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CONTROL MANUAL

IEEE488 (GPIB)
RS232 SERIAL
LAN INTERFACE

CONTENTS

6.0   RS232/IEEE488 CONTROL MODULE

General
CYTEC's RS232/IEEE488 Control Module, **Drwg. # 6-013-3 (SHTS. 1&2)**, is designed to control general purpose switching systems. Three forms of control are available on the module: Manual Control, RS232 and IEEE488. All three interfaces may be active and used simultaneously.

The control module also contains a non-volatile memory allowing the system to be configured for various matrix addressing combinations and remember that configuration. Interface controls for IEEE 488, Baud rate, answerback, echo, verbose and SRQ are also saved in this memory allowing these functions to be set-up once and restore those functions every time the power is turned on.

Control Module Styles
Interface options: RS232, IEEE488 and Manual Control must be specified when purchasing the switch system to allow for proper mounting and cabling of hardware and connectors.

The following control modules are described in this manual:

IF-3 RS232 Control Module
RS232 control.

IF-4 IEEE488 Talk/Listen Module
IEEE488 Talk/Listen control.

IF-5 IEEE488/RS232 Module
Includes both IEEE488 and RS232 control.

6.1   RS232 INTERFACE

Signal Connections
The control module is set-up at the factory to operate as Data Communications Equipment (DCE) per the EIA RS232D Standard. In this configuration the module transmits on pin 3 and receives on pin 2. Pin 4 is required to be high for the control module to transmit and pin 5 is output high by the control module to indicate a ready for data state and low when busy. Jumpers on the module allow for reversing the functions of these pins (2-3, 4-5) and operating as Data Terminal Equipment (DTE).

Pin	Signal	Function
1	GND	Ground.
2	TxD	Data in to Control Module.
3	RxD	Data out of Control Module.
4	RTS	Control Mod. requires +V to transmit.
5	CTS	Control Mod. provides +V when ready.
6	DSR	Control Mod. provides +V.
7	Common	Signal Ground.
8	RLD	Control Mod. provides +V.

The mating connector is type DB25S.

I/O Configuration
To configure the control module as Data Communications Equipment (DCE) the top two pin jumpers should be in the lower (closest to the card edge) position and the lower two jumpers should be in the upper position.

To configure as Data Terminal Equipment (DTE) the top two pin jumpers should be in the upper position and the lower two in the bottom position. This will reverse the functions of pins 2 and 3, and 4 and 5.

Baud Rate
Baud rate is set at the factory at 9600 Baud. Change is under software control and the control module must be connected to a serial interface to effect the change.

Baud	110	300	600	1200	2400	4800	9600	19200	38400
	0	1	2	3	4	5	6	7	8

Command: "R baud handshake 73"
            "R 6 0 73"   factory default.

If the Baud rate is inadvertently set to an unknown rate the default value may be restored. See the section on Setting Defaults for procedure.

6.1   RS232 INTERFACE (Cont'd)

CTS/RTS Handshake

The Clear to Send, CTS, and Request To Send, RTS, functions may be modified by the 'R' command. The second entry of this command determines the operational status of these two lines. The least significant bit controls RTS and the next to least significant bit controls CTS. A binary 1 in those positions disables normal operation of that line.

Entry	Function
0	RTS(busy) and CTS(send) active
1	CTS(send) active, RTS always high.
2	RTS(busy) active, CTS ignored.
3	RTS always high, CTS ignored.

Command: "R baud handshake 73"

"R 6 0 73"   factory default.

Stop Bits/Parity

The Matrix always transmits eight data bits and two stop bits, with the eighth bit sent as a Space. Reception is set for eight bits and one or two stop bits, the eighth bit is ignored. These values are fixed and may not be changed.

6.3   IEEE488 INTERFACE

Signal Connections

Per IEEE Std. 488.1-1987 specification.

Talk/Listen Address

The talk and listen addresses are the same and set by the five position DIP switch near the top edge of the control module. Setting is in binary, switch one being the least significant bit and five the most significant. Setting a switch to the on or closed position will indicate a zero value for that position. The factory default address is 7, switches 1, 2, 3 OFF, 4, 5 ON. With this setting the listen address signified by the apostrophe character (') and the talk address is signified by a 'G' character.

Device Subsets

The following list summarizes the device subsets implemented by the control module:

SH1	-	Source Handshake: Complete capability.
AH1	-	Acceptor Handshake: Complete capability.
T6	-	Talk Functions: Talk capability, Serial Poll, no talk only mode, untalk if MLA.
TE0	-	No Talker extended address capability.
L4	-	Listen Functions: Listen capability, no listen only mode, unlisten if MTA.
LE0	-	No Listener extended address capability.
SR1	-	Service Request: complete capability.
RL1	-	Remote Local: complete capability.
PP0	-	Parallel Poll: no capability.
DC1	-	Device Clear: complete capability.
DT0	-	Device Trigger: no capability.
C0	-	Controller: no capability.

SRQ Response

The service request function (SRQ) may be used to signal when the control module has completed an operation. The Program command (P) allows for enabling or disabling the SRQ response. When enabled the SRQ line will be set true when the control module has completed the last command received. The line will be set regardless of completion status.

P 1 0 73	SRQ off, no SRQ function. Default.
P 1 2 73	SRQ active and set true upon completion of each command.

Completion status may be read by a serial poll (SPE, MTA) or by enabling the talk address alone (MTA). After reading the status the SRQ line will be sent false.

6.3   IEEE488 INTERFACE (Cont'd)

Serial Poll, Talk Mode

Upon being addressed to talk the control module will return a single byte with EOI true indicating the switch-point and command completion status of the last matrix operation. If the previous command was for multi-character output (status, interrogate, revision ...) all data must be read before reading the command completion character. If the SRQ line was asserted it will be set passive false.

Char	Hex	Completion Status
'0'	30	Successful Operation, switch open.
'1'	31	Successful Operation, switch closed.
'2','3'	32,33	Unknown Command, the first character of the command string was unrecognizable.
'4','5'	34,35	Incorrect entries, the number or type of entries was incorrect.
'6','7'	36,37	Entries out of limits, a switch-point was requested that was outside the limits of the specified matrix.
'8','9'	38,39	Invalid access code, the code number 73 was not included or incorrect in a command requiring the access code or in the wrong entry position.
as above with SRQ true		
'p'	70	Success, Switch Open.
'q'	71	Success, Switch Closed.
'r','s'	72,73	Unknown Command.
't','u'	74,75	Incorrect entries.
'v','w'	76,77	Limits Error.
'x','y'	78,79	Access Error.

WARNING:
The control module will return a completion character any time it is addressed to talk. If the control module is currently executing a command the completion status of the previous command will be sent. It is strongly recommended that the SRQ function be enabled to provide positive indication of actual command completion.

Remote/Local Operation
The interface responds to the Go To Local (GTL) and Local Lockout (LLO) commands by enabling or disabling front panel controls. Response to LLO, GTL, and REN signals may be disabled by the Program command 'P 4 0 73' and enabled by 'P 4 1 73'. Enabling or disabling is stored in non-volatile memory and will not be affected by turning power off then on. Factory default is disabled. Factory default is disabled.

6.3 IEEE488 INTERFACE (Cont'd)

Device Clear, Selected Device Clear
The interface will respond to both device clear (DCL) and selected device clear (SDC) by clearing any pending operations, aborting pending output and optionally clearing the control module.

The matrix clear feature may be disabled by the Program command 'P 3 0 73' and enabled by the command 'P 3 1 73'. Enabling or disabling is stored in non-volatile memory and will not be affected by turning power off then on. Factory default is Disabled.

6.4 COMMAND LINE/COMPLETION

Command lines will be received by the control module but not executed till an end of line is signaled. Multiple commands may be entered on one line. Each command must be separated by a semi-colon (;). Command line length may not exceed 36 characters. Commands from the RS232 interface may be aborted at any time by sending an asterisk ('*') charcater. Commands from the IEEE488 interface may be aborted by the DCL/SDC bus command.

  eg. "L 10 8;L 12 2" eol Close Module 10, Switch 8 then Close Module 12 Switch 2.

Format
Commands will be received by the RS232 port when the Clear to Send Signal is at +V and by the IEEE488 port after the listen address has been received (MLA). Matrix command strings consist of ASCII text strings terminated by an end message.

The command string will always consist of at least one ASCII character to indicate the operation desired. For matrix commands requiring data entry each entry must be separated by at least one space or comma character.

  eg.   "S eol"
        "X 1 2" eol

End of Line Character
A received end of line character will cause the control module to execute the ASCII command string. The end of line character may be sent as a carriage return (CR) or line feed (LF) character for RS232 interfaces and a LF for IEEE488 interfaces.

The IEEE488 also allows for the END control line being true with the last data character to initiate the command.

    Valid end of Lines:
      CR   RS232 only.
      CR and END IEEE488.
      LF   RS232 or IEEE488.
      LF and END IEEE488.
      DAB and END IEEE488.

6.4   COMMAND LINE/COMPLETION (Cont'd)

Access Code
Some commands require an access code number to be included with the command. This code prevents inadvertent operation of system modifying commands. The access code is 73.

Command Completion
A code representing the last requested switchpoint status (open or closed) and command completion will be stored by the matrix.

If the RS232 answerback function is enabled a single character followed by end of line will be sent upon completion of all commands. With IEEE488 interfaces enabling the talk address (MTA) will cause the single code byte to be transmitted along with the END line true. This code is also available by a serial poll. DIO1 will indicate status from the last operation affecting switch-point status and DIO2 through DIO4 will be the command completion code.

> **Note: Command Completion is NOT updated until the matrix finishes the requested operation.**

Recommended Operation
In order to guarantee the command has actually completed it is recommended that Answerback is used with RS232 interfaces and that the SRQ function is enabled for IEEE488 interfaces.

Command Completion Codes

Char	Hex	Completion Status
'0'	30	Successful Operation, switch open.
'1'	31	Successful Operation, switch closed.
'2','3'	32,33	Unknown Command, the first character of the command string was unrecognizable.
'4','5'	34,35	Incorrect entries, the number or type of entries was incorrect.
'6','7'	36,37	Entries out of limits, a switch-point was requested that was outside the limits of the specified matrix.
'8','9'	38,39	Invalid access code, the code number 73 was not included or incorrect in a command requiring the access code or in the wrong entry position.

6.5   MATRIX COMMANDS

L,U,X - Latch, Unlatch, Multiplex Commands

Syntax: Cmd Switch
                Cmd Module, Switch

                Cmd = 'L', 'U' or 'X'.

The specified switchpoint is operated on.

L - Latch   Closes the specified point, all others unaffected.
U - Unlatch   Opens the specified point, all others are unaffected.
X - Multiplex Opens all points in the specified matrix then closes the specified point.

Eg.   "L 1"   Switch 1 is closed. (Uses previous Module value.)
            "U 5,3"   Module 5, Switch 3 is opened.
            "L 0,1"   Module 0, Switch 1 is closed.

C - Clear Command

Syntax: C

All points in the chassis are opened.

Eg.   "C"   All switches in the chassis are opened.

6.5   MATRIX COMMANDS (Cont'd)

S - Status Command

    Syntax: S
                   S Module, Switch

Status may be requested of a single switchpoint or for the entire chassis. After receipt of the Status command the Matrix will return a character or string of characters representing the status, open or closed, of a switchpoint or switchpoints. A one, '1', signifies a closed switchpoint and a zero, '0', an open switchpoint.

In the case of a single switchpoint a single character is returned followed by an end of line. For multiple switchpoints a line of ones and zeros will be returned for each switch row in the matrix. Each line returned will be followed by a end of line for RS232 interfaces and a semi-colon, ';', for IEEE488 interfaces. At the end of all output rows an end of line will be sent for both interfaces.

    Eg. 1
            Send: "S 3,4"   Test Module 3, Switch 4
            Receive: "0" eol   Switchpoint open, end of line.

    Eg. 2, A 16 Module, 8 Switch Matrix shown in this example.
            Send: "S"   Status of chassis
            Receive: "0001000100000000" eol
                           "0000000000000000" eol
                           "1111111111111111" eol
                             "   "
                             "   "
                           "1010101010101010"

                           The above status indicates:
                                   Line 1 - Switch 0, Module 3 and 7 closed.
                                   Line 2 - Switch 1, none closed.
                                   Line 3 - Switch 2, all closed.
                                   Line 7 - Switch 7, even Modules closed.

Notes - RS232:
        1.   The end of line will be a carriage return with Echo disabled or a carriage return and line feed if Echo is enabled.
        2.   If Answerback is enabled, the answerback character and end of line will follow the status output.

Notes - IEEE488:
        1.   The end of line character will be a line feed.
        2.   A DCL or SDC command will abort output.

Notes - both interfaces:
        1.   Upon requesting status output characters MUST be received by the requesting device. Failure to do this will prevent further use of the matrix.

6.5   MATRIX COMMANDS (Cont'd)

I - Interrogate

Syntax: I

The Interrogate function will return a list of all closed switchpoints.

Eg.
Send: "I"		Request interrogation.
receive:	"0,0" eol	Module 0, Switch 0 Closed.
	"1,6" eol	Module 1, Switch 6 Closed.
	"12,13" eol	Module 12, Switch 13 Closed.

Notes - RS232:
1.   The end of line will be a carriage return with Echo disabled or a carriage return and line feed if Echo is enabled.
2.   If Answerback is enabled, the answerback character and end of line will follow the interrogate output.

Notes - IEEE488:
1.   The end of line character will be a line feed.
2.   A DCL or SDC command will abort output.

Notes - both interfaces:
1.   Upon requesting interrogation all characters MUST be received by the requesting device. Failure to do this will prevent further use of the system.

F - Front Panel

Syntax: F n 73   n = 0 or 1

Front panel lock-out will be initiated by the receipt of a 0 character and enabled by the receipt of a 1 character followed by the access code. The access code prevents inadvertent lock-out from occurring. Lock-out will prevent any operation of the system from the front panel until it is terminated from the remote (F 1) or power is turned off then on. Preset to panel enabled at power on.

Eg.	"F 0,73"	Lock-out local operation.
	"F 1 73"	Enable local operation.

6.5   MATRIX COMMANDS (Cont'd)

T - Diagnostic Test

Syntax: T 0, Delay, 73

Perform diagnostic test. The matrix will cycle through all switchpoints until any command is received by the initiating device (RS232/IEEE488). The received command will NOT be executed only the test will be stopped. A delay variable (0 to 255) allows slowing of the switch-point time with 0 being the fastest cycle time. The access code, 73, prevents inadvertent activation of the diagnostic.

Eg.   "T 0,100,73"   Test matrix. Delay 100 per point.

P - Program

Syntax: P n1,n2,73

The program command allows the operator to setup matrix dependent variables. These include matrix switch configuration and certain interface functions. See section Matrix Programming for complete description.

N - Revision Number

Syntax: N

The 'N' command will cause the matrix to return it's current revision number followed by an end of line.

Eg.   Send: "N"   Request revision Number
       Receive: "1.2" eol   Text string indicating revision.

Note: When requesting the Revision number all characters must be received before the system can be resumed.

6.6   RS232 SPECIFIC MATRIX COMMANDS

R - Baud Rate, RTS/CTS Control

Syntax: R rate control 73

The R command is used to set the Baud rate and RTS/CTS functions for the RS232 port. After issuing the command the matrix must be turned off then on to initialize the new rate. Both entries are required.

1st Entry	Baud Rate
0	110
1	300
2	600
3	1200
4	2400
5	4800
6	9600
7	19200

2nd Entry	Function
0	RTS(busy) and CTS(send) active
1	CTS(send) active, RTS always high.
2	RTS(busy) active, CTS ignored.
3	RTS always high, CTS ignored.

Eg.   "R 1 0 73"   Set Baud rate to 300.
                                     Enables CTS and RTS Functions.

A - Answerback

Syntax: A n 73   n = 0 or 1

Answerback will enable or disable the transmission of a single character followed by an end of line upon the completion of all commands.

Eg.   "A 0 73"   Turn answerback off.
                  "A 1 73"   Turn answerback on.

E - Echo

Syntax: E n 73   n = 0 or 1

Echo will enable or disable echoing of all received characters. In addition a line feed character will be transmitted upon receipt or transmission of a carriage return character.

Eg.   "E 0 73"   Turn echo off.
               "E 1 73"   Turn echo on.

V - Verbose

Syntax: V n 73   n = 0 or 1

The verbose mode will enable the instrument to return text strings during operation and upon completion of matrix commands. It is most useful when connecting a terminal or computer in the terminal mode to the matrix. Verbose must be active to acquire help text and interactive program set-up.

Eg.   "V 0 73"   Turn verbose mode off.
               "V 1 73"   Turn verbose mode on.

H - Help

Syntax: H

The matrix contains a help menu which summarizes all commands. It may be accessed only on the RS232 interface when verbose is enabled.

Eg.   "H"   Display help screens.

6.7 MATRIX PROGRAMMING/SETUP, P COMMAND

The matrix command program (P) allows the operator to set matrix dependent parameters and certain interface functions. The control module is designed to be of general purpose use and is "trained" as to the number of switchpoints and their usage in the system. Certain interface functions may also be modified to allow easier communications to other equipment.

The Configuration appendix summarizes matrix configuration.

P 0 - Number of Matrices

    Syntax: P 0 1 73

    Always set to 1.

    Eg.   "P 0 1 73"

P 1 - Set IEEE488 SRQ Function

    Syntax: P 1 mode 73   mode = 0 or 2

    Mode 0   -   SRQ not used.
    Mode 2   -   SRQ signals command completion.

    Eg.   "P 1 2 73"   Sets SRQ operation to mode 2.

P 2 - Specify VX Matrix

    Syntax: P 2 n 73   n = 0 or 1

    Set to 1 for VX256 style chassis.

    Eg.   "P 2 1 73"   VX256 Style Chassis.

P 3 - IEEE488 Enable/Disable DCL/SDC Function

    Syntax: P 3 n 73   n = 0 or 1

    Enables or disables response to the IEEE 488 Device Clear and Selected Device Clear commands.

    Eg.   "P 3 0 73"   Disable DCL/SDC functions.
                     "P 3 1 73"   Enable DCL/SDC functions.

P 4 - IEEE488 Enable/Disable LLO/GTL Function

Syntax: P 4 n 73   n = 0 or 1

Enables or disables response to the IEEE 488 Local Lockout and Go To Local commands.

Eg.   "P 4 0 73"   Disable LLO/GTL functions.
                   "P 4 1 73"   Enable LLO/GTL functions.

P 10 - Set Logical Number of Modules

Syntax: P 10 Modules 73

The P 10 sets the logical number of modules. The logical number modules refers to the horizontal signal addressing for the matrix and not necessarily to physical switch modules in the chassis. For example the LX series matrices (16 module, 8 switches) may be set up to be addressed as a 16 X 8, 32 X 4 or 64 X 2 matrix.

This entry also affects how the status array is presented, determining the number of columns transmitted.

Eg 1.   "P 10 16 73"   16 Addressable Modules.
Eg 2.   "P 10 32 73   32 Addressable Modules.

P 20 - Set Logical Number of Switches

Syntax: P 20 Switches 73

The P 20 set the logical number of switches. The number of logical switches refers to the vertical signal addressing for each matrix and not necessarily to the physical switch modules in the chassis. For example the LX series matrices (16 module, 8 switches) may be set up to be addressed as a 16 X 8, 32 X 4 or 64 X 2 matrix.

This entry also affects how the status array is presented, determining the number of rows transmitted.

Eg.   "P 0 2 73"   Set number of matrices to 2.
         "P 20 8 73"   Set matrix 1 for 8 addressable switches.
         "P 21 32 73"   Set matrix 2 for 32 addressable switches.

6.8 MATRIX COMMAND SUMMARY

COMMAND	FUNCTION
L sw L mod, sw	Latch switchpoint.
U sw U mod, sw	Unlatch switchpoint.
X sw X mod, sw	Multiplex switchpoint.
C	Clear entire system.
S S mod, sw	Return status.
I	Interrogate Closed Points.
F 0/1 73	Disable/Enable Front Panel.
T 0 delay 73	Test matrix.
P parameter value 73	Program parameter.
N	Revision Number

RS232 Specific Commands

COMMAND	FUNCTION
R baud, RTS/CTS 73	Baud Rate, RTS/CTS operation.
A 0/1 73	Disable/Enable Answerback.
E 0/1 73	Disable/Enable Echo.
V 0/1 73	Disable/Enable Verbose.
H	Help (verbose required).

6.9   DEFAULT CONFIGURATION SETTINGS

Should the non-volatile memory fail on the system default setup parameters will be placed in memory on power up. The unit may then be properly set-up by P commands.

Forcing Defaults
Default values may be forced by setting the IEEE488 listen/ talk address to all ones and turning power on. This is an illegal address and should be changed back to the proper address immediately. A legal address must be set before turning power back on or defaults will be set.

Default Values

P	0	1	One Matrix.
P	1	0	SRQ function off.
P	2	1	VX Style Chassis.
P	3	0	DCL/SDC disabled.
P	4	0	LLO/GTL disabled.
P	10	16	16 Logical Modules.
P	20	16	16 Logical Switches.
E	0		Echo off.
V	0		Verbose off.
A	1		Answerback on.
R	6	0	Baud rate 9600, DTR and CTS active.

6.10   LCD DISPLAY/KEYPAD OPERATION

The keypad/display option **(Drwg.#6-057)** allows manual control of the matrix from the front panel. Keypad operation is always enabled at power on but may be disabled by the remote command, 'F'.

Display

The display contains two lines with sixteen characters per line. The top line displays matrix commands and numeric entry. The bottom line displays the status of the entry or operation.

Keypad

The keypad consists of ten numeric keys, four function keys, a space key and an enter key.

Key	Function
0-9	Numeric entries.
space	Delimits between numeric entries.
L	Latch operation.
U	Unlatch operation.
Mux	Multiplex operation.
C	Clear operation.
ENTR	Execute displayed operation.

Operation

A matrix command key, **L**, **U**, **Mux** or **C**, MUST be pressed before numeric entry keys. Pressing any key except a matrix command key causes the message **Enter Cmd First** to be displayed. After pressing a matrix command key the command and a cursor are displayed. The switchpoint to be operated on may now be entered with the numeric and space keys. The entry format is the same as described in the MATRIX OPERATION section and described briefly by the following table:

Command Key	Display Line 1	Line 2
L	Lat _	Enter Point
U	Unl _	Enter Point
Mux	Mux _	Enter Point
C	Clr _	Enter Matrix

The numeric keypad now allows selection of the Matrix, Module and Relay to be operated on. Each entry may be multiple digits and a space must be pressed between selections.

Key	Line 1	Line 2
L	Lat _	Enter Point
1	Lat 1_	
space	Lat 1 _	
2	Lat 1 2_	
3	Lat 1 23_	
space	Lat 1 23 _	
4	Lat 1 23 4_	

Number of Entries	Leftmost Entry	2nd Entry	Rightmost Entry
1	Relay	-	-
2	Module	Relay	-
3	Matrix	Module	Relay

APPENDIX A - SHIPPED CONFIGURATION

This system was setup with the following Program (P) commands (all commands were followed by the access code 73):

P 0   _1_   # of Matrices, always 1.

P 1   _0_   SRQ Function   _none_ - command completion.

P 2   ___   VX/CXE/PX Chassis   VX/CXE   Set bit 1
                                           PX: Set bit 16

P 3   _0_   DCL/SDC   enabled - _disabled_.

P 4   _0_   LLO/GTL   enabled - _disabled_.

P 9   ___   Chassis Information
Mux Mode (1) Dual Mux (2) CL2 (256) CL4 (512)

P 10   ___   # of Inputs.

P 20   ___   # of Outputs.

E   _0_   Echo   on - _off_.

V   _0_   Verbose   on - _off_.

A   _1_   Answerback   _on_ - off.

R _6_   _0_ Baud rate   _9600_ ,

                             DTR   _active_ - inactive,

                             CTS   _active_ - inactive.

Thumbwheel Positions:

P30   ___   Matrix thumbwheel positions._6 5 4 3 2 1_

P31   ___   Input thumbwheel positions.   _6 5 4 3 2 1_

P32   ___   Output thumbwheel positions.   _6 5 4 3 2 1_

APPENDIX B -QBASIC RS232 EXAMPLE PROGRAM

```
'Cytec Matrix Test Program for IBM-PC Compatibles using QBASIC and COM1 port.
'    16x16  (Change parameters X and Y for other configurations.)
'
'    Matrix should be set up for:
'         E 0 73       Echo off
'         V 0 73        Verbose off
'         A 1 73        Answerback on
'    Set-up may be done by any Terminal emulation program or
'    by adding these lines to the program, be sure to clear
'    input buffer after set-up.
'The Answerback character is read after every write operation and can be
'    tested for successful operation if desired.
'
CLS
OPEN "COM1:9600" FOR RANDOM AS #1
COM(1) ON
PRINT "Setting up and Clearing Matrix"
PRINT #1, "E0 73;V0 73;A1 73;C"
'Some delay gather Answers from the previous command
INPUT "Press ENTER to continue", a$
WHILE NOT EOF(1)
   INPUT #1, a$
WEND
'----------------------------------------------------------
PRINT ""
PRINT "Cycling through 256 channels using Latch/Unlatch Commands"
FOR Y% = 0 TO 15   'Loop For Selecting Input
   FOR X% = 0 TO 15    'Loop For Selecting Output
         'Write Instruction To Matrix (Command,Input,Output)
      PRINT #1, "L" + STR$(Y%) + STR$(X%): INPUT #1, a$
      'check status (S module, relay)
      PRINT #1, "S" + STR$(Y%) + STR$(X%): INPUT #1, a$
      INPUT #1, Stat$
      IF Stat$ = "0" THEN PRINT "Error latching"; Y%; X%

      PRINT #1, "U" + STR$(Y%) + STR$(X%): INPUT #1, a$
      PRINT #1, "S" + STR$(Y%) + STR$(X%): INPUT #1, a$
      INPUT #1, Stat$
      IF Stat$ = "1" THEN PRINT "Error unlatching"; Y%; X%
    NEXT X%
NEXT Y%
'----------------------------------------------------------
CLOSE #1
END
```

APPENDIX C - TURBO C/IEEE488 TEST PROGRAM

```c
/* CYTEC Matrix / National Instruments IEEE488 Test Program    */
/*      This program was compiled under TURBO C ver. 2.0 and linked */
/*      with National Instruments file: TCIBS.OBJ.  Though not          */
/*      tested with other compilers it has been written following       */
/*      ANSI C rules and should be compatible with other compilers.     */
/*      National Instruments configuration program IBCONF was used      */
/*      to assign dev7 listen and talk addresses of the matrix (7).     */
#include <stdio.h>
#include "decl.h"

static int brd0, matrix;/* device ID variables */
static char cmd_line[10];
/* ------------- initialize I/O ---------------------------- */
int init_GPIB()
{
        if ((brd0 = ibfind("gpib0")) < 0)        /* 'Find' devices      */
                return(1);                                      /* that were setup by    */
        ibsic(brd0);                                     /* IBCONF program        */
        if ((matrix = ibfind("dev7")) < 0)       /* dev7 setup for Matrix */
                return(2);
        matrix_clear();
        return(0);
}
/* ------------- clear matrix ----------------------------- */
int matrix_clear()
{
        ibwrt(matrix,"C",1);             /* "C", alternate methods of  */
/*      ibcmd(brd0,"\x14",1);   DCL, clearing the matrix   */
/*      ibclr(matrix);          */
}
/* ------------- switchpoint operation -------------------- */
int switchpoint_operation(cmd, inp, outp)
int cmd, inp, outp;
{
        int     sp_status;

        sprintf(cmd_line,"%c%d %d", cmd, inp, outp); /* build   */
        ibwrt(matrix,cmd_line,strlen(cmd_line));   /* and send */
        ibrsp(matrix,&sp_status);
        return(sp_status & 0x3f);        /* ret status less SRQ bit   */
}
/* ------------- switchpoint status ----------------------- */
int switchpoint_status(inp, outp)
int inp, outp;
{

lkjhljhsdfkljdfgsdfgsg sprintf(cmd_line,"S%d %d", inp, outp);        /* Request status  */
        ibwrt(matrix,cmd_line,strlen(cmd_line));
        ibrd(matrix,cmd_line,10);                /* and read        */
        return(cmd_line[0] & 0x3f);
}
```

```c
/* ************************************************************ */
#define N_INPUTS 16
#define N_OUTPUTS 8
#define RCV_BUFFER_SIZE N_INPUTS * N_OUTPUTS + N_INPUTS + 1

int main()
{
        int i,inp,outp;
        char rcv_buffer[RCV_BUFFER_SIZE];

        printf("Cytec Matrix Test Program.\n\n");

        /* initialize and trap errors */
        if (init_GPIB()) {
                printf("Initialize error.\n");
                return(1);
        }

        /* Latch & Unlatch Switches */
        for (inp=0; inp<N_INPUTS; inp++)
                for (outp=0; outp<N_OUTPUTS; outp++) {
                        if (switchpoint_operation('L',inp,outp) != '1')
                                printf("Error: point %d %d not closed.\n",
                                                inp,outp);
                        if (switchpoint_operation('U',inp,outp) != '0')
                                printf("Error: point %d %d not open.\n",
                                                inp, outp);
                }

        /* Latch 'Random' switches */
        for (outp=0; outp<N_OUTPUTS; outp++) {
                switchpoint_operation('L',outp,outp);
                /* direct status read */
                if (switchpoint_status(outp,outp) != '1')
                        printf("Error: point %d %d not closed.\n",outp,outp);
        }

        /* request status of entire matrix */
        ibwrt(matrix,"S",1);
        ibrd(matrix,rcv_buffer,RCV_BUFFER_SIZE);

        /* display status */
        printf("Bytes read = %d.\n",ibcnt);
        for (i=0; i<ibcnt; i++) {
                if (rcv_buffer[i] == ';')
                        printf("\n");
                else
                        printf("%c",rcv_buffer[i]);
        }
        ibloc(matrix);  /* Leave local controls enabled when done */
}
```

CYTEC IF-6

TCP/IP TO RS232

CONTROL INTERFACE

CYTEC IF-6
TCP/IP TO RS232
CONTROL INTERFACE

DRAWINGS

IF-6

TCP/IP TO RS232

CONTROL INTERFACE

1.0   GENERAL

CYTEC's IF-6 10Base-T LAN interface is designed for twisted pair interface to TCP/IP Networks and acts as a Server for controlling CYTEC Switching Systems. The interface is fully configurable, and setup information is permanently stored in internal NVRAM.

The Switching System is controlled by raw TCP/IP transfer to a preset port number, 2001. The data is received by the Server and then sent through an RS232 port to the Switching System. A description of all RS232 commands is contained in the **RS232 Switching System Operator's Manual**. Return data from the Switching System (when applicable) is sent back to the requesting Client by raw TCP/IP transfer to the requesters port.

Make sure you received one RJ45 to D9S terminal connection cable for RS232 setup and one RJ45 to D25S matrix cable to connect the IF-6 to the RS232 controller of your switch matrix. These cables are shown in **(Drwg. #11-00-30)**.

1.1   INITIAL RS232 SETUP

The IF-6 must be configured via its RS232 port when it is installed. This setup procedure allows the user to enter a valid IP Address and Sub-net Mask. These values must be properly set in order for the IF-6 to communicate over your TCP/IP network.

Connect the port labeled RS232 of the IF-6 to a terminal or PC using the provided terminal connection cable. The proper terminal settings are 9600 baud, 8 bits, 1 stop bit, no parity, and hardware flow control. All commands should be followed by the <enter> key. Issuing a command without specifying any parameters will display the current values associated with that command. Try the following example to verify the current set TCP/IP address.

Type:
>   hosts

The IF-6 should respond:
>   10.0.0.2   cytec
>   127.0.0.1   localhost.

The TCP/IP address is 10.0.0.2 (This value may be different if you specified an IP address when you ordered your system). See the shipped configuration sheet in this manual. The host name is cytec.

Type:
>   ifconfig
The reponse is:
>   lo0: flags=49<UP, LOOPBACK,RUNNING>
>   inet 127.0.0.1 netmask FF000000
>   ec0: flags=61<UP,NOTRAILERS,RUNNING>
>   inet 10.0.0.2 netmask FF000000
>   ether   00:20D0:00:13:24.

The Netmask is 255.0.0.0 (FF000000Hex) and follows the TCP/IP address on the second line from the bottom.

1.2   SETTING IP ADDRESS AND NETMASK

Type:

    ifconfig xxx.xxx.xxx.xxx yyy.yyy.yyy.yyy

where the desired TCP/IP address is xxx.xxx.xxx.xxx and the desired netmask is yyy.yyy.yyy.yyy. Both values are in dotted-decimal format. The entries can be confirmed by issuing the ifconfig command without parameters.

Example: Set IP address 145.143.75.27 and Netmask 255.255.255.0.

Type:

    ifconfig 145.143.75.27 255.255.255.0

    ifconfig

The reponse is:

    lo0: flags=49<UP, LOOPBACK,RUNNING>
        inet 127.0.0.1 netmask FF000000
    ec0: flags=61<UP,NOTRAILERS,RUNNING>
        inet 145.143.75.27 netmask FFFFFF00   <---IP Address and Netmask
        ether   00:20D0:00:13:24.

1.3   SETTING THE PORT

The IF-6 accepts raw TCP/IP at port 2001.

Type:

    snet tcp

The response is:

    TCP:
            icon   =   on
            msl   =   2 seconds
            port   =   2001
            urg   =   one octet per packet.

A similar command sets the port.

Example: set port to 2001.

Type:

    snet tcp port 2001

    snet tcp

The response is:

    TCP:
            icon   =   on
            msl   =   2 seconds
            port   =   2001
            urg   =   one octet per packet.

Once the IP address, netmask and raw serial port number are set, the IF-6 may be connected to a UTP 10BASE-T network. Disconnect the IF-6 from the terminal and connect it to the RS232 port RS232 interface of the switch matrix using the RJ45 to D25 matrix control cable. The switch matrix is now ready to be controlled via the network.
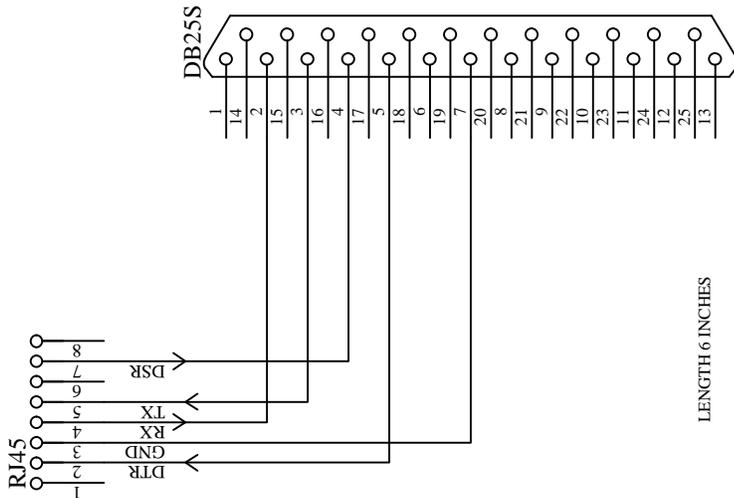

2.0   NETWORK OPERATION

2.1   CONNECTION VERIFICATION

The network connection may be verified at any time by using a ping utility. Any network ping program will verify a proper network connection to the IF-6 and that it is set to the correct IP address. If you cannot ping the IF-6, then there is a problem with either the network connection or the TCP/IP settings which you must go back and correct.
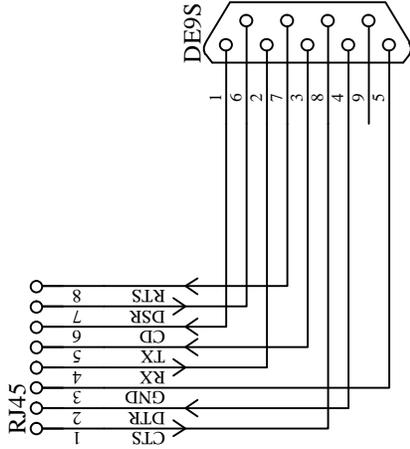
3.0 TCP/IP SETTINGS

	Default Setting	Requested Setting	New Setting
IP ADDRESS:	10.0.0.2		
NETMASK:	255.0.0.0		
PORT:	2001		

REAR PANEL CONECTIONS

RS232

10BASE-T

MATRIX
RS232
CONTROL

RS232 TO PC CABLE

DE9S

1
6
2
7
3
8
4
9
5

RJ45
8   RTS
7   DSR
6   CD
5   TX
4   RX
3   GND
2   DTR
1   CTS

LENGTH 3 FEET

RS232 TO MATRIX CABLE

DB25S

1
14
2
15
3
16
4
17
5
18
6
19
7
20
8
21
9
22
10
23
11
24
12
25
13

RJ45
8
7   DSR
6
5   TX
4   RX
3   GND
2   DTR
1

LENGTH 6 INCHES

LAN DC POWER (INTERNAL)

RCA-PLUG

+5
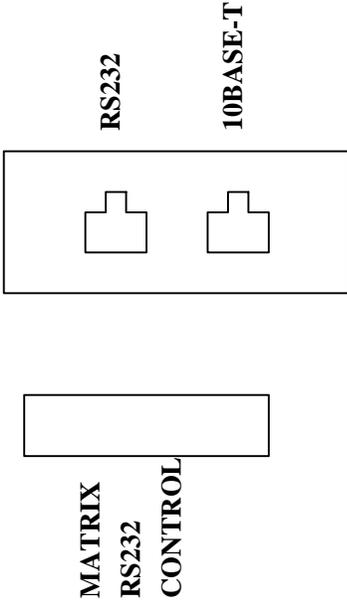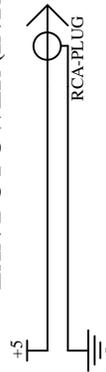
*** WARRANTY ***

CYTEC Corp. warrants that all products are free from defect in material and workmanship and perform to published specifications for five years from date of shipment. This warranty is in lieu of any other warranty expressed or implied.

The liability of CYTEC Corp. shall be limited to replacement or repair of any defective units which are returned F.O.B. to its factory. Units which have been subjected to abuse, misuse, accident, alteration, neglect, or unauthorized repair are not covered by this warranty.

No liability is assumed for expendable items such as lamps or fuses.

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