

SEABUS-2 Interface specification RT v1.20+

5/08/97

This document describes the packet structure used in the SEA 235 radio. These packets are used for communication between the Control Head and the main radio. They are used for setting frequencies, changing modes, storing and recalling bins and bin tags.

The SEA 235 radio contains two serial data busses, one is the SEABUS-2 which is used for communication between control heads and the main radio, and the other is the SEABUS-232 which is used to connect to a computer and which has a simplified structure.

The format used is as follows:

Serial data using 9600 bps, 8 bits, no parity, 1 stop bit.
Information is sent in ASCII format with high bit always zero.

Conventions used in this document:

Flags separated by a | character are logical OR. Only one of them may be present at a time.

Numbers preceded by a 0x indicate a hexadecimal number. For example: A decimal 16 is a hexadecimal 0x10. Numbers not preceded by 0x are decimal numbers. In the packet itself the type of number depends on its position and purpose in the packet. See the Basic Packet Structure for more information.

Basic Packet Structure

Start Character : \$
Start of Checksum : *
Field Delimiter : ,
End of Packet : CR (0x0D)

These characters \$ * , cannot appear within the data fields.

Seabus-2 is a multiple receiver, multiple transmitter bus for communication between SEA devices. Each device must have a unique ID number that is used to address the packets.

The basic packet structure is as follows:

\$<TO>,<FROM>,<ACK>,<COMMAND>,...*<CHECKSUM><CR>

Some data is sent as ASCII HEX and other data is sent as decimal. The basic packet information is all in HEX. The Unit numbers, the

command value, and the checksum are all in the range of 0x00-0xFF.

The maximum packet length is 60 characters.

The '\$' character indicates the start of a packet, and cannot be used within the data fields. Every packet must have this minimum format (TO unit ID, FROM unit ID, COMMAND, ACK/NAK, CHECKSUM).

If a data field is not used (ie. no ACK or NAK to send) then it should be left blank, BUT the comma should be included. For example:

```
$10,11,,10*hh
```

Notice the 2 commas with nothing between them. This is where the ACK or NAK flag would appear. For an ACK/NAK packet with no command to send, the command field is left blank like this:

```
$10,11,A,*hh
```

Also notice that the * before the checksum is equal to a ',' as the final field delimiter. If there is a comma immediately preceding the '*' then the last field is blank. In the above example the command field is blank.

Basic Communications Protocol

A packet is constructed by the sender, and the bus is checked for any activity, and a wait with a length equal to xx mS * unit ID before sending the packet (after checking again for any activity). This delay method gives a higher priority to the lower numbered units, such as the main radio which is unit 0x10.

Each unit on the bus receives all packets and checks to see if it is addressed to it, or if the type of packet is something it should use, even when not addressed to it (ie. a update packet #11). It then parses the command and takes whatever action is needed. See the Unit number section for a description of reserved unit numbers.

If the packet was addressed to that unit then it replies with an ACK if the checksum is okay, or a NAK if the checksum fails. The NAK will tell the sender that it needs to resend the packet.

If the sender doesn't receive an ACK or a NAK within 450mS of sending the packet it will repeat it. The sender will retry 4 times before giving up.

Unit IDs

Each unit has a unique ID to identify it for packet communications. A packet should only respond to packets addressed to it, but other packets may have important information that should be used by the control head. For example, a status update (0x11) is addressed to a different control head, but the information it contains still indicates a frequency or mode change that should be acted on by all control heads. Only the control head that the packet is addressed to should respond with the ACK or NAK.

Unit IDs are sent as Hex values ranging from 0x10-0xFF.

The SEA 235 radio has an id of 0x10
Control Heads have ID's of 0x11-0x1F
The Tuner has a unit ID of 0x30

Checksum Calculation

The Checksum appended to the end of every packet is calculated on all of the packet data AFTER the start character and up to and including the * immediately before the checksum itself. It includes all data in ASCII as well as the field separating commas.

The checksum is calculated by exclusive ORing the data together and with a 0xFF. An example of this would be:

This packet is a status request to the radio from control head #1

\$10,11,,10*hh

0xFF XOR 0x31 XOR 0x30 XOR 0x2C XOR 0x31 XOR 0x31 XOR 0x2C
XOR 0x31 XOR 0x30 XOR 0x2C XOR 0x2A = 0xhh

Mode Flags

Mode flags indicate the status of the radio, and are included in the status update, mode update, full radio status packet. They are also used to set the radio's mode in the set mode packet. The SQL and NB flags are a little different than the others because they can be used to turn these modes on and off by using a +/- modifier.

In a status update SQL off is indicated by no S in the packet. In a set mode command a S+ turns on SQL and S- turns off SQL. This same method is used for the noise blanker, which is flag B.

The flags are as follows:

R T	RX OR TX MODE
V W H	VERY LOW, LOW or HIGH POWER

```

U | L | E | X | C | M   USB, LSB, AME, TLX MODE, CW-USB, TRUE AM
  | CU | CL | XW       CW-USB, CW-LSB, TLX-GW
S                       SQUELCH STATUS
N                       TUNED STATUS
B                       NOISE BLANKER
F                       HAM MODE OF OPERATION
A1                      ALARM TEST MODE
A2                      ALARM TRANSMIT MODE
I                       Intercom mode, all CH okay
D                       High VSWR warning flag
K                       PLL is unlocked
G0                      Scanning, Audio Off
G1                      Scanning, Audio On

```

These modes are not currently included in the radio:

```

Iaa-bb                  Intercom mode, private between aa and bb
Pxx                    Private mode, only Control Head xx with audio open

```

The flags with the or operator | between them are exclusive and cannot be set at the same time. eg. the radio cannot be in both RX and TX mode at the same time.

SEABUS-232 Bus Operation

The SEABUS-232 connector is the 9 pin connector on the back of the radio. Internal DIP switches can be used to selected non-standard functions for some of the extra pins on the connector. Check the manual for the proper dip switch settings. To connect it to a PC make sure that all the switches are set to OFF.

The SEABUS-232 uses a simplified form of the SEABUS-2 protocol. It doesn't use unit id numbers or acks. It is meant for the connection of only one device (eg. a PC) and is not a multidrop format.

```
$PSEAS,<COMMAND>,...*<CHECKSUM><CR>
```

The checksum is calculated on everything between the \$ and the *, but not including the \$ and * characters. This means that PSEAS and all commas are included in the checksum.

The central portion of the packet, including the command number, is identical to the rest of the SEABUS-2 specification. Only the header differs between the two formats.

Packets sent to the SEA 235 are preceded with a \$PSEAS. Packets sent from the radio to the SEABUS-232 port are preceded with \$PSEAR to differentiate between sender and receiver of the packets.

When a command sent to the radio requires a response packet (eg. You

send a 0x10 to request a status update 0x11) that response is indication that all went well. If there is an error then the 0x1B packet will be returned instead, indicating the type of error.

If a command isn't a status request, then a error packet 0x1B with and error number of 00 indicates that all went well with the command.

Command values

Command values range from 0x00-0xFF

Command	Description

10	Status Request to radio
11	Status update from radio
13	Mode Update from radio
14	SWR update from radio
15	Set radio bin, frequency, and mode
16	Set radio mode
17	Save Scratchpad information to radio eeprom
18	Check scratchpad bin state request to radio
19	Bin status update from radio
1A	Clarifier up/down
1B	Error Status Packet
1C	ASCII TAG group browse command to radio
1D	Antenna Tuner Control
1E/1F	DSC Control/Status
20	Alarm Control
21	Intercom Mode control
22	Scan mode control
23	Necode control (v1.20+)
24	Necode call received (v1.20+)
25	Data Mode Status Request (not implemented)
26	Data Mode Status Update (not implemented)
27	Set Data Mode (not implemented)
28	Send Data (not implemented)
29	Receive Data (not implemented)
30	RS232 Configuration Status Request (v1.20+)
31	RS232 Configuration Status Update (v1.20+)
32	Set RS232 Configuration (v1.20+)
33	EEPROM Read Request (not implemented)
34	EEPROM Read Update (not implemented)
35	EEPROM Write Command (not implemented)
36	Radio Configuration Status Request
37	Radio Configuration Status Update
38	Set Radio Configuration
39	Retrieve the Radio's Serial number
40	Save ASCII TAG for a bin
43	HAM/Marine mode setting

```

44      Bargraph update packet
45      Two tone mode control
46      AGC Control
47      SEA 2320 TX Watchdog Reset (not used in SEA 235)
48      DSC Abort Diagnostic (used only in SEA2320)
4A      Request Tuner Status/Tuner Status Update
4B      Extended Tuner Status Command
4C      Tuner EEPROM dump command

60      Diagnostic Status Request
61      Diagnostic Status Update
62      Set Diagnostic values
63      DSP Status Request
64      FROM_DSP status
65      TO_DSP status
66      Set TO_DSP packet
67      Set/Get Radio Calibration Factor

```

ACK/NAK

The field before the command is reserved for the ACK/NAK flag. If the packet is acknowledging a previous packet an ,A, will appear, and if the packet is Not-Acknowledging a previous packet a ,N, will appear. If the packet is doing neither then a ,, will appear.

ACK indicates that the packet was received and the checksum matches. NAK indicates that the checksum did not match on the previous packet and that it should be resent.

```

$10, FROM, A, 10*hh      ACK
$10, FROM, N, 10*hh      NAK
$10, FROM, , 10*hh      Neither

```

If there is no command to be sent, the ACK/NAK can be sent without a command being included:

```

$11, 10, A, *hh
$11, 10, N, *hh

```

Status Update Request from Control Head to Radio 10

```

$10, FROM, , 10*hh

```

This requests the RT to respond with a Status update packet #11

Full Status Update from Radio to Control Heads 11

\$TO, FROM, ACK, ll, CHAN, RXFREQ, TXFREQ, TAG, MODE FLAGS*hh

This packet indicates the current frequency and mode that the radio is operating on.

The CHAN/BIN number is an ITU channel if it is > 200 and is a BIN if it is 1-200. The number is in decimal, and may or may not have leading zeros.

,05, is a BIN selection and ,5, is without leading zeros.

,401, is an ITU selection and ,0401, is with leading zeros.

The RX Frequency is in 1Hz resolution, with a range of 490000 to 30000000 Hz (490kHz to 30MHz), and may or may not contain leading zeros.

,2182000, is 2182.0kHz and ,002182000, is the same.

,25000000, is 25MHz

The TX frequency format is exactly the same as the RX frequency format, except that its limits are 1600000 to 30000000 Hz.

ASCII Tag if it is a scratchpad bin, including spaces

eg. ,FAX 1,

Mode Flags

R T	RX or TX mode
V W H	Very low, Low or High Power
U L E X C M	USB, LSB, AME, TLX MODE, CW-USB, TRUE AM
CU CL XW	CW-USB, CW-LSB, or TLX-GW mode
S	Squelch on
N	Tuned flag on
B	Noise blanker on
F	Ham mode
A1	Alarm test
A2	Alarm transmit
I	Intercom mode, all CH okay
D	High VSWR warning flag
K	PLL is unlocked
G0	Scanning, Audio Off
G1	Scanning, Audio On

These modes are not currently included in the radio:

Iaa-bb	Intercom mode, private between aa and bb
Pxx	Private mode, only Control Head xx

Here is an example of a 2182000 AME update from the Radio to unit 0x11, no ASCII tag, no ACK/NAK, RX mode, High power, Squelch is on.

\$11,10,,11,0,2182000,2182000,,R,H,E,S*hh

Mode Update

13

Mode update sent by the Radio when only the mode has changed, for example when doing TX/RX transitions.

R T	RX OR TX MODE
V W H	VERY LOW, LOW or HIGH POWER
U L E X C M	USB, LSB, AME, TLX MODE, CW-USB, TRUE AM
CU CL XW	CW-USB, CW-LSB, TLX-GW
S	SQUELCH ON
N	TUNED STATUS
B	NOISE BLANKER ON
F	HAM MODE OF OPERATION
A1	ALARM TEST
A2	ALARM TRANSMIT
I	Intercom mode, all CH okay
D	High VSWR warning flag
K	PLL is unlocked
G0	Scanning, audio on
G1	Scanning, audio off

These modes are not currently included in the radio:

Iaa-bb	Intercom mode, private between aa and bb
Pxx	Private mode, only Control Head xx

Here is an example of a packet to unit 0x10, the radio is transmitting in high power and is in USB mode.

\$10,11,,13,T,H,U*hh

SWR Update

14

\$TO, FROM, ACK, 14, CMND, VSWR*hh

CMND = 0	Request a SWR update, ignore VSWR field
= 1	SWR update

A SWR update is automatically sent at the end of a Demand Tune packet (0x1D). It can also be requested by sending a request packet with CMND set to 0.

ASCII SWR reading from the last transmission, including decimal point. The SWR has a resolution of 0.1 and maximum of 9.9:1

eg. a SWR of 1.7:1 would be sent as:

\$TO,10,,14,1,1.7*hh

Requesting a swr update from the RT:

\$10,\$11,,14,0,*hh

\$11,\$10,,14,1,1.5*hh

Set radio state

15

 \$TO, FROM, ACK, 15, CHAN, RX FREQ, TX FREQ, TAG, MODE*hh

This packet is used to set the radio's channel number, frequency, and mode.

Channel number or Bin Number 1-200 or 201-2999

If the number is <= 200 then it is a bin number. If > 200 then it is an ITU channel number. Leading zeros may or may not be present. If blank then the frequency is loaded. If not blank then any frequency information sent is ignored and this bin or channel is loaded.

RX Frequency 490000 - 30000000

This number is in 1Hz, and may or may not have leading zeros.
 eg. ,2182000,

TX Frequency 1600000 - 30000000

This number is in 1Hz, and may or may not have leading zeros.
 eg. ,2182000,

Mode Flags

R T	RX OR TX MODE
V W H	VERY LOW, LOW or HIGH POWER
U L E X C M	USB, LSB, AME, TLX MODE, CW-USB, TRUE AM
CU CL XW	CW-USB, CW-LSB, TLX-GW
S	SQUELCH STATUS (S+ = ON / S- = OFF)
N	TUNED STATUS
B	NOISE BLANKER (B+ = ON / B- = OFF)
F	HAM MODE OF OPERATION
A1	ALARM TEST
A2	ALARM TRANSMIT
I	Intercom mode, all CH okay

These modes are not currently included in the radio:

Iaa-bb	Intercom mode, private between aa and bb
Pxx	Private mode, only sending Control Head xx

Here is an example of a 3400000RX/3450000TX frequency setting from control head #2. It puts the radio into LOW power LSB mode as well.

\$10,12,,15,,3400000,3450000,,R,W,L*hh

Set Mode

16

The mode update command is sent by the Control head when it wants to change the state of the radio:

Mode Flags

R T	RX OR TX MODE
V W H	VERY LOW, LOW or HIGH POWER
U L E X C M	USB, LSB, AME, TLX MODE, CW-USB, TRUE AM
CU CL XW	CW-USB, CW-LSB, TLX-GW
S	SQUELCH STATUS (S+ = ON / S- = OFF)
N	TUNED STATUS
B	NOISE BLANKER (B+ = ON / B- = OFF)
F	HAM MODE OF OPERATION
A1	ALARM TEST
A2	ALARM TRANSMIT
I	Intercom mode, all CH okay

These modes are not currently included in the radio:

Iaa-bb	Intercom mode, private between aa and bb
Pxx	Private mode, sending CH only

Here is an example of the radio being put into TELEX mode with the Squelch turned on.

```
$10,11,,16,R,X,S+*hh
```

Save Scratchpad information

17

```
$10, FROM, ACK, 17, BIN, RX FREQ, TX FREQ, ASCII TAG, MODE FLAGS*hh
```

The SEA 235 has space to store 200 custom frequency pairs, including a 7 character ASCII tag for each. This packet is used to store a frequency pair and mode to one of these bins.

BIN # is 1-200 and is the scratchpad bin to store the frequency, mode, and ascii tag into.

RX and TX FREQ are the receive and transmit frequencies to store. See the previous sections on frequency setting, the limits and format are the same.

ASCII TAG is the ASCII name to associate with this channel. 7 characters maximum, no \$, or * characters allowed. Spaces are OK.

Mode is the mode of the channel, see the above section on Mode flags. This is the mode that will be set when the bin is recalled.

A RX ONLY frequency can be stored by leaving the TX frequency field blank.

eg. Store BIN 1 as a RX only frequency of 2365.0 USB

```
$10,12,,17,1,2365000,,U*hh
```

The Bin can be erased by leaving all the fields blank (except for the bin number field of course).

eg. Erase BIN #23

```
$10,12,,17,23,,,,*hh
```

eg: Store 12500000RX/12501500TX USB frequency pair into bin 180 and call it NORM 2, from control head #2, no ACK.

```
$10,12,,17,180,12500000,12501500,NORM 2,MODE FLAGS,U*hh
```

Request scratchpad bin status

18

```
-----
$10, FROM, ,18, BIN*hh
```

This command is used to request the status of a scratchpad bin from the radio without having to change the operating frequency of the radio. Used to check to see if a bin is full or empty, retrieve the ascii tag, etc.

The radio replies with a bin status update (command 0x19).

eg. Control head #3 requests the status of bin 24.

```
$10,13,,18,24*hh
```

Scratchpad Bin status update

19

```
-----
$TO, FROM, ACK, 19, BIN, STAT, RX FREQ, TX FREQ, ASCII TAG, MODE*hh
```

This packet is in response to a request for scratchpad update from a control head.

BIN is the bin number 1-200

STAT is the status of the bin.

0 = Empty

1 = Full

E = Error reading from EEPROM

RX and TX FREQ are the stored RX and TX frequencies.

ASCII TAG is the 7 digit ASCII tag for the channel. It may or may not be present.

MODE is the mode of the stored channel

eg. Radio responding to request from CH #2 for status of scratchpad bin 24. Includes and ack and the information stored in bin 24 in the example for the save scratchpad command.

\$13,10,A,19,24,1,17311000,16429000,KMI 1624,U*hh

Clarifier up/down

1A

\$TO, FROM, ACK, 1A, RX DIR, RX CLARIFY, TX DIR, TX CLARIFY*hh

This packet is used to adjust the current operating frequency in small steps. RX DIR and TX DIR are the direction to clarify, a + or - character. The RX CLARIFY and TX CLARIFY are the amount to adjust the RX and/or TX freq in Hz.

\$10,11,,1A,+ ,100,*hh	RX FREQ +100Hz
\$10,11,,1A,- ,10,*hh	RX FREQ -10Hz
\$10,11,,1A,+ ,1,*hh	RX FREQ +1Hz
\$10,11,,1A,+ ,10,+ ,10*hh	RX FREQ and TX FREQ +1Hz

Error Packet

1B

\$TO, FROM, ACK, 1B, ERROR*CHECKSUM

This packet is used to report various errors that may occur. It also reports that a command was completed successfully to the RS232 port when a command is received from it.

ERROR = 0	Command Completed OK (used for RS232 only)
ERROR = 1	Error parsing packet
ERROR = 2	Illegal BIN/FREQ/ITU entry
ERROR = 3	EEPROM read/write error
ERROR = 4	Checksum Error
ERROR = 5	Limit Command error (command not allowed)
ERROR = 6	Unknown Error
ERROR = 7	Error communicating with the DSP
ERROR = 8	Demand Tune Failed
ERROR = 9	Empty bin, non-existent itu
ERROR = A	End of list during Group and Bin browse commands
ERROR = B	Going to Remote mode
ERROR = C	Leaving Remote mode

- 0 Command completed successfully
This indicates that there were no errors executing the command. This is sent when no response packet is associated with the command (ie. alarm on, power setting, etc.) It is only used by the SEABUS-232 bus.
- 1 Error parsing packet
This indicates that a parameter was missing from the packet. eg. A frequency set packet without the tx frequency.
- 2 Illegal BIN/FREQ/ITU
The BIN or ITU channel requested is not valid, or the frequency requested is not legal.
- 3 EEPROM read/write error
An error occurred when trying to read or write the eeprom.
- 4 Checksum Error
This means that the last packet sent to the interface had an invalid checksum.
- 5 Limit Command Error
The command requested is not valid at this time. Commands are currently limited (usually used by the alarm mode). When the radio is in Alarm, Scan, or Intercom mode the commands are limited to status updates and the command packet for the respective mode.
- 6 Unknown Error
This error indicates that the interface couldn't determine the type of error that occurred.
- 7 Error communicating with the DSP
Communications between the microprocessor and the DSP are not working.
- 8 Demand Tune Failed
This packet is sent by the interface when a demand tune (#1D) failed to return a tune within the timeout period.
- 9 Empty BIN, non-existent ITU
This is sent when a non-existent ITU channel is requested, or the bin requested doesn't have a valid frequency stored.
- A End of list during Group and Bin browse commands
This is sent by the RT after a bin/group browse command rolls over from 200 to 0 or from 0 to 200 in group, and when the bin browse rolls over from first to last and from last to first bin in the group.

ASCII Tag Group browse command

1C

\$10, FROM, ACK, 1C, COMMAND*CHECKSUM

COMMAND = 1 Go to Next Group
COMMAND = 2 Go to Previous Group
COMMAND = 3 Go to Next Bin within Group
COMMAND = 4 Go to Previous Bin within Group
COMMAND = 5 Go to Next Bin (ignore Group)
COMMAND = 6 Go to Previous Bin (ignore Group)

These commands are used by a control head to search through the Ascii TAGS attached to EEPROM bins. While they are being selected the channels are loaded so that they can be heard by the user.

The next and previous groups will skip between tagged groups (see the manual for an explanation of how bins are grouped by tag). The next and previous bin commands will change between bins within the same ascii tag group.

If the command causes the channel to wrap around from bin 200 to bin 1, or from the last bin within a group to the first bin the radio will go to 2182.0 instead and return an error packet with an error number of 0x0A to indicate that the control head should show and exit prompt.

A status packet (0x11) is returned in response to each request.

Antenna Tuner Control

1D

\$TO, FROM, ACK, 1D, CMND, LIMIT*hh

This packet is used to control an attached SEA 1635 Antenna Tuner

CMND = 1 Put tuner in bypass mode
 = 2 Start a demand tune and stop after LIMIT seconds.

Putting the tuner into bypass mode will set the relays to no C in, no C out, no L.

Demand tune will start a demand tune, keying the transmitter and using an internally generated tune tone. It will time out after LIMIT seconds have passed without a tune indication from the tuner.

When the tune is successful the tuned flag is turned on and a swr update packet (#14) is sent to the control heads and the radio is returned to RX mode.

The time limit defaults to 15 seconds if no limit parameter is included in the packet.

If the tune fails, then an error packet with an error code of 0x08 is sent to the control heads.

The Step relay function will only work if the attached coupler is a SEA1630 modified for SEABUS-2 usage (what will its name be?). If the tuner is present a ok packet (#1B,00) will be returned. If it isn't present then an error packet (#1B,02) will be returned.

```
$10,11,,1D,2,30*hh      Tune for max 30S
$10,11,,1D,2,*hh       Tune for a max of 15S (default time)
$10,11,,1D,1,*hh      Put the tuner into bypass mode
```

Alarm Control

20

```
$TO, FROM, ACK, 20, COMMAND*hh
```

Command the Radio to turn on the Alarm for 45 seconds.

```
COMMAND = 0      Turn off Alarm
COMMAND = 1      Turn on the Alarm Test
COMMAND = 2      Turn on the Alarm (Transmit it)
```

eg. Control Head #1 commanding the Radio's alarm modes:

```
$10,11,,20,0*hh      Turn off Alarm signal
$10,11,,20,1*hh      Turn on Test Alarm signal
$10,11,,20,2*hh      Transmit the Alarm signal
```

Intercom Mode/Private Mode

21

```
$TO, FROM, ACK, 21, COMMAND, UNIT*hh
```

```
COMMAND = 0      Intercom/Private mode off
COMMAND = 1      Intercom mode on
COMMAND = 2      Private Intercom mode between 2 control heads
COMMAND = 3      Private Radio operation mode
```

Commands 1 & 2 are intercom modes between control heads.
 Command 3 is the Private Radio mode which causes all control heads except the one sending the command to mute their audio until private mode is turned off (indicated by Pxx in mode update).

Commands 2 and 3 are not currently implemented in the radio.

eg. Control head #2 commanding intercom modes

```
$10,12,,21,0,*hh      Intercom/Private Off
```

```

$10,12,,21,1,*hh      Intercom On
$10,12,,21,2,12*hh    Intercom with #12
$10,12,,21,3,*hh      Private Radio mode

```

Scan mode control

22

```
$TO, FROM, ACK, 22, COMMAND, MODE, BIN*hh
```

```

COMMAND = 0      Stop Scan
COMMAND = 1      Start scan
COMMAND = 2      Hold/Pause the scan
COMMAND = 3      Resume the scan
COMMAND = 4      Skip to next BIN

```

```

MODE      = 0      Voice scan : Hold 5 seconds after squelch closes
MODE      = 1      Pause scan : Hold for only 5 seconds on active bin
MODE      = 2      Telex scan : Hold for 4.1 seconds on each
MODE      = 3      NECODE scan: Stop on a 2KHz tone.

```

The Hold/Pause scan command causes the radio to stop on the current channel, but not exit the scan mode. Resume scan will restart the scan. The skip to the next bin command will cause the radio to move to the next bin, even if the squelch is open.

eg. Control Head #1 controlling scan mode of group starting at 30

```

$10,11,,22,0,*hh      Stop Scan
$10,11,,22,1,0,30*hh  Start Voice scan at bin 30
$10,11,,22,2,*hh      Hold the scan
$10,11,,22,3,*hh      Resume the scan
$10,11,,22,4*hh       Skip to next BIN

```

Necode control

23

```
$TO, FROM, ACK, 23, COMMAND, NECODE ID, CALLER*hh
```

This command is not yet implemented in the radio.

Control the SEACODE Necode encoder/decoder built into the Radio. Supports standard 4 digit necode IDs and 5 digit Seacode IDs.

```

COMMAND = 0      Request a Necode Status update
COMMAND = 1      Necode Status update
                   Current ID is in NECODE field
                   Necode decoding is OFF.
                   CALLER field contains the ID of the last caller
COMMAND = 2      Necode Status update
                   Current ID is in NECODE field
                   Necode decoding is ON.

```

CALLER field contains the ID of the last caller

COMMAND = 3 Stop Nocode decoding.
NECODE ID and CALLER are left blank.

COMMAND = 4 Start Nocode decoding and optionally set the
Nocode ID for the radio. If the NECODE ID
parameter is blank then the last Nocode ID is
used.

COMMAND = 5 Send a Nocode Call to ID # in the Nocode argument.

COMMAND = 6 Set the Nocode ID to NECODE field, don't change
the current Nocode operating mode.

eg. Control Head #1 setting Nocode ID 1234 and calling ID 4567

\$10,11,,23,0,*hh	Request a status update
\$10,11,,23,1,1234*hh	Nocode is OFF, ID is 1234
\$10,11,,23,2,1234*hh	Nocode is ON, ID is 1234
\$10,11,,23,3,*hh	Stop Nocode
\$10,11,,23,4,*hh	Enable Nocode use last ID
\$10,11,,23,4,1234*hh	Enable Nocode and set Nocode ID
\$10,11,,23,5,4567*hh	Send a call to ID #4567

Nocode call received

24

\$TO, FROM, ACK, 24, NECODE ID*hh

This command is implemented in v1.20+

Nocode Call notification from the Radio. NECODE ID is the id of
the calling station.

eg. Radio alerting control heads to a Nocode Call - note all
control heads watch for the #24 packet, whether or not it is
addressed directly to them.

\$11,10,,24,23*hh Received a call from 23.

Data Mode Status Request

(Not currently implemented)

25

\$TO, FROM, ACK, 25*hh

This command is not yet implemented in the radio.

Request a status mode update packet (#26)

Data Mode Status Update

(Not currently implemented)

26

data so that as much data as possible can be transmitted in one packet.

example, send 21 bytes:

```
$10,$11,,28,000102030405060708090A0B0C0D0E0F101112131415*hh
```

Receive Data (Not currently implemented) 29

```
$TO, FROM, ACK, 29, DATA*hh
```

This command is not yet implemented in the radio.

This packet is used to receive data in the data mode. Up to 30 bytes of data can be received with each packet.

The DATA field consists of 2 character ASCII HEX values, including leading zeros on values from 00 to 0F. No commas separate the data so that as much data as possible can be received in one packet.

example, receive 21 bytes:

```
$10,$11,,28,000102030405060708090A0B0C0D0E0F101112131415*hh
```

Modem Configuration Status Request 30

```
$TO, FROM, ACK, 30*hh
```

Request a status update on the Modem configuration of the radio. Returns packet #31

v1.20+ of the SEA 235 radios can be configured to use a modem to communicate with it. The Multitech DSVD modem is recommended for its ability to transport voice and data over standard dialup telephone lines.

Modem Configuration Status 31

```
$TO, FROM, ACK, 31, MODEM, RESET, CONNECT, PASSWD*hh
```

MODEM mode - If this option is set to 1 then the RS232 port will send the ANSWER command to an attached modem when it receives the RING string from the modem. If it is set to 0, the RS232 port is in normal mode, responding to \$PSEAS commands. Defaults to 0, no modem mode.

- RESET - String to send to the modem to reset it.
Sent at powerup
Defaults to ATZS0=1
- CONNECT - String to look for that indicates a connection
Defaults to CONNECT
- PASSWD - Password that needs to be entered in modem mode
before access to granted.

Set Modem Configuration

32

\$TO, FROM, ACK, 32, MODEM, RESET, CONNECT, PASSWD*hh

This packet is used to setup the configuration of the RS232 interface of the SEA 235.

MODEM mode - If this option is set to 1 then the RS232 port will send the ANSWER command to an attached modem when it receives the RING string from the modem. If it is set to 0, the RS232 port is in normal mode, responding to \$PSEAS commands.
Defaults to 0, no modem mode.

RESET - String to send to the modem to reset it.
Sent at powerup and after the modem drops carrier.
Defaults to ATZ

CONNECT - String to look for that indicates a connection
Defaults to CONNECT

PASSWD - Password that needs to be entered in modem mode before access to granted. To set a blank password send a ',' in the password field.

The initialization string should accomplish the following:

1. Set the modem to a known state.
AT&F resets it to the factory setting.
2. Autoanswer the phone without and additional help
S0=1
3. No echo in command mode. This is very important, if the modem echos in command mode it will cause the radio to 'talk to itself' forever.
E0 turns off echo in the command mode
4. Flow control off. There are no flow control lines to the radio, and XON/XOFF is not used.
&K0 turns off flow control

```
$TO, FROM, ACK, 32, 1, AT&F-SMS=1#VLS=5E0L3S0=1&K0, CONNECT, , *hh
```

This will setup the modem to autoanswer the phone, not echo in command mode, no flow control, Speaker at maximum volume. This string is for the Multitech MultimodemDSVD and it enables the voice+data mode of operation.

EEPROM Read Request

33

```
-----
$10, FROM, ACK, 33, START, END*hh
```

This command is not yet implemented in the radio.

This function is used to request a dump of the EEPROM storage of the SEA 235 radio. The EEPROM contains all of the 'personality' of the radio, including stored bins, alphanumeric tads, etc.

The contents of the EEPROM will be returned by packet #34 in 16 byte blocks of data (or less if required).

START is the starting address (in HEX) of the data to be read.
END is the ending address (in HEX) of the data to be read.

Include a map of the eeprom?

eg. Request a dump of EEPROM data from 0x0000 thru 0x00FF

```
$10, $11, , 33, 0000, 00FF*hh          Dump 0x0000 to 0x00FF from EEPROM
```

EEPROM Read Update

34

```
-----
$TO, 10, ACK, 34, START, DATA1, ...*hh
```

This command is not yet implemented in the radio.

This packet is used transfer the contents of the EEPROM. Each packet indicates the EEPROM address of the first byte in the data stream. Each byte is separated by a comma from the previous and the address increases by 1 for each byte.

START is the starting address of the data in HEX.
DATA is one byte of data in HEX.

eg. dump of data from 0x0000 thru 0x0010

```
$11, 10, A, 34, 0000, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B, 0C, 0D, 0E, 0F, 10*hh
```

EEPROM Write command

35

```
$10, FROM, ACK, 35, START, DATA1, ...*hh
```

This command is not yet implemented in the radio.

This packet is used to write data to the EEPROM of the SEA235.

Misuse of this function can erase bin storage and scramble the internal state of the radio. It should be used only if the exact memory addresses are known. Only the data to be changed should be written, instead of writing a full eeprom image.

START is the starting address (in HEX) to write to.

DATA is one byte of data in HEX.

eg. Write 3 bytes to location 0x013B

```
$10, 11, A, 35, 013B, 01, 02, 03*hh
```

Configuration Status Request

36

```
$10, FROM, ACK, 36*hh
```

Request a status update containing the radio's configuration. Command #37 returns things like Beep on/off setting, Dim level, Sql status, and any other stored data.

Configuration Status Update

37

```
$TO, 10, ACK, 37, VERSION, BEEP, TUNER, SQL, BAR, NECODE, AUDIO, REMOTE,  
SSBAF, TLXAF, POWER, SPAUSE*hh
```

This packet returns the status of various radio settings.

VERSION The RT Software Version number in the form xxx
eg. 100 = version 1.00

BEEP Beep on or off.
0 = OFF and 1 = ON

TUNER Antenna Tuner present 0=NO 1=YES

SQL Squelch setting
0 to 15

BAR Bargraph Update status (Packet #44 sent every second)
0 = OFF
1 = SEABUS-2 SEND ON
2 = SEABUS-232 SEND ON

3 = SEND Packet #44 on BOTH SEABUS-2 and SEABUS-232
Off by default at bootup. SEA235 CH sets to #1 at powerup

NECODE Radio's current NECODE ID (not implemented)

AUDIO Audio Source to DSP
 0 = SEABUS audio
 1 = DB-9 adapter audio

REMOTE 0 = Normal operation
 1 = Remote mode (no RS485 packets)

SSBAF 0 = MIC audio input is the default on non TLX frequencies
 1 = DB9 audio input is the default on non TLX frequencies

TLXAF 0 = MIC audio input is the default on TLX and TLX-GW
 1 = DB9 audio input is the default on TLX and TLX-GW

POWER 0 = Normal Power shutdown operation (default at powerup)
 Low voltage, high temperature, bad swr turn down the power level.
 1 = Override power shutdown. Low voltage, high temperature will not turn down the power level. High SWR will still turn down the power. This is reset to 0 at powerup.

SPAUSE Added in v1.20+, requires hardware modification to the radio to operate in the Analog PTT/Scan Pause.
 0 = Digital PTT input, no Scan Pause operation
 1 = Analog PTT/Scan Pause input
 Internally pin 66 of the HC11 processor needs to be connected to pin 24.
 Externally connect a 10k resistor in series with the Scan Pause line and the PTT input. When pulled low this will pause a scan. In non-scan mode it will act like PTT.

eg. Update with beep on, No Tuner, SQL=5, Bargraph updates on, No necode ID, and Audio source = SEABUS audio, Remote mode off, MIC is audio source for SSB and DB9 is audio source for TLX. Normal power shutdown operation. Digital PTT operation.

\$11,10,,37,100,1,0,5,0,,0,0,0,1,0,0*hh

Set Radio Configuration

38

\$10, FROM, ACK, 38, BEEP, TUNER, SQL, BAR, NECODE, AUDIO, REMOTE, SSBAF, TLXAF, POWER, SPAUSE*hh

Set the radio options. If a field doesn't need to be changed just leave it blank, but make sure to include all fields in the command.

BEEP Beep on or off.
 0 = OFF and 1 = ON

TUNER Antenna tuner present 0=NO 1=YES

SQL Squelch setting
 0 to 15

BAR Bargraph update control (Packet #44 sent every second)
 At powerup this is set to a 0. A SEA 235 control head sets this to a 1 when it powers up.

0 = OFF
 1 = SEABUS-2 SEND ON (RS485 interface)
 2 = SEABUS-232 SEND ON (RS232 interface)
 3 = SEND Packet #44 on BOTH SEABUS-2 and SEABUS-232

NECODE Radio's current NECODE ID (not implemented)

AUDIO Temporarily change the radio's audio source for the current channel only. A channel or mode change will set the audio source to the default for the selected mode (see the SSBAF and TLXAF settings below.

*** This setting is overridden by the SSB or TLX AF settings if they are included in the same sentence.

0 = SEABUS audio
 1 = DB-9 adapter audio

REMOTE This setting cause the RS485 interface to be turned off, leaving the RS232 interface as the only radio controller. At powerup the radio is in the Normal mode of operation.

*** When switching in and out of Remote Only mode with SEA 235 RT v1.18 and previous the REMOTE field must be the only parameter in the configuration command. When setting other options the REMOTE field should be left blank (,,) so that it isn't changed.

0 = Normal operation
 1 = Remote mode (no RS485 packets)

SSBAF This setting is saved to EEPROM when it is changed, and it is recalled from EEPROM at powerup

0 = MIC audio input is the default on non TLX frequencies
 1 = DB9 audio input is the default on non TLX frequencies

TLXAF This setting is saved to EEPROM when it is changed, and it is recalled from EEPROM at powerup

0 = MIC audio input is the default on TLX and TLX-GW
 1 = DB9 audio input is the default on TLX and TLX-GW

POWER 0 = Normal Power shutdown operation (default at powerup)
 Low voltage, high temperature, bad swr turn down the power level.

1 = Override power shutdown. Low voltage, high temperature will not turn down the power level. High SWR will still turn down the power. This is reset to 0 at powerup.

SPAUSE Added in v1.20+, requires hardware modification to the radio to operate in the Analog PTT/Scan Pause.

0 = Digital PTT input, no Scan Pause operation
 1 = Analog PTT/Scan Pause input

Internally pin 66 of the HC11 processor needs to be connected to pin 24.

Externally connect a 10k resistor in series with the Scan Pause line and the PTT input. When pulled low this will pause a scan. In non-scan mode it will act like PTT.

When a device sets any of these radio configurations it is recommended that it first read the current state of the radio and when it is finished using the radio that it restore the previous

parameters. This will allow more devices to successfully use the radio.

For example, if a device need to change the SQL setting it should record the current SQL setting (using packet #36 and #37), set it SQL value that it needs to use. When it is finished operating the device should then restore the original SQL setting.

Examples:

\$10,11,,38,1,0,5,0,,0,,0,1,0,0*hh	Set Everything
\$10,11,,38,,,10,,,,,,*hh	Set only SQL
\$10,11,,38,,,,,,1,,,*hh	Remote mode On
\$10,11,,38,,,,,,0,,,*hh	Remote mode Off

Retrieve the Serial Number

39

\$10, FROM, ACK, 39, 0, SERIAL*hh

This command returns the serial number from the radio, up to 8 characters long.

Send:

\$10, FROM, ACK, 39, 0, *hh

Receive

\$FROM, \$10, ACK, 39, 1, SERIAL*hh

Save ASCII TAG for a bin

40

\$10, FROM, ACK, 40, BIN, ASCII TAG*hh

Save a 7 digit ASCII TAG for a scratchpad BIN without affecting any previously stored frequency in the bin.

BIN is the bin number from 1 to 200

ASCII TAG is the 7 digit ascii string to store for this bin. It can include spaces, but not , * or \$

eg. Set the ASCII TAG for bin 23 to KMI1603

\$10,11,,40,23,KMI1603*hh

The ASCII TAG can be ERASED by leaving the ASCII TAG field blank.

eg. Erase the TAG for bin 14

\$10,11,,40,14,*hh

HAM / Marine mode selection 43

\$10, FROM, ACK, 43, MODE, LOCK*hh

MODE = 0 sets Marine mode
MODE = 1 sets HAM mode
LOCK = 0 or blank does nothing
LOCK = 1 locks TX FREQ to the current RX FREQ

In ham mode the RX/TX clarifier is enabled, clarifier limits are removed, the RT indicates Ham mode to the control heads with a 'F' flag.

Bargraph update packet 44

\$10, FROM, ACK, 44, DATA*hh

This packet is sent by the RT so that the control head can update its bargraph. This packet is sent by the RT once a second, and does not require an ACK.

By default the bargraph packet is not sent. The attached control head will request that it be sent at powerup. Other devices can then request that it not be sent by using the Set Radio Configuration packet (#38)

The packet can be sent over the SEABUS-2 bus only, the RS232 bus only, or over both of them at the same time.

Two tone test mode 45

\$10, FROM, ACK, 45, TTONE*hh

TTONE = 0 turns off the special two tone test TX
TTONE = 1 turns on the special two tone test TX

When this mode is on a PTT will generate a 2-tone output.
It is always off at powerup.

AGC/VOGAD Control 46

\$10, FROM, ACK, 46, CMND, SSBAGC, TLXAGC, VOGAD*hh

CMND = 0 Request a Status update
CMND = 1 Status update
CMND = 2 Set the AGC value

SSBAGC AGC setting for SSB channels (0-3)

TLXAGC AGC setting for TLX channels (0-3)
 VOGAD Vogad setting (0-3)

These values are all stored to EEPROM after they are changed,
 and are recalled at powerup.

Tuner Status request/update RT V1.20+ 4A

\$TO, FROM, ACK, 4A, CMND, TUNE, RECALL, COUNT*hh

CMND = 0 Request a status update from the Tuner. The
 remaining fields are ignored.
 CMND = 1 Status update from the Tuner
 CMND = 2 Set Tuner status
 CMND = 3 Demand Tune (from RT to Tuner)
 CMND = 4 Step Relays
 CMND = 5 Go to LOW power (from Tuner to RT only)

TUNE Current Tune state
 0 = Untuned
 1 = Tuned
 2 = Bad Tune
 3 = Low power

RECALL Recall Only/Normal Tune mode
 0 = Normal Recall mode
 1 = Recall Only mode (no tuning)

COUNT Frequency Counter Value
 When sent to the Tuner with CMND=2 this will make
 the Tuner recall the tune data for this freq. as
 long as the CIN/COU is not set at the same time.
 If there is no tune data then it will go to
 passthru mode.

When setting the Tuner state you cannot set the TUNE state, this
 field should be left blank.

The Demand Tune function is for use by the RT to tell the Tuner to
 restart the tune. Other devices should use packet 1D to start the
 Demand tune.

The CMND = 5, go to LOW power command is used only by the Tuner to
 tell the RT to go to LOW power while it is tuning. The RT is free
 to return to high power when the tune is completed successfully.

\$30,10,,4A,0,*hh Request an update
 \$10,30,A,4A,1,1,0,1D5*hh Update from the Tuner
 \$30,10,,4A,2,,,0E4*hh Set Counter value
 Tuner recalls the relay data
 \$30,10,,4A,2,,1,*hh Set Recall Only mode of Tuner

Extended Tuner Status request/update RT V1.20+ 4B

\$TO, FROM, ACK, 4B, CMND, CIN, COUT, IND, TUNE, TEMP, PKI, IFWD, FPEAK, SWR*hh

CMND = 0 Request a status update from the Tuner. The remaining fields are ignored.
 CMND = 1 Status update from the Tuner
 CMND = 2 Set Tuner status

CIN CIN relay value (HEX 00-FF)
 COUT COUT relay value (HEX 00-FF)
 IND Inductance value (HEX 00-FFFF)
 TEMP Temperature reading (A/D reading HEX 00-FF)
 PKI Antenna Current (A/D reading HEX 00-FF)
 IFWD Matching Forward (A/D reading HEX 00-FF)
 FPEAK Peak Forward power (A/D reading HEX 00-FF)
 SWR SWR reading 1.0 to FF.0

When the Set Tuner status option is selected there are several options that cannot be set:

TEMP, I, FPOW, RPOW, FPEAK, PHASE, SWR

The SWR reading is valid only after a tune, and is a hex value from 1 to FF, when not tuned it will return a 0.00

These fields should be left blank when setting the Tuner options.

\$30,10,,4B,0,*hh Request an update
 \$30,10,,4B,1,2,0,FFFE,98,0,0,0,0.00*hh Update from Tuner
 \$10,30,A,4B,2,0,0,FFFF,,,,*hh Set Tuner to Passthru

Tuner EEPROM Dump RT V1.20+ 4C

\$TO, FROM, ACK, 4C, CMND, ADDRESS, DATA*hh

This command allows the EEPROM of the Tuner to be read without having to recall every single frequency that has been tuned.

CMND = 0 Request a Address block
 CMND = 1 Address block update from Tuner

ADDRESS Starting EEPROM address in HEX
 DATA A block of 16 bytes of EEPROM data. In HEX with 2 characters per byte, no commas.

\$30,10,,49,0,00,*hh
 \$10,30,,49,1,00,000102030405060708090A0B0C0D0E0F*hh

Diagnostic Status Request 60

\$10, FROM, ACK, 60*hh

Request that the radio return a Diagnostic status update #61.

Diagnostic Status Update 61

\$10, FROM, ACK, 61, ALC, IRQ, DSP, STOP, WAIT, FWD, REF, PATMP, OSCTMP
 , VOLTS, MINFWD, MAXFWD, GAIN, CARRIER, FLTFWD, FWDCAL
 , PLLCAL, AMELVL, ATTACK, DECAY, HOLD, MINDRV, GNCAL
 , FLTREF*hh

This packet returns the following internal data:

ALC	Automatic Level control (TX Power)	0=OFF	1=ON
IRQ	DSP 5mS IRQ ON/OFF	0=OFF	1=ON
DSP	DSP RUN/RESET	0=RUN	1=RESET
STOP	HC11 RUN/STOP	0=RUN	1=STOP
WAIT	HC11 RUN/WAIT	0=RUN	1=STOP
FWD	Forward power A/D reading (0-255)		
REF	Reflected power A/D reading (0-255)		
PATMP	PA Temperature Reading (0-255)		
OSCTMP	Oscillator oven temperature reading (0-255)		
VOLTS	Supply Voltage (0-255)		
MINFWD	Minimum Forward power for ALC (0-255)		
MAXFWD	Maximum Forward power for ALC (0-255)		
GAIN	Current power Gain setting (0-255)		
CARRIER	Current Carrier level setting (0-255)		
FLWFWD	Filtered Forward power (peak detect) (0-255)		
FWDCAL	Forward power calibration factor (0-255)		
PLLCAL	Frequency Calibration Factor (0-255) (+/-127)		
AME	AME Carrier level (0-255)		
ATTACK	ALC Attack constant 5mS resolution (0-255)		
DECAY	ALC Decay constant 5mS resolution (0-255)		
HOLD	ALC Hold constant 5mS resolution (0-255)		
MINDRV	ALC Minimum Drive constant (0-255)		
GNCAL	GAIN calibration factor (0-255)		
FLTREF	Filtered Reflected (peak detect) (0-255)		

Set Diagnostic values 62

\$10, FROM, ACK, 62, ALC, IRQ, DSP, STOP, WAIT, GAIN, CARRIER, MINFWD,
 MAXFWD, FWDCAL, PLLCAL, AMELVL, GNCAL*hh

Set internal values of the radio:

ALC	Automatic Level Control (TX Power)	0=OFF	1=ON
IRQ	DSP IRQ ON/OFF	0=OFF	1=ON
DSP	DSP RUN/RESET	0=RUN	1=RESET
STOP	HC11 RUN/STOP	0=RUN	1=STOP
WAIT	HC11 RUN/WAIT	0=RUN	1=STOP
GAIN	Set the TX Power Gain	(0-255)	
CARRIER	Set the Carrier level	(0-255)	
MINFWD	Minimum Forward Power for ALC	(0-255)	
MAXFWD	Maximum Forward Power for ALC	(0-255)	
FWDAL	Forward Power Calibration Factor	(0-255)	
PLLCAL	Frequency Calibration Factor	(0-255)	
AMELVL	AME Carrier Level	(0-255)	
GNCAL	Gain calibration factor	(0-255)	

If the ALC is turned on then the GAIN value is ignored (because the ALC calculates its own GAIN value internally). Turning off ALC without sending a new GAIN value will leave the GAIN setting at its last value.

IRQ will turn on/off the interrupt that updates the DSP and calculates ALC values. The normal state of this is 1.

DSP will hold the DSP in RESET when it is set to a 1. The normal state of this is a 0.

STOP will put the HC11 into a STOP mode. This shuts down the OSC and all clocks. It can be exited by resetting the radio (powerup).

WAIT will put the HC11 into a low power mode, but with the OSC still active. You can exit from this state by sending commands from a control head (press enter), the rs232 port, or turning it off then on.

The WAIT mode can be combined with the DSP reset and IRQ on/off for various shutdown states:

1. WAIT with IRQ on and DSP running
The code sits in a tight loop, waiting for a character over the SEABUS-2 or RS232 interfaces, it then reboots the radio. The DSP and codec are still running, as well as the DSP update interrupt (using the SPI).
2. WAIT with IRQ off and DSP running
Same as above except that the DSP update interrupt is off.
3. WAIT with IRQ on and DSP RESET
Same as #1 except that the DSP and codec are not running. The DSP update is still attempted using the SPI.
4. WAIT with IRQ off and DSP reset
Same as #1, except that the DSP and codec are stopped and the DSP update interrupt is not running.

MINFWD is the minimum forward power setting for the ALC routine to try and keep the Forward power reading above

MAXFWD is the maximum forward power setting for the ALC routine to try and keep the Forward power reading below

FWDCAL is used to adjust the FORWARD power reading when running the ALC. It is multiplied with FORWARD and the MS 8 bits of the 16 bit result are used as the forward power for the purposes of ALC checks. Essentially scales the FORWARD power reading by ??

PLLCAL is a frequency calibration factor that is stored to EEPROM. (add explanation here...)

AMELVL is the AME carrier value, which is store to EEPROM and used on 2182.0 AME and on HAM AME channels.

GNCAL Gain calibration factor. final gain = (gain*gncal)/256
default is mid-range 0x80

Leaving a field blank leaves it in its current state.

examples:

\$10,12,,62,0,,,,,5A,*hh	Turn off ALC and set gain to 0x5A
\$10,12,,62,1,,,,,*hh	Turn on ALC, no gain change
\$10,12,,62,,0,1,0,0,,*hh	No ALC change, IRQ off, DSP Reset, HC11 running.
\$10,12,,62,,,,,,28,18*hh	Set GAIN and CARRIER, leave all other settings in their present state.

DSP Status Request and modeset

63

\$10, FROM, ACK, 63, MODE, DSP*hh

The radio will respond with the requested packet:

MODE = 0	Normal operation
MODE = 1	100ms loop talking to the DSP and sending DSP updates of FROM_DSP.
DSP = 0	Return packet #64 -- FROM_DSP update
DSP = 1	Return packet #65 -- TO_DSP update

DSP FROM_DSP Status Update

64

\$TO, FROM, ACK, 64, DATA*hh

This packet displays the current status of the DSP. It reflects the current FROM_DSP packet in the radio.

The DATA field consists of 2 character ASCII HEX values, including leading zeros on values from 00 to 0F. No commas separate the data so that as much data as possible can be received in one packet.

\$10,\$11,,64,0001020304050607*hh

DSP TO_DSP Status Update

65

\$TO, FROM, ACK, 65, DATA*hh

This packet displays the current status of the DSP. It reflects the current TO_DSP packet in the radio.

The DATA field consists of 2 character ASCII HEX values, including leading zeros on values from 00 to 0F. No commas separate the data so that as much data as possible can be received in one packet.

\$10,\$11,,65,0001020304050607*hh

Set TO_DSP Data

66

\$TO, FROM, ACK, 66, DATA*hh

This packet sets the TO_DSP packet in the radio to the DATA sent. All bytes of the TO_DSP packet must be sent for the update. The current state of TO_DSP can be requested from the radio by using the packet #63 command.

The DATA field consists of 2 character ASCII HEX values, including leading zeros on values from 00 to 0F. No commas separate the data so that as much data as possible can be received in one packet.

\$10,\$11,,66,0001020304050607*hh

Set/Get Radio Calibration data

67

\$TO, FROM, ACK, 67, CMND, CARRIER, AMELVL, PLLCAL, FWDCAL, GNCAL*hh

CMND = 0 Request a status update (ignore all other fields)
 = 1 Status update packet
 = 2 Set calibration data

CARRIER	Current carrier setting (0-255)
AMELVL	Stored AME carrier level for 2182.0 (0-255)
PLLCAL	PLL calibration factor 0-127 with +128 for negative flag. \$00-\$7F with \$80 for the negative flag.
FWDCAL	Forward power calibration factor. (0-255)
GNCAL	Gain calibration factor (0-255)

Adjusted Forward power update

\$TO, FROM, ACK, 68, CMND, ADJFWD*hh

CMND = 0 Request a ADJFWD update (ignore ADJFWD field)
= 1 ADJFWD status update packet

ADJFWD = Filtered, Adjusted forward power from ALC in the
RT.

Radio Cloning Operations

The SEABUS-2 and SEABUS-232 protocols implement various commands that make it easy to clone all or part of a SEA 235 radio. The scratchpad commands (bin status, bin programming) can be used to copy the entire scratchpad storage. The Configuration Status commands can be used to copy and set the other radio options.

TX Operation

PTT is pressed at a control head. The Radio receives this if the CH determines that it should pass it along (Not a RX only channel).

The Radio enters TX mode and sends a mode update (0x13) to the control heads, with the TX flag set.

PTT is released, and the radio exits TX mode. It sends a mode update with the TX flag cleared.

Packet traffic is minimized to allow the fastest TX/RX turnaround possible. With the new interrupt drive serial send routine there is minimal disturbance of PTT by extraneous packets on either serial bus.

Alarm Operation

When the radio enters Alarm mode a status update is sent to the control heads indicating which alarm mode is enabled (A1 or A2),

all other modes (except status update request) are locked out until the alarm is complete, or the alarm is canceled.

Squelch programming

There will be one squelch setting for all of the control heads. The Configuration packet is used to read and update this setting at powerup and when squelch is changed by any of the control heads.

When the squelch is updated, a new value is sent to the radio, which then sends out a full update to all of the control heads.

Scanning

The radio handles the mechanics of the scan, holding on an open channel, stopping.

Control head can tell it to skip to next channel, stop scan, pause scan.

A scan is started by sending a start command with the bin number of a member of the ascii tag group to be scanned. The Radio starts scanning all the bins in that group, sending out updates when the channel changes. PTT or a stop scan command stops the scan.

During scan the only commands allowed are scan commands and status request commands.

Data Mode Operation (not implemented)

Eventually this radio will have support for digital data modes using the DSP. With a data mode enabled the data send and receive packets (#27 & #28) are used to transfer data across the link.

All other details remain to be determined.

Necode Operation (not implemented)

Necode ID is stored in the Radio's eeprom.
Necode decoding can be turned on and off by the control head.
Control head can program the ID to decode.
Radio alerts the Control Head when a Necode call is decoded.
Radio automatically sends the response.
Necode ID is part of the full update (at powerup and on change).

Intercom/Privacy Modes (not implemented)

Use the mode flags to control the state that the radio is in.

CH 11 sends a ,I, to the RT
RT sends an update with ,I, to all control heads
RT is now in intercom mode, PTT doesn't transmit, audio is routed
to seabus instead. RT includes ,I, in all status updates.
CH 12 sends a command ,I0, Intercom off command.
RT sends a normal update, radio is now back in normal mode

CH 11 sends a ,I11-14, to the RT
RT sends an update with ,I11-14, to all control heads
CH11 and 14 keep their audio enabled. CH 12 & 13 mute their
audio. RT include ,I11-14, in all status updates.
CH 11 sends a command ,I0, - intercom off command to exit
RT sends a normal update, radio is now back in normal mode

CH 11 sends a ,P, to the RT - private mode
RT sends an update with ,P11,
all subsequent updates contain this flag to keep other CH audio
muted.
All CH other than #11 mute their audio
CH 11 can now use the radio w/o others hearing
CH 11 sends a ,P00, command - private off
RT sends a normal update, radio is back to normal operation.

While in an intercom or private mode any control head can send
an intercom off command. How this is generated is up to the
control head software.