TES9 SOFTWARE USER'S MANUAL

norpak corporation

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Chapter 1
INTRODUCTION

1.1 DATA DISTRIBUTION OVERVIEW

The TES9 encoder is part of a system that allows data to be inserted into the VANC (Vertical Ancillary) area of one or two SMPTE 292M or 259M video signals for distribution over a video network. This method of data embedding ensures that the data follows the video signal wherever it is routed. Eventually, the video signal reaches a location where the data is extracted and processed.

The TES9 can be used to add the data to the digital video stream, or extract it, or both. Figure 1 shows the flow of video and data through the TES9. This shows that each channel is equipped with a VANC/VBI decoder that provides extracted data to the CPU, and a VANC/VBI encoder that accepts data from the CPU for insertion into the video. The CPU also has access to a variety of standard data ports: RS-232, LAN and modem.

These facilities allow the TES9 to perform a number of functions:

Inserting data received from one or more of the data ports into the video. This is normally called "encoding", "inserting" or "embedding".

Extracting data from the video and forwarding it to one or more data ports. This is normally called "decoding", "extracting" or "disembedding".

Inserting data extracted from one video signal into the other. This is called "bridging".

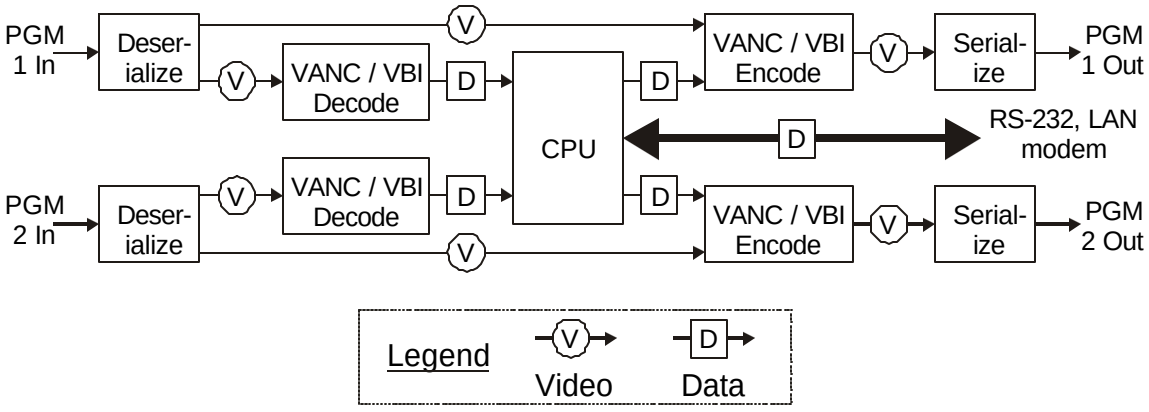


Figure 1: Video and Data Flow in the TES9

NOTES
On some models of TES9, the two video channels may be labeled "PROGRAM" and "AUXILIARY", instead of "PROGRAM 1" and "PROGRAM 2", respectively. Their functions are nevertheless identical.

Figure 2 shows the pieces of equipment involved in a simple data distribution system. Each of the pieces in this system is described briefly in the following sections. For clarity, only one video signal and one data stream are used in this example.

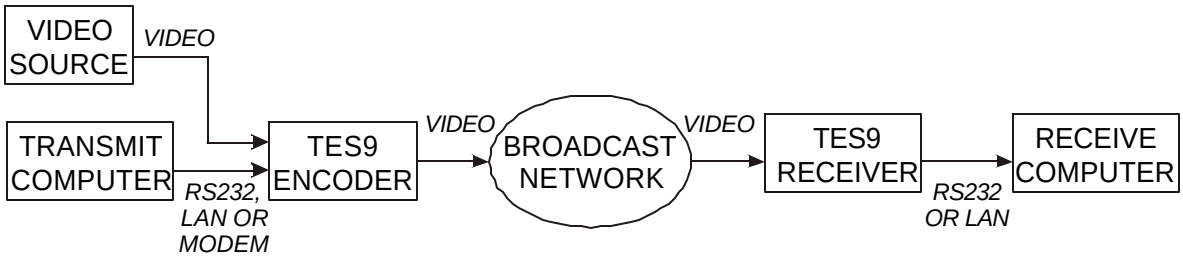


Figure 2: Simple Data Distribution System Block Diagram

VIDEO SOURCE

The video source provides the serial digital video signal into which the TES9 encoder inserts the VANC or VBI data. The video signal may be any of those listed in the following table.

Type	Format Description	Defining Standards
259M	525 lines, 59.94 Hz	ITU-R BT.601, SMPTE 125M
	625 lines, 50 Hz	ITU-R BT.601
292M	1080i, 50 Hz	SMPTE 274M
	1080i, 59.94 Hz	SMPTE 274M
	1080i, 60 Hz	SMPTE 274M
	1080p, 23.98 Hz	SMPTE 274M
	1080p, 24 Hz	SMPTE 274M
	1080sf, 23.98 Hz	SMPTE 274M, RP211
	1080sf, 24 Hz	SMPTE 274M, RP211
	720p, 50 Hz	SMPTE 296M
	720p, 59.94 Hz	SMPTE 296M
	720p, 60 Hz	SMPTE 296M

TRANSMIT COMPUTER

The transmit computer executes application programs that

- configure the encoder; and/or
- supply data to the encoder

SETTES9, the application program used to configure the TES9, is supplied with the TES9. This is for use on computers equipped with Windows 98 or later.

Data is sent to the encoder by application programs which may be written specifically for the data distribution system (e.g. a closed captioning server), or may be a generalized source of a serial data stream.

TRANSMIT COMPUTER TO TES9 ENCODER LINK

The link between the transmit computer and encoder is a combination of LAN and serial connections.

The LAN system is Ethernet 100baseT using TCP/IP, with up to eight data connections.

In addition to the eight possible LAN connections, there can be up to 4 serial feeds connected to the encoder. Three of these are RS232 operating at speeds up to 115,200 baud. The fourth serial feed is a 33.6K bps modem connection.

TES9 ENCODER

The TES9 can be loaded with up to a total of sixteen software modules. It can encode up to eight different input data streams into VANC lines of each PROGRAM 1 and PROGRAM 2 video signals. The software modules in the encoder determine the format of VANC data that is inserted. The software modules currently available for the encoder, which are described in this manual, are:

- Transparent
- Closed Captioning (with optional Redistribution Control feature)
- Constant Data

TES9 RECEIVER

The TES9 receiver is identical to the TES9 encoder, but has been configured by the user (with SETTES9) to operate as a receiver. In this mode, it extracts the data from the VANC data area of the SMPTE 292M signal, and sends it to the receive computer via LAN and serial connections.

NOTE
In this section of the manual, the term 'encoder' is used to refer to a TES9 which is being used to insert data into the video signal, and 'receiver' is used to refer to a TES9 which is extracting data from the video signal. In general, however, the TES9 is often referred to as an encoder, regardless of its current function; it can, in fact, be used to insert and receive data simultaneously.

TES9 RECEIVER TO RECEIVE COMPUTER LINK

The link between the TES9 receiver and the receive computer can be any combination of LAN serial connections, as discussed above for the Transmit Computer to TES9 Encoder link.

RECEIVE COMPUTER

The receive computer processes the extracted VANC data. The program that processes the data can be either a Norpak application program or a user-provided program. The term "computer" is used here to represent any type of device that can accept data from the TES9; for example, in the case of captioning data, this might be an MPEG video encoder.

1.2 HOW TO USE THIS MANUAL

The following is a brief description of the contents of each chapter in this manual:

Chapter 1 - introduction

Chapter 2 - describes the installation of the TES9.

Chapter 3 - describes the part of the configuration program that applies to both the Transparent and Closed Captioning modules.

Chapter 4 - describes the Transparent module.

Chapter 5 - describes the Captioning module.

Chapter 6 - describes the Constant Data module.

Chapter 7 - gives troubleshooting procedures for various situations.

Appendix A - describes the interface between the transmit computer software and the LAN encoder.

You should read chapters 1 to 3 and the chapters for the software modules that you have installed in your encoder. Consult Chapter 7 if you are having problems using your TES9.

Chapter 2
INSTALLATION

The procedure for installing the TES9 is as follows:

1. Install and connect the TES9 chassis, following the procedure described in the TES9 Hardware Manual, Document 85-10467-01.

2. It is advisable to make all your connections to the TES9 rear panel with the power off. Once you have made all necessary connections, you can turn the power on.

If you plan to use the TES9 as an encoder, proceed as follows:

3. Connect the equipment providing the video signal source to the PROGRAM 1 IN connector on the encoder.

4. Connect the PROGRAM 1 OUT connector on the encoder to the equipment that is to receive the video signal with the inserted VANC data.

5. If using a serial data connection, connect the transmit computer(s) to the serial port(s) on the encoder using a null modem cable (a null modem cable is shipped with the encoder). Alternatively, connect the transmit computer to the LAN connector on the encoder via an Ethernet LAN, using a standard RJ45 cable.

When using the TES9 as a receiver, proceed as follows:

3. Connect the equipment providing the video signal containing the VANC data to be received to the PROGRAM 1 IN connector on the encoder.

4. Connect the TES9's PROGRAM 1 OUT connector to other equipment that needs this video signal; if there is none, connect a 75 ohm termination to PROGRAM 1 OUT. Note: for proper operation, it is essential that the output be terminated in 75 ohms.

5. If using a serial data connection, connect the receive computer(s) to the serial port(s) on the encoder using the supplied null modem cable. Alternatively, connect the receive computer to the LAN connector on the encoder via an Ethernet LAN, using a standard RJ45 cable.

If your TES9 is equipped with a second program video channel and you plan to use it, follow the procedure described above for the Program 1 channel, connecting to PROGRAM 2 IN and OUT instead of PROGRAM 1 IN and OUT.

Chapter 3
ENCODER CONFIGURATION

A computer running Windows 98 or later is required in order to execute the SETTES9 configuration program. As discussed previously, the computer and the encoder can be connected locally via RS232, or remotely using the modem or LAN port.

For an RS232 connection, connect the supplied null modem cable from the encoder's Port A jack to a COM port on the setup computer. Note that this can be the "transmit computer" connected in Chapter 2.

3.1 INSTALLING THE SETUP SOFTWARE

The configuration program, SETTES9, is supplied with the TES9 on a CD-ROM. To install SETTES9 on the computer's hard drive:

1. Place the SETTES9 disk in the CDROM drive.

2. If the setup program does not start automatically, select "My Computer", double-click the Compact Disk drive, then double-click "SETUP.EXE".

3. Follow the Install Shield instructions.

There are three steps involved in configuring the encoder:

1. Connect the computer to the encoder through Port A or the modem or LAN jack, as discussed above.

2. Put the encoder into setup mode (this is not necessary for the LAN encoder if its IP address has already been set up).

3. Run SETTES9.

The last two steps are explained in more detail in the following sections.

3.2 PUTTING THE ENCODER INTO SETUP MODE

Whenever the TES9's power is turned on, it begins operation using parameters stored in its configuration memory. In order to change these operating parameters via Port A or the modem, the TES9 must be placed in setup mode. To select setup mode once the TES9 has completed its power-up sequence and is operational, press and hold the LOAD switch located on the TES9's rear panel for at least two seconds. When the STATUS 1 LED begins

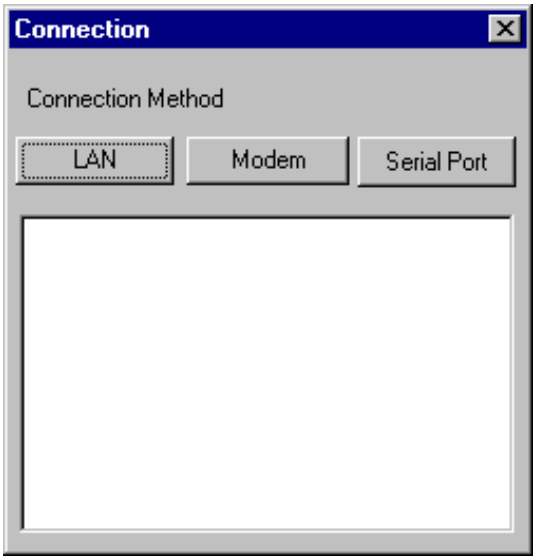
alternating between green and yellow, the TES9 is ready to be configured, and waiting for SETTES9 to communicate with it using one of its ports (Port A, modem or LAN). The TES9 will leave setup mode when you exit from SETTES9 or you turn the TES9's power off and on again.

To use setup via the LAN, you need to initially set the encoder's IP address through port A or the modem, using the above procedure. After this initial setup, the TES9's configuration can be changed via the LAN connection at any time, without pressing the LOAD switch to select setup mode.

All data sources should stop sending data to the encoder before running SETTES9.

3.3 STARTING SETTES9

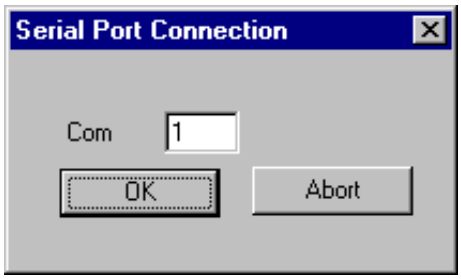
To start SETTES9, select the SETTES9 menu entry from the Start | Programs menu.
Select the type of connection you wish to use from the Connection menu.



Serial Port Connection

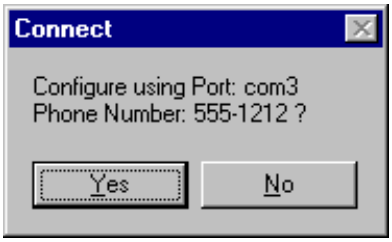
After selecting Serial Port as the method of connection, the following message box appears.

Selecting ‘No’ displays the following message box and allows you to specify the COM port of your computer that is connected to Port A of the TES9.

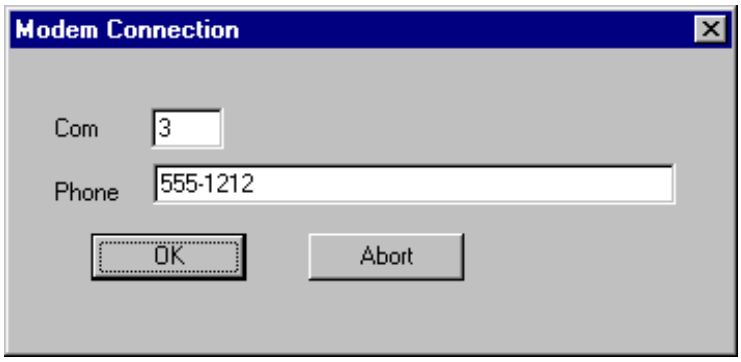


Modem Connection

Selecting the modem as the configuration method displays the following message box.

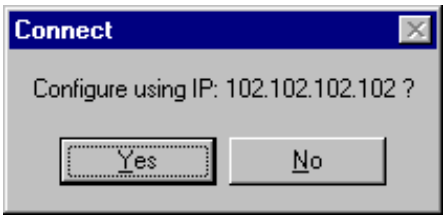


Selecting ‘No’ displays the following message box and allows you to specify the COM port of your computer’s modem, and the phone number of the telephone line connected to the TES9's modem jack.

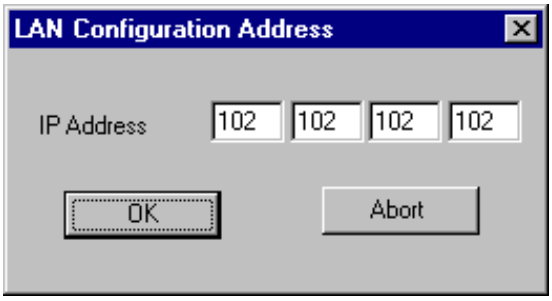


LAN Connection

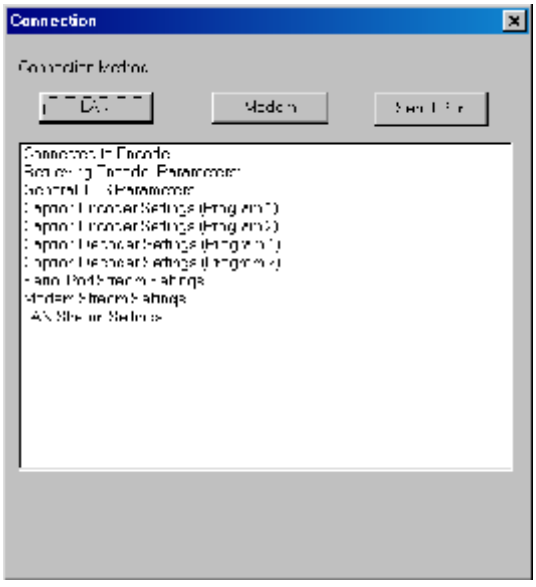
Selecting the LAN as the configuration method displays the message box shown below.



Selecting 'No' displays the following message box and allows you to select the IP address of the TES9 to be configured.

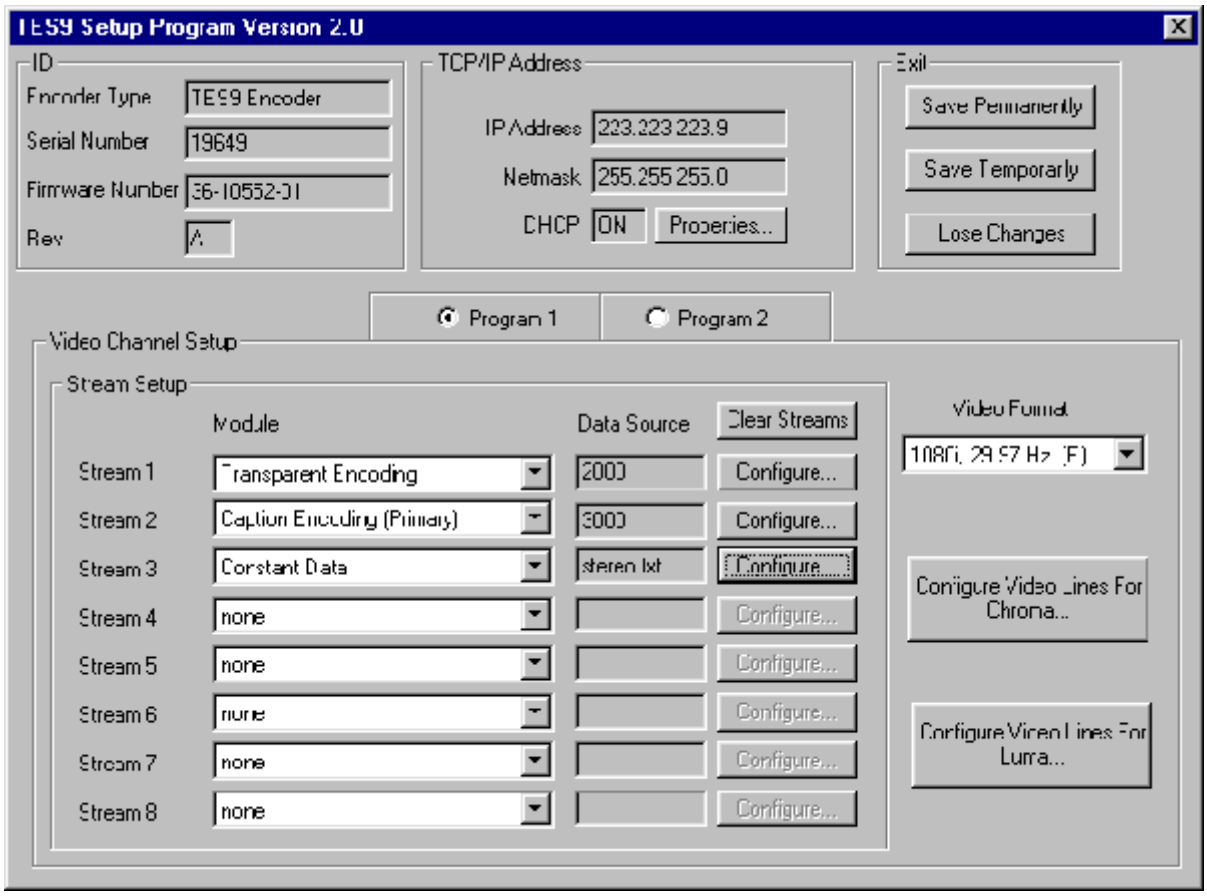


After a connection has been established, SETTES9 downloads the encoder's module and stream settings. The Connection display is updated with periodic progress reports. The display shows the modules which are installed. The figure below shows a typical connection display.



3.4 MAIN SETTES9 MENU

After the settings are downloaded from the encoder, the main SETTES9 menu, similar to the one shown below, appears.



The following is a brief description of the controls on the main SETTES9 menu.

3.4.1 ID

The ID section of the menu displays general information about the encoder being configured. The Encoder Type and Serial Number describe the encoder's hardware, while the Firmware Number and Rev describe the software that is currently running on the encoder.

3.4.2 TCP/IP Address

This area is for display purposes only; to change any of the values, select the 'Properties' button.

IP Address - The IP address of the encoder when it was powered up.

Netmask - The Netmask used by the encoder. The IP Address and Netmask are assigned to the encoder so that it can communicate over a TCP/IP network with other computers. The IP Address and Netmask values are controlled by your network administrator.

DHCP - This feature (Dynamic Host Configuration Protocol) allows the encoder to get an IP address assigned to it by a DHCP server, as opposed to using a fixed number. 'ON' indicates DHCP is used and 'OFF' indicates that the encoder is using the static IP address displayed in the 'IP Address' area. Consult your network administrator as to whether your network uses DHCP. In the event of a DHCP failure, the encoder uses the 'IP Address' and 'Netmask' displayed as a default.

Properties - This button allows the displayed items in the TCP/IP Address section to be altered using the LAN Card Configuration menu.

3.4.3 Program 1/Program 2

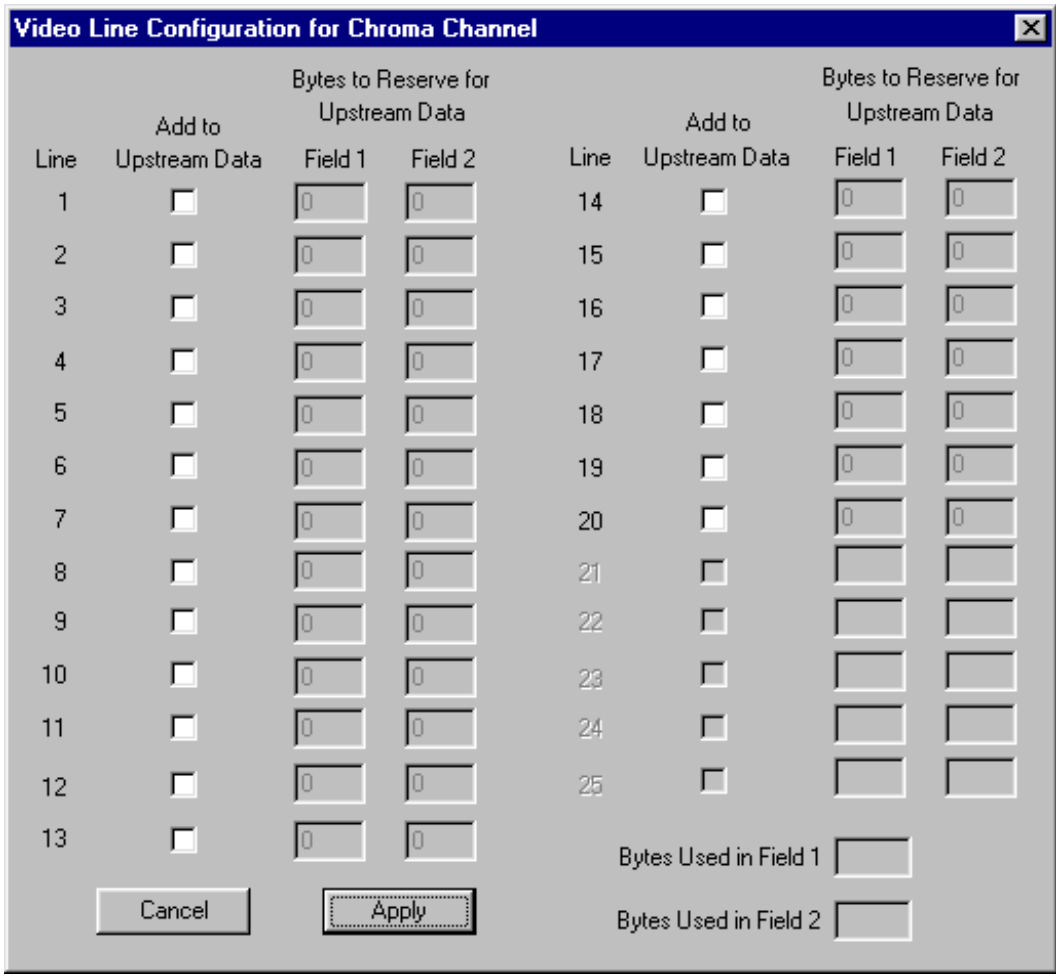
Use these radio buttons to select which video channel you are setting up. The selected encoder is PROGRAM 1 or PROGRAM 2, respectively.

3.4.4 Video Format

This setting specifies the type of video signal that is expected at the PROGRAM IN jack of the selected encoder. Any time the format of the video signal is to be changed, you should configure the TES9 for that format by running SETTES9 and setting the Video Format parameter. The TES9 will still operate if the video input is different from the one specified here, provided that it recognizes the format. However, some parameters such as the lines used for insertion may not be appropriate if the input format has a different range of allowable lines than the one you specify here.

3.4.5 Configure Video Lines For Chroma

When this button is selected, the following menu is displayed:



This menu allows you to specify, for each video line, whether the VANC data being inserted is to be added to the upstream VANC data in the line, or whether all upstream data is to be discarded. Note, lines that are assigned to a Transparent Stream configured for Byte Mode for High Capacity cannot be used by any other stream, and any upstream data on any of the assigned lines will be overwritten. If the VANC data being inserted is to be added to the upstream data, then you may specify, for that line, the number of bytes to reserve for upstream data for each field in the line. This is only necessary if the inserted data, from all of the streams using the Chroma channel of that line, will be close to the capacity of the line (i.e 1880 bytes for interlaced video, or 1240 bytes for progressive video). If this is the case, then specifying the Bytes to Reserve for Upstream Data will allow SETTES9 to display in the Bytes Used Field box the total number of bytes (including the bytes to reserve for upstream data) used by all of the streams in that line and channel, and to warn you if the streams that you have configured will exceed the capacity of the line. If Add to Upstream Data is selected,

then the Caption data packet, if it is being inserted, is added before any upstream packets, and all other packets are added after all upstream packets.

3.4.6 Configure Video Lines For Luma

This button provides the same facility as Configure Video Lines for Chroma, but for the Luma channel.

3.4.7 Stream Setup

The Stream Setup section allows you to attach a data source to a module.

Under the 'Module' heading is a column of boxes in which the different modules available on the encoder can be selected. The example menu shows a Transparent module being used for stream 1, a Closed Caption module being used for stream 2 and a Constant Data module being used for stream 3.

The column of boxes under the heading 'Data Source', shows the data source that the selected module is connected to. The example main menu shows that the Transparent module is connected to LAN Port 2000.

The 'Module' boxes, depending on which modules have been purchased, can contain 'Transparent Stream', 'Caption Stream' or 'Constant Data'.

The available data sources are: LAN Ports, Port A, Port B, Port C, Modem, Btest, and a file of constant data.

NOTE
Btest is special test data used in conjunction with a TES9 Receiver and Btest decoding program to diagnose end-to-end data transmission problems. Btest acts as a data source and can only be used with the Transparent module. The Btest decoding program is capable of calculating and displaying the BER (Bit Error Rate) of the transmission channel.

To set up a stream, select the module you wish to configure from the 'Module' box and click the 'Configure' button for that stream. The Stream Configuration menu for the module selected is displayed, allowing you to select the data source and other stream related parameters.

The 'Clear Streams' button resets all streams, removes all Btest data sources and resets other data related settings to the factory presets. All streams are lost if this option is selected, and the encode and decode lines are set back to their default values. The reset does not change any of the other parameters on the SETTES9 main menu.

The available Stream Configuration menus and the chapter in which each menu is described are:

Transparent Stream Configuration Menu	Chapter 4
Caption Stream Configuration Menu	Chapter 5
Constant Data Configuration Menu	Chapter 6

3.4.8 Exit Buttons

'Save Permanently' saves the current changes in non-volatile storage in the encoder and then exits. When this command is selected, the configuration information is sent to the TES9; the STATUS 1 LED then starts blinking alternately yellow and red while the configuration is being saved, and finally turns green again.

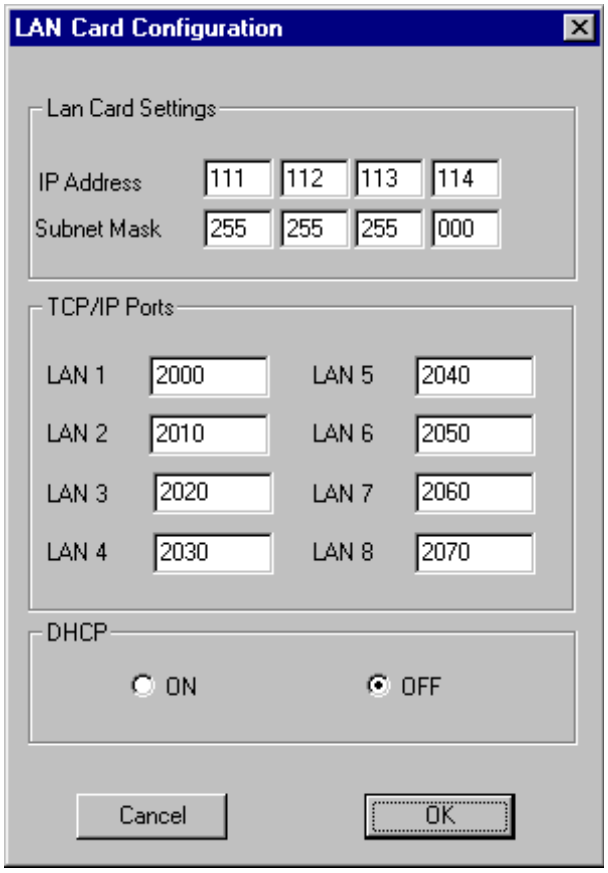
CAUTION
It is important to avoid powering down the encoder while the STATUS 1 LED is blinking yellow and red, as doing so could cause the encoder's configuration and software to be lost, requiring it to be re-loaded by Norpak. After selecting the 'Save Permanently' command, you should ensure that you do not power down the encoder until the STATUS 1 LED stops blinking yellow and red.

'Save Temporarily' exits SETTES9 and saves the current changes to temporary storage in the encoder. The next time the encoder is powered off and back on again, these changes are erased and the TES9 restores the configuration that was last saved permanently .

'Lose Changes' discards the changes and exits SETTES9.

3.5 LAN CONFIGURATION MENU

The menu shown below is displayed when the 'Properties' button within the TCP/IP address section of the main SETTES9 menu is selected. The LAN Configuration menu allows you to set the TCP/IP related parameters used for the LAN connection.



NOTE
The TES9 must be powered off and back on if you change the DHCP On/Off, IP Address or Subnet Mask settings.

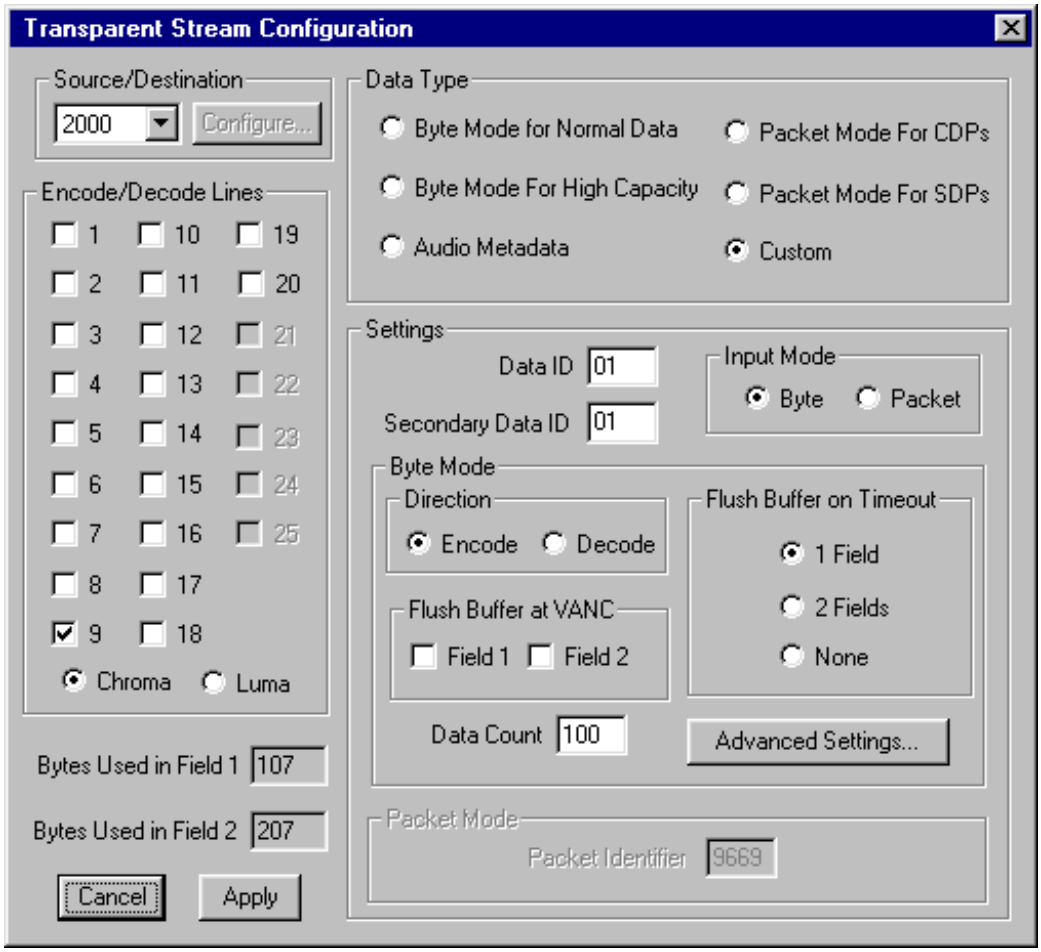
The meaning of the IP Address, Subnet Mask and the DHCP control are described in the section pertaining to the main SETTES9 menu.

The TCP/IP ports are similar to serial ports on a serial encoder, as they are used as data sources. The port numbers can be specified by the user and are used by computers sending data to, or receiving data from, the encoder. The valid range for TCP/IP port numbers is 1 to 65535. However, it is recommended that the port numbers used be greater than 1024, as many lower numbers have been assigned specific functions within TCP/IP networks. Using one of these lower numbers could adversely affect the operation of a TCP/IP network. Norpak uses port numbers 1080 and 1090 for configuration of the encoder, so these port numbers cannot be used for a stream.

Chapter 4
TRANSPARENT MODULE

The Transparent module allows any 8-bit data to be inserted into the VANC data area of the HDTV signal. The module can be configured to operate in a number of ways, depending on the format of the data generated by the sending computer, and the way in which the data is to be inserted into the HDTV signal.

When a Transparent module is selected for configuration in the main SETTES9 menu, the Transparent Stream Configuration menu is displayed:



Select one of the available LAN ports, serial ports or btest data from the “Source/Destination” drop-down box. Data sources used by other modules do not appear in the drop-down box.

A detailed level of control is provided in the Settings section of the Transparent Stream

Configuration menu. For convenience, however, the configuration required by some of the common applications of the Transparent module can be set by selecting one of the radio buttons in the Data Type section. Each of the Data Type buttons sets a particular combination of controls in the Settings section, then greys out those controls affected. At this point, you need only set the controls that have not been greyed out. The exception to this is the Custom data type, which allows you to manually configure the encoder using all of the controls in the Settings section.

The common applications which are supported by the Data Type selection are described in the following section.

4.1 DATA TYPE

4.1.1 Byte Mode for Normal Data

This button sets the Input Mode and Flush Buffer parameters to those which would most often be required for inserting transparent data. When using this Data Type, only one video line can be selected for insertion, and therefore the throughput is limited by the capacity of one video line, or the selected Data Count. Any 8 bit data can be sent, and the data will be inserted no later than 2 video fields after it has been received by the encoder, provided that the Data Count has been set to a value which provides the required throughput. When using this data type, you must specify the Encode Line and Channel, Data ID, Secondary Data ID, Data Count and the Source port to be used to receive data from the transmit computer. If a serial connection is being used, you must also specify the communications parameters using the Configure button.

4.1.2 Byte Mode for High Capacity

This Data Type is similar to Byte Mode for Normal Data, except that it allows you to specify more than one video line to use for insertion, and hence the throughput is not limited by the capacity of one video line. Note that the lines allocated to a High Capacity stream cannot be used by any other stream, and any upstream data on any of the allocated lines will be overwritten. When using this data type, you must specify the set of Encode Lines, Encode Channel, Data ID, Secondary Data ID, and the Source port to be used to receive data from the transmit computer. If a serial connection is being used, you must also specify the communications parameters using the Configure button.

4.1.3 Byte Mode for Audio Metadata

This button configures the TES9 to receive audio metadata via the selected port. When using this data type, you must specify the Encode Line and Channel, Data ID, Secondary Data ID and the Source port to be used to receive data from the transmit computer. If a serial connection is being used, you must also specify the communications parameters using the Configure button.

4.1.4 Packet Mode for CDPs

This button sets the Input Mode, Data ID, Secondary Data ID and Packet Identifier to those required for inserting Caption Distribution Packets (CDP) as defined by SMPTE 334M and CEA-708. When using this data type, you must specify the Encode Line and Channel and the Source port to be used to receive data from the transmit computer. If a serial connection is being used, you must also specify the communications parameters using the Configure button.

4.1.5 Packet Mode for SDPs

This button sets the Input Mode, Data ID, Secondary Data ID and Packet Identifier to those required for inserting Subtitle Distribution Packets (SDP) as defined by SMPTE 334M. When using this data type, you must specify the Encode Line and Channel and the Source port to be used to receive data from the transmit computer. If a serial connection is being used, you must also specify the communications parameters using the Configure button.

4.1.6 Custom

This button allows you to manually configure the encoder using all of the controls in the Settings section. When using this data type, you must also specify the Encode or Decode Line and Channel and the Source port to be used to receive data from the transmit computer. If a serial connection is being used, you must also specify the communications parameters using the Configure button.

4.2 SETTINGS

4.2.1 Input Mode

If the Custom Data Type is selected, then the Input Mode radio buttons allow you to configure the encoder to accept data in either Byte or Packet mode.

In Byte mode, for every Data Type except audio metadata, the Transparent module allows a pair of TES9 Encoder/Receivers to act as a transparent data channel for any 8-bit data. The raw data (i.e. data with no protocol) received by the TES9 Encoder, via a serial port or LAN connection, is inserted into the VANC data area of the HDTV signal, and then extracted from the VANC area by the TES9 Receiver and sent (with no protocol) to the receiving computer via the serial port or LAN connection.

If the Data Type is set to audio metadata, the data received by the TES9 encoder must be valid audio metadata in order to be inserted correctly.

In Packet mode, the Transparent module allows packets of data to be formatted by the transmit computer such that each packet will correspond to one VANC packet inserted into the HDTV signal. The packet of data sent to the encoder by the transmit computer must be formatted as follows:

{Identifier} {Length} {data} {Footer ID} {Footer data}

The components of the packet are as follows:

Parameter	Meaning
{Identifier}	a 2-byte sequence indicating the start of the packet.
{Length}	a 1-byte unsigned number indicating the number of bytes in the entire packet, from the first byte of the Identifier to the last byte of the Footer data, inclusive.
{data}	a sequence of any 8-bit data, maximum number of data bytes is 249 (256-7)
{Footer ID}	one byte with a hexadecimal value of 0x74, indicating the start of the Footer data.
{Footer data}	a 3-byte sequence of any 8-bit data.

Two applications for this mode are:

- Inserting Caption Distribution Packets (CDPs), carrying DTV Closed Captioning data, as defined by CEA-708.
- Inserting Subtitle Distribution Packets (SDPs), carrying WST teletext data and EST Enhanced Systems Teletext, as defined by SMPTE 334M.

When Packet mode is being used for one of these applications, the values for the various fields must conform to the applicable standard. For any user-defined applications, however, the transmit computer need only ensure that the fields conform to the format given above.

Packet mode of operation applies only to encoding. Decoding is done using Byte mode, regardless of the mode used to encode the data. When decoding, all of the bytes, from the Identifier to the last byte of Footer data, inclusive, are sent to the receiving computer.

4.2.2 Direction

If the Direction is set to ‘Encode’ then the TES9 receives data from the transmit computer and inserts it into the VANC area of the video signal. If the Direction is set to ‘Decode’ then the TES9 extracts data from the VANC area of the video signal and sends it out the specified port. Before selecting ‘Decode’, you must first set the Data Type to ‘Custom’.

The remainder of the controls in the Settings section of the menu, and the Source/Destination selection, are described in the following sections. Each section describes the controls that pertain to a specific type of stream, as determined by the Input Mode and Direction.

4.3 BYTE MODE (ENCODING STREAM)

The TES9 acts as an Encoder in byte mode if the Data Type is Byte Mode for Normal Data, Byte Mode for High Capacity or Audio Metadata or the Data Type is Custom and the Input Mode is Byte and the Direction is set to ‘Encode’. The meaning of the other menu items are described in the following sections.

4.3.1 Data IDs

The Data ID and Secondary Data ID specify (in hexadecimal) the values to be used for the corresponding fields in the encoded Ancillary Data Packet, as defined by SMPTE 291M.

4.3.2 Data Count

The Data Count specifies the maximum number of data bytes that will be inserted for the stream in the VANC area of one video field. This value must be in the range of 1 to 1824 or 1205 for interlaced and progressive respectively, otherwise an warning message is displayed. The Data Count can only be set if the Data Type is Byte Mode for Normal Data or Custom.

4.3.3 Advanced Settings

This selection is greyed for all Data Types except Custom.

This menu lets you set the Data Count for video fields 1 and 2 separately, and is only enabled when the Data Type is set to Custom. Note that the Data Count field on the main Transparent Stream Configuration menu specifies the Data Count for both field 1 and field 2. Also, if you use the Advanced Settings to set the Data Counts for fields 1 and 2 separately, and then subsequently set the Data Count on the main Transparent Stream configuration menu, this will set the Data Count back to the same specified value for both fields.

4.3.4 Flush Buffer on Timeout

This selection is greyed for all Data Types except Custom.

If this parameter is Off, then a data packet will only be inserted when enough bytes have been received from the transmit computer to fill a packet, using the specified Data Count. If one of the other settings is selected, then any received data will be inserted, using a smaller Data Count if necessary, when no data has been received for the specified period of time, as given below:

1 Field	-	1 complete video field (i.e. no data has been received between 2 consecutive VANC areas of the video signal)
2 Fields	-	2 complete video fields

4.3.5 Flush Buffer at VANC

This selection is greyed for all Data Types except Custom.

If neither of these check boxes is checked, then a data packet will only be inserted when enough bytes have been received from the transmit computer to fill a packet, using the specified Data Count. If one or both of the check boxes are checked, then any data which has been received, at the point when the specified VANC area of the video occurs, will be used to form a packet (with a smaller Data Count if necessary) and will be inserted in the following VANC area.

As an example, assume that only the Field 2 checkbox is checked, the Data Count is set to 180 bytes, and the baud rate is set to 9600. At this baud rate, a maximum of 32 characters will be received during any 2 field period of 59.94 or 60 Hz video signal. If the data is being sent by the transmit computer at the maximum rate, then at each field 2 VANC the data received during the previous 2 fields (usually 32 characters) will be used to form a packet and will be inserted in the following field 1 VANC area.

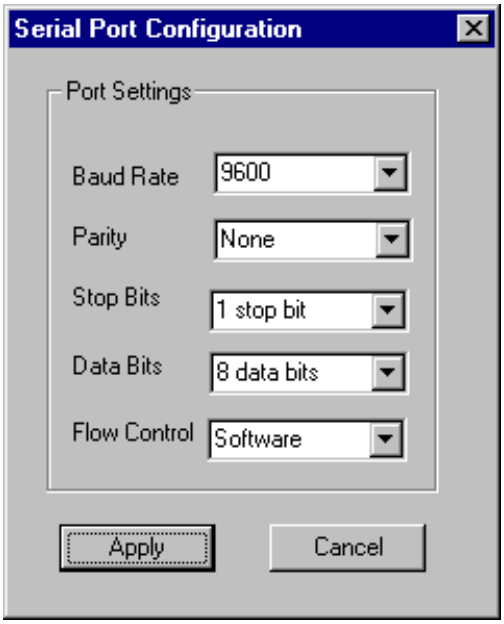
If a progressive video signal (i.e. 720p or 1080p) is being used, then the Field 2 check box is greyed out, since the Field 1/Field 2 designation only applies to an interlaced signal. If the Field 1 check box is checked in this case, then the buffer is flushed at every VANC area.

4.3.6 Source/Destination

The Source/Destination field is used to select the LAN or serial port used to transfer data to the Transparent module. Since the module is being used to insert VANC data, this port is the Source of the data to be inserted by the Transparent module.

The drop-down box labeled: “Source/Destination” indicates the currently selected port, which can be one of eight selectable LAN ports, Port A, Port B, Port C, Modem, Btest data or none.

If you have selected a serial port, use the ‘Configure’ button to set the serial port parameters using the Serial Port Configuration menu shown below. Note that the TES9 can be set to use either software flow control (XON/OFF) or none. The serial port configuration parameters must match those used by the device connected to the specified port.



4.3.7 Encode/Decode Lines

The desired Data Type should be selected before using this section. This section specifies the video line number(s) and channel (Chroma or Luma) to insert the VANC data into. If the Data Type is High Capacity, then any number of lines can be selected. For any other Data Type, only one line can be selected. The allowable range is 1 to 20 for an interlaced or segmented video signal, and 1 to 25 for a progressive signal. When any VANC data is being inserted into the selected PROGRAM signal, the corresponding ENCODE indicator on the front panel of the TES9 is green.

4.4 BYTE MODE (DECODING STREAM)

If the Input Mode is set to 'Custom' and the Direction is set to 'Decode', then the TES9 acts as a Receiver for the data. The meanings of the other menu items are described in the following sections.

4.4.1 Data IDs

The Data ID and Secondary Data ID specify (in hexadecimal) the Data Identifiers for the Ancillary Data Packets to be extracted and sent to the receive computer. Any other Ancillary Data Packets are discarded.

4.4.2 Source/Destination

The Source/Destination field is used to select the port used to output data from the Transparent module. Since the module is being used to decode VANC data, this port is the Destination to which the Transparent module sends the data extracted from the VANC.

The drop-down box labeled: "Source/Destination" indicates the currently selected port, which can be a LAN port number, Port A, Port B, Port C, or none.

If you have selected a serial port, use the 'Configure' button to set the serial port parameters using the Serial Port Configuration menu shown below. The serial port configuration parameters must match those used by the device connected to the specified port.

For a Decoding stream, the flow control should be set to none. This is because the TES9 cannot obey flow control from the receive computer, since it must send the data to the receive computer as it is extracted from the video signal.

4.4.3 Encode/Decode Lines

This section specifies the video line number(s) and channel (Chroma or Luma) to extract the VANC data from. The allowable range is 1 to 20 for an interlaced or segmented video signal, and 1 to 25 for a progressive signal. When any VANC data is found in the selected PROGRAM signal, in the line number(s) and channel selected for decoding, the DECODE indicator on the front panel of the TES9 is green.

4.5 PACKET MODE (ENCODING STREAM)

The TES9 acts as an Encoder in packet mode if the Data Type is Packet Mode for CDPs or Packet Mode for SDPs or the Data Type is Custom and the Input Mode is Packet and the Direction is set to 'Encode'. The meaning of the other menu items are described in the following sections.

4.5.1 Data IDs

This selection is greyed for all Data Types except Custom.

The Data ID and Secondary Data ID specify the values to be used for the corresponding fields in the encoded Ancillary Data Packet, as defined by SMPTE 334M and SMPTE 291M. For CDPs, the values are Data ID = 61, Secondary Data ID = 01. For SDPs, the values are Data ID = 61, Secondary Data ID = 03.

4.5.2 Packet Identifier

This selection is greyed for all Data Types except Custom.

The Packet Identifier specifies the 2-byte sequence which indicates the start of the packet. The 2-byte sequence is specified as 4 hexadecimal digits.

4.5.3 Source/Destination

The meaning of the Source/Destination field is the same as for encoding using Byte mode. When operating in Packet mode, however, this field will specify a Source, since Packet mode applies only to encoding.

4.5.4 Encode/Decode Lines

This section specifies the video line number and channel (Chroma or Luma) to insert the VANC data into. The allowable range is 1 to 20 for an interlaced or segmented video signal, and 1 to 25 for a progressive signal. When any VANC data is being inserted into the selected PROGRAM signal, the corresponding ENCODE indicator on the front panel of the TES9 is green.

4.6 BYTES USED

The menu items Bytes Used in Field 1 and Bytes Used in Field 2 display the total number of bytes (including the bytes to reserve for upstream data) used by all of the streams in the selected video line and channel.

4.7 DATA THROUGHPUT CALCULATIONS

When encoding a transparent stream using data supplied through the LAN, the throughput is completely defined by the Data Count specified for the stream, assuming that the transmit computer and LAN can supply data as needed. This is defined by the following equation:

T = FV x DC bytes/second, where FV is the field rate for interlaced formats or the frame rate for progressive formats.

When encoding a transparent stream using data supplied through a serial port, the throughput depends on the Data Count and also on the serial port baud rate. The maximum throughput is the lesser of the baud rate and the value resulting from the following equation:

DR = FV x 10 x DC bits/second, where:

- FV is the field rate for interlaced formats, or the frame rate for progressive formats.
- DC is the Data Count set for the Transparent module in SETTES9.
- The factor 10 in the equation reflects the fact that each 8-bit value is carried on the serial link with one start and one stop bit.

This is expressed in bits/second to allow comparison with the serial port baud rate.

For example, if FV = 59.94 and DC = 100, DR = 59,940 bits/second.

If the serial port speed is set to 57,600 bits/sec, the TES9 cannot fully use the capacity that has been reserved for this stream, and the throughput will be 57,600 bits/second. If the port speed is 115,200 bits/sec, the TES9 will use flow control to maintain an average rate of 59,940 bits/sec. However, if the transmit computer does not respect flow control, data will be lost.

This points out the importance of flow control. If you are not certain that the program you are using to send data to the TES9 responds properly to XON/XOFF flow control, it is advisable to select a Data Count value for the transparent stream which is large enough to ensure that flow control is never needed. For example, with FV= 59.94, a DC value of 193 or greater can transport a 115,200 bits/second stream without flow control.

Similarly, when decoding a transparent stream, care must be taken to set the serial port baud rate high enough for the throughput of the stream. In the above example with DC=100, the serial port for the decode stream would need to be set to 115,200 bits/sec, since 57,600 bits/sec is insufficient to sustain the throughput of 59,940 bits/sec.

Chapter 5
CAPTIONING MODULE

5.1 CAPTION ENCODING

The captioning module accepts commands and data from the transmit computer and inserts the caption data into the VANC area as Caption Distribution Packets (with cc_type = NTSC Line 21 data and cc_type = DTVCC data) conforming to CEA-708.

The TES9 uses exactly the same protocol for caption encoding as Norpak's TES3 and TES5 VBI encoders and the TES7 VANC encoder. This allows encoding of services which may not be present in DTV (Digital Television) captioning. However, this approach has two significant benefits: a caption server which works with a TES3, TES5 or TES7 can be connected without modification to a TES9; and all the services produced by the caption server are available downstream for VBI insertion if the DTV stream is downconverted to standard definition for analog broadcast.

The TES9 provides a command (N_T Start Encoding Text Data) for inserting Internet URL information into one of the Text channels (T1 - T4) on a periodic basis, conforming to specifications CEA-608 and EIA-746. It also provides commands for inserting XDS data on a periodic basis.

Given this ability to mix together and insert more than one channel, the possibility exists that data sent to the Captioning module is to be inserted at the same time as the data from the N_T command. If this situation occurs, the Captioning module applies a priority based on data type to determine which data gets inserted. The table below shows this priority, with the highest priority data type listed first. The references to fields 1 and 2 indicate the fields where the data would be inserted in a standard definition video signal.

Field 1	Field 2
C1	C3
C2	C4
URLs	URLs
T1	T3
T2	T4
	XDS (Interval Packets)
	XDS (Fill Packets)

This means that the insertion of URL information may be delayed by caption channel data which must be inserted (in the same field), but takes precedence over other text channel data and XDS data (in the same field).

In the above table, URLs refers to any Text channel data being inserted using the N_T command (Start Encoding Text Data).

In the current version of the TES9 software, the caption encoding stream does not handle decoding and re-insertion of upstream caption data. Therefore, the effect of the encoding commands associated with decoding upstream data (Turn Off Channels, Turn On Channels, Specify Upstream Packet Priority, and Store and Forward Upstream Packets) is as if null bytes were continuously being received from upstream.

5.2 CAPTION DECODING

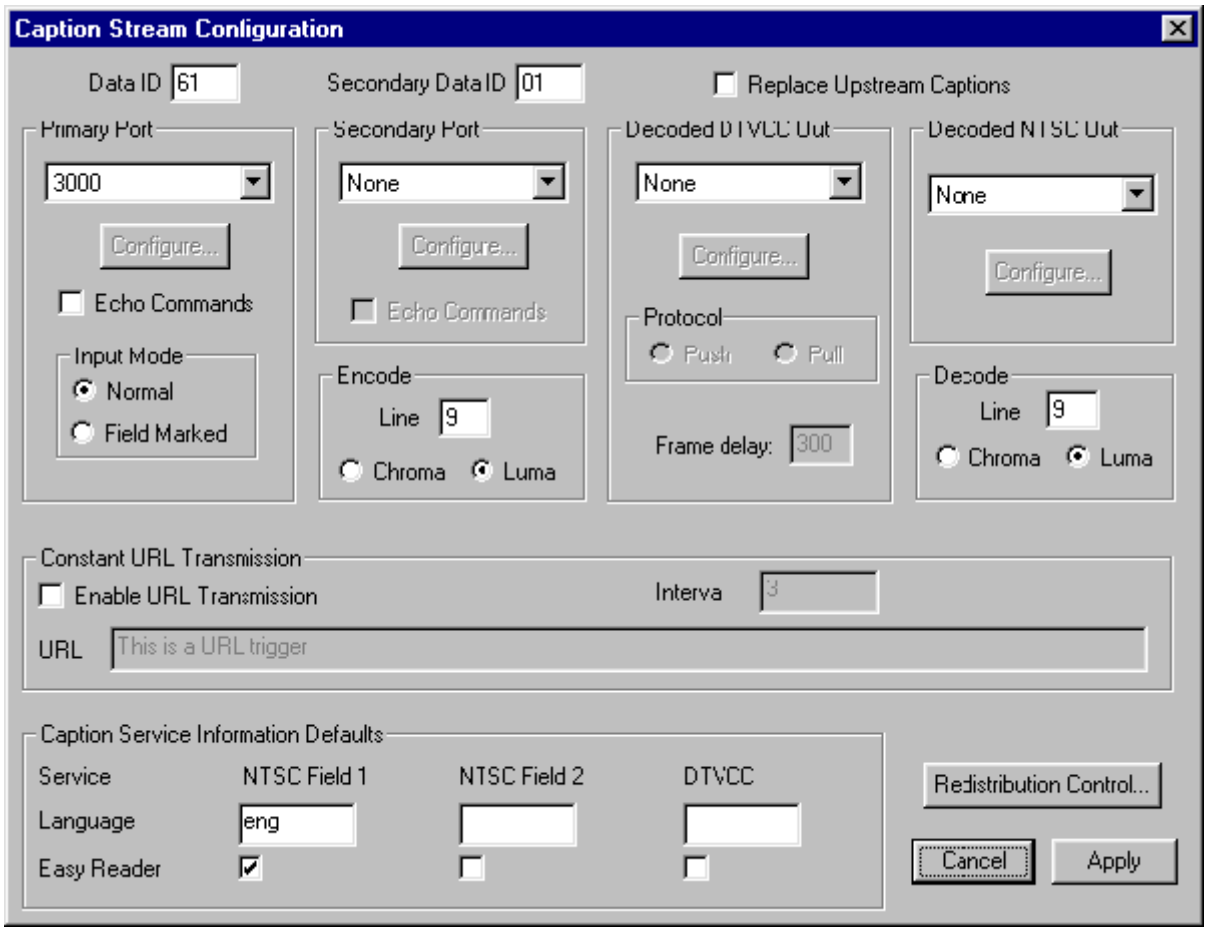
The caption decoding streams decode Caption Distribution Packets from the VANC area of the video line selected for decoding, and output either DTVCC or legacy (standard definition) data, depending on the type of decode stream.

5.3 CAPTIONING CONFIGURATION

The Captioning module differs from the other encoder modules in that one Captioning module can be used to control multiple streams of data - two encode streams, two decode streams and two monitoring streams. The reason for allowing two encode streams is that the captioning specification, CEA-608, allows data sent to the Captioning module to be associated with one of four caption channels (C1, C2, C3 and C4), one of four text channels (T1, T2, T3 and T4) or the XDS data channel. Caption channels C1 and C2 can only occur in field 1 of the video signal, while C3 and C4 can only occur in field 2. Similarly, Text channels T1 and T2 can only occur in field 1, and T3 and T4 can only occur in field 2. The XDS data can only occur in field 2.

Since the Captioning module can receive data from two sources, it can be configured to receive, for example, closed caption data via Port A, and XDS data from a different host computer via Port B. Since the data from both of these streams is inserted on the same video line, it is necessary for the software to place some restrictions on the type of data that can be received from the second stream. The first stream, referred to as the "Primary stream" in this manual, can receive and insert data in any of the nine channels defined by CEA-608 (C1 through C4, T1 through T4, and XDS). However, the second stream, referred to as the "Secondary stream" in this manual, can only receive and insert data in the XDS channel. This means that a number of the Captioning commands, such as <CTRL-A>2 and <CTRL-A>3, can only be used in the Primary stream. As well, if only one stream is being used, it must be the Primary stream.

When a Captioning module is selected for configuration in the main SETTES9 menu, the Caption Stream Configuration menu is displayed.



Each of the menu items is described in the following sections.

5.3.1 Data IDs

The Data ID and Secondary Data ID specify the values to be used for the corresponding fields in the encoded Ancillary Data Packet, as defined by SMPTE 291M. It should be noted that the TES9 is shipped with these fields set to the values specified by SMPTE 334M, and therefore it is normally not necessary for the user to change these fields.

5.3.2 Replace Upstream Captions

This check box indicates that the caption packet being inserted is to replace any upstream caption packet in the same video line of the Program In video signal (i.e. the upstream packet is discarded). If this box is not checked, and there is an upstream caption packet, then the upstream packet is re-inserted, and the new caption data is not inserted.

5.3.3 Sources

The source fields in the Primary and Secondary streams are used to select the source device that supplies data to the Caption module for each Encode stream being used. The drop-down box indicates the currently selected source device. The source device can be one of the eight user defined TCP/IP port numbers, Port A, Port B, Port C, Modem or none. If you selected a serial port, use the 'Configure' button to set the serial port parameters using the Serial Port Configuration menu. Note that the TES9 can be set to use software flow control (XON/OFF) or none.

NOTE
Although a baud rate as high as 115200 can be selected, the maximum baud rate for a stream being used to send caption data to be inserted is 19200. If the stream is only being used to receive Caption Service Information or Content Advisory data being extracted from the Program In video, then any baud rate can be used.

If you selected a LAN port, the port numbers can be configured by selecting the 'Properties' button in the Encoder Interface section of the main SETTES9 menu (see the TCP/IP Address Configuration Menu section).

It is important to note that the Secondary stream is only used if the Primary stream is already used. If the Primary stream is disabled (i.e. set to none, then the Secondary stream is disabled as well.

Setting the Source to none does not turn off the encoding of Redistribution Control Program Descriptor (Broadcast Flag) packets if they were enabled.

5.3.4 Echo Commands

This check box indicates that commands and lines of Realtime mode data received by the encoder are to be echoed back as they are received. As well, the command or line of data being entered can be corrected using the Backspace key, before terminating the line with a Carriage Return.

If the encoder is being controlled by host software that does not expect commands that it sends to be echoed back, then this box should not be checked. If, however, the encoder is being controlled by a user entering commands manually, with a terminal emulator such as HyperTerminal, then it is useful to have this option enabled.

5.3.5 Input Mode

This field indicates how the data received by the encoder is to be interpreted. If set to Normal, then the encoder accepts the set of commands described in the Caption Commands section of this manual. If set to Field Marked, then the encoder accepts caption data in the format generated by the Caption Data Output feature of the TES3 or TES5. When using this mode, the Output Protocol on the TES3 or TES5 must be set to Field Marked.

5.3.6 Encode

This section specifies the video line number and channel (Chroma or Luma) into which the VANC caption data and Redistribution Control Descriptor are inserted. The allowable range is 1 to 20 for an interlaced or segmented video signal, and 1 to 25 for a progressive signal. When any VANC data is being inserted into the video in signal, the corresponding ENCODE indicator on the front panel of the TES9 is green.

5.3.7 Decoded DTVCC Out

This parameter specifies the destination for DTVCC caption data received in the video in signal.

5.3.8 Protocol

This parameter specifies the protocol to be used to send the DTVCC caption data out the specified port, normally a serial port. The Push protocol refers to the “Grand Alliance” protocol, where the caption data is sent to the MPEG encoder without checking for acknowledgments. The Pull protocol refers to that specified by SMPTE 333M, “DTV Closed-Caption Server to Encoder Interface”.

5.3.9 Frame Delay

This field specifies the number of video frames to delay before sending the data to an MPEG encoder. The purpose of this is to account for delays in the MPEG encoding of the video channel (relative to the caption data channel) to allow the video and caption data to be synchronized at the final destination..

5.3.10 Decoded NTSC Out

This parameter specifies the destination for NTSC caption data received in the PROGRAM IN signal. The NTSC caption data is output using Norpak’s “Field Marked” protocol, which refers to the format of data expected by the TES3, TES5 or TES9 when the Input Mode is set to Field Marked. Data is sent in groups of 3 bytes, as shown below:

Format	Meaning
0x81 {byte1} {byte2}	2 bytes of NTSC field 1 data
0x82 {byte1} {byte2}	2 bytes of NTSC field 2 data
0x11 0x80 0x80	Caption packet was received with no NTSC field 1 data
0x12 0x80 0x80	Caption packet was received with no NTSC field 2 data

The Field Marked protocol allows standard-definition CEA-608 caption data embedded within CEA-708 in a SMPTE 292M signal to be decoded and sent to a TES3 or TES5 to be inserted into an analog or SMPTE 259M serial digital video signal, respectively.

5.3.11 Decode

This section specifies the video line number and channel (Chroma or Luma) from which to extract the VANC caption data. The allowable range is 1 to 20 for an interlaced or segmented 292M video signal, and 1 to 25 for a progressive signal. When any VANC data is found in the video in signal, in the line number and channel selected for decoding, the DECODE indicator on the front panel of the TES9 is green.

5.3.12 Caption Service Information Defaults

The fields in this section specify the data for the Closed Caption Service Information for each caption service being inserted. The Language field specifies the 3-character language code as given in ISO 639.2/B. The "Easy Reader" check box indicates that the closed caption service contains text tailored to the needs of beginning readers.

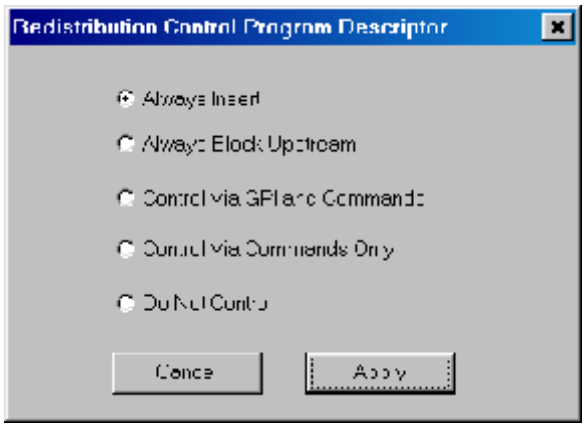
5.3.13 Constant URL Transmission

This feature configures the encoder to insert, on a periodic basis, a Uniform Resource Locator, in Text channel T2, according to the CEA-608 and EIA-746 specifications. This feature provides the same functionality as the "N_T" command (Start Encoding Text Data) but allows the encoder to be configured to automatically start inserting the string on power-up (i.e. it is not necessary to send the "N_T" command to the encoder) and to continue inserting the string forever. Checking "Enable URL" turns on this feature. The Interval is the time interval, in seconds, between each insertion of the URL.

When this feature is used, the checksum for the string to be inserted (specified in the URL field) is automatically generated by the encoder (according to CEA-608 and EIA-746) and appended to the string.

5.3.14 Redistribution Control (Broadcast Flag)

This feature, which is an optional component to the Caption module, allows for the insertion of the Redistribution Control Program Descriptor (also referred to as the Broadcast Flag), as defined by SMPTE RP207. The inserted VANC packets have Data ID=62 and Secondary Data ID = 01. When the button is selected, the following menu is displayed:



The meaning of each of the radio buttons in this menu is as follows:

Always Insert

This selection causes the TES9 to insert the Redistribution Control packet every two seconds. Also, if the Encode Mode on the main SETTES9 menu is set to Add, then all Redistribution Control packets from upstream (i.e. in the PROGRAM IN signal) are blocked.

Always Block Upstream

This selection causes the TES9 to ensure that the Redistribution Control packet is never inserted, by disabling the “N_PD” command for the Redistribution Control packet and by ignoring the GPIO input which controls the insertion of the Redistribution Control packet. Also, if the Encode Mode on the main SETTES9 menu is set to Add, then all Redistribution Control packets from upstream are blocked.

Control Via GPIO and Commands

This selection allows the insertion of the Redistribution Control packet to be controlled via the GPIO port on the rear panel of the TES9 and by the “N_PD” command from the transmit computer. When using the GPIO port, an open circuit or a high logic level (i.e. from 2 to 5 volts) signals the inactive state, and a low logic level (i.e. from 0 to .8 volts) signals the active state. When pin 1 of the GPIO port changes from the inactive to the active state by connecting it to ground, then the Redistribution Control packet is inserted within 2 video fields

and every 2 seconds thereafter, until the GPIO input changes back to the inactive state. While the GPIO input is in the active state, any Redistribution Control packets received from upstream are blocked (i.e. deleted). Whenever the GPIO input is in the inactive state, then the insertion of the Redistribution Control packet is controlled via the "N_PD" command from the transmit computer. For details of the wiring of the GPIO port, see the TES9 Hardware Manual.

Control Via Commands Only

This selection allows the insertion of the Redistribution Control packet to be controlled by the "N_PD" command only.

Do Not Control

This selection disables the Redistribution Control feature of the Caption module, so that no Redistribution Control packet is inserted, and upstream Redistribution Control packets are not blocked.

If the TES9 being used supports two video channels (Program 1 and Program 2), but only one Caption module is loaded, then setting the radio button to anything other than 'Do Not Control' causes the Caption module to be used for the selected video channel (Program 1 or Program 2), so that it will be not be available for the other channel. Therefore, if you wish to define a caption stream for, say, Program 1, then you must ensure that the Redistribution Control feature for Program 2 is set to 'Do Not Control'.

5.4 CAPTION COMMANDS

On power up, the Captioning module enters Command mode. In this mode, the Captioning module is controlled by a set of commands. This set of commands is summarized below.

Command	Format
Reset Encoder	<CTRL-F><CTRL-F>
Enter Realtime Mode	<CTRL-A> 2 {channel} {rows} {base row} <CR>
Enter Pass-Through Mode	<CTRL-A> 3 {n} {field} <CR>
Set Null Mode	<CTRL-A> 6 {field} <CR>
Set Transparent Mode	<CTRL-A> 7 {field} <CR>
Turn Off Channels	<CTRL-A> 6 {channels} <CR>
Turn On Channels	<CTRL-A> 7 {channels} <CR>
Start Encoding Text Data	<CTRL-A> N_T {string} {text channel} I={interval} D={duration}<CR>
Stop Encoding Text Data	<CTRL-A> N_T <CR>
Start XDS (Interval Packets)	<CTRL-A>P{packet type} {repeat count} {data} {delay} <CR>
Start XDS (Fill Packets)	<CTRL-A>P{packet type} {duration} {data} {priority} P <CR>
Stop Encoding XDS Data	<CTRL-A>P{packet type} <CR>
Specify Upstream Priority	<CTRL-A>P{packet type} {priority} P <CR>
Store and Forward	<CTRL-A>N_U{packet type} {delay} <CR>
Start Program Descriptor	<CTRL-A> N_PD {tag and data} I={interval} D={duration} <CR>
Stop Program Descriptor	<CTRL-A> N_PD {tag} <CR>
Block Program Descriptor	<CTRL-A> N_PDU {tag} BLOCK={state}<CR>
Service Information Enquiry	<CTRL-A> N_E1 <CR>
Content Advisory Enquiry	<CTRL-A> N_E2 <CR>
Set Operating States	<CTRL-A> N_SET ECHO={state} MR={state}<CR>
Set Baud Rate	<CTRL-A> I {baud rate} <CR>
Vendor and Version Enquiry	<CTRL-A> ? <CR>

The meanings of the parameters in the above commands are shown in the following table:

Parameter	Meaning
{channel}	the channel to use to encode the Realtime data (C1, C2, C3, C4, T1, T2, T3 or T4)
{rows}	the number of rows (2, 3 or 4) to use for the roll-up captions
{base row}	the base row (specified as B1 to B15) to use for the roll-up captions
{n}	is the optional degree of processing (from 1 to 4) to be performed on the received data. If the {n} parameter is not specified, then a default of 4 is used.
{field}	the optional field specification (F1 or F2). If the {field} parameter is not specified, then a default of F1 is used.
{channels}	the list of channels to turn on or off (C1, C2, C3, C4, T1, T2, T3, T4 or XDS)
{string}	the string of displayable characters representing the Text data to be encoded
{text channel}	the Text channel to use for encoding Text data (T1, T2, T3 or T4)
{interval}	the time interval between each insertion of Text data or Program Descriptor packets
{duration}	the length of time for which the Text, XDS or Program Descriptor data is to be encoded, in the format "mmm:ss", allowing times up to 999 minutes, 59 seconds.
{packet type}	a 4-digit hex number, where the first two digits represent the class of the packet and the second two digits represent the type of the packet. Note that there must be no space between the 'P' and the packet type parameter.
{repeat count}	the number of times (in hex) to send the packet. A value of -1 or FFFF indicates that the packet should be repeated forever.
{data}	the ASCII-encoded hex values representing the data in the packet, or the actual displayable data enclosed in curly braces.
{delay}	the delay, specified as the decimal number of video frames, between each insertion of an XDS packet
{priority}	the decimal value which specifies the relative time interval between insertions of the packet, compared to other packets created with this format of the command. For example, the time between insertions of a packet with a priority of 10 would be twice the time between insertions of a packet with a priority of 5.
{tag and data}	the ASCII-encoded tag and data for the Program Descriptor packet to be inserted
{tag}	the ASCII-encoded tag for the Program Descriptor packet to be stopped
{state}	the state to set the specified operating state to (ON or OFF)

{baud rate}	the baud rate to set the serial port to (1200, 2400, 4800, 9600 or 192). NOTE: Since the {baud rate} parameter must be 4 digits or less, a baud rate of 19200 is specified by the 3-digit value 192.

In the above commands, the space immediately after the <CTRL-A> and immediately before the <CR> is not required. For the <CTRL-A>P and <CTRL-A>N_U commands, however, there must be no spaces between the command type (i.e. P or N_U) and the {packet type}. Also, there is no space between the two <CTRL-F> characters in the Reset Encoder command, and there are no spaces on either side of the equal sign, in commands with parameters using this format.

When the encoder is ready to accept a command from the transmit computer, it sends the 3-character prompt sequence

<CR><LF> *

out the serial or LAN port being used for Captioning. The hexadecimal values for the bytes in this sequence are 0D, 0A, 2A. In order to ensure that no data is lost, the transmit computer should wait until it receives the prompt from the encoder before sending each new command. Note that some terminal emulators may strip <LF> characters from the stream.

The encoder handles most of the commands in the same way as Captioning Encoders designed by other manufacturers. However, the commands which begin with the letter "N" followed by an underscore are specific to the Norpak Caption Encoder.

It should be noted that, in the current version of the software, the caption encoding stream does not handle decoding and re-insertion of upstream caption data. Therefore, the effect of the commands associated with decoding upstream data (Turn Off Channels, Turn On Channels, Specify Upstream Packet Priority, and Store and Forward Upstream Packets) is as if null bytes were continuously being received from upstream.

A description of each of the above commands is given in the following sections.

5.4.1 Reset Encoder

Format: <CTRL-F> <CTRL-F>

This command resets all modes and operating parameters of the encoder, with the exception of the Echo and Monitor Ratings states, which are not changed, so that it is in transparent mode is not inserting any captions. This includes resetting the baud rate to the value set in the Serial Port Configuration menu.

5.4.2 Enter Realtime Mode

Format: <CTRL-A> 2 {channel} {rows} {base row} <CR>

This command puts the encoder into Realtime mode, where data received is encoded using the specified channel. If a caption channel (C1 to C4) is specified, then the captions are encoded using the Roll-Up style, with the specified number of rows and base row. While in Realtime mode, the encoder receives and buffers a line of data at a time, encoding the line when a carriage return is received.

If any of the parameters are omitted, the default for the omitted parameter(s) is used: channel = C1, rows = 3, base row = 15.

While in Realtime mode, the channel being used is turned OFF (i.e. any upstream data for that channel is discarded).

While the encoder is in Realtime mode, it sends the 3-byte sequence

<CR><LF> >

to the transmit computer each time it is ready to accept a new line of data. The hexadecimal values for the bytes in this sequence are 0D, 0A, 3E. If the transmit computer does not wait for this prompt before sending each line, then the encoder may issue flow control (i.e. send an XOFF character) to the transmit computer. In order to avoid losing data, the transmit computer must temporarily stop sending data until it receives the XON character, at which point it may continue.

Realtime mode is terminated by the sequence <CTRL-C> <CR>, at which point the encoder can once again accept commands from the host, and the channel being used for Realtime mode data is restored to its previous state (ON or OFF).

Null Caption Distribution packets are inserted when there are no captions available for insertion.

5.4.3 Enter Pass-Through Mode

Format: <CTRL-A> 3 {n} {field} <CR>

This command puts the encoder into Pass-Through mode, where all further data received is inserted into the video signal. The {field} parameter specifies which field of the video signal the data is to be inserted into. The {n} parameter is a value from 1 to 4 inclusive, and specifies the degree of processing which is applied to the received data, as follows:

Value of {n}	Result
1	All data is inserted as it is received.
2	Legitimate caption control code pairs are aligned and delayed so that the 2 bytes are transmitted in the same field.
3	Provides the same processing as when {n} is 2, with the addition that all caption control codes are doubled (inserted twice).
4	Provides the same processing as when {n} is 3, but filters out all non-caption control codes and discards the character following a <CTRL-A>.

If the {n} parameter is not specified, then the default value of 4 is used.

While the encoder is in Pass-Through mode, it does not send any prompt sequence to the transmit computer. If the transmit computer sends data faster than the encoder can insert it (limited by the CEA-608 standard, and equal to 60 characters per second), the encoder issues flow control (i.e. sends an XOFF character) to the transmit computer. In order to avoid losing data, the transmit computer must temporarily stop sending data until it receives the XON character, at which point it may continue.

In all four settings for the degree of processing, the parity bit is stripped off on input and set to odd parity on output. Any occurrence of <CTRL-C> or <CTRL-F> in the data is interpreted as a command to the encoder and is not inserted. All line 21 data in the incoming video signal (in the field being used for insertion) is discarded.

Pass-Through mode is terminated by a <CTRL-C> character, at which point the encoder enters Null mode for the field being used for Pass-Through mode.

Pass-Through mode is also terminated by two <CTRL-F> characters in a row, which resets the encoder and puts it into Command mode.

5.4.4 Set Null Mode

Format: <CTRL-A> 6 {field} <CR>

This command causes null bytes to be inserted in the video signal, for the field specified by the {field} parameter.

5.4.5 Set Transparent Mode

Format: <CTRL-A> 7 {field} <CR>

This command causes the video line selected for caption insertion, in the field specified by the {field} parameter, to be passed through the encoder unchanged.

5.4.6 Turn Off Channels

Format: <CTRL-A> 6 {channels} <CR>

This command causes all upstream data in the specified channels to be discarded.

5.4.7 Turn On Channels

Format: <CTRL-A> 7 {channels} <CR>

This command causes all upstream data in the specified channels to be encoded into the video signal.

5.4.8 Start Encoding Text Data

Format: <CTRL-A> N_T {string} {text channel} I={interval} D={duration} <CR>

This command starts the periodic insertion of data into a Text channel, and is designed to allow for the transport of Internet Uniform Resource Locator (URL) information using the T2 Text channel, according to specifications CEA-608 and EIA-746.

This command can also be used as a replacement for the N_V command, to insert V-chip ratings in the Canadian format.

NOTE
This command cannot be used in conjunction with Pass-Through mode. When the command to enter Pass-Through mode (<CTRL-A>3) is received, the cyclic insertion of the Text data is stopped immediately.

The parameters are as follows:

Parameter	Meaning
{string}	string of displayable characters to be inserted, enclosed in delimiting characters (any printable characters can be used). The maximum length of this string is 256 characters.
{text channel}	text channel to use (T1, T2, T3 or T4)
{interval}	time interval, in seconds, between each insertion of the string
{duration}	length of time for which the string is to be inserted, in the format "mmm:ss", allowing times up to 999 minutes, 59 seconds.

After this command is received, all upstream data in the specified Text channel is discarded, and the specified string is inserted on a cyclic basis, with the specified time interval between successive insertions. The string is inserted until the time specified by the duration expires. If a duration with no colon is specified, then it is assumed to be in minutes. If a duration of -1 is specified, then the string is inserted forever. If any of the {text channel}, {interval} or {duration} parameters are not specified, then the default for the omitted parameter is used (channel = T2, interval = 5 seconds, duration = 240 minutes).
To insert the specified string in the proper Text channel, the encoder automatically precedes the string by a Text Restart command. The values used for the 2-byte Text Restart command depend on the selected channel, as follows:

Channel	Text Restart Command (hexadecimal)
T1	14, 2A
T2	1C, 2A
T3	15, 2A
T4	1D, 2A

The Text Restart command clears the portion of the screen used for Text display and sets the cursor to the upper-left corner. This means that if the user of a caption decoder selects the Text channel being used for the insertion of the URL, the URL is displayed in the upper-left corner, with the rest of the Text area remaining blank.

The URL being encoded can be changed at any time simply by sending another "N_T" command with the desired parameters, as described above.

It should be noted that the checksum at the end of the string, as described in CEA-608 and EIA-746, is **not** generated by the encoder; it must be sent by the host computer.

5.4.9 Stop Encoding Text Data

Format: <CTRL-A> N_T <CR>

This command stops encoding the text data. After this command is received, the data channel which was being used for the text data is restored to its previous state (ON or OFF).

5.4.10 Start Encoding XDS Data (Interval Packets)

Format: <CTRL-A>P{packet type} {repeat count} {data} {delay} <CR>

This command starts inserting, on a cyclic basis, the specified XDS packet. The packet is referred to as an Interval packet since it is inserted once for every interval given by the {delay} parameter.

The parameters are as follows:

Parameter	Meaning
{packet type}	4-digit hex number, where the first two digits represent the class of the packet and the second two digits represent the type of the packet. Note that there must be no space between the 'P' and the packet type parameter.
{repeat count}	number of times (in hex) to send the packet. A value of -1 or FFFF indicates that the packet should be repeated forever.
{data}	ASCII-encoded hex values representing the data in the packet, or the actual displayable data enclosed in curly braces.
{delay}	number of video frames (in decimal) to wait between each insertion of the packet.

If a command is received where the {data} parameter is not specified, then the packet is inserted with no informational characters. This would be used for packet types 0110 to 0117 (Program Description) corresponding to a blank line.

Special Processing on Specific Packet Types

Special processing is performed on the following packet types, when received from the host computer or from upstream:

0701 (Time of Day)	-	used to set the time in the encoder, according to Coordinated Universal Time
0102 (Length/Time-in-Show)	-	used to set the elapsed time of the program

Special processing is performed on the following packet types as they are inserted:

0701 (Time of Day)	-	data used is the current time of day, in Coordinated Universal Time
0102 (Length/Time-in-Show)	-	data used is the current elapsed time of the program
010C (Composite Packet-1)	-	data used in the Time-in-Show field is the current elapsed time of the program

Examples

The following command will insert, every 2 seconds (60 video frames), the XDS Program Name packet. The name used will be “National News” and the packet is inserted forever.

<CTRL-A>P0103 -1 {National News} 60 <CR>

The following command inserts, every 5 seconds, the XDS Program Rating packet. The data defining the rating is 4042 (hexadecimal) and packet is inserted 360 times.

<CTRL-A>P0105 360 4042 150 <CR>

5.4.11 Start Encoding XDS Data (Fill Packets)

Format: <CTRL-A>P{packet type} {duration} {data} {priority} P <CR>

When this format of the command is used, the packet is inserted as often as possible, based on the space available in field 2 of line 21, and the other XDS packets being inserted. The packet is referred to as a Fill packet since it fills the unused space in field 2 of line 21.

The parameters are as follows:

Parameter	Meaning
{packet type}	same as for Interval packets
{duration}	length of time to insert the packet for, in the format "mmm:ss", allowing times up to 999 minutes, 59 seconds.
{data}	same as for Interval packets
{priority}	decimal value which specifies the relative time interval between insertions of the packet, compared to other packets created with this format of the command. For example, the time between insertions of a packet with a priority of 10 would be twice the time between insertions of a packet with a priority of 5.

The special processing performed on XDS Interval packets is also performed on Fill packets.

Example

The following command will insert the XDS Program Type packet, using values of 21 and 7F for the program type keywords. The packet is inserted as often as possible, given a priority of 40, and is inserted for 30 minutes.

<CTRL-A>P0104 30:00 217F 40 P <CR>

5.4.12 Stop Encoding XDS Data

Format: <CTRL-A>P{packet type} <CR>

When this format of the command is used, the Interval or Fill packet of the specified type is no longer inserted.

5.4.13 Specify Upstream Packet Priority

Format: <CTRL-A>P{packet type} {priority} P <CR>

When this format of the command is used, it does not cause the packet to be inserted; it simply specifies the priority with which upstream packets of that type are passed through. This is necessary, since there may not be sufficient space in field 2 to re-insert (pass through) the packet as often as it is received from upstream. If upstream packets are received, and their priority has not been specified with this command, then a default of 50 is used.

5.4.14 Store and Forward Upstream Packets

Format: <CTRL-A>N_U{packet type} {delay} <CR>

This command provides a “Store and Forward” capability for upstream packets. This means that the encoder can receive and store an upstream packet, then continue to insert the packet, on a cyclic basis, in a period of time during which it is not being received. This would be useful in the case where a network affiliate wishes to insert information relating to the current program from the network feed when he is providing a local commercial containing captions.

When this command is received, no packets of the specified packet type are inserted until that upstream packet is received. Each time the required packet is received, the data is stored in the encoder. When the time specified by the {delay} parameter expires, then the currently stored packet of this type is inserted.

5.4.15 Start Encoding Program Descriptor

Format: <CTRL-A> N_PD {tag and data} I={interval} D={duration} <CR>

This command starts the periodic insertion of a Program Descriptor packet, as described in section 6.9 (Core Descriptors), of the ATSC document A/65B.

NOTE
In order to use this command to insert the Redistribution Control Program Descriptor (Program Descriptor using a tag with a value of 0xAA), the optional Redistribution Control feature must be purchased. If this feature has not been purchased, then the Redistribution Control button on the Caption Stream Configuration menu will be greyed out.

The parameters are as follows:

Parameter	Meaning
{tag and data}	ASCII-encoded hex values for the Descriptor Tag and data (beginning with the Descriptor Tag) to be inserted, each byte being defined by 2 hex digits. This parameter consists only of hex digits, and must contain no spaces.
{interval}	time interval, in fields, between each insertion of the packet. The maximum allowable interval is 32767.
{duration}	length of time for which the packet is to be inserted, in the format "mmm:ss", allowing times up to 999 minutes, 59 seconds.

After this command is received, the specified packet is inserted on a cyclic basis, with the specified time interval between successive insertions. The packet is inserted until the time specified by the duration expires. If a duration with no colon is specified, then it is assumed to be in minutes. If a duration of -1 is specified, then the packet is inserted forever. If the {interval} or {duration} parameters are not specified, then the default for the omitted parameter is used (interval = 60 fields, duration = forever).

Example

The following command inserts the Stuffing Program Descriptor with a length of zero bytes. The packet is inserted every 10 video fields, and is inserted forever.

<CTRL-A> N_PD 8000 I=10 D=-1 <CR>

5.4.16 Stop Encoding Program Descriptor

Format: <CTRL-A> N_PD {tag} <CR>

This command stops the periodic insertion of a Program Descriptor packet. The parameter {tag} is a 2-digit hex value specifying the Descriptor Tag for the Program Descriptor to be stopped.

5.4.17 Block Upstream Program Descriptor

Format: <CTRL-A> N_PDU {tag} BLOCK={state} <CR>

This command controls the re-insertion of the upstream Program Descriptor packets specified by {tag}. In order for this command to have an effect, the Encoder Mode on the Main SETTES9 Menu must be set to 'Add'.

NOTE
In order to use this command to insert the Redistribution Control Program Descriptor (Program Descriptor using a tag with a value of 0xAA), the optional Redistribution Control feature must be purchased. If this feature has not been purchased, then the Redistribution Control button on the Caption Stream Configuration menu will be greyed out.

The parameters are as follows:

Parameter	Meaning
{tag}	2-digit hex value for the Descriptor Tag.
{state}	If {state} is specified as 'ON', then upstream Program Descriptor packets of the specified type are blocked. If the state is specified as 'OFF', then upstream Program Descriptor packets of the specified type are re-inserted (i.e. passed through).

5.4.18 Service Information Enquiry

Format: <CTRL-A> N_E1 <CR>

This command is used by a PSIP generator to retrieve the Caption Service Information from the Caption Distribution Packet in the Decode video line in the Program In video signal.

When this command is received by the encoder, the complete set of service information most recently extracted is sent out the serial port in the following format:

<LF> {ccsinfo_section} {checksum} <CR>

The components of this message are as follows:

<LF> - Line Feed (0x0A)

{ccsinfo_section} - the data formatted according to Table 28 in CEA-708.

{checksum} - the 8-bit value necessary for the modulo-256 sum of all the 8-bit values between the <LF> and <CR> characters to be zero.

<CR> - Carriage Return (0x0D)

Note that every 8-bit value in {ccsinfo_section} and {checksum} is sent as 2 ASCII-encoded hex digits, with the most-significant digit sent first. If a serial connection to the encoder is being used, then each hex digit is encoded with odd parity. For example, the first byte in Table 28, ccsvcinfo_id, which has a value of 0x73, would be represented by the 2 bytes: 0x37, 0xB3. Also, there is no space between {ccsinfo_section} and {checksum}.

5.4.19 Content Advisory Enquiry

Format: <CTRL-A> N_E2 <CR>

This command is used by a PSIP generator to retrieve the Content Advisory Program Descriptor packet from the Decode video line in the Program In video signal.

When this command is received by the encoder, the Content Advisory packet most recently extracted is sent out the serial port in the following format:

<LF> {content_advisory_descriptor} {checksum} <CR>

The component {content_advisory_descriptor} is the data formatted according to Table 6.18 in ATSC A/65.

The Content Advisory message is sent to the PSIP generator as ASCII-encoded hex values, similar to the Service Information message.

5.4.20 Set Operating States

Format: <CTRL-A> N_SET ECHO={state} MR={state} <CR>

This command sets the Echo state and/or the Monitor Ratings state to that specified (ON or OFF). Either one or both of the ECHO and MR parameters may be specified.

If the Echo state is ON, then commands and lines of Realtime mode data received by the encoder are echoed back as they are received. As well, the command or line of data being entered can be corrected using the Backspace key, before terminating the line with a Carriage Return. The default value for the Echo state, on power-up, is the setting in the Caption Stream Configuration menu.

If the Monitor Ratings state is ON, then the Caption module sends to the host computer all program rating packets (type 0105) that it receives from upstream. The packet sent to the host is in the following format:

<CTRL-A>P0105{rating}

where {rating} is a 4-character string representing the ASCII-encoded hexadecimal value of the 2 program rating bytes received from upstream. The default value for the Monitor Ratings state, on power-up, is OFF.

5.4.21 Set Baud Rate

Format: <CTRL-A> I {baud rate} <CR>

This command sets the baud rate of the serial port to the value specified by the {baud rate} parameter. To set the baud rate to 1200, 2400, 4800 or 9600, the appropriate 4-digit value is specified. To set the baud rate to 19200, the 3-digit value 192 is specified. The default value for the baud rate, on power-up or reception of the Reset Encoder command, is the setting selected in the Serial Port Configuration menu. Note that the Configuration menu allows selection of a wider range of baud rates than are available with this command.

5.4.22 Vendor and Version Enquiry

Format: <CTRL-A> ? <CR>

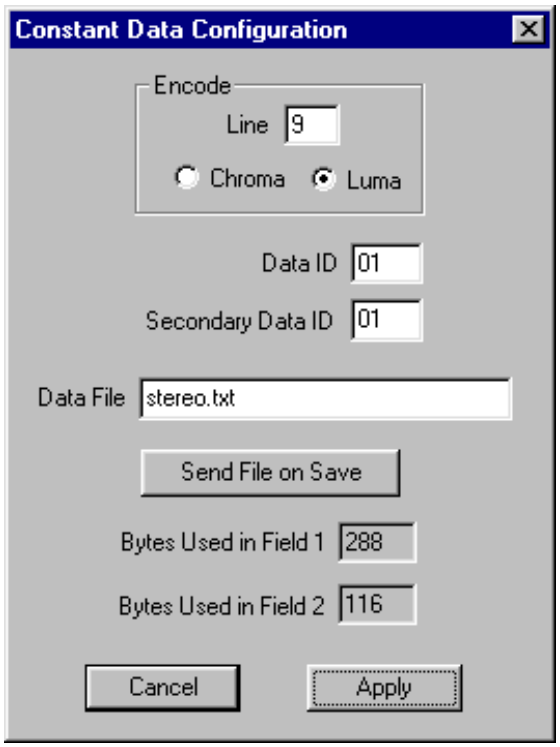
This command returns the string "Norpak TES9 Caption Encoder Vx" to the host computer, where “x” is the revision level of the software.

Chapter 6
CONSTANT DATA MODULE

The Constant Data module allows a packet consisting of a fixed pattern of data to be inserted into the VANC data area of the HDTV signal. An example of its use is to insert fixed metadata for use by downstream equipment.

6.1 CONSTANT DATA CONFIGURATION

When a Constant Data module is selected for configuration in the main SETTES9 menu, the Constant Data Configuration menu, similar to one shown below, is displayed:



Each of the menu items is described in the following sections:

6.1.1 Encode

This section specifies the video line number and channel (Chroma or Luma) into which the constant VANC data is inserted. The allowable range is 1 to 20 for an interlaced or segmented video signal, and 1 to 25 for a progressive signal. When any VANC data is being inserted into the PROGRAM signal, the corresponding ENCODE indicator on the front panel of the TES9 is green.

6.1.2 Data IDs

The Data ID and Secondary Data ID specify the values to be used for the corresponding fields in the encoded Ancillary Data Packet, as defined by SMPTE 291M.

6.1.3 Data File

This parameter specifies the name of the file containing the constant data to be inserted. The file is assumed to be in the directory into which SETTES9 has been installed (default is C:\Program Files\Norpak\TES9). The file is an ASCII text file in which bits 7 through 0 of each User Data Word to be inserted are specified as 2 hexadecimal digits, and the values for the User Data Words are separated by one or more spaces. The file must begin with the tag <field=1>, followed by all of the data to be inserted into each field 1 of the video signal, followed by the tag <field=2>, followed by all of the data to be inserted into each field 2 of the video signal. Any text which is preceded by a semi-colon on the same line is assumed to be a comment (i.e. for documentation purposes) and is ignored (see the included data files for examples). Since the data files are ASCII text files, they can be created and modified with any text editor, such as Notepad or WordPad, which handles files of this type.

If no data file is specified, then no constant data is inserted, and no Constant Data stream will appear in the list of streams on the main SETTES9 menu.

The data files included with SETTES9 are as follows:

STEREO.TXT	- Audio Metadata for Stereo or Lt/Rt
5_1.TXT	- Audio Metadata for 5.1

NOTE
If a progressive video signal (where the field type does not apply) is being used, then the field 1 and field 2 data specified in the data file are still inserted in a manner similar to the insertion of data into an Interlaced signal: the frames of the progressive signal contain alternating field 1 and field 2 data. If every frame of the progressive signal is to contain the same data, then the data file must specify the data twice: first as field 1 data and then again as field 2 data.

Removing the filename stops the insertion of the Constant Data packets.

6.1.4 Send File on Save

When this command is selected, the format of the data file will be verified. If the format is correct, then the file will be sent to the encoder when one of the commands 'Save Temporarily' or 'Save Permanently' on the SETTES9 main menu is selected. If the format is not correct or the specified file is not present, then an error message will be displayed and you must edit the file to correct the format before selecting the command 'Send File on Save' again.

When either 'Save Temporarily' or 'Save Permanently' on the main SETTES9 menu is selected, the current configuration of the Constant Data module (i.e. the DID, SDID, name of the data file, as well as the data file itself) is sent to the encoder. However, when the configuration of the Constant Data module is being read back by SETTES9 (when SETTES9 is started), only the DID, SDID and name of the data file are read back -- the actual file itself is not.

6.1.5 Bytes Used

The menu items Bytes Used in Field 1 and Bytes Used in Field 2 display the total number of bytes (including the bytes to reserve for upstream data) used by all of the streams in the selected video line and channel.

Chapter 7
TROUBLESHOOTING

This chapter is intended to help you determine the cause of problems you may have with your encoder. The first section of the chapter contains a brief set of troubleshooting questions to aid you in determining the cause of problems that you may have. The second section explains how to interpret the STATUS 1-3 LEDs.

7.1 TROUBLESHOOTING QUESTIONS

This section presents a list of questions in the form of "if..then..else" statements to help you in determining the source of problems you may be having with your encoder. These questions are similar to ones you would be asked if you contacted Norpak for help in determining the source of your problem.

if STATUS 1 LED is off then
    is unit plugged into AC outlet ?
    is power switch on ?
    is fuse blown ?

if STATUS 1 LED is red for more than 40 seconds after power-up then
    power unit off and on
    if STATUS 1 LED is red for more than 40 seconds then
        contact Norpak

if any of STATUS 1-3 LEDs is flashing red and/or yellow then
    refer to section on STATUS LEDs for more information

if ENCODE LED is off then
    is the corresponding VIDEO LED on ?
    is at least one of the following LEDs on or blinking: Port A, B, C, LAN or MODEM ?

if ENCODE LED is blinking once per second then
    too much data for an insertion line. The user has given too much priority to incoming data , so local data is lost.

if ENCODE LED is blinking five times per second then
    too much data for an insertion line. The user has given priority to local data , so incoming data is lost.

if VIDEO LED is off then
    if BYPASS LED is red then
        is Active/Bypass switch in bypass position (out) ?
        is there a connection on Remote Bypass pins on rear panel GPIO connector ? (see TES9 Hardware Manual)
    is a video signal connected to Program In BNC ?

if VIDEO LED is yellow then
    Is the video input one of the formats listed in the Introduction to this manual?

if VIDEO LED is blinking then
    see section 2.1.3 of TES9 Hardware Manual for a description of the LED patterns

if the serial port LED for the port being used (A, B or C) does not turn on when the host computer sends data then
    is the cable connected to the serial port with a null modem?
    is the cable securely attached to the connector on the encoder ?
    is other end of cable connected to correct serial port connector on transmit computer?
    is transmit computer sending data ?
    is transmit computer in a flow controlled state ?

if using modem as data source & MODEM LED is off then
    is phone cable plugged into rear panel phone jack ?
    is other end of phone cable plugged into phone jack ?
    is the transmit computer connected to phone line correctly ?
    has the transmit computer dialed the Encoder's number to establish a connection ?

if using modem as data source & MODEM LED was on & now off then
    lost phone line connection, have transmit computer establish connection again

if Port A or B or C LED flicker unexpectedly then
    is the Data Count for the transparent stream sufficient for serial port speed ?

if using LAN as data source & LAN LED is off then
    is a LAN cable connected to LAN connector ?
    is the transmit software using the IP address and Port Number that the encoder is configured for ?
    is the transmit software sending data ?

if data inserted on incorrect line then
    check insertion line using SETTES9

7.2 STATUS 1-3 LEDs

On power up, the STATUS 1-3 LEDs are red. They remain red while the system is booting up and performing self diagnostic tests. The booting and tests take about 35 seconds to complete. When the encoder has finished booting, and if the encoder passed all the tests, the STATUS 1 LED turns green and STATUS 2-3 turn off. If not, contact Norpak Technical Support for assistance.

If you press the TES9's LOAD switch while the power is off, and turn on power while holding the LOAD switch in, the TES9 enters a mode which allows its software to be updated. In this state, the STATUS 1 LED is alternately yellow and off. In this state, the TES9 cannot be used for any of its normal operations, including setup. If this state has been reached inadvertently, turn the TES9 power off for a couple of seconds, then turn it back on with the LOAD switch released.

If, at any time after the power-up sequence, the STATUS 3 LED shows any yellow or red, the TES9's software has detected a major error condition. Please note the color and flashing pattern if any, and contact Norpak Technical Support for assistance.

If the encoder passes its self diagnostic tests, and it was powered on for normal operation (i.e. without the LOAD switch pressed in), but there are problems with its settings or inputs, the STATUS 2 LED may not be solid green. In this case, please run SETTES9 and verify that all the settings are appropriate for the desired operation.

One such error condition is caused by data being sent to the encoder faster than it can be processed. If data is sent via a serial port, the encoder will assert flow control to the transmit computer when needed, to avoid losing data. If the program sending the data does not respect flow control, for example because it is incorrectly configured with flow control OFF, the TES9 will receive more data than it can process and data will be lost. An example will illustrate this.

The maximum data rate in bits/second of a serial port feeding data to a transparent module is:

DR = FV x 10 x DC, where:

FV is the field rate for interlaced formats, or the frame rate for progressive formats.
DC is the Data Count set for the Transparent module in SETTES9. The factor 10 in the equation reflects the fact that each 8-bit value is carried on the serial link with one start and one stop bit.

For example, if FV = 59.94 and DC = 100, DR = 59,940 bits/second.

If the serial port speed is set to 57,600 bits/sec, the transmit computer cannot fully use the capacity that has been reserved for it, but the TES9 should operate correctly. On the other

hand, if the port speed is 115,200 bits/sec, the transmit computer has the ability to transmit more data to the TES9 than it can insert into VANC packets. The TES9 will use flow control to maintain an average rate of 59,940 bits/sec. However, if the transmit computer does not respect low control, data will be lost.

A similar error condition can occur when decoding a transparent stream, if the port rate is set too low for the throughput of the stream. In the above example with DC=100, the serial port for the decode stream needs to be set to 115,200 bits/sec, since 57,600 bits/sec is insufficient to sustain the throughput of 59,940 bits/sec.

Appendix A
SOFTWARE INTERFACE FOR LAN

This appendix is intended to provide guidance to developers of transmit software used to send data to a TES9 encoder through a LAN connection. To interface to the LAN port, the sending computer must be equipped with an Ethernet LAN card and TCP/IP must be added to the computer's networking abilities. The encoder responds to TCP packets sent to its IP address and port addresses. This determines which encoder stream receives the data.

The LAN encoder makes use of the TCP/IP protocol to transfer data. Better error free data transmission is ensured since the encoder uses TCP packets as opposed to UDP packets. This eliminates the possibility of lost data during transmission.

The basic steps to establish a connection and send data to the encoder using the *winsock* static library are :

1. Initialize *winsock* using the *WSAStartup* command.
2. Get the name of the sending computer using *gethostname* command.
3. Get the IP address of the sending computer using *gethostbyname* command.
4. Copy the IP address part of the HOSTENT structure to another structure of type IN_ADDR.
5. Create a socket for making a connection using *socket* command.
6. In order to improve efficiency and make it possible to run multiple copies at once, it is necessary to use the non-blocking commands available in the *winsock* static library. This makes use of the Windows' message processing loop. Do this by issuing the *WSAAsyncSelect* command.
7. Bind the socket created in the step above to the TCP/IP protocol and accept connections for any port number using the *bind* command.
8. Fill structure SOCKADDR_IN with the destination information.
9. Establish a connection using the *connect* command.
10. When connection has been established the WM_USER + 100 message is sent to the Windows' message loop.
11. After all data transmission is finished, the sockets must be shut down using the following commands: *shutdown, closesocket, WSACleanup* commands.

The following code snippets are intended to demonstrate the use of winsock to communicate with a LAN encoder.

```
/* declarations */
 SOCKET s;
 extern unsigned char rndata[1024];
 char hostname[50];
 char description[50];
 char maxsockets[6];
 char portnum[5];
 char ipsend[20];
 WORD wVersionRequired = 17;        /* 17 for winsock 1.1 or 2 for winsock 2.0 */
 WSADATA wdata;
 HOSTENT FAR *phostentm;
 IN_ADDR in;
 SOCKADDR_IN addr;
 SOCKADDR_IN clientIn;

case WM_INITDIALOG:
    {
    WSAStartup(wVersionRequired,&wdata );      /* initialize winsock */
    gethostname (hostname,sizeof(hostname));   /* get your computer's name */
    phostentm = gethostbyname(hostname);       /* get your computer's IP number */
    _fmemcpy(&in,phostentm->h_addr,4);          /* copy IP address of HOSTENT */
    s = socket(AF_INET,SOCK_STREAM,0);      /* create socket */
    WSAAsyncSelect(s,hWnd,WM_USER +100,FD_CONNECT); /* Non-blocking
winsock */
    addr.sin_family = AF_INET;
    addr.sin_port = 0;
    addr.sin_addr.s_addr = htonl(INADDR_ANY); /*allow connection from any port
number*/

     /* Bind the socket to our specifications */
     bind(s,(LPSOCKADDR)&addr,sizeof(addr)); /* bind socket to above criteria */
     strcpy(portnum, " 2000");
     strcpy(ipsend, "102.102.102.102");
     clientIn.sin_family = AF_INET;
     clientIn.sin_port = htons(atoi(portnum));        /*fill in port number to send to */
     clientIn.sin_addr.s_addr = inet_addr(ipsend);  /*fill in IP address to send to */

      /* make a connection on this socket */
     connect(s, (LPSOCKADDR)&clientIn, sizeof(clientIn)); /* connect to destination */
     }
```



```
case (WM_USER + 100):
        {
        switch (WSAGETS       ELECTEVENT(lParam))
          {
          case FD_CONNECT:
            {
            result = WSAAsyncSelect(s,hWnd,WM_USER +100,FD_WRITE);
            x=send(s,(const char *) rndata,sizeof(rndata),0); /* send predefined data */
            }

          case FD_WRITE:
            {
            x=send(s,(const char *) rndata,sizeof(rndata),0); /* send predefined data */
            result = WSAAsyncSelect(s,hWnd,WM_USER +100,FD_WRITE);
            break;
            }
         }
       }
     break;

WM_CLOSE:
     {
     shutdown(s,1);   /* shut down connection on socket */
     closesocket(s);  /* close the open socket */
     WSACleanup();    /* clean up residue left by winsock */
     }
```

