

LAXX-NW, NX, NY/LA180 BUFFERED SERIAL INTERFACE USER'S MANUAL

COMPONENTS GROUP

LAXX-NW, NX, NY/LA180 buffered serial interface user's manual

EK-LAXXN-OP-002

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CHAPTER 1 INTRODUCTION

1.1 GENERAL DESCRIPTION

The LAXX/LA180 Buffered Serial Interface is a double-height, extended-length, single-width module designed to interface an LA180 printer to a serial line or a type 202 modem. LAXX is available as three separate options. These options are: LAXX-NW, LAXX-NX, and LAXX-NY. LAXX-NW is the basic option designed to accept a serial ASCII input and output parallel ASCII to the LA180. LAXX-NX converts serial ASCII to parallel ASCII for the LA180, but also has 20 mA current loop optical isolators on the serial input/output lines. LAXX-NY converts EBCDIC code to parallel ASCII for the LA180. All options can operate at rates of 300, 600, 1200, 2400, 4800, or 9600 baud. The baud rate is switch selectable on the module. All versions of the module contain automatic modem answering functions that allow for unattended operation of type 202 modems. In addition, the LAXX modules are available in kits of five modules. These kits are designated as LAXX-MW (five LAXX-NW modules), LAXX-MX (five LAXX-NX modules), and LAXX-MY (five LAXX-NY modules). The LAXX module mounts on the rear door of the LA180 printer and is interfaced to the LA180 logic board via a short cable which is supplied with the LAXX option. Power for the LAXX is from the LA180 +5 V, +12 V, and -12 V supplies.

Figure 1-1 shows the interface signals between the LAXX-NW,NX,NY*, an LA180 printer, a type 202 modem, and a user's serial device. WAKE UP from the LA180 initializes the LAXX, while the 591 ns clock signal clocks the interface. EIA RECEIVED DATA (or EBCDIC code if the interface is an LAXX-NY) is applied to the LAXX and converted to parallel ASCII and stored in a buffer. When the LA180 raises the DEMAND line, 8-BITS of PARALLEL DATA is strobed (by the STROBE line) to the LA180. Since the LA180 is a slow device (compared to the user's serial line device), the LAXX has a buffer that can store up to 256 characters. When the buffer is full the LAXX transmits an ASCII XOFF signal to the user's serial device. XOFF signals the user's device to stop sending data. (Full is defined as 192 characters. Buffer space for 64 characters is available to allow for added characters transmitted by the user's serial device before the user's device stops transmitting.) As the LA180 removes characters from the LAXX buffer, and when the buffer is empty, LAXX transmits an ASCII XON signal to the user's serial device. XON signals the user's device to resume transmitting. XON and XOFF are not shown in Figure 1-1. These signals are generated internal to the LAXX and are available to the user via the EIA TRANSMITTED DATA line or via the TTL OUTPUT line.

The LAXX module (all versions) is designed for the standard EIA input. User's desiring a TTL input can use the TTL INPUT line which is provided on all versions of the module. Similarly, EIA- or TTL-compatible outputs are provided (all module versions) for XON and XOFF. The LAXX-NX version has 20 mA current loop optical isolators that can be used on the serial input and serial output (XON-XOFF) lines. The use of these current loops is at the user's option.

^{*}For simplicity, the LAXX-NW, NX, NY will be referred to as the LAXX in this manual.

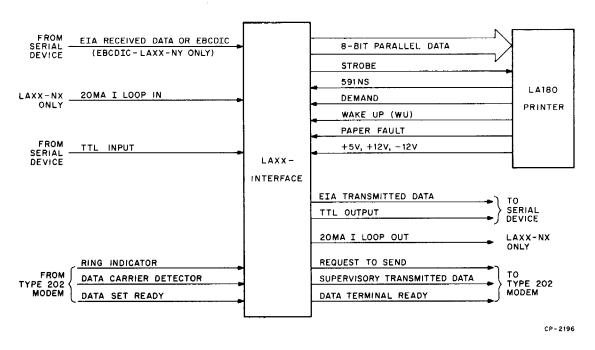


Figure 1-1 LAXX/LA180 Simplified Interface Diagram

All versions of the LAXX option can be interfaced to a type 202 modem for unattended operation. The RING INDICATOR is received from the modem and starts a 30-second timer in the LAXX interface. (LAXX must respond to the "ring" within the 30-second time-out.) LAXX answers the "ring" with DATA TERMINAL READY. When the 202 modem receives DATA TERMINAL READY, it responds with DATA SET READY. LAXX now transmits REQUEST TO SEND to the modem. The modem then transmits data to the LAXX for subsequent outputting to the LA180 printer. This assumes that a proper DATA CARRIER DETECTOR signal has been received by the LAXX and that reverse channel operation (SUPERVISORY TRANSMITTED DATA) is not controlling the sending modem. Data will be printed by the LA180 until the sending modem terminates the transmission or the LAXX generates SUPERVISORY TRANSMITTED DATA. A PAPER FAULT from the LA180 will also terminate the transmission by removing DATA TERMINAL READY.

1.2 SPECIFICATIONS

The following specifications and particulars are for informational purposes only and are subject to change without notice.

Physical

Double-height, single-width, extended-length module

Dimensions

10 in. l, 0.5 in. w, 5-1/4 in. h (25.40 cm l, 1.27 cm w, 13.34 cm h)

Weight

6 oz (170 g)

User Input Connections

Two 40-pin connectors; one to interface to the user's device, the other to interface to the LA180. Interface cables are supplied with the LAXX.

Mounting Requirements

The LAXX module mounts on the rear door of the LA180 printer. It is secured to the door's four mounting bosses by four screws.

Electrical

Logic Power Requirements

+5 V @ 820 mA

+12 V @ 10 mA

-12 V @ 10 mA

All LAXX input power is supplied by the LA180.

Interfaces

EIA Interface - The signals for the EIA interface conform to the EIA RS-232-C standard.

LA180 Interface – Outputs from the LAXX are open collector drivers capable of sinking 40 mA. LAXX inputs are high-impedance, high-threshold receivers. All LAXX input and output lines are terminated in the LA180 with 150 Ω to +5 V and 330 Ω to ground.

20 mA Current Loop Interface (LAXX-NX only) – This interface converts a 20 mA current loop to TTL signals for use by the LAXX-NX and also converts TTL signals (from LAXX-NX) to 20 mA current loop.

EBCDIC Interface (LAXX-NY only) - The LAXX-NY module converts EBCDIC code to ASCII.

Modem Interface – The modem control functions on the LAXX module conform to the EIA RS-232-C standard and are compatible with type 202 modems.

Baud Rates - All modules can operate at 300, 600, 1200, 2400, 4800, or 9600 baud. The baud rate is switch selectable.

Module Types

LAXX-NW - Accepts EIA RS-232-C serial ASCII input and outputs parallel ASCII to the LA180. LAXX-NW does not have the 20 mA current loop or the EBCDIC converter.

LAXX-NX - Same input and output as the LAXX-NW, but in addition has input/output 20 mA current loops.

LAXX-NY - Accepts EBCDIC code as input and converts it to parallel output for the LA180. The 20 mA current loop is not available with this module.

Environmental

Temperature

Storage: -40° to 66° C (-40° to 150° F) Operating: 5° to 50° C (41° to 122° F)

Relative Humidity

10% to 95% noncondensing

1.3 RELATED LITERATURE

The following list of documents contain useful information for installing, operating, and maintaining the LAXX option. Documents published by DEC may be ordered from the nearest Digital Equipment Corporation Sales Office.

Document Title

DEC Document No.

EIA Standard RS-232-C

Bell System Technical Reference Data Sets 202C and 202D Interface Specification PUB41202

LA180 DECprinter I User's Manual

(EK-LA180-OP-001)

LA180 DECprinter I Maintenance Manual

(EK-LA180-MM-001)

CHAPTER 2 INSTALLATION

2.1 GENERAL

Installation of the LAXX consists of selecting the operating mode by means of jumpers and switches on the module, and ensuring that the jumpers on the LA180 logic module are configured for use with the LAXX.

2.2 LAXX JUMPERS

The NW and NX versions of the LAXX module have eight jumpers (W1 through W8) in place of an EBCDIC converter. Jumpers W1 through W8 are not installed on the LAXX-NY module as this module is manufactured with an EBCDIC converter.

2.3 LAXX SWITCHES

The LAXX module has an 8-switch switch pack. Figure 2-1 shows the location of the switch pack. Switches S1 through S3 are used to select the baud rate at which the LAXX operates. Baud rates from 300 to 9600 baud can be selected. Baud rate selection is summarized in Table 2-1. Note that when S1 and S2 are set to ON and S3 is set to OFF, or when S1 and S2 are set to OFF and S3 is set to ON, no baud rate is established and the LAXX module will not operate.

Switches S4 and S8 allow the RING INDICATOR line to control the state of the modem DATA TERMINAL READY line. When S4 and S8 are set to ON, the DATA TERMINAL READY line will go high when the RING INDICATOR line from the transmitting modem goes high; DATA TERMINAL READY will be cleared (go low) by the loss of the DATA CARRIER DETECTOR line from the transmitting modem. When S4 is set to OFF, the DATA TERMINAL READY line will be held high at all times.

S5 controls the state of the REQUEST TO SEND line. When S5 is set to ON, the REQUEST TO SEND line is held high at all times. S5 in the OFF position causes the REQUEST TO SEND line to go low and enables the SUPERVISORY TRANSMITTED DATA line. Reverse channel operation is selected by setting S5 to the OFF position.

Switch S6 allows the PAPER FAULT line from the LA180 printer to clear the DATA TERMINAL READY line providing S4 is ON, S7 is OFF, and S8 is ON. With S4, S7, and S8 set as mentioned, setting S6 to ON causes the DATA TERMINAL READY line to go low (clear) if the PAPER FAULT line from the LA180 goes high. Setting S6 to OFF disables the PAPER FAULT input from the LA180.

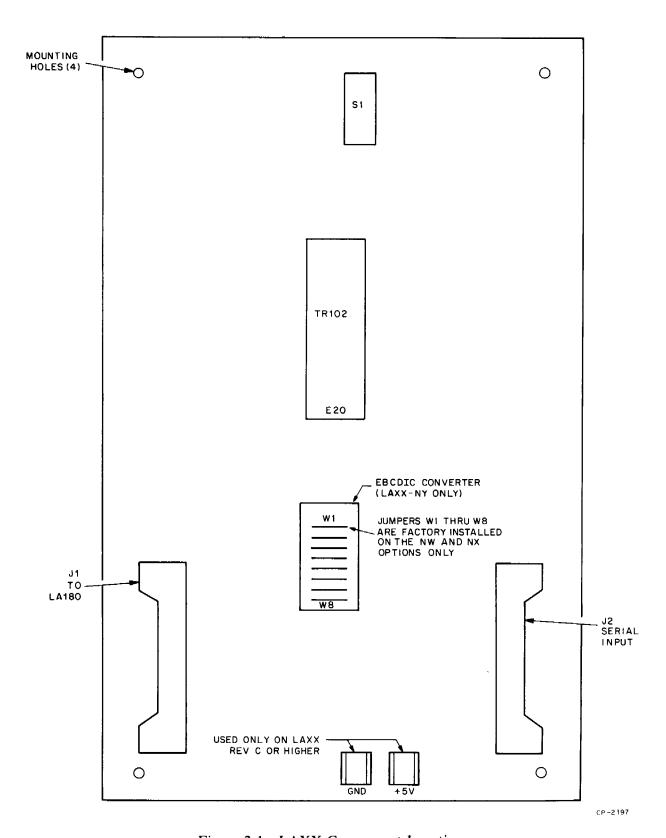


Figure 2-1 LAXX Component Locations

Table 2-1 Baud Rate Selection

	Switch	Selected	
1	2	3	Baud Rate
ON	ON	ON	300 baud
ON	OFF	OFF	600 baud
OFF	OFF	OFF	1200 baud
ON	OFF	ON	2400 baud
OFF	ON	ON	4800 baud
OFF	ON	OFF	9600 baud
ON	ON	OFF	None
OFF	OFF	ON	None

The DATA TERMINAL READY line can also be controlled by the state of the LAXX character buffer, i.e., when the buffer is full DATA TERMINAL READY goes low; when empty it goes high. This is accomplished by setting S5 and S8 to OFF, and S4 and S7 to ON. It should be noted that the REQUEST TO SEND line will now be low at all times.

Switches S4, S5, S7, and S8 determine which of the three (SUPERVISORY TRANSMITTED DATA, DATA TERMINAL READY, EIA TRANSMITTED DATA) LAXX signals is used to indicate the buffer full state of the LAXX. Each signal line is unique to a particular user's application. Table 2-2 describes the different switch configurations and their applications.

Table 2-3 summarizes the use of the switches on the LAXX module.

NOTE

There are two types of switch packs used in the manufacture of LAXX modules:

Switch packs by CTS: These switches are ON when the switch slides are adjacent to the switch position number.

Switch packs by AMP: These switches are ON when the switch toggles are down adjacent to the switch position number.

Table 2-2 Buffer Full Switch Configurations

Signal Line	Switch Configuration	Function
SUPERVISORY TRANSMITTED DATA (J2-FF* high indicates buffer is full).	S4 OFF S5 OFF S7 OFF S8 OFF	This configuration is used with a man- ual control 202 modem with reverse channel.
SUPERVISORY TRANSMITTED DATA and DATA TERMINAL READY (J2-FF* high indicates buffer is full. J2-DD* high indicates LA180 is ready to accept data.)	S4 ON S5 OFF S7 OFF S8 ON	This configuration is used with an auto-answer 202 modem with reverse channel. The SUPERVISORY TRANSMITTED DATA signal is used to indicate a full buffer. The DATA TERMINAL READY signal is used to indicate that the LA180 is ready to accept data.
EIA TRANSMITTED DATA [X ON (DC1) X OFF (DC3) J2-F*]	S4 OFF S5 ON S7 OFF S8 OFF	Standard signal for DIGITAL software.
DATA TERMINAL READY (J2-DD* low indicates buffer is full.)	S4 ON S5 OFF S7 ON S8 OFF	Typically used when the LA180 is hard-wired to another terminal.

^{*}J2 on LAXX module

Table 2-3 LAXX Switch Functions

Switch	Function	Description					
S1	Baud	S1, S2, S3 are used to select baud rates from					
S2	Rate	300 to 9600 baud. Refer to Table 2-1 for baud					
S 3	Selection	rate selection.					
S4	Conditions DATA TERMINAL READY	When set to ON, DATA TERMINAL READY can be set (high) by RING INDICATOR or the state of the LAXX character buffer. The set conditions are determined by switches S5, S6, S7, and S8. Refer to the text for a complete description of S4 functions.					
		When set to OFF, DATA TERMINAL READY is always set (high).					

Table 2-3 LAXX Switch Functions (Cont)

Switch	Function	Description
S 5	Conditions REQUEST TO SEND and SUPERVISORY TRANSMITTED DATA	When set to ON, REQUEST TO SEND is set (high) at all times and SUPERVISORY TRANSMITTED DATA is inhibited (remains low).
		When set to OFF, REQUEST TO SEND is low at all times and SUPERVISORY TRANSMITTED DATA is controlled by the LAXX character buffer.
		S5 also controls DATA TERMINAL READY providing S7 is ON. Refer to the text for a complete description of S5 functions.
S 6	Conditions PAPER FAULT	When set to ON, allows PAPER FAULT to clear DATA TERMINAL READY providing S4 and S8 are ON and S7 is OFF.
		When set to OFF, PAPER FAULT has no effect on DATA TERMINAL READY. Refer to the text for a complete description of S6 functions.
S7	Allows control of DATA TERMINAL READY by LAXX character buffer	When set to ON, and providing S5 is OFF and S4 is ON, the state of the LAXX character buffer will control DATA TERMINAL READY. When the buffer is full DATA TERMINAL READY goes low. DATA TERMINAL READY goes high (sets) when the buffer is less than full.
		When set to OFF the buffer cannot control DATA TERMINAL READY. Refer to the text for a complete description of S7 functions.
S8	Allows control of DATA TERMINAL READY by RING INDICATOR, DATA SET READY, or PAPER	When set to ON, and providing S4 is ON and S7 is OFF, RING INDICATOR will cause DATA TERMINAL READY to set (high).
	FAULT	When set to OFF, RING INDICATOR will not set nor will PAPER FAULT or DATA SET READY clear DATA TERMINAL READY. Refer to the text for a complete description of S8 functions.

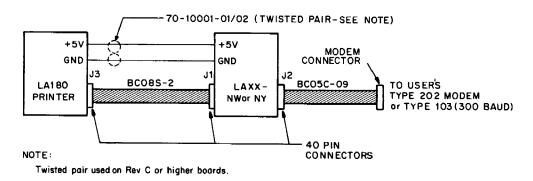
2.4 CABLES

Cable requirements for the LAXX option depend on the module option. LAXX-NW and NY require two cables – one BC08S-2 and one BC05C-09. These cables are supplied with the LAXX-NW and NY options. The BC08S-2 interfaces the LAXX module to the LA180 logic module and is connected from J1 on the LAXX module to J3 on the LA180 module. The BC05C-09 is an EIA interface cable. BC05C-09 connects from J2 on the LAXX-NW or NY module to the serial connector on the user's modem. Figure 2-2 illustrates the cabling between the LAXX-NW or NY module, the LA180 printer, and the user's modem. Pinning for J1 and J2 on the LAXX-NW or NY module and J3 on the LA180 logic module is shown in Figure 2-3.

The LAXX-NX module requires three cables – one BC08S-2, one BC05M-2C, and one BC05F-09. BC08S-2 interfaces the LAXX-NX output to the LA180 logic module. The BC05M-2C is a special 20 mA current loop cable. BC05F-09 is an extension interface cable designed for use with the BC05M-2C. These cables are supplied with the LAXX-NX option.

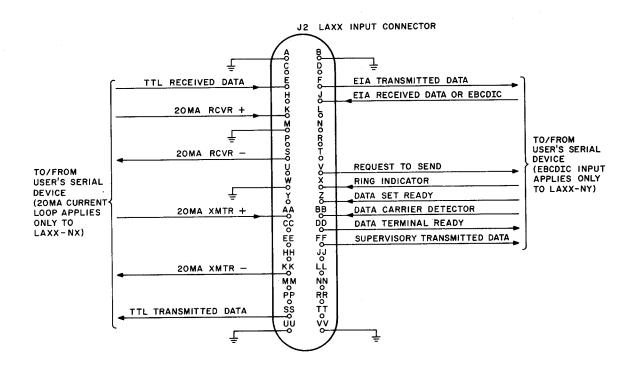
Figure 2-4 illustrates the cabling between the LAXX-NX module, the LA180 printer, and the user's serial device. Pin assignments for J1 and J2 on the LAXX-NX module and J3 on the LA180 module are shown in Figure 2-3.

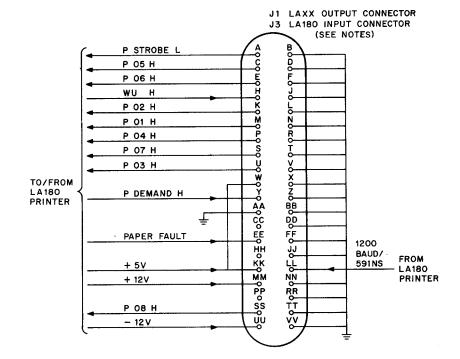
In addition to the cables just described, a twisted-pair cable is used to supply +5V power to the LAXX module from the LA180 logic module. The twisted-pair is only required for LAXX modules of revision C or higher.



CP -2198

Figure 2-2 LAXX-NW/NY Cabling





CP-2204

NOTES:

- 1. Signal flow arrows are shown for LAXX J1.
 Arrows are reversed for LA180 J3.
- 2. LAXX J1-LL: 591 ns
- 3. LA180 J3-LL: 1200 baud/591ns

From Serial Interface	To User's Equipment	Signal Name
P2-KK	P1-3	20 MA XMTR –
P2-S	P1-2	20 MA RCVR -
P2-AA	P1-7	20 MA XMTR +
P2-K	P1-5	20 MA RCVR +
P2-H**		
P2-E		

^{*}P2 connects to J2 on the serial interface.

20 mA Current Loop Cable Pinning

From Serial Interface*	To User's Equipment	Signal Name
J1-B	P1-7	GROUND
J1-F	P1-2	EIA TRANSMITTED DATA
J1-J	P1-3	EIA RECEIVED DATA OR EBCDIC
J1-V	P1-4	REQUEST TO SEND
J1-X	P1-22	RING INDICATOR
J1-Z	P1-6	DATA SET READY
J1-BB	P1-8	DATA CARRIER DETECTOR
J1-DD	P1-20	DATA TERMINAL READY
J1-FF	P1-11	SUPERVISORY TRANSMITTED DATA
J1-VV	P1-1	GROUND

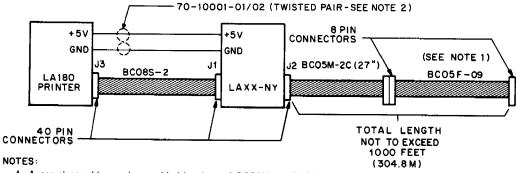
^{*}J1 connects to J2 on serial interface.

EIA Cable Pinning

Figure 2-3 LAXX and LA180 Connector Pin Assignments

2-7

^{**}P2 H is connected to P2-E.



1. A one piece cable may be provided in place of BCO5M and BCO5F.

2. Twisted pair on Rev C or higher boards.

CP -2199

Figure 2-4 LAXX-NX Cabling

2.5 MODULE INSTALLATION

The LAXX module mounts on the rear door of the LA180 printer cabinet. Four screws and four quarter-inch spacers are used to secure the module to the mounting bosses on the door. Position the module with the input/output connectors (J2/J1) facing the bottom edge of the door (Figure 2-5). Insert and tighten the four mounting screws $(6-32 \times 5/8)$. Do not overtighten the screws; this may damage the module.

Early models of the LA180 are equipped with two mounting bosses near the rear door hinge. The LAXX is mounted to these bosses using two screws and two quarter-inch spacers. The rear of the LAXX module is supported by two threaded spacers. These spacers are not attached to the LA180 rear door. Refer to Figure 2-5, view B.

After the LAXX module has been secured to the rear door, connect the BC08S-2 cable from J1 on the LAXX module to J3 on the LA180 logic module. Make the appropriate folds and bends in the BC08S-2 cable and ensure that the smooth side of the cable is connected to J1 and the ribbed connector to J3. Position the cable in the cable runway of the LA180 rear door (Figure 2-5).

WARNING

The BC08S-2 cable and the LAXX module will be damaged if the BC08S-2 cable is not properly installed.

Route the serial input cable (either the BC05C-09 cable or the BC05M-2C and the BC05F-09, whichever applies) into the LA180 from beneath and connect the 40-pin connector to J2 on the LAXX module. The free end of the serial cable is then connected to the user's device.

If the LAXX module is of revision C or higher, connect the RED wire from the RED/BLACK twisted-pair cable to the +5V tab on the LAXX module and connect the BLACK wire to the LAXX GND tab. (Refer to Figure 2-1 for LAXX tab identification.) The other ends of the RED/BLACK twisted-pair are connected to the +5 V tab (RED wire) and GND tab (BLACK wire) on the LA180 logic module. (Refer to Figure 2-6 for LA180 logic module tab identification.) Position the twisted-pair cable in the cable runway, of the LA180 rear door.

Installation of the LAXX module is now complete. However, before applying power, the LA180 logic module must be examined to determine if certain jumpers are installed (refer to Paragraph 2.6).

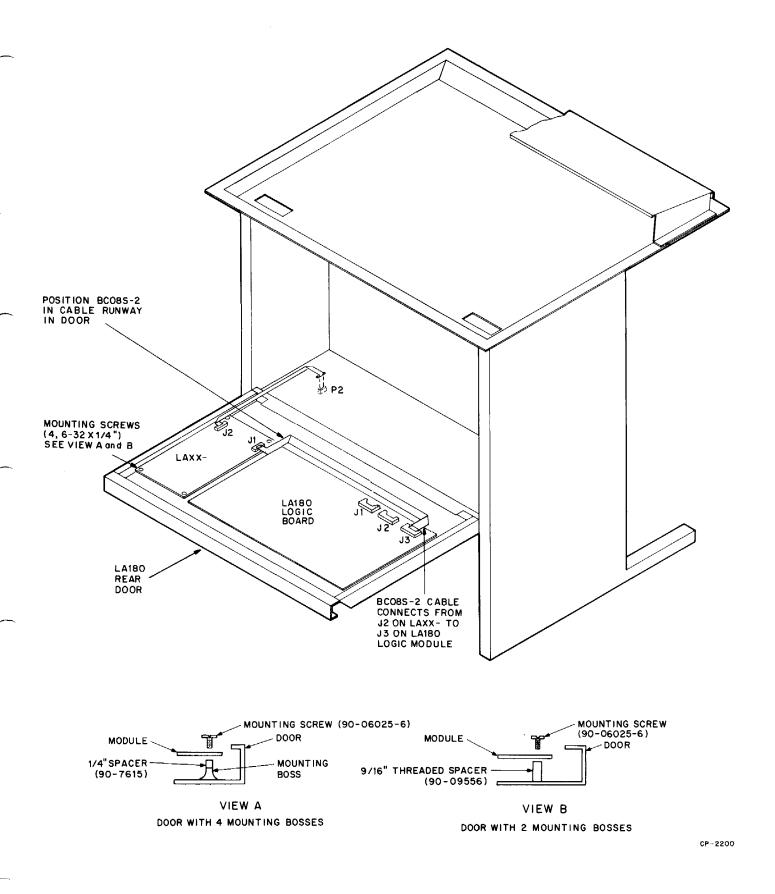


Figure 2-5 Module Installation on LA180 Rear Door

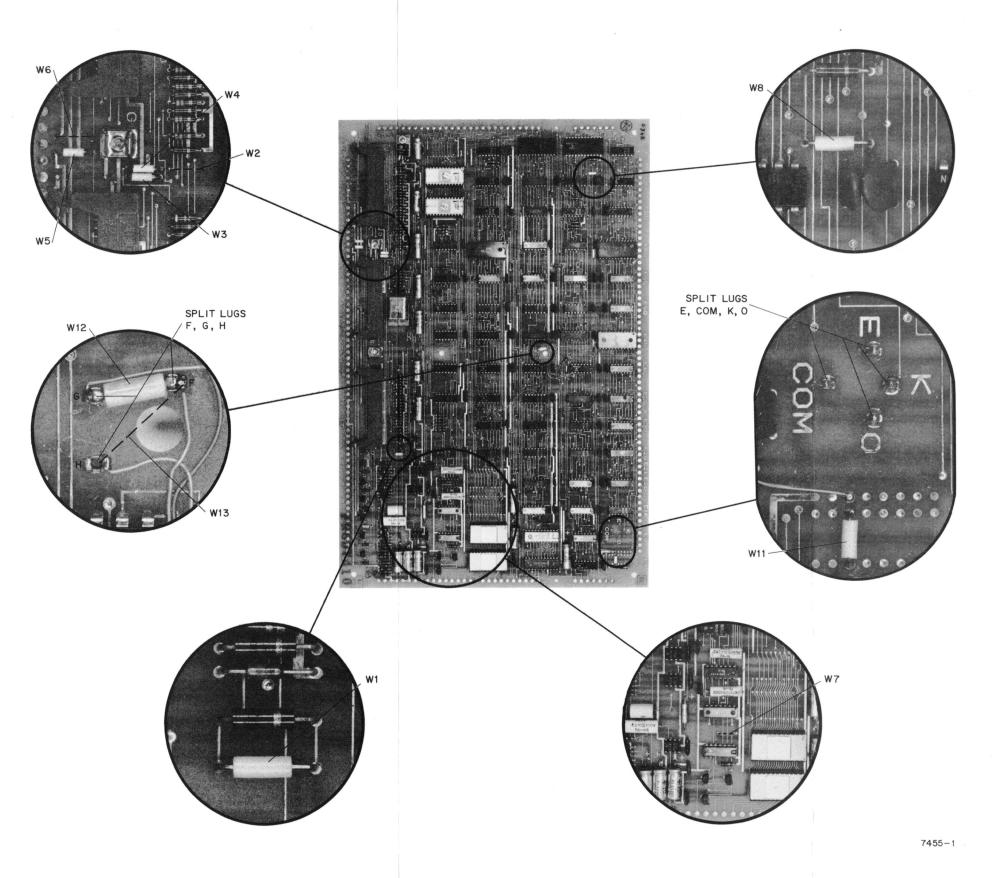


Figure 2-6 LA180 Logic Module Jumper Locations

2.6 LA180 LOGIC MODULE JUMPERS

Figure 2-6 shows the location of the jumpers on the LA180 logic module. The actual jumpers installed on the module may vary to reflect factory-installed options. However, for use with the LAXX module, the following LA180 logic module jumpers must be installed:

Jumper	Function
W3	-12 V interface voltage
W4	Clock
W5	+12 V interface voltage
W12	591 ns

If installation of one or more of the above-mentioned jumpers is necessary, removal of the LA180 logic module is required. The module is removed by disconnecting the cables at J1, J2, J3, and removing the six screws that secure the module to the rear door of the LA180. The jumpers can now be soldered in place using a low wattage soldering iron. After installing the jumpers, place the module on the rear door mounting bosses with J3 on the right (Figure 2-5). Fasten the module to the door with the six screws previously removed. Do not overtighten the screws. Connect the previously removed cables to J1, J2, and J3.

2.6.1 Parity Jumpers

The LA180 has provisions for checking the parity of the incoming data. Even or odd parity can be checked. However, in order to implement parity checking at the LA180, the transmitting device must be configured to transmit seven data bits plus one parity bit. A nine-bit data pattern (eight bits of data plus one parity bit) cannot be checked for parity by the LA180 because the parity bit (ninth bit) is not transferred to the LA180 (the LA180 is an eight-bit device). Parity checking at the LA180 for an eight-bit pattern (seven data bits plus one parity bit) is accomplished by installing jumpers per Table 2-4 on the LA180 logic module (Figure 2-6). The module does not have to be removed to install these jumpers – split lugs are provided. The LA180 indicates parity errors by printing three vertical lines. If parity checking is not desired, do not install the jumpers and remove them if they have been previously installed.

Table 2-4 LA180 Parity Jumpers

Parity	Jumper Configuration
NONE	No jumpers between split lugs COM, E, or O.
EVEN	Jumper installed between split lugs COM and E.
ODD	Jumper intalled between split lugs COM and O.

NOTE

If the LA180 uses the extended character set, a jumper will be installed between split lugs COM and K. Do not remove this jumper.

2.6.2 Delete Function - Jumper (W11) Installed

Jumper W11 is installed on the LA180 logic module to delete the delete code (177). The delete code resets the character address register on the LA180 logic module to zero. This clears all data between a line terminator and the delete code. A line terminator is defined as any of the following:

Input Printout

(Example 1)
ABCDEFG <CR>
HIJK LMNOP

ABCDEFG LMNOP

(Example 2)

"THE QUICK BROWN FOX <CR>LEAPED JUMPED OVER"

"THE QUICK BROWN FOX

JUMPED OVER"

2.6.3 Delete Function – Jumper (W11) Removed

When jumper W11 is removed, the delete code (177) is used as a fill character. This is done to ensure programming compatability with the LA180 when using the LAXX module.

Input Printout

(Example) ABCD < DEL > EFG

ABCDEFGH

2.6.4 Clock Jumpers (W12 and W13)

Jumpers W12 and W13 make the 591 ns or 1200 BAUD signals available at J3-LL through jumper W4 on the LA180. The 591 ns signal is a 591 ns square wave. Table 2-5 lists the jumper configuration for selecting either the 591 ns signal or the 1200 BAUD signal.

Table 2-5 LA180 Clock Jumpers

Jumper	591 ns (NOTE)	1200 Baud
W4	Insert	Insert
W12	Insert	Remove
W13	Remove	Insert

NOTE

The jumper configuration for 591 ns must be used when the LA180 is equipped with an LAXX-NW, NX, or NY module. If the LA180 is not equipped with an LAXX module, the selection of 591 ns or 1200 BAUD is optional at the user's discretion.

2.6.5 WAKE UP Signal (WU H)

WAKE UP is a 700-ms pulse. It initializes the logic (LA180 logic as well as the LAXX) before the microprocessor on the LA180 logic module starts to run. During power-up, WU is at a logic zero level. After one time constant (approximately 700 ms), WU goes to a logic one level and the microprocessor starts to run. The WAKE UP signal is available at J3-H on the LA180 logic module.

CHAPTER 3 BASIC OPERATION

3.1 GENERAL

This chapter contains a general functional description of the LAXX modules. Figure 3-1 is a block diagram of the LAXX. It should be noted that Figure 3-1 is a composite illustration. That is, it shows the 20 mA current loops as well as the EBCDIC converter along with the standard LAXX circuits. The 20 mA current loops are available only with the LAXX-NX option, while the EBCDIC converter is available only with the LAXX-NY option. All LAXX options contain the standard circuits.

Functionally, the LAXX module can be divided into two functions:

- 1. The Serial Input Parallel output conversion circuits.
- 2. The Modem Control Automatic answering circuits.

These functions are discussed in this chapter along with the LA180 interface timing.

3.2 SERIAL INPUT-PARALLEL OUTPUT CONVERSION CIRCUITS

The serial input-parallel output conversion circuits accept serial ASCII or EBCDIC code (LAXX-NY only) as an input and converts this input to an eight-bit parallel output which is applied to the LA180 printer. The serial input can be either a TTL input, an EIA RS-232-C input, or in the case of the LAXX-NX option, a 20 mA current loop input. TTL, EIA, and current loop converters (whichever the user desires) convert the input to TTL for acceptance by the UART (Universal Asynchronous Receiver/Transmitter).

The UART and the 256-character RAM storage buffer form the heart of the LAXX module. The RECEIVED DATA serial input is applied to the UART where it is converted to parallel ASCII. In the case of the LAXX-NW and NX modules, the parallel output from the UART is applied directly to the 256-character RAM storage buffer. (The LAXX-NW and NY options do not have the EBCDIC converter. These options are manufactured with jumpers W1 through W8 in place of the converter.) As the UART receives the serial input, it generates a data available (DA) pulse. The DA pulse is applied to the input strobe counter. The input strobe counter counts the DA pulses and produces a clock input to the input address counter. For each DA pulse generated, the input address counter places an input address on the address lines to the 256-character RAM storage buffer. This address is the location where the parallel ASCII eight-bit word from the UART is stored until retrieved by the LA180 printer. Words are written into the RAM storage buffer starting at location zero and progress upward to location 256. Therefore, for input transfers to the RAM storage buffer the input address counter is incremented.

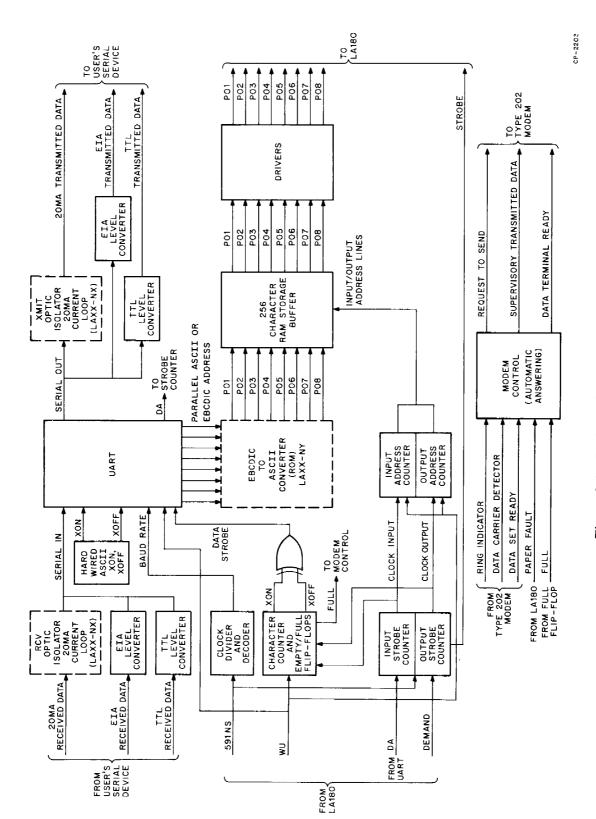


Figure 3-1 LAXX Block Diagram

The ASCII characters remain stored in the 256-character buffer until the LA180 requests them. When DEMAND from the LA180 goes high, the output strobe counter generates a clock output pulse to the output address counter. The output address counter places an output address on the address lines to the 256-character RAM storage buffer. This output address is the location from which the parallel eight-bit ASCII word is read via the drivers to the LA180 printer. It should be noted that the input and output address counters and the 256-character RAM storage buffer function as a first-in first-out memory. That is, the first word written into the RAM storage buffer is the first word read out. When the buffer is empty, both counters will contain the same address.

As the UART places ASCII characters into the buffer and the LA180 removes the characters, the character counter will be incremented and decremented by the clock input and clock output pulses from the input and output strobe counters. The character counter keeps track of the full and empty states of the buffer. When the buffer is full (defined as 192 characters), the character counter sets the full flip-flop which produces XOFF. XOFF is XORed with XON (buffer empty) to produce data strobe. Data strobe is applied to the UART and causes a hard-wired ASCII XOFF to be transmitted from the serial out port of the UART to the user's device via the appropriate converter (as determined by the user and the LAXX option). XOFF signals the user's transmitting device to stop sending characters.

However, because there is some time lag in the generation of XOFF and the time at which the user's device stops transmitting, additional characters (beyond 192) are transmitted. These additional characters (up to 64) will be stored in the 256-character RAM storage buffer.

When characters are read from the RAM storage buffer by the LA180, the character counter is decremented. When the buffer empties, the character counter sets the empty flip-flop. The empty flip-flop produces XON which is XORed with XOFF to produce data strobe. This time, data strobe causes the UART to transmit a hard-wired ASCII XON from the serial out port to the user's device. XON signals the user's device to resume transmitting until the RAM storage buffer is again full.

Thus far, the discussion has revolved around a serial ASCII input which applies to the LAXX-NW and NX options. With the exception of the ASCII and EBCDIC code differences, the operation of the LAXX-NY option is the same as the LAXX-NW or NX options. The LAXX-NY option has the EBCDIC-to-ASCII converter ROM and jumpers W1 through W8 are not installed. In the case of the LAXX-NY option, the EBCDIC serial input to the UART is converted to an eight-bit EBCDIC address which is applied to the EBCDIC-to-ASCII converter. The EBCDIC address causes the EBCDIC converter to transfer the corresponding ASCII character to the 256-character RAM storage buffer. Table 3-1 shows the relationship between EBCDIC (designated as E) and ASCII (designated as A) characters.

As mentioned in the previous chapter, the LAXX module can operate at 300, 600, 1200, 2400, 4800, or 9600 baud. The baud rate is switch selectable via S1, S2, and S3 (refer to Table 2-1). A 591 ns clock from the LA180 printer is used to produce the switch-selected baud rate for the UART by means of the clock divider and decoder.

3.3 MODEM CONTROL (AUTOMATIC ANSWERING) CIRCUITS

The modem control circuits allow for unattended modem operation of the LA180 printer via a type 202C modem. When the RING INDICATOR is received, a 30-second timer is started within the modem control circuits. The modem control must answer the "ring" with DATA TERMINAL READY within the 30-second time-out, or the modem control will "hang-up" the line. When the 202 modem receives DATA TERMINAL READY, it responds with DATA CARRIER DETECTOR and DATA SET READY. The LAXX modem control responds to DATA SET READY by inhibiting the time-out from clearing DATA TERMINAL READY. The 202 modem may then transmit serial ASCII data (via one of the RECEIVED DATA inputs) to the LAXX UART for subsequent outputting to the LA180 printer. Data transmission from the modem to the UART will continue until the LAXX 256-character RAM storage buffer is full, or until the LA180 generates a PAPER FAULT.

Table 3-1 EBCDIC – ASCII Relationship

E*	A*	E	A	E	A	E	A	E	A	E	A	E	A	E	A
NUL	NUL	DLE	DLE	DS			_	SP	SP	&	&		_		
SOH	SOH	DC1	DC1	SOS		_	-					/	/		
STX	STX	DC2	DC2	FS		SYN	SYN								
ETX	ETX	TM	DC3			_	****								
PF		RES		BYP		PN									
HT	HT	NL		LF	LF	RS									
LC		BS	BS	EOB	ETB	UC				NO'	THIN	IG IN	THI	S AR	EA
DEL	DEL	IL		PRE	ESC	EOT	EOT								
\checkmark		CAN	CAN	_		_									
	_	EM	EM	_	_	w/s	_								
SMM		CC		SM		_		¢		!	!			:	:
VT	VT	CU1		CU2		CU3				\$	\$,	,	#	#
FF	FF	IFS	FS		_	DC4	DC4	<	<	*	*	%	%	@	@
CR	CR	IGS	GS	ENQ	ENQ	NAK	NAK	(())	_	_	′	φ
SO	SO	IRS	RS	ACK	ACK		_	+	+	;	;	>	>	=	=
SI	SI	IUS	US	BEL	BEL	SUB	SUB		:		Λ	?	?	,,	"
_	_		_	•	_					****				0	0
a	a	j	j	_	_			A	A	J	J			1	I
b	b	k	k	s ,	S			В	В	K	K	S	S	2	2
c	c	1	1	t	t			C	C	L	L	T	T	3	3
d	d	m	m	u	u			D	D	M	M	U	U	4	4
e	e	n	n	v	V			E	E	N	N	V	V	5	5
f	f	0	O	W	W			F	F	0	0	W	W	6	6
g	g	p	p	X	X			G	G	P	P	X	X	7	7
h	h	q	q	У	У			H	H	Q	Q	Y	Y	8	8
i	i	r	r	Z	Z			I	I	R	R	Z	Z	9	9

^{*}E = EBCDIC

When the RAM storage buffer is full, the character counter sets the full flip-flop as explained previously. However, the XON and XOFF signals are not used for modem operation. Instead, the output of the full flip-flop is applied to the modem control to govern the state of the SUPERVISORY TRANSMITTED DATA line. When the buffer is full, the SUPERVISORY TRANSMITTED DATA line goes high and signals the 202 modem to halt the transmission of data. When the buffer empties, the character counter resets the full flip-flop and the SUPERVISORY TRANSMITTED DATA line goes low. The modem can now resume data transmission. The use of the SUPERVISORY TRANSMITTED DATA line is known as reverse channel operation.

A PAPER FAULT from the LA180 will also terminate modem data transmission by causing the DATA TERMINAL READY line to go low. The sending station can terminate the call by dropping the DATA CARRIER DETECTOR line. This will reset the DATA TERMINAL READY line.

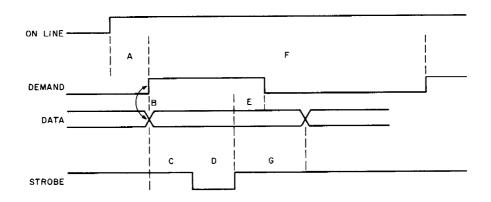
A = ASCII

The modem control signals are conditioned by switches S4, S5, S6, S7, and S8 on the LAXX module. Switch functions are explained in Paragraph 2.3 and in Tables 2-2 and 2-3.

Additional information on modem interfacing can be found in the EIA Standard RS232C and in Bell System Technical Reference, Data Sets 202C and 202D Interface Specification, PUB 41202.

3.4 LA180 INTERFACE TIMING

Figure 3-2 shows the LA180 interface timing. ON LINE (not used by LAXX) goes high when the printer is ready to function with a controller. DEMAND goes high for each character request from the LAXX. DATA represents the time allotted to transfer eight bits of character information (P01 through P08) to the printer from the LAXX. STROBE is the signal from the LAXX that gates the character bits (P01 through P08) into the printer buffer.



- A TIME FROM ON-LINE TO FIRST DEMAND: 0 SEC MIN. 1 SEC MAX.
- B 0 SEC MIN
- C DATA MUST BE STABLE AT LEAST 50 nSEC PRIOR TO LEADING EDGE OF STROBE.
- D STROBE MUST BE LOW AT LEAST 100 nSEC.
- E DEMAND WILL REMAIN HIGH FOR 50 nSEC MAX. AFTER STROBE RETURNS HIGH.
- F NEXT DEMAND WILL OCCUR 8.26 μ SEC FROM LEADING EDGE OF DEMAND, MINIMUM.
- G DATA MUST REMAIN STABLE FOR 100 DISEC AFTER STROBE RETURNS HIGH.

CP-2202

Figure 3-2 LA180 Interface Timing

APPENDIX A PARTS LIST

Table A-1 lists the parts supplied with the LAXX/LA180 Buffered Serial Interface by part number, description, and quantity.

Table A-1 Parts List

Part No.	Description	Quantity†
LAXX*	Serial interface module	1
BC08S-2	2-ft interface cable (supplied with all module options)	1
BC05C-09	9-ft EIA interface cable (supplied with LAXX-NW and -NY options)	1
BC05F-09	9-ft extension interface cable (supplied with LAXX-NX module option)	1
BC05M-2C	27-in, 20-mA current loop cable (supplied with LAXX-NX module option)	1
70-10001-01/02	Cable, twisted-pair	1
90-7615	1/4 in – no. 6 spacer	4
90-06025-6	$6-32 \times 5/8$ in screws	4
90-09556	9/16 in - threaded (L-32) spacer	2
CS-5412166-0-1	Print Set	1 set
EK-LAXXN-OP-002	LAXX User's Manual	1

^{*}The module part number can be LAXX-NW, -NY, or -NX depending on user requirements. The same modules are available in kits of five modules. Kit designations are LAXX-MW, -MX, or -MY.

[†]Kits contain 5 modules, 5 cables of each type, and 20 screws, 20-1/4 in spacers, and 10-9/16 in spacers.

Reader's Comments

LAXX-NW, NX, NY/LA180 BUFFERED SERIAL INTERFACE USER'S MANUAL EK-LAXXN-OP-002

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