53A-353 RELAY SWITCHING CARD

OPERATING MANUAL

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DESCRIPTION

The 53A-353 Relay Switching Card is a printed circuit board assembly for use in a CDS 53/63 Series System. The card provides 24 independently controlled single pole, single throw relays that can sustain 100 operations per second while providing a dwell time of at least 4 ms. All relays are randomly opened or closed by transmitting ASCII characters from the system controller to the 53/63 Series card cage.

Diagnostics include LED indicators and a self test feature that allows the user to interrogate individual channels under software control to determine if they are open or closed. The self test uses a second pole on each relay so that not only the relay drive circuitry but also the relay is tested.

CONTROLS AND INDICATORS

The following controls and indicators are provided to select and display the functions of the 53A-353 Card's operating environment.

Address-Select Switch

The 53A-353 Card has a miniature 10-position switch labeled "ADDRESS" that selects the 53A-353 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-353 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-353 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

Relay LEDs

The column of 24 LEDs represent relays 00 through 23 from top to bottom. A lit LED indicates that the associated relay is closed.

Halt Switch

This two-position slide switch is located near the card's backplane edge connector. It selects the state of the 53A-353 Card after an @XH (Halt) or STOP command is received by the 53/63 Series System.

a. In position C2 the relays reset to their open state after an @XH command or STOP command is received.

b. In position C1 the relays hold their present output setting after an @XH command or STOP command is received.

Delay Enable Switch

The Delay Enable switch is a two-position slide switch, located above the Halt Switch near the relays, that delays any commands from the system controller following an O or C command to the card. The purpose of this switch is to allow the user to break-before-make on relay closures, or to insure relay closure or opening before subsequent commands are sent by the system controller to other equipment. The amount of delay depends on the setting of the Delay Value switch. Operation for the two switch settings is as follows:

Switch Position	Operation
ON	Delay Enabled
OFF	Delay Disabled

Delay Value Switch

The Delay Value switch, a two-position slide switch below the fuse near the rear connector, changes the delay value between 10 ms and 50 ms. This delay operates when the Delay Enable Switch is enabled. The purpose of this switch is to slow the maximum operating speed of the card to 20 operations a second for improved relay reliability in higher current-switching applications (see Specifications section). Operation for the two switch settings is as follows:

Switch Position	Operation
ON	50-ms delay (when Delay Enable switch is enabled).
OFF	10-ms delay (when Delay Enable switch is enabled).

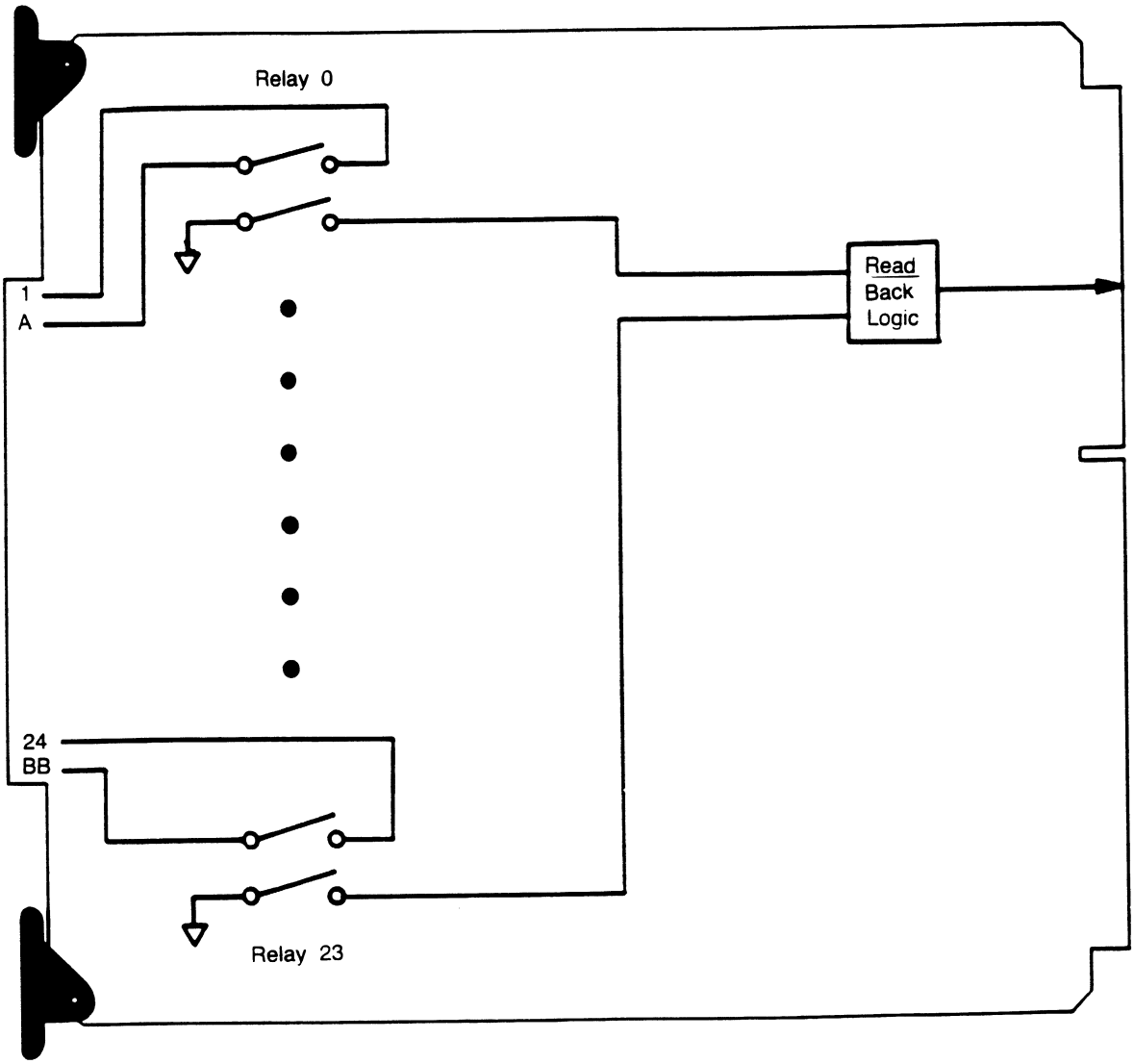

Figure 353-1: 53A-353 Controls and Indicators

SPECIFICATIONS

Configuration: 24 SPST relays.

Relay Manufacturer: Aromat Corporation
Model: S2EB-5V (per CDS specification).

Contact Ratings: Maximum switching power: 1000VA AC, 192W DC.
Maximum switching voltage: 250V AC, 48V DC.
Maximum switching current: 4A (<20 OPM)

Maximum Operating Speeds: Switch-selectable for 20 OPS and 100 OPS. The required delays for 40 OPM must be handled in software.

Recommended Maximum Operating Conditions and Operational Life:

Operating Speed	40 OPM	20 OPS	100 OPS
Switching Voltage, DC	30V	30V	1.0V
Switching Current, DC	3.0A	2.0A	1.0mA
Switching Voltage, AC	250V	250V	- -
Switching Current, AC	4A	0.5A	- -
Operational Life	10^5	10^6	10^6

NOTE: OPS - operations per second
OPM - operations per minute
An operation is defined as a close or open.
A close/open cycle is two operations.

Duty Cycle: Continuous.

Dwell: Dwell time at maximum switching rate is 4ms minimum.

Signal Path Specifications: Single-line thermal offset: less than 10 microvolts.
Initial Signal path resistance: less than 300 milliohms.
Signal path resistance at end of full load life: less than 350 milliohms.
Insulation resistance: greater than 10 gigohms between all insulated parts.

Crosstalk Between Relays:

1 kHz	Less than -95dB
10 kHz	Less than -68dB
100 kHz	Less than -48dB
1 MHz	Less than -30dB

Measurement was made on a closed relay with a 600-ohm termination and signal applied into an adjacent channel,

	open or closed relay, with and without 600-ohm termination.
Power Up:	When power is turned on, the 53A-353 Card goes to the following known states: Card unaddressed (Power LED - lit). All relays open (Relay LEDs - out).
Power Down:	When power is turned off, the card goes to the following known states: All relays open.
Power Requirements:	All required dc power is provided by the internal Power Supply in the 53/63 Series Card Cage.
Voltage:	4.75V to 5.25V DC.
Current:	0.45 A, maximum quiescent (all relays open) 1.45 A, peak (all relays closed).
Cooling:	Provided by the fan in the 53/63 Card Cage.
Temperature:	-10 °C to +65 °C, operating (assumes ambient temperature of 55 ° and airflow to assure less than 10 °C temperature rise). -40 °C to +85 °C, storage.
Humidity:	Less than 95% R.H. noncondensing, -10 °C to +30 °C. Less than 75% R.H. non-condensing, +31 °C to +40 °C. Less than 45% R.H. non-condensing, +41 °C to +55 °C.
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:	0.4 kg. (0.9 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: 0.8 kg. (1.8 lbs.)
Mounting Position:	Any orientation.
Mounting Location:	Installs in any function card slot of the 53/63 Card Cage.

Relay Connection:	A 48-pin printed circuit type hooded connector (53A-780), provides a connection for all relays.
Required Equipment (Not Supplied):	A 53A-780 Hooded Connector or 53A-727 Analog Cable is required with this card.
Equipment Supplied:	53A-353 Relay Switching Card Spare Fuse (Part #42202-52001) Operating Manual (Part #00000-13530) Service Manual (Part #00000-23530)

OPERATION

The 53A-353 Relay Switching Card is programmed by ASCII characters issued from the system controller to the 53/63 System's communications card. The 53A-353 Card is interfaced to the communications card through the 53 Series or 63 Series Card Cage's backplane.

To address a function card for the first time, the system command @XY must be issued. X is the card cage address (0-9) selected on the 53A-171 Control Card in the addressed card cage; Y is the 53A-353 Card's address (0-9) within the addressed card cage. The 53A-353 Card's 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-353 Card is addressed, the commands listed below may be issued until another function card is addressed.

Command	Description
R	This command RESETs (open) all relays on the 53A-353 card. Example: The command @05R opens all relays on the 53A-353 Card with address 5 in the mainframe with address 0. Status: Power LED - out. Relay LEDs - all out.
C	This command CLOSEs a single relay on the 53A-353 Card. Syntax: CZ_1Z_2 The C in the command sequence instructs the card to close a single relay defined by Z_1Z_2. Z_1Z_2 represents the relay number (00-23) to be closed by the C command. Example: Assume all relays initially open. The command @05C04 closes relay 4 of the 53A-353 Card with address 5 in the mainframe with address 0. Status: Power LED - out. Relay LEDs- #4 lit, all others out.
O	This command OPENs a single relay on the 53A-353 Card. Syntax: OZ_1Z_2 The O in the command sequence instructs the card to open a single relay defined by Z_1Z_2.

Z_1Z_2 represents the relay number (00-23) to be opened by the O command.

Example:
Assume relays 4 and 5 are closed and all others open. The command @05O04 opens relay 4 on the 53A-353 Card with address 5 in the mainframe with address 0.

Status:
Power LED - out.
Relay LEDs - #5 lit, all others out.

Example:
Assume all relays are initially open. The command @05C00C01C02C03C04O03 closes Relays 0, 1, 2, 3, 4 and then opens relay 3. Notice that it is only necessary to address the 53A-353 Card once.

Status:
Power LED - out.
Relay LEDs - #'s 0, 1, 2, 4 lit, all others out.

Q

The QUERY command allows the user to interrogate the 53A-353 Card to determine if a particular relay is closed or open.

Syntax: QZ_1Z_2

The Z_1Z_2 characters (00-23) specify the relay number to be interrogated. After issuing the QUERY command sequence, the system controller should next request input from the 53/63 System. The 53A-353 Card then returns a single ASCII character (0 or 1) followed by carriage-return and line-feed <CR><LF> characters. A "1" is returned if the interrogated relay is closed and a "0" if the relay is open.

The QUERY command is not required for status if the last command was an O or C command to the desired relay. The system controller may request input following the O or C command and the status for that relay is returned as described for the Q command.

Example:
Assume that relay 2 is closed and all other relays are open. The command sequence @05Q02 followed by the controller requesting input causes the ASCII character "1" followed by carriage-return and line-feed <CR/LF> to be sent from the 53A-353 Card to the system controller because relay 2 is closed. If the command sequence @05Q04 is issued, an ASCII "0" followed by carriage-return and line-feed <CR><LF> characters are returned because relay 4 is open.

INSTALLATION

The 53A-353 Card is a function card; therefore, it may be installed in 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-353" is at the top for a 53 Series Chassis and to the left for a 63 Series Chassis.

CAUTION:

The 53A-353 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.

APPENDIX A

53/63 SERIES SYSTEM COMMANDS

Command	Description

@XY The @XY (Address) 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 halts all function cards within the card cage defined by X. This command does not affect function cards in other card cages. How a function card reacts to the @XH command depends on the particular card. In all cases, an addressed function card (Power LED out) becomes unaddressed (Power LED lit).

On the 53A-353 Card, the position of the Halt switch causes the @XH command to have the following effect: If the Halt switch is in position C2, the 53A-353 Card resets to its power-up state; if the Halt switch is in position C1, the 53A-353 Card is simply unaddressed.

STOP The STOP command is not a string of ASCII characters. The command is hard-wired from the system controller to the 53/63 System's communications card in each card cage. When the system controller issues a STOP command, each function card, including the 53A-353 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

INPUT/OUTPUT CONNECTIONS

Relay	Front-Edge Connector Pin Number	
	Wiper	Normally Open Contact
0	A	1
1	2	B
2	C	3
3	D	4
4	E	5
5	F	6
6	H	7
7	J	8
8	K	9
9	L	10
10	M	11
11	N	12
12	P	13
13	R	14
14	S	15
15	T	16
16	U	17
17	V	18
18	W	19
19	X	20
20	Y	21
21	Z	22
22	AA	23
23	BB	24

53A-353 WIRE LIST

* Relay Pin: N O = Relay Normally Open contact
W = Relay Wiper

Rel.	Pin #	Relay Pin *	Wire Colors		User Pin #
			53A-727 Cable	User's Cable	
00	1	N O	Black		
	A	W	Brown		
01	2	W	Red		
	B	N O	Orange		
02	3	N O	Yellow		
	C	W	Green		
03	4	N O	Blue		
	D	W	Violet		
04	5	N O	Gray		
	E	W	White		
05	6	N O	White/Black		
	F	W	White/Brown		
06	7	N O	White/Red		
	H	W	White/Orange		
07	8	N O	White/Yellow		
	L	W	White/Green		
08	9	N O	White/Blue		
	K	W	White/Violet		
09	10	N O	White/Gray		
	L	W	White/Black/Brown		
10	11	N O	White/Black/Red		
	M	W	White/Black/Orange		
11	12	N O	White/Black/Green		
	N	W	White/Black/Green		
12	13	N O	White/Black/Blue		
	P	W	White/Black/Violet		

Rel.	Pin #	Relay Pin *	Wire Colors		User Pin #
			53A-727 Cable	User's Cable	
13	14	N O	White/Black/Gray		
	R	W	White/Brown/Red		
14	15	N O	White/Brown/		
	S	W	White/Brown/		
15	16	N O	White/Brown/Green		
	T	W	White/Brown/Blue		
16	17	N O	White/Brown/Violet		
	U	W	White/Brown/Gray		
17	18	N O	White/Red/Orange		
	V	W	White/Red/Yellow		
18	19	N O	White/Red/Green		
	W	W	White/Red/Blue		
19	20	N O	White/Red/Violet		
	X	W	White/Red/Gray		
20	21	N O	White/Orange/Yellow		
	Y	W	White/Orange/Green		
21	22	N O	White/Orange/Blue		
	Z	W	White/Orange/Violet		
22	23	N O	White/Orange/Gray		
	AA	W	White/Yellow/Green		
23	24	N O	White/Yellow/Blue		
	BB	W	White/Yellow/Violet		