

Monitor Sensors 630m Transverter Operator's Manual



Installation

Location

The transverter should be located near to the HF transceiver, but make sure there is sufficient ventilation around the transverter. The air in-take vent, beneath the front panel, and the outlet vent on the rear panel should be kept clear at all times.

Power Supply

The transverter requires +13.8VDC at up to 15A. It will operate from 10 to 16V with reduced power output at 10V. The negative side of the supply is connected directly to chassis. There are two Anderson power pole connectors on the rear of the transverter. These are connected directly in parallel, so either can be used to power the transverter. The other is then available to power other equipment. The transverter itself is protected against reverse polarity and will not turn on. However, be aware that any other equipment connected to the second power socket will not be protected if the supply is reversed. Locate the power cable supplied with the transverter. One end is terminated in an Anderson power pole. The other end needs to be connected to your PSU. The red wire is positive and the black wire negative. Never connect the Anderson power pole with power on the cable. Make sure the Anderson power pole is properly seated before turning on the PSU.

RF Connections

The rear of the transverter has three SO239 sockets.



First, remove the cable which is attached to your transceiver's RF output and connect it to the socket on the transverter labeled HF ANT. This cable is carrying RF to your HF antennas or linear amplifier. Locate the coax cable supplied with the transverter. This has PL259 plugs on each end. Connect one end to your transceiver's, now vacant, RF output socket and connect the other end to the centre socket on the transverter. Connect the socket labeled MF ANT to your 630m antenna. This completes the basic installation. Optionally, you may connect your transceiver's keyline output to either of the RCA sockets labeled PTT using the RCA cable supplied. These sockets are wired directly in parallel, with the outer ring grounded. The transverter requires the centre pin of either socket to be grounded to switch the transverter to transmit mode. The centre pins are pulled up to +5 Volts internally through 10K Ohms. Your transceiver's keyline output may already be in use to key an HF linear amplifier. If your linear amplifier's keyline also has a low positive voltage (+3 to +12 Volts) which is grounded on transmit, it will be compatible with the transverter and may be connected to the second RCA socket on the transverter. This will not be the case if the amplifier provides a negative or high voltage switching voltage. If in doubt, seek further advice. If your linear amplifier does share the keyline successfully, you will need to turn off the linear amplifier or put it in standby mode, while operating on 630m. Otherwise the linear amplifier will draw unnecessary current when transmitting on 630m.

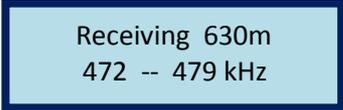
Operating

When the toggle switch on the front of the transverter is in the off position, the transverter draws no current and your transceiver is connected to your HF antenna or linear amplifier for normal HF operation. For 630m operation turn on the toggle switch. The screen will light with a brief message and will start receiving on 630m from the signal at the MF ANT socket. Set your transceiver to the 160m band and tune to 1802 to 1809 kHz. You are now listening to signals on 472 to 479 kHz. You may notice a large increase in noise in this frequency range. This is normal. The roofing filter will attenuate signal and noise outside the 630m band. The true frequency of a signal is obtained by ignoring the first three digits of your transceiver's frequency display (180) and replacing them with 47. For example, to receive on the 630m WSPR frequency of 474.2 kHz, set the transceiver dial to 1804.2 kHz.

The Display

There are three sets of screens indicated by different screen colors. The light blue color indicates Receive mode, the light green Transmit mode, and magenta indicates a Menu screen. Rotating the scroll knob selects the parameters to be displayed in each mode. The transmit screens are only displayed when transmitting.

The Receive Screens

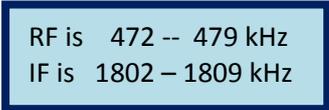


Receiving 630m
472 -- 479 kHz



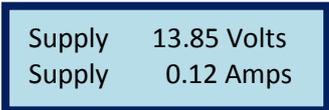
Software version 115
Ser # 001 VK4YB

This is the main receive display. Pushing the knob briefly displays the Software version, Serial number and your callsign.

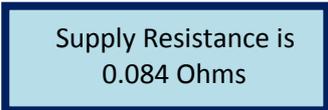


RF is 472 -- 479 kHz
IF is 1802 - 1809 kHz

The next screen is a reminder of the Intermediate Frequency in use. The band is not inverted. USB on 160m is still USB on 630m.

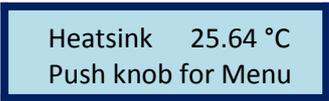


Supply 13.85 Volts
Supply 0.12 Amps



Supply Resistance is
0.084 Ohms

Supply voltage and current are displayed. To measure the power supply resistance, press the scroll knob. In a short time the supply resistance is displayed. This is especially useful if operating from batteries. Values below 0.1 Ohms are generally satisfactory. Higher values suggest a flat battery or poor connections.



Heatsink 25.64 °C
Push knob for Menu

The present temperature of the heatsink is displayed. Pushing the knob enters the Menu.

The Menu Screens

The menu is entered from the Rx screen which shows heat sink temperature. Press the scroll button to enter the menu. All changes are stored in non-volatile memory. There are 7 adjustment screens:

Welcome to the Menu
Scroll for items

Scroll forward once to reach this screen.

Push to adjust
screen brightness

Push to enter, and then rotate to adjust screen brightness. Push again to exit and save setting.

Push to adjust
color balance

Push to enter, and then rotate to adjust red/blue color balance. Push again to exit and save setting.

VOX delay is fast
Push to select

Set Vox Delay to slow, mid or fast. Select slow or mid for ssb, mid or fast for cw, fast for data. If PTT switching is in use, the Vox Delay setting has no effect, because the transverter returns to receive immediately the PTT line is released.

Rx attenuator = 0dB
Push to select

Set the Receiver input attenuator to 0dB or 20dB. The normal position is 0dB but 20dB may be useful in the presence of very strong signals.

Tx attenuator = Auto
Push to select

Set the Transmitter input attenuator to Auto (default) or 2, 4, 6, 8, 10, 12 or 14dB to reduce transmitter output power. This may be useful when feeding a sensitive Linear Amplifier. In any setting the overdrive and high SWR protection is still in operation.

Transmitter enabled
Push to select

Enable or disable the Transmitter. When disabled, the Transmitter will not come on under any circumstances. Attempts to transmit will result in a warning screen. This is useful if operating in receive only using a pre-amplifier. The pre-amplifier may be damaged if accidentally transmitting.

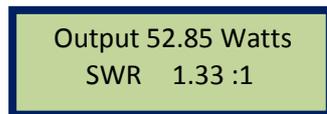
Edit your callsign
VK4YB

Edit your callsign. This only needs to be done once. The character which has the flashing cursor underneath is changed by rotating the scroll button. Press the scroll button to move to the next character. A character can be deleted by replacing it with a space. Up to 8 characters can be accommodated. Keep pressing the scroll button until a choice is offered to store the changes or revert to the original callsign. New callsigns are added to the provenance list.

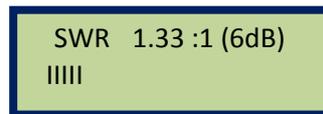
Continuing to scroll forward will exit the menu.

The Transmit Screens

The transmit screens are only displayed when transmitting. There are two ways to put the transverter in transmit mode. Either by grounding the PTT line, or by applying RF drive from your transceiver. The transverter is in transmit mode when one of the following screens is displayed.

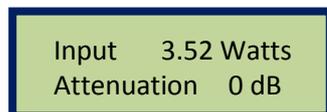


Output 52.85 Watts
SWR 1.33 :1



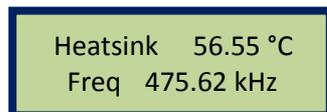
SWR 1.33 :1 (6dB)
IIIIIIII

The main screen in transmit mode displays the output power being delivered to the antenna on the top line. The SWR is shown on the bottom line together with the attenuation, if any, being applied. This screen may be used to adjust the antenna loading coil or antenna matching unit, while observing the SWR numerical value. Alternatively the knob may be pressed to enable the special tune screen, shown above on the right. This shows the SWR in numerical and graphical form for easy antenna tuning. It also turns off the auto SWR protect function and allows the user to manually adjust the TX attenuation using the scroll knob. Rotating anti-clockwise increases attenuation and reduces output power. The purpose of defeating the SWR protect circuit, is to prevent the output power jumping as the SWR varies. This is important if, for example, a remote adjustment is being made to maximize antenna base current. The output transistors can survive operating at full power into a short or open circuit. Nevertheless, it is still wise to commence tuning with the maximum attenuation of 14dB in circuit and only increase power when nearing a match. When tuning is complete, push the knob to return to the normal output screen. This also restores automatic attenuator operation.



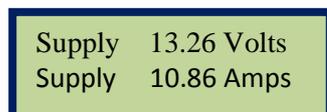
Input 3.52 Watts
Attenuation 0 dB

Drive power is displayed accurately in this screen. Many transceivers have unreliable power meters at low output. The second line displays the transmit attenuation in use.



Heatsink 56.55 °C
Freq 475.62 kHz

The heatsink temperature is displayed. When drive level exceeds 1 watt, the input frequency is measured, and the output frequency is calculated and displayed. The frequency counter works on CW and narrow band signals such as WSPR. The frequency counter does not work on wideband signals such as SSB. When operating wideband modes, the operator must ensure that the entire transmission falls within the legal band.



Supply 13.26 Volts
Supply 10.86 Amps

Supply voltage and current are displayed. The supply resistance cannot be measured while transmitting.

Adjusting the Drive Level

The transverter requires approximately 3 to 5 watts of drive from the transceiver for full output power. This will require the power from most transceivers to be reduced from that normally used for HF operation. Depending on the transceiver, this may require adjustment of the power level control, carrier level or mic gain control. If too much power is delivered, the transverter will automatically switch in additional attenuation. The amount of attenuation in use can be seen on the Power output screen. It appears at the end of the second line of the display as a dB value in brackets. If no value is shown, it means the attenuation is 0dB, which is the normal condition. A value of 0dB or occasionally 2dB is permissible. Higher values indicate the transverter is being overdriven and the drive level should be reduced. If the drive power is high enough to overheat the input resistors, the drive power will be automatically switched to bypass mode. This means the input power will be diverted to the HF antenna socket. A warning message will be displayed if this happens. The transverter incorporates automatic transmit-receiver switching. The transverter will automatically switch to transmit mode when RF drive is present. The transverter will drop back to receive after RF is removed and after a delay determined by the VOX delay setting. There are three options, fast, mid or slow, selected in the menu. This auto TX switching is always operative even if the PTT connection is in use, as a safety back-up. However the advantage of using the PTT connection is that switching to RX will occur immediately the PTT line is released.

Warning Screens

The warning screens are always displayed in red. There are 6 possible screens

RF detected on input
Signal is bypassed

RF on input. This screen will only appear if RF drive is present at start-up. Remove the RF drive and the transverter will continue running-up normally.

Low supply Volts
9.2 Volts

Low Supply voltage. This will be displayed if the supply voltage falls below 10 Volts. The transverter will still attempt to function but performance will be degraded, especially in transmit mode.

Drive level too high
Signal is bypassed

Overdrive. If the drive level exceeds about 15 watts the input terminating resistors may overheat. Drive power is bypassed to the HF antenna socket. The drive power must be removed completely, to resume normal operation.

Freq above band edge
Freq = 479.02 kHz

Out of frequency high or low. Attempts to transmit on a carrier frequency above 479.00 or below 472.00 will result in this screen. Drive power is bypassed to the HF antenna socket. The drive power must be removed and adjusted to an in-band frequency to resume normal operation.

Temp is above 90°C
Signal is bypassed

Heatsink is cooling
Temp = 76.84°C

Over temperature. If the temperature of the internal heat sink exceeds 95°C, transmission will stop and will not resume until the temperature has fallen below 70°C. Drive power is bypassed to the HF antenna socket until a safe temperature is reached.

Receiver Overload
Reduce MF Ant signal

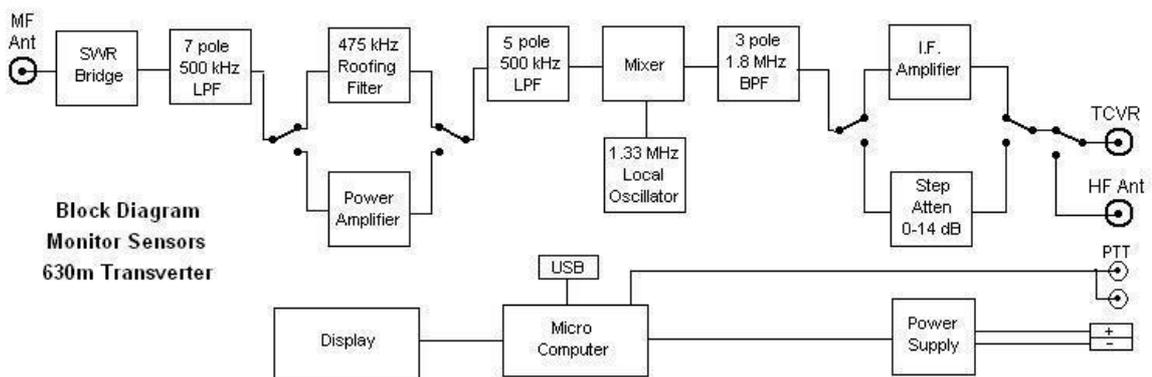
Receiver Overload. If 1 watt or more of RF is detected on the receiver MF input, the input is switched to the transmitter output circuits and safely dissipated. This protection only works if the transverter is on.

USB Socket

The front panel USB socket is provided for future code up-upgrades. These will be made available, free-of-charge, from the Monitor Sensors web page together with full instructions. The USB socket has a dust cover which should be kept in place, when not in use.

Theory of Operation

In receive, signals from the MF Antenna pass through the SWR Bridge and 7 pole, Chebychev, 500 kHz, low pass filter. This filter provides 30 to 50 dB of attenuation against Broadcast Stations operating in the 550 to 1600 kHz Medium Wave Band. This filter is followed by a half lattice, roofing filter. The pass band is 472 to 479 kHz. The filter is steep sided, but flat within +/- 1.5 dB within the pass band. The ceramic elements resonate at 473.3 and 478.2 kHz. The roofing filter is followed by a 5 pole Chebychev low pass filter. At this point the RF signals have not encountered any active or non-linear devices, which might cause intermodulation products. The next stage is the double balanced commutating mixer. The mixer is fed by a MEMS local oscillator operating at 1.33 MHz. This oscillator has extremely low phase noise and is temperature compensated by its own dedicated micro-processor. The following 3 pole Chebychev 1.8 MHz Band Pass Filter selects the desired mixer product before amplification by a current feedback video op-amp. The op-amp combines low noise operation with ultra linear performance and incorporates a protection circuit to prevent damage, even in the event of 100 watts of RF, fed accidentally into its output port.



In transmit, signals from the transceiver pass through a 0 - 14 dB step attenuator, which is under control of the micro-computer. Signals that would tend to overload the Power Amplifier are attenuated at this point. Attenuation is also increased in the event of high output SWR. From the step attenuator the signals pass through the mixer and its associated filters to the input of the Power Amplifier. The Power Amplifier has a gain of 50dB, and employs four lateral FETs in class AB, push-pull. Lateral FETs are inherently linear and thermally stable. The output passes through the 7 pole, Chebyshev low pass filter, which reduces all harmonics to better than -50dB. Finally the signal passes through the SWR Bridge. Measurements made in the SWR Bridge enable the micro-computer to calculate the power delivered to the load and the SWR at the output socket.

Specifications

RF frequency range	472 to 479 kHz
IF frequency range	1802 to 1809 kHz (others available in the 160m band)
Transmission modes	CW, SSB, WSPR, all other data modes
Output Power	50 Watts Continuous, 100% duty cycle
Input and Output Impedance	50 Ohms
Supply voltage	13.8 VDC @ 15 Amps nominal, 10-16 VDC operational
Rx noise floor	-123 dBm in 500Hz band width
Rx 3dB compression point	15 dBm (Rx attenuator out)
Rx IF rejection	better than 70dB
Rx conversion gain	6dB nominal
Roofing filter in-band ripple	+/- 1.5dB, 472 to 479 kHz
Tx 3 rd order IMD	-33 dB typical below PEP
Tx 5 th order IMD	-45dB typical below PEP
Tx harmonics and spuri	All better than -50dB
Tx conversion gain	10dB nominal
Power input connector	2 * Anderson Power Poles (one Power cable supplied)
RF connectors	3 * SO239 (one PL259 to PL259 cable supplied)
PTT connectors	2 * RCA (one RCA to RCA cable supplied)
USB connector	Micro B USB, (matching cable supplied)
Dimensions	12½ * 4¼ * 3 inches
Weight	3.4 lbs

Warranty

Monitor Sensors products are covered by a warranty which warrants "that all equipment supplied is free from defects in material and workmanship for a period of **one year** from the date of delivery from the works, providing there is no evidence of abnormal use. The obligation under the warranty is limited to replacing or repairing, at our option, any of the items so determined to be defective. The warranty shall not apply to any item that has been repaired or altered by others or which has been subjected to misuse." Customers should contact our service department (service@monitorsensors.com) before returning goods.

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Instructions to update the code in your Monitor Sensors TVTR1 or TVTR2 Transverter.

To update the code, your computer needs two files. The first is the TvtrUpdater.exe file which is the executive program which will load the new code for you. Once this file is resident in your computer, you can use it for all future updates. You only need to load it once. The other file you need is the one that contains the new code itself. It consists of hex values that only mean something to the PIC microcomputer inside the Transverter. It will not run under Windows and has a txt extension.

The TvtrUpdater.exe file can be downloaded from the Monitor Sensors Web page in a zip version. Go to www.monitorsensors.com. Click "firmware release 109" on the left hand side of the home page. Then click the link "Windows firmware downloader" written in green, half way down. Your computer will rightly be very suspicious of any exe file you try to download, even if it is hidden in a zip file. You will likely see a warning to this effect depending on your operating system and virus protection. When you subsequently unzip the file, you will likely see more warnings and you will need to insist that the file is safe and be given full access to the computer. It doesn't really matter where you put the TvtrUpdater, but it would be a good idea to put it in a new directory called "Transverter". You can then place the new code files in the same directory, where the TvtrUpdater will easily find them.

Switch on your Transverter using its normal power supply. Note the code version number in the opening screens. If you missed it, you can press the scroll knob and see it again. Let's say you have version 109 currently installed and version 110 is the latest available. If you haven't already done so, download the file code110.txt and put it in the Transverter directory. Do not plug the USB cable into the computer and Transverter yet. First run the TvtrUpdater program. On the right hand side of the box, you will see the words "Port setup". Click the drop down arrow beneath. This will show you which com ports are available. The com port you need will not be in that list yet. Use a pin or small screwdriver to remove the dust cover from the USB socket on the Transverter. Connect the USB cable, supplied with your Transverter, from the Transverter to a convenient vacant USB socket on the computer. Always use the same USB socket when connecting the Transverter. In most cases it will not make any difference but some computers are a bit quirky about this. When the cable is connected you may see a message in the dialog box of TvtrUpdater. The message will say a "USB Serial Port connected" and it may tell you the com port number in brackets. Note this number. Now close TvtrUpdater. Run TvtrUpdater again. Use the drop down arrow on "Port setup". This time the new com port appears in the list. Select this com port. Then click "Open". The flashing cursor will return in the dialog box, but no message is displayed. This is normal. Now click "UPDATE". If the connection to the Transverter is good, messages will be displayed and a file select box will open and you should select the new code file, code110.txt in this example, and click OK. The TvtrUpdater will do the rest. It will check that the file you have selected is a genuine Transverter code. It will install the code and check it is working and then make the new code the default code. You will be informed of progress and finally advised the process has completed successfully. You may now close TvtrUpdater and disconnect the USB cable. Switch off the Transverter and then on again. Confirm the new code version is displayed.

If your computer does not recognize the Transverter, no new com port will be created when you plug in the USB cable. The Transverter uses an FTDI Virtual com port chip. The drivers for this are normally resident in the computer operating system. If not, you will need to install the drivers first. They can be downloaded from www.ftdichip.com/Drivers/VCP.htm. Look at the Windows comments column on the right hand side. There is a link "setup executable". Clicking this link will download a file called CDM21226_Setup.zip which is suitable for Windows 7 or 10. If your computer is running an earlier version of Windows or Linux, scroll down the page a little further and download the appropriate file. Unzipping and running this file will load the drivers. If it still doesn't recognize the Transverter, try running the setup program again, but this time right-click it and select "Run as Administrator". If all of that fails, send an email to service@monitorsensors.com for more help.

Protection features of the TVTR1 and TVTR2 Transverters

- 1) **Reverse polarity protection**. The transverter will not turn on if supplied with the incorrect polarity. When polarity has been corrected, the transverter will operate normally.
- 2) **Over current protection**. If the supply current exceeds 20 Amps for any reason, the internal circuit breaker will operate and remove power. The circuit breaker operates within 2 microseconds of the overload being exceeded. The circuit breaker can be reset by turning off the transverter and turning it on again. The circuit breaker will not reset if the fault condition persists.
- 3) **Overdrive protection**. It is not uncommon, when changing from HF operation to MF operation to forget to turn down the drive level. This means typically 100 watts of RF is fed into the transverter's IF Amplifier output. The transverter will detect this and bypass the high power to the HF antenna socket. The bypass relay takes 6 mSec to operate. During this time the IF amplifier will be subject to the full force of the 100 watts. It is designed to handle this, but we recommend trying to keep such stressful instances to a minimum.
- 4) **High SWR protection**. The transverter will detect high SWR and progressively reduce drive to the power amplifier. In the tune screen, this SWR protection is temporarily removed and replaced by a fixed manually selected gain. This avoids the confusion of the power jumping around while trying to get the best match. It does however permit the possibility of operating at high power into a badly mismatched load. The output transistors are robust enough to operate at full power into a short or open circuit without damage. Nevertheless we recommend you try to avoid this situation as much as possible.
- 5) **High temperature protection**. The heatsink temperature is continuously monitored and excessive temperature will cause the transverter to bypass the drive RF to the HF antenna socket, and rest the power amplifier, until the heatsink has cooled down.
- 6) **Receiver overload protection**. If the power to the receiver exceeds 1 watt, components in the receiver front end may be damaged. The transverter detects this condition and switches the MF input signal to the output of the power amplifier stage, where it will be safely absorbed. When the high input is removed, normal operation will be resumed. This protection can only work when the transverter is switched on.
- 7) **Out of band operation protection**. The input frequency is continuously monitored and if the incoming frequency will result in an out of band signal, the transmitter is inhibited. The input frequency must be adjusted in-band before normal operation will be restored. This protection will only work on CW or narrow band data signals. The operator must insure that wideband transmission such as SSB always fall entirely within the legal band.
- 8) **Over and under voltage protection**. The supply voltage is continuously monitored and voltages above 16 Volts and below 10 Volts will result in warning screens being displayed repeatedly.