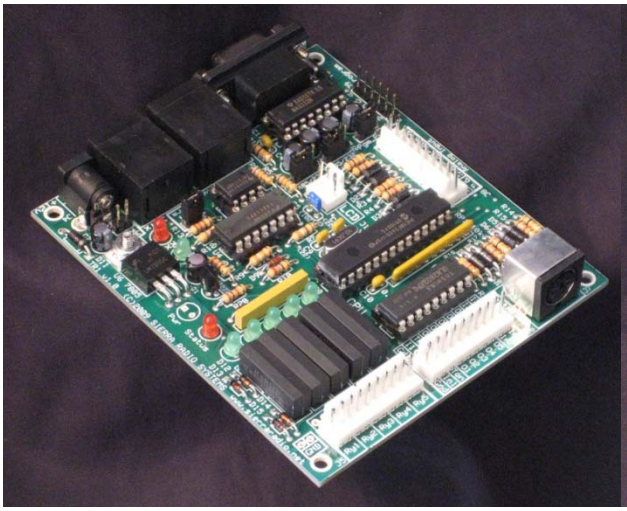
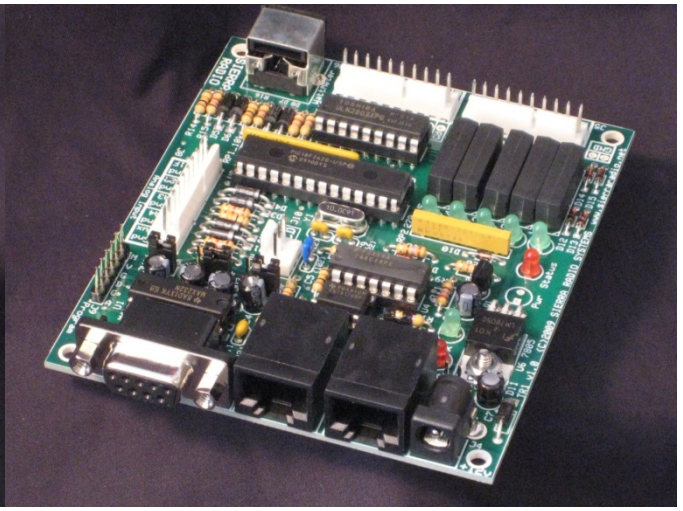
TR1 - Transmit / Receive Sequencer





Overview

The TR1 transmit / receive sequencer is designed to allow the smooth operation of amateur radio stations where several devices must be switched on or off in the transition from transmit to receive and back. Sequencers are used in HF contest, microwave weak signal stations, VHF/UHF roving, Dxpeditions and just about amateur station. The TR1 is a microprocessor controlled sequencer that offers precise timing between each output transition.

Features

-2 trigger inputs (active pull to ground)
- 1 input inhibit (optional, active pull to ground) that stops the sequence the sequence
- 5 open collector outputs - active pull to ground. Sinks up to 500 ma.
- 5 SPST high speed reed relays that provide dry contact switching up to 500 ma.
- Each relay is driven by one of the 5 outputs
- Sequence timing is set via serial interface from the computer.
- Individual turn on and turn off delays between each output event.
- Output delay is programmable from 1 to 5000 milliseconds.
- All configuration parameters set via serial port using our PC program or dumb terminal
- All configuration parameters stored in on-board flash memory
- 4 Analog inputs that can measure a DC voltage from 0 - 30 VDC in 0.1 v increments.
- Analog inputs support a Wavenode directional coupler for automatic high SWR shutdown
- LEDs on all outputs to monitor output state, status LED tells you that the unit is in operation
- Manual serial commands allow you to set any output state, query state, read A/D voltages, etc.
- Built in RS485 serial network running on standard CAT5 cable for multi unit installation (contest stations)
- Power over CAT5 cable to allow remote location / remote control from the PC graphic user interface
- Runs on 6 or more VDC and draws about 40 - 120 ma. depending on relay state. 2.1mm DC coaxial connector.
- 3 IO connector blocks are common Molex 10 pin (in line) 0.1" spaced male header connectors with locking ramp.

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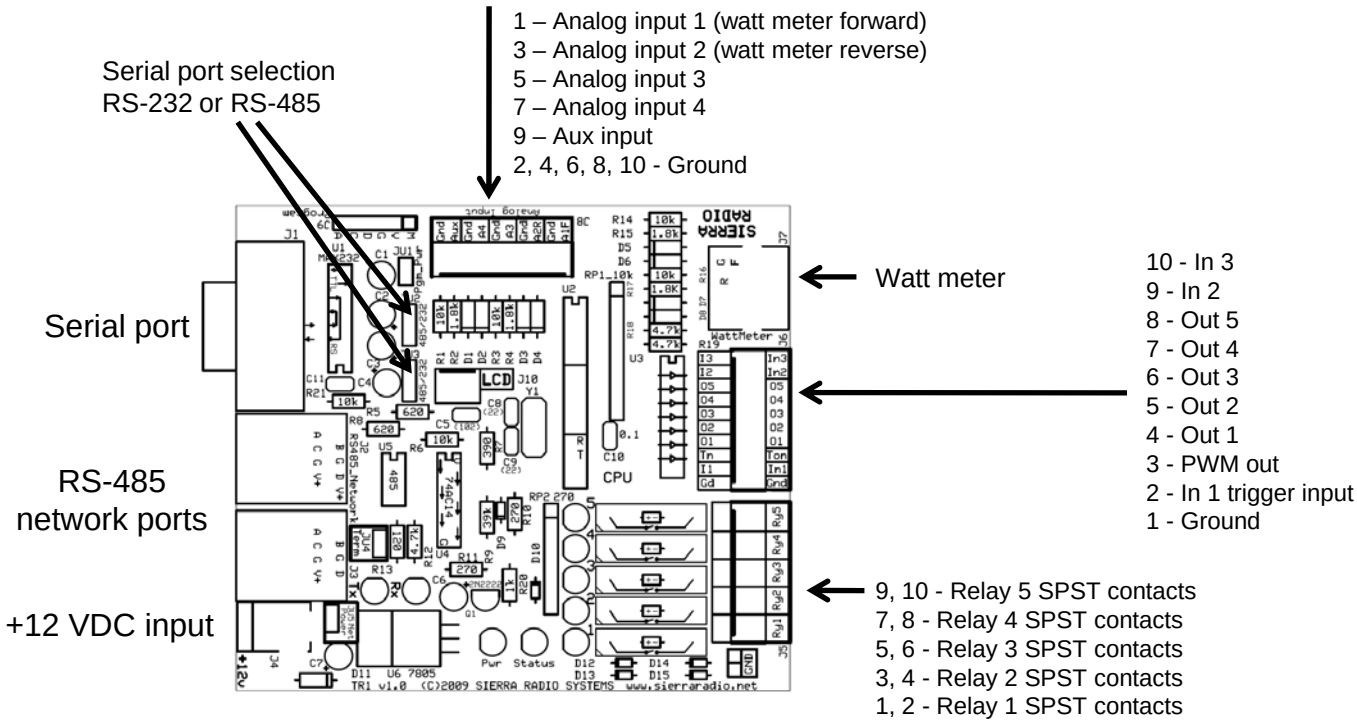
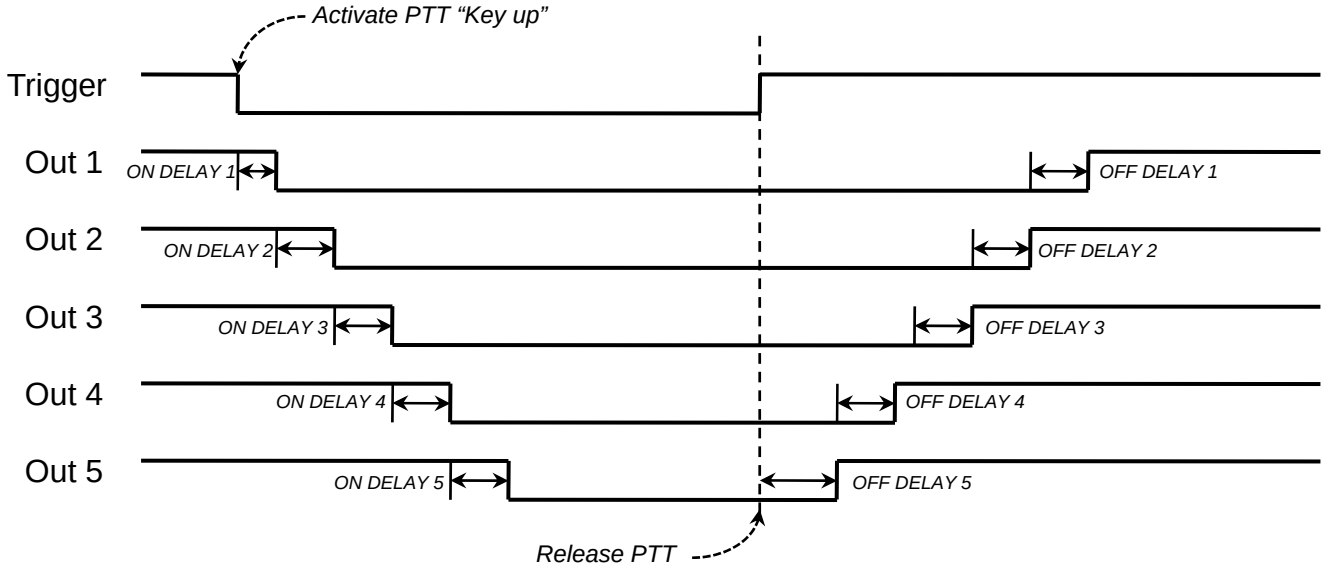
TR1 Connections



Timing Diagram



For more details go to

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TR1 Basic Installation and Setup

Hardware setup

The minimum connections are the +6 to +12 VDC input power, a trigger input (In1) and 1-5 open collector outputs (Out1 … Out 5). The sequencer will run very cool with a 6-8 volt power source. When running all outputs on for long periods of time and supplying 13.8 VDC, the regulator will get hot. This is OK but for a high reliability contest station, we recommend keeping the supply voltage between 6-8 volts. When the trigger input is pulled to ground, the TR1 will begin the transmit enable sequence. Between every output transition, there is a software programmable time delay. These delays are called “on delay 1”, “on delay 2”, etc. When the trigger input is released (pulled high), the sequence will reverse. First waiting for “off delay 5”, then “off delay 4” etc until the TR1 is back in its normal, standby mode waiting to be triggered again.

The TR1 primary trigger input should be connected to a signal that pulls to ground on transmit. This is typically the PTT button of a microphone, the output of an electronic keyer or the contacts of a CW key.

The open collector outputs #1 through #5 are active pull to ground signals and typically connected to relays or solid state keyed inputs.

Software configuration

When using the TR1 in the normal configuration, connect a serial interface cable between the TR1 board and the computer. All configuration parameters can be set by using a dumb terminal or through the TR1’s configuration program.

When the TR1 board is powered up, it will display the current operating parameters on the config program or send them to the dumb terminal. The default on/off delays are 100 ms between activating or deactivating the outputs. If you need different delays, simply enter the values in the config program or type the command followed by the delay in ms.

For example, to set the delay from initial trigger input pulling to ground and the first output going low after 50 ms., enter:

```
//ONDELAY01 50
```

The command is composed of “//” followed by “ONDELAY” followed by a zero “0” followed by the output number “1” to “5”, followed by a space then the value of the delay in milliseconds. The zero in the middle is used to maintain command compatibility with devices that support more than 9 outputs.

The corresponding off delay is a similar format, for example an off delay of 200 from the 4th output to the 3rd output would be:

```
//OFFDELAY03 200
```

The initial characters “//” are used to tell the TR sequencer that a new command follows.

Note that if the command is not entered exactly right, nothing will be executed and you will not get any indication from the TR sequencer that you entered a bad command. To check the current configuration you can enter the “status” command

```
//status
```

This will list all current operating parameters.

Once you have set the operation parameters you want to keep, enter the “save” command and all current operating parameters will be written to the on-board flash memory and will be reloaded automatically the next time the TR sequencer is powered up.

```
//save
```

That is all you really need to know to get your TR sequencer up and running.

Advanced User Commands

Advanced sequencing and Io control commands

The TR1 has many commands that can be used to set various operating parameters beyond the basic setup commands. These commands follow the same syntax as the basic commands.

`//enable x`	Enable output x (1-5)	Default is all outputs enabled
`//disable x`	Disable output x (1-5)	

Enables or disables output x in the sequence. If an output is disabled, when it comes time to transition the output to pull to ground, that output will be skipped and left in a floating state as if it did not exist.

`//normalon`	Turn on sequence order set to 1, 2, 3, 4, 5 Default
`//normaloff`	Turn off sequence order set to 5, 4, 3, 2, 1 Default
`//reverseon`	Turn on sequence order set to 5, 4, 3, 2, 1 (opposite of `//reverseoff`)
`//reverseoff`	Turn off sequence order set to 1, 2, 3, 4, 5 (opposite of `//reverseon`)

The normal/reverse on/off commands let you change the order of outputs turning on and off with a single command. This is used in very limited cases and the default should be used for typical applications.

`//out0x on`	Turns on output x (1-5)	Example: "`//out04` on" turns out output 4
`//out0x off`	Turns off output x (1-5)	

The //out commands allow you to manually force an output to the on or off state. This is helpful for testing individual output signals.

Build in CW Keyer

The TR1 has a built in CW keyer that will take a command string and send it in CW. This is not used in normal TR sequencing, it can be handy for some applications. When the TR1 is set to "keyer" mode, output 5 will send a string of characters in CW.

`//keyer on`	Turns on keyer mode
`//keyer off`	Turns off keyer mode, back to TR sequencer mode
`//cw xxxxx`	Sends the string xxxxx in CW to putput #5
`//wpm xx`	Sets the CW speed to approximately xx words per minute

For example:
`//cw cq cq cq de k6abc` will send the characters "CQ CQ CQ DE K6ABC" to output $5

Advanced User Commands

Analog Inputs

The TR1 has 4 analog inputs which are constantly being monitored. Each input can measure a slow moving DC voltage between 0 and 30 VDC in approximately 0.1 volt increments. In normal operation the analog inputs are not used, however they can be used determine if the TR sequencing should be allowed to continue or be inhibited. The behavior of the TR sequencer is set by the following commands.

`//rad`	Read and display all A/D input values.

Interactive command to read the current values of the 4 A/D converters.

`//ad1min x.xxx`	Set minimum acceptable voltage to x.xxx volts (0-30 VDC)
`//ad2min x.xxx`	Set minimum acceptable voltage to x.xxx volts (0-30 VDC)
`//ad3min x.xxx`	Set minimum acceptable voltage to x.xxx volts (0-30 VDC)
`//ad4min x.xxx`	Set minimum acceptable voltage to x.xxx volts (0-30 VDC)
`//ad1max x.xxx`	Set maximum acceptable voltage to x.xxx volts (0-30 VDC)
`//ad2max x.xxx`	Set maximum acceptable voltage to x.xxx volts (0-30 VDC)
`//ad3max x.xxx`	Set maximum acceptable voltage to x.xxx volts (0-30 VDC)
`//ad4max x.xxx`	Set maximum acceptable voltage to x.xxx volts (0-30 VDC)

The adxmin and adxmax commands are used to set the min and max threshold voltage that is an acceptable operating range. If the sampled voltage drops below the minimum or goes above the maximum voltage, the TR1 will be put in an alarm condition. The default alarm sends a text message to the serial port. The TR1 configuration program constantly monitors the messages sent from the TR1 board. When the alarm condition is triggered, the configuration program will alert the operator.

The TR sequencer can also be set to inhibit sequencing based on an alarm condition.

`//adcal1 x.xxx`	Sets the voltage calibration offset for AD input #1 to x.xxx volts
`//adcal2 x.xxx`	Sets the voltage calibration offset for AD input #1 to x.xxx volts
`//adcal3 x.xxx`	Sets the voltage calibration offset for AD input #1 to x.xxx volts
`//adcal4 x.xxx`	Sets the voltage calibration offset for AD input #1 to x.xxx volts

Due to variations in component values on the input voltage divider, each AD input may report a slightly different voltage value. These variations are typically up to +/- 10%. To offset these variations, the user can optionally add an offset to each AD converter input. The offset value should be between -30.0 and +30.0 volts but are typically less than one volt.

Advanced User Commands

Using a Wavenode directional coupler

Wavenode makes a very nice high speed digital wattmeter. They interface their wattmeter to the feed line with a directional coupler that is used to sample the forward and reflected voltages on the feed line. The 6 pin mini-DIN connector is plug compatible with the Wavenode directional couplers. This means that you can monitor the forward and reflected voltages on the feedline while operating the TR sequencer. While the TR1 is not designed to be a highly accurate wattmeter, it can be used to detect a disconnected antenna or other major antenna system failure. All that is required is the coupler. Analog input #1 is connected to the Wavenode forward power to the antenna and analog input #2 is connected to the reflected power of the coupler. When using the mini DIN connector for the coupler, do NOT connect any other inputs the 10 pin analog input header connector pins 1 or 3. These are the normal pins used for analog input 1 and 2 respectively.

`//wm off`	Turn off monitoring the coupler. Regular analog input monitoring
`//wm on`	Turn on monitoring the coupler.
`//wm custom`	Turn on monitoring the coupler and use the custom trigger voltage.
`//wmlimit x.xxx`	Set the custom trigger voltage to x.xxx

When the "//wm on" condition is set the TR1 reads the forward and reflected feedline voltage. When the reflected voltage is equal to or greater than the forward voltage, the TR sequence will be inhibited.

While this is not a very accurate mode, it is a quick way to check to make sure there is no major antenna system failure like a broken feedline, missing antenna or loose connector.

To calibrate the watt meter checking mode, set the limit voltage with the "`//wmlimit x.xxx`" command and set the mode to customer with the "`//wm custom`" command. This will interrupt the TR sequence when the reverse voltage is above x.xxx volts. To determine the proper value, you should put a digital voltmeter on pin 3 of the 10 pin analog input connector. Transmit into the coupler to the antenna. Reproduce the effect you want to use when you want to inhibit the TR sequence. Note the voltage and enter that value with the "`//wmlimit x.xxx`" command.

Configuration save, restore and status commands

`//save`	Take the current operating parameters and saves them to flash memory.
`//load`	Take the operating parameters stored in flash memory and loads them into the working variables.
`//reset`	Reset all operating parameters to the default state.
`//reboot`	Soft reset. Restarts the TR sequencer after loading parameters from flash memory.
`//status`	Lists all operating parameters in human readable form.
`//ping`	Checks to see if the TR sequencer is working. Returns the health, and network address.
`//state`	Returns the current values of the outputs, analog inputs, and other operating state. Uses the networked addressed format.

Advanced User Commands

Unofficial Commands

These commands are used for system testing and software development. These commands may come and go with various versions of firmware.

`//eyecandy`	Force outputs to turn on and off in sequence causing the LEDs to chase back and forth.
`//srdebugon`	`Generates a lot of messages used to debug the software`
`//srdebugoff`	Turns off debug messages
`//netdebugon`	Turns on network traffic debugging
`//netdebugoff`	Turns off network traffic debugging
`//forcefail`	Forces the TR sequencer into an inhibited state and will not accept commands until a hardware reset.
`//echo xxxxx`	Returns the payload xxxxx with full addressing
`//msgdirect`	Sets messaging mode to direct
`//msgnet`	Sets messaging mode to network

Advanced Applications

Multi-Unit Network Configuration for Contest Stations Using the SierraBus

The TR1 supports multiple units on a twisted-pair local area network called the SierraBus. The SierraBus network uses the RS485 half duplex signaling interface. This allows several units to be multi-dropped off the same pair of wires. The SierraBus uses common CAT5 ethernet cable and RJ45 connectors for the physical network cable. In addition to the two wires used for data, the SierraBus also provides a hardware carrier detect signal, ground and power. The SierraBus allows you remotely locate TR1 board anywhere along the bus cable for a really distributed network. Power must be supplied at one node and all TR1 board maybe powered from the network or locally with its own power adapter.

In an SierraBus networked configuration, the serial commands to configure and control the TR1 boards are sent in an addressed packet format. Every node on the network has a unique address and error detection is built into the protocol.

Device address assignments

00	Master PC
01 – 15	TR sequencers #1 to #15
16 – 98	Reserved
99	Broadcast to all devices

Network commands

`//net`	Puts the TR sequencer in network address mode
`//local`	Puts the TR sequencer in local (direct) address mode (default)

`//setaddr xx` Set TR sequencer board network address to xx

All TR1 boards come pre-programmed with an address of 1. The user can select any address between 1 and 15. Legal values are 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15. No leading 0 is required for addresses from 1 to 9.

`//getaddr` Return the current address set in the TR1 board.

`//silent on`	Turns off messages
`//silent off`	Turns on messages

When various commands are executed, the TR1 board will reply with various text messages. Putting the TR1 board in silent mode will suppress the generation of the messages. Commands will still be executed.

`//boot silent`	Turn off boot message.
`//boot verbose`	Turns on boot message.

When the TR1 board is powered up or rebooted, it will send a long message to the serial port listing all operating parameters. Setting the boot mode to silent will turn off the boot up message generation.

Recommended for network installations to minimize network traffic.