

QRV-1 Repeater System Controller for Amateur Radio Owner's Manual

Introduction

QRV is an ham radio Q-code signal used to either ask "Are you ready?" or exclaim "I am ready". We think it's an appropriate name for this controller because we designed it with an emphasis on dependability since repeater systems are the mainstay of community based communications when other usual means tend to fail. At the heart of this controller is an high reliability (Motorola based) NXP MC9S12XEG128 microcontroller that is utilized by nearly all late model automotive manufacturers in their engine control (ECM) and anti-lock braking systems. It is a 16-bit CISC (complex instruction set computer) in an 80 pin LQFP package that zips along at a 40MHz buss clock.

QRV Features:

- Competitively priced
- User friendly menu driven programming via RS-232 serial communications data port.
- User alterable DTMF control codes
- User alterable parameters
- Additional microcontroller spares available through us with latest firmware.
- CW message buffer for code practice
- CW or Speech based legal ID
- Low power requirement
- Reliability
- Directly coupled and very low harmonic distortion audio circuitry featuring high slew rate op-amps
- Optional Vacuum Fluorescent or LCD display interface
- Optional board for telephone hybrid interface (autopatch), two additional links, voice recorder, ethernet networking.
- 24 hour technical support (except weekends).

Installation

Jumper Header Settings

JP201 and JP202

Jumpers JP201 and JP202 are used to introduce a small amount of bias current into the carrier sensing inputs of the universal COR (carrier operated relay) logic detection circuits of the controller. JP201 applies to the main receiver and JP202 applies to an optional “link” receiver. Some receiver COR output lines may require some sink or source current to get them to function correctly. Three selections are available and are described as follows:

**Jumper removed – Receiver requires neither external sink or source current.
Jumper between pins 1 and 2 – Receiver employs an internal sink device and requires some source current.
Jumper between pins 2 and 3 – Receiver employs an internal source device and requires some sink current.***

JP301

Jumper JP301 is for application of bias voltage to an optional local microphone connected at J103. Typically an ICOM electret type microphone will require 8.0 volts DC for its internal preamplifier. Three selections are possible:

**Jumper removed – No DC voltage
Jumper between pins 1 and 2 - 8.0 Volts D.C.*
Jumper between pins 2 and 3 - 5.0 Volts D.C.**

JP302, JP303, and JP304

Jumpers JP302 through JP304 controls routing of audio to the voice recorder option. There are two selections possible for each of these and they are described as follows:

JP302

**Pins 1 and 2 jumpered – Main receiver audio not muted to voice recorder option.*
Pins 2 and 3 jumpered – Main receiver audio muted to voice recorder option.**

JP303

**Pins 1 and 2 jumpered – Local microphone audio not muted to voice recorder option.*
Pins 2 and 3 jumpered – Local microphone audio muted to voice recorder option.**

JP304

Pins 1 and 2 jumpered – Link 1 receiver audio not muted to voice recorder option.*

Pins 2 and 3 jumpered – Link 1 receiver audio muted to voice recorder option.

NOTE: (*) Indicates the default factory setting.

Initial Programming

At your request we can supply a pre-programmed controller at no additional cost. Simply provide us with your callsign and any other timing requests (time out time, other parameters, password, etc.). If you need to change anything at a later date programming is a simple procedure. All you need to customize the controller's settings will be either a dumb terminal or a computer that has a built in serial com port. A laptop computer is an excellent alternative and gives you the freedom from having to locate a power outlet at the repeater's site. If you still lack a serial com port, USB to (RS-232) serial communication port conversion cables are inexpensive and easy to obtain via mail order or through most computer stores. If you are using an older PC or terminal you may need to adapt from its DB-25 connector to a DB-9 male that will connect to J201 of the controller. Most USB to serial converter cables already have a DB-9 male connector that will plug directly into the controller's com port.

The QRV controller's communications data rate is 9600 baud so you will need to set your PC/terminal at that rate before you can communicate with it.

Audio Adjustments

Before any adjustments are performed the repeater's main receiver should be connected to terminal block TB102 and power applied. It is highly recommended that a service monitor or RF generator capable of being frequency modulated with a 400Hz tone and adjusted to +/-5KHz deviation be connected to the main receiver.

Adjust potentiometer R315 "RX AF CAL" to obtain 3.40V peak to peak at test point TP303 using an oscilloscope or 1.20 Vrms using a Fluke model 87 (or equivalent) multimeter set to AC volts.

Default DTMF Control Codes

<u>CODE</u>	<u>DESCRIPTION</u>
101	Tone Squelch enable
102	Carrier access mode
201	Reset beep, single (CTCSS mode)
202	Reset beep, multi-tone (CTCSS mode)
203	Reset beep type no. 3 (CTCSS mode)
204	Reset beep type no. 4 (CTCSS mode)
205	Reset beep type no. 5 (CTCSS mode)
206	Reset beep type no. 6 (CTCSS mode)
301	System off then lock
302*	Superfunctions disabled
302#	Superfunctions enabled
303*	System Off [Note 1]
303#	System On [Note 1]
401*	Identify in CW [Note 1]
401#	Identify in voice [Note 1]
501*	Link #1 On
501#	Link #1 Off
05	5 WPM CW Practice Begin [Note 2]
07	7.5 WPM CW Practice Begin [Note 2]
10	10 WPM CW Practice Begin [Note 2]
13	13 WPM CW Practice Begin [Note 2]
15	15 WPM CW Practice Begin [Note 2]
18	18 WPM CW Practice Begin [Note 2]
20	20 WPM CW Practice Begin [Note 2]
25	25 WPM CW Practice Begin [Note 2]
30	30 WPM CW Practice Begin [Note 2]
35	35 WPM CW Practice Begin [Note 2]
#	Terminate CW Message
601*	Inhibit play of CW message buffer at QSO end
601#	Enable play of CW message buffer at QSO end [Note 2]

Note 1: This function can only be changed if “superfunctions” are enabled.

Note 2: Morse code buffer must first be programmed via serial com port for this function to work.

Default DTMF Control Codes (continued)

<u>CODE</u>	<u>DESCRIPTION</u>
701*	End QSO with CW farewell (SK)
701#	End QSO with voice farewell
702*	Timeout occurrence in CW (HI HI)
702#	Timeout occurrence in voice
A01*	I/O Function #1 Off (E201)
A01#	I/O Function #1 On (E201)
A02*	I/O Function #2 Off (E202)
A02#	I/O Function #2 On (E202)

Additional DTMF Control Codes (With Option PWA Installed)

To access the following codes you must have the optional board installed in the main controller board at the designators J101 and J102.

<u>CODE</u>	<u>DESCRIPTION</u>
502*	Link #2 Off
502#	Link #2 On
503*	Link #3 Off
503#	Link #3 On
801	“Autopatch” access [Note 1]
802	Reverse “autopatch” patch Access [Note 1]
*	Extend “autopatch” time [Note 1]
803*	Disable the “autopatch” [Note 1]
803#	Enable the “autopatch” [Note 1]
804*	Disable reverse Telco “autopatch” [Note 1]
804#	Enable reverse “autopatch” [Note 1]
##	Terminate “autopatch”

Note 1: This function can only be changed if “superfunctions” are enabled.

Optional Display Interface

Two types of displays are compatible with the QRV-1. A New Haven display model NHD-0216K3Z-FL-GBW-V3 (16X2) or the Noritake Itron model CU24043-Y100 (24X4) vacuum florescent display. Either type is automatically detected by the controller.

An example of the LCD display is shown in Figure 1. Your callsign will be displayed in the top row along with certain legends indicated in row two as shown below.



Figure 1

CS or PL denotes whether repeater decode mode is Carrier Squelch or Private Line (tone decode).

SE or SD denotes whether superfunctions are enabled or disabled.

NM or L1 denotes whether the repeater is in Normal Mode or in a Linked state.

RX is followed by the valid receive signal count. This will be a number between 0 and 65535 and wraps back to zero upon overflow. A loss of power will reset the count to zero.

The display also serves to indicate a string of received DTMF codes as entered by users of the repeater system as shown in Figure 2. This offers a convenient troubleshooting aid if a user is having difficulty with their touch tone encoder. After several seconds (dwell) the display reverts back to the one shown in Figure 1.

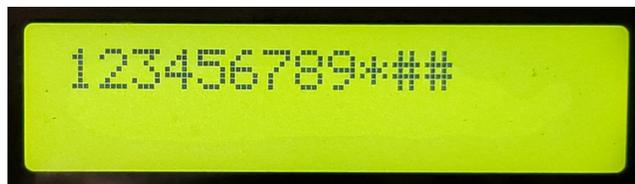


Figure 2

Private Line is a registered trademark of Motorola Inc.

Resetting Your Password

The default factory administrator password for the QRV controller is “admin”. There is a built in feature that allows you to reset your password in the event that you forgot what you set it to. Note that no other settings are affected by this procedure. This “backdoor” method requires you to have physical access to the top side of the circuit board (PWB). To achieve this:

Step 1: Remove all power.

Step 2: Connect a jumper wire from J102 pin 5 to pin 7. Please note that since these dual row headers are numbered in a staggered sequence that these are the third and fourth pins from the silkscreened “1” on the top side of the board (if you disregard the normal numbering sequence). Also be very careful that your jumper does not come in contact with either the +12 or -12 volt rails as they are very close in proximity to these two pins. If you make a mistake here the microcontroller will likely be destroyed. Warranty does not cover this.

Step 3. Apply power.

Step 4. After a few moments the green LED (D108) “L1ENBL” will flash rapidly indicating that the password was successfully reset to the default.

Step 5. Remove all power.

Step 6. Remove the wire jumper at J102.

You may (at your option) log into the controller via the RS-232 communications port using a remote computer or a dumb terminal to re-program a password of your choice. See the section on Initial Programming.

Transferring audio files to your controller

If so equipped, the QRV controller can accept audio files for storage in the CPU's internal flash memory via the popular Motorola S record format. This is a pure text format that allows the transfer of binary files without having to deal with embedded control codes. It is simple and yet provides a built in error checking system. An amazing software tool (written by Peter Miller) is available via the internet that can be used to convert an audio file you create and save in the raw file format into the Motorola S record format. This tool has been ported to several different operating systems including Microsoft Windows.

You can download Srecord from <https://sourceforge.net/projects/srecord/files/srecord-win32/> If you don't find the link above then try searching the web for Srecord elsewhere.

Convert your raw audio file that you created by typing:

```
srec_cat audio.raw -raw -o audio.srec
```

Next configure the communications port by issuing the following:

```
MODE COMx:9600,N,8
```

To send the audio.srec file from Windows to the QRV controller:

```
ECHO "CHAUD1" > \\.\COMx:  
ECHO "CHAUD2" > \\.\COMx:  
ECHO "CHAUD3" > \\.\COMx:
```

```
COPY audio.srec \\.\COMx:
```

Hardware Description

Troubleshooting

Test point (TP201) can be used to tell if the CPU is running and has successfully initialized. With a frequency counter connected at TP201 verify that a 100KHz signal is present. If a counter is not available use an oscilloscope to observe the signal. It should be a fifty percent duty cycle square wave with a near 5 volt peak-peak amplitude. A Fluke Model 87 Type 5 multimeter in its frequency counter mode can count the frequency present at this test point as well.

Contact Information

Custom Design Tech
751 W. Ewing Ave.
South Bend, Indiana 46613
Phone: (888) 265-6193

Ordering and Tech Support: mike sienicki

20230710-0402