



BAND DECODER-Y for YAESU RADIOS and COMPUTER LPT PORTS

Quick Start

1. Connect your transceiver Band Data outputs to the Band Decoder input J1. (Alternatively, connect your computer's LPT port to input J1 and launch your compatible logging software program.)
2. Connect a source of 12 Vdc to the Band Data power connector with the provided 5.5/2.5 mm OD/ID coaxial plug.
3. Connect the external relays, such as the Top Ten Devices Six Way Relay Box, to output connector J2.
4. Program the outputs by installing wire jumpers or diodes on the internal programming header, as required by your antenna farm. (Note that a prefabricated jumper plug is already installed in your decoder's programming header at the factory. If Figure 2a suits your needs, the decoder needs no further programming.)

You're in business! (Details on all the above steps are provided in the following paragraphs.)

Contacting Top Ten

You may write to us at the following address:

Top Ten Devices, Inc.
143 Camp Council Road
Phoenixville, PA 19460

A telephone answering machine may be found at (610) 935-2684. All messages are answered promptly.

We are also available on the Internet. With the proliferation of Internet Services Providers, e-mail addresses may be changed frequently. As of February, 1999, the following were in effect:

N3RD: n3rd@ix.netcom.com
W2VJN: w2vjn@rosenet.net

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Overview

The Band Decoder continuously follows your Yaesu transceiver's band changes, and provides a separate NPN transistor switch to ground for each of the nine bands your rig can operate on. By connecting external antenna relays to the Decoder's output, automatic antenna selection is possible, relieving the operator of this task.

Light emitting diodes (LEDs) on the front of the decoder indicate the band in use. If the transceiver is on a WARC band, both adjacent LEDs will light. For example, if the rig is on 30 meters, both the 40 and 20 meter LEDs will light. A seven position manual bandswitch is provided to override the input signals or to manually select antennas if the rig is not available for some reason.

The basic Band Decoder provides NPN outputs, which switch the negative side of the external relays to ground. External relays which require a source of 12 Vdc to operate rather than a switch to ground can also be controlled. In this case, the Band Decoder must be fitted with the *Source Driver Modification* described later in this manual.

The Band Decoder may also be attached to a computer running software which sends the current band information to the computer's LPT port. Latest versions of CT by K1EA, TRLog by N6TR, NA by K8CC, and LogEQF by N3EQF support this feature, which is useful if you have a Kenwood transceiver. Consult your transceiver and software manuals on how to interface your radio to the computer and how to enable the software's antenna control feature.

Finally, a transistor is included in the Band Decoder to provide a CW keying signal to the transceiver. This transistor may be driven by the contest logging software to provide memory keyer functions for contest operations.

Circuit Description

The schematic of the Band Decoder is shown in Figure 1. The schematic represents a decoder which has been fitted with the *Source Driver Modification*, which will be described later.

All components except the input/output connectors and bandswitch are mounted either on the decoder board or source driver (SD) printed circuit boards.

The decoder accepts a four bit binary-coded decimal (BCD) word at TTL levels and decodes it at U1 (a BCD-Decimal Decoder). Data Bit A is the Least Significant Bit (LSB) and Data Bit D is the Most Significant Bit (MSB). All nine bands are decoded with 160 meters (BCD= 0001) decoding as Band 1 and 10 meters (BCD=1001) decoding as Band 9. The outputs of U1 go high to reflect that band in use. The following table indicates which U1 pin goes high for each possibility.

Band In Use	U1 Pin High
160	14
80	2
40	15
30	1
20	6
17	7
15	4
12	9
10	5

Seven of the U1 outputs are routed to U2, which contains seven N-channel Darlington pair transistor switches. The other two outputs are taken to two discrete N-channel Darlington pairs, Q1 and Q2. All nine switches function in the same manner. When their input goes high, their output switches to ground. All unselected outputs float at 12-13.8 Vdc, depending upon the actual power supply voltage.

The following table shows which U2 output pin (or Q1 or Q2 collector) is low for each band in use.

Band In Use	U2 Pin Low
160	11
80	12
40	13
30	10
20	14
17	Q2
15	15
12	Q1
10	16

The seven outputs from U2 are taken to the programming header, designated as U4. This is where you install either wire jumpers or diodes to program the outputs for your particular antenna farm. The header is removable to allow easy wiring or rewiring. (TIP: Put the header in a loose socket when soldering the wires or diodes. This will prevent the pins on the header from wandering when the soldering pencil heats the connection.) Outputs from Q1 (12 meters) and Q2 (17 meters) do not pass through the programming header. Any programming of these lines must be done externally to the decoder, as is shown in the examples later in this manual.

Several examples of how to install diodes and wire jumpers for typical antenna configurations are shown in Figures 2a-f. The outputs from the programming header are routed to output connector J2 for connection to the external antenna relays.

The manual bandswitch has seven positions, an AUTO and positions for the normal contesting bands 160 through 10 meters. In AUTO, the base of Q3 is grounded, turning Q3 off. When the switch is rotated off of AUTO, Q3 base goes high, turning on Q3, which connects the inputs of decoder U1 to ground through isolation diodes D1-D4. This drives the decoder inputs to all low, which effectively disables the decoder function. The bandswitch provides the switch to ground for the six contesting bands. The LEDs will follow the position of the bandswitch.

The Band Decoder requires a 12 Vdc nominal supply. The power connection can either be made at the 2.5 mm coaxial connector on the rear panel or via input connection J1 Pin 12. Diodes CR1 and CR2 isolate these two sources to prevent circulating currents in case voltage is applied to both inputs simultaneously.

Transistor Q4 is provided to CW key the transmitter. Inputs to this transistor are on J1 Pins 1 and 17, and conform to the circuit shown by K1EA in his CT manual. The key line is available at an RCA connector on the rear panel of the decoder.

Source Driver Modification

When installed, Source Driver IC U5 provides a 12 Vdc nominal source to energize external relays. This may be useful to control remote relays from Ameritron and DX Engineering. The inputs to U5 behave just like a normal relay coil being switched to ground. This means that programming for the source driven outputs is done on U4 in exactly the same manner as if the relays were actually being switched directly by U2. However, if for any reason programming diodes need to be placed externally of the band decoder enclosure, then they must "point to" the source driven relays.

Input Cable Considerations

Yaesu Transceivers

A cable must be made to bring the four band data bits and reference ground from the rig to the decoder. This information is available at the Band Data Jack on the rear of the radio. There are three very important points to be aware of when constructing this cable:

1. The Band Data Plug is Non-Standard. This non-standard 8-pin DIN plug is available from your local radio store or from Yaesu or Kenwood. If you attempt to insert the wrong 8-pin DIN plug into the radio, you will damage the jack.
2. The Band Data Jack Carries Non-Standard Pin Numbering. Yaesu for some unknown reason have adopted a different pin numbering scheme for their Band Data Jack. When making the cable, refer to Figure 2a of this manual. Wire it exactly as shown. Do not worry that the pin numbers on the plug do not match that shown in Figure 2a.



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3. A Jumper is Required Between Pins 3 and 8. There is a slide switch inside the radio which detects that a plug has been inserted into the jack. A contact on this switch opens upon plug insertion, and this opening acts to defeat transmitter output. Placing a jumper between Pins 3 and 8 remakes the circuit, enabling transmitter output.

If desired, the radio can supply power to the Band Decoder and relays. In this case, an additional wire needs to be included in the cable. Be aware that this power supply line is generally not fused, and damage could result to the radio from a short circuit in the external circuitry. For this reason, **Top Ten Devices does not recommend using the transceiver as the source of power for the decoder and relays or other external devices.**

Computer Control

If the decoder is being driven by a computer running CT by K1EA or TRLog by N6TR, a standard 25 wire DB25M-DB25M cable of any convenient length can be used to connect the computer's LPT port to Band Decoder Input J1. Band data and transmitter keying signals are landed on the proper decoder input pins.

If you are using NA by K8CC or other software that provides band data on the computer LPT port, a separate cable will need to be made. Consult the software manual for instructions.

Typical Applications

Several typical installations are shown in Figures 2a-2f (Yaesu radios) and Figure 3a (computer control). These few examples are shown to illustrate the necessary cabling and programming for fairly typical configurations. There are countless other variations.

In applying your Band Decoder in your automatic antenna selection configuration, you should be aware of the following considerations:

1. The source of power for the decoder and relays can either be from the radio or an external supply. Top Ten recommends that an external supply be used, as shown (and required) in Figure 3a. Use the provided 5.5/2.5 mm OD/ID coaxial plug.
2. The decoder can be "programmed" to select various combinations of antennas. A programming header is provided inside the decoder for conveniently locating diodes or wire jumpers. However, programming may be done externally as well, and in fact may be required (see Figure 2e).
3. The Top Ten Devices band decoders provide individual band outputs for use in **automatically** activating external antenna relays and other devices. By making antenna selection automatic, the operator is relieved of this chore, and can focus his attentions on working the contest or chasing that rare DX station. However, to truly

relieve the operator of any worry, it must be assured that there is no way for the automatic controls to select an antenna which is not resonant. Several simple examples will illustrate the point.

The simplest configuration to imagine is one with a single monoband antenna for each band, as shown in Figure 2a. Wired as shown there is no way possible for the system to select an improper antenna.

However, to complicate the example, let us assume that a 5 band trapped vertical antenna is being used as the primary antenna on 80 meters, but the operator would like to be able to access this antenna as a back up for the 10-40 meter bands. The operator might be tempted to place a manual coaxial switch in the line to select the 5 band vertical vs. the balance of the station antennas. The problem with this approach is that if the op forgets to return the switch to its normal position before a QSY to 160 meters, he may inadvertently apply 160 meter power to the vertical and damage one of the traps. This hybrid of partly automatic and partly manual antenna selection is consequently somewhat dangerous, since the operator will quickly become accustomed to the automatic controls and may forget about the manual switch.

In this latter case, by eliminating the manual coax switch and application of programming diodes and external manual control switches, **it is possible** to allow manual access to the 5 band vertical while on 10, 15, 20, 40, or 80 meters while preventing its access on 160 meters. While this may appear to be considerably more complicated than just inserting a manual coaxial switch, and it is, Top Ten recommends that the extra effort be made to properly configure the station for fully automatic selection of a resonant antenna.

Regardless of how complicated the station antenna farm is, it is definitely possible to implement a switching scheme which will positively assure that a resonant antenna is received when you switch bands. It is hoped that the fundamental concepts regarding "programming the decoder outputs" described elsewhere and shown in the various examples will provide the necessary knowledge to allow the operator to tackle the more challenging configurations. Discussion of these scenarios is beyond the scope of this manual.

4. Antenna relays and bandpass filters, such as those available from Dunestar and ICE, can be switched simultaneously by a single decoder, as is shown in Figure 2e. The only limitation is that the total current that U2 is required to sink not exceed 500 mA, which represents over 10 standard Top Ten antenna relays. If the Source Driver modification is fitted, total U5 current must not exceed 400 mA. Be careful that your relays are really rated at 12 Vdc nominal and are wired appropriately (sink versus source).

5. ALWAYS test your circuit with a continuity checker first, prior to application of any RF power. Most DVMs have a "bell" which can be conveniently used to verify that the proper relays pick up on the various bands. NEVER use RF power to check out your relays.



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Limited Warrantee

Top Ten Devices warrants this unit to be free from defects in parts and workmanship for a period of one year. The unit will be either repaired or replaced, at our discretion. The only cost will be the cost of return shipping. If repairs are required during the warrantee period for other than manufacturing or parts defects, an estimate of the repair cost will be provided prior to repair.

Top Ten Devices is not responsible for any consequential damages to other equipment or personnel injury as a result of using this product, or any of the suggested uses.

If the terms of the above Warrantee and Limitation of Liability are not acceptable, please return the unit to Top Ten Devices for a full refund.

Specifications

Power Supply Voltage	+12 to +15 volts dc
Current required (no relays).....	10 mA
Output current capability	
Sink driver (U2-U1N2003A)	500 mA
Source driver (U5-UDN2580A)	400 mA
Output open circuit voltage	
Sink driver (U2-U1N2003A)	50 V max
Source driver (U5-UDN2580A)	25 V max