Model 8074
Digital Video Closed Caption Encoder

Instruction Manual

EVERTZ MICROSYSTEMS LTD.
3465 Mainway, Burlington, Ontario, Canada, L7M 1A9
Phone: 905-335-3700
Fax: 905-335-3573
BBS: 905-335-9131
Internet: Sales: sales@evertz.com
Tech Support: eng@evertz.com
Web Page: http://www.evertz.com

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INFORMATION TO USERS IN EUROPE

NOTE

CISPR 22 CLASS A DIGITAL DEVICE OR PERIPHERAL

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to the European Union EMC directive. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

INFORMATION TO USERS IN THE U.S.A.

NOTE

FCC CLASS A DIGITAL DEVICE OR PERIPHERAL

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or Modifications not expressly approved by Evertz Microsystems Ltd. could void the user's authority to operate the equipment.

Use of unshielded plugs or cables may cause radiation interference. Properly shielded interface cables with the shield connected to the chassis ground of the device must be used.

NOTICE TO MODEM USERS IN THE USA

The 8074 Digital Video Caption Encoder complies with the FCC Rules Part 68. The 8074 is designed to be used on standard device telephone lines. It connects to the telephone line by means of a standard jack called the USOC RJ11C. The 8074 should be connected to the telephone network with an FCC compliant telephone cord and modular plug.

It is not necessary to notify the telephone company before connecting the modem in the 8074. However, the telephone company may request the telephone number to which the 8074 modem is connected and the FCC registration number and ringer equivalence number (REN), both of which are on the label on the rear panel.

The REN is used to determine the number of devices you may legally connect to your telephone line. In most areas, the sum of the REN of all devices connected to one line must not exceed five (5.0). You should contact your telephone company to determine the maximum REN for your calling area.

The 8074 may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

If the modem in the 8074 is malfunctioning, it may affect the telephone lines. In this case, disconnect the modem until the source of the difficulty is traces.

REVISION HISTORY

REVISION	DESCRIPTION	DATE
1.0	Original issue	February 1998
	8074 Port A Adaptor Cable drawing added on page 2-7	July 1998

8075 DTV Caption Encoder

The 8074 with the ATSC option is now called the 8075 DTV Caption Encoder. The 8074 user manual is still applicable with the following additions.

Overview

The ATSC option allows the 8074 to interface the caption information to an ATSC compression encoder. The 8074 combines the SDI-video upstream captions, the incoming modem captions/text/XDS data, and the Port A and Port C incoming captions/text/XDS data and places the combined caption stream onto the 8074 SDI-video output as normal. With the ATSC option, the same combined caption data that is placed on the output video is also bundled into packets and transmitted via the 8074's Port B RS-232 serial link into the ATSC caption encoder. The packets can formatted according to two different protocols. The original Grand Alliance protocol (shown as **ATSC GA** on the 8074) is a transmit only protocol, running at 19200 bps. The enhanced interface protocol (shown as **ATSC** on the 8074) is a bi-directional, polled protocol which requires the ATSC encoder to poll for the appropriate size packet.

Connecting to an ATSC Encoder

The connection to the ATSC encoder must be done using the Port B connector of the 8074. The connection to a typical ATSC encoder system with a DTE type port is as follows (a standard 'Null Modem' cable can be used):

8074 Port B Female			**ATSC Encoder End (DTE) Female**	
Description	**DB-9**		**DB-9**	**Description**
Shield				Shield
RS 232 Transmit	3	----------	2	RS 232 Receive
Ground	5	----------	5	Signal Ground
RS 232 Receive	2	----------	3	RS 232 Transmit
RS 232 CTS	8	----------	7	RS 232 RTS
RS 232 DTR	4	----------	6	RS 232 DSR
RS 232 RTS	7	----------	8	RS 232 CTS
RS 232 DSR	6	----------	4	RS 232 DTR

Figure ATSC -2: Cable Wiring Diagram Port B to DTE port

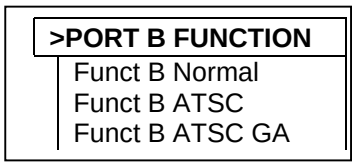
The connection to a typical ATSC encoder system with a DCE type port is as follows (a standard 'Direct Connect' cable can be used):

8074 Port B Female Description	DB-9		ATSC Encoder End (DCE) Female DB-9	Description
Shield				Shield
RS 232 Transmit	3	----------	3	RS 232 Receive
Ground	5	----------	5	Signal Ground
RS 232 Receive	2	----------	2	RS 232 Transmit
RS 232 CTS	8	----------	8	RS 232 RTS
RS 232 DTR	4	----------	4	RS 232 DSR
RS 232 RTS	7	----------	7	RS 232 CTS
RS 232 DSR	6	----------	6	RS 232 DTR

Figure ATSC -2: Cable Wiring Diagram Port B to DCE port

Enabling the ATSC Interface

The ATSC interface must be enabled at the 8074. A new Engineering Setup menu item has been added called **>PORT B FUNCTION**. This menu is accessed by entering the Engineering Setup menus using the **SHIFT+SETUP** key combination. Then use the up arrow until the **>PORT B FUNCTION** prompt is displayed. Use the LEFT ARROW or RIGHT ARROW keys until the desired function is displayed (the currently active function will be blinking). Press the SELECT key to change the function of Port B to the currently displayed function. (The function text should start blinking). Use the SETUP key to exit the menus.



PORT B FUNCTION is used to select the operating mode of the Port B serial port.

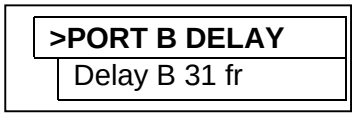
Select **Funct B Normal** for standard 8074 interface to captioning computers and software

Select **Funct B ATSC** for interfacing Port B to ATSC compression encoders using the enhanced, bi-directional, polling protocol at 38400 bps. The 8074 Port B communication parameters will be changed to 38400 baud, 8 bits, No Parity. No other baud rate options or word options will be available while in this functional mode. The COMM light on the 8074 front panel will turn on when the ATSC encoder sends a valid polling character.

Select **Funct B ATSC GA** for interfacing Port B to ATSC compression encoders using the original, Grand Alliance, uni-directional protocol at 19200 bps. The 8074 Port B communication parameters will be changed to 19200 baud, 8 bits, No Parity. No other baud rate options or word options will be available while in this functional mode. The COMM light on the 8074 front panel will turn on continuously when this mode, since the 8074 is unilaterally broadcasting the packet data.

Controlling the ATSC interface delay

An additional delay may be added to the ATSC interface data. This delay can offset other processing delays in the ATSC video path. A new Engineering Setup menu item has been added called **>PORT B DELAY**. This menu is accessed by entering the Engineering Setup menus using the **SHIFT+SETUP** key combination. Then use the up arrow until the **>PORT B DELAY** prompt is displayed. Use the LEFT ARROW or RIGHT ARROW keys until the desired frame delay is displayed (the currently displayed delay value is always the currently active delay value and will be blinking). Use the SETUP key to exit the menus.



PORT B DELAY is used to select the ATSC packet data delay of the Port B serial port. When set to zero, the 8074 will encode and transmit the ATSC packet as soon as possible (there will likely be a small, unavoidable delay due to the 8074 processing, the transmission delay, and the ATSC processing). When set to the maximum of 31 frames, the 8074 will delay the ATSC packet data by 31 video frames.

Select **Delay B 0 fr** for minimum data delay through the 8074

Select **Delay B 31 fr** for maximum data delay through the 8074

Error Displays

The ATSC option includes an additional error message: **ATSC OVERFLOW**, which indicates that the ATSC compression encoder has not polled the 8074 sufficiently often, and some caption data (null or otherwise) has accumulated to the point of overflowing the 8074's delay buffer. Some caption data has been lost due to the insufficient polling.

Port C

Port C is not functional in this version of the software.

The following document describes the operational changes to the 8074 related to firmware version 990715. References to the 8074 manual are to version 1.0 printed February 1998.

1. Overview of New Features

- Serial Port B may be configured to echo out serial commands received through other serial ports.
- Closed caption data may be extracted and output directly to serial port B.
- Closed caption data may be input through port B and inserted directly into the outgoing SDI video.
- Text article line length has been increased to accommodate longer WebTV links.

2. Port Passthrough Features

Through the Engineering Setup menu system, the user may now place the 8074 into one of several serial port passthrough modes. The new modes are referred to as “Port Passthrough” and “Caption Data Passthrough”. These modes allow control commands or closed caption data to be cascaded from one 8074 to another through the serial ports. This functionality is useful for copying captions from one video stream to another, or to re-insert captions that have been removed or damaged by processing operations.

All of the new port B passthrough modes require port B of the 8074 unit to be connected to a serial port of another 8074, an 8075 or an 8070 depending on the application.

2.1 Port Echo Modes

These modes cause serial commands received on the respective serial port or modem port to be echoed out of serial port B. These commands may then be cascaded to a second 8074 using a serial interface cable as described in section 2.3. The successive unit(s) will then receive the same serial commands as the first unit, after a slight propagation delay. The receiving unit does not need to be placed in a special operating mode, and may be another 8074, an 8075 or an 8070 unit.

The following figure depicts a typical configuration to use the Port Echo Modes.

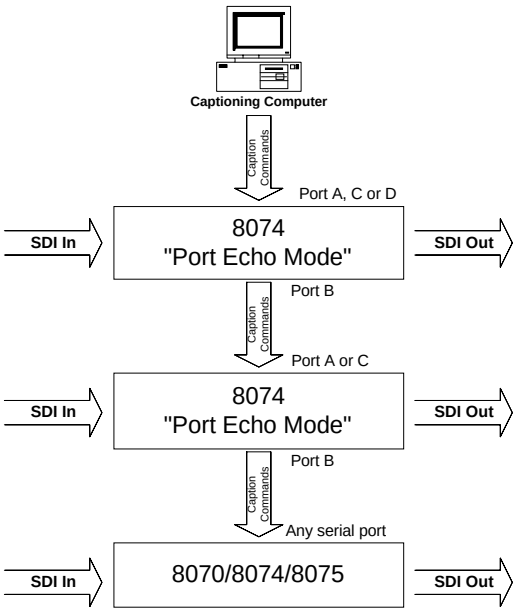


Figure 1: Connections for Port Echo Mode

2.2 Caption Data Passthrough Modes

To use these modes, one 8074 is configured to extract caption data and transmit it via the serial port. Another 8074 unit is configured to receive caption data over the serial port and insert it into the SDI video. This ability is useful for copying captions from one video stream to another, or reinserting captions into video after it has been passed through a standards converter or other device that damages the caption data.

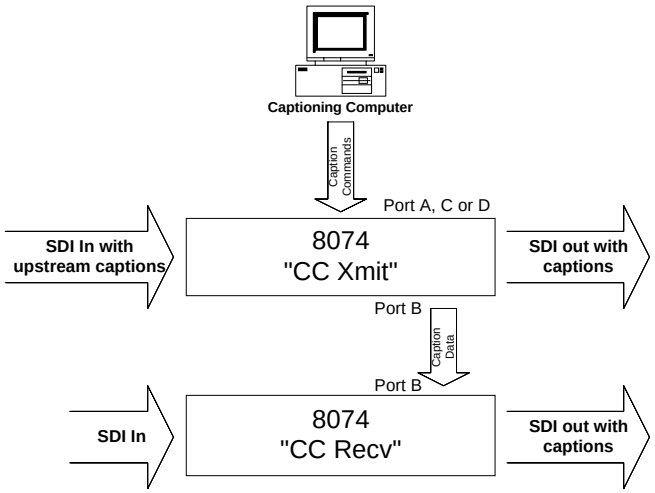


Figure 2: Setup to Copy Captions Between Video Streams

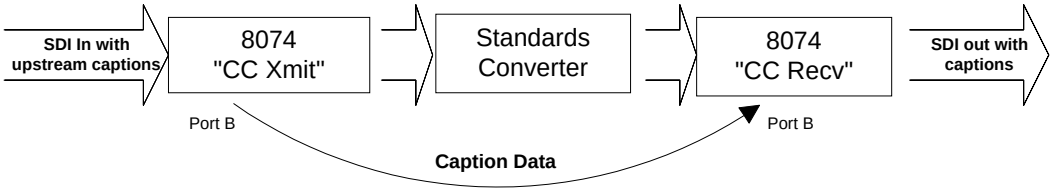
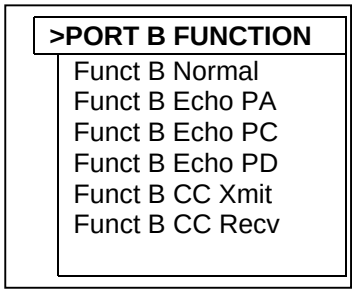


Figure 3: Re-Inserting Captions Into a Video Stream

2.3 Configuring 8074 for Port Passthrough Modes

This new functionality must be enabled through the 8074 front panel controls. A new Engineering Setup menu item has been added called **>PORT B FUNCTION**. This menu is accessed by entering the Engineering Setup menus using the **SHIFT+SETUP** key combination. Then use the up arrow until the **>PORT B FUNCTION** prompt is displayed. Use the LEFT ARROW or RIGHT ARROW keys until the desired function is displayed (the currently active function will be blinking). Press the SELECT key to change the function of Port B to the currently displayed function. (The function text should start blinking). Use the SETUP key to exit the menus.



PORT B FUNCTION is used to select the operating mode of the Port B serial port.

Funct B Normal is used for standard 8074 interface to captioning computers and software.

Funct B Echo Px where x=(A, C or D) initiates one of the “Port Echo” passthrough modes.

For any “Funct B Echo Px” (Port Echo) mode, use the cable described by Figure 4 if you wish to connect to port B or port C of the cascaded encoder unit.

The 8074 may also be connected to port A of the receiving encoder, which may be an 8070, 8074 or 8075. To connect to port A of the receiving encoder, use a cable with the pinout described in Figure 5.

In this mode the user is responsible for configuring identical baud rates and data words on the serial ports of the transmitting and receiving units.

Funct B CC Xmit will extract all captions from the output video and transmit them out of serial port B. To use this “Caption Data Passthrough” mode, port B must be connected to port B of another 8074 that is configured for **Funct B CC Recv** mode (see below). To connect the units, use a standard “NULL MODEM CABLE” having the pinout described in section 2.3.

In this mode the port B data word is set and locked to "8 none". The user is responsible for configuring identical baud rates on serial ports B of the transmitting and receiving units.

Funct B CC Recv configures an 8074 to encode closed caption data received over serial port B directly into the video. This is the receiver side of "Caption Data Passthrough" mode. When this function is selected, the 8074 encoder is placed and locked into field mode. All upstream captions are blocked. All other communications ports are blocked so that they will not provide caption data. Additionally, the internal test message is disabled.

In this mode the port B data word is set and locked to "8 none". The user is responsible for configuring identical baud rates on the serial ports of the transmitting and receiving 8074 units.

It is not possible to select "Funct B CC Recv" operation if any other port is currently supplying caption data to be encoded into the video stream.

The Caption Data Passthrough setup will introduce a delay in the captions on the receiver side, typically one to three frames. Other equipment in the SDI video stream also influences the length of this delay.

2.3 Physical Connections for Passthrough Modes

8074 Port B Female Description	DB-9		Other Encoder Port B or Port C Female DB-9	Description
Shield				Shield
RS 232 Transmit	3	----------	2	RS 232 Receive
Ground	5	----------	5	Signal Ground
RS 232 Receive	2	----------	3	RS 232 Transmit
RS 232 CTS	8	----------	7	RS 232 RTS
RS 232 DTR	4	----------	6	RS 232 DSR
RS 232 RTS	7	----------	8	RS 232 CTS
RS 232 DSR	6	----------	4	RS 232 DTR

Figure 4: "NULL MODEM" Cable Wiring Diagram 8074 Port B to Port B or Port C

8074 Port B Female Description	DB-9		Other Encoder Port A Male DB-9	Description
Shield				Shield
Ground	1	----------	1	Ground
RS 232 Receive	2	----------	5	RS 232 Transmit
RS 232 Transmit	3	----------	8	RS 232 Receive
Ground	5	----------	6	Ground
RS 232 CTS	8	----------	4	RS 232 RTS

Figure 5: Cable Wiring Diagram 8074 Port B to Port A

The following document describes the operational changes to the 8070 related to the 8070-SER2 Option. This option adds a second serial port (Port B) to the 8070. References to the 8070 manual are to version 2.0 printed January 1997.

1. CHANGES FROM THE STANDARD 8070 SOFTWARE

- Serial Port B

2. INSTALLATION INSTRUCTIONS

- With the top cover removed, unscrew the two Phillips head screws holding the 8033 submodule to main printed circuit board.
- Carefully lift up on the submodule until it unplugs from the main board.
- Set aside submodule in a safe place.

These devices are subject to damage by electrostatic charge buildup which can occur with improper handling. The devices should always be carried and stored in the anti-static packaging tube provided.

- Using a small screwdriver, carefully lift out the EPROM U21 being careful not to bend the pins. Store the old EPROM in electrostatic conductive foam. Install the new EPROM, labelled **DK87D7**, in the socket U21, so that the notched end is in the same orientation as the silk screening on the circuit card.
- Remove the two screws, holding the Port B blank cover plate to the rear panel.
- Position submodule inside chassis so that the mounting holes align with the stand offs on the main printed circuit boards. The submodule connector and main board header should now be in perfect alignment.
- **Firmly** push down on the front end of the submodule until the connector plugs into the mating connector on the main circuit board. Make sure that all pins are mated.
- Install the Phillips head screws to secure the submodule to main board.
- Position the DB9 connector through the cutout in the rear panel from the inside so that the row with 5 pins is toward the top of the unit. Fasten to the rear panel using the two hex mounting screws and nuts provided.
- Carefully align the connector on the opposite end of the ribbon cable with the header J2 on the 8037 submodule. The Red stripe on the ribbon cable should be beside pin 1 on the header. Press the connector firmly onto the header.

3. SERIAL PORT

PORT B: An optional 9 pin male 'D' connector is fitted when the 8070-SER2 option is installed. This connector may be used for connection a second computer with captioning or XDS control software. The port may also be directly connected to a modem using an industry standard PC to modem cable. The front panel Engineering menus are used to set the correct baud rate, word size and parity for use with your captioning software. (See section 3.3)

Pin	Description	
1	DCD	Data Carrier Detect (in)
2	RxD	RS-232 Receive Data In
3	TxD	RS-232 Transmit Data Out
4	DTR	Data Terminal Ready (out)
5	GND	Ground
6	DSR	Data Set Ready (in)
7	RTS	Request to Send (out)
8	CTS	Clear to Send (in)
9		not used

4. OPERATIONAL CHANGES

4.1 Port Baud Rate and Data Format

Individual menu items have been added to select the baud rate and data format for each serial port.

4.2 Port Mapping

Two new menu items have been added to determine whether a specific serial port has permission to send data to the various caption and text data streams. There is a separate map function for each serial port. The power up default is that both ports have permission to send data to all the data streams when the other port does not have control of that stream.

PORT A MAP
A:CF12 TF12X
PORT B MAP
B:CF12 TF12X

When you select the menu item, you will see a display similar to

A:CF12 TF12X

The letter at the beginning of the display indicates which port the map is for. CF12 refers to the caption streams for field 1 or field 2. TF12 refers to the text streams for field 1 or field 2. The X refers to the XDS data stream. If the respective map item shows a dash (-) that means that it is not accessible from the port. If it shows a 1,2 or X that means that it is accessible from the port. Use the ← or → keys to place the blinking cursor above one of the channels. Press the **SELECT** key to enable or disable the respective caption, text or XDS permission. For example: A:CF1- TF--- means that Port A only has permission for the field 1 caption data streams.

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1. OVERVIEW

The Model 8074 Digital Video Closed Caption Encoder provides a cost effective method of encoding closed captions into the digital video bitstream.

1.1. THE CLOSED CAPTION SYSTEM

The Closed Caption System provides for the transmission of data on line 21 of the NTSC composite signal, or Line 22 of the PAL composite video signal. The data that can be encoded is separated into three distinct classes: caption, text, and Extended Data Services (EDS). Caption or text data may be encoded in either field 1 or field 2, or both while EDS data may only be encoded into field 2. The data encoded in each field is independent of each other.

The caption data may be encoded into one of four logical data channels, two in each field. Similarly the Text data may also be encoded into one of four data channels. The EDS data is encoded into its own data channel, giving a total of nine data channels. This allows for multiple sets of data to be encoded and for the viewer to select which data channel will be decoded.

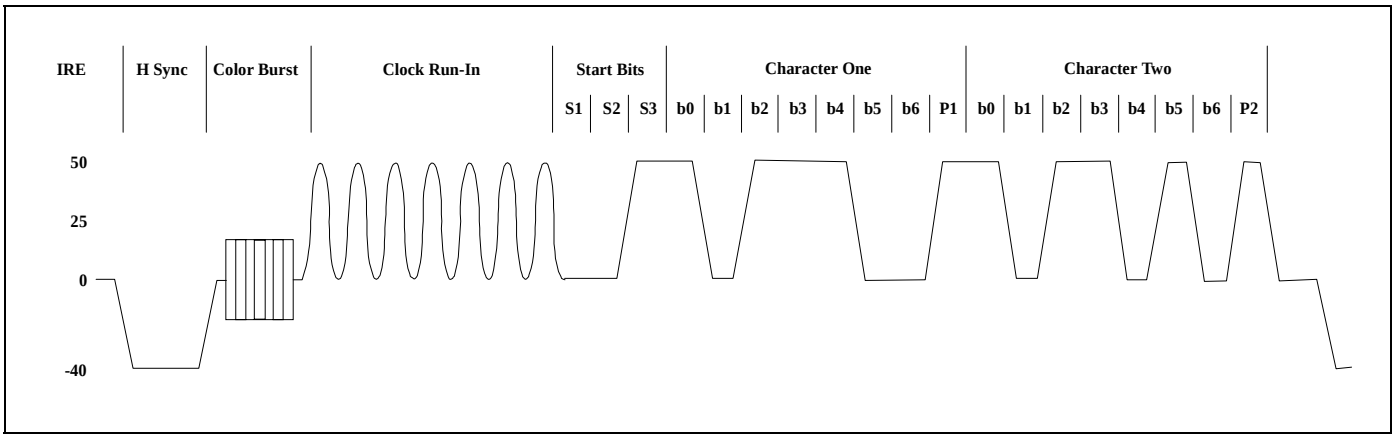

Figure 1-1: Typical Line 21 Closed Caption Signal

Figure 1-1 shows the typical waveform of the signal. The line 21 data signal consists of a 7 cycle sine wave clock burst, a start bit, and two data characters. Each character consists of seven data bits with odd parity. The clock rate is 32 times the horizontal line frequency or 503.4 KHz. The signal amplitude is 50 IRE units peak to peak. There is no setup on the line when the caption signal is present. When caption data is encoded into field 2, there must at least be null characters encoded into field 1. The full specification for the caption data waveform and data content is given in the EIA-608 standard.

1.2. FEATURES

- Keys directly into 4:2:2 (525 or 625 line) or 4 Fsc NTSC digital video bitstream
- Serial digital video input provides automatic cable equalization on cable lengths up to 200 meters of low loss coax such as Belden 8281
- Serial digital video output provides two separate outputs
- Serial Digital Video bypass relay activates automatically on power failure to maintain the integrity of the program video path.
- Keyer bypass mode allows video to pass through without keying any signal in
- Emulates EEG 270, EEG 370 and EEG 470 Encoders
- Inserts Captions or Text articles into previously captioned material
- Inserts Extended Data Services packets
- Supports Real-time and off-line captioning methods
- Monitor mode extracts caption data from incoming video and sends it out the serial port
- 3 RS-232 serial ports can be configured for direct connection to the captioning computer.
- One built-in modem and an optional second modem for connection to remote captioning computers via the telephone network.
- Rack mountable
- 8 or 10 bit resolution
- 16 digit Alpha-numeric display, with 8 push buttons
- Optional Analog composite monitor output
- Optional caption decoder for composite monitor output provides a means of verifying the caption information that is being encoded

The 8074 is a multi-purpose closed caption encoder for digital video designed to meet the needs of both television broadcast and post production facilities. The 8074 uses advanced digital signal processing combined with intelligent processing of the caption data. The 8074 allows data to be encoded into all caption and text channels in both field 1 and field 2 of the video. In addition Extended Data Services packets can be encoded into field 2 supporting such services as station name and call letter identification, program name, classification and remaining air time, and violence ratings (compatible with V-chip decoders)

The 8074 Caption Encoder can be configured to operate in either a ‘field’ mode or a ‘stream’ mode. The two modes of operation are supported to guarantee maximum compatibility with a wide variety of caption software packages.

When set to the stream mode, each individual data stream can be manipulated independent of each other. When the 8074 is in stream mode, incoming captions can be passed through on a channel by channel

basis, or replaced by new data. New caption data may also be inserted into existing data streams.

When the 8074 is in field mode, all the data streams in a particular field will be passed, removed, or replaced with new data. This mode of operation is only suitable for encoding data on material that has not been previously captioned, as previously recorded captions in the same field will be removed.

When the 8074 is in stream mode, it can store text articles and insert them in any of the text data streams on a repetitive basis. The user can program the frequency and number of times each article will be inserted. These articles replace any previously encoded data in the respective channels, and can be simultaneously encoded along with real time caption data. The 8074 comes with a software utility to give you an easy way to load text articles.

When the 8074 is in stream mode, it can store Extended Data Service packets and insert them in the EDS data stream in field 2 on a repetitive basis. The user can program the frequency and number of times each packet will be inserted. These packets replace any previously encoded data in the EDS channel, and can be simultaneously encoded along with real time caption data.

The 8074 encoder works with both 525 and 625 line component digital video as well as 4 Fsc NTSC video. The default line for encoding caption data is line 21 for 525 line (NTSC) and line 22 for 625 line (PAL) video standards, however the user has the option of encoding the data on lines 11 to 25 in NTSC and lines 6 to 25 in PAL.

The 8074 has two optional analog video outputs available. The 8074-MON option provides an analog composite output from the serial digital video out. This signal can be used with external caption decoders and analog monitors to view the caption data being encoded. The 8074-DECODER option includes a built in caption decoder that inserts the open captions on the analog output. The user can select which of the caption data streams to monitor.

1.3. HOW TO USE THIS MANUAL

This manual is organized into 5 chapters : Overview, Installation, Operation, Serial Command Protocol and Technical Description.

Items of special note are indicated with a double box like this.

1.4. DEFINITIONS

AES: (Audio Engineering Society): A professional organization that recommends standards for the audio industries.

AES/EBU: Informal name for a digital audio standard established jointly by the Audio Engineering Society and the European Broadcasting Union organizations.

ANALOG: An adjective describing any signal that varies continuously as opposed to a digital signal that contains discrete levels representing digits 0 and 1.

A-TO D CONVERTER (ANALOG-TO-DIGITAL): A circuit that uses digital sampling to convert an analog signal into a digital representation of that signal.

BIT: A binary representation of 0 or 1. One of the quantized levels of a pixel.

BIT PARALLEL: Byte-wise transmission of digital video down a multi-conductor cable where each pair of wires carries a single bit. This standard is covered under SMPTE 125M, EBU 3267-E and CCIR 656.

BIT SERIAL: Bit-wise transmission of digital video down a single conductor such as coaxial cable. May also be sent through fiber optics. This standard is covered under SMPTE 259M and CCIR 656.

BIT STREAM: A continuous series of bits transmitted on a line.

BNC: Abbreviation of "baby N connector". A cable connector used extensively in television systems.

BYTE: A complete set of quantized levels containing all the bits. Bytes consisting of 8 to 10 bits per sample are typical in digital video systems.

CABLE EQUALIZATION: The process of altering the frequency response of a video amplifier to compensate for high frequency losses in coaxial cable.

CCIR (International Radio Consultative Committee) An international standards committee. (This organization is now known as ITU.)

CCIR-601: (This document now known as ITU-R601). An international standard for component digital television from which was derived SMPTE 125M and EBU 3246-E standards. CCIR-601 defines the sampling systems, matrix values and filter

characteristics for both Y, B-Y, R-Y and RGB component digital television signals.

CCIR-656 (This document now known as ITU-R656).The physical parallel and serial interconnect scheme for CCIR-601. CCIR-656 defines the parallel connector pinouts as well as the blanking, sync and multiplexing schemes used in both parallel and serial interfaces. It reflects definitions found in EBU Tech 3267 (for 625 line systems) and SMPTE 125M (parallel 525 line systems) and SMPTE 259M (serial 525 line systems).

CLIFF EFFECT (also referred to as the 'digital cliff') This is a phenomenon found in digital video systems that describes the sudden deterioration of picture quality when doe to excessive bit errors, often caused by excessive cable lengths. The digital signal will be perfect even though one of its signal parameters is approaching or passing the specified limits. At a given moment however, the parameter will reach a point where the data can no longer be interpreted correctly, and the picture will be totally unrecognizable.

COMPONENT ANALOG: The non-encoded output of a camera, video tape recorder, etc., consisting of the three primary colour signals: red, green, and blue (RGB) that together convey all necessary picture information. In some component video formats these three components have been translated into a luminance signal and two colour difference signals, for example Y, B-Y, R-Y.

COMPONENT DIGITAL: A digital representation of a component analog signal set, most often Y, B-Y, R-Y. The encoding parameters are specified by CCIR-601. The parallel interface is specified by CCIR-656 and SMPTE 125M.

COMPOSITE ANALOG: An encoded video signal such as NTSC or PAL video, that includes horizontal and vertical synchronizing information.

COMPOSITE DIGITAL: A digitally encoded video signal, such as NTSC or PAL video that includes horizontal and vertical synchronizing information.

D1: A component digital video recording format that uses data conforming to the CCIR-601 standard. Records on 19 mm magnetic tape. (Often used incorrectly to refer to component digital video.)

D2: A composite digital video recording format that uses data conforming to SMPTE 244M. Records on 19 mm magnetic tape. (Often used incorrectly to refer to composite digital video.)

D3: A composite digital video recording format that uses data conforming to SMPTE 244M. Records on 1/2" magnetic tape.

EBU (European Broadcasting Union): An organization of European broadcasters that among other activities provides technical recommendations for the 625/50 line television systems.

EBU TECH 3267-E: The EBU recommendation for the parallel interface of 625 line digital video signal. This is a revision of the earlier EBU Tech 3246-E standard that was in turn derived from CCIR-601.

EDH Error Detection and Handling (EDH) is defined in SMPTE RP-165 as a method of determining when bit errors have occurred along the digital video path. According to RP-165, two error detection check words are used, one for active picture samples, and the other on a full field of samples. Three sets of flags are used to convey information regarding detected errors, to facilitate identification of faulty equipment or cabling. One set of flags is associated with each check word, and the third is used to evaluate ancillary data integrity. The check words and flags are combined into a special error detection data packet that is included as ancillary data in the serial digital signal.

EMBEDDED AUDIO: Digital audio is multiplexed onto a serial digital video data stream.

EXTENDED DATA SERVICES (EDS): EDS is a third data service in field 2 that is intended to supply program related and other information to the viewer. This information may include such items as program title, length of show, type of show and program content codes such as violence ratings (V-CHIP).

ITU: The United Nations regulatory body governing all forms of communications. ITU-R (previously CCIR) regulates the radio frequency spectrum, while ITU-T (previously CCITT) deals with the telecommunications standards.

ITU-R601: See CCIR601

PIXEL: The smallest distinguishable and resolvable area in a video image. A single point on the screen. In digital video, a single sample of the picture. Derived from the words *picture element*.

RESOLUTION: The number of bits (eight, ten, etc.) determines the resolution of the signal. Eight bits is the minimum resolution for broadcast television signals.

SERIAL DIGITAL(SDI): Digital information that is transmitted in serial form. Often used informally to refer to serial digital television signals.

SMPTE (Society of Motion Picture and Television Engineers): A professional organization that recommends standards for the film and television industries.

SMPTE 125M: The SMPTE standard for bit parallel digital interface for component video signals. SMPTE 125M defines the parameters required to generate and distribute component video signals on a parallel interface.

SMPTE 244M: The SMPTE standard for bit parallel digital interface for composite video signals. SMPTE 244M defines the parameters required to generate and distribute composite video signals on a parallel interface.

SMPTE 259M: The SMPTE standard for 525 line serial digital component and composite interfaces.

TRS: Timing reference signals used in composite digital systems. (It is four words long).

TRS-ID: Abbreviation for "Timing Reference Signal Identification". A reference signal used to maintain timing in composite digital systems. (It is four words long.)

XDS: See Extended Data Services.

4:2:2 A commonly used term for a component digital video format. The details of the format are specified in the CCIR-601 standard. The numerals 4:2:2 denote the ratio of the sampling frequencies of the luminance channel to the two colour difference channels. For every four luminance samples, there are two samples of each colour difference channel.

4Fsc Four times subcarrier sampling rate used in composite digital systems. In NTSC this is 14.3 MHz. In PAL this is 17.7 MHz.

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2. INSTALLATION

2.1 REAR PANEL

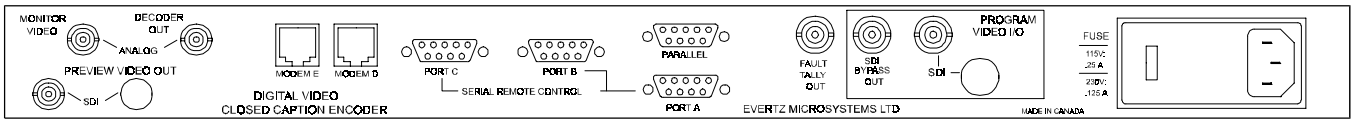

Figure 2-1: 8074 Rear Panel

The following sections describe the purpose of the rear panel connectors of the 8074. Sections 2.1.1 to 2.1.5 describe the specific signals that should be connected to the 8074.

2.1.1 Program Video Connections

SDI IN: A BNC connector for input of 10 bit serial digital video signals compatible with the SMPTE 259M standard.

SDI BYPASS OUT: A BNC connectors for output of 10 bit serial digital video signals compatible with the SMPTE 259M standard. This video will be normally be the video input with caption data inserted onto it. When the SDI bypass relay is activated (on power failure or by closing the SDI Bypass GPI to ground) the SDI BYPASS OUT is a direct relay connection to the SDI IN.

FAULT TALLY OUT: A BNC connector for output of a SMPTE 269M fault tally. The output will be open circuit when the 8074 is processing video normally. The output will be grounded when the 8074 is bypassed.

2.1.2 Preview Video Connections

SDI OUT: A BNC connector for output of 10 bit serial digital video signals compatible with the SMPTE 259M standard. This video will be the video input with data inserted onto it when the SDI bypass relay is NOT activated. If the SDI bypass relay is activated, this connector will have NO video output.

MONITOR VIDEO: A BNC for composite analog output with the closed caption data inserted. This output can be connected to any analog caption decoder to verify that the captions have been encoded correctly. If the 8074-MON option is not installed, this BNC will not be connected internally.

DECODER OUT: A BNC for composite analog output with the captions decoded and inserted as open captions over the video. The front panel menus are used to determine which data channels will be decoded. This output can be connected to any analog monitor to verify that the captions have been encoded correctly. If the 8074-DECODER option is not installed, this BNC will not be connected internally.

2.1.3 Serial Port Connections

PORT A: A 9 pin female 'D' connector for connection to a computer with captioning or EDS control software. The front panel Engineering menus are used to set the correct baud rate, word size and parity for use with your captioning software. (See section 3.3)

The pinout of this connector requires a special cable to be made.

Pin	Description
1	not used
2	not used
3	Data Carrier Detect
4	Request to Send
5	RS-232 Transmit
6	not used
7	not used
8	RS-232 Receive
9	Ground

PORT B, C: These 9 pin male 'D' connectors may be used for connection computers with captioning or EDS control software. The front panel Engineering menus are used to set the correct baud rate, word size and parity for use with your captioning software. (See section 3.3)

The pinout of these connectors is designed so that you can use an industry standard 9 pin “null modem” cable to connect to your computer.

Pin	Description	
1	DCD	Data Carrier Detect (in)
2	RxD	RS-232 Receive Data In
3	TxD	RS-232 Transmit Data Out
4	DTR	Data Terminal Ready (out)
5	GND	Ground
6	DSR	Data Set Ready (in)
7	RTS	Request to Send (out)
8	CTS	Clear to Send (in)
9		not used

MODEM D, E These RJ11 jacks are used to connect the internal modems to the telephone line, so that computers at other locations that are running captioning or EDS control software can connect to the 8074. Use of the MODEM E port requires the 8074-MDM2 option to be installed in your unit. If the option is not installed, this RJ11 jack will not be connected internally. The front panel Engineering menus are used to set the correct baud rate, word size and parity for use with your captioning software. (See section 3.3)

2.1.4 Parallel Remote Control Connections

PARALLEL: A 9 pin female 'D' connector for connection to 'closure to ground' remote control signals. Each input has an internal 47 K ohm pull-up to +5 volts. The pinout of the connector is as follows:

Pin	Description
1	Ground
2	Port A Disable
3	Port B Disable
4	Port C Disable
5	Port D Disable
6	SDI Bypass Enable GPI
7	Master keyer disable GPI
8	Temporary keyer disable GPI
9	Ground

2.1.5 Power Connections

LINE: The 8074 may be set for either 115v/60 Hz or 230v/50 Hz AC operation. The voltage selector switch is accessible on the rear panel. The line voltage connector contains an integral slow blow fuse (and a spare one).

2.2 MOUNTING

The 8074 Digital Video Closed Caption Encoder is equipped with rack mounting angles and fits into a standard 19 inch by 1 3/4 inch (483 mm x 45 mm) rack space. The mounting angles may be removed if rack mounting is not desired.

2.3 POWER REQUIREMENTS

2.3.1 Selecting the Correct Mains Voltage

Power requirements are 115 or 230 volts AC at 50 or 60 Hz, switch selectable on the rear panel. Power should be applied by connecting a 3 wire grounding type power supply cord to the power entry module on the rear panel. The power cord should be minimum 18 AWG wire size, type SVT marked VW-1, maximum 2.5 m in length.

Before connecting the line power, be sure to select the proper line voltage. Also, check that the line fuse is rated for the correct value marked on the rear panel.

The power entry module combines a standard IEC 320 power inlet connector, voltage selector switch, two 5 x 20 mm fuse holders (one active, one spare) and an EMI line filter.

To change the mains voltage setting, disconnect the mains cord from the IEC power inlet connector. Open the cover of the power entry module using a small screwdriver. Remove the drum selector switch, and re-insert it so that the desired voltage is visible through the opening on the mains connector cover. Check that the correct fuse is in use as shown in section below.

2.3.2 Changing the Fuse

The fuse holder is located inside the power entry module. To change the fuse, disconnect the mains cord from the IEC power inlet connector. Open the cover of the power entry module using a small screwdriver. The fuse holder on the bottom contains the active fuse. The one at the top contains a spare fuse. Pull the bottom fuse holder out and place a fuse of the correct value in it. Use slo blo (time delay) 5 x 20 mm fuses rated for 250 Volts with the following current ratings:

For 115 Volt operation	250 mA
For 230 Volt operation	125 mA

Make sure that the arrow is pointing down when you replace the fuse holder. Close the door on the power entry module and connect the mains voltage.

Never replace with a fuse of greater value.

2.4 CONNECTING THE DIGITAL VIDEO

2.4.1 Video Input

The 8074 requires that a digital video source be connected to the SDI video input. The 8074 may be configured to accept either 525 or 625 line digital video in the component (4:2:2) format or 525 line digital video in the composite (4Fsc) format. The VIDEO TYPE parameter on the front panel menu must be set correctly to match the video input. (See section 3.2.1 for information on changing the video type setting).

The 4:2:2 and 4 Fsc LED's indicate which input is active and if there is video present. When either LED is blinking it indicates that there is no video present.

2.4.2 Video Output

The two SDI outputs contain the input video with closed caption data keyed in. The SDI BYPASS OUT output is bypass protected in case of power failure. Normally this output should be used for the main program output of the 8074. A second non-bypassed output (SDI VIDEO OUT) may be connected for preview applications. When the Bypass relay is active, this output contains no video signal. The Bypass relay will be activated on power failure and when the SDI Bypass GPI is closed to ground. It may also be manually activated using the front panel menus. The Fault Tally Output will be open circuit when the bypass relay is processing video normally, and will be grounded when the relay is activated.

2.5 CONNECTING THE ANALOG VIDEO

When the 8074-MON is installed, connect the analog monitor output to a video monitor with a built in caption decoder to allow you to verify that the captioning is being applied correctly.

When the 8074-DECODER option is installed connect the DECODER output to a video monitor to verify that the captioning is being applied correctly. The Monitor output provides a clean analog output for recording on a check cassette.

2.6 CONNECTING THE 8074 TO A CLOSED CAPTION COMPUTER

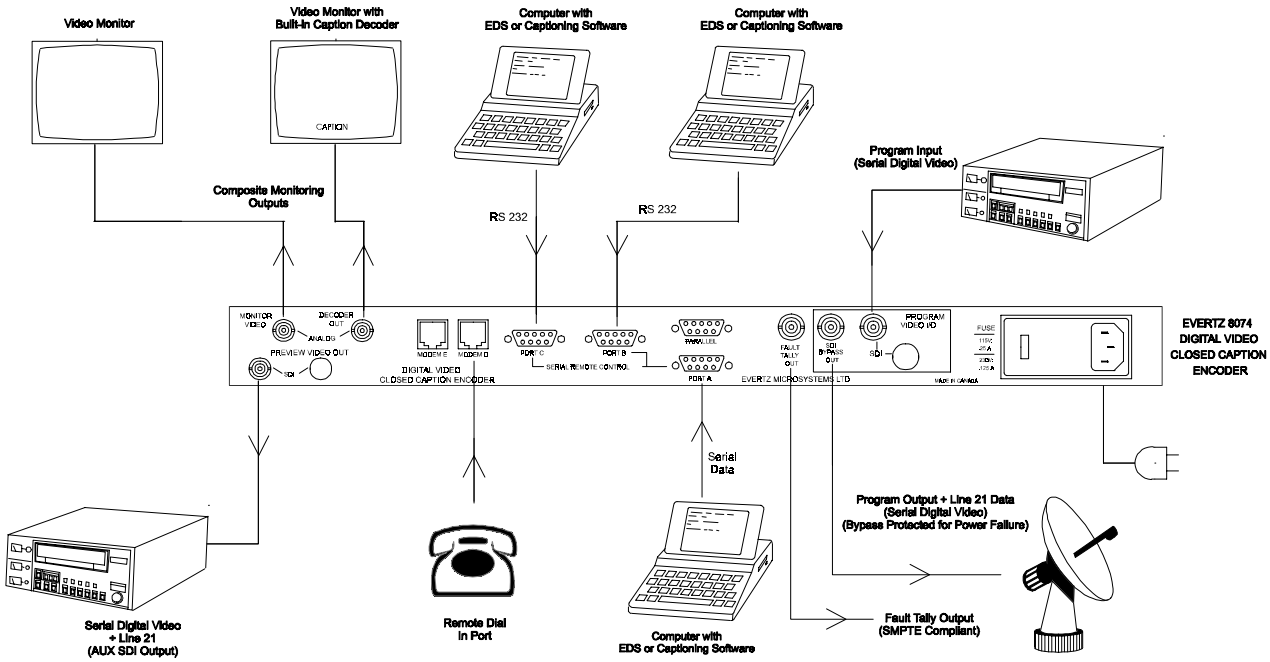

Figure 2-2: Typical Connections to the 8074 Caption Encoder

Figure 2-2 shows the typical connections required when using the 8074 in conjunction with a computer running captioning software.

Connect the PORT A, B, or C connector of the 8074 to one of the serial ports (COM1 or COM2) of your computer. Figure 2-3 below shows the connections between the 8074 Port A and a PC compatible computer. Figure 2-4 below shows the connections between the 8074 Port B or Port C and a PC compatible computer. You can use a standard "NULL MODEM" cable to connect your PC to Port B or C.

The baud rate, word size and parity of the 8074 must be set up to match your software. The most common settings are 1200 Baud, 7 bits odd parity. The Engineering Setup menu BAUD RATE and SERIAL WORD menu items are used to configure these parameters. (See section 3.3.1)

8074 Serial I/O Male			Computer End Female		
Description	DB-9		DB-25	DB-9	Description
Shield					Shield
Ground	1	1		1	Ground
RS 232 Transmit	5	3		2	RS 232 Receive
Ground	6	7		5	Signal Ground
RS 232 Receive	8	2		3	RS 232 Transmit
RS 232 RTS	4	5		8	RS232 CTS
			20	4	DTR
			6	6	DSR

Figure 2-3: Cable Wiring Diagram Port A to Computer

8074 Serial I/O Female			Computer End Female		
Description	DB-9		DB-25	DB-9	Description
Shield					Shield
RS 232 Transmit	3	3		2	RS 232 Receive
Ground	5	7		5	Signal Ground
RS 232 Receive	2	2		3	RS 232 Transmit
RS 232 CTS	8	4		7	RS 232 RTS
RS 232 DTR	4	6		6	RS 232 DSR
RS 232 RTS	7	5		8	RS 232 CTS
RS 232 DSR	6	20		4	RS 232 DTR

Figure 2-4: Cable Wiring Diagram Port B or C to Computer

A short adaptor cable can be constructed to convert Port A pinouts to a similar pinout as Port B or Port C. (This will allow easier interchange of cables)

8074 Port A End DB9P (male)			System End DB9P (male)	
Description	Pin		Pin	Description
Shield				Shield
DCD	3	1	1	8074 DCD in
RTS	4	7	7	8074 RTS out
TXD	5	3	3	8074 TXD out
RXD	8	2	2	8074 RXD in
GND	9	5	5	GND
			4	DTR
			6	DSR

Figure 2-5: 8074 Port A Adaptor Cable

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3. HOW TO OPERATE THE DIGITAL CLOSED CAPTION ENCODER

3.1 AN OVERVIEW OF KEY AND DISPLAY FUNCTIONS

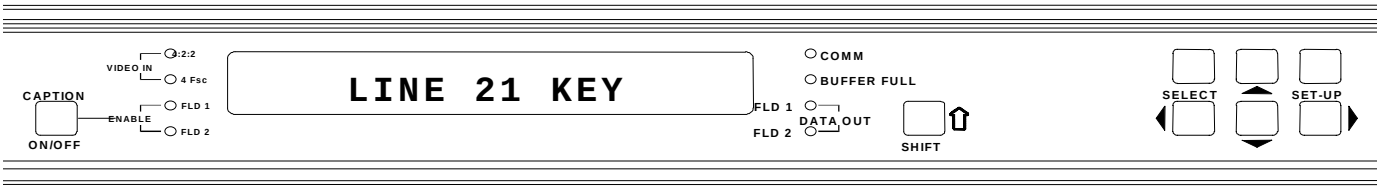

Figure 3-1: Front Panel Layout

The display area consists of a 16 digit alphanumeric display, 8 LED status indicators and an 8 pushbutton keypad.

The keypad is used to control the front panel menu system, and to provide a global Keyer disable. When the **SHIFT** key is held down, the meanings of some of the keys are modified, gaining quick access to a wider variety of functions. (Throughout this manual **SHIFT +** indicates that you should hold down the **SHIFT** key while pressing the second key.)

A front panel programming menu provides a quick and simple method of configuring the 8074 Digital Closed Caption Encoder for your application.

The remainder of section 3.1 gives an overview of the 8074 operation. Sections 3.2 and following give detailed information on the specific operations required to control the 8074.

3.1.1 The Setup Pushbutton Group

The Setup key group consists of the **SELECT, SETUP** and ←, →, ↑, ↓ keys and is used to navigate the front panel programming menu system.

Press the **SETUP** key to enter the Setup mode. Press the **SHIFT + SETUP** keys to enter the Engineering Setup mode. The Engineering Setup Mode provides additional configuration items which should only be used by qualified engineering personnel.

The 8074 will automatically return to the operating mode if no key presses are made for several seconds.

↑ ↓ When in either of the Setup modes, the ↑ & ↓ arrow keys are used to move up or down the main items in the menu system.

← → When in either of the Setup modes the ← & → keys are used to show the choices for the current item in the menu system.

SELECT When in either of the Setup modes the **SELECT** key is used to activate the current choice for the selected item.

SETUP Exits the Setup mode or the Engineering Setup mode and returns to operating mode. One of the front panel messages shown in section 3.1.4 will be shown on the front panel.

3.1.2 The Function Pushbutton Group

The function key group consists of the Caption On/Off pushbutton.

CAPTION ON / OFF Toggles the caption encoder on and off. When the keyer is Off, the 8074 will merely clock the digital video through its internal registers and route it to the digital video output. When the encoder is turned back on, both the Fld 1 and Fld 2 LED's will indicate if the respective keyer is enabled or not. Software commands received by the 8074 may turn the keyer on or off.

SHIFT + CAPTION ON / OFF Locks the caption encoder keyer off. Software commands received by the 8074 will not turn the keyer on when it is in the locked mode.

Lock the Keyer off when you want to guarantee pass through of existing line 21 closed caption information that is already on the program material. See section 3.5.2 for information on controlling the bypass relay.

3.1.3 An Overview of the Status Indicators

There are 8 status indicators located on the front panel that show operational status of the 8074 at a glance.

4:2:2 Indicates that the 8074 is set for 525 or 625 line component digital video. If it is blinking, it indicates that the component digital video mode is selected, but a valid component digital video signal is not present.

4 Fsc Indicates that the 8074 is set for 525 line composite digital video. If it is blinking, it indicates that the composite digital video mode is selected, but a valid composite digital video signal is not present.

FLD 1 ENABLE Indicates that 8074 Encoder is keying caption information into Field 1 of the video.

In stream mode null characters will be inserted if there is no incoming data from the communications ports for field 1 or if there is no upstream field 1 caption information. The front panel message will display `LINE 21 KEY`

In field mode, null characters will be inserted if there is no incoming data from the communications ports for field 1. When it is blinking, the LED indicates that the 8074 has detected incoming captions and is in automatic bypass mode. The front panel message will display `LINE 21 THRU`.

FLD 2 ENABLE Indicates that 8074 Encoder is keying caption information into Field 2 of the video.

In stream mode null characters will be inserted if there is no incoming data from the communications ports for field 2 or if there is no upstream field 2 caption information. The front panel message will display `LINE 21 KEY`.

In field mode, null characters will be inserted if there is no incoming data from the communications ports for field 2. When it is blinking, the LED indicates that the 8074 has detected incoming captions and is in automatic bypass mode. The front panel message will display `LINE 21 THRU`.

COMM Indicates that data is being received or transmitted on one of the communications ports. The LED will also be on during the 8074 Test Message Mode which simulates communications with captioning software.

BUFFER FULL Indicates that one of the communications buffers is full. The 8074 sends an XOFF command to the sending computer to temporarily stop the communications until the communications buffer is empty, at which time an XON command will be sent to the computer. RTS flow control is also used to temporarily stop the communications.

FLD1 DATA OUT Indicates that non-null data being received on one of the communications port or from the upstream captions is being inserted into the Field 1 data queue. When the Field 1 captions are enabled, this data will be inserted on line 21 in field 1.

FLD2 DATA OUT Indicates that non-null data being received on one of the communications port or from the upstream captions is being inserted into the Field 2 data queue. When the Field 2 captions are enabled, this data will be inserted on line 21 in field 2.

3.1.4 Front Panel Operating Messages

The front panel display is used to indicate the current operating mode of the 8074 as shown below.

422 THRU 525 line Component Keyer. Encoder is disabled but may be enabled by the computer. Video will pass through the 8074 unmodified.

422P THRU 625 line Component Keyer. Encoder is disabled but may be enabled by the computer. Video will pass through the 8074 unmodified.

4Fs THRU 525 line Composite Keyer. Encoder is disabled but may be enabled by the computer. Video will pass through the 8074 unmodified.

LINE 21 KEY Line 21 Keyer. The line number that the 8074 is encoding captions on will be displayed. The caption encoder is enabled for field 1 or field 2 as indicated by the FLD 1 Enable and FLD 2 Enable LEDs.

LINE 21 THRU Line 21 Keyer. The line number that the 8074 is encoding captions on will be displayed. The 8074 is operating in field mode and has detected incoming captions and is in auto thru mode. Incoming captions will be passed through. When incoming captions are no longer present, the 8074 will revert to `LINE 21 KEY` mode.

In the displays shown above, if upstream data is present on field 1 a period (`.`) will be shown to the left of the display. If incoming data is present in field 2 then a colon (`:`) will be shown to the left of the display

REMOTE OVERRIDE Indicates that the 8074 keyer has been disabled by a GPI input on the parallel connector.

EXTERNAL BYPASS Indicates that the 8074 SDI video has been bypassed due to a GPI input on the parallel connector.

LOCAL BYPASS ON Indicates that the 8074 SDI video has been bypassed due to a front panel menu selection.

LOCKED THRU The caption encoder is disabled and may not be enabled by computer. Video will pass through the 8074 unmodified.

C1234 T1234E The channel monitor display is accessible by pressing the SHIFT + 🡻 keys when the 8074 is in stream mode. The four characters to the right of the C indicate what is happening to the 4 caption data streams. The four characters to the right of the T indicate what is happening to the 4 text data streams. The rightmost character indicates what is happening to the Extended data services stream. (See section 3.4.1 for further information). Return to the normal front panel displays by pressing the SHIFT + 🡻.

F1KEY F2KEY The field monitor display is accessible by pressing the SHIFT + 🡻 keys when the 8074 is in field mode. The message to the right of the F1 indicates what is happening to the data in field 1. The message to the right of the F2 indicates what is happening to the data in field 2. (See section 3.4.2 for further information). Return to the normal front panel displays by pressing the SHIFT + 🡻.

MODEM D ONLINE This message will alternate with other displays to indicate that the 8074 is on-line with the built-in modem D.

MODEM D DISABLED This message will alternate with other displays to indicate that Modem D is not in auto-answer mode, either because of the 8074 menu selection or parallel port GPI.

A DISABLED This message will alternate with other displays to indicate that Port A is disabled because of a parallel port GPI. All input on Port A will be ignored while in this mode. Similar messages may appear for other ports.

23:59:59 The current local time display will alternate with the `LINE 21 KEY` or `LINE 21 THRU` displays.

When Modem D is enabled, the front panel display will show various messages received from the modem such as `CONNECT 1200` or `NO CARRIER` or `OKOK`.

When in the Setup modes, the front panel is used to display the current menu item and selected option.

3.1.5 An Overview of the Front Panel Setup Menu

The key to the operational flexibility of the 8074 Digital Video Closed Caption Encoder lies in the front panel setup menu system. The setup menu system uses the 16 digit alphanumeric display and provides a quick, intuitive method of configuring the 8074 Digital Video Closed Caption Encoder, guiding you to the correct setup for your application. The six keys in the Setup key group (**SELECT**, **SETUP,** 🡸 🡺 🡹 🡻) are used to cycle through the various items on the programming menu. Press the **SETUP** key to enter the setup menu. Press the 🡹 or 🡻 keys to move to the next menu item. When you have chosen the desired menu item, press the 🡸 or 🡺 keys to view the settings available for that menu item. The currently selected setting will be flashing. When you have chosen the desired setting for the menu item, press the **SELECT** key to save that value.

The 8074 setup menu system consists of a main menu with two or more choices for each menu item. A **")"** symbol to the left of the main level menu items allows them to be easily distinguished from the front panel

operating messages. The sub menu items are shown in lower case to allow them to be easily distinguished from the main level items.

There is also an Engineering Setup menu which contains items not normally required during normal operation. A **">"** symbol is shown to the left of the main level Engineering setup menu items. Figure 3-2 is an overview of the front panel setup menu system, and shows all the menu items and where you will find the menu choices. Figure 3-3 is an overview of the Engineering menu system, and shows all the Engineering menu items and where you will find the menu choices.

To enter the front panel setup menu, press the **SETUP** key. To enter the Engineering Setup menu press the **SHIFT + SETUP** keys.

The two vertical arrow keys (↑, ↓) allow you to move vertically within the menu tree. When you have selected the desired menu item, press the → key to reveal the choices for that item. The choice that is currently selected will be blinking. When you have selected the desired sub menu choice press the **SELECT** key to save your choice.

When you have made all the desired changes, press the **SETUP** key to return to the normal display mode.

Each of the setup menu items is described in section 3.2 with an explanation of what each choice does. Each of the Engineering Setup menu items are described in section 3.3 with an explanation of what each choice does. Some menu items may not be available depending on the options installed in the 8074.

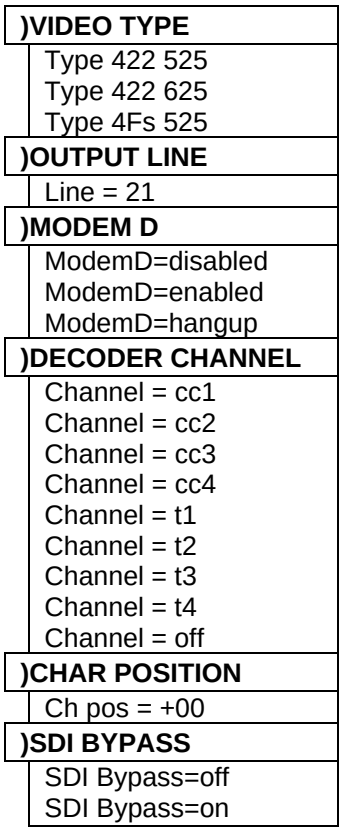

Figure 3-2: Overview of the 8074 Setup Menu System

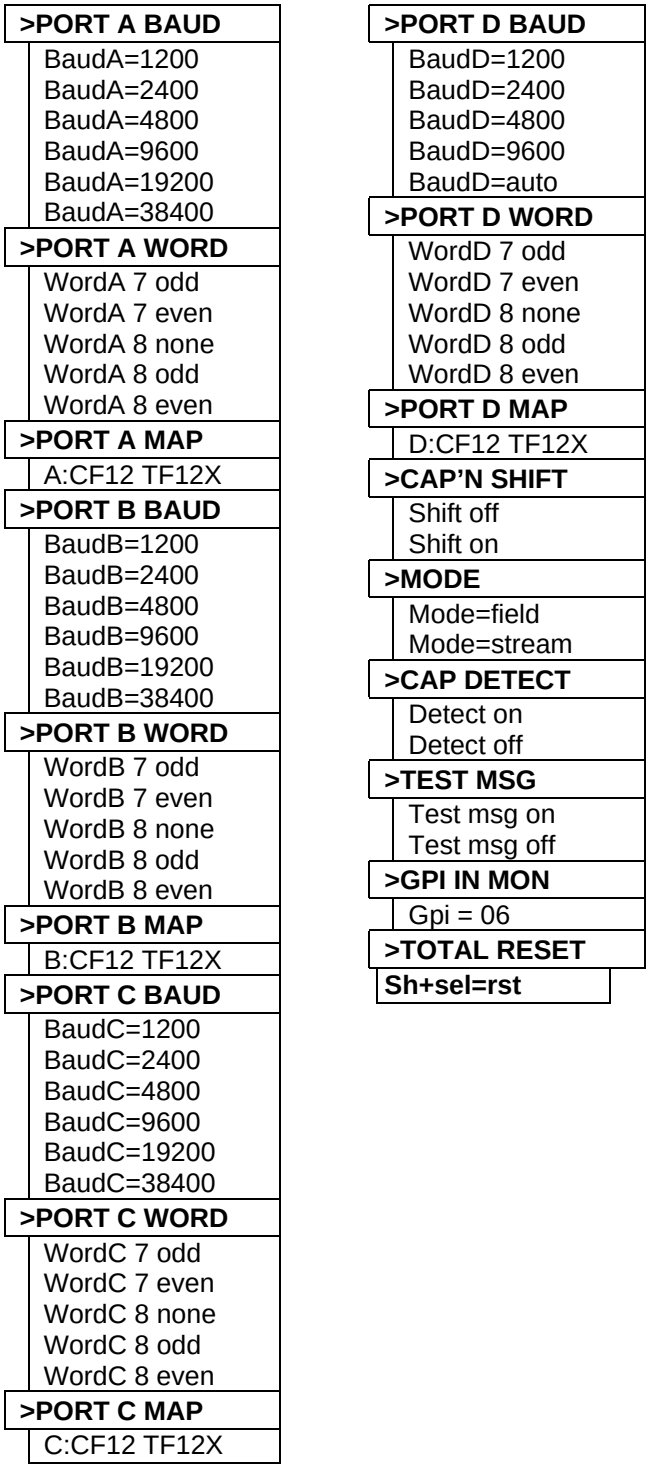

Figure 3 [illegible]74 Engineering Menu System

3.2 PROGRAMMING THE 8074 OPERATIONAL MODES - THE SETUP MENU

The front panel setup menu is used to configure the basic operational modes of the 8074 Digital Video Closed Caption Encoder such as selecting which type of video is present, how the serial port will be used, etc. A **")"** symbol to the left of the main level menu items allows them to be easily distinguished from the front panel operating messages. The sub menu items are shown in lower case to allow them to be easily distinguished from the main level items.

The six keys in the Setup key group (**SELECT**, **SETUP,** ← → ↑ ↓) are used to cycle through the various items on the menu. Press the **SETUP** key to enter the setup menu. Press the ↑ or ↓ keys to move to the next menu item. When you have chosen the desired menu item, press the ← or → keys to view the settings available for that menu item.

The currently active setting will be flashing.

When you have chosen the desired setting for the menu item, press the **SELECT** key to save that value.

3.2.1 Selecting The Type Of Video Being Used

VIDEO TYPE
Type 422 525
Type 422 625
Type 4 Fs 525

VIDEO TYPE is used to select the correct digital video format.

Select **Type 422 525** for operation with component video with a line rate of 525 lines per frame. (Conforming to SMPTE 125M) or

Select **Type 422 625** for operation with component video with a line rate of 625 lines per frame. (Conforming to EBU Tech 3267 E)

Select **Type 4Fs 525** for operation with composite video with a line rate of 525 lines per frame. (Conforming to SMPTE 244M)

3.2.2 Selecting the Line Caption Data Will be Encoded On

OUTPUT LINE
Line = 21

OUTPUT LINE is used to select the line that caption data will be encoded on. Normally caption data is encoded on line 21 in NTSC systems and line 22 in PAL systems. Press the → key to see what line is currently selected. Use the ← and → keys to change the line numbers. The output line number will immediately change when the ← and → keys are pressed. This menu item also selects which line the decoder uses.

3.2.3 Selecting Whether the 8074 will Auto Answer

MODEM D
- ModemD=disabled
- ModemD=enabled
- ModemD=hangup

MODEM D is used to select whether the built in modem is enabled for receiving phone calls.

Select **ModemD=disabled** to configure the 8074 to ignore incoming phone calls. The 8074 will hang up the modem (if currently online) and configure the modem to auto answer off when this item is selected.

Select **ModemD=enabled** to configure the 8074 for a dial up connection to the caption computer using the built-in modem. The 8074 will configure the modem to auto answer when this item is chosen.

The 8074 will display **ModemD=hangup** when the modem is currently connected to a remote modem. If this item is selected, the modem will hang-up the current connection and return to **ModemD=disabled** mode.

3.2.4 Configuring the Optional Caption Decoder

Two menu items are used to configure the operation of the optional caption decoder. These menu items will not be available when the decoder option is not installed.

DECODER CHANNEL
- Channel = cc1
- Channel = cc2
- Channel = cc3
- Channel = cc4
- Channel = t1
- Channel = t2
- Channel = t3
- Channel = t4
- Channel = off

DECODER CHANNEL is used to select which channel the decoder will display. The chart below shows the menu settings to decode each of the channels.

Designator	Channel	Field
CC1	Caption Channel 1	1
CC2	Caption Channel 2	1
CC3	Caption Channel 3	2
CC4	Caption Channel 4	2
T1	Text Channel 1	1
T2	Text Channel 2	1
T3	Text Channel 3	2
T4	Text Channel 4	2
Off	Disables decoder	

CHAR POSITION
Ch pos = +00
Ch pos = -02
Ch pos = +04

CHAR POSITION is used to adjust the horizontal position of the decoder display on the screen. Press the → key to view the current position. Use the ← and → keys to change the position and press the SELECT key to save the new position.

Ch pos = +00 is the default position
Ch pos = -02 is the leftmost position
Ch pos = +04 is the rightmost position

SDI BYPASS
SDI Bypass = on
SDI Bypass = off

SDI BYPASS is used to control the SDI bypass relay. This relay automatically engages on power failure and directly connects the SDI VIDEO IN connector to the SDI BYPASS OUT connector, effectively bypassing the 8074. This relay can also be forced into bypass from the SDI Bypass parallel port control pin. (see section 3.5.1)

Select **SDI Bypass=off** to configure the 8074 for normal operation.

Select **SDI Bypass=on** to configure the 8074 to be bypassed.

When the 8074 is bypassed, the 8074 will indicate that the input video is missing. No video will be routed through the 8074, and consequently the MONITOR and DECODER video outputs will not be active.

3.3 ENGINEERING SETUP MENU ITEMS

The Engineering Setup menu is used to configure the advanced operational modes and hardware configuration items of the 8074 Digital Video Closed Caption Encoder such as selecting baud rate for communications, type of command emulation, and enabling test message encoding. A **">"** symbol to the left of the main level menu items allows them to be easily distinguished from the main setup items and the front panel operating messages. The sub menu items are shown in lower case to allow them to be easily distinguished from the main level items.

The six keys in the Setup key group (**SELECT**, **SETUP,** ← → ↑ ↓) are used to cycle through the various items on the menu. Press the **SHIFT + SETUP** keys to enter the Engineering Setup menu. Press the ↑ or ↓ keys to move to the next menu item. When you have chosen the desired menu item, press the ← or → keys to view the settings available for that menu item.

The currently active setting will be flashing.

When you have chosen the desired setting for the menu item, press the **SELECT** key to save that value. Press **SETUP** or **SHIFT + SETUP** to exit the Engineering Setup menu.

3.3.1 Setting the Serial Port Baud Rate and Data Format

Two menu items are used to set up the serial port physical connection parameters. These settings are used regardless of whether the serial port is configured for modem or direct connections (See section 3.2.3). There is a pair of menu items for each of the ports.

>PORT A BAUD
- **BaudA=1200**
- **BaudA=2400**
- **BaudA=4800**
- **BaudA=9600**
- **BaudA=19200**
- **BaudA=38400**

PORT A BAUD is used to set the baud rate of the communications port A (similar menu items are available to configure the buad rates for ports B and C). Adjust this setting to match the baud rate of your computer. If unsure what the baud rate is, set it to 1200 baud (the factory default setting).

>PORT D BAUD
- **BaudD=1200**
- **BaudD=2400**
- **BaudD=4800**
- **BaudD=9600**
- **BaudD=auto**

PORT D BAUD is used to set the baud rate of the built-in modem (port D). Adjust this setting to match the baud rate of your computer. The modem will connect at the specified baud rate. When auto baud rate is selected, the modem will connect at any baud rate up to 9600. You may want to choose a specific lower baud rate if your software does not properly respond to flow control and you are experience buffer overlow errors. If unsure what the baud rate is, set it to auto baud (the factory default setting).

PORT A WORD
- **WordA 7 odd**
- **WordA 7 even**
- **WordA 8 none**
- **WordA 8 odd**
- **WordA 8 even**

PORT A WORD is used to select the number of data bits and parity of the communications port A. (similar menu items are available to configure the data format for ports B and C).

Select **WordA 7 odd** to select 7 data bits, 1 stop bit odd parity. This is the factory default setting.

Select **WordA 7 even** to select 7 data bits, 1 stop bit even parity.

Select **WordA 8 none** to select 8 data bits, 1 stop bit no parity.

Select **WordA 8 odd** to select 8 data bits, 1 stop bit odd parity.

Select **WordA 8 even** to select 8 data bits, 1 stop bit even parity.

3.3.2 Setting the Serial Port Access Permission

PORT A MAP is used to permit communications port A access to the various data (similar menu items are available to configure permissions for ports B,C and D). See section 4.7 for a discusion of port permissions.

The display indicates which caption fields are enabled ('CF12') and which text fields are enabled ('TF12') and if extended data services are enabled ('X'). A dash character in place of the numeral indicates that field is not permitted for communications port A.

Use the left and right arrows to until the desired field is blinking, then hit the SELECT key to toggle the enabled or disabled state.

3.3.3 Compensating for the 7.5 IRE Setup in 422 to Analog Encoders

It is common for 4:2:2 component to composite video encoders to add setup to line 21 regardless of whether there is closed caption information on line 21 or not. Closed caption data generated at 0 IRE on component video will be translated to 7.5 IRE when setup is added by the video encoder.

The EIA 608 waveform specification says that there should be no setup on line 21. In order to eliminate the setup when the encoding to composite video takes place, it is necessary to shift the caption data down by 7.5 IRE when it is generated by the 8074. Unfortunately, in order to shift the caption data down by 7.5 IRE it is necessary to use digital video values that are not legal according to the SMPTE 125M Component Digital Video specification.

CAP'N SHIFT
Shift off
Shift on

CAP'N SHIFT is used to select whether the caption data will be shifted to adjust for setup on line 21.

Select **Shift off** to encode captions at 0 IRE on 4:2:2 video signals. The resulting closed caption signal will contain legal SMPTE 125 data values but may have 7.5 IRE of setup added when it is encoded to a composite video signal. (Depending on the video encoder)

Select **Shift on** to encode captions at -7.5 IRE on 4:2:2 video signals. The resulting closed caption signal will contain illegal SMPTE 125 data values but may have the 7.5 IRE of setup cancelled out when it is encoded to a composite video signal. (Depending on the video encoder)

3.3.4 Setting the Overall Operating Mode of the 8074

MODE
Mode = stream
Mode = field

MODE Two modes of operation are supported to guarantee maximum compatibility with a wide variety of caption software packages.

Select **Mode = stream** to operate the 8074 in 'stream' mode. See sections 4.4 to 4.6 for a list of the serial commands that the 8074 supports in stream mode. When set to stream mode, each individual data streams can be manipulated independent

of each other. In stream mode, each of the individual caption data streams can be passed through, removed, or replaced with new data by the 8074. Extended Data Services packets may also be inserted into the existing data streams.

The handling of the individual data streams requires that all the upstream caption information be read and regenerated on the output. This requires that outgoing caption data will be delayed by 2 video frames as described in the EIA-608 recommendations. If the caption encoder is turned off (see section 3.1.2) the upstream caption information will be passed through without delay.

Select **Mode = field** to operate the 8074 in 'field' mode. See section 4.3 for a list of the serial commands that the 8074 supports in field mode. When set to the field mode, the 8074 manipulates caption on a field-wise basis. In field mode, all the data streams in a particular field will be passed, removed, or replaced with new data. When upstream caption data is being passed through, the corresponding ENABLE LED on the 8074 front panel will be Off, and the data is passed through with no delay.

3.3.5 Auto Detecting Incoming Captions

CAP DETECT
- **Detect on**
- **Detect off**

CAP DETECT is used to select whether automatic detection of previously captioned digital video is enabled or not. (Field mode only)

Select **Detect on** to enable incoming caption detection. When incoming captions are detected, the Caption keyer will be automatically shut off to allow the incoming captions to pass through. In this mode the FLD 1 ENABLE or FLD 2 ENABLE LED will blink. In this mode the front panel display will show `LINE 21 THRU`. This method of operation is only applicable in Field Mode.

When there are no incoming captions the front panel display will show `LINE 21 KEY`.

Select **Detect off** to disable incoming caption detection.

3.3.6 Configuring the 8074 to Encode a Test Message

During system setup and verification it is often desirable to have the 8074 generate a test message so data integrity and signal quality of the captioned signal may be verified.

TEST MSG
- **Test msg on**
- **Test msg off**

TEST MSG is used to select whether the encoder will generate test messages or not.

Select **Test msg on** to enable the encoder test message. The encoder will insert a test message that includes all 9 data

channels. The test message is generated by simulating a data stream into the Port A communications buffer. The COMM LED will blink On and the Port A output will generate a stream of prompt characters ('*').

(e.g.: TST F2 C1) is encoded for the cc3 data stream

This will allow you to verify the setup of your system without having a computer sending data to the 8074.

The test message mode will be automatically turned off whenever the CAPTION ON/OFF key is pressed or when communications commences with the captioning software. (i.e. a Control-C is received on any communications port.)

Select **Test msg off** to disable the encoder test message.

3.3.7 Monitoring the Status if the Parallel Remote Control Inputs

GPI IN MON
Gpi = 80

GPI IN MON is used to show the current status of the parallel remote control inputs. When you press the **SELECT** button, the display shows something similar to Pin = 06. The number is a hexadecimal representation of the bit mapped parallel input. Bit 0 is the least significant bit, bit 7 is the most significant bit. (See section 3.5 for a description of the remote control functions).

Parallel Pin	Monitor Bit	Function
1		Ground
2	0	Port A Disable
3	2	Port B Disable
4	4	Port C Disable
5	6	Port D Disable
6		External SDI Bypass Enable
7	1	Master Keyer Disable
8	3	Temporary Keyer Disable
9	5	Future use
none	7	SDI Bypass sense (0=bypass active)

3.3.8 Resetting the 8074 to Factory Defaults

TOTAL RESET
Sh+sel=rst

TOTAL RESET is used to reset the 8074 to its factory defaults. When you press the ➔ button, the display shows something similar to `Sh+sel=rst`. Press the SHIFT+SELECT keys to reset the 8074. The display will show `Reset Done`.

3.3.9 Performing a Front Panel Reset to Transparent State

Sometimes it may be desirable to perform a reset of the encoder back to transparent state, especially if a communications error has left one port active, which may cause an ACCESS ERROR when another port attempts

to caption. This can be accomplished by holding down the SHIFT +↑+→ keys simultaneously. The encoder will be completely reset to the transparent state and the Article and EDS queues will be cleared. Articles and EDS packets will not be removed from memory. The display will show `Reset Done`.

3.4 MONITORING THE INCOMING DATA

There are two displays provided to allow the user to view how incoming data will be handled by the 8074. The Stream monitor display is available when the 8074 is configured for the 'stream' mode of operation. The Field monitor display is available when the 8074 is configured for the 'field' mode of operation. (See section 3.3.4 for information on configuring stream or field mode of operation.) To toggle in and out of the monitor displays, press the **SHIFT +** ↓ keys when you are not in either of the Setup menus.

3.4.1 Monitoring the Data in 'Stream Mode'

The stream monitor display shows each of the nine data streams and indicates how the 8074 is processing the data in each stream.

Indicator	Description	Explanation
↓	Regen Upstream Through	Data in this stream will be decoded and regenerated in the encoder output.
X	Block Upstream	Data in this stream will be removed from the encoder output
1,2,3,4,E	Incoming Data	Indicates that the data stream is present at the encoder input. The number corresponds to the respective caption or text channel. The letter E corresponds to the Extended Data Services data stream.
D	Direct Control State	Direct Control state has been enabled for this data stream. Upstream captions will be replaced by the incoming captions from the serial port which will be encoded into the corresponding data stream at the encoder output.
R	Real Time State	Real Time state has been enabled for this data stream. Upstream captions will be replaced by the incoming captions from the serial port which will be encoded into the corresponding data stream at the encoder output.
A	Article State	Article state has been enabled for this data stream. Upstream data will be replaced by text Articles from the article queue.
|	Direct Wire	Data in this stream is copied directly to the output without regeneration.

Table 3-1: Front Panel Data Monitoring in Stream Mode

The front panel display shows something similar to **`C1234 T1234E`** when it is in the stream monitor mode. The 4 characters to the right of the `C` are used to monitor the four caption streams. The 4 characters to the right of the `T` are used to monitor the four text streams. The rightmost character is used to monitor the Extended data services stream. The character in each data stream monitor position can have several values, indicating different processing options in the 8074. The processing options are shown in Table 3-1.

3.4.2 Monitoring the Data in 'Field' Mode

The field monitor display shows how the 8074 is processing the data in each field.

The front panel display shows **F1KEY F2KEY** when it is in the field monitor mode. The 3 characters to the right of the F1 are used to show what is happening to the data in field 1. The 3 characters to the right of the F2 are used to show what is happening to the data in field 2. The message in each field monitor position can have several values, indicating different processing options in the 8074. The processing options are shown in Table 3-2.

Indicator	Description	Explanation
|		Data in this field is copied directly to the output without regeneration.
KEY	Keying Data	Incoming captions from the serial port are being encoded in the corresponding field at the encoder output.
NUL	Keying Nulls	Null characters are being inserted in the corresponding field at the encoder output.

Table 3-2: Front Panel Data Monitoring in Field Mode

3.5 PARALLEL REMOTE CONTROL CONNECTIONS

The PARALLEL 9 pin female 'D' connector provides a method of connecting 'closure to ground' remote control signals for the keyer. Each input has an internal 47K ohm pull-up to +5 volts. The pin assignment of the connector is as follows:

Pin	Description
1	Ground
2	Port A Disable
3	Port B Disable
4	Port C Disable
5	Port D Disable
6	SDI Bypass Enable GPI
7	Master keyer disable GPI
8	Temporary keyer disable GPI
9	For future use

3.5.1 Disabling the Caption Keyer using the Parallel Remote Control

The keyer will be turned off when the Master GPI input is low and turned on when the Master GPI input is high.

The keyer will be disabled while the Temporary GPI is held low and will remain disabled after the temporary GPI input returns HIGH until the next byte of data is received on any serial remote control port.

3.5.2 Bypassing the 8074 using the Parallel Remote Control

The 8074 SDI video input will be connected directly to the SDI Bypass Out when the SDI Bypass Enable GPI is held low. The 8074 SDI video input and output will return to normal when the SDI Bypass Enable GPI returns high.

3.5.3 Disabling the Serial Ports using the Parallel Remote Control

When the Port A Disable input is initiated low, Port A will be reset as though a ^F^F had been received. Further input on this port will be ignored until the Port A Disable input is released high. This input can be used to select which port will control the 8074.

When the Port B Disable input is initiated low, Port B will be reset as though a ^F^F had been received. Further input on this port will be ignored until the Port B Disable input is released high. This input can be used to select which port will control the 8074.

When the Port C Disable input is initiated low, Port C will be reset as though a ^F^F had been received. Further input on this port will be ignored until the Port C Disable input is released high. This input can be used to select which port will control the 8074.

When the Port D Disable input is initiated low, Port D will be reset as though a ^F^F had been received. If online, the modem will be forced to hang-up, and the modem will refuse to answer any further phone calls. Further input on this port will be ignored, until the Port D Disable input is released high. This input can be used to select which port will control the 8074.

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4. SERIAL COMMAND PROTOCOL

4.1 COMMAND SYNTAX DESCRIPTION

The following sections present the command protocol for the 8074 encoder. The Command line shows the required information in **bold underlined text**. Optional parameters are shown in **bold normal text.** The default line shows the parameter values that will be invoked if the optional parameter(s) are omitted. Many of the commands use control characters which are indicated by a carat character '^' preceding a letter. (E.g. Control-A is shown as ^A). Other special characters are shown enclosed in <brackets>. (See section 4.1.1 for a description of the control characters and special characters and their ASCII values). (All ASCII values are shown in hexadecimal notation). Parameters are shown in lower case. (See section 4.1.2 for a description of the parameters and their values). All upper case alphanumeric characters that are not preceded by the carat or enclosed in brackets are to be interpreted as individual characters. (E.g. F1 is an 'F' followed by a '1').

4.1.1 Special Characters

Most commands use control characters to communicate with the encoder. The chart below shows the designators for the control characters and other special characters that are used in the command descriptions

Designator	Name	ASCII Values (Hex)
^A	Control-A	01
^B	Control-B	02
^C	Control-C	03
^F	Control-F	06
^G	Control-G	07
^H	Control-H (backspace)	08
^X	Control-X (delete line)	18
<sp>	Space	20
<cr>	Carriage Return	0D
<xon>	Halt transmission	11
<xoff>	Start Transmission	13

4.1.2 Parameters

Some commands use parameters with variable values. The command descriptions use a generic designator to indicate these parameters. The chart below shows each of the designators with their meanings and the permitted values. The values shown are the actual characters to be inserted into the command message. Normally parameters should be separated from each other by a <sp>.

Designator	Name	Values	Description
fx	Field Number	F1	Field 1
		F2	Field 2
dc	Data Channel	C1	Caption Channel 1
		C2	Caption Channel 2
		C3	Caption Channel 3
		C4	Caption Channel 4
		T1	Text Channel 1
		T2	Text Channel 2
		T3	Text Channel 3
		T4	Text Channel 4
		XD	Extended Data Services Channel
		For compatibility with older software the following designators are also used to describe caption data channels	
		CC1	Caption Channel 1
		CC2	Caption Channel 2
		CC3	Caption Channel 3
		CC4	Caption Channel 4
tc	Text Channel	T1	Text Channel 1
		T2	Text Channel 2
		T3	Text Channel 3
		T4	Text Channel 4
		For compatibility with older software the following designators also refer to the text channels	
		L1	Text Channel 1
		L2	Text Channel 2
		L3	Text Channel 3
		L4	Text Channel 4
name	Article Name	1 to 8 alphanumeric character article name	

edsid	EDS packet Id	input as 2 ASCII hex digit class followed by 2 ASCII hex digit type. (cctt) Valid class numbers are: 01, 03, 05, 07, 09, 0B, OD. Leading zeros of the class numbers are optional. In cases where the class and type bytes are not sufficient to uniquely distinguish the packets, (such as for 0D05 packets) the first 2 digits of the packet data may also be appended to the end of the edsid. (ccttdd)	
k/d	Keep/Delete	K D	Keep article Delete article
o/h	Output/Hold	O H	Place article in output queue Do not place article in output queue
n/l	Next/Last	N L	Place article next in output queue Place article at the end of output queue
rc	Repeat Count	0 to 9998 9999 FFFF hh:mm:ss	Decimal number of times to repeat article Repeat indefinitely Repeat indefinitely Repeat until this time is being requested by the computer (Current software treats this as equivalent to 9999)
ln	Output Line	10 to 25	
bl	Caption Base Line	1 to 15	Base line of caption rollup display
rl	Caption Rollup Lines	2 to 4	Number of lines of rollup captions
pn	Port Name	P1, PA, EN1, = port A P2, PB, EN2, = port B P3, PC, EN3, = port C P4, MA, MD, EN4 = modem D P5, MB, ME, EN5 = modem E (if installed)	

dt	Data Type	CF1	captions field 1
		CF2	captions field 2
		TF1	text field 1
		TF2	text field 2
		EDS	extended data services
ws	Word size	7	7 bit data word
		8	bit data word
par	Parity	O	Odd parity
		E	even parity
		N	no parity
tz	Time zone	0:00 to 23:59	time zone hours and minutes relative to UTC
ovr	Override	O	forces override

4.1.3 Flow Control Handshaking

When the 8074's input buffer is nearly full the 8074 sends an XOFF for each character received. If the Caption software continues to send data and the 8074 input buffer fills completely the 8074 will show the message `BUFFER OVERFLOW` on the front panel display. When the input buffer has overflowed some data may be lost. When the input buffer is nearly empty the 8074 will send an XON.

The 8074 also uses hardware flow control to prevent lost data. The 8074 will turn off the RS232 RTS signal when the buffer is nearly full, and will turn RTS on when the input buffer is nearly empty.

4.1.4 Break Handling

A break character can be sent to the 8074 to cause the content of the associated input buffer to be discarded. If the break character is sent to a modem port (Modem D or Modem E), the modem character buffers will also be discarded. This allows the user to circumvent a backlog of data input, and regain immediate control of the 8074. The best way to reset a communications port is to send a break followed by a Control-F – Control-F command.

4.1.5 Command Responses and Error Messages

When the 8074 accepts any of the Control-A commands it will respond by sending back an asterisk '*' prompt with the following exceptions: When the 8074 is in real time mode it will respond with a colon ':' prompt. When an article is being defined, it will respond with a '>'.

If the 8074 receives a command that it does not understand it will respond by sending back an error code 'E1'. The front panel display will show the message COMMAND ERR.

If the 8074 receives invalid parameters for a command it will respond by sending back an error code 'E2' The front panel display will show the message CMD FMT ERROR.

If the 8074 receives a request to delete an article that has not been defined it will respond by sending back an error code 'E4' The front panel display will show the message CMD FMT ERROR.

If the 8074 has no more article/EDS memory available it will respond by sending back an error code 'E6' The front panel display will show the message OUT OF MEMORY.

If there is a problem with the serial communications baud rate, parity or word size the 8074 will show the message PARITY ERROR on the front panel display.

If one of the control ports tries to gain control of a data stream which is already being controlled by another port, or if the control port has not been given access privilege to the data stream, the 8074 will show the message ACCESS ERROR on the front panel, and will respond by sending back an error code 'E9'.

4.1.6 What is a Data Stream?

EIA-608 specifies nine data channels for line 21 data services as shown in the chart below:

Field 1		Field 2	
CC1	Primary Synchronous Caption Service	CC3	Secondary Synchronous Caption Service
CC2	Special Non-synchronous Use Captions	CC4	Special Non-synchronous Use Captions
T1	First Text Service	T3	Third Text Service
T2	Second Text Service	T4	Fourth Text Service
		EDS	Extended Data Services

Throughout this manual, the designators CC1, CC2, CC3, and CC4 are equivalent to C1, C2, C3, and C4 respectively.

The primary Synchronous Caption Service (CC1 is primary language captioning data that must be in sync with the sound. The Secondary Synchronous Caption Service (CC3) is an alternate captioning data channel in sync with the sound usually used for a second language.

The special Non-Synchronous channels (CC2, CC4) carry data that is intended to augment information carried in the program and is not necessarily in sync with the sound.

The four text services are used to carry general text information that may not be related to the program content.

Extended Data services contains information about the program such as program title, length, and violence rating (V-chip) information.

Because up to 5 data channels can be encoded in one field of the video, it is necessary to logically group the data from each channel into data streams. This is done by inserting control codes along with the data to allow decoders to distinguish the contents of one channel from the other within the same field. The data from the different channels is interleaved to allow the CC1 and CC3 channels to maintain synchronism with the sound.

In stream mode, the 8074 can manipulate each of these data channels independently. Throughout this manual the term 'data channel' is used interchangeably with 'data stream' and refers to a collection of data for one channel and the control codes necessary to distinguish it from other channels.

4.1.7 Operating Modes

The 8074 operates in one of two basic modes - stream mode or field mode. Use the MODE menu item on the Engineering Setup Menu to select which operating mode is to be used.

When stream mode is selected the 8074 manipulates each data stream independently of each other. In Stream mode, each of the individual caption data streams can be passed through, removed, or replaced with new data by the 8074. New caption data may also be inserted into existing data streams. The commands available in Stream mode are discussed in section 4.4.

When Field mode is selected the 8074 manipulates caption data on a field-wise basis. In Field mode, all the caption data in a particular field will be passed, removed, or replaced with new data. The commands available in Field mode are discussed in section 4.3.

Some of the commands are common to both emulation modes and are discussed in section 4.2

4.2 COMMANDS COMMON TO BOTH OPERATING MODES

4.2.1 Set Baud Rate

The 8074 encoder's serial remote control ports may be set to operate at any standard baud rate from 1200 to 38400. When this command is executed the new baud rate will become immediately active, and the sending computer must immediately switch to the new rate. The new baud rate is stored in non-volatile memory and will be restored when the unit is powered up. The baud rate can also be set using the Engineering Setup menu BAUD RATE item. (See section 3.3.1)

The modem ports may have a lower maximum baud rate that is related to the maximum baud rate of the built-in modems. The baud rate for the modem ports will also limit the maximum connection rate that the modems will allow.

Command: **^AI<sp>pn<sp>baud<sp>ws<sp>par<cr>**
or **^AI<cr>**

Default: none

The parameter **baud** specifies the baud rate that will be used. The permitted values of parameter **baud** are shown in the table below.

Parameter	**Baud rate**
12	1200
1200	1200
24	2400
2400	2400
48	4800
4800	4800
96	9600
9600	9600
192	19200
19200	19200
384	38400

If the optional port name parameter is missing, then the current control port will be assumed. If no parameters are specified, the 8074 will respond with a report of the communication parameters of all the comm ports as shown below.

Port A: 1200 7 Odd
Port B: 9600 8 None
Port C: 1200 7 Odd
Port D: 4800 8 None

Examples:	^AI<sp>19200<cr>	Set baud rate to 19200
	^AI<sp>P1<sp>96<sp>8<sp>N	Sets Port A to 9600,8,N

4.2.2 Reset Encoder

This command immediately clears the input and output data queues and resets the 8074 to the Transparent State in field 1 and field 2. Article and EDS output queues are not reset by this command. They must be explicitly reset by using the queue articles and queue EDS commands. (See sections 4.5.4 and 4.6.2.) Because other control ports may be simultaneously sending data, this command only affects the fields and data types that have not been appropriated by other control ports.

Command: **^F^F<cr>**

Default: none

4.2.3 Test Message State

In the Test Message state, the 8074 encoder will generate a test message into the Port A input buffer which includes data in each of the 4 caption and 4 text data streams. (See section 3.3.5.) This test message must be turned on from the 8074 front panel.

The test message will also turn off when the ^C character is received on any control port. This character is commonly transmitted at the beginning by most captioning software programs.

4.2.4 Set Output Line

The normal line for caption information is line 21 in NTSC and line 22 in PAL. This command allows the 8074 to output caption information on different line numbers. This command also changes the line number used by the decoder.

Command: **^AE<sp>LIn<cr>**

Default:	^AE<sp>L21<cr>	for NTSC systems
	^AE<sp>L22<cr>	for PAL systems

The parameter **In** specifies the line number that caption information will be output on. The permitted values of parameter **In** are 11 to 25.

Examples:	^AE<cr>	Reset to default
	^AE<sp>L20<cr>	Set for line 20
	^AE<sp>?<cr>	Show current line

4.2.5 Monitoring the Line 21 Data on the Serial Port

This command allows the 8074 to extract line 21 information from the input or output of the 8074 and send it out the serial port. Enter a ^G to end monitor mode.

Command: **^A5<sp>fx<sp>o<cr>**

The parameter **fx** specifies the field that data will be extracted from
The parameter **o** specifies that the output of 8074 will be monitored.

Example:	^A5<sp>F1<cr>	Monitor Field 1 Input
	^A5<sp>F2<sp>O<cr>	Monitor Field 2 Output

4.2.6 Controlling the Caption Decoder

This command allows the 8074 to display line 21 information on the optional caption decoder.

Command:	**^AM<sp>dc<cr>**	Decode a specific channel
or	**^AM<sp>OFF<cr>**	Turn off Decoder off

The parameter **dc** specifies the data channel that will be decoded and displayed.

Example:	^AM<sp>C1<cr>	Display Caption Channel 1

4.2.7 Report Firmware Version

The 8074 encoder will respond with message identifying its firmware version and port name.

Command: **^A?<cr>**

Returns
```
Evertz 8074 Ver:DK87D4 U961217 -- Use ^AH{return} for
help
Port B
```

4.2.8 Command Help

This command returns a help message from the 8074.

Command: **^AH<cr>**

Default: none

Returns:
```
Cmds supported - ^C,^F,...
```

```
^A
+0,1,2,3,4,5,6,7,8,9,A,B,c,,E,H,I,M,O,P,Q,r,t,u,S,Y,?
```

4.2.9 Set Stream Mode

This command will place the 8074 in STREAM operating mode.

Command: **^Au<cr>**

4.2.10 Set Field Mode

This command will place the 8074 in FIELD operating mode.

Command: **^At<cr>**

4.2.11 Report Bypass Switch Mode

This command returns a message that shows the status of the SDI video bypass relay and the line 21 video keyer.

Command: **^AS<cr>**

Example results:

`REMOTE OVERRIDE`	indicates keyer is disabled but video will be passed through the 8074
`EXTERNAL BYPASS`	indicates the SDI bypass relay has been activated by an external signal
`LOCAL BYPASS ON`	indicates the SDI bypass relay has been activated by the 8074 menu selection.

4.2.12 Report Battery Status

This command will return the 8074 battery status

Command: **^AY<cr>**

Example results: `Battery OK`

4.2.13 Set / Report Time of Day Clock

This command will return the current time of day or will allow the 8074 internal clock to be set. The 8074 will maintain the correct time even through power outages.

Command: **^Ac<cr>**

Example results:
`Local time is 13:47:39, Time zone is 05:00, DST is ON`

Command: **^Ac<sp>U<cr>**

Example results:
`UTC is 13:56:05, Time zone is 05:00, DST is ON`

Command: **^Ac<sp>hh:mm:ss<sp>hh:mm<sp>ON<cr>**

Example: ^Ac<sp>13:10:00<sp>5<sp>ON<cr>
Set local time to 1:10 pm in EST with Daylight Savings Time enabled
^Ac<sp>06:10:00<cr>
Set local time to 6:10 am. Time zone and DST unchanged.
^Ac<sp>13:10:00<sp>4:30<sp>OFF<cr>
Set local time to 1:10 pm in Newfoundland Time Zone with Daylight Savings Time disabled

4.3 COMMANDS SUPPORTED IN THE FIELD OPERATIONAL MODE

The following commands are supported when the 8074 is operating in **field** mode.

4.3.1 Transparent State

In Transparent state, the 8074 encoder keyer will be off for the selected field. Incoming line 21 video will be passed directly through on the selected field. The FLD1 and FLD2 Enable LED's indicate which field the keyer is enabled for. If both Field 1 and Field 2 are in transparent state the front panel display will show `422 THRU`, `422P THRU` or `4Fs THRU` depending on whether the video type is 4:2:2 Component or 4 Fsc Composite video.

Command: **^A7<sp>fx<cr>**

Default ^A7<sp>F1<cr>

The optional parameter **fx** identifies the field that will be placed in transparent state.

Field 1 cannot be placed into transparent state unless field 2 is also in the transparent state. This is because the caption specification stipulates that there will always be caption information in field 1 when there is caption information in field 2.

Examples: ^A7<cr> Field 1 in transparent state
^A7<sp><cr> Field 1 in transparent state

	^A7<sp>F1<cr>	Field 1 in transparent state
	^A7<sp>F2<cr>	Field 2 in transparent state

4.3.2 Null State

In the Null state, the 8074 encoder keyer will be on for the selected field and the 8074 will insert Null characters into line 21. Incoming line 21 video will not be passed through on the selected field. The FLD1 and FLD2 Enable LED's indicate which field the keyer is enabled for. The front panel display will show LN 21 KEY.

Command: **^A6<sp>fx<cr>**

Default ^A6<sp>F1<cr>

The optional parameter **fx** identifies the field that will be placed in the Null state.

If Field 2 is placed in the Null state Field 1 will automatically be placed in the Null state if it was in the transparent state. This is because the caption specification stipulates that there will always be caption information in field 1 when there is caption information in field 2.

Examples:	^A6<cr>	Field 1 in Null state
	^A6<sp><cr>	Field 1 in Null state
	^A6<sp>F1<cr>	Field 1 in Null state
	^A6<sp>F2<cr>	Field 2 in Null state

4.3.3 Direct Control State

This command causes the 8074 encoder to enter the Direct Control state. In the Direct Control state, caption information is inserted into the appropriate video field in one of 4 modes that are described below. All upstream caption and text data in that field will be blocked. The computer supplies all the information for that field, formatting it with the appropriate stream control codes. The front panel display will be LN 21 KEY, and the FLD1 and FLD2 Enable LED's will indicate which fields data is being inserted into. Direct Control state is normally terminated by sending the End Of State command (^C) which will cause the encoder to revert to the Null state.

Command: **^A3<sp>n<sp>fx<cr>data . . . data<cr>^C**

Default ^A3<sp>4<sp>F1<cr>

The optional parameter **fx** identifies the field that will be placed in the Direct Control state.

The optional parameter **n** identifies which variation of Direct Control state will be used.

n=1 provides the same processing as n=2.

n=2 means that legitimate line 21 control codes are aligned and delayed so that the two byte control code pairs are transmitted in the same field.

n=3 means that legitimate line 21 control codes are aligned and delayed so that the two byte control code pairs are transmitted in the same field. Each control code pair is sent twice.

n=4 provides the same processing as for n=3. No non-line 21 codes are transmitted and the control codes are converted (if necessary) to the correct equivalent code for the current video field.

If Field 2 is placed in the Direct Control state Field 1 will automatically be placed in the Null state if it was in the transparent state. This is because the caption specification stipulates that there will always be caption information in field 1 when there is caption information in field 2.

Examples:	^A3<cr>	Field 1 in Direct Control mode 4
	^A3<sp><cr>	Field 1 in Direct Control mode 4
	^A3<sp>1<cr>	Field 1 in Direct Control mode 1
	^A3<sp>F2<cr>	Field 2 in Direct Control mode 4
	^A3<sp>3<sp>F1<cr>	Field 1 in Direct Control mode 3

4.3.4 Real Time State

In the Real Time state, incoming data from the caption computer is stored in the real time input buffer until a complete line of data has been accumulated. When a carriage return (<cr>) character is encountered, the line of data is transferred into the appropriate data stream. The line may be edited using ^H (backspace) or ^X (delete line) before the <cr> is input. A delay of 1 to 9 seconds can be inserted by including ^Bn into the data. (n is the number of seconds of delay desired)

If a caption data channel is specified, captions will be in rollup format with a specified number of lines. The default format is 3 line caption rollup for caption data channels, and text format for text channels.

When the specified data channel is put into the real time state, all upstream data in the corresponding **field** will be blocked from entering the output queue of the encoder. Subsequent data received from the computer is part of the data stream until ^C is received or the encoder is reset.

Real Time state is terminated by a ^C. If upstream data was enabled prior to entering the Real Time State then it will be re-enabled when the Real Time state is terminated.

Command: **^A2<sp>dc<sp>rl<sp>Bbl<cr>data<cr> . . . data<cr>^C**

Default ^A2<sp>C1<sp>3<sp>B15<cr>

The parameter **dc** identifies the field that will be placed in the Real Time state.

The parameter **rl** identifies the number of rollup rows and the parameter **bl** identifies the base line if the **dc** parameter is one of the caption data channels. If the base line is specified the roll up line must also be specified.

Examples:

^A2<cr>	Caption 1 in Real Time State with 3 line rollup at base line 15 *
^A2<sp>T2<cr>	Text 2 in Real Time State *
^A2<sp>C3<sp>2<cr>	Caption 3 in Real Time State with 2 line rollup at base line 15 **
^A2<sp>C4<sp>3<sp>B10<cr>	Caption 4 in Real Time State with 3 line rollup at base line 10 **

* Upstream FIELD 1 will be blocked. Data will be prefixed with control codes appropriate for designated data channel.

** Upstream FIELD 2 will be blocked. Data will be prefixed with control codes appropriate for designated data channel

4.3.5 Display System Status

This command displays the state of the Field 1 and Field 2 caption keyers and the number of bytes of memory remaining to store articles and EDS packets.

Command: **^AA<cr>**

Default none

Examples: ^AA<cr>

Returns:
Example with both fields in the transparent state:

```
Memory Status: Avail-027386  # Segments-000001 Largest
Avail-027386
Channel Status:
Field 1:TRANSPARENT
Field 2:TRANSPARENT
```

Example with field 2 in the transparent state:

```
Memory Status: Avail-027386  # Segments-000001 Largest
Avail-027386
Channel Status:
```

```
Field 1:NULL
Field 2:TRANSPARENT
```

Example with field 2 in the Real Time or Direct Control state:

```
Memory Status: Avail-027386  # Segments-000001 Largest
Avail-027386
Channel Status:
Field 1:NULL
Field 2:KEY
```

4.4 COMMANDS SUPPORTED IN STREAM OPERATING MODE

The following commands are supported when the 8074 is set to stream mode. The front panel display will be `LN 21 KEY` and both FLD1 and FLD2 ENABLE LED's will be on.

4.4.1 Transparent State

In Transparent state, incoming line 21 video in the respective data stream will be copied through to the output.

Command: **^A7<sp>fx<cr>**
^A7<sp>dc<cr>

Default ^A7<sp>F1<cr>

In the first form of the command, the optional parameter **fx** identifies the field (i.e. all channels in that field) that will be placed in the transparent state.

In the second form of the command the parameter **dc** identifies the data channel that will be placed in transparent state.

Examples:	^A7<sp>F1<cr>	Field 1 in transparent state
	^A7<sp>C1<cr>	Caption 1 in transparent state
	^A7<sp>T3<cr>	Text 3 in transparent state

4.4.2 Null State

In the Null state, the 8074 will insert Null characters for the selected data channel into line 21. Incoming line 21 video will not be copied through on the data channel.

Command: **^A6<sp>fx<cr>**
^A6<sp>dc<cr>

Default ^A6<sp>F1<cr>

In the first form of the command, the optional parameter **fx** identifies the field (i.e. all channels in that field) that will be placed in the Null state.

In the second form of the command the parameter **dc** identifies the data channel that will be placed in the Null state.

Examples:	^A6<sp>C1<cr>	Caption Channel 1 in Null state
	^A6<sp>T3<cr>	Text 3 in Null state

4.4.3 Direct Control State

This command causes the 8074 encoder to enter the Direct Control state. Direct Control state is normally terminated by sending the End Of State command (^C) which will cause the encoder to revert to the Null state.

Command: **^A3<sp>n<sp>fx<cr>data . . . data^C**
or **^A3<sp>n<sp>dc<cr>data . . . data^C**

Default ^A3<sp>4<sp>F1<cr>

In the first form of the command, the optional parameter **fx** identifies the field (i.e. all channels in that field) that will be placed in the Direct Control state. In the Direct Control state caption information is inserted into the appropriate video field in one of 4 modes which are described below. All upstream caption and text data in that field will be blocked. Any articles queued for insertion to that field will also be blocked. The computer supplies all the information for that field, formatting it with the appropriate stream control codes.

In the second form of the command, the optional parameter **dc** identifies the data channel that will be placed in the Direct Control state. All upstream caption and text data in the specified data channel will be blocked. Any articles queued for insertion to that data channel will also be blocked. The computer supplies all the information for that data channel, formatting it with the appropriate stream control codes. All caption information in the non specified data channels will be passed through.

The optional parameter **n** identifies which variation of the Direct Control state will be used.

n=1 provides the same processing as n=2.

n=2 means that legitimate line 21 control codes are aligned and delayed so that the two byte control code pairs are transmitted in the same field.

n=3 means that legitimate line 21 control codes are aligned and delayed so that the two byte control code pairs are transmitted in the same field. Each control code pair is sent twice.

n=4 provides the same processing as for n=3. No non-line 21 codes are transmitted and the control codes are converted (if necessary) to the correct equivalent code for the current video field.

Examples:	^A3<cr>	Field 1 in Direct Control mode 4
	^A3<sp><cr>	Field 1 in Direct Control mode 4
	^A3<sp>1<cr>	Field 1 in Direct Control mode 1
	^A3<sp>F2<cr>	Field 2 in Direct Control mode 4
	^A3<sp>3<sp>F1<cr>	Field 1 in Direct Control mode 3
	^A3<sp>C1<cr>	Caption channel 1 in Direct Control mode 4
	^A3<sp>3<sp>T1<cr>	Text channel 1 in Direct Control mode 3

4.4.4 Real Time State

In Real Time state, incoming data from the caption computer is stored in the real time input buffer until a complete line of caption/text data has been accumulated. When a carriage return (<cr>) character is encountered, the line of data is transferred into the appropriate data stream. The line may be edited using ^H (backspace) or ^X (delete line) before the <cr> is input. A delay of 1 to 9 seconds can be inserted by including ^Bn into the data. (n is the number of seconds of delay desired)

If a caption data channel is specified, captions will be in rollup format with a specified number of lines. The default format is 3 line caption rollup for caption data channels, and text format for text channels.

When the data channel is put into the real time state, upstream data on the specified channel will be blocked from entering the output queue of the encoder. All subsequent data is part of the data stream until ^C is received or the encoder is reset. If the specified data stream is a text channel, articles will be suspended from the output queue while the real time state is active. All caption information in the non specified data channels will be passed through.

Real Time state is normally terminated by a ^C. Articles will be re-enabled into the output queue starting with the suspended article. If upstream data

was enabled prior to entering the Real Time State then it will be re-enabled when the Real Time state is terminated.

Command: **^A2<sp>dc<sp>rl<sp>Bbl<cr>**

Default ^A2<sp>C1<sp>3<sp>B15<cr>

The parameter **dc** identifies the data channel that will be placed in the Real Time state.

The parameter **rl** identifies the number of rollup rows and the parameter **bl** identifies the base line if the **dc** parameter is one of the caption data channels. If the base line is specified the roll up line must also be specified.

Examples:

^A2<cr>	Caption 1 in Real Time State with 3 line rollup at base line 15
^A2<sp>T2<cr>	Text 2 in Real Time State
^A2<sp>C3<sp>2<cr>	Caption 3 in Real Time State with 2 line rollup at base line 15
^A2<sp>C4<sp>3<sp>B10<cr>	Caption 4 in Real Time State with 3 line rollup at base line 10

4.5 TEXT ARTICLES (STREAM MODE ONLY)

When the Article state is active, text data can be entered and stored as complete messages. These messages can be transmitted in any order, any number of times in any of the text channels. Display attributes contained within the articles (such as colour, etc.) specifically coded for one data stream will be translated into the appropriate codes for the text channel they are ultimately inserted into.

The message can be kept in memory or deleted when you have finished transmitting it. Articles will be lost from the 8074's memory in the event of a power loss. The 8074 uses an advanced memory allocation scheme that allows it to store a virtually unlimited number of articles at one time. The only requirement is the maximum amount of random access memory available.

The 8074 allows editing of each line of the message by use of the ^H (backspace) and ^X (delete line) characters before the <cr> is input. A delay of 1 to 9 seconds can be inserted into the article by inserting ^Bn into the article. (n is the number of seconds of delay desired)

Once a text channel is put into Article state, upstream data on that channel will be blocked from the output queue. A data channel will be in the article state as long as any article is assigned to its output queue.

The software program called ARTICLE (supplied with your 8074) can be used to quickly download text articles into the 8074. For further information consult section 4.5.8.

4.5.1 Input Article

This command allows the user to input an article to the 8074 and assign it to the output queue of one of the text data channels.

Command: **^A0<sp>name<sp>tc<sp>rc<sp>k/d<sp>o/h<sp>n/l<cr>**
data<cr>data . . .data<cr>^C

Default ^A0<sp>name<sp>T1<sp>9999<sp>D<sp>O<sp>L<cr>

The parameter **name** identifies the name of the article. The article can subsequently be referred to by its name. If the article name already exists, the previous article with that name will be replaced by the new article.

The parameter **tc** identifies the text channel number that the article will be placed into.

The parameter **rc** identifies number of times the article will be repeated. Values of 9999 or FFFF indicate that the article should be repeated indefinitely. An article's repeat count will be decremented each time the article is output in each output data stream.

The parameter **k/d** identifies whether the article should be kept or deleted when it has been transmitted the specified number of times.

The parameter **o/h** identifies whether the article should be placed into the output queue or whether it should just be held in memory for later use.

The parameter **n/l** identifies whether the article should be placed as the first article in the output queue or the last article in the queue.

All subsequent data is part of the article until ^C is received. The 8074 will respond to each line of the article with a '>' prompt while the article is being defined.

Examples: ^A0<sp>Test<sp>T1<sp>5<cr>
This is the first line<cr>
and this is the last line ^C

A two line article called 'Test" which will be placed at the end of the Text 1 output queue. The article will be deleted after it is output 5 times.

4.5.2 Output Article

This command allows the user to put an existing article (defined by the Input article command) into the output queue of the specified text data channels. An article may be put into an output queue more than once.

Command: **^A1<sp>name<sp>tc<sp>rc<sp>k/d<sp>o/h<sp>n/l<cr>**

Default		
	tc:	last text channel the article was sent to
	rc	current repeat count
	k/d	last keep/delete status specified for the article
	o/h	O
	n/l	last next/last status specified for the article

The parameters have the same meaning as for the Input article command. If the **o/h** parameter is H then this command may be used to change other attributes of the article without outputting it.

The parameter **name** specifies the name of a previously defined article.

If the parameter **k/d** is D, and the article is currently being output, it will not be removed until it has been completely output.

Examples: ^A1<sp>Test<sp>T2<sp>5<sp>D<cr>

The article called 'Test" will be placed at the end of the Text 2 output queue. The article will be deleted after it is output 5 times.

^A1<sp>Test<sp>T2<sp>9999<sp>H<cr>

The article called 'Test" will have its repeat count change to indefinite. It will not be placed into any of the output queues.

4.5.3 Delete Article

This command allows the user to remove an article from all output queues. If the article is currently being output, it will not be removed until it has been completely output.

Command: **^A4<sp>name<sp>k/d<cr>**

Default		
	k/d	last keep/delete status specified for the article

The parameter **name** identifies the name of the article.

The parameter **k/d** indicates whether the article will be deleted from memory or not.

Examples: ^A4<sp>Test<sp>D<cr>

The article called 'Test" will be removed from all output queues and deleted from memory.

4.5.4 Queue Articles

This command will delete the entire specified output queue and replace it with the articles named (if any). The user enters the names of the articles separated by <cr> in the order that they are to appear in the output queue. The 8074 continues to add articles to the queue until it receives a ^C. The article names may be edited by using the ^H (backspace) and ^X (delete line) characters before the <cr> is input.

Command: **^A8<sp>tc<cr>**
name<cr>name<cr>....name<cr>^C

Default none

The parameter **tc** identifies the text channel number of the output queue the articles will be placed into.

The parameter **name** identifies the name of each article to be placed in the queue. If no article names are given, the specified article output queue is cleared and no articles will be output in that data stream.

Example: ^A8<sp>T1<cr>TEST<cr>TEST2^C

Puts the previously defined articles named TEST and TEST2 into the output queue for Text Channel 1.

4.5.5 Display Article Status

This command allows the user to view the list of articles stored in the 8074 and display their status.. The status includes the article name, repeat count, (9999 if infinite) the keep/delete status, and the memory storage needed for the article. The first line of the article will also be shown. A "..." will indicate multiple lines of text.

Command: **^A9<cr>**

Default none

Examples: ^A9<cr>

Returns:

```
Article Status:
Name        Repeat K/D size text
test1       009999 D 000031 "this is a sample" ...
test2       009999 D 000014 "second article"
```

4.5.6 Display System Status

This command displays the upstream line 21 data channels that are turned on (i.e.: upstream data being passed through to the output) and the number of bytes of memory remaining to store articles and EDS packets.

Command: **^AAcr>**

Default none

Examples: ^AAcr>

Returns:
Example with all channels On:

```
Memory Status: Avail-005453  # Segments-000011 Largest
Avail-005453
Channel Status:
Field 1:C1 C2 T1 T2 ON
Field 2:C3 C4 T3 T4 XD ON
```

Example with all channels On except T3:

```
Memory Status: Avail-005453  # Segments-000011 Largest
Avail-005453
Channel Status:
Field 1:C1 C2 T1 T2 ON
Field 2:C3 C4 T4 XD ON
```

4.5.7 Display Output Queue

This command displays the articles in all 5 output queues in the order in which they reside in the queues.

Command: **^A9<cr>**

Default none

Examples: ^A9<cr>

Returns a list of articles such as the following:

```
Output Q: T1
test1
Output Q: T2
test2  test2
Output Q: T3

Output Q: T4

Output Q: EDS
```

4.5.8 Using the ARTICLE Software Utility to Upload Text Articles to the 8074.

A software utility called **ARTICLE** is supplied with the 8074 to provide a simple way of uploading text articles to the 8074. This utility is a DOS program that you can copy to a convenient location on the hard disk of your computer. The simplest way is to create a new directory for the program and place the text files you wish to upload into that directory. Switch to that directory before running the program.

Text files that are used for articles should be formatted with no more than 32 characters per line (the maximum amount available in text mode). Each line should end in a <carriage return> and optional <line feed> characters. These characters are usually placed at the end of a line automatically by most DOS or Window text editors.

The article loader software utility (called ARTICLE.EXE) uploads the text file to the 8074. Run ARTICLE.EXE, with the appropriate '.txt' file as the first argument. For example:

ARTICLE MYARTICL.TXT

This will run the article loader program in its default configuration: COM1, 1200 baud, 7 bit Odd parity, repeat indefinitely. If you connected the computer using COM2 you will need to use additional command line parameter to specify the COM port as follows:

ARTICLE MYARTICL.TXT /p2

Entering the ARTICLE with no file name will generate a usage message to show you all the available options for the article loader program.

4.6 EXTENDED DATA SERVICES (STREAM MODE ONLY)

Extended Data Services (EDS) information is encoded into field 2 and is intended to supply program related and other information to the viewer. EDS data can inform the viewer of such information as current program title, length of show, type of show, time left in show, and the new violence rating (V-chip) information.

The EDS output stream consists of a distinct EDS packet for each type of information. Each packet consists of a 1 byte class, a 1 byte type, one or more informational characters, a 1 byte end of packet code, and a 1 byte checksum.

EDS packets are stored in the 8074 article pool and output in the EDS data channel in field 2. These packets are placed into the EDS output queue in the order specified by the user and inserted into field 2 according to the space available.

The computer uses an ASCII hex notation in describing the EDS packet id and data to the 8074. For example to specify the letter A enter a 4 followed by a 1 (the hex ASCII code for A is 41)

The EDS packets are deleted from memory when they have been transmitted the specified number of times. EDS packets will be lost from the 8074's memory in the event of a power loss. The 8074 uses an advanced memory allocation scheme that allows it to store a virtually unlimited number of EDS packets at one time. The only limit is the total amount of random access memory available.

Upstream EDS packets will be blocked by packets of the same type in the output queue. One exception is the 0D05 (PRCC - Program Rating Configuration Control) packet which will block all upstream EDS packets. Because 0D05 packets must be sent as an uninterrupted block, the 0D05 packets will not be output, when it is defined by the ^AP command. Instead the 0D05 packets will be held until a non-0D05 packet is defined by the ^AP command. Then all upstream and internal EDS packets will be blocked and the queued 0D05 packets will be released. When the last 0D05 packet has expired from memory, upstream EDS will be re-enabled.

4.6.1 Input EDS

This command allows the user to input an EDS packet to the 8074

If an EDS packet with identical **edsid** exists it will be deleted and replaced with the new packet definition.

Command: **^AP<sp>edsid<sp>rc<sp>data...data<cr>**

Default none

The parameter **edsid** identifies the EDS packet id. The EDS packet can subsequently be referred to by its packet id. If the EDS packet already exists, the previous EDS packet with that packet id will be replaced by the new packet. The **edsid** is entered in ASCII hex notation. For example to enter a packet id with a class of 01h and a type of 23h enter a 0 followed by a 1 followed by a 2 followed by a 3. The leading zero of the class is optional.

The parameter **rc** identifies number of times the packet will be repeated. Values of 9999 or FFFF indicate that the packet should be repeated indefinitely. A packet's repeat count will be decremented each time it is output.

The parameter **data** is the information bytes of the packet. This data is entered in ASCII Hex format. For example to enter the letter A enter a 4 followed by a 1 (the hex ASCII code for A is 41)

Examples: ^AP<sp>0103<sp>9999<sp>41424344<cr>

Sets the program name packet to ABCD. The program name will be repeated indefinitely.

^AP0D05<sp>40602043414E414441<cr>
A PRCC packet setting the rating system name to 'CANADA'.

^AP0D05<sp>1<sp>6147<cr>
A PRCC packet setting the level 1 rating to 'G'.

^AP0D0561<sp>1<sp>47<cr>
A non-ambiguous form of the above command.

4.6.2 Queue EDS Packets

This command will delete the entire specified EDS output queue and replace it with the packets named (if any). The user enters the packet ids of the EDS packets separated by <cr> in the order that they are to appear in the output queue. The user enters the packet id of each packet separated by <sp> in the order that they are to appear in the output queue.

Command: **^A8<sp>F2 edsid<sp>edsid...edsid<cr>**

Default none

The parameter **edsid** identifies the packet id of each packet to be placed in the EDS queue. If no packet id's are given, the EDS output queue is cleared and no EDS information will be output.

4.6.3 Delete EDS Packet

This command allows the user to remove an EDS packet from the 8074's memory. If the EDS packet is currently being output, it will not be removed until it has been completely output.

Command: **^AP<sp>edsid<cr>**

Default none

The parameter **edsid** identifies the packet to be deleted.

Examples: ^AP<sp>0103<cr> The program name packet will be removed from memory.

4.7 COMM PORT CONTROL COMMANDS (FIELD and STREAM MODES)

The 8074 can allow simultaneous access by all the communication ports to the caption keyer. This can be the effective equivalent of multiple caption encoders, linked in series. By using a single video keyer, the 8074 provides the added advantage of minimizing the delays and the impact on the video quality.

Several commands are provided in order to prevent data conflicts and to allow the user to control which ports can affect the data.

The 8074 maintains a permission list which indicates which ports will be allowed to alter various kinds data. The permissions for each port can be set from the front panel menus (see section 3.3.2) or they may be set from the communication control ports. The permission list is maintained in non-volatile memory. The data types are denoted as follows:

Data Type	CF1	captions field 1
	CF2	captions field 2
	TF1	text field 1
	TF2	text field 2
	EDS	extended data services

When multiple ports are permitted access to a particular data type, conflicts will be resolved on a “first come, first served” basis. The 8074 maintains a list of which ports are active for each data type.

Normally, the various keyer commands (such as ^A2, ^A3, ^A6, ^A7) will set and clear the active status automatically. To obtain maximum compatibility with existing software, these commands will exhibit the following special behavior:

> If a port does not have permission for the full field 1, but does have permission for the captions in field 1, then the command will not be denied, but will revert to the C1 form of the command.
>
> For example, if Port A has permission for CF1 only, and a ^A3<cr> or ^A3 F1<cr> is issued, then although Port A does not have permission for the full field 1, the command will not be rejected. Instead, the command will be treated as though ^A3 C1<cr> had been sent.

4.7.1 Show Port Permission Maps

This command will report the permission map for each port. The permission map controls what data types a port is allowed to become active in. (eg, captions field 1, text field 2, EDS, etc.)

Command: **^AQ<cr>**

Example result:

```
Permission Map
PORT A: CF1 CF2 TF1 TF2 EDS
PORT B: CF1 CF2 TF1 TF2 EDS
PORT C: CF1 CF2 TF1 TF2 EDS
PORT D: CF1 CF2 TF1 TF2 EDS OFFLINE
```

This example shows all ports are permitted access to all data types (the factory default setting) and the Port D modem is offline.

```
Permission Map
PORT A:     CF2 TF1 TF2 EDS
PORT B: CF1     TF1 TF2 EDS
PORT C: CF1 CF2     TF2 EDS
PORT D: CF1 CF2 TF1 TF2     ONLINE
```

This example shows port A is denied access to captions in field 1, port B is denied access to captions in field 2, port C is denied access to text in field 1 and port D is online and is denied access to extended data services.

4.7.2 Alter Port Permission Maps

This command will alter the permission map for any port by adding or subtracting various data types.

Command: **^AQ<sp>pn<sp>-dt…dt…dt<cr>**

Default: none

Example:

^AQ PB –EDS –TF2 –CF2 CF1 TF1<cr>

This command will disallow Port B from all field 2 data types, and enable Port B for captions and text in field 1.

^AQ CF1<cr>

This command will allow the current port to access captions in field 1. Permissions for other data types remain as previously set.

^Au<cr>
^AQ PD –EDS –TF2 –CF2 –TF1 CF1<cr>
^AQ PB –EDS –TF2 –CF2 -CF1 TF1<cr>
^AQ PC –TF2 –CF2 -CF1 -TF1 EDS<cr>

These commands show a typical application which places the 8074 in stream mode, allows modem Port D to process captions in Field 1,

allows Port B to process text articles in field 1, and enables Port C for extended data services.

4.7.3 Show Port Active Maps

This command will report the active map for each port. The active map controls what port has control of a data type.

Command: **^AO<cr>** (capital letter 'O')

Example result:

```
Active Map
PORT A: CF1
PORT B:     CF2
PORT C:
PORT D:                  EDS ONLINE
```

This example shows Port A is actively controlling the captions in field 1, Port B is controlling the captions in field 2, Port C is not actively controlling any data, and the Port D modem is online and is controlling the extended data services.

4.7.4 Alter Port Active Maps

This command will alter the active map for any port by adding or subtracting various data types. The optional override parameter ('O') forces other control ports to relinquish control of the specified data type.

Command: **^AO<sp>pn<sp>-dt…dt…dt<sp>ovr<cr>**

Default: none

Example:

^AO PB –CF1<cr>

This command will remove the active indication for Port B from field 1 captions.

^AO CF1<cr>

This command will indicate that the current port is active in the captions in field 1. Activity for other data types remain as previously set.

^AO CF1 O<cr>

This command will forces the current port to be active in the captions in field 1. Activity for other

data types remain as previously set. If any other control port is active in CF1 will be reset.

4.7.5 Reset Port

This command will reset a port. This command immediately clears the input and output data queues and resets the 8074 to the Transparent State in field 1 and field 2. Article and EDS output queues are not reset by this command. They must be explicitly reset by using the queue articles and queue EDS commands. (See sections 4.5.4 and 4.6.2.) Because other control ports may be simultaneously sending data, this command only affects the fields and data types that have not been appropriated by other control ports.

Command: **^Ar<sp>pn<cr>**

Example: ^Ar PB<cr> Resets Port B

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5. TECHNICAL DESCRIPTION

5.1 OVERVIEW

The model 8074 Digital Video Closed Caption Encoder combines the latest LSI technology with sophisticated microcontroller firmware to provide a powerful, flexible caption encoder system. The 8074 receives line 21 closed caption data from a computer running captioning software and encodes the closed caption data into the digital video bitstream.

The optional decoder output provides a low cost method of verifying the correct insertion of the captioning data.

The front panel alphanumeric display is used to configure various items. The 8074's menu system consists of a main menu with two or more choices on each menu item. An Engineering menu mode gains access to additional items that are normally only required at installation time. (See section 3.2 and 3.3 for a complete description of the programming menu).

5.2 JUMPERS AND SWITCHES

Component layout drawing 8025-80 shows the location and function of the switches and jumpers inside the model 8074. The jumper positions marked in **bold** face type are the default settings.

5.2.1 DIP Switch Functions

The main circuit board of the model 8074 contains an 8 position DIP switch that is used to invoke various diagnostic and calibration functions. The functions of each switch are described below.

Switch	Name	Normal	Function when Open	Function when Closed
1	Not used	Open		
2	Port B	Open	Normal Port B Function	Engineering Function Only
3	Monitor	Open	Monitor support disabled	Monitor hardware installed
4	Factory Reset	Open		Resets 8074 to factory defaults on power up
5	Not Used	Open		
6	Quick Boot	Closed	Display boot messages	Faster boot up
7	Decoder	Open	Decoder support disabled	Caption decoder support enabled
8	Not used	Open		

Figure 5-1: DIP Switch Functions

5.2.2 Jumper Functions - Main Board

All jumpers are printed circuit board links and are installed in the default position. To change the position, the board link must be cut and a wire link must be installed in the desired location.

JP1	LCA Size	A	3042
		B	3064/3090
JP3	EPROM Size	**512**	Board link installed connects MCU EPROM U19 Address A15 to microprocessor A15 for use with 512K size EPROM.
		256	Board link installed connects MCU EPROM U19 Address A15 to +5 volts for use with 256K size EPROM.
JP4	EPROM CE	**Pin 2,3**	Board link installed connects Char EPROM CE to ground.
		Pins 1,2	Board link installed connects Char EPROM CE to +5 Volts after LCA loads.
JP5			Not installed for 8074
JP8	RS232	**left side**	Connects RS 232 transmit to pin 5 of the serial I/O connector
		right side	Disconnects pin 5 of the serial I/O connector for RS 4:2:2 applications
JP10,11,12,13			Not installed for 8074

5.3 CIRCUIT DESCRIPTION

The model 8074 is a microcontroller based device functionally divided into the following hardware subsystems:

1 Microcontroller
2 Display and Pushbuttons
3 Serial Digital Video Input, and Bypass Relay
4 Serial Digital Video Output
5 Keyer LCA
6 RS-232 Communications Ports and Modems
7 Analog Composite Monitor (optional)
8 Caption Decoder (optional)

The microcontroller, RS-232 Port A, serial video inputs and outputs, and keyer LCA circuits are all contained on the main circuit card (8025). The SDI bypass relay is contained on circuit board 8039. The circuits for the parallel port, for serial ports B and C, the modems for ports D and E are contained on a submodule (8038) which also contains RAM and replaces the 8033 submodule. The display and keypad circuitry is contained on a separate circuit board (5220) which plugs into the main board via a twenty conductor ribbon cable. The optional analog composite monitor and caption decoder circuitry is contained on a separate circuit board (8029) which plugs into the main board via two forty-four pin headers. The

relevant schematic drawings are shown in brackets for each section of the circuit.

5.3.1 Microcontroller (8025-36)

At the heart of the model 8074 keyer is an DS80C320 microcontroller, (MCU) U19. Its' three 8 bit bi-directional ports and 8 bit bus provide peripheral interfacing to the rest of the circuits. Program memory is contained on EPROM U21. Scratch pad RAM is provided internally by the MCU. Data RAM for the serial communications buffer is contained on a submodule 8038. An onboard oscillator, also part of the MCU, is crystal controlled. Its' 14.7456 MHz frequency is internally divided by 12, resulting in a processor operating frequency of 1.2288 MHz. Address decoder U23 provides decoded chip enables to each of the peripheral devices on the board. Addressable latches U24 and U34 provide mode select control lines used throughout the board.

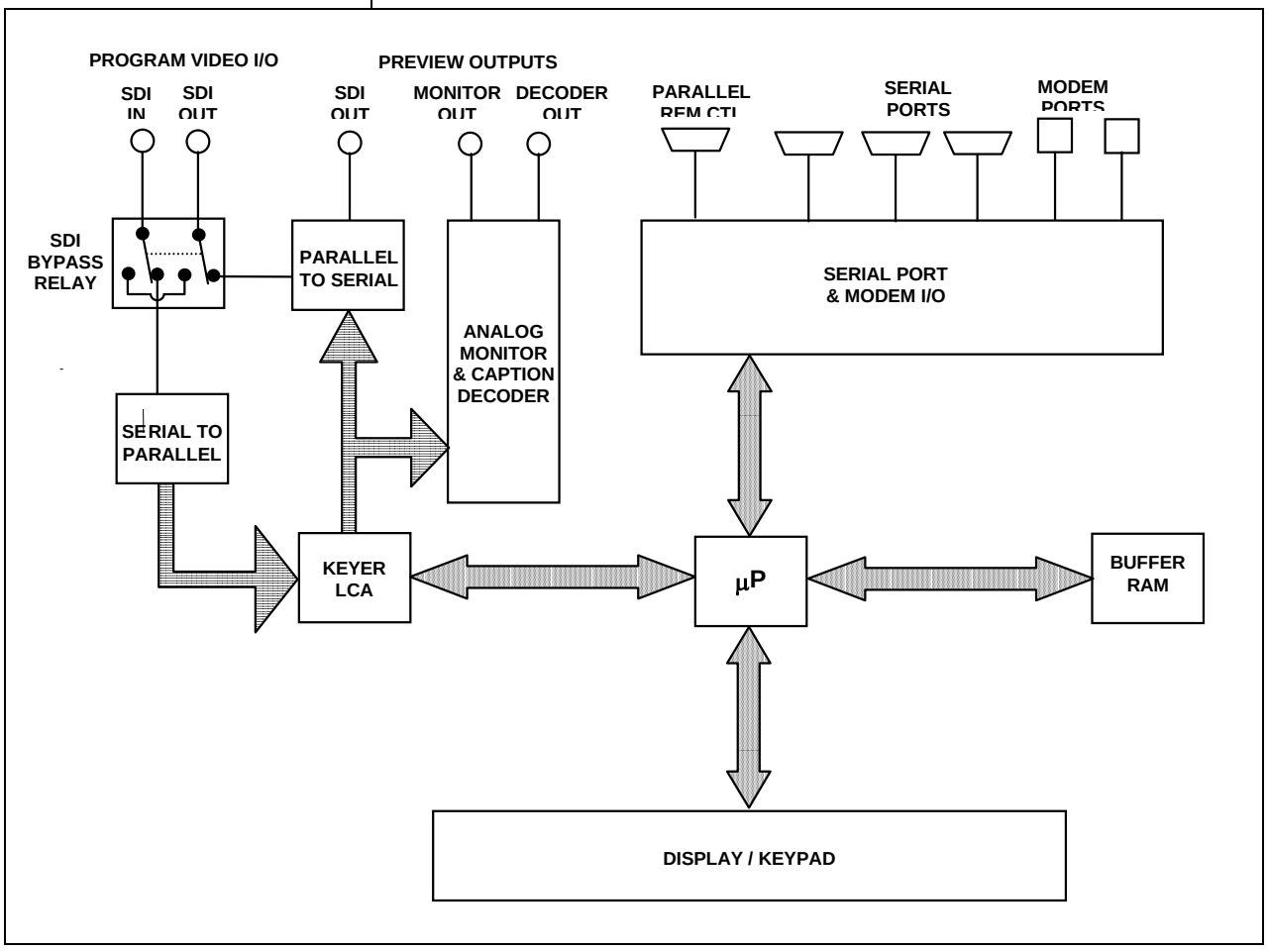

Figure 5-2: Block Diagram

5.3.2 Front Panel Display and Pushbuttons (5220-31)

A 16 digit alphanumeric display, and a 8 button keypad are contained on a separate circuit card (5220) which is connected to the main circuit board via a 20 conductor ribbon cable.

The 16 digit display is self scanning and contains its own character display memory. Data is written to the displays once per frame. Address Latch U1 generates chip enable and address information to the display devices to allow the MCU to write data to the display and control registers.

The status LED's are controlled by interface driver U3. This driver is accessed with a serial clock and data stream once per frame. When all the LED information has been shifted into the driver, it is latched there by the LEDSTB signal from the MCU (display header pin 10).

The 8 pushbuttons are arranged in a 8 x 2 matrix. Data from 8 keys at a time is latched into U2 by signal SH/LD on U2 pin 1. Address decoder U1 selects which set of 8 switches is latched into U2 using enable lines A0 and A1. Each time a key is pressed, the MCU firmware generates a key scan code corresponding to the position of the key in the key matrix.

To perform a Keyboard test and lamp test of the front panel LED's hold down the SETUP key on power up. The front panel display will show:

```
00    KEY
```

As you press various key combinations various of the LEDs will illuminate. The front panel display will show the Keyboard scan codes for each key combination pressed. Table 5-1 below shows the SCAN code for each key. To exit LED test mode, remove and re-apply power to the unit.

CAPTION ON/OFF	01	→	07
SHIFT	02	SELECT	45
←	05	↑	46
↓	06	SETUP	47

Table 5-1: Keyboard Scan Codes

5.3.3 Serial Digital Video Bypass Relay (8039-31)

The 8074 is equipped with a bypass relay feature which directly connects the input video to the main output BNC in case of a power failure, or if activated manually by the user. The bypass relay circuitry is contained on a separate circuit card (8039). When the bypass relay is in the non-bypassed position, input video is fed to the SDI receiver on the main circuit board by a coaxial cable. Serial video out from the cable driver on the main board by a coaxial cable.
When the relay is in the bypass condition, the Fault tally is grounded. When the relay is in the normal position, the fault tally is open circuit. The

front panel shows a message when the relay is in the bypass condition also.

5.3.4 Serial Digital Video Input (8025-33)

The serial digital input circuitry is based on the Gennum Genlinx Serial Digital Video chip set. The 9005 (U13) receiver/equalizer provides automatic cable equalization and clock extraction form the serial digital signal. It provides a balanced ECL level recovered clock and data signals to the 9000 decoder. The 9000 (U14) decoder de-serializes the signal and provides a parallel clock and 10 bits of parallel data to input B of the input multiplexer U7, U8, and U9.

The 9005 receiver is capable of working with 143 MHz 4 Fsc composite NTSC, or 270 MHz 4:2:2 component video data rates. The capture frequency of the 9005 is set by trim pots VR2 for 270 MHz, and VR4 for 143 MHz. The capture range can be adjusted with the following procedure.

1. Connect a digital volt meter set on a 10 volt range to the Loop filter test point LF (located at the rear left corner of the 8025 board).

2. Connect a serial digital video signal to the serial input of the 8074. Connect the serial output of the 8074 to a digital monitor, or connect the analog monitor output to an analog monitor.

3. Configure the 8074 to the same video type that you have connected to the input. The input test signal should now be visible on your monitor. If it is not, then still proceed with step 4.

4. Rotate trimpot VR2 for component video (VR4 for composite) fully clockwise. Slowly rotate the trimpot counter clockwise monitoring the loop filter voltage on the digital volt meter. Continue turning the trimpot until the picture appears. Note the voltage on the LF test point.

5. Continue rotating the trimpot until the loop filter voltage is 200 mVolts above the voltage measures in step 4.

5.3.5 Serial Digital Video Output (8025-34)

The serial digital output circuitry is based on the Gennum Genlinx chip set, and consists of the 9002 (U29) encoder and 9008 (U15) cable driver. The 9002 receives TTL level parallel data and clock signals from the keyer LCA (U17) and encodes the data into the SMPTE 259 specified bitstream. Cable driver 9008 receives the serial data from the 9002. The output of the 9008 is adjustable using trim pot VR7 and is normally set to 800 mVolt p-p. Two identical serial outputs are provided.

5.3.6 Keyer LCA (8025-32, 8025-35, 8025-37)

The heart of the 8074 is the Keyer LCA U17. Input video from the serial input is passed through the input multiplexer circuitry U7, U8, and U9 and fed to the inputs of the keyer LCA.

The microcontroller writes to a data shift register in the LCA that in turn shifts out the caption data bit by bit into the keyer. The LCA generates the closed caption clock burst and inserts it along with the data into the serial digital bitstream on line 21.

5.3.7 RS-232 Communications Ports (8025-32, 8038-32, 8038-33)

The basic 8074 is fitted with three RS-232 ports which are known as Port A , B and C. The circuitry for Port A is contained on the main circuit board. The circuitry for port B and C is contained on submodule 8038.

The pin out for the 9 pin female connector for serial port A is shown below.

Pin	Description
1	Ground
2	not used
3	Data Carrier Detect
4	Request to Send
5	RS-232 Transmit
6	Ground
7	not used
8	RS-232 Receive
9	Ground

RS-232 data from port A is translated to/from TTL levels by RS232 driver U10. The receive and transmit data is sent directly to the MCU serial port pins. Data carrier Detect and Request to Send are buffered by U10 and connect to pins 80 and 81 of the LCA.

The pin out for the 9 pin male connector for serial port B and C is shown below. This port has a pinout similar to the 9 pin port on a PC so that a standard “Null Modem” cable may be used to connect to the computer.

Pin	Description	
1	DCD	Data Carrier Detect (in)
2	RxD	RS-232 Receive Data In
3	TxD	RS-232 Transmit Data Out
4	DTR	Data Terminal Ready (out)
5	GND	Ground
6	DSR	Data Set Ready (in)
7	RTS	Request to Send (out)
8	CTS	Clear to Send (in)
9		not used

RS-232 data from Ports B and C is translated to/from TTL levels by RS232 drivers U12 and U14 and sent to UARTs U11 and U13 respectively.

5.3.8 Modems (8038-32, 8038-33)

The basic 8074 is fitted with a Cermetek CH1794 modem (M1) known as port D. A second optional modem (M2) known as port E may be fitted. These modems are capable of baud rates up to 14400, but the actual connection rate parameters are set from the front panel menus or serial ports. The modems handle all the necessary interconnection to the telephone network, and communicate to the microprocessor through UARTs U9 and U8.

5.3.9 Analog Composite Monitor (8029-30, 8029-31)

The composite analog monitor output circuitry is contained on the 8029 submodule located to the right of the unit. Parallel digital video from the LCA is fed up the header to the encoder integrated circuit U1. This device converts the component digital signals to composite analog, and provides a video output amplifier to drive an analog monitor.

When the optional Caption decoder output circuitry is installed on the submodule, the monitor video output is buffered by U19 and associated components. This requires that there are two slightly different procedures to adjust the video level of the analog output, depending on whether the optional Caption Decoder circuitry is installed or not.

When the caption decoder circuitry is not installed:

1. Connect a test pattern source (e.g. colour bars) to the digital video input of the 8074. Connect a 75 ohm termination on the monitor output video connector.

2. Adjust the Encoder **GAIN** trimpot (VR1) so that the amplitude of the sync tip is 0.286 volts for NTSC or 0.300 volts for PAL measured at the JP1 test point.

When the caption decoder circuitry is installed:

1. Connect a test pattern source (e.g. colour bars) to the digital video input of the 8074. Connect a 75 ohm termination on the monitor output video connector.

2. Adjust the Encoder **GAIN** trimpot (VR1) so that the amplitude of the sync tip is 0.286 volts for NTSC or 0.300 volts for PAL measured at the JP1 test point.

   Note: Adjusting VR1 affects the output level of both the analog monitor output and the caption decoder output.

3. Adjust the monitor output buffer **GAIN2** trimpot (VR6) so that the amplitude of the sync tip is 0.286 volts for NTSC or 0.300 volts for PAL measured at the Monitor output video connector.

5.3.10 Caption Decoder Output (8029-32)

The optional caption decoder output circuitry is contained on the 8029 submodule located to the right of the unit. The composite analog video from the encoder (U1) is buffered by emitter follower Q2 and distributed to the sync separator U10, the caption decoder U11, and DC restorer U9. The sync separator provides V sync and H sync to the caption decoder, and a back porch clamp pulse to drive the DC restorer circuitry U9 and associated components. The composite video from Q2 is fed through the Video Buffer/DC Restorer to the video keyer U 12.

The Caption decoder RGB character outputs are combined through 1K series resistors to provide keyer data to the video keyer. Character white level is adjusted by **CHAR LEVEL** trimpot VR2. The video keyer is controlled by the BLANK output of the caption decoder. Then the BLANK signal is low the program video is passed though the keyer. When the BLANK signal is high the character data is added to the black level of the video. The resulting video output from the keyer is then fed to output buffer U13 and is available at the decoder output BNC.

To calibrate the output level of the Decoder output:

1. Connect a test pattern source (e.g. colour bars) to the digital video input of the 8074. Connect a 75 ohm termination on the decoder output video connector.

2. Adjust the Encoder **GAIN** trimpot (VR1) so that the amplitude of the sync tip is 0.286 volts for NTSC or 0.300 volts for PAL measured at the JP1 test point.

   Note: Adjusting VR1 affects the output level of both the analog monitor output and the caption decoder output.

3. Adjust the decoder output buffer **GAIN1** trimpot (VR3) so that the amplitude of the sync tip is 0.286 volts for NTSC or 0.300 volts for PAL measured at the Decoder output video connector.

To set the character white level of the decoder, adjust VR2 to so that the inserted characters are approximately at the peak white level.

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