Reference Manual

IBM 1414 Input/Output Synchronizer

Original Equipment Manufacturers' Information

IBM

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IBM 1414 Input/Output Synchronizer

Original Equipment Manufacturers' Information

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This manual will assist designers of accessory equipment used with IBM 1410-7000 Series Data Processing Systems that use IBM 1414 Input-Output Synchronizers or input-output control adapter units. If more detailed information is needed on a particular unit, IBM Customer Engineering Manuals are available from the local IBM Sales Office.

The IBM 1414 Input-Output Synchronizers attach IBM Magnetic Tape Units, IBM Unit Record Equipment, and communications equipment to IBM 1410-7000 Series Data Processing Systems. Other accessory equipment; such as telegraph input-output units, may also be attached to some of the 1414 models.

IBM 1414 Input-Output Synchronizers and devices that may be attached include:

1414-1, 1414-7	IBM 729 Magnetic Tape Units; IBM 7330 Magnetic Tape Units may be attached if the tape intermix feature (SF 7814) is installed on the 1414.
1414-2	IBM 7330 Magnetic Tape Units.
1414-3	IBM 1402 Card Read Punch and IBM 1403 Printer.
1414-4	IBM 1402 Card Read Punch, IBM 1403 Printer, IBM 1009 Data Transmission Unit, IBM 1011 Paper Tape Reader, IBM 1014 Remote Inquiry Unit, and telegraph type input-output units.
1414-5, 1414-6	Only the IBM 1009, 1011, 1014, and the telegraph units may be attached.

IBM 1414-1, 2, AND 7 INPUT-OUTPUT SYNCHRONIZERS

The IBM 1414-1, 2, or 7 Input-Output Synchronizers function as magnetic tape control units and may have ten tape units attached (Figure 1). Simultaneous read-write operations (on a given 1414) are not possible.

Information flows between the tape unit and the 1414 in parallel groups of seven bits; six bits contain data and the seventh is a check bit for the group. A group coded in binary coded decimal (BCD) format is called a character and contains a letter, number, or special character; a group coded in binary format contains six data bits of a computer word. Characters are sent to the computer at a speed governed by the tape unit being used.

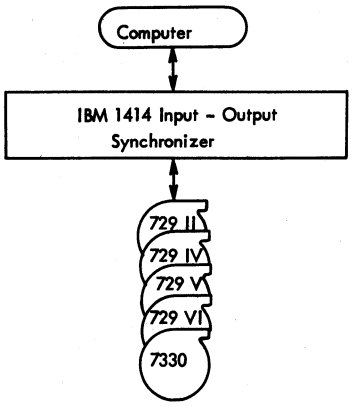


Figure 1. IBM 1414 Input-Output Synchronizer Devices

IBM 1414-3 INPUT-OUTPUT SYNCHRONIZER

The IBM 1414-3 Input-Output Synchronizer functions as a unit record equipment control unit and may have an IBM 1402 Card Read Punch and an IBM 1403 Printer attached (Figure 2).

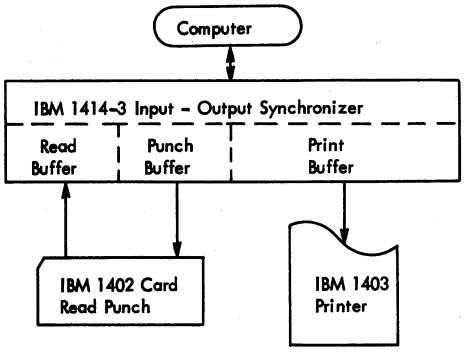


Figure 2. IBM 1414-3 Input-Output Sync Devices

Two 80-position buffers in the 1414 are used with the card read punch, one for reading cards, and the other for punching cards. On a read operation, IBM card code characters are read from the card, translated to BCD characters, and placed in the read buffer. When the buffer is full (one card has been read) the characters are sent to the computer at a rate of one character per 11 microseconds. On a punch operation, the procedure reverses and BCD characters from the punch buffer are translated to IBM card code characters and sent to the card punch to be recorded.

One 132-position print buffer is used with the printer. BCD characters are sent to the print buffer from the computer at a rate of one character per 11 microseconds. When the buffer is full (one line of printing), buffer contents are sent to the printer at the speed and in the order required by the printer.

IBM 1414-4, 5, AND 6 INPUT-OUPTUT SYNCHRONIZER

The 1414-4 may have the unit record equipment of the 1414-3 and, in addition, IBM communication equipment and other accessory equipment such as telegraph input-output units attached (Figure 3). Buffers, translation, and procedures with unit record equipment are the same as with the 1414-3.

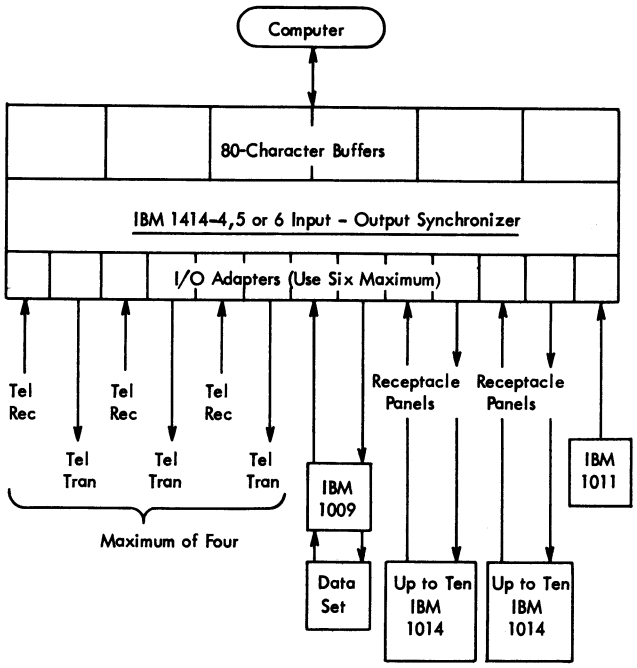


Figure 3. 1414-4, 5, and 6 Input-Output Sync Devices

The 1414-5 and 6 may have only the communication equipment of the 1414-4 attached. The main difference between the 1414-5 and the 1414-6 is the type of interface used with each unit and internal functions of the units.

Six 80-character buffers are available for the communications equipment. These buffers are permanently assigned to specific input-output adapters for any one 1414. Each adapter, in turn, is assigned a particular type of input-output device. Input-output adapters include:

IBM 1009 Data Transmission Unit Adapter: One adapter controls one 1009. Two 80-character buffers are required.

IBM 1011 Paper Tape Reader Adapter: One adapter controls one 1011 Paper Tape Reader. One 80-character buffer is required.

IBM 1014 Remote Inquiry Unit Adapter: One adapter can control ten 1014's. Two buffers (one for input and one for output) are required for each adapter.

Telegraph Input-Output Adapter: One adapter controls two simplex, one half-duplex, or one full-duplex communication circuits. Two buffers (one for input and one for output) are required.

Additional Telegraph Input Adapter: One adapter controls one simplex, one half-duplex, or one full-duplex communication circuit in conjunction with the additional telegraph output adapter. One buffer is required for each adapter.

Additional Telegraph Output Adapter: One adapter controls one simplex, one half-duplex, or one full-duplex communication circuit in conjunction with the additional telegraph input adapter. One buffer is required for each adapter.

Any combination of the adapters listed is permissible if the limitation on multiples of the same adapter is observed and the limit of six 80-character buffers is not exceeded.

A particular adapter is selected by a unit select register (which is set by a program instruction). The adapter remains selected until the attached input-output device reaches a logical end of operation. An adapter requiring service (an output adapter buffer empty or an input adapter buffer full) can be signaled through an internal function in the 1414.

ADAPTER INTERFACE CONTROL UNITS

Adapter interface control units attach IBM 1414-6 Input-Output Synchronizer, IBM 1301 Disk Storage, IBM 7340 Hypertape Drive, and IBM 7750 Programmed Transmission Control to IBM 7000 Series Data Processing Systems (Figure 4).

Any input-output device designed to the adapter interface may be attached to any control unit designed

to the same interface regardless of the computer system being used with the input-output devices. The control units include:

Data Processing System	Adapter Interface Control Unit	Attached Devices (I-O or Systems)
7040/7044	7904 Data Channel	1301, 1414-6, and 7750
7074	7907 Data Channel	1301, 1414-6, 7340, and 7750
7080	7908 Data Channel	1301, 1414-6, 7340, and 7750
7090/7094	7909 Data Channel	1301, 1414-6, 7340, and 7750

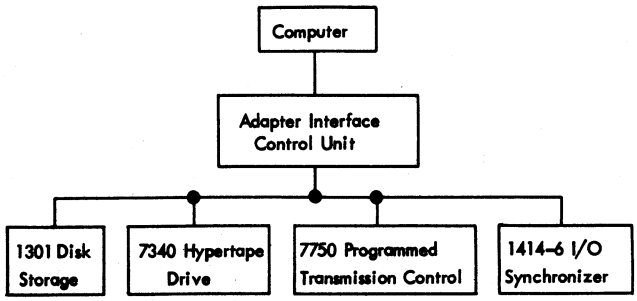


Figure 4. Adapter Interface Input-Output Devices

MAGNETIC TAPE UNIT TO 1414 INTERFACE

Interface between IBM Magnetic Tape Units and the 1414 Input-Output Synchronizer is accomplished with a cable and 200 position connector.

Except for read pulse outputs from the tape unit, all input-output signals are current-switching levels. In the current-switching logic system, signal swings are made about two separate reference levels. The level for a -N line is ground and the level for a -P line is -6 volts.

For reliable operation, a minimum swing of +0.4 volts about either reference level is required. A -3 volt swing below ground for a -N line and a +3 volt swing above -6 volts for a -P line is the maximum swing each line can tolerate before forcing the transistor to conduct into saturation. Voltage swings opposite to these place the transistors into the off condition and are limited only by the breakdown specifications of the transistors. Normally, signal swings are maintained at a nominal level of ±1 volt about either the N or P reference level.

Minimum current necessary for each -N or -P block is 0.264 milliamperes for an end-of-life α_{CB} and 0.164 for an initial purchase value of α_{CB}. When the lines are off, all are considered to be at end-of-life I_{CO} and I_{eo} limits of 0.14 milliamperes.

Signal levels are:

+N minimum level: +0.4 volts
-N minimum level: -0.4 volts
+P minimum level: -5.6 volts
-P minimum level: -6.4 volts

Input lines that have no rise time, fall time, or pulse width specifications are:

+P Select
-N Backward
+P Go
-N Write Check Character

Input lines that require a minimum pulse width of one microsecond are:

+P Set Read Status
-N Set Write Status
-N Turn On Tape Indicator
+P Turn Off Tape Indicator
-N Write Pulse

Input lines whose pulses require either a response from the tape unit to indicate completion (about 10 milliseconds) or maintenance at the pulsed level for a minimum of 20 milliseconds without a response are:

-N Start Rewind
+P Rewind and Unload

Input write lines (7) must be at the -N level for 4.5 microseconds before the write pulse line begins to rise. The down time for the write lines is equal to the write pulse width time.

Output lines that require no rise time, fall time, or pulse width specifications are:

+P Select and Ready
-N Select and Tape Indicate Off
-N Select and Tape Indicate On
+P Select and at Load Point
+P Select and Not at Load Point
+P Select Ready and Read
+P Select Ready and Write
-N Select and Rewind
+P High Density
-P Low Density

The -N write echo output line provides a minimum pulse width of one microsecond. Maximum capacitance on any output line is 3000 picofarads.

Input Lines to the Tape Unit

All input lines to the tape units have a level of either +P or -N. With the exception of the write check character line, all input signals work into a standard IBM alloy transistor circuit conversion block. The write check character line works directly into a logical -OR circuit. Input lines include:

+P Select: This line (one of ten select lines) selects one tape unit from the group connected in line to the common control unit. This signal gates the tape unit selected, allowing it to receive all subsequent signals from the control unit. This line must be made positive before any tape unit operation can be started and must be held positive for the duration of the operation. Dropping the select line to a -P level immediately stops any tape operation except rewind.

+P Go: This input line is brought positive after the status lines have been set to establish the tape operation to be performed. Bringing "Go" to a +P level immediately starts the operation. Dropping "Go" to a -P level stops tape motion and operation, except for rewind.

+P Set Read Status: This input conditions the read circuits in the tape unit and deconditions its write circuits. It does this with a +P signal (1 microsecond minimum width) that sets the read-write trigger in the tape unit to read status. This line must be pulsed or held at a +P level before bringing up the Go line, whenever a read or backspace operation is performed. It is held at a -P level whenever a write operation is performed.

-N Set Write Status: This input conditions the write circuits in the tape unit and allows current to flow in the write head if a file-protect ring has been placed into the file tape reel. It does this with a -N signal (1 microsecond minimum width) that sets the read-write trigger in the tape unit to write status. This line must be pulsed or held at a -N level before bringing up the Go line every time a write operation is performed. It is held at a +N level whenever a read, rewind, or backspace operation is performed.

-N Write Pulse: These input pulses are brought into the tape unit on a line common to the write circuits of all seven tracks. They are -N write pulses, one microsecond minimum duration, at a frequency established by the tape control. The pulses must be delayed after the rise of "Go" until tape has attained full speed and the write lines have had time to gate each track. The pulses continue, one for each character, until the last character of the record is written.

-N Write Lines: These seven input signal lines gate the write pulse to the write circuits of each track and write a 1 bit in that track. The up or down level of these lines is determined by the coded data sent to the tape unit. Gating the write circuits must be delayed after the rise of "Go" until tape reaches full speed. The pulses continue their gating action until the last character of the record is written.

-N Write Check Character: This input is used in writing a record to reset the seven write triggers (not the same as the read-write status triggers) in the tape unit so that polarity of all write heads is the same. The input must be held at -N level at all times except during the write operation. Then, the write check character line must be brought to a +N level with the rise of the first write pulse in the first character and must be held positive for the full length of the record. The tape control unit delays the drop of the line to a -N level until it has been assured that no further characters are to be written. This delay is called the write check character delay. The fall of this line resets the write triggers (odd bit longitudinal count) that have not been reset by the last character of the record. This procedure permits longitudinal bit checking for write errors.

-N Turn on Tape Indicate: This line turns on the tape indicator in the tape unit under automatic control. It is a one microsecond -N pulse. This line is held at a +N level during all other operations and can be pulsed only after the tape unit is in select and ready status.

+P Turn Off Tape Indicate: This line turns off the tape indicator when the tape unit is under automatic control. It is a one microsecond minimum +P pulse. This line is at a -P level during all other operations.

-N Start Rewind: This line starts the rewind operation. It is one of two lines available for this purpose; the other is the rewind and unload line. The start-rewind line is held at the +N level during all operations except starting the rewind operation. To start a rewind, the line is brought to the -N level and held a minimum of 20 milliseconds or until a response (active select and rewind) is received by the tape control (about 10 milliseconds). A start-rewind pulse is sent to the tape unit after it has been put into read status.

+P Rewind and Unload: This line is similar to the start rewind, but a +P pulse is used instead of a -N and the operation does not stop when the load point is reached. When the rewind operation is completed, the tape unit unloads the tape.

Output Lines from the Tape Unit

Except for the read signals, all lines from the tape unit are status or condition response lines. Their signals are either a +P or a -N pulse or level and are outputs of the same type of convert block used to receive input signals from the tape control. In IBM tape control units, these signals work into -N or -P type line terminators.

+P Select and Ready: This line is at -P level until the tape unit receives a +P select signal. The tape unit switches this line to a +P level to indicate that it is ready for operation. Except when the unit is rewinding, the line is held at the +P level until the select line is dropped, the address selector switch is changed, the tape unit is reset to manual control, or any one of the interlocks within the tape unit is broken.

-N Select and Tape Indicate On: This line is changed to a -N level whenever the tape unit is selected and the tape indicator is turned on by any of the manual methods. This line is held at the -N level until either the select line drops or the tape indicator is turned off.

+P Select and at Load Point: This line is changed to a +P level whenever the tape unit is selected and the load point reflective spot is photosensed. The line is held at a +P level until the select line is dropped or the tape moves from the load point. This line

must be at a -P level to permit a backspace operation. Circuits in the tape unit prevent backspacing beyond load point.

+P Select and not at Load Point: This line is changed to a +P level wherever the tape unit is selected and the tape is in any position other than load point. It is held at the +P level until the select line is dropped or the load point reflective spot is photosensed. The line must be at a +P level to permit backspacing.

+P Select Ready and Read: This line responds to the tape unit condition "set read status." The line changes from a -P level to a +P level, indicating that the read-write trigger is set to read and the tape unit is ready to start a read, backspace, or rewind operation. The line must always be at +P level before any of these operations can begin. Except when the unit is rewinding, the line is held at +P level until the select line is dropped or the unit goes out of ready or is changed to write status. The line is held at a -P level for all other operations.

+P Select Ready and Write: This line responds to "set write status." The line changes from a -P level to a +P level, indicating that the read-write trigger is set to write status and the tape unit is ready for a write operation. The line is held at this level until the select line is dropped or the unit goes out of ready or is changed to read status. The line is held at a -P level for all other operations.

+P High Density, -P Low Density: This line is at either level depending on the density mode selected.

-N Select and Rewind: This line tells the control unit that the tape unit has started a rewind. The line is changed from the +P level to the -N level as soon as the rewind relay is picked. It is held at the -N level until the select line is dropped or the rewind is completed. The tape unit select line is usually dropped as soon as this response signal is received by the tape control. The line is held at the +N level during all other operations.

-N Write Echo: This line is held at a +N level during all operations except writing. A one microsecond -N pulse appears on this line every time a 1 bit is written into any one of the seven tracks; the pulse is common to all seven tracks. There is no echo pulse when the longitudinal check characters are written.

Read Bus Lines: These are seven lines, one for each track. The signals on the lines are amplified outputs of the read heads. Each pulse, positive or negative, represents a 1 bit.

Select and Ready (729 V or VI Only): This line is normally AND'ed with "select and ready model II" or "select and ready model IV" in the tape control to provide 800 character-per-inch operation.

CABLE CONNECTIONS

Interface between the computer and 1414, and the 1414 and input-output devices, consists of signal, data, and control lines and the necessary internal 1414 functions. Each 1414-6 cable terminates in a 40-position connector that is plugged into the 1414-6 and the input-output device or the computer. All other 1414 models use a cable slide connector for termination. These slide connectors are plugged into the 1414 in one of 104 possible locations. The locations are numbered 1 through 52, upper and lower, and are on the wiring side of the 1414. For example, a cable wire designated L10A would be the top pin on the slide connector plugged into the 10th location from the right side of the 1414, in the lower section. Figure 5 shows the 1414-6 40-position connector and cable slide connectors; Figure 6 shows the 1414 receptacle.

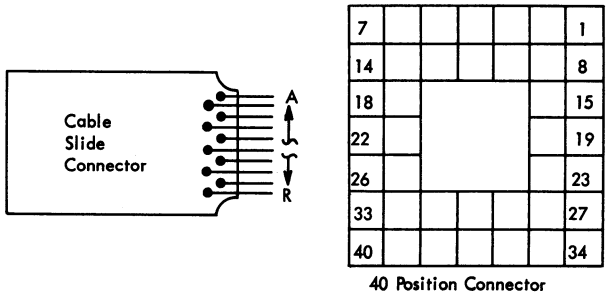


Figure 5. Cable Connectors

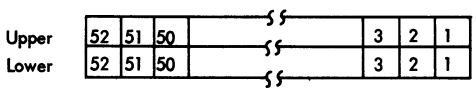


Figure 6. IBM 1414 Cable Connector Receptacle

Adjacent wires on a slide connector are normally either a twisted pair or a coaxial wire with a signal return (or coaxial shield) on the first connection and the signal wire on the second connection. For example, L10A is the return or the shield connection for signal wire L10B. Both connections are concerned with the same function. A tw function designates twisted pair return or shield in the following cable lists. Function signal levels are:

+n	= +0.8 volts	-n	= -0.8 volts
+p	= -5.2 volts	-p	= -6.8 volts
+w	= +0.0 volts	-w	= -48 volts
+z	= +6.0 volts	-z	= -6.0 volts
+c	= 0 milliamperes	-c	= -13.5 milliamperes
+s	= +0.0 volts	-s	= -12.0 volts
+v	= +0.0 volts	-v	= -36 volts

Computer to 1414-1, 2, 7 Input-Output Synchronizer Connections

Slide connectors from the computer are plugged into locations L11 through L18 on the 1414. The line location, function, and line name are:

Location	Function	Line Name
L11J	tw	
L11K	+s	Density Switch at 800 and 556 cpi*
L11L	tw	
L11M	+s	Density Switch at 556 and 200 cpi*
L12A	tw	
L12B	-c	Select Unit 8
L12C	tw	
L12D	-c	Select Unit 9
L12E	tw	
L12F	-c	Select Unit 4
L12G	tw	
L12H	-c	Select Unit 5
L12J	tw	
L12K	-c	Select Unit 6
L12L	tw	
L12M	-c	Select Unit 7
L12N	tw	
L12P	-c	Select Unit 0
L12Q	tw	
L12R	-c	Select Unit 1
L13A	tw	
L13B	-c	Select Unit 2
L13C	tw	
L13D	-c	Select Unit 3
L13E	tw	
L13F	-c	Tape Unit Busy
L13G	tw	
L13H	-c	Tape Unit Error
L13J	tw	
L13K	-c	Tape Unit Ready
L13L	tw	
L13M	-c	Tape Unit Select and Rewind
L13N	tw	
L13P	-c	Tape Unit Select and at Load Point
L13Q	tw	
L13R	-c	Tape Unit Select and Tape Indicate On
L14A	tw	
L14B	-c	Tape Unit Write Condition
L14C	tw	
L14D	-c	Tape Unit Disconnect Call
L14E	tw	
L14F	-c	Tape Character Odd Parity
L14G	tw	
L14H	-c	Tape Unit Erase Call
L14J	tw	
L14K	-c	Tape Unit Rewind Call
L14L	tw	
L14M	-c	Tape Unit Rewind and Unload Call
L14N	tw	
L14P	-c	Turn Off Tape Indicate
L14Q	tw	
L14R	-c	Write Tape Unit Call
L15A	tw	
L15B	-c	Read Tape Unit Call
L15C	tw	
L15D	-c	Tape Unit Backspace Call
L15E	tw	
L15F	-c	Write Tape Mark Call
L15G	tw	
L15H	-c	Tape Unit in Process
L15L	tw	
L15M	-c	Set Tape Unit Select Register
L15N	tw	
L15P	-c	Reset Tape Unit Select Register
L16A	tw	
L16B	-c	1-Bit to CPU
L16C	tw	
L16D	-c	2-Bit to CPU
L16E	tw	
L16F	-c	4-Bit to CPU
L16G	tw	
L16H	-c	8-Bit to CPU
L16J	tw	
L16K	-c	A-Bit to CPU
L16L	tw	
L16M	-c	B-Bit to CPU
L16N	tw	
L16P	-c	C-Bit to CPU
L17A	tw	
L17B	-c	A-Bit to 1414
L17C	tw	
L17D	-c	B-Bit to 1414
L17E	tw	
L17F	-c	C-Bit to 1414
L17G	tw	
L17H	-c	1-Bit to 1414
L17J	tw	
L17K	-c	2-Bit to 1414
L17L	tw	
L17M	-c	4-Bit to 1414

Location	Function	Line Name
L17N	tw	
L17P	-c	8-Bit to 1414
L18A	tw	
L18B	-c	Tape Unit Read Strobe Pulse
L18C	tw	
L18D	-c	Tape Unit Write Strobe Pulse
L18E	tw	
L18F	-c	Computer Reset to 1414
L18Q	tw	
L18R	-c	Write Clock Two

*Special Feature

IBM 1414-1, 2, 7 Input-Output Synchronizer to Tape Unit Connections

Slide connectors to the tape units are plugged into locations L1-4 and U1-4 for 729 tape units, and locations L7-10 and U7-10 for 7330 tape units. Tape connector pin assignments (at the tape unit) are made with a 200-position connector. The 1414 slide connector location, line function, line name, and tape connector pins are:

Location	Function	Line Name	Connector
U01A	tw		197
U01B	-n	Write Pulse	196
U01C	tw		195
U01D	-n	Reset Write Trigger	194
U01E	tw		8
U01F	-n	Backward Call	7
U01G	tw		10
U01H	-n	Rewind Call	9
U01J	tw		4
U01K	+p	Turn Off Tape Indicate	3
U01L	tw		14
U01M	+p	Set Read Status	13
U01N	tw		6
U01P	+p	Go Line	5
L01A	tw		40
L01B	+p	Rewind Unload	39
L01C	tw		26
L01D	+p	Select and at Load Point	27
U02E	tw		28
U02F	+p	Select and Not at Load Point	29
U02G	tw		38
U02H	-n	Select and Rewind	37
U02J	tw		12
U02K	-n	Set Write Status	11
U02L	tw		46
U02M	+p	High-Low Density	47
U02N	tw		22
U02P	-n	Select and Tape Indicate On	23

Location	Function	Line Name	Connector
L02A	tw		2
L02B	-n	Turn On Tape Indicate	1
L02C	tw		34
L02D	+p	Select, Ready, and Read	33
L02E	tw		193
L02F	-n	Write Echo	192
L02G	tw		36
L02H	+p	Select, Ready, and Write	35
L02J	tw		20
L02K	+p	Select and Ready, Model 4	21
L02L	tw		32
L02M	+p	Select and Ready, Model 2	31
L02N	tw		24
L02P	-n	Select and Tape Indicate Off	25
U03A	tw		83
U03B		Read Bus Bit 1	82
U03C	tw		85
U03D		Read Bus Bit 2	84
U03E	tw		92
U03F		Read Bus Bit 4	93
U03G	tw		94
U03H		Read Bus Bit 8	95
U03J	tw		103
U03K		Read Bus Bit A	102
U03L	tw		105
U03M		Read Bus Bit B	104
U03N	tw		112
U03P		Read Bus Bit C	113
L03A	tw		171
L03B	-n	Write Bus Bit 1	172
L03C	tw		173
L03D	-n	Write Bus Bit 2	174
L03E	tw		175
L03F	-n	Write Bus Bit 4	176
L03G	tw		177
L03H	-n	Write Bus Bit 8	178
L03J	tw		179
L03K	-n	Write Bus Bit A	180
L03L	tw		181
L03M	-n	Write Bus Bit B	182
L03N	tw		183
L03P	-n	Write Bus Bit C	184
U04A	tw		116
U04B	+p	Select 729 Tape Unit 8	117
U04C	tw		118
U04D	+p	Select 729 Tape Unit 9	119
U04L	tw		114
U04M	+p	Model 5 or Model 6 Tape Unit	115
L04A	tw		76
L04B	+p	Select 729 Tape Unit 0	77
L04C	tw		78
L04D	+p	Select 729 Tape Unit 1	79
L04E	tw		87
L04F	+p	Select 729 Tape Unit 2	86
L04G	tw		89
L04H	+p	Select 729 Tape Unit 3	88
L04J	tw		96
L04K	+p	Select 729 Tape Unit 4	97
L04L	tw		98

Location	Function	Line Name	Connector
L04M	+p	Select 729 Tape Unit 5	99
L04N	tw		107
L04P	+p	Select 729 Tape Unit 6	106
L04Q	tw		109
L04R	+p	Select 729 Tape Unit 7	108
U07A	tw		197
U07B	-n	Write Pulse	196
U07C	tw		195
U07D	-n	Reset Write Trigger	194
U07E	tw		8
U07F	-n	Backward Call	7
U07G	tw		10
U07H	-n	Rewind Call	9
U07J	tw		4
U07K	-n	Turn Off Tape Indicate	3
U07L	tw		14
U07M	-n	Set Read Status	13
U07N	tw		6
U07P	-n	Go Line	5
L07A	tw		40
L07B	-n	Rewind and Unload	39
L07C	tw		26
L07D	-n	Select and at Load Point	27
U08E	tw		28
U08F	-n	Select, Ready, and Backward	29
U08G	tw		38
U08H	-n	Select and Rewind	37
U08J	tw		12
U08K	-n	Set Write Status	11
U08N	tw		22
U08P	-n	Select and Tape Indicate On	23
L08A	tw		2
L08B	-n	Turn On Tape Indicate	1
L08C	tw		34
L08D	-n	Select, Ready, and Read	33
L08E	tw		193
L08F	-n	Echo Pulse	192
L08G	tw		36
L08H	-n	Select, Ready, and Write	35
L08J	tw		20
L08K	-n	Select and Ready-High Density	21
L08L	tw		32
L08M	-n	Select and Ready-Low Density	31
U09A	tw		83
U09B		Read Bus Bit 1	82
U09C	tw		85
U09D		Read Bus Bit 2	84
U09E	tw		92
U09F		Read Bus Bit 4	93
U09G	tw		94
U09H		Read Bus Bit 8	95
U09J	tw		103
U09K		Read Bus Bit A	102
U09L	tw		105
U09M		Read Bus Bit B	104
U09N	tw		112
U09P		Read Bus Bit C	113
L09A	tw		171
L09B		Write Bus Bit 1	172
L09C	tw		173
L09D		Write Bus Bit 2	174
L09E	tw		175
L09F		Write Bus Bit 4	176
L09G	tw		177
L09H		Write Bus Bit 8	178
L09J	tw		179
L09K		Write Bus Bit A	180
L09L	tw		181
L09M		Write Bus Bit B	182
L09N	tw		183
L09P		Write Bus Bit C	184
U10A	tw		116
U10B	-n	Select 7330 Tape Unit 8	117
U10C	tw		118
U10D	-n	Select 7330 Tape Unit 9	119
L10A	tw		76
L10B	-n	Select 7330 Tape Unit 0	77
L10C	tw		78
L10D	-n	Select 7330 Tape Unit 1	79
L10E	tw		87
L10F	-n	Select 7330 Tape Unit 2	86
L10G	tw		89
L10H	-n	Select 7330 Tape Unit 3	88
L10J	tw		96
L10K	-n	Select 7330 Tape Unit 4	97
L10L	tw		98
L10M	-n	Select 7330 Tape Unit 5	99
L10N	tw		107
L10P	-n	Select 7330 Tape Unit 6	106
L10Q	tw		109
L10R	-n	Select 7330 Tape Unit 7	108

Computer to 1414-3, 4, and 5 Input-Ouput Synchronizer Connections

Slide connectors from the computer to the 1414 plug into locations L25, 30, 31, 32, 33, 34, and U30, 33, and 34. The line location, function, and unit affected are:

Location	Function	Line Name	Unit
L25A	tw		
L25B	-c	Forms Busy Status	Printer
L25C	tw		
L25D	-c	Print Buffer Busy	Printer
L25E	tw		
L25F	-c	Printer Channel 12	Printer
L25G	tw		
L25H	-c	Printer Channel 9	Printer
L25J	tw		
L25K	-c	Unit 2 Select to I/O	Printer
L25L	tw		
L25M	-c	Forms Control to Buffer	Printer
L25N	tw		
L25P	-c	I/O Printer Ready	Printer
L30A	tw		
L30B	-c	Channel Select Unit P	1011
L30C	tw		
L30D	-c	Channel Select Unit L	Telegraph
L30G	tw		
L30H	-c	Channel Select Unit N	Unit Record
L30J	tw		
L30K	-c	Channel Select Number 0 to Buffer	All Units
L30L	tw		
L30M	-c	Channel Select Number 1 to Buffer	All Units
L30N	tw		
L30P	-c	Channel Select Number 2 to Buffer	All Units
L30Q	tw		
L30R	-c	Channel Select Number 3 to Buffer	All Units
L31E	tw		
L31F	-c	Buffer Inquiry Request	All Units
L31J	tw		
L31K	-c	Channel Select Unit Q	1014
L31L	tw		
L31M	-c	Channel Select Unit D	1009
L32A	tw		
L32B	-c	Channel Input Mode to Buffer	All Units
L32C	tw		
L32D	-c	Channel Output Mode to Buffer	All Units
L33A	tw		
L33B	-c	CPU to I/O Sync 1 Bit	All Units
L33C	tw		
L33D	-c	CPU to I/O Sync 2 Bit	All Units
L33E	tw		
L33F	-c	CPU to I/O Sync 4 Bit	All Units
L33G	tw		
L33H	-c	CPU to I/O Sync 8 Bit	All Units
L33J	tw		
L33K	-c	CPU to I/O Sync A Bit	All Units
L33L	tw		
L33M	-c	CPU to I/O Sync B Bit	All Units
L33N	tw		
L33P	-c	CPU to I/O Sync C Bit	All Units
L33Q	tw		
L33R	-c	Buffer Strobe	All Units
L34A	tw		
L34B	-c	I/O Sync to CPU 1 Bit	All Units
L34C	tw		
L34D	-c	I/O Sync to CPU 2 Bit	All Units
L34E	tw		
L34F	-c	I/O Sync to CPU 4 Bit	All Units
L34G	tw		
L34H	-c	I/O Sync to CPU 8 Bit	All Units
L34J	tw		
L34K	-c	I/O Sync to CPU A Bit	All Units
L34L	tw		
L34M	-c	I/O Sync to CPU B Bit	All Units
L34N	tw		
L34P	-c	I/O Sync to CPU C Bit	All Units
L34Q	tw		
L34R	-c	CPU Reset to Buffer	All Units
U30A	tw		
U30B	-c	Reader Busy	1402
U30C	tw		
U30D	-c	Punch Busy	1402
U30E	tw		
U30F	-c	Paper Tape Reader Busy	1011
U30G	tw		
U30H	-c	I/O Clock	1410
U33A	tw		
U33B	-c	CPU Ready to Buffer	All Units
U33E	tw		
U33F	-c	Forms Stacker Go	1402
U33G	tw		
U33H	-c	Buffer End of Transfer	All Units
U33J	tw		
U33K	-c	Buffer Ready	All Units
U33L	tw		
U33M	-c	Buffer Conditions	All Units
U33N	tw		
U33P	-c	Buffer Busy	All Units
U33Q	tw		
U33R	-c	Buffer Error	All Units
U34C	tw		
U34D	-c	Buffer No Transfer Condition	All Units
U34E	tw		

Location	Function	Line Name	Unit
U34F	-c	Reset Select Buffer Latches	All Units
U34G	tw		
U34H	-c	1401 Mode to Buffer	All Units
U34J	tw		
U34K	-c	Stack Select to Buffer	1402
U34L	tw		
U34M	-c	Unit 1 Select to I/O Sync	All Units
U34N	tw		
U34P	-c	Unit 4 Select to I/O Sync	All Units
U34Q	tw		
U34R	-c	Correct Transfer to Buffer	All Units

IBM 1414-3 or 4 to IBM 1402 (Punch) Connections

Slide connectors from the 1414 to punch circuits of the 1402 use locations L36, 37, 39, 40, 42, and 43, and U36, 37, 39, 40, 42, and 43. The line location, function, line name, and connector pin on the 1402 are:

Location	Function	Line Name	1402 Pin
L36A	+z	Punch Brush 22	102
L36B	+z	Punch Brush 36	116
L36C	+z	Punch Brush 33	113
L36D	+z	Punch Brush 34	114
L36E	+z	Punch Brush 31	111
L36F	+z	Punch Brush 32	112
L36G	+z	Punch Brush 6	86
L36H	+z	Punch Brush 3	83
L36J	+z	Punch Brush 4	84
L36K	+z	Punch Brush 1	81
L36L	+z	Punch Brush 2	82
L36M	+z	Punch Brush 16	96
L36N	+z	Punch Brush 13	93
L36P	+z	Punch Brush 14	94
L36Q	+z	Punch Brush 11	91
L36R	+z	Punch Brush 12	92
L37A	+z	Punch Brush 71	151
L37B	+z	Punch Brush 72	152
L37C	+z	Punch Brush 46	126
L37D	+z	Punch Brush 43	123
L37E	+z	Punch Brush 44	124
L37F	+z	Punch Brush 41	121
L37G	+z	Punch Brush 42	122
L37H	+z	Punch Brush 56	136
L37J	+z	Punch Brush 53	133
L37K	+z	Punch Brush 54	134
L37L	+z	Punch Brush 51	131
L37M	+z	Punch Brush 52	132
L37N	+z	Punch Brush 26	106
L37P	+z	Punch Brush 23	103
L37Q	+z	Punch Brush 24	104
L37R	+z	Punch Brush 21	101
L38A	+z	Punch Brush 66	146
L38B	+z	Punch Brush 63	143
L38C	+z	Punch Brush 64	144
L38D	+z	Punch Brush 61	141
L38E	+z	Punch Brush 62	142
L38F	+z	Punch Brush 76	156
L38G	+z	Punch Brush 73	153
L38H	+z	Punch Brush 74	154
L38J	+z	Punch Brush 47	127
L38K	+z	Punch Brush 50	130
L38L	+z	Punch Brush 49	129
L38M	+z	Punch Brush 55	135
L38N	+z	Punch Brush 58	138
L38P	+z	Punch Brush 57	137
L38Q	+z	Punch Brush 60	140
L38R	+z	Punch Brush 59	139
L40A	+z	Punch Brush 18	98
L40B	+z	Punch Brush 17	97
L40C	+z	Punch Brush 20	100
L40D	+z	Punch Brush 19	99
L40E	+z	Punch Brush 65	145
L40F	+z	Punch Brush 68	148
L40G	+z	Punch Brush 67	147
L40H	+z	Punch Brush 70	150
L40J	+z	Punch Brush 69	149
L40K	+z	Punch Brush 75	155
L40L	+z	Punch Brush 78	158
L40M	+z	Punch Brush 77	157
L40N	+z	Punch Brush 80	160
L40P	+z	Punch Brush 79	159
L40Q	+z	Punch Brush 45	125
L40R	+z	Punch Brush 48	128
L42A	+z	Punch Brush 25	105
L42B	+z	Punch Brush 28	108
L42C	+z	Punch Brush 27	107
L42D	+z	Punch Brush 30	110
L42E	+z	Punch Brush 29	109
L42F	+z	Punch Brush 35	115
L42G	+z	Punch Brush 38	118
L42H	+z	Punch Brush 37	117
L42J	+z	Punch Brush 40	120
L42K	+z	Punch Brush 39	119
L42L	+z	Punch Brush 5	85
L42M	+z	Punch Brush 8	88
L42N	+z	Punch Brush 7	87
L42P	+z	Punch Brush 10	90
L42Q	+z	Punch Brush 9	89
L42R	+z	Punch Brush 15	95
L43A	-w	Punch Stop	176
L43B	+w	Punch Clutch	177
L43C	-w	Punch Process	178
L43D	-w	Not Punch Process	179
L43E	-w	Punch Jam	180
L43F	-w	Stacker Latch Reset	183
L43G	-w	Stacker 4	184
L43H	-w	Stacker 8	185
L43K	-w	Punch Run	186
L43L	-w	Punch Brush Clutch Delay	188
L43M	-w	Stacker Inhibit	189
L43N	+s	Punch Check	190
L43P	+s	Punch Ready	192
L43Q	-w	Punch Brush Impulse CB	187

Location	Function	Line Name	1402 Pin
U36A	+w	Punch Magnet 1	1
U36B	+w	Punch Magnet 2	2
U36C	+w	Punch Magnet 11	11
U36D	+w	Punch Magnet 12	12
U36E	+w	Punch Magnet 21	21
U36F	+w	Punch Magnet 22	22
U36G	+w	Punch Magnet 31	31
U36H	+w	Punch Magnet 32	32
U36J	+w	Punch Magnet 41	41
U36K	+w	Punch Magnet 42	42
U36L	+w	Punch Magnet 51	51
U36M	+w	Punch Magnet 52	52
U36N	+w	Punch Magnet 61	61
U36P	+w	Punch Magnet 62	62
U36Q	+w	Punch Magnet 71	71
U36R	+w	Punch Magnet 72	72
U37A	+w	Punch Magnet 3	3
U37B	+w	Punch Magnet 4	4
U37C	+w	Punch Magnet 13	13
U37D	+w	Punch Magnet 14	14
U37E	+w	Punch Magnet 23	23
U37F	+w	Punch Magnet 24	24
U37G	+w	Punch Magnet 33	33
U37H	+w	Punch Magnet 34	34
U37J	+w	Punch Magnet 43	43
U37K	+w	Punch Magnet 44	44
U37L	+w	Punch Magnet 53	53
U37M	+w	Punch Magnet 54	54
U37N	+w	Punch Magnet 63	63
U37P	+w	Punch Magnet 64	64
U37Q	+w	Punch Magnet 73	73
U37R	+w	Punch Magnet 74	74
U39A	+w	Punch Magnet 5	5
U39B	+w	Punch Magnet 6	6
U39C	+w	Punch Magnet 15	15
U39D	+w	Punch Magnet 16	16
U39E	+w	Punch Magnet 25	25
U39F	+w	Punch Magnet 26	26
U39G	+w	Punch Magnet 35	35
U39H	+w	Punch Magnet 36	36
U39J	+w	Punch Magnet 45	45
U39K	+w	Punch Magnet 46	46
U39L	+w	Punch Magnet 55	55
U39M	+w	Punch Magnet 56	56
U39N	+w	Punch Magnet 65	65
U39P	+w	Punch Magnet 66	66
U39Q	+w	Punch Magnet 75	75
U39R	+w	Punch Magnet 76	76
U40A	+w	Punch Magnet 7	7
U40B	+w	Punch Magnet 8	8
U40C	+w	Punch Magnet 17	17
U40D	+w	Punch Magnet 18	18
U40E	+w	Punch Magnet 27	27
U40F	+w	Punch Magnet 28	28
U40G	+w	Punch Magnet 37	37
U40H	+w	Punch Magnet 38	38
U40J	+w	Punch Magnet 47	47
U40K	+w	Punch Magnet 48	48
U40L	+w	Punch Magnet 57	57
U40M	+w	Punch Magnet 58	58
U40N	+w	Punch Magnet 67	67
U40P	+w	Punch Magnet 68	68
U40Q	+w	Punch Magnet 77	77
U40R	+w	Punch Magnet 78	78
U42A	+w	Punch Magnet 9	9
U42B	+w	Punch Magnet 10	10
U42C	+w	Punch Magnet 19	19
U42D	+w	Punch Magnet 20	20
U42E	+w	Punch Magnet 29	29
U42F	+w	Punch Magnet 30	30
U42G	+w	Punch Magnet 39	39
U42H	+w	Punch Magnet 40	40
U42J	+w	Punch Magnet 49	49
U42K	+w	Punch Magnet 50	50
U42L	+w	Punch Magnet 59	59
U42M	+w	Punch Magnet 60	60
U42N	+w	Punch Magnet 69	69
U42P	+w	Punch Magnet 70	70
U42Q	+w	Punch Magnet 79	79
U42R	+w	Punch Magnet 80	80
U43A	+w	Emit 12	161
U43B	+w	Emit 11	162
U43C	+w	Emit 0	163
U43D	+w	Emit 1	164
U43E	+w	Emit 2	165
U43F	+w	Emit 3	166
U43G	+w	Emit 4	167
U43H	+w	Emit 5	168
U43K	+w	Emit 6	169
U43L	+w	Emit 7	170
U43M	+w	Emit 8	171
U43N	+w	Emit 9	172
U43P	+w	Latch Reset	173
U43Q	+w	After 9 Cam	174
U43R	+w	Punch Scan CB	175

IBM 1414-3 or 4 to IBM 1402 (Read) Connections

Slide connectors from the 1414 to read circuits of the 1402 use locations L45, 46, 48, 49, 51, 52, and U45, 46, 48, 49, 51, and 52. The line location, function, line name, and connector pin on the 1402 are:

Location	Function	Line Name	1402 Pin
L45A	-w	1 CB	164
L45B	-w	2 CB	163
L45C	-w	4 CB	162
L45D	-w	8 CB	161
L45E	-w	B CB	166
L45F	-w	A CB	165
L45G	-w	C CB	167
L45P	+s	Reader Ready	192

Location	Function	Line Name	1402 Pin
L46A	+z	2nd Read Brush 65	145
L46B	+z	2nd Read Brush 79	159
L46C	+z	2nd Read Brush 80	160
L46D	+z	2nd Read Brush 77	157
L46E	+z	2nd Read Brush 78	158
L46F	+z	2nd Read Brush 75	155
L46G	+z	2nd Read Brush 49	129
L46H	+z	2nd Read Brush 50	130
L46J	+z	2nd Read Brush 47	127
L46K	+z	2nd Read Brush 48	128
L46L	+z	2nd Read Brush 45	125
L46M	+z	2nd Read Brush 59	139
L46N	+z	2nd Read Brush 60	140
L46P	+z	2nd Read Brush 57	137
L46Q	+z	2nd Read Brush 58	138
L46R	+z	2nd Read Brush 55	135
L48A	+z	2nd Read Brush 38	118
L48B	+z	2nd Read Brush 35	115
L48C	+z	2nd Read Brush 9	89
L48D	+z	2nd Read Brush 10	90
L48E	+z	2nd Read Brush 7	87
L48F	+z	2nd Read Brush 8	88
L48G	+z	2nd Read Brush 5	85
L48H	+z	2nd Read Brush 19	99
L48J	+z	2nd Read Brush 20	100
L48K	+z	2nd Read Brush 17	97
L48L	+z	2nd Read Brush 18	98
L48M	+z	2nd Read Brush 15	95
L48N	+z	2nd Read Brush 69	149
L48P	+z	2nd Read Brush 70	150
L48Q	+z	2nd Read Brush 67	147
L48R	+z	2nd Read Brush 68	148
L49A	+z	1st Read Brush 58	58
L49B	+z	1st Read Brush 57	57
L49C	+z	1st Read Brush 56	56
L49D	+z	1st Read Brush 50	50
L49E	+z	1st Read Brush 49	49
L49F	+z	1st Read Brush 48	48
L49G	+z	1st Read Brush 47	47
L49H	+z	1st Read Brush 46	46
L49J	+z	2nd Read Brush 29	109
L49K	+z	2nd Read Brush 30	110
L49L	+z	2nd Read Brush 27	107
L49M	+z	2nd Read Brush 28	108
L49N	+z	2nd Read Brush 25	105
L49P	+z	2nd Read Brush 39	119
L49Q	+z	2nd Read Brush 40	120
L49R	+z	2nd Read Brush 37	117
L51A	+z	1st Read Brush 9	9
L51B	+z	1st Read Brush 8	8
L51C	+z	1st Read Brush 7	7
L51D	+z	1st Read Brush 6	6
L51E	+z	1st Read Brush 80	80
L51F	+z	1st Read Brush 79	79
L51G	+z	1st Read Brush 78	78
L51H	+z	1st Read Brush 77	77
L51J	+z	1st Read Brush 76	76
L51K	+z	1st Read Brush 70	70
L51L	+z	1st Read Brush 69	69
L51M	+z	1st Read Brush 68	68

Location	Function	Line Name	1402 Pin
L51N	+z	1st Read Brush 67	67
L51P	+z	1st Read Brush 66	66
L51Q	+z	1st Read Brush 60	60
L51R	+z	1st Read Brush 59	59
L52A	+z	1st Read Brush 40	40
L52B	+z	lst Read Brush 39	39
L52C	+z	1st Read Brush 38	38
L52D	+z	1st Read Brush 37	37
L52E	+z	1st Read Brush 36	36
L52F	+z	1st Read Brush 30	30
L52G	+z	1st Read Brush 29	29
L52H	+z	1st Read Brush 28	28
L52J	+z	1st Read Brush 27	27
L52K	+z	1st Read Brush 26	26
L52L	+z	1st Read Brush 20	20
L52M	+z	1st Read Brush 19	19
L52N	+z	1st Read Brush 18	18
L52P	+z	1st Read Brush 17	17
L52Q	+z	1st Read Brush 16	16
L52R	+z	1st Read Brush 10	10
U45A	-w	Reader Stop	168
U45B	+w	Reader Clutch	170
U45C	-w	Process Feed	171
U45D	-w	Not Process Feed	172
U45E	-w	Last Card	176
U45F	-w	Read Stacker Reset	178
U45G	-w	Brush Drive 1	179
U45H	-w	Brush Drive 2	180
U45K	-w	Card Lever Delay 2	181
U45L	-s	Read Error	182
U45M	+s	Validity	183
U45N	+w	Stacker 1	184
U45P	+w	Stacker 2	185
U45Q	-w	CB Reset	187
U45R	-w	Brush Impulse CB	188
U46A	+z	1st Read Brush 35	35
U46B	+z	1st Read Brush 21	21
U46C	+z	1st Read Brush 22	22
U46D	+z	1st Read Brush 23	23
U46E	+z	1st Read Brush 24	24
U46F	+z	1st Read Brush 25	25
U46G	+z	1st Read Brush 12	12
U46H	+z	1st Read Brush 13	13
U46J	+z	1st Read Brush 14	14
U46K	+z	1st Read Brush 15	15
U46L	+z	1st Read Brush 16	16
U46M	+z	1st Read Brush 1	1
U46N	+z	1st Read Brush 2	2
U46P	+z	1st Read Brush 3	3
U46Q	+z	1st Read Brush 4	4
U46R	+z	1st Read Brush 5	5
U48A	+z	1st Read Brush 64	64
U48B	+z	1st Read Brush 65	65
U48C	+z	1st Read Brush 51	51
U48D	+z	1st Read Brush 52	52
U48E	+z	1st Read Brush 53	53
U48F	+z	1st Read Brush 54	54
U48G	+z	1st Read Brush 55	55
U48H	+z	1st Read Brush 41	41

Location	Function	Line Name	1402 Pin
U48J	+z	1st Read Brush 42	42
U48K	+z	1st Read Brush 43	43
U48L	+z	1st Read Brush 44	44
U48M	+z	1st Read Brush 45	45
U48N	+z	1st Read Brush 31	31
U48P	+z	1st Read Brush 32	32
U48Q	+z	1st Read Brush 33	33
U48R	+z	1st Read Brush 34	34
U49A	+z	2nd Read Brush 4	84
U49B	+z	2nd Read Brush 3	83
U49C	+z	2nd Read Brush 6	86
U49D	+z	2nd Read Brush 12	92
U49E	+z	2nd Read Brush 11	91
U49F	+z	2nd Read Brush 14	94
U49G	+z	2nd Read Brush 13	93
U49H	+z	2nd Read Brush 16	96
U49J	+z	1st Read Brush 71	151
U49K	+z	1st Read Brush 72	152
U49L	+z	1st Read Brush 73	153
U49M	+z	1st Read Brush 74	154
U49N	+z	1st Read Brush 75	155
U49P	+z	1st Read Brush 61	141
U49Q	+z	1st Read Brush 62	142
U49R	+z	1st Read Brush 63	143
U51A	+z	2nd Read Brush 51	131
U51B	+z	2nd Read Brush 54	134
U51C	+z	2nd Read Brush 53	133
U51D	+z	2nd Read Brush 56	136
U51E	+z	2nd Read Brush 22	102
U51F	+z	2nd Read Brush 21	101
U51G	+z	2nd Read Brush 24	104
U51H	+z	2nd Read Brush 23	103
U51J	+z	2nd Read Brush 26	106
U51K	+z	2nd Read Brush 32	112
U51L	+z	2nd Read Brush 31	111
U51M	+z	2nd Read Brush 34	114
U51N	+z	2nd Read Brush 33	113
U51P	+z	2nd Read Brush 36	116
U51Q	+z	2nd Read Brush 2	82
U51R	+z	2nd Read Brush 1	81
U52A	+z	2nd Read Brush 62	142
U52B	+z	2nd Read Brush 61	141
U52C	+z	2nd Read Brush 64	144
U52D	+z	2nd Read Brush 63	143
U52E	+z	2nd Read Brush 66	146
U52F	+z	2nd Read Brush 72	152
U52G	+z	2nd Read Brush 71	151
U52H	+z	2nd Read Brush 74	154
U52J	+z	2nd Read Brush 73	153
U52K	+z	2nd Read Brush 76	156
U52L	+z	2nd Read Brush 42	122
U52M	+z	2nd Read Brush 41	121
U52N	+z	2nd Read Brush 44	124
U52P	+z	2nd Read Brush 43	123
U52Q	+z	2nd Read Brush 46	126
U52R	+z	2nd Read Brush 52	132

IBM 1414-3 or 4 to IBM 1403 Printer Connections

Slide connectors from the 1414 to the 1403 printer use locations L and U 10, 12, 13, 15, 18, 19, 21, 22, 24, and U25. Two 160-position connectors, SC1 and SC2, are used on the printer end of the cables. The line location, function, line name, and connector pin on the 1403 are:

Location	Function	Line Name	1403 Pin
L10A	-w	Shield (all hammer shields are common)	SC1-98
L10B	+w	Hammer 129	SC1-97
L10C	-w	Shield	SC1-98
L10D	+w	Hammer 131	SC1-99
L10P	-v	Chain delay	
L12A	-w	Shield	SC1-74
L12B	+w	Hammer 97	SC1-73
L12C	-w	Shield	SC1-74
L12D	+w	Hammer 99	SC1-75
L12E	-w	Shield	SC1-77
L12F	+w	Hammer 101	SC1-76
L12G	-w	Shield	SC1-77
L12H	+w	Hammer 103	SC1-78
L12J	-w	Shield	SC1-80
L12K	+w	Hammer 105	SC1-79
L12L	-w	Shield	SC1-80
L12M	+w	Hammer 107	SC1-81
L12N	-w	Shield	SC1-83
L12P	+w	Hammer 109	SC1-82
L12Q	-w	Shield	SC1-83
L12R	+w	Hammer 111	SC1-84
L13A	-w	Shield	SC1-50
L13B	+w	Hammer 65	SC1-49
L13C	-w	Shield	SC1-50
L13D	+w	Hammer 67	SC1-51
L13E	-w	Shield	SC1-53
L13F	+w	Hammer 69	SC1-52
L13G	-w	Shield	SC1-53
L13H	+w	Hammer 71	SC1-54
L13J	-w	Shield	SC1-56
L13K	+w	Hammer 73	SC1-55
L13L	-w	Shield	SC1-56
L13M	+w	Hammer 75	SC1-57
L13N	-w	Shield	SC1-59
L13P	+w	Hammer 77	SC1-58
L13Q	-w	Shield	SC1-59
L13R	+w	Hammer 79	SC1-60
L15A	-w	Shield	SC1-26
L15B	+w	Hammer 33	SC1-25
L15C	-w	Shield	SC1-26
L15D	+w	Hammer 35	SC1-27
L15E	-w	Shield	SC1-29
L15F	+w	Hammer 37	SC1-28
L15G	-w	Shield	SC1-29
L15H	+w	Hammer 39	SC1-30
L15J	-w	Shield	SC1-32
L15K	+w	Hammer 41	SC1-31
L15L	-w	Shield	SC1-32

Location	Function	Line Name	1403 Pin
L15M	+w	Hammer 43	SC1-33
L15N	-w	Shield	SC1-35
L15P	+w	Hammer 45	SC1-34
L15Q	-w	Shield	SC1-35
L15R	+w	Hammer 47	SC1-36
L16A	-w	Shield	SC1- 2
L16B	+w	Hammer 1	SC1- 1
L16C	-w	Shield	SC1- 2
L16D	+w	Hammer 3	SC1- 3
L16E	-w	Shield	SC1- 5
L16F	+w	Hammer 5	SC1- 4
L16G	-w	Shield	SC1- 5
L16H	+w	Hammer 7	SC1- 6
L16J	-w	Shield	SC1- 8
L16K	+w	Hammer 9	SC1- 7
L16L	-w	Shield	SC1- 8
L16M	+w	Hammer 11	SC1- 9
L16N	-w	Shield	SC1-11
L16P	+w	Hammer 13	SC1-10
L16Q	-w	Shield	SC1-11
L16R	+w	Hammer 15	SC1-12
L18A	-w	Shield	SC2-86
L18B	+w	Hammer 114	SC2-85
L18C	-w	Shield	SC2-86
L18D	+w	Hammer 116	SC2-87
L18E	-w	Shield	SC2-89
L18F	+w	Hammer 118	SC2-88
L18G	-w	Shield	SC2-89
L18H	+w	Hammer 120	SC2-90
L18J	-w	Shield	SC2-92
L18K	+w	Hammer 122	SC2-91
L18L	-w	Shield	SC2-92
L18M	+w	Hammer 124	SC2-93
L18N	-w	Shield	SC2-95
L18P	+w	Hammer 126	SC2-94
L18Q	-w	Shield	SC2-95
L18R	+w	Hammer 128	SC2-96
L19A	-w	Shield	SC2-62
L19B	+w	Hammer 82	SC2-61
L19C	-w	Shield	SC2-62
L19D	+w	Hammer 84	SC2-63
L19E	-w	Shield	SC2-65
L19F	+w	Hammer 86	SC2-64
L19G	-w	Shield	SC2-65
L19H	+w	Hammer 88	SC2-66
L19J	-w	Shield	SC2-68
L19K	+w	Hammer 90	SC2-67
L19L	-w	Shield	SC2-68
L19M	+w	Hammer 92	SC2-69
L19N	-w	Shield	SC2-71
L19P	+w	Hammer 94	SC2-70
L19Q	-w	Shield	SC2-71
L19R	+w	Hammer 96	SC2-72
L21A	-w	Shield	SC2-38
L21B	+w	Hammer 50	SC2-37
L21C	-w	Shield	SC2-38
L21D	+w	Hammer 52	SC2-39
L21E	-w	Shield	SC2-41

Location	Function	Line Name	1403 Pin
L21F	+w	Hammer 54	SC2-40
L21G	-w	Shield	SC2-41
L21H	+w	Hammer 56	SC2-42
L21J	-w	Shield	SC2-44
L21K	+w	Hammer 58	SC2-43
L21L	-w	Shield	SC2-44
L21M	+w	Hammer 60	SC2-45
L21N	-w	Shield	SC2-47
L21P	+w	Hammer 62	SC2-46
L21Q	-w	Shield	SC2-47
L21R	+w	Hammer 64	SC2-48
L22A	-w	Shield	SC2-14
L22B	+w	Hammer 18	SC2-13
L22C	-w	Shield	SC2-14
L22D	+w	Hammer 20	SC2-15
L22E	-w	Shield	SC2-17
L22F	+w	Hammer 22	SC2-16
L22G	-w	Shield	SC2-17
L22H	+w	Hammer 24	SC2-18
L22J	-w	Shield	SC2-20
L22K	+w	Hammer 26	SC2-19
L22L	-w	Shield	SC2-20
L22M	+w	Hammer 28	SC2-21
L22N	-w	Shield	SC2-23
L22P	+w	Hammer 30	SC2-22
L22Q	-w	Shield	SC2-23
L22R	+w	Hammer 32	SC2-24
L24A	-w	Stop Brush 4	SC2-145
L24B	-w	Stop Brush 3	SC2-144
L24C	-w	Stop Brush 2	SC2-143
L24D	-w	Stop Brush 1	SC2-142
L24E	-w	Slow Brush 12	SC2-141
L24F	-w	Slow Brush 11	SC2-140
L24G	-w	Slow Brush 10	SC2-139
L24H	-w	Slow Brush 9	SC2-138
L24J	-w	Slow Brush 8	SC2-137
L24K	-w	Slow Brush 7	SC2-136
L24L	-w	Slow Brush 6	SC2-135
L24M	-w	Slow Brush 5	SC2-134
L24N	-w	Slow Brush 4	SC2-133
L24P	-w	Slow Brush 3	SC2-132
L24Q	-w	Slow Brush 2	SC2-131
L24R	-w	Slow Brush 1	SC2-130
U09A	-s	Restore, Normally Closed	SC1-137
U09B	+s	Restore, Normally Open	SC1-138
U09C	-s	Space key, Normally Closed	SC1-156
U09D	+s	Space key, Normally Open	SC1-157
U09E		Drum Pulse 1	
U09F		Drum Pulse 2	
U09G	+s	Sync Check Indicator	SC1-160
U09M	+v	Row Bit 108	
U10A	-w	Shield	SC1- 86
U10B	+w	Hammer 113	SC1- 85
U10C	-w	Shield	SC1- 86
U10D	+w	Hammer 115	SC1- 87
U10E	-w	Shield	SC1- 89
U10F	+w	Hammer 117	SC1- 88
U10G	-w	Shield	SC1- 89

Location	Function	Line Name	1403 Pin
U10H	+w	Hammer 119	SC1- 90
U10J	-w	Shield	SC1- 92
U10K	+w	Hammer 121	SC1- 91
U10L	-w	Shield	SC1- 92
U10M	+w	Hammer 123	SC1- 93
U10N	-w	Shield	SC1- 95
U10P	+w	Hammer 125	SC1- 94
U10Q	-w	Shield	SC1- 95
U10R	+w	Hammer 127	SC1- 96
U12A	-w	Shield	SC1- 62
U12B	+w	Hammer 81	SC1- 61
U12C	-w	Shield	SC1- 62
U12D	+w	Hammer 83	SC1- 63
U12E	-w	Shield	SC1- 65
U12F	+w	Hammer 85	SC1- 64
U12G	-w	Shield	SC1- 65
U12H	+w	Hammer 87	SC1- 66
U12J	-w	Shield	SC1- 68
U12K	+w	Hammer 89	SC1- 67
U12L	-w	Shield	SC1- 68
U12M	+w	Hammer 91	SC1- 69
U12N	-w	Shield	SC1- 71
U12P	+w	Hammer 93	SC1- 70
U12Q	-w	Shield	SC1- 71
U12R	+w	Hammer 95	SC1- 72
U13A	-w	Shield	SC1- 38
U13B	+w	Hammer 49	SC1- 37
U13C	-w	Shield	SC1- 38
U13D	+w	Hammer 51	SC1- 39
U13E	-w	Shield	SC1- 41
U13F	+w	Hammer 53	SC1- 40
U13G	-w	Shield	SC1- 41
U13H	+w	Hammer 55	SC1- 42
U13J	-w	Shield	SC1- 44
U13K	+w	Hammer 57	SC1- 43
U13L	-w	Shield	SC1- 44
U13M	+w	Hammer 59	SC1- 45
U13N	-w	Shield	SC1- 47
U13P	+w	Hammer 61	SC1- 46
U13Q	-w	Shield	SC1- 47
U13R	+w	Hammer 63	SC1- 48
U15A	-w	Shield	SC1- 14
U15B	+w	Hammer 17	SC1- 13
U15C	-w	Shield	SC1- 14
U15D	+w	Hammer 19	SC1- 15
U15E	-w	Shield	SC1- 17
U15F	+w	Hammer 21	SC1- 16
U15G	-w	Shield	SC1- 17
U15H	+w	Hammer 23	SC1- 18
U15J	-w	Shield	SC1- 20
U15K	+w	Hammer 25	SC1- 19
U15L	-w	Shield	SC1- 20
U15M	+w	Hammer 27	SC1- 21
U15N	-w	Shield	SC1- 23
U15P	+w	Hammer 29	SC1- 22
U15Q	-w	Shield	SC1- 23
U15R	+w	Hammer 31	SC1- 24
U16A	+s	Low Speed Start Ind Drive	SC1-115
U16B	+s	High Speed Start Ind Drive	SC1-116

Location	Function	Line Name	1403 Pin
U16C	-s	Forms Stop	SC1-117
U16D	+s	Low Speed Stop Ind Drive	SC1-118
U16E	+s	High Speed Stop Ind Drive	SC1-119
U16F	-s	Numeric Mode	
U16G	+s	Print Ready Ind	
U16H	+c	End of Forms	SC1-159
U16J	-s	Forms Interlock	
U16K	+s	Start Key	SC1-153
U16L	+s	Stop Key	SC1-149
U16M	-s	Panel Single Cycle Key, Normally Closed	SC1-151
U16N	-s	Panel Single Cycle Key, Normally Open	SC1-152
U16P	-s	Carriage Interlock	SC1-127
U16Q	+s	Print Check	SC1-150
U16R	+s	Check Reset Key	SC1-144
U18A	-w	Shield	SC2- 98
U18B	+w	Hammer 130	SC2- 97
U18C	-w	Shield	SC2- 98
U18D	+w	Hammer 132	SC2- 99
U19A	-w	Shield	SC2- 74
U19B	+w	Hammer 98	SC2- 73
U19C	-w	Shield	SC2- 74
U19D	+w	Hammer 100	SC2- 75
U19E	-w	Shield	SC2- 77
U19F	+w	Hammer 102	SC2- 76
U19G	-w	Shield	SC2- 77
U19H	+w	Hammer 104	SC2- 78
U19J	-w	Shield	SC2- 80
U19K	+w	Hammer 106	SC2- 79
U19L	-w	Shield	SC2- 80
U19M	+w	Hammer 108	SC2- 81
U19N	-w	Shield	SC2- 83
U10P	+w	Hammer 110	SC2- 82
U19Q	-w	Shield	SC2- 83
U19R	+w	Hammer 112	SC2- 84
U21A	-w	Shield	SC2- 50
U21B	+w	Hammer 66	SC2- 49
U21C	-w	Shield	SC2- 50
U21D	+w	Hammer 68	SC2- 51
U21E	-w	Shield	SC2- 53
U21F	+w	Hammer 70	SC2- 52
U21G	-w	Shield	SC2- 53
U21H	+w	Hammer 72	SC2- 54
U21J	-w	Shield	SC2- 56
U21K	+w	Hammer 74	SC2- 55
U21L	-w	Shield	SC2- 56
U21M	+w	Hammer 76	SC2- 57
U21N	-w	Shield	SC2- 59
U21P	+w	Hammer 78	SC2- 58
U21Q	-w	Shield	SC2- 59
U21R	+w	Hammer 80	SC2- 60
U22A	-w	Shield	SC2- 26
U22B	+w	Hammer 34	SC2- 25
U22C	-w	Shield	SC2- 26
U22D	+w	Hammer 36	SC2- 27
U22E	-w	Shield	SC2- 29
U22F	+w	Hammer 38	SC2- 28
U22G	-w	Shield	SC2- 29
U22H	+w	Hammer 40	SC2- 30

Location	Function	Line Name	1403 Pin
U22J	-w	Shield	SC2- 32
U22K	+w	Hammer 42	SC2- 31
U22L	-w	Shield	SC2- 32
U22M	+w	Hammer 44	SC2- 33
U22N	-w	Shield	SC2- 35
U22P	+w	Hammer 46	SC2- 34
U22Q	-w	Shield	SC2- 35
U22R	+w	Hammer 48	SC2- 36
U24A	-w	Shield	SC2- 2
U24B	+w	Hammer 2	SC2- 1
U24C	-w	Shield	SC2- 2
U24D	+w	Hammer 4	SC2- 3
U24E	-w	Shield	SC2- 5
U24F	+w	Hammer 6	SC2- 4
U24G	-w	Shield	SC2- 5
U24H	+w	Hammer 8	SC2- 6
U24J	-w	Shield	SC2- 8
U24K	+w	Hammer 10	SC2- 7
U24L	-w	Shield	SC2- 8
U24M	+w	Hammer 12	SC2- 9
U24N	-w	Shield	SC2- 11
U24P	+w	Hammer 14	SC2- 10
U24Q	-w	Shield	SC2- 11
U24R	+w	Hammer 16	SC2- 12
U25A	+v	Low-Speed Start Magnet	SC2-155
U25B	+v	Low-Speed Stop Magnet	SC2-156
U25C	+v	High-Speed Start Magnet	SC2-157
U25D	+v	High-Speed Stop Magnet	SC2-158
U25E	+c	Forms Check Indicator	SC2-160
U25F			
U25G			
U25H	-w	Carriage Emitter	
U25J	-w	Stop Brush 12	SC2-153
U25K	-w	Stop Brush 11	SC2-152
U25L	-w	Stop Brush 10	SC2-151
U25M	-w	Stop Brush 9	SC2-150
U25N	-w	Stop Brush 8	SC2-149
U25P	-w	Stop Brush 7	SC2-148
U25Q	-w	Stop Brush 6	SC2-147
U25R	-w	Stop Brush 5	SC2-146

IBM 1414-4, 5, or 6 to Communication Devices

Data are handled on a character basis, with each character coded in Baudot or standard IBM BCD code. With telegraph code input, each incoming character is placed in a five-bit adapter. This character is then automatically translated to standard seven-bit BCD code and is placed in an 80-character buffer. With standard BCD input, each character is placed in a seven-bit adapter and then sent to a 80-character buffer without translation. In either case, when the buffer is filled, all 80 characters are sent to the computer serially by character. Figure 7 shows this data flow; both Baudot and BCD codes are shown in Figure 8.

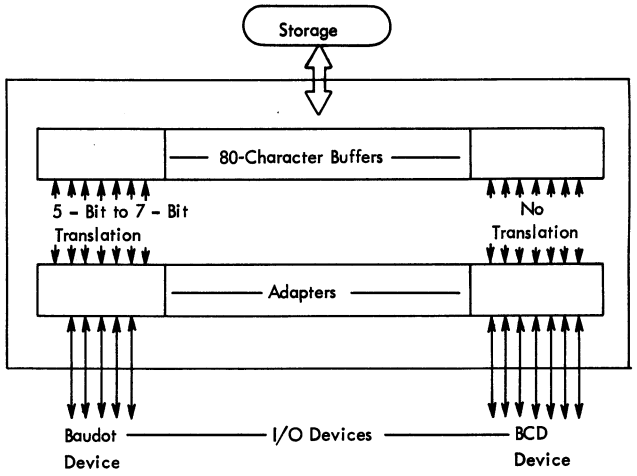


Figure 7. IBM 1414 Data Flow

Character	BCD Code C	B	A	8	4	2	1	Baudot Code 5	4	3	2	1	Ls	Fs
A		B	A				1				2	1	S	
B		B	A			2		5	4				S	
C	C	B	A			2	1		4	3	2		S	
D		B	A		4				4			1	S	
E	C	B	A		4		1					1	S	
F	C	B	A		4	2			4	3		1	S	
G		B	A		4	2	1	5	4		2		S	
H		B	A	8				5		3			S	
I	C	B	A	8			1			3	2		S	
J	C	B					1		4		2	1	S	
K	C	B				2			4	3	2	1	S	
L		B				2	1	5			2		S	
M	C	B			4			5	4	3			S	
N		B			4		1		4	3			S	
O		B			4	2		5	4				S	
P	C	B			4	2	1	5		3	2		S	
Q	C	B		8				5		3	2	1	S	
R		B		8			1		4		2		S	
S	C		A			2				3		1	S	
T			A			2	1	5					S	
U	C		A		4					3	2	1	S	
V			A		4		1	5	4	3	2		S	
W			A		4	2		5			2	1	S	
X	C		A		4	2	1	5	4	3		1	S	
Y	C		A	8				5		3		1	S	
Z			A	8			1	5				1	S	
0	C			8		2		5		3	2			S
1							1	5		3	2	1		S
2						2		5			2	1		S
3	C					2	1					1		S
4					4				4		2			S
5	C				4		1	5						S
6	C				4	2		5		3		1		S
7					4	2	1			3	2	1		S
8				8						3	2			S
9	C			8			1	5	4					S
BLANK														
.		B	A	8		2	1	5	4	3				S
¤ CR	C	B	A	8	4				4					None
[(		B	A	8	4		1		4	3	2	1		S
< (BLANK)		B	A	8	4	2			None					
‡	C	B	A	8	4	2	1		None					
¢	C	B	A					5	4		2			S
$	C	B		8		2	1		4			1		S
* LTRS		B		8	4			5	4	3	2	1		None
])	C	B		8	4		1	5			2			S
;	C	B		8	4	2		5	4	3	2			S
Δ		B		8	4	2	1		None					
-		B									2	1		S
/	C		A				1	5	4	3		1		S
,	C		A	8		2	1		4	3				S
%FIGS			A	8	4			5	4		2	1		None
V	C		A	8	4		1		None					
\ '	C		A	8	4	2			4		2	1		S
++			A	8	4	2	1		None					
δ			A						None					
#				8		2	1	5		3				S
@ LF	C			8	4						2			None
:				8	4		1		4	3	2			S
> "				8	4	2		5				1		S
?	C	B	A	8		2		5	4			1		S

Notes:
When more than one character is shown in the character column, the right hand character is the Baudot character.
Ls and Fs refer to letters shift and figures shift.

Figure 8. Standard IBM BCD and Baudot Code

IBM 1414-4, 5, or 6 to Telegraph Adapter

Both duplex and simplex cables use an Amphenol MS-3100-28-21S type male connector or equivalent. For duplex operation, both send and receive connections are used. For simplex operation, only the send or the receive connections are used. Because of the low voltages involved in the interface circuits, it is recommended that the contacts be gold plated. The maximum cable length is limited to 250 feet over-all. Wire assignments for the connecting cables are shown in Figure 9.

Receive		Send	
Pin	Line Name	Pin	Line Name
A	Station Selected	W	Not Used
B	Equipment Check	X	Not Used
C	1414 Ready	*Z	Ground (Frame)
D	Read Pulse	a	Bid
E	Not Used	b	Equipment Check
F	5 Data Bit	c	1414 Ready
G	4 Data Bit	d	Cycle Timing
H	3 Data Bit	e	Start
J	2 Data Bit	f	5 Data Bit
K	1 Data Bit	g	4 Data Bit
*L	Equipment Interlock	h	3 Data Bit
*M	1414 Power Off Interlock	j	2 Data Bit
N	Non Text	k	1 Data Bit
P	1414 Ready Common	*m	Equipment Interlock
*R	Ground (Signal)	*n	1414 Power Off Interlock
*S	Ground (Frame)	p	Start Common
T	Receive Data Common	r	Send Data Common
U	Not Used	*s	Ground (Signal)
V	Not Used	t	Not Used

Duplex Cable P/N 762735
Simplex Send Cable P/N 762733
Simplex Receive Cable P/N 762732

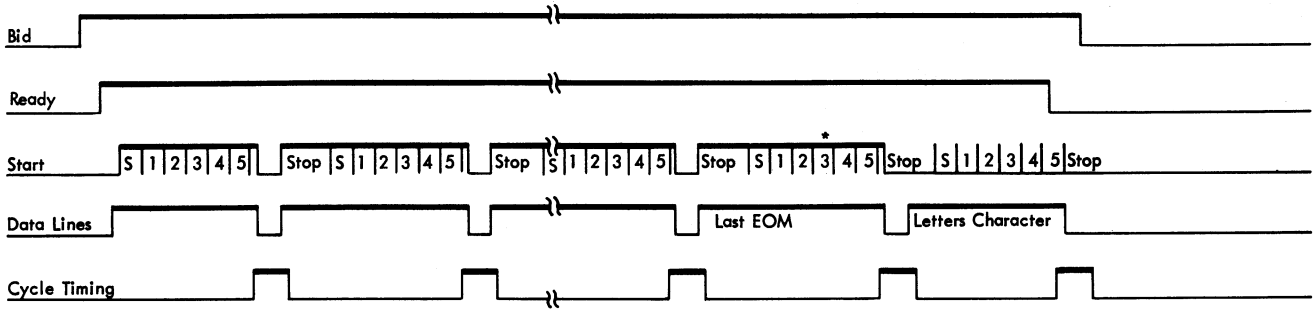
* For Duplex Operation Lines L-m, M-n, R-s, and S-z May Be Tied Together

Figure 9. Telegraph Equipment Connector Wires

Telegraph Output Interface:

Line Name	Pin	Comment
Bid	a	Signals that the 1414 has a message to be transmitted. The signal remains until the character cycle following transmission of the last character from the 1414 and is removed by the rise of the "cycle timing line." The line need not be used with an RT (reperforator-transmitting) set.
Ready	c	Answers the "bid" line and indicates that the 1414 can begin transmission. Removal of "ready" indicates that output equipment is disconnected from the line. Under normal operating conditions, "ready" must be dropped during the character cycle following the end-of-message sequence. This line must be tied to signal ground when used with an RT set.
Start	e	Indicates that the character to be transmitted is established on the data lines. The "start" is removed with the falling edge of "cycle timing," following transmission of the last character from the 1414. A letters character is placed on the data lines for the character cycle following the fall of "start."
Start Common	p	Electromechanical only. The line is a non-ground return path for the start signal.
Cycle Timing	d	Indicates that output equipment is ready for another character cycle. The minimum duration of this signal must be 3.5 milliseconds.
Send Data	f-k	Five lines, one for each code bit. Data are placed on these lines within 5 milliseconds of the rise of "cycle timing" and remain until the rise of the following "cycle timing."
Send Data Common	r	Electromechanical only. The line is a non-ground return path for all data lines.
Equipment Check	b	May be used to indicate any condition in the output equipment that requires manual intervention.
Frame Ground	Z	Frame bond between the 1414 and the output equipment.
Signal Ground	s	Electrical ground between the 1414 and output equipment
Connector Interlock	m	Indicates that the connecting cable is disconnected. This line should be tied to "signal ground."
1414 Power Off Interlock	n	Indicates that 1414 power is off.

Signal exchange between the 1414 and output equipment is started by a bid signal from the 1414. When the output equipment is capable of handling the transmission, the ready line is raised. Following "ready," the start signal indicates to the output equipment that the first character to be transmitted is on the data lines. When the first character has been transmitted, the output equipment requests the next character with the cycle timing line. This "start" and "cycle timing" sequence continues for each character cycle. The last character placed on the data lines is the letters character. The ready line should be dropped during the letters cycle. The bid line is dropped with the rise of "cycle timing" following the last (letters) cycle. Figure 10 is a timing chart of the output sequence.



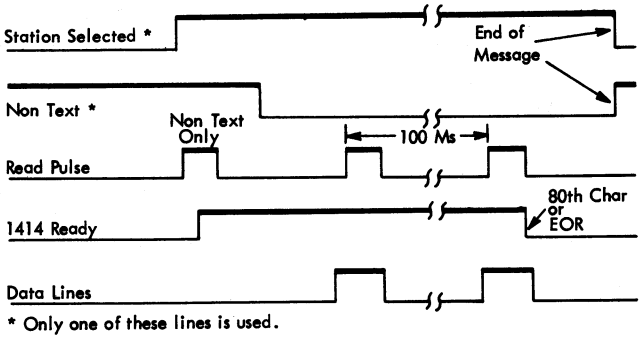
* This is the latest time the start line can be dropped to avoid another cycle.

Figure 10. Telegraph Output Adapter Timing Sequence

Telegraph Input Interface:

Line Name	Pin	Comment
Station Selected	A	Indicates that the adapter is selected by the input equipment. The signal must remain until the adapter is disconnected from input equipment. This line is tied to ground when used with an RT set.
Non Text	N	Indicates that the adapter is disconnected from input equipment. "Station selected" and "non text" are exclusive; only one of the lines should be used on any one system.
1414 Ready	C	Answer to "station selected" or "non text." This line indicates that the 1414 is ready to receive.
1414 Ready Common	P	Electromechanical only. The line provides a non-ground return for the 1414 "ready" line.
Read Pulse	D	Indicates that a character is on the input data lines. Minimum duration of this signal is 6 milliseconds.
Receive Data	F-K	Five lines, one for each code bit. Data must be placed on these lines during the "read pulse" time.
Receive Data Common	T	Electromechanical only. This line provides a non-ground return for the "receive data" lines.
Equipment Check	B	May be used to indicate any condition in the input equipment that requires manual intervention.
Frame Ground	S	Frame bond between the 1414 and input equipment.
Signal Ground	R	Electrical ground between the 1414 and input equipment.
Connector Common	L	Indicates that the connecting cable is disconnected. The line should be tied to "signal ground."
1414 Power Off Interlock	M	Indicates that 1414 power is off.

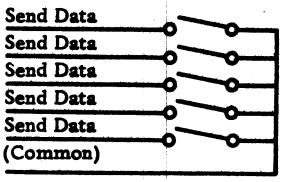
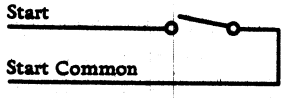
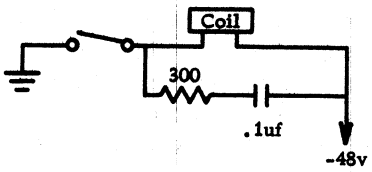
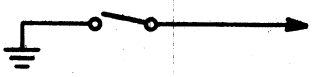
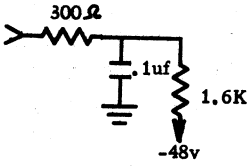
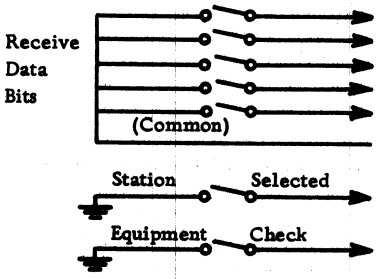
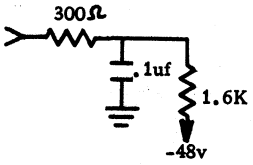
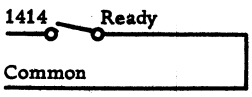
Signal interchange between the 1414 and input equipment is started by a station selected or non text signal from the input equipment. Station selected can be tied to signal ground when used with an RT set. The 1414 answers with the 1414 ready line when the 1414 is capable of receiving data. The input equipment then produces a read pulse when data are established on the input data lines, and the 1414 transfers the character during the read pulse time. The 1414 removes the 1414 ready line after sensing certain control characters from the incoming data. When an RT set is used, removal of 1414 ready should prevent further cycles from input equipment. When the 1414 is again capable of receiving data, the 1414 ready line is again activated. "Station selected" or "non text" should be removed, except with RT sets, when the input equipment is disconnected from the system. Figure 11 is a timing chart of the input sequence.



* Only one of these lines is used.

Figure 11. Telegraph Input Adapter Timing Sequence

Circuits: Electronic signals for a 1 data bit range between +1 and -1 volts; a 0 data bit signal, between -9 and -12 volts. A receiving circuit will not present less than 5000 ohms to ground to an incoming signal. Except for send data, start, and 1414 ready signals, logical one condition circuits are provided by relay contact closures to ground. Circuits include:

Circuit	Comment
 Send Data Lines	Relay points for "send data" and "bid" lines carry a maximum of 3 amps continuous current. A minimum of 10 milliamps is required for reliable operation. Maximum switching current for a non-inductive load is 35 milliamps. Open circuit voltage is from 20 volts to 200 volts.
	This contact is provided by an H.P. Clare HGS 1005 relay.
	Relay coils are 1380 ohms at 2.0 henries. Used with the "read pulse," "non text," and "cycle timing" lines.
	"Equipment check" and "ready" lines terminate with: 
	"Receive data bits," "station selected," and "equipment check" operate into: 
	Relay points carry a maximum of 3 amps continuous current. A minimum of 10 milliamps is required for reliable operation. Maximum switching current is 200 milliamps and open circuit voltage ranges from 20 volts to 200 volts.

IBM 1009 Data Transmission Unit Adapter Interface

Data are moved between the 1414 and the 1009 in a seven-bit BCD code. Transmission occurs in a serial-by-character, parallel-by-bit fashion. A four-of-eight code is used for transmission between the 1009 and a subset. Translation occurs automatically in the 1009. Figure 12 shows data characters and their codes.

	BCD Code							4/8 Code							
Character	C	B	A	8	4	2	1	N	X	O	R	8	4	2	1
1							1	N	X	O					1
2						2		N	X	O				2	
3	C					2	1	N			R			2	1
4					4			N	X	O			4		
5	C				4		1	N			R		4		1
6	C				4	2		N			R		4	2	
7					4	2	1				R		4	2	1
8				8				N	X	O		8			
9	C			8			1	N			R	8			1
0	C			8		2		N			R	8		2	
#				8		2	1				R	8		2	1
@	C			8	4			N			R	8	4		
Special				8	4		1					8	4	2	1
Special				8	4	2					R	8	4	2	
Tape Mark	C			8	4	2	1				R	8	4		1
1401 Special			A							O		8	4	2	
/	C		A				1	N		O	R				1
S	C		A			2		N		O	R			2	
T			A			2	1	N		O				2	1
U	C		A		4			N		O	R		4		
V			A		4		1	N		O			4		1
W			A		4	2		N		O			4	2	
X	C		A		4	2	1			O			4	2	1
Y	C		A	8				N		O	R	8			
Z			A	8			1	N		O		8			1
Record Mark			A	8		2		N		O		8		2	
,	C		A	8		2	1			O		8		2	1
%			A	8	4			N		O		8	4		
Word Separator	C		A	8	4		1		X		R	8		2	
Special	C		A	8	4	2				O	R	8		2	
Tape Segment			A	8	4	2	1			O		8	4		1
-		B							X			8	4	2	
J	C	B					1	N	X		R				1
K	C	B				2		N	X		R			2	
L		B				2	1	N	X					2	1
M	C	B			4			N	X		R		4		
N		B			4		1	N	X				4		1
O		B			4	2		N	X				4	2	
P	C	B			4	2	1		X				4	2	1
Q	C	B		8				N	X		R	8			
R		B		8			1	N	X			8			1
ō		B		8		2		N	X			8		2	
$	C	B		8		2	1		X			8		2	1
*		B		8	4			N	X			8	4		
Special	C	B		8	4		1		X		R	8	4		
Special	C	B		8	4	2				O	R	8	4		
Delta		B		8	4	2	1		X			8	4		1
a	C	B	A					N				8	4	2	
A		B	A				1		X	O	R				1
B		B	A			2			X	O	R			2	
C	C	B	A			2	1		X	O				2	1
D		B	A		4				X	O	R		4		
E	C	B	A		4		1		X	O			4		1
F	C	B	A		4	2			X	O			4	2	
G		B	A		4	2	1	N					4	2	1
H		B	A	8					X	O	R	8			
I	C	B	A	8			1		X	O		8			1
ŏ	C	B	A	8		2			X	O		8		2	
.		B	A	8		2	1	N				8		2	1
¤	C	B	A	8	4				X	O		8	4		
Special		B	A	8	4		1		X		R		4	2	
Special		B	A	8	4	2				O	R		4	2	
Group Mark	C	B	A	8	4	2	1	N				8	4		1
Blank	C							N	X	O	R				

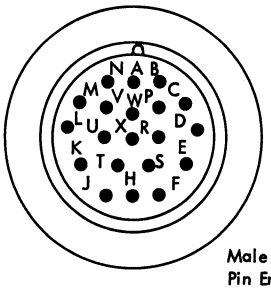
Figure 12. BCD to Four-out-of-Eight Code

IBM 1009 Data Transmission Unit Connections: Cable connections between the 1414 and the 1009 are terminated with two 40-position connectors at the 1009 and cable slide connectors at the 1414-4 and 5. The 1414-6 uses 40-position connectors on both cable ends. In the following list, connector designations indicate both the line shield (first number) and the line itself (second number).

Line Name	Connector	Comment
I/O Write Call	D-7/6	Brought up by the computer during an I/O write operation. Fall of the line indicates that the computer has proceeded to the next instruction.
I/O Read Call	D-13/14	Brought up by the computer when ready and waiting to read and while reading the I/O unit.
I/O Select	D-18/17	Brought up by the computer when a move, load, or unit control instruction that selects the I/O unit is executed.
I/O Process Check	D-21/22	Signals the 1009 that the computer is in an error condition.
I/O Time 000-030	D-30/37	Timed pulse from the computer indicating that the computer has restarted after a character has been taken by the 1009.
I/O Time 030-060	D-38/31	Timed pulse from the computer indicating that the computer has restarted after a character has been taken from the 1009.
Not Start Reset	D-40/39	Signals that the computer is not in a start reset status.
Unit 1 Control	D-3/10	Signal from the computer that it is ready to start transmitting. The signal should be ended before a disconnect signal is given by the computer.
Unit 2 Control	D-11/4	Signal from the computer that it is ready to receive a message.
I/O Disconnect	D-32/33	Signal from the computer that it has recognized an end of message. The signal should end before the next unit 1 control signal.
Service Response	D-26/25	Signal from the computer that it has a character ready for the 1009.
I/O Output 1	D-1/2	Information bus to the 1009. All I/O output lines must be available during the 1009 input call time.
I/O Output 2	D-9/8	
I/O Output 4	D-15/16	
I/O Output 8	D-20/19	
I/O Output A	D-23/24	
I/O Output B	D-28/27	
I/O Output C	D-34/35	

Line Name	Connector	Comment
Service Request	C-36/29	Transmit: Signal to the computer that the character on the bus has been taken by the 1009; terminated by the timed pulse 000-030. Receive: Signal to the computer that the character has been taken from the 1009; terminated by the timed pulse 030-060.
I/O Input 1	C-1/2	Information bus from the 1009. Data are available for 22 microseconds (with a 128 kc oscillator) or 38 microseconds (with a 76.8 kc oscillator).
I/O Input 2	C-9/8	
I/O Input 4	C-15/16	
I/O Input 8	C-20/19	
I/O Input A	C-23/24	
I/O Input B	C-28/27	
I/O Input C	C-34/35	
End of Transmission	C-30/37	Signal to the computer that the 1009 has sensed an end of message during a "read call." The signal is terminated by a "unit 2 control" or the fall of "read call."
I/O Trans 1	C-7/6	Signal to the computer that the 1009 is in an alarm condition.
I/O Trans 2	C-13/14	Signal to the computer that the 1009 is in a send-end-of-transmission status. The signal is started by a computer disconnect and terminated by a "unit 1 control."
I/O Trans 3	C-18/17	Signal to the computer that the reply to the last message was good.
I/O Trans 4	C-21/22	Signal to the computer that an error was the reply to the last message.
I/O Trans 5	C-26/25	Signal to the computer that the 1009 is in a receive-end-of-message status. The signal is started by a "send reply" in the 1009 and terminated by a "unit 2 control" signal from the computer.
I/O Trans 6	C-32/33	Signal to the computer that the 1009 is in an output error status. The signal is started by a 1009 output check or character error and terminated by a "unit 2 control" signal or depression of the 1009 start key.
Emergency Off Switch	C-11/4	25-volt AC power-on interlock. The computer must provide a circuit for power on and off interlocking of the 1009.

Communications-Channel Terminal-Equipment Connections: This equipment must be able to handle serial binary data in a 4-of-8 code. Connection to the 1009 is through a 20-position connector; Figure 13 shows the connector and signal line names, pin



Male Connector,
Pin End View

Signal Line Name	Pin	Signal Level ON(Volts)	Signal Level OFF (Volts)	1009 Input	1009 Output
Data Ground	D	-----	-----	---	---
Receive Data	F	+3 to +20	-3 to -20	x	
Send Data	E	+6	-6		x
Request Send	H	+6	-6		x
Start Send	J	+3 to +20	-3 to -20	x	
Carrier On	K	Not Used			
Interlock	L	+3 to +20	-3 to -20	x	
Frame Ground	M	-----	-----	---	---
New Sync	N	+6	-6		x
Serial Clock Tran	P	+3 to +20	-3 to -20	x	
Serial Clock Rec	S	+3 to +20	-3 to -20	x	

Figure 13. IBM 1009 Connector and Chart

designations, signal levels, and whether an input or an output line (from or to the 1009). These lines are the interface between the 1009 and the communications equipment and conform to the standards outlined in Electronic Industries Association (EIA) Standards, RS-232.

Line	Comment
Signal Ground	Zero-volt reference in the 1009; may or may not be connected to the frame ground in equipment to which the 1009 is connected. The power supply ground is not the frame ground in the 1009.
Send Data	Transfers serial binary data from the 1009 to the communications equipment.
Receive Data	Transfers serial binary data from communications equipment to the 1009.
Request Send	Signals the communications equipment that the 1009 has data to transmit. In half-duplex operation, the signal level is held at +6 volts by the 1009 during data transfer, and goes to -6 volts when the transfer is complete. In full-duplex operation, signal level is held at +6 volts.
Start Send	Comes from communications equipment and signals the 1009 that the equipment is ready to accept data for transmission. In half-duplex operation, this line is a delayed response to a "request send" signal from the 1009. In full-duplex operation, the signal level must be held between +3 volts and +20 volts by the communications equipment.
Interlock	Signals the 1009 that the communications equipment is conditioned to transmit and/or to receive data. The line must be held between +3 volts and +20 volts to indicate that communications equipment is conditioned to transmit or receive data. The line must be held at -3 volts and -20 volts to indicate that communications equipment is not conditioned to transmit or receive data.

The following lines are not specified in the EIA Standards, RS-232:

Serial Clock Transmit	From communications equipment; synchronizes the 1009 transmission rate to the communications equipment frequency. The signal must be a square wave. The rate of rise time must be equal to, or greater than, 0.5 volts per microsecond. The signal levels on the send data line change coincidentally with the negative-to-positive changes of the serial clock transmit signal. This signal is used only when the 1009 speed-select switch is in the EXTERNAL position.
Serial Clock Receive	From communications equipment; synchronizes the 1009 receiving rate to the communications equipment. This signal must be a square wave and its rate of rise and fall must be equal to, or greater than, 0.5 volt per microsecond. The signal levels on the receive data line must change coincidentally with the negative-to-positive changes of the "serial clock receive" signal. This signal is used only when the 1009 speed-select switch is in the EXTERNAL position.
New Sync	Originates in the 1009 and can be used to destroy synchronism in the attached communications equipment on a receive operation. This is done by raising the signal level to a +6 volts for 1.5± .25 milliseconds at the end of the transmit operation.

IBM 1011 Paper Tape Reader Adapter Interface

The IBM 1011 Paper Tape Reader is a photoelectric type of paper tape reader. Paper tapes of 5, 6, 7, or 8 track--chad or chadless--are read at 500 characters per second. Paper tape characters are decoded and converted into 7-bit BCD characters. As each character is read from paper tape, a translate-control cycle is initiated within the 1011. The translate-control circuitry uses a clock to time the reader operation and signals the computer when the translated data is available on the output bus.

Signal and control lines are brought to a single shoe connector. Figure 14 shows connector pin assignments. The diagonal dotted line connecting two adja-

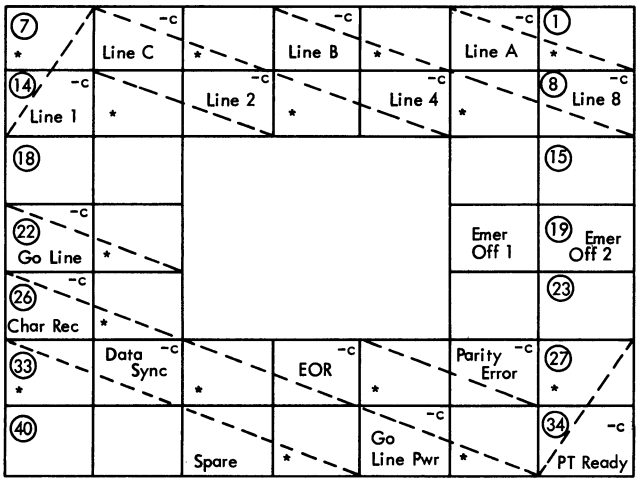


Figure 14. IBM 1011 Signal Connector

cent blocks indicates that the two are a twisted pair (a signal wire and ground reference wire for a given function). Signal level designator (-C) identifies the signal wire; an asterisk (*) identifies the shield or reference wire. The shield must connect to the DC ground of the computer.

A cable driver circuit (Figure 15) powers all C level output lines, and a cable terminator (Figure 16) ends all C level input lines. C level is a current shift between driver and terminator in which the negative shift is considered the On or logical one condition. C level swings around a ground reference from a +6 volt to a -5 volt level. Maximum ground shift between driver and terminator is ±3/4 volt.

A control panel on the 1011 (Figure 17) is used for coding flexibility.

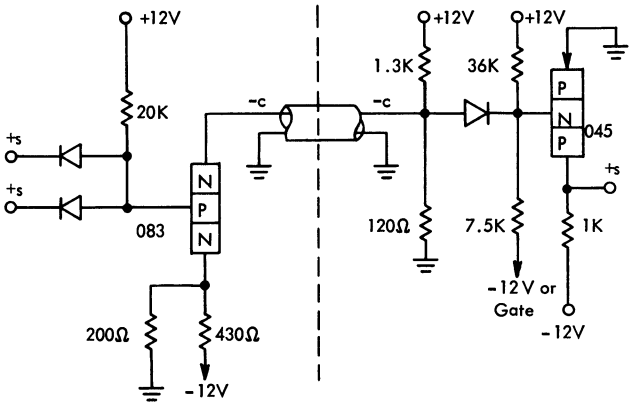


Figure 15. Cable Driver

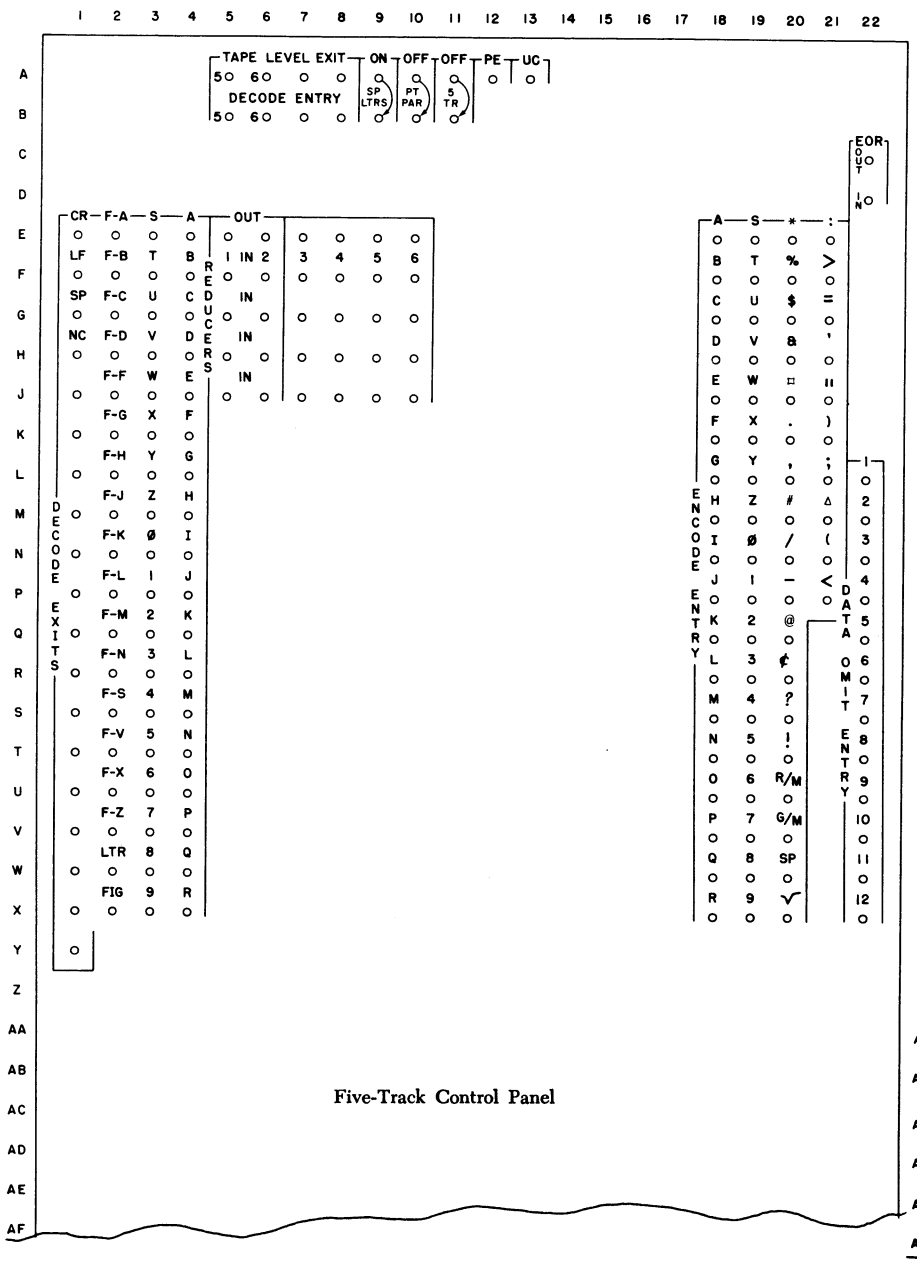
Figure 16. Cable Terminator

Output Lines from the 1011:

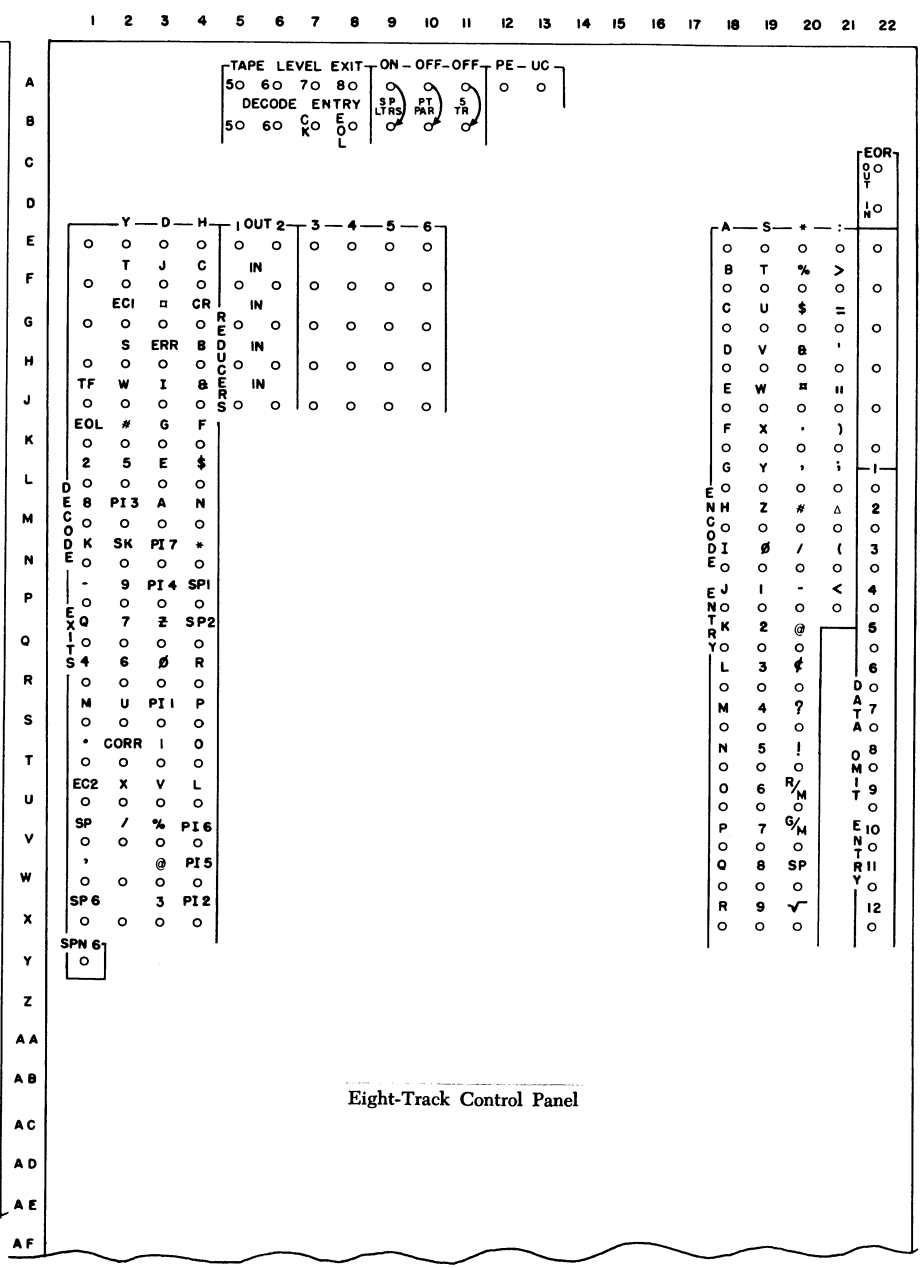
Line Name	Connector	Comment
Line C Line B Line A Line 8 Line 4 Line 2 Line 1	5/6 3/4 1/2 8/9 10/11 12/13 7/14	Seven data lines (C,B,A,8,4,2, and 1) that contain, at -c level, the character bits as encoded from the 1011. These lines are sensed during "data sync" time. Line C contains odd parity for the other six lines (total number of 1-bits in all seven bit positions is always odd).
Data Sync	33/32	At -c level when the data lines are ready to be sensed, provided that data are on one or more of the data lines and the character is not wired to data omit at the control panel.
End Of Record-EOR	31/30	At -c level (as determined by which character is wired to the EOR-in hub at the control panel) and can be sensed during "data sync" time. EOR may also be used to transmit data to the computer by wiring the EOR-out hub to any encode entry hub.
Parity Error	29/28	When the control panel is wired for parity checking, this line is dropped to -c level if a character with incorrect parity is sensed. The line remains at -c level until a correct parity character is sensed.
Paper Tape Ready	35/34	Goes to -c level when the 1011 has tape properly loaded and the start key is pressed. The line remains at -c level until the ready indicator is turned off by a machine reset or by a machine malfunction.
Go Line Power	37/36	At -c level whenever paper tape is being fed. The line is raised to +c level by the computer dropping the "go" line or by the 1011 dropping the "PT ready" line.

Input Lines to the 1011:

Character Received	25/26	This line must be a -c level pulse sent from the computer in response to a "data sync" line. The "character received" signal must be a minumum of 10 microseconds duration with a 1.0 microsecond maximum rise time and must be sent within 300 microseconds from the beginning of "data sync" time. If these conditions are not met, the "PT ready" line drops. The "character received" pulse signifies that information on data lines has been received.
Go Line	21/22	This line must be a -c level whenever tape is fed. At +c level, tape stops feeding. To stop tape feeding, the computer sends a "character received"



Five-Track Control Panel



Eight-Track Control Panel

Figure 17. IBM 1011 Control Panel

Line Name	Connector	Comment
		pulse in response to the "data sync" for the last character, and then raises the "go" line to +c level within 300 microseconds after the beginning of the "data sync" pulse. The computer should insure that "go" line is not brought to -c level unless the "PT ready" line is at -c level.
Emergency Off (1 and 2)	19/20	These two lines are brought to the computer to complete a 24-volt AC circuit from the 1011. The lines are connected to a normally closed relay contact that is part of the computer emergency-off circuit. Opening the contact removes all power from the 1011.

IBM 1014 Remote Inquiry Unit Adapter Interface

One remote inquiry adapter can control up to ten 1014 inquiry stations. Two sets of wires connect each 1014 inquiry station to the adapter. One set is for data and its current return; the other set is for synchronization and its current return. Figure 18 shows the connection of these lines to the adapter and the relative timing between the data and synchronization lines for request and reply operation.

The maximum distance the inquiry station can be located from the adapter is eight miles. The maximum line impedance is 1700 ohms per leg of a wire set or 3400 ohms per set. The minimum voltage to reliably pick the data and synchronization relays is +16 volts.

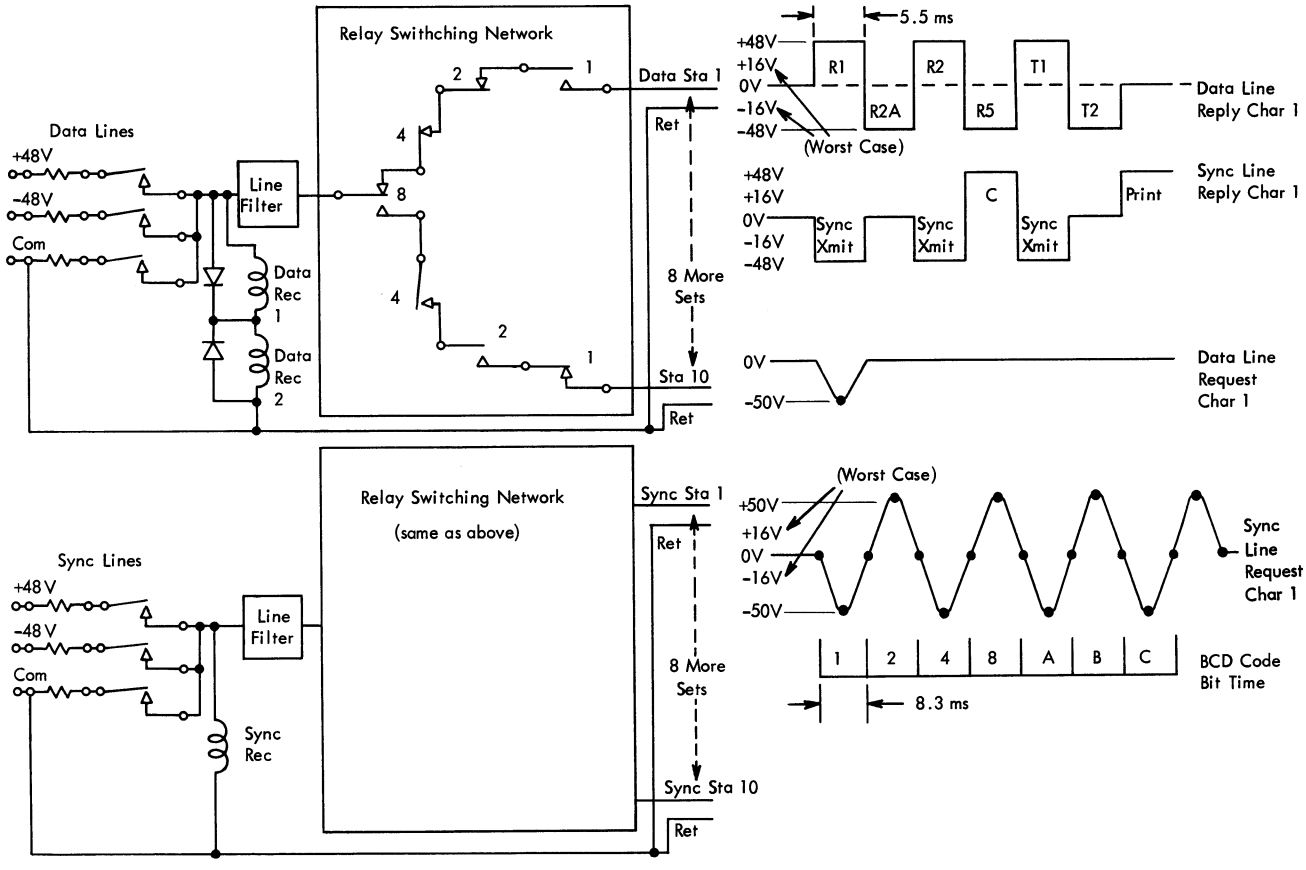


Figure 18. IBM 1014 Schematic

COMPUTER AND INPUT-OUPUT ADAPTER INTERFACE

This type of interface is concerned with connections and logic between the computer and the input-output adapter being used with a class of input-output devices. These devices include IBM Hypertape, IBM Disk Storage, IBM 7750 Programmed Transmission Control, and devices attached to the IBM 1414-6 Input-Ouput Synchronizer.

Data flow between the computer system and the input-output device is normally through a data channel. The characters are assembled or disassembled in the data channel and data transfer to or from the computer system is in full word size (or groups of characters) at the same time. The computer is not held up while a word is being transmitted one character at a time but only for the time needed to transmit a full word to the data channel.

The interface consists of two cables, each containing 40 lines and 40 line shields. Cable wires are described with location, connector, pin number, and line name.

Computer to 1414-6 Connections

Line Name	Connector	Comment
Operational Out	1/2	Used for an interlock between the computer and the 1414 to indicate that the computer is ready for 1414 operation.
Read Command	3/4	Tells the I/O device that it should send information to the computer via the "read" lines. On receipt of this line, the I/O device will (if it is in ready status) use the "command response" line to indicate that it is ready to answer the computer by sending information. The "command response" line is held up until the I/O device has completed sending information.
Write Command	5/6	Signals the I/O device to proceed with the write operation. Ready checking and timing are the same as with the "read command" line.
Control Command	7/8	Signals the I/O device that it must accept information from the computer over the "Write" lines and must execute the operation coded in this information. Examples include rewind and backspace operations. Ready checking and timing are the same as with the "read command" line.
Sense Command	9/10	Signals the I/O device to send status information to the computer over the "read" lines. The information sent depends on the definition of the sense operation for the I/O device. Examples include, error indicators, rewind, or seek status. Ready checking and timing are the same as with the "read command" line.
Write Parity	11/12	Nine "write" lines, eight for data and one for parity checking of the eight, transfer information in parallel (nine lines at a time). One transfer is called a byte. A computer may use only four of the "write" lines (for numeric characters) or may use all eight lines to transfer two numeric characters. Alphameric information uses six of the eight lines, but a computer system with expanded logic may use all eight lines for alphameric information. Line values are:
Write Bit 0	13/14	
Write Bit 1	15/16	
Write Bit 2	17/18	
Write Bit 3	19/20	
Write Bit 4	21/22	
Write Bit 5	23/24	
Write Bit 6	25/26	
Write Bit 7	27/28	

Write Line	BCD Code (6-lines)	Numeric Code	
Parity	Bit C	Bit Parity	
Bit 0	Unused	Bit 8	1st Numeric Character
Bit 1	Bit Word Mark	Bit 4	
Bit 2	Bit B	Bit 2	
Bit 3	Bit A	Bit 1	
Bit 4	Bit 8	Bit 8	2nd Numeric Character
Bit 5	Bit 4	Bit 4	
Bit 6	Bit 2	Bit 2	
Bit 7	Bit 1	Bit 1	

Service Response	29/30	Signals the I/O device in recognition of a signal on the "service request" line and indicates to the I/O device that the computer is transmitting or has received information on the data lines. During write and control operations, the rise of "service response" must be delayed to guarantee that it does not precede data when measured at the computer end of the cable connectors under the worst-case skew conditions. Within the worst-case skew conditions, data must be valid from the rise of "service response" until the fall of "service request." During read and sense operations, "service response" must rise when the computer has accepted the information on the "read" lines (before the fall of "service request").
Stop	31/32	Signals the I/O device that the computer has recognized the end of record or end of operation. If the I/O device recognizes the end of operation first and generates an "end" or "unusual end" signal, no "stop" occurs. On receipt

Line Name	Connector	Comment
		of "stop," the I/O device proceeds to its normal ending point. No further "service request" is sent and no further "service response" is expected. To complete the ending procedure, the I/O device sends an "end" or "unusual end" signal at the proper time and receives in return an "end response" from the computer. "Stop" may rise any time that "command response" is up, except when both "service request" and "service response" are also up. If "stop" is issued when "service request" is up, it replaces "service response." In this case, data on the "read" lines are not accepted (read and sense) or data are not provided for the "write" lines (write and control). The "stop" must remain up until the fall of "command response." It must fall when or before a new command signal is sent to the I/O device.
End Response	33/34	This line signals the I/O device in recognition of an "end" or "unusual end" signal. The "end Response" signal restores the I/O device to the conditions necessary for accepting a new command. The "end response" must remain up until the fall of both "command response" and "end" or "unusual end." It must fall when or before a new command is sent to the I/O device.
Attention Response	35/36	Signals the I/O device in recognition of a signal on the "attention" line. The "attention response" signal causes the fall of the "attention" line and must remain up until the fall of "attention" and fall after the fall of "attention."
	37-40	Not used.

1414 to Computer Connections

Operational In	1/2	Used for interlocking purposes. When the "operational in" line is down, the I/O device does not respond to any signals from the computer.
	3-10	These lines are not used.
Read Parity Read Bit 0 Read Bit 1 Read Bit 2 Read Bit 3 Read Bit 4 Read Bit 5 Read Bit 6 Read Bit 7	11/12 13/14 15/16 17/18 19/20 21/22 23/24 25/26 27/28	Nine lines, eight for data and one for parity, used to send both data and sense information to the computer. Data must be valid on the "read" lines from the rise of "service request" until the rise of "service response," except during skew conditions described under "Service Request." In this case, the availablity of data on the "read" lines may lag the rise of "service request" by an adjustable time. This time may not be longer than the shortest interval in which the particular computer can accept data after the rise of "service request."
Service Request	29/30	Signals the computer when the I/O device wants to transmit or receive a byte of information. During read and sense operations, "service request" rises when information is available on the "read" lines and "service response" is down. The rise of "service request" must be delayed to guarantee that it does not precede data when measured at the cable connections at the computer under the worst-case skew conditions. Within skew limitations, data must be valid until the rise of "service response." During write and control operations, "service request" rises when or before information is required on the "write" lines and "service response" is down. The "service request" must fall after the rise of "service response" and, during read and sense operations, "service request" must fall within 6 microseconds of the rise of "service response."
End	31/32	Signals the computer that the I/O device has recognized the normal ending of an operation. With unnormal conditions, the "end" signal is not used and an "unusual end" signal is given instead. The "end" cannot rise until "service response" for the last "service request" has been received. "End" must stay up until "end response" is received from the computer, and it must fall within 6 microseconds of the rise of "end response." After every normal operation, the I/O device gives an "end" signal. The computer may or may not have previously given a "stop" signal. In any case, the computer gives an "end response" signal after receiving an "end" signal from the I/O device.
	33/34	Not used.
Attention	35/36	Signals the computer that some asynchronous condition has occurred in the I/O device. The conditions are a part of the I/O specification. The "attention" line can rise any time, except when "attention response" is up, and must stay up until the I/O device receives an "attention response" from the computer. Attention must fall within 6 microseconds of the rise of "attention response."
Unusual End	37/38	Signals the computer that the operation being executed has resulted in an unusual condition and has been terminated. If an "unusual end" occurs, an "end" signal is

Line Name	Connector	Comment
		not given. The "unusual end" must stay up until "end response" is received from the computer and must fall within 6 microseconds of the rise of "end response."
Command Response	39/40	This line signals the computer in recognition of a signal on any of the four command lines. It indicates the ability of the I/O device to initiate the command. "Command response" must rise within 6 microseconds of the rise of any of the four commands. If, because of skew, "stop" or "end response" from the preceding operation overlap the command, "command response" cannot rise until "stop" and "end response" are down. "Command response" must not fall during the execution of the command and must fall within 6 microseconds of the rise of "end response."

All physical, power, and environmental specifications and electronic circuits needed are described for each unit covered by this manual.

IBM 1414-1, 2, and 7 Input-Output Synchronizers

Physical:
- 37-1/2 inches Front
- 31-1/2 inches Side
- 70 inches Height
- 500 pounds

Power:
- .5 kva
- 1400 BTU/hr
- 500 cfm

Environmental:
- 60° to 90° F
- 20% to 80% RH

IBM 1414-3 Input-Output Synchronizer

Physical:
- 37-1/2 inches Front
- 31-1/2 inches Side
- 70 inches Height
- 500 pounds

Power:
- .8 kva
- 2120 BTU/hr
- 500 cfm

Environmental:
- 60° to 90° F
- 20% to 80% RH

IBM 1414-4 Input-Output Synchronizer

Physical:
- 73-1/2 inches Front
- 31-1/2 inches Side
- 70 inches Height
- 1000 pounds

Power:
- 1.8 kva
- 5000 BTU/hr
- 1000 cfm

Environmental:
- 60° to 90° F
- 20% to 80% RH

IBM 1414-5 and 6 Input-Output Synchronizers

Physical:
- 73-1/2 inches Front
- 31-1/2 inches Side
- 70 inches Height
- 1200 pounds

Power:
- 1.2 kva
- 4050 BTU/hr
- 1000 cfm
- Power Cable (1414-6 only):
  - 20 amperes, Russell & Stoll FS 3720
- Power Regulation (1414-6 only):
  - Voltage, ±10%
  - Frequency, ±1/2 cycle

Environmental:
- 60° to 90° F
- 20% to 80% RH

IBM 729 Magnetic Tape Units

Physical:
- 29-1/8 inches Front
- 33-7/8 inches Side
- 69-1/4 inches Height
- 1160 pounds

Power:
- 1.6 kva
- 3900 BTU/hr
- 550 cfm

Environmental:
- 60° to 90° F
- 20% to 80% RH

Circuits and Connections: Figures 19 through 35 show miscellaneous cable connections, converter blocks, terminators, and amplifiers used with the IBM 729 Magnetic Tape Units. "Control Unit" references mean the IBM 1414 Input-Output Synchronizer.

NOTES:

1. T/C Signal Connector cable (460673) is used only to connect the Tape Unit Tester to the Tape Unit. It differs from the one used in the systems installation (Figures 24 and 25) in that 460673 must carry the +6v, -6v, & -12v to the Tester as supply voltages. The cable is available in 8 foot lengths only.
2. CE Control Box (460605) can be used in place of the Tester when motion control only is required.
3. Terminating Shoe (529285) must be connected to Tape Unit for operation with the Tester.

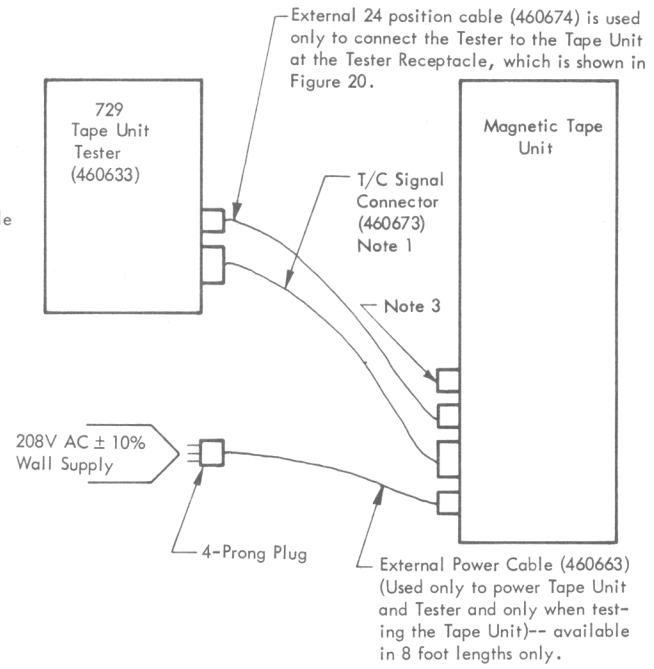


Figure 19. Tape Tester and Tape Unit Connections

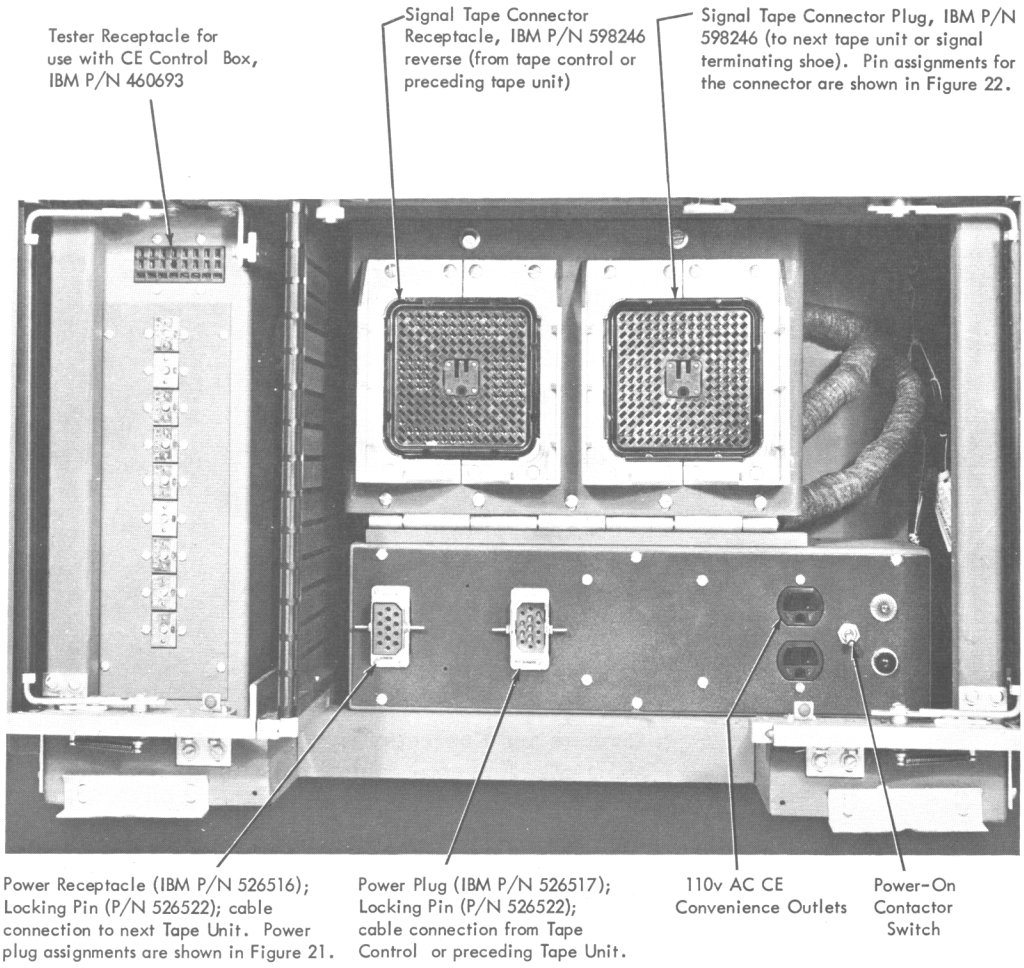
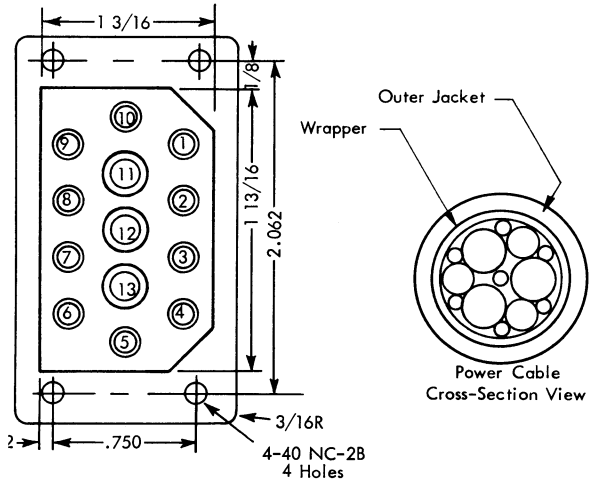


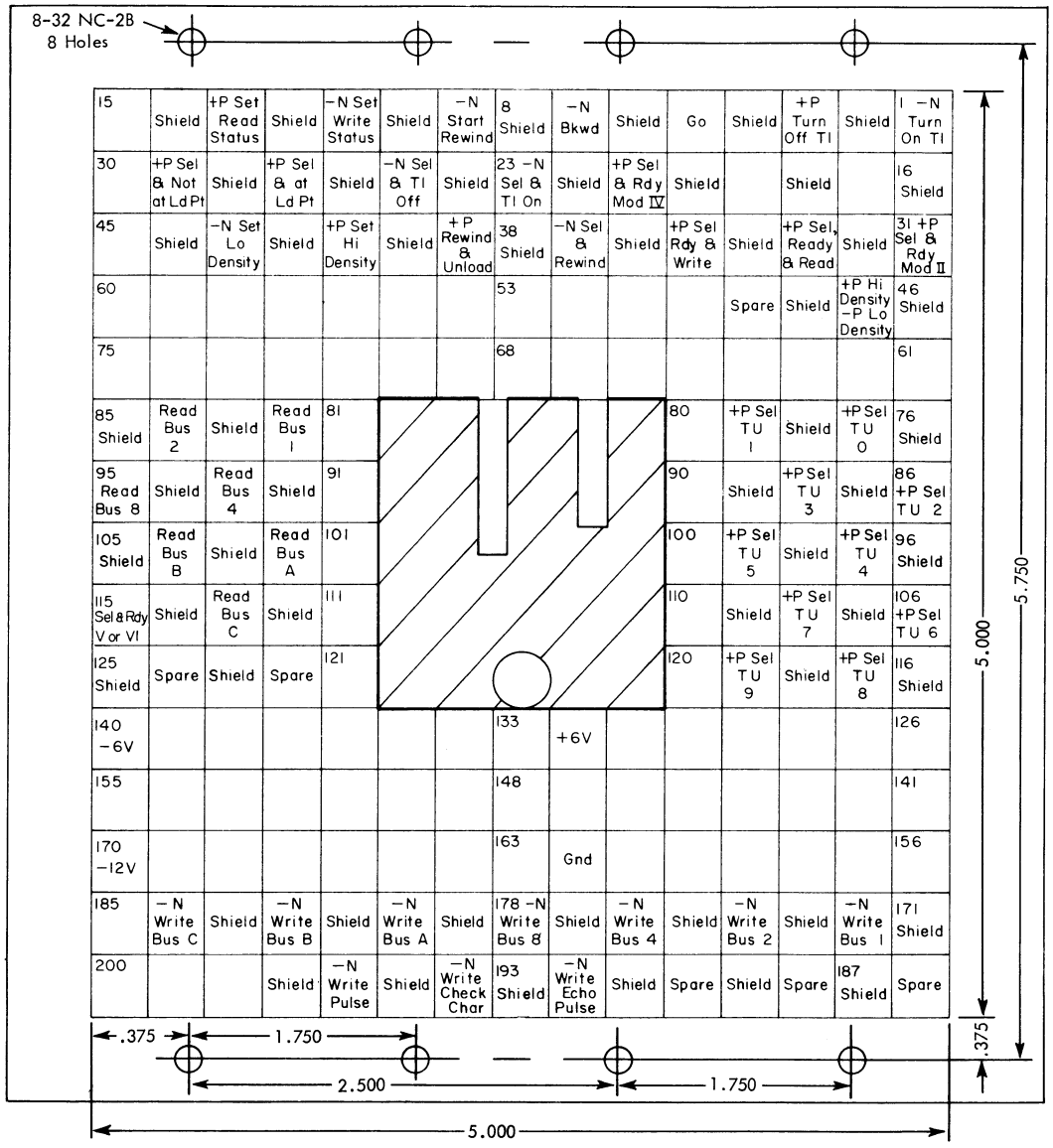
Figure 20. Power and Signal Connections

POWER PLUG PIN ASSIGNMENTS			
TAPE UNIT		POWER CABLE	
Pin No	Voltage or Control	Wire Size	Type
1	AC outlet - 115 volts	14	AC
2	AC outlet - 115 volts	14	AC
3	Bond	14	
4	Spare	18	
5	Model II & IV reset - 208 volts	18	AC
6	Spare	18	
7	Spare	18	
8	Spare	18	
9	Spare	18	
10	Model II & IV reset - 208 volts	18	AC
11	Unreg AC Ø1	10	AC
12	Unreg AC Ø2	10	AC
13	Unreg AC Ø3	10	AC



Pin Layout, Power Plug - Male
Wiring Side

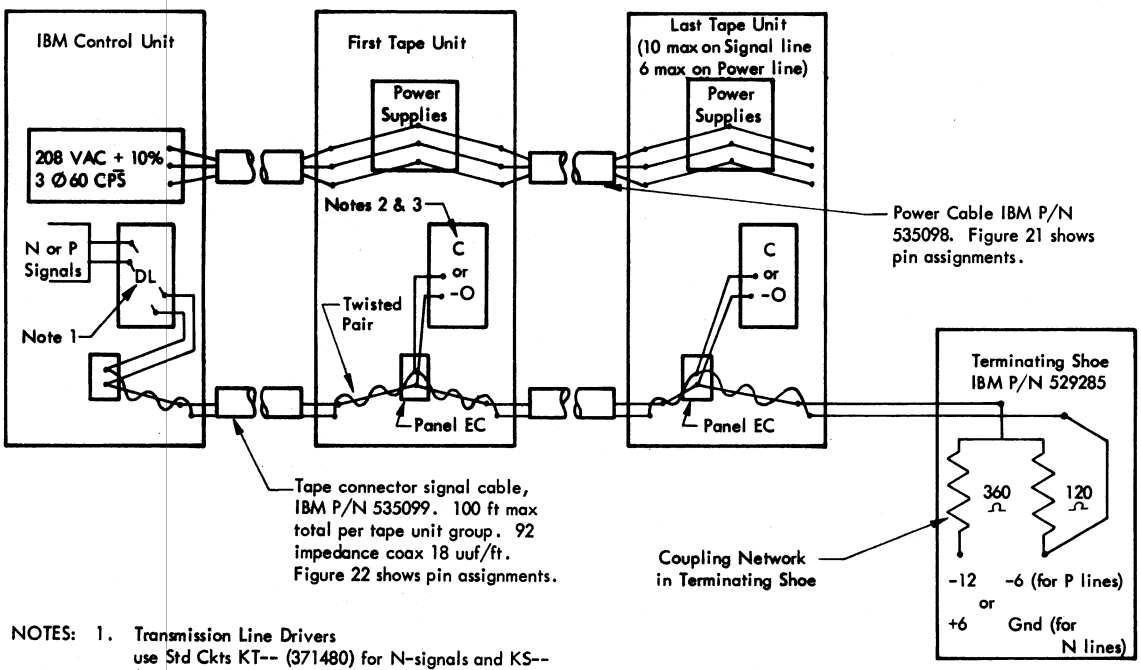
Figure 21. Power Plug Assignments



15	Shield	+P Set Read Status	Shield	−N Set Write Status	Shield	−N Start Rewind	8 Shield	−N Bkwd	Shield	Go	Shield	+P Turn Off TI	Shield	1 −N Turn On TI
30	+P Sel & Not at Ld Pt	Shield	+P Sel & at Ld Pt	Shield	−N Sel & TI Off	Shield	23 −N Sel & TI On	Shield	+P Sel & Rdy Mod IV	Shield		Shield		16 Shield
45	Shield	−N Set Lo Density	Shield	+P Set Hi Density	Shield	+P Rewind & Unload	38 Shield	−N Sel & Rewind	Shield	+P Sel Rdy & Write	Shield	+P Sel Ready & Read	Shield	31 +P Sel & Rdy Mod II
60							53				Spare	Shield	+P Hi Density −P Lo Density	46 Shield
75							68							61
85 Shield	Read Bus 2	Shield	Read Bus 1	81						80	+P Sel TU 1	Shield	+P Sel TU 0	76 Shield
95 Read Bus 8	Shield	Read Bus 4	Shield	91						90	Shield	+P Sel TU 3	Shield	86 +P Sel TU 2
105 Shield	Read Bus B	Shield	Read Bus A	101						100	+P Sel TU 5	Shield	+P Sel TU 4	96 Shield
115 Sel & Rdy V or VI	Shield	Read Bus C	Shield	111						110	Shield	+P Sel TU 7	Shield	106 +P Sel TU 6
125 Shield	Spare	Shield	Spare	121						120	+P Sel TU 9	Shield	+P Sel TU 8	116 Shield
140 −6V							133	+6V						126
155							148							141
170 −12V							163	Gnd						156
185	− N Write Bus C	Shield	−N Write Bus B	Shield	−N Write Bus A	Shield	178 −N Write Bus 8	Shield	−N Write Bus 4	Shield	−N Write Bus 2	Shield	−N Write Bus 1	171 Shield
200			Shield	−N Write Pulse	Shield	−N Write Check Char	193 Shield	−N Write Echo Pulse	Shield	Spare	Shield	Spare	187 Shield	Spare

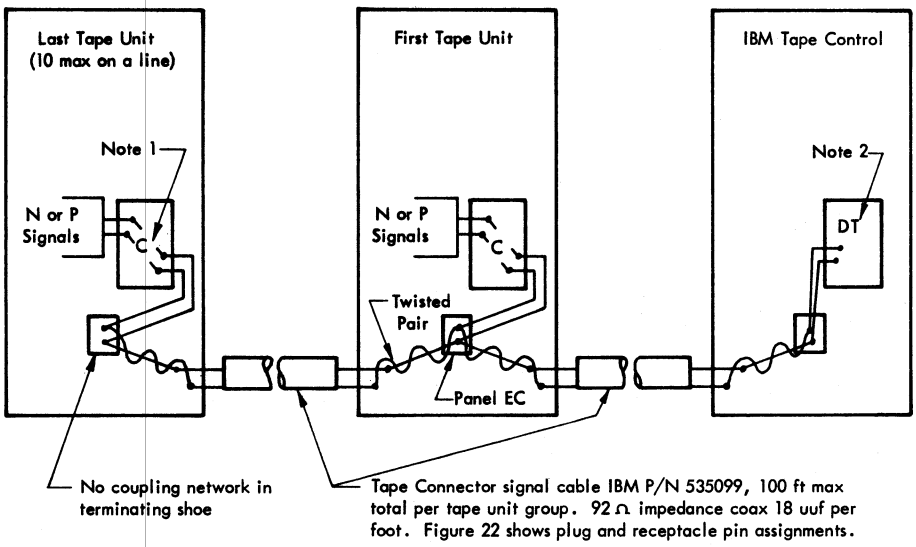
NOTE: Although pins 132, 140, & 170 are designated for +6v, -6v, & -12v, no lines are provided in the coax cable (535099) to carry these voltages from Tape Unit to Tape Unit.

Figure 22. Tape Control Connector Receptacle Pin Assignments (Wiring Side)



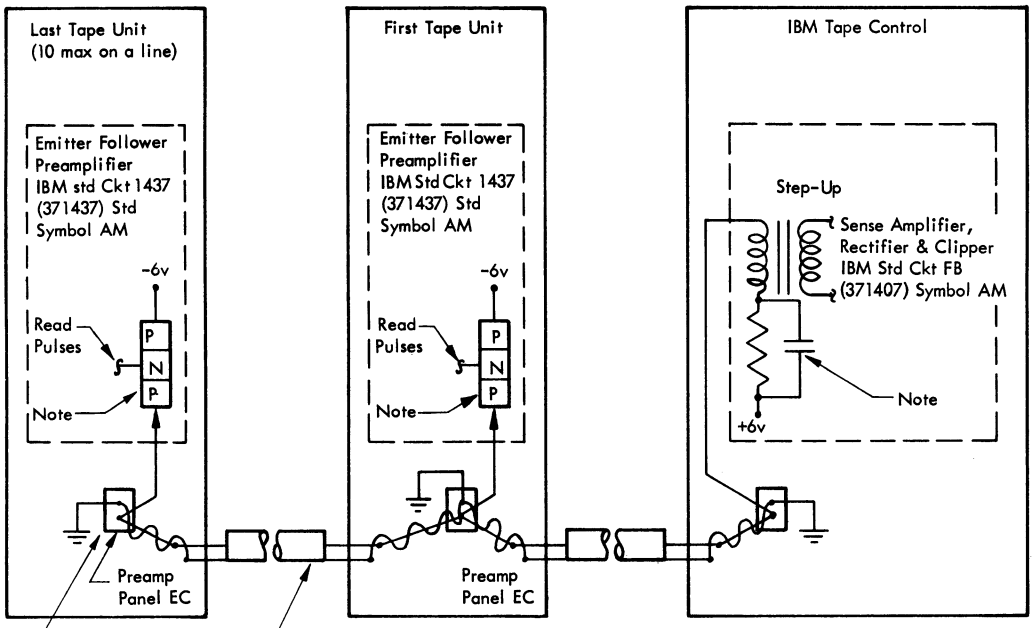
NOTES:
1. Transmission Line Drivers use Std Ckts KT-- (371480) for N-signals and KS-- (371476) for P-signals.
2. Convert circuits. Both models use Std IBM Ckts ANZZ (371209) for P lines and AMZZ (371200) for N lines (or equivalent).
3. All input lines except Wr Check Char terminate in a Convert circuit. Wr Check Char works directly into a -OR Ckt, IBM Std Ckt AAZU (371206).

Figure 23. Signals and Power from Control to Tape Unit



NOTES:
1. Convert Circuit. Both models use Std IBM Ckts ANZX (371211) for P lines and AMZX (371202) for N lines (or equivalent).
2. Line Driver Terminator Circuit uses Std Ckt AI-- (371243) for P lines and AF-- (371242 for N lines.

Figure 24. Signals from Tape Unit to Control



NOTE: The load for the emitter-follower transistor in the preamplifier in the Tape Unit is located in the Sense Amplifier Rectifier and Clipper circuit of the Tape Control. This load is common for all Tape Units connected to the Tape Control on that line. There are seven lines, one for each track.

Figure 25. Read Signals from Tape Unit to Control

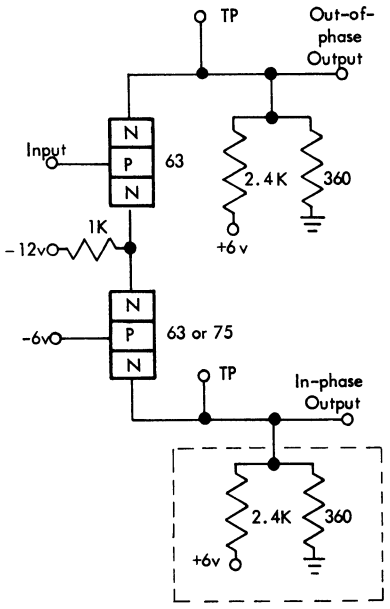
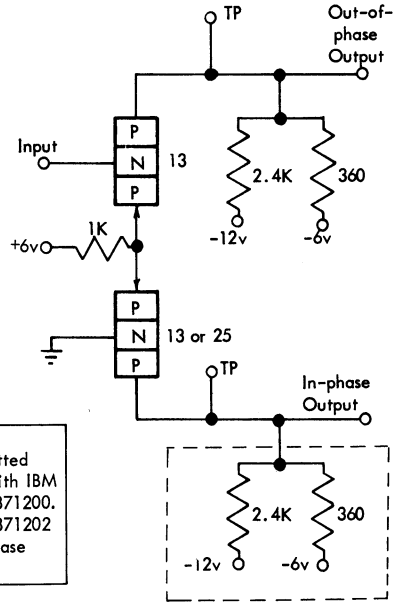


Figure 26. P Converter Block



NOTE:
In-phase load (dotted area) used only with IBM P/N 371209 and 371200. P/N 371211 and 371202 do not have in-phase load.

Figure 27. N Converter Block

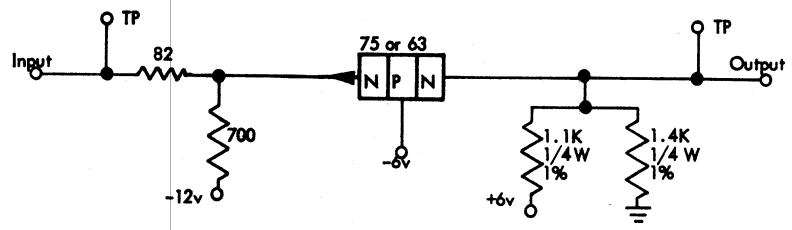


Figure 28. P Line Terminator, IBM Part No. 371243

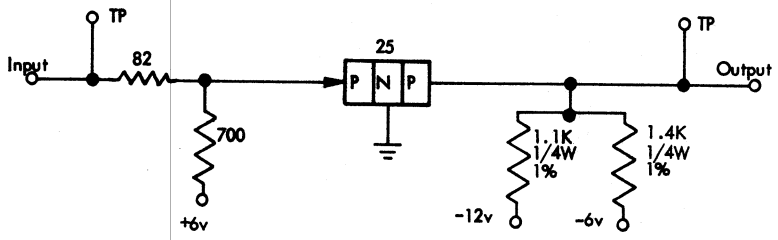


Figure 29. N Line Terminator, IBM Part No. 371242

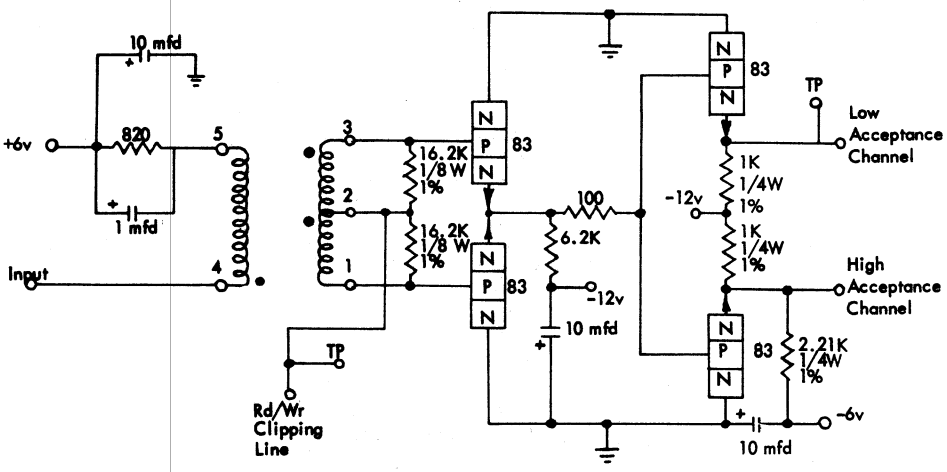


Figure 30. Alloy Sense Amplifier, Rectifier and Clipper, IBM Part No. 371407

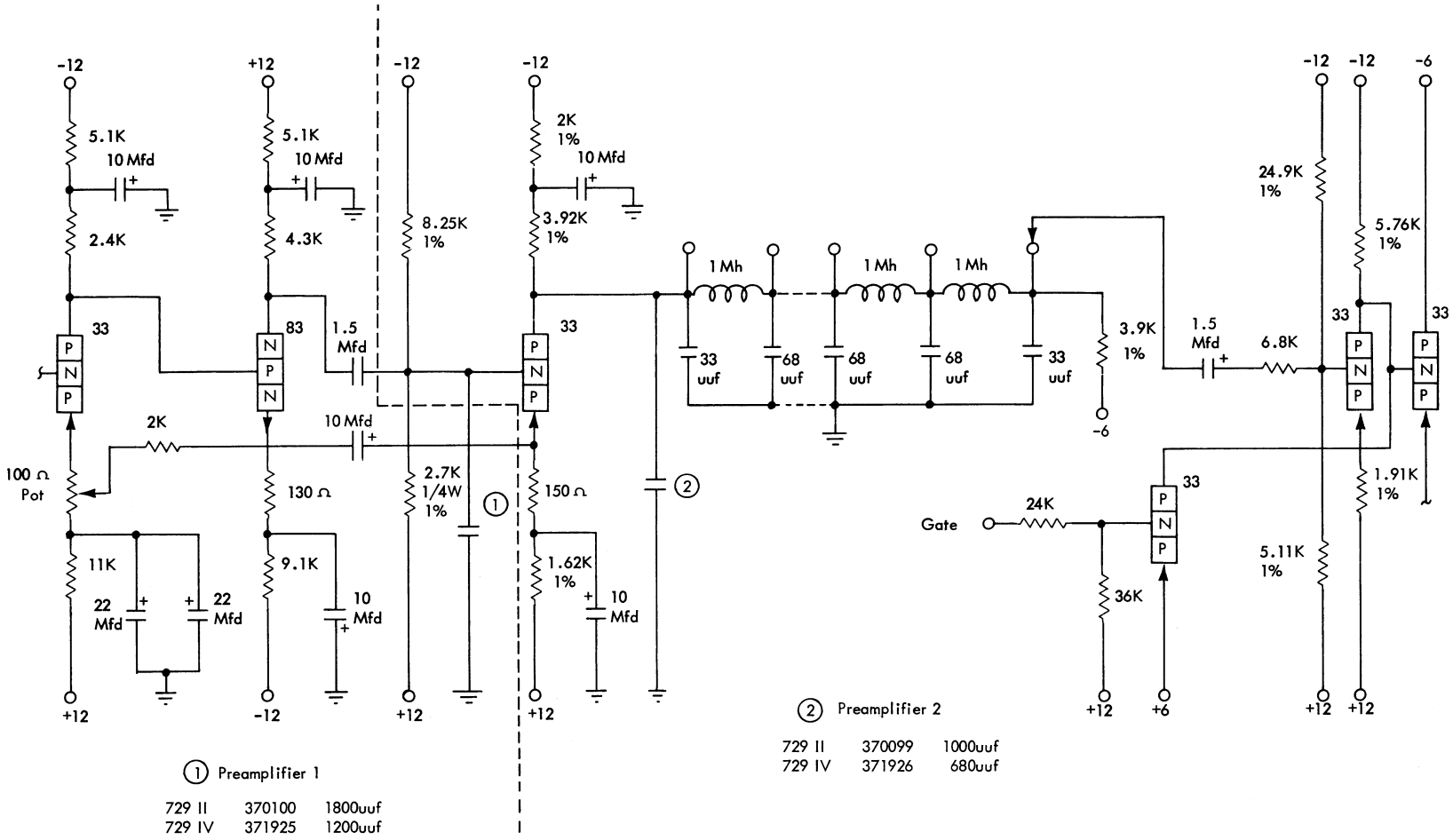


Figure 31. Preamplifier for IBM 729 II and IV

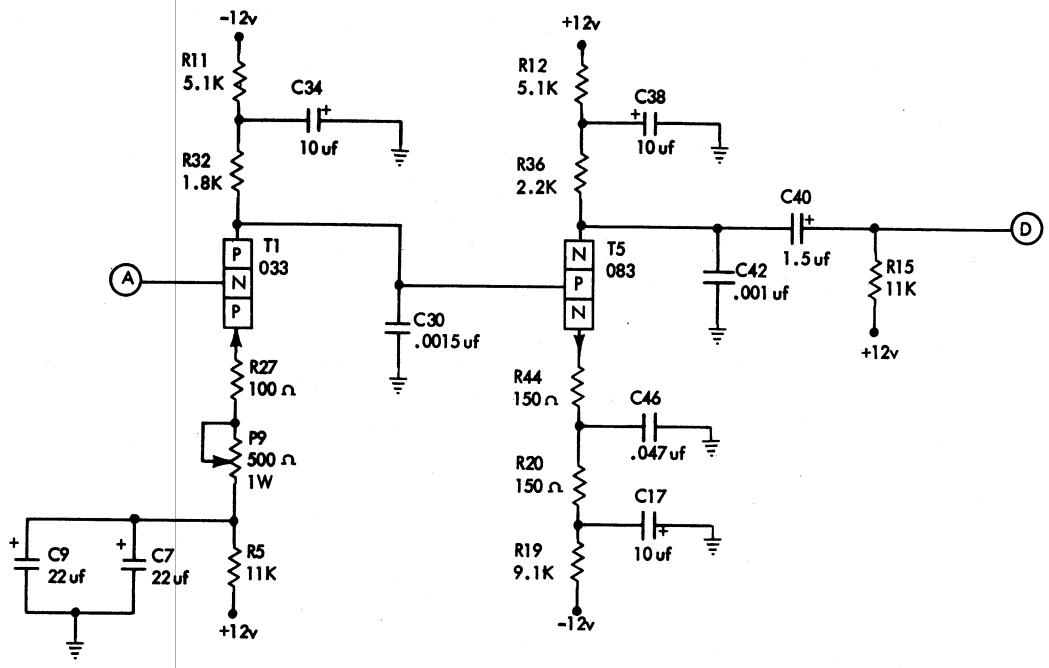


Figure 32. Preamplifier for 729 V

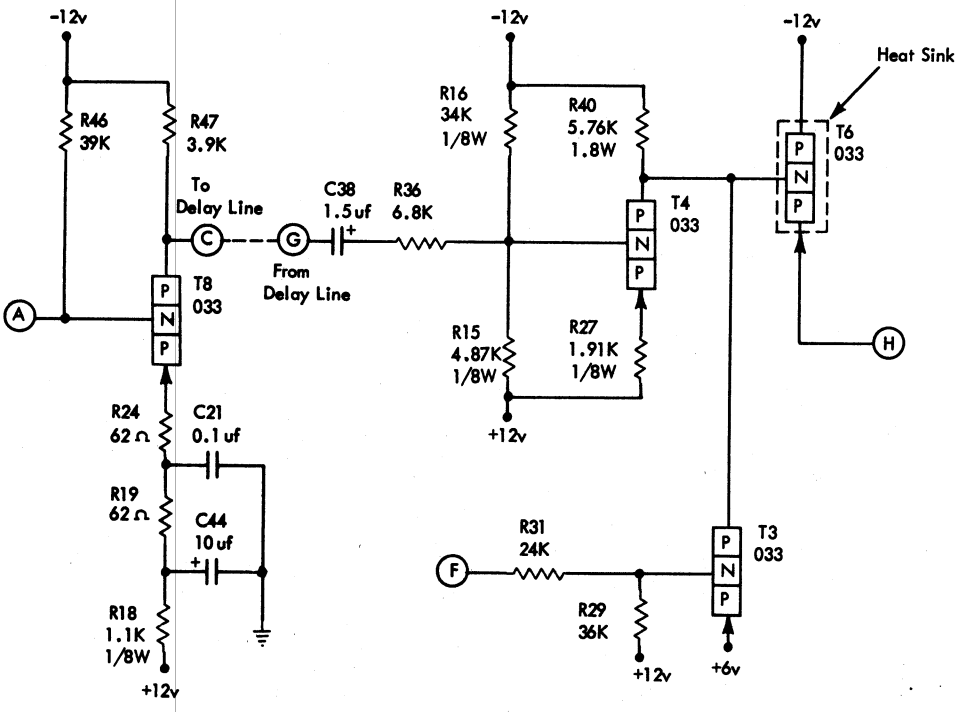


Figure 33. Preamplifier for 729 V

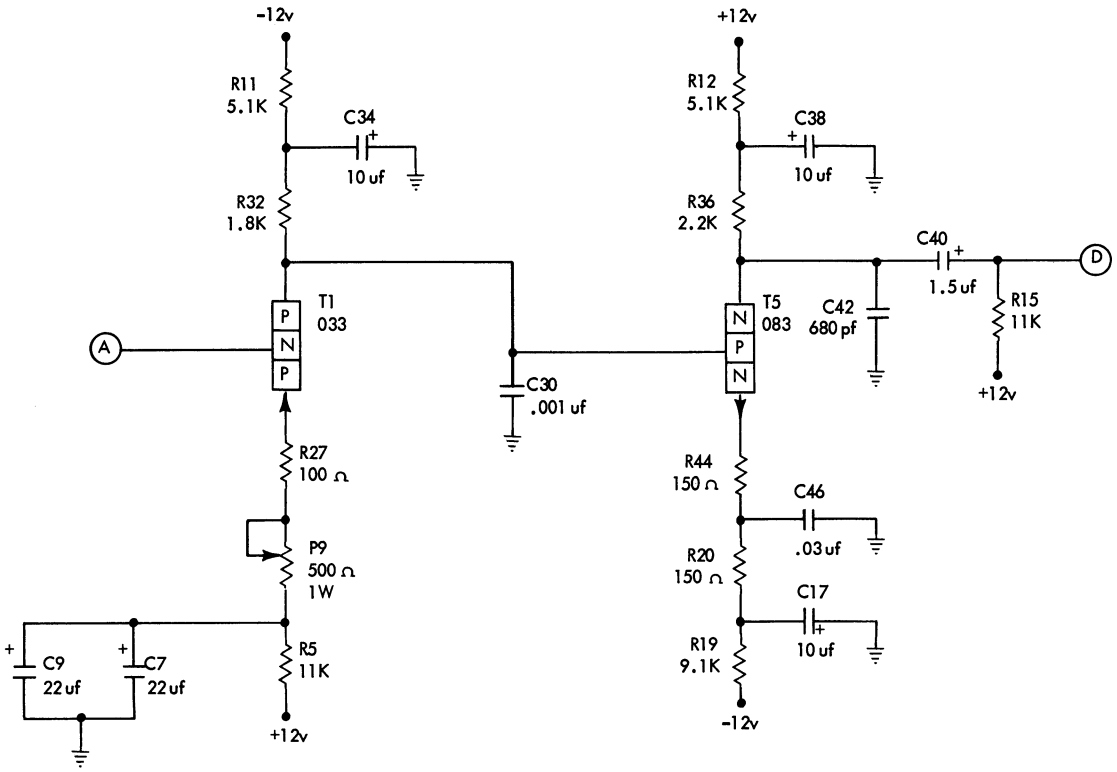


Figure 34. Preamplifier for 729 VI

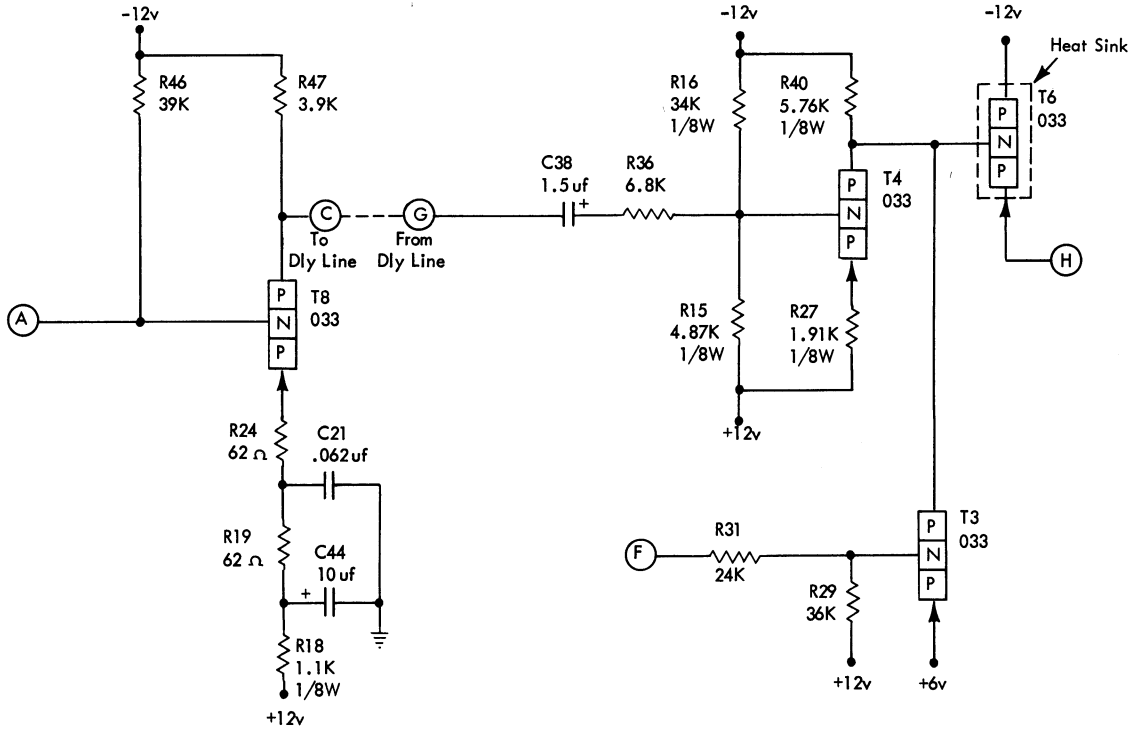


Figure 35. Preamplifier for 729 VI

IBM 7330 Magnetic Tape Units

Physical:

29 inches	Front
30-3/4 inches	Side
58 inches	Height
637 pounds	

Power:

1.1 kva
3415 BTU/hr
150 cfm

Environmental:

60° to 90° F
20% to 80% RH

Circuits and Connections: Figures 36 through 42 show miscellaneous connections, drivers, terminators, and amplifiers used with the IBM 7330 Magnetic Tape Unit.

15	Shield	Set Read	Shield	Set Write	Shield	Rewind Call	8 Shield	Bkwd	Shield	Go	Shield	TI Off	Shield	1 TI On
30	Sel Rdy Bkwd	Shield	Sel Rdy LP	Shield			23 Sel Rdy TI On	Shield	Sel Rdy HI	Shield				16
45					Shield	Rew Unld Call	38 Shield	Sel Rewind	Shield	Sel Rdy Write	Shield	Sel Rdy Read	Shield	31 Sel Rdy LO
60							53							46
75							68							61
85 Shield	Read Bit 2	Shield	Read Bit 1	81						80	Sel TU 1	Shield	Sel TU 0	76 Shield
95 Read Bit 8	Shield	Read Bit 4	Shield	91						90	Shield	Sel TU 3	Shield	86 Sel TU 2
105 Shield	Read Bit B	Shield	Read Bit A	101						100	Sel TU 5	Shield	Sel TU 4	96 Shield
115		Read Bit C	Shield	111						110	Shield	Sel TU 7	Shield	106 Sel TU 6
125				121						120	Sel TU 9	Shield	Sel TU 8	116 Shield
140 -6v				+12v			133	+6v						126
155							148							141
170 -12v							163	Gnd						156
185	Write Bus C	Shield	Write Bus B	Shield	Write Bus A	Shield	178 Write Bus 8	Shield	Write Bus 4	Shield	Write Bus 2	Shield	Write Bus 1	171 Shield
200			Shield	Write Pulse	Shield	Wr Tr Rel	193 Shield	Echo Pulse						186

Figure 36. Input-Output Signal Lines

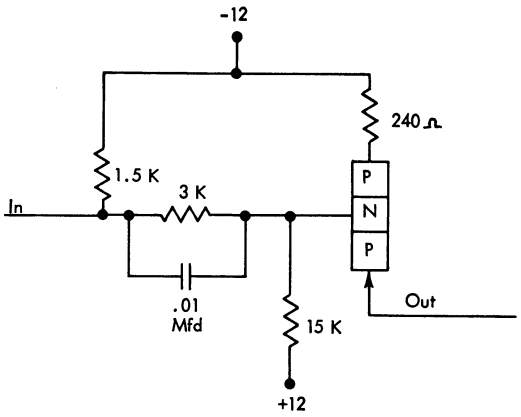


Figure 37. Line Driver Circuit

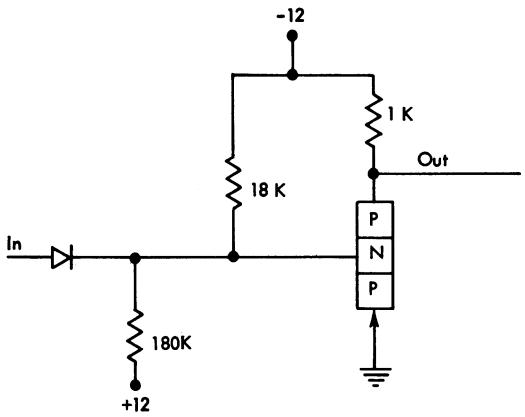


Figure 39. Line Terminator Circuit

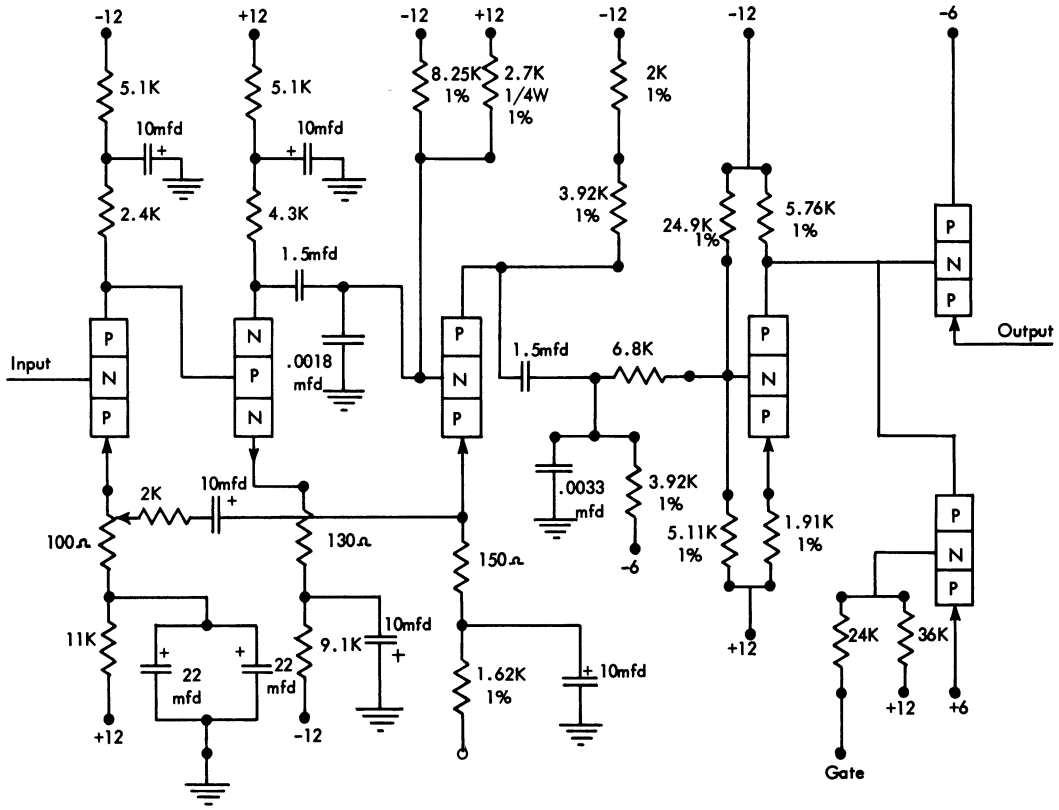


Figure 38. Read Preamplifier

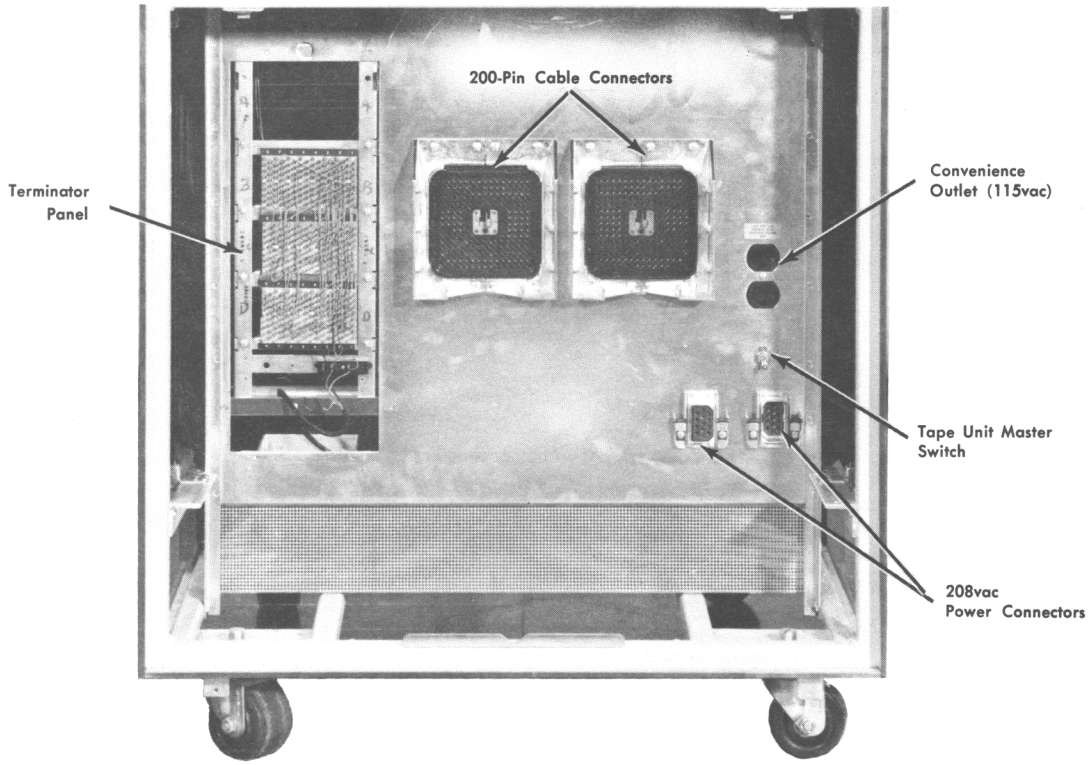


Figure 40. Signal and Power Receptacles

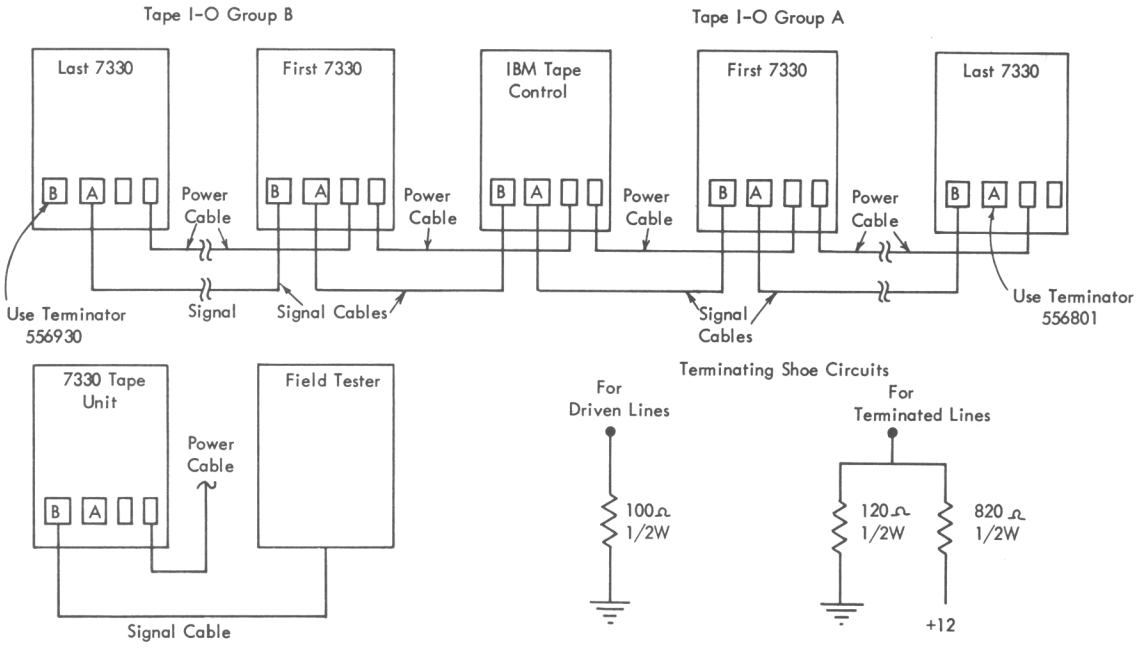


Figure 41. Tape Signal and Power Connections

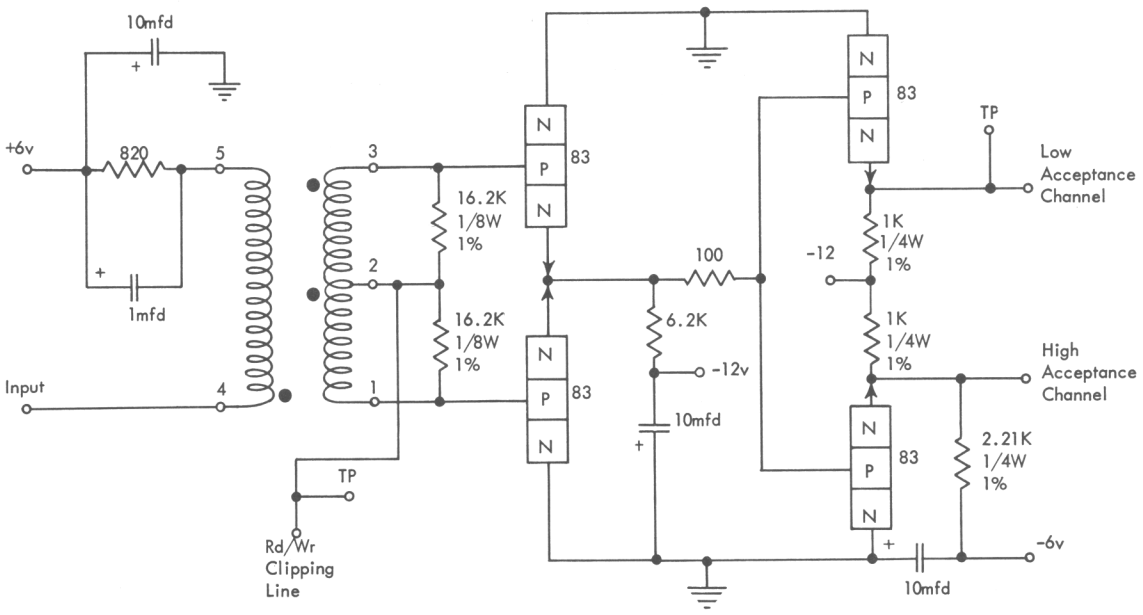


Figure 42. Sense Amplifier, Rectifier, and Clipper

IBM 1009 Data Transmission Unit

Physical:

29 inches	Front
30-5/8 inches	Side
40 inches	Height
669 pounds	

Power:

.3 kva
1000 BTU/hr
120 cfm

Environmental:

50° to 90° F
20% to 80% RH

Circuits and Connections: Figures 43 through 47 show miscellaneous connections, drivers, terminators, and reference charts used with the IBM 1009 Data Transmission Unit.

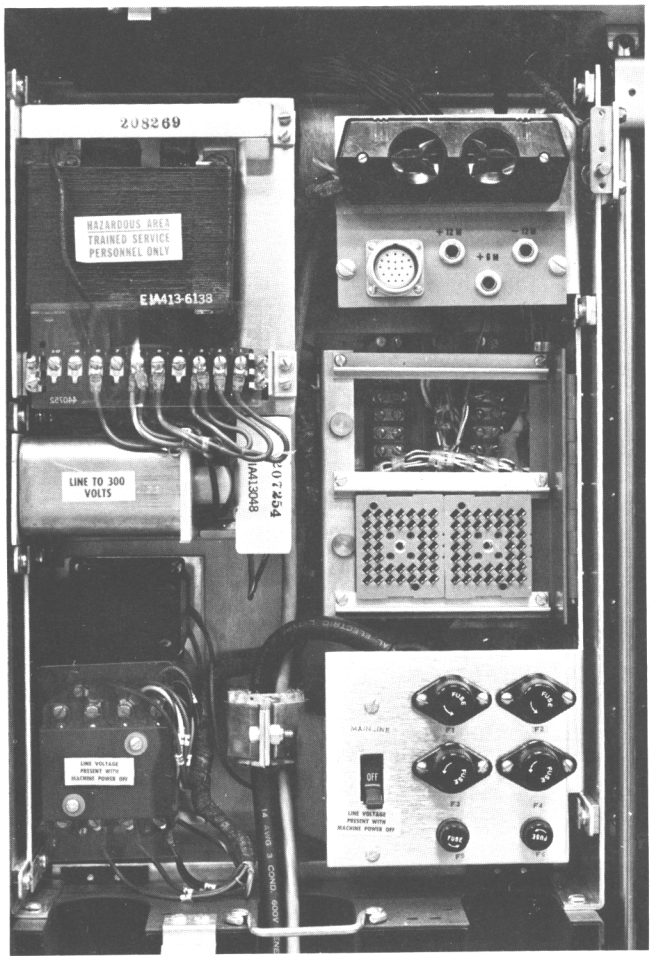


Figure 43. IBM 1009 Cable Entry

IBM 1011 Paper Tape Reader

Physical:

31-3/4 inches	Front
24-1/8 inches	Side
60 inches	Height
529 pounds	

SIGNAL NAME	CONNECTOR PIN	SIGNAL LEVEL		TERMINATOR	
		ON	OFF	1	2
I/O Attachment Write Call	D-7 and 6	-1V	+1V	✓	
I/O Attachment Read Call	D-13 and 14	-1V	+1V	✓	
Select I/O Attachment	D-18 and 17	-1V	+1V		✓
I/O Process Check	D-21 and 22	-1V	+1V	✓	
I/O Time 000-030	D-30 and 37	-1V	+1V	✓	
I/O Time 030-060	D-38 and 31	-1V	+1V	✓	
Not Start Reset	D-40 and 39	-1V	+1V	✓	
I/O Unit 1 Control	D-3 and 10	-1V	+1V	✓	
I/O Unit 2 Control	D-11 and 4	-1V	+1V	✓	
I/O Disconnect	D-32 and 33	-1V	+1V	✓	
Service Response	D-26 and 25	-1V	+1V	✓	
I/O Output 1	D-1 and 2	-1V	+1V		✓
I/O Output 2	D-9 and 8	-1V	+1V		✓
I/O Output 4	D-15 and 16	-1V	+1V		✓
I/O Output 8	D-20 and 19	-1V	+1V		✓
I/O Output A	D-23 and 24	-1V	+1V		✓
I/O Output B	D-28 and 27	-1V	+1V		✓
I/O Output C	D-34 and 35	-1V	+1V		✓
I/O 1 Select	D-5 and 12	-1V	+1V	✓	
Spare	D-29 and 36	—	—	—	—

NOTE: **The first connector pin of each pair is the signal pin. The second connector pin is the Signal Reference pin.**

Figure 44. DPS to DTU Connector Reference Chart

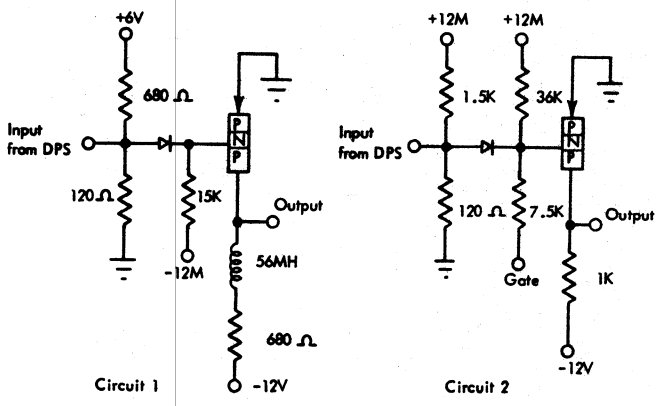


Figure 45. Line Terminator Circuits

SIGNAL NAME	CONNECTOR PIN	SIGNAL LEVEL	
		ON	OFF
Service Request	C-36 and 29	-1V	+1V
I/O Input 1	C-1 and 2	-1V	+1V
I/O Input 2	C-9 and 8	-1V	+1V
I/O Input 4	C-15 and 16	-1V	+1V
I/O Input 8	C-20 and 19	-1V	+1V
I/O Input A	C-23 and 24	-1V	+1V
I/O Input B	C-28 and 27	-1V	+1V
I/O Input C	C-34 and 35	-1V	+1V
End of Transmission	C-30 and 37	-1V	+1V
I/O Transfer 1	C-7 and 6	+1V	-1V
I/O Transfer 2	C-13 and 14	-1V	+1V
I/O Transfer 3	C-18 and 17	-1V	+1V
I/O Transfer 4	C-21 and 22	-1V	+1V
I/O Transfer 5	C-26 and 25	-1V	+1V
I/O Transfer 6	C-32 and 33	-1V	+1V
I/O Selecting Unit	C-38 and 31	-1V	+1V
Single Character Transmission	C-40 and 39	-1V	+1V
Emergency Off Sw.	C-4 and 11	—	—
Spare	C-3 and 10	—	—
Spare	C-5 and 12	—	—

NOTE: **The first connector pin of each pair is the Signal pin. The second connector pin is the Signal Reference pin.**

Figure 46. DTU to DPS Connector Reference Chart

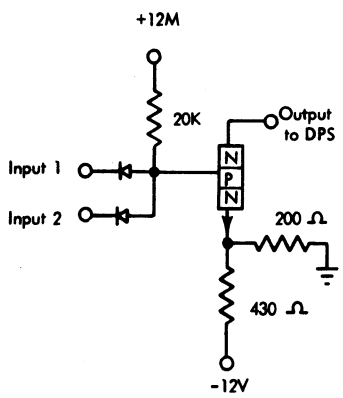


Figure 47. Line Driver Circuit

Power:
1.8 kva
4100 BTU/hr
150 cfm

Environmental:
60° to 90° F
20% to 80% RH

Circuits and Connections: Figures 48 through 50 show connections, drivers, and terminator circuits used with the IBM 1011 Paper Tape Reader.

7	Line C		Line B		Line A	1
14 Line 1		Line 2		Line 4		8 Line 8
18						15
22 Go Line					Emer Off 2	19 Emer Off 1
26 Char Rec						23
33	Data Sync		EOR		Parity Error	27
40		Spare		Go Line Pwr		34 PT Ready

Figure 48. IBM 1011 Connector

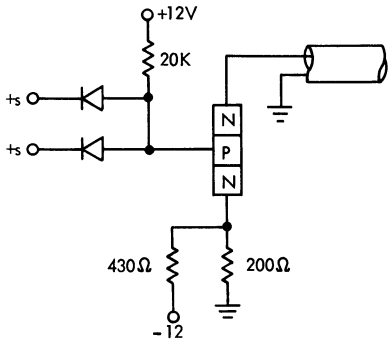


Figure 49. Cable Driver

IBM 1014 Remote Inquiry Unit

Physical:

24 inches	Front
29 inches	Side
35 inches	Height
175 pounds	

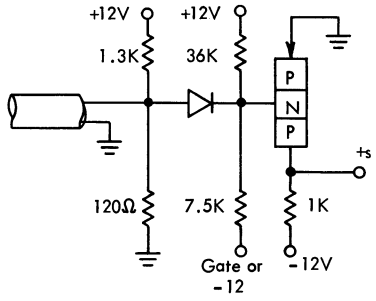


Figure 50. Cable Terminator

Power:
.4 kva
1000 BTU/hr
0 cfm

Environmental:
60° to 90° F
20% to 80% RH

IBM Adapter Interface Devices

Each signal line in the interface cable must have an accompanying DC ground line that goes between the two devices. The DC ground line can be a shield around the signal wire or it can be used with the signal line to form a twisted pair. The type used is determined by the using system requirements, but interface cable length is limited to 100 feet.

Pulse duration on the interface lines is not limited except as previously specified; most lines are interlocked so that a minimum pulse duration does not have to be specified.

Circuits and Connections: Figure 51 shows the line driver circuit used with adapter interface driven lines; Figure 52 shows the line terminator used.

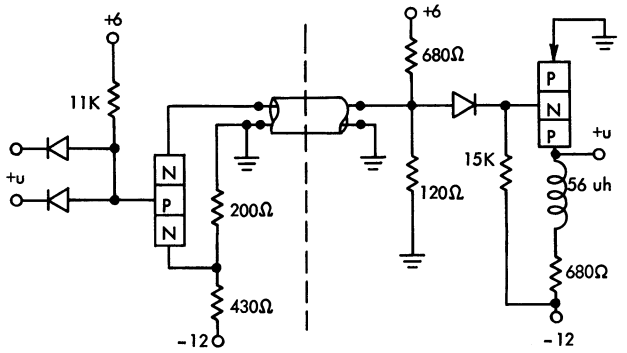


Figure 51. Line Driver

Figure 52. Line Terminator

Signal and Power Cables

Signal and power cables between the computer system and IBM 1414-1, 2, 3, 4, 5, and 7 Input-Output Synchronizers are listed in the following table and shown in Figure 53.

Cable No.	Routing	IBM P/N	Max External Length (feet)
1	Computer to 1414	760739	50
2	Computer to 1414	761367	40
3	1414 to 729/7330	761354	Note 1
4	729/7330 to 729/7330	352464	Note 2
5	729/7330 to 729/7330	535099	Note 1
6	Computer to 729/7330	760739	50
7	729/7330 to 729/7330	535098	Note 3
8	Computer to 1414	761365	45
9	Computer to 1414	761370	45
10	Computer to 1414	761365	45
11	Computer to 1414	761364	45
12	Computer to 1414	761363	45
13	Computer to 1414	760368	45 (Note 4)
14	1414 to 1402	760672	25
15	1414 to 1402	760671	25
16	1414 to 1402	760737	28
17	1414 to 1402	760741	28
18	1414 to 1403	760673	25
19	1414 to 1403	760674	25
20	1414 to 1403	760754	25
21	1414 to 1009	763345	60
22	1414 to 1011	760683	80
23	1414 to Wall Terminal Box	761289	50 (Note 5)
24	Terminal Box to 1014	761290	50 (Note 6)
25	1414 to TTY 1 Send	762733	250
26	1414 to TTY 2 Send	762733	250
27	1414 to TTY 1 Receive	762732	250
28	1414 to TTY 2 Receive	762732	250
29	1414 to TTY 1 Send/Receive	762735	250
30	1414 to TTY 2 Send/Receive	762735	250
31	Computer to 1402	760736	50

Notes:
1. Total length of tape signal cables may not exceed 100 feet to the farthest 729 tape unit on each channel or 80 feet to the farthest 7330 tape unit.
2. Needed with tape interchange. Terminator 352463 is used with 729; terminator 556930 with 7330.
3. Total length of power cable may not exceed 80 feet per leg. There are two power legs per channel, a maximum of five tape units per leg.
4. Used with 1410 Priority Feature.
5. A total of four cables of 50 feet each.
6. A total of 20 cables of 50 feet each.

Signal and power cables for the 1414-5 and 6 input-output synchronizers not shown in Figure 53 are listed in the following table and shown in Figure 54.

Cable No.	Routing	IBM P/N	Max External Length (feet)
1	1414 to 1411	761363	45 (Note 2)
2	1414 to 1411	761364	45 (Note 2)
3	1414 to 1411	761365	45 (Note 2)
4	1414 to 1411	760368	45 (Note 2)
5	1414 to 1411	761370	45 (Note 2)
6	1414 to 1411	763337	45 (Note 2)
7	1414 to 7106/7107	5235682	45 (Note 1)
8	1414 to 7106/7107	763337	45
9	1414 to 7106	352303	60
10	1414 to 7107	352303	60
11	1414 to 7602	352303	75
12	1414 to 7804	352303	75
13	1414 to 7909	352303	100
14	1414 to 7904	587330	50 (Note 2)
15	1414 to 7907	587330	55 (Note 2)
16	1414 to 7908	587330	50 (Note 2)
17	1414 to 7909	587330	25 (Note 2)

Notes:
1. Four cables are used.
2. Two cables are used.

Emergency Power-Off Cabling

Safety regulations require that power to all system components located in a room be turned off by an emergency power-off switch located in a convenient place (normally the computer system console). In room configurations of more than one computer system, each system's emergency power-off switch is able to remove power from the entire room configuration.

Each component is connected in series to other components. When an emergency power-off switch is pressed, a power control relay in the first unit is released, dropping power and breaking the circuit to the next unit. Each unit in turn has its control circuit broken and removes power.

Cable 352303 is used with all units. AMP plug C-480004-5 is used on each end of the cable, and each unit has an AMP C-480003-5 socket.

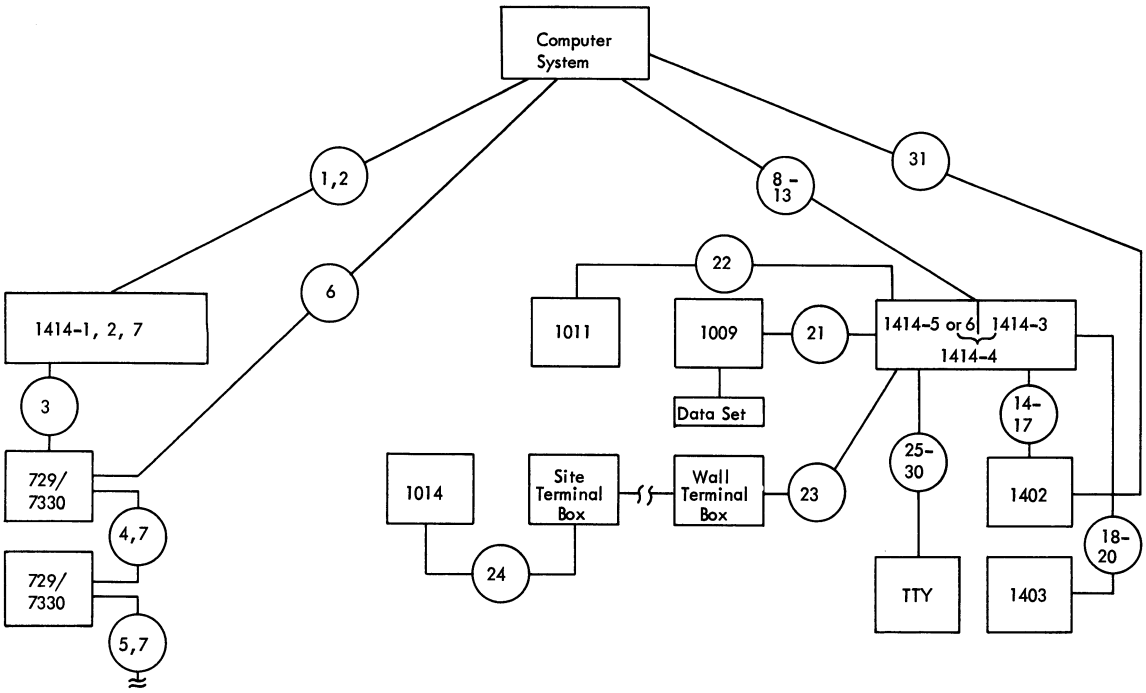


Figure 53. IBM Computer to 1414-1, 2, 3, 4 and 7 Cables

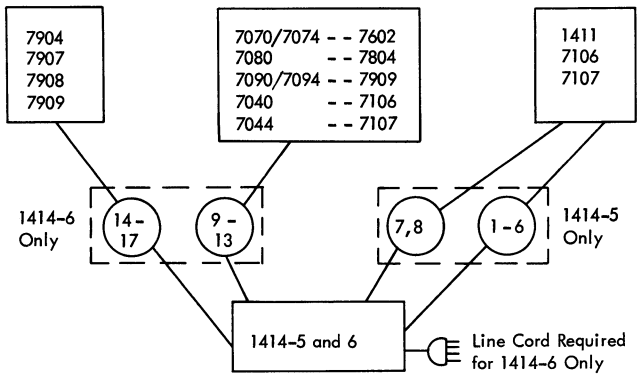


Figure 54. IBM 1414-5 and 6 Cables

8/62:5M-FW-56

A22-6701

IBM 1414 OEM Printed in U.S.A. A22-6701

IBM

International Business Machines Corporation
Data Processing Division
112 East Post Road, White Plains, New York