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53A-307 RELAY DRIVER CARD

OPERATION MANUAL

BFGoodrich
Aerospace

JcAIR Test Systems

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through
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53A-307 RELAY DRIVER CARD

OPERATION MANUAL

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53A-307 RELAY DRIVER CARD

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53A-307 RELAY DRIVER CARD

DESCRIPTION

The 53A-307 Relay Driver Card is a printed circuit board assembly for use in a CDSbus 53/63 Series system. The 53A-307 Card enables the 53/63 Series System to control up to 40 independent external relays. The external relays may be randomly opened or closed by transmitting ASCII characters from the system controller to the 53/63 Series System. Diagnostics are provided by LED indicators on the card.

The control output to external relays is through Darlington-pair drivers that can sink up to 100 mA per output. The external voltage to be switched is supplied by the user and may range from 1V DC to 50V DC. The 40 output lines have built-in transient suppression diodes.

CONTROLS AND INDICATORS

The following controls and indicators are provided to select and display the functions of the 53A-307 Card's operating environment.

Address-Select Switch

The 53A-307 Card has a miniature 10-position switch labeled "ADDRESS" that selects the 53A-307 Card's address (0-9) in the 53/63 Series System. The switch's cover opens to allow the address to be reselected. A screwdriver with a narrow, flat blade should be used to turn the cam-action wiper to the desired address position.

Power LED

The Power LED provides a valuable diagnostic tool by giving the system programmer a visual indication of the action which the system is currently taking. Whenever the 53A-307 Card is addressed by the system controller, the Power LED goes out. The LED remains out until another function card is addressed. Since only one function card can be addressed at a time, an unlit Power LED indicates the function card with which the system controller is currently communicating. The Power LED being lit not only indicates that the 53A-307 Card is unaddressed, but that all required dc power (5V dc, "15V dc) is being supplied.

Fuse

The 5V DC power bus has a fuse that protects the system from overloads. If the fuse has blown, the Power LED will not light.

Function LEDS and Switches

LEDs
The following LEDs are provided at the top front edge of the 53A-307 Card to indicate the status of the card's operation:

> Range LEDs (0, 10, 20, 30)
> One of the four Range LEDs lights to display the range of the Units LEDs. The Range LEDs step each time the Step Switch is depressed.

Units LEDs (0-9)
The Range and Units LEDs together display the state of any output control line.

Example:

The output control lines are numbered 0 through 39. To view the state of line 27, depress the Step switch until Range LED 20 is lit. Now the Units LEDs are displaying lines 20 through 29. If Units LED 7 is lit, this indicates that line 27 is low and conducting current, that is, the coil of the external relay connected to line 27 is energized.

Switches

The following switches are provided to select the proper functions for the 53A-307 Card's operating environment:

Halt Switch

This two-position slide switch is located near the card's backplane edge connector. It selects the state of the 53A-307 Card after an @XH (Halt) or STOP command is received by the 53/63 Series System.

a. In position "Z" (or "C2"), all output bits are set to the "open" state, that is, not conducting current.

b. In position "H" (or "C1"), all output bits hold their present state after a "@XH" command or STOP command is received.

Step Switch

The Step switch is a push button switch located at the bottom front edge of the 53A-307 Card. The programmer can view the state of any output control line (0-39) by stepping through the four decades (0, 10, 20, 30) using the Step switch.

SPECIFICATIONS

Relay Drivers

Capacity:	40 open-collector transistor switches.
Each Transistor Collector-Emitter Saturation Voltage:	1.1V max. at I_c = 100mA.
Max Collector Current (I_c):	100mA.
Collector-Emitter Break-down Voltage:	50V.
*Turn-on Delay:	1Ts max.
*Turn-off Delay:	1Ts max.
	* From the time the L command is received until transistor turns on or off.
Output Driver:	Sprague ULN-2803A. (See Figure I).

Power Requirements:	5V dc power is provided by the internal Power Supply in the 53/63 Series Card Cage.
Voltage:	4.75V to 5.25V DC.
Current:	1.59A maximum, quiescent. 1.65A peak.

NOTE: The power to be switched on and off to the relays is supplied externally by the user.

Cooling:	Provided by the fan in the 53/63 Card Cage.
Temperature:	-10EC to +65EC, operating (assumes ambient temperature of 55E and airflow to assure less than 10EC temperature rise). -40EC to +85EC, storage.
Humidity:	Less than 95% R.H. non-condensing, -10EC to +30EC. Less than 75% R.H. non-condensing, +31EC to +40EC. Less than 45% R.H. non-condensing, +41EC to +55EC.
Dimensions:	197 mm high, 220 mm deep, 13 mm wide. (7.75" x 8.66" x 0.5")
Dimensions, Shipping:	When ordered with a 53/63 Card Cage, the card is installed in one of the card cage's function-card slots. When ordered alone, the shipping dimensions are: 254 mm x 254 mm x 127 mm (10" x 10" x 5")
Weight:	0.23 kg (0.5 lbs)
Weight, Shipping:	When ordered with a 53/63 Card Cage, the card is installed in one of the card cage's function-card slots. When ordered alone, the shipping weight is: 0.64 kg (1.4 lbs)
Mounting Position:	Any orientation.
Mounting Location:	Installs in any function-card slot of the 53/63 Card Cage.
Required Equipment (not supplied):	53A-780 Hooded Connector or 53A-742 Cable.
Equipment Supplied:	53A-307 Relay Driver Card Operating Manual (Part# 00000-13070) Service Manual (Part# 00000-23070)

OPERATION

Overview

The 53A-307 Card is programmed by ASCII character commands sent from the system controller to the 53/63 Series System communications card. The 53A-307 Card interfaces to the communications card through the 53A-002/63A-012 Card Cage backplane.

To address a function card for the first time, the system command "@XY" must be issued. "X" is the mainframe address (0-9) selected on the 53A-171 Control Card for that mainframe; "Y" is the card address (0-9) within that mainframe. The 53A-307 Card address is selected using the card's Address Select Switch. Once a function card is addressed, it remains addressed until the system receives another "@" character. Appendix A fully discusses the "@XY" command and the other 53/63 Series System commands. After the 53A-307 Card is addressed, the following commands may be issued until another function card is addressed.

Command	Description
C or O	The Open and Close commands allow the system controller to open (O) or close (C) an external relay connected to an individual control line. Closed - Conducting current (active low), Units LED lit. Open - Not conducting current. Syntax: CZ_1Z_2L or OZ_1Z_2L Z_1Z_2 represents a decimal number (0 to 39), which is the control line to be open or closed. The output pin controlled as a function of Z_1Z_2 is defined in Appendix B. The state of the control line is updated when the L (load) character is received by the card. Example: The command sequence "@04C1LC30L09L" closes relay 1 and 30, and opens relay 9. In this example, it is assumed that the 53A-307 Card has address 4 and is in mainframe 0. The Power LED is out.
L	The parallel Load command randomly opens or closes all relays controlled by the 53A-307 Card simultaneously. Syntax: $Z_{10}. \ . \ .Z_1L$

The "Z_{10}. . .Z_1" characters represent ten ASCII characters sent by the system controller to control all forty outputs simultaneously. Each of the ten characters controls 4 of the forty outputs with one of 16 ASCII character values. (See Table I and Appendix B, section 2). When the parallel Load command is used, all 10 characters must be output.

The "L" in the command sequence simultaneously loads the data to all forty output lines.

Once this command is issued, the system controller is free to address other function cards.

Example:
The command sequence "@049?76543210L" causes the 53A-307 Card to parallel-load the outputs with 9?76543210. To understand what relay output drivers are turned on or off by this command, refer to Table I and section 2 of Appendix B: For example, the character "9", position Z_{10}, causes the output transistors connected to output control line numbers 39 and 9 to conduct current; the character "?", position Z_9, causes the transistor connected to output control line numbers 8, 18, 28 and 38 to conduct current, and so on. The Power LED is out.

The above example assumes that the 53A-307 Card is at address 4 in mainframe 0.

Table I

Parallel Load ASCII Character Definition

ASCII Output (from system controller)	Relay Driver Card Output (to data receptor) BCD Bit Position
	8 4 2 1
0	0 0 0 0
1	0 0 0 1
2	0 0 1 0
3	0 0 1 1
4	0 1 0 0
5	0 1 0 1
6	0 1 1 0
7	0 1 1 1
8	1 0 0 0
9	1 0 0 1
:	1 0 1 0
;	1 0 1 1
<	1 1 0 0
=	1 1 0 1
>	1 1 1 0
?	1 1 1 1

See Appendix B, section 2, for a list of output pins controlled as a function of character number and bit number.

Command	Description
D	The Delay command causes the 53A-307 Card to delay approximately 1 ms before accepting the next command. This command lets the user program the relays controlled by the 53A-307 Card to be either "make-before-break" or "break-before-make". Example: The command sequence "@04C7LDDD08L" closes relay 7, waits 3 ms, and then opens relay 8, that is, make-before-break. The Power LED is out.
R	The Reset command opens all relays. Example: The command sequence "@04R" opens all the relays, that is, all outputs are not conducting current, and all unit LEDs are out. This example assumes that the 53A-307 Card is at address 4 in mainframe 0.

INSTALLATION

The 53A-307 Card is a function card; therefore, it may be plugged into any blue card slot. Setting the Address Select switch defines the card's programming address. To avoid confusion, it is recommended that the slot number and the programming address be the same.

CAUTION:
To avoid plugging the card in backwards, observe the following:

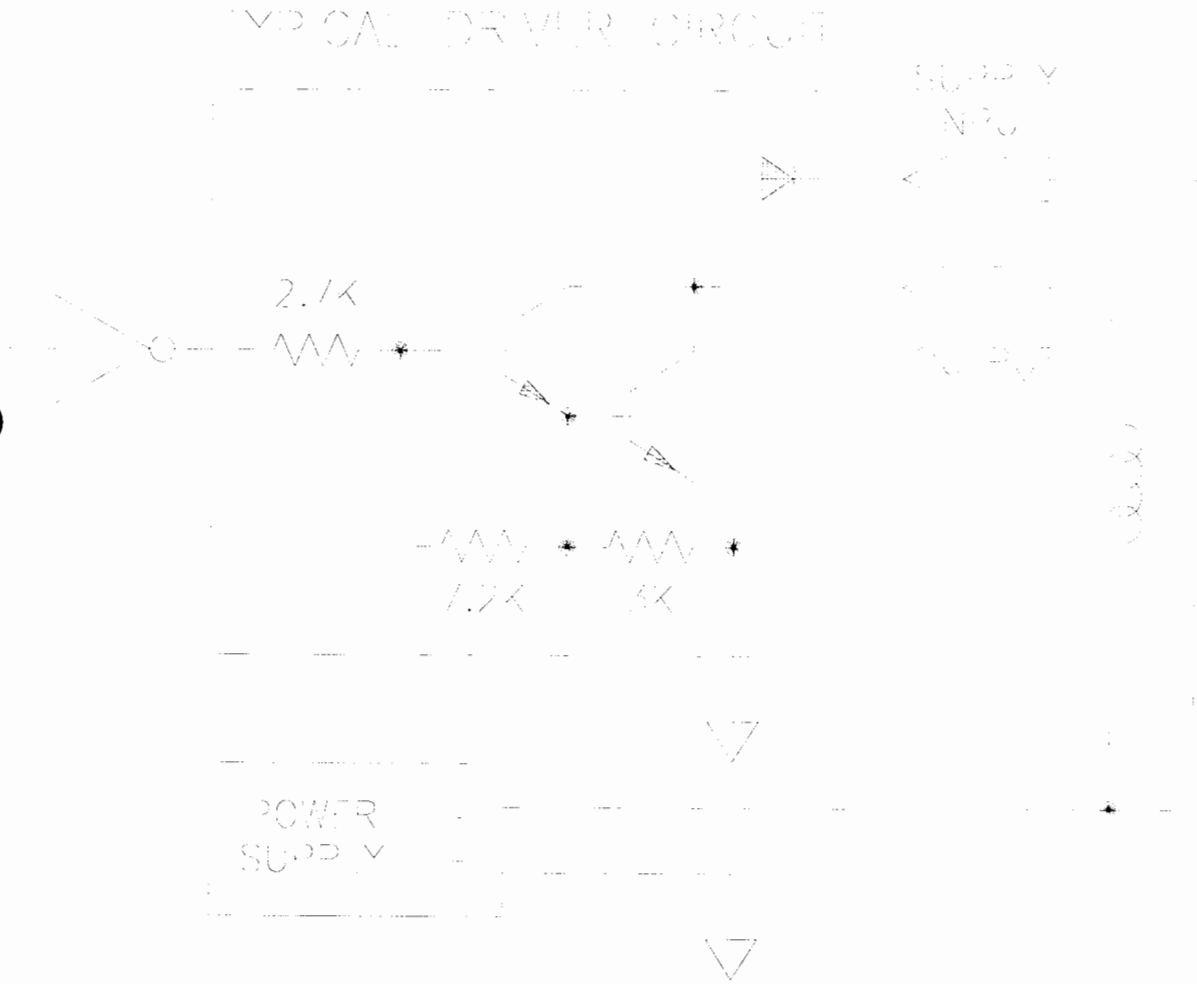
a. Match the keyed slot on the card to the key in the backplane connector. The component side should be to the right for a 53 Series Chassis and to the top for a 63 Series Chassis.

b. There are two ejectors on the card. Make sure the ejector marked "53A-307" is at the top for a 53 Series Chassis and to the left for a 63 Series Chassis.

CAUTION:
The 53A-307 Card is a piece of electronic equipment and therefore has some susceptibility to electrostatic damage (ESD). ESD precautions must be taken whenever the module is handled.

Figure I - TYPICAL DRIVER CIRCUIT

CAUTION:
To avoid damage to the 53A-307 Card from inductive voltage spikes created when relays are turned off, the "Supply Input" must be connected to the positive terminal of the external supply that powers the relay coils.



APPENDIX A

53/63 SERIES SYSTEM COMMANDS

Command	Description
@XY	The "@XY" command addresses a function card in the 53/63 Series System. @ is a delimiter used by the 53/63 Series System. X is a card cage address (0-9) defined by the Address-select Switch on the 53A-171 Control Card in the addressed card cage. Y is a function-card address (0-9) defined by the Address-select Switch on the function card. Once a card cage/function-card combination is addressed, it remains addressed until the 53/63 Series System detects a new @ character.
@XH	The @XH (HALT) command is used to halt all function cards within a mainframe. Individual types of function cards will react differently to the @XH command. However, all function cards, if addressed (Power LED - out) will become unaddressed (Power LED - Lit) after the @XH command. The @XH command affects only the function cards in the mainframe defined by "X". The effect of an @XH command on the 53A-307 Card is determined by the card's Halt Switch.
STOP	The STOP command is not a string of ASCII characters. The command is a hard-wired signal from the system controller (calculator or computer) to the 53/63 Series System communications card in each mainframe. When the system controller issues a STOP command, each function card, including the 53A-307 Card, reacts as if it received the "@XH" command described above. How the system controller executes the STOP command depends on the communications card used. With the 53A-128 IEEE-488 Card, for example, a STOP command is executed when the system controller asserts the IEEE-488 bus line IFC (InterFace Clear) true.

APPENDIX B

FRONT EDGE CONNECTOR PIN ASSIGNMENTS

On the following pages, two pin assignment lists are provided. The first defines the output pins as a function of the Open or Close command. The second defines the output pins as a function of the parallel Load command (10 BCD characters followed by an L). The Open or Close commands and the parallel Load may be used interchangeably to control an output pin. The Open or Close command may be correlated to the parallel Load command by the output pin for the two lists. For example, a C28L command is equivalent to setting BCD bit 4 in Z_9 of the parallel Load command since they both set pin 13 low.

1. Output Pin Assignments as Function of Open or Close Command

OUTPUT CONTROL LINES	OUTPUT PINS
0	11
1	10
2	9
3	8
4	7
5	6
6	5
7	4
8	3
9	2
10	M
11	L
12	K
13	J
14	H
15	F
16	E
17	D
18	C
19	B
20	21
21	20
22	19
23	18
24	17
25	16
26	15
27	14
28	13
29	12
30	Y
31	X
32	W
33	V
34	U
35	T
36	S
37	R
38	P
39	N
SUPP. INPUT	A
GROUND RETURN	24,BB

2.Output Pin Assignments as Function of Parallel Load Command

Digit	BCD BIT (See Table I)	Output Pin
Z_{10} (First Character)	1 2 4 8	2 B 12 N
Z_9	1 2 4 8	3 C 13 P
Z_8	1 2 4 8	4 D 14 R
Z_7	1 2 4 8	5 E 15 S
Z_6	1 2 4 8	6 F 16 T
Z_5	1 2 4 8	7 H 17 U
Z_4	1 2 4 8	8 J 18 V
Z_3	1 2 4 8	9 K 19 W
Z_2	1 2 4 8	10 L 20 X
Z_1 (First Character)	1 2 4 8	11 M 21 Y
Supp. Input Ground Return		A 24,BB

APPENDIX C

LED ASSIGNMENTS

Range LEDs

0
10
20
30

Units LEDs

0
1
2
3
4
5
6
7
8
9

Example: If Range LED 10 and Units LEDs 6 and 9 are lit, then the transistors connected to output bit 16 and 19 are conducting, and the transistors connected to output bits 10, 11, 12, 13, 14, 15, 17, and 18 are not conducting.

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53A-307 RELAY DRIVER CARD

DESCRIPTION

The 53A-307 Relay Driver Card is a printed circuit board assembly for use in a CDSbus 53/63 Series system. The 53A-307 Card enables the 53/63 Series System to control up to 40 independent external relays. The external relays may be randomly opened or closed by transmitting ASCII characters from the system controller to the 53/63 Series System. Diagnostics are provided by LED indicators on the card.

The control output to external relays is through Darlington-pair drivers that can sink up to 100 mA per output. The external voltage to be switched is supplied by the user and may range from 1V DC to 50V DC. The 40 output lines have built-in transient suppression diodes.

CONTROLS AND INDICATORS

The following controls and indicators are provided to select and display the functions of the 53A-307 Card's operating environment.

Address-Select Switch

The 53A-307 Card has a miniature 10-position switch labeled "ADDRESS" that selects the 53A-307 Card's address (0-9) in the 53/63 Series System. The switch's cover opens to allow the address to be reselected. A screwdriver with a narrow, flat blade should be used to turn the cam-action wiper to the desired address position.

Power LED

The Power LED provides a valuable diagnostic tool by giving the system programmer a visual indication of the action which the system is currently taking. Whenever the 53A-307 Card is addressed by the system controller, the Power LED goes out. The LED remains out until another function card is addressed. Since only one function card can be addressed at a time, an unlit Power LED indicates the function card with which the system controller is currently communicating. The Power LED being lit not only indicates that the 53A-307 Card is unaddressed, but that all required dc power (5V dc, "15V dc) is being supplied.

Fuse

The 5V DC power bus has a fuse that protects the system from overloads. If the fuse has blown, the Power LED will not light.

Function LEDS and Switches

LEDs

The following LEDs are provided at the top front edge of the 53A-307 Card to indicate the status of the card's operation:

Range LEDs (0, 10, 20, 30)
One of the four Range LEDs lights to display the range of the Units LEDs. The Range LEDs step each time the Step Switch is depressed.

Units LEDs (0-9)
The Range and Units LEDs together display the state of any output control line.

Example:

The output control lines are numbered 0 through 39. To view the state of line 27, depress the Step switch until Range LED 20 is lit. Now the Units LEDs are displaying lines 20 through 29. If Units LED 7 is lit, this indicates that line 27 is low and conducting current, that is, the coil of the external relay connected to line 27 is energized.

Switches

The following switches are provided to select the proper functions for the 53A-307 Card's operating environment:

Halt Switch

This two-position slide switch is located near the card's backplane edge connector. It selects the state of the 53A-307 Card after an @XH (Halt) or STOP command is received by the 53/63 Series System.

a. In position "Z" (or "C2"), all output bits are set to the "open" state, that is, not conducting current.

b. In position "H" (or "C1"), all output bits hold their present state after a "@XH" command or STOP command is received.

Step Switch

The Step switch is a push button switch located at the bottom front edge of the 53A-307 Card. The programmer can view the state of any output control line (0-39) by stepping through the four decades (0, 10, 20, 30) using the Step switch.

SPECIFICATIONS

Relay Drivers

Capacity:	40 open-collector transistor switches.
Each Transistor Collector-Emitter Saturation Voltage:	1.1V max. at I_c = 100mA.
Max Collector Current (I_c):	100mA.
Collector-Emitter Break-down Voltage:	50V.
*Turn-on Delay:	1Ts max.
*Turn-off Delay:	1Ts max.
	* From the time the L command is received until transistor turns on or off.
Output Driver:	Sprague ULN-2803A. (See Figure I).

Power Requirements:	5V dc power is provided by the internal Power Supply in the 53/63 Series Card Cage.
Voltage:	4.75V to 5.25V DC.
Current:	1.59A maximum, quiescent. 1.65A peak.

NOTE: The power to be switched on and off to the relays is supplied externally by the user.

Cooling:	Provided by the fan in the 53/63 Card Cage.
Temperature:	-10EC to +65EC, operating (assumes ambient temperature of 55E and airflow to assure less than 10EC temperature rise). -40EC to +85EC, storage.
Humidity:	Less than 95% R.H. non-condensing, -10EC to +30EC. Less than 75% R.H. non-condensing, +31EC to +40EC. Less than 45% R.H. non-condensing, +41EC to +55EC.
Dimensions:	197 mm high, 220 mm deep, 13 mm wide. (7.75" x 8.66" x 0.5")
Dimensions, Shipping:	When ordered with a 53/63 Card Cage, the card is installed in one of the card cage's function-card slots. When ordered alone, the shipping dimensions are: 254 mm x 254 mm x 127 mm (10" x 10" x 5")
Weight:	0.23 kg (0.5 lbs)
Weight, Shipping:	When ordered with a 53/63 Card Cage, the card is installed in one of the card cage's function-card slots. When ordered alone, the shipping weight is: 0.64 kg (1.4 lbs)
Mounting Position:	Any orientation.
Mounting Location:	Installs in any function-card slot of the 53/63 Card Cage.
Required Equipment (not supplied):	53A-780 Hooded Connector or 53A-742 Cable.
Equipment Supplied:	53A-307 Relay Driver Card Operating Manual (Part# 00000-13070) Service Manual (Part# 00000-23070)

OPERATION

Overview

The 53A-307 Card is programmed by ASCII character commands sent from the system controller to the 53/63 Series System communications card. The 53A-307 Card interfaces to the communications card through the 53A-002/63A-012 Card Cage backplane.

To address a function card for the first time, the system command "@XY" must be issued. "X" is the mainframe address (0-9) selected on the 53A-171 Control Card for that mainframe; "Y" is the card address (0-9) within that mainframe. The 53A-307 Card address is selected using the card's Address Select Switch. Once a function card is addressed, it remains addressed until the system receives another "@" character. Appendix A fully discusses the "@XY" command and the other 53/63 Series System commands. After the 53A-307 Card is addressed, the following commands may be issued until another function card is addressed.

Command	Description
C or O	The Open and Close commands allow the system controller to open (O) or close (C) an external relay connected to an individual control line. Closed - Conducting current (active low), Units LED lit. Open - Not conducting current. Syntax: CZ_1Z_2L or OZ_1Z_2L Z_1Z_2 represents a decimal number (0 to 39), which is the control line to be open or closed. The output pin controlled as a function of Z_1Z_2 is defined in Appendix B. The state of the control line is updated when the L (load) character is received by the card. Example: The command sequence "@04C1LC30L09L" closes relay 1 and 30, and opens relay 9. In this example, it is assumed that the 53A-307 Card has address 4 and is in mainframe 0. The Power LED is out.
L	The parallel Load command randomly opens or closes all relays controlled by the 53A-307 Card simultaneously. Syntax: Z_{10}. . .Z_1L

The "Z_{10}. . .Z_1" characters represent ten ASCII characters sent by the system controller to control all forty outputs simultaneously. Each of the ten characters controls 4 of the forty outputs with one of 16 ASCII character values. (See Table I and Appendix B, section 2). When the parallel Load command is used, all 10 characters must be output.

The "L" in the command sequence simultaneously loads the data to all forty output lines.

Once this command is issued, the system controller is free to address other function cards.

Example:
The command sequence "@049?76543210L" causes the 53A-307 Card to parallel-load the outputs with 9?76543210. To understand what relay output drivers are turned on or off by this command, refer to Table I and section 2 of Appendix B: For example, the character "9", position Z_{10}, causes the output transistors connected to output control line numbers 39 and 9 to conduct current; the character "?", position Z_9, causes the transistor connected to output control line numbers 8, 18, 28 and 38 to conduct current, and so on. The Power LED is out.

The above example assumes that the 53A-307 Card is at address 4 in mainframe 0.

Table I

Parallel Load ASCII Character Definition

ASCII Output (from system controller)	Relay Driver Card Output (to data receptor) BCD Bit Position
	8 4 2 1
0	0 0 0 0
1	0 0 0 1
2	0 0 1 0
3	0 0 1 1
4	0 1 0 0
5	0 1 0 1
6	0 1 1 0
7	0 1 1 1
8	1 0 0 0
9	1 0 0 1
:	1 0 1 0
;	1 0 1 1
<	1 1 0 0
=	1 1 0 1
>	1 1 1 0
?	1 1 1 1

See Appendix B, section 2, for a list of output pins controlled as a function of character number and bit number.

Command	Description
D	The Delay command causes the 53A-307 Card to delay approximately 1 ms before accepting the next command. This command lets the user program the relays controlled by the 53A-307 Card to be either "make-before-break" or "break-before-make". Example: The command sequence "@04C7LDDD08L" closes relay 7, waits 3 ms, and then opens relay 8, that is, make-before-break. The Power LED is out.
R	The Reset command opens all relays. Example: The command sequence "@04R" opens all the relays, that is, all outputs are not conducting current, and all unit LEDs are out. This example assumes that the 53A-307 Card is at address 4 in mainframe 0.

INSTALLATION

The 53A-307 Card is a function card; therefore, it may be plugged into any blue card slot. Setting the Address Select switch defines the card's programming address. To avoid confusion, it is recommended that the slot number and the programming address be the same.

CAUTION:
To avoid plugging the card in backwards, observe the following:

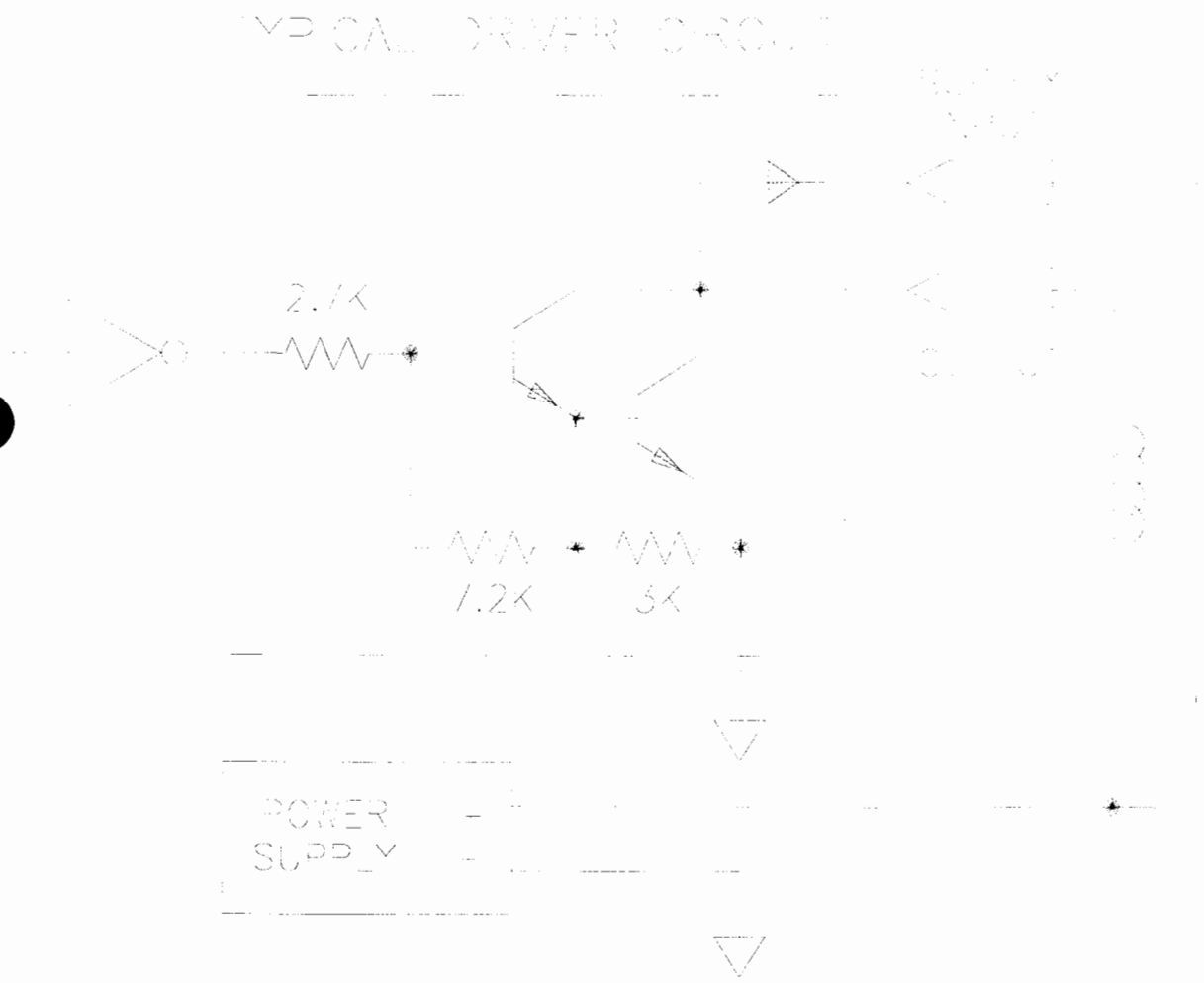
a. Match the keyed slot on the card to the key in the backplane connector. The component side should be to the right for a 53 Series Chassis and to the top for a 63 Series Chassis.

b. There are two ejectors on the card. Make sure the ejector marked "53A-307" is at the top for a 53 Series Chassis and to the left for a 63 Series Chassis.

CAUTION:
The 53A-307 Card is a piece of electronic equipment and therefore has some susceptibility to electrostatic damage (ESD). ESD precautions must be taken whenever the module is handled.

Figure I - TYPICAL DRIVER CIRCUIT

CAUTION:
To avoid damage to the 53A-307 Card from inductive voltage spikes created when relays are turned off, the "Supply Input" must be connected to the positive terminal of the external supply that powers the relay coils.



APPENDIX A

53/63 SERIES SYSTEM COMMANDS

Command	Description
@XY	The "@XY" command addresses a function card in the 53/63 Series System. @ is a delimiter used by the 53/63 Series System. X is a card cage address (0-9) defined by the Address-select Switch on the 53A-171 Control Card in the addressed card cage. Y is a function-card address (0-9) defined by the Address-select Switch on the function card. Once a card cage/function-card combination is addressed, it remains addressed until the 53/63 Series System detects a new @ character.
@XH	The @XH (HALT) command is used to halt all function cards within a mainframe. Individual types of function cards will react differently to the @XH command. However, all function cards, if addressed (Power LED - out) will become unaddressed (Power LED - Lit) after the @XH command. The @XH command affects only the function cards in the mainframe defined by "X". The effect of an @XH command on the 53A-307 Card is determined by the card's Halt Switch.
STOP	The STOP command is not a string of ASCII characters. The command is a hard-wired signal from the system controller (calculator or computer) to the 53/63 Series System communications card in each mainframe. When the system controller issues a STOP command, each function card, including the 53A-307 Card, reacts as if it received the "@XH" command described above. How the system controller executes the STOP command depends on the communications card used. With the 53A-128 IEEE-488 Card, for example, a STOP command is executed when the system controller asserts the IEEE-488 bus line IFC (InterFace Clear) true.

APPENDIX B

FRONT EDGE CONNECTOR PIN ASSIGNMENTS

On the following pages, two pin assignment lists are provided. The first defines the output pins as a function of the Open or Close command. The second defines the output pins as a function of the parallel Load command (10 BCD characters followed by an L). The Open or Close commands and the parallel Load may be used interchangeably to control an output pin. The Open or Close command may be correlated to the parallel Load command by the output pin for the two lists. For example, a C28L command is equivalent to setting BCD bit 4 in Z_9 of the parallel Load command since they both set pin 13 low.

1. Output Pin Assignments as Function of Open or Close Command

OUTPUT CONTROL LINES	OUTPUT PINS
0	11
1	10
2	9
3	8
4	7
5	6
6	5
7	4
8	3
9	2
10	M
11	L
12	K
13	J
14	H
15	F
16	E
17	D
18	C
19	B
20	21
21	20
22	19
23	18
24	17
25	16
26	15
27	14
28	13
29	12
30	Y
31	X
32	W
33	V
34	U
35	T
36	S
37	R
38	P
39	N
SUPP. INPUT	A
GROUND RETURN	24,BB

2.Output Pin Assignments as Function of Parallel Load Command

Digit	BCD BIT (See Table I)	Output Pin
Z_{10} (First Character)	1 2 4 8	2 B 12 N
Z_9	1 2 4 8	3 C 13 P
Z_8	1 2 4 8	4 D 14 R
Z_7	1 2 4 8	5 E 15 S
Z_6	1 2 4 8	6 F 16 T
Z_5	1 2 4 8	7 H 17 U
Z_4	1 2 4 8	8 J 18 V
Z_3	1 2 4 8	9 K 19 W
Z_2	1 2 4 8	10 L 20 X
Z_1 (First Character)	1 2 4 8	11 M 21 Y
Supp. Input Ground Return		A 24,BB

APPENDIX C

LED ASSIGNMENTS

Range LEDs

0
10
20
30

Units LEDs

0
1
2
3
4
5
6
7
8
9

Example: If Range LED 10 and Units LEDs 6 and 9 are lit, then the transistors connected to output bit 16 and 19 are conducting, and the transistors connected to output bits 10, 11, 12, 13, 14, 15, 17, and 18 are not conducting.

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