LEMCO®
DIGITAL TV SOLUTIONS

Operation
Manual
v1.0

HDMOD Q1

"Home" modulator

4x HDMI to 4x DVB-T (COFDM)

1. IMPORTANT SAFETY PRECAUTIONS INFORMATION

READ THE FOLLOWING WARNINGS BEFORE YOU USE YOUR DEVICE

WARNING
The following safety precautions must be observed to prevent fire or electric shock hazard. Safety precautions include but are not restricted to the following:

Power supply / Mains cord
▮▶ Operate the unit only within the voltage range defined as appropriate by the manufacturer.
▮▶ Occasionally check the power connector and remove dirt or dust that may have accumulated.
▮▶ Use only the mains cord that comes with your unit.
▮▶ Do not operate the unit or plug in the mains cord if it is broken, split, or damaged in any way.
▮▶ Do not place the mains cord next to heating devices. Do not pull it, place heavy objects on it or damage it in any way. Keep it out of reach of children.
▮▶ Ensure that the device is plugged in a properly grounded socket. Insufficient grounding may cause electrocution.
▮▶ Always carefully disconnect all plugs by pulling on the plug and not on the cord. Make sure the unit's power switch is turned off before removing the cord from an outlet.
▮▶ Disconnect the mains cord when the unit is not in use for long periods of time or during storms.
▮▶ Do not connect the unit to a multiple-outlet to avoid plug overheating.

Disassembling
▮▶ This unit contains parts that cannot be repaired by the user. Do not disassemble or try to repair it as this will void all warranties. Please contact the manufacturer if you experience any problems with your unit.

Water/humidity
▮▶ Do not keep the unit in a humid place or near water.
▮▶ Do not plug/unplug the unit with wet hands.

Fire

❚▶ Never place a candle or another source of fire on the unit as it may fall and start a fire.

❚▶ If the mains cord or the power connector is damaged or destroyed, or if there is a sudden loss of picture during operation, or if you notice a strange smell or there is smoke, immediately switch the unit off, disconnect the mains cord and contact the manufacturer's technical support department.

Installation / Storage

❚▶ This unit contains high precision pieces of electronics. To ensure optimal perform-ance and avoid damage, do not store it in any location where it may collect dirt, duct, 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.

❚▶ When installing the unit, make sure that an outlet is within easy reach. In case of malfunction, switch the unit off and unplug the power cord. When the unit is not in use for a long period of time, make sure that the mains cord is disconnected.

Connectivity

❚▶ Before connecting the unit to other electronic devices, always switch off and unplug all devices.

Maintenance

❚▶ 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.

Handling

❚▶ Do not poke your finger into the openings on your unit.

❚▶ Never put paper, metal parts or other objects into the openings of your unit. If you suspect that there are foreign parts in your unit, switch it off and unplug the mains cord. Contact the manufacturer's technical support department.

❚▶ Do not step on or place heavy objects on top of the unit. To avoid hardware dam-age, handle all buttons, connectors and switches gently.

2. INTRODUCTION

Congratulations on purchasing the HDMOD-Q1. You now own a high quality, "Home" 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 HDMOD-Q1 is a high quality quad DVB-T "Home" modulator which accepts four HDMI inputs and converts them into four RF DVB-T channels on its output. The excellent picture (Full HD 1920*1080-30p) and modulation quality (MER~35dB) renders the HDMOD-Q1 the ideal solution for distributing SD/HD digital 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 HDMOD-Q1 for advance programming.

Finally, the HDMOD-Q1's metal case provides excellent electromagnetic shielding as well as great temperature dissipation and rigidness.

3.2 - Features

▮▶ 4 x DVB-T RF out

▮▶ High quality and performance

▮▶ Very clean RF spectrum

▮▶ MER value ~ 35dB

▮▶ RF output frequencies 174...862MHz

▮▶ H.264 HD encoder bitrate 1-19Mbps

▮▶ HDCP support

▮▶ User friendly 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 HDMOD-Q1, 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 HDMOD-Q1 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.

3.2.2 Buttons lock-mechanism

The HDMOD-Q1 will lock the functionality of its buttons after 5 min 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 5sec approximately.

3.2.3 Digital attenuator

The HDMOD-Q1 has an embedded digital attenuator. The user is able to select between three different attenuation steps as follows:

1. 0 dB attenuation   (Output level: 90dbμV)   SSD will display: "00"
2. 10 dB attenuation (Output level: 80dbμV)   SSD will display: "10"
3. 25 dB attenuation (Output level: 65dbμV)   SSD will display: "25"

3.2.4 HDCP ON/OFF function

By pressing the "Channel / Profile" button for more than 5sec the user enables the HDCP ON/OFF function. The SSD will display this status as follows:

1. H1 : Indicating that the HDCP is ON
2. H0 : Indicating that the HDCP is OFF

Using the Up/Down buttons the user is able to select one of the above status to enable/disable the HDCP function. The HDMOD-Q1 will exit from the current functionality after being idle for more than 2-3sec.

3.2.5 USB interface for advance programming

The HDMOD-Q1 provides a USB interface with the appropriate software for advanced programming. For more information please read Appendix A.
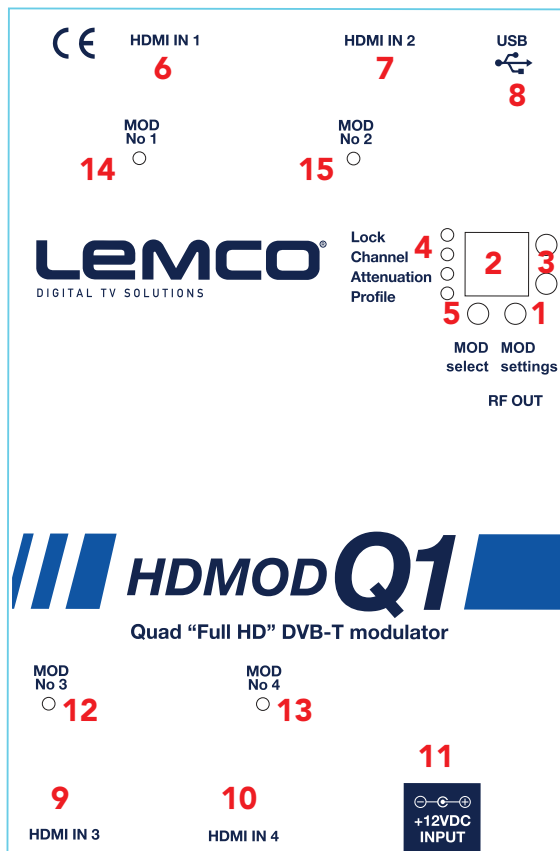
3.3 - Block Diagram
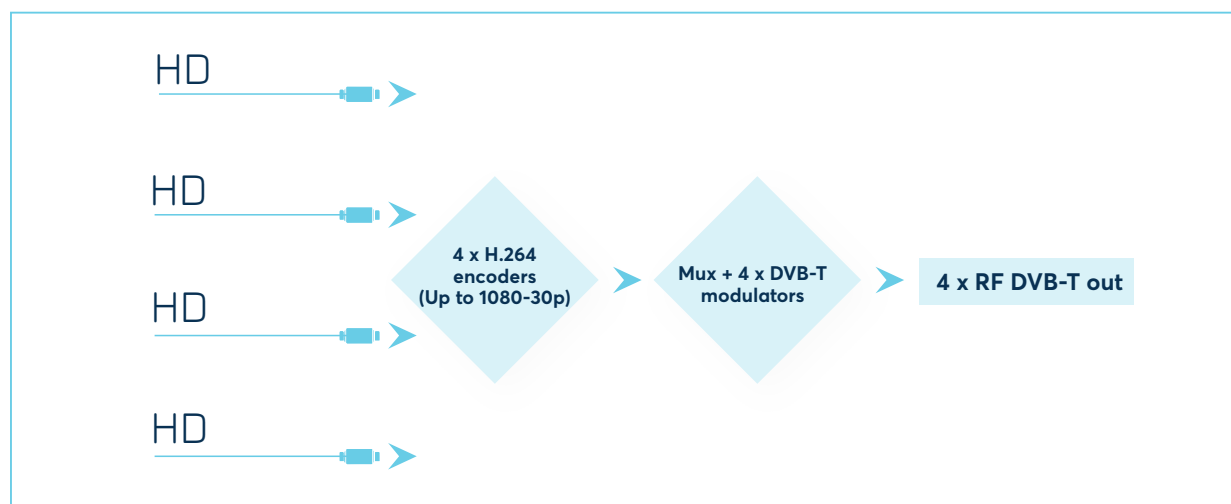
Figure No.1

3.4 - Front Panle

1. Channel / Profile selection button
2. Seven Segment Display (SSD)
3. Up / Down buttons
4. LED indicators
   a. Lock: ON when HDMI communication have been established
   b. Channel: ON when "Channel" mode is selected
   c. Attenuation: ON when "Attenuator" mode is selected
   d. Channel: ON when "Profile" mode is
      selected
5. Modulator selection button
6. HDMI input for modulator No 1
7. HDMI input for modulator No 2
8. USB port for advanced programming
9. HDMI input for modulator No 3
10. HDMI input for modulator No 4
11. +12VDC / 2A PSU input
12. Choice indication LED for modulator No 3
13. Choice indication LED for modulator No 4
14. Choice indication LED for modulator No 1
15. Choice indication LED for modulator No 2

3.3 - Installation

The HDMOD-Q1 can be programmed with one of the following ways:
- ▌▶ From the front panel display
- ▌▶ From the USB interface

3.3.1 Installation using the Front panel display

The user is able to install very quick and easy multiple HDMOD-Q1s using the SSD + Button interface of the front panel of the device, following the steps below:

1st Step

Power up the HDMOD-Q1 by adding the external power supply. The HDMOD-Q1 will need 40-50secs to initialize itself. The SSD (Seven Segment Display – No 2 / Figure No1) depicts the initialization status.

2nd Step

Choose a modulator by pressing the MOD Select button (No 5 / Figure No.1). The LED display will turn on depending on the modulator that is selected.

3rd Step

Choose "*Channel mode*" by pressing the Channel/Profile button (No 1 / Figure No.1) The "Channel LED" will lit indicating that "Channel" selection mode is selected.

4th Step

Choose "*Attenuation mode*" by pressing the Channel/Profile button (No 1 / Figure No.1) The "Attenuation LED" will lit indicating that "Attenuation" selection mode is selected.

5th Step

Choose "*Profile mode*" by pressing the Channel/Profile button (No 1 / Figure No.1) The "Profile LED" will lit indicating that "Profile" selection mode is selected.

6th Step

Repeat the procedure from step No 2 up to step No 5 for the rest of the modulators of the HDMOD-Q1.

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 select 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 HDMOD-Q1 will apply a full reset to itself that will last for 40-50 seconds.
▌▶ Using the USB interface, we have the ability to add custom values to the above fields.

3.3.2 Installation using the USB interface

The HDMOD-Q1 provides a USB interface with the appropriate software for advanced programming. For more information please read Appendix A.

4. TECHNICAL SPECIFICATIONS

Input

Type:	4 x HDMI
Connector:	4 x HDMI Type A
Video coding:	MPEG-4 AVC/H.264
Profile:	High profile 4.0
Resolution:	Up to 1920x1080-30p
HDCP support:	Yes
Audio:	HDMI
Audio encoding:	MPEG2, ACC, AC3
Standard:	MPEG-1 Layer II
Audio Bit Rate:	64, 96, 128, 192, 256, 320, 384 kbps

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

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:	Nordig, 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

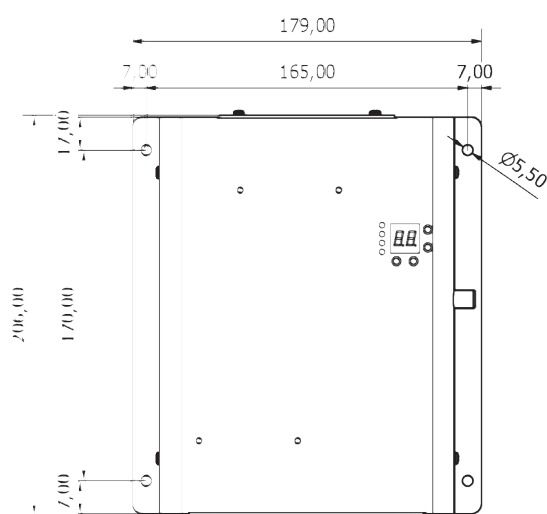|	
Type:	4 x RF DVB-T (COFDM)
Output frequencies:	174…862MHz
Output level:	4 x 90dbµV max.
Connector:	75Ω - F, female
Output attenuator:	0…25dB
MER:	35dB (Typical)
Shoulder attenuation:	>45dBc
Connectors:	1 x F - female

Programming interface	Seven Segment Display + keypad
	USB interface

General

Power supply:	+12VDC
Power supply consumption:	1.3A max.
Operating temperature:	0 °C to 50 °C
Storage temperature:	-10 °C to +70 °C
Humidity:	Up to 90%
Dimensions:	206 x 179 x 30mm
Weight:	0.55Kg

5. DIMENSIONS

179,00
161,93
151,00

30,00

110,35

179,00
7,00   165,00   7,00

17,00

200,00   170,00

17,00

Ø5,50
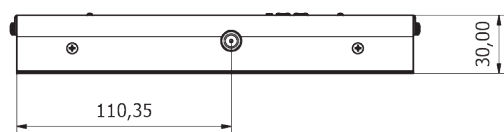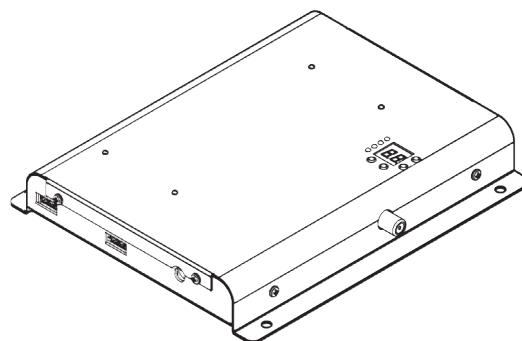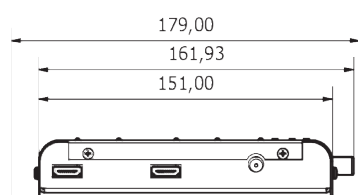
*dimensions in mm

6. LEMCO LIMITED WARRANTY

This Lemco unit is guaranteed against defects in workmanship and materials for a period of five (5) years beginning on the date of purchase of the product. During the applicable warranty period, Lemco will repair or replace at our sole option, without charge, any defective component part of the purchased unit. The unit is to be delivered packed in adequate packing AFTER an authorization for return has been received.

The owner's responsibilities are to use the instrument in accordance with its written instructions, to provide transport to and from our facilities in the event service is required, and to provide proof of purchase if requested.

Our warranty does not cover any problem resulting from:
(a) accident; abuse; neglect; shock; electrostatic discharge; heat or humidity beyond product specifications; improper installation, operation, maintenance or modification
(b) any misuse contrary to the instructions in the user manual
(c) malfunctions caused by other equipment.

WARNING!!
Our limited warranty is considered void if a product is returned with removed, damaged or tampered labels or any alterations (including removal of any component or external cover) carried out by unauthorized personnel.

OUT OF WARRANTY SERVICING
We repair and service units of our production even once the warranty has expired, if this is economically the best solution to the customer.

The mechanical and electronic spare parts are replaceable for a five-year period after production when the circuits are assembled with discrete components. When integrated circuits are used, the supply of spare parts is guaranteed up to the depletion of our stock and, depending on the possibility of procuring them on the worldwide market.

To avoid any unnecessary loss of time, it is very important that the instrument be returned to our premises accompanied by a proper delivery note, duly completed with all the required information, as per the legal dispositions currently enforced.

7. WARNINGS

Content warning

This document contains preliminary information about a product of Lemco company. Lemco reserves the right to make any changes or modifications at any time without prior notice.

APPENDIX A

The HDMOD-Q1 offers a USB interface with the appropriate software (Lemco GUI.exe) for advance programming. The software can be downloaded from www.lemco.tv.

System requirements
- ▌▶ Windows XP (SP1 or higher)
- ▌▶ Windows Vista
- ▌▶ Windows 7 (32 & 64bit)
- ▌▶ Windows 8 (32 & 64bit)
- ▌▶ Windows 10 (32 & 64bit)

Device connection via software

1. Download the appropriate software from www.lemco.gr and run it.
2. Connect the HDMOD-Q1 via the USB cable (A-male to B-male type) and wait until the drivers are installed.
3. In case Windows cannot install the USB drivers automatically, when prompt, insert the correct path of the folder named "USB drivers", which contains the HDMOD-Q1 USB drivers.
4. Once Windows have successfully installed the USB drivers of the HDMOD-Q1, a pop-up message appears to verify this process.
5. Run the Lemco GUI xxx.exe file and the main screen will appear (Figure No 2):
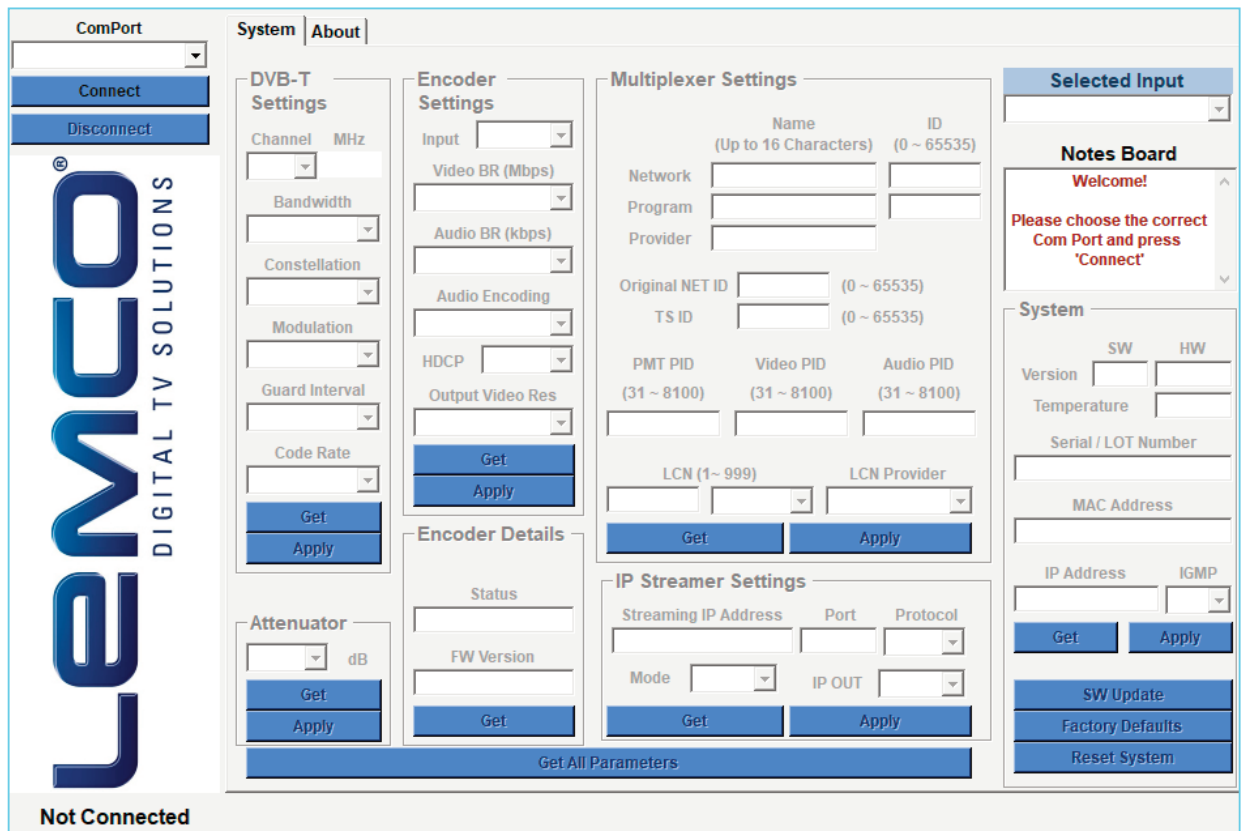
Software guidelines

1. From the "ComPort" combo box choose the correct USB port that connects the HDMOD-Q1 and press "Connect".

2. Once the software has successfully connected with the device, it will automatically download all the settings of the HDMOD-Q1.

3. The Lemco GUI xxx.exe consists of five 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
▌▶ Selected input – Modulator selection (No1, No2, No3 ή No4)

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 (Mpbs)** – Set the video bitrate

2.3   **Audio BR (Kbps)** – Set the audio bitrate

2.4   **Audio Encoding** – Select the audio encoding

2.5   **HDCP ON/OFF** – Enables/disables HDCP

2.6   **Output Video Res** – Select ouput video resolution

3.Multiplexer Settings

In this category the user is able to adjust parameters of the HDMOD-Q1 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 must always be different between DVB-T modulators in the same network.

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:	8MHz

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 20.107MBps limit, otherwise artifacts may occur.

For example, one valid selection in case of four encoders would be to set each encoder bitrate to 5Mbps since: 4 x 5Mbps = 20Mbps < 20.107MBps

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 HDMOD-Q1
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.

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

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

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

8. NOTES

LEMCO®
DIGITAL TV SOLUTIONS

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