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53A-332 REED RELAY SCANNER CARD

OPERATING MANUAL

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53A-332 REED RELAY SCANNER CARD

OPERATING MANUAL

DESCRIPTION 1

CONTROLS AND INDICATORS
- Address Select Switch 2
- Power LED 2
- Fuse 2
- Function LEDS and Switches 2

SPECIFICATIONS 4

OPERATION 7

INSTALLATION 9

APPENDIX A
- 53/63 SERIES SYSTEM COMMANDS 10

APPENDIX B
- USING THE 53A-332 WITH DC VOLTAGES GREATER THAN 100V 11

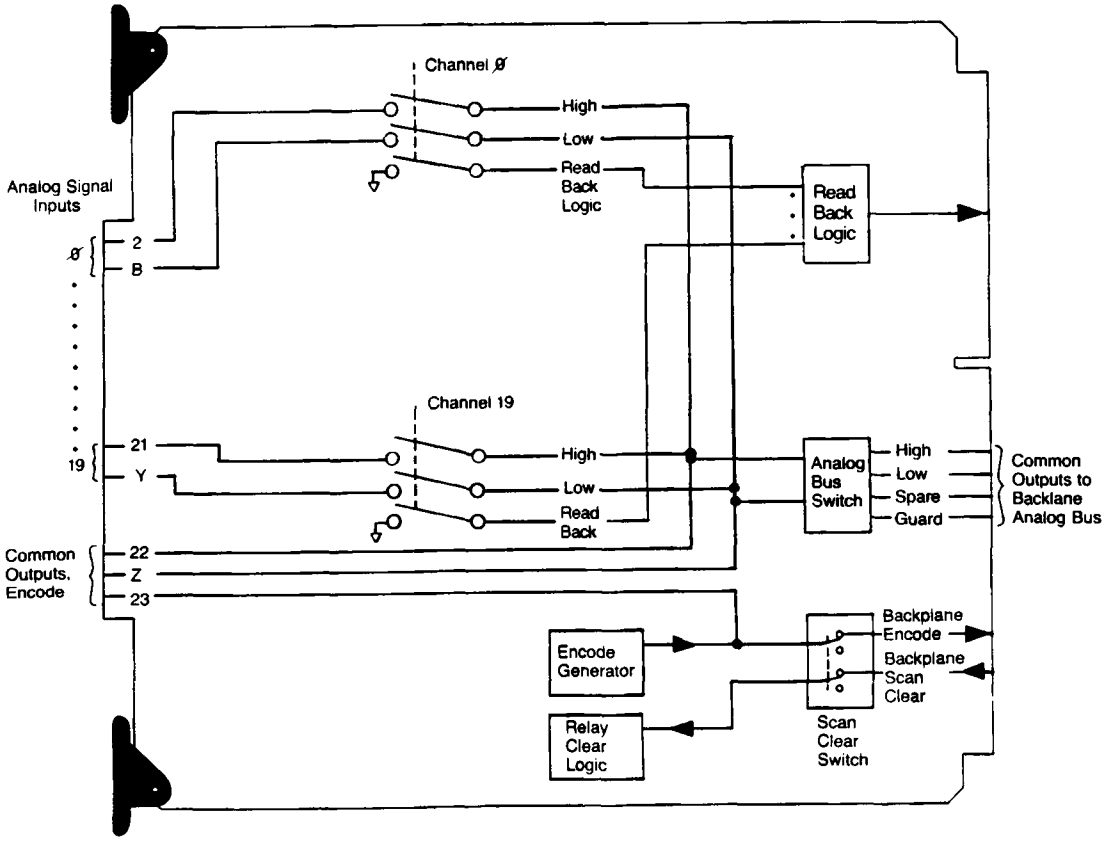
53A-332 WIRE LIST 13

53A-332 REED RELAY SCANNER CARD

DESCRIPTION

The 53A-332 Reed Relay Scanner Card is a printed circuit board assembly for use in A cds 53/63 Series System. The 53A-332 Card provides twenty 2-wire channels of analog signal acquisition that route one of twenty input channels to a common bus at 150 channels per second. Up to ten 53A-332 Cards can be plugged into a single card cage to provide scanning of up to two hundred channels. As many as ten card cages can be chained together to provide a system with up to two thousand 2-wire channels. If desired, both 53A-331 (ten 4-wire channels per card), 53A-336 (sixteen 2-wire high voltage channels per card) and 53A-332 Reed Relay Scanner Cards can be installed within the same card cage.

A channel can be randomly selected (closed) by transmitting ASCII characters from the system controller to the 53/63 Series System. Diagnostics include LED indicators and a readback feature that returns a 2-digit number to the system controller indicating the closed channel number. The read-back feature uses a third pole on each relay to test all 53A-332 Card circuitry, including the relay coil. If there are multiple channel closures, an error code is generated.



CONTROLS AND INDICATORS

The following controls and indicators are provided to select and display the functions of the 53A-332 Card's operating environment.

Address Select Switch

The 53A-332 Card has a miniature 10-position switch which selects the 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

This LED provides a valuable diagnostic tool by giving the system programmer a visual indication of what action the system is taking. Whenever the 53A-332 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-332 Card is unaddressed, but that all required dc power (5V dc) is being supplied.

Fuse

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

Function LEDS and Switches

Channel LEDs

The column of 12 LEDs near the front edge connector are provided to indicate the specific scanner channel closed. If the scanner channel closed is between 0 and 9, the 0X LED and one of the 0 through 9 LEDs is lit. If the closed scanner channel is between 10 and 19, the 1X LED and one of the 0 through 9 LEDs is lit.

Scan Clear Switch

At the rear of the 53A-332 Card is a 1-section rocker switch that determines if the card will automatically open all channels whenever a channel is closed on another scanner card, and whether the card will send a clear signal to open all channels on other cards when a channel is closed on the card.

Rocker Setting	Action
—> C1	a) A closed channel on this card is opened when a channel is closed on any other scanner card (53A-331, 53A-332 or 53A-336). b) Closing a channel on this card sends a clear pulse to all other scanner cards.
C2	a) Closing channels on other scanner cards has no effect on the 53A-332 Card. b) When a channel is closed on this card, a clear pulse is <u>not</u> sent to other scanner cards.

Analog Bus Switch

The two-section rocker switch located at the rear of the 53A-332 Card connects the Scanner Common output lines to the Analog Backplane Bus of the 53A-002 or 63A-012 Card Cage.

Rocker Settings	Action
C1, C3	Scanner Common High and Low connected to Backplane High and Low respectively.
C2, C4	Scanner Common High and Low connected to Backplane Guard and Spare respectively.
C2, C3	Scanner Common High and Low disconnected from Analog Backplane Bus.
C1, C4	Normally not used. Connects Scanner Common High to Backplane High and Guard, connects Scanner Common Low to Backplane Low and Spare.

SPECIFICATIONS

Configuration:	20 channel 2 wire scanner with common output bus, 2 lines.
Relay Type:	Coto, Model: 3400-0092 or equivalent, dry reed, 3 pole, form A, third pole for readback.
Contacts	
Maximum Switching Power (resistive):	10W
Maximum Switching Voltage:	200V DC. 60V AC RMS, balanced input. 110V AC RMS, balance input*. 10V AC RMS, one side grounded. 50V AC RMS, one side grounded *. * Maximum voltage with 1-megohm resistors installed between front connector pin 22 to 24, and pin Z to AA.
Maximum Switching Current:	0.5 A.
Contact Resistance:	Initial - less than 100 milliohms. End at Reed life - less than 1 ohm.
Reed Life:	At least 10^7 operations per channel at rated load of 10 W.
Duty:	Continuous.
Scanning Rate:	Random channel selection at greater than 150 channels per second.
Signal Path Specifications:	These specifications include the effects of the card cage backplane and are valid at the backplane analog output connector.
Differential Thermal Offset:	Less than 10 µV.
Single-Line Thermal Offset:	Less than 40 µV.
Initial Signal Path Resistance:	Less than 600 milliohms.
Signal Path Resistance at End of Reed Life:	Less than 1.4 ohms.
Insulation Resistance:	Greater than 10 gigohms between all insulated parts.

Crosstalk
Between Channels: Measured at Scanner Common output with closed channel terminated with 600 ohms and signal applied to unselected channels.

1 kHz - Less than -93dB
10 kHz - Less than -84dB
100 kHz - Less than -65dB
1 MHz - Less than -47dB

Isolation Impedance

Without 1-megohm resistors installed on front connector

Closed Channel: Greater than 10 gigohms high side common bus to ground; greater than 10 gigohms low side common bus to ground.

Open Channel: Greater than 10 gigohms any open input to ground.

With 1 Megohm resistors installed on front connectors

Closed Channel: 1 megohm high side common bus to ground, 1 megohm low side common bus to ground.

Open Channel: Greater than 10 gigohms any open input to ground.

Power Up: When power is turned on, the 53A-332 Card goes to the following known states:
Card unaddressed (Power LED - lit).
All channels open (Channel LEDs - out).

Power Down: When power is turned off, the 53A-332 Card goes to the following known states:
All channels open.

Encode Pulse: Issued 5 ms after the 53A-332 Card is instructed to close a channel to allow for relay settling time. The encode pulse typically triggers an external instrument such as a digital voltmeter.

Type Output: TTL Level, negative going pulse, 500 mA sink capability.

Pulse Width: 500 µs, nominal.

Power Requirements: Power is provided by 53A-060 Power Supply located in the 53A-002 or 63A-012 Card Cage.

Voltage: 4.75V to 5.25V DC.

Current: 0.85 A, quiescent.
0.90 A, peak.

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:	0.28 Kg. (0.63 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 Series Card Cage.
Input Connection:	A 48-pin card-edge connector (53A-780) or 53A-725 Analog Cable connects to all analog signal inputs.
Output Connection:	The analog output connection is through either the 48-pin front-edge connector of the 53A-332 Card or the analog output connector on the 53A-002 or 63A-012 card cage backplane.
Required Equipment (not supplied):	* A 53A-725 Analog Cable or 53A-780 Hooded Connector is required with this card.
Equipment Supplied:	53A-332 Reed Relay Scanner Card. Spare fuse (Part #42202-52001). Operating Manual (Part #00000-13320). Service Manual (Part #00000-23320).

OPERATION

The 53A-332 Card is programmed by ASCII characters issued from the system controller to the 53/63 System's communications card. The 53A-332 Card is interfaced to the communications card through the 53 Series or 63 Series Card Cage's backplane.

When a command is issued to close a channel on a 53A-332 Card, all channels on all scanner cards in the system (either 53A-331, 53A-332, or 53A-336) are automatically opened. This feature is provided to prevent accidentally connecting more than one set of scanner input lines to the common output lines at the same time. A scanner channel, once closed, remains closed until another scanner channel is closed. Only one channel on a card may be closed at any time. If the user does not want to have all channels automatically open whenever a channel on any other scanner card is closed, then the Scan Clear Switch described in the Description section should be set to position C2.

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 for that card cage; Y is the card address (0-9) within that card cage. The 53A-332 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-332 Card is addressed, the commands listed below may be issued until another function card is addressed.

Command	Description
ZZ	This command connects the two input lines of a channel to the two common output lines. "ZZ" is the channel number (00-19) to be closed. When closing channels 00 through 09, the 0 character(s) may be replaced with an ASCII space character if the user desires. A leading 0 or leading space may not be omitted. Example: The command @0205 opens any closed channel then closes channel 5 of the 53A-332 Card with address 2 in the card cage with address 0. Status: Power LED - out. Channel LEDs - 0X,5 lit, all others out.
R	The R command RESETs (Opens) all channels of a given scanner. If the card's Scan Clear switch is in position C2, a "clear" signal is sent to all other Scanner Cards (53A-331, 53A-332 or 53A-336) in the system. Example: The command @02R opens all channels on the 53A-332 Card with address 2 in the card cage with address 0. If the card's Scan Clear switch was in position C2, a "clear" signal would be sent to all other scanner cards (53A-331, 53A-332, and 53A-336).

Status:
Power LED - out.
Channel LEDs - out.

READBACK

The READBACK feature of the Relay Scanner Card allows you to interrogate the card to determine which, if any, channel is closed. Whenever the 53A-332 Card is addressed (Power LED out) and the system controller requests input from the 53/63 System, the card will return a two-digit number followed by carriage-return and line-feed characters. The number returned corresponds to the closed channel (00 through 19). If no channels are closed, a "20" is returned. If the card has malfunctioned and multiple channels are closed, a "30" is returned. Since the READBACK feature uses a third pole on each relay to detect a closed channel, the user is insured of accurate readback data.

INSTALLATION

The 53A-332 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-332" is at the top for a 53 Series Chassis and to the left for a 63 Series Chassis.

CAUTION:

The 53A-332 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. The command does not affect function cards in other card cages. If the 53A-332 Card is addressed (Power LED out) when a @XH command is received, the card will become unaddressed (Power LED lit). The @XH command has no other effect on the 53A-332 Card. If a scanner channel is closed, it remains closed.
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 card cage. When the system controller issues a STOP command, each function card, including the 53A-332 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 Communications Card, for example, a STOP command is executed when the system controller asserts the IEEE-488 bus line IFC (Interface Clear) true.

APPENDIX B

USING THE 53A-332 WITH DC VOLTAGES GREATER THAN 100V

The relays used on the 53A-332 Card have switch contact ratings of 200V DC. The relay can switch from 200V DC to 0V DC or 0V DC to -200V DC.

With a scanner system, a special situation exists: more than one relay can switch different voltages to a high impedance common bus. Since this common bus also has stray capacitance or cable capacitance associated with it, a residual voltage is left from the previous signal switched to the common bus. If ±200V DC signals are being measured, a residual voltage of -200V DC could be on the bus. Switching a +200V DC input to this bus is the same as switching 400V DC on the relay contact exceeding its rating by 2:1.

Two resistors can be installed on the front-edge connector of any 53A-332 Card; these resistors place a 1-megohm load between each side (common high, low) of the common analog backplane (assuming the Analog Bus Switch is closed) and ground. If more than one 53A-332 Card is installed in a scanner system, typically, the resistors should be installed on the front-edge connector of only one 53A-332 Card in the system. The bus resistors may need to be installed considering the following: The 1-megohm impedance that the resistors place on the analog backplane bus in parallel with any other bus impedance, such as a voltmeter, is a discharge path for any parasitic capacitance on the bus. Using the value of the impedance and capacitance, the time constant for the backplane discharge can be determined. (For those systems with chained CDS card cages, the 53A-715 Analog Chaining Cable has a capacitance of approximately 14 pF per foot). This discharge time is then compared to the minimum time interval between releasing a 53A-332 Card relay and closing a relay on the next scanner card. The minimum time intervals are:

53A-331 Card	0.2 ms
53A-332 Card (next channel)	1.7 ms
53A-336 Card	5 ms

If the residual voltage remaining by the time the next channel is closed is greater than 200V, then a relay channel not being used on the 53A-332 Card should be closed in between. This allows another 6.5 ms for the bus to decay.

Example:

Input voltage on 2 successive 53A-332 channels	= 127V DC first channel, -127V DC second channel
Backplane Analog Bus Capacitance	= 1000 pF
Backplane Analog Bus Impedance	= 1 megohm
Residual Voltage after 1.7 ms	= VR

$$V_R = V \times e^{-(t/RC)}$$
$$= 127 \times e^{-(.0017/1 \times 10^6 \times 1000 \times 10^{-12})}$$
$$= 14.0V$$

For this example, the next channel to be closed is at -127V. Therefore, the voltage across the relay contacts could be 14 - (-127), or 141.0V. Since 141.0V is less than 200V (the

switching voltage of the 53A-332 Card) successive channels of the 53A-332 Card can be closed without additional delay.

Additional considerations exist when using the 53A-332 Card. The maximum switching power of the relay contacts on these cards (10W) needs to be considered. A substantial capacitive load can cause inrush currents that will seriously degrade the contacts. It is difficult to determine analytically if the amount of voltage and capacitance present will create an inrush current greater than 10 W for a long enough time to pit the 53A-332 relay contacts. CDS has found that the following rule-of-thumb applies: if the switching voltage multiplied by the capacitance is greater than 1x10-8 volt-farads, a 53A-336 Card (150-W switching power) should be used instead of a 53A-332 Card. For example, 10V may be safely switched into a 1000-pF capacitive load, or 100V into a 100-pf capacitive load. Above those levels, a 53A-336 Card should be used.

Another constraint on using the 53A-332 Card is the card's voltage rating for maximum contact breakdown. The differential voltage between the scanner bus and any input to an open scanner channel of a 53A-332 Card cannot exceed this break-down rating. The 53A-332 Card has a voltage breakdown rating of 200V DC. For example, if a 53A-332 Card is placing 110V DC on the scanner bus, and another 53A-332 Card input has -100V DC on it, then 210V DC is being placed across the 53A-332 Card contacts; this exceeds the contact rating.

53A-332 WIRE LIST

Cable No. _____

Chan.	Sig.	Pin	53A-725 Cable	Wire Color	Termination	Pin
0	H	2	Brown of Brown/White			
	L	B	White of Brown/White			
1	H	3	Red of Red/White			
	L	C	White of Red/White			
2	H	4	Orange of Orange/White			
	L	D	White of Orange/White			
3	H	5	Yellow of Yellow/White			
	L	E	White of Yellow/White			
4	H	6	Green of Green/White			
	L	F	White of Green/White			
5	H	7	Blue of Blue/White			
	L	H	White of Blue/White			
6	H	8	Violet of Violet/White			
	L	J	White of Violet/White			
7	H	9	Gray of Gray/White			
	L	K	White of Gray/White			
8	H	10	Brown of Brown/Black			
	L	L	Black of Brown/Black			
9	H	11	Red of Red/Black			
	L	M	Black of Red/Black			
10	H	12	Orange of Orange/Black			
	L	N	Black of Orange/Black			
11	H	13	Yellow of Yellow/Black			
	L	P	Black of Yellow/Black			
12	H	14	Green of Green/Black			
	L	R	Black of Green/Black			
13	H	15	Blue of Blue/Black			
	L	S	Black of Blue/Black			
14	H	16	Violet of Violet/Black			
	L	T	Black of Violet/Black			
15	H	17	Gray of Gray/Black			
	L	U	Black of Gray/Black			
16	H	18	Red of Red/Brown			
	L	V	Brown of Red/Brown			
17	H	19	Orange of Orange/Brown			
	L	W	Brown of Orange/Brown			
18	H	20	Yellow of Yellow/Brown			
	L	X	Brown of Yellow/Brown			
19	H	21	Green of Green/Brown			
	L	Y	Brown of Green/Brown			
Com-	H	22	Blue of Blue/Brown			
mon	L	Z	Brown of Blue/Brown			
Ground		24,BB	Shield			
Encode		23	Violet of Violet/Brown			
Ground		AA	Brown of Violet/Brown			
+5V		A	White of Black/White			
+5V		1	Black of Black/White			

Sig.: H = High; L = Low

J. C. AiR

53A-332 REED RELAY SCANNER CARD

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53A-332 REED RELAY SCANNER CARD

OPERATING MANUAL

DESCRIPTION 1

CONTROLS AND INDICATORS
- Address Select Switch 2
- Power LED 2
- Fuse 2
- Function LEDS and Switches 2

SPECIFICATIONS 4

OPERATION 7

INSTALLATION 9

APPENDIX A
- 53/63 SERIES SYSTEM COMMANDS 10

APPENDIX B
- HIGH VOLTAGE SWITCHING WITH THE 53A-332 11

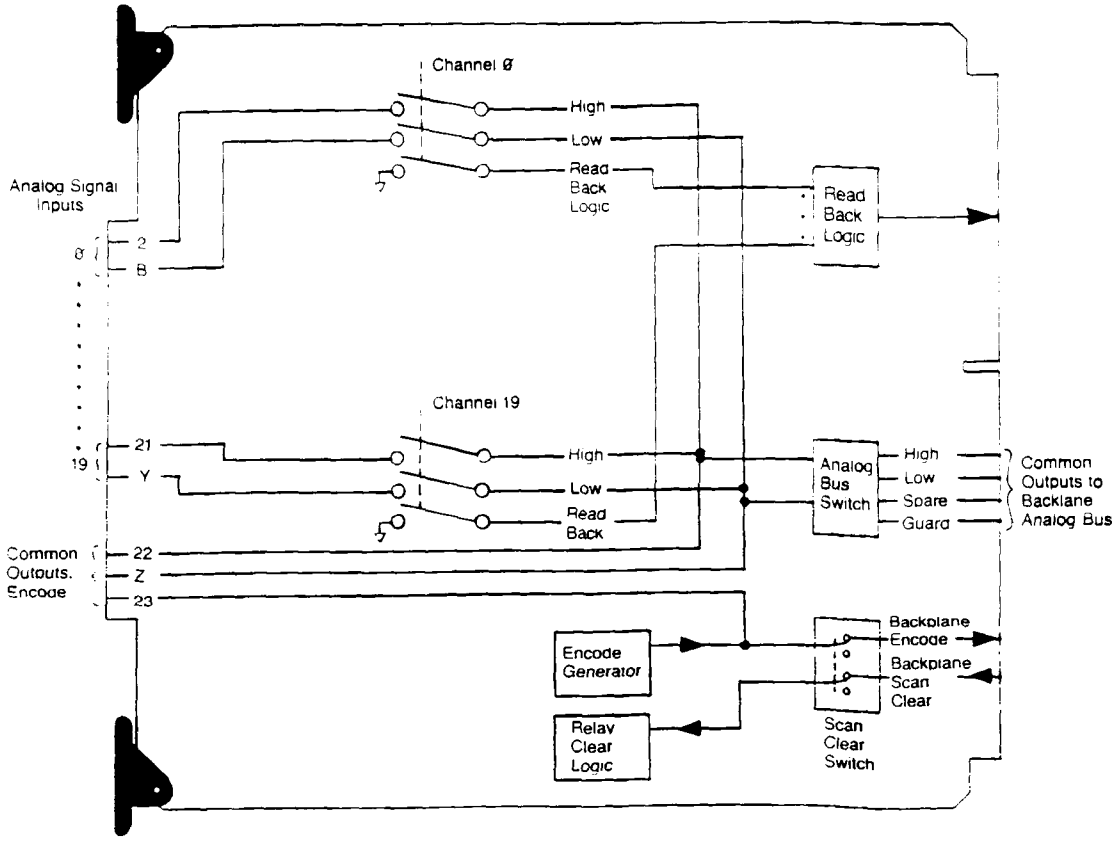
53A-332 WIRE LIST 13

53A-332 REED RELAY SCANNER CARD

DESCRIPTION

The 53A-332 Reed Relay Scanner Card is a printed circuit board assembly for use in A cds 53/63 Series System. The 53A-332 Card provides twenty 2-wire channels of analog signal acquisition that route one of twenty input channels to a common bus at 150 channels per second. Up to ten 53A-332 Cards can be plugged into a single card cage to provide scanning of up to two hundred channels. As many as ten card cages can be chained together to provide a system with up to two thousand 2-wire channels. If desired, both 53A-331 (ten 4-wire channels per card), 53A-336 (sixteen 2-wire high voltage channels per card) and 53A-332 Reed Relay Scanner Cards can be installed within the same card cage.

A channel can be randomly selected (closed) by transmitting ASCII characters from the system controller to the 53/63 Series System. Diagnostics include LED indicators and a readback feature that returns a 2-digit number to the system controller indicating the closed channel number. The read-back feature uses a third pole on each relay to test all 53A-332 Card circuitry, including the relay coil. If there are multiple channel closures, an error code is generated.



CONTROLS AND INDICATORS

The following controls and indicators are provided to select and display the functions of the 53A-332 Card's operating environment.

Address Select Switch

The 53A-332 Card has a miniature 10-position switch which selects the 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

This LED provides a valuable diagnostic tool by giving the system programmer a visual indication of what action the system is taking. Whenever the 53A-332 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-332 Card is unaddressed, but that all required dc power (5V dc) is being supplied.

Fuse

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

Function LEDS and Switches

Channel LEDs

The column of 12 LEDs near the front edge connector are provided to indicate the specific scanner channel closed. If the scanner channel closed is between 0 and 9, the 0X LED and one of the 0 through 9 LEDs is lit. If the closed scanner channel is between 10 and 19, the 1X LED and one of the 0 through 9 LEDs is lit.

Scan Clear Switch

At the rear of the 53A-332 Card is a 1-section rocker switch that determines if the card will automatically open all channels whenever a channel is closed on another scanner card, and whether the card will send a clear signal to open all channels on other cards when a channel is closed on the card.

Rocker Setting	Action
C1	a) A closed channel on this card is opened when a channel is closed on any other scanner card (53A-331, 53A-332 or 53A-336). b) Closing a channel on this card sends a clear pulse to all other scanner cards.
C2	a) Closing channels on other scanner cards has no effect on the 53A-332 Card. b) When a channel is closed on this card, a clear pulse is <u>not</u> sent to other scanner cards.

Analog Bus Switch

The two-section rocker switch located at the rear of the 53A-332 Card connects the Scanner Common output lines to the Analog Backplane Bus of the 53A-002 or 63A-012 Card Cage.

Rocker Settings	Action
C1, C3	Scanner Common High and Low connected to Backplane High and Low respectively.
C2, C4	Scanner Common High and Low connected to Backplane Guard and Spare respectively.
C2, C3	Scanner Common High and Low disconnected from Analog Backplane Bus.
C1, C4	Normally not used. Connects Scanner Common High to Backplane High and Guard, connects Scanner Common Low to Backplane Low and Spare.

SPECIFICATIONS

Configuration:	20 channel 2 wire scanner with common output bus, 2 lines.
Relay Type:	Coto, Model: 3600-0031 or equivalent, dry reed, 3 pole, form A, third pole for readback.
Contacts	
Maximum Switching Power (resistive):	10W
Maximum Switching Voltage:	200V DC (see Appendix B). 60V AC RMS, balanced input. 110V AC RMS, balance input*. 10V AC RMS, one side grounded. 50V AC RMS, one side grounded *. * Maximum voltage with 1-megohm resistors installed between front connector pin 22 to 24, and pin Z to AA.
Maximum Switching Current:	0.5 A.
Contact Resistance:	Initial - less than 100 milliohms. End of reed life - less than 1 ohm.
Dielectric Strength:	250V (between contacts).
Reed Life:	At least 10^7 operations per channel at rated load of 10 W.
Duty:	Continuous.
Scanning Rate:	Random channel selection at greater than 150 channels per second.
Signal Path Specifications:	These specifications include the effects of the card cage backplane and are valid at the backplane analog output connector.
Differential Thermal Offset:	Less than 10 µV.
Single-Line Thermal Offset:	Less than 40 µV.
Initial Signal Path Resistance:	Less than 600 milliohms.
Signal Path Resistance at End of Reed Life:	Less than 1.4 ohms.
Insulation Resistance:	Greater than 10 gigohms between all insulated parts.

Crosstalk
Between Channels: Measured at Scanner Common output with closed channel terminated with 600 ohms and signal applied to unselected channels.

1 kHz - Less than -93dB
10 kHz - Less than -84dB
100 kHz - Less than -65dB
1 MHz - Less than -47dB

Isolation Impedance

Without 1-megohm resistors installed on front connector

Closed Channel: Greater than 10 gigohms high side common bus to ground; greater than 10 gigohms low side common bus to ground.

Open Channel: Greater than 10 gigohms any open input to ground.

With 1 Megohm resistors installed on front connectors

Closed Channel: 1 megohm high side common bus to ground, 1 megohm low side common bus to ground.

Open Channel: Greater than 10 gigohms any open input to ground.

Power Up: When power is turned on, the 53A-332 Card goes to the following known states:
Card unaddressed (Power LED - lit).
All channels open (Channel LEDs - out).

Power Down: When power is turned off, the 53A-332 Card goes to the following known states:
All channels open.

Encode Pulse: Issued 5 ms after the 53A-332 Card is instructed to close a channel to allow for relay settling time. The encode pulse typically triggers an external instrument such as a digital voltmeter.

Type Output: TTL Level, negative going pulse, 500 mA sink capability.

Pulse Width: 500 µs, nominal.

Power Requirements: Power is provided by 53A-060 Power Supply located in the 53A-002 or 63A-012 Card Cage.

Voltage: 4.75V to 5.25V DC.

Current: 0.85 A, quiescent.
0.90 A, peak.

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:	0.28 Kg. (0.63 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 Series Card Cage.
Input Connection:	A 48-pin card-edge connector (53A-780) or 53A-725 Analog Cable connects to all analog signal inputs.
Output Connection:	The analog output connection is through either the 48-pin front-edge connector of the 53A-332 Card or the analog output connector on the 53A-002 or 63A-012 card cage backplane.
Required Equipment (not supplied):	A 53A-725 Analog Cable or 53A-780 Hooded Connector is required with this card.
Equipment Supplied:	53A-332 Reed Relay Scanner Card. Spare fuse (Part #42202-52001). Operating Manual (Part #00000-13320). Service Manual (Part #00000-23320).

OPERATION

The 53A-332 Card is programmed by ASCII characters issued from the system controller to the 53/63 System's communications card. The 53A-332 Card is interfaced to the communications card through the 53 Series or 63 Series Card Cage's backplane.

When a command is issued to close a channel on a 53A-332 Card, all channels on all scanner cards in the system (either 53A-331, 53A-332, or 53A-336) are automatically opened. This feature is provided to prevent accidentally connecting more than one set of scanner input lines to the common output lines at the same time. A scanner channel, once closed, remains closed until another scanner channel is closed. Only one channel on a card may be closed at any time. If the user does not want to have all channels automatically open whenever a channel on any other scanner card is closed, then the Scan Clear Switch described in the Description section should be set to position C2.

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 for that card cage; Y is the card address (0-9) within that card cage. The 53A-332 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-332 Card is addressed, the commands listed below may be issued until another function card is addressed.

Command	Description
ZZ	This command connects the two input lines of a channel to the two common output lines. "ZZ" is the channel number (00-19) to be closed. When closing channels 00 through 09, the 0 character(s) may be replaced with an ASCII space character if the user desires. A leading 0 or leading space may not be omitted. Example: The command @0205 opens any closed channel then closes channel 5 of the 53A-332 Card with address 2 in the card cage with address 0. Status: Power LED - out. Channel LEDs - 0X,5 lit, all others out.
R	The R command RESETs (Opens) all channels of a given scanner. If the card's Scan Clear switch is in position C2, a "clear" signal is sent to all other Scanner Cards (53A-331, 53A-332 or 53A-336) in the system. Example: The command @02R opens all channels on the 53A-332 Card with address 2 in the card cage with address 0. If the card's Scan Clear switch was in position C2, a "clear" signal would be sent to all other scanner cards (53A-331, 53A-332, and 53A-336).

Status:
Power LED - out.
Channel LEDs - out.

READBACK

The READBACK feature of the Relay Scanner Card allows you to interrogate the card to determine which, if any, channel is closed. Whenever the 53A-332 Card is addressed (Power LED out) and the system controller requests input from the 53/63 System, the card will return a two-digit number followed by carriage-return and line-feed characters. The number returned corresponds to the closed channel (00 through 19). If no channels are closed, a "20" is returned. If the card has malfunctioned and multiple channels are closed, a "30" is returned. Since the READBACK feature uses a third pole on each relay to detect a closed channel, the user is insured of accurate readback data.

INSTALLATION

The 53A-332 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-332" is at the top for a 53 Series Chassis and to the left for a 63 Series Chassis.

CAUTION:

The 53A-332 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. The command does not affect function cards in other card cages. If the 53A-332 Card is addressed (Power LED out) when a @XH command is received, the card will become unaddressed (Power LED lit). The @XH command has no other effect on the 53A-332 Card. If a scanner channel is closed, it remains closed.
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 card cage. When the system controller issues a STOP command, each function card, including the 53A-332 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 Communications Card, for example, a STOP command is executed when the system controller asserts the IEEE-488 bus line IFC (Interface Clear) true.

APPENDIX B

HIGH VOLTAGE SWITCHING WITH THE 53A-332

Because a scanning system has multiple sources that can be switched to a common bus, with each source having system-dependent amounts of capacitance, several considerations besides the 200V rating of the relay contacts affect the level of voltage that can actually be switched.

The first, and most serious, problem is caused by high voltage switching into a capacitive bus. The severity of the problem depends on current and heat limitations of the relay. The contacts on the 53A-332 are rated at 10W and 0.5 amp. Even though the currents appear to be very low in a high impedance measurement application, the bus capacitance causes extremely large inrush currents which may be enough to seriously damage or degrade the reliability of the relay contacts.

It is not easy to determine analytically the amount of voltage and capacitance that will cause enough inrush current to degrade the contacts. Tek/CDS has found the following approximation to work, though:

> The voltage times the capacitance should not exceed 10^{-8} volt-farads for a 10W contact.

(40V into a 250 pF bus, for example.) If this value is exceeded, the 53A-336 (which has a contact rating of 150W) may be used, or resistors may be placed between the scanner card common and the bus. The resistors need to be installed in the mating connector to the 53A-332. A resistor of 20 to 200 Ohms is typically used, depending on how much series resistance can be tolerated in the application. Consult the factory for installation or resistor selection assistance.

The second problem is that the previous switched voltage may still be present on the common bus (due to the bus capacitance). A situation could occur where the previous voltage is -200V (DC or instantaneous AC) and the new voltage is +200V, placing 400V across the relay contacts and exceeding their 200V rating. This problem may be relieved by placing discharge resistors on each leg of the bus. A typical discharge resistance might be 1 megohm and can typically be attached within the hood of the mating connector between the bus line and analog ground.

The selection of this resistor needs to take into consideration the required measurement impedance of the application and whether the time constant of the resistance with the bus capacitance is sufficient to discharge the voltage to the required level within the switching time of the scanning card. The bus capacitance depends on the amount of cabling. The typical capacitance of a Tek/CDS 53A-715 Cable, for example, is 15 pF per foot. The minimum time between release of one voltage and contact is 3.0 msec. (See below for an example analysis.)

The scanning time can be lengthened by switching in an unused scanning channel between the two switched voltages. A time delay in the program will have no effect. Tek/CDS scanning modules automatically release the previous relay a fixed time prior to the closing of a new channel to automatically preclude two scanner sources being shorted.

The third consideration is the maximum contact breakdown of 250V DC or 1000V RMS. In DC applications particularly, the maximum difference between any two DC sources is, as a result, limited to 250V DC.

Example:

Input voltage on 2 successive 53A-332 channels	= 165V DC first channel; -165V DC second channel
Backplane analog bus capacitance	= 1000 pF
Backplane analog bus impedance	= 1 megohm
Residual voltage after 3.0 ms	= VR

$$VR = V \times e^{-(t/RC)}$$
$$= 165 \times e^{-(.003 / 1 \times 10^6 \times 1000 \times 10^{-12})}$$
$$= 8.2$$

For this example, the next channel to be closed is at -165V. Therefore, the voltage across the relay contacts could be 8.2 - (-165), or 173.2. Since 173.2V is less than 200V (the switching voltage of the 53A-332 Card), successive channels of the 53A-332 Card can be closed without additional delay.

53A-332 WIRE LIST

Cable No. _____

Chan.	Sig.	Pin	53A-725 Cable	Wire Color	Termination	Pin
0	H	2	Brown of Brown/White			
	L	B	White of Brown/White			
1	H	3	Red of Red/White			
	L	C	White of Red/White			
2	H	4	Orange of Orange/White			
	L	D	White of Orange/White			
3	H	5	Yellow of Yellow/White			
	L	E	White of Yellow/White			
4	H	6	Green of Green/White			
	L	F	White of Green/White			
5	H	7	Blue of Blue/White			
	L	H	White of Blue/White			
6	H	8	Violet of Violet/White			
	L	J	White of Violet/White			
7	H	9	Gray of Gray/White			
	L	K	White of Gray/White			
8	H	10	Brown of Brown/Black			
	L	L	Black of Brown/Black			
9	H	11	Red of Red/Black			
	L	M	Black of Red/Black			
10	H	12	Orange of Orange/Black			
	L	N	Black of Orange/Black			
11	H	13	Yellow of Yellow/Black			
	L	P	Black of Yellow/Black			
12	H	14	Green of Green/Black			
	L	R	Black of Green/Black			
13	H	15	Blue of Blue/Black			
	L	S	Black of Blue/Black			
14	H	16	Violet of Violet/Black			
	L	T	Black of Violet/Black			
15	H	17	Gray of Gray/Black			
	L	U	Black of Gray/Black			
16	H	18	Red of Red/Brown			
	L	V	Brown of Red/Brown			
17	H	19	Orange of Orange/Brown			
	L	W	Brown of Orange/Brown			
18	H	20	Yellow of Yellow/Brown			
	L	X	Brown of Yellow/Brown			
19	H	21	Green of Green/Brown			
	L	Y	Brown of Green/Brown			
Com-mon	H	22	Blue of Blue/Brown			
	L	Z	Brown of Blue/Brown			
Ground		24,BB	Shield			
Encode		23	Violet of Violet/Brown			
Ground		AA	Brown of Violet/Brown			
+5V		A	White of Black/White			
+5V		1	Black of Black/White			

Sig.: H = High; L = Low

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