B 1700 TRAIN PRINTER CONTROL II

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Burroughs

FIELD ENGINEERING

TECHNICAL MANUAL

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SECTION I

INTRODUCTION AND OPERATION

INTRODUCTION

This section contains information on the operation and characteristics of the Train Printer and the Train Printer Control II.

TRAIN PRINTER

The Train Printer (figure I-1) is an unbuffered printer operating at either 400 or 750 lines per minute (LPM). The basic 400 LPM printer contains 120 print positions with an option to provide 132 print positions. The basic 750 LPM printer also contains 120 print positions with an option to provide 132 print positions.

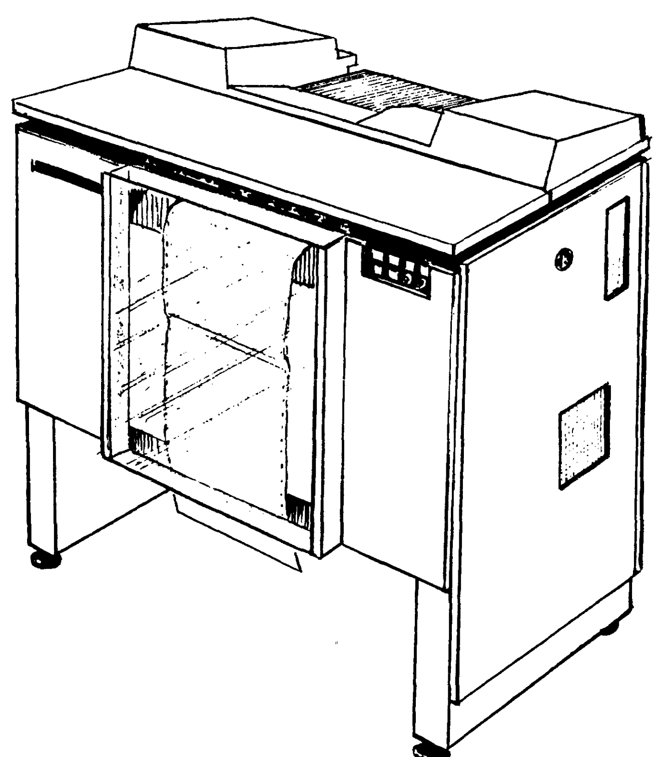


Figure I-1. Train Printer, 400 or 750 LPM

PHYSICAL CHARACTERISTICS

The physical characteristics of the Train Printer are listed below:

Height	44 inches
Depth:	28 inches
Width:	42 inches
Unit Weight:	775 pounds
Shipping Weight:	830 pounds

ELECTRICAL CHARACTERISTICS

The Train Printer will operate using any of the following single phase power sources.

Voltage	Frequency (~~Hertz~~) cps
100	50/60
110	50/60
115	60
120	60
127	50/60
200	50/60
230	50/60
240	50/60

The Train Printer contains a taped input transformer to permit operation at any of the above specified voltage sources. The average power consumption of the Train Printer will not exceed 2.6 KVA.

OPTIONAL CHARACTER SETS

The optional character sets (print trains) are listed below:

Character Set	Name
16	EBCDIC-3
48	FORTRAN
48	B 300/B 500
48	RPG
64	EBCDIC-3
64	U.K. B 3500
64	U.K. B 6500
64	LATIN/PORTUGUAL
64	LATIN/SPAIN-3
64	SWEDEN/FINLAND-3
64	DENMARK
64	BCL
64	TURKEY
64	ANSCII-3
64	FRANCE/BELGIUM
64	U.K.
64	GERMANY/AUSTRIA
64	ITALY
64	SWEDEN/FINLAND-2
64	LATIN/SPAIN-2
64	ANSCII-2
64	BRAZIL

Character Set	Name
64	DENMARK/NORWAY
64	YUGOSLAVIA
64	EBCDIC-2
64	DCR-A NUMERIC
64	DCR-B NUMERIC
96	EBCDIC-3
96	ANSCII-2
96	KATAKANA

PRINTER SWITCHES AND INDICATORS

The operator switches and indicators listed below are located on a control panel at the front of the printer.

Name	Type
POWER ON	Indicator/Pushbutton
POWER OFF	Switch
START/STOP	Indicator/Pushbutton
SKIP TO HEADING	Switch
PAPER/PRINT	Indicator/Pushbutton
ERROR/OVERRIDE	Indicator/Pushbutton
CHARACTER SETS	Rotary Switch
FORMAT	Rotary Switch

- POWER ON

Pressing the POWER ON pushbutton allows power to be applied to the printer and illuminates the green POWER ON indicator.

- POWER OFF

Pressing the POWER OFF pushbutton powers-down the printer.

- START/STOP

The START/STOP pushbutton indicator is a complementing switch. The upper half of the switch is green and labeled START. This section of the switch is illuminated when the printer is in a READY condition. The bottom half of the switch is red and labeled STOP. This section of the switch is illuminated if any of the following NOT READY conditions exist.

a. Out-of-paper.

b. Paper slews for approximately one second.

c. Print mechanism is open.

d. Print train is not installed.

e. One or more printer interlocks are open.

The switch, when pressed, will change from START to STOP; or, from STOP to START if none of the above listed error conditions exist.

- SKIP TO HEADING

The SKIP TO HEADING pushbutton is only operative when the printer is in a NOT READY (STOP) condition. When pressed, it enables advancing the form to the next heading position.

- PAPER/PRINT

The PAPER/PRINT pushbutton indicator is a dual indicator, single purpose switch. The upper half of the indicator is yellow and labeled PAPER. This section of the indicator will be illuminated when the out-of-paper condition is sensed by a switch located approximately three inches prior to the print station. If the out-of-paper condition exists, pressing this pushbutton will allow successive print commands to be executed until the paper break sensor, located after the print station, is activated. Single line printing can also be accomplished by pressing the START/STOP pushbutton if the out-of-paper condition exists (paper) <u>and</u> the printer is in a NOT READY (STOP) condition.

The lower half of the indicator is blue and labeled PRINT. This section of the indicator will be illuminated when none of the following conditions exist:

a. Train motor is off.

b. Print mechanism is open.

c. Print train is not installed.

d. One or more printer interlocks are open.

- ERROR/OVERRIDE

The ERROR/OVERRIDE pushbutton indicator is a dual indicator, single purpose switch. The upper half of the indicator is red and labeled ERROR. This section of the indicator will be illuminated if a column did not print and the printer goes NOT READY after the print line is completed. Pressing this pushbutton will clear the ERROR indicator, illuminate the white, lower half of the indicator (OVERRIDE) and will permit the printer to become READY (START) when the START/STOP switch is pressed. When the OVERRIDE indicator is illuminated, all detection of print errors is inhibited. The OVERRIDE indicator can only be cleared by a power-down/power-up cycle on the printer.

- CHARACTER SETS

The CHARACTER SETS rotary switch has eight positions (1 through 8). These positions correspond to the train character set. The switch setting determines the state of three result descriptor bits that are used to describe the printer character set to the B 1700 software. The switch settings and their chain set equivalents are listed below:

Switch Setting	Train Set
1	64 Character EBCDIC
2	48 Character EBCDIC
3	16 Character EBCDIC
4	96 Character EBCDIC
5	48 Character FORTRAN

Switch Setting	Train Set
6	48 Character B 500
7	48 Character RPG
8	Unassigned

Failure to set the CHARACTER SETS switch to the correct position will generally result in print errors.

- FORMAT

The FORMAT rotary switch has two positions; FORM and TAPE. In the FORM position, the printer uses pre-printed marks on the right-hand edge of the form for format control. The pre-printed marks on the form consist of two channels. The use of these two channels is as follows:

a. A mark in the right channel is defined as a line mark.

b. A mark in the left channel is defined as an end-of-page (EOP) mark.

c. A mark in both left and right channels is defined as a field mark.

d. The heading position is defined as the first field mark following an EOP mark.

The 4-bit paper advance code sent as part of the line printer I/O descriptor provides the following action:

Code	Paper Action
Binary 0	No action.
Binary 1	Advance paper to heading.
Binary 2 thru 11	Advance paper to the second field mark through the 11th field mark, respectively.
Binary 12	Advance paper to EOP.
Binary 13	Advance paper to the next field mark or EOP mark.
Binary 14	Advance to next mark, line mark, field mark or EOP mark.
Binary 15	Advance to the second mark, line mark, field mark or EOP mark.

If the code is binary 2 through 11 <u>and</u> the value is greater than the number of field marks between the form heading and the EOP mark, the paper will slew for one second.

In the TAPE position, paper format is determined by the coding of the paper tape cartridge inserted in the right-hand side of the printer.

PRINTER TO I/O CONTROL INTERFACE SIGNALS

The following signals are provided from the line printer to the I/O control:

a. Printer Ready Levels (PRIL, PR2L). Ready chain Motor running

b. Chain Sync Level (CSL). cut Tooth

c. Printer Column Strobe Level (PCSL). pulse of chain Teeth

d. Printer Final Column Level (PFCL). 1 scan left to go

e. Paper Motion Level (PAML).

f. End-of-Page Level (EDPL). hole in ch. 12

g. Printer Speed Level (PRSL). Lo. 400 cm hi. 750

h. Code Set Levels (CS1L, CS2L, CS4L). 3 Train models

PRINTER READY LEVELS (PR1L, PR2L)

PR1L when true, designates the following:

a. Power is on.

b. Paper is loaded.

c. No slew alarm exists.

d. Print train is installed and locked in PRINT position.

e. START pushbutton is pressed.

PR2L when true, designates that PR1L is true <u>and</u> the train drive motor is on.

CHAIN SYNC LEVEL (CSL)

The Chain Sync Level occurs once per character set and defines the beginning of the character set. This signal has a 24 microsecond duration, starting at the trailing edge of a Printer Column Timing Pulse (PCTP).

PRINTER COLUMN STROBE LEVEL (PCSL)

The Printer Column Strobe Level, when true, indicates the printer is prepared to accept information into the column storage. PCSL is true for a minimum of 425 microseconds, and occurs twice during each 1.17 millisecond interval that is required to advance one character pitch on the train. Data for the even columns is transferred during the first PCSL and data for the odd columns is transferred during the second PCSL.

PRINTER FINAL COLUMN LEVEL (PFCL)

The Printer Final Column Level is true when the printer column counter is at 59 or 65 for 120 or 132 column printers, respectively. The printer will accept one additional information bit after PFCL goes true for the odd or even transfer.

PAPER MOTION LEVEL (PAML)

Paper Motion Level is true when the Data Control Levels (DC1L and DC2L) equal a binary 2, in response to format information on the Data Transfer Lines (DTxL). PAML remains true until the paper advance is completed. In the 400 LPM printer, PAML also goes true in response to a Data Control Level equal to binary 3 indicating a dummy paper advance. In this case, PAML will remain true for approximately 16 milliseconds.

END-OF-PAGE LEVEL (EDPL)

The End-of-Page Level, when true, indicates that the end of a page was sensed. EDPL is only transferred when the printer is advancing paper in a single or double space mode of operation. EDPL is reset when information is transferred for the next line.

PRINTER SPEED LEVEL (PRSL)

The Printer Speed Level, when true, defines a 750 LPM printer, and when false, defines a 400 LPM printer.

CODE SET LEVELS (CS1L, CS2L, CS4L)

The Code Set Levels indicate the code set selected by the CHARACTER SETS rotary switch. This switch must be set to reflect the train character set installed in the printer.

PRINTER TIMING

The timing diagrams for the 400 LPM and 750 LPM Train Printers are shown in figures I-2 and I-3, respectively.

I/O CONTROL TO PRINTER INTERFACE SIGNALS

The following signals are provided from the I/O control to the printer.

a. Printer Column Timing Pulse (PCTP). clock

b. Data Control Levels (DC1L, DC2L).

c. Data Transfer Lines (DT1L, DT2L, DT4L, DT8L).

d. Motor Start Level (MOSL).

PRINTER COLUMN TIMING PULSE (PCTP)

The Printer Column Timing Pulse is a two microsecond pulse with a maximum pulse repetition rate (PRR) of 250 KHz. During the information transfer cycle, PCTP is used to gate bit information into column storage and to advance the printer column storage. PCTP is always transmitted when power is on in the printer.

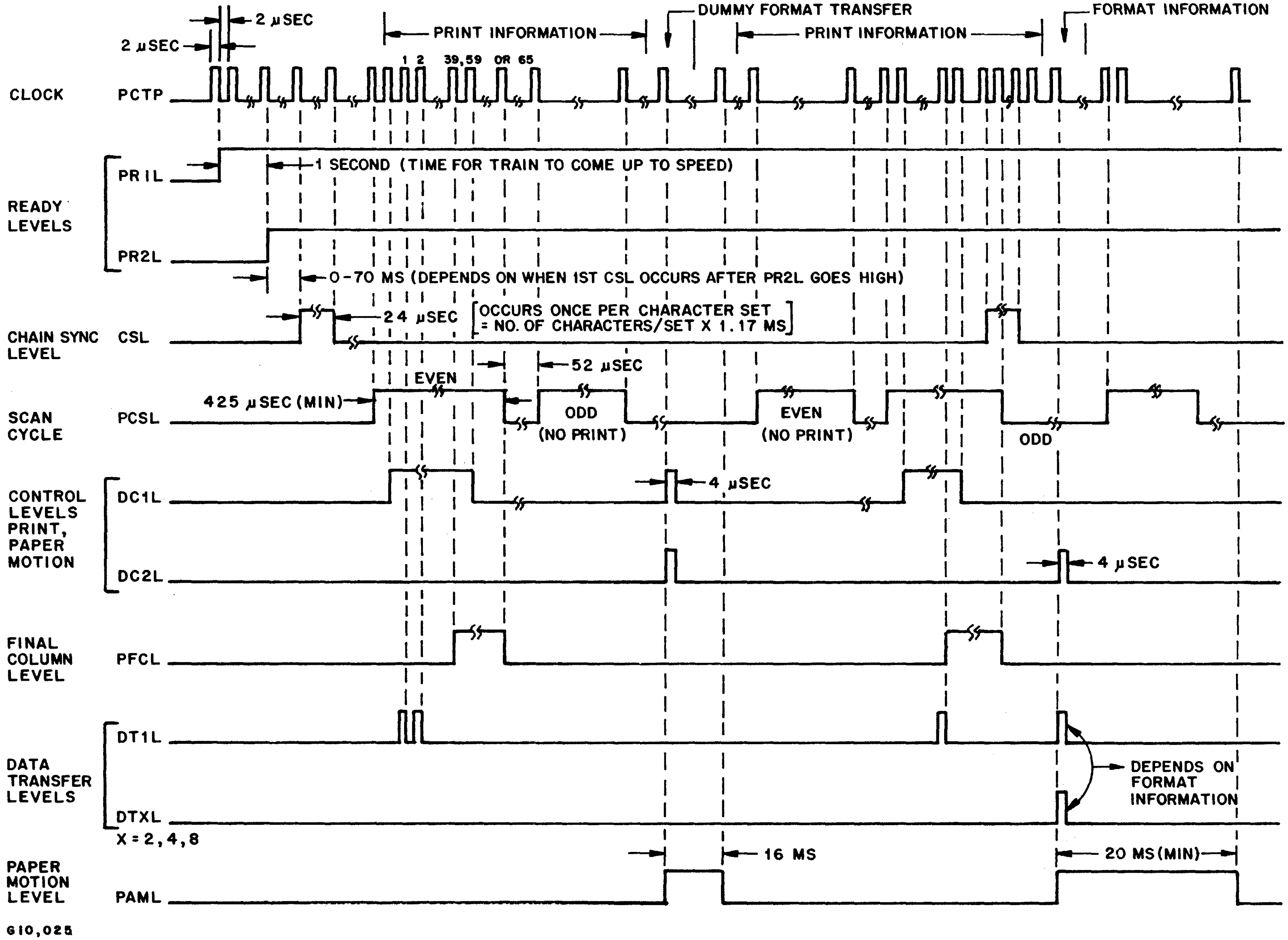


Figure I-2. Timing Diagram for 400 LPM Printer

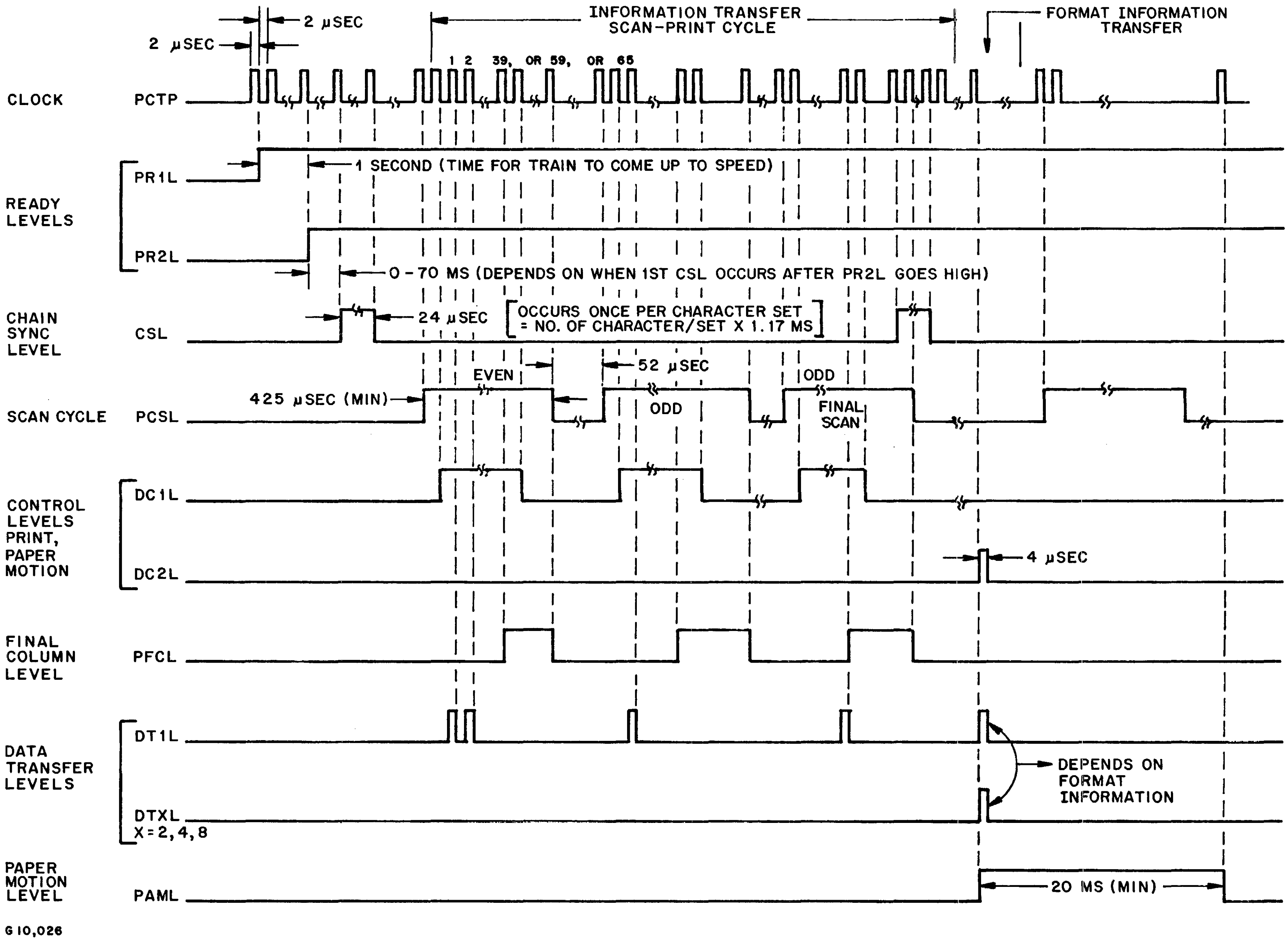


Figure I-3. Timing Diagram for 750 LPM Printer

DATA CONTROL LEVELS (DC1L, DC2L)

The Data Control Levels are used to indicate that format control information is present on the Data Transfer Lines. The coding of these levels is as follows:

DC1L	DC2L	Action
0	0	idle state No action (binary 0).
1	0	Column storage load (binary 1).
0	1	Format transfer (binary 2).
1	1	Dummy format transfer (binary 3). [illegible] Paper Motion

DATA TRANSFER LINES (DT1L, DT2L, DT4L, DT8L)

The Data Transfer Lines are used to transfer print or format information to the printer. If the Data Control Levels equal binary 1, the information contained in the Data Transfer Lines is print information and is to be transferred to the printer column storage. If the Data Control Levels equal binary 2, the information contained in the Data Transfer Lines is format information that is decoded as follows:

DTxL Binary Value	Function
0	No paper advance.
1	Advance paper to heading position.
2,11	Advance paper to designated field position.
12	Advance paper to the end-of-page position.
13	Advance paper to either the next field position or an end-of-page position.
14	Advance paper to the next line position (single space).
15	Advance paper to the second line position (double space).

If the Data Control Levels equal binary 3, a dummy format transfer occurs.

MOTOR START LEVEL (MOSL)

The Motor Start Level is used to start the train drive motor from the I/O control. The Motor Start Level is only available if the printer is in the READY state <u>and</u> the train drive motor is off.

TRAIN PRINTER CONTROL II

Data is transferred in 8-bit parallel bytes between the B 1700 system and the Train Printer Control II. The control provides a buffer capable of holding 132 bytes of data. If fewer bytes of data are required by the printer, the control will terminate the data transfer by changing to Status Count 17 (STC=17). If less than the required bytes of data are transferred to the control from the system, the control will assume all remaining data positions to be blanks.

The Train Printer Control II transfers paper motion information (format control) after all graphics have been printed. A result descriptor is then returned to the system.

This I/O control provides soft code conversion from any internal code for any train character set by means of a translator memory that can be loaded from main memory. In addition to the soft translation capabilities, the control provides for the hard translation of the two codes (1100 0000 and 1101 0000) under variant control. These two codes correspond to the two codes (0100 1110 and 0111 0000), respectively, enabling printing of the same graphic by two different data codes.

Invalid codes in the data are detected and reported in the result descriptor.

SOFT TRANSLATOR UNIT

The soft translator in the 400 LPM or 750 LPM Train Printer Control II is a software loaded universal translator capable of translating any 8-bit code to any character set on the printer train. Once the translator is initially loaded, it need not be reloaded until the printer train character set is changed, or power to the control is dropped. Included is a quick cancel feature which completes the operation as soon as all characters are identified. The use of this translator eliminates the need for numerous hard translators for each particular train character set.

A basic block diagram of the basic units that comprise the soft translator is shown in figure I-4. A description of each of the basic units shown in the block diagram is as follows:

- INPUT REGISTER

The Input Register is required as an input buffer to the MOS Shift Register. It is also used as the character data input to the translator during the translator load cycle. The input register consists of two 4-bit latches (LFAN). These latches have an enable line which allows stored information to appear at output only when desired.

- MOS SHIFT REGISTER

The MOS Shift Register consists of four quad 100-bit registers (SSAN). The four combine to provide an 8 byte by 200 bit register. Since the length of the printer line is a maximum of 132 characters, only 132 characters of register is required. Available MOS devices are built in multiples of 100; therefore, a 200 bit register is required. This construction requires right-hand justification each time the 132 characters are loaded into the register.

- OUTPUT REGISTER

The Output Register is required as an output buffer to the MOS Register. Like the Input Register, it consists of two 4-bit latches plus an enable line that allows its data to appear only when desired. The data from the Output Register is fed back to the Input Register and to two comparator circuits. The data is compared with both the appropriate data in the translator and with the code for the blank character.

Byte 200 stores Byte #3 of Ref. Add.
Byte 208 stores Byte #2 " "
Byte 224 stores Byte #1 " "

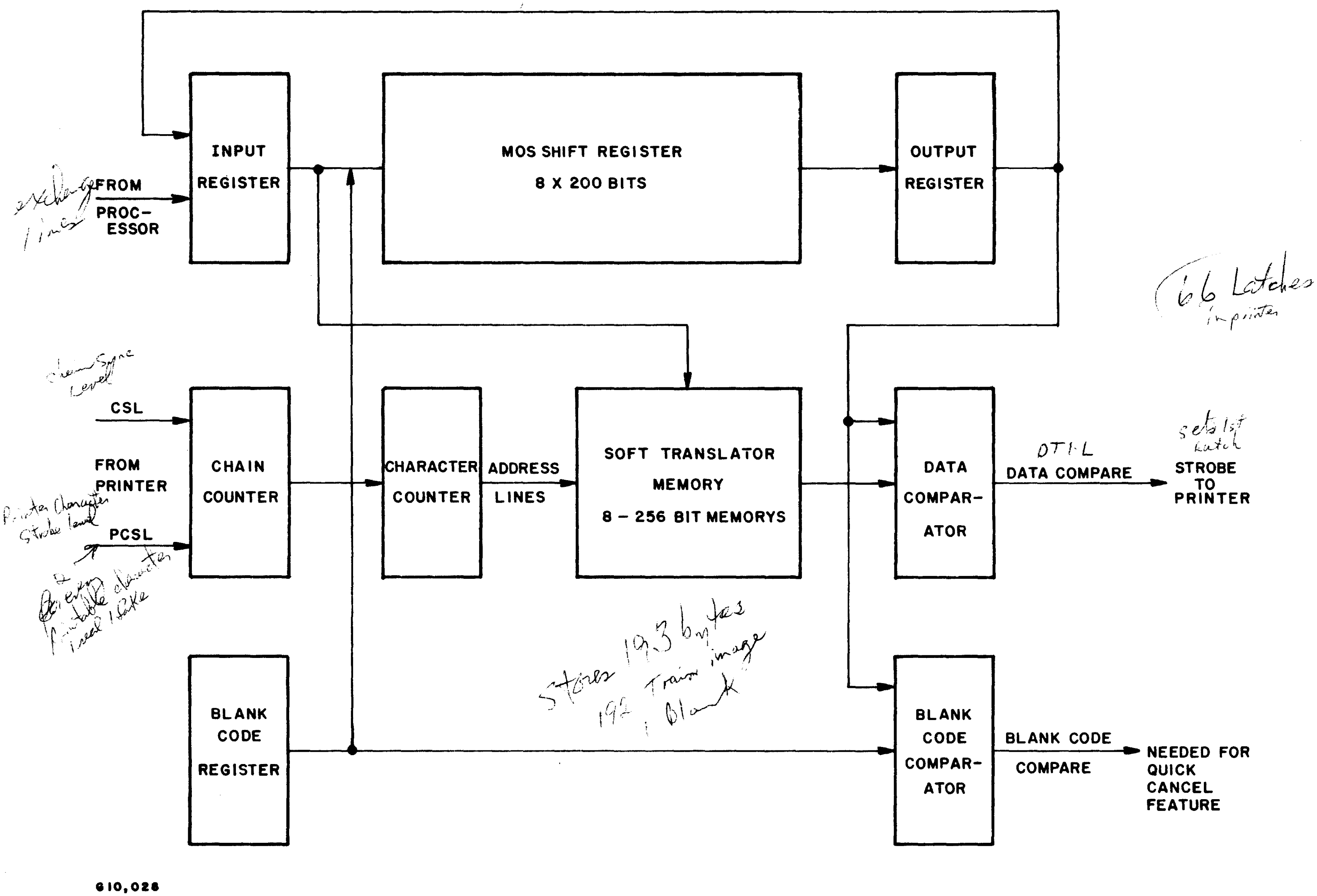


Figure I-4. Soft Translator Basic Block Diagram

- TRAIN COUNTER

The train counter consists of three 3-bit registers (RFAN). This counter keeps track of the train position. Each time the train comes to the start of a character, a Chain Sync Level signal (CSL) is emitted. The counter uses this signal to initialize to count one and synchronize with the train. The second of each pair of Printer Column Strobe Levels (PCSL) from the printer indicates the train has advanced one position. The train counter uses this signal to increment the count by one to keep in step with the train position. The counter keeps counting until the next CSL signal resets it to one. Once this counter is initially synchronized with the first CSL, its output will always indicate the position of the train.

- CHARACTER COUNTER

This counter consists of three 3-bit registers. Its output is used to address the translator. During the Load Translator operation, its initial value is one. After a piece of data is written into the translator, the counter is incremented by one and the next location in the translator memory is addressed. The counter must have the capability of counting up to 193. The first 192 counts are for the addresses of each of the 192 train positions. The 193rd count is the address where the code for the blank character is stored. During the data scan cycle, the character counter is initialized to the value of the train counter.

Each time a new piece of data is shifted out of the MOS Shift Register to be compared against the contents of the translator, the character counter is incremented by one. This keeps the appropriate train data at the translator output as the print data is shifted through the MOS. To load the blank code into the Blank Code Register, the character counter is set to 193, the address of the blank code.

- SOFT-TRANSLATOR-MEMORY

The soft translator consists of eight 256 bit random-access-memories (RFDN). This provides the capability of storing 256, eight-bit characters. Since only 193 characters, (192 data characters plus the blank character) are required, the additional memory storage capabilities can be used to store additional miscellaneous information.

- DATA COMPARATOR

This circuit consists of two 4-bit comparators (CFAN). It compares the data from the Output Register with that of the corresponding translator address, and indicates when there is a comparison.

- BLANK CODE COMPARATOR

This circuit consists of two 4-bit comparators. It compares data from the Output Register with the blank code.

- BLANK CODE REGISTER

The Blank Code Register contains the code for the blank character obtained at address 193 of the translator. It consists of two 4-bit latches (LFAN). An enable line allows the data to appear only when desired.

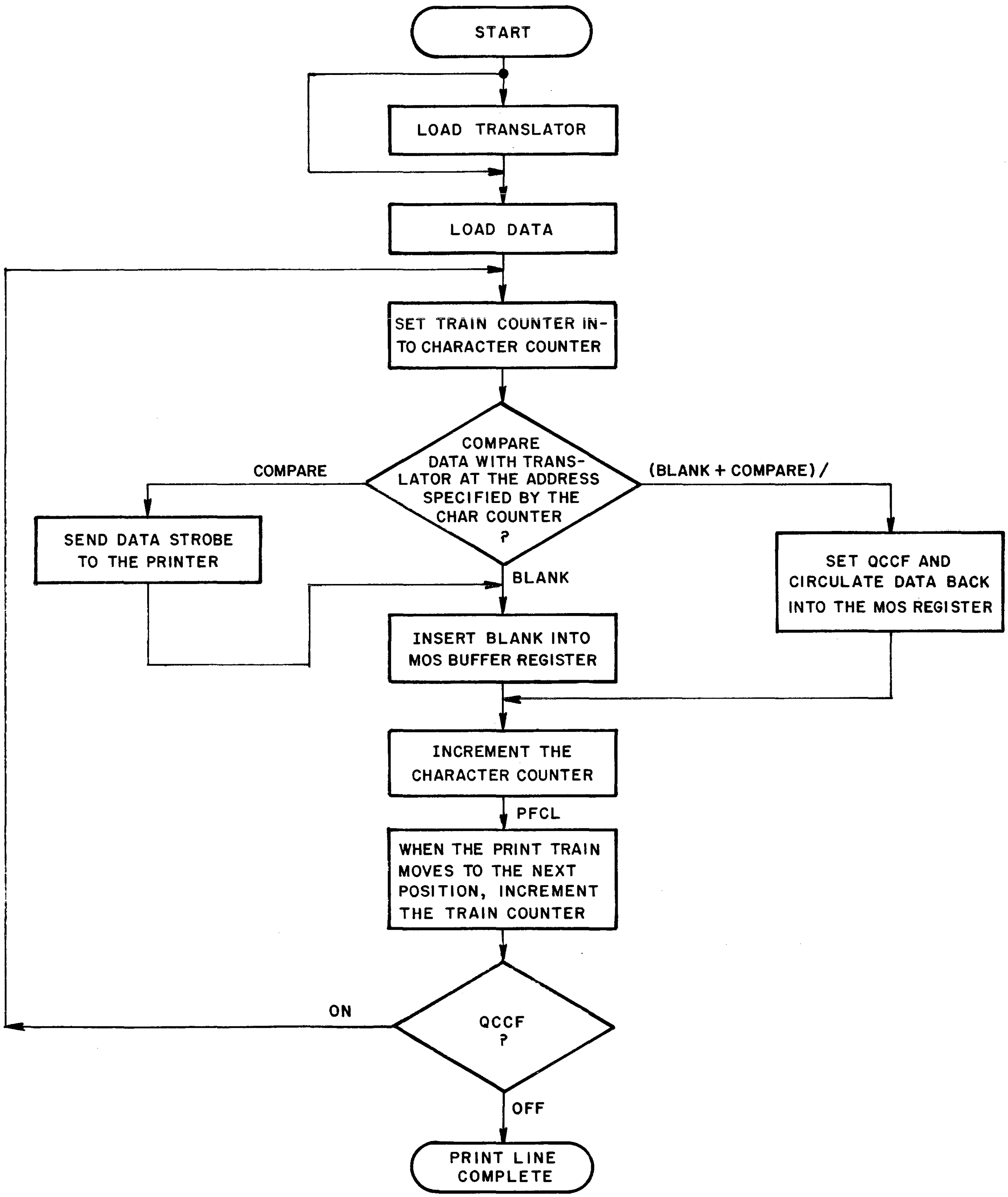
SOFT TRANSLATOR FLOW

The flow diagram depicting the use of the soft translator is shown in figure I-5. The first requirement is to pre-load the translator. Once loaded, the translator requires reloading only if the character set is changed or the control powers-down. It is loaded as follows: data is brought into the Input Register from the main processor. The Write enable line to the translator is activated and the data is written from the Input Register into the translator to the address given by the character counter. This is initially accomplished at address one. After the first data is written, the next data is entered into the Input Register and the character counter is incremented by one. This process is repeated 193 times. Each piece of data corresponds to the character on the train in the position indicated by the character counter. For example, when the character counter, and hence the address lines, is at 88, the data being written into the translator corresponds to the character at train position 88. If another train is put on the printer, the character at position 88 can be easily changed by reloading the translator. The train contains 192 positions, therefore, 192 characters must be stored. Depending on the character set, the characters may be repeated, i.e., train position 65 may be the same as position two. The 193 character is the blank code.

After the translator is loaded, the print data must be entered into the MOS Shift Register. Each piece of data is entered into the Input Register and then shifted into the MOS. This is repeated until a complete line of data is entered. If only a partial line is to be printed, dummy blanks are loaded to fill all character positions on the line.

The data scan cycle now begins. The character counter is set to 193 so the blank code can be put into the Blank Code Register. When this is accomplished, the character counter is set to the value of the train counter. This allows entering the data scan cycle at any train position and prevents waiting until the train is at position one. At this point, the print data is shifted through the MOS Register and compared with the train data from the translator. After each shift, the character counter is incremented by one to compare the next character on the train with the next piece of data. At each compare time, a clock is sent to the printer to increment the printer column counter. If a comparison is achieved, a Data Strobe Pulse is gated to the printer to indicate that the hammer over that particular train position should be fired. When a comparison is achieved, the data from the Output Register is recirculated to the Input Register and the Blank Code Register is enabled. On the next shift, the blank code is inserted in place of the compared piece of data. If the blank was not inserted when the train got back to its original or equivalent position, the data would recompare and overprinting would result.

If a comparison does not exist at compare time, the data from the Output Register is recirculated through the Input Register and into the MOS. If a comparison does not exist and the data is not the blank code, the Quick Cancel Flip-Flop (QCCF) is set. When the printer sends the Printer Final Column Pulse (PFCL) all the data for each train character in that particular train position has been checked. At this time, QCCF is checked. If QCCF is set, there is at least one character that has not compared and is not a blank. Therefore, let the train advance one position, clear the QCCF, reset the character counter with the train counter (which should be one value higher than the previous time since the train has advanced one position) and start the scan cycle over. When all of the data in the MOS is finally matched with the proper train position, and hence comparisons made, the QCCF will not be set at PFCL time and the operation is complete. There is no need to look at the



G10,027

Figure I-5. Soft Translator Flow Diagram remaining train positions. If invalid code exists in the data, it would never compare. In this case, the control waits for a second CSL from the printer indicating an entire character set on the train has been checked and therefore end the operation.

FUNCTIONAL DESCRIPTION

The I/O driver assumes a linked list of I/O descriptors and is initiated by the receipt of a 24-bit start address which points to the Result Status (RS) field of an I/O descriptor. The I/O driver inspects the first two bits of the RS field and if they are equal to 00, exchanges them with 01. If the exchanged bits are still 00, the I/O driver initiates the control with the indicated operation. If the first two bits of the RS field are not equal to 00, the I/O driver either initiates a pause operation to the control, or goes idle depending upon a system software option. If the driver goes idle, the driver must be reinstated. After completion of a pause, the I/O driver repeats the inspection on the same I/O descriptor. After completion of any other operation, the I/O driver uses the link address as a new start address. The following are exceptions to the conditions described above.

a. If the result had an exception condition, the I/O driver will go idle after returning a result and an interrupt.

b. If the I/O driver receives a STOP OP code, it will also go idle after returning a result and returning an interrupt if applicable.

c. If the I/O driver receives a memory parity error signal during the fetch of an I/O descriptor (RS, OP, A, B, C, RS swap, or link fields), or during the fetch of the start address, the I/O driver sends a special interrupt message to port number 0 and channel number 15 consisting of an address pointing near the field in error. The I/O driver then exits.

At the completion of an operation and after the actual ending data address is stored, the information in the RS field is exchanged with the Result Status bits from the operation. This exchange must be accomplished without the possibility of another process interfering.

The information read from the Result Status field includes one interrupt request bit, one high interrupt bit, and 3-bit port number and one 4-bit channel number as shown in figure I-6.

RS POINTER → RS POINTER + 24

To Be Defined	INTERRUPT	HIGH INTERRUPT	TO PORT #	CHANNEL #
15-Bits	1-Bit	1-Bit	3-Bits	4-Bits

Figure I-6. Result Status Field

Hi Priority Interrupt Request Bit #16 used with Reader sorter

If the interrupt request bit is true, the I/O driver will generate an appropriate interrupt message to the port indicated. The interrupt returned will be a high interrupt type if the high interrupt bit is true, and a normal interrupt type if the high interrupt bit is false.

If the interrupt request bit is false, the I/O driver will generate an interrupt message only if the Result Status bits returned had an exception (bit number 2 set).

The interrupt message is a 24-bit address pointing between the Result Status bits and the link address. The channel number contained in the result description status area is also returned to the port indicated.

I/O DESCRIPTOR FORMAT

The format of the I/O descriptors is shown in figure I-7. All bits of descriptors not defined are reserved for expansion. All fields are 24-bits in length.

Gismo is incapable of sending data

E	RS	L	OP	A	B

E= Ending Address

RS= Result Status Information

L= Link Address

OP= OP, Variants and Unit Number

A= Start Address of Data

B= End + 1 Address of Data

Figure I-7. I/O Descriptor Format

E FIELD

After an operation, the I/O driver will store into the E field, the final incremented A address. For Write, this address will be equal to the B address unless the operation is terminated by the control because of line length (80, 120 or 132). For the Load Translator operation, the actual ending address will and must be exactly A + (193 x 8). The E field is undefined after a Space-Skip, a Test or a Stop operation.

RS FIELD

used 2 ways

After the completion of an operation and after storing the actual ending address in the E field, the I/O driver will exchange the Result Status information with the interrupt control information. During an operation, the I/O driver uses certain bit positions of the RS field for functions internal to the drive.

L FIELD

After storing the Result Status information and after returning any requested interrupt message, the I/O driver, in the absence of any reported error, will fetch the LINK address from the L field. The LINK address is a

24-bit address pointing to the RS field of the next I/O descriptor. Linking is terminated if any exception condition is reported.

A AND B FIELDS

For a Write or a Load Translator operation, the A and B fields are 24-bit fields which contain the begin and end memory bit addresses, respectively, for the operation. They must define an integer number of 8-bit bytes. B must be equal to or greater than A for the Write operation. If A equals B, blanks are written. For the Load Translator operation, the B address must be 193 x 8 greater than A. The A and B fields are not used for the Space/Skip, Test or Stop operations.

OP FIELD

The OP code, variant and unit number are contained in a 24-bit OP field. The left-most three bits are used to designate the operator code. The remaining bits are used for variants and are described with the description of the operator. All bits unassigned are reserved and must be left as zeros.

The OP fields of the I/O descriptors for the Train Printer Control II consist of the following:

a. Print.

b. Space/Skip.

c. Test.

d. Pause.

e. Load Soft Translator.

- PRINT - 010V SSSS 0000 0000 0000 0000

Write data to the printer from ascending memory locations beginning at the location specified by the A address continuing until, but not from, the location specified by the B address or until all columns (80,120,132) have been printed, whichever occurs first.

SSSS =	0000	No paper advance.
	1110	Single space after printing.
	1111	Double space after printing.
	0001	Skip to channel-1 after printing.
	.	
	.	
	.	
	1100	Skip to channel-21 after printing.
	1101	Skip to next channel after printing.
V = 1		If this operation calls for single or double spacing and if the EOP signal from the printer is true, then skip to channel-1 after printing instead of spacing. Do not report EOP.

- SPACE/SKIP - 101V 0000 0000 0000 0000

  Space or skip paper as specified by the SSSS variants.

- TEST - 100V 0000 0000 0000 0000 0000

  Test the printer and printer control for the following information:

  a. Not Ready.

  b. Print check condition (Control number 3).

  c. End-of-Page.

  d. Character set (Control number 2).

  e. Paper-in-Motion (Control number 1, number 3).

  f. Translator Unloaded (Control number 2).

  g. Control ID.

If V=0, the result is stored immediately. If V=1, the result is delayed until the printer is Ready and paper motion has stopped.

- PAUSE - 1110 0000 0000 0000 0000 0000

Return an SR after a pause of 8 milliseconds. The result descriptor returned must have bit-17 equal to 0.

NOTE

> This command is generated by the I/O driver when an I/O descriptor is encountered that is not yet Ready for execution. There is no explicit pause operator in the linked list of I/O descriptors. Upon completion of the pause, the same I/O descriptor is reinspected by the I/O driver and is initiated if Ready. If Not Ready, another pause operator is sent to the control.

- LOAD SOFT TRANSLATOR - 011V 0000 0000 0000 0000 0000

Load data to the translator memory. The A and B addresses must define 193 characters. If character sets are repeated on the chain, then the characters loaded to the translator memory must be repeated. The 193 character must be the code for blank.

V=1 enables additional hard translation for 1100 0000 ({) and 1101 0000 (}).

The left bracket is translated to a "+", the right bracket is translated to a "!".

RESULT STATUS (RESULT DESCRIPTOR)

The result descriptor (24-bits) is stored in the Result Status field. The usage of the result descriptor bits are listed on the following page.

OPERATION COMPLETE

Bit 1 and 17 are always set to indicate operation complete. A result is never stored for the Pause operation.

EXCEPTION CONDITION

Bit 2 indicating an exception condition is set if one or more of bits 3 through 7 are set. An interrupt is also returned regardless of request.

NOT READY

If at the start of any operation, the unit is Not Ready or goes Not Ready, the operation is terminated immediately and bit-3 is set. In the case of print, one buffer of Write data is accepted before the result is returned. Refer to the Test operator for an exception.

DATA ERROR

Data error (bit-4) indicates that an invalid code was detected in the data stream during the present print operation.

RESERVED

Bits 5, 11, 12, 15 and 16 are reserved for future assignment.

MEMORY PARITY ERROR

If during a print or a Load Soft Translator operation, a memory parity error is detected; bit-6 is set after the operation is completed.

END-OF-PAGE

The End-of-Page signal does not terminate any operation. If the signal is true, bit-7 is reported on Test, Print and Space/Skip operations unless the operator specifies Skip to a channel or unless the V variant specified otherwise.

CHARACTER SET IDENTIFICATION

Bits 8, 9 and 10 are returned on a Test operation to indicate the CHARACTER SETS switch position on the printer. The assignments are:

000 - 64 character set	EBCDIC or BCL	
001 - 48 character set	EBCDIC or BCL	
010 - 16 character set	EBCDIC or BCL	
011 - 96 character set	EBCDIC or BCL	
100 - 48 character set	FORTRAN	(translation not shown)
101 - 48 character set	B 500	(translation not shown)
110 - 48 character set	RPG	(translation not shown)
111 - Unassigned		

PAPER-IN-MOTION

Bit-13 is reported on a Test operation to indicate printer paper-in-motion.

SOFT TRANSLATOR UNLOADED

Bit-14 is reported on a Test or a Print operation to indicate that the soft translator in the control must be loaded.

OPERATION COMPLETE (Bit-17)

Bits 1 and 17 are always set to indicate operation complete. A result is never stored for the Pause operation.

CONTROL IDENTIFICATION

On a Test operation, bits 18 through 24 are set as follows to indicate control type.

18	19	20	21	22	23	24
0	0	1	0	0	0	0

SECTION IV

ADJUSTMENTS

ADJUSTMENTS

There are no adjustments for the B 1700 Train Printer Control II. Refer to section V of this manual for information on determining the control channel number associated with this control. For information concerning I/O clock adjustments refer to section IV of the B 1700 I/O Base Field Engineering Technical Manual, Form 1053352.

SECTION V

MAINTENANCE PROCEDURES

INTRODUCTION

The purpose of this section is to provide information and directions to maintain the B 1700 Train Printer Control II. This control is used only with the 400 LPM or 750 LPM Train Printer.

PREVENTIVE MAINTENANCE

There is no preventive maintenance required for the Train Printer Control II.

SPECIAL MAINTENANCE TOOLS REQUIRED

The following tools and test routines are required to maintain a Train Printer Control II:

a. I/O Debug Test Routine (I/O DEBUG).

b. Line Printer Control Diagnostic Routine (LINE PRTR).

c. Tektronix type 453A oscilloscope or equivalent.

d. Tripplet type 630 VOM or equivalent.

MAINTENANCE CONCEPT

The I/O controls used with the B 1700 are soft controls and do not contain any off-line testing capabilities. The B 1700 maintenance concept is structured around the use of diagnostic test routines in conjunction with the Field Card Tester. Hardware interface test points are provided for conventional troubleshooting.

LINE PRINTER CONTROL II DIAGNOSTIC ROUTINE

Instructions on the usage of the Line Printer Control Diagnostic Routine (LINE PRTR) are provided in the B 1700 System Test and Field Documentation. The diagnostic routine is divided into five sections. The scope and function of each section is described below.

SECTION 1:

Performs an alphanumeric ripple test using both single and double space operations.

SECTION 2:

Performs an end-address test by decreasing each succeeding print line by one character position.

SECTION 3:

Performs a broadside test by printing 10 lines of each character on the print train.

SECTION 4:*

Performs a no-paper-advance test by printing NO SPACE OK in serial fashion 10 times on each line.

SECTION 5:

Performs a skip-to-channel test by successively skipping from channel 1 through channel 11.

I/O DEBUG TEST ROUTINE

The I/O Debug Routine is a general purpose troubleshooting test routine written in Micro Implementation Language (MIL). The operation (OP) code and control identification (ID) for the peripheral device to be tested must be inserted into the appropriate registers prior to running the test routine. Specific information on the operation of the I/O Debug Routine is contained in the B 1700 Test and Field Documentation.

The I/O Debug Routine provides no-op instructions between subroutines and also, within certain routines. These no-op instructions can be replaced by Halt operators to stop the program at pre-determined sections of the routine. Also, the field engineer has the option of stepping certain portions of the routine to aid in troubleshooting problems.

The processor-to-I/O control flow is shown in figure V-1. This flow portrays the path used by any Printer Control operation.

*A 16 character set chain contains only numeric characters. If the Train Printer has a 16 character set train, the print out for section IV of the Test routine will be "12 34567 89".

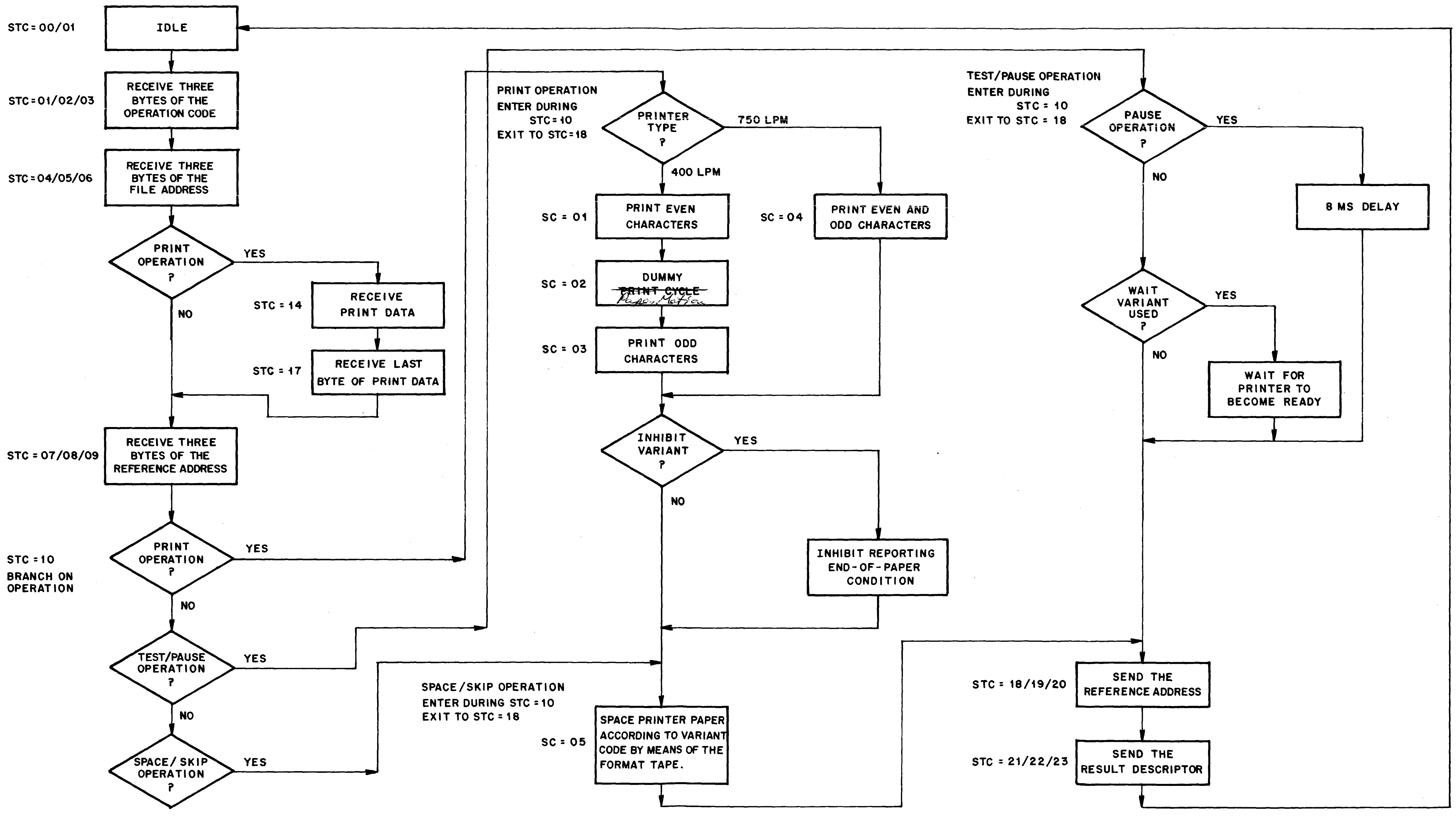


Figure V-1. Train Printer Control II Flow

I/O DEBUG TROUBLESHOOTING PROCEDURE

The following procedure is used to troubleshoot problems in the Line Printer Control II:

a. Load the I/O Debug Routine tape cassette into the console cassette reader. Press the CLEAR, then press the START pushbutton. After the program is read in, the program will Halt with a hexadecimal 000001 displayed in the LR register (Halt 1).

b. Load the Device ID into the X register. The Device ID for the Line Printer Control II is a hexadecimal 000010.

c. Load the desired hexadecimal operation code and variants into the I register. The applicable operation codes and variants are as follows:

OP Code	Function
4X0000	Print, then space printer paper as determined by the value of X.
5X0000	Print, then skip to channel 1 if the value of X specifies a single or double space and the end-of-paper is sensed. Also, inhibit reporting an end-of-paper condition. Otherwise, print, then space printer paper as determined by the value of X.
AX0000	Space or skip printer paper as determined by the value of X.
BX0000	Skip to channel 1 if the value of X specifies a single or double space and the end-of-paper is sensed. Also, inhibit reporting an end-of-paper condition. Otherwise, space printer paper as determined by the value of X.
800000	Test the printer and return a result descriptor immediately.

X Value	Function
0	Do not space or skip printer paper.
1	Skip to channel 1.
2	Skip to channel 2.
3	Skip to channel 3.
4	Skip to channel 4.
5	Skip to channel 5.
6	Skip to channel 6.
7	Skip to channel 7.
8	Skip to channel 8.
9	Skip to channel 9.
A	Skip to channel 10.
B	Skip to channel 11.
C	Skip to channel 12.
D	Skip to the next sequented channel.
E	Single space the printer paper.
F	Double space the printer paper.

d. Load the desired program toggles into the L register. (This must be done at Halt 1 time only.) The program toggles are arranged from left to right with program toggle 0 assigned to the left-most position. The applicable program toggles and their functions are listed below:

Program Toggle	Function
0	Trace the operation on the line printer.
1	Do not Halt on an exception.
2	Delay before answering a service request.
3	Halt after receiving a result descriptor.
4	Single step through the operation.
6	Print the contents of the data buffer in hexadecimal.
7	Print the contents of the data buffer in EBCDIC.
15	Fill the data buffer with three copies of 64 EBCDIC printer graphics followed by a blank (193 bytes).
17	Fill the data buffer with an EBCDIC character set.
23	Use the memory buffer for write data instead of the file address.

e. If the console INTERRUPT switch is placed in the "up" position, the program will Halt at the completion of each operation (Halt 1). Pressing the START pushbutton will reinitiate the operation. If the INTERRUPT switch is in the "down" position, the number of passes for each operation is determined by the OP code and the settings of the program toggles.

f. After the registers are loaded, the programs can be initiated by pressing the START pushbutton.

g. When the system Halts, the result descriptor will be contained in either the T of L register. The result descriptor bits and their functions are listed below:

Result Bit	Function
1	Operation complete.
2	Exception condition; one or more bits (3 through 16) are set.
3	Printer Not Ready.
4	Data error.
5	Reserved.

Result Bit	Function
6	Reserved.
7	End-of-Page.
8,9,10*	Character set identification (Test OP).
11	Reserved.
12	Reserved.
13	Paper-in-Motion (Test OP).
14	Soft Translator Unloaded.
15	Reserved.
16	Reserved.
17	Operation complete.
18-23	Control ID (001000).
24	Reserved.

*The character set identification bits are used to provide the system with information on the character set used in the Train Printer. This information is controlled by the setting of a rotary switch labeled CHARACTER SETS located on the printer. The character set information is used to load the soft translator in the Train Printer Control II to the correct configuration. The switch position and the affected result descriptor bits are listed below.

CHARACTER SETS Switch Position	State of Result Descriptor Bits 8,9 and 10	Corresponding Train Set
1	000	64 character EBCDIC
2	001	48 character EBCDIC
3	010	16 character EBCDIC
4	011	96 character EBCDIC
5	100	48 character FORTRAN
6	101	48 character B 500
7	110	48 character RPG
8	111	Unassigned

I/O DEBUG LINE PRINTER TEST OP DETAILED FLOW

A detailed flow of the I/O Debug Line Printer Test OP procedure is contained in the following steps.

a. Assure that the B 1700 system is powered on. (The POWER indicator ON is illuminated.)

b. Place the I/O Debug tape cassette in the tape reader.

c. Place the tape cassette ON/OFF switch, located on the control panel, in the ON position.

d. Set the MODE switch, located on the control panel, to the TAPE position.

e. If the BOT indicator is illuminated, proceed to the next step. If the BOT indicator is not illuminated, press the tape cassette REWIND pushbutton and wait until the BOT indicator is illuminated.

f. Press the HALT, CLEAR, and START pushbuttons in the indicated sequence. The cassette information will be read into the system.

g. If, during a Read operation from the tape cassette, the PARITY indicator becomes illuminated, press the HALT and CLEAR pushbuttons. Then press the tape cassette REWIND pushbutton and return to step "e" of this procedure. If the PARITY indicator turns on a second time, reverse the tape cassette and return to step "b" of this procedure.

h. After the tape cassette is read in, press the REWIND pushbutton and place the MODE switch in the RUN position.

i. Set the controls to display the LR register as follows:

1. Set the Register Group switch, located on the lower left corner of the control panel, to the CB/FLCN/LR/XORY position.

2. Set the REGISTER switch to the 2 position.

j. Press the START pushbutton. The I/O Debug Routine will be initiated

k. When the routine Halts, a hexadecimal 000001 (i.e., the right-most bit in the display is illuminated) will be displayed.

l. Load the Device ID number into the X register as follows:

1. Set the Register Group switch to the TA/FU/X/SUM position.

2. Set the REGISTER switch to the 2 position.

m. Load a hexadecimal 0000010 in the display indicators by setting the appropriate CONSOLE switches to the "up" position as shown in figure V-2.

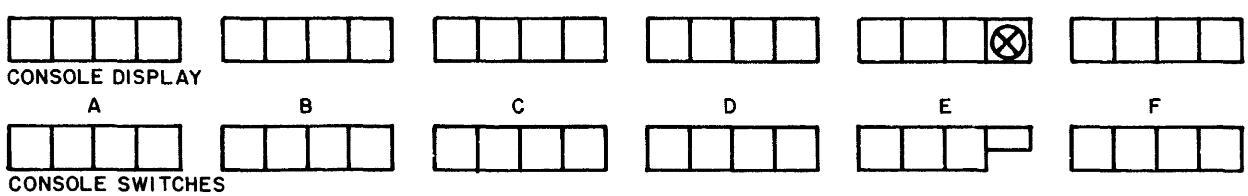


Figure V-2. Console Display and Console Switches

n. Store this information into the X register by pressing the LOAD pushbutton. The X register now contains the Device ID of a Train Printer Control II. Restore the DISPLAY INDICATOR switches to the "down" position.

o. Load the operation code (TEST) into the T register as follows:

1. Set the Register Group switch to the TC/FLC/T/CMPY position.

2. Set the REGISTER switch to the 2 position.

3. Load a hexadecimal 800000 (test and report immediately) into the T register by setting the appropriate display switches to the "up" position.

4. Store the OP code in the T register by pressing the LOAD pushbutton.

5. Restore the display switches to the "down" position.

p. Set the fourth console switch from the left to the "up" position. Set the Register Group switch to the TD/FLD/L/XANY position. Set the REGISTER switch to the 2 position and press the LOAD pushbutton. This will store a program toggle "3" in the L register to provide a Result Descriptor at the end of each operation. Restore the console switch to the "up" position.

q. Initiate the Test operation by pressing the START pushbutton.

r. When the system Halts, the result descriptor will be displayed in the T register as shown in figure V-3.

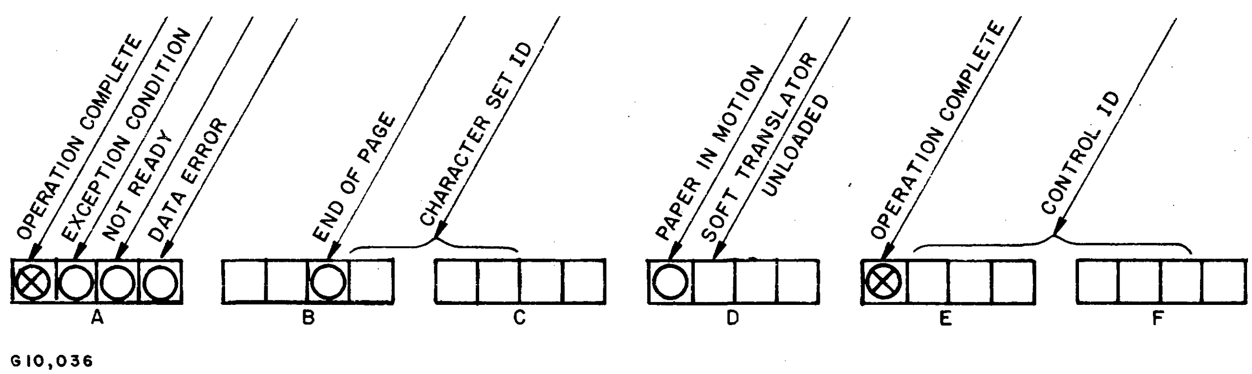


Figure V-3. Printer Test OP Result Descriptor

s. The bit configuration of the result descriptor is dependent on existing conditions as listed below:

1. The Operation Complete bits will always be on.

2. The Exception Condition bit will be on if any bit, from bit-3 to bit-15 is on.

3. The Not Ready bit will be on if the line printer is in a Not Ready state.

4. The Data Error bit will be on if a character to be printed was not contained on the printer train set.

5. The End-of-Page bit will be on if the printer is at the end of a page.

6. The Character Set ID bits will be on after a Test operation.

7. The Paper-in-Motion bit will be on if paper was in motion during a Test operation.

HARDWARE TEST POINTS

The hardware test points are the I/O Control card(s) interface levels. The Line Printer Control II consists of two cards. The backplane and frontplane interfaces to these cards are listed in tables V-1 through V-4.

Table V-1. Card 1 Frontplane Connector Test Points

$ X CONNECTOR	# X CONNECTOR	$ Y CONNECTOR	# Y CONNECTOR
A PPCTP/.1	A CMD1...1	A	A
B CHKCOM.1	B CMD2...1	B	B
C	C BCNT1280	C PCTP/..1	C
D	D BCNT64.1	D DC1L/..1	D
E	E BCNT32.1	E DC2L/..1	E
F	F BCNT16.1	F DT1L/..1	F
G	G BCNT8..1	G DT2L/..1	G
H	H BCNT4..1	H DT4L/..1	H
I	I BCNT2..1	I DT8L/..1	I
J	J BCNT1..1	J MOST/..1	J
K	K XFRIN..1	K PR1L/..1	K
L	L XFROTA.1	L CSL/...1	L
M	M SC4F...1	M PCSL/..1	M
N	N SC2F...1	N PFCL/..1	N
P OP1....1	P SC2F...1	P PAML/..1	P
Q OP2....1	Q STC16F.1	Q EDPL/..1	Q
R OP4....1	R STC08F.1	R PRSL/..1	R
S ERRORF.1	S STC04F.1	S CS1L/..1	S
T STARTF.1	T STC02F.1	T CS2L/..1	T
U CSL2F..1	U STC01F.1	U CS4L/..1	U
V CSL1F..1	V	V	V
W	W PCTP...1	W PR2L/..1	W
X CVAR1..1	X	X	X
Y CVAR2..1	Y PC5LONF1	Y	Y
Z CVAR4..1	Z SYNCF..1	Z	Z

Table V-2. Card 1 Backplane Connector Test Points

X CONNECTOR			Y CONNECTOR		
0 SIDE	LOCATION	1 SIDE	0 SIDE	LOCATION	1 SIDE
	A		CSL....0	A	
EXCH00.0	B	EXCH01.0		B	IOS....0
EXCH02.0	C	EXCH03.0	TPCSL..0	C	CLRB...0
EXCH04.0	D		CLEAR..0	D	
EXCH05.0	E	EXCH06.0	OUT....0	E	RC.....0
EXCH07.0	F	EXCH08.0	WRITE..0	F	CA.....0
EXCH09.0	G	EXCH10.0	STC07..0	G	SRF....0
EXCH11.0	H	EXCH12.0	STC18..0	H	
EXCH13.0	I	EXCH14.0	STC08..0	I	
EXCH15.0	J		STC19..0	J	
EXCH16.0	K	EXCH17.0	STC09..0	K	STC20..0
EXCH18.0	L	EXCH19.0	PC5L2F.0	L	
EXCH20.0	M	EXCH21.0	CHKCOM.0	M	
EXCH22.0	N			N	TESTER.0
QCCF/..0	P	STC14170	WEFFOFF0	P	CLEAR..0
4US....0	Q			Q	

Table V-2. Card 1 Backplane Connector Test Points (Cont)

X CONNECTOR			Y CONNECTOR		
0 SIDE	LOCATION	1 SIDE	0 SIDE	LOCATION	1 SIDE
1US....0	R	EXITF..1		R	
	S	SC134..0		S	STC06..0
1024US.0	T	COMPARE0	DT1LF..0	T	SHFSTP.0
	U	JUSTIFY0	VAR....0	U	LOAD...0
PCTPDIS0	V	STC10SC0	PCDISON0	V	
SCPM...0	W			W	
CHXFWR.0	X	BCNT2000		X	
SHFCT..0	Y	CH*XFR00	TOCLR..0	Y	SRFF...0
	Z	SETIR..0		Z	

Table V-3. Card 2 Frontplane Connector Test Points

$ X CONNECTOR	# X CONNECTOR	$ Y CONNECTOR	# Y CONNECTOR
A	A DATA0..1	A ENIR...1	A
B	B DATA1..1	B IR0....1	B
C	C DATA2..1	C IR1....1	C
D	D DATA3..1	D IR2....1	D
E	E DATA4..1	E IR3....1	E
F	F DATA5..1	F IR4....1	F
G	G DATA6..1	G IR5....1	G
H	H DATA7..1	H IR6....1	H
I	I ENFF...1	I IR7....1	I
J	J EVENSHF1	J WEFF...1	J
K	K MOSCLK.1	K	K
L	L PH-2F/.1	L	L
M	M HARDXLT1	M	M
N	N 1100F..1	N	N
P	P 1101F..1	P	P
Q	Q WEFF/..1	Q	Q
R	R	R	R
S	S CHNCT1.1	S	S
T	T CHNCT2.1	T	T
U	U CHNCT4.1	U	U
V	V CHNCT8.1	V	V
W	W CHNCT161	W	W
X	X CHNCT321	X	X
Y	Y CHNCT641	Y	Y
Z	Z CNCT1281	Z	Z

Table V-4. Card 2 Backplane Connector Test Points

X CONNECTOR			Y CONNECTOR		
0 SIDE	LOCATION	1 SIDE	0 SIDE	LOCATION	1 SIDE
	A		CSL....0	A	
EXCH00.0	B	EXCH01.0	TPCSL..0	B	
EXCH02.0	C	EXCH03.0	CHAXFRN0	C	CLRB...0
EXCH04.0	D		CLEAR..0	D	
EXCH05.0	E	EXCH06.0	OUT....0	E	
EXCH07.0	F		CHAR1280	F	CHAR16.0
	G		STC07..0	G	
	H		STC18..0	H	
	I		STC08..0	I	
	J		STC19..0	J	
	K		STC09..0	K	STC20..0
	L		PCSL2F.0	L	CHAR4..0
	M		CHKCOM.0	M	PCSL/PC0
	N		WRITE..0	N	CHAR1..0
QCCF/..0	P		WEFF0FF0	P	CHAR2..0
	Q			Q	
	R	EXITF..0		R	WE.....0
	S	SC134..0		S	STC06..0
	T	COMPARE0	DT1LF..0	T	SHFSTP.0
CH←CHN.0	U	JUSTIFY0	VAR....0	U	LOAD...0
PCTPDIS0	V	STC10SC0	PCDISON0	V	
SCPM...0	W			W	
CHXFWR.0	X	BCNT2000		X	
SHFCT..0	Y	CH*XFR00		Y	
	Z	SETIR..0		Z	

SECTION VI

INSTALLATION PROCEDURES

INTRODUCTION

This section contains the necessary information to install a Train Printer Control II in a B 1700 I/O base or I/O base extension. Read this entire section carefully prior to attempting to install a Train Printer Control II.

GENERAL DESCRIPTION

The Train Printer Control II consists of two cards containing a soft translator, a data buffer, control logic and I/O interface circuitry. One Train Printer Control II is required for each 400 or 750 LPM Train Printer used on a B 1700 system.

PHYSICAL INSTALLATION

A Train Printer Control II occupies any two-card slot position in either an I/O base or I/O base extension. A frontplane view (card insertion side) of an I/O base or an I/O base extension is shown in figure VI-1. The designated I/O control slots for a two-card I/O control are either locations 4 and 5 or locations 6 and 7. Card 1 is installed in location 4 or 6; card 2 is installed in location 5 or 7, respectively.

CABLING (CONTROL TO I/O ADAPTER PANEL)

Information between the Train Printer Control II and the Train Printer is conducted by means of a ribbon cable. This ribbon cable is connected from $Y, card 1 frontplane, to a connector that is mounted on the I/O adapter panel.

CABLING (TRAIN PRINTER TO ADAPTER PANEL)

The standard Train Printer cable is terminated in a card edge receptacle. This receptacle is mounted on the I/O adapter panel. The ribbon cable from the Train Printer Control II is terminated in a card edge connector and is plugged into the printer card edge receptacle mounted on the adapter panel.

CHANNEL DESIGNATION

The Train Printer Control II has the capability of 16 different channel designations (0 through 15). Channel 15 is presently used for software applications. Channel designation is accomplished by hardwiring two channel designate jumper chips. These chips are located at position C9 and B9 on card 1 of the Train Printer Control II.

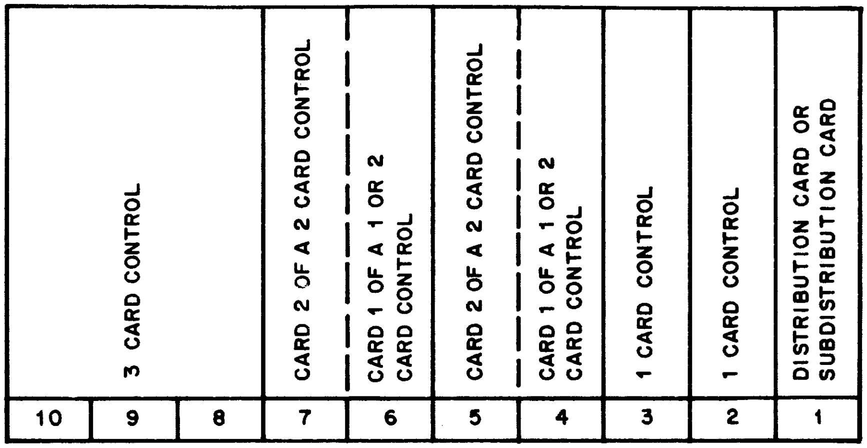


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Figure VI-1. I/O Base Card Loading Layout (Frontplane View)

Wire the channel designate chip(s) for the desired channel designation as shown in figures VI-2 and VI-3. An explanation of the function of the channel designate chips is listed below:

a. The wire from pin R of jumper chip C9 designates the channel number.

b. The wire from pin A of jumper chip C9 designates the channels 0 through 7.

c. The wire from pin A of jumper chip B9 designates channels 8 through 15.

COLUMN LENGTH IDENTIFIER

The column length identifier is used to allow system software to determine the number of print positions used in the Train Printer.

The column length identifier jumper chip is located at position K5 of the Train Printer Control II, card 1.

Wire the jumper chip as depicted in figure VI-4.

DYNAMIC CHECKOUT PROCEDURE

After the Train Printer Control II is installed and the Train Printer is cabled to the control, dynamically test the line printer subsystem by using the Line Printer Diagnostic Routine (LINE PRTR). Check for satisfactory results from each section of the routine. If any failures occur, check the line printer subsystem in the following sequence:

a. Recheck the Train Printer to I/O control cabling.

b. Check both printer I/O control cards on the B 1700 Card Tester. Refer to the card test data sheets contained in Train Printer Control II Test and Field Documentation.

c. If the problem is not resolved by performing steps a and b, refer to section V of this manual for troubleshooting procedures.

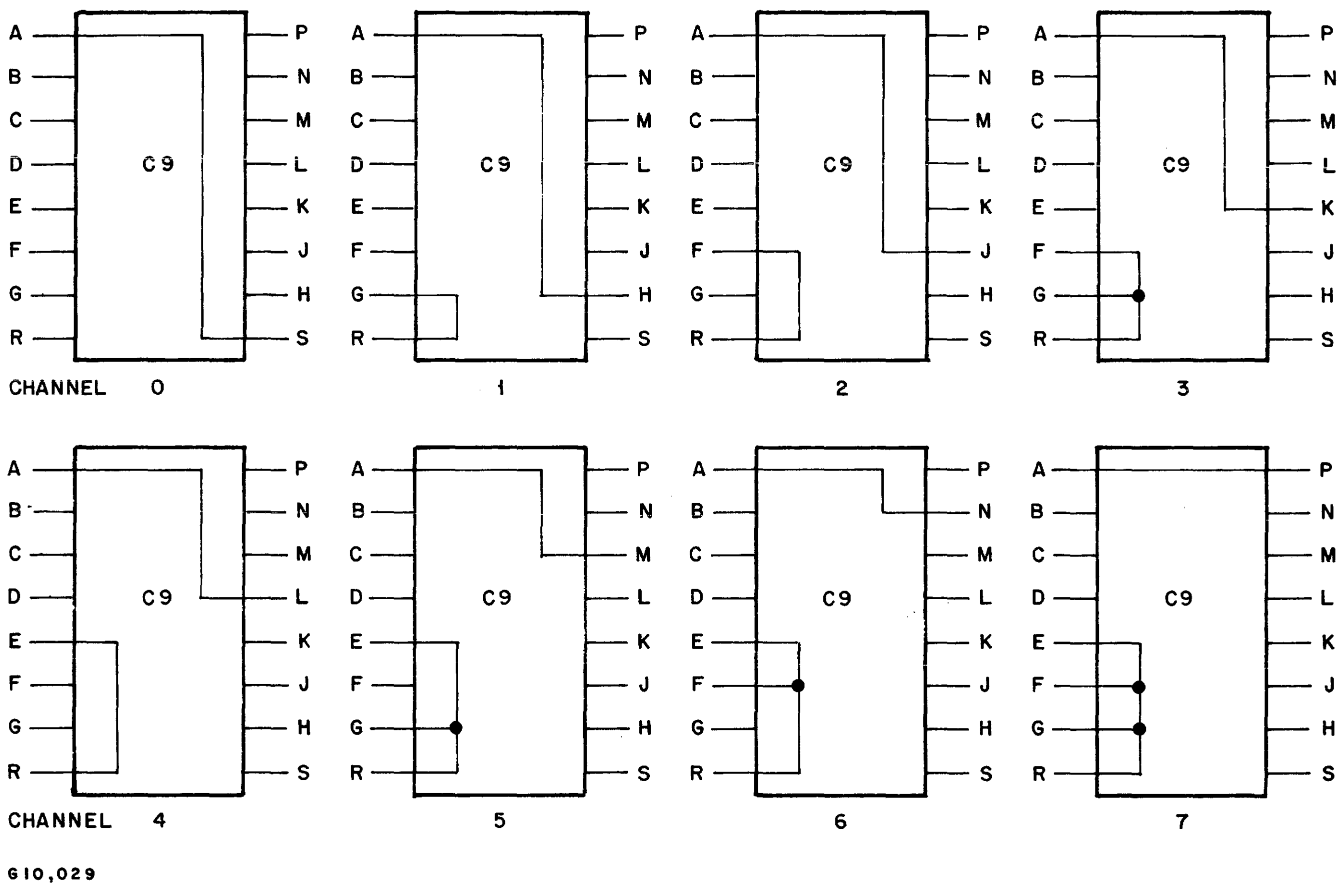

Figure VI-2. Channel Designate Wiring (Channels 0 through 7)

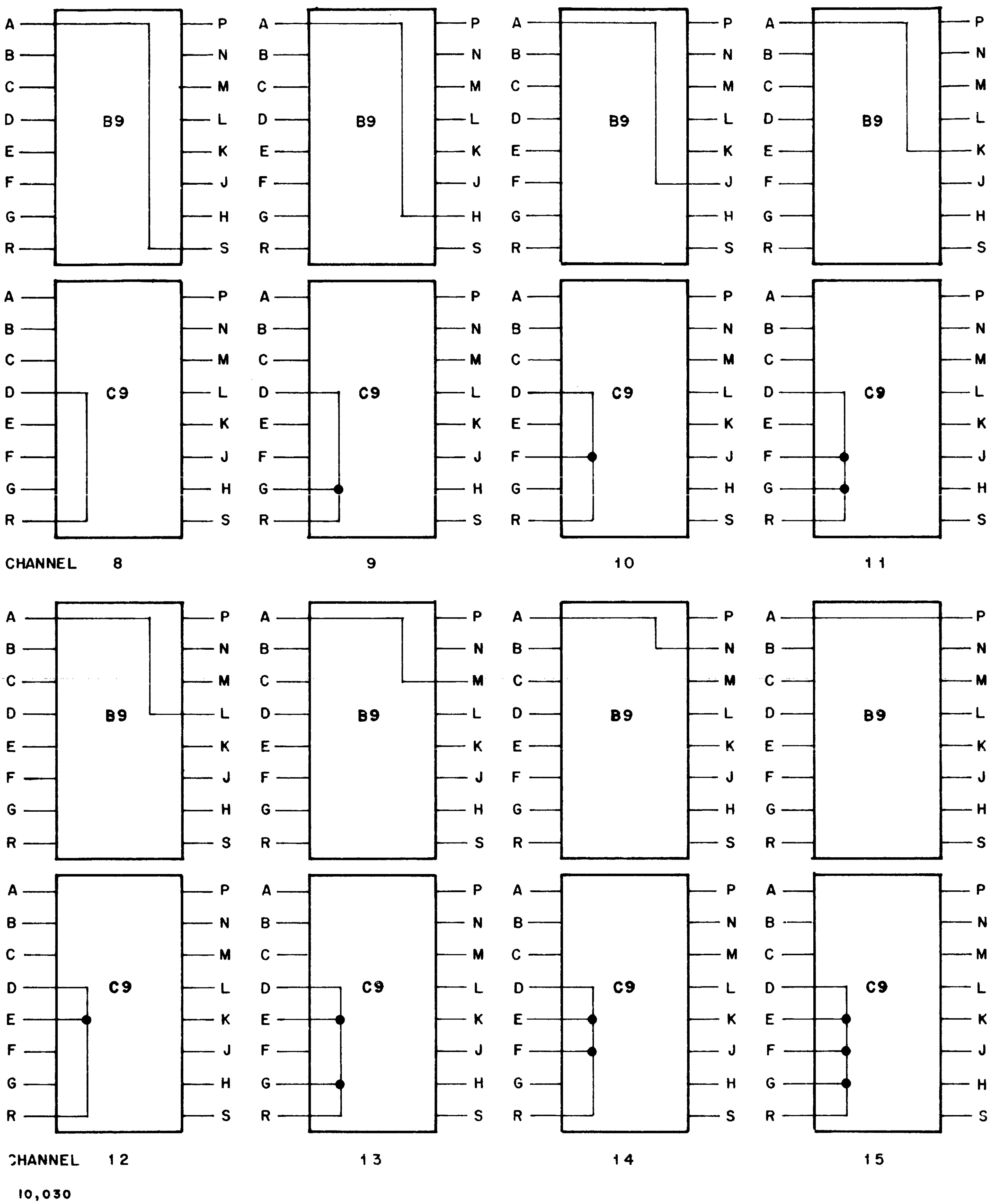

Figure VI-3. Channel Designate Wiring (Channels 8 through 15)

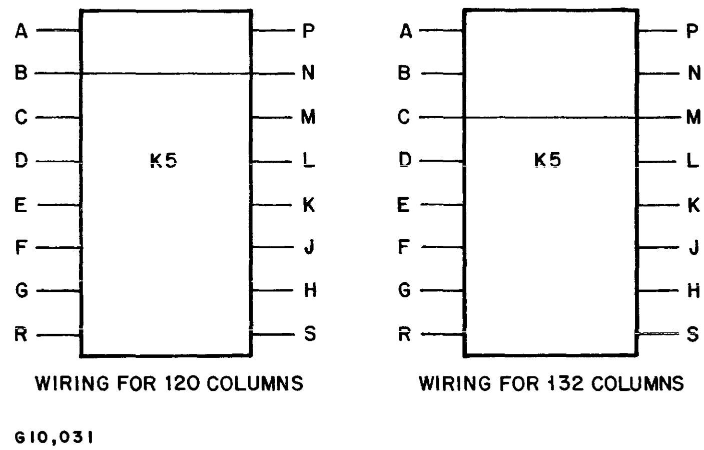

Figure VI-4. Column Length Identifier Wiring