

Alpha 9500 Remote Operation  
Version: Preliminary

**Alpha 9500 Remote Operation**



## Alpha 9500 Remote Operation

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## 1 Introduction

This document describes the serial command interface for the Alpha 9500 microprocessor controlled HF amplifier.

### 1.1 General

The 9500 is equipped with both a conventional 9-pin RS232 connector and a USB connector. The USB is supported by an FTDI chip. USB is the recommended way to communicate with the amp. The FTDI chip has drivers which allow it to communicate as a "Virtual COM Port", or VCP. So as far as the PC is concerned, it makes little difference which interface is actually used.

The PC port must be set to 115,200 Baud, 8 data bits, 1 stop bit, no parity.

Some of the commands are timing critical.

### 1.2 Enabling the serial port

When the amplifier is first turned on, the serial port does not respond to commands. To enable it, the sequence "+++" (three plus characters) must be sent

## 2 Amp-to-PC Communications

The amp communicates with the PC using a "sentence" structure based on the NMEA-0183 style of packet. Each sentence starts with a "\$". The payload portion of the sentence ends with a "\*", which is followed by a 4 digit Fletcher Checksum. The structure is as follows:

```
$APAnn,P1,P2,...Pn*cccc
```

where:

APAx is an identifier for the the sentence type, such as APA00, APA01 etc.

P1, P2...PN are parameters separated by commas

cccc is the 4 digit Fletcher Checksum (FCS)

The FCS is calculated as follows:

```
sum1=0
```

```
sum2=0
```

```
for i=<char after$> to <char before *>
```

```
sum1=asc(char(i))
```

```
sum2=sum2+sum1
```

```
next
```

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`cccc=bytetohex(sum2)+byttohex(sum1)`

In other words, sum1 is the modulo 256 sum of the ascii codes for the characters between the \$ and the \*, and sum2 is the modulo 256 sum of all the sum1's.

Occasionally, the amplifier may send data that is not in this format. The PC application should ignore such data.

## 2.1 Message type APA00

This message contains the serial numbers for the amp plus the firmware revision level information.

The format is:

APA00,MSN,ESN,MCVN,MBVN,DCVN,SMVN,SGVN\*cccc

where:

**APA00** is the sentence type identifier

**MSN** is the 12-digit manufacturers serial number, which can contain any text characters

**ESN** is 10 characters representing the 5-byte electronic serial number

**MCVN** is the Master Controller Version Number, in the form n.nn

**MBVN** is the Mains Board Version Number, in the form n.nn

**DCVN** is the Display Controller Version Number, in the form n.nn

**SMVN** is the Stepper Motor Version Number, in the form n.nn

**SGVN** is the Sound Generator Version Number, in the form n.nn

**cccc** is the FCS

Example:

\$APA00,AmateurProto,63942A0008,1.19,1.19,1.16,1.16,1.16\*283E

MSN is AmateurProto

ESN is 63942A0008

Master Controller code is Ver. 1.19

Mains board code is Ver. 1.19

Display Controller code is Ver. 1.16

Stepper Motor code is Ver. 1.16

Sound Generator code is Ver 1.16

FCS is 0x283E

## 2.2 Message type APA02

This is the basic RF parameter sentence that contains the most pertinent telemetry about the current state of the amp.

The format is:

APA02,PFwd,SWR,Pin,Vp,Ip,Gain,Vg,Ig,Band,State,Fault,Key,PEP\*cccc

where:

**APA02** is the sentence type identifier

**PFwd** is the average forward power in tenths of a watt

**SWR** is the SWR in tenths of a unit

**Pin** is the input power in tenths of a watt

**Vp** is the plate voltage in volts

**Ip** is the plate current in milliamps

**Gain** is the output power divided by the input power

**Vg** is the grid voltage in tenths of a volt (25.5 V maximum)

**Ig** is the grid current in milliamps

**Band** is the amplifier band (1=1.8 MHz; 9=28 MHz)

**State** is the amplifier state ( 0: OFF 1:On no HV 2: warming up etc...)

**Key** is the state of the Key In line: 1: Not keyed 0: Key asserted

**PEP** is the current PEP estimate in tenths of a watt

**cccc** is the FCS

Example:

\$APA02,15017,010,2590,3169,0768,230,096,057,1,6,01,0,15721\*D83F

Forward power is 1501.7 watts

SWR is 1.0 to 1

Input power is 25.9 watts

Plate voltage is 3169 Volts

Plate current is 768 milliamps

Gain is 23.0

Grid voltage is 9.6 volts

Grid current is 57 milliamps

Band is 1 (1.8 MHz)

State is 6 (Operate mode, keyed, power sensed, band set)

Fault is 1 (last fault was a gain fault)

Key Sense is 0 (Key in being asserted by exciter)

PEP estimate is 1572.1 watts

FCS is D83F

## 2.3 Message type APA03

This sentence contains data mostly pertaining to the various power supply voltages in the amp.

The format is:

APA03,+5V,+12V,+24V,-12V,+40V,ACLIne,MBStatus,MBTap,Temp\*cccc

where:

**APA03** is the sentence type identifier

**+5V** is the 5V power supply voltage in hundredths of a volt

**+12V** is the positive 12V power supply voltage in tenths of a volt

**+24V** is the positive 24V power supply voltage in tenths of a volt

**-12V** is minus one times the negative 12V power supply voltage in tenths of a volt

**+40V** is the positive 40V power supply voltage in tenths of a volt

**ACLIne** is the estimated rms AC line (mains) voltage in tenths of a volt

**MBStatus** is the amins board status (0= no faults)

**MBTap** is the number associated with the primary side taps selected by the Mains Board (1= 100V, 2=120V, 3=200V, 4=220V, 5=240V)

**Temp** is the temperature of the cathode board in tenths Celsius

**cccc** is the FCS

Example:

\$APA03,499,121,240,121,389,2370,000,5,+028.0\*9D7D

APA03 is the sentence type identifier

The positive 5V power supply voltage is 4.99 volts

The positive 12V power supply voltage is 12.1 volts

The positive 24V power supply voltage is 24.0 volts

The negative 12V power supply voltage is -12.1 volts

The positive 40V power supply voltage is 38.9 volts

The estimated AC line voltage is 237.0 volts

The Mains Board status is clear

The mains tap is set for 240V

The temperature of the cathode board is 28.0 celsius

The FCS is 0x9D7D

## 2.4 Message type APA04

This message contains the frequencies of the band edges for each band. These are the frequencies used by the amp to determine if the transmit signal can be amplified.

The format is:

APA04,B1Min,B1Max,B2Min,B2Max,B3Min,B3Max,B4Min,B4Max,B5Min,B5Max,B6Min,B6Max,B7Min,B7Max,B8Min,B8Max,B9Min,B9Max\*ccc

where:

**B1Min** is the lowest frequency that the amp will allow for Band 1  
**B1Max** is the highest frequency that the amp will allow for Band 1  
**B2Min** is the lowest frequency that the amp will allow for Band 2  
**B2Max** is the highest frequency that the amp will allow for Band 2  
**B3Min** is the lowest frequency that the amp will allow for Band 3  
**B3Max** is the highest frequency that the amp will allow for Band 3  
**B4Min** is the lowest frequency that the amp will allow for Band 4  
**B4Max** is the highest frequency that the amp will allow for Band 4  
**B5Min** is the lowest frequency that the amp will allow for Band 5  
**B5Max** is the highest frequency that the amp will allow for Band 5  
**B6Min** is the lowest frequency that the amp will allow for Band 6  
**B6Max** is the highest frequency that the amp will allow for Band 6  
**B7Min** is the lowest frequency that the amp will allow for Band 7  
**B7Max** is the highest frequency that the amp will allow for Band 7  
**B8Min** is the lowest frequency that the amp will allow for Band 8  
**B8Max** is the highest frequency that the amp will allow for Band 8  
**B9Min** is the lowest frequency that the amp will allow for Band 9  
**B9Max** is the highest frequency that the amp will allow for Band 9  
**cccc** is the FCS

All frequencies are in kilohertz.

\$APA04,01750,02000,03450,04100,06900,07500,09900,10600,13900,14600,17900,18600,20900,21600,24400,25000,27995,29900\*E213

Band 1 is from 1.750 to 2.000 MHz  
Band 2 is from 3.450 to 4.100 MHz  
Band 3 is from 6.900 to 7.500 MHz  
Band 4 is from 9.900 to 10.600 MHz  
Band 5 is from 13.900 to 14.600 MHz  
Band 6 is from 17.900 to 18.600 MHz  
Band 7 is from 20.900 to 21.600 MHz  
Band 8 is from 24.400 to 25.000 MHz  
Band 9 is from 27.995 to 29.900 MHz



## 2.5 Message type APA05

This is a short sentence which contains much of the information required to set up the remote indicators analogous to the front panel LED indicators. It is sent after every button push on the front panel and during the warmup countdown.

the format is:

APA05,Band/Seg,Mem/Ant,Meter/Control,Options/State, WTime,TCmd,LCmd\*cccc

where:

**Band/Seg** is the ascii representation of a byte, with the upper nibble being the band and the lower nibble the current segment

**Mem/Ant** is the ascii representation of a byte, with the upper nibble being the current memory selection and the lower nibble being the antenna selection

**Meter/Control** is the ascii representation of a byte, with the upper nibble being the current selected parameter for display on the digital meter (1=Fwd power) and the lower nibble being a bit image of the four control buttons (OPER..ON/OFF)

**Options/State** is the ascii representation of a byte, with the upper nibble being the bit image representation of which LEDs in the option group (DIM..DEL) are on. State is the amplifier state.

**WTime** is the remaining time in seconds until the amp is warmed up

**TCmd** is the hex value of the commanded setting for the Tune capacitor

**LCmd** is the hex value of the commanded setting for the Load capacitor

**cccc** is the FCS

Example:

\$APA05,11,18,1B,34,00,2A,01\*A844

Band is 1 (1.8 MHz)

Segment is 1 (low end of band)

Memory is 1 (factory default)

Antenna 1 is selected (bit map)

Digital meter is displaying forward power

OPER, ON AMP and ON/OFF button LEDs are on

PEP and DEL LEDs are illuminated

Amp is in state 4 (Warmed up, standby)

Warmup time remaining is zero (amp is warmed up)

Tune cap has been commanded to be at step 42

Load cap has been commanded to be at step 1

FCS is 0xA844

## 2.6 Message type APA06

This sentence contains the fault log for the amplifier. The amp keeps a log of the codes associated with the last 20 faults that it has experienced.

The format is:

APA06,f1,f2,f3,f4,f5,f6,f7,f8,f9,f10,Ptr,F1,F2,F3,F4,F5...F20\*ccc

where:

APA06 is the sentence type identifier

**f1..f10** are factory info parameters

**Ptr** is the pointer telling where in the circular buffer the most recent fault is. This refers to EEPROM location, and Ptr can go from 111 to 130

**F1** is the fault code at EEPROM location 111

**F2** is the fault code at EEPROM location 112

.

**F20** is the fault code at EEPROM location 130

**cccc** is the FCS

Example:

```
$APA06,FF,FF,FF,FF,FF,FF,FF,FF,FF,FF,71,01,01,01,01,01,01,01,04,01,01,01,01,01,  
01,01,01,01,01,01,01*4203 | |  
Most recent fault _____ | |  
Fault before most recent _____ |
```

Pointer is 113 (0x71)

List of faults from youngest to oldest

01

01

01

01

01

04

01

.

.

## 2.7 Message type APA07

This sentence contains the center frequencies for the segments being used on the current band with the current memory settings.

The format is:

APA07,Band,FS1,FS2,FS3,FS4,FS5\*ccc

where:

**APA07** is the sentence type identifier

**Band** is a number from 1-9 denoting the band

**FS1** is the center frequency for segment 1

**FS2** is the center frequency for segment 2

**FS3** is the center frequency for segment 3

**FS4** is the center frequency for segment 4

**FS5** is the center frequency for segment 5

**cccc** is the FCS

All frequencies are in kHz.

## 2.8 Message type APA08

This sentence contains the frequency counter data as well as associated data on tune and load cap settings. It is sent after the frequency counter routine is called when transitioning from State 5 to State 6.

The format is:

APA08,Band,Segment,TCmd,LCmd,Freq,FCValid\*cccc

where:

**APA08** is the sentence type identifier

**Band** is the current band

**Segment** is the current segment

**TCmd** is the commanded position for the Tune capacitor (decimal, 1-100)

**LCmd** is the commanded position for the Load capacitor (decimal, 1-100)

**Freq** is the ascii hex representation of the frequency in kHz

**FCValid** is a flag. 1 indicates the frequency count was judged to be valid; 0 means that it was invalid (insufficient power or frequency outside of band edges)

**cccc** is the FCS

## 2.9 Message type **APA09**

This sentence contains the raw analog-to-digital converter values. This can be useful in calibration and in diagnosing problems.

Format is: **APA09**, InVfRaw, InVrRaw, OutVfRaw, OutVrRaw, VgRaw, IgRaw\*ccc

Where:

**APA09** is the sentence type identifier

**InVfRaw** Is the raw value of the input forward power detector

**InVrRaw** is the raw value of the input reflected power detector

**OutVfRaw** is the raw value of the output forward power detector

**OutVrRaw** is the raw value of the output reflected power detector

**VgRaw** is the raw value of the grid voltage

**IgRaw** is the raw value of the grid current

**Ccc** is the FCS

## 2.10 Message type **APA10**

This sentence contains a block (16 bytes) of EEPROM data.

Format is:

**APA10**,StartAdr,B0,B1,.....B15\*cccc

Where:

**APA10** is the sentence type identifier

**StartAdr** is the address of the first byte

**B0** is the first byte

**B1** is the second byte

.

.

**B15** is the last byte

**cccc** is the FCS

## 2.11 Message type APA11

This sentence is sent as a response to a calibration (#08) command.

Format is: APA11,Param#,Value,RawAD,ValInst,ValAv\*cccc

Where:

**APA11** is the sentence type identifier

**Param#** is a decimal number indicating which calibration parameter is being reported

**Value** is the current value of this parameter

**RawAD** is the raw A-D converter value of the quantity to which the parameter is applied

**Valinst** is the instantaneous converted value of this quantity

**ValAv** is the average value of this quantity

**cccc** is the FCS

Parm#	Description
01	Grid current slope
02	Grid current offset
03	Grid voltage slope
04	Output forward power offset
05	Output forward power slope
06	Output reflected power offset
07	Output reflected power slope
08	Input forward power offset
09	Input forward power slope
10	Input reflected power offset
11	Input reflected power slope
12	Frequency counter gate time
13	Band pot setup
14	Set bias

Example:

```

      Grid current offset
      |
$APA11,02,0000,00EA,0068,0068*72B4
value_____
raw A-D_____
Instantaneous value_____
Average value_____

```

### 3 PC-to-Amp Communications

Communications from the PC to the amp start with # symbol, and contain parameters delimited by commas. The parameters are two or four bytes long, and are ascii numerals.

Example:

#01,02,03

The parameter immediately after the # symbol (01) is the command type. 02 is the first parameter, 03 is the second parameter.

If the command cannot be properly interpreted, the word “Invalid” is sent out the serial port.

#### 3.1 Command Type #00

This is used to cause the amp to send any desired telemetry sentence.

The format is: #00,xx

Where xx is a decimal number indicating the desired sentence. Possible values are 00 through 11.

00	Identification
01	Not used
02	Current state of the amp
03	Miscellaneous voltages and temperature
04	Band upper and lower limits
05	Sent when a button is pushed. Other data about state of amp
06	Fault list
07	Segment limits for current band
08	Tune/Load/Frequency information
09	Raw A-D values
10	Block of EEPROM data
11	Calibration command response

Table showing the sentence type to be sent corresponding to the parameter.

#### 3.2 Command Type #01

This is used to simulate pushing a front panel button.



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The format is #01,xx

Where xx is a decimal number related to the button whose action is to be simulated. The buttons are numbered from 01 at the top left to 42 at the bottom right.

01	Band 1 (1.8 MHz)	15	Save	29	Meter Fwd
02	Band 2 (3.5 MHz)	16	Rcl	30	Meter Ip
03	Band 3 (7 MHz)	17	Default	31	Meter Vp
04	Band 4 (10 MHz)	18	User 1	32	Meter Ig
05	Band 5 (14 MHz)	19	User 2	33	Meter SWR
06	Band 6 (18 MHz)	20	Auto	34	Meter Flt
07	Band 7 (21 MHz)	21	Tune decrease	35	Dim
08	Band 8 (24 MHz)	22	Tune increase	36	Snd
09	Band 9 (28 MHz)	23	Load decrease	37	PEP
10	Segment 1	24	Load increase	38	Del
11	Segment 2	25	Antenna 1	39	Oper
12	Segment 3	26	Antenna 2	40	Stby
13	Segment 4	27	Antenna 3	41	Amp On
14	Segment 5	28	Antenna 4	42	On/Off

Table showing the button action corresponding to the parameter value in the command.