ROHDE&SCHWARZ

Test and Measurement
Division

## Service Manual Instrument

# SPECTRUM ANALYZER

## FSU3
**1129.9003.03**

## FSU8
**1129.9003.08**

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Republic of Germany

# Tabbed Divider Overview

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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.

1. 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:

   Pollution severity 2, overvoltage category 2, IP degree of protection 2X, altitude max. 2000 m.

   The unit may be operated only from supply networks fused with max. 16 A.

2. 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).

3. 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).

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

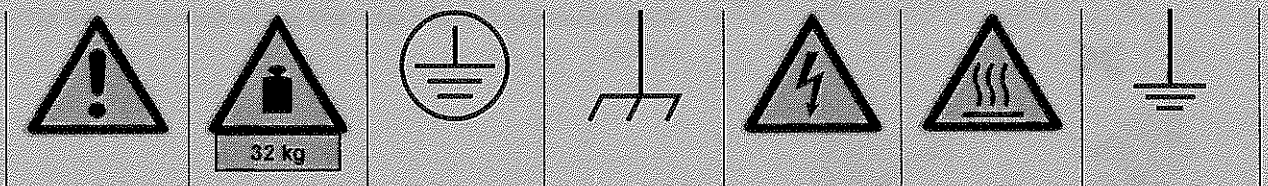
   (visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

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

11. Equipment returned or sent in for repair must be packed in the original packing or in packing with electrostatic protection.

12. Any additional safety instructions given in this manual are also to be observed.

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

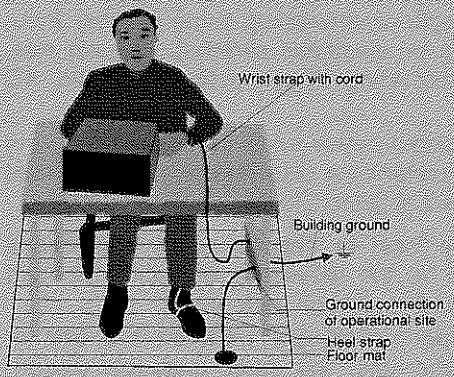



| Observe operating instructions | Weight indication for units >18 kg | PE terminal | Ground terminal | Danger! Shock hazard | Warning! Hot surfaces | Ground |
|---|---|---|---|---|---|---|

# Safety Instructions

The instrument contains components which are hazardous to electrostatic exposure and which are marked by the following symbol:


- To avoid damage of electronic components, the operational site must be protected against electrostatic discharge (ESD).

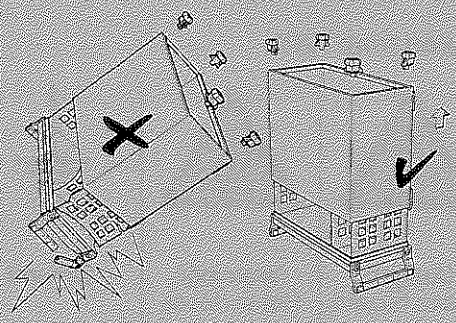



The following two methods of ESD protection may be used together or separately:

- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

The batteries used in the instrument are high-power lithium cells with a life utility of approx. 5 years. If you do not handle them properly, there is a danger of explosion. Therefore, observe the following safety instructions:

- Avoid short-circuit and loading of the battery
- Do not expose lithium batteries to high temperature or fire.
- Do not open used batteries
- Keep batteries away from children.
- Replace battery only by R&S type battery (R&S ordering number 0565.1687.00)
- Make sure to connect the battery to the appropriate terminals when replacing
- Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.



- *Put the instrument on the front handles before loosing the rear feet and the tube to avoid damage of the instrument.*
- *When mounting the tube take care not to damage or pull off cables.*

# 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.

# Certified Quality System

# ISO 9001

**DQS REG. NO 1954-04**

## 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 nach ISO 9001 zertifiziert.

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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 ISO 9001.

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ROHDE&SCHWARZ

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# Contents of Manuals for Spectrum Analyzer FSU

## Service Manual - Instrument

The service manual - instrument 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 FSU by the replacement of modules.

The service manual comprises four chapters and an annex (chapter 5) containing the FSU circuit documentation:

**Chapter 1** provides all the information necessary to check FSU 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 of FSU 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 of FSU 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 of FSU.

## Operating Manual

In the operating manual for FSU you will find information about the technical specifications of FSU, 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.

# Contents - Chapter 1 "Performance Test"



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# 1 Performance Test

## Test Instructions

- The rated specifications of the analyzer are tested after a warm-up time of at least 15 minutes and overall calibration. Only in this case can the compliance with the guaranteed data be ensured. Starting of overall adjustment: [***CAL** : CAL TOTAL*]
- If nothing else specified, all measurements will be done with external reference frequency.
- Values given in the following sections are not guaranteed. Only the technical specifications of the data sheet are binding.
- The values given in the datasheet are the guaranteed limits. Due to measurement errors these limits must be extended by the tolerance of the measuring equipment used in this performance test.
- Inputs for settings during measurements are shown as following:

  [**<KEY>**] Press a key on the front panel, eg **[SPAN]**

  [<SOFTKEY>] Press a softkey, eg [MARKER -> PEAK]

  [<**nn unit**>] Enter a value and terminate by entering the unit, eg [**12 kHz**]

  Successive entries are separated by [:], eg. [ **BW** : RES BW MANUAL : **3 kHz** ]

## Measuring Equipment and Accessories

| Item | Type of equipment | Specifications recommended | Equipment recommended | R&S Order No. | Use |
|---|---|---|---|---|---|
| 1 | Frequency counter | accuracy < $1x10^{-9}$,<br>frequency range up to 10 MHz | Advantest R5361B<br>with option 23 | | Frequency Accuracy of<br>Reference Oscillator |
| 2 | Signal generator | 1 MHz - 13 GHz | SMP02 | 1035.5005.02 | Immunity to Interference<br>Third-Order Intercept<br>Frequency Response |
| 3 | Signal generator | 1 MHz - 3.6 GHz<br>Phase noise at 640 MHz:<br>< -100 dBc/Hz @ 100 Hz<br>< -115 dBc/Hz @ 1 kHz<br>< -127 dBc/Hz @ 10 kHz<br>< -130 dBc/Hz @ 100 kHz<br>< -142 dBc/Hz @ 1MHz | SMHU | 0835.8011.52 | Calibration Source 128 MHz<br>2nd-Order Harmonic Dist.<br>Third-Order Intercept<br>IF Filters<br>Frequency Response<br>Display Linearity<br>RF Attenuator<br>Reference Level Switching<br>Phase Noise |
| 4 | Signal generator | FSU 8: 3.6 GHz to 8 GHz | SMP02 | 1035.5005.02 | Third-Order Intercept |
| 5 | 3-dB coupler<br>(power combiner) | FSU 3: 10 MHz to 3.6 GHz<br>FSU 8: 10 MHz to 8 GHz | | | Third-Order Intercept |
| 6 | 6-dB divider<br>(power splitter) | FSU 3: 10 MHz to 3.6 GHz<br>FSU 8: 10 MHz to 8 GHz | | | Frequency Response |
| 7 | 50-Ω termination | Return loss > 20 dB<br>FSU 3: to 3.6 GHz<br>FSU 8: to 8 GHz | <br>RNA<br>RNA | <br>0272.4510.50<br>0272.4510.50 | Noise Display |
| 8 | Power meter | | NRVD | 0857.8008.02 | Frequency Response |
| 9 | Power sensor | 1 MHz to 3 GHz<br>RSS ≤ 0.8%<br>Meter noise ≤ 20 pW | NRV-Z4 | 0828.3618.02 | Frequency Response |

| Item | Type of equipment | Specifications recommended | Equipment recommended | R&S Order No. | Use |
|---|---|---|---|---|---|
| 10 | Power sensor | RSS referred to indicated Power:<br>1 MHz to 1 GHz ≤1.5 %<br>1 GHz to 7 GHz ≤2 %<br>7 GHz to 8 GHz ≤3.5 %<br><br>FSU 3: 10 MHz to 3.6 GHz<br>FSU 8: 10 MHz to 8 GHz | <br><br><br><br>NRV-Z4<br>NRV-Z4 | <br><br><br><br>0828.3218.02 | Frequency Response |
| 11 | Step attenuator | variable attenuation<br>0 dB to 100 dB, 1-dB steps<br>attenuation accuracy<br>< 0.1 dB (f = 5 MHz) | RSP | 0831.3515.02 | Reference Level Switching<br>Display Linearity<br>RF Attenuator |
| 12 | Attenuator (2 x) | fixed attenuation 10 dB<br>FSU 3: 10 MHz to 3.6 GHz<br>FSU 8:: 10 MHz to 8 GHz | <br>DNF<br>DNF | <br>0272.4210.50<br>0272.4210.50 | Third-Order Intercept |
| 13 | Lowpass[1)] | cut-off frequency:<br>28 MHz, 107 MHz, 262 MHz, 640 MHz, 1000 MHz,<br>1700 MHz | | | $2^{nd}$-Order Harmonc Dist. |
| 14 | VSWR-Bridge | <br>FSU 3 : 10 MHz to 3,6 GHz<br>FSU 8: 10 MHz to 7 GHz | <br>ZRC<br>Wiltron 87A50<br>with adapter<br>34AN50,<br>Open/Short<br>22NF50 | 1039.9492.55 | VSWR |

1) The lowpass filters improve the harmonics suppression of the test signal. If the harmonics suppression at the signal generator output is already large enough, no filters are required for the frequency ranges concerned (see section "Checking Imunity to Interference" for harmonics suppression required)

# Performance Test FSU

## Checking the Reference Frequency Accuracy

Test equipment:
Frequency counter (Section "Measurement Equipment", item 1):
accuracy < $1x10^{-9}$
frequency range up to 10 MHz

Test setup:
➢ connect frequency counter to 10-MHz reference output of the FSU (rear panel)

FSU settings:
- [**SETUP** : REFERENCE INT / EXT ]
➢ toggle to internal reference (INT)

Measurement:
➢ measure frequency with frequency counter

nominal frequency:
model without option FSU-B4 ..... 10 MHz ± 1 Hz
.. model with option FSU-B4 .....10 MHz ±0.3Hz

***Note:***
*The frequency of the reference oscillator can be adjusted by means of a service function (see chapter "Adjustment")*

## Checking Imunity to Interference

Test equipment:
Signal generator (Section "Measurement Equipment", item 2):
frequency range FSU 3: 10 MHz to 13 GHz
FSU 8: 10 MHz to 13 GHz
maximum level ≥ 0 dBm

Test setup:
➢ connect RF output of the signal generator to RF input.

Signal generator settings:
Level: adjust the output level of signal generator for an RF-Input level of 0 dBm

FSU settings:
- [ **PRESET** ]
- [ **AMPT** : RF ATTEN MANUAL : **0 dB** ]
- [ **AMPT** : REF LEVEL : **-30 dBm** ]
- [ **SPAN** : **100 kHz** ]
- [ **BW** : RES BW MANUAL : **3 kHz** ]

## 1st IF Image Frequency Rejection

Additional signal generator settings: - frequency $f_{in}$ + 9256.8 MHz

Additional FSU settings: - [ **FREQ** : CENTER : {$f_{in}$} ]

See table of performance test report for values of $f_{in}$

Measurement: ➢ Set marker to peak of signal
[ **MKR** ⇒ : PEAK ]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 ($L_{dis}$):
Image frequency rejection = 0dBm – $L_{dis}$

## 2nd IF Image Frequency Rejection

Additional signal generator settings: - frequency $f_{in}$ + 808.8 MHz

Additional FSU settings: - [ **FREQ** : CENTER : {$f_{in}$} ]

See table of performance test report for values of $f_{in}$.

Measurement: ➢ Set marker to peak of signal
[ **MKR** ⇒ : PEAK ]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 ($L_{dis}$):
Image frequency rejection = 0dBm – $L_{dis}$

## 3rd IF Image Frequency Rejection

Additional signal generator settings: - frequency $f_{in}$ + 40.8 MHz

Additional FSU settings: - [ **FREQ** : CENTER : {$f_{in}$} ]

See table of performance test report for values of $f_{in}$.

Measurement: ➢ Set marker to peak of signal
[ **MKR** ⇒ : PEAK ]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 ($L_{dis}$):
Image frequency rejection = 0dBm – $L_{dis}$

## 1st IF Rejection

Additional signal generator settings: - frequency 4628.4 MHz

Additional FSU settings: - [ **FREQ** : CENTER : {$f_{in}$} ]

See table of performance test report for values of $f_{in}$.

Measurement: ➢ Set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

Evaluation: The IF rejection is the difference between the output level of the signal generator and the level reading of marker 1 ($L_{dis}$):

IF rejection = 0dBm – $L_{dis}$

## 2nd IF Rejection

Additional signal generator settings: - frequency 404.4 MHz

Additional FSU settings: - [ **FREQ** : CENTER : {$f_{in}$} ]

See table of performance test report for values of $f_{in}$.

Measurement: ➢ Set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

Evaluation: The IF rejection is the difference between the output level of the signal generator and the level reading of marker 1 ($L_{dis}$):

IF rejection = 0dBm – $L_{dis}$

# Checking Non-linearities

## Third-Order Intercept Point

Test equipment:

- 2 signal generators
  - FSU 3: Section "Measurement Equipment", item 2 and 3
  - FSU 8 Section "Measurement Equipment", item 2, 3, 4
  - frequency range:
    - FSU 3: 10 MHz to 3.6 GHz
    - FSU 8: 10 MHz to 8 GHz
  - Maximum level ≥ 0 dBm
- 2 attenuators (Section "Measurement Equipment", item 12)
  - attenuation $a_{ATT}$ = 10 dB
  - frequency range
    - FSU 3: 10 MHz to 3.6 GHz
    - FSU 8: 10 MHz to 8 GHz
- 3-dB coupler (Section "Measurement Equipment", item 5)
  - frequency range
    - FSU 3: 10 MHz to 3.6 GHz
    - FSU 8: 10 MHz to 8 GHz
  - decoupling > 12 dB

Test setup:

- ➢ Connect RF outputs of the signal generators via 10-dB attenuators to the inputs of the 3-dB coupler
- ➢ Connect output of the 3-dB coupler to RF input of the FSU.

Signal generator settings: (both generators)

- frequency: generator 1 $f_{g1} = f_{in} - 50$ kHz
  generator 2 $f_{g2} = f_{in} + 50$ kHz

See table of performance test report for values of $f_{in}$

- ➢ Adjust the output level of signal generators for an input level at the FSU of –10 dBm.
- ➢ Switch off the ALC of the generators to reduce the interference between the generators

FSU settings:

- [ **PRESET** ]
- [ **AMPT** : RF ATTEN MANUAL : **0 dB** ]
- [ **AMPT** : **0 dBm** ]
- [ **SPAN** : **500 kHz** ]
- [ **BW** : RES BW MANUAL : **3 kHz** ]
- [ **FREQ** : CENTER : {$f_{in}$} ]

See table of performance test report for values of $f_{in}$

Measurement

- ➢ [ **MKR FCTN** : TOI ]

Evaluation:

The third order intercept point (T.O.I) referred to the input signal is displayed in the marker field by the reading [TOI].

## Second-Order Harmonic Distortion

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)

frequency range:
FSU 3 / 8: 9 kHz to 1.8 GHz

Recommended harmonic suppression:
f <100 MHz : >35 dBc
100 MHz < f < 1 GHz : >45 dBc
f >1 GHz : >35 dBc

In order to improve the harmonic suppression of the generator it is recommended to insert a lowpass filter with a suitable cut-off frequency (Section "Measurement Equipment", item 13) after the generator.

Test setup:

- ➢ connect RF output of signal generator to the input of the lowpass
- ➢ connect the output of the lowpass to the RF input of the FSU

***Note:***

*If the harmonic suppression of the signal generator is sufficient, the lowpass can be left out.*
*The RF output of the generator can be connected directly to the RF input of the FSU in this case.*

Signal generator settings:

- level:0 dBm
- frequency: $f_{in}$

see table of performance test report for values of $f_{in}$

FSU settings:

- [ **PRESET** ]
- [ **AMPT** : RF ATTEN MANUAL : **0 dB** ]
- [ **AMPT** : **0 dBm** ]
- [ **SPAN** : **3 kHz** ]
- [ **BW** : RES BW MANUAL : **1 kHz** ]
- [ **FREQ** : CENTER : { $f_{in}$ } ]

See table of performance test report for values of $f_{in}$

Measurement:

- ➢ set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

The level of the input signal $L_{IN}$ is displayed by the marker reading for marker 1.

- ➢ set center frequency of the FSU to the frequency of the 2nd harmonic
- [ **FREQ** : CENTER : {2 x $f_{in}$} ]

Measurement:

- ➢ set marker to peak of the 2nd harmonic
- [ **MKR** ⇒ : PEAK ]

The level of the harmonic signal $L_{K2}$ is displayed by the marker reading for marker 1.

Evaluation:

The second order harmonic distortion can be calculated as

$$IP_{k2} / dBm = ( L_{IN} - L_{K2} ) + L_{IN}$$

# Checking IF Filters

Test equipment: Signal generator (Section "Measurement Equipment", item 3):
frequency 128 MHz
level ≥ 0 dBm

Test setup: ➢ connect RF output of the signal generator to the RF input of the FSU.

## Checking the bandwidth switching level accuracy

**Reference measurement (RBW 10 kHz)**

Signal generator settings:
- frequency: 128 MHz
- level:-30 dBm

FSU settings:
- [ **PRESET** ]
- [ **AMPT** : **-30 dBm** ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]
- [ **FREQ** : CENTER : **128 MHz** ]
- [ **SPAN** : **5 kHz** ]
- [ **TRACE** : DETECTOR : RMS ]
- [ **BW** : RBW MANUAL : **10** : **kHz** ]

Reference measurement:

➢ Set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

➢ Set reference to peak of signal
- [ **MKR** : REFERENCE FIXED ]

**Checking the level accuracy**

FSU settings:
- [ **SPAN** : {0.5 x RBW} ]
- [ **BW** : RBW MANUAL : {RBW} : **ENTER**]

***Note:***

*To check the FFT- filter, the resolution bandwidth has to be set manually to FFT-Mode.*

- [ **BW** : BW MODE : FFT ]

Measurement:

➢ set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

Evaluation: The level difference is displayed in the marker field by the reading ´Delta [T1 FXD] {xxx} dB´.

## Checking Bandwidth

Signal generator settings:
- frequency: 128 MHz
- level:-10 dBm

FSU settings:
- [ **PRESET** ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]
- [ **AMPT** : **0 dBm** ]
- [ **FREQ** : CENTER : **128 MHz** ]
- [ **BW** : COUPLING RATIO : SPAN/RBW MANUAL : **3** : **ENTER** ]

➢ Determine 3-dB-Bandwith
- [ **MKR FCTN** : N DB DOWN : **3 dB** ]
- [ **SPAN** : {3 x RBW} ]

See table of performance test report for values of RBW.

***Note:***

*To check the filters > 3 MHz, the resolution bandwidth has to be set manually to X MHz. All other bandwidths will be set automatically by changing the span.*

- [ **BW** : RES BW MANUAL : **X MHz** ] , with X = 5, 10, 20 or 50 MHz

Measurement:
- [ **MKR** ⇒ : PEAK ]

The 3-dB bandwidth is displayed by the reading ´BW {bandwidth}´.

## Checking the Shape Factor

**Note:** *To check the shape factor the values of the 3 dB bandwith will be needed. Please check before this measurement.*

Signal generator settings:
- frequency: 128 MHz
- level:0 dBm

FSU settings:
- [ **PRESET** ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]
- [ **AMPT** : **0 dBm** ]
- [ **FREQ** : CENTER : **128 MHz** ]
- [ **BW** : COUPLING RATIO : SPAN/RBW MANUAL : **20 ENTER** ]
- [ **BW** : COUPLING RATIO : RBW/VBW NOISE [10] ]
- [ **MKR FCTN** : N DB DOWN : **60 dB** ]
- [ **SPAN** : {20 x RBW} ]

See table of performance test report for values of RBW.

***Note:***

*To check the filters > 3 MHz, the resolution bandwidth has to be set manually to X MHz. All other bandwidths will be set automatically by changing the span.*

- [ **BW** : RES BW MANUAL : **X MHz** ] , with X = 5, 10, 20 or 50 MHz

Measurement:
- [ **MKR** ⇒ : PEAK ]

The 60 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

Evaluation:

The shape factor is calculated by BW (60dB) / BW (3dB).

# Checking Noise Display

Test equipment: 50-Ω termination (Section "Measurement Equipment", item 7)
frequency range FSU 3: to 3.6 GHz
FSU 8: to 8 GHz

Test setup: ➢ terminate the RF input of the FSU with 50 Ω

FSU settings:

**Measurement for $f_n \leq$ 1 kHz:**
- [ **PRESET** ]
- [ **AMPT** : RF ATTEN MANUAL : **0 dB** ]
- [ **SPAN** : **10 Hz** ]
- [ **BW** : BW MODE : **FFT** ]
- [ **BW** : RES BW MANUAL : **10 Hz** ]
- [ **TRACE 1** : AVERAGE ]
- [ **TRACE 1** : SWEEP COUNT : **30 ENTER** ]
- [ **AMPT** : {RefLev} ]
- [ **FREQ** : CENTER : {$f_n$} ]

**Measurement for $f_n$ >1 kHz:**
- [ **PRESET** ]
- [ **AMPT** : RF ATTEN MANUAL : **0 dB** ]
- [ SPAN : 0 Hz ]
- [ **BW** : RES BW MANUAL : **1 kHz** ]
- [ **BW** : SWEEP TIME MANUAL : **50 ms** ]
- [ **TRACE 1** : AVERAGE ]
- [ **TRACE 1** : SWEEP COUNT : **30 ENTER** ]
- [ **AMPT** : {RefLev} ]
- [ **FREQ** : CENTER : {$f_n$} ]
- [ **MEAS** : Time Dom Power : **Mean** ]

See table below for values of RefLev.

See table of performance test report for values of $f_n$.

Measurement: Set the marker to the center frequency for the value below or equal 1 kHz, read out the mean marker for frequencies above 1 kHz.

Evaluation: The noise level is displayed by the level reading of marker 1.

| **Frequency** | < 10kHz | < 100kHz | < 1MHz | < 10MHz | > 10kHz |
|---|---|---|---|---|---|
| **RefLev** | -10 dBm | -20 dBm | -30 dBm | -60 dBm | -60 dBm |

# Checking the Level accuracy and the Frequency Response

Test equipment:

- Signal generator :
  FSU 3: Section "Measurement Equipment", item 3
  FSU 8: Section "Measurement Equipment", item 3 and 4

  frequency range FSU 3: to 3.6 GHz
  FSU 8: to 8 GHz

  maximum level ≥ 0 dBm

- power meter (Section "Measurement Equipment", item 8)

- power sensor :
  FSU 3: Section "Measurement Equipment", item 9
  FSU 8 / 13 /30: Section "Measurement Equipment", item 9 and 10

  frequency range FSU 3: to 3.6 GHz
  FSU 8: to 8 GHz

  maximum power $P_{max} \geq 100\ \mu W$

  RSS referred to indicated power
  1 MHz to 1 GHz .....≤ 1.5 %
  1 GHz to 7 GHz .....≤ 2 %
  7 GHz to 8 GHz .....≤ 3.5 %

  impedance Z = 50 Ω

- 6-dB divider (Section "Measurement Equipment", item 6)

  frequency range FSU 3: to 3.6 GHz
  FSU 8: to 8 GHz

  level imbalance[1]) 1 MHz to 3.6 GHz ≤ 0.1 dB
  3.6 GHz to 8 GHz ≤ 0.2 dB

  [1]) If a power splitter with higher level imbalance is used correction of the measured frequency response is recommended.

**Determining the level accuracy at 128 MHz**

Test setup:

- ➢ connect power sensor (item 9) to the power meter and execute function ´ZERO´ when there is no signal applied to the power sensor
- ➢ connect power sensor to RF output of signal generator

Signal generator settings:

- frequency 128 MHz
- level -30 dBm

Measurement:

- ➢ determine output power of the signal generator with the power meter
- ➢ connect RF output of the signal generator to RF input of the FSU

FSU settings:

- [ **PRESET** ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]
- [ **AMPT** : **-30 dBm** ]
- [ **SPAN** : **30 kHz** ]
- [ **BW** : RES BW MANUAL : **10 kHz** ]
- [ **TRACE** : DETECTOR : RMS ]
- [ **FREQ** : CENTER : **128 MHz** ]

➢ set marker to peak of signal

- [ **MKR** ⇒ : PEAK ]

Evaluation:

The difference between the signal levels measured with the power meter and the FSU (level reading of marker 1) reflects the absolute level accuracy of the FSU. It can be calculated as:

$$\text{Level accuracy}_{128\text{MHz}} = L_{\text{FSU}} - L_{\text{powermeter}}$$

**Checking the frequency response**

Test setup:
- ➢ connect RF output of the signal generator to input of the divider
- ➢ connect output 1 of the divider to the power sensor / power meter
- ➢ connect output 2 of the divider to RF input of the FSU

Signal generator settings:
- level 0 dBm
- frequency 128 MHz

FSU settings:
- [ **PRESET** ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]
- [ **AMPT** : **0 dBm** ]
- [ **SPAN** : **100 kHz** ]
- [ **BW** : RES BW MANUAL : **10 kHz** ]
- [ **TRACE** : DETECTOR : RMS ]
- [ **FREQ** : CENTER : **128 MHz** ]

Reference measurement:
- ➢ Determine signal level $L_{powermeter}$ .
- ➢ set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

The signal level $L_{FSU}$ is displayed by the level reading of marker 1.

$$Ref_{128MHz} = L_{FSU} - L_{powermeter}$$

**Measurement**

Signal generator settings:
- frequency $f_{fresp}$

see table of performance test report for values of $f_{fresp}$

Power meter settings:

Determine signal level $L_{powermeter}$ . To achive higher accuracy it is Recommended to compensate the frequency response of the power sensor.

FSU settings:
- [ **FREQ** : CENTER : {$f_{fresp}$} ]

see table of performance test report for values of $f_{fresp}$

- ➢ - set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

The signal level $L_{FSU}$ is displayed by the level reading of marker 1.

Evaluation:

The frequency response can be calculated as:

$$\text{Frequency response} = L_{FSU} - L_{powermeter} - Ref_{128\ MHz}$$

## Checking the Display Linearity

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  frequency 5 MHz [1)]
  maximum level ≥ 10 dBm
- step attenuator (Section "Measurement Equipment", item 11)
  frequency 5 MHz [1)]
  attenuation 0 to 100 dB in 1 dB steps
  attenuation accuracy < 0.1 dB

Test setup:

➢ connect RF output of the signal generator to RF input of the step attenuator

➢ connect RF output of the step attenuator to RF input of the FSU

Signal generator settings:

- frequency 5 MHz [1)]
- level +10 dBm

Step attenuator settings:

Attenuation 20 dB

FSU settings:

- [ **PRESET** ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]
- [ **AMPT** : **0 dBm** ]
- [ **FREQ** :CENTER : **5 MHz** ]
- [ **SPAN** : **0 Hz** ]
- [ **TRACE** : DETECTOR : RMS ]

1.Measurement:
- [ **BW** : RES BW MANUAL : **500 Hz** ]

2.Measurement:
- [ **BW** : RES BW MANUAL : **300 kHz** ]

3.Measurement:
- [ **BW** : RES BW MANUAL : **20 MHz** ]

Reference measurement:

➢ set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

➢ set reference to peak of signal
- [ **MKR** : REFERENCE FIXED ]

**Measurement**

Step attenuator settings:

Attenuation $\{a_{ATT}\}$

See table of performance test report for values of $a_{ATT}$.

Evaluation:

The difference between the level of the input signal of the FSU and the reference (about 10 dB below the reference level) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

[1)] A frequency between 5 MHz and 1 GHz may be used. It is recommended to use correction values for the uncertainty of the attenuator.

## Checking the RF Attenuator

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  frequency 128 MHz
  maximum level ≥ 0 dBm

- step attenuator (Section "Measurement Equipment", item 11)
  frequency 128 MHz
  attenuation 0 to 80 dB in 5 dB steps
  attenuation accuracy < 0.1 dB

Test setup:

➢ connect RF output of the signal generator to RF input of the step attenuator
➢ connect RF output of the step attenuator to RF input of the FSU

Signal generator settings:

- Frequency 128 MHz
- Level 0 dBm

Step attenuator settings: Attenuation 70 dB

FSU settings:

- [ **PRESET** ]
- [ **FREQ** : CENTER : **128 MHz** ]
- [ **SPAN** : **500 Hz** ]
- [ **BW** : RES BW MANUAL : **1 kHz** ]
- [ **TRACE** : DETECTOR : RMS ]
- [ **BW** : VIDEO BW MANUAL : **100 Hz** ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]
- [ **AMPT** : **-30 dBm** ]

Reference measurement:

➢ set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

➢ set reference to peak of signal
- [ **MKR** : REFERENCE FIXED ]

**Measurement**

Step attenuator settings: Attenuation { 80dB - $a_{FSU}$ }
See table below for values of $a_{ATT}$.

FSU settings:

- [ **AMPT** : RF ATTEN MANUAL : { $a_{FSU}$ } ]
- [ **AMPT** : {-40dBm + $a_{FSU}$ } **dBm** ]
- [ **MKR** ⇒ : PEAK ]

see table below for values of $a_{FSU}$ , $a_{ATT}$ and reference level.

Evaluation: The difference between the level of the input signal of the FSU and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

| $a_{ATT}$ | 80 dB | 75 dB | 70 dB | 60 dB | 40 dB |
|---|---|---|---|---|---|
| $a_{FSU}$ | 0 dB | 5 dB | 10 dB | 20 dB | 40 dB |
| **reference level** | -40 dBm | -35 dBm | -30 dBm | -20 dBm | 0 dBm |

## Checking the Reference Level Switching (IF-Gain)

Test principle:

The IF gain of the FSU can be switched from 0 to 50 dB by changing the reference level at fixed RF attenuation. To prevent the IF gain accuracys to be mixed up with the log amplifier accuracy it is determined by comparison using an external precision attenuator.

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  frequency 5 MHz
  maximum level ≥ -10 dBm
- step attenuator (Section "Measurement Equipment", item 11)
  frequency 5 MHz
  attenuation 0 to 60 dB in 1 dB steps
  attenuation accuracy < 0.1 dB

Test setup:

➢ connect RF output of the signal generator to RF input of the step attenuator

➢ connect RF output of the step attenuator to RF input of the FSU

Signal generator settings:

- frequency 5 MHz
- level -10 dBm

Step attenuator settings:

Attenuation 20 dB

FSU settings:

- [ **PRESET** ]
- [ **FREQ** : CENTER : **5 MHz** ]
- [ **SPAN** : **2 kHz** ]
- [ **BW** : RES BW MANUAL : **1 kHz** ]
- [ **BW** : VIDEO BW MANUAL : **100 Hz** ]
- [ **TRACE** : DETECTOR : RMS ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]
- [ **AMPT** : **-10 dBm** ]

Reference measurement:

➢ set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

➢ set reference to peak of signal
- [ **MKR** : REFERENCE FIXED ]

**Measurement**

Step attenuator settings: Attenuation {$a_{ATT}$}

See table below for values of $a_{ATT}$.

FSU settings: - [ **AMPT** : {reference level} **dBm** ]

see table below for values of reference level.

- [ **MKR** ⇒ : PEAK ]

Evaluation: The difference between the level of the input signal of the FSU and the reference (at 10 dB IF-Gain) is displayed in the marker field by the reading 'Delta [T1 FXD]'.

**10-dB gain steps:**

| $a_{ATT}$ | 10 dB | 20 dB | 30 dB | 40 dB | 50 dB | 60 dB |
|---|---|---|---|---|---|---|
| **reference level** | 0 dBm | -10 dBm | -20 dBm | -30 dBm | -40 dBm | -50 dBm |

**1-dB gain steps:**

| $a_{ATT}$ | 20 dB | 21 dB | 22 dB | 23 dB | 24 dB | 25 dB | 26 dB | 27 dB | 28 dB | 29 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| **reference level** | -10 dBm | -11 dBm | -12 dBm | -13 dBm | -14 dBm | -15 dBm | -16 dBm | -17 dBm | -18 dBm | -19 dBm |

## Checking the Phase Noise

Test equipment:

Signal generator (Section "Measurement Equipment", item 3)

| | |
|---|---|
| frequency | 640 MHz |
| level | ≥ 0 dBm |
| Phase Noise at 640 MHz: | < -100 dBc/Hz @ 100 Hz |
| | < -115 dBc/Hz @ 1 kHz |
| | < -127 dBc/Hz @ 10 kHz |
| | < -130 dBc/Hz @ 100 kHz |
| | < -142 dBc/Hz @ 1MHz |

Test setup:

➢ connect RF output of the signal generator to RF input of the FSU

Signal generator settings:

- frequency 640 MHz
- level 0 dBm

Fineadjust the frequency of the generator so that the FSU shows exactly 640 MHz .

FSU settings:

- [ **PRESET** ]
- [ **FREQ** : CENTER : **640 MHz** ]
- [ **AMPT** : **0 dBm** ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]
- [ **SPAN** : {span} ]

depending on offset, see table below for values of span.

- [ **BW** : COUPLING RATIO : RBW/VBW NOISE[10] ]
- [ **BW** : RBW MANUAL : {RBW} ]

depending on offset, see table below for values of RBW.

- [ **TRACE 1** : AVERAGE ]
- [ **SWEEP** : SWEEP COUNT : **20** : **ENTER** ]

➢ activate phase noise marker

- [**MKR FCTN**: PHASE NOISE ]
- [ **FREQ** : CENTER : {640 MHz + offset} ]

see table below for values of offset.

- [ **AMPT** : {reference level} ]

depending on offset, see table below for values of reference level.

- [ **AMPT** : RF ATTEN MANUAL : {$a_{FSU}$} ]

depending on offset, see table below for values of $a_{FSU}$ .

➢ set Phase Noise Marker
[ **MKR :** MARKER 2 : {offset} ]

see table below for values of offset.

***Note**: Please make sure not to measure on a spurious signal.*

Evaluation: The Phase Noise is displayed in the marker field by the reading ´Delta 2 [T1 PHN]´.

| Phase noise measurement settings | | | | |
|---|---|---|---|---|
| **Offset** | **Span** | **RBW** | **Reference Level** | **$a_{FSU}$** |
| 100 Hz | 20 Hz | 30 Hz | 0 dBm | 10 dB |
| 1 kHz | 200 Hz | 100 Hz | 0 dBm | 10 dB |
| 10 kHz | 2 kHz | 300 Hz | 0 dBm | 10 dB |
| 100 kHz | 10 kHz | 3 kHz | -10 dBm | 0 dB |
| 1 MHz | 100 kHz | 30 kHz | -30 dBm | 0 dB |

***Note:*** *To obtain a precise measurement of the phase noise at high offsets the level used at the FSU input is 10 to 30 dB higher than the reference level. To reduce the measurement time the phase noise is measured with a small span around the frequency offset. This prevents the FSU from being overloaded.*

# Checking the Return Loss at the RF Input

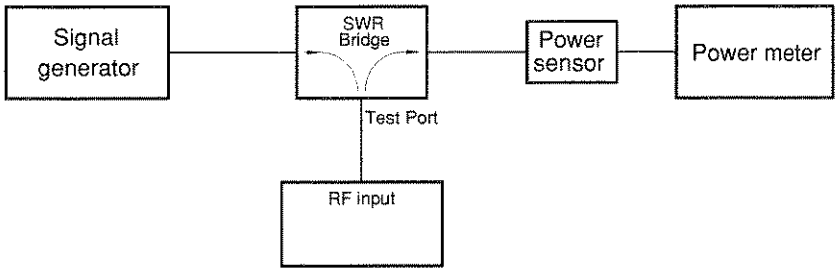
Test equipment:

FSU 3 / FSU 8:

- Signal generator (Section "Measurement Equipment", item 2)
  - frequency range FSU 3: 10 MHz bis 3,6 GHz
    FSU 8 10 MHz bis 8 GHz
  - level range ≥ -10 dBm
- power meter (Section "Measurement Equipment", item 8)
- power sensor
  - frequency range FSU 3: 10 MHz to 3,6 GHz
    FSU 8 10 MHz to 7 GHz
- SWR-bridge (Section "Measurement Equipment", item 14)
  - frequency range FSU 3: 10 MHz to 3,6 GHz
    FSU 8 10 MHz to 7 GHz

Test setup:

FSU 3 / FSU 8:




Signal generator settings:

- level -10 dBm
- frequency $\{f_{in}\}$

See performance test report for values of $f_{in}$.

FSU settings:

- [ **SYSTEM PRESET** ]
- [ **INPUT** : RF ATTEN MANUAL : **10 dB** ]

Calibration:

FSU 3 / FSU 8:

Use total reflection (OPEN or SHORT) at the test port of the SWR bridge as a reference:

Remove cable from RF input of the FSE and connect precision short or open to the cable. Determine reflected power with the power meter and store measured level LRef as reference. Repeat this procedure for every measurement over the whole frequency range.

Measurement:

FSU 3 / FSU 8:
Connect the RF input of the FSE to the test port of the SWR bridge. Measure reflected power $L_r$ with the power meter. The return loss $a_r$ of the RF input of the FSE can be calculated as:

$$a_r = L_{Ref} - L_r .$$

The VSWR can be calculated as:

$$s = \frac{10^{0.05a_r} + 1}{10^{0.05a_r} - 1} .$$

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# Performance Test Report FSU

Table 1-1 Performance Test report

| ROHDE & SCHWARZ | Performance Test Report | Spectrum Analyzer FSU | Version 27-Jul-00 |
|---|---|---|---|
| Model (FSU-3/ 8): | | | |
| Order number: | 1129.9003. | | |
| Serial number: | | | |
| Test person: | | | |
| Date: | | | |
| Sign: | | | |

| Characteristic | included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| Frequency accuracy Reference oscillator | Page 1.3 | | | | | |
| Model w/o Opt. B4 | | 9.999999 | _____ | 10.000001 | MHz | |
| Model with Opt. B4 | | 9.9999997 | _____ | 10.0000003 | MHz | |
| Image frequency rejection,1st IF, $f_{in}$ | Page 1.4 | | | | | |
| 11 MHz | | 90 | _____ | - | dB | |
| 100 MHz | | 90 | _____ | - | dB | |
| 1701 MHz | | 90 | _____ | - | dB | |
| 3001 MHz | | 90 | _____ | - | dB | |
| image frequency rejection 2nd IF, $f_{in}$ | Page 1.4 | | | | | |
| **FSU 3 / 8:** | | | | | | |
| 100 MHz | | 90 | _____ | - | dB | |
| **FSU 8:** | | | | | | |
| 3700 MHz | | 70 | _____ | - | dB | |
| 5000 MHz | | 70 | _____ | - | dB | |
| 7999 MHz | | 70 | _____ | - | dB | |

| Characteristic | Included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| Image frequency rejection 3rd IF, $f_{in}$ | Page 1.4 | | | | | |
| **FSU 3 / 8:** | | | | | | |
| 100 MHz | | 90 | _____ | - | dB | |
| **FSU 8:** | | | | | | |
| 4500 MHz | | 70 | _____ | - | dB | |
| 1st IF rejection $f_{in}$ | Page 1.5 | | | | | |
| 11 MHz | | 90 | _____ | - | dB | |
| 100 MHz | | 90 | _____ | - | dB | |
| 1701 MHz | | 90 | _____ | - | dB | |
| 2990 MHz | | 90 | _____ | - | dB | |
| $2^{nd}$ IF rejection $f_{in}$ | Page 1.5 | | | | | |
| **FSU 3 / 8:** | | | | | | |
| 100 MHz | | 90 | _____ | - | DB | |
| **FSU 3 / 8:** | | | | | | |
| 4500 MHz | | 70 | _____ | - | dB | |
| 3rd-order intercept point, $f_{in}$ | Page 1.6 | | | | | |
| **FSU 3 / 8:** | | | | | | |
| 28 MHz | | 17 | _____ | - | dBm | |
| 106 MHz | | 17 | _____ | - | dBm | |
| 261 MHz | | 17 | _____ | - | dBm | |
| 640 MHz | | 20 | _____ | - | dBm | |
| 1000 MHz | | 20 | _____ | - | dBm | |
| 1700 MHz | | 20 | _____ | - | dBm | |
| 2500 MHz | | 20 | _____ | - | dBm | |
| 3590 MHz | | 20 | _____ | - | dBm | |
| **FSU 8 :** | | | | | | |
| 4001 MHz | | 18 | _____ | - | dBm | |
| 5001 MHz | | 18 | _____ | - | dBm | |
| 7999 MHz | | 18 | _____ | - | dBm | |

| Characteristic | Included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| $2^{nd}$-order harmonic distortion, $f_{in}$ : | Page 1.7 | | | | | |
| **FSU 3 / 8:** | | | | | | |
| 28 MHz | | 35 | _____ | - | dBm | |
| 106 MHz | | 35 | _____ | - | dBm | |
| 261 MHz | | 45 | _____ | - | dBm | |
| 640 MHz | | 45 | _____ | - | dBm | |
| 1000 MHz | | 45 | _____ | - | dBm | |
| 1700 MHz | | 35 | _____ | - | dBm | |
| IF bandwidth switch. level accuracy | Page 1.8 | | | | | |
| 100 Hz | | -0.1 | _____ | +0.1 | dB | |
| 1 kHz | | -0.1 | _____ | +0.1 | dB | |
| 10 kHz | | - | reference | - | | |
| 100 kHz | | -0.1 | _____ | +0.1 | dB | |
| 300 kHz | | -0.2 | _____ | +0.2 | dB | |
| 1 MHz | | -0.2 | _____ | +0.2 | dB | |
| 3 MHz | | -0.2 | _____ | +0.2 | dB | |
| 10 MHz | | -0.2 | _____ | +0.2 | dB | |
| 20 MHz | | -0.5 | _____ | +0.5 | dB | |
| FFT Bandwidth level accuracy | Page 1.8 | | | | | |
| 100 Hz | | -0.2 | _____ | +0.2 | dB | |
| 300 Hz | | -0.2 | _____ | +0.2 | dB | |
| 1 kHz | | -0.2 | _____ | +0.2 | dB | |
| 3 kHz | | -0.2 | _____ | +0.2 | dB | |
| IF bandwidth Bandwidth: | Page 1.9 | | | | | |
| 100 Hz | | 97 | _____ | 103 | Hz | |
| 1 kHz | | 970 | _____ | 1030 | Hz | |
| 10 kHz | | 9.7 | _____ | 10.3 | kHz | |
| 100 kHz | | 97 | _____ | 103 | kHz | |
| 300 kHz | | 270 | _____ | 330 | kHz | |
| 1 MHz | | 900 | _____ | 1100 | kHz | |
| 3 MHz | | 2.7 | _____ | 3.3 | MHz | |
| 10 MHz | | 7 | _____ | 11 | MHz | |
| 20 MHz | | 14 | _____ | 22 | MHz | |
| 50 MHz | | 35 | _____ | 55 | MHz | |

| Characteristic | Included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| IF Bandwidths<br>Shape factor: | Page 1.9 | | | | | |
| 100 Hz | | - | _____ | 6 | - | |
| 1 kHz | | - | _____ | 6 | - | |
| 10 kHz | | - | _____ | 6 | - | |
| 100 kHz | | - | _____ | 6 | - | |
| 300 kHz | | - | _____ | 12 | - | |
| 1 MHz | | - | _____ | 12 | - | |
| 3 MHz | | - | _____ | 12 | - | |
| 10 MHz | | - | _____ | 7 | - | |
| Noise Display<br>$f_{noise}$: | Page 1.10 | | | | | |
| 20 Hz | | - | _____ | -80 | dBm | |
| 90 Hz | | - | _____ | -100 | dBm | |
| 900 Hz | | - | _____ | -110 | dBm | |
| Noise Display<br>**FSU 3 / 8:** $f_{noise}$<br>normalized to 10Hz: | Page 1.10 | | | | | |
| 9 kHz | | - | _____ | -120 | dBm | |
| 95 kHz | | - | _____ | -120 | dBm | |
| 999 kHz | | - | _____ | -130 | dBm | |
| 9.99 MHz | | - | _____ | -145 | dBm | |
| 19.99 MHz | | - | _____ | -145 | dBm | |
| 49.99 MHz | | - | _____ | -145 | dBm | |
| 99.99 MHz | | - | _____ | -145 | dBm | |
| 199.9 MHz | | - | _____ | -145 | dBm | |
| 499.9 MHz | | - | _____ | -145 | dBm | |
| 999.9 MHz | | - | _____ | -145 | dBm | |
| 1499 MHz | | - | _____ | -145 | dBm | |
| 1999 MHz | | - | _____ | -145 | dBm | |
| 2499 MHz | | - | _____ | -143 | dBm | |
| 2999 MHz | | - | _____ | -143 | dBm | |
| 3599 MHz | | - | _____ | -142 | dBm | |

| Characteristic | Included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| Noise Display<br>**FSU 8:** $f_{noise}$:<br>normalized to 10Hz: | Page 1.10 | | | | | |
| 3999 MHz | | - | _____ | -142 | dBm | |
| 4499 MHz | | - | _____ | -142 | dBm | |
| 4999 MHz | | - | _____ | -142 | dBm | |
| 5499 MHz | | - | _____ | -142 | dBm | |
| 5999 MHz | | - | _____ | -142 | dBm | |
| 6499 MHz | | - | _____ | -142 | dBm | |
| 6999 MHz | | - | _____ | -142 | dBm | |
| 7499 MHz | | - | _____ | -142 | dBm | |
| 7999 MHz | | - | _____ | -142 | dBm | |
| Level accuracy<br>at 128 MHz. -30dBm | Page 1.11 | -0.2 | _____ | +0.2 | dB | |
| Frequency response<br>RF Attenuation 10 dB<br>DC coupling<br>**FSU 3 / 8:** $f_{fresp}$ | Page 1.11 | | | | | |
| 1 MHz | | -0.5 | _____ | +0.5 | dB | |
| 10 MHz | | -0.3 | _____ | +0.3 | dB | |
| 50 MHz | | -0.3 | _____ | +0.3 | dB | |
| 100 MHz | | -0.3 | _____ | +0.3 | dB | |
| 200 MHz | | -0.3 | _____ | +0.3 | dB | |
| 300 MHz | | -0.3 | _____ | +0.3 | dB | |
| 400 MHz | | -0.3 | _____ | +0.3 | dB | |
| 500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 600 MHz | | -0.3 | _____ | +0.3 | dB | |
| 700 MHz | | -0.3 | _____ | +0.3 | dB | |
| 800 MHz | | -0.3 | _____ | +0.3 | dB | |
| 900 MHz | | -0.3 | _____ | +0.3 | dB | |
| 1000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 1500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 2000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 2500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 3000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 3599 MHz | | -0.3 | _____ | +0.3 | dB | |

| Characteristic | Included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| Frequency response<br>RF Attenuation 10 dB<br>DC coupling | Page 1.11 | | | | | |
| **FSU 8:** $f_{fresp}$ | | | | | | |
| 3610 MHz | | -2 | _____ | +2 | dB | |
| 4000 MHz | | -2 | _____ | +2 | dB | |
| 4500 MHz | | -2 | _____ | +2 | dB | |
| 5000 MHz | | -2 | _____ | +2 | dB | |
| 5500 MHz | | -2 | _____ | +2 | dB | |
| 6000 MHz | | -2 | _____ | +2 | dB | |
| 6500 MHz | | -2 | _____ | +2 | dB | |
| 6990 MHz | | -2 | _____ | +2 | dB | |
| 7990 MHz | | -2 | _____ | +2 | dB | |
| Frequency response<br>RF Attenuation 10 dB<br>AC coupling | Page 1.11 | | | | | |
| $f_{fresp}$ | | | | | | |
| 10 MHz | | -0.3 | _____ | +0.3 | dB | |
| 50 MHz | | -0.3 | _____ | +0.3 | dB | |
| 100 MHz | | -0.3 | _____ | +0.3 | dB | |
| 200 MHz | | -0.3 | _____ | +0.3 | dB | |
| 500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 1000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 1500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 2000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 2500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 3000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 3599 MHz | | -0.3 | _____ | +0.3 | dB | |

| Characteristic | Included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| Frequency response<br>RF Attenuation 5 dB<br>DC coupling | Page 1.11 | | | | | |
| $f_{fresp}$ | | | | | | |
| 10 MHz | | -0.3 | _____ | +0.3 | dB | |
| 50 MHz | | -0.3 | _____ | +0.3 | dB | |
| 100 MHz | | -0.3 | _____ | +0.3 | dB | |
| 200 MHz | | -0.3 | _____ | +0.3 | dB | |
| 500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 1000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 1500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 2000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 2500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 3000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 3599 MHz | | -0.3 | _____ | +0.3 | dB | |
| Frequency response<br>RF Attenuation 20 dB<br>DC coupling | Page 1.11 | | | | | |
| $f_{fresp}$ | | | | | | |
| 10 MHz | | -0.3 | _____ | +0.3 | dB | |
| 50 MHz | | -0.3 | _____ | +0.3 | dB | |
| 100 MHz | | -0.3 | _____ | +0.3 | dB | |
| 200 MHz | | -0.3 | _____ | +0.3 | dB | |
| 500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 1000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 1500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 2000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 2500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 3000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 3599 MHz | | -0.3 | _____ | +0.3 | dB | |

| Characteristic | Included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| Frequency response<br>RF Attenuation 40 dB<br>DC coupling<br><br>$f_{fresp}$ | Page 1.11 | | | | | |
| 10 MHz | | -0.3 | _____ | +0.3 | dB | |
| 50 MHz | | -0.3 | _____ | +0.3 | dB | |
| 100 MHz | | -0.3 | _____ | +0.3 | dB | |
| 200 MHz | | -0.3 | _____ | +0.3 | dB | |
| 500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 1000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 1500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 2000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 2500 MHz | | -0.3 | _____ | +0.3 | dB | |
| 3000 MHz | | -0.3 | _____ | +0.3 | dB | |
| 3599 MHz | | -0.3 | _____ | +0.3 | dB | |
| Display linearity<br>RBW 500 Hz<br><br>$a_{ATT}$ : | Page 1.14 | | | | | |
| 10 dB | | 9.9 | _____ | 10.1 | dB | |
| 15 dB | | 4.9 | _____ | 5.1 | dB | |
| 20 dB | | - | Referenz | - | - | |
| 25 dB | | -5.1 | _____ | -4.9 | dB | |
| 30 dB | | - 10.1 | _____ | -9.9 | dB | |
| 35 dB | | -15.1 | _____ | -14.9 | dB | |
| 40 dB | | -20.1 | _____ | -19.9 | dB | |
| 45 dB | | -25.1 | _____ | -24.9 | dB | |
| 50 dB | | -30.1 | _____ | -29.9 | dB | |
| 55 dB | | -35.1 | _____ | -34.9 | dB | |
| 60 dB | | -40.1 | _____ | -39.9 | dB | |
| 65 dB | | -45.1 | _____ | -44.9 | dB | |
| 70 dB | | -50.1 | _____ | -49.9 | dB | |
| 75 dB | | -55.1 | _____ | -54.9 | dB | |
| 80 dB | | -60.1 | _____ | -59.9 | dB | |
| 85 dB | | -65.3 | _____ | -64.7 | dB | |
| 90 dB | | -70.3 | _____ | -69.7 | dB | |
| 95 dB | | -75.3 | _____ | -74.7 | dB | |
| 100 dB | | -80.3 | _____ | -79.7 | dB | |

| Characteristic | Included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| Display linearity<br>RBW 300 kHz<br><br>$a_{ATT}$ : | Page 1.14 | | | | | |
| 10 dB | | 9.8 | _____ | 10.2 | dB | |
| 15 dB | | 4.8 | _____ | 5.2 | dB | |
| 20 dB | | - | Referenz | - | - | |
| 25 dB | | -5.2 | _____ | -4.8 | dB | |
| 30 dB | | - 10.2 | _____ | -9.8 | dB | |
| 35 dB | | -15.2 | _____ | -14.8 | dB | |
| 40 dB | | -20.2 | _____ | -19.8 | dB | |
| 45 dB | | -25.2 | _____ | -24.8 | dB | |
| 50 dB | | -30.2 | _____ | -29.8 | dB | |
| 55 dB | | -35.2 | _____ | -34.8 | dB | |
| 60 dB | | -40.2 | _____ | -39.8 | dB | |
| 65 dB | | -45.5 | _____ | -44.5 | dB | |
| 70 dB | | -50.5 | _____ | -49.5 | dB | |
| 75 dB | | -55.5 | _____ | -54.5 | dB | |
| 80 dB | | -60.5 | _____ | -59.5 | dB | |
| Display linearity<br>RBW 20 MHz<br><br>$a_{ATT}$ : | Page 1.14 | | | | | |
| 10 dB | | 9.5 | _____ | 10.5 | dB | |
| 15 dB | | 4.5 | _____ | 5.5 | dB | |
| 20 dB | | - | Referenz | - | - | |
| 25 dB | | -5.5 | _____ | -4.5 | dB | |
| 30 dB | | – 10.5 | _____ | -9.5 | dB | |
| 35 dB | | -15.5 | _____ | -14.5 | dB | |
| 40 dB | | -20.5 | _____ | -19.5 | dB | |
| 45 dB | | -25.5 | _____ | -24.5 | dB | |
| 50 dB | | -30.5 | _____ | -29.5 | dB | |
| 55 dB | | -35.5 | _____ | -34.5 | dB | |
| 60 dB | | -40.5 | _____ | -39.5 | dB | |
| 65 dB | | -45.5 | _____ | -44.5 | dB | |
| 70 dB | | -50.5 | _____ | -49.5 | dB | |
| Attenuator accuracy<br><br>$a_{ATT}$ : | Page 1.15 | | | | | |
| 0 dB | | -9.8 | _____ | -10.2 | dB | |
| 5 dB | | -4.8 | _____ | -5.2 | dB | |
| 10 dB | | - | reference | - | - | |
| 20 dB | | +9.8 | _____ | +10.2 | dB | |
| 40 dB | | +29.8 | _____ | +30.2 | dB | |

| Characteristic | Included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| Reference level switching accuracy | Page 1.16 | | | | | |
| Reference level | | | | | | |
| 0 dBm | | +9,85 | _____ | +10,15 | dB | |
| -10 dBm | | - | reference | - | - | |
| -20 dBm | | -10.15 | _____ | -9,85 | dB | |
| -30 dBm | | -20.15 | _____ | -19,85 | dB | |
| -40 dBm | | -30.15 | _____ | -29,85 | dB | |
| -50 dBm | | -40.15 | _____ | -39,85 | dB | |
| -11 dBm | | -1.15 | _____ | -0,85 | dB | |
| -12 dBm | | -2.15 | _____ | -1,85 | dB | |
| -13 dBm | | -3.15 | _____ | -2,85 | dB | |
| -14 dBm | | -4.15 | _____ | -3,85 | dB | |
| -15 dBm | | -5.15 | _____ | -4,85 | dB | |
| -16 dBm | | -6.15 | _____ | -5,85 | dB | |
| -17 dBm | | -7.15 | _____ | -6,85 | dB | |
| -18 dBm | | -8.15 | _____ | -7,85 | dB | |
| -19 dBm | | -9.15 | _____ | -8,85 | dB | |
| Phase noise | Page 1.18 | | | | | |
| Offset frequency: | | | | | | |
| 100 Hz | | - | _____ | -90 | dBc (1Hz) | |
| 1 kHz | | - | _____ | -112 | dBc (1Hz) | |
| 10 kHz | | - | _____ | -120 | dBc (1Hz) | |
| 100 kHz | | - | _____ | -120 | dBc (1Hz) | |
| 1 MHz | | - | _____ | -138 | dBc (1Hz) | |

| Characteristic | Included in | Min. value | Actual value | Max. value | Unit | Tolerance |
|---|---|---|---|---|---|---|
| Return Loss<br>RF input<br>RF Att 10 dB / DC<br>$f_{in}$ | Page 1.20 | | | | | |
| **FSU 3 / FSU 8:** | | | | | | |
| 10 MHz | | 14 | _____ | - | dB | |
| 250 MHz | | 14 | _____ | - | dB | |
| 500 MHz | | 14 | _____ | - | dB | |
| 750 MHz | | 14 | _____ | - | dB | |
| 1000 MHz | | 14 | _____ | - | dB | |
| 1250 MHz | | 14 | _____ | - | dB | |
| 1500 MHz | | 14 | _____ | - | dB | |
| 1750 MHz | | 14 | _____ | - | dB | |
| 2000 MHz | | 14 | _____ | - | dB | |
| 2250 MHz | | 14 | _____ | - | dB | |
| 2500 MHz | | 14 | _____ | - | dB | |
| 2750 MHz | | 14 | _____ | - | dB | |
| 3000 MHz | | 14 | _____ | - | dB | |
| 3250 MHz | | 14 | _____ | - | dB | |
| 3500 MHz | | 14 | _____ | - | dB | |
| **FSU 8:** | | | | | | |
| 3750 MHz | | 9,5 | _____ | - | dB | |
| 4000 MHz | | 9,5 | _____ | - | dB | |
| 4250 MHz | | 9,5 | _____ | - | dB | |
| 4500 MHz | | 9,5 | _____ | - | dB | |
| 4750 MHz | | 9,5 | _____ | - | dB | |
| 5000 MHz | | 9,5 | _____ | - | dB | |
| 5500 MHz | | 9,5 | _____ | - | dB | |
| 6000 MHz | | 9,5 | _____ | - | dB | |
| 6500 MHz | | 9,5 | _____ | - | dB | |
| 7000 MHz | | 9,5 | _____ | - | dB | |

# Contents - Chapter 2 "Adjustment"

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# 2 Adjustment

The following chapter describes the adjustment of the reference sources as well as the software-controlled adjustment of individual module data following module replacement.

The FSU permits the following manual adjustments:

- Adjustment of the 10 MHz reference oscillator which determines the frequency accuracy of the FSU
- Adjustment of the 128 MHz calibration source which determines the level accuracy of the FSU

The adjustment permits to maintain and restore the data integrity of the instrument.

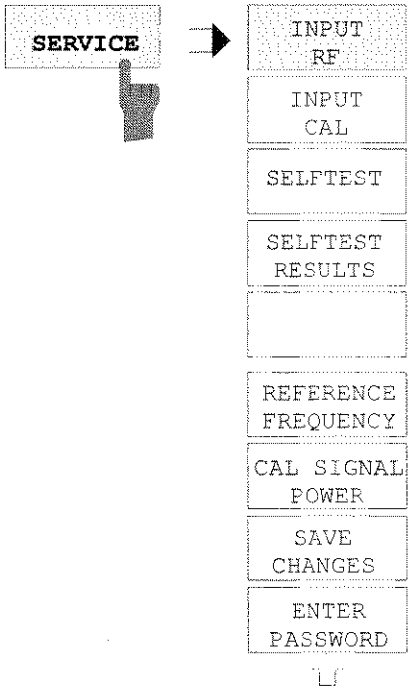
Manual adjustments must be performed at an ambient temperature between +20 °C and +30 °C after the instrument has warmed up.

After the adjustment and an internal total calibration has been performed, the FSU is ready for use and offers full data integrity.

## Service Menu

The service functions for adjusting the boards are only useable after the entry of a password to prevent impairment of instrument functionality by unintended data changes.

*SETUP* menu:




The *SERVICE* softkey opens a submenu for selection of the service function

## Entering the Password

*SETUP SERVICE* submenu:


The *ENTER PASSWORD* softkey allows the entry of a password.

The FSU contains a variety of service functions which, if incorrectly used, can impair the functionality of the analyzer. These functions are normally not accessible and are only usable after the entry of a password.

The password permits change of data which must be modified for calibration or repair of the instrument (for example reference frequency adjustment, level adjustment, general board data). The password is "894129".

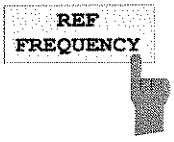
IEC/IEEE-bus command: `SYST:PASS "<Password>"`

## Adjustment Functions

***Caution:***

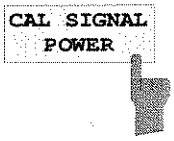
*The re-alignment should be carried out by qualified personnel since any change considerably influences the measurement accuracy of the instrument. This is the reason why the softkeys REF FREQUENCY, CAL SIGNAL POWER and SAVE CHANGES can only be accessed after entering a password.*

*SETUP SERVICE submenu*:



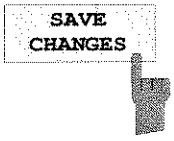

The *REF FREQUENCY* softkey opens the data input for the adjustment of the reference frequency. Values can be selected between 0 and 255 (without option FSU-B4 OCXO) or between 0 to 4095 (with option FSU-B4 OXCO). They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store it permanently in the nonvolatile memory.

IEC/IEEE-bus command: `SENS:ROSC:INT:TUN 155`




The *CAL SIGNAL POWER* softkey opens the data input for the adjustment of the currently set level of the calibration signal (0 dBm or -30 dBm, compare *INPUT CAL* softkey). Values can be selected between 0 and 255. They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store it permanently in the nonvolatile memory.

IEC/IEEE-bus command: --




The *SAVE CHANGES* softkey stores the modifications in the nonvolatile memory of the instrument. Since these modifications considerably influence the measurement accuracy of the instrument, confirmation by the user is requested before storing.

IEC/IEEE-bus command: `SENS:ROSC:INT:TUN:SAV`

# Manual Adjustment

In the following, the measuring instruments and auxiliary means required for the manual adjustment of the FSU, the appropriate preparations of the instrument as well as the individual adjustments will be explained.

## Test Instructions

- The adjustment of the analyzer must be done after a warm-up time of at least 30 minutes and overall calibration. Only in this case can the compliance with the guaranteed data be ensured.
- Inputs for setting the FSU during measurements are shown as following:

  [**<KEY>**] Press a key on the front panel, eg **[SPAN]**

  [<SOFTKEY>] Press a softkey, eg [MARKER -> PEAK]

  [**<nn unit>**] Enter a value and terminate by entering the unit, eg **[12 kHz]**

  Successive entries are separated by [:], eg. [ **BW** : RES BW MANUAL : **3 kHz** ]

## Measuring Equipment and Accessories

Table 2-1 Measuring Equipment and Accessories for manual adjustment of the FSU

| Item | Type of equipment | Specifications recommended | Equipment recommended | R&S Order No. | Use |
|---|---|---|---|---|---|
| 1 | Frequency counter | error < $1x10^{-9}$, frequency range up to 10 MHz | Advantest R5361B with option 23 | | Frequency Accuracy of Reference Oscillator |
| 2 | Signal generator | frequency range to 1 GHz:<br>output level -10 dBm | SMHU | 0835.8011.52 | Calibration Source 128 MHz Frequency Accuracy of Reference Oscillator |
| 3 | Power meter | | NRVD | 0857.8008.02 | Calibration Source 128 MHz |
| 4 | Power sensor | 1 MHz to 3.6 GHz<br>RSS ≤ 0.8%<br>Meter noise ≤ 20 pW | NRV-Z4 | 0828.3618.02 | Calibration Source 128 MHz |

# Adjusting the level measurement accuracy

Test equipment:

- Signal generator (Section "Measurement Equipment", item 2):
  frequency 128 MHz
  level -30 dBm
- power meter (Section "Measurement Equipment", item 3)
- power sensor (Section "Measurement Equipment", item 4)
  frequency 128 MHz
  maximum power $P_{max} \geq 1$ µW
  meter noise ≤ 20 pW
  RSS ≤ 0.8% referred to indicated power
  impedance Z = 50 Ω

Power meter settings:

➢ connect power sensor to power meter and carry out function ´ZERO´ when no signal is applied to the power sensor.

➢ connect power sensor to RF output of signal generator.

Signal generator settings:

- frequency 128 MHz
- level –30 dBm ± 0.05 dB

➢ use power meter for exact level adjustment.

Test setup:

➢ connect RF output of the signal generator to RF input of the FSU

Overall calibration of FSU:

- [ **PRESET** ]
- [ **CAL** : CAL TOTAL ]

FSU settings:

- [ **FREQ** : CENTER : **128 MHz** ]
- [ **SPAN** : **15 kHz** ]
- [ **BW** : RES BW MANUAL : **10 kHz** ]
- [ **BW** : VID BW MANUAL : **1 kHz** ]
- [ **TRACE** : DETEKTOR : RMS ]
- [ **AMPT** : REF LEVEL : **-20 dBm** ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]

Reference measurement

➢ set marker to peak of signal
- [ **MKR SEARCH** : PEAK ]

➢ set reference to peak of signal
- - [ **MKR** : REFERENCE FIXED ]

➢ switch internal reference generator to RF input
- [ **SETUP** : SERVICE : INPUT CAL ]

➢ set marker to peak of signal
- [ **MKR** ⇒ : PEAK ]

Adjustment:

The reading ´Delta [T1 FXD]´ displays the difference between the output level of the signal generator and the level of the calibration source.

***Caution:***

*The following re-alignment changes the level of the internal calibration source. Since this adjustment influences the level measurement accuracy of the FSU, it is strongly recommended to perform this adjustment only if the level is not within the tolerance. .*

FSU settings:

- [ **SETUP :** SERVICE : ENTER PASSWORD : **894129 ENTER** ]
- [ **SETUP :** SERVICE : CAL SIGNAL POWER ]

➢ The correction value for the calibration signal level will be displayed in the data entry field. Change the value with the step keys or spin wheel until the marker reading ´Delta [T1 FXD]´ displays a value of 0 ± 0,05 dB.

Store value in instrument

- [ **SETUP :** SERVICE : SAVE CHANGES ]

➢ Confirm message on display with ´YES´ . The correction values will be stored in the non volatile memory of the boards.

***Note:***

*The changed level of the calibration source will be used with the following total calibration.*

- [ **CAL :** TOTAL CALIBRATION ]
- [ **CAL :** CALIBRATION RESULTS ]

➢ Check the calibration results. The calibration must be performed with the status ´PASSED`.

# Adjusting the frequency accuracy

Preparation: The measurement can be performed either with a signal generator at connector RF INPUT (front of FSU) at 1 GHz or at connector EXT REF OUT (rear of FSU) at 10 MHz using a frequency counter
For the adjustment, the FSU must be set to internal reference.

**Note:** *The measurement at 1 GHz can be performed with a lower frequency counter resolution in order to achieve a faster adjustment.*

**Preparations for adjustment with signal generator:**

Test equipment:
- Signal generator (Section "Measurement Equipment", item 2):
  frequency 1000 MHz
  level -20 dBm
  frequency accuracy $<1x10^{-9}$

If the frequency accuracy of the signal generator is not sufficient, adjust the frequency with a frequency counter to the correct frequency before the adjustment.

Test setup:
➢ connect RF output of the signal generator to RF input of the FSU

FSU settings:
- [ **PRESET** ]
- [ **FREQ** : CENTER : **1 GHz** ]
- [ **SPAN** : **0 Hz** ]
- [ **BW** : RES BW MANUAL : **30 kHz** ]
- [ **AMPT** : REF LEVEL : **-20 dBm** ]
- [ **AMPT** : RF ATTEN MANUAL : **10 dB** ]
- [ **SETUP** : REFERENCE INT / EXT ]

➢ toggle to internal reference (INT)

***Note:*** *Before the following measurement, the FSU must warm up for at least 30 minutes to heat the reference oscillator.*

Measurement:
➢ switch on marker frequency counting:
- [ **MKR** : SIGNAL COUNT ]

➢ Set the necessary resolution:
Model without OCXO (Option B4) 1 GHz ± 100 Hz
- [ **MKR** : **NEXT** : CNT RESOL 10 HZ]

Model with OCXO (Option B4) 1 GHz ± 30 Hz
- [ **MKR** : **NEXT**: CNT RESOL 1 HZ]

**Preparation for adjustment with frequency counter:**

Test equipment:

Frequency counter (Section "Measurement Equipment", item 1):
error < $1x10^{-9}$
frequency range up to 10 MHz

Test setup:

➢ connect frequency counter to 10-MHz reference output of the FSU (rear panel)

FSU settings:

- [**SETUP** : REFERENCE INT / EXT ]
➢ toggle to internal reference (INT)

frequency counter settings:

➢ Set the necessary resolution:
model without OCXO (option FSU-B4): 1 Hz
model with OCXO (option FSU-B4): 0.1 Hz

***Note:***

*Before the following measurement, the FSU must warm up at least 30 minutes to heat the reference oszillator.*

Measurement:

➢ measure frequency with frequency counter:

nominal frequency:
model without OCXO (option FSU-B4) ..... 10 MHz ± 1 Hz
model with OCXO (option FSU-B4) ..... 10 MHz ± 0.3 Hz

**Adjustment:**

**Important Note !**

*The following adjustment changes the frequency of the internal reference source. Since this adjustment influences the frequency accuracy of the FSU, it is strongly recommended to perform this adjustment only if the frequency is not within the tolerance.*

FSU settings:

- [ **SETUP :** SERVICE : ENTER PASSWORD : **894129 ENTER** ]
- [ **SETUP :** SERVICE : REF FREQUENCY ]

➢ The correction value for the reference frequency adjust will be displayed in the data entry field. Change the value with the step keys or spin wheel until the frequency counter reading or the marker count reading displays a value within the tolerance.

Store value in instrument

- [ **SETUP :** SERVICE : SAVE CHANGES ]

➢ Confirm message on display with ´YES´ . The correction values will be stored in the non volatile memory of the boards.

## Figures



## Tables

# 3 Repair

This chapter describes the design of the FSU, simple measures for repair and troubleshooting and, in particular, the replacement of modules. For troubleshooting and diagnosis, a selftest is available, which permits to poll diagnostic voltages of the modules and indicate limit violations.

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

## Instrument Design and Function Description

A detailed schematic of the FSU design will be presented in the block diagrams below and in the attachments (see also chapter 5).
The following function description of the instrument refers to the block diagram.

### Block diagram

see also chapter 5, drawings, for a detailed block circuit.

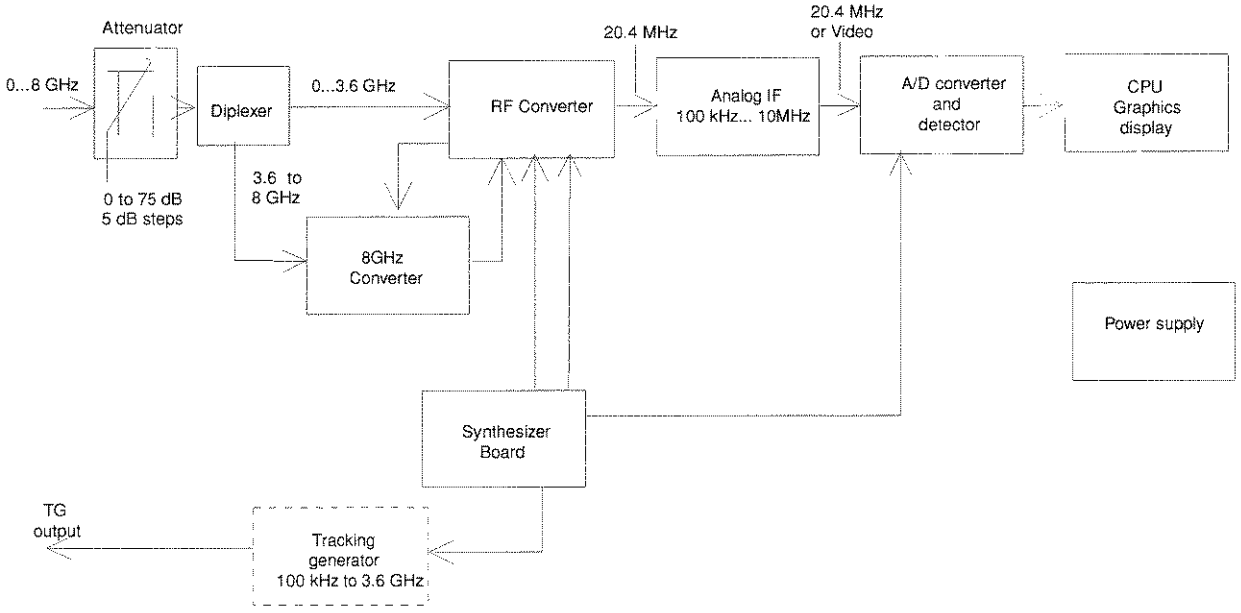



Fig. 3-1 Block diagramm

# Description of Block diagram

The FSU is a triple-conversion superhet receiver (double-conversion for receive frequencies >3.6 GHz) for the frequency range 20 Hz to several GHz, depending on the instrument model. The signals are processed by one RF board (two for models > 3.6 GHz), one IF board, one signal detection board and a controller comprising a Pentium industry PC, an I/O interface and a graphic controller. The instrument can be upgraded to meet future requirements by retrofitting options in the analog and digital sections.

The input signal is reduced in level by the attenuator and routed to the RF modules depending on the instrument type. In instruments with option B25 (electronic attenuator), this module follows in the signal path. In 3.6 GHz-Models the attenuator is followed by the RF-Converter directly, in the high-frequency models a diplexer is connected in between. The high-frequency signal component >3.6 GHz is routed to the microwave converter module following the diplexer. The IF module is the same in all instrument models, likewise the signal path through signal detection to the display.

The internal reference and calibration signals are generated in the frequency and level reference part on the synthesizer board. Here the 128 MHz reference frequency is generated and made available to the instrument as a reference frequency, and a level-controlled output signal is generated as an internal level reference for instrument calibration.

A detailed description of the modules is given in the following.

## Attenuator

The RF signal passes from the input connector via the input switch to the input attenuator, which can be set from 0 to 75 dB in steps of 5 dB. The input signal is applied to the switch as well as a 128 MHz signal which has a close-tolerance level of -30 dBm for calibration purposes or 0 dBm for the selftest of the instrument. AC coupling can be set via an additional switch, the lower cut off frequency is app. 1 MHz.

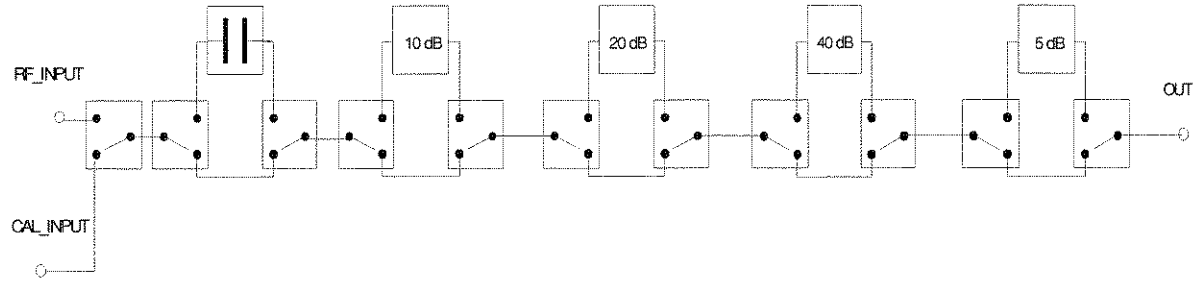



Fig. 3-2 RF Attenuator

## Electronic Attenuator (Option FSU-B25)

The Electronic attenuator is fitted in the RF signal pass directly behind the input attenuator. It consists of different parts: an electronic attenuator, which can be switched from 0 to 30 dB in steps of 5 dB and an switchable preamplifier to reduce the noise figure of the instrument.

## RF to IF Conversion for Frequencies < 3.6 GHz – Frontend

FSU-3 uses the RF converter for conversion to the 20.4 MHz IF. There is a symmetrical input mixer on this board which converts the input signal to an intermediate frequency of app. 4.63 GHz. The symmetric design reduces second order intermodulation .
The local oscillator in the frequency range 4.63 to 8.23 GHz is generated with a YIG tuned oscillator. This oscillator is synchronized via several dividers to the signal from the synthesizer module (600 to 620 MHz). The output of the first mixer is amplified with two bipolar transistors to avoid 1/f noise. This balanced signal is feed to a three stage filter with dielectric resonators. Flatness and group delay of the filter are optimized for broadband vector analyses in a bandwidth of 30 MHz. The filter feeds a second mixer, which converts the signal to the second IF of 404.4 MHz. The symmetric output is amplified with two amplifiers to reduce intermodulation products. The signal from the two amplifiers are combined in a transformer to an unbalanced signal. The symmetric design reduces the need of transformers in the mixers and therefore reduces the conversion loss.
The 404.4 MHz signal can be filtered to a bandwidth of 10 or 20 MHz with two filters with five stages each. A bypass for a 50 MHz bandwidth (= 3dB bandwidth of the first IF Filter) can be selected also. The signal is feed to a 31 dB step attenuator (1dB resolution) which reduces the signal level in the case of broadband FFT mode. With 30 MHz FFT span the K2 of the 3rd mixer causes spurious within the band. Therefore the level has to be reduced before this mixer stage if high input levels are used (> -25dBm) . The attenuator can be used also to take reference values of up to +5 dBm mixer level in phasenoise or spurious measurements with very high dynamic range.
Fast overload detectors are used with directional couplers to detect compression in the stages of the first and second intermediate frequency. The bandwidth of this detectors is above 100 MHz, therefore pulse signals can be detected correctly with a 100 MHz wide preselector. The output signal of the detector on the first IF is also used with a fast logarithmic amplifier as a RF power trigger with about 60 dB dynamic range.

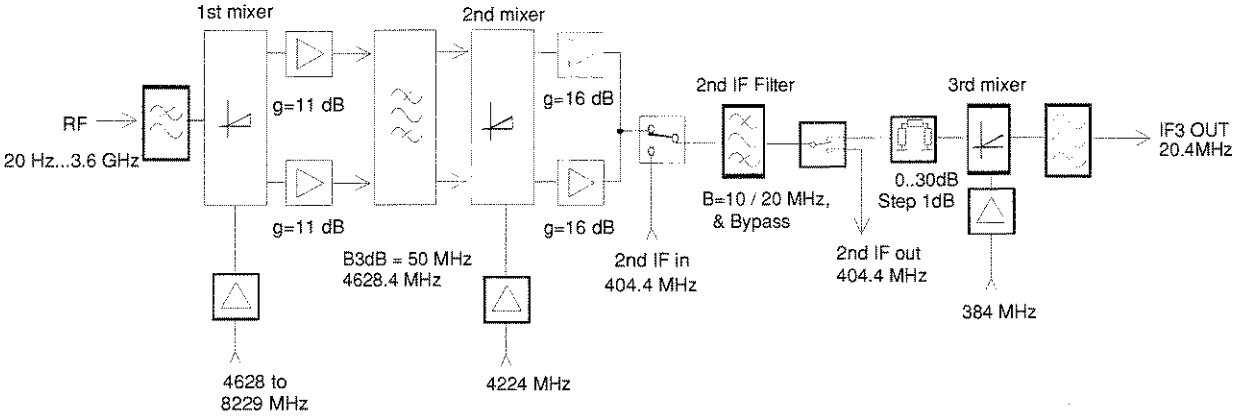



Fig. 3-3 RF to IF Conversion for Frequencies < 3.6 GHz

## RF to IF Conversion for Frequencies > 3.6 GHz - MW Converter

The high frequency models of FSU (frequency range > 3.6 GHz) also comprise a microwave converter board. From the attenuator output the input signals are feed to the microwave converter and split up in the diplexer to frequencies below 3.6 GHz and above 3.6 GHz. Signals below 3.6 GHz are forwarded to the RF converter like in the FSU 3. Signals in the range higher than 3.6 GHz are feed to the mixer via the YIG filter for an intermediate frequency of 404.4 MHz. This output is connected to the RF converter, where it is filtered and down converted to 20.4 MHz.

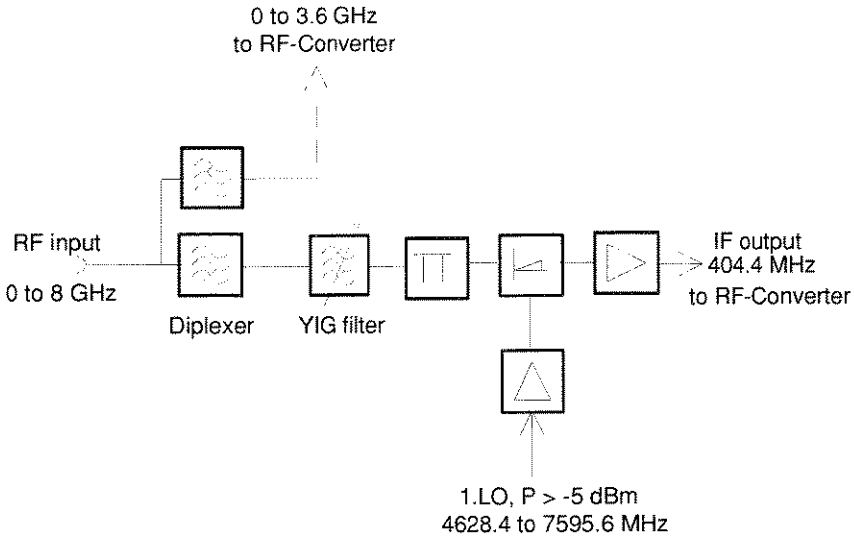



Fig. 3-4 RF to IF Conversion for Frequencies > 3.6 GHz

The first LO converts the input frequency directly to the 404.4 MHz IF. For this purpose the LO signal (4 to 7.6 GHz) generated in the RF-converter is amplified to the required LO level.
The basic model is equipped with the necessary interfaces (IF input 404.4 MHz, LO output 4 to 7.6 GHz) for extending the frequency range by simply adding a microwave converter.

## IF Filter – Module

The RF converter is followed by the IF filter module :

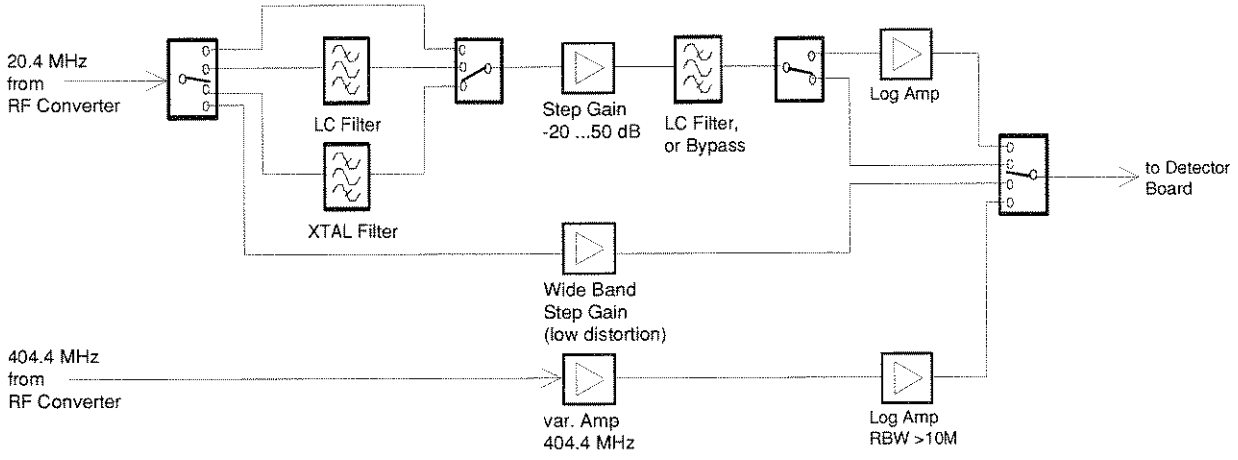



Fig. 3-5 IF Filter

FSU offers resolution bandwidths from 1 Hz to 20 MHz in steps of 1/2/3/5 and 50 MHz. The selection filter at the 2nd IF of 404.4 MHz in the RF converter yields the 10, 20 and 50 MHz bandwidth.

The tunable bandwidths 200 kHz to 5 MHz are at the 3rd IF (20.4 MHz) on the IF filter module. The bandwidths 100 kHz to 5 MHz are provided by 5 LC circuits. Two stages are in front of the step gain amplifier and three are after this amplifier due to a compromise between good noise figure and overrange protection of the step gain amplifier.
The step gain can be set from -20 to 50 dB in 0.1 dB steps and is adjusted as a function of the reference level and the input attenuation.
The LC filters are followed by a log detector to obtain the display dynamic range.
The module also comprises a limiting amplifier (in the log-amp) with a TTL output for the frequency counter.
With 10 MHz of resolution bandwidth the LC filters are bypassed, the log amp is used in the same manner than with bandwidth between 200 kHz and 10 MHz.

For the digital resolution filters from 1 Hz to 100 kHz, the 20.4 MHz IF signal at the IF filter output is routed to the A/D converter. With bandwidth below or equal 30 kHz a crystal filter in front of the step gain is used to avoid over-steering of the step gain and the ADC. This filter can be tuned from about 2.5 to 70 kHz in bandwidth. With bandwidth 50 kHz and 100 kHz the two LC filters in front of the step gain are set to about 300 kHz for the same reason.

An additional path without any filtering is used for the broadband vector analyses. The variable gain amplifier is optimized for low distortion, as with a bandwidth of 30 MHz at 20.4 MHz center frequency the harmonics of the IF are also present at the input of the ADC.

## OCXO Reference (Option FSU-B4)

The FSU contains as an option FSU-B4 an oven controlled reference oscillator. This OCXO generates a 10 MHz signal which is routed to the IF-Filter board and used as reference signal.

## Processing of Measured Data - Detector Board

The chapters below explain the signal and data paths required for result processing in the various operating modes:

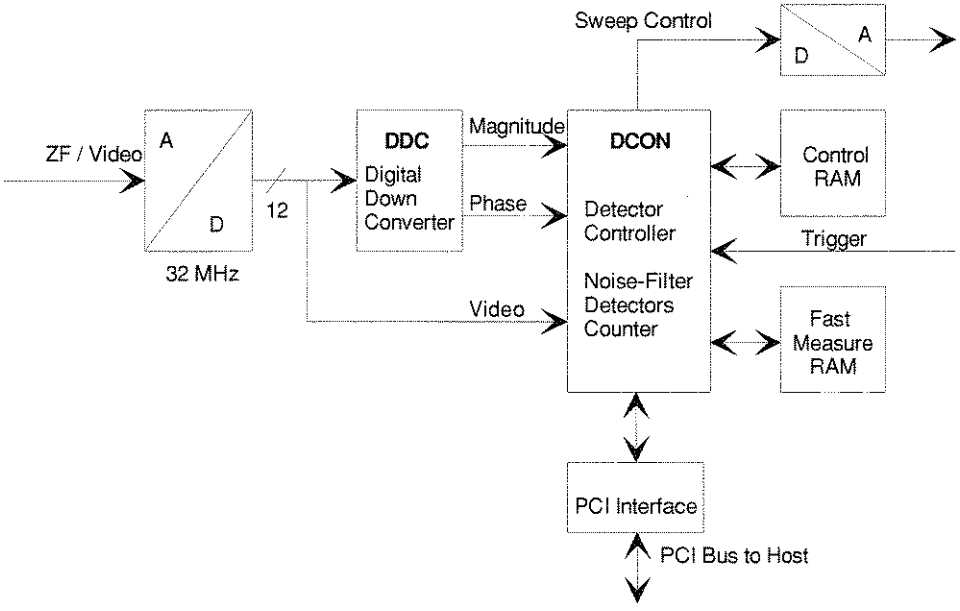



Fig. 3-6 Processing of measured data

## Spectrum Analysis Using an RBW >100 kHz

In this mode only the analog resolution filters on the IF filter board are used. The signal applied to the A/D converter via the input IF/Video is therefore already a log video signal. The signal is continuously sampled at 32 MHz in the ADC and digitized.
The signal path is now directly routed to DCON.
In the DCON, the data are directly applied to the noise filter. The noise filter serves for limiting the video bandwidth or for averaging the noise content. The signal path is routed to the detector logic where the results are processed, ie peak max, peak min, sample, average and RMS values as well as the number of measured values and quasi-peak values are determined.
With measurement data rates > 1 MHz, detector data have to be stored in the measurement RAM because online processing is no longer possible at these high speeds. Upon completion of the sweep, the sweep data are read by the host from the measurement RAM, processed and displayed.

## Spectrum Analysis Using an RBW ≤ 100 kHz

In this operating mode the resolution bandwidths are generated digital with the aid of the DDC (digital down converter). This IC converts the input signal into the baseband using an NCO (numeric controlled oscillator), and then filters the obtained I/Q signal via a HDF (**h**igh **d**ecimation **f**ilter) and a FIR (**f**inite **i**mpulse **r**esponse) filter stage. At the end of the DDC processing chain, the I/Q signal in the CORDIC block is split up in magnitude and phase. For signal processing in the DDC, the IF signal from the IF filter module directly represents the linear IF.
Further signal processing on the detector board is identical to that of operating mode RBW > 100 kHz.

## FFT bandwidth

In FFT bandwith mode, the synthesizer is set to the desired frequency via the DCON which also generates the tuning voltages for the analog hardware. The signal path is routed via ADC, Corr RAM and DDC. The DDC first mixes the input IF into the baseband using an NCO, then the obtained I/Q signal is filtered in a HDF (**h**igh **d**ecimation **f**ilter) and FIR stage (**f**inite **i**mpulse **r**esponse). The I/Q output data are then stored by the DDC in the I/Q RAM. With data logging completed the I/Q data from the I/Q RAM are transferred to the host via DDC and PCI interface FPGA. The host then performs the FFT for this sweep section.

## Video Bandwidths (VBW)

The video filters of FSU can be adjusted between 1 Hz and 10 MHz in steps of 1/2/3/5. They are designed as a digital lowpass filter for the video signal. The video bandwidth can either be coupled to the resolution bandwidth (= default setting) or manually set to a fixed value.

## Detectors

The FSU uses a detector for the positive peak (peak+) and one for the negative peak value (peak-). In the sample mode, the video signal can also be directly sampled by the A/D converter without a peak detector being required . *Quasi-Peak, Average* and *RMS* detectors are available in addition. The RMS detector forms the rms value of the input signal for one point in the display during the measurement time.

## 1st Local Oszillator- RF Converter

The 1st Local is a YIG Oscillator on the RF Converter. It is synchronized via a fractional N divider to the synthesizer signal of 600...620 MHz or 20 ... 40 MHz. This signal can be set with very high resolution in steps of less than mHz. With 20 to 40 MHz a whole octave can be swept with one divider setting. Therefore this is used with fast sweep time over big spans. The other setting with app. 600 MHz is used with spans below 200 MHz because of the better phasenoise.

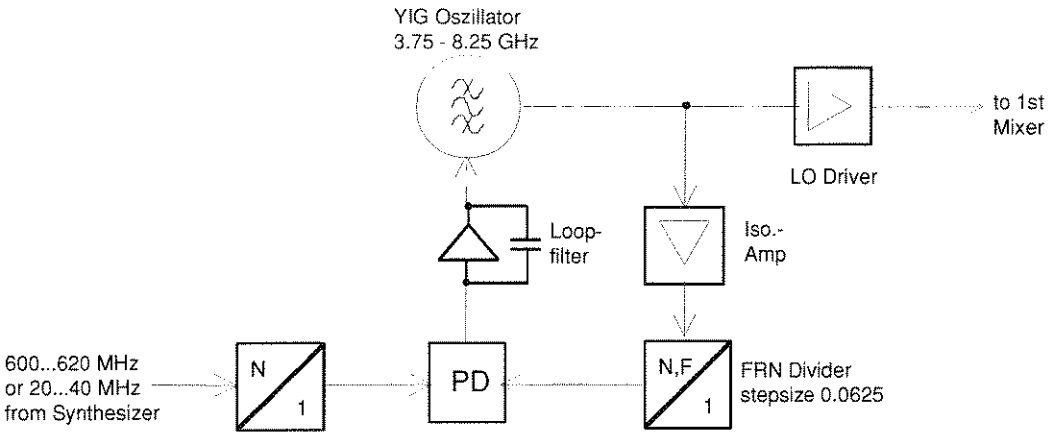



Fig. 3-7 Synchronization 1st Local Oscillator

## 2nd Local Oszillator- Synthesizer

The second local oscillator is a DRO (dielectric resonator oscillator) on the Synthesizer board at 4224 MHz. It can be set also to a frequency offset of up to 10 MHz to avoid mixing-products with the first local oscillator. The oscillator is synchronized to a harmonic of the 3rd LO directly or with the wanted offset. This type of oscillator was used because of the excellent phasenoise performance.

## 3rd Local Oszillator- Synthesizer

The third oscillator is a VCO with ceramic resonator, it is synchronized via a mixer to the third harmonic of the crystal oscillator at 128 MHz

## Reference Frequency 128 MHz – Synthesizer

This reference is generated on the synthesizer board and is synchronized to the 10 MHz Reference. For best phasenoise performance a SC cut crystal is used as resonator. The oscillator is synchronized with a bandwidth of app. 30 Hz to the 10 MHz Reference or to an external reference.
Harmonics of this signal are used for the synchronization of the 3rd local oscillator and the sweep oscillator 600 ... 620 MHz. It is also used for the 128 MHz self alignment signal with a automatic level control. The level can be switched between 0 dBm and -30 dBm. The level ist adjustable with an D/A-Converter.
An 4:1 Divider is generating the 32 MHz Clock for the Detector Board ( A/D-Converter ).

## Reference Frequency 10 MHz – Synthesizer

The reference frequency is generated by an OCXO, the frequency is adjustable by an D/A-Converter. If the input external reference is used, this OCXO is switched off and the external signal is used instead.

## OCXO Reference (Option FSU-B4)

The FSU contains as an option FSU-B4 an oven controlled reference oscillator with extra low ageing and improved phasennoise at 10 Hz offset. If the option is present this OCXO is used instead of the OCXO on the synthesizer board. If an external reference is used both OCXO´s are switched off. The heater of the B4 option stays on.

## Sweep VCO - Synthesizer

The sweep VCO on the synthesizer board is used to synchronize the YIG oscillator on the RF converter. A oscillator with ceramic resonator at app. 600 MHz is used. This VCO can be controlled over quite a small range of about 20 MHz for good phasenoise performance. A bigger tuning range would reduce the quality factor of the resonator. The oscillator is mixed with a comb line of the 128 MHz crystal oscillator to an IF between 20 and 40 MHz. Via this IF the VCO is synchronized to a digitally generated signal from a fractional N divider. This signal can be tuned in steps of smaller than 1mHz in frequency. For fast sweeps the output is switched to the IF.

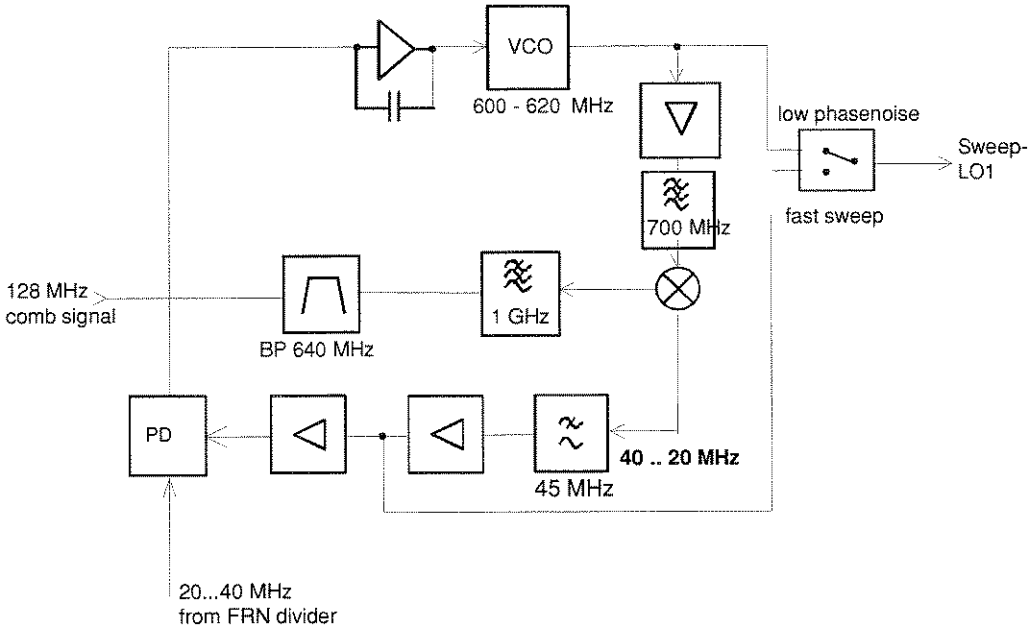



Fig. 3-8 Sweep Synthesizer

## Front Panel

The Front panel consists of an aluminum case panel (part of the FSU frame) and of an mounting plate which accommodates the LCD, the backlight inverter, the keyboard mat with the membrane and the spinwheel. The case panel incorporates the front-module controller

**LCD**
The color LCD provides a visible output of any information, measurements etc. to the user. The resolution of the LCD is 800 * 600 pixels (SVGA).
The display incorporates a cold cathode tubes for the illumination. The high voltage required for this purpose is generated in an extra DC/AC converter mounted next to the display on the mounting plate and connected both to the display and the controller board via a cable.

**Keyboard**
The keyboard consisting of a keyboard mat and a membrane release a contact when the rubber key is pressed. Two LEDs for the STANDBY/ON key (orange for STANDBY/green for ON) are also accommodated on this membrane.
The key evaluation and LED control are effected via a film cable connector on the controller board. Like the control of the two LEDs, it is controlled in a special microprocessor on the controller board by means of a matrix technique. This microprocessor permits to store the status of the STANDBY/ON key when switching off using the power switch.

**Front module controller**
The front module controller contains all the necessary components on a board such as processor, memory chips (SIMM modules), I/O devices (ISA bus), lithium battery, IEC-bus controller (IEEE), two serial interfaces (COM1/2), a parallel interface (LPT), LCD graphics controller, external VGA monitor graphics interface (monitor) and an external keyboard connection (keyboard PS/2).
In addition, a floppy controller for an external floppy disk drive and an IDE hard disk controller are integrated on the controller board.

**Hard disk**
The hard disk is screwed to the rear of the aluminium case panel and connected to the printed circuit board via a ribbon cable.

## Power Supply Module

The power supply module provides all currents necessary for the operation of the FSU. It can be switched off by means of the power switch on the rear panel.
The power supply module is a primary clocked switching power supply with Power Factor Correction (PFC) and Standby circuit (+12 V Standby).On the secondary side, it generates DC voltages (+3.3 V; +5.2 V; +6 V; +8 V; +12 V; +12 VFAN; +12 V Standby; +28 V; -12 V).
The control signal STANDBY/ON controlled by the front module controller (depending on the operating key STANDBY/ON on the front of the instrument frame) activates the power supply. In standby operation, it only supplies the 12V-standby voltage for the crystal oscillator and the LED STANDBY on the frontpanel.
The secondary voltages are open-circuit-proof and short-circuit-proof with respect to ground and each other.
An overtemperature protective circuit is additionally installed to prevent overheating. This status is taken to the front module controller via a status signal (*OT*).

**Fuses**
Two fuses are also fitted in the power supply as a means of fire protection.

***Note:*** *These fuses are not accessible to the user from outside and are only blown in the case of a serious fault of the power supply (servicing required!).*

## Motherboard

The motherboard generates the –6V supply for the analog boards with an integrated DC/DC-Converter.
The Noise source control voltage (28V Noise Source) is also generated on this board.
All external supplies (Probe, Keyboard,...) are protected by polyswitches (current-dependent, self-opening and closing fuses) or electronicly against external short circuit.
On the motherboard a circuit for temperature-dependent instrument fan control is also implemented.

**Probe / Keyboard**
The probe / keyboard board is located at the front of the instrument frame and serves for supply and connection of the connectors located at the front panel, the KEYBOARD (PS/2) and a PROBE POWER connector. For connection with motherboard a ribbon cable is used.

**Volume / Phones**
The volume/phones board is located at the front of the instrument frame and is used to connect the rotary encoder for the Volume setting of the AF-Demodulator and the Headphones connector with the motherboard.
For connection with the motherboard a ribbon cable is used.

# Module Replacement

This section describes the service concept and contains the spare parts list and the basic documents for the overall FSU instrument. Replacement of modules is described in detail in Section 3 under "Module Replacement".

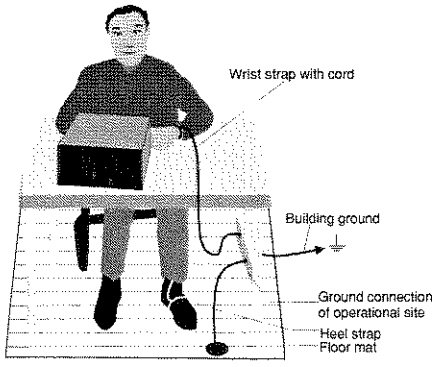
***Note:*** *The numbers indicated in brackets refer to the position in the list of mechanical parts in Section 5.*

*These items correspond to the item numbers in the illustrations on board replacement (see also Section 5):*
*1129.9003 (FSU Basic Model, Its. 1-455),*
*1129.9032 (Dig. Basic Unit, Its. 500-750),*
*1093.4708 (Display Unit, Its. 800-950),*
*1129.6791 (Option FSU-B4, Its. 1110-1130) and*
*1129.7246 (Option FSP-B10. Pos. 1600-1630).*

***Note:*** *The words "left" and "right" in the manual always refer to the front view of the instrument.*

**Caution!**

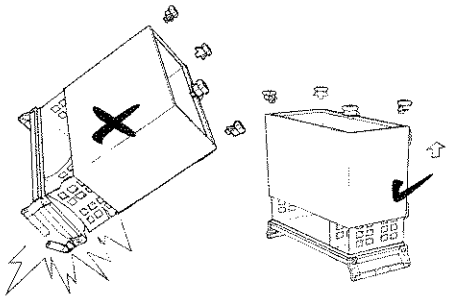
- *Please note the safety instructions at the beginning of this manual.*
- *Disconnect the instrument from the mains before opening the case.*
- *Protect the replacement site against electrostatic discharge to avoid damage of electronic components of the modules.*




*The following two methods of ESD protection may be used together or separately:*

*- Wrist strap with cord to ground connection*

*- Conductive floor mat and heel strap combination*



- *Put the instrument on the front handles before loosing the rear feet and the tube to avoid damage of the instrument.*
- *When mounting the tube take care not to damage or pull off cables.*

# Overview of the Modules

Table 3-1 Overview - module replacement

| Module | Required tests and adjustments after replacement | | |
|---|---|---|---|
| | **Function tests and system error correction** | **Adjustment** | **Other** |
| Front module controller | SYSTEM MESSAGES/ SELFTEST / CAL | | DOS/BIOS update |
| Lithium battery | SYSTEM MESSAGES/ SELFTEST / CAL | | Cold boot |
| Harddisk | SYSTEM MESSAGES/ SELFTEST / CAL | | Cold boot / FW update |
| LCD / DC/AC-converter | | | |
| Keyboard membrane or mat | | | |
| Labeling panel | | | |
| Floppy disk drive | Check of directories | | |
| Power supply | SYSTEM MESSAGES/ SELFTEST / CAL | | |
| Fan | | | |
| RF-Input connector | SELFTEST / CAL | Frequency response | |
| Motherboard | SYSTEM MESSAGES/ SELFTEST / CAL | | EEPROM entry |
| RF-Attenuator | SYSTEM MESSAGES/ SELFTEST / CAL | Frequency response | |
| Key probe and Vol./Phone | Voltage / keyboard / volume | | |
| RF Converter | SYSTEM MESSAGES/ SELFTEST / CAL | Frequency response | |
| Detector | SYSTEM MESSAGES/ SELFTEST / CAL | | |
| IF-filter | SYSTEM MESSAGES/ SELFTEST / CAL | Frequency accuracy/ cal. source | |
| MW-Converter | SYSTEM MESSAGES/ SELFTEST / CAL | Frequency accuracy/ frequency response | |
| Synthesizer | SYSTEM MESSAGES/ SELFTEST / CAL | | |
| OCXO FSU-B4 | SYSTEM MESSAGES/ SELFTEST / CAL | Frequency accuracy | |
| External Generator Control FSP-B10 | SYSTEM MESSAGES/ SELFTEST / CAL | | |

# Replacing the Front Module Controller A90

*(see chapter 5, spare part list position (570) and explosion drawing 1129.9003, 1129.9032)*

The front module controller is mounted behind the front panel.

## Opening the Instrument and Removing the Front Panel

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove volume control knob (47) by pushing off the front hood and loosing the screw. Pull off the labeling panel (270) towards the front.
- Unscrew two countersunk screws (610) in the front frame each at the top and at the bottom.
- Remove the frontpanel with keyboard and display (600, 620, 630, 640, 650, 660) to the front.

***Caution!***

*Note the connecting cables are still connected to the controller.*

- Pull off the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel.

***Note:*** *When pulling off the connecting cables be careful with the cable connecting to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

## Removing the Front Module Controller

➢ Unscrew the ten combi screws of the front module controller board and take out the front module controller as follows (see Fig. 3-9)

***Note:*** *The force to disconnect the controller connectors of the motherboard are very high. The pulling of the controller to the front side will be done with the help of the slits at the bottom side of the mounting plate. Please push the board with a flat, blunt tool carefully and step by step to the front.*

***Caution:***

*Don´t move the tool to deep in the slits and press only against the pc board !. Pull out the board by preesing at alternate slits. The board must not be bend!*

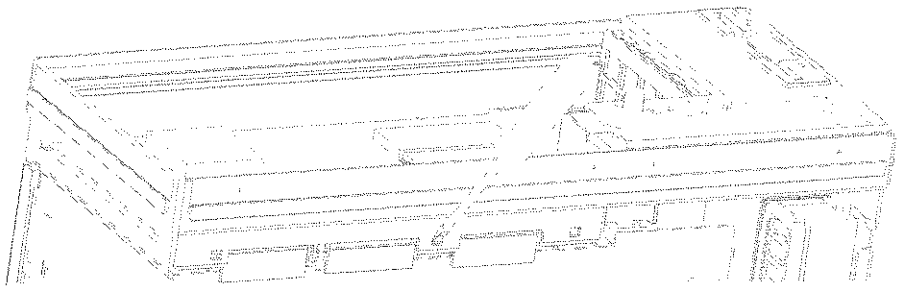


Fig. 3-9 Removing the front module controller

## Installing the New Front Module Controller and Completing the Instruments

- Carefully plug the new front module controller to the motherboard and fasten it using the ten combi screws (590).
- Carefully insert the cable connectors to the controller board, taking care not to reverse the polarities.
- Remove jumper at JP28 (see Fig. 3-10).

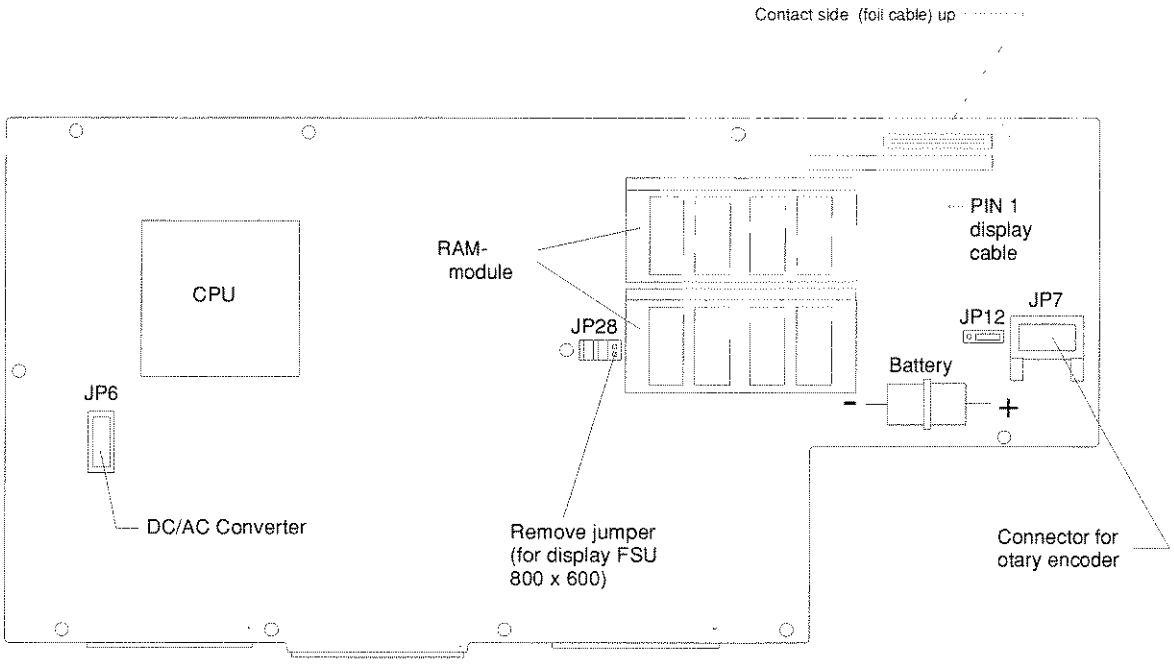



Fig. 3-10 Installing a new front module controller - position of connectors

- Plug the front panel track into the instrument and screw with four countersunk screws (610) in the front frame at the top and at the bottom.

***Caution!***

*Make sure to route the cables properly*

- Install the labeling panel (270).
- Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).
- Mount volume control knob (47) by fixing the screw and push on the front hood.

## Putting into Operation

- Connect the instrument to the mains and switch on the instrument power switch. The instrument is now in stand-by mode.
- Insert a a floppy disk with DOS and BIOS-Update in the floppy disk drive.
- Switch ON the FSU and wait until the first Beep. Press Key "FILE". The BIOS-Update starts.
- During the programming of the flash eeprom the FSU must not be switched off.
- Follow the message indicated on the display, then switch off and on the FSU.
- After starting the instrument check for system messages:
  - [ **SETUP** : SYSTEM INFO : SYSTEM MESSAGES ]
- Start selftest and check results:
  - [ **SETUP** : SELFTEST ] , then- [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]

# Replacing the Lithium Battery on the Front Module controller

(see chapter 5, spare part list, part item *(775)* and explosion drawing *1129.9003 and 1129.9032*)

The lithium battery is accommodated on the front module controller board behind the front panel.

**Caution!**

*Lithium batteries must not be exposed to high temperatures or fire.*

*Keep 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, pos. 775).*

*Lithium batteries are hazardous waste and must be disposed of in dedicated containers.*

*Do not short-circuit the battery!*

## Opening the Instrument and Removing the Front Panel

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove volume control knob (47) by pushing off the front hood and loosing the screw.
- Pull off the labeling panel (270) towards the front.
- Unscrew each two countersunk screws (610) in the front frame at the top and at the bottom.
- Remove the frontpanel with keyboard and display (600, 620, 630, 640, 650, 660) to the front.

***Caution!***

*Note the connecting cables are still connected to the controller.*

- Pull off the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel.

***Note:*** *When pulling off the connecting cables be careful with the cable connecting to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

## Removing the Lithium Battery

- Unplug jumper JP12.
- Remove the mechanical lock (cable clamp). Carefully unsolder the negative terminal from the soldering lug first using the soldering iron (medium temperature). Then unsolder the positive terminal and take out the battery.

  ***Note:*** *The lithium battery is of the type 3.4 V ( ∅ 15mm * 25mm ) with soldering lug terminals (R&S ordering number 0565.1687.00.)*

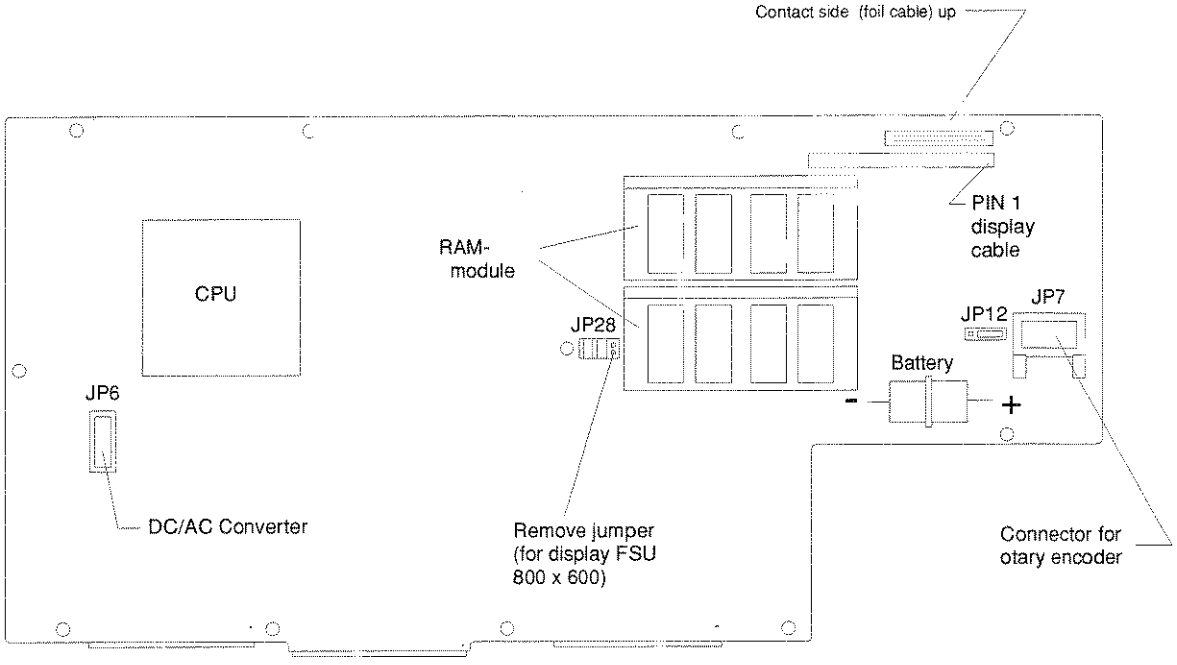



Fig. 3-11 Position of lithium battery and jumper 12 on the front module controller

## Installing the New Battery and Completing the Instrument

➢ Shorten the connecting wires of the new battery to a right length and replace with the correct polarity.

***Warning!***
*Do not short-circuit the battery!*

➢ If necessary, replace the mechanical lock (cable clamp). First solder the positive terminal to the PC board, then the negative terminal.

➢ Plug jumper JP12 to position 1 and 2 (position before battery replacement) (see Fig. 3-11).

➢ Plug the front panel track into the instrument and screw with four countersunk screws (610) in the front frame at the top and at the bottom.

***Caution!***
*Make sure to route the cables properly*

➢ Install the labeling panel (270).

➢ Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).

➢ Mount volume control knob (47) by fixing the screw and push on the front hood, if existing.

## Putting into Operation

➢ Connect the instrument to the mains and switch on the instrument power switch. The instrument is now in stand-by mode.

➢ After the change of the battery a cold boot is necessary. Press the decimal point key while switching on the instrument with the ON/STANDBY-Key, until the FSU is beeping.

➢ After starting the instrument check for system messages:
- [ **SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**

➢ Start selftest and check results:
**- [ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]

➢ Start a total calibration and check the result:
- [ **CAL** : CAL TOTAL ], then [ CAL RESULTS ]

# Replacing the Harddisk A60

(see chapter 5, *spare part list, item (710), and explosion drawing 129.9003 und 1129.9032)*

The hard disk is incorporated between the front module and the analog boards.
The spare part is already formatted for the FSU and contains the complete software.

## Opening the Instrument and Removing the Harddisk

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the 10 countersunk screws (260) at the top of the instrument and the 3 combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Disconnect the ribbon cable (720) at the harddisk.
- Unscrew the two countersunk screws (740) on the harddisk mounting plate (730).
- Take the harddisk (710) completely with the harddisk mounting plate (730 out of the FSU.
- Unscrew the four countersunk screws (750) remove the harddisk and mount a new harddisk to the mounting plate (730).

## Installing the New Hard Disk and Putting into Operation

- Fit the harddisk and the disk holder with two screws (740) to the instrument

  ***Note:*** *Be careful with the lower cover plate locking in the concerning opening.*
- Connect the ribbon cable (720) to the harddisk.

  ***Note:*** *Connect cable as drawing 1129.9032.*
- Put the top cover (240) on the instrument and mount it with 10 countersunk screws (260) and 3 combi screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains and switch on the instrument power switch. The instrument is now in stand-by mode.
- After the change of the harddisk a cold boot is necessary. Press the decimal point key while switching on the instrument with the ON/STANDBY-Key, until the FSU is beeping three times.
- After starting the instrument check for system messages:
  - [ **SETUP :** SYSTEM INFO : SYSTEM MESSAGES ]
- Start selftest and check results:
  - **[ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]

# Replacing the LCD and/or DC/AC Converter in the Front Module

(see chapter 5, *spare part list item (600), (871), (921) and explosion drawing 1129.9003, 1129.9032, 1093.4708*)

The LCD is accommodated on the mounting plate together with the associated DC/AC converter. It is connected to the front module controller via cables, which can also be replaced individually. For replacement proceed as follows:

## Opening the Instrument and Removing the Front Module

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove volume control knob by pushing off the front hood and loosing the screw.
- Pull off the labeling panel (270) towards the front.
- Unscrew two countersunk screws (610) in the front frame each at the top and at the bottom.
- Remove the frontpanel with keyboard and display (600, 620, 630, 640, 650, 660) to the front.

***Caution!***

*Note the connecting cables are still connected to the controller*

- Pull off the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel.

  ***Note:*** *When pulling off the connecting cables be careful with the cable connecting to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

- Place the Front Module onto a clean surface.

## Removing the DC/AC Converter

- Pull off the plug of the connecting cable to the DC/AC converter (871).
- Unscrew the two screws (890) and remove the DC/AC-Converter (870) with the *spacing pieces* (900).

## Removing the LCD

- Remove display cable (945) after cutting thename plate (946).
- Unscrew the four screws (930) at the display (921) and remove the display.

## Installing the New LCD and/or DC/AC converter and Completing the Instrument

- Insert new LCD and/or DC/AC converter in the reverse order, connect all connecting cables in the correct position and replace all screws (drawing 1093.4708).
- After excange of the display (921)or display cable (945), affix new label (946) to protect label.
- Place the front panel with the keys on the top of the instrument, with the cables in the right direction to the front modul controller.
- Carefully plug the cable connectors to the controller board without reversing the polarities and replace the mounting plate in the reverse order.

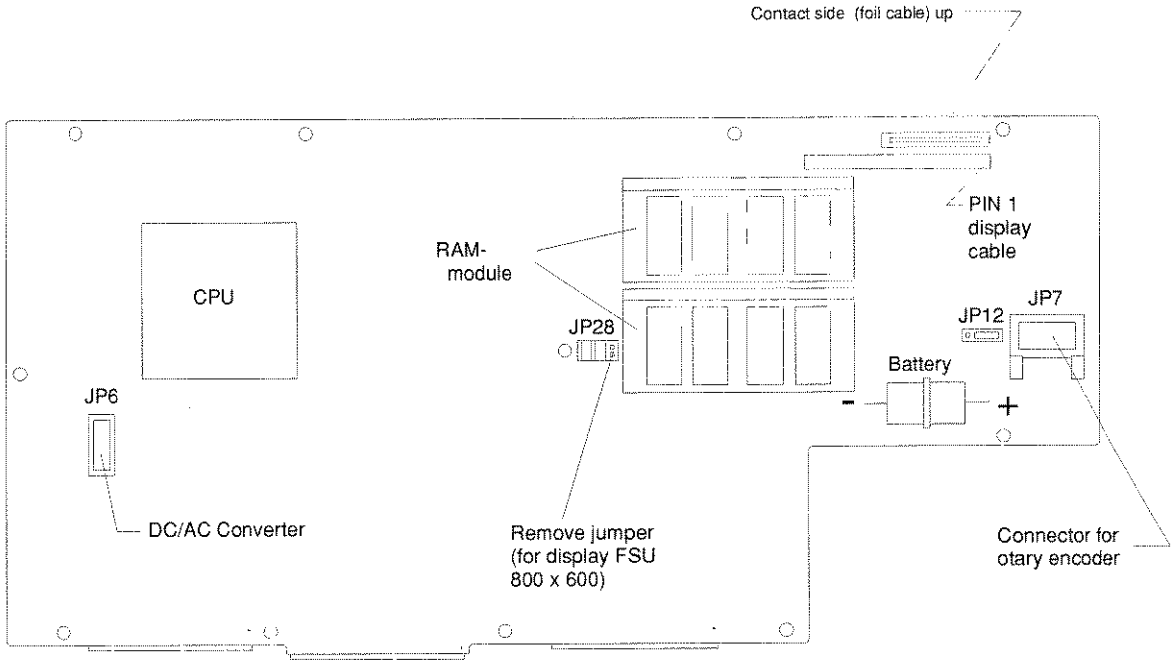



Fig. 3-12 Position of connectors on front module controller

- Plug the front panel track into the instrument and screw with four countersunk screws (610) in the front frame at the top and at the bottom.

***Caution!***

*Make sure to route the cables properly.*

- Install the labeling panel (270).
- Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).
- Mount volume control knob (47) by fixing the screw and push on the front hood, if existing.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON-Key

# Replacing the Keyboard Membrane or Mat on the Front Module

(see chapter 5, *spare part list item (630) and (640), and explosion drawing 1129.9003, 1129.9032)*

The keyboard membrane is the contact film for the rubber keys (mat) behind the labeling panel and the keyboard frame. For replacement proceed as follows:

## Opening the Instrument and Removing the Front Panel

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove volume control knob (47) by pushing off the front hood and loosing the screw
- Pull off the labeling panel (270) towards the front.
- Unscrew each two countersunk screws (610) in the front frame at the top and at the bottom.
- Remove the frontpanel with keyboard and display (600, 620, 630, 640, 650, 660) to the front and rotate it to the top of the instrument.

***Caution!***

*Note the connecting cables are still connected to the controller .*

- Pull off the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel.

**Note:** *When pulling off the connecting cables be careful with the cable connecting to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

## Removing the membrane

- Place the mounting plate onto the surface with the keyboard frame pointing upwards.
- Pull off the knob (650) of the spinwheel.
- Unscrew the 10 countersunk screws (660) and remove the keyboard frame (620).
- The keyboard membrane (640) as well as the mat (630) is now accessible.

## Installing the New membrane and Completing the Instrument

➢ Put the new mat (630) into the keyboard frame (620).

***Note:*** *The pins of the mat must be pressed in the wholes at the keyboard frame.*

➢ Locate the new keyboard membrane (640) on the back of the mat (630) .

***Note:*** *Push the foil cable of the membrane through the slit in the mounting panel. The membrane must be positioned to let the pins of the mat come trough the holes in the membrane.*

➢ Locate the mounting plate with the display (600) onto the membrane (640) .

***Note:*** *The mounting plate must be positioned to let the pins of the mat come trough the holes in the mounting plate (800).*

➢ Press the front panel together, turn the keys to the top and screw ten countersunk screws (660) into the keyboard frame.

➢ Place the front panel with the keys on the top of the instrument, with the cables in the right direction to the front modul controller.

➢ Carefully plug the cable connectors to the controller board without reversing the polarities and replace the mounting plate in the reverse order.

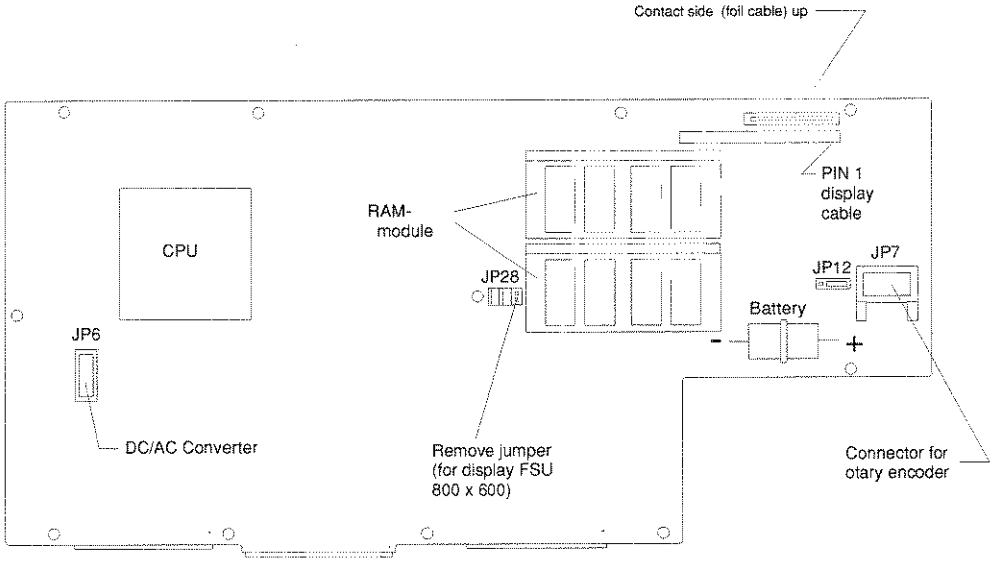



Fig. 3-13 Position of connectors on front module controller

➢ Plug the front panel track into the instrument and screw with four countersunk screws (610) in the front frame at the top and at the bottom.

***Caution!***

*Make sure to route the cables properly.*

➢ Install the labeling panel (270).

➢ Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).

➢ Mount volume control knob (47) by fixing the screw and push on the front hood, if existing.

➢ Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON-Key

# Replacing the Labeling Panel on the Front Module

*(see chapter 5, spare part list item (270/280), and explosion drawing 1129.9003)*

The labeling panel is the outer front panel which carries the labeling of all the parts on the front side of the FSU. Every model has its own labeling panel (270, 280, 290)

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove volume control knob (47) by pushing off the front hood and loosing the screw.
- Pull off the labeling panel (270) towards the front.
- Install the New labeling panel and tighten all screws.
- Complete the instrument.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key

# Replacing the Floppy Disk Drive A30

*(see chapter 5, spare part list item (670), and explosion drawing 1129.9003, 1129.9032)*

## Opening the Instrument and Removing the Floppy Disk Drive

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the 10 countersunk screws (260) at the top of the instrument and the 3 combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Remove 3 screws (700) at the fan side of the FSU and carefully pull out the Floppy Disk Drive (670) with Floppy mounting plate (680) to the upper side.
- Disconnect the cable (690 and 691) at the floppy disk drive .

## Install the New Floppy Disk Drive and Completing the Instrument

- Unscrew the three combi screws (700) and remove the floopy disk from the mounting plate (680) and mount a new disk drive (670) to the floppy mounting plate (680).
- Connect the foil cable (690 and 691) to the disk drive.
- Insert the floppy mounting plate (680) and mount it to the fan side with 3 combi screws (700).

  ***Note:*** *Please mount the floppy disk drive in the middle of the front panel break out.*
- Put the top cover (240) on the instrument and mount it with 10 countersunk screws (260) and 3 combi screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key

## Function Test

- Instrument is booting and the firmware is starting.
- Insert 3 ½ ″ Disk with any files.
- Press key ‚FILE' , then Softkey ‚File Manager' and ‚Edit Path'.
- Enter " a " and " : " and confirm with "Enter"-key.
- The file structure of the inserted disk must be displayed.

# Replacing the Power Supply A20

*(see chapter 5, spare part list item (550), and explosion drawing 1129.9032)*

The power supply is fitted at the rear of the instrument frame of the FSU.

## Removing the Power Supply

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the ten screws (560) at the rear of the power supply.
- Pull out the power supply approx. 20 mm towards the rear, slightly tilt towards the bottom and then pull out completely.

## Installing the New Power Supply

- Install the New power supply in the reverse order.

  ***Note:*** *Make sure that the 96-contact connector to the MOTHERBOARD locks in place correctly.*
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains and switch on.
- After starting the instrument check for system messages:
  - [ **SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  **- [ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]

# Replacing the Fan

*(see chapter 5, spare part list item (15), and explosion drawing 1129.9003)*

The fan is fitted at the right side of the frame.

## Opening the Instrument and Removing the Fan

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the 10 countersunk screws (260) at the top of the instrument and the 3 combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Disconnect the fan cable at the motherboard connector X35 (FAN) .
- Unscrew the four screws off the FAN (15) and remove the fan.

## Installing the New Fan and Completing the Instrument

- Connect the fan cable at the motherboard connector X35 (FAN)
- Insert the new fan and mount it to the frame with 4 pieces fan screws.

  ***Note:*** *Please note the direction of the airflow printed on the fan. The fan must blow the cold air into the instrument.*
  *Make sure to route the cables with enough space to the fan.*
- Put the top cover (240) on the instrument and mount it with 10 countersunk screws (260) and 3 combi screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON-Key

# Replacing the RF Input Connector (Cable W1)

*(see chapter 5, spare part list item (295), and explosion drawing 1129.9003)*

The RF input connector is fitted at the right lower side of the front panel.
Depending on the frequency range two different models of the connector are available.

## Opening the Instrument and Removing the Cable W1

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove volume control knob (47) by pushing off the front hood and loosing the screw.
- Pull off the labeling panel (270) towards the front.
- Remove three countersunk screws (70) at the frame and 1 countersunk screw (70) at the connector mounting plate (60).
- Unscrew the cable W1 (295) to 8 GHz at the RF attenuator (20).
- Remove the connector mounting plate (60) together with W1 and modules Probe/Key (50) and Vol./Phone Board (43) to the front.

  ***Note:*** *The modul Probe/Key (50 and Vol./Phone Board (43) are connected via a ribbon cable to the motherboard X80, X81.*
- Unscrew the four countersunk screws (350) and remove cable W1 together with mounting plate (330).

## Installing the New Cable and Completing the Instrument

- Put the mounting plate (330) onto the new cablel W1 and mount the connector with four countersunk screws (350), move the mounting plate (60) back to the instrument and connect cable W1 to the input of RF attenuator.
- Screw three countersunk screws (70) to the instrument frame and one countersunk screw (70) to the mounting plate (60).
- Install the labeling panel (270).
- Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).
- Mount volume control knob (47) by fixing the screw and push on the front hood.
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- Start selftest and check results:
  **- [ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]
- Check frequency response with chapter 1 and do a correction if necessary.

# Replacing the Motherboard A10

*(see chapter 5, spare parts list item (510) and explosion drawing 1129.9003, 1129.9032)*

The motherboard is fitted from the bottom side.

## Opening the Instrument and Removing the Motherboard

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the 10 countersunk screws (260) at the top of the instrument and the three combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the boards.
- Push out all boards to the top side of the instrument.

  *Note: The boards can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the boards.*
- Removing the power supply(550). Unscrew the ten screws (560) at the rear of the power supply. Pull out the power supply approx. 20 mm towards the rear, slightly tilt towards the bottom and then pull out completely.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove volume control knob (47) by pushing off the front hood and loosing the screw.
- Pull off the labeling panel (270) towards the front.
- Unscrew each two countersunk screws (610) in the front frame at the top and at the bottom.
- Remove the frontpanel with keyboard and display (600, 620, 630, 640, 650, 660) to the front and rotate it to the top of the instrument.

***Caution:***

*Note the connecting cables are still connected to the controller .*

- Pull off the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel.

  ***Note:*** *When pulling off the connecting cables be careful with the cable connecting to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*
- Remove the front modul controller (see chapter: Replacing the Front Module Controller A90)
- Remove the screws of all motherboard connectors at the rear panel . Unscrew the bolts (530) at the "COM" and "LPT" ports and (540) aa "Monitor" port. Unscrew the nuts at "SWEEP" and "Ext. TRIGGER" connectors and the bolts at the "IEC"-port.

  ***Note:*** *Don´t change the bolts of the "Monitor" and the "LPT" or "COM" !*
- Pull off the connecting cables at the motherboard (RF-Attenuator, fan, Floppy, Probe/Key, rear panel, Vol./Phone Board ....).
- Unscrew 7 combi screws in bottom side of the Motherboard
- Move the Motherboard (510) carefully to th front panel (ca. 15 mm) and lift it out of the instrument to the downside.

## Installing the New Motherboard and Completing the Instrument

- Insert the Motherboard into the instrument in the reverse order.

  ***Note:*** *Please move the Motherboard carefully to the rear panel without causing damage to the parts on the board.*

  *Connect all cables (see label on cable for position).*

- Insert the Frontmodulcontroller, Frontpanel, power supply, boards and cables, top cover, tube and rear panel feet in reverse order.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- After starting the instrument check for system messages:
  - [ **SETUP** : SYSTEM INFO : SYSTEM MESSAGES ]
- Start selftest and check results:
  - **[ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]
- Store the serial number of the instrument to the Eeprom:
  - [ **SETUP** : SERVICE : ENTER PASSWORD "30473035" ] , then input serial number of the instrument in HW-Info table (see also Chapter 2, Section "Automatic Adjustment of Module Data").

# Replacing the Module RF Attenuator A40

*(see chapter 5, spare parts list item (20/30) and explosion drawing 1129.9003)*

The RF attenuator is fitted at the bootom side behind the RF input connector.
There are different models of the attenuator for instruments to 7GHz (20) and to 30GHz (30).

## Opening the Instrument and Removing the RF Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Place the instrument on the left side and unscrew the RF cable or the diplexer (150) at the RF output of the RF Attenuator.
- Unscrew the two combi screws (40) at the right frame.
  ***Note**: The RF Attenuator will only be fixed with the RF cables at the front.*
- Disconnect RF-cable W1 (295) or (315) at the input of the RF Attenuator.
- Move carefully out the RF Attenuator and disconnect the flexible RF-cable at the input.
- Disconnect ribbon cable at motherboard connector X40.

## Installing the New RF Attenuator and Completing the Instrument

- Connect the ribbon cable of the new RF Attenuator (20) or (30) at motherboard connector X40.
- Connect the flexible RF-cable at the input of new RF Attenuator (see label on cable)
- Move the new RF Attenuator in the instrument and connect cable W1 (295) or (315) at the input.
- Screw the two combi screws (40) at the right frame in the RF-Attenuator.
- Screw the RF cable or the diplexer (150) at the RF output of the RF Attenuator.
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- After starting the instrument check for system messages:
  - [ **SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  **- [ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]
- Check frequency response with chapter 1 and make a correction if necessary.

# Replacing the Module Key/Probe A80 and Vol./Phone Board A191

*(see chapter 5, spare parts list item (43, 50 and 1040) and explosion drawing 1129.9003)*

The boards are fitted behind the front panel connectors Keyboard, Probe, Headphone and the volume control knob.

## Opening the Instrument and Removing the Boards

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove volume control knob (47) by pushing off the front hood and loosing the screw.
- Pull off the labeling panel (270) towards the front.
- Remove three countersunk screws (70) at the frame and 1 countersunk screw (70) at the connector mounting plate (60).
- Unscrew the cable W1 (295) at the RF attenuator (20).
- Remove the mounting plate (60) completely with W1 and Probe/Key board (50) and Vol./Phone Board (43) to the front side.

  ***Note:*** *The Probe/Key (50) and Vol./Phone boards (43) are connected with a ribbon cable to the motherboard X80 und X81.*
- Disconnect the ribbon cable at the motherboard connector X80 and X81.
- Unscrew the 4 countersunk screws (55) and remove the board Key-Probe (50).
- Unscrew the three countersunk screws (46) and remove the board Vol./Phone Board (43) from mounting plate (60) .
- Unscrew the combi screw (45) and the nut of the volume control at the mounting plate (44) and remove Vol./Phone Board (43) .

## Installing the New Modules and Completing the Instrument

- Mount the new Key-Probe board (50) with 4 countersunk screws (55) to mounting plate (60).
- Mount the new Vol./Phone Board (43) with tne nut of the volume control and one countersunk screw (45) to the mounting plate (44). Mount Vol./Phone board (43) with two countersunk screws (46) to mounting plate (60).
- Connect the ribbon cable at motherboard-connector X80 and X81.
- Move the complete mounting plate (60) carefully back in the instrument.

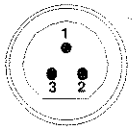
***Caution***

*Make sure to route the cables properly.*

- Connect RF-cable W1 (295) or (315) at the input of the RF Attenuator (20) or (30).
- Screw three countersunk screws (70) to the instrument frame and one countersunk screw (70) to the mounting plate (60).
- Install the labeling panel (270).
- Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).
- Mount volume control knob (47) by fixing the screw and push on the front hood.
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).

## Function Test

- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- Measure the output voltage at the Probe-connector (see Fig. 3-14).
- Connect a keyboard to the instrument and test the function.
- If the option FSU-B3 (AF-Demodulator) is fitted, test the function of headphone connector and volume control. Press the Key *MKR,* press Softkey *MARKER DEMOD.* Noise can be heard in the loudspeaker, the volume can be changed with the *VOLUME* knob at the front panel. Connect a headphone to the *AF OUTPUT* at the frontpanel, the loudspeaker must be switched off and the noise can be heared in the headphone.




| Pin | Signal |
|---|---|
| 1 | GND |
| 2 | -12.6 V |
| 3 | +15 V |

Fig. 3-14 Pin assignments of PROBE POWER connector

# Replacing the RF RF Converter A100

*(see chapter 5, spare part list item (100), and explosion drawing 1129.9003)*

The RF RF Converter is installed in the middle of the instrument .

## Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the 10 countersunk screws (260) at the top of the instrument and the 3 combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the board.
- Push out board to the top side of the instrument.

***Note:*** *The board can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the board.*

## Installing the New RF RF Converter Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.
  ***Note:*** *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with 10 countersunk screws (260) and 3 combi screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- After starting the instrument check for system messages:
  - [ **SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  **- [ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]
- Check frequency response with chapter 1 and make a correction if necessary, using the correction software.

# Replacing the Sythesizer A110

*(see chapter 5, spare part list item (105), and explosion drawing 1129.9003)*

The board is installed in the front part of the instrument.

## Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the two combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the board.
- Push out board to the top side of the instrument.

***Note:*** *The board can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the board.*

## Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.
  ***Note:*** *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and 2 combi screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- After starting the instrument check for system messages:
  - [ **SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  **- [ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]
- Check frequency response according to chapter 1 and readjust with correction software if necessary.

# Replacing the Detector A140

*(see chapter 5, spare part list item (105), and explosion drawing 1129.9003)*

The board is installed in the front part of the instrument.

## Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the two combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the board.
- Push out board to the top side of the instrument.

  ***Note:*** *The board can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the board.*

## Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.

  ***Note:*** *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with 10 countersunk screws (260) and 3 combi screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- After starting the instrument check for system messages:
  - [ **SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  **- [ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]

# Replacing the IF-Filter A130

*(see chapter 5, spare part list item (120), and explosion drawing 1129.9003)*

The board is installed in the middle of the instrument.

## Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the 10 countersunk screws (260) at the top of the instrument and the 3 combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the board.
- Push out board to the top side of the instrument.

***Note:*** *The board can be moved up by pressing carefully from the downside through the connector holes in the motherboard against the board.*

## Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.
  **Note:** Please refer to the cable wiring drawing on the motherboard.
- Put the top cover (240) on the instrument and mount it with 10 countersunk screws (260) and 3 combi screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- After starting the instrument check for system messages:
  - [ **SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  **- [ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]
- Check frequency accuracy and the calibration source level with chapter 1 and readjust with chapter 2 if necessary.

# Replacing the MW-Converter Unit A160

*(see chapter 5, spare part list item (130 to 140), and explosion drawing 129.9003)*

The board is installed in the middle of the instrument.

## Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the 10 countersunk screws (260) at the top of the instrument and the 3 combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side and loosen all cables at the bottom to the board.
- Push out board to the top side of the instrument.

  ***Note:*** *The board can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the board.*

## Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.

  ***Note:*** *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with 10 countersunk screws (260) and 3 combi screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- After starting the instrument check for system messages:
  - [ **SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  **- [ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]
- Start frequency correction of the YIG-Filter (external correction software).
- Start frequency response correction of all frequency ranges (external correction software).

# Replacing the OCXO A200 (Option FSU-B4)

*(see chapter 5, spare part list item (1100), and explosion drawing 1093.4495 and 1129.6791)*

The board is fitted in the front part behind the front module .

## Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the two combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to board.
- Push out board to the top side of the instrument.

  ***Note:*** *The board can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the board.*

## Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.

  ***Note:*** *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and 2 combi screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- After starting the instrument check for system messages:
  - [ **SETUP** : SYSTEM INFO : SYSTEM MESSAGES ]
- Start selftest and check results:
  - **[ SETUP** : SERVICE : SELFTEST ], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [ **CAL** : CAL TOTAL ] , then [ CAL RESULTS ]
- Check frequency response according to chapter 1 and readjust with correction software if necessary.

# Replacing the External Generator Control A210 (Option FSP-B10)

*(see chapter 5, spare part list item (1600), and explosion drawing 1093.4495 and 1129.7298)*

The board is fitted in the front part of the instrument .

## Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the 10 countersunk screws (260) at the top of the instrument and the 3 combi screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Push out board to the top side of the instrument.

## Installing the New Module and Completing the Instrument

- Plug the new board into the instrument.
- Put the top cover (240) on the instrument and mount it with 10 countersunk screws (260) and 3 combi screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY-Key
- After starting the instrument check for system messages:
  - [ **SETUP** : SYSTEM INFO : SYSTEM MESSAGES ]

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# Troubleshooting

Malfunctions may have simple causes but also may be caused by faulty components.

These troubleshooting instructions allow for locating the error causes down to board level and make the instrument ready for use again by means of board replacement.

We recommend to ship the instrument to our experts in the service centers (cf. address list) for module replacement and further error elimination.

**Warning!**

*Do not plug or unplug boards prior to disconnecting them from ac supply!*

*Be careful not to cause short-circuits when measuring voltages!*

## The following utilities are provided in the FSU for diagnosis purposes:

- Permanent monitoring of levels and frequencies in the instrument
- Selftest
- System error correction

***Note:*** *When problems occur, first check, whether any connections (cables, plug-in connections of boards etc.) are damaged or wrongly connected.*

## Measuring Equipment and Accessories

| Item | Type of equipment | Specifications recommended | Equipment recommended | R&S-Order No. | Use |
|---|---|---|---|---|---|
| 1 | DC meter | | URE | 0350.5315.02 | Troubleshooting |
| 2 | Spectrum analyzer | Frequency range 0 to 7GHz | FSEB 20 | 1066.3010.20 | Troubleshooting |
| 3 | Adapting cable | 1m long<br>SMP- to SMA connection | - | 1129.8259.00 | Troubleshooting |
| 4 | Adapting cable | 0,5m long<br>SMP-to SMP-connection | - | 1129.8265.00 | Troubleshooting |
| 5 | Adapter board | Extension 150mm high<br>48-contact, 2mm spacing | - | 1100.3542.02 | Troubleshooting |

# Troubleshooting Switch-on Problems

- **Error: FSU cannot be switched on.**

| Action | Possible error causes and further steps |
|---|---|
| Check power-on switch on the rear<br>⇓ | Power switch OFF: Switch on power supply.. |
| Check yellow LED (Stand-by).<br>⇓ | LED remains dark:<br>➢ Measure voltage at X20.D24 (power supply unit)<br>Rated value: +12 V ± 1V<br>Voltage o.k.: Keyboard or controller faulty.<br>No voltage: remove analog modules one by one.<br>➢ Measure voltage at X20.D24 (power supply unit):<br>Rated value: +12 V ± 1V<br>Correct voltage: Removed module faulty<br>No voltage: Power supply faulty or short-circuit at 12V standby. |
| Switch on instrument. Check green LED<br>⇓ | LED remains dark:<br>Measure PWR-ON signal on the power supply X20.B1:<br>< 1V for ON<br>Voltage > 1V: Keyboard membrane or controller faulty. |
| Power supply starts, screen remains dark? | Measure voltages on the motherboard, see "Short-circuit of one or more operating voltages". |

- **Error: Short-circuit of one or more operating voltages**

| Action | Possible error causes and further steps |
|---|---|
| Check on the bottom of the motherboard which of the voltages is short-circuited: | No voltage or considerably low voltage:<br>Remove the respective boards from the instrument one by one and repeat the measurement.<br><br>If the voltage is supplied, then, the error is probably located on the module removed.<br><br>***Note:*** *The power supply switches off all voltages after a short time in case of a short-circuit. Restart by pressing the Standby/On key.* |
| Computer, hard disk, Eeproms :<br>X20.A7 bis A10: rated value: +5 V2<br><br>Detector board :<br>X20.A5 und X20.A6: rated value +3 V3<br><br>Analog boards:<br>X130.A10: rated value +12 V<br>X130.A9: rated value +8 V<br>X130.A8: rated value +6 V<br>X130 A12 rated value –6 V<br>X130.D12: rated value –12 V | |

**Error: Fan does not work.**

| Action | Possible error causes and further steps |
|---|---|
| Check voltage at connector:<br>X35 pins 1+ 3 : rated value 7 V<br>(depends on temperature) | Voltage o.k.: fan is defective<br>Voltage too low: fan is blocked or power consumption too high |

## Troubleshooting Problems with Boot-process

- **Error: FSU does not start the measurement application.**

Following switch-on, the FSU first boots the computer BIOS. After successful initialization of the computer the Windows NT operating system starts up. Subsequently, the test application is loaded as start-up program. Simultaneously, selftests are performed at various locations and error messages, if any, are output. The messages are disabled with normal operation, but can be enabled for troubleshooting purposes. It is advisable for troubleshooting to connect a keyboard to the keyboard socket.

**Normal action**

➢ Start FSU

Subsequent to switching on the FSU, the following BIOS message is displayed:

```
Award Modular BIOS v4.51PG, An Energy Star Ally
Copyright (C) 1984-97, Award Software, Inc.

R&S FSU FMR 5 BIOS V1.0-22-1
        ----------------------------------------------------
        | Rohde&Schwarz GmbH & Co KG      |
        | Analyzer BIOS V1.0              |
        ----------------------------------------------------

06/24/99-i430TX-67X-2A59IED4C-00
```

After the first beep, the computer starts the hardware test and the message:

```
, ESC to skip Memory test...
```

is shortly displayed at the lower edge of the screen.

The test results are usually not displayed. If errors occur during the boot procedure, these messages may indicate defects.

➢ The messages can be made visible by pressing the "DISP" key following the beep. The keystroke is acknowledged by a second beep.

Then, all messages are displayed.

```
Award Modular BIOS v4.51PG, An Energy Star Ally
Copyright (C) 1984-97, Award Software, Inc.

R&S FSU FMR 5 BIOS V1.0-22-1
            65536K OK (= the result of the
memory test is indicated here)
```

**Error and error cause**

If no result of the memory test is indicated, the memory is defective.

**Normal action**

06/24/99-i430TX-67X-2A59IED4C-00

The memory test issues the memory capacity of the front module controller. The basic version of the FSU provides 64 Mbytes. Subsequently, BIOS starts the hardware check and displays all PC boards found.

➢ This procedure may be interrupted using the "BREAK" key on the connected external keyboard, any other key continues the boot process.

**Award Modular BIOS v4.51PG, An Energy Star Ally**
**Copyright (C) 1984-97, Award Software, Inc.**

**R&S FSU FMR 5 BIOS V1.0-22-1**
**65536K OK**

**Award Plug and Play BIOS Extension v1.0A**
**Copyright (C) 1997, Award Software, Inc.**
**Detecting HDD Primary Master...*IBM-DKLA-24320***
*(depends on the hard disk installed)*

06/24/99-i430TX-67X-2A59IED4C-00

Then, the SETUP is displayed.

➢ This procedure may also be interrupted using the "BREAK" key.

The contents partly depend on the hardware provided:

**Error and error cause**

If this hard disk entry is missing, the hard disk may be faulty

**System Configurations**

| | | | |
|---|---|---|---|
| CPU Type | : AMD-K6 3 D | Base Memory | : 640K |
| Co-Prozessor | : Installed | Extended Memory | : 64512K |
| CPU Clock | : 300 | Cache Memory | : 512K |
| Diskette Drive A | : 1.44M, 3.5 in. | Display Type | : EGA/VGA |
| Diskette Drive B | : None | Serial Port(s) | : 3F8 |
| Hard Disk Drive C | : LRG ,UDMA 2, 4327MB | Parallel Port(s) | : 3F8 |
| Hard Disk Drive D | : None | EDO DRAM at Row(s) | : None |
| | | SDRAM at Row(s) | : 0 2 |
| | | L2 Cache Type | : Pipelined Burst |

**PCI device listing.....**

| Bus No. | Device No. | Funct No. | Vendor ID | Device ID | Device Class | IRQ |
|---|---|---|---|---|---|---|
| 0 | 7 | 1 | 8086 | 7111 | IDE Controller | 14 |
| 0 | 7 | 2 | 8086 | 7112 | Serial Bus Controller | NA |
| 0 | 17 | 0 | 5333 | 8C01 | Display Controller | NA |
| 0 | 17 | 0 | 10EE | 4013 | Unknown PCI Device | 11 |

| Normal action | Error and error cause |
|---|---|
| The PCI hardware test is displayed in the lower half of the screen. All modules found during the test are displayed with their names and PCI device IDs. The Device Class column lists the types of PCI device. The detector board of the FSU is indicated as "Unknown PCI Device". | If the line "Unknown PCI Device" is missing, the detector board was not identified and the measuring application cannot be started. If the remaining PCI devices have all been identified, the detector board will probably contain the error, which is why the board must then be replaced |
| After this test, the BIOS has been loaded and the operating system is started. | The message "No System Disk or Disk error ..." at this point indicates that the contents of the hard disk are not correct. Replace the hard disk. |
| After Windows NT was installed correctly, the following selection menu is displayed:<br>**OS Loader V4.00**<br>**Please select the operating system to start:**<br>**Analyzer Firmware**<br>**Analyzer Firmware Backup**<br>**Use ↑ and ↓ to move the highlight to your choice.**<br>**Press Enter to choose.**<br>**Seconds until highlighted choice will be started automatically: 0**<br>**NT Detect V4.0 Checking Hardware ...** | After Windows NT was installed correctly, the following selection menu is displayed: |
| Approx. 5 sec later, the following message is displayed:<br>**OS Loader V4.01....**<br>**Press spacebar now to to invoke Hardware Profile/Last Known Good menu** | |
| followed by (blue background):<br>**Microsoft (R) Windows NT (TM) Version 4.0 ( Build 1381 : Service pack 5)**<br>**1 System Processor [64 MB Memory]** | |
| The version numbers depend on the used version | |

### Normal action

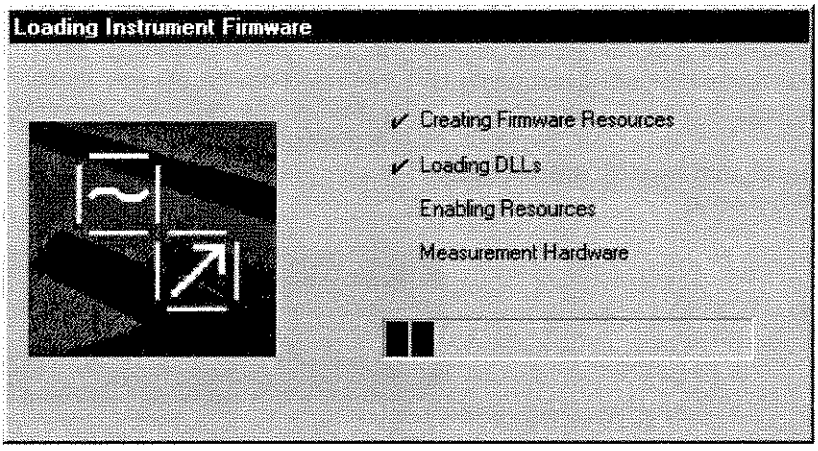
Subsequent to starting the operation system, the application for the FSU is loaded in a start-up program. The program start is initiated automatically and generates a window , which displays information on the start-up procedure.

### Error and error cause

If the operating system on the hard disk has been destroyed and cannot be loaded correctly, Windows NT reacts by a "Bluescreen". This bluescreen contains all essential information on the internal states of the computer which are displayed as follows (by way of example):


Windows NT and the instrument firmware must then be updated from the back-up partition (cf. Chapter 4, Section "Initial Setup/ Update of the Instrument Firmware").

**Normal action**



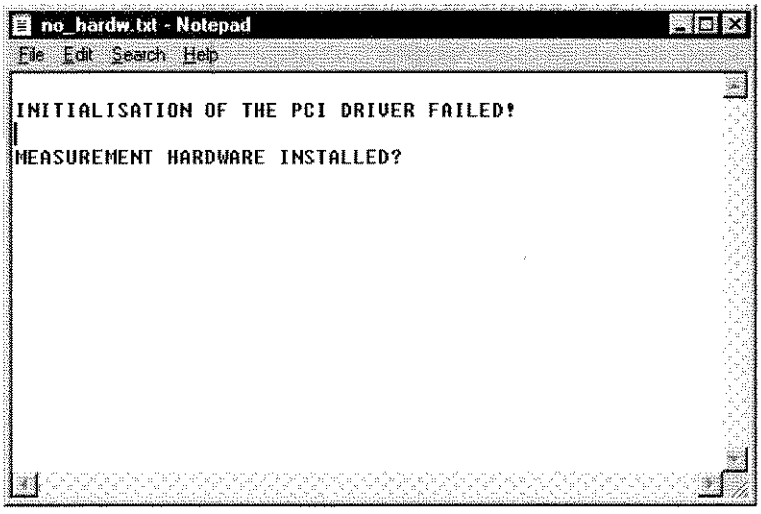

While booting, the detector board is identified again.

**Error and error cause**

If a "Bluescreen" is displayed with loading, a cold start may be necessary. Proceed as follows in such a case:

- Cold start (keep point key pressed after first beep until display of the selection menu)
- Firmware update from the backup partition, if cold start does not succeed.(see chapter 4)

If the detector board is not identified, the following message is issued:



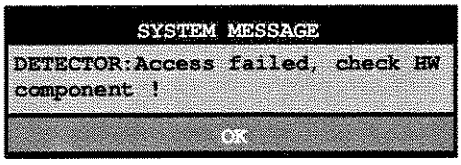
**Normal action**

When the program has been loaded, the measurement hardware is initialized first. A timer which is controlled by a 32-MHz clock signal is set on the detector board. This test reveals proper functioning of the detector board and the clock oscillator in the FSU (frontend).

After passing the function tests, the analog boards are initialized and the correction data EEPROMs are loaded.

**Error and error cause**

If an error occurred on the detector board or the clock is missing, the following message is displayed:




➢ In this case, first check the clock generation in the instrument.

The reference is generated on the synthesizer module. The 32 / 128-MHz reference are necessary for the correct operation of the detector board.

The following mesasurements are appropriate to check the reference supply:

| **Measurement:** | **Result:** |
|---|---|
| Synthesizer , X122: rated value 128 MHz, 0 dBm ⇓ | No signal: replace synthesizer |
| Synthesizer , X123 : rated value 32 MHz, 0 dBm | No signal: replace syntheszer. |

If no error occurs with the clock generation, booting can be continued by acknowledging the error message entering "OK"

If no error message or any other information on the error source was issued with booting, the error can only be determined by replacement of the detector board or the front-module controller.

# Troubleshooting - Loading Module EEPROMs

- **Error: Data of modules cannot be read.**

| Normal action | Error and error cause |
|---|---|
| On booting the instrument all calibration data required must be written into the RAM of the computer. The calibration data of a module are either read from the EEPROM (in case of a cold start from EEPROM only) or from the associated binary file.<br>For each module identified by the software it is checked first the EEPROM can be read. | |
| If reading at the desired address is not possible, the software assumes that the module is not available. | For modules that must always be available (eg IF filter) an error message will be output:<br><br>Error reading EEPROM of IF Filter |
| The calibration data are then read from the file pertaining to the module (eg iffilt.bin). | If error-free reading of the binary file is not possible either, an error message is output again.<br><br>Error reading file of IF Filter |
| If reading at the address of an optional module is not possible, this module is marked as not available in the module array for storage of the module information.<br>If the file pertaining to the non-available module does exist, it is assumed that upon the last successful booting the module was available but has been removed meanwhile. The file with the calibration data of the module is erased. Moreover the data collected during the last calibration are invalid and only saved as a backup copy on the hard disk | |
| | If reading at the address of a module is possible but the contents of the data block faulty (eg check sum of header block incorrect), the calibration data of the respective module are read from the associated file. The firmware assumes that the module is available.<br><br>Error reading EEPROM of IF Filter |

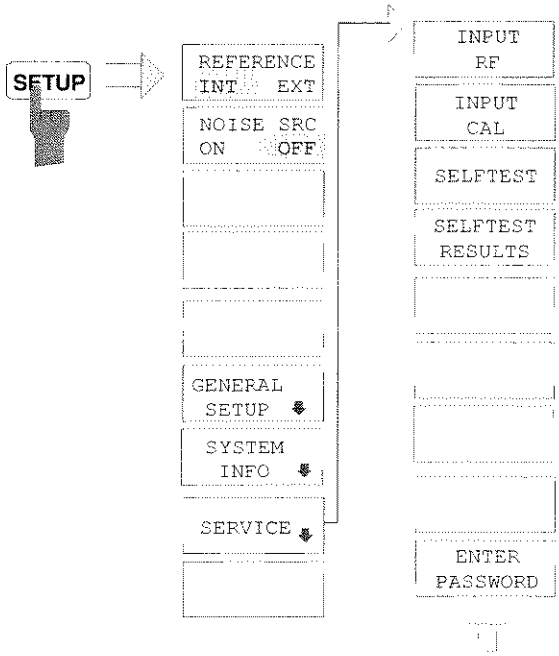
| Normal action | Error and error cause |
|---|---|
| Upon successful reading of the module header from the EEPROM the contents of the module header is entered into the array for storing the module information. The module header read from the EEPROM is compared with the module header of the associated binary file. If the module header can be read from the file and agrees with the header read from the EEPROM it is assumed that the contents of the module EEPROM has already been mapped in the binary file. The calibration data can thus be written from the file to the RAM. | If however the associated file cannot be found or if the module header of the EEPROM differs from that of the file, the total EEPROM contents must be written to the RAM and then saved in the binary file.<br><br>Error finding file of IF Filter |
| After loading the calibration data from the EEPROMs, the calibration data are loaded from the calibration data files (eg DDC settings for various filters). First the relevant calibration data file is written to the calibration data memory. | If an error occurs upon loading the file into the memory, an error message is output:<br><br>Error reading file of DDC Filter |
| Upon successful loading of the calibration data file the latter is compared with its backup copy on the hard disk. | |
| After loading the calibration data from the EEPROMs and files, the data collected during the last calibration are loaded from the 'rdf_cal.bin' file into the calibration data memory. This process takes only place if valid calibration data (and the 'rdf_cal.bin' file) are available. | If there are no valid calibration data, the status message "UNCAL " is output informing the user that the instrument is uncalibrated. |

# Troubleshooting via Selftest

The selftest is provided for identification of instrument errors and tolerance violations which can not be corrected with self-alignment of the instrument.
All signal paths are connected and the signal is traced via test points. The selftest checks all possible hardware settings which are used for the self-calibration with regard to sufficient setting range including reserves.

**Service Level 1 - Test after Entry of the Password**
When entering the password, the test result is recorded in detail and in case of a fatal error (such as a failure of the operating voltage), the selftest is *not* aborted..

All operating functions required in connection with the selftest are offered in the *SETUP - SERVICE* menu:




➢ Enter the password 894129 for service le

➢ Initiate the selftest of the instrument modules using the *SELFTEST* softkey

While the selftest is running, a message box is displayed, which shows the current test and test result.

➢ .....Pressing ENTER ABC

All modules are tested one by one and the test result (selftest PASSED or FAILED) is output in the message box


The *SELFTEST RESULTS* softkey calls a complete list of all test results.
If an error occurs, a brief description of the failed test, the module concerned, the valid range and the measurement value are displayed.

```
Total Selftest Status: ***FAILED***
Date (dd/mm/yyyy): 10/06/1999 Time: 16:34:47
Runtime: 05:59

Supply voltages detector
test description      min        max        result     state
+6V                   5.88       6.42       6.06       PASSED
+8V                   7.84       8.96       8.56       PASSED
+12V                 11.76      12.83      12.42       PASSED
-12V                -11.33     -13.28     -11.85       PASSED
+28V                 26.62      29.39      28.34       PASSED
```

## Selftest design and Error Messages

### Overview

The calibration source on the synthesizer module is used as signal source for testing the signal path.

1. Measurement of the operating voltages of the power supply and the regulated operating voltages on the analog modules
2. Temperature measurement on the analog boards
3. Testing the fourfold D/A converter on the detector
4. Test of the synthesizer module
5. Test of the 1st local oscillator and test of the lo level's on the RF converter module
6. Testing of the signal-path via RF converter, IF filter and detector board
7. Test of optional modules

All measurements on the analog boards are independent of the gate arrays on the detector board, since individual A/D converters are provided for them on the analog boards. The interface section in the FPGA of the detector board must function properly to read these A/D converters. This is always tested with switching on the instrument.
The signal path via the gate arrays on the detector board is tested using a known, analog signal at the input of the A/D converter on the detector board. The analog test signal is provided by the preceding analog tests.
Since the operating voltages are measured first, it is ensured that the selftest can be performed correctly. If an operating voltage failed which is not required by the selftest this is correctly signaled in the error list. If, however, all operating voltages are indicated to be faulty, it may well be assumed that the operating voltage for the selftest has failed or the selftest A/D-converter itself is defective.

## Operating Voltages

When an operating voltage fails, the selftest is aborted to avoid subsequent error.
The test is not aborted under service level 1. All subsequent errors are then listed in the result record. Errors which occurred independent of the voltage failure can then be detected, still.
The error message indicates the error source (f.e. power supply, IF filter, detector board) and the voltage which failed.

| Normal action | Error and error cause |
|---|---|
| **Power Supply**<br>The voltages of the power supply and the –6 V regulator (dc-dc converter from –12 V to –6 V on the motherboard) are measured at the board connector by means of the selftest A/D-converter on the detector board. | |
| | FATAL ERROR!<br>Power supply: DC FAIL +6V.<br>Selftest aborted. |
| | ➢ If error messages occur, the voltages on the motherboard should be checked. The tolerances given in the column "Tolerance range power supply / voltage regulator" apply in this case. If the voltages adhere to the tolerance limits, the error must be located in the selftest:<br>➢ Replace the detector board. |
| **Regulated Voltages on the Boards**<br>**Detector Board** | |
| | FATAL ERROR!<br>Detector: DC FAIL -5V.<br>Selftest aborted. |
| | ➢ If the preceding tests passed, the detector board has to be replaced. |

| Channel | Nominal voltage |
|---|---|
| 1 | +6V |
| 2 | +8V |
| 3 | +12V |
| 4 | -12V |
| 5 | +28V |
| 7 | -6V |

| Channel | Nominal voltage |
|---|---|
| 6 | -5V |

## Temperature Measurement on IF-Filter

**Normal action**

The **temperature** is measured, first. If the temperature violates the permitted range from 0° to 70°C, the following warning is output:

**Error and error cause**

WARNING!

IF-FILTER: Operating Temperature xx °C - out of range

➢ Check the temperature data to plausibility. The fan might be defective or the ventilation slots might be covered.

If the temperature data indicated are not reasonable, e.g., if the temperature of the instrument is indicated to be 120° C, the temperature sensor or the selftest may be faulty.

If , in the following, the *first* operating voltage (or all operating voltages under service level 1) is measured incorrectly, the selftest will obviously be defective.

| Channel | Nominal voltage | Designation, name which occurs in the error message |
|---|---|---|
| 74 | - 5 V | UREF-5 |
| 77 | +2,5 V | UREF+2.5 |
| 76 | +3,3 V | +3.3V |
| 73 | +5 V | +5V |
| 72 | +10,6 V | +10V |
| 71 | -5 V | -5V |
| 70 | -10,6 V | -10V |
| 75 | +5 V | +5VR |

➢ The IF filter board must be replaced in any case, if an error message occurs which refers to these operating voltages or the temperature (if not plausible).
The voltage of the temperature sensor is used for temperature compensation of the filters. Thus, a faulty temperature sensor may detune the filters such that subsequent errors are likely to occur.

## Checking the 4-fold D/A-converter on the detector board.

| Normal action | Error and error cause |
|---|---|
| **Detector Board Pretune-DAC Test**<br>The 4-fold D/A-converter on the detector board is checked.<br>One D/A converter controls the frequency-dependant IF gain on the IF filter for frequency response correction. The other ones are provided for options (microwave converter, tracking generator).<br>The first output voltage of the 4-fold D/A converter is measured, thus checking the basic function of the control interface (in DCON gate array), also. | |

| Channel | Nominal voltage |
|---|---|
| 8 | 666 mV |

FATAL ERROR!
Detector: Pretune DAC FAIL – check DCON and pretune DAC
Selftest aborted.

➢ Replace the detector board

## Testing of the Synthesizer Module

| Normal action | Error and error cause |
|---|---|

| Channel | Nominal voltage | Designation, name which occurs in the error message |
|---|---|---|
| 11 | - 5 V | -5 V |
| 01 | +5 V | +5 V |
| 21 | +7 V | +7 V |
| 60 | +12 V | +12 V |
| 41 | +28 V | +28 V |

➢ The synthesizer board must be replaced in any case, if an error message occurs which refers to these operating voltages .

**Temperature Measurement:**
There are two temperature sensors on the synthesizer board, one for the temperature of the module and one for the temperature of the oven of the 128 MHz reference oscillator.

**10 MHZ Output level:**

Channel 71

Warning!
Synthesizer: Temperature out of range

Channel 51

Warning!
Synthesizer: Temperature 128 MHz reference out of range

➢ With low temperature at the reference oscillator the reference oscillator might be unlocked, due to it´s temperature drift.

➢ Replace synthesizer board

| Normal action | Error and error cause |
|---|---|

**Reference signals on the synthesizer board:**
The phase locked loops on the synthesizer board are checked if they are locked and within their allowed tuning range.

**10 MHz OCXO level:**
level detector channel 00

FATAL ERROR!
10 MHz OCXO defect !

Replace Synthesizer !

**128 / 384 MHz Oszillators:**
Test of the 128 MHz XTAL oscillator and of the 3rd Local

ERROR!
Reference 128 MHz / 3rd LO unlocked !
or:
Reference 128 MHz / 3rd LO out of tuning range

The FSU might work ok, but the tuning voltages are close to their limits, or the frequency accuracy might be out of tolerance.

➢ Replace the Synthesizer board !

| | |
|---|---|
| **Sweep-Synthesizer:**<br>Test of the tuning voltage of the Sweep VCO 600 (595 ) – 620 MHz. | ERROR!<br>Sweep Synthesizer unlocked !<br>or:<br>Sweep Synthesizer out of tuning range<br><br>Additionally the YIG oscillator might be unlocked as it´s reference is missing or wrong in frequency.<br>➢ Replace the Synthesizer board ! |
| **2nd Local Oscillator:**<br>Test of the control voltage of the 2nd Local | ERROR!<br>2nd LO tuning voltage out of range<br><br>Additionally the YIG oscillator might be unlocked as it´s reference is missing or wrong in frequency.<br>➢ Replace the Synthesizer board ! |
| **Control voltage of calibration signal:**<br>Test of the detector voltage in the level control of the calibration signal. | ERROR!<br>Calibration signal error<br><br>As soon as the control voltage violates the tolerance, the level control loop unlocks and the level becomes inaccurate. If the level error is small, the selftest of the signal path can be performed. However, following the calibration of the instrument, the level measuring accuracy will be out of tolerance.<br><br>➢ Replace synthesizer board ! |

## Testing of the RF Converter Module

| Normal action | Error and error cause |
|---|---|

| Channel | Nominal voltage | Designation, name which occurs in the error message |
|---|---|---|
| 60 | + 5 V | + 5 V |
| 61 | -5 V | - 5V |
| 62 | +7 V | +7 V |
| 63 | +11 V | +11 V |
| 64 | +28 V | +28 V |

➢ The RF converter board must be replaced in any case, if an error message occurs which refers to these operating voltages .

**Measurement of board temperature:**
Channel 67

Warning!
RF Converter: Temperature out of range

➢ Check if the fan works ok !

➢ Replace RF converter !

**Test of Local Oscillator level´s:**
The level detectors of the 2nd and 3rd local oscillators are tested.

| Channel | Signal | Error Message |
|---|---|---|
| 3 | 2nd LO | Level 2nd Local |
| 2 | 3rd LO | Level 3rd Local |

➢ If error message occurs check the signal level at the following inputs of the module RF converter. Setting FSU: Preset, Center 128 MHz, Zero Span.

➢ + 10 dBm / 384 MHz at X101

➢ + 7 dBm / 4224 MHz at X105

If the signals are within +-3dB level error then replace RF converter. If the signals are low check the cables from the synthesizer and replace synthesizer or the defective cable !

**Test 1st Mixer**

Both mixer diodes rectify a part of the LO power. This two voltages can be checked via the selftest.

Are both voltages low, the LO level might be low, therefore the error message:

FATAL ERROR!
1st LO level low or 1st mixer defective !

If the two voltages are more than 20 % different, then one diode might be defect.

FATAL ERROR!
1st mixer symmetry out of tolerance !
Selftest aborted.

➢ Replace RF converter in both cases !

## Test of the Signal Path on the RF Converter Board

| Normal action | Error and error cause |
|---|---|

**Signal Path over RF Attenuator**

The following attenuator settings are tested with the 0 dBm test signal at 128 MHz. It is measured via a logarithmic detector on the 2nd IF of the RF converter.

| Rf-Att | Coupling | Levelcheck |
|---|---|---|
| 0 dB | DC | 0 +- 5 dBm |
| 0 dB | AC | 0 +- 5 dBm |
| 5 dB | DC | -5 +- 5dBm |
| 10 dB | DC | -10 +- 5 dBm |
| 20 dB | DC | -20 +- 5 dBm |
| 40 dB | DC | -40 +- 10 dBm |

If **no** setting is in tolerance, the error message is:

FATAL ERROR!
Input Level RF converter out of tolerance

➢ Check the input signal of the RF converter with Cal signal 0dBm, input attenuator 0 dB and DC coupling. The signal should be at 128 MHz with 0 dBm. If the level is more than 3 dB inaccurate, check the signal also directly at X125 of the synthesizer.

➢ If signal ok, then replace RF converter !

➢ If signal not within the tolerance at the output of the synthesizer replace the synthesizer

➢ If only few measurements out of tolerance or the signal is present at the input, but not at the output of the RF attenuator, the RF attenuator is defective:

If minimum one setting is in tolerance, the error message is:

FATAL ERROR!
RF Attenuator XX pad failed !

➢ Replace RF attenuator !

## Signal Path on the IF Filter Board

The RF attenuator is used to provide an appropriate test level. Therefore, a fault in the RF attenuator will entail subsequent errors with the IF filter test.

| Normal action | Error and error cause |
|---|---|
| **Input Level of IF Filter / Calibration Amplifier (CAL-Amps 1 + 2 )** | FATAL ERROR!<br>IF Board: IF input level / CALAMP<br>Selftest aborted<br><br>Possible error causes:<br>• Signal path interrupted in the RF converter<br>• Erroneous EEPROM data in the RF converter leading to incorrect setting of CAL_Amp1.<br>• CAL_Amp1 or 2 faulty.<br><br>Troubleshooting<br>➢ Check the level applied at X132 with, Cal Source 0 dBm, Center 128 MHz, RF attenuation 0 dB.<br>Level = -3 +- 4 dBm, frequency 20.4 MHz<br><br>➢ Replace the RF converter, if the deviation exceeds this value |

| Normal action | Error and error cause |
|---|---|
| | If the level adheres to the tolerance, a defective CAL_Amp may have caused the error. The setting ranges of the CAL_Amps are tested during the selftest, later.<br>The selftest passes under service level 1.<br>➢ Note, whether the result file contains any error messages concerning the CAL_Amps. If no CAL_Amp error occurred, the CAL_Amps will be set incorrectly. The EEPROM data in the frontend are obviously incorrect (cf. troubleshooting instructions for the frontend) |
| **LC-Filter I and XTAL Filter**<br>**Selftest detector B (see block diagram)**<br><br>The level measurement is performed with wide and narrow bandwidths of the LC filter. Subsequently, it is additionally measured via the crystal filter. If the LC filter does not work properly, the measurement of the crystal filter is not performed. | ERROR!<br>IF Board: LC Filter-1/2 wide<br>XTAL Filter not tested<br><br>ERROR!<br>IF Board: LC Filter-1/2 narrow<br>XTAL Filter not tested<br><br>ERROR!<br>IF Board: XTAL Filter<br><br>➢ The IF filter board must be replaced in all cases. |

| Normal action | Error and error cause |
|---|---|
| **StepGain (IF Amplifier)**<br>**Selftest detector C (see block diagram)**<br><br>The 10-dB Step Gain (Step Gain Coarse) and the 0.1 dB Step Gain (Step Gain Fine) are tested. The input level is attenuated in steps of 10 dB by the RF attenuator and amplified by means of the StepGain by the same amount, simultaneously. The level detector C checks to ±6 dB (user) or ±4 dB (service level 1). | FATAL ERROR!<br>IF Board: Step Gain Fine<br>Selftest aborted<br><br>➢ Replace the IF-filter board.<br><br>ERROR!<br>IF Board: Step Gain Coarse<br><br>➢ Testing the amplifier stages.<br><br>ERROR!<br>IF Board: Step Gain Fine<br><br>➢ Testing the amplifier stages.<br><br>***Attention:*** *If the RF attenuator test caused output of an error message, Step Gain cannot be tested and an error message must be ignored*<br><br>➢ If the RF attenuator test passed without any error, Step Gain is defective.<br><br>➢ Replace the IF-filter board.<br><br>However, the selftest can be continued, since it does not require the IF gain. |

| Normal action | Error and error cause |
|---|---|
| **Test of detector board:**<br>Several settings of the detector board are tested via the normal functions on the display. The three modes are FFT, digital bandwidth and analog bandwidth. The possible errors are: | FATAL ERROR!<br>Detecttor Board: FFT failed<br>Selftest aborted<br>FATAL ERROR!<br>Detecttor Board: FIR filter failed<br>Selftest aborted<br>FATAL ERROR!<br>Detecttor Board: Video failed<br>Selftest aborted |

# Troubleshooting RF Converter

Depending on the kind of error a few measurements should be performed on the frontend prior to replacing the module:

- **IP3 too high**
- **Signal level too low**
- **LO feedthrough too high**
- **Spurious signals**

Depending on the kind of error a few measurements should be performed on the RF converter prior to replacing the module.
Very high values with input frequency 0, > -10dBm with an input attenuation of 0 dB indicate that the mixer does not work properly.

| Action | Error and error cause |
|---|---|
| Measure with diode tester at X108:<br>rated value: 0.6 V voltage in the forward and reverse directions with a current of 1 mA. | Different values in both directions, high-impedance or very low-impedance:<br>mixer defective :<br>replace RF converter |

- **Signal missing or displayed with incorrect frequency**

If the signal is missing or the instrument signals "LOUNL", the conditioning of the 1st LO is probably not correct. The function of this oscillator requires both, the EEPROM data and the reference frequency of the second module.

| Action | Error and error cause |
|---|---|
| Measure function of the 1st LO in zero span.<br>check signal at X107:<br>rated value: 4628.4 MHz above the current input frequency (between 0Hz and 3.6 GHz) and the signal level is approx. + 5dBm. | The frequency is considerably higher or lower or ithe signal is not stable<br>RF converter defective<br>replace RF converter |

# Contents - Chapter 4 "Software Update/Installing Options"

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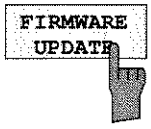
# 4 Software Update / Installing Options

This chapter contains information on Software-Update and Installing Options to the FSU. Additional manuals obtained together with a software/firmware update or with subsequently acquired options can be filed here.

## Installation of new FSU Software

The installation of a new firmware version can be performed using the built-in diskette drive. The firmware update kit contains several diskettes.
The installation program is called up in the *SETUP* menu.

*SETUP* sidemenu:




The *FIRMWARE UPDATE* softkey starts the installation program and leads the user through the remaining steps of the update

IE/IEEE-bus command: --

Performing the update:

Insert diskette 1 into the drive.
Call *SETUP* side menu *[**SETUP**][**NEXT**]*

Start update *[FIRMWARE UPDATE]*


The *RESTORE FIRMWARE* softkey restores the previous firmware version

IEC/IEEE-bus command: --

# Installing the Options

The following options are available with the FSU:

| | | |
|---|---|---|
| Option OCXO | FSU-B4 | 1144.9000.02 |
| Option External Generator Control | FSP-B10 | 1129.7246.02 |
| Option LAN Karte | FSU-B16 | 1144.9498.02 |
| Option Elektronic Attenuator | FSU-B25 | 1144.9298.02 |

For retrofitting, please note the mounting instructions enclosed with the options.
These mounting instructions can be filed at this place in the service manual and are thus easily available whenever they are required.

**Caution!**

*Disconnect the instrument from the mains before opening the casing. Also note the safety instructions at the beginning of this manual.*

*The components used in the instrument are sensitive to electrostatic discharges which is why they are to be dealt with according to the ESD regulations.*

When installing hardware options note the following:

- Switch off instrument and pull the mains plug.
- Unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- After installing the option replace the tube and fasten the rear panel feet again.

**Caution!**

*When replacing the tube take care not to damage or pull off cables.*

- Switch on FSU.
- Install additional software, if supplied, according to the instructions enclosed with the option.
- If an adjustment is required for this option, the appropriate hints are to be found in the installation instructions for the option.

# Contents - Chapter 5 "Documents"



## Figures

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## Tables

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# 5 Documents

This chapter provides information on the ordering of spare parts and contains the spare part list and the documents for the complete FSU unit.

## Shipping of Instrument and Ordering of Spare Parts

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

### Shipping of Instrument

When shipping the instrument, be careful to provide for sufficient mechanical and antistatic protection

➢ Repack the instrument as it was originally packed when transporting or shipping. The two protective caps for the front and rear panels prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.

➢ If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the package. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

### Shipping of a Module

When shipping a module, then, also be also careful to provide for sufficient mechanical and antistatical protection

➢ Ship the module in a sturdy, padded box.

➢ Wrap the board into antistatic foil.
If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the enclosed packaging is conductive.
Exception: If the module contains a battery, the tightly fitting packaging must always consist of antistatic, non-chargeable material to protect the battery from being discharged.

## Ordering Spare Parts

To deliver replacement parts promptly and correctly we need the following indications:

- Stock number (see component lists in this chapter)
- Designation
- Component number according to component list
- Number of pieces
- Instrument type the replacement part belongs to
- Contact person for possible questions

The stock numbers necessary for ordering replacement parts and modules as well as power cables can be found further down.

## Refurbished Modules

Refurbished modules are an economic alternative for original modules. It should be kept in mind that refurbished modules are not new, but repaired and fully tested parts. They may have traces from use but they are electrically and mechanically equivalent to new modules.

To find out which refurbished modules are available, please refer to your Rohde & Schwarz representative (or to the central service division, Rohde & Schwarz Munich).

## Taking back Defective Replaced Modules

Defective modules of the replacement program which can be repaired are taken back within **3 months** after delivery of the replaced module. A repurchasing value is credited.

Excluded are parts which can not be repaired, e.g. PCBs that are burnt, broken or damaged by repair attempts, incomplete modules, parts which are heavily damaged mechanically.

The defective parts must be sent back with a **returned accompanying document** containing the following information:

- Stock number, serial number and designation of the dismounted part,
- **Precise** description of the error,
- Stock number, serial number and designation of the instrument the part was dismounted from,
- Date of dismounting,
- Name of the technician who exchanged the part.

A returned accompanying document is provided with each replacement module.

# Spare Parts

The stock numbers necessary for ordering replacement parts and modules can be found in the component lists further down.

**Important Note!**

*When replacing a module please note the safety instructions and the repair instructions given in chapter 3 and at the beginning of this service manual*

*When shipping a module be careful to provide for sufficient mechanical and antistatical protection.*

## Available Power Cables

Table 5-1 List of power cables available

| Stock No. | Earthed-contact connector | Preferably used in |
|---|---|---|
| DS 006.7013 | BS1363: 1967' complying with IEC 83: 1975 standard B2 | Great Britain |
| DS 006.7020 | Type 12 complying with SEV-regulation 1011.1059, standard sheet S 24 507 | Switzerland |
| DS 006.7036 | Type 498/13 complying with US-regulation UL 498, or with IEC 83 | USA/Canada |
| DS 006.7107 | Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap. | Australia |
| DS 0025.2365<br>DS 0099.1456 | DIN 49 441, 10 A, 250 V, angular<br>DIN 49 441, 10 A, 250 V, straight | Europe (except Switzerland) |

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# Spare Part List

# Mechanical Drawings

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# List of FSU parts including spare parts

The FSU is constructed in accordance with R&S design 2000.

Overall dimension: W x H x L, 372,75 x 176,50 x 395,00

Rackmount: 4E 7/8 T350

Accessories: 19"-Adapter ZZA-411, Stock no. 1096.3283.00

***Note:*** *The recommended spare parts are marked x in the like column.*

Table 5-2 List of all FSU part and spare parts

| Position | Designation | Stock No. | Number | Electrical designation | Recommended Spare Parts |
|---|---|---|---|---|---|
| Document 1129.9032.00 (FSU-Basic unit) | | | | | |
| 10 | Basic Unit | 1129.9032.00 | 1 S | | |
| 15 | Fan | 1091.1001.00 | 1 S | E1 | x |
| 17 | Speaker | 1129.9332.00 | 1 S | B1 | x |
| 20 | Attenuator.(6-STUFIG) | 1137.0599.02 | 1 S | A40 | x |
| 40 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 2 S | | |
| 43 | VOL/PHONES BOARD | 1093.7094.02 | 1 S | A191 | x |
| 44 | Retaining bracket AF-OUT | 1129.9326.00 | 1 S | | |
| 45 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 1 S | | |
| 46 | DIN965-M2,5X6-A4-PA | 0852.3614.00 | 2 S | | |
| 47 | Rotary knob 9,5ACHS-RD4T-GR | 0852.1111.00 | 1 S | | |
| 50 | KEY-PROBE | 1130.2996.02 | 1S | A80 | x |
| 55 | DIN965-M2,5X6-A4-PA | 0852.3614.00 | 4 S | | |
| 60 | Subassembly plate | 1129.9255.00 | 1 S | | |
| 70 | DIN965-M2,5X6-A4-PA | 0852.3614.00 | 4 S | | |
| 80 | Adhesive foil 30X20 SW | 1093.9051.00 | 4 S | | |
| 90 | Cover RD15,9 | 0009.9200.00 | 1 S | | |
| 100 | RF CONVERTER | 1130.1990.02 | 1 S | A100 | x |
| 105 | SYNTHESIZER | 1130.2096.02 | 1 S | A110 | x |
| 110 | DETECTOR BOARD 1 | 1130.2196.04 | 1 S | A140 | x |

| Position | Designation | Stock No. | Number | Electrical designation | Recommended Spare Parts |
|---|---|---|---|---|---|
| 120 | IF-FILTER | 1130.2296.02 | 1 S | A130 | x |
| 130 | CONVERTER UNIT(8 GHZ) | 1130.2396.02 | 1 S | A160 | x |
| 135 | Angle bracket MW converter | 1129.9384.00 | 1 S | | |
| 136 | DIN965-M2,5X6-A4-PA | 0852.3614.00 | 2 S | | |
| 160 | Air cover | 1129.9355.00 | 3 S | | |
| 170 | Rear panel | 1129.9149.00 | 1 S | | |
| 180 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 6 S | | |
| 190 | Cover 9-pin SUB-D | 1093.8990.00 | 1 S | | |
| 200 | Cover 25-pin SUB-D | 1093.9000.00 | 2 S | | |
| 210 | Cover RD11,1/9,9 | 0009.9217.00 | 5 S | | |
| 220 | Cover f. LAN-connector | 0852.0467.00 | 3 S | | |
| 225 | Cover f. IEC-BUS | 0852.0450.00 | 1 S | | |
| 240 | Instrument top cover | 1129.9261.00 | 1 S | | |
| 250 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 3 S | | |
| 260 | DIN965-M2,5X6-A4-PA | 0852.3614.00 | 10 S | | |
| 270 | Printed front panel 3.6GHz | 1129.9203.00 | 1 S | | |
| 280 | Printed front panel 8GHZ | 1129.9210.00 | 1 S | | |
| 295 | RF-cable W1 8GHZ | 1129.9503.00 | 1 S | W1 | x |
| 330 | Assembly plate | 1093.4750.00 | 1 S | | |
| 350 | DIN965-M2,5X6-A4-PA | 0852.3614.0 | 4 S | | |
| 410 | BW2-TUBUS 4E1/1T450 EMU | 1129.9410.00 | 1 S | | |
| 420 | BW 2 - front handle 4U | 1096.1480.00 | 2 S | | |
| 430 | Screen. M4X14 | 1096.4909.00 | 4 S | | |
| 440 | BW2-instrument foot | 1096.2506.00 | 4 S | | |
| 445 | BW2-lateral handle.T450 | 1096.2670.00 | 2 S | | |
| 450 | BW2-rear panel foot 50MM | 1096.2493.00 | 4 S | | |
| 455 | BW2-foil f. rear panel foot | 1096.2435.00 | 1 S | | |

| Position | Designation | Stock No. | Number | Electrical designation | Recommended Spare Parts |
|---|---|---|---|---|---|
| Documnet 1129.9032.00 (Grundeinheit FSU) | | | | | |
| 500 | Instrument frame | 1129.9090.00 | 1 S | | |
| 510 | MOTHERBOARD | 1130.1960.02 | 1 S | A10 | x |
| 520 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 7 S | | |
| 530 | Locking bolt M3 | 0009.6501.00 | 4 S | | |
| 540 | Locking bolt H=4,5-40 | 1093.9180.00 | 2 S | | |
| 550 | Power supply unit 230W | 1091.2320.00 | 1 S | A20 | x |
| 560 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 10 S | | |
| 570 | FMR 5+ VARIANTE | 1091.2789.00 | 1 S | A90 | x |
| 580 | AWARD BIOS ZU FMR5 | 1093.5327.00 | 1 S | | |
| 590 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 10 S | | |
| 600 | Display unit | 1093.4708.03 | 1 S | | |
| 610 | DIN965-M2,5X6-A4-PA | 0852.3614.00 | 4 S | | |
| 620 | Keyboard frame | 1093.5127.00 | 1 S | | |
| 630 | Keyboard mat | 1093.5133.00 | 1 S | A16 | x |
| 640 | Keyboard membrane | 1093.5140.00 | 1 S | A15 | x |
| 650 | Rotary knob RD28 ACHS-RD6 | 0852.1086.00 | 1 S | | |
| 660 | DIN965-M2X6-A4-PA | 0852.3520.00 | 10 S | | |
| 670 | 3,5" FLOPPY DRIVE STD. | 0048.4935.00 | 1 S | A30 | x |
| 680 | Floppy bracket | 129.9161.00 | 1 S | | |
| 690 | W300 FLOPPY DATA | 1129.9726.00 | 1 S | W300 | |
| 691 | FLOPPY POWER | 1129.9732.00 | 1 S | W301 | |
| 700 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 3 S | | |
| 702 | DIN6900-M3,0X6 -A2 | 0071.6847.00 | 3 S | | |
| 710 | Harddisk with firmware | 1130.1948.00. | 1 S | A60 | x |
| 720 | Ribbon cable | 1093.5156.00 | 1 S | W29 | |
| 730 | Disk bracket | 1093.4837.00 | 1 S | | |
| 740 | DIN965-M2,5X6-A4-PA | 0852.3614.00 | 2 S | | |
| 750 | DIN965-M3X5-A4-PA | 0396.8023.00 | 4 S | | |

| Position | Designation | Stock No. | Number | Electrical designation | Recommended Spare Parts |
|---|---|---|---|---|---|
| 775 | 3,4V LITHIUM-BATTERIE | 0565.1687.00 | 1 S | | |
| Documnet 1093.4708.01 Blatt 2 (Display unit) | | | | | |
| 805 | Assembly tray | 1129.9426.00 | 1 S | | |
| 810 | Shielded filter plate | 1091.2014.00 | 1 S | | x |
| 820 | RF spring (177) | 1069.3011.00 | 2 S | | |
| 830 | RF spring (137) | 1069.3105.00 | 2 S | | |
| 840 | Plate holder | 0852.0844.00 | 4 S | | |
| 850 | DIN965-M2X4-A4-PA | 0852.3508.00 | 4 S | | |
| 865 | Dust sealing | 1129.9449.00 | 1 S | | |
| 871 | VNR-08C351-INVERTER | 0048.8760.00 | 1 S | T10 | x |
| 880 | DIN7985-M2X10-A4-PA | 0396.8175.00 | 2 S | | |
| 890 | DIN125-A2,2-HP | 0049.7396.00 | 2 S | | |
| 892 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 2 S | | |
| 905 | Converter cable L=350 | 1091.2589.00 | 1 S | W100 | x |
| 910 | Spin wheel | 0852.1170.00 | 1 S | B10 | x |
| 921 | 800X600X3 TFT DISPLAY | 0048.8599.00 | 1 S | A70 | x |
| 930 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 4 S | | |
| 932 | Space | 1129.9432.00 | 4 S | | |
| 934 | DIN965-M2,5X5-A4-PA | 0852.3608.00 | 4 S | | |
| 945 | Display connector | 1091.2595.00 | 1 S | W70 | x |
| 946 | Name plate for display cable | 1129.9703.00 | 1 S | | |
| 950 | DIN6900-M2,5X6 -A2 | 0071.5040.00 | 2 S | | |
| Documnet 1144.9017.00 (Option FSU-B4 1144.9000.02) | | | | | |
| 1100 | OCXO | 1093.7871.03 | 1 S | A200 | x |
| 1120 | RF-cable W21 | 1129.9926.00 | 1 S | W21 | |
| Documnet 1129.7298.00 Page 2 (Option FSP-B10 1129.7246.02) | | | | | |
| 1600 | EXT. GEN. CONTROL | 1093.8590.02 | 1 S | A210 | x |
| 1610 | IEC-BUS Cable W21 | 1129.7252.00 | 1 S | W21 | x |
| 1612 | DIN125-A3,2-A4 | 0082.4670.00 | 2 S | | |

| Position | Designation | Stock No. | Number | Electrical designation | Recommended Spare Parts |
|---|---|---|---|---|---|
| 1614 | DIN137-A3-A2 | 0005.0296.00 | 2 S | | |
| 1620 | Aux control cable W22 | 1129.7269.00 | 1 S | W22 | x |
| 1622 | Locking bolt M3 | 0009.6501.00 | 2 S | | |
| 1624 | DIN137-A3-A2 | 0005.0296.00 | 2 S | | |
| 1626 | DIN934-M3-A4 | 0016.4398.00 | 2 S | | |
| Documnet 1129.7298.00 (Option FSU-B16 1144.9498.02) | | | | | |
| 1240 | LAN- Interface COMPACT-PCI | 1093.9080.00 | 1 S | A220 | x |
| 1250 | Cable 2XRJ45 ST/ST 8P | 1130.0935.00 | 1 S | W32 | |
| 1260 | Cable-Feedthrough 10X17X6,8 | 0099.1433.00 | 2 S | | |
| 1270 | Adapter 8P.GER | 1093.9122.00 | 1 S | X220 | x |

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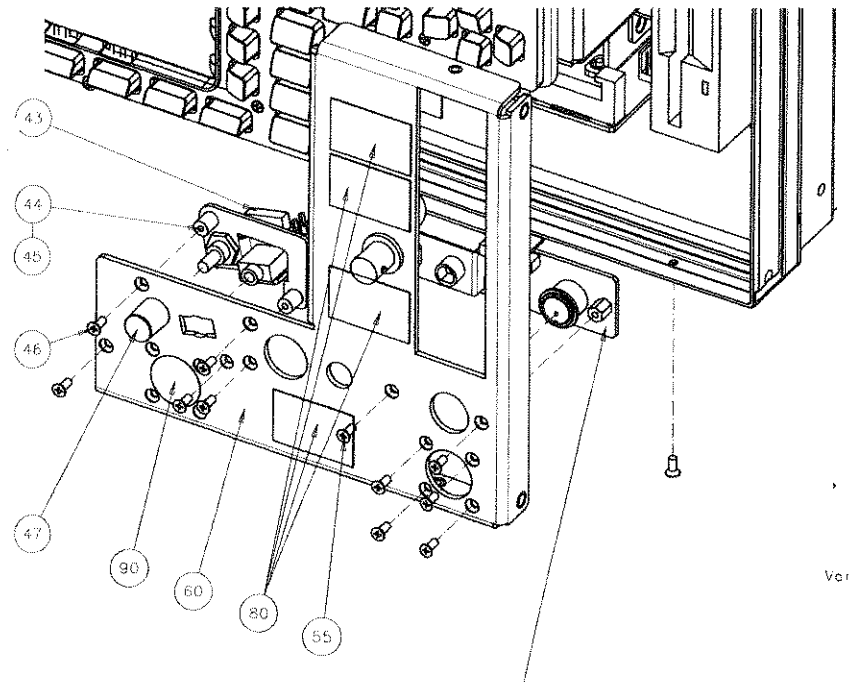
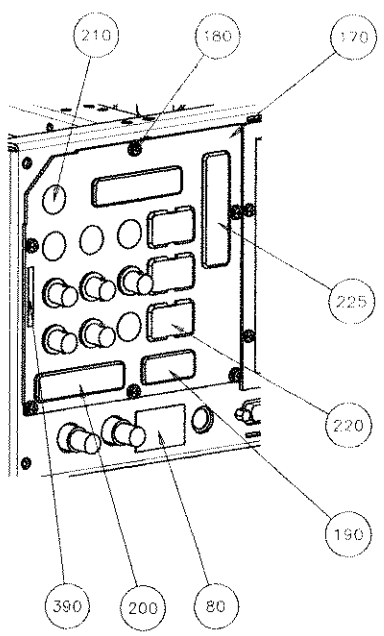
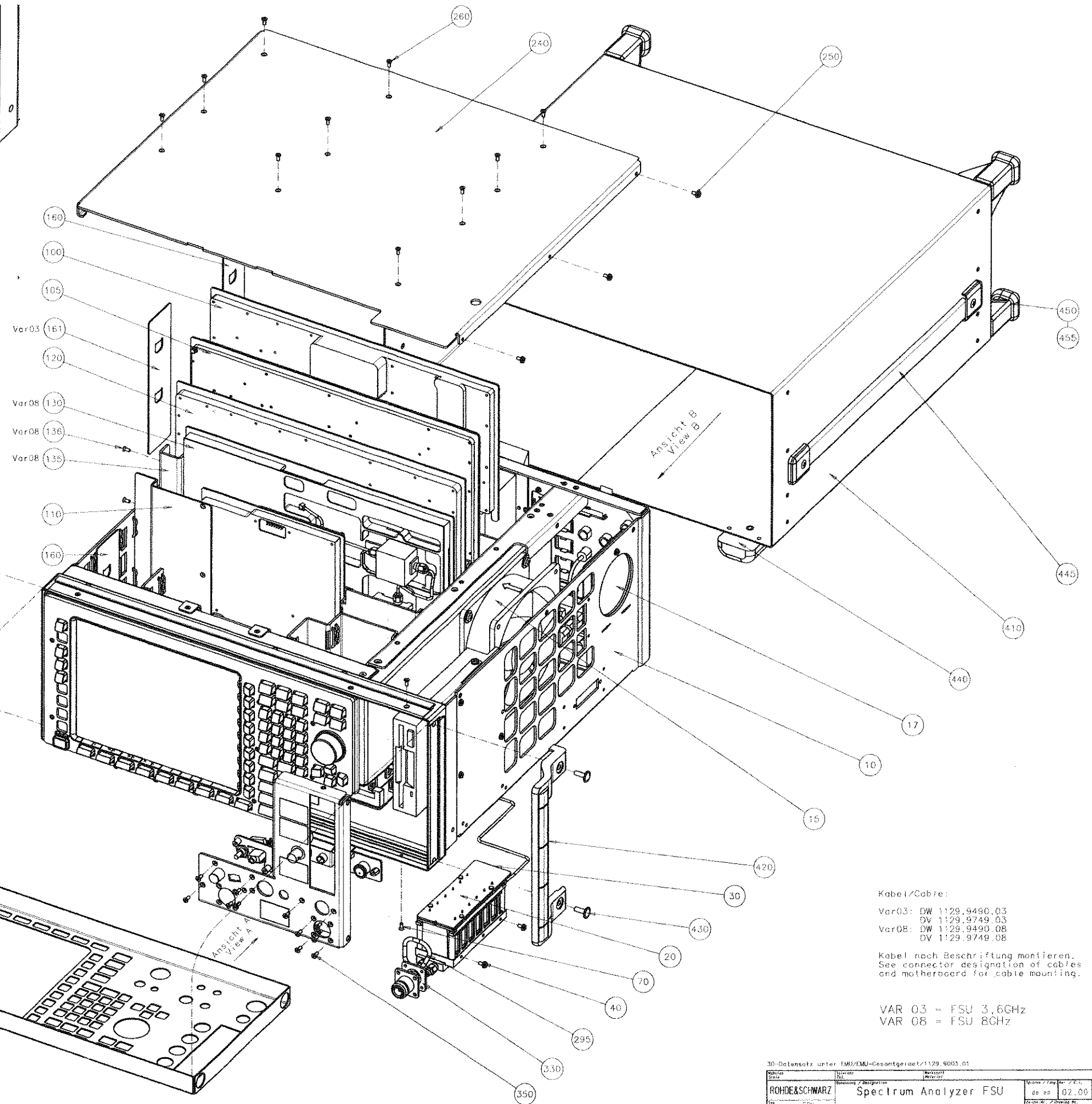



Ansicht A
View A



Ansicht B
View B







Kabel/Cable:

Var03: DW 1129.9490.03
DV 1129.9749.03
Var08: DW 1129.9490.08
DV 1129.9749.08

Kabel nach Beschriftung montieren.
See connector designation of cables and motherboard for cable mounting.

VAR 03 = FSU 3,6GHz
VAR 08 = FSU 8GHz

30-Datensatz unter EMB/EMU-Gesamtgeraet/1129.9003.01

ROHDE&SCHWARZ

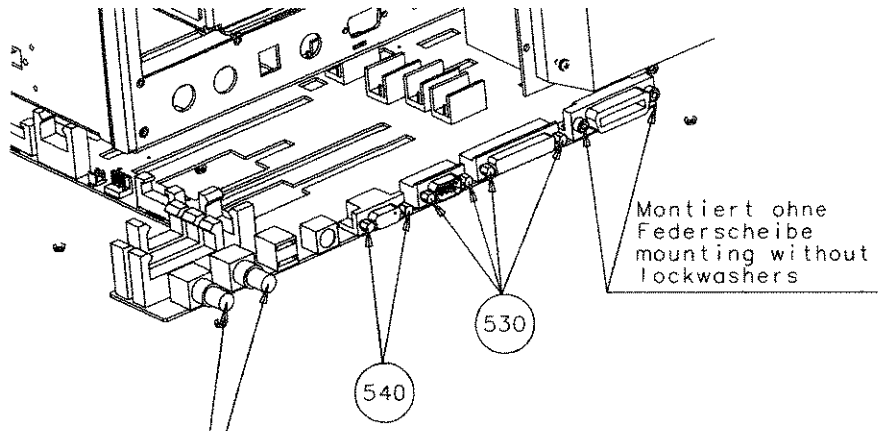
Spectrum Analyzer FSU

FSU

01.12.2000 IESK YF

de en 02.00 1

1129.9003.01 D







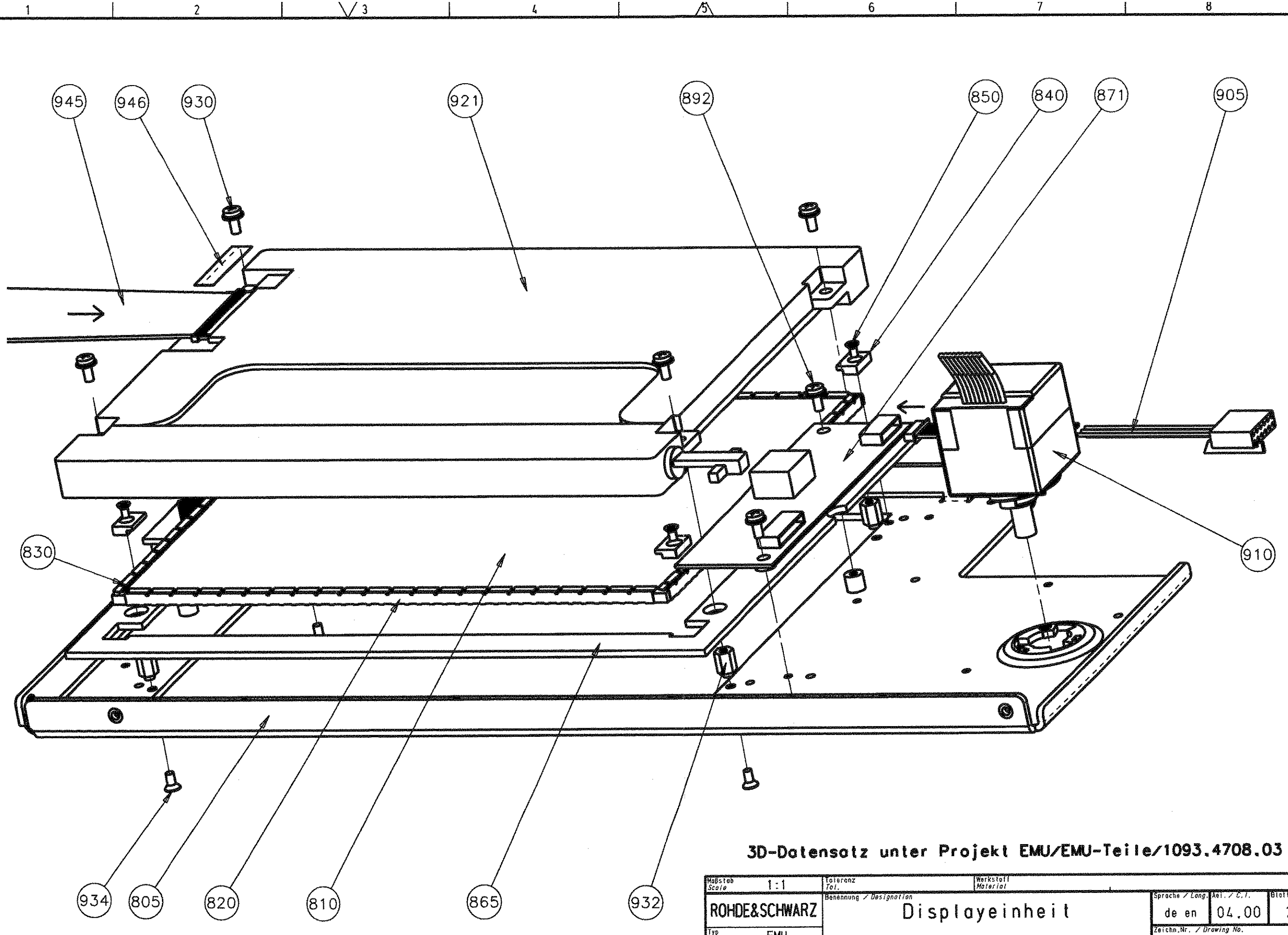
Einzelheit A




3D-Datensatz unter EMU/EMU-Teile/1129.9032.00

| | | | | | |
|---|---|---|---|---|---|
| Maßstab / Scale | Toleranz / Tol. | Werkstoff / Material | | | |
| ROHDE&SCHWARZ | Benennung / Designation: Grundeinheit | | | Sprache / Lang. de en | Änd. / C.I. 03.00 | Blatt / Sh. 1 |
| Typ / Type EMU | | | | Zeichn.Nr. / Drawing No. 1129.9032.00 D | | |
| T.Z. appr. ja 1129.9090.00 | Datum / Date 29.09.2000 | Abteilung / Dept. 1ESK | Name TF | | | |

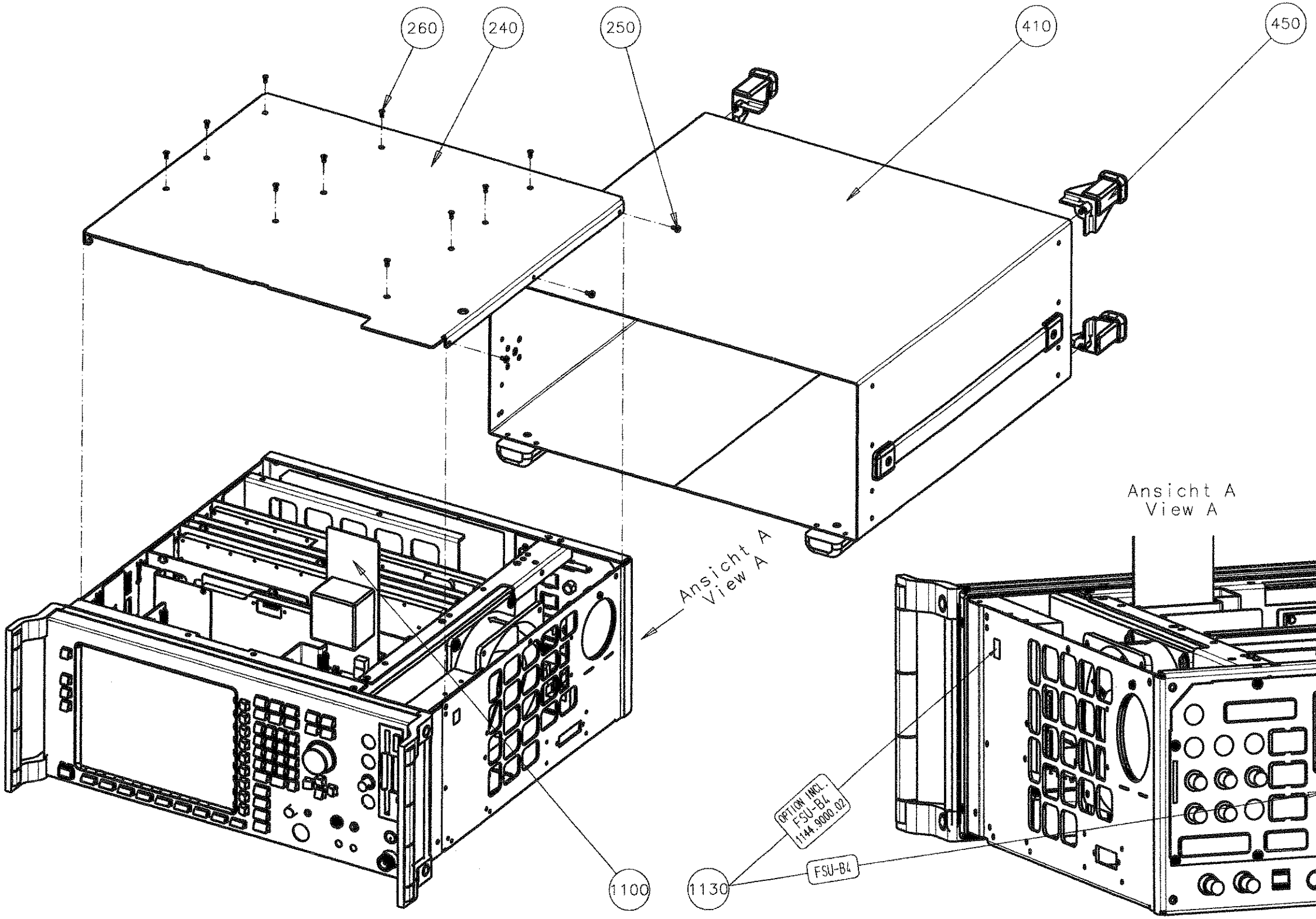
Projektionsmethode




Projektions-methode
*Projection Method*

**3D-Datensatz unter Projekt EMU/EMU-Teile/1093.4708.03**

| | | | | | |
|---|---|---|---|---|---|
| Maßstab *Scale* 1:1 | Toleranz *Tol.* | Werkstoff *Material* | | | |
| ROHDE&SCHWARZ | Benennung / *Designation* Displayeinheit | | | Sprache / *Long.* de en | Aei. / *C.I.* 04.00 | Blatt / *Sh.* 2 |
| Typ *Type* EMU | | | | Zeichn.Nr. / *Drawing No.* 1093.4708.01 D | |
| I.Z. *used in* 1129.9090.01 | Datum *Date* 10.10.2000 | Abteilung *Dept.* 1ESK | Name *Name* Wn | | |




Kabel nach Beschriftung montieren.
See connector designation of cables and motherboard for cable mounting.

Projektionsmethode
*Projection Method*

| | | | | | |
|---|---|---|---|---|---|
| Maßstab / *Scale* | Toleranz / *Tol.* | Werkstoff / *Material* | | | |
| ROHDE&SCHWARZ | Benennung / *Designation* Einbauanweisung FSU-B4 Installation Instruction | | | Sprache / *Lang.* de en | Aei. / *C.I.* 02.00 | Blatt / *Sh.* 1 |
| Typ / *Type* FSU-B4 | | | | Zeichn.Nr. / *Drawing No.* 1144.9017.00 D | |
| 1.Z. / *used in* 1144.9000.01 | Datum / *Date* 24.11.2000 | Abteilung / *Dept.* 1ESK | Name / *Name* TF | | |

ROHDE&SCHWARZ

# Block Circuit Diagram

# Part List

Floppy A30

W32 X220 LAN
W34 I/Q DATA OUT
W11 IF OUT 20.4 MHZ
W10 IF OUT 404.4 MHZ
W12 VIDEO OUT
W17 REF IN 1...20MHZ
W16 REF OUT 10 MHZ

W300 W301 W6 W21 W3 W4 W5 W7 W19 W20 W18 W8 W9 W15 W14 W13

A70 DISPLAY — W70
T10 WANDLER — W100
A60 Hard DISK — W20

A90 FRONT MODULE CONTROLLER
A16 FLEX. SWITCHBOARD
A15 FLEX. SWITCH FOIL
X90 X91 X92

Option FSU-B16 A220 LAN INTERFACE X221
Option FSU-B4 A200 OCXO X200 (X201)
Option FSP-B10 A210 EXTERNAL GENERATOR X210

FSU-B17

A140 DETECTOR BOARD 1
X143 I/Q D OUT 32 MHZ
X148 32 MHZ
X146 128 MHZ
X147 IFCOUNT
X149 VID_IF
X142 X140 X141

A160 MW CONVERTER FSU 8 X160
X162 X169 RF IN X167 LO IN X168 RF 0..3.6 GHZ OUT X165 LO OUT X161 IF OUT

A130 IF FILTER X130
X138 VIDEO IF X136 IF COUNT X137 IFOUT2 X134 2ND IFOUT X139 VIDEO_BP X132 IF IN X133 2ND IF IN IFOUT

A110 SYNTHESIZER X110
X122 128MHZ TG X123 CAL/COMB X128 10MHZ OCXO X127 128MHZ DIST X126 EXT.REF IN X124 REF OUT X121 640MHZ X114 2ND LO TG X112 3RD LO OUT TG X117 SWEEP LO X113 2ND LO REF X111 3RD LO OUT REC

A100 RF CONVERTER X100
X101 3RD LO IN X102 3RD LO OUT X105 SWEEP LO X104 2ND IF OUT X110 3RD IF OUT X108 2ND IF IN X107 LO OUT X109 LO IN X106 RF IN

X180 X260 X150 X170

A20 POWER SUPPLY X20
LINE IN

A10 MOTHERBOARD
X60 IEC
X61 LPT
X62 COM1
X63 VGA
X64 TRIGGER/GATE
X65 SWEEP
X66 MOUSE
X69 USB
X67 X300 X68
IEC 2 FSP-B10
AUX CONTROL FSP-B10

B10 ROTARY PULS GENERATOR
A191 Vol./Phones PHONES Volume
X81 X80 X40 X41 X71 X50 X50 X240 X241 X242 X250 X35 X70

W50 FSU8
Option FSU-B25 A50 ELECTRONIC ATTENUATOR
W26 W28 FSU3
W27

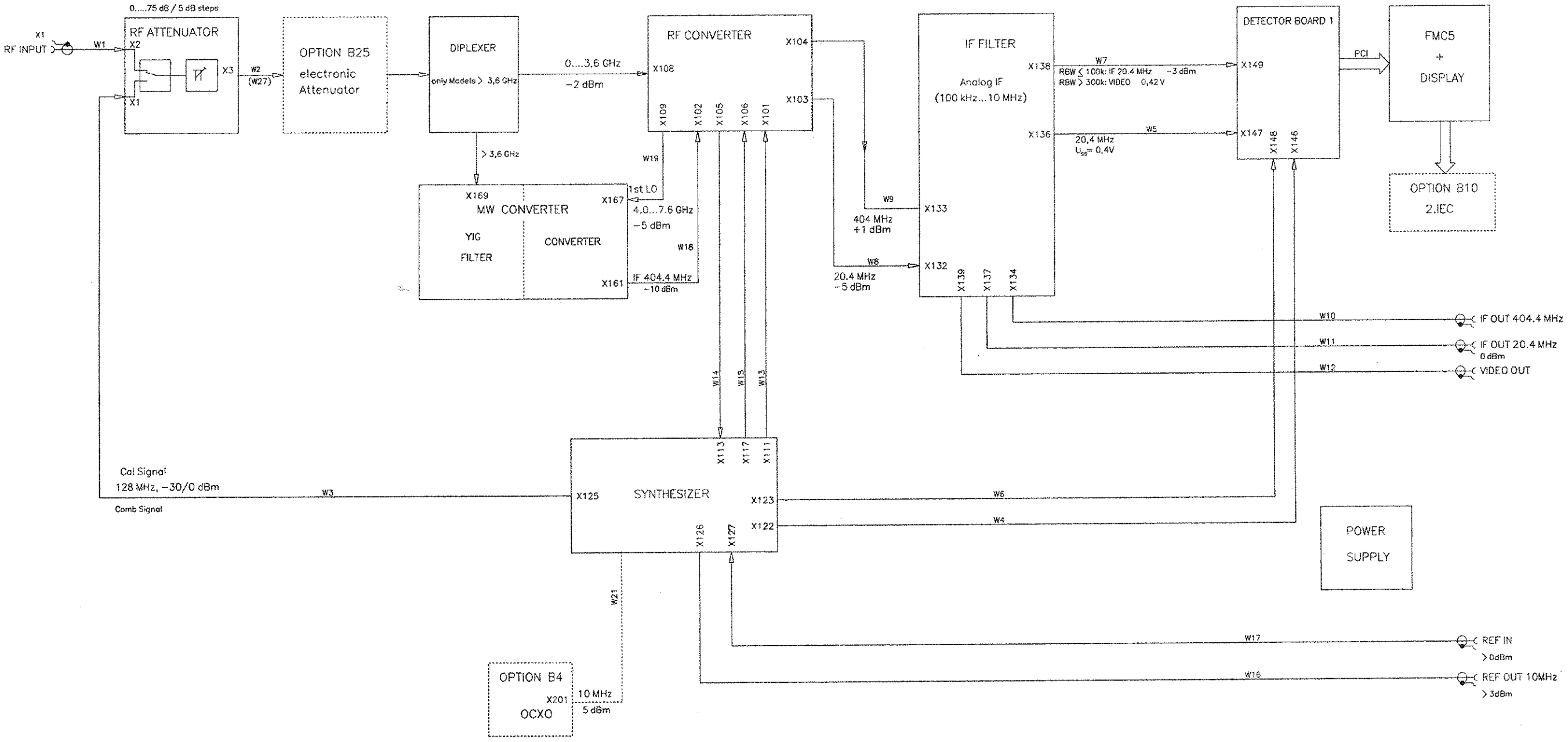
NOISE SOURCE W22
A80 Key Probe
Probe Power
Probe Power
PS2 Keyboard

W3
X1 CAL A40 RF ATTENUATOR X2 X3
RF-IN X1 W1
W2 FSU6
W2 FSU3

M E1 FAN
B1 SPEAKER

Legend of line styles:
FSU 3/8
FSU 8
Options

| | | | | | |
|---|---|---|---|---|---|
| ROHDE&SCHWARZ | Benennung: / Designation: FSU SPECTRUM ANALYZER | | | Sprache: / Lang.: DE | Aei: / C.I.: 01.00 | Blatt: / Sh.: 1+ |
| Typ: / Type: FSU | Datum: / Date: 00-10-23 | Abteilung: / Dpt: 1ESK | Name: / Name: REITBOEC | Zeichn. Nr.: / Drawing No.: 1129.9003.01 S | | |
| 1. Z.: / used in: 1129.9003.01 | TOP/TOP.1 | | | | | |






| | | | | | | |
|---|---|---|---|---|---|---|
| ROHDE&SCHWARZ | Benennung: / Designation: FSU SPECTRUM ANALYZER | | | | Sprache: / Lang.: DE | Ael: / C.I.: 01.00 | Blatt: / Sh.: 2+ |
| Typ: / Type: FSU | Datum: / Date: 00-10-23 | Abteilung: / Dpt: 1ESK | Name: / Name: REITBOEC | | Zeichn. Nr.: / Drawing No.: 1129.9003.01 S | | |
| 1. Z.: / used in: 1129.9003.01 | TOP/TOP.2 | | | | | | |

RF CONVERTER

2ND IF IN
W18 X102
404,4 MHz
from MW CONVERTER

RF IN
W2/20 X108
20 Hz...3,6 GHz
from ATTENUATOR/ MW CONVERTER

LOWPASS
fg = 3,6 GHz
4628,4 MHz...8128,4 MHz

DIPLEXER
1St LO

X2

1ST MIXER

X12
-44 dB
1ST IF AMP

X15
-33 dB

1ST IF FILTER
BW 400 MHz
BW = 50 MHz

X6
-29 dB

Overload

2ND MIXER
+20dBm

2ND IF AMP

X11
+ 2 dBm

LOGAMP
OVERLOAD DETECTOR
OVERLOAD DETECTOR IF2

2ND IF FILTER
404,4 MHz
BW = 10 MHz
BW = 20 MHz

Step-ATT

IF2out_SW

3RD MIXER
fg = 40 MHz

X13

X103 3RD IF OUT
W8
20,4 MHz
-3 dB to input
to IF Filter

X101 3RD LO IN
W13
364 MHz
from SYNTHESIZER

X104 2nd IF out
W9
to IF FILTER

X109 LO1 Aux
W19
-5 dBm
to MW CONVERTER

X107 LO1_OUT
+5 dBm

2nd_LOin
X105
W14
+7dBm
from SYNTHESIZER

LO2 AMP
4224 MHz
ISO AMP
-20 dB

SWEEP_LO1
X106
W15
from SYNTHESIZER

+7dBm

2xPD_DIV
PHASEDETECTOR MAIN LOOP

SWEEP FREQUENCY DIVIDER
Data
100EL52

PD

BFP420
4224 MHz
4,2 GHz BANDPASS
2ND LO
4224 MHz

3xMGA81563
405...3968 MHz
fc < 3,5 GHz
2ND LO OFF

WILKINSON8.gds
SNA176
:4
MGA81563

DIVIDER MAIN LOOP

MUX
Data

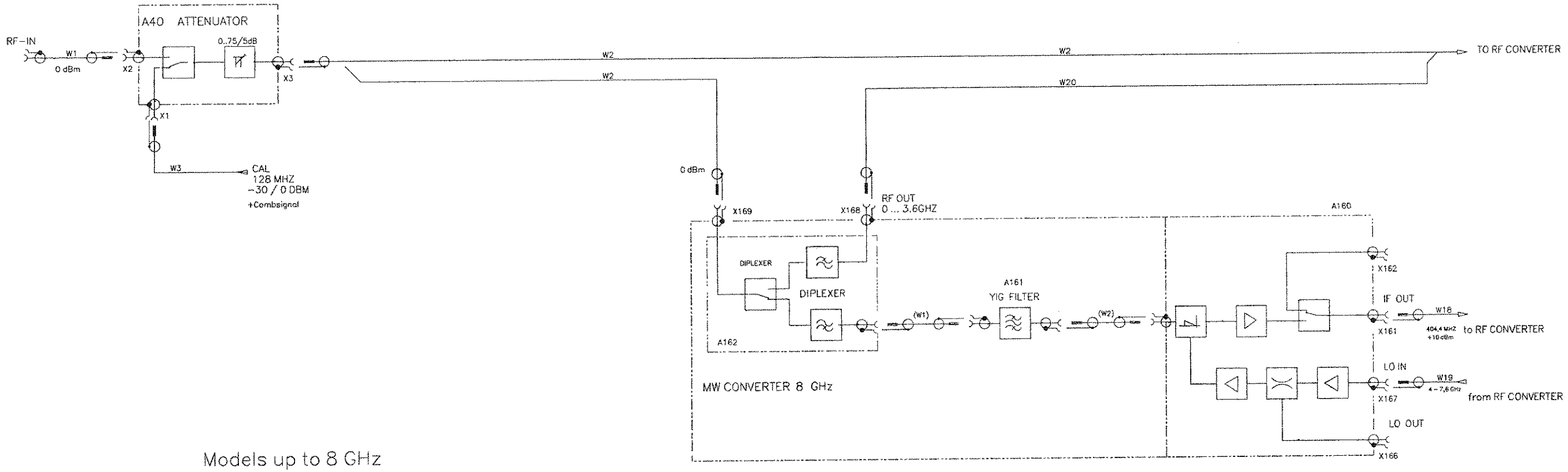
YIG
4,6 ... 8,2 GHz
BW. 100...500 kHz

15 dB
- 2 dB
LO AMP
- 2 dB

ISO AMP
SNA176

1ST LO
4628.4 .. 8228.4 MHz
+ 20 dBm

| | | | | | |
|---|---|---|---|---|---|
| ROHDE&SCHWARZ | Benennung: / Designation: FSU SPECTRUM ANALYZER | | | Sprache: / Lang.: DE | Ael: / C.I.: 01.00 | Blatt: / Sh.: 3+ |
| Typ: / Type: FSU | Datum: / Date: 00-10-23 | Abteilung: / Dpt: 1ESK | Name: / Name: REITBOEC | Zeichn. Nr.: / Drawing No.: 1129.9003.01 S | | |
| T. Z.: / used in: 1129.9003.01 | | | TOP/TOP.3 | | | |




Models up to 8 GHz



| | | | | | | |
|---|---|---|---|---|---|---|
| ROHDE&SCHWARZ | Benennung: / Designation: FSU SPECTRUM ANALYZER | | | | Sprache: / Lang.: DE | Aei: / C.I.: 01.00 | Blatt: / Sh.: 4+ |
| Typ: / Type: FSU | Datum: / Date: 00-10-23 | Abteilung: / Dpt: 1ESK | Name: / Name: REITBOEC | | Zeichn. Nr.: / Drawing No.: 1129.9003.01 S | | |
| 1. Z.: / used in: 1129.9003.01 | | | | TOP/TOP.4 | | | |

# IF FILTER

X131 IF OUT1 0 DBM

FILTER FFT CAL FFT

Level Offset

CALAMP 1 −3...+3 DB

XTAL CAL XTAL XTAL CAL XTAL

FILTER 0 CAL LC

20.4 MHz IF IN W8 X132 from RF CONVERTER

SELFTEST/ RF OVERLOAD DETECTOR

STEP GAIN 0/10 dB

CALAMP2 0 ... 6 DB

Freq. Resp.

FILTER1 CAL LC FILTER2 CAL LC

RBW 200 KHz...3 MHz

RBW 10 MHz Path

SELFTEST/ IF OVERLOAD DETECTOR

STEP GAIN −20...+40 DB

STEP FINE 0...12 dB

STEP COARSE −20/−10/0/10/ 20/30/dB

SELFTEST/ IF OVERLOAD DETECTOR

RBW 200 kHz... 3MHz

FILTER3 CAL LC FILTER4 CAL LC

RBW 10 MHz Path

X137 IF OUT2 0 DBM W11 to REAR PANEL

NOISE FILTER LOGAMP

20.4 MHz RBW > 200 kHz

IF 20.4 MHz

X136 IF_COUNT W5 to DETECTOR BOARD

Video

VIDEO OFFSET D/A

10 MHZ

11.6 MHZ

RBW ≤ 100 kHz

LINEAR DETECTOR

only for Calibration

SELFTEST

RBW < 200 kHz: IF 20,4 MHz, − 1 dBm
RBW >= 200 kHz: Video, 0.336V

X138 VIDEO/IF OUT W7 to DETECTOR BOARD

X139 VIDEO_RP W12 to REAR PANEL

1 MHZ

DITHER GENERATOR F0 = 500 KHZ

AWB. CALAMP 1 −3...+3 DB

AWB. CALAMP 2 −0...+6 DB

NOISE FILTER LOGAMP

2 nd IF IN W9 X133 from RF CONVERTER

2 nd IFOUT W10 X134 to REAR PANEL

WB. STEPGAIN −3...+20 DB/1DB

## Demodulator / Audio

AUDIO IN

QUASIPEAK

AM/FM−DEMOD. AM FM

0...40 dB

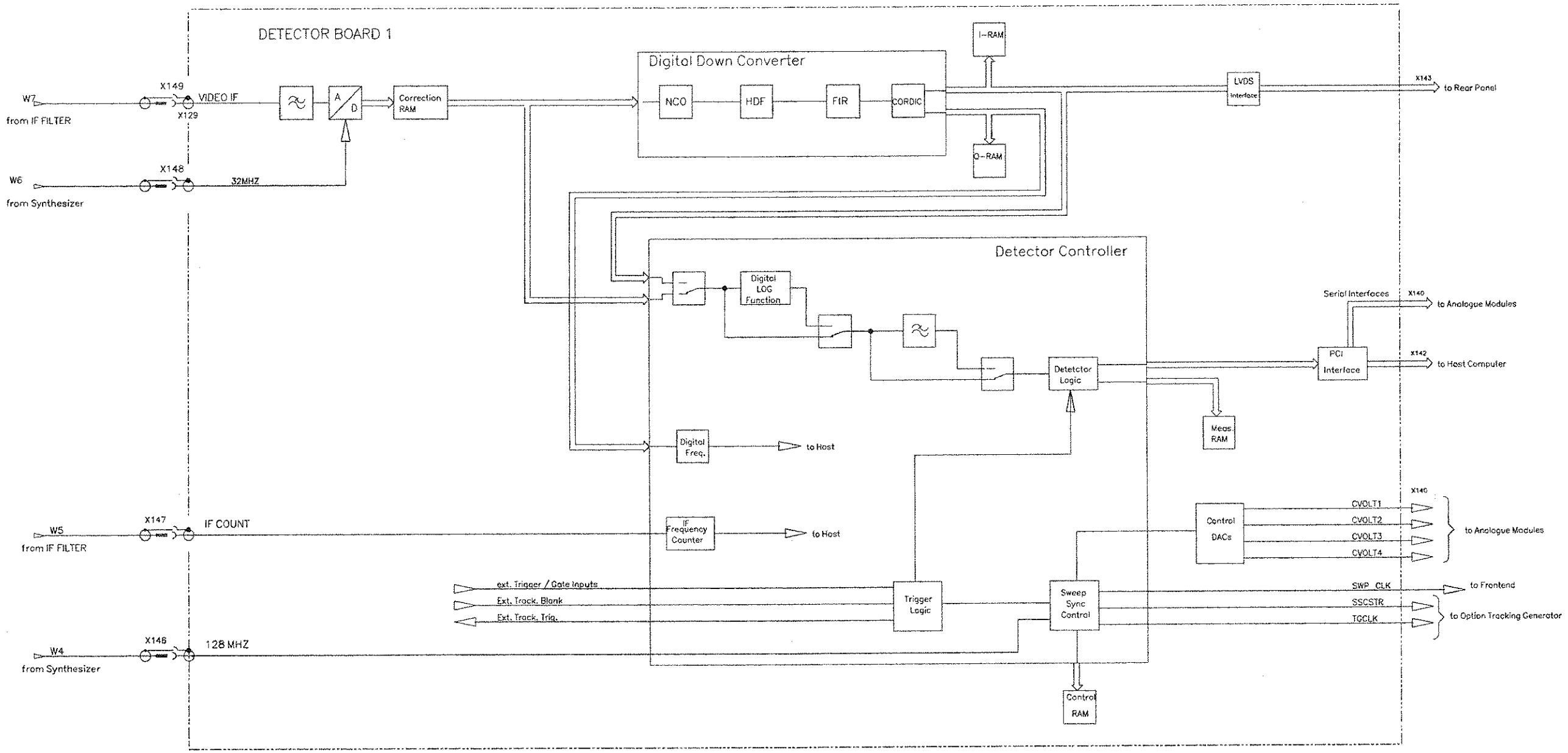
COUNTER PR U D

D/A

from Knob VOLUME

TO SPEAKER/PHONES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ROHDE&SCHWARZ | Benennung: / Designation: FSU SPECTRUM ANALYZER | | | | | Sprache: / Lang.: DE | Aei: / C.I.: 01.00 | Blatt: / Sh.: 5+ |
| Typ: / Type: FSU | Datum: / Date: 00−10−23 | Abteilung: / Dpt: 1ESK | Name: / Name: REITBOEC | | | Zeichn. Nr.: / Drawing No.: 1129.9003.01 S | | |
| 1. Z.: / used in: 1129.9003.01 | TOP/TOP.5 | | | | | | | |




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ROHDE&SCHWARZ | Benennung: Designation: FSU SPECTRUM ANALYZER | | | | | Sprache: / Lang.: DE | Aen: / C.i.: 01.00 | Blatt: / Sh.: 6+ |
| Typ: Type: FSU | Datum: Date: 00-10-23 | Abteilung: Dpt: 1ESK | Name: Name: REITBOEC | | | Zeichn. Nr.: / Drawing No.: 1129.9003.01 S | | |
| 1. Z.: used in: 1129.9003.01 | TOP/TOP.6 | | | | | | | |

SYNTHESIZER

OPTION B4
OCXO

ext. REF in
W17
X127
1..20MHz
+0 dBm...+10 dBm
from REAR PANEL

W21
X128
10 MHz
+3 dBm...+10 dBm
from OCXO OPT

OCXO 10MHz

128MHz

Finecomb
10 KHz
100 KHZ
1 MHz

CalGen
128MHz
0dBm / −30 dBm

MULT

COMB 128

640 MHz

384 MHz

CombGen
640 MHz

1..4
1

Ref out 1..20MHz
W16
X126
+4dBm...+11dBm
to REAR PANEL

W4
X122
128MHz
−0 dBm
to DETECTOR BOARD 1

W6
X123
128MHz 0 dBm
32MHz −1dBm
to DETECTOR BOARD 1

W3
X125
CAL out 128MHz/0dBm/−30dBm
COMB out
to RF ATTENUATOR

640 MHz
X124 640MHz out
+13dBm

384 MHZ
G

384MHz
W13
X111 3rd LO out +11dBm
to RF CONVERTER
X112 3rd LO out +11dBm

N
1

W11

4224 MHz

f offset

DRO
G

4224 MHz offset
W14
X113 2nd LO out +8 dBm
to RF CONVERTER
X114 2nd LO out +4 dBm

SYNCON

Sweep LO1
W15
X117
595..620MHz / +6 dBm
45..20MHz / + 2 dBm
to RF CONVERTER

595...620 MHz
G

| | | | | | |
|---|---|---|---|---|---|
| ROHDE&SCHWARZ | Benennung: FSU SPECTRUM ANALYZER | | | Sprache / Lang.: DE | Aei. / C.I.: 01.00 | Blatt / Sh.: 7− |
| Typ: FSU | Datum: 00−10−23 | Abteilung: 1ESK | Name: REITBOEC | Zeichn. Nr.: / Drawing No.: 1129.9003.01 S | | |
| T. Z.: used in: 1129.9003.01 | | | TOP/TOP.7 | | | |

| Kennz. Comp. No. | Benennung Designation | Sachnummer Stock No. | Hersteller Manufacturer | Bezeichnung Designation | enthalten in contained in |
|---|---|---|---|---|---|
| A10 | ED MOTHERBOARD<br>MOTHERBOARD | 1130.1960.02 | | | 1129.9032.00 |
| A15 | SB SCHALTFOLIE F."FSP"<br>FLEXIBLE SWITCH FOIL | 1093.5140.00 | HOF_KRIPPN | 1093.5140 | 1129.9032.00 |
| A16 | SB SCHALTMATTE F."FSP"<br>FLEX.SWITCHBOARD | 1093.5133.00 | MAAG | 1093.5133 | 1129.9032.00 |
| A20 | GJ NETZTEIL 230W UL/CSA<br>POWER SUPPLY | 1091.2320.00 | PULS | SN230 | 1129.9032.00 |
| A30 | GM 3,5" FLOPPY DRIVE STD.<br>FLOPPY DRIVE 3.5" | 0048.4935.00 | TEAC | FD-235HF-B291 | 1129.9032.00 |
| A40 | ZE EICHL.(6-STUFIG EMU)<br>ATTENUATOR 6-WAY EMU | 1137.0599.02 | | | |
| A60 | GM 2,5" FESTPL. 6,0 GB<br>2.5" HARDDISK 6,0 GB | 0048.8130.00 | IBM_DEUTSC | DARA 206000 | 1129.9032.00 |
| A70 | BP TFT 640X3X480 FARB-LCD<br>8.4" COLOR LCD MODULE<br>NUR VAR/ONLY MOD: 02<br>ONLY FOR FSP" | 0048.6980.00 | SHARP | LQ084V1DG21 | 1093.4708.01 |
| A70 | BP 800X600X3 TFT DISPLAY<br>8.4" COLOR TFT<br>NUR VAR/ONLY MOD: 03<br>ONLY FOR FSU" | 0048.8599.00 | TOSHIBA | LTM08C351 | 1093.4708.01 |
| A80 | ED KEY-PROBE<br>KEY-PROBE | 1130.2996.02 | | | |
| A90 | GM FMR 5+ VARIANTE<br>FRONT MOD. CONTROLLER | 1091.2789.00 | E_E_P_D_ | RSFMP NACH SPEC. | 1129.9032.00 |
| A100 | EE RF CONVERTER<br>RF CONVERTER | 1130.1990.02 | | | |
| A110 | EE SYNTHESIZER<br>SYNTHESISER | 1130.2096.02 | | | |
| A130 | EE IF-FILTER<br>IF-FILTER | 1130.2296.02 | | | |
| A140 | EE DETECTOR BOARD 1 | 1130.2196.04 | | | |
| A160 | ZE CONVERTER UNIT(8 GHZ)<br>CONVERTER UNIT (8GHZ)<br>NUR VAR/ONLY MOD: 08 | 1130.2396.02 | | | |
| A191 | ED VOL/PHONES BOARD<br>VOL/PHONES BOARD | 1093.7094.02 | | | |
| B1 | DX LAUTSPRECHER | 1129.9332.00 | | | 1129.9090.00 |
| B1 | DX LAUTSPRECHER | 1129.9332.00 | | | |
| B10 | EM DREHIMPULSGEBER<br>ROTARY PULS-GENERATOR | 0852.1170.00 | ELMA | 0852.1170 | 1093.4708.01 |
| E1 | ZM LUEFTER<br>BLOWER | 1091.1001.00 | | | 1129.9090.00 F |
| E1 | ZM LUEFTER<br>BLOWER | 1091.1001.00 | | | |
| T10 | BV CXA-L0605-VJL DC-AC<br>DC TO AC INVERTER UNIT<br>NUR VAR/ONLY MOD: 02<br>ONLY FOR FSP" | 0048.6996.00 | TDK | CXA-L0605-VJL | 1093.4708.01 |
| T10 | BV VNR-08C351-INV<br>DC TO AC INVERTER UNIT<br>NUR VAR/ONLY MOD: 03<br>ONLY FOR FSU" | 0048.8760.00 | SYSTEMELEK | VNR-08C351-INV | 1093.4708.01 |
| W1 | DW HF-KABEL W1 8GHZ | 1129.9503.00 | | | |
| W2 | DW HF-KABEL W2 3.6GHZ<br>NUR VAR/ONLY MOD: 03 | 1129.9510.00 | | | 1129.9490.01 |
| W2 | DW HF-KABEL W2 8GHZ<br>RF CABLE W2 8GHZ<br>NUR VAR/ONLY MOD: 08 | 1129.9526.00 | | | 1129.9490.01 |
| W3 | DV HF KABEL W3<br>RF-CABLE W3 | 1129.9755.00 | | | 1129.9749.01 |
| W4 | DV HF-KABEL W4<br>RF-CABLE W4 | 1129.9761.00 | | | 1129.9749.01 |
| W5 | DV HF-KABEL W5<br>RF-CABLE W5 | 1129.9778.00 | | | 1129.9749.01 |
| W6 | DV HF-KABEL W6<br>RF-CABLE W6 | 1129.9784.00 | | | 1129.9749.01 |
| W7 | DV HF KABEL W7<br>RF-CABLE W7 | 1129.9790.00 | | | 1129.9749.01 |
| W8 | DV HF-KABEL W8<br>RF-CABLE W8 | 1129.9803.00 | | | 1129.9749.01 |
| W9 | DV HF-KABEL W9<br>RF-CABLE W9 | 1129.9810.00 | | | 1129.9749.01 |



| 1ESK 213 3PLU | Ai | Datum Date | Schaltteilliste für Parts list for | Sachnummer Stock No. | Blatt-Nr. Page |
|---|---|---|---|---|---|
| ROHDE&SCHWARZ | 23 | 01.03.01 | GG SPECTRUM ANALYZER FSU | **1129.9003.01 SA** | 1+ |

| Kennz. Comp. No. | Benennung Designation | Sachnummer Stock No. | Hersteller Manufacturer | Bezeichnung Designation | enthalten in contained in |
|---|---|---|---|---|---|
| W10 | DV HF KABEL W10<br>RF-CABLE W10 | 1129.9826.00 | | | 1129.9749.01 |
| W11 | DV HF KABEL W11<br>RF-CABLE W11 | 1129.9832.00 | | | 1129.9749.01 |
| W12 | DV HF KABEL W12<br>RF-CABLE W12 | 1129.9849.00 | | | 1129.9749.01 |
| W13 | DV HF-KABEL W13<br>RF-CABLE W13 | 1129.9855.00 | | | 1129.9749.01 |
| W14 | DV HF-KABEL W14<br>RF-CABLE W14 | 1129.9861.00 | | | 1129.9749.01 |
| W15 | DV HF-KABEL W15<br>RF-CABLE W15 | 1129.9878.00 | | | 1129.9749.01 |
| W16 | DV HF KABEL W16<br>RF-CABLE W16 | 1129.9884.00 | | | 1129.9749.01 |
| W17 | DV HF-KABEL W17<br>RF-CABLE W17 | 1129.9890.00 | | | 1129.9749.01 |
| W18 | DV HF KABEL W18<br>RF-CABLE W18<br>NUR VAR/ONLY MOD: 08 | 1129.9903.00 | | | 1129.9749.01 |
| W19 | DW HF-KABEL W19<br>NUR VAR/ONLY MOD: 08 | 1129.9549.00 | | | 1129.9490.01 |
| W20 | DW HF-KABEL W20<br>RF CABLE W20<br>NUR VAR/ONLY MOD: 08 | 1129.9532.00 | | | 1129.9490.01 |
| W22 | DV HF-KABEL W22<br>RF-CABLE W22 | 1129.9710.00 | | | 1129.9749.01 |
| W29 | DY FLACHBANDLEITUNG<br>FLAT CABLE W29 | 1093.5156.00 | | | 1129.9032.00 |
| W40 | DY FLACHBANDKABEL W40<br>CABLE 16 PIN | 1130.2515.00 | | | |
| W70 | DF DISPLAYVERBINDER<br>CABLE<br>NUR VAR/ONLY MOD: 02<br>ONLY FOR FSP" | 1091.0911.00 | LACON | 1091.0911 | 1093.4708.01 |
| W70 | DF DISPLAYVERBINDER L=550<br>CABLE<br>NUR VAR/ONLY MOD: 03<br>ONLY FOR FSU" | 1091.2595.00 | MBS | 1091.2598 | 1093.4708.01 |
| W100 | DF WANDLERKABEL L=250<br>CABLE<br>NUR VAR/ONLY MOD: 02<br>ONLY FOR FSP" | 1091.0928.00 | LACON | 1091.0928 | 1093.4708.01 |
| W100 | DF WANDLERKABEL L=350<br>CABLE<br>NUR VAR/ONLY MOD: 03<br>ONLY FOR FSU" | 1091.2589.00 | MBS | 1091.258 | 1093.4708.01 |
| W300 | DY W300 FLOPPY DATA<br>W300 FLOPPY DATA | 1129.9726.00 | | | 1129.9032.00 |
| W301 | DX FLOPPY POWER<br>FLOPPY POWER | 1129.9732.00 | | | 1129.9032.00 |