Model 70-14, DVB-T & DVB-S Receiver Modifications

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The KH6HTV Video, model 70-14 is a DTV receiver capable of receiving either DVB-T or DVB-S transmissions, Fig. 1. It was originally designed for normal consumer use in the European market as a set-top box. It was designed to be powered from the AC mains with a universal input of 100-250Vac, 50/60 Hz. For amateur radio/TV service and in particular for ARES operations, the ability to operate on 12Vdc and free from the commercial AC mains is desirable. The purpose of this application note is to document a couple of simple modifications to the 70-14 that the owner can make to add +12Vdc capability and also provide a Valid Signal logic output. When operating from an external 12Vdc source, the receiver draws only 400 mA.

MECHANICAL MODS: The first thing to do is to drill three, 1/4" dia. holes in the rear panel. One is for the AC/DC selector toggle switch. The second is for an entry for the DC power cord. The third is for an RCA jack for the Valid Signal Logic output. Fig. 2 shows where these items were added. The toggle switch was mounted next to the AC
power switch. The DC power cord was passed through a rubber grommet located beneath the AC cord. The RCA jack was mounted next to the other RCA jacks.

Mounting holes for new voltage regulators, U1 & U2, need to also be drilled in the bottom plate. See Fig. 5 for their location. U1 requires a single 6-32 mounting screw. U2 requires two, 4-40 mounting screws.

![Fig. 2 Model 70-14 View of rear panel showing the added AC/DC toggle switch, 12Vdc power cable, and Valid Signal Logic output jack.](image)

**Fig. 2** Model 70-14 View of rear panel showing the added AC/DC toggle switch, 12Vdc power cable, and Valid Signal Logic output jack.

**POWER SUPPLY MODIFICATION:** Fig. 3 shows the schematic diagram of the new DC power supply to be installed. The AC/DC switching power supply is the existing supply. U1 is the new 10.4V voltage regulator. It is a low drop-out (0.2V), linear regulator. U2 is an inexpensive ($0.90), complete pc board, DC/DC, adjustable, switching regulator using an LM2596 IC. **CAUTION** -- You must preset the output voltage from this regulator to precisely +5.2Vdc prior to wiring it to the toggle switch, S1. Failure to do this will probably apply excessive voltage to the TV tuner board and destroy it.
MODIFICATION DETAILS: The built-in power supply for the 70-14 is an AC powered, universal switcher design. It is a separate pc board, Fig. 4. It provides two, regulated outputs of +10.4Vdc and +5.2Vdc to power the main, TV tuner, mother board and front panel display / control switch pc boards. The DC outputs are on a five conductor ribbon cable soldered directly to the board. This cable is cut in half at the mid point. This is seen in the lower left corner of the photo, Fig. 4. The two wires closest to the mounting screw carry +5.2V. The next two wires carry the Ground circuit. The single wire on the right carries +10.4V. Note that these wires all have unique coding of red dots and dashes. You need to note this coding to identify the correct wires on the TV tuner board.

Fig. 5 shows where the new voltage regulators, U1 & U2 are installed. U2 is mounted with two, 4-40, screws. Add extra nuts or washers to the screws to act as standoffs for
the U2 pc board. Make sure they are not too large of diameter which would cause shorting to adjacent solder pads on the board.

The various components associated with U1 (i.e. R1, R2, C1 & C2) are all soldered directly to the various pins of U1, Fig. 6

Fig. 6 Wiring of U1 (right) & U2 (left)

Fig. 7 Wires to be attached to the existing AC power supply pc board. Purple is soldered to +5.2V pad. Orange/White is soldered to +10.4V pad.
Fig. 8  Wire to be attached to the existing AC power supply pc board. Green/White wire is passed through existing hole and soldered to Ground pad on bottom of board.

Fig. 9  AC/DC toggle switch, S1 wiring

With U1, U2 & S1 installed, you are now ready for the final wiring, per the schematic, Fig. 3. The connections to the existing AC power supply are shown in Figs. 7 & 8 for +5.2V, +10.4V and Ground. The connections for voltages to the TV Tuner pc board are made by soldering onto the existing ribbon cable wires attached to that board, Fig. 9. Use small diameter shrink tubing to protect these connections. This completes the installation of the new +12Vdc power supply.
VALID SIGNAL LOGIC MODIFICATION: If one plans to use the 70-14 receiver in a TV repeater, then it is desirable to also add another modification. This is to provide a logic output signal indicating when the receiver is receiving a valid DTV signal. This logic signal can be used to key on a TV repeater. The 70-14 has on it's front panel display a Red / Green LED which is a status indicator. When it is Red, a valid TV signal is not present. When it is Green, then a valid TV signal is present. The schematic in Fig. 10 shows a simple, one transistor circuit to provide this logic signal. Fig. 11 shows the location on the front panel display pc board of the Green LED signal. Fig. 12 shows the new RCA jack installed on the rear panel along with Q1 circuit wired directly to the jack.
Fig. 12  Q1 circuit wiring on RCA jack
The Model 70-14 is a set-top box, TV receiver imported from China and marketed by KH6HTV Video to the amateur radio/TV market. It is capable of receiving DVB-T signals on the 70cm, amateur radio band (420-450 MHz). It can also be used as a DVB-S receiver on the 23cm amateur radio band (1240-1300 MHz). KH6HTV Video pre-programs these set-top receivers to receive all five of the USA amateur 70cm band, 6 MHz bandwidth, TV channels, (423, 429, 435, 441 & 447 MHz). The specifications on the following pages are from the Chinese manufacturer. While the manufacturer specifies the receiving power range to be -85dBm to -5dBm, measurements made at KH6HTV Video have shown the 70cm sensitivity to be much better at typically -95dBm for DVB-T / QPSK.
Features:
1. Complies with DVB-T2 & DVB-S2 standards
2. Supports MPEG2/4, H.264 standards
3. Supports ground automatic station search, manual station search
4. Supports blind scan, manual search
5. Supports 3D graphics, video, programs
6. Supports Sleep Timer
7. Supports teletext, subtitles TV
8. Supports 7 days EPG function
9. Supports PVR recorder, TIMESHIFT, & media file playback
10. Video output resolution: 480i, 576i, 480p, 576p, 720p, 1080i & 1080 p
11. Video, audio decoder supports: MPEG2/4, H.264 (L3L4.1) format
12. MediaCodec: dat, vob, div, mov, mkv, jpeg, ts, etc.
13. Audio codec supports: wma, MP3, AAC (.wma, MP3, m4a), etc.
14. Photo codec supports: jpeg, BMP, PNG, etc.

Specifications:
1. Front Panel push button Controls: Power, CH+, CH-, VOL+, VOL-, MENU, OK
2. Front Panel Display: 4 digit green LED numeric readout, Power ON red LED, & Valid Signal green LED
3. Front Panel Connector: USB 2.0 host
4. Rear Panel Controls: Master AC power On/Off switch
5. Rear Panel Terrestrial RF Connector: Belling-Lee, (IEC1622, IEC female)
6. Rear Panel Satellite LNB Input RF Connector: type F, (IEC601692)
7. Audio/Video Connectors: HDMI, Component Video, Composite Video, Stereo L&R Audio, plus Coaxial digital audio
8. Color: Black
9. Dimensions: 21.5 x 13 x 4 cm (8 1/2" x 5 1/8" x 1 5/8")
10. AC Power Cord Plug: EU or UK
11. AC Power Required: 100-250 Vac, 50/60 Hz
12. Remote Control Power Required: 2 x AAA batteries (not included)

Hardware Specifications:
1. CPU: Montage VT6000 (128 pin) MIPS 34Kf@600MHz
2. Memory: 32X16Mbit DDR2 Frequency1066
3. Flash: 32M bytes
4. Demodulator Type: Montage DM6000 Chip Set.
5. S2+TUNER: MaxLinear MXL 608
6. DVB-T2 Demodulation: Terrestrial Receiver Standard DVB-T2/T(EN_302755 V1.3.1/EN 300744).
7. Input RF Frequency: 48~866 MHZ.
8. Bandwidth: 6 MHz, 7 MHz, 8 MHz.
9. Constellation: QPSK 16QAM, 64QAM and 256QAM.
10. Input level: 83~5dBm.
11. DVB-S2 Channel Decoder:
12. Frequency Range: 950 MHz - 2150 MHz.
13. Sensitivity Level: 10~ 81dBm.
14. FEC Mode: 1 / 4, 1 / 3, 2 / 5, 1 / 2, 3 / 5, 2 / 3, 3 / 4, 4 / 5, 5 / 6, 8 / 9, 9 / 10.
15. Guard intervals: 1 / 4, 1 / 8, 1 / 16, 1 / 32.
17. Active Ant Power: 13/18V DC @ 500mA MAX, Overload Protection.

Package Includes:
1 * DVB-T2 + S2 COMBO Receiver
1 * Remote control
1 * European to USA AC Adapter
1 * RCA composite A/V Cable
1 * English User manual

KH6HTV Video also includes a type F (female) to PAL DIN (male) coax adapter

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