53A-365 MATRIX RELAY BOARD

OPERATING MANUAL

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53A-365 MATRIX RELAY BOARD

OPERATING MANUAL

53A-365 MATRIX RELAY BOARD

DESCRIPTION

The 53A-365 Matrix Relay Board is a printed circuit board assembly for use in a CDS 53/63 Series System. The card provides 32 independently controlled DPDT relays which may be configured as a either two- or four-wire matrix in various combinations. Relays are independently opened or closed by transmitting ASCII characters from the system controller to the 53A-365 Card.

The 53A-365 is one of the most flexible matrix cards available for IAC systems. The matrix is organized as wire pairs, and can be configured as two independent 2 x 8 matrices or one 2 x 16 matrix with the on-board Split Matrix switch. In addition, jumper pads provide the capability to configure the 53A-365 for many two- and four-wire applications (see Installation). A few of the many possibilities are:

Two-wire - 2 each 2x8, 1 each 2x16, or 1 each 4x8
Four-wire - 2 each 1x4, 1 each 1x8, or 1 each 2x4

Front panel connectors provide input and output to the unit under test. The front panel connectors also allow chaining multiple 53A-365 Cards to create larger matrices. Since chaining can occur in either the X or the Y direction, up to 320 cross points are available in a single CDSbus chassis.

The operational status of the card is indicated by LEDs at the front edge of the card. Using the Group and Relay LEDs (as described in the Controls and Indicators section), the status of each cross point (closed or open) can be displayed.

CONTROLS AND INDICATORS

The following controls and indicators are provided to select and display the functions of the 53A-365 Card's operating environment. See Figure 365-1 for their physical locations.

Address Select Switch

The 53A-365 Card has a miniature 10-position switch that selects the 53A-365 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 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-365 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-365 Card is unaddressed, but that all required dc power is being supplied.

Fuses

A single 3 amp fuse on the 5 volt power bus 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-365 Card to indicate the status of the card's operation:

Relay Group LEDs
The first four LEDs in the column represent relay groups J, K, P, and Q. Pressing the Step switch will activate these LEDs one at a time.

Relay LEDs
The next eight LEDs, labeled 0 through 7, represent the eight relays that make up the group. The lit LEDs indicate which relays are closed.

Switches
The following switches are provided to select the proper functions for the 53A-365 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-365 Card after an @XH (Halt) or STOP command is received by the 53/63 Series System.

a. If the Halt switch is in the C1 position, then the 53A-365 Card is reset to its power-up state, all parameters are reset to their default values, and the Power LED is lit.

b. If the Halt switch is in the C2 position, then the 53A-365 Card becomes unaddressed, the Power LED is lit, and any programmed parameters of the card remain unchanged.

Step Switch
This momentary push button switch is located on the front of the card above the connectors. Pressing this switch will step the Relay Group LED readout through the sequence of the four relay groups.

Split Matrix Switch
The relay matrix can be split into two independent matrices of sixteen relays each (two 2-wire 2 x 8 matrices) by setting the dual DPDT switch to the C2/C4 position. In the C1/C3 position the card is configured as a single 32 relay matrix (one 2-wire 4 x 8 matrix). See Figure 365-2 for a block diagram of the Split Matrix switch function.

Delay Switch

This two-position slide switch is located near the top edge of the board. If the Delay switch is ON, a 10 ms delay will occur after each relay opening or closing before the card can accept another command. There is no delay if the switch is OFF.

Matrix Jumpers

There are two 16-pin jumper blocks in the center of the card. When installed, they connect certain input pins together to allow matrices (such as a 2-wire 4 x 8 matrix) to be created.

The location of the jumper blocks is shown in Figure 365-1. Figure 365-2, in Appendix B, shows a high level schematic diagram of the actual relay configuration on the 53A-365. Appendix B also contains descriptions of the switch/jumper settings and input/ output pins to be used for various matrix configurations.

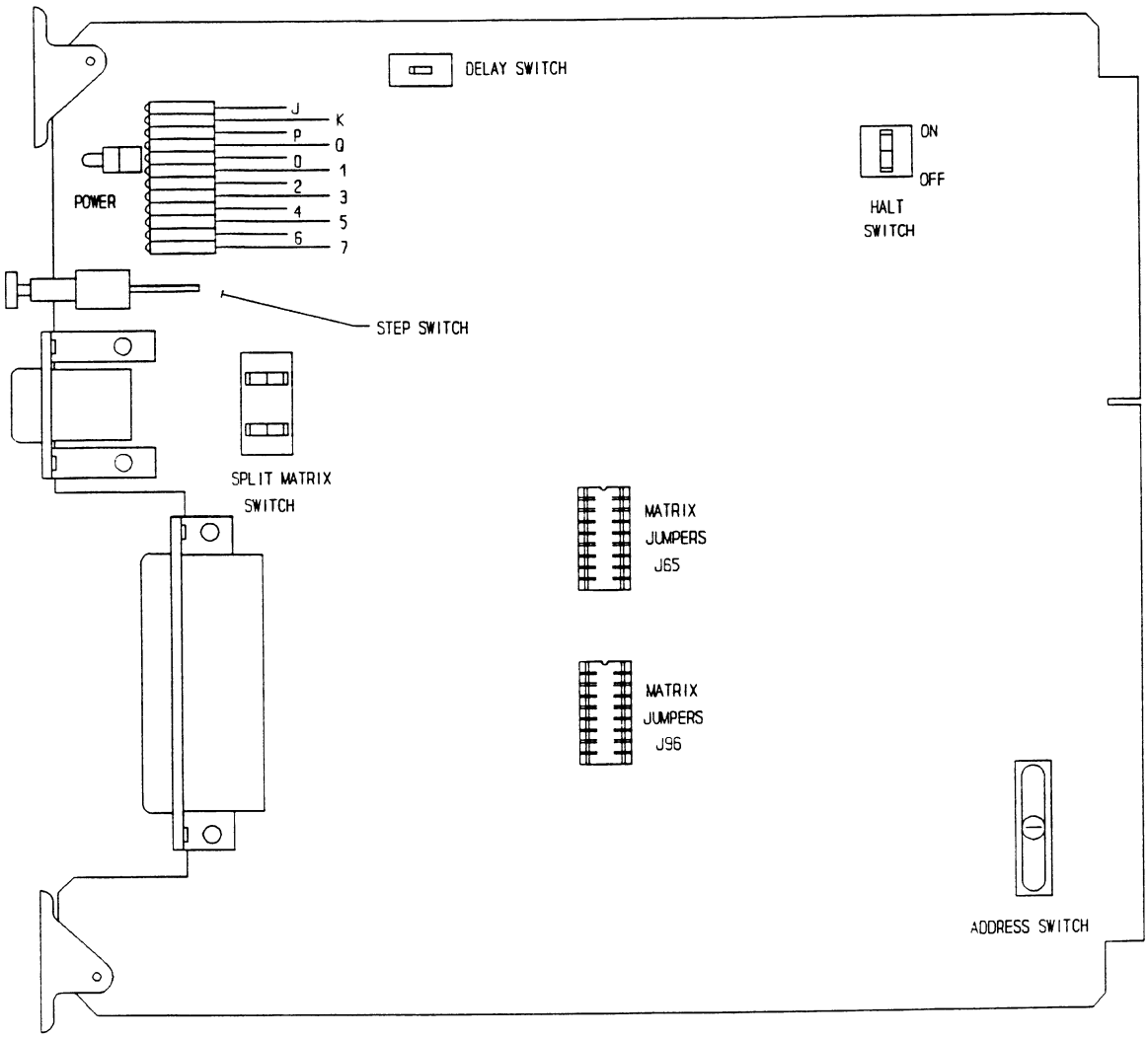

Figure 365-1: 53A-365 Controls and Indicators

SPECIFICATIONS

Relays:	32 each DPDT relays in 4-wire matrix. Relay Manufacturer: Aromat.
Contact Ratings:	Maximum resistive, 2.0 amperes at 28V DC. Maximum resistive, 0.3 amperes at 115V AC 60-400 Hz. Maximum inductive, 200 millihenries, 0.75 amperes at 28V DC. Initial contact resistance, less than 400 milliohms. Contact resistance at end of full load life, less than 400 milliohms.
Sealing:	Hermetic.
Operational Life:	500,000 operations minimum, at maximum rated loads.
Duty:	Continuous.
Switching Rate:	100 relay closures per second, nominal.
Dwell:	Dwell time at maximum switching rate is 4ms minimum.
Signal Path Specifications:	Single-line thermal offset, less than 150 microvolts. Initial Signal path resistance, less than 400 milliohms. Signal path resistance at end of full load life, less than 400 milliohms. Insulation Resistance: greater than ten gigohms between all insulated parts.
Crosstalk Between Relays:	1 KHz less than -91 dB. 10 KHz less than -71 dB. 100 KHz less than -51 dB. 1 MHz less than -32 dB. Measurement made with a signal applied through a closed relay into 600 ohms. Each open relay loaded with 600 ohms at the N.T. terminals with the measuring instrument connected to the open relays.
Power Up:	When power is turned on, the card will go 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 will go to the following known state: All relays open.

Power Requirements:	5V dc power is provided by the internal Power Supply in the 53/63 Series Card Cage.
Voltage (5 Volt Supply):	4.75 V dc to 5.25 V dc.
Current (5 Volt Supply):	2.5 A, maximum quiescent (all relays closed). 2.5 A peak (all relays switching).
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. 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:	197mm wide, 214mm high, 15mm deep (7.75" x 8.40" x 0.6")
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 card's shipping dimensions are: 254 mm x 254 mm x 127 mm. (10 in x 10 in x 5 in).
Weight:	0.41 kg. (0.9 lb).
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 card's shipping weight is: 0.77 kg. (1.7 lb).
Mounting Position:	Any orientation.
Mounting Location:	Installs in any function-card slot of the 53/63 Series Card Cage.
Relay Connection:	A right angle, p.c. mount, female, 50 pin, D connector provides a connection for all relays.
Optional Equipment: (Not Supplied)	1 - 53A-719P 5 meter 50 pin cable. 2 - Jumpers for 4 x 8 matrix (Part # 45020-88136).
Equipment Supplied:	1 - Matrix Relay Board 1 - Spare fuse (Part # 42202-52003). 1 - Users Manual (Part # 00000-13650). 1 - Service Manual (Part # 00000-23650).

OPERATION

Overview

The 53A-365 Card is programmed by ASCII characters issued from the system controller to the 53/63 System's communications card. The 53A-365 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-365 Card's address (0-9) within the addressed card cage. The 53A-365 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-365 Card is addressed, the commands listed below may be issued until another function card is addressed.

Command Summary

An overview of the commands, in the order they typically would be programmed, is as follows:

R Reset (open) all relays on the card addressed.

C Close a single relay on the card addressed.

O Open a single relay on the card addressed.

Detailed descriptions of these commands with examples of how each command is issued are given on the following pages. Appendix C provides a user programming example.

Card Commands

Detailed descriptions of the 53A-365 Card's commands, in the same order as listed above, are as follows:

Command	Description
R	This command Resets (opens) all relays on the card addressed. Syntax: @XYR Example: The command sequence @05R will open all relays on the 53A-365 Card with address 5 located in the card cage with address 0. Status: Power LED - out. Relay LEDs - all out.

Command	Description
C	This command Closes a single relay on the card addressed.

Syntax: @XYCz

z represents the two character address of the relay to be closed by the C command. Since the relays are arranged into four groups of eight relays, the first character is used to select the group. This character may be J, K, P or Q. The second character represents the number (0-7) of the relay to be closed by the C command.

Example:

Assume all relays are initially open. The command @05CJ4 will close relay 4 of group J on the Relay Matrix Card with address 5 located in the card cage with address 0.

Status:

Power LED - out.

Relay LED #4 lit when group J is selected by the Step switch.

Command	Description
O	This command Opens a single relay on the card addressed.

Syntax: Oz

z specifies a single relay (J0 - Q7).

Example:

Assume relays J4 and J5 are closed and all others are open. The command @05OJ4 will open relay 4 of group J on the Relay Matrix Card with address 5 located in the card cage with address 0.

Status: Power LED - out.

Example:

Assume all relays are initially open. The command

@05CJOCJ1CJ2CJ3CJ4OJ3

will close relays J0, J1, J2, J3, J4 and then open relay J3. Note that it was only necessary to address the Relay Matrix Card once.

Status:

Power LED - out.

Relay LEDs 0, 1, 2, and 4 lit when relay group J is selected using the Step switch.

INSTALLATION

The 53A-365 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.

The 53A-365 can be configured in a number of different matrix configurations. Figure 365-2 in Appendix B provides a high level schematic diagram of the actual relay configuration on the 53A-365. Appendix B also contains descriptions of the switch/jumper settings and input/output pins to be used for various matrix configurations.

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-365" is at the top for a 53 Series Chassis and to the left for a 63 Series Chassis.

CAUTION:

The 53A-365 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. On the 53A-365 Card the position of the Halt Switch causes the @XH command to have the following effects: If the Halt Switch is ON, then the 53A-365 Card is reset to its power-up state, all parameters are reset to their default values, and the Power LED is lit. In all cases, an addressed function card (Power LED out) becomes unaddressed (Power LED lit).
STOP	The STOP command is not a string of ASCII characters. This 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-365 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

The first tables in this appendix list the input/output connections and switch/jumper block settings for the most common matrix configurations for the 53A-365. Following these is a block diagram of the on-card relay configuration and a list of individual input/output pins and signal names.

In addition to the main 50-pin front connector, there is a 9-pin connector at the front edge of the card that can be used to connect multiple 53A-365 Cards together to form larger matrices.

Configuration: Two 2-wire 2 x 8 Matrices

Matrix A

Input Channel	50 Pin Connector Pin Number	
0	High	33
	Low	16
1	High	31
	Low	14
2	High	29
	Low	12
3	High	27
	Low	10
4	High	25
	Low	8
5	High	23
	Low	6
6	High	21
	Low	4
7	High	19
	Low	2

Common Output	50 Pin Connector Pin Number	
J	High	34
	Low	35
K	High	36
	Low	37

Matrix B

Input Channel	50 Pin Connector Pin Number	
0	High	32
	Low	15
1	High	30
	Low	13
2	High	28
	Low	11
3	High	26
	Low	9
4	High	24
	Low	7
5	High	22
	Low	5
6	High	20
	Low	3
7	High	18
	Low	1

Common Output	50 Pin Connector Pin Number	
P	High	44
	Low	45
Q	High	46
	Low	47

Split Matrix Switch: position C2/C4

Matrix Jumpers: Both jumper blocks removed.

To connect channel 3 of the A matrix to the K output, use the command CK3 .

Input Channel	50 Pin Connector Pin Number	
0	High	33
	Low	16
1	High	31
	Low	14
2	High	29
	Low	12
3	High	27
	Low	10
4	High	25
	Low	8
5	High	23
	Low	6
6	High	21
	Low	4
7	High	19
	Low	2

Common Output	50 Pin Connector Pin Number	
J	High	34
	Low	35
K	High	36
	Low	37
P	High	44
	Low	45
Q	High	46
	Low	47

Split Matrix Switch: Position C1/C3

Matrix Jumpers: Both jumper blocks installed.

To connect channel 3 to the Q output, use the command CQ3 .

Configuration: One 2-wire 2 x 16 Matrix

Input Channel	50 Pin Connector Pin Number	
0	High	33
	Low	16
1	High	31
	Low	14
2	High	29
	Low	12
3	High	27
	Low	10
4	High	25
	Low	8
5	High	23
	Low	6
6	High	21
	Low	4
7	High	19
	Low	2

Input 32Channel	50 Pin Connector Pin Number	
8	High	32
	Low	15
9	High	30
	Low	13
10	High	28
	Low	11
11	High	26
	Low	9
12	High	24
	Low	7
13	High	22
	Low	5
14	High	20
	Low	3
15	High	18
	Low	1

Common Output	50 Pin Connector Pin Number	
J	High	34
	Low	35
K	High	36
	Low	37

Split Matrix Switch: Position C1/C3

Matrix Jumpers: Both jumper blocks removed.

To connect channels 0 through 7 to the J or K outputs, use the command Z_1J or Z_1K where Z_1 is the channel number (from 0 through 7). To connect channels 8 through 15 to the J output, use the command Z_1P where Z_1 is 'CHANNEL NUMBER minus 8'. That is, 1P to connect channel number 9 to the J output. To connect channels 8 through 15 to the K output, use the command Z_1Q where Z_1 is 'CHANNEL NUMBER minus 8'.

Input Channel	50 Pin Connector Pin Number	
0	High	33
	Low	16
	Guard	32
	Sense	15
1	High	31
	Low	14
	Guard	30
	Sense	13
2	High	29
	Low	12
	Guard	28
	Sense	11
3	High	27
	Low	10
	Guard	26
	Sense	9
4	High	25
	Low	8
	Guard	24
	Sense	7
5	High	23
	Low	6
	Guard	22
	Sense	5
6	High	21
	Low	4
	Guard	20
	Sense	3
7	High	19
	Low	2
	Guard	18
	Sense	1

Common Output	50 Pin Connector Pin Number	
K	High	36
	Low	37
Q	Guard	46
	Sense	47

Split Matrix Switch: Position C2/C4

Matrix Jumpers: Both jumper blocks removed.

To connect channel 3 to the K/Q common outputs, use the command CQ3CK3.

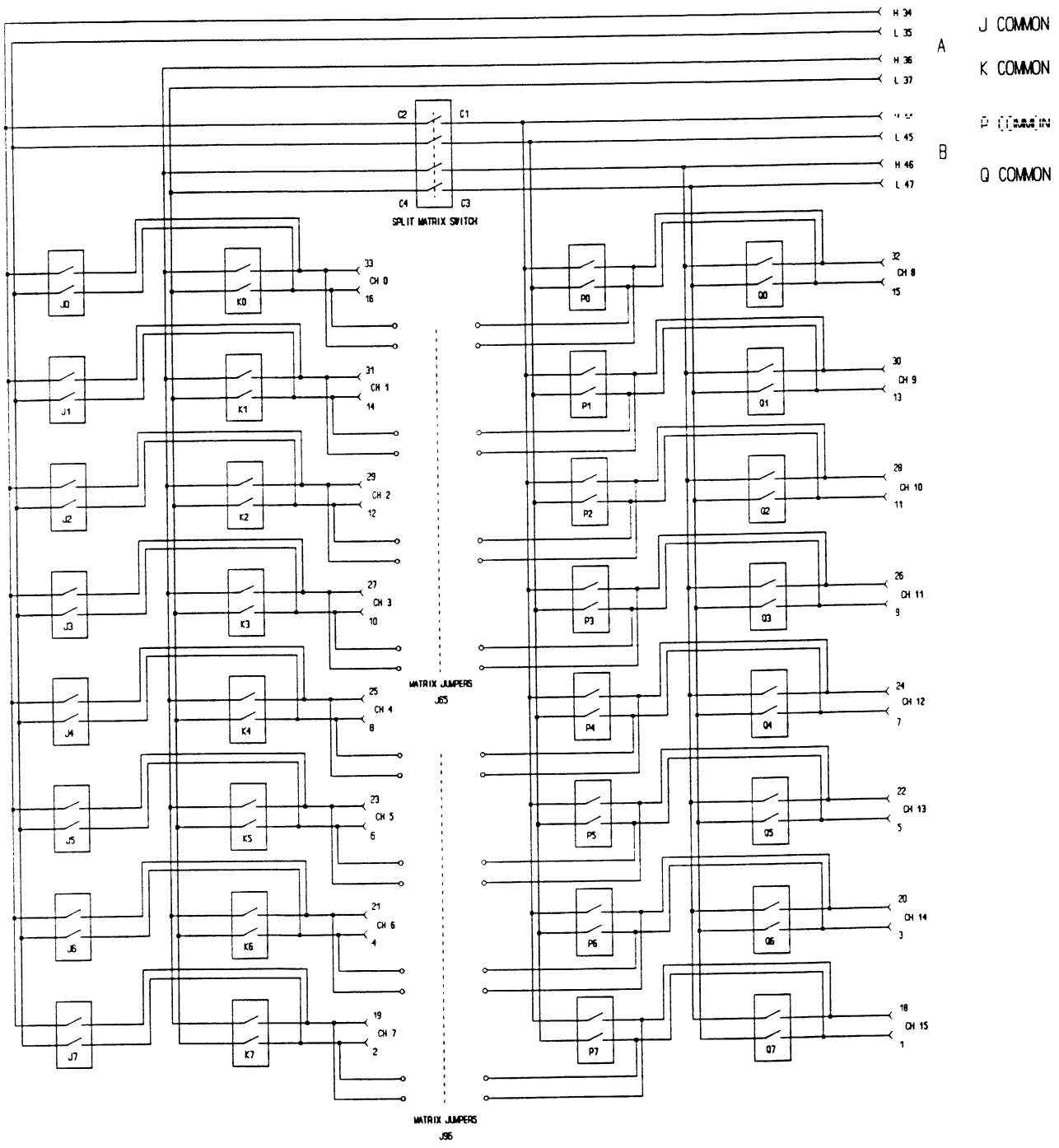

Figure 365-2: 53A-365 Relay Schematic

The Split Matrix switch is shown in the open position (C2/C4). To close both banks of the switch and form a single 4 x 8 matrix, set the switch to position C1/C3.

Pin numbers refer to the front edge 50 pin connector.

50 PIN CONNECTOR

Pin	Signal Name	Pin	Signal Name	Pin	Signal Name
1	CHAN 15 'L/S'	18	CHAN 15 'H/G'	34	J Common 'H'
2	CHAN 7 'L'	19	CHAN 7 'H'	35	J Common 'L'
3	CHAN 14 'L/S'	20	CHAN 14 'H/G'	36	K Common 'H'
4	CHAN 6 'L'	21	CHAN 6 'H'	37	K Common 'L'
5	CHAN 13 'L/S'	22	CHAN 13 'H/G'	38	no connection
6	CHAN 5 'L'	23	CHAN 5 'H'	39	no connection
7	CHAN 12 'L/S'	24	CHAN 12 'H/G'	40	no connection
8	CHAN 4 'L'	25	CHAN 4 'H'	41	no connection
9	CHAN 11 'L/S'	26	CHAN 11 'H/G'	42	no connection
10	CHAN 3 'L'	27	CHAN 3 'H'	43	no connection
11	CHAN 10 'L/S'	28	CHAN 10 'H/G'	44	P Common 'H'
12	CHAN 2 'L'	29	CHAN 2 'H'	45	P Common 'L'
13	CHAN 9 'L/S'	30	CHAN 9 'H/G'	46	Q Common 'H/G'
14	CHAN 1 'L'	31	CHAN 1 'H'	47	Q Common 'L/S'
15	CHAN 8 'L/S'	32	CHAN 8 'H/G'	48	no connection
16	CHAN 0 'L'	33	CHAN 0 'H'	49	no connection
17	no connection			50	GROUND

9 PIN MATRIX BUS CONNECTOR

Pin	Signal Name	Pin	Signal Name
1	Q Common 'L/S'	6	Q Common 'H/G'
2	P Common 'L'	7	P Common 'H'
3	K Common 'L'	8	K Common 'H'
4	J Common 'L'	9	J Common 'H'
5	GROUND		

Channel	50 Pin Connector	Relay	Input
Out 0	33 / 16	J0	High A / Low A
		K0	Guard A / Sense A
Out 1	31 / 14	J1	High A / Low A
		K1	Guard A / Sense A
Out 2	29 / 12	J2	High A / Low A
		K2	Guard A / Sense A
Out 3	27 / 10	J3	High A / Low A
		K3	Guard A / Sense A
Out 4	25 / 8	J4	High A / Low A
		K4	Guard A / Sense A
Out 5	23 / 6	J5	High A / Low A
		K5	Guard A / Sense A
Out 6	21 / 4	J6	High A / Low A
		K6	Guard A / Sense A
Out 7	19 / 2	J7	High A / Low A
		K7	Guard A / Sense A
Out 8	32 / 15	P0	High B / Low B
		Q0	Guard B / Sense B
Out 9	30 / 13	P1	High B / Low B
		Q1	Guard B / Sense B
Out 10	28 / 11	P2	High B / Low B
		Q2	Guard B / Sense B
Out 11	26 / 9	P3	High B / Low B
		Q3	Guard B / Sense B
Out 12	24 / 7	P4	High B / Low B
		Q4	Guard B / Sense B
Out 13	22 / 5	P5	High B / Low B
		Q5	Guard B / Sense B
Out 14	20 / 3	P6	High B / Low B
		Q6	Guard B / Sense B
Out 15	18 / 1	P7	High B / Low B
		Q7	Guard B / Sense B

High A	34	High B	44		
Low A	35	Low B	45		
Guard A	36	Guard B	46		
Sense A	37	Sense B	47	Common	50

APPENDIX C

SAMPLE BASIC PROGRAM FOR THE 53A-365

The sample program below is written in Advanced BASIC (BASICA) for an IBM PC. The PC is connected to the CDS 53/63 Series Card Cage using a 53A-903 Card installed in the PC. The 53A-903 I/O Card provides an IEEE-488 interface between the PC and the CDS Card Cage. The 53A-365 Card has been set to address 1. The address of the 53/63 Card Cage containing the 53A-365 Card is address 1.

IBFIND, IBINIT1, IBINIT2
: These commands load and initialize the software drivers for the 53A-903 card in the PC. The drivers are loaded from the software disk supplied with the 53A-903.

IBSIC
: Resets the IEEE-488 interface, setting the interface IFC line true for 100 microseconds.

IBWRT
: Writes the contents of a string variable to the 53/63 Series Card Cage.

Example:

The following sample program sets up the IEEE-488 interface, resets the 53A-365, and closes four relays. It assumes that the GPIB.COM has been set up using IBCONF.EXE or PCXCONF.EXE, with PCX as the label for the 53A card cage address and GPIB0 as the label for the 53A-903 Card address.

```
10  CLEAR ,&HF600
```
Set top of BASIC's memory making room for BIB.M.

```
20  IBINIT1 = &HF600: IBINIT2 = IBINIT1 + 3

30  BLOAD "BIB.M",IBINIT1
```
Load BIB.M into memory. The next two program lines initialize the call addresses

```
40  CALL  IBINIT1(IBFIND,IBTRG,IBCLR,IBPCT,IBSIC,IBLOC,IBPPC,IBBNA,IBONL,
    IBRSC,IBSRE,IBRSV,IBPAD,IBSAD,IBIST,IBDMA,IBEOS,IBTMO,IBEOT,IBRDF,
    IBWRTF)

50  CALL  IBINIT2(IBGTS,IBCAC,IBWAIT,IBPOKE,IBWRT,IBWRTA,IBCMD,IBCMDA,
    IBRD,IBRDA,IBSTOP,IBRPP,IBRSP,IBDIAG,IBXTRC,IBRDI,IBWRTI,IBRDIA,
    IBWRTIA,IBSTA%,IBERR%,IBCNT%)

60  BD$="GPIB0":CALL IBFIND (BD$,GP0%)
```
Initialize the IEEE-488 board in the PC.

```
70  BD$="PCX":CALL IBFIND (BD$,CAGE%)
```
Initialize the 53A card cage.

```
80   CALL IBSIC(GP0%)
     Reset the IEEE-488 devices.

90   CRLF$ = CHR$(13)+CHR$(10)
     Terminator for the strings to be written.

200  WRT$ = "@11R"+CRLF$
     String to address the board and reset all relays.

210  CALL IBWRT(CAGE%,WRT$)
     Write the string to the 53A card cage.

220  WRT$ = "CJ0CK1CP2CQ3"+CRLF$
     String to close relays J0, K1, P2, and Q3.

230  CALL IBWRT(CAGE%,WRT$)
     Write the string to the 53A card cage.

240  END
```