

Specifications:	I/F TX Input	28MHz - 144MHz Up to 3Watts Maximum Input
	TX/RX Delay	200mS 10uF Capacitor / 10kohm Resistor
	Switched Inputs (PTT)	+12v to TX (FT290R) 0v to TX (IC202) RF Sensed RX/TX Switching
	Switched Outputs	Delay1, RX +12v, TX 0v (RX Power supply) Delay2, RX 0v, TX +12 to 28v (Coaxial Antenna Relay) Delay3, RX 0v, TX +12 to 28v (Power supply to TX Power Amplifier) Delay4, RX 0v, TX +12v (TX Stages Power supply)
	Power supply	Voltage required +12v (J5) Current, RX mode 40mA, TX mode 70mA (Includes Relay)

DESCRIPTION: The complete Sequencer is built on a single 55 x 90mm size PC board & should take around 4 hours to construct. This Sequencer has been designed to fully control a Transverter & various other components like, antenna relays, power amplifiers & preamplifiers etc. High powered stations with GasFET preamplifiers generally require proper sequencing of the RX to TX, & TX to RX switching so that preamplifiers & relay contacts are not damaged. The general sequence used to switch from RX to TX is.....

1. Turn off the RX stages but leave the local oscillator running (Delay1.)
2. Energize the antenna coaxial relay (Delay2.)
3. Apply power to the TX Power Amplifier Enable (Delay3.)
4. Apply power to the TX Exciter/Driver stages (Delay4.)

The sequence from TX to RX is the complete opposite. The Sequencers PTT interface accepts either a voltage from the antenna connector of a modified FT290R/IC202, or when a DC control voltage is not used, a RF sensing circuit detects when RF is applied to the **J1** input from a 10, 6, or 2meter Radio. Alternatively either 0v or 12v TX can be directly applied to connector **J12** of the PTT circuitry for switching. A 12volt relay is used to switch the **J1** I/F Transceiver connection through to the RX **J3** & TX **J4** Transverter I/F connections. In RX mode the relay is turned off allowing RX I/F signals from the Transverters RX I/F output to pass from **J3** via the Relay to the radio on **J1**. In TX mode, the Relay is turned on by applying +12volts to **J2**, RF from the Radio up to 3Watts into **J1** passes via the Relay to the TX output **J4** to be routed to the TX I/F input on the Transverter board. The two back to back 1N4148 Diodes in the RX I/F protect the Transverter RX I/F stages from RF when the Transceiver initially goes to TX mode. Resistor attenuators are used in the RX and TX I/F paths to allow adjustment of the TX drive to the Transverter, (up to 3Watts) in TX mode, and RX gain in receive mode depending on the gain used in the Transverters receiver (i.e. extra GasFET RF Preamps), and the sensitivity of the Radio that is being used. The Coaxial Relay & PA enable switching transistors, Delay 2 & 3, to allow the use of voltages other than +12volts for switching. Most commonly available SMA microwave relays are often 28volts, so a 28volt switching power supply can easily be connected to the sequencer PC boards **J9** or **J10** connections.

CONNECTIONS:

- J1** I/F connection to the Radio Transceiver (28 - 144MHz Max RF input 3Watts)
- J2** Connected to the onboard Relay, (+12v TX on J2 switches the Relay on). Normally connect J2 to J8
- J3** RX I/F connection to Transverters RX Mixer output.
- J4** TX I/F connection to Transverters TX Mixer Input (0dBm 1mW Maximum)
- J5** +12 Volts to Sequencer circuitry, & voltage supply to Delay 1 & Delay 4 Transistors
- J6** Delay4 output +12volts in TX, (Normally connects to Transverters TX exciter stages)
- J7** Delay1 output +12volts in RX, (Normally connects to Transverters RX stages).
- J8** Delay2 output +12 or +28volts in TX, (Normally connects to Coaxial Antenna Relays).
- J9** Voltage supply to Delay2 switching transistor, (Normally connected to +12 or +28volts, depends on relay voltage)
- J10** Voltage supply to Delay3 switching transistor, (Normally connected to +12 or +28volts, depends on PA Volts)
- J11** Delay3 output +12 or +28volts in TX, (Normally used for PA enable on TX to high powered amplifier)
- J12** PTT Interface options, the connections depend on the type of Radio Transceiver used.

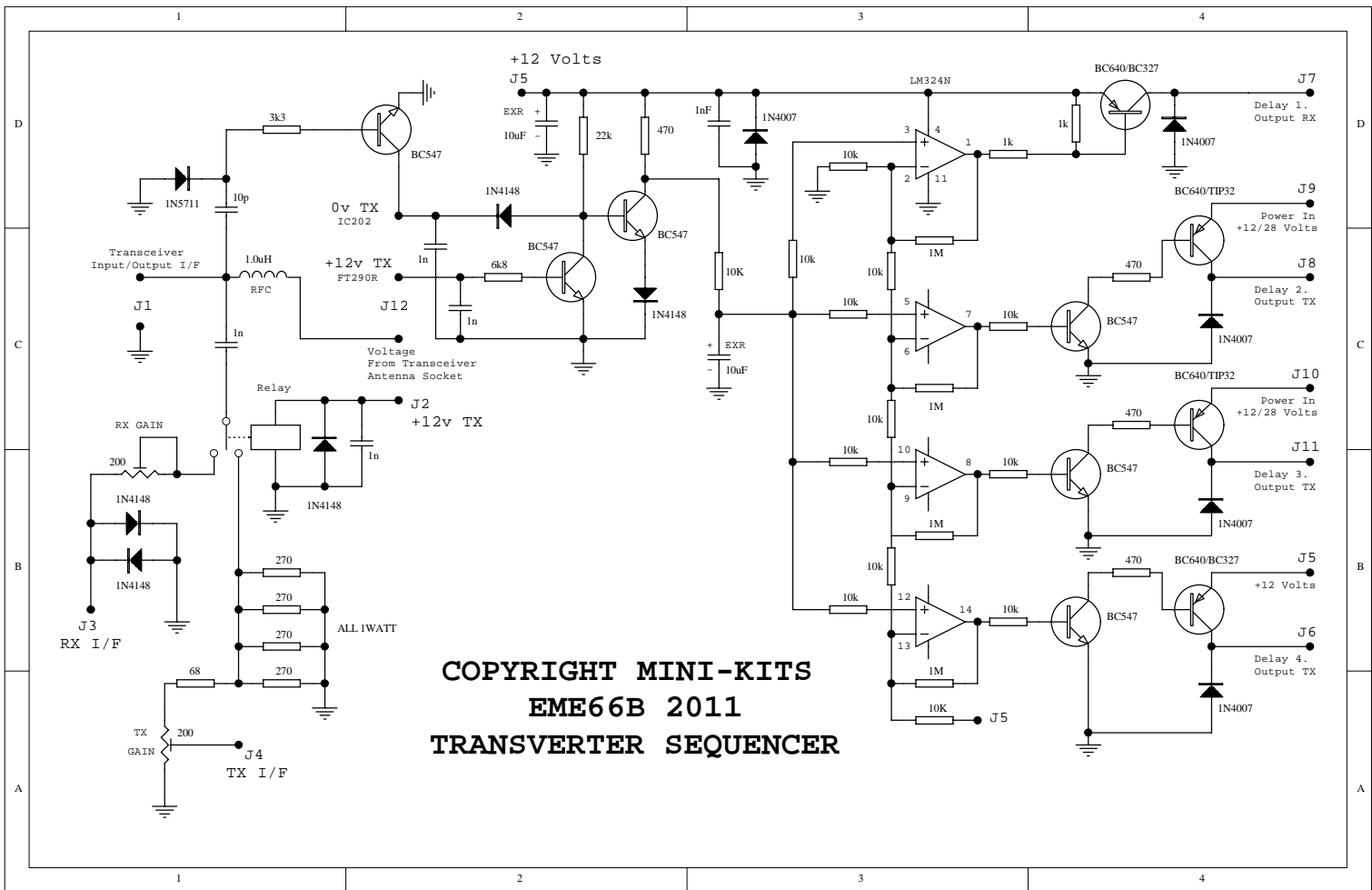
TRANSVERTER SEQUENCER KIT EME66B

CONSTRUCTION:

1. The PC board supplied is a professional plated through hole board, so all pads shown as black dots on the overlay diagram, are connected directly to the top ground plane of the board for earthing. These connections do not have to be soldered on the top ground plane of the board.
2. The components can be mounted onto the PC board in any order, refer to the PC board overlay & circuit diagrams. **Leave the BC640/TIP32/42 switching transistors until last & refer to the additional construction notes section below. 0.9mm PC Board pins are mounted in the holes on the PC board to solder the switching transistors to. This allows the transistors to be easily replaced if they fail which could damage the PC board.**

ADDITIONAL CONSTRUCTION NOTES:

1. **One high current, & three lower current PNP transistors are supplied for the switching.** The RX Delay1 should only require one of the low current 1A BC640 Transistors. You will need to decide which transistors you want to use in the Delay2 to Delay4 TX circuits. The higher current 3A TIP32/42 would normally be used for either switching the Antenna relays, (Delay2) or Power to the Power Amplifier, (Delay3). The TX exciter stages, (Delay4) would normally only require low current up to a couple hundred mA. Depending on the current requirement from the RX & TX switched power outputs, will depend on whether the PNP power transistors will need Heat sinking. If you are using the Sequencer for controlling a low powered Transverter that doesn't require much current in RX or TX modes then, the PNP power transistors can normally be soldered directly to the PCB Pins on the board without a Heat sink. For higher current requirements you may have to extend the transistors leads & mount them onto a Heat sink. Remember to insulate the transistors from the Heat sink if you mount them this way. On Prototype Transverters, low cost Relays were used to switch the high current supplies, so Heat sinking of the transistors was not required. The design already incorporates diodes for back EMF across the switching transistors to directly drive relays.
2. The BC640/TIP32/42 transistors may require more base current to switch multiple relays etc. The 470ohm base bias resistor may need changing to a 220 to 270ohm 0.6w metal film type. The resistor should be positioned around 5mm off the top off the board due to the higher heat dissipation.
3. The PC board should be mounted either in a metal box, or shielded from the RF stages in the Transverter. Holes can be drilled in the side of the box for plastic solder posts, or feed through capacitors for the various power connections to & from the Sequencer board. Fit ferrite beads onto each of the wires to stop any RF from flowing on the wires.
4. Some of the newer Transverter designs operate on lower voltages typically 8 or 9 volts using low dropout voltage regulators. These voltage regulators will provide a regulated output when the input voltage is only around 1.5volts higher than the required secondary voltage. So a 9 volt regulator will provide a regulated output when the input voltage from a 12volt battery gets down to around 10.5volts. This allows portable equipment to still function correctly & produce good RF output power when the battery is getting down a bit. The output of the low dropout voltage regulator, e.g. +9volt type LM2940T-9, can be connected directly to the J5 pin on the Sequencer PC board. The Sequencer will quite easily operate on 9 volts, & this will provide switched RX & TX +9volt outputs on pins J6 & J7 for the Transverter.
5. The onboard Relay is normally operated by applying +12volts in TX mode to pin J2. For most applications it is suggested that Delay 2 is used for controlling the Relay by connecting pin J2 to J8, & J9 to J5.
6. If you require a switched +28 volt output to drive a coaxial or microwave SMA relay in TX mode, connect a 28 volt power supply to pin J9 on the PC board. In TX mode 28 volts will be present on pin J8 to switch the relay. The onboard DS2E/Y 12 volt relay, will then require a resistor to drop the 28volts down to 12volts.
7. LED indicators can be mounted on the box & connected to the various power supplies to show that everything is working OK. Bear in mind that they draw current so you might only want to connect up a couple LEDs for RX & TX indicators.
8. All RF connections to & from the PC board should be made using mini 50ohm Teflon coax. Either BNC or SMA connectors could be mounted on the box for the RF connections. Make sure that you use good UHF techniques when connecting the coax to the connectors. Poor 50ohm termination's may cause RF to propagate into the Sequencers circuitry.
9. Check your construction carefully to ensure that you have no shorts, solder dags etc before any power is connected.



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TESTING:

Before connecting the Sequencer to any Transverter or other circuitry, test the power supply outputs for correct operation. Measure the Delay 1 to 4 outputs for the correct voltage in RX mode. +12volts should only appear on the Delay1 output, all others should be 0 volts. Connect the 0v TX connection to ground to activate the circuit & re-measure the voltages & confirm that the Delay1 is now 0 volts & Delays 2 to 4 are now +12/28volts. If you have LEDs connected to each output then you can confirm the sequencing delays when switching from RX to TX modes.

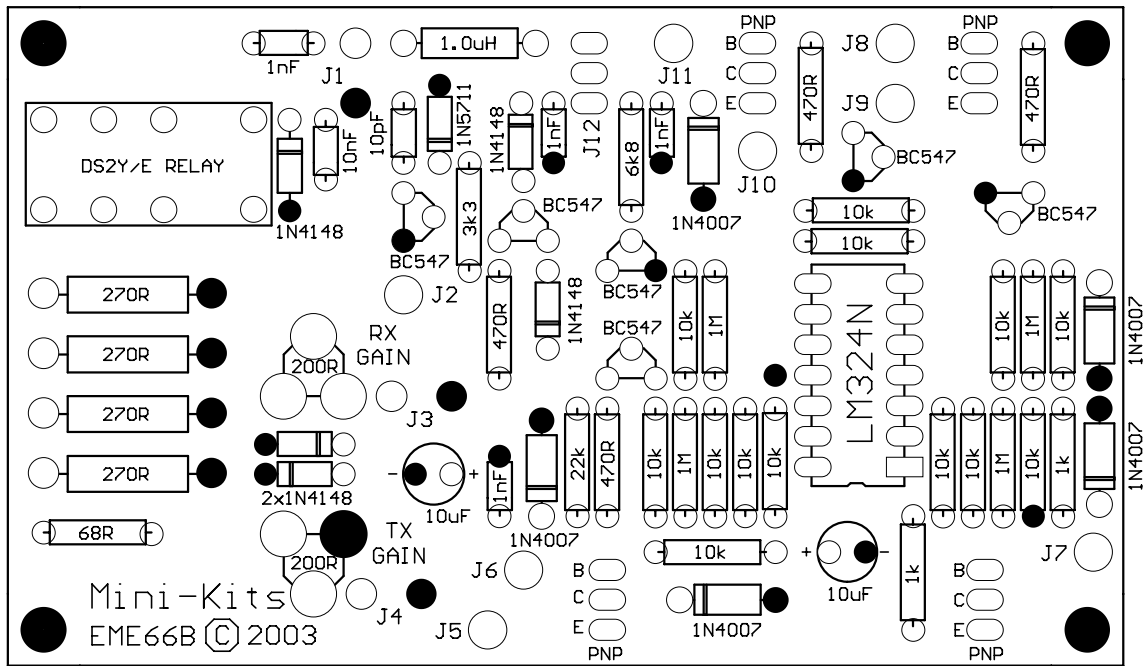
OPTIONS:

1. When using the RF sensing on SSB mode, extra delay will be required so that the relay does not chatter between words. Fit the supplied 470uF capacitor from the 0V TX connection on the board to ground.
2. The Sequencer has been used successfully with a 432MHz Transceiver. Losses on receive are expected to be higher but probably not an issue if there is enough gain in the Transverter. Relay isolation is also expected to be lower which should not be an issue when using less than 5 watts.

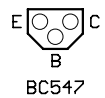
PARTS LIST:

RESISTORS		SEMICONDUCTORS	
1 x 68R	1/4 Watt Resistor	5 x 1N4148	Diode (Orange Black Band)
4 x 470R	1/4 Watt Resistor	5 x 1N4007	Diode (Black Silver Band)
2 x 1k	1/4 Watt Resistor	1 x 1N5711	Schottky Diode (Blue Black Band)
1 x 3k3	1/4 Watt Resistor	6 x BC547/8	NPN GP Transistor
1 x 6k8	1/4 Watt Resistor	1 x TIP32/42	PNP Transistor 3A (Sub BD204)
13 x 10k	1/4 Watt Resistor	3 x BC640	PNP Transistor 1A (Sub BC327)
1 x 22k	1/4 Watt Resistor	1 x LM324	IC Quad OP Amplifier
4 x 1M	1/4 Watt resistor		
4 x 270R	1 Watt Resistor		
TRIMPOTS		INDUCTORS	
2 x 200R	TPV 5mm Trimpot Resistor	1 x 1uH	RF Choke (Brown Black Gold)
CAPACITORS		MISCELLANEOUS	
1 x 10pF	Ceramic Capacitor	1 x PC Board	EME66B
4 x 1nF	Ceramic Capacitor	1 x Instructions	EME66B
1 x 10nF	Monolithic Capacitor	1 x Relay	NAIS 12volt DS2E-S-DC12
2 x 10uF	EXR Electrolytic Capacitor	14 x Pin	0.9mm PC Board Pin
1 x 470uF	EXR Electrolytic Capacitor	1 x 3 Pin	DIP Header Socket
		6 x FB43-101	Ferrite Beads
		For Product Support, Visit the Mini-Kits WEB site.	
		www.minikits.com.au/kithelp.html	

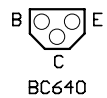
Top PC board Overlay Diagram © 2011



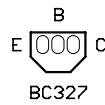
TOP VIEW



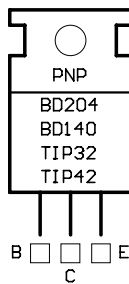
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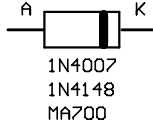
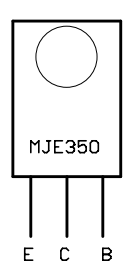
TOP VIEW



FRONT VIEW



FRONT VIEW



● = Plated Through Holes