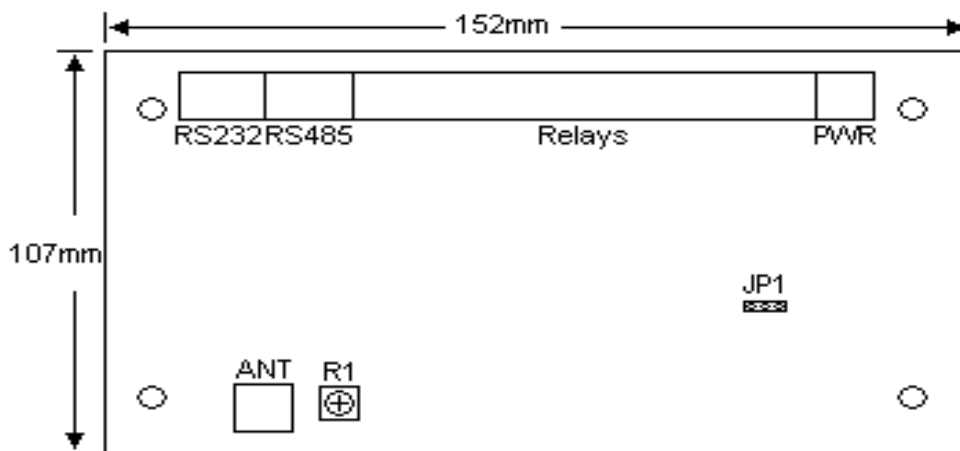


TROMR8

The TROMR8 is a RFID Programmable Relay Controller. Each tag read, new or pre-recorded in the on-board memory, activates up to eight 240VAC, 4A relays (256 combinations). Communications to and from the TROMR8 is via a RS485 and/or RS232 serial interface. The TROMR8 is used where different processes or actions must be taken automatically given different tagged items. Tags can be placed on totes, carrier sheets, or embedded in the item itself. It is perfect for conveyor belt routers, sorting conveyors, multi-product assembly lines, or anywhere automation is needed for multiple decision-action scenarios.



Specifications

Function	Reader/writer/decoder with 8 bit binary converter with relay output for passive 125 kHz ASK RF/64 Manchester 64 bit RFID tags such as the EM410x, Atmel E5xxx.
Communication Interface	Serial: 9600 baud, 8 N 1 RS232 RS485 Half duplex, Address 01 to FF, up to 32 devices per cable.
Relay Output	Eight 240VAC,4A relay, Life: mechanical: 20M, electrical: 100K
Antenna type	1.62 mH coil (calculated, see notes)
Read range	Antenna and tag dependent
Power requirements	24 VDC regulated, 250 mA max
Dimensions	152 mm x 107 mm x 19 mm (6.0 inches x 4.2 inches x 0.75 inches)
Operating temperature	-10 °C to +50 °C
Humidity	non-condensing
Connections	All connections are screw-type terminal blocks accepting wires AWG 30 to 14.

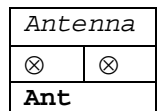
General Description

The TROMR8 board performs all functions necessary for reading RFID tags. It continuously powers, reads, and decodes transponders that are within its reading range. When an RFID tag passes within range of the reader antenna, the RF magnetic field generated by the reader powers the tag. The tag transmits its data and the board demodulates and decodes it. Depending on the programming of the TROMR8 the tag data packet may be transmitted via the serial interface; and one or more relays may be activated.

Connections

There are 26 terminal block screw connections. These can accept wire sizes from 30 to 14 AWG.

RS232		RS485			Relays												Power	
TX	RX	GND	B+	A-	GND	8	7	6	5	4	3	2	1	GND	+24V			
⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗			
Transmit	Receive	Common	Non-Inverting	Inverting	Common	CO	NO	CO	NO	CO	NO	CO	NO	Common (CO)	Normally Opened (NO)			



Power: Connect to +24V DC linearly regulated power supply. The maximum power requirement with all relays on is less than 250 mA.

Relays 1 – 8: Connect each relay to up to 220VAC, 4A load @ 25°C. There are separate ‘Normally Opened’ and ‘Common’ connections for each relay. At power up, all relays are opened (ie. off, no connection between NO and CO).

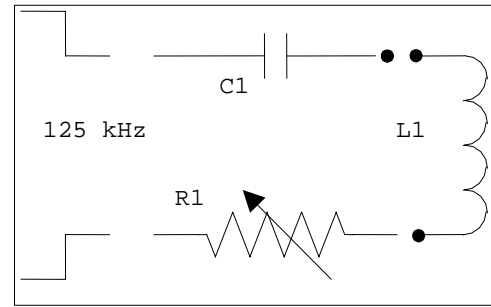
RS485: Connect A- to A-, B+ to B+ , and Commons. The TROMR8 has no collision detection. You must therefore ensure that only one device is transmitting at a time. Also ensure that each device address is unique on the network. Transmission from the TROMR8 is done on both the RS485 and RS232 interface at the same time. Jumpers JP6 and JP7, if connected, implement biasing (560 ohm) on the A and B line. Jumper J9 enables a 120-Ohm termination.

RS232: Connect RX to the TX of an RS232 device, connect TX to RX and connect Common to Common. Transmission from the TROMR8 is done on both the RS485 and RS232 interface at the same time.

Antenna: Connect to a tuned antenna.

Antenna Design

A single antenna is required for powering and reading the transponders. The antenna is used in a series-resonant circuit, formed by C1, L1, and R1. The board requires, based on calculation with the on-board 1nF capacitor, an antenna with an inductance of 1.62 milliHenries. Proper value and shape of the antenna are installation-dependent and must be determined by the user. The nominal resonant frequency is 125 kHz. To improve the reading range, the board will automatically adjust the driver's frequency to the resonance of the antenna circuit. The antenna can be a simple air-wound coil. As an example, the demonstration antenna is a 7" (18cm) diameter round antenna with 58 turns of 27 AWG wire. Its inductance is 1.5mH with 6 ohm DC resistance. The reading range is spherical around the antenna. Minimum and maximum read range is determined largely by the size of the reader and tag antennas



Quality Factor Adjustment

Adjusting the trimmer potentiometer, R1, changes the quality factor of the series-resonant circuit. Although increasing the Q factor of the circuit (by turning clockwise) will provide a slight increase in read range, it also increases the amount of spurious signal received. The boards should be individually adjusted with each attached antenna in their final environment.

Tag Data Transmission

When a tag is read, if serial transmission is enabled (S command), the TROMR8 will transmit via the RS485 and RS232 interfaces the tag's serial number. The data packet transmitted is comprised of: 1 start byte; a variable number of data bits depending on how the tag has been programmed; 2 checksum bytes; and one stop byte.

The start byte is always a ':' (58d, 3Ah). The 10 data bytes are an ASCII representation of the hexadecimal digits stored in the tag. The checksum is two bytes long. It is an ASCII representation of the 8-bit sum of the 10 data bytes sent. The stop byte is always an ASCII 'carriage return' (13d, 0Dh) and is followed by a 'line feed' (10d, 0Ah). An example of a transmitted packet (tag number is 2DEABE00FE) is:

3A	32 44 45 34 42 45 30 30 46 45	36 31	0D
:	2D E4 BE 00 FE	61	<CR>
<i>Start byte</i>	<i>ASCII codes of the data (5 numbers –10 digits)</i>	<i>Checksum</i>	<i>Stop byte</i>

Relay Operation

The 8 relays normally operate as the binary output/conversion for the last data byte of the last tag read. For instance, as in the above example, if the last byte of the tag is FEh (11111110b), then relays 8,7,6,5,4,3, and 2 will be turned on; relay 1 will be off. If the next tag has a last byte value of 32 then relays 6,5,2 will be on and relays 8,7,4,3,1 will be off.

To give maximum flexibility in using read-only, one-time-programmable, or read/write tags the TROMR8 implements several useful settings. Certain relays can be disabled so that no matter what tag value is read they will not be activated (command R). The firmware can be set so that only 'powers of 2' last byte values will activate the relays (command P). Therefore only 1 of 8 relays will be on at a time.

One-time-programmable or read/write tags can be written with a specific last byte to turn on specific relays. Or the TROMR8 can learn up to 256 read-only tags and only allow these tags to activate the relays. These pre-programmed tags can even be assigned different relay activation values than their last byte value (command L and T). For example tag number 4523FE10 could be assigned the value 00. In this case all relays would be turned off once it was read.

The relay's position can be set to remain on for either a given amount of time after the tag is read (command H and M) or until a different tag is read.

Setting up the board

The TROMR8 implements a simple command interface for modifying the different settings. These commands are received via either the RS485 or the RS232 serial connection. Settings are stored in an onboard EEPROM and are retained even while the board is un-powered.

To reset the setting to factory defaults, move jumper JP1 to position RST (right) and apply power momentarily. This will also **erase all preprogrammed tags** previously recorded. Remove power from the board and move Jumper JP1 back to the left for normal operation.

Command Description

All commands sent to the device are of the format:

>AACP[cr]

where:

>	=	Command start character ([>], 3Eh, 62d)
AA	=	Address of the TROMR8 device ([‘0’-‘9’, ‘A’ – ‘F’], 00h – FFh)
C	=	Command (see below)
P	=	Command parameters (see below)
[cr]	=	Command end character ([ENTER], 0Dh, 13d)

Note: All commands are upper case. The device address is 2 hexadecimal digits [00 – FF]. There are no spaces in the command string. An ‘X’ (58h) anywhere in the command string prior to the Command End Character will cancel the command.

After a command is received and executed, the TROMR8 will respond either with:

OK if the command was understood and executed without error

or

ERR if the command could not be understood or executed.

The commands are (firmware version 1.0):

A	(57h, 87d)	Set Device Address	(default: 01)
H	(48h, 72d)	Set Relay Latch Time	(default: 1000 ms)
L	(4Ch, 76d)	Learn/Record Tags	(default: none)
M	(4Dh, 77d)	Set Read Continuous/Read Once Mode	(default: Continuous)
P	(50h, 80d)	Set ‘Single Relay’ Mode	(default: Disabled)
R	(52h, 82d)	Set Relay Mask	(default: FF)
S	(53h, 83d)	Enable/Disable Serial Transmission	(default: Enabled)
T	(54h, 84d)	Enable/Disable Use Non-Recorded Tags	(default: Disabled)

A - Set Device Address

Assigns an address to the TROMR8 device. Although only 32 devices should be connected to a single RS485 network, the device address can range from 01h to FFh.

By factory default all TROMR8 devices have the same address (01). In multiple node RS485 use, the device address must be different for each node.

Examples:

>01A05[cr]

Assigns the address 05 to TROMR8 with a current device address of 01.

>9AA13[cr]

Assigns the address 13 to TROMR8 with a current device address of 9A.

H - Set Relay Latch Time

The parameter (4 digit decimal) sets the number of milliseconds that the relay(s) is latched on after being activated. A parameter of '0000' means that the relay(s) will remain on until another tag is read.

Examples:

>09H0000[cr]

Relays of TROMR8 with a device address of 09 that have been activated by the tag that has just been read are on until another tag is read.

>03H1250[cr]

Relays of TROMR8 with a device address of 03 that have been activated by the tag that has just been read are on for 1250 milliseconds (1¼ seconds) or until a tag is read.

>31H9999

Relays of TROMR8 with a device address of 31 that have been activated by the tag that has just been read are on for 9999 milliseconds (almost 10 seconds) or until a tag is read.

L – Learn/Record Tags

Records RFID tags into the onboard EEPROM. A maximum of 256 tags can be stored.

If a two-digit hexadecimal number follows the command, the tag scanned will be assigned that relay activation byte. If the tag scanned has been previously recorded, then the new relay activation byte, if given, will be used.

Examples:

>08L41[cr]

This command will assign 41h (01000001b) to the relay activation byte of the tag that is being scanned by the TROMR8 with a device address of 08. Upon receipt of the command the TROMR8 will respond with the message: SCAN. An RFID tag must be read at this time. The tag number scanned [ex: 2D E4 BE D6 A5] will be stored and the relay activation byte (41h) will be assigned to this tag. Thereafter, whenever this tag is read during normal operation relays, 1 and 7 will be activated and relays 2,3,4,5,6,8 will be off.

>37L[cr]

This command will assign the last byte of the tag that is being scanned by TROMR8 device 37 to the relay activation byte. Upon receipt of the command, the TROMR8 will respond with the message: SCAN. An RFID tag must be read at this time. The tag number scanned [ex: 2D E4 BE D6 A5] will be stored and the relay activation byte (A5h, 10100101b) will be assigned. Thereafter, whenever this tag is read during normal operation, relays 1, 3, 6, 8 will be activated and relays 2, 4, 5, 7 will be off.

M - Set Read Continuous/Read Once Mode

This commands sets the method by which the TROMR8 acts upon the same tag present in the read field.

If disabled, a tag that is continuously in the read field will continuously set the relays according to its relay activation byte. It will reset the relay timeout, and its data packet will be continuously transmitted.

If enabled, a tag remaining in the read field will only activate the relay once until it is replaced by a different numbered tag.

Examples:

>11M0[cr]

The same tag read continuously by TROMR8 with a device address of 11 will activate the relays and reset the relay timeout.

>09M1[cr]

A tag read continuously by TROMR8 with a device address of 09 will only activate the relays once for the set latching time.

P - Set 'Single Relay' Mode

The parameter (1 or 0) turns on or off the 'Single Relay' Mode. When enabled, tag numbers that have a 'power of 2 value' in their last byte activate the corresponding relay. All other values are ignored. The following tag values 01h, 02h, 04h, 08h, 10h, 20h, 40h, 80h (1d, 2d, 4d, 8d, 16d, 32d, 64d, 128d) turns on relay 1, 2, 3, 4, 5, 6, 7 and 8 respectively. All other values are ignored.

Examples:

>15P0[cr]

Disables 'Power of 2' Relay Mode for TROMR8 with a device address of 15.

>07P1[cr]

Enables 'Power of 2' Relay Mode for TROMR8 with a device address of 07.

R - Set Relay Mask

The parameter value (two hexadecimal digits) sets an 8-position (bit) mask to permanently enable or disable the relays.

Examples:

>01RFF[cr]

Relays 1 through 8 (FFh, 11111111b) of the TROMR8 with device address 01 are enabled.

Depending on the tag number read, all relays can be activated.

>23R00[cr]

Relays 1 through 8 (00h, 00000000b) of the TROMR8 with device address 23 are disabled.

Regardless of the tag number read, no relays can be activated.

>05R7A[cr]

Relays 1, 3 and 8 (7Ah, 01111010b) of the TROMR8 with device address 05 are disabled.

Tag numbers with bits 1, 3, and 8 set will not activate relays 1, 3 and 8.

All others can be activated, depending on the tag number read.

S - Enable/Disable Serial Transmission

This command enables or disables serial output of tag data read. If enabled, whenever an RFID tag is read its data packet will be transmitted using the serial interface (RS232 and RS485). It is strongly recommended that serial transmission be disabled if the TROMR8 is attached to a multiple device RS485 network

Examples:

>25S0[cr]

Transmission of RFID tag data packet by TROMR8 with a device address of 25 is disabled.

>25S1[cr]

Transmission of RFID tag data packet by TROMR8 with a device address of 25 is enabled.

T - Enable/Disable Use Non-Recorded tags

This command enables or disables using recorded tags and their assigned relay activation bytes.

If enabled, any tag read (recorded or not) will activate the relays. The relays will be turned on and off according to the tag's last byte. Recorded tag's values will be ignored.

If disabled, only tags that have been previously recorded will activate the relays. If disabled, and no tags have been recorded then no relays will be activated.

Examples:

>27T1[cr]

The TROMR8 with a device address of 27 will activate the relays when any RFID tags, recorded or not, are read. The relays will be activated according to the last byte of the tag read.

>01T0[cr]

The TROMR8 with a device address of 01 will activate the relays only when a recorded RFID tag is read. The relays will be activated according to the byte that was assigned to the recorded tag.

Part Number for Ordering

TROMR8-STD