

# ELECRAFT PX3 PROGRAMMER'S REFERENCE

Rev. A6 (See Appendix A for change history)

## Command Set Overview

The PX3 provides a set of remote-control commands to control the most important instrument functions (Table 1). Details on individual commands start on page 2. PX3 macro import/export/edit operation starts on page 9.

**Table 1.** PX3 Control Commands.

| Name | Description               | Name  | Description              | Name  | Description            |
|------|---------------------------|-------|--------------------------|-------|------------------------|
| =    | Product ID                | #FNX  | Function key execute     | #OSBP | OSB Phase              |
| #AVG | Averaging time            | #FXA  | Fixed auto-adjust mode   | #PKM  | Peak mode on/off       |
| #BCI | Beacon interval           | #FXT  | Fixed or Tracking select | #PS   | Power status/control   |
| #BCL | Beacon location           | #KBMP | Internal use only        | #PT   | Pass-Through mode      |
| #BCN | Beacon on/off             | #LBL  | Labels on/off            | #QSY  | QSY to current marker  |
| #BMP | Bitmap upload             | #LD   | Internal use only        | #RCF  | Relative Center Freq.  |
| BR   | Baud rate set             | #MAA  | Marker A Adjust          | #REF  | Reference Level        |
| #BR  | Baud rate set             | #MBA  | Marker B Adjust          | #RST  | Reset the PX3          |
| #CAL | Calibration signal on/off | #MFA  | Marker A frequency       | #RVM  | Main firmware revision |
| #CTF | Center frequency          | #MFB  | Marker B frequency       | #SCL  | Scale                  |
| #DSM | Display mode              | #MKA  | Marker A on/off          | #SPN  | Span                   |
| #ER  | Internal use only         | #MKB  | Marker B on/off          | #TXH  | Text TX hang time      |
| #EW  | Internal use only         | #MSS  | MSD Screen Shot          | #TXM  | Text TX Mode           |
| #EXR | Internal use only         | #NB   | Noise blanker on/off     | #USB  | USB connected?         |
| #EXW | Internal use only         | #NBL  | Noise blanker Level      | #VFB  | VFO B cursor on/off    |
| #FNL | Function key label        | #OSBA | OSB Amplitude            |       |                        |

The **Command Tester** screen of the *PX3 Utility* computer program is a convenient way to try individual control commands. You can also define macros, which allow sending strings of PX3 and/or KX3 commands with a single mouse click. The **Capture Image** screen uses the **#BMP** command to upload the current PX3 screen to a standard bitmap graphics file. See the *PX3 Utility* help facility for details.

When a KX3 is connected to the RS232 "ACC1 XCVR" port, both KX3 and PX3 commands can be sent from the same computer program. For example, **#RVM;** returns the revision number of PX3 firmware and **RVM;** returns the revision number of main firmware in the KX3. Sending those two commands is a handy way to check the connectivity of the two RS232 ports on the PX3. If you get a response to **#RVM;** then the PC port is connected; if you get a response to **RVM;** then the XCVR port is connected as well.

### Command Format

Commands sent from the computer to the PX3 are considered either GETs or SETs. GET commands are used by the computer to get information from the PX3; the PX3 will then provide an appropriate response message (RSP). SET commands are sent by the computer to change the instrument's configuration or initiate an event. Commands with an incorrect format or an out-of-range parameter are ignored. A SET can be followed by a GET to verify the new settings.

SET commands use 2-4 characters, optional data fields, and a terminating semicolon (;). Examples:

**#AVG05;**      Computer turns on averaging with a time constant of 5.  
**#DSM1;**      Computer selects spectrum+waterfall display mode.

Many SET commands have a corresponding GET command, which is just the command letters with no data, plus the semicolon. The data format of the response message from the PX3 (RSP) is usually identical to the format of the SET data. Exceptions are noted in the command descriptions.

Characters sent to the PX3 can be in either upper or lower case. The PX3 always responds with upper case.

## Command Reference

This section describes all PX3 GET, SET and RSP (response) command formats. Unless otherwise noted, the GET format is just the 2 or 3 letters of the command followed by a semicolon. The SET and RSP data formats are identical unless otherwise noted. All commands must be followed by a semicolon except where noted.

= (*Product identification; GET only*)

RSP format: **PX3** (main firmware executing) or **px3** (boot loader ready to download new firmware). There is no "#" or semicolon in either the query or the response.

**#AVG** (*Averaging Time, GET/SET*)

SET/RSP format: **#AVGnn**; where **nn** is 00 (average mode off) or the averaging time constant, 02-20 (average mode on).

**#BMP** (*Bitmap upload, GET only*)

RSP format: **[bmp]cc** where **[bmp]** is 131,638 bytes of binary image data in standard .BMP file format and **cc** is a two-byte checksum. Note that the response does not include the command name and has no terminating semicolon. The checksum is the modulo-65,536 sum of all 131,638 bytes, sent least-significant byte first.

**#BCI** (*Beacon Interval; GET/SET*)

SET/RSP format: **#BCInnnn**; where **nnnn** is the beacon interval or time to wait between beacon transmissions, in seconds when beacon mode is activated 1 – 3600.

**#BCL (Beacon Location; GET/SET)**

SET/RSP format: **#BCLnn**; where **nn** is the text memory location to send when beacon mode is activated 1 – 50.

**#BCN (Beacon Mode On/Off; GET/SET)**

SET/RSP format: **#BCNn**; where **n** is **1** (active, on) or **2** (disabled, off).

**BR and #BR (Baud Rate of the PC RS232 port, SET only)**

SET format: **BRn**; or **#BRn**; where **n** is **0** (4800 b), **1** (9600 b), **2** (19200 b), or **3** (38400 b). The *PX3 Utility* program automatically sets the PX3 to 38400 baud for downloads, then restores the baud rate to the user's selection (that was made using either this command or the PX3's *RS232* menu entry). Note that the RS232 port that connects to the KX3 always runs at 38400 baud. Any **BR** command that is received from a host computer affects the baud rate of the PX3 (on the RS232 port that connects to the PC), not the KX3.

**#CAL (Calibration signal on/off, GET/SET)**

SET/RSP format: **#CALn**; where **n** is **0** (calibration signal off) or **1** (calibration signal on). The calibration signal generated is based on the current KX3 band.

**#CTF (Center Frequency, GET/SET)**

SET/RSP format: **#CTFsxxxxxxxx**; where **s** is +/- and **xxxxxxxx** is the center frequency in Hz. **s** can also be a space in lieu of +. Example: **#CTF+0001406000**; sets the center frequency to 14060 kHz. If the specified frequency is outside the range the PX3 can tune to, the action is undefined. A value of zero sets the center frequency to the main VFO frequency of the transceiver. For transceivers other than the KX3, the center frequency is interpreted relative to the frequency the transceiver is tuned to and may be positive or negative.

**#DSM (Display Mode, GET/SET)**

SET/RSP format: **#DSMn**; where **n** is **0** (spectrum only) or **1** (spectrum + waterfall).

**#FNL (Function Key Label, GET only)**

GET format: **#FNLn**; where **n** = 1-8, for keys FN1-FN8.

RSP format: **#FNLncccccccc**; where **n** = 1-8 and **cccccccc** are the 9 ASCII characters in the key label for FNn.

**#FNX (Function Key Execute, SET only)**

SET format: **#FNXn**; where **n** = 1-8, for keys FN1-FN8. Executes the function assigned to the key, if any.

**#FXA (Fixed-tune Auto-adjust Mode, GET/SET)**

SET/RSP format: **#FXAn**; where **n** is **0** (Full screen), **1** (Half screen), **2** (Slide) or **3** (Static) to specify how far the PX3 center frequency moves when the KX3 VFO A is tuned off screen in fixed-tune mode.

**#FXT (Fixed or Tracking Select, GET/SET)**

SET/RSP format: **#FXTn**; where **n** is **0** (Tracking mode), or **1** (Fixed-tune mode).

**#LBL (Labels on/off, GET/SET)**

SET/RSP format: **#LBLn**; where **n** is **0** (FN key labels off), **1** (FN key labels on) or **2** (text decode on).

**#MAA, #MBA (Marker Adjust, SET ONLY)**

Adjusts the Marker frequency by either adding or subtracting a value. If the marker is turned off, the marker frequency will still be updated. There are two ways to use this command, either specify an adjustment selection or use an internal value which is based on the current span and mode. Specifying the adjustment uses the same values as used by the K3/KX3 UP and DN commands. Usage: #MAAsn

s = + to increment, - to decrement

n = 0 adjust by 1 Hz

n = 1 “ “ 10 Hz

n = 2 “ “ 20 Hz

n = 3 “ “ 50 Hz

n = 4 “ “ 1 kHz

n = 5 “ “ 2 kHz

n = 6 “ “ 3 kHz

n = 7 “ “ 5 kHz

n = 8 “ “ 100 Hz

n = 9 “ “ 200 Hz

The other way to use this command is to simply give the sign, or direction and allow the PX3 to determine the adjustment based on the current span and mode:

#MAAs

s = + to increment, - to decrement. The step size is automatically determined by the current span and mode:

**USB, LSB, AM & FM**

Span < 5 kHz – step = 10 Hz

Span 2-9.99 kHz – step = 20 Hz

Span 10-49.9 kHz – step = 50 Hz

Span 50-99.1 kHz – step = 100 Hz

Span 100-200 kHz – step = 200 Hz

**CW & Data**

Span < 5 kHz – step = 2 Hz

Span 2-9.99 kHz – step = 10 Hz

Span 10-49.9 kHz – step = 20 Hz

Span 50-99.1 kHz – step = 50 Hz

Span 100-200 kHz – step = 100 Hz

***#MFA, #MFB (Marker A/B Frequency, GET/SET)***

SET/RSP format: **#MFA**sxxxxxxxxx; or **#MFB**sxxxxxxxxx; where s is +/- and xxxxxxxxxxx is the marker frequency in Hz. s can also be a space in lieu of +. Example: **#MFA+0001406000**; sets the marker A frequency to 14060 kHz. If the specified frequency is in a different band than the KX3 is tuned to, the action is undefined. A value of zero sets the marker to the main VFO frequency of the transceiver. For transceivers other than the KX3, the marker frequency is interpreted relative to the frequency the transceiver is tuned to and may be positive or negative.

***#MKA, MKB (Marker A/B on/off, GET/SET)***

SET/RSP format: **#MKAn**; or **#MKBn**; where n is **0** (marker off) or **1** (marker on). The last marker to be turned on automatically becomes the active marker, meaning it can be adjusted with the knob and is the one that responds to the QSY command. If the marker was off-screen before executing a marker-on command, it will default to the center frequency.

**#MSS (MSD Screen shot, SET)**

Creates a bitmap copy of the LCD screen (screen shot) and saves it to the MSD flash drive (thumb drive, flash memory stick). Each time the screen shot is performed, a new file is created. Filenames use a numeric format in which the first 3 characters are "PX3" followed by a 5 digit number, i.e. PX300009.BMP **Note: while the PX3 is busy saving a screen shot, other commands will be received but not processed.**

**#NB (Noise blanker on/off, GET/SET)**

SET/RSP format: **#NBn**; where **n** is **0** (noise blanker off) or **1** (noise blanker on).

**#NBL (Noise blanker level, GET/SET)**

SET/RSP format: **#NBLnn**; where **nn** sets the aggressiveness of the noise blanker algorithm, 1 = least aggressive, 15 = most aggressive.

**#OSBA (Opposite side band null amplitude value, GET/SET)**

SET/RSP format: **#OSBA snnnn**: where **s** is the sign (+ or -) and **nnnn** is the value. **s** can also be a space in lieu of +. Value range is -9999 to +9999. This is a per-band setting.

**#OSBP (Opposite side band null phase value, GET/SET)**

SET/RSP format: **#OSBP snnn**: where **s** is the sign (+ or -) and **nnn** is the value \* 10. **s** can also be a space in lieu of +. Value range is -450 (-45.0) to 450 (45.0). This is a per-band setting.

**#PKM (Peak Mode on/off, GET/SET)**

SET/RSP format: **#PKMn**; where **n** is **0** (peak mode off) or **1** (peak mode on).

**#PS (Power Status, GET/SET)**

SET/RSP format: **#PSn**; where **n** = **1** indicates the PX3 is on. **#PS0** turns the PX3 off, but this removes power so **#PS1** cannot be used to turn it on. Note that if the power-on jumper on the rear-panel I/O board is in the "always on" position, then the **#PS0** command has no effect.

**#PT (Pass Through, SET only)**

SET format: **#PT**; Sets the PX3 to pass-through mode, that is, the panadapter operation ceases and all data received on either RS232 port is passed through immediately to the other RS232 port without delay or modification. This command is used by *PX3 Utility* when downloading new firmware to the KX3 transceiver. Pass-through mode ends automatically 20 seconds after the last RS232 activity.

***#QSY (QSY to current marker, SET only)***

SET format: **#QSYn**; where **n** is **1** (QSY ) or **0** (undo QSY). "QSY" means the currently-active marker frequency is transferred to the associated VFO on the KX3. MKR A controls VFO A and MKR B controls VFO B. "Undo QSY" means to return the VFO to the frequency it was on before the last QSY, a one-level undo command.

***#RCF (Relative Center Frequency, GET/SET)***

SET format: **#RCFsnnnnnn**; where **s** is +/- and **nnnnnn** is the offset in Hz which when added to the VFO A frequency becomes the new center frequency. This command is used to position the VFO A cursor on the screen. For example, if the current span is set to 50 kHz, **#RCF+025000** will move the VFO A cursor to the left edge of the screen. (the center frequency moves up 25 kHz, which shifts the VFO A cursor to the left)

RSP format: **#RCFsnnnnnn**; where **s** is +/- and **nnnnnn** is the difference between the current center frequency and the VFO A frequency.

***#REF (Reference Level, GET/SET)***

SET/RSP format: **#REFsnnn**; where **s** is +/- and **nnn** is the reference level in dBm, between -170 and +010 dBm. **s** can also be a space in lieu of +. For example, **#REF-120**; sets the reference level (at the bottom of the PX3 spectrum screen) to -120 dBm.

***#RST (Reset the PX3, SET only)***

Forces a power-on reset.

***#RVM (Main Firmware Revision, GET only)***

RSP format: **#RVMNN.NN**; where **NN.NN** is the firmware revision, e.g. **01.23**.

***#SCL (Scale, GET/SET)***

SET/RSP format: **#SCLnnn**; where **nnn** is the scale (the difference in dB between the top and bottom of the spectrum screen), between 010 and 080 dB. Example: **#SCL080**; sets the scale to 80 dB.

***#SPN (Span; GET/SET)***

SET/RSP format: **#SPNxxxxxx**; where **xxxxxx** is 000020-002000, the span in 100-Hz units. Example: **#SPN000500**; sets the span to 50 kHz.

***#TXH (Text TX hang time; GET/SET)***

SET/RSP format: **#TXHnnnnn**; where **nnnnn** is 00000-90000 milliseconds to keep the KX3 transmitting after the last PX3 keyboard text character is sent. Example: **#TXH03000**; sets a 3 second (3000 ms) hang time. (*PSK/RTTY data modes only*)

**#TXM** (*Text TX mode; GET/SET*)

SET/RSP format: **#TXMnn**; where **nn** is **00** (Enter key), **01** (^R/^T toggle), **02** (Any key), or **03** (Space key).

**#USB** (*USB connected state; GET only*)

RSP format: **#USBn**; where **n** is **1** (USB keyboard detected) or **2** (no keyboard detected).

**#VFB** (*VFO B cursor on/off; GET/SET*)

SET/RSP format: **#VFBn**; where **n** is **0** (VFO B cursor off) or **1** (VFO B cursor on).

## PX3 MACRO EXPORT/IMPORT

Starting with firmware revision 1.48, the PX3 supports keyboard macro import and export using a USB memory stick/flash drive plugged into the USB port on the left side of the unit. Macros may be exported, modified and then imported. This feature allows easy sharing of macros between multiple PX3's as well as custom editing of macros using a PC. A simple worksheet can be used to create the hexadecimal key code when creating new macros (included in this manual)

### Exporting Macros

To export macros:

- Insert a USB “thumb drive” or flash drive into the USB port on the left side of the PX3. Make sure the letter ‘M’ appears in the upper right hand portion of the screen.
- Press Menu, and using the encoder, select “MSD Menu.”
- Press the encoder knob to enter the sub-menu and rotate the encoder knob to select “**XportMacr**”.
- Pressing the encoder knob will start the export. Once the macros have been exported, the message “Macros exported” will be displayed in the upper right corner of the screen.

### Importing Macros

To import macros:

- Insert a USB “thumb drive” or flash drive into the USB port on the left side of the PX3. Make sure the letter ‘M’ appears in the upper right hand portion of the screen.
- Press Menu, and using the encoder, select “MSD Menu.”
- Press the encoder knob to enter the sub-menu and rotate the encoder knob to select “**ImpprtMacr**”.
- Pressing the encoder knob will start the import. Once the macros have been imported, the message “Macros imported” will be displayed in the upper right corner of the screen.

### Macro File Format

The exported macros/text messages are written to a file on the memory stick called “macros.txt”. Only macros/messages that are not empty are written out to the file. Each line constitutes one macro or message. Fields within the line are delimited with commas (.). Lines that begin with the ‘#’ (pound) character are ignored. This permits comments and other text to be added.

*number, key code, ..... contents .....*

number: 1 – 100

The number determines if the entry is for macro or a text message. Valid macro numbers are **1 - 50** while valid text message numbers are **51 - 100**.

**NOTE: specifying the number of an existing macro/message will overwrite that location when imported.**

key code:

The key code is a special 8 digit hexadecimal number built up using a key value and optional key modifiers. Special key code modifiers (Alt, Ctrl, etc.) can be added to the base key code if needed. For example, the F1 base key code value is 0x3A . Adding the Alt modifier of 0x200 results in a key code of 0x23A for “Alt-F1”.

contents:

Up to 94 characters are allowed for text messages or macros.

**Supported USB Keyboard Codes (note: some codes may not be present on all keyboards)**

|      |                             |      |                          |
|------|-----------------------------|------|--------------------------|
| 0x04 | Keyboard a and A            | 0x36 | Keyboard, and <          |
| 0x05 | Keyboard b and B            | 0x37 | Keyboard . and >         |
| 0x06 | Keyboard c and C            | 0x38 | Keyboard / and ?         |
| 0x07 | Keyboard d and D            | 0x3A | Keyboard F1              |
| 0x08 | Keyboard e and E            | 0x3B | Keyboard F2              |
| 0x09 | Keyboard f and F            | 0x3C | Keyboard F3              |
| 0x0A | Keyboard g and G            | 0x3D | Keyboard F4              |
| 0x0B | Keyboard h and H            | 0x3E | Keyboard F5              |
| 0x0C | Keyboard i and I            | 0x3F | Keyboard F6              |
| 0x0D | Keyboard j and J            | 0x40 | Keyboard F7              |
| 0x0E | Keyboard k and K            | 0x41 | Keyboard F8              |
| 0x0F | Keyboard l and L            | 0x42 | Keyboard F9              |
| 0x10 | Keyboard m and M            | 0x43 | Keyboard F10             |
| 0x11 | Keyboard n and N            | 0x44 | Keyboard F11             |
| 0x12 | Keyboard o and O            | 0x45 | Keyboard F12             |
| 0x13 | Keyboard p and P            | 0x46 | Keyboard PrintScreen     |
| 0x14 | Keyboard q and Q            | 0x48 | Keyboard Pause           |
| 0x15 | Keyboard r and R            | 0x49 | Keyboard Insert          |
| 0x16 | Keyboard s and S            | 0x4A | Keyboard Home            |
| 0x17 | Keyboard t and T            | 0x4B | Keyboard PageUp          |
| 0x18 | Keyboard u and U            | 0x4C | Keyboard Delete Forward  |
| 0x19 | Keyboard v and V            | 0x4D | Keyboard End             |
| 0x1A | Keyboard w and W            | 0x4E | Keyboard PageDown        |
| 0x1B | Keyboard x and X            | 0x4F | Keyboard RightArrow      |
| 0x1C | Keyboard y and Y            | 0x50 | Keyboard LeftArrow       |
| 0x1D | Keyboard z and Z            | 0x51 | Keyboard DownArrow       |
| 0x1E | Keyboard 1 and !            | 0x52 | Keyboard UpArrow         |
| 0x1F | Keyboard 2 and @            | 0x54 | Keypad /                 |
| 0x20 | Keyboard 3 and #            | 0x55 | Keypad *                 |
| 0x21 | Keyboard 4 and \$           | 0x56 | Keypad -                 |
| 0x22 | Keyboard 5 and %            | 0x57 | Keypad +                 |
| 0x23 | Keyboard 6 and ^            | 0x58 | Keypad ENTER             |
| 0x24 | Keyboard 7 and &            | 0x59 | Keypad 1 and End         |
| 0x25 | Keyboard 8 and *            | 0x5A | Keypad 2 and Down Arrow  |
| 0x26 | Keyboard 9 and (            | 0x5B | Keypad 3 and PageDn      |
| 0x27 | Keyboard 0 and )            | 0x5C | Keypad 4 and Left Arrow  |
| 0x28 | Keyboard Return (ENTER)     | 0x5D | Keypad 5                 |
| 0x29 | Keyboard ESCAPE             | 0x5E | Keypad 6 and Right Arrow |
| 0x2A | Keyboard DELETE (Backspace) | 0x5F | Keypad 7 and Home        |
|      |                             | 0x60 | Keypad 8 and Up Arrow    |
| 0x2B | Keyboard Tab                | 0x61 | Keypad 9 and PageUp      |
| 0x2C | Keyboard Spacebar           | 0x62 | Keypad 0 and Insert      |
| 0x2D | Keyboard - and (underscore) | 0x63 | Keypad . and Delete      |
| 0x2E | Keyboard = and +            | 0x64 | Keyboard Non-US \ and    |
| 0x2F | Keyboard [ and {            | 0x65 | Keyboard Application     |
| 0x30 | Keyboard ] and }            | 0x66 | Keyboard Power           |
| 0x31 | Keyboard \ and              | 0x67 | Keypad =                 |
| 0x32 | Keyboard Non-US # and ~     | 0x68 | Keyboard F13             |
| 0x33 | Keyboard ; and :            | 0x69 | Keyboard F14             |
| 0x34 | Keyboard ' and "            | 0x6A | Keyboard F15             |
| 0x35 | Keyboard Grave Accent Tilde | 0x6B | Keyboard F16             |

|      |                         |      |                           |
|------|-------------------------|------|---------------------------|
| 0x6C | Keyboard F17            | 0x89 | Keyboard International3   |
| 0x6D | Keyboard F18            | 0x8A | Keyboard International4   |
| 0x6E | Keyboard F19            | 0x8B | Keyboard International5   |
| 0x6F | Keyboard F20            | 0x8C | Keyboard International6   |
| 0x70 | Keyboard F21            | 0x8D | Keyboard International7   |
| 0x71 | Keyboard F22            | 0x8E | Keyboard International8   |
| 0x72 | Keyboard F23            | 0x8F | Keyboard International9   |
| 0x73 | Keyboard F24            | 0x90 | Keyboard LANG1            |
| 0x74 | Keyboard Execute        | 0x91 | Keyboard LANG2            |
| 0x75 | Keyboard Help           | 0x92 | Keyboard LANG3            |
| 0x76 | Keyboard Menu           | 0x93 | Keyboard LANG4            |
| 0x77 | Keyboard Select         | 0x94 | Keyboard LANG5            |
| 0x78 | Keyboard Stop           | 0x95 | Keyboard LANG6            |
| 0x79 | Keyboard Again          | 0x96 | Keyboard LANG7            |
| 0x7A | Keyboard Undo           | 0x97 | Keyboard LANG8            |
| 0x7B | Keyboard Cut            | 0x98 | Keyboard LANG9            |
| 0x7C | Keyboard Copy           | 0x99 | Keyboard Alternate Erase  |
| 0x7D | Keyboard Paste          | 0x9A | Keyboard SysReq/Attention |
| 0x7E | Keyboard Find           | 0x9B | Keyboard Cancel           |
| 0x7F | Keyboard Mute           | 0x9C | Keyboard Clear            |
| 0x80 | Keyboard Volume Up      | 0x9D | Keyboard Prior            |
| 0x81 | Keyboard Volume Down    | 0x9E | Keyboard Return           |
| 0x85 | Keypad Comma            |      |                           |
| 0x86 | Keypad Equal Sign       |      |                           |
| 0x87 | Keyboard International1 |      |                           |
| 0x88 | Keyboard International2 |      |                           |

## Key Code Worksheet

|   |   | NUMLOCK | GUI    | CAPS/SHIFT | Ctrl/Alt   | Base key code |  |
|---|---|---------|--------|------------|------------|---------------|--|
| 0 | 0 | 0 or 1  | 0 or 1 | 0 or 1     | 0,1,2 or 3 |               |  |

Position = 1 for NUMLOCK   
 Position = 1 for GUI   
 Position = 1 for Shift or CapsLock   
 Position = 1 for Ctrl, 2 for Alt or 3 for Ctrl-Alt

To add modifier codes to an existing base key code, use the table above. For example, to create a key code for **Alt-Shift-Y**, first find the base key code for Y which is **1C** and put those 2 digits into the cells on the right:

|   |   | NUMLOCK | GUI | CAPS/SHIFT | Ctrl/Alt | Base key code |   |
|---|---|---------|-----|------------|----------|---------------|---|
| 0 | 0 | 0       | 0   | 0          | 0        | 1             | C |

Then put a 1 in the Shift cell:

|   |   | NUMLOCK | GUI | CAPS/SHIFT | Ctrl/Alt | Base key code |   |
|---|---|---------|-----|------------|----------|---------------|---|
| 0 | 0 | 0       | 0   | 1          | 0        | 1             | C |

Then put a 1 in Alt cell:

|   |   | NUMLOCK | GUI | CAPS/SHIFT | Ctrl/Alt | Base key code |   |
|---|---|---------|-----|------------|----------|---------------|---|
| 0 | 0 | 0       | 0   | 1          | 1        | 1             | C |

The new key code is: **0000111C**

## **Appendix A: Change History** [Applicable firmware revision shown in brackets]

|                     |  |
|---------------------|--|
| A1, 7-14-15 [01.25] | Original   |
| A2, 10-8-15 [01.34] | Added #BCI, #BCL, #BCN, #TXH, #TXM, #USB                                       |
| A3, 3-22-16 [01.42] | Added #RCF   |
| A4, 7-1-16 [01.45]  | Added #MAA, #MBA, #MSS   |
| A5, 7-14-16 [01.46] | Fixed #MAA, wrong step values given for CW/DATA, added internal command #KBMP. |
| A6, 2-13-17 [01.48] | Added macro import/export section.   |