9002 HF Data Modem

User Guide

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1. About this guide

Who should use it

This guide is written for users of the 9002 HF Data Modem with or without the aid of the 9102 Fax & data controller software.

How to use it

This guide contains 5 Chapters and several Appendices. You should read Chapters 2, 3 and 4 before you start to use the 9002 HF Data Modem.

These Chapters explain:

- what the 9002 modem does and how it works
- how to set it up and prepare it for operation
- the operational procedures and commands necessary to use the 9002 modem.

Chapter 5 contains simple trouble-shooting tests to be used if your 9002 does not function correctly.

The expert trouble-shooting tests described in Appendix A are only to be used by qualified and experienced personnel who have the necessary equipment to conduct them.

Standards and icons

The following standards and icons have been used throughout this handbook.

- All text accompanying an icon is highlighted in italics.
- Whenever a term is defined it appears in bold text.

This icon…	**Means…**
☞	the subject is continued over the page.
☛	a reference to other sections or procedures within the user guide or related documentation.
📒	a note or reminder.
⚠	this is a warning, and information associated with this symbol must be adhered to.
❑	the end of a subject.

Other related documentation

- Codan Transceiver handbook.
- 8570 & 8571Remote control operators handbook (Code 15-04018) and 8570 & 8571Remote control installation handbook (Code 15-04070).
- 9102 Fax and data controller software User guide (Code 15-04039).
- Optional ALE Controller type 9300—Installation and Operators handbook (Code 15-04046).

Glossary

ALE	Automatic link establishment
ARQ	Automatic repeat request
ASCII	The translation of numbers to characters
bps	Bits per second (a measure of speed of data transfer)
HF	High Frequency
OC	Open Collector (active high)
PCB	Printed Circuit Board
PTT	Press To Talk
TTL	Transceiver to Transceiver Logic
Options	
DM	Data Mode (on transceiver)
F	Fan (on transceiver)
PM	Miscellaneous facilities (on Remote Control Console system)
SD	Selective call Decode (on transceiver)

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2. Overview

CODAN

Your 9002 modem, when combined with the appropriate HF SSB transceiver and computer terminal, allows you to transmit and receive error free data at high speed over a high frequency (HF) channel.

The 9002 HF Data Modem employs the latest concepts in design and reliability for long range communications. It is particularly useful in remote areas where existing communications are poor or even non-existent.

In addition, it incorporates data compression to boost effective throughput.

The 9002 modem has been designed for 12V DC operation in fixed base and mobile installations. It can be integrated easily with Codan voice and signalling networks.

The 9002 station

A typical 9002 modem station consists of:

- 9002 HF Data Modem
- Codan 'data capable' transceiver
- Power supply
- Computer terminal with 9102 software
- Antenna system.

The Codan 9102 Fax and data controller software, supplied with your 9002 modem, gives a friendly, easy to operate interface to the 9002 and its features. Alternatively you can directly control the 9002 using a standard AT-command set.

HF channels can be manually selected using the transceiver or automatically selected using a Codan 9300 ALE controller.

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Types of data transmission

There are three types of data transmission you can send:

- selective calls
- group calls
- broadcast calls.

Selective calls contain no errors, while group and broadcast calls may contain errors under poor channel conditions.

Selective calls

This is the most common type of data call. A selective call allows you to transmit data to a single, specific station. To start the call, specify a station address to which you wish to send. The receiving station must be ready to receive your call.

Once a link has been established using a selective call, data may be sent in both directions between the two stations.

The 9002 has been optimised for file data transfer, however interactive 'chat' type mode is possible between the two stations.

☞

Group calls

A group call allows you to send data to as many as 99 stations at one time. These stations must be ready to receive and be able to communicate on your channel.

Only the calling station can send data during group calls. This type of call is useful for sending a message to a number of stations without having to establish a separate link with each station.

A group call is identified by a '00' at the end of the called address.

Broadcast calls

A broadcast call allows you to send data to all stations that are ready and able to communicate on your channel.

To start a broadcast call, you call with no address.

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Modem terminology

Transmission protocol

The method used by a modem to transmit and receive information is called the **transmission protocol**.

The 9002 HF Data Modem transmission protocol has been developed by Codan to ensure reliable and efficient HF data transmission.

Signalling rate

Data is transmitted in **packets** of information at a rate of 2400 bits per second. This is referred to as the **signalling rate**.

Throughput

The average data transfer rate between stations is referred to as the **throughput**. This varies with different channel conditions but the signalling rate remains constant.

Effective Throughput

Effective throughput is the average data transfer rate taking the effects of data compression into account. For example, if system **throughput** is 1000 bits per second and data compression reduces your data size by 50%, the **effective throughput** will be 2000 bits per second.

Frequency offset

A modem station's transmission frequency can vary slightly due to changes in temperature or variations in power supply voltage. Therefore the frequencies being used by a sending and a receiving modem station can differ. This difference is referred to as the **frequency offset**.

The 9002 modem measures the frequency offset and uses this information to allow for differences in frequency between the sending and receiving stations.

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The 9002 transmission protocol

Link establishment

Before data can be transmitted to a receiving station the 9002 modem must establish a link. This is done using a robust signalling protocol which determines the receiving station's address and frequency offset between the sending and receiving stations.

Once the link has been established, control is transferred to a high speed data transmission protocol to send the data.

The link establishment protocol is less sensitive to channel conditions than the high speed signalling protocol. This means under some channel conditions, link establishment may succeed where the data transmission will fail.

Selective transmission

Selective transmissions involve a two-way communication process between two modem stations. Data is transferred in information packets. Every packet contains information to let the receiving station know if the data was correctly received.

Notification of any corrupt transmissions are sent back to the sending station and retransmitted in the next information packet.

The receiving station keeps a history of any corrupt transmissions. All 'retransmitted' packets can use this information to decode or correct information packets sent under poor channel conditions. Therefore it is no longer necessary to have an error-free transmission to receive error-free data.

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Group and broadcast transmissions

Group and broadcast transmissions involve a one-way communication process used to send data to multiple modem stations. During a transmission, a receiving station is unable to respond to the transmitting station.

The transmitting station sends information packets in the same way as a selective transmission but all packets are sent four times. After the transmission, a receiving station will have four copies of each packet of information from which to extract correct data. This is sufficient for most conditions however, under poor channel conditions errors can occur. This may cause blocks of missing data.

Automatic channel selection with the 9300 ALE Controller

The Codan 9300 ALE Controller automatically selects a suitable frequency from a list of pre-set transceiver-scan channels.

When used in conjuction with the 9002 modem, the 9300 ALE Controller removes the need for you to manually find a suitable working channel.

☞   *Refer to the 9300 ALE Controller manual.*

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3. Getting Started

What you will need

The following equipment is required to set up your 9002 station:

- Codan 'data capable' transceiver with appropriate options (eg. 8528 transceiver with options F, DM and PS, Option SD recommended).
- AC power supply unit
- 9002 HF Data Modem
- Antenna system
- PC with 9102 software or terminal
- Optional 8570/71 Remote control system with option PM
- Optional 9300 ALE Controller.

On receipt of your 9002, check the contents against the packing list. Ensure all items are available before commencing installation.

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Installation

The 9002 HF Data Modem may be used in two ways:

- as a local system
- as a remote control system.

In a local system the transceiver, the 9002 and computer terminal are all located together.

A remote control system allows the transceiver to be located away from the station. This system can substantially improve communication channels when the reception is poor at the 9002 site.

☞ *Refer to 'Figure 3.2 Example remote control station'.*
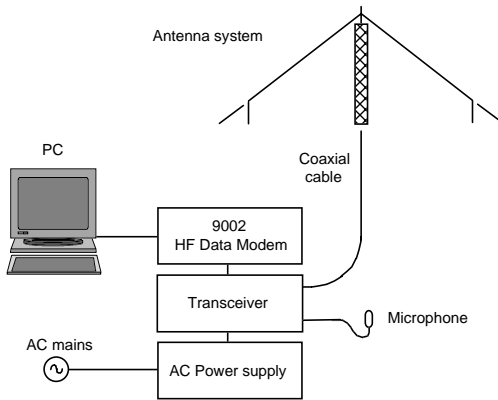
Figure 3.1 Example local station

☞

Local installation procedure

Please read this installation procedure in conjunction with Figures 3.1, 3.3 and 3.4.

1. Position the AC power supply with adequate ventilation at the rear for the fan to operate effectively.

2. Place the transceiver on top of the power supply.

3. Place the 9002 HF Data Modem on top of the transceiver.

4. Connect the DC power cable from the transceiver to the power supply unit.

5. Connect the earth strap between the transceiver and 9002, (i.e. to earth connections marked '⏚ ').

> ⚠ *Ensure you connect the earth strap between the transceiver and 9002 or excess noise may result on the channel.*

6. Connect the cable labelled '08-05014-001' to the connection marked 'Transceiver' on the 9002 and to the modem socket of the transceiver (a round, unlabelled 10 pin connector on the rear panel of the transceiver).

7. Connect the cable labelled '08-05086-001' to the serial port of the computer terminal and to the connection marked 'Terminal' on the 9002.

8. Connect both the power supply and the terminal to a mains power socket.

> ⚠ *Ensure the correct mains voltage has been selected for the power supply and PC equipment.*

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9.   Connect the transceiver to the antenna system.

10.   Turn on the power supply and the transceiver. The red
      light in the top left corner of the 9002 should turn on.

☛   *Refer to 'Setting up the 9002 on page 3-7.*
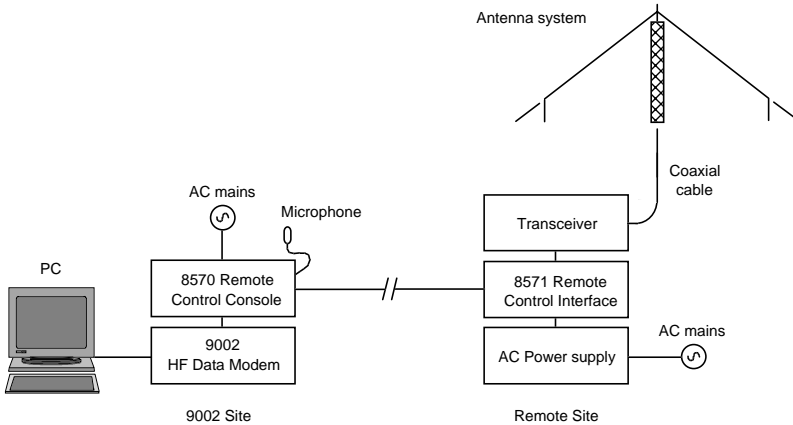
Figure 3.2 Example remote control station

Remote Control System installation procedure

Please read this installation procedure in conjunction with
Figures 3.2, 3.3, 3.4 and 3.5.

1.   Setup the remote site and control system as described in
      the 8570 & 8571 Remote control operators handbook
      (Code 15-04018) and the 8570 & 8571 Remote control
      installation handbook (Code 15-04070).

☞

2. Connect the cable labelled '08-05014-001' between the connection marked 'Transceiver' on the 9002 and the socket marked 'Option PM' on the Remote Control Console.

3. Connect the cable labelled '08-05086-001' to the serial port of the terminal and to the connection marked 'Terminal' on the 9002.

4. Turn on the Remote Control System. The red light in the top left corner of the 9002 should turn on.

☞ *Refer to 'Setting up the 9002' on page 3-7.*
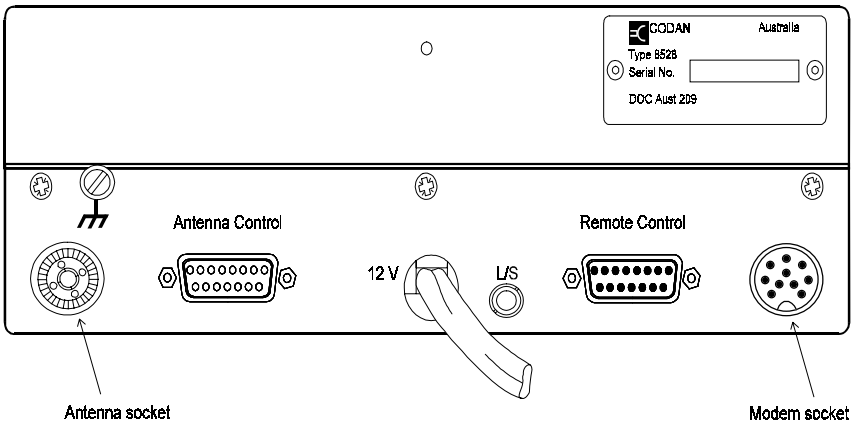
Figure 3.3 Example transceiver rear panel
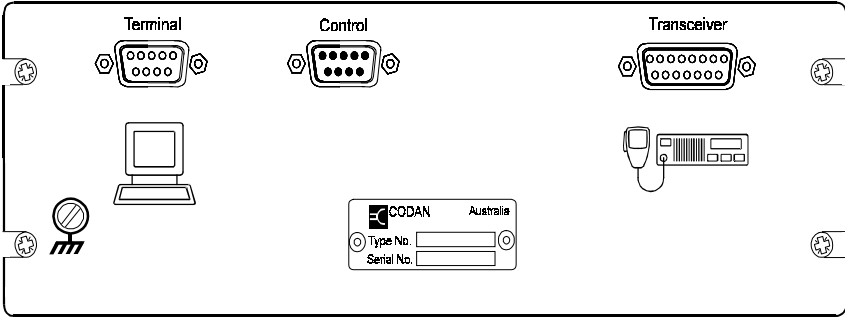
Figure 3.4 The 9002 rear panel
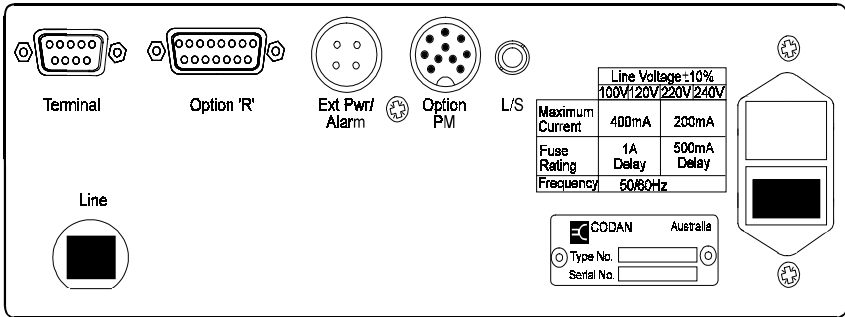
Figure 3.5 The 8570 remote control console rear panel

Setting up the PC/terminal

When using the 9102 software the PC setup is automatically done for you.

If you are not using the 9102 software provided, the terminal connected to the 9002 modem must be setup as follows:

- 9600 baud
- 8 data bits
- No parity
- 1 stop bit
- Hardware hand-shaking (RTS/CTS signals)—for error free file transfer.

⚠ *If you are not using the 9102 software provided with the 9002 modem and are using a PC running Windows, you may experience data loss due to limitations in the windows operating system.*

Setting up the 9002

Before you can use your 9002 you must set the station address. The station address is the number other stations will use to contact you.

Setting your station address

All settings within the 9002 are configured via the terminal using the AT-command set. Alternatively these can be set using the 9102 software provided with the 9002 Data Modem.

☞ *Refer to the '9102 Fax & data controller software User guide'.*

☞

Your station address can be from 1 to 6 numbers in length. The command for setting the station address is:

AT&I=NNNNNN

The numbers after '=', ('NNNNNN'—up to six numbers) are what you choose for your station address.

> ⚠️ *Do not set a station address to any number ending in '00' or you will not be able to use the selective call feature of the 9002.*

Example:

On the terminal keyboard type the following to set the station address to '123401':

1. **AT&I=123401**
2. Once you have typed in the address press **Enter** to set the new station address

   The terminal will display OK.

You can confirm or display the current modem address setting as follows:

1. **AT&I?**
2. Press **Enter** and the modem will display the current address setting.

   The terminal will display OK on the next line.

☞ *Refer to 9002-AT commands on page 4-5.*

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4.   Using the 9002

The 9002 HF Data Modem has no operator controls. All operation is conducted using the transceiver front control panel and the terminal.

If you are like most users, you'll rely on the '9102 Fax & data controller software' to take care of everything you want to do with your modem. If this is the case you can skip the '9002-AT Commands' section of this chapter.

If, however, you want to manually control your 9002 modem, you'll need to learn a few simple commands, as introduced in this chapter and detailed in Appendix C.

9002 station indicators

The 9002 has three indicators on its front panel.

• 9002 HF Data Modem (power)

• HF Link Established (9002 link to transceiver)

• Throughput (data transfer rate).
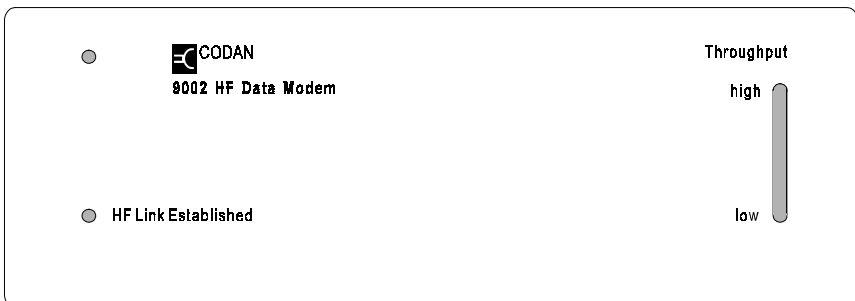
Figure 4.1 The 9002 front panel

The throughput indicator on the 9002 front panel allows you to monitor link quality between the sending and receiving stations. This will vary with different channel conditions.

The 9002 (power) and HF Link Established indicators on the front panel are used to identify the 9002's different operating states. Different modem states can be identified using the 9002 indicators as follows:

During HF link establishment

The HF Link indicator flashes.

- Green indicates link establishment with an incoming call.
- Red indicates an outgoing call.

During HF link data transfer

The HF Link indicator stops flashing once the link is established.

- Green indicates an incoming call.
- Red indicates an outgoing call.

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Selective and broadcast transmissions

When using the 9002, you can send data to a specific station or to many stations at the same time. The fastest and most reliable option is to send to one station (a selective call transmission). Selective transmissions allow the receiving station to receive error-free data. Data compression is available only when making selective transmissions.

Broadcast transmissions (sending to many stations) involve a one way link to the receiving stations. No acknowledgment is given from a receiving station to indicate the data was received error-free. All broadcast transmissions are sent four times by the 9002. This provides a relatively reliable reception without excessively degrading the transmission speed.

Two types of broadcast transmission are possible:

- broadcast call
- group call.

The throughput indicator is at the maximum setting when transmitting a broadcast or group call.

Broadcast call

A broadcast call allows you to send data to all stations that are ready and able to communicate on your channel.

To initiate a broadcast call, you type **ATD**.

Group call

A group call allows you to send data to up to 99 stations. These stations must be ready to receive and be able to communicate on your channel.

A group call is identified by a '00' at the end of the called address. For example, sending to address 123400 will send to all stations with addresses between 123401 and 123499 inclusive.

If you want to make use of group calls you must plan your address allocation to cater for this.

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9002-AT commands

AT commands are a common set of commands commonly used to operate many types of commercially available modems. Software using these commands can be utilised for such modems. The 9102 Fax & data controller software has been specifically developed to comply with the 9002 HF Data Modem AT commands.

Local command and on-line modes

The 9002 HF Data Modem has two modes of operation—the local command and the on-line modes. When you turn the 9002 on it automatically 'powers up' in the command mode.

Local command mode allows the selection of options like echo, auto answer, modem address and other control parameters.

On-line mode is achieved whenever a successful link is established between two or more modems. On-line mode is used for actual transfer of data between modems.

AT command structure

You must start all command lines with the characters 'AT'. Commands can be typed in upper or lower case and all command lines must be terminated by a Carriage Return. You can include spaces anywhere on the command line, as these will be ignored when the command is processed. Commands may be grouped together up to a maximum length of 40 characters.

☞

The AT command structure for the 9002 HF Data Modem uses a simple line editor. This allows you to backspace over data already typed on the same line to correct mistakes. The 'AT' at the beginning of the command line must be typed correctly without backspacing.

Example:

Setting the AT&A command to a value of zero **AT&A=0** would mean the auto answering of calls would be disabled and the modem would not answer an incoming ring without a user request. Setting **AT&A=1** would cause the modem to answer on the first ring automatically.

The escape sequence

The escape sequence puts the 9002 HF Data Modem back from on-line to local command mode. Its format is fixed but the parameters may vary. The format is a time delay followed by a character repeated 3 times, followed by another time delay. The default time delay is one second and the default escape sequence character is '+'.

Enter the escape sequence, using the default values, as follows:

1. Wait at least 1 second after the last character was entered in on-line mode.
2. Type +++.
3. Wait at least 1 second before entering another character.

You will be back in local command mode when you see the modem respond 'OK' on your terminal. The HF link is not terminated at this stage. This only happens when the Hang Up command (**ATH**) is issued, or if the HF link is lost due to poor channel conditions.

☞

The time delay either side of the Escape Characters is a protection mechanism to allow the three escape characters to be part of a message without switching the modem to command mode.

☞   *Refer to 'On-line command' on page 4-11.*

The answer command

The answer command forces the 9002 to answer a call.

ATA

The 9002 immediately answers a call and waits for a carrier signal.

⚠   *Don't type any characters until your terminal displays 'CONNECT', otherwise the 9002 modem will abort link establishment.*

📝   *The 9002 will not execute any command entered in the command line after the second 'A'. Extra commands must be placed before this 'A'.*

Telephone Compatibility command

When telephone compatibility mode is turned on, the behaviour of the 9002 approximates a standard telephone modem more closely, allowing easier integration into computer-controlled applications.

ATB0   turns off compatibility mode (Default)

ATB1   turns on compatibility mode

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Telephone compatibility mode has the following effects:

i.   If ATA command has been given and ATX is 3, 4 or 5 and the H/W busy input signal is active then the modem will respond with NO CARRIER instead of BUSY.

ii.   If ATD command has been given and ATX is 2, 4 or 5 and there is HF modem traffic (carrier) on the current channel then the modem will respond with NO DIALTONE instead of BUSY.

iii. Responses to AT commands will have an extra Linefeed (LF) and Carriage Return (CR) after them.

iv.   Responses to each AT command will be delayed by 120ms after receipt of the CR at the end of the AT command.

v.   ATS0 can be used to set the auto answer on and off. However any value entered that is greater than 1 will be reduced to 1.

vi.   The ATL command is disabled to provide compatibility with the loudspeaker volume on other modems. Use ATF to change the local echo setting .

vii. Any unknown commands are responded to by OK instead of ERROR. This does not include commands with illegal values which will still respond with ERROR.

Call a station

The following command (ATD) will call the station with address '123456' then wait for a response from the remote modem.

ATD123456 (selective call)

If no response is detected within the time-out period (approximately 2 minutes), the 9002 HF Data Modem aborts and issues a 'NO ANSWER' response code on your terminal. If a response is detected and the link established successfully, the 'CONNECT' response code is issued and the 9002 goes to on-line mode.

This command is also used to send broadcast and group calls. For example:

ATD (broadcast call)

ATD123400 (group call).

ATDS=2 dials the number stored in memory 2. Refer to the AT&Z command.

☞ *Refer to 'Selective and broadcast transmissions' on page 4-3.*

Command echo

When the 9002 is in command mode, this command enables the characters you type on the keyboard to be displayed on the screen.

ATE0   turns off the command echo

ATE1   turns on the command echo (default).

Local echo command

This command is the same as the local data echo command and is provided for use when telephone compatibility mode is on.

ATF0   turns off the data echo (default)

ATF1   turns on the data echo.

☞ *Refer to 'Local data echo command' on page 4-11.*

Hang-up command

This command causes the 9002 modem to terminate the HF link. It is issued from command mode after the escape sequence ('+++') has been issued.

ATH or **ATH0** hang up connection at both stations (Default).

ATH2   terminate link when all data in buffer has been transmitted.

ATH3   hang up connection immediately (data in buffers is lost).

Identification command

This command is used to display the product identity and version number. The format is:

ATI   to view product identity and software version.

Local data echo command

This command enables the data sent to the 9002 modem, while on-line, to be echoed back for display on your local terminal screen. Data is immediately echoed back to the terminal by your 9002 modem. This occurs whether or not it has been successfully transmitted to the remote station.

ATL0   turns off the data echo (default)

ATL1   turns on the data echo.

Don't enable the local and remote data echo at the same time as you will get all data echoed back twice and at different times. This makes the display very confusing.

On-line command

To return the 9002 HF Data Modem to on-line mode from command mode issue the '**ATO**' command (letter O). The format is:

ATO or   return to on-line mode
ATO0

ATO1 or   hang up connection after all data has been
ATOH   transmitted.

☞   *Refer to 'The escape sequence' on page 4-6.*

Remote data echo command

This command enables the data sent to the destination station, while on-line, to be echoed back on your terminal screen. Data is only echoed once the remote station has received it.

ATR0   turns off the remote data echo (default)

ATR1   turns on the remote data echo.

If you enable both local and remote data echo at the same time, you will get all data echoed back twice and at different times. This makes the display very confusing.

Response code command

A response code is the message the 9002 HF Data Modem displays on your screen to prompt you to:

- type commands or data
- report whether the HF link is connected or disconnected
- report an error.

Each response has a number and/or message attached to the code.

ATV0   displays numeric responses

ATV1   displays message responses.

☞   *Refer to 'Response codes' on page 4-17.*

Warning level command

This command tells the 9002 how much diagnostic information it should display in response to AT commands.

ATW   do not give reasons for error messages

ATW1   give reason for error messages

ATW2   show status when connecting or disconnecting

ATW3   selects both ATW1 and ATW2

Extended response code command

This command is used to tell the 9002 which format of message to report after a connection has been established.

ATX0 or
ATX   Send the message 'CONNECT' once a connection has been made (default).

ATX1   The 9002 sends the message:

      'Method   : QPSK...'
      'Channels   : <n>'
      'Secure   : YES or NO'
      'Freq offset : <f> Hz'
  or   'CONNECT BCAST'

After the link finishes (i.e. after NO_CARRIER) the terminal displays what caused it to stop.

Reset command

The Reset command is issued to return the 9002 HF Data Modem to a known state. It resets all of the registers and parameter values to the values which have been stored in memory.

ATZ   to reset parameters to stored values.

Enabling auto answer

When a remote 9002 modem station attempts to call your modem station, a 'RING' is displayed on the terminal to alert you of the incoming call. The called modem will not respond until the 'RING' is answered.

The auto-answer feature of the 9002 is enabled and disabled using the AT&A command as follows:

AT&A=0   disables auto answer (when disabled you will need to use the ATA command to answer an incoming call).

AT&A=1   answers call after 1 ring

AT&A?   displays current auto-answer setting.

DTR command

The DTR command tells the 9002 how to respond to changes in state on the DTR (Data Terminal Ready) input line.

AT&D0   ignore the DTR input

AT&D1   modem changes to command state if currently connected and DTR goes low

AT&D2   modem hangs up when DTR goes low and will not answer calls until DTR goes high

AT&D3   modem performs a reset equivalent to ATZ if DTR goes low

*The DTR input line only behaves as described above when the hardware link "P5" is **not** fitted. When link "P5" **is** fitted, the 9002 resets when the DTR input line becomes active. Refer to Figure A.1 on page A-2.*

Escape character command

The escape character, used to switch from on-line mode to command mode, may be changed if necessary using this command.

AT&E=42   set escape character to '*'

AT&E?   display the escape sequence character.

The number entered is the ASCII value of the character you wish to use for the escape sequence (i.e. '+' = 43).

☞   *Refer to 'The escape sequence' on page 4-6.*

Read factory default parameters command

This command reads in the factory default values for the 9002 HF Data Modem. The format is:

AT&F   read factory defaults.

The &F command should be followed by an '&W' command if you want to re-assign to factory default parameters. i.e. 'AT&F&W'.

Set station address command

Use this command to set your 9002 modem station address. This is the address used by all other modems when calling your modem. The address may be up to 6 digits in length. The format is as follows:

AT&I=   set the station address

AT&I?   displays the local station address

For example:

AT&I=15   (will set the 9002 station address to 15).

⚠️ *Never set your station address to a number ending in '00' as your modem will not be able to receive selective calls.*

Flow Control command

This command tells the 9002 what sort of data flow control to use on the serial port. It applies to both command and connect modes.

AT&K0   use no flow control

AT&K3   use hardware (RTS/CTS) flow control (default).

AT&K4   use software (XON/XOFF) flow control. This should not be used when when binary data transfers are in progress.

AT&K5   as for AT&K4

Remote Station Address command

This displays the address of the remote station to which this station is currently or was most recently connected.

AT&R?   display remote station address

Write current parameters to non-volatile memory command

The **AT&W** command stores current parameters in non-volatile memory.

The saved parameters are restored after issuing the **ATZ** command or turning the 9002 HF Data Modem off and on.

AT&W   store current parameters.

☞   *Refer to 'Non-volatile RAM' on page 4-19.*

Stored Station Address command

This command works in conjunction with the ATDS command. It allows you to set up to 4 stored addresses (numbered 0 to 3) for quick-dialling.

AT&Z0=123456   save 123456 as stored station address 0.

Data Compression command

This command tells the 9002 whether or not to use data compression. Data compression increases the effective throughput of the modem. It only works for selective transmissions.

At the start of a call, compression is automatically disabled if either station does not support it.

AT%C   turns data compression off

AT%C2   turns data compression on (default).

Response codes

The 9002 HF Data Modem response codes, output to the terminal to acknowledge commands, are listed below.

Code Digit – (ATV=0)	Code Characters – (ATV=1)	Description
0	OK	Command line accepted and executed.
1	CONNECT BCAST	Broadcast connection.
2	RING	Ringing signal detected.
3	NO CARRIER	Carrier lost or not detected.
4	ERROR	Command line longer than 40 characters, or invalid command.
5	–	Not used.
6	–	Not used.
7	BUSY	HF channel in use.
8	NO ANSWER	No response from remote station.
9	–	Not used.
10	CONNECT	Selective connection.
13	RINGING	Attempting to establish link with remote station.

Remember: all commands except '+++' must end with a carriage return.

Non-volatile RAM

In order to simplify its operation the 9002 HF Data Modem has the ability to store details of its set up. These details can be retained even when the 9002 has been turned off. They are stored in 'non-volatile RAM' (Random Access Memory).

After initial set up, every time the modem is powered on, or the reset command is issued, the configuration of the modem is restored from non-volatile RAM.

AT&W   used to store the current configuration of the 9002 modem.

This configuration remains until another '**AT&W**' command is issued.

☞   *Refer to 'Appendix C—AT Commands'*

❑

Using the 9002

5. Trouble-shooting

The following trouble-shooting guide has been prepared to help you resolve problems that may occur when installing or using the 9002.

None of these tests require you to remove the cover.

Condition	Action required
All lights on the 9002 modem are off.	The 9002 modem is powered via the transceiver. Ensure the cable to the transceiver is firmly secured at both ends and the transceiver is on.
Strange characters appear on the screen of the terminal when you type.	This indicates the data transfer rate (baud) setting for your terminal is incorrect.

☞ *Refer to 'Setting up the PC/terminal' on page 3-7.*

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Condition	**Action required**
When listening to the transceiver there is a lot of background noise.	Check that the data cable between the 9002 and the transceiver has the lock nut tightened at the transceiver end. Check that the earth cable is secure at the 9002 and at the transceiver. A 'humming' noise on the transceiver can be caused by other equipment nearby. Try to identify the source of interference by turning other equipment off. If possible move the transceiver and/or the antenna away from the source of interference.

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Appendix A—Expert Trouble-shooting

This appendix is designed to help qualified personnel locate any fault with the 9002 HF Data Modem. If repair by board replacement is required you should consider the following points:

- *A newly commissioned 9002 should not require testing as all 9002 units are passed by a detailed and extensive test procedure at the factory before being despatched.*

- *The following tests should only be performed by a technical operator familiar with the 9002.*

- *The removal and substitution of components may damage them and/or the printed circuit boards. In some cases it is impossible to remove components without destroying them. It is strongly recommended that fault diagnosis be performed to a board level only and that complete board replacement be carried out.*

What you need

You may require the following equipment when conducting fault tests:

- Multimeter
- Pozi-drive screw driver (1 point).
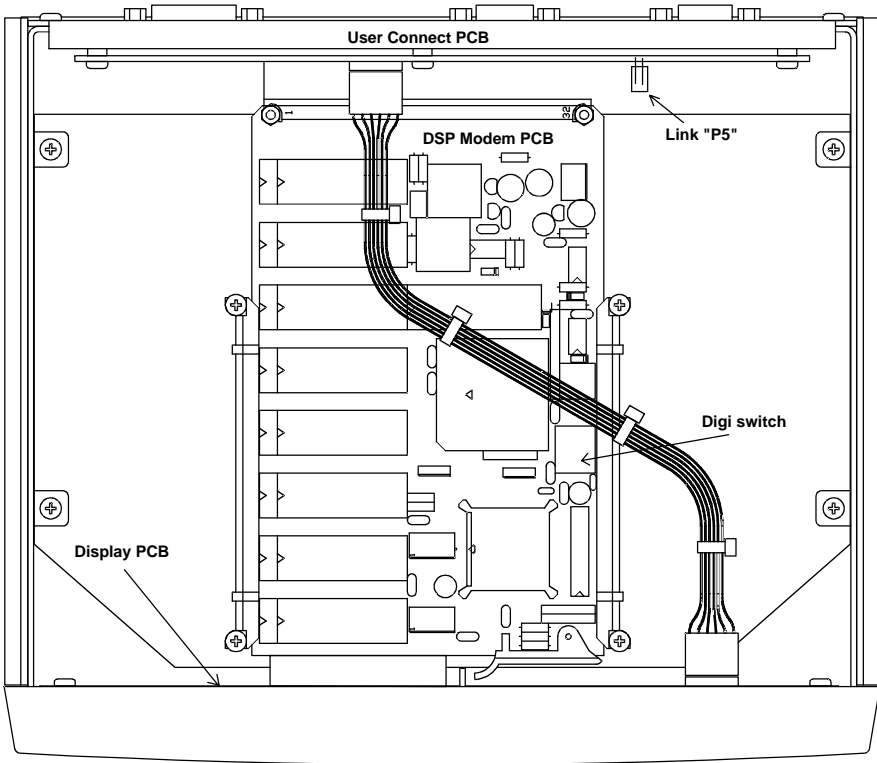
Figure A.1 View of 9002 with top cover removed

Fault detection tests

If you cannot identify a particular faulty PCB after conducting the fault detection tests or if the modem still does not work after replacing the PCBs specified, then the complete 9002 should be returned to Codan for servicing.

Power supply

You will need to remove the 9002 top cover to see the Power Supply.

☛ *Refer to Figure A.1 View of 9002 with top cover removed.*

The Power Supply is integrated into the User Connect PCB. This is in a vertical position located at the rear of the 9002.

Use the following procedure to test the voltages on the User Connect PCB:

1. Turn off power to the 9002 modem.
2. Remove the 9002 top cover.
3. Remove the front cover.

☛ *Refer to 'Removing the 9002 covers' on page A-6.*

4. Unplug the DSP Modem PCB and slide out of card guides.
5. Turn on power to the 9002 modem.

❑

6. Measure across 0V and +Volts test points on the User Connect PCB and ensure the voltage is between 11 and 15 volts (this is the supply from the transceiver). If this is not the case, check the cabling to the transceiver and transceiver power supply. Also check C1, D1, L1 on the User Connect PCB.

7. Measure across 0V and -Volts test points on the User Connect PCB and ensure the voltage is between -11 and -15 volts. If there is a fault, check the IC2 chip and its associated components (C4, C5 and C6).

8. Measure across 0V and +5V test points on the User Connect PCB and ensure the voltage is between 4.75 and 5.25 volts. If there is a fault, check the voltage regulator IC1 chip and its associated components (C2 and C3).

9. Turn off power to the 9002 modem.

10. Install the DSP Modem PCB.

11. Turn on power to the 9002 modem.

12. Repeat steps 6 to 8. If there is a fault and the voltages were correct without the DSP Modem plugged in, then replace the DSP Modem PCB.

Testing the HF sub-system

This procedure is used to confirm the correct operation of the 9002 modem audio output path.

1. Turn off power to the 9002.

2. Remove the top cover.

☞ *Refer to 'Removing the 9002 covers' on page A-6.*

3. Switch the 'digi' switch on the DSP Modem board to the 'E' position. This puts the DSP modem PCB into a service test mode.

❑

4. Turn on power to the 9002.

5. Turn the 'digi' switch to the '0' position. This causes the DSP modem to generate a 1 kHz tone of approximately 2 volts from peak to peak in the transmit audio path.

6. Check if you can hear a tone from the transceiver speaker.

   If no tone can be heard one of the following items may be faulty:

   • DSP Modem board faulty

   • cable between 9002 and transceiver or 9002 and 8570.

7. Turn the 9002 system off. Ensure the digi switch is in the '0' position.

8. Ensure the system is set up correctly and all cables are secure.

☞ *Refer to the 'Installation' section on page 3-2.*

9. Turn on the 9002 system. 'OK' should be displayed on the terminal screen.

❑

Removing the 9002 covers
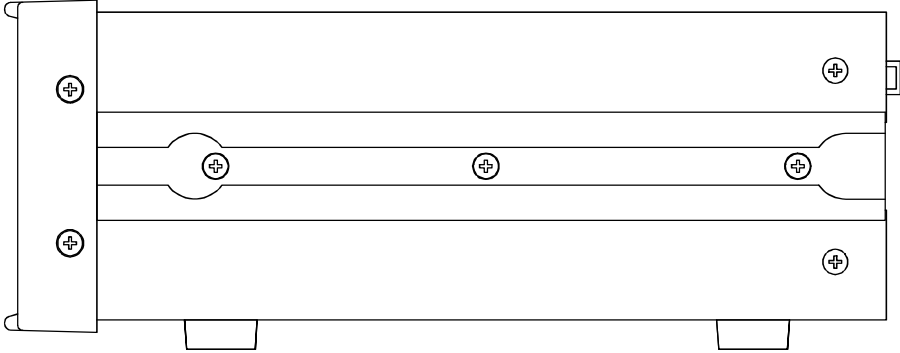
Figure A.2 Side view of 9002

The 9002 is housed in a standard Codan case. The 9002 is designed in a modular fashion allowing you to remove major modules easily.

Front panel

Remove the front panel by unscrewing four screws, two each side of the front panel.

Top cover

Remove the top cover of the 9002 by unscrewing two screws, one each side, toward the rear of the top cover. Lift the cover and pull towards the rear of the unit to remove.

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Appendix B—Connectors
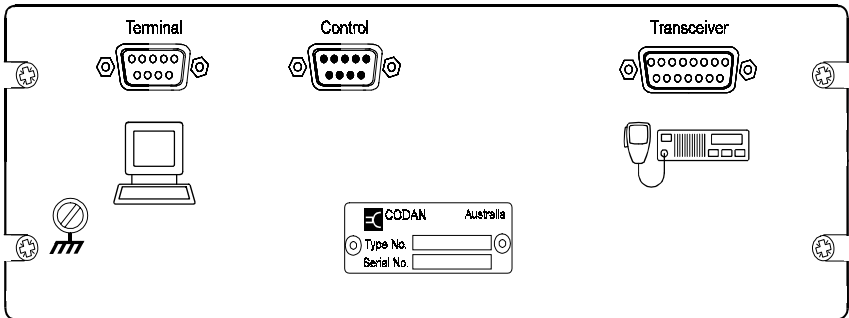
Figure B.1 The 9002 rear panel

External Interface specifications

The 9002 HF Data Modem may have up to three external interfaces with the following functions:

1.   Terminal interface for data operation.
2.   Transceiver interface–includes DC supply.
3.   Control interface.

The rest of this appendix contains a detailed description of the mechanical and electrical interface specifications for the 9002 HF Data Modem.

'Terminal' Interface

The 9002 can interface to data terminal equipment (DTE) by means of the 9-position D-type connector having male contacts and a female shell. The terminal is the primary-user interface to the 9002 HF Data Modem. This connector is labelled 'Terminal'.

Pin No.	Name	In/ Out	Signal Description
1	NC	-	Not connected
2	RxD	In	Receive Serial data
3	TxD	Out	Transmit Serial data
4	CD	Out	Carrier Detect
5	GND	-	Signal ground connected to case
6	Reset	In	Modem reset input
7	RTS	Out	Ready To Send (Flow Control)
8	CTS	In	Clear To Send (Flow Control)
9	NC	-	Not connected

The 9002 modem activates the flow control output (CTS) signal whenever it is ready to accept commands or data from the terminal. The terminal issues the flow control input (RTS) signal to the 9002 modem when it ready to accept command responses or data from the 9002 modem.

'Control' interface

Pin No.	Signal Description
1	Not connected
2	Serial control data output from 9002
3	Serial control data input to 9002
4	Not connected
5	Signal ground connected to case
6	Not connected
7	Transceiver in use (input to 9002) – drive input > 3 Volts to indicate transceiver in use. Float when transceiver available for use
8	Transceiver in use (output from 9002) – OC grounded when transceiver in use
9	Not connected

'Transceiver' Interface

The 9002 interfaces to the transceiver or to the optional type 8570 remote control console by means of a 15-position D-type connector having female contacts and a male shell. This connector is labelled 'Transceiver'. This also supplies switched DC power from the transceiver.

Pin No.	Signal Description
1	+12V power supply input
2	+12V power supply input
3	Serial control data output (TTL)
4	Not connected
5	Control output, +12V when in data mode
6	Spare output (OC)
7	PTT out (OC)
8	Audio output (3Vpp max)
9	Ground
10	Ground
11	Scan input
12	Spare input
13	Spare input
14	Serial control data input (TTL)
15	Audio input (4Vpp max)

❑

Appendix C—AT commands

The 9002 AT commands are listed in the following table:

Command	Description
AT?	Online help mode
ATA	Answer incoming call
ATB0	Use normal HF modem response codes (Default)
ATB1	Telephone compatibility mode (see following notes)
ATD<num>	Dial and connect to remote station. (If the last two digits of <num> are 0 then a group call will be made instead of a selective one.) (Default is a broadcast call—no address)
ATDL	Dial last number
ATDS=n	Dial number stored in station memory 'n' where 'n' is a number 0 to 3. Refer to AT&Z command
ATE0	Command echo disabled
ATE1	Command echo enabled (Default)
ATF0	No local echo (full duplex)

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Command	Description
ATF1	Immediate local echo (half duplex)
ATH0, **ATH**	Hang up connection at both stations (Default)
ATH2	Hang up connection after all data has been transmitted
ATH3	Hang up connection immediately
ATI	Display version and date/time information
ATL0	Disable local echo of data entered while connected (Default)
ATL1	Enable local echo of data entered while connected
ATO0	Return to on-line mode
ATO1, ATOH	Hang up connection after all data has been transmitted
ATR0	Disable remote echo of data received by destination (Default)
ATR1	Enable remote echo of data received by destination
ATS[0..36]**?**	Display diagnostic parameters
ATS[0..36]=<val>	Modify diagnostic parameters
ATV0	Use numeric response codes to AT commands
ATV1	Use verbose response codes to AT commands (Default)
ATW	Do not give reason for ERROR messages
ATW1	Give reason for ERROR messages
ATW2	Show status when connecting or disconnecting
ATW3	Selects both ATW1 and ATW2
ATX0	Ignore carrier or H/W busy when dialling
ATX1	Ignore carrier or H/W busy when dialling
ATX2	Monitor carrier, ignore H/W busy

☞

Command	Description
ATX3	Ignore carrier, monitor H/W busy
ATX4	Monitor carrier and H/W busy
ATX5	Monitor carrier and H/W busy, also shows RINGING measage when dialling
ATZ	Perform reset
AT&A?	Display whether auto answer is enabled or not
AT&A=0	Disable auto answering of calls (Default)
AT&A=1	Enable auto answering of calls
AT&D0	Ignore DTR input
AT&D1	Modem changes to command state if currently connected and DTR goes low
AT&D2	Modem hangs up when DTR goes low and will not answer calls until DTR goes high
AT&D3	Modem performs a reset equivalent to ATZ if DTR goes low
AT&E?	Display the escape sequence character
AT&E=<val>	Set the escape sequence character to be the ASCII value of <val> (Default = 43)
AT&F	Restore all parameters to their default values
AT&I?	Display the local station address
AT&I=<id>	Set the local station address (<id> can be up to 6 numbers)
AT&K0	No flow control
AT&K1	Error
AT&K2	Error
AT&K3	RTS/CTS (hardware) flow control (Default)

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Command	Description
AT&K4	XON/XOFF flow control
AT&K5	XON/XOFF flow control
AT&R?	Display remote station address currently or last connected to
AT&T	Perform local test functions
AT&W	Write parameters to non-volatile memory
AT&Zn=dddddd	Saves 'dddddd' number in station memory 'n' where 'n' can be 0 to 3
AT%C	Disable data compression
AT%C2	Enable data compression (only works for selective calls)

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Command	Description
Link Busy Input	
AT%IO?	Returns status of input pin, not active (0) or active (1)
AT%I1=0	Set the link busy input pin to active low (Default)
AT%I1=1	Set the link busy input pin to active high
AT%I1?	Returns status of link busy input pin, active low (0) or active high (1)
AT%I2=0	Ignore the link busy input pin
AT%I2=1	Enable the link busy input pin (Default)
AT%I2?	Returns status of link busy input pin, ignored (0) or enabled (1)
Link Busy Output	
AT%O0=0	Set the link busy output pin to 'not active' (Default)
AT%O0=1	Set the link busy output pin to 'active'
AT%O0?	Returns status of link busy output pin
AT%O1=0	Set the link busy output pin to active low (Default)
AT%O1=1	Set the link busy output pin to active high
AT%O1?	Returns status of link busy output pin, active low (0) or active high (1)

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S -registers

An S-register is a special purpose register that stores the value of a modem parameter. These parameters are sometimes related to time, for example, S39 stores the time (seconds) to connect to the destination station. An S-register may also hold a character value to have a special meaning.

The 9002 S-registers are listed in the following table:

Command	Description
ATS0	System reset cause (when telephone compatibility is off)
ATS0	Same as AT&A (when telephone compatibility is on)
ATS1	Start-up failure code 1. ROM checksum failure 2. RAM checksum failure 4. EEPROM checksum failure
ATS2	Link termination cause 0 ALE terminated 1. Normal stop requested 2. Inactivity time-out 3. Link lost time-out 4. Link blocked time-out 5. protocol sequence error 7. reset during link
ATS3	Remote ID
ATS4-19	Throughput per channel (bps) (receive only)

☞

Command	Description
ATS20	Number of data bits received
ATS21	Throughput for receive (bps)
ATS22	Number of data bits transmitted
ATS23	Throughput for transmit (bps)
ATS39	Time to connect to the destination station (seconds)
ATS40	Frequency offset (Hz)
ATS41	Estimate of channel quality, i.e. the number of bits transmitted without error (bit error rate measured in header)
ATS42	Compression ratio of current or most recent link expressed in percentage points (eg. 75 means that data was compressed to 75% of its original size)
ATS43	Compression setting negotiated for the current or most recent link. 0 compression was disabled 2 compression was enabled

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Appendix D—Specifications

System Features

- Simple user interface–all operation and configuration from terminal

- 2400 bps signalling rate

- Selective, Group and Broadcast transmission

- All error-free data received is positively acknowledged in selective transmissions

- Error free data transfer in selective calls under all conditions

- Leading edge digital technology throughout–no calibrations or adjustments required.

Accessories

15-00164	Rack mounting frame (483mm) for type 9002.
15-00127	Vehicle mounting cradle for type 9002.
15-00122	Module clamps.
15-04041	User guide for type 9002.
08-05014-002	Transceiver interface cable (3 metres).
08-05086-002	Computer cable (5 metres).
05-06220	Earth braid (1.5 metres).

General specification

High speed data mode

High speed selective repeat ARQ data transfer.

2400 bps, 16-channel QPSK.

Effective transmission rate 1475 bps (uncompressed) under optimum conditions.

Link establishment mode

Proprietary link establishment.

80 Baud CHIRP.

Primary power

12V DC nominal (350 mA).

(operating voltage range 9–16V DC.)

Temperature

0 to 55° C.

Size and weight

250 mm W x 250 mm D x 80 mm H; 1.55 kg.

(includes allowance for rear connectors.)

2400 bps HF modem

TMS320C31 32-bit DSP processor, 27 MHz.

TR.29 based 'AT' port, 9600 baud RS-232.

Data compression.

Control lines and PTT.

System requirements

HF SSB transceiver

Maximum frequency offset error ± 100 Hz (between transceivers).

Audio passband 500 to 2500 Hz ± 1 dB.

Power amplifier ALC–long time constant; peak limiting.

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