53A-355 RELAY SWITCHING CARD

OPERATING MANUAL

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## 53A-355 RELAY SWITCHING CARD

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DESCRIPTION

The 53A-335 (Relay Switching Card) is a printed circuit board assembly for use in a CDS 53/63 Series Card Cage. The card provides ten independently controlled double pole double throw relays which can sustain one hundred switchings per second while providing a minimum dwell time of 4 ms. All relays are randomly opened or closed by transmitting ASCII characters from the system controller to the card cage. Diagnostics are provided by LED indicators.

Four wires of each relay are brought out to the front edge connector. The remaining two relay wire are terminated on the printed circuit card at N.T. (Normally Through) pads which are available to the user. The N.T. pads can be used to terminate a circuit with a load resistor or by placing a wire jumper across a pair of N.T. pads, the relay outputs at the front edge connector can be converted from double pole single throw to single pole double throw.
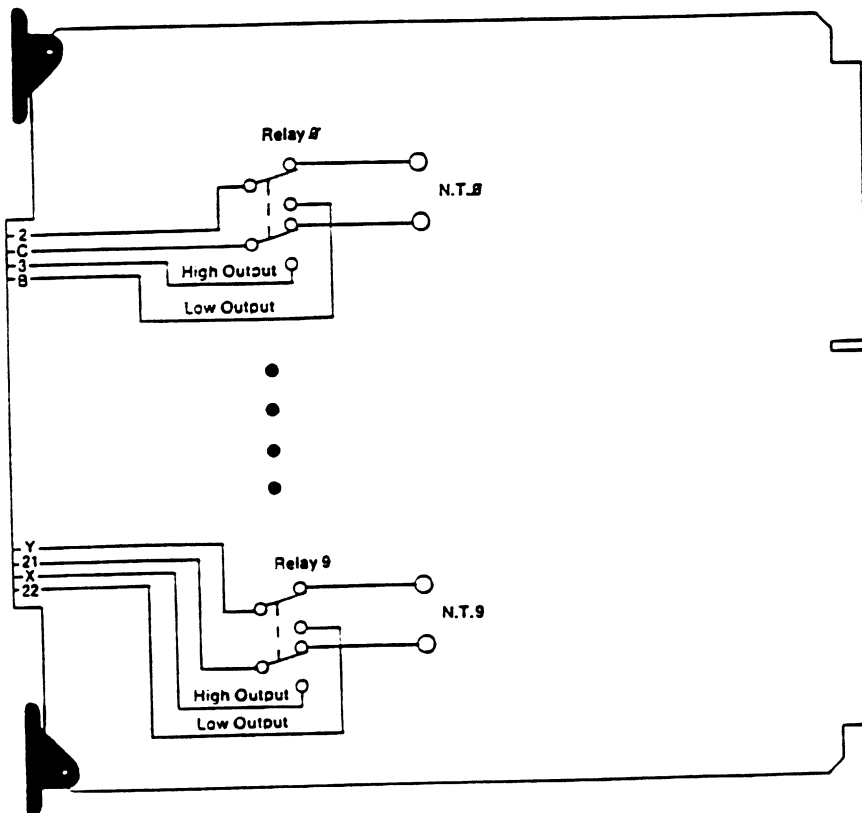
CONTROLS AND INDICATORS

Address Select Switch

The 53A-355 Card has a miniature 10-position switch which selects the 53A-355 Card's address (0-9) in the 53/63 Series System. Open the switch's cover and use a screwdriver with a narrow, flat blade to turn the cam-action wiper to the desired 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-355 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-355 Card is unaddressed, but that all required dc power (5 V dc) is being supplied.

Fuses

There is a 5-volt 2A fuse on the 53A-355 Card. The fuse protects the system from overloads. If the fuse has blown, the Power LED will not light.

Function LEDs And Switches

Relay LEDs
A column of ten LEDs represents relays 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 from top to bottom. A lit LED indicates that the associated relay is closed.

Halt Switch
Near the backplane edge connector is a 1-section rocker switch located below the Address Select Switch that selects the state of the 53A-355 Card after an @XH or STOP command is received by the 53/63 Series System. Appendix A discusses the system level commands @XH and STOP.

a. In position "C1" the relays reset to their open state after an @XH command or STOP command is received.

b. In position "C2" 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 2-position slide switch located to the left of the Address Select Switch that can delay any command from the system controller, following an O or C command to the card. The purpose of this switch is to allow the user to insure break-before-make operation on relay closures, or to insure that the relays are appropriately closed or opened 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. The two switch settings of the Delay Enable Switch are as follows:

Switch Position	Operation
On	Delay enabled
Off	Delay disabled

The Delay Enable Switch is normally placed in the ON position for most applications. The OFF position, delay disabled, should only be used if the test applications program itself provides a delay between commanding a relay to open/close and use of the resultant signal. An individual relay requires approximately 8 ms to open and 5 ms to close, including contact bounce.

Delay Value Switch

The Delay Value Switch is a 2-position slide switch, halfway between the Address Select Switch and the relays that sets the delay value to either 10 ms or 50 ms. This delay occurs only when the Delay Enable Switch is on. The purpose of this switch is to slow the maximum operating speed of the card to 100 operations per second for "break before make" applications or 20 operations per second for improved relay reliability in high-current switching applications (see the Specifications section). The two switch settings are as follows:

Switch Position	Operation
On	50-ms delay (when Delay-Enable Switch is enable)
Off	10-ms delay (when Delay-Enable Switch is enabled)

SPECIFICATIONS

Configuration:	10 Form 2A-2B relays, each configured as DPST relays
Relay Manufacturer:	Aromat Corporation Model: S2EB-5V (per CDS specification).

Contact Ratings

Maximum Switching Power:	1000 VA ac, 192 W dc.
Maximum Switching Voltage:	250 V ac 48 V dc.
Maximum Switching Current:	4 A (< 20 operations per minute)
Maximum Operating Speeds:	Switch-selectable for 20 operations per minute and 100 operations per second. Required delays for 40 operations per minute must be handled in software.

Recommended Maximum
Operating Conditions and
Operational Life

	40 opm	20 ops	100ops
Switching Voltage, dc:	30 V	30 V	1.0 V
Switching Current, dc:	3.0 A	2.0 A	1.0 mA
Switching Voltage, ac:	250 V	250 V	- -
Switching Current, ac:	4 A	0.5 A	- -
Operational Life:	10^6	10^6	10^6

NOTE: An operation is defined as a close or an open. A close/open cycle is two operations.

Duty Cycle:	Continuous.
Dwell:	Dwell time at maximum switching rate (100 ops) is 4 ms, minimum.

Signal-Path Specifications

Single-Line Thermal Offset:	< 8 μV.
Differential Thermal Offset:	< 5 μV.
Initial Signal-Path Resistance:	< 300 milliohm.

<u>Signal-Path Resistance at End of Full Load Life</u>:	< 350 milliohm.
<u>Insulation Resistance</u>:	> 10 gigohm between all insulated parts.
<u>Cross Talk Between Relays</u>:	1 kHz < -95 dB 10 kHz < -75 dB 100 kHz < -57 dB 1 MHz < -40 dB Measurement is made on a closed relay with a 600-ohm termination; and the signal applied into an adjacent channel, open or closed relay, with and without a 600-ohm termination.
<u>Isolation</u>:	1 kHz < -95 dB 10 kHz < -75 dB 100 kHz < -50 dB 1 MHz < -35 dB Measurement is made with signal applied differential to an open relay and measured differential across normally open contacts with a 600 ohm termination.

<u>Power Up</u>:	When power is turned on, the 53A-355 Card goes to the following known state:
	    Card unaddressed (Power LED lit).
	    All relays open (Relay LEDs unlit).

<u>Power Down</u>:	When power is turned off, the card goes to the following known state: All relays open.
<u>Power Requirements</u>:	5-volt dc power is provided by the internal Power Supply in the 53/63 Series Card Cage.
<u>Voltage</u> (<u>5-volt Supply</u>):	4.75 V dc to 5.25 V dc.
<u>Current</u> (<u>5-volt Supply</u>):	0.35 A, maximum quiescent (all relays open). 0.90 A, peak (all relays closed).
<u>Cooling</u>:	Provided by the fan in the 53/63 Series Card Cage.
<u>Temperature</u>:	-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. non-condensing, -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, 221 mm deep, 13 mm wide.
(7.75 in x 8.69 in x 0.5 in).

Dimensions, Shipping: When ordered with a 53/63 Series Card Cage, the card is installed in one of the card cage's function-card slots.

When ordered alone, shipping dimensions are:
254 mm x 254 mm x 127 mm.
(10 in x 10 in x 5 in).

Weight: 0.32 kg. (0.7 lb).

Weight, Shipping: When ordered with a 53/63 Series Card Cage, the card is installed in one of the card cage's function-card slots.

When ordered alone, shipping weight is:
0.73 kg. (1.6 lb).

Mounting Position: Any orientation.

Mounting Location: Plugs into a function-card slot of the 53/63 Series 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-722 Analog Cable is required with this card.

Equipment Supplied:
1 - 53A-355 Relay Switch Card.
1 - Spare fuse (Part # 42202-52001).
1 - Operating Manual (Part # 00000-13550).
1 - Service Manual (Part # 00000-23550).

OPERATION

Overview

The 53A-355 Card is programmed by ASCII characters issued by the system controller to the 53/63 System's communications card. The 53A-355 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 @XY system command 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-355 Card's address (0-9) within the addressed card cage. The 53A-355 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 System commands. After the 53A-355 Card is addressed, the commands listed below may be issued until another function card is addressed.

Summary

An overview of the commands, in alphabetical order, is as follows:

Command	Description	
C	Close -	closes a single relay.
O	Open -	opens a single relay.
R	Reset -	opens all relays.
S	Set -	closes all relays.

Card Commands

Detailed descriptions of the 53A-355 Card's commands, in the same order as listed above, are as follows:

Command	Description

CZ   This command closes a single relay on the 53A-355 Card.

The "C" in the command sequence instructs the card to close a single relay defined by Z.

"Z" represents the relay number (0-9) to be closed by the C command.

Example:
Assume all relays initially open. The command @05C4 closes relay 4 of the 53A-355 Card with address 5 in the card cage with address 0.

Status:
Power LED - out.
Relay LEDs - #4 lit, all others out.

OZ   This command opens a single relay on the 53A-355 Card.

The "O" in the command sequence instructs the card to open a single relay defined by Z.

"Z" represents the relay number (0-9) to be opened by the O command.

Example:
Assume relays 4 and 5 are closed and all others open. The command @05O4 opens relay 4 on the 53A-355 Card with address 5 in the card cage with address 0.

Status:
Power LED - out.
Relays LED s - #5 lit, all other out.

Example:
Assume all relays are initially open. The command @05C0C1C2C3C4O3 closes Relays 0,1,2,3,4 and then opens relay 3. Notice that it is only necessary to address the 53A-355 Card once.

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

R   This command resets (opens) all relays on the 53A-355 Card.

Example:
The command @05R opens all relays on the 53A-355 Card with address 5 in the card cage with address 0.

       Status:
       Power LED - out.
       Relay LEDs - all out.

S   This command sets (closes) all relays on the 53A-355 Card.

Example:
The command @05S closes all relays on the 53A-355 Card with address 5 in the card cage with address 0.

       Status:
       Power LED - out.
       Relay LEDs - all lit.

INSTALLATION

The 53A-355 Card is a function card; therefore, it may be installed in any <u>blue</u> 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 <u>right</u> for a 53 Series Chassis and to the <u>top</u> for a 63 Series Chassis.

      b.   There are two ejectors on the card. Make sure the ejector marked "53A-355" is at the <u>top</u> for a 53 Series Chassis and to the <u>left</u> for a 63 Series Chassis.

CAUTION:
The 53A-355 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-355 Card the position of the Halt Switch causes the @XH command to have the following effect: If the Halt Switch is in Position "C1" the 53A-355 Card resets to its power-up state; if the Halt Switch is in position "C2" the 53A-355 Card is simply unaddressed.

STOP   The STOP command is not a string of ASCII characters. This command is hard-wired from the system controller (calculator or computer) to the 53/63 Series System's communications card in each card cage. When the system controller issues a STOP command, each function card (including the 53A-355 Card) reacts as if it had received the @XH command described above.

How the system controller executes a STOP command depends on the communications card used. For example, when using the 53A-128 IEEE-488 Communications Card, a STOP command is executed whenever the system controller asserts the IEEE-488 bus line IFC (Interface Clear) true.

APPENDIX B

INPUT/OUTPUT CONNECTIONS

I/O = Input/Output   H/L = High/Low

Relay	I/O	H/L	Pin #	Wire Color 53A-722 Cable	User's Cable	Pin
0	I	H	C	Brown of Brown/White		
		L	2	White of Brown/White		
	O	H	3	Red of Red/White		
		L	B	White of Red/White		
1	I	H	E	Orange of Orange/White		
		L	4	White of Orange/White		
	O	H	5	Yellow of Yellow/White		
		L	D	White of Yellow/White		
2	I	H	N	Green of Green/White		
		L	10	White of Green/White		
	O	H	12	Blue of Blue/White		
		L	L	White of Blue/White		
3	I	H	7	Violet of Violet/White		
		L	F	White of Violet/White		
	O	H	H	Gray of Gray/White		
		L	6	White of Gray/White		
4	I	H	9	Brown of Brown/Black		
		L	J	Black of Brown/Black		
	O	H	K	Red of Red/Black		
		L	8	Black of Red/Black		
5	I	H	15	Orange of Orange/Black		
		L	P	Black of Orange/Black		
	O	H	S	Yellow of Yellow/Black		
		L	13	Black of Yellow/Black		
6		H	V	Green of Green/Black		
		L	19	Black of Green/Black		
		H	18	Blue of Blue/Black		
		L	W	Black of Blue/Black		

7	I	H	T	Violet of Violet/Black		
		L	17	Black of Violet/Black		
	O	H	U	Gray of Gray/Black		
		L	16	Black of Gray/Black		
8	I	H	23	Red of Red/Brown		
		L	20	Brown of Red/Brown		
	O	H	AA	Orange of Orange/Brown		
		L	Z	Brown of Orange/Brown		
9	I	H	X	Yellow of Yellow/Brown		
		L	22	Brown of Yellow/Brown		
	O	H	21	Green of Green/Brown		
		L	Y	Brown of Green/Brown		
+5 V			1,A	Black and White Pair		
Ground			24,BB	Blue and Brown Pair		
Ground			24,BB	Shield		