

**1 x HDMI to DVB-T (COFDM)
"Home" modulator**

MHD100

Operation Manual

TERRA UAB

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1. IMPORTANT SAFETY PRECAUTIONS INFORMATION

READ THE FOLLOWING WARNINGS BEFORE YOU USE YOUR DEVICE

To avoid electric shock and prevent fire follow instructions:

- Operate the unit only within mains voltage range defined on external power supply.
- To disconnect the modulator from the mains completely, disconnect external power supply from the mains socket.
- The mains socket must be easily accessible;
- Disconnect the external power supply from the mains when the unit is not in use for long periods of time or during storms.
- Any repairs must be done by a qualified personnel.
- The modulator shall not be exposed to dripping or splashing water and no objects filled with liquids, such as vases, shall be placed on it.
- Avoid placing the modulator next to central heating components and in areas of high humidity.
- Do not plug/unplug the external power supply with wet hands.
- No naked flame sources, such as lighted candles, should be placed on the modulator.
- If the modulator has been kept in cold conditions for a long time, keep it in a warm room no less than 2 hours before plugging into the mains.
- Do not insert any objects into ventilation openings.
- The ventilation should not be impeded by covering the ventilation openings with items, such as newspapers, table-cloths, curtains.
- Mount the modulator in vertical position with RF connections underneath.
- From top, front and bottom of installed modulator must be at least 10 cm free space.



This product complies with the relevant clauses of the European Directive 2002/96/EC. The unit must be recycled or discarded according to applicable local and national regulations.



Equipment intended for indoor usage only.



TERRA confirms, that this product is in accordance to following norms of EU EMC norm EN50083-2, safety norm EN60065, RoHS norm EN50581.



TERRA confirms, that this product is in accordance to following norms of Russian Federation: EMC GOCT P 51318.22-2006, GOCT P 51318.24-99, GOCT P 51317.3.2-2006, GOCT P 51317.3.3-2008 and safety norm GOCT P IEC 60950-1-2011.

DVB-T bitrates (Mbit/s) for **6 MHz** bandwidth (non-hierarchical systems).

Modulation	Coding Rate	Guard Interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	3.732	4.147	4.391	4.524
	2/3	4.976	5.529	5.855	6.032
	3/4	5.599	6.221	6.587	6.786
	5/6	6.221	6.912	7.318	7.540
	7/8	6.532	7.257	7.684	7.917
16-QAM	1/2	7.465	8.294	8.782	9.048
	2/3	9.953	11.059	11.709	12.064
	3/4	11.197	12.441	13.173	13.572
	5/6	12.441	13.824	14.637	15.080
	7/8	13.063	14.515	15.369	15.834
64-QAM	1/2	11.197	12.441	13.193	13.572
	2/3	14.929	16.588	17.564	18.096
	3/4	16.796	18.662	19.760	20.358
	5/6	18.662	20.735	21.995	22.620
	7/8	19.595	21.772	23.053	23.751

DVB-T bitrates (Mbit/s) for **7 MHz** bandwidth (non-hierarchical systems).

Modulation	Coding Rate	Guard Interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	4.354	4.838	5.123	5.278
	2/3	5.806	6.451	6.830	7.037
	3/4	6.532	7.257	7.684	7.917
	5/6	7.257	8.064	8.538	8.797
	7/8	7.620	8.467	8.965	9.237
16-QAM	1/2	8.709	9.676	10.246	10.556
	2/3	11.612	12.902	13.661	14.075
	3/4	13.063	14.515	15.369	15.834
	5/6	14.515	16.127	17.076	17.594
	7/8	15.240	16.934	17.930	18.473
64-QAM	1/2	13.063	14.515	15.369	15.834
	2/3	17.418	19.353	20.491	21.112
	3/4	19.595	21.772	23.053	23.751
	5/6	21.772	24.191	25.614	26.390
	7/8	22.861	25.401	26.895	27.710

Installation / Storage

- This unit contains high precision pieces of electronics. To ensure optimal performance and avoid damage, do not store it in any location where it may collect dirt, dust, lint, etc. Do not expose it to extreme heat or cold (e.g. in direct sunlight, near a heater or in the car during the day). Place the unit in a secure place to avoid falls.
- Before moving the unit, always unplug all cords first.
- In case of malfunction, unplug the external power supply from the mains. When the unit is not in use for a long period of time, make sure that external power supply is disconnected from the mains.
- Before connecting the unit to other electronic devices, always switch off and unplug all devices.
- Do not spill liquids on the unit. Do not use any diluents or volatile liquid to clean the unit. Instead, use a soft slightly damp cloth and allow the unit to dry completely before using again.
- Do not step on or place heavy objects on top of the unit. To avoid hardware damage, handle all buttons, connectors and switches gently.

2. INTRO

Congratulations on purchasing the MHD100. You now own a high quality, professional DVB-T HD modulator. To get the most out of your purchase, please take the time to carefully read through this manual.

3. INSTRUCTIONS

3.1 DESCRIPTION

The MHD100 is a high quality DVB-T "Home" modulator which accepts one HDMI or analog Stereo Audio / CVBS signal and converts it into one RF DVB-T channel on its output. The excellent picture (Full HD 1920*1080-30p) and modulation quality (MER~35 dB) renders the MHD100 the ideal solution for distributing HD or analog TV signals coming from e.g. a DVD player, STB or camera in a CATV network using the DVB-T technology.

The user has the ability to control the device by either using the onboard SSD (Seven Segment Display) interface and keypad for quick installation or by using the USB interface with the appropriate software accompanying the MHD100 for advance programming.

Finally, the MHD100's metal case provides excellent electromagnetic shielding as well as great temperature dissipation and rigidity.

3.2 FEATURES

- High quality and performance
- CVBS and HDMI input (with redundant source mode)
- Very clean RF spectrum
- MER value ~ 35 dB
- RF output frequencies 174...862 MHz
- H.264 HD encoder bitrate 1-19 Mbps
- HDCP support
- Very friendly user interface for quick installation
- USB interface for advanced programming
- External power supply

3.2.1 Auto-reset functions and watchdog

During the normal operation of the MHD100, the main CPU monitors all the internal parts in order to ensure that the device works normally. In case of an internal error or module failure, the MHD100 immediately initiates the recovery procedure by resetting the appropriate module or the device. Finally, watchdog timers ensure that the device will be reset in case of CPU failure.

APPENDIX B

DVB-T bitrates (Mbit/s) for **8 MHz** bandwidth (non-hierarchical systems).

Modulation	Coding 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	30.160
	7/8	26.126	29.029	30.737	31.668

Caution!!!

- Modulation settings must be applied with care and in order to have adequate output bitrate. The output bitrate (which can be calculated from the tables in Appendix B) must be equal or greater than the total sum of the bitrate of the encoders.

Example: Assuming we select the following modulation settings:

Modulation:	8K
Constellation:	16-QAM
Code Rate:	5/6
Guard Interval:	1/32
Bandwidth:	8 MHz

We have an output bitrate of **20.107 Mbps** according to Appendix B.

This means that encoder's bitrate must be adjusted in such a way that the total bitrate of the encoder does not exceed the 20.107 Mbps limit, otherwise artifacts may occur.

For example, one valid selection in case of four encoders would be to set each encoder bitrate to 5 Mbps since: $4 \times 5 \text{ Mbps} = 20 \text{ Mbps} < 20.107 \text{ Mbps}$

4. System Settings

This category depicts information about the system's settings as follows:

- 4.1 **Status** - Depicts the status of the modulator (Idle or Running)
- 4.2 **FW Version** – Depicts the firmware version of the uP
- 4.3 **SW Version** – Depicts the software version of the DVProbe
- 4.4 **HW Version** – Depicts the hardware version of the MHD100
- 4.5 **Serial number** – Depicts the serial number of the device

Buttons

- By pressing the “Get” button in any sub-category, all the settings of this category are downloaded from the modulator.
- By pressing the “Apply” button in any sub-category, all the settings of this category are uploaded to the modulator.
- The “Factory Defaults” button sets the modulator's setting to factory default.
- The “Reset System” button applies a reset to the modulator.

3.2.2 Buttons lock-mechanism

The MHD100 will lock the functionality of its buttons after one minute idle time to avoid of being pushed accidentally. Two red dots on the SSD notify the user that the button interface is locked. To unlock it, the user must press simultaneously the UP + DOWN buttons for 5 seconds.

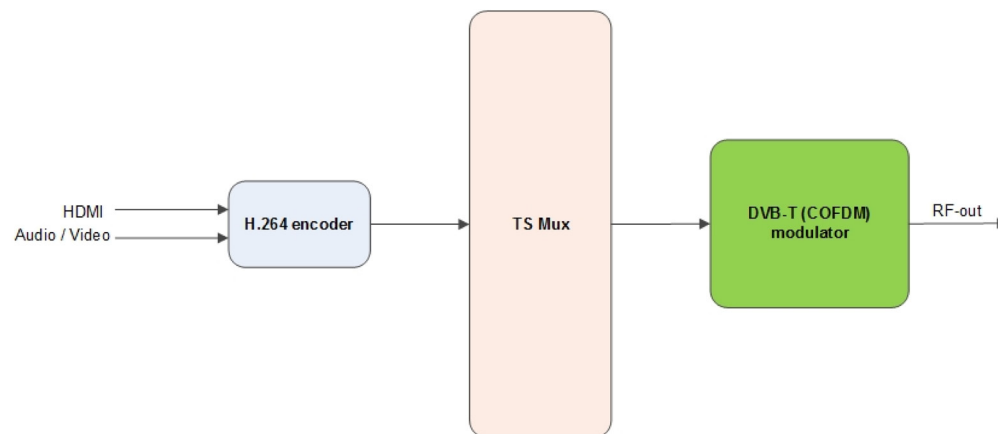
3.2.3 Input redundant source mode

When the MHD100 detects a valid input source coming (eg. from the HDMI input), it will “mark” this source as its primary source. In case of a failure of the primary source, the MHD100 will automatically switch to secondary source which in our case the CVBS input.

3.2.4 USB interface for advance programming

The MHD100 provides a USB interface with the appropriate software for advanced programming. For more information please read Appendix A.

3.3 BLOCK DIAGRAM



3.4 FRONT PANEL

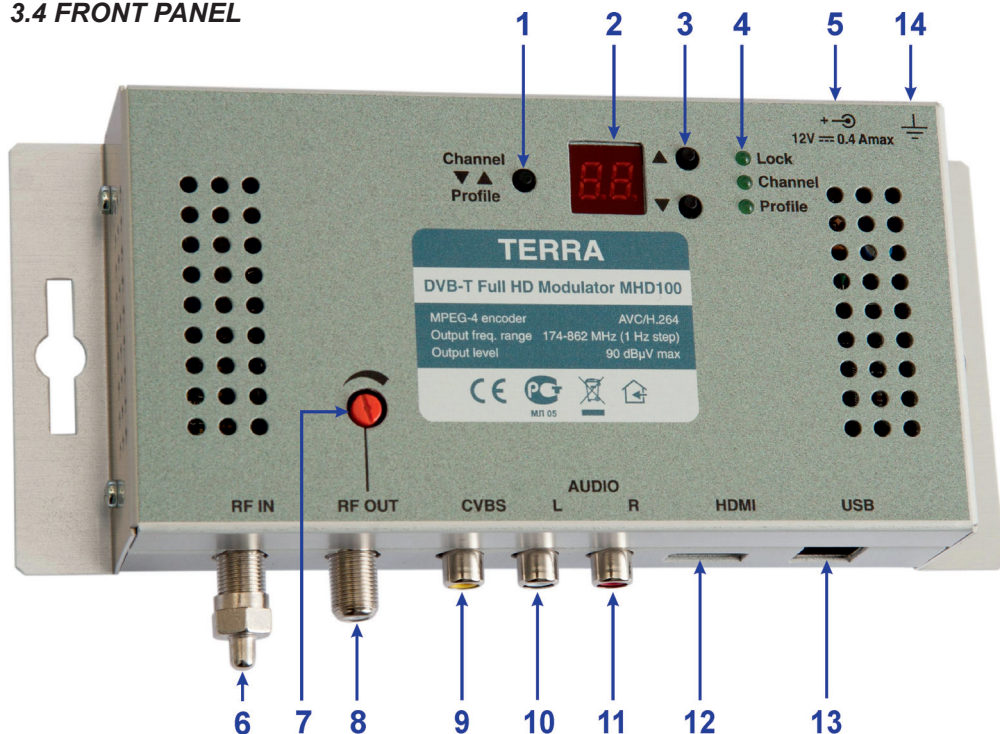


Figure 1. External view and operating controls

1. Channel or Profile selection button
2. Seven Segment Display
3. UP / DOWN buttons
4. LED indicators
5. +12 V/2 A VDC input
6. RF-IN loop-through
7. 20 dB RF output attenuator
8. RF-OUT main output
9. CVBS input
10. Left audio channel input
11. Right audio channel input
12. HDMI input
13. USB input
14. Functional grounding clamp

3.3 INSTALLATION

The MHD100 can be programmed with one of the following ways:

- From the front panel display
- From the USB interface

Software guidelines

1. From the “ComPort” combo box choose the correct USB port that connects the MHD100 and press “Connect”.
2. Once the software has successfully connected with the device, it will automatically download all the settings of the MHD100.
3. The DVProbe consists of four sub-categories as described below:
 - DVB-T Settings – Parameters regarding the modulator part
 - Encoder Settings – Parameters regarding the H.264 encoder
 - Multiplexer Settings – Parameters regarding the multiplex part
 - System Settings – Parameters regarding system information

1. DVB-T Settings

In this category the user is able to adjust several parameters of the modulator RF output part, as described below:

- 1.1 **Channel** - Output channel selection (VHF:5-12 & UHF:21-69)
- 1.2 **Bandwidth** - Bandwidth selection
- 1.3 **Constellation** - Constellation selection
- 1.4 **Modulation** - Modulation selection
- 1.5 **Guard Interval** - Guard Interval selection
- 1.6 **Code rate** - Code rate selection

2. Encoder settings

In this category the user is able to adjust parameters of the H.264 encoder, as described below:

- 2.1 **Input source** - Select the primary input source
- 2.2 **Video BR (Mbps)** - Set the video bitrate
- 2.3 **Audio BR (Kbps)** - Set the audio bitrate

3. Multiplexer settings

In this category the user is able to adjust parameters of the MHD100 multiplexer, as described below:

- 3.1 **Network Name + ID** - Enter the Network name + ID*
- 3.2 **Program Name + ID** - Enter the Program name + ID
- 3.3 **Provider Name** - Enter the Provider name
- 3.4 **Original Net ID** - Set the Net ID (0-65535)*
- 3.5 **TS ID** - Set the Transport Stream ID (0-65535)*
- 3.6 **PMT PID** - Set the PID value
- 3.7 **Video PID** - Set the Video PID value
- 3.8 **Audio PID** - Set the Audio PID value
- 3.9 **LCN No** - Set the LCN No (1-999) (must be enabled first)
- 3.10 **LCN Provider** - Set the LCN provider

* TS ID, Net ID and Original Net ID must always be different between DVB-T modulators in the same network.

APPENDIX A

The MHD100 offers a USB interface with the appropriate software (DVProbe.exe) for advance programming. The software can be found in the CD that accompanies the MHD100.

System requirements

- Windows XP (SP1 or higher)
- Windows Vista
- Windows 7 (32 & 64 bit)
- Windows 8 (32 & 64 bit)

Device connection via software

1. Insert the supplied software CD into your CD-ROM drive.
2. Connect the MHD100 via the USB cable (A-male to B-male type)
3. In case Windows cannot install the USB drivers automatically, when prompt, insert the correct path of the CD folder named "USB drivers", which contains the MHD100 USB drivers.
4. Once Windows have successfully installed the USB drivers of the MHD100, a pop-up message appears to verify this process.
5. Run the DVProbe.exe file and the main screen will appear (Figure 2.):

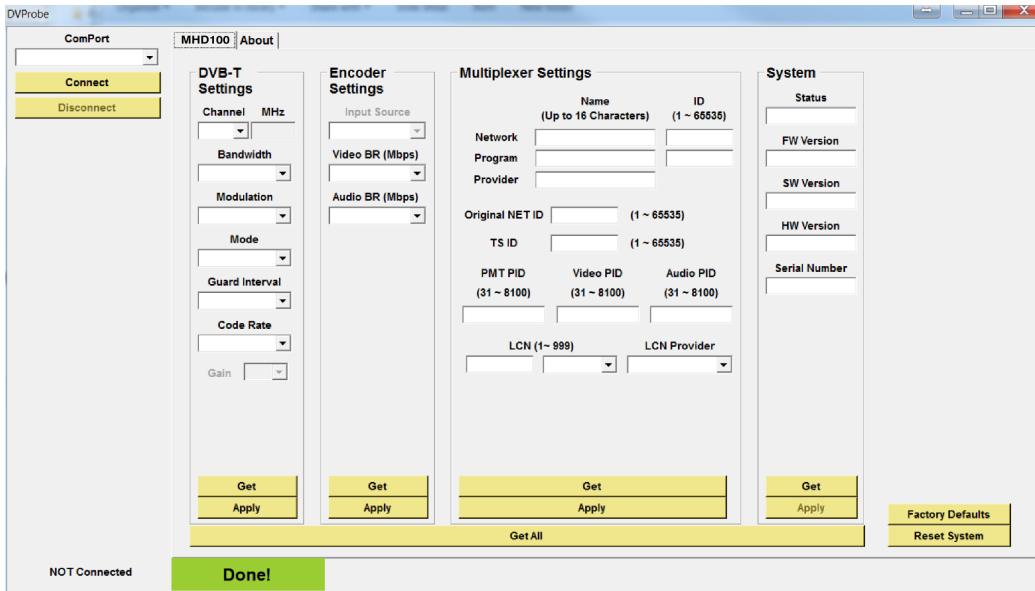


Figure 2. Main screen

3.3.1 Installation using the Front panel display

The user is able to install very quick and easy multiple MHD100s using the SSD + Button interface of the front panel of the device, following the steps below:

1st Step

Power up the MHD100 by adding the external power supply. The MHD100 will need 20-30 seconds to initialize itself. The SSD (Seven Segment Display – No2/Figure 1.) depicts the initialization status.

2nd Step

Choose "*Channel mode*" by pressing the Channel/Profile button (No 1 / Figure 1.) and the "Channel LED" will lit.

3rd Step

Adjust the output power using the output 20 dB attenuator.

4th Step

Choose "*Profile mode*" by pressing the Channel/Profile button (No 1 / Figure 1.) and the "Profile LED" will lit.

How Profiles works

In an installation all the modulators (or Mux in general) need to have different values of the following fields to avoid conflicts in the automated scan of the TV sets:

Program Name Service ID TS ID

For that reason, the user must always selects a different Profile number in every modulator starting from Number #1.

Eg. Let's say we want to install three modulators in a CATV network. In step No 4 we will choose:

- Profile No **1** for the **1st** modulator
 - meaning: Program Name = DTV **1**
 - meaning: Service ID = **1**
 - meaning: TS ID = 224**0**
- Profile No **2** for the **2nd** modulator
 - meaning: Program Name = DTV **2**
 - meaning: Service ID = **2**
 - meaning: TS ID = 224**1**
- Profile No **3** for the **3rd** modulator
 - meaning: Program Name = DTV **3**
 - meaning: Service ID = **3**
 - meaning: TS ID = 224**2**

As a result, all the above modulators have different values in the above fields.

Caution!!!

- Every time we choose a different Profile number the MHD100 will apply a full reset to itself that will last for 20-30 seconds.
- Using the USB interface, someone has the ability to add custom values to the above fields.
- The “HDMI LED” indicates the lock status of the HDMI input.

3.3.2 Installation using the USB interface

The MHD100 provides a USB interface with the appropriate software for advanced programming. For more information please read Appendix A.

4. TECHNICAL SPECIFICATIONS

Input

Type:	1 x HDMI & 1 x CVBS
Connector:	1 x HDMI & 1 x RCA – Female (White, Red, Yellow)
Video coding:	MPEG-4 AVC/H.264
Profile:	High profile 4.0
Resolution:	1920x1080-30p for HDMI PAL 720x576@25fps
HDCP support:	Yes
Audio:	HDMI & Mono/Stereo
Standard:	MPEG-1 Layer II
Audio Bit Rate:	64, 96, 128, 192, 256, 320, 384 kbps
Level:	0.5 Vpp to 1.0 Vpp adjustable

H.264 Encoder

Standard:	MPEG-4 AVC/H.264
Bit Rate:	1 – 19 Mb/s adjustable

Configurable Parameters:	Service Name, Service ID, Video PID, Audio PID, PMT PID, PCR PID
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Transport Stream Processing

Automatic Regeneration:	NIT, PAT, CAT, SDT, PMTs, EITs tables
Configurable Parameters:	TS ID, Original Network ID, Network ID, Provider Name
LCN support:	Yes
LCN Providers:	Nordin, ITC/UK, EICTA/Europe, New Zealand

DVB-T Output

Standard:	EN 300 744
Bandwidth:	5,6,7,8 MHz
Mode:	2K,8K
Constellation:	QPSK,16QAM, 64QAM
Guard Interval:	1/4, 1/8, 1/16, 1/32
Code Rate:	1/2, 2/3, 3/4, 5/6, 7/8

RF Output

Type:	RF DVB-T (COFDM)
Output Frequencies:	174...862 MHz (1 Hz step)
Output Level:	90 db μ V max.
Connector:	75 Ω - F, female
Output Attenuator:	0...20 dB
MER:	35 dB (Typical)
Shoulder Attenuation:	>45 dBc
Output loop-through loss:	<1 dB
Connectors:	2 x F - female

Programming Interface

SSDisplay + keypad
USB interface

General

Supply voltage:	+12 V DC
Current consumption:	400 mA max.
Operating Temperature:	0 °C to 50 °C
Storage Temperature:	-10 °C to +70 °C
Humidity:	up to 90% non condensing
Dimensions:	205 x 101,80 x 41 mm
Weight:	0.3 kg

5. LIMITED WARRANTY

This unit is guaranteed against defects in workmanship and materials for a period of two (2) years beginning on the date of purchase of the product. During the applicable warranty period, producer will repair or replace at our sole option, without charge, any defective component part of the purchased unit.