?) in yellow and the correct values (O) in green.

On the 10 MHz leds a pop-up shows the measured value in Vrms and dBm.



**TLC**

Show the status of the 4 telecontrols.

- 0 → telecontrol inactive
- 1 → telecontrol active



**TLS**

Shows the status of the 7 telesignals.

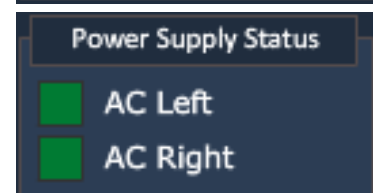
- 0 → telesignal inactive
- 1 → telesignal active



**Supply**

Shows the status of the 2 power supplies (left and right).

- OFF → power supply inactive
- ON → power supply active



**GPS Main**

*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.

*Holdover*

This setting relates to how many seconds keep active the PPS of an unsynchronized GPS module. When this threshold has been passed the muting conditions given by the user will be applied and when the synchronization will be back the PPS will be instantly resynced, loosing the fixed ratio with the 10 MHz output.

In order to deactivate this feature set the value to 0.

*T-RAIM Alarm*

Set the precision requested to the GPS radio (usually a value between 500 and 1000 ns is optimal).

Please refer to the *Quality Factor* section.

*Power 10 Mhz*

Permits to independently change the output power of the 10 MHz signal of the GPS module.

*PPS Mute*

Allows to mute the PPS output until the GPS module has completed the synchronization phase.

*Show Statistics*

Shows some statistics of the GPs module (radio GPS, antenna and disciplining algorithm).  
Please refer to the *Quality Factor* section.



*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

All of these variables are reported in the *GPS status* window. *Cable Delay* can be set in the *GPS Configuration*, whilst *Latitude*, *Longitude* and *Height* cannot be set by WEB, but only from SNMP or front panel.

**Backup GPS**

PPS Status: ■ 4/04/2011 10:08

PPS Sync: ■ OPERATIVE

Antenna: ■

Position: ■

Quality: ■ 34 Polar view

Visible Sat: 9

Tracked Sat: 9

Data Mode: **Normal Position**

Vtune: 43172

Height: 199

Latitude (hold): 45° 32' 38" (0° 0' 0")

Longitude (hold): 9° 11' 42" (0° 0' 0")

The satellite view can be opened by pressing the *Polar view* button.

**>> GPS-DS**

GPS satellites

Persistence: ON    GPS status

Visible: 0  
Tracked: 0

SVID	S/N	Azimuth	Elevation
11	36	294	75
24	34	315	72
19	39	168	41
32	32	238	71
14	17	57	36
28	21	286	19
20	45	244	39
3	31	163	9
22	24	59	9
6	0	156	1
17	35	319	12
23	17	192	2

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**GPS Backup**

Please refer to "GPS Main".



**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.

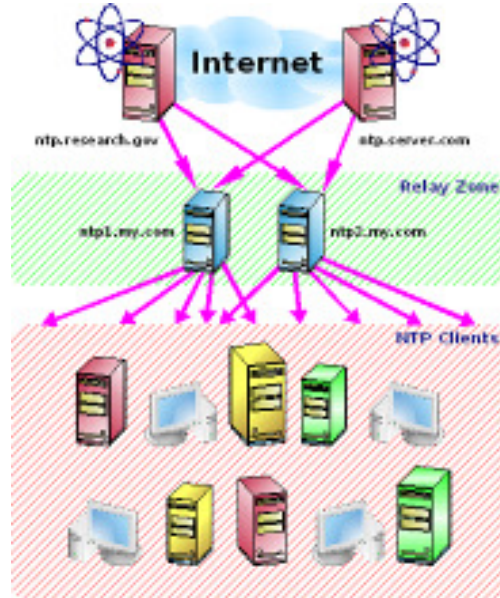
*Reboot*

Reboots the device.

## 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.

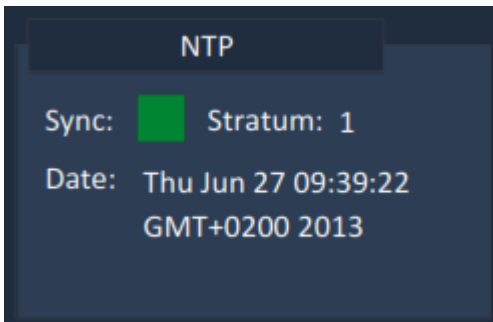
The accuracy of the order of tens of milliseconds, can be considered adequate for most situations. Its flexibility and strength, thanks to the many servers widely available, make it a very smart choice for the time synchronization.



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 successful sync the holdover status may lose 8  $\mu$ s 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.



## Event Log

From WEB it is possible to view the *Event log*, consisting of 50 events, of which the first 30 are related to the GPS-DS board, the following 10 to the main GPS module and the last 10 to the backup GPS module. The log can be cleared or saved in csv format.

<b>ID</b>	<b>Date</b>	<b>Time</b>	<b>Code</b>	<b>Description</b>
33	00/17/??	01:27:06	032	GPS ANT OK
34	00/17/??	01:33:31	030	GPS OK
35	02/03/09	10:56:41	000	Power ON
36	02/03/09	10:57:14	032	GPS ANT OK
37	02/03/09	11:04:53	030	GPS OK
38	02/03/09	12:13:24	038	PPS Syncr
39	02/03/09	12:22:39	034	GPS ANT UC
40	02/03/09	12:22:40	031	GPS KO
41	04/03/09	09:49:14	000	Power ON
42	04/03/09	09:55:46	063	
43	04/03/09	09:55:52	063	
44	04/03/09	09:55:58	063	
45	04/03/09	09:56:06	063	
46	04/03/09	09:59:21	000	Power ON
47	04/03/09	09:59:45	000	Power ON
48	04/03/09	10:00:08	000	Power ON
49	04/03/09	10:10:01	000	Power ON
50	04/03/09	12:30:12	038	PPS Syncr

Filters: All

### Board related events

Event Code 001	Power ON	→ Power on
Event Code 002	Switch	→ Change in module used for disciplining (M, B)
Event Code 003	PPS Alarm	→ Alarm on a PPS channel (M1÷M8, B1÷B8)
Event Code 004	Clock Alarm	→ Alarm on a 10 MHz channel (M1÷M8, B1÷B8)
Event Code 005	Serial	→ Insertion/removal of a GPS module (M, B)
Event Code 006	Supply	→ Insertion/removal of a power supply module (L, R)
Event Code 007	Switch Alarm	→ More than 3 switches done in less than 5 minutes
Event Code 008	NTP Sync	→ NTP Sync changed (ON / HOLD / OFF)
Event Code 009	PPS OK	→ Alarm on a PPS channel ended (M1÷M8, B1÷B8)
Event Code 010	Clock OK	→ Alarm on a 10 MHz channel ended (M1÷M8, B1÷B8)

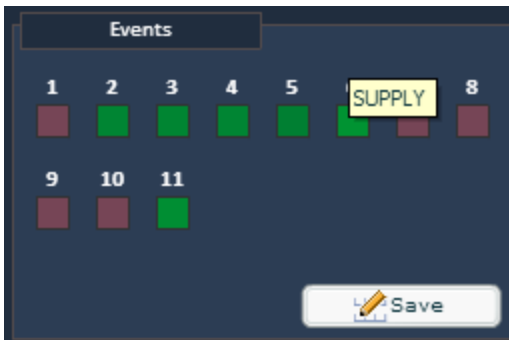
### GPS related events

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

## SNMP traps handling

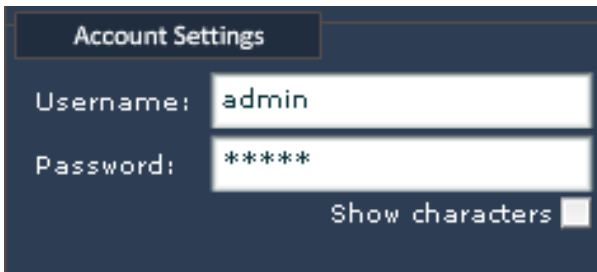
For each event a trap is sent to the host set in *Trap Dest* (if any). The number of the trap describes the type of event and its content explains the details (the channel or the module that caused the event).

It is also possible to filter the traps that have to be sent to the server from the *Board configuration* panel.



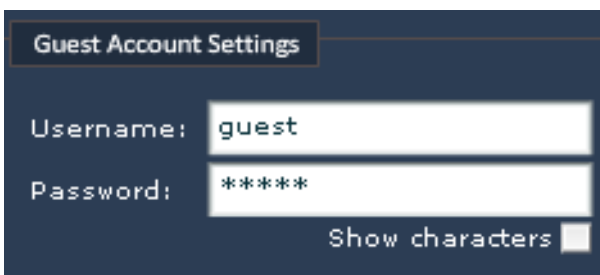
## User account

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	→	<b>admin / admin</b>
Guest	→	<b>guest / guest</b>
SNMP	→	<b>public / public</b>

## Switching mode

The **GPS-DS** allows to switch its 10 MHz and PPS outputs by selecting one of the two generating modules as source. This switching can be configured to be done automatically upon the detection of an alarm condition:

- 10 MHz signals out of limit
- PPS signals abset
- GPS module missing
- GPS antenna disconnection

In the log is reported the reason for each switch:

Mweb	→ manual switch from WEB
Msnmp	→ manual switch from SNMP
Mlcd	→ manual switch from LCD panel
Mopto	→ manual switch from telecommands
Aser	→ automatic switch because of loss of serial connectivity
Aant	→ automatic switch because of loss of GPS antenna
Aclk	→ automatic switch because of an alarm on a 10 MHz channel
Apps	→ automatic switch because of an alarm on a PPS channel
Apref	→ automatic switch toward the main GPS module
Acass	→ automatic switch because of missing of GPS module

## Switching policies

When the device is configured for automatic switching three different policies can be applied:

### Switch & Block

Permits to switch toward the backup GPS in case of failure of the main GPS module. No other additional swithes are permitted in automatic.

### Switch & Free

*As Switch & Block.*

Allows to come back to the main GPS module if the backup GPS module would exhibit a problem and the main GPS module would not.

### Switch & Pref

*As Switch & Free.*

Tries to always choose the main GPS module when it does not present any error condition.

In order to avoid continuous switching in case of intermittent alarms a particular event has been accounted that is triggered when more than 3 switches have been done in less than 5 minutes. This event lowers the switching policy in use toward a more restrictive one (*Switch & Pref* → *Switch & Free* → *Switch & Block*). In this way the board may stop with the backup GPS module selected in the *Switch & Block* configuration.

This event as been assigned the following code:

Event Code 007 Switch Alarm → More than 3 switches done in less than 5 minutes

## Switchover

This variable allows to define a time interval (in seconds) that should pass between the moment an alarm has been identified and the moment the switch will be activated. If during this period the error would disappear the switch would be cancelled.

Two distinct switchover times have been accounted. One from the main GPS module toward the backup (Switchover Main) and one from the backup GPS module toward the main (Switchover Backup).

## Switching conditions

Four alarm conditions have been defined:

1. Absence of the 10 MHz signal (*Clock*)

- None* → this condition does not triggers any switch
- Any* → an error on any of the channels triggers a switch
- All* → in order to trigger the switch all the channels must be in error

2. Absence of the PPS signal (*PPS*)

- None* → this condition does not triggers any switch
- Any* → an error on any of the channels triggers a switch
- All* → in order to trigger the switch all the channels must be in error

3. Absence of the GPS antenna (*Antenna*)

- No* → this condition does not triggers any switch
- Yes* → this condition does trigger a switch

4. Absence of the serial connectivity (*Serial*)

- No* → this condition does not triggers any switch
- Yes* → this condition does trigger a switch

## First run

### First installation

1. Connect the antenna cables to their respective GPS ANTENNA connectors placed on the back.
2. Eventually connect an ethernet cable.
3. Insert the GPS modules and tight the screws.
4. Power on the **GPS-DS**.

Please check that the modules do fit well in their sockets and that their PWR leds are on.

After a few seconds the LCD display should light up (without an ethernet cable it would take a little more) and the leds under the keyboard should start blinking.

It is good practice to close 10 MHz and PPS connectors on 50  $\Omega$  terminators.

### Checkup

On power on the board starts with the following settings:

- Main GPS module selected
- Automatic switch
- Switch & Free policy
- PPS muting of the GPS modules enabled
- Remote connectivity

Follows this simple procedure to verify the correct behaviour of the apparatus:

- Presence of the GPS modules  
Go with the front panel on *Status*  $\rightarrow$  *GPS* and check that both the modules can be seen
- Presence of the GPS antenna  
Go to *GPS Main*  $\rightarrow$  *Show Global Info* and check the value of the *Antenna* field  
Do the same for *GPS Backup*  
After a few minutes from power-up (and with the GPS antenna connected) the PPS leds on the GPS modules should start to blink.
- Presence of the 10 MHz outputs  
Go to *Status*  $\rightarrow$  *Clock Main* and check that a O is shown where the cable is connected and terminated with 50  $\Omega$ , or ? is shown where the connector is unconnected or open  
Do the same for the backup module
- Presence of the PPS outputs  
Go to *Status*  $\rightarrow$  *PPS* and check that only O are shown  
Do the same for the backup module

### Local/remote mode

The device can be used in two different modes:

1. *local*  
It is possible to change the device settings only from the front panel  
Info are visible in read-only mode from WEB, SNMP or via TLS
2. *remote*  
Info are visible in read-only mode from the front panel  
It is possible to change device settings from WEB, SNMP or TLC

To change mode operate the *Mode Menu*  $\rightarrow$  *Local/Remote* setting from the front panel.

## Network configuration

To configure the network is possible to operate via the front panel under the *Network* menu. A reboot is required for the changes to take effect.

After having obtained a valid IP address it is possible to connect with the device via WEB by using a common browser at the address `http://<board_ip>`

The default credentials are:

Administrator (read and write) → **admin / admin**  
Guest (read only) → **guest / guest**

From WEB it is possible to do the same checks described above:

- Presence of GPS modules  
In the page *Global Status* check the presence of both the modules.
- Presence of the GPS antenna  
In the page *GPS Status* check if the *Antenna* leds are green and, after a few minutes, if the *PPS Status* leds are the same.
- Presence of 10 MHz outputs  
In *GPS Status* the *Clock 10MHz* leds should be green (or yellow if unconnected or open).
- Presence of PPS outputs  
In *GPS Status* all the *PPS* leds should be green.

## Automatic switch

In order to configure the automatic switch is usually needed to check a few additional settings for proper operation:

- **Power thresholds**  
It is good practice to set the thresholds out of which to trigger an alarm on the 10 MHz signals.  
The condition of unplugged cable does not represent an alarm, but just a notification.  
These settings can be changed from the front panel (*Switch* → *Gate*), from SNMP (*autoSwitchMin* and *autoSwitchMax*) or from WEB in the *GPS Configuration* page.
- **Switch conditions**  
It is possible to specify which error conditions may trigger a switch.  
These settings can be changed from front panel (*Switch* → *Conditions*), from SNMP (*switchConditions*) or from WEB in the *GPS Configuration* page.
- **Switch policies**  
It is possible to specify different switch policies to use.  
The setting can be changed from the front panel (*Switch* → *Policy*), from SNMP (*policy*) or from WEB in the *GPS Configuration* page.
- **Switchover time**  
It is possible to set a time interval to wait before switching, to filter some spurious errors.  
These settings can be changed from the front panel (*Switch* → *Holdover*), from SNMP (*holdoverMain* and *holdoverBackup*) or from WEB in the *GPS Configuration* page.
- **Automatic switch**  
The automatic switch mode is controlled by a particular setting.  
This setting can be changed from the front panel (*Switch* → *Manual/Auto*), from SNMP (*switchMode*) or from WEB in the *GPS Configuration* page.



## Appendix A: Quality Factor

### General Review

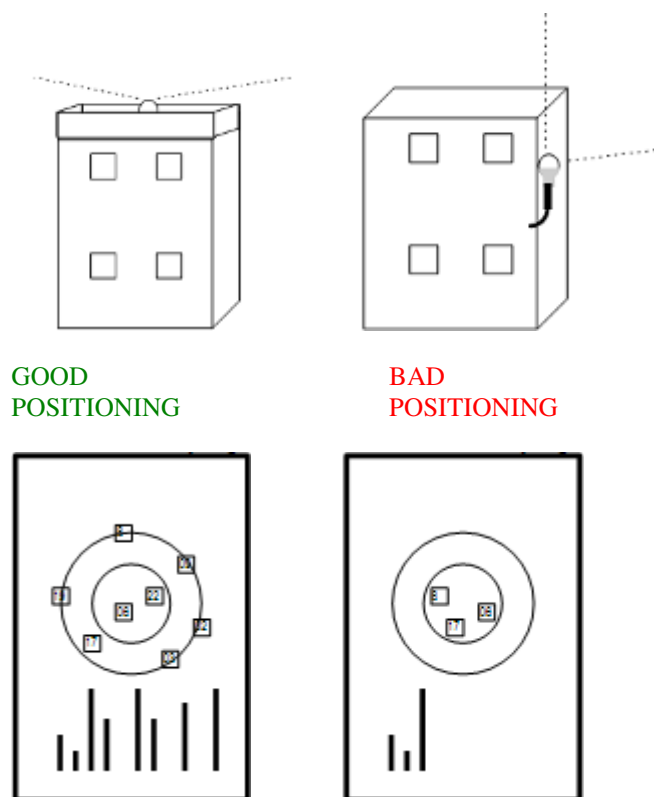
This appendix is intended to illustrate the meaning and motivation of the introduction of the Quality Factor within the Digital Instruments equipments.

Although the installation of a GPS device is relatively easy, it can hide certain issues that in some cases it can affect the proper functioning.

It is therefore expected to monitoring certain operating parameters so as to make immediate validation of a Circuit or finding the source of any problems.

### GPS antenna positioning

GPS antenna should be positioned on a tower or on a roof with a good view of the GPS satellite constellation.



If not, the algorithm of regulation may not behave optimally and *short term stability* of the PPS and 10 MHz references it could be invalidated.

It's possible to evaluate the goodness of the positioning of the antenna in some ways:

1. checking the **power of received signal** from each satellite from the *Polar Plot*
2. checking and verifying that the **Quality Factor** is acceptable (typically > 25)
3. checking that the PPS generated by the radio (**PPS Status**) is valid (green LED)

Se così non fosse l'algoritmo di disciplinamento potrebbe non comportarsi in maniera ottimale e la *short term stability* dei riferimenti PPS e 10 MHz ne potrebbe venire inficiata.

It's possible get an idea of potential obstacles that limit the visibility of the GPS constellation to the radio observing the polar graph of satellites after a few hours of persistence.



### Quality Factor

**Quality Factor** is the operating parameter that indicates the quality of the GPS signal received by the antenna. It is considered an acceptable value if  $> 25$ . If the Q.F. is lower, it is possible that there are problems with the GPS signal reception and this involves a greater number of holdover and therefore a less precise synchronization.

The value of the Quality Factor is shown in *GPS* tab of *Main Panel* Page.

PPS Status: ■

PPS Sync: ■

Antenna: ■

Position: ■

Quality: ■ 28

### Statistics

The device stores some useful statistical informations to evaluate the proper functioning over time:

- Holdover Num** shows the number of times that the GPS radio has entered into holdover mode in response to a problem (under optimal conditions should be low)
- Holdover Max** shows the duration of the longer hold-over (under optimal conditions should be low)
- Quality Min** indicates the smallest GPS antenna quality factor recorded (under optimal conditions should be high)
- PPS Dist Max** indicates the maximum distance affected by the PPS generated by the GPS radio (under optimal conditions should be low)
- Pos Alarm Num** indicates the number of times that there was a wrong geo-positioning under optimal conditions should be low)



It's a good idea to reset the stats before a capture session, because some values may be spurious in the first phase of synchronization or acquisition of satellites by the GPS radio.

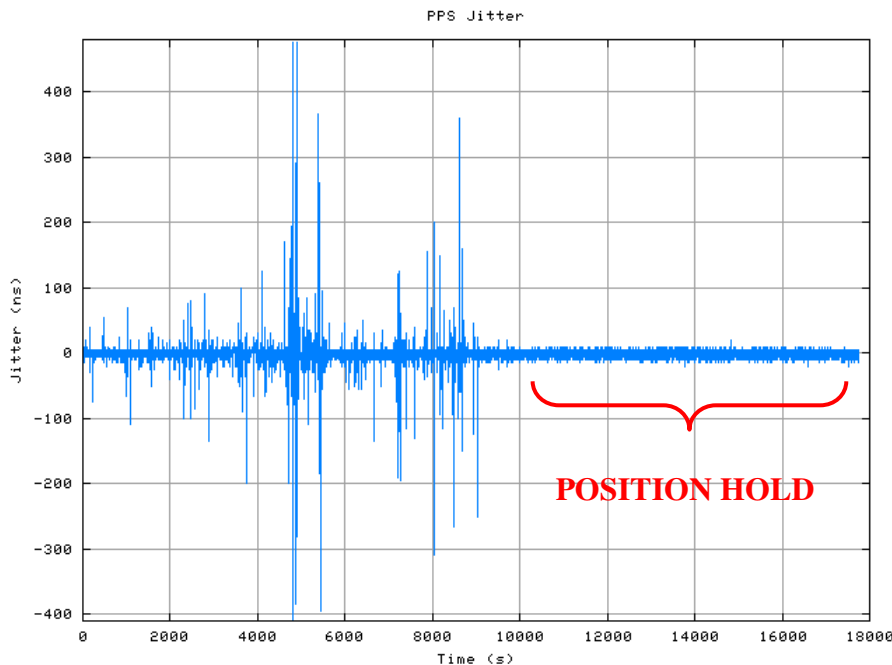
### Automatic Site Survey



In certain situations it may be convenient activate the *Positioning Mode* of GPS radio in *Automatic Site Survey*. In this mode the radio privileges the accuracy of temporal information at the expense of that position (as long as the antenna is not moved), so as to preserve signal integrity PPS in limited visibility conditions or in the GPS constellation or in presence of potential sources of interference.



If there are problems or abnormalities during the first installation or after moving the unit in a distant geographic location, GPS radio can be resetted by deleting the almanac and positioning information that is saved by the appropriate entry in the GPS menu. Should be also necessary to reset the device in *Automatic Site Survey* mode, since the radio, after completing the survey - which takes about 3 hours - automatically returns to *Position Hold* mode.



## Appendix B: FAQ

### GPS Modules

**Q:** What is the difference between a GPS-MODULE and a GPS-RADIO? Are they interchangeable?

**A:** A GPS-MODULE contains a GPS radio and an OCXO and may be used in the GPS-DS and GPS-SU devices. A GPS-RADIO only contains a GPS radio and may be used in the GPS-DR and REF-DS devices. The two modules are not interchangeable.

**Q:** Why the GPS radio takes so long to track the GPS satellites after installation?

**A:** After having moved the GPS radio from a geographical location to another or having turned it on after a long down time it needs to reacquire the GPS constellation. This automatic operation takes some times, till 15 minutes.

During this initial period the tracking of satellites is slow. This condition does not apply for subsequent reboots.

**Q:** Is it possible to clear the almanac of a GPS module?

**A:** It can be done by using the feature called *reset* or *restore defaults*, inserted starting from release 2.7 of GPS-DS and 2.1 of GPS-DR. It is possible that after a clear the saved variables may need to be reset (in particular *Positioning Mode*).

**Q:** What is the difference between *reboot* and *reset*?

**A:** *Reboot* means power cycling the main board, similar (but not identical) to what would happen by removing and restoring the power supply. *Reset* applies to the GPS radio and clears its internal almanac.

**Q:** Why the GPS-MODULE is not blinking?

**A:** The GPS-MODULE blinks when the PPS from the GPS radio is stable enough. If the GPS signal acquisition is difficult or noisy is possible that the number of tracked satellites would not allow to reach this condition. If this is the case is suggested to investigate the antenna placement and the possible source of noise.

Please refer to the *Quality Factor* section for further details.

**Q:** What can be done in case of bad acquisition of the GPS signal in order to improve the system stability?

**A:** If it is not possible to track the root cause of the problem and fix it, the GPS radio may be set in *Automatic Site Survey* mode in order to improve its precision even with few satellites being tracked.

Please refer to the *Quality Factor* section for further details.

**Q:** I have set the GPS radio in *Automatic Site Survey* mode, but I read *Position Hold*. Why?

**A:** Once the GPS radio has completed the *Automatic Site Survey* procedure it automatically puts itself into *Position Hold* mode. Starting from the software release 2.8 for GPS-DS and 2.2 for GPS-DR it is possible to see the auto-computed hold values.

**Q:** I have set the GPS radio in *Automatic Site Survey* mode. What happens if I switch off the device or remove the module?

**A:** If the radio would not have completed the survey procedure it will start again automatically the next time it boots. If it would have already been completed the *Position Hold* mode will be kept across reboots.

**Q:** What kind of difficulties may arise during the update procedure of a GPS-MODULE?

**A:** When upgrading a GPS-MODULE is needed to ensure that the whole update procedure is completed (ERASE – UPDATE – RESET cycle) in order to restore the module in a working condition. If some problems arise during the update, the whole procedure may be restarted, BUT THE MODULE SHALL NOT BE REMOVED OR POWER CYCLED until the end of the update process. Starting from version 2.5 the update process is more robust and the risk of putting a module in a not working condition is greatly reduced.

**Q:** Is the PPS signal in phase with the 10 MHz?

**A:** Usually yes. At the boot of the device (or after plugging a GPS module) two resyncs are carried on in which this phase relationship is not guaranteed. After the second resync the synchronization is completed and the PPS is generated, whenever the muting setting would be on.

The phase relationship may also be lost in case of a long holdover (more than the user defined *holdover* threshold), by default set in two hours. To avoid such behaviour is sufficient to set the variable to 0. There is still a hard-coded holdover threshold of two days.

## GPS Devices

**Q:** Why after powering on the device there is no PPS signal (whilst there is a 10 MHz signal)?

**A:** There is a setting called *PPS Mute* that inhibits the device from outputting the PPS until the device (or the module) has completed the synchronization process.

**Q:** How much time does it take for the device to reach the synchronization after power on?

**A:** Usually less than two minutes after a warm start (turned off for less than 10 minutes). From 3 to 5 minutes whenever the devices has been turned off for a longer period (this timings may not apply to GPS-MODULEs with firmware version < 2.5c and to GPS-DR with version < 2.2b).

**Q:** Is it possible to monitor the behaviour of the GPS device during time?

**A:** It is possible to monitor the statistics collected from the device to get the idea about its behaviour. Before conducting an analysis is better to clear the statistics (for each of the modules in case of a GPS-DS). These values indicate the quality of the signal from the GPS antenna, the number and the maximum length of eventual holdovers and the maximum distance of the PPS in respect to the UTC second.

**Q:** I cannot see the polar plots. What can I do?

**A:** In the past a Java Virtual Machine and a few Java libraries were needed on the host computer in order to see the polar plots. In the current version of the software this is not needed anymore since the polar plots have been integrated with the rest of the WEB interface.

## GPS-DS

**Q:** Why the modulator in daisy chain with the GPS-DS notifies errors about the absence of the 10 MHz and/or the PPS signal?

**A:** When the GPS-DS device switches from a module to the other a hole that may last 3 ms is inserted in the outputs. If such switching is frequent it may be indication of some other anomaly (that may be investigated by looking at the *Event Log*).

**Q:** How is it possible to limit unwanted switches?

**A:** In order to avoid switching due to false positives it may be needed to set a *holdover* threshold of at least one minute and eventually change the alarm conditions of the 10 MHz/PPS signals on *All*. This is indeed the most common cause of false positive errors.

**Q:** Why the device notifies many errors on the 10 MHz channels?

**A:** The GPS-DS measures the power of the 10 MHz signal on the output connectors and compares them with some user defined thresholds. By default these thresholds are set for a 13dBm output closed on a 50  $\Omega$  termination. Whenever the output power of a GPS module is changed is needed to change the thresholds accordingly.

## Appendice C: Changelog

### GPS-DS

#### Release 2.1 (march 2009)

- Implemented timezone and reboot feature
- Fast scroll through keyboard

#### Release 2.2 (june 2009)

- Added Spansion flash support

#### Release 2.3 (september 2009)

- Fixed bug that was preventing the change of the switchMode from Web

#### Release 2.4 (september 2009)

- At boot the device does not start in manual switch but remember the saved setting

#### Release 2.5 (november 2009)

- Improved automatic switch feature
- Force a switch if the selected module is removed (ignoring the holdover timeout)
- Increased priority of the network update thread
- Added fix to avoid erasing network variables
- At boot the devices always starts in remote mode
- Added support for auto-discovery

#### Release 2.6 (march 2010)

- Fixed bug that was preventing SNMP to properly function (introduced in version 2.5)

#### Release 2.7 (january 2011)

- Introduced quality factor (need GPS module  $\geq 2.4$ )
- Introduced possibility to change positioning mode from web
- Improved flash handling though double bank in order to have redundant saved settings
- Change gps radio settings independently of each other

#### Release 2.8 (march 2011)

- Show positioning hold data used by the GPS module (need GPS module  $\geq 2.5$ )
- Introduced possibility to reset the almanac of the GPS modules from Web (need GPS module  $\geq 2.4$ )
- Firmware update of GPS modules has become more robust (need GPS module  $\geq 2.5$ )

#### Release 3.0 (may 2011)

- Allows to save serial number of GPS modules
- Added support for PPS holdover

### GPS-MODULE

#### Release 2.0 (august 2009)

- Initial release

#### Release 2.1 (november 2009)

- Limited maximum allowed frequency drift when recovering phase

#### Release 2.2 (april 2010)

- No more than 2 resyncs are done in normal operative conditions (a resync is performed after a long holdover  $> 2$  days)

#### Release 2.3 (august 2010)

- Fix to recover from spurious synchronizations

**Release 2.4** (janiary 2010)

- Distance limit set to 100 ns (instead of 150 ns) until 100 ns frequency adjustment is carried on, over 100 ns the PPS is aligned back to the one received from GPS
- Drift limit based on distance (and not time) in order to recover the PPS phase there are some speed limits that would prevent the clock to drift too much. Usually this limit is 0.25 ns/s, but can grow to 3 ns/s in the worst case (unusual)
- Stable vtune is gradually restored  
After the phase has been recovered the stable vtune is gradually applied in order to avoid an abrupt change of speed (steps are usually 0.25 ns/s)
- Speed-up in synchronization time
- Added support for quality factor
- Added possibility to reset the GPS radio

**Release 2.5b** (march 2011)

- Firmware upgrade has been made more robust by copying to RAM the whole firmware and by writing to flash in a later time, after integrity check has been performed
- Added possibility to reboot the GPS module

**Release 2.5c** (april 2011)

- Speed-up in synchronization time after warm boot (usually < 2 minutes)

**Release 2.6** (april 2011)

- Memory for firmware upgrade allocated only when needed

**Release 2.7** (may 2011)

- Introduced serial number
- Introduced holdover limit to mute the PPS after a certain amount of time

**Release 2.8** (june 2013)

- Support for holdover values different than 7200 seconds

## Appendix D: First run

### First installation

1. Connect the antenna cables to their respective GPS ANTENNA connectors placed on the back..
2. Eventually connect an ethernet cable.
3. Insert the GPS modules and tight the screws.
4. Power on the **GPS-DS**.

Please check that the modules do fit well in their sockets and that their PWR leds are on.

After a few seconds the LCD display should light up (without an ethernet cable it would take a little more) and the leds under the keyboard should start blinking.

It is good practice to close 10 MHz and PPS connectors on 50  $\Omega$  terminators.

### Checkup

The factory settings of the devices are shown in the following figure:



The screenshot displays the 'GPS Configuration' web interface. On the left is a navigation menu with options: Global status, GPS status, Event log, Board configuration, GPS configuration (selected), Quality factor, and Logout. The main content area is titled 'Configuration' and contains several sections:

- 10MHz Output Power:** main: 13 dBm, backup: 13 dBm
- Holdover:** main: 7200 sec, backup: 7200 sec
- Switchover:** main»backup: 30 sec, backup»main: 30 sec
- Position Mode:** main: Normal Positioning, backup: Normal Positioning
- TI RAIM Alarm:** main: 500 ns, backup: 500 ns
- Cable Delay:** main: 0 ns, backup: 0 ns
- Autoswitch Threshold:** min: 0.6 Vrms, max: 1.2 Vrms
- Switch Policy:** choose: Switch and Free
- Switch Mode:** manual (radio button), automatic (radio button, selected)
- Switch Conditions:** Clock: Any, PPS: Any, Antenna: Yes, Serial: Yes
- PPS Mute:** main: On (radio button), Off (radio button); backup: On (radio button), Off (radio button)
- Reset:** Main GPS, Backup GPS buttons
- Remote Mode:** ENABLED (checkbox)

At the bottom right, there is a 'Save' button and a copyright notice: © 2011 Digital Instruments. All rights reserved.

In order to restore them is possible to use the command in the **Board configuration** panel or from the front panel under **Setup** → **Restore defaults**.

The device at boot configures itself in the following mode (overwriting eventual modifications of the user):

- Main GPS module selected
- Automatic switch
- Switch & Free policy
- PPS muting of the GPS modules enabled
- Remote connectivity



Follows this simple procedure to verify the correct behaviour of the apparatus:

- Presence of the GPS modules  
Go with the front panel on *Status* → *GPS* and check that both the modules can be seen
- Presence of the GPS antenna  
Go to *GPS Main* → *Show Global Info* and check the value of the *Antenna* field  
Do the same for *GPS Backup*  
After a few minutes from power-up (and with the antenna connected) the PPS leds on the GPS modules should start to blink.
- Presence of the 10 MHz outputs  
Go to *Status* → *Clock Main* and check that a *O* is shown where the cable is connected and terminated with 50 Ω, or *?* is shown where the connector is unconnected or open  
Do the same for the backup module
- Presence of the PPS outputs  
Go to *Status* → *PPS* and check that only *O* are shown  
Do the same for the backup module

## Position mode



A particular note shall be done about the *Position mode* feature of the GPS radio.

Per factory settings the GPS modules are in *Normal Positioning* (so that they can work everywhere).

Whenever on a particular GPS module the *Automatic Site Survey* feature has been activated is possible that the radio is put in *Position Hold*. Is possible to check that the coordinates in the *GPS status* panel under the *Position* field and the saved values (hold) for latitude and longitude are coherent with the current geographical position.



If this is not the case (red *Position* led) is possible to set the radio in *Normal Position* mode, in *Automatic Site Survey* or eventually clear the saved almanac.

Everything is accessible from the *GPS configuration* panel.

## 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, 2.048 MHz sine wave
Spectral Purity	-70 dBc (harmonic) -75 dBc (non-harmonic)
Phase noise	-130 dBc at 1kHz
Outputs	N° 8 independent
Output level	from -2 dBm to 16 dBm
Output impedance	50 $\Omega$
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, 100 $\mu$ s Duty, Rising Edge
Outputs	N° 8 independent
Output level	TTL 5 Vpp, Square wave
Output impedance	50 $\Omega$
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

### Signaling

Network connection	N° 1 Ethernet 10/100 interfaces, TCP/IP protocol
Signaling	N° 7 led on front panel
Serial Connection	RS-232 connector DB9 Male +/- 15 kV (ESD)
Remote signalling	7 Dry contact on Weidmuller connector with 3.5 mm step
Remote controllers	4 Dry contact on Weidmuller connector with 3.5 mm step

### Supply

Input	N° 2 independent supply
Network	85 Vac < > 265 Vac Plug IEC320 integrated, filter EMI/RFI

### Sizes

Width	1 Unit 19"
Depth	300 mm without connectors
Weight	1.5 Kg

### Accessories

1 x GPS Antenna
1 x 30 m Belden PRG 7 Cable
2 m Cordon for network supply
Handbook in English/Italian