RFI DV115E/D

VIDEO ENCODER AND DECODER

OPERATION MANUAL
Software Revision 1.0

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FIGURES AND TABLES

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1. INTRODUCTION

This manual covers the installation and operation of the DV115E/D Video Encoder/Decoder boards alone or as fitted into various RFI data radio products. For information on the features and capabilities of the RFI-9256 data radios in some of these products, please see the RFI manual 9256V121.doc

1.1 DV115E, DV115D, DV20E and DV20D video board features

- Single board compressed video Encoder or Decoder.
- Input selection from one of 4 cameras.
- Audio link option.
- RS232 link option.
- Direct connection to PAL video camera for signal in, PAL monitor for signal out.
- Informational screens for status of radio/modem and video connections.
- Compatible with RF and Telephone modems for data connection, and can be installed inside RF Innovations 115Kbaud and 2Mbit Radio chassis.
- Real Time video compression and decompression in hardware.
- High compression reduces detail, but does not create 'blocky' images like MPEG.
- Programmable baud rates from 600 to 230K baud.
- Data transfer over any speed RS232 link from 600 Baud to 230K Baud.
- Data transfer over high speed synchronous serial channel up to 20Mbits/second.
- Power Supply from 10 to 16V DC (24V option available).

1.2 DV115E and DV115D bare board

The bare board version is intended for OEM installation, and will not be covered here.

1.3 DV115E and DV115D RS232 module

The RS232 version of the DV115E/D can be used in any situation where a serial link is available between the video encoder and decoder modules. This can be a direct hardwired link, or any other medium such as dialup modems, PC serial ports, RS485 (with appropriate adaptors) etc. The baud rate of the module can be programmed to any standard rate between 600 and 230k baud to match existing equipment.

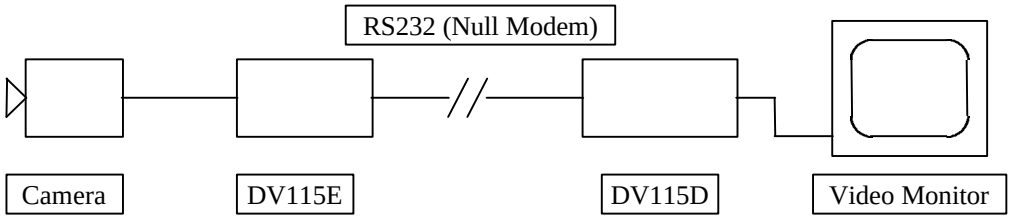

Figure 1.1 DV115E/D Cable Connection

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1.4 DV115E/9256 and DV115D/9256

The DV115E and DV115D video boards can also be fitted into the same box as RFI's 9256 data radio, making a very compact real-time video monitoring system with no external components other than a camera and monitor. Future versions will also include audio as well as video.

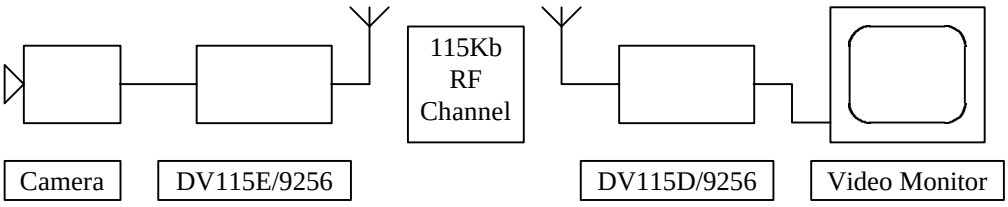

Figure 1.2 DV115E/D RFI9256 Connection

1.5 DV115E and DVSoft Software

The most popular use of the DV115E is as a security/monitoring system controlled by the DVSoft application running on a PC, talking through an RFI-9256 data radio to one (or more) DV115E/9256 modules, each with up to four cameras attached. Decompression of the received video data is handled within the DVSoft application, therefore this is a more cost effective solution as a DV115D (decoder) is not required.

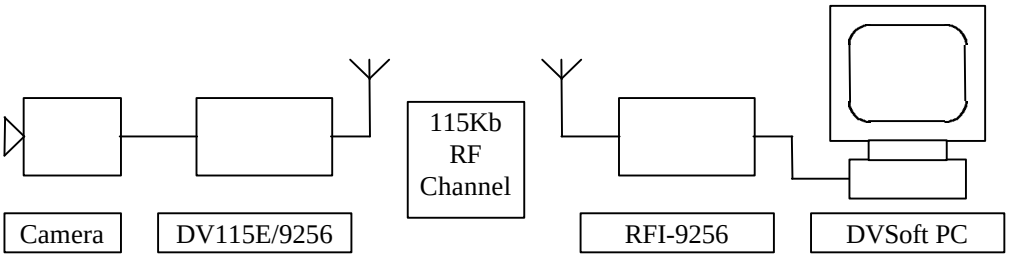

Figure 1.3 DV115E/9256 with DVSoft

1.6 DV20E and DV20D

A high speed version of the DV-series will soon be available with a 2Mb radio link for real-time monitoring with very high quality audio and video, suitable for remote control of vehicles in hazardous areas and other specialised applications.

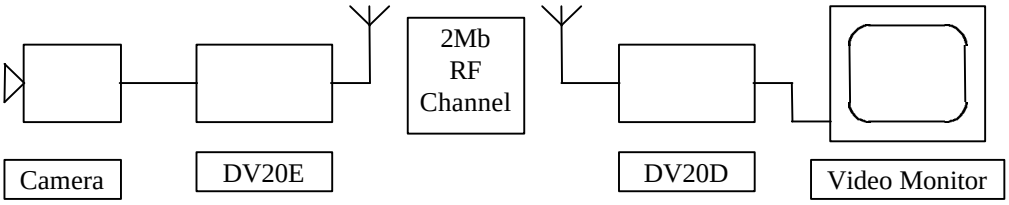

Figure 1.4 DV20E/D 2Mb System

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2. INSTALLATION

The DV115E video encoder and DV115D video decoder boards can be supplied alone or as part of an advanced modular video system, comprising of the video encoder/decoder boards, a communication medium which may be direct cable (RS232 or Ethernet) or various radio modems depending on the required video update rate and distance, and PC software for video monitoring applications.

2.1 DV115E and DV115D bare board

The bare board version is intended for OEM installation, and will not be covered here.

2.2 DV115E and DV115D RS232 module

The DV115E and DV115D require only 12v DC power, a video source, and a video monitor to operate. Video fields are transferred across the link at a rate dependent on the RS232 baud rate and the compression factor set in the DV115E.

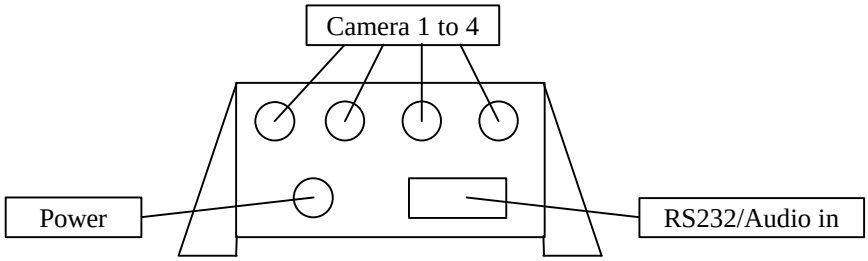

Figure 2.1 DV115E Connectors

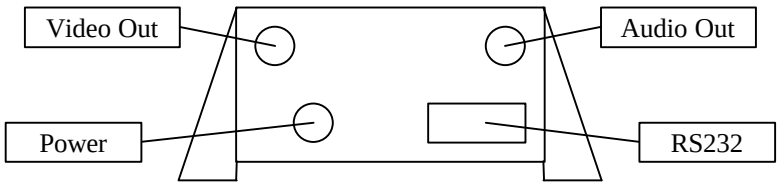

Figure 2.2 DV115D Connectors

2.2.1 Power

Both the encoder and decoder need to be supplied with 12v DC, either from a mains powered source, batteries or other appropriate supply. The DV115E and DV115D require a maximum of 300mA at 12v.

2.2.2 Video

Video in (DV115E) and out (DV115D) use standard BNC sockets on the equipment, and should be connected with 75-ohm video co-axial cable. The video signal accepted and generated conform to the CCIT-656 PAL/NTSC international standard.

2.2.3 Audio

Audio input is on pin 9 of the RS232 connector. The input level at default settings should be standard 1v p-p line-in level, although the input gain is configurable from 0dB to +38dB in 6dB steps to support low-level inputs such as microphones.

NOTE: Audio is not supported on this model.

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2.2.4 RS232

RS232 connection is through an industry standard 9-pin Male 'D' type connector, with a minimum of GND, Rx, Tx, RTS and CTS connected.
NOTE: The standard pin-out of the connector has been modified to allow audio input on pin 9 and power out for a mic preamp on pin 6 of the connector. Therefore the normal 'RI' and 'DCE' signals are not available for RS232 control.

Pin Number	Signal
1	DCD
2	Tx
3	Rx
4	n/c
5	GND
6	Mic power out +12v
7	CTS
8	RTS
9	Mic/Audio In

Table 2.1 DV115E RS232 Connector

2.3 DV115E/9256 and DV115D/9256

The DV115E/9256 and DV115D/9256 are essentially the same as the DV115E and DV115D except for the addition of a 9256 data radio in the same box, instead of an RS232 wire connection. Obviously the correct configuration of the RFI-9256 radio is crucial to the correct operation of the video link, and should not be changed from the setup as delivered unless you are competent in this operation. Please see the RFI-9256 data radio manual for more information about configuring the radio.
Under normal circumstances a DV115E/D/9256 pair will be supplied programmed to connect automatically in a point-to-point mode. This means that the two units must be used as a pair, as they will not connect to (or interfere with) any other RFI-9256 data radios unless reprogrammed to do so.

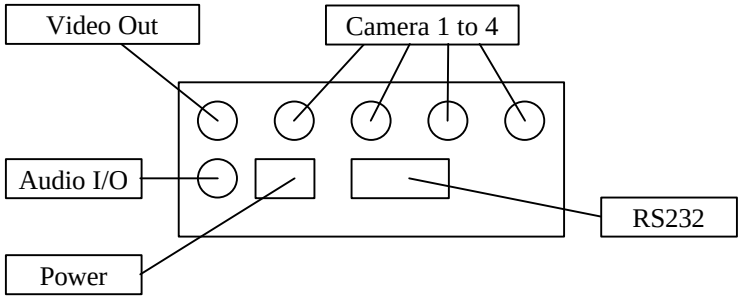

Figure 2.3 DV115E/9256 Connectors

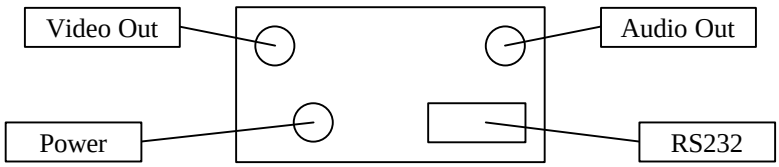

Figure 2.4 DV115D/9256 Connectors

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2.3.1 Power

Both the encoder and decoder need to be supplied with 12v DC, either from a mains powered source, batteries or other appropriate supply. The DV115E/9295 requires a maximum of 300mA, and the DV115D/9256 a maximum of 1.3A.

2.3.2 Video

Video in (DV115E) and out (DV115D) use standard RCA sockets on the equipment, and should be connected with 75-ohm video co-axial cable. The video signal accepted and generated conform to the CCIT-656 PAL/NTSC international standard.

2.3.3 Audio

Audio input level at default settings is standard 1v p-p line level, although the input gain is configurable from 0dB to +38dB in 6dB steps to support low-level inputs such as microphones.

Audio output at default settings is standard 1v p-p line level. The output signal level can be adjusted from -15dB to +6dB in 3db steps.
NOTE: Audio is not supported on this model.

2.3.4 RS232

RS232 to the **AUXILLIARY** port of the included RFI-9256 radio is through an industry standard 9-pin Male 'D' type connector.

Pin Number	Signal
1	n/c
2	Tx
3	Rx
4	n/c
5	GND
6	n/c
7	n/c
8	n/c
9	n/c

Table 2.2 DV115E/9256 RS232 Connector

2.4 DV115E/9256, 9256 and DVSOFT Software

The most popular use of the DV115E/D is as a security/monitoring system controlled by the DVSOFT application running on a PC, talking through an RFI-9256 data radio to one (or more) DV115E/9256 modules, each with up to four cameras attached.

For this system, only one standard RFI-9256 data radio is connected to the PC running the DVSoft application, and depending on the system requirements, an internal or external antenna. Multiple remote DV115E/9256 units can be placed at various monitoring points from several metres away up to the maximum range of the RFI-9256 radio system.

All configuration and management of the remote Encoders is controlled by the DVSoft application.

2.5 DV20E and DV20D

A high speed version of the DV-series will soon be available with a 2Mb radio link for real-time monitoring with very high quality video, suitable for remote control of vehicles in hazardous areas and other specialised applications.

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3. CONFIGURATION

3.1 Default Configuration

The DV115 series boards have many configurable options. The factory defaults for these settings are:

Parameter	DV115E	DV115D	DV115E/9256	DV115D/9256	DV20E	DV20D
autostart	off	off	on	on	on	on
baudrate	115Kb	115Kb	115Kb	115Kb	115Kb	115Kb
compression	40	n/a	40	n/a	40	n/a
dynamic compression	off	n/a	off	n/a	on	n/a
DCOMP	001A704801	n/a	001A704801	n/a	011A704810	n/a
camera	00	n/a	00	n/a	01	n/a
channel	n/a	n/a	n/a	n/a	00	00
power	n/a	n/a	high (+30dB)	high (+30dB)	high (10W)	n/a

Table 3.1 DV Series Default Configuration

3.2 Configuration commands

The Video Encoder and Decoder boards have an ASCII command line interface to allow setting of operational parameters and diagnostics to be run. These may be accessed by connecting an RS232 terminal (115200 Baud, 8 bits, No Parity, 1 Stop) to the serial port.

If the port is in RS232 link mode, typing the Hayes escape command (delay +++ delay) (or cycling the power) will release the port from link mode into command mode.

If all else fails, connect RTS to CTS on the RS232 connector and cycle the power. This will put the board in 'Factory Mode', disabling video operation an allow access to all commands (including the protected 'SETDEF' command). The default comms setting in Factory mode is 115K Baud, 8-bit data, no parity and 1 stop bit.

3.3 Miscellaneous Commands

Command	Description	Range	Default
AUTOSTART	Set startup type	00/01/ON/OFF	00
VER	Read software version		
BAUD	Set the RS232 baud rate	600-230Kb	115Kb
CONFIGR	Read EEROM configuration data		
CONFIGS	Store new configuration data to EEROM		
CONFIGW	Write current configuration to EEROM		

3.4 Video Encoder Commands

Command	Description	Range	Default
CAMERA nn	Select camera nn		
	115Kb serial version	0-3	0
	2Mb SPORT version	1-4	1
PLAY nn	Start video transmission from camera nn	0-3	0
STOP	Stop compression		
GRAB nn ff cc	Grab from camera nn, ff fields at cc compression	00-FF	none
DCOMP ON	Dynamic compression ON		
DCOMP OFF	Dynamic compression OFF		

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DCOMP MIN nn	Set minimum compression level	10-70	70
DCOMP MAX nn	Set maximum compression level	10-70	10
DCOMP SU nn	Dynamic compression step up	00-FF	60
DCOMP SD nn	Dynamic compression step down	00-FF	2
DCOMP	Read back dynamic compression settings as an ASCII string: byte 0: 00 = off, 01 = on byte 1: nn = Minimum compression level byte 2: nn = Maximum compression level byte 3: nn = Dynamic Compression step up byte 4: nn = Dynamic Compression step down e.g. DATA 00640A6402/r OK/r		
DCOMP nnnnnnnnnn	Set Dynamic compression parameters in the same format as above.		

3.5 2Mb Radio Commands

Command	Description	Range	Default
FAN ON nn	Fan on temperature		factory setting
FAN OFF nn	Fan off temperature		factory setting
CHANNEL nn	RF channel selector	1-4	1
POWER nn	RF output power set	1-4	2
OVERTEMP nn	shutdown temperature (°C)	0-255	factory setting
VSWR nn	VSWR shutdown level	0-255	factory setting
VSWR	Read current VSWR level		
RSSI	Read receiver RSSI	0-255	
TEMP	Read transmitter temperature	0-255	
POWER TABLE	Set power calibration table DATA 00000000/r	4 16-bit words	factory setting
SYNTH TABLE	Set synthesiser table DATA 000000000000000000/r	9 16-bit words	factory setting

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3.6 VIDEO BOARD detailed command descriptions:

3.6.1 COMMAND: AUTOSTART p1

Board: Encoder, Decoder
Interface: RS232, SPORT
Parameters: p1 - 00/01 or ON/OFF

Starts video compression or decompression automatically when the board is initialised. Used mainly when the camera and encoder are remotely mounted for unattended monitoring applications.

NOTE: The Encoder will not output data unless CTS is on.

3.6.2 COMMAND: BAUD p1

Board: Encoder, Decoder
Interface: RS232, SPORT
Parameters: p1 - 00-0F (See Baud Rate Table below)
Default: 01 = 115Kbaud.
Factory mode will always start at 115Kbaud, regardless of what the programmed rate is set to.

Displays or Sets the current baud rate for the RS232 interface.

Value	Baud Rate	Value	Baud Rate	Value	Baud Rate	Value	Baud Rate
00	230.4K	01	115.3K	02	57.6K	03	28.8K
04	14.4K	05	7200	06	3600	07	1800
08	76.8K	09	38.4K	0A	19.2K	0B	9600
0C	4800	0D	2400	0E	1200	0F	600

Table 3.2 Programmable baud rates

3.6.3 COMMAND: CAMERA p1

Board: Encoder
Interface: RS232, SPORT
Parameters: p1 - camera number 00-03 (115Kb) 0r 01-04 (2Mb SPORT)

Selects the required camera input from one of the four input connectors on the encoder board. Video from the selected camera will also be echoed out on the video out connector. This is useful for adjusting the zoom and focus of the camera by attaching a video monitor to this output.

3.6.4 COMMAND: DCOMP

Board: Encoder
Interface: RS232, SPORT
Parameters: none
Returns: DATA 0000000000/r

Dynamic compression is used to modify the compression of fields of video depending on the amount of change between successive fields. This means that steady image will allow the compression level to drop, transmitting a higher quality picture at lower update rates. Conversely, if any part of the image is changing (or moving), then the compression will be increased to allow faster updates at the expense of picture quality. Using the following **DCOMP** commands, the minimum and maximum compression levels can be set, and also the rate at which the compression level rises and falls

Read the Dynamic Compression settings as a packed string of hexadecimal bytes.

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Byte	0	Dynamic Compression Off or On [00-01]
	1	Minimum compression level [00-FF]
	2	Maximum compression level [00-FF]
	3	Dynamic Compression step-up value [00-FF]
	4	Dynamic Compression step-down value [00-FF]

3.6.5 **COMMAND:** DCOMP p1p2p3p4p5

Board: Encoder
Interface: RS232, SPORT
Parameters: **The following parameters MUST be 2 digit hexadecimal numbers [00-FF] with no spaces between them!**
p1 - Dynamic Compression OFF or ON [00-01]
p2 - Minimum compression [00-FF]
p3 - Maximum compression [00-FF]
p4 - Dynamic Compression step-up value [00-FF]
p5 - Dynamic Compression step-down value [00-FF]
e.g. DCOMP 011A704810
Returns: none

This command is used mainly for automated setting of dynamic compression parameters by external programs such as DVSOFT. All parameters can then be set in a single instruction.
For more information on how **DCOMP** works, see description of **DCOMP** above.

3.6.6 **COMMAND:** DCOMP ON

Board: Encoder
Interface: RS232, SPORT
Parameters: none
Returns: none

Turn Dynamic Compression ON.

3.6.7 **COMMAND:** DCOMP OFF

Board: Encoder
Interface: RS232, SPORT
Parameters: none
Returns: none

Turn Dynamic Compression OFF.

3.6.8 **COMMAND:** DCOMP MIN p1

Board: Encoder
Interface: RS232, SPORT
Parameters: p1 - minimum compression level [00-FF]
Returns: none

Set Dynamic Compression minimum compression level (maximum field data size).

3.6.9 **COMMAND:** DCOMP MAX p1

Board: Encoder
Interface: RS232, SPORT

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Parameters: p1 - maximum compression level [00-FF]
Returns: none

Set Dynamic Compression maximum compression level (minimum field data size).

3.6.10 **COMMAND:** DCOMP SU p1

Board: Encoder
Interface: RS232, SPORT
Parameters: p1 - compression increase step size [00-FF]
Returns: none

Set Dynamic Compression increase step size. This parameter is used when the software detects movement in the image, and increases the compression factor to allow faster frame rates (at lower quality). Normally this would be set relatively high, such as 80 (Hex) so that the frame rate would increase to maximum immediately movement is detected.

3.6.11 **COMMAND:** DCOMP SD p1

Board: Encoder
Interface: RS232, SPORT
Parameters: p1 - compression decrease step size [00-FF]
Returns: none

Set Dynamic Compression decrease step size. This parameter is used when the software detects movement in the image has ceased, and decreases the compression factor to allow higher quality (but slower) video. Normally this would be set relatively low, such as 01 (Hex) so that the quality would slowly increase to maximum over several seconds.

3.6.12 **COMMAND:** GRAB p1 p2 p3

Board: Encoder
Interface: RS232, SPORT
Parameters: p1 - camera number [00-03]
p2 - number of fields to grab [00-FF]
p3 - compression factor for grabbed fields [00-FF]

Digitise single or multiple fields on demand, and send to receiver via RS232 channel.

3.6.13 **COMMAND:** PORT p1

(not yet implemented)
Board: Encoder, Decoder
Interface: RS232, SPORT
Parameters: p1 - RS232 (115Kb) or SPORT (2Mb) [00-01]
Default: none

Sets the output port for compressed video.

3.6.14 COMMAND: PLAY p1

Board: Encoder, Decoder
Interface: RS232, SPORT
Parameters: p1 - camera number [00-03]
Default: last used camera number

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Selects the given camera as input (or last used camera if p1 is not supplied), starts the video encoder and the output channel. The output channel depends on user selection, and can be either RS232 or SPORT (see **PORT** command).
The encoder can be automatically enabled on startup if required with the **AUTOSTART** command.

3.6.15 COMMAND: RESET

Board: Encoder, Decoder
Interface: RS232, SPORT
Parameters: none

Perform software reset, reloads program from FLASH into DSP.

3.6.16 COMMAND: SETDEF

Board: Encoder, Decoder
Interface: RS232, SPORT
Parameters: none

NOTE: This command is only available in 'Factory Mode'.

WARNING: Do not use this command except in an emergency - it will destroy all factory defined and user configuration entries!!!

Initialise EEROM parameters to known defaults. Video board will become a basic DV115 Encoder or Decoder depending on the hardware.

3.6.17 COMMAND: STOP

Board: Encoder, Decoder
Interface: RS232, SPORT
Parameters: none

Stops the video encoder.

3.6.18 COMMAND: VER

Board: Encoder, Decoder
Interface: RS232, SPORT
Parameters: none

Displays the version number of the software in the DV115E/D board.

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4. FRONT PANEL LEDs

4.1.1 DV115D and DV115E

The LED indicators on the DV115E and DV115D indicate the status of the video encoder/decoder board and data stream. Figure 4.1 DV115E LEDsbelow describes the DV115E front panel indicators.

LED NAME	Description
POWER	• Flashing Green - Power on and encoder board running. • Steady green - power on, software failure. • Off - no power, or possible software failure.
ENCODE	• Green - Encoder running • Off - Encoder halted.
VIDEO	• Green - Recognisable video present at video input connector. • Off - no video input
FAULT	• RED - hardware or software fault • Off - no problem!.

Figure 4.1 DV115E LEDs

LED NAME	Description
POWER	• Flashing Green - Power on and encoder board running. • Steady green - power on, software failure. • Off - no power, or possible software failure.
DECODE	• Green - Decoder running • Off - Decoder halted.
DATA	• Green - Video data packets being received on the RS232 port. • Off - no video data packets on the input port
FAULT	• RED - hardware or software fault • Off - no problem!.

Figure 4.2 DV115D LEDs

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5. DIAGRAMS

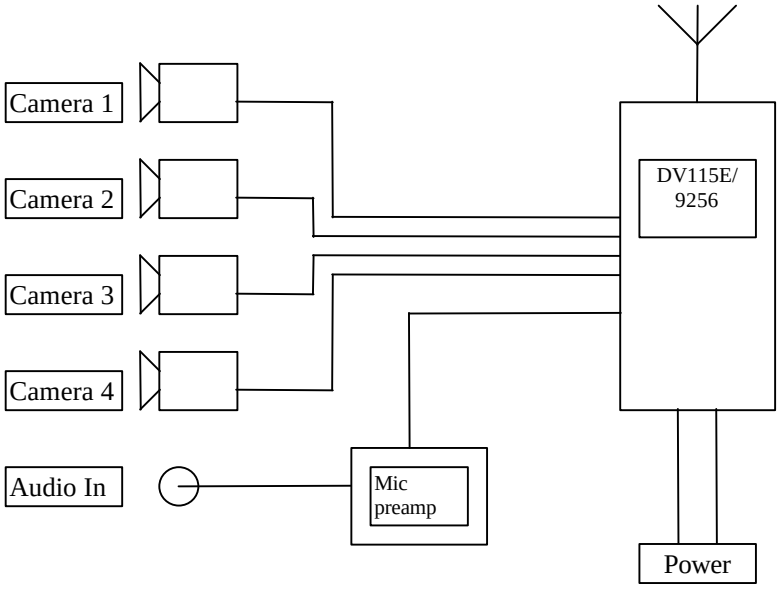

Figure 5.1 DV115E/9256 Encoder and Camera/Microphone Inputs

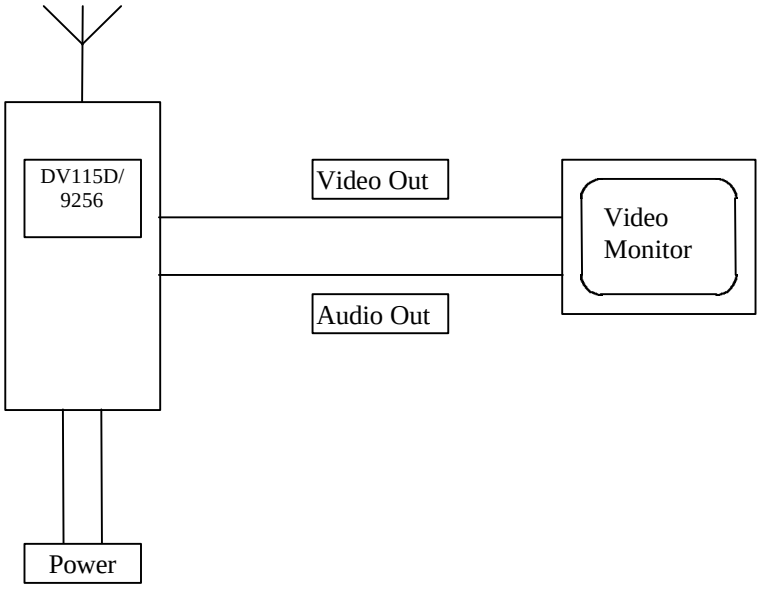

Figure 5.2 DV115D/9256 Decoder and Video Monitor

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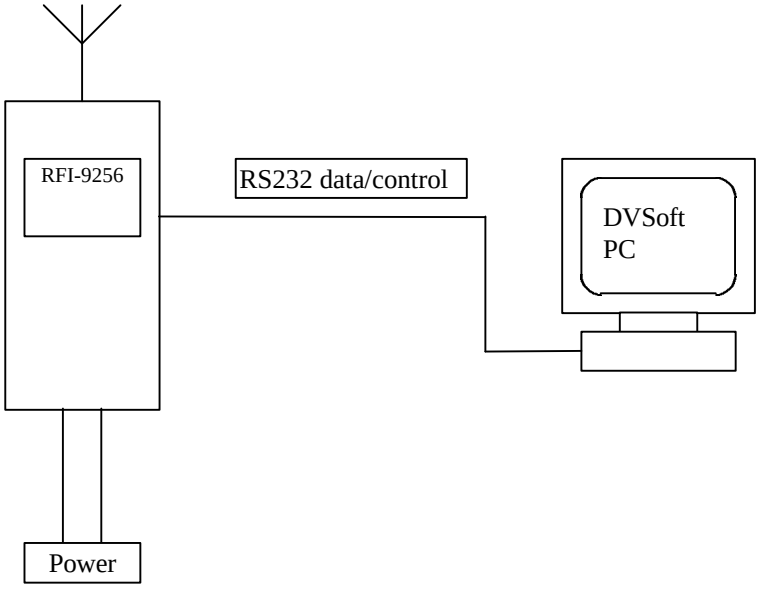

Figure 5.3 RFI-9256 Radio and DVSoft PC

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6. TECHNICAL SPECIFICATIONS

6.1 VIDEO BOARD SPECIFICATIONS

Description	Specification
Video Format	CCIR-656 PAL/NTSC
Audio Format	1V p-p 300Hz to 3000Hz (not yet available)
Power Supply	DV115E/D: 10-16V at 300mA, < 500mV ripple DV20E: 10-16V at 3.0A, <500mV ripple DV20D: 10-16V at 500mA, <500mV ripple (24V options available)
RS232 interface	Standard RS232 signal levels
Compression	4:1 to >200:1
Video Frame Rate	DV115E: 0.2 to 4 frames/second (RS232 speed dep.) DV20E: 10 to 25 frames/second

Table 6.1 Video Board Specifications

6.1.1 DV115E/9256 and DV115D/9256 CONNECTORS

The DB9 connector on the DV115E/9256 and DV115E/9256 devices connect to the **AUXILLIARY** port of the internal 9256 radio (the main port is connected through the internal 9256 radio).

Pin Number	Signal
1	n/c
2	Tx
3	Rx
4	n/c
5	GND
6	n/c
7	n/c
8	n/c
9	n/c

Table 6.2 DV115E/D/9256 RS232 Connector

6.2 RFI-9256 DATA RADIO SPECIFICATIONS

These specifications pertain to the RFI-9256 radio embedded in the DV115E/9256 and DV115D/9256.

Range*	>20 KM
RS-232 Data Rates	110 baud - 115.2 K baud
RS-232 Interface	Asynchronous, full duplex
System Gain	135dB
Minimum Receiver Decode Level	-108 dBm @ 10-4 raw BER -100 dBm @ 10-6 raw BER
Operating Frequency	915-928 MHz(Australia)
Modulation Type	Spread Spectrum, MGFSK
Spreading Code	Frequency Hopping
Hop Patterns	32 (user selectable)
Output Power	1 Watt (+30 dBm)
Error Detection	32 Bit CRC with packet retransmit (ARQ)
Antenna	BNC to fit required antenna

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Power Requirements	9.0-16.0 VDC (negative ground)
Power Consumption	600 mA Transmit 200 mA Receive 320 mA Average (normal data loading)
Connector	DB25 male (power and data combined)
Unit Address (Network ID)	User programmable
Operating Modes	• Point-to-Point • Point to Multipoint Dial (Hayes™) • Back to Back Repeater • Protocol Router • Custom
Operating Environment	-10°C - +60°C
ACA Identifier	N161

Table 6.3 RFI-9256 Radio Specifications

*RANGE is dependent upon antenna and environment, a typical range calculator is available to download from the RFI Application notes on the RFI WEB page. (www.rfinnovations.com.au)

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7. Troubleshooting

7.1 ERROR MESSAGES ON STARTUP

If the DV115E or DV115D do not appear to respond when power is applied, there may be some error condition recognised by the software that will output an error message to inform the user. To see these messages, an RS232 terminal (or terminal program on a PC) should be connected to the RS232 port. In an error situation, the RS232 port will be configured to 115Kbaud, 8 bits, no parity, 1 stop bit before issuing error messages. If an message is issued, the port will be left in command mode and diagnostic commands can be entered to find the problem.

7.2 FACTORY MODE

A special 'Factory' diagnostic mode can be entered to reset the video board totally if bad configuration data has been entered which has locked up the encoder or decoder. This mode is enabled by connecting RTS and CTS together on the RS232 connector before resetting the video board or cycling the power.

WARNING! Some commands available in 'Factory Mode' can totally erase the operating program stored in FLASH, the user configurations stored in EEROM, or both! This option is not recommended except for factory service personnel or in extreme circumstances!

7.3 ERROR MESSAGES

Note that the DV115E is silent on startup unless an error is encountered.

2Mb Radio mode enabled
Normal startup message for DV20E/D (2Mb RF) version

Factory Mode enabled
Usually accompanied by one of the messages below describing why factory mode was enabled. This should be one of the messages below:

RTS-CTS Link detected
User forced 'Factory Mode' by connecting RTS and CTS together on the RS232 serial port before reset or cycling the power.

Radio Preamble Added
This is not an error message - it appears if synchronisation bytes are being added to the transport layer packets on the DV20E (2Mb RF transmitter) version.

EEROM read failed or **EEROM Error - data stuck low**
or
EEROM Uninitialised
Internal error - The EEROM chip has failed.

ADV7176 write error
Internal error - The Video Digital-to-Analog converter has failed.

SAA7111A write error
Internal error - The Video Analog-to-Digital converter has failed.

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8. Factory Defaults

This section describes the factory defaults for the DV115E/D video boards.

Transmitter	Receiver
9256 (115Kb serial) mode	9256 (115Kb serial) mode
Auto-start off	Auto-start on
Channel 0	Channel 0
Dynamic Compression on	n/a
PAL Video	PAL Video
Camera 0	n/a

Table 8.1 DV115E/D Factory Defaults

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9. Glossary

A

Alphanumeric
Roman Letters (alphabetic) and Arabic numbers (numeric).
ARQ
Automatic Request Repeat. A form of error correction protocol. That uses retries to correct bad packets of data.
ARQ Retries
The number of times the radio modem will try to send a packet of lost information before it gives up.
ASCII
American Standard Code for Information Interchange. Pronounced as-kee. A code by which alphanumeric, punctuation and control characters, commonly found on computer keyboards, are each assigned a unique value between 0-127 (decimal).
Asynchronous
A data transmission in which the time between characters may vary. Characters are delimited by start and stop bits.
Attention Commands (AT Commands)
A group of commands created by Hayes™ that are recognised by the modem and that begin with AT (or at).
Attenuation
The loss of power through transmission equipment, lines or other communication devices.
Auto answer
A modem capability that allows it to automatically pick-up.
Auxiliary Port (Aux Port)
Port connected to 3 wire modem cable. Cable contains Rx, Tx and ground wires. Only enables software flow control.

B

Bandwidth
The range of signal frequencies that are accepted or passed by a circuit or network.
Base Frequency
The frequency band occupied by a signal in its original or unmodulated form. The base frequency for the RFI-9256 is 915-928MHz (in Australia) and 921-929MHz (in New Zealand).
Baud
This term represents the number of discrete signalling events per second. If each signal element has more than one bit associated with it then this will not be the same as BPS. Compare with bit rate. Also called Baud Rate.
Binary
A number system with a base of two, using the digits 0 and 1. Commonly used in computers since the values 0 and 1 can easily be represented as OFF and ON in electrical circuits.
Bit
The smallest piece of information in a binary number system. The word stands for Binary digit.
Bit rate
The speed at which bits are transmitted, usually expressed as bits per second (BPS).
Block
Group of characters treated as a unit for the purpose of data transmission.
BPS
An acronym for Bits Per Second. Transmission rate of binary numbers (bits).
Bridge
Joins dissimilar networks and converts protocols such that data can passed between them. For example, a bridge may allow data to be passed from a TCP/IP network to a ISDN network.
Buffer
Temporary storage area used to compensate for a difference in the rate of data flow into and out of a device.
Byte
A grouping of bits to specify a single character usually consisting of eight consecutive bits. See also Bit.

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C

Carrier signal
The base frequency which is modulated by another signal containing information to be transmitted.

Carriage Return (CR)
The enter key on a keyboard. Causes the curser to move to the beginning of the next line.

Carrier Detect (CD)
An RS-232 interface signal from the modem to a terminal or personal computer indicating that the modem is receiving a signal from a remote modem. See also DCD.

Character
A letter, number or other symbol contained in a message or used in a control function. See Byte and ASCII.

Clear to Send (CTS)
Control signal sent by the DCE to indicate that the DTE may begin a transmission.

Communications Link
When communication is established between modems, information can be passed between them. Signified on the RFI-9256 by both modems having Network Link, Carrier Detect and On-Line LEDs activated and the receive and transmit LEDs flash as data is sent.

Competing System
A Leased Line. For example X25, QPSX, ISPN.

Connection Commands
Commands that enable information to be passed between two modems, after a communications link has been established.

Connector
A physical devices, such as a plug, socket or jack, used to connect one hardware component of a system to another. A connector may also be called a port.

Console
Part of a computer system, usually a video display terminal, used by the operator to communicate with the computer. See terminal.

Contention
Condition arising when two or more devices try to transmit at the same time using the same channel.

Control Character
Any character assigned as ASCII numeric code less than the SPACE character. These characters are used to initiate a control function on the receiving device. Also a symbol you can create by pressing one of your computer's keys while holding down the Control key. These symbols are not usually printed, and are generally used to control screen formatting and cursor positioning.

Clear to Sent (CTS)
This signal is generated by a modem in response to RTS to indicate that a communications channel has been established and that data can be sent.

Cyclic Redundancy Check (CRC)
An error-detection technique in which a data validation value is mathematically derived from a block of data and transmitted at the end of the block. The receiving end recomputes the value and if it matches the value sent, the data is assumed to be valid (error-free). If not, the receiver notifies the transmitter that an error has occurred and the block is retransmitted.

D

Data
Any type of information, such as numbers, letters and symbols, that can be processed by a computer.

Data Bits
The actual characters being transmitted between two computers when asynchronous communications is being used. Usually 7 or 8 data bits are used. A normal byte has 8 bits. 7 data bits are used for ASCII/alphanumeric data.

Data Communications Equipment (DCE)

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Equipment that is used to access a communications network. The DCE provides all the functions required to establish, maintain and terminate a connection, and provides the signal conversion required for communications between the Data Terminal Equipment (DTE) and the telephone network. With RS-232 connections, the modem is generally the DCE device while the computer or terminal connected to a modem is generally the DTE device. See also Data Terminal Equipment.

Data Compression

An encoding technique which provides for the transmission of fewer data bits without the loss of information. The receiving end expands the data received to its original form. For example, a ZIP file/drive, ARJ file formats, MPEG/JPEG and GIf formats.

When applied to video data, the common compression methods are Wavelet, MPEG, JPG etc which are 'lossy' compression algorithms. This is acceptable because the visual content is more important than the actual data values.

Data Latency

Time delay between input stream and output data.

Data Set Ready (DSR)

An RS-232 control signal used to indicate the readiness of the DCE (Usually a modem) to accept data from the DTE (usually a terminal or computer).

Data Terminal Equipment (DTE)

The equipment which provides the data source and/or receiving end of a data transmission link. The DTE may be a personal computer, a printer, a front-end processor to a large mainframe computer or any other device which can transmit or receive data. With RS-232 connections the designation of DTE or DCE determines which device is responsible for generating certain control signals. See also Data Communications Equipment.

Data Terminal Ready (DTR)

An RS-232 control signal used to indicate the readiness of the DTE for data transmission.

DB9

A port connection used in RS-232 convention with 9 pins.

DB25

A port connection used in RS-232 convention with 25 pins.

DCD

An acronym for Data Carrier Detect. See also Carrier Detect.

Dedicated Line

A communications line which is not dialled. Also known as a leased or private line.

Decibel (dB/dBm)

Unit of measure indicating the logarithmic ratio of output signal power to input signal power. dB is relative to Watts while dBm is scaled so that is relative to milli-Watts.

Default

A value, action or setting that is automatically used by a computer system when no other explicit information has been given.

Demodulate

To recover the information being transmitted by a modulated signal. For example, a conventional radio receiver demodulates an incoming broadcast signal top convert it into sound emitted by a speaker. See also Modulate and Modem.

Dial Tone

A call progress signal returned by a telephone switching machine to indicate that it is ready to accept a telephone number. ATDT (Hayes™ commands) supported for compatibility.

Dial-up

Establishing a temporary connection to a remote system or computer.

Digital Signal

A signal composed of discrete signal levels as opposed to the continuous signal levels of an analog signal.

DIP Switch

Acronym for Dual In-line Package. Options chosen by pushing a switch to one of two positions.

Distortion

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Undesired change in a signal's original waveform resulting from the characteristics of the transmission circuits or other external influences.

Downloading
Refers to the transferring of software from a remote system to your computer.

DTE
An acronym of Data Terminal Equipment. See Data Terminal Equipment.

Dual Port Control
The ability of the RFI-9256 modems to communicate out of both the Aux and Main ports to either the Aux or Main port of the receiving modem.

Dumb Terminal
Terminals that do not contain an intelligent microprocessor and usually send data one character at a time.

Duplex Transmission
Independent, simultaneous, two-way transmission.

E

Echo
The re-transmission of characters received by either the modem or remote system back to the DTE.

EIRP
Effective Isotropic Radiated Power.

End Point Radio
Radios that are connected to the data device, such as SCADA/Aquisistion/PC. As opposed to a repeater.

Escape Guard Time
The amount of time for which no activity is allowed on the data line before and after the sequence is entered, otherwise the escape sequence will be ignored.

Even Parity
Even parity refers to the addition of a 0 value or 1 value bit to the data bits which form a character to cause an even number of 1 value data bits to be sent. See also Parity.

Extension Numbers
The numbers that must be placed after the destination radio's number, to access the required port (internal or external). Only available in Point to Multipoint mode.

F

Fault Log
Contains a list of modem faults since the log was last cleared.

Firmware
Computer program stored permanently in Flash Memory.

Flash Memory
Non-volatile memory for storing programs and configuration data.

Flow Control
Controls the flow according to the readiness of the associated terminals to receive and transmit data. May be controlled with hardware or software.

Frame
See Block.

Frame Time
Specifies the maximum length of each packet frame (larger the time, the more information that can be contained within the frame).

Forward Error Correction (FEC)
Technique of transmitting additional information with the original data so that if small errors are detected the correct information can be recreated by the receiving end without requiring a retransmission.

Full Duplex
Data transmission which allows data to flow in two directions at the same time.

G

Gateway

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An electronic connection that joins similar networks together, for example IP to IP. Generally transparent to the user.

H

Half Duplex
Data transmission in which data may flow in either direction at one time, but not both directions simultaneously. Transmission direction is alternatively switched to allow two way flow of data.

Handshake
A predetermined interchange of signals between two devices to establish conditions for a transfer of data.

Hang-up
Termination of the Communications Link. As with a normal phone call, the phone must be hung-up so that you can call and receive other calls.

Hang-up on DTR
Only available with the Main Port. If activated, will terminate the Communication Link when the Data Terminal Ready pin is low.

Hardware
The electronic or electro-mechanical devices in a computer system as opposed to the programs or software.

Hardware Handshaking
The use of special RS-232 signals to halt or commence the flow of data between two computers or terminals, between computers and modems or between facsimile machines. See also Software Handshaking, RTS and CTS.

Hayes™
Company that designed the AT commands.

Hertz (Hz)
Unit of frequency, one cycle per second.

Hopping Pattern
Pattern to which the modem jumps through the frequency spectrum as it transmits and receives information. There are 32 hopping patterns available, all modems that are to communicate with each other must have the same hopping pattern.

Host Computer
A computer that manages information for many terminals. A host computer may be mainframe, minicomputer or a microcomputer.

I

Input
Information transferred into a computer from some external source, such as the keyboard, a disk drive, a modem or a scanner. Also, the act or process of transferring such information.

Input/Output Device
A device that transfers information into or out of a computer.

Interface
A physical point of interconnection between two devices where electrical signal levels, timing, handshaking and pin numbers are defined. The devices, rules or convention by which one component of a system communicates with another.

Interference
Undesirable disturbances or distortions in a data transmission signal.

I/O
Input/Output. The transfer of information into and out of a computer.

K

Kermit
Kermit is a file transfer protocol developed for operating systems which could not support the XModem protocol.

L

Light Emitting Diode (LED)
A diode which glows when a current flows through it. Often used as an indicator light.

Link
A circuit or transmission path, including all equipment, between a sender and a receiver.

Local Echo

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A method of communication in which your modem or software displays data locally on your screen, without relying on the host computer to echo the characters back.

Local Command State

Also called Terminal Command State. When a computer is communicating with a local modem. The local mode, assumes all commands are for it and acts on the AT commands. As opposed to being connected to a remote modem (see On-Line State).

Local Rx Address

4 digit phone number/address of the modem that you are dialling. Each modem, within a point to multipoint network, must have a unique Rx address, otherwise more than one modem will be dialled. Used when dialling a remote modem. In point to point communication, there is no dialling so it does not matter if both modems have the same Rx Address.

Log

List of information concerning the modem. See Fault Log, Physical Layer Log, Serial Layer Log.

Loop-back

Directing signals back toward the source at some point in the communications path. Used in testing RFI-9256.

M

Main Port

Port connected to full RS-232 (7 wire) cable. Cable contains Tx, Rx, DCD, RTS, CTS, DTR, and ground. Allows hardware flow control (hardware handshaking).

Master

Active Modem that synchronises the slave modems to enable the transmission of information. Can communicate with all slaves in its network.

Modem

Modulator/Demodulator. A device to convert data from a computer or terminal into a form suitable for transmission across a telephone system.

Modem Returns Response Codes

Suppresses (when activated) the Response Codes, so that they are not displayed on the terminal.

Modem Eliminator

A usually passive device which takes the place of a modem between a local terminal which requires a modem and a computer. Also called Null Modem.

Modulate

To modify or alter a signal so as to transmit information. For example, conventional broadcast radio transmits sound by modulating the amplitude or the frequency of a carrier signal. See also Demodulate and Modem.

Multiplex

To interleave or simultaneously transmit two or more messages on a single channel.

N

NAK

Negative Acknowledgment. This control character indicates that the last block transmitted was in error and that the receiver is expecting a re-transmission.

Network Address

If the modem is a master, then this is the network identification number. Slaves are synchronised by the master that has the same network address. A radio will ignore messages originating from radios with differing addresses. Must be the same for all radios within a network.

Network Fail Timeout

The length of time that the system will wait after a signal is lost before trying to re-synchronise.

Network Identification Number

See Network Address

Node

A point of interconnection on a circuit.

Noise

Random electrical signals introduced by components of the circuit or natural disturbances which can produce errors in transmission.

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Non-Volatile Memory
Stores data/programs/configurations without the need for a battery backup. Will not be erased if there is a power failure. Nearly permanent.

Null Modem
See Modem Eliminator.

O

Odd Parity
Odd parity refers to the appending of a 0 or 1 value bit to the data bits of a character to ensure that an odd number of 1 value bits are sent. See also Even Parity and Parity.

Off-line
Describes to state of a connection as not in session or not currently connected. There is no communications link between the modems, system has not dialled.

On-line
Describes to state of a connection as in session and currently connected. The system has dialled and a communications link has been formed allowing the transfer of data. On-line LED on front of RFI-9256 is activated.

On-line Requests Timer
Controls the time between slave integrity checks by the master.

On-line State
When a Communications Link is established and dialogue is between your computer and a remote system. The local modem assumes that all information from your computer is to be sent on to the remote modem. All AT commands are ignored by the local modem but are acted upon by the remote modem. See also Local Command State.

On-line Time
The amount of time spent on-line with an information service.

P

PABX
Private Automatic Branch Exchange. An automatic switchboard for handling large concentrations of telephones (extensions).

Packet
Group of bits including data and control elements that are transmitted as a whole.

Packet Switched Network
System where messages are transmitted in packets, each individually addressed and routed through the network.

Packet Timer
Sends the packet of information when no information has been received for the specified length of time.

Parity
A simple method of error checking by which the number of data bits received are added together to ensure that the correct number have been received.

Password
Password protection for the menu to prohibit unauthorised menu access and the ability to alter the radio's settings. Consists of 12 to 18 Alpha-numeric characters.

Peripheral (Peripheral Device)
A device, such as a video monitor, disk drive, printer or modem, used in conjunction with a computer. Often (but not necessarily) physically separate from the computer and connected to it by wires, cables or some other form of interface.

Physical Layer Logging
Shows the modem statistics relating to the quantity of data throughput.

Point-to-Multipoint Communication
One radio (the master) communicates with more that one slave, while each slave can only talk to the master. As opposed to Point to Point Communication.

Point-to-Point Communication
A connection between two points only. Communications established automatically with the RFI-9256 and is not controlled by the AT commands. As opposed to Point to Multipoint Communication..

Port

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The point of connection, usually a physical connector, between a computer and a peripheral device, another computer or a network.

Propagation Delay
The time required for a signal to travel from one end of a circuit to another.

Protocol
A set of conventions controlling the timing and format of data communications between two pieces of communications equipment.

Public Switched Telephone Network (PSTN)
Telephone system providing circuit switching to many customers.

Pulse
An abrupt and relatively short change in voltage, either positive or negative, resulting in the conveyance of data in a circuit.

R

RAM
Random Access Memory. RFI-9256 has 64k on board. See technical specifications page 17.

Received Line Signal Detector
See Carrier Detect.

Redundancy Check
Technique of error detection involving the transmission of additional data related to the message so that the receiving device can determine if the data transmitted is valid (error-free).

% Registers
Registers inside the modem that usually contain string values. Can be read and altered on a remote modem using a Communications Link. Examples include Unit Name, Security Code and Local Address.

Remote Configuration
The accessing of information from a remote radio and the ability to change the remote radio's attributes via a Communications Link.

Remote System
A another PC or network that can be communicated with via modem.

Repeater
Radio that receives and repeats the signal in a communications path, to extend the range between the End Point Radios. They do not act on the information, only pass it on.

Request to Send (RTS)
Control signal by the DTE to inform the DCE that it is ready to transmit data. When used for flow control between the DTE and the modem, this signal indicates to the modem that the DTE is ready to accept data. Used mainly in half-duplex communications.

Response Codes
Also called Result Codes. Screen messages that indicate what the modem is doing. For example, OK will appear when a command has been executed successfully.

RF Channels
Steps or intervals of frequency divisions in the 915-928MHz spectrum. 51 channels available.

Routing Table
A table that is used by the radios to convert packet addresses into radio addresses.

Router
Guides data through a network by the address of the data.

RS-232C
Frequently shortened to RS-232. A standard which defines the physical and electrical interface between Data Communications Equipment and Data Terminal Equipment. The most commonly used interface between modems and computers. Also known as ITU-T V24.

RSSI Trigger Level
Signal threshold/trigger level in dBm. This is the level at which the radio decides what it is hearing is no longer noise.

RTS/CTS

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Control characters for hardware handshaking.

RTU

Acronym for Remote Terminal Unit. Device attached to remote radio.

Rx

Abbreviation for Receive.

S

Security Code

4 digits, same as a PIN number. The code is known only to the user and protects the user from interference from other networks using RFI-9256 modems.

Serial Data

Data transmission in which each bit of information is sent sequentially through a single data path.

Serial Logging

Shows information regarding the performance of both serial ports.

Serial Port

Port that receives/transmits serial data. The RFI-9256 has two serial ports, the Main and Auxiliary (Aux) ports.

Simplex

Data communications in one direction only.

Slave

Passive modem. Requires a Master to synchronise timing to enable successful transmission. May initiate communication, but can only communicate with the Master.

Software

Computer program or set of computer programs held in storage, and loaded into RAM for execution.

Software Handshaking

A method of controlling the flow of data between two computers or terminals. Special control characters are sent from one terminal to the other in order to halt or recommence the flow of data. See also Hardware Handshaking.

Spread Spectrum Modem

Modem that operates within a frequency band (as opposed to operating at a single, fixed frequency), jumping through the frequencies according to the Hopping Pattern.

Spread Spectrum Standard

Standard that specifies the way in which the frequencies of the spread spectrum are to be utilised.

S Registers

Registers, inside the modem, that contain whole number values. These can be read and obtained from remote modems by using a communications link. Examples include Escape Sequence Guard Time, Number of Retries for ARQ.

Start Bit

When a character is transmitted asynchronously to another computer, a start bit always precedes the actual data. Seven or eight data bits, an optional parity bit and a stop bit will follow.

Stop Bit

The last bit or element transmitted in asynchronous transmission of a character to return the circuit to an idle state. One or two stop bits are sent at the end of each character of data.

Synchronous

A data transmission in which the time between characters is fixed by synchronising the transmitting and receiving communications equipment. The clock signal is typically derived from the data stream in order to maintain synchronisation.

T

Telecommunications

The transmission of information across long distances, such as over telephone lines.

Terminal

An input/output device consisting of a typewriter-like keyboard and a display device, used for communicating with a large computer. Any device capable of sending and/or receiving data over a communications channel.

Terminal Emulation

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Refers to the type of ASCII terminal your software will imitate (the control characters used to perform certain screen and cursor movement tasks vary from one terminal to another).

Terminal Program

Also called Terminal Software, terminal package, emulator. Computer program that deciphers the information received from the modem and send information to the modem as required.

Test Link Margin

Displays the average signal and noise the modem is measuring.

Text

The message portion of a data block in synchronous data transmissions.

Transmit Power

Power of signal emanating from the antenna. This should be the minimum required to maintain a solid data link.

Turnaround Time

The time required to reverse the direction of transmission when operating in half duplex mode.

Tx

Abbreviation for Transmit.

U

UNIMODEM PnP Response

The unit response to a PnP (Plug and Play) query.

Unit Name

User defined name for radio. May be used to indicate radio position or other identifying feature.

Upload

Refers to sending files or text from the user's computer to another user.

V

Virtual Hayes Connection

Interface for communication with and management of a remote radio.

W

Wait Time for Connect

Time the radio will wait for valid connection, before indicating communication unsuccessful.

Whip Antenna

Small antenna (usually approx. 15 cm)

X

XModem

A communications protocol developed in the late '70s by Ward Christensen to perform error checking on data being sent between two computers. See Kermit.

XON/XOFF

Special control characters used to control the flow of data between your computer and a remote system. See Software Handshaking.

Y

Yagi Antenna

Directional antenna.

Z

ZModem

Designed to rectify limitations of previous models as well as providing support for high speed, packet and network communications environments.

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NOTES

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