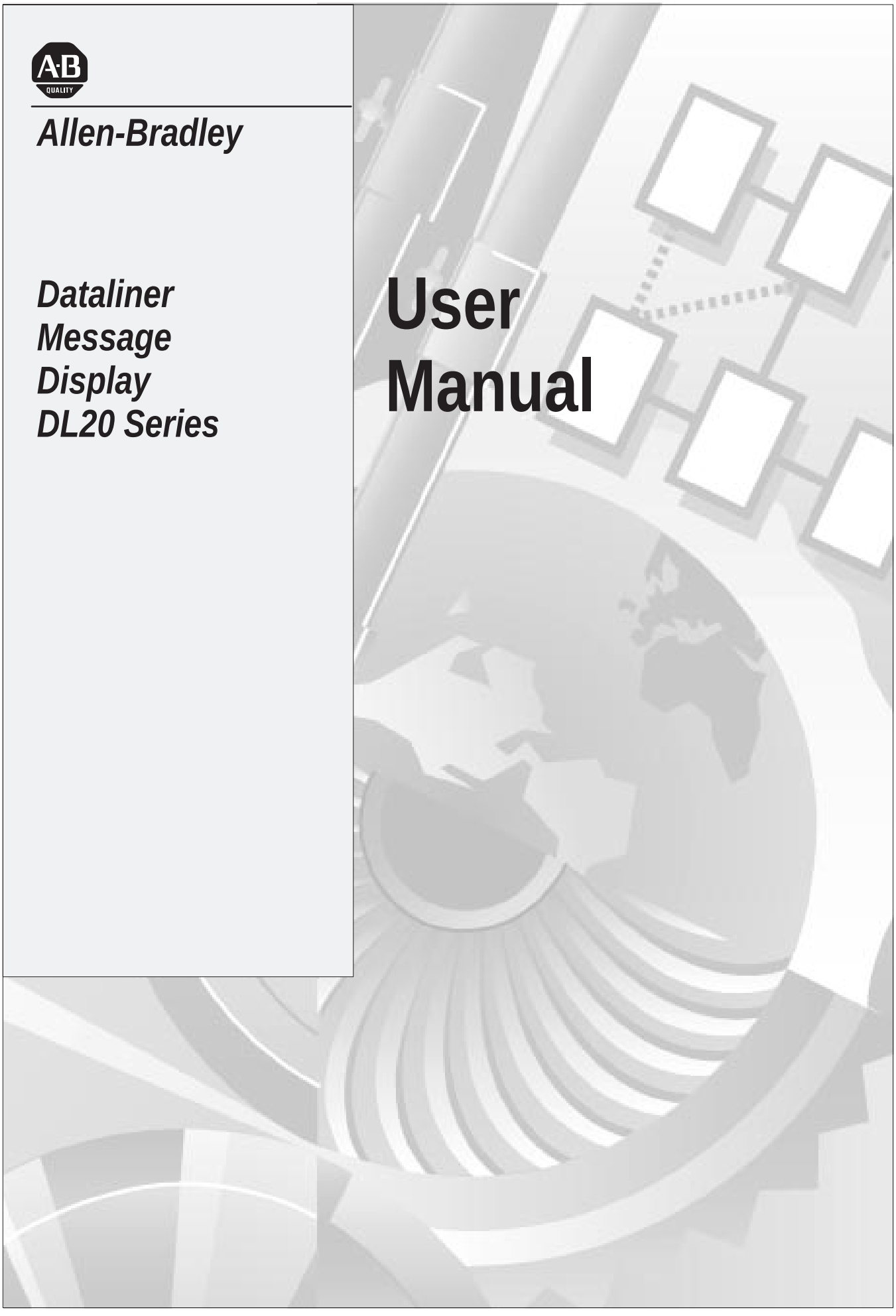

Allen-Bradley

Dataliner
Message
Display
DL20 Series

User Manual

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. “Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls” (Publication SGI-1.1) describes some important differences between solid state equipment and hard–wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will the Allen-Bradley Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, the Allen-Bradley Company cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Allen-Bradley Company with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual we use notes to make you aware of safety considerations.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attentions help you:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is especially important for successful application and understanding of the product.

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Dataliner Message Display
DL20 Series

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Chapter 1

Using this Manual

Chapter Objectives

Read this chapter to familiarize yourself with the rest of the manual. You will learn about:

- Contents of this manual
- Intended audience
- Conventions used
- Related publications

Manual Overview

This manual instructs you on how to install and use your Dataliner DL20 Series G display. This manual is divided into the following chapters.

Table 1.A
Chapter Descriptions

Chapter	Title	Purpose
1	Using this Manual	Provides an overview of the manual.
2	Introduction to the DL20	Describes the main features and operating capabilities of the DL20.
3	Getting Started	Provides instructions for the initial desktop hookup along with a description of the menus and prompts.
4	Entering, Reviewing, and Editing Messages	Provides step-by-step instructions on how to enter a message along with message attributes.
5	The Run Mode	Describes the operation of the DL20 in the run mode.
6	Using the Serial Port	Describes the connections to and operation of the serial port.
7	Using the Parallel Port	Describes the connections to and operation of the parallel port.
8	Special Functions	Describes the functions available under the Special Functions menu.
9	Installation and Maintenance	Provides instructions on how to install the DL20. Fuse replacement is described.
10	Specifications	Mechanical, electrical, and environmental specifications.
	Appendices, Glossary, Index	

Intended Audience

No special knowledge is needed to enter or edit messages. However, since the Dataliner message display must be connected to peripheral equipment, you should be familiar with computer communication terminology.

Conventions Used

The following conventions are used:

- Messages that are displayed on the DL20 are shown centered and in bold characters. For example:

  EDIT?

- A symbol or word in brackets represent a single key that you should press. These include keys such as [Y] or [Esc].
- Since the DL20 can be programmed with a variety of terminals, the printing on your terminal keyboard may be different than the symbol or word indicated in brackets. In this manual, we use [Return] to specify the carriage return function of the keyboard. On your keyboard this may correspond to the [ENTER] or [↵] keys.
- In the following chapters we refer to the Dataliner DL20 Series Message Display as the DL20.

Related Publications

Table 1.B lists the additional publications you may require.

Table 1.B
Related Publications

Publication / Catalog Number	Title
2706-800	Dataliner DL10 Series User Manual
2706-804	Dataliner DL20 Offline Programming Software User Manual
1771-6.5.34	BASIC Module (Catalog No. 1771-DB) User's Manual
1746-ND005	SLC-500™ BASIC Module (Catalog No. 1746–BAS) Design and Integration Manual
1775-6.5.4	Peripheral Communications Module (Catalog No. 1775-GA) User Manual

Chapter 2

Introduction to the DL20

Chapter Objectives

This chapter describes some of the key features and operating capabilities of the DL20. For more detailed information, refer to the section of the manual that describes the use of the feature or operating capability.

Overview of DL20

Dataliner DL20 Message Displays can store up to 1022 messages of varying lengths and are available in three versions:

- 1 line by 20 characters
- 2 lines by 20 characters
- 4 lines by 20 characters

The operation of the 1, 2, and 4 line displays are similar. Exceptions are noted in this manual.

The 20 character alphanumeric Vacuum Fluorescent Display (VFD) can be read from a distance of:

- 30 feet (9.1 meters) on the 1 line display
- 25 feet (7.6 meters) on the 2 and 4 line displays

The DL20 can display:

- Uppercase and lowercase letters
- Punctuation marks
- Special symbols (see Appendix A)

You program messages using:

- Keyboards (Catalog No. 2706-NK1 or -NK2)
- RS-232 terminal
- Allen-Bradley Industrial Terminals
- DEC VT series terminals

Messages are stored in DL20 memory which is maintained by a lithium battery-backed power supply. The lithium battery is part of the internal circuitry, no additional batteries are required. An EPROM for nonvolatile message storage can override the message RAM (on 16K or 8K units).

Message Editing Software

You configure and enter messages into the DL20 by attaching an optional keyboard, RS-232 CRT, or dumb terminal. The DL20 display prompts you with easy to follow questions and instructions simplifying setup and configuration. Using a terminal or printer, you can list operating parameters such as baud rate or parity.

A DL20 time and date clock lets you display and/or print the time and date with a message.

A debug mode verifies the operation of the host controller program. You can also perform self test functions.

Optional Offline Programming Software

DL20 Offline Programming Software (Catalog No. 2706-NP3) for IBM or compatible computers lets you create, edit, and store messages on a personal computer. You can then download messages to the DL20 using a communications cable.

Storing Messages

You can store DL20 messages on:

- Tape using an Allen-Bradley Data Recorder (Catalog No.1770-SA, -SB) or EPI STR-LINK II, III Data Recorder.
- Disk when using the DL20 Offline Programming Software.

All tape and computer operations (writing, reading, write verify, and read verify) are automatic with easy to follow prompting from the DL20.

Host and Slave Devices

Addressable Master

The addressable master feature allows you to connect 100 DL20s to a single RS-422 port on the controller. Each display has its own unique address. The controller can command any one, or all of the DL20s on the network to display a message.

Slave Mode Master

The DL20 can operate as a *slave* device. In run mode, special commands place the DL20 into slave mode. As a slave device, the DL20 does not respond to message triggers, but displays strings of ASCII text sent by the controller.

Programmable Controller Interface

The host controller can trigger a message display using either:

- **Parallel Data Lines**
  The DL20 has ten data lines and two strobe lines which accept DC input voltages from 5 to 30 volts.

  The optional Parallel Input Converters (Catalog No. 2706-NG1, -NG2) allow the DL20 to accept 120VAC input signals. The logic program in the controller turns some lines ON and some OFF. The DL20 recognizes this combination as a message number.

ATTENTION: Parallel Input Converters (Catalog No. 2706-NG1, -NG2) cannot accept 220/240VAC. If 220/240VAC is applied to the Parallel Input Converter, damage to the input converter will occur.

- **RS-422 / RS-232 Serial Ports**
  Both the RS-232 and RS-422 ports accept serial commands and variable message data. The serial commands are formatted and recognized identically to the parallel commands. The only difference between the two is the wiring of the signals and the host controller program.

Auxiliary Devices

Messages that display on the DL20 can be sent to a printer with the time and date.

On large machines, or on production lines, you may want to use a remote display. The DL20 can connect to 100 slave DL10 displays (up to 4000 feet away). Each DL10 can have a different address. You can define, on a message-by-message basis, the slave display on which a triggered message appears. Triggered messages can be sent to individual or all slaves.

Self Testing and Diagnostics

Power On Testing

When power is first applied to the DL20, a series of test programs are run. They check the circuitry in the display and the integrity of messages stored in memory. You can run these test programs from the programming keyboard or a controller program.

Autorun

The autorun feature allows the display to restart in run mode on powerup if the display was turned off in run mode. A message displays for three seconds indicating that the DL20 is entering the autorun mode. An autorun message, if present, is the first message displayed.

Note: All diagnostics must pass before the DL20 restarts in run mode. In addition, the user memory must not have been lost while the power was off.

CPU ACTIVE Light

The CPU ACTIVE light on the front panel must receive a periodic signal from the CPU to illuminate. Its normal appearance ranges from periodic flashing to steady illumination.

Message Options

Background Message
The background message is a user-defined message that automatically displays when no other messages are being displayed.

Invisible Message
Invisible messages do not appear on the display when triggered, nor do they affect what is on the display. Invisible messages can be sent to slaves, printed, or saved in the Historical Event Stack.

Special Messages
Sixteen preprogrammed messages are available to trigger specific functions. They can clear the display, reset the DL20, test batteries, print Historical Event Stack, clear the Historical Event Stack, halt run mode and start run mode. Special messages are optional and can simplify programming requirements.

Formatted Variables with Decimal Point
You can imbed a formatted variable with a decimal point in a message. When programming a message variable, you can specify:

- number of spaces the variable will occupy
- where to place the decimal point
- whether leading zeros should appear or be replaced by blanks

Data Trigger Modes
Separate data modes are available for inputting message triggers and variables through the parallel port. Message triggers can be binary, while variable data can be BCD, or vice versa.

Dynamic Message Chaining
Dynamic chaining allows you to load 20 message triggers into the DL20 causing those messages to display over and over again.

Historical Event Recording
Historical Event Recording allows the DL20 to remember messages that were displayed. These messages can then be printed all at once or at a later time. See Chapters 4 and 5 for details on Historical Event Recording.

Communications Options

Baud Rate

The DL20 supports baud rates of 300, 1200, 9600. On powerup, the DL20 displays the baud rate currently in effect.

Parity
The DL20 can transmit data with odd, even or no parity. Data received by the DL20 is not checked for parity. The parity you select is displayed immediately after the baud rate on powerup.

Accessories

Table 2.A lists the optional accessories.

Table 2.A
Accessories

Item	Description	Catalog No.
DL20 Cable	Connects Allen-Bradley Industrial Terminals T1 through T4 or most DTE type dumb terminals. (Male 25 pin D-shell)	2706-NC1
DL20 Cable	Connects Allen-Bradley Terminals 1784-T45, -T47, -T50, -T60, other IBM compatibles or DEC VT52, VT100, or VT101 Terminals. (Female 25-pin D-shell) Use 25 to 9-Pin AT Adapter with this cable for 1784-T50 or -T60 Industrial or IBM AT computers.	2706-NC2
Data Recorder Cable	Connects EPI STR-LINK II or III Data Recorders to DL20.	2706-NC3
Data Recorder Cable	Connects Allen-Bradley 1770-SB or -SA Data Recorders to DL20.	2706-NC4
A-B Terminal Cable	Connects A-B Terminals to EPI STR-LINK II or III Data Recorders. Cable is required if an Allen-Bradley Industrial Terminal and EPI STR-LINK II or III Data Recorder is used. Cable is not needed if programming keyboards (Catalog No. 2706-NK1 or -NK2) are used.	2706-NC5
DL20 Development Software	Off-line Programming Software for IBM or compatible computers with 5.25 inch or 3.5 inch disk drive.	2706-NP3
Keyboard	Full travel keyboard	2706-NK1
Keyboard	Membrane keyboard	2706-NK2
Addressing Bar	Allows DIP switch selection of an address when multiple DL20s are on an RS-422 network. If Addressing Bar is not used, address is selected during programming.	2706-NF1
120V Parallel Input Converter	Connects to the DL20 parallel input port and allows messages to be triggered using 120 VAC inputs. Display Mounted Converter Panel Mounted Converter	 2706-NG1 2706-NG2
Enclosure	NEMA Type 12/13 enclosure with mounting holes and cutout for DL20. Access door has gasket. One or Two Line Displays Four Line Displays	 2706-NE1 2706-NE2
Flush Mounting Kits	Eliminates the standard bezel supplied with the display. One or Two Line Displays Four Line Displays	 2706-NJ1 2706-NJ2

Chapter 3

Getting Started

Chapter Objectives

This chapter describes how to connect and powerup the DL20 for desktop message programming.

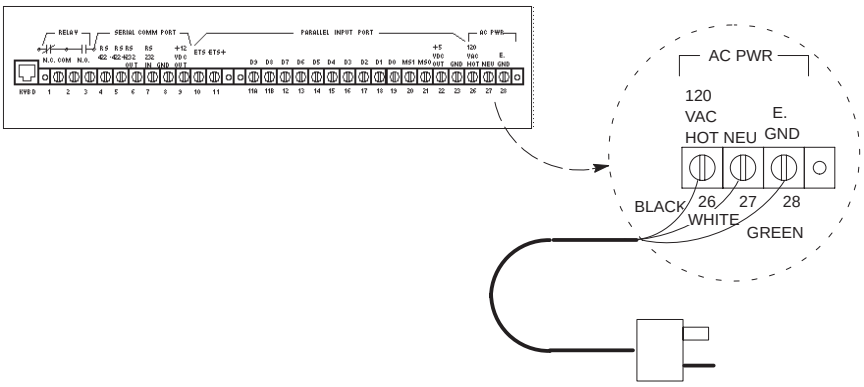
Desktop Hookup

To set up the DL20 for desktop use, you need:

- Three-prong AC line cord
- Keyboard (Catalog No. 2706-NK1 or -NK2)
  The keyboard connects to the DL20 via a cable attached to the keyboard

Cables are available to connect the DL20 with Allen-Bradley Industrial Terminals T1 through T4, most DTE type dumb terminals, DEC VT52, VT100, VT101 Terminals and IBM compatible computers. See Table 2.A, Accessories.

Connect Power Cord



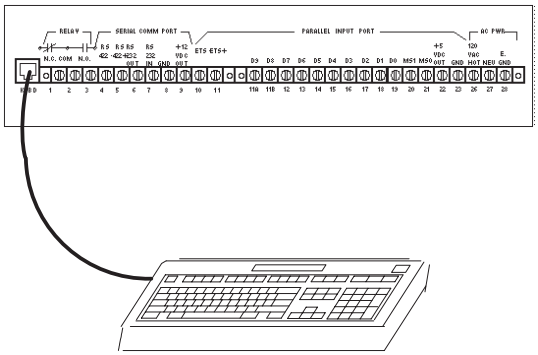
Attach the power cord. One end of the cord has a three-prong plug, the other end has three colored spade connectors: white, green, and black.

- Connect the black lead to terminal 26, the 120V AC HOT terminal on the rear of the DL20
- Connect the white lead to terminal 27, the NEU terminal
- Connect the green lead to terminal 28, the E. GND terminal.

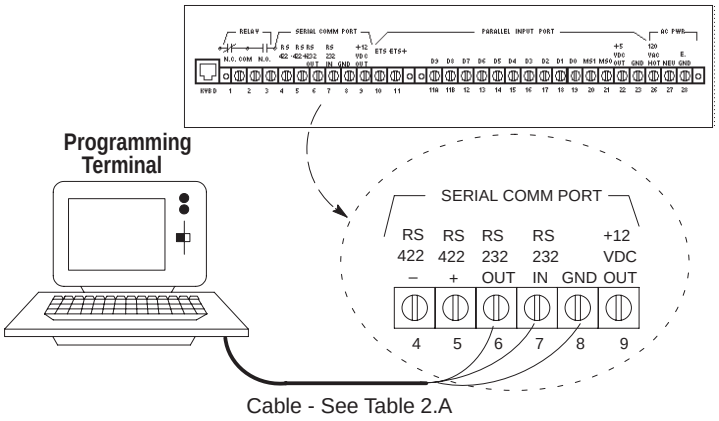
ATTENTION: The ground wire is ESSENTIAL for proper operation. Without this lead, the chassis does not protect the internal circuitry from static electricity or electrical noise; nor will it protect you from shock if there is an electrical short to the case.

Connect Programmer

To create messages, you need to connect a keyboard or attach a programming terminal.



Keyboard
Catalog No. 2706-NK1, -NK2



Programming Terminals

The programming cable hooks up similarly. One end of your cable has a D type connector which mates to a D connector on your terminal. Connect this end of the cable to the serial communication port on your computer. On the Allen-Bradley terminals, use the Port B connector.

The other end of your cable has three numbered spade connectors which attach to the similarly numbered terminals on the back of the DL20.

Keyboard

The telephone type connector on the keyboard cable plugs into the KY BD connector on the back of the DL20. Only use the KY BD connector with programming keyboards (Catalog No. 2706-NK1 or -NK2).

ATTENTION: Do not connect or disconnect the keyboards when power is applied to the DL20. Damage to the DL20 could result. Do not connect or disconnect a peripheral device to the serial RS-232/RS-422 ports of the DL20 when the display is in run mode. Erroneous data could be entered.

Initial Startup

When power is applied, the DL20 automatically enters a self test mode and displays the firmware revision number of the DL20 and the number of lines.

TESTING UNIT 3.00 2L

If the BATTERY LOW message is displayed, return the DL20 for battery replacement. The battery is not user-serviceable.

BATTERY OK

All display segments light up briefly.

SELF TEST OK

Note: If PRESS 9 @ 9600 BAUD is displayed, press the number [9] and the DL20 will continue normally.

The following message appears after the diagnostic tests have passed showing the size of the user memory (8K, 16K, or 31K).

RAM SIZE; 31K

The baud rate then appears: 300, 1200, or 9600. The baud rate of the programming terminal or keyboard must match this baud rate.

BAUD = XXXX

Appendix E describes how to configure baud rate of the keyboards (Catalog No. 2706-NK1 or -NK2).

Note: After the baud rate (or other switch selectable setting) is changed on many programming terminals, you must cycle the power before the changes take effect.

The parity setting (odd, even, or none) of the DL20 appears. Characters are always sent from the DL20 with the indicated parity. Characters of any parity are received by the DL20, regardless of the parity setting.

NO PARITY

The master address of the DL20 then appears. A 0 indicates that a master address was not selected. Chapter 8 tells how to select a master address.

MASTER ADDRESS: 0

Finally, this prompt appears (unless the DL20 was powered down in the run mode.):

EDIT?

If the DL20 was powered down in the run mode, this prompt appears:

AUTORUN

possibly followed by other messages.

To return to edit mode, press [Esc] on your terminal three times. The EDIT? prompt will appear.

You are now ready to create messages.

Types of Prompts

When programming the DL20, you are prompted to enter specific types of information. The DL20 uses two types of prompts, Yes/No prompts and numeric prompts. Each type requires a specific type of response.

Yes/No Prompts

Yes/No prompts require that you type [Y] for Yes or [N] for No. Only the letters Y or N (upper or lowercase) are accepted as responses. An example Yes/No prompt is:

EDIT?

Press [Return] after typing [Y] or [N] to accept the response. For example:

EDIT? [Y]

Some Yes/No prompts have a default response that displays. For example:

PRINT MSGS? N

To accept the default, just press [Return]. To change the response, enter [Y] and [Return].

Numeric Prompts

A numeric prompt requires that you enter a number followed by [Return]. The DL20 evaluates 0 through 1022 as valid numeric responses. For example:

MESSAGE NUMBER: 0

If you wanted to enter 27, here is what would happen:

Type [2].

MESSAGE NUMBER: 2

Type [7].

MESSAGE NUMBER: 27

Notice how the number scrolls in from the right. You must press [Return] to accept the response. If you wanted to enter the number 5, you could type it over the old response by typing 0005. The display would look like this:

Type [0].

MESSAGE NUMBER: 270

Type [0].

MESSAGE NUMBER: 2700

Type [0].

MESSAGE NUMBER: 7000

Type [5].

MESSAGE NUMBER: 5

Press [Return] to accept the response of 5.

Some numeric prompts also have default values. Here is an example:

WAIT TIME? 5

To accept the default response, press [Return]. To enter another response, type over the default, like this:

WAIT TIME? 5

Type [2].

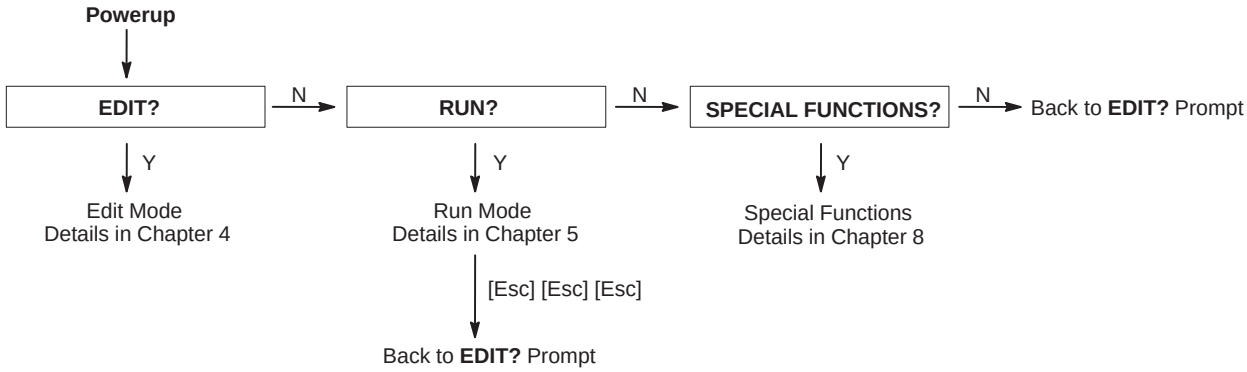
WAIT TIME? 2

Pressing [Return] now accepts 2 as your response.

Main Menu

Figure 3.1 shows the main menu flowchart.

Figure 3.1
Menu Flowchart



Three selections are available from the main menu (edit mode, run mode, and special functions). The first entry in the main menu is:

EDIT?

Edit mode lets you enter new messages or modify old ones. Chapter 4 describes edit mode in detail. For now, if you type [N] and [Return] the next main menu prompt appears:

RUN?

Run mode is used most of the time. In run mode, the DL20 accepts commands and data from the programmable controller or control system. Chapter 5 describes run mode. To exit run mode, press [Esc] three times. Type [N] [Return] to get the next main menu prompt:

SPECIAL FUNCTIONS?

Special functions are support tools for programming. Special functions are accessed via menu control like all functions in the DL20. Chapter 8 describes the special functions.

The various special functions fall into nine categories. Some categories, like debug mode, simply execute the special function selected. Other categories, like tape operations, have submenus.

Returning to Main Menu

Most functions return to the main menu when done. However, you can return to the main menu at any time by pressing [Esc] three times. You can do this in any mode without losing message data. You can also abort many special functions, such as print messages or tape operations, by pressing [Esc] three times.

Chapter 4

Creating and Editing Messages

Chapter Objectives

This chapter describes how to create, edit, and save messages.

Entering the Editor

The DL20 can store up to 1022 messages of varying lengths. Each message consists of:

- message number (1 - 1022)
- message text
- message attributes (control how message displays)

The process of entering and changing messages in the DL20 is called message editing. You can add or delete characters or words at any point in a message. If the display is in run mode, you need to press [Esc] three times to exit run mode and display the EDIT? prompt. To enter edit mode, simply press [Y] [Return] at the EDIT? prompt. See Figure 4.1.

EDIT? Y

You will be prompted for a message number:

MESSAGE NUMBER: 0

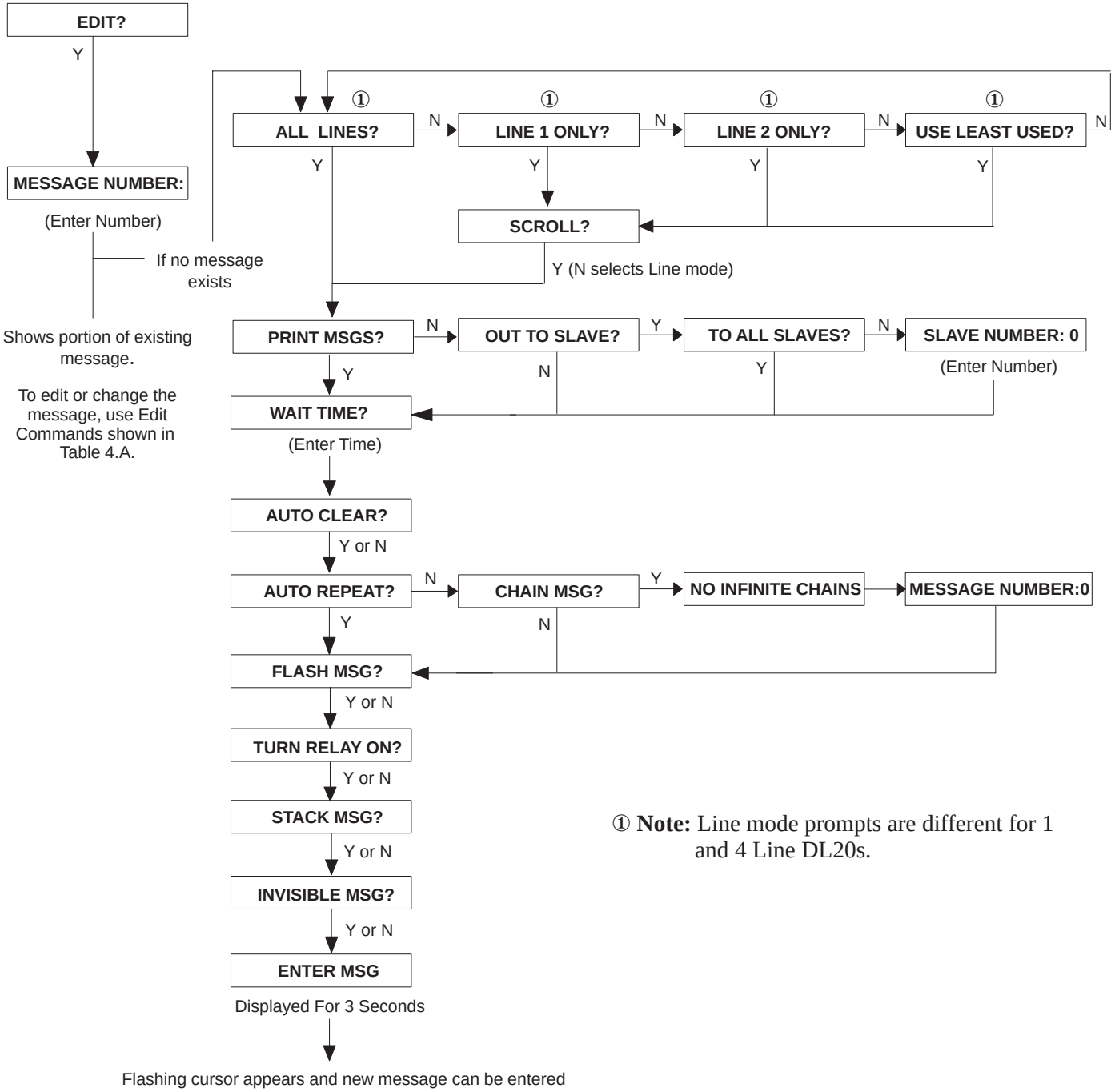
Enter the message number you want to edit. Most message numbers between 1 and 1022 are valid. Message numbers 255, 256, 511, 512, 767, and 768 are invalid message numbers.

Note: Messages 1 thru 16 are pre-programmed special messages which you may want to use. Refer to Chapter 5 for details.

The editor tries to find the selected message. If the message is located, a portion of it is displayed. You can make changes to an existing message at any time. Editing an existing message is described later in this chapter. However, if the message is not located, a new message is created. Before you can enter the message you must specify its attributes.

Many times when entering new messages into the DL20 you may not be sure which message numbers are used. The default value for the message number prompt will always be the last message edited. Press [Return] to select the default. Typing a [?] now causes the DL20 to search and find the next higher unused message number. Pressing [Return] again selects that message number for editing.

Figure 4.1
Edit Mode Menu for 2 Line DL20



① **Note:** Line mode prompts are different for 1 and 4 Line DL20s.

Specifying Message Attributes

Message attributes are properties that an individual message may have. You are prompted for each attribute, one at a time. Some attributes are mutually exclusive-you can select either one, but not both.

Line Selection

If using a two or four line display, you must first specify the line or lines on which the message is to appear. The choices for the two line display are:

ALL LINES?
LINE 1 ONLY?
LINE 2 ONLY?
USE LEAST USED?

On the four line display, you have six choices:

ALL LINES?
LINE 1 ONLY?
LINE 2 ONLY?
LINE 3 ONLY?
LINE 4 ONLY?
USE LEAST USED?

The prompts for the two line display appear like this:

ALL LINES? N

If you select all lines, the message is displayed automatically as a line mode message. The first line of the message appears on line 1, the second line appears on line 2. If the message is longer than two lines, two new lines of the message appear on lines 1 and 2 after the wait time has elapsed. A multi-line message can only be displayed in line mode.

LINE 1 ONLY? N

If you select line 1 only, the message is displayed on line 1 only. The message (if any) on line 2 is left intact.

LINE 2 ONLY? N

If you select line 2 only, the message is displayed on line 2 only. Again, the message on line 1 is left intact.

USE LEAST USED? N

If you use the least-recently-used line, the message overwrites the oldest line of information. The other line or lines are left intact.

Specifying Message Attributes

Line-Scroll Mode

If you do not select ALL LINES, but choose to have a message displayed on one line only, you will be asked to select line or scroll mode:

SCROLL? N

At this point, you must decide whether the message is to be a line mode message or a scroll mode message.

Scroll Mode
Select scroll mode to scroll a message across the display one character at a time. Characters enter from the right of the display and exit on the left.

Line Mode
Line mode displays messages one line at a time. Messages are broken into lines of 20 characters or less and displayed one line at a time. The lines are automatically centered in the display. For example, the message "This is a line mode display." would be displayed like this:

This is a line mode
display.

Remember, messages displayed on all lines of a two or four line display can be line mode messages only, and you will not be prompted for SCROLL?

Printing Messages

The next attribute prompt allows you to send the message to the printer when it is triggered:

PRINT MSG? N

If you answer Yes, this message prints every time it is triggered. Any variables within the message along with the date and time are also printed.

Slave Messages

If you answer No to the print messages prompt, you are asked if you want to send messages to slave displays when triggered. It is possible to connect one or more DL10 slave displays to the DL20. Messages displayed on the DL20 can be sent to the slaves. In addition, a message can display on a particular slave display. Since there is only one serial port, a message cannot be both printed and sent to a slave. The DL20 displays the following prompt only if you have selected not to print the message:

OUT TO SLAVE? N

If you answer Yes, the message is routed to slave displays every time it is triggered. The DL20 prompts you with the message:

TO ALL SLAVES? Y

If you answer Yes to this prompt, the message you are editing is displayed on all connected slave devices, regardless of their addresses. You are then prompted for the next attribute, message wait time. If you answer No to the above prompt, this prompt appears:

SLAVE NUMBER: 0

Enter a number from 1 through 127. For example, if you enter the number 30, all connected slaves that have 30 as their address will display this message when triggered. The following slave addresses are reserved and cannot be used: 0, 4, 6, 13, 18, 20, 22, 43, 45, 48-57. Address 127 displays all messages sent to any slave number. Chapter 9 describes how to connect slave displays.

Message Wait Time

The next message attribute controls how long the message is displayed. Wait time range is 0-31.

WAIT TIME? 5

For a scroll mode message, the wait time is the amount of time that passes before the next character is scrolls the display. The units of time are *Tenths of a Second*.

For a line mode message, the wait time is the amount of time that passes before the next line shows in the display. The units of time are *Seconds*.

Specifying Message Attributes

Auto Clear

Auto clear controls whether the display clears after a message displays:

AUTO CLEAR? N

If you answer Yes, the DL20 clears the display after the message has been displayed for the specified wait time. If you answer No, the last line or lines of the message are displayed until replaced by another message.

Auto Repeat

Auto repeat allows a message to display repeatedly for an indefinite period of time.

AUTO REPEAT? N

A message set to AUTO REPEAT continually retriggers itself after completing its display. Auto repeat is inhibited if there are any pending message triggers in the message queue. The queue will be explained later. Auto repeat terminates if another message is triggered. If an auto repeat message was called by another message in a message chain, the calling message repeats, followed by the auto repeat message.

Note: Do not use auto repeat for messages with variables or in a background message.

Chaining Messages

The chain attribute allows a series of messages to display by triggering only one message. A message which automatically repeats itself cannot be chained to another message. If you answer Yes to auto repeat, the chain message prompt will not appear. The chain message prompt looks like this:

CHAIN MSG? N

If you answer Yes, a warning message appears:

NO INFINITE CHAINS

Note: A message should not be chained to itself, or a loop of chained messages should not be defined. Message loops such as these are not allowed. They can only be terminated by special messages #2 or #3, described in Chapter 5.

You are then prompted to enter a message number.

MESSAGE NUMBER: 0

Enter a number (1-254), then press [Return]. Now, whenever this message is triggered in the run mode, it is displayed normally. Then the message chained to this one is displayed, regardless of whether messages are waiting in the message queue. The message queue is described in Chapter 5. Chains of up to 35 messages can be created. Only message numbers 1 through 254 are accepted.

Specifying Message Attributes

Here are some examples of AUTO REPEAT and CHAIN MSG attributes. In these examples, there are six messages:

Message 1: chained to 2

Message 2: chained to 4

Message 3: chained to 4

Message 4: neither chain nor auto repeat selected

Message 5: chained to 6

Message 6: auto repeat

Triggering a message causes it to be displayed. To illustrate the operation of an auto repeat message, we will trigger message number 6. Message 6 is displayed, then redisplayed. Message 6 continues to be redisplayed until another message is triggered. If message 5 is triggered, it is displayed, followed by message number 6. Since message number 6 is an auto repeat message, message 5, then message 6 repeats until another message is triggered.

Here are some more examples. Triggering message 2 will cause message 2, then message 4 to be displayed. Triggering message 3 will cause message 3, then message 4 to be displayed. Triggering message 1 will cause message 1, then message 2, then message 4 to be displayed. Triggering message 4 only causes message 4 to be displayed. Since message 4 is not an auto repeat message, none of these triggering sequences is repeated.

Message chains up to 35 messages long can be automatically repeated. This feature can be useful when using the DL20 as an informational display.

Note: Do not use messages with variables when using the chain messages attribute.

Flashing Messages

The next attribute prompt is self explanatory:

FLASH MSG? N

Answering Yes to this prompt causes the message to flash once per second when the message is triggered.

Relay Operation

ATTENTION: Use relay for annunciator purposes only. Do not use it for control.

The DL20 has a single-throw, double-pole internal relay. This relay can be energized by messages. The relay attribute prompt looks like this:

TURN RELAY ON? N

If you answer Yes to this prompt, the relay is energized when the message is triggered, and de-energized when the message has terminated its display.

Important: The relay does not stay energized between message displays; triggering two messages with this attribute selected does not guarantee that the relay will remain energized continuously between the two messages. Similarly, an auto repeat message does not guarantee a continuously energized relay.

The relay can also be energized by the battery low detector circuit within the DL20. This option is described in Chapter 8. If the relay is used to flag a low battery, it cannot be controlled by message attributes.

Specifying Message Attributes

Historical Event Recording

The Historical Event Recording prompt determines whether to place a message in the Historical Event Recording Stack for later printing.

STACK MSG? N

If you answer Yes, every time the message is triggered, it is displayed and sent to a printer or slave as determined by the other message attributes. It is also placed in the Historical Event Recording Stack to be printed out later. Any variables or the time and date within the message are also saved. Refer to Chapter 5 for more information on the function of Historical Event Recording.

Invisible Messages

Invisible messages do not appear on the display when triggered, nor do they affect what is displayed. All other message features remain in effect. The message can still be sent to slaves, printed or saved in the Historical Event Recording Stack. To use invisible messages, enter Yes to this prompt:

INVISIBLE MSG?

This feature is useful if you only want a certain message to be displayed on a slave, printed, or put into the Historical Event Recording Stack.

Attribute Defaults

All attributes have default values. The first time you enter a message into a new DL20, or one which has had its memory cleared, the defaults are shown. From then on, the defaults used when entering a new message are those last selected. This feature allows you to quickly enter a number of messages that have the same or similar attributes. To accept attributes as default, hold down the [ENTER] key until prompted for the message.

Editing Messages

After you have specified all the attributes, the DL20 displays:

ENTER MSG

for a few seconds. This alerts you to the fact that you are ready to enter the message. Enter messages at the cursor position. The cursor initially appears as a reverse space (all dots lit up). Most edit commands either affect the character at the cursor position (which is called the cursor character), or they move the cursor to different characters within the message. The cursor is always at the center of the display. Edit long messages by moving the cursor to see various portions of the message using edit commands.

Edit Commands

Table 4.A lists the edit commands.

Table 4.A
Edit Commands

Function	Keys Pressed (Simultaneously)
Forward One Space	Ctrl [L]
Back One Space	Ctrl [H]
Up a Line (Move 20 characters to left within message)	Ctrl [K]
Down a Line (Move 20 characters to right within message)	Ctrl [J]
Delete a Character	Ctrl [D]
Change or Review Message Attributes	Ctrl [A]
Run Message	Ctrl [R]
Erase Message	Ctrl [E]
Toggle Uppercase Lock	Ctrl [U]
Show Free Memory	Ctrl [F]
Imbed Non-Decimal Point Variable	Ctrl [V]
Imbed Formatted Decimal Point Variable	Ctrl [X]
Change Variable Format	Ctrl [C]
Imbed Time and Date	Ctrl [T]
Show Edit Commands	Ctrl [S]
Quit Edit	Ctrl [Q]

These commands are described in the following paragraphs. Then we will go through an example edit session.

To enter an edit command, hold down the control key (CTRL on some terminals), press the letter of the command, then release the control key. If you are using the Allen-Bradley Industrial Terminal, the control key should be pressed and released followed by the letter of the command.

Moving the Cursor

Move Cursor Forward One Space (Ctrl L)

Move the cursor forward one character position by typing control L. If the cursor is positioned at the last character in the message, the command is ignored. Many terminals, other than the keyboards (Catalog No. 2706-NK1, -NK2), have a key with a forward arrow (→) marked on them. This key may move the cursor forward (depending upon terminal type).

Move Cursor Backward One Space (Ctrl H)

Move the cursor backward one character position by typing control H. It moves the cursor one space back in the message. If the cursor is already at the first character in the message, the command is ignored. Many terminals have a key with a back arrow (←). Others have a key labeled backspace. Still others have both. These keys may move the cursor backward (depending upon terminal type).

Move Cursor Up One Line (Ctrl K)

The up-one-line command (control K) moves an entire display line (20 characters) backward in a message. The command is ignored if the cursor is already at the first line. Most terminals, other than the keyboards (Catalog No. 2706-NK1, -NK2), have an up arrow key (↑) which generates this command. This key may move the cursor up one line (depending upon terminal type).

Move Cursor Down One Line (Ctrl J)

The down-one-line command (control J) moves an entire display line (20 characters) forward in a message. The command is ignored if the cursor is already at the last line. Most terminals, other than the keyboards (Catalog No. 2706-NK1, -NK2), have a down arrow key (↓) which generates this command. This key may move the cursor down one line (depending upon terminal type).

Deleting a Character (Ctrl D)

The delete character command (control D) removes the character at the cursor position from the message. The cursor then moves to the next character. If the character deleted was the last character in the message, the cursor moves to the new last character. You can delete an entire message using the delete command. However, the message remains in memory and exists as a message with no characters; a null message.

Erasing a Message (Ctrl E)

Use the erase message command (control E) to delete an entire message. Before the message is erased, the following is displayed:

SURE? N

Press [Return] to ignore the command. Editing resumes where you left off. If you answer yes to the prompt, the message is erased from memory, and the editor is exited. You will see the following prompts:

MSG DELETED

and then:

EDIT?

Setting New Message Attributes (Ctrl A)

You may need to change the attributes of a message that you are editing. The new message attributes command (control A), allows you to change the message attributes without retyping the message. The command provides a series of prompts just like you saw when you entered a new message. However, the defaults for the prompts now match the attributes currently in effect for this message. You will also be given an opportunity to change the message number. Type [Ctrl] [A]:

MESSAGE NUMBER: 7

The default for the prompt is the current message number. Type the new message number over the current number. Since no two messages can have the same number, you must reassign a unique message number to the message before pressing [Return]. If no new message number is desired, just press return without changing the displayed message number. The DL20 searches message memory for a message with the same number. If one exists, you will see this prompt:

MSG EXISTS

followed by:

MESSAGE NUMBER: 7

You must try again. If the message number does not exist, the message under edit will be renumbered. The old message number then becomes free for re-assignment.

At this point, you will now be re-prompted for the message attributes, any of which can be changed.

Previewing a Message (Ctrl R)

During editing, messages are displayed 20 characters at a time. As noted previously, you can move about the message, examining any part. When this same message is displayed in Run mode, it is displayed much differently. The message may scroll, it may flash, or it may have variable data in it. To quickly preview a message, type [Ctrl] [R], and the message is displayed just as it would in the run mode.

An auto repeat message will only run once, and a message with variable data will have random data displayed. The run time simulation is as real as possible, attached slaves and printers will work as they should and message chains will be displayed. After the message has been displayed, the window will be restored, with the cursor left where it was originally. When editing your first message, use control A to try different attributes and then use control R to display the message and see for yourself what the different attributes do.

Imbedding Variable Data (Ctrl V)

Variable data from the programmable controller may be imbedded in a message. Up to twenty valid variables (total) per message may be displayed or printed this way. To imbed a variable in a particular location, type control V. The control V will be shown as an up arrow (↑). When the message is triggered, the first numerical variable in the data queue replaces the up arrow. Chapter 5 describes this queue, and how to put values in these locations. Variables can be in the range of -32,768 to +32,767.

Imbedding Formatted Variable with Decimal Point (Ctrl X)

This feature allows you to control the displayed format of variable data within a message.

Variables can be in the range of -32,768 to +32,767.
Three format parameters can be varied:

- field width, that is the number of spaces that the variable will take up
- decimal place, where a decimal place should be imbedded
- whether leading spaces in the field should be padded with blanks or zeros

To imbed a formatted variable into a message, use the message editor and type control X where you wish the formatted variable to appear in the message. The control X will be shown as a down arrow (↓) within the message. The following prompt is displayed:

FIELD WIDTH: 0

A field width of 1 through 7 is valid.

Note: If a negative number is displayed, the first character of the field is a minus sign. You have no control over where the minus sign is placed in the field. The amount of space taken by the variable when it is displayed, or on the printout sheet when it is printed, is always equal to the field width.

You are then prompted for the decimal place:

DECIMAL PLACE: 0

The valid settings range from 0 thru 6. If the decimal position is selected to be zero, no decimal place will be shown in the field. The value entered for the decimal position is always the location that the decimal place occupies. That is, entering 1 for decimal position places the decimal in the rightmost character position, i. e. the last character of the field. Entering a 2 for decimal puts it one to the left of the rightmost character. The value entered for the decimal position can never exceed the number entered for field width. That is, entering a field width of four means that you can only specify 0 thru 4 for a decimal position.

The last prompt appears like this:

PAD WITH 0? N

This controls whether the unused spaces in the field are padded with zeros or spaces. For example, if you have a field width of 4, 0 as your decimal place, and the value being displayed is 2, it can be displayed one of two ways, either as **2** or as **0002**.

Changing Variable Format (Ctrl C)

Use the change variable command (control C) to change the format of a formatted variable. Position the cursor at the variable. A formatted variable is shown as being a down arrow (↓), as opposed to a simple variable, which is shown as an up arrow. When the cursor is positioned for the formatted variable down arrow, type [Ctrl] [C]. You are again prompted for the formatting parameters. The defaults for these formatting parameters are the current settings.

Note: Do not use the chain message or auto repeat attribute when imbedding variables.

Imbedding Time and Date (Ctrl T)

Imbed the time and date in a message, by typing a [Ctrl] [T] at the location in the message that you want the time displayed at. The control T is displayed as the character @. When the message is displayed, the time and date replace the @ character. The time and date string has the following format:

HH;MM;SS DDD MMM DT YEAR where:

HH = hour
MM = minute
SS = second
DDD = day (MON,TUE, etc.)
MMM is the month (JAN, FEB, etc.)
DT = date
YEAR

The YEAR string is not displayed, but is printed on the printer if the message is printed and if the printer has a carriage width of 26 characters or more.

Showing Available Memory (Ctrl F)

If you want to see how much free memory is left for new messages, or additions to the message under edit, type [Ctrl] [F]. You will see this prompt:

FREE MEM = 16042

The example above means there are 16042 bytes left to be filled. Each message reserves 14 bytes of memory, in addition to the memory used for the actual characters of the message. Blank spaces, control T's (@) and control V's (↑) use one byte each.

Upper Case Lock-Unlock (Ctrl U)

Some people prefer all uppercase type for all messages. Others prefer all uppercase type for just important messages. The optional keyboards (Catalog No. 2706-NK1, -NK2) have a shift-lock key. If you are using another type of terminal, type [Ctrl] [U], and this prompt is displayed:

UPCASE ONLY

After three seconds (or press any key) the prompt will go away. The edit window is restored with the cursor where you left it last. Type any lower case letter, and note that it is converted into uppercase, then inserted into the message. Type [Ctrl] [U] again and this prompt is displayed:

LOWCASE OK

Once again, after three seconds the prompt will disappear. The uppercase lock/unlock setting is stored in memory and the setting will remain the same, even between edit sessions or when power is disconnected.

Show Commands (Ctrl S)

The show command displays a brief description of all the available edit commands. If you happen to forget a control code, type [Ctrl] [S] to list the commands. Press [Esc] to stop the listing. Pressing any other key allows you to step through the listing more rapidly. After pressing [Esc], editing resumes where you left off.

Exiting the Editor (Ctrl Q)

To exit the edit mode, type [Ctrl] [Q]. The edit session terminates, and the message is saved. A notice is displayed and the EDIT? prompt reappears.

EDIT DONE

EDIT?

Press [Esc] three times to exit from the editor. The message under edit is saved, but a prompt is not displayed.

Entering an Example Message

Let's go through an example edit session. This should clarify the operation of the editor. Enter the editor by responding with a Yes to the edit prompt. You will then see the following prompt:

MESSAGE NUMBER: 0
(or last edited message number)

Enter a number, for example [1][8] [Return].

Let us assume the message number does not exist. The next prompt, assuming you are using a one line display, is the scroll mode prompt:

SCROLL? N

The default in this case is line mode. Press [Return] to make message 18 a line mode message. The next prompt is the print message prompt:

PRINT MSG? N

The default this time is not to print the message. Just press [Return]. The next prompt will appear:

OUT TO SLAVE? N

We do not have slaves connected, so just press [Return].

WAIT TIME: 5

The wait time controls how fast different lines are displayed. This is a line mode message, so the wait time between lines of the message is five seconds. This seems OK, so just press [Return].

AUTO CLEAR? N

We will set this message up so that the display is cleared when the message is finished. Type [Y].

AUTO CLEAR? Y

Now press [Return].

AUTO REPEAT? N

We do not want the message to continually repeat so just press [Return].

CHAIN MSG? N

We do not want to chain this message, so just press [Return].

FLASH MSG? N

We do not want the message to flash, so just press [Return].

TURN RELAY ON? N

We do not want to energize the relay so just press [Return]

STACK MSG? N

We do not want to stack the message in the Historical Event Stack so press [Return].

INVISIBLE MSG? N

We want this message to actually be displayed, so press [Return]. The following prompt then appears:

ENTER MSG

--

The last prompt appears for a few seconds indicating that a new message is being created, followed by a cursor. The cursor is a blinking solid block; it is shown as an underline in this manual. Enter a sample message.

ALLEN-BRADLEY

Here, the string ALLEN-BRADLEY was typed in. Note that the characters scrolled off to the left, and the cursor is positioned at the last character typed. Type some more:

ALLEN-BRADLEY BULLETIN 2706 MESSAGE DISPLAYS

Try moving the cursor. Forward one space (control L), backward one space (control H), up a line (control K), and down a line (control J). Type a few backspace characters (control H) and watch the cursor move back.

ALLEN-BRADLEY BULLETIN 2706 MESSAGE DISPLAYS

Here we typed backspace six times. Now type up a line (control K).

ALLEN-BRADLEY BULLETIN 2706 MESSAGE DISPLAYS

Change the words BULLETIN 2706 to DATALINER. First position the cursor to the B in BULLETIN. Type backspace (control H) three times:

ALLEN-BRADLEY BULLETIN 2706 MESSAGE DISPLAYS

Now type delete (control D).

ALLEN-BRADLEY ULLETIN 2706 MESSAGE DISPLAYS

Notice that the character is eliminated and the remainder of the message to the right of the cursor scrolls one position to the left. Type delete (control D) 12 more times:

ALLEN-BRADLEY _ MESSAGE DISPLAYS

Type the word DATALINER.

ALLEN-BRADLEY DATALINER MESSAGE DISPLAYS

Type quit (control Q) to exit the editor.

EDIT DONE

EDIT?

If we wanted to re-edit message 18, you would not have to reanswer the attribute prompts.

EDIT? Y

MESSAGE NUMBER: 18

ALLEN-BRADLEY DATALINER MESSAGE DISPLAYS

The cursor is positioned at the first character of the message. Editing may proceed as before.

Estimating Memory Usage

The example below shows how to estimate memory usage. Every message programmed has 14 bytes of overhead. Also, every space, control T, control V, and control X also use one byte.

Example: DL20 contains 475 messages with an average length of 35 characters.

Overhead + Message Text = Approximate Total

(475 x 14) + (475 x 35) = 23,275

31,000	Total Memory Available
-23,275	Total Memory
7,725	Unused Memory

The Historical Events Stack uses a maximum of 3000 bytes of unused memory. If the Historical Event Stack is used in your application, enough non-message memory space should be allocated.

Chapter 5

Run Mode

Chapter Objectives

This chapter describes how to trigger and display previously entered messages.

Entering the Run Mode

To place the DL20 in the run mode, answer Yes to the run mode prompt:

RUN? Y

The DL20 clears the display and enters the run mode.

Autorun Feature

The DL20 remains in the run mode indefinitely. If power fails, the DL20 remembers that it was in the run mode. On powerup, it resumes the run mode, if it passes the powerup self diagnostics.

The messages:

TEMP MASTER ADD: (0)

or

MASTER ADDRESS:

and

AUTORUN

are displayed for three seconds before the DL20 enters the run mode. If an autorun message has been selected, it is now displayed. It takes about twenty seconds to run the powerup self test and during this time prior to AUTORUN, no messages may be triggered.

Autorun Message

A message can be specified as an autorun message. This message is triggered immediately after entering run mode. It is always the first message in the queue, regardless of the state of the parallel port data lines. Use this feature as a method of displaying an initial message upon powerup.

An autorun message is also useful when using the DL20 for demonstrations or as an information display. Any number of messages may be displayed automatically on powerup by chaining the autorun message to them. These messages are displayed on powerup, whether the DL20 is hooked up to a controller or not. Remember, do not make a closed loop of chained messages (i.e., 1 chained to 2 chained to 3 chained to 1). If you want the chain to repeat continuously, make the last message in the chain an auto repeat message.

Chapter 8 describes how to set or disable the autorun message.

Background Message

The background message is displayed when the message stack is empty. Use the background message to display a fixed message when the DL20 is not showing anything pertinent to the operation of the application. For example, you can have the DL20 show the time of day when no other messages are displayed. Use the Set Up Master special function (Chapter 8), to enter a background message number.

Exiting the Run Mode

To exit run mode, you must press [Esc] three times. The DL20 displays the following prompt when the run mode is terminated:

EDIT?

Triggers and Queues

In run mode, the DL20 waits for commands from the host. These commands can:

- Trigger a message display
- Contain variable display data

To get a better idea of how the DL20 works, you must understand the concept of a queue. A queue is simply an ordered pile of data. Information can be put in or taken out of the queue. Information is always taken out in the same order that it is put in, (i.e. first-in first-out). There are two queues:

- One queue holds message numbers
- The other queue holds variable data

The DL20 queues up data and message numbers. It empties the message number queue as fast as it can. A message requires a certain amount of time to display. An entry is pulled from the data queue each time a control V or control X is found in a message. Control V or control X is imbedded in a message in the edit mode. Control V or control X designates “display data value here”. Control V appears as ↑ (up arrow) when editing a message. Control X appears as ↓ (down arrow) when editing a message.

Loading and Unloading Queues

To better understand how the queues operate, refer to this example: Assume message 2, is “Boiler pressure is ↑ PSI, temperature is ↑ degrees”. This message is printed along with actual variable data from the host.

Loading Data Queue

First, you must load up the data queue with the variable data. Since the first control V (up arrow) is the pressure reading, this is the first data that should be sent followed by the temperature. The data queue will look like this:

First entry:	775
Second entry:	451

Loading Message Trigger Queue

Assume that the message queue is empty. To get the message to display, you must load the message queue with the message number 2. When this is done, the message queue will look like this.

First entry:	2

The message is displayed immediately if there are no messages in the queue, or after any previously-triggered messages have been displayed.

Unloading Queues

A queued message is displayed immediately if there are no messages in the queue, or as soon as any previously-queued messages have been completely executed. The message may also be shown on slave displays, or it may be listed on a printer. The message is evaluated up to the first control V.

Boiler pressure is

At this point, the variable queue still looks like this:

First entry: 775
Second entry: 451

Now, the first entry is taken from the queue.

Boiler pressure is 775

The queue now looks like this:

First entry: 451

The message is then evaluated at the second variable.

Boiler pressure is 775 PSI, temperature is

Now, the second variable is unqueued, leaving both queues empty, and the message is displayed.

Boiler pressure is 775 PSI; temperature is 451 degrees.

Queue Capacity

Both the data queue and the message queue have a capacity of twenty entries. The DL20 will ignore all entries when the queue is full. Because of this, the DL20 is limited to twenty variables embedded within any one stored message.

Queuing Examples

In this example, three messages are triggered in rapid succession. First, the message 1 is triggered. The message queue looks like this:

First entry: 1

The entry is removed from the queue immediately. Message 1 is displayed. While it is being displayed, a command to trigger message 2 is queued. The message queue now looks like this:

First entry: 2

This entry is NOT removed, because message 1 is still being displayed and its wait time has not elapsed. Next, a command to trigger message 3 is received. The message queue now looks like this:

First entry: 2
Second entry: 3

After a short time, message 1 completes its display period. The DL20, always working to empty the queue, removes the first entry from the queue, a trigger for message 2. The message queue looks like this:

First entry: 3

When message 2 completes its display, the trigger for message 3 is removed. The queue is now empty. The DL20s message 3 then waits indefinitely for another message.

Display characteristics are determined by the attributes assigned to a particular message. For example, if zero wait time is assigned to 3 messages triggered in rapid succession, the first two messages are displayed too quickly to be read. However, assigning a wait time to a message assures it is displayed for the selected period of time. Other messages triggered during this time are stacked in the queue.

Transferring Data to be Queued

The DL20 displays messages and data as a result of commands sent to it from a host. Commands may be entered in one of two ways:

- Parallel input consisting of twelve inputs (See Chapter 7)
- Serial input using RS-232 or RS-422 port (See Chapter 6)

Important: Both serial and parallel inputs to the display *cannot* be used simultaneously. One or the other must be used.

Special Messages

Message numbers 1-16 are special messages which provide a variety of functions. Special messages are disabled by entering a regular message in their place. Once a regular message is created, it must be erased to regain the function of the special message.

For example, if a user message is stored as message 3, triggering message 3 no longer resets the DL20.

Note: Use Control E to erase a regular message.

Special Message #1: Clear Display

All lines of the DL20 are cleared when special message #1 is triggered. All lines of any attached DL10 slave displays are also cleared.

Here is an example of using special message #1: fault messages need to be displayed and remain displayed until the fault is cleared and some acknowledgement is made by the machine operator. One way to do this is to program fault messages as auto repeat messages. When the fault message is triggered, it is displayed continuously. A *fault cleared* button on the machine triggers special message #1 which clears the display. The display remains clear until another message is sent.

Special Message #2: Clear Display and Queues

Special message #2 clears the display along with the message trigger and variable data queues.

This message is useful when implementing priority messages. For example: you might want to display routine progress prompts and have three or four messages waiting to be displayed. Now let's say a fault happens. The fault message is displayed after the other (presumably less urgent) messages ahead of it in the message queue are displayed.

Triggering special message #2 prior to a fault message interrupts whatever message is being displayed, cancels the display of any message triggers in the queue and immediately displays the fault message. This allows the fault message to be displayed immediately, no matter what the DL20 was doing previously.

Special Message #3: Reset DL20

Special message #3 has the same effect as cycling power. This is useful if you want to run the powerup self test. This is sometimes useful for systems that have a system test function. If you send the DL20 special message #3 when the *test* button is pressed, the display will go through its self tests.

Triggering special message #3:

- terminates the display of any message running
- clears message and data queues
- causes the autorun message to be displayed

Special message #3 exactly mimics the conditions that occur when the power is removed and then restored.

Special Message #4: Test Battery

Special message #4 tests the battery. When special message #4 is triggered, the battery is tested and a message is shown, either BATTERY OK or BATTERY LOW. Although the battery is normally checked on powerup, some applications are running continually. Special message #4 provides a way for your programmable controller to periodically test the battery. If the relay flags battery special function is selected, then the relay is energized each time special message #4 is triggered and the batteries are low.

Special Message #5: Print HE Stack

Special message #5 prints the contents of the Historical Event (HE) Stack, with the most recently stacked messages printed first. Messages are not removed from the stack as they are printed. Messages are printed until the entire stack is printed, or until stack printing is halted by triggering special message #6.

While the HE Stack is being printed, any message triggers or variable data that are received are stored in the queue. If a message trigger is received while printing the HE Stack, it is displayed when you terminate printing or when the entire HE Stack is printed.

Special Messages

Special Message #6: Stop Printing HE Stack

Special message #6 stops the printing of the Historical Event (HE) Stack. Special message #6 terminates the printout, but whatever message is currently being printed prints out in its entirety. Normal message run mode resumes when printing ends.

Printing of the stack with special message #5, stopping printing with message #6 and restarting printing again with special message #5 causes the stack to be printed out again from the beginning. This allows you to obtain duplicate copies of the messages in the HE Stack. Printing messages does not remove them from the HE Stack.

Special Message #7: Clear HE Stack

There are only two ways to remove messages from the HE Stack. One is to exit the run mode. The other is to trigger special message #7. Triggering special message #7 immediately causes the contents of the HE Stack to be cleared. If messages are being printed from the HE Stack, the DL20 will resume the run mode as soon as printing of the stack is finished, but will not clear the stack.

Special Message #8: Resume Run Mode

Special message #8 enables the DL20 to start unqueuing and displaying messages from the message trigger queue if special message #9 had previously been triggered. Special messages #8 and #9 are related to dynamic chaining. Also use special message #8 to resume the run mode if special message #12 had previously been triggered (interactive clock setting).

Special Message #9: Clear Queues, Halt Run Mode

Use special message #9 when dynamic chaining has been selected. Special message #9 inhibits the unqueuing and display of incoming message triggers. Message and data queues are also cleared.

Special messages #8 and #9 work together to start and stop message display. Use these messages when dynamic chaining is enabled. The dynamic chaining mode is described in more detail later in this chapter. The way these messages would be used with dynamic chaining is as follows:

1. Trigger special message #9. This causes the display to stop unqueuing messages and empties the message and data queues.
2. Send other message triggers (up to 20). They are stored in the queue.
3. Trigger special message #8 to begin unqueing and repetitive display of these messages.
4. Messages are displayed continuously, until special message #9 is triggered.
5. Trigger special message #9, you will be able to reload the message queue with new message triggers.
6. The process can be repeated.

Special Message #10: Clear Queues

Special message #10 clears the queues. This special message works exactly the same as special message #2, except that the display is not cleared. This is useful when messages are triggered with variable data.

To trigger a message with variable data, your program must send the variable data followed by the message number. The way some programs are written, if they are interrupted or switch modes (from run to test, for example) they may have sent over some variable data but did not trigger the message associated with it. If a new message with variable data is triggered, incorrect variable data (intended for the never-triggered message) is displayed. To ensure that the variables in the messages are in sync with the message trigger, you can trigger special message #10, send the variable data, and then trigger the new message. The old message is replaced with the new message without the display going blank between messages.

Special Message #11: Test Display

Special message #11 tests the display. All the segments of the display as well as all the segments of any attached slave displays are illuminated. This feature is useful if your application includes a *lamp test* button. You can program the controller to trigger special message #11 when this button is pressed.

Special Messages

Setting Clock Using Special Messages

Special messages #12 and #13 allow you to set the clock remotely from the programmable controller either:

- Interactively. This is most useful when the programmable controller does not know the time, but the operator does.
- With variable data. This is useful when the host controlling the DL20 does have the time available.

Special Message 12: Interactive Clock Setting

Special message #12 allows the clock to be set interactively. When special message #12 is triggered, the current clock setting is displayed on line 1 of the DL20. After triggering special message #12, trigger messages to set the time and date.

Message #1 increments the seconds

Message #2 increments the minutes.

Message #4 increments the hour.

Message #16 increments the day (Sunday, Monday, Tuesday).

Message #32 increments the date.

Message #64 causes the month to increment.

Message #128 forces PM mode, if the clock is in 12-hour display mode. When the hour is incremented, the display automatically assumes it is AM. If you need to set a PM time, trigger message #128 to force PM mode after the correct hour is set.

Message #8 resumes run mode, even if a regular message is programmed in as message number 8.

Note: When setting the clock interactively, you cannot change the year or clock display mode (12-or 24-hour display). Setting the clock with special message #13 allows you to change all clock settings.

Special Message 13: Set Clock Using Variable Data

Hosts that have real time clocks should use special message #13 to set the clock. To set the clock using special message #13, up to eight variables must be sent. These eight variables represent (in order) seconds, minutes, 12/24-hours mode, hours, day, date, month and year. Table 5.A lists the variable order and the allowable data ranges:

Table 5.A
Clock Variable Data

Variable	Meaning	Range
1	Seconds	0 - 59
2	Minutes	0 - 59
3	Mode	0 = 12 hour 1 = 24 hour
4	Hours	1 - 12 (12 hour mode) 0 - 23 (24 hour mode)
5	Day	1 - 7
6	Date	1- 31
7	Month	1 - 12
8	Year	0 - 99

To set the clock, send the variables in the correct order and trigger special message #13. The variables are checked for out-of-range and used to set the clock.

An out of range variable leaves the clock unchanged. For example, if the variable containing the seconds count is set to 80 (80 seconds being an invalid number of seconds), the old setting is maintained. This allows you to selectively update one or more clock settings.

Note: You can set an illegal number of days for the month. You can never set over 31 days per month, or that setting is rejected; but you can still set 31 days for a short month.

Special Messages

Special Message #15: Enable HE Stack

Special message #15 enables the Historical Event Recording Stack. After special message #15 is triggered, messages designated as stackable messages are stored in the Historical Event Stack as they are triggered.

When the DL20 enters run mode, this is the default condition. It is not necessary to trigger special message #15 to enable the Historical Event Stack. It is usually used to turn on the Historical Event Stack after it has been turned off by special message #16.

Special Message #16: Disable HE Stack

Special message #16 disables the Historical Event Stack. After special message #16 is triggered, messages designated as stackable are not stored as they are triggered. The Historical Event Stack remains disabled until power is cycled or until special message #15 is triggered.

Special message #16 is useful when your application has a set-up or test mode and messages are being stored in the Historical Event Stack having to do with production counts. You may not want to stack messages with production counts in them while in the set-up mode or when manufacturing a few test parts. To do this, trigger special message #16 when the machine is in the test mode. Now as the operator goes through a few practice sequences, triggering messages such as part dimension xx inches, or batch temperature was xx for xx minutes, these messages are not recorded in the HE Stack. When the operator is ready to make an actual production run, he switches the machine over into the production mode. At this time, special message #15 is triggered so messages are stacked again.

Dynamic Chaining

Dynamic chaining allows the DL20 to continuously repeat a sequence of messages over and over again. These may be fault or status messages that have been triggered over a period of time.

Select dynamic chaining using the Set Up Master special function as described in Chapter 8. With dynamic chaining enabled, messages are displayed as they are triggered. These messages are displayed continuously according to the selected attributes (scroll or line mode, wait time, etc.).

The dynamic chaining queue capacity is 20 message triggers. If the queue capacity is reached, any following message triggers are ignored until the queue is cleared. Clear the message queue by triggering any of the following special messages described earlier in this chapter:

Special Message #2 - Clears Display and Queues

Special Message #9 - Clears Queues and Halt Run Mode

Special Message #10 - Clears Queues

The order in which message triggers are displayed may not be the same as the order in which they were actually triggered. However, you can use special messages #8 and #9 with dynamic chaining so that messages are displayed in the exact same order as triggered. The sequence would be:

1. Trigger special message #9. This causes the display to stop unqueuing messages and empties the message and data queues.
2. Send other message triggers (up to 20). They are stored in the queue.
3. Trigger special message #8 to begin unqueing and repetitive display of these messages.
4. Messages are displayed continuously, until special message #9 is triggered.
5. Trigger special message #9, you will be able to reload the message queue with new message triggers.
6. The process can be repeated.

Note: Do not use messages with variable data when using dynamic chaining.

Dynamic Chaining Example #1

This example does not use special messages #8 and #9, therefore, messages may not be displayed in the exact order in which they are triggered. This is acceptable for most applications, and requires a more simple application program in the host controller. Dynamic chaining must be enabled.

Event 1: A machine or system fault occurs and message #21 is triggered.

Event 2: Message #21 is displayed immediately, and remains displayed until another message is triggered.

Event 3: A second machine or system fault occurs and message #31 is triggered.

Event 4: Message #21 remains displayed for the specified wait time. Then message #31 is displayed for the specified wait time. Then back to message #21. Then back to message #31. This continues until a third message is triggered. Then the display will simply alternate between all three in a similar fashion. Up to 20 such messages can be triggered.

Event 5: An operator observes the various messages, responds accordingly, and acknowledges the faults using some input to the host controller. The host controller then triggers special message #2 to clear the display and the queue. The DL20 is ready to receive new message triggers.

For some applications, as described above, it is recommended that an *acknowledge* button be provided to assure that particular messages have been seen by an operator.

If more than 20 messages must be displayed at the same time, use the PRINT MSG attribute (without dynamic chaining). Otherwise the host controller must be programmed to handle the extra messages.

Dynamic Chaining Example #2

This example uses special message #8 and #9. This insures that the first message triggered is the first displayed, and the remaining messages are also displayed in the same order in which they are triggered. The messages are continuously repeated in this order. Dynamic chaining mode must be enabled.

Event 1: Under normal conditions (with dynamic chaining enabled) the DL20 could be waiting for any fault or status message trigger.

Event 2: The operator attempts to start the system or machine, but several fault conditions exist.

Event 3: The host controller sends the respective message triggers to the DL20 as follows:

First special message #9 is triggered.

Then the message triggers that correspond to the faults are sent to the DL20.

Next, special message #8 is sent to the DL20 so that the messages can continuously be repeated.

Event 4: The operator corrects one or more of the fault conditions.

Event 5: If any change in a fault condition occurs, the host controller sends an updated list of message triggers, as described in event 3.

Event 6: The operator again looks at the list of faults to see what else must be done. Event 3 through 6 may be repeated until all faults have been eliminated.

Event 7: When no more faults exist, the host controller triggers a message that says NO FAULTS.

It is good practice to provide operators with a *display messages* button. This enables the operator to refresh the DL20 while assuring the operator that communications are functioning properly.

Illegal Message Trigger Indication

An error message is displayed when a non-existing message is triggered. This feature is selected by responding with a [Y] to the FLAG ERRORS? prompt in the Set Up Master special function. Then, if an invalid message trigger is received, the message

ILLEGAL MSG TRIGGER

is displayed on line one. The message is displayed until a valid message trigger is received. If the error reporting is not enabled, invalid message triggers are ignored.

Variable Stack Empty Indication

It is possible to signal an error when a control V (which tells the DL20 to look for a new variable in the queues) is found in a message and there is no new data in the variable queue. This feature is selected by responding to the menu prompt as described in Chapter 8 (FLAG ERRORS?).

This is done by displaying characters in place of the variable(s):

- If it is a formatted variable, stars are displayed filling the entire field.
- If it is a non-formatted variable, a random number of stars (up to 6) are displayed.

If error reporting is not enabled, random numbers appear as the variables, if new data is not found in the stack.

Printer Handshaking

Printer handshaking controls the flow of data between a DL20 and a printer. DL20s use the software XON/XOFF protocol so that the DL20 starts and stops sending characters as the printer is able to print them. If the printer sends an XOFF, but does not send an XON while a message is being displayed, the message remains on the display until it receives three [Esc]s, an XON character, or special message #2, #3 or #10.

Historical Event Recording

Historical Event Recording allows you to designate messages as stackable messages. These messages are triggered, displayed, and stored. Later, all the messages in this stack can be printed on demand. Any variable data contained within a message, such as time of day, is also stored.

Use Historical Event Recording feature when you want a printed record of all the error messages or a report generated from your application. Even though the DL20 already supports printing of messages, it requires a printer hooked up permanently because the messages are printed immediately after they are triggered. With the Historical Event Recording feature, you can connect a printer, print the contents of the Historical Event Recorder, and disconnect the printer. An advantage is that a printer is not required for every DL20. If you have more than one DL20, one printer can be shared among them.

Using the Historical Event Recording feature involves three steps.

1. Select messages that you want stacked using the message editor.

2. Messages are triggered in the usual way in the run mode.

3. Print out the contents of the Historical Events Recorder at any time.

The STACK MSG attribute designates the messages that are to be stored in the Historical Event Recorder. All messages in the DL20 can be designated as stackable messages. You only want to stack only the most important messages, or the alarm messages. See Chapter 4 for setting message attributes.

The stack is limited to 3K of the DL20's unused memory. Typing control F while in the message editor displays the amount of available memory. Each stacked message requires 3 bytes of stack memory; each variable in the message requires 4 bytes of stack memory; and the time-of-day string requires 26 bytes of stack memory. As you can see, a stack with 3,000 byte capacity can hold quite a few message triggers. This stack is stored in battery-backed RAM memory and is retained even when the power is off. It will not be retained if the run mode is exited. To print the stack messages use special message #5.

Special messages #5, #6, #7, #15 and #16 are directly associated with Historical Event Recording. These special messages were described earlier in this chapter.

Chapter 6

The Serial Port

Chapter Objectives

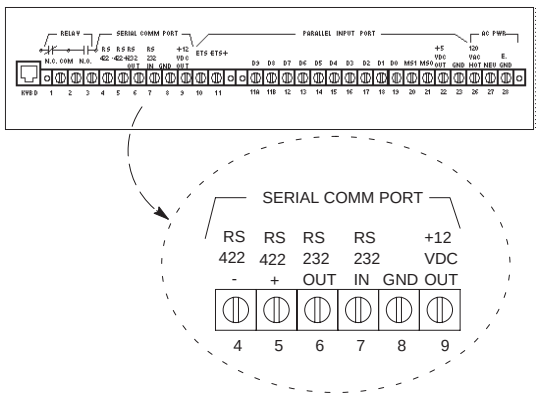
This chapter describes the serial port of the DL20. You can use the serial port to send or receive data using RS-232 or RS-422 standards. It describes:

- Serial port connectors
- How to connect devices to the serial port
- Serial port data formats
- Addressable master feature
- Slave displays

Serial Port Connectors

Figure 6.1 shows the serial port connectors of the DL20. All serial port connectors are optically isolated from the main circuitry in the DL20.

Figure 6.1
Serial Port Connectors



See Chapter 9 for wiring connections.

Terminal	Function
4, 5	Send or Receive RS-422 Data
6	RS-232 Data Output
7	RS-232 Data Input
8①	RS-232 Common
9	+12 VDC asserts certain RS-232 Handshake Lines, on terminals or printers. Do not use as a power source.

① Cable shields should terminate at terminal 8 (Common).

Terminals 4 and 5 send and receive RS-422 data.
Terminal 7 is the RS-232 input and terminal 6 is the output.
Terminal 8 is RS-232 common; all cable shields are terminated here.
Terminal 9 is a +12 VDC output for asserting handshake lines on some printers or terminals. Do not use this output as a power source. There is a plastic cover over terminal 9 to prevent inadvertent connections.

Serial Data Format

The format is the same for both the RS-232 and RS-422 ports. The device connected to either serial port must match the DL20. The transmission standards used by the DL20 are:

Baud Rate:	**300, 1200, or 9600**
Data Length:	**8 Bits (including parity if any)**
Parity:	**Odd, Even, None**
Stop Bits:	**1**

Note: Literature for non Allen-Bradley terminals may be misleading. Setting eight data bits and selecting parity sometimes results in nine total data bits. Only eight bits should be sent. Also, the DL20 accepts data sent with 1-1/2 or 2 stop bits.

Using the Serial Port

Note that both the serial port and the parallel port cannot be used simultaneously. One or the other must be chosen to input data.

Chapter 7, describes the parallel port. Refer to Chapter 9 for serial port connections.

Selecting Serial Port Parameters

Serial port parameters, such as baud rate and parity, are set using the special function Set Up I/O Ports. Chapter 8 describes the serial port setup procedures.

Serial Data Format

The DL20 must be set for BINARY MSG & VAR DATA of the parallel port options if the serial port is used to input data and message triggers. This is true even though the parallel port is not being used. The Set-Up I/O Port special function (explained in Chapter 8) sets the DL20 up for binary data input. This restriction is due to the internal operation of the DL20.

Host messages to the serial port contain three fields:

The control code indicates whether the data is a message number or a variable. The ASCII string represents the message number or variable. For example, the number 4,286 would be sent out like this:

ASCII	4	2	8	6
Decimal Equivalent:	52	50	56	54
Hex Equivalent:	34	32	38	36
Octal Equivalent:	64	62	70	66

If the data is a message number, it must contain one or more digits. If it contains more than four digits, only the last four are accepted. If the number input is greater than 1022 (the highest message number) it is ignored. Zero is also ignored.

If the data is a variable, it also must contain one or more digits. If the number contains more than five digits, only the last five sent are accepted. In addition, the first character of the field may be a plus or minus sign. The number is assumed to be positive if no sign is sent. The highest number accepted is +32,767 and the lowest is -32,768. All other characters in this field are ignored, including spaces. For example, these two strings are equivalent:

ASCII	-	2	2
Decimal Equivalent:	45	50	50
Hex Equivalent:	2D	32	32
Octal Equivalent:	55	62	62

ASCII	(sp)	-	2	q	2
Decimal Equivalent:	32	45	50	113	50
Hex Equivalent:	20	2d	32	71	32
Octal Equivalent:	40	55	62	161	62

Important: Sending three consecutive [Esc] characters (decimal 27, hex 1B, octal 33) takes the DL20 out of run mode.

All data entered must be followed by the carriage return character (decimal 13, hex D, octal 15). The DL20 queues the data following receipt of the carriage return.

Using the Serial Port

Serial Data Example

Here is an example of a message containing variables, which is triggered using the serial link. The example message (number 4) is:

Voltage = ↑, current = ↑

To trigger this message, the following strings are sent:

ASCII	(Ctrl V)	4	1	6	0	[Return]
Decimal Equivalent:	22	52	49	54	48	13
Hex Equivalent:	16	34	31	36	30	0D
Octal Equivalent:	26	64	61	66	60	15

This queues up 4160 as the “voltage” value.

ASCII	(Ctrl V)	1	2	0	0	[Return]
Decimal Equivalent:	22	49	50	48	48	13
Hex Equivalent:	16	31	32	30	30	0D
Octal Equivalent:	26	61	62	60	60	15

This queues up 1200 as the “current” value.

ASCII	(Ctrl T)	4	[Return]
Decimal Equivalent:	20	52	13
Hex Equivalent:	14	34	0D
Octal Equivalent:	24	64	15

This queues up a trigger for message number 4, which causes this message to be displayed:

Voltage = 4160, Current = 1200

Note: Don’t forget that the DL20 must be set up for BINARY MSG & VAR DATA of the parallel port options for serial port queuing to work. This is selected from the special functions menu.

Addressable Master

The addressable master option allows you to uniquely address over 100 DL20s linked to the same host.

A message trigger is only recognized by the similarly addressed master display. To set up a master address, use the special function Set Up Master. A master address can be any number from 1 to 127 with some exceptions. The address assigned in the sequence is the decimal value of the associated ASCII symbol.

To trigger a display with an address of 65, the character ”A” is typed.

Certain addresses are not valid for DL20s. These illegal addresses are decimal 0, 4, 6, 13, 18, 20, 22, 43, 45, 48-57. Setting a master address of 0 disables the feature. More than one master may have the same address assigned to it. Invalid addresses may result in the display of invalid data.

Note: A message trigger or variable data entry with an address of 127 is recognized by all DL20s regardless of their address. This provides a quick and easy method of triggering a message on all interconnected masters.

The format of the message trigger is:

CONTROL T	MESSAGE NUMBER	MASTER ADDRESS	CARRIAGE RETURN

The format of a variable is:

CONTROL V	VARIABLE DATA	MASTER ADDRESS	CARRIAGE RETURN

DL20 master addresses are always one byte (1 - 127 Decimal or 1 - 7F Hex). Set the DL20 address according to the decimal equivalent (1-127). Use Appendix A to convert ASCII characters, hex, and decimal values.

Slave Mode

When DL20s are connected on an RS-422 network, the port must be set as an input using the Set Up Master special function. Since DL10 slaves are addressed using the RS-422 port as an output, using DL20s as addressable masters precludes the use of this port for sending data out to DL10 slaves.

Entering Slave Mode

Enable the slave mode by sending the DL20 the following control sequence, while in the run mode:

[CTRL D] [Address] [Return]

Exiting Slave Mode

While in the slave mode, the DL20 will not respond to message number triggers. To exit the slave mode, send the following control sequence:

[CTRL S] [Address] [Return]

Note: If the DL20 is powered down in the slave mode, it will power up in the normal run mode, not slave mode.

Slave Mode Protocol

Slave mode protocol is as follows.

20 DISPLAY CHARACTERS	SLAVE ADDRESS	LINE NUMBER	CARRIAGE RETURN

1. Send the 20 display characters. Any valid ASCII character, upper or lowercase, can be sent. Previously described control codes do not apply.
2. Send the address. This is a one-byte character, ranging anywhere from 1 through 127 decimal (1 through 7F hex). If the address is 65, type the character ”A”.

   Note: Restrictions for address byte are the same as described previously for the addressable master feature. Any packet containing the address 127 is received by all DL20s, regardless of their address.
3. Send the line number. Valid line numbers are line 1 through line 4. Send the decimal equivalent values not the ASCII value:

   Line 1 = CTRLA
   Line 2 = CTRLB
   Line 3 = CTRLC
   Line 4 = CTRLD
4. Send the carriage return [Return].

Slave Mode Control Codes

There are certain control codes that slave DL20s respond to:

Control F is a flash code. If you want flashing characters, send a control F with the 20 character packet. Every character on the specified line will flash. A second control F cancels flash mode.

Control R is the reset command. After receiving a control R within the 20 character packet, all the data registers in the DL20 are cleared. For example, if you were to send 10 characters, then a control R, you could then send 20 more characters followed by the slave address, followed by the line number, followed by a carriage return. The 20 characters that you sent would be displayed on the appropriate DL20. The ten characters sent before the control R would be lost. Control R also resets the flash status to nonflash.

Important: Send a control R to all DL20s when the host controller powers up, because when a serial port powers up it may inadvertently transmit erroneous data.

Slave Mode Baud Rate

The current address and baud rate are displayed on power up. The baud rate of the DL20s must match the baud rate of the host controller. There are three baud rates: 300, 1200, and 9600 baud. Generally, any of these can be used. However, it is possible that some host devices could be programmed to transmit too many characters too fast at 9600 baud. If you do find a problem, change the rate to 1200 baud, as most users have found that to be an acceptable rate.

Slave Mode Individual Relay Control

Turn off relays in individual slave displays on an RS-422 network by sending the command sequence:

[Slave Address] [Line Number] [Return]

Line number 48 (ASCII 0) turns the relay on and line number 49 (ASCII 1) turns the relay off. One possible use for this feature is to signal an incoming message by connecting a bell or light to the relay.

ATTENTION: The relay must only be used for the annunciator, not control functions.

Chapter 7

The Parallel Port

Chapter Objectives

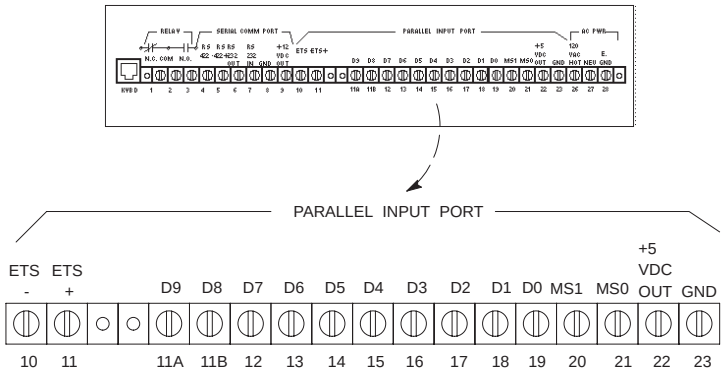
This chapter describes the parallel port:

- Data formats
- Electrical requirements
- Timing requirements
- AC input converters
- Sampling modes

Parallel Port Description

The DL20 can connect to a programmable controller with parallel outputs. These outputs can trigger messages and transfer variable data. Figure 7.1 shows the parallel port terminals.

Figure 7.1
Parallel Port Connectors



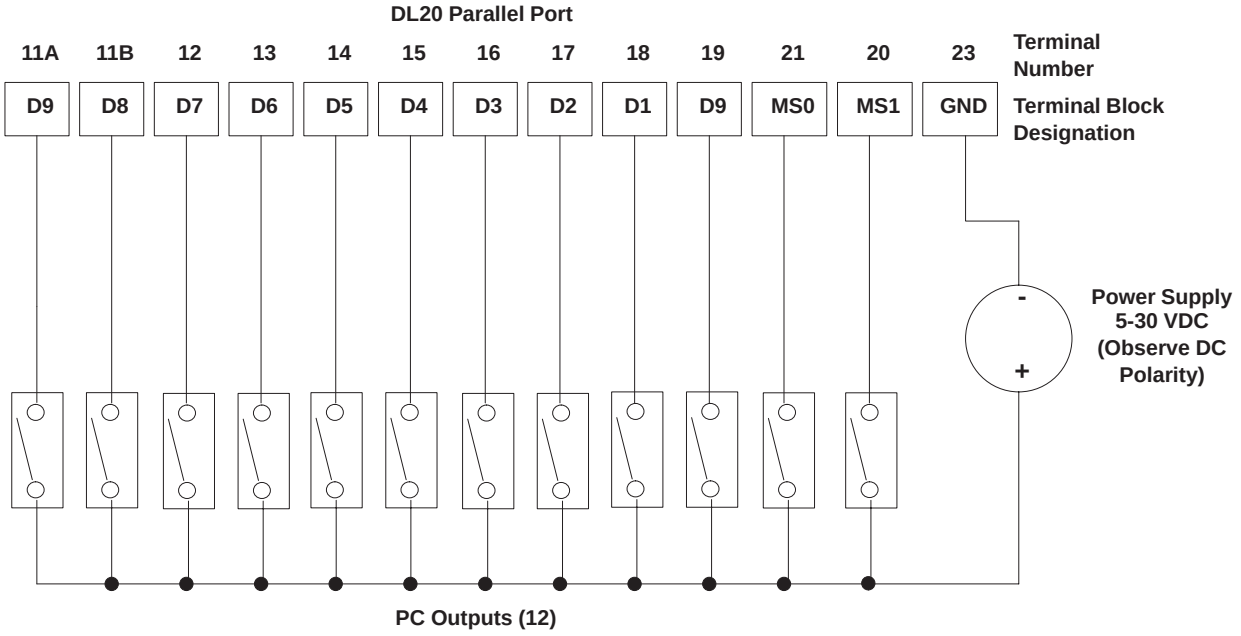
Refer to Chapter 9 for wiring connections.

The parallel input accepts either binary or BCD data formats to transfer data. The parallel input consists of 12 terminals, divided into two groups. Terminals in the first group, numbering 10, are known as data lines. The remaining two are known as strobe lines. The data terminals are designated D0 through D9. Where data line D0 is known as the least significant line. The strobe lines are designated MS0 and MS1.

Using the Parallel Port

Figure 7.2 illustrates a typical example of using discrete I/O outputs with the DL20 parallel port:

Figure 7.2
Using Discrete Outputs With the Parallel Port



Logic Levels

Data line D0 can have a value of either 0 (ground level) or 1 (voltage present). The convention of having voltage representing a 1 and ground representing a 0, is known as positive logic. The opposite convention is known as negative logic. The DL20 can accept either.

Each parallel input understands two voltage levels: On or Off. There is also an indeterminate state when the voltage level is between On and Off. Table 7.A shows the voltage levels and their logic values for input terminals D0-D9 and strobe lines MS0 and MS1.

Table 7.A
Voltage Levels for Each Logic State
(Typical Input Resistance = 10K Ohms)

Voltage Range	Low True Logic Value	High True Logic Value
0-1.5 VDC	1 or ON	0 or OFF
1.5 - 3.5 VDC	Indeterminate	Indeterminate
3.5 - 30 VDC	0 or OFF	1 or ON

As Table 7.A illustrates, the DL20 can accept high true (higher voltage level=1) or low true (lower voltage level=1) logic. Chapter 8 explains how to set parallel port logic levels. Choose whichever logic level best suits your application.

Note: The Allen-Bradley TTL Output Module (1771-OG), DC Output Module (1771-OB), or AC Output Module (1771-OA) can be used to drive the parallel port.

Binary vs. BCD

You can use separate data modes for input message triggers and variables when using the parallel port. Message triggers can be in binary and variable data can be in BCD or vice versa. This means you could input variables in BCD format, which may be easier to use, and the message triggers could be in binary, which provides access to the full 1022 message capacity. Select the data modes using the special functions menu as described in Chapter 8.

Each numbering system, binary or BCD, has its own merits. Your choice will often be based on the format used by the host. However, binary values provide certain advantages:

- Range of binary message triggers is from 1 - 1022.
  Range of BCD message triggers is from 1 - 399.
- Variable range for binary values is -32,768 through 32,767.
  Variable range for BCD values is 0 through 9,999.

Also, it is not possible to represent negative numbers using BCD format.

Using the Parallel Port

Data Line Values (Binary)

Table 7.B shows the value of the data lines using binary data inputs.

Table 7.B
Binary Data Line Values

Data Line	Data Line Value	Comments
D0	1	Least Significant Bit
D1	2	
D2	4	
D3	8	
D4	16	
D5	32	
D6	64	
D7	128	
D8	256	
D9	512	Most Significant Bit

The binary value of the data lines is the sum of the individual data lines: D0 + D1 + D2 + D3 + D4 + D5 + D6 + D7 +D8 + D9 = Value. For example: if D0, D4 and D7 are at some voltage level, and the others are at ground level, the value on the data lines is D0 + D4 + D7 = 1 +16 + 128 = 145.

Data Line Values (BCD)

In the BCD system, 4 bits represent one decimal digit. Table 7.C shows the value of the data lines using BCD data inputs.

Table 7.C
BCD Data Line Values

Data Line	Data Line Value	Comments (Range = 0 to 399)
D0	1	Ones Digit (0-9)
D1	2	
D2	4	
D3	8	
D4	10	Tens Digit (0-9)
D5	20	
D6	40	
D7	80	
D8	100	Hundreds Digit (0-3)
D9	200	

Parallel Port Strobe Lines

If the DL20 receives a value like 145, this could mean either a variable 145 or a message number 145. The function of the strobe lines (MS0 and MS1) is to tell the DL20 what to do with information on the data lines (D0-D9).

When strobing over a variable, the high order data should be strobed over first. The variable will be queued up after the low byte data is strobed in.

Note: If the variable is in the range of 0 - 255 for binary or 0 - 99 for BCD, only the low order data needs to be strobed in. The DL20 will assume that the high order data is zero.

MS0 and MS1 qualify and identify the data lines. The process of using these lines to transfer data to the DL20 is known as strobing in data. There are four possible types of strobes that can occur with these two lines:

Table 7.D
Strobe Commands

Strobe Line MS0	Strobe Line MS1	Name	Strobe Command
0	0	NULL	Ignore Data Lines
1	0	LDAT	Data lines are least significant byte of variable.
0	1	HDAT	Data lines are most significant byte of variable.
1	1	MSGA	Data lines are a message number.

NULL or MSGA

The NULL tells the DL20 to ignore the data lines. The fourth strobe, MSGA, tells the DL20 to put the value of the data lines into the message queue.

LDAT

LDAT means the least significant byte of a variable is being strobed in. Variables are usually sixteen bits in size or four BCD digits long. Since there are only ten (eight used for variable data) wires in the data group, the variable must be strobed over in two steps. The two values strobed in are then added together.

HDAT

HDAT means that the most significant byte is being strobed in. The data lines are interpreted a little differently this time. Table 7.E shows how the data lines are interpreted using binary values. Table 7.F shows the values when using BCD values.

Using the Parallel Port

Table 7.E
Binary Data Line Values Using HDAT Strobe

Data Line	Value
D0	256
D1	512
D2	1024
D3	2048
D4	4096
D5	8192
D6	16384
D7	Sign Bit: 0 = Positive 1= Negative
D8	D8 and D9 are not used when variable data is strobed in. Set both lines to 0.
D9	

The value is the sum of D0 through D6: D0 + D1 + D2 + D3 + D4 + D5 + D6 = Value. The seventh wire, D7, is called the sign bit -- numbers can be positive or negative. The value read during the LDAT strobe is added to the value read during the HDAT strobe to obtain the value of the variable from -32,768 to +32,767. Negative numbers are interpreted as two's compliment values by the DL20 and should be transmitted that way. Most programmable controllers use two's compliment values and no conversion is required.

In the BCD numbering system, the data lines are also interpreted differently. When the HDAT portion of the variable is being strobed in, the lines still represent two BCD digits; this time the digits are the hundred and thousand places of the desired variable. Table 7.F defines the new digit weights:

Table 7.F
BCD Data Line Values Using HDAT Strobe

Data Line	Data Line Value	Comment
D0	100	Hundreds Digit (0-9)
D1	200	
D2	400	
D3	800	
D4	1000	Thousands Digit (0-9)
D5	2000	
D6	4000	
D7	8000	
D8		D8 and D9 are not used when variable data is strobed in. Set both lines to 0.
D9		

Edge Triggered Strobe

Note: Refer to event driven sampling in this chapter for a description of how to use the ETS inputs.

The edge triggered strobe (ETS) is typically used with non Allen-Bradley programmable controllers. The DL20 can be set up to either look at the data and strobe lines periodically (time-driven sampling); or based on a signal present on edge triggered strobe (event-driven sampling).

The edge triggered strobe is especially useful with non Allen-Bradley programmable controllers which support word I/O modules. These modules typically multiplex two or more channels onto one set of data lines. A strobe is brought out for each channel; a channel's strobe becomes active when data for that channel is present on the data lines.

Edge triggered strobe does not alter the values present on the data lines, nor does it affect their interpretation.

Unchanged Data Rejection

When data is read at the parallel port, a copy is saved. If the next reading is the same, the reading is ignored. This prevents a single message from being read multiple times.

For example, if the sampling time is 4 and the debounce time is 1, the parallel port is scanned about 100 times per second. If the control system changed the data on the parallel port from null to trigger message 12 and held the trigger for 100 milliseconds before returning to null, the message would be displayed once, not ten times, even though the parallel port will have been sampled ten times.

Input Converters

The parallel input circuit allows inputs to accept DC input voltages from 5 to 30V. An input voltage of 120VAC 60Hz is also accepted if a Parallel Input Converter (Catalog No. 2706-NG1 or NG2) is installed.

Almost all programmable controller output modules have some leakage current in the off state. The parallel inputs on the DL20 are designed to ignore this output leakage current. The Parallel Input Converter is especially insensitive to the larger levels of leakage current that typically come from AC output modules.

ATTENTION: The Parallel Input Converters (Catalog No. 2706-NG1 or 2706-NG2) cannot accept 220/240 VAC. If 220/240 VAC is applied, damage to the Parallel Input Converter will occur.

Parallel Port Sampling Methods

The DL20 can read data on the parallel port two different ways:

- **Time-Driven Sampling**
  Reads the parallel port periodically.
- **Event-Driven Sampling**
  Reads the parallel port whenever a transition occurs on the edge triggered strobe (ETS) input (terminals 10 and 11). This method is slightly more difficult to implement with a programmable controller's discrete I/O than time-driven sampling, however it may allow slightly faster input.

Choose the method most suitable to your application using the Set Up I/O Ports special function as described in Chapter 8.

Event Driven Sampling

Event driven sampling uses the edge triggered strobe (ETS) input. Terminal 10 is the ETS - and Terminal 11 is the ETS+ (1.5-15VDC). The DL20 reads data on the parallel port on either the rising edge or falling edge (one or the other - not both) as selected in the special functions menu (Set Up I/O Ports). Data must be present on the parallel data port when the edge occurs. The data must remain stable for at least 2 milliseconds after the edge occurs. No more than 50 edges per second should be triggered on the ETS input. Also, since data is sampled only once with this method, only DC input is permissible on the parallel input. When using AC modules, we recommend that data is at the parallel port at least 34 milliseconds before the ETS is changed.

Note: Strobe line transitions, either from OFF to ON, or from ON to OFF, should occur in less time than the debounce time for DC sampling or in less than 1 millisecond for AC sampling.

Important: If AC voltage is used, it could be inadvertently sampled during the zero crossover of the AC waveform of the Parallel Input Converter (Catalog No. 2706-NG1, -NG2 Series A or B).

The ETS input (terminal 11) is measured with respect to ETS common (terminal 10). ETS common is isolated. This input presents a DC load of 470 ohms and 2 diode drops (0.7 Volts per diode).

Terminal 23 (GND) is a ground reference for the data lines D0 through D9, MS0, MS1, and +5VDC out. If needed, ETS common (terminal 10) can be externally connected to the ground reference (terminal 23).

Table 7.G shows the voltage and current requirements of the ETS inputs.

Table 7.G
ETS Voltage and Current Requirements

ETS Input Logic Level		ETS Input Current Requirements	
Voltage Range	**Logic Level**	**Voltage**	**Current**
0-1.5 VDC	0 or OFF	4.0	5 mA
1.5-4.0 VDC	Indeterminate	5.0	7 mA
4.0-15 VDC	1 or ON	12.0	22 mA
		15.0	28 mA

Important: A TTL output module cannot be used to trigger the ETS line. It cannot supply sufficient current at 5VDC.

Time Driven Sampling

Because it does not require an additional ETS rising or falling edge to read DL20 data lines, time-driven sampling is the recommended way of looking at DL20 data lines. When time-driven sampling is selected, the DL20 looks at the data lines periodically. The time interval used by the DL20 is set using the special functions menu described in Chapter 8.

Time-Driven Sampling Methods

AC and DC sampling can be used. Both sampling methods reduce false message triggering and invalid data. When DC sampling is selected, you can select the debounce time (see Chapter 8).

AC sampling is required when using a Parallel Input Converter (Catalog No. 2706-NG1, -NG2 Series A or B).

DC sampling is required when using a Parallel Input Converter (Catalog No. 2706-NG1, -NG2 Series C or later). These converters convert the AC signal to DC.

AC Sampling

The DL20 uses a special AC sampling method when AC sampling is chosen and the Series A or B Parallel Input Converters are used. See Appendix H for more information.

Data Hold Time
For AC data input to be recognized on the parallel port, it must be present and unchanging for a minimum of 180ms (Series A and B Parallel Input Converters).

AC Sampling Restrictions
The frequency of AC is approximately 60 Hz. The voltage must fall within the range of 108-132 VRMS. The AC on all inputs must be in phase.

Note: The AC power input used to power the device does not need to be in phase with the AC on the parallel port inputs. A Parallel Input Converter (Catalog No. 2706-NG1, -NG2) is required for AC parallel inputs.

DC Sampling

The parallel port is always sampled more than once and all readings must agree. This provides a variable degree of insensitivity to noise on the data lines.

For example, assume you are sending the binary data 010 and change it to 100. For a very brief time the data lines may assume the intermediate state of 000 or 110 before settling at 100, the desired number. If the parallel port was sampled only once, the erroneous intermediate state could be read instead of correct data.

DC Sampling Debounce

The debounce process works like this: during each scan, the parallel port is read, and the debounce sampling is started. Every 1/512 second until the debounce count is satisfied, the parallel port is read again. All readings must agree, or the data is ignored. For example, if the debounce value is set to 2, the parallel port will be read 3 times (having one initial reading) and the two readings must match the initial reading for data to be accepted.

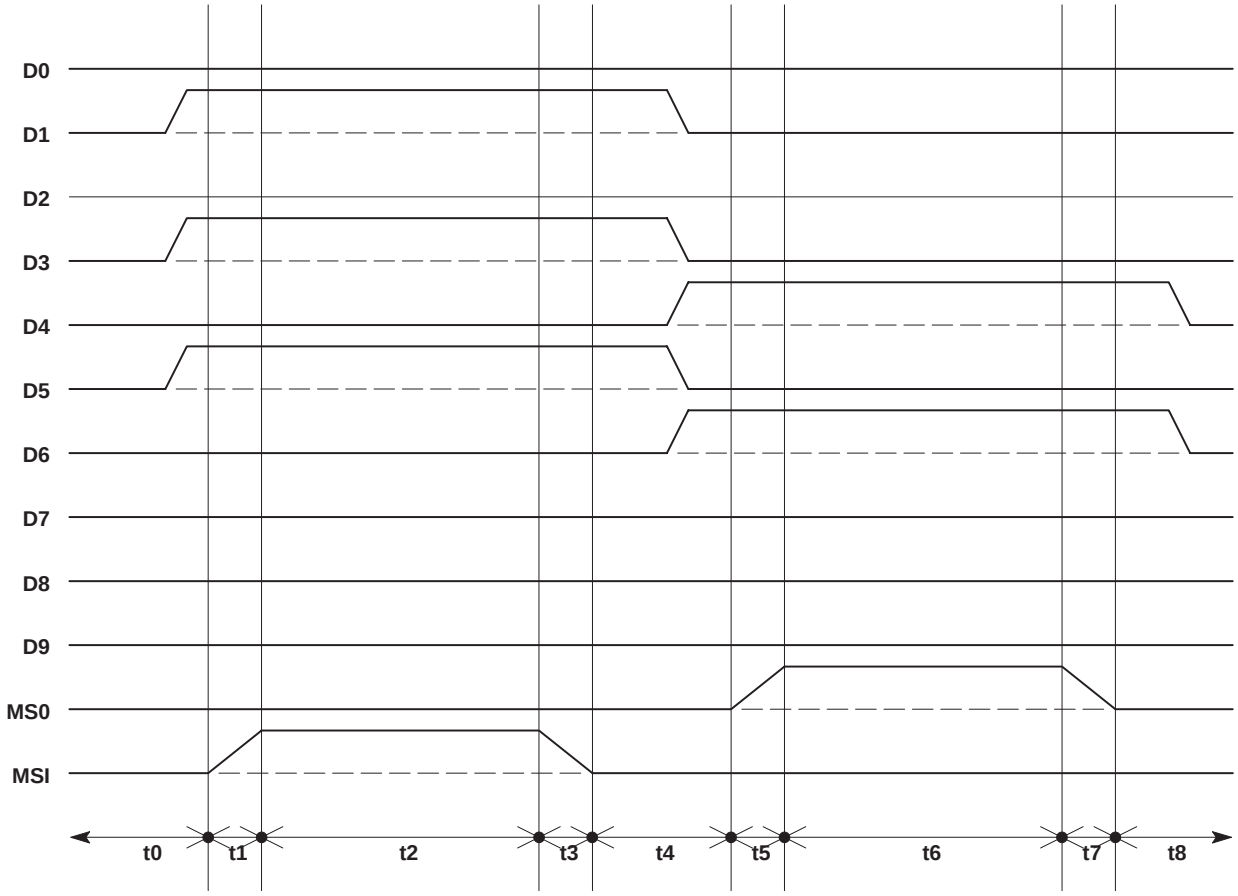
Data Hold Time

For DC data input to be recognized on the parallel port, it must be present and unchanging for a minimum of 15 milliseconds when using the default scan rate and debounce.

Note: The Parallel Input Converter Series C or later uses a DC sampling method. For the data input to be recognized on the parallel port, it must be present and unchanging for 100 ms.

Transferring Variable Data

Variable data is transferred up to eight bits at a time. The high order data bits are strobed over, then the low order data bits are strobed over. Only then is the data queued up. The strobing order is important; high order data bits must be strobed in first. The timing of a typical data transfer using binary data could look like this:



t0: The binary code for 10,832 is 0010 1010 0101 0000. During t0 the first eight bits of the data word are set up on the parallel input lines: D5, D3, and D1 are ON and D7, D6, D4, D2 and D0 are OFF. Since both strobe lines are OFF, the DL20 ignores the data lines.

t1: Strobe line MS1 is turned ON, strobe line MS0 is left OFF. This tells the DL20 that we are entering high order data.

t2: The data lines are latched in and they are interpreted as high order data during the period t2 because MS1 is ON and MS0 is OFF. The data read in is equal to the sum of the values of the bits. We can look at the table 7.E and see that the value strobed over is 8,192 + 2,048 + 512 or 10,752. t2 should be long enough so data can be sampled by the DL20. As noted before, this sampling time is user-selected. If edge triggered sampling is used, the edge should occur during t2.

t3: Strobe line MS1 is turned OFF.

t4: The data lines can now change to indicate the low order byte. The DL20 will ignore the data lines because both MS0 and MS1 are OFF. t4 can last for any length of time.

t5: Strobe line MS0 is turned ON.

t6: The data lines are latched in and they are interpreted as low order data because MS1 is OFF and MS0 is ON. The data read in is equal to the sum of the values of the bits. We can look at the table 7.B and see that the value strobed over is 64 + 16 or 80. The DL20 will now queue up a variable since both high order data and low order data have now been strobed in. The value of the variable queued will be 10,752 + 80 or 10, 832.

t7: Strobe line MS0 is turned OFF.

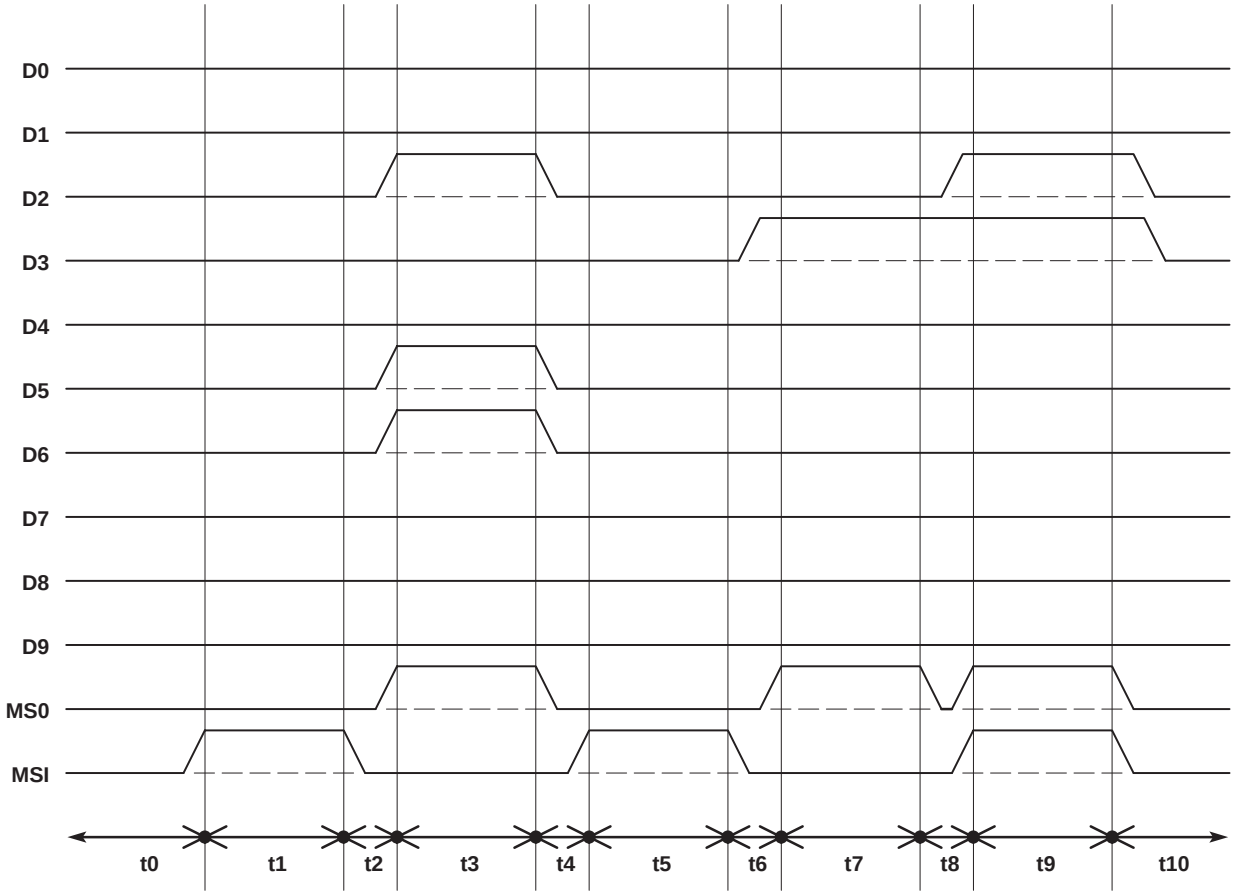
t8: As long as MS0 and MS1 are OFF, the DL20 ignores the data lines.

Example Message Trigger with Variable Data

Message number 12 contains two variables.

PARTS COUNT = ↑ REJECTS = ↑

First, transfer over the parts count, 8 bits at a time. Then transfer over the reject count, 8 bits at a time. Lastly, transfer over the message number, which triggers the message. The timing of the message would look like this:



t0: The high order bits of the first variable are set up on the data lines; they are zero in this case, then MS1 is turned ON.

t1: The DL20 stores a zero, the value on the data lines, as the high order byte of a variable. Steps t0 and t1 are optional; if low order data is strobed in without high order data having been strobed in, the DL20 will assume that the high order data is zero.

t2: MS1 is turned OFF; then the low order bits of the first variable are set up on the data lines, 100 in this case, then MS0 is turned ON.

t3: The DL20 stores 100, the value on the data lines, as the low order byte of a variable. Both the high order and low order portion of a variable have now been read in, so the DL20 queues the variable up. In this case, the value 100 is queued up.

t4: First MS0 is turned OFF; then the high order bits of the second variable are set up on the data lines, zero in this case; the MS1 is turned ON.

t5: The DL20 stores zero, the value on the data lines, as the high order byte of a variable. Once again, t4 and t5 are optional.

t6: First MS1 is turned off; then the low order bits of the second variable are set up on the data lines, 8 in this case; then MS0 is turned on.

t7: The DL20 stores 8, the value on the data lines, as the low order byte of a variable. Both the high order and low order portion of a variable have now been read in, so the DL20 queues the variable up. In this case, the variable 8 is queued up.

t8: First MS0 is turned OFF; then the data lines are set to the value 12, which is the message number we wish to trigger; then both MS0 and MS1 are turned ON.

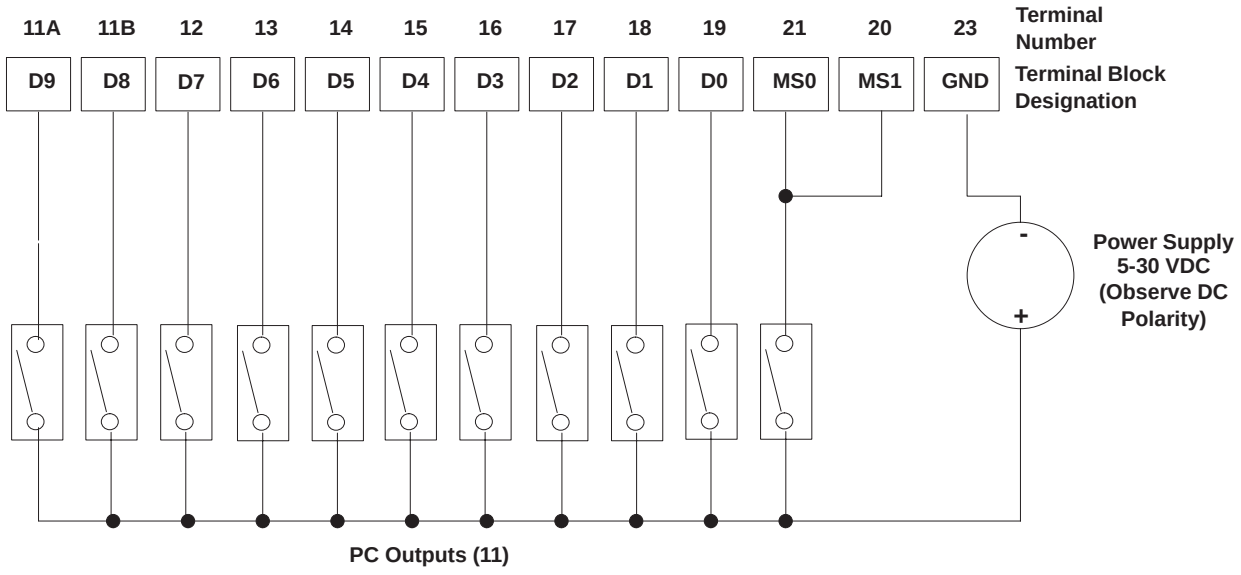
t9: The value on the data lines, 12, is queued up as a message trigger.

t10: MS0 and MS1 are turned OFF. The DL20 ignores the data lines.

Reducing Host Output Requirements

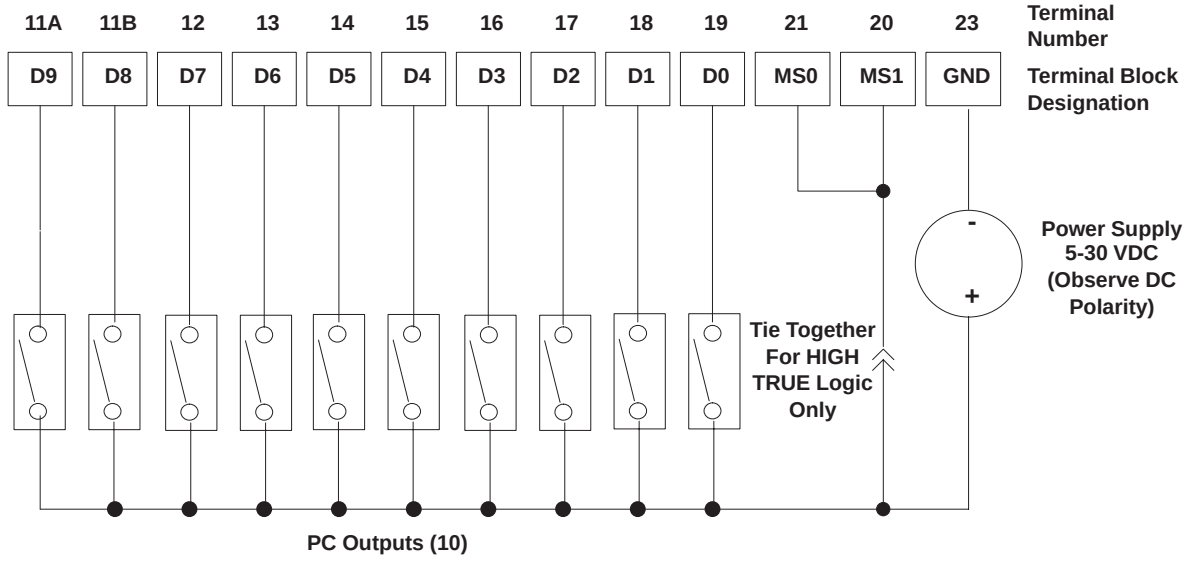
If messages don't contain variable data, the number of outputs can be reduced. Since no variable data is transferred, both strobe lines are always zero, or always one. In addition, some data lines (D0 - D9) could be eliminated depending on the highest message number used. Figure 7.3 illustrates this method.

Figure 7.3
11 Ouput Configuration

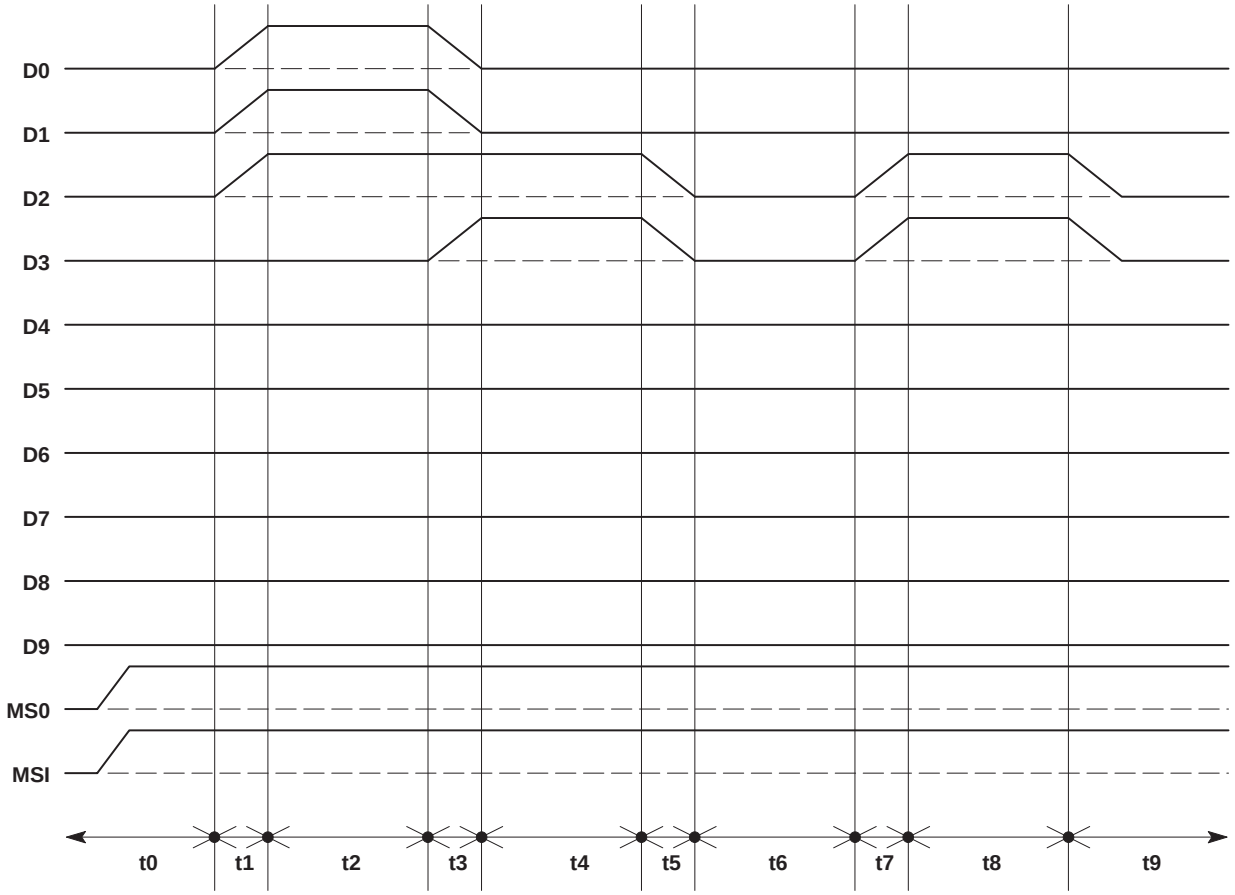


You can further reduce the output requirements by tying the strobe lines high as shown in Figure 7.4

Figure 7.4
10 Output Configuration



You can tie the strobe lines high because message zero is ignored. Keep all data lines at zero, until you want to trigger a message. The last message is only triggered once --no matter how long the data lines stay in their state (DL20 rejects unchanging data). To trigger the same message twice in a row, the message must be triggered, the data lines must return to a zero state, the message can then be retriggered. The following diagram shows how message 7 could be triggered once and message 12 triggered twice using the connections shown in Figure 7.4.



t0: The value on the data lines is zero, the DL20 ignores this value because there is no message zero.

t1: The data lines change state, from zero to seven.

t2: The message trigger seven is queued up.

t3: The data lines change state, from seven to twelve.

t4: The message trigger twelve is queued up.

t5: The data lines change state, from twelve to zero.

t6: A zero is presented to the DL20. Twelve cannot be presented here, because the DL20 will not queue the same message twice in a row, as long as MS0 and MS1 remains ON. In this example, MS0 and MS1 are always ON.

t7: The data lines change state, from zero to twelve.

t8: The message trigger twelve is queued up.

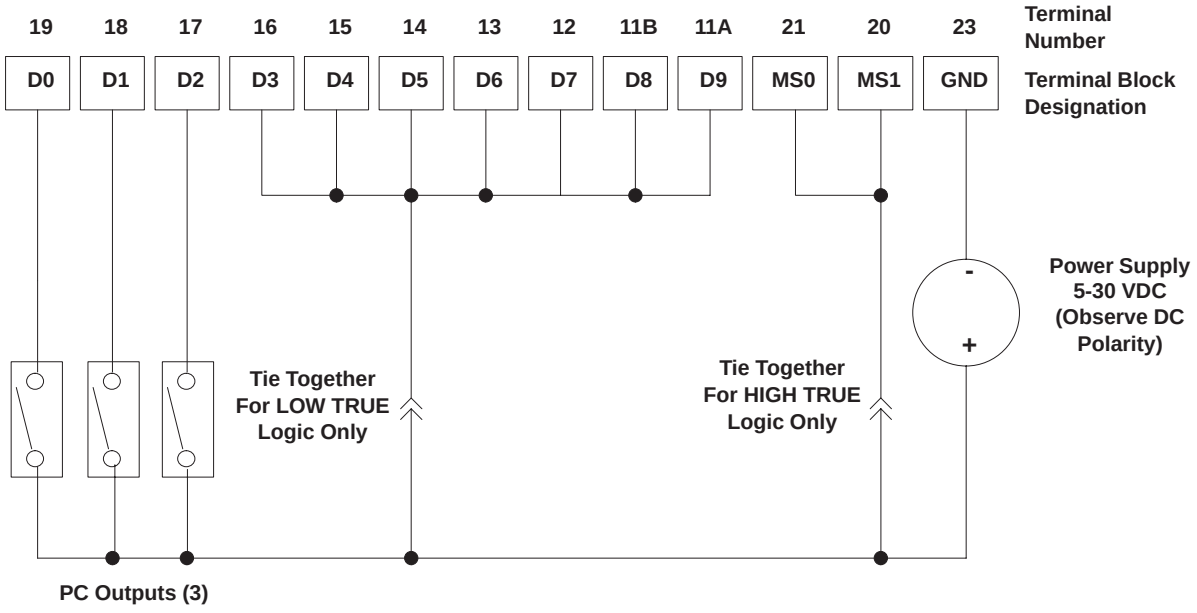
t9: The last message has been triggered, the data lines may remain in their previous state or they may change back to zero.

Reducing Host Output Requirements

In these examples where MS0 AND MS1 are not strobed, the data lines change state quickly, or the DL20 could read erroneous data. The DL20 samples the data and strobe lines at the set scan rate. The lines are always resampled at least twice, depending on the debounce time setting, and whether AC or DC sampling is selected. All readings must agree, or the DL20 will continue to sample them until they do. If the data takes longer to change than the debounce time, then erroneous data could be entered into the DL20.

Figure 7.5 shows how to reduce output requirements even further. Many applications do not require the full 1022 message capability of the DL20. If fewer messages are required, you need only enough data lines to address all the messages. The number of messages addressed by n data lines is 2 to the nth power less one. For example, 4 data lines can address 16 - 1, or 15 messages. A total of seven messages may be displayed by the example shown in Figure 7.5.

Figure 7.5
3 Output Configuration



Chapter 8

Special Functions

Chapter Objectives

This chapter describes the following special functions:

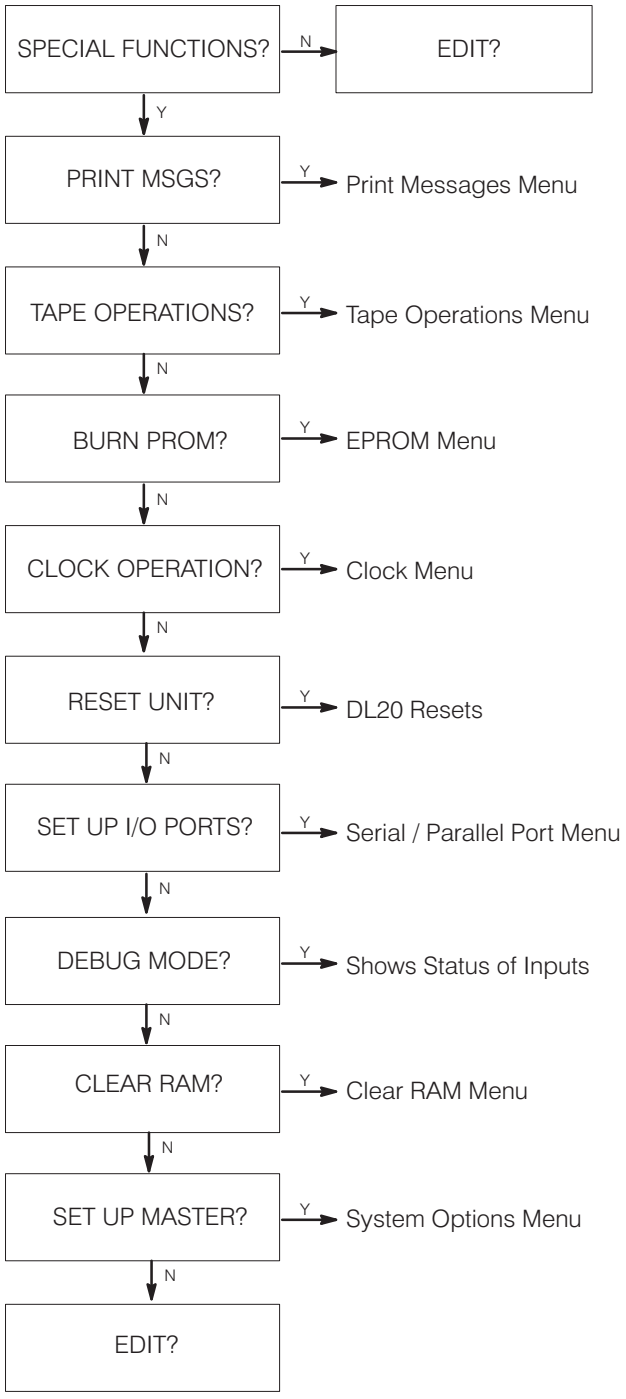
- Send Messages to Printer
- Load Message to Tape①
- Load Messages from Tape①
- Verify Tape Messages①
- Download Message Data as EPROM File①
- Show Time and Date
- Set Time and Date
- Reset and Self Test
- Set Serial Port①
- Set Parallel Port①
- Debug
- Clear All Messages①
- Set Autorun Message①
- Set Background Message①
- Set Master Address①
- Enable Dynamic Chaining①
- Set Relay for Low Battery Indication①
- View All Edit, Menu, and Special Function Prompts on Slave DL10s①
- Enable Flagging of Triggering Errors①

① Not available if messages are stored in EPROM.

Special Functions Menu

Figure 8.1 shows the basic menu structure.

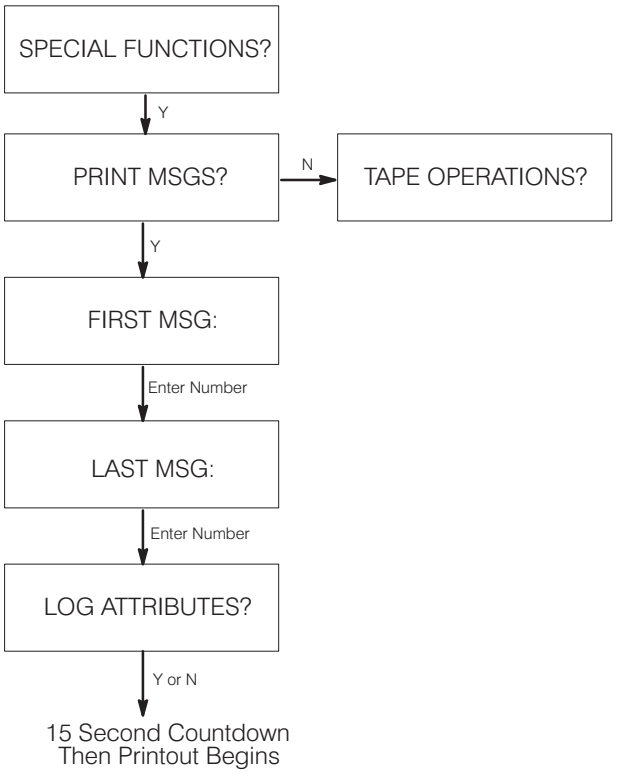
Figure 8.1
Special Functions Menu



Print Messages

Figure 8.2 shows the Print Messages prompts.

Figure 8.2
Print Messages Menu



You need a printer or a terminal to perform this function. You can select to print all or a range of messages. You can also obtain a printout of system attributes.

The first two prompts define the range to be printed. All messages between and including these values are printed in ascending order. Here is an example:

FIRST MSG: 1
LAST MSG: 1022

The first message printed is #1, then #2 through #1022.

Print Messages

The next prompt is:

LOG ATTRIBUTES?

If you answer Yes, the system attribute settings, such as baud rate, parity, port settings, autorun message, master address, and background message are printed followed by a listing of the messages selected and their attributes.

After responding to the LOG ATTRIBUTES? prompt, there is a 15 second delay before printing begins. This allows you to disconnect the terminal and connect the printer.

Note: If you are using keyboards (Catalog No. 2706-NK1 or -NK2), the printer can already be connected to the RS-232 port terminals 6, 7, and 8. If you are using a printer with a keyboard, you do not have to wait, just press the [Esc] key to begin printing.

An example of a message print:

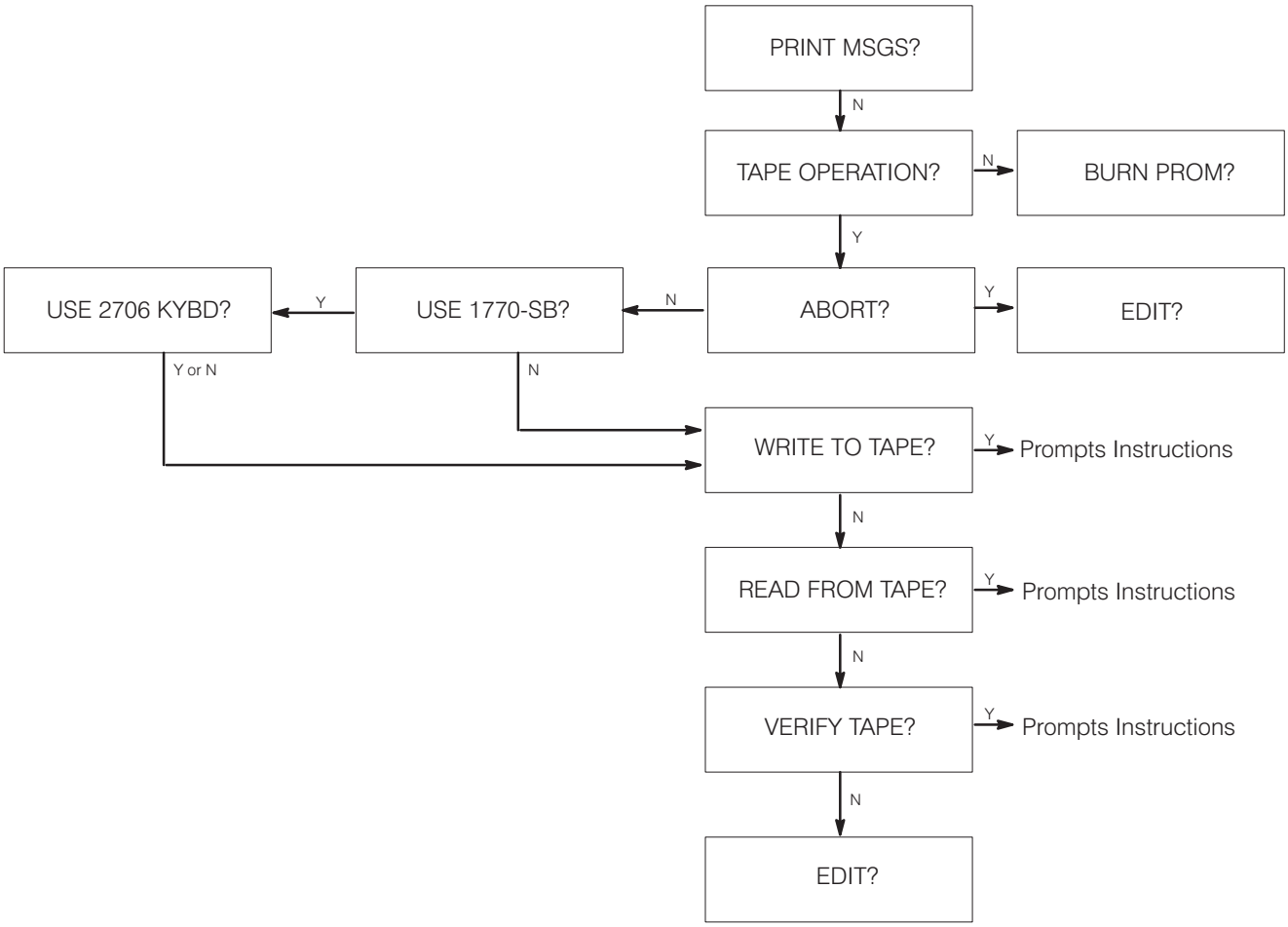
```
message number: 3
uses all lines
line mode msg
to slave: 100
wait time: 3
chained to: 7
msg stacked
Overload Tripped On Heater
```

Lines are automatically formatted for the line length of your printer. Printer line lengths are set using the Set Up I/O Ports special function described later in this chapter.

Tape Operations

Figure 8.3 shows the Tape Operations prompts.

Figure 8.3
Tape Operations Menu



The tape operations are:

- Write to tape
- Read from tape
- Verify tape

You can perform tape operations using one of the following:

- Allen-Bradley Data Recorder (Catalog No. 1770-SA or -SB)
- EPI STR-LINK II or III

Tape Operations

Before using the tape special functions, the recorder must be properly connected and set up. Refer to Appendix B for instructions.

Note: Make sure that the ECHO ALL TO SLAVE special function is not selected.

The first prompt on the Tape Operations menu is:

ABORT?

Answer Yes to return to EDIT?, otherwise you will see this prompt:

USE 1770-SB?

Answer Yes if you are using an Allen-Bradley Data Recorder or No if you are using a STR-LINK II or III Data Recorder. If you are using an Allen-Bradley Data Recorder, you will see this prompt:

USE 2706 KYBD?

Answer Yes if you are using a keyboard (Catalog No. 2706-NK1, -NK2). When using a 2706 keyboard, you must press the return key to acknowledge the prompts. If you answer No, the DL20 will assume that you are using a terminal with an RS-232 port and prompt you to disconnect the terminal.

Writing Tapes

When writing a tape, all message data as well as system attributes are transferred. In addition, special codes for verifying the data are also written to the tape. The verify operation uses these codes to check the integrity of the data.

Reading Tapes

Reading a tape overwrites all messages currently stored in the DL20. You are prompted twice to make sure that important data is not lost:

SURE? N

and then

POSITIVE? N

If there is not adequate memory available or if the tape is read back with an error, the following is displayed:

CANNOT READ TAPE

Verifying Tapes

Always use the verify after writing a tape or if you question the readability of a tape. Verify performs a checksum on the tape data and compares that checksum with the checksum stored on the tape. If the checksums don't match, the tape fails verification. The data does not have to match the data stored in the DL20. The DL20 displays the results of the operation.

Using Data Recorders

Using Allen-Bradley Data Recorders

Note: See Appendix B for setup and operating instructions.

If you are using an Allen-Bradley Data Recorder (Catalog No. 1770-SA or -SB), you will need a special cable (Catalog No. 2706-NC4). This cable has a three position toggle switch (*Record / Off / Play*).

The DL20 prompts you through the tape operation. If you are writing to tape, you have 15 seconds to unplug the programming terminal, plug in the data recorder, press *Record on Tape*, and place the toggle switch to *Record*. The display counts down the time.

Using STR-Link II and III Data Recorders

Note: See Appendix B for setup and operating instructions.

After selecting one of the tape operations, you will be prompted:

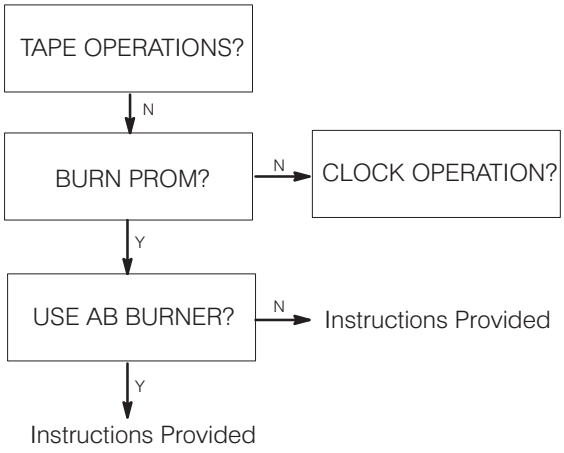
PRESS REMOTE CONTROL
LOAD TAPE - HIT <CR>

Load the tape and press the REMOTE button on the data recorder. Press [Return] and the tape will rewind. After rewinding, the taping begins. The DL20 displays the status of the tape operation. Press [Esc] to return to the main menu.

EPROM Programming

Figure 8.4 shows the Burn EPROM prompts.

Figure 8.4
EPROM Operations Menu



The DL20 can transfer message data and system attributes to an EPROM file. The EPROM file can be used to burn an EPROM. When this EPROM is inserted into a DL20, message and system attributes cannot be modified. Use EPROMs as a reliable method of programming multiple DL20s with identical messages.

Appendix C describes how to transfer the EPROM file. Data is sent as an EPROM file in S record format using the RS-232 port.

Important: EPROMs can only be created from DL20s with 16K memory programmed or less. Make sure the ECHO TO ALL SLAVES special function is not selected when using the EPROM function.

DL20 Operation Using an EPROM

Instructions for installing an EPROM are provided in Chapter 9. After an EPROM is installed in a DL20, it will overwrite the RAM memory. There are some restricted modes when using an EPROM:

- DL20s enter run mode on powerup. You cannot enter edit mode.
- The following special functions are not accessible:

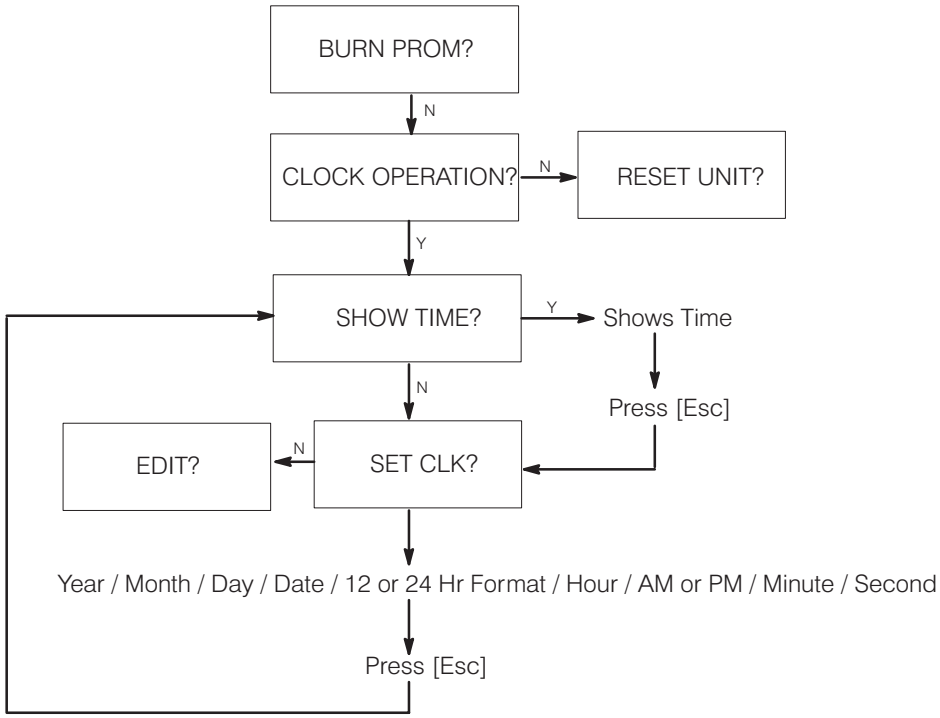
  Tape Operations
  Burn PROM
  Clear RAM
  Set Up Master
  Set Up I/O Ports

Other than these restrictions, the DL20 functions like a DL20 using RAM.

Real Time Clock Functions

Figure 8.5 shows the Clock Operation prompts.

Figure 8.5
Clock Operations Menu



Use the real time clock to time stamp message logs or to display the current time. The Clock Operation special function sets the correct time and date. The time is displayed in the format:

12:33:26 WED FEB 26

Real Time Clock Functions

For example, to set the clock to 1:34 pm you would answer Yes to the SET CLK? prompt. You are prompted to enter a year.

YR:93

Enter the correct year and press [Return]. You are prompted for a month.

MONTH:2

Enter the correct month and press [Return]. You are prompted for a day of the week.

DAY:4

Enter a value 1 through 7 where 1 = Sunday and 7 = Saturday and press [Return]. You are prompted for a format?

24 HOUR FORMAT?

Enter [N] and press [Return] to select 12 hour format. You are prompted for an hour:

HR: 12

Enter [1] [Return] to set the new hour. You will be prompted for AM or PM.

AM? N

Enter [N] and press [Return] to select PM. You are prompted for the minute.

MIN: 59

Enter 34 and press [Return]. You are prompted for the seconds.

SEC: 26

Look at the clock you are using to set the time and enter the current seconds plus an additional 15 seconds. When the time is exactly as set, press [Return]. The DL20 continuously displays the time until you press [Esc].

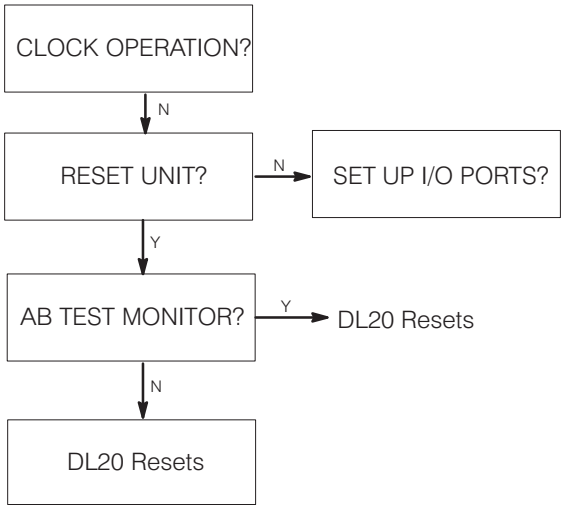
You can also set the clock using special messages #12 and #13 as described in Chapter 5.

Important: Once you begin setting the clock, you must finish. Pressing [Esc] does not exit the function.

Reset Unit Function

The Reset Unit special function has the same effect as turning the power off and then back on. After resetting, the DL20 goes through its normal powerup self test sequence. The reset function provides a convenient method of making a baud rate change take effect. Figure 8.6 illustrates the reset menu.

Figure 8.6
Reset Operations Menu



Resetting the DL20

To reset the DL20, answer Yes to the RESET UNIT? prompt. Press [Return] at the AB TEST MONITOR? prompt to accept the default, No.

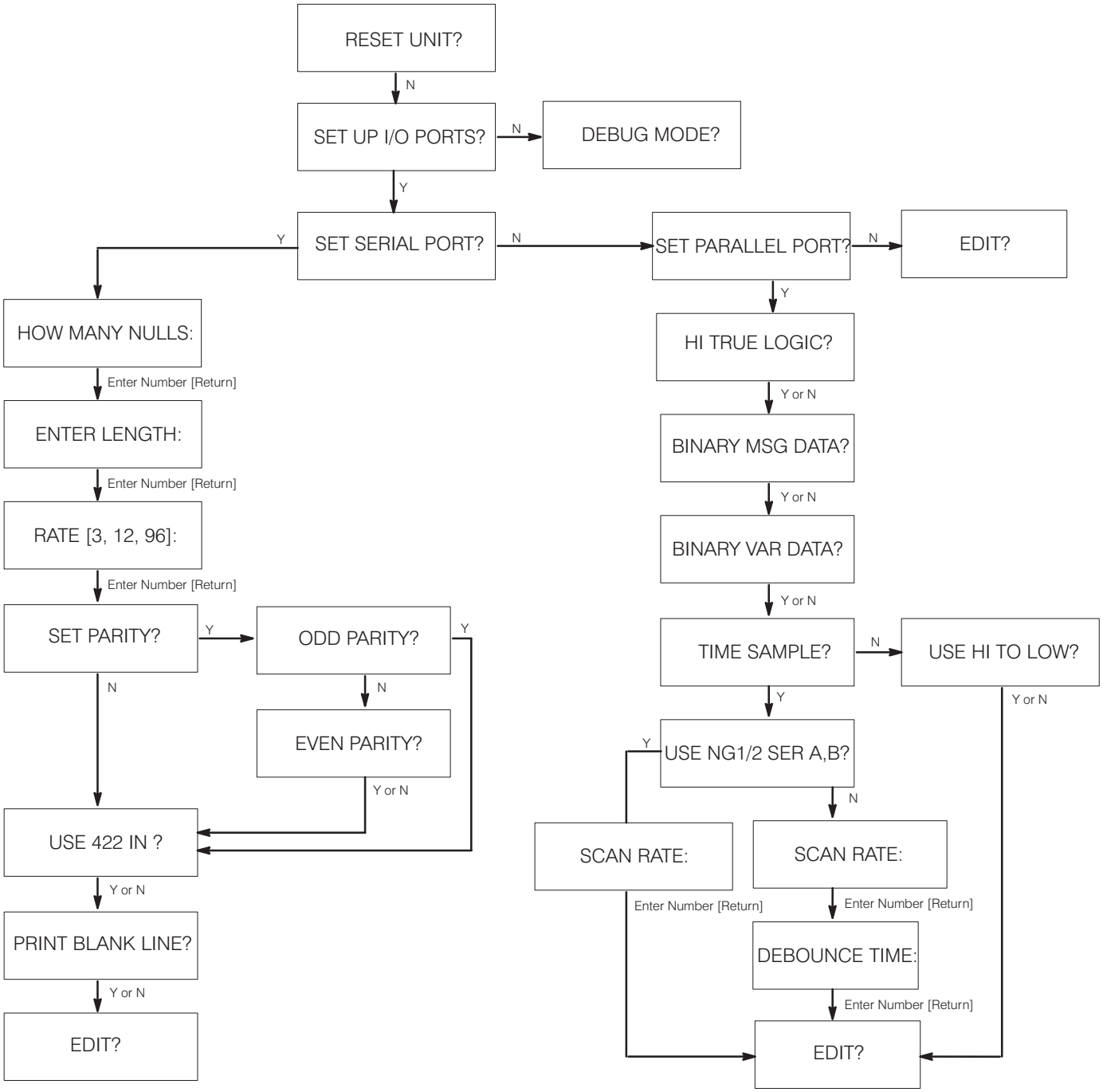
Test Monitor Function

AB Test Monitor provides testing functions when used with special equipment. A test code (not available to user) is required to enter the mode. If this mode is entered inadvertently, make sure 9600 baud is set and press [9] to exit.

Setting Up I/O Port Functions

Figure 8.7 shows the Set Up I/O Ports prompts. Use the Set Up I/O Ports function to configure the parallel or serial port.

Figure 8.7
Set Up I/O Operations Menu



Setting Serial Port

After selecting Set Serial Port, you are prompted for the number of nulls.

HOW MANY NULLS: 4

Nulls are do nothing characters sent to the printer or other serial devices after a carriage return. Slower terminals might require nulls because the carriage takes some time to return to the first print column. Enter 0 or another value and press [Return]. You are prompted for the carriage width of your printer.

ENTER LENGTH: 80

Messages are automatically broken into lines that fit the page. You can adjust the carriage width from 20 to 200 characters. Enter a value and press [Return]. You are prompted for the baud rate.

RATE [3, 12, 96]: 3

Enter the baud rate in hundreds and press [Return]. The baud rate changes the next time power is cycled or the DL20 is reset.

Note: If you change the baud rate, make sure the baud rate of your terminal is changed also.

After entering the baud rate, you are prompted for parity.

SET PARITY? N

The DL20 ignores the parity bit, but is capable of generating it. If you choose to set parity, you will be prompted for odd or even parity. If neither odd or even parity is selected, no parity is set. A message displays showing the parity in effect.

Setting Up I/O Port Functions

Setting Serial Port

After setting parity, you are prompted for the RS-422 port.

USE 422 IN? N

The DL20 RS-422 port can transmit and receive data from other DL20 devices used as addressable masters or slave DL10 / DL50 displays.

- If you want to use the port as an output, answer No. All data output at the RS-232 port will also be transmitted at the RS-422 port. Set the port to output if slave displays or addressable masters are being used.
- If you want to use the port as an input, answer Yes. Data can then be received at the RS-422 port just like the RS-232 port.

After selecting RS-422 port direction, you are prompted for a blank line between messages.

PRINT BLANK LINE?

Answering No reduces the amount of paper used and answering Yes makes the printout easier to read.

Serial Port Default Values
Table 8.A lists the default values for the serial port.

Table 8.A
Serial Port Defaults

Parameter	Setting	Options
Printer Carriage Width	80 Columns	20 - 220 Columns
Number of Nulls	4	0 - 250
Baud Rate	9600	300, 1200, 9600
Parity	None	None, Odd, Even
422 Port Direction	Output	Input or Output
Print Blank Line	Yes	Yes or No

Setting Parallel Port

Data Formats
The parallel port can be configured to accept either binary or BCD data for either message triggers or variable data. This allows you to input variables in a BCD format and triggers in a binary format (allows full 1022 message capability).

Important: Binary data must be selected if the serial port is being used for message triggers.

Data Sampling
Sampling of the data on the parallel port can be either:

- Event driven using an edge triggered strobe (ETS) input
- Time driven using a set sample rate

Logic Levels
The parallel port can be configured to accept either:

- High true logic where:
  On state = 1 = voltage across input
- Low true logic where:
  On state = 0 = no voltage across input

High true logic is the default.

Message Prompts
After selecting Set Parallel Port, you are prompted for the logic level.

```
HI TRUE LOGIC? Y
```

After selecting the logic level, you are prompted for the message data type (binary or BCD).

```
BINARY MSG DATA? N
```

You are then prompted for the variable data type (binary or BCD).

```
BINARY VAR DATA? N
```

After selecting the data types, you are prompted for the type of data sampling (time or event driven).

```
TIME SAMPLE? Y
```

Note: It is recommended that you use time driven sampling unless a non Allen-Bradley programmable controller with word I/O modules is used.

If you select event driven sampling, you are prompted for the trigger transition (high to low or low to high).

```
USE HI TO LOW?
```

Setting Up I/O Port Functions

Setting Parallel Port

If you selected time driven sampling, you are prompted for the type of inputs used.

USE NG1/2 SER A,B?

Answer [Y] for AC sampling if you are using:

- A 2706-NG1 or -NG2 Series A or B Parallel Input Converter

Answer [N] for DC sampling if you are using:

- DC inputs
- Catalog No. 2706-NG1 or -NG2 Series C or later Parallel Input Converter

When specifying time driven samples, you must provide a scan rate.

SCAN RATE: 25

The scan rate is the period between samplings in units of 1/512 seconds (1.95 ms).

- For DC sampling, the range for the scan rate is 4 to 255 (7.8 ms to 500 ms).
- For AC sampling the range for the scan rate is 28 to 255 (54.6 ms to 500 ms).

The DL20 always samples the data more than once. If all of the samples do not agree, the data is ignored and not scanned again until the next sampling period.

If you are using DC inputs or a Parallel Input Converter (Catalog No. 2706-NG1, -NG2 Series C or later), you must provide a debounce time:

DEBOUNCE TIME: 2

During the debounce time, data samples are read every 1/512 second (1.95 ms). The allowable range is from 1 to 255 (1.95 through 500 ms). Increasing the debounce time provides better noise immunity. Decreasing the debounce time provides a faster response. The debounce time should be 3 less than the scan rate.

Parallel Port Default Values

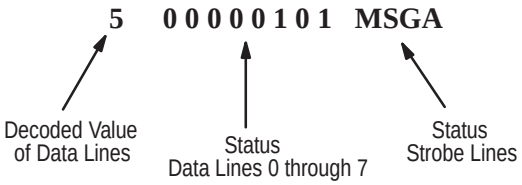
Table 8.B lists the default values for the parallel port.

Table 8.B
Parallel Port Defaults

Parameter	Setting	Range
Logic Level	High True	High or Low True
Message Data Format	Binary	Binary or BCD
Variable Data Format	Binary	Binary or BCD
Sampling Method	Time Driven	Time or Event Driven
Input Type	DC	AC or DC
Scan Rate	25	4-255 (DC Input) 28-255 (AC Input)
Debounce	2	1-255 (DC Input) Not Used for AC

Debug Mode

Use the debug mode to check the status of the parallel port inputs. The debug mode checks the parallel port and displays the status of each line. The debug mode uses the parallel port sampling method specified in the Set Parallel Port function. Remember that if edge triggered strobe is selected, the ETS inputs must be toggled. For example, if D2 and D0 were at a logic 1 (positive logic) and all other data lines were 0, the display would look like this:



Note: If BCD input is selected and an invalid digit (> 9) is entered, an asterisk is displayed.

Use Table 8.C to interpret the strobe line mnemonic name.

Table 8.C
Strobe Line Mnemonics

Status	MS0	MS1
NULL	0	0
LDAT	1	0
HDAT	0	1
MSGA	1	1

Clear RAM

The Clear RAM option allows you to delete all message data in the DL20. Since this data cannot be recovered, you are requested to confirm the operation.

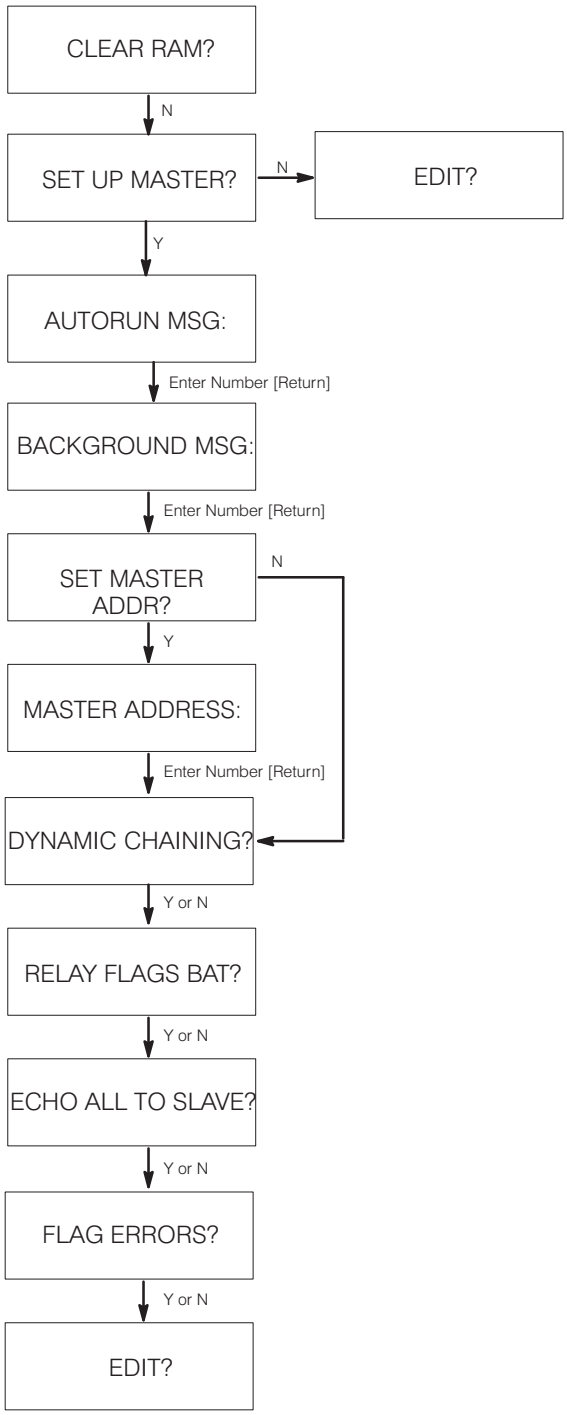
SURE? N
POSITIVE? N

You must answer Yes to both of these prompts to clear the memory.

Set Up Master

Figure 8.8 shows the Set Up Master prompts.

Figure 8.8
Set Up Master Operations Menu



Use the Set Up Master function to:

- Select autorun message
- Select background message
- Set master address
- Enable or disable dynamic chaining
- Set relay to turn on when batteries are low
- Output all prompts and messages to slave displays
- Display error messages

Selecting an Autorun Message

Autorun causes the run mode to be entered on powerup if the DL20 was shut off in the run mode or if a message EPROM is installed. An autorun message can automatically be triggered when the DL20 powers up. The autorun message is the first message displayed after self tests regardless of the message queue or triggers. When setting up the DL20, you will see this prompt:

AUTORUN MSG: 0

The current autorun message number is displayed. You can enter a valid message number between 1 and 1022 and press [Return]. Entering 0 disables the autorun message.

Note: An autorun message can be chained to other messages. The chain is repeated if the last message in the chain has auto repeat selected.

Selecting a Background Message

The background message is displayed when the message trigger queue is empty. Background messages can be the time of day or any other message. The prompt for the background message looks like this:

BACKGROUND MSG: 0

The current background message number is displayed. You can enter a valid message number between 1 and 1022 and press [Return]. Entering 0 disables the background message. A background message can be chained to other messages. The messages automatically repeat until a message is triggered.

Important: The background message or the last message in a background message chain SHOULD NOT have auto repeat enabled. Enabling auto repeat could cause improper operation.

Selecting a Master Address

The addressable master option allows you to connect up to 32 DL20s on a single RS-422 network (up to 100 with inline repeaters). You can trigger messages at one or all of the DL20s by sending a master address with the message number. Refer to Chapter 5 for a description of addressable master protocol.

The prompt for setting a MASTER ADDRESS looks like this:

SET MASTER ADDR? N

If you answer Yes to this prompt, the DL20 will display:

MASTER ADDRESS: 0

You can now enter the master address. Some values are illegal addresses, Table 8.D lists them:

Table 8.D
Illegal Master Addresses

Decimal	Hex	ASCII Character
4	04	EOT (CTRL D)
6	06	ACK (CTRL F)
7	07	BEL (CTRL G)
13	0D	CR
18	12	DC2 (CTRL R)
20	14	DC4 (CTRL T)
22	16	SYN (CTRL V)
43	2B	+
45	2D	-
48 through 57	30 through 39	0 through 9

A master address of 0 disables the master address feature.

Note: Address 127 is recognized by all masters, regardless of the master address. Use this a convenient means of triggering a message to all master displays.

Note: A master address can also be selected using the Addressing Bar (Catalog No. 2706-NF1) at the parallel port. This method does not require a keyboard or terminal and is useful if you are downloading messages from a tape. The Addressing Bar can only be used if communication to the display is through the serial port.

Enable Dynamic Chaining

The prompt for DYNAMIC CHAINING looks like this:

DYNAMIC CHAINING? N

When dynamic chaining is enabled and the DL20 powers up in the run mode, the DL20 can be controlled using special messages #2, #8, and #9. Up to 20 messages may be repeatedly displayed. Chapter 5 provides a description of how to use dynamic chaining.

Turn Relay On When Batteries are Low

The prompt for setting the relay looks like this:

RELAY FLAGS BAT? N

If you answer Yes to this prompt, the relay will be energized whenever the batteries are low and one of the following occurs:

- Special message #4 test battery is triggered in the run mode.
- Power is cycled or the DL20 is reset.
- Internal clock time is 1:01:01

Use the relay to control a remote battery low indicator such as a light.

Note: Batteries are not user-serviceable, the DL20 must be returned for service.

Displaying Prompts on All Slaves

The prompt for selecting the echo function looks like this:

ECHO ALL TO SLAVE?

Answering Yes to this prompt allows you to view menu edit and special function prompts on all slave DL10 displays.

ATTENTION: Do not use the ECHO ALL TO SLAVES special function when sending messages to a printer, tape recorder or computer.

Flagging Errors

The prompt for flagging errors looks like this:

FLAG ERRORS? N

Answering Yes to this prompt enables the flagging of triggering errors for variable stack data and invalid message triggers. If you select this feature and the DL20 cannot locate new data for a message containing variable data, asterisks will be displayed in place of the variable. If FLAG ERRORS is not selected, random numbers will appear in place of the variable data.

If FLAG ERRORS is enabled and a non-existing message is triggered, the following error message is displayed:

ILLEGAL MSG TRIGGER

The error message is displayed until a valid message trigger is received.

If FLAG ERRORS is not enabled, all invalid message triggers are ignored.

Chapter 9

Installation and Maintenance

Chapter Objectives

This chapter describes:

- How to install the DL20
- How to connect external devices
- Replacement fuses

Installation Dimensions

Panel cutout dimensions to install a display are shown in Appendix D. Overall dimensions, optional flush mount dimensions and enclosure dimensions are also shown in Appendix D.

DL20 Installation

Use these steps to mount a DL20 in a custom panel, enclosure, or optional Bulletin 2706 enclosures (Cat. No. 2706-NE1 and 2706-NE2). When properly installed, the display faceplate provides a NEMA Type 12/13 enclosure.

Mounting Procedure

1. Cut and drill the appropriate mounting holes according to the panel cutout dimensions found in Appendix D.

ATTENTION: Displays should not be installed in a panel until all panel cutouts and holes are completed. Metal filings created when cutting and drilling could enter ventilation holes on the display and cause the display to fail.

Mounting hardware (nuts) behind the panel can be eliminated by drilling and tapping the six mounting holes in the panel. Number 10 mounting screws are recommended.

2. Insert the display in the panel cutout and tighten the six faceplate mounting screws.

Wiring Procedures

Refer to Figure 9.1 for wiring terminal descriptions. The procedures described below and the wiring terminal diagram guides you through the wiring process.

1. Connect an 85-264 VAC, 47-63 Hz input voltage source to terminals 26, 27, and 28 of the DL20. The voltage source must have 15 amp (max) short circuit protection.

ATTENTION: Terminal 28 (E. GND) must be connected to a reliable low impedance earth ground to protect the display from electrical noise. This ground connection will also protect personnel from electrical shock if the electronics short to the DL20 case.

Do not turn on power to the display until all other wiring to the serial or parallel ports is completed.

2. Connect communication lines from the host programmable controller or computer as well as peripheral equipment to the serial or parallel ports of the DL20. Refer to Figures 9.2 through 9.12.

ATTENTION: The DL20 has simplex (single direction) communication only. Only use the DL20 for non-critical display applications. Simplex communication provides no ACK/NAK (duplex) verification that messages sent by the programmable controller or computer have been received and displayed.

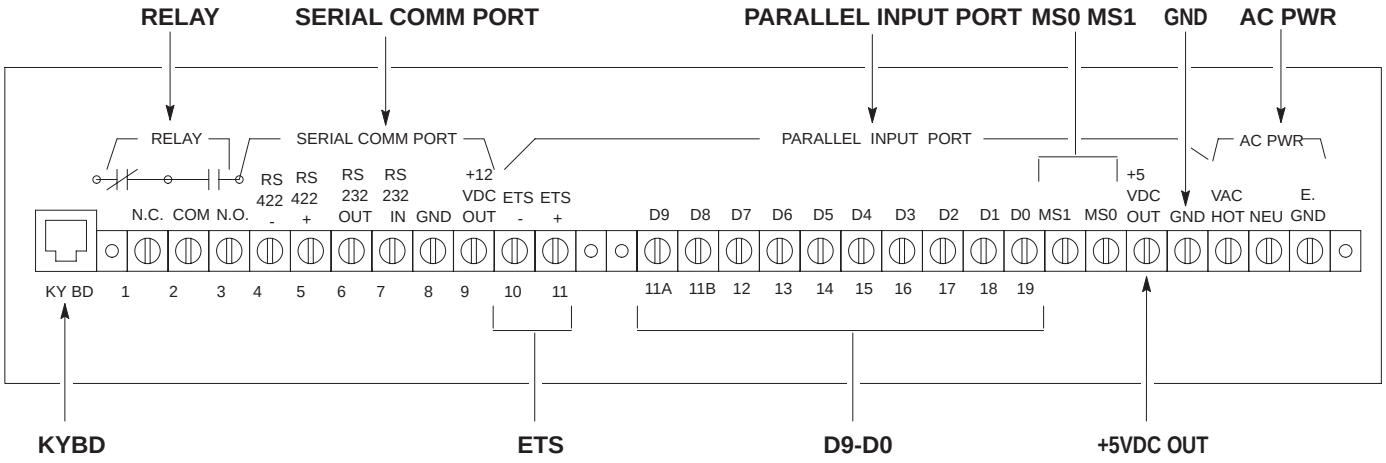
The data format for the RS-232 and RS-422 ports is identical. It is very important that the communication parameters of the DL20 and the connected device are the same.

Baud rate: 300, 1200, or 9600
Data length: 8 bits (including parity if any)
Parity: odd, even, or none
Stop bits: 1

Use terminal 9 on the DL20 (+12 VDC OUT) to tie RS-232 handshake lines high if necessary. Do not use terminal 9 for any other purpose.

DL20 Wiring Terminals

Figure 9.1
DL20 Connection Terminals



RELAY
(Terminals 1, 2, and 3). Relay is switched whenever specified messages are displayed. It can be used, for example, to sound a horn and alert an operator to read the display. The relay contacts are rated for 3 Amperes at 250 VAC or 30 VDC.

KYBD
This input connector connects optional keyboards (Catalog No. 2706-NK1, -NK2).

Important: Only the 2706 keyboards may be plugged into this port. All other programming keyboards must be connected to the SERIAL COMM PORT.

SERIAL COMM PORT
(Terminals 4 thru 9). The DL20 is capable of two communication protocols on the SERIAL COMM PORT.

- RS-422 interface on terminals 4 and 5 is typically used to send data to remote displays or a printer. These devices may be up to 4,000 feet away.
- RS-232 output (terminal 6) can be connected to a printer. RS-232 input (terminal 7) can be used to program the DL20 or trigger messages. The GND connection (terminal 8) doubles as an RS-232 common and a shield ground. The +12 VDC (terminal 9) is for tying RS-232 handshake lines high. DO NOT USE for any other purpose.

  Data recorders, for storing messages on tape, are also connected to the RS-232 port.

PARALLEL INPUT PORT
(Terminals 10 thru 23). The parallel input port accepts both commands and variable data. Refer to Chapter 6 for more information.

MS1 MS0
(Terminals 20 and 21). These lines indicate whether the data on the input lines is a message number or variable data.

ETS
(Terminals 10 and 11). The DL20 can be interfaced to multiplexed word output modules via this input. When programmed properly, an edge or voltage transition on this input causes data on the other parallel input terminals to be read by the DL20.

Note: For use with non Allen-Bradley programmable controllers.

D9-D0
(Terminals 11A thru 19). Binary or BCD data on these lines is interpreted either as a message number or as variable data.

+5VDC OUT
(Terminal 22). Use to apply an ON voltage to any of the parallel input signal terminals (terminals 11A thru 21). Also use with Parallel Input Converters (Catalog No. 2706-NG1, -NG2).

Important: Do not use for any other purpose.

GND
(Terminal 23.) Doubles as both a common reference for terminals 11A thru 22 and a shield ground.

AC PWR
(Terminal 26 thru 28.) The DL20 requires 85-264 VAC, 47-63 Hz. The terminal marked E GND (terminal 28) must be connected to a reliable, low impedance earth ground.

Note: The DL20 uses low voltage signaling on both the parallel and the serial inputs. Any low voltage signals in a control panel are particularly noise susceptible. Although the DL20 contains circuitry to filter noise, reasonable precautions are necessary to ensure proper operation of the DL20. The earth ground terminal (28) of the DL20 must be tied to a good earth ground. Data input lines should be routed away from high energy wiring, transformers, solenoids or coils, and devices known to generate large amounts of EMI or RFI. Transient noise suppressors across solenoids, and coils are often helpful in reducing interference.

Connecting RS-232 Devices

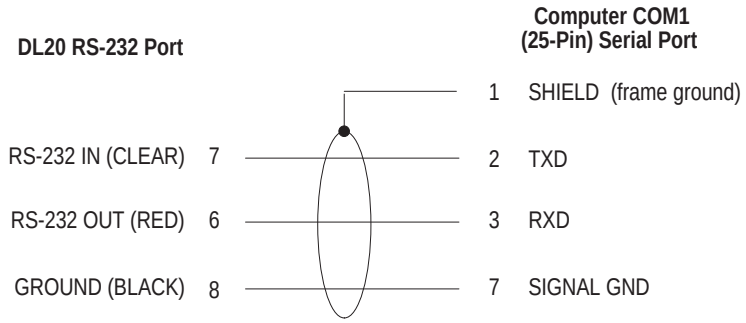
When connecting RS-232 devices refer to the following diagrams.

Note: The shield is connected to common at one end only. It is recommended not to use the shield as a conductor; if necessary, use a separate wire. Some devices may require certain hardware handshaking lines to be asserted. Refer to appropriate documentation.

Connecting IBM XT or Compatible

Figure 9.2 shows how to connect an IBM XT or compatible computer.

Figure 9.2
Connecting IBM XT (25-Pin) or Compatible

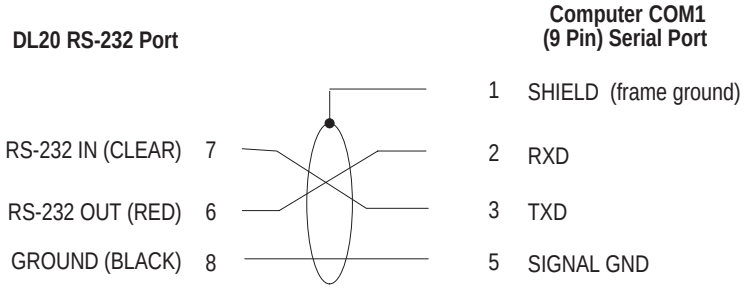


The wire colors refer to the Allen-Bradley 2706-NC1 and -NC2 cables.

Connecting IBM AT or Compatible

Figure 9.3 shows how to connect an IBM AT or compatible computer.

Figure 9.3
Connecting IBM AT (9-Pin) or Compatible



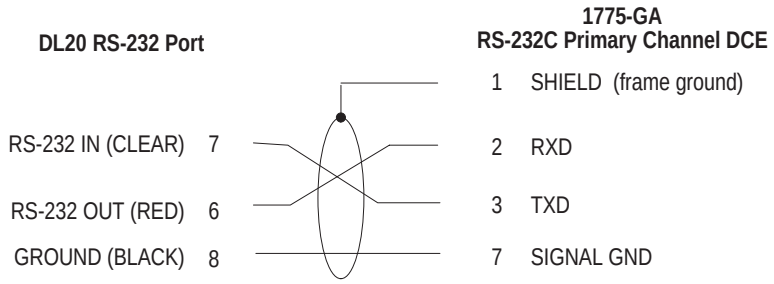
The wire colors refer to the Allen-Bradley 2706-NC1 and -NC2 cables.

Connecting RS-232 Devices

Connecting 1775-GA Peripheral Communications Module

Figure 9.4 shows how to connect an Allen-Bradley Peripheral Communications Module (Catalog No. 1775-GA).

Figure 9.4
Connecting Allen-Bradley 1775-GA Module

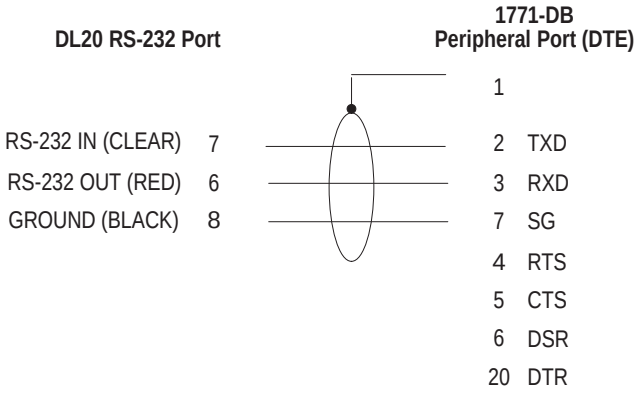


The wire colors refer to the Allen-Bradley 2706-NC1 and -NC2 cables.

Connecting 1771-DB Basic Module

Figure 9.5 shows how to connect an Allen-Bradley BASIC Module (Catalog No. 1771-DB.

Figure 9.5
Connecting Allen-Bradley 1771-DB Basic Module



The wire colors refer to the Allen-Bradley 2706-NC1 and -NC2 cables.

Connecting a Data Recorder

Refer to Appendix B for instructions on how to connect and use a data recorder.

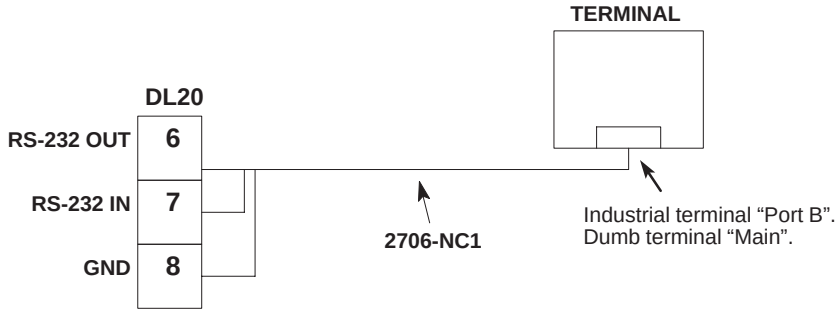
Connecting a Programming Terminal

The optional keyboards (Catalog No. 2706-NK1, -NK2) connect directly to the telephone-type connector (labeled KYBD) on the rear of the DL20. Power should not be applied to the display when connecting or disconnecting the 2706-NK1 or -NK2 keyboards.

To connect an Allen-Bradley Industrial Terminal or most dumb DTE type terminals to the DL20, use a Catalog No. 2706-NC1 programming cable connected as shown in Figure 9.6.

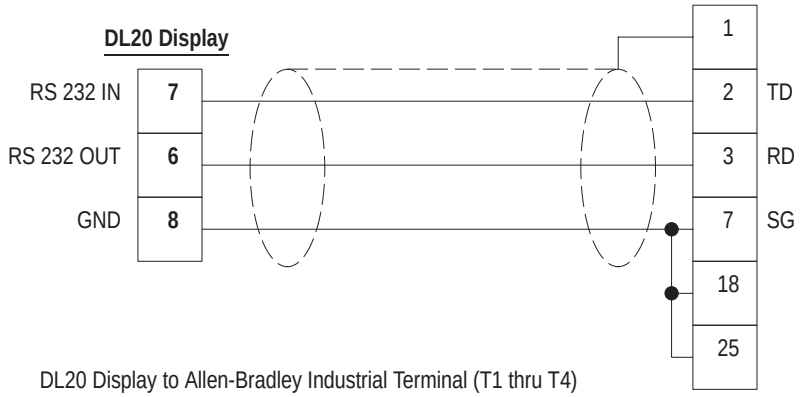
Connecting Allen-Bradley Industrial Terminals (T1-T4)

Figure 9.6
Connecting Allen-Bradley Industrial or Most Dumb DTE Type Terminals



If you want to create your own cable to connect Allen-Bradley Industrial Terminals, refer to Figure 9.7.

Figure 9.7
Cable Diagram (Catalog No. 2706-NC1)

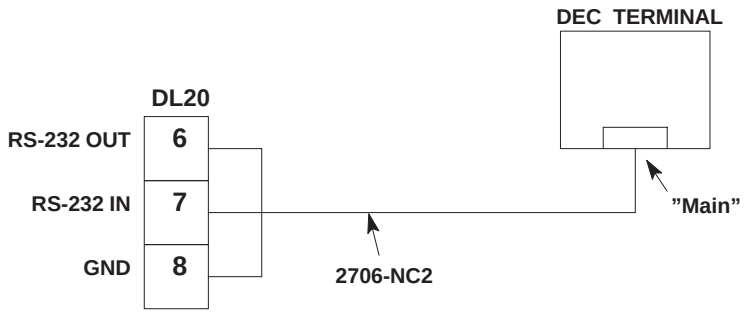


DL20 Display to Allen-Bradley Industrial Terminal (T1 thru T4)
(Catalog No. 2706-NC1)

DEC VT Terminals

To connect a DEC VT Series Terminal to the DL20 use a Catalog No. 2706-NC2 programming cable connected as shown in Figure 9.8.

Figure 9.8
Connecting DEC VT Series Terminals



Connecting RS-422 Devices

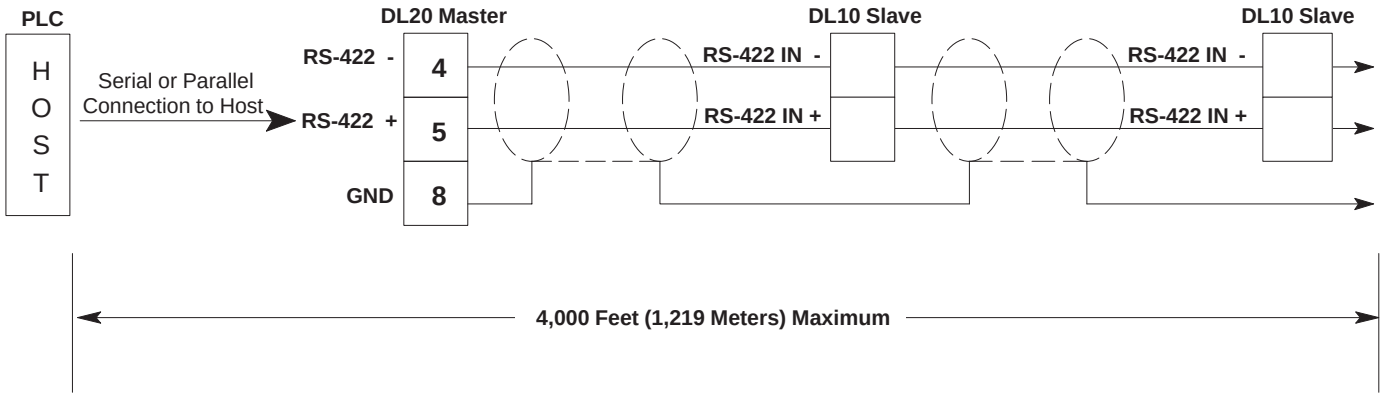
Data at the RS-422 port is interpreted identically to data input on the RS-232 port. The chief advantage of using the RS-422 port is that it has better output characteristics and transmits data in a way that is inherently more noise-immune than RS-232. This enables RS-422 links to be up to 4000 feet long (3/4 miles). Use the RS-422 to connect one or more DL20s to a host controller or to one or more DL10 slave displays.

Connecting DL10 Slaves

Connect DL10 slave displays to either the RS-232 or RS-422 port. Up to 32 DL10 slaves can be connected to the RS-422 output port at a maximum distance of 4,000 feet without the use of in-line amplification. Using in-line RS-422 amplification up to 100 separately addressable slave DL10s can be connected to the RS-422 output of the DL20 out to a maximum distance of 4,000 feet (1219 meters).

Connect the slaves to the RS-422 output of the DL20 using a 100% shielded twisted pair cable with drain wire. Slave address and baud rates are selected by a DIP switch on the DL10. The DL10 baud rate must match that of the DL20.

Figure 9.9
Connecting DL10 Slaves



Note: It's possible to use RS-232 output to one slave, however the distance limitation is 50 feet.

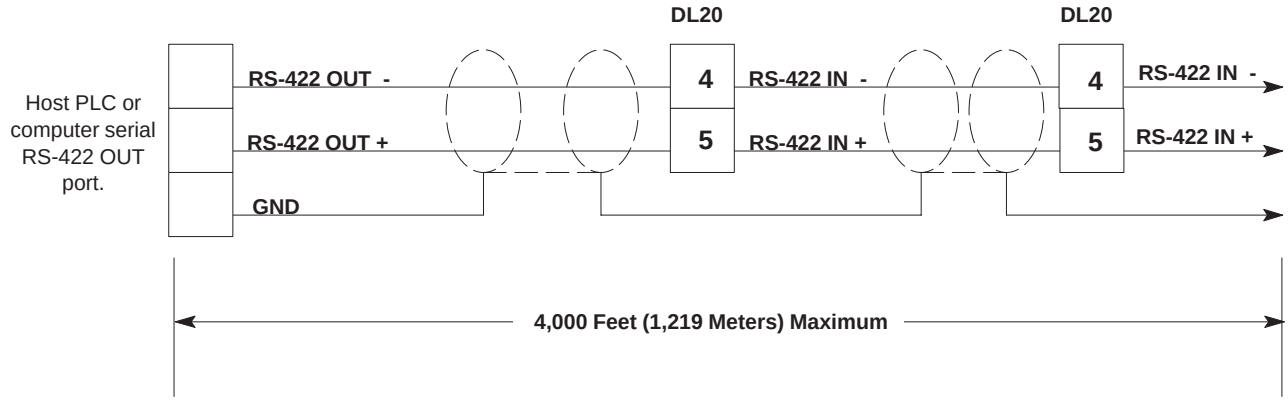
Connecting Addressable DL20 Masters

Connect up to 32 individually addressable DL20s to an RS-422 port of a PLC or computer. The connection is made using a 100% shielded twisted pair cable with drain wire.

All DL20s must have their RS-422 port set for input, and their baud rates set identically. Using in-line amplifiers, up to 100 addressable masters can be placed on one RS-422 network up to 4,000 feet (1219 meters) in length.

Figure 9.10 illustrates how to connect addressable masters.

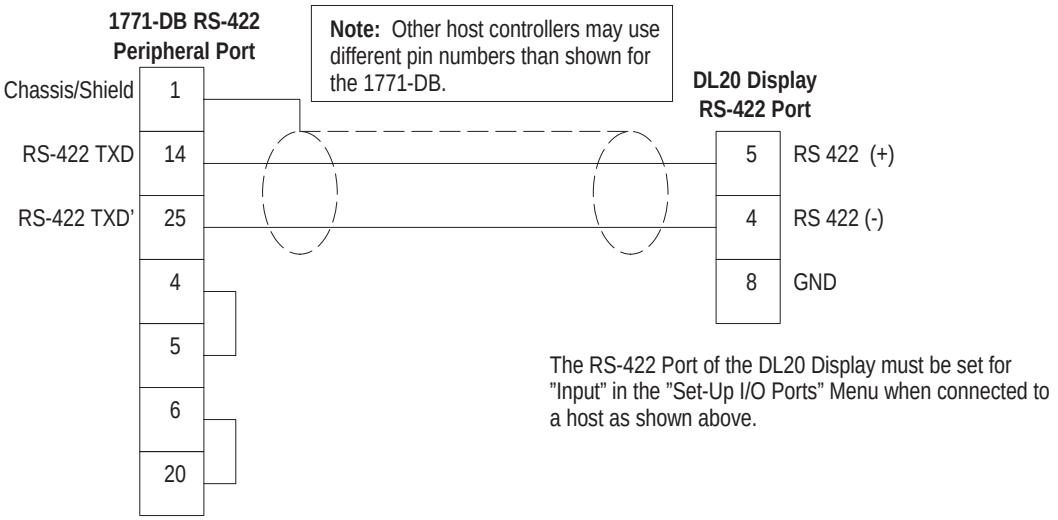
Figure 9.10
Connecting Addressable DL20 Masters



Connecting 1771-DB BASIC Module to a Single DL20

Figure 9.11 shows how to connect an Allen-Bradley BASIC Module (Catalog No. 1771-DB) to a single DL20.

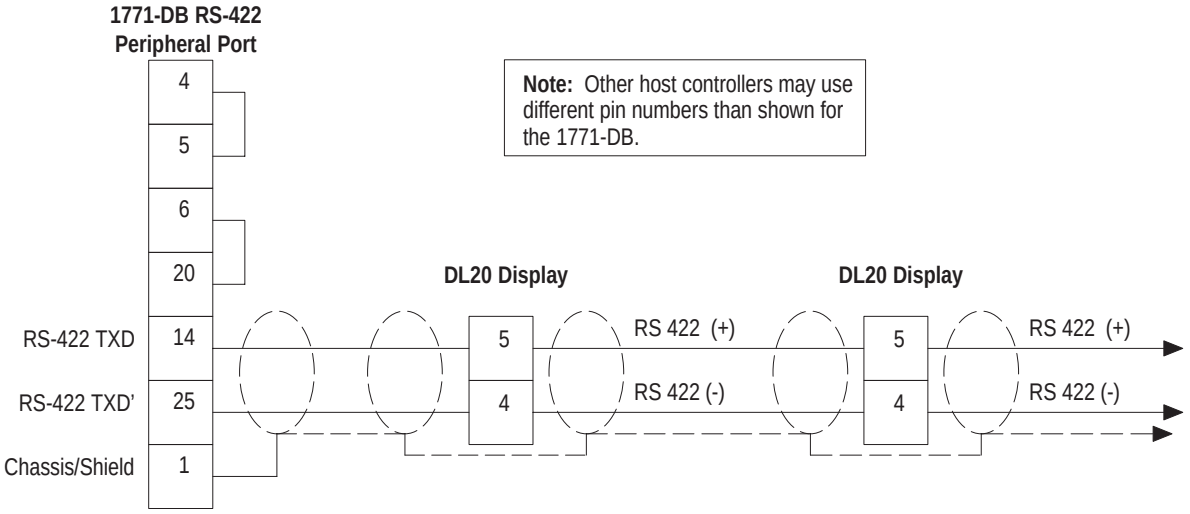
Figure 9.11
Connecting a DL20 to Allen-Bradley 1771-DB Basic Module



Connecting 1771-DB BASIC Module to Multiple DL20s

Figure 9.12 shows how to connect an Allen-Bradley BASIC Module (Catalog No. 1771-DB) to multiple DL20s.

Figure 9.12
Connecting DL20s to Allen-Bradley 1771-DB Basic Module



Replacing Fuses

If it is necessary to replace the internal fuse of the DL20, first remove power to the display. Remove the fuse. Replacement fuses are listed below:

1.25A, 250 Volt AC, Type MDL
1.5A, 250 Volt AC, Type GMC

Chapter 10

Specifications

Display

Character Height
- 1 Line Display . . . . . 0.59 inches (15.1 mm)
- 2 Line Display: . . . . . 0.44 inches (11.3 mm)
- 4 Line Display . . . . . 0.49 inches (12.5 mm)

Character Set: . . . . . Uppercase, lowercase, and symbols

Characters per Line: 20

Character Type: . . . . . Vacuum fluorescent, dot matrix

Approximate Viewing Distance
- 1 Line Display: . . . . . 30 feet (9.1 meters)
- 2 Line Display: . . . . . 25 feet (7.6 meters)
- 4 Line Display: . . . . . 25 feet (7.6 meters)

Input Power

Input Power:
- 4 Line Display . . . . . 85-264 VAC, 45 VA max at 85 VAC
- 1 & 2 Line Display . . . . . 85-264 VAC, 30 VA max at 85 VAC

Fuse Type: . . . . . 1.25A, 250 VAC, Type MDL
1.5A, 250 VAC, Type GMC

Parallel Port

Typical Input Resistance: 10KΩ
2.4 mA/Terminal @ 24VDC

Voltage Range: . . . . . 5 to 30 VDC
110/120 VAC using Input Converter

Logic Levels (High True Logic)
- 0 or OFF . . . . . 0 to 1.5 VDC
- Indeterminate . . . . . 1.5 to 3.5 VDC
- 1 or ON . . . . . 3.5 to 30 VDC

Terminals . . . . . 10 data input / 2 strobe inputs

+5 VDC Out . . . . . 15 mA maximum

ETS Input

Logic Levels (Low True Logic)
- 0 or OFF . . . . . 0 to 1.5 VDC
- Indeterminate . . . . . 1.5 to 4.0 VDC
- 1 or ON . . . . . 4.0 to 15.0 VDC

Serial Port

Standards . . . . . RS-232 / RS-422
- Baud Rate . . . . . 300 / 1200 / 9600
- Parity (send only) . . . . . Odd / Even / None
- Data Length . . . . . 7 data bits (+ parity)
  8 data bits (no parity)
- +12 V Output . . . . . 3 mA maximum

Environmental

Operating Temperature: . . . . . 32 to 140°F (0 to 60°C)
Storage Temperature: . . . . . -40 to 185°F (-40 to 85°C)
Humidity Rating: . . . . . 5 to 95% (no condensation)
NEMA Rating: . . . . . UL Listed for Type 12/13 and designed but not UL Listed for Type 4

Shipping Weights
- 1 Line Display . . . . . 9.5 pounds (4.32 kg)
- 2 Line Display . . . . . 9.5 pounds (4.32 kg)
- 4 Line Display . . . . . 12 pounds (5.4 kg)

Appendix A

ASCII Character Set

Dec.	Oct.	Hex	Char	Control Code	Dec.	Oct.	Hex	Char	Dec.	Oct.	Hex	Char	Dec.	Oct.	Hex	Char
0	000	00	NUL	CTRL @	32	040	20	SP	64	100	40	@	96	140	60	\
1	001	01	SOH	CTRL A	33	041	21	!	65	101	41	A	97	141	61	a
2	002	02	STX	CTRL B	34	042	22	"	66	102	42	B	98	142	62	b
3	003	03	ETX	CTRL C	35	043	23	#	67	103	43	C	99	143	63	c
4	004	04	EOT	CTRL D	36	044	24	$	68	104	44	D	100	144	64	d
5	005	05	ENQ	CTRL E	37	045	25	%	69	105	45	E	101	145	65	e
6	006	06	ACK	CTRL F	38	046	26	&	70	106	46	F	102	146	66	f
7	007	07	BEL	CTRL G	39	047	27	'	71	107	47	G	103	147	67	g
8	010	08	BS	CTRL H	40	050	28	(	72	110	48	H	104	150	68	h
9	011	09	HT	CTRL I	41	051	29	)	73	111	49	I	105	151	69	i
10	012	0A	LF	CTRL J	42	052	2A	*	74	112	4A	J	106	152	6A	j
11	013	0B	VT	CTRL K	43	053	2B	+	75	113	4B	K	107	153	6B	k
12	014	0C	FF	CTRL L	44	054	2C	,	76	114	4C	L	108	154	6C	l
13	015	0D	CR	CTRL M	45	055	2D	-	77	115	4D	M	109	155	6D	m
14	016	0E	SO	CTRL N	46	056	2E	.	78	116	4E	N	110	156	6E	n
15	017	0F	SI	CTRL O	47	057	2F	/	79	117	4F	O	111	157	6F	o
16	020	10	DLE	CTRL P	48	060	30	0	80	120	50	P	112	160	70	p
17	021	11	DC1	CTRL Q	49	061	31	1	81	121	51	Q	113	161	71	q
18	022	12	DC2	CTRL R	50	062	32	2	82	122	52	R	114	162	72	r
19	023	13	DC3	CTRL S	51	063	33	3	83	123	53	S	115	163	73	s
20	024	14	DC4	CTRL T	52	064	34	4	84	124	54	T	116	164	74	t
21	025	15	NAK	CTRL U	53	065	35	5	85	125	55	U	117	165	75	u
22	026	16	SYN	CTRL V	54	066	36	6	86	126	56	V	118	166	76	v
23	027	17	ETB	CTRL W	55	067	37	7	87	127	57	W	119	167	77	w
24	030	18	CAN	CTRL X	56	070	38	8	88	130	58	X	120	170	78	x
25	031	19	EM	CTRL Y	57	071	39	9	89	131	59	Y	121	171	79	y
26	032	1A	SUB	CTRL Z	58	072	3A	:	90	132	5A	Z	122	172	7A	z
27	033	1B	ESC	CTRL [	59	073	3B	;	91	133	5B	[	123	173	7B	{
28	034	1C	FS	CTRL \	60	074	3C	<	92	134	5C	\	124	174	7C	|
29	035	1D	GS	CTRL]	61	075	3D	=	93	135	5D	]	125	175	7D	}
30	036	1E	RS	CTRL ^	62	076	3E	>	94	136	5E	^	126	176	7E	~
31	037	1F	US	CTRL _	63	077	3F	?	95	137	5F	_	127	177	7F	DEL

Appendix B

Tape Recorder Setup

Overview

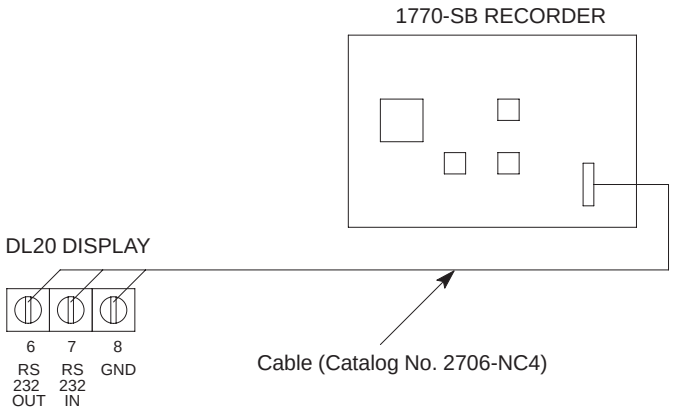
This appendix describes how to upload and download messages using a data recorder in various configurations including:

- Allen-Bradley Data Recorder (Catalog No. 1770-SB) with keyboard (Catalog No. 2706-NK1 or -NK2)
- Allen-Bradley Data Recorder (Catalog No. 1770-SB) with Allen-Bradley Industrial Terminal
- Allen-Bradley Data Recorder (Catalog No. 1770-SA) with keyboard (Catalog No. 2706-NK1 or -NK2)
- Allen-Bradley Data Recorder (Catalog No. 1770-SA) with Allen-Bradley Industrial Terminal
- EPI STR-LINK II or III with a dumb terminal.

1770-SB Data Recorder Using a Keyboard

Refer to Figure B.1 when using a 1770-SB Data Recorder with optional keyboard (Catalog No. 2706-NK1 or -NK2).

Figure B.1
Data Recorder (Catalog No. 1770-SB) with Keyboard (2706-NK1 or -NK2)



1. Connect the 2706-NC4 cable to terminals 6,7 and 8 of the DL20 as shown. DO NOT plug the cable into the 1770-SB at this time. Set toggle switch on cable connector to the OFF or middle position.

2. Set baud rate of 1770-SB and the DL20 to 1200.

Note: For the new baud rate to be in effect at the DL20, the power must be cycled, or the DL20 must be reset. Also, the keyboard baud rate must match the DL20 selection. (See DIP switch settings, Appendix E.)

Important: ECHO ALL TO SLAVES under the special functions must be **OFF** for Tape Operations to work properly.

3. Set Track Select of the 1770-SB to CONT.

4. Select USE AB 1770-SB in the Tape Operations special function.

5. Select desired function: WRITE TO TAPE, READ FROM TAPE or VERIFY TAPE.

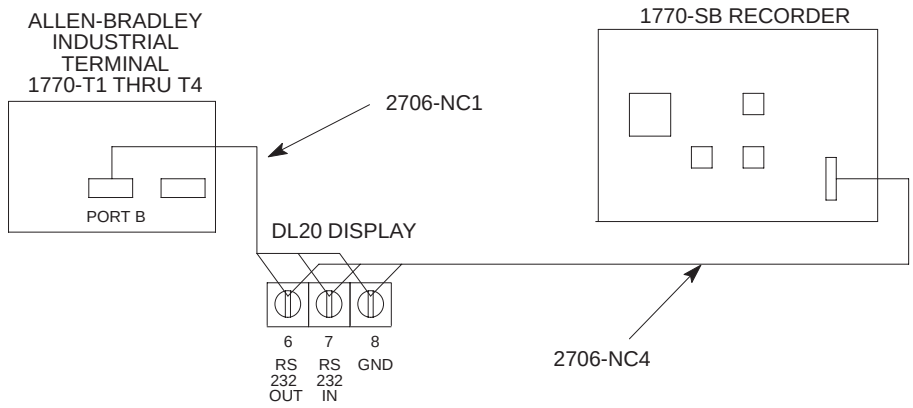
6. Follow the instructions provided by the DL20. The following is an example of WRITE TO TAPE.

DL20 Prompt	Action Required
WRITE TO TAPE?	Type [Y] [Return] on the keyboard.
HIT STOP/REWIND	Press Stop/Rewind on the data recorder and wait for the tape to rewind.
PLUG IN 1770-SB	Plug the cable (Catalog No. 2706-NC4) into the CONTROLLER EQUIPMENT port on the data recorder.
PRESS RECORD ON TAPE	Press Record on Tape button on the data recorder.
PUT TOGGLE ON RECORD	Put toggle switch on cable (Catalog No. 2706-NC4) to the REC position.
TIME LEFT: 15 (counts down to 1, then additional 10 second delay)	Wait until timer counts down or press [Esc]. An additional 10 second pause occurs.
ADDR: (counts up as data is output)	Wait while data is being transferred.
PUT TOGGLE ON OFF	Put toggle switch on cable (Catalog No. 2706-NC4) to the OFF (middle) position.
HIT STOP / REWIND	Press Stop/Rewind button on the data recorder.
UNPLUG 1770-SB	Unplug the cable (2706-NC4) from the data recorder.
VERIFY TAPE?	Answer [Y] and follow the prompts, press [N] to return to edit.

1770-SB Data Recorder Using an Industrial Terminal

Refer to Figure B.2 when using a 1770-SB Data Recorder with an Allen-Bradley Industrial Terminal or other dumb terminal.

Figure B.2
Data Recorder (Catalog No. 1770-SB) with Industrial Terminal



ATTENTION: Do not plug in the data recorder end of the cable (Catalog No. 2706-NC4) until the Industrial Terminal cable is unplugged. If both cables are plugged in at the same time, the DL20 may be damaged.

1. Connect the 2706-NC4 cable to the DL20 as shown. Do not connect the other end of the 2706-NC4 Cable to the 1770-SB until the Industrial Terminal is disconnected later in this procedure. Damage to the DL20 could result. Set toggle switch on cable connector to OFF or middle position.

2. Using the Industrial Terminal, set baud rate of 1770-SB and the DL20 to 1200.

Note: For the new baud rate to take effect for the DL20, the power must be cycled, or the DL20 must be reset. Also, the Industrial Terminal baud rate must match the DL20 selection.

Note: ECHO ALL TO SLAVES under the special functions must be **OFF** for Tape Operations to work properly.

3. Set Track Select of the 1770-SB to Track 1 or 2.

4. Using the Industrial Terminal, select USE AB 1770-SB under Tape Operations special function.

5. Select the desired function: WRITE TO TAPE, READ FROM TAPE or VERIFY TAPE.

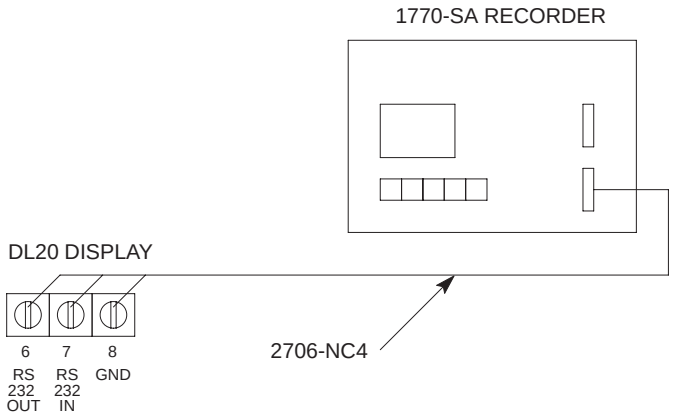
6. Follow the instructions given by the DL20. The following is an example of WRITE TO TAPE.

DL20 Prompt	Action Required
WRITE TO TAPE?	Type [Y] [Return] on the terminal.
UNPLUG TERMINAL	Unplug the cable (2706-NC1) from the Industrial Terminal.
HIT STOP/REWIND	Press Stop/Rewind on the data recorder and wait for the tape to rewind.
PLUG IN 1770-SB	Plug the cable (Catalog No. 2706-NC4) into the CONTROLLER EQUIPMENT port on the data recorder.
PRESS RECORD ON TAPE	Press Record on Tape button on the data recorder.
PUT TOGGLE ON RECORD	Put toggle switch on cable (Catalog No. 2706-NC4) to the REC position.
TIME LEFT: 15 (counts down to 1, then additional 10 second delay)	Wait until timer counts down. An additional 10 second pause will occurs.
ADDR: (counts up as data is output)	Wait while data is being transferred.
PUT TOGGLE ON OFF	Put toggle switch on cable (Catalog No. 2706-NC4) to the OFF (middle) position.
HIT STOP / REWIND	Press Stop/Rewind button on the data recorder.
UNPLUG 1770-SB	Unplug the cable (2706-NC4) from the data recorder.
PLUG IN TERMINAL	Reconnect the cable (Catalog No. 2706-NC1) to the Industrial Terminal port B.
VERIFY TAPE?	Answer [Y] and follow the prompts, press [N] to return to edit.

1770-SA Data Recorder Using a Keyboard

Refer to Figure B.3 when using a 1770-SA Data Recorder with optional keyboards (Catalog No. 2706-NK1 or -NK2).

Figure B.3
Data Recorder (Catalog No. 1770-SA) with Keyboard (2706-NK1 or -NK2)



1. Connect the 2706-NC4 cable to terminals 6, 7 and 8 of the DL20 as shown. DO NOT connect to the 1770-SA at this time. Set toggle switch on cable connect to the OFF or middle position.

2. Set baud rate of DL20 to 1200 baud.

Note: In order for the new baud rate to be in effect, the power must be cycled at the DL20, or the DL20 must be reset. Also, the keyboard baud rate must match the DL20 selection. (See DIP switch settings, Appendix E.)

Note: ECHO ALL TO SLAVES under the special functions must be **OFF** for Tape Operations to work properly.

3. Using the 2706-NK1 or NK2 Keyboard, select USE A-B 1770-SB from Tape Operations special function.

4. Select desired function: WRITE TO TAPE, READ FROM TAPE or VERIFY TAPE.

5. Follow the instructions provided by the DL20.

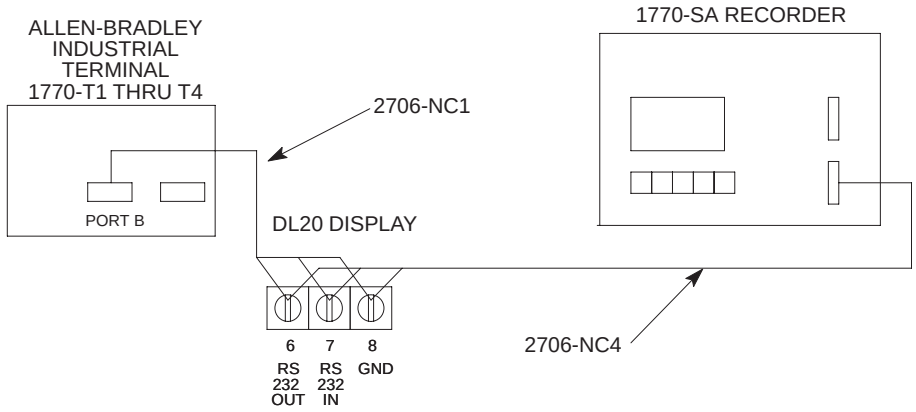
The following is an example of WRITE TO TAPE.

DL20 Prompt	Action Required
WRITE TO TAPE?	Type [Y] [Return] on the keyboard.
HIT STOP/REWIND	Press Stop/Rewind on the data recorder and wait for the tape to rewind.
PLUG IN 1770-SB	Plug the cable (Catalog No. 2706-NC4) into the OTHER PRODUCTS port on the data recorder.
PRESS RECORD ON TAPE	Press Record on Tape button on the data recorder.
PUT TOGGLE ON RECORD	Put toggle switch on cable (Catalog No. 2706-NC4) to the REC position.
TIME LEFT: 15 (counts down to 1, then additional 10 second delay)	Wait until timer counts down or press [Esc]. An additional 10 second pause occurs.
ADDR: (counts up as data is output)	Wait while data is being transferred.
PUT TOGGLE ON OFF	Put toggle switch on cable (Catalog No. 2706-NC4) to the OFF (middle) position.
HIT STOP / REWIND	Press Stop/Rewind button on the data recorder.
UNPLUG THE 1770-SB	Unplug the cable (2706-NC4) from the data recorder.
VERIFY TAPE?	Answer [Y] and follow the prompts, press [N] to return to edit.

1770-SA Data Recorder Using an Industrial Terminal

Refer to Figure B.4 when using a 1770-SA Data Recorder with an Allen-Bradley Industrial Terminal or other dumb terminal.

Figure B.4
Data Recorder (Catalog No. 1770-SA) with Industrial Terminal



ATTENTION: Do not plug in the data recorder end of the cable (Catalog No. 2706-NC4) until the Industrial Terminal Cable is unplugged. If both cables are plugged in at the same time, the DL20 may be damaged.

1. Connect the 2706-NC4 cable to the DL20, as shown. Do not connect the other end of the 2706-NC4 Cable to the 1770-SA until the Industrial Terminal is disconnected later in this procedure. Damage to the DL20 could result. Set toggle switch on cable to the OFF (middle) position.

2. Set baud rate of DL20 to 1200 Baud.

Note: In order for the new baud rate to be in effect, the power must be cycled at the DL20, or the DL20 must be reset. Also, the Industrial Terminal baud rate must match the DL20 selection.

Note: ECHO ALL TO SLAVES under the special functions must be **OFF** for Tape Operations to work properly.

3. Using the industrial terminal, select Tape Operations special function.

4. Select USE AB 1770-SB from Tape Operations menu.

5. Select the desired function: WRITE TO TAPE, READ FROM TAPE or VERIFY TAPE.

6. Follow the instructions given by the DL20.

The following is an example of WRITE TO TAPE.

DL20 Prompt	Action Required
WRITE TO TAPE?	Type [Y] [Return] on the terminal.
UNPLUG TERMINAL	Unplug the cable (2706-NC1) from the Industrial Terminal.
HIT STOP/REWIND	Press Stop/Rewind on the data recorder and wait for the tape to rewind.
PLUG IN 1770-SB	Plug the cable (Catalog No. 2706-NC4) into the OTHER PRODUCTS port on the data recorder.
PRESS RECORD ON TAPE	Press Record on Tape button on the data recorder.
PUT TOGGLE ON RECORD	Put toggle switch on cable (Catalog No. 2706-NC4) to the REC position.
TIME LEFT: 15 (counts down to 1, then additional 10 second delay)	Wait until timer counts down. An additional 10 second pause occurs.
ADDR: (counts up as data is output)	Wait while data is being transferred.
PUT TOGGLE ON OFF	Put toggle switch on cable (Catalog No. 2706-NC4) to the OFF (middle) position.
HIT STOP / REWIND	Press Stop/Rewind button on the data recorder.
UNPLUG 1770-SB	Unplug the cable (2706-NC4) from the data recorder.
PLUG IN TERMINAL	Reconnect the cable (Catalog No. 2706-NC1) to the Industrial Terminal port B.
VERIFY TAPE?	Answer [Y] and follow the prompts, press [N] to return to edit.

EPI STR-LINK Data Recorders

The EPI STR-LINK Recorders can be used as as storage device for DL20 messages. There are DIP switches inside the STR-LINK II and III which configure its operation. Refer to the user manual for the data recorder to access DIP switches. The DIP switches must be set as follows:

STR-LINK II Switch Settings

I/O Board DIP Switch

Switch 1 Open
Switch 2 Open
Switch 3 Open
Switch 4 Closed

Tape Interface Board DIP Switch

Switch 1 Open
Switch 2 Closed
Switch 3 Open
Switch 4 Open
Switch 5 Open
Switch 6 Closed
Switch 7 Closed

The front panel switches must be set as follows:

Baud Rate	1200
I/O Select	RS-232
Stop Bits	1
Mode Select	Full Duplex

STR-LINK III Switch Settings

10 Position DIP Switch

Switch 1 Left
Switch 2 Left
Switch 3 Left
Switch 4 Right
Switch 5 Left
Switch 6 Right
Switch 7 Right
Switch 8 Right
Switch 9 Left
Switch 10 Right

The front panel switches must be set as follows:

Track Select	Both
Baud Rate	1200

DL20 Configuration

Make sure that the DL20 is set for:

Baud Rate =	1200
Parity =	None

Connecting EPI STR-LINK Recorders

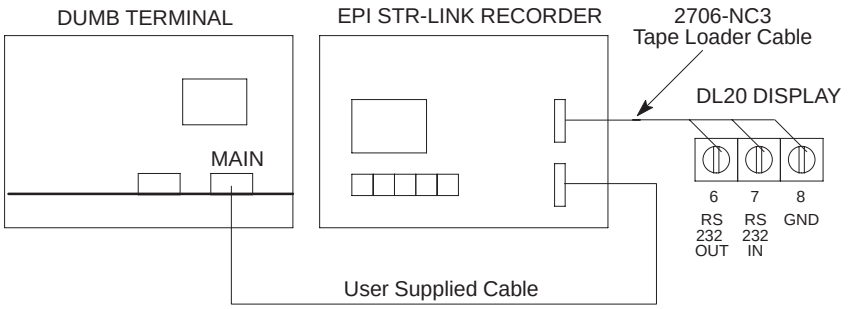
Figure B.5 illustrates the connections. Connect the STR-LINK Recorder (DATA SET INTERFACE connector) to the DL20 RS-232 port using the Tape Loader Cable (Catalog No. 2706-NC3) as shown.

If you are using a keyboard (Catalog No. 2706-NK1 or -NK2), plug the keyboard into the rear of the DL20. No other connections are required.

If you are using an Allen-Bradley Industrial Terminal (T1 through T4), use cable (Catalog No. 2706-NC5). This cable connects to the DATA TERMINAL INTERFACE connector on the data recorder and Port B on the industrial terminal.

If you are using another type of dumb terminal, you must construct your own cable.

Figure B.5
EPI STR-LINK Data Recorder



Operating Procedures

The DL20 prompts you through the procedure. If necessary, refer to the previous Allen-Bradley Data Recorder procedures for examples.

Appendix C

Creating EPROM Files

Overview

This section describes how to transfer an application to a personal computer in an EPROM file format. Refer to Chapter 8, Special Functions, for the BURN PROM menu description.

File Transfer Programs

The BURN PROM function converts the application to a Motorola hex file format that can be used to burn an EPROM. The file is transferred to a host Personal Computer (PC). Once stored in the PC, the file can be downloaded to an EPROM Programmer.

The file can be transferred to the PC using the WINDOWs program TERMINAL.exe or any other type of serial file transfer program.

Note: This appendix describes how to transfer files using the WINDOWS program TERMINAL.exe. If you are using a different type of transfer program, you may see different prompting.

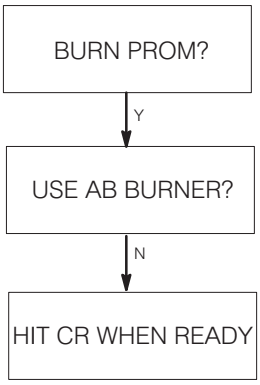
File Conversion

Refer to the following when transferring an application file to an EPROM programmer.

1. Connect a keyboard (Catalog No. 2707-NK1 or -NK2) to the DL20. Make sure that the baud rate of the keyboard and DL20 are the same.

2. Connect your PC to the DL20 RS-232 port as described in Chapter 9.

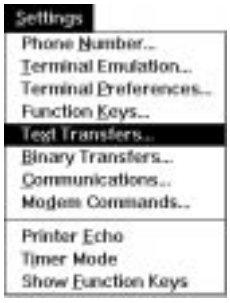
3. Enter the BURN PROM function of the DL20 as described in Chapter 8. Refer to the following sequence. When HIT CR WHEN READY is displayed, proceed to the next step.

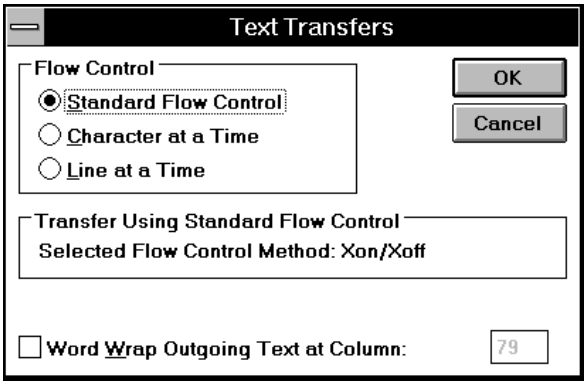


4. Set your PC to receive the file by running the program TERMINAL.exe.

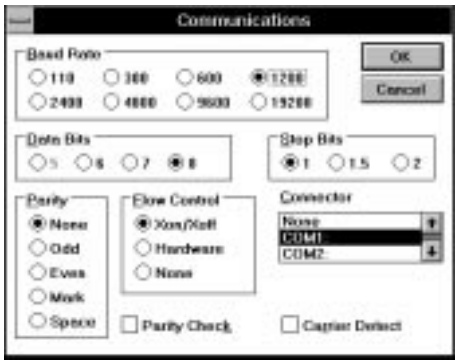
5. In the TERMINAL Window, select Settings ▶Text Transfers and enter the following parameters:

   Standard Flow Control (Xon/Xoff)
   No Word Wrap





6. In the TERMINAL Window, select Settings ▸Communications and enter the following parameters:

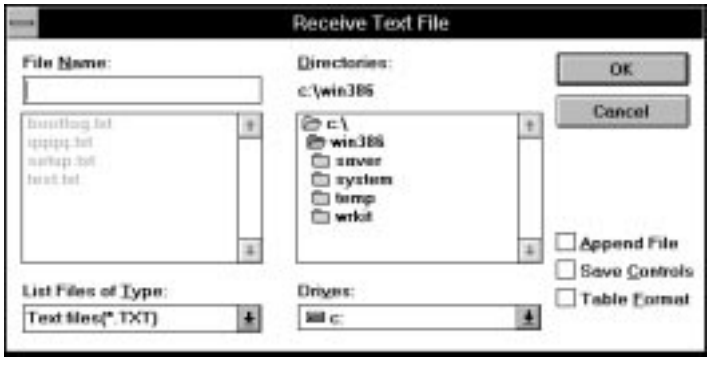


Baud Rate, Parity, and Data Bits to match DL20
Stop Bit = 1
Flow Control = Xon/Xoff
No Parity Check and No Carrier Detect Selected
Connector = port connected to DL20

Note: If possible, set the PC communications for COM2, allocating COM1 for the mouse.

7. In the TERMINAL Window, select Transfers ▸Receive Text File and enter the file name that will contain the hex file for burning the EPROM, i.e. U_EPROM.H.

   Note: Don't exit TERMINAL.exe.



8. At the DL20 keyboard, send the file by pressing [ENTER]. The timer will start a countdown beginning at 15. At the end of the countdown, the file is transferred.
9. When the DL20 has finished sending the file, select Stop on the bottom bar of the terminal window.
10. The file is now in a Motorola hex format that can be used to program an xx '128 EPROM.

Inserting the EPROM

To insert a programmed EPROM into the DL20:

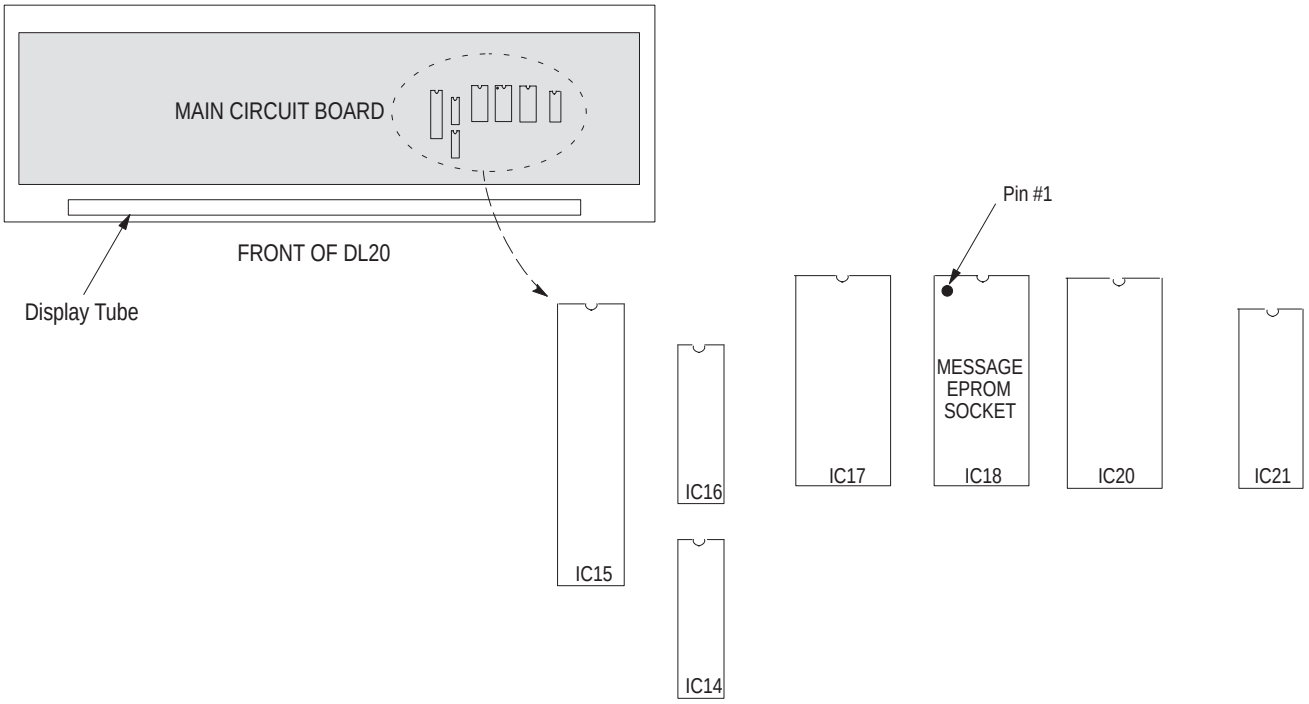
ATTENTION: Disconnect all power from the DL20 before removing the cover. Failure to do so may result in electrical shock or damage to the DL20.

ATTENTION: Make sure you are properly grounded to prevent damage from Electrostatic Discharge (ESD). An ESD grounding strap is recommended. Failure to do so may result in damage to the DL20 circuit board.

Important: An EPROM can only be programmed and inserted into a DL20 display having 16K bytes or less of messages programmed into RAM.

1. Loosen the three cover screws and lift the top cover off the DL20.
2. Insert the EPROM into the socket designated IC18. See Figure C.1. Pin #1 of the EPROM should be in the upper left corner of the socket as you face the front of the DL20.

Figure C.1
Message EPROM Socket



3. Replace the cover and tighten screws to a torque of 10 inch/lbs.

Appendix D

Dimensions

Overview

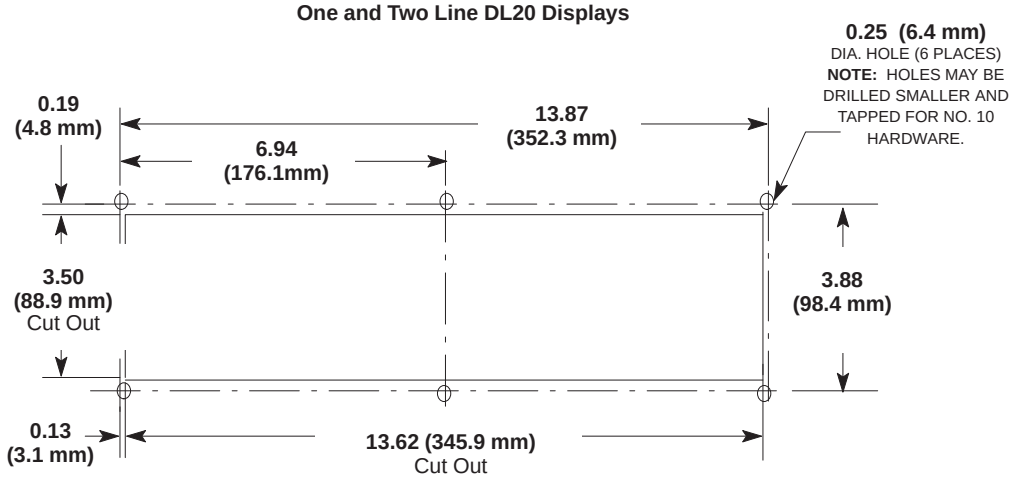
This appendix provides the approximate dimensions for DL20s.

Panel Cutout Dimensions

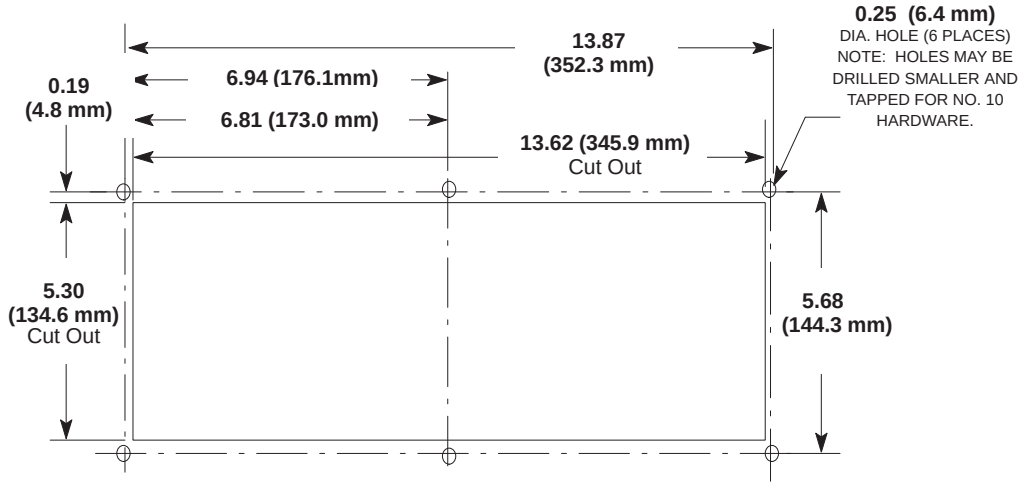
Figure D.1 provides the dimensions for the panel cut out.

Figure D.1
Panel Cut Out Dimensions

One and Two Line DL20 Displays



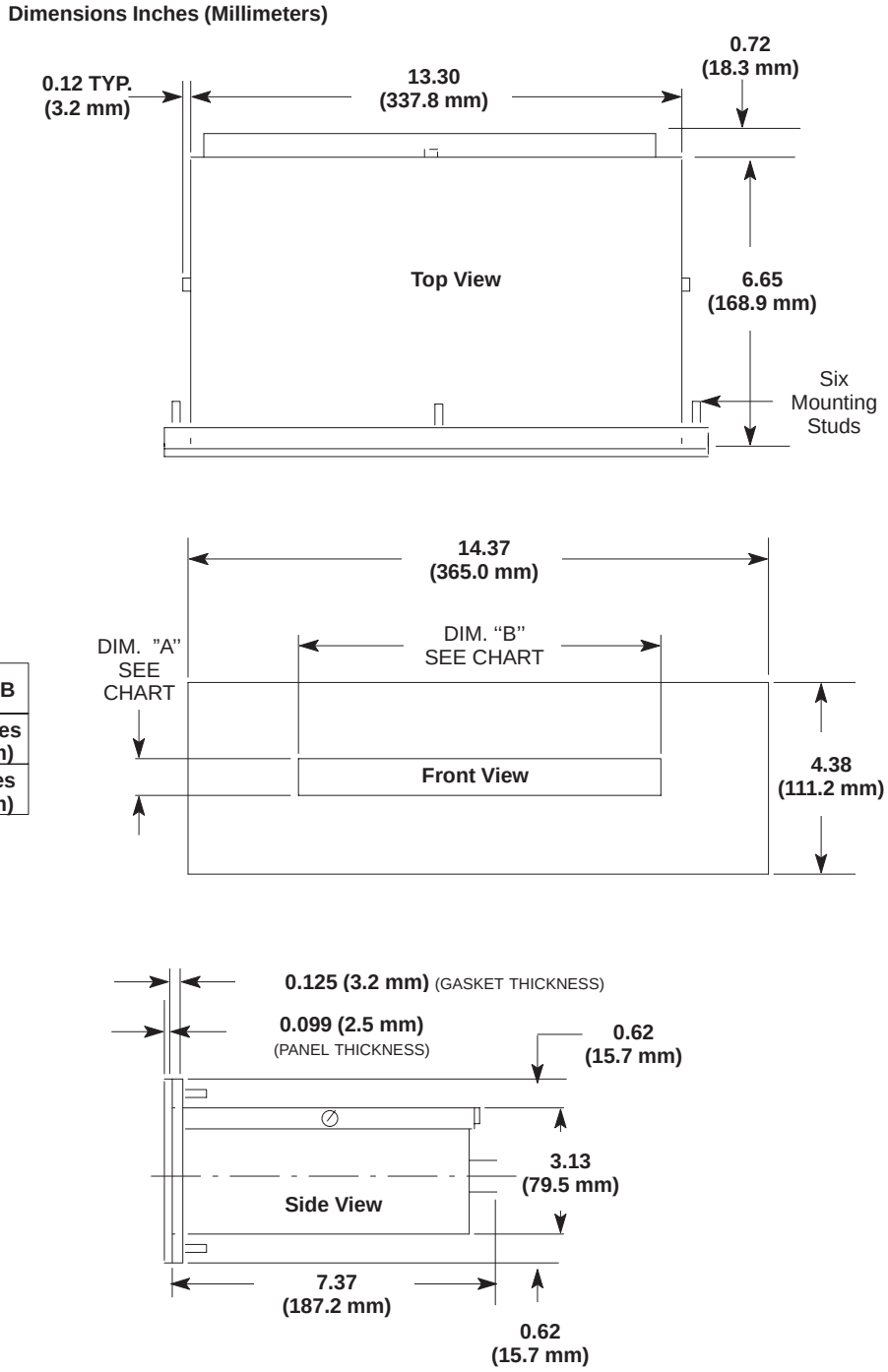
Four Line DL20 Display



Overall Dimensions

Figure D.2 provides the overall dimensions of the one and two line DL20.

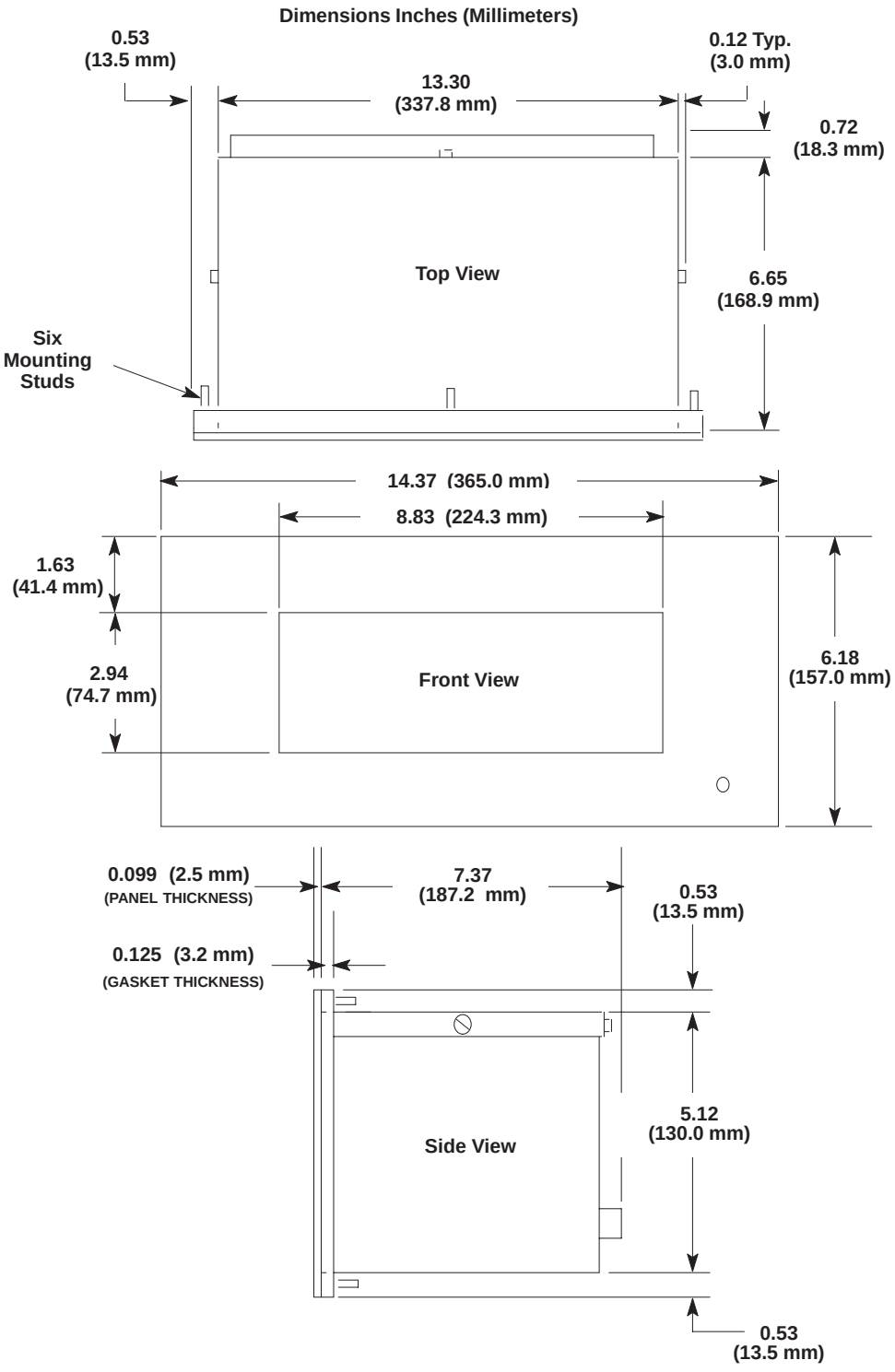
Figure D.2
One and Two Line DL20 Dimensions



Display Type	Dimension A	Dimension B
One Line	1.25 inches (31.8 mm)	10.12 inches (257.2 mm)
Two Line	1.70 inches (43.2 mm)	8.81 inches (223.8 mm)

Figure D.3 provides the overall dimensions of the four line DL20.

Figure D.3
Four Line DL20 Dimensions



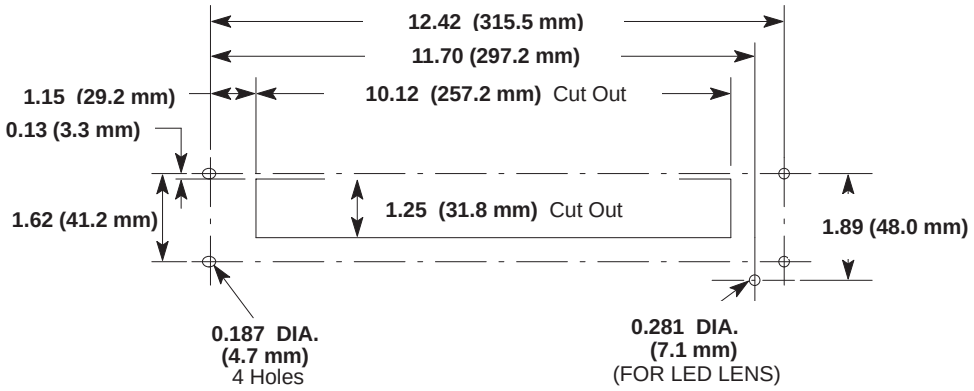
Flush Mount Panel Cutout Dimensions

Figure D.4 provides the dimensions of the optional flush mount displays.

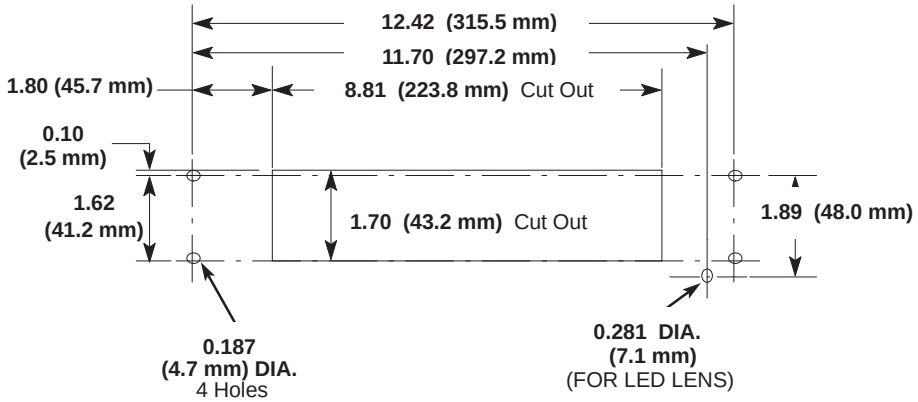
Figure D.4
Flush Mount Panel Cut Out Dimensions

Dimensions Inches (Millimeters)

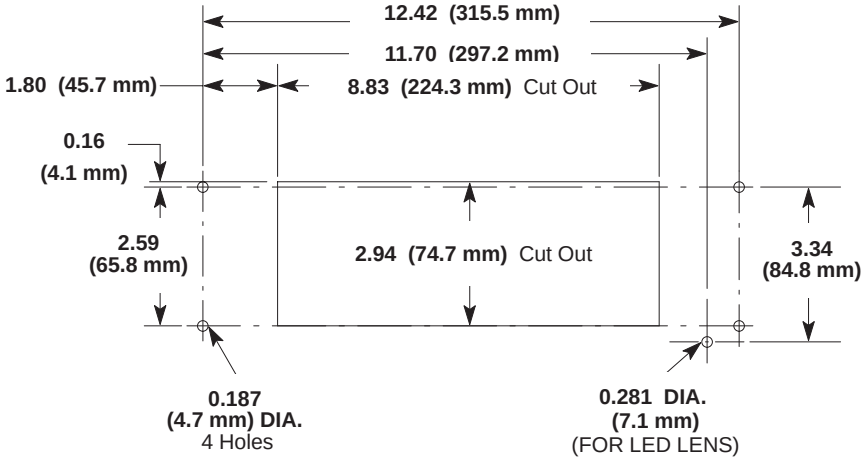
One Line Flush Mount Display



Two Line Flush Mount Display



Four Line Flush Mount Display



Parallel Input Converter Dimensions

Figure D.5 provides the dimensions of the panel mounted Parallel Input Converter. Figure D.6 shows the dimensions of the display mounted Parallel Input Converter.

ATTENTION: Parallel Input Converters (Catalog No. 2706–NG1, –NG2) cannot accept 220/240VAC. If 220/240VAC is applied to the Parallel Input Converter, damage to the input converter will occur.

Figure D.5
Panel Mounted Converter (Catalog No. 2706-NG2) Dimensions

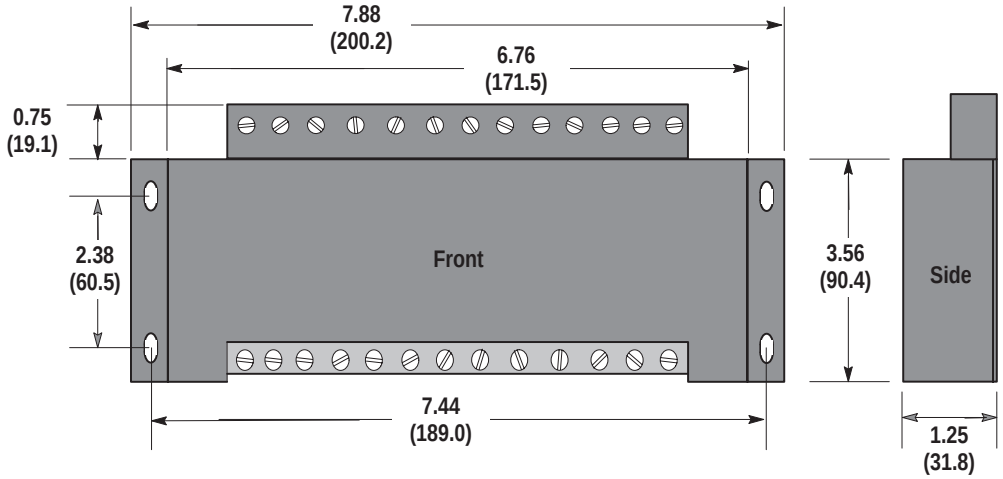
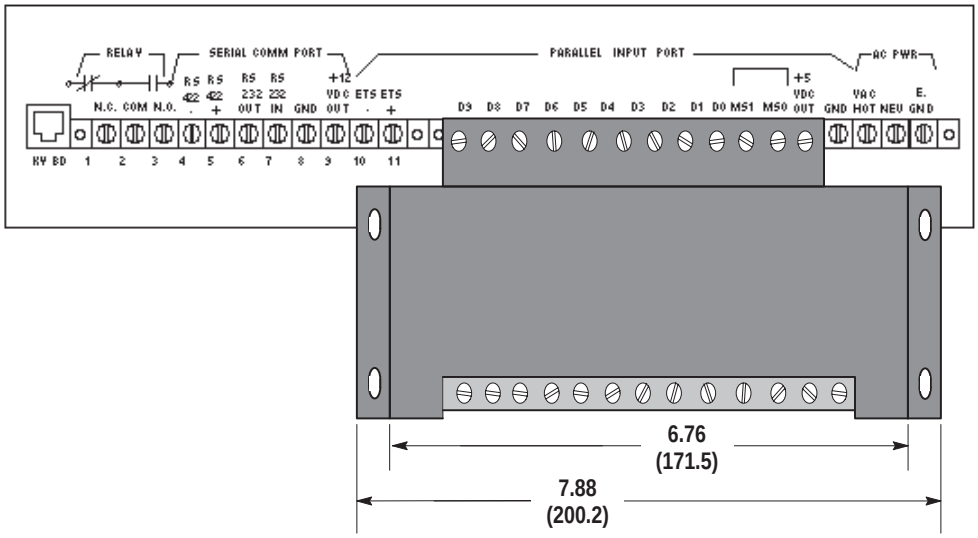
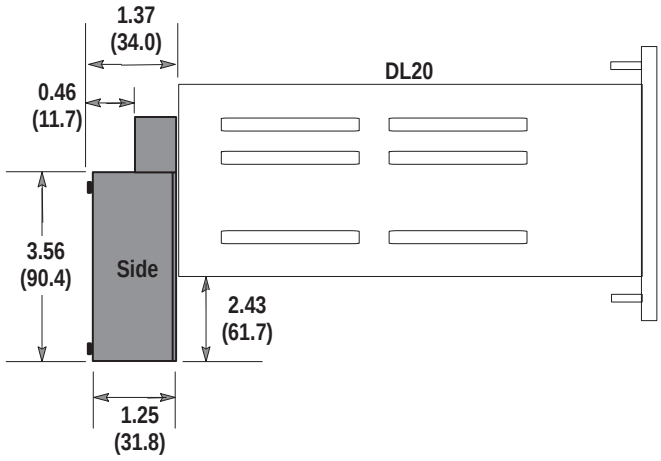


Figure D.6
Display Mounted Converter (Catalog No. 2706-NG1) Dimensions





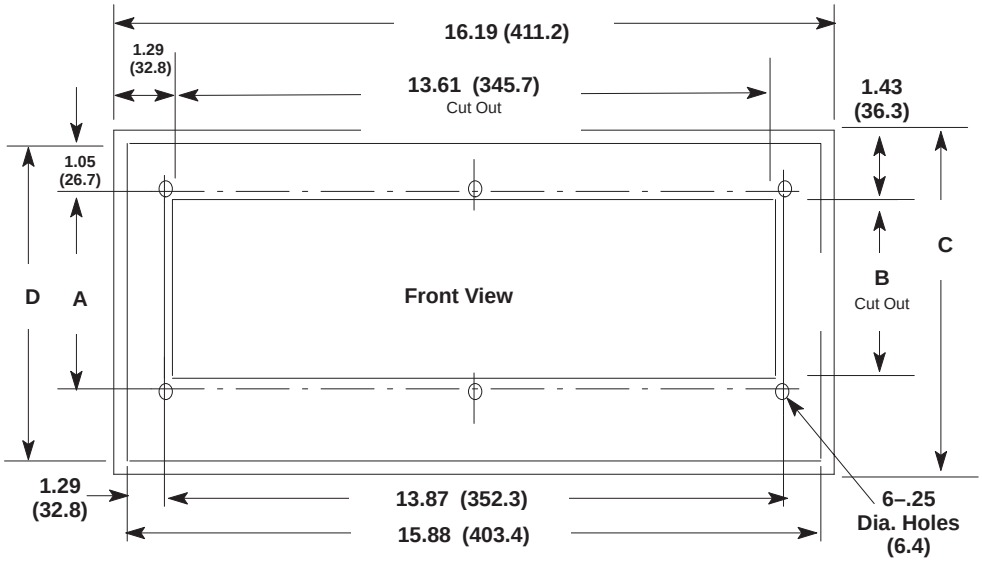
Enclosure Dimensions

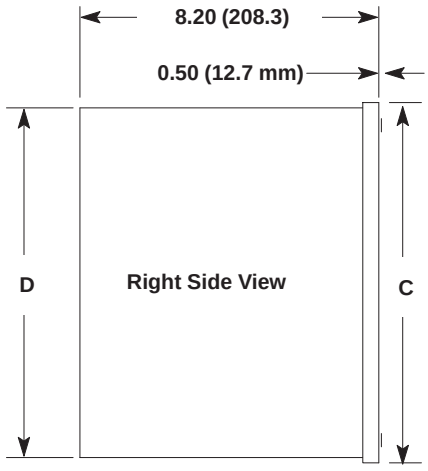
Figure D.7 provides the dimensions of the optional enclosure.

Figure D.7
Enclosure Dimensions

Dimensions Inches (Millimeters)

	A	B	C	D
2706–NE1	3.87 (98.3)	3.44 (87.4)	6.31 (160.3)	5.96 (151.4)
2706–NE2	5.68 (144.3)	5.25 (133.4)	8.11 (206)	7.77 (197.4)





Appendix E

Setting Keyboard Baud Rate

Overview

This appendix provides instructions for setting the baud rate on keyboards (Catalog No. 2706-NK1 or -NK2).

Setting Baud Rate

Before the 2706-NK1 or 2706-NK2 keyboards can be connected to the DL20, the baud rate of the keyboard must match the display baud rate. Displays are shipped from the factory with a baud rate of 9600. The keyboard baud rate must be set to 9600 to work with a DL20.

Use the following procedures to change or verify the keyboard baud rate

1. Turn the keyboard over and slide the DIP switch access door open.

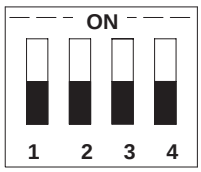
Cat. No. 2706-NK1
Full Travel Keyboard.

Cat. No. 2706-NK2
Membrane Keyboard.

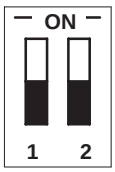
2. Set DIP switch to appropriate baud rate.

ON=UP=CLOSED

OFF=DOWN=OFF



2706-NK1 DIP Switch



2706-NK2 DIP Switch

BAUD RATE SWITCH SETTINGS

Baud Rate	SW1	SW2	SW3	SW4
300	OFF	OFF	ON	ON
1200	OFF	OFF	OFF	ON
9600	OFF	OFF	OFF	OFF

BAUD RATE SWITCH SETTINGS

Baud Rate	SW1	SW2
300	ON	ON
1200	ON	OFF
9600	OFF	OFF

Note: When programming the DL20, it is possible to change the baud rate of the serial port. Once this baud rate is changed, the keyboard baud rate must be changed to match.

Appendix F

Message Display Worksheets

One Line Worksheet

Two Line Worksheet

MESSAGE NUMBER ______

MESSAGE NUMBER ______

MESSAGE NUMBER ______

MESSAGE NUMBER ______

MESSAGE NUMBER ______

MESSAGE NUMBER ______

MESSAGE NUMBER ______

MESSAGE NUMBER ______

MESSAGE NUMBER ______

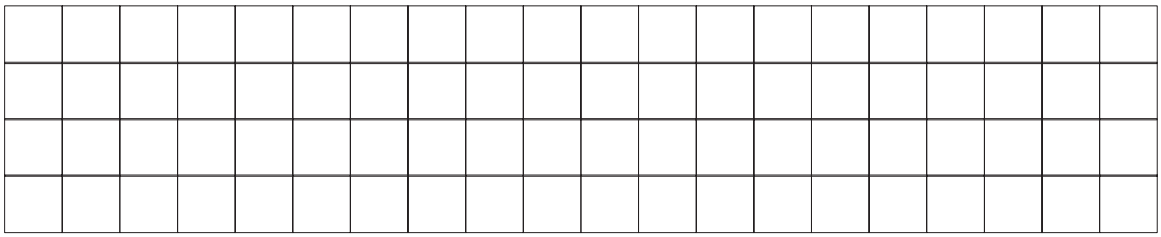
MESSAGE NUMBER ______

MESSAGE NUMBER ______

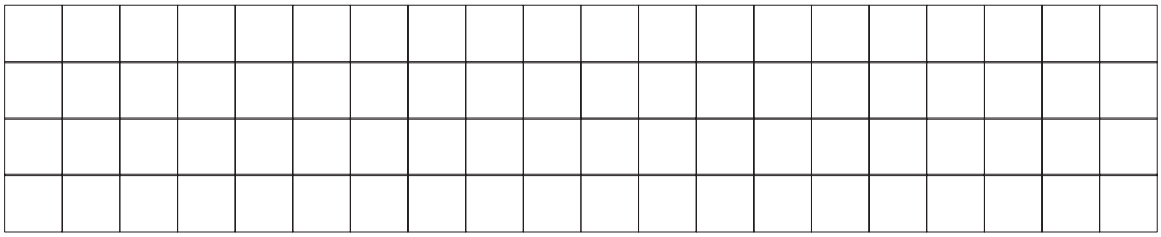
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Four Line Worksheet

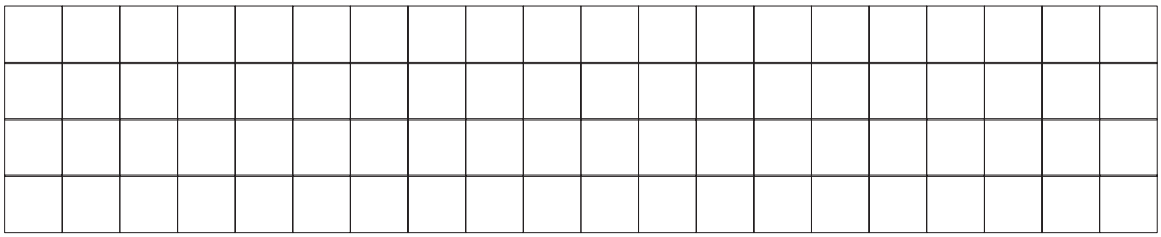
MESSAGE NUMBER _____



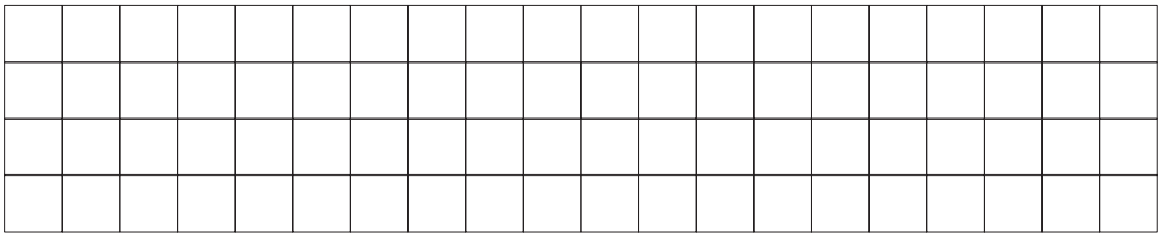
MESSAGE NUMBER _____



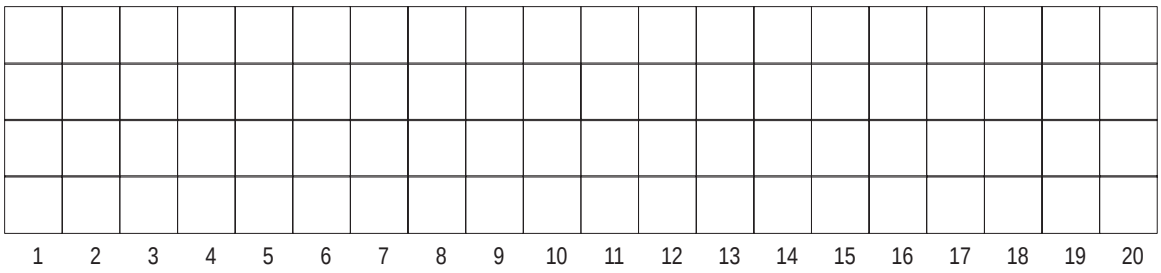
MESSAGE NUMBER _____



MESSAGE NUMBER _____



MESSAGE NUMBER _____



Appendix G

Application Notes

Overview

This appendix provides examples of interfacing a DL20 with PLC-2 and PLC-5 Programmable Controllers through the DL20 parallel port. Programming examples and connection diagrams show how to transfer message triggers and variable data from 1771 I/O modules to the DL20 parallel port.

The examples and diagrams used in this appendix are included solely for illustrative purposes.

ATTENTION: The DL20 has single direction communication and should be used only for non-critical display applications. Single direction communication does not provide verification that messages from the programmable controller have been received and displayed by the DL20.

PLC-2 Programming Examples

The PLC-2 processor configuration for both examples is listed below. This configuration may vary for different applications.

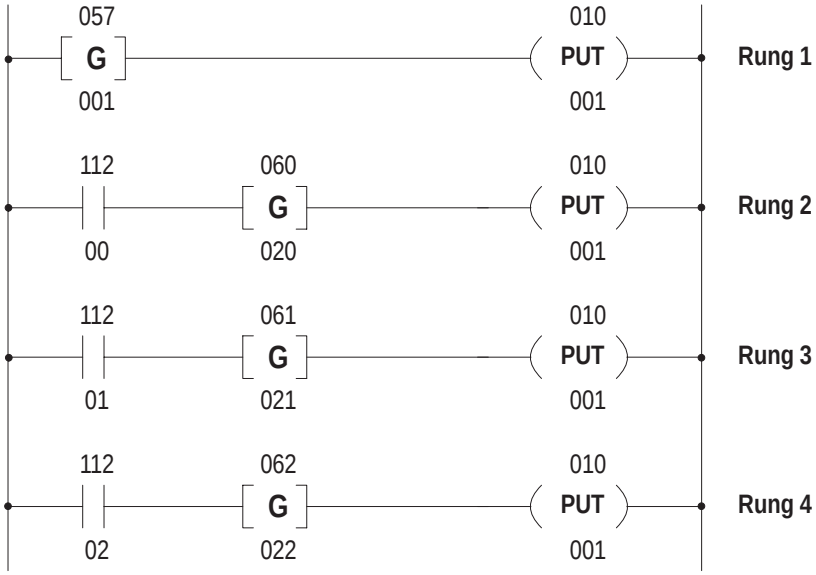
1. A 1770-T3 Industrial Terminal is used.
2. The “SEARCH 50” command configures the data table for 1 data table block and 2 I/O racks. The Mini PLC-2/15 or Mini PLC-2/05 processors automatically default to the 2 I/O rack configuration.
3. The output modules (2) are in Rack 1, module group 0 (word address 010).
4. The DL20 configuration is defined separately for each program example.
   - high true logic
   - BCD messages / variable data
   - time driven
   - DC inputs
   - scan = 4, debounce = 1

PLC-2 Programming Examples

Triggering Simple Messages (PLC-2)

Figure G.1 illustrates how individual inputs can trigger corresponding messages.

Figure G.1
Triggering Messages Using Individual Inputs (PLC-2)



If two or more inputs are true at the same time, the rung closest to the end of the ladder diagram has priority and only this message is triggered during the program scan.

When no inputs are true, the display clears since the 1st rung shown always triggers special message #1 if none of the rungs after it are true. Special message #1 clears the display. If your application requires that the last message displayed remains displayed indefinitely, do not program the first rung in this example. The DL20 Auto Clear message feature must be disabled for this type of operation.

In this example, one rung is required for each unique message triggered.

The DL20 examines 10 bits (D0-D9) on the parallel port when a message number is strobed in. If binary is selected, a range of message numbers from 1 to 1022 is allowed. If BCD is selected, a range of message numbers from 1 to 399 is allowed.

Rung Descriptions (Figure G.1)

Rung 1
Triggers special message #1 to clear the display if no other messages are being triggered in a later rung. A constant 1 is stored in address 057.

Rung 2
Triggers message 20 if input 112:00 is true and if rungs 3 and 4 are not true.

Rung 3
Triggers message 21 if input 112:01 is true and if rung 4 is not true.

Rung 4
Triggers message 22 if input 112:02 is true.

The ladder diagram (Figure G.1) provides a priority type operation. For example, rung 4 (message 22) has priority over rung 3 (message 21) because the later rung (if enabled) will write over any previous message number placed into word 010.

Bits 14 and 15 of words 057 through 062 must be set. The message numbers stored in these words are entered while programming the GET instructions as described below. Next, bit 14 and 15 are set using the "SEARCH 53" command. Bits 14 and 15 correspond to the strobe terminals MS0 and MS1 on the DL20. Any other available bit addresses can be used for strobes (MS0 and MS1), however, the module outputs must be wired accordingly.

Get and Put Instructions (PLC-2)

The GET instruction transfers 16 bits of the designated word and places it in the PUT instructions designated word. However, only the lowest 12 bits are displayed on the industrial terminal in BCD form (such as 001).

The GET instructions shown in Figure G.1 have two additional bits set which are not visible on the industrial terminal ladder diagram. These are bits 14 and 15. These outputs are connected to the MS0 and MS1 strobe bits on the DL20 parallel port.

These outputs must be turned on along with any message number being triggered. In this example, the message numbers stored in addresses 057, 060, 061, and 062 must also include bits 14 and 15 being set in each of those words. This is done using the SEARCH 53 Data Manipulation instruction after entering the GET instruction and the message number.

PLC-2 Programming Examples

Triggering Messages with Variable Data (PLC-2)

This example illustrates how a message with a variable data value from a PLC-2 Programmable Controller can be displayed on a DL20.

There are 10 data lines (D0-D9) and 2 strobe lines (MS0 and MS1) on the DL20. If both MS0 and MS1 are high, it indicates to the DL20 that the value present on the data lines D0-D9 is a message number to be triggered. At this point all 10 data lines (D0-D9) are examined. If binary message data is selected in the DL20 menu, the range is 1 to 1022. If BCD message data is selected, the range is 1 to 399.

The DL20 displays variable data from the programmable controller within a range of 0 to ±32, 767 binary or 0 to 9999 BCD. Because these are 16 bit data values and the DL20 has only 10 data lines, each variable must be strobed into the DL20 in two parts, 8 bits at a time. First the high byte is strobed in. This is indicated by setting the strobe bit MS0 low and MS1 high. Next the low byte (least significant data) is strobed in to the DL20. This is indicated by setting the strobe bit MS0 high and MS1 low.

When a message is created on the DL20 a variable data symbol ↑ or ↓ can be placed anywhere, and up to twenty times, within a message by pressing the [Ctrl] key and [V] or [X] at the same time. For most keyboards (2706 keyboards) the [Ctrl] key and [V]or [X] must be pressed simultaneously. For the 1770-T3 Industrial Terminal, they must be pressed sequentially. Control V is for non-decimal point variables and control X is for decimal point variables and/or fixed format variables. The programmable controller must sequentially strobe the variables into the DL20 data queue in the same order that the variables are to appear in the message. After the variables are queued, then the message number is triggered.

The following program example uses a sequencer output instruction from the PLC-2 to strobe the information into the DL20 parallel port.

Table G.A
PLC-2 Sequencer Outputs

PC Word	Step	BCD Format	Binary Format	Comments
037	1	3010	0011000000010000	Special Message 10 (Clear Queues)
040	2	0000	0000000000000000	Null Step
041	3	2012	0010000000010010	Hi Data (1st Variable)
042	4	0000	0000000000000000	Null Step
043	5	1034	0001000000110100	Low Data (1st Variable)
044	6	0000	0000000000000000	Null Step
045	7	3020	0011000000100000	Message Member
046	8	0000	0000000000000000	Null Step

The steps of a sequencer instruction can be viewed on the 1770-T3 Industrial Terminal by moving the cursor to the sequencer instruction and pressing <Display> 1 for BCD display format or <Display> 0 for binary display format.

The NULL STEPS shown in the above sequence are added to satisfy timing requirements of the DL20.

In the following program example, steps 1 through 8 shown above represent word 037-046 (octal) as defined in the sequencer instruction.

The resulting message would be displayed:

TIMER 032 = 1234

The variable 1234 shown on the above display and in the example steps is for illustration purposes only. Actually, the free running timer 032 in the rung examples to follow range from 0 to 999.

PLC-2 Programming Examples

Figure G.2 shows the example ladder program for transferring variable data with a PLC-2.

Figure G.2
PLC-2 Ladder Program (Messages with Variable Data)

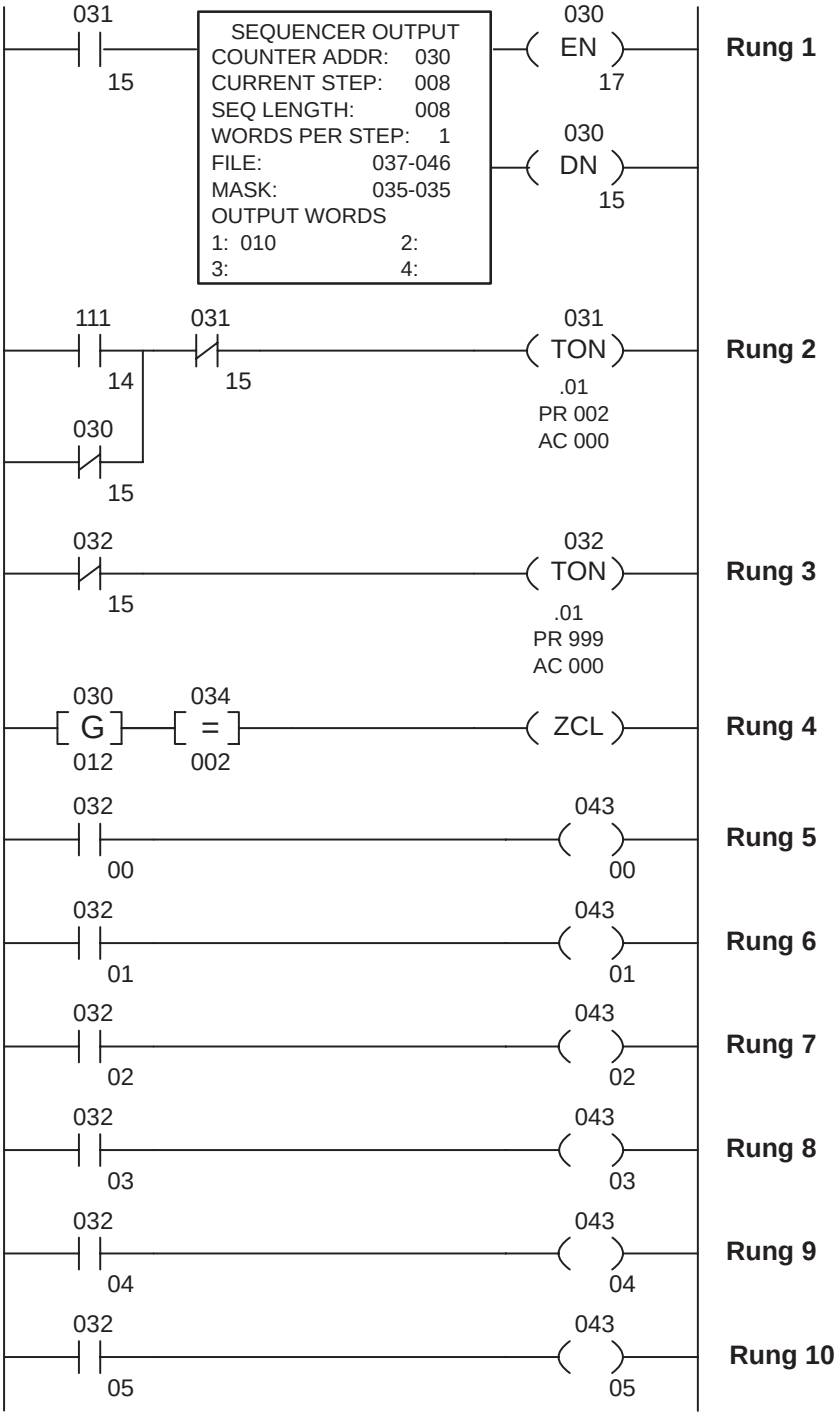
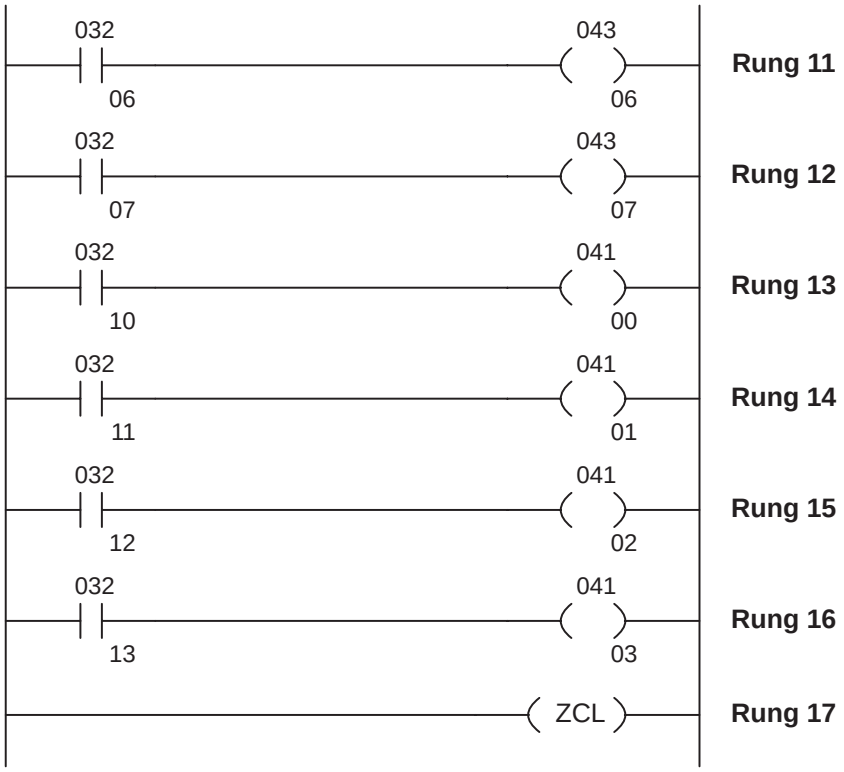


Figure G.2
PLC-2 Ladder Program (Messages with Variable Data) Continued



Rung Descriptions (Figure G.2)

Rung 1
Each time TON 031 is done, the sequencer instruction outputs the next step. These steps were described previously. The sequencer done bit is set when the sequencer reaches its last step.

SEQ LENGTH: Number of steps (8 for this example).

WORDS PER STEP: 1 (for this example).

FILE: Address range of steps (037-046 for this example).

MASK: Select any available address and set all bits equal to 1 (035 for this example).

OUTPUT WORD: I/O address at which the output modules for the DL20 are located (010 for this example).

PLC-2 Programming Examples

Rung 2

This is the rung that actually triggers the message. Setting input address 111:14 momentarily will initiate one complete sequence, displaying the message with variable data. If the application requires the variables to be continuously updated on the display, then, address 111:14 should be set high continuously for that period of time.

Timer 031 determines the time between step changes. This time should not be set lower than 70 milliseconds per step for AC output module applications using a Parallel Input Converter (2706-NG1, -NG2, Series A or B).

For DC output module applications the minimum timer value (031) is 20 milliseconds (002 in the example). The DL20 scan time should be near the minimum value 4 and likewise the debounce time should be set near its minimum, 1.

Rung 3

A free-running timer is used to create the data value being displayed.

Rung 4

This rung and rung 17 assure that both the high byte and low byte data portion of the variable are both moved to the appropriate word in the sequencer file at the same time. Otherwise, the timer value could change between the time that the high byte and low byte are strobed to the DL20.

The GET instruction (address 030) is the same address used for the sequencer instruction and contains the current “step number”. The equal instruction (address 034) could have been any available address and must store a constant (2 in this case), so that rungs 5-16 will only be scanned and updated once per sequencer cycle. Any step can be selected, however, step 2 is the last step prior to the variable data being sent to the DL20.

Rungs 5-12

Transfer the low byte data from timer 032 accumulative value to the appropriate sequencer step (word 043).

Rungs 13-16

Transfer the high byte data from timer 032 accumulative value to the appropriate sequencer step (word 041).

Rung 17

Marks the end of the zone to be controlled according to rung 4.

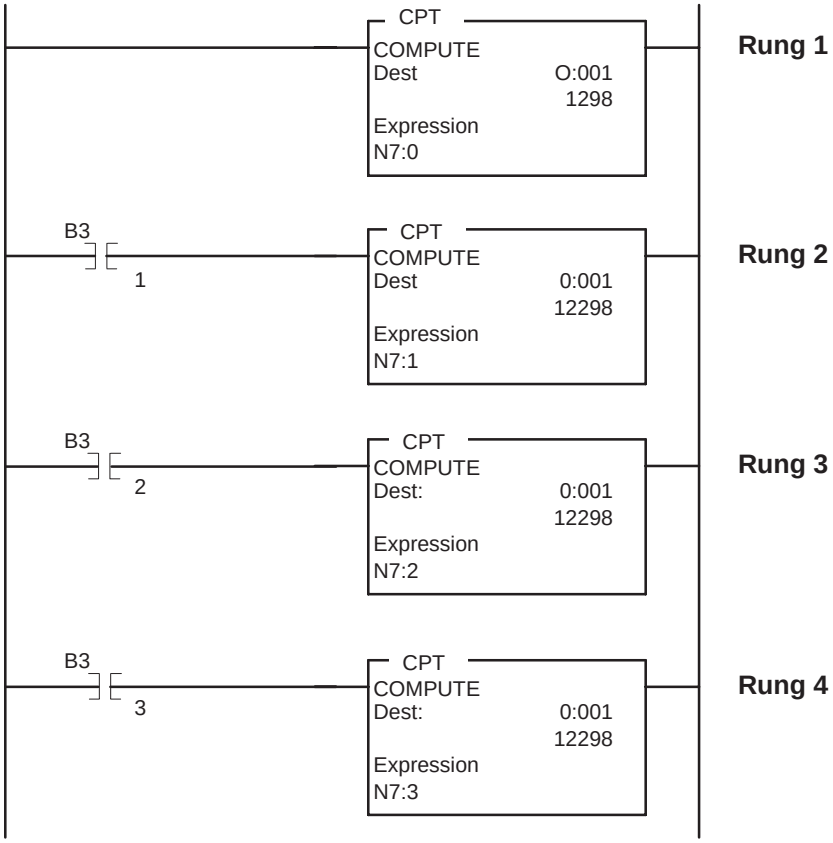
PLC-5 Programming Examples

The PLC-5 processor configuration used for both examples is listed below. This configuration may vary for different applications.

1. An Allen-Bradley 1784-T45 Industrial Computer is used.
2. The Data Monitor command is used to configure the sequencer table.
3. Two output modules in Rack 0, module group 0 (O:000).
4. The DL20 is defined as follows:
   - high true logic
   - binary message/variable data
   - time driven
   - DC inputs
   - scan = 4, debounce = 1

Figure G.3 illustrates how individual inputs can trigger unique corresponding messages. If two or more inputs are true at the same time, the rung closest to the end of the ladder diagram has priority and only that message is triggered during this program scan.

Figure G.3
Triggering Messages Using Individual Inputs (PLC-5)



PLC-5 Programming Examples

When no inputs are true, the display clears since the 1st rung shown always triggers special message #1. If your application requires that the last message remains displayed indefinitely, do not program the first rung. The DL20 Auto Clear message feature must be disabled for this type of operation.

In this example, one rung is required for each unique message to be triggered.

The DL20 examines 10 bits (D0-D9) on the parallel port when a message number is strobed in. If binary message data is selected, a range of unique message numbers from 1 to 1022 is allowed. If BCD message data is selected, a range of unique message numbers from 1 to 399 is allowed.

Rung Descriptions (Figure G.3)

Rung 1
: Triggers special message number 1 to clear the display if no other messages are being triggered in a later rung. A constant 1 is stored in address N7:0.

Rung 2
: Triggers message number 20 if input B3:1 is true and if rungs 3 and 4 are not true.

Rung 3
: Triggers message number 21 if input B3:2 is true and if rung 4 is not true.

Rung 4
: Triggers message number 22 if input B3:3 is true.

This example provides a priority type of operation. For example, rung 4 (message 22) has priority over rung 3 (message 21) because the later rung (if true) will write over any previous message number put into output word 0:000.

Compute Instruction

The CPT instruction will get all 16 bits of the designation source word and move it into the designated destination word. This instruction may also be substituted with a MOV (move) or MVM (move with mask) instruction.

Triggering Messages with Variable Data

This program example illustrates how a message with a variable data value from a PLC-5 Programmable Controller can be displayed on a DL20.

There are 10 data lines (D0-D9) and 2 strobe lines MS0 and MS1 on the DL20. If both MS0 and MS1 are high, it indicates to the DL20 that the value present on the data lines D0-D9 is a message number to be triggered. At this point, all 10 data lines (D0-D9) are examined. If binary message data is selected, then the range is 1 to 1022. If BCD message data is selected, then the range is 1 to 399.

The DL20 displays variable data from the programmable controller within a range of 0 to ±32, 767 binary or 0 to 9999 BCD. Because these are 16 bit data values and the DL20 has only 10 data lines, each variable must be strobed into the DL20 in two parts, 8 bits at a time. First the high byte is strobed in. This is indicated by setting the strobe bit MS0 low and MS1 high. Next the low byte (least significant data) is strobed in to the DL20. This is indicated by setting the strobe bit MS0 high and MS1 low.

When a message is created on the DL20 a variable data symbol ↑ or ↓ can be placed anywhere and up to twenty times within a message by pressing the [Ctrl] key and [V] or [X] at the same time. For most keyboards (2706 keyboards) the [Ctrl] key and [V] or [X] must be pressed simultaneously. For the 1770-T3 Industrial Terminal, they must be pressed sequentially. Control V is for non-decimal point variables and control X is for decimal point variables and or fixed format variables. The programmable controller must sequentially strobe the variables into the DL20 data queue in the same order that the variables appear in the message. After the variables are queued, the message number is triggered.

The following program example uses a sequencer output instruction from the PLC-5 to strobe the information into the DL20 parallel port.

PLC-5 Programming Examples

Table G.B
PLC-5 Sequencer Outputs

PLC 5 Data Table Address	Binary Radix N7 Integer File MSB 15 0 LSB	SQO Step#	Bit 9 DL20 MS1	Bit 8 DL20 MS0	DL20 Data Lines① D7 ..... D0	Decoded Data	Comments
N7:0	0000 0000 0000 0000	0	0	0	0000 0000	0	Initial output step for SQO.
N7:1	0000 0011 0000 1010	1	1	1	0000 1010	10	Special Msg #10 clears DL20 queue.
N7:2	0000 0010 0000 0001	2	1	0	0000 0001	1	High Byte for variable data = 256.
N7:3	0000 0001 0001 1111	3	0	1	0001 1111	31	Low Byte for variable data = 31.
N7:4	0000 0011 0001 0001	4	1	1		17	Triggers message #17.
N7:9	0000 0000 0001 1111						**T4:1.ACC = 287**
N7:10	0000 0000 0000 0001						

① D8 and D9 are not used in this example.

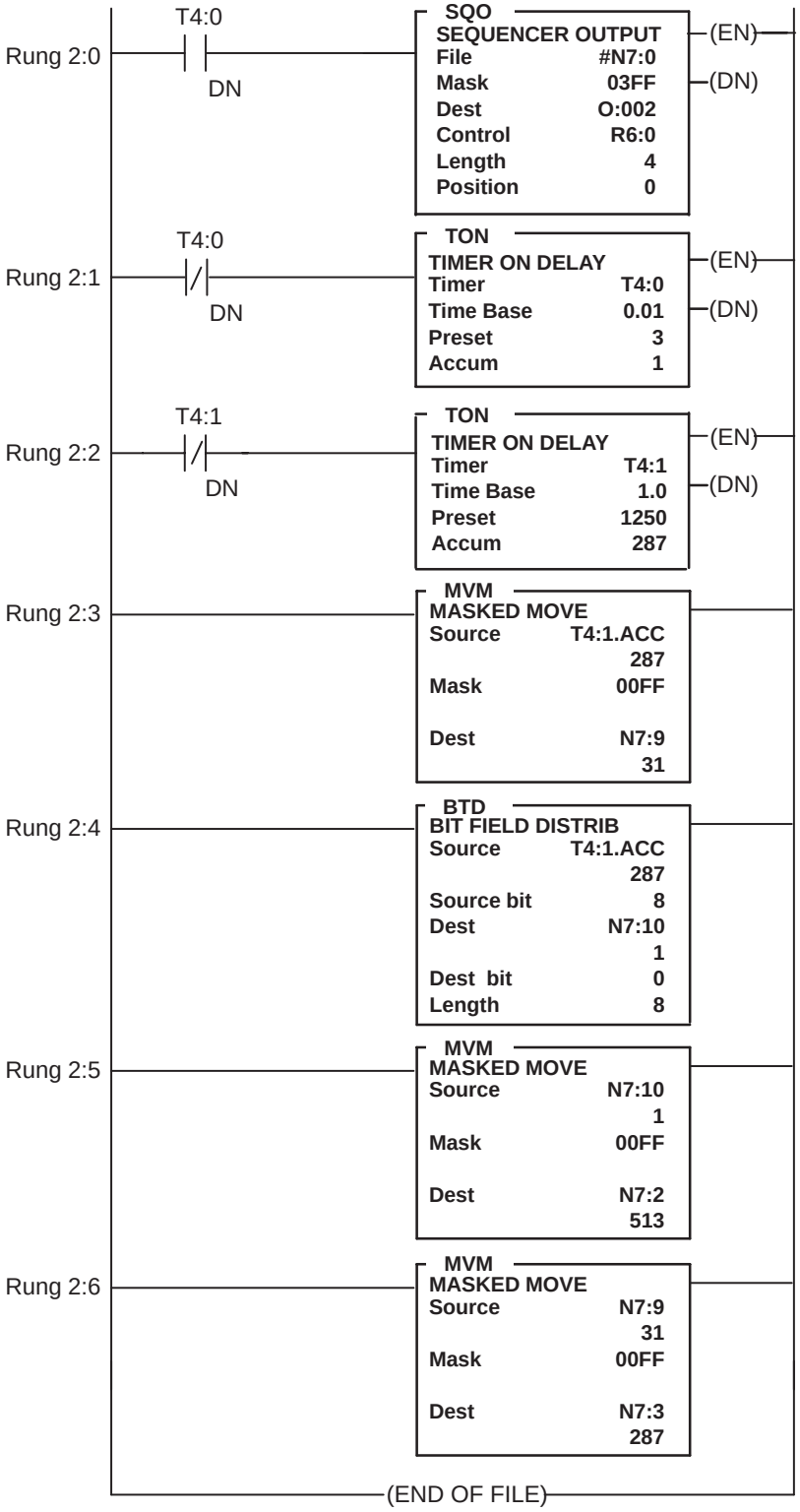
The steps of the sequencer can be viewed on your PLC-5 programming software using the Data Monitor Command to view file #N7:0 file array.

The resulting message would be displayed:

TIMER T4:1 = 287

The variable 287 on the above display is the accumulated value for T4:1, free running timer.

Figure G.4
PLC-5 Ladder Program (Messages with Variable Data)



PLC-5 Programming Examples

Rung Descriptions (Figure G.4)

Rung 2:0

Each time input T4:0/dn is true, the sequencer output instruction outputs the next step. The sequencer done bit is set when the sequencer reaches rung 2:4. The sequencer then resets itself and begins again.

Rung 2:1

Timer T4:0 is a free running timer which drives the SQO. A preset value of 3 provides a pulse every 30 msec.

Rung 2:2

Timer T4:1 is a free running timer which generates the variable data for the DL20.

Rung 2:3

Masks off the low byte data from T4:1.ACC and moves it to lower byte of N7:9. The low byte data is now in a format that can be output to the DL20 data lines (D0 through D7).

Rung 2:4

Transfers or distributes the high byte of T4:1.ACC to the lower byte of N7:10. The high byte data is now in a format that can be output to the DL20 data lines (D0 through D7).

Rung 2:5

Takes the high byte data at N7:10 and moves it to N7:2 for use with the SQO. The upper byte of N7:2 is preloaded with the correct bit pattern to control the strobe lines using the Data Monitor. This has the effect of a logic OR for the changing high byte variable data and the constant strobe bit settings.

Rung 2:6

Takes the low byte data at N7:9 and moves it to N7:3 for use with the SQO. The upper byte of N7:3 is preloaded with the correct bit pattern to control the strobe lines using the Data Monitor. This has the effect of a logic OR for the changing low byte variable data and the constant strobe bit settings.

DL20 Parallel Port Configuration

The following parameters are configured within the SET PARALLEL PORT menu of the DL20.

HI TRUE LOGIC? (Y for PLC-2/PLC-5 example)

Selecting Y (yes) means that the DL20 is expecting the parallel inputs to be high (ON) when a logic 1 is represented.

Selecting N (no) means that the DL20 is expecting the parallel inputs to be low (OFF) when a logic 1 is represented.

BINARY MSG DATA? (N for PLC-2 example) (Y for PLC-5 example)

Selecting Y (yes) means that the DL20 will expect message triggers in a binary format. (Binary format works well with the PLC-5)

Selecting N (no) means that the DL20 will expect message triggers in a BCD format. (BCD format works well with the PLC-2)

BINARY VAR DATA? (N for PLC-2 example). (Y for PLC-5 example)

Selecting Y (yes) means that the DL20 will expect variable data to be strobed in a binary format.

Selecting N (no) means that the DL20 will expect variable data to be strobed in a BCD format.

TIME SAMPLE? (Y for PLC-2 / PLC-5 example)

Selecting Y (yes) means that all parallel port data will be sampled automatically at a rate determined by the SCAN TIME. If DC parallel port operation was selected the user is also prompted for DEBOUNCE TIME.

Selecting N (no) means that the user wishes to use the edge triggered strobe (ETS) input to strobe all data into the parallel port. The user is then restricted to a DC voltage interface and must select “high to low” or “low to high” edge sensing for the ETS input. The ETS lines of the DL20 are provided for use with other manufacturers programmable controllers having output modules with strobe lines.

USE NG 1/2 SER A,B? (N for PLC-2 / PLC-5 example)

Selecting Y (yes) means that a Parallel Input Converter (Catalog No. 2706-NG1, -NG2 Series A or B) is being used. TIME DRIVEN must have been selected previously.

Selecting No (no) means that a DC parallel interface or Parallel Input Converter (Catalog No. 2706-NG1, -NG2 Series C or later) is being used.

DL20 Parallel Port Configuration

SCAN RATE: (4 for PLC-2/PLC-5 example)

If TIME DRIVEN mode was selected previously, then the value entered represents the period between samplings of the parallel port. The value entered is in units of 1.95 milliseconds.

Example: 28 = 28 x 1.95 = 54.6 milliseconds between samplings.

Important: You must be sure that data (each step) is present on the parallel port for at least the scan rate.

If a Parallel Input Converter (Catalog No. 2706-NG1 or -NG2 Series A or B is used, the SCAN RATE range is 28 - 255 (54.6 - 500 ms). If not, the range is 4 - 255 (7.8 ms - 500 ms).

DEBOUNCE TIME: (1 for PLC-2/PLC-5 example)
Not applicable for applications using Parallel Input Converters (Catalog No. 2706-NG1, -NG2 Series A or B).

The debounce time is in units of 1.95 milliseconds. The range is 1 - 255. Debounce time determines how many samples are evaluated during the sampling period as determined by the scan rate selected. For example, if a debounce time of 5 is selected, then 5 samples are taken 1.95 milliseconds apart. All of these samples must match for the data to be read by the DL20. The debounce time should be at least 3 less than the scan rate.

Variable Data Update Times

For AC parallel interface applications using Parallel Input Converters (Catalog No. 2706-NG1, -NG2 Series A or B), data should be present (each step of sequencer) at the parallel port for at least 180 milliseconds.

For DC parallel interface applications, data should be present (each step of sequencer) for at least 20 milliseconds. These are the minimum allowed values for the sequencer step timer (031 in the PLC -2 example or T4:1 in the PLC-5 example).

To determine update time, multiply the time interval between sequencer steps by the number of sequencer steps. In the PLC-2 variable data example, timer 031 in rung 2 determines the time interval between steps. For a setting of PR010 (100 milliseconds), the update time for the variable data in this example of 8 steps, will be 800 milliseconds (100 ms x 8).

Parallel Interface Connections

The following connections are applicable to the program examples shown previously.

The standard voltage levels required for the DL20 parallel port are 5 to 30 VDC. When using DC Output Modules, an external power supply of the appropriate voltage level and current capacity is required.

AC Output Modules can be used, however, these applications require one of the Parallel Input Converters as described below. The need for an external DC power supply is eliminated.

2706-NG1 - Display Mounted 120VAC Parallel Input Converter.

2706-NG2 - Panel Mounted 120VAC Parallel Input Converter.

Figure G.5 shows connections between a parallel Input Converter and AC Output Module (Catalog No. 1771-OA).

Figure G.6 shows connections between a DL20 and DC Output Modules (Catalog No. 1771-OB or -OG)

Figure G.7 shows connections between a DL20 and High Density Output Module (Catalog No. 1771-OBD).

Figure G.5
Parallel input Converter to AC Output Module

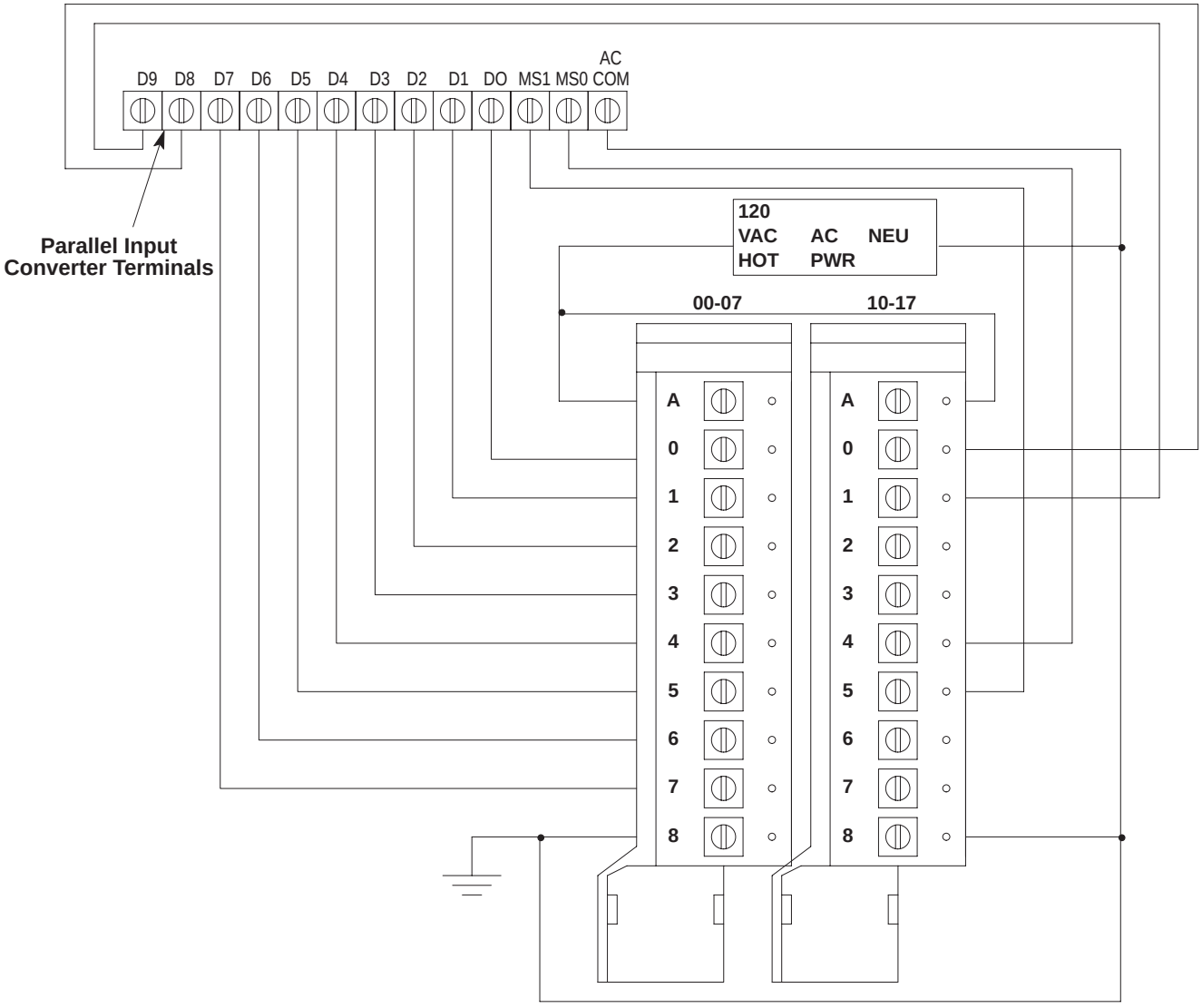
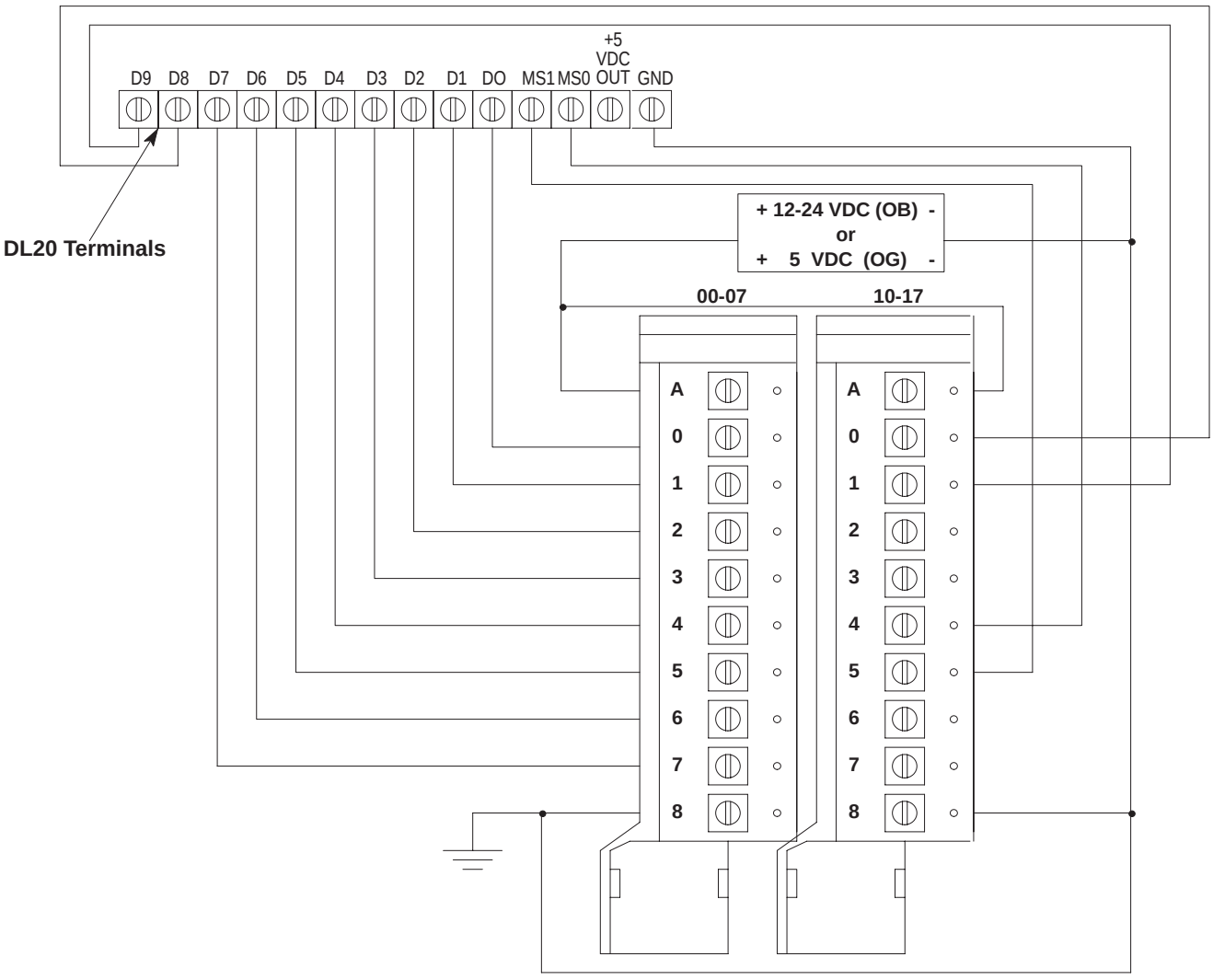


Figure G.6
DL20 to DC Output Module (Catalog No. 1771-OB, -OG)



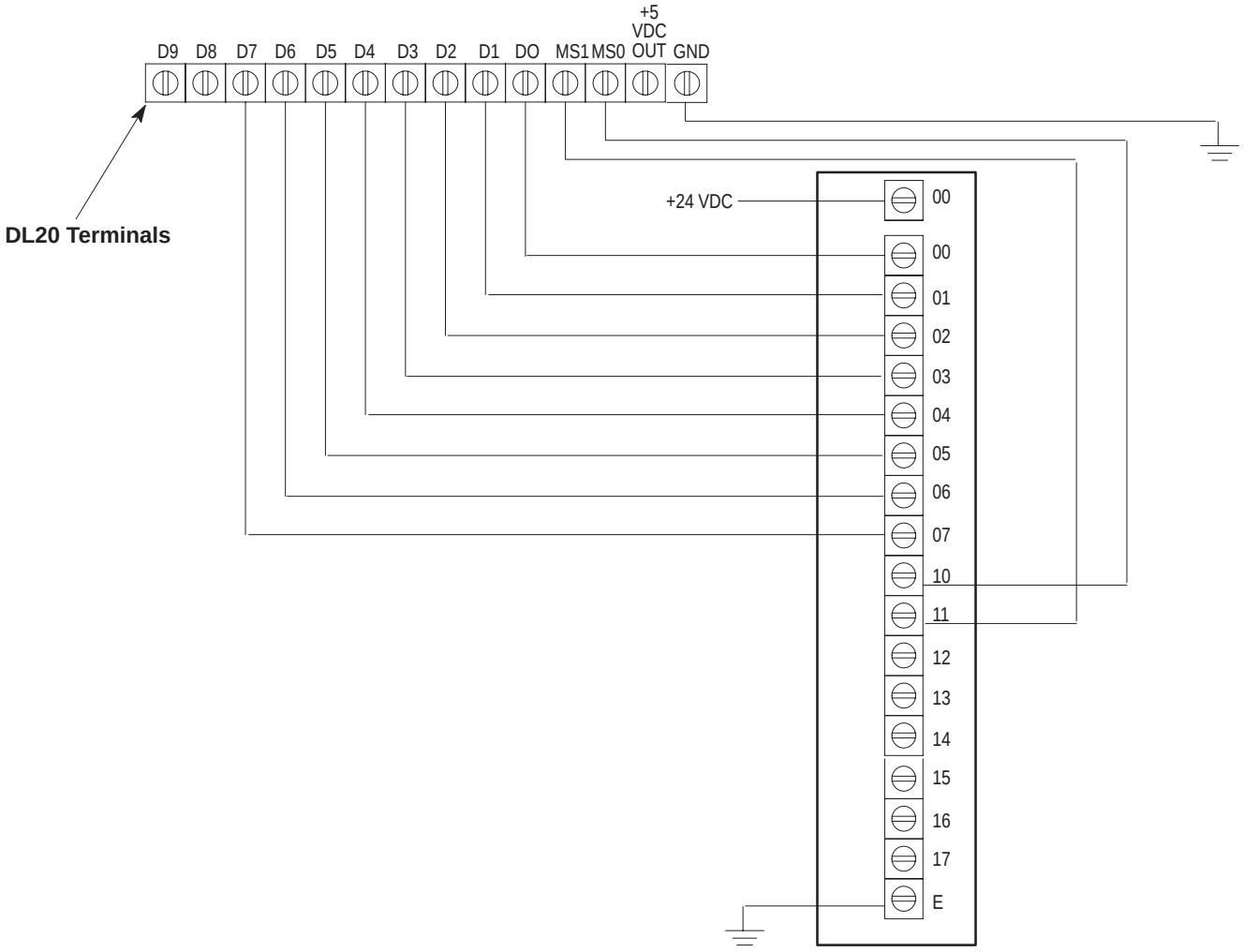
1771-OB DC Output Modules (12-24 VDC)
or
1771-OG DC Output Modules (5VDC)

Set both internal switches in the OG module ON for high true logic.

Important Note: The 1771-OG TTL output modules 5VDC signals are more noise susceptible than 12-24 DC signals. In applications where noise may be a problem, it is strongly recommended that a 1771-OB DC output module be used.

ATTENTION: Do not connect to terminal 22 (+5 VDC OUT). Applying any voltage to this terminal will damage the DL20.

Figure G.7
DL20 to High Density DC Output Module (Catalog No. 1771-OBD)



ATTENTION: Do not connect to terminal 22 (+5 VDC OUT). Applying any voltage to this terminal will damage the DL20.

Appendix H

120 VAC Parallel Input Converters

Description

The 110/120V AC Parallel Input Converters connect to the parallel port of a DL20 one, two, or four line display. Input converters allow AC connections to the DL20 parallel port which normally accepts DC voltages from 5–30 volts. The Parallel Input Converter converts the AC signal to either pulsating or constant 5V DC depending upon which series converter you use:

- Series A and B Parallel Input Converters accept 120V AC ±10%, 60 Hz input signals and convert them to a pulsating 5V DC input signal to the DL20 parallel port.
- Series C and later Parallel Input Converters accept the same AC input signals, but convert them to a constant 5V DC input. An external power supply is not needed when the Parallel Input Converter is installed.

Appendix D shows the converter dimensions.

Description

Figures H.1 and H.2 provide block diagrams of the converter circuits.

Figure H.1
Series A and B Parallel Input Converter Block Diagram

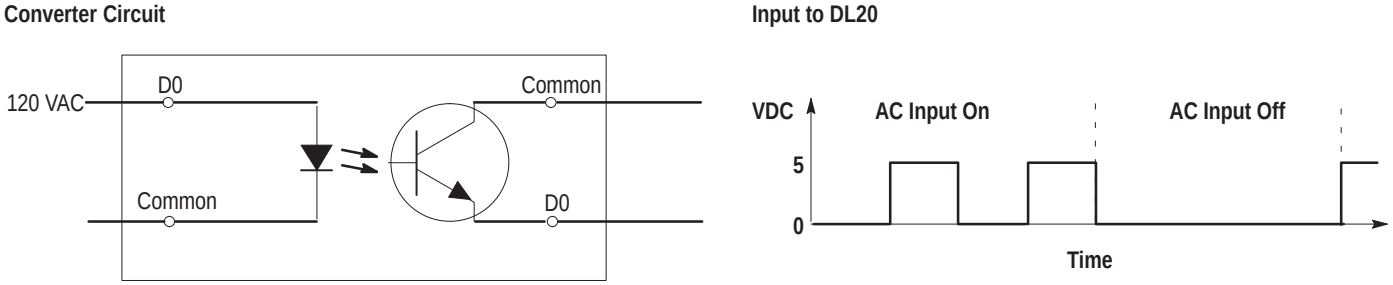
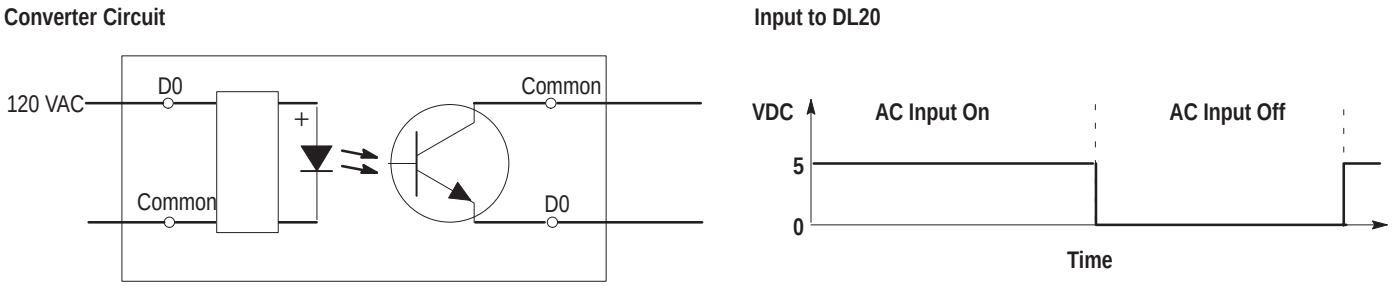


Figure H.2
Series C and Later Parallel Input Converter Block Diagram



The Parallel Input Converter is available in two different mounting styles:

- Catalog Number 2706–NG1 is a display mounted input converter which mounts directly to the parallel port terminals 11A through 22. No wiring between the display and the converter is necessary. With the 2706–NG1 installed, the overall depth of the display is increased by 0.46 inches.
- Catalog Number 2706–NG2 is panel mounted and wired to terminals 11A through 22 of the DL20 parallel port.

Note: A Parallel Input Converter does not fit inside the 2706–NE1 or 2706–NE2 enclosure. If a parallel input converter is used with a display in one of these enclosures, use a panel–mounted input converter (Catalog Number 2706–NG2) in a separate enclosure.

Terminals on both input converters are marked identically to the terminals on the back of the DL20.

PLC Output / DL20 Input Signals

You will need to configure the parallel port to communicate with the input converter and determine the timing for data transfers between the DL20 and the converter.

Use the instructions below to set up the DL20 parallel port for operation with Series A, B, C or later Parallel Input Converters.

1. Select the AC input mode of the parallel port when programming the DL20. You can do this by accessing the special function Set Up I/O Ports and answering appropriately to the prompt USE NG 1/2 SER A,B? Answering Yes to this prompt selects an AC sampling method. Answering No selects a DC sampling method.

2. Select a scan rate of 28 (default) for AC sampling with Parallel Input Converters (Catalog No. 2706-NG1, -NG2 Series A, B, C or later). The scan rate is used to determine the minimum amount of time that stable data must be present on the input terminals of the AC converter to allow for two samples of the parallel port.

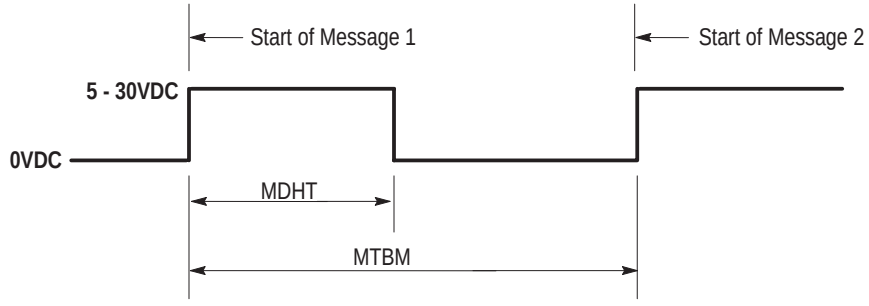
3. If the Parallel Input Converter (Catalog No. 2706-NG1, -NG2 Series C or later) is used, the debounce value must also be specified. Use the value of 25 ms for the debounce.

Minimum Data Hold Times (MDHT) values listed below are based on a scan rate of 28.

Series A or B Converter MDHT = 180 ms
Series C and Later Converter MDHT = 100 ms

The following diagram shows the relationship between Minimum Data Hold Times (MDHT) and Minimum Time Between Messages (MTBM).

Timing Diagram



4. To insure that the DL20 message or variable queue does not overflow resulting in lost messages/variables, determine the minimum time between message (MTBM) triggers (see Table H.A). The MTBM is critical for applications where variables are being updated fast. Minimum Time Between Messages (MTBM) values listed below are based on a scan rate of 28.

Table H.A
MTBM Values (Scan Rate = 28)

Parallel Input Converter	Dataliner	MTBM
Series A, B, & C	One / Two Line	MTBM = MDHT
Series A & B	Four Line	360 ms
Series C & Later	Four Line	310 ms

Installation

Use the following instructions to mount and connect the Parallel Input Converter to the DL20. Instructions are provided for both the display mounted and the panel mounted versions. The approximate mounting dimensions are shown in Appendix D.

ATTENTION: Before installing the parallel input converter, disconnect all power from the DL20.

Display Mounted Version (Catalog No. 2706–NG1)

1. Mount the converter to the back of the DL20 by positioning it directly under parallel port terminals 11A through 22 (D9–D0, MS1, MS0, and +5V DC out).

2. Fasten the converter to the display using the two captive #6–32 screws (supplied). Tighten the two #6 screws to 10 in.–lbs.

3. Tighten terminal screws 11A through 22 on the DL20 for electrical continuity.

Panel Mounted Version (Catalog No. 2706–NG2)

1. Secure the converter to the panel.

2. Connect the input converter to the DL20 by wiring terminals 11A through 22 of the 2706–NG2 to the identically numbered terminals on the DL20.

Connecting the AC Inputs

1. Connect up to twelve 120V AC ±10%, 60 Hz inputs to the 120V AC source inputs (D9 through D0, MS1 and MS0) on the parallel input converter.

2. Connect the AC common to the terminal marked AC COM on the converter.

Important: The AC voltage on all inputs to the Parallel Input Converter must be in phase i.e., they must all come from the same power source.

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DL20 EDIT COMMANDS

Function	Keys Pressed (Simultaneously)
Forward One Space	Ctrl [L]
Back One Space	Ctrl [H]
Up a Line (Move 20 characters to left within message)	Ctrl [K]
Down a Line (Move 20 characters to right within message)	Ctrl [J]
Delete a Character	Ctrl [D]
Change or Review Message Attributes	Ctrl [A]
Run Message	Ctrl [R]
Erase Message	Ctrl [E]
Toggle Uppercase Lock	Ctrl [U]
Show Free Memory	Ctrl [F]
Imbed Non-Decimal Point Variable	Ctrl [V]
Imbed Formatted Decimal Point Variable	Ctrl [X]
Change Variable Format	Ctrl [C]
Imbed time and Date	Ctrl [T]
Show Edit Commands	Ctrl [S]
Quit Edit	Ctrl [Q]

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