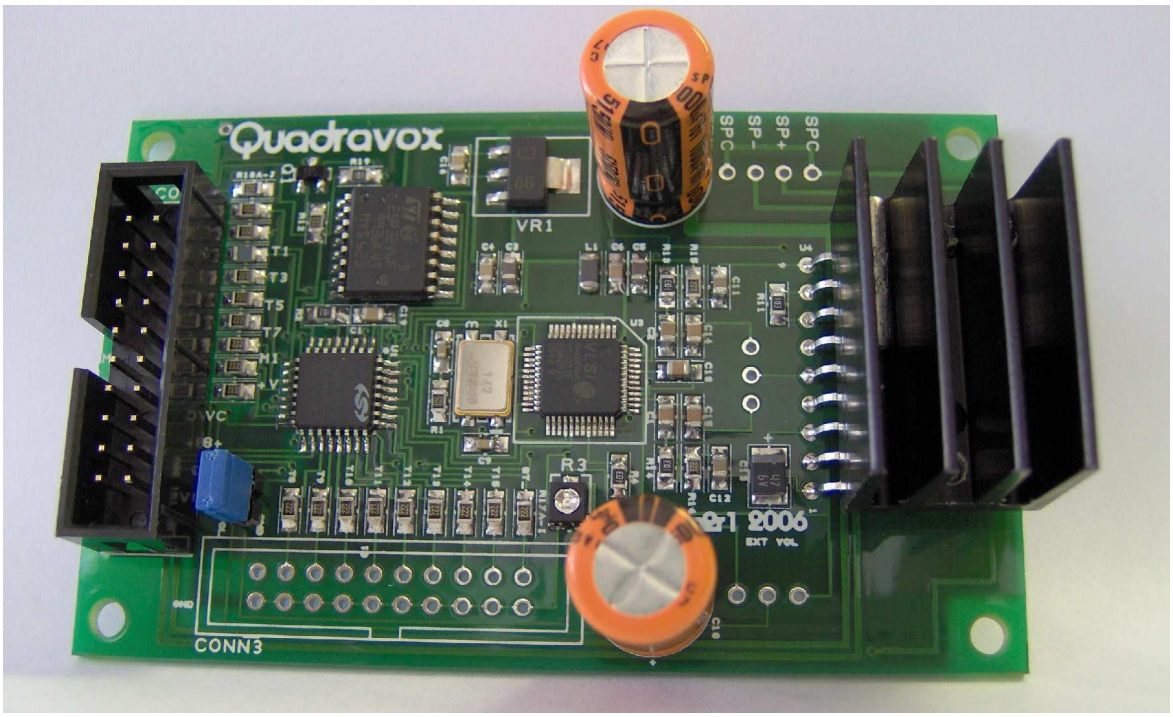
Quadravox

QV601m2 type 2 firmware, Parallel/RS232 controlled sound playback module

The QV601m2 MP3-based digital message module is available with several firmware options. Type 1 firmware provides a parallel interface as well as a fully functional serial mode. The serial mode is used primarily for data downloading, but is comparable to the QV301m2's serial mode.



Features:

- standard model QV601m2(-16) has approximately 14 minutes capacity at a 20kbps coding rate suitable for voice.
- up to 240 messages
- three addressing mode options
- single 10V-16V supply
- potentiometer controlled DC volume control, external volume potentiometer, or RS232 controlled
- 22W mono or 11W/ch stereo BTL amplifier
- free recording software (QV600s) from our website
- programmed via the QV430P RS232, QV460P USB, or QV461 stand-alone programmers
- stereo line output is available
- capacity varies with coding rate chosen: two minutes of near-CD-quality stereo up to 35 minutes of intelligible mono voice grade output are available with the standard 16Mbit memory.
- coding rate/quality can be chosen independently for each file.

RS232 control option:

RS232 mode is selected by tying “T4” (pin 5) and the amplifier control line (pin 11) together (do not connect to ground or other signals). The amplifier control line is labeled “PWR_” on the QV430P and “P_” on the QV601. In the type 1 firmware, the primary function of the RS232 mode is to allow data and firmware downloads, but this mode has all the functions of the QV301m2 serial mode.

The connection is RXD-TXD with no flow control. The return path provides only status information and it not used for handshaking, so is optional. The signal levels are 0 and 3.3-5.0V and inverted for use with a conventional inverting level shifter like the MAX232, or for direct connection to another microprocessor’s UART. That is, the resting level is high and the start bit is low.

The QV601 manages up to 240 separate messages without explicit reference to physical addresses. Three phrase selection modes are provided and are selected via a mode setting command. The addressing mode can be changed at any time.

A single n,8,1 byte transfer selects one of 240 messages (subject to the constraints explained later in this document). A code of 0fxh is interpreted as a mode- or volume- set command. A byte in the range 0-239 selects a single message in direct addressing mode, or determines the upper bound of a linear sequence or random selection. Upon power up or after a recording, the system will automatically detect the number of messages and define its own maximum upper bound. When the loop all option is selected, the system will restart at message 0 after reaching the maximum.

QV601m2 pinout and control lines in RS232 mode:

Control lines	pin	Level	Function
T1-RXD (3.3-5.0V)	**2**	**--**	RS232 receive line
T3-TXD (3.3-5.0V)	**4**	**--**	RS232 transmit line
T4	**5**	**--**	Must be connected to pin 11 (AMP_)
T5 (BUSY_)	**6**	**--**	Active low busy indication
T6 (RECLED_)	**7**	**Low**	can be used to sink current for record LED. The external system must provide the current-limiting resistor.
+12V	**12**	**+10-16V**	system power
GND	**17,18**	**0**	system ground
VC	**14**	**--**	External volume control connection (also separate hdr)
3.3V	**20**	**--**	External volume control top reference
SPK COM	**19**	**--**	Common for stereo speaker output
AMP_	**11**	**--**	Active low indication that amplifier is enabled. Must be connected to pin 5 (T4)
RESET_	**13**	**Low**	system reset, active low
SP-	**15**	**--**	Speaker output; bridge tied load
SP+	**16**	**--**	Speaker output; bridge tied load

Note:
Speakers, external volume control, and stereo line outputs are available on separate headers at the amplifier end of the PCB.
Rev 1 PCBs have a jumper J1 to disconnect the internal volume control. Rev 2 PCBs utilize a separate pin selected via setup.

RS232 Commands:

Value (hex)	Function
000h-0efh	play file 0-239
0f0h	set play mode to direct addressing
0f1h	set play mode to linear sequence
0f2h	loop current file (0f7h clears)
0f3h	set play mode to random sequence
0f4h	pause playback
0f5h	resume playback
0f6h	stop play immediately
0f7h	stop play at end of current file
0f8h	Sleep
0f9h	open string
0fah	close string
0fbh	play string
0fch	set volume with next byte transmitted. Only values 0-63 are valid
0fdh	Software reset
0feh	return version byte (002h)
0ffh	return type byte (066h)

Setting the addressing mode:

The QV601m2 type 1 offers three modes of playback addressing for individual phrases. The modes are selected using the two low-order bits of the set mode command. Bit 0 selects direct or sequential addressing. In direct addressing (bit 0 = 0), the value transferred in the command byte is used to select the phrase of the same number. If a value exceeding the maximum number of recorded phrases is sent, the last phrase in the memory will be played. If bit 0 is set to one, the phrase played will lie within the bounds of zero and the number transferred in the command byte. If bit 1 of the mode value is 0, the phrases in this range will be played in sequence, rolling back to zero after the top phrase (the one corresponding to the command byte) has been played. If bit 1 is 1, a randomly-selected one of the same range will be played. The previously unused 0f2h command now causes indefinite looping in the mode determined by commands 0f0h, 0f1h, and 0f3h.

The mode can be changed at any time, so system operation can combine the different addressing options. For example, to have ten phrases triggered by specific events and a different set of ten randomly selected by a fifth event, do the following:

- Record the phrases in order with the ten randomly selected ones as the first ten in the list.
- To randomly select one of the bottom group, first issue a set mode command specifying “random sequence” (0f3h). Repeatedly sending a command byte of “9” will produce a random selection of phrases 0-9.
- To select one of the fixed phrases, issue a set mode command for “direct” (0f0h), the send the number of the phrase to be played.
- If you desire that the phrases in the first group be played in sequence, issue a set mode “linear sequence” (0f1h) instead of 0f3h.

Playing messages:

To play a message, first ensure that the mode (as explained as above) matches your intentions. Then, issue a single byte in a contiguous range from 0 to the number of recorded messages – 1 (maximum 239). When the phrase has completed, a byte with the number of the phrase spoken will be returned.

Message play can be stopped by issuing a stop command (0f6h). There is no return code for a stop command. The BUSY_ line can also be used to determine when the message is complete.

String play:
In some cases it is desirable to set up a long string of words or phrases to be played as one utterance. This simplifies message management and allows the segments to be contiguous as the amplifier does not need to be powered down between phrases. To use the string mode, open a new string by sending the command 0f9h. Send up to 64 phrase numbers. The phrases will not be spoken in this process. Send the close string command, 0fah. Until you change the string by reopening it, the stored sequence can be played by issuing the play string command, 0fbh. Individual words are still accessible in the usual way- playing them does not affect the stored string.

Parallel input control option:

If pins 5 and 11 are not tied, the QV601m2 type 1 enters the parallel mode. Sixteen pins are available for a parallel control interface, eight within the main connector and a further eight in an auxiliary pad set. The lines have internal pullup resistors and 2.2k ohm series protection resistors. Although the QV601 operates on 3.3V internally, it is possible to use 0-5V signals for the triggers.

Operation of the parallel interface is controlled by several flags in the configuration section of the memory. These flags are loaded at the same time as the sound data.
The QV600s software provides check boxes in the configuration section to set the following options. Please note that some displayed options are not available for the QV601t1 code and so are not shown below.

pushbutton mode (if not selected, mode is "addressed")-
If pushbutton mode is selected, each of the eight trigger lines will select one file. Trigger T0 plays the first file in the memory, T1, the second, and so on up to T15, which plays the sixteenth file. If the loop option is also set, the file will be repeated until the trigger is released.
If pushbutton mode is not selected, the eight low order input pins will be treated as a file address. All lines are normally held high by internal pullup resistors. This state, value 255, is considered to be "idle". When one or more lines are brought to ground level within 5ms of each other, the resulting binary value is considered to be a message address. Addresses beyond the number of files loaded will cause the highest valued file present to be played.

sequential access mode-

Mode bit M1 determines whether the file number entered is considered to be a direct play request or a limit for a sequential play. If M1 is 0, the file number entered (0-62 or 0-5) is played. If M1 is 1, the files are played sequentially and looped back to 0 when the limit is reached. That is, entering 31 on the parallel lines would cause the 606 to play file 0, then 1 (after the lines have been released and re-asserted), up through file 30, after which file 0 is played again.

Additional flag bits not available in the QV301 further modify the operation in parallel mode:

play interruption allowed-
If this option is checked, any trigger activated during file playback will cause the current file to be terminated and the new file to start.

disable amplifier-
Should the onboard amplifier not be needed, this option keeps it turned off, shortening the trigger response time. Only the line output pins are active in this mode.

loop-
If sequential access mode is selected, this option will cause the player to cycle through all files in the memory. If sequential mode is off, only the selected file will repeat.

start automatically-
This option causes the first file in the list to be played on power up. If the loop flag is also set, the first tile will be repeated until power is removed.

always on-
By default, the QV601 in parallel mode is held in idle power mode between files unless a repeat operation is in progress. The “always on” option keeps the decoder active and the amplifier on between plays. This shortens the response time from the trigger input.

no startup beeps-
By default, the module makes a double-beep when powered up. The intonation is rising if the data memory is loaded, falling if it is blank. In some cases, particularly in the case of automatic start, this beep is undesirable.

repeat if held-
In normal operation a trigger must be released before another can be accepted. If this option is set, holding the trigger beyond the end of the playback will start playback again.

use T7 as strobe-
This option has meaning only if pushbutton mode is not selected. In this case, the input lines are to be interpreted as an address, but T7 has the special function as an enabling strobe (active low). The address defined by T0-T6 is not accepted until T7 is held low for at least 80ms.

use external volume control-
Revision 1 PCBs use a jumper to select the internal volume control potentiometer. For external volume control via either the three pin header or the main 20 pin connector, the jumper must be removed. Revision 2 and later PCBs simply select another input for the volume control using this option.

random-
This option is a modifier of the sequential access mode. If set, the file selected will be a random selection of files with file numbers at or below the trigger or address used to initiate playback.

QV601m2 pinout and control lines in parallel mode:

Main connector – 20 pin IDC

Control lines	Pin	level	Function
T0	**1**	**low**	trigger 0 or trigger bit value 0
T1	**2**	**low**	trigger 1 or trigger bit value 1
T2	**3**	**low**	trigger 2 or trigger bit value 2
T3	**4**	**low**	trigger 3 or trigger bit value 3
T4	**5**	**low**	trigger 4 or trigger bit value 4
T5	**6**	**low**	trigger 5 or trigger bit value 5
T6	**7**	**low**	trigger 6 or trigger bit value 6
T7	**8**	**low**	trigger 7, trigger bit value 7, or active low strobe
M0	**9**	**--**	Mode pin 0
M1	**10**	**--**	Mode pin 1
AMP_	**11**		Active low output indicating amplifier is enabled
+10-16V	**12**		System power
RST_	**13**	**low**	Active low system reset
VC	**14**	**--**	External volume control input
SPK2	**15**	**--**	speaker output; bridge tied load
SPK1	**16**	**--**	speaker output; bridge tied load
GND	**17**	**0**	System ground
GND	**18**	**0**	System ground
SPK COM	**19**	**--**	Capacitively coupled stereo speaker common return
3.3V	**20**	**--**	External volume control top reference

Auxiliary connector – pads for 16 pin IDC

Control lines	Pin	level	Function
GND	**1**	**--**	System ground
T8	**2**	**low**	trigger 8
GND	**3**	**--**	System ground
T9	**4**	**low**	trigger 9
GND	**5**	**--**	System ground
T10	**6**	**low**	trigger 10
GND	**7**	**--**	System ground
T11	**8**	**low**	trigger 11
GND	**9**	**--**	System ground
T12	**10**	**low**	trigger 12
GND	**11**	**--**	System ground
T13	**12**	**low**	trigger 13
GND	**13**	**--**	System ground
T14	**14**	**low**	trigger 14
GND	**15**	**--**	System ground
T15	**16**	**low**	trigger 15

Message development software:

The QV600s software and QV430P or QV460P programming hardware provide a low-cost method of programming the QV601m2 modules. The QV600s software is available free from the Quadravox website.

The QV601m2 uses standard MPEG 1 layer 3 formatted files. It can play both VBR and CBR files and can accept coding rates from 8kbps to 320kbps. For licensing reasons, the QV600s software does not include the MP3 encoder function, but many are available at reasonable cost, or free for non-commercial use. The capacities listed in the specification are based on 20kbps mono files with a sampling rate of 16kHz and a nominal bandwidth of 8kHz, double that of the telephone standard and better than AM radio. For voice announcements the quality is essentially transparent. However, it is also possible to use lower rates to extend capacity or higher ones (especially when using the stereo line-level outputs) for better quality. Capacity will be inversely proportional to the data rate. The coding rate need not be fixed – each file can have a rate suited to its use. 8192 bits (1024 bytes) of the digital memory is reserved for the directory. If the random option is used, an additional 1024 bytes is used for the sequence file. Even in the smallest memory option 99.9% of the memory is available for sound data, so the simple calculation of capacity is (memory size in bits) / (coding rate in bits per second).

The QV600s software allows the user to define a collection of files as a project, to order them as desired, and to set any of the options mentioned, as well as to generate the appropriate randomization file if that feature is used. The software communicates with the QV460P programmer via full-speed (12Mbps) USB1.1. The time required for programming is determined by the fixed bulk erase time of the memory and by the programming and verification times, which are proportional to the project size. The following table gives estimates for a fully used memory.

Memory timing QV460P:

Memory size	Erase time	Program/verify time	Capacity at 20kbps
16Mbit (standard)	17-40 sec	15 sec	13 min, 58 sec
32Mbit	34-80 sec	30 sec	27 min, 56 sec
64Mbit	68-160 sec	60 sec	55 min, 54 sec

Memory timing QV430P @ 115200B:

Memory size	Erase time	Program/verify time	Capacity at 20kbps
16Mbit (standard)	17-40 sec	3m, 2 sec	13 min, 58 sec
32Mbit	34-80 sec	6 min, 4 sec	27 min, 56 sec
64Mbit	68-160 sec	12 min, 8 sec	55 min, 54 sec

Electrical Characteristics:

Absolute Maximum Ratings:

Stresses above these limits may cause permanent damage to the controller device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may effect device reliability.

Ambient temperature under bias	-40°C to +125°C
Storage temperature	-65°C to +150°C
Voltage on V_{DD} with respect to Vss	0 to +18.0 V
Voltage on all other pins with respect to Vss	-0.6 v to (VDD + 0.6V)
Total power dissipation	40 W
Maximum current into V_{DD} pin	4 A
Maximum output current sunk by any output pin	25 mA
Maximum output current sourced by any input pin	25 mA

DC Characteristics: standard operating temperature 0°C ≤ TA ≤ +70°C

Power supply pins:

Symbol	Description	Min	Typ[1]	Max	Units	Conditions
V_{DD}	**Supply voltage**	10		16	V	
I_{DD}	**Supply current operating**	--	60	4000	mA	V_{DD} = 12.0V[3]
I_{DI}	**Supply current idle**		9	10	mA	V_{DD} = 12.0V
V_{IL}	**Input low voltage** RXD, BR0-1-	Vss	--	0.5	V	
V_{IH}	**Input high voltage** RXD, BR0-1	2.0	--	V_{DD}	V	
I_{IL}	**Input leakage current**[2] RXD, BR0-1	--	--	+/- 1	µA	Vss ≤ V_{PIN} ≤ V_{DD}
V_{OL}	**Output low voltage** RECLED_, TXD	--	--	0.6	V	I_{OL}=8.5mA, I_{DD}=4.5V
V_{OH}	**Output high voltage** RECLED_, TXD	V_{DD}-0.7	--	--	V	

Note 1: Data in the typical ("typ") column is based on characterization results at 25°C. This data is for design guidance only and is not tested.
2: Negative current is defined as current out of the pin
3: Includes speaker current which depends on volume setting and load impedance.

AC Characteristics: standard operating temperature 0°C ≤ TA ≤ +70°C

Symbol	Description	Min	Typ	Max	Units	Conditions
TioR	**Pin output rise time**	--	10	25	ns	
TioF	**Pin output fall time**	--	10	25	ns	

Online Support:

Quadravox maintains the latest specifications, schematic diagrams, and support software in the support section of our web site <www.quadravox.com>.

For questions not answered there or for other inquiries, please write us at support@quadravox.com, or call 1-972-669-4002.

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