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Chapter 1
Bulletin Board System (BBS) Serial Port Access

Two RS-232C serial ports are accessible at the Computer connector on the rear of the controller. A terminal or computer running a terminal emulation program (communication program) can connect directly to the DB-25 connector, or may connect indirectly through a modem or packet TNC.

For local access, either port may connect directly to a terminal by connection of transmit data, receive data, and signal ground. Note that both the controller and the terminal are Data Terminal Equipment (DTEs), so that transmit and receive data pins must be reversed between the controller and the terminal.

For remote access, Port 1 is intended to connect to a Smartmodem 1200 or software/hardware compatible, and provides automatic baud rate selection based on the High Speed Indicator from the modem. Port 2 is intended to connect to a packet TNC, and provides hardware flow control to prevent overflowing the TNC input character buffer. Other remote access configurations are possible, such as use of higher speed modems, but are the responsibility of the user to design and implement. See Table I for the Computer connector pinout.

<table>
<thead>
<tr>
<th>Pin</th>
<th>RS-232 Standard</th>
<th>CI Conn. / Port 1</th>
<th>CI Conn. / Port 2</th>
<th>TNC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AA</td>
<td>Protective Ground</td>
<td>Description</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>2</td>
<td>BA</td>
<td>Transmitted Data</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>3</td>
<td>BB</td>
<td>Received Data</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>4</td>
<td>CC</td>
<td>Data Set Ready - not used</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>5</td>
<td>AB</td>
<td>Signal Ground</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>6</td>
<td>SCF</td>
<td>High Speed Indicator</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>7</td>
<td>SCB</td>
<td>Sec. Clear to Send</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>8</td>
<td>SBA</td>
<td>Sec. Transmitted Data</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>9</td>
<td>SBB</td>
<td>Sec. Received Data</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>10</td>
<td>SCA</td>
<td>Sec. Request to Send - not used</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>11</td>
<td>CD</td>
<td>Data Terminal Ready - not used</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
</tr>
<tr>
<td>12</td>
<td>Unassigned - Serial Port 3 Output</td>
<td>Protective Ground</td>
<td>CI&lt;-&gt;SM</td>
<td>Unassigned - Serial Port 3 Output</td>
</tr>
</tbody>
</table>

### PORT 1

SMARTMODEM 1200 (DCE)

<table>
<thead>
<tr>
<th>Pin</th>
<th>CI (DTE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
</tr>
</tbody>
</table>

### PORT 2

TNC (DCE)

<table>
<thead>
<tr>
<th>Pin</th>
<th>CI (DTE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin</th>
<th>Terminal (DTE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
</tr>
</tbody>
</table>

(BBS Serial Port Access)
Computer Interface Option

Baud Rate
Port 1 may be set to 300 or 1200 baud based on the level applied to the High Speed Indicator signal (pin 12) of the RS-232 connector. It is controlled automatically by 1200 baud intelligent modems such as the Smartmodem 1200. (If a High Speed Indicator signal is not available, an RS-232 low signal or an open circuit selects 300 baud, and an RS-232 high signal selects 1200 baud. A high level signal is typically available at the connector of a terminal, such as at pin 20 - Data Terminal Ready. Consult your terminal or computer manual for details if you’d like to strap the port to 1200 baud.)

The baud rate of port 2 is DIP switch selectable between 300 and 9600 baud as shown in Table II. Be sure to leave only one switch ON.

<table>
<thead>
<tr>
<th>TABLE II — PORT 2 BAUD RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud Rate</td>
</tr>
<tr>
<td>300</td>
</tr>
<tr>
<td>600</td>
</tr>
<tr>
<td>1200</td>
</tr>
<tr>
<td>2400</td>
</tr>
<tr>
<td>4800</td>
</tr>
<tr>
<td>9600</td>
</tr>
</tbody>
</table>

Terminal / Communications Program Setup
Characters sent and received by the controller are asynchronous, 8 data bits, 1 stop bit, and no parity. The controller does not echo characters, so select half duplex. Configure your terminal or comm program so that typing a carriage return causes the cursor to be line fed to a new line.

Flow Control
Both ports support software flow control by recognizing <control>S to suspend character transmission and <control>Q to resume. For example, if you’re downloading a long file, such as the entire command log, you may freeze the transmission to look at the information on the screen by typing <control>S and resume transmission of the file by typing <control>Q.

Character <control>P will terminate the downloading of a file.

In addition, hardware flow control is supported on Port 2 to prevent buffer overflow in a packet TNC when sending long files. The controller will hold back from sending characters when the CTS signal supplied from the TNC is low, and will resume when the signal is high. Note that port 2’s CTS signal must be connected to the TNC or terminal, or must be strapped high for the port to function.

Menu
The serial ports provide a text menu from which the user may enter commands. See Appendix 1 for a tour of the screen displays, including the text of the Help file, which provides information about the operation of each of the commands, and views of the menus and downloadable files. Type “Return” to see the menu.
Connection to a Modem (Port 1)

For telephone line data connection between the controller and your terminal or computer, an auto-answer modem such as a Hayes Smartmodem 1200 or software/hardware compatible is recommended at the repeater controller location. An intelligent or manual modem may be used at the terminal or computer location. Note that some modems which are represented as "Hayes compatible" may only be compatible to varying degrees. We've had good results with the Packard Bell PB1200PLUS. Before hooking the controller to a modem, try using the modem with your home terminal or computer and communications program. Ensure that the modem is working properly before taking it to the repeater site. Offshore clones of Hayes' modems seem to have a relatively high "out of the box failure" rate.

See Table I for hookup to a Smartmodem 1200. Set the modem DIP switches as follows:

<table>
<thead>
<tr>
<th>Switch</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DOWN</td>
<td>Forces DTR TRUE; enables modem to execute commands.</td>
</tr>
<tr>
<td>2</td>
<td>DOWN</td>
<td>(don't care in this application)</td>
</tr>
<tr>
<td>3</td>
<td>UP</td>
<td>No result codes sent from modem to CI.</td>
</tr>
<tr>
<td>4</td>
<td>DOWN</td>
<td>Modem does not echo characters.</td>
</tr>
<tr>
<td>5</td>
<td>DOWN</td>
<td>Modem will not auto-answer. Overridden by modem command sent by controller to auto-answer after 5 rings. AA light should be on after controller reset.</td>
</tr>
<tr>
<td>6</td>
<td>UP</td>
<td>Must be up to use Carrier Detect output as signal to Phone Line Busy</td>
</tr>
<tr>
<td>7</td>
<td>UP</td>
<td>Setting used for connection to RJ 11 modular telephone jack.</td>
</tr>
<tr>
<td>8</td>
<td>DOWN</td>
<td>Enables modem command recognition.</td>
</tr>
</tbody>
</table>

You may call the modem at either 300 or 1200 baud and the Smartmodem and Computer Interface will automatically adjust to the proper baud rate.

Sharing a Telephone Line

The auto-answer modem may share a telephone line with the controller. With both the controller and the modem on the line, answering priority should go to the controller. In other words, normally, the controller should answer first.

Set the controller's phone answer delay timer to 10-15 seconds. Unless otherwise specified, the controller sends the modem command "AT S0=5" on reset to set the modem to answer after the fifth ring (~30 seconds). This may be modified using the controller's T command (see Appendix I).

To access the modem, call the controller or enter on another command channel the Don't Answer Next Time Control Op level command. Then immediately call back and the controller will allow the modem to answer the phone.

When the modem is in use sharing the controller's patch telephone line, it is desirable to inhibit telephone patches by indicating to the repeater user that the line is busy. Since the modem is independent of the controller, the controller has no way of knowing when the modem is actually using the telephone line. For best results, a signal should be taken from the modem to indicate to the controller's Phone Line Busy input when the phone is in use by the modem.
A modem in use signal can be derived in one of two ways. In both cases, the controller’s Shared Phone Line mode should be selected with the *5405 Programming command.

(1) *Get a signal from inside the modem - probably no added parts.*

Most modems have an Offhook (OH) LED indicator, with its anode pulled up to five volts through a resistor, and the cathode driven by a high current driver to ground to light the LED. This low true signal [at cathode of LED] can be taken to an unused pin of the DB-25 connector, typically such as pin 25, and taken directly to the Phone Line Busy input of the controller (Analog Connector pin 24). When the modem is offhook, the logic low signal to the controller causes a “Busy” response to anyone attempting to make a patch.

If more than one controller is already sharing a phone line with the new modem, then method 2 is recommended.

(2) *No need to get inside the modem but must add a transistor.*

If the modem does not have an Offhook LED, you aren’t sure of the modem circuitry, or you don’t want to get inside the modem, the Carrier Detect output of the modem may be used to indicate to the controller that the shared phone line is in use. This high true RS-232 signal must be inverted as shown below to change the logic sense and also provide the logic levels acceptable to the controller. Pin 5, the Clear to Send output of the modem, may be used as a convenient pullup resistor, depending on your modem.
Connection to a Packet TNC (Port 2)

Port 2 may be connected to a packet radio terminal node controller. The signals to be connected include transmit and receive data, and, depending on your application and your TNC, the flow control signal to prevent the controller from overflowing the TNC's incoming character buffer. See Table 1 for hook-up. (Check the operation of your TNC to verify that pin 5 provides a CTS signal which goes low to indicate buffer full.)

Control Timers

For security, certain commands and downloadable files may not be accessed via the serial ports unless control is enabled through that port. The protected commands include Command entry, Text message entry, Print a programmable message, Edit a programmable message, Autodial number examine and load, and Front Panel display. The protected downloadable files include COMMAND.LOG, CALL.TXT, AUTODIAL.TXT and E2PROM.HEX.

For each port, a control enable and disable Control Op level command is available. See the Command Code Summary for the codes. The enable/disable status for each port is stored in the controller macro sets. In addition, each port has a programmable timer which begins to run when control is enabled for that port. The timer is refreshed each time a protected command is entered or a protected file is downloaded. If the timer is allowed to expire, control is disabled for that port and must be reenabled via another port.

To keep control permanently enabled on a serial port, program the timer value to zero to effectively disable the timer, and enable control. Otherwise, a value of approximately three to five minutes might be appropriate.
Chapter 2

Auxiliary Touch-Tone Decoders

Two auxiliary Touch-Tone decoders are provided on the Computer Interface Board. The audio inputs to the decoders appear at solder pads on the CI board and may be taken to the spare phono jacks on the rear panel of the controller. The audio level may range between .5 and 5 volts peak-to-peak. The decoder outputs are read by the controller's CPU through computer input ports implemented on the board.

Commands may be entered independently and simultaneously through the shared decoder on the main controller board and the two auxiliary decoders on the Computer Interface Board. Each auxiliary decoder may be assigned to replace a channel of the shared decoder with Programming commands. The decoders may be assigned to the telephone, the links or remote bases, and the control receiver.

Each command is acted on independently at the command evaluation point - when the command channel COS goes inactive, or after # if assigned to the phone. Command responses are directed to the system transmitters or the telephone.

**Programming Commands**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*5411x</td>
<td>Assign Auxiliary Decoder #1</td>
</tr>
<tr>
<td>*5412x</td>
<td>Assign Auxiliary Decoder #2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channel</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>phone</td>
</tr>
<tr>
<td>1</td>
<td>Link / RB 1</td>
</tr>
<tr>
<td>2</td>
<td>Link / RB 2</td>
</tr>
<tr>
<td>3</td>
<td>Link / RB 3</td>
</tr>
<tr>
<td>4</td>
<td>Link / RB 4 / Control Receiver</td>
</tr>
<tr>
<td>5</td>
<td>Not used</td>
</tr>
</tbody>
</table>

**Example**

Auxiliary Decoder #1 may be assigned to replace the telephone channel of the shared decoder and wired to the telephone audio available on the Telephone Interface Board. The telephone is then "uncoupled" from the shared decoder, and the audio from the phone is always being monitored for commands by the new Touch-Tone decoder.

Wire the decoder input pad labeled DTMF1 on the CI board to the telephone interface board U5 pin 7. No ground wire is necessary.

With the controller unlocked, enter Programming command *54110.

Now when the phone rings and is answered by the controller, the shared decoder will not switch to the phone, and commands (terminated with #) will be accepted through the Auxiliary Decoder #1. Commands will be evaluated after the #.
Example
Auxiliary Decoder #2 may be assigned to replace link 3 channel of the shared decoder and may be wired to link 3 receiver audio. Link 3 is then “uncoupled” from the shared decoder, and the audio from the link is always being monitored for commands by the new Touch-Tone decoder.

Wire the decoder input labeled DTMF2 on the CI board to a spare phono jack on the rear panel. Using a phono Y connector, route link 3 receiver audio to the phono jack.

With the controller unlocked, enter Programming command *54123.

Now when the link COS is active, the shared decoder will not switch to the link, and commands will be accepted through the Auxiliary Decoder #2. Commands will be evaluated when link 3 COS goes away (actually after the Delay to Segment 1 period for Courtesy Tone 11).
Chapter 3
Vocabulary Expansion Option

The VEO adds new words to the controller’s vocabulary, bringing the total to over 530 words. Each word is accessible from the Touch-Tone activated message editor and from the terminal accessible message editing capability. The vocabulary codes for the complete word list are shown on the following pages. All words take up one slot in messages, except that *2, *3, *4, *5 and *9 words each take up two slots. Remember this when figuring how long messages can be. The vocabulary listing may also be viewed from the serial ports by downloading the file WORDLIST.TXT.
Computer Interface Option

(Vocabulary)
LIMA *653  OCLOCK† *824  REPAIR *745  TELEPHONE *438
LINE *942  OCTOBER *346  REPEAT *982  TEMPERATURE *724
LINK *998  OF *694  REPEATER 80  TEN 10
LIST *296  OFF *614  RICH *383  TEN† 810
LOCK *297  OHT† *800  RIG *384  TERMINAL *400
LONG *298  OHIO *348  RIGHT *665  TEST *792
LOOK *957  OHMS *933  ROAD *385  -T(suffix) *441
LOW *771  OIL *360  ROGER *386  THANK YOU *978
LOWER *310  ON *613  ROMEO *672  THAT *442
LUNCH *311  ONE 01  ROUTE *388  THE 24
     ONE† 801  RUNWAY *390  THE(long e) *443
M 61  OPEN 94  S 73  THE† *821
MACHINE 84  OPERATION *352  -S(suffix) *915  THIR-(prefix) 13 or 30
MAINTAIN *312  OPERATOR *630  SAFE *784  THIRD *447
MANUAL *965  OSCAR *663  SAND *391  THIRTEEN *448
MARCH *313  OTHER *353  SANTA CLARA *392  THIRTEEN† *813
MARKER *314  OUT *740  SATURDAY *393  THIRTY† *830
MAY *315  OUTER *355  SCATTERED *394  THIS *451
MAYDAY *316  OVER *773  SECONDED *395  THIS IS 65
ME *920  OVERCAST *356  SECONDS *635  THOUSAND *644
MEAN *317  P *71  SECURITY *396  THREE 03
MEASURE *970  P.M. *358  SELECT *397  THREE† *803
MEETING 35  PAPA *671  SEPTEMBER *398  THUNDERSTORMS *452
MEGA *680  PEACE *914  SERVICE *723  THURSDAY *453
MESSAGES *625  PARTIALY *361  SET *685  TIME 44
METER *620  PASS *774  SEVEN 07  TIME† *822
MICRO *931  PASSED *974  SEVEN† *807  TIMER *732
MIKE *661  PATCH *966  SEVENTEEN† *874  TO *455
MILES *322  PATH *362  SEVERE *413  TODAY *456
MILLI *825  PER *364  SIX *06  TOMORROW 55
MILLION *323  PERCENT *675  SIXX *413  TOGA 45
MINUS *612  PHONE *914  SHORT *415  TOOL *985
MINUTES *645  PLEASE *967  SHOWERS *416  TORNADO *457
MIST *624  PLUS *611  SHUT *765  TOUCHDOWN *458
MOBILE *958  POINT *674  SIDE *417  TOWER *450
MODERATE *326  POLICE *968  SIERRA *673  TRAFFIC *461
MONTH *327  POSITION *780  SIGHT *418  TRANSMIT *462
MORE THAN *330  POWER *714  SIX 06  TRIM *463
MORNING† *841  PRACTICE 85  SIX† *806  TUESDAY *464
MOTOR *972  PRESS *781  SIXTEEN† *864  TURBULENCE *465
MOVE *973  PRESSURE *935  SLEET *423  TURN *990
MUCH *332  PRIVATE *366  SLOPE *424  TWELVE 12
MONTHLY PROGRAMMING *367  PROBE *975  SLOW *983  TWENTY 20
M’N 62  PULL *980  SMOKE *795  TWENTY† *820
NEAR *333  PUSH *977  SNOW *425  TWO 02
NEGATIVE *334  Q *70  SPEED *984  TWO† *802
NET 25  QUEBEC *670  SPRAY *427  -T(suffix) 60
NEW *335  QUEBEC *670  SQUAWK *428  V 83
NEXT *336  QUIT *70  STALL *431  USE(noun) *470
NIGHT *337  R *72  START *730  USE(verb) *471
NINE 09  RADIO *576  STOP *731  UNDER *775
NINE† *809  RAIN *374  STORM *433  UNIFORM *682
NINETEEN† *894  RAISE *375  SYSTEM *997  UNIT *715
NO *342  RANGE *981  SWING *725  UP *650
NORTH *772  RATE *376  SUNSHINE *434  USE(noun) *470
NOT *695  READY *783  SUNDAY *434  USE(verb) *471
NUMBER *662  REAR *377  SWITCH *726  UNTIL *468
O 63  RECEIVE *378  TANGO *681  V 83
OCCUPIED *344  REMARK *382  TANK *435  VALLEY *986
OCCLOCK *345  REMOTE *910  TARGET *436  VALVE *941

(Vocabulary) 3 - 3  V3.5 7/88
Computer Interface Option

VERIFY *475
VICTOR *683
VISIBILITY *475
VOLTS *750
W 91
WAIT 54
WAKE *477
WAKE UP *478
WARNING *480
WATCH *481
WATTS *815
WAY *462
WEATHER 95
WEDNESDAY *484
WELCOME *913
WEST *793
WHISKEY *691
WILL *912
WIND *487
WITH *490
WRONG *491
X 92
X-RAY *692
Y 93
YANKEE *693
YELLOW *794
YESTERDAY *492
YOU *493
YOUR *987
Z 90
ZED *988
ZERO 00
ZONE *494
ZULU *690

SOUND EFFECTS
CROWD *892
EXPLOSION *891
LASER *873
PHASER *882
TIC *860
TOC *870
TRAIN *883
WHISTLE *881

NUMBERS (MALE)
NUMBER *734
ZERO 00
OH 63
ONE 01
TWO 02
THREE 03
FOUR 04
FIVE 05
SIX 06
SEVEN 07
EIGHT 08
NINE 09
TEN 10
ELEVEN 11

TWELVE 12
THIRTEEN *48
THIR-(prefix) 13
-TEEN-(suffix) 14
TWENTY 20
FIF-(prefix) 50
HUNDRED *640
THOUSAND *644
MILLION *323
-TY-(suffix) 60
FIRST *225
SECOND *395
THIRD *447
FOURTH *234

COLORS
GREEN *762
RED *744
YELLOW *794

DIRECTIONS
EAST *754
NORTH *772
SOUTH *790
WEST *793

NAMES
CHARLIE *623
DEE 31
HENRY *642
JAY 51
JULIET *651
KAYE 52
MIKE 661
OSCAR *663
PAPA *671
ROMEO *672
VICTOR *683

MACROS
MACRO 1 *861
MACRO 2 *865
MACRO 3 *863
MACRO 4 *852

RUN-TIME VARIABLES
M/A/E *844
TIME *872
AM/PM *832
DATE *833
MAIL PRESENT *994
T. O. PERIOD *5731
# MESSAGES *5732
VRT *57xx

CHANGE TYPE
MORSE *50
SPEECH *51
DTMF *52(digits)
PAGER *53xx
DVR *55xyz
EXT. DEVICE *56x

SOUND EFFECTS
CROWD *892
EXPLOSION *891
LASER *873
PHASER *882
TIC *860
TOC *870
TRAIN *883
WHISTLE *881

NUMBERS (MALE)
NUMBER *734
ZERO 00
OH 63
ONE 01
TWO 02
THREE 03
FOUR 04
FIVE 05
SIX 06
SEVEN 07
EIGHT 08
NINE 09
TEN 10
ELEVEN 11

TWELVE 12
THIRTEEN *48
THIR-(prefix) 13
-TEEN-(suffix) 14
TWENTY 20
FIF-(prefix) 50
HUNDRED *640
THOUSAND *644
MILLION *323
-TY-(suffix) 60
FIRST *225
SECOND *395
THIRD *447
FOURTH *234

COLORS
GREEN *762
RED *744
YELLOW *794

DIRECTIONS
EAST *754
NORTH *772
SOUTH *790
WEST *793

NAMES
CHARLIE *623
DEE 31
HENRY *642
JAY 51
JULIET *651
KAYE 52
MIKE 661
OSCAR *663
PAPA *671
ROMEO *672
VICTOR *683

MACROS
MACRO 1 *861
MACRO 2 *865
MACRO 3 *863
MACRO 4 *852

RUN-TIME VARIABLES
M/A/E *844
TIME *872
AM/PM *832
DATE *833
MAIL PRESENT *994
T. O. PERIOD *5731
# MESSAGES *5732
VRT *57xx

CHANGE TYPE
MORSE *50
SPEECH *51
DTMF *52(digits)
PAGER *53xx
DVR *55xyz
EXT. DEVICE *56x

(Vocabulary) 3 - 4 V3.5 7/88
Chapter 4
ICOM IC-900 Remote Base / Link Support

The ICOM IC-900 band units are supported as an alternative to BCD controllable radios as frequency synthesized remotes and links. Only the ICOM band units are needed – not the fiber optic controller – for a considerable cost savings. The FC-900 Interface from ACC provides the interface between the controller and the band units.

Connections to the FC-900 Interface consist of RB CLK, RB DATA, RB STB, link COS, receive and transmit audio. (PTT control is accommodated as part of the serial data sent to the band units by the controller.) The connection between the FC-900 interface and the IC-900 modules is the daisy-chained multiconductor cable supplied by ICOM.

One or two FC-900 Interfaces, each controlling up to six band units, are supported. One FC-900 Interface may attach to link ports 1 and 2, and a second interface to link ports 3 and 4 if desired.

On each port pair, any two band units may be on at the same time. For example, ports 1/2 could have 10M, 6M, 2M, 220, 440 and 1200 MHz transceivers for remotes, while ports 3/4 might have 430 MHz and 1200 MHz transceivers as synthesized links. Ports 1/2 could have the 10M and 2M remotes up, while 430 and 1200 MHz links are up on ports 3/4.

The link / remote base User commands are supplemented to allow for assignment of the desired band unit to the port.

(Remote Base prefix) 1x  Link / Remote Base 1 Band Unit Assignment
(Remote Base prefix) 4x  Link / Remote Base 2 Band Unit Assignment
(Remote Base prefix) 7x  Link / Remote Base 3 Band Unit Assignment
(Remote Base prefix) *x  Link / Remote Base 4 Band Unit Assignment

\[
x = 0 \quad 1240-1249.995 \text{ MHz, simplex or } \pm 12 \text{ MHz offset} \\
1 \quad 10M \ (29-29.995 \text{ MHz}), \text{ simplex or } \pm 100 \text{ kHz offset} \\
2 \quad 2M \ (144-147.995 \text{ MHz}), \text{ simplex or } \pm 600 \text{ kHz offset} \\
3 \quad 220-224.995 \text{ MHz, simplex or } \pm 1.6 \text{ MHz offset} \\
4 \quad 440-449.995 \text{ MHz, simplex or } \pm 5 \text{ MHz offset} \\
5 \quad 430-439.995 \text{ MHz, simplex or } \pm 5 \text{ MHz offset} \\
6 \quad 6M \ (50-53.995 \text{ MHz}), \text{ simplex or } \pm 1 \text{ MHz offset} \\
7 \quad 420-429.995 \text{ MHz, simplex or } \pm 5 \text{ MHz offset} \\
8 \quad 1280-1289.995 \text{ MHz, simplex or } \pm 12 \text{ MHz offset} \\
9 \quad 1290-1299.995 \text{ MHz, simplex or } -20 \text{ MHz offset} \\
* \quad \text{Off}
\]

Additional installation and operation information is available with the FC-900 Interface documentation.
Chapter 5
Rotor Control Interface

The RC-850 Repeater Controller with V3.5 software may control an antenna rotor through the RCB-2 Rotor Control Board interfaced to a Hygain/Telex CD-45-II, HAM IV or T²X Rotor System control unit. The rotor control board mounts inside the rotor’s control unit and simulates operation of the clockwise, counter clockwise, and brake switches in response to Touch-Tone commands sent to the controller. The control unit remains available for normal use locally when the RC-850 controller is not being used. The RC-850 controller software is set up for north center.

Commands available through the controller include rotate clockwise (right), rotate counter clockwise (left), stop, interrogate direction, rotate to a particular direction in degrees, and “budge” clockwise or counter clockwise. The controller always knows the direction of the rotor by measuring the potentiometer voltage from the control unit. An adjustable delay on the board keeps the brake released for several seconds to allow the rotor to coast to a stop.

Use of the Rotor Control Board requires giving up the controller’s Power Amplifier remote control output. UF6 / Link 4 PTT output, and VRT analog channel 14, which become dedicated to support of the RCB-2. These signals become RCB-2 signals when an RCB command code prefix is defined using a Programming command (i.e., not an empty prefix). Note that the Link 4 PTT output is not needed for support of Link 4 when an FC-900 Interface to the ICOM IC-900 modules is used.

A command code prefix must be programmed for the RCB operation. Use Programming command *5023(prefix) to define a command code prefix for the RCB commands. Be careful to avoid conflicts with existing command codes.

Note: The Rotor Control Board support is completely independent of the direction information set using the "(Remote Base prefix) 8 (0-360)" command, supplied as part of the serial data stream at RB DATA and RB STROBE. The RCB responds only to manual commands, and is not affected by direction information stored in link memories or macro sets.

Installing the Rotor Control Board
The RCB-2 board is designed to mount inside the bottom of the control unit. Unplug the control unit from the ac line. Remove the mounting hardware for the smaller of the two transformers and mount the rotor control board using the spacers and screws supplied with it. Position the board so that the card edge connector is oriented toward the back of the control unit. Wire the points from the RCB-2 to points inside the rotor control unit as follows:
Computer Interface Option

"2" CW and CCW switches common terminal, to rear panel terminal 2
"5" CW switch terminal, to rear panel terminal 5
"6" CCW switch terminal, to rear panel terminal 6
"3 or 7" "15" on p.c. board, to rear panel terminal 3
"GND" Ground lug on top at small transformer
"110V" Brake release switch terminals (two wires)

Several signals must be connected from the RCB-2 to the controller. In addition, a +12 volt supply voltage must be obtained. These signals appear at the RCB-2 card edge connector which mates to the supplied ribbon cable. Prepare the ribbon cable as shown below. Note that every other lead carries a signal. The cable will be folded at a 90° angle near the connector and will be brought out the back of the control unit. Provide some means of insulation so that the ribbon wire is not pinched by the metal back. The connector should be plugged into the board with the cable exiting the connector away from the chassis, although plugging it in wrong will not cause any harm (it just won't work).

Prepare the end of the ribbon cable and make the connections to the RC-850 controller logic and analog connectors. Obtain +12 volts directly from your 12 volt supply. You may partially peel away the ribbon wire pair carrying the 12 volts and ground if they need to go in another direction.

```
+12
+12
GND
GND
DIR
DIR
GND
GND
CCW
CCW

(CLOSED SIDE)

(REDD WIRE)
```

"CW" Digital I/O connector pin 10 (UF6)
"CCW" Digital I/O connector pin 5 (PA)
"GND" Analog connector pin 14
"DIR" Analog connector pin 5 (channel 14)
"GND" To 12 volt power supply ground
"+12V" To 12 volt power supply, minimum 100 mA capacity

The RCB-2 Rotor Control Board will now allow you to control your antenna rotor through the RC-850 controller.
Adjustments
Two pots on the RCB-2 board allow calibration of the rotor direction voltage and adjustment of the brake release time.

First calibrate the rotor control unit as described in the manual, independent of the RCB-2. Now turn the rotor using the control unit switches to exactly 90 degrees as indicated on the meter. Read back the direction through the controller by entering the Rotor Control Prefix. Adjust pot R101 on the rotor control board for a speech readback of 90 degrees. Turn the rotor using the controller commands "[Rotor Control Prefix] 1" (left) or "[Rotor Control Prefix] 3" (right). Stop with "[Rotor Control Prefix] 2". Notice that when stopping, the brake relay hangs in for a period of time (you should be able to hear the second relay drop out). Adjust pot R102 for the desired hang time - typically two or three seconds - which should depend on the size of the antenna array you're rotating.

Commands
The RC-850 controller controls the rotor through several Touch-Tone commands. They include:

- Left (cw)  [Rotor Control Prefix] 1
- Right (cw) [Rotor Control Prefix] 3
- Stop      [Rotor Control Prefix] 2
- Budge Left (cw) [Rotor Control Prefix] 4
- Budge Right (cw) [Rotor Control Prefix] 6
- Go to direction [Rotor Control Prefix] (degrees - 0-360)
- Interrogate [Rotor Control Prefix]

The Left and Right commands cause the rotor to turn continuously until stopped. The RC-850 stops the rotor automatically at approximately 195 degrees when turning left, and 165 degrees when turning right, to prevent excessive twisting when the rotor hits the stopper. The Stop command may be entered at any time.

The Budge Left and Budge Right commands apply power to the rotor for a half second to cause the rotor to turn slightly in either direction. After coasting, the RC-850 reads back the new rotor direction.

The Go command causes the rotor to turn to a particular direction specified in the command. Directions from 165 to 195 are ignored by this command since they are dangerously near the ends. When the desired direction is reached, the actual direction measured is spoken by the RC-850. There may be a small error because the rotor will coast for a short time after power is removed. The RC-850 intentionally "undershoots" by about eight degrees to allow for coasting. While rotating in response to the Go command, other Touch-Tone commands may not be sent to the RC-850.

The Interrogate command causes the RC-850 to read back the current rotor direction. In addition, it reads back "Right" or "Left" if the rotor is currently turning.
Chapter 6
V3.5 New Command Code Summary

Programming Commands

Timers
*4029(seconds)  Serial Port 1 Control Timer
*4030(seconds)  Serial Port 2 Control Timer

Auxiliary Touch-Tone Decoder Command Channels
*5411x  Assign Auxiliary Decoder #1
*5412x  Assign Auxiliary Decoder #2

Channel
0 = phone
1 = Link / RB 1
2 = Link / RB 2
3 = Link / RB 3
4 = Link / RB 4 / Control Receiver
5 = Not used

Rotor Control Board Command Prefix
*5023(prefix)

Command Log Filter
*5420  Disable logging of all commands
*5421xx  Enable logging of command xx

xx Command
00  Unlock
01  Control Op (air)
14  Control Op (phone)
05  Primary Autopatch
16  Secondary Autopatch
17  Tertiary Autopatch
03  Primary Emergency Autodialer
18  Secondary Emergency Autodialer
04  User Loadable Autodial Bank 0
19  User Loadable Autodial Bank 1
29  User Loadable Autodial Bank 2
07  User Loadable Autodial Bank 0 L/E
20  User Loadable Autodial Bank 1 L/E
30  User Loadable Autodial Bank 2 L/E
13  Patch Utility P (rp answer, custom hu, duplex, cover, timer extend)
21  Patch Utility Q (redial, hookflash)
11  Reverse Patch Activate
22  Patch/Spare 1 Hangup, Lock
23  Rotor Control
02  User Function Remote Control
06  Link / Remote Base
15  Paging
12  Spare Audio 1 On
10  Demo Message / Bulletin Board

(Command Code Summary)  6 - 1  V3.5 7/88
Control Operator Commands

<table>
<thead>
<tr>
<th>Code</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>254</td>
<td>444</td>
<td>724</td>
<td>984</td>
<td>+Don’t Answer Next Time</td>
</tr>
<tr>
<td>S1E</td>
<td>271</td>
<td>461</td>
<td>741</td>
<td>001</td>
<td>Enable Control From Serial Port 1</td>
</tr>
<tr>
<td>S1D</td>
<td>272</td>
<td>462</td>
<td>742</td>
<td>002</td>
<td>Disable Control From Serial Port 1</td>
</tr>
<tr>
<td>S2E</td>
<td>273</td>
<td>463</td>
<td>743</td>
<td>003</td>
<td>Enable Control From Serial Port 2</td>
</tr>
<tr>
<td>S2D</td>
<td>274</td>
<td>464</td>
<td>744</td>
<td>004</td>
<td>Disable Control From Serial Port 2</td>
</tr>
<tr>
<td>CCL</td>
<td>275</td>
<td>465</td>
<td>745</td>
<td>005</td>
<td>+Clear Command Log</td>
</tr>
</tbody>
</table>

User Commands

**Rotor Control (RCB-2 Board)**

(Rotor Control prefix) 1  Rotate Left
(Rotor Control prefix) 2  Stop
(Rotor Control prefix) 3  Rotate Right
(Rotor Control prefix) 4  Bump Left
(Rotor Control prefix) 6  Bump Right
(Rotor Control prefix)  Direction Interrogate
(Rotor Control prefix)  Go to Direction
Appendix I
Screen Examples

Computer terminal screen displays are shown below in this font. Commands entered by the user are in this font. Each line entered by the user should be terminated by a carriage return. Commands may be entered in either upper or lower case after the prompt character >.

Menu
There are two forms of the menu available at any time when entering carriage return – the short form and the long form. The short form just says “de [the repeater callsign]”. The long form includes additional information and displays the commands available.

Each form of the menu includes your repeater callsign which you program with the T command, described in detail later.

This is the short form of the menu:

de [the repeater callsign]
>

In other words, with the repeater callsign having been loaded with the T command, the short menu might look like this:

de WA6AXX 440 Repeater
>

Note that before a callsign is loaded using the T CALL <callsign> command, as will be the case when you first fire up the Computer Interface, the short menu will look like this:

de
>

Program your repeater’s callsign into the controller by entering the following command. Control must be enabled from the serial port (Touch-Tone command [COP prefix]271 for serial port 1, assuming Control Op root set #1). The T command will take several seconds to execute, since the text callsign is being programmed into your controller’s E²PROM.

> t call WA6AXX 440 Repeater

de WA6AXX 440 Repeater
>

The long form of the menu may be selected by entering the Short/Long Menu command, X. This is the long menu when control is not enabled from the serial port.
Computer Interface Option

`de WA6AXX 440 Repeater`

The date is given in yymmd format, along with time in military format. The number of messages in the mailbox is indicated.

The List, Send and Kill commands relate to the electronic mailbox.

The What command causes the list of downloadable files to be displayed, and the Download command is used to download these files.

The Short/Long menu command toggles the menu form between the short and long form as described above. The Information command causes a programmable text message to be displayed. The Help command displays on-line help messages about the various commands.

When control is enabled from the serial port (via the Enable Control From Serial Port command entered from a Touch-Tone channel), the long menu looks like this:

```
de : Date 880830  Time 1347    1 active message(s)
Messages: L - List, S - Send, K - Kill
Files:    W - What, D - Download
Control:  C - Command entry, T - Text message entry
          P - Print a programmable message
          E - Edit a programmable message
          A - Autodial number print/load/erase
          F - Front Panel display
Misc:     X - Short/Long menu, I - Information, H - Help
```

The additional “Control” commands are available only when control is enabled from the serial port.

The Command entry command allows any Touch-Tone command to be entered from the terminal, with a text response message displayed on the terminal screen. The Text message entry command allows defining certain text messages associated with the BBS, including the repeater callsign, VRT channel descriptions, and others. The Print command allows any programmable message in the controller (IDs, tail messages, etc.) to be printed as text on the terminal display. The Edit command allows these messages to be edited by typing the words themselves rather than vocabulary codes. The Autodial command allows programming autodial
numbers from the terminal. The Front Panel command presents a display of
the controller's front panel on the screen.

Toggle between the short and long form of the menu at any time by entering
x. When the long form of the menu is selected, the Control commands are
listed only when control is enabled from the serial port. If a control
command is entered when control is not enabled, a message is sent
indicating that control is not enabled.

de WA6AXX 440 Repeater

>×</

de WA6AXX 440 Repeater : Date 880830 Time 1353 0 active message(s)
Messages: L - List, S - Send, K - Kill
Files: W - What, D - Download
Misc: X - Short/Long menu, I - Information, H - Help

>×</
Control not enabled from this port.

de WA6AXX 440 Repeater : Date 880830 Time 1353 0 active message(s)
Messages: L - List, S - Send, K - Kill
Files: W - What, D - Download
Misc: X - Short/Long menu, I - Information, H - Help

Help
On-line help messages are available by typing H, or H and the letter
representing the command that you'd like help with. HH gives help
messages for all commands.

Below is the text of the Help file, printed here for your convenience. It may
be displayed by typing HH, or by downloading the help file (D HELP.TXT).

>hh
(H)elp
Help on any command may be requested by entering 'Hx'.
[C]ommand entry, [T]ext message entry,
[P]rint a programmable message, [E]dit a programmable message,
[A] utodial number print/load/erase,
[F]ront Panel display,
[X]Short/Long menu, [I]nformation, [H]elp All.

(L)ist
List mailbox messages in the repeater. These mailbox messages
were entered either through the voice port or computer port.

(S)end
Send a mailbox message to the voice repeater.
Computer Interface Option

Arguments - recipient callsign, sender callsign, message number.
Example: For WA6AXX to send mailbox message number 2 to WB6KHP ...
        S WB6KHP WA6AXX 2.
The recipient and sender callsigns must be stored in the
controller's non-volatile memory by the repeater owner
to be recognized. To see the available messages to be sent
[messages 0-9], download [D] MAILMSG5.TXT.

(K)ill
Kill mailbox messages destined for a user.
Argument - callsign of the user.
Example: For WA6AXX to kill his mailbox messages ... K WA6AXX.

(W)hat
What repeater controller files are available for Download.
See Download.

(D)ownload a file FROM the repeater.
Argument - Name of file to download.
Example: To download the meter reading file ... D METER.RDG.
See What.
File downloading may be frozen by entering <cntl>S and resumed
by entering <cntl>Q, and may be aborted by entering <cntl>P.

(C)ommand
Enter a Touch-Tone equivalent command from the keyboard.
Argument [x] - Touch-Tone digits. The command is acted on by
the controller and the command response is sent to the terminal
as text.
Example: Command User Function 1 high ... C 911

(T)ext message
Program a text message into the controller.
Arguments

[x] - The name of the text message, including:
MMEM0-MMEM9 - Text equivalent of mailbox messages
(MMEM0-2 15 chars, MMEM3-8 23 chars, MMEM9 31 chars)
INFO0-INFO8 - Lines 1-9 of [I]nformation message (63 chars)
(all lines must be programmed and will be displayed)
VRT1-VRT16 - VRT channel description for METER.RDG (15 chars)
CALL - Repeater callsign for menus and headings (19 chars)
BATCH1-BATCH2 - Text sent by the controller on reset to
initialize modem, etc. (15 chars)
[y] - The text string, which should be limited to the
number of characters indicated above.
Example: To define VRT channel 15 as internal temperature ...
        T VRT15 internal temp.

(P)rint
Print a remotely programmable controller message by entering 'Px'.
Argument [x] - message name. Download [D] MSGNAMES.TXT for the names
of messages stored in the controller.

(E)dit
Edit a remotely programmable controller message by entering 'Ex'.
Argument [x] - message name. Download [D] MSGNAMES.TXT for the names
of messages stored in the controller.

(Screen Examples) App I - 4 V3.5 7/88
Computer Interface Option

The controller responds with a * prompt, rather than the normal > prompt. At the *, type the words, letters and tokens which make up the programmable message. Download [D] WORDLIST.TXT for the words and tokens which are recognized by the controller. If the entire message does not fit on a line, terminate the line with % to tell the controller that the message continues on the next line.
Example: To program the Special ID ...
>E SPID
*THIS IS THE NUMBER 1 REPEATER IN THE AREA PAUSE W A 6 A X X %
*ON 2 TWENTY 4 POINT 6 8 MEGA Hertz <MORSE> 7 3
>
(A)utodial number print/load/erase
Print, load, or erase Autodial numbers.
Print - A [x] x=autodial slot 0-249
Load - A [x][y] x=autodial slot, y=telephone number
Erase - A E [x] x=autodial slot 0-249
Example: Load autodial slot 39 with 253-8085
>A E 39
Slot erased.
>A 39 2538085
>A 39
2538085
>
(F)ront Panel
Display the controller's front panel.
The display resembles the LED panel on the controller, and is enhanced with some additional information.
See the manual for an explanation of the abbreviations used.

(X) Short/Long Menus
Toggle between short and long form of the menu. The long form includes Control commands only when control is enabled from this port.

(I)nformation
Display "canned" informational message about the system loaded by the system operator.

Mailbox
Electronic mailbox messages may be exchanged between the voice repeater channel and the serial ports. From the terminal, messages may be listed, sent, and killed using the L, S, and K commands. It isn't necessary to know the callsign slot numbers of the users, since entry and listings are based on callsigns - not slot numbers. The callsign slots must contain just the user callsign, without pager memories, sound effects, or other words.
The text of the message is displayed in the last column. The text is intended to be a parallel of the speech message stored in the canned mailbox messages 0-9. In order to allow the displayed text to be formatted and spelled properly, it is programmed independent of the speech message. Program the text equivalent of each mail speech message using the T

(Screen Examples) App I - 5 V3.5 7/88
command. For example, if the mailbox message 3 is programmed as a synthesized speech message “c u tomorrow”, program mailbox text message 3 as “See you tomorrow”.

>1
Sorry, no messages.

de WA6AXX 440 Repeater
> snu6p wa6axx 0
To From Date Time Message
NU6P WA6AXX TODAY 01:55pm Pse call me.(0)

de WA6AXX 440 Repeater
>1
To From Date Time Message
NU6P WA6AXX TODAY 01:55pm Pse call me.(0)

de WA6AXX 440 Repeater
>x

de WA6AXX 440 Repeater : Date 880830 Time 1356 1 active message(s)
Messages: L - List, S - Send, K - Kill
Files: W - What, D - Download
Misc: X - Short/Long menu, I - Information, H - Help

Downloading Files
Several files are available to be downloaded from the controller. The names
of the files may be viewed with the What command.

de WA6AXX 440 Repeater
> w
ACTIVITY.RDG  AUTODIAL.TXT  CALLSIGN.TXT
COMMAND .LOG  E2PROM .HEX  HELP .TXT
MAILMSGS.TXT  METER .RDG  MSGNAMES.TXT
MINMAX .RDG  WORDLIST.TXT

de WA6AXX 440 Repeater
>
Descriptions of each downloadable file follow.

ACTIVITY.RDG - The readings of VRT channels 25-32.

> d activity rdg

REPEATER ACTIVITY READINGS - 880830 1350
Chnl Total Description
-----------------------
(25) 298 repeater receiver keyups (clear ch. 57)
(26) 103 minutes of repeater activity (clear ch. 58)
(27) 3 phone patches (clear ch. 59)
(28) 4 mailbox accesses (clear ch. 60)
(29) 29 command entries (clear ch. 61)
(31) 0 seconds of timed out period (clear ch. 63)
(32) 0 message(s) in the mailbox (clear ch. 64)

(Screen Examples) App 1 - 6 V3.5 7/88
AUTODIAL.TXT - The Emergency and User Loadable autodial numbers. Empty autodial slots are not listed.

>d autodial.txt
EMERGENCY
(00) 0
(01) 5551212
(04) 411
(06) 611
(07) 8005551212
(08) 7678900
(09) 911
USER BANK 0
(20) 5552020
(40) 7273330
(41) 2538085
(42) 3582999
(43) 5551213
(44) 9761234
USER BANK 1
(01) 5551234
(02) 5552345
USER BANK 2
(01) 5553456
(02) 5554567

CALLSIGN.TXT - The callsigns stored in the controller for use with the reverse patch and mailbox. Empty callsign slots are not listed.

>d callsign.txt
(00) <speech> W A 6 A X X
(01) <speech> W B 6 K H P
(02) <speech> N U 6 P
(03) <speech> N 6 Q Y U
(38) <speech> TRAIN SMOKE TEST EXPLOSION EXPLOSION EXPLOSION
(39) <speech> N 6 H W L
(99) <speech> N 6 P P Y
de WA6AXX 440 Repeater
>

COMMAND.LOG - The contents of the command log. The controller stores information about the commands entered from all ports. Only desired commands are logged, as specified by the Command Log Filter programming commands. The selective logging reduces the size of the file to be downloaded by only storing commands of interest. For example, it may be desirable to log Control Op commands, patches, and link activity but nothing else. Lock and unlock commands may be logged, but programming commands entered during an unlocked period cannot be logged.

Each entry of the command log contains the name of the command, the time entered (military time), the command channel it was entered through, and the digits following the command prefix.
The command names are abbreviated (i.e. COPA = Control Op over the air, HU = hang up or lock, PAP = primary autopatch, etc.). The command channels include RX (repeater receiver), L1-L4 (link channels), PH (phone), LM (local mic), S1-2 (serial ports 1 or 2), and A1-2 (auxiliary DTMF decoders 1 or 2). The arguments are the digits following the command prefix. For example, following a COP prefix, the argument would be the root code. Following an autopatch prefix, the argument would be the phone number. Following an emergency autodial, the argument would be the autodial location.

> d command.log
REPEATER COMMAND LOG - 880830 1352
Cmd Time Ch Arguments
-------------------------
***DATE000000***
***DATE880829***
UL 1527 A1
HU 1529 A1
HU 1529 A1
COPA 1732 A1 254
COPA 1732 A1 271
HU 1732 A1
COPA 1925 S1 187
COPA 1925 S1 120
COPA 1931 S1 054
COPA 1933 S1 130
***DATE880830***
COPA 1331 A1 254
HU 1331 A1
COPA 1335 RX 271
COPA 1337 S1 031
COPA 1345 A1 254
COPA 1345 A1 271
HU 1345 A1

de WA6AXX 440 Repeater
>

E2PROM .HEX – The contents of the E2PROM in Intel hex format. This file is intended to be used with an IBM PC compatible program to be available from ACC which will allow printout of complete Programming Sheets based on the contents of this file.

HELP .TXT – The entire Help file. See the Help section earlier in this manual for a complete listing.

MAILmsgs .TXT – The mailbox text messages, programmed with the T command, paralleling the stored speech mailbox messages 0 - 9.
Computer Interface Option

>d mailmsgs.txt
Call me.(0)
Call me tonight.(1)
Call me at home.(2)
Call me at ...(3)
Cancel our meeting.(4)
See you at the meeting.(5)
(6)
(7)
(8)
The meeting tomorrow is at 9 pm.(9)

de WA6AXX 440 Repeater
>

METER .RDG - The current values of VRT channels 1-16. Text messages providing a description of each channel may be defined using the T command. Only those VRT channels which are assigned a meter type are displayed.

>d meter.rdg
    ANALOG METER READINGS - 860830 1351
Ch Reading     Description
--------------------------
(1)  S9+          
(3)  15.6 Volts   
(4)  North       
(5)  31 Watts     
(6)  7 Watts      
(7)  1.9 Watts    
(8)  3.1 Watts    
(9)  7.6 Watts    
(10) 100         
(11) 15.9 Amps   
(12) 15.9 Amps   
(15) 115 degrees  int. temp.
(16) 13.5 Volts  int. volt.

de WA6AXX 440 Repeater
>

(Screen Examples)    App 1 - 9    V3.5  7/88
**MSGNAMES.TXT** – The names of the remotely programmable messages available to be printed using the Print a programmable message command. This is a “memory jogger” file, and specifies the exact name of the messages.

```
> d msgnames.txt

*** REMOTELY PROGRAMMABLE CONTROLLER MESSAGE NAMES ***
/IDS/ qst iid1...iid3, fid, aid, pid1, pid2, pid2a...pidc, spid, tid1, tid2, pgid, phid
/TAIL MESSAGES/ tm1, tm2, tm3, tm40...tm49
/TIMEOUTS/ repeater time out, repeater time out cancel, time out alert
/COVER TONES (TT and PATCH)/ ttct, pct
/EMERGENCY AUTODIAL/ ade0...ade9
/PATCH UP, PHONE ANSWER AND HANGUP/ ap up, adu up, phan, hang
/ANTIDIAL, RP CALL FOR/ anti, rpc4 /PHONE NUMBER MACROS/ ma mb mc
/PATCH DIALING PREFIXES (PRM., SEC., TERT.)/ ppre, spre, tpre
/AREA CODES/ area code l, area code j, area code p1...area code p3
/UF OUTPUTS/ ufl high... uf8 high, ufl low... uf8 low, ufbl, ufbl2
/COURTESY TONES/ ct1 ... ct13
/LINK/RB NAMES/ l1...l14
/LINK/RB FREQ. PREFIXES/ remote lp, remote 2p
/LINK 1 AND 2 MEMORY NAMES/ l1n1 ... l1n7, l2n1 ... l2n7
/LEADING 1 OVERRIDE/ ld over
/MAILBOX MESSAGES/ mbm0...mbm9 /MAIL PRESENT MESSAGE/ mail
/BULLETIN BOARD MESSAGES/ b1...b5 /DEMO TAG/ demo
/PAGER PROMPT/ ppro /ALARM/ all...al4
/GENERIC COP RESPONSE/ copr /MESSAGE MACROS/ m1...m4
/TOUCH-TONE PAD TEST RESPONSES/ pad
/SCHEDULER CHANGEOVER, EVENT MESSAGES/ changeover, el...e5
```
d e WA6AXX 440 Repeater

**MINMAX .RDG** – The stored min and max readings of VRT channels 1-16.

```
> d minmax.rdg

ANALOG METER MIN/ MAX READINGS - 880830 1351

<table>
<thead>
<tr>
<th>Ch</th>
<th>Max Reading</th>
<th>Date/Time</th>
<th>Min Reading</th>
<th>Date/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) S9+</td>
<td>0000 880101</td>
<td>S9+</td>
<td>0000 880101</td>
<td>0400 880823</td>
</tr>
<tr>
<td>(3) 15.9 Volts</td>
<td>0000 880101</td>
<td>7.4 Volts</td>
<td>0002 880101</td>
<td></td>
</tr>
<tr>
<td>(4) North</td>
<td>0000 880101</td>
<td>South</td>
<td>0002 880101</td>
<td></td>
</tr>
<tr>
<td>(5) 31 Watts</td>
<td>0000 880101</td>
<td>5 Watts</td>
<td>0002 880101</td>
<td></td>
</tr>
<tr>
<td>(6) 7 Watts</td>
<td>0000 880101</td>
<td>0 Watts</td>
<td>0002 880101</td>
<td></td>
</tr>
<tr>
<td>(7) 1.9 Watts</td>
<td>0000 880101</td>
<td>0.9 Watts</td>
<td>0730 880824</td>
<td></td>
</tr>
<tr>
<td>(8) 3.9 Watts</td>
<td>0000 880101</td>
<td>2.0 Watts</td>
<td>0400 880823</td>
<td></td>
</tr>
<tr>
<td>(9) 7.9 Watts</td>
<td>0000 880101</td>
<td>4.3 Watts</td>
<td>0730 880824</td>
<td></td>
</tr>
<tr>
<td>(10) 100</td>
<td>0000 880101</td>
<td>97</td>
<td>0730 880825</td>
<td></td>
</tr>
<tr>
<td>(11) 15.9 Amps</td>
<td>0000 880101</td>
<td>12.7 Amps</td>
<td>0830 880829</td>
<td></td>
</tr>
<tr>
<td>(12) 15.9 Amps</td>
<td>0000 880101</td>
<td>13.2 Amps</td>
<td>0730 880824</td>
<td></td>
</tr>
<tr>
<td>(15) 188 degrees</td>
<td>1421 880825</td>
<td>66 degrees</td>
<td>0436 880824</td>
<td></td>
</tr>
<tr>
<td>(16) 13.7 Volts</td>
<td>0040 880101</td>
<td>12.7 Volts</td>
<td>1749 880823</td>
<td></td>
</tr>
</tbody>
</table>
```

(Screen Examples) App I - 10 V3.5 7/88
Computer Interface Option

WORDLIST.TXT - The list of synthesized speech vocabulary words available to be used with the Edit programmable messages command.

>d wordlist.txt
*RTS* (TIME) (DATE) (AM/PM) (M/A/E) (MAILPRESENT)
*MACROS* MACRO1 MACRO2 MACRO3 MACRO4
*TYPES* <SPEECH> <MORSE> <DVR> <VRT> <PAGER> <EXT>
*MALE NUMBERS* 0 OH 1 2 3 4 5 6 7 8 9 10 11 12 13 20 THIR-
-TEEN FIF- -TY HUNDRED THOUSAND MILLION FIRST SECOND THIRD FOURTH
*FEMALE NUMBERS* 0/F OH/F 1/F 2/F 3/F 4/F 5/F 6/F 7/F 8/F 9/F
10/F 11/F 12/F 13/F 14/F 15/F 16/F 17/F 18/F 19/F 20/F 30/F
40/F 50/F
*A* A.M. A.M./F ABORT ABOUT ABOVE ACKNOWLEDGE ACTION ADJUST ADVANCED
ADVISE AERIAL AFFIRMATIVE AFTERNOON/F AIR AIRPORT ALERT ALL ALOFT
ALPHA ALTERNATE ALTIMETER ALTITUDE AMATEUR ANPS AND ANSWER APRIL
ARE AREA ARRIVAL AS AT AUGUST AUTO AUTOMATIC AUTOPILOT AUXILIARY
*B* BANK BASE BATTERY BE BEE BELOW BETWEEN BLOWING BOARD BOOST
BRAKE BRAVO BREAK BROKEN BUTTON BY
*C* CABIN CALIBRATE CALL CALLING CALM CANCEL CAUTION CEILING CENTER
CHANGE CHARLIE CHECK CIRCUIT CLEAR CLIMB CLOCK CLOSED CLUB CODE COME
COMPLETE COMPUTER CONDITION CONGRATULATIONS CONNECT CONTACT CONTROL
CONVERGING COUNT COURSE CRANE CROSSTOWN CROWD CURRENT CYCLE
*D* DANGER DAYS DAYTON DAVE DECEMBER DECREASE DECREASING DEGREES DELTA
DEPARTURE DEVICE DIAL DINNER DIRECTION DISPLAY DOOR DOWN DOWNWIND DRIVE
DUST
*E* EAST ECHO ED EIGHT EIGHT/F EIGHTEEN/F ELECTRICIAN ELEVATION ELEVEN
ELEVEN/F EMERGENCY ENGINE ENTER EQUAL -ER ERROR ESTIMATED EVACUATE
EVACUATION EVENING/F EXIT EXPECT EXPLOSION EYE
*F* FAIL FAILURE FARAD FARADHEM FEBRUARY FEET FIFTEEN/F FIFTY/F
FILED FINAL FIRE FIRST FIVE FIVE/F FLAPS FLOW FOG FOR FORTY/F
FOUR FOUR/F FOURTEEN/F FOURTH FOXTROT FREEDOM FREEZING FREQUENCY FRIDAY
FROM FRONT FULL
*G* GALLONS GATE GAUGE GEAR GEE GET GLIDE GO GOLF GOOF/F GREEN GROUND
GUSTING
*H* HAIR HALF HAM HAMMER HAMVENTION HAVE HAZARDOUS HAZE HEAVY HELP HENRY
Hertz HIGH HOLD HOME HOTEL HOUR HOURS HUNDRED
*I* ICE ICING IDENTIFY IGNITE IGNITION IMMEDIATELY IN INBOUND INCH
INCREASE INCREASING/TO INDIA INDICATED INFILTRATION INFORMATION -ING INNER
INSPECTOR INTRUDER IS IS/F IT
*J* JANUARY JULIET JULY JUNE
*K* KEY KILO KNOTS
*L* LAND LANDING LASER LATE LAUNCH LEAN LEFT LEG LESS THAN LEVEL LIGHT
LIMA LINE LINK LIST LOCK LONG LOOK LOW LOWER LUNCH
*M* MACHINE MAINTAIN MANUAL MARK MARCH MARKER MAY MAYDAY ME MEAN MEASURE MEETING
Mega MESSAGES METER MICRO MIKE MILES MILL MILLI MILLION MINUS MINS MIST
MOBILE MODERATE MONDAY MONTH MORE THAN MORNING/F MOTOR MOVE MUCH
*N* NEAR NEGATIVE NET NEW NEXT NIGHT NINE NINE/F NINETEEN/F NO NORTH NOT
NOVEMBER NUMBER
*O* OBSCURED O'CLOCK O'CLOCK/F OCTOBER OF OFF OH OH/F OHIO OHMS OIL ON ONE
ONE/F OPEN OPERATION OPERATOR OSCAR OTHER OUT OUTER OVER OVERCAST
*P* P.M. P.M./F PAPA PAST PASS PASTED PATCH PATH PAUSE PER PERCENT
PHASER PHONE PICO PLEASE PLUS POINT POLICE POSITION POWER PRACTICE PRESS
PRESSURE PRIVATE PROBE PROGRAMMING FULL PUSH
*Q* QUEBEC
*R* RADIO RAIN RAISE RANGE RATE READY REAR RECEIVE RED RELEASE REMARK
REMOTE REPAIR REPEAT REPEATER RICH RIG RIGHT ROAD RODE ROGER ROMEO
ROUTE RUNWAY
*S* -S SAFE SAND SANTACLARA SATURDAY SCATTERED SECOND SECONDS SECURITY
SEE SELECT SEPTEMBER SEQUENCE SERVICE SET SEVEN SEVEN/F SEVENTEEN/F
SEVERE SEXY SHORT SHOWERS SHUT SIDE SIERRA SIGHT SIX SIX/F SIXTEEN/F
SLEET SLOPE SLOW SMOKE SNOW SOUTH SPEED SPRAY SQUAWK STALL START STOP
STORM SUNDAY SWITCH SYSTEM
*T* TANGO TANK TARGET TAXI -TEEN TELEPHONE TEMPERATURE TEN TEN/F
TERMINAL TEST -TH THANK YOU THAT THE THE (LONGE) THE (SHORTE) THE /F THRIR-
THIRD THIRTEEN THIRTEEN/F THIRTY/F THIS THISIS THOUSAND THREE THREE/F
THUNDERSTORMS THURSDAY TIC TIME TIME/F TIMER TO TOC TODAY TOMORROW
TONIGHT TOO TOOL TORNADO TOUCHDOWN TOWER TRAFFIC TRAIN TRANSMIT TRIM
TRUE TUESDAY TURBULANCE TURNTWELVE TWELVE/F TWENTY TWENTY/F TWO TWO/F
*U* UNDER UNIFORM UNIT UNLIMITED UNTIL UP USE (NOUN) USE (VERB)
*V* VALLEY VALVE VARIABLE VERIFY VICTOR VISIBILITY VOLT
*W* WAIT WAKE WAKEUP WARNING WATCH WATTS WAY WEATHER WEDNESDAY WELCOME
WEST WHISKEY WHISTLE WHY WILL WIND WITH WON WRITE WRONG
*X* X-RAY
*Y* YANKEE YELLOW YESTERDAY YOU YOUR
*Z* ZED ZERO ZONE ZULU
*CUSTOM* CUSTOM1 CUSTOM2 CUSTOM3 CUSTOM4
*MORSE PUNCTUATION* SPACE - / : ? ; , AR AS SK

de WA6AXX 440 Repeater
>

**Information**
The repeater owner may create an 8 line message providing information about the repeater system, or serving any other purpose desired. Entering the I command causes this message to be displayed. All 8 lines of the message must be programmed with the T command. Blank lines must be programmed as well, with at least 2 spaces.

de WA6AXX 440 Repeater
>i
Welcome to the WA6AXX 440 Repeater, with its voice channel on 440.025 MHz (output). The repeater is co-located with WB6KHP Repeater on 224.14 MHz in the east foothills of San Jose.

Both repeaters are open, with autopatch facilities available. Contact Dave, WB6KHP for codes.

Enjoy using the repeaters. 73

This message would be programmed as follows, with control enabled from the serial port.

> t info1 Welcome to the WA6AXX 440 Repeater, with its voice channel on

de WA6AXX 440 Repeater
> t info2 440.025 MHz (output). The repeater is co-located with WB6KHP

de WA6AXX 440 Repeater
> t info3 Repeater on 224.14 MHz in the east foothills of San Jose.
Computer Interface Option

de WA6AXX 440 Repeater
>\texttt{t info4} \ [at least 2 spaces]

de WA6AXX 440 Repeater
>
   etc.

Command Entry

Any Touch-Tone command may be entered through the terminal using the C command followed by the Touch-Tone equivalent, when control is enabled from the port. The controller responds with a text equivalent of the speech response message. Remember to enter the C, then the entire Touch-Tone command. User level and Control Operator commands may be entered.

de WA6AXX 440 Repeater
>\texttt{c 73}
Command executing ...
<speech> 2 METER -S OFF

de WA6AXX 440 Repeater
>\texttt{c 815}
Command executing ...
<speech> 1 HUNDRED FIFTEEN DEGREES

de WA6AXX 440 Repeater
>\texttt{c 123031}
Command executing ...
<speech> REPEATER E

de WA6AXX 440 Repeater

The controller may also be unlocked and Programming commands may be entered. Remember to precede all Touch-Tone commands with the C command, and to lock the controller with "C #" when you're done.

Text Message Entry

Several terminal screen text messages may be programmed by the repeater owner. These include the repeater callsign, VRT channel descriptions, mailbox messages, the information message, and text messages directed to a modem for initialization. Each message is allowed up to a maximum number of characters, specified in the Help file. Programming the information message using the T command was illustrated earlier in this manual. Several other examples are shown below.

>\texttt{t vrt15 int. temp.}

de WA6AXX 440 Repeater
>\texttt{t batch1 AT SO=3}

de WA6AXX 440 Repeater
>\texttt{t call WA6AXX Repeater}

de WA6AXX Repeater

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Computer Interface Option

Print A Programmable Message
Any of the controller's programmable messages (IDs, tail messages, etc.) may be viewed using the P command. The list of message names may be viewed to jog your memory by downloading the MSGNAMES.TXT file (D MSGNAMES.TXT). Stored user callsigns can be viewed by entering P CALL [00-99]. For example, to view callsign 15, enter P CALL 15.

Female speech words are appended with /F. Run time variables are enclosed in parentheses (). Messages can consist of combinations of <speech>, <morse>, <pager> (pager memories), <dtmf> (Touch-Tone sequences), <dvr> (DVR tracks), and <ext> (external devices).

de WA6AXX 440 Repeater
   > p aid
   <morse> W A 6 A X X / R

de WA6AXX 440 Repeater
   > p pid1
   <speech> PAUSE THISIS W A 6 A X X REPEATER

   > p spid
   <speech> GOOD/F (M/A/E) PAUSE THISIS <speech> W A 6 A X X REPEATER PAUSE <morse> S C V

de WA6AXX 440 Repeater
   >

Edit a Programmable Message
Any of the controller's programmable messages (IDs, tail messages, etc.) may be edited using the E command. The controller then prompts with an asterisk (*) rather than the greater-than (>) symbol. Type the words and letters which make up the message directly. A message is assumed to begin as speech unless another type is specified. If the entire message cannot fit on one line, type a percent (%) following the last word on the line. Include a space between the last word on the line and the %. The controller will then again prompt with *, allowing you to continue entering the message. When you terminate a line without the %, the message is converted to tokens and is written into the controller's non-volatile memory. This process will take several seconds. The message will then be printed as it was loaded into memory (identical to using the P command).

The list of message names may be viewed to jog your memory by downloading the MSGNAMES.TXT file (D MSGNAMES.TXT). The list of synthesized speech words, Morse code punctuation, change type tokens, etc. may be viewed by downloading the WORDLIST.TXT file. Stored user callsigns can be edited by entering E CALL [00-99]. For example, to edit callsign 15, enter E CALL 15.

(Screen Examples)  App 1 - 14  V3.5  7/88
Female speech words are appended with /F. Run time variables are enclosed in parentheses (). Messages can consist of combinations of <speech>, <morse>, <pager> (pager memories), <dvr> (DVR tracks), and <ext> (external devices). DTMF sequences cannot be included in messages using the E command.

de WA6AXX 440 Repeater
e fid
*a morse* de space w a 6 a x x / r
<morse> D E SPACE W A 6 A X X / R

de WA6AXX 440 Repeater
> e spid
*this is the number 1 two twenty repeater n the santaclara &
*valley pause w a 6 a x x pause 2 twenty 4 point 68 mega hertz
<speech> THIS IS THE NUMBER 1 2 20 REPEATER N THE SANTACLAARA
VALLEY PAUSE W A 6 A X X PAUSE 2 20 4 POINT 6 8 MEGA HERTZ

de WA6AXX 440 Repeater
> e uf4 low
*low power
<speech> LOW POWER

de WA6AXX 440 Repeater
> e call 01
* k 8 j w
<speech> K 8 J W

de WA6AXX 440 Repeater
>

**Autodial Number Print/Load/Erase**

Autodial numbers stored in the controller may be viewed, loaded and erased using the A command. The A followed by a number 0-249 will cause the controller to display the telephone number stored in that slot, or a message “Slot is empty”. A, E and the slot number will cause the slot to be erased. A, the slot number, and a telephone number will cause the telephone number to be loaded into the slot, unless there is already a number present, in which case the message “Slot not empty” will be present. A new number may only be entered into an empty slot. Erase the slot before writing a new number.

de WA6AXX Repeater
> a 40
2538095

de WA6AXX Repeater
> a 40

de WA6AXX Repeater
> a 40 9870229

(Screen Examples) * App 1 - 15 * V3.5 7/88
Computer Interface Option

de WA6AXX Repeater
> a 40
9870229

de WA6AXX Repeater
>

Front Panel Display
An enhanced replica of the controller's LED front panel may be displayed on the terminal screen by typing F. Control must be enabled from the serial port to view the front panel.

de WA6AXX 440 Repeater
>f

*** WA6AXX 440 Repeater 'FRONT PANEL' DISPLAY ***

<table>
<thead>
<tr>
<th>STATUS</th>
<th><em>CONTROL</em></th>
<th><em>AUDIO</em></th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>ENABLE</td>
<td>XMTR</td>
<td>OUTPUTS</td>
</tr>
<tr>
<td>A</td>
<td>ACCESS MODE</td>
<td>COS</td>
<td>- RCVR</td>
</tr>
<tr>
<td>D</td>
<td>TT ACCESS</td>
<td>COS/LINK1</td>
<td>- LINK1</td>
</tr>
<tr>
<td></td>
<td>IDENT</td>
<td>- COS/LINK2</td>
<td>LINK2</td>
</tr>
<tr>
<td></td>
<td>KERCH</td>
<td>COS/LINK3</td>
<td>LINK3/SP1</td>
</tr>
<tr>
<td>E</td>
<td>PRIM AP</td>
<td>COS/LINK4</td>
<td>LINK4/CR</td>
</tr>
<tr>
<td>E</td>
<td>SEC AP</td>
<td>COS/CR</td>
<td>SPEECH/LM</td>
</tr>
<tr>
<td>E</td>
<td>TERT AP</td>
<td>PL</td>
<td>PHONE</td>
</tr>
<tr>
<td>E</td>
<td>PRIM EAD</td>
<td>USER PL</td>
<td>TONE</td>
</tr>
<tr>
<td>E</td>
<td>SEC EAD</td>
<td>PHONE KNG</td>
<td>PHONE</td>
</tr>
<tr>
<td>L</td>
<td>UAD BANK0</td>
<td>OUTPUTS</td>
<td>RCVR</td>
</tr>
<tr>
<td>L</td>
<td>UAD BANK1</td>
<td>PTT</td>
<td>SPEECH</td>
</tr>
<tr>
<td>L</td>
<td>UAD BANK2</td>
<td>PTT/LINK1</td>
<td>TONE</td>
</tr>
<tr>
<td>R</td>
<td>LINK1</td>
<td>PTT/LINK2</td>
<td>TONE</td>
</tr>
<tr>
<td>E</td>
<td>LINK2</td>
<td>PTT/LINK3</td>
<td>L2 DTMF CHANNEL</td>
</tr>
<tr>
<td>E</td>
<td>LINK3</td>
<td>PTT/LINK4</td>
<td>ON MACRO SET</td>
</tr>
<tr>
<td>E</td>
<td>LINK4</td>
<td>- PWR AMP</td>
<td>6.520S L1 FREQ</td>
</tr>
<tr>
<td>L</td>
<td>LOCK</td>
<td>PHONE OFF/HK</td>
<td>0.000- L2 FREQ</td>
</tr>
</tbody>
</table>

de WA6AXX 440 Repeater
>

Under the Status column, the following abbreviations apply:
ENABLE E = Enabled
T = Timed out
D = Disabled

ACCESS MODE A-K

TT ACCESS E = Enabled but down
U = Enabled and up
D = Disabled

IDENT R = ID required
A = Anxious ID waiting
P = Pending ID waiting

KERCH K = has been Kerchunked in the last few seconds

(Screen Examples)  App I - 16  V3.5  7/88
### Computer Interface Option

<table>
<thead>
<tr>
<th>APs</th>
<th>U = In use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L = Enabled and long distance enabled</td>
</tr>
<tr>
<td></td>
<td>E = Enabled but long distance disabled</td>
</tr>
<tr>
<td></td>
<td>D = Disabled</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EADs</th>
<th>U = In use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E = Enabled</td>
</tr>
<tr>
<td></td>
<td>D = Disabled</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UADs</th>
<th>U = In use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L = Enabled and locked</td>
</tr>
<tr>
<td></td>
<td>E = Enabled and unlocked, available for load/erase</td>
</tr>
<tr>
<td></td>
<td>D = Disabled</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LINKs</th>
<th>E = Enabled but off</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R = On in Receive only</td>
</tr>
<tr>
<td></td>
<td>T = On in Receive/Transmit</td>
</tr>
<tr>
<td></td>
<td>D = Disabled</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOCK</th>
<th>U = Unlocked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L = Locked</td>
</tr>
</tbody>
</table>

Under the other columns, a "-" indicates that the input or output is active, resembling the LED front panel display. The shared DTMF decoder channel is indicated (RX, L1-L4, PH, LM). The currently selected macro set 0-9, and scheduler on/off status is indicated. For example, "ON" indicates macro set 0, with the scheduler turned on. The currently selected link frequencies are also indicated.
Appendix II
Schematic
Computer Interface Board Installation  10/26/88

Please read the following instructions through completely before beginning installation of the Computer Interface Board.

1. Turn power off to controller.

2. Install RP-2 rear panel if necessary. See separate RP-2 instructions.

3. Unplug the DB-25 connector and cable assembly (J1) from the Computer Interface Board. Attach the DB-25 connector to the rear panel cutout labeled COMPUTER using the two small screws and nuts. (You may attach the connector to the RP-2 before installing the rear panel if required in step 2 – this will make DB-25 installation slightly easier.)

4. Remove EPROMs at locations U7 and U8 on the main controller board and U6 and U8 on the Voice Response Telemetry board.

5. Remove the MX-2 piggyback board on the main controller board at the BUS connector.

6. Install the CI board on the existing four mounting posts between the main controller board and the telephone interface board. If the posts are not present, mount the enclosed posts in the pre-drilled holes.

7. Plug the 34 pin cable connector into the BUS connector on the main controller board. Plug the short cable from the DB-25 cable attached to the COMPUTER cutout on the rear panel to the J1 connector on the Computer Interface Board.

8. Plug the supplied U8 EPROM into the U8 location on the main controller board.

9. Solder the wire coming from pin 3 of U1 to the bottom pad of R2 (closest to the edge) on the main controller board.

10. Double check each of the above steps.

11. Restore power to the controller. It should sign on with the 3.5 revision announcement.

12. Have a beer. You have successfully completed the installation of the Computer Interface Board. Now read Chapter 1, "Bulletin Board System (BBS) Serial Port Access" for connection instructions to a MODEM and/or packet TNC.
Computer Interface Board

The Computer Interface Board option for the RC-850 Repeater Controller supplies a variety of resources for hardware expansion of the controller, including:

- Four serial I/O ports
- Socket for 300/1200 baud FSK MODEM chip - AMD 7910
- Secondary Touch-Tone decoder with 8-input multiplexer
- Two 4x4 audio cross-point switches
- Additional general purpose logic I/O
- EPROM socket for firmware expansion to total of 96K bytes

The Computer Interface Board mounts inside the RC-850 controller cabinet, between the Telephone Interface Board and the main controller board. It connects to the main controller board with a 34 pin ribbon cable (supplied). It forms part of the planned long-term upgrade path for the controller.

Serial Ports

Two serial I/O ports are implemented with Zilog's Z8530 Serial Communications Controller (SCC). These ports are buffered for RS-232 level interfaces. The SCC supports both asynchronous and synchronous (HDLC) formats. Version 3 firmware supports asynchronous communication with terminals, and computers running terminal emulation software or other applications software which can make use of the serial interface to the controller. Baud rates of 300 to 9600 baud are supported.

Two additional RS-232 serial ports are implemented in software, for dedicated interface to peripheral equipment as determined by the controller's firmware.

MODEM Chip

A socket is provided for use with the AMD 7910 FSK MODEM "World-Chip". The single chip MODEM implements Bell 103 and Bell 202 functions. [The Bell 103 standard is commonly used in 300 baud home computer MODEMs and amateur RTTY. The Bell 202 FSK standard is not compatible with popular 1200 baud PSK (Bell 212A) MODEMs, but is the 1200 baud packet radio standard.]

The MODEM chip is connected to serial port #1, and its input and output are connected to the cross-point switch audio matrix.

As an alternative to the internal MODEM chip, an external MODEM connected to one of the serial ports may be used for remote computer communication with the controller.
Secondary Touch-Tone Decoder
A second hardware Touch-Tone decoder is provided which supplements the existing shared decoder on the main controller board. The additional decoder implements a fully independent command decoder with Version 3 firmware. An 8-input analog multiplexer selects one of eight audio signals which may be applied to the decoder, based on internal mapping using the toolbox. (See the Version 3 Operation Manual - "Logical I/O and the Toolbox".)

The decoder may be dedicated to high priority command sources such as a link or remote base receiver, without the need to share it with other command channels.

Cross-point Switch Matrix
Two 4x4 cross-point switch audio matrices are supplied, which may alternately be wired as one 8x4 matrix. Control of the matrices is performed using logical I/O mapping with the toolbox. The audio matrix can assist in developing complex linking systems and perform other audio switching.

General Purpose I/O
Four logic outputs, and three logic inputs may be assigned functions using the logical I/O mapping capabilities of the toolbox.

EPROM Socket
A socket is provided for firmware expansion to a total of 96K bytes (32K on main controller board, 64K on Computer Interface board). The socket accommodates EPROMs up to the Intel 27513, which is a paged 64K byte memory. A portion of Version 3.5 (and higher) firmware resides in this socket.

Pricing
Assembled and tested board with cable (does not include 7910 MODEM chip) $295
Rear panel upgrade $25

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RC-850 Repeater Controller
Computer Interface Board
Hardware Specification

The Computer Interface Board which mounts inside the '850 controller cabinet supplies expansion resources, including:

- **Two RS-232C serial I/O ports**
  Two serial I/O ports are implemented with CMOS 82C51 USARTs. These ports are buffered for RS-232C levels using CMOS line drivers and receivers. Version 3.5 and later firmware support communication with terminals and computers running terminal emulation software. The user interface resembles a packet BBS, making operation intuitive to anyone with packet experience, and easy for anyone else to learn.

  The serial ports are brought out at the new DB-25 connector accessible from the rear of the controller. Typical applications of the two serial ports would include connection to a telephone MODEM and to a packet TNC for remote access to the BBS.

- **Two auxiliary Touch-Tone receivers**
  Two additional Touch-Tone receivers are provided (Mitel MT8870s) which supplement the existing shared Touch-Tone receiver on the main controller board. The additional receivers implement fully independent command decoders with Version 3.5 and later firmware. The receivers may connect to any audio source desired. A typical application might be connection of one decoder to the telephone audio to allow simultaneous command entry from the phone and the repeater receiver. The second decoder might be dedicated to the control receiver or a link.

  The decoder inputs are accessible at solder pads on the board, and may be brought to spare phono jacks on the rear panel (RP-2).

- **Three EPROM sockets for extensive firmware expansion**
  Version 3.5 firmware and up reside in these expansion sockets. Three sockets accommodate 27128, 27256, or the paged family of 27513 and larger EPROMs. Future firmware expansion of the previous 48K bytes (V3.42) to beyond 384K bytes is feasible with this feature. V3.5 software occupies 144K bytes of EPROM.

  Version 3.5 software is included as standard with the Computer Interface Board to owners currently running Version 3.41 or 3.42. (Owners of Version 1 or 2 software must purchase the V3 family upgrade.)

  Two software options which utilize the features of the new hardware include:

  - **Vocabulary Expansion Option**
    A major expansion of the synthesized speech vocabulary is available in EPROM which may reside on the Computer Interface Board. Over 500 words become accessible from the message editor, including new words from ACC's custom library, plus semi-custom and standard speech vocabulary. See the new vocabulary list on the back of this sheet. The Vocabulary Expansion Option requires the Computer Interface Board hardware.

  - **PC Software for Printing Programming Sheets**
    Software on floppy diskette for the IBM PC and compatibles provides high level menu-driven display and printout of the programmed contents of your controller. Information programmed in the controller may be viewed on the screen and may be printed for thorough documentation of your repeater. (Available Winter '88)
Vocabulary Expansion Option Word List

(PAUSE) DEGREES HELP MOVE \(-\text{suffix}\)
A DELTA HRDZ \(-\text{suffix}\)
A.M. DELTA HEAT MACHINERY \(-\text{suffix}\)
ABOUT DESK HOME MODERATE \(-\text{suffix}\)
ABOUT DEVIL HOMESTAY MODERATE \(-\text{suffix}\)
ABOVE DIAL HOTEL MOOD \(-\text{suffix}\)
ACKNOWLEDGE DORSAL HOUR POOD \(-\text{suffix}\)
ACID DOWNSWIND JOINER \(-\text{suffix}\)
ADVISE DRAW JUDICIAL "POLICE"
AFFIRMATIVE DUST IDENTIFY "POLICE"
AIR E EAST IGNITE IDENTIFY "POLICE"
AIRPORT EAST IDENTIFY "POLICE"
ALERT EAST INDUCT IDENTIFY "POLICE"
ALPACA EAST INLET IDENTIFY "POLICE"
ALTERNATE EIGHTY INCREASE "POLICE"
ALTITUDE EIGHTY INFORMATION "POLICE"
AMATEUR EIGHTY INFORMATION "POLICE"
AMPHIBIAN EIGHTY INFORMATION "POLICE"
AND EIGHTY INFORMATION "POLICE"
AN MERRY INFORMATION "POLICE"
AREA ENTER INLET INFORMATION "POLICE"
ARRIVAL ENTER INSPECTOR "POLICE"
AT ERROR IT INFORMATION "POLICE"
AUGUST ESTIMATE IT INFORMATION "POLICE"
AUTOMATIZE EVALUATION J INFORMATION "POLICE"
AUGUST EVALUATION J INFORMATION "POLICE"
AUXILIARY EXIT JOURNAL INFORMATION "POLICE"
B BAND F JUNE INFORMATION "POLICE"
BANK FAIL KOE INFORMATION "POLICE"
BASE FAILURE L INFORMATION "POLICE"
BELOW FARENHEIT L INFORMATION "POLICE"
BELOW KB INFORMATION "POLICE"
BIRDING KB INFORMATION "POLICE"
BOARD FEET LB INFORMATION "POLICE"
BOOST LF INFORMATION "POLICE"
BREAKER LF INFORMATION "POLICE"
BROKEN LF INFORMATION "POLICE"
BUTTON LF INFORMATION "POLICE"
BY LF INFORMATION "POLICE"
C BAND F LEVEL INFORMATION "POLICE"
CABIN FLIGHT LEVEL INFORMATION "POLICE"
CABINET FLOW "POLICE"
CALL ROG "POLICE"
CALLING ROG "POLICE"
CELL FORTY "POLICE"
CENTER FOURTH "POLICE"
CHANGE FORTY-NINTH "POLICE"
CHECK FREEDOM "POLICE"
CIRCUIT FREQUENCY "POLICE"
CLEAR FRIDAY "POLICE"
CLIMB FROM "POLICE"
CLOSED FRONT "POLICE"
CLOSED FULL "POLICE"
CLUB G "POLICE"
COME GALLONS "POLICE"
COMPLETE GATE "POLICE"
COMPUTER GEAR "POLICE"
CONDITION GEOMETRY "POLICE"
CONGRATULATIONS GIG "POLICE"
CONTACT GO "POLICE"
CONTROL GOODY "POLICE"
CONVERSING GROUND "POLICE"
COUNT GAUGE "POLICE"
COURSE GAUSTO "POLICE"
CREA CROSSWORD "POLICE"
CURREN H "POLICE"
CYCLE HAIL "POLICE"
D DART "POLICE"
DAY HAM "POLICE"
DECEMBER HAZARDOUS "POLICE"
DECREASE HAZER "POLICE"
DECREASING HEAVY "POLICE"

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NOTE: * = female voice
RC-850 Repeater Controller
V3.5 Software Specification

• Bulletin Board System (BBS) Style Serial Port Access

Remote Repeater Control
All User, Control Op, and Programming commands may be entered through the serial ports with text command responses sent back to the port. The commands may be originated manually or automatically under remote computer control.

Message Editing
Programmable messages stored in the controller may be viewed directly as text, and may be reprogrammed by typing the letters, words, and other tokens directly (i.e., “meeting tomorrow”). It isn’t necessary to refer to vocabulary codes.

Downloading of Repeater Information
Various information may be downloaded from the controller manually or automatically under remote computer control. It may be presented for visual display on the screen, or may be used as input to user written data processing programs to analyze repeater and site activity and characteristics.

Front Panel Display — An enhanced version of the LED front panel display may be viewed on the remote terminal or computer screen. The Front Panel Display option is not necessary to employ this feature.

Command Log — A listing of commands tagged with time and date may be downloaded. The particular commands to be logged may be specified with programming commands (i.e., log patches, linking, Control Op commands, unlocks, etc. but do not log Touch-Tone pad test, demo message playback, etc.).

Metering Information — A display of the 16 VRT channels current meter readings may be requested. The measurements are tagged with a user defined description (i.e., heat sink temp.). In addition, the stored highs and lows for each channel along with the time/date tag for each reading are available.

Activity Information — VRT channels 25-32 may be viewed, which provide ongoing running totals on aspects of repeater activity.

E’PROM Contents — The contents of the E’PROM may be downloaded to be processed by a separate program which runs on IBM PCs and compatibles to print Programming Sheets, which document how the controller has been programmed.

Voice - Packet Mailbox
Electronic messages may be exchanged between the voice repeater and the serial ports. Messages may be sent, listed and killed from the repeater or the serial ports. Mail may be sent by typing the source and destination callsigns and the mailbox message number.

The list of mail currently in the controller may be displayed, including the source and destination callsign, message, and the time and day of entry.

On-Line Help
Extensive on-line help is available for each command to get the user going quickly. In addition, lists of the names of the controller’s programmable messages and the words in the speech synthesizer’s vocabulary can be viewed to assist in programming messages without having to refer to a manual.

Informational Text Message
A programmable text message may be viewed by users to provide information about the repeater system.

Security
Access to remote repeater control, message editing and downloading of E’PROM contents through the serial ports must be enabled by a Touch-Tone Control Operator level command. Each port has a programmable access timeout. Typically, access to these functions would be enabled by entering the Control Op command on a Touch-Tone command channel, such as through the Control Receiver. If this security is not needed, access may be kept enabled by setting the access timer value to 0.
• **Auxiliary Touch-Tone Decoders (2)**

**Independent dedicated command channels**

Commands may be entered independently and simultaneously through the shared decoder on the main controller board and the two auxiliary decoders on the Computer Interface Board. Each auxiliary decoder may be assigned to replace channels of the shared decoder with Programming commands.

Commands from each channel are acted on at their command evaluation point – when the command channel COS goes inactive, or after # if assigned to the phone. Command responses are directed to the repeater and link transmitters or the telephone.

**Applications:**
- Connect to links/remotes for 100% coverage for incoming commands
- Connect to Control Receiver so a transmission on the control channel doesn’t steal the decoder from other channels
- Connect to telephone audio so a call to the repeater doesn’t steal the decoder from other channels (i.e., Touch-Tones will still mute over the air when someone is on the phone)

• **ICOM IC-900 Remote Base / Link Support**

The ICOM IC-900 band units are supported as an alternative to BCD controllable radios for frequency synthesized remotes and links. Only the ICOM band units are needed – not the fiber optic controller – for a considerable cost savings. The FC-900 interface from ACC provides the interface between the controller and the band units.

Connections to the FC-900 interface consist of RB CLK, RB DATA, RB STB, link COS, receive and transmit audio. The connection between the FC-900 interface and the IC-900 modules is simply the daisy-chained multiconductor cable supplied by ICOM. The FC-900 interface mounts on top of the stacked band units.

One or two FC-900 interfaces, each controlling up to six band units are supported. One interface may attach to link ports 1 and 2 and a second to ports 3 and 4 if desired. The FC-900 interface includes a remotely programmable CTCSS (PL) encoder.

Any two band units may be on at any time on each port pair. For example, ports 1/2 could have 10M, 6M, 2M, 220 and 440 MHz transceivers used as remotes, while ports 3/4 might have 220 MHz and 1200 MHz transceivers as synthesized links. Ports 1/2 could have the 10M and 2M remotes up, while 220 and 1200 MHz links are up on ports 3/4. (FC-900 available Fall '88)

• **Rotor Control Board**

The RCB-2 Rotor Control Board allows the RC-850 controller to control a Hygain/Telex CD-45-II, Ham IV or T²X Rotor System control unit. The rotor control board mounts inside the control unit and simulates operation of the clockwise, counterclockwise and brake switches in response to Touch-Tone commands sent to the controller.

Commands available to users include rotate clockwise, rotate counter clockwise, stop, interrogate direction, rotate to a particular direction in degrees, and "budge" clockwise or counter clockwise. The controller always knows the direction of the rotor by measuring the potentiometer voltage from the control unit. An adjustable delay on the board keeps the brake released for several seconds to allow the rotor to coast to a stop.

• **Vocabulary Expansion Option – Over 500 Synthesized Speech Words**

- Amateur radio words
- Public service words
- Days of the week
- Months of the year
- Weather words
- Alternative inflections of key words (a.k.a., female words)
- Sound effects

• **Improvements to Version 3.42**

Various aspects of V3.42 software have been improved based on suggestions from customers.

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