Argonaut V

Programmer's Reference Guide

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Contents

Introduction

The Ten-Tec model 516 DSP HF QRP transceiver is a product that is defined more by firmware than hardware. The transceiver, front panel and PC Interface is controlled by firmware running on a single 16 bit DSP processor operating at 30 MHz.

Ten-Tec has produced this document as a starting point for software developers undertaking the development of a PC based interface program for the Argonaut V.

Interface Settings

The RS-232 serial interface on the Argonaut V is a software implementation of a simple UART. The interface parameters are fixed at 1200 baud, No Parity, 8 Data bits, 1 Stop bit. Hardware handshaking or software flow control is not available on the model 516.

Conventions used in this manual

Numeric Types:

0x0A, 0Ah	Hexadecimal Numbers.
10	Decimal Number.
'A'	ASCII character code.
	example: ASCII 'A' is 0x41.
BCD	Binary Coded Decimal format
	example: decimal 25 is 0x25 in BCD format

The Argonaut V Command Set

The Argonaut V command set is similar to the command sets for the RX-320 & RX-350 receivers and Pegasus & Jupiter Transceivers.

Every effort has been made to keep the individual commands as simple as possible.

In general an Argonaut V instruction is a two character command which may be followed by data and then terminated by a carriage return <cr>. The interface operates with binary data and unless otherwise noted all commands that require numeric data will need that data to be in binary format. Using a binary format requires fewer bytes when compared to an ASCII format. In binary format a number like 25 decimal is represented as 19 hexadecimal or 19h or may be written as 0x19. All refer to the same number.

The DSP system provides control over the FRONT PANEL user interface as well as MODE, FREQUENCY, FIL-TER, and other features. In addition, the DSP can respond to requests for SIGNAL STRENGTH, DSP FIRMWARE REVISION and other status information.

In general, the Argonaut V will accept any provided data as being valid. It is up the programmer to ensure that the supplied data is correct. Where a command has a limited number of data options failure to provide a valid selection may result in the radio choosing a default setting. There will be no notification that the data is invalid. Where a command is unrecognized the radio will send back a response consisting of a single letter 'Z' followed by a carriage return <cr>. Some commands may have data fields that may contain the binary number 0x0d which is also the carriage return character. The firmware in the radio which is responsible for parsing the command strings has the intelligence to properly handle carriage returns (0x0d) embedded in the data field.

Because the Argonaut V was built to be reprogrammed in-system the command set presented here is subject to change or enhancement. We will make every effort to make the system backward compatible with existing documented com-mands whenever possible. However, the Argonaut V is an HF TRANSCEIVER PLATFORM that could host a variety of radio services. Persons or companies developing control software for the transceiver should not assume that the radio is operating original factory firmware but rather should always query the radio's firmware revision to ensure compatibil-ity.

G/Z Response:

Every command and query to the radio will cause not only the expected response as documented, but also, following the response, a one-character result code meaning "Good" or "no-good." This code is either "G<cr>" or "Z<cr>." The "G" code is issued when a command is recognized, REGARDLESS OF DATA VALIDITY. That is, if you send a frequency command with out-of-bounds data, the radio will still issue a "G" response. The "Z" response is sent when the Argonaut parser does not recognize a command at all. If, for instance, a "?D" command were sent, the radio would respond with "Z<cr>" indicating that it did not recognize the command code.

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Argonaut V Command Set Quick List

Firmware version 1.07

*A	Vfo A Freq (binary)
*B	Vfo B Freq (binary)
*E	Vfo/Mem A/B
*J	Attn
*K	Noise Blanker
*M	Set Receiver Modes
*O	Split Mode
*P	PBT setting
*R	Recall mem
*S	Store Mem
*W	Filter Selection
*X	DSP Restart Command
#0	Goto Receive
#1	Goto Transmit
#4	Disable Transmitter
#5	Enable Transmitter
#6	Keyer Off
#7	Set Keyer Speed
?A	vfo A query
?B	vfo B query
?E	Vfo/Mem A/B
?F	Forward Power
?H	query squelch knob position
?J	query Attenuator setting
?K	query Noise Blanker setting
?M	query receive modes
?O	query Split
?P	PBT query
?R	query reflected power
?S	query S-units
?V	Query Version
?W	bandwidth query
?X	Query signal strength
?Y	Query analog portion of signal strength

Mode Codes
 '0' - AM
 '1' - USB
 '2' - LSB
 '3' - CW
 '4' - FM

Restart and Notify

This command will cause the radio to do a software restart. Upon start-up the radio will issue the start message "RADIO START" indicating that it is initialized and ready to accept commands. Sending this command to the Argonaut-V will cause the DSP firmware to reinitalize and generate the "RADIO START" message. This command can be used to determine that a Ten-Tec Flash Based radio is attached.

        format: '*' 'X' <cr>

        where: 'X' = is the ASCII 'X' character (0x58)

                      <cr> = ASCII carriage return (0x0D)

        response: " RADIO START"

Receive Modes

The Argonaut-V supports AM,FM,LSB,USB,and CW modes.

        format: '*' 'M' vfoAmode vfoBmode <cr>

        where: '*' = the ASCII '*' symbol (0x2a).

                      'M' = the ASCII M character (0x4d).

                      vfoAmode, vfoBmode =

                            ASCII '0' (0x30) for AM mode

                            ASCII '1' (0x31) for USB mode

                            ASCII '2' (0x32) for LSB mode

                            ASCII '3' (0x33) for CW mode

                            ASCII '4' (0x34) for FM mode

                      <cr> = ASCII carriage return (0x0D) character.

        response: G/Z Response

        example: *M11<cr> for USB on VFO-A, USB ON VFO-B.

                      M23<cr> for LSB on VFO-A, CW on VFO-B.

Receive Filter

The Argonaut-V contains a large number of selectable filters that can be used in AM, LSB, USB, and CW modes.

format:	'*' 'W' fn <cr>	
where:	'*' = the ASCII '*' symbol (0x2a).	
	'W' = the ASCII W (0x57) character.	
	fn = a filter number in the range 0 thru 33 (binary). From Table 1 below.	
	<cr> = ASCII carriage return (0x0D) character.	
response:	G/Z Response	
example:	*W 0x10 <cr> for filter number 16, 2100 Hz bandwidth.	

Filter #	Bandwidth	Filter #	Bandwidth	Filter #	Bandwidth
0	200	12	800	24	1800
1	250	13	850	25	1900
2	300	14	900	26	2000
3	350	15	950	27	2100
4	400	16	1000	28	2200
5	450	17	1100	29	2300
6	500	18	1200	30	2400
7	550	19	1300	31	2500
8	600	20	1400	32	2600
9	650	21	1500	33	2700
10	700	22	1600	34	2800
11	750	23	1700	35	2900
				36	3000

Frequency Tuning

Tuning the Argonaut V over the serial interface is accomplished by two commands that provide for frequency entry into either the A or B vfo. The frequency data is the desired frequency in Hz formatted as a 4 byte binary number.

format:	'*' ['A' or 'B'] b3 b2 b1 b0 <cr>
where:	'*' = the ASCII '*' symbol (0x2a).
	A = the ASCII 'A' character (0x41).
	B = the ASCII 'B' character (0x42).
	b3-b0 =
	Frequency in Hz as a 4 byte binary number. The most significant byte is b3. The least significant byte is b0.
response:	G/Z Response
example1:	*A <0x00> <0xe4> <0xe1> <0xc0> <0x0d> would set the A vfo to 15,000,000 Hz or 15 MHz.
example1:	*B <0x00> <0x5b> <0x2b> <0xd8> <0x0d> would set the B vfo to 5,975,000 Hz or 5.975 MHz.
default:	none

Split Mode

This command is used to turn Split mode on and off.

format:	'*' ['O'] n <cr>
where:	'*' = the ASCII '*' symbol (0x2a).
	'O' = the ASCII letter O (0x0x4f)
	n = 0x00 = SPLIT OFF, 0x01=SPLIT ON
response:	G/Z Response
example:	*O <0x01> <0x0d> would turn SPLIT ON.
default:	none

Passband Tuning (PBT)

The passband tuning range of the Argonaut-V is +/- 2.99 kHz. Setting the PBT to 0 will turn the passband tuning control OFF. The data format is a 2 byte binary number which represents the PBT value in Hz.

format:	'*' 'P' b1 b0 <cr>
where:	'*' = the ASCII '*' symbol (0x2a).
	P = the ASCII 'A' character (0x50).
	b1-b0 =
	PBT frequency in Hz as a signed 2 byte binary number. The most significant byte is b1. The least significant byte is b0.
response:	G/Z Response
example1:	*P <0x03> <0xe8> <0x0d> would set the PBT to 1000 Hz.
example2:	*P <0x00> <0x00> <0x0d> would set the PBT to OFF.
default:	none

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VFOs or Memory Mode Select

The active VFO can be set using this command. Also, the radio can be set to MEM or VFO mode.

format:	'*' ['E'] vm ab <cr>
where:	'*' = the ASCII '*' symbol (0x2a).
	vm = ASCII 'V' for VFO mode or ASCII 'M' for MEM mode.
	ab = ASCII 'A' for VFO A or ASCII 'B' for VFO B.
response:	G/Z Response
example:	*EVA<0x0d> would select VFO mode with VFO A active.
default:	none

RF Attenuator Control

An RF Attenuator may be switched in or out under software control. The Attenuator applies approximately 15 db of attenuation. Because this control directly affects the RF hardware this will directly affect S-Unit responses and Squelch settings.

format:	'*' 'J' ch <cr>
where:	'*' = the ASCII '*' symbol (0x2a).
	J= is the ASCII 'J' (0x4A) character
	ch = Setting
	'1' (0x31) = ON
	'0' (0x30) = OFF
	<cr> = ASCII carriage return (0x0D)
response:	G/Z Response
example:	* J <0x30><0x0d> sets the Attenuator OFF.
default:	Off

Memory Store

The Argonaut V has 100 memories. The memory store command will write the current contents of A and B VFOs to the indicated memory channel.

format:	'*' 'S' nn <cr>
where:	'*' = the ASCII '*' symbol (0x2a).
	'S' = the ASCII S character (0x53).
	nn = the memory channel in a one byte binary format (range 1 -100).
	<cr> = ASCII carriage return (0x0D) character.
response:	G/Z Response
example:	*S <0x10><0x0d> would write the current vfo to memory channel 16 (0x10). If SPLIT mode is on, both VFO's are written to memory channel 16.

After performing a Memory Write using the *S command, the memory is not permanent (nonvolatile) until a dummy write to nonexistant memory 255 is performed. This triggers a write of the entire 100 memory block into FLASH storage. The FLASH write routine is time-intensive and should only be performed at the end of all of the desired memory writes.

Memory Recall

The Argonaut V has 100 memories. The memory recall command will recall the selected memory channel. If the memory is empty the operation will not be performed. If the memory data is valid the stored data will replace the vfo contents.

format:	'*' 'R' nn <cr>
where:	'*' = the ASCII '*' symbol (0x2a).
	'R' = the ASCII R character (0x52).
	nn = the memory channel in a one byte binary format (range 1-100).
	<cr> = ASCII carriage return (0x0D) character.
response:	G/Z Response
example:	*R <0x10><0x0d> would recall the contents of memory channel 16 to the current VFO. If the memory were stored while the radio was in SPLIT operation both VFOs will be recalled.

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"Write Memory Direct" / "Read Memory Direct" Command:

This command allows a PC control program to dump or restore radio memory channel data without the necessity of restoring into a current VFO. This command is designed to make backups or reloads much faster. In fact, a control program may use this command as a faster method of setting many user parameters, by Writing Direct to an unused memory location, then issuing a *R command to activate those settings. The command format is as follows:

*@<binary memory number><19 bytes of binary data>
?@<binary memory number>
*@<255>

The *@<255> causes a write of the entire 100-memory block to FLASH storage, and is equivalent to *S<255>.

Here is the 19-byte data is format:

Byte	Length	Content
0	1	NON-EMPTY bit
1	1	SPLIT bit
2	1	SKIP bit
3	1	BW index
4	1	CW BW index
5	1	SUB TONE on/off
6	1	SUB TONE value
7	1	MODE index of current VFO
8	4	FREQUENCY of current VFO
12	1	FM SHIFT index of current VFO
13	1	MODE index of other VFO
14	4	FREQUENCY of other VFO
18	1	FM SHIFT index of other VFO

All 19 bytes are required for every *@ command.

These parameters require explanation:

NON-EMPTY, SPLIT and SKIP are all one-byte values, and are boolean values containing either 0=false and 1=true. (note that true is NOT -1 or 0xff)

NON-EMPTY describes whether a memory contains data. EMPTY memories (NON-EMPTY=0) display as "--.---.---." You can erase memories by sending the *@ command with NON-EMPTY set to zero, and the rest of the data, though required, can be any normal values.

SPLIT carries the status of radio SPLIT mode. If this memory bit is set, upon recall by a user with FUNC-V/M, BOTH VFOS are recalled. If this bit is clear, only the current VFO will be overwritten.

SKIP sets or clears the SCAN SKIP flag, same as user set FUNC-SKIP in MEM mode.

BW index is a lookup into the 37-filter table. This index ranges from 0 to 36. NOTE: The filter table values are displayed as 2 X filter bandwidth in AM mode. The filter table is as follows:

Index	Bandwidth
0	200
1	250
2	300
3	350
4	400
5	450
6	500
7	550
8	600
9	650
10	700
11	750
12	800
13	850
14	900
15	950
16	1000
17	1100
18	1200
19	1300
20	1400
21	1500
22	1600
23	1700
24	1800
25	1900
26	2000
27	2100
28	2200
29	2300
30	2400
31	2500
32	2600
33	2700
34	2800
35	2900
36	3000

CW BW index uses exactly the same table, but this filter is used only in CW mode.

SUB TONE refers to the FM CTCSS generator.
SUB TONE ON/OFF enables or disables CTCSS generation during FM transmit.
SUB TONE index is a lookup, similar to BW, into the following 42-entry CTCSS table with indices ranging from 0 to 41:

Index	CTCSS Tone Frequency
0	67.0
1	69.3
2	71.9
3	74.4
4	77.0
5	79.7
6	82.5
7	85.4
8	88.5
9	91.5
10	94.8
11	97.4
12	100.0
13	103.5
14	107.2
15	110.9
16	114.8
17	118.8
18	123.0
19	127.3
20	131.8
21	136.5
22	141.3
23	146.2
24	151.4
25	156.7
26	162.2
27	167.9
28	173.8
29	179.9
30	186.2
31	192.8
32	203.5
33	206.5
34	210.7
35	218.1
36	225.7

37	229.1
38	233.6
39	241.8
40	250.3
41	254.1

MODE of current VFO: (Please note that the index in this parameter is described in hexadecimal, and is ASCII for "0, 1, 2, 3, 4")

Index	Mode
0x30	AM
0x31	USB
0x32	LSB
0x33	CW
0x34	FM

FREQUENCY of current VFO:
Four bytes in MSB..LSB format represent the frequency in Hz.
For example,
<0x01><0x14><0xA4><0x50> indicates 18.130000MHz.

FM SHIFT index of current VFO

0	-100KHz
1	-100KHz
2	0KHz
3	+100KHz
4	+100KHz

(the extra table entries are a carryover from 6-meter operation on the model 526 where there were five possible shift values)

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Goto Receive

Used to place the Argonaut V in receive. Complement of the #1 GOTO TRANSMIT command.

format:	'#' '0' <cr>
where:	'#' = the ASCII '#' symbol (0x23).
	'0' = the ASCII number zero (0x0x30)
response:	G/Z Response
example:	#0<0x0d> would place the radio in receive.

Goto Transmit

Used to place the Argonaut V in transmit. Complement of the #1 GOTO RECEIVE command.

format:	'#' '1' <cr>
where:	'#' = the ASCII '#' symbol (0x23).
	'1' = the ASCII number 1 (0x0x31)
response:	G/Z Response
example:	#1<0x0d> would place the radio in transmit.

RS-232-Initiated Transmit Watchdog Timer:
A three-minute timer has been added to comply with 47CFR97.213(b) "Remote control of a station" in case of remote-site installation of the Argonaut V. This timer begins a countdown upon initiation of transmit via the "#1" command. This timer is reset by ANY RS-232 command, and does not require constant "heartbeat" polling as in the Pegasus. If transmit is initated by "#1" and no further RS-232 commands are received within three minutes, the transceiver unkeys. This timer is NOT active for normal microphone PTT operation.

Keyer Off

This command turns OFF the internal keyer to facilitate the use of an external key or keyer.

format:	'#' '6' <cr>
where:	'#' = the ASCII '#' symbol (0x23).
	'6' = the ASCII number six (0x0x36)
response:	G/Z Response
example:	#6<0x0d> would turn the internal keyer OFF. To turn the keyer ON see SET KEYER SPEED command.

Set Keyer Speed

Set the Operating speed of the Argonaut V's internal keyer. can be set from 1-40 wpm. A setting of 0 turns the keyer off.

format:	'#''7'n <cr>
where:	'#' = the ASCII '#' symbol (0x23).
	'7' = the ASCII number seven (0x0x37)
	n = keyer speed in binary format (range 0-40)
response:	G/Z Response
example:	#7<0x10><0x0d> would set the keyer to 16 wpm.

Transmitter Control:

A new command pair has been added to inhibit/enable transmit.

"#4"   Disables transmit
"#5"   Enables normal transmit

Noise Blanker

The Noise Blanker (nb) is available for use in all modes.

format:	'*' 'K' nb an nr <cr>	
where:	'*' = the ASCII '*' symbol (0x2A)	
	'K' = is the ASCII 'K' character (0x4B)	
	nb = Noise Blanker State (0 =off action 1-9)	
	<cr> = ASCII carriage return (0x0D)	
response:	none.	
example:	*K<0x05><0x0d>	
	Sets the Noise Blanker to 5	
default:	nb off.	

Query

The Argonaut query commands allow a host PC to determine the state of various radio controls. In general, each control setting command has a query counterpart. See the specific command for the format of the data returned.

format: '?' ch <cr>
where: '?' = is the ASCII '?' (0x3F) character
ch = ASCII code of the parameter

?A	query vfo A frequency
?B	query vfo B frequency
?E	query Vfo/Mem mode & Vfo A/B selection
?F	query Forward Power (Bridge Voltage)
?H	query squelch knob position
?J	query Attenuator setting
?K	query NB setting
?M	query receive modes
?O	query SPLIT setting
?P	query PBT
?R	query reflected power
?S	query S-units
?V	query Version
?W	query bandwidth
?X	query DSP and Analog signal strength
?Y	query AGC voltage

Format of Query Responses

'?A' (VFO A Frequency Query)

    String response formatted as per frequency setting command

'?B' (VFO B Frequency Query)

    String response formatted as per frequency setting command

'?E' (Vfo/Mem mode & Vfo A/B selection)

    String response formatted as per setting command

'?F' (Query Forward Power)

    Bridge Forward Voltage A/D reading. Single byte (0-255).

'?H' (Query Squelch Knob Position)

    A/D reading indicating Squelch knob position. Single byte (0-255).

'?J' (Query Attenuator setting)

    String response formatted as per setting command

'?K' (Query Noise Blanker setting)

    String response formatted as per setting command

'?M' (Query Receive Modes)

    String response formatted as per setting command

'?O' (Query Split setting)

    String response formatted as per setting command

'?P' (Query PBT adjustment)

    String response formatted as per setting command

'?R' (Query Reflected Power)

    Bridge Reflected Voltage A/D reading. Single byte (0-255).

'?S' (Query Signal Strength)

    Responds with the letter 'S' followed by the signal strength in 'S' units.

    The data format is a 2 byte binary string. The upper part of the number is the

    signal strength in 'S' units while the lower part is the fractional part of the signal in 'S' units.

'?V' (Version Query)

    String response in the form 'VER 1010-516' which indicates version 1.010 for model 516.

'?W' (Query Filter Setting)

    String response formatted as per setting command

'?X' (Query Signal Strength)

'?Y' (Query AGC Voltage)

?S Query Reponse:

This signal-strength query responds with the result expressed in S-units, with two bytes for the response as follows: the first byte is the integer S-units and the second byte is the fractional S-units, in units of 1/256 of 1 S-unit. For example, if the signal strength

IN DECIMAL were S-7-and-a-half, the response from the "?S" query would be:
"S<0x07><0x80> where 0x07 is S-7 and 0x80 is 128/256 of an S-unit.

Of course, the Argonaut is not expected to respond with extreme precision, but S-9 should represent approximately -73dBm.

?X Response:

X<IF sig MSB><IF sig LSB><analog AGC byte><cr>
where the first two bytes represent a 16-byte value which describes the signal strength that the DSP is seeing. The third byte describes the analog signal strength for very strong signals in the radio front end. The front-end AGC only activates for signals above approximately S-9+10. The two AGC signals have different decay rates, so there may be unusual interactions if the DSP IF strength is simply added to the front-end AGC value.

?C General Status Query:

This command gives the following response:
C<byte1><byte2><cr>
where <byte1> and <byte2> represent 16 status bits describing various conditions of the Argonaut V.

Bitwise description of the two bytes:
BYTE1   BYTE2
xxxxxxxx   xxxxxxxA

Where A is a single bit indicating the transmit/receive state of the transceiver. 0=RECEIVE
1=TRANSMIT

Currently only the LSB of byte2 is used; the others are reserved for future expansion.

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Revision Notes:

Revision 1.1 - First Release

Revision 1.2 - Second Release - Applies to Firmware Version 1.07 and later
      Modified documentation for Memory Store (*S) command.
      Added description of G/Z response.
      Added detailed description of the ?S response.
      Corrected description of the ?X command
      Added expanded description of the ?X response.
      Corrected erroneous description of the ?B command.
      Added *@/?@ command direct memory write commands.
      Added "?C" query transmit/receive command.
      Added 3-minute watchdog timer for software initiated transmit.
      Added #4/#5 command for allow/inhibit transmit.