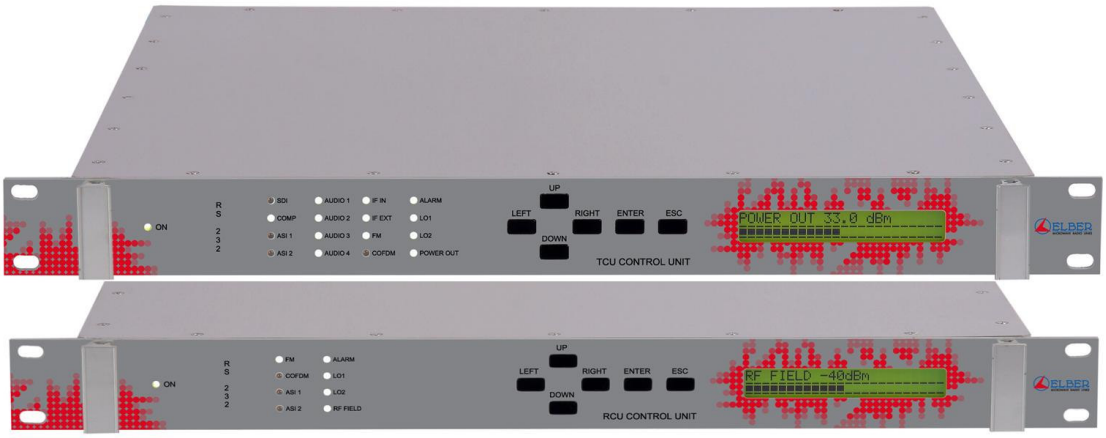
www.elber.com

elber@elber.it

TCU/RCU
RF Head Control Units



User Manual

Elber s.r.l.- Via Pontevecchio, 42W Phone +39-0185.35.13.33

16042 Carasco (GE) Italy *Fax +39-0185.35.13.00*

1 Sommario

2 General Description.

The TCU and RCU are the control units for Elber RF Heads.

Their aim is to program the oscillators of the RF Head and to provide configuration data, acquiring measures, feeding the DC supply and providing the IF input at the transmitter and receiving the IF output of the receiver.

Optionally it's possible to install in the control unit the FM modulator (TCU) and FM demodulator (RCU) boards. In this way, a complete analogue link is provided.

The TCU and RCU are compatible with monochannel TMC/P and R/P and with the multichannel MT and MR Elber RF Head.

3 Technical Specifications

IF Frequency	70 MHz
IF/DC Connector	LEMO(ERA.3T.275.CTL)
Video S/N weighted	> 70 dB
Audio S/N weighted	> 60 dB
Differential Phase	< 2°
Differential Gain	< 2%
Amplitude/frequency response 70 MHz	< 1 dB
Group Delay 70 MHz	< 5 ns
Control	Front Panel
	RS-485
	SNMP
Power Supply	AC: 230V/50Hz or 110V/60Hz
	DC: 22V ÷ 65V
Maximum Consumption	30 W
Width	482 mm
Length	44 mm
Depth	480 mm
Weight	4 Kg
Temperature Operation Range	-10°C÷60°C
Relative Humidity	0-95% non condensing

4 Installation Procedure.

1. Open the package box, using a cutting tool, ensuring no damage is done to the content. Verify any damage caused during transportation.
2. Check the package contents. The package should contain:
    a. TCU transmitting control unit.
    b. RCU reception control unit.
    c. Two AC power cords.
    d. Two DC power cords.
    e. Two RG-216 cables used to connect the RF heads with the control units.
    f. User Manual.
3. Install the control units in a cabinet rack. The space required is 1 rack unit.
4. Verify that there is sufficient clearance on both sides of the equipment in order not to restrict air flow.
5. No heat sources should be placed too close to the equipment: the proper functioning is warranted for ambient temperature between -5℃ to +60℃.
6. Install the power cord and connect to the primary power source.
7. Make the ground connection to the screw located on the rear of the equipment, to meet the EMC directives. Assure of the right input voltage reading the data on the user manual or on the adhesive stickers, located on each equipment, that show the register number.
8. Connect the control units to the relative RF heads through the RG-216 cables.
9. Switch on the power switch of the control units located on the rear of the equipment. The state and the operations of the device can be checked using the keyboard and the display following the instructions in the paragraph related to the user interface 5.4

5 Operational Theory

5.1 Block Diagram

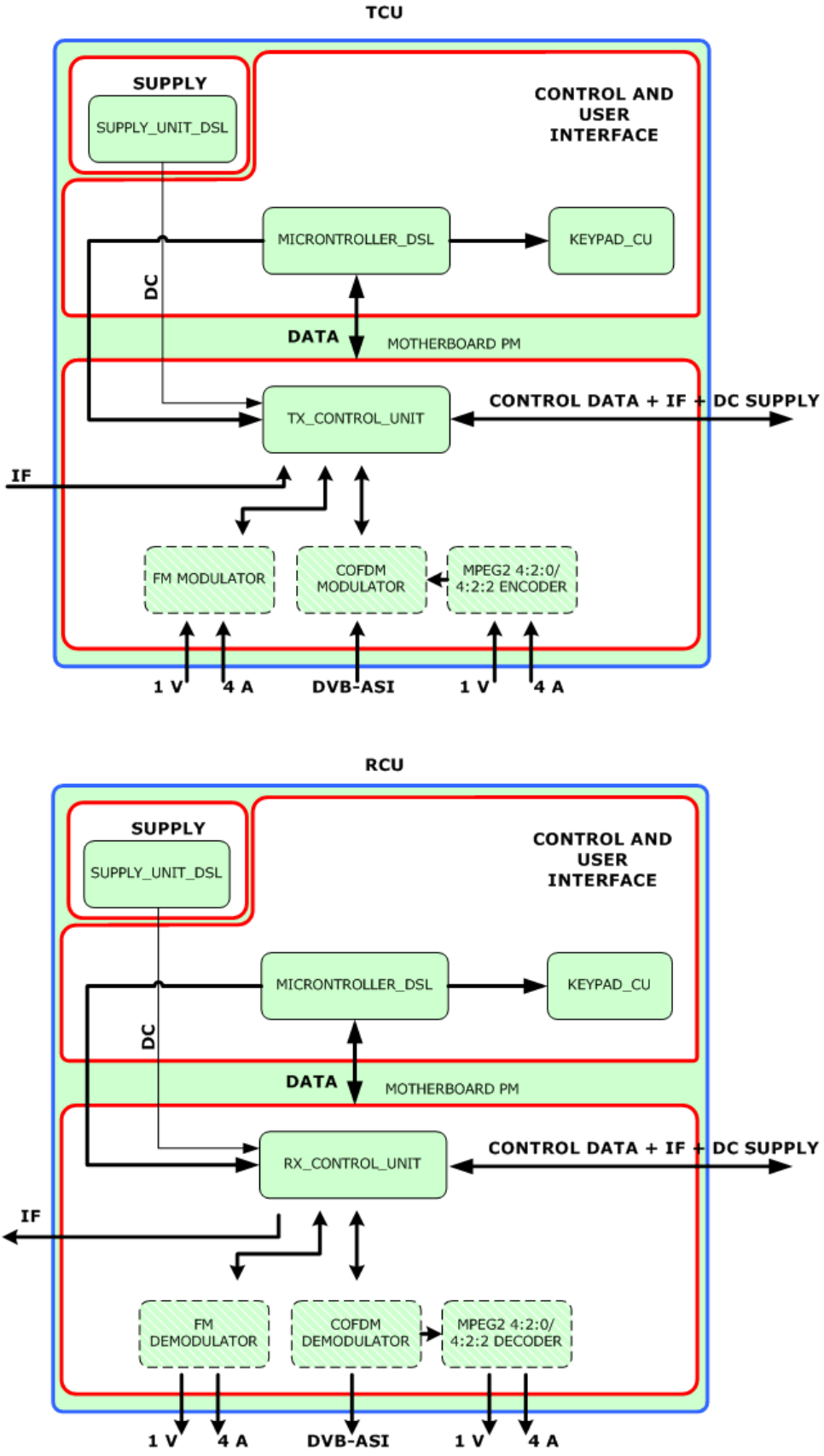


Figure 1: TCU/RCU block diagram

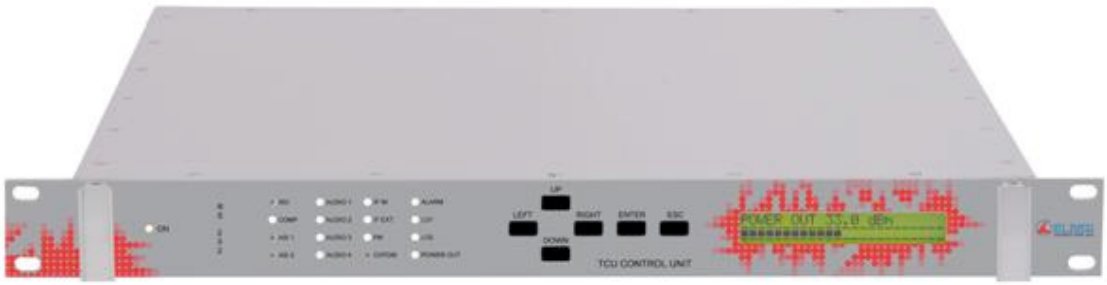


Figure 2: TCU - Transmitting Head Control Unit

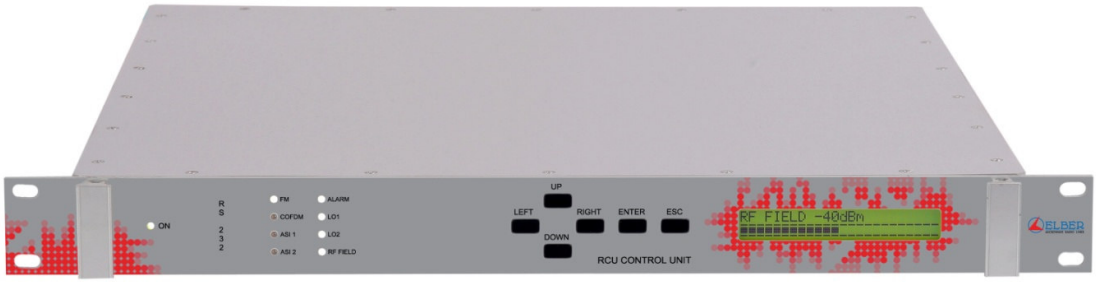


Figure 3: RCU - Receiving Head Control Unit

The connection between the control Unit and its respective RF head is effected through an RG-216 coaxial cable with LEMO connector at both ends. The connector is located at the back of the equipment.

5.2 Control Unit Tx Head

The head control unit is composed of 6 different blocks as depicted in Figure 1:

1. Supply_Unit_DSL
2. Microcontroller_DSL
3. Keypad_CU
4. UCT
5. Mod70_digitale
6. Motherboard PM

5.2.1.1 Supply_Unit_DSL

The Transmitter control Unit (TCU) power supply could be:

A.C.	230 V +/-20% 50Hz
	115 V +/-10% 60Hz
D.C.	25 ÷ 65 V
Power	60W

The installed power supply protection fuse on the alternating current is 1.6 amps. An automatic switch is present between the two supplies. In case the A.C. current reaches a lower threshold, the input supply is switched to D.C. current. The switching occurs instantaneously without causing any power interruption of the equipment.

The D.C. voltage input connector is a 4 pin connector. The power cable must be connected to pin 2 and 4, independent of the polarity.

The D.C. input is galvanically isolated from the equipment earth.

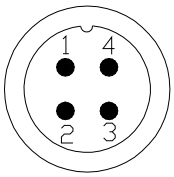


Figure 4: D.C. Power Connector.

5.2.1.2 Microcontroller_DSL

The controller caters for the following functions:

- Programming of the transmission frequency.
- Programming of the correct output power *backoff* as necessary according to the digital modulation scheme used.(if the link is multichannel)
- Front panel keypad, display and LEDs management.
- Selection of the IF input (Internal/External).
- System equalisation according to the coaxial cable length used between control unit and head (10/100/200m).
- Programming and monitoring of optional boards such as FM modulator.
- Alarms management.
- Data communication with remote control interface.

5.2.1.3 Keypad_CU

The keypad board is installed directly on the front panel. It is composed of the 24x2 characters LCD display, the 16 LEDs and the 6 keys for menu scrolling and selection.

5.2.1.4 UCT

The UCT board provides for a multiplexed output signal (on a SMB connector directly connected to the LEMO connector on the rear panel). This signal is composed of a 48Vdc power supply signal, a data sub-carrier for head control and IF at 70MHz which are all directed towards the transmitting head. Two IF inputs are available, selectable by the user, through a microcontroller controlled relay. Input voltage polarity of the head is set by changing the position of the jumper connection on connector J18 and J19.

5.2.1.5 MOD70_digitale

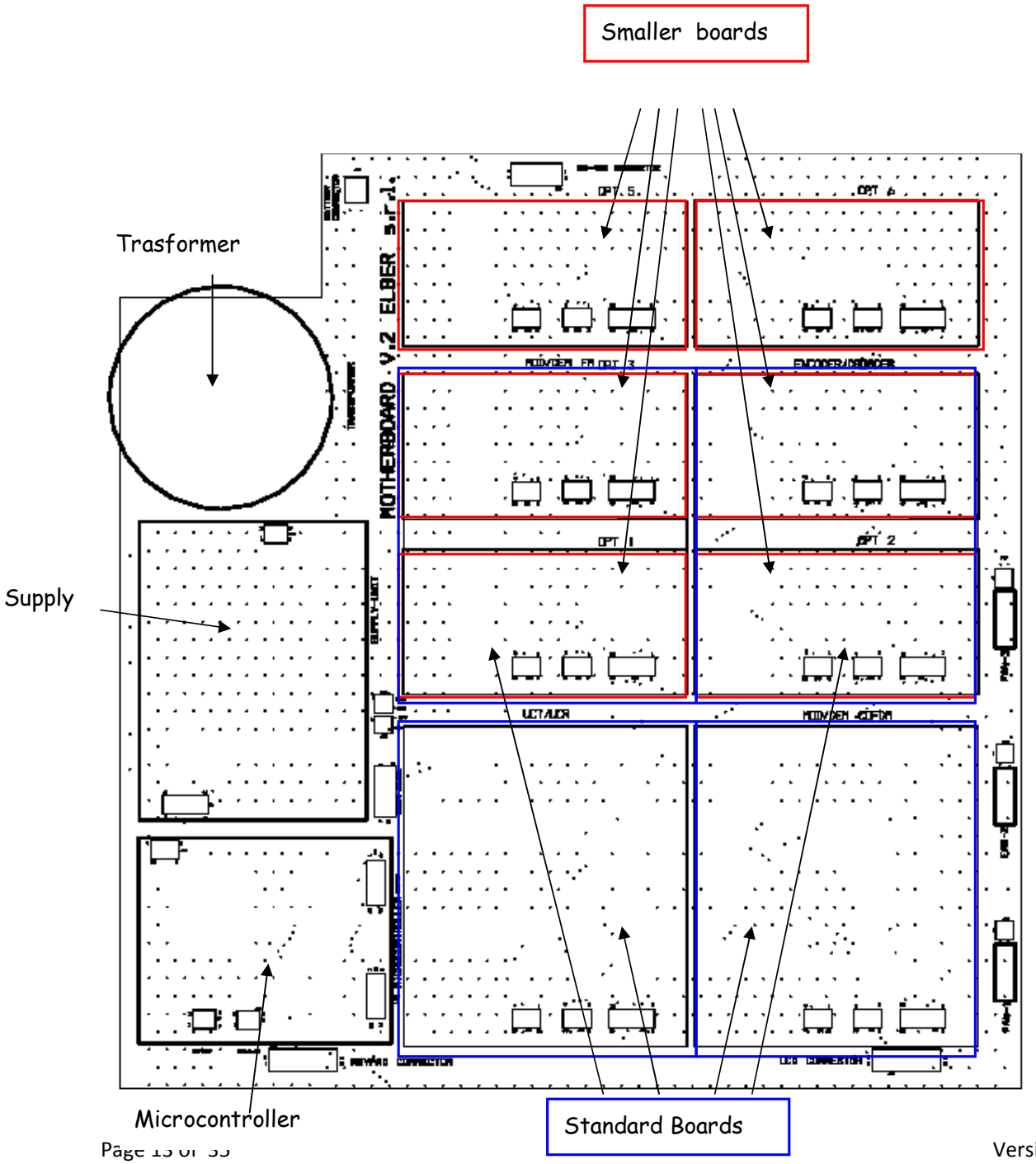
The MOD70_digitale is a complete FM modulator with one video and four audio channels input.

Output Frequency	70 MHz ± 10 KHz
Output Level	8 dBm ± 1 dB
Audio 1 subcarrier	7500 KHz ± 100 Hz
Audio 2 subcarrier	8065 KHz ± 100 Hz
Audio 3 subcarrier	7020 KHz ± 100 Hz
Audio 4 subcarrier	8590 KHz ± 100 Hz

No tuning is required; all signal processing is performed digitally on FPGA.

5.2.1.6 Motherboard PM

The PM motherboard is designed to house up to 4 standard size boards and 2 of reduced dimensions or 2 standard and 6 smaller size. It is also designed to incorporate the Microcontroller_DSL, Supply_DSL boards and the voltage transformer. The presence of the motherboard extensively reduces the use of interconnecting cables which would otherwise be very complex. It also provides for future upgrades.



5.3 Control Unit Rx Head

The receiving head control Unit as depicted in Figure 1 is also composed of 6 different blocks:

1. Supply_Unit_DSL
2. Microcontroller_DSL
3. Keypad_CU
4. UCR
5. DEM70_digitale
6. Motherboard PM

5.3.1.1 Supply_Unit_DSL

Please refer to paragraph 5.2.1.1

5.3.1.2 Microcontroller_DSL

The controller provides for the following functions:

- Programming of the receiving frequency.
- Front panel keypad, display and LEDs management.
- System equalisation according to the coaxial cable length used between control unit and head (10/100/200m).
- Programming and monitoring of optional boards such as FM modulator.
- Alarms management
- Data communication with remote control interface.

5.3.1.3 Keypad_CU

The keypad board is installed directly on the front panel. It is composed of the 24x2 characters LCD display, the 16 LEDs and the 6 keys for menu scrolling and selection.

5.3.1.4 UCR

The UCR board receives a 70MHz input from the RF head, to which it adds up the data sub carriers and the 48 V_{dc} signals. A 70 MHz filter followed by an equalisation circuitry ensures a clean received signal.

Another equalisation process allows to adequately compensate for the distortions introduced by the cable. Three equalisation settings are foreseen, optimised for a 10, 100 and 200 metres long cable. The most suitable equalisation setting could be set through the use of the keypad and display.

5.3.1.5 DEM70_digitale

The DEM70_digitale is a complete FM demodulator with two video and four audio channels output.

Input Frequency	70 MHz ± 10 KHz
Input Level	8 dBm ± 4 dB
Audio 1 subcarrier	7500 KHz ± 100 Hz
Audio 2 subcarrier	8065 KHz ± 100 Hz
Audio 3 subcarrier	7020 KHz ± 100 Hz
Audio 4 subcarrier	8590 KHz ± 100 Hz

No tuning is required; all signal processing is performed digitally on FPGA.

5.3.1.6 Motherboard PM

Please refer to paragraph 5.2.1.6

5.4 User interface (keypad + display)

The setup, control, and monitoring is provided through the navigation in the embedded software menu presented on a 24x2 alphanumeric display and operated by a six way keypad.

The six way keypad enables navigation through the various menus of the embedded system. The function of the keypad depends on the menu position. A short description follows:

Keys	**Configuration menu**		**Status menu**
	Position 1	*Other positions*	
UP	Previous menu		Previous menu
DOWN	Next menu		Next menu
RIGHT	Cursor scrolls one position to the right	Cursor scrolls one position to the right	Not used
LEFT	No use	Cursor scrolls one position to the left	No use
ENTER	Next Menu	Saves and applies changes	Next Menu
ESC	Displays Main Menu	Discard any changes	Displays Main Menu

Table 1: Menu Description

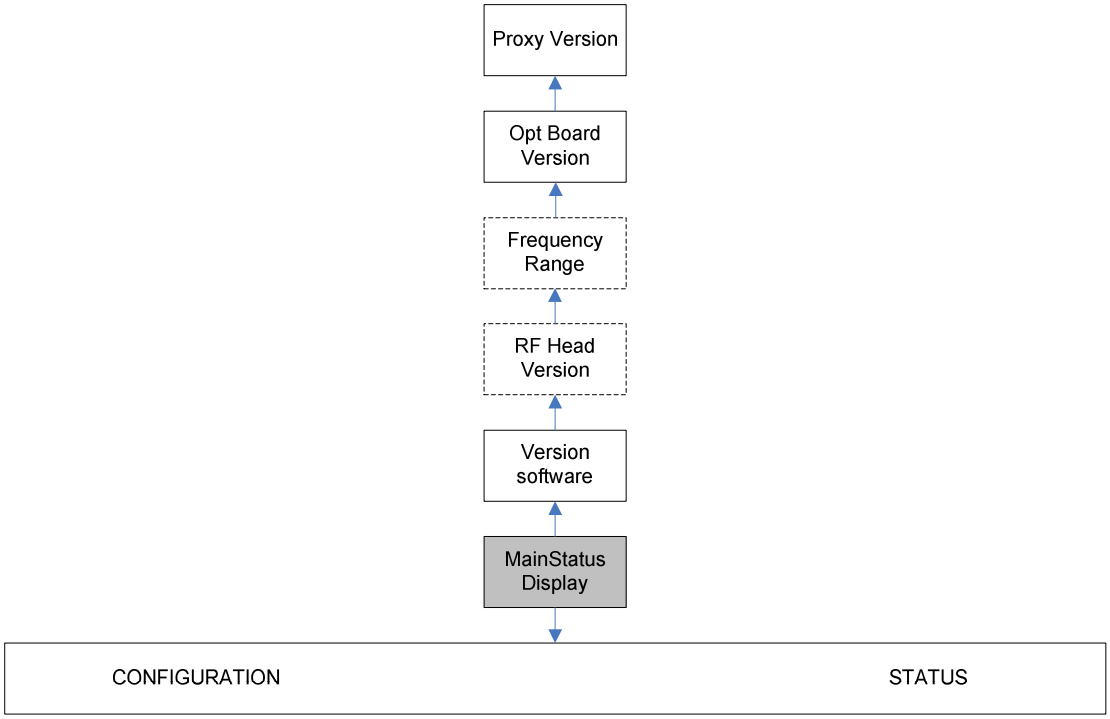


Figure 5: Menu Structure

Options	Description
Main Status Display	It shows the measured transmitted power of the CPM/T and the received field of the CPM/R.
Version Software	This is automatically displayed on both transmitter and receiver for 3 seconds after which the display shows again the main menu.
RF HEAD Version	The menu shows the head type to which the control unit is connected and the relative firmware version.
Frequency Range	It shows the frequency range of the equipment
Opt. Board Version	Shows the version of optional boards installed such as the FM modulator and demodulator.
Proxy Version	Shows the proxy version for the remote control monitoring, if it is present; N/A in contrary case.

Configuration	The Configuration Menu option allows to access to the System configuration parameters.
Status	The Configuration Menu option allows to access to the System status parameters.

Table 2: Main Menu Description

5.5 Transmitter control unit TCU.

5.5.1.1 Configuration menu.

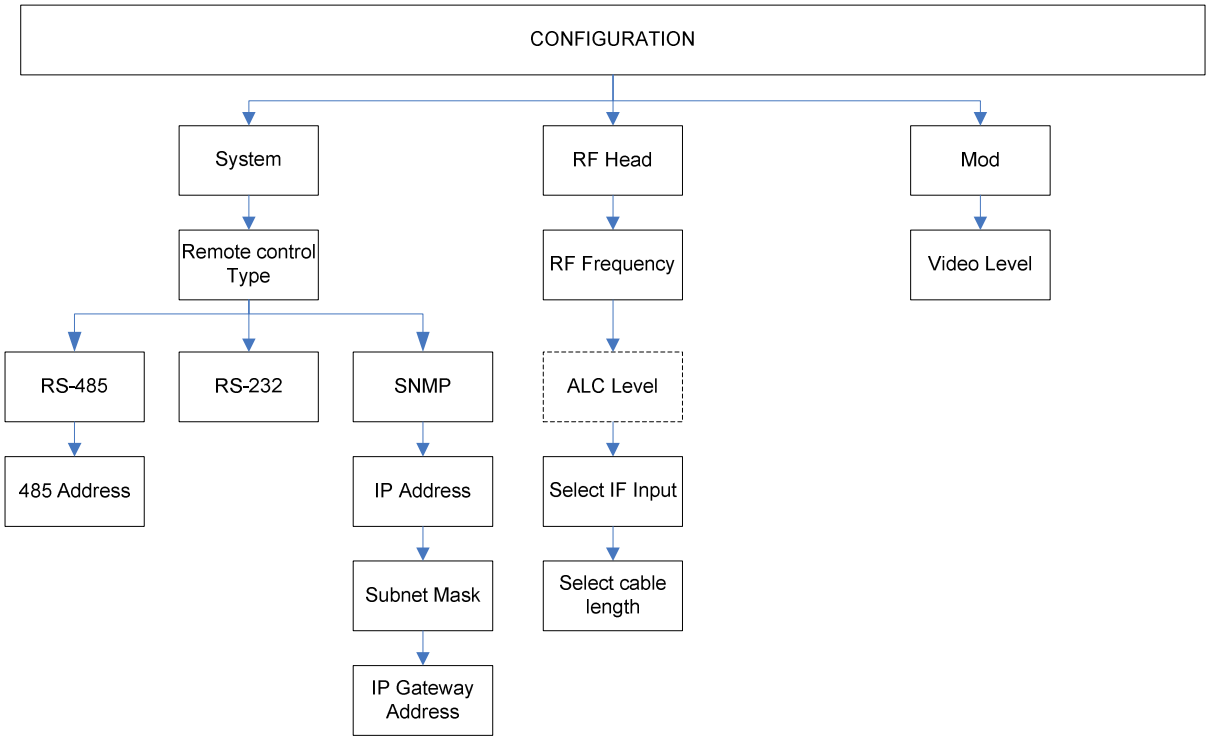


Figure 6: TCU configuration menu

Option	Description
RF frequency	The frequency of apparatus can be changed. Frequency span up to 500MHz; frequency resolution: 500KHz.
ALC level	Available only on multichannel links. Set-up the value of "back-off" for the transmitter output power. Range 0 dB / -15dB, step 1dB.
Select IF Input	It allows to select the IF input (Internal/External).
Select Cable Length	It allows to select the cable length so as to qualify the right equalization net.
Remote Control Type	Selection of the remote control type enabled (RS-485 and Ethernet SNMP).
485 address	Setting of internal RS-485 Address (0-31) and the external one (0-255) of the proxy.
IP address	Setting of IP Address for remote control via SNMP of the equipment.
Subnet Mask	Setting of Subnet Mask for the right identification of the equipment on the network.
IP Gateway address	Setting of IP Address for Gateway IP for the network.
Video Level	Setting of the video carrier modulation level (± 25%). Shows also a monitor of the level set.

Table 3: Configuration Menu Description

5.5.1.2 Status menu.

The menu status permits the user to monitor the equipment status.

Figure 6 shows the menu status tree.

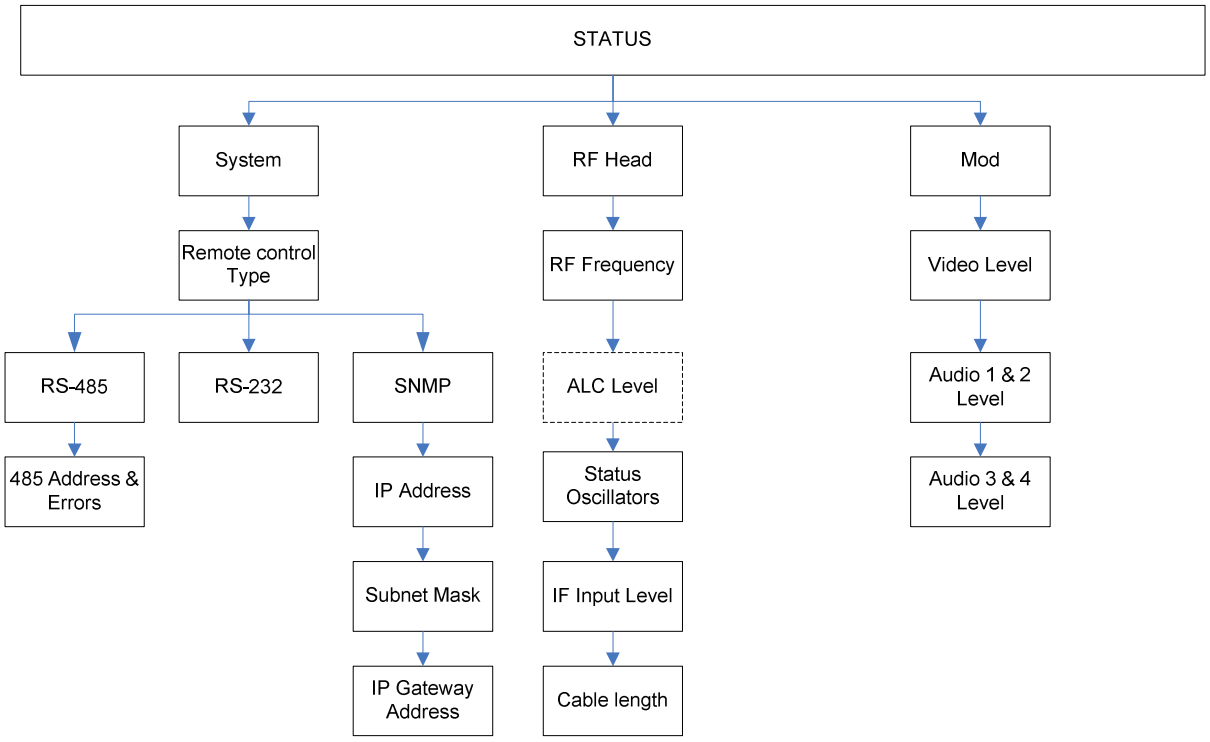


Figure 6: Status menu tree

Option	Description
Status RF frequency	It shows the frequency of the apparatus.
Status ALC	The menu shows the back-off value of the transmitter power. Range 0 dB / -15dB. Available only on multichannel links.
IF Input level	Shows the IF selected and the presence of both the internal and external IF input.
Status Cable Length	It shows the selected cable length
Status Oscillators	Status of the first & second oscillator: LOCK locked UNLOCK unlocked N/A not available
Video Level	This menu shows the modulator input video level, after user regulation.
Audio 1 & 2 Level	Shows 2 bars indicating the deviation of audio 1 & 2 subcarriers
Audio 3 & 4 Level	Shows 2 bars indicating the deviation of audio 3 & 4 subcarriers
Remote Control Type	It shows the remote control type enabled (RS-485 and Ethernet SNMP).
485 address & Errors	Shows the RS-485 Address (0-31) and the external one (0-255) of the proxy. It shows also the communication errors.
IP address	Shows the IP Address for remote control via SNMP of the equipment.
Subnet Mask	Shows the Subnet Mask for the right identification of the equipment on the network.
IP Gateway address	Shows the IP Address for Gateway IP for the network.

Table 4: Menu Description

5.6 Receiver control Unit RCU.

5.6.1.1 Configuration Menu.

The configuration menu allows the user to change the equipment parameters.

Figure 7 shows this configuration.

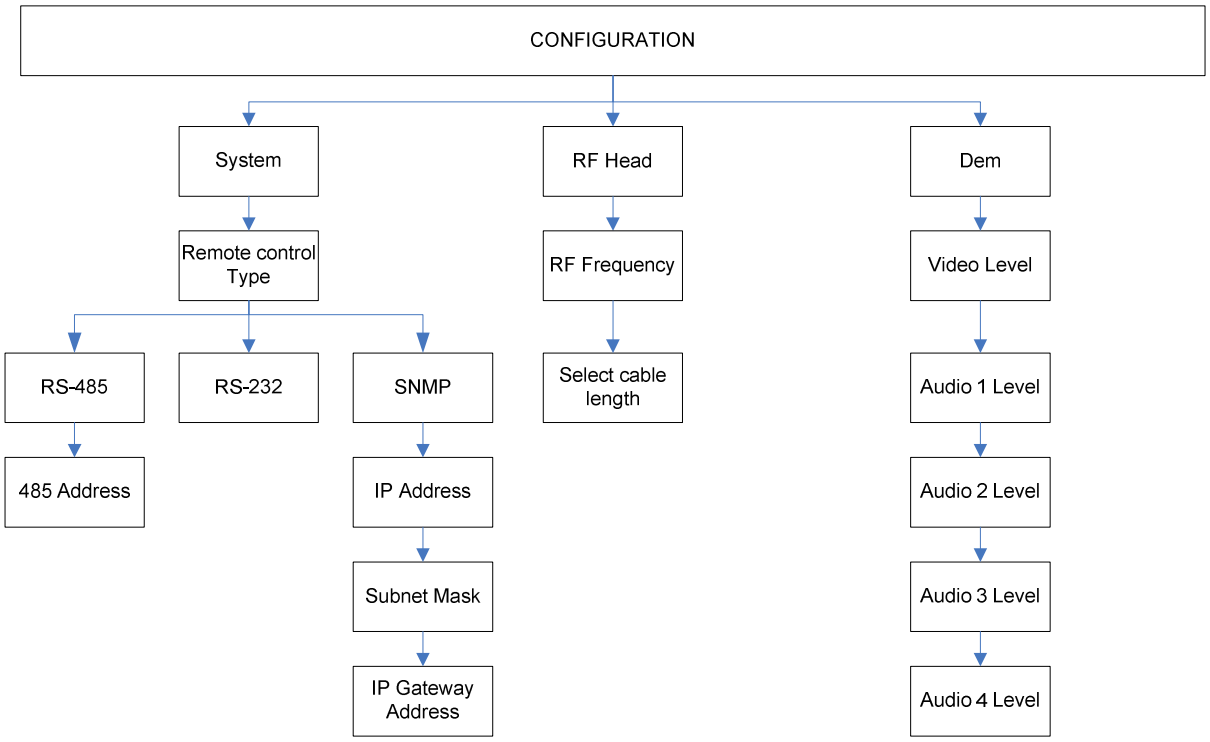


Figure 7: RCU configuration menu.

Options	Description
RF frequency	The frequency of apparatus can be set. Frequency span up to 500MHz; frequency resolution: 500KHz.
Select Cable Length	It allows to select the cable length so as to qualify the right equalization net.
Remote Control Type	Selection of the remote control type enabled (RS-485 and Ethernet SNMP).
485 address	Setting of internal RS-485 Address (0-31) and the external one (0-255) of the proxy.
IP address	Setting of IP Address for remote control via SNMP of the equipment.
Subnet Mask	Setting of Subnet Mask for the right identification of the equipment on the network.
IP Gateway address	Setting of IP Address for Gateway IP for the network.
Video Level	Setting of output video level (± 25%)
Audio 1 Level	Setting of output audio 1 level (± 25%)
Audio 2 Level	Setting of output audio 2 level (± 25%)
Audio 3 Level	Setting of output audio 3 level (± 25%)
Audio 4 Level	Setting of output audio 4 level (± 25%)

Table 5- Configuration Menu Description

5.6.1.2 Status menu.

The status menu permits the user to monitor the equipment performance.

Figure 8 shows the status tree menu.

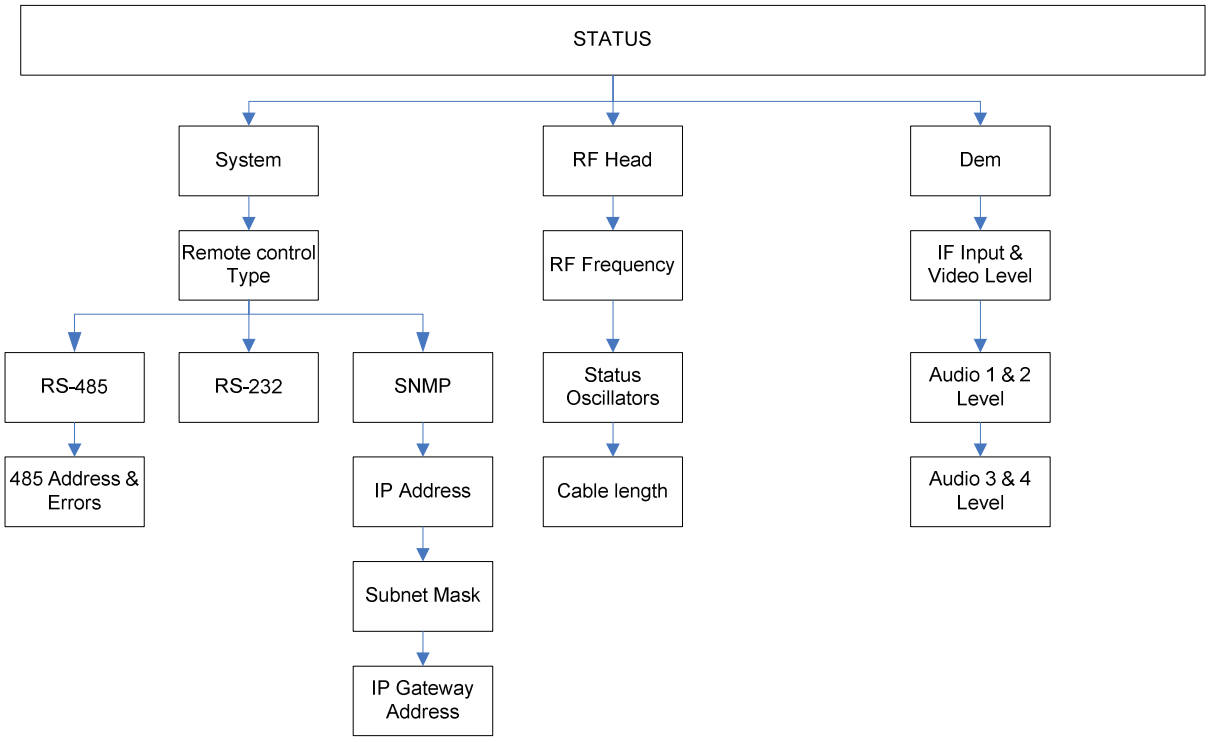


Figure 8: Status tree menu

Option	Description
Status RF frequency	It shows the frequency of the apparatus.
Status Oscillators	Status of the first & second oscillator: LOCK locked UNLOCK unlocked N/A not available
Status Cable Length	It shows the selected cable length
IF input & Video Level	This menu shows the output video level and the IF input level.
Audio 1 & 2 Level	Shows the audio 1 & 2 output channels.
Audio 3 &4 Level	Shows the audio 3 & 4 output channels.
Remote Control Type	It shows the remote control type enabled (RS-485 and Ethernet SNMP).
485 address & Errors	Shows the RS-485 Address (0-31) and the external one (0-255) of the proxy. It shows also the communication errors.
IP address	Shows the IP Address for remote control via SNMP of the equipment.
Subnet Mask	Shows the Subnet Mask for the right identification of the equipment on the network.
IP Gateway address	Shows the IP Address for Gateway IP for the network.

Table 6: Menu Description

6 Equipment external description

6.1 TCU

6.1.1 Front Panel

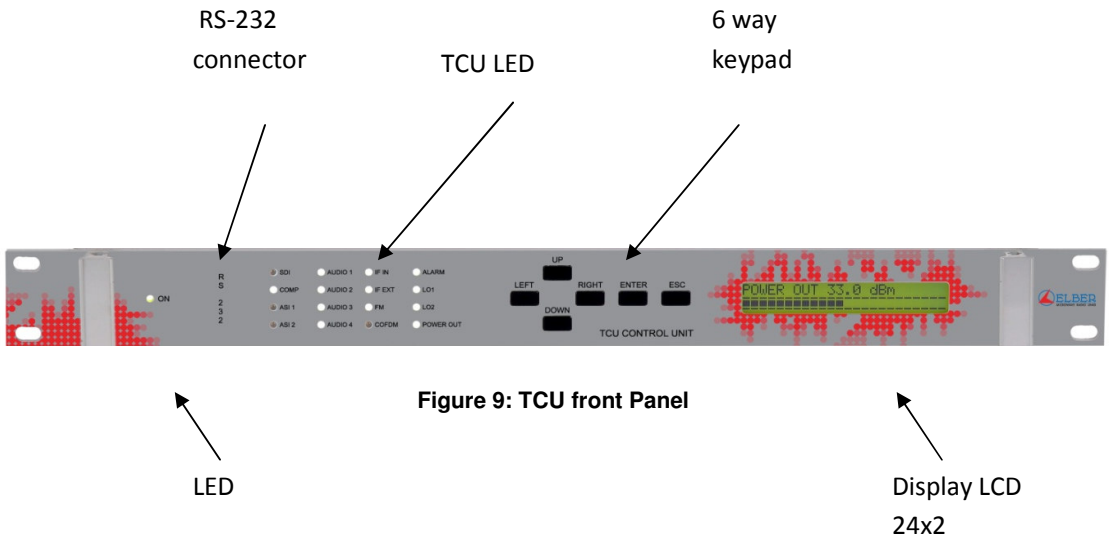


Figure 9: TCU front Panel

6.1.1.1 Indication LEDs and Controls

Item	Description		
LED	Green: Unit switched on Red: Unit switched off		
TCU LED	**GREEN**	**YELLOW**	**RED**
SDI	Not used	Not used	Not used
COMP	Video Present	Video too high	Video Absent
ASI1	Not used	Not used	Not used
ASI2	Not used	Not used	Not used
AUDIO1	Audio 1 Present	Audio 1 too high	Audio 1 Absent
AUDIO2	Audio 2 Present	Audio 2 too high	Audio 2 Absent
AUDIO3	Audio 3 Present	Audio 3 too high	Audio 3 Absent
AUDIO4	Audio 4 Present	Audio 4 too high	Audio 4 Absent
IF IN	Internal IF in correct range (flashing if	Not used	Internal IF not present

	enabled)		
IF EXT	External IF in correct range(flashing if enabled)	Not used	External IF not present
FM	Modulator version correct	Not used	Modulator not present or wrong version
COFDM	Not used	Not used	Not used
ALARM	No alarm detected	Not used	Alarm
LO1	1st Oscillator locked	Not used	1st Oscillator unlocked
LO2	2° Oscillator locked	Not used	2° Oscillator unlocked
POWER OUT	Output power OK	Not used	Low output power
6 button keypad	Keypad used for menu access		
LCD	Alphanumeric display 24×2		

6.1.1.2 Connectors description

RS232: DB9 connector for *firmware* uploads.

- Pin 2: Reception
- Pin 3: Transmission
- Pin 5: Earth
- Other pins not connected

6.1.2 Back panel

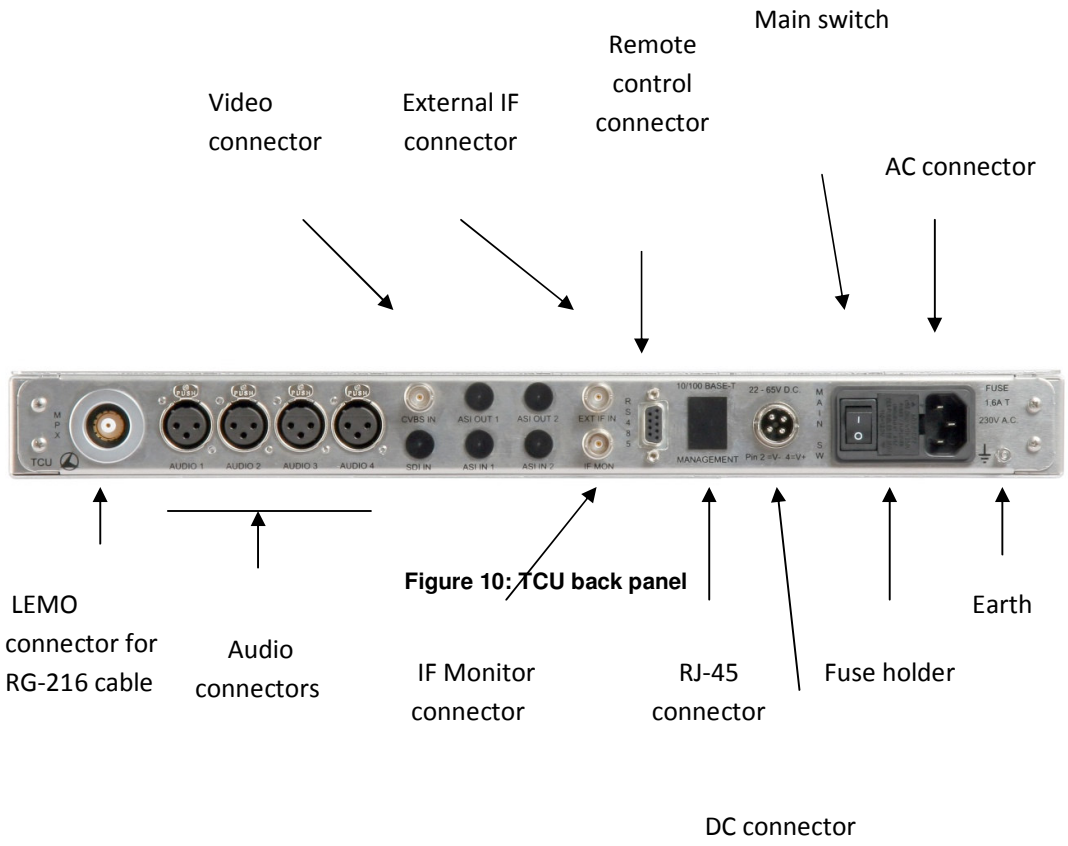


Figure 10: TCU back panel

6.1.2.1 Connectors Description

<table>
<tr><th>Connector</th><th>Description</th></tr>
<tr><td>TCU Connectors</td><td>
<table>
<tr><th>Connector</th><th>Description</th></tr>
<tr><td>EXT IF IN</td><td>IF input connector (70MHz), type BNC</td></tr>
<tr><td>MUX</td><td>LEMO connector for RG-216 cable</td></tr>
<tr><td>IF MON</td><td>IF monitoring connector type BNC</td></tr>
<tr><td>CVBS IN</td><td>Video Input connector, type BNC</td></tr>
<tr><td>Audio1</td><td>Audio 1 input connector, XLR type</td></tr>
<tr><td>Audio2</td><td>Audio 2 input connector, XLR type</td></tr>
<tr><td>Audio3</td><td>Audio 3 input connector, XLR type</td></tr>
<tr><td>Audio4</td><td>Audio 4 input connector, XLR type</td></tr>
</table>
</td></tr>
<tr><td>Remote Control Connector</td><td>Pin 1: A 485
Pin 2: B 485
Pin 3: +5V
Pin 4: NOT CONNECTED
Pin 5: RESET
Pin 6: NORMALLY OPEN ALARM
Pin 7: NOLRMALLY CLOSED ALARM
Pin 8: ALARM COM
Pin 9: EARTH</td></tr>
<tr><td>DC Connector</td><td>25÷65V DC input.</td></tr>
<tr><td>Main Switch</td><td>Equipment ON/OFF</td></tr>
<tr><td>Fuse</td><td>230V 1.6A</td></tr>
<tr><td>AC connector</td><td>230V 50/60Hz – 115V 50/60Hz</td></tr>
</table>

6.2 RCU

6.2.1 Front Panel

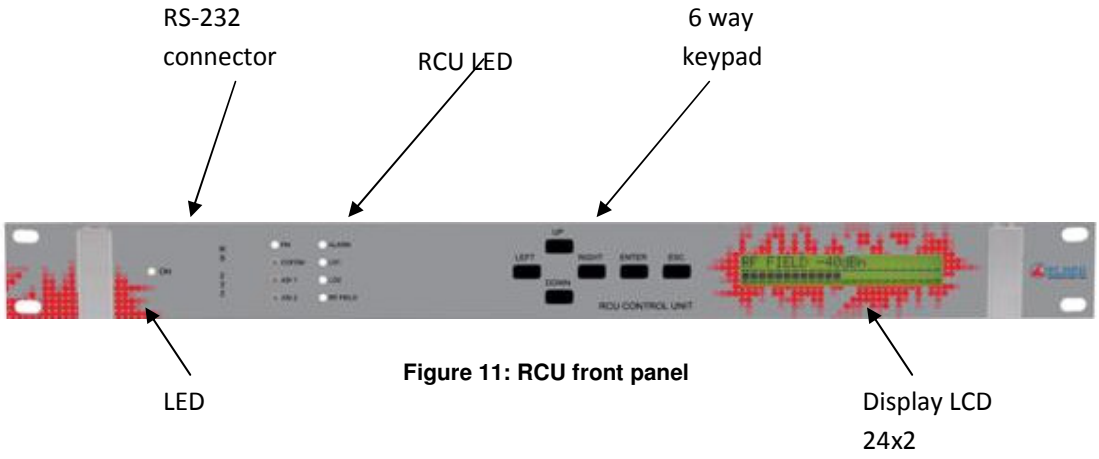


Figure 11: RCU front panel

6.2.1.1 Controls and Indications

Item	**Description**
LED	Green: Unit switched on Red: Unit switched off
LED RCU	
FM	**GREEN**: Demodulator version correct **RED**: Demodulator not present or wrong version
ASI1	**GREEN**: Not used **RED**: Not used
ASI2	**GREEN**: Not used **RED**: Not used
COFDM	**GREEN**: Not used **RED**: Not used
ALARM	**GREEN**: No alarm detected **RED**: Alarm
LO1	**GREEN**: 1st Oscillator locked **RED**: 1st Oscillator unlocked
LO2	**GREEN**: 2nd Oscillator locked **RED**: 2nd Oscillator unlocked
RF FIELD	**GREEN**: Received field OK **RED**: Low received field (< 71 dBm)
Six-Way-Keypad	Keypad used to navigate through embedded software menu
LCD	Alpha numeric display 24×2

6.2.1.2 Connector description

RS232: DB9 connector for serial communication.

- Pin 2: Reception
- Pin 3: Transmission
- Pin 5: Earth
- Other pins not connected

6.2.2 Back panel

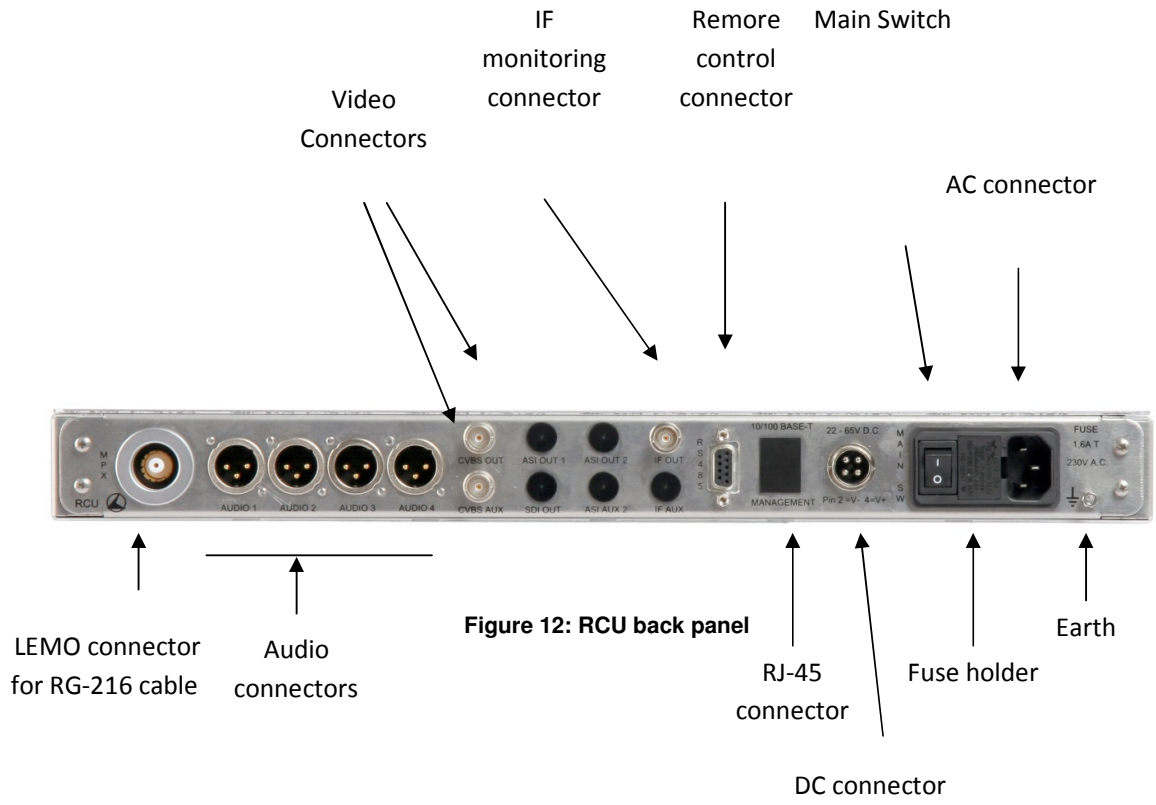


Figure 12: RCU back panel

6.2.2.1 Connectors description.

Connector	Description
RCU Connector	**Connector** / **Description** **IF OUT** — IF Output connector (70MHz), type BNC **CVBS IN** — Video Output connector, type BNC **CVBS AUX** — Video Output connector, type BNC **Audio1** — Audio 1 output connector, XLR type **Audio2** — Audio 2 output connector, XLR type **Audio3** — Audio 3 output connector, XLR type **Audio4** — Audio 4 output connector, XLR type **MUX** — LEMO connector for RG-216 cable

Remote Control Connector	Pin 1: A 485 Pin 2: B 485 Pin 3: +5V Pin 4: NOT CONNECTED Pin 5: RESET Pin 6: NORMALLY OPEN ALARM Pin 7: NOLRMALLY CLOSED ALARM Pin 8: ALARM COM Pin 9: EARTH
DC connector	25÷65V DC input.
Main Switch	Equipment ON/OFF
Fuse	230V 1.6A
A.C. connector	230V 50/60Hz 115 50/60Hz