KWS | ELECTRONIC TEST EQUIPMENT GMBH

VAROS 109

Digital satellite measuring receiver
Manual

Contents

Chapter 01
Release notes

Version		Neuer Inhalt (Beschreibung)
10.0		Initial Version
10.1 (Vxx.10e)	JESS-Menu	Jess-Menu modified
	UNICABLE-Menu	UNICABLE-Menu modified
10.2 (Vxx.10f)	Assistance Mode	Assistant Mode on startup can be disabled

Chapter 02

Notes on Safety and Use, Maintenance and Service

2.1 Safety notes

Please note the instructions and warnings contained in these operating instructions.

This device is built and tested according to EN 61010-1 (protective measures for electronic measuring instruments).

Important!
This device may only be powered with the power cable originally delivered from the factory.

The device is in perfect working order upon leaving the factory. To maintain this condition and to ensure safe operation, the user must check the device and the power cord regularly for damage. A damaged power cord must be replaced immediately.

The device has protection class IP20 in accordance with EN 60529.

Discharges across the plug connector can damage the device. Protect the device from electrostatic discharge when handling and operating it.

The maximum external voltage that van be applied to the measuring receiver's RF input is 24 V. A higher voltage may destroy the input circuits.

Do not cover the ventilation slots on the device. Covering the slots can result in reduced air circulation in the device, which can cause heat build-up and overheating of the electronic components.

Passage from the battery regulations (BattV)
This device contains a battery which incorporates hazardous substances. It must not be disposed of I domestic waste. At the end of its working life it should be disposed of only through the ESC customer service department or at a designated collection point.

2.2 Usage Notes

The guarantee for a new device ends 24 months after delivery.

The guarantee is invalidated if the device is opened.

Sharp tools (e.g. a screwdriver) can damage the plastic glass in front of the TFT display, thus destroying the TFT.

The contrast of the TFT display deteriorates at ambient temperatures below 5 °C.

The TFT display does not reach maximum brightness for a few seconds after the device is cold-started.

The device reaches full measurement accuracy after about 5 minutes of operation.

The use of wireless DECT phones and GSM phones close to the device can cause disturbances and faulty measurements.

2.3 Maintenance

The device is maintenance-free.

2.4 Cleaning

The case and the TFT display should be cleaned with a soft, lint-free dust cloth. Never use solvents such as diluents for cellulose lacquers, acetone or similar since they may damage plastic parts or the coating on the front panel.

Any dust should be removed from the ventilation slots regularly so that the air circulation provided by the built-in ventilator is not obstructed.

2.5 Calibration

The device should be recalibrated at least every two years. It is automatically calibrated at the factory in case of upgrading, repairs or servicing.

2.6 Service

Service address: see back cover of operating manual.

Chapter 03

Specifications

Subject to technical change

FREQUENCY RANGE

SAT	910–2,150 MHz
Auflösung	1 MHz
	Transponder frequency or 1st IF entry

OPERATING MODES

DVB-S, DVB-S2

Analyzer in all ranges

OPERATION

Input	via keyboard
Monitor	5.7" Color TFT, VGA resolution
User promting	via OSD (On Screen Display)
	in German, English, French and Italian

Built-in speaker for audio reproduction

RF-INPUT

F socket/75 Ohm (IEC 60169-24) (ACCESSORIES, exchangeable)

Return loss	> 8 dB (910– 2,150 MHz)

INPUT ATTENUATOR

0–30 dB in 4 dB increments

LEVEL MEASUREMENT

Measuring range	30–100 dBμV
Information range	30 – 110 dBμV
Resolution	0.5 dB
Measuring accuracy	±2.0 dB (at 20 °C)
	±2.5 dB (0 °C–40 °C)
Measuring bandwidth (RB)	> = 10 MHz depending on symbol rate
Acoustic level trend indicator	can be switched on/off
Level trend bar	with MaxHold Indicator

ANALYZER

Digital analyzer

Measuring bandwidth (RB)	10 MHz full Span, 4 MHz for Span 1 and 2
Span (frequency segment))	SAT: Total range, 300 MHz or 76 MHz

Switch directly between analyzer and receiver modes

DVB-S

QPSK demodulator	(Per ETS 300421)
Symbol rates	2–45 MSym/s
Frequency offset (df)	Resolution: 0.1 MHz
	Measuring accuracy: ±100 kHz
Measuring parameters	(Per ETR 290)
VBER	10^{-2} to 10^{-8} (bit error rate after Viterbi)
CBER	10^{-2} to 10^{-8} (bit error rate before Viterbi)
MER	2–20 dB resolution 0.1 dB
Noise Margin	NM in dB, resolution 0.1 dB
Searching function	

DVB-S2

QPSK/8PSK demodulator	(Per ETS 302307)
16APSK, 32APSK	not supported
FEC 1/4, 1/3, 2/5	not supported
Symbol rates	2–45 MSym/s
Frequency offset (df)	Resolution: 0.1 MHz
	Measuring accuracy: ±100 kHz
Measuring parameters	(Per ETR 290)
LBER	10^{-1} to 10^{-8} (bit error rate after LDPC)
CBER	10^{-2} to 10^{-8} (bit error rate before LDPC)
MER	1–20 dB resolution 0.1 dB
Noise Margin	NM in dB, resolution 0.1 dB
Automatic detection of DVB-S/DVB-S2	
Searching function	

CONSTELLATION DIAGRAM

	(Option) I/Q analysis of digitally modulated signals
Sources	DVB-S, DVB-S2
Reception rate	Approx. 15 seconds
3-dimensional display	in color
(Status frequency)	

MPEG2, MPEG4 decoder

NIT evaluation

Direct tuning of the receiver from the NIT
Display of MPEG video parameters
Video bit rate measurement in Mbit/s

Video decoding	MPEG-2 (ISO/IEC 13818-2)
	H.264/AVC Level 4.1 HP (ISO/IEC 14496-10)
Audio decoding	MPEG-2 (ISO/IEC 13818-3)
	Dolby Digital AC-3, Dolby Digital Plus
	MPEG-2 AAC (ISO/IEC 13818-7)
	MPEG-4 AAC (ISO/IEC 14496-3)
Chinese Font	GB2312

CI (Common Interface)

1 CI slot

Presentation of card menu

DATA LOGGER

Stores measurements automatically in the form of an XML file
on a USB stick

INTERFACES

DVI	Digital video output for connecting a TV device with a DVI/ HDMI input.
	Output impedance 100 Ohm
	Difference output level typ $1V_{pp}$
USB-A	USB-A socket for data logger and software update USB 2.0

OPTICAL RECEIVER

(Option)

Connector	SC/APC (with protective cap)
Wavelength (Lambda)	1,260–1,620 nm (with protective cap)
Max. optical input power	+8 dBm (continous power)
Return loss	> 40 dB
Equivalent Input Noise (ON)	< 8 pA/$\sqrt{Hz}$
RF frequency range	910–2,150 MHz
Input power, nominal	−7…+3 dBm

Measuring parameters

Optical power	−35d Bm … +9 dBm
Wavelength (calibrated)	1,310 nm, 1,490 nm, 1,550 nm
Resolution	0.1 dB
Measuring accuracy	± 0.35 dB
Optical modulation index (OMI)	Individual OMI
Resolution	0.1 %
Measuring accuracy	± 10 % (of displayed value)

| **TUNING MEMORY** | 99 Memory locations |
| | Memory protection function |

REMOTE SUPPLY

Maximum power	500 mA (kurzschlussfest)
Voltages	14 V/18 V
22 kHz modulation	$U_{SS} = 0.8\ V_{PP}$
DiSEqC	Versionen V1.0, V1.1, V1.2, V2.0

UNICABLE

Current measuring	0–500 mA
Resolution	1 mA
Tolerance	+5 % of final value

POWER SUPPLY

| **External 12 V** | 11–15 V DC max. 2,5 A |

or external primary power supply 12 V/2.5 A (included in delivery) via extra-low voltage jack according to DIN 45323
Power consumption: max. 30 W

Storage battery	Li-Ion battery pack 7.2 V/6.6 Ah
Operating time	approx. 3.5 hours (dependant upon the LNB load) automatic cutout as protection against exhaustive discharge
Charging time	Approx. 3 hours
Battery managemen	Battery can be charged using 12 V external supply

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UMGEBUNG

Betriebstemperatur	0° C bis +45° C
Lagertemperatur	−10° C bis +55° C
Akku-Ladetemperatur	+15° C bis +35° C

| **ELEKTROMAGNETISCHE VERTRÄGLICHKEIT** | nach EN 61000-6-2 und EN 61000-6-3 |

| **SCHUTZMASSNAHMEN** | nach EN 61010-1 |

| **ABMESSUNGEN** | B 164 mm × H 266 mm × T 70 mm |

| **GEWICHT** | ca. 1,3 kg mit eingebautem Akkupack |

| **LIEFERUMFANG** | Im Lieferumfang enthalten |

Transportkoffer, IEC-Messkabel 75 Ohm, Optisches Kabel SC/APC auf FC/PC (Option Optik), Netzteil und Netzkabel extern, USB-Stick, Bedienungsanleitung

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Chapter 04

Contol and connections elements, pin configurations

4.1 Front Panel with Top and Bottom Section

4.2 Back of the device

4.3 USB-A socket

Pin 1 = V_{CC} (+5 V)
Pin 2 = Data D −
Pin 3 = Data D +
Pin 4 = GND
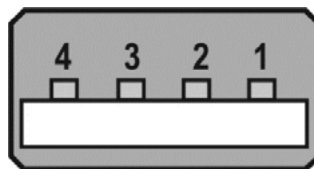
Socket A

4.4 DVI output

Compliant with DDWG (Digital Display Working Group) DVI (Digital Visual Interface) Revision 1.0.
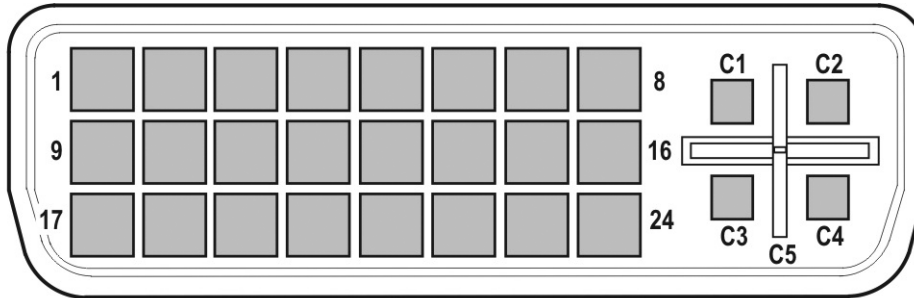

```
 1 =  T.M.D.S. Data 2-          11 =  T.M.D.S. Data 1/3 Shield    21 =  n.c.
 2 =  T.M.D.S. Data 2+          12 =  n.c.                        22 =  T.M.D.S. Clock Shield
 3 =  T.M.D.S. Data 2/4 Shield  13 =  n.c.                        23 =  T.M.D.S. Clock+
 4 =  n.c.                      14 =  +5V Power                   24 =  T.M.D.S. Clock-
 5 =  n.c.                      15 =  GND
 6 =  DDC Clock                 16 =  Hot Plug Detect             C1 =  n.c.
 7 =  DDC Data                  17 =  T.M.D.S. Data 0-            C2 =  n.c.
 8 =  n.c.                      18 =  T.M.D.S. Data 0+            C3 =  n.c.
 9 =  T.M.D.S. Data 1-          19 =  T.M.D.S. Data 0/5 Shield    C4 =  n.c.
10 =  T.M.D.S. Data 1+          20 =  n.c.                        C5 =  n.c.
```

4.5 12 V power supply

Extra-low voltage jack per DIN 45 323

Chapter 05

Installation

5.1 Mains operation

Only power the device from the mains using an external mains adapter connected to the 12 V extra-low voltage jack. A suitable adapter with connecting cable is included in delivery (see "External power supply").

> **!** **IMPORTANT!**
> Always disconnect the device from the power supply when disassembling the device (e.g. replacing batteries).

5.2 Battery opreation

5.2.1 Replacing the battary

Only the manufacturer or service technicians authorised by the manufacturer may replace the internal battery. The manufacturer's guarantee will be void if the housing of the measuring receiver is opened by anyone else.

5.2.2 Battery management

The device has internal battery management, which optimises the charging and discharging of the battery. The battery begins to charge as soon as the device is connected to the mains or an external voltage supply. The device starts in charging mode if it is not being used; during this time only the OSD window on the top left is shown with the text "Charging BATT" and the battery symbol.

The display screen turns off after a minute. Pressing any button turns the display back on. If the device is operated in measuring mode, the charging current may be reduced somewhat depending on the operating status, causing the charging process to take longer. When the battery is being charged, the "charge" LED lights up red. Once the battery is fully charged, the internal battery management switches to maintenance charging and the "charge" LED turns green.

The device also has a charge status indicator. A status bar in the frequency window indicates the remaining charge of the battery at all times. If the battery charge becomes critical, the word "low" appears in red next to the bar. You can still complete the current measurement, but the battery should then be recharged as soon as possible. The device shuts down automatically to prevent total discharge.

5.3 Operation using an external power supply

In addition to using the battery, you can run the device on external direct current supplied by the mains adapter or the cigarette lighter adapter in a vehicle, for example. Direct current is fed via the extra-low voltage jack on the bottom section of the device. The external voltage supply must be in the range of 11 V to 15 V. The maximum current consumption is 2.5 A. When the device is supplied with appropriate voltage, the "charge" LED on the front side of the device lights up.

5.4 Fan control

A small, in-built fan ensures that the electronic components are well ventilated. This fan is controlled by the microprocessor using a temperature sensor.

5.5 Turn on

The device processor requires approx. 5 seconds to boot up. During this time, the "charge" LED lights up yellow. Afterwards, a display appears on the screen.

5.6 Adjust volume, image brightness, color temperature and saturation

Mit der Taste AV SET wird je einen Balken für die Bildhelligkeit und für die Lautstärke auf dem Bildschirm eingeblendet.

These can then be set with the arrow keys. This function is not possible in some operating states such as level measurement. With the MODE button, the function of the lower bar can be changed from image brightness to color temperature and further to color saturation.

This allows the color representation of the display to be optimized and the set values are stored in the non-volatile memory. By pressing AV SET or ESC again, the bars are hidden and the arrow keys have their original function again. When the AV menu is called up again, the lower bar again shows the set image brightness.

Chapter 06

Menu structure

Most functions of the device can be selected in a clear menu structure.

The main menu of the device is adjusted to the currently set operating mode respectively. This ensures that functions can only be selected where needed.

Selecting main menu: Press **MODE** key

Leaving the menu: Press **MODE** or **ESC** key

Selecting a menu point: Select the desired menu item using the arrow keys (Up or Down) and press **ENTER**.

Back to previous menu level: Press **ESC** key
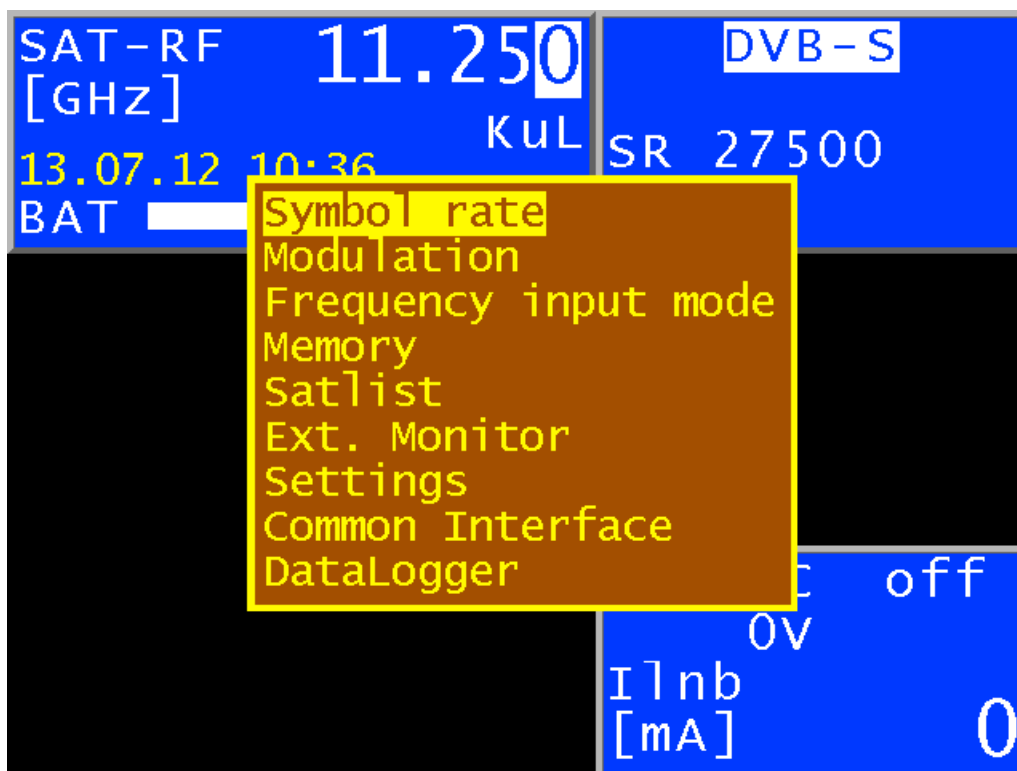
The picture shows the menu in the DVB-S range with RF frequency input mode.

Chapter 07

Measuring range

7.1 Frequency input

Frequencies are displayed in the frequency window. Enter the value of the frequency in MHz or GHz (see below). Set the desired frequency using the number keys or arrow keys. The decimal unit can be changed from 0 to 9 by pressing the **Up and Down arrow keys** when the cursor is on that unit. Use the ← and → keys to move the cursor left and right. Pressing a number key enters the corresponding value in the lowest decimal unit. All the positions above are set to zero. Every time an additional number is entered, the existing value shifts a position to the left and the latest entry is used for the lowest unit. Confirm by pressing **ENTER**. If the value entered is not within the valid range, it will be limited to the corresponding minimum or maximum value.

After that, the receiver is tuned and the actual measured values are displayed.

Press the **ESC** key, an arrow key or a number key to end the measurement procedure. A new frequency can be set as described above.

7.1.1 IF input

To change the device to IF input, select
MODE > Frequency input mode > SAT-IF. The frequency window displays SAT-IF (MHz).

7.1.2 RF input

To change the device to RF input, select
MODE > Frequency input mode > HF[GHz]. The frequency window displays SAT-RF (GHz).
This function serves to incorporate frequency conversion in an LNB from the transponder frequency (RF) to the first SAT IF, depending on the LNB oscillator frequency (LO).

For Ku band LNBs: ZF = HF − LO.   The device calculates: HF = ZF + LO.
For C band LNBs: ZF = LO − HF.   The device calculates: HF = LO − ZF.

7.1.2.1 Ku-band

The device provides two user-defined LNB oscillator frequencies for RF inputs in the Ku band. These can be changed under **MODE > Settings > LNB-Frequencies > Ku low band (Ku high band)** within the range of 9,000 to 11,000 GHz. The factory presettings are 9,750 GHz (low band) and 10,600 GHz (high band).

The device also provides three ways of using the two oscillator frequencies: Using the menu **MODE > Settings > LO-Allocation**, choose between
"Ku standard" (coupled to the LNB setting), "Ku LOLow" (low-band oscillator always incorporated regardless of LNB setting) and
"Ku LOHigh" (the high-band oscillator respectively).

7.1.2.2 C band

The device provides one user-defined LNB oscillator frequency for RF inputs in the C band. This can be changed under
MODE > Settings > LNB-Frequencies > C band
within the range of 4,000 to 6,000 GHz. The factory presetting is 5,150 GHz. To use the LNB oscillator frequency, select the "C band" menu item via **MODE > Settings > LO-Allocation**.

If the device is operating with RF input, the LO used is shown in the frequency window with the abbreviations
»KuL« (LO for Ku low band),

»KuH« (LO for Ku high band) bzw.

»_C_« (LO for C band).

7.2 DVB-S mode

Using this mode, QPSK-modulated DVB-S signals can be received and measured.

Frequeny window ———

Level window ———

VBER/CBER window ———

MPEG window ———

——— Parameter window

——— MER window

——— LNB window

```
SAT-RF   10.744   DVB-S
[GHz]             locked
           KuL  SR 22000
23.09.20 14:41   CR=5/6
BAT ▭▬▭
LEVEL[dBµV]
              66.5
▬▬▬▬▭▬▬▬▬
     VBER<1.00e-8   NM[dB]  6.9
CBER  <1.00e-8   MER[dB]  14.9
PSI extraction   DiSEqC   V1.0
ready!           P1 H/Lo
ARD              Ilnb
19.2° East       [mA]     134
```
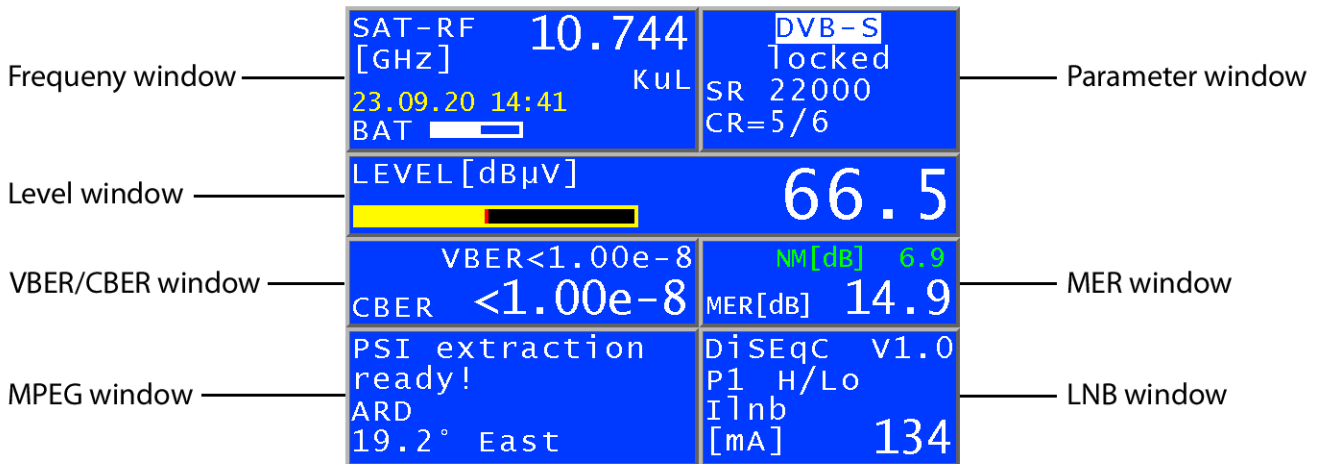
7.2.1 Symbol rate input

You must set the corresponding symbol rate before receiving a DVB-S signal. The device offers the operator ten preset symbol rates for rapid input. Select **MODE > Symbol rate** to use one of the ten preset symbol rates. Use the **Up/Down** arrow keys to select the required symbol rate. The new symbol rate is selected when you press **ENTER**.

Press > to change the preset symbol rate between 2,000 and 45,000 kBd (2,000—45,000 MSym/s). At tuning the device tries out every symbol rate of this list until it is locked. To shorten this procedure you can use only the first five of the list or all ten. You can choose between these options via the menu Used SRs. This setting is store in the non-volatile memory.

```
SAT-RF   10.744   DVB-S
[GHz]             locked
                  22000
29.07.15 09:34  Symbol rate  =5/6
BAT ▭▬▭    1 27500
             2 22000
LEVEL[dBµV   3  5632     68.0
             4  4000
▬▬▬▭▬▬▬       5  2400
     VBER<1   6 30000   NM[dB]  6.2
             7 29900
CBER  <1.    8 29700  [dB]  13.9
             9 29500
PSI extrac  10  6666   SEqC   V1.0
ready!     Used SRs      H/Lo
ARD                    Ilnb
19.2° East             [mA]    28
```
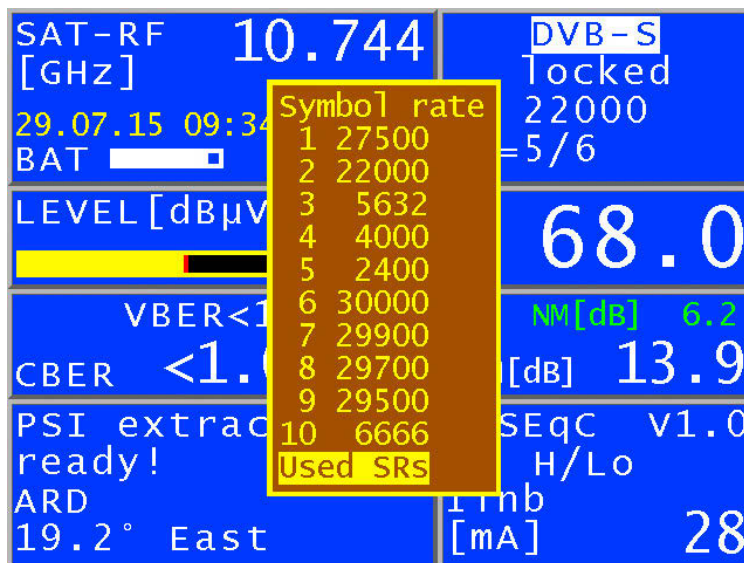
7.2.2 Scan

Use this function to search the entire satellite frequency range (910—2,150 MHz) for DVB-S signals whose symbol rates correspond to the value that is currently set in the device. During the search, the device alternates between the currently set symbol rate and the first two preset symbol rates.

This means that the device scans the satellite range with a maximum of three different symbol rates.

Start the scan by tuning the measuring receiver to a frequency at which the scan should begin (see "Frequency input"). Pressing **ENTER** begins the process, as indicated by the "SCAN" message in the frequency window. When the device finds a transponder, the scan is halted and the measuring receiver measures the frequency found. Stop the scan by pressing a number key, the **Up or Down** keys, or the **ESC** key.

During the scan, the device also detects DVB-S and DVB-S2 signals and switches the measuring receiver to the relevant operating mode.

Note: In the UNICABLE and JESS operating mode the scan function is deactivated.

7.2.3 DVB-S parameters

The parameters are shown in the parameter window. If the measuring receiver is tuned to a frequency (see "Frequency input"), the DVB-S channel decoder attempts to synchronise with the signal that is present; this activity can be traced using the "SCAN" message in the parameter window.

The measuring receiver attempts to synchronise to the DVB-S signal that is present using the set symbol rate. If this is not successful, all of the preset symbol rates are set one after another.

If a QPSK signal with the set symbol rate is present, the channel decoder locks and **LOCKED** is displayed in the device's parameter window. Otherwise, the **UNLOCKED** message is shown. This may be caused by the following: none of the set symbol rates fit; the receive level is too low; there is too much noise in the signal; or there is no DVB-S signal at this frequency.

When the DVB-S channel decoder receives a signal, the device shows its code rate and modulation scheme in the parameter window. At the same time, bit error rate and MER measurement is activated. The measured values are shown in the BER window and the MER window. The MPEG window is also displayed; here you can follow the search for PSI (program service information) in the transport stream. Further information can be found in the "MPEG Decoder" section.

7.2.4 AFC (Automatic Frequency Control)

The device operates with the AFC switched on in the standard settings. This means that if the DVB-S/S2 receiver detects a frequency offset between the transmitter and the receiver, the tuner on the receiver is adjusted accordingly so that the frequency offset disappears.

However, if, for example, the frequency drift of an LNB is to be observed, it is useful to switch off the AFC. In this case, the device shows the frequency offset in the display (df = …). The resolution is 0.1 MHz. The sign in front of the value is determined by the following relationship:

$f_{LNB} = f_{instrument} + \Delta f$

with f_{LNB} = LNB frequency, $f_{instrument}$ = adjusted frequency in the intrument, Δf = frequency drift.

```
SAT-RF   !10.733       DVB-S2
[GHz]                  locked
            KuL     SR 22000
10.10.16 12:11      CR=2/3 8PSK
BAT ▭▭▭▭ df= 3.0MHz
LEVEL[dBµV]
▭▭▭▭▭▭▭▭▭▭▭        62.0
PE=      0 /00.00.00   NM[dB]   7.7
CBER    1.25e-3   MER[dB]  14.8
PSI extraction    DiSEqC   v1.0
ready!            P1 V/Lo
Movistar+         Ilnb
19.2° East        [mA]       12
```
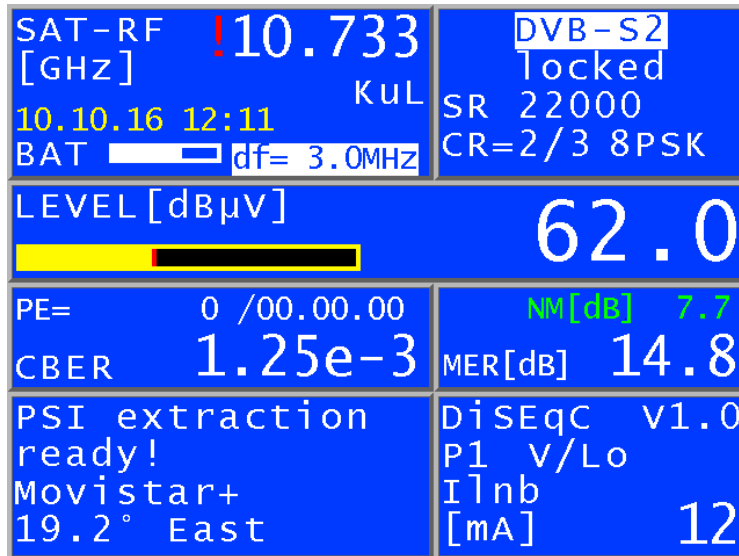
Note:

The measured values from the measuring receiver are calibrated with AFC switched on. Therefore, the AFC should only be switched off in order to check for a frequency offset.

The AFC of the receiver can be switched on and off using the menu **MODE > AFC** and it is always activated after stopping the measurement using **ESC**.

7.2.5 BER measurement (bit erroe rate measurement)

As mentioned in the previous section, the BER measurement result is displayed in the BER window. The measuring receiver can measure the bit error rate before Viterbi (CBER) and after Viterbi (VBER) simultaneously. VBER is displayed in a smaller font on the top line of the BER window. CBER is below in a large font.

7.2.6 MER measurement

The MER value of the signal in the baseband (after the demodulator) is displayed in dB in the MER window. The measuring range is between 2.0 and 20.0 dB. The resolution is 0.1 dB.

7.2.7 Noise Margin (NM)

For "white noise" a minimum limit for the signal quality where no error occurs (QEF) can be defined.

The margin of the MER to this limit is the noise margin (NM). That value is displayed in the MER-window in dB with a resolution of 0.1 dB.

To simplify the decision if the signal is good, NM is colored green, yellow if it's less optimal or red if it's bad. The limits of the VBER (> $2e^{-4}$ is bad and <$1e^{-6}$ is good) also contributes to this decision.

The following table shows minimum signal quality in relation to the FEC.

DVB-S (QPSK)

FEC	MER (QEF) rounded values
1/2	5 dB
2/3	6 dB
3/4	7 dB
5/6	8 dB
7/8	9 dB

7.3 DVB-S2 mode

Use this mode to receive and measure QPSK/8PSK-modulated DVB-S2 signals.

Frequeny window ——

Level window ——

VBER/CBER window ——

MPEG window ——

—— Parameter window

—— MER window

—— LNB window

```
SAT-RF    11.303     DVB-S2
[GHz]                locked
         KuL   SR 22000
23.09.20 14:42       CR=2/3 8PSK
BAT

LEVEL[dBµV]
                    72.0

LBER<1.00e-8    NM[dB]  7.6
CBER  1.80e-3   MER[dB]  14.7

PSI extraction  DiSEqC  V1.0
ready!          P1  H/Lo
ORF             Ilnb
19.2° East      [mA]    134
```
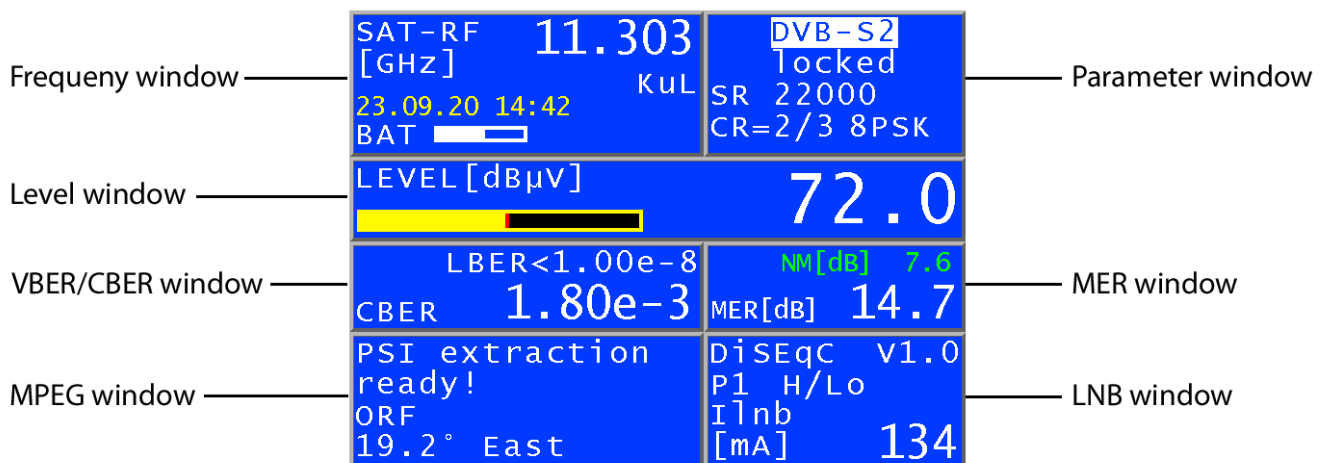
DVB-S2 is a further development of DVB-S. In addition to QPSK a higher-quality modulation scheme (8PSK) has been introduced. As an option, pilots can be transmitted to help the receiver synchronise when reception conditions are not favourable. Furthermore, more efficient error protection (LDPC/BCH) increases bandwidth effectiveness (bit rate/bandwidth at the same MER).

7.3.1 Symbol rate input

You must set the corresponding symbol rate before receiving a DVB-S2 signal. The device offers the operator ten preset symbol rates for rapid input.

MODE > Symbol rate opens the selection area for the five preset symbol rates. Use the **Up/Down** arrow keys to select the required symbol rate. The new symbol rate is set when you press **ENTER**.

Press > to change the preset symbol rate between 2,000 kBd and 45,000 kBd (2,000—45,000 MSym/s). At tuning the device tries out every symbol rate of this list until it is locked. To shorten this procedure you can use only the first five of the list or all ten. You can choose between these options via the menu Used SRs (see above at DVB-S mode). This setting is store in the non-volatile memory.

7.3.2 Scan

Use this function to scan the entire satellite frequency range (910—2,150 MHz) for DVB-S signals whose symbol rates correspond to the value that is currently set in the device.

During the scan, the device alternates between the currently set symbol rate and the first two preset symbol rates.

This means that the device scans the satellite range with a maximum of three different symbol rates.

Start the scan by tuning the measuring receiver to a frequency at which the scan should begin (see "Frequency input"). Pressing **ENTER** begins the process, as indicated by the "SCAN" message in the frequency window. When the device finds a transponder, the search is halted and the measuring receiver measures the frequency found. You can stop the scan by pressing a number key, an arrow key (**Up/Down**) or the **ESC** key.

During the scan, the device also detects DVB-S and DVB-S2 signals and adjusts the measuring receiver to the relevant operating mode.

> **Note:**
> In the UNICABLE and JESS operating mode the scan function is deactivated.

7.3.3 DVB-S2 parameters

The parameters are shown in the parameter window. If the measuring receiver is tuned to a frequency (see "Frequency input"), the DVB-S2 channel decoder attempts to synchronise with the signal that is present; this activity can be traced using the "SCAN" message in the parameter window.

The receiver first attempts to synchronise to the DVB-S2 signal that is present using the set symbol rate. If this is not successful, all of the preset symbol rates are set one after another. In addition, the device automatically detects the DVB-S/DVB-S2 operating modes.

If a QPSK/8PSK signal with the set symbol rate is present, the channel decoder locks and **LOCKED** is displayed in the parameter window. Otherwise, the **UNLOCKED** message is shown. This may be caused by the following: none of the set symbol rates fit; the receive level is too low; the signal is too noisy; or there is no DVB-S2 signal at this frequency.

When the DVB-S2 channel decoder receives a signal, the device shows its code rate and modulation scheme in the parameter window. At the same time, bit error rate and MER measurement is activated. The measured values are shown in the BER window and the MER window. The MPEG window is also displayed; here you can follow the search for PSI (program service information) in the transport stream.

Further information can be found in the "MPEG Decoder" section.

7.3.4 AFC (Automatic Frequency Control)

Siehe oben unter DVB-S Betrieb.

7.3.5 BER measurement (bit error rate measurement)

As mentioned in the previous section, the BER measurement result is displayed in the BER window. The measuring receiver can measure the bit error rate before LDPC (CBER) and afterwards (LBER) at the same time.

The LBER is displayed in a smaller font on the top line of the BER window. CBER is below in a large font.

Note:

The internal error protection is called LDPC (Low Density Parity Check) in the DVB-S2 standard, and the external error protection is called BCH (Bose Chaudhuri Hocquenghem). In particular, the performance of the LDPC error protection is significantly better than that of the inner error protection of DVB-S (Viterbi).

7.3.6 MER measurement

The MER value of the signal in the baseband (after the demodulator) is displayed in dB in the MER window. The measuring range extends to 20.0 dB; the resolution is 0.1 dB.

7.3.7 Systemreserve NM (Noise Margin)

For "white noise" a minimum limit for the signal quality where no error occurs (QEF) can be defined.

The margin of the MER to this limit is the noise margin (NM). That value is displayed in the MER-window in dB with a resolution of 0.1 dB. To simplify the decision if the signal is good, NM is colored green, yellow if it's less optimal or red if it's bad. The limits of the LBER ($>1e^{-7}$ is bad) also contributes to this decision.

The following table show minimum signal quality in relation to the FEC and modulation.

DVB-S (QPSK)		DVB-S2 8PSK	
FEC	MER (QEF) rounded values	FEC	MER (QEF) rounded values
2/3	3 dB	2/3	3 dB
3/4	5 dB	3/4	5 dB
5/6	6 dB	5/6	6 dB
9/10	7 dB	9/10	7 dB

7.3.8 Packet error measurement

Short interruptions in the DVB-S/S2 signal usually cannot be detected using MER or BER measurements.

They can make entire packets in the transport stream unusable for the MPEG decoder, however. This can cause the picture to freeze temporarily or the sound to crackle. The extent of this depends largely on the receiver hardware.

In the **MODE** menu, a function can be activated which sums up all corrupt transport stream packets starting from the time of activation or when a new frequency is entered. The number of packet errors (PE = Packet Error) and the amount of time that has passed since the last tuning process is displayed in the BER window instead of the VBER or LBER. This function can be deactivated again in the above menu or by performing a restart.

7.4 Level measurement

As soon as the device is set to a frequency (see "Frequency setting"), it begins to measure the level and displays the measured value in dBµV in the level window.

The measuring range extends from 30 to 110 dBµV with a resolution of 0.5 dB.

The measuring bandwidth is automatically adjusted to the channel bandwidth being measured. The measuring rate for the numerical level value is approximately 3 Hz.

7.4.1 MAX-Hold function

In addition to the numerical level value, the level window also displays a yellow level trend bar whose length changes proportionally to the level value.

A vertical red line remains on the trend bar to indicate its maximum level since the last tuning process.

The repetition rate of the level bar is 10 Hz. Use this function as an aid when aligning the parabolic antenna.

7.4.2 Acoustic level trend indicator

The acoustic level trend signal also helps you to align a parabolic antenna. The loudspeaker emits a tone whose frequency changes in proportion to the level that is measured. The frequency of the signal tone rises as the level increases.

The function can be switched on or off at any time via the menu **MODE > Acoustic level > on (off)**.

7.5 LNB supply

The measuring receiver controls a connected LNB or a multiswitch using the conventional 14/18 V–22 kHz control (maximal four SAT IF levels) or with the DiSEqC control. The supply is short-circuit-proof and provides a maximum current of 500 mA. In the event of a short circuit, or if the current is too high, the device automatically turns off the LNB feed.

If an external LNB feed is present that is higher than that set, this feed is also switched off. The LNB-LED lights up as soon as the LNB feed is active.

7.5.1 14/18 V–22 kHz contol

LNB > DiSEqC > off activates the 14/18 V–22 kHz control (or DiSEqC off).
Once it is active, the LNB feed is set to 0 V.

The required SAT IF layer can be set via the menu **LNB > SAT-IF-Layer > 14 V, 18V, 14 V/22 kHz, 18 V/22 kHz**.

7.5.2 DiSEqC

DiSEqC defines a standard which transmits control commands from the master (e.g. receiver) via the RF cable to the slave (e.g. multiswitch, positioner) using FSK (frequency shift keying with 22 kHz). DiSEqC is backward compatible with the 14/18 V–22 kHz control.

Die folgende Abbildung zeigt den zeitlichen Ablauf einer DiSEqC-1.0-Sequenz:
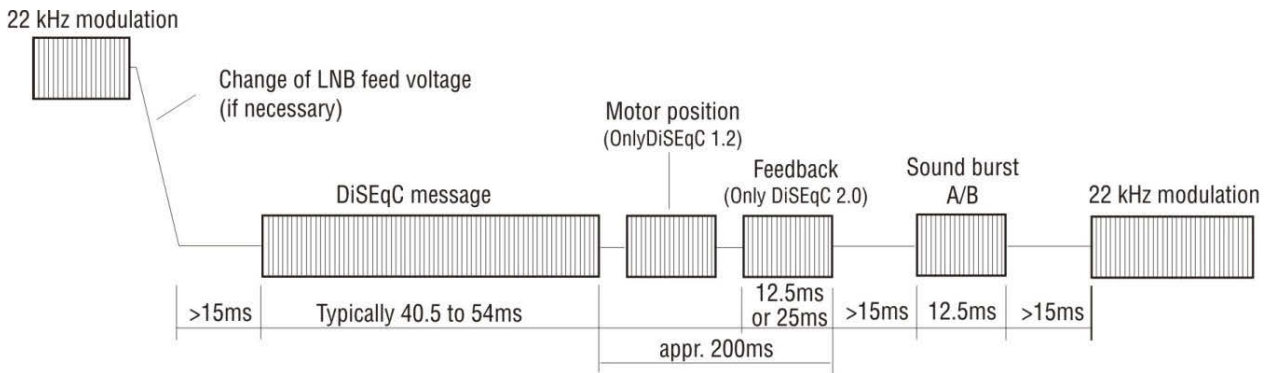
The 14/18 V–22 kHz control follows immediately after a DiSEqC sequence. This allows non-DiSEqC-compatible components to be run when DiSEqC control is active.
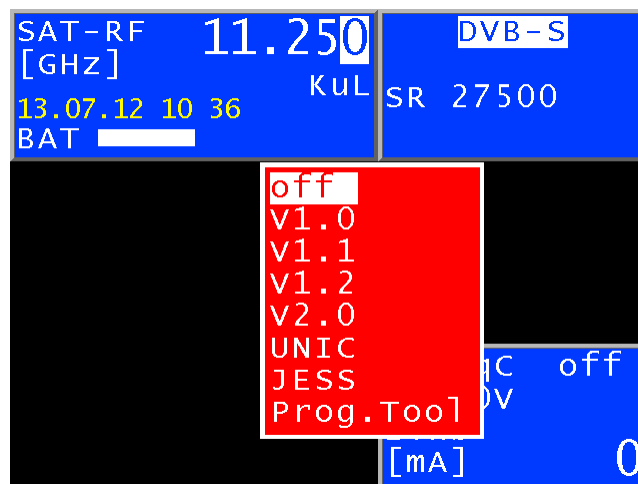
The image shows the selection menu for the DiSEqC versions and single-cable standards.

7.5.2.1 DiSEqC V1.0 control

When **LNB > DiSEqC > V1.0** is set, the device operates according to DiSEqC Standard V1.0 and allows you to control up to four satellite positions with up to four SAT IF levels each.

A SAT IF level is set using **LNB > SAT-IF-Layer > V/Lo, H/Lo, V/Hi, H/Hi**.

Set a satellite position using **LNB > Satellite > P1—P4**. P1 can be used for ASTRA and P2 for EUTELSAT, for example.

7.5.2.2 DiSEqC V1.1 control

LNB > DiSEqC > V1.1 activates the DiSEqC V1.1 menu. V1.1 allows you to control a total of up to 256 SAT IF levels. V1.1 also allows for DiSEqC component cascading.

This means that compatible multiswitches or switching relays can be connected in series. Multiple repetitions of the DiSEqC command(s) are required for this. See the following example for further information.

The SAT IF level settings and satellite position settings are identical to those for V1.0. Added to this is the control "Uncommitted switches", which is operated via **LNB > Uncommitted Switch**. With "Uncommitted switches" you can split the 16 SAT IF levels that are possible with V1.0 into another 16 branches using the cascading option; this is achieved using 4 additional switches (uncommitted switches). In total, up to 256 SAT IF levels can be controlled. The "uncommitted switches" are binary controlled. The Up/Down arrow keys allow one of the 16 possible combinations of

the 4 "uncommitted switches" to be selected using a hexadecimal number ("0" hex—"F" hex). Press **ENTER** to confirm the setting.

V1.1 incorporates DiSEqC component cascading. Therefore, the commands must be repeated. Select the minimal necessary number of repetitions to prevent unnecessary DiSEqC commands being sent, which would slow the control. **LNB > Repeats** allows you to select between 0, 1 (default), 2 or 3 repetitions. Press **ENTER** to confirm the setting.
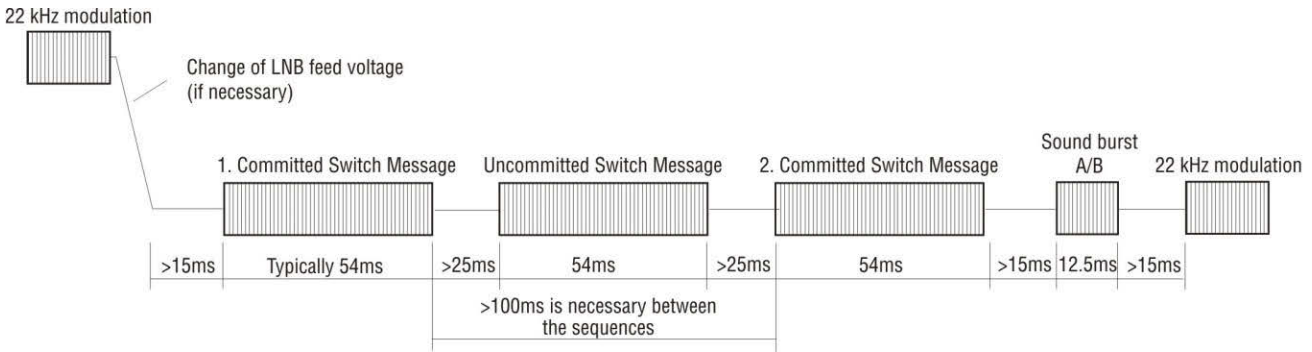
DiSEqC1.1 control sequence with 1 repetition

As mentioned above, DiSEqC1.1 is capable of cascading. The control sequences must therefore be repeated a number of times. DiSEqC components further back in the chain cannot receive the commands intended for them until the earlier components in the chain have processed their commands.

DiSEqC1.0 (committed switches) and DiSEqC1.1 (uncommitted switches) commands are repeated for this reason. The next picture shows a possible configuration in which 64 SAT IF levels are controlled.
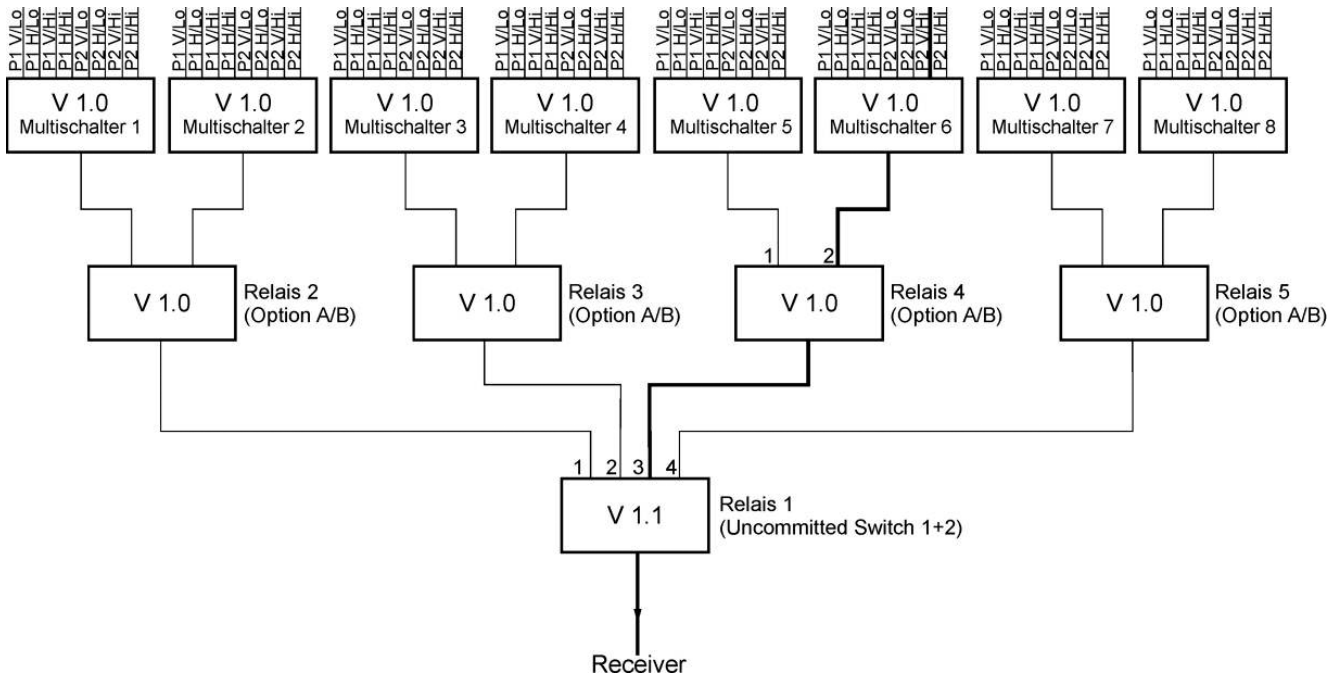
The structure incorporates three hierarchy levels; two repetitions must therefore be set. The following settings must be made to connect the SAT IF route marked in bold:

Relay 1 works with "uncommitted switches" and reacts to switches 1 and 2. The binary combination "10" is required to connect the route to output 3, which corresponds to "2 hex" in hexadecimal.

Relay 4 works with "committed switches" and reacts to the option bit. The option bit must be set to connect the route to output 2. This corresponds to DiSEqC1.0 positions P3 or P4.

Multiswitch 6 switches 8 SAT IF levels. The selected path can be reached via P2V/Hi. However, as relay 4 requires the option bit to be set, the "committed switches" setting must be P4V/Hi.

Settings must thus be made in all 4 DiSEqC1.1 submenus for the marked SAT IF route:

- Set SAT-IF level to V/Hi
- Set satellite position to P4
- Set "uncommitted switches" to "2 hex"
- Set repetitions to 2

Afterwards, the display should show "P42V/Hi". This setting connects the SAT IF route marked bold in the example. All settings are incorporated in the tuning memory and can conveniently be recalled at a later date.

7.5.2.3 DiSEqC V1.2 control

Enter **LNB > DiSEqC > V1.2** to open the DiSEqC V1.2 menu. V1.2 can be used to control positioners with DiSEqC rotors. The menu includes the selection of the 4 LNB levels (identical to V1.0) and the control of a DiSEqC positioner.

The display of the position after "P" in the LNB window does not refer to the position of the position bit as in DiSEqC1.0. Instead, it corresponds to the position number most recently called from the position memory of the DiSEqC rotor. If you switch to DiSEqC V1.1 position number 1 of the DiSEqC rotor is moved to first.

Open the corresponding menu using **LNB** > Positioner.

Drive:

This allows the positioner to be moved to the east and west.

The cursor is at STOP when the menu is open. You can move the cursor to the "East" or "West" menu item using the arrow keys. The motor then moves immediately to the east or west. You do not have to press **ENTER** first. The positioner stops immediately when the **STOP** menu item is activated.

Limit east:

This allows you to set an eastern limit that the positioner cannot pass. To do so, proceed as follows: First use the "Drive" function to move the positioner to the position to be set as the eastern limit.

Then open the "Limit east" function. The limit is saved in the positioner when you press **ENTER** to confirm.

Limit west:

This allows you to set a western limit that the positioner cannot pass. To do so, proceed as follows: First use the "Drive" function to move the positioner to the position to be set as the western limit. Then open the "Limit west" function. The limit is saved in the positioner when you press **ENTER** to confirm.

Limits off:

This function allows you to cancel the east and west limits of the positioner. The motor can then travel back and forth between its mechanical limits.

Save:

This function allows you to save a position reached using the "Drive" function in one of the position memory spaces 0—99. Position 0 is reserved for the reference position of 0 degrees. When called up, some positioners are subject to a special function (e.g. Enable limits).

Go to:

The "Recall" function allows you to open positioner positions that were previously stored using the "Save" function. The positioner then turns to the saved position. Position 0 corresponds to the reference position of 0 degrees. The last position accessed is displayed in the LNB window after "P", e.g. "P03". This position is incorporated into the tuning memory. As a result, various orbital positions can conveniently be recalled from the tuning memory. There is no need do so indirectly via the **Positioner** > Go to menu.

7.5.2.4 DiSEqC V2.0 control

LNB > DiSEqC > V2.0 activates the DiSEqC control V2.0. The difference from V1.0 is the additional feedback query of a controlled DiSEqC component. When the device controls a multiswitch with DiSEqC V2.0, it sends an answer back to the device.

The device evaluates this feedback and reports "**DiSEqC reply correctly received**" if successful, or "**DiSEqC reply incorrectly received**" if there is an error. If the reception of the reply is correct, but the contents is not 0xE4 (reception ok), the reply 'DiSEqC reply = 0x…' (including the HEX-Code) is shown in a blue window.

7.5.3 UNICABLE

The UNICABLE version (satellite signal distribution over a single coaxial cable distribution network) is a variant of the DiSEqC control and corresponds to DIN EN 50494. With this system, the desired transponder is converted to a fixed frequency (center frequency of the UB slot or bandpass) in the UNICABLE unit (LNB or multiswitch). The information coordinating transponders and UB slots is transmitted via the special DiSEqC command to the UNICABLE unit. The standard supports up to 8 UB slots. This allows up to 8 receivers to be operated on 1 cable.

The UNICABLE message contains the following information:
SCR address, horizontal and vertical polarisation, low or high band, and the transponder frequency to be set.

The following control routine is used in this device:
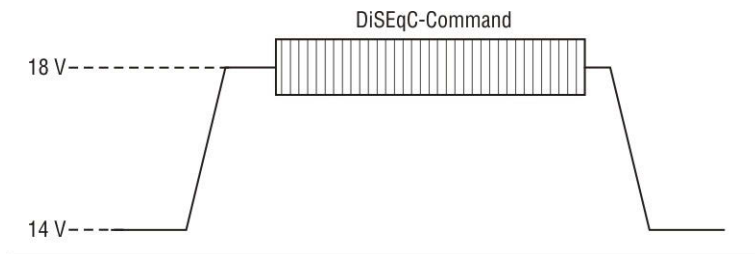
With UNICABLE systems, the signal-generating receiver generates a high DC level as it transmits, which is added to the UNICABLE message (special DiSEqC command). After transmitting the UNICABLE message, the receiver returns to an idle state, in which a low DC level is generated. The receiver must return to a low DC level so that the system is available for other receivers.

The measuring receiver uses 14 V for the low DC level and 18 V for the high DC level.

7.5.3.1 Activation and Configuration

The UNICABLE control is activated via **LNB > DiSEqC > UNIC**.

The first menu that appears allows the user to choose between selecting the SCR-ADR-BANK and setting the SCR-ADR (satellite channel router address) among other things. In the SCR-ADR menu, users can select the user band (UB) bandpass slot for the measuring receiver to use and edit the corresponding center frequency. These parameters can be obtained from the data sheet of the UNICABLE unit being used.
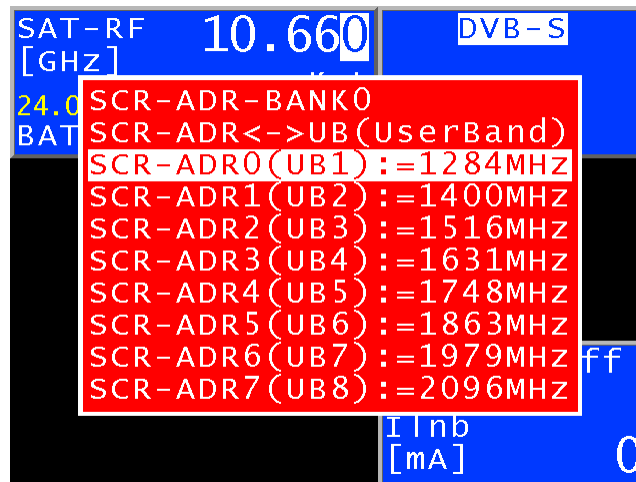
This figure shows the default settings with the following relationships:

SCR-ADR0: = 1,284 MHz	SCR-ADR1: = 1,400 MHz
SCR-ADR2: = 1,515 MHz	SCR-ADR3: = 1,632 MHz
SCR-ADR4: = 1,748 MHz	SCR-ADR5: = 1,864 MHz
SCR-ADR6: = 1,979 MHz	SCR-ADR7: = 2,095 MHz

Note:

Manufacturers have different methods for numbering the UBs. They are numbered either from 0 to 7 or from 1 to 8. The physical address always goes from 0 to 7. For example, the lowest slot, which could also be marked as UB1 on the converter unit, can be activated by selecting SCR-ADR0 (UB1).

To change the settings displayed, proceed as follows:

Use the **Up and Down keys** to select the required SCR address. Then press the > key to access the following menu:
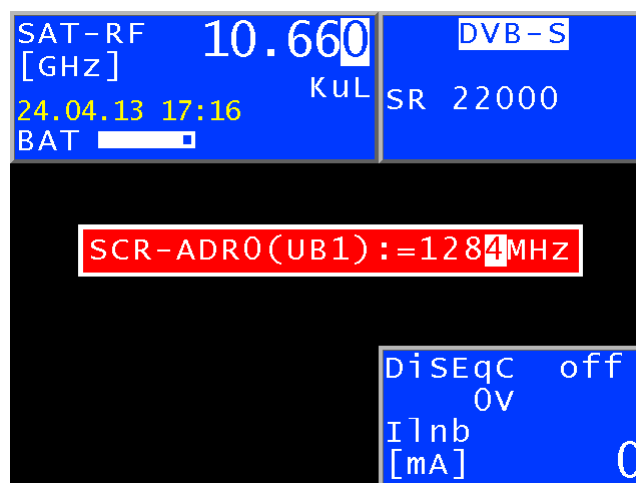
Here you can set the UB center frequency that corresponds to the selected SCR address. This is the frequency that a connected receiver needs to tune to. Use the **Up and Down keys**, the ← and → keys, or the numeric keypad to set the UB center frequencies within the range from 950 MHz to 2,150 MHz.

Press **ENTER** to save the entry; the menu with the SCR address list reappears. Press **ENTER** again to complete configuration of the UNICABLE control in the measuring receiver. All entries are stored in non-volatile memory; the device will operate using these settings when it is next switched on.

SCR-ADR-Bank

Some UNICABLE units operate with eight receivers per cable and others with four receivers. Such units generally operate with differing UB center frequencies.

To simplify the procedure for the user, the device offers a feature that enables switching between eight SCR-ADR banks. That means that the device has 7 banks of SCR addresses for UNICABLE units that operate with 8 receivers and a different bank of SCR addresses for UNICABLE units that operate with 4 receivers. The UB center frequencies can also be changed within the banks as described above. That means that the next time the device is switched on, it will operate again with these SCR-ADR < > UB center frequency settings. In addition, the bank setting is stored in the tuning memory. This makes it possible for you to combine memory locations from Bank 0 to Bank 7 as desired.

Entering a name for the bank

You can select a bank in the Select Bank menu. After pressing **ENTER** a menu appears where the name oft he bank can be edited. For example the name of the manufacturer of the UNICABLE components. Using the ← or → arrow keys, you can move the cursor to the desired position in the label. You can edit the label with alphanumeric characters using the arrows or the number keys. The lenght of the name can be up to 19 characters.

Confirming and saving the entry

Pressing the **ENTER** key closes the input menu and stores the values in the non-volatile memory.

Wideband RF mode

Some UNICABLE units (LNB) work exclusively on a single oscillator frequency. This means that the low band and the high band are combined in a single band.

This special mode can be set on the device via **LNB > MODE > WIDEBAND RF**. The UNICABLE control can be switched back into standard mode (2 oscillator frequencies) via **LNB > MODE > STANDARD RF**.

This is also the device's default setting. The setting is non-volatile; the measuring receiver will work in this mode when UNICABLE control is next accessed. This setting is also stored in the tuning memory.

LO Frequency (applies to wideband RF mode only)

As already mentioned, some UNICABLE units (LNB) work exclusively on a single oscillator frequency. This frequency must be set before in the device can be used to control such units.

You can choose between oscillator frequencies 10,000, 10.200, 13,250 and 13,450 GHz via **LNB > LO-Frequency**. The setting is also non-volatile. This position is also incorporated in the tuning memory. The default setting is 10,200 GHz.

7.5.3.2 Operation

The UNICABLE control can be used to convert up to eight SAT IF levels in up to eight UB slots. These are further divided into two satellite positions, each with four SAT IF levels. Each connected receiver (maximal 8) operates using a dedicated UB slot. This is defined via the SCR address.

These UNICABLE control parameters are set via **LNB > SAT-IF-Layer > Satellite and > SCR-ADR**.

The measuring receiver is tuned as described in "Frequency input". The difference when using the UNICABLE control is that the desired transponder frequency is converted to the center frequency of a UB slot in the UNICABLE unit.

This means that the measuring receiver must send the transponder frequency to the UNICABLE unit as a UNICABLE command and then tune itself to the correct UB slot center frequency.

Whenever there is a new tuning process, the entire UNICABLE control command is sent to the UNICABLE unit. Since UNICABLE enables up to eight receivers to be connected to a single cable, collisions may occur between the connected receivers during control. If this situation arises when using the measuring receiver, send the control command again by pressing **ESC** and **ENTER** in sequence.

The following figure shows the device in UNICABLE mode with the LNB menu open.

Wideband RF mode

As described above, these UNICABLE units operate with a single oscillator frequency and the low and high bands combined on one band. This reduces the number of SAT IF levels to 2 (vertical and horizontal). If the device is in this mode, vertical (V) or horizontal (H) polarisation can be set via **LNB > SAT-IF-Layer**. This also switches the measuring receiver to RF frequency input mode. A transponder frequency of between 10,700 GHz and 12,750 GHz can be entered.

Scan SCR-ADR

This menu is only shown when the device is not tuned (default status). When this menu is opened, the number of available UB slots (SCR-ADR) on the connected converter is determined, and they are displayed along with their center frequencies. This may take a few seconds.
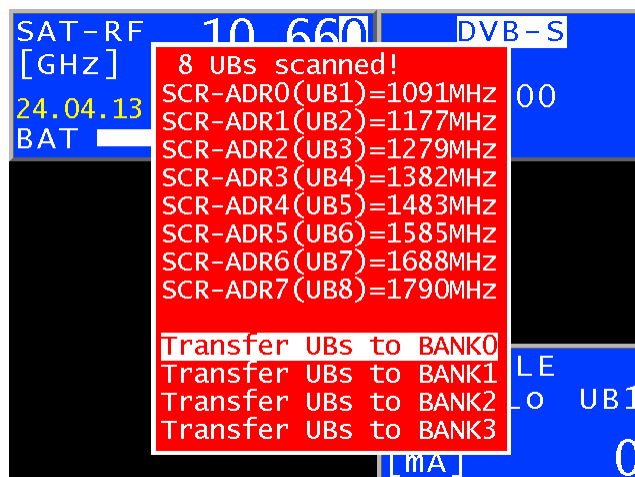
Selecting one of the **Transfer UBs to BANKx!** menu items saves the displayed frequencies in the non-volatile memory of the bank selected and overwrites the existing frequencies.

Note:

Switched-in antenna wall outlets or poor signal conditions could impede the SCR-ADR scan.

The search function in the operating mode of UNICABLE and JESS has been deactivated.

7.5.4 JESS (EN 50607)

JESS (Jultec Enhanced Stacking System) is an expansion on UNICABLE Standard with a larger range of functions and is now part of the EN50607 standard. Among other functions, it supports 24 UB slots and allows the frequency of the individual slots to be read directly from the converter unit. The transmission of the commands occurs exactly as described above for UNICABLE and in accordance with the DIN EN 50494 standard.

7.5.4.1 Activation and Configuration

The JESS control is activated by selecting **LNB > DiSEqC > JESS**.

A menu appears, where the user band (UB) the measuring receiver should use can be set. Here, 32 UB slots are available in one bank. By pressing **ENTER**, JESS will be actived with the selected UB.

By selecting Edit UBs in the menu, the center frequencies of the user bands can be edited. These parameters can be obtained from the data sheet of the converter unit being used, or much easier, can be read from the JESS-device by using DiSEqC-commands. To read the parameters, select Scan UBs from the menu. The following figure shows the device in JESS mode with the LNB menu open.
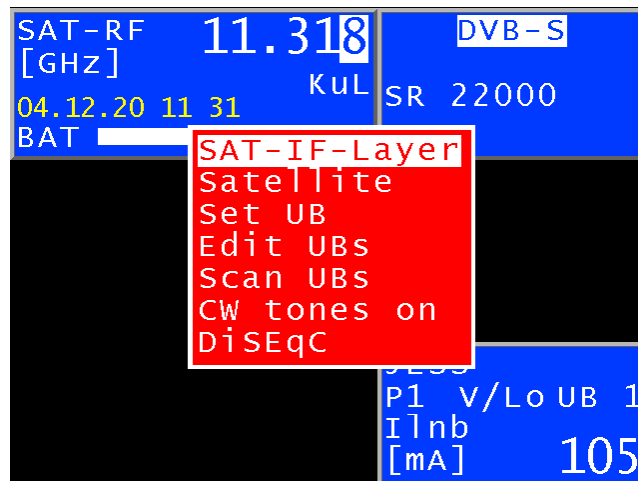

7.5.4.2 Operation

The JESS control can be used to convert 32 SAT-IF layers in a maximum of 32 UB slots. These are further divided into 4 satellite positions with 4 to 8 SAT-IF layers each. Each connected receiver (maximum of 32) operates using a dedicated UB slot. This is defined via the UB number.

These JESS control parameters are set via **LNB > SAT-IF-Layer > Satellite and > set UBs**.

The measuring receiver is tuned as described in the "Frequency input" chapter.

The difference when using the JESS control is that the desired transponder frequency is converted to the center frequency of a UB slot in the converter unit.

That means that the measuring receiver must send the transponder frequency to the converter unit as a JESS command and then tune itself to the correct UB slot center frequency.

Whenever there is a new tuning process, the entire JESS control command is sent to the converter unit again. Because JESS enables the use of up to 32 receivers connected to one cable, clashes may occur between the connected receivers during control. If this situation arises when using the measuring receiver, send the control command again by pressing the ESC and ENTER key combination.

Scan UBs

When this menu is opened, the number of available UB slots on the connected converter is determined, and they are displayed along with their center frequencies. UB slots which are currently active are marked yellow.
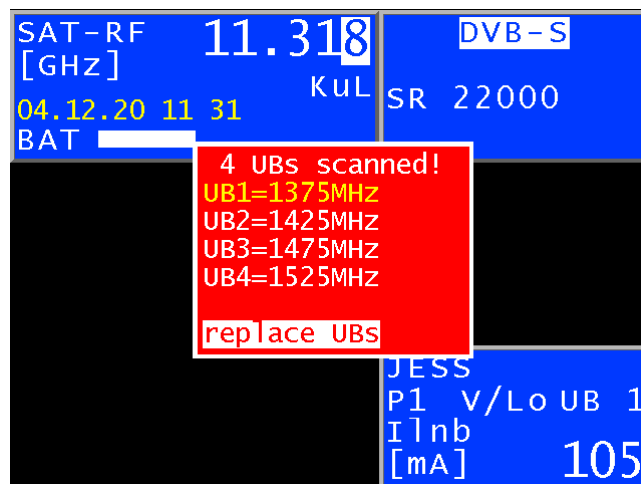
Selecting the "**replace Ubs**" menu item saves these frequencies in non-volatile memory and overwrites the existing frequencies. In combination with a programmable antenna wall outlet, only unblocked UBs are shown.
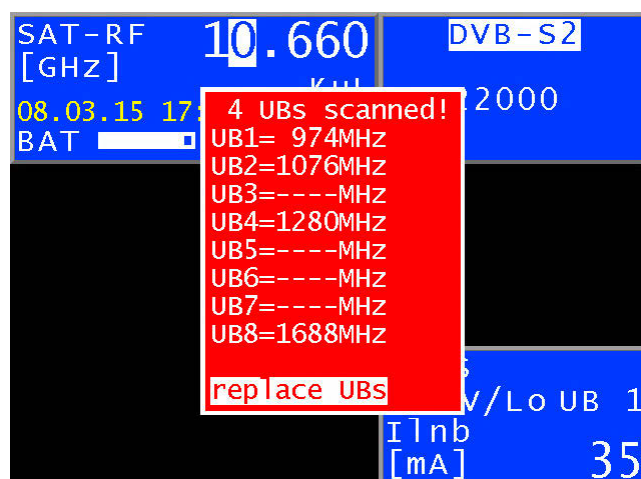
Note:
Switched-in antenna wall outlets or poor signal conditions could impede the SCR-ADR scan. In the JESS operating mode the scan function is deactivated.

7.5.5 Show Continuous Wave (CW) tones

To get a general survey of the available UBs and the frequency-response curve, a CW tone at all available UBs is started and can displayed by the analyzer.
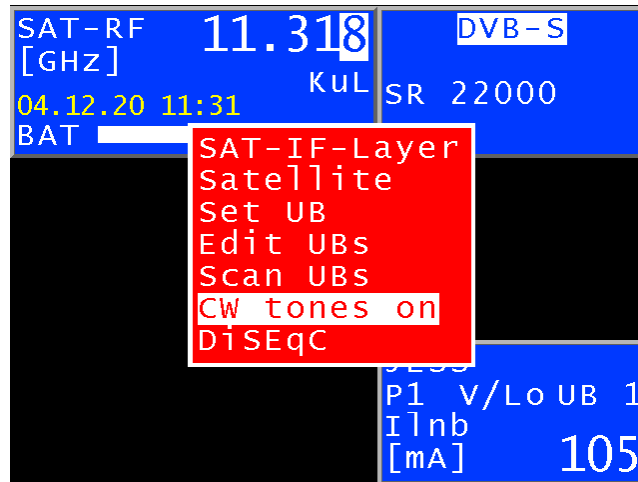
First, the JESS-Mode must be activated. Selecting **LNB > CW** tones on, a CW tone at all available UBs is started and the device gets in the analyzer mode.
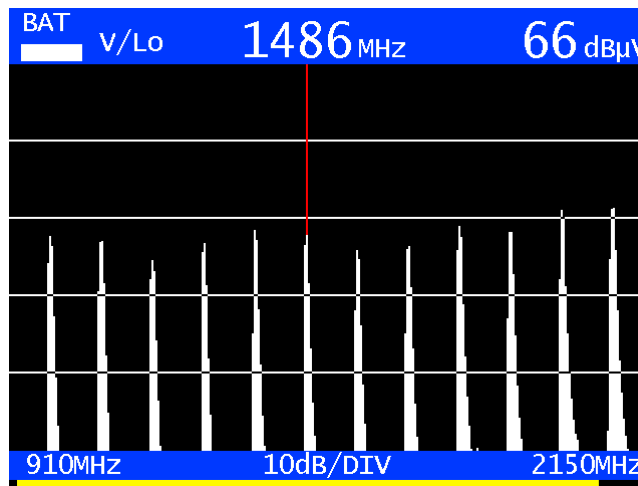
Note:

This feature is only available for devices according the EN50607. Using this, other receivers on the same cable are impeded, so it's only for service purpose.

7.5.6 Program antenna sockets

For single-cable systems, there is a possibility that participants sharing a cable will cause each other interference by using the same UB slots. To prevent this, programmable antenna wall outlets are available which accept only UNICABLE or JESS commands for the programmed UB slots (e.g., the SSD6 series of wall outlets from Axing or the JAP series from Jultec, etc.).

First, the device has to be in initial state (running measurements stop by pressing ESC).

Selecting **LNB > Prog.ADo.** opens a "Configurator" which can be used to analyse and program an antenna wall outlet connected to the measuring device.

The figure below shows the measuring device in the antenna wall outlet configuration mode.
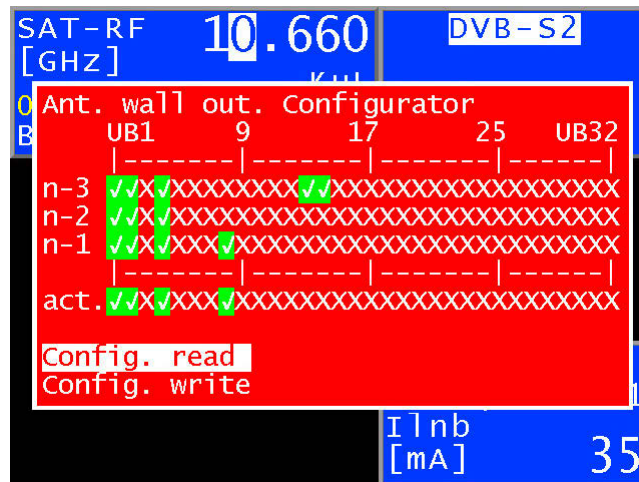
An X represents a locked user band (UB) bandpass slot and a green check mark indicates an unlocked UB slot. The current configuration is displayed in the "act." line. This configuration can be determined by selecting "**Config. read**" or edited by selecting "**Config. write**". The "n-1" line displays the last successfully programmed configuration, "n-2" displays the configuration previous to this, etc.

To change the current configuration, proceed as follows:

Select the "**Config. write**" menu using the **up and down keys**. Then press the > key to access the following menu.
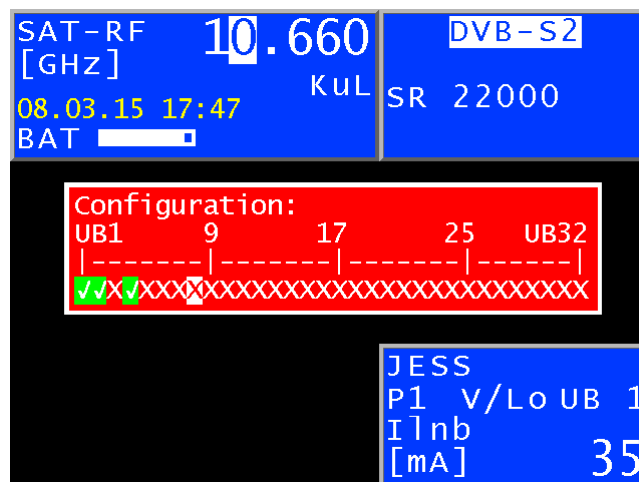
The desired configuration can be set using the up and down keys as well as the ← and → keys. Pressing **ENTER** programs this configuration and returns you to the original menu.

If the programming was successful, this configuration is shown in the lines "n-1" and "akt.", the previous contents of line "n-1" is now in line "n-2", etc. If the programming was not successful, the message "**DiSEqC answer incorrect**" appears briefly and the lines n-1 to n-3 remain unchanged (the configuration is transmitted using DiSEqC commands).

> **Note:**
> The search function in the operating mode of JESS has been deactivated.

7.5.7 LNB current measurement

The measuring receiver measures the power of the direct current that comes from the RF input (e.g. for a LNB supply) and indicates it in mA in the LNB window. The measuring range is between 0 and 500 mA, the resolution is 1 mA.

7.5.8 DiSEqC Skript

Newer multiswitches for single-cable systems are programmable by DiSEqC-signals (like JULTEC a2CSS series). Usually manufacturers provide special program adaptors and PC-software tools. But this programming is also possible by this measuring receiver with the DiSEqC-Script function.

A set of DiSEqC commands according EN 50494/50607 can be easily edited in a common texteditor end saved with the ending .dsq. Appropriate files can you get from the manufacturer (e.g. JULTEC). These files must be stored on an USB-stick which can be connected to the measuring receiver. The script function sends the of DiSEqC commands line by line over RF-connector to the DiSEqC-Uint.

7.5.8.1 Execute DiSEqC script

First, the device has to be in initial state (running measurements stop by pressing ESC). Plug the USB-Stick containing the Script-Files to the receiver and connect the the DiSEqC-Uint via RF-Connector.

Selecting **LNB > DiSEqC Script**, choose one of the ".dsq-files" shown in a directory and by pressing **ENTER** the function starts. A window shows the first comment of the script file and the currently processed line. In the last line of the window a possible DiSEqC-Responce is shown.
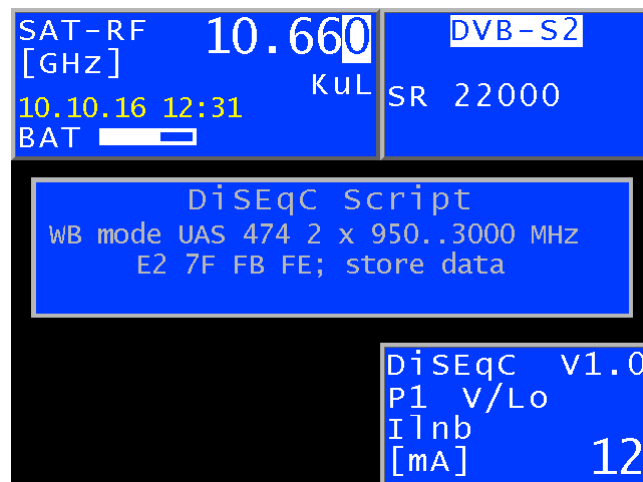
7.5.8.2 Skript structure

Sample of a DiSEqC-Script:

```
WideBand mode UAS 474 2 x 950..3000 MHz
E2 7F FB 40 00 00 03 52 00 00 03 52; LOF 9,75 GHz, IF 950..3000 MHz
E2 7F FB FE; store data
// comment
```

First line: Comment, which is show during the whole processing.

Further lines: DiSEqC-Commands composed of hexadecimal figures and a blank between each 2 Bytes. A command must start in the first column of a line and is terminated by a semicolon. The rest of the line is treated as a comment.

A double backslash // marks a comment.

An exception is the "18V", which must be in an own line. Thereby the LNB-Voltage is set to 18V to create an UNICABLE standard transmission. The LNB-Voltage gets back to 14V after the next DiSEqC-Command was transferred.

Chapter 08
Analyzer

The safest way to look for a satellite position is in the **analyzer mode**. By rotating the dish, one tries to locate a satellite system while adjusting the transponder to maximal level.

The picture below shows an analyzer screen.
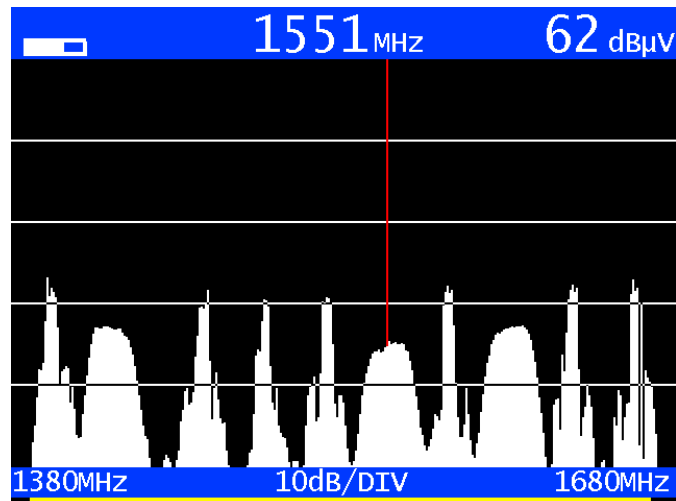
The level grid is 10 dB/DIV. The start and stop frequencies are shown at the bottom of the screen. The level display (top right) and the frequency display (top center) relate to the cursor position.

8.1 Accessing the analyzer

Press **ANALYZ** to initiate the analyzer. The status of the measuring receiver is now important. If the receiver is not tuned to a channel (e.g. ESC was previously pressed), the analyzer sweeps over the entire measuring range (FULLSPAN). But if the device is in tuned mode (measuring mode), the analyzer shows a smaller section of the frequency spectrum (SPAN1) above and below the measuring frequency. When the UNICABLE control is active, the analyzer displays the frequency spectrum above and below the center frequency of the last UB slot that was activated.

8.2 Frequency segment (SPAN)

The frequency segment (SPAN) can be changed.

In "FULLSPAN" mode, the frequency segment spans the entire measuring range. The frequency segment (SPAN) can be changed using the Up and Down arrow keys.

The table below provides an overview of the frequency segments that may be set.

Gesamt (FULLSPAN)	SPAN1	SPAN2
910–2.150 MHz	300 MHz	76 MHz

8.3 Cursor

The cursor appears as a vertical red line on the screen. You can use the ← and → keys to move the cursor within the frequency segment. The current cursor frequency is shown in the upper center of the screen.

A new cursor frequency can also be entered with the numeric keypad and confirmed with **ENTER**. The cursor is then shifted to the new position, or the frequency segment is shifted so that the cursor is in the middle if the distance to the frequency limits allows it.

8.4 Level measurement

During each sweep, the level of the cursor frequency is measured and displayed at the top right of the screen in dBµV. Level measurement in analyzer mode is comparable to that of a pure spectrum analyzer. The power within the measuring bandwidth (RB) is measured and converted into dBµV as a level. On the other hand, the level measurement in measuring receiver mode always measures the power (level) in the channel.

8.5 Progress bar

A yellow bar at the bottom of the screen runs from left to right during each new search by the analyzer. This allows you to trace the progress of the sweep.

8.6 Switching to measuring receiver mode

You can switch directly from analyzer mode to measuring receiver mode. The device uses the current cursor frequency to tune the measuring receiver. However, frequency segment SPAN1 or SPAN2 must be set.

Press **ENTER** to begin the process. When the UNICABLE control is active, the frequency display always refers to the spectrum that was converted by the UNICABLE unit. If the **ANALYZ** button is then pressed again, the device returns to analyzer mode.

8.6.1 Switching to measuring receiver mode with SCAN

A menu will appear as soon as the scan button is pressed, here you can choose between **SAT SCAN** and **TRANSPONDER SCAN**. Access for this function can be obtained by pressing either the **SCAN** or **ENTER** button.
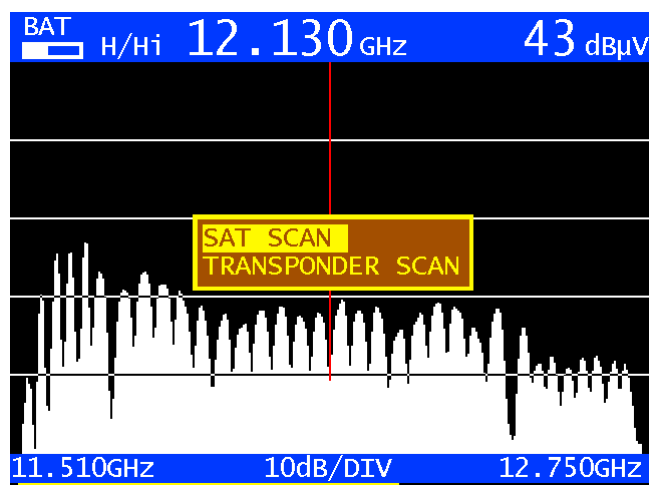
8.6.2 Transponder SCAN

Depending on the respective SPAN, the following additional functions are executed when the SCAN button is pressed.

FULLSPAN: Starting from the current cursor position, the next maximum is searched and the center frequency of this transponder is determined. The analyzer then switches to SPAN1 with the frequency it has determined as the cursor position.

SPAN1:   As is the case with FULLSPAN, the center frequency of the next transponder is searched and tuned to. In addition to the five preset symbol rates, the entire range of the symbol rates is searched from 2 to 45 MSym/s.

SPAN2:   For fine-tuning, the device is tuned directly to the frequency of the cursor position. In addition to the five preset symbol rates, the entire range of the symbol rates is searched from 2 to 45 MSym/s.

8.7 Activating the remote supply

The LNB supply can be activated while in analyzer mode in the same way as was discussed in previous sections. First press the LNB button to access the relevant menu.

Chapter 09

SCAN support for satellite discovery

Several Functions are gathered together in the **SCAN**-function which makes looking and identifying a satellite position easier. As soon as the SCAN function is selected, a submenu will appear where the following functions can be selected: ANALYZER; SAT SCAN; SAT List.
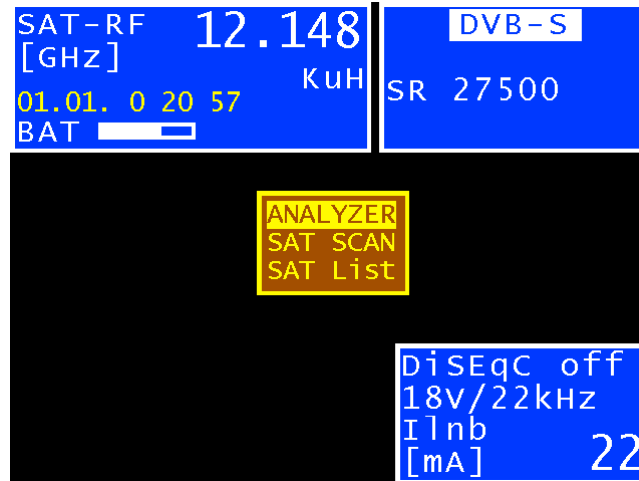
A spectral illustration appears on the screen as soon as the analyzer is activated and then it switches to the input connector from the LNB-supply 18V/22kHz. The SCAN function from the analyzer mode is in the chapter **„ANALYZER" - changing over into the measurement mode** is described in „SCAN".

9.1 SAT SCAN

This function can be choosen from the above displayed menu with the keys **SCAN** or **ENTER**. A search cycle starts in a range from east to west where the most important satellites are tuned to the transponder. The positions that are being tested will be shown in a distinct red window and a reference "searching for position" will be shown in the MPEG window. If the satellite system can be clearly identified out of this data stream, the adjusted position will be shown in the MPEG-window with the level specification (view picture). The search cycle can be continued with SCAN, discontinued with ESC, switched to analyzer mode with **ANALYZ** and changed into regular measurement mode with **ENTER**.
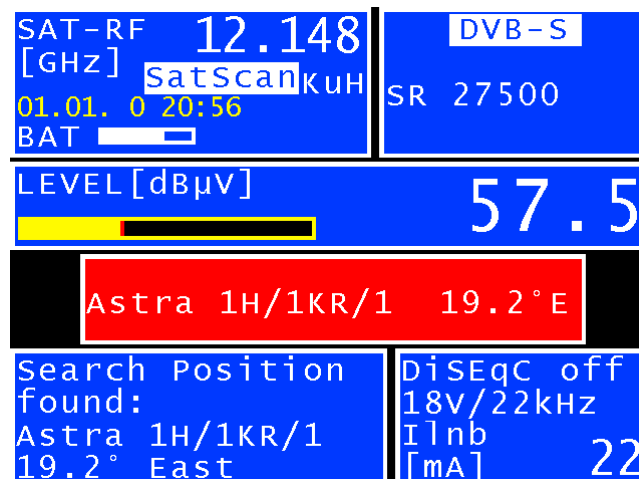
The scan parameter (satellite, transponder frequency etc.) are a fixated componant of the satellite and cannot be found in lists prior to 21.01.2011. Therefore the SAT lists should be kept up-to-date. (View the chapter "SAT- lists import").

Note:

If Quattro LNBs are used, the various SAT identifications are not sent on all levels.
The LNB should be connected to the connectors for the horizontal high or vertical low levels since only these levels are searched. The relevant data can be found in the document which accompanies the SAT list.

9.2 SAT list

Pressing the **SCAN** button in the main menu calls up the Sat list. With the arrow keys ← and → you can scroll through the list page by page and with the up or down key you can select individual satellites. Pressing the **SCAN** button again displays the transponder list for the selected satellite.

The SAT list is provided by the device manufacturer and updated on a regular basis. Check whether the list being used is up-to-date (use the date code in the second line of the list for this). To update the list please view the chapter SAT-list import.

9.3 Transponder list

In addition to reception parameters such as frequency and modulation, the transponder list includes transponder numbers and names if they are known. As for other lists, one element can be selected. Press **SCAN** or **ENTER** to tune. Press **ESC** to return to the previous list.

```
SAT-IF        1610      DVB-S2
[    ]
08 95 items for
B  Astra 1H/1KR/1L/1M/2C K 19.2°East
   TP: Name        RF[GHz]   SR    Mod
   50  Canal+ Com 10.729 V 22000 DVBS2
   54  Taquilla 1 10.788 V 22000 DVBS
   56  Fox HD Spa 10.818 V 22000 DVBS2
   58  Novedades  10.847 V 22000 DVBS
   60  Golf +     10.876 V 22000 DVBS
   64  Mezzo HD   10.936 V 22000 DVBS2
   34  Clan TVE   10.979 V 22000 DVBS
   38  Canal + Es 11.038 V 22000 DVBS
   0              11.097 V 22000 DVBS
   42  Multi X    11.097 V 22000 DVBS
                                [mA]  24
```

9.4 Favourites list

You can save frequently required satellites in a favourites list so that they can be found more quickly. To do so, select the corresponding satellite from the SAT list and press SAVE. The following menu appears:

```
SAT-IF        1610      DVB-S2
[MHz]
08:08:11 09 56          SR 22000
BA Set satellite for favorit
   at following pos.

   01 Eutelsat W2A Ku        10.0°E
   02 Astra 1H/1KR/1L/1M/2C  19.2°E
   03 Astra 1E/4A, Thor 2A K 04.8°E
   04 Astra 1H/1KR/1L/1M/2C  19.2°E
   05 empty
                          DiSEqC off
                             18V
                          Ilnb
                          [mA]  24
```
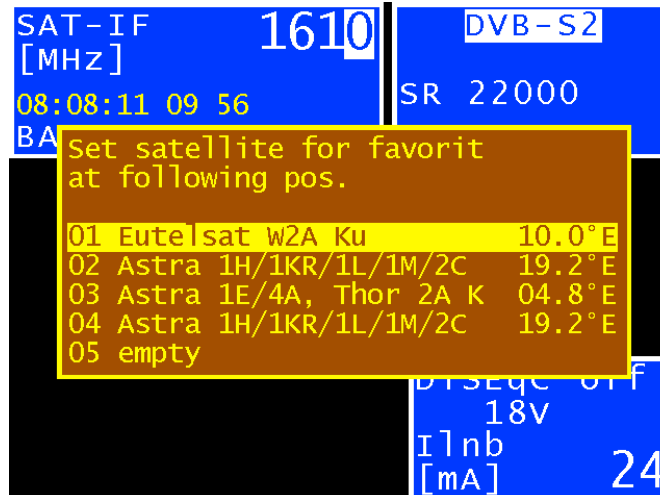
You can now select the position in the favourites list. Pressing SAVE again saves the item as a favourite and the SAT list is displayed again. The favourites now appear at the top of the SAT list and are marked with (*). You can replace one favourite with another at any time.

With **MODE > Satlist > Erasing Favourites list** to erase all favourites.

9.5 Importing a SAT list

Open the "Satlist" menu from the main menu (press **MODE**). The following submenu is then displayed:
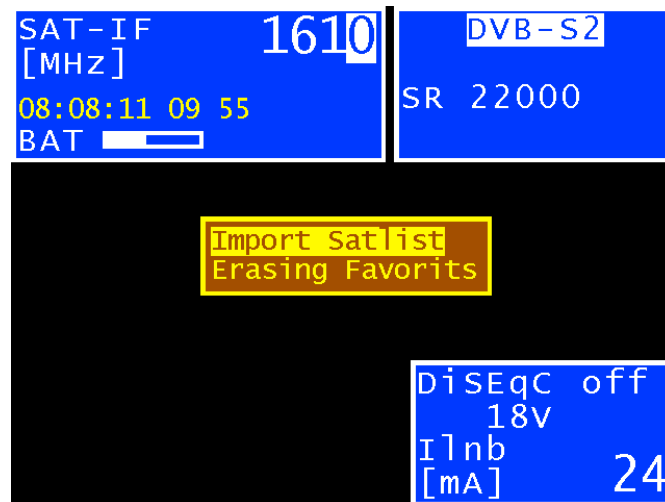
The current SAT-list can be found at **www.kws-electronic.com**. To import a SAT list, you first need to connect a USB memory device with a corresponding file. Select **Import Satlist** to call up all of the ".sat" files stored on the memory device. Select and import the desired list by pressing **ENTER**. This action overwrites any list that previously existed on the device.

Chapter 10

Assistance mode

The assistant function helps the user to complete certain tasks. A short instruction or explanation as well as only the most necessary measured values are shown on the screen, step by step. These measured values are rated as good, sufficient or bad and displayed accordingly in the colors green, yellow or red. The change to the next step then depends on these results. If the measured values are good, the arrow key is released to switch to the next step. On the other hand, it is always possible to go back with the left arrow key or to cancel with **ESC**.
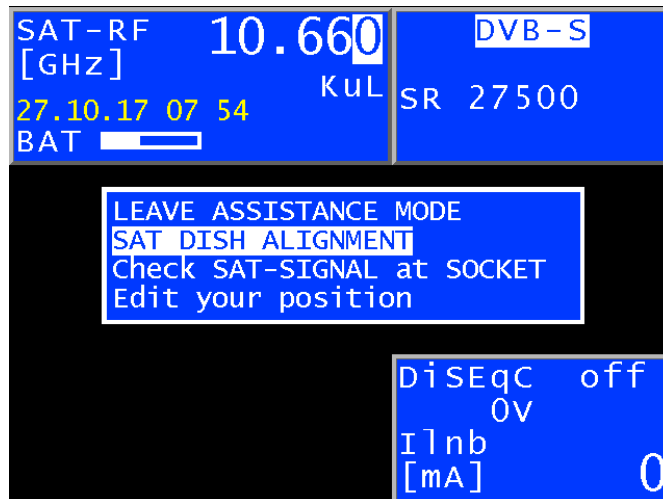
By starting the device the menu to select an assistant mode is shown. This menu could be closed using **ENTER** or **ESC** if no assistant mode is needed. With **MODE > Assistance Mode** that menu could be recalled.

10.1 SAT Dish alignment

This function guides the user during setting up a common SAT dish. This function is started from the menu above.
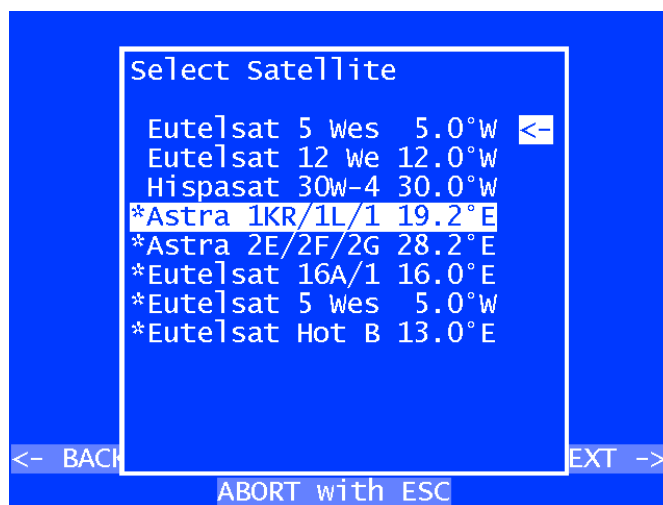
In the first step, the desired satellite must be chosen from a list (SAT List). The satellites marked with * are the recently used ones and are recommended to use first. Pressing **ENTER** the highlighted one is taken and switch over to the next step.

```
23.06.17 07 34              BAT ▬▬▬

       Connect to LNB-output-H/Hi
            or to Quad LNB!

         LNB-current = 25 mA

          LNB ok!  NEXT ->




<- BACK          ..2..              NEXT ->
              ABORT with ESC
```
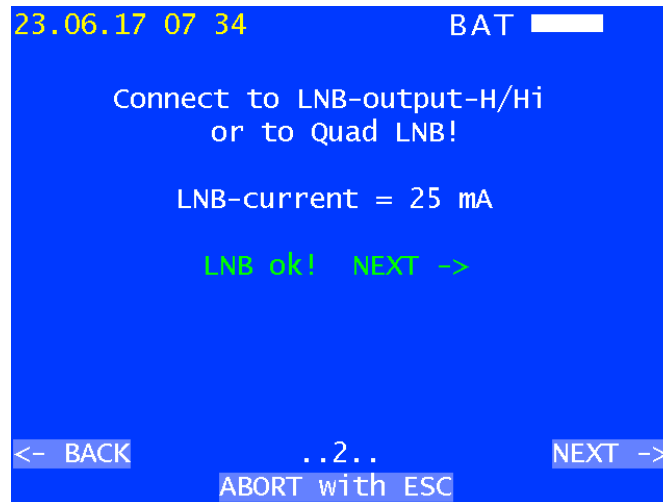
As second step the connection is tested by measuring the LNB current. The text "NEXT →" is shown only if a LNB current is detected and the function of the arrow key > is enabled to switch over to the next step.

```
27.10.17 07 54              BAT ▬▬▬

       Please adjust dish to:

          Elevation  34.2°*
     Direction  10.2°E* from south

  *for position L= 11.6°, W= 48.2°,
         input your position or
        investigate angle exactly
         (e.g. per mobile app)

<- BACK          ..3..              NEXT ->
              ABORT with ESC
```
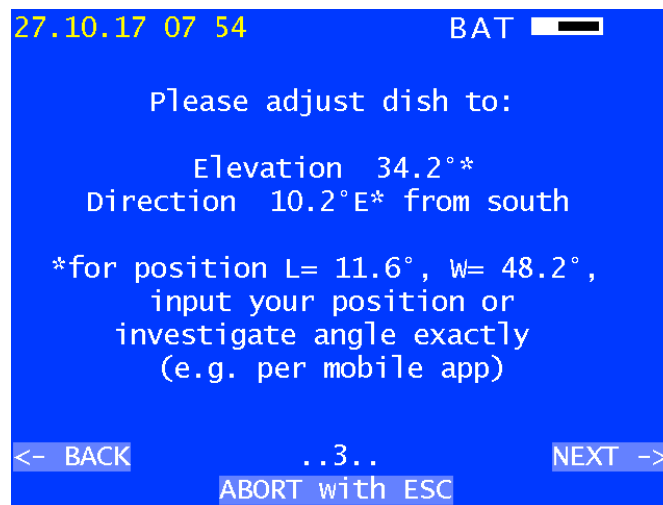
At 3rd step an advice to align the SAT dish is shown. The angles to align the dish are individually calculated for the chosen satellite at this position. The shown position is for the region around Munich. To adapt the position to yours, use the menu "Edit your position" (see Assistance Mode above). These geographical data then are stored in the nonvolatile memory.
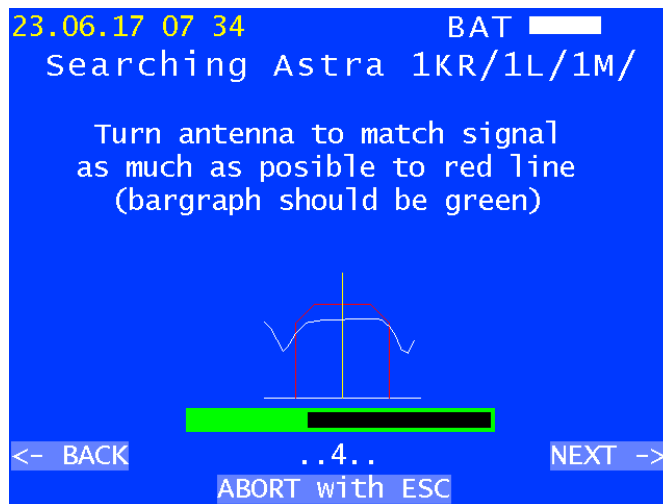
The 4th step is a small fast analyzer, limited to the certain transponder. The measured envelope of level should as match as possible the scheme of the transponder, which is also indicated by the color of the bar diagram below (it's not always possible to became green). Because there are some similar transponders it is necessary to identify it by locking in, this is next step for.
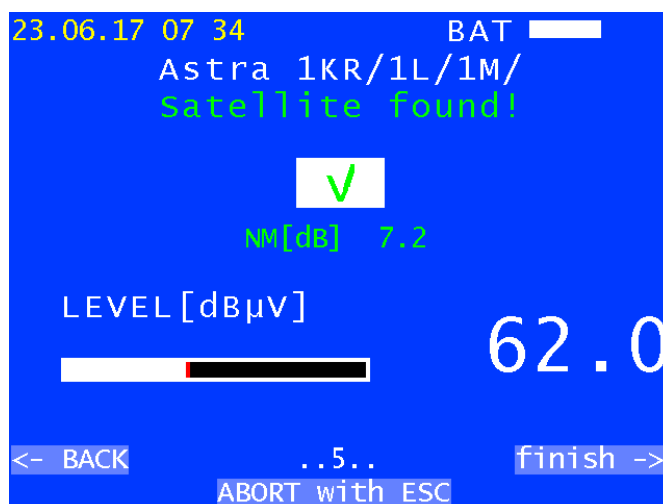
At step 5 it is tried to lock in using parameters from the chosen list. If this succeeded, the satellite could be identified by the received information. Is it the correct satellite a green tick mark is shown. If another satellite was found, the difference of the angel is used to show where to move the dish. By using the arrow key → you get back to the assistance mode menu.

If not succeed, use other functions of the measuring receiver like SAT SCAN, Analyzer etc.

10.2 Check SAT-Signal at socket

This function checks if there is a SAT-signal at the socket, from what satellite this is and if the levels fit recommendations. This function is also started from the assistance mode menu.

```
23.06.17 07:34                BAT ▬▬▬


        Check SAT-SIGNAL at SOCKET

             Current = 12 mA

          Current  ok!  NEXT ->




<- BACK           ..1..            NEXT ->
                ABORT with ESC
```
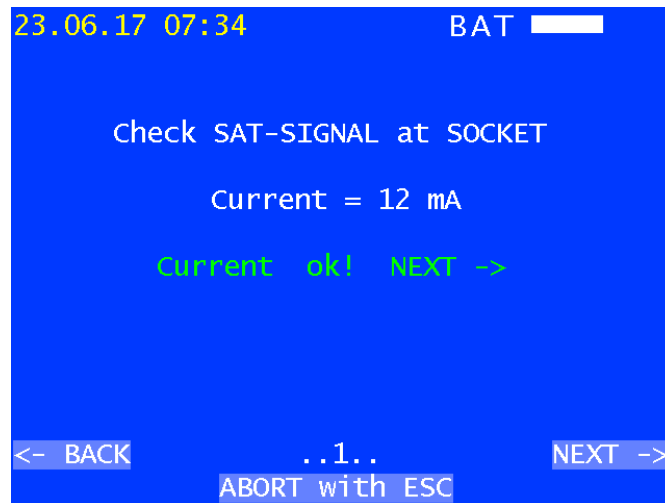
As first step the connection to SAT-System is tested by measuring the current. The text "NEXT →" is shown only if a current is detected and the function of the arrow key → is enabled to switch over to the next step.

```
23.06.17 07:34                BAT ▬▬▬
  Check SAT-SIGNAL  at SOCKET

        Service found: 3sat HD
        Astra 1KR/1L/1 19.2° E

           MER[dB]  15.0
            NM[dB]   8.0
         LEVEL[dBµV] =   57.5
              ┌──────┐
              │  √   │
              └──────┘
            Signal ok!
<- BACK           ..2..            finish ->
                ABORT with ESC
```
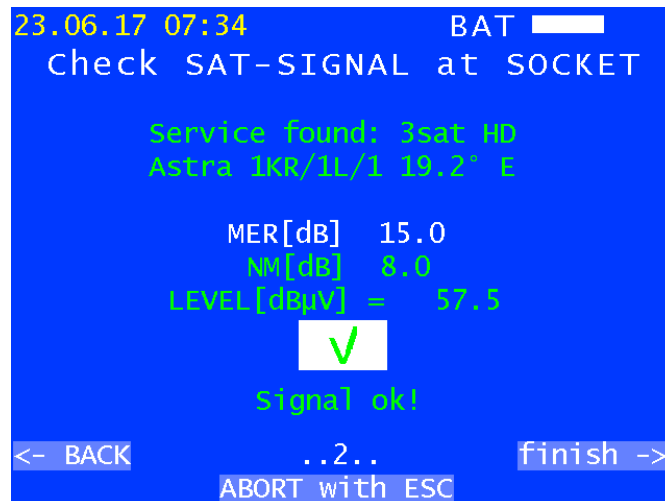
The next step is searching for known transponders. If one is found and locked in, the satellite and the service are shown and the quality of the signal is measured. Are the values ok, a green tick mark is shown and the arrow key → is enabled to return to the start menu.

It is recommended to record a set of measurements by using the function DataLogger to verify a SAT system.

Chapter 11

MPEG decoder

An MPEG2/4 decoder is included in the delivery of this device. It functions as the Back-End of a DVB receiver. It evaluates the Program Service Information (PSI) and decodes the digital audio and video data.

11.1 Program Service Information (PSI)

In digital television (DVB) technology, data is transmitted in byte-serial format via a transport stream (TS). The transport stream usually contains several audio and video channels as well as data streams and additional program information, all of which is transmitted in time-division multiplexing. Special tables transmitted in the transport stream provide information about the channels and data services being sent. The receiver first needs to interpret these PSI tables in order to give the user an overview in the form of channel lists. This process can take a few seconds (depending on the number of programs they contain) and can be monitored in the MPEG window.
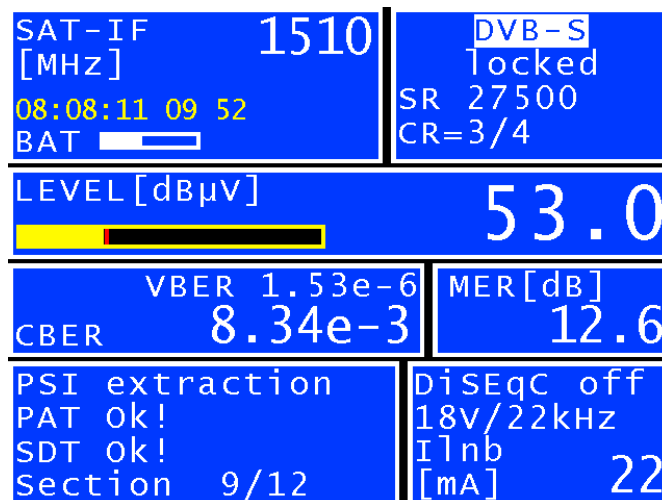
The MPEG window is seen at the bottom left of the screen. While this is being displayed, a new channel search is running in a DVB-S transponder.

For a quick overview of the current transponder, the provider name and its orbital position are shown in the MPEG window when the channel search is finished.

11.2 Network Information Table (NIT)

The NIT (Network Information Table) is a special table that contains information about other transponders and channels within the network (e.g. satellite, cable, DVB-T network). The information from the NIT can be used for navigation (programme search).

The measuring receiver first needs to receive a digital channel. **MODE > NIT** starts the NIT search. If a NIT is found, the decoder lists the entries of the NIT.

```
SAT-IF      1510      DVB-S
[MHz]                       ed
         NIT consists of 87 items  0
08:08:1  Name: ASTRA 1
BAT      Network_ID: 1
         71*12.1095GHz H 19.2°E
LEVEL    72  12.6105GHz V 19.2°E    .0
         73  12.6990GHz V 19.2°E
         74  12.7285GHz V 19.2°E
         75  10.7438GHz H 19.2°E  B]
CBER     76  12.7218GHz H 19.2°E  12.9
         77  11.3618GHz H 19.2°E
PSI e    78  11.1707GHz H 19.2°E    off
ready    79  11.3027GHz H 19.2°E  kHz
ARD      80  12.6695GHz V 19.2°E
19.2°  East             [mA]     22
```
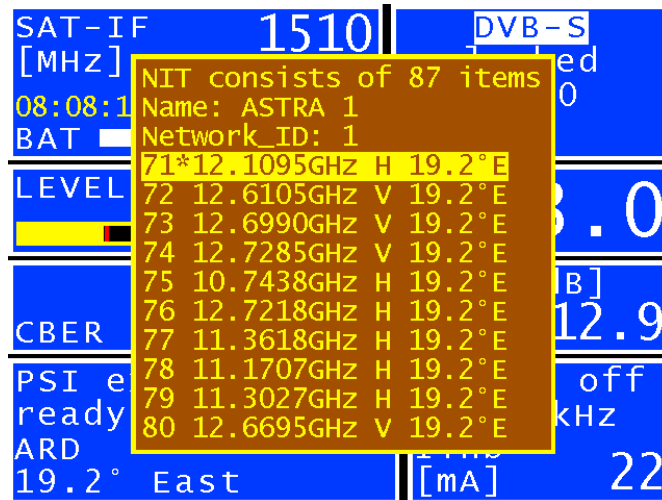
The transponder or channel that is being tuned on the receiver at any specific time is marked in the NIT with (*). You can now select another entry with the Up and Down keys. By pressing the **ENTER** key you get a menu displaying more details about the chosen channel including the transport stream-ID, the Original-Network-ID and the NIT-Version. Press **ENTER** again to tune the receiver to the new transponder or channel. The device fetches the information from the previously selected NIT entry.

```
SAT-RF    10.744     DVB-S
[GHz]                locked
29.07.15 09:33  KuL SR 22000
BAT      NIT consists of 112 items
LEVEL    Name: ASTRA 1
         Network_ID:1 Version:2      .0
         41*10.7438GHz H 19.2°E
             SR: 22000 kBd        6.2
             FEC:  5/6
CBER         TS_ID: 1051 = 41bh   13.9
             OrgNetw_ID:1=1h
PSI e                              V1.0
ready!                  P1  H/Lo
ARD                     Ilnb
19.2°  East             [mA]     28
```
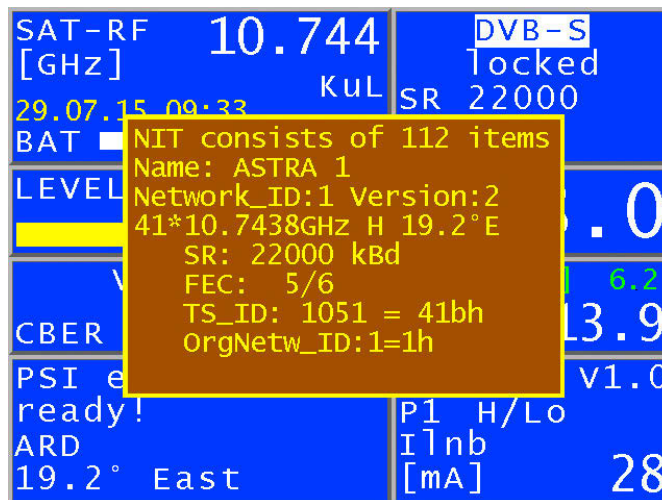
For the SAT NIT, transponders transmitted by different satellites can be listed. Only transponders on the same satellite that is sending the NIT can be selected directly from the NIT.

You can assign items to the tuning memory directly from the NIT. To do so, select the corresponding entry from the NIT list. As described in section "Memory management (saving)", you can then select a memory location and save the NIT entry. SAVE takes you to the SAVE menu.

If the NIT has more than 10 entries, the ← and → keys can be used to scroll between the pages of the list.

11.3 Picture and sound control

As explained in section "Program Service Information (PSI)", several video and audio channels are transmitted in the same multiplex (TS). As soon as the MPEG decoder recognises a TS, the PSI data is analysed and the channel lists are created. This process can be monitored in the MPEG window. Once the decoder has created the channel lists, "PSI

extraction ready" appears in the MPEG window. You can then display the channel list by pressing the **OSD/VID** button. The picture below shows a video channel list.

```
SAT-IF       1510       DVB-S
[MHz]                   locked
08:08:11   Video: Total 12    500
BAT                            4
            1 rbb Brandenburg
LEVEL[d     2 rbb Berlin        3.0
            3 ARD-TEST-1
            4 NDR FS MV
            5 NDR FS HH       [dB]
       V    6 NDR FS NDS       12.9
CBER        7 NDR FS SH
            8 MDR Sachsen
PSI ext     9 MDR S-Anhalt    C off
ready!     10 MDR Thüringen    2kHz
ARD                     lInb
19.2° East              [mA]    22
```

The list of video channels always appears first. **MODE > AUDIO** List displays the list of audio channels. **MODE > VIDEO** List takes you back to the video list. All channels marked with (*) are encrypted.

Use the Up/Down arrow keys to select the required channel from the list. The ← or → buttons scroll between the pages of the channel list.

Press **ENTER** to call up additional details about the selected channel. This includes the channel name, provider, Service-ID, Transportstream-ID, OriginalNetwork-ID and PIDs (packet identifiers) of the associated elementary streams.

Some channels are broadcast with several audio streams (e.g. several languages). You can choose the desired audio stream in the "programme properties" menu.

Pressing **ENTER** again switches to the channel. The screen now shows just the video channel. The speaker sound can be checked at the same time.

Note:

For digital transmission, no conclusions can be drawn about the reception quality based on the quality of the picture and sound. The picture and sound are always perfect to a certain transmission quality, below which the signal cannot be reproduced. Only within a small threshold range can you notice characteristic blocks in the picture ("brick wall effect") and constant interruptions to the sound. Broadcast quality can only be determined based on measurements (BER, MER).

Press **ESC** to return to the previous channel list, from which you can select another channel. **OSD/VID** takes you back to normal measuring mode.

11.4 Display of MPEG video parameters

As soon as a live picture can be seen, the MPEG decoder displays the following parameters in a window at the lower right edge of the screen.

Profile and level: e. g. MP @ ML
Chroma format: e. g. 4:2:0
Video resolution: e. g. 720*576
LetterBoxFormat: 4:3 or 16:9

The parameter window can be displayed or hidden at any time using the ← or → arrow keys.

11.5 Video bit rate measurement

The MPEG decoder measures the current bit rate of the video stream being broadcast while a live picture is shown. It is shown in the unit [Mbit/s] in the window described in the section above. The measuring period is 1 second.

11.6 Dynamic program switching

Some program providers divide their programming into regional content at specific times. This means that, for example, 4 programs may appear in the MPEG program list which have the same content at certain times and different content at other times. The program map table (PMT) in the data stream therefore changes over time. In this way, the station can prompt the receiver to use different packet identities (PIDs).

In the standard setting, the MPEG decoder of the device uses the PMT that was sent at the time of the last program search. In other words a static PMT.
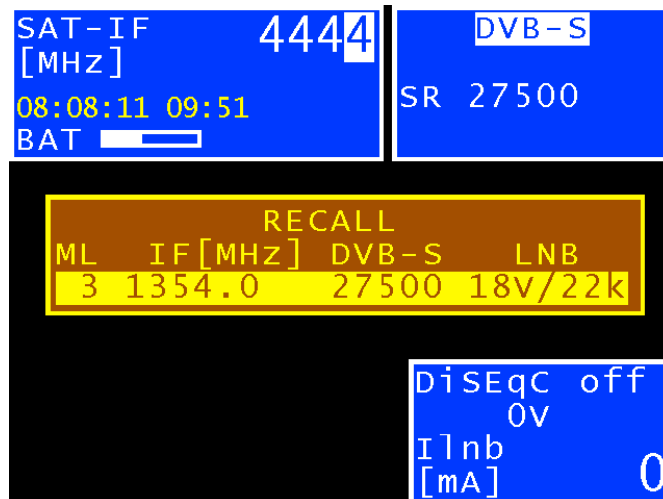
The dynamic PMT update function can be activated using **MODE > Settings > Dyn.program switching**. If you start the program now, the decoder continually searches for a new PMT version. If the device detects a change in the PMT, the current program is stopped, the message "Dyn. program switching" appears and then the program is restarted with the updated PIDs. These settings are saved in the non-volatile memory and remain active until they are deactivated in the above menu.

Chapter 12

Memory management

The tuning memory of the device can store up to 99 channels. The memory preview function provides an overview of the turning memory without requiring the user to call up all memory locations ahead of time or to note down information when saving. The memory preview is activated when saving and recalling program locations and with many memory functions. Use the **Up and Down keys** to navigate in the tuning memory; the ← and → buttons scroll through pages.

```
SAT-IF      4444        DVB-S
[MHz]
                        SR 27500
08:08:11 09:51
BAT ▭▬▭

          RECALL
ML    IF[MHz] DVB-S    LNB
 3 1354.0    27500 18V/22k


                        DiSEqC off
                               0V
                        Ilnb
                        [mA]        0
```

12.1 Saving

As a first step, the receiver needs to be tuned. **SAVE** takes you to the "SAVE" menu. The device searches the tuning memory for the first free location and suggests this as the number to be used for saving. You can also use the keypad to enter any memory location between 0 and 99. The contents of the memory location are displayed next to the location number. Press **SAVE** or **ENTER** to save the location. If the desired memory location is already assigned, the device issues a warning. To overwrite the memory, press the **ENTER** or **SAVE** button a second time.

12.2 Recalling

Press the RECALL button to open the "Recall" menu. When this menu is opened for the first time after the device is switched on, the device suggests memory location 1. Each time the recall function is accessed, the memory location number increases by one.

That means that the device will suggest memory location 2 next. It is also possible to select any other memory location using the numeric keypad or up/down keys (1 memory location) ← and → keys (10 memory locations). Press **RECALL** or **ENTER** to recall the memory. The measuring receiver then accepts the settings from the memory. If the memory location is empty, the old settings remain unchanged.

12.3 Memory functions

The memory functions can only be operated if the measuring receiver is not tuned.

12.3.1 Erasing the memory

Use **MODE > Memory - erasing all memory** to erase the entire tuning memory. A warning is issued before the information is erased. The device does not erase the tuning memory until you confirm again by pressing **ENTER**. This can take a few seconds. The device then issues a message that the process is complete.

12.3.2 Erasing a memory location

This function can be used to erase a continuous block of memory locations or an individual memory location within the tuning memory.

Access this function via **MODE > Memory > Erasing memory location**. The device first asks for the first location to be erased. After you confirm with **ENTER**, the device asks for the last location. If the first and last numbers refer to the same memory location, only one memory location is deleted. The device issues a warning before erasing anything in either case. Acknowledge the warning by pressing **ENTER**, at which point the device erases the memory location(s). Afterwards, the device confirms that the process is complete.

12.3.3 Sorting the memory

This function can be used to sort the entire tuning memory according to a variety of criteria.

Sorting by frequency:
To sort the memory by ascending frequency, enter:
MODE > Memory > Sorting memory > According frequency.

Sorting by range:
To sort the memory by DVB-S (beginning) and DVB-S2, enter:
MODE > Memory > Sorting Memory > According range.

Sorting by satellite:
This option sorts the memory by satellite positions. However, it is only available for SAT memories with DiSEqC. To access the function, enter:
MODE > Memory > Sorting memory > According position.

Sorting the memory can take a few seconds. The device does not respond during this time. A message is issued once the process is complete.

12.3.4 Memory protection

This function can be used to protect the entire tuning memory, groups of memory locations, or individual memory locations. This prevents a memory location from being overwritten by mistake.

Access via **MODE > Memory > Protection memory**. Similar to the description in section "Erasing a memory location", the device asks for the first and last memory location to be protected. Press **ENTER** to start the process. The device issues a message when the process is complete. The next section explains how to disable memory protection.

Memory locations marked with (*) are protected.

12.3.5 Disable memory protection

Use this function to disable an existing memory protection.

Access via **MODE > Memory > Disable memory protection**. This is done in the same way as when activating memory protection. The device confirms that protection has been disabled with a corresponding message.

12.3.6 Memory export

Use this function to copy the entire tuning memory onto a USB memory device as a "mem" file.
Access via **MODE > Memory > Export all memory**.

The device suggests a file name that might stand for a system (measuring location), for example. This can be changed in alphanumeric format using the arrow keys or the numeric keypad and the ← and → keys. Press **ENTER** to complete the entry. The entered name is identical to the file name of the "mem" file. If a file with the same name already exists, you will receive a warning. Enter a different name by pressing **ESC**, or press **ENTER** to overwrite the existing file. The next section describes how to import a tuning memory.

12.3.7 Memory import

Use this function to import an existing tuning memory as a "mem" file from a USB memory device onto the device.

Access via **MODE > Memory > Import memory**. A selection screen appears with all saved "mem" files. Use the Up/Down arrow keys to move the cursor to the desired file. Press **ENTER** to overwrite the current tuning memory of the device with the data from the "mem" file. The name of the selected "mem" file is saved in the device as a system name and displayed in the header of the Save menu.

This name is suggested as a file name during the next measurement.

Note:

Any other general settings by the user, such as LNB oscillator frequencies for RF inputs or the UB center frequency for UNICABLE or JESS, are not transferred with the memory. These may have to be adjusted manually.
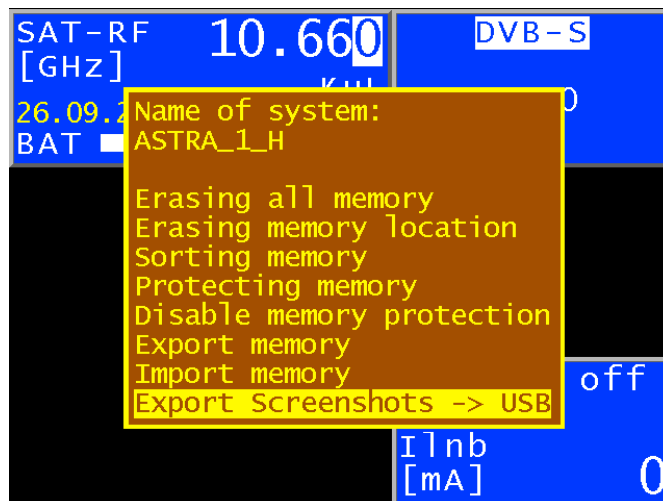
Chapter 13

USB-A interface

The device has a USB-A interface. The corresponding port is at the top of the device. The interface is compatible with USB 2.0 specification in high speed mode. The measuring device only supports the MASS STORAGE DEVICE class (USB stick).

The measuring receiver software can read files from, and write files to, a USB stick using the FAT32 file system. A USB stick is used to carry out firmware updates or to record measurement data (DataLogger).

We recommend using the original USB stick from the device manufacturer. The USB stick is included in delivery.

USB-A interface

Chapter 14

Common Interface

The device is equipped with a CI interface. This consists of a PCMCIA slot (see the bottom of the device). The PCMCIA slot is compatible with all common conditional access modules (CAM). The device also supports Premiere CAM. This means that all DVB channels can be decoded with an appropriate CA module and activated smartcard. Data streams are exclusively decoded in the inserted CAM, not in the MPEG decoder itself.

14.1 Inserting a CA module

14.1.1 Install before version Vxx.02

The device must be switched off when a CA module is inserted. Insert the module into the port at the bottom of the device. When inserting the module, ensure that the polarity is correct and that the barcode is **pointing up**. Do not force the module into the slot if there is significant resistance.

Place the Barcode on top

14.1.2 Install after version V01.02

The device must be switched off when a CA module is inserted. Insert the module into the port at the bottom of the device. When inserting the module, ensure that the polarity is correct and that the barcode is **pointing down**. Do not force the module into the slot if there is significant resistance.

Place the Barcode underneath

The version (firmware) can be activated in the device by **MODE** > Settings > Software > Info.

14.2 Operation

The inserted module is initialised when the device is cold-started. Use the Common Interface menu to query the inserted CA module. Enter **MODE > Common Interface** to access the menu. The CA module name is shown as a menu title.

Use the first menu item ("CA-SystemIDs") to query CA systems supported by the module. The next section explains the second menu item ("Card Menu"). To check the picture and sound quality of encoded channels, proceed as described in the "MPEG decoder" section.

14.3 Card menu

This option allows you to access the module-specific menu. Various details and services can be called up for each module. For example, smartcard information, software version, software update, PIN code entry for child protection, and so on. The menu is laid out just like the other menus on the device. The text and menu items come from the CAM itself, however. The language is also defined by the module. The picture below shows the card menu of an AlphaCrypt CAM.

Chapter 15

Optical Receiver (Option)

15.1 Introduction

RF signals are increasingly being transmitted via fibre optic cables. Optical transmission in broadband networks is gaining importance. While optical transmission in most existing networks still occurs exclusively at network level 2, the trend is moving towards fibre optic distribution up to the subscriber terminals. Even in the field of SAT-IF distribution, solutions are already available for optical transmission.

Optical fibres:

The optical fibre is the medium through which the light signal is transmitted. There are 2 different fibre types. With multi-mode fibres, the light can move through the optical fibres on multiple "paths" (modes). This results in modal dispersion (distortion), which limits the bandwidth and the transmission distance. With single-mode fibres, on the other hand, the light can only move through the fibres on a single path, preventing modal dispersion and resulting in higher bandwidths. At the moment, almost all the fibres used are single-mode.

They have a core diameter of 9 μm and a sheath diameter of 125 μm. A single-mode optical fibre has an attenuation of approx. 0.3 dB/km.

Optical plug connection:

There are 2 different kinds of fibre optic plug connection. The first one has a straight polish. This version, called PC (physical contact), has a somewhat worse return loss. Connectors with APC (angled physical contact) have an interface with an angle of 8°. PC connectors have blue markings, whereas APC connections have green ones.

Fibre optic plug connections are available in various forms such as FC (threaded connection), SC (plug connection), and E2000 and LC (both with snap/plug connection). An SC/APC plug connection is built into the measuring device.

The measuring device is equipped with an optical receiver that converts the light signal back into an RF signal. After the optical receiver, the RF signal behaves as if it had been supplied via the coax input of the measuring receiver. This means that all the measurements available through the RF input can also be taken via the optical input.

The optical receiver itself is not wavelength-selective. In some systems, light with different wavelengths is transmitted via one and the same optical fibre. This is known as a wavelength division multiplex. In this type of system, the wavelengths must be separated again before the optical receiver because otherwise the signals from the two wavelengths would be mixed in the optical receiver, leading to interference. A patch cable with an integrated wavelength filter should be used for this type of application. But generally, only one wavelength is used, making this unnecessary. In most cases, wavelengths of 1,310 nm, 1,490 nm and 1,550 nm are used.

Optical input power:

The measuring device does not have an integrated adjustable optical attenuator element.

As a result, the measuring device's optical receiver can be operated with up to 8 dBm of continuous power. However, the optimal range for the receiver is from −7 dBm to +3 dBm. At lower power levels, the reception quality is reduced because of the receiver noise.

At higher input power levels, the intermodulation products have a negative effect on the performance. In this case, optical attenuation elements should be used.

Example:

Measurements must be taken on an optical transmitter with an output power of 8 dBm. The optical power can be measured directly. However, an attenuation element of 5 to 10 dB should be connected between the transmitter and the receiver to determine the signal quality.

SAT-IF transmission via fibre optics:

There are systems that stack the individual SAT-IF levels in order of frequency. This means that multiple (e.g. 4) SAT-IF levels are transmitted via one optical fibre and one optical wavelength. Other systems use a separate optical wavelength for every SAT-IF level (wavelength division multiplex). Multiple SAT-IF levels can also be transmitted via one optical fibre in this case. The first system (lower cost) requires more effort in the RF range. The complex aspect of the wavelength division multiplex is that each SAT-IF level requires its own optical transmitter, which must be demultiplexed again in the receiver of the wavelength division multiplex using optical filters. The second system has higher quality.

The measuring device can receive SAT-IF signals in the range from 910 to 2,150 MHz. With this system, transmission of the level is generally vertical/low. However, this is sufficient for setting up a satellite antenna with an optical LNB. An optical LNB can be supplied with power through the LNB supply of the RF input.

15.2 Activating the optical input

You can activate the devices optical input using **MODE** > Input RF/Fiber.
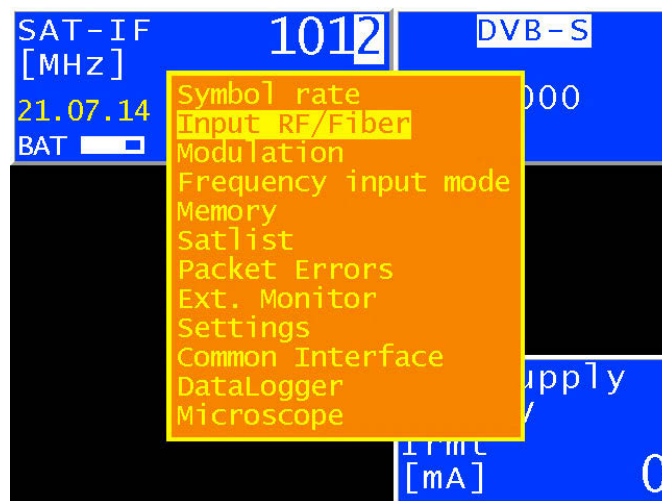
If the device's optical input is activated, "FIB XXXXnm" will appear in the display. XXXXnm stands for the wavelength set, e.g. 1310 nm. Now you can set a specific measuring range, e.g. TV. The spectrum analyzer also uses the signal from the optical receiver.

15.3 Setting the wavelength

As previously stated, the integrated optical receiver is not wavelength-selective. However, you must set the wavelength used because it is required for measurement of the optical power and the optical modulation index (OMI). The responsivity of the integrated photodiode depends on the wavelength.

Using **MODE > Settings > Wavelength LAMBDA** (second page) you can set the wavelength as 1,310 nm, 1,490 nm or 1,550 nm.

```
SAT-IF      1012    DVB-S
[MHz]               locked
                    SR 22000
21.07.14 16 44      CR=5/6
BAT ▭▬▭   FIB 1310nm
LEVEL[dBµV]   83.0    PwR[dBm]   6.8
                          OMI= 1.9%
     VBER<1.00e-8 MER[dB]
CBER    1.15e-8       14.5
PSI extraction   Rmt.supply
ready!               0V
SES ASTRA        Irmt
19.2° East       [mA]      0
```

15.4 Measuring the optical power

Optical transmission involves modulation of the intensity of the light power.

The measuring device measures the average optical power in dBm. This power is also measured when the light is supplied from an unmodulated laser source. In this case, the device can be used as a purely optical power measuring device. Start the measurement by entering the frequency and pressing ENTER to confirm.

15.5 Measuring the optical modulation index (OMI)

The optical modulation index (OMI) is comparable with the modulation index for an amplitude modulation. The amplitude (intensity) of a carrier—here, the light— is modulated. The greater the difference between the maximum intensity and the minimum intensity, the greater the OMI and the RF voltage (level) after the optical receiver. The OMI is specified in %. With this device, the OMI is selectively measured for a certain frequency, meaning that only the RF power within the signal bandwidth is taken into account. It is designated as the individual OMI or the channel OMI. The attainable signal-to-noise ratio depends on the individual OMI. A value of around 4 % is ideal.

Note:

The level specified after the OMI value corresponds to the internal RF level after the optical/electrical converter. This information is only relative. This specification is primarily used to determine the relationships between the levels of the individual channels.

A brief overview of the relationships between optical power, RF level and OMI is provided below:

If the optical power is increased by 1 dB for optical transmission, the RF voltage increases by 2 dB after the optical receiver, while the optical modulation index (OMI) remains unchanged. The RF voltage is proportional to the square of the optical power. If the optical modulation index is doubled (e.g. increased from 2 % to 4 %) with the same optical

power, the RF voltage after the optical receiver increases by 6 dB. This means that the OMI and RF voltage are linearly proportional to one another.

15.6 Remote supply

An optical LNB can be supplied with a voltage of 14 V and max. 500 mA using the F connector. For Invarcom FibreMDU and equivalent products, you can use a 14 V supply.

15.7 Cleaning the fibre optic plug connection

The weak point of every optical transmission system lies in the splice and plug connections. For plug connections, it is important to ensure that the contact surfaces are very clean.

But the ferrules of a fibre optic connection must also remain free of dust so that no contamination reaches the connectors' interfaces when they are plugged in. Industry-standard cleaning sets are available for this purpose. Immediately after cleaning the plugs and connections, you should put dust covers on them unless you are going to use them again right away.

The measuring device's fibre optic connection is equipped with a hinged lid that seals the connection as soon as the plug is removed. However, you must still ensure that the area around the lid remains free of contamination.

15.8 USB Microskope

A USB microscope can be connected to the device for plug connector inspection. The device supports DI-1000 type USB microscopes from Lightel Technologies.

Contamination in optical plug connections can impair the signal quality. Typical types of contamination include dust particles, hand lotion, skin and alcohol residues.
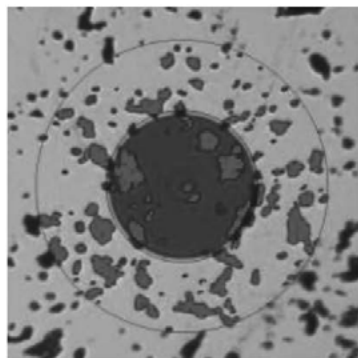
Dust Particles
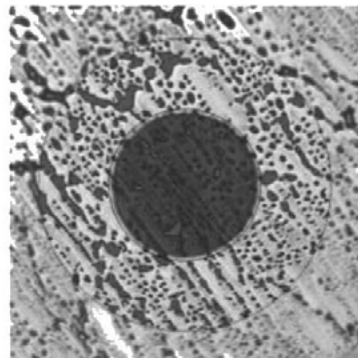
Hand Lotion
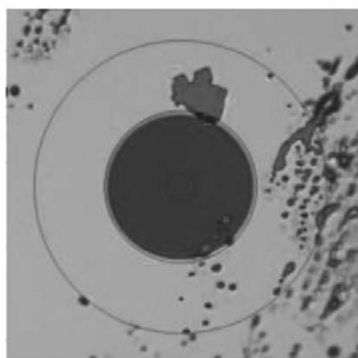
Skin Oil and Dead Skin Flakes
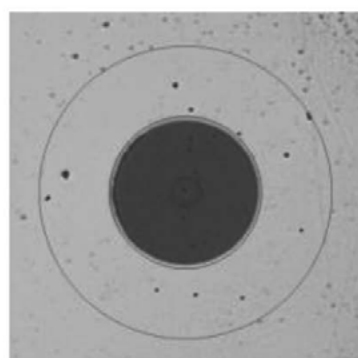
Alcohol Residue

Contamination on the optical fibres can cause the following problems:

> the signal path can be disrupted in the core region
> good physical contact can be prevented in the plug connector
> cause scratches and associated damage

The following figure shows a typical example of a poor physical contact in a plug connector. Here, a dust particle prevents the two optical fibres from creating a flush contact with one another.
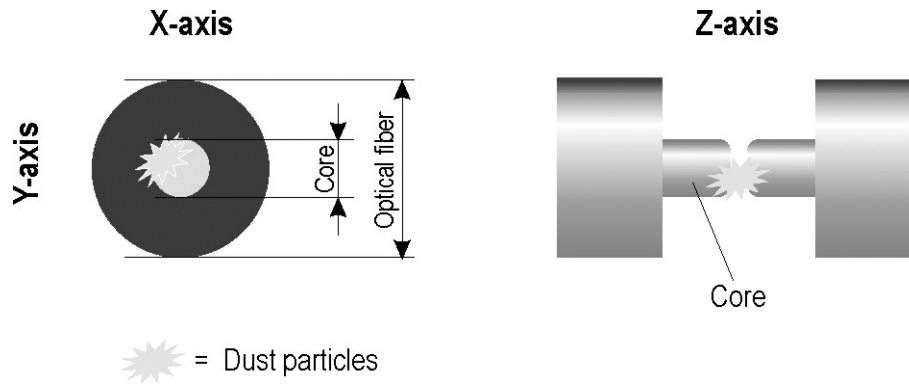

The microscope image in the measuring device shows a large magnification of the optical fibre from above. The following image is from the Lightel DI-1000 USB microscope with an optical magnification of 200. The core of the optical fibre is visible in the center.
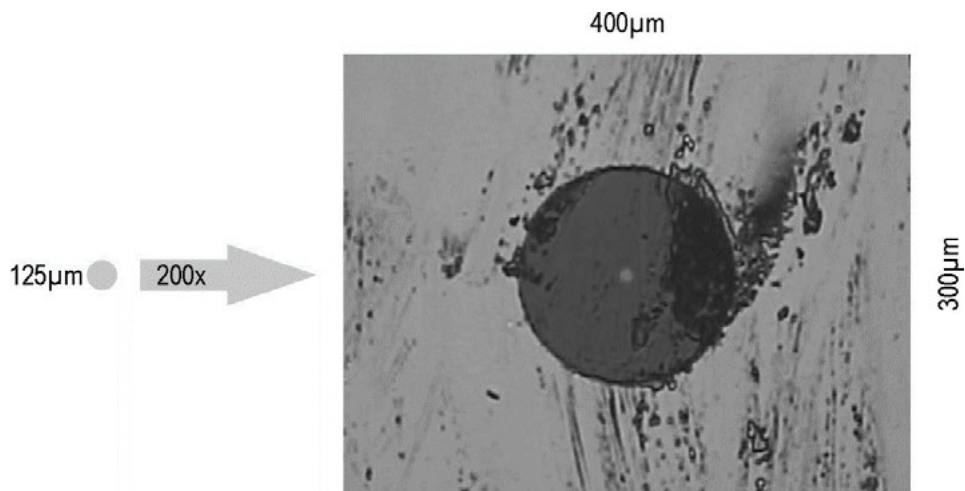
Typical requirements for single-mode fibres:

Zone name (diameter)	Scratches	Damage
A: Core (0 to 9 µm, 0 to 25 µm)	Non permitted	Non permitted
B: Cladding (25 to 120 µm)	No limits	all < 2 µm 5 in 2 to 5 µm range none > 5 µm
C: Adhesive (120 to 130 µm)	No limits	No limits
D: Contact (>130 µm)	No limits	No limits

The figure shows the schematic structure of a typical single-mode fibre with a 9 µm core.
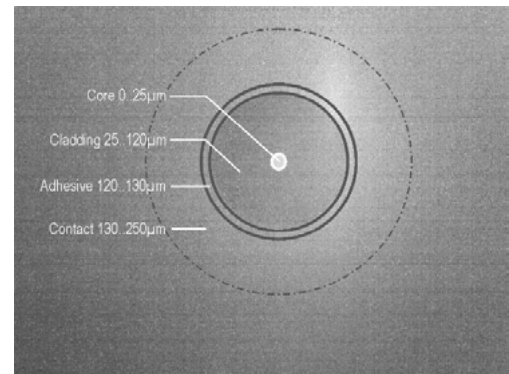
15.8.1 Operation

The microscope range is called up by pressing the **MODE > Microscope key**. Select **MODE** to access the image settings menu. You can activate the individual menu items with **ENTER** and change the parameters by using the arrow buttons or entering the number directly.
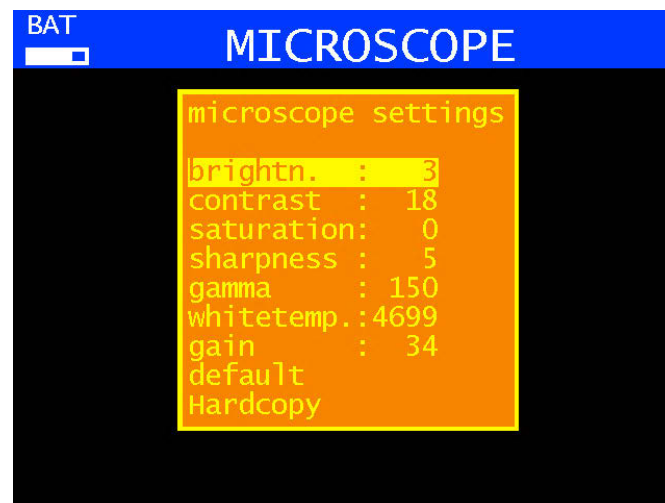
Selecting the **Default** menu item loads the microscope's default settings. As the manufacturer's settings are not always ideal, you can permanently save the currently set values in the measuring device by selecting the **SAVE** button. You can load these values again any time by selecting the **RECALL** button.

The ESC button allows you to exit the USB microscope section.

15.8.2 Logging

For documentation purposes, it is possible to make a hardcopy (screenshot) of the current microscope image. As the measuring device is only equipped with a USB interface, only 4 images can be saved in the internal buffer of the measuring device.

If all 4 memory locations are occupied, these images must be transferred to a USB stick. Then the 4 memory locations are available again.

Saving an image as a screenshot in the cache:

- Open the **MODE>Hardcopy** menu item; if there is space available in the cache, the image will be saved. This can take several seconds; a corresponding message will appear on the screen "**Screenshot saving...**".
- The screen message changes to "**Screenshot saved**" as soon as the image is saved.
- The message "no free memory loc." appears if no more space is free in the buffer. All storage locations must first be saved to a USB stick. See the following point.

Saving buffer images to a USB stick:

- Exit the microscope section with the **ESC** button.
- Unplug the USB microscope and connect a USB memory stick.
- Press **MODE**.
- Select **Memory > Export Hardcopy > USB**
- Depending on the number of occupied storage locations, corresponding files are generated with the file name MICROSCOPE_xx.BMP, (xx represents a consecutive number). Files already saved on the USB memory stick are not overwritten.

The message "Screenshots transferred, memory locations cleared" appears on the screen once the data has been successfully transferred to the USB memory stick.

Constellation diagram (Option)

16.1 Introduction

The constellation diagram is a graphical representation of the states of a digitally modulated signal in a two dimensional coordinate system. Individual signal states can be viewed as source vectors with I (inphase, horizontal axis) and Q (quadrature, vertical axis) components. Only the peaks of the vectors are shown in diagram, however. Depending on modulation method, there is a varying number of decision fields within the two dimensional field (e.g. 8 with 8PSK). These decision fields are assigned to a fixed bit combination.

In the ideal case, all signal states are in the center of the decision fields. A real signal is exposed to variable interferences, however. If you view these interferences as vectors that are superimposed on the ideal signal states, the peaks of the sum vectors depict the deviation from the ideal state. The worse the signal quality is, the larger the distribution in the two-dimensional state space. It is possible for you to draw conclusions about the type of signal interference based on the form of the constellation diagram. This is explained later using examples.

The mean between two ideal states is designated as the decision limit (indicated in the diagram by horizontal and vertical lines). A signal with enough interference to move several signal states beyond the decision limit will result in bit errors. This means: The better all signal states center on the ideal states (the smaller the signal clouds are), the better the signal.

Approx. 15,000 symbols are recorded, analysed and displayed in colour on the TFT according to an analysis of frequency of occurrence. The colour gradation provides information about the distribution of the occurrence frequency of the signal states. Blue, green, yellow and red represent increasing frequency. This gives the constellation diagram a three dimensional appearance.

16.2 Operation

You must first tune the measuring receiver. Afterwards, you can use the **MODE > Constellation diagr.** menu item to activate the constellation diagram. You can use **MODE** to access the hardcopy menu. From the constellation diagram, you can use **ESC** to return to the normal measured value display.
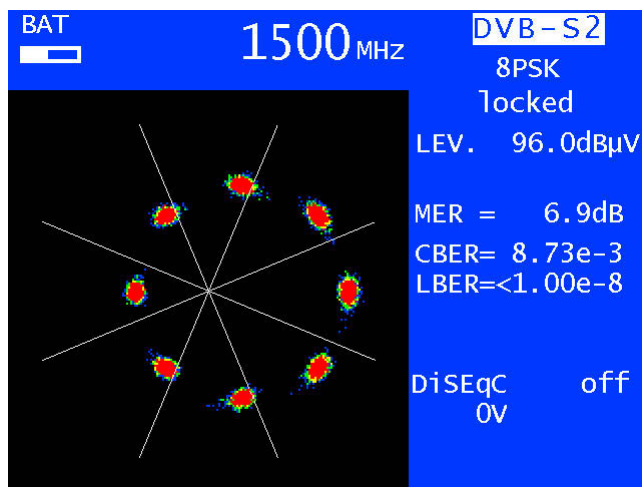

Real 8PSK signal
with MER=16,2 dB
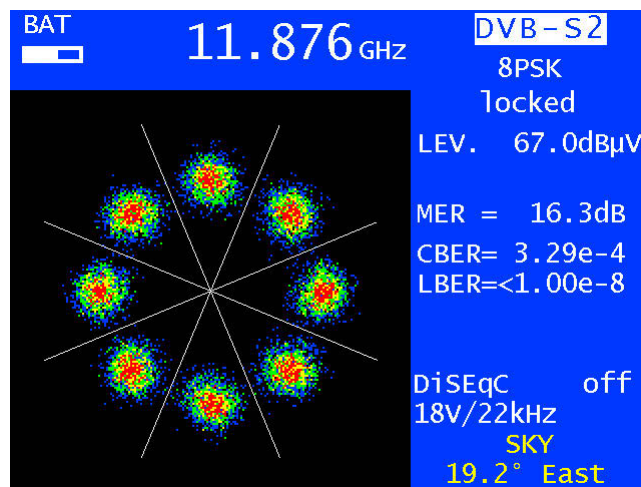
Ideal constellation diagram
> signal source SFU
(Rohde & Schwarz)
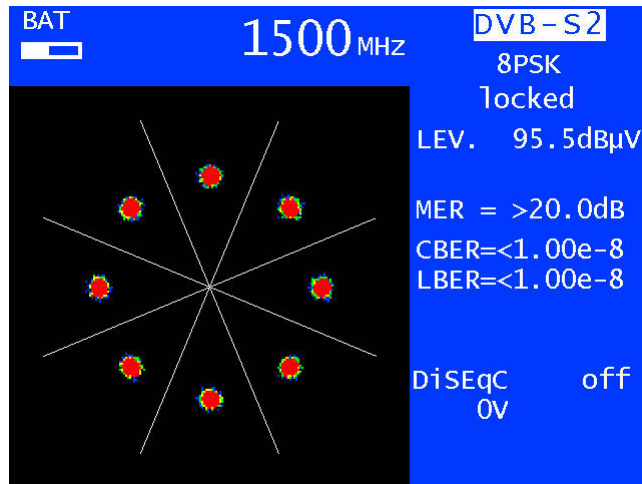
8PSK signal with 8%
I-Offset > signal source
SFU (Rohde & Schwarz)

Chapter 17

Device management

These functions can only be accessed when the device is not tuned.

17.1 Language of the operator guidance

The user guidance (menu interface) can be displayed in German, English, French or Italian. Use **MODE > Settings > Language > German, English, French, Italian** to select the desired language.

17.2 Software version

Use this function to query the software (firmware) version of the device.

This is done as follows: **MODE > Settings > Software > Info**.

17.3 Software update

You can upload a new firmware release onto the device at any time.

The software is saved as a ".bin" file. Request this file from the manufacturer and copy it from a computer onto the included USB stick.

When updating the firmware, the device should be plugged in to the mains for safety reasons. Do not switch the device off while the update is in progress.

Next insert the USB stick into the device and select **MODE > Settings > Software > Update**. A selection appears containing all saved ".bin" files. Select the desired file using the arrow keys (Up/Down) and press **ENTER** to start the software update. The device deletes the old version from the memory before writing the new software to the internal flash drive.

This takes approximately 1 minute.

17.4 Serial number

The serial number can be found on the name plate on the back of the device. It can also be requested on the device using **MODE > Settings > Serial number**.

17.5 Default setting

Use the "PRESET" function **MODE > Settings > Factory settings** to reset all device settings to the factory default settings. The content of the tuning memory is not included; PRESET does not make any changes to it.

17.6 Clock

The device has a real time clock that is powered by the internal battery.

Set the date and time using the Clock menu. To do this, select the corresponding menu item and open it with **ENTER**. You can now set the time and date. Press **ENTER** to accept the value and return to the previous menu.
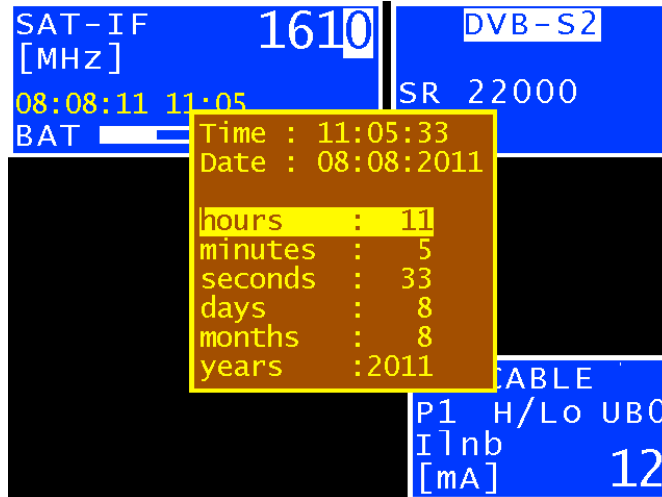
17.7 Modulation

Use the **MODE > Modulation** menu to preset the standard to DVB-S or DVB-S2. During tuning, the device first attempts to log into the preset standard and then tries the other. The standard with which log-in was successful then becomes the new preset standard.

17.8 Botton tone (beeper)

The device has a signal generator that can confirm that a button or key has been pressed. You can switch this function on and off via **MODE > Settings > Keyboard buzzer**.

17.9 Hard copy

For documentation purposes, the contents of the screen can be saved on a USB stick, or, alternatively, one of 2 two internal memory locations, provided the device is in tuned mode or analyzer mode. Videos and drop-down menus for settings, etc. cannot be copied.

By selecting **MODE > Hardcopy**, you can access a menu where you can choose between **Hardcopy > USB, Hardcopy > int. memory location** and **USB Directory**. Any existing files with the "BMP" file extension can be deleted in the USB Directory menu. Under **Hardcopy > USB**, you can enter a name for the new file and create it with **ENTER**.

17.9.1 Transfer of the internally stored images to a USB stick

The device must be in ground state (eventually terminate with ESC a measurement or a process). Start procedure with **MODE > Memory > Export Screenshots > USB**.

The device creates appropriate files depending on the number of occupied memory locations. For the screen copy the file name HARDCOPY_xx.BMP is used. For microscope screenshots MICROSCOPE_xx.BMP is preset. The xx is a sequential number. The device will not overwrite any existing files on the USB stick.

After successful transmission to the USB stick a message on the screen "Screenshots transferred, memory locations cleared.

17.10 Activating software options

Software options can be activated by entering an 8-digit key code. You can request the individual key code for each option from the manufacturer. **MODE > Settings > SoftwareKeys** takes you to a submenu, which currently only offers the constellation diagram option.

To activate this option, confirm the menu item with **ENTER**. An entry field for the 8-digit key code is then displayed.

If the code is entered correctly, the following message appears: **Option activated!** Now the corresponding option is enabled for use.

17.11 Display MER or C/N

The signal quality in baseband can be displayed as MER (Modulations Error Rate) or as C/N (Carrier to Noise). The values between MER and C/N differ only about 0.16 to 0.39 dB depending of the roll off factor r.

MER[dB] = C/N[dB] + 10 log(1−r/4)

You can switch between MER and C/N via **MODE > Settings > MER<>C/N**. This setting persists between reboots.

17.12 Enable/disable assistance mode on startup

When the device starts up, a assistance mode for setting up dishes and checking SAT signals at sockets is shown. This assistant can be switched off in the settings. It can still be reached by pressing **MODE > Assistance Mode**. It is only no longer started automatically when the device has boot up.

The assistance mode can be switched on or off by pressing **MODE > Settings > Assistance Mode** on startup. Factory preset is on.

Chapter 18
DVI output

The measuring device is equipped with a DVI/HDMI interface for connecting a Full HD TV set. This allows you to check the functionality of the DVD/HDMI interface on an LCD screen, for example. The DVI interface is on the top of the device.

The device cannot output a video signal to the DVI output and to the internal device display at the same time. Do not tune the device to a station if you wish access the monitor function. This function can be accessed via **MODE > Ext. Monitor**.

When you call up the **DVI out**, **LCD off** menu item, the screen of the device darkens and the video signals are only output through the DVI output. For this reason you should connect the device to a suitable display device via the DVI output before the device is switched over. When the device is switched off and restarted, the picture is shown again on the internal display.
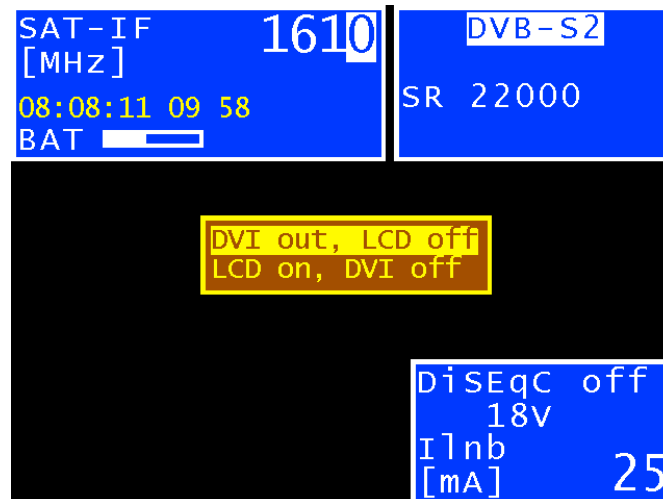
DVI stands for "Digital Visual Interface" (HDMI means "High-Definition Multimedia Interface"). Physically, the interface is designed as a DVI-I socket. However, the protocol is HDMI-compliant. This means that both video and audio data are transmitted. The measuring device can be connected to the HDMI input of a TV set using a DVI/HDMI adapter.

However, the measuring receiver does not support HDCP (High-bandwidth Digital Content Protection). HDCP prevents digital and audio material from being tapped within the HDMI connection. HDCP is required by the playback program. If an HDTV program requires HDCP, the measuring device cannot transmit the data via the DVI/HDMI interface. The connected TV set remains blank in this case.

Important!
– The device's screen is dimmed when the DVI output is active.
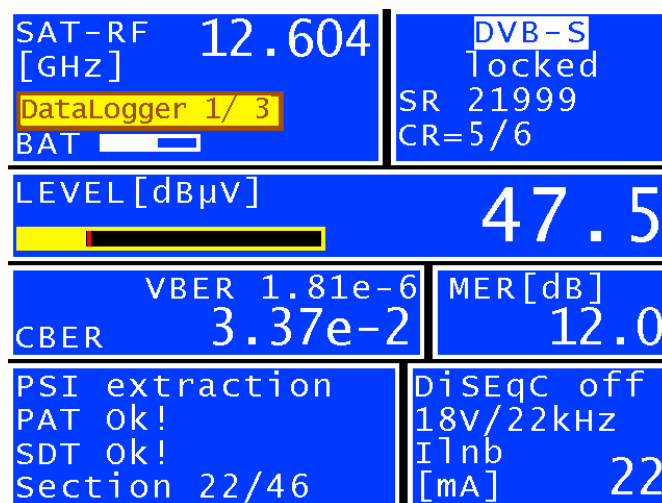– The screen resolution is fixed at 1920 × 1080i.

DataLogger

The device is equipped with measurement data memory (a data logger). This allows you to save measured values automatically on a USB stick as an ".xml" file. The data can then be read and processed using applications such as MSExcel or OpenOfficeCal.

19.1 Automatic recording of measurement sets

To call up the "DataLogger" menu item enter **MODE > DataLogger**. The menu then appears with the selection "New Measurement" or "Directory". Add measurements by selecting the menu item "New Measurement". A prompt asks for a name for the system (measuring location). Set this in alphanumeric format using the arrow keys or the numeric keypad. Press **ENTER** to complete the entry.

The entered name is identical to the file name of the ".xml" file containing the measured values at the end. If a file with the same name already exists, you will receive a warning. Enter a different name by pressing **ESC**, or press **ENTER** to overwrite the existing file. Then enter the individual measurement parameters. The device now refers to the tuning memory, whereby only the first and last memory locations need to be entered for the measurements. Any unassigned memory locations are skipped. The device then automatically accesses the tuning memory locations one by one and saves the measured values in the ".xml" file mentioned above. The progress of the measurement can be traced in a corresponding message in the frequency window.

The following picture shows the process:

```
SAT-RF   12.604      DVB-S
[GHz]                locked
DataLogger 1/ 3   SR 21999
BAT ▭▬▬▭          CR=5/6
LEVEL[dBµV]
                      47.5
▮▮▮▮▮▮▮▮▮
        VBER 1.81e-6  MER[dB]
CBER   3.37e-2         12.0
PSI extraction    DiSEqC off
PAT Ok!           18V/22kHz
SDT Ok!           Ilnb
Section 22/46     [mA]    22
```

If the signal does not lock due to poor signal quality or an incorrect parameter, and if, as a result, not all measured values can be recorded, "Signal unlocked" appears. The series of measurements can be continued by pressing **ENTER** and can be interrupted by pressing **ESC**.

At the end of the series of measurements, a status message is displayed in a window. This message shows how many of the measurements were successful.

If all of the measurements were successful then the window is blue; otherwise it is red. The display is shown until it is confirmed by pressing **ENTER**.
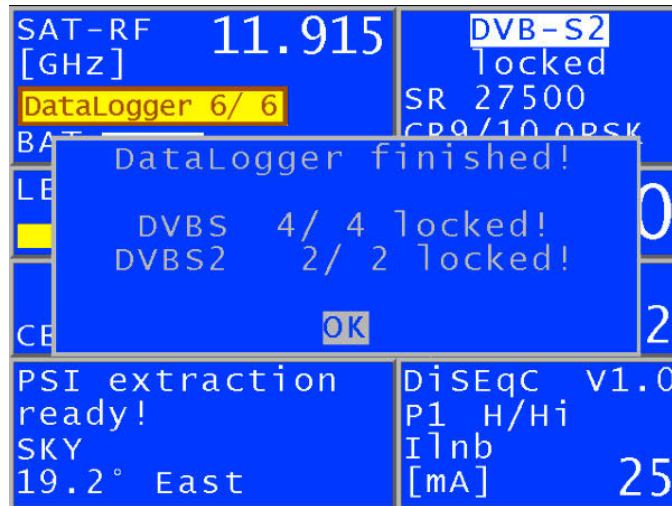
19.2 Transferring and evaluating the measurements on a PC

To evaluate, document or process a set of measurements, the data must first be transferred to a PC or laptop using the USB stick. As previously mentioned, the measurement data ".xml" file on the USB stick can be read and processed by MSExcel or OpenOfficeCalc. Right-click the required file and select "**Open with**" then choose from MSExcel or OpenOfficeCalc.

Important!

Transfer is only possible with MSExcel version 2002 or later.

The illustration below shows a set of measurements in MSExcel:

19.3 Deleting measurement sets from the device

If the USB stick is in the device, you can enter **MODE > DataLogger > Directory** to access the files saved on the external memory. The remaining memory capacity of the USB stick can also be seen in percent. For example, the file shown above takes up 18 KB on a USB stick. With a capacity of 512 MB, approx. 29,000 measurement sets of this type can be saved.

To delete a file, move the cursor with the arrow keys (Up/Down) onto the file you wish to remove and select **ENTER**. The device issues a warning message. This function allows you to remove measurement sets that are no longer needed on-site, which gives a clearer overview for later evaluations.