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PMC-200/PMC200-P 2-Axis Controller System

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Newport Corporation warrants this product to be free from defects in material and workmanship for a period of one year from the date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's option.

To exercise this warranty, write or call your local Newport office or representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

Limitation of Warranty

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1791 Deere Avenue
Irvine, CA 92606
(714) 863-3144

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About This Manual

This operator's manual contains all the necessary information for the proper installation and operation of the Newport Corporation PMC200 and PMC200-P 2-Axis Motion Controller Systems.

The manual has been divided into the following sections:

Section 1 gives a brief overview of the Controllers, including instructions for unpacking and available options for upgrading the system.

Section 2 describes the controls and connectors of the system and provides you with operating procedures.

Section 3 provides an overall theory of operation for the system.

Section 4 offers troubleshooting suggestions.

Section 5 instructs you on how to obtain service for your Controller.

This manual uses the following conventions:

- Brackets refer to a particular key on the control panel. For example: [ENTER] or [STOP].
- **Boldface** indicates information that you enter, as opposed to system prompts or messages.
- System prompts and messages appear in italics. For example: *Press Exit to Escape*.

Note

Model PMC200-P includes IEEE-488 and RS-232 computer interfaces. Model PMC200 does not. This manual covers both Controllers. Where operation of the two models is similar, the generic term "PMC200/200-P" will be used to refer to either model.

"850" Actuator refers to 850, 850A and 850B models.

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Safety Precautions

The following safety precautions should be observed prior to operation of the PMC200/200-P 2-Axis Motion Controller System.

This instrument is intended for use by qualified personnel who recognize shock hazards and are familiar with safety precautions required to avoid possible injury. Read the manual carefully before operating the instrument and heed all written warnings.

For your own safety and that of your equipment, always take the following precautions.

Disconnect the power plug under the following circumstances:

- If the power cord or any attached cables are frayed or damaged in any way
- If the power plug is damaged in any way
- If the unit is exposed to rain, excessive moisture, or liquids are spilled on the unit
- If the unit has been dropped or the case is damaged
- If you suspect service or repair is required
- Whenever you clean the case

To protect the unit from damage, be sure to:

- Keep all air vents free of dirt and dust
- Keep all liquids away from the unit
- Do not expose the unit to excessive moisture

  (>90% humidity)
- Read the manual before using the unit for the first time

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WARNING

All attachment plug receptacles in the vicinity of this unit are to be of the grounding type and properly polarized. Contact your electrician to check your receptacles.

WARNING

This product is equipped with a 3 wire grounding type plug. Any interruption of the grounding connection can create an electric shock hazard. If you are unable to insert the plug into your wall plug receptacle, contact your electrician to perform the necessary alterations to assure that the green (green-yellow) wire is attached to earth ground.

WARNING

This product operates with voltages that can be lethal. Pushing objects of any kind into cabinet slots or holes, or spilling any liquid on the product, may touch hazardous voltage points or short out parts.

WARNING

Opening or removing covers will expose you to hazardous voltages. Refer all servicing internal to this instrument enclosure to qualified service personnel who should observe the following precautions before proceeding:

- **Turn OFF power and unplug the unit from its power source**
- **Disconnect all cables**
- **Remove any jewelry from hands and wrist**
- **Use only insulated hand tools**
- **Maintain grounding by wearing a wrist strap attached to instrument chassis**

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Features

- Two-axis design
- Simultaneous control and display of two motorized drives/stages
- Separate front panel controls and display for each axis
- Real-time position and velocity displays
- Menu-driven operation
- Position continuously tracked to 1 quadrature count
- User-defined, adjustable position entry capability
- Backlash and positioning error compensation
- Built-in keyboard and joystick controls
- Stall (limit) detection/protection
- Programmable version (PMC200-P) with RS-232 and IEEE-488 interfaces
- Standard Model PMC200 may be factory-upgraded to PMC200-P
- 10 MHz Motorola 68000 CPU controls all operation
- Each axis has a dedicated motion controller IC
- Real-time multi-tasking operating system
- Self-diagnostic power up routine
- 45 WATT 90-132/180-264V international power supply
- Battery backed-up memory retains latest system configuration

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Specifications

PARAMETER	SPECIFICATION
Physical	
Dimensions	11 x 9.5 x 5.5"
Weight	6.8 lbs.
Power Requirements:	
Input Voltage	90-132/180-264 VAC 47-63 Hz
Input Current	<1.0A for 90-132 VAC <0.5A for 180-264 VAC
Output	0.5A ±15VDC max simultaneous on each axis. 1.0A ±15VDC max on a single axis.
Ground Impedance Leakage Current	<0.1Ω <650 μA
Environmental Limits:	
Ambient Operating Temperature	15-40°C
Relative Humidity	40-90%
Storage Temperture	80°C max
Chemical Solvent Resistance	Resists repeated use of mild alkaline cleaning solution or isopropyl alcohol.
Program Storage:	Battery-backed RAM
Joystick Port:	IBM PC-compatible
Serial Port:	RS-232C
IEEE Interface:	IEEE-488.2

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Section 1
Introduction

1.1 System Overview

The PMC200/200-P is a 2-axis motion controller designed to drive Newport Model 495 and 496 integrated motorized rotation stages, and 850 Series motorized drives. Utilizing motion control ICs and a Motorola 68000 host processor, the PMC200/200-P performs all the position and velocity control for each axis. This is a digital control system, so analog compensation and velocity feedback are not necessary. The axes are set up and controlled in an easy-to-learn, menu-driven environment. Using the setup routines, you have complete control over axis movement, including setting absolute jog step and compensating for backlash and positioning errors. A non-programmable version (PMC200) without RS232 and IEEE-488 interfaces is available. Model PMC200 controllers may be upgraded to the PMC200-P at the factory.

1.2 Scope of the Manual

The purpose of this manual is to document the setup and operation of the Newport Corporation PMC200/200-P 2-Axis Motion Controller for use with 495 and 496 motorized stages, and 850 series motorized drives.

1.3 Unpacking and Inspection

The PMC200/200-P was thoroughly tested and inspected before shipping. Prior to unpacking the equipment, carefully inspect the outer containers for signs of damage. If you find any damage, immediately notify the shipping company and contact Newport Corporation for further instructions.

NOTE

Retain the original packing materials. They will be necessary if reshipment of the product is in order. They can also be useful for transporting the equipment to other locations.

The following table lists the components that you should have received with your order.

Model #	Quantity	Description
PMC200/200-P	1	2-Axis Controller Unit
	1	Power Cable

1.4 System Accessories

The following accessories may be ordered separately.

Model #	Description
PMC200-J	IBM PC-Compatible Joystick
850IA-10	15-Pin D to 9-Pin D Interconnect Cables (one required for each axis)

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Section 2
System Operation

2.1 Overview of PMC200/200-P

The controller keyboard is the primary input device on the PMC200/200-P, but a joystick may be used as well. The PMC200/200-P can operate in two modes: Setup mode and Execute mode. In Setup mode, you "configure" the PMC200/200-P for operation. In Execute mode, the controller accepts motion commands.

The PMC200/200-P has three types of built-in output devices:

1. A Vacuum Fluorescent Display containing 2 lines of 20 ASCII characters each.
2. LEDs on the front panel switches indicate the modes and states of the controller.
3. An Audio Alarm indicates an actuator limit with an audible tone. The alarm also acts as a general purpose audible indicator in the following manner:

   Beep on Power Up
   Beep for 4 seconds on Self-Test Failure

2.2 Preparing the Controller for Operation

Prior to operating the PMC200/200-P, there are a few preliminary steps to be followed to set up the controller.

2.2.1 Rear Panel Connections

On the controller rear panel (refer to Figure 2-1), you will find a power cord connector, a RESET button, and two 15-pin female D-Type connectors (one for each axis).

1. Select the correct VAC setting on the power cord connector on the rear panel to match your AC voltage. To do this:
   a. Insert a flat-head screwdriver into the notch at the top of the power cord connector and pry open the panel.
   b. Rotate the drum until the desired voltage setting will show through the window when the panel is closed.
   c. If you need to replace a fuse, insert a screwdriver under the fuse pull tabs and gently slide the fuse holders straight out. Replace the fuses only with the same type and rating of fuse.
   d. Gently press the panel shut.
2. Attach the power cord to the controller rear panel and to the power source selected in step 1.
3. Actuators may be attached to the rear panel connectors any time prior to power-up.

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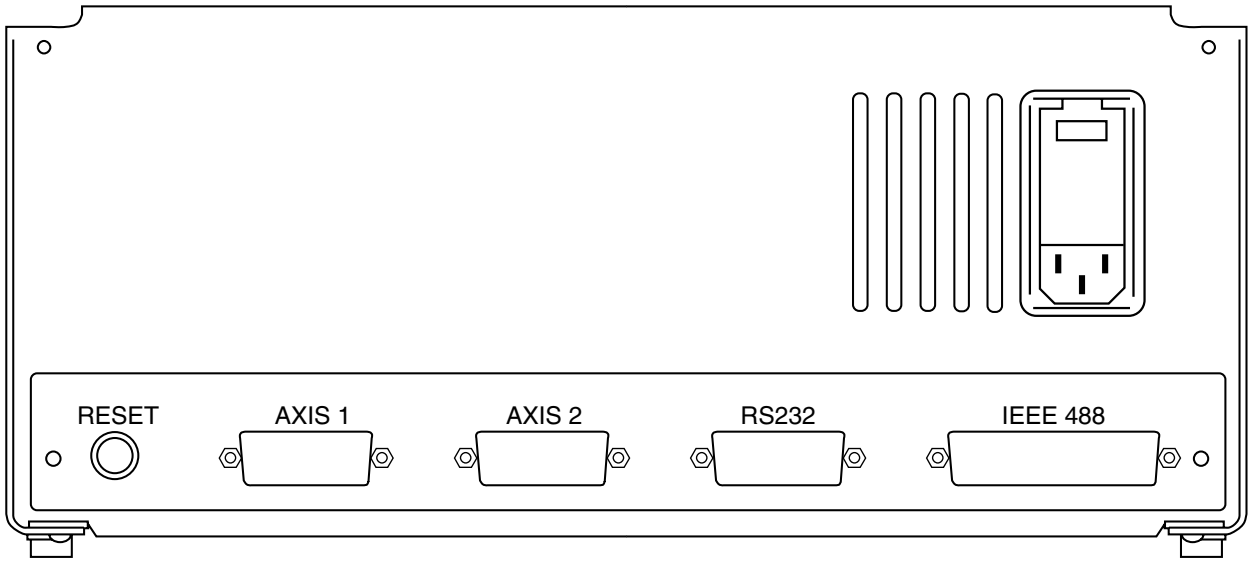


Figure 2-1 — Controller Rear Panel

CAUTION

The connector on the right-hand side of the controller is for the joystick only. Attaching an actuator or rotary stage to this connector may cause damage to the controller. Refer to Section 2.7 for joystick operation procedures.

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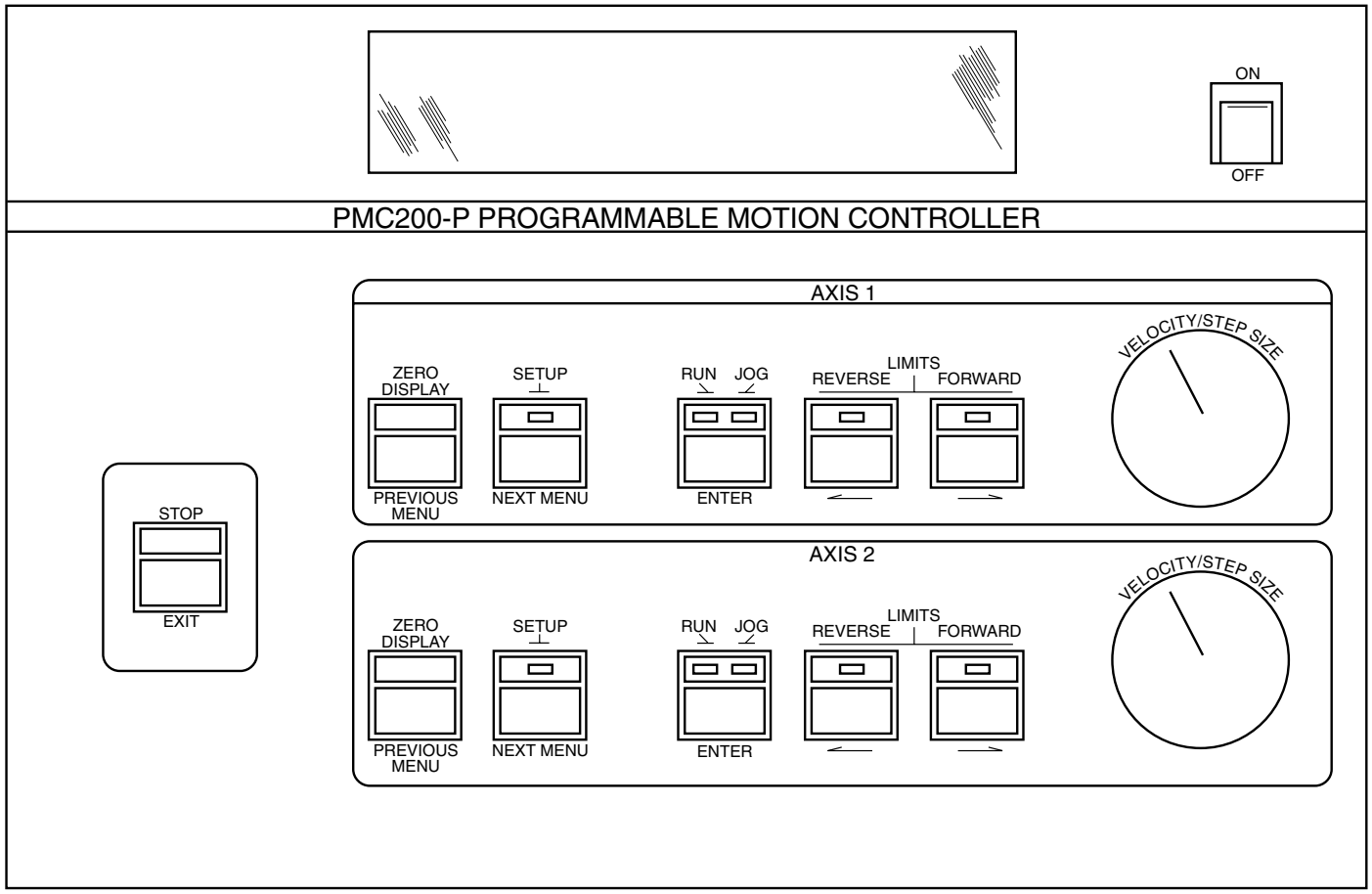


Figure 2-2 — Front Panel Keyboard

2.3 Front Panel Description

The PMC200/200-P controller front panel consists of 5 switches and 1 potentiometer per axis, plus an emergency stop switch (refer to Figure 2-2).

The PMC200/200-P can run in 2 modes:

Setup Mode: The PMC200/200-P is being configured for operation.
Execute Mode: The PMC200/200-P accepts and executes motion commands.

The functions of the switches and pots depend upon which of the two modes of operation you are running. Each switch has two labels, one above and one below, e.g., the left-most switch is labeled STOP and EXIT. The upper label is used in Execute mode and the lower label is used in Setup mode. Sections 2.5.1 and 2.6.1 describe the functions of the switches in each mode.

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2.4 Power Up Sequence

The PMC200/200-P has battery back-up memory which holds the latest PMC200/200-P configuration parameters. If the front panel power switch is pressed, the PMC200/200-P memory maintains the system parameter configuration set at the time of the last power down. If the RESET button (on rear panel) is pressed, the PMC200/200-P memory will be reset to the system default parameters shown in Table 2-1.

2.4.1 Front Panel Power Switch

When the power switch is pressed, the following information is displayed on the vacuum florescent display:

1. Two blank rows are displayed.

   The software is carrying out a self-test. If the hardware passes the test, an audible beep will be issued. If an error is detected, then an error message will be displayed, accompanied by four audio beeps. See Section 5 for help.

2. *ROM Version X.X*
   Passed Self Test

The PMC200/200-P is now in Execute mode and is ready to accept commands for motion. If the '*No Actuator*' message is displayed, you will need to enter SETUP mode and configure the axes (refer to Section 2.6).

2.5 EXECUTIVE Mode

When the PMC200/200-P is in Execute mode, the controller will be in either RUN STATE or JOG STATE. You may access Execute mode at any other time by pressing the **[EXIT]** switch (so that the SETUP switch LED is not lighted).

2.5.1 Keyboard Functions in Execute Mode

In Execute mode, the labels **above** the front panel switches indicate the functions of the controller as follows.

STOP	This switch will stop both axes immediately. The position servo however, remains active.
ZERO DISPLAY	This switch zeroes the position display of the axis.
SET UP	If neither axis is moving, this switch will cause the system to enter SETUP mode. The LED will light up and the display will show the last menu choice used. If either axis is moving, the switch will be inactive.
RUN/JOG	This switch toggles between RUN and JOG states for the particular axis. The RUN or JOG LED will be lit indicating the state of motion. If the axis is moving when the switch is pressed, the axis will stop, but the position servo will remain active.

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REVERSE	RUN STATE - If an axis is moving in the reverse direction, pressing this switch will stop the motion. If the axis is moving forward, pressing this switch will cause it to reverse direction. When moving, the velocity of the axis is controlled by the VELOCITY STEP SIZE potentiometer. When an overload occurs or an end of travel limit is encountered, the REVERSE LIMIT LED lights up and the axis will stop, but the position servo will remain active. JOG STATE - If the axis is not moving, pressing this switch will initiate a step movement in the reverse direction. The size of the step is determined by the VELOCITY-STEP SIZE potentiometer. If an axis is in the act of jogging forward, the switch will have no effect. When an overload occurs or an end of travel limit is encountered, the REVERSE LIMIT LED lights up and the axis will stop, but the position servo will remain active. Note that the maximum velocity will be the same value that was set during RUN State.
FORWARD	RUN STATE - If the axis is moving forward, pressing this switch stops the motion. If the axis is moving reverse, pressing this switch will cause it to move forward. When moving, the velocity of the axis is controlled by the VELOCITY-STEP SIZE potentiometer. When an overload occurs or an end of travel limit is encountered, the FORWARD LIMIT LED lights up and the axis will stop. JOG STATE - If the axis is not moving, pressing this switch will initiate a step movement in the forward direction. The size of the step is determined by the VELOCITY-STEP SIZE potentiometer. If an axis is in the act of jogging reverse, the switch will have no effect. When an overload occurs or an end of travel limit is encountered, the FORWARD LIMIT LED lights up and the axis will stop, but the position servo will remain active. Note that the velocity will be the same value that was set during RUN State.
VELOCITY– STEP SIZE CONTROL	RUN STATE - When the actuator is moving, the potentiometer sets the real-time velocity of the actuator. The setting of the potentiometer determines the maximum velocity at which the actuator will move. JOG STATE - The potentiometer varies the jog step size. Note that the maximum velocity will be the same value that was set during RUN State.

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2.5.2 Output Devices in Execute Mode

Like the front panel switches, the functions of the output devices depend upon the operating mode.

Display

RUN STATE - The display shows the real time position and real-time velocity of the axis. When the actuator is not moving, the display shows the velocity setting of the VELOCITY/STEP SIZE potentiometer. This value is used as the maximum velocity in the Jog State.

JOG STATE - The display shows the real time position, followed by the jog step size.

NOTE

When the PMC200/200-P is in operation, you may notice that the display flickers, even when no axis motion is occurring. This is normal for this type of display being used.

Front Panel LEDs

SETUP LED - This LED will be off in Execute mode.

RUN LED - This LED will be lit in RUN STATE and off in JOG STATE.

JOG LED - This LED will be off in RUN STATE and lit in JOG STATE.

REVERSE LIMIT LED - The LED will be lit when the axis is overloaded or has reached an end of travel limit in the reverse direction. If lit, pressing the opposite direction switch twice will clear the limit state and turn off the LED.

NOTE: After pressing the [REVERSE] switch, the LED will remain ON until the limit is cleared.

FORWARD LIMIT LED - The LED will be lit when the axis is overloaded or has reached an end of travel limit in the forward direction. If lit, pressing the opposite direction switch twice will clear the limit state and turn off the LED.

NOTE: After pressing the [FORWARD] switch, the LED will remain ON until the limit is cleared.

Audio Alarm

The Audio Alarm will sound if either axis overloads or reaches an end of travel in either direction.

NOTE: If the limit is not cleared after pressing the [FORWARD] or [REVERSE] switches the alarm will only beep twice.

2.6 SETUP Mode

In Setup mode, the controller allows you to set parameters for actuator movement through menu selections. Both axes must be stopped before you may enter Setup mode. Press the **[SET UP]** switch to enter Setup mode. The display will show the last menu choice selected.

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2.6.1 Keyboard Functions in Setup Mode

In setup mode, the labels **below** the switches on the controller front panel perform the following functions.

EXIT	This switch exits Setup mode and enters Execute mode.
Previous Menu	This switch selects the previous menu.
Next Menu	Press this switch to leave the current menu selection unchanged, and go to the next menu.
ENTER	This switch saves the displayed value for the present menu and selects the next menu.
`	This switch selects the previous choice within a menu, or it decreases the menu choice value. If the menu choice has a large range, the switch will select the next digit to the left.
^	This switch selects the next choice within a menu, or it increases the menu choice value. If the menu choice has a large range, the switch will select the next digit to the right.
VELOCITY-STEP SIZE CONTROL	This potentiometer selects the value of a digit when a menu choice has a large range.

2.6.2 Output Devices in Setup Mode

Like the front panel switches, the functions of the output devices depend upon which mode the system is running on.

Display	The display shows menu choices and prompts.
Front Panel LEDs	SETUP LED - This LED will be on in Setup mode. RUN LED - This LED will be off. JOG LED - This LED will be off. REVERSE LIMIT LED - The LED will be off. FORWARD LIMIT LED - The LED will be off.
Audio Alarm	The Audio Alarm is deactivated in Setup mode.

2.6.3 Setup Menus

In Setup mode, the parameters for actuator movement are set through menu choices. Upon entering Setup mode, the following message is displayed:

Setup AXIS __: <Exit> key to quit

Press **[Previous Menu]** to display the last menu used. Press **[Next Menu]** to display the next menu in order. Press **[EXIT]** to exit Setup mode. The menus are arranged in a rotary fashion, so there is no 'first' menu. The menus are listed below.

ACTUATOR SETUP ^ SET DISPLAY UNITS ^ SET JOG STEP SIZE ^ ACTUATOR DIRECTION ^ DISPLAY SCALE FACTOR ^ PRESET DISPLAY

a

SYSTEM DEFAULT 、 ACTUATOR CALIBRATION 、 GPIB SETUP* 、 RS-232 SETUP* 、 JOYSTICK MENU 、 AUDIO ALARM 、 BACKLASH FACTOR

*PMC200-P only

The settings for each menu are retained in memory until they are changed, or the RESET button on the rear panel is pressed.

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When you enter a menu, the most recent menu selection will be displayed in the setup structure, i.e., the ACTUATOR TYPE menu might show '495,' if that is the most current selection.

To change a menu selection, such as the Actuator Type, press **[^]** or **[`]** to scroll through the possible choices. When the desired choice is displayed, press **[ENTER]** to save the selection.

To change the numerical value of a selection, press **[^]** or **[`]** to highlight the digit that you want changed. Turn the potentiometer to increase or decrease the value of that digit. Continue in like fashion until all changes have been made and then press **[ENTER]** to save the selection. For example, to change 100.000 to 010.000 press **[^]** until the first digit (1) is highlighted and turn the potentiometer backward until (0) is displayed. Press **[^]** until the second digit is highlighted (0) and turn the potentiometer forward until (1) is displayed. To save the changed parameter, press **[ENTER]**.

The possible Setup menu choices and system defaults are listed below.

ACTUATOR SETUP:

ACTUATOR TYPE The menu choices are:

NONE (default)
850
850B
850B-LS
850B-HS
495
496
SPECIAL - When selected, you will be prompted for:
MOTOR TYPE: 1616
1624
1516

COUPLING FACTOR: Quad counts per mm

Select SPECIAL if you are using an actuator or rotary stage not listed in the menus. Under ACTUATOR TYPE, the 1616 is a standard motor, the 1624 is a high torque motor, and the 1516 is a low torque motor.

The COUPLING FACTOR sets, in millimeters, the quadrature count using the following formula:

1 mm = X quadrature counts

This can be calculated from the gearbox ratio of the actuator:

$$\text{Coupling ratio} = 20{,}000 * \frac{\text{Gearbox ratio}}{262}$$

That is, a standard 850/850A actuator (which has a 262:1 gearbox) has a coupling ratio of 20,000.

DISPLAY UNITS The DISPLAY UNITS menu sets the units of measurement to be displayed. The menu choices are:

For Linear Actuator/Motorized Driver:
Millimeters (default)
Inches

For Rotary Stage:
Milliradians
Degrees (default)

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JOG STEP SIZE

The JOG STEP SIZE is a pre-defined distance that the motor device will move each time an axis JOG switch is pressed. The menu choices are:

For Actuator in millimeters:
- 0 - 0.01000 mm
- 0 - 0.10000 mm (default)
- 0 - 1.00000 mm
- 0 - 10.0000 mm
- 0 - 100.000 mm

For Actuator in inches:
- 0 - 0.00100 in
- 0 - 0.01000 in (default)
- 0 - 0.10000 in
- 0 - 1.00000 in
- 0 - 10.0000 in

For Rotary Stage in milliradians:
- 0 - 000.100 mr
- 0 - 001.000 mr (default)
- 0 - 010.000 mr
- 0 - 100.000 mr
- 0 - 1000.00 mr

For Rotary Stage in degrees:
- 0 - 000.010 deg
- 0 - 000.100 deg (default)
- 0 - 001.000 deg
- 0 - 100.000 deg

ACTUATOR DIRECTION

The ACTUATOR DIRECTION menu is used to set the actuator or stage directions of motion. The menu choices are:

For Linear Actuator/Motorized Driver:
- Forward = out (default)
- Forward = in

For Rotary Stage:
- Forward = cw (clockwise) (default)
- Forward = ccw (counter-clockwise)

DISPLAY SCALE FACTOR

Before a position is displayed on the VFD, its position in RAM is multiplied by the DISPLAY SCALE FACTOR. The DISPLAY SCALE range is:

0.001 - 9.999 (DEFAULT = 1.000)

PRESET DISPLAY

The PRESET DISPLAY menu is used to set a starting position for the axes on the display. The menu choices are:

±0.0000 - 99.9999 mm
±0.0000 - 9.99999 in
±0.0000 - 6238.18 mr
±0.0000 - 360.000 deg
(default = 0.0000)

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BACKLASH FACTOR

Backlash occurs when direction of the actuator is reversed, due to "play" in the gear linkages. Backlash is specified as the discrepancy between motion as read from the encoder, and the actual motion of the lead screw. This is determined by an external measurement device (i.e., interferometer). The BACKLASH menu allows the system to compensate for actuator backlash and backlashes in the stage and other "downstream" devices. The menu choices are:

±0.0000 - 99.9999 mm
±0.0000 - 9.99999 in
±0.0000 - 6238.18 mr
±0.0000 - 360.000 deg
(default = 0.0000)

AUDIO ALARM

The AUDIO ALARM menu is used to activate/deactivate the Audio alarm which sounds when limits are met or an actuator stalls. The two menu choices are:

Enabled (default)
Disabled

JOYSTICK MENU

Select whether the joystick is to be enabled. **Do not connect actuators to the JOYSTICK port.**

Disabled (default)
Enabled
Disable X Axis
Disable Y Axis

If either axis is enabled, you will be prompted to select:

JOYSTICK X AXIS =	Axis 1 (default)
	Axis 2
JOYSTICK X AXIS =	Right = Forward (default)
	Right = Reverse
JOYSTICK Y AXIS =	Up = Forward (default)
	Up = Reverse

JOYSTICK X AXIS - JOG STEP

For Actuator in millimeters:

0 - 0.01000 mm
0 - 0.10000 mm (default)
0 - 1.00000 mm
0 - 10.0000 mm
0 - 100.000 mm

For Actuator in inches:

0 - 0.00100 in
0 - 0.01000 in (default)
0 - 0.10000 in
0 - 1.00000 in
0 - 10.0000 in

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For Rotary Stage in milliradians:

0 - 000.100 mr
0 - 001.000 mr (default)
0 - 010.000 mr
0 - 100.000 mr
0 - 1000.00 mr

For Rotary Stage in degrees:

0 - 000.010 deg
0 - 000.100 deg (default)
0 - 001.000 deg
0 - 010.000 deg
0 - 100.000 deg

JOYSTICK Y AXIS - JOG STEP

For Actuator in millimeters:

0 - 0.01000 mm
0 - 0.10000 mm (default)
0 - 1.00000 mm
0 - 10.0000 mm
0 - 100.000 mm

For Actuator in inches:

0 - 0.00100 in
0 - 0.01000 in (default)
0 - 0.10000 in
0 - 1.00000 in
0 - 10.0000 in

For Rotary Stage in milliradians:

0 - 000.100 mr
0 - 001.000 mr (default)
0 - 010.000 mr
0 - 100.000 mr
0 - 1000.00 mr

For Rotary Stage in degrees:

0 - 000.010 deg
0 - 000.100 deg (default)
0 - 001.000 deg
0 - 010.000 deg
0 - 100.000 deg

RS-232 SETUP
(PMC200-P only)

Select whether the RS-232 serial port is to be enabled.
Disabled (default)
Enabled

If RS-232 is enabled, you will be prompted to select:

RS-232 BAUD RATE:
1200
2400
4800
9600 (default)
19.2k

PARITY:
none (default)
odd
even

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DATABITS:	8 (default) 7
STOPBITS:	1 (default) 2
INPUT ECHO MODE:	enabled (default) disabled

NOTE:

With the Input Echo Mode enabled all characters sent to the PMC200-P controller are echoed back to the sender with a '>' prompt at each new llne. The error codes and messages are also echoed back immediately.

With the Input Echo Mode disabled characters sent to the controller are not echoed back to the sender. Nor are the error codes and messages immediately echoed back to the sender. To retrieve the error codes and messages an error query must be made.

In general it will be more convenient to have the Input Echo Mode enabled when using a dumb terminal, or software that emulates a dumb terminal, and disabled when writing programs in a high-level language where echoed characters and error messages may stack up in the programs input buffersystem and get in the way when retrieving query returns from the PMC200-P controller.

GPIB SETUP (PMC200-P only) — Select whether the lEEE-488 interface will be enabled
Disabled (default)
Enabled

If GPIB is enabled, you will be prompted to select:

IEEE-488 ADDRESS: 00 - 30 (default = 04)

NOTE:

This IEEE-488 ADDRESS is the GPIB address assigned to the PMC200-P controller device.

850 CALIBRATION — The 850 CALIBRATION menu is used with the 850 servo alignment procedure in Section 4.2.

SYSTEM DEFAULTS — You will be prompted: *Set ALL menu choices to defaults? <Enter>* If you press **[ENTER]**, you will be prompted: *Are you sure? <Enter>* Press **[ENTER]** to set all menu choices to defaults. Table 2-1 lists the system defaults. To quickly reset all parameters to their default values, press the red RESET button on the rear panel.

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Table 2-1
System Defaults

Parameter	Defaults
JOG STEP SIZE	
Actuator	0 - 0.10000 mm 0 - 0.01000 in
Rotary Stage	0 - 001.000 mr 0 - 000.100 deg
DISPLAY UNITS	
Actuator	Millimeters
Rotary Stage	Degrees
ACTUATOR DIRECTION	
Actuator	Forward = out
Rotary Stage	Forward = cw (clockwise)
DISPLAY SCALE FACTOR	1.000
PRESET DISPLAY	0.0000
BACKLASH	0.0000
AUDIO ALARM	Enabled
ACTUATOR TYPE	No Actuator
JOYSTICK	Disabled
RS-232	Disabled
IEEE-488	Disabled

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2.7 Operation with the Joystick

The connector for the joystick is located on the right hand side of the controller (refer to Figure 2-3).

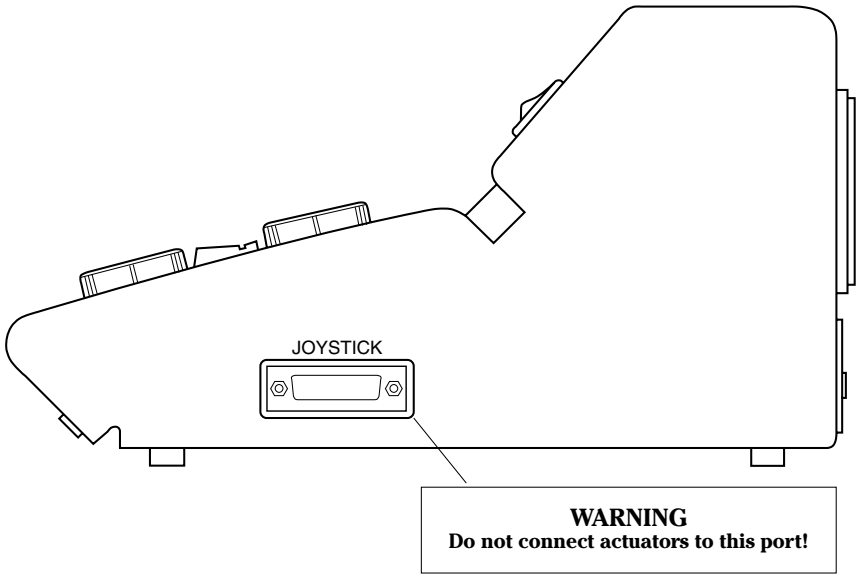


Figure 2-3 — PMC200/200-P Controller - Right-Hand Side View

2.7.1 Selecting Joystick Control

To set the controller for joystick operation on two axes, use the following procedure:

1. Press **[SETUP]** on Axis 2 and define the Actuator Type and Display Settings. Press the **[EXIT/STOP]** key when all parameters have been entered.
2. Press **[SETUP]** on Axis 1 and define the Actuator Type and Display Settings as you did for Axis 2.
3. Press **[NEXT MENU]** until the JOYSTICK MENU is displayed (refer to Section 2.6). Select 'Enabled' and define the joystick axes and directions.
4. Press **[EXIT/STOP]**. The letters 'J' or 'V' in front of the step/velocity value on the display will be lower case, indicating joystick control.

When the joystick is enabled in the Execute mode, the front panel keys are disabled, with the exception of the **[STOP]** key and ZERO DISPLAY button. The joystick now becomes the only input device. The **[STOP]** key transfers control from the joystick to the front panel.

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2.7.2 Using the Joystick

Figure 2-4 shows the location of the joystick controls and their functions in the Execute mode.

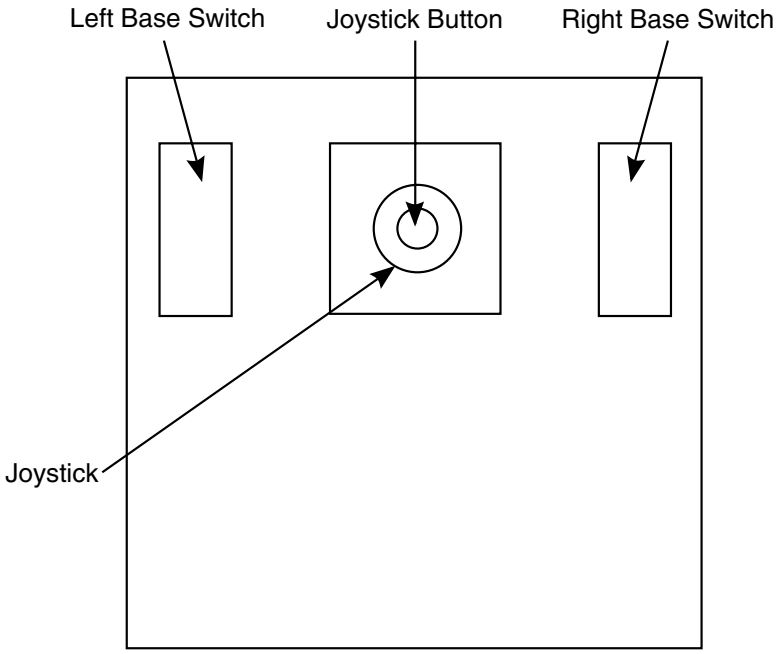


Figure 2-4 — Joystick Controls

NOTE:

The Joystick button and left Base Switch perform the same functions

The functions of the joystick controls in the Execute mode are as follows:

JOYSTICK	RUN STATE - The joystick is used to set the velocity and direction of both axes.
	JOG STATE - The joystick sets the step size and direction of the axes.
RIGHT BASE SWITCH	Toggles between RUN and JOG state.
	JOG STATE - If the base switch is held down, the step size is changed by pressing the joystick button. In order to observe the change, the joystick must be deflected from the center position.
JOYSTICK BUTTON OR LEFT BASE SWITCH	RUN STATE - The joystick button will start and stop axis movement. Velocity is determined by relative joystick position and direction for both axes.
	JOG STATE - Pressing the joystick button initiates a step movement. The step sizes and directions are determined by the joystick position. Holding the switch down, will maintain the step movement until the switch is released.

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To use the joystick for control, use the following procedure:

1. Be sure the controller is in Joystick Control Mode (a lower case 'j' or 'v' is displayed).
2. Press the Right Base switch to select JOG (j) or RUN (v) mode.
3. Press and hold the Right Base switch and Joystick button. Move the joystick to increase or decrease the Jog Step (JOG mode) or Velocity (RUN mode) value. Release the button when the desired value is displayed.
4. Move the joystick in the desired direction and press the joystick button or Left Base switch. The actuator(s) will begin to move. If one actuator encounters a limit, then the other axis will also stop.
5. The direction of the actuator(s) are now controlled by moving the joystick. To stop motion, press the joystick button or Left Base switch.
6. To exit Joystick mode, press **[EXIT/STOP]**.

2.8 Operation with the RS-232 Port
(PMC200-P only)

The connector for the RS-232 port is located on the controller rear panel.

2.8.1 Selecting RS-232 Control

To set the controller for RS-232 operation use the following procedure:

1. Press **[SETUP]** on axis 2 and define the actuator Type and Display Settings. Press the **[EXIT/STOP]** key when all parameters have been entered.
2. Press **[SETUP]** on axis 1 and define the Actuator Type and Display Settings as you did for axis 2.
3. Press **[NEXT MENU]** until the RS-232 SETUP: prompt is displayed (refer to Section 2.6). Select 'Enabled' and define the baudrate, parity, databits, stopbits, and input echo mode.
4. Press **[EXIT/STOP]**. The letters 'J' or 'V' in front of the step/velocity value on the display will be lower case, and 'RS-232' will appear in place of the step/velocity display indicating RS-232 port control.

When the RS-232 port is enabled in the Execute mode, the front panel keys are disabled, with the exception of the **[STOP]** key. The RS-232 port now becomes the only input device.

Even when the RS-232 port is disabled queries can be made to the controller through this port.

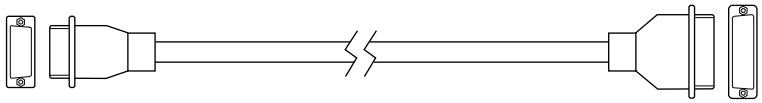
2.8.2 Using the RS-232 Port

The RS-232 port can communicate with a dumb terminal or a programmable device like a computer that has a serial port that follows the RS-232 and PCTALK C standard. Third party communication programs for example Mirror as well as high level programming languages such as Quick Basic can be used to establish communication between the PMC200-P and computer.

Commands are sent to the PMC200-P through the RS-232 port via a standard RS-232 cable. These commands are executed as if they had been executed from the key pad. However, the PMC200-P command set gives the user much more control of the PMC200-P controller than does the keypad. Such

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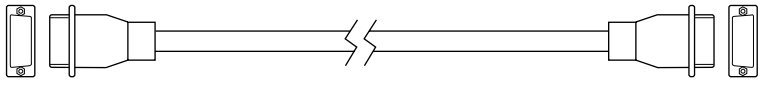
commands as HOME or MOVE and macro capabilities give the RS-232 port user an advantage over the keypad user. (See the PMC200-P Command Reference manual) For RS-232 cable connections see figure 2-5.



TO PMC200-P TO COMPUTER

CABLE TERMINATORS (RS-232)
9 pin to 25 pin

9 PIN PIN NO.	CODE	DESCRIPTION	25 PIN PIN NO.
1	DCD	CARRIER DETECT	8
2	RXD	RECEIVE DATA	3
3	TXD	TRANSMIT DATA	2
4	DTR	DATA TERM. READY	20
5	GND	SIGNAL GROUND	7
6	DSR	DATA SET READY	6
7	RTS	REQUEST TO SEND	4
8	CTS	CLEAR TO SEND	5
9	RI	RING IND.	22



TO PMC200-P TO COMPUTER

CABLE TERMINATORS (RS-232)
9 pin to 9 pin

9 PIN PIN NO.	CODE	DESCRIPTION	9 PIN PIN NO.
1	DCD	CARRIER DETECT	1
2	RXD	RECEIVE DATA	2
3	TXD	TRANSMIT DATA	3
4	DTR	DATA TERM. READY	4
5	GND	SIGNAL GROUND	5
6	DSR	DATA SET READY	6
7	RTS	REQUEST TO SEND	7
8	CTS	CLEAR TO SEND	8
9	RI	RING IND.	9

Figure 2-5 — Cable Terminators

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2.9 Operation with the IEEE-488 Port
(PMC200-P only)

The connector for the IEEE-488 port is located on the controller rear panel.

2.9.1 Selecting IEEE-488 Control

To set the controller for GPIB operation use the following procedure:

1. Press **[SETUP]** on Axis 2 and define the Actuator Type and Display Settings. Press the **[EXIT/STOP]** key when all parameters have been entered.
2. Press **[SETUP]** on axis 1 and define the actuator Type and Display Settings as you did for axis 2.
3. Press **[NEXT MENU]** until the GPIB SETUP: prompt is displayed (refer to Section 2.6). Select 'Enabled' and define the IEEE-488 device address of the PMC200-P.
4. Press **[EXIT/STOP]**. The letters 'J' or 'V' in front of the step/velocity value on the display will be lower case and GPIB will appear in place of the step/velocity display indicating IEEE-488 port control.

When the IEEE-488 port is enabled in the Execute mode the front panel keys are disabled, with the exception of the **[STOP]** key. The IEEE-488 port now becomes the only input device.

Even when the IEEE-488 port is disabled queries can be made to the controller through this port.

2.9.2 Using the IEEE-488 Port

The IEEE-488 port can communicate with devices that have IEEE488 ports that follow the IEEE488.2 standards. Third party add-on boards and software, such as Newport's LA Series, can be used to program a personal computer to communicate with the PMC200-P controller through the IEEE488 port. With these add-on boards and software, high-level language programs, can also be written to customize control of the PMC200-P through the IEEE488 port.

Commands are sent to the PMC200-P controller through the IEEE-488 port via a standard IEEE-488 cable. These commands are executed as if they had been executed from the key pad. However, the PMC200-P command set gives the user much more control of the PMC200-P controller than does the keypad. Such commands as HOME or MOVE and macro capabilities give the IEEE-488 port user an advantage over the keypad user(See the PMC200-P Command Reference manual)

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Section 3
Theory of Operation

The PMC200/200-P is a specialized, highly integrated, 16-bit microcomputer. The block diagram for the PMC200-P is shown in Figure 3-1.

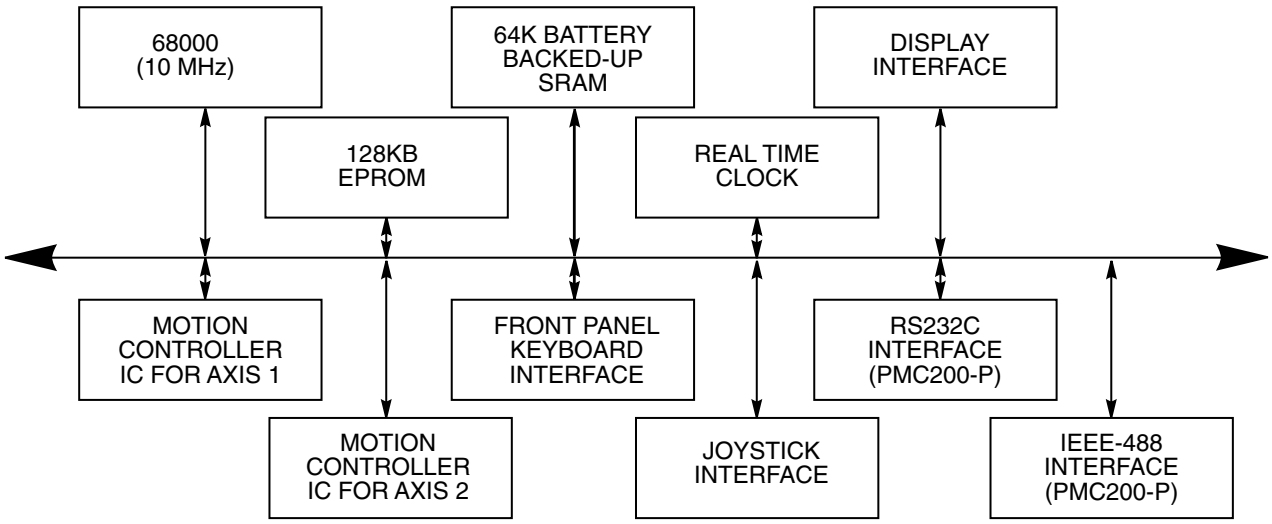


Figure 3-1 — PMC200/200-P Block Diagram

3.1 PMC200/200-P CPU

The CPU is a Motorola 68000 (10 MHz) microprocessor. Timer functions, interrupt control, and memory control are provided internally. Main program storage is contained in ROM. Nonvolatile storage for axis and system parameters is provided by a battery backed-up RAM.

3.2 User I/O Interface

User input can come from the following sources:

Front Panel Keyboard
IBM-PC Compatible Joystick
RS-232C (PMC200-P only)
IEEE-488 (PMC200-P only)

Keyboard inputs are read via a MM74C923 keyboard encoder IC. Joystick input values are read via an A/D converter circuit. The RS-232C is handled via a DUART chip. IEEE-488 communication is handled via a 9914 controller chip. The front panel LEDs and vacuum florescent display provide system status output to the user.

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3.3 Motion Control

Using a digital servo circuit, the motion control ICs (HCTL-1000) perform all of the position and velocity control for each axis. The system software directs all position and velocity control by writing to its registers.

Positional feedback comes to the motion control ICs from an incremental encoder in the actuator assembly. The encoder outputs are TTL compatible signals on two feedback channels. The two channels are 90° out of phase.

The behavior of the digital servo circuit is controlled by a digital filter in each motion controller IC. The actuator dynamics dictate the selection of the digital filter parameters.

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Section 4
Troubleshooting

The following section has been provided to keep the PMC200/200-P system functioning properly and efficiently. The Troubleshooting Guide lists problems that you may encounter and will either suggest an action to correct the problem or will direct you to the solution elsewhere in this manual. Some basic maintenance procedures which may lengthen the life of the unit are also offered.

4.1 Troubleshooting Guide

Problems that you may encounter while operating the unit will be discussed, and solutions designed to keep the PMC200/200-P operating smoothly will be offered.

Problem: **The unit will not power up.**

Action:
1. Check the power cord connections.
2. Check the fuse on the back panel (1 Amp fuse).
3. Check the line voltage setting.

Problem: **On power-up, BATLOW is displayed.**

Action: This indicates that the battery is low and should be replaced as follows:

1. **Warning:** Turn the controller OFF and disconnect all cables.
2. Using an Allen wrench, open the two screws below the front panel.
3. Remove the two screws attaching the front bar labeled 'PMC200-P (Programmable) Motion Controller.'
4. Turn the front panel over to reveal the two attached batteries.
5. Replace the batteries (3.8V Lithium).
6. Close the front panel and reverse steps 2 and 3 to close the controller unit.

Problem: **The display reads: DAC FAILURE at power-up.**

Action: This message means that the voltage levels on the Digital to Analog Chip which drives the Motion Devices is out of specification. This can be caused by a defective motion device that is plugged into the Axis ports.

1. Turn off the unit and unplug all motion devices.
2. Turn the unit on and press the RESET button located on the back of the unit.
3. Turn the unit off. Plug in one of the motion devices into Axis port 1. If the Error occurs, plug that same motion device into Axis port 2, power on and reset. If the error follows a particular motion device, that motion device is defective. Do not attempt repair. Return the device to the factory for repair. Repeat the same steps for other motion devices (if you have them).

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If the error occurs in spite of the above procedures the Controller is defective. Do not attempt repair. It is recommended that the Controller and Motion devices be returned for repair and testing.

Problem: **The display reads VRTPWRFAIL or is BLANK or the keyboard does not respond.**

Action: This message indicates that a power failure or surge has occurred. When this happens, the default menu options are automatically copied from EPROM to RAM. Press the RESET button on the rear panel.

If this does not clear the problem, disconnect the actuators from the controller, press the RESET button and see if the controller returns to normal. If the controller does return to normal then the actuator may be causing a problem.

Problem: **Powering the unit down and up, in quick succession, caused the system to display a fatal system error.**

Action:
1. Power down the controller, wait a few seconds, and power the system up again.

Problem: **Model 850/850A actuator oscillates when connected to the PMC200-P.**

Action: Actuator velocity servo must be aligned. Refer to Section 4.2 for procedure. This problem is most common with older 850 actuators.

Problem: **If the actuator overshoots?**

Action:
1. Be sure that the acceleration is set to the default value for the selected axis.
2. Increase the zero filter using the ZEROF command by steps of about 5 until the overshoot is eliminated.

See ZEROF in the command reference section of this manual for more information about the zero filter parameter.

Problem: **If the actuator undershoots?**

Action: An actuator that is undershooting will stop short of where it was commanded to go. If the undershoot is severe, limits may be triggered at the end of the actuator travel. This problem can occur when the actuators are pushing heavy loads, especially in the case of the -HS high speed actuators. One or both of the steps below should eliminate this problem.

1. Decrease the zero filter using the ZEROF command by steps of about 5 until the undershoot is eliminated.
2. Increase the acceleration by a factor of between 2 and 10 using the ACL command.

See ZEROF in the command reference section of this manual for more information about the zero filter parameter.

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Problem: **If the actuator jitters?**

Action: Actuator jitter can be caused by several factors. A gain filter parameter can cause jitter in an actuator if set too high. However, if the gain is set very low, velocity regulation during a RUN motion will suffer. The zero filter parameter can also contribute to jitter if it is set very low or very high.

The following steps should minimize the jitter in an actuator.

1. If the actuator has a servo box (ie. a black box on the actuator cable) adjust the servo box by following the instructions in section 4.2 of this manual. A properly adjusted servo box is crucial in eliminating actuator jitter.
2. Set the gain filter parameter lower using the GAINF command by steps of about 10 until the jitter is gone or very small.
3. If necessary adjust the zero filter parameter using the ZEROF command by steps of ±5.

A possible side effect of adjusting the gain and zero filter parameters to eliminate jitter is undershoot of the actuator during the MOVE, JOG, or HOME. When this happens the zero filter parameter is probably too high and should be lower.

Problem: **Actuator oscillates or reports false limits when connected to the PMC200.**

Action: First, ensure that the correct actuator type is selected for the axis. If you are using a non-standard gearbox, be sure you have correctly entered the motor type and coupling ratio. If the setup information is correct, then the actuator velocity servo might be aligned. This problem is occasionally seen with older 850/850A actuators with non-detachable servo boxes on their cables. If there are oscillations when using an 850B actuator—which is manufactured without a servo-box—call Newport after verifying that the PMC200 setup parameters are correct for the actuator.

4.2 850/850A Actuator Velocity Servo Alignment
(not for 850B)

The following procedure is used to correct oscillation of an 850 or 850A actuator when used with the PMC200/200-P Controller. To perform this alignment, you will need an oscilloscope and an alignment tool or small, flat-blade screwdriver.

1. Remove the cover (4 screws) from the servo box which is located between the 850 actuator and the PMC200/200-P.
2. Connect the oscilloscope leads to TP1 (ground) and TP5 on the servo board (Figure 4-1). set the oscilloscope for a vertical sensitivity of 5 volts/division and a time base of 10msec/division.
3. Turn the power to the PMC200/200-P on and press **[SETUP]**. Select CALIBRATION from the main menu. The display will read ADJUST NULL <ENTER> WHEN DONE.
4. Turn GAIN pot (R14) fully clockwise (CW) until it stops (25 turn pot).

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5. Adjust NULL pot (R12) for zero volts at TP5. The voltage may be ±50mV.
6. Turn (R14) counter-clockwise (CCW) until the actuator oscillates. You will also see the oscillation on the oscilloscope. Turn GAIN (R14) clockwise (CW) until the oscillation stops.
7. Repeat Steps 5 and 6 until the actuator is stable and TP5 is at ground (zero) ±50mV. Press **[**ENTER**]** ON THE PMC200/200-P keyboard. Display will read ADJUST GAIN <ENTER> WHEN DONE>.
8. Adjust GAIN (R14) for a waveform similar to that shown in Figure 4-1. The square wave must be followed by a curve as shown in the figure.
9. Verify that TP5 is within ±50mV of ground. Adjust (R12) if required.
10. Repeat Steps 8 and 9 until both conditions are met. Press **[ENTER]** to return to the main menu.
11. Press **[EXIT]** to enter the EXECUTE mode. Set the appropriate VELOCITY/STEP SIZE potentiometer to maximum (fully clockwise).
12. Press **[RUN]** and verify that the actuator is running at a steady 0.45 to 0.5mm/sec. Adjust (R14) if required to attain this value.
13. Replace the servo cover and four screws.

If the conditions described in any step cannot be accomplished, there may be a problem with the servo or actuator (other than alignment). In that case, contact Newport Corporation to arrange for factory service.

NOTE: If the actuator hits a 'hard limit' (end of travel) enter the EXECUTE mode and drive the actuator off the limit.

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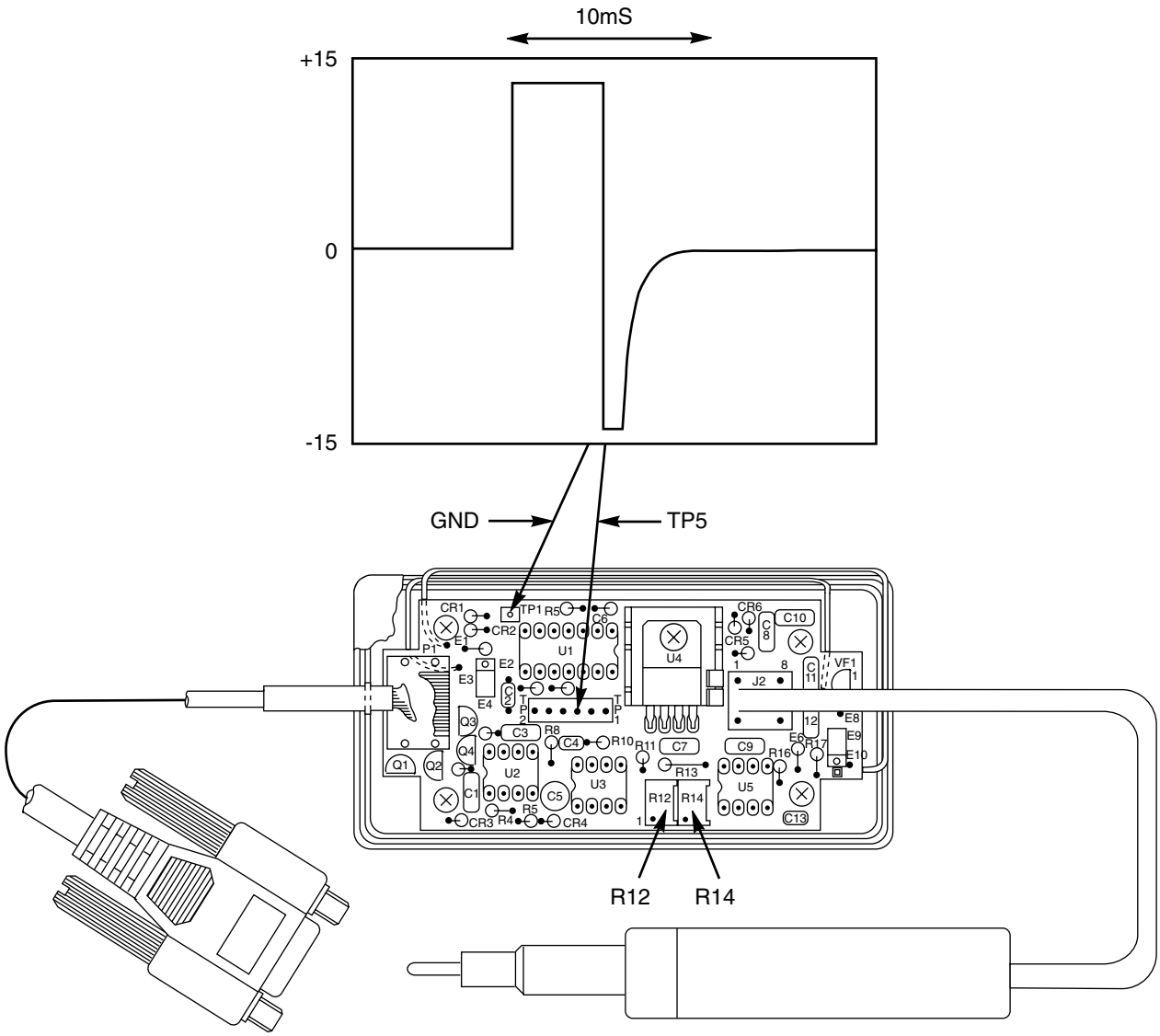


Figure 4-1 — Servo Board Alignment

NOTE:

Component layout may differ. Alignment procedure is the same in any case.

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Section 5
Service

5.1 Introduction

In the event that typical troubleshooting practices fail to resolve any problems you may encounter with the PMC200/200-P, contact Newport Corporation or your Newport representative.

5.2 Obtaining Service

To obtain information concerning factory service, contact the factory or your Newport representative. Have the following information available:

1. Instrument Model Number
2. Instrument Serial Number
3. ROM version number
4. Description of the problem

When returning the PMC200/200-P to Newport, please complete the service form provided, and return it with the instrument.

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5.3 Service Form

Newport Corporation
U.S.A. Office: 714/863-3144
FAX: 714/253-1800

Name _____ RETURN AUTHORIZATION # _____

Company _____ (Please obtain prior to return of item)

Address _____

Country _____ Date _____

P.O. Number _____ Phone Number _____

Item(s) Being Returned:

Model # _____ Serial # _____

Description: _____

Reason for return of goods (please list any specific problems) _____

_____

Please complete the below, as appropriate.

List all control settings and describe problem: _____

_____

_____

_____ (Attach additional sheets as necessary).

Show a block diagram of your measurement system including all instruments connected (whether power is turned on or not). Describe signal source. If source is a laser, describe output mode, peak power, pulse width, repetition rate and energy density.

Where is the measurement being performed?

(factory, controlled laboratory, out-of-doors, etc.) _____

What power line voltage is used? _____ Variation? _____

Frequency? _____ Ambient Temperature? _____

Variation? _____ °F. Rel. Humidity? _____ Other? _____

Any additional information. (If special modifications have been made by the user, please describe below).

_____

_____

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WORLDWIDE HEADQUARTERS
NEWPORT CORPORATION
1791 Deere Avenue
Irvine, CA 92606

(In U.S.): 800-222-6440
Tel: 714-863-3144
Fax: 714-253-1680

INTERNET
tech@newport.com

BELGIUM
Tel: 016 402927
Fax: 016 40 2227

CANADA
Tel: 905-567-0390
In Canada: 800-267-8999
Fax: 905-567-0392

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