



ROHDE & SCHWARZ

Test and Measurement
Division

Service Manual

Power Meter

R&S[®] NRP

1143.8500.02

Printed in the Federal
Republic of Germany

Dear Customer,

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.
Trade names are trademarks of the owners.

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**Contents of Manuals for Power Meter R&S NRP
Service and Repair**

Tabbed Divider

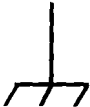
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Safety Instructions

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 standards.

To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

Safety-related symbols used on equipment and documentation from R&S:

							
Observe operating instructions	Weight indication for units >18 kg	PE terminal	Ground terminal	Danger! Shock hazard	Warning! Hot surfaces	Ground	Attention! Electrostatic sensitive devices require special care

- The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:
IP degree of protection 2X, pollution severity 2, overvoltage category 2, only for indoor use, altitude max. 2000 m.
The unit may be operated only from supply networks fused with max. 16 A.
Unless specified otherwise in the data sheet, a tolerance of $\pm 10\%$ shall apply to the nominal voltage and of $\pm 5\%$ to the nominal frequency.
- For measurements in circuits with voltages $V_{rms} > 30$ V, suitable measures should be taken to avoid any hazards.
(using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).
- If the unit is to be permanently wired, 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.
- For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.
- Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.
If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.
- Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.
- It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.
Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.
- If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.
If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.
- Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.
Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.
Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.
Only original parts may be used for replacing parts relevant to safety (eg power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety.
(visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

continued overleaf

Safety Instructions

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| <p>10. Ensure that the connections with information technology equipment comply with IEC950 / EN60950.</p> <p>11. Lithium batteries must not be exposed to high temperatures or fire.
Keep batteries away from children.
If the battery is replaced improperly, there is danger of explosion. Only replace the battery by R&S type (see spare part list).
Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.
Do not short-circuit the battery.</p> <p>12. Equipment returned or sent in for repair must be packed in the original packing or in packing with electrostatic and mechanical protection.</p> | <p>13. Electrostatics via the connectors may damage the equipment. For the safe handling and operation of the equipment, appropriate measures against electrostatics should be implemented.</p> <p>14. The outside of the instrument is suitably cleaned using a soft, lint-free dustcloth. Never use solvents such as thinners, acetone and similar things, as they may damage the front panel labeling or plastic parts.</p> <p>15. Any additional safety instructions given in this manual are also to be observed.</p> |
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Qualitätszertifikat

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde & Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde & Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO 9001 und ISO 14001 zertifiziert.

Certificate of quality

Dear Customer,

You have decided to buy a Rohde & Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde & Schwarz quality management system is certified according to standards such as ISO 9001 and ISO 14001.

Certificat de qualité

Cher client,

Vous avez choisi d'acheter un produit Rohde & Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde & Schwarz a été homologué, entre autres, conformément aux normes ISO 9001 et ISO 14001.



ROHDE & SCHWARZ

Spare Parts Express Service

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In case of urgent spare parts requirements for this Rohde & Schwarz unit, please contact our spare parts express service.

Outside business hours, please leave us a message or send a fax or e-mail. We shall contact you promptly.

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Contents of Manuals for Power Meter R&S NRP

Service Manual

The service manual informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S NRP by the replacement of modules.

The service manual comprises four chapters and an annex (chapter 5) containing the R&S NRP circuit documentation:

- | | |
|------------------|---|
| Chapter 1 | provides all the information necessary to check for compliance with rated specifications. The required test equipment is included, too. |
| Chapter 2 | describes the manual adjustment of the calibration source and of the frequency accuracy as well as the automatic adjustment of individual module data following module replacement. |
| Chapter 3 | describes the design as well as simple measures for repair and fault diagnosis, in particular, the replacement of modules. |
| Chapter 4 | contains information on the extension and modification by installing instrument software and retrofitting options. |
| Chapter 5 | describes the shipping of the instrument and ordering of spare parts and contains spare parts lists and exploded views. |

Operating Manual

In the operating manual you will find information about the technical specifications, the controls and connectors on the front and rear panel, necessary steps for putting the instrument into operation, the basic operating concept, manual and remote control.

For introduction typical measurement tasks are explained in detail using the functions of the user interface and program examples.

The operating manual further provides hints on preventive maintenance and fault diagnosis by means of warnings and error messages output by the unit.

Service and Repair

Please contact your Rohde & Schwarz support center or our spare parts express service if you need service or repair of your equipment or to order spare parts and modules.

The list of the Rohde & Schwarz representatives and the address of our spare parts express service are provided at the beginning of this service manual.

We require the following information in order to answer your inquiry fast and correctly and to decide whether the warranty still applies for your instrument:

- Instrument model
- Serial number
- Firmware version
- Detailed error description in case of repair
- Contact partner for checkbacks

Rohde & Schwarz offers the following calibrations:

- Calibration on R&S-type test systems. The calibration documentation meets the requirements of the quality management system ISO 9000.
- Calibration at an R&S calibration center approved by the German Calibration Service (DKD). The calibration documentation consists of the DKD calibration certificate.

Refer to Chapter 5 for a detailed description on shipping of the instrument and ordering of spare parts.

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1 Performance Test

This part of the service manual describes the steps for testing the R&S NRP base unit and its installed options with respect to function and compliance with specifications.

Test Instructions

- The tests are to be performed at an ambient temperature of 20 °C to 25 °C. The R&S NRP base unit must be switched on at least one hour prior to start of testing.
- The test limits used in the following sections are based on the data sheet. However, they are valid only under the conditions defined in the corresponding test step. They are therefore not legally binding as accuracy specifications; only data sheet specifications are legally binding.
- Entries on the Power Meter R&S NRP are abbreviated as follows:
 - [<KEY>] Press a key on the front panel, e.g. [**ZERO/CAL**].
 - [<SOFTKEY>] Press a softkey, e.g. [Sensor], or select a menu item.
 - [<nn unit>] Enter a value and terminate it with a unit, e.g. [**50 MHz**].Successive entries are separated by [:], e.g. [**FREQ : 3 GHz**].

Required Measuring Equipment and Accessories

Table 1-1 Required measuring equipment and accessories

Item	Instrument type	Recommended characteristics	Recommended instruments	R&S Order No.	Application
1	Power sensor		R&S NRP-Z11 or R&S NRP-Z21	1138.3004.02 1137.6000.02	Testing of sensor connectors, hardware trigger and analog outputs
2	PC	IEC bus interface, USB host interface, 10/100Base-T Ethernet interface, Windows™ 2000 operating system or more recent, NRP Toolkit software installed			Controller
3	10/100Base-T Ethernet hub				Testing of R&S NRP-B4
4	Ethernet patch cable (through-connected 1:1)	CAT 5, RJ-45 connector on both ends			Testing of R&S NRP-B4
5	Ethernet patch cable (through-connected 1:1)	CAT 5, RJ-45 connector on both ends			Testing of R&S NRP-B4
6	USB cable	USB connector type A to USB connector type B			Testing of USB device connection
7	IEC bus cable				Testing of IEC bus connection
8	Power calibration system	Calibration uncertainty <0.5 % at 50 MHz	R&S NRVC R&S SMP02 R&S NRVC-B1	1109.0500.02 1035.5005.02 1109.1007.02	Calibration of reference power sensor (item 9)
9	Power sensor	Measurement uncertainty <0.7 % at 50 MHz	R&S NRP-Z11 R&S NRP-Z21	1138.3004.02 1137.6000.02	Reference power sensor for testing of R&S NRP-B1
10	Power meter		R&S NRP	1143.8500.02	Reference power meter for testing of R&S NRP-B1 Testing of analog outputs
11	Test generator	1 mW at 50 MHz	R&S NRP-B1 installed in item 10	1146.9008.02	Testing of analog outputs
12	Digital multimeter				Testing of analog outputs
13	BNC adapter for digital multimeter				Testing of analog outputs
14	BNC cable				Testing of analog outputs
15	BNC feed-through termination	50 Ω	R&S RAD 50	0844.9352.02	Testing of hardware trigger
16	Pulse generator				Testing of hardware trigger

Putting the R&S NRP into Operation and Testing the Fan

Test setup:	No special setup required
Setting the DUT:	Switch off with the [ON/STBY] key. Connect power cable.
Test:	The LED (yellow) at right above the ON/STBY key is on (power supply operating).
Setting the DUT:	Switch on with the [ON/STBY] key.
Test:	The LED (green) at left above the ON/STBY key is on. Booting completes without error messages (see following notes). Fan starts after booting completed.

Notes regarding booting:

The automatic tests check the addressability and function of the internal components but do not allow (except with the option R&S NRP-B4; see below) any conclusions to be drawn about the interfaces to the outside. For example, if the keyboard controller passes the test, this merely means that communication between the keyboard controller and the main processor is functioning, not that the keyboard itself is functioning. Reliable interface tests normally require either additional measurement and testing tools and/or user interaction.

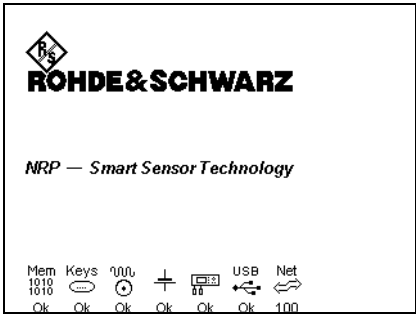


Fig. 1-1 Boot screen

Detected hardware components and options are indicated by symbols in the display (Fig. 1-1). If a test has been completed successfully, *Ok* appears beneath the corresponding symbol. If an error has been detected, *failed* appears instead and the symbol is displayed in inverse video. Table 1-2 provides an overview of the possible symbols.

If the option R&S NRP-B4 (Ethernet connection) is installed, a test is performed to determine whether the R&S NRP is connected to a network. If this is the case, the number *10* or *100* (rather than *Ok*) will appear under the symbol, where *10* indicates a 10Base-T network and *100* a 100Base-T network. If a network connection is not found within a predefined timeout, *NC* ("not connected") will appear under the symbol.

Table 1-2 Boot symbols

Symbol	Definition
	RAM
	Keyboard controller
	Test generator (option R&S NRP-B1)
	Sensor connector A
	Sensor connector A on rear panel (option R&S NRP-B6)
	Sensor connectors A and B (option R&S NRP-B2)
	Sensor connectors A and B on rear panel (options R&S NRP-B2/-B6)
	Sensor connectors A to D (option R&S NRP-B5)
	USB device connection
	Ethernet connection (option R&S NRP-B4)
	Battery operation (option R&S NRP-B3)

Testing the Keyboard and Beeper

Test setup: No special setup required.

Setting the DUT:

- [System : Test : Keyboard...]
- Press all keys once in any sequence.

Test:

- Acoustic response (short beep) occurs when each key is pressed.
- The message *Test Result: ...successful* appears at lower left in display.

Setting of DUT: Press [↵ **MENU**] twice to return to the main menu.

Testing the Display

Test setup:	No special setup required.
Setting the DUT:	- [] - Press [Contrast +] several times.
Test:	Entire display becomes darker.
Setting the DUT:	Press [Contrast –] several times.
Test:	Entire display becomes brighter.
Setting the DUT:	- Set optimum contrast with [Contrast +] and [Contrast –]. - Press [Brightness +] several times.
Test:	Backlighting becomes brighter (if not already set to maximum brightness).
Setting the DUT:	Press [Brightness –] several times.
Test:	Backlighting becomes darker and then goes completely dark. - Set backlighting to optimum brightness with [Brightness +]. - [ MENU] - [System : Test : Display Test Pattern]
Test:	A sequence of test patterns is displayed. No picture degradations due to continuously bright or dark pixels should be visible.
Setting the DUT:	Press [ MENU] twice to return to the main menu.

Note:

This test step runs automatically, i.e. you cannot change its speed.

Testing the IEC Bus Interface

Test setup: Connect the DUT to the PC's IEC bus interface using an IEC bus cable.

Setting the DUT:

- [System : Remote : GPIB]
- For *GPIB Address*, set any value other than 0.

Setting the PC: Start a suitable program for direct communication via the IEC bus, e.g. the *Measurement & Automation Explorer* program that is supplied together with IEC bus cards from *National Instruments*.

If using the *Measurement & Automation Explorer* program, proceed as follows:

Setting the PC:

- Start *Measurement & Automation Explorer*.
- In the left display window (*Konfiguration*) (=configuration) under *Mein System – Geräte und Schnittstellen* (my system – instruments and interfaces), mark the IEC bus card (if the system has only one IEC bus card, it will bear the designation *GPIB0*). Then press the *Scan For Instruments* button (Fig. 1-2).

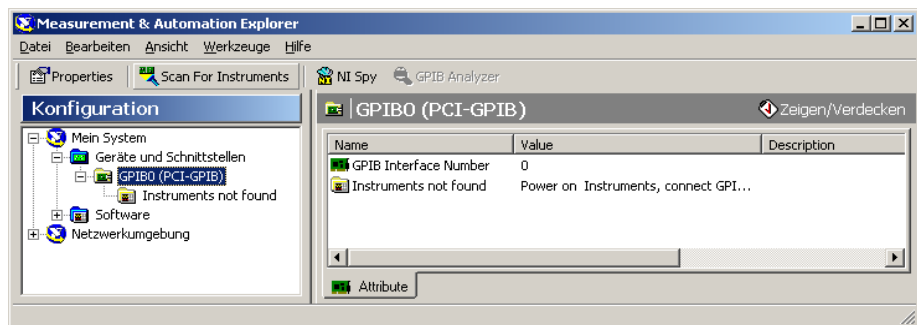


Fig. 1-2 Scanning the IEC bus in *Measurement & Automation Explorer*

- A list of instruments connected to interface card GPIB0 must appear (if the R&S NRP is the only instrument on the IEC bus, it will bear the name *Instrument0*). If you mark the list entry for the R&S NRP by using the mouse, information about the instrument will appear in the right display window (Fig. 1-3).

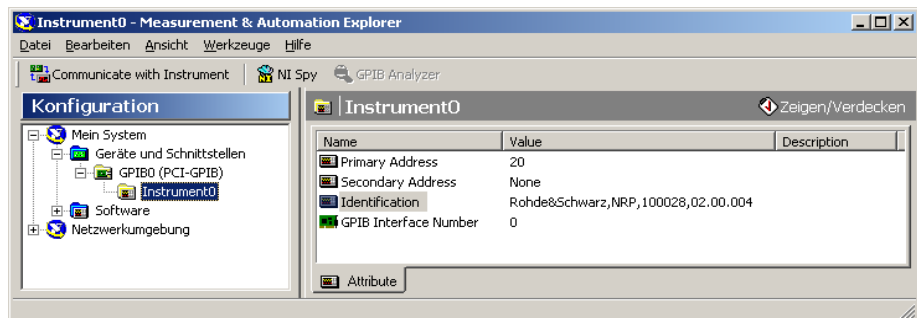


Fig. 1-3 Displaying the identification string in *Measurement & Automation Explorer*

Test: The identification string of the R&S NRP must be assigned to the *Identification* entry. The format of the R&S NRP identification string is as follows:

Rohde&Schwarz,NRP,<serial number>,<firmware version>

where *<serial number>* is the serial number of the instrument and *<firmware version>* is the version of the firmware running in the instrument.

If you use a different program, proceed as follows:

Setting the PC:

- Send query **IDN?*.
- Receive the data returned by the DUT.

Test: The R&S NRP identification string in the format shown above must be received.

Testing the Sensor Connectors and Hardware Trigger

Test setup: Connect the DUT trigger input (female connector I/O2 at the rear) to the pulse generator using a BNC cable (if the trigger signal is taken from a 50 Ω output, insert a feed-through termination before the trigger input of the R&S NRP).

Setting the pulse generator:

- Signal shape: squarewave, 50 % duty cycle, $V_{o,L} = 0 \text{ V}$, $V_{o,H} = 3.3 \text{ V}$
- Frequency: 800 Hz
- First switch off the pulse generator output signal.

Setting the DUT: Connect the Power Sensor R&S NRP-Z11/-Z21 to sensor connector A.

Test: Sensor must be recognized (the message *Initializing sensors* appears briefly).

Note:

If no display window is assigned to the sensor connector being used, a query to open a window will appear (e.g. Open new window for attached sensor A?). Confirm with [$\downarrow$ MENU].

Setting the DUT:

- [(PRE)SET : PRESET]
- [Sensor : Mode... : T'slot]
- [No. of Timeslots 1], [Nominal Width 1 ms], [$\downarrow$ MENU]
- [Sensor : Trigger...]
- Source [External $\swarrow$], [$\downarrow$ MENU]

Setting the pulse generator: Switch on the output signal.

Test:

- The $\blacksquare ?$ symbol in the DUT display must disappear.
- Measurement values must be displayed in rapid succession.

Setting the pulse generator: Switch off the output signal.

Test:

- The $\blacksquare ?$ symbol in the DUT display must reappear.
- Last measurement value must remain on screen.

Additional steps: In the case of multichannel DUTs, connect the sensor to each sensor connector in turn and perform the test for each connector.

Testing the Ethernet Interface

- Test setup:
- Connect the DUT Ethernet interface to the Ethernet hub using an Ethernet patch cable.
 - Connect the PC's Ethernet interface to the Ethernet hub using an Ethernet patch cable.

Setting the PC: Set the IP address for the network card, e.g. 10.0.0.1 (needs to be set only once).

- Setting the DUT:
- [System : Remote : Ethernet]
 - If 0.0.0.0 is set as an IP address, enter a meaningful value, e.g. 10.0.0.2.

Note:

When testing several R&S NRP instruments in succession, enter a different IP address for each one. The IP addresses assigned to the instruments are retained several minutes after the Ethernet connection is broken. If command arp -a still indicates a previously assigned IP address, do not assign this address again.

- Setting the PC:
- Open the command line window: [Start : Execute ... : cmd.exe ↵]
 - Enter command: [ping <IP address of the DUT> ↵],
e.g. [ping 10.0.0.2 ↵]

Note:

In its standard configuration, the ping program tests the network connection four times in succession and outputs the DUT response times.

- Test:
- The response times must be less than 10 ms in each case.
 - Packet loss is not allowed.

- Setting the DUT:
- If the IP address for the DUT was altered for the test, restore the original state.
 - [System : Remote : GPIB]

Testing the USB Interface

Test setup: Connect the USB interface of the DUT to the USB host interface of the PC using a USB cable.

Note:

The "NRP Toolkit" software must have been installed on the PC prior to running this test.

Setting the DUT:

- Switch off with the [**ON/STBY**] key.
- Switch on with the [**ON/STBY**] key.

Test: The image shown in Fig. 1-4 must appear on the DUT display.



Fig. 1-4 Firmware update screen

Settings on the PC:

Windows 2000

- Open the *System Properties* window:
[Start : Settings : Control Panel : System]
- Open the Device Manager:
Tab [Hardware], Button [Device Manager...]
- Expand the *USB-Controller* list.

Windows XP

- Same procedure except go directly from the Start menu to the Control Panel.

Test: The list must contain the entry *R&S NRP* (Fig. 1-5).



Fig. 1-5 Entry in the device manager

Testing the Analog Outputs

- Test setup:
- Connect the Power Sensor R&S NRP-Z11/-Z21 to sensor connector A of the DUT or to the test generator output of the DUT or to a second R&S NRP.
 - Connect the digital multimeter to connector *Out 1* at the rear.
- Setting the DUT:
- [**CAL/ZERO** : Zero (All)]
 - [**(PRE)SET** : **(PRE)SET**]
 - [Measurement : Relative On]
 - [$\Delta\%$]
- Setting the test generator:
- Switch on RF power [System : Power Ref On].
- Setting the DUT:
- [Relative Reset]
 - [System : I/O]
 - Parameter for *Out 1*: [Analog]; set first test case shown in Table 1-3 (enter values for *0 V Equivalent* and *3 V Equivalent*).
- Test:
- The digital multimeter must show the voltage $V_{O,nom}$ associated with the first test case as shown in Table 1-3.
- Additional steps:
- On the DUT, set each of the remaining test cases shown in Table 1-3 and check whether the digital multimeter shows the voltage $V_{O,nom}$ associated with each test case.
 - After completing the last measurement on *Out 1*, connect the digital multimeter to connector *I/O 2*.
- Setting the DUT:
- Parameter for *I/O 2*: [Analog Out]; set first test case shown in Table 1-3 (enter values for *0 V Equivalent* and *3 V Equivalent*).
- Additional steps:
- Same as for test of analog output *Out 1*.

Table 1-3 Settings for testing the analog outputs

Test case No.	0 V equivalent	3 V equivalent	$V_{O,nom}$ in V 1
1	0 %	100 %	0.0 ± 0.004
2	-100 %	0 %	3.0 ± 0.027

1 The tolerances consist of a zero error (4 mV) and a percent deviation (0.75 % from the nominal value, where 0.25 % is from the converter and 0.5 % from the reference voltage source). They are valid when the R&S NRP is operated at normal room temperature.

Testing the Test Generator R&S NRP-B1

A reference power sensor with sufficiently small measurement uncertainty is required in order to test the test generator. A Power Sensor R&S NRP-Z11/-Z21 that has previously been checked using the Calibration Kit R&S NRVC and corrected/adjusted as needed should be used for this purpose.

Test setup: Connect the reference power sensor to the reference power meter and then directly connect it (without adapter or cable) to the test generator output of the DUT.

Setting the DUT:

- Switch off with the [**ON/STBY**] key.
- Switch on with the [**ON/STBY**] key.
- Do the following during booting (Fig. 1-6a): [Boot Menu]
- Enter password (Fig. 1-6b): [7 : 3 : 9 : 6]
- In the Boot menu (Fig. 1-6c): [Service]
- In the Service menu Fig. 1-6d): [Power Ref Calibration]
- Enter password Fig. 1-6b): [9 : 6 : 0 : 3]

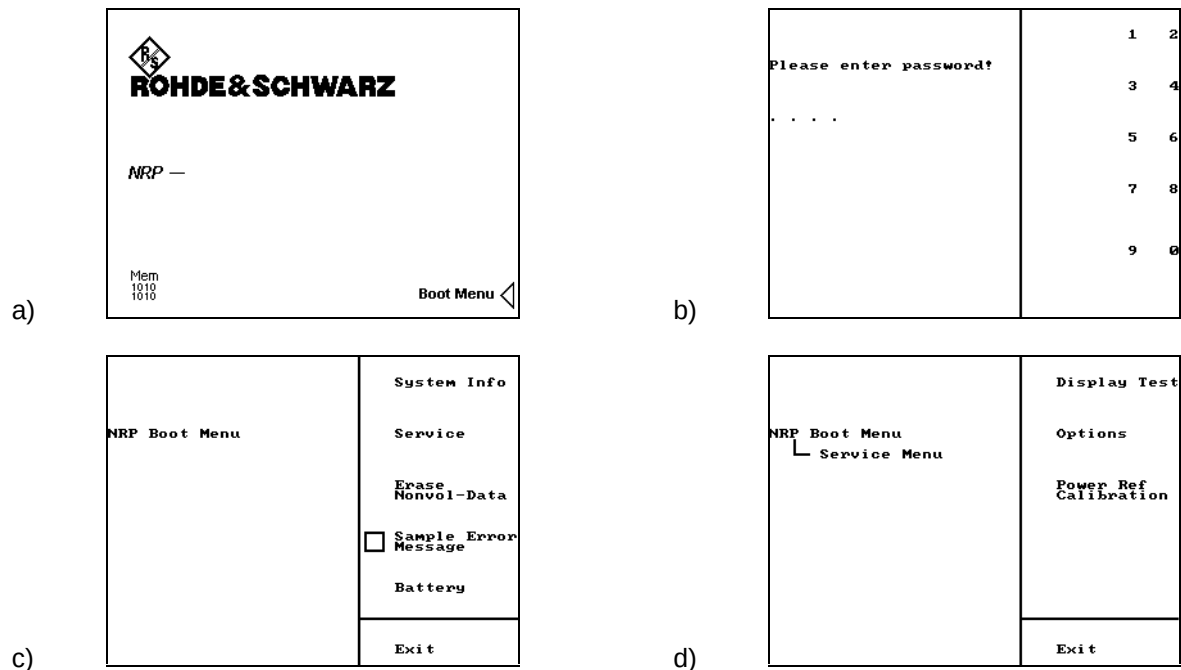


Fig. 1-6 a-d Calling up the dialog for adjusting the test generator

Test: The yellow LED on the test generator output of the DUT must flash.

Setting the DUT: In the dialog for manually adjusting the test generator (Fig. 1-7): Switch off test generator with [Power Ref].

Power Level: <u>1mW</u> 10uW	< >
Coarse Tune [-----;-----]	☒ Power Ref
Fine Tune [-----;-----]	- +
	- +
	OK
	Cancel

Fig. 1-7 Dialog for adjusting the test generator

- Setting the reference power meter:

Perform zeroing.
- Setting the DUT:

[Power Level 1mW]
Switch on test generator with [Power Ref].
- Test:

Read the measurement value for power level 1 mW on the reference power meter and compare it with the limit values in the Performance Test Record².
- Setting the DUT:

[Power Level 10uW]
- Test:

Read the measurement value for power level 10 μ W on the reference power meter and compare it with the limit values in the Performance Test Record³.
- Setting the DUT:

[Cancel : Exit : Exit]

Note:
Even if the permitted tolerances have been adhered to, a follow-up adjustment of power level 1 mW is recommended since this is the only way to ensure adherence to the specification until the next calibration (chapter 2).

² The test limits are based on the data sheet specification for uncertainty of the test generator in the temperature range 20 °C to 25 °C and the measurement uncertainty of the reference power sensor.
³ Power level 10 μ W is not specified in the data sheet, because it is only used as an auxiliary value in the automatic sensor test and its tolerance is not included in the test result.

Performance Test Record

Performance Test

Power Meter R&S NRP

Stock No.: 1143.8500.02

Name:

Serial number:

Date:

Item	Property	Min.	Actual	Max.	Unit
1	LED (yellow) on when AC supply voltage present.	—		—	
2	LED (green) on after switch-on.	—		—	
3	Booting completed without error messages.	—		—	
4	Fan starts.	—		—	
5	Acoustic response if keyboard test is running.	—		—	
6	Keyboard test completed successfully.	—		—	
7	[Contrast +] makes entire display darker.	—		—	
8	[Contrast –] makes entire display brighter.	—		—	
9	[Brightness +] makes backlighting brighter.	—		—	
10	[Brightness –] makes backlighting darker (until completely dark).	—		—	
11	All display test patterns displayed without error.	—		—	
12	Battery fully charged (parameter <i>Full Cap</i>).	1200		2200	mAh
13	<i>Condition Bit "Initialized"</i> of battery is set.	—		—	
14	Instrument keeps running after power cable has been unplugged.	—		—	
15	Discharging is indicated.	—		—	
16	Discharge current.	–500		–200	mA
17	Identification string is output correctly via IEC bus.	—		—	
18	Sensor is detected at connector A.	—		—	
19	Symbol  in the DUT display disappears when the external trigger signal is switched on; rapid sequence of measurement values (with sensor at connector A).	—		—	
20	Symbol  in the DUT display appears when the external trigger signal is switched off; last measurement value retained (with sensor at connector A).	—		—	

21	Sensor is detected at connector B.	—		—	
22	Symbol  in the DUT display disappears when the external trigger signal is switched on; rapid sequence of measurement values (with sensor at connector B).	—		—	
23	Symbol  symbol in the DUT display appears when the external trigger signal is switched off; last measurement value retained (with sensor at connector B).	—		—	
24	Sensor is detected at connector C.	—		—	
25	Symbol  symbol in the DUT display disappears when the external trigger signal is switched on; rapid sequence of measurement values (with sensor at connector C).	—		—	
26	Symbol  in the DUT display appears when the external trigger signal is switched off; last measurement value retained (with sensor at connector C).	—		—	
27	Sensor is detected at connector D.				
28	Symbol  in the DUT display disappears when the external trigger signal is switched on; rapid sequence of measurement values (with sensor at connector D).				
29	Symbol  in the DUT display appears when the external trigger signal is switched off; last measurement value retained (with sensor at connector D).				
30	All Ping times less than 10 ms; no packets lost.	—		—	
31	Upon switch-on with USB connection to PC, firmware update screen appears.	—		—	
32	R&S NRP is displayed in the device manager.	—		—	
33	Voltage at analog output Out 1 (test case 1)	−0.004		0.004	V
34	Voltage at analog output Out 1 (test case 2)	2.973		3.027	V
35	Voltage at analog output I/O 2 (test case 1)	−0.004		0.004	V
36	Voltage at analog output I/O 2 (test case 2)	2.973		3.027	V
37	Yellow LED above test generator output flashes when test generator adjustment dialog is opened.	—		—	
38	Output power of test generator at power level 1 mW	0.989		1.011	mW
39	Output power of test generator at power level 10 µW	9.5		10.5	µW

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2 Calibrating the Test Generator R&S NRP-B1

- The test generator module contains digital potentiometers (with coarse and fine tuning) for adjusting the two power levels 1 mW und 10 μ W. The potentiometer settings are stored in internal EEPROMs.
- The option R&S NRP-B1 is adjusted while already installed and within closed housing.
- The adjustment is to be performed at an ambient temperature of 20 °C to 25 °C. The R&S NRP base unit, the Test Generator R&S NRP-B1 and the reference sensor must be switched on at least one hour prior to start of adjustment.
- A Power Sensor R&S NRP-Z11/-Z21 that has already been calibrated with the Calibration Kit R&S NRVC prior to the actual calibration serves as a reference sensor for both power levels.
- Entries on the Power Meter R&S NRP are abbreviated as follows:
 [<KEY>] Press a key on the front panel, e.g. [**ZERO/CAL**].
 [<SOFTKEY>] Press a softkey, e.g. [Sensor], or select a menu item.
 [<nn unit>] Enter a value and terminate it with a unit, e.g. [**50 MHz**].
 Successive entries are separated by [:], e.g. [**FREQ : 3 GHz**].

Required Measuring Equipment and Accessories

Table 2-1 Required measuring equipment and accessories

Item	Instrument type	Recommended characteristics	Recommended instruments	R&S Order No.	Application
1	Power calibration system	Calibration uncertainty <0.5 % at 50 MHz	R&S NRVC R&S SMP02 R&S NRVC-B1	1109.0500.02 1035.5005.02 1109.1007.02	Calibration of the reference power sensor
2	Power sensor	Measurement uncertainty <0.7 % at 50 MHz	R&S NRP-Z11 R&S NRP-Z21	1138.3004.02 1137.6000.02	Reference power sensor for calibrating the R&S NRP-B1
3	Power meter		R&S NRP	1143.8500.02	Reference power meter for calibrating the R&S NRP-B1

Manual Adjustment

Test setup: Connect the reference power sensor to the reference power meter and directly connect it (without an adapter or cable) to the test generator output of the DUT.

- Setting the DUT:
- Switch off with the [**ON/STBY**] key.
 - Switch on with the [**ON/STBY**] key.
 - During booting (Fig. 2-1 a): [Boot Menu]
 - Enter password (Fig. 2-1 b): [7 : 3 : 9 : 6]
 - In the Boot menu (Fig. 2-1 c): [Service]
 - In the Service menu (Fig. 2-1 d): [Power Ref Calibration]
 - Enter password (Fig. 2-1 b): [9 : 6 : 0 : 3]

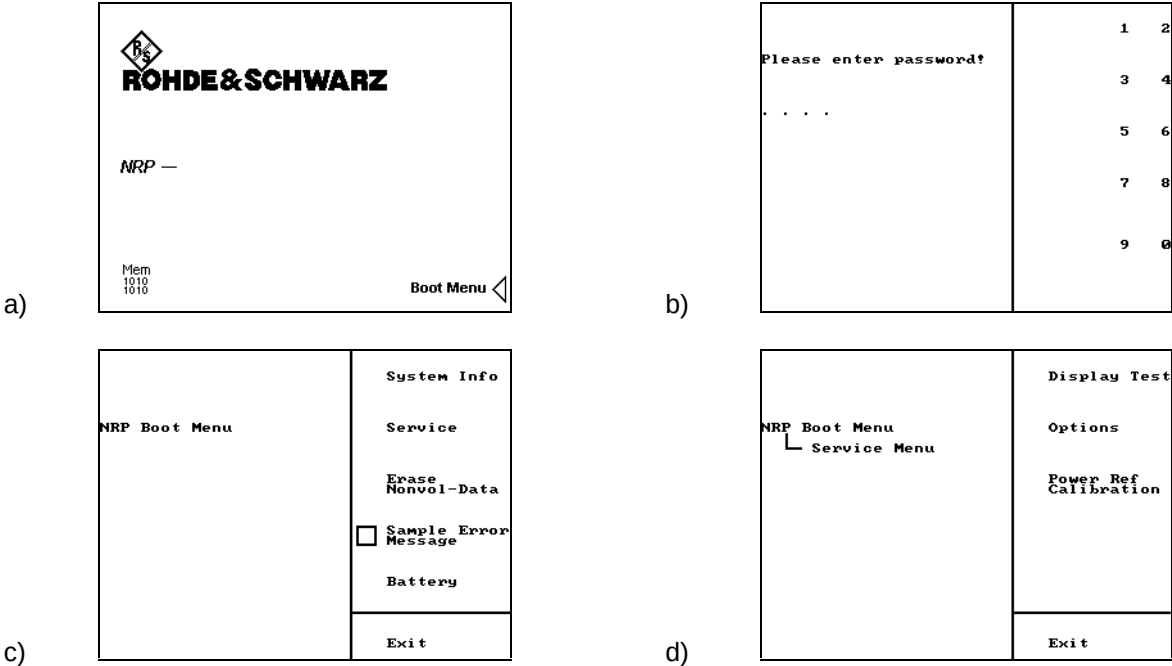


Fig. 2-1 a-d Calling up the dialog for adjusting the test generator

- In the dialog for manually adjusting the test generator (Fig. 2-2): Switch off the test generator with [Power Ref].

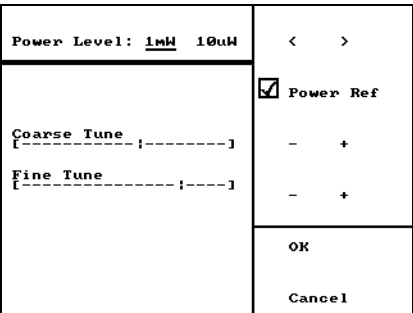


Fig. 2-2 Dialog for adjusting the test generator

Setting the reference power meter: Perform zeroing.

Setting the DUT:

- [Power Level 1mW]
- Switch on test generator with [Power Ref].
- Set *Fine Tune* to center position.
- Find optimum coarse tuning (*Coarse Tune*).
- Find optimum fine tuning (*Fine Tune*).
- [Power Level 10uW]
- Set *Fine Tune* to center position.
- Find optimum coarse tuning (*Coarse Tune*).
- Find optimum fine tuning (*Fine Tune*).
- [OK]

Note:

Clicking [OK] stores the current settings in the EEPROM and exits the adjustment dialog. To exit the adjustment dialog without storing the current settings in the EEPROM, enter [Cancel].

Setting the DUT: Switch off with the [**ON/STBY**] key.

Additional steps: Check the Test Generator R&S NRP-B1 again for compliance with specifications as described in chapter 1.

Program-Controlled Adjustment

If the options R&S NRP-B1 are to be adjusted frequently, the procedure should be performed via remote control. Remote-control commands for reading out, writing to and controlling the digital potentiometers are available for this purpose (Table 2-2). For quick adjustment, the start values shown in Table 2-3 should be selected. This table also contains the adjustment sensitivity values of the four digital potentiometers.

Table 2-2 Remote-control commands for program-controlled adjustment of the R&S NRP-B1

Action	Remote-control command
Switch on test generator (LED state not affected).	OUTPut:ROSCillator:CALibration:WRITe 1, 1
Switch off test generator (LED state not affected).	OUTPut:ROSCillator:CALibration:WRITe 1, 0
Set power level 1 mW (High).	OUTPut:ROSCillator:CALibration:WRITe 2, 1
Set power level 10 μ W (Low).	OUTPut:ROSCillator:CALibration:WRITe 2, 0
Switch off LED.	OUTPut:ROSCillator:CALibration:WRITe 3, 0
Switch on LED.	OUTPut:ROSCillator:CALibration:WRITe 3, 1
Switch LED to flashing.	OUTPut:ROSCillator:CALibration:WRITe 3, 2
Enable adjustment (cancel write protection).	OUTPut:ROSCillator:CALibration:WRITe 4, 0

Action		Remote-control command
Enter <value> 0 to 255	Coarse tuning of power level 1 mW	OUTPut:ROSCillator:CALibration:WRITe 5, <value>
	Fine tuning of power level 1 mW	OUTPut:ROSCillator:CALibration:WRITe 6, <value>
	Coarse tuning of power level 10 μ W	OUTPut:ROSCillator:CALibration:WRITe 7, <value>
	Fine tuning of power level 10 μ W	OUTPut:ROSCillator:CALibration:WRITe 8, <value>
Perform calibration: Store current settings in EEPROM, read out again to double-check and restore write protection.		OUTPut:ROSCillator:CALibration:WRITe 9, 0
Stop calibration: Discard current settings.		OUTPut:ROSCillator:CALibration:WRITe 10, 0
Read out current (volatile) setting	Coarse tuning of power level 1 mW	OUTPut:ROSCillator:CALibration:READ? 1
	Fine tuning of power level 1 mW	OUTPut:ROSCillator:CALibration:READ? 2
	Coarse tuning of power level 10 μ W	OUTPut:ROSCillator:CALibration:READ? 3
	Fine tuning of power level 10 μ W	OUTPut:ROSCillator:CALibration:READ? 4
Read out setting stored in EEPROM	Coarse tuning of power level 1 mW	OUTPut:ROSCillator:CALibration:READ? 33
	Fine tuning of power level 1 mW	OUTPut:ROSCillator:CALibration:READ? 34
	Coarse tuning of power level 10 μ W	OUTPut:ROSCillator:CALibration:READ? 35
	Fine tuning of power level 10 μ W	OUTPut:ROSCillator:CALibration:READ? 36

Table 2-3 Recommended start values and adjustment sensitivity

	Power level 1 mW (High)		Power level 10 μ W (Low)	
	Coarse tuning	Fine tuning	Coarse tuning	Fine tuning
Start value	176 = 0xB0	128 = 0x80	120 = 78	128 = 0x80
Adjustment sensitivity	1.06 μ W / bit	7.8 nW / bit	54 nW / bit	0.61 nW / bit

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3 Repair

This chapter describes the design of the R&S NRP and simple measures for repairing and determining faults as well as the replacement of modules.

The installation of options and the firmware update are explained in chapter 4 of this service manual.

Design and Circuit Description

The design of the instrument is represented in the following block diagrams and in the exploded-view drawings (see also chapter 5).

The block diagram is used for the subsequent circuit description of the instrument.

Block diagram

See also chapter 5, annex and drawings.

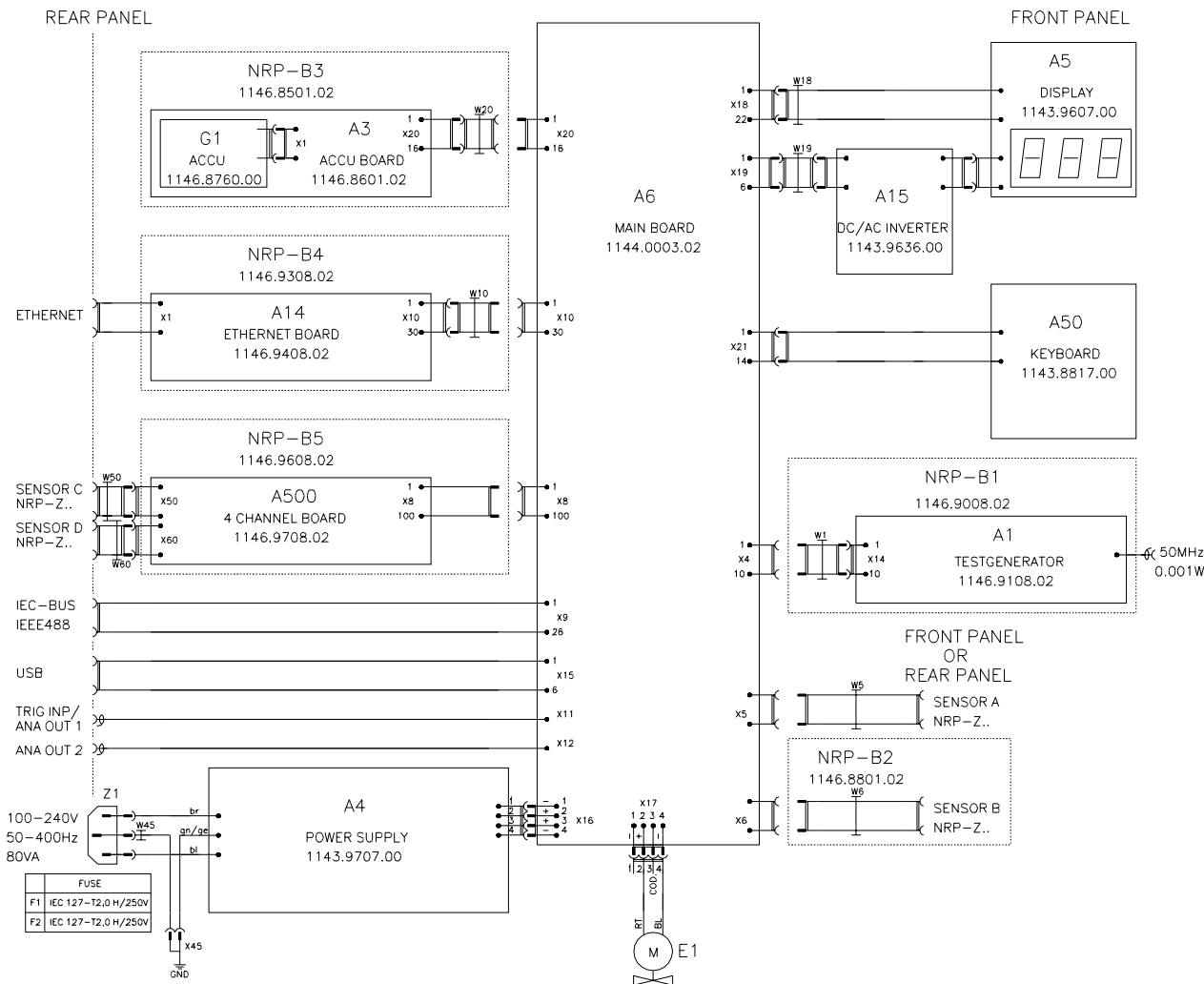


Fig. 3-1 Block diagram R&S NRP

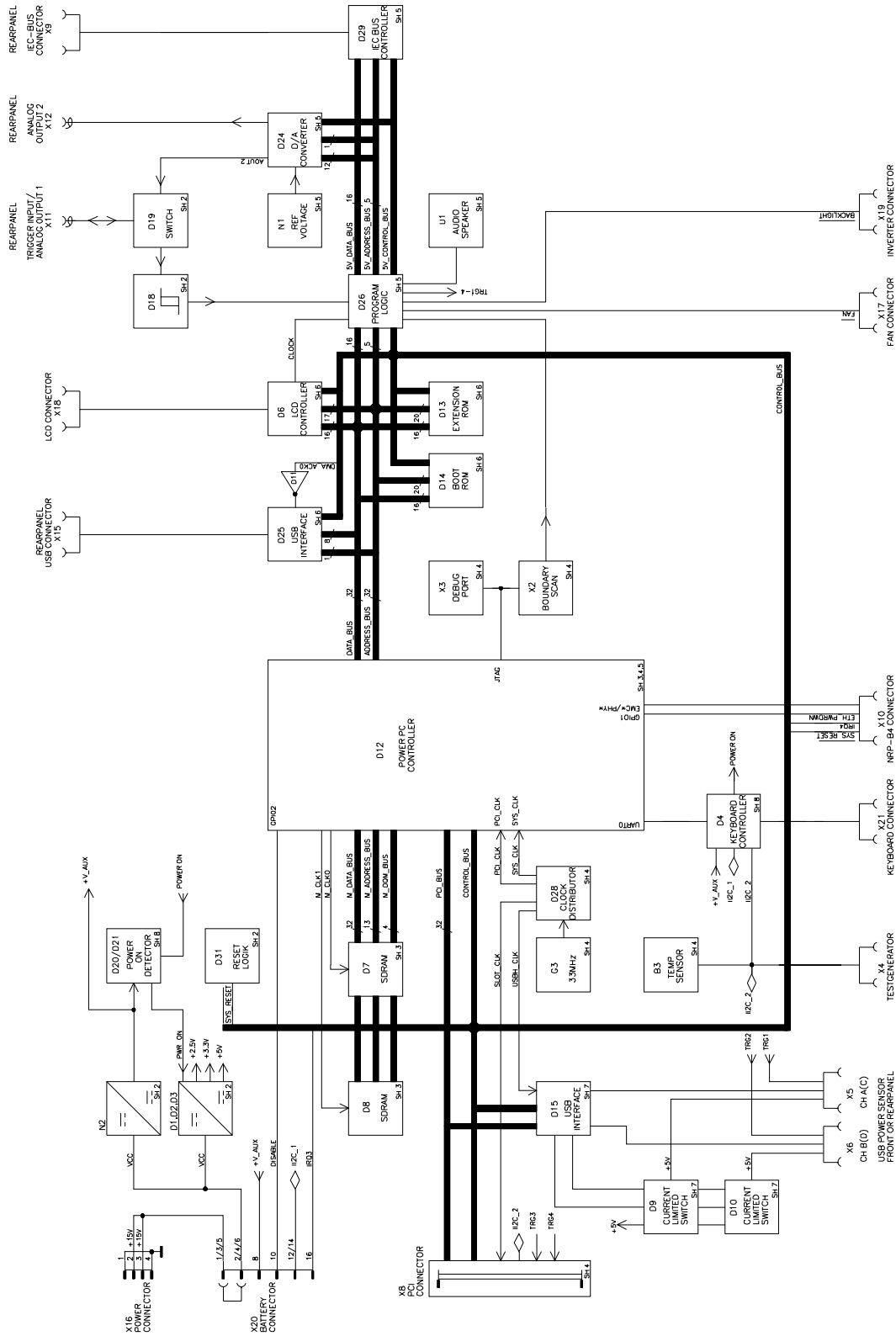


Fig. 3-2 Block diagram of the R&S NRP mainboard 1144.0003.02

Description of the Block Diagram

The R&S NRP is the central unit in an RF power measurement system. It provides connectors for up to four power sensors of the R&S NRP-Z family, a display and control unit, an IEC bus interface, a USB interface and an optional Ethernet interface for remote control, an optional RF test generator for checking the sensors for proper function and the power supply for the entire system via the AC power supply or an optional rechargeable battery.

Mainboard

Voltage transformers

The R&S NRP mainboard contains three voltage transformers for providing the regulated supply voltages of 5 V, 3.3 V und 2.5 V. They obtain their input voltage ranging from 9 V to 18 V (V_{CC}) either from the power supply or the rechargeable battery. The transformers are switched off if the instrument is in standby.

There is also a continuously available auxiliary voltage of 3.3 V (regulated by a linear regulator) for supplying the communications processor.

Main processor

The main processor is an IBM PowerPC 405 with at least 16 Mbyte SDRAM and 4 Mbyte flash memory.

Communications processor

The communications processor is an 8-bit controller of type PIC16LC763. It monitors the keyboard, controls instrument switch-on/switch-off, and operates slow modules such as the test generator, rechargeable battery, charge regulator, lighting of the display and a temperature sensor.

Internal interfaces

Power supply (X16)

The 15 V output voltage from the power supply is fed to the R&S NRP with protection against reversal of polarity via the four-contact DC input.

The positive pole is supplied via pin pairs 3/4 and 5/6 from X20 (battery board). If the R&S NRP does not contain a battery board, each of these pin pairs is bypassed with a short-circuit connector (☞ Removing the battery power supply, p. 3.20)!

Battery board (X20)

X20 provides the output voltage of the power supply, the supply voltage of the mainboard (V_{CC}), the 3.3 V auxiliary voltage and an SMB interface for controlling the rechargeable battery and the charge regulator for the battery board.

DC/AC converter (X19)

The display is backlit with a cold cathode fluorescent lamp that requires an AC voltage of $>1250\text{ V (V}_{\text{rms}})$ for operation. The AC voltage is obtained from the 5 V supply voltage via a DC/AC converter. X19 provides the 5 V supply voltage (+: pins 1 and 2, GND: pins 3 and 4) and a 5 V PCM signal for controlling the brightness (pin 5). On the mainboard, the 5 V supply voltage is supplied via a switch that can be used to switch off the lighting.

Keyboard (X21)

X21 provides the signal voltages for the keyboard matrix and the supply currents for the two LEDs that signal the switched-on/standby state. The current for the green LED is obtained directly from the 3.3 V supply voltage via a series resistor; the current for the yellow LED is likewise obtained from the output voltage of the power supply (15 V).

Display (X18)

X18 provides the 5 V supply voltage (pins 22 and 14), row and column signals for controlling the individual pixels and a 2-bit control signal for the contrast setting.

Sensors A and B (X5 und X6)

X5 and X6, respectively, are used to supply the four standard connectors of the USB (+5 V, D+, D-, GND) and a balanced trigger signal. The 5 V supply voltage is protected via electronic fuses.

4-channel board (X8)

All signals of the internal PCI and I²C bus as well as two balanced signals each for sensor connectors C and D are present at press-in connector X8.

Test generator (X4)

The supply voltages V_{CC} , 3.3 V and 5 V as well as the internal I²C bus for control are supplied via X4.

Ethernet board (X10)

Ethernet interface X10 on the mainboard is a standard MII interface.

Fan (X17)

A switchable 5 V voltage is present at fan connector X17.

External instrument interfaces*IEC bus and USB device interface*

The above two interfaces meet the IEEE488.1 und USB1.1 standards.

Trigger input / analog output 1 and analog output 2

Logic input with Schmitt trigger for standard logic (3.3 V) or analog output 0 to 3.3 V.

Display

The display module includes the liquid crystal display, the row and column drivers, an auxiliary voltage transformer for the contrast voltage of the display and the cold cathode fluorescent lamp for lighting.

Option R&S NRP-B1

The Test Generator R&S NRP-B1 generates a level-precise and low-harmonics 50 MHz signal which is produced in a quartz oscillator, stabilized with a PIN diode controller and subjected to harmonics suppression in an output filter. The reference voltage of the regulator is set by using a digital potentiometer that contains an EEPROM in which the calibration data is stored.

Option R&S NRP-B2

The hardware for the second measurement channel (B) consists of a female connector for the circular male connector of the sensor. This female connector is connected with connector X6 on the mainboard via a soldered-on membrane cable. Before it can be used, the option R&S NRP-B2 must be software-enabled.

Option R&S NRP-B4

The Ethernet option R&S NRP-B4 includes a physical layer controller for 10/100Base-T Ethernet, the required isolating transformers and an RJ-45 female connector.

Option R&S NRP-B5

The 4-channel option R&S NRP-B5 is linked to the processor in the R&S NRP via the PCI bus and communicates with the sensors via its own USB host controller with a root hub and two ports. The 5 V supply voltage for the USB is protected via electronic fuses.

Module replacement

The following section provides a detailed description of the module replacement. Chapter 5 provides information on how to order spare parts. It includes a list of mechanical parts and drawings illustrating the module replacement.

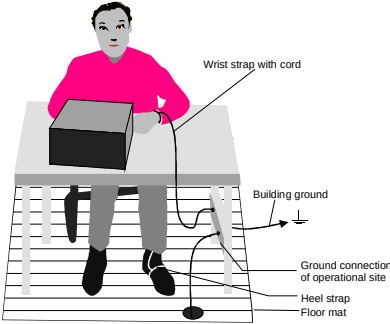


Caution!

- *Observe the safety instructions at the beginning of this manual.*
- *Disconnect the instrument from the AC supply before opening the housing.*
- *To avoid damaging electronic components, the instrument should only be opened on a workplace protected against electrostatic discharges.*

The following methods can be used separately or combined to ensure protection against electrostatic discharges:

- *Anti-static wrist strap with grounding cable.*
- *Conductive flooring with foot strap.*



Wrist strap with cord

Building ground

Ground connection of operational site

Heel strap

Floor mat

Tools required

Size	T6	T8	T10	T20
Thread	M 2	M 2.5	M 3	M 4

Screwdriver size 3



Note:

The numeric values in brackets refer to the item in the list of mechanical parts and spare parts in chapter 5 (cross references).

These items are identical to the item numbers in the drawings illustrating the module replacement.



Note:

Remove membrane cables:
Membrane cables can be removed after unlocking the female connector.

Connect membrane cables:
Observe the contact side and lock the female connector.

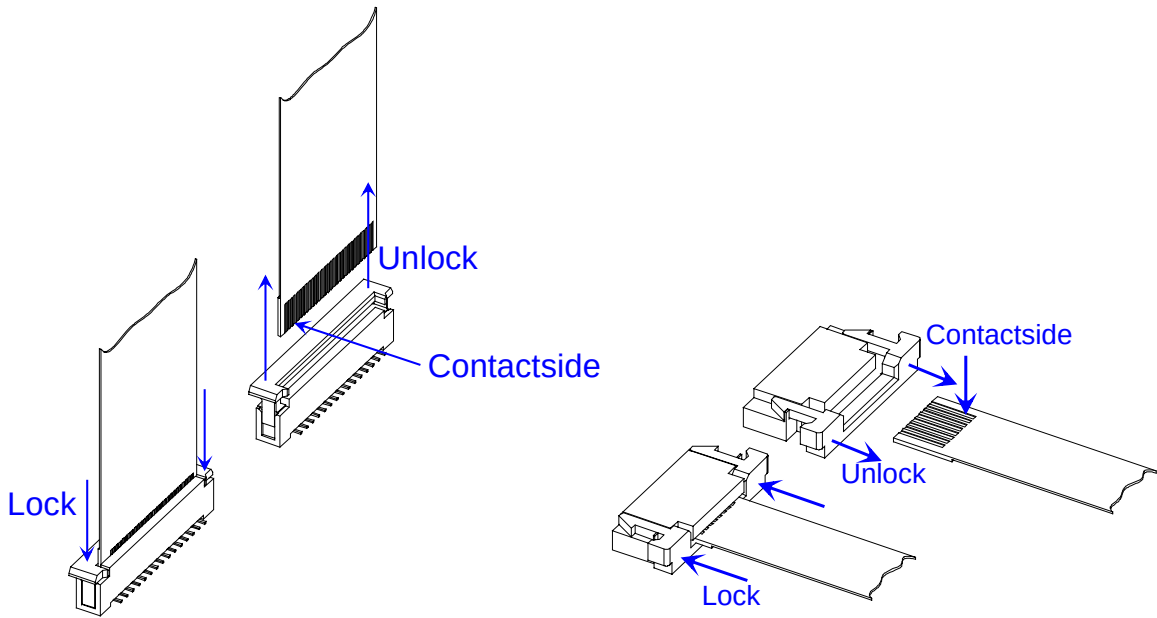


Fig. 3-3 Membrane cables

List of modules

Table 3-1 Overview of module replacement

Identification	Module	Measures after replacement		
		Functional tests and system error correction	Adjustment	Miscellaneous
A4	AC supply	SYSTEM MESSAGES / SELFTEST / CAL		
A5	Display		Contrast, brightness (section 4.2, (operating manual))	
A6	Mainboard			Replacement board is supplied by Central Service Munich with pre-installed serial number and keys for enabling the options.
A15	DC/AC inverter			
A50	Switching foil			
R&S NRP-B1	Sensor Check Source		(chapter 2, (service manual))	
R&S NRP-B2	Second Sensor Input			Can only be installed by Central Service Munich.
R&S NRP-B3	Battery supply			
R&S NRP-B4	LAN Interface			
R&S NRP-B5	3 rd and 4 th Sensor Input			
R&S NRP-B6	Rear-panel sensor inputs A and B			

Opening and reassembling the instrument

Opening

- Switch off the instrument and disconnect from power.
- Pull the carrying handle (260) at the swivel point towards the outside and swivel it towards the top. Put the instrument on the front shock protection. Undo 4 screws in rear feet (250) and remove them together with the two feet.
- Remove the enclosure (240).

Reassembly

- Push the enclosure completely to the front into the groove of the front panel (observe the front shock protection and contact springs).



Caution:

*Observe cables when pushing the enclosure.
Cables should be laid properly.*

- Press the screws of rear-panel feet (250) into the threaded holes and tighten them.
- After opening the instrument always check for electrical safety according to national / international tests (e.g. to VBG4 {Safety Instructions}).

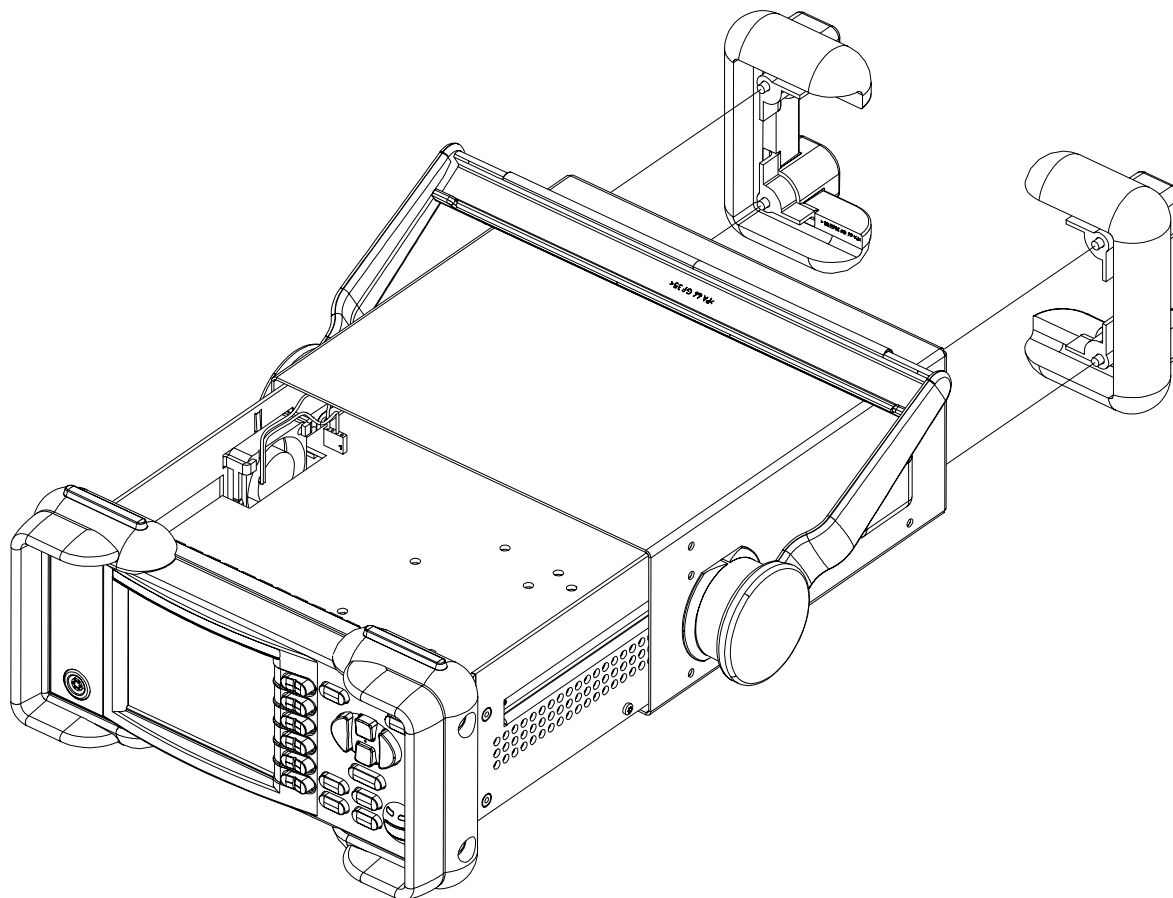


Fig. 3-4 Opening and reassembling the instrument

Front panel (switching foil, silicone mat, display) and DC/AC inverter

Removing the front panel

- Opening the instrument (see page 3.10).
- Put the instrument in the normal operating position. Undo 2 screws (250) on the side of the two front moulded shock protection parts (250) and remove them together with the front shock protection. Undo the 4 screws (235) on the front side.
- If the option R&S NRP-B1 (test generator) is installed, also undo one screw (1065) on the side.
- Remove the following cables from mainboard A6:

W18 (display)	from connector X18
W21 (switching foil)	from connector X21
W1 (test generator)	from connector X4 (option R&S NRP-B1)
- Pull off the front panel towards the front and place it with the keyboard upside down on a clean surface.
- Remove the following cables to remove the complete front panel from the instrument (optional):

W15 (display)	from DC/AC inverter A15
W5 (sensor A)	from connector X5 (mainboard A6)
W6 (sensor B)	from connector X6 (mainboard A6)

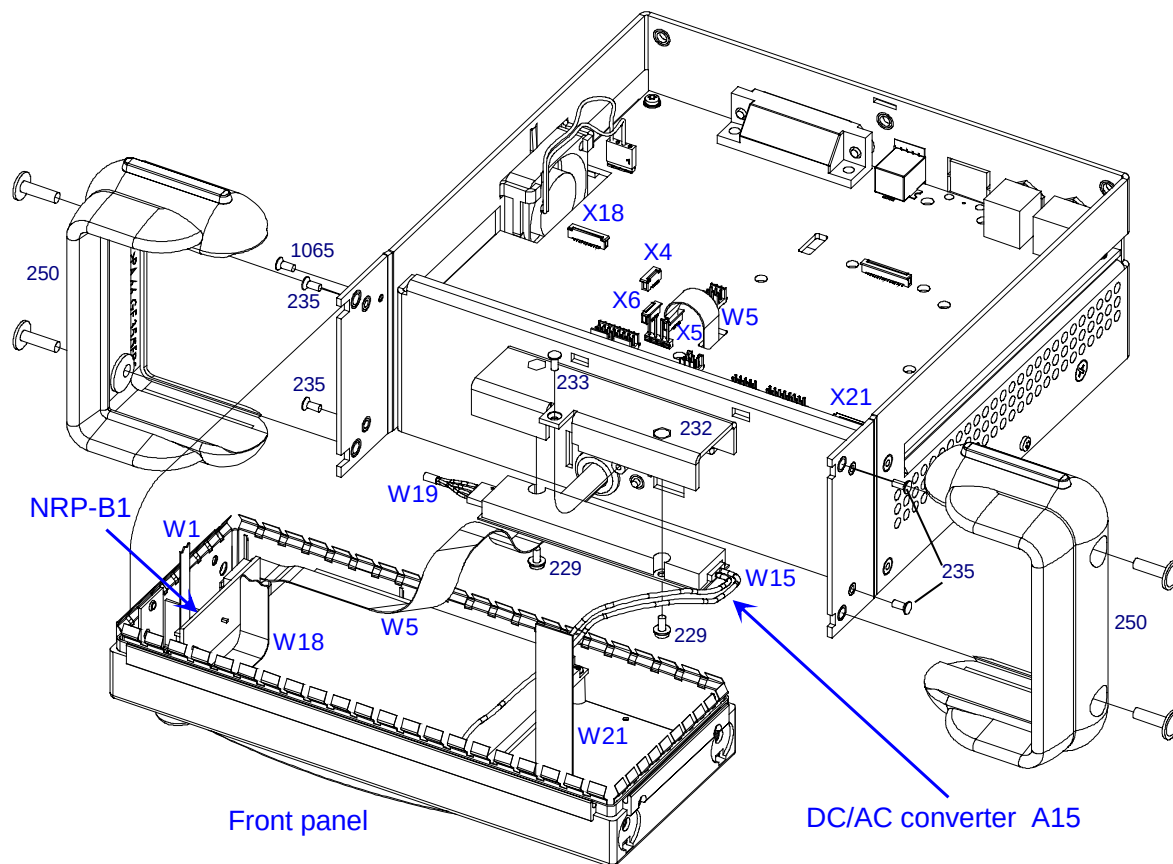


Fig. 3-5 Removing and reassembling the front panel

Removing the different components

- **Display A5:** Undo 4 screws (220) and remove the display.
- **Switching foil A50:** Undo 2 screws (180) and remove the switching foil and the silicone mat (150).
- **DC/AC inverter A15:** Disconnect cables W19 and W15 from the DC/AC inverter. Remove the holding angle (232) by undoing a screw (233) and remove the DC/AC inverter after undoing two other screws (229).

Installing the new components

- Install in the reverse order.
- When installing the switching foil A50 ensure that it is free from dust.
- Do not forget the cable connectors.

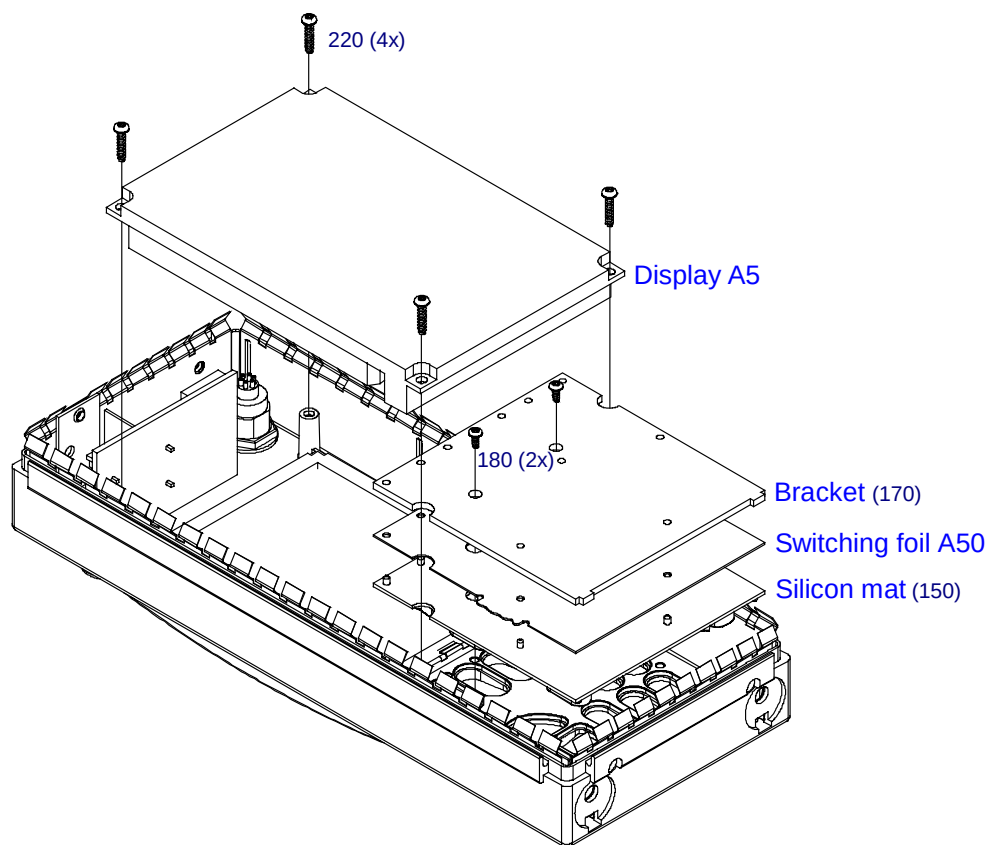


Fig. 3-6 Front panel

Mainboard

Removing the mainboard

- Opening the instrument (see page 3.10).
- Remove the options R&S NRP-B4 and R&S NRP-B5 (if installed) before removing the mainboard (see pages 3.21 and 3.22).
- Remove the following cables from mainboard A6:

W5 (sensor A)	from connector X5	
Secondary cable	from connector X16	
W17 (fan)	from connector X17	
W18 (display)	from connector X18	
W19 (inverter)	from connector X19	
W21 (switching foil)	from connector X21	

Optional:

W1 (test generator)	from connector X4	(R&S NRP-B1)
W6 (sensor B)	from connector X6	(R&S NRP-B2)
W20 (battery supply board)	from connector X20	(R&S NRP-B3)
- Undo 5 fixing screws (35) and the two locking bolts for the IEC/IEEE BUS connector X9 from the rear panel. Undo the union nut and the tooth lock washer of the two BNC connectors X11 and X12 from the rear panel.
- Lift the mainboard at the front and take it out of the instrument.

Installing the mainboard

- Install the new mainboard and, if available, the options R&S NRP-B4 and R&S NRP-B5 in the reverse order.
- Do not forget the cable connectors.
- Load the software (see chapter 4, Firmware Update).

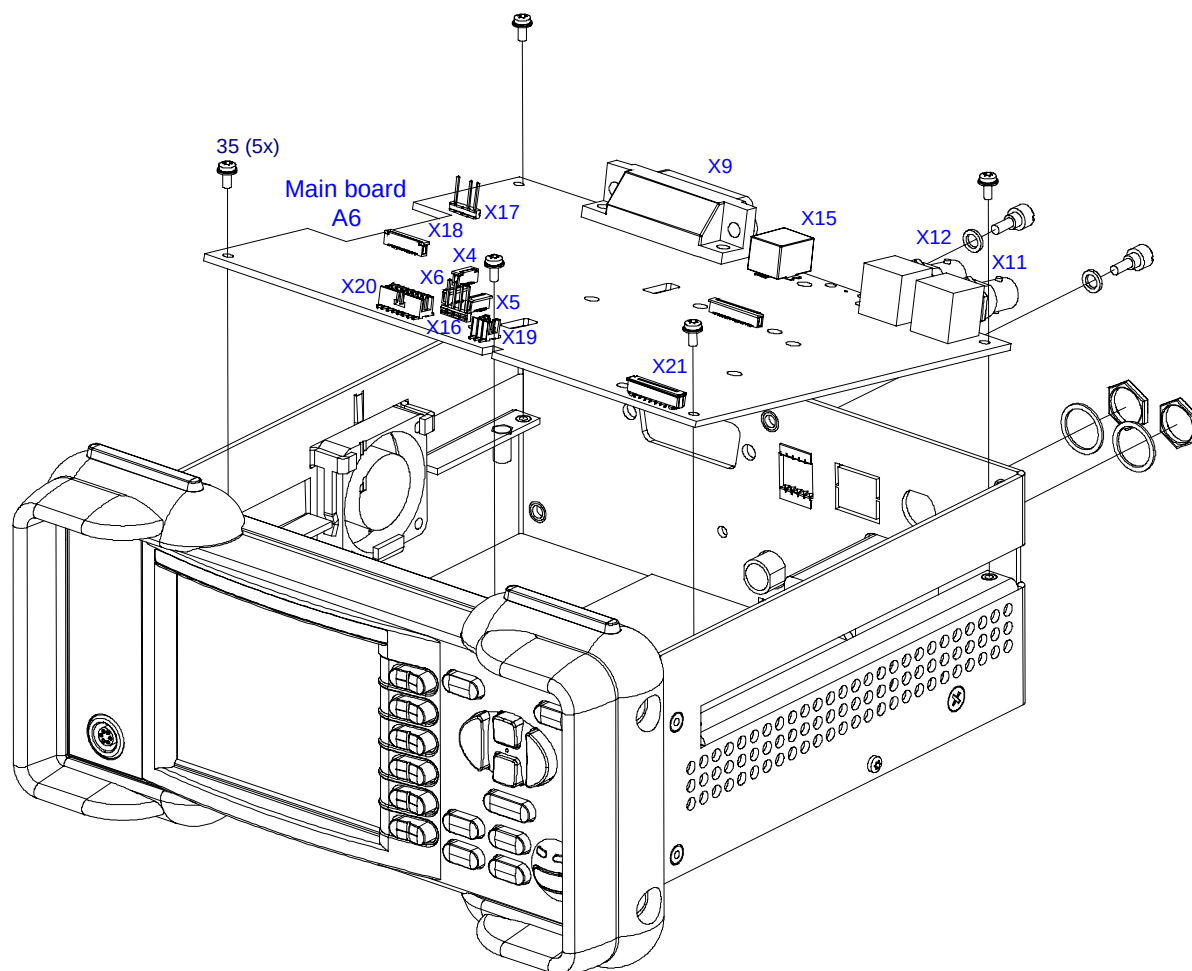


Fig. 3-7 Removing and installing the mainboard

AC supply

Removing the AC supply

- Opening the instrument (see page 3.10).
- Disconnect the secondary cable from connector X16 (mainboard A6).
- Turn the instrument upside down (AC supply on top).
- Undo 2 screws (110 / 120).
- Push the AC supply slightly to the rear and take it out of the instrument. Put the AC supply next to the instrument.
- Disconnect the primary cable from line filter Z1 and the protective-earth conductor of housing X45.

Installing the AC supply

- Install in the reverse order.
- Connect the primary cable; brown or black to Z1-L, blue to Z1-N and **yellow/green to X45**.

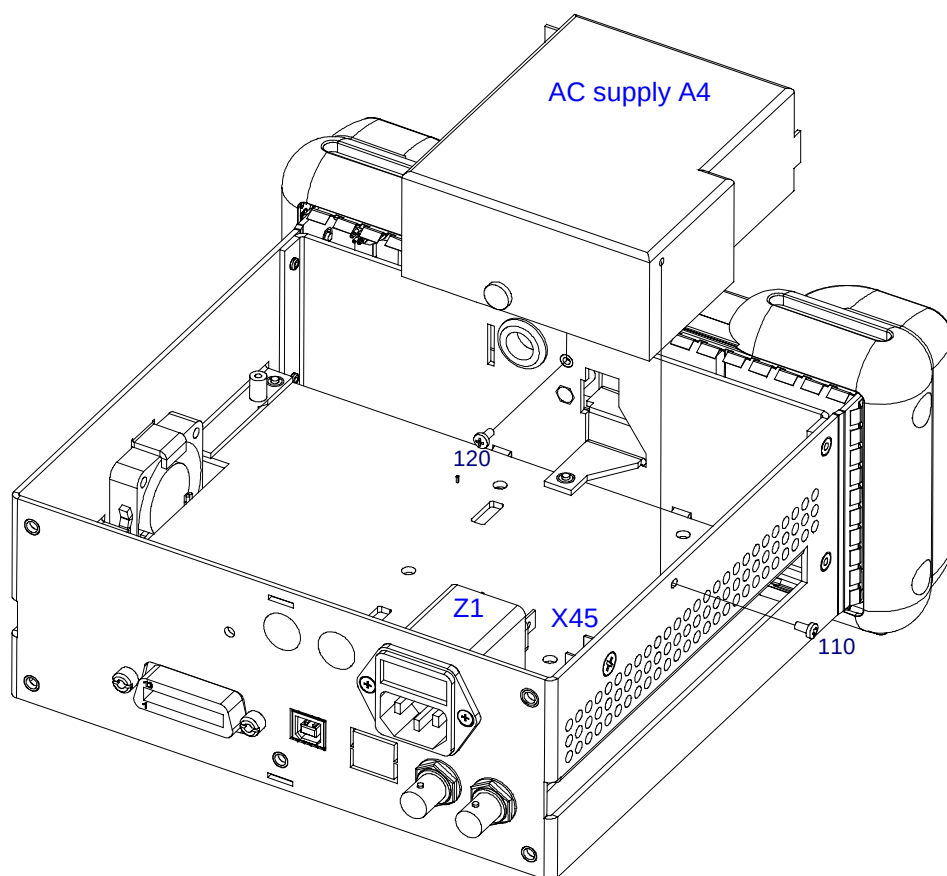


Fig. 3-8 Removing and installing the AC supply

Fan

Removing the fan

- Opening the instrument (see page 3.10).
- Disconnect the fan cable from connector X17 (mainboard A6).
- Snap off the fan by carefully pressing the aluminium bracket using a screwdriver or pliers.

Installing the fan

- Install in the reverse order.
- Before inserting the new fan, slightly press the aluminium bracket to the inside using a screwdriver.
- A click should be heard when the fan snaps in.

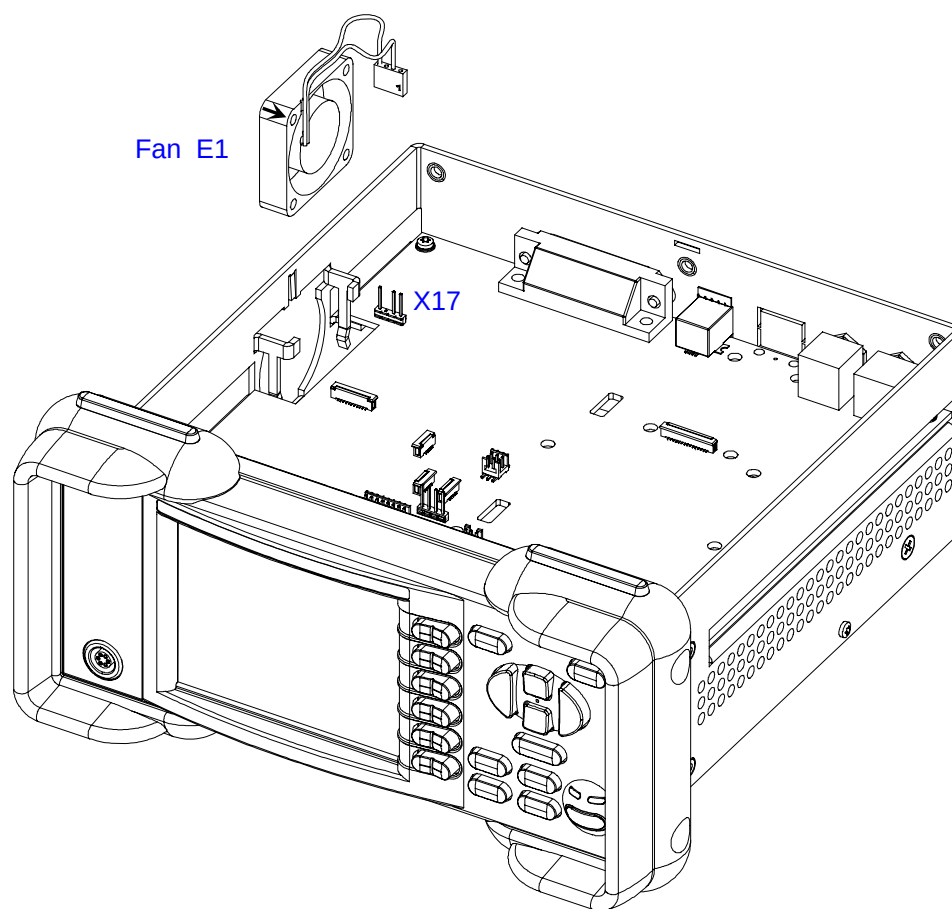


Fig. 3-9 Removing and installing the fan

Test generator 50 MHz (option R&S NRP-B1)

Removing the test generator

- Opening the instrument (see page 3.10).
- Put the instrument in the normal operating position. Undo 2 screws from the two front moulded shock protection parts (250) and remove them together with the front shock protection. Undo the 5 screws (235 / 1065) on the front side.
- Disconnect the following cables from mainboard A6:
 - W18 (display) from connector X18
 - W21 (switching foil) from connector X21
 - W1 (test generator) from connector X4
- Pull off the front panel towards the front and place it with the keyboard upside down on a clean surface.
- Remove the following cables to completely detach the front panel from the instrument (optional):
 - W15 (display) from DC/AC inverter A15
 - W5 (sensor A) from connector X5 (mainboard A6)
 - W6 (sensor B) from connector X6 (mainboard A6)
- Carefully pull off the adhesive label (132) (POWER REF ...) on the left of the front panel. Undo the two screws (1060).
- Remove the option.

Installing the test generator

- Install in the reverse order.
- Do not forget the cable connectors.
- Affix the appropriate adhesive label (1070).
- Carry out performance test as described in chapter 1. No adjustment is necessary if the option was obtained as a new module from Rohde & Schwarz.

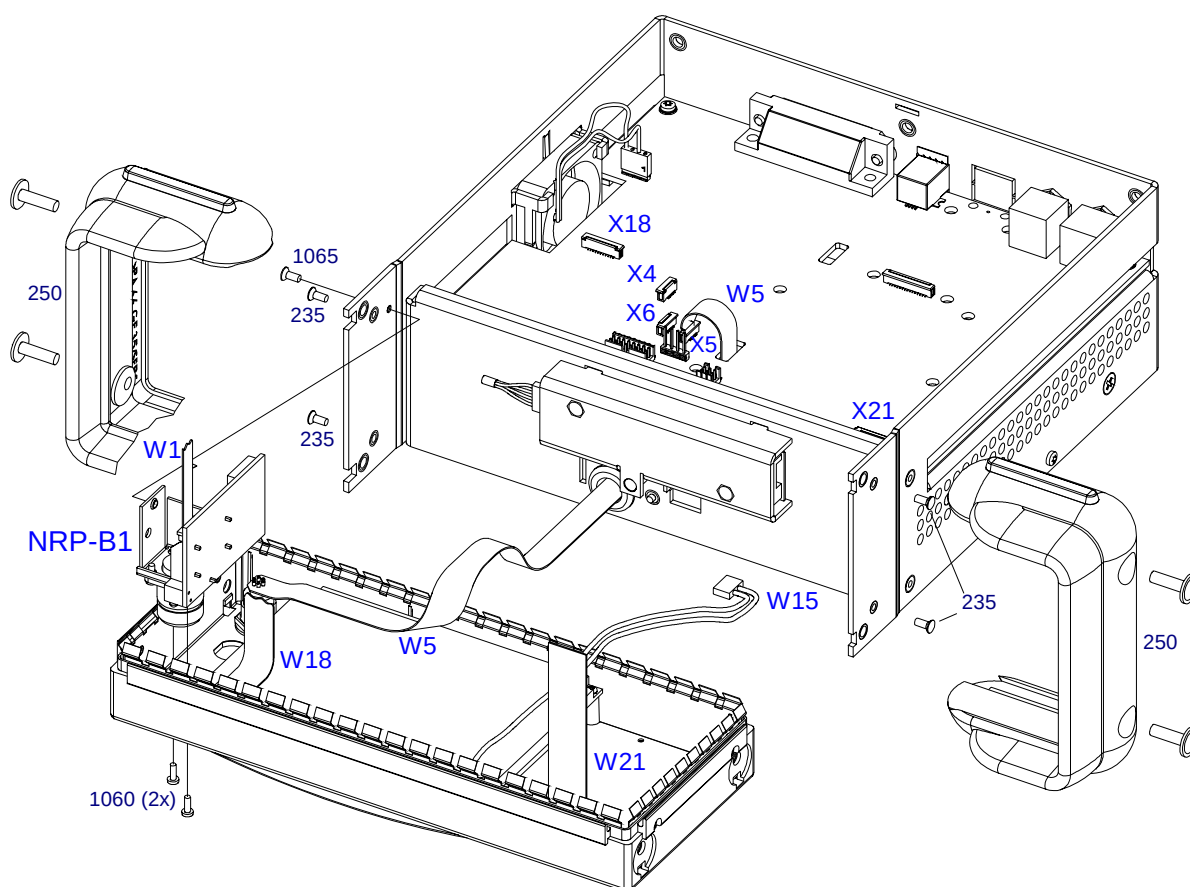


Fig. 3-10 Removing and installing the test generator

Second test input (option R&S NRP-B2) or sensor connector A

Removing the second test input or sensor connector A

- Opening the instrument (see page 3.10).
- Put the instrument in the normal operating position. Undo 2 screws from the two front moulded shock protection parts (250) and remove them together with the front shock protection. Undo the 4 screws (235) on the front side.
- If the option R&S NRP-B1 (test generator) is installed, also undo one screw (1065) on the side.
- Remove the following cables from mainboard A6:
 - W18 (display) from connector X18
 - W21 (switching foil) from connector X21
 - W1 (test generator) from connector X4 (option R&S NRP-B1)
- Pull off the front panel towards the front and place it with the keyboard upside down on a clean surface.
- Loosen and remove cable W5 (sensor A) and/or W6 (sensor B) of mainboard A6 from connector X5 or X6 (mainboard A6).
- To remove the complete front panel from the instrument, disconnect cable W15 (display) from the DC/AC inverter.
- Remove the union nut and tooth lock washer from sensor connector A and/or B. Remove connector(s) to the front.
- If the option R&S NRP-B1 (test generator) is installed, proceed as described in section Test generator 50 MHz (option R&S NRP-B1) on page 3.17.

Installing the second test input or sensor connector A

- Mark the new sensor cable end with label W5 (A) for measurement channel A or W6 (B) for measurement channel B.
- Install in the reverse order.
- Do not forget the cable connectors.

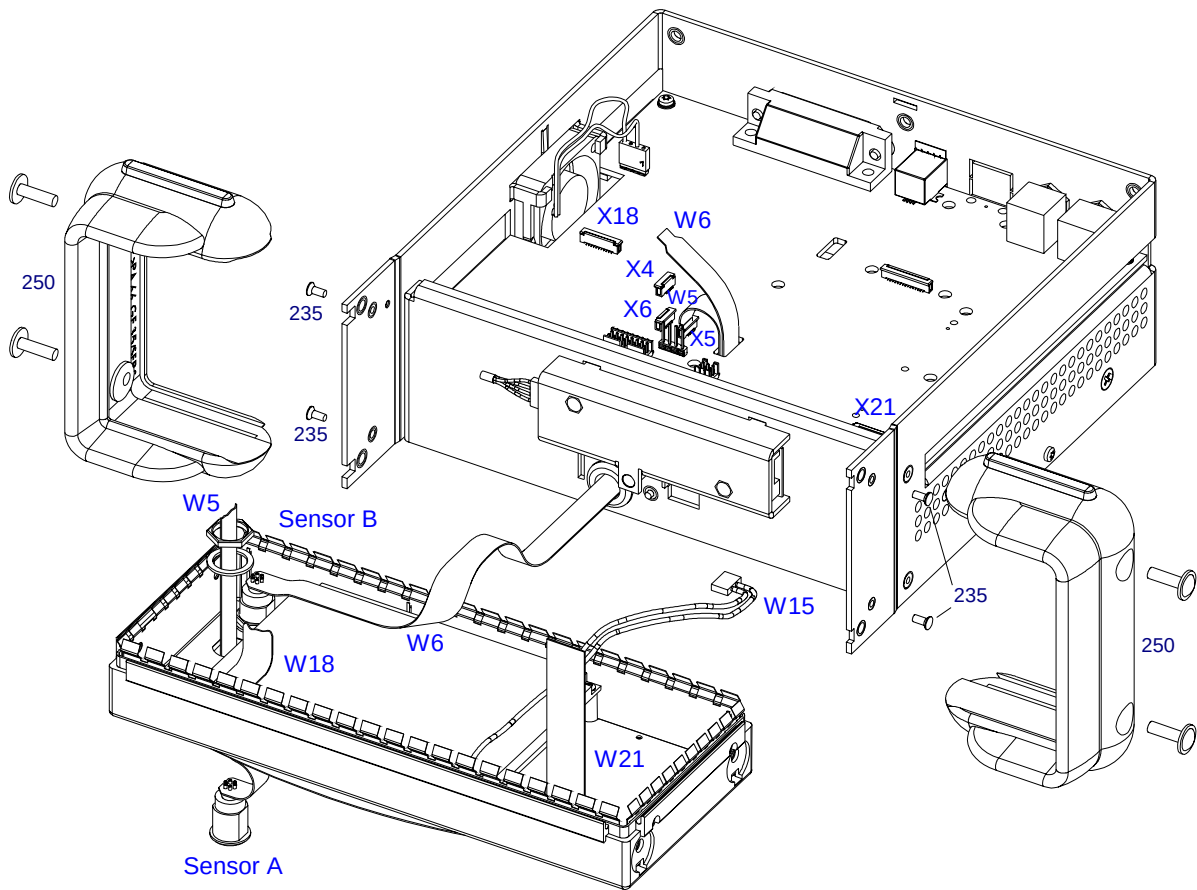


Fig. 3-11 Removing and installing the sensor connectors

LAN interface (option R&S NRP-B4)

Removing the LAN interface

- Opening the instrument (see page 3.10).
- Undo 4 screws (4050). Take care of the lock washers (4060, 4070).
- Disconnect cable W10 from connector X10 (mainboard A6).
- Remove the option.

Installing the LAN interface

- Install in the reverse order.
- Carry out performance test as described in chapter 1.

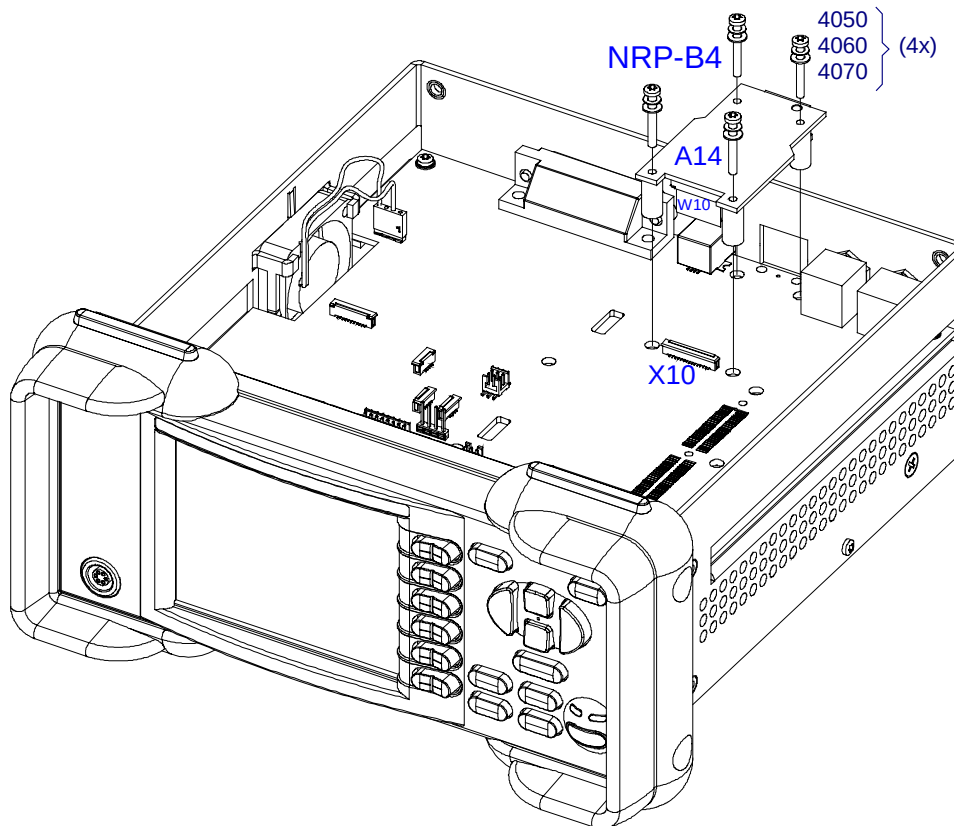


Fig. 3-12 Removing and installing the LAN interface

Third and fourth test input (option R&S NRP-B5)

Removing the third and fourth test input

- Opening the instrument (see page 3.10).
- Disconnect cables W50 and W60 from X50 and X60 (3rd and 4th sensor board A500).
- Undo 3 screws (5060). Take care of the lock washers (5050, 5070).
- Remove the option.
- Detach cable W50 of sensor C and cable W60 of sensor D, if required. Remove cables, union nut and tooth lock washer. Take out the connectors to the rear.

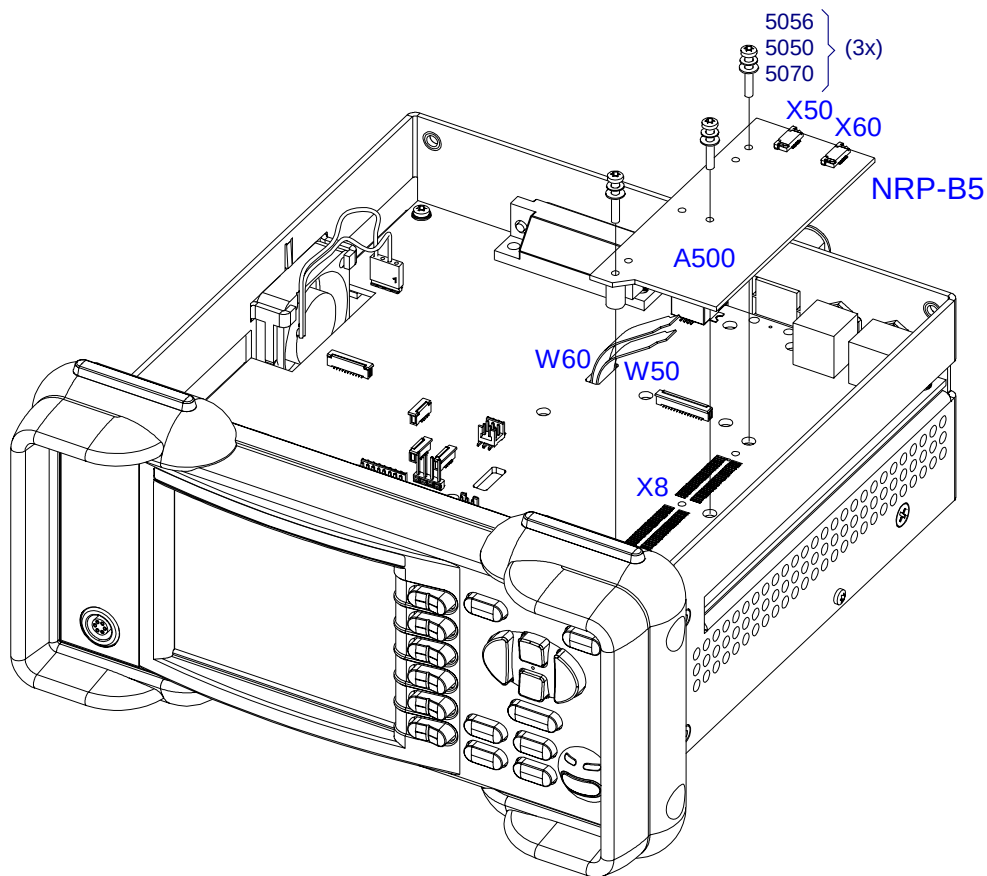


Fig. 3-13 Removing and installing the 3rd and 4th test input (board A500)

Installing the third and fourth test input

- Install in the reverse order.
- If required, mark the ends of the new cables with label W50 (C) for sensor C or W60 (D) for sensor D.
- Carry out performance test as described in chapter 1.

**Note:**

The press-in connector X8 has small guide pins that should be inserted into the corresponding boreholes in mainboard A6.

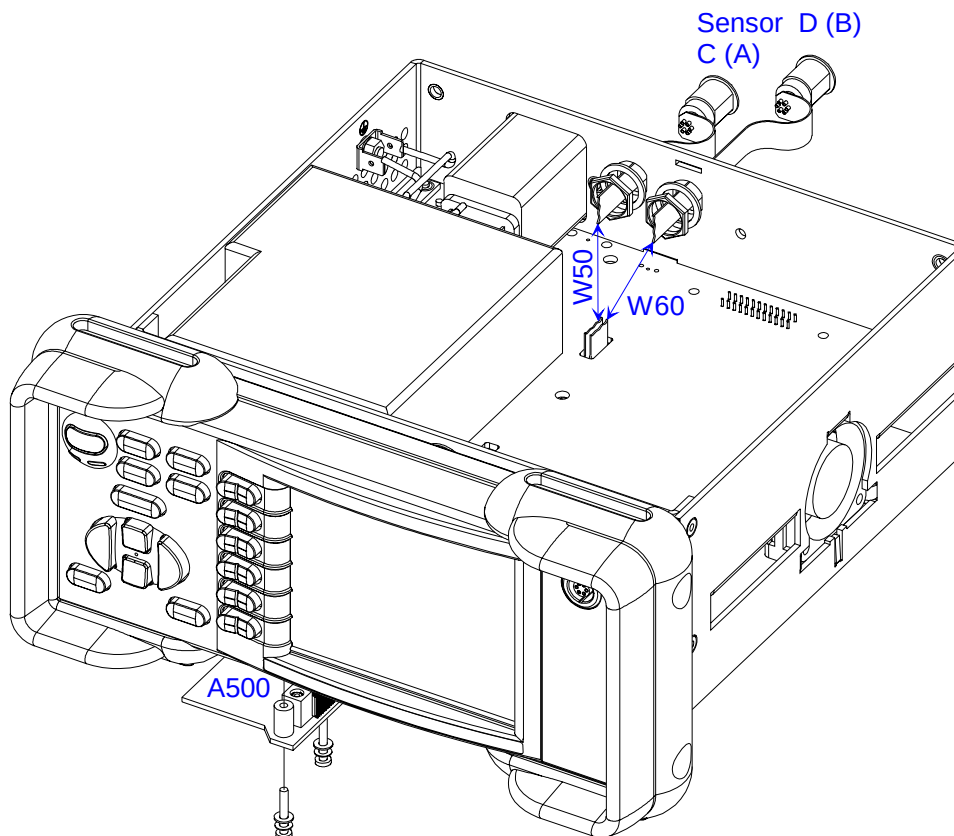


Fig. 3-14 Removing and installing the third and fourth test input (sensor connectors)

Rear-panel test inputs A and B (option R&S NRP-B6)

Removing rear-panel test inputs A and B

- Opening the instrument (see page 3.10).
- Loosen and remove cable W5 (sensor A) and W6 (sensor B) from connector X5 or X6 (mainboard A6).
- Remove the union nut and tooth lock washer from sensor connector A and B. Take out the connectors to the rear.

Installing rear-panel test inputs A and B

- Mark the ends of the new sensor cables with label W5 (A) for measurement channel A and W6 (B) for measurement channel B.
- Install in the reverse order.
- Carry out performance test as described in chapter 1.

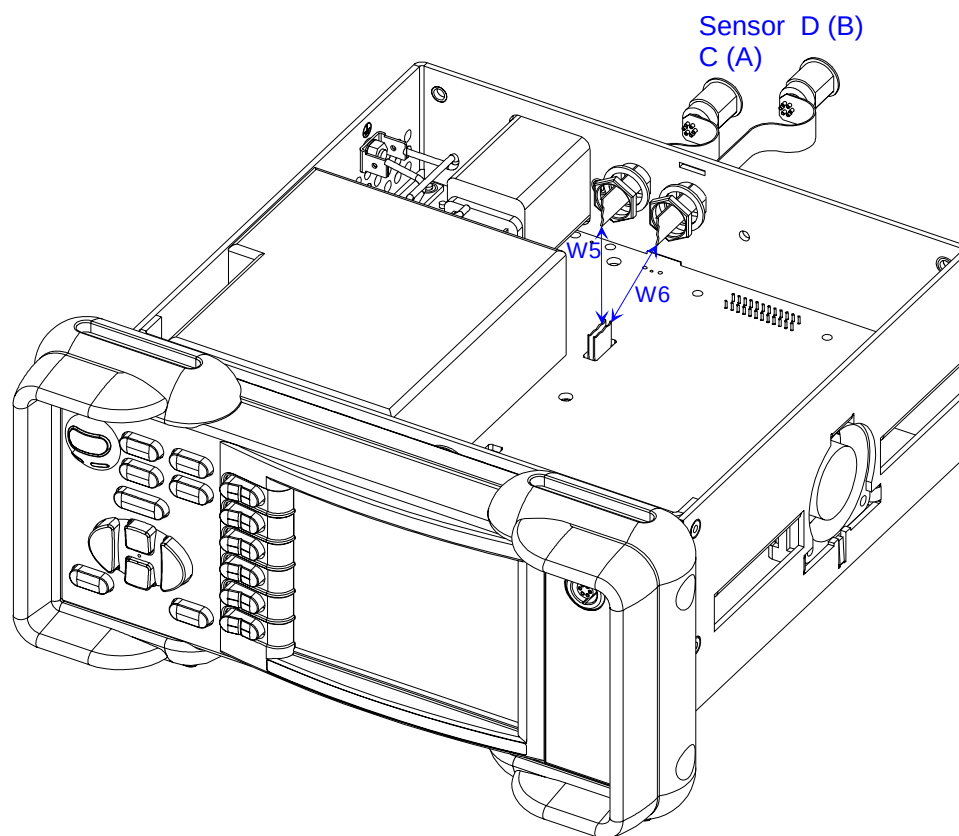


Fig. 3-15 Removing and installing rear-panel test inputs A and B

Troubleshooting

Malfunctions may be due to simple reasons but may also be caused by defective components. These troubleshooting instructions will enable you to isolate the error down to the module level. Module replacement and repair should be carried out by our customer service. It is therefore recommended to send the unit to the nearest service center (see list of addresses at the beginning of this manual).

**Warning!**

Make sure that no voltage is present when removing or inserting modules. When measuring voltages, be sure not to cause short circuits.

The following tools are provided in the R&S NRP to allow easy diagnostics.

- Selftest during booting

**Important!**

If problems occur, first check all connections (cables, connectors of module, etc) to make sure that they are not damaged or improperly connected.

Measuring equipment and accessories

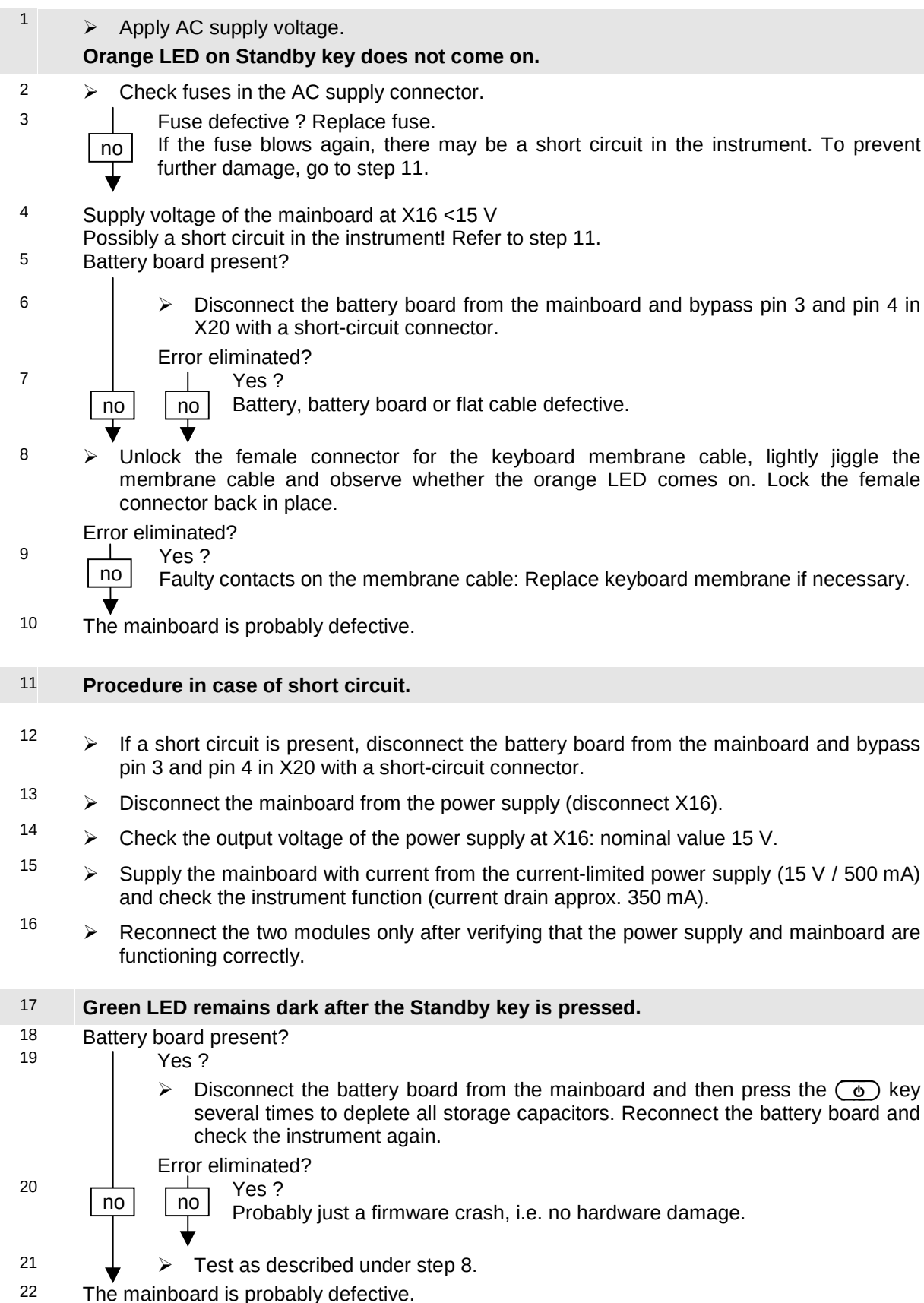
Table 3-2 Measuring equipment

Item	Instrument type	Recommended characteristics	Recommended instruments	R&S Order No.	Application
1	Digital multimeter				To test supply voltages
2	Power sensor		R&S NRP-Z11	1138.3004.02	To test sensor interfaces

Table 3-3 Built-in test functions

Item	Type	Application
1	Orange LED next to  key.	Indicates presence of output voltage of power supply (connected directly via series resistor).
2	Three SMD LEDs on mainboard next to processor.	After switch-on, they come on in sequence (very quickly) if the processor and its elementary auxiliary chips are functioning. They go out again once booting has been completed.
3	Selftest during booting.	Runs automatically and displays a series of icons as messages.
4	Test program for display test in the Boot menu.	Under Service -> Display test. Various test patterns can be displayed.
5	Test program for a display test in the main software.	In the System menu under Test... The test program automatically shows a succession of various test patterns.
6	Test program for a keyboard test in the main software.	In the System menu under Test... The program is described in the operating manual, chapter 4.
7	Display of the capacity of the fully charged battery.	In the Boot menu under Battery -> Info. The parameter is named FullyCharged Capacity and is to be compared with DesignCapacity.

The R&S NRP cannot be switched on



Display is dark or malfunctioning

Prerequisite: Green LED on. Otherwise, troubleshoot as described under (☞ The R&S NRP cannot be switched on, page 3.27).

23	Blank screen
24	➤ Switch off the R&S NRP. Switch it back on by pressing the Standby key and then immediately press the  key. This restores brightness and contrast to their default settings. A menu then appears that allows you to manually adjust each of the two parameters.
	Screen contents now visible?
25	Yes ? no The display parameters were obviously incorrectly set.
26	➤ Unplug membrane cable W18 (to the display) from connector X18 (must first be unlocked), plug it back in and lock the connector.
	Screen contents now visible?
27	Yes ? no Loose connection.
28	➤ After switching the instrument on, check whether the three LEDs next to the processor (mainboard) come on and then go out after about 5 seconds.
29	Yes ? no Processor is functioning properly. The display is probably defective, although mainboard damage also cannot be ruled out.
30	Processor is not functioning properly; the mainboard is probably defective.
31	Incorrect screen contents
32	The test programs for a display test are located in the Boot menu (☞ 4.2 Display Test Dialog) and in the System menu under Test... (☞ operating manual, chapter 4).
33	Display or mainboard defective.
34	Normal screen contents but poor quality (blurry, too bright/dark)
35	➤ Press the  key and then set brightness and contrast separately. Image quality better?
36	Yes ? The display parameters were obviously incorrectly set.
37	No lighting
38	➤ First follow the procedure under step 24-25.
39	➤ Check the supply voltage for the DC/AC converter at X19: the center pin should supply the ground potential, and the two outer pins should supply a potential of +5 V.
40	Supply voltage faulty ? no Either a short circuit in the input of the DC/AC converter or a defective mainboard.
41	DC/AC converter or lamp defective. The lamp is not available as a separate item, only as part of the display.

Keyboard detection faulty

- 42 A test program for a keyboard test is located in the System menu under Test... (☞ operating manual, chapter 4).
- 43 The keyboard membrane or mainboard is defective.

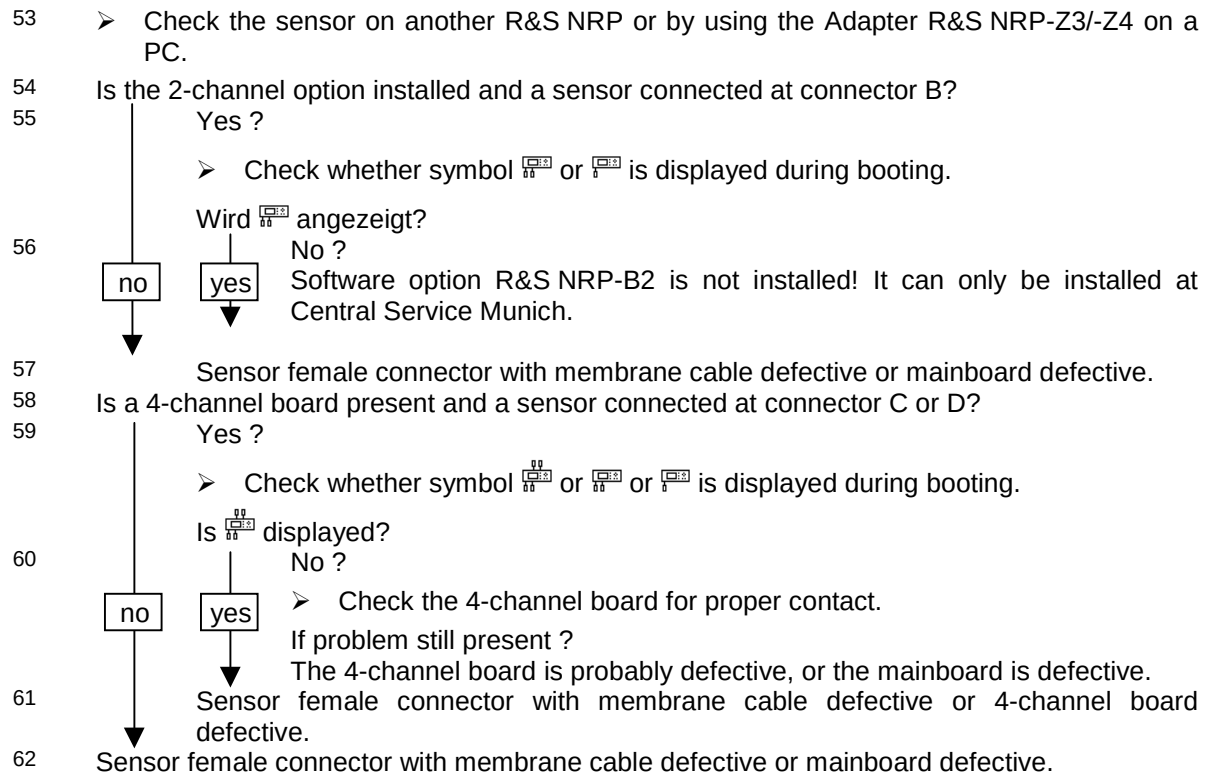
Error during booting

- 44  Battery, battery option (R&S NRP-B3) or perhaps the mainboard is defective.
- 45 ➤ Pull the power connector, remove the battery, and deplete all storage capacitors by pressing the  key several times. Reassemble the instrument and check it again.
- If problem still present ?
Battery or battery board defective.
- 46  A 4-channel instrument shows only two channels when booting.
Option R&S NRP-B5 defective, the mainboard defective, or both.
- 47  RAM error
? Mainboard defective.
- 48  Keyboard controller does not respond.
- Pull the power connector, remove the battery, and deplete all storage capacitors by pressing the  key several times. Reassemble the instrument and check it again.
- If problem still present ?
Mainboard defective.
- 49  USB ?
Mainboard defective.

Software unstable

- 50 ➤ Completely reinstall the software and update it (☞ section 4.1).
- 51 Erase data memory for nonvolatile data
(☞ section 4.2 Boot menu: Erase Nonvol-Data)
- 52 Problem still present ?
Mainboard probably defective.

Sensor not detected



Test generator does not produce any signals

- 63 ➤ Check function as described in chapter 1 (Performance Test).
- 64 If errors occur ?
- Test generator option (R&S NRP-B1), membrane cable or mainboard defective.

LAN interface does not function correctly

- 65 ➤ Check function as described in chapter 1 (Performance Test).
- 66 If errors occur ?
- Ethernet option, membrane cable or mainboard is defective.

IEC bus does not function correctly

- 67 ➤ Check function as described in chapter 1 (Performance Test).
- 68 If errors occur ?
- Mainboard is defective.

Analog output / trigger input does not function correctly

- 69 ➤ Check function as described in chapter 1 (Performance Test).
- 70 If errors occur ?
Mainboard defective.

Contents

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Installation of New R&S NRP Software 4.1

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4 Firmware Update/Installation of Options

Chapter 4 provides information on the software update and the installation of options. Descriptions enclosed with the software update or options can be filed here.

Installation of New R&S NRP Software

Use the Firmware Update program module from the R&S NRP Toolkit to load new firmware. The toolkit comes on a CD-ROM and is supplied together with the sensors. It enables you to update the application firmware, the boot loader and the firmware for the keyboard controller. The current firmware versions can be downloaded from the R&S homepage on the Internet, since the CD-ROM accompanying the power sensors contains the firmware status at the time of delivery.

Hardware and software requirements

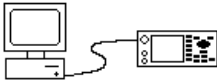
- PC with free USB port, commercially available USB connecting cable.
- Operating system Windows™ 98, Windows™ ME, Windows™ 2000, or Windows™ XP.
- **The R&S NRP Toolkit software must already be installed on your PC.**
- One of the following files must be selected (depending on the software component to be updated):
 - nrpt_<version number>.nrp Application
 - openbios_<version number>.nrp Boot loader
 - keyb_<version number>.nrp Keyboard controller

The files are available in the \software\firmware\baseunit directory of the CD-ROM.

Preparation

- Connect the R&S NRP to the AC supply, but do not switch it on (only the yellow LED at the ON/STANDBY key must light up).
- Connect the R&S NRP to the PC using the USB connecting cable. The flat connector (type A) has to be plugged into the PC and the square one (type B) into the R&S NRP.
- If a second R&S NRP or an R&S NRP-Z power sensor is connected to the PC, unplug these devices from the PC.

Firmware Update



When finished,
please disconnect and restart

- Switch on the R&S NRP. The picture opposite should appear on the display after a short time.
- In addition, the PC should have identified the new USB hardware and assigned the appropriate driver from the R&S NRP Toolkit to the R&S NRP (brief message in a small window).



If you forgot to install the R&S NRP Toolkit software beforehand, Windows will try in vain to find a USB driver for the R&S NRP. If this happens, the R&S NRP is highlighted by a yellow exclamation mark in the Windows device manager. In this case, proceed as follows:

- *Abort the dialog for driver installation.*
- *Install the R&S NRP Toolkit from the CD-ROM.
Then manually assign the USB driver from the toolkit to the R&S NRP.*
- *Go to Control Panel – Add/Remove Hardware and start the hardware assistant to search for new components.*
- *Mark the R&S NRP in the list of hardware components and complete the driver installation.*
- *Switch off the R&S NRP and back on.*

Updating the application firmware



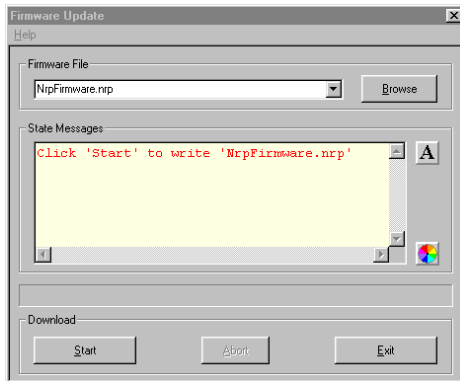
nrpt_01.10.nrp



The update can be started as follows:

- Either double-click the icon of the update file named nrpt_<Version Number>.nrp
- Or start **NRP Toolkit – Firmware Update** from the Windows Start menu.

The dialog box on the left is displayed next.

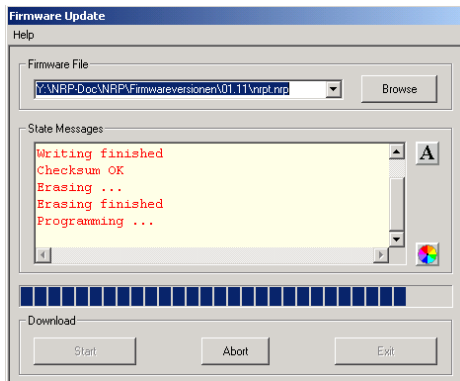


- If the update was started via the Windows Start menu, enter the file name of the application firmware in the **Firmware File** box (or search for the name by using the **Browse** button).
- Click the **Start** button to start the file transfer, which is performed automatically.

- Observe the following during the update:



- Do not disconnect the R&S NRP from the PC.
- Do not switch off the R&S NRP and do not disconnect the power plug.
- Exit the Firmware Update program only after it has been completely executed.



- During the update, the State Messages box informs you of the progress. The update has been completed successfully if the message 'Device <Type Designation><Serial Number> is active' appears.
- Then disconnect the R&S NRP from the PC, switch it off and back on.



Potential problems

- Error in the compatibility and consistency checks.

In this case, the update is aborted and an error message is output.

- Switch the R&S NRP off and back on and start the update again.

Updating the boot loader



openbios_01_02.nrp

The boot loader update is similar to the update of the application firmware (see above).

- Instead of the application, however, you must load the new boot loader named
openbios_<Version Number>.nrp

Potential problems

- Program aborted by timeout (R&S NRP in measurement mode)
- Switch the R&S NRP off and back on and start the update again.

Updating the firmware for the keyboard controller



keyb_01_02.nrp

This update is similar to the update of the application firmware (see above).

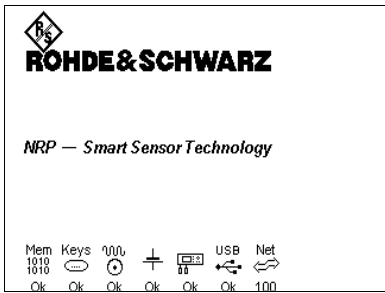
- Instead of the application, however, you must load the new controller firmware named
keyb_<Version Number>.nrp

Note:

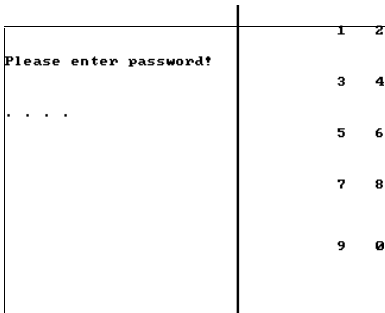
If the previous firmware of the keyboard controller was 1.80 or later, the R&S NRP switches off after the update has been completed.



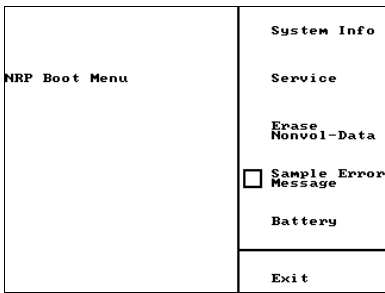
Boot menu



To access the Boot menu, press the lowermost softkey immediately after switch-on.

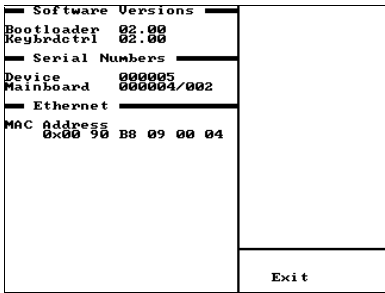


The Boot menu password is „7396“.



- System Info Submenu, see below.
- Service Submenu, see below.
- Erase Nonvol-Data Restores the nonvolatile memory to its factory state.
- Sample Error Message Activates the display of sample errors for the measurement values. Sample errors normally do not cause any measurement errors.
- Battery Submenu, see below (only if the option R&S NRP-B3 has been installed).

System Info menu



Selected basic data for the instrument is displayed.

Service menu

NRP Boot Menu └ Service Menu	Display Test
	Options Power Ref Calibration
	Exit

The following can be called up from this menu:

- Display test
- Dialog for installing options and
- Dialog for manually calibrating the Test Generator R&S NRP-B1

Display Test dialog

Select Tests. When finished, press ESC.	1	2
	3	4
	5	6
	7	8
	9	0
	Exit	

10 different test patterns can be called up with the softkey toggles.

To return to the menu, press the **(ESC)** key.

Options dialog

Installed Options	
NRP-B1 1146.9008.00 Sensor Check Source	deinstall NRP-B2
NRP-B2 1146.8801.00 Second Sensor Input	install NRP-B6
NRP-B3 1146.8501.00 Battery Supply	install LAN-Boot
NRP-B4 1146.9308.00 LAN Interface	deinstall NRP-B4
NRP-B64 0000.0000.00 Lab Device	
	Exit

Shows the installed options in the left field.

Options can be installed by entering an enabling code; they can be deinstalled by entering the same code again.

Power Ref Calibration Dialog

Power Level: <u>1mW</u> 10uW	< >
	☒ Power Ref
Coarse Tune [-----!-----]	- +
Fine Tune [-----!-----]	- +
OK	
Cancel	

Used for manually calibrating the Test Generator R&S NRP-B1.

The password "9603" is required in order to access the dialog.

Two power levels can be calibrated: 1 mW and 10 μW

The generator can be switched on and off.

The level for the selected power can be adjusted using the Coarse Tune and Fine Tune settings.

The data can be stored in the calibration data memory of the option by pressing the OK key.

The action can be aborted at any time by pressing the Cancel key. The previous calibration data will then be retained.

Battery dialog

Charging State ■	Relearn Cap Start >
Running from Battery	Bat. Status
% full: 89 %	Chrg. Status
t to empty: --- %	Info
Exit	

Start page of the battery menu.

The current charge state is displayed.

Relearn Cap Starts one or more discharge/charge cycles. Results are displayed in the lower part of the window.

Bat. Status Opens the dialog that displays comprehensive status information about the battery.

Chrg. Status Opens the dialog that displays the charge controller data.

Info Opens the dialog that displays the basic information about the battery.

Battery Info dialog

Battery Data ■	
Manuf.: Totex	
Model: DR15	
Chemistry: NiMH	
Revision 0x00 (?)	
Spec Version 0x01 (1.0)	
Serial Num 5000	
Manuf. Date: 1999-09-23	
Initialized x	
Capacity	
dsgr cap: 1800 mAh	
Status	
Cycles: 65294	
Cond. Required:	
Charger Data	
Spec Version 0x00 (?)	
Charger Level 0x00 (?)	
2040 Data	
EDU1: 9100	
EDU2: 9100	
Flags: 0x9000	
Exit	

Detailed information about what the data means can be obtained from the Smart Battery specification:

<http://www.sbs-forum.org/>

Caution!

The data stored in rechargeable batteries by their manufacturers is not always correct (e.g. manufacture date).

Battery Status dialog

Alarm Bits	
Overcharged	Req. U invalid
Terminate chrg	Req. I invalid
Overtemp	Req. I not met
Terminate dischrg	Req. U not met
Rem. Capacity	Master Mode
Rem. Time	Inp. Power fail
Fully charged	Alarm inhibited
Fully discharged	Therm under-range
	Therm hot
	Therm cold
	Therm over-range
Battery Status	
% full:	89 %
Remain Cap:	1093 mAh
Full cap:	1230 mAh
I act: b->	9 mA
U act:	12021 mV
t to empty:	--
T Bat:	31 °C
T LP:	35 °C
Condition Bits	
Cond. required:	x
Initialized	x
☐ Manual Charge	
Exit	

Shows detailed information about the charge state and charge process.

"Manual Charge" allows you to overwrite the automatic charger, and C/10 allows you to manually charge the battery without any time restrictions.

Caution!
Continuous overcharging can damage the battery.

Charger Status dialog

Charger Status	
☐ Discharge	
☐ Chrg inhibit	
Reset	
Exit	
Battery present	x
AC present	x

Indicates the presence of a battery and that power is provided through a power supply.

Installation of Options

- The following options can be added to the Power Meter R&S NRP:
- Option test generator R&S NRP-B1 1146.9008.02
- Option second test input R&S NRP-B2 1146.8801.02
This option can only be retrofitted
by Central Service Munich.
- Option battery power supply R&S NRP-B3 1146.8501.02
- Option LAN interface R&S NRP-B4 1146.9308.02
- Option third and fourth test input R&S NRP-B5 1146.9608.02
- Option rear-panel sensor inputs A and B R&S NRP-B6 1146.9908.02

The installation of the option is described in the enclosed instructions related to the option. The installation instructions supplied with the option can be filed in this chapter.

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5 Documents

This chapter provides information for ordering spare parts and contains the relevant documents for the Power Meter R&S NRP.

Returning the Instrument and Ordering Spare Parts

For service and repair work as well as ordering spare parts and modules, please contact your Rohde & Schwarz representative or our spare express service.

A list of addresses of all Rohde & Schwarz representatives as well as our spare express service is provided at the beginning of this service manual.

- The following data is required so that we can process your requests quickly and correctly and determine if your instrument is still under warranty.
 - Type designation (R&S NRP)
 - Model
 - Serial number (on the rear panel)
 - Firmware version (can be read in the device menu, see section Boot Menu in chapter 4).
 - In case of repair, a precise error description
 - Contact person for questions

Sending the Instrument to the Factory

For the transport of the instrument, ensure that it is sufficiently protected against mechanical damage and use antistatic packing materials.

- Use the original packaging for the dispatch or transport of the instrument as far as possible.
- If other packing materials are used pad the instrument adequately. Wrap the instrument in an antistatic packing foil to protect it against electrostatic charges.

Sending a Module to the Factory

When dispatching a module, also observe the following:

- Send the module in a sturdy cardboard box with padding material.
- For individual modules, use conductive secondary packing additionally or exclusively.

Exception: If the module contains a battery, the packing material in direct contact with the ESD must always consist of antistatic non-conductive material. For this purpose, first pack the module with antistatic material and use conductive material for the secondary packing.

Ordering Spare Parts

The following data is required so that we can deliver spare parts quickly and correctly:

- Designation
- Stock No.
- Serial number (if available, e.g. for modules)
- Electrical identification (if available, e.g. W10)
- Quantity
- Type designation, model and serial number of the instrument for which the spare part is required
- Contact person for questions

List of spare parts (see page 5.3.)

Replacement Modules

Replacement modules are a cost-effective alternative to new parts. These are repaired and tested modules that show signs of use but are equivalent to new modules from the electrical and mechanical point of view.

- Your Rohde & Schwarz representative and spare express service can inform you on which replacement modules are available.
- Please send the defective module with a return dispatch slip, the note "Replacement module" and the following specifications:
 - Designation, stock No., serial number
 - Type designation (R&S NRP), model and serial number of the instrument from which the module was removed
 - Date of removal
 - Name of the technician who replaced the part
 - Detailed description of the fault
- The return dispatch note will be sent with the delivered replacement module.

Repairable modules of the replacement program will be accepted within 3 months after delivery against a credit at a repurchase value. Any parts that cannot be repaired such as burnt, broken or circuits damaged by repair tests as well as incomplete modules shall be excluded.

Spare Parts

The spare parts stock numbers required for ordering are specified in the following lists.

Power cable

Table 5-1 Available power cables

Stock No.	Length / angle	Safety plug connector in line with	Used in
0006.7013	2 m / angular	BS1363: 1967' equivalent to IEC 83: 1975 Standard B2	Great Britain
0006.7020	2 m / straight	Type 12 to SEV standard 1011.1059, standard sheet S 24 507	Switzerland
0006.7036	2 m / straight	Type 498/13 to US standard UL 498, or IEC 83	USA/Canada
0006.7107	2 m / straight	Type SAA3 10 A, 250 V, to AS C112-1964 Ap.	Australia
0025.2365	2 m / angular	DIN 49 441, 10 A, 250 V	Europe (without Switzerland)
0099.1456	2 m / straight	DIN 49 441, 10 A, 250 V	Europe (without Switzerland)

List of Mechanical Parts and Spare Parts

The Power Meter R&S NRP is designed in accordance with the R&S concept 2000.

Housing size: 2E 1/2 T250

Overall dimensions: W x H x D: 274 mm x 114 mm x 268 mm

Table 5-2 List of spare parts for the R&S NRP

Item No.	Designation	Electrical identification	Stock No.
20	CHASSIS		1143.8600.00
25	COVER RD11.1/9.9 FOR SENSOR REAR-PANEL BOREHOLES		0009.9217.00
27	FAN WITH FEMALE CONNECTOR	E1	1143.9807.00
30	MAINBOARD	A6	1144.0003.02
35	SCREW WITH WASHER 6900/ISR-M2.5X6 FOR MAINBOARD A6		1148.3059.00
40	EURO CONNECTOR WITH LINE FILTER 6A	Z1	1144.0755.00
45	SAFETY FUSE T2 IEC127-2/V FOR EURO CONNECTOR Z1	F1, F2	0020.7546.00
50	SCREW 965/ISR-M3X6-A4 FOR EURO CONNECTOR WITH LINE FILTER Z1		1148.2781.00
60	FLAT CONNECTOR GR 6.3 FOR PROTECTIVE-EARTH CONNECTOR	X45	0543.6705.00
65	PROTECTIVE-EARTH CABLE	W45	1090.3881.00
70	SCREW 965/ISR-M4X8 FOR PROTECTIVE-EARTH CONNECTOR X45		1148.2817.00
80	TOOTH LOCK WASHER A4.3 DIN6797 FOR PROTECTIVE-EARTH CONNECTOR X45		0016.2837.00
85	CURVED WASHER DIN137-A4 FOR PROTECTIVE-EARTH CABLE X45		0005.0315.00
90	NUT M4 DIN934 FOR PROTECTIVE-EARTH CONNECTOR X45		0016.4400.00
100	POWER SUPPLY AC/DC CONVERTER 25 W	A4	1143.9707.00
110	SCREW 7985/ISR-M2.5X5-A4 FOR POWER SUPPLY A4		1148.2617.00
120	SCREW WITH WASHER 6900/ISR-M2.5X6 FOR POWER SUPPLY A4		1148.3059.00
125	USB SENSOR CABLE	W5	1144.0103.02
126	SET OF ADHESIVE LABELS FOR SENSOR CABLE		1144.0149.00
130	BW2 FRONT PANEL FOR R&S NRP		1143.8530.00
131	R&S LOGO LABEL R&S NRP FOR FRONT PANEL		1143.8669.00
132	SET OF LABELS R&S NRP (2 PARTS)		1143.8681.00
135	PSC FILTER WASHER		1143.8830.00
140	SHIELDING R&S NRP FOR BW2 FRONT PANEL		1143.8552.00
150	SILICONE MAT R&S NRP		1143.8800.00
160	SWITCHING FOIL R&S NRP	A50	1143.8817.00
170	BRACKET FOR SWITCHING FOIL A50		1143.8630.00
180	SCREW FOR PLASTICS 1.8 x 4.4 FOR SWITCHING FOIL A50		1066.2066.00

Item No.	Designation	Electrical identification	Stock No.
200	DUST SEALING FOR FRONT PANEL		1143.8846.00
210	DISPLAY LCM089-02	A5	1143.9607.00
220	SCREW FOR PLASTICS 2.2 x 10 FOR DISPLAY A5		1137.6322.00
229	SCREW WITH WASHER 6900/ISR-M2.5X6 FOR DC/AC INVERTER A15		1148.3059.00
230	DC/AC INVERTER PS-8M052501	A15	1143.9636.00
231	INVERTER CABLE FOR PS-8M052501	W19	1143.9620.00
232	COVER / HOLDING BRACKET FOR DC/AC INVERTER A15		1143.8723.00
233	SCREW 965/ISR-M2:5X5-A4 FOR HOLDING BRACKET		1148.2752.00
235	SCREW 965/ISR-M2:5X5-A4 FOR FRONT PANEL		1148.2752.00
240	BW2 ENCLOSURE 2E ½ T250 – R&S NRP		1143.8752.00
250	SHOCK PROTECTION 2E COMPLETE WITH SCREWS (4 PARTS)		1096.5940.00
260	CARRYING HANDLE 2E ½		1143.9007.00
270	BW2 SIDE COVER		1096.2558.00

Table 5-3 List of spare parts for options

Item No.	Designation	Electrical identification	Stock No.
1146.9008.01 (R&S NRP-B1 test generator)			
1040	TEST GENERATOR	A1	1146.9108.02
1050	FLEXIBLE CABLE 10-CONTACT	W1	1146.9150.00
1060	SCREW 7985/ISR-M2X6-A4 FOR TEST GENERATOR A1		1148.2700.00
1065	SCREW 965/ISR-M2.5X5-A4 FOR TEST GENERATOR A1		1148.2752.00
1070	SET OF LABELS FOR R&S NRP (6 PARTS)		1143.8675.00
1146.8801.01 (R&S NRP-B2 second test input)			
2020	USB SENSOR CABLE	W6	1144.0103.02
2040	SET OF LABELS FOR R&S NRP (6 PARTS)		1143.8675.00
2050	SET OF ADHESIVE LABELS FOR SENSOR CABLE		1144.0149.00
1146.8501.01 (R&S NRP-B3 battery power supply)			
3020	BATTERY BOARD	A3	1146.8601.02
3030	BATTERY POWER CABLE	W20	1146.8660.00

Item No.	Designation	Electrical identification	Stock No.
3040	GS BRACKET FOR BATTERY BOARD		1146.8699.00
3050	BATTERY HOLDING BRACKET		1146.8701.00
3060	10.8 V 1.85 AH NIMH BATTERY	G1	1146.8760.00
3070-3085	SELF-ADHESIVE TAPE POLYURETHANE FOAM 6 MM THICK, 9 MM WIDE		0002.5097.00
3090	SCREW WITH WASHER 6900/ISR-M2.5X6 FOR BATTERY HOLDING BRACKET		1148.3059.00
3160	SCREW WITH WASHER 6900/ISR-M2.5X6 FOR BATTERY BOARD A3		1148.3059.00
3170	SHORT-CIRCUIT CONNECTOR RASTER 2 MM		1043.9870.00
1146.9308.01 (R&S NRP-B4 LAN interface)			
4020	LAN INTERFACE ETHERNET BOARD	A14	1146.9408.02
4040	FLEXIBLE CABLE 30-CONTACT	W10	1146.9450.00
4050	WASHER A2.7 DIN125 FOR ETHERNET BOARD A14		0082.4663.00
4060	SCREW 7985/ISR-M2.5X20 FOR ETHERNET BOARD A14		1148.2946.00
4070	CURVED WASHER A2.6 DIN137 FOR ETHERNET BOARD A14		0005.0280.00
1146.9608.01 (R&S NRP-B5 third and fourth test input)			
5020	THIRD/FOURTH SENSOR BOARD	A500	1146.9708.02
5040	SET OF ADHESIVE LABELS FOR SENSOR CABLE		1144.0149.00
5050	WASHER A2.7 DIN125 FOR SENSOR BOARD A500		0082.4663.00
5060	SCREW 7985/ISR-M2.5X16-A4 FOR SENSOR BOARD A500		1148.2869.00
5070	CURVED WASHER A2.6 DIN137 FOR SENSOR BOARD A500		0005.0280.00
5080	USB SENSOR CABLE	W50, W60	1144.0103.02
5090	SET OF LABELS FOR R&S NRP (6 PARTS)		1143.8675.00
1146.9908.01 (R&S NRP-B6 rear panel sensor input)			
6040	SET OF LABELS FOR R&S NRP (6 PARTS)		1143.8675.00

Component Layout Diagram R&S NRP Mainboard

Component Layout Diagram R&S NRP Mainboard (Part 1)

