5.0 CM-8 RS232/IEEE488/LAN CONTROL MODULE

CYTEC's CM-8 RS232/IEEE488/LAN Control Module, **Drwg**. **#11-09-50-1**, is designed to control large multi-chassis switching systems from the MESA II series Control Mainframes as well as newer large Matrices such as DXM and VDM systems. Four forms of control are available on the module: RS232, IEEE488, Ethernet LAN and optionally keypad manual control. All four interfaces may be active and used simultaneously.

It is also possible to have redundant CM-8 control modules when used with the Mesa II Control Chassis and both may be active and operational at the same time.

Interface options: RS232, IEEE488 and LAN are standard but the Manual Control must be specified when purchasing the system.

Non-volatile RAM
The control module also contains a non-volatile memory allowing the system to be configured for various matrix addressing combinations and then remembering that configuration. Interface controls for IEEE488, Baud Rate, Answerback, Echo, Verbose, TCP/IP, Netmask and Port numbers are also saved in this memory allowing these functions to be set-up once and then be restored every time the power is turned on.

Hot Swappable
The CM-8 Module is designed to be hot swappable and may be removed and reinstalled with the system running without affecting the current switch state. On relay based systems a status request would still work normally when the control module is reinstalled. On solid state switching systems (DX, TX, VDX) the status is stored in a look-up table on the control module which will be lost. The only way to restore the correct status readings to the module in this instance would be to reload the current configuration.

Memory Sanitation Procedure
This control module includes a RCM3200 core module which contains volatile and non-volatile RAM. No user information other than switch configurations and interface settings are stored. If the system is ever removed from service or needs to be sanitized for disposal all Volatile and Non-Volatile RAM can be erased using one of the following methods. **Refer to Drwg # 11-09-10**.

1) Easiest with least damage. Remove CM-8, install Jumper JP2 across the pins and reinstall. Cycle the power. All memory will be erased and the system will be set to factory default values. Remove Jumper. JP2 and offset. System can be reset to user values when needed.
2) Easiest but disables control. Remove CM-8. Remove battery from control module and install jumper JP2. Reinstall control and cycle power. System can not be reused until battery is replaced and jumper is removed and offset.
3) Permanent. Remove CM-8. Remove the RMC3200 core board by disconnecting LAN cable prying it off CM-8 (blue outline on page 3 of drwg. 11-09-10). Destroy RMC3200 board. Unit is non functional until CM-8 has been replaced.

Basic Command Syntax

All commands are composed of alpha characters followed by a series of integer values separated by a white space character. The only non alpha-numeric characters allowed are '*" and '?" which are only used for compliance with specific IEEE488.2 commands. The alpha characters are not case sensitive and will accept whitespace or no whitespace between the alpha characters and the first integer value.

There are two types of commands:

1) Set-up and Parameter commands which are used to establish control options and configuration set-ups. Typically, the set-up and parameter commands are only used when you first get the system and then the switch control commands are used to operate the switch. Some examples include P commands for system parameters, snet commands for LAN set-up and E command for turning RS232 Echo on and off. The integer value 73 is often used as an access control value on set-up commands to prevent inadvertent or unintentional commands from being processed.

    Examples:

    P6 0 73   Turn off hardware handshaking for RS232 control.
    Snettcpport 0 8088   set-up port number for TCP/IP socket 0.

2) Switch Control commands cause actions to occur at the connected switching system. These are the commands that are used to control what gets connected to what through the switch. These commands include L for latch, C for clear, etc..

    Examples:

    L0 2 17   Latch Matrix #0, Module #2, Switch #17
    C 0   Clear all connections in Matrix # 0.

Numeric entries must always be separated from each other by spaces!

Multiple commands may be sent as a single string but each command must be separated by a semi colon. Up to 50 characters are allowed on one line so the number of commands will be dependent on the characters required. Only the first 15 characters sent will actually show up on the front panel LCD display (if that option has been included). Cytec does not encourage using this programming technique as it makes status feedback almost unusable but we do recognize that there are specific instances where this can greatly speed up operation of the system.

Commands are covered in detail throughout the rest of the Control sections 5.1 through 5.10.

5.1   RS232 INTERFACE

Signal Connections
The control module is pre-configured at the factory to operate as Data Communications Equipment (DCE) per the EIA RS232D Standard. In this configuration, the module transmits on the RxD Pin and receives on the TxD Pin. RTS is required to be high for the control module to transmit and CTS is output high by the control module to indicate a ready for data state and low when busy. If it is ever necessary to operate the module as a DTE (Data Terminal Equipment) device you will need to provide a Null Modem or Crossover adaptor.

The RS232 rear panel connector is a D9P (male) and can be run directly from a D9 computer com port with a straight through (one to one) D9S to D9S cable. A null modem cable will not work with the factory default settings! Adaptors are available at any computer store to convert from D25 to D9. Do not use any adaptor that also acts as a null modem converter. If you are building your own cables, consult CYTEC Corp., for D25 to D9 pin out conversion.

D9P (male) PIN OUTS

Pin	Signal	Function
1	DCD	No Connection.
2	RxD	Data out of CM.
3	TxD	Data in to CM.
4	DTR	No Connection.
5	Common	Signal Ground.
6	DSR	No Connection.
7	RTS	CM requires + V to transmit if Hardware Handshaking is enabled.
8	CTS	CM provides +V when ready if Hardware Handshaking is enabled.
9	RI	No Connection.

Default Values

As delivered from Cytec, the system uses the default Windows Com Port settings shown below:

Bits per second (Baud)	**9600**
Data bits	**8**
Parity	**None**
Stop bits	**1**
Flow control	**Hardware**

Only Baud rate (Bits per second) and Flow Control (Hardware handshaking) can be modified. See **Section 5.1.1** for command syntax.

5.1.1 RS232 INTERFACE I/O CONFIGURATION

I/O Configuration
Module # 11-09-50-1

Default values:

Baud Rate	9600
Hardware Handshaking	On
Answerback	On
Echo	Off
Verbose	Off

The RS232 interface can be accessed using any standard terminal emulation program such as Hyperterm (Windows). Connect a one to one D9 female to D9 female cable between the computer and the Cytec switch.

The first thing you should do is turn on Echo. This will enable you to see what you are typing. Make sure you turn echo back off when you are done with the terminal session. Echo being left on will normally interfere with programs written specifically to control the switch.

Echo
Echos the characters back to your screen while you type them so you can see what you type.

Command:	"E 0 73"	Turns Echo Off
	"E 1 73"	Turns Echo On

Answerback
Answerback allows the Control Module to return information to the com port. Answerback should almost always be left on.

Command:	"A 0 73"	Turns Answerback Off
	"A 1 73"	Turns Answerback On

Verbose
Verbose causes the system to return more specific information when you request status or read answerback characters. It is sometimes helpful when troubleshooting but it slows the interface down a lot. While there may occasionally be a good reason to turn on Verbose during a Hyperterm session, it is almost never used in a programmatic interface. All of the same information could be generated in code based on the non-verbose responses without slowing down the RS232 interface.

Command:	"V 0 73"	Turns Verbose Off
	"V 1 73"	Turns Verbose On

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	Baud# n
2400	4
4800	5
9600	6
19200	7
38400	8
57600	9
115200	10
230400	11 (untested)
460800	12 (untested)

Command: "P19 n 73"
                    "P19 7 73"   sets baud rate to 19200.

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.

Obviously as soon as you reset the Cytec baud rate you will no longer be able to communicate with the switch until you reset the baud rate on your computer or communication device.

CTS/RTS Handshake

The Clear to Send (CTS) and Request To Send (RTS) hardware handshaking functions may be modified by the 'P6' command.

Command:"P6 handshake 73"

handshake = 0   Handshaking off
handshake = 1   Handshaking on (default)

Example
          "P6 0 73"   Turn handshaking off.

5.2   IEEE488 INTERFACE

Signal Connections
Per IEEE Std. 488.1-1987 specification.

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 1 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.

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.

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.

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.

5.3   LAN INTERFACE

The Cytec LAN interface is a 10BaseT / 100BaseT auto-ranging Ethernet interface with an RJ45 connector. A Category 5e or better cable is recommended.

Default settings:

IP Address:	10.0.0.144
Netmask:	255.0.0.0
Gateway	0.0.0.0
Telnet Port:	23
TCP/IP Port 0:	8080
TCP/IP Port 1:	8081
Telnet Lockout:	0 (disabled) Telnet Sessions allowed by default.
Telnet Echo:	0 (disabled) Telnet Sessions do not echo.
TCP Idle	60

The Default LAN settings may be modified by any control port (RS232, LAN, or IEEE488). The most common methods are:

Telnet to default telnet port 23. Any Telnet program will work. Depending on the program you may have to turn on Echo to see the commands that you type. Some Telnet programs automatically echo even with ours turned off. If you turn on Echo, be sure to turn it back off when you are done.

Telnet via TCP/IP to ports 8080 or 8081. This works the same as above except it will probably never automatically Echo.

Use Hyperterm or any other terminal emulation program to communicate to the RS232 port from a com port on your computer. See section 5.1 for RS232 details.

Use Hyperterm to Telnet to port 23 or speak TCP/IP to ports 8080 or 8081.

Use a command line IEEE488 (GPIB, HPIB) program such as National Instruments IBIC.exe (Interactive Control).

TCP/IP commands

IFCONFIG   Set IP Address and Netmask

ifconfig aaa.aaa.aaa.aaa nnn.nnn.nnn.nnn

a = ip address in dotted decimal format
n = subnet mask in dotted decimal format

Example: ifconfig 10.0.0.100 255.0.0.0

SNET TCP PORT   Set Port number for TCP/IP sockets

SNET TCP PORT n m where = equals one of two sockets and m is the port number

Example:
                snet tcp port 0 8088   socket 0 is port #8088
                snet tcp port 1 8089   socket 1 is port #8089

Port numbers must be between 1024 and 65535.

The Telnet port (23) may also be available. See TELNETLOCK command

TELNET LOCK   Disable Telnet socket.

TELNETLOCK n   where n = 0,1

Example:
                telnet lock 0   Connections to Port 23 are allowed
                telnet lock 1   Connections to Port 23 are not allowed

TELNET ECHO   Echo characters sent to Telnet socket.

TELNET ECHO n   where n = 0,1

Example:
                telnet echo 0   Character are not echoed back to telnet application
                telnet lock 1   Character are echoed back to telnet application
                                    (May cause double characters).

SOCKET LIFE

The LAN Interface uses a program called TCP Tick to tell whether or not the network connection is intact between the computer that established the socket and the LAN interface. The socket will remain until the requesting IP address terminates the socket or there is a break in the network connection. Sockets will automatically terminate after a pre-determined period of inactivity. That period is set by the SNET TCP Idle commands. Each open socket needs activity to stay alive.

SNET TCP Idle n   (n=seconds)   (1 to 3600 sec)
Default = 60 sec

SNET TCP Idle   (display)
TCP Idle = 60

GATEWAY

Hosts   xxx.xxx.xxx.xxx   // to set gateway

Hosts   //display gateway
Gateway = 0.0.0.0

5.4   OPERATION

COMMAND FORMAT
All commands consist of at least one ASCII character indicating the command followed by optional values. An End of Line character must be sent in order to execute the command.

If values are included with the command, the first value does not need to be separated from the command; all subsequent values MUST be separated by spaces or commas, eg. L1 2.

Multiple commands may also be sent on one line. Commands must be separated by a semi-colon character. Command line length is limited to 50 characters.

Examples:	Print #1,"L 2 7"	;Connect Input 2 to Output 7.
	Print #1,"C;L 1 2;"	;Clear then connect In 1, Out 2.

COMMAND COMPLETION

Upon completing a command, the status of that operation is updated. The completion code is sent for each command received and command lines with multiple commands will cause multiple completion codes to be returned. Return Strings and Completion codes are only sent to the calling interface. In other words, an RS232 command only generates a response on to the RS232 interface.

The completion code is always returned with a Carriage Return/Line Feed if the LAN interface is used.

Answerback and/or Echo must be enabled for the completion code to be returned via the RS232 port.   Each completion code will be followed by a Carriage Return or Carriage Return/Line feed character if Echo is enabled.

Char	Completion Status
'0', '1'	Successful Operation.
'2', '3'	Unknown Command, the first character of the command string was unrecognizable.
'4', '5'	Incorrect entries, the number or type of entries was incorrect.
'6', '7'	Entries out of limits, a crosspoint was requested that was outside the size of the matrix.
'8', '9'	Invalid access code, the required code number 73 was not included or was entered incorrectly in a control command.

Command lines will be received by the control module but not executed until 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 50 characters. 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 begin with at least one alpha or '*' 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 or LAN 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 or LF   RS232
CR or LF   LAN
CR and END   IEEE488
LF and END   IEEE488
DAB and END   IEEE488

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 switch point status (open or closed) and command completion will be stored by the matrix.

If LAN interface is used or 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.

Command Completion Codes

Char	Hex	Completion Status
'0'	30	Successful Operation, last addressed switch open.
'1'	31	Successful Operation, last address 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.

MATRIX COMMANDS

L - Latch.   Close selected switch point.

Syntax: L <matrix> <module> <switch>
                 L <matrix> <input> <output>

Example: L 0 31 7   //connect input 31 to output 7 in matrix 0.

U - Unlatch.   Open selected switch point.

Syntax: U <matrix> <module> <switch>
                 U <matrix> <input> <output>

Example: U 0 31 7   //disconnect output 7 from input 31 in matrix 0.

X - Multiplex.   Clear matrix then close selected switch point

Syntax: X <matrix> <module> <switch>
                 X <matrix> <input> <output>

Example: X 0 31 7   //Clear matrix 0, then connect input 31 to output 7 .

C - Clear.   Clear system or specified matrix.

(Disconnect all switch points)

Syntax: C
              C <matrix>

Example: C 0   //Clear matrix 0
             C   //Clear entire system.

S - Status

Query switch points for latched/unlatch condition.

Syntax: S <matrix> <Input> <Output>   //Point Status
         S <matrix> <Input>   //Input Status
         S<matrix>   //Matrix Status
         S   //System Status

Depending on the number of parameters entered the Status command returns a list of closed switch points or a 0/1 represent the open/closed state of a specified path.

Point Status (3 parameters)

Entering an S command with 3 parameters (matrix #, input # output #) causes the system to return a '0' if the point is unlatched or a '1' if the point is latched.

Matrix or System Status (1 or 0 parameters)

Entering an S command with 1 parameter causes the system to return a list of latched switch points for the specified matrix.. The list has the following format:

Matrix #, Input #, Output #;<cr><lf>

Example:

0, 12, 14;
0, 123, 15;
0, 78, 37;
0, 12, 78;

If no parameters are specified, the latched switch points in every matrix are returned.

Input Status (2 Parameters)

Entering an S command with 2 parameters returns a list of latched points in the specified matrix (first parameter) which are connected to the specified input (second parameter). This provides a convenient way of querying all the out puts that are connected to a specified input.

I Interrogate (Same as Status command)

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.

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.

D - Display Setup.

Display system setup parameters

Syntax: D

Example: D

Return: F1
                A1, E0, V0
                Baudnumber = 6, RS Handshaking = 1
                GPIB = 7
                IP Address = 10.0.0.144
                Netmask = 255.0.0.0
                Gateway = 0.0.0.0
                Port0 = 8080, Port1 = 8081
                TCP idle = 60
                Telnetlock = 0, Telnet Echo = 1
                Battery Ram = 0, Default List = 0

N - Revision Query.

Display device identification and revision information. Same as IEEE488.2 *idn? command.

Syntax: N

Example: N

Return: Cytec, 11-09-10, 1.00, 0

Z - System Size Query.

Display matrix dimensions.

Syntax: Z

Example: Z

Return: 4, 128, 128, 32, 64, 1, 8, 16, 8

Number of Matrices = 4
Matrix 0 is 128 inputs by 128 outputs
Matrix 1 is 32 inputs by 64 outputs
Matrix 2 is 1 input by 8 outputs
Matrix 3 is 16 inputs by 8 outputs

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.

Integer identifier

The N command now includes a single bite which can be used as an identifier for Cytec systems. The identifier is a single bite integer so it may 0 to 255. WE do not assign this and it has no meaningful relationship to any product. It is simply a number which may be assigned to a chassis so that the end user can acknowledge that a specific Cytec chassis is communicating. It is up to the customer to assign the number and keep track of it. It allows them to poll multiple chassis and know that the one they are talking to is, for example, the JX/256 that they assigned the identifier A13" to.

Command to enter or change the number:

P90 n 73   where n is the number from 0 to 255

See Section 5.6 for more details

NOTE - The text string received from the >N= Command will vary depending on the type of system.

5.4.1 ADDITIONAL MATRIX COMMANDS

DT - DX128x128 Temperature Query.

Display approximate VSC3140 die temperature.

Syntax: DT 0

Example: DT 0

Return: 4   (0-15)

The returned number 0-15 represents a temperature range. Lower numbers represent cooler
temperatures. See VSC3140 data sheet.

Return
Value   Die Temperature Range (Degrees Celsius)
0   23 to 41
1   33 to 50
2   42 to 60
3   52 to 69
4   61 to 78
5   70 to 88
6   80 to 97
7   89 to 106
8   98 to 116
9   108 to 125
10   117 to 135
11   127 to 144
12   136 to 153
13   145 to 163
14   155 to 172
15   164 to 181

Temperature above 100 degrees C (return value 8 or higher) are cause for alarm.

DXR - Read DX128x128 switch register.

Read the value assigned to any switch fabric (VSC3140) output register. The S command is preferred over DXR.

Syntax: DXR <output register>   0<=Output <= 127

Example: DXR 119

Return: 28   Input 28 is latched to output 119

If the return value is 143, the output is not active.

STATCOMPARE - Compare DX128x128 switch registers with status values.

Syntax: STATCOMPARE

Example: STATCOMPARE

Return: NULL   All DX/128 switch output registers match status registers in the MESA II.

This command should only be necessary if some failure condition is recognized–-perhaps after a power glitch, brownout, or in the event that the MESA II expansion cable is removed from the DX/128x128 while the MESA II is receiving commands.

Status information is stored in the MESA II controller. In the unlikely event that this status information does not match the switch resisters, the unmatched registers will be displayed. The format is:

DX output register #, status(input) value, actual DX (input) register value.

If the return value (status or DX resister value) is 143, the output is not active.

Example(showing error): STATCOMPARE

Return: 17, 34, 79   Output 17 is connected to Input 79 but should be connected to 34.

Solution:

Latch 17 34.

5.5   RS232 SPECIFIC MATRIX COMMANDS

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.

P6 n 73 :   RS232 Hardware Handshaking

Hardware Handshaking	n
No	0
Yes	1 (default)

Example: P6 1 73   //Use RS232 Hardware Handshaking

P19 n 73   RS232 Baud Rate:

Baud	n	
2400	4	
4800	5	
9600	6	(Default)
19200	7	
38400	8	
57600	9	
115200	10	
230400	11	untested
460800	12	untested

Example: P19 10 73   //Set Baud To 115200, requires Reset or Reboot

5.6   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 switch points and their usage in the system. Certain interface functions may also be modified to allow easier communications to other equipment.

The Control Module Shipped Configuration Appendix A summarizes the 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 (Future use, not functional 3/25/08)
        Syntax: P 1 mode 73   mode = 0 or 1

        Mode 0   SRQ not used.
        Mode 1   SRQ signals command completion.

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

*P 3 - IEEE488 Enable/Disable DCL/SDC Function (Future use, not functional 3/25/08)
        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 (Future use, not functional 3/25/08)
        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.

Matrix size   Supersedes (P10..P13 and P20..P23 programming commands)

Define the chassis type for each matrix controlled by the MESA II
Syntax: matrix size , <mtx> <# inputs> <#outputs>
      Eg.
      "Matrix size 1 16 8"   Define matrix 1 to have 16 inputs and 8 outputs.
      "Matrix size 0 64 64"   Define matrix 0 to have 64 inputs and 64 outputs.

Matrix size entered without parameters displays the chassis type setting for each of the 16
possible matrices and the total number of active matrices (Default values shown)

      Max Matrices = 2

      Mtx 0, Type = 128, Ins = 128, Outs = 128
      Mtx 1, Type = 128, Ins = 128, Outs = 128
      Mtx 2, Type = 0, Ins = 16, Outs = 8
      Mtx 3, Type = 0, Ins = 16, Outs = 8
      Mtx 4, Type = 0, Ins = 16, Outs = 8
      Mtx 5, Type = 0, Ins = 16, Outs = 8
      Mtx 6, Type = 0, Ins = 16, Outs = 8
      Mtx 7, Type = 0, Ins = 16, Outs = 8
      Mtx 8, Type = 0, Ins = 16, Outs = 8
      Mtx 9, Type = 0, Ins = 16, Outs = 8
      Mtx 10, Type = 0, Ins = 16, Outs = 8
      Mtx 11, Type = 0, Ins = 16, Outs = 8
      Mtx 12, Type = 0, Ins = 16, Outs = 8
      Mtx 13, Type = 0, Ins = 16, Outs = 8
      Mtx 14, Type = 0, Ins = 16, Outs = 8
      Mtx 15, Type = 0, Ins = 16, Outs = 8

P 90 - Set Integer identifier
      Syntax: P 90 n 73   where n is a number from 0 to 255

The N command will now include a single byte which can be used as an identifier for Cytec
systems. The identifier is a single bite integer so it may 0 to 255. WE do not assign this and it
has no meaningful relationship to any product. It is simply a number which may be assigned to a
chassis so that the end user can acknowledge that a specific Cytec chassis is communicating. It is
up to the customer to assign the number and keep track of it. It allows them to poll multiple
chassis and know that the one they are talking to is the CXAR/32 to which they gave the number
A13".

5.6.1 ADDITIONAL MATRIX PROGRAMMING/SETUP, P COMMAND

Chassis Type (Supersedes P2 programming command)

Define the chassis type for each matrix controlled by the MESA II

Syntax: chassis type , <mtx> <type>

    Eg.

"Chassis type 3 0"	Define matrix 3 to be a CL8 (8 switches per module) type.
"Chassis type 1 64"	Define matrix 1 to be DXM64x64.

Chassis type entered without parameters displays the chassis type setting for each of the 16 possible matrices. (Default values shown)

    Mtx 0, Type= 128
    Mtx 1, Type= 128
    Mtx 2, Type= 0
    Mtx 3, Type= 0
    Mtx 4, Type= 0
    Mtx 5, Type= 0
    Mtx 6, Type= 0
    Mtx 7, Type= 0
    Mtx 8, Type= 0
    Mtx 9, Type= 0
    Mtx 10, Type= 0
    Mtx 11, Type= 0
    Mtx 12, Type= 0
    Mtx 13, Type= 0
    Mtx 14, Type= 0
    Mtx 15, Type= 0

Chassis Type Codes

    0 = chassis with CL8s LX128, CX128, RJM128, RSM128 etc.
    1 = chassis with CL16s, VX256, JX256 CX256, etc.
    16 = PX512
    32 = VDM32x32
    48 = RJV48
    64 = DXM64
    65= DXM64 as Dual 32x32
    128 = DXM128
    129 = DXM128 as Dual 64x64
    144 = RJV144

P6 - RS232 Handshaking--RTS/CTS Control
    Syntax: P6 n 73   n= 0, 1, 2, 3

The R command is used to set the RTS/CTS functions for the RS232 port.

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

Eg.   "P6 0 73"   Enables CTS and RTS Functions.

P 14 - Set IEEE488 (GPIB) Address
    Syntax: P 14 n 73   n = GPIB address 1-31

Set the IEEE488 (GPIB) address. Command is completed at the old address. Subsequent commands must be at the new address.

Eg.   "P 14 7 73"   GPIB address 7 (Factory Default)
            "P 14 16 73"   GPIB address 16.

P 19 - Set RS232 Baud Rate
    Syntax: P 19 n 73   n = 0, 1, 2, 3, 4, 5, 6

Set the RS232 baud rate. Command is completed at the old baud rate. Subsequent commands must be given at the new baud rate.

n	Baud Rate
0	300
1	600
2	1200
3	2400
4	4800
5	9600
6	19200

Eg.   "P 19 4 73"   Set Baud to 4800.
            "P 19 5 73"   Set Baud to 9600. (Factory Default)
            "P 19 6 73"   Set Baud to 19.2K.

P 98 - Load Factory Default Setup Values
    Syntax: P 98 0 73

    Reset setup parameters to factory default values.

NOTE: The default values may also be set with hardware. Temporarily install a pin jumper shunt at JP5 **(See Drwg. #11-01-60)** and turn the power on and off. Remove the pin jumper and turn the power on. Operation resumes at factory default setup values.

*P 99 - Soft Reset Command (Future use, not functional 3/25/08)
    Syntax: P 99 0 73

    Reboot control module. This will clear the matrix. It will also reload the points stored in RAM if the control module has the battery back-up ram option.

5.7   MATRIX COMMAND SUMMARY

COMMAND	FUNCTION
L input output	Latch switchpoint.
U input output	Unlatch switchpoint.
X input output	Multiplex switchpoint.
C	Clear entire system.
R 0/1	Reset switch matrix, 0-to-All or One-to One.
S S input output	Return status.
I	Interrogate Closed Points.
F 0/1 73	Disable/Enable Front Panel.
P parameter value 73	Program parameter.
N	Identification and Revision Number
D	Display Setup

RS232 Specific Commands

A 0/1 73	Disable/Enable Answerback.
E 0/1 73	Disable/Enable Echo.
V 0/1 73	Disable/Enable Verbose.

5.8   DEFAULT CONFIGURATION SETTINGS

Default Values   (Corresponding commands)

Matrix Values
Number of Matrices   1   (P0 1 73)

Modules in Matrix #0   128   (P10 128 73)
Modules in Matrix #1   0   (P11 0 73)
Modules in Matrix #2   0   (P12 0 73)
Modules in Matrix #3   0   (P13 0 73)

Relays in Matrix #0   128   (P20 128 73)
Relays in Matrix #1   0   (P21 0 73)
Relays in Matrix #2   0   (P22 0 73)
Relays in Matrix #3   0   (P23 0 73)

RS232
Echo Off   (E0 73)
Verbose Off   (V0 73)
Answerback On   (A1 73)
Baudnumber = 6 (9600 Baud)   (P19 6 73)
RS232 Handshaking Enabled   (P6 1 73)

LCD
Front Panel Enabled   (F1 73)

TCP/IP
IP Address   10.0.0.144   (ifconfig 10.0.0.144 255.0.0.0)
Netmask   255.0.0.0   (ifconfig 10.0.0.144 255.0.0.0)
Port0   8080   (snet tcp port 0 8080)
Port1   8081   (snet tcp port 1 8081)
Telnet   23   <u>unchangeable</u>
Telnet Lock disabled (telnet sessions allowed)   (telnet lock 0)
Telnet Echo disabled (no echo)   (telnet echo 0)

Default settings may be restored by installing jumper JP2 on the control module and turning the power off and on or pressing the reset button next to jumper JP2 while the jumper is installed. Remove jumper JP2 for normal operation.

Note: If there are switch points stored in non-volatile ram forcing the default settings will clear these points.

5.9   LCD DISPLAY/KEYPAD MANUAL CONTROL OPTION

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. The display will also show the last command entered from the remote computer interface when the front panel is enabled.

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.
X	Multiplex operation.
C	Clear operation.
ENTR	Execute displayed operation.

Operation
A matrix command key, **L**, **U**, **X** 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
X	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

The **ENTR** key may now be pressed to execute the displayed operation. If the displayed entry is incorrect or the operation is not desired, pressing any matrix command key will clear the display and restart the entry.

Status Display

After the **ENTR** key is pressed, the displayed operation is attempted to be executed by the control module. If the execution is successful, a **Point Closed** or **Point Open** message will be displayed on line 2. If the operation cannot be executed, an error message will be displayed.

Line 2 Message	Status
Ready	Displayed after power on.
Enter Point	The ENTR key has not been pressed, command and selection mode.
Point Closed	The selected point was closed.
Point Open	The selected point was opened.
Points Open	All points opened, Clear operation.
***Err: limits	The selected point is outside the programmed size of the matrix.
***Err: entry	An incorrect entry was selected.

Front Panel Disable

The >F= command allows enabling or disabling front panel operation. If the front panel is disabled, no operation can be performed from the keypad.

Remote Command	Line 1	Line 2
F 0 73	Panel	Disabled
F 1 73	Panel	Enabled

Contrast and LED Backlight Adjustment

Controls are provided to adjust the LCD contrast and LED backlight level. These controls should only need adjustment in extremely bright or dim environments or for acute viewing angles. Both LCD and LED circuits have temperature sensing elements that will automatically adjust the output level for changes in the ambient temperature.

5.10   BATTERY BACKUP RAM OPTION

The control module keeps track of all closed points. These points may be saved and later recalled in any of 74 storage lists. List number 0 always keeps track of the currently latched switch points and may be used to restore them at power on. Alternatively a set of points may be saved in List number 1 to be loaded as default switch settings at power on. A total of 1364 points may be saved in the Lists. This is a total for lists including list 0. Any single list may contain 1 to 1364 points.

List 0,   Currently Closed Points
> The currently closed switch points are saved in this list. The control module keeps track of all operations to the matrix and keeps that information in list 0. This list may be re-loaded at power on.

List 1,   Default List
> The switch points saved in this list may be loaded at power on. The list may also be recalled at any time.

Lists 2 - 74,   General Purpose Lists
> Current configurations may be saved and reloaded from any of these lists.

BATTERY BACKUP RAM OPTION SETUP COMMANDS

P 7 0 73   Disable RAM load at power on.
P 7 1 73   Enable RAM load at power on.
P 8 0 73   Load List 0, Currently closed switches, at power on. Requires previous P 7 1 73 command.
P 8 1 73   Load List 1, default switchpoints, at power on. Requires previous P 1 73 command.

BATTERY RAM OPTION SAVE/LOAD/DISPLAY COMMANDS

BT 0 73   Test RAM, reports errors to communication port (RS232 or IEEE488).
BS N 73   Save current switchpoints in list N, N=1 through 74.
BL N 73   Load switchpoints from list N.
BC N 73   Clear points in list N. Use the matrix command 'C', Clear, to clear List 0.
BP 0 73   Purge (clear) all storage points. Clears Matrix.
BF 0 73   Return Free storage space left. Single numeric string returned. RS232 numeric followed by a End of Line sequence. IEEE488 numeric followed by a semi-colon(;) and Line Feed. END (EOI) true with the Line Feed character.
BD N 73   Display list N. Three numerics separated by commas returned per list point. RS232 - each set of three followed by an End of Line sequence. IEEE488 - each set followed by a semi-colon.

Example RS232:	Example IEEE488:
0,0,0EOL	0,0,0;1,2,3;4,5,6;LF
1,2,3EOL	
4,5,6EOL	

APPENDIX A – MESA II CONTROL MODULE SHIPPED CONFIGURATION

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

P 0   __   # of Matrices

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 7   ___   NV RAM (if option installed)

P 8   ___   Load List #0 or #1 if NVRAM Enabled

P 10   ___   # of Inputs (For Matrix #0)

P 11   ___   # of Inputs (For Matrix #1)

P 12   ___   # of Inputs (For Matrix #2)

P 13   ___   # of Inputs (For Matrix #3)

P 20   ___   # of Outputs (For Matrix #0)

P 21   ___   # of Outputs (For Matrix #1)

P 22   ___   # of Outputs (For Matrix #2)

P 23   ___   # of Outputs (For Matrix #3)

E   _0_   Echo   on - off.

V   _0_   Verbose   on - off.

A   _1_   Answerback   on - off.

P19   _6_   Baud rate   9600 ,

P6   _1_   RTS, CTS   active - inactive

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 */
}
```