QRP Labs — QMX

QMX: QRP Labs Multimode Xcvr (transceiver)
CAT programming manual, firmware 1.03_000

For ALL QMX-series transceivers

Introduction

CAT (Computer Aided Transceiver) is a standard serial interface which allows computer control of your radio transceiver. Many software applications such as WSJT-X, JS8Call etc use CAT to switch the transceiver between Transmit and Receive, or to change band, etc.

QMX transceivers inherited functionality from the earlier QCX- and QDX-series transceivers. Originally the CAT commands were based loosely on the Kenwood TS-480 transceiver, which is well supported in all software, and well documented (see https://www.kenwood.com/i/products/info/amateur/ts_480/pdf/ts_480_pc.pdf) – also similar to TS-440. Subsequently QRP Labs transceivers now have their own entry in the hamlib library transceiver dropdown. Additional QRP Labs specific commands were added.

CAT commands never contain a carriage return or linefeed character. They are alwasys terminated by a semicolon. Multiple commands may be strung together. QMX interprets an incoming carriage return character as a trigger to switch the serial port to terminal mode. In this way the serial ports can be used either for CAT or for terminal access.

QMX provides up to three Virtual COM Serial ports (for CAT or terminal) as well as the possibility to use the PTT and AUX (QMX+ only) ports as UART serial ports.

Cat command set

QMX implements a subset of the Kenwood TS-480/TS-440 CAT command set which is an old standard, but contains all the necessary commands for WSJT-X and other software to be able to control QMX, and is old enough that it is widely supported by most software packages.

QMX provides a standard set of two-character CAT commands, which are similar to the Kenwood ones, and which act on the transceiver, such as changing the VFO frequency or switching to Transmit. Most of these commands have a temporary effect only on the transceiver, the values are not permanently stored in EEPROM.

QMX also provides an extended set of CAT commands, primarily for legacy reasons (QDX compatibility), called Q0, Q1, Q2 and so on until QB. These commands allow a host program to set and get various configuration parameters of QMX. Parameters set by the Q commands are not saved in EEPROM, they are valid for the current operating session only.

Finally, the ML and MM commands provide access to a powerful menu management function which allows host application "discovery" of the QMX menu tree, as well as read/write of any parameters in the QMX configuration menu. These are described in a subsequent section.

The following lists the commands and responses in alphabetical order:

AG: Get/Set AF Gain (volume)

Set: AG0n Sets the audio gain to n. The actual setting is in steps of 0.25 dB. So for example command AG091; will set the volume to 22.75dB. The parameter range is 000-799. Of course maximum gain would make no sense, it would be far too high gain.

Get: Returns the audio gain in steps of 0.25 dB. For example AG; or AG0; (actual Kenwood TS-480 command) returns AG0091 for 22.75dB.

C2: Get/Set Signal Generator frequency

Set: Sets the Si5351A Clk2 output frequency (the signal generator).

Get: Gets the frequency of Si5351A Clk2 (the signal generator)

FA: Get/Set VFO A

Set: Sets VFO A value. Example: FA7030000; sets VFO A to 7.030MHz

Get: Returns the VFO A contents as an 11-digit number. Example: "FA;" returns "FA00007030000;"

FB: Get/Set VFO B

Set: Sets VFO B value. Example: FB7016000; sets VFO B to 7.016MHz

Get: Returns the VFO B contents as an 11-digit number. Example: "FB;" returns "FA00007016000;"

FR: Get/Set Receive VFO Mode

Set: Set VFO Mode: 0, 1, 2 correspond to VFO A, VFO B or Split respectively. This is the case for both the FR and FT commands (which are nominally Receive and Transmit VFOs) because in the QMX the VFO mode use does not correspond exactly to TS-480.

Get: Get Receive VFO Mode: 0 means VFO A is used for receive (could be due to VFO mode being VFO A, or VFO Mode being Split); 1 means VFO B is being used for receive (must be VFO Mode B).

FT: Get/Set Transmit VFO Mode

Set: Set VFO Mode: 0, 1, 2 correspond to VFO A, VFO B or Split respectively. This is the case for both the FR and FT commands (which are nominally Receive and Transmit VFOs) because in the QMX the VFO mode use does not correspond exactly to TS-480.

Get: Get Transmit VFO Mode: 0 means VFO A is used for transmit (must be VFO Mode A); 1 means VFO B is being used for transmit (could be due to VFO mode being VFO B, or VFO Mode being Split)

FW: Get filter bandwidth

Get: Returns 3200 in Digi mode, and 0300 for CW mode (300Hz CW bandwdith).

ID: Get radio ID

Get: Always returns 020 (Kenwood TS-480)

IF: Get transceiver information (TS-480 format).

Get: Returns a composite information string containing the state of the transceiver, as follows (excluding command ID and ; terminator character):

- 11-digit operating frequency (VFO A or B, according to the VFO mode setting and transmit/receive state
- 5 spaces
- 5-digit RIT frequency, as +/-9999Hz e.g. RIT up 200Hz returns "+0200" in this field
- RIT status: 0 = RIT OFF, 1 = RIT ON
- XIT status: always 0 because QMX has no XIT
- Memory channel bank number: always 0
- Memory channel number: always 00
- Transceiver status: 0 = RX, 1 = TX
- Operating mode: returns mode character (see MD command for details)
- Receive VFO: 0 = VFO A, 1 = VFO B
- Scan status: always 0
- Split: 0 = Simplex operation (VFO mode A or VFO mode B), 1 = Split
- Tone: always 0
- Tone number: always 0
- Space character

KS: Get/Set Keyer speed

Set: Sets the Keyer speed to the specified number of words per minute

Get: Gets the current Keyer speed setting (in words per minute)

KY: Get/Set message for immediate sending when Kenwood TS480 compatibility mode is OFF

Set: Initiates a CW message transmission at the current keying speed. The format of the command is KY followed by a space, followed by the message to be sent, followed by a semicolon termination character. For example command
`KY HELLO;`
will initiate CW transmission of the text "HELLO".

Get: Returns:
KY0; if message sending is in progress and the transmit text buffer is not more than 75% full
KY1; if message sending is in progress and the transmit text buffer is more than 75% full
KY2; if no message is being sent, therefore the transmit text buffer is emtpy
?; if the attempted message would overflow the transmit buffer; in this case it is canceled

Note: The KY transmit text buffer is 80 characters long. It is a circular buffer. It is acceptable to send new messages with KY before the message sending is complete, they are simply appended to the transmit buffer. You may not send a message that would overflow the buffer, if attempted the message will simply be ignored and error code ?; returned.

Note: Kenwood TS480 compatibility mode for the KY command is a setting in the System configuration menu.

KY: Get/Set message for immediate sending when Kenwood TS480 compatibility mode is ON

Set: Initiates a CW message transmission at the current keying speed. The format of the command is KY followed by a space, followed by the message to be sent, followed by a semicolon termination character. For example command

```
KY HELLO                        ;
```

will initiate CW transmission of the text "HELLO". Note that in Kenwood TS480 compatibility mode the messaged is a fixed 24-character length. A ' ' (space) character must be used for the unused characters. If all characters of the message are spaces, the transceiver stops sending the message.

The following special ASCII characters can be used to transmit CW prosigns:

[is sent as prosign BT, _ is AR, < is AS, # is HH, > is SK, is = KN, \ is BK, % is SN.

Get: The KY; command returns:

KY0; if the character buffer is available (for using the KY command to add more characters)

KY1; if the character buffer is not available (insufficient remaining buffer space)

Note: Users are referred to the KY command description on page 12 of the Kenwood TS480 CAT specification document:

https://www.kenwood.com/i/products/info/amateur/ts_480/pdf/ts_480_pc.pdf

Note: Kenwood TS480 compatibility mode for the KY command is a setting in the System configuration menu.

LC: Get LCD contents

Get: Command LC; returns 32 characters containing the entire contents of the 1602 LCD screen. Note that any customized pixel mapped characters such as the S-meter, Power-meter, Battery icon are converted to spaces. The values of these parameters are available from other CAT commands. The exception is the VFO indicators A and B which are included in the LC; response as ASCII 'A' and 'B' characters.

MD: Get/Set operating mode

Set: Set to 3 (CW), 6 (FSK), 7 (CWR) or 9 (FSR/FSK Reverse)

Get: Returns 3 (CW), 6 (FSK), 7 (CWR) or 9 (FSR/FSK Reverse)

ML: Get menu list: see Menu Manager section below

MM: Get/Set/Query menu item: see Menu Manager section below

OM: Get the radio's model number

Get: Returns the radio's model number. For QMX this is QC so the result is simply OMQC;

PC: Get power output

Get: Returns power output in tenths of a watt. For example, if command PC; returned PC45; then this would mean the output power is currently measured as 4.5 W.

PL: Get/Set MS5351M Synth PLL parameters

Set: Set MS5351M PLL parameters. This is an advanced setting for **experimenting** to see if birdies are due to - and can be reduced by - PLL configuration. It only affects the Receiver PLL. Set command format:

```
PLDivider|Multiplier|Numerator|Denominator;
```

where:

Divider: An even integer divider between 6 and 126, for the division from the MS5351M internal PLL frequency down to the synthesized output frequency.
Multiplier: Integer in the range 15-90, for the multiplication of the 25 MHz TCXO reference up to the internal PLL frequency.
Numerator: The numerator of the fractional part of the multiplier, range 0 to 1,048,575.
Denominator: The denominator part of the multiplier, range 0 to 1,048,575 and must be larger than denominator.

The generated frequency is 25 MHz * (Multiplier + Numerator / Denominator) / Divider

Note that the generated frequency differs from the "operating frequency" depending on mode; there is a 12kHz offset due to the 12kHz Intermediate Frequency superhet, and potentially a further 700 Hz offset in CW mode.

The command is only allowed following sanity check of all parameters – which includes checking they are all within range, and that the generated frequency must be within 500 Hz of the original synthesized frequency for the current operating frequency of the radio.

If any parameters are invalid, or the generated frequency deviates from the original by more than 500Hz, the command returns an error ?; otherwise, the command returns nothing. Use the PL; command below if you are unsure and wish to verify the settings took effect.

The settings are only valid until the next action to alter the tuning of the radio (via CAT command or turning the Tune knob), or change RX to TX and back.

Example:

```
PL20|22|274|625;
```

sets the generated frequency to 28,048,000 Hz.

Get: Get MS5351M PLL parameters for Receive LO synthesis. Command result format is

```
PLFrequency|Divider|Multiplier|Numerator|Denominator;
```

where:

Frequency: the synthesized frequency. Remember that this is NOT the same as the receiver operating frequency, there is an offset for the 12 kHz intermediate frequency, and potentially a further 700 Hz offset in CW mode.
Divider: An even integer divider between 6 and 126, for the division from the MS5351M internal PLL frequency down to the synthesized output frequency.
Multiplier: Integer in the range 15-90, for the multiplication of the 25 MHz TCXO reference up to the internal PLL frequency.

<u>Numerator</u>: The numerator of the fractional part of the multiplier, range 0 to 1,048,575.
<u>Denominator</u>: The denominator part of the multiplier, range 0 to 1,048,575.

Example when the radio is set to 28,060,000 in DiGi mode, PL; returns:

```
PL28048000|20|22|210981|481252;
```

The actual generated frequency is 25 MHz * (Multiplier + Numerator / Denominator) / Divider
In this case: 28,048,000.32 Hz.

Q0: Get/Set TCXO reference frequency

Set: Set TCXO reference frequency. Only values between 24999000 and 25001000 are allowed. The setting is for the current operating session only and is not written to EEPROM.

Get: Get TCXO reference frequency.

Q1: Get/Set Sideband

Set: Set sideband; 1 sets Lower Sideband (LSB), any other value sets Upper Sideband (USB). The setting is for the current operating session only and is not written to EEPROM.

Get: Get sideband; 0 = USB, 1 = LSB

Q2: Get/Set VFO A frequency – same as FA

Set: Set default operating frequency.

Get: Get default operating frequency.

Q3: Get/Set VOX Enable

Set: Set VOX enable: 1 enables VOX, 0 disables VOX. The setting is for the current operating session only and is not written to EEPROM.

Get: Get VOX enable; 1 = Enabled, 0 = Disabled

Q4: Get/Set TX Rise Threshold

Set: Set TX Rise Threshold, which should be a percentage number between 0 and 99 (see description elsewhere in this manual). The default setting of 80 is normally appropriate. The setting is for the current operating session only and is not written to EEPROM.

Get: Get TX Rise Threshold value

Q5: Get/Set TX Fall Threshold

Set: Set TX Fall Threshold, which should be a percentage number between 0 and 99 (see description elsewhere in this manual). The default setting of 60 is normally appropriate. The setting is for the current operating session only and is not written to EEPROM.

Get: Get TX Fall Threshold value

Q6: Get/Set Cycle Min parameter

Set: Set Cycle Min parameter (see description elsewhere in this manual). The setting is for the current operating session only and is not written to EEPROM.

Get: Get Cycle Min parameter value

Q7: Get/Set Sample Min parameter

Set: Set Sample Min parameter (see description elsewhere in this manual). The setting is for the current operating session only and is not written to EEPROM.

Get: Get Sample Min parameter value

Q8: Get/Set Discard parameter

Set: Set Discard parameter (see description elsewhere in this manual). The setting is for the current operating session only and is not written to EEPROM.

Get: Get Discard parameter value

Q9: Get/Set IQ Mode

Set: Set IQ Mode: 1 enables IQ Mode, 0 disables IQ Mode. In IQ Mode, the raw I & Q samples from the ADC are streamed directly to the USB Sound card. The setting is for the current operating session only and is not written to EEPROM.

Get: Get IQ Mode; 1 = Enabled, 0 = Disabled

QA: Get/Set Japanese Band Limits mode

Set: Set Japanese Band Limits mode: 1 enables Japanese band limits, 0 disables Japanese band limits. In Japanese Band Limits mode, QMX cannot transmit outside the allowed Japanese band limits. The setting is for the current operating session only and is not written to EEPROM.

Get: Get Japanese Band Limits mode; 1 = Enabled, 0 = Disabled

QB: Get/Set CAT timeout enable mode

Set: Set CAT timeout enable. 1 enables CAT timeout, 0 disables CAT timeout. When enabled, if in transmit mode, if there is no CAT command for a specified timeout, QMX automatically returns to receive mode.

Get: Get CAT timeout enable mode; 1 = Enabled, 0 = Disabled

QC: Get/Set CAT timeout

Set: Set CAT timeout. Specifies the CAT timeout in seconds.

Get: Get CAT timeout. Returns the CAT timeout in seconds

QJ: Get/Set TX shift threshold

Set: Set TX shift threshold (see explanation in Configuration screen description section of this manual)

Get: Get TX shift threshold

RC: Clear RIT mode

Set: RC; clears RIT mode, setting RIT to zero

RD: Set negative RIT offset amount (absolute setting of RIT, not a change to current value)

Set: If System Config menu setting "CAT RU and RD" is Absolute, sets negative (down) RIT; for example "RD200;" sets the RIT to -200 Hz.
If System Config menu setting "CAT RU and RD" is Relative, moves the current RIT value down by the specified amount; for example "RD010;" moves RIT down by 10 Hz.

RG: Get/Set RF Gain

Set: RGn Sets the RF gain to n. The actual gain setting is the supplied gain in dB. So for example command RG63; will set the gain to 63dB, in the currently active band. Note that the RF gain can also be set in the Terminal Band Configuration application.

Get: Returns the RF gain in dB. For example RG; returns RG063 for 63dB.

RT: Get RIT status

Get: Returns RIT status: 0 = RIT off, 1 = RIT on

Set: Sets RIT mode: 0 = OFF, 1 = ON

RU: Set positive RIT offset amount (absolute setting of RIT, not a change to current value)

Set: If System Config menu setting "CAT RU and RD" is Absolute, sets positive (up) RIT; for example "RU150;" sets the RIT to +150 Hz.
If System Config menu setting "CAT RU and RD" is Relative, moves the current RIT value up by the specified amount; for example "RU005;" moves RIT up by 5 Hz.

RX: Set the radio into Receive mode immediately

Set: Command RX; immediately puts the radio into receive mode. It is equivalent to TQ0;

SA: Get the AGC meter value

Get: The AGC gain attenuation setting is returned, in dB.

SM: Get the S-meter value

Get: Returns the S-meter value in dB.

SP: Get/Set Split mode

Set: Sets Split mode: 0 = OFF, 1 = ON. For example "SP1;" switches QMX to split mode

Get: Returns the Split state: 0 = OFF, 1 = ON.

SS: Get/Set SSB transmission source

Set: Sets the SSB transmission source. 0 = USB (audio samples from host PC); 1 = Internal 700 + 1900 Hz two-tone test generator; 2 = External microphone.

Get: Returns the SSB transmission source, 0 1 or 2 as per the above definition.

SW: Get the SWR-meter value

Get: Returns the SWR-meter value in hundredths. For example if the CAT command SW; returns SW121; this indicates that the SWR is 1.21:1. If called while the radio is in Receive mode, the command simply returns SW;

TA: Transmit audio

Set: In Digi mode, sets the transmitted audio tone frequency, which may be specified to a decimal fraction of a Hz. The actual transmission RF frequency is the USB Dial frequency plus the specified audio frequency. For example TA1502.34; would set the audio tone to 1502.34 Hz. The correct sequence of operations by the CAT host should be:

- FAnnn; command to set the USB "dial frequency" as required.
- TX; command to switch the radio into Transmit mode.
- TAnnn; command, multiple times, to set all the audio tones you want. The first TA command does key-down with a nice Blackmann-Harris shaped RF envelope.
- TA0; command, any number less than 10 Hz causes a key-up, with a nice Blackmann Harris shaped RF envelope.
- Wait a few milliseconds, say 5ms, for the RF envelope shaping to finish.
- RX; command to switch the radio back to Receive mode.

If you did not do TA0; and wait and then RX; but instead you just sent command RX; to go instantly back to Receive mode, that would also terminate the transmission but with a hard switch off, not a well shaped envelope-decay.

TB: Command to retrieve decoded text from the QMX's CW decoder text buffer

Get: Returns the contents of the decoded CW buffer to the CAT host, and empties the buffer, so decoding CW will fill it up again. The format of the response is TBtnns; where
TB   two-character result code, the same as the command "TB"
t   indicates whether message sending is in progress via the KY command, and how many characters remain to be sent. If more than 9 characters remain to be sent, then this parameter is 9. If this character is 0 then the QMX is in receive mode.
nn   the number of decoded characters being returned
s   the string of nn decoded characters
;   CAT response terminator.

Note that the decoded CW buffer is a special 40-character buffer, where incoming decoded CW is stored for sending to CAT. This buffer is NOT a circular buffer. When it fills up, it simply discards any new incoming characters. The host application wishing to use this feature, should therefore ensure that it reads the buffer sufficiently often that it does not fill up.

TM: Get/Set Real time clock time

Set: Sets the real time clock. Format is Tmhhmmss; for example to set the real time clock to 13:55:32, send CAT command "TM135532;"

Get: Returns the real time clock value. For example command "TM;" will return "TM135532;" if the real time clock value is 13:55:32.

TQ: Get/Set transmit state

Set: Sets transmit state: 0 = RX, 1 = TX. For example "TQ1;" switches QMX to transmit mode

Get: Returns the transmit state: 0 = RX, 1 = TX.

TX: Set the radio into Transmit mode immediately	
Set:	Command TX; immediately puts the radio into transmit mode. It is equivalent to TQ1;
VN: Returns firmware version	
Get:	Returns the firmware version. For example, VN; command returns VN1_00_021QMX; (the same as the firmware file name, without the dot)

Menu manager commands MM and ML

MM and ML commands provide a powerful means for a CAT host to query the QMX configuration menu structure in its entirety (menu discovery), or to Get or Set any value in the configuration menu. The function of the command is determined by the command syntax. In summary:

- Get: Mmpath;
- Set: MMpath=value;
- Query: Mmpath?;

path specifies the full path to the menu item, through the menu structure. Menu names are delimited by the | character. For example:

`Audio|AGC settings|Threshold S`

is the path to the Audio sub-menu, then to the AGC settings sub-sub-menu, then the Threshold S-points value.

Note that paths are case insensitive, so equivalently in this case one may write:

`AUDIO|AGC SETTINGS|THRESHOLD S`

One can also use index numbers, starting from zero. So the above path is also equivalent to:

`0|0|1`

since the "Audio" menu is the first of the top-level menu items (index 0), "AGC settings" is the first sub-sub-menu of the "Audio" menu (index 0) and "Threshold S" is the second item in the "AGC settings" sub-sub menu (index 1).

It is probably preferable to use the longer real names of the menu items, as it will probably be less likely that menu items will change their name in future firmware releases, than change their position in their menu pages.

Menu item Get

The Get form of the MM command is simply the path followed by the semicolon. For example:

`MMAUDIO|AGC SETTINGS|THRESHOLD S;`

may return for example:

`MM4;`

indicating that the AGC threshold is set to signal level S-4.

Note that if the Get command format is issued for a menu item which is a sub-menu or application type, the result will simply be an standard error return "?;".

The Band config. screen is a particular case, because it is a table of values:

```
   ▼                              /dev/ttyACM1 - PuTTY                        ↑  −  +  ✕

  +---Main menu------+
  |+---Configuration----+
  ||+---Band config.-----------------------------------------------+
  |||                                                              |
  |||  Band index        0       1        2        3        4        5        |
  |||  Band name (m)     160     80       60       40       30       20       |
  |||  RF gain (dB)      54      54       54       54       54       74       |
  |||  Frequency min.    1700000 3200000  4000000  6000000  7500000  10500000 |
  +||  Frequency center  1838100 3573000  5357000  7074000  10136000 14074000 |
   ||  Frequency max.    2100000 4000000  6000000  7500000  10500000 14500000 |
   ||  Sweep start       1500000 3200000  3200000  3200000  5000000  6500000  |
   ||  Sweep step        10000   20000    60000    75000    110000   150000   |
   ||  BPF number (0-7)  0       1        1        2        2        3        |
   ||  LPF number (0-5)  0       1        1        2        2        3        |
   ||  PIN fwd bias mA   30      30       30       30       30       30       |
   ||  Transmit          ENABLED ENABLED  ENABLED  ENABLED  ENABLED  ENABLED  |
   ||  TX PTT +5V        DISABLED DISABLED DISABLED DISABLED DISABLED DISABLED |
   ||  TX PTT grounded   DISABLED DISABLED DISABLED DISABLED DISABLED DISABLED |
  +|  RX PTT +5V        DISABLED DISABLED DISABLED DISABLED DISABLED DISABLED |
   |  RX PTT grounded   DISABLED DISABLED DISABLED DISABLED DISABLED DISABLED |
   |                                                                          |
   +--------------------------------------------------------------------------+
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```

When accessing a grid parameter configuration page such as for example the Band Configuration screen, which has 16 columns of data (band configurations), the path must be appended with an array subscript, such as [2] (for the 3rd column of the grid). For example, on a QMX+, if you wanted to retrieve the RF gain setting of the 40m band, which is in the 4th column (array subscript 3, since they start at zero), then the CAT command would be:

`MMBand config.|RF gain (db)[3];`

The result (in a default factory reset configuration) would be:

`MM54;`

Menu item Set

The Set form of the MM command is the path, followed by = then the value, and finally the terminating semicolon. For example, to set the AGC settings sub-menu AGC threshold S-meter value to S-5, you could use the following command:

`MMAUDIO|AGC SETTINGS|THRESHOLD S=5;`

Setting the value of a sub-menu or application type is not possible.

As with the Get form of the MM command, on grid pages such as the Band Configuration screen, you append the path with an array suffix. So to set the 40m band RF gain to 63 dB:

```
MMBand config.|RF gain (db)[3]=63;
```

Note that whilst the regular two-letter CAT commands only affect the radio's current operating session, they are not stored in the EEPROM configuration memory, Menu Manager MM Set commands ARE stored in the configuration memory.

Menu discovery

In discovery mode, the MM command returns information about the specified menu item. For example command:

```
MM0?;
```

queries the first menu item on the top level menu. The result is:

```
MM0|0|Audio;
```

The explanation of the command result is as follows:

MM	the CAT command echoed back.
0	the data type of the menu (see below); 0 means it's a sub-menu item.
0	For list menu items, this is the list type applied to the menu item.
	For numeric and string menu items, this is the character length of value field.
Audio	The name of the menu item.
;	Terminating character, indicating the end of the CAT command result.

The possible data types are:

0	Sub-menu
1	Application or action menu item
2	String, with field length indicated by the next parameter (see above)
3	Number, with field length indicated by the next parameter (see above)
4	Byte, a number in the range 0 to 255
5	List of defined values, with a list type indicated by the next parameter (see above)
6	Info, a dummy menu item type solely for displaying information to the user
7	Mask, a collection of up to 8 named boolean parameters

When the data type is a List, you may query the available values in the list using the ML command.

For example, this MM discovery mode command queries the first menu item (index 0) in the CW keyer sub-menu of the CW menu:

```
MMCW|CW Keyer|0?
```

returns:

```
MM5|3|Keyer mode;
```

indicating that this is a menu item named "Keyer mode", of type List (5, see above), and that the list type is 3. Now we may find out the value of the current setting using:

```
MMCW|CW Keyer|Keyer mode;
```

which returns for example:

```
MMIAMBIC A;
```

But if we are curious what other values the list contains, we can use the ML command to find out:

```
ML3;
```

resulting in a | delimited specification of the list values:

```
MLStraight|IAMBIC A|IAMBIC B|Ultimatic;
```

Several further points are worthy of note

Consider the menu discovery command:

```
MM12?;
```

which queries the 13th (index 12) item on the top level configuration menu. The result is:

```
MM0|0|Band config.[16];
```

This is the Band Configuration screen, and is mentioned here to demonstrate how a grid page menu is identified in menu discovery. The menu item type is zero (sub-menu), the name is "Band config." and the subcript [16] in square brackets, here indicates that the table has 16 columns.

We may then proceed if we wish, to discover the rows in the Band Configuration screen. For example to query the information about the first row (index 0) of the table:

```
MMBand config.|0?;
```

returns

```
MM3|4|Band name (m);
```

Which means the row is named "Band name (m)", it has a type 3 (number) and it is 4 characters long. This means it can hold band numbers even down to 2200 (2200m LF band, 136 kHz). But of course 6 (6m, 50MHz band) is also possible, one character is less than four so it is allowed.

Now to demonstrate the "mask" menu page type, consider the |Choose filters" sub-menu of the "CW" sub-menu. In the terminal, the menu looks like this:

```
+---Main menu------+
|+---Configuration----+
|| +---CW------------------------------+
||| +---Choose filters--+               |
||||                    |               |
||||   50     ENABLED   |               |
||||   100    ENABLED   | 300           |
||||   150    ENABLED   | 700           |
+|||   200    ENABLED   | YES           |
 |||   250    ENABLED   | 700           |
 |||   300    ENABLED   | 700           |
 |||   400    ENABLED   | 53            |
 |||   500    ENABLED   | Relative      |
 |||                    | OFF           |
 ||+--------------------+               |
 ||                                     |
 |+-------------------------------------+
 |                     |
 +---------------------+

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```

There are 8 possible filter widths, each may be enabled or disabled. Internally in QMX these are stored in a single byte for the whole sub-menu, with one bit per row of configuration.

"Choose filters" is the 11th item in the CW menu so:

MMCW|10?;

returns

MM0|0|Choose filters;

which just means, as usual, Choose filters looks like an ordinary menu. Now I make look inside that menu:

MMCW|Choose filters|0?;

returns

MM7|6|50;

which means the menu item row is named "50", its type (7) is Mask, and 6 is the type of List parameter which each row consists of. In this case, type 6 is DISABLED/ENABLED. In the case of Mask menus, the List type can only have TWO entries, in other words it's a boolean represented by a single bit in the mask. So NO/YES, DISABLED/ENABLED, OFF/ON etc.

Get and Set operations are the same as previously. However, an important EXCEPTION to the rule exists; previously it was stated that a path can contain menu item names OR numeric indexes. Indeed, the path can even contain a mixture of names and numbers. However, if the name itself is numeric (as in this case, the names are 50, 100, 150, 200 etc.), then you can ONLY specify the path in numeric form. This is because as the name is a number, the system will try to interpret it as a numeric path (index in the menu item list). Therefore:

MMCW|Choose filters|50;

does not work, it returns the usual error result:

`?;`

You would have to use:

`MMCW|Choose filters|0;`

where the 0 in the final part of the path, is the index into the list of menu items; in this case the first menu item (as indexing starts at zero). So the result is:

`MMENABLED;`

indicating the 50 Hz filters are ENABLED.

Document Revision History

1_02_006   30-Oct-2025   First version, for firmware 1_02_006

1_03_000   06-Feb-2026   Added PL; command for firmware 1_03_000