53A-415 TRI-STATE DISCRETE OUTPUT CARD

OPERATING MANUAL

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DESCRIPTION

The 53A-415 Tri-State Discrete Output Card is a printed circuit board assembly for use in the 53A-002 Card Cage. The card enables the 53A System to control up to forty independent discrete TTL output lines. The output lines may be independently set, high or low, by transmitting ASCII characters from the system controller to the 53A-002 Card Cage. All forty output lines may also be set simultaneously to any random pattern using the parallel load feature. Using either program control or external pulse inputs, the TTL output lines can be switched between active and tri-state modes. (In the tri-state mode, each TTL output assumes a high output impedance and neither sinks nor sources current.)

On-card LEDs indicate the state of each output line (High or Low).

CONTROLS AND INDICATORS

The following controls and indicators are provided to select and display the functions of the 53A-415 Card's operating environment.

Address-Select Switch

The Tri-State Discrete Output Card has a miniature ten-position switch, labeled ADDRESS that selects the 53A-415 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-415 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-415 Card is unaddressed, but that all required dc power (5V dc, ±15V dc) is being supplied.

Fuse

The fuse is on the 5 volt power bus and protects the system from overload conditions. 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-415 Card to indicate the status of the card's operation:

Range LEDs (0, 10, 20, 30)

One of the four Range LEDs will be lit to display the range of the Units' LEDs. The Range LEDs will step each time the Step Switch is depressed.

Units' LEDs (0 through 9)

The Range and Units' LEDs together are used to 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. The Units' LEDs will display Lines 20 through 29. If Units' LED 7 was lit, this would indicate that Line 27 was high.

TS LED

The TS LED will be lit when the TTL output control lines are in the Tri-state Mode (See T Command).

Switches

The following switches are provided to select the proper functions for the 53A-415 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-415 Card after an @XH (Halt) or STOP command is received by the 53/63 Series System.

a. In position C2, all output lines will be set to the "Low" state and the card placed in the Tri-state Mode when a HALT Command or STOP is received.

b. In position C1, all output lines will hold their present state after a HALT Command or STOP has been received. The card's mode (Tri-state or Active) will remain as it was prior to receiving the HALT Command or STOP.

NOTE: If the Active Over-ride input (Pin A) is low, all output lines will remain in the Tri-State Mode irrespective of the setting of the Halt switch when a HALT or STOP Command is received by the 53A System.

Step Switch

The user 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.

Hardware Tri-state Control Lines

The output mode of the card, Tri-state or active, may be controlled using either software commands or hardware inputs. Two hardware input lines are available, Tri-state Set and Tri-state Clear.

To place the card's output lines in the active mode using hardware, the Tri-state Clear input line (front edge connector Pin 23) is pulsed low for a minimum of 50 ns. To place the output

lines in the Tri-State Mode via hardware, the Tri-state Set line (front edge connector Pin 22) is pulsed low for a minimum of 50 ns.

In addition to the hardware tri-state set and clear inputs, a TTL level Active Over-ride input is provided. Whenever the Active Over-ride input (Front edge connector Pin A) is low, all output lines will be in the Tri-state Mode. The Active Over-ride input is pulled-up to 5V with a 3.3K resistor so that the input may be left floating if unused.

The output mode of the card can be controlled using any combination of hardware or software commands, i.e., hardware active mode set, software active mode clear and etc.

SPECIFICATIONS

Output Control Lines:

Capacity: 40 TTL outputs
Output Driver: 74LS241
Max. sink current (I_ol): 24 mA
Max. source current (I_oh): -15 mA

Tri-State Control (On-Off):

Programmable or hardware controllable using external pulse inputs or level input:
 External Pulse inputs - TTL, low true pulse;
 Minimum pulse width - 50 ns;
 Loading - 2 std. TTL loads.

External Level Input - TTL, low true;
Loading - 2 std. TTL loads.

Power Requirements:

Power for the Discrete Output Card is provided by a 53A-060 (5 volt) power supply located in the 53A-002 Card Cage.
Voltage: 4.75V to 5.25V DC.
Current: 1.24 amperes, maximum quiescent.
   1.30 amperes, peak.

Cooling:

Provided by the fan in the 53A-002 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:

0.23 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.)

<u>Mounting Position:</u>	Any orientation.
<u>Mounting Location:</u>	Installs in any function-card slot of the 53A-002 Card Cage.
<u>Required Equipment:</u>	53A-780 Hooded Connector or 53A-742 Data Cable.
<u>Equipment Supplied:</u>	53A-415 Tri-State Discrete Output Card. Spare Fuse (Part #42202-52001) Operating Manual (Part #00000-14150) Service Manual (Part #00000-24150)

OPERATION

The Tri-State Discrete Output Card is programmed by ASCII characters issued from the system controller to the 53/63 System's communications card. The 53A-415 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-415 Card's address (0-9) within the addressed card cage. The 53A-415 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-415 Card is addressed, the commands listed below may be issued until another function card is addressed.

In the examples in the following descriptions, it is assumed that the Tri-State Discrete Output Card has address 4 and is located in a card cage with address 0.

Command	Description
T	The Tri-state Command places all output control lines in their Tri-state Mode.

Syntax: @XYT

In this mode, each output assumes a high output impedance and neither sinks nor sources current.

On power up, all outputs are automatically placed in the Tri-state Mode.

Example:
The command sequence @04T will place all output control lines in the tri-state mode.
     Status:
     Power LED - out
     TS LED - lit

A	The Active command switches all output control lines to their active TTL state (sourcing or sinking current, depending if they are programmed High or Low respectively).

Syntax: @XYA

Following power up, an A command must be issued before the output control lines will become active.

The command sequence @04A will place all output control lines in the active state.
> Status:
> Power LED - out
> TS LED - out

NOTE: The Active Mode set by the "A" Command may be over-ridden by the hardware Active Over-ride input, i.e., if the Active Over-ride input is set low by an external device, all output lines will be in the Tri-state Mode.

S

This command allows the system controller to set an individual output control line to either a High or Low output state.

Syntax: @XYHZ$_1$Z$_2$S

The L or H in the command sequence sets the output line defined by Z$_1$Z$_2$ to either the Low or High output state.

Z$_1$Z$_2$ represents a decimal number (0 to 39) which defines the output line to be set either Low or High.

Example:
The command sequence @04H10SH3SL9S would set output lines 1 and 30 High and 9 Low.
> Status:
> Power LED - out.

S

The Parallel Strobe Command is used when the user wishes to randomly set High or Low all output lines simultaneously.

Syntax: @XYZ$_{10}$ . . .Z$_1$S

The Z$_{10}$ . . .Z$_1$ characters represent ten ASCII characters which are converted to BCD format for output (See Table III). When the Parallel Load Command is used, all 10 characters must be output.

Example:
The command sequence @049?76543210S will cause the Discrete Output Card to parallel load the outputs with 9?76543210. To understand what output control lines will be set High or Low by this command, refer to Tables II and III. For example, referring to Tables II and III, the character 9, position Z$_{10}$, would cause the output control lines number 39 and 9 to be set high, the character ?, position Z$_9$, causes the output control line numbers 8, 18, 28 and 38 to be set High and etc.
> Status:
> Power LED - out.

TABLE I

Pin Assignments - Discrete Output Control Lines

Discrete Output Control Line	Output Pin	Equivalent BCD Output Pin
0	11	Z_1 - B1
1	10	Z_2 - B1
2	9	Z_3 - B1
3	8	Z_4 - B1
4	7	Z_5 - B1
5	6	Z_6 - B1
6	5	Z_7 - B1
7	4	Z_8 - B1
8	3	Z_9 - B1
9	2	Z_{10} - B1
10	M	Z_1 - B2
11	L	Z_2 - B2
12	K	Z_3 - B2
13	J	Z_4 - B2
14	H	Z_5 - B2
15	F	Z_6 - B2
16	E	Z_7 - B2
17	D	Z_8 - B2
18	C	Z_9 - B2
19	B	Z_{10} - B2
20	21	Z_1 - B4
21	20	Z_2 - B4
22	19	Z_3 - B4
23	18	Z_4 - B4
24	17	Z_5 - B4
25	16	Z_6 - B4
26	15	Z_7 - B4
27	14	Z_8 - B4
28	13	Z_9 - B4
29	12	Z_{10} - B4
30	Y	Z_1 - B8
31	X	Z_2 - B8
32	W	Z_3 - B8
33	V	Z_4 - B8
34	U	Z_5 - B8
35	T	Z_6 - B8
36	S	Z_7 - B8
37	R	Z_8 - B8
38	P	Z_9 - B8
39	N	Z_{10} - B8
Tri-state Set*	22	
Tri-state Clear*	23	
Active Over-ride*	A	
Ground Return	Z,24,AA,BB	

*Low True TTL input

Digit	BCD BIT (See Table III)	Output Pin	Equivalent Discrete Output Control Line
Z_1	1	11	0
	2	M	10
	4	21	20
	8	Y	30
Z_2	1	10	1
	2	L	11
	4	20	21
	8	X	31
Z_3	1	9	2
	2	K	12
	4	19	22
	8	W	32
Z_4	1	8	3
	2	J	13
	4	18	23
	8	V	33
Z_5	1	7	4
	2	H	14
	4	17	24
	8	U	34
Z_6	1	6	5
	2	F	15
	4	16	25
	8	T	35
Z_7	1	5	6
	2	E	16
	4	15	26
	8	S	36
Z_8	1	4	7
	2	D	17
	4	14	27
	8	R	37
Z_9	1	3	8
	2	C	18
	4	13	28
	8	P	38
Z_{10}	1	2	9
	2	B	19
	4	12	29
	8	N	39
Tri-state Set*		22	
Tri-state Clear*		23	
Active Over-ride*		A	
Ground Return		Z,AA,BB,24	

*Low True TTL input

Table III

Parallel Load

ASCII Character (Output from system controller)	BCD Bit Controlled (See Table II)
	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

Legend:
1 Output set High
0 Output set Low

Command	Description
R	The RESET Command is used to set all output control lines Low. Syntax: @XYR Example: The command sequence @04R will set all output control lines Low. All unit LEDs will be out.

LED ASSIGNMENTS

0   **Range LEDs**
01
02
03

0   **Units LEDs**
1
2
3
4
5
6
7
8
9
TS   Tri-state (lit when outputs in Tri-state Mode)

Example:
If Range LED 10 was lit and Units' LEDs 6 and 9 were lit, then the discrete outputs 16 and 19 would be High and the discrete outputs 10, 11, 12, 13, 14, 15, 17, and 18 would be Low.

INSTALLATION

The 53A-415 Card is a function card; therefore, it may be plugged into 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-415" 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-415 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

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). The effect of the HALT Command on the Tri-State Discrete Output Card is determined by the card's Halt Switch.

STOP   The STOP command is not a string of ASCII characters. This command is hardwired 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-415 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.

The STOP command is typically used to clear a system that has hung-up from an illegal operation, i.e., a request for input from a nonexistent System Card.