Elecraft KXPA100 Amplifier
Serial Command Reference

Revised 02/27/2014 firmware revision 01.18

Serial port overview

Commands are sent to the KXPA100 via its "PC DATA" serial port. Use 4800, 9600, 19200, or 38400 bit/s, 8 bit characters, one stop bit and no parity. There is no hardware flow control. The *KXPA Utility* discovers the KXPA100's PC DATA serial port speed by sending a pair of null commands (**;;**) at each of the supported speeds and selects the speed that results in responses. You can change the KXPA100's PC DATA serial port speed with the Baud Rate (**^BRP**) command.

Command Format

All commands and almost all responses use the printable ASCII character set (some KX3 responses such as DS and IC contain unprintable characters).

Commands sent to the KXPA100 are either GET or SET.

GET commands are used to get information from the KXPA100; the information is returned in a RESPONSE message.

SET commands are used to change the KXPA100's internal state or to initiate an action. SET commands do not generally generate a RESPONSE. SET can be followed by a GET to verify the SET.

KXPA100 commands generally start with a caret (^). This is done to distinguish KXPA100 commands from KX3 commands.

A Host PC may be connected to the 3.5 mm TRS connector PC RS-232 serial port (using a KXUSB, KXSER, or equivalent). The other KXPA100 serial port (included in the 8-conductor RJ-45 connector) may be connected to a KX3 transceiver. The KXPA100 forwards KX3 commands (generally commands that do not begin with "^") to the "downstream" KX3.

Each serial command is terminated with a semicolon character. For example, to query the current software revision, send "**^RV;**" (send ^, R, V, and semicolon).

Input commands and their responses are fixed length, and leading zeros are required on input and are not suppressed on output. The command parser expects a command terminator (a semicolon) in exactly the position indicated in this reference. Don't embed spaces or omit leading zeros.

Generally, after sending a GET command, wait for the corresponding RESPONSE before sending more commands. The KXPA100 has a limited input command buffer. You may safely "stack up" at least 64 bytes of commands without risk of overrun. If you wish to send a very long sequence of SET commands, break them up with an intervening GET (such as the null command **;** or **^RV;**) that returns a RESPONSE, and wait for those responses. Flow control is done at the application level.

Several commands require installation of an optional KXAT100 Antenna Tuner to be meaningful. For example, you may set the ATU Capacitors with the **^CR** command. If no Antenna Tuner is installed, the microcontroller's ports are set and may be read, but there are no ATU relays connected to these microcontroller I/O ports.

Using *KXPA Utility* to Test Commands

The Command Tester tab of the *KXPA Utility* can be used to try individual commands. Try typing "**^RV;**" in the input area. The command and its response are shown on the output area.

Commands and responses

; (Null, GET only)

GET format: **;**

RESPONSE format: **;**

KXPA100 firmware echoes a semicolon. The *KXPA Utility* sends two semicolons to determine the PC DATA serial port speed during a connection sequence.

This command is not forwarded to the KX3.

^AD (Dynamic attenuator reason, GET only)

GET format: **^AD;**

RESPONSE format: **^ADx;**

Returns a character indicating the reason the attenuator was most recently deployed by firmware:

^AD; response	Reason
^ADD;	Dissipated power limit was reached
^ADF;	Forward power limit was reached
^ADI;	Input power limit was reached
^ADJ;	JA Mobile power limit was reached
^ADN;	The attenuator has not been deployed by firmware since the last power on
^ADV;	Reverse (reflected) power limit was reached

^AE (Antenna Enable, GET and SET)

Antenna Enable is used to enable or disable each of the KXPA100 antenna connectors, by band. This may be used to prevent accidental switching to an unconnected antenna.

GET format (single band): **^AEbb;** where **bb** is the Band Number **00** through **10** (see **BN;** command).

SET/RESPONSE format (single band): **^AEbbn;** where **bb** is the Band Number **00** through **10** and **n** is a digit from **1** through **3** indicating which antenna connectors are enabled:

1	Only ANT1 is enabled, ANT2 is disabled
2	Only ANT2 is enabled , ANT1 is disabled
3	ANT1 and ANT2 are both enabled. This is the default value.

GET format (all bands): **^AEA;**

SET/RESPONSE format (all bands): **^AEAnnnnnnnnnnn;** where **nnnnnnnnnnn** has one digit for each of 11 bands, 160 through 10 meters.

Abbreviated SET format to set all bands to the same value: **^AEAn;**

For example, **^AEA1;** has the same result as entering **^AEA11111111111;** or
^AE001;^AE011;^AE021;AE031;AE041;AE051;AE061;AE071;AE081;AE091;AE101;

AE is meaningful only if the optional KXAT100 Antenna Tuner is installed.

AE was added in firmware version 01.18.

^AN (ATU Select Antenna, GET and SET)

GET format: **^AN;**

SET/RESPONSE format: **^AN1**; **^AN2**;

It may take a few tens of milliseconds after issuing an **^ANx** setter before the relays are changed.

The SET form of this command is ignored while transmitting or tuning, or the antenna is disabled (see AE).

Set form **AN0;** is interpreted as "advance to next antenna", equivalent to HOLD of the ANT button.

This command is meaningful only if the optional KXAT100 Antenna Tuner is installed.

^AT (Enable/Disable Attenuator, GET and SET)

GET format: **^AT;**

SET/RESPONSE format: **^AT0**; (disabled) or **^AT1;** (enabled). The response **^AT2;** is returned if the attenuator is engaged by the back panel switch.

Energizes **(^AT1;)** or releases (**^AT0;**) the attenuator relay, K203. If the back panel 3 dB ATTEN switch is ON, the **^AT** setter has no effect.

It may take a few tens of milliseconds after issuing an **^AT** setter before the relay is changed.

Firmware enables the attenuator as needed to protect the amplifier, and may release it after a period without transmission.

^BN (Band Number, GET and SET)

GET format: **^BN;**

SET/RESPONSE format: **^BNbb;** where **bb** is 00 to 10. A leading zero may not be omitted.

^BNbb; may be used to select the Band Number when receiving.

The amplifier changes the Band Number from the transmit frequency counter.

If you know the frequency, it is better to band switch with the **^MT** command, because **^MT** also sets ATU settings memorized for that frequency.

bb	Band
00	160 meters
01	80 meters
02	60 meters
03	40 meters
04	30 meters
05	20 meters
06	17 meters
07	15 meters
08	12 meters
09	10 meters
10	6 meters

^BRP (PC DATA RS-232 Serial I/O Speed, GET and SET)

GET format: **^BRP;**

SET/RESPONSE format**:**

> **^BRP0;** for 4800 bit/s,
> **^BRP1;** for 9600 bit/s,
> **^BRP2;** for 19200 bit/s or
> **^BRP3;** for 38400 bit/s. Firmware load automatically chooses 38400 bit/s.

^BRX (Transceiver RS-232 Serial I/O Speed, GET and SET)

GET format: **^BRX;**

SET/RESPONSE format**:**

> **^BRX0;** for 4800 bit/s,
> **^BRX1;** for 9600 bit/s,
> **^BRX2;** for 19200 bit/s or
> **^BRX3;** for 38400 bit/s.

Note: KX3 firmware load through the KXPA100 requires that the Transceiver RS-232 serial I/O speed be preset to 38400 bit/s.

^BY (ATU Bypass, GET and SET)

GET format: **^BY;**

SET/RESPONSE format: **^BYN;** (not bypassed) **or ^BYB;** (bypassed).

Gets or sets ATU bypass relay K118.

Firmware releases inductor, capacitor, and side relays while bypassed to reduce power consumption.

Firmware may change the bypass relay during ATU tune operations.

PA bypass relay K24 is not affected by the **^BY** command. See **^OP** for PA Bypass.

This command is meaningful only if the optional KXAT100 Antenna Tuner is installed.

^CR (ATU Select Capacitors, GET and SET)

GET format: **^CR;**

SET/RESPONSE format: **^Chh;** where **hh** are two hexadecimal digits indicating the selected capacitors.

See http://en.wikipedia.org/wiki/Hexadecimal for a description of this notation.

Examples:

    ^CR00; selects no capacitors.
    ^CRFF; selects all capacitors.
    ^CR80; selects only the largest capacitor.
    ^CRC1; selects the largest, second largest, and smallest capacitors.

Hex Digits	Relay	Capacitance (pF)
80	K116	1360
40	K115	660
20	K114	300
10	K113	150
08	K112	82
04	K111	40
02	K110	22
01	K109	10

The *KXPA Utility* Operate page displays capacitor relay settings as check boxes and as a total capacitance.

It may take a few tens of milliseconds after issuing **^CR** before the relays are changed.

Capacitor settings are changed by ATU tuning operations. **^CR** set is ignored while tuning.

Capacitor relays are released while the ATU bypass relay is in its bypassed setting.

^CR is meaningful only if the optional KXAT100 Antenna Tuner is installed.

^DM (ATU Display Frequency Memory, GET only)

GET format: **^DMfffff;** where **fffff** is a frequency in kHz, from 01500 through 60000.

RSP format:

^DM Ffffff BNbb BINnnn FRccccc-ddddd
AN1 BYy SIt CRhh LRhh
AN2 BYy SIt CRhh LRhh;

Where: **fffff** is the frequency, **bb** is the Band Number (see **^BN**), **nnn** is the 0-based index of the frequency memory "bin" within the band, **ccccc**-**ddddd** is the frequency range for that bin. The two frequency memories for antenna 1 and 2 are then displayed: ATU bypass relay setting (**BYN or BYB**), ATU Side Relay setting (**SIT** for Side Transmitter and **SIA** for Side Antenna), and the capacitor (**CR**) and inductor (**LR**) relay settings. "**EMPTY**" is displayed for erased frequency memories.

Example:

```
^DM03805;
^DM F03805 BN01 BIN040 FR03800-03819
AN1 BYN SIT CR0E LRD8
AN2 EMPTY;
```

^EC (Erase Configuration, SET only)

SET format: **^EC;** erases EEPROM containing ATU frequency memories, per-band settings and all configuration selections, including the current RS-232 speed. Configuration and per-band settings are formatted to default values during restart after a microcontroller reset. **^EC;** does not disturb the KXPA100 serial number, its fault table, or factory calibration data.

^EC; is ignored while the ATU is tuning or transmitting.

^EC is used by the *KXPA Utility* Reset Configuration dialog.

^EM (ATU Erase Frequency Memory, SET only)

SET format: **^EMbba;** erases ATU memories for one or both antennas on band **bb** (See **^BN**).

bb 15 is interpreted as "all bands" for this command.

a is 0 for both antennas, 1 for antenna 1, 2 for antenna 2.

Examples:

^EM011; erases just antenna 1 memories for band 01 (80 meters).

^EM152; erases just antenna 2 memories for all bands, leaving antenna 1 memories unchanged.

^EM150; erases all memories on all bands.

This command may take as long as a couple of seconds.

^EM is ignored while the ATU is tuning or the amplifier is transmitting.

^EM is used by the *KXPA Utility* Erase Memory dialog.

^F (Frequency Count, GET only)

GET format: **^F;**

RESPONSE format: **^Fnnnnn;** where **nnnnn** is the approximate frequency of the last transmission, in kHz.

Use **^MT** to perform a memory recall tune for a specified frequency.

^FE (Cancel ATU Full Search Tune, SET only, with ^FE response)

SET/RESPONSE format: **^FE;**

^FE; cancels an in-progress full search tune. If a full search tune was interrupted, the "best so far" tuner settings are loaded.

A normal full search tune also receives an **^FE** response when the tune completes. This signals "end of tune".

^FE is ignored if the optional KXAT100 Antenna Tuner is not installed.

^FL (Fault, GET and SET)

GET format: **^FL;**

RESPONSE format: **^FLcddddd;** where **c** is a fault code and **ddddd** is an associated detail value.

SET format: **^FLC**; to turn off the FAULT LED.

Fault Code	Name	Detail value	Description
N	**N**one	# of power on events since some other fault	No fault
A	**A**ntenna Tuner Match	Best SWR * 10. (999 is interpreted as 99.9:1 SWR)	**NO TUNE** ATU could not find an acceptable match for antenna
C	Drain **C**urrent	Current in tenths of an Ampere. See **^PC**	**HI CUR** Excessive PA drain current
D	**D**issipation	Dissipated power in tenths of a watt. See **^PD**	**HI DISS** Excessive dissipation: supply voltage * PA current – output power exceeds limit
H	**H**igh Supply **V**oltage	millivolts	**HI SPPLY** Excessive supply voltage
I	**I**nput power	Input power, in tenths of a watt. See **^PI**	**HI P IN** Excessive input power
L	**L**ow supply voltage	millivolts	**LO SPPLY** Insufficient DC supply voltage
P	Forward **P**ower	Forward (output) power, in tenths of a watt. See **^PF**	**HI P OUT** Excessive output power
R	**R**eflected power	Reflected (reverse) power, in tenths of a watt. See **^PV**	**HI PREFL** Excessive reflected power. Improve SWR or

Fault Code	Name	Detail value	Description
			reduce power.
S	**S**WR	SWR * 10 (999 means 99.9:1)	**NO TUNE** Excessive SWR. ATU is not available or is in a mode that inhibits automatic retune.
T	**T**emperature	Temp in tenths of a degree C. See **^TM**	**HI TnnC** Excessive Heat Sink Temperature

Note: Seven segment display limitations require that fault codes not be defined with K, M, Q, V, W, X, or Z.

^FT (ATU Full Search Tune, SET only, with ^FE response)

SET format: **^FT;**

^FT; starts a Full Search Tune. If Mode is Bypass, the Mode is changed to Manual.

An **^FE;** RESPONSE is sent when a Full Search Tune initiated by **^FT;** completes. Use **^FE** to cancel a full search tune in progress.

This command is ignored if the optional KXAT100 Antenna tuner is not installed.

^I (Identify, GET only)

GET format: **^I;**

RESPONSE format: **^IKXPA100;**

Note: KXPA100 permanent boot block firmware responds to **I** with "**kxpa100;**" in lower case.

^LR (ATU Select Inductors, GET and SET)

GET format: **^LR;**

SET/RESPONSE format: **^LRhh;** where **hh** are hexadecimal digits (0-9 and A-F) indicating the selected inductors.

Examples:

> **^LR00;** selects no inductors
> **^LRFF;** selects all inductors
> **^LR80;** selects only the largest inductor.
> **^LRE0;** selects the three largest inductors.

See http://en.wikipedia.org/wiki/Hexadecimal for a description of hexadecimal notation.

The *KXPA Utility* Operate page displays the relay settings as check boxes and total inductance.

Hex digits	Relay activated	Inductance (nH)
80	K108	9000
40	K107	4400
20	K106	2100
10	K105	1000
08	K104	480
04	K103	230
02	K102	110
01	K101	50

It may take a few tens of milliseconds after issuing **^Lxx;** before the relays are changed.

Inductor relays are released whenever the bypass relay is in bypass (**^BYPB;**).

Inductor relays are changed by ATU tuning. **^LR** is ignored during ATU tune.

^LR is meaningful only if the optional KXAT100 Antenna Tuner is installed.

^MD (ATU Mode, GET and SET)

GET format**: ^MD;**

SET/RESPONSE format: **^MDB;** or **^MDM;** or **^MDA;**

^MDB; is "**B**ypass" mode. The bypass relay is released to its Bypassed setting and the KXPA100 does not attempt to tune. A TUNE button press changes the mode to Manual and initiates a full search tune.

^MDM; is "**M**anual" mode. In "manual" mode, the KXPA100 recalls tuner settings memorized from a prior tune whenever the antenna changes or the frequency changes significantly. A TUNE button press also used to initiate a full search tune.

^MDA; is "**A**utomatic" mode. The KXPA100 recalls memorized tuner settings on frequency change, and performs a full search tune if the SWR exceeds a threshold (typically 1.8:1). A TUNE button press also initiates a full search tune.

^MD set may be ignored while transmitting.

Mode is changed from Bypass to Manual if an ATU tune is initiated (**^MT**, **^FT**, or front panel TUNE button press).

This command is meaningful only if the optional KXAT100 Antenna Tuner option is installed.

^MT (ATU Memory Recall Tune, SET only)

SET format: **^MT;** to perform a memory recall tune on the current Transmit frequency, or

^MTfffff; where **fffff** is a frequency, in kHz.

^MT performs a "memory recall tune" by changing to the memorized tuner setting for the current antenna.

If **fffff** is zero or missing, the last Transmit frequency is used. If the amplifier is currently transmitting, the measured transmit frequency is used instead of **fffff**.

If there is no memorized tuner setting for the specified frequency, adjacent memories are searched above and below the specified frequency, as far as the band edges, until a suitable memory is found.

If no KXAT100 Automatic Antenna tuner is installed, **^MTfffff;** performs a band switch to the appropriate band.

^OP (Operate / Standby, GET and SET)

GET format: **^OP;**

SET/RESPONSE format: **^OP0;** (standby) or **^OP1;** (operate)

^OP controls the PA bypass relay K24 on the LPF board. The relay is released to its normally closed "bypass" setting with **^OP0; (**letter O, letter P, digit 0) and is pulled in to the "not bypassed" or "Operate" setting with **^OP1;**

The KXPA100 has no physical switch for operate/standby, and the amplifier starts in "operate" mode unless a serial command is sent. KXPA100 firmware may change this setting as part of its power-on initialization.

The *KXPA Utility* uses an Operate page "PA Bypass" checkbox for this command. When the "PA Bypass" check box is selected, relay K24 is in its "bypassed" (**^OP0;**) setting. When the "PA Bypass" is not checked, relay K24 is in its "not bypassed" (**^OP1;**) setting.

Operate/Standby is one of several conditions that must be set appropriately for the amplifier's T/R switch to reach Transmit. Other conditions include key line assert, no current fault, ATU not tuning, and a frequency count that is not between 26 and 28 MHz.

^PC (PA Drain Current, GET only)

GET format**: ^PC;**

RESPONSE format: **^PCnnnn;** where **nnnn** is the PA Drain Current, in tenths of amperes.

For example, **^PC0125;** is 12.5 Amperes.

^PD (Power Dissipation, GET only)

GET format **^PD;**

RESPONSE format: **^PDnnnn;** where **nnnn** is the dissipated power, in tenths of a watt. Computed as supply voltage * PA Drain Current – Forward Power. **^PD1200;** is 120.0 watts

^PF (Forward Power, GET only)

GET format: **^PF;**

RESPONSE format: **^PFnnnn;** where **nnnn** is the forward power output of the amplifier, in tenths of watts. For example, **^PF1234;** is 123.4 watts.

^PI (Input Power, GET only)

GET format: **^PI;**

RESPONSE format: **^PInnnn;** where **nnnn** is the input power to the amplifier, in tenths of watts. For example, **^PI0054;** indicates an input power of 5.4 watts.

^PV (Reflected (reverse) Power, GET only)

GET format: **^PV;**

RESPONSE format: **^PVnnnn;** where **nnnn** is the reflected power from the antenna connector, in tenths of watts. For example, **^PV0034;** indicates a reflected power of 3.4 watts.

^RS (Reset, SET only)

SET format**: ^RS;**

^RS; resets the microcontroller. This is equivalent to removing the power plug and plugging it back in again.

^RV (Firmware Revision, GET only)

GET format**: ^RV;**

RESPONSE format: **^RVnn.nn;**

^SB (ATU Bypass SWR, GET only)

GET format: **^SB;**

RESPONSE format: **^SBnnn;** Range is **^SB010;** to **^SB999;** for 1.0 to 99.9 SWR.

^SB is the SWR of the antenna, as measured at the KXPA100 coupler, when the KXAT100 Antenna Tuner was last in bypass (which occurs in each full search tune).

^SI (ATU Side Relay, GET and SET)

GET format: **^SI;**

SET/RESPONSE format: **^SIT;** or **^SIA;**

Gets or sets the state of SIDE relay K117.

The selected capacitors (see **^CR**) are connected to the *transmitter* side of the inductor (a CL network) when K117 is not energized (**^SIT;**)

The selected capacitors are connected to the *antenna* side of the inductor (an LC network) when K117 is energized (**^SIA;**).

The inductance is in series between the transmitter and antenna connector. The capacitance can shunt either end of the inductor.

Generally, the capacitors shunt the higher impedance sid*e.*

It may take a few tens of milliseconds after issuing **^SIx;** before the relay is changed.

The SIDE relay is released while the bypass relay is bypassed. The antenna tuner changes the SIDE relay as needed during tune operations.

This command is meaningful only if the optional KXAT100 Antenna Tuner option is installed.

^SM (ATU Save Memory, SET only)

SET format: **^SM;** or **^SMfffff;** where **fffff** is a frequency in kHz.

^SM saves the current tuner settings (bypass and side, inductor, capacitor) in the memory for the indicated (or most recent transmit) frequency.

If **fffff** is zero or missing, the last Transmit frequency is used. If transmitting, the measured transmit frequency is used.

^SM; is used by the *KXPA Utility* Operate Page Memorize button.

This command is meaningful only if the optional KXAT100 Antenna Tuner is installed.

^SM may be used to store an ATU setting for a receive-only frequency, or to override the setting stored by the antenna tuner's full search.

^SN (Serial Number, GET only)

GET format: **^SN;**

RESPONSE format: **^SNnnnnn;**

The serial number is installed during factory initialization and remains unchanged thereafter.

^SV (Supply Voltage, GET only)

GET format: **^SV;**

RESPONSE format: **^SVnnnnn;** where **nnnnn** is the DC power supply voltage in millivolts.

Example response: **^SV13400;** for 13.400 volts.

^SW (SWR, GET only)

GET format: **^SW;**

RESPONSE format: **^SWnn.n;** Range is **^SW00.0;** to **^SW99.9;** for 99.9 to 1 or higher SWR.

Displays the SWR computed at the most recent forward power peak.

^TM (Temperature, GET only)

GET format: **^TM;**

RESPONSE format: **^TMtttt;** where **tttt** is the PA heat sink temperature in tenths of a degree Celsius.

For example, **^TM0271;** indicates a temperature of 27.1 degrees Celsius.

^TP (Tune Poll, GET only)

GET format: **^TP;**

RESPONSE format: **^TP0;** (not currently tuning) or **^TP1;** (tune in progress)

^TU (ATU Installed, GET only)

^TU; is used to determine if the KXAT100 Automatic Antenna Tuner option has been installed.

GET format: **^TU;**

RESPONSE format: **^TU0;** (ATU not detected) or **^TU1;** (ATU detected).

^XI (Transceiver Interface select, GET and SET)

GET format: **^XI;**

SET/RESPONSE format: **^XIn;** where **n** is one of the letters in the left column below.

Describes how the amplifier interprets band voltage changes.

Transceiver Type	Band Change	Radio
A (Any)	Tx frequency count, serial command	Any radio that does not supply band voltage.
D (Dynamic) (the default)	Tx frequency count, serial command, band voltages	Dynamic determination, depending on polling and band reference voltage. Band voltage ignored and KX3 assumed if transceiver is polling KXPA100. ICOM assumed if band reference voltage >= 6V. Yaesu FT-817 assumed if band reference voltage < 6V.
I (ICOM)	Tx frequency count, serial command, band voltages	ICOM 703, 0-8V. Chooses Band30 for 0 volts, Band6 for 1 volt, Band10 for 10/12 and Band15 for 15/17.
X (Elecraft KX3)	Tx frequency count, serial command	Elecraft KX3
Y (Yaesu FT-817ND)	Tx frequency count, serial command, band voltages	Yaesu FT-817ND, 0.33 – 3.33V. Ignores 2m and 70 cm voltages. Cannot select 60 meters from band voltage.

^XP (Transceiver Polling, GET only)

GET format: **^XP;**

RESPONSE format: **^XP1;** if the transceiver has sent a KXPA100 command in the last 5 seconds, **^XP0;** if no KXPA100 command has been received in the last 5 seconds. This is used by the *KXPA100 Utility* to indicate that a KX3 is polling the KXPA100 for status.