Q5 SIGNAL 5-BAND VHF/UHF TRANSVERTER

Part Number 5BVUX SN _____

Transverter Configuration		
Power Output:	25W (10W on 1296)	
RX Gain @ Noise Figure:	>20dB Conversion Gain @ 1.0dB NF Typical	
DC Power Requirement:	11.5 - 15.5 VDC @ ☐ 10 Amp Max. ☐ Other_____	
IF Option:	☐ Common	☐ Separate TX and RX (Split)
RF Option:	☐ Common	☐ Separate TX and RX (Split)
IF Drive Level:		
Keying Option:	☐ PTT-L (To Ground)	☐ PTT-H (Positive Voltage)

☐ Additional Specified Options:

Operational Overview: The 5BVUX is a complete 5-Band Full-Power Transverter for the 144, 222, 432, 902, and 1296 Amateur Radio Bands. It measures only 10” x 10” x 5” and weighs just 7.5 lbs. and offers the following standard features:

28MHz IF
25W Output (10W on 1296)
20dB Receive Conversion Gain Minimum
1.0dB Noise Figure Typical
High Level Mixer
Front End PIN Diode Protection
2-Stage SAW Filter Design
RF Output Level Meter
PLL Synthesized LO
Internal 0.28ppm TCXO Reference
Connection for Optional External 10MHz Reference
Front Panel Band Selector and Indicator
Accepts 4-Bit or 5-Bit Band Data
Sequenced PTT Output for Each Band
Dual Independent Cooling Fans
Optional PTT on IF Coax
IF Drive from -20dB to 10W
Common or Split IF Connection
Common or Split RF Connection for Each Band

The 5BVUX contains a separate optimized RF section for each band sharing a common IF section, mixer, and synthesized LO all managed by a microcontroller. The 5BVUX offers 5 bands in a compact space with less cabling and less expense than five individual transverters all without compromising performance.

The 5BVUX may be configured with Common or Split IF at any drive level between -20dBm to 10 Watts. All IF connections are made through standard BNC connectors. Common or Split RF configurations are available. The Common RF (Antenna) connector is Type-N. For Split RF, the TX port is Type-N and the RX port is SMA. The 5BVUX is keyed through its PTT line – a RCA Phono connector or through Pin 15 of the AUX connector. Both PTT polarities are available – PTT-L (Ground to Transmit) or PTT-H (Voltage to Transmit). The AUX connector also contains the Band Data connections for remote control of band selection. Also contained in the AUX connector is the sequenced PTT outputs that can be used for keying external amplifiers.

Configuration Overview: The 5BVUX is designed to interface to all modern amateur radio transceivers but has been specifically configured to your transceiver's specifications. As indicated on the front page, some user options and configurations need to be selected before delivery. Please review your configuration to verify that your interface will be easy and trouble free. Please refer to the front page chart for the following:

RF Output : This is the maximum linear output power level of the 5BVUX that should not be exceeded if linear operation is expected. In most cases, the transverter is capable of higher output power but is not recommended because of excessive "on the air" distortion products.

RX Gain and Noise Figure: The Receive Conversion Gain and Noise Figure listed are the typical specifications for each band. Utilizing the latest E-PHEMT and SAW filter technology, the receiver chain has been designed for gain management, IMD performance, and noise figure to eliminate overload and out of band interference maintaining a stable, quiet, sensitive receiver. Please note that the noise figure of the 5BVUX is always better through a separate RX connector and not through the Common Antenna connection.

DC Power Requirement: The DC power requirement listed should be used as a guideline. Please include some headroom in your power supply to eliminate voltage drop. Always choose the correct level of fusing for protection.

IF Option: The IF option has two choices – a Common IF connector in which both TX and RX IF signals are conducted through a single connector, or Split IF connections with a separate connector for the receive and transmit connections to your transceiver.

RF Option: The RF option has two choices for each band – a Common RF connector in which both TX and RX RF signals are conducted through a single connector (Antenna), or Split RF connections with a separate connector for the receive and transmit RF connections.

IF Drive Level: The IF Drive Level is adjustable over a 15-20dB range using the TXIF Gain Pot accessible through a hole in the transverter's bottom cover. Proper adjustment of this level will allow the 5BVUX to operate at its maximum linear output power.

Keying Option: The Keying Options are either PTT-L or PTT-H. PTT-L is the most common configuration and requires a connection to ground to transmit. PTT-H requires a voltage of at least 1.7VDC to transmit. This option can also be placed on the IF Coax if desired.

Additional Specified Options: All other customer specified options will be listed and identified along with special instructions required for proper operation.

Installation

Theory of Operation: The basic principle of a transverter is to convert a chosen band of operation to your transceiver of choice. Following the recommendations of the transceiver's operation manual for transverter use is the most important aspect of correct transverter operation. If configured correctly, the transverter will convert both transmit and receive signals to a new band of operation and be "invisible" to your transceiver's operation. In simple terms, the transverter will not improve the performance of your transceiver but if configured correctly, will not cause any degradation of performance in any way and will appear as if it was meant to be on that "new" band all the time.

Interfacing and Operation: The interfacing starts with a complete understanding of your transceiver and manual. Your transceiver's manual should cover the setup for transverter operation if it has transverter ports and depict the connections to be made. Some transceivers do not have ports but may still be interfaced with some instruction. Some transceivers are simple and some are complex. Some transceivers may have more than one correct way of interfacing. Hopefully, you have decided how this transverter is to be interfaced at the time of order so we were able to configure the transverter to fit your requirements.

Start with good quality 50 ohm cables for the IF (28MHz) and REF (10 MHz) connections. These connections are low level (10W or less) and are BNC connectors on the 5BVUX. We find that simple RG-58 type BNC cables work fine with or without adapters to your transceiver.

The 5BVUX requires a PTT Line to enable its Transmit mode. The PTT input to the 5BVUX is the RCA Phono connector or Pin 15 of the AUX connector. Many transceivers have RCA connectors for PTT outputs. But be sure to have whatever cable that is required ready to go.

The DC Power Cable is supplied with the 5BVUX and needs to be prepped and fuse-protected on the power supply end.

Connecting Your Transceiver to the 5BVUX: Interfacing the 5BVUX to your transceiver is easy. After reviewing the front-page configuration and verifying that it is configured correctly for your purpose, begin cabling. **An Important Note:** It is recommended that during the initial setup of the 5BVUX to not connect it to your complete system (HPA or LNA). All aspects of the transverter's performance should be tested before a complete installation is made to an existing system. Drive levels need to be established and proper switching needs to be verified before complete integration for protection of your existing system.

Connect the DC Power Cable to your power supply remembering to install the proper fuse for protection. Connect the twist-lock DC Power Plug to the 5BVUX. 13.8VDC is optimum but it will operate normally from 11 to 15VDC. Toggle the transverter's power switch. Its "ON" LED turns Green. Leave the 5BVUX powered on.

Connect an optional 10MHz Reference to the transverter's "REF" connector. The optimum level is between 0dBm and +13dBm. The transverter's "LOCK" LED turns Green. When not using an external reference, always terminate the "REF" port with a short or load.

Use the Band Select Knob on the front panel of the 5BVUX to choose the Amateur Radio Band of interest. Note how the Band Indicator LEDs change as the Band Select Knob is rotated to the left and right.

Connect the IF cable(s). The 5BVUX may be configured with a Common IF port labeled "COM" or two separate ports, "TX IF" and "RX IF", for the IF connections. The IF Cable is either connected to a transverter port connector or the main antenna connection of your transceiver. Refer to your manual.

If separate TX and RX RF ports were ordered, they are labeled "RX" and "ANT/TX" for the appropriate bands. If you have requested a Common RF (Antenna) connection, the "ANT/TX" port has both TX and RX functions. Connect your antenna system or dummy load with optional power meter to the appropriate RF connector on the 5BVUX.

With your transceiver powered off, connect its "PTT" line to the transverter's RCA connector labeled PTT on the 5BVUX. Refer to the configuration sheet for the type of keying required.

On the bottom of the 5BVUX, verify the TXIF and RXIF gain controls. Turn the RXIF control fully clockwise and the TXIF control counter-clockwise. This is maximum attenuation on Transmit and minimum attenuation on Receive.

Power-on your transceiver. If your transceiver cycles during power up, it may briefly key the 5BVUX. This is indicated by the Red "XMIT" light and the sound of relays cycling. Verify that the transceiver is in "receive" and that the red XMIT light is off on the 5BVUX. If not, shut off your transceiver and check the PTT connection with the IF cables disconnected from the transverter. If both transceiver and 5BVUX are in their receive modes, tune the transceiver to a frequency between 28.100 and 28.250MHz.

Observe the noise level in the transceiver on the "S" meter and by ear. If it is too high, adjust the RXIF gain control in the 5BVUX until a slight noise increase is heard in the transceiver or just a slight movement in the "S" meter is detected. It may help to power the 5BVUX on and off to verify the change. The RXIF gain may be increased beyond this point, but it will start to degrade the dynamic range of your transceiver.

It is now recommended to test the transverter's transmit section in the CW mode because most transceivers have carrier level or power level controls in this mode only. Do not use full or semi break-in if possible. Do not use FM, SSB, or AM because it may not be possible to obtain maximum output power with a transceiver in these modes. Set the carrier/output power control to minimum or "0" output power (if you can). Place the transceiver into transmit. If the PTT circuit is connected correctly, the red "XMIT" light on the 5BVUX will turn on. While observing the transverter's built-in RF Power meter or an inline RF power meter, slowly increase the carrier control (with key down) or increase the power output control to the maximum desirable IF drive level obtainable by your transceiver. If this level is not what is indicated on the front page of this document, do not exceed that level. Contact Q5 SIGNAL if you find that the 5BVUX is not configured for your transceiver's range.

If the 5BVUX is configured correctly for your transceiver, minimal power may be detected on the power meter. With the transceiver's drive level at maximum specified for the transverter, slowly adjust the TXIF Pot in the 5BVUX in a clockwise direction while observing the power meter. Set it to any desired level between 0 and the maximum specified output power. The relative power meter is set to show 9 LEDs for the specified maximum linear output power. This may vary with a high VSWR but will be true into a 50 ohm dummy load. Switch the transceiver to USB and make a transmission. The power output and current drain should correlate to your speech pattern.

Basically, the 5BVUX is ready to use and may be integrated into your system.

General Operation: If everything is adjusted correctly, the operation of the 5BVUX should be transparent to the transceiver and the user. Except for the frequency read out (if your transceiver doesn't allow its display to be adjusted for transverter operation), it will be like operating with your transceiver on any other band. All of the functions of the transceiver (filtering, DSP, split band operation, dual VFO) will be transposed to one of the frequency bands of the 5BVUX.

Some precautions should be taken when operating CW or VOX. Operating the 5BVUX in a "Full Break-In" mode is not recommended. Because of the mechanical relays and the sequencer in the transverter, there will be too much delay to operate "Full Break-In" effectively. And the relays would be abused if "Full Break-In" was enabled. It is best to operate in "semi break-in" and adjust the delay of the PTT on your transceiver to match your comfortable CW operating speed in a way that the delay will hold the PTT until your transmission is complete. This delay will actually need to be a little longer to allow all components within the system (HPA, LNA, Relays, etc.) to complete their transition if utilized.

Common or Split IF Option: The IF configuration may be changed at any time according to the type of transceiver you are utilizing. The component designators are silk screened on the printed circuit board. K6 is the Common IF relay. To split the IF lines into separate RXIF and TXIF, remove the IF coax from its position on the board (junction of K6 and C136) and re-attach the center conductor between C135 and K6. The shield may be now soldered to the ground pad marked RXIF. The TXIF cable can be prepped and soldered to the pad between K6 and C128. The shield can be soldered to the ground pad labeled TXIF. Install a BNC connector in the rear panel (TXIF) and attach the TXIF coax. Reverse the procedure if you want to change to (or back to) Common IF.

TXIF Drive Level Range: The TXIF drive level range can be changed at anytime to conform to your transceiver type. Basically, there are three configurations. For high IF drive levels (250mW-10W), the 50 Ohm load (R31) will be installed with a low value capacitor in the C129 position (3pF typical). Mid level drives between 1mW and 250mW will not have the load installed and will have a 1000pF capacitor installed for C129. For low drive levels (-20dBm to 0dBm), U26 will be installed. If you desire to change the drive level for whatever reason, just duplicate the info above. To install U26, remove the printed bypass jumper before installing. For -10 to -6dBm inputs, use a MAR-3 for U26. For -20dBm, use a MAR-6. Other MMIC's may be used, but the bias resistor R35 may need to be changed. Adjust R33 to obtain the desired level in all cases. **An Important Note:** Do not assume that low transverter output power is due to inadequate IF drive. Please consult Q5 SIGNAL if you have problems obtaining full output power with your specified drive level.

AUX Connector: The AUX Connector is a 15-Pin D-Sub High Density Female Connector containing the connections for Band Data Inputs, Sequenced PTT Outputs, Alternate PTT Input, and Ground. Refer to the table below for the pin-out:

PIN	DESCRIPTION
1	BAND DATA 0
2	BAND DATA 1
3	BAND DATA 2
4	BAND DATA 3
5	BAND DATA 4
6	PTT 144
7	PTT 222
8	PTT 432
9	PTT 902
10	PTT 1296
11	GND
12	GND
13	GND
14	GND
15	PTT

Band Data Inputs: The Band Data Inputs are active-low inputs (sink 5mA) providing an alternate method for band selection. When valid band data is present on these pins, the front-panel Band Select Knob is ignored. Custom Band Data configurations may be available. For the standard Band Data configuration, refer to the truth table below:

BAND	BAND DATA				
	4	3	2	1	0
144	1	0	0	1	0
222	1	0	0	1	1
432	1	0	1	0	0
902	1	0	1	0	1
1296	1	0	1	1	0

Sequenced PTT Outputs: A Sequenced PTT Output is provided for each band to facilitate the connection of add-on equipment such as a power amplifier. Each PTT Output is open-collector rated for 30V @ 100mA and switches to ground 100ms before the 5BVUX produces RF output.