User's Manual

HP-01

MAGNETOMETER
FIELD ANALYZER

From DC up to 1000 Hz

SERIAL NUMBER OF THE INSTRUMENT
You can find the Serial Number on the upper side panel of the instrument.
The Serial Number is in the form: 000XY00000.
The first three digits and the two letters are the Serial Number prefix, the last five digits are the Serial Number suffix. The prefix is the same for identical instruments, it changes only when a configuration change is made to the instrument.
The suffix is different for each instrument

NOTE:

® Names and Logo are registered trademarks of Narda Safety Test Solutions GmbH – Trade names are trademarks of the owners.

⚠ CAUTION If the instrument is used in any other way than as described in this User's Manual, it may become unsafe.

Before using this product, the related documentation must be read with great care and fully understood to familiarize with all the safety prescriptions.

To ensure the correct use and the maximum safety level, the User shall know all the instructions and recommendations contained in this document.

⚠ WARNING This product is a **Safety Class III** instrument according to IEC classification and has been designed to meet the requirements of EN61010-1 (Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use).

In accordance with the IEC classification, the battery charger of this product meets requirements **Safety Class II** and **Installation Category II** (having double insulation and able to carry out mono-phase power supply operations).**.**

It complies with the requirements of **Pollution Class II** (usually only non-conductive pollution). However, occasionally it may become temporarily conductive due to condense on it.

The information contained in this document is subject to change without notice.

KEY TO THE ELECTRIC AND SAFETY SYMBOLS:

You now own a high-quality instrument that will give you many years of reliable service. Nevertheless, even this product will eventually become obsolete. When that time comes, please remember that electronic equipment must be disposed of in accordance with local regulations. This product conforms to the WEEE Directive of the European Union (2002/96/EC) and belongs to Category 9 (Monitoring and Control Instruments). You can return the instrument to us free of charge for proper environment friendly disposal. You can obtain further information from your local Narda Sales Partner or by visiting our website at http://www.narda-sts.it .

⚡ **Warning, danger of electric shock**	⏚ **Earth**
⚠ **Read carefully the Operating Manual and its instructions, pay attention to the safety symbols.**	**Unit Earth Connection**
Earth Protection	**Equipotential**

KEY TO THE SYMBOLS USED IN THIS DOCUMENT:

⚠ DANGER **The DANGER sign draws attention to a serious risk to a person's safety, which, if not avoided, will result in death or serious injury. All the precautions must be fully understood and applied before proceeding.**

⚠ WARNING **The WARNING sign indicates a hazardous situation, which, if not avoided, could result in death or serious injury. All the precautions must be fully understood and applied before proceeding.**

⚠ CAUTION **The CAUTION sign indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.**

NOTICE **The NOTICE sign draws attention to a potential risk of damage to the apparatus or loss of data.**

☞ NOTE **The NOTE sign draws attention to important information.**

II	**Note and symbols**

Contents

Figures

Tables

⚠ **WARNING** | *SAFETY RECOMMENDATIONS AND INSTRUCTIONS*

This product has been designed, produced and tested in Italy, and it left the factory in conditions fully complying with the current safety standards. To maintain it in safe conditions and ensure correct use, these general instructions must be fully understood and applied before the product is used.

- In case of devices permanently connected to the power supply, and lacking any fuses or other devices of mains protection, the power line must be equipped with adequate protection commensurate to the consumption of all the devices connected to it;
- Devices in Safety Class I, equipped with connection to the power mains by means of cord and plug, can only be plugged into a socket equipped with a ground wire;
- Any interruption or loosening of the ground wire or of a connecting power cable, inside or outside the device, will cause a potential risk for the safety of the personnel;
- Ground connections must not be interrupted;
- To prevent the possible danger of electrocution, do not remove any covers, panels or guards installed on the device, and refer only to NARDA Service Centers if maintenance should be necessary;
- To maintain adequate protection from fire hazards, replace fuses only with others of the same type and rating;
- Follow the safety regulations and any additional instructions in this manual to prevent accidents and damages.

⚠ **WARNING** | *DANGER BY HIGH FORCES IN STATIC FIELDS*

Danger: high static magnetic fields – as found, for example, around an MRI or NMR spectroscopy magnet – will subject the USB connector or other ferromagnetic parts to strong forces.
To prevent injury from flying objects or whiplashing cables, be sure to hold these components securely when you are around a strong magnet.

narda ⚠️
Safety Test Solutions

Dichiarazione di Conformità
EU Declaration of Conformity CE

In accordo alla Decisione 768/2008/EC, conforme alle direttive EMC 2014/30/UE, Bassa Tensione 2014/35/UE e RoHS 2011/65/UE, ed anche alle norme ISO/IEC 17050-1 e 17050-2.
In accordance with the Decision 768/2008/EC, compliant to the Directives EMC 2014/30/EU, Low Voltage 2014/35/EU and RoHS 2011/65/EU, also compliant to the ISO/IEC standard 17050-1 and 17050-2

Il costruttore *The manufacturer*	**narda Safety Test Solutions S.r.l. Socio Unico**
Indirizzo *Address*	**Via Benessea, 29 / B**
	I-17035 Cisano sul Neva (SV) - Italy

sulla base delle seguenti norme europee armonizzate, applicate con esito positivo:
based on the following harmonized European Standards, successfully applied:

EMC - Emissioni: *EMC - Emission:*	**IEC EN 61326-1** (2021)
EMC - Immunità: *EMC - Immunity:*	**IEC EN 61326-1** (2021)
Sicurezza: *Safety:*	**EN 61010-1** (2010)

dichiara, sotto la propria responsabilità, che il prodotto:
declares, under its sole responsibility, that the product:

Descrizione *Description*	**ANALIZZATORE DI CAMPI MAGNETICI STATICI** ***MAGNETOMETER - FIELD ANALYZER***
Modello *Model*	**HP-01**

è conforme ai requisiti essenziali delle seguenti Direttive:
conforms with the essential requirements of the following Directives:

Bassa Tensione *Low Voltage*	**2014/35/EU**
Compatibiltà Elettromagnetica *EMC*	**2014/30/EU**
RoHS *RoHS*	**2011/65/EU**

Cisano sul Neva, 06 December 2022 **Egon Stocca**

General Manager

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1 - General information

1.1 Documentation

The following documents are included in this Manual:
- A questionnaire to be sent to NARDA together with the apparatus should service be required.
- A checklist of the Accessories included in the shipment.

This Manual includes description of HP-01 standard and optional accessories.

1.2 Introduction

This section provides a general overview of HP-01 Magnetometer - Field Analyzer.

HP-01 is a magnetic DC and low frequency isotropic field probe-analyzer. It provides an advanced technology solution for field analysis in the DC to 1 kHz frequency range in an extremely high dynamic range. It includes X, Y and Z axes simultaneous measurements with a powerful, built in, spectrum analyzer.

HP-01 can be used either connected to 8053B, NBM-550 portable field meters, FieldMan electromagnetic field meter or PC.

HP-01 includes a non volatile memory which stores frequency and level calibration tables and an internal optical repeater which allows connection to external devices through the optical fibre.

Spectral analysis, obtained through DSP (Digital Signal Processor), is performed on different frequency Span values and displayed on the PC monitor.
Marker function is available to provide accurate field strength and frequency measurement.

HP-01 is managed internally with a microprocessor that controls all the main functions, from the battery charging to the serial communication with the DSP unit.
The Magnetic field is picked up by three sensors on the X, Y and Z orthogonal axes. A Digital/Analog conversion follows which transforms the signal into numeric information processed by a Digital Signal Processing unit.

HP-01 is housed in a small cylindrical housing. The bottom side panel includes an optical fibre connector, extension rod screw, battery charger connector, ON/OFF button and Status LEDs.

The magnetic sensor system is composed by three Hall effect elements, positioned orthogonal to each other.

The notch near the end of the tip marks the sensor position.
The orientation of the three axis is depicted onto the top panel.

Fig. 1-1 Sensor position

1.3 Configuration and Standard Accessories

The HP-01 Set for NBM-550, FieldMan and PC use, includes the following items:

- HP-01 Basic Unit;
- Zero-Gauss Chamber;
- AC/DC Converter with plug adapters;
- Cable, FO Duplex, RP-02, 10 m;
- USB-OC Optical Converter;
- Cable, FO Duplex, RP-02, 25 cm;
- Conical Tripod support;
- HP-01 / NBM Adapter;
- HP-01 / FieldMan Adapter;
- Carrying Case 170/37;
- Software Media including user's manual;
- Cerfiticate of Calibration.

The HP-01 Set for 8053B and PC use, includes the following items (available for Italy only):

- HP-01 Basic Unit;
- Zero-Gauss Chamber;
- AC/DC Converter with Italian plug adapters;
- Cable, FO Duplex, RP-02, 10m;
- USB-OC Optical Converter;
- Cable, FO Duplex, HFBR, 10m;
- Conical Tripod support;
- Carrying Case 170/37;
- HP-TS Software Media including User's Manual;
- Cerfiticate of Calibration.

1.4 Optional Accessories

The following accessories may be ordered as options:

- Cable, FO Duplex, RP-02, 20m;
- Cable, FO Duplex, RP-02, 40m.
- 100% Wooden tripod TR-03

1.5 HP-01 Main specifications

When not differently specified the following specifications are referred to an operating ambient temperature of 23°C and relative humidity 50%.

Table 1-1 Technical specifications of the HP-01 Magnetometer - Field Analyzer				
Frequency range	DC ÷ 1000 Hz			
Measurement range (1)	10 µT ÷ 60 mT (lower range) 10 mT ÷ 10 T (higher range) 10 µT ÷ 10 T (advanced autoranging feature)			
Overload	20 T			
Dynamic range (after zeroing)	120 dB			
Resolution (2)	100 nT (lower range) 100 µT (higher range)			
Displayed average noise level (3)	10 µT			
Frequency flatness (typ)	0.5 dB (DC ÷ 1000 Hz)			
Expanded Measurement Uncertainty (4)	1%			
Field sensor	Triaxial orthogonal Hall effect devices (temperature compensated) Sensor area approx.: 0.6 x 0.6 mm (higher range) 0.15 x 0.15 mm (lower range)			
Acquisition method	Simultaneous triaxial acquisition			
Spectrum analysis method	Realtime Gapless (5) FFT			
SPAN	20 Hz	30 Hz	100 Hz	1000 Hz
Frequency resolution	0.2 Hz	0.3 Hz	1 Hz	3 Hz
RBW (-3 dB)	0.8 Hz	1.2 Hz	4 Hz	10 Hz
Reading update time	< 350 ms			
Start frequency	User selectable within the whole range			
Stop frequency	User selectable within the whole range			
Time domain analysis method	DC ÷ 1 Hz FIR filter 1 Hz (-3dB), reading updating time 67 ms			
Calibration (6)	internal E^{2}PROM			
Temperature and humidity meter	-20 ÷ +55 °C 0.01° resolution 5 ÷ 95 % 0.1% resolution			
Typical temperature deviation @ 0 Hz referred to 23°C	0.05% / °C			
Dimensions	Sensor stick φ 9 mm, L 143 mm Main body φ 43 mm, L 55 mm Overall length 200 mm			
Weight	100 g			
Tripod support	Threaded insert ¼"			
Internal battery	3.7 V / 250 mAh Li-Ion, rechargeable			
Operating time	> 6 hours			
Recharging time	< 2.5 hours			
External supply	10 ÷ 15 VDC, I = approx. 100 mA			
Optical fiber connection	Serial Optical Interface 115200 Baud (7) - RP02 connector up to 40 m (USB-OC)			
Firmware updating	Through the optical link by USB or RS232			
Self test	Automatic at power on			
Operating temperature	-20 ÷ +55 °C			
Operating relative humidity (8)	5 ÷ 95 %			
Charging temperature	0 ÷ +40°C			
Storage temperature	-30 ÷ +75°C			

(1) For each single axis. Positive and negative at DC.
(2) At 20 Hz and 30 Hz SPAN.
(3) After zeroing. DANL is frequency and SPAN depending. The specified performance is referred to 0 Hz and SPAN 20 Hz.
(4) At DC.
(5) Overlapping for SPAN lower than 1000 Hz
(6) Recommended re-calibration interval 24 months
(7) 38400 Baud with 8053B
(8) Without condensation

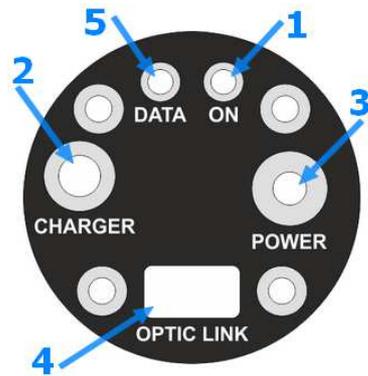Specifications are subject to change without notice

1.6 HP-01 Panel

Fig. 1-2 Panel of HP-01

Key:

1. Power-on LED
2. Battery charger connector
3. ON/OFF button
4. Fiber optic connector
5. Data LED

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2 - Installation and use

2.1 Introduction

This section provides the information required for installing and using the HP-01 Analyzer.

Information is included regarding initial inspection, power requirements, interconnections, work environment, assembly, cleaning, storage and shipment.

2.2 Preliminary inspection

Inspect the packaging for any damage.

NOTICE

If the packaging or anti-shock material have been damaged, check that the contents are complete and that the meter has not suffered electric or mechanical damage.
Check that all the Accessories are there against the checklist found with the apparatus.
Inform the carrier and NARDA of any damage that has occurred.

2.3 Work environment

The work environment of the Accessories, must come within the following conditions:

- Temperature   From -20°C to +55°C
- Humidity   5 to 95% relative

The meter must be stored in a clean and dry environment, free from acid dusts and humidity.
The storage environment must come within the range of the following conditions:

- Temperature   From -30°C to + 75°C
- Humidity   < 100% relative without condense

2.4 To return for repair

When the meter needs to be returned to NARDA for repair, please complete the questionnaire appended to this User's Manual, filling in all the data that will be useful for the service you have requested.
For reducing the period of time required for the repairs, it is necessary to be as specific as possible in describing the problem. If the problem only occurs in certain circumstances, please describe in detail how it happens.
If possible it is better to reuse the original packaging; making sure that the apparatus is wrapped in thick paper or plastic.
Otherwise, use strong packaging by using a sufficient quantity of shock absorbent material around all sides of the meter to ensure that it is compact and does not move around inside the package.
In particular, take every precaution to protect the front panels.
Finish the package by sealing it up tightly.
Apply a FRAGILE label to the package to encourage greater care in its handling.

NOTE

Nowadays there are restrictions on the shipment of hazardous materials, eg. some types of lithium batteries.
Please, check the proper, safe, shipping mode, with the help of your courier, in the case the product is equipped with batteries.

2.5 To clean the meter

Use a dry, clean and non-abrasive cloth for cleaning the meter.

NOTICE

Do not use solvents, acids, turpentine, acetone or other similar products for cleaning the meter in order to avoid damaging it.

2.6 HP-01 Led status   Turn on HP-01 by pushing the POWER button for one second.
After switching on the probe, the ON led lights orange for about 1/2 second and turns off, afterwards the DATA led lights red as an auto-check. Then the two three-color leds will provide the following information:

TABLE 2-1 Led color			
Blinking speed	**LED DATA Color**	**LED ON Color**	**Meaning**
Depending on the SPAN	Green	Off	Communication correct (Single or wide frequency selection)
Medium	Red / Green	Off	Communication correct (DC frequency selection)
Medium	Red	Off	HP-01 disconnected - Communication error or in pause
Medium	Off	Orange	Recharging battery
Fast	Off	Green	Battery recharging completed

2.7 Power supply and battery recharging   HP-01 has an internal rechargeable Li-Ion battery that can be recharged with the battery charger supplied with it.
Make a full charging cycle before using the Analyzer for longest battery operation time.

👉NOTE   **ALWAYS connect the battery charger to the power supply BEFORE connecting it to the HP-01.**
The battery charger has an internal protective circuit that will limit the output of current if there is any load when connecting to the mains.
Battery charger:
output: DC, 10 - 15 V, ~ 100 mA

Connector: - → (●) ← +

👉NOTE   **In order to safeguard the features of the batteries, it is crucial to have a complete recharge before storing them for periods longer than 4 months. Therefore, it is warmly suggested recharging the batteries at least every 4 months even though the device has not been used.**

👉NOTE   **The minimum voltage level for operation is about 3.25V. The batteries must be recharged for lower voltages. Below such voltage the analyzer will turn OFF automatically.**

The time required for recharging the batteries is about 2.5 hours. When the recharge is complete, this is indicated by the Led of the HP-01, with a rapidly blinking Green light.

👉NOTE   **If the battery charger is plugged in to the HP-01 while the software is running, the analyzer will stop the measurements.**

The battery status is reported by the HP-01 control program

Temp.: 23.82 C   Bat.: 45 %
RH: 30.8 %   Range: Auto

⚠ Bat... ▢ ▢ ✕

3.71 V

Close
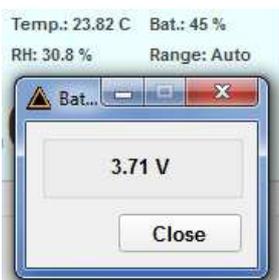
| 2.8 Battery management | The battery autonomy of the Analyzer depends on its mode of operation. It is designed to be more than 6 hours. |

| 2.9 HP-01 connected to a PC | Using the HP-TS software spectrum analysis can be displayed on a PC. |

NOTE **Switch the unit on with a short key press of the Power button to set the probe for communication with HP-TS pc software.**

| 2.10 HP-01 with 8053B | HP-01 is linked to 8053B via the fiber optic link. |

NOTE **Switch the unit on with a short key press of the Power button, wait 2 seconds and press the key a second time until the ON LED lights up to set the probe for communication with 8053B.**

NOTE **Please, see 8053B Manual for further details**

| 2.11 Avoiding measurement errors | We recommend that the probe be set up a long way from metal objects or masses to avoid disturbance of the magnetic field. |

NOTE **The support must be amagnetic to perform correct measurements. Using an unsuitable support could influence the measurements and, therefore, determine incorrect results. We recommend always using the amagnetic extension support supplied with HP-01 for supporting the Analyzer.**

NOTE **The intensity of the measured field mainly depends on its currents and the geometry of the system under examination as well as the distance between the conductors/magnets and the measurement points. In the vicinity of cables, the reading of the field value may be very high and vary with the location of the probe.**

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3 – HP01-TS installation

3.1 Introduction

HP01-TS is a useful software tool developed for remote PC control, through fibre optic link, of HP family Magnetometers and field analyzers.

By means of the USB-OC optical to USB converter, HP-01 can be connected to a PC USB port.

If needed, the selected COM port should be assigned to the application software (see cap.5 HP01-TS applications).

HP01-TS software requires an analyzer is connected to PC in order to run.

The HP01-TS installation program automatically installs the driver for USB optical converter.

3.2 Hardware requirements

Minimum requirements:

- Processor: Pentium or equivalent
- 256 MB RAM
- At least 64 MB of free space on hard disk
- 1 free USB port
- Windows 7 or higher

NOTE

The User might have the need of administrator privileges to install the software in Windows 7 or higher. For further information, please see the next paragraph.

NOTE

The new releases can be downloaded directly from the narda website http://www.narda-sts.it

3.3 Installing HP01-TS Software

Before connecting the Magnetic field analyzer to PC the HP01-TS software installation should be performed:

Double click on the file "HP01-TS Setup.exe" included on Software Media

Fig. 3-1 Setup icon

NOTE

The User must have administrator privileges to install the HP01-TS software in Windows 7 or higher; right click on the program .exe file and click on "Run as administrator" to temporarily run the program or application as an administrator until close it (Windows also allows to mark an application so that it always runs with administrator rights).
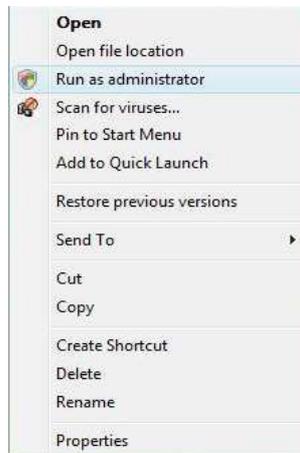
Fig. 3-2 Run as administrator

Follow set-up program instructions
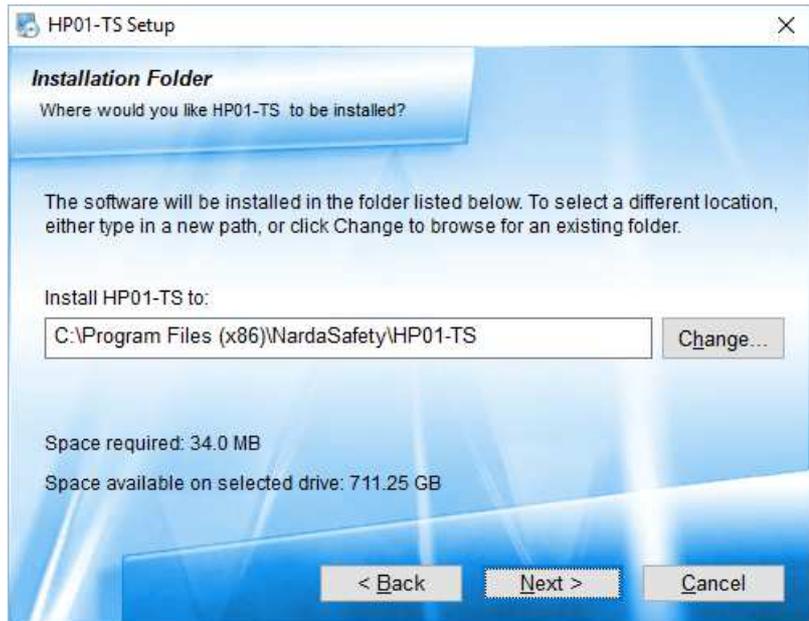

Fig.3-3 HP01-TS installation

Fig.3-4 Installation folder
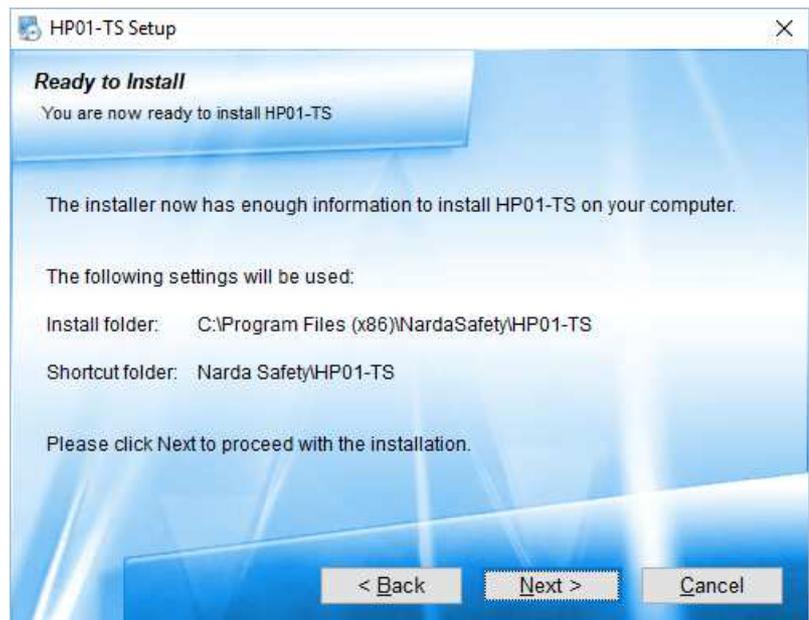

Fig.3-5 Ready to install
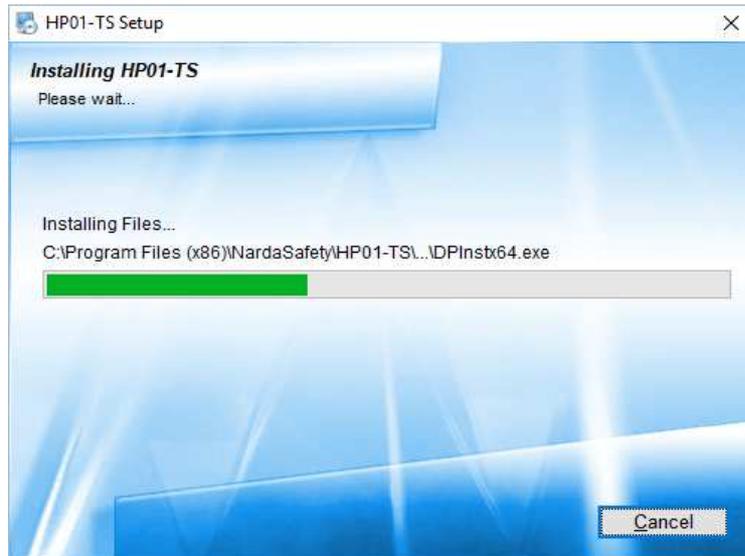
Fig.3-6 Installing HP01-TS
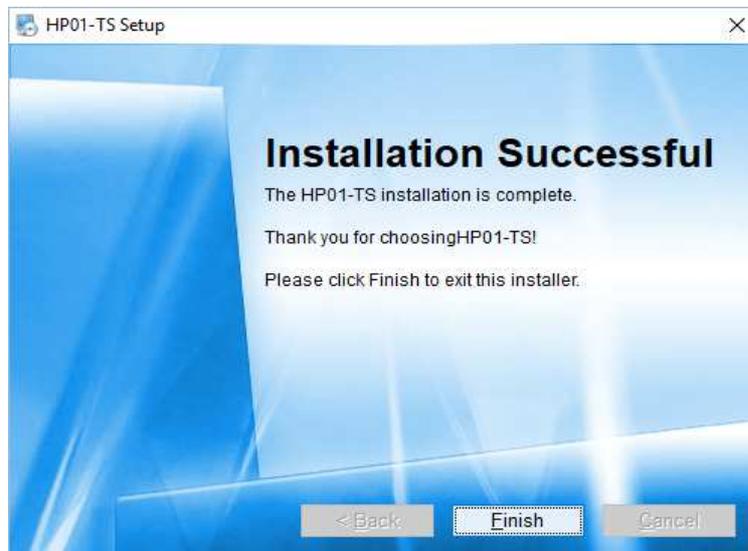
Fig.3-7 Installation successful

When asked for, reboot your system to complete installation
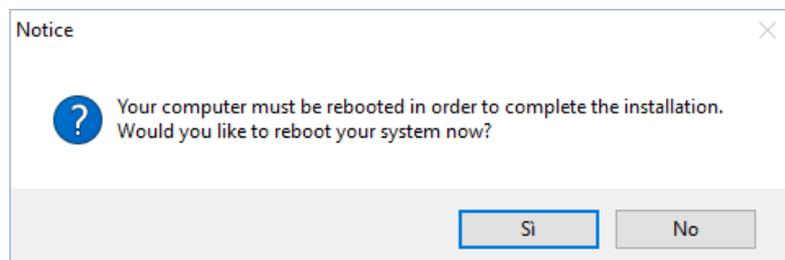
Fig.3-8 Reboot

HP01-TS software is now installed in your PC, you can remove it, if needed, simply running the "Uninstall HP01-TS" application (see cap.8).

4 – HP-TS software

4.1 HP-TS Applications

This chapter describes controls and functions provided by the HP-TS application for time domain and spectrum analysis, included in HP-TS software package.

HP-TS software includes different applications to be used with HP family analyzers. Shortcuts are shown in Windows 7 or higher by clicking **Windows (🟦)** and **Programs:**
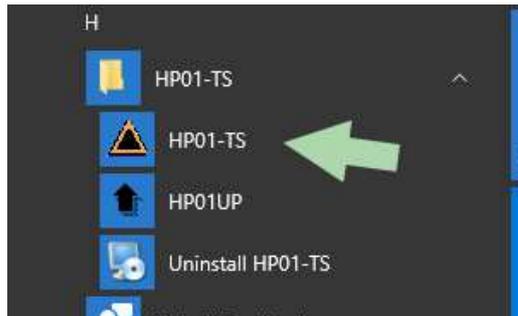
Fig.4-1 HP01-TS icons

The HP01-TS section includes two different applications:

HP01-TS: this program is used to perform live Time Domain and Spectrum Analysis measurements when an HP-01 analyzer is connected to PC.

HP01UP: this is the tool for internal firmware upgrading.

Uninstall HP01-TS: to remove the software package from the PC.

📢 NOTE

This document describes applications for HP-01 analyzer only.

Switch the unit on with a short key press of the power button and double click on HP01-TS icon. A welcome screenshot will appear for a few seconds.

Fig.4-2 Welcome logo

4.2 HP-TS Main window   The program HP01-TS main window will be shown:
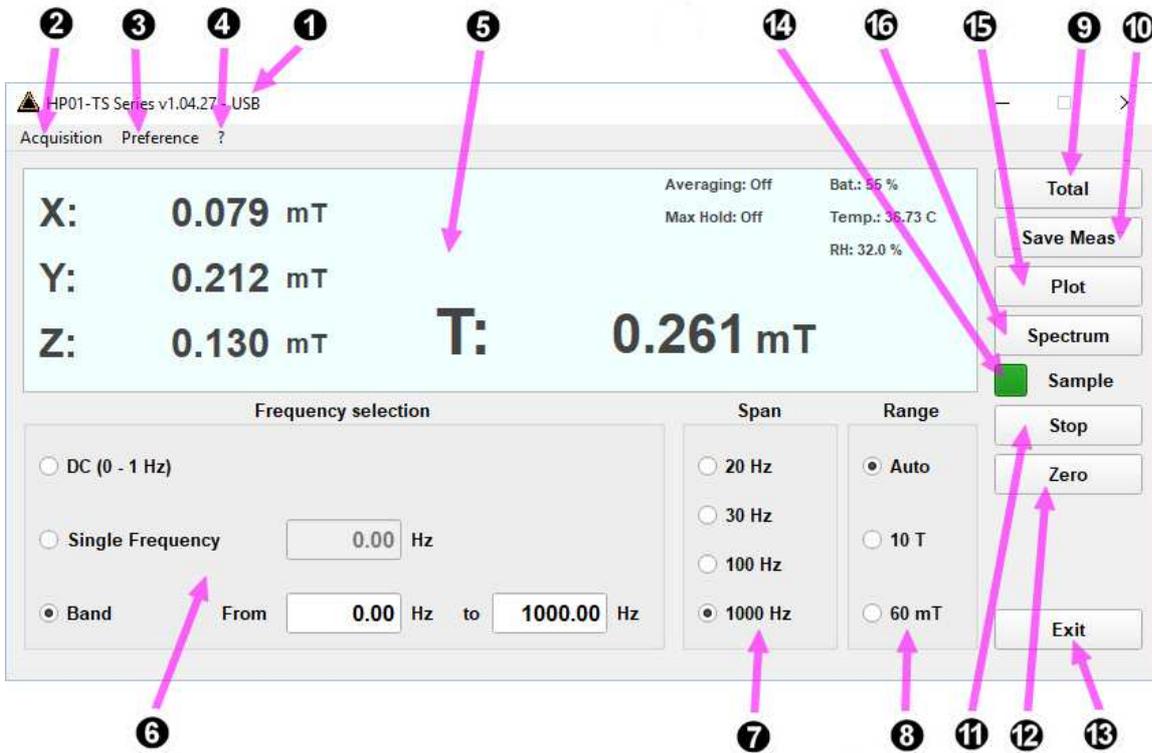
Fig.4-3 HP01-TS Main Window

Description:
1 - **Title bar**: see §4.2.1
2 - **Acquisition toolbar**: see §4.2.2
3 - **Preference toolbar**: see §4.2.3
4 - **Info ? toolbar**: see §4.2.4
5 - **Displayed measurements**: see §4.2.5
6 - **Frequency selection**: see §4.2.12
7 - **Span selection**: see §4.2.13
8 - **Range selction**: see §4.2.14
9 - **Total / XYZ button**: see §4.2.6)
10 - **Save Meas button** (if Measurement log enabled): see §4.2.7
11 - **Stop / Run button**: see §4.2.8
12 - **Zero button**: see §4.2.9
13 - **Exit button**: see §4.2.10
14 - **Sample**: see §4.2.11
15 - **Plot button**: Opens the graphical display where the values are traced in time domain; see §4.3.
16 – **Spectrum button**: Opens the graphical display for frequency domain trace (classical spectrum analyzer view and Waterfall view, 2D and 3D); see §4.4 and §4.5.

☞ NOTE   **All operating modes include the possibility to select the dynamic range, the span and the averaging desired.**

4.2.1 Title bar

The software release shown here, together with the PC port in use to connect the HP-01.

HP01-TS Series v1.04.30 - USB

The control buttons allow to minimize to icon, enlarge/restore the main window and exit the program:

When minimizing the main window the information is displayed in the Windows application bar at the bottom of screen.

The total field measurement remains displayed on desktop meanwhile if Minimized UI is actived (for more information see § 4.2.4.2).

HP01-TS - Total Field

0.260   mT

4.2.2 Acquisition toolbar To set Averaging and to activate the Max Hold function.
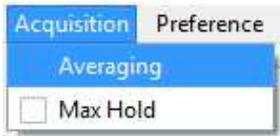
4.2.2.1 Averaging This function can be used to select the proper averaging for the displayed level. The number, between 1 (OFF) and 64, corresponds to the quantity of measurements participating in the calculation of the mean value.
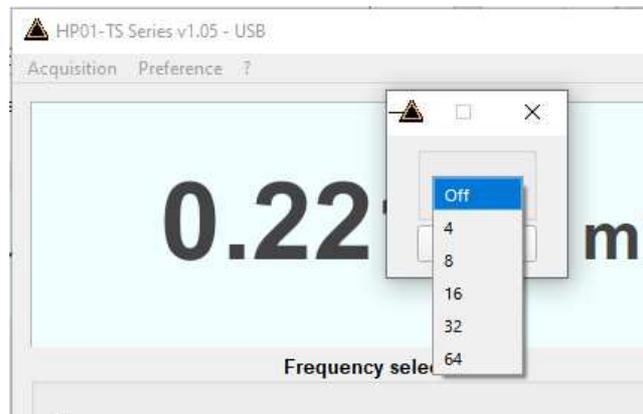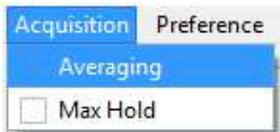
Fig.4-4 Averaging

4.2.2.2 Max Hold Click on it to enable the function **Max Hold** (√). The maximum field strength value measured is retained and displayed since the Max Hold function has been activated.
The value is therefore updated only if the new value is greater than the previously displayed one.
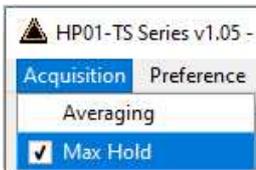
NOTE **The Max Hold function can be activated in the numeric representation and in the spectrum analyzer view.**

4.2.3 Preference toolbar   It includes **Settings**, **Minimized UI**, **Measurements log** and **Languages** selection.

Preference   ?
  Settings
  ☐ Minimized UI
  ☐ Measurements log
  Languages   ▶
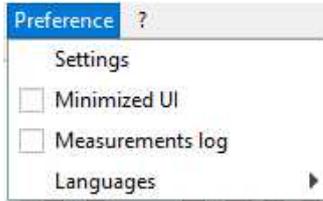
4.2.3.1 Settings   This section concerns the appearance of the program.

Preference   ?
  Settings
  ☐ Minimized UI
  ☐ Measurements log
  Languages   ▶
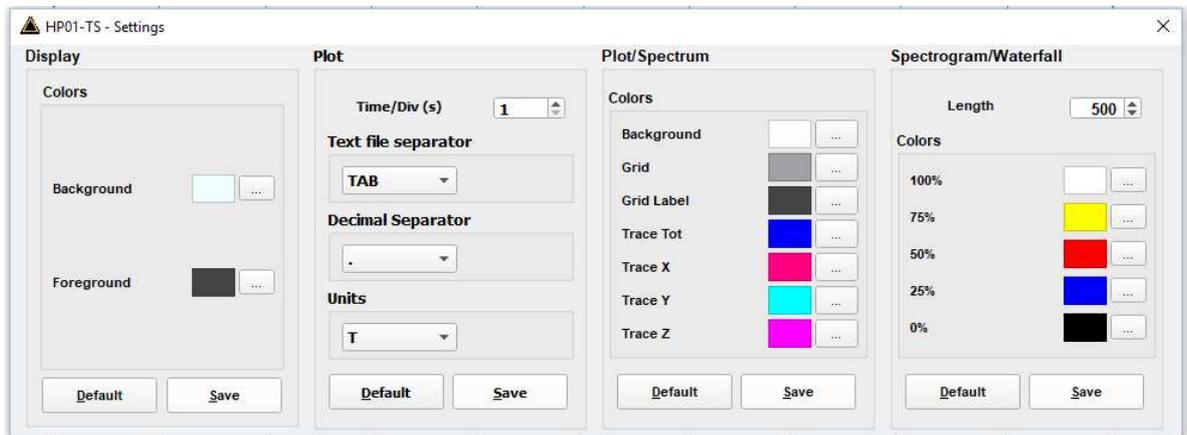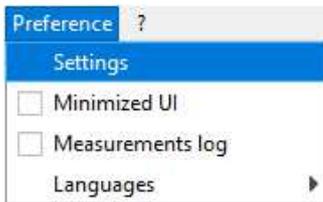
Fig.4-5 Settings

Display, Plot, Plot/Spectrum, Spectrogram/Waterfall boxes allow selecting each environment parameters and color palette.

Default button to set appearance to the default parameters

Press Save button to store the specific choice.

4.2.3.2 Minimized UI   A minimized visualization is also available, and it can be activated under the **Preference** menu.

Preference   ?
  Settings
  ☑ Minimized UI
  ☐ Measurements log
  Languages   ▶
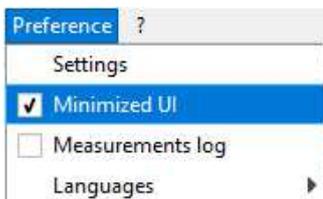
If active, a small window with the Total Field value is shown on the screen when trying to reduce the main window to icon.
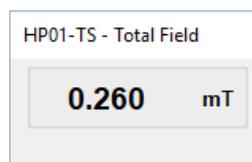
Fig.4-6 Minimized UI

4.2.3.3 Measurements log

Click on it to enable the function **Measurements Log** to display the **Save Meas** button in the main window. The symbol √ means that the function is activated.
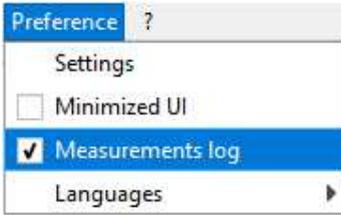
See § 4.2.4.3.1 Save Meas button for further information.

NOTE **Every time the software starts, the function Measurements Log is disabled.**

4.2.3.4 Languages

Selection of different language of the main window among:

Once selected the new language, a message will appear:
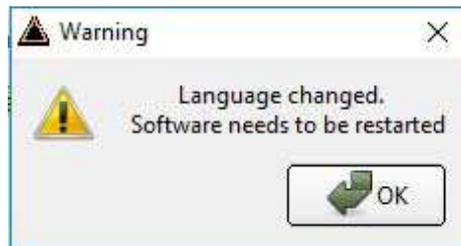
Confirm with **OK** to restart the software with the new language.

4.2.4 Info ? toolbar

The Info (?) toolbar allows the User to visualize the data of the probe, such as **internal firmware release**, **Serial Number**, current **Battery Voltage** and last **Calibration Date**.

4.2.4.1 Release
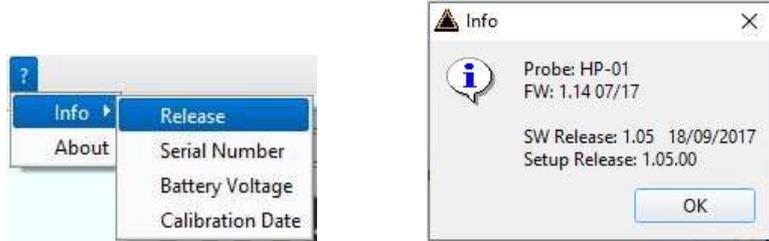
4.2.4.2 Serial Number
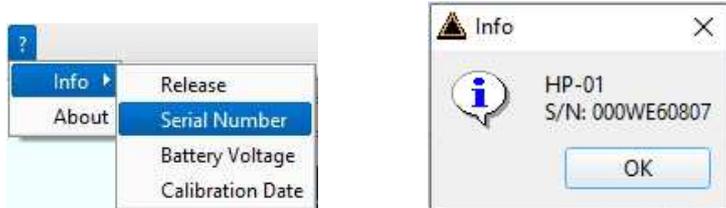
4.2.4.3 Battery Voltage

4.2.4.4 Calibration Date

4.2.4.5 About

 - About: Manufacturer information.

Fig.4-7 Info toolbar

4.2.5 Displayed measurements

The following parameters and values are diplayed in the measurement window:

- **Field values** as x - y - z or total mode (see §4.1.7 "XYZ / TOT" button).

Mode X - Y - Z
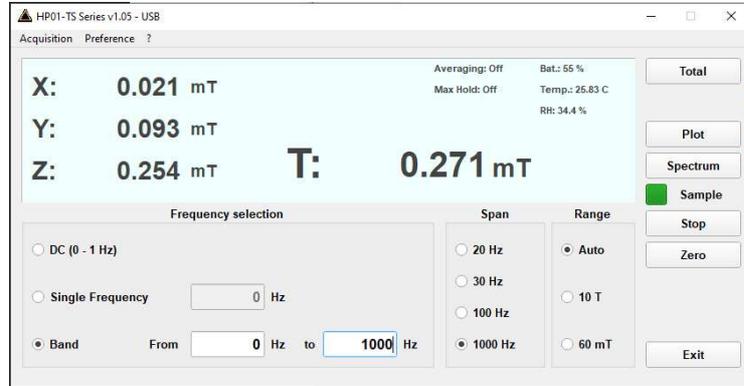
Mode Total (T)
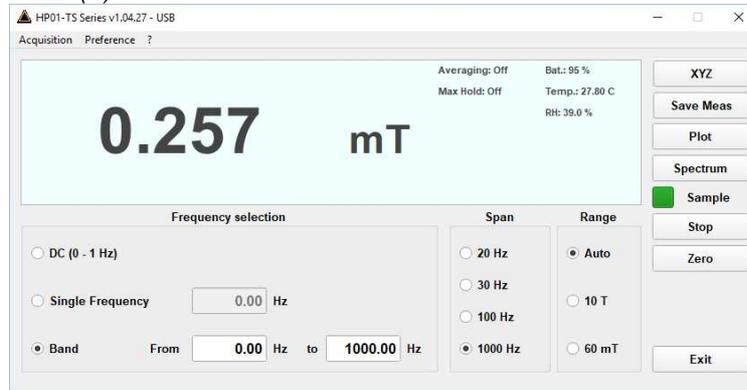
- **Measuring unit** The unit can be mT (G) or T (kG) depending on the level range and unit setting; It is displayed with three decimals.

- **Averaging** (number of measurements / Max Hold)

- **Max Hold** (on or off)

NOTE - **Battery status** displayed in 5% steps. It shows the residual autonomy during measurements and the achieved autonomy during charging.

NOTE **Battery voltages below 3.59V (5% of charge) are displayed red.**

NOTE **If the battery charger is plugged in to the HP-01 while the software is running, the analyzer will stop the measurements.**

- **Temperature** in degrees Celsius

- **Relative Humidity** in percentage

4.2.6 TOT / XYZ
      Mode button

Mode button allows activating X, Y, Z axis levels indication or not.
In any case, the total value is always shown.
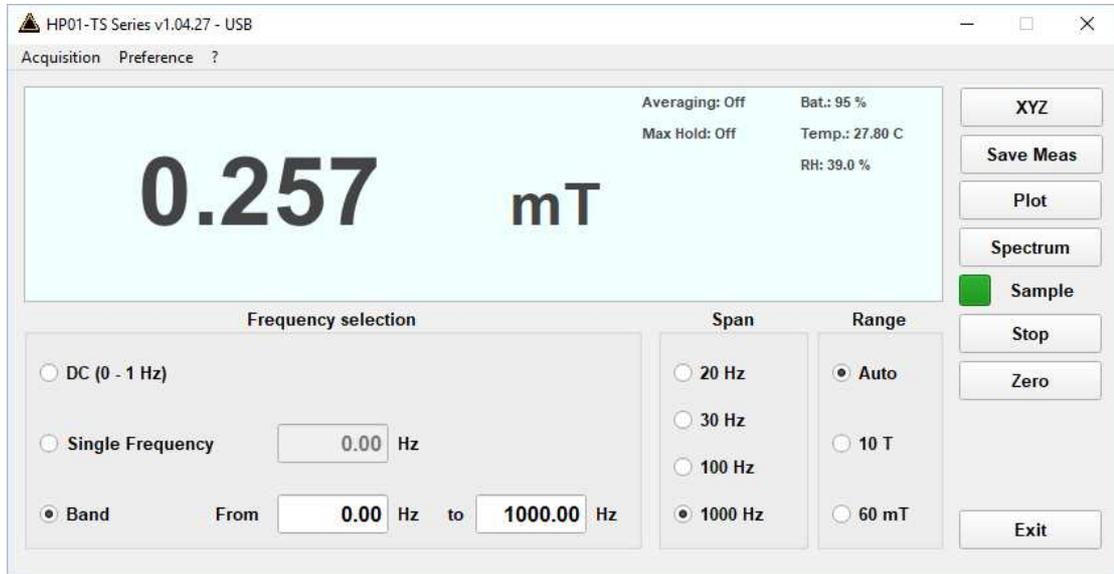
Fig.4-8 Total and XYZ display

4.2.7 Save Meas button

Active **Measurements Log** (√) to display the **Save Meas** button in the main window.
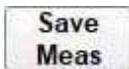
When the button **Save Meas** is selected, the field values displayed on the main window are stored in the file *HP01-TS_Measurements.txt* in the mode selected (see XYZ or Total button).
The file is located on Documents\NardaSafety\HP01-TS\ and It is created at the first selection automatically**.**

Description   **4-9**
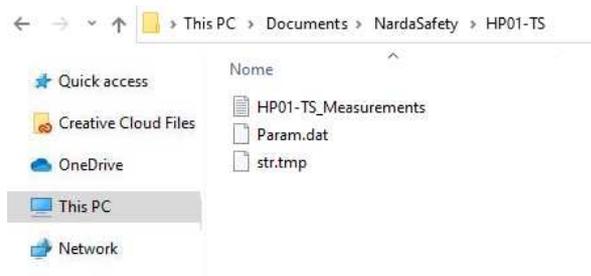
For every working session (from starting to closing the software) a headline is created in the text file with data probe, software settings and field values:

Every time the button **Save Meas** is selected, new values are saved in the corresponding headline.

Bx(unit), By(unit), Bz(unit) are the field values on x, y and z axis; if the **XYZ** mode is not enabled, each axis will be marked with a minus sign "-".
Btot (unit) is the Total field value
Between brackets is reported the unit.

In case a new software setting is set during the working session, the new value is reported in the text file; in the example below, the frequency selection has been changed.

```
Storing Date      21-01-2022
Storing Time      9:52:56
Device Name       HP-01
Device Serial Number    000WE60807
Result Display    Numerical
Frequency         0 Hz
Range    Auto
Span     1000 Hz
Averaging         Off
Max Hold          Off
Temperature (°C)          21.38
Humidity (%)      21.9


Time              Bx(mT)  By(mT)  Bz(mT)  Btot(mT)
09:52:56.838       0.013   0.098   0.229   0.250
09:57:31.193       0.011   0.094   0.213   0.233
09:57:36.328       -       -       -       0.241
```

Working session 1 headline

Field values

```
Storing Date      21-01-2022
Storing Time      9:58:04
Device Name       HP-01
Device Serial Number    000WE60807
Result Display    Numerical
Frequency         0 Hz
Range    Auto
Span     1000 Hz
Averaging         Off
Max Hold          Off
Temperature (°C)          21.58
Humidity (%)      22.0


Time              Bx(mT)  By(mT)  Bz(mT)  Btot(mT)
09:58:04.505       -       -       -       0.244
09:58:07.210       0.008   0.098   0.224   0.245
09:58:08.458       0.017   0.094   0.218   0.238


Frequency         0-50 Hz
10:27:05.459       0.072   0.021   0.245   0.256
10:27:08.501       0.067   0.018   0.226   0.236
10:27:10.685       -       -       -       0.245
```

Working session 2 headline

Field values

Change setting

Field values

NOTE   **The recorded data can be viewed either as a graph or as a table using common software as an example Word or Excel application.**

     Description

4.2.8 Stop / Run button

Press Stop to momentary suspend the samples acquisition. Press again to resume

| Stop | Run |

 NOTE

The button XYZ/TOT is active even when in Stop mode.
If the program is exit when in Stop mode, it will restart in Run mode.

4.2.9 Zero button
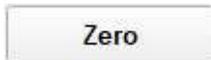
Zeroing is used for offset correction in order to optimize the sensitivity for low static fields. To zero the probe, insert the tip of the probe into the provided Zero Gauss Chamber to eliminate the Earth magnetic field, then click on the Zero button.

| Zero |

Fig.4-9 Zero Gauss Chamber

Then click Yes and please wait for the zeroing process to complete.

Fig.4-10 Zeroing
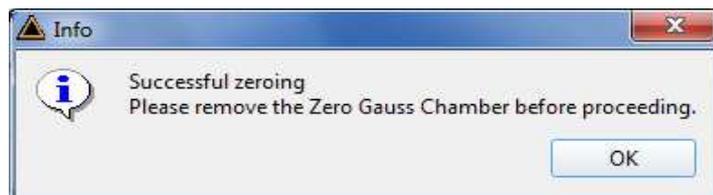
Fig.4-11 Successful zeroing

At the end of the zeroing procedure, please remove the Zero Gauss Chamber. The analyzer is immediately ready to be used.

 NOTE

Please pay attention the Zero Gauss Chamber is a very fragile tool. It must be handled with care.

 NOTE

Even though the Zero Gauss Chamber was designed properly to have a high shielding against surrounding magnetic fields, it is anyway advisable to find an area where the magnetic field is low before running the Zero calibration.

4.2.10 Exit button

Press EXIT to end the program. The current settings are saved and will be recalled at the next start.

Exit

The following message will appear:
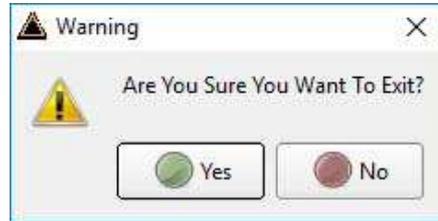
Press YES to close the software (the HP01-TS will remain on).

Press NO to continue using the software

4.2.11 Sample status

The Sample status will provide the following information:

Blinking green square shows valid acquisition

Blinking red square means operation in pause

Static gray square means connection to the probe managed by another window, example Spectrum graph

Description

4.2.12 Frequency selection   It includes **DC**, **Single Frequency** or **Wide Band** selection with parameters

Frequency selection
○ DC (0 - 1 Hz)
○ Single Frequency   0.00 Hz
◉ Band   From   0.00 Hz   to   1000.00 Hz

☞ NOTE
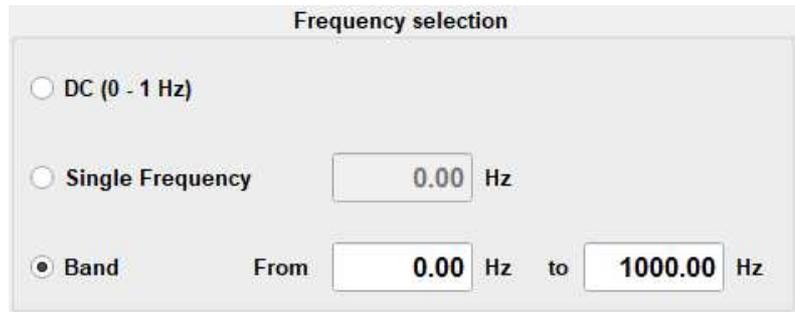
In DC mode (0 – 1 Hz) there is no Span selection available.

In **Wide Band** Mode the displayed measurement result is integrated over frequency from Fstart to Fstop. The user can enter Fstart and Fstop depending on the selected Span. We recommend to consider the following settings for best results.

To obtain accurate integration results, the minimum setting for Fstart should be:
Fstart >= 2 x RBW

To obtain accurate integration results, the minimum bandwidth Fstop - Fstart should be:
Fstop - Fstart >= 4 x RBW

The values for RBW are given above in §4.2.13 Span

4.2.13 Span selection   This is the box where it is possible to choose one of the four options available:
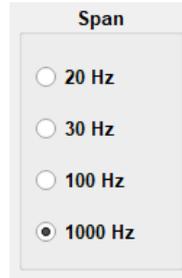
Fig.4-12 Span selector

NOTE   **No Span selection available when DC mode (0 – 1 Hz) is selected (see §4.2.12)**

NOTE   **The Resolution Bandwidth RBW (selectivity) of the measurements is depending on the Span setting:**

Span	RBW
20 Hz	0.8 Hz
30 Hz	1.2 Hz
100 Hz	4 Hz
1000 Hz	10 Hz

4.2.14 Range selection   To choose among the Automatic, lower and higher dynamic ranges

Fig.4-13 Range selector

    Description

4.3 Plot mode

The Plot function is a time domain graph of the measured level.

Fig.4-14 Plot graph

NOTE
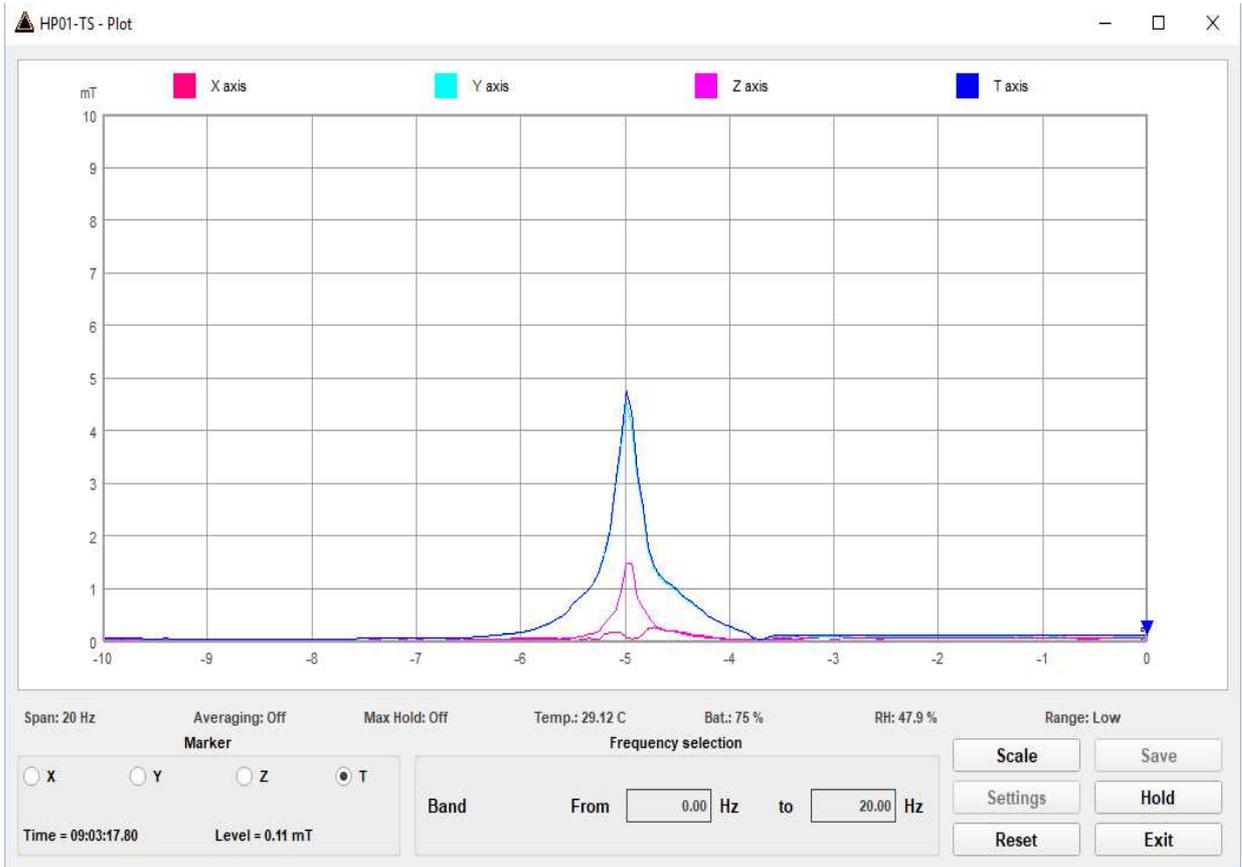
The Total field is always traced, while the X,Y and Z axis traces are shown only when activated in the main window.

The marker can be activated for one of the X, Y, Z and T (Total) traces.
It will show the time and the level measured for that time.

The vertical axis shows the level, which can be chosen among several full-scales.

The horizontal axis shows the time course of the field in seconds, starting from the right to the left with the latest measurement on the right.
The time scale can be set under Settings from 1 s to 1000 s per division.

4.3.1 Hold / Run

Pauses or resumes the display of the traces; the acquisition keeps running in the background.

4.3.2 Exit

Press Exit to exit from Plot mode.

Description   **4-15**

4.3.3 Scale

This control is used to select the full-scale of the level axis.
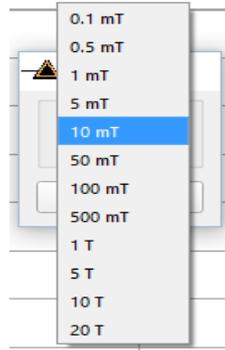
Scale

Fig.4-15 Scale selector

4.3.4 Save File

All collected measurements can be saved in a text file using this function.

Save

![NOTE hand pointer] **NOTE**

To enable the "Settings" and "Save" buttons it is necessary to stop acquisition by clicking the "Hold" button.

Fig.4-16 Settings and SaveButtons
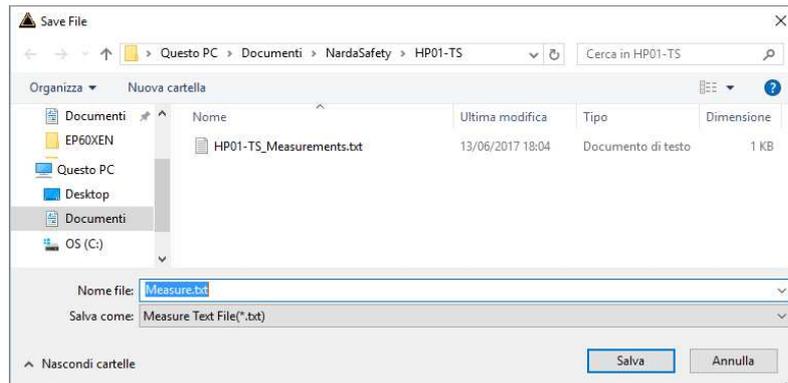
Fig.4-17 Save file

This section allows to input the name of the file which will contain all the measurements acquired up to the time the **Hold** button was clicked.
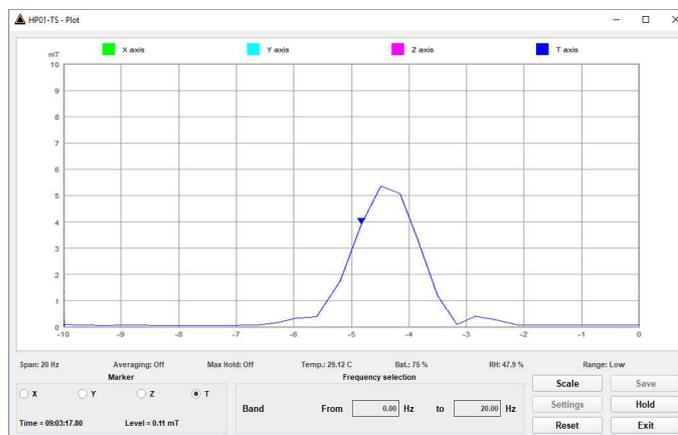
Fig.4-18 Plot Total

4.4 Spectrum mode

Spectrum

HP-01 includes an FFT analyzer to show frequency spectrum of measured field. The Spectrum section includes the following:

Span: select one of the 4 available **spans,** keeping in mind that the HP-01 minimum operating frequency is DC and maximum **stop** frequency is about equal to the span itself.
The resolution bandwidth depends on the selected span.

HP-01 performs selective measurement over the entire frequency range defined by the Span setting. HP-TS is able to select data in order to display a user specified marker frequency within the selected span. For this purpose, the Marker function can be activated.
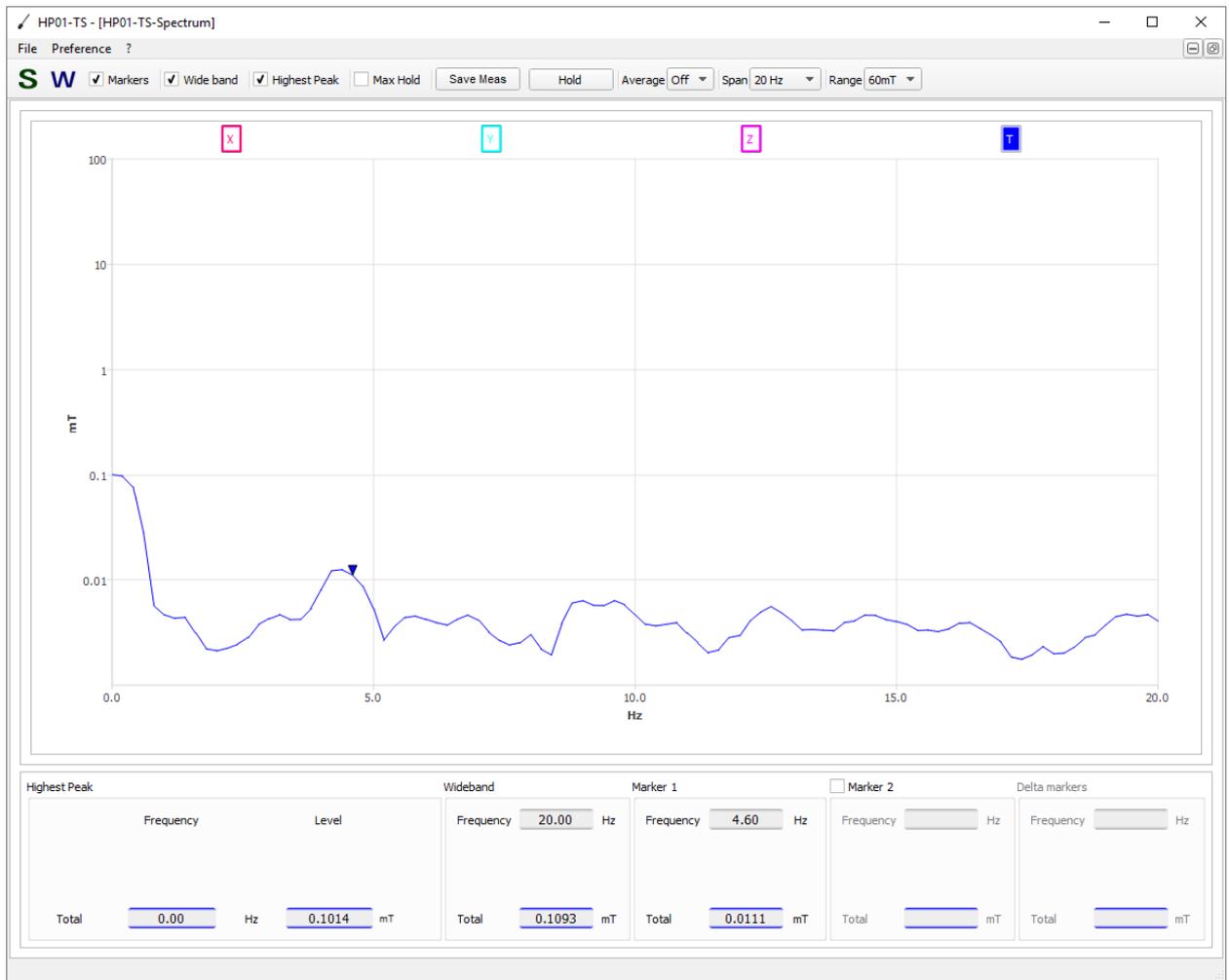
Fig.4-19 Spectrum graph

A second marker can be also enabled. In this way the two values are shown (Marker 1 and Marker 2) and also the difference between them (Delta Markers) is displayed.

The desired Span can be selected among four choices available, as depicted below.
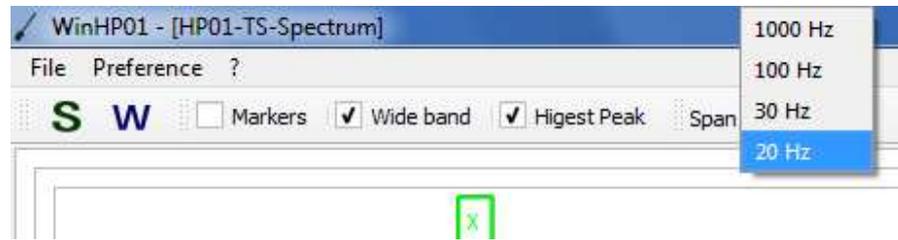
Fig.4-20 Span selection

Spectrogram and **Waterfall:** the buttons "**S**" and "**W**" allow the User to select the waterfall display. It can be the Spectrogram (2D) view or the Waterfall (3D) view.
The Waterfall graph is used to explore the trend, over time, of the signals in the frequency domain.

4.5 Waterfall mode

In addition to the spectrum view, another representation has been introduced in the software, commonly called Waterfall.

The advantage of this view is that the disturbances are shown with different colors depending on their strength. This helps evaluate level variations over time and to easily investigate sporadic signals.

HP01-TS implements both a bidimensional Spectrogram plot and a tridimensional Waterfall graph. The two dimensions are frequency and time and the third dimension is the level. Level variations can also be distinguished by differences in color.

In this way, it is possibile to detect and track time-varying signals.

The ranges for Frequency and Level are the same as the Spectrum view.

When entering the **Waterfall** function a screen similar to the following appears:
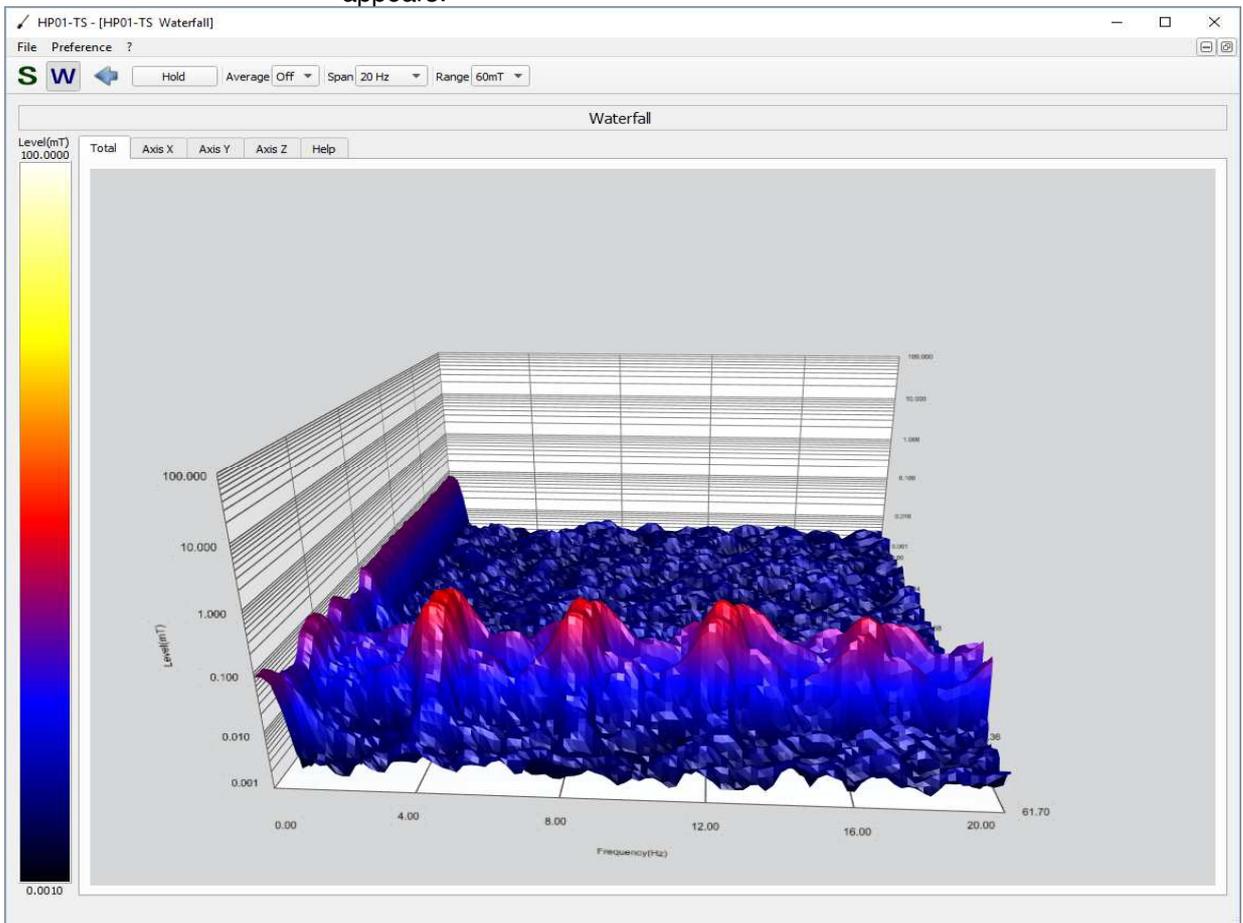
Fig.4-21 Waterfall screen

The Waterfall graphs need OpenGL® version 3.0 or grater.

Tick "don't show this message again" to hide the pop-up for the future.
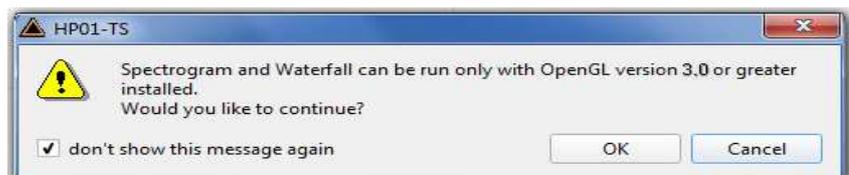
Fig.4-22 OpenGL version warning

Description   **4-19**

In the **Graph 2D,** the horizontal axis represents Frequency, the vertical axis is the Time and the color is the Level.

The signal amplitude is represented in a scale of arbitrary colors, usually the darker the lower and the brighter the higher, like in thermography.

The Color Scale referenced to levels and units, is indicated on the left bar on the screen.
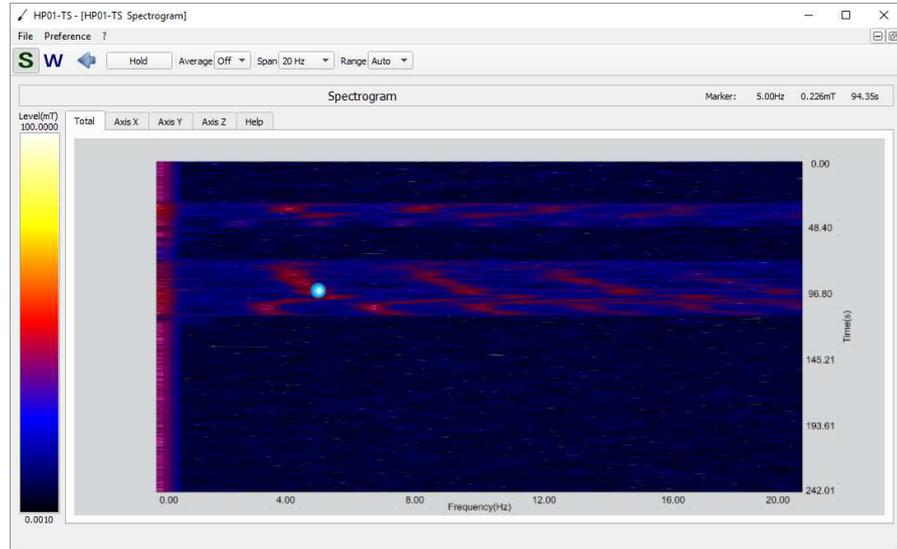
Fig.4-23 Waterfall: 2D Graph

A Marker function is also available, to allow investigating a specific signal.
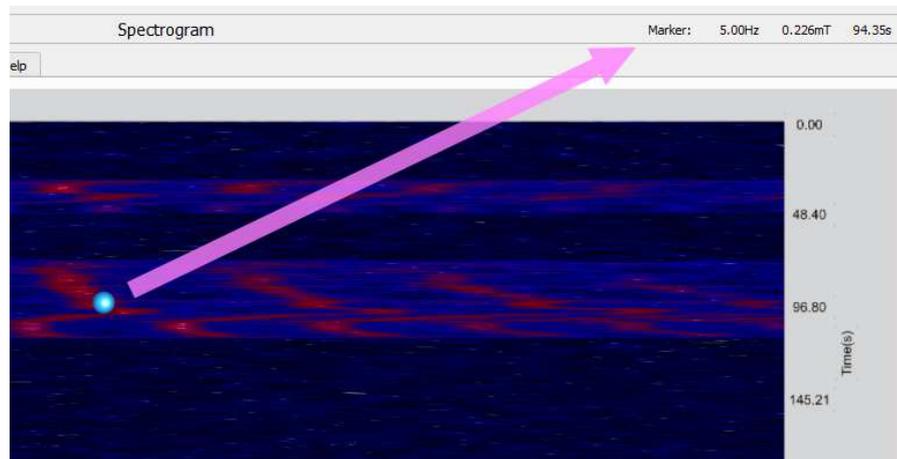
Fig.4-24 2D Marker

In the box indicated by the arrow it is shown the Frequency of the Marker (5.00 Hz in the example above), the level (0.226 mT) and the time of the trace since the waterfall window was started. You can place a marker anywhere on the spectrum display with a mouse click.
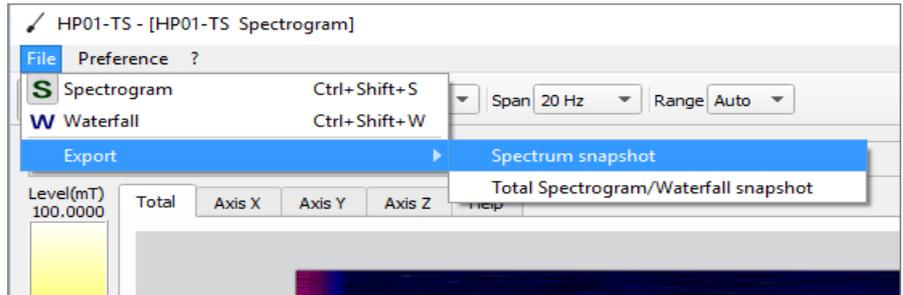
Fig.4-25 Export tool

The Export tool allows the User to save the screen snapshot.

In the **Graph 3D,** one axis (horizontal) represents Frequency, another the Level (vertical) and the third the Time (depth).

For this mode, the marker can be placed by a left click of the mouse over any point of the signals, while the graph aspect can be changed as desired by clicking the right button and dragging the mouse in a simple and intuitive way. Use the mouse wheel for zooming.
By choosing the appropriate functions, pointing the most suitable area, the User can move, rotate and zoom the view to his liking, simply using the mouse.
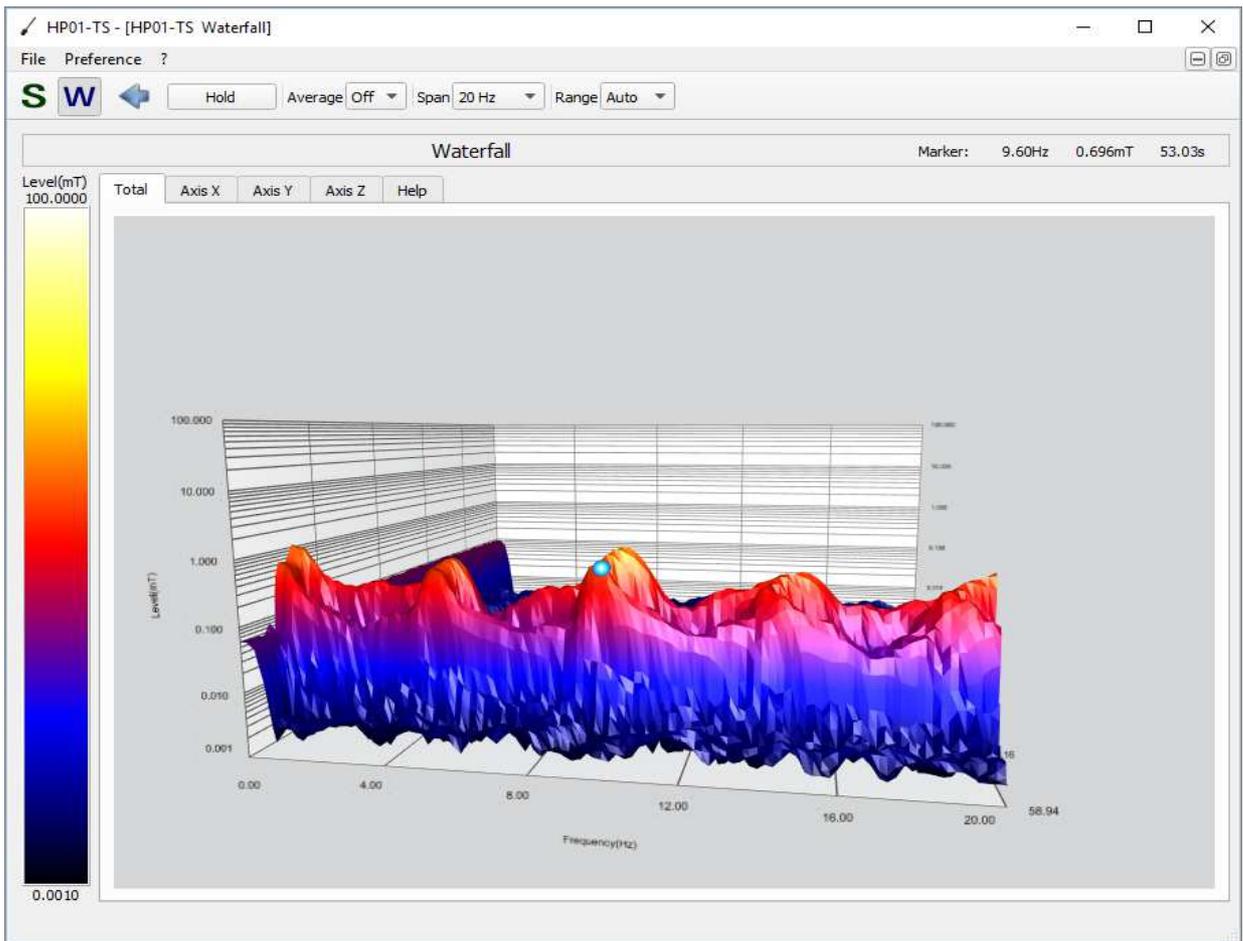
Fig.4-26 Waterfall: 3D Graph

Description   **4-21**

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5 – Update Firmware

5.1 Update firmware

The HP-01 internal firmware can be updated easily by the user.

This section provides all the information required for firmware updating.

The Update Firmware Program is available after HP-TS package installation.

5.2 To run the update software

Turn off the HP-01 and connect it to a free USB port of the PC.
Run **HP-01 Update Firmware** to start the update program.

Fig.5-1 HP-01 Update software icons

5.3 To transfer data

Main window displayed after the updating program **HP-01 Update Firmware** has been run:

Fig.5-2 HP-01 Upgrading utility main window

Select USB or RS232 communication port.
Before selecting RS232 port, choose the COM port used.

NOTE The User should check that the battery level is at least 3.9 V before starting the upgrade.
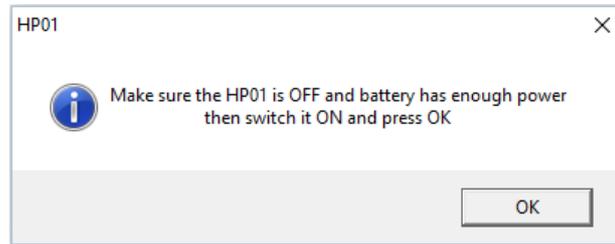
Fig.5-3 Switch HP-01 on

As soon as the connection is established, a message informs to turn the HP-01 **OFF** and turn it **ON** again; press **OK** to confirm.

The following window will appear:
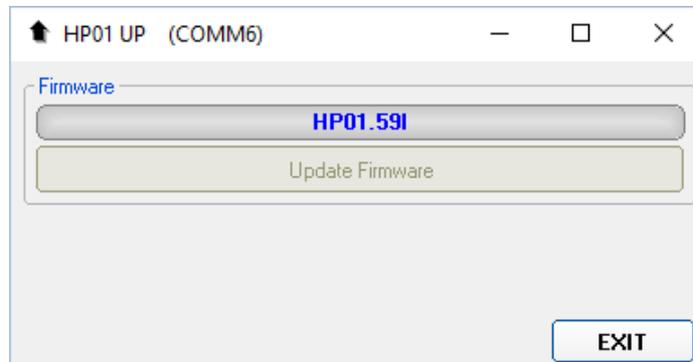
Fig.5-4 Update firmware

The firmware components can be updated by this application. The: Firmware is the main analyzer internal program and it is automatically stored within the HP01-TS directory during HP01-TS software installation. To start the process simply select **Update Firmware** button, and wait (less than one minute) until the automatic transfer is completed.
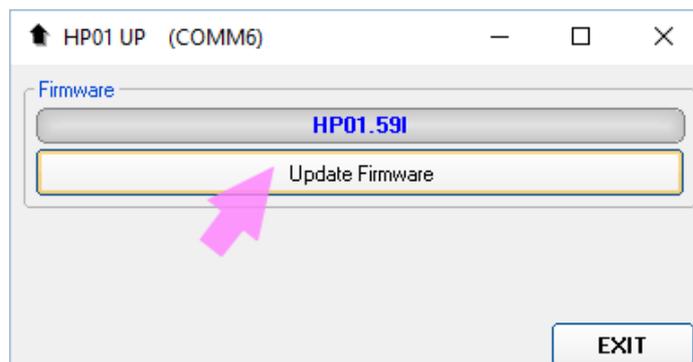
Fig.5-5 Update firmware button

In case of problems in the data communication with the HP-01, the following message will be displayed.
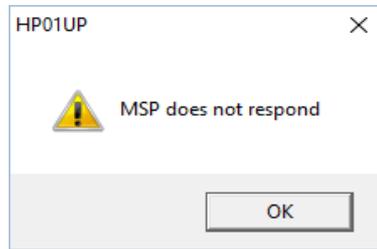
Fig.5-6 Error message

During proper data transfer, a progressive bar is displayed.
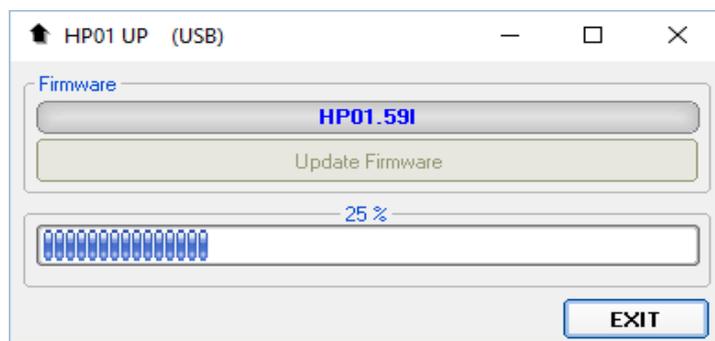
Fig.5-7 Progressive bar

At the end, a message informs if the update has been successfully performed.
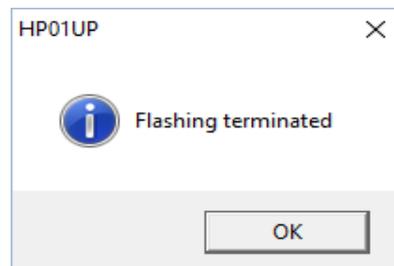
Fig.5-8 Flashing terminated

Turn the HP-01 **OFF** (it could seem to be already OFF but it is not) and turn it **ON** again.

The HP-01 is now updated with the new version of the internal firmware.

It is now possible to disconnect the cable connected to the PC, with the HP-01 meter either switched on or off.

Subsequently, when the meter is switched on again, the new version will be displayed in the 8053B or HP01-TS application software.

To obtain firmware or FPGA or program updates for HP-01, please contact your NARDA distributor or download it directly from the NARDA Web site http://www.narda-sts.it

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6 – Uninstalling Software

6.1 Uninstalling HP-TS Software

It is possible to remove the HP-TS software from the PC according to the following procedure:

Run the Uninstall HP01-TS utility.

Fig.6-1 Uninstall icon

Follow the uninstaller instructions.

Fig. 6-2 Uninstalling HP01-TS

Before removing any shared system file, the uninstaller will ask for a confirmation.
Answer "NO" in case you are not sure whether the showed system file is required for other applications.
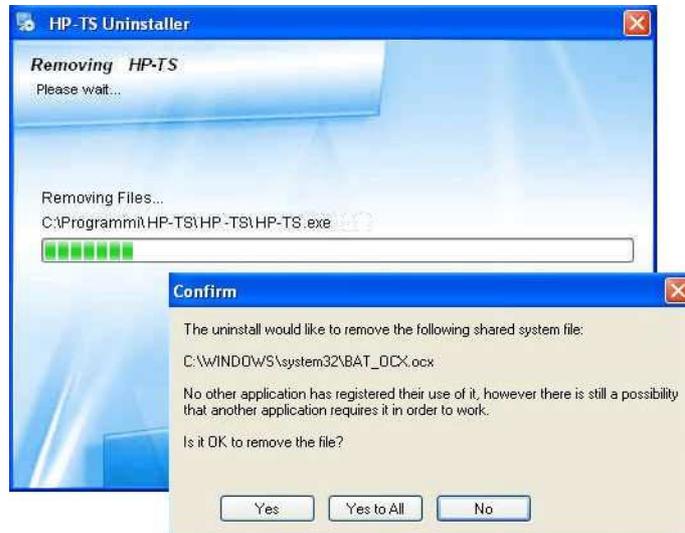
Fig.6-3 File remove confirmation request

Fig.6-4 Uninstallation successful

HP01-TS software is now removed from the system, click "Finish" to close uninstaller utility

7 – Uninstalling USB-OC

7.1 Uninstalling driver for USB-OC

It is possible to remove the USB-OC driver from the PC according to the following procedure.

NOTE

The following procedure shows how to remove the driver in Windows 7 or higher environment.

Click Control Panel → Programs and Features. Look for the "PL-2303 USB-to-Serial" program and click the **Uninstall** button.

Fig.7-1 Uninstall driver program

Select **Remove** and click **Next** button to continue.

Click **Yes** to confirm.
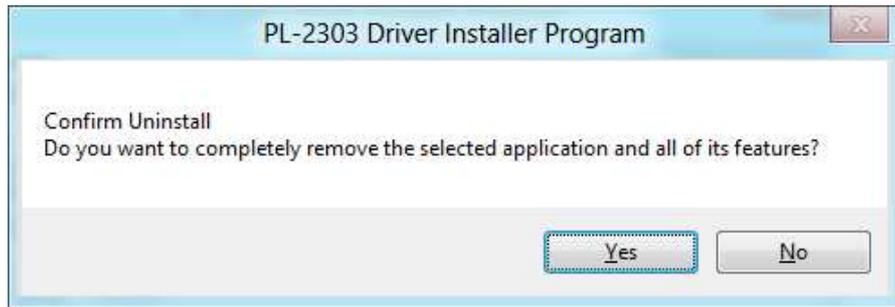
Click "finish" to exit the uninstaller; USB driver is now removed from your system.

8 - Accessories

8.1 Introduction

This section provides information required for installing and using accessories for HP-01 Analyzer.
Information is included regarding initial inspection, power requirements, interconnections, work environment, assembly, cleaning, storage and shipment.
The following general information is applicable to all accessories.

8.1.1 Preliminary inspection

Inspect the packaging for any damage.

If the packaging or anti-shock material have been damaged, check that the contents are complete and that the product has not suffered electric or mechanical damage.
Check that all the Accessories are there against the checklist found with the apparatus.
Inform the carrier and NARDA of any damage that has occurred.

> NOTICE

8.1.2 Work environment

Unless otherwise specified, the work environment of the Accessories, must come within the following conditions:

- Temperature   From -10°C to +50° C (0°C to 40°C for Battery Charger)
- Humidity   < 90% relative

The Accessories must be stored in a clean and dry environment, free from dust, acids and humidity.
The storage environment must come within the range of the following conditions:

- Temperature   From -30°C to + 70°C (-20°C to 60°C for Battery Charger)
- Humidity   < 95% relative

8.1.3 Return for repair

When the Accessories need to be returned to NARDA for repair, please complete the questionnaire appended to this User's Manual, filling in all the data that will be useful for the service you have requested.

For reducing the period of time required for the repairs, it is necessary to be as specific as possible in describing the problem. If the problem only occurs in certain circumstances, please describe in detail how it happens.
If possible it is better to reuse the original packaging; making sure that the apparatus is wrapped in thick paper or plastic.
Otherwise, use strong packaging by using a sufficient quantity of shock absorbent material around all sides of the product to ensure that it is compact and does not move around inside the package.
In particular, take every precaution to protect the front panels.
Finish the package by sealing it up tightly.
Apply a FRAGILE label to the package to encourage greater care in its handling.

8.1.4 Cleaning

Use a dry, clean and non-abrasive cloth for cleaning the instruments.

> NOTICE

Do not use solvents, acids, turpentine, acetone or other similar products for cleaning the devices in order to avoid damaging them.

8.1.5 Power supply and battery chargers

HP-01 accessories are powered by either internal rechargeable batteries or directly from other devices which they are connected to.

The AC/DC battery charger can be used with a power frequency at either 50 Hz or 60 Hz with a supply voltage between 100 and 240 AC Volt. International AC plug adapters are provided according to the various national standards.

AC plug adapter can be easily removed from the battery charger to be replaced by a different one.

To have the greatest autonomy, a full recharging cycle should be carried out before using the Accessories.

ALWAYS connect the battery charger to the mains BEFORE connecting to the charge input of the accessories.
The battery charger has an internal protective circuit that will break the output if any load is detected while connecting to the mains.

Battery charger:
output: DC, 10 - 15 V, ~ 500 mA

Connector:
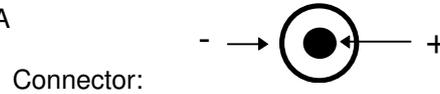
In order to preserve battery efficiency a complete recharge cycle is required before storing them for periods longer than 4 months. Therefore, it is warmly suggested recharging the batteries at least every 4 months even though the device has not been used.

Software and Firmware updates for Accessories can be downloaded from the Web site http://www.narda-sts.it or requested directly from NARDA Sales Centres.

Danger: high static magnetic fields – as found, for example, around an MRI or NMR spectroscopy magnet – will subject ferromagnetic parts to strong forces.
To prevent injury from flying objects or whiplashing cables, be sure to hold these components securely when you are around a strong magnet.

8.2   *USB-OC Optical USB Converter*

8.2.1 Introduction

USB-OC is standard accessory of the HP-01 Analyzer.

It converts the signals of some of the system's accessories, which are only connected via fiber optic, into USB-compatible signals. It, therefore, makes it possible to link the following items up to the USB port of any Personal Computer to operate them in conjunction with specific application software and for firmware updating:

- EHP-50F Electric and Magnetic Field Analyzers, 1Hz-400kHz
- EHP-200A Electric and Magnetic Field Analyzers, 9kHz-30MHz
- EHP-200AC Electric and Magnetic Field Analyzers, 3kHz-30MHz
- NBM-550 Broadband meter
- FieldMan electromagnetic field meter
- HP-01 Magnetometer, DC to 1000 Hz

USB-OC is indispensable for updating the internal firmware of the above-mentioned items via a Personal Computer and the related update software is available free-of-charge on NARDA's Web site at **http://www.narda-sts.it**

8.2.2 Installation

Insert USB-OC in the connector of a free USB port of the PC, connect the fiber optic coming from the probe or other Accessories treating the locating key with care.

Considering the very low consumption of the device, the power required by USB-OC is taken directly from the USB port of the PC. This means no maintenance is needed.

Table 8-1 Technical specifications of the USB-OC Optical USB Converter	
Max. length of the fiber optic	40 m (10m with EHP-200A/AC)
USB Connector	Type A Male

NOTE

The link between USB-OC and a HUB USB device or USB cable extension could not work properly. Connect the USB-OC to the PC directly.

Front view

Key:

Fiber optic connector

Rear view

Key:

USB Type A Male

Fig. 8-1 USB-OC adapter

Power supply

USB-OC is powered directly from the USB port of the PC.

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Accessories

9 - Communication protocol

9.1 Disclaimer

This chapter provides the information required to control the HP-01 Magnetometer via the fiber optic connected to a PC and by means of user's own PC software applications. Narda STS s.r.l supports the correctness of the information only, and disclaim for any consequence the use of such information may cause to anybody. The inclusion of Narda's communication protocol into User's or third party software is entirely at the User's risks and responsibility. In no way Narda STS s.r.l shall be liable for damages of any kind consequent to the use of the information provided in this chapter.

9.2 Protocol

The serial communication between PC and Narda HP-01 Magnetometer is the USB standard (via the USB-OC Optical Converter).
Specifications:
- Rate 115200 baud
- No Parity
- Data: 8 bits
- Start: 1 bit
- Stop: 1 bit

The commands are composed by an ASCII string delimited by "**#**" (0x23) and "*****" (0x2A)

Every command must start with the header **H1**.

The answer can be either in ASCII or Binary, according to the command sent.

NOTE

The HP-01 must be switched on in PC mode in order the communication protocol to work properly.
This is the same standard mode used with the provided software.
If the Magnetometer will continue sending measurement data independently by receiving commands, it is likely that it was switched on in 8053B mode (this is the way the probe communicates with the optional handheld field meter).
When the unit is switched on in 8053B mode but it fails to establish a communication with the portable field meter, it turns automatically to PC mode.
Please, push the POWER button briefly (before the Power-on LED turns orange) to switch the HP-01 on in PC mode.
Push and release the button to switch the unit off.
To force hardware switching off, press and hold the button for, at least, 10 seconds.

NOTE

To save battery, the HP-01 turns automatically off 10 minutes after last received command.

NOTE

HP-01 is off during battery charge.

9.3 LEDs behaviour   **DATA LED**

Right after HP-01 switched on, DATA LED remains RED for 500ms.
Then it starts blinking. The on and off periods depend on:
- Sensor range: The time DATA LED is on is longer when HP-01 is in high range mode than when HP-01 is in low range mode.
- Span: The time DATA LED is off is longer with narrower spans (higher span id) than with broader spans (lower span id).

DATA LED changes to green (still blinking with the same periods as described above) as soon as HP-01 receives a recognised command.
The green color lasts for 2s; then DATA LED changes back to red.

DATA LED blinks green (same periods as described above) when HP-01 successfully communicates with 8053B.
The green color lasts for 2s since last successful communication; then DATA LED switches to red.

DATA LED is off when HP-01 is being charged.

Power-on LED

Power-on LED blinks (roughly with 0.5s-period) only when HP-01 is powered.

When HP-01 is still on charge Power-on LED is orange; whereas when HP-01 has finished charging (still powered), Power-on LED is green.

Power-on LED blinks red when the User tries to switch off HP-01 when powered (not allowed action).

Power-on LED blinks red when HP-01 is going to switch off after a period of inactivity (10 minutes).
Auto-switch-off blinking starts in the last 30 seconds of activity and it becomes faster in the very last 5 seconds.

Power-on LED is orange during the sensor zeroing process.

On switch on, Power-on LED is normally orange (PC mode).
On 8053B-mode switch-on (button pressed twice), Power-on LED is green.
Power-on LED is green during the whole pairing process with 8053B, until a successful communication with 8053B is established.
Then Power-on LED turns off.

9.4 HP-01 COMMANDs

Following are Commands to control and set various operating modes of the HP-01 Magnetometer, that can be distinguished in two main categories:

- **Query Commands: ?**
- **Setting Commands: S**

The commands have this format:
#H1Qcommand(parameters)* where:

# = command string start
H1 = header string always present (model identifier)
Q = **?** for query commands
S for setting commands
Command = command string
(parameters) = setting parameters value (where present)
***** = command string end

All commands, except for **#H1?SPC***, produce a reply which contains the command itself.
Example: **#H1?SPA*** Reply: **SPA=0**.

In the case of an unrecognized command (available commands are **?** and **S**),
HP-01 replies with **Command ERROR.**
Example: **#H1&SPA*** Reply: **Command ERROR**

In the case of a wrong command field, HP-01 replies with the received command followed by **ERROR** string**.**
Example: **#H1?SIPA*** Reply: **SIPA ERROR.**

Query COMMANDs

Syntax	Function
#H1?BAT*	Battery voltage.
#H1?DCE*	Filter output 3dB@1Hz
#H1?FLD <f>*	3-axis field value at <f>Hz (Verbose).
#H1?FLP<a> <fs>,<fe>*	Wide band field (channel power) over [<fs>,<fe>]Hz span on axis <a>.
#H1?FLS<a> <f>*	Field value at <f>Hz on axis <a>.
#H1?FLW<a> <fs>,<fe>*	Wide band field over [<fs>,<fe>]Hz span on axis <a>.
#H1?GDC <a>*	DC field on axis <a>.
#H1?IDN*	Instrument identifier and firmware version.
#H1?MAX<a>*	Peak's amplitude and frequency on axis <a>.
#H1?RDF*	Data and Spectrum availability (query-specific).
#H1?RDY*	Data and Spectrum query command (global).
#H1?RNG*	Current sensor range (Automatic, Low or High).
#H1?SPA*	Current span id (0,1,2, or 3).
#H1?SPC*	Binary spectrum data.
#H1?TMP*	Temperature and humidity.

Setting COMMANDs

Syntax	Function
#H1SDCE*	Enable DCE mode (0,1, or 2)
#H1SSPA*	Current span id (0,1,2, or 3).
#H1SRNG*	Current sensor range (Automatic, Low or High).
#H1SZESI*	Initiate sensor zeroing

9.4.1 Query Commands   Query commands ask the instrument about a specific status; it responds back with a message containing the requested information.
Query commands contain a **?** character in the command string.

Command	Description	Example
?BAT	Battery voltage query command. The reply gives back the voltage in V of the battery	Example: **#H1?BAT*** Reply: **3.99**
?DCE	Field values at the output of the filter (3dB@1Hz). This command is valid only in DCE mode, see #H1SDCE* related section. The reply is in the format: ***DCE vx;px;X;vy;py;Y; vz;pz;Z;vt;T;u;n;*** where ***vx*** is the field on the ***x***-axis (similar for y, z axis and total field) ***px*** is the field polarity for ***x***-axis (similar for y, z axis and total field. ***u*** is the measurement unit ***n*** is a measurement index that spans from 0 to 31. Same index values means that no measurements have been performed meanwhile. + means an over-range has occurred.	Example: **#H1?DCE*** Reply: **DCE 0.0640;S;X;0.0581;S;Y;0.2200;S;Z;0.2364;T;mT;17** Example: **#H1?DCE*** Reply: **DCE 86.8121+;N;X;86.9110+;N;Y;50.1291+;S;Z;132.6755+;T;mT;12** Example: **#H1?DCE*** Reply: **DCE 0.0508;S;X;0.0813;S;Y;0.2257;S;Z;0.2453;T;T;24**
?FLD f	Verbose field query command. The command must specify the frequency f at which the field has to be evaluated. The reply is in the format: FLD (fHz) [u] x=a, y=b, z=c, tot=d where: f is the frequency in Hz at which the field has been measured u is the measurement unit a is the field on the x-axis b is the field on the y-axis c is the field on the z-axis d is the total field $(d=sqrt[a^2+b^2+c^])$ With static field measurements (f=0.0Hz), indication of field polarity (S or N) is given for the three axis x, y, and z. An error is returned when f is higher than the span. + means an over-range has occurred.	Example: **#H1?FLD 12.3*** Reply: **FLD (12.30Hz) [mT]** **x=0.02,y=0.02,z=1.29,tot=1.29** Example: **#H1?FLD 0.0*** Reply: **FLD (0.00Hz) [mT]** **x=0.00N,y=0.02N,z=0.05N,tot=0.06** Example: **#H1?FLD 2000*** Reply: **FLD ERROR** Example: **#H1?FLD 12.3*** Reply: **FLD (12.30Hz) [mT] x= 34.17+,y=23.44+,z=63.33+,tot=75.69+**

?FLP*a fs,fe*	Wide band field query command (channel power). The command can specify the axis *a* on which the field has to be evaluated (T for total field value). When no axis is indicated field values for X, Y, Z axis fields and T field are returned. The command must specify the frequency *f* range [*fs,fe*] in Hz. The reply is in the format: **FLP*v;u;fs,fe;a*** where: *v* is the wide band field on the *a*-axis *u* is the measurement unit *fs* is the start frequency in Hz. *fe* is the end frequency in Hz. *a* is axis which can be X, Y, Z, or T. Or in the format **FLP *vx;X;vy;Y;vz;X;vt;T;u;fs,fe;a*** where: *vx* is the wide band field on the *x*-axis (similar for y and z axis) *vt* is the total wide band field *u* is the measurement unit *fs* is the start frequency in Hz. *fe* is the end frequency in Hz. *a* is axis which can be X, Y, Z, or T. An error is returned when **fe** is lower than **fs**+10*(frequency resolution), or when **fe** is higher than the span. Frequency values may differ from the requested ones because they depend on the selected frequency resolution (span setting). + means an over-range has occurred	Example: **#H1?FLPX 10.3,110*** Reply: **FLP 1.349;mT;9.00,111.00;X** Example: **#H1?FLP 3,120.0*** Reply: **FLP 0.051;X;0.153;Y;0.077;Z;0.179;T;mT;3.00,120.00**

NOTE

"Channel Power Field" (FLP) represents the field integrated over full-amplitude bandwidth limits. The returned value is greater than Wide Band Field value (FLW).

| **?FLS***a f* | Field value query command. The command can specify the axis ***a*** on which the field has to be evaluated (T for total field value). When no axis is indicated field values for X, Y, Z axis fields and T field are returned. The command must specify the frequency ***f*** at which the field has to be evaluated. The reply is in the format:
FLS *v;u; f;a;[p]*
where:
v is the field on the ***a***-axis evaluated at frequency ***f***
u is the measurement unit
f is the frequency in Hz at which the field has been measured
a is axis which can be X, Y, Z, T.
Or in the format:
FLS *vx;X;vy;Y;vz;Z;vt;T;u;f*
where
vx is the field on the ***x***-axis (similar for y and z axis)
vt is the total field
u is the measurement unit
f is the frequency in Hz at which the field has been measured (this value may differ from the requested one because it depends on the selected frequency resolution (span setting)).

An error is returned when **f** is higher than the span.
+ means an over-range has occurred | Example: **#H1?FLSX 13.1***
Reply: **FLS 0.10;mT;12.00;X**

Example: **#H1?FLST 12.2***
Reply: **FLS 1.03;mT;12.2;T**

Example: **#H1?FLST 3000***
Reply: **FLS ERROR**

Example: **#H1?FLST 2.0***
Reply: **FLS 63.33+;mT;2.0;T**

Example: **#H1?FLS 0.0***
Reply: **FLS 62.06;X;61.87;Y;0.66;Z;87.63;T;mT;0.00** |

?FLW*a* **_fs,fe_**	Wide band field query command. The command can specify the axis ***a*** on which the field has to be evaluated (T for total field value). When no axis is indicated field values for X, Y, Z axis fields and T field are returned. The command must specify the frequency ***f*** range [***fs,fe***] in Hz. The reply is in the format: **FLW*v;u;fs,fe;a*** where: ***v*** is the wide band field on the ***a***-axis ***u*** is the measurement unit ***fs*** is the start frequency in Hz. ***fe*** is the end frequency in Hz. ***a*** is axis which can be X, Y, Z, or T. Or in the format **FLW*vx;X;vy;Y;vz;X;vt;T;u;fs,fe;a*** where: ***vx*** is the wide band field on the ***x***-axis (similar for y and z axis) ***vt*** is the total wide band field ***u*** is the measurement unit ***fs*** is the start frequency in Hz. ***fe*** is the end frequency in Hz. ***a*** is axis which can be X, Y, Z, or T. An error is returned when **fe** is lower than **fs**+10*(frequency resolution), or when **fe** is higher than the span. Frequency values may differ from the requested ones because they depend on the selected frequency resolution (span setting). + means an over-range has occurred	Example: **#H1?FLWX 12.3,100.2*** Reply: **FLW 1.03;mT; 12.00,99.00;X** Example: **#H1?FLWT 12.3,100.2*** Reply: **FLW 1.05;mT; 12.00,99.00;T** Example: **#H1?FLWT 4.2,16.2*** Reply: **FLW 0.50;mT; 4.2,16.2;T** Example: **#H1?FLW 12.3,13.0*** Reply: **FLW ERROR** Example: **#H1?FLW 8.03,200.2*** Reply: **FLW 22.62;X;22.50;Y;0.22;Z;31.91;T;mT;6.00,198.00**

NOTE

"Wide Band Field" (FLW) represents the field integrated over 3 dB bandwidth limits.
The returned value is lower than Channel Power Field value (FLP).

?GDC*a*	DC field value query command. The command can specify the axis **_a_** on which the field has to be evaluated (T for total field value). When no axis is indicated field values for X, Y, Z axis fields and T field are returned. The reply is in the format: **GDC *v;u;0,f;a;[p]*** where: ***v*** is the field on the **_a_**-axis ***u*** is the measurement unit ***f*** is the filter frequency in Hz related to the selected span ***a*** is axis which can be X, Y, Z, T. ***p*** is the field polarity (**S** or **N**) given only for scalar values (x, y, and z). Or in the format: **GDC _vx;px;X;vy;py;Y; vz;pz;Z;vt;T;u;0,f;_** where ***vx*** is the field on the **_x_**-axis (similar for y and z axis) ***px*** is the field polarity for **_x_**-axis (similar for y and z axis) ***u*** is the measurement unit ***f*** is the filter frequency in Hz related to the selected span + means an over-range has occurred	Example: **#H1?GDCX*** Reply: **GDC 0.10;mT;0,5.0;X;N** Example: **#H1?GDCT*** Reply: **GDC 0.79;T;mT;0,5.0** Example: **#H1?GDC*** Reply: **GDC 0.09;N;X;0.78;S;Y;0.09;N;Z;0.00;T;mT; 0,5.0**
?IDN	Identifier query. The answer displays the name of the machine, its serial number; the firmware version and date, and the calibration date.	Example: **#H1?IDN*** Reply: **IDN=HP-01 Narda; S/N:000AA00000; FW:A.50 06/16; Cal:21.06.16**
?MAX*a*	Peak's amplitude and frequency on axis **a**. The reply is in the format: **MAX _v;u;f;a_** where: ***v*** is the peak value of the field over the whole span ***u*** is the measurement unit ***f*** is the frequency in Hz of the peak value. ***a*** is axis which can be X, Y, Z, or T (default).	Example: **#H1?MAXZ*** Reply: **MAX 1.30;mT;12.00;Z** Example: **#H1?MAX*** Reply: **MAX 1.30;mT;12.00;T**

?RDF	Flag availability query command. The reply is in the format: **RDF=0+0x1**(x_rdy)**+0x2**(y_rdy)**+0x4**(z_rdy)**+0x08**(spectr_rdy) First 3 least-significant bits refer to new data availability (new data since last **FLD** or **FLS** or **FLW** or **GDC** queries are available). 4th least-significant bit refers to new spectrum availability (new spectrum since last **SPC** query are available). Queries about total field (e.g. **FLST** or **FLD**) reset all first 3 least-significant bits.	Example: **#H1?RDF*** Reply**: RDF=8** Spectrum ready (0b1000) Example: **#H1?RDF*** Reply**: RDF=4** z-data ready (0b0100) Example: **#H1?RDF*** Reply**: RDF=15** x, y, z -data and spectrum ready (0b1111)
?RDY	Spectrum and Data availability query command. The reply is in the format: **RDY=x** where: **Y:** new spectrum and data are both available **N:** no spectrum and no data are available (since last **SPC, FLD, FLW, FLS,** or **GDC** queries)	Example: **#H1?RDY*** Reply**: RDY=Y**
?RNG	Sensor range query command. The reply is in the format: **RNG=x** Where **x** reports on the span **A**: Automatic range **H**: High range **L**: Low range	Example: **#H1?RNG*** Reply: **RNG=L**
?SPA	Span mode query command. The reply is in the format: **SPA=x** where: **x** is an index to indicate the span **0**: 1000Hz span, 3Hz resolution **1**: 100Hz span, 1Hz resolution **2**: 30Hz span, 0.3Hz resolution **3**: 20Hz span, 0.2Hz resolution	Example: **#H1?SPA*** Reply: **SPA=0**
?SPC	Spectrum query command. The reply is the structure containing the spectrum info. See Spectrum Structure Paragraph.	Example: **#H1?SPC***
?TMP	Temperature and humidity query command. The reply is in the format: **TMP=t;h** where: **t** is the temperature in °C **h** is the humidity in %	Example: **#H1?TMP*** Reply: **TMP=29.49;45.1**

9.4.2 Setting COMMANDs

Setting commands set the instrument; it responds back with a message containing the set parameter.

Setting commands contain a **S** character in the command string.

Command	Description	Example
SSPA	Span mode setting command. The command must be in the format **SPA x.** The reply is in the format: **SPA=x** where: **x** is an index to indicate the span **0**: 1000Hz span, 3Hz resolution **1**: 100Hz span, 1Hz resolution **2**: 30Hz span, 0.3Hz resolution **3**: 20Hz span, 0.2Hz resolution	Example: **#H1SSPA1*** Reply: **SPA=1**
SRNG	Sensor range setting command. The command must be in the format **RNG x.** The reply is in the format: **RNG=x** where: **x** is an index to indicate the span **A**: Automatic range **H**: High range **L**: Low range In automatic mode, sensor range is selected automatically to optimize the sensitivity and avoid saturation phenomena. When High or Low mode are selected, respectively, high and low sensor range is enforced.	Example: **#H1SRNG*** Reply: **RNG=L**
SZESI	Initiate sensor zeroing. Process starts printing **Zeroing sensors...** and ends with **Successful zeroing**	Example: **#H1SZESI*** Reply: **Zeroing sensors...** **LOW -- Offsets:24;-18;26** **HIGH -- Offsets:23;-20;9** *Different Low range trials outcomes* ****LOW**** **Offset:22,65518,23 DC fields:0.0,0.0,0.0** ********** *Different High range trials outcomes* ****HIGH**** **Offset:22,65518,23 DC fields:0.0,0.0,0.0** ********** **Successful zeroing**

| SDCE | DCE mode setting command.
The command must be in the format **DCE x.**
The reply is in the format: **DCE=x**
where:
x can be
0: No DCE mode, standard FFT mode
1: DCE mode
2: DCE mode, automatic DCE values, 15 measurements per second. Reply formatted as described for #H1?DCE* command.

DCE mode makes unavailable commands such as SPA, GDC, FLS, etc. In case of one of these commands, the reply would be "DCE ERROR". | Example: **#H1SDCE 0***
Reply: **DCE=0**

Example: **#H1SDCE 1***
Reply: DCE=1

Example: **#H1SDCE 2***
Reply:
DCE=2
DCE
0.0698;N;X;0.0602;S;Y;0.3048;S;Z;0.3 185;T;mT;21
DCE
0.0704;N;X;0.0598;S;Y;0.3050;S;Z;0.3 187;T;mT;22
… |

9.4.3 Analyzer reply

The HP-01 Magnetometer replies to the command **?SPC** sending back an array of bytes which contains all the information needed to draw a sweep.

Typically, the User should first send the HP-01 all the setting commands to insure the analyzer is correctly set with the wanted parameters, and then ask for the spectrum and read the reply.

Spectrum Structure

Header

Bytes	Position	Mnemonic	Type	Description
2	0	bytes2beSent	Uint	Total number of bytes
2	2	Reserved	Uint	
2	4	Bat	Uint	Battery
2	6	SpanId	Uint	Id of Span
2	8	Range	Uint	Id of Range
2	10	Bins	Uint	Used Bins (frequencies)
2	12	overrange	Uint	0:no overflow, >0:overflow
2	14	Reserved	Uint	
4	16	scaleFact X	float	Factor For X Axis
4	20	scaleFact Y	float	Factor For Y Axis
4	24	scaleFact Z	float	Factor For Z Axis
4	28	Reserved	float	

Spectrum X

Bytes	Position	Mnemonic	Type	Description
2	32	1st bin lev	Uint	Level to be multiplied by scaleFact X
2	34	2nd bin lev	Uint	….
2	…		… Uint	….
2	32+2*bins	Last Bin Lev	Uint	….

Spectrum Y

Bytes	Position	Mnemonic	Type	Description
2	2+32+2*Bins	1st bin lev	Uint	Level to be multiplied by scaleFact Y
2	4+32+2*Bins	2nd bin lev	Uint	….
2	…		… Uint	….
2	32+4*Bins	Last Bin Lev	Uint	….

Spectrum Z

Bytes	Position	Mnemonic	Type	Description
2	2+32+4*Bins	1st bin lev	Uint	Level to be multiplied by scaleFact Z
2	4+32+2*Bins	2nd bin lev	Uint	….
2	…		… Uint	….
2	32+6*Bins	Last Bin Lev	Uint	….
2	2+32+6*Bins	Reserved	Uint	

Terminator

Bytes	Position	Mnemonic	Type
2	4+32+6*Bins	**	dual char

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Communication protocol

Caro cliente

grazie per aver acquistato un prodotto NARDA! Sei in possesso di uno strumento che per molti anni ti garantirà un'alta qualità di servizio. NARDA riconosce l'importanza del Cliente come ragione di esistenza; ciascun commento e suggerimento, sottoposto all'attenzione della nostra organizzazione, è tenuto in grande considerazione. La nostra qualità è alla ricerca del miglioramento continuo. Se uno dei Suoi strumenti NARDA necessita di riparazione o calibrazione, può aiutarci a servirla più efficacemente compilando questa scheda e accludendola all'apparecchio.

Tuttavia, anche questo prodotto diventerà obsoleto. In questo caso, ti ricordiamo che lo smaltimento dell'apparecchiatura deve essere fatto in conformità con i regolamenti locali. Questo prodotto è conforme alle direttive WEEE dell'Unione Europea (2002/96/EC) ed appartiene alla categoria 9 (strumenti di controllo). Lo smaltimento, in un ambiente adeguato, può avvenire anche attraverso la restituzione del prodotto alla NARDA senza sostenere alcuna spesa. Può ottenere ulteriori informazioni contattando i venditori NARDA o visitando il nostro sito Web www.narda-sts.it.

Dear Customer

thank you for purchasing a NARDA product! You now own a high-quality instrument that will give you many years of reliable service. NARDA recognizes the importance of the Customer as reason of existence; in this view, any comment and suggestion you would like to submit to the attention of our service organization is kept in great consideration. Moreover, we are continuously improving our quality, but we know this is a never ending process. We would be glad if our present efforts are pleasing you. Should one of your pieces of NARDA equipment need servicing you can help us serve you more effectively filling out this card and enclosing it with the product.

Nevertheless, even this product will become obsolete. When that time comes, please remember that electronic equipment must be disposed of in accordance with local regulations. This product conforms to the WEEE Directive of the European Union

(2002/96/EC) and belongs to Category 9 (Monitoring and Control Instruments). You can return the instrument to us free of charge for proper environment friendly disposal. You can obtain further information from your local NARDA Sales Partner or by visiting our website at **www.narda-sts.it**.

☑ **Servizio richiesto:** ☑ *Service needed*:

☐ Solo taratura   ☐ Riparazione   ☐ Riparazione & Taratura   ☐ Taratura SIT   ☐ Altro:
☐ Calibration only   ☐ Repair   ☐ Repair & Calibration   ☐ Certified Calibration   ☐ Other:

Ditta:
Company:

Indirizzo:
Address:

Persona da contattare: **Telefono:**
Technical contact person: *Phone n.*

Modello: **Numero di serie:**
Equipment model: *Serial n.*

☑ *Accessori ritornati con l'apparecchiatura:* ☐ **Nessuno**   ☐ **Cavo(i)**   ☐ **Cavo di alimentazione**   **Altro:**
☑ *Accessories returned with unit:*   ☐ None   ☐ Cable(s)   ☐ Power cable   Other:

☑ *Sintomi o problemi osservati:* ☑ *Observed symptoms / problems*:

☑ *Guasto*: ☐ **Fisso**   ☐ **Intermittente**   *Sensibile a :* ☐ **Freddo**   ☐ **Caldo**   ☐ **Vibrazioni**   ☐ **Altro**
☑ *Failure*: ☐ Continuous   ☐ Intermittent   *Sensitive to*: ☐ Cold   ☐ Heat   ☐ Vibration   ☐ Other

Descrizione del guasto/condizioni di funzionamento:
Failure symptoms/special control settings description:

Se l'unità è parte di un sistema descriverne la configurazione:
If unit is part of system please list other interconnected equipment and system set up:

Suggerimenti / Commenti / Note:
Suggestions / Comments / Note: