



ELECRAFT® P3

HIGH-PERFORMANCE PANADAPTER

OWNER'S MANUAL

Revision A1, July 29, 2010

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Contents

**NOTE: IF YOU PURCHASED YOUR P3 AS A KIT, GO DIRECTLY TO APPENDIX B,
KIT ASSEMBLY INSTRUCTIONS TO ASSEMBLE YOUR KIT.**

Key to Symbols and Text Styles.....	3	Basic Operation.....	14
Quick-Start Guide.....	4	Advanced Operating Features.....	17
Introduction.....	7	Firmware Upgrades.....	18
P3 Features.....	7	Configuration.....	18
Specifications.....	8	Frequency Calibration Procedure.....	19
Customer Service and Support.....	9	Menu Functions.....	20
Front Panel.....	10	Troubleshooting.....	21
Control Groups.....	10	Parameter Initialization.....	21
Display.....	11	Theory of Operation.....	22
Primary Controls.....	11	Appendix A – Parts List.....	A1
Menu.....	12	Appendix B – Kit Assembly Instructions.....	B1
Programmable Function Keys.....	12		
Rear Panel Connectors.....	13		

Key to Symbols and Text Styles



Important – read carefully



Operating tip

-100

Characters displayed on the LCD screen

DISPLAY

Tap switch function (labeled *above* a switch)

AVERAGE

Hold switch function (labeled *below* a switch; hold for 1/2 sec. to activate)

⌚ **SELECT**

Rotary control

⌚ **QSY**

Tap switch function of rotary control (labeled *above* the knob)

⌚ **UNDO QSY**

Hold switch function of rotary control (hold for 1/2 sec.)

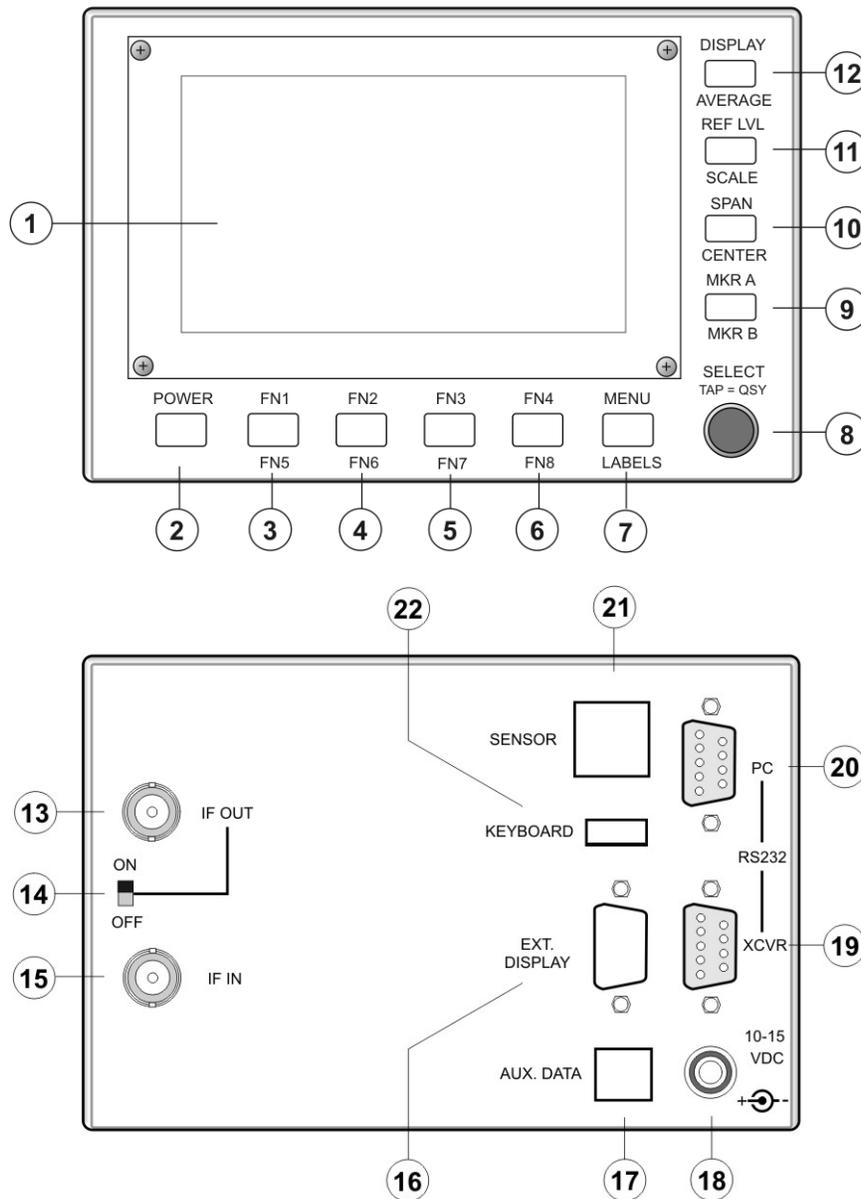
MENU:Font

Typical menu entry

Quick-Start Guide

To get started using your P3 right away, please read this page and the two pages that follow, trying each of the controls. The text uses braces to refer to numbered elements in the front- and rear-panel illustrations below. For example, {1} refers to ①, the display. Later sections provide greater detail on all aspects of P3 operation.

⚠ The first thing you need to know about the P3 is that most switches have two functions. **Tap** (*press briefly*) to activate the function labeled **above** a switch. **Hold** activates the function labeled **below** the switch. In the text, tap functions are shown like this: **DISPLAY**. An example of a hold function is **AVERAGE**. Additional typographical conventions are shown on the previous page.



⚠ IMPORTANT

K3's built before September 2009 should have the I.F. Buffer Gain Modification installed to work with the P3. This modification is included on K3 RF boards version H3 and later. It changes a single resistor to increase the I.F. output from the K3 by about 10 dB. The modification is described on the Elecraft web site at:

http://www.elecraft.com/K3/mods/IF_Output_Buffer_Gain_Mod_Rev_A.pdf

<p>Connections</p> 	<ul style="list-style-type: none"> • Connect a power supply to the DC input jack {18} (see Specifications, pg. 8). When used with a K3, this power may be taken from the 12VDC OUT jack on the K3 rear panel. • Connect a coaxial cable between the IF IN {15} and the I.F. output of your transceiver. When used with a K3, connect the cable to the IF OUT on the K3's rear panel.. • When used with a K3, connect a Male-Female DE-9 cable between the P3 XCVR connector {19} and the K3's rear-panel RS232 connector. • Connector openings {16}, {17}, {21}, and {22} are provided for future use.
<p>The Basics</p>	<ul style="list-style-type: none"> • Turn on the power supply that is supplying the P3. If power is obtained from the 12VDC OUT jack of a K3, turn on the K3. If necessary, press POWER {2} to turn on the P3. You can position a jumper to have the P3 turn on automatically with the K3 (Pg 18). • TAP and HOLD Functions: <i>Tapping</i> briefly activates the function labeled in white <i>above</i> a switch. <i>Holding</i> for about 1/2 second activates the function labeled in yellow <i>below</i> a switch. Try tapping MENU {7} to bring up the main menu. Rotate SELECT {8} knob to scroll through the menu entries. Tapping the knob selects the entry currently displayed. Tap the knob again to deselect the entry. Tap MENU {7} to exit the menu. • Tap DISPLAY {12} to cycle between spectrum and waterfall display modes (Pg 14). • Activating most functions enables the SELECT {8} knob so you can adjust the parameter associated with the function. The current parameter value is shown on the screen {1}. You can exit and save the parameter by tapping the same key a second time, even for hold functions. • For hold functions, you can also hold the key a second time to exit parameter-entry mode. In the case of the hold functions associated with the four keys along the right edge of the front panel {9-12}, holding the key a second time also de-activates the function itself. For example, holding (CENTER) a second time returns the display center frequency to the transceiver frequency and holding (MKR B) a second time turns off marker B.

Other Features

- Hold **LABELS** {7} to toggle on or off the function key labels located at the bottom of the screen, just above the function keys (Pgs 11 and 12).
- Tap **MENU** {7} and use the **SELECT** knob {8} to scroll through the list. You can tap or hold one of the function keys {3-6} to assign the currently-displayed function to the key. If the function key labels are on, the label for that key will change to show the selected function (Pg 11).
- Tapping the **SELECT** knob {8} while the menu is active causes the currently-selected menu function to execute. Select *LCD Brt* from the menu and tap the knob. The knob now adjusts the brightness of the LCD display backlight. Tap the knob again to exit the selection or tap **MENU** {7} to select a different menu item. Menu items are listed on page 20.
- Tap **MKR A** {9} or hold **MKR B** {9} to turn on marker A or B. Rotate the **SELECT** knob to place the selected marker at a desired frequency on the display. Markers may be used to measure the frequency of an interesting signal and, if the transceiver is a K3, tapping the knob will QSY (change the frequency of) the K3 to that frequency. **MKR A** controls the K3's VFO A and **MKR B** controls VFO B. The marker colors match the corresponding VFO cursors to emphasize the correspondence. Whichever marker is currently selected is the one that causes the K3 to QSY (Pg 11).
- To return from the last QSY ("undo" function), *hold* the **SELECT** knob pushbutton. To turn off marker A, tap **MKR A** {9} while marker A is selected. To turn off marker B, hold **MKR B** {9} while marker B is selected.
- Tap **SPAN** {10} to set the frequency span of the display. The relative start and stop frequencies are displayed at the top (left and right edge respectively) of the spectrum window (Pg 11).
- Hold **CENTER** {10} to set the center frequency of the display, which is also displayed at the top center of the spectrum window (Pg 12).
- Tap **REF LVL** {11} to set the amplitude reference level of the display, both spectrum and waterfall. The term "reference level" means the signal level that corresponds to the bottom of the spectrum display (Pg 12).
- Hold **SCALE** {11} to set the scale, or range, of both the spectrum and waterfall displays. For example, "60 dB" means that the bottom of the display is 60 dB below the top (Pg 12).
- Hold **AVERAGE** {12} to turn on display averaging and allow adjustment of the averaging time (Pg 12).

Introduction

This comprehensive manual covers all the features and capabilities of the Elecraft P3 panoramic display. We recommend that you begin with the **Quick-Start Guide** (pg. 4). The **Front Panel** (pg. 10) and **Rear Panel** (pg. 13) sections are for general reference. **Basic Operation** (pg. 14) and **Advanced Operation** (pg. 17) fill in the details.

P3 Features

The P3 offers a number of advanced features to enhance performance and versatility:

Compatible Receivers/Transceivers

- May be used with any receiver having an I.F. output between 455 kHz and 21.7 MHz (including the Elecraft K2 with suitable modification). The P3 is usable with frequencies as low as 300 kHz.
- Integrates very closely with the Elecraft K3 with point-and-click QSY and an “undo” feature with simple control press to return to the previous frequency.

Easy Set-Up

- Only two cables for basic operation (I.F. and power).
- Optional additional connections provided for transceiver communications, a personal computer and optional accessories.
- No configuration or calibration is required.

Display

- Bright, high-resolution, full color display.
- Both Spectrum and Waterfall displays.
- Fast display update.
- Up to 200 kHz span.
- Frequency resolution automatically increases as span is decreased.
- Excellent sensitivity and dynamic range.

Ergonomic Design

- Uncluttered interface.
- No unused controls on the screen.

Field Upgradable

- Software defined architecture so many new features will require only a simple firmware update using the provided PC utility program.
- Room inside for future hardware updates.

Specifications

I.F. Frequency Range:	455 kHz to 21.7 MHz (usable with frequencies as low as 300 kHz)
Noise Figure:	< 10 dB measured at P3 input typical
Blocking Dynamic Range:	> 120 dB (500 Hz bandwidth) typical
Absolute Level Accuracy:	± 3 dB plus display resolution after calibration at S9 (-73 dBm)
Relative Level Accuracy:	± 0.1 dB plus display resolution
Display Update Rate:	Selectable 1 Hz to 20 Hz (slower at narrowest spans)
Amplitude Scale:	10 dB minimum, 80 dB maximum
Span:	2 kHz minimum, 200 kHz maximum
Resolution Bandwidth:	Span / 450
Power Requirements:	10 to 15 VDC, 0.5 A maximum
Weight:	5.5 lbs (2.5 kg)
Size:	Enclosure only, 4.0 x 6.1 x 10.0 in., HWD (10.2 x 15.6 x 25.4 cm). With projections, 4.4 x 6.1 x 11.8 in. (11.2 x 15.6 x 30.0 cm).

Customer Service and Support

Technical Assistance

You can send e-mail to k3support@elecraft.com and we will respond quickly – typically the same day Monday through Friday. If you need replacement parts, send an e-mail to parts@elecraft.com. Telephone assistance is available from 9 A.M. to 5 P.M. Pacific time (weekdays only) at 831-662-8345. Please use e-mail rather than calling when possible since this gives us a written record of the details of your problem and allows us to handle a larger number of requests each day.

Repair / Alignment Service

If necessary, you may return your Elecraft product to us for repair or alignment. (Note: We offer unlimited email and phone support, so please try that route first as we can usually help you find the problem quickly.)

IMPORTANT: You must contact Elecraft before mailing your product to obtain authorization for the return, what address to ship it to and current information on repair fees and turn around times. (Frequently we can determine the cause of your problem and save you the trouble of shipping it back to us.) Our repair location is different from our factory location in Aptos. We will give you the address to ship your kit to at the time of repair authorization. *Packages shipped to Aptos without authorization will incur an additional shipping charge for reshipment from Aptos to our repair depot.*

Elecraft 1-Year Limited Warranty

This warranty is effective as of the date of first consumer purchase (or if shipped from the factory, the date the product is shipped to the customer). It covers both our kits and fully assembled products. For kits, before requesting warranty service, you should fully complete the assembly, carefully following all instructions in the manual.

Who is covered: This warranty covers the original owner of the Elecraft product as disclosed to Elecraft at the time of order. Elecraft products transferred by the purchaser to a third party, either by sale, gift, or other method, who is not disclosed to Elecraft at the time of original order, are not covered by this warranty. If the Elecraft product is being bought indirectly for a third party, the third party's name and address must be provided at time of order to ensure warranty coverage.

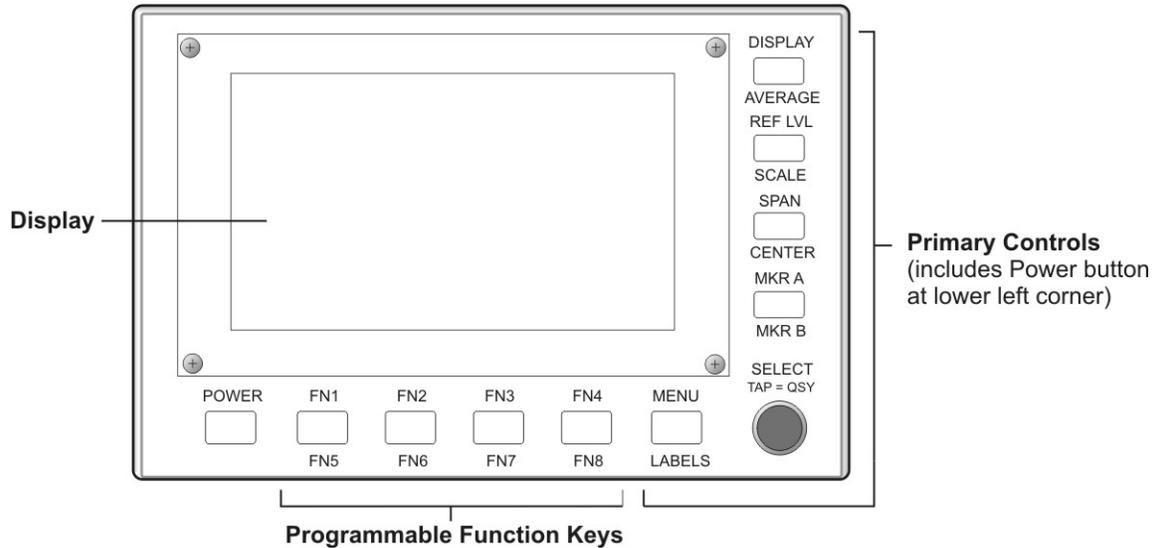
What is covered: During the first year after date of purchase, Elecraft will replace defective or missing parts free of charge (post-paid). We will also correct any malfunction to kits or assembled units caused by defective parts and materials. Purchaser pays inbound shipping to us for warranty repair; we pay shipping to return the repaired equipment to you by UPS ground service or equivalent to the continental USA and Canada. For Alaska, Hawaii, and other destinations outside the U.S. and Canada, actual return shipping cost is paid by the owner.

What is not covered: This warranty does not cover correction of kit assembly errors. It also does not cover misalignment; repair of damage caused by misuse, negligence, or builder modifications; or any performance malfunctions involving non-Elecraft accessory equipment. The use of acid-core solder, water-soluble flux solder, or any corrosive or conductive flux or solvent will void this warranty in its entirety. Also not covered is reimbursement for loss of use, inconvenience, customer assembly or alignment time, or cost of unauthorized service.

Limitation of incidental or consequential damages: This warranty does not extend to non-Elecraft equipment or components used in conjunction with our products. Any such repair or replacement is the responsibility of the customer. Elecraft will not be liable for any special, indirect, incidental or consequential damages, including but not limited to any loss of business or profits.

Front Panel

This reference section describes all front panel controls and the liquid crystal display (LCD). Operating instructions are covered in later sections.



Control Groups

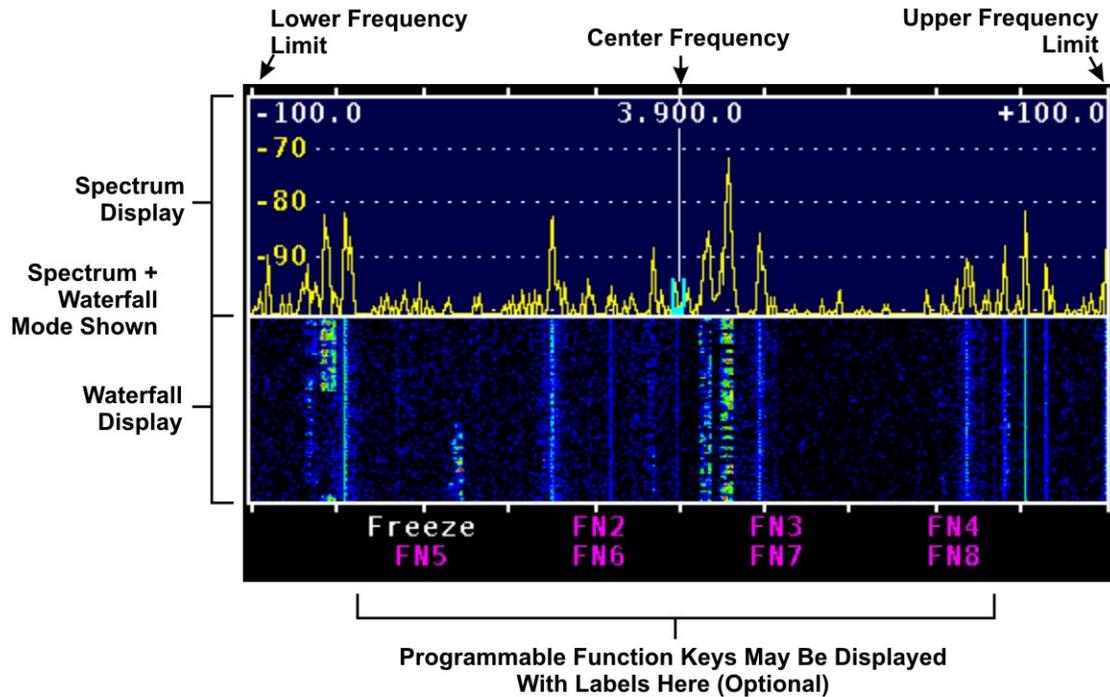
Primary controls (pg 11): These keys are hard-coded with permanent function assignments. They provide the most important operational features needed for basic panadapter operation, including display options, amplitude scaling, frequency control and markers.

Programmable function keys (pg 12): The function keys may be assigned to any of the functions in the MENU list. These include less-used operational features, test functions, and setup and calibration routines.

Display

The 480x272-pixel, color TFT-LCD display is used both for the panadapter spectrum and waterfall graphics as well as for general-purpose information needed by the operator. All graphics and text are

bit-mapped and so are software-defined. The backlight brightness and the text size can be changed via a **MENU** entry (Pg 20).



Primary Controls

POWER Turns the P3 on or off. The P3 may be configured to turn on automatically whenever power is applied, such as when it is powered from a K3 transceiver, by moving a jumper on the rear-panel I/O board (see *Configuration* on page 18 for details.) Holding the POWER switch for more than 10 seconds places the P3 in boot-load mode, ready to receive new firmware via the RS-232 PC connector. If you do this accidentally, simply cycle the POWER to restore normal operation.

MKR A and **MKR B** Selecting one of these functions causes a marker to appear on the display, using different colors for A and B. The marker frequency can be adjusted by turning the **SELECT** knob. If the transceiver is a K3 and it is connected to the P3 via RS-232, then tapping the knob changes the frequency of (QSY) the K3 to that frequency. **MKR A** controls the K3's VFO A and **MKR B** controls VFO B. The marker colors match the corresponding VFO cursors to emphasize the

correspondence. Whichever marker is currently selected is the one that causes the K3 to QSY. To return from the last QSY ("undo" function), hold the **SELECT** knob pushbutton.

To turn off **MKR A**, tap the key while marker A is selected. To turn off **MKR B**, hold the key while marker B is selected. When a marker is turned back on after having been turned off, it will come back at the same frequency unless it is off-screen, in which case the marker defaults to the center frequency.

When another function that uses the **SELECT** knob is activated, the marker(s) stay visible and when that other function is de-selected the last active marker automatically becomes active again.

SPAN Sets the frequency span of the display. The available range is 2 kHz to 200 kHz. The relative start and stop frequencies are displayed at the top (left and right edge respectively) of the spectrum window.

CENTER Sets the center frequency of the display, which is also displayed at the top center of the spectrum window. If the transceiver is a K3, the center frequency equals the VFO A frequency of the K3, but it may be tuned above and below that value. It will then track any changes in the K3's VFO A. To return the center frequency to the K3's VFO A frequency, *hold* the **CENTER** key a second time.

REF LVL Sets the amplitude reference level of the display, both spectrum and waterfall. The term "reference level" means the signal level that corresponds to the bottom of the spectrum display and the minimum signal level (dark blue) of the waterfall. The amplitude labels along the left edge of the spectrum display are in units of dBm. If the transceiver is a K3, the amplitude is that of the signal at the K3 antenna input, with the state of the K3's attenuator and preamp taken into account. Tap any key to de-select the parameter entry.

SCALE Sets the scale, or range, of both the spectrum and waterfall displays. For example, "60 dB" means that the bottom of the display is 60 dB below the top. Tap any key to de-select the parameter entry.

DISPLAY Toggles between the spectrum, and combination spectrum/waterfall display modes.

AVERAGE Turns on display averaging and allows adjustment of the averaging time, in units of the display update period. To de-select parameter entry and turn off averaging at the same time, *hold* the key a second time. To de-select parameter entry while leaving averaging turned on, *tap* the key.

Menu

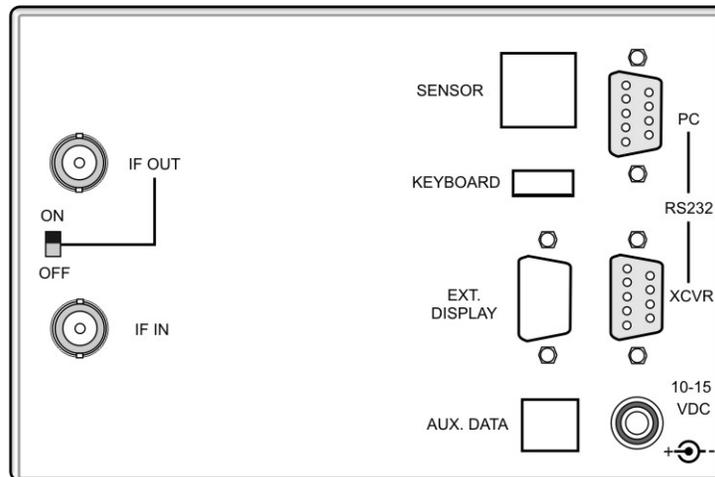
MENU Accesses an alphabetical list of functions (see Menu Functions, pg. 20). Scroll through the list with the  **SELECT** knob and tap the knob to select an item. Tapping the knob a second time unselects the item and tapping **MENU** turns off the menu.

Programmable Function Keys

Any menu function can be assigned to a function key by tapping or holding the **FN1** – **FN4** or **FN5** – **FN8** key while the menu item is displayed but not selected. The label for that function key will then change to the function name (when labels are turned on with the **LABELS** key).

LABELS Toggles the function key labels on and off. Note that the function keys are still active even when the labels are turned off.

Rear Panel Connectors



I.F. Signals: **IF IN** is a BNC jack that connects to the intermediate-frequency output connector of the transceiver (IF OUT on the K3). This should be a buffered, low-level, high-bandwidth signal from the receiver that is tapped off at a point before the high-selectivity filters.

IF OUT is a BNC jack that may be connected to any other device that needs the I.F. output signal from the transceiver. When the IF OUT switch is in the ON position, the IF IN signal is directed to a 3 dB splitter whose outputs feed both the P3 and the IF OUT connector.

RS-232: **XCVR** is a male DE-9 connector that connects to the RS-232 port on a K3 (if used) using a standard 9-pin serial extender cable. It should be

a straight-through cable (not a null modem) with a female connector on one end and male connector on the other. **PC** is a female DE-9 that may optionally be connected to a personal computer that can be used for downloading new firmware and for sending and receiving commands to the P3 and K3 (if connected).

Power: **10-15 VDC** is a standard 2.1 mm barrel connector for a 10-15 VDC supply capable of delivering up to 0.5A.

SENSOR, Keyboard, Ext Display and Aux Data: Spaces for these connectors provided for future use.

Basic Operation

This section covers the fundamentals of P3 operation. Once you're familiar with the P3, please go on to *Advanced Operating Features* (pg.17).

Using Tap/Hold Switches

Most P3 switches have two options. **Tapping** (pressing for less than 1/2 second) activates the function labeled in white above the switch.

Holding (pressing for more than 1/2 second) activates the function labeled in yellow below the switch.

Initial Power-Up

- Connect a power supply, I.F. input and (optionally) an RS-232 cable (pg 13).
- Press **POWER** to turn the P3 on, if it is not on already. The display should light and you should see a spectrum and/or waterfall. If a K3 is connected via RS-232 you should see the correct frequency at the top center of the display.

Configuring the Display

Tap **DISPLAY** to cycle between spectrum, waterfall and spectrum + waterfall displays.

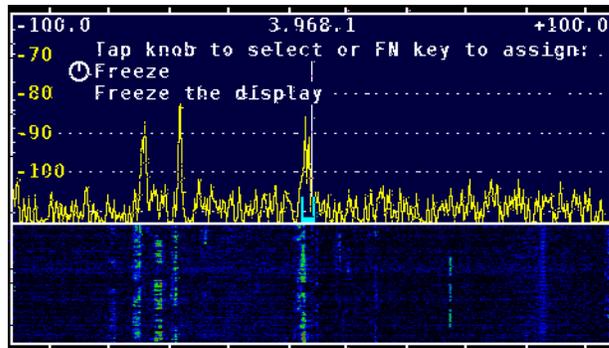
Hold **AVERAGE** to turn on averaging and to set the averaging time constant with the **SELECT** knob.

You can hold **AVERAGE** again to turn off averaging or just tap the same key to clear the parameter-entry text from the display while leaving averaging enabled.

Hold **LABELS** to show or hide the function key labels.

There are also several MENU functions that configure the display, such as *LCD Brt* (display brightness), *Peak hold*, *Freeze display*, *Font size* and *Waterfall height*.

Using the Menu



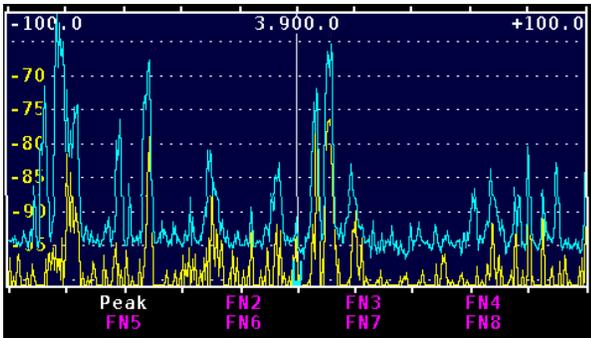
Typical Display Showing a Menu Selection.

- Tap **MENU** to access the menu.
- Turn the **SELECT** knob to scroll through an alphabetical list of available menu functions, as documented in the Menu Functions section (pg.20).
- Tap the **SELECT** knob to select a function.
- Most functions have a parameter which can then be adjusted with the **SELECT** knob.
- Tap the **SELECT** knob again to exit the function.
- Tap **MENU** again to exit the menu.

Programmable Functions

Any MENU function that you'd like quick access to can be assigned to any programmable function key, FN1 to FN8, by tapping or holding the desired function key while the function is visible on the display but *not* selected by tapping the **SELECT** knob. The function name then becomes the function key label which can be seen if labels are currently displayed. To un-assign a function key, select *MENU:FN Erase* and tap or hold the function key you wish to erase.

Some menu items are much more useful when assigned to a function key. Examples are *Peak* hold and *Freeze* display.



PEAK assigned to Function Key FN1.

Adjusting the Amplitude

Tap **REF LVL** to adjust the reference level, which is the signal level that corresponds to the bottom of the spectrum display and the low-signal level of the waterfall display. Hold **SCALE** to adjust the "vertical gain" of the display. For example if the reference level is set to -100 dBm and the scale to 30 dB, then the top of the spectrum display is at -70 dBm and the bottom at -100 dBm.

The waterfall display is most useful if the reference level is adjusted to place the noise level near the bottom of the display and the scale is adjusted so that the strongest signals of interest are near the top.

Adjusting the Frequencies Displayed

Tap **SPAN** to adjust the range of frequencies that can be seen on the display at one time. The start and stop frequencies (calculated as offsets from the center frequency) are shown at the top left and right of the display.

Hold **CENTER** to adjust the center frequency on the display. When used with the K3, the actual RF frequency is shown at the top center of the display.

Hold **CENTER** again to return the actual frequency being received to the center of the display.

Using Markers

Tap **MKR A** to turn on marker A and allow you to change the marker frequency by rotating the **SELECT** knob. To determine the frequency of a signal, move the marker so that it overlays the carrier and read the frequency from the display. For single sideband signals, place the marker where the carrier would be if it was transmitted, i.e. on the lower (left) edge of an upper sideband signal and on the upper (right) edge of an signal upper sideband signal.

If a K3 is connected, you can QSY (change the frequency of) the K3's VFO A to the marker A frequency by tapping the **SELECT** knob. To return to the previous frequency, hold the knob. To turn off marker A, tap **MKR A** again.

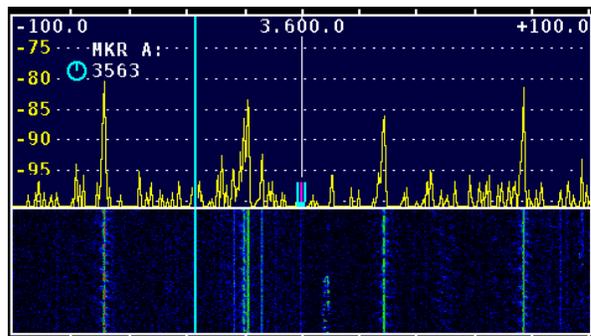
Hold **MKR B** to turn on marker B and allow you to change the marker frequency by rotating the **SELECT** knob. If a K3 is connected, you can QSY the K3's VFO B to the marker B frequency by tapping the **SELECT** knob. To return to the previous frequency, hold the knob. To turn off marker B, hold **MKR B** again.

To turn off a marker you must first make it active, if necessary, by tapping **MKR A** or holding **MKR B**. Then tap or hold the key a second time to hide the marker.

If some other function that uses the **SELECT** knob is activated, the marker stays on and automatically becomes active again (you can adjust it with the knob) when the other function is terminated. The tap-to-QSY function affects VFO A if marker A is active and VFO B if marker B is active.

Waterfall Markers

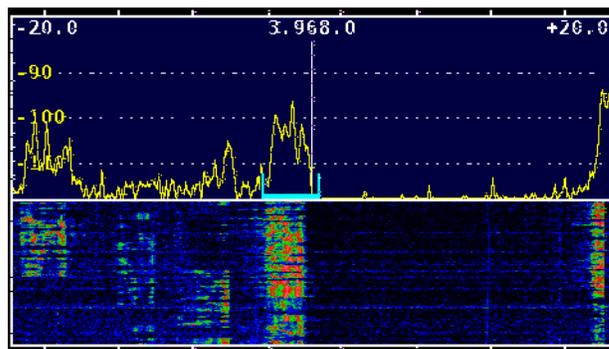
Select *MENU:WfallMkrs*. Turning the **SELECT** knob will turn the waterfall markers on, causing the marker line(s) to travel down into the waterfall display, or turn the markers off.



Marker A Enabled at 3563 KHz for Both Spectrum and Waterfall.

Using Cursors

When used with a K3 transceiver, two U-shaped cursors show the position of the A and B VFOs. VFO A is indicated by a cyan cursor and VFO B is indicated by a magenta cursor. The position and width of each cursor indicates the passband being received.



Cursor on Lower Sideband of Signal at 3,968 kHz.

The VFO B cursor may be turned off using *MENU:VFO B*. Turn the knob to select *ON* or *OFF* as desired.

Advanced Operating Features

Use with Other Radios

The P3 can be used with any receiver or transceiver that has means to output an intermediate-frequency (I.F.) signal between approximately 455 kHz and 21.7 MHz. Frequencies a little beyond that range can be used at reduced sensitivity.

The I.F. may be selected via *MENU: Xcvr Sel*. If you are not sure what frequency is used by your receiver, apply a test signal to the receiver antenna and scroll through the menu list until you see the signal on the display. Many receivers use an inverted I.F., meaning that signals tune in the opposite direction, so many of the selections include that feature. As you tune the receiver upwards in frequency the signal should move to the left on the display.

If the correct I.F. is not in the list, the frequency of the *USER* selection may be set manually via *MENU: Xcvr Def*.

```
==== User transceiver definition ====
IF: 1 - 10 kHz digits:
⊙ 15

Language      Name
  K3          USER

IF tuning     IF center frequency
Inverted      8215.000 kHz

Language <=>Name=>  ↕Name↕  EXIT
  Invert   100 kHz  1 kHz    1 Hz
```

Xcvr Def Display.

Xcvr Def also allows you to select between inverted and non-inverted I.F., change the name "USER" to something else, and select the programming language (currently either None or K3).

The *Xcvr Def* function temporarily re-defines the function (FN) keys with legends across the bottom of the display as shown above. There are three keys to set the frequency in 100 kHz, 1 kHz or 1 Hz steps.

The FN2 and FN3 keys are used for changing the transceiver name. The one with the horizontal arrows selects the character position as you rotate the **SELECT** knob and the one with the vertical arrows selects a character from a list by rotating the knob.

Tap **FN4** (EXIT) to return the P3 to normal operation.

Remote-Control Commands

Many P3 functions may be accessed by remote-control commands sent via RS-232. These commands use ordinary ASCII text, so they can be tested using a terminal emulator or the Command Tester tab in P3 Utility. When the P3's XCVR RS-232 port is connected to a K3, then both P3 and K3 commands may be sent and received via the PC RS-232 port.

To distinguish them from K3 commands, P3 commands begin with the "#" symbol. For example, "#RVM;" returns the P3 firmware revision and "RVM;" returns the K3 main firmware revision. P3 remote-control commands are fully described in the *P3 Programmer's Reference*.

P3 Utility Program

In addition to downloading firmware (pg 18) the P3 Utility can perform several other functions. For example, it can upload a bitmap image of the P3 display which can be saved to a file or pasted into a graphics program on the computer. Refer to the Help menu in P3 Utility for more information.

Firmware Upgrades

New features and improvements are available to all P3 owners via firmware upgrades.

Please visit the Elecraft K3 software page (www.elecraft.com) to obtain our free firmware download application, *P3 Utility*. Versions of the Utility program are provided for PCs, Macs, and Linux platforms.

⚠ Some applications or peripheral devices may interfere with P3 downloads; check the Help information in *P3 Utility* if you have difficulty.

If you don't have Internet access, you can obtain a firmware upgrade on CD. If you don't have a computer, you can send your P3 to Elecraft to be upgraded. See Customer Service, pg. 9.

Checking your Firmware Revision

Use the MENU entry *FW Rev* to determine your firmware revision.

P3 Firmware Self-Test

The P3 checks for firmware errors at turn-on. If an error occurs, the P3 Boot Loader is started automatically. Connect the P3 to your computer and reload firmware.

Forcing a Firmware Download

If you accidentally load an old or incompatible firmware version and find the P3 unresponsive, do the following: (1) Disconnect the P3 from the power supply and wait 5 seconds; (2) connect the power supply again while holding the P3's **POWER** switch in; after about 10 seconds you'll see the Boot Loader screen; (3) load the correct firmware version.

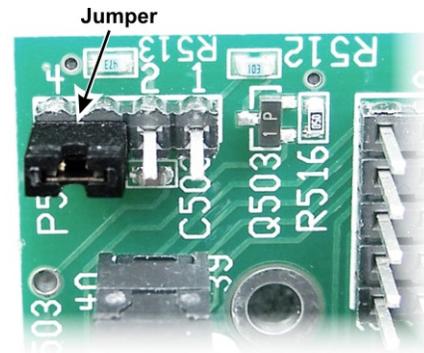
Updating K3 Firmware

If you have your P3 XCVR port connected to the K3 RS232 port, you can update your K3 firmware without disconnecting the cables from the P3. Connect the P3 RS232 cable to your computer just as you would to update the P3 and turn the P3 off before starting the K3 update.

Configuration

The front panel **POWER** switch may be bypassed so the P3 turns on whenever power is applied. This is useful to turn the P3 on automatically when it is powered from the auxiliary jack on a transceiver such as the Elecraft K3 so the P3 turns on with the transceiver.

To configure the power control, remove the six flat head screws holding the P3 top cover and lift it off. A small slot is provided in the cover so you can use a fingernail to lift it. The I/O board at the back of the P3 has a jumper at the top corner farthest from the rear panel above the large ribbon cable connector (see below).



The jumper may be positioned on the pins as follows:

Pins 3 & 4: Normal operation of the **POWER** switch.

Pins 2 & 3: P3 turns on automatically whenever power is applied to the rear panel connector. P3 may be turned off and on using the **POWER** switch as long as power is applied.

Pins 1 & 2: **POWER** switch is disabled. P3 turns on automatically whenever power is applied to the rear panel connector.

Even if bypassed so power is on all the time, the **POWER** switch is still used in the event it is necessary to put the P3 in Boot Loader mode to force a firmware download. To cancel Boot Loader mode, remove power from the P3.

Frequency Calibration Procedure

The P3 requires no calibration for normal panadapter operation. However if additional frequency accuracy is desired, you can perform the following calibration procedure.

Frequency Calibration

- If the transceiver has a calibration procedure to correct its frequency errors, perform that procedure first.
- Using a well-calibrated signal generator or an on-the air carrier signal of known frequency, tune in the signal on the transceiver. An A.M. broadcast station can serve as a suitable test signal.
- Adjust the transceiver frequency to the known frequency of the test signal. Depending upon the modulation mode of the transceiver, the signal may not be audible.
- Set the P3 for minimum span and adjust the reference level and scale so you can easily see the signal.
- Select *MENU:Ref Cal*, tap the  **SELECT** knob, and adjust the frequency calibration until the carrier is centered horizontally on the display. If the required correction is more than a few kHz, it may be that the I.F. frequency is set incorrectly. That can be adjusted via *MENU:Xcvr Def*.

Menu Functions

Tap **MENU** and then turn the  **SELECT** knob to scroll through the following list of menu functions. Tap the  **SELECT** knob to select the displayed function.

Entry	Default	Description
DispTest	off	Shows a test pattern with a color bar and the complete character set of each font. Tap the  SELECT knob to exit.
Font	9 x 14	Changes the font size.
FN Erase	N/A	Resets a function key to its un-programmed state. Tap or hold the function key to be erased while this menu item is displayed.
Freeze	off	Freezes or un-freezes the current spectrum and waterfall display. This function is most useful when assigned to a function key, which toggles between the frozen and un-frozen state.
FW Rev	N/A	Displays the main firmware version number. It is not necessary to tap the  SELECT knob for this function.
LCD Brt	100	Adjusts the display brightness from 0-100.
LCD Test	off	Set all display pixels to white at full brightness.
Peak	off	Toggles peak-hold mode on and off. This function is most useful when assigned to a function key.
Rate	10	Changes the display update rate in milliseconds. Although values down to zero may be entered, the minimum display period is actually limited by hardware.
Ref Cal	0	Calibrates the 60 MHz P3 reference clock frequency in Hz (Pg 19).
Reset	N/A	Resets the P3.
RS-232	38400	Change the baud rate in bits per second of the serial port that connects to a host computer. During firmware download (via the P3 Utility program), the baud rate is set automatically to 38400 baud, but it is then restored to the value selected in this menu entry.
SpanScale	REF LVL only	Specifies the way the P3 responds to changes in SPAN. "Off" means do not change REF_LVL or SCALE when SPAN is changed. "REF LVL only" means change the reference level to keep the noise level approximately constant. "REF LVL & SCALE" means also change SCALE to keep the level corresponding to the top of the screen at a constant level as well.
Sw Test	off	Toggle switch test mode on or off. When on, a special test screen is displayed that shows the state of each switch and the current encoder count. Tap the  SELECT knob twice to exit.
VFO B	on	Turns the VFO B cursor on or off.
Waterfall	100	Changes the height of the waterfall window when the display is in waterfall mode.
WfallMkrs	off	Enables or disables markers on the waterfall display.
Xcvr Def	off	This key brings up a menu to define the "User" transceiver in the transceiver selection menu, Xcvr Sel. You can change the intermediate frequency (IF), the IF tuning direction (inverted or not), the transceiver's command language, and the transceiver name.
Xcvr Sel	K3	Allows changing among a list of transceivers. For transceivers not listed, it also allows selecting a user-defined transceiver or simply the IF frequency.

Troubleshooting

The most common symptoms and their causes are listed below.

Can't turn power off. The most likely cause is the power turn-on jumper located on I/O board is set incorrectly. See *Configuration* on page 18.

"FAILED CHECKSUM" message appears in the "P3 BOOT LOADER" screen. Main P3 firmware is not present or corrupted. Use P3 Utility to download new firmware. (Pg.18)

"DOWNLOAD FIRMWARE, READY FOR DOWNLOAD" message appears in the "P3 BOOT LOADER" screen. Either cycle power to return to normal operation or use P3 Utility to download new firmware. (Pg. 18)

Center frequency shows zero Hertz. This is normal if the transceiver is not connected to the P3's RS-232 port. If the transceiver is a K3 that is connected via RS-232, check for a loose or defective serial cable.

P3 displays the wrong center frequency. Hold the **CENTER** key to select the center frequency adjustment and then hold it again to re-tune the P3 center frequency to the K3 VFO A frequency.

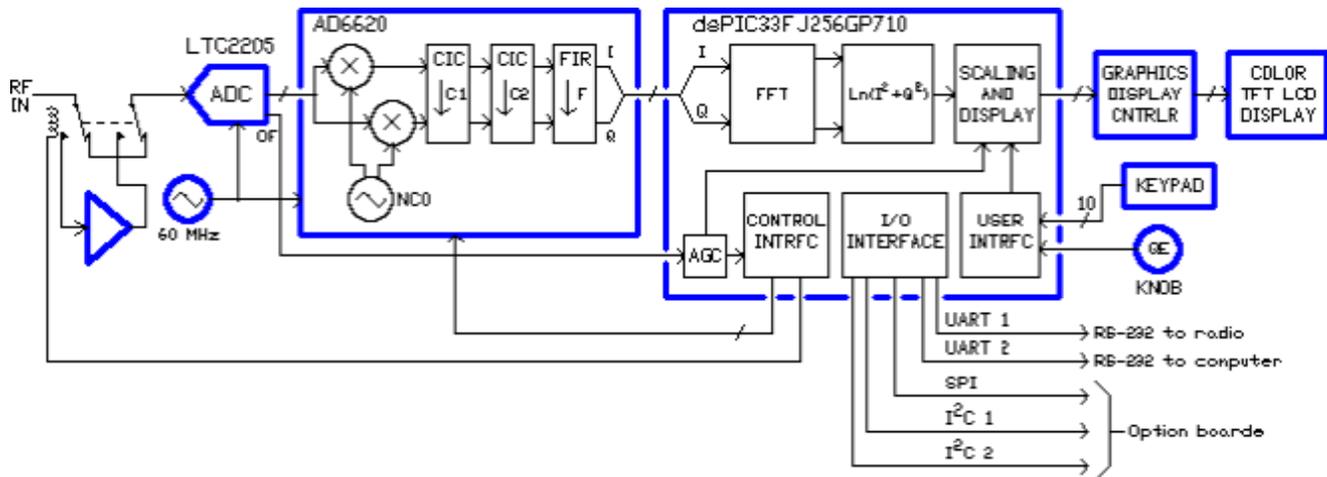
Amplitude display is in error by about 3 dB. Check that the rear-panel IF OUT switch is in the correct position.

Parameter Initialization

Menu parameters are stored in non-volatile EEPROM memory. It is possible, though rare, for parameters to become altered in such a way as to prevent the firmware from running correctly. If you suspect this, you can reinitialize parameters to defaults.

- Write down your function (FN) key assignments and MENU parameters you have set. They will be lost during the process.
- Turn the P3 OFF (using the P3's POWER switch, not your power supply). If the power-on jumper on the I/O board is in the "always-on" position (pg 18), then skip this step.
- While holding in the MENU/LABELS key, turn power ON by tapping the K3's POWER switch. Let go of the MENU/LABELS key after about 2 seconds. You should now see **CONFIGURATION RESET** on the LCD screen.
- Re-enter all the menu parameters that and function key assignments you wrote down.
- See if the original problem has been resolved.

Theory of Operation



The P3 is a true software-defined receiver — the input goes through an amplifier directly to a 60 Msample/sec analog-to-digital converter (ADC), with all tuning, signal processing and the user interface under software control. The Analog Devices AD6620 digital down-converter includes a numerically-controlled oscillator (NCO) which acts as a local oscillator and a pair of multipliers that act as a quadrature mixer that down-convert a band of frequencies to a pair of baseband in-phase and quadrature (I/Q) signals. Those signals then pass through three decimating low-pass filters to generate a lower-bandwidth, lower-sample-rate I/Q signal that is passed to a Microchip dsPIC digital signal processor/controller.

The dsPIC further processes the signal for presentation on the 480x272-pixel color TFT LCD display. The "circuitry" shown inside the processor box in the block diagram is actually implemented as software routines. The FFT is the fast Fourier transform, which is a software version of a hardware spectrum analyzer. It reads the incoming signal and calculates the frequency spectrum. Further software routines calculate the power of the spectrum, take the logarithm, and then scale and offset the result so that it reads correctly in dBm on the display.

The dsPIC also acts as a controller for the rest of the circuitry. For example, whenever the user changes the span, new decimation and filter values are calculated and loaded into the AD6620 digital down-converter and new constants are calculated for interpolating the FFT output for display. In that way, the optimum sample rate is used for any span, which optimizes the display update speed and ensures that each horizontal pixel on the display always represents a distinct frequency, with minimum bleed-over between pixels.

One firmware task is to maintain communications with the K3 transceiver over one of the RS-232 ports. A special P3-specific command set has been implemented in the K3 to maximize communications efficiency. In addition, a special P3-K3 communications protocol was set up to ensure that the P3 gets the information it needs when it needs it, so that the P3 acts as a fully-integrated extension of the K3.

In addition to two UART (universal asynchronous receiver-transmitter) ports for the two RS-232 connectors, an SPI (serial peripheral interface) and two I²C (inter-integrated circuit) interfaces are provided for option modules. Those interfaces, plus power supplies and other signals, are carried on a 40-wire ribbon cable between the main front-panel processor board and the rear-panel I/O board. Option boards are stacked on the I/O board, with the 40-pin connectors daisy-chained together, acting like a bus or backplane. In that way, more options may be included in the future simply by stacking more boards.

For best efficiency, the +3.3 V and +5 V internal power supplies are supplied by a pair of switching DC-DC converters from the +12 VDC input. The input power is approximately independent of the voltage, which means the lower the input voltage the higher the current. While the P3 will typically work with input voltages of less than 8 V, the current may exceed the 0.5 A specification at that voltage.