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13. MULTIPLEX STRIPER CONTROLLER MODULE

13.1 DESCRIPTION

The Multiplex Striper Controller Module, hereafter referred to as the Controller Module, contains all the control, monitoring, and interface components for the striping operations. The operator indicators, controls, and interface connections are located on the front and rear panels. (Please refer to Chapter 3 for additional information)

13.1.1 Front Panel Indicators (Figure 13.1)

The front panel of the Controller Module contains the system indicators and the main power switch. The following indicators and switch are located on the front panel.

1. ACTIVE Indicator
2. IDLE Indicator
3. TIPS DOWN Indicator
4. FAULT Indicator
5. On/Off (1/0) Switch

Figure 13.1 Multiplex Striper Controller Module Front Panel

13.1.1.1 ACTIVE Indicator

This white indicator illuminates while the Multiplex Striper is operating.

13.1.1.2 IDLE Indicator

This white indicator illuminates while the Multiplex Striper is not operating.

13.1.1.3 TIPS DOWN Indicator

This white indicator illuminates while the Multiplex Striper tips are down.

13.1.1.4 FAULT Indicator

This yellow indicator illuminates when a fault has been detected.

13.1.1.5 On/Off (1/0) Switch

This 2-position rocker switch turns the Controller Module main power (AC input) "ON" (1) or "OFF" (0).

13.1.2   Rear Panel (Figure 13.2)

The rear panel contains the following:

1. Power Entry Module
2. MOTOR Connector
3. CONTROL POWER FUSE
4. E-STOP Connector
5. DUMP VALVE Connector
6. CONTROLLER COMMUNICATION Connector
7. RS-232 Connector (Factory use only)
8. START / STOP PENDANT Connector (Refer to section 13.4.1)
9. STRIPER CONTROL Connector

The power entry module provides an entry point for power coming into the Controller Module and the main line fuse(s). The striper bed motor connector interfaces to the motor on the Striper Module. The Control fuse protects the internal +24V power supply and fan. The emergency stop (E-Stop) enables or disables power to the motor. The dump valve connector controls the systems air dump solenoid. The controller communication connector provides Controller Module to Controller Module

communications. The RS-232 Connector is not used. The striper control connector interfaces to the sensors on the Striper Module. The start / stop pendant option connector connects to the optional start / stop pendant.

13.1.2.1 Power Entry Module

The power entry module contains a receptacle for a standard IEC power cord, a voltage selector switch and main fuse holder.

<u>CAUTION</u>

Before plugging in the system, insure the line voltage setting appearing in the window agrees with the available line voltage. Damage to the equipment could result if the two voltages do not match.

The design of the power entry module requires that the line cord be disconnected before either the voltage select switch is changed or a line fuse is removed. Perform the following steps if it is necessary to change the setting of the line voltage select switch.
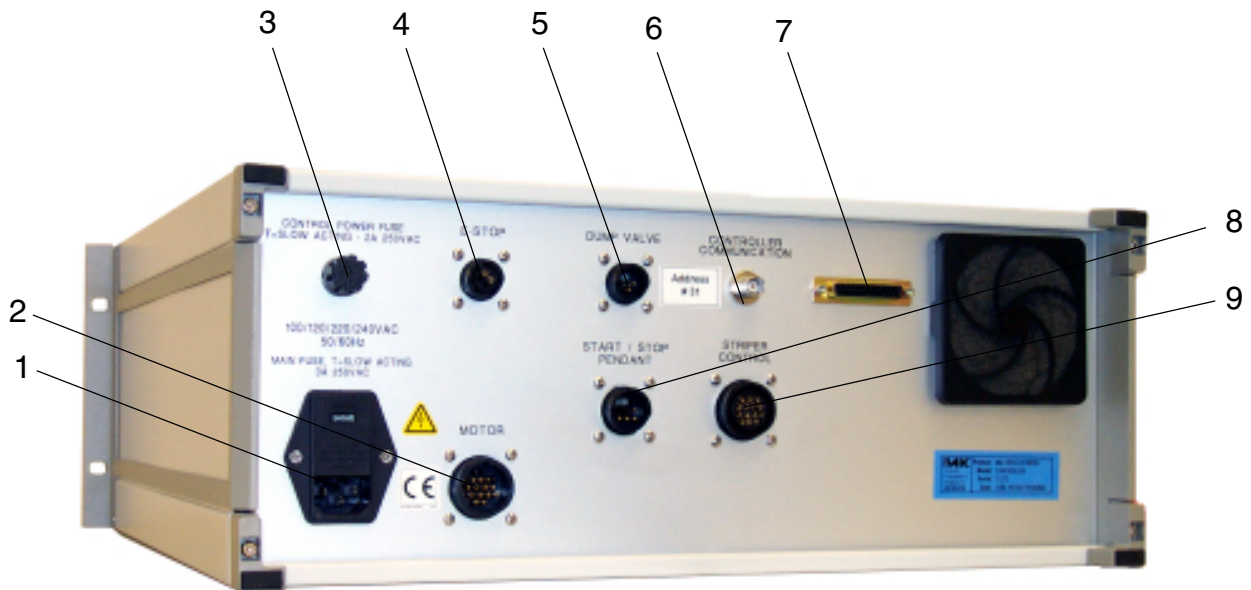

Figure 13.2 Multiplex Striper Controller Module Rear Panel

1.   Disconnect the line cord at the power entry module and open its cover.

2.   Remove the selection cam from the unit and replace it oriented so the desired voltage will appear in the window when the cover is closed.

CAUTION

Rotating the voltage select cam while it is in the module may damage the module.

3.   With the voltage select cam in the proper position, close the cover and replace the line cord. If the cover does not completely close, open the cover and slightly reposition the voltage select cam.

13.1.2.2 MOTOR Connector

The Controller Module has a 16-pin connector on the rear panel used to connect to the Striper motor. The motor provides linear motion for the striper bed. This connector provides both power and feedback to and from the motor.

13.1.2.3 CONTROL POWER FUSE

A fuse is provided to protect the auxiliary components located inside the Controller Module (24V power supply and fan).

13.1.2.4 E-STOP Connector

This provides the connection to the emergency stop switch (or switches). The emergency stop switch must be connected in order for the Controller Module to operate.

13.1.2.5 DUMP VALVE Connector

This connector controls the system air dump solenoid.

13.1.2.6 CONTROLLER COMMUNICATION Connector

The BNC connectors provide controller-to-controller communications. The first Controller (Master) and last Controller (Channel) MUST have a 93 Ohm terminating resistor installed on the output connector (terminating resistors are provided with the units). The Striper Controller Module has the terminating resistor installed and should be the last connected controller.

13.1.2.7 RS-232 Connector

On Striper Controllers this interface is not used (factory use only).

13.1.2.8 STRIPER CONTROL Connector

The Controller Module has a 14-pin connector on the rear panel used to control and sense the Striper bed assembly. This connector provides solenoid control and sensor feedback for the bed and tip assemblies.

13.2 OPERATION

The Striper Controller Module receives information from the Multiplex Master Controller Module via the Controller Communications cable. (Refer to Chapter 3 for more information.)

13.2.1 Commands

The commands are sent to the controller(s) and can either command one controller or all controllers depending on the code sent. If a 0 is sent as the controller number, all controllers will be affected except the Striper Controller. Striper commands MUST be preceded by the striper channel number 31. Broadcast commands have no effect or response from a Striper Controller. The following tables list the commands for the controller(s).

MULTIPLEX Linear Striper Controller Commands
(Precede command with 31 for striper controller)

COMMAND RESPONSE DESCRIPTION

b => BEGIN

b	b	Initiates a stripe according to the current settings.

c => CLEAR FAULTS

c	c<value1>	Clears all faults. Error number returned as value1.

d => DIRECTION

d	d<value1>	Returns current stripe direction setting as value1.
d<value1>	d<value1>	Determines stripe direction.

                                                     <value1>: 0 = Stripe in both directions (default)
                                                        1 = Stripe Left-to-Right and Return
                                                        2 = Stripe Right-to-Left and Return

e => END

e   e   Stops current striping bed operation. When this is used during a reference, the bed will have to be re-referenced ('f' command) before a striping cycle can begin. When this is used during a striping operation, the system will lift the pens and stop as soon as possible. Another begin command will return the bed to the closest end (depending on selected direction value.)

f => REFERENCE

f   f   Establishes left and right end of travel position locations.

k => KEYLOCK

k   k<value1>   Returns the current setting which inhibits or allows operation of the striper controller.

k<value1>   k<value1>   Inhibits or allows operation of a striper controller.
         <value1>:
            0 = Disabled (bed will not stripe)
            1 = Enabled (default)

p => TIPS

p   p<value1>   Returns the current commanded tip position.
p<value1>   p<value1>   Changes the tip position.
         <value1>:
         0 = Auto-up, lowers when making stripe (de fault)
         1 = Down (bed will not move)
         2 = Up (will not stripe, bed will move)

q => READY/BUSY

q   q<value1>   Indicates Ready/Busy status. <value1> is 0 for Ready and not zero for Busy. Individual operational information can be determined using binary decoding as follows:

bit	value	active if bit set
0	1	Any Motion
1	2	Striping Cycle
2	4	Reference Cycle
3	8	Moving Right
4	16	Moving Left

r =>STRIPE RATE

r	r<value1>	Returns the surface speed while a line is being dispensed in millimeters per second.
r<value1>	r<value1>	Sets the surface speed while a line is being dispensed in millimeters per second.

        <value1> represents a 3 digit decimal value.
        Maximum: 100
        Minimum: 1
                25 (default)

s =>STATUS INFORMATION

s	s<value1>	Returns the striper position in mm from left home sensor.
31s10	31s10,<value2>	Returns the striper trigger delay. This delay is between when the pump actuators are triggered and when the bed motion starts.
31s10,<value2>	31s10,<value2>	Sets the striper trigger delay. A value of zero will start the pump motion when the bed motion begins.

        <value2> Delay in milliseconds.
        Maximum: 2000
        Minimum: 0
                300 (default)

31s11	31s11,<value2>	Returns the pen dwell time. This dwell time is the time within which the desired pen position must be sensed.
31s11,<value2>	31s11,<value2>	Sets the pen dwell time.

        <value2> Delay in tens-of-milliseconds.
        Maximum: 300
        Minimum: 0
                200 (default)

u => LINE MARGIN

u	u<value1>	Returns the current line margin (distance from reference edge to start of line) in millimeters.
u<value1>	u<value1>	Sets the margin in millimeters.

        <value1> represents a 2 digit decimal value.
        Maximum: 100
        Minimum: 0
                0 (default)

v => LINE LENGTH

| v | v<value1> | Returns the current line length in millimeters. |
| v<value1> | v<value1> | Sets the line length in millimeters. |

                                                    <value1> represents a 4 digit decimal value.
                                                    Maximum:440
                                                    Minimum: 0
                                                               400 (default)

NOTE

The LINE MARGIN setting PLUS the LINE LENGTH (u<value1> + v<value1>) setting must be less than the maximum Line Length of 440 millimeters.

y =>BED RATE (Not Striping)

| y | y<value1> | Returns the surface speed for bed movement while not striping in millimeters per second. |
| y<value1> | y<value1> | Sets the surface speed for bed movement while not striping in millimeters per second. |

                                                    <value1> represents a 3 digit decimal value.
                                                    Maximum:200
                                                    Minimum: 1
                                                               75 (default)

z => SOFTWARE VERSION

| z | z<value1> | Returns the software version. Software version information includes the Multiplex family or group and date code (revision code). The versions include: |

                                                PMBdddyy   For striper bed
                                                  PMCdddyy   For custom systems
                                                  PMDdddyy   For SF series W/O Touchscreen
                                                  PMEdddyy   For LF series W/O Touchscreen
                                                  PMFdddyy   Reserved
                                                  PMGdddyy   For SF series W Touchscreen
                                                  PMHdddyy   For LF series W Touchscreen
                                                  PMJdddyy   Reserved
The revision code is 'ddd' the day of the year and 'yy' the last two digits of the year.

13.2.2   Warnings

Warnings indicate problems in the command received, or a state of the Controller Module which prohibits immediate operation. An asterisk (*) precedes warnings in responses. An appropriate command (other than 'clear faults') may be required to operate the striper.

1	Command Not Valid	Response to any unrecognized command.
2	Value Not Valid	Response to any out of range value.
3	(not used)	Warning number reserved for consistency with functions of other controllers.
4	Home Required	Striper bed needs to locate left and right end of travel reference positions. Home cycle, using "f" command, must be completed before continuing. If a home is required, this warning will be returned in response to the 'f' home command since at that point the bed has not been successfully homed.
5	(not used)	Warning number reserved for consistency with functions of other controllers.
6	(not used)	Warning number reserved for consistency with functions of other controllers.
7	Controller Not Installed	No response from controller with that address.
8	(not used)	Warning number reserved for consistency with functions of other controllers.
9	Controller Not Enabled	Specific controller triggered with 'begin' command but NOT enabled.
10	E-Stop, Guard	Emergency Stop or Guard switch (if installed) is open.

13.2.3   Faults

Faults are a result of the system detecting improper operation of the striper bed. All fault numbers will be greater than or equal to 1000. An asterisk (*) precedes warnings in responses. The 'clear faults' command must be used before any subsequent operation of the affected controller is performed.

1000	Fault On Other Controller	An unspecified fault has been detected on another controller. This error will not appear if a warning or fault condition exists in the controller for the command (won't replace warning or fault information from command's controller to indicate fault elsewhere). This error will not appear in a broadcast response.
1001	Linear Sensor Fault	"Home" position sensor was not detected or error while moving. Clear faults using "c" command and re-reference using "f" command.
1006	Right Home Sensor Fault	"Home" position sensor on right side was not detected. Clear faults using "c" command and re-home using "f" command.
1007	Left Home Sensor Fault	"Home" position sensor on left side was not detected. Clear faults using "c" command and re-home using "f" command.
1008	Pen Up Sensor Fault	Pen up sensor was not detected. Clear fault using "c" command.
1009	Pen Down Sensor Fault	Pen down sensor was not detected. Clear fault using "c" command.
1010	Control Cable Fault	Control cable either not connected or incorrectly connected.

13.2.4 Command Summary (Striper Bed Option)

The command summary section is almost identical to the Command section except it has been abbreviated into one page.

Striper Bed Controller Commands Summary (Precede command with 31)

COMMAND	RESPONSE	DESCRIPTION
b	b	Initiates a striping cycle.
c	c<value1>	Clears all faults
d<value1>	d<value1>	Determines stripe direction. <value1>: 0 = Stripe in both directions (default) 1 = Stripe Left-to-Right and Return 2 = Stripe Right-to-Left and Return
e	e	Stops current striping operation.
f	f	Establishes left and right end of travel position locations.
k<value1>	k<value1>	Inhibits or allows operation of a striper controller. 0 = Disabled (bed will not stripe) 1 = Enabled (default)
p<value1>	p<value1>l	Changes the tip position. 0 = Auto - up, lowers when making stripe (default) 1 = Down (bed will not move) 2 = Up
q	q<value1>	Returns the Ready / Busy status. <value1>: 0 = Ready not 0 = Busy
r<value1>	r<value1>	Sets the surface speed while a line is being dispensed in millimeters per second. Maximum: 100 Minimum: 1 25 (default)
s	s<value1>	Returns the striper position in mm from left home sensor
31s10	31s10,<value2>	Returns the striper trigger delay. This delay is between when the pump actuators are triggered and when the bed motion starts.
31s10,<value2>	31s10,<value2>	Sets the striper trigger delay. A value of zero will start the pump motion when the bed motion begins. <value2> Delay in milliseconds. Maximum: 2000 Minimum: 0 300 (default)
31s11	31s11,<value2>	Returns the pen dwell time. This dwell time is the time within which the desired pen position must be sensed.
31s11,<value2>	31s11,<value2>	Sets the pen dwell time. <value2> Delay in tens-of-milliseconds. Maximum: 300 Minimum: 0 200 (default)
u<value1>	u<value1>	Sets the margin in millimeters. Maximum: 100 Minimum: 0 0 (default)
v<value1>	v<value1>	Sets the line length in millimeters. Maximum: 440 Minimum: 0 400 (default)
y<value1>	y<value1>	Sets the surface speed for bed movement while not striping in millimeters per second. <value1> represents a 3 digit decimal value. Maximum: 200 Minimum: 1 75 (default)
z	z<value1>, <value2>, <value3>	Returns the software version

	WARNINGS				FAULTS
1	Command Not Valid	6	(not used)	1000	Fault On Other Controller
2	Value Not Valid	7	Controller Not Installed	1001	Linear Sensor Fault
3	(not used)	8	(not used)	1006	Right Home Sensor Fault
4	Home Required	9	Controller / Pump Not Enabled	1007	Left Home Sensor Fault
5	(not used)	10	E-Stop, Guard	1008	Pen Up Sensor Fault
				1009	Pen Down Sensor Fault
				1010	Cable Fault

13.2.5   Striping Sequence

Typical reagent striping sequence for a Multiplex Striper. Example is for two 12 channel Multiplex Controller units and striper controller. The system must be Primed prior to striping. The Multiplex pump controllers are set up for meter mode in striping applications.

	COMMAND	RESPONSE	OUTCOME
1.	0a2<CR>	1a2;2a2<CR>	Sets the pumps to load on every. (After every striping pass)
2.	0d1<CR>	1d1;2d1<CR>	Sets the pump direction for forward.
3.	0k4096<CR>	1k4096, 2k4096<CR>	Enable all pump modules on the controllers.
4.	0r300<CR>	1r300;2r300<CR>	Sets the Dispense/Meter Rate to 300 increments/sec.
5.	31v350<CR>	31v350<CR>	Sets the line length to 350 millimeters.
6.	31u0<CR>	31u0<CR>	Sets the line margin to 0 millimeters.
7.	31p0<CR>	31p0<CR>	Sets the pens to auto mode.
8.	1s10,12<CR>	1s10,12<CR>	Delays the start of controller 1 by 12 milliseconds after begin command (trigger) is received.
9.	31r35<CR>	31r35<CR>	Sets the surface speed for striping to 35 millimeters/sec.
10.	31y50	31y50<CR>	Sets the surface speed of the bed to 50 millimeters/sec for non-striping movement.
11.	31d0<CR>	31d0<CR>	Stripe both directions.
12.	0m2<CR>	1m2;2m2<CR>	Sets the Multiplex Controller to Meter mode.
13.	31b<CR>	31b<CR>	Begin the stripe.

13.2.6   Striper Reference Sequence

Typical sequence for referencing a striper bed. A reference is required every time the unit is powered or after a system fault.

	COMMAND	RESPONSE	OUTCOME
1.	31q<CR>	31q*4<CR>	Query pumps on power-up (or after fault clear).
2.	31f<CR>	31f*4<CR>	Start the reference sequence for the Striper Controller.
3.	31q<CR>	31q5*4<CR>	Striper Controller is busy, reference in progress. The query can be repeated until the controller has completed the reference successfully. The reference sequence is processor time intensive. The repeated polling frequency should be as slow as the application allows and should not be less than the maximum response time.
4.	31q<CR>	31q0<CR>	The controller has completed the reference sequence successfully. The striper controller is ready to use. An unsuccessful completion would result in the response of the form "31q0*<fault code>". This would require a clear error "31c" and the reference sequence to be retried. A second attempt resulting in a fault would require operator action to correct the fault condition.

13.2.7   Striper Bed Fault Recovery Sequence

If, during the process of operation, the system encounters a fault it will report the fault in the response string. An example is given for a Striper Controller where the fault occurs during the striping sequence.

	COMMAND	RESPONSE	OUTCOME
1.	31q<CR>	31q3<CR>	Striper controller is in the process of striping. Polling sequence for the ready / busy status (repeating this step for polling).
2.	31q<CR>	31q0*1001<CR>	Striper Controller linear sensor fault.
3.	31c<CR>	31c*1001<CR>	Clear fault.
4.	31q<CR>	31q0*4<CR>	Fault cleared, reference required.
5.	31f<CR>	31f*4<CR>	Start the reference sequence for the striper controller.
6.	31q<CR>	31q5*4<CR>	Striper Controller is busy, reference in progress. The query can be repeated until the controller has completed the reference successfully. The reference sequence is processor time intensive. The repeated polling frequency should be as slow as the application allows and should not be less than the maximum response time.
7.	31q<CR>	31q0<CR>	The controller has completed the reference sequence successfully. The striper controller is ready to use. An unsuccessful completion would result in a response of the form "31q0*<fault code>". This would require a clear error "31c" and the reference sequence to be retried. A second attempt resulting in a fault would require operator action to correct the fault condition.

13.3   INSTALLATION

The Controller Module enclosure is provided as a tabletop piece of equipment (standard).

A 19" rack-mount version is available as an option. The 19" rack-mount version must be supported from the bottom of the enclosure, NOT the front mounting holes. The front mounting holes are provided to prevent the enclosure from accidentally moving in and out of the rack.

The controller communication output connector on the last Controller Module connected MUST have a 93 Ohm terminating resistor installed. The terminating resistor is provided with the equipment and is installed at the factory. The factory installs the terminating resistor on the expected last controller, that is, the controller with the highest number address.

The Striper Controller Module has the terminating resistor installed inside the enclosure and should be the last controller connected in the chain.

13.4   OPTIONS

IVEK Corporation offers a variety of options to best meet the customers needs. Following is a list and description of available options for the Controller Module.

13.4.1   Start / Stop Pendant

The Start/Stop Pendant is a control box located on the end of a five meter cable. The cable connects to the START/STOP PENDANT connector on the rear of the Controller Module. The control box contains two switches for turning the Striper on and off. The control box contains a CYCLE START switch and a STOP switch.

The system has to be setup as described in Chapter 3 prior to using the control box. The CYCLE START switch initiates one complete cycle for the Striper.

The STOP switch should only be used if a problem occurs during the striping operation.

WARNING

Power will still be applied to the Striper after the STOP push-button has been pressed. Do not connect or disconnect cables. Do not touch any electrical connections.

13.5   MAINTENANCE

No periodic maintenance is required on the Controller Module, beyond standard practices for electronic equipment.

13.5.1   Assembly/Disassembly Procedures

The Controller Module contains the following replaceable parts.

- Main Power Fuse(s)
- Control Power Fuse

13.5.1.1 Main Power Fuse(s)

The main power fuse(s), located in the Power Entry Module on the rear panel, are replaceable. Replace the fuse(s) with the same type and value as supplied with the unit.

Disassembly
1.   Remove the power cord.
2.   Using a small flat blade screwdriver, open the power entry module's cover.
3.   Slide the fuse tray out and remove the fuse.

Assembly
1.   Install the new fuse into the fuse tray and slide the tray in. The arrow on the fuse holder should point to the right.
2.   Close the power entry module's cover.
3.   Connect the power cord.

13.5.1.2 Control Power Fuse

The control power fuse is located on the rear panel is replaceable. Replace the fuse with the same type and value as supplied with the unit.

Disassembly

1.   Remove the power cord.
2.   Turn the fuse holder counterclockwise. Remove the fuse.

Assembly

1.   Install the new fuse into fuse holder
2.   Insert holder turning clockwise.
3.   Connect the power cord.

13.6   SPECIFICATIONS

Input Power Requirements: 100/120 VAC – 3A - 50/60Hz
                                 220/240 VAC – 3A - 50/60Hz

13.7   ILLUSTRATED PARTS BREAKDOWN

The illustrated parts breakdown (Figure 13.3) contains the information required for identifying and ordering replacement parts.

INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY
		Multiplex Controller Module	**1**
1	520166	Ctrlr Mdl, Multiplex Striper Ver 2.0	1

Figure 13.3 Multiplex Striper Controller Module (Sheet 1 of 1)