

ENERDYNE

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ENC1000A94-00 thru -06, -CO, -EF, -LW Video Compression Encoder

User Manual

**Manual Part No.
ENC1000A9400MAN**

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Chapter 1 Introduction

About This Manual

This manual, P/N ENC1000A9400MAN, is a user guide for the ENC1000A94 Video Compression Encoder, a member of Enerdyne's family of ADVS[®] compatible video encoders. The ENC1000A94 is a compact, self-contained, airborne qualified unit requiring 28 VDC power (Figure 1-1).

This manual contains the information required to install, operate, and maintain the ENC1000A94. If you have questions or problems that cannot be resolved using this manual, please contact Customer Support at 877-363-7396 for assistance.

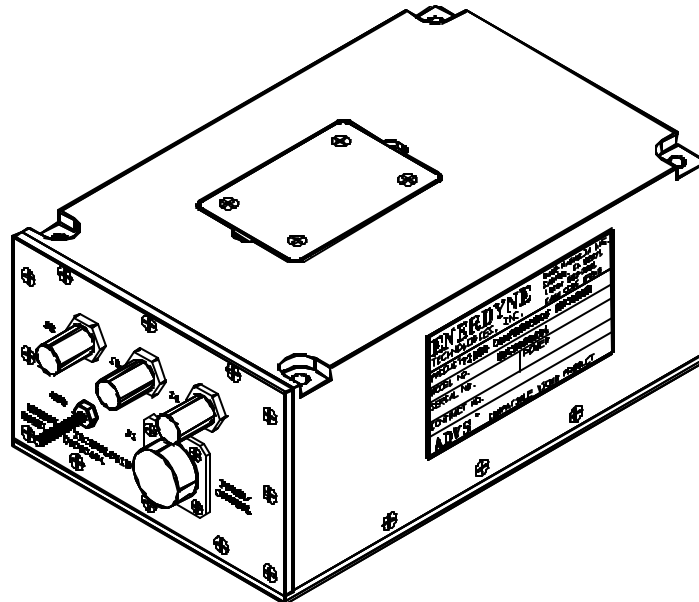


Figure 1-1 ENC1000A94 Airborne Video Compression Encoder

Theory of Operation

Encoder Functional Description

The ENC1000A94 Encoder digitizes and compresses any of the analog video signal formats listed in Table 1-1. A Data Multiplexer provides an interface for user supplied PCM data, audio or EIA-232 data. The encoder and the multiplexer are controlled via the EIA-232 control port using a dumb terminal or a PC with a terminal emulation program.

Table 1-1 Analog Video Input Formats

| Color | Monochrome |
|----------------|------------|
| NTSC Composite | EIA-170 |
| NTSC Y/C | CCIR |
| PAL Composite | |
| PAL Y/C | |

Figure 1-2 is a functional block diagram of the encoder system. Up to three video sources may be connected to the video inputs (J2-J4). The Analog-to-Digital (A/D) converter changes the selected input video signal to a digital format. The digital video is then compressed and routed to the Parallel/Serial Converter. The compressed video is converted from parallel data to serial data, and routed to the Data Multiplexer, where user data (PCM data, audio or EIA-232 data) is multiplexed with the compressed video data stream. The interface adapter provides one system clock output and one buffered data output. The encoder can be configured to clock the data outputs using the ENC1000A94 internal clock or an externally supplied clock signal. The external clock input is factory selectable as either EIA-422 or TTL/CMOS. The PCM clock and data inputs are factory selectable as either EIA-422 or TTL/CMOS. The EMUX audio data channel is not available if EIA-422 PCM inputs are ordered. When the TTL/CMOS setting is ordered, TTL or CMOS interface may be user selected via the encoder control port.

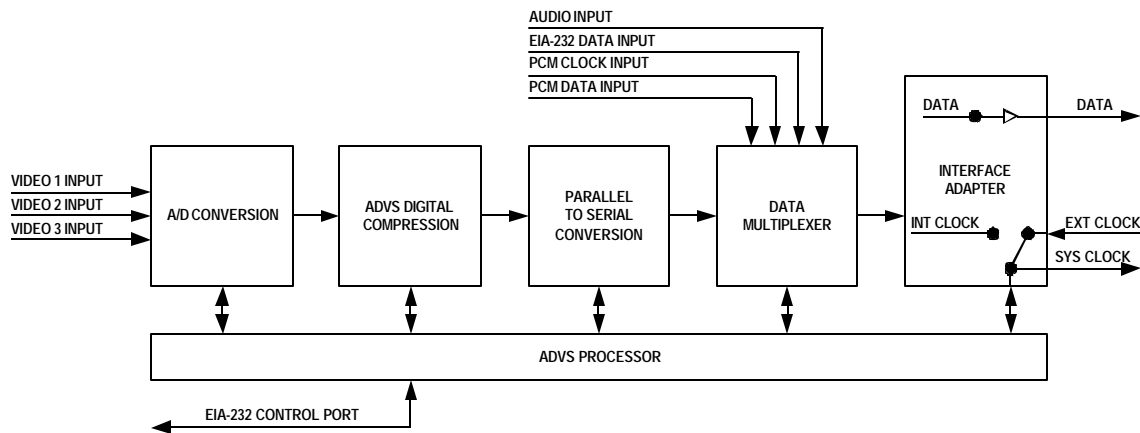


Figure 1-2 ENC1000A94 Functional Block Diagram

Data Multiplexer Format

The Data Multiplexer (Figure 1-3) allows the user to combine compressed video, audio, asynchronous digital, and synchronous digital data into one transmission over any digital transmission facility. The audio data channel accepts a 1 Vp-p, 600 ohm audio signal and provides a frequency response of 300 Hz to 3000 Hz. The simplex asynchronous data channel is an EIA-232 interface and is user programmable from 300 baud to 9600 baud in eight steps. The PCM synchronous data channel accepts PCM data and clock. PCM input level is factory

preset as either TTL/CMOS or EIA-422 (audio input is not available when EIA-422 PCM inputs are ordered). The user supplied PCM clock rate may be as high as 49% of the total transmission link frequency. Additionally, a Forward Error Correction (FEC) feature is available for systems using wireless transmission. See Appendix A of this document for a detailed discussion on configuring the Data Multiplexer.

FEC allows the user to transmit data in a noisy environment by correcting a number of bit errors received at the ground site. The scheme used by Enerdyne is a Reed-Solomon based algorithm. The encoder applies a Reed-Solomon algorithm that generates check bytes for a transmission message. The check bytes and message data form an error correcting code word that can be transmitted over noisy transmission media. The decoder at the receiving end uses the check bytes to detect and correct any errors that are introduced by noise into the transmitted code word. If used, FEC must be selected at both the encoder and decoder. There are four coding levels using two, four, six or eight check bytes to correct one, two, three or four data bytes in each twenty-five-byte packet. The level of FEC is user selectable.

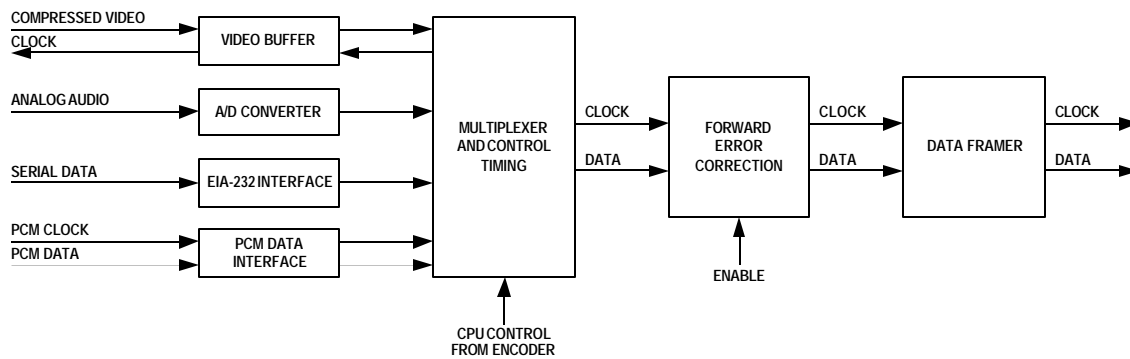


Figure 1-3 Data Multiplexer Functional Block Diagram

Typical Applications

Figure 1-4 shows an example of a typical user installation for the ENC1000A94. Various configurations are possible and are dependent upon user requirements and equipment.

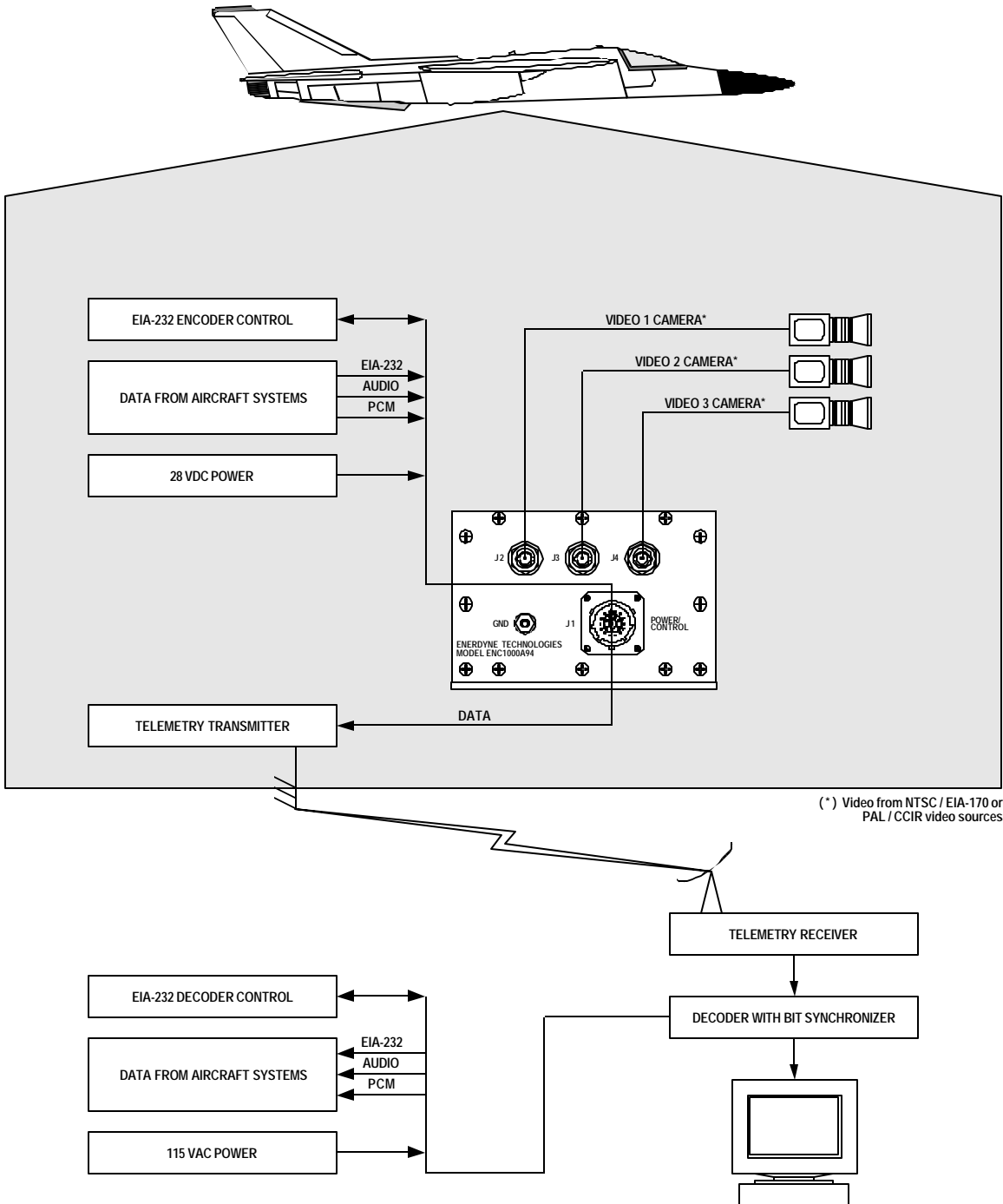


Figure 1-4 Typical Application of ENC1000A94

Specifications

Table 1-1. ENC1000A94 Video Compression Encoder Specifications

| ELECTRICAL | |
|---------------------------|---|
| Video Inputs | NTSC composite, 1 Vp-p, 75 Ohm, 60 Hz PAL composite, 1 Vp-p, 75 Ohm, 50 Hz NTSC Y/C Component, 1 Vp-p, 75 Ohm, 60 Hz PAL Y/C Component, 1 Vp-p, 75 Ohm, 50 Hz CCIR Monochrome, 1 Vp-p, 75 Ohm, 50 Hz EIA-170 Monochrome, 1 Vp-p, 75 Ohm, 60 Hz |
| Video Input Connector | TNC type isolated ground (3) |
| Horizontal Resolution | 560, 280 or 140 pixels/line, user selectable |
| Vertical Resolution | 240 lines/field digitized, 480 lines/frame, 60 Hz 288 lines/field digitized, 576 lines/frame 50, Hz |
| Data Output Rates | 19 Kbps to 13.3 Mbps (10 Mbps with multiplexer options) |
| Data Output Connections | 22-pin circular connector (Table 3-1) |
| Power | +28 VDC \pm 20% , 8.5 Watts, typical |
| MECHANICAL | |
| Dimensions | 4.50 inches wide x 7.00 inches deep x 3.00 inches high |
| Weight | 50 oz. |
| Enclosure Materials | 5052 aluminum, stainless steel hardware. |
| Enclosure Materials | Machined aircraft aluminum chassis, stainless-steel hardware. |
| ENVIRONMENTAL | |
| Operational Temperature | -40°C to +85°C normal range |
| Non-Operating Temperature | -55°C to +85°C |
| Humidity | 95% maximum (noncondensing) |

Chapter 2 Encoder Operation

Series 1000 Encoding Equipment

This chapter provides detailed explanations of each operating mode and option available for the ENC1000A94 ADVS[®] compatible Video Compression Encoder.

Software Interface

The encoder contains all of the software required to communicate with terminal hardware. The user must provide only a dumb terminal operating at 9600 baud or a PC running terminal-emulation software set for half-duplex (local echo) mode.

Upon power-up, the encoder-to-terminal link displays power-on test messages, followed by the logon message.*

```
ENC1000A94   Firmware   Rev    6.5    970722-  
0930/Xe51_a6  
(c) 1993-1999 Enerdyne Technologies Inc. All rights  
reserved.
```

```
Multiplexer Firmware version is 62
```

```
Lca configured from Eprom.  
DCT is setup.  
Formatter is setup.  
ADVS encoder configuration is completed.
```

```
The firmware checksum is 9403 verified as  
correct.
```

*This is a typical power-on message sequence. The actual message sequence varies with the software revision and installed options.

Following the power-up messages, the system prompt is displayed:

```
ADVS:\Encoder>
```

The prompt text can be customized with the **PR** command. See **PR** command in this chapter for details.

There is *no* battery in the system. All software configuration values are stored in an EEPROM and are retained through power-off/power-on cycles.

Manual Programming

The manual programming interface consists of a four-character alphanumeric display and four momentary action push buttons located under the display cover plate (Figure 1-1). Normal (inactivated) mode is indicated by a right to left decimal point animation. This indicates that the encoder is operating properly. Manually program the encoder as follows:

1. Remove the display cover plate.
2. Momentarily depress the MODE button. The word MODE will appear in the display. Each depression of the MODE button will sequence through the modes. The “+” and “-” buttons will sequence through the available values for the mode selected.
3. Once the mode and value have been selected, depress the enter button to store the setting in the EEPROM.
4. Repeat steps 2 and 3 to make the desired settings.
5. Replace the display cover plate.

Using the Software Interface

Software commands are entered at the system prompt. They may be either a single word, or a single word followed by a space and an argument string. The software is not case sensitive. Upper and lower case alpha characters are interpreted as the same value. Depressing the ENTER key (RETURN key) executes the command.

Commands must be entered at the system prompt, one command at a time. Command sequences, executed in rapid succession, before the system prompt returns to the screen, are not buffered for execution, and may cause truncated character strings to appear in the command field when the prompt is redisplayed. When this occurs, the error message below is displayed:

```
[String] < was an invalid command.
```

Use the BACKSPACE key to edit incorrect entries. If a system prompt fails to appear, press the ENTER key to display the prompt. If the prompt still fails to appear, check all connections and ensure that the terminal is set to 9600 baud.

In addition to a default single-word or character command structure, some of the commands permit the use of alternate command entries. These alternate entries are shown in parenthesis. Where applicable, the default settings are identified by the word *default* next to the appropriate

character string. The command set currently supported by the system software and hardware follows. Type **HELP** or **?** followed by ENTER to display this command list.

BAUD nn

This command selects the baud rate for the serial communications port. The baud rate actually changes, however, only after the encoder is reset. The baud rates supported follow:

| nn | rate |
|-----------|---------------------|
| 00 | 300 baud |
| 01 | 300 baud |
| 02 | 300 baud |
| 03 | 19200 baud |
| 04 | 1200 baud |
| 05 | 2400 baud |
| 06 | 4800 baud |
| 07 | 9600 baud (default) |

CAUTION

Communication with the serial port may be lost if an invalid baud rate is selected. It is recommended that the baud rate be set to the highest rate supported by the terminal.

BR nn (BRIGHT nn)

This command sets the picture brightness level of the encoded signal. There are 256 steps of picture brightness. All values from 00 to FF HEX may be used. The normal (default) setting is HEX 00. The list below shows examples of typical HEX values used to define picture brightness levels:

| nn | relative brightness |
|-----------|----------------------------|
| 80 | Minimum |
| 81-FF | |
| 00 | Normal (default) |
| 01-7E | |
| 7F | Maximum |

CD nn (CLOCK nn)

This command sets the serial-link clock rates. Valid frequencies are from 13.3 Mbps to 19 Kbps. Hex values of 08 to 2D select fixed frequencies. The command **HELP 03** displays the list of valid entries. An external clock can be selected by entering the hex value **2E**. The T1 phone frequency of 1.544 can be selected by entering the hex value **2F**. The available frequencies follow:

| Frequenc y | Hex Value | Frequenc y | Hex Value | Frequenc y | Hex Value | Frequenc y | Hex Value |
|---------------|-----------|---------------|-----------|---------------|-----------|---------------|-----------|
| 13.3 | 08 | 1.67 | 13 | .250 | 1E | .039 | 29 |
| 10.0 | 09 | 1.42 | 14 | .208 | 1F | .031 | 2A |
| 8.00 | 0A | 1.25 | 15 | .178 | 20 | .026 | 2B |
| 6.67 | 0B | 1.00 | 16 | .156 | 21 | .022 | 2C |
| 5.71 | 0C | .833 | 17 | .125 | 22 | .019 | 2D |
| 5.00 | 0D | .714 | 18 | .104 | 23 | Ext Clock | 2E |
| 4.00 | 0E | .625 | 19 | .089 | 24 | 1.544 (T1) | 2F |
| 3.33 | 0F | .500 | 1A | .078 | 25 | | |
| 2.85 | 10 | .416 | 1B | .062 | 26 | | |
| 2.50 | 11 | .357 | 1C | .052 | 27 | | |
| 2.00 | 12 | .312 | 1D | .045 | 28 | | |

CONTRAST mn

This command sets the contrast level of the encoded signal. There are 256 steps of picture contrast. All values from 00 to FF HEX may be used. The normal setting is 6C HEX. The list below shows examples of typical HEX values used to define contrast:

| | |
|-----------|-----------------------|
| mn | Contrast Level |
| 00 | Minimum |
| 01-6B | |
| 6C | Normal (default) |
| 6D-FE | |
| FF | Maximum |

CROP mn

This command sets the current screen cropping value. Cropping reduces the actual number of pixels per video frame that are included in the image that is compressed and transmitted. A value of 00 HEX processes the entire video area lines, plus the normally blanked data lines starting at line 10. A value of 01 HEX processes the entire video area, but excludes data lines below line 20. A value of 02 HEX processes the entire visible image area, excluding the overscanned areas around the edges of the picture (some monitors may display blanked video around the edges - this is normal). A value of 03 HEX digitizes and processes the center 'window' of the screen. **CROP 04** and **05** perform the same functions as **CROP 00** and **01** respectively, except that 6% more of the NTSC signal (3% at each end of a video line) is encoded to ensure that edge encoded data is consistently recovered. In **CROP 04** or **05**, each line of video is 594 pixels (560 plus 6%) instead of the normal 560 pixels. The additional pixels on each end of a video line are outside the normal viewing area. **CROP 04** and **05** require 6% more bandwidth to maintain the same frames per second yielded by **CROP 00** or **01**.

| nn | Percent of Total Lines |
|-----------|--|
| 00 | 104% standard video |
| 01 | 100% standard video |
| 02 | 85% standard video |
| 03 | 63% standard video |
| 04 | 104% standard video with edge encoded data |
| 05 | 100% standard video with edge encoded data |

NOTE

The CROP command is not functional when the encoder is operating in the interlaced mode.

DATE mm:dd:yy

This command sets the default date used by the system. The date is entered in the month/day/year format and does not automatically increment. When power is lost or a reset occurs, the system date is set to the last date entered.

DEFAULT nn

This command resets all of the internal EEPROM variables to one of the two factory default settings. After this command is executed, a reset (Z or RESET command) should be performed. Default values may be set to the following:

| nn | Default Variables |
|-----------|--|
| 00 | Standard NTSC encoder with 560 pixels, 5 Mbps bit rate, quantization set to 18, tint, saturation, contrast, and brightness are set to default values |
| 01 | Standard PAL encoder with 560 pixels, 5 Mbps bit rate, quantization set to 18, tint, saturation, contrast, and brightness are set to default values |

To execute this command, the write protect mode must be disabled. To disable write protect enter the **PROTECT OFF** command. (The **PROTECT ON** command is automatically executed after the **RESET** command is entered. Consultation with the factory is recommended before any additional changes are made with write protect disabled.)

NOTE

When write protect is disabled, configuration data can be changed or invalid data conditions may be entered.

ERROR *nn*

This command enables or disables the error handling hardware. This parameter *must* be the same at the encoder and decoder. Entering a value of **00** disables the mode; entering a value of **01** enables the mode. If enabled, the unit will exhibit a much greater tolerance when decoding unrecoverable errors, but requires about 10% more from the system when compared to the disabled mode. This command must be followed by a reset.

| nn | Status |
|-----------|---------------|
| 00 | OFF |
| 01 | ON |

FPANEL *nn*

This command sets the front panel alphanumeric LED display brightness. Entering a HEX value of **03** restores 100% brightness. Entering a HEX value of **02** generates 50% brightness. A HEX value of **01** generates 25% brightness. The brightness should be set to the minimum setting required to conserve power.

HELP (?)

This command invokes the main help screen. Secondary help screens can be invoked with the **HELP *nn*** commands below. If video sync is lost and regained while viewing the help screen, video at the monitor is not restored until the help screen is exited.

HELP *nn*

| nn | Help Screen |
|-----------|-----------------------------------|
| 00 | Troubleshooting hints, baud rates |
| 01 | Factory assistance |
| 02 | Hardware interconnctions |
| 03 | Clock modes |
| 04 | Video input modes |

ID *nn*

This command embeds a video channel identification code in the compressed video data packets output by the encoder. The normal default value is HEX 00. Ensure that the decoder is also programmed to receive the video channel ID selected. Encoders and decoders that do not have this command fix this code at HEX 00.

| nn | Channel ID |
|-----------|-------------------------------|
| 00 | Channel 1 ID on current video |
| 01 | Channel 2 ID on current video |
| 02 | Channel 3 ID on current video |
| 03 | Channel 4 ID on current video |

INTERLACE ON/OFF

This command sets the system operation to either interlaced (**ON**) or non-interlaced (**OFF**) operation. Normal operation is non-interlaced. NOTE: Interlaced operation is designed to be used only when sufficient is available to maintain 30 frames per second (30 Hz), otherwise interlaced operation may cause the video image to jump and appear to vibrate.

NOTE

Interlace mode will not function properly when crop mode is selected.
Enter **CROP 00** before selecting **INTERLACE ON**.

JACK m

This command allows the user to synchronously switch between the three inputs without reloading any other parameters. This results in almost instantaneous switching.

| mn | Input Number |
|-----------|---------------------|
| 00 | J2 |
| 01 | J3 |
| 02 | J4 |

If all video inputs are gen-locked, switching will be synchronous. After executing this command, the switch will occur at the end of the current source's vertical sync period.

MODE m

This command selects the system operating mode. This mode change requires several frames of video and remains in effect until it is changed again. The table below shows the currently supported modes (**HELP 04** displays this list).

| nn | mode |
|-----------|---|
| 00 | NTSC 3.58 MHz burst, 60 Hz composite input on J2 |
| 01 | NTSC 3.58 MHz burst, 60 Hz composite input on J3 |
| 02 | NTSC 3.58 MHz burst, 60 Hz composite input on J4 |
| 03 | NTSC 3.58 MHz burst, 60 Hz Y input on J3, C input on J4 |
| 04 | RS-170 60 Hz monochrome input on J2 |
| 05 | RS-170 60 Hz monochrome input on J3 |
| 06 | RS-170 60 Hz monochrome input on J4 |
| 07 | 60 Hz RGB input, R on J2, G on J3, B on J4 |
| 08 | PAL 4.43 MHz burst, 50 Hz composite input on J2 |
| 09 | PAL 4.43 MHz burst, 50 Hz composite input on J3 |
| 0A | PAL 4.43 MHz burst, 50 Hz composite input on J4 |
| 0B | PAL 4.43 MHz burst, 50 Hz Y input on J3, C input on J4 |
| 0C | CCIR 50 Hz monochrome input on J2 |
| 0D | CCIR 50 Hz monochrome input on J3 |
| 0E | CCIR 50 Hz monochrome input on J4 |

NOTE

The RGB converter option internally converts RGB input on J2 (R), J3 (G), and J4 (B) into NTSC format prior to digitization and compression.

NORMAL

This command sets the HUE, SATURATION, BRIGHTNESS, and CONTRAST parameters to their default values, which are HEX 00, 5A, 00, and 6C respectively.

NTSC

This command forces the system to accept standard 525 line NTSC video. This command performs the same function as **MODE 00**. It also executes the **NORMAL** command.

OPTION1 nn, OPTION2 nn, OPTION3 nn, OPTION4 nn

These commands configure the data multiplexer by enabling selected bits in each of four eight-bit registers. See Appendix A of this document for an overview of data multiplexer functions and a detailed presentation of the commands used to configure it.

PAL

This command forces the system to accept standard 625 line PAL video. This command performs the same function as **MODE 08**. It also executes the **NORMAL** command.

PROMPT mmmmmmm

This command changes the text of the system prompt. Up to eight alpha-numeric characters are accepted. Prompts entered using the PROMPT command are retained through reset.

Q mn (QUANT mn) or (QUANTIZATION mn)

This command sets the relative quantization level for the system. The Q value has a direct relationship to the amount of compression achieved. As with all DCT based systems, the compression level cannot be specified. The resulting compression level depends on quantization, resolution, picture content, and other system parameters.

Valid ranges for the variable are 10 to FF HEX, with 10 HEX being the best picture quality (minimum compression) and with FF HEX being very poor picture quality. As a rule of thumb, a Q value of 18 yields good quality, 28 yields average quality, and values greater than 50 yield poor quality.

There is a direct correlation between quantization and the number of frames per second (frame rate or speed). As the Q value decreases, the number of video frames per second decreases, with each individual video frame represented at a higher quality. Conversely, as the Q value is increased, the system throughputs more video frames per second, but at a lower pixel resolution. The quantization parameter is usually adjusted for every specific video situation, depending upon the video subject matter, overall data link speed (bit rate), and required resolution. If the Q value is adjusted too low (below 10) in relation to other system parameters, the input image can create an internal data file size that exceeds the amount of physical RAM. This condition causes what appear to be system errors. Keeping the Q value above 10 HEX avoids instances of such file overflow problems.

The decoder will automatically detect the Q value of the encoder and operate accordingly.

RES nn

High horizontal resolution roughly corresponds to laser disc quality, standard horizontal resolution to VHS quality and low horizontal resolution to multimedia-adequate quality. Each time the resolution is lowered, the frame rate will almost double, and vice-versa.

| nn | Resolution | Pixels |
|-----------|---------------------|---------------|
| 00 | low resolution | 140 |
| 01 | standard resolution | 280 |
| 02 | high resolution | 560 |

RESET (Z)

This command reinitializes all parameters from EEPROM and resets all internal timing.

SP (SPEED)

This command displays the current motion processing speed of the system in average fields per second: over the last two seconds, over the last 15 seconds, and over the last 60 seconds. This command also assists in determining resolution and Q values. On execution, speeds are displayed as follows:

Average fields per second, last 2 seconds = 030
Average fields per second, last 15 seconds = 030
Average fields per second, last 60 seconds = 030

S (STATUS)

This command displays all of the current operating modes that are stored in EEPROM. It also displays other current status and errors, if any.

SAT nn (COLOR nn) or (SATURATION nn)

This command sets the color saturation level for the selected video source. There are 256 steps of saturation, all values from 00 to FF are valid. The normal value is 59.

| nn | Saturation Level |
|-----------|-------------------------|
| 00 | Minimum (Monochrome) |
| 01-58 | |
| 59 | Normal (default) |
| 5A-FE | |
| FF | Maximum |

TEST nn

This command puts the system into VIDEO test mode. Solid colors are in the 00 to 1F HEX range. Entering the command **TEST** displays the list of colors. Entering the command **TEST 20** generates a color bar. The order of colors on the bar is white, yellow, cyan, green, violet, red, blue, and black. To return to normal operation after completion of this test, enter the **RESET** command.

TIME hh:mm:ss

This command sets the current system time. The time is entered in 24 hour military format. When a reset or power failure occurs, system time is reset to 00:00:00. System time is also reset to 00:00:00 when system setup parameters such as Quantization and Resolution are changed.

TINT nn (HUE nn)

This command sets the hue/tint for the selected video source. There are 256 valid steps, from 00 to FF HEX.

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| mn | Phase Shift |
|-----------|--------------------|
| 80 | Maximum Green |
| 81-FF | |
| 00 | Normal (default) |
| 01-7E | |
| 7F | Maximum Red |

NOTE

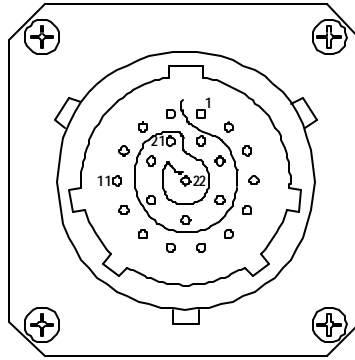
In PAL mode, TINT must be = 00.

Chapter 3 Installation and Maintenance

System Setup

This chapter describes the procedures for configuration, test, installation and maintenance of the ENC1000A94 unit. Initial system setup is performed on the bench using the test setup configuration shown in Figure 3-1. See Table 3-1 for 28 volt equipment pinouts.* All commands are entered on a CRT terminal or PC with terminal emulator software as described in Chapter 2. It is recommended that initial setup commands be invoked in the order in which they are presented in this section. Refer to Chapter 2 for encoder operation and commands.

Table 3-1 ENC1000A94 J1 22-Pin Circular Power/Control Pinouts



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| 422 SYS CLOCK/DATA OUT TTL PCM CLOCK/DATA IN TTL EXT CLOCK IN BALANCED AUDIO IN | |
|--|---------------------------|
| Pin | Signal Description |
| 1 | System clock out + |
| 2 | Signal ground |
| 3 | System clock out- |
| 4 | System data out + |
| 5 | Signal ground |
| 6 | System data out - |
| 7 | System control TXD out |
| 8 | System control RXD in |
| 9 | Signal ground |
| 10 | Biphase system data out |
| 11 | Signal ground |
| 12 | External clock in |
| 13 | Signal ground |
| 14 | Auxiliary RXD in |
| 15 | Signal ground |
| 16 | Audio in + |
| 17 | Audio in - |
| 18 | Signal ground |
| 19 | PCM clock in |
| 20 | PCM data in |
| 21 | Main power return - 0 VDC |
| 22 | Main power in + 28 VDC |

| TTL SYS CLOCK/DATA OUT TTL PCM CLOCK/DATA IN TTL EXT CLOCK IN BALANCED AUDIO IN | |
|--|---------------------------|
| Pin | Signal Description |
| 1 | System clock out |
| 2 | Signal ground |
| 3 | Signal ground |
| 4 | System data out |
| 5 | Signal ground |
| 6 | Signal ground |
| 7 | System control TXD out |
| 8 | System control RXD in |
| 9 | Signal ground |
| 10 | Biphase system data out |
| 11 | Signal ground |
| 12 | External clock in |
| 13 | Signal ground |
| 14 | Auxiliary RXD in |
| 15 | Signal ground |
| 16 | Audio in + |
| 17 | Audio in - |
| 18 | Signal ground |
| 19 | PCM clock in |
| 20 | PCM data in |
| 21 | Main power return - 0 VDC |
| 22 | Main power in + 28 VDC |

| 422 SYS CLOCK/DATA OUT 422 PCM CLOCK/DATA IN 422 EXT CLOCK IN NO AUDIO | |
|---|---------------------------|
| Pin | Signal Description |
| 1 | System clock out + |
| 2 | Signal ground |
| 3 | System clock out- |
| 4 | System data out + |
| 5 | Signal ground |
| 6 | System data out - |
| 7 | System control TXD out |
| 8 | System control RXD in |
| 9 | Signal ground |
| 10 | Biphase system data out + |
| 11 | Signal ground |
| 12 | External clock in + |
| 13 | External clock in - |
| 14 | Auxiliary RXD in |
| 15 | Signal ground |
| 16 | PCM clock in - |
| 17 | PCM data in - |
| 18 | Signal ground |
| 19 | PCM clock in + |
| 20 | PCM data in + |
| 21 | Main power return - 0 VDC |
| 22 | Main power in + 28 VDC |

| 422 SYS CLOCK/DATA OUT TTL PCM CLOCK/DATA IN TTL EXT CLOCK IN NO AUDIO 422 BIPHASE OUT | |
|--|---------------------------|
| Pin | Signal Description |
| 1 | System clock out + |
| 2 | Signal ground |
| 3 | System clock out- |
| 4 | System data out + |
| 5 | Signal ground |
| 6 | System data out - |
| 7 | System control TXD out |
| 8 | System control RXD in |
| 9 | Signal ground |
| 10 | Biphase system data out + |
| 11 | Signal ground |
| 12 | External clock in |
| 13 | Signal ground |
| 14 | Auxiliary RXD in |
| 15 | Signal ground |
| 16 | Biphase system data out - |
| 17 | Not connected |
| 18 | Signal ground |
| 19 | PCM clock in |
| 20 | PCM data in |
| 21 | Main power return - 0 VDC |
| 22 | Main power in + 28 VDC |

| TTL SYS CLOCK/DATA OUT TTL PCM CLOCK/DATA IN TTL EXT CLOCK IN NO AUDIO 422 BIPHASE OUT | |
|--|---------------------------|
| Pin | Signal Description |
| 1 | System clock out |
| 2 | Signal ground |
| 3 | Signal ground |
| 4 | System data out |
| 5 | Signal ground |
| 6 | Signal ground |
| 7 | System control TXD out |
| 8 | System control RXD in |
| 9 | Signal ground |
| 10 | Biphase system data out + |
| 11 | Signal ground |
| 12 | External clock in |
| 13 | Signal ground |
| 14 | Auxiliary RXD in |
| 15 | Signal ground |
| 16 | Biphase system data out - |
| 17 | Not connected |
| 18 | Signal ground |
| 19 | PCM clock in |
| 20 | PCM data in |
| 21 | Main power return - 0 VDC |
| 22 | Main power in + 28 VDC |

*** NOTE:**
As of the date of this publication forward, the Configuration label affixed to the body of the unit identifies the configuration profile specified for that unit. The items on this Configuration label directly correspond to one of the five configuration sets identified in the title areas of the Pinout Tables illustrated here. Units manufactured before the date of this publication carry a Configuration label which differs in terminology from the one presently in use. If you have questions on the pinout configuration of your unit, record the serial number of the unit, and contact Customer Support at 877-363-7396 for assistance.

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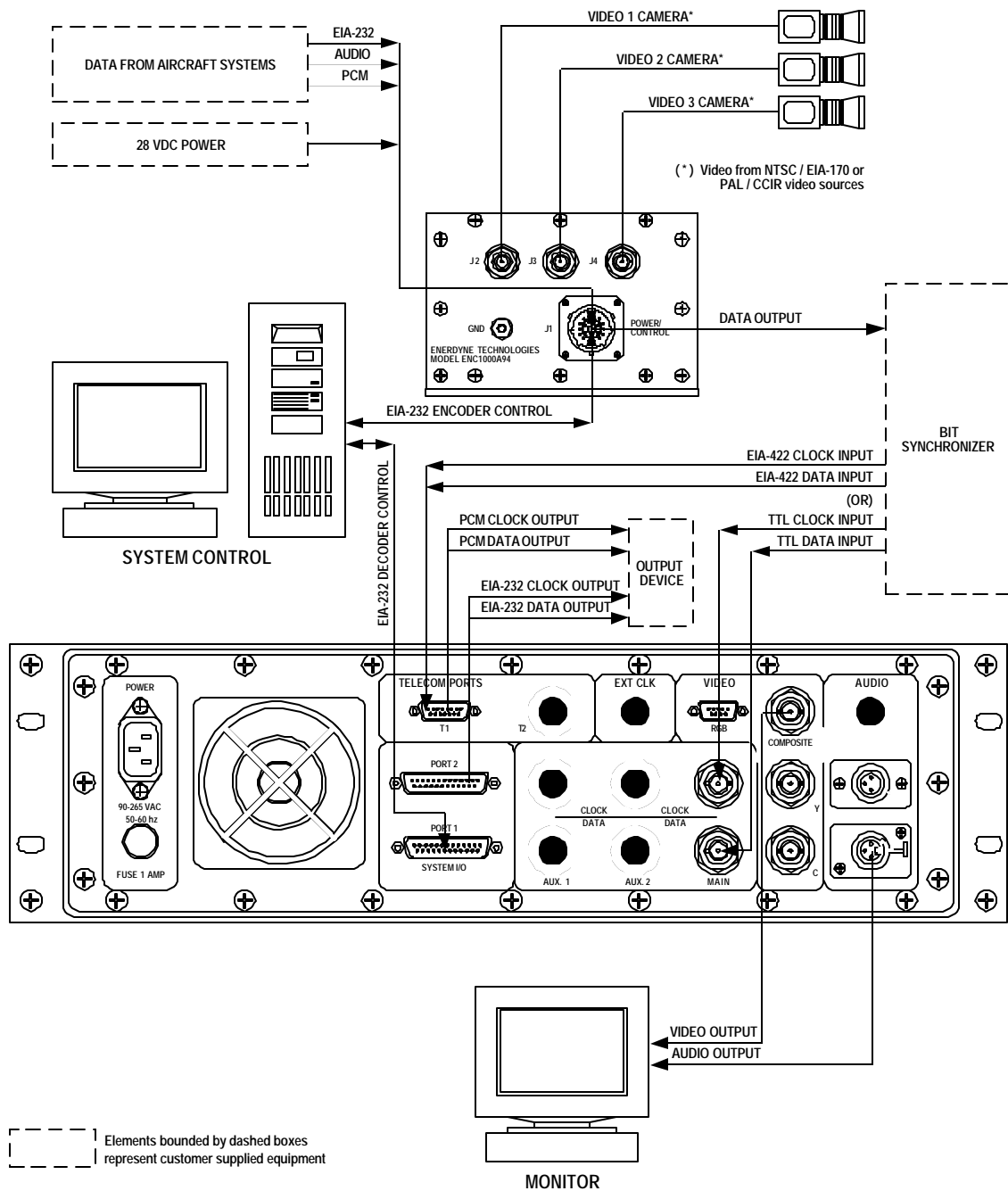


Figure 3-1 ENC1000A94 Test and Setup Configuration

Step 1 - Verify system control communications

All encoder and decoder commands are issued through a dumb terminal or through a PC with terminal-emulation software. One com port of this terminal is used to communicate with the encoder. Another com port is used to communicate with the decoder. See Table 3-1 in the respective encoder and decoder manuals to determine the proper pinout connections to these devices.

The steps outlined below presume a working knowledge of the terminal software sufficient to properly access the respective com ports for each device. Refer to Chapter 2 of the respective manuals for a complete description of available encoder and decoder commands.

Step 2 - Power up units

Configure the test system as shown in Figure 3-1 with the Data 0 ENCODER output connected to the bit synchronizer. The DECODER must be supplied with 115 VAC power using the line cord provided. The ENCODER must be supplied with 28-VDC power through pins 21 and 22 of the 22-pin connector. Power up both units, and ensure that the respective logon messages conform to the descriptions in Chapter 2 of each manual.

Step 3 - Set encoder clock rate

Use the ENCODER **CD** clock command to set the desired output clock rate to the data rate of the communications link. Typing **HELP 03** displays a complete list of possible inputs and their related link speeds. Use **CD 2E** to turn off the system clock if an external clock is supplied.

Step 4 - Set encoder resolution

Use the ENCODER **RES** command to set the desired encoder resolution. For example, enter **RES 02** for 560 pixels per line (high resolution) or enter **RES 01** for 280 pixels per line (standard resolution).

Step 5 - Turn encoder multiplexer off

Use the ENCODER **OPTION1 08** command, described in Appendix A, to disable the encoder multiplexer.

Step 6 - Set decoder demultiplexer options

Use the DECODER **OPTION** commands described in the decoder manual to configure the decoder demultiplexer data (audio, EIA-232 or PCM) and FEC options. The decoder configuration settings set by the **OPTION3** and **OPTION4** commands must be identical those set in the encoder.

Step 7 - Set encoder multiplexer options

Use the ENCODER **OPTION1 00** command, described in Appendix A, to enable the encoder multiplexer. Use the ENCODER **OPTION** commands described in Appendix A to configure Data Multiplexer data (audio, EIA-232 or PCM) and FEC options. The encoder

configuration settings set by the **OPTION3** and **OPTION4** commands must be identical to those set in the decoder.

Step 8 - Reset decoder

Following encoder configuration, reset the decoder using the RESET button on the front panel of the decoder. After reset, the decoder front panel LED display cycles through the current system settings, and a video picture is displayed on the monitor. System setup and test are complete.

Encoder Installation

Figure 3-2 illustrates the overall package dimensions and the mounting-hole pattern for the ENC1000A94. Special shock mounting or vibration dampening is not required. Mounting bolts should be protected from vibrating loose by the standard method for the platform. Proper grounding is required.

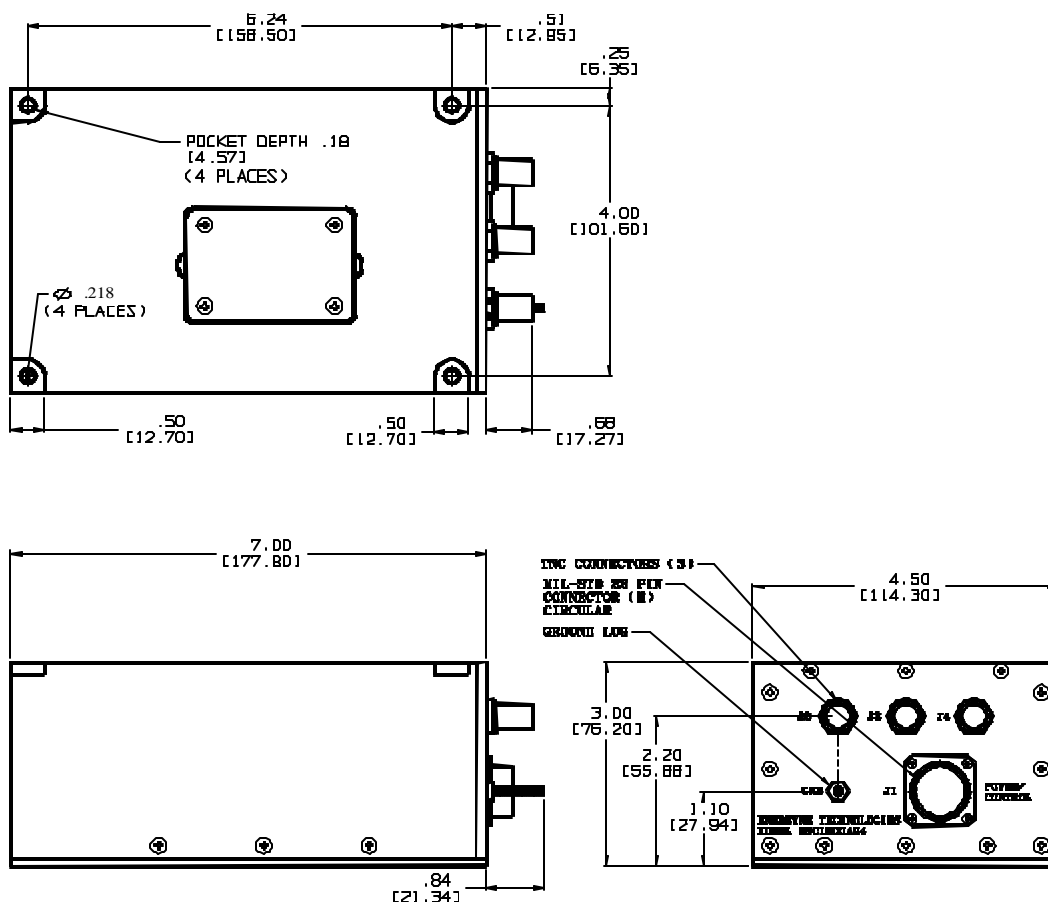


Figure 3-2 ENC1000A94 Overall Package Dimensions

Interconnecting Cable Installation

Ensure that all TNC connectors are fully seated. The 22-pin connector must also be firmly seated.

Dress and secure all cables in accordance with local safety and EMI standards.

Maintenance

The Enerdyne ENC1000A94 Video Compression Encoder requires very little maintenance.

A mild nonabrasive cleanser may be used to clean the unit. Care should be taken to prevent liquid from entering the connectors.

NOTE

There are no user serviceable parts located within the unit. Opening the unit or removing a circuit card will void the warranty. Units requiring service during the warranty period must be returned to the factory.

APPENDIX A

DATA MULTIPLEXER CONFIGURATION

Data Multiplexer Overview

Introduction

The Data Multiplexer frames the encoder serial data output in a series of eight recurring time slots as shown in Figure A-1.

Each time slot may be configured to contain compressed video data and PCM, EIA-232, or audio data, when FEC is not enabled. If FEC is enabled, time slot 8 is reserved for FEC. When the multiplexer is disabled, **(OPTION1 08)** all available transmission is allocated to video.

When the multiplexer is enabled, framing overhead consumes $\approx 7.7\%$ of the transmission link. The maximum PCM rate is 50% of the transmission link when audio, EIA-232, and FEC are not enabled. When any combination of audio, EIA-232 or FEC is enabled, the maximum PCM rate is 25% of the transmission link. Refer to Table A-1 for Data Multiplexer usage.

Each group of eight time slots is 130 bits long regardless of link rate. Each time slot is 16 bits long with 2 framing bits at the start of time slot 1 (130 bits = $(8 \times 16) + 2$). *The allocation of time slots on the decoder must be identical to the allocation of time slots on the encoder. This allows the demultiplexer to synchronize time slots, and to identify the type of data contained in each time slot, when a time slot is allocated for data other than video.*

Rules for designating time slots are described in the following sections. These rules are identical for both the encoder and the decoder.

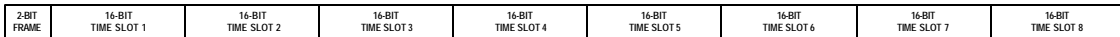


Figure A-1 Encoder Serial Data Output Time Slot Sequencing

Table A-1 Data Multiplexer Usage

| Configuration | Transmission Link Usage | | | | | |
|---------------------------------|-------------------------|--------|-----------|-------|-----------|----------|
| | PCM | Audio | EIA-232 | FEC | Video | MUX Freq |
| Video, PCM | $\leq 50\%$ | - | - | - | Remainder | 7.7% |
| Video, PCM, Audio | $\leq 25\%$ | 64Kbit | - | - | Remainder | 7.7% |
| Video, PCM, Audio, EIA-232 | $\leq 25\%$ | 64Kbit | Baud Rate | - | Remainder | 7.7% |
| Video, PCM, Audio, EIA-232, FEC | $\leq 25\%$ | 64Kbit | Baud Rate | 11.5% | Remainder | 7.7% |
| MUX Disabled (OPTION1 08) | - | - | - | - | 100% | - |

Audio Data Rules

Audio data will consume 64 Kbps of link . Each time slot designated for audio will contain 8 bits of audio data if an audio packet is ready, otherwise compressed video will be inserted. If only audio data is being multiplexed with compressed video, all time slots should be designated audio slots. This will result in the highest audio quality at the decoder output. If audio and PCM or EIA-232 data are being multiplexed with compressed video, slots should be assigned on an interleaved basis (Table A-2) to ensure maximum audio quality.

Table A-2 Time Slot Interleaving Examples

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-------|-------|---------|-------|-------|---------|-------|-----|
| AUDIO | PCM | EIA-232 | AUDIO | PCM | EIA-232 | AUDIO | PCM |
| PCM | AUDIO | EIA-232 | PCM | AUDIO | EIA-232 | PCM | FEC |
| AUDIO | PCM | AUDIO | PCM | AUDIO | PCM | AUDIO | PCM |
| PCM | AUDIO | PCM | AUDIO | PCM | EIA-232 | PCM | FEC |

PCM Data Rules

Each time slot designated for PCM may contain up to 50% PCM data and the remaining bits will be compressed video. When FEC is NOT enabled, the PCM clock rate may be as high as 50% of the link rate, assuming the FEC, AUDIO, and EIA-232 data channels are not enabled.

EIA-232 Data Rules

As with PCM and Audio data time slots, time slots designated for EIA-232 should be interleaved as shown in Table A-2. The baud rate at the DECODER must be set to *one baud rate higher than at the encoder*. The baud rate at the encoder and the decoder can be the same if there is at least one character delay between EIA-232 characters. EIA-232 data is fixed at eight bits with one start bit, one stop bit, and no parity. Each time slot designated as EIA-232 will contain one eight bit character. The remaining bits will be compressed video.

Option Commands

Introduction

The Data Multiplexer is configured by enabling (setting high to 1) or disabling (setting low to 0) selected bits in each of four eight-bit registers. Each bit, in each register, is assigned a dedicated function. The four OPTION commands, one for each register, **OPTION1 nn**, **OPTION2 nn**, **OPTION3 nn**, and **OPTION4 nn**, are used to either enable or disable these dedicated functions. See Figure A-2.

The bit values of registers 1 and 2 are set respectively by the OPTION1 and OPTION2 commands. These registers are used to set various I/O, clock and baud rate functions.

The *combined* bit values of registers 3 and 4, however, set respectively by the OPTION3 and OPTION4 commands, are used together by the software, to control the allocation of 8 equal time slots to various mixes of FEC, audio, PCM and EIA-232 data. See Figure A-2.

NOTE

When the Data Multiplexer is *enabled*, all time slots are designated as PCM types by default unless OPTION3 and OPTION4 commands are used to designate slots as audio, EIA-232 or FEC.

Any given time slot can be allocated to only one data type at a time. The user cannot invoke the OPTION3 command to reserve time slot 6 for EIA-232 data, and then use the OPTION4 command to reserve the same time slot for audio data.

When FEC is enabled, the eighth time slot of every frame is reserved for FEC. This leaves the remaining seven time slots available for varying combinations of audio, PCM or EIA-232 data. With the exception of when FEC is enabled, where the same single bit in registers 3 and 4 is set high, *any bit set high in one register (3 or 4) to allocate a time slot for a specific data type, must have the equivalent bit set low, or disabled, in the other register (3 or 4).*

In the sections which follow, other specific conditions governing the configuration and transmission of data types are addressed. These conditions are discussed in the specific OPTION command where they are relevant.

CAUTION

The ENC1000A94 encoder can function with any ADVS[®] compatible decoder. It is important that the encoder and the decoder configurations match, or unpredictable transmission results will occur. Generally speaking, it is better to set decoder options first, then proceed to match those settings at the encoder.

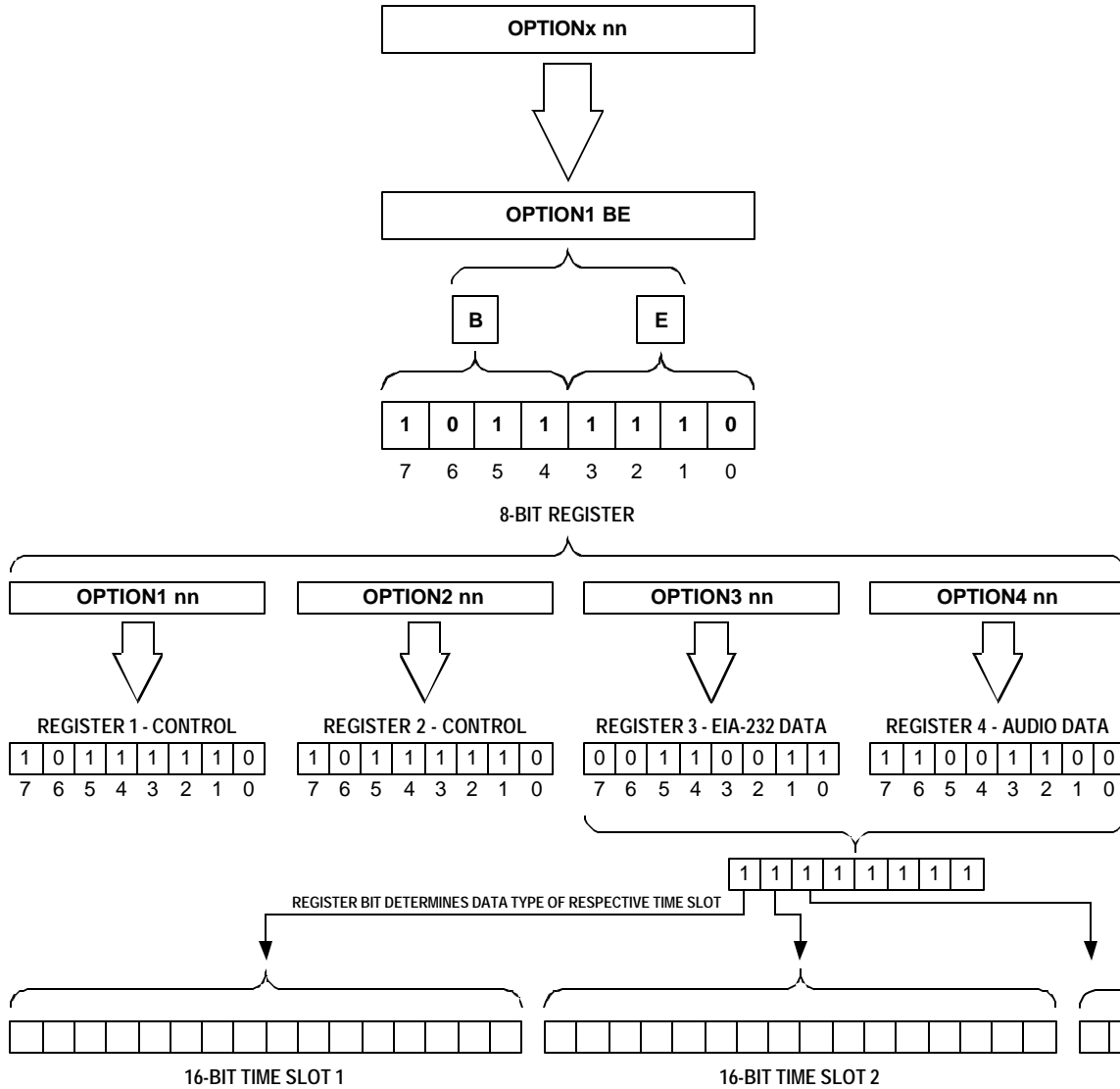


Figure A-2 Option Command Structure

Option Command Structure

Each of the four OPTION commands accepts input arguments in the same format (Figure A-3). The two digit argument (**nn**) of these commands represents a HEXADECIMAL number in the range of 00 to FF. The left HEX number of the two sets the four high order bits in the target register. The right HEX number sets the four low order bits. In affect, each HEX number in the argument **nn** sets a separate 4-bit binary value in the target register.

Table A-3 provides an easy way to select the appropriate HEX numbers. For example, if the configuration requires that the high order bits be set to 1011, and the low order bits to 1110, a quick look at the table shows that the left digit should be HEXADECIMAL “B” and the right

digit should be HEXADECIMAL "E". The correct argument string for the command then is "BE."

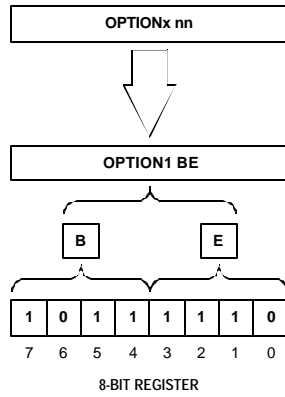


Figure A-3 OPTION Command Arguments

Table A-3 Option Register Hexadecimal Conversion Chart

| Low Register Bits | 3 | 2 | 1 | 0 |
|--------------------|-----|-----|-----|-----|
| High Register Bits | 7 | 6 | 5 | 4 |
| Bit Value | (8) | (4) | (2) | (1) |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 |
| 2 | 0 | 0 | 1 | 0 |
| 3 | 0 | 0 | 1 | 1 |
| 4 | 0 | 1 | 0 | 0 |
| 5 | 0 | 1 | 0 | 1 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 0 | 1 | 1 | 1 |
| 8 | 1 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 1 |
| A | 1 | 0 | 1 | 0 |
| B | 1 | 0 | 1 | 1 |
| C | 1 | 1 | 0 | 0 |
| D | 1 | 1 | 0 | 1 |
| E | 1 | 1 | 1 | 0 |
| F | 1 | 1 | 1 | 1 |

OPTION1 mn

This command enables or disables the various Data Multiplexer functions controlled by each bit. Encoder OPTION1 bit settings follow:

| | | Encoder Function When Bit = 1 | | |
|-----|---------|-------------------------------|-------------------------------|----------|
| Bit | Default | Serial Number 0748 or LOWER | Serial Number 0846 and HIGHER | Not Used |
| 0 | 0 | Must be = 0 | Randomizer Enable | |
| 1 | 0 | PassLink® Enable | PassLink® Enable | |
| 2 | 0 | FEC Enable | FEC Enable | |
| 3 | 0 | Data Multiplexer Disable | Data Multiplexer Disable | |
| 4 | 0 | PCM Input Level Select 'LSB' | PCM Input Level Select 'LSB' | |
| 5 | 0 | PCM Input Level Select 'MSB' | PCM Input Level Select 'MSB' | |
| 6 | 0 | Data Output Invert | Data Output Invert | |
| 7 | 0 | Clock Output Invert | Clock Output Invert | |

Note that bits 4 and 5 determine the PCM input level in accordance with the following table:

| PCM Level | MSB | LSB |
|-----------|-----|-----|
| TTL | 0 | 0 |
| CMOS | 0 | 1 |
| 422 | 1 | 0 |
| 422 | 1 | 1 |

RANDOMIZER BIT 0

The Randomizer limits the maximum number of consecutive 1's or 0's in the ENC1000A94 encoder output data stream to 15. The Randomizer should be used when digital transmission equipment or bit synchronizers between the ENC1000A94 encoder and DEC1000R5 or DEC1000R10 decoder require randomized data to prevent long strings of 1's or 0's. When the encoder Randomizer bit (OPTION1 command) is set high to **1** the decoder Randomizer bit (OPTION1 command) must be set high to **1** to derandomize the data for decoding and for proper display.

Errors introduced after the data is randomized are multiplied during the derandomization process. The decoder derandomizer has an error multiplication factor of 3 for isolated bit errors (separated from adjacent bit errors by at least 15 bits). An isolated bit error will produce 3 errors in the output data; the original bit error and 2 additional errors 14 and 15 bits later. In addition, a burst of errors occurring after the data has been randomized will produce a burst of errors in the derandomized output. The number of errors in the output depends on the distribution of errors in the burst and can be greater than, equal to or less than the number of errors in the input to the derandomizer. However, the derandomizer always increases the number of bits between the first and last error in the burst by 15.

OPTION2 mn

This command allows the user to enable or disable the various Data Multiplexer functions controlled by each bit. Encoder OPTION2 bit settings follow:

| Bit Number | Default | Encoder Function When Bit = 1 All Serial Numbers |
|------------|---------|---|
| 0 | 0 | PCM Clock Input Invert |
| 1 | 0 | PCM Data Input Invert |
| 2 | 0 | External Clock Input Select 'LSB' |
| 3 | 0 | External Clock Input Select 'MSB' |
| 4 | 0 | Baud Rate Select 'LSB' |
| 5 | 0 | Baud Rate Select 'Bit 5' |
| 6 | 0 | Baud Rate Select 'MSB' |
| 7 | 0 | Must be = 0 |

Note that bits 2 and 3 determine the external clock input level according to data in the following table:

| External Clock Level | MSB | LSB |
|----------------------|-----|-----|
| TTL | 0 | 0 |
| CMOS | 0 | 1 |
| 422 | 1 | 0 |
| 422 | 1 | 1 |

And that bits 4, 5, and 6 determine baud rate on the decoder in accordance with the following table:

| Baud Rate | MSB | Bit 5 | LSB |
|-----------|-----|-------|-----|
| 38400 | 0 | 0 | 0 |
| 19200 | 0 | 0 | 1 |
| 9600 | 0 | 1 | 0 |
| 4800 | 0 | 1 | 1 |
| 2400 | 1 | 0 | 0 |
| 1200 | 1 | 0 | 1 |
| 600 | 1 | 1 | 0 |
| 300 | 1 | 1 | 1 |

OPTION3 mn

This command allows the user to enable or disable time slots 1-8 for EIA-232 data. Encoder and decoder settings must be the same. Encoder OPTION3 bit settings follows:

| Bit Number | Default | Encoder Function When Bit = 1 All Serial Numbers |
|------------|---------|---|
| 0 | 0 | Enable Time Slot 1 for EIA 232 |
| 1 | 0 | Enable Time Slot 2 for EIA 232 |
| 2 | 0 | Enable Time Slot 3 for EIA 232 |
| 3 | 0 | Enable Time Slot 4 for EIA 232 |
| 4 | 0 | Enable Time Slot 5 for EIA 232 |

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| | | |
|----|---|--------------------------------|
| 5 | 0 | Enable Time Slot 6 for EIA 232 |
| 6 | 0 | Enable Time Slot 7 for EIA 232 |
| 7* | 0 | Enable Time Slot 8 for EIA 232 |

* Set this bit to '1' if FEC is enabled by OPTION1.
This slot will be used for the FEC check word.

CAUTION

OPTION3 settings at the encoder and the decoder must be the same.

OPTION4 nn

This command allows the user to enable or disable time slots 1-8 for Audio data. Encoder and decoder settings must be the same. Encoder OPTION4 bit settings follows:

| Bit Number | Default | Encoder Function When Bit = 1 All Serial Numbers |
|------------|---------|---|
| 0 | 0 | Enable Time Slot 1 for Audio |
| 1 | 0 | Enable Time Slot 2 for Audio |
| 2 | 0 | Enable Time Slot 3 for Audio |
| 3 | 0 | Enable Time Slot 4 for Audio |
| 4 | 0 | Enable Time Slot 5 for Audio |
| 5 | 0 | Enable Time Slot 6 for Audio |
| 6 | 0 | Enable Time Slot 7 for Audio |
| 7* | 0 | Enable Time Slot 8 for Audio |

* Set this bit to '1' if FEC is enabled by OPTION1.
This slot will be used for the FEC check word.

Option Command Examples

Table A-4 lists 16 sets of encoder and decoder option command settings and the resulting Data Multiplexer configuration.

Table A-4 Option Register Settings

| Settin g | Encoder Registers | | | | Decoder Registers | | | |
|---------------------|---------------------------------------|----------|----------|----------|-------------------|----------|----------|----------|
| | Option 1 | Option 2 | Option 3 | Option 4 | Option 1 | Option 2 | Option 3 | Option 4 |
| 1 | 08 | XX | XX | XX | XX | XX | XX | XX |
| 2 | 00 | 20 | 00 | 00 | 00 | 10 | 00 | 00 |
| 3 | 04 | 20 | 80 | 80 | 01 | 10 | 80 | 80 |
| 4 | 00 | 20 | 00 | FF | 00 | 10 | 00 | FF |
| 5 | 04 | 20 | 80 | FF | 01 | 10 | 80 | FF |
| 6 | 00 | 20 | FF | 00 | 04 | 10 | FF | 00 |
| 7 | 04 | 20 | FF | 80 | 05 | 10 | FF | 80 |
| 8 | 00 | 20 | AA | 00 | 04 | 10 | AA | 00 |
| 9 | 04 | 20 | AA | 80 | 05 | 10 | AA | 80 |
| 10 | 00 | 20 | 00 | AA | 00 | 10 | 00 | AA |
| 11 | 04 | 20 | 80 | AA | 01 | 10 | 80 | AA |
| 12 | 00 | 20 | AA | 55 | 04 | 10 | AA | 55 |
| 13 | 04 | 20 | AA | 05 | 05 | 10 | AA | 05 |
| 14 | 00 | 20 | A4 | 09 | 04 | 10 | A4 | 09 |
| 15 | 04 | 20 | A4 | 89 | 05 | 10 | A4 | 89 |
| 16 | 04 | 20 | 82 | 88 | 05 | 10 | 82 | 88 |
| Settin g | Multiplexer Configuration | | | | | | | |
| 1 | Disable multiplexer (factory setting) | | | | | | | |

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| | |
|----|---|
| 2 | All slots PCM, FEC disabled |
| 3 | All slots PCM, FEC enabled |
| 4 | All slots audio, FEC disabled |
| 5 | All slots audio, FEC enabled |
| 6 | All slots EIA-232, FEC disabled |
| 7 | All slots EIA-232, FEC enabled |
| 8 | Four slots PCM, four slots EIA-232, FEC disabled |
| 9 | Four slots PCM, three slots EIA-232, FEC enabled |
| 10 | Four slots PCM, four slots audio, FEC disabled |
| 11 | Four slots PCM, three slots audio, FEC disabled |
| 12 | Four slots EIA-232, four slots audio, FEC disabled |
| 13 | Four slots EIA-232, three slots audio, FEC enabled |
| 14 | Three slots PCM, three slots EIA-232, two slots audio, FEC disabled |
| 15 | Three slots PCM, two slots EIA-232, two slots audio, FEC enabled |
| 16 | Five slots PCM, one slot EIA-232, one slot audio, FEC enabled |