



Part of **axing** group

CHP - Compact High Performance Headends

MK-40x | MK-80x | MK-160x

MK-82x

MK-40x | MK -80xN | MK-120xN

DVB headends

Operation instructions

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WARNING

- Observe the safety instructions supplied with the device! They are also available at the following Internet address:
https://download.axing.com/BAs/Sicherheitshinweise_9sprachig.pdf
- Use the device only as described in these operating instructions and in particular in accordance with the state of the art. If the device is used for other purposes, no warranty will be assumed!



Herewith RF-Tuote Oy declares that the marked products comply with the valid guidelines.



WEEE Nr. DE26869279 | Electrical and electronic components must not be disposed of as residual waste, it must be disposed of separately.

1. Product description

1.1. General

MK-800	8 independent multituner inputs Transmodulates 8 × DVB-S/S2/S2X/T/T2/C into 8 × DVB-C or DVB-T (depending on the configured modulation standard, see 5.2 on page 48) Expandable to 16 modulators with MKS 8-16 software.
MK-806	Like MK-800, with 6 CI slots (see chapter 6 on page 68)
MK-1600	16 independent multituner inputs Transmodulates 16 × DVB-S/S2/S2X/T/T2/C into 16 × DVB-C or DVB-T (depending on the configured modulation standard, see 5.2 on page 48)
MK-1606	Like MK-1600, with 6 CI slots (see chapter 6 on page 68)
MK-820	8 independent multituner inputs Transmodulates 8 × DVB-S/S2/S2X/T/T2/C into 8 × DVB-T2
MK-826	Like MK-820, with 6 CI slots (see chapter 6 on page 68)
MK-800N	8 independent tuner inputs Transmodulates 8 × DVB-S/S2/S2X into 8 × DVB-C or DVB-T (depending on the configured modulation standard, see 5.2 on page 48)
MK-803N	Like MK-800N, with 3 CI slots (see chapter 6 on page 68)
MK-1200N	12 independent tuner inputs Transmodulates 12 × DVB-S/S2/S2X into 8 × DVB-C or DVB-T (depending on the configured modulation standard, see 5.2 on page 48)
MK-1203N	Like MK-1200N, with 3 CI slots (see chapter 6 on page 68)

Common Features:

- Output modulation configurable
- Remux | Crossmultiplex
- NIT editing option¹
- PID Filtering²
- Interface for CASimulcrypt Server³
- Class A according to EN 50083-2
- Web-based configuration, remote maintenance (SMARTPortal)
- Supports SNMPv1 and SNMPv2c
- Can be used for wall mounting or as a 19" unit

1.2. Scope of delivery

- 1 × Compact headend
- 1 × AC power cord
- 1 × Quick start guide
- 1 × Drilling template (MK-80xN and MK-120xN only)

¹ software extension MKS 1-00 required

² software extension MKS 1-01 required

³ software extension MKS 1-02 required

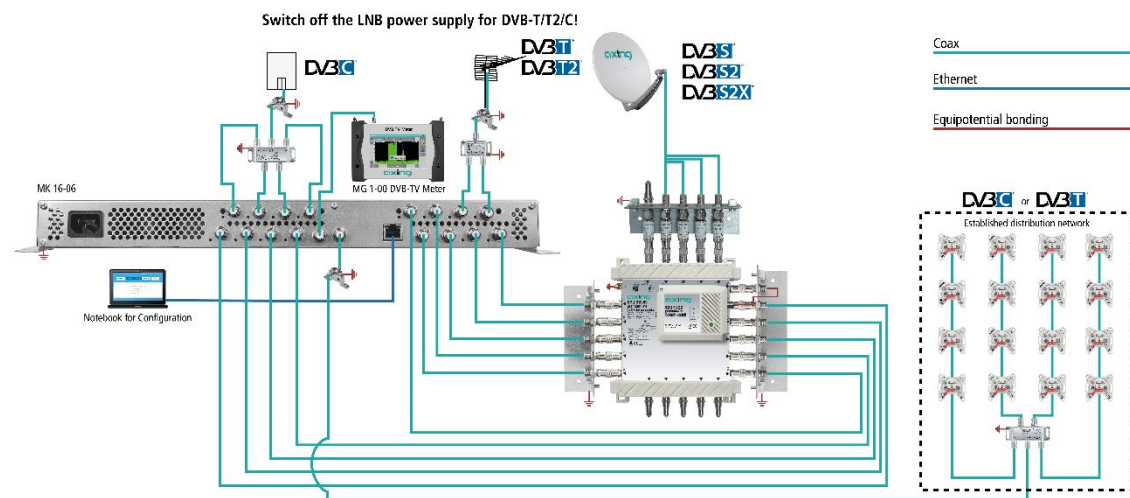
1.3. Available Accessories

MKS 1-00	Software extension to edit a NIT
MKS 1-01	Software extension for PID filtering
MKS 1-02	Software extension for CASimulcrypt
MKZ 1-00	Front panel for 19" usage (MK-800/MK-1600)
MKZ 1-01	Front panel for 19" usage, with cut-outs for CI slots (MK-806/MK-1606)
MKZ 1-02	Front panel for 19" usage (MK-800N/MK-1200N)
MKZ 1-03	Front panel for 19" usage, with cut-outs for CI slots (MK-803N/MK-1203N)

1.4. Inputs

1.4.1. MK-80x | MK-160x | MK-82x

MK-80x | MK-160x | MK-82x with multiteners can receive DVB-S/S2/S2X, DVB-T/T2 or DVB-C.

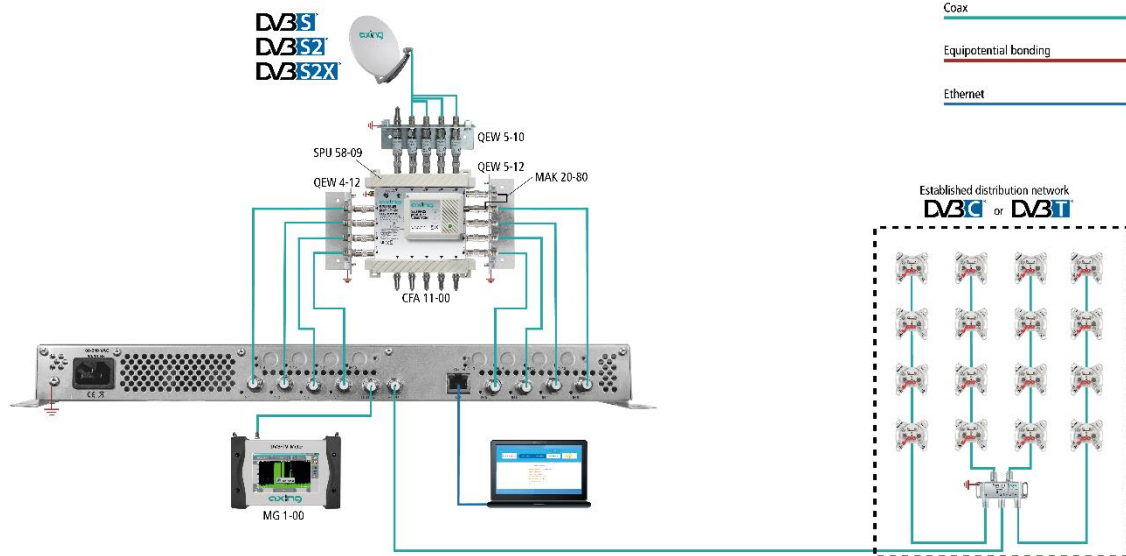


CAUTION

For receiving DVB-T/T2 or DVB-C the LNB power has to be switched off before connecting a antenna cabel to one of the HF inputs (see 4.1.2 on page 24)!

1.4.2. MK-80xN | MK-120xN

MK-80xN | MK-120xN can receive DVB-S/S2/S2X.



1.5. Demodulation of the data stream

The selection of the frequency and the demodulation of the data stream are both done in the tuner. If needed, the programs from the data flow of the demodulated transponder can be filtered (Remux mode).

Thanks to the Cross Multiplex Mode, FTA programs (Free to Air) can be filtered from the data flow of several tuners for a common output channel and be bundled again.

The prepared data flow is passed on to the modulators.

1.6. Output/modulators

1.6.1. MK-80x | MK-160x | MK-80xN | MK-120xN

MK-80x and MK-80xN have eight output modulators

MK-120xN have 12 output modulators

MK-160x have 16 output modulators

The modulators can be set to any output channel (DVB-C = S2...K87 | DVB-T = S2...K69). Due to the possibility of setting a frequency offset, any centre frequency in the output frequency range can be configured beyond the stored channel table.

1.6.2. MK-82x

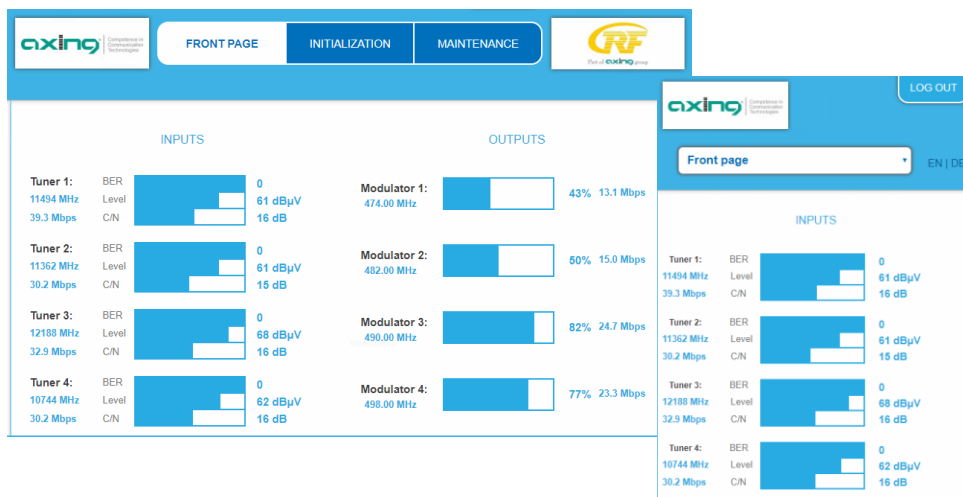
MK-82x have eight output modulators

If the output modulation is set to FFT 32K or 32Kext mode, the number of output modulators is reduced to four.

The modulators can be set to any output channel (DVB-T2 = S2...K69). Due to the possibility of setting a frequency offset, any centre frequency in the output frequency range can be configured beyond the stored channel table.

1.7. Graphical user interface

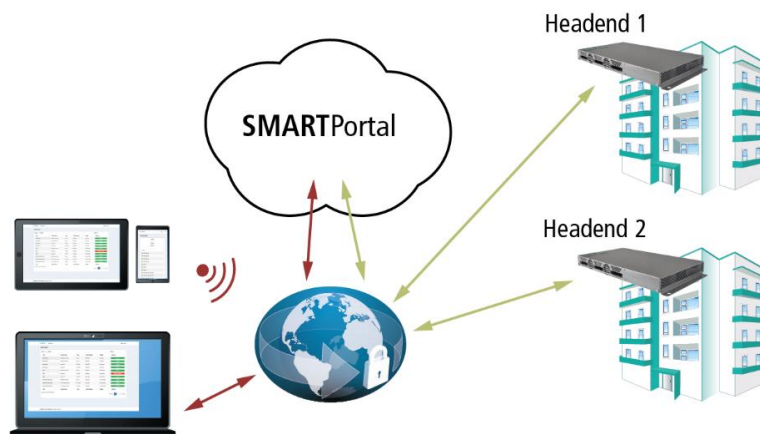
The settings can be changed via the user interface of the integrated web interface. To access the user interface and thus configure the devices, you need a standard PC/laptop with a network interface and the actual version of the installed web browser (left).



The configuration interface is "mobile ready" and can therefore also be used from the smartphone or tablet (right).

1.8. SMARTPortal

The AXING SMARTPortal connects each RF-Tuote headend device with a cloud-based portal and thus provides worldwide access to the devices. The connection is password-saved and scrambled. The only requirement on site is an internet connection of the device e. g. via LAN, EoC, 3G/LTE-Router (see 2.7 on page 17).



With AXING's SMARTPortal a worldwide configuration of all settings or software updates can be ensured. On customer request AXING can provide the necessary support.

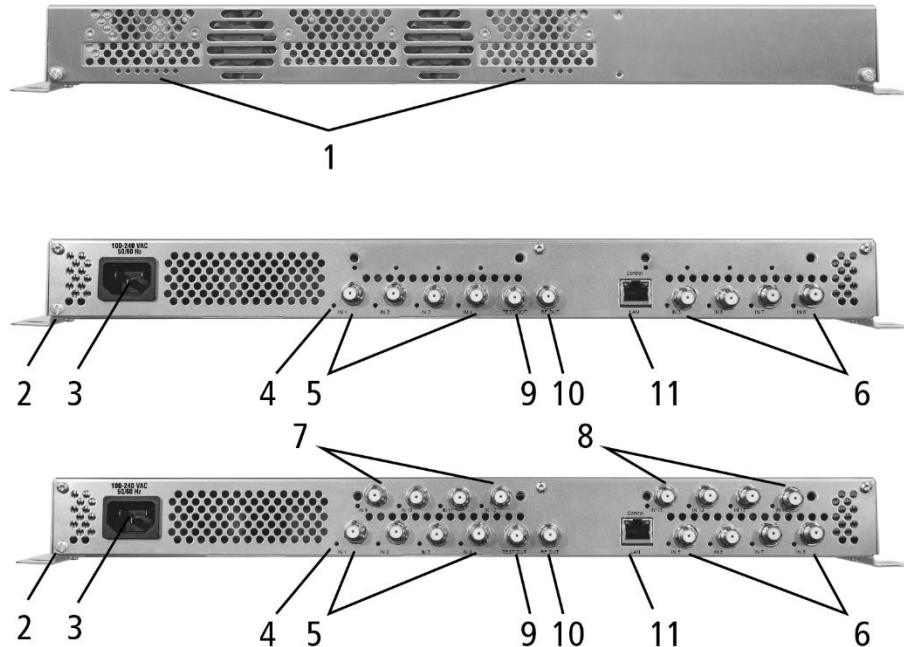
In addition, the SMARTPortal also sends error messages to a configured e-mail address. This makes monitoring the devices simple and safe. Error messages occur in the following cases, for example:

- Power supply failure
- Processor temperature > 90 °C
- Airflow temperature > 50 °C (MK-800/806, MK-1600/1606, MK-820/826 only)
- Power supply temperature >85 °C
- Failure of the input signal
- CAM failure (MK-806, MK-1606, MK-826, MK-803N and MK-1203N only)

- Modulator overflow
- RF output-level not according to settings

1.9. Display elements and connectors

1.9.1. MK-80x | MK-160x

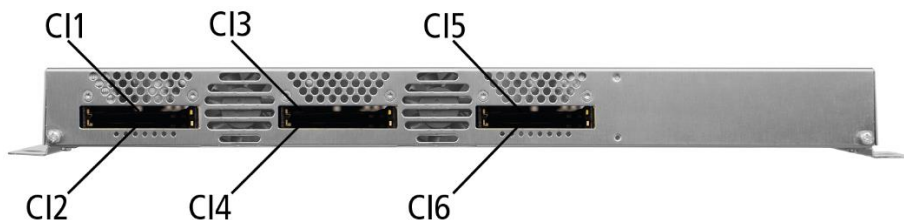


- LED indicators for 8 or 16 output modulators
 - Green = modulation is ok
 - Green (blinking) = something is missing from the programmed TS
 - Red = modulator overload.
- Equipotential bonding connection
- Mains connection
- HF input LEDs:
 - Yellow = MPEG data stream present
 - Off = MPEG data stream not present
- RF input 1...4
- RF input 5...8
- RF input 9...12 (MK-160x only)
- RF input 13...16 (MK-160x only)
- Test port (-30 dB)
- RF output
- Control Interface for Configuraton and CAS-Server

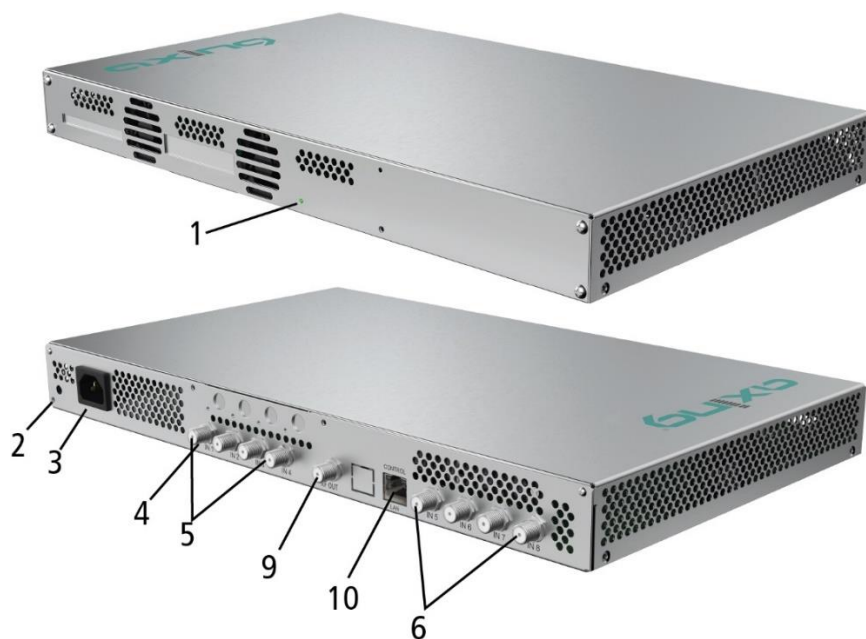
MK-806 | MK-1606

MK-806 and MK-1606 each have 6 CI slots (CI1 ... CI6).

Which encrypted program you decrypt with which interface; you determine in the configuration.



1.9.2. MK-80xN | MK-120xN



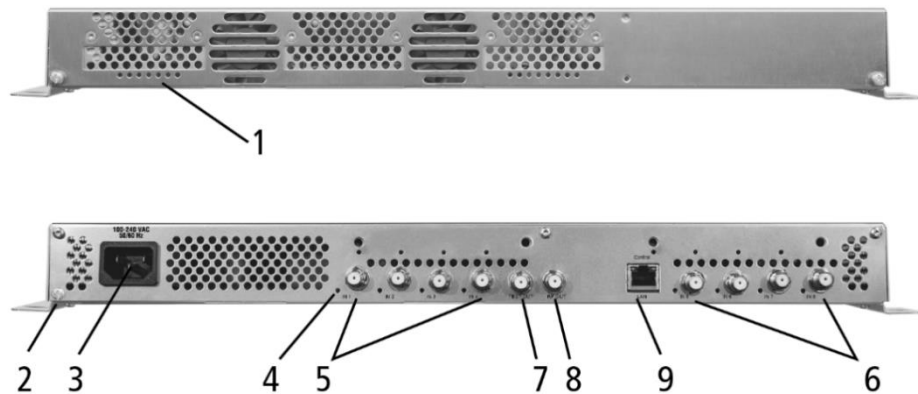
- 1 One LED for all output modulators
 Green = all modulators ok
 Green (blinking) = no data stream at the output (no input signal, tuner not configured, no program for output configured)
 Red = at least one modulator level too high overload.
- 2 Equipotential bonding connection
- 3 Mains connection
- 4 HF input LEDs:
 Yellow = MPEG data stream present,
 Off = MPEG data stream not present
- 5 RF input 1...4
- 6 RF input 5...8
- 7 RF input 9...12 (MK-120x only)
- 8
- 9 RF output
- 10 Control interface for Configuration and CAS-Server

MK-803N | MK-1203N

MK-803 and MK-1203 each have 3 CI slots (CI1 ... CI3).
 Which encrypted program you decrypt with which interface; you determine in the configuration.



1.9.3. MK-82x

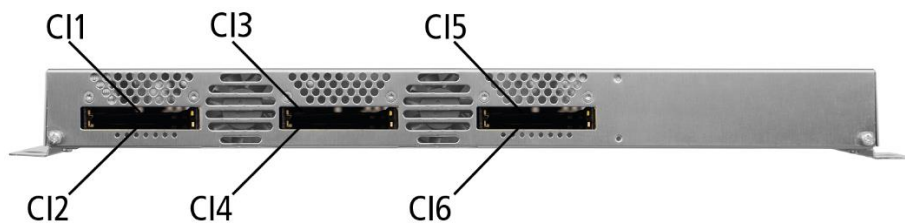


- 1 LED indicators for 8 output modulators
 - Green = modulator ok
 - Green (blinking) = no data stream (no input signal, tuner not configured, no program for output configured)
 - Red = modulator overload.
- 2 Equipotential bonding connection
- 3 Mains connection
- 4 HF input LEDs:
 - Yellow = MPEG data stream present,
 - Off = MPEG data stream not present
- 5 RF input 1...4
- 6 RF input 5...8
- 7 Test port (-30 dB)
- 8 RF output
- 9 Control interface for Configuraton and CAS-Server

MK-826

MK-826 have 6 CI slots (CI1 ... CI6).

Which encrypted program you decrypt with which interface; you determine in the configuration.



1.10. Application Notes

You can find application notes on the AXING website about the installation and configuration of RF/AXING headends. <https://axing.com/en/service/application-notes/>

2. Mounting and Installation

The compact headend can be mounted on either at the wall or be mounted in a 19 "rack.

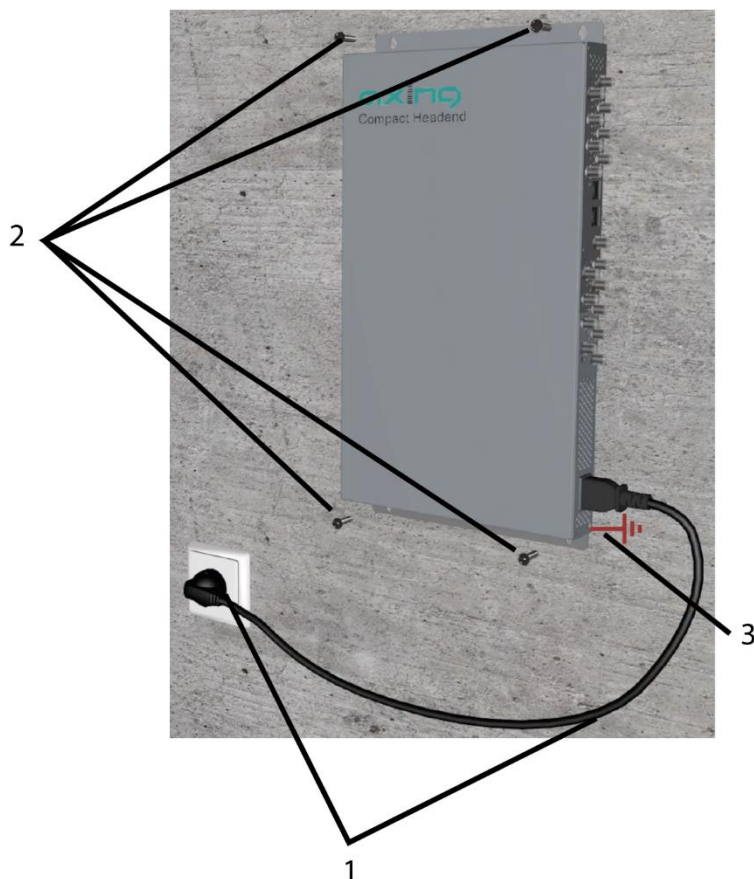
- Installation must be performed by authorized and skilled electricians only.
- The headend must only be operated indoors.
- Before mounting and installation, pull the mains plug (1)!
- The antenna system must be installed and grounded according to the EN 60728-11 standard.
- Install the device in compliance with the safety regulations defined by the EN 60728-11 standard.

2.1. Wall mounting of MK-80x, MK-160x and MK-82x

The compact headend are factory-fitted with wall brackets.

Notes:

- The unit must be wall mounted with at least 5 cm clearance along the 4 sides.
- The head units can be mounted horizontally or vertically on the wall. For horizontal mounting, the connections must be on the top, for vertical mounting on the right.



- The installation must be carried out on an even and vertical surface (any unevenness must be compensated).
- Fix the headend with minimum four pcs. of 4 × 30 mm screws (2).

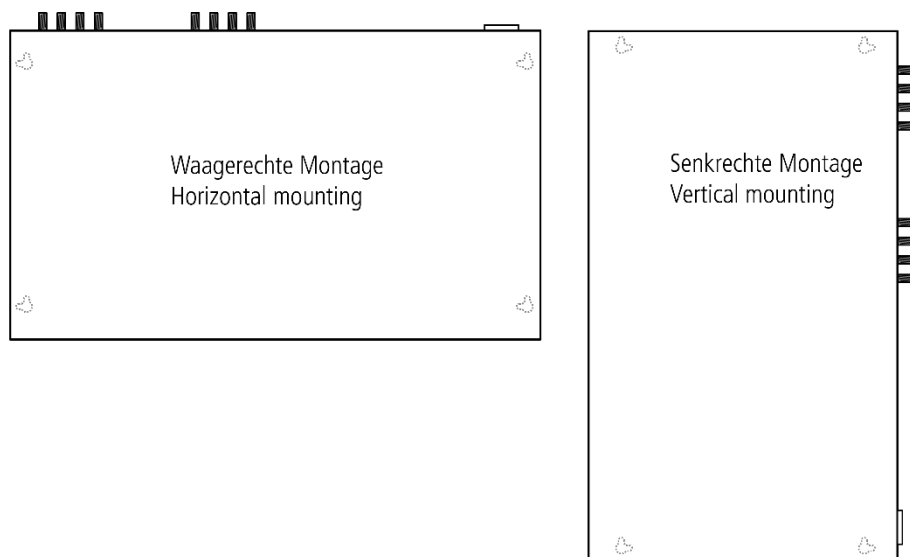
2.2. Wall mounting of MK-80xN and MK-120xN

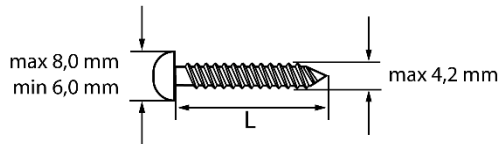
The MK-80xN and MK-120xN head ends have mounting holes on the underside with which they can be hung on the wall using four suitable screws. We recommend mounting the headend on a perforated mounting plate QMP 4065 or larger.

The following illustration shows the positions of the four fixing screws to be fitted. A drilling template true to scale is enclosed with the device.



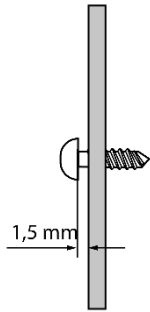
Note: The unit must be wall mounted with at least 5 cm clearance along the 4 sides. The head-end unit can be mounted horizontally or vertically on the wall. For horizontal installation, the connections are at the top; for vertical installation, they are on the right.





→ Use four suitable mounting screws.

L = depending on the mounting form and the mounting surface



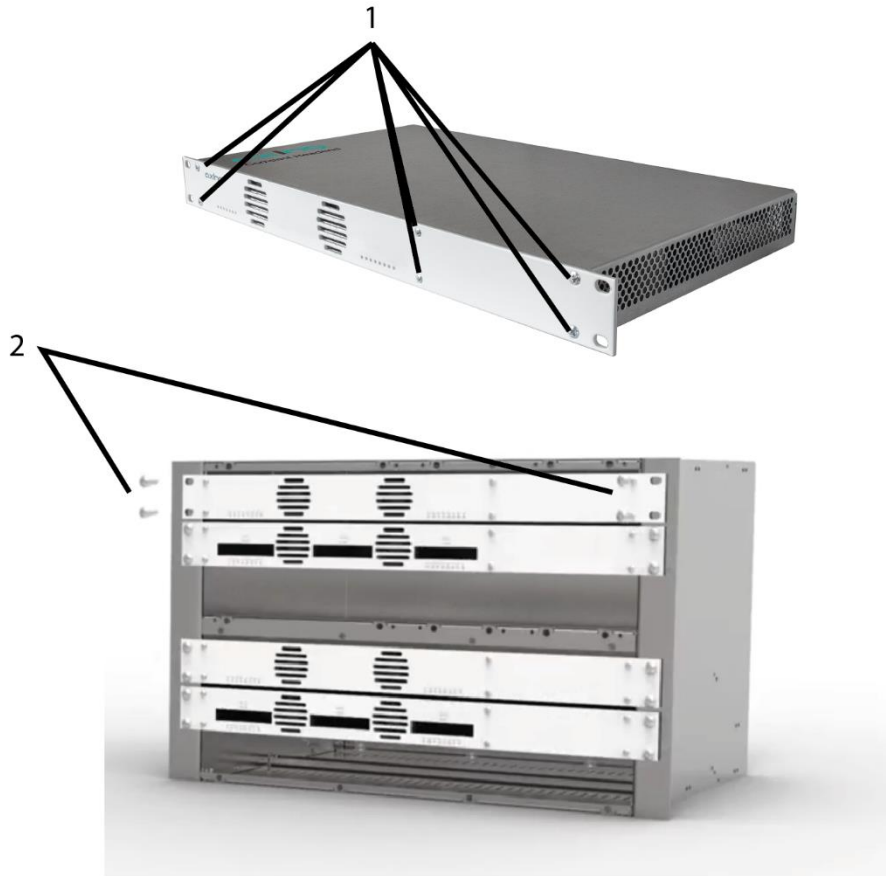
→ Screw the mounting screws down to 1,5 mm, e.g. into the mounting plate.

→ Hook the head unit into the four mounting screws. Make sure that all four mounting screws engage correctly in the mounting holes.

2.3. Mounting in a 19" rack

Note: For 19-inch rack mounting, there must be at least 5 cm clearance in front of and behind the unit.

- Remove the wall bracket from the housing of the compact headend (MK-80x/MK-160x and MK-82x only).
- Mount the front plate MKZ 1-0x onto the MK-800 / 1600 (1).



- ➔ Slide the compact headend into the 19 "rack.
- ➔ Screw the compact headend with four screws (2).
- ➔ Install the device in compliance with the safety regulations defined by the EN 60728-11 standard.

2.4. Equipotential bonding

- ➔ The device must be connected to the equipotential bonding according to EN 60728-11. Use the equipotential bonding connection at the device.
- ➔ To connect the outer conductor of the coaxial cable to the equipotential bonding, use e.g., QEW earthing angles or CFA earth connection blocks at the inputs and output.

2.5. Power supply

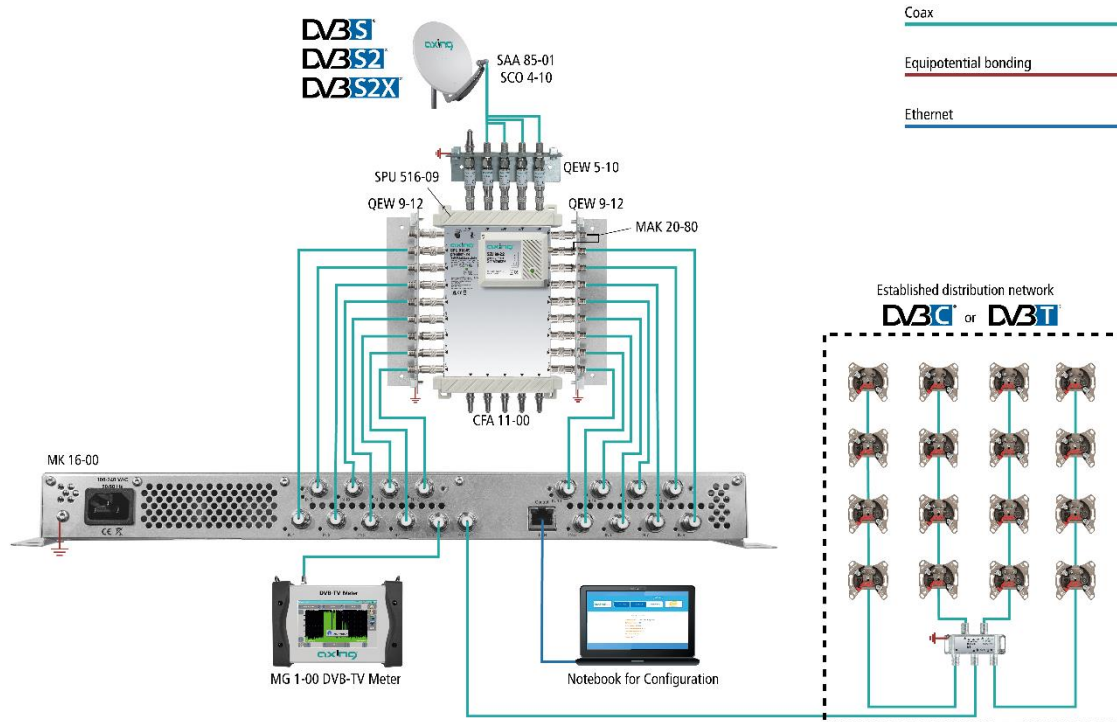
The headend has a built-in power supply unit. Connect the headend to a mains socket using the enclosed mains cable.

2.6. RF Installation

The input levels for the DVB standards must be complied with (see Chapter 7 on page 71).

2.6.1. Connection to DVB-S/S2/S2X

Multiswitches as input distributors (recommended)



Multiswitches can be used as input distributors. The advantage of this solution is that you can set both the polarization and the satellite via the user interface. Changes in the list of programs can be made using remote maintenance, so that it is not necessary to change or modify the input distribution on site.

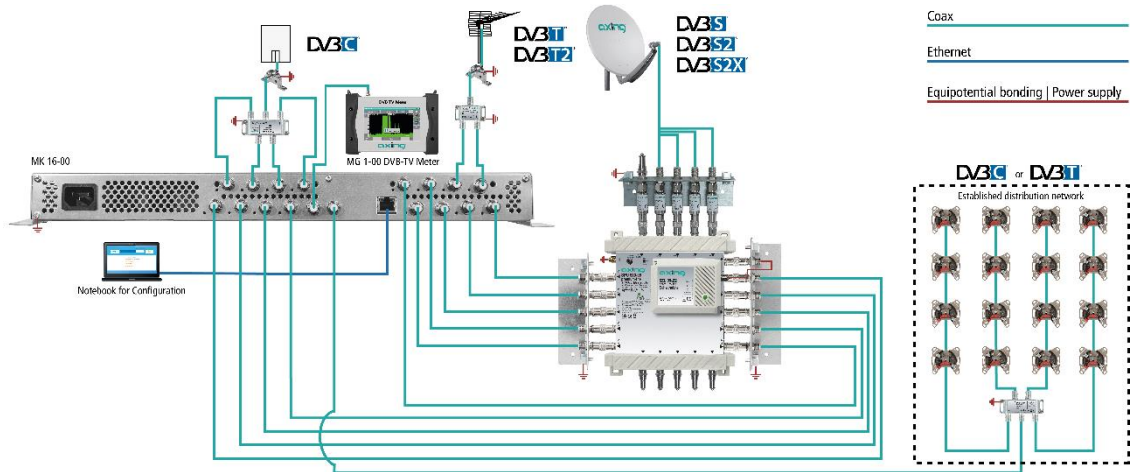
Direct connection to the LNBS

The devices have a remote supply voltage for the LNB and DiSEqC 1.0 functionalities at the inputs. The inputs can be connected directly to the LNB.

2.6.2. Connection to DVB-T/T2 or DVB-C (MK-80x, MK-82x and MK-160x only)

CAUTION

Before connecting the antenna cable, the LNB power has to be switched off (see 4.1.2 on page 24). Active DVB-T antennas have to be supplied by an external power supply.

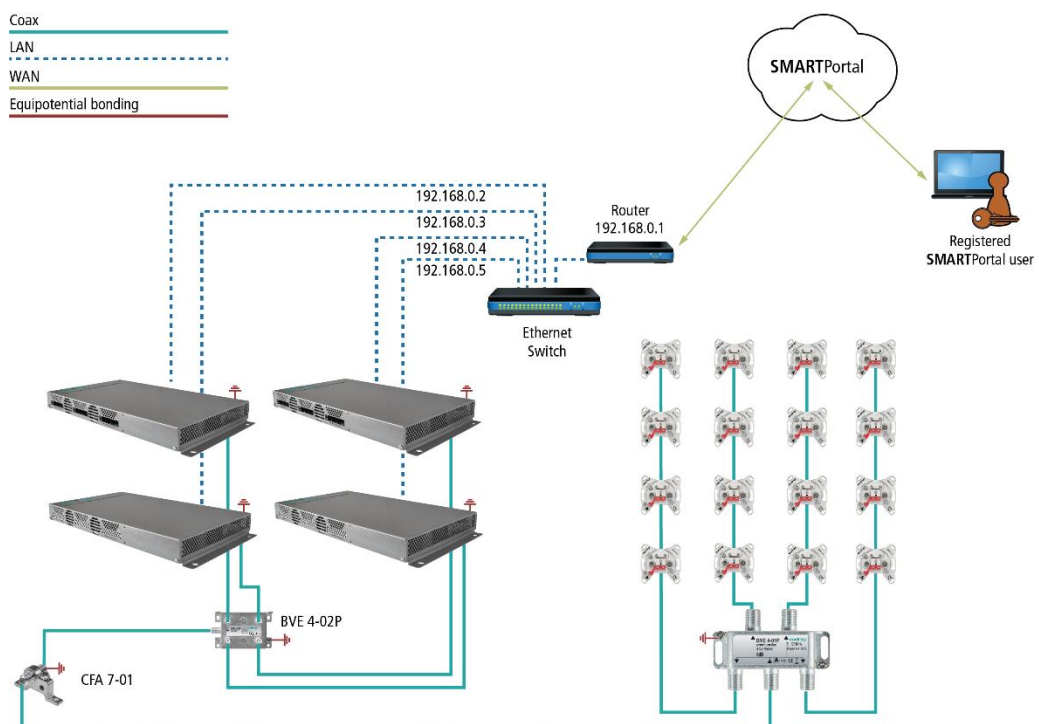


2.6.3. RF Output

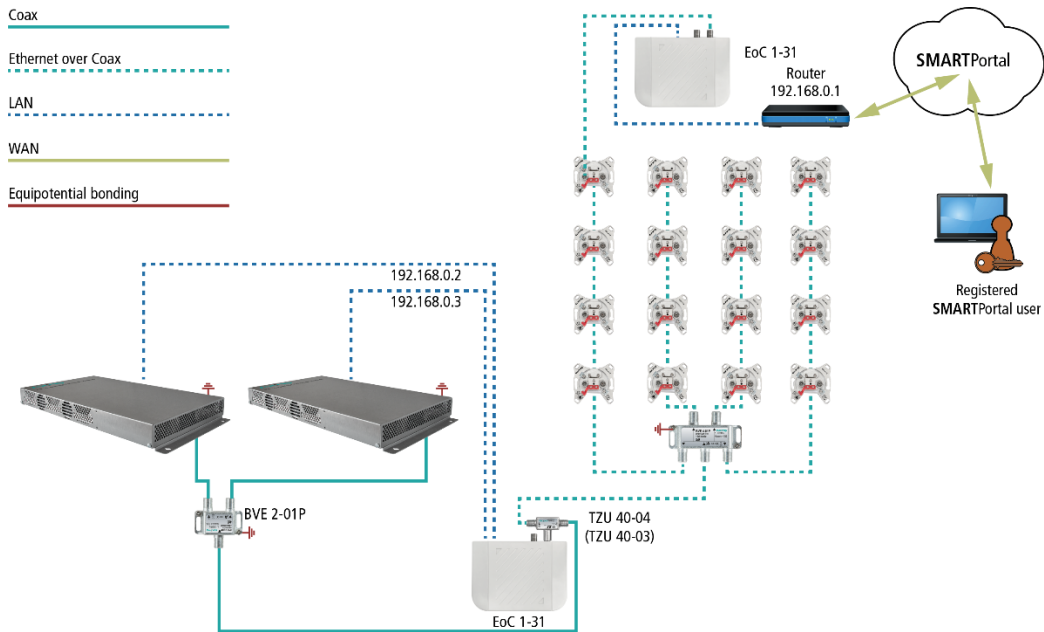
- ➔ Install the device in compliance with the safety regulations defined by the EN 60728-11 standard.
- ➔ Connect the output (RF OUT) of the device to the established distribution network. Use a high-shielded coaxial cable with an F connector.
- ➔ If you are using several devices, the outputs must be connected with suitable combiners.
- ➔ There has to be used galvanic isolator between the output connector and antenna network in Sweden and Norway state area.

2.7. Connection to the Internet

2.7.1. Connection via Ethernet switch to a router which is connected to the Internet



2.7.2. Connection via Ethernet over Coax to a router which is connected to the Internet

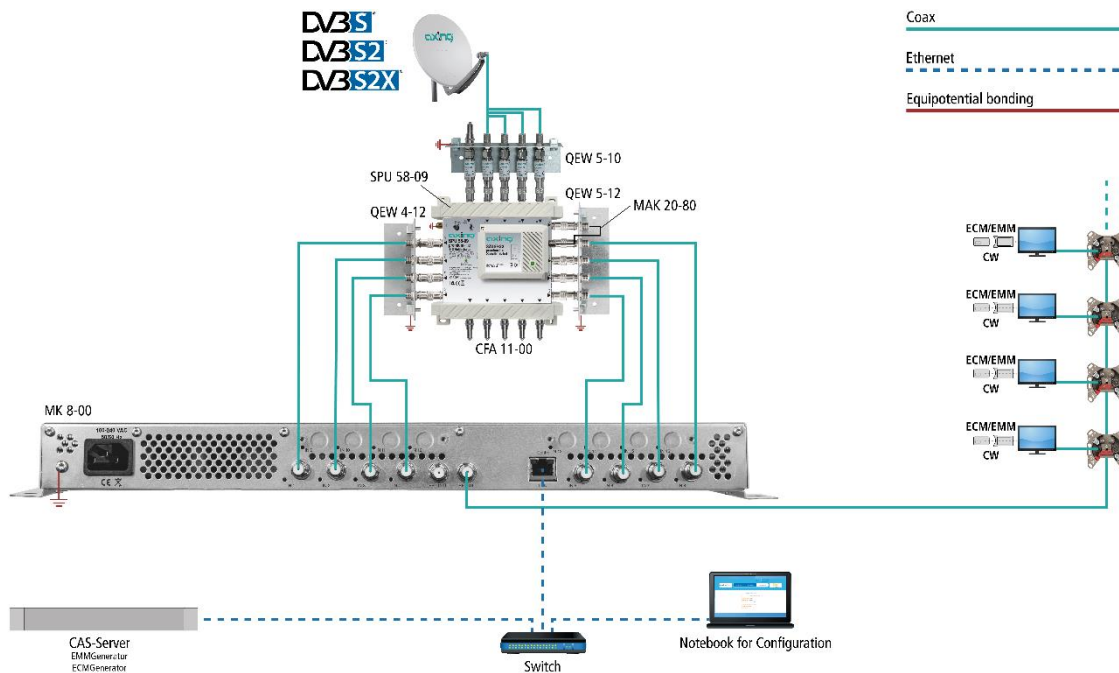


2.8. Connecting to a CAS server (with MKS 1-02)

The headend can be connected to a CAS server. The connection can be established via the Control interface.

Requirements:

- Access to an appropriately configured CAS server must be available. It is not part of the headend, nor is it described in this document.
- A valid license must be installed for the device (see 5.10 on page 61).
- The headend must be configured accordingly (see 5.11 on page 63).



If the headend station is connected to the CAS server and configured correctly, it can encrypt programs. The encrypted programs can be decrypted by connected users with the appropriate CA module/smart card.

3. Configuration

The device is configured via the graphical user interface of the integrated web interface. To access the user interface, you need a standard PC/laptop with a network interface and the actual version of the installed web browser. To connect the network interface of the headend to the computer, you need a commercially available network cable. The HTTP protocol is used for communication allowing a worldwide remote maintenance of the systems at various locations via the Internet. Access protection is implemented by means of the password prompt.

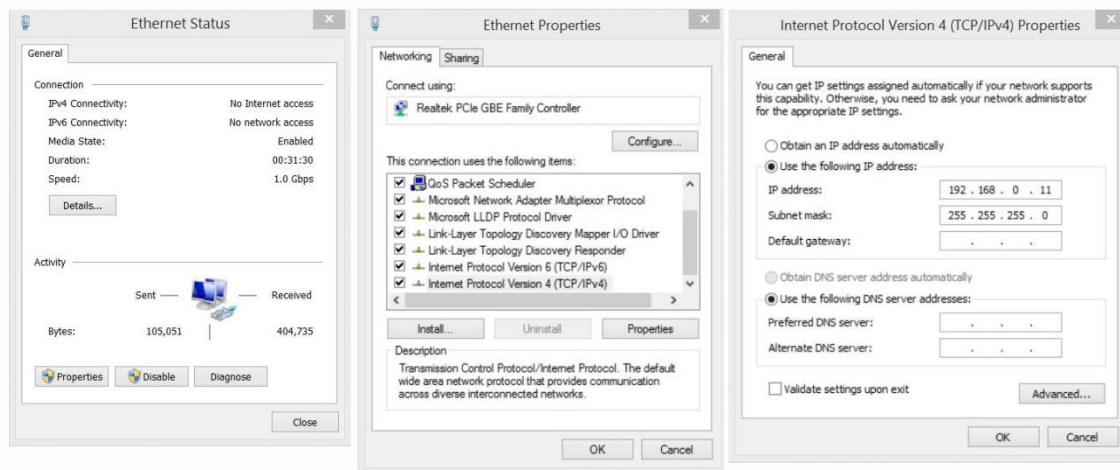
IP address:	192.168.0.145
Subnet mask:	255.255.255.0.

The computer and the headend must be in the same subnet. The network part of the IP address of the computer must be set to 192.168.0. and the subnet mask must be set to 255.255.255.0. The host part of the network address is required for the identification of the devices and can be assigned in the subnet only once. You can allocate to the computer any not allocated host address between 1 and 254.

Hint:

Change the IP address and the subnet mask of your computer accordingly.
(e.g.: IP address:192.168.0.11 and subnet mask: 255.255.255.0)

Control panel > Network connections > LAN connection > Properties > Internet protocol version 4 TCP/IPv4 > Properties > Use the following IP address:



- ➔ Click OK to save.
- ➔ Start your web browser and enter the IP address of the headend: e.g.: 192.168.0.145.

3.1. Login and logout

The web-based user interface is protected against unauthorized access. When accessing the user interface, the first thing is the password request.

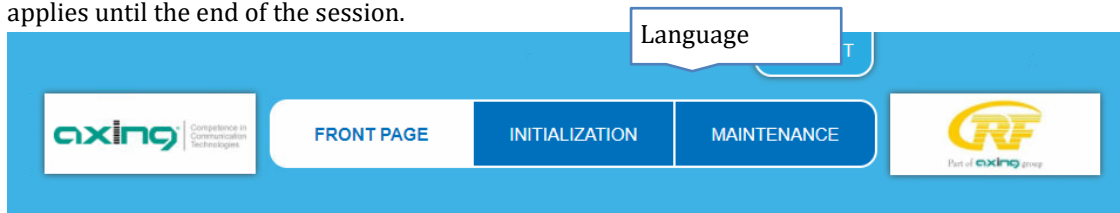
PLEASE ENTER PASSWORD:

ENTER PASSWORD

OPEN PAGE

- ➔ Enter the default password: *Ramsen8262*
- ➔ Click ENTER PASSWORD.
- ➔ If you are not automatically forwarded to the start page, click OPEN PAGE.

The standard language of the user interface is English. In the header, the the language of the user interface can be changed. The possibilities are German (DE) and English (EN). The chosen language applies until the end of the session.



- ➔ To log out, click LOG OUT.

Notes:

- If the browser is closed while you are still logged in, an automatic logout occurs 2.5 minutes later.
- If the browser window stays open, there is no automatic logout. It allows monitoring the installation via the web browser.

Changing the password:

- ➔ Please change the password immediately after the first commissioning and choose a sufficiently safe password. Keep this password at a safe place.
- ➔ Menu item: MAINTENANCE > SET NEW PASSWORD (see 5.3.2 on page 50).

Changing the IP address:

If needed, the headends can be integrated in a network. For this application, some changes must be applied to the network configuration.

- ➔ Menu item MAINTENANCE > SYSTEM.

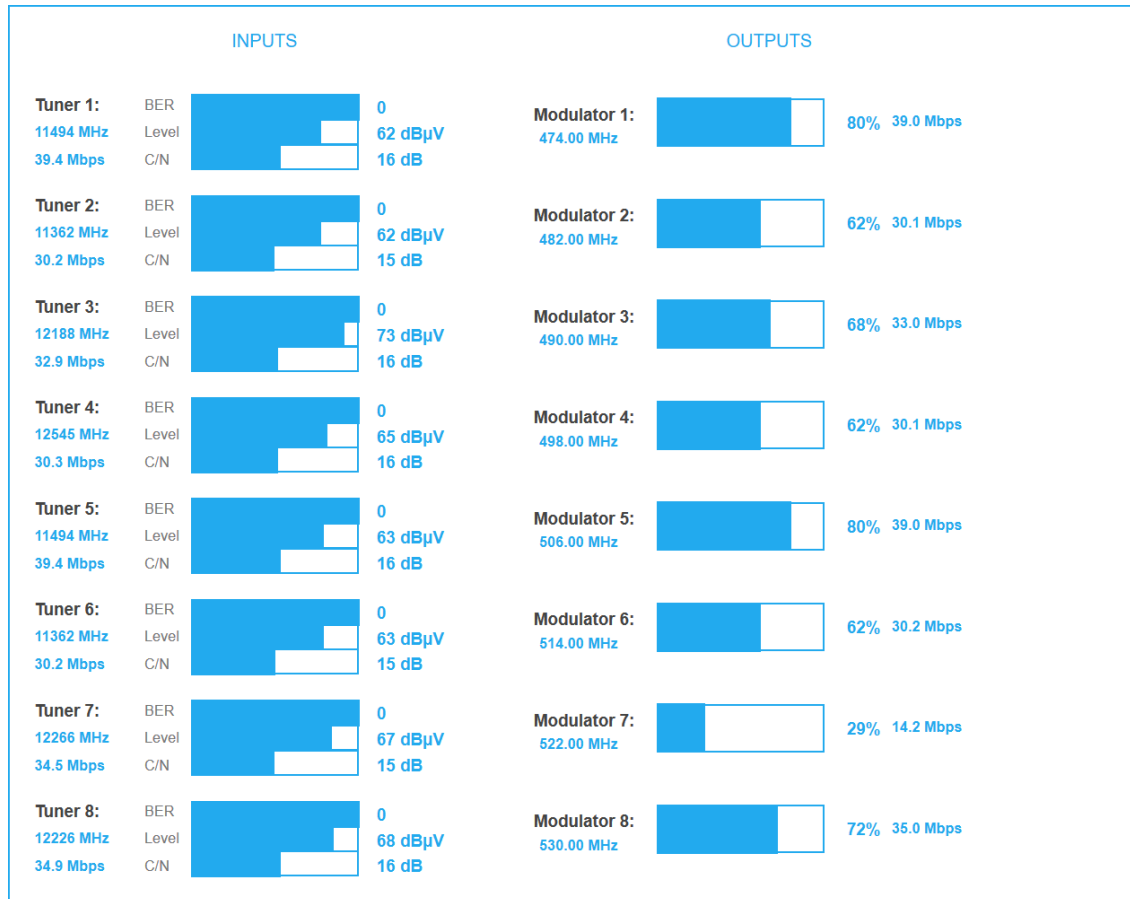
3.2. Front page

The relevant information required for the function of the system are shown on the front page. The decisive thing is the quality of the signals at the INPUT and the utilization of the modulators at the OUTPUT.

3.2.1. Input

The bit error rate BER of all tuners is shown on the left side. The amount of bit errors for the last 1,000,000 transferred bits is calculated.

Also the LEVEL and the C/N ratio are shown.



3.2.2. Outputs

The fill level of all modulators is shown. 100% modulator fill level correspond to the maximal net data rate of the output channel.

If the current fill level exceeds the maximal fill level, it may cause image disturbances, e.g. mosaic images.

The data rates of the programs are not constant. They are dynamically changed by the sender. To ensure an undisturbed reception, a reserve must absolutely be observed.

We recommend you to set the maximal fill level to 90%.

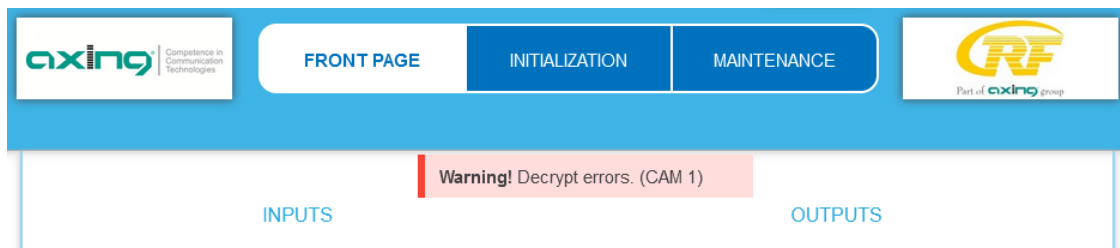
From a fill level of 95%, this is indicated in red.



The number of chosen programs (see 4.2 on page 26) and the configuration of the modulators (see 4.3 on page 38) have an influence to the fill level.

3.2.3. Alerts

If alerts, warnings, or messages of the head-end are active, then these are displayed on the start page after logging in.



The example shows a warning about CA module 1.

4. Initialization

4.1. Initialization - phase 1

➔ Choose INITIALIZATION from the main menu.

During the first phase of the initialization, the tuner settings required for the scan are made and the station scanning is carried out. The tuners work independently from each other and after the same principle.

4.1.1. DVB-S/S2/S2X

➔ Click TUNER 1...8/12/16 to select one tuner.

➔ Configure the needed settings for all tuners.

The diagram illustrates the initialization process in three phases:

- PHASE 1:** Setting up transponders for tuners.
- PHASE 2:** Selecting programs from tuners to modulators.
- PHASE 3:** Modifying settings for modulators.

The screenshot shows the 'TUNER 1 - TRANSPONDER SETTINGS' interface. On the left, there is a vertical list of buttons for TUNER 1 through TUNER 8. The main panel for TUNER 1 includes a 'Tuner enabled' checkbox and the following settings:

Field	Value
Freq (MHz)	11494
Low LNB LO Freq (MHz)	9750
High LNB LO Freq (MHz)	10600
Polarisation	Horizontal
DiSEqC	No
LNB Power	On
Stream ID (optional)	
PLS Mode	None
PLS Code (optional)	

A 'SAVE & SCAN' button is located at the bottom of the settings panel.

- ➔ The frequency of the transponder is entered in the input field **Freq (MHz)**. The frequency must be ≥ 1300 MHz, otherwise an error message appears.
- ➔ The input fields **Low LNB LO Freq (MHz)** and **High LNB LO Freq (MHz)** correspond to the oscillator frequencies of the LNB in low and high band. The default settings of the oscillator frequencies are 9,750 MHz for the low band and 10,600 MHz for the high band.
- ➔ In the optional field **Polarisation**, you can switch from horizontal to vertical.
- ➔ In the optional field **DiSEqC**, the DiSEqC command signals can be turned off or set to switch a DiSEqC-enabled multi switch on the positions 1 to 4.
- ➔ If required, the operating voltage for the LNB can be switched off via the optional field **LNB Power**.
- ➔ If **multistreams** are to be received, then the **PLS mode** must be set to root or gold. In addition, the correct **Stream ID** (three digits) and the **PLS code** (six digits) must be entered.
- ➔ After all settings have been made, click SAVE & SCAN. A rotating circle is shown during the scanning process.

4.1.2. DVB-C, DVB-T or DVB-T2 (MK-80x, MK-82x and MK-160x only)



Before connecting an antenna cable to a tuner, the **LNB Power** has to be set to **Off**.

- ➔ Click TUNER 1...8/12/16 to select one tuner.
- ➔ In the field **LNB power** choose the option **Off**.
- ➔ Enter the center frequency (see table below) for the receiving channel into the field **Freq (MHz)**.

Channel	Input	Channel	Input	Channel	Input	Channel	Input
S 21	306	21	474	41	634	61	794
S 22	314	22	482	42	642	62	802
S 23	322	23	490	43	650	63	810
S 24	330	24	498	44	658	64	818
S 25	338	25	506	45	666	65	826
S 26	346	26	514	46	674	66	834
S 27	354	27	522	47	682	67	842
S 28	362	28	530	48	690	68	850
S 29	370	29	538	49	698	69	858
S 30	378	30	546	50	706		
S 31	386	31	554	51	714		
S 32	394	32	562	52	722		
S 33	402	33	570	53	730		
S 34	410	34	578	54	738		
S 35	418	35	586	55	746		
S 36	426	36	594	56	754		
S 37	434	37	602	57	762		
S 38	442	38	610	58	770		
S 39	450	39	618	59	778		
S 40	458	40	626	60	786		
S 41	466						

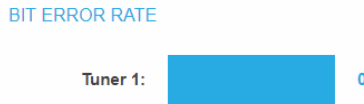
Note: The center frequency of channels using a bandwidth of 7MHz will be rounded down to 3 full digits. For example: center frequency of CH 5 = 177,5 MHz, the according input = 177.

Note: All other entry fields are not relevant. Modulation and all other important parameter for reception are detected automatically.

- ➔ If multistreams are to be received, then the **PLS mode** must be set to root or gold. In addition, the correct **Stream ID** (three digits) and the **PLS code** (six digits) must be entered.
- ➔ After all settings have been made,

4.1.3. Bit error rate

The BIT ERROR RATE is shown. The amount of bit errors for the last 1,000,000 transferred bits is calculated.



4.1.4. Found programs

After a successful station scanning, the radio and TV stations are shown in the area FOUND PROGRAMS. The table contains information about the Program Name, the Type and the Encryption.

FOUND PROGRAMS

Program Name	Type	Encryption
Das Erste HD	TV	FTA
arte HD	TV	FTA
SWR BW HD	TV	FTA
SWR RP HD	TV	FTA

4.1.5. Deactivating a tuner

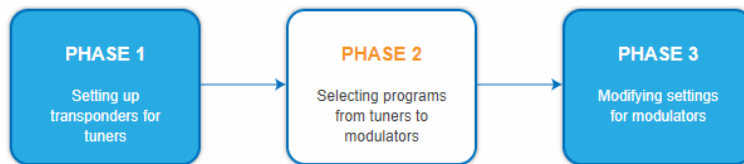
If a tuner is not needed, it can be deactivated. The tuner then no longer searches for stations. In phase 2 and in the station list, which can be printed as PDF, no programs are displayed for the tuner.



- ➔ Click TUNER 1...8/12/16 to select one tuner.
The **Tuner enabled** check box is set at the factory.
- ➔ To deactivate a tuner, deselect the **Tuner enabled** check box.
- ➔ Then click SAVE AND SCAN.
This deactivates the tuner.

4.2. Initialization - phase 2

➔ Click on PHASE 2, to select programs.



The found programs are subdivided by tuner. After the station scanning in initialization phase 1 no programs are activated.

In the **Modulator** column there are coloured buttons M1 to M8/M12/M16. The buttons correspond to the modulators of the headend. By clicking on the respective buttons in the tables, programs can be activated or deactivated again.

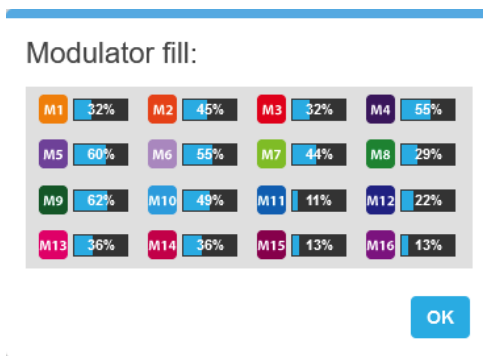
You can assign programs to modulators in REMUX MODE or in CROSS MULTIPLEX MODE.

Important:

➔ After you have made any changes, click on SAVE CHANGES.

Only then will the changes be saved and applied.

The more programs you assign to a modulator, the higher its data rate. When saving, the fill levels of the modulators are therefore displayed.



➔ Check the fill levels and click OK.

4.2.1. Remux mode

If the **Network ID** are set on **auto**, the device works in the Remux mode. In this mode, the IDs from the set transponder and from the satellite are used and forwarded to the modulators with virtually no changes. The **TS ID1** to **TS ID8**, **TS ID 12** or **TS ID 16** of the modulators, are also set on **auto**.

COLOR CODES

- M1 = Modulator 1
- M2 = Modulator 2
- M3 = Modulator 3
- M4 = Modulator 4
- M5 = Modulator 5
- M6 = Modulator 6
- M7 = Modulator 7
- M8 = Modulator 8
- M9 = Modulator 9
- M10 = Modulator 10
- M11 = Modulator 11
- M12 = Modulator 12
- M13 = Modulator 13
- M14 = Modulator 14
- M15 = Modulator 15
- M16 = Modulator 16

TRANSPORT STREAMS AND NETWORK

TS ID1: M1 auto	TS ID2: M2 auto	TS ID3: M3 auto
TS ID4: M4 auto	TS ID5: M5 auto	TS ID6: M6 auto
TS ID7: M7 auto	TS ID8: M8 auto	TS ID9: M9 auto
TS ID10: M10 auto	TS ID11: M11 auto	TS ID12: M12 auto
TS ID13: M13 auto	TS ID14: M14 auto	TS ID15: M15 auto
TS ID16: M16 auto	Network ID: auto	

Network Name: Region:

REMUX MODE

Note:

- ➔ If the device is already set to CROSS MULTIPLEX MODE, set the **Network ID** to **auto**.
- ➔ Click on **SAVE CHANGES**.
The device is set back to **REMUX MODE**.

Assigning programs

Every tuner is assigned to a modulator. The programs of the tuner can only be assigned to the associated modulator.

➔ For example, click in table TUNER 1 on M1.

The program is assigned to modulator 1. The button of the modulator is highlighted in colour (a new click on a modulator allows the assignment to be cancelled. The button fades then again).

Chosen programs for modulator 1

TUNER 1		Input mode: DEFAULT												
Modulator		LCN	Program Name	Type	Encryption	Decrypt								
M1	M2	M3	M4	M5	M6	M7	M8			Das Erste HD	TV	FTA	no	
M9	M10	M11	M12	M13	M14	M15	M16			arte HD	TV	FTA	no	
M1	M2	M3	M4	M5	M6	M7	M8			SWR BW HD	TV	FTA	no	
M9	M10	M11	M12	M13	M14	M15	M16			SWR RP HD	TV	FTA	no	

➔ Choose the programs for TUNER 1 to TUNER 8/12/16.

➔ Click on SAVE CHANGES.

The assignment is saved to the device.

4.2.2. Cross Multiplex Mode

The cross-multiplex mode is used:

- To split the programs of a transponder to several modulators.
- To merge programs of several transponders into one output channel.

Transmission capacities in the distribution networks can be optimized.

COLOR CODES

- M1 = Modulator 1
- M2 = Modulator 2
- M3 = Modulator 3
- M4 = Modulator 4
- M5 = Modulator 5
- M6 = Modulator 6
- M7 = Modulator 7
- M8 = Modulator 8
- M9 = Modulator 9
- M10 = Modulator 10
- M11 = Modulator 11
- M12 = Modulator 12
- M13 = Modulator 13
- M14 = Modulator 14
- M15 = Modulator 15
- M16 = Modulator 16

TRANSPORT STREAMS AND NETWORK

TS ID1: 1 TS ID2: 2 TS ID3: 3
TS ID4: 4 TS ID5: 5 TS ID6: 6
TS ID7: 7 TS ID8: 8 TS ID9: 9
TS ID10: 10 TS ID11: 11 TS ID12: 12
TS ID13: 13 TS ID14: 14 TS ID15: 15
TS ID16: 16

Network ID: 01 ONID: 02

Network Name: Axing Region (PDS): Central Europe (0x28) v

ADVANCED OPTIONS CROSS MULTIPLEX MODE

➔ Change the **Network ID** to a value greater than zero.

➔ Click on **SAVE CHANGES**.

The IDs of the transport streams **TS ID1** to **TS ID8 [12/16]** are automatically incremented by one to 8 [12/16], the cross-multiplex mode is activated.

In the **ONID** field (Original Network ID), the network ID is taken by default. If necessary, the ONID can be entered manually here.

Important:

If you use several MK in a network, then the network IDs must be the same and the network name should also be the same. Transport stream IDs, on the other hand, may only be assigned once in the network.

Assigning programs to the modulators

In the cross-multiplex mode, the tuners are no longer assigned to one modulator.

Programs, assigned to modulator 2

TUNER 1		Input mode: DEFAULT					
Modulator	LCN	Program Name	Type	Encryption	Decrypt		
M2		Das Erste HD	TV	FTA	no	<input type="radio"/>	
M2		arte HD	TV	FTA	no	<input type="radio"/>	
M2		SWR BW HD	TV	FTA	no	<input type="radio"/>	
M2		SWR RP HD	TV	FTA	no	<input type="radio"/>	

TUNER 2		Input mode: DEFAULT					
Modulator	LCN	Program Name	Type	Encryption	Decrypt		
M2		ZDF HD	TV	FTA	no	<input type="radio"/>	
M2		zdf_neo HD	TV	FTA	no	<input type="radio"/>	

- ➔ Click in the column Modulator on M2.
The programs are assigned to modulator 2.

Splitting the programs of a transponder

If there are too many programmes transmitted in one transponder, they can be splitted to several modulators.

The programs of one tuner are splitted to two modulators

TUNER 1		Input mode: DEFAULT					
Modulator	LCN	Program Name	Type	Encryption	Decrypt		
M1		Das Erste HD	TV	FTA	no	<input type="radio"/>	
M1		arte HD	TV	FTA	no	<input type="radio"/>	
M2		SWR BW HD	TV	FTA	no	<input type="radio"/>	
M2		SWR RP HD	TV	FTA	no	<input type="radio"/>	

- ➔ For example: choose modulator M1 for two programs and modulator M2 for two other programs.

4.2.3. Choosing input mode

For each tuner, an input mode can be selected.

TUNER 1															
Input mode: DEFAULT ?															
Modulator								LCN	Program	Type		Encryption	Decrypt		
M1	M2	M3	M4	M5	M6	M7	M8	1	Das Erste	TV	FTA	no ▼ <input type="radio"/>			
M9	M10	M11	M12	M13	M14	M15	M16								
M1	M2	M3	M4	M5	M6	M7	M8	4	BR Fernsehen Süd	TV	FTA	no ▼ <input type="radio"/>			
M9	M10	M11	M12	M13	M14	M15	M16								

- Default**
 The programs can be assigned to the respective modulators in Remux mode or distributed to different modulators in cross-multiplex mode
- Select all**
 Each program is activated for the modulator. If the option is activated, then no settings can be made in the columns LCN, Decrypt etc.
- Transmodulator**
 The programs and information (PIDs, NIT etc.) are transmitted 1:1 from the tuner to the modulator, nothing is changed.
Important: In the input mode Transmodulator, no changes can be made to the programs, such as LCN, program name, etc.

4.2.4. LCN (Logical Channel Numbering)

The LCN function enables channel allocation for the station scan of the TV devices. The TV device must support the LCN function.

- The TV devices must support the LCN function.
 - The maximum number of LCNs per modulator is 63.**
 - Different LCN standards can be set with the Region selection field. The selected LCN standard must match the connected devices for LCN to work.
 - An LCN can only be entered for programs assigned to a modulator.
- ➔ Click on the **LCN** column for the corresponding program.

Modulator								LCN	Program	Type	Encryption	Decrypt		
M1	M2	M3	M4	M5	M6	M7	M8	3	ServusTV HD Oesterreich	TV	CA	Cl 4 ▼ <input checked="" type="radio"/>		
M9	M10	M11	M12	M13	M14	M15	M16							

- ➔ Enter the LCN with the keyboard or increase / decrease the LCN with the arrow buttons right of the number.
- ➔ Enter a separate LCN for each desired program.

M1	M2	M3	M4	M5	M6	M7	M8	1	ORF1 HD	TV	CA	Cl 4 ▼ <input checked="" type="radio"/>		
M9	M10	M11	M12	M13	M14	M15	M16		ORF2W HD	TV	CA	no ▼ <input type="radio"/>		
M1	M2	M3	M4	M5	M6	M7	M8	3	ServusTV HD Oesterreich	TV	CA	Cl 4 ▼ <input checked="" type="radio"/>		
M9	M10	M11	M12	M13	M14	M15	M16		ServusTV HD Deutschland	TV	FTA	no ▼ <input type="radio"/>		
M1	M2	M3	M4	M5	M6	M7	M8	2	ORF2N HD	TV	CA	no ▼ <input type="radio"/>		
M9	M10	M11	M12	M13	M14	M15	M16							

- ➔ To clear the LCN, enter 0 in the LCN column.
- ➔ Click **SAVE CHANGES**.
 The numbers of the channels are saved.

4.2.5. Changing Program Name

The name of a program can be changed. The entered program name will later appear in the channel list of the connected TV sets.

- ➔ Click on one of the programs.
The table with the Information opens.

Program Name (orig: Das Erste):	Germany's first program	✓ ✗
Service-ID:	28106	

- ➔ Click right of the field **Program Name**.
- ➔ Enter an individual program name and click on the green check mark.
This first completes the entry.
- ➔ After you have changed the desired program name(s), click SAVE CHANGES.
The entered program name(s) are stored in the headend.

4.2.6. Edit service ID

In cross-multiplex mode you can also edit the service ID.



Not provided modifications will cause problems!

Changes of the SID are only necessary for STBs using a fix pre-set ID. These STBs are used of some providers to suppress reception for external devices. Modifications should only be done after consulting the provider.

Service-ID	4911	✓ ✗		
------------	------	-----	--	--

- ➔ Enter the Service ID with the keyboard or increase / decrease the ID with the arrow buttons right of the number.
- ➔ Click on the green check mark to accept the ID or on the red cross to discard the entry.

4.2.7. PID-Remapping

Automatic PID remapping

If several programs within an output modulator contain packets that have the same PID, this can cause interferences. Therefore these PIDs are re-mapped automatically.

1

Stream type	IN PID	OUT PID	FIXED	BLOCK
PMT	100	100	<input type="checkbox"/>	<input type="checkbox"/>
MPEG2 Video	101	101	<input type="checkbox"/>	<input type="checkbox"/>
MPEG1 Audio (deu)	102	102	<input type="checkbox"/>	<input type="checkbox"/>
MPEG1 Audio (mis)	103	103	<input type="checkbox"/>	<input type="checkbox"/>
Teletext (deu)	104	104	<input type="checkbox"/>	<input type="checkbox"/>
AC-3 Audio (deu)	106	106	<input type="checkbox"/>	<input type="checkbox"/>
Private data	84	84	<input type="checkbox"/>	<input type="checkbox"/>
Subtitles (deu)	105	105	<input type="checkbox"/>	<input type="checkbox"/>
DSM-CC	1176	1176	<input type="checkbox"/>	<input type="checkbox"/>
Private data	2070	2070	<input type="checkbox"/>	<input type="checkbox"/>
DSM-CC	2171	2171	<input type="checkbox"/>	<input type="checkbox"/>

2

Stream type	IN PID	OUT PID	FIXED	BLOCK
PMT	280	280	<input type="checkbox"/>	<input type="checkbox"/>
MPEG2 Video	101	5590	<input type="checkbox"/>	<input type="checkbox"/>
MPEG2 Audio (ger)	103	4464	<input type="checkbox"/>	<input type="checkbox"/>
Private data	104	7997	<input type="checkbox"/>	<input type="checkbox"/>
Teletext (ger)	102	931	<input type="checkbox"/>	<input type="checkbox"/>
SCTE-35	105	3338	<input type="checkbox"/>	<input type="checkbox"/>

In the example, both programs are assigned to modulator M1 **(1)**. The IN PIDs 101 to 105 are identical for both the upper program „Das Erste“ and the lower program „Eurosport“. Therefore, the PIDs are re-mapped in the lower program and other IDs are automatically entered in the OUT PID column **(2)**.

Fixing PIDs

Fixing a PID prevents PIDs from being re-mapped.

➔ Click on one of the programs.

The table with the packages opens.

Stream type	IN PID	OUT PID	FIXED	BLOCK
PMT	280	280	<input type="checkbox"/>	<input type="checkbox"/>
MPEG2 Video	101	101	<input checked="" type="checkbox"/>	<input type="checkbox"/>
MPEG2 Audio (ger)	103	103	<input type="checkbox"/>	<input type="checkbox"/>
Private data	104	104	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Teletext (ger)	102	102	<input type="checkbox"/>	<input type="checkbox"/>
SCTE-35	105	105	<input type="checkbox"/>	<input type="checkbox"/>

➔ For the PIDs that you want to fix, set the check mark in the FIXED column.

- ➔ Click SAVE CHANGES.
The fixed PIDs are saved in the headend.

Re-mapping PIDs by hand

If packets should get a very specific OUT PID, this can be entered manually.

Stream type	IN PID	OUT PID	FIXED	BLOCK	
PMT	280	280	<input type="checkbox"/>	<input type="checkbox"/>	
MPEG2 Video	101	110	<input type="checkbox"/>	<input type="checkbox"/>	✓✗
MPEG2 Audio (ger)	103	103	<input type="checkbox"/>	<input type="checkbox"/>	
Private data	104	104	<input type="checkbox"/>	<input type="checkbox"/>	
Teletext (ger)	102	102	<input type="checkbox"/>	<input type="checkbox"/>	
SCTE-35	105	105	<input type="checkbox"/>	<input type="checkbox"/>	

- ➔ Click in the OUT PID column of the program.
- ➔ Enter the PID with the keyboard or increase/decrease the PID with the arrow keys.
- ➔ Click on the green check mark.
This will complete the entry first.
- ➔ Click SAVE CHANGES.
The entered PIDs are saved in the headend.

4.2.8. PID Filtering (with MKS 1-01)

The transport streams consist of packets that are identified by PIDs (Packet Identifier). With the fee-based software extension MKS 1-01, individual packages can be filtered out of the transport stream.

- ➔ Click on one of the programs.
The table with the packages contained in the program is opened.

Stream type	IN PID	OUT PID	FIXED	BLOCK	
PMT	100	100	<input type="checkbox"/>	<input type="checkbox"/>	
MPEG2 Video	101	101	<input type="checkbox"/>	<input type="checkbox"/>	
MPEG1 Audio (deu)	102	102	<input type="checkbox"/>	<input type="checkbox"/>	
MPEG1 Audio (mis)	103		<input type="checkbox"/>	<input checked="" type="checkbox"/>	1 2
Teletext (deu)	104		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
AC-3 Audio (deu)	106	106	<input type="checkbox"/>	<input type="checkbox"/>	
Private data	84	84	<input type="checkbox"/>	<input type="checkbox"/>	
Subtitles (deu)	105	105	<input type="checkbox"/>	<input type="checkbox"/>	
DSM-CC	1176	1176	<input type="checkbox"/>	<input type="checkbox"/>	
Private data	2070	2070	<input type="checkbox"/>	<input type="checkbox"/>	
DSM-CC	2171	2171	<input type="checkbox"/>	<input type="checkbox"/>	

- ➔ For the PIDs that you want to filter out of the transport stream, place a checkmark in the BLOCK column (1).
The package is no longer transferred in the transport stream. The OUT PID column is empty for these PIDs (2).

4.2.9. EPG and EIT options

Electronic Program Guide (EPG)

Only possible in Remux mode: If a satellite makes the EPG available on a special transponder, then the tuner receiving this transponder can be selected as the EPG input.

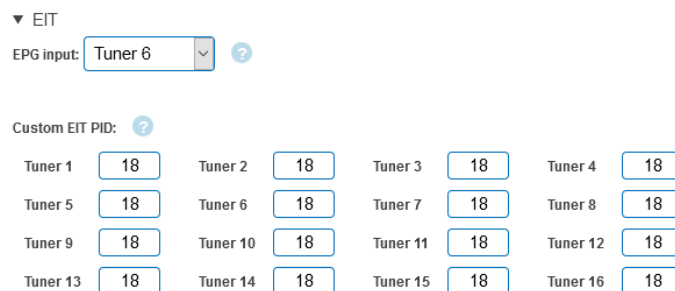
➔ In PHASE 2 click on ADVANCED OPTIONS.



A dialog with options will open.

➔ Open the **EIT** option.

➔ Select the tuner in the EPG input box.



Special Packet Identifier (PID) for the Event Information Table (EIT)

The function is particularly relevant for multistreaming with DVB-T2. In some countries, the EIT is not transmitted with PID 18 (for example, Israel PID 90). In this case, the headend can convert the PID into the PID 18.

➔ For tuners 1 to 8, 12 or 16, enter the PIDs used to transmit the EIT.
The entered PID of the EIT is then converted to PID 18.

4.2.10. SDT table versions

The Service Description Table (SDT) contains information about the transmitted programmes (services). It is usually transmitted with the PID 17. However, if the SDT is transmitted with a different PID, the headend can change this other PID to PID 17.

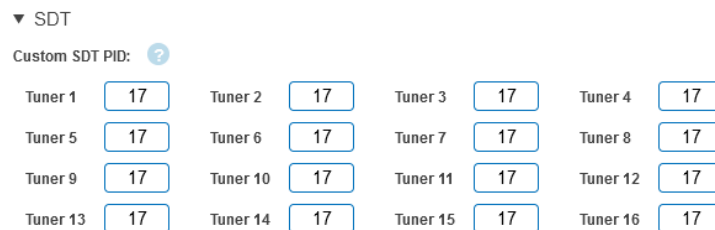
➔ In Phase 2 click on ADVANCED OPTIONS.



A dialog with options will open.

➔ Open the **SDT** option.

The currently used SDT PIDs of the individual tuners are displayed (PID 17 ex works).



➔ For tuners 1 to 8, 12 or 16, enter the PIDs used to transmit the SDT. Permissible values are 32 to 8190.

The entered PID of the SDT is then converted to PID 17.

4.2.11. "Freeze" NIT version

If programs of a transponder change, then the NIT is recreated. In most countries, the end user does not notice, because the receivers automatically read in the new NIT. However, in some countries (eg France) end users are asked to start a channel search.

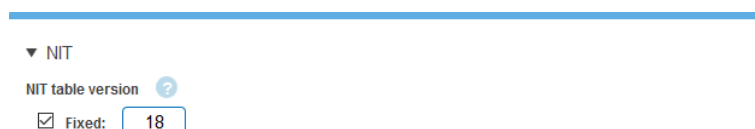
If it comes to the case that one or more stations are weak to receive, then the NIT changes frequently and the end users are always unnecessarily prompted to start a channel search. In this case, the NIT version can be "frozen" (recommended for use in France).

➔ In PHASE 2 click on ADVANCED OPTIONS.



A dialog with options will open.

➔ Open the NIT option.



➔ Under NIT version, select Fixed.

➔ Enter a version between 1 and 31.

Note: If the station list really changes, the channel search must be done manually.

You can obtain extended options for editing the NIT with the software extension MKS 1-00 (see 5.8 auf Seite 56)

4.2.12. OTA upgrade (add non-referenced PIDs)

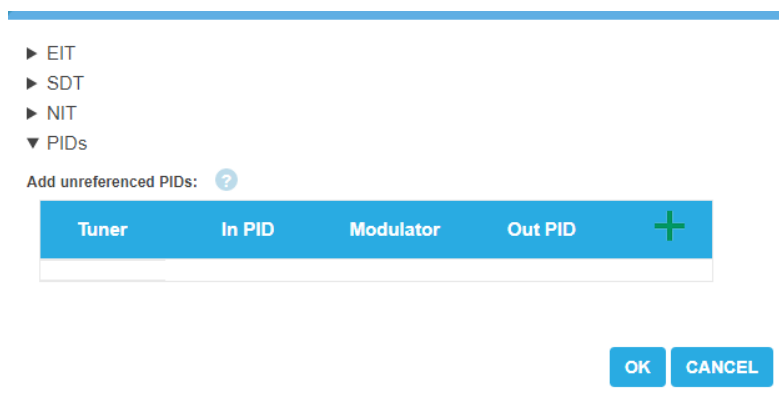
To enable an **Over-the-Air** upgrade, non-referenced PIDs can be manually added to the output modulators. **Notes:**

- The function requires a valid license for "PID-Filtering" (see 5.10 on page 61).
- In PHASE 1 a transport stream must already be selected which contains the unreferenced PIDs.

➔ Click in PHASE 2 on ADVANCED OPTIONS.

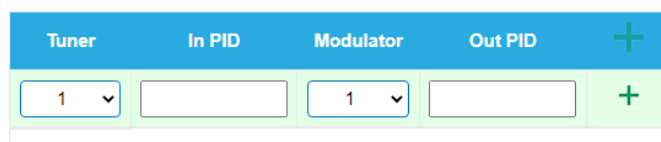
A dialog with options will open.

➔ Open the PIDs option.



➔ Under **Add unreferenced PIDs**, click the **green plus sign** in the table header.



A line for entering the PID is inserted.









- Under **Input**, select one of the available input streams.
- Under **In PID**, enter an unreferenced PID.
- Select the output **Modulator**.
- Under **Out PID**, enter the output PID. The output PID can be the same or different from the input PID.

Tuner	In PID	Modulator	Out PID	+
2	7496	1	7496	+

- Click on the **green plus sign** next to the line. The entered data are inserted.

Tuner	In PID	Modulator	Out PID	+
1		1		+
1	7496	1	7496	 







- If necessary, enter additional non-referenced PIDs. The same input PID can be added to multiple outputs if needed. Output PID value can be set separately for each output. In the example below, PID 7496 from the tuner 1 is added to the output modulators 1, 2 an 3.

Tuner	In PID	Modulator	Out PID	+
1		1		+
1	7496	1	7496	 
1	7496	2	7496	 
1	7496	3	7496	 

- Click **SAVE** after completing the entries. This saves the entries in the headend.

Editing or deleting entries

- Click on the **pencil icon** to the right of the line. You can now change **Input**, **In PID**, **Modulator** and **Out PID**

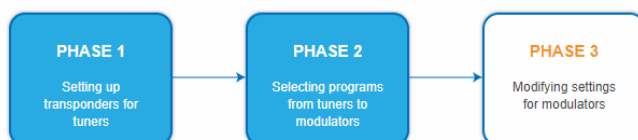
Tuner	In PID	Modulator	Out PID	+
1		1		+
1	7496	1	7496	 
1	7496	2	7496	 
1	7496	3	7496	 

- Then click on the **green check mark**. The changes are accepted.
- To delete, click on the **trashcan icon** to the right of the line. The line is deleted.
- Click **SAVE**. This changes the entries in the headend.

4.3. Initialization - phase 3

Note: Depending on the configured modulation standard or depending on the device type, the signals are modulated DVB-C, DVB-T or DVB-T2. (see 5.2 on page 48).

In phase 3, the modulators are configured.



➔ Click on PHASE 3, to modify the setting of the modulator.

4.3.1. MK-80x, MK-160x, MK-80xN and MK-120xN (DVB-C)

Configuration of the modulator

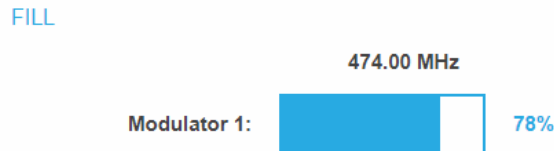


Parameters

Output channels and channel spacing	The modulators can be set to any output channel between S2 and CH 87. No output channel can be assigned several times!
DVB-C modulation:	With DVB-C modulation, you can choose between 16QAM, 32QAM, 64QAM, 128QAM and 256QAM. 256QAM enables the highest data transmission rate, but it also requires the best network quality.
DVB-C symbol rate:	The DVB-C symbol rate can be freely set between 1000 and 7500. The standard value is 6900. Some networks also work with 6875. When working with a bandwidth of 7 MHz, 6111 is customary.
Common Output level	The <i>Common Output Level</i> option include a general attenuation of all modulator outputs. The highest output level is reached with a setting of 20 dB, the lowest level with a setting of 0 dB.
Fine Level	The <i>Fine Level</i> option include fine attenuation from 0 to -3dB of each modulator output and the deactivation of the modulator (off).
Fine Tune:	The <i>Fine Tune</i> adjustment of the output channel is performed in 0.5 MHz steps.

Fill level

The fill level depends on the number of activated channels in the channel list (menu item Phase 2). If the cross-multiplex mode is active, it must be ensured that the maximum number of activated channels in one modulator is not exceeded.



The data rate of the channels on the DVB-S/S2/S2X transponders may vary depending on the image contents and on the transmission quality. To ensure an undisturbed reception, a reserve must absolutely be observed. We recommend you to set the maximum fill level to 90%. If the current fill level exceeds the maximal fill level, it may cause image disturbances, such as mosaic images. The LEDs on the front panel will light up in red in this case.

The data rate of a DVB-C channel depends on the selected channel bandwidth (7 or 8 MHz), the set symbol rate and the DVB-C modulation (16QAM, 32QAM, 64QAM, 128QAM or 256QAM) of the modulator.

If the displayed data rate exceeds 90%, there are different possibilities to change it:

- ➔ Change to a channel with a bandwidth of 8 MHz if a 7 MHz channel was selected previously.
- ➔ Set DVB-C modulation to a larger value, for example, change from QAM 64 to QAM 128.
- ➔ Reduce the number of selected channels in the channel list.
- ➔ If the connected receivers support this option, increase the symbol rate.

Selected Programs

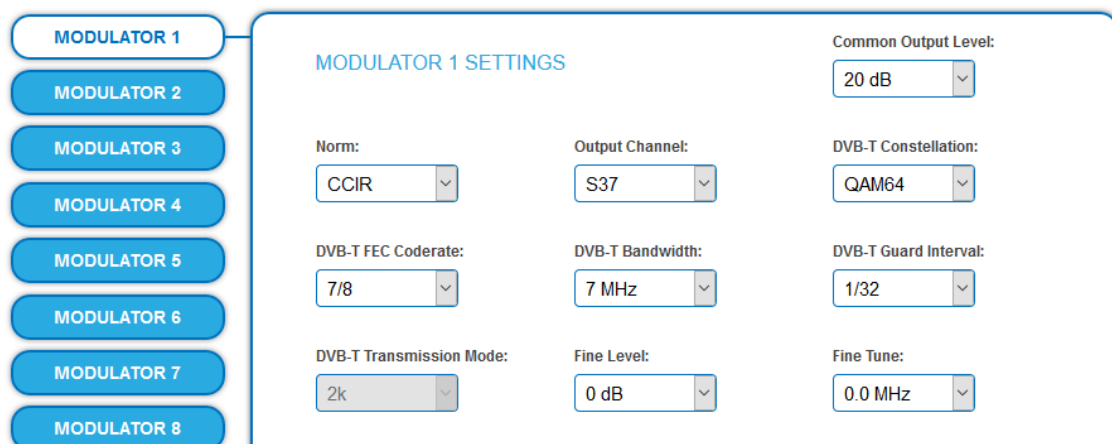
The program table SELECTED PROGRAMS shows the programs that were activated in phase 2.

SELECTED PROGRAMS

Program Name	Type	Encryption
Das Erste HD	TV	FTA
SWR BW HD	TV	FTA

4.3.2. MK-80x, MK-160x, MK-80xN and MK 120xN (DVB-T)

Configuration of the modulator



MODULATOR 1

MODULATOR 2

MODULATOR 3

MODULATOR 4

MODULATOR 5

MODULATOR 6

MODULATOR 7

MODULATOR 8

MODULATOR 1 SETTINGS

Common Output Level: 20 dB

Norm: CCIR

Output Channel: S37

DVB-T Constellation: QAM64

DVB-T FEC Coderate: 7/8

DVB-T Bandwidth: 7 MHz

DVB-T Guard Interval: 1/32

DVB-T Transmission Mode: 2k

Fine Level: 0 dB

Fine Tune: 0.0 MHz

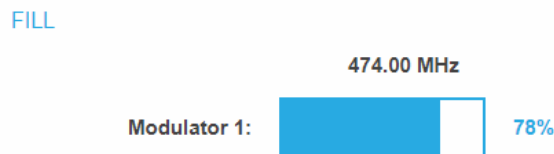
Parameters

Norm:	<p>In this selection field, you can set the norm for the output channel spacing.</p> <p>Note: Changing the norm works now according to following rules: CCIR-->Australia : all modulators forced to 7MHz Australia-->CCIR : all modulators forced to 8MHz, however with following exception: low channels S2-S20 are 7MHz only, so those remain in 7MHz</p>
Output channel:	<p>The first modulator can be set to any output channel between S2 and CH 69. The other three modulators are automatically set by incrementing the output channels in accordance with the chosen channel spacing.</p> <p>For example: modulator 1 = Channel 21 modulators 2, 3 and 4 = Channels 22, 23 and 24</p>
Common Output level	<p>The <i>Common Output Level</i> option include a general attenuation of all modulator outputs. The highest output level is reached with a setting of 20 dB, the lowest level with a setting of 0 dB.</p>
DVB-T modulation:	<p>The modulation can be set on QPSK, on QAM 16 or on QAM 64. The QPSK-setting provides the smallest data rate to the output channel. The QPSK-modulation process is used in bad distribution networks because of its robustness against disturbances and of its safe transmission.</p> <p>The QAM-modulation process allows reaching higher data rates, so that more programs can be transmitted on a channel. The QAM 64-modulation gives the highest data rate.</p> <ul style="list-style-type: none"> • QPSK (2 bit/symbol) – small data rate – very robust signal. • QAM 16 (4 bit/symbol) – middle data rate. • QAM 64 (6 bit/symbol) – high data rate.
DVB-T FEC (forward error correction):	<p>Thanks to the error correction, errors resulting from high-disturbed transmission routes can be balanced by restoring data. The data required to restore the signal are included in the transmitted FEC bits.</p> <p>Changing the FEC factor modifies the part of the FEC data in relation to the application data.</p> <p>A higher part of FEC data means a higher transmission redundancy. But this reduces the bandwidth for the useful data too. A FEC of 7/8 means the highest rate for the useful data and the smallest transmission redundancy.</p> <ul style="list-style-type: none"> • FEC 1/2 - small data rate - strong protection against errors. • FEC 7/8 - high data rate - weak protection against errors.
DVB-T bandwidth:	<p>The DVB-T standard plans a broadcast on 6, 7 or 8 MHz channels. A bigger bandwidth means that more data can be transmitted on a single channel.</p> <p>In the CCIR channel spacing, the lower channels: C5...S20 have a provided bandwidth of 7 MHz. The other channels have a bandwidth of 8 MHz.</p> <p>If the bandwidth is changed, the channel does not correspond any longer to the set channel spacing. Therefore, the output frequency for all 4 modulators also changes.</p>

DVB-T guard interval:	<p>A guard interval is transmitted between the symbols of the useful signal.</p> <p>This guard interval avoids the intersymbol interference during the DVB-T transmission.</p> <p>The delayed signals of other synchronized DVB-T senders or reflections have no effects on the decoding of the useful signal if they arrive during the guard interval. The period of the echoes must be shorter than the duration of the guard interval.</p> <p>Changing the guard interval adjusts the ratio between the transmission duration of the useful symbols and the duration of the guard interval.</p> <p>A great guard interval (e.g. 1/4) leads to a really small data rate.</p> <p>When transmitting on a perfect coaxial distribution network, a really small guard interval (1/32) is enough.</p>
DVB-T transmission modes (2 k and 8 k):	<p>Using the 8 k mode is recommended for reflections with really long durations. Due to the long symbol duration, long guard intervals are possible.</p>
Fine Level:	<p>The <i>Fine Level</i> option include fine attenuation from 0 to -3dB of each modulator output and the deactivation of the modulator (off).</p>
Fine Tune:	<p>The fine Tuning of the output channel is performed in 1 MHz steps.</p>

Fill level

The data rate of the sender may vary depending on the image contents and on the transmission quality. To ensure an undisturbed reception, a reserve must absolutely be observed.



We recommend you to set the maximal fill level to 90%.

If the current fill level exceeds the maximal fill level, it may cause image disturbances, e.g. mosaic images.

If the net data rate of the signal exceeds the net data rate of the output channel, the modulator overflows. This overflow leads to disturbances. If the modulator overflows, the status LED on the front side of the device lights in red.

Filtering the programs reduces the net data rate of the input signal. Subsequently, the net data rate of the output signal is also reduced.

The data rate of the DVB-T channel depends furthermore on the chosen channel bandwidth (7 or 8 MHz), on the set error correction rate (FEC) and the modulation rate (QPSK, QAM16, QAM64) of the modulator.

If the displayed data rate exceeds 90%, there are different possibilities to change it:

- ➔ Change to a channel with a bandwidth of 8 MHz if a 7 MHz channel was selected previously.
- ➔ Raise the modulation rate to 64 QAM. QPSK corresponds to the lowest, the QAM64 setting to the highest output data rate.
- ➔ Set the forward error correction to 7/8. With this setting, the data rate is increased, but the error correction is lower. A lower error correction requires a better transmission quality from the antenna network.
- ➔ Set the guard interval to 1/32. This shorter guard interval allows you to reach greater data rates.

➔ Reduce the number of selected programs in the channel list.

COFDM modulated channels allow net data rates from 4.98 up to 31.67 Mbit/s (typically 24).

Modulation	Code rate	Guard interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	4.976	5.529	5.855	6.032
	2/3	6.635	7.373	7.806	8.043
	3/4	7.465	8.294	8.782	9.048
	5/6	8.294	9.216	9.758	10.053
	7/8	8.709	9.676	10.246	10.556
16-QAM	1/2	9.953	11.059	11.709	12.064
	2/3	13.271	14.745	15.612	16.086
	3/4	14.929	16.588	17.564	18.096
	5/6	16.588	18.431	19.516	20.107
	7/8	17.418	19.353	20.491	21.112
64-QAM	1/2	14.929	16.588	17.564	18.096
	2/3	19.906	22.118	23.419	24.128
	3/4	22.394	24.882	26.346	27.144
	5/6	24.882	27.647	29.273	30.16
	7/8	26.126	29.029	30.737	31.668

Selected Programs

The program table SELECTED PROGRAMS shows the programs that were activated in phase 2.

SELECTED PROGRAMS

Program Name	Type	Encryption
Das Erste HD	TV	FTA
SWR BW HD	TV	FTA

4.3.3. MK-82x (DVB-T2)

Configuration of the modulators

Select a modulator

➔ Select a modulator from MODULATOR 1 to MODULATOR 3 on the left.

➔ Make the required settings.

➔ Click SAVE for each modulator.

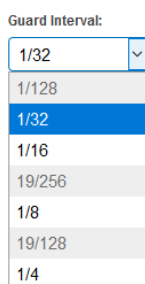
Only then the changes will be saved, **otherwise the changes will be lost.**

Parameters:

Common Output level	The <i>Common Output Level</i> option include a general attenuation of all modulator outputs. The highest output level is reached with a setting of 20 dB, the lowest level with a setting of 0 dB.
Norm	In this selection field, you can set the norm for the output channel spacing. Note: Changing the norm works now according to following rules: <ul style="list-style-type: none">• CCIR ->Australia : all modulators forced to 7MHz• Australia ->CCIR : all modulators forced to 8MHz, however with following exception: low channels S2-S20 are 7MHz only, so those remain in 7MHz
Output Channel	Each of the modulators can be set to any output channel. No output channel may be selected more than once!
DVB-T2 Constallation	The modulation can be adjusted to the following methods: <ul style="list-style-type: none">• QPSK (2 Bit/symbol) – small data rate – very robust signal.• QAM 16 (4 Bit/symbol) - low data rate.• QAM 64 (6 Bit/symbol) - middle data rate.• QAM 256 (8 Bit/symbol) - high data rate.
FEC Coderate	Thanks to the error correction, errors resulting from high-disturbed transmission routes can be balanced by restoring data. The data required to restore the signal are included in the transmitted FEC bits. Changing the FEC factor modifies the part of the FEC data in relation to the application data (1/2, 3/5, 2/3, 3/4, 4/5, 5/6). A higher part of FEC data means an higher transmission redundancy. But this reduces the bandwidth for the useful data too. <ul style="list-style-type: none">• FEC 1/2 - small data rate - strong protection against errors.• FEC 5/6 - high data rate - weak protection against errors.

Bandwidth	<p>If CCIR is selected as the Norm, the bandwidth of the channels can be changed. With a larger bandwidth, more data can be transmitted in one channel.</p> <p>By adjusting the bandwidth, the channels no longer correspond to the channel grid specified by the Norm.</p>
Guard Interval	<p>A guard interval is transmitted between the transmitted symbols of the useful signal. The guard interval protects against inter-symbol interferences.</p> <p>A very long guard interval (e.g. 1/4) leads to a very low data rate. A small guard interval is usually sufficient for transmission in a coaxial distribution network.</p>
Transmission Modes	<p>The setting options for the transmission mode depend on the modulation mode (see 5.2.1 on page 48).</p> <p>DVB-T2 8x16K: The transmission mode can be set between 1k and 16k (ext). 16k (ext) allows the shortest guard interval in percent and the highest data transmission.</p> <p>DVB-T2 4x32K: The transmission mode can be set between 1k and 32k (ext). 32k (ext) allows the shortest guard interval in percent and the highest data transmission.</p>
FEC length	<p>An FEC frame with 64k FEC length or a (short) one with 16k FEC length can be configured.</p>
L1-Post Constellation	<p>The L1 post signaling contains parameters that provide information to the receiver. Constellation types BPSK, QPSK, QAM16 and QAM64 can be configured for L1 post signaling.</p> <p>L1 pre-signalling is always BPSK modulated.</p>
Pilot Pattern	<p>Depending on the Guard Interval and the transmission mode, Pilot Pattern PP1 to PP8 can be selected.</p>
Fine Level	<p>The level fine adjustment attenuates the output level of each individual modulator output separately from 0 to -3 dB.</p>
Fine Tune	<p>In addition, each modulator output can be disabled (Off option).</p> <p>The fine tuning of the output channel is performed in 0.5 MHz steps.</p>

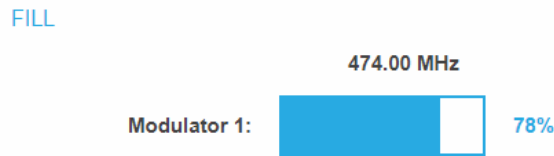
Note



Some configuration options are dependent on each other. In this case, selectable values are highlighted in white, non-selectable values in gray.

Fill level

The data rate of the sender may vary depending on the image contents and on the transmission quality. To ensure an undisturbed reception, a reserve must absolutely be observed.



We recommend you to set the maximal fill level to 90%.

If the current fill level exceeds the maximal fill level, it may cause image disturbances, e.g. mosaic images.

If the net data rate of the signal exceeds the net data rate of the output channel, the modulator overflows. This overflow leads to disturbances. If the modulator overflows, the status LED on the front side of the device lights in red.

Filtering the programmes reduces the net data rate of the input signal. Subsequently, the net data rate of the output signal is also reduced. The data rate depends furthermore on:

- channel bandwidth (7 or 8 MHz)
- error correction rate (FEC)
- modulation rate
- guard interval
- transmission mode

Selected Programmes

The programme table SELECTED PROGRAMS shows the programmes that were activated in phase 2.

SELECTED PROGRAMS

Program Name	Type	Encryption
Das Erste HD	TV	FTA
SWR BW HD	TV	FTA

5. Maintenance

In the menu item MAINTENANCE, status information of the head-end can be viewed, and the technical conditions can be configured.

5.1. STATUS

5.1.1. Current Settings

The screenshot shows the Axing web interface. The top navigation bar includes 'FRONT PAGE', 'INITIALIZATION', and 'MAINTENANCE'. The left sidebar contains buttons for 'STATUS', 'OUTPUT', 'SYSTEM', 'CONFIG', 'REBOOT', 'SMARTPORTAL', 'SNMP', 'NIT', 'LOGS', 'LICENSES', and 'CAS'. The main content area is titled 'CURRENT SETTINGS' and displays the following information:

- Firmware version: V270-20201110-U (DVB-C)
- Software version: 1.08
- Serial number: 8689535
- Devicename: MK 16-06_Axing
- Processor temperature: 69 C
- Ventilation temperature: 39 C
- RF output level: OK
- Power: 15.8V

Below this information, there is a section titled 'UPDATE A NEW DESIGN TO FLASH'. It contains a 'SOFTWARE FILE:' label, a search input field with the text 'Keine Datei ausgewählt.', and an 'UPDATE' button.

Under Current Settings, you will find the following information:

- Firmware version: Displays the firmware version and the output modulation type.
- Software version: Displays the version of the interface
- Serial number of the device
- Device name entered under SYSTEM
- Processor temperature - must remain below 90° C
- Ventilation temperature⁴ - must remain below 50° C (only from hardware version 12-2018)
- State of the RF output level (only from hardware version 12-2018)
- Output voltage of the power supply

⁴ MK-80x, MK-82x and MK-160x only

5.1.2. Updating software

NOTICE

- ➔ After an update, initialization data saved with older Software versions can be loaded into the headend with a newer Software version.
- ➔ Initialization data saved with the current Software versions can **not be loaded** into headends with an **older Software** version.
- ➔ Therefore, if possible, make a Software update of all headends.
We recommend the AXING SMARTPortal for easier handling and overview (see 1.8 on page 8)

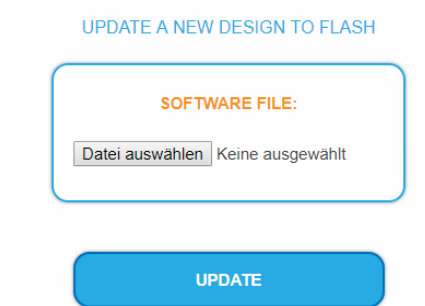
Download

You can find software/firmware updates for download by entering the article in the search field on www.axing.com. On the product page you will find the current software/firmware in the Downloads tab.

- ➔ Download the current version of the file to your computer and unpack it.

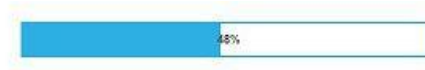
Update

New software for the graphical user interface can be installed under SOFTWARE FILE.



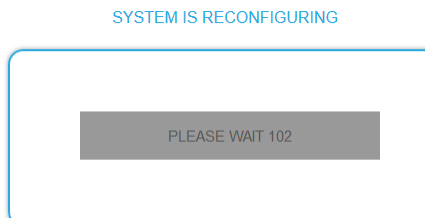
- ➔ Click under SOFTWARE FILE on „Browse...“.
- ➔ Browse for the file on your computer.
- ➔ Click on UPDATE.

The file will be uploaded to the device.



System Reconfiguration

After the upload the reconfiguration of the device begins automatically, the remaining time is shown in seconds. **Note:** During the update, the modulator outputs are disabled. So there is no reception for the subscribers possible.



The headend will be automatically rebooted after the reconfiguration (setted parameters will not be lost).

- ➔ After the restart, log in again.

5.2. Output

5.2.1. Modulation standard

MK-80x, MK-160x, MK-80xN and MK-120xN

Depending on the modulation standard the output signals are modulated into DVB-C or DVB-T.

MODULATION STANDARD

Select Modulation Standard:

DVB-C

SAVE & REBOOT

MK-82x

Depending on the configured modulation standard, the output signals are modulated in DVB-T2 8x16K or DVB-T2 4x32K.

MODULATION STANDARD

Select Modulation Standard:

DVB-T2 8x16k

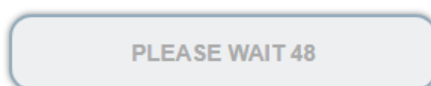
SAVE & REBOOT

- In DVB-T2 8x16K mode, a transmission mode between 1k and 16k (ext) can be set. There are 8 output modulators available
- In DVB-T2 4x32K mode, a transmission mode between 1k and 32k (ext) can be set. There are 4 output modulators available

Change modulation standard

- ➔ Select a **Modulation Standard**.
- ➔ Click **SAVE & REBOOT**.

The changing of the modulation standard begins, the remaining time ist shown in seconds as a countdown.



The headend will be automatically rebooted, the enter password dialog will be displayed.

- ➔ Enter the password again.
- ➔ Check especially the modulator settings and their fill level.

5.3. System

5.3.1. Changing the IP address

The network options are configured under the menu item SYSTEM OPTIONS.

Dynamic IP address

➔ Use **dynamic IP address** to connect the device to a network with a DHCP server.

Static IP address

➔ Use a **static IP address** to connect the device to a network with a fixed IP address. The IP address, netmask and the gateway can be changed here. In addition, DNS server 1 and DNS server 2 can be entered.

SYSTEM OPTIONS

Use dynamic IP address
 Use static IP address

IP Address (0-255):
 . . .

Netmask (0-255):
 . . .

Gateway (0-255):
 . . .

DNS Server 1 (0-255):
 . . .

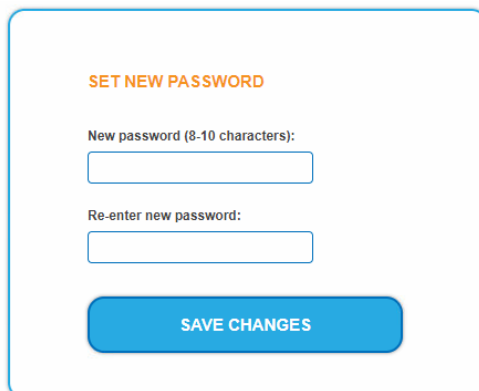
DNS Server 2 (0-255):
 . . .

- ➔ Click SAVE & REBOOT to confirm and save the changes.
When the changes are saved, the device will reboot automatically.
- ➔ The **new IP address** has to be entered in the web browser and the enter password dialog will be displayed.

5.3.2. Changing the password

The default password is: *Ramsen8262*.

The default password should be changed right after commissioning the headend.



SET NEW PASSWORD

New password (8-10 characters):

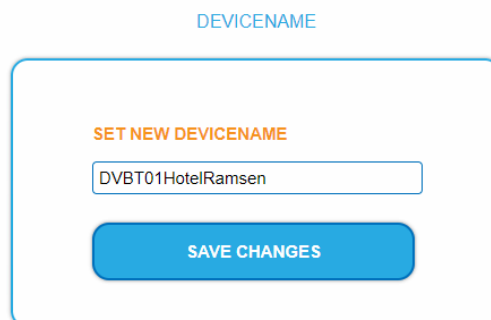
Re-enter new password:

SAVE CHANGES

- ➔ Type an new password with 8-10 characters (letters and/or digits).
- ➔ Re-enter the password.
- ➔ Click SAVE CHANGES to confirm and save the changes.
The saving of the password is confirmed.

5.3.3. Device name

In the section DEVICE NAME you can set a new device name for the headend.



DEVICENAME

SET NEW DEVICENAME

DVBT01HotelRamsen

SAVE CHANGES

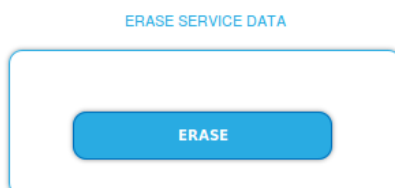
- ➔ Enter a name in the field SET NEW DEVICE NAME.
- ➔ Click on SAVE CHANGES.
The new device name is shown at the login.

5.4. Config

5.4.1. Erasing service data

In the section ERASE SERVICE DATA you can erase the settings from phase 2. The transponder data must be read again for tuners 1-4 by executing a scan.

The headend is also set to remux mode.



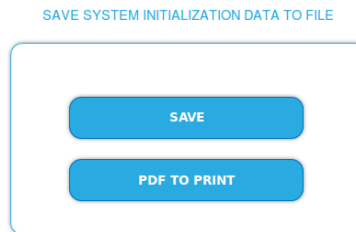
ERASE SERVICE DATA

ERASE

-
- Click on erase.
The frontpage will be shown.

5.4.2. Save Initialization Data

In the section SAVE SYSTEM INITIALIZATION DATA TO FILE you can save the current initialization data from phase 1 to 3 into a file on your computer.



- Click on SAVE,
the data is offered to you for saving as a config.dat file
- Click on PDF TO PRINT,
a PDF is generated and offered as Config.pdf for opening or saving.

Note: Password and IP address will not be saved.

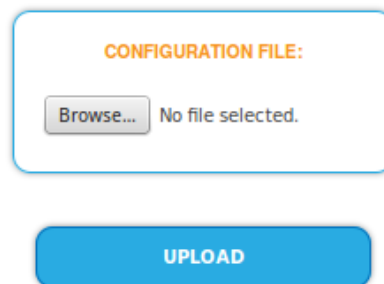
5.4.3. Upload Initialization Data

In the section UPLOAD SYSTEM INITIALIZATION DATA FROM FILE you can upload the initialization data from a file to the modul.

NOTICE

- After an update, initialization data saved with older software versions can be loaded into the device with a newer Software version.
- Initialization data saved with a newer software version **cannot be loaded** into devices with an **older Software** version.

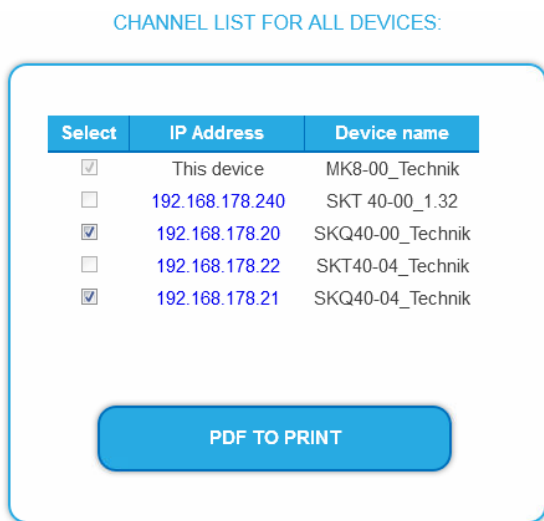
UPLOAD SYSTEM INITIALIZATION DATA FROM FILE



- Choose a configuration file.
- Click on UPLOAD.
The upload will take a few seconds.

5.4.4. Channel list for all devices

You can create a common channel list for all devices with the same output modulation in the network.

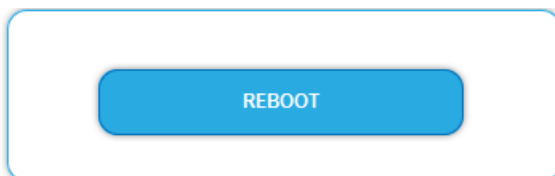


- ➔ Select the headends to be included in the channel list.
Notes: The device to which you are logged on is named "This device" and is always selected. You can only select headends with the same output modulation.
- ➔ Click on PRINT TO PDF.
 A PDF of the channel list is generated which you can open or save.

5.5. Reboot

5.5.1. Rebooting

Under REBOOT THE SYSTEM the device can be rebooted.



- ➔ Click on REBOOT.
- ➔ After rebooting, the password must be entered again.
Note: If SAT signals are temporarily unavailable (e.g. due to snow), the headend will reboot every 10 minutes. This ensures that all configured programmes are available again after reception is possible again.

5.6. SMARTPortal

5.6.1. Access to SMARTPortal

If you are a registered user of the SMARTPortal, then you can remotely control the device via the SMARTPortal and, if necessary, receive support from AXING (see also <https://axing.com/en/produkte/smartportal/>).

Prerequisite is an internet connection for the headend.

ACCESS TO SMARTPORTAL

State:

AXING support allowed

Location:

Email address:

Userkey:

- ➔ In the **State** field, select **Enabled**.
- ➔ Activate, if required, the option **AXING support allowed**.
- ➔ In the field **Location**, enter a name for the location of the headend. This name will appear later in the SMARTPortal to help you identify the headend.
- ➔ In the field **Email address**, enter the e-mail address with which you are registered at SMARTPortal.
- ➔ In the field **User key**, enter the user key that you received when registering at SMARTPortal.
- ➔ Click on **SAVE & REBOOT**. The data is saved, the headend is rebooted and the connection to the SMARTPortal is established.

Where required, you have to adjust the connection data (see 5.3 on page 49).

5.7. SNMP

5.7.1. SNMP (Simple Network Management Protocol)

The Simple Network Management Protocol (SNMPv1 or SNMPv2c) is supported. With the help of a Network Management Station (NMS) information can be read or alarms can be received.

Supported SNMP message types are GET-REQUEST, GETNEXT-REQUEST and TRAP.

SNMP

The image shows a configuration interface for SNMP. It includes the following fields and controls:

- Agent:** A toggle switch set to **ON**.
- Agent Port:** A text input field containing the value **161**.
- SNMP Version:** A dropdown menu currently showing **Version 2c**.
- Community Name:** A text input field containing the value **public**.
- Traps:** A toggle switch set to **ON**.
- Destination Address:** A text input field containing the value **192.168.178.104**.
- Destination Port:** A text input field containing the value **162**.
- MIB:** A text label showing **AXING-MIB.txt**.
- SAVE:** A large blue button at the bottom of the form.

SNMP Agent

- ➔ Set the **Agent** switch to **ON** to use GET-REQUEST and GETNEXT-REQUEST.
- ➔ The **Agent Port** is by default 161, if necessary, enter another port.
- ➔ In the **SNMP Version** field, select version SNMPv1 or SNMPv2c. SNMPv2c is recommended.
- ➔ The **Community Name** (the SNMP "password") is public by default, if necessary enter a different community name.

Traps

Traps can also be output independently of the SNMP agent.

- ➔ If traps are to be transmitted from the headend, then set the **Traps** switch to **ON**.
- ➔ Enter the **Destination Address** of the NMS receiving traps.
- ➔ Enter **Destination Port** of NMS, by default 162 is used.

MIB object definition

The MIB object definition is stored in the device.

- ➔ Click AXING-MIB.txt to open the definition.

If you are connected to the device in the network, then you can download the file from the device.

URL = [IP address of device] /MIB/AXING-MIB.txt

For example: 192.168.0.145/MIB/AXING-MIB.txt

Notes on support for OpManager and Paessler PRTG Network Monitor

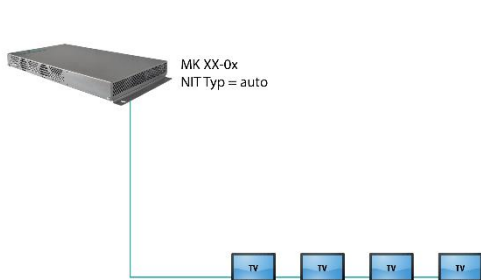
- ➔ When adding a device, check that the credentials ("password") has been used.
By default, the headend supports the "SNMP v1/v2 Public" profile (community name "public").
- The following SNMP settings must be changed to also display the CPU load:
- ➔ Select Axing Device → Settings
- ➔ Scroll down to "SNMP Compatibility Options".
- ➔ Disable "Inherit from".
- ➔ Change the Walk Mode value to: "Use GETNEXT requests".
- ➔ Click Save.

5.8. NIT (Network Information Table)

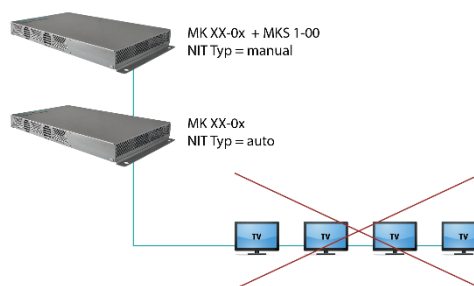
The NIT contains information about the signal configuration of a headend. A TV needs this information for a fast channel search. The LCN (Logical Channel Numbering) is located within the NIT, which virtually allocates the programs to a place.

The headend provides an auto NIT at the factory, which includes all channels from 114 MHz to 1002 MHz and only the most important parameters such as symbol rate and modulation.

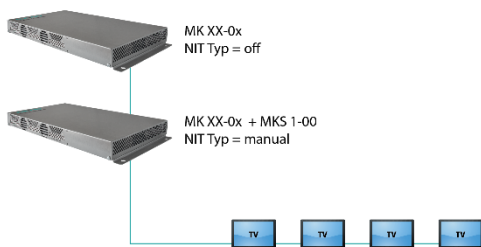
With the fee software extension MKS 1-00 a Network Information Table (NIT) be read from the devices. The NIT can be edited and uploaded back to the devices.



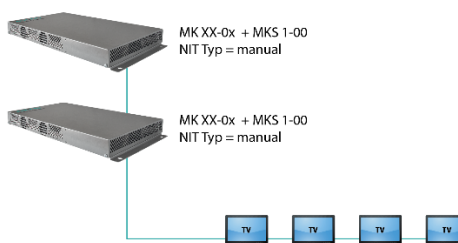
Operation with auto NIT supplies all channels from 114 MHz to 1002 MHz.



Operation leads to a conflict because of two NITs with ON IDs and Network IDs.

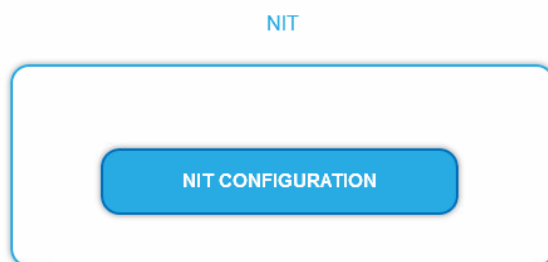


Operation does not lead to conflict (NIT, ON ID, Network ID). But no LCN from the headend without MKS 1-00 is delivered.



Ideal solution, operation with MKS 1-00 in each device: One common NIT, ON ID, Network ID and LCN from both headends.

5.8.1. Start NIT Configuration



➔ Click on NIT CONFIGURATION to open the settings dialog.

5.8.2. Select type

NIT TYP:

➔ Select Auto.

An NIT is created that contains all channels (from 114 MHz to 1002 MHz).

The unoccupied channels contain only the most important parameters such as symbol rate and modulation.

➔ Select Off.

There is no NIT created and therefore no LCN output.

➔ Select Manual.

The input fields for reading, checking and uploading the NIT are displayed.

Note: Only with the software extension MKS 1-00 can the type be set to Manual and a Network Information Table (NIT) be read from the devices, edited and uploaded back to the devices.

The MKS 1-00 must be installed by AXING support (for this purpose, a connection with the Internet is necessary).

5.8.3. Read NIT

Under STEP 1: READ NIT (DVB-C) the devices in the network are displayed.

Select	IP Address	Device name
<input checked="" type="checkbox"/>	This device	MK 8-00 Trainingroom
<input checked="" type="checkbox"/>	192.168.178.148	SKQ 81-00 Axing_L
<input checked="" type="checkbox"/>	192.168.178.147	SKQ 81-00 Axing_R
<input checked="" type="checkbox"/>	192.168.178.149	SKQ 40-04 Axing

RESET NIT READ NIT

➔ Select the devices from which the NIT is to be read out.

The device you are currently configuring (This device) is always selected.

➔ Click on READ NIT.

The data of the devices are read in and listed under STEP 2: VERIFY NIT.

Note: If necessary, you must reset the NIT before importing

5.8.4. NIT Check

Note: If the NIT is edited, the headend automatically switches to cross-multiplex mode.

STEP 2: VERIFY NIT

Network Name: Axing
Network ID / ON-ID: 4660

Freq (MHz)	SR	Mod	TS-ID	ON-ID	
354.000	6900	QAM256	1091	1	
362.000	6900	QAM256	1101	1	
370.000	6900	QAM256	1089	1	
378.000	6900	QAM256	9700	702	
386.000	6900	QAM256	1073	1	
394.000	6900	QAM256	7	133	
402.000	6900	QAM256	1089	1	
410.000	6900	QAM256	1101	1	

Values that overlap

Values that overlap are displayed in red. These errors must be cleaned up before uploading.

Notes:

- Different TS-IDs must always be assigned
- The ON-ID must be the same for all headends

5.8.5. Edit NIT

- ➔ Click the pen symbol next to a line.
The fields can be edited.
- ➔ Click on the plus sign in the column header.
An additional line is inserted.
Enter plausible data in the fields, matching the other values.
- ➔ Click on the plus sign next to the cell.
The line will be adopted.

STEP 2: VERIFY NIT

Network Name: Axing
Network ID / ON-ID: 4660

Freq (MHz)	SR	Mod	TS-ID	ON-ID	
1004	6900	QAM256	123	1	
1002.000	6900	QAM256	1019	1	
354.000	6900	QAM256	1091	1	

Add cell

Adopt cell

Edit cell

Delete cell

- ➔ Click the wastebasket icon next to a line.
The line is deleted.

5.8.6. Upload NIT to the devices

STEP 3: UPLOAD NEW NIT TO DEVICES

Select	IP Address	Device name
<input checked="" type="checkbox"/>	This device	MK 8-00 Trainingroom
<input checked="" type="checkbox"/>	192.168.178.148	SKQ 81-00 Axing_L
<input checked="" type="checkbox"/>	192.168.178.147	SKQ 81-00 Axing_R
<input checked="" type="checkbox"/>	192.168.178.149	SKQ 40-04 Axing

UPDATE

- ➔ Select the devices you want to upload to.
- ➔ Click UPDATE.
The data is uploaded and stored in the headend.

5.8.7. Add NIT from DVB-C input (optional)

In cases where DVB-S and DVB-C are used, the NIT of a CATV provider can be read in via a tuner of the MK and added to the output NIT.

STEP 4 (OPTIONAL): ADD NIT FROM DVB-C INPUT

Tuner input:

Select the relevant tuner in the field **Tuner input**.

5.8.8. Reset the NIT

Resetting the NIT is necessary in certain circumstances.

Example:

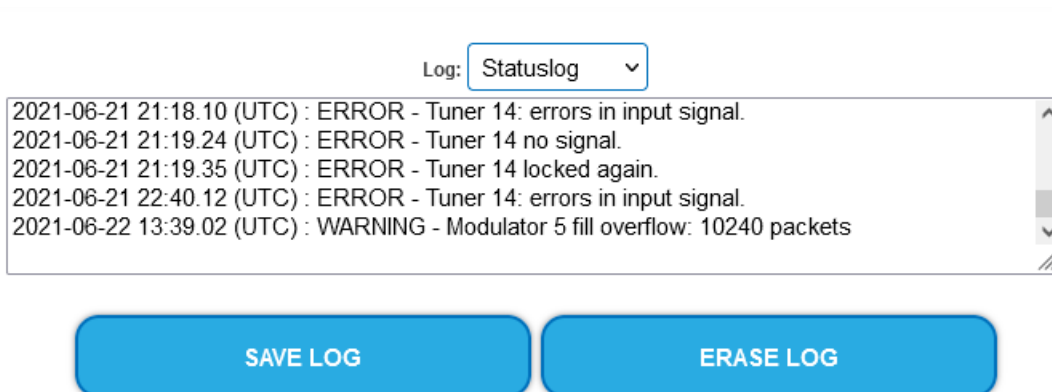
Three devices are used.

In the first device, the NIT is edited and uploaded to all devices. Subsequently, in the modulator output of the first device, parameters such as the channel output frequency are changed. If the NIT is read in again, the old channel output frequency will also be read in as it is still in device 2 and 3. Resetting removes all previous loaded NIT configurations from the devices. These now only return their current configured settings while reading.

- ➔ Click RESET NIT.
The NIT entries of the devices are reset.

5.9. Logs

5.9.1. Log entries



Under LOGS you can see the log entries of the headend.

- The system log is written to the flash memory, so it is still available after rebooting the headend.
 - The status log is written to RAM and is empty after rebooting the headend.
- Choose **Statuslog**.
The entries of the status log are displayed.
- Choose **Systemlog**.
The entries of the system log are displayed.
- Click SAVE LOG to save the respective log entries as a txt file.
- Click on ERASE LOG to delete the respective log entries.

5.9.2. Tuner monitoring

TUNERS TO MONITOR

- Tuner 1
- Tuner 2
- Tuner 3
- Tuner 4
- Tuner 5
- Tuner 6
- Tuner 7
- Tuner 8
- Tuner 9
- Tuner 10
- Tuner 11
- Tuner 12
- Tuner 13
- Tuner 14
- Tuner 15
- Tuner 16

SAVE CHANGES

Under TUNER TO MONITOR you select the tuners that are to write log entries.

5.10. Licenses

5.10.1. Licenses for Software Extensions

Software extensions can be used to extend the functions of a headend. You require a license for a software extension.

Purchase licenses

You can purchase a license by ordering the appropriate software extension from AXING. When ordering, you must provide the serial number of the headend. A license file will be generated for you to match exactly this serial number. Important: The license is bound to the serial number and is not transferable to other devices!

Load license file

Licenses can be loaded onto the headend in different ways:

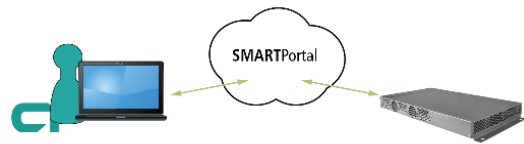
By AXING support via remote maintenance software (e.g. TeamViewer):

- The headend must be connected to a PC/notebook via Ethernet.
- The notebook requires Internet access.
- You need a valid software license and the current version of the remote maintenance software.



By the user or AXING support via SMART Portal:

- The headend must be integrated into the SMART Portal and requires Internet access.
- If AXING support should upload the license file, the option Allow AXING support must be activated for the headend.



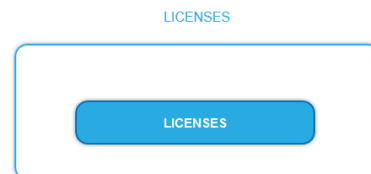
By the user in the configuration interface:

- You have ordered a software extension and received a license file by e-mail.
- You upload the license file (SN.lic) in the configuration interface of the headend under MAINTENANCE>LICENSES.



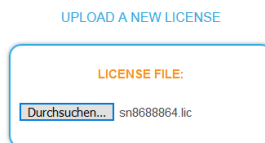
Note: The new function is only available after a restart of the headend.

- ➔ Click on LICENCES.
The dialog ACTIVATED LICENSES will be opened.



The already activated licenses and their expiration date are displayed (permanent means that the license never expires).

- Under UPLOAD A NEW LICENSE, select a LICENSE FILE.



- Click on UPLOAD.
The upload will take a few seconds.
The new license is listed in the ACTIVATED LICENSES dialog.

ACTIVATED LICENSES

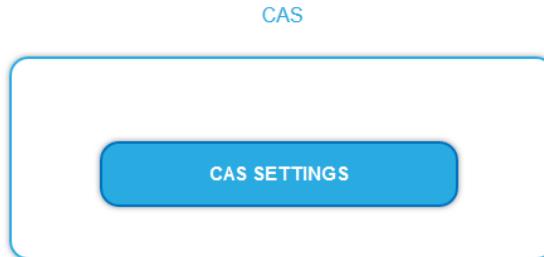
Feature	Expires
PID filtering	permanent

- Reboot the device and log in again. **The new function is only available after a restart of the headend.**

5.11. CASimulcrypt (with MKS 1-02)

The setup for the conditional access system requires the installation and configuration of a CAS server, which generates ECMs and EMMs, among other things. Setting up a CAS server is not described in this document.

To configure the settings for the headend unit, you must have a corresponding licence (see 5.10 on page 61). If this licence is activated in the headend, the necessary settings can be made under CAS.



➔ Click on CAS SETTINGS.

Several fields and tables for the CAS settings are displayed.

5.11.1. Global Settings

GLOBAL SETTINGS	
Enable Simulcrypt:	<input checked="" type="checkbox"/>
Network Interface:	<input type="text" value="Control"/>
EMMG Listening Port:	<input type="text" value="9998"/>

Enable Simulcrypt: Enable or disable Simulcrypt (license needed to activate).





Network Interface used for simulcrypt-related network traffic, option is Control (Configuration port).

The IP address of the port must be configured for EMMG (CAS server), see 5.3 on page 49.

EMMG Listening Port: TCP port configured in EMMG (CAS server) to connect the headend.

5.11.2. Scrambling Control Groups (SCG)

This table lists all Scrambling Control Groups used in the device. Programs connected to the same SCG are scrambled at the same time with the same control word (encryption key). Each SCG can contain one or more program. Programs are connected to SCGs at page Phase2 (see 5.11.7 on page 67).







SCG LIST						
Name	Algorithm	Scrambling Policy	Fallback	Crypto Period (sec)	Status	+
Conax 2501	DVB-CSA-1	All ECMGs	Keep last CW	15	●	 
Conax 2504	DVB-CSA-1	All ECMGs	Keep last CW	15	●	 
Conax 2511	DVB-CSA-1	All ECMGs	Keep last CW	15	●	 
Conax 2521	DVB-CSA-1	All ECMGs	Keep last CW	15	●	 
Conax 2531	DVB-CSA-1	All ECMGs	Keep last CW	15	●	 
Conax 2505	DVB-CSA-1	All ECMGs	Keep last CW	15	●	 

Name: Only used in GUI to easily identify the scrambling groups. Therefore groups should have descriptive names to enable easy identification at Phase 2 when connecting programs to SCGs.

- **Algorithm** (Scrambling algorithm) option values:
 - # unscrambled (scrambling for this SCG is actually disabled)
 - # DVB-CSA-1
 - # DVB-CSA-2
 - # DVB-CISSA
 - # ATIS-IDSA
 - # AES-ECB
 - # AES-CBC
- **Scrambling Policy** option values:
 - # All ECMGs: Programs connected to this SCG are scrambled only if all ECMGs are connected
 - # Any ECMG: Programs connected to this SCG are scrambled as long as at least one ECMG is connected
 - # Always: Programs are scrambled always. If all ECMG connections are lost, no one is able to descramble.
- **Fallback:** (Fallback rule) in case Scrambling Policy (defined above) is not fulfilled. Option values:
 - # Revert to clear: Stop scrambling. Subscribers will receive programs as unscrambled. Also non-subscribers are able to view the content.
 - # Keep last CW: Scrambling is continued using the last CW and the last received ECM. Subscribers are able to continue the descrambling.
- **Crypto Period (sec):** Min. period in seconds for one control word (encryption key). Also ECM generator can specify a minimum period it supports and in this case larger of these two values is used.
- **Status** (scrambling status) shown as traffic lights, to provide a quick visual feedback.

5.11.3. CAS List

The table is used to assign readable names to CAS-IDs in order to be able to assign them more easily in the following tables.

CAS LIST			
Name	CAS ID	Sub ID	+
Conax	0x0B00	0x0001	 
Test	0x1234	0x5678	 
Verimatrix	0x5604	0x0000	 

Add here all connected CA-Systems. Each CA-System is identified by two IDs, the “CA system id” (**CAS ID**) and “CA subsystem id” (**Sub ID**)⁵.

⁵ Sometimes both values can be seen combined to a single “Super CAS ID”.

5.11.4. ECM Generators

ECM generator is provided by CAS supplier to produce ECM messages.

ECM GENERATOR LIST						
Name	Channel ID	Remote IP	Port	CAS	Status	+
Conax	1	192.168.0.100	8007	Conax		

- **Name:** Only used in web interface to easily identify separate ECMG servers
- **Channel ID** <optional>: 'ECM_channel_id' used when communicating with ECMG. Some ECMGs require a specific value for this ID (info if necessary from the CAS supplier). If left empty, device uses some unused random ID.
- **Remote IP:** IP address of the ECMG server to connect to.
- **Port:** Port of the ECMG server to connect to.
- **CAS:** CA system of this ECMG (name from the CAS table)
- **Status:** ECMG server connection status shown as traffic lights

5.11.5. ECM List

ECM contains CAS supplier private information which carries the control word (encryption key) in a secure manner and private entitlement information. Each ECM entry corresponds to one generated ECM stream. Each SCG requires at least one ECM stream, otherwise nobody is able to descramble.





ECM LIST						
ECM Generator	ECM ID	SCG	Access Criteria	Private Data	Status	+
Conax	2501	Conax 2501	00 00 09 C5	<empty>		
Conax	2504	Conax 2504	00 00 09 C8	<empty>		
Conax	2505	Conax 2505	00 00 09 C9	<empty>		
Conax	2521	Conax 2521	00 00 09 D9	<empty>		
Conax	2511	Conax 2511	00 00 09 CF	<empty>		
Conax	2531	Conax 2531	00 00 09 E3	<empty>		

- **ECM Generator:** ECM generator responsible for generating this ECM stream (value from ECM Generator list)
- **ECM ID** <optional>: 'ECM_id' used when communicating with ECMG. Some ECMGs may require a specific value for this (info from CAS supplier). If left empty some random ID is used.
- **SCG:** Scrambling Control Group whose control words are transmitted by this ECM (value from SCG table)
- **Access Criteria:** Arbitrary binary data transmitted to the ECMG. Typically used to tell the ECMG which clients should be able to decode the ECMs. Format and value is given by CAS supplier.
- **Private Data:** Arbitrary binary data included as 'private_data' in the CA_descriptor of the PMT associated to this ECM (info from CAS supplier).
- **Status:** ECM stream status shown as traffic lights

5.11.6. EMM Configuration




EMM contains CAS supplier private information which for example specifies the authorization levels of subscribers or groups of subscribers. EMM generator is an external server from CAS supplier which produces EMM messages and repeatedly sends them to the headend.

EMM configuration is divided to two tables: **EMM Generator List** and **EMM List**.

EMM GENERATOR LIST				
Name	IP Filter	CAS	Client ID	+
Conax	<none>	Conax	<use Super_CAS_id>	 
Test	<none>	Test	<use Super_CAS_id>	 

EMM Generator List:

- **Name:** Only used in web interface to easily identify separate EMMG servers
- **IP filter <optional>:** By default different EMM generators are separated by Client ID and this cell can be left empty. But if IP address is entered, only connections from this address are allowed.
- **CAS:** CA-System from the CAS List.
- **Client ID <optional>:** The value EMMG uses to identify itself (info from CAS supplier). Often 'Super_CAS_id' is used as 'client_id', so can be left empty and device automatically uses 'Super_CAS_id' of the selected CAS.

EMM LIST				
EMM Generator	Data ID	Bandwidth (kbps)	Private Data	Status +
Conax	<auto>	100	<empty>	  

EMM List:

- **EMM Generator:** Name from EMM Generator List
- **Data ID <optional>:** EMMG identifies separate streams by Data ID. If left empty, all Data Ids will be accepted.
- **Bandwidth:** Allocated bandwidth (kbps) for this EMM stream. It is responsibility of the EMMG to actually maintain the bitrate.
- **Private Data <optional>:** Arbitrary binary data included as 'private_data' in the CA_descriptor for this EMM.
- **Status:** EMM receiving status shown as traffic lights

5.11.7. Program Scrambling at Phase 2

Programs will be connected to SCGs at Phase 2:

- ➔ Click the desired program to view its details.
- ➔ Select a **Simulcrypt SCG** from the drop-down list (it shows all configured SCGs).

By default all video and audio PIDs for the program are selected for the scrambling.

- ➔ Select/unselect individual PIDs at “Scramble” column to overwrite the defaults.
- ➔ Click “Save changes” once ready.

After saving the changes encryption status column shows scrambling status for each program selected for scrambling.

Modulator	LCN	Program Name	Type	Encryption	Input
M1 M2 M3		RTL Television	TV	●	239.0.0.1:1234
		Program Name: RTL Television			
		Service-ID: 12003			
		Simulcrypt SCG: Conax 2501			
		Duplicate program: Add			
Stream type	IN PID	OUT PID	FIXED	BLOCK	SCRAMBLE
PMT	44	44	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MPEG2 Video	163	163	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
MPEG1 Audio (ger)	104	104	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Private data	108	108	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Teletext (deu)	105	105	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AC-3 Audio (ger)	106	106	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Subtitles (deu)	110	110	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DSM-CC	111	111	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DSM-CC	112	112	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
M1 M2 M3		RTL Regional NRW (user modified)	TV	●	239.0.0.2:1234

5.11.8. Scrambling status monitoring

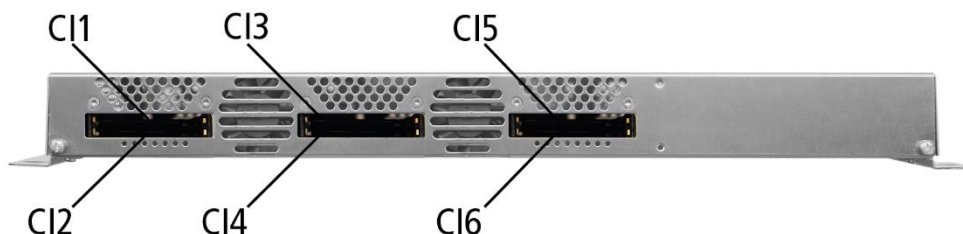
Web interface contains multiple Simulcrypt status traffic lights and they all give different level of details:

- **Phase 2 → Programm Encryption column:** This is the most important status. If all scrambled services have green light, system is working without problems. But if any service has red light, Maintenance → CAS page gives more details.
- **SCG table status:** Once SCG status is green, services connected to this SCG are scrambled and status must be green also at related rows in ECMG and ECM tables. If SCG status is red, please check status columns at ECMG and ECM tables.
- **ECM table status:** Status of each ECM stream. Re-check access criteria value if status is red.
- **ECMG table status:** Server connection status. The least important item but indicates some network setup problem if status color is red. Check that e.g. network cable is properly connected to the device. All the other status items stay red until ECMG status becomes green.
- **Maintenance → View Logs** gives overview about scrambling status in long-term. All SCG errors are reported here.
- **SNMP traps** give the most detailed immediate information for studying e.g. CAS server connection problems. One good tool for collecting SNMP traps is iReasoning MIB Browser. SNMP traps must first be enabled at Maintenance page.

6. Use of CA modules

6.1. Insertion of CA modules

Up to six CA modules can be inserted into the CI-slots at the front side of the MK-806, MK-826 or MK-1606.



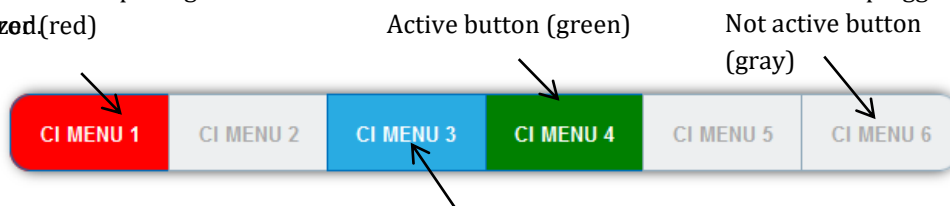
Up to three CA modules can be inserted into the CI-slots at the front side of the MK-803N or MK-1203.



➔ Carefully insert the CA modules to the corresponding CI slot without exerting force.

6.2. CI menu

The settings for the CA modules can be made in the CI menus on the start page of the user interface. The buttons for opening the CI menu will be activated after the modules have been plugged in and initialized.



If an error occurs, e.g. during decryption, the button is shown in red. CA is plugged in but not used

➔ Click one of the buttons.
The corresponding CI menu is displayed.

6.2.1. Using CI menu and rebooting the CAM

The content of the CI menu depends on the CAM manufacturer and the card being used. Depending on the manufacturer, various settings are possible. Information on validity and authorisation are the most important.

➔ Please observe the operating instructions provided by the manufacturer.

According to the used CAM different settings can be done. Most important is getting information about authorisation.

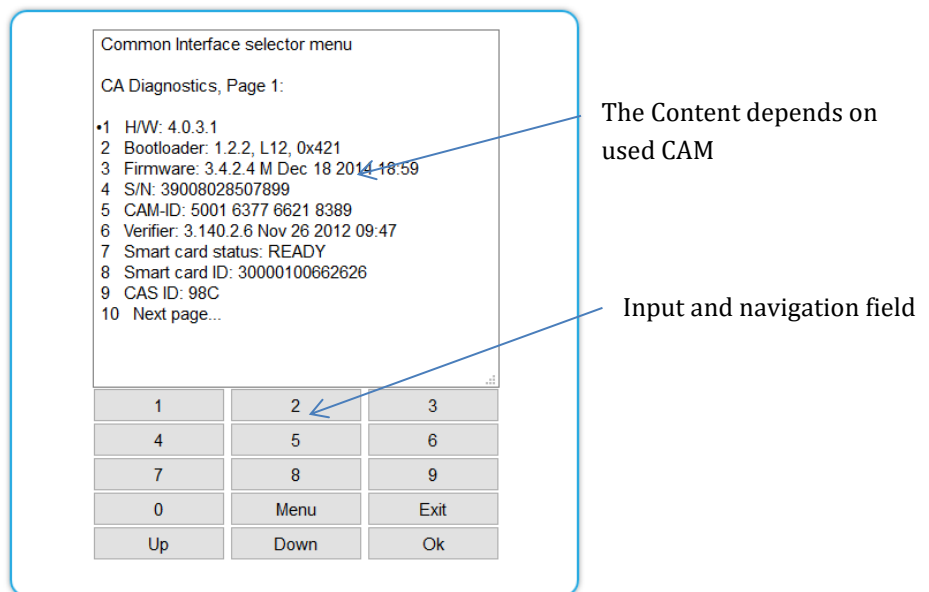
The input and navigation field is used for navigation within the CI menu.

➔ Use **Up** or **Down** to reach a higher or lower selection point.

➔ Use **Ok** to enter a corresponding sub menu or confirm a selection.

➔ Use **Menu** to come back to the next superordinate level.

➔ Use **Exit** to leave the menu.



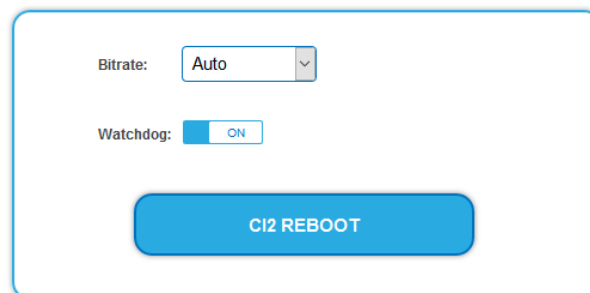
6.2.2. Bit rate for high-speed CAM and restarting the CAM

Bit rate

The bit rate is factory set to "Auto". The bitrates of the most common CAM are thus recognized. If necessary, the bit rate can also be set manually.

➔ Select the desired bitrate in the **Bitrate** field.

➔ For example, select 105 Mbps for a high-speed CAM



Reboot the CAM

The CAM can be rebooted if necessary.

➔ Click CI1...6 to reboot it.

6.3. Decryption of programs

Scrambled programs are indicated by the abbreviation CA in the column **Encryption** of the TUNER table.

By default, in the column **Decrypt** the option **no** is chosen. The program will be transferred to the modulator in encrypted form and must be decrypted in the receiver.

If CA modules are plugged in, the corresponding programs can be decrypted.

TUNER 1							
Modulator	LCN	Program Name	Type	Encryption	Decrypt	Service ID	Audio Lan
M1 M2 M3 M4 M5 M6 M7 M8		SRF 1 HD	TV	CA	CI 1		ALL
M1 M2 M3 M4 M5 M6 M7 M8		SRF zwei HD	TV	CA	no		ALL
M1 M2 M3 M4 M5 M6 M7 M8		RTS Un HD	TV	CA	no CI 1		ALL
M1 M2 M3 M4 M5 M6 M7 M8		RTS Deux HD	TV	CA	CI 2		ALL
M1 M2 M3 M4 M5 M6 M7 M8		Test17205	TV	CA	CI 3 CI 4 CI 5 CI 6		ALL

Choose a CI slot

- ➔ Choose **CI 1...CI 6** respective **CI 1...CI 3** in the column **Decrypt**.
The programm will be transferred to the choosen modulator in decrypted form.

7. Technical specifications

7.1.1. MK-800 | MK-806 | MK-1600 | MK-1606

Type	MK-800	MK-806	MK-1600	MK-1606
Inputs				
Number of tuners	8 × DVB-S/S2/S2X/T/T2/C	8 × DVB-S/S2/S2X/T/T2/C	16 × DVB-S/S2/S2X/T/T2/C	16 × DVB-S/S2/S2X/T/T2/C
Connector	8 × F-female	8 × F-female	16 × F-female	16 × F-female
Frequency range	900...2150 MHz @ DVB-S/S2/S2X 50...898 MHz @ DVB-C 50...898 MHz @ DVB-/T/T2			
Channel bandwidth	5/6/7/8 MHz @ DVB-T/T2	5/6/7/8 MHz @ DVB-T/T2	5/6/7/8 MHz @ DVB-T/T2	5/6/7/8 MHz @ DVB-T/T2
Input level	43...84 dBμV @ DVB-S/S2/S2X 49...84 dBμV @ DVB-C 39...84 dBμV @ DVB-/T/T2			
LNB voltage	13/17 V; 22 kHz on/off; DiSEqC 1.0			
Max. LNB current	250 mA per input 1000 mA per device			
CI slots	-	6	-	6
Input modulation				
Type	QPSK/8PSK/ 8APSK/16APSK/32APSK @ DVB-S/S2/S2X QAM16, QAM32, QAM64, QAM128, QAM256 @ DVB-C QPSK, QAM16, QAM64 @ DVB-T QPSK, QAM16, QAM64, QAM256 @ DVB-T2			
Compliance	DVB-S = EN 300 421 DVB-S2 = EN 302 307-1V1.4.1 DVB-S2X = EN 302 307-2V1.1.1 DVB-C = EN 300 429/ITU-TJ.83 Annex A/C DVB-T = EN 300 744 DVB-T2 = ETSI EN 302 755			
Supported input transport streams	MPEG-2 ISO/IEC 13818 MPEG-4 ISO/IEC 14496			
Error correction	auto			
Symbol rate	1.5...45 MS/s (<40MSymbol/s in 32APSK) @ DVB-S 1...7.2 Mbaud @ DVB-C			
Transportstreams				
Modifiable program information	Program name, SID remapping, PID remapping, PID filtering* TSID, ONID			
LCN	Yes			
NIT handling @ DVB-C	auto off manual*			
Encryption	DVB-CSA*, DVB-CISSA*, ATIS-IDSA*, AES-ECB*, AES-CBC*			
Output				

Type	MK-800	MK-806	MK-1600	MK-1606
Number of channels	8 × DVB-C/DVB-T	8 × DVB-C/DVB-T	16 × DVB-C/DVB-T	16 × DVB-C/DVB-T
Frequency range	109...1006 MHz @ DVB-C 109...862 MHz @ DVB-T			
Channels selectable	S2...K87 @ DVB-C S2...K69 @ DVB-T			
Channel bandwidth	7/8 MHz @ DVB-T			
Possible frequency shift	-4...+4 MHz (0.5 MHz steps)			
Connector	1 × F-female			
Test port	1 × F-female (-30 dB)			
Impedance	75 Ω			
Output level adjustable	80...100 dBμV @ DVB-C 77...98 dBμV @ DVB-T			
Output modulation				
Compliance	DVB-T (EN 300 744) DVB-C (EN 300 429/ITU-T 83 AnnexA/C)			
Type	16QAM, 32QAM, 64QAM, 128QAM, 256QAM @ DVB-C QPSK, 16QAM, 64QAM @ DVB-T			
MER	≥ 40 dB @ DVB-C ≥ 36 dB @ DVB-T			
Bit rate, max	50.87 Mbps @ DVB-C 31.668 Mbps @ DVB-T			
FFT	2K mode @ DVB-T			
FEC	1/2, 2/3, 3/4, 5/6, 7/8 @ DVB-T			
Guard interval	1/4, 1/8, 1/16, 1/32			
Symbol rate	1...7.5 MBaud/s @ DVB-C			
Interfaces				
Control/CAS	1 × RJ-45			
Compliance Control/CAS	IEEE 802.3, 100 Base-T			
Supported configuration protocols	HTTP, SNMP v1, SNMP v2c, AXING SMARTPortal**			
General				
Operating voltage	100...240 VAC/50...60 Hz			
Power consumption	50 W	50 W	60 W	60 W
Equipotential bonding connection	4 mm ²			
Operating temperature range (acc. to EN 60065)	-10°C...+50°C			
Dimensions (W × H × D) appr.	480 × 253 × 47 mm			
Weight	2.550 kg	2.800 kg	2.900 kg	3.150 kg
Comments	* with software extension only			

Type	MK-800	MK-806	MK-1600	MK-1606
	** encrypted, cloud-based application for configuration, monitoring and remote maintenance			

7.1.2. MK-800N | MK-803N | MK-1200N | MK-1203N

Type	MK-800N	MK-803N	MK-1200N	MK-1203N
Inputs				
Number of tuners	8 × DVB-S/S2/S2X	8 × DVB-S/S2/S2X	12 × DVB-S/S2/S2X	12 × DVB-S/S2/S2X
Connector	8 × F-female	8 × F-female	12 × F-female	12 × F-female
Frequency range	900 ... 2150 MHz @ DVB-S/S2/S2X			
Input level	43 ... 84 dBμV @ DVB-S/S2/S2X			
Max. LNB current	250 mA per input 1000 mA per device			
CI slots	-	3	-	3
Input modulation				
Type	QPSK/8-PSK/8-APSK/16-APSK/32-APSK @ DVB-S/S2/S2X			
Compliance	DVB-S = EN 300 421 DVB-S2 = EN 302 307-1 v1.4.1 DVB-S2X = EN 302 307-2 v1.1.1			
Supported input transport streams	MPEG-2 ISO/IEC 13818 MPEG-4 ISO/IEC 14496			
Error correction	auto			
Symbol rate	1.5 ... 45 MS/s (< 40 MSymbol/s in 32-APSK)			
Transportstreams				
Modifiable program information	Program name, SID remapping, PID remapping, PID filtering* TSID, ONID			
LCN	Yes			
NIT handling @ DVB-C	auto off manual*			
Encryption	DVB-CSA*, DVB-CISSA*, ATIS-IDSA*, AES-ECB*, AES-CBC*			
Output				
Number of channels	8 × DVB-C/DVB-T	8 × DVB-C/DVB-T	12 × DVB-C/DVB-T	12 × DVB-C/DVB-T
Frequency range	109 ... 1006 MHz @ DVB-C 109 ... 862 MHz @ DVB-T			
Channels selectable	S2...K87 @ DVB-C S2...K69 @ DVB-T			
Channel bandwidth	7/8 MHz @ DVB-T			
Possible frequency shift	-4 ... +4 MHz (0,5-MHz-Schritte)			
Connector	1 × F-female			
Impedance	75 Ω			

Type	MK-800N	MK-803N	MK-1200N	MK-1203N
Output level adjustable	70 ... 90 dB μ V @ DVB-C/DVB-T			
Output modulation				
Compliance	DVB-T (EN 300 744) DVB-C (EN 300 429/ITU-TJ.83 Annex A/C)			
Type	16QAM, 32QAM, 64QAM, 128QAM, 256QAM @ DVB-C QPSK, 16QAM, 64QAM @ DVB-T			
MER	≥ 40 dB @ DVB-C ≥ 36 dB @ DVB-T			
Bit rate, max	50.87 Mbps @ DVB-C 31.668 Mbps @ DVB-T			
FFT	8K mode @ DVB-T	8K mode @ DVB-T	2K mode @ DVB-T	2K mode @ DVB-T
FEC	1/2, 2/3, 3/4, 5/6, 7/8 @ DVB-T			
Guard interval	1/4, 1/8, 1/16, 1/32 @ DVB-T			
Symbol rate	1 ... 7.5 MBaud/s			
Interfaces				
Control/CAS	1 \times RJ-45			
Compliance Control/CAS	IEEE 802.3, 100 Base-T			
Supported configuration protocols	HTTP, SNMP v1, SNMP v2c, AXING SMARTPortal**			

Type	MK-800N	MK-803N	MK-1200N	MK-1203N
General				
Operating voltage	100 ... 240 VAC/50 ... 60 Hz			
Power consumption	50 W	50 W	55 W	60 W
Equipotential bonding connection	4 mm ²			
Operating temperature range (acc. to EN 60065)	-10°C...+50°C			
Dimensions (W × H × D) appr.	436 × 253 × 47 mm			
Weight	2.550 kg	2.650 kg	2.750 kg	2.850 kg
Comments	* with software extension only ** encrypted, cloud-based application for configuration, monitoring and remote maintenance			

7.1.3. MK-820 | MK-826

Type	MK-820	MK-826
Inputs		
Number of tuners	8 × DVB-S/S2/S2X/T/T2/C	8 × DVB-S/S2/S2X/T/T2/C
Connector	8 × F-female	
Frequency range	900...2150 MHz @ DVB-S/S2/S2X 50...898 MHz @ DVB-C 50...898 MHz @ DVB-/T/T2	
Channel bandwidth	6/7/8 MHz @ DVB-T/T2	
Input level	43...84 dBμV @ DVB-S/S2/S2X 49...84 dBμV @ DVB-C 39...84 dBμV @ DVB-T/T2	
Max. LNB current	250 mA per input 1000 mA per device	
CI slots	-	6
Input modulation		
Type	QPSK/8PSK/ 8APSK/16APSK/32APSK @ DVB-S/S2/S2X QAM16, QAM32, QAM64, QAM128, QAM256 @ DVB-C QPSK, QAM16, QAM64 @ DVB-T QPSK, QAM16, QAM64, QAM256 @ DVB-T2	
Compliance	DVB-S = EN 300 421 DVB-S2 = EN 302 307-1V1.4.1 DVB-S2X = EN 302 307-2V1.1.1 DVB-C = EN 300 429/ITU-TJ.83 Annex A/C DVB-T = EN 300 744 DVB-T2 = ETSI EN 302 755	
Error correction	auto	

Type	MK-820	MK-826
Symbol rate	1.5...45 MS/s (<40MSymbol/s in 32APSK) @ DVB-S 1...7.2 Mbaud @ DVB-C	
Transportstreams		
Modifiable program information	Program name, SID remapping, PID remapping, PID filtering* TSID, ONID	
Encryption	DVB-CSA*, DVB-CISSA*, ATIS-IDSA*, AES-ECB*, AES-CBC*	
Output		
Number of channels	8 × DVB-T2	
Frequency range	109 ... 862 MHz	
Channels selectable	S2...K69	
Channel bandwidth	7/8 MHz	
Possible frequency shift	-4 ... +4 MHz (0,5-MHz-steps)	
Impedance	75 Ω	
Output level adjustable	78 ... 98 dBμV	
Output modulation		

Type	MK-820	MK-826
Compliance	EN 50083-9 ETSI TS 101 154 ETSI EN300 429 ETSI EN 300 744 DVB-T2 acc. to EN 302 755, mode A (single PLP)	
Type	QPSK, QAM16, QAM64, QAM256	
MER	≥ 43 dB	
Bit rate, max	47,7 Mbps	
FFT	1K, 2K, 4K, 8K, 8Kext, 16K, 16Kext mode @ 8 ch. 32K, 32Kext mode @ 4 ch. only	
FEC	1/2, 3/5, 2/3, 3/4, 4/5, 5/6	
Guard interval	1/128, 1/32, 1/16, 19/256, 1/8, 19/128, 1/4	
Interfaces		
Control/CAS	1 × RJ-45	
Compliance Control/CAS	IEEE 802.3, 100 Base-T	
Supported configuration protocols	HTTP, SNMP v1, SNMP v2c, AXING SMARTPortal**	
General		
Operating voltage	100 ... 240 VAC/50 ... 60 Hz	
Power consumption	50 W	
Equipotential bonding connection	4 mm ²	
Dimensions (W × H × D) appr.	480 × 253 × 47 mm	
Weight	2.550 kg	2.650 kg
Comments	* with software extension only ** encrypted, cloud-based application for configuration, monitoring and remote maintenance	



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