Motoman, Inc.

ProfileStar Operator's Manual
for Software Version 2.2

Part Number 143020-1

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SECTION 1
INTRODUCTION

The Motoman ProfileStar is a two axis, servo-driven mechanism, designed for high-speed, high-accuracy cutting applications. Completely self-contained with independent CPU and servo controls, the ProfileStar is a very independent and highly versatile system. Programming and operation are performed via a dedicated programming pendant with LCD readout, and keypad interface. Up to 98 separate programs can be stored in the system and accessed using discrete I/O communication with a master controller.

As a system, the ProfileStar includes the ProfileStar mechanism, separate controller cabinet, and dedicated programming pendant. This package can be fitted to any robot in the Motoman family or retrofitted for any robotic or motion control system you might currently be using.

1.1 About this Document

This manual provides information for the ProfileStar system, and contains the following sections:

SECTION 1 - INTRODUCTION
Provides general information about the ProfileStar system and its components, a list of reference documents, and customer service information.

SECTION 2 - SAFETY
Provides information regarding the safe use and operation of the ProfileStar.

SECTION 3 - DESCRIPTION OF EQUIPMENT
Provides detailed descriptions of the major components of the ProfileStar. This section also includes a table of component specifications.

SECTION 4 - INSTALLATION
Provides instructions for installing the ProfileStar system.

SECTION 5 - OPERATION
Provides instructions for basic operation of the ProfileStar. This section provides procedures for programming the ProfileStar. A number of sample programs are included in this section.

APPENDIX A - CALIBRATION AND ALIGNMENT
Provides calibration and alignment procedures for the ProfileStar.

APPENDIX B - TROUBLESHOOTING
Contains basic troubleshooting procedures for the ProfileStar.

APPENDIX C - SYSTEM DRAWINGS
Provides engineering drawings specifically for the ProfileStar.

1.2 System Overview

The ProfileStar can be used with a variety of applications requiring precise, intricate movements of the tool, including; laser, plasma, water-jet, and dispensing. The typical ProfileStar system is designed around the Motoman SK45X robot and XRC controller. However, with its independent controller cabinet and dedicated programming pendant, it can be interfaced with most motion control systems. Every ProfileStar system is integrated and tested at the factory prior to shipment.

1.2.1 System Layout

The ProfileStar system includes the following components (see Figure 1-1):

- ProfileStar controller cabinet
- ProfileStar trepanning mechanism
- Dedicated, hand-held programming pendant
- Servo motor cables
- Motion Works software (optional)
- Rotary axis calibration tool (optional)

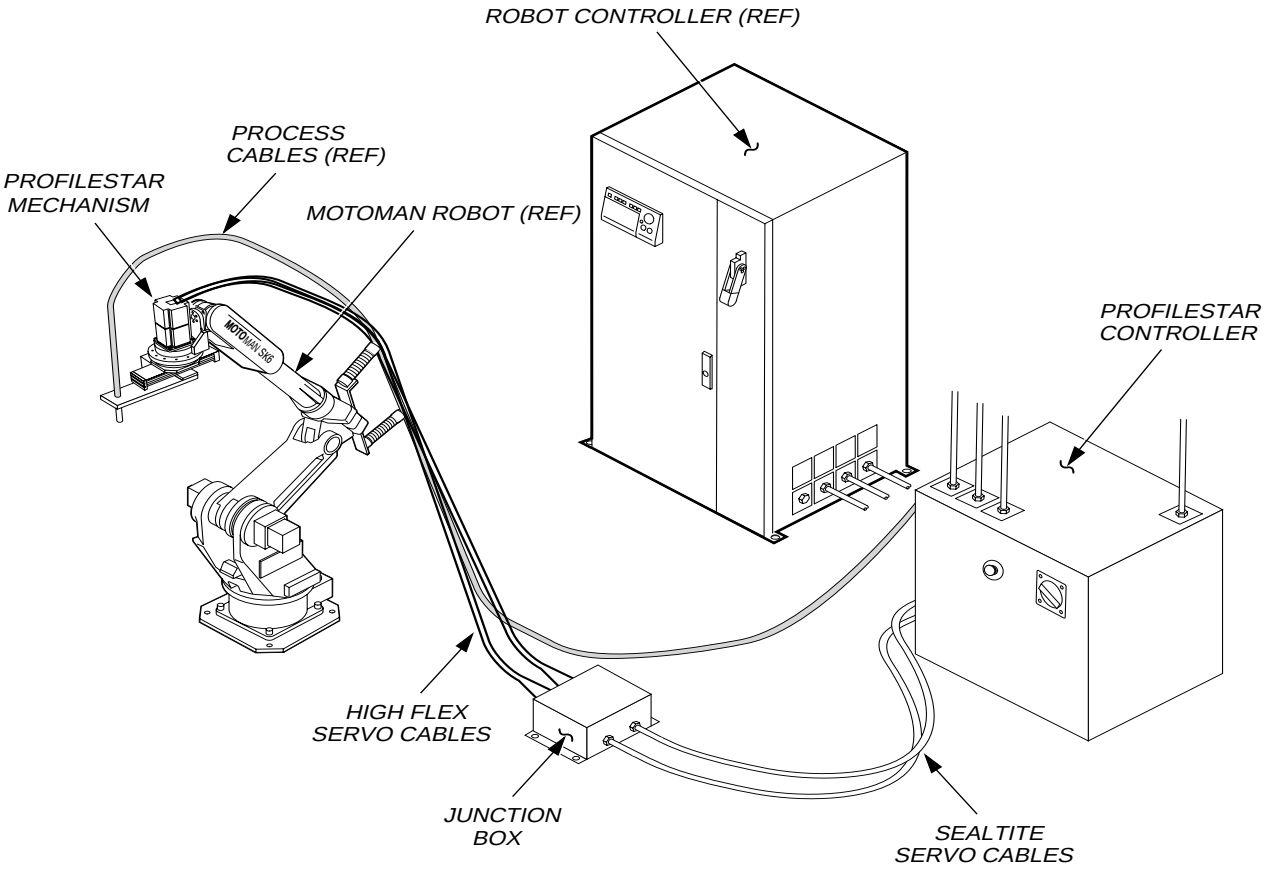


Figure 1-1 Typical ProfileStar System Layout

1.3 Reference to Other Documentation

For additional information, refer to the following:

- Motoman SK45X Manipulator Manual (P/N 142106-1)
- Motoman Concurrent I/O and Parameters Manual (P/N 142102-1)

1.4 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

- Robot Type (SK45X)
- Application (laser, plasma, dispensing, etc.)
- Robot Serial Number (located on the back side of the robot arm)
- Robot Sales Order Number (located on the back side of the controller)

NOTES

SECTION 2
SAFETY

2.1 Introduction

It is the purchaser's responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06. The address is as follows:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: 313/994-6088
FAX: 313/994-3338

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. **The robot must not be operated by personnel who have not been trained!**

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.

This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming Safety (Section 2.6)
- Operation Safety (Section 2.7)
- Maintenance Safety (Section 2.8)

2.2 Standard Conventions

This manual includes information essential to the safety of personnel and equipment. As you read through this manual, be alert to the four signal words:

- DANGER
- WARNING
- CAUTION
- NOTE

Pay particular attention to the information provided under these headings which are defined below (in descending order of severity).

DANGER!

Information appearing under the DANGER caption concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.

WARNING!

Information appearing under the WARNING caption concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.

CAUTION!

Information appearing under the CAUTION caption concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.

NOTE: Information appearing in a NOTE caption provides additional information which is helpful in understanding the item being explained.

2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06, section 6.13.4 and 6.13.5, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety measures are available:

- Safety fences and barriers
- Light curtains
- Door interlocks
- Safety mats
- Floor markings
- Warning lights

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.

2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 Programming Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Programming tips are as follows:

- Any modifications to PART 1 of the controller PLC can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1. Making any changes without the written permission of Motoman will **VOID YOUR WARRANTY!**
- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. **YOUR WARRANTY WILL BE VOID** if you use these special passwords.
- Back up all programs and jobs onto a floppy disk whenever program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- The concurrent I/O (Input and Output) function allows the customer to modify the internal ladder inputs and outputs for maximum robot performance. Great care must be taken when making these modifications. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations that may damage the robot or other parts of the system.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.

- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place.
- Check the E-Stop button on the teach pendant for proper operation before programming.
- Carry the teach pendant with you when you enter the workcell.
- Be sure that only the person holding the teach pendant enters the workcell.
- Test any new or modified program at low speed for at least one full cycle.

2.7 Operation Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Operation tips are as follows:

- Be sure that only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories are permitted to operate this robot system.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Inspect the robot and work envelope to ensure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Ensure that all safeguards are in place.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.

2.8 Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Maintenance tips are as follows:

- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Back up all programs and jobs onto a floppy disk whenever program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- Be sure all safeguards are in place.
- Use proper replacement parts.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).

SECTION 3
EQUIPMENT DESCRIPTION

3.1 ProfileStar Carrier Assembly

The carrier assembly consists of two servo-driven axes, A1- and B1-, mounted to the end of the robot tooling flange. The A1-axis provides ± 90° rotary motion about the central axis, while the B1-axis provides radial motion for the tool. The carrier assembly is designed to work in a plane of motion parallel to the work surface. This allows the tool to trace small, intricate patterns with no movement of the robot (see Figure 3-1).

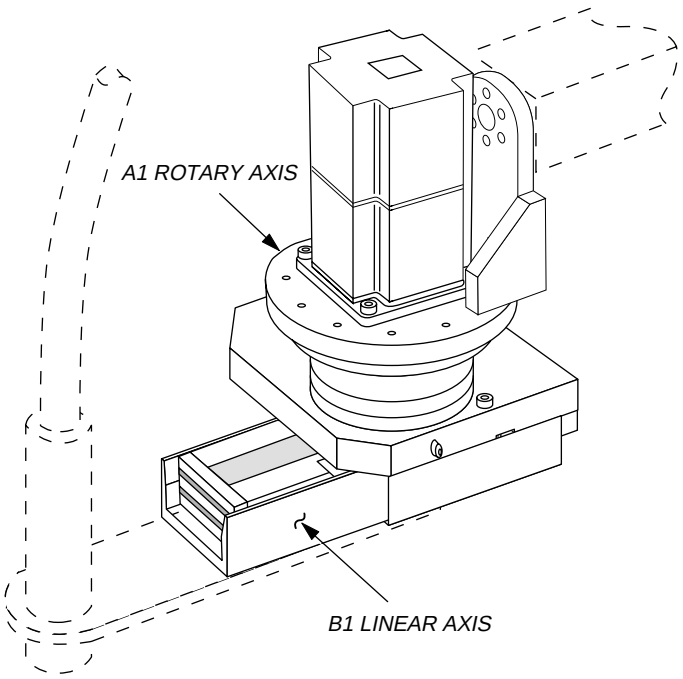


Figure 3-1 ProfileStar Carrier Assembly

Table 3-1 ProfileStar Specifications

Condition	Specifications
Work Envelope (see Figure 3-2)	100 mm x 180° (3.94 in. x 180°). Area is approximately 560 cm^2 (86.8 $in.^2$).
Temperature Range	4-43°C (40-110°F)
Humidity	Non-condensing 10-90% relative humidity
Shock (maximum)	Less than 0.5 G
Speed	Up to 15 m/min (9.84 in/sec) (shape dependent)
Electrical Requirements	208V AC, can be supplied by robot controller.
Payload	6.0 kg (13.23 lbs)
Path Repeatability	± 0.15 mm (0.006 in.) including robot

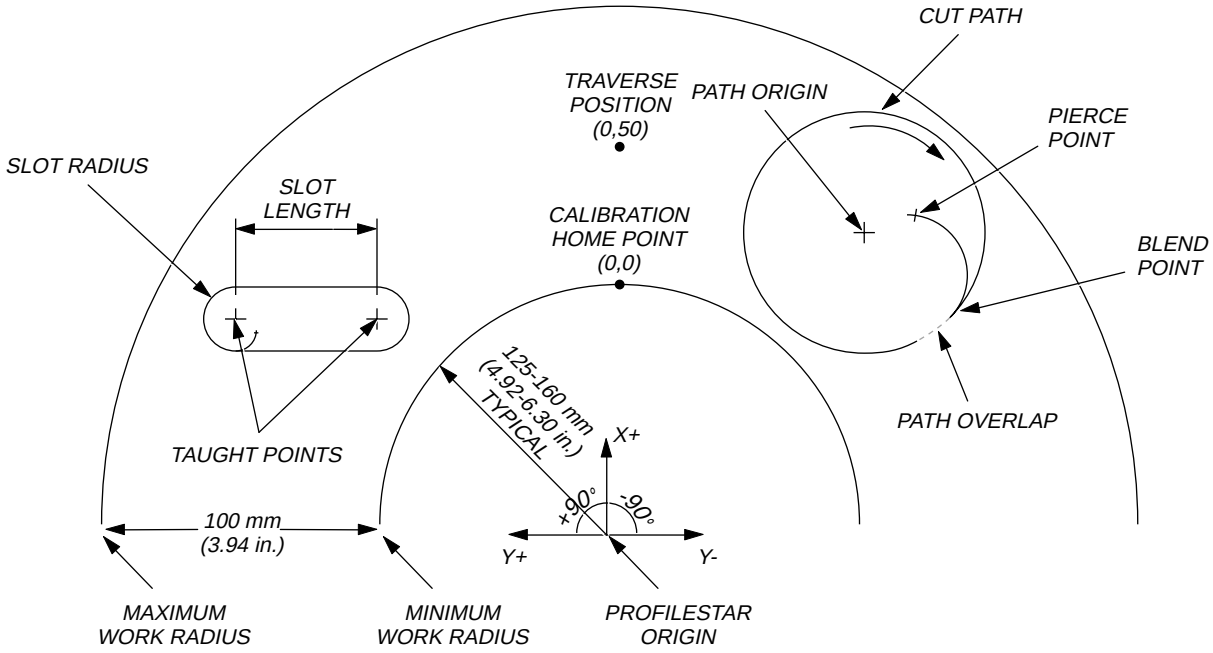


Figure 3-2 ProfileStar Work Envelope

The carrier assembly has a payload of 6 kg (13.23 lbs). The maximum path velocity is 15 m/min (49.21 ft/min) (see Table 3-2). The maximum pattern radius is 50 mm (1.97 in.). Overall weight of the unit is approximately 16 kg (35.27 lbs) without tooling. Spring cable supports, attached to the upper arm of the manipulator, keep the servo cables away from manipulator pinch points.

Table 3-2 Maximum Rated Velocities

Radius	Velocity
30-47.5 mm (1.18-1.87 in.)	15 m/min (9.84 in./sec)
20 mm (0.79 in.)	11 m/min (7.22 in./sec)
10 mm (0.39 in.)	7.5 m/min (4.92 in./sec)
5 mm (0.20 in.)	6 m/min (3.94 in./sec)
2.5 mm (0.10 in.)	3.75 m/min (2.46 in./sec)
1.4 mm (0.06 in.)	3 m/min (1.97 in./sec)
Straight Line	15 m/min (9.84 in./sec)

3.2 Controller

The ProfileStar controller is a separate stand alone-unit containing the servo packs, power, and dedicated CPU. Up to 98 separate programs can be stored in the controller and accessed by the robot controller via discrete I/O communication.

The Emergency Stop (E-Stop) button on the ProfileStar controller must be connected in series with the host system Emergency Stop circuit. Pressing the E-Stop button interrupts this circuit, removes servo power, and stops **all** system operation.

3.2.1 Programming Pendant

The programming pendant provides the primary user interface with the ProfileStar system. The pendant has a 4-line LCD display and push-button keypad. Using the pendant, the operator can teach new patterns, perform editing functions, run check jobs, and manually jog the ProfileStar.

NOTE: The programming pendant is enabled by placing the host controller in TEACH mode.

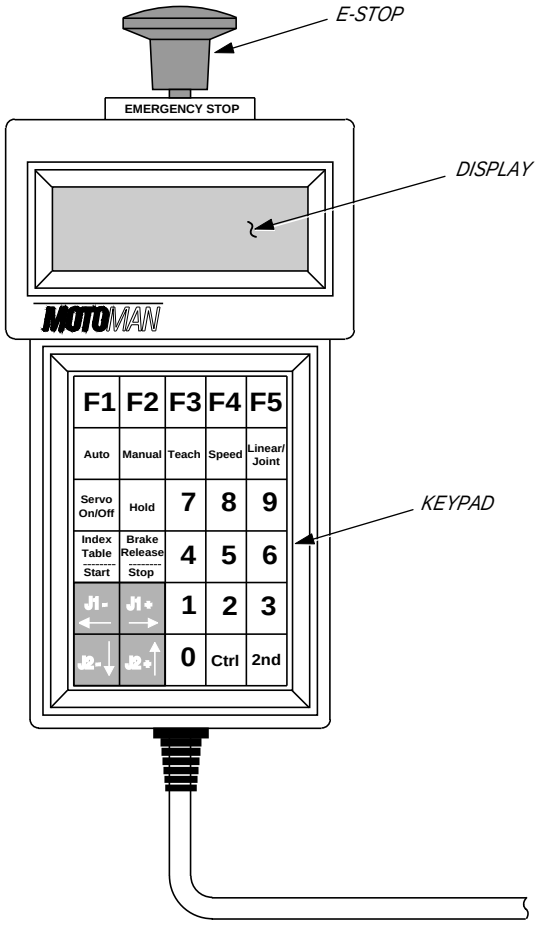


Figure 3-3 Programming Pendant

Display

The programming pendant has a 4-line LCD display which provides jog status information and pattern programming through a series of screen prompts.

Emergency Stop

The *Emergency Stop* (E-Stop) button must be connected in series with the host system Emergency Stop circuit. Pressing the E-Stop button interrupts this circuit, removes servo power, and stops **all** system operation.

Numeric Keypad

The keypad enables the operator to enter numeric values for programming parameters (i.e. radius, velocity, offsets, etc.).

Auto

Pressing the *Auto* key places the ProfileStar in Auto mode, enabling playback operation.

Manual

Pressing the *Manual* key places the ProfileStar in Manual mode, enabling the axis coordinate keys.

Teach

Pressing the *Teach* key places the ProfileStar in Teach mode allowing the operator to edit or teach new jobs.

NOTE: The ProfileStar can only be placed in Teach mode from Manual. If you are in Auto mode, first place the system into Manual mode before selecting Teach.

Speed

Selects jog speed for the ProfileStar while in Manual mode. Pressing the *Speed* button toggles through the following selections:

Slow Speed	A1 = 90 degrees/min B1 = 150 mm/min
Medium Speed	A1 = 360 degrees/min B1 = 600 mm/min
Fast Speed	A1 = 540 degrees/min B1 = 900 mm/min
Incremental	N/A

Linear/Joint

Not applicable at time of printing.

Servo On/Off

Pressing the *Servo On/Off* button toggles servo power to the ProfileStar On or Off. All E-Stop conditions must be released before servo power can be applied.

Hold

The *Hold* button stops motion of the ProfileStar during Auto cycle. Pressing the *Hold* button once stops motion of the ProfileStar until the button is pressed again.

NOTE: Pressing the Hold button while executing a high-speed path may cause a servo alarm.

Index Table

Not applicable at time of printing.

Start

Pressing the *Start* key while in Auto mode causes the ProfileStar to cycle through the current job pattern.

Stop

Pressing the *Stop* key stops all motion of the ProfileStar and aborts the current job during Auto cycle.

J1- Coordinate Key

Jogs the A1 rotary axis in the negative direction (clockwise while looking at work surface) with servos ON in Manual mode.

J1+ Coordinate Key

Jogs the A1 rotary axis in the positive direction (counterclockwise while looking at work surface) with servos ON in Manual mode.

J2- Coordinate Key

Jogs the B1 linear axis in the negative direction (towards A1 axis) with servos ON in Manual mode.

J2+ Coordinate Key

Jogs the B1 linear axis in the positive direction (away from A1) with servos ON in Manual mode.

Ctrl

While in AUTO, simultaneously pressing the CTRL and START keys will execute the HOME job, placing the ProfileStar in the Home position.

2nd

While in AUTO, simultaneously pressing the *2nd* and START keys will execute the TRAVERSE job, placing the ProfileStar in the Traverse position.

The *2nd* key is also used in conjunction with other keys to provide additional software functions.

NOTES

SECTION 4
INSTALLATION

Installation of the ProfileStar system should be performed by either an approved integrator or personnel who have received the appropriate training from Motoman and who are familiar with the particular robot model. Motoman application technicians are available for in-house training and/or to help with the installation of your system. For more information, call the Motoman Customer Service Department 24-Hour Hot Line at (937) 847- 3200.

4.1 Mounting the Carrier Assembly

The ProfileStar carrier assembly is mounted to the T-axis of the manipulator using six M8 bolts (recommended torque: 4.10 kgfm). Because the carrier assembly mounting plate is an aluminum alloy casting, maximum contact surface force should be 15 kgf/mm^2 or less. A dowel pin is used to align the carrier assembly with the T-axis of the robot (see Figure 4-1).

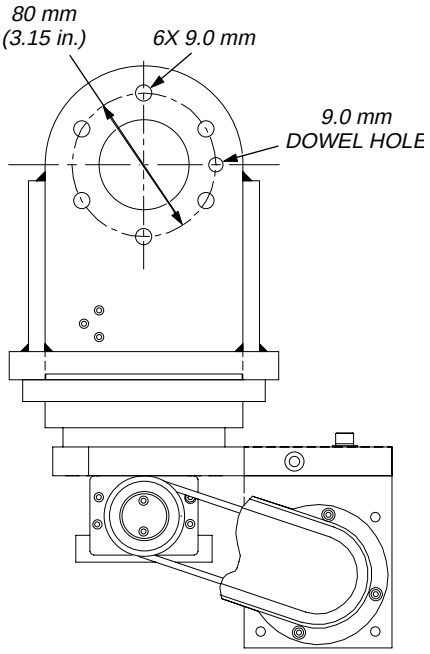


Figure 4-1 Mounting the Carrier Assembly

4.2 Tool Installation

CAUTION!

Before installing any tool to the carrier assembly, be sure tool weight is less than 6 kg (13.23 lbs), otherwise serious injury to personnel or damage to equipment can occur.

1. Ensure tool weight is 6 kg (13.23 lbs) or less.
2. Route any tool cabling along robot to carrier assembly.
3. Mount tool to carrier assembly (contact Motoman for bracket design guidelines).

4.3 Installing the ProfileStar Controller

The ProfileStar controller contains the power, servopacks, and CPU for the ProfileStar. The ProfileStar controller can be mounted directly to the robot controller, wall mounted, or mounted on a bracketed stand.

4.4 Connecting the Cables

After the controller is securely in place, the cables should be unpacked and laid out on the floor for installation. Each cable connection is clearly marked for ease of installation.

4.4.1 Connecting the ProfileStar Cables (Robot Application)

Two Sealtite servo cables and junction box are wired to the controller at the factory prior to shipment. One conduit contains the servo encoder cables and the other contains the servo power cables. To connect the high-flex servo cables, proceed as follows:

1. Locate junction box near base of robot.
2. Carefully route high-flex servo cables from junction box to carrier assembly.
3. Connect cables to carrier assembly as marked.
4. Utilize provided protective leather and brackets as required.

4.4.2 Connecting the Robot Controller Cables

The I/O cable runs between the ProfileStar controller and robot controller.

4.4.3 Connecting Positive Air Pressure

An air pressure port is provided on the carrier assembly. Air pressure of at least 10 to 80 psi is required to keep process dirt out of linear axis mechanism. To connect the air line, proceed as follows:

1. Locate air connection on carrier assembly.
2. Route air line to carrier assembly.
3. Connect airline to carrier assembly.

4.5 Connecting the Power

After all system components have been properly installed, connect power to the ProfileStar controller. The ProfileStar requires 220V AC ± 10% single-phase, 15 amp.

DANGER!

- ***Power should be connected only by a qualified electrician. Electrical and grounding connections must comply with applicable portions of the national electrical code and/or local electrical codes.***
- ***The ProfileStar is configured for single-phase 220V AC. It is the users responsibility to provide the appropriate voltage.***

1. Install power wiring to fused disconnect located inside right side of ProfileStar controller.
2. Tighten screws.
3. Install an M5 lug on incoming ground wire.
4. Terminate ground wire to frame ground M5 threaded stud.

NOTE: The required single-phase 220V AC power can be tapped directly from the robot controller circuit breaker.

4.6 Conducting a Safety/Operation Check

Before operating the ProfileStar system, take a few minutes to perform a safety/ operation check. To conduct a safety/operation check, proceed as follows:

1. Check that all cable connections are tight.
2. Verify that incoming line power matches 220V AC power required.
3. Check all system E-Stops (programming pendant, controller).
4. Check Hold button for proper operation.

NOTES

SECTION 5
OPERATION

The ProfileStar system provides a simple and effective way to program a variety of very small to medium-sized precise patterns (shape jobs) for the process tool to navigate. A series of screens prompt the user for programming information such as shape type, center point(s), and radii. Once this data has been entered, the job has been programmed and can be called from a master job by the robot controller.

5.1 Programming

Programming the ProfileStar should be performed only by either an approved Motoman integrator or personnel who have received operator training from Motoman. Motoman application technicians are available for in-house system training and to give programming advice for your application. For more information, call the Motoman Customer Service Department 24-Hour Hot Line at (937) 847-3200.

Programming shape jobs with the ProfileStar is a very simple operation. Once a shape is selected, a series of windows prompt the programmer for shape-defining parameters such as center point(s), radii, and velocity. Once the shape has been defined, this job can be called from the robot controller. The following is an example of typical operation of the ProfileStar:

The robot positions the ProfileStar carrier assembly over the workpiece. The robot controller then sends a series of signals to the ProfileStar controller informing it which shape job to run. An initial Start signal is sent from the robot controller to the ProfileStar controller to move the carrier assembly to the pierce point. A pierce point signal is sent to the robot controller informing it that the carrier assembly is in position. The cutting process is initiated and a second start signal is sent to begin tracing the shape. When the end of the job is reached, a signal is sent to stop the cutting process and return the carrier assembly to a ready position.

The host controller must be in Teach mode to enable the ProfileStar teach pendant. The ProfileStar controller must be in Manual mode before editing or teaching a selected shape. Shape parameters are modified using the programming pendant numeric keypad and function keys F1 thru F5 as described below.

F1- Modify Parameter

The *F1* function key allows the operator to modify the current parameter.

F2- Next

The *F2* function key saves the current data and moves to the next screen.

F3- Previous

The *F3* function key jumps to the previous screen.

F4- Shape Table/Servos

The *F4* function key provides software options for different screens. It checks status of servos from the *Teach Center Pt*. screen, and selects patterns from the Shape Table on the *Shape* screen.

F5- Cancel

The *F5* function key is used to cancel any changes made to a parameter.

5.1.1 Programming/Editing a Circle

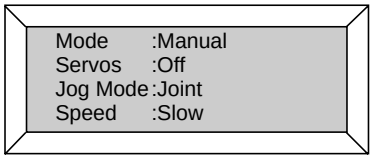
CAUTION!

It is very important to step through all job parameter screens using the F2-Next key until the default user screen appears. Failure to do so will result in loss of all modified data.

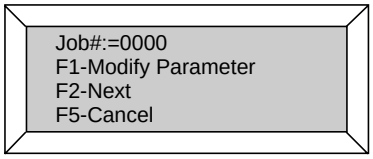
To modify an existing circle job, or teach a new one, proceed as follows:

1. Turn power ON. Power-On screen appears.

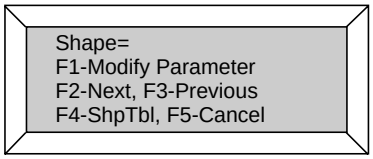
2. Press any key. Default user screen appears.



3. Press Teach key on programming pendant. Job screen appears.

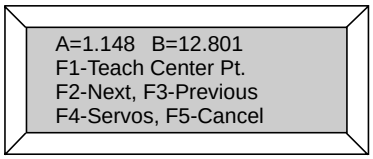


4. Press F1-Modify Parameter and enter job number using numeric keypad.
5. Press F2-Next. Shape screen appears.



NOTE: When modifying an existing job, skip Step 6. and proceed to Step 7.

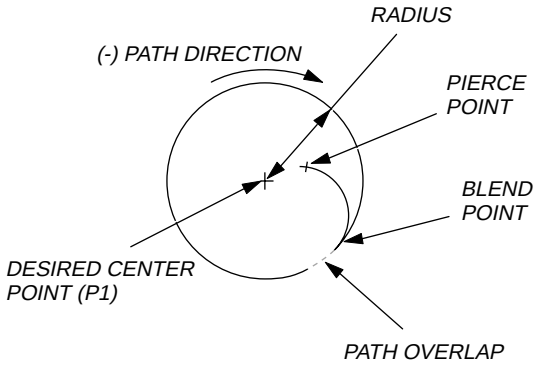
6. Press F1-Modify Parameter and press **1 (circle)**, 2 (slot), 3 (line), 4 (triangle), or 5 (rectangle) using numeric keypad. (If necessary, press F4-ShpTbl to view Shape Table.)
7. Press F2-Next to begin creating or modifying selected shape.



NOTE: When programming large diameter circles, the center point should be taught with the B-axis near the middle of its allowable range to avoid Overtravel errors. Executing Job 100 will place the ProfileStar in the Traverse position (A1=0, B1=50).

8. Jog tool to desired center point (P1).

NOTE: Press F4-Servos to change jogging speeds.

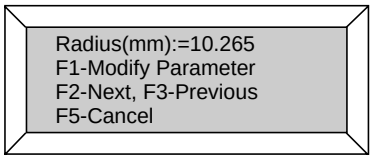


NOTE: When editing, the operator may jog the ProfileStar to a previously taught point by pressing and holding the Start button when Teach Point screen is displayed.

9. Press F1-Teach Center Pt. to update A1- and B1- axis data.

NOTE: The A1- and B1- axis data does not update automatically. To update axis data, press the F1 function key. Use F1 key in conjunction with coordinate keys to jog tool to exact numeric value.

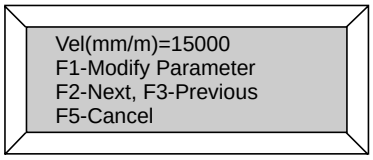
10. Press F2-Next to save data and move to next screen. Radius screen appears.



11. Press F1-Modify Parameter and enter desired radius using numeric keypad.

NOTE: Use the Stop key to enter decimal points.

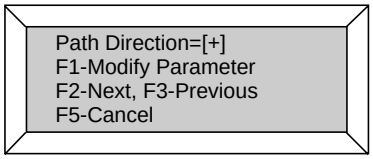
12. Press F2-Next. Velocity screen appears.



13. Press F1-Modify Parameter and enter desired velocity.

NOTE: Velocity units are in millimeters per minute.

14. Press F2-Next. Path Direction screen appears.



15. Press F1-Modify Parameter and enter desired path direction using **J1–** coordinate key for negative, and **J1+** for positive.

NOTE: Path direction determines the direction, clockwise or counterclockwise, in which the tool will trace the shape; negative - clockwise, positive - counterclockwise.

16. Press F2-Next to save data. Job data is saved and default user screen appears.

Once a job has been programmed, it should be tested by placing the ProfileStar in Auto mode and pressing the *Start* button.

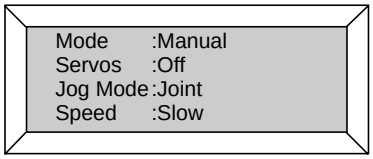
5.1.2 Programming/Editing a Slot

CAUTION!

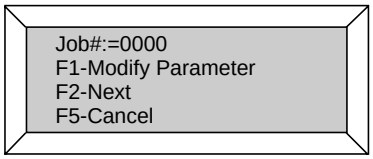
It is very important to step through all job parameter screens using the F2-Next key until the default user screen appears. Failure to do so will result in loss of all modified data.

To modify an existing slot job, or teach a new one, proceed as follows:

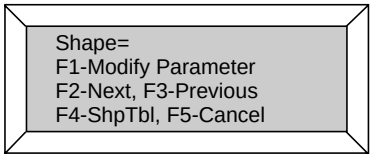
1. Turn power ON. The "Motoman ProfileStar Version" screen appears.
2. Press any key. The default user screen appears.



3. Press the Teach key to modify or teach a new job.

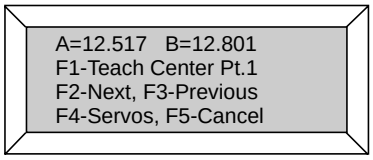


4. Press F1-Modify Parameter and enter job number using numeric keypad.
5. Press F2-Next. Shape screen appears.



NOTE: When modifying an existing job, skip Step 6. and proceed to Step 7.

6. Press F1-Modify Parameter and press 1 (circle), **2 (slot)**, 3 (line), 4 (triangle), or 5 (rectangle) using numeric keypad. (If necessary, press F4-ShpTbl to view Shape Table.)
7. Press F2-Next to begin creating or modifying selected shape.



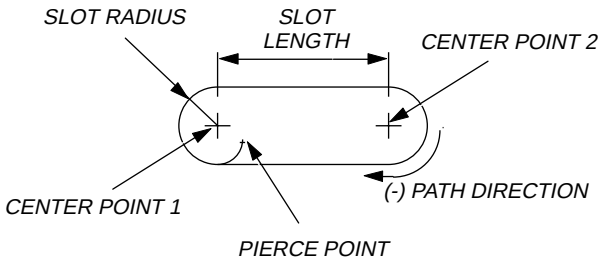
NOTE: When programming large diameter or long slots, be sure to teach each center point well within the allowable work area to avoid overtravel errors.

8. Jog tool to first center point (P1).

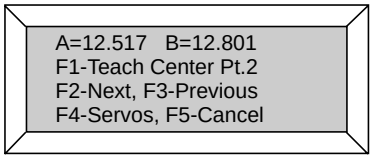
NOTE: When editing, the operator may jog the ProfileStar to a previously taught point by pressing and holding the Start button, when the Teach Point screen is displayed.

9. Press F1-Teach Center Pt. 1 to update A1- and B1- axis data.

NOTE: The A1- and B1- axis data does not update automatically. To update the A1- and B1- axis data, press the F1 function key. Use the F1 key in conjunction with the coordinate keys to jog the tool to an exact numeric value.

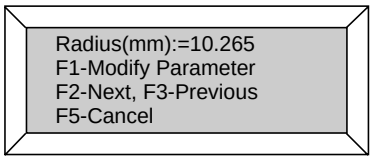


10. Press F2-Next to save data. Center point 2 screen appears.



NOTE: During playback, the ProfileStar may not start at center point #1. Instead, the ProfileStar will start at that point located furthest in the Y+ direction.

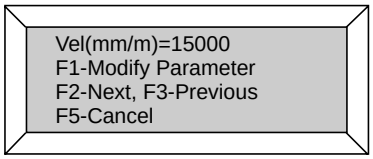
11. Jog tool to second center point using axis keys.
12. Press F1-Teach Center Pt. 2 to update A1- and B1- axis data.
13. Press F2-Next to save data and move to next screen. Radius screen appears (slot width = 2x radius).



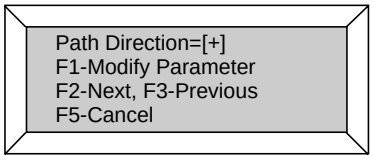
14. Press F1-Modify Parameter and enter desired radius using numeric keypad.

NOTE: Use the Stop key to enter decimal points.

15. Press *F2-Next*. Velocity screen appears.



16. Press F1-Modify Parameter and enter desired velocity using numeric keypad. *Velocity units are in millimeters per minute.*
17. Press F2-Next. Path Direction screen appears.



18. Press F1-Modify Parameter and enter desired path direction using **J1–** coordinate key for negative, and **J1+** for positive.

NOTE: Path direction determines the direction, clockwise or counterclockwise, in which the tool will trace the shape; negative - clockwise, positive - counterclockwise.

19. Press F2-Next to save data. Job data is saved and default user screen appears.

Once a job has been programmed, it should be tested by placing the ProfileStar in Auto mode and pressing the *Start* button.

5.1.3 Programming/Editing a Line

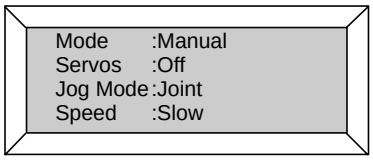
CAUTION!

It is very important to step through all job parameter screens using the F2-Next key until the default user screen appears. Failure to do so will result in loss of all modified data.

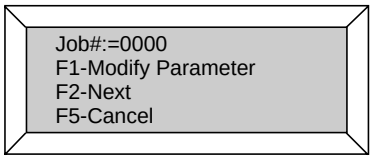
To modify an existing line job, or teach a new one, proceed as follows:

1. Turn power ON. The Power-On screen appears.

2. Press any key. The default user screen appears.

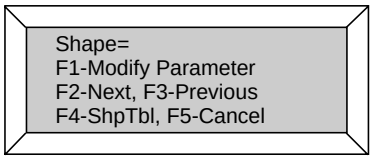


3. Press the Teach key to modify or teach a new job.



4. Press F1-Modify Parameter and enter job number using numeric keypad.
5. Press F2-Next. Shape screen appears.

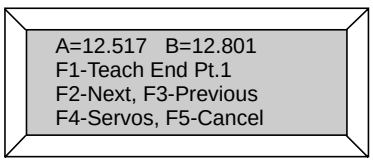
NOTE: When modifying an existing job, skip Step 6. and proceed to Step 7.

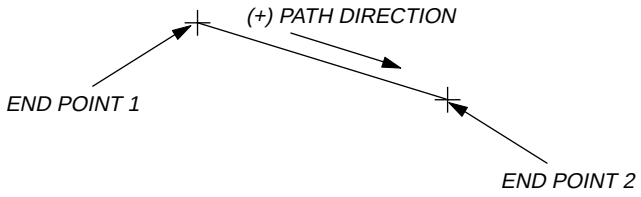


6. Press F1-Modify Parameter and press 1 (circle), 2 (slot), **3 (line)**, 4 (triangle), or 5 (rectangle) using numeric keypad. (If necessary, press F4-ShpTbl to view Shape Table.)
7. Press F2-Next to begin creating or modifying selected shape.

NOTE: When editing, the operator may jog the ProfileStar to a previously taught point by pressing and holding the Start button when the Teach Point screen is displayed.

8. Jog tool to first end point.

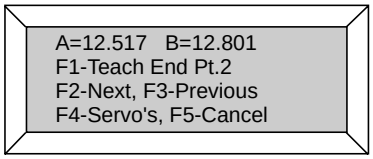




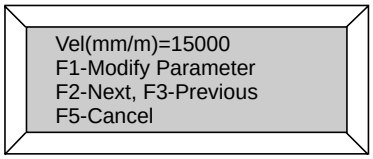
9. Press F1-Teach End Pt. 1 to update A1- and B1- axis data.

NOTE: The A1- and B1- axis data does not update automatically. To update the A1- and B1- axis data, press the F1 function key. Use the F1 key in conjunction with the coordinate keys to jog the tool to an exact numeric value.

10. Press F2-Next to save data and move to next screen. End Pt. 2 screen appears.



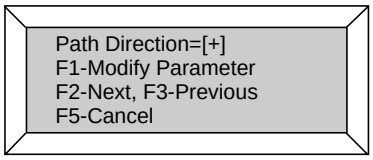
11. Jog tool to desired second end point using axis keys.
12. Press F1-Teach End Pt. 2 to update A1- and B1- axis data.
13. Press F2-Next to save data and move to next screen. Velocity screen appears.



14. Press F1-Modify Parameter and enter desired velocity using numeric keypad.

NOTE: Velocity units are in millimeters per minute.

15. Press F2-Next. Path Direction screen appears.



16. Press F1-Modify Parameter and enter desired path direction using **J1–** coordinate key for negative, and **J1+** for positive.

NOTE: Path direction determines the order the tool will trace the line. + (Positive): the ProfileStar starts at end point 1 and proceeds to end point 2. - (Negative): the ProfileStar starts at end point 2 and proceeds to end point 1.

17. Press F2-Next to save data. Job data is saved and default user screen appears.

Once a job has been programmed, it should be tested by placing the ProfileStar in Auto mode and pressing the *Start* button.

5.1.4 Programming/Editing a Triangle

The ProfileStar is able to create both isosceles and equilateral triangles.

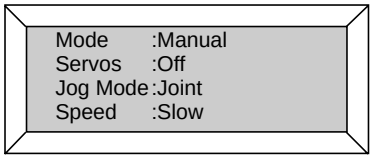
CAUTION!

It is very important to step through all job parameter screens using the F2-Next key until the default user screen appears. Failure to do so will result in loss of all modified data.

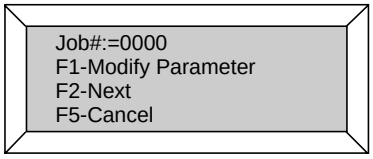
To modify an existing line job, or teach a new one, proceed as follows:

1. Turn power ON. The Power-On screen appears.

2. Press any key. The default user screen appears.

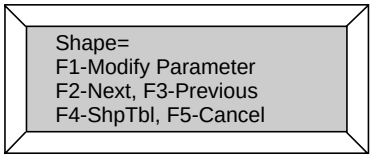


3. Press the Teach key to modify or teach a new job.



4. Press F1-Modify Parameter and enter job number using numeric keypad.
5. Press F2-Next. Shape screen appears.

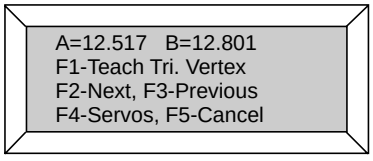
NOTE: When modifying an existing job, skip Step 6. and proceed to Step 7.

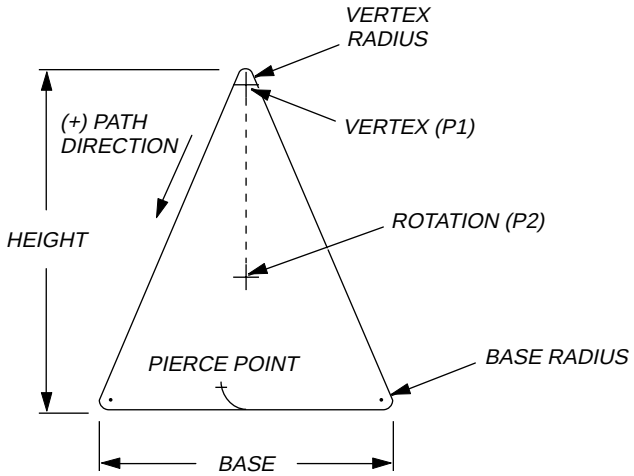


6. Press F1-Modify Parameter and press 1 (circle), 2 (slot), 3 (line), **4 (triangle)**, or 5 (rectangle) using numeric keypad. (If necessary, press F4-ShpTbl to view Shape Table.)
7. Press F2-Next to begin creating or modifying selected shape.

NOTE: When editing, the operator may jog the ProfileStar to a previously taught point by pressing and holding the Start button when the Teach Point screen is displayed.

8. Jog tool to triangle vertex (P1).

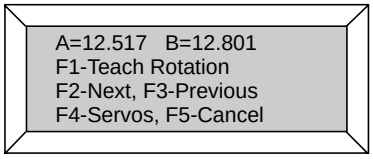




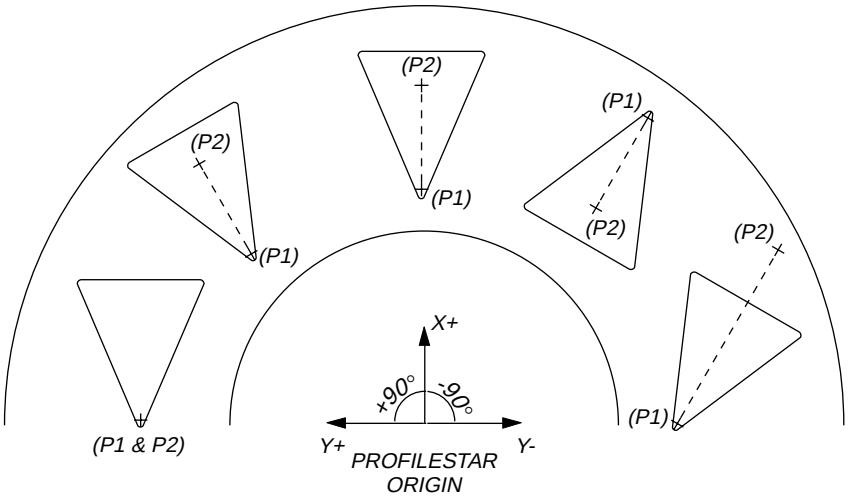
9. Press F1-Teach Tri. Vertex to update A1- and B1- axis data.

NOTE: The A1- and B1- axis data does not update automatically. To update A1- and B1- axis data, press F1 function key.

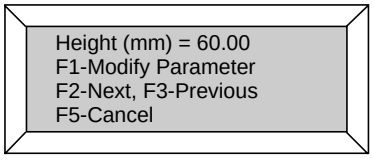
10. Press F2-Next to save data and move to next screen. Triangle rotation screen appears.



11. Jog tool to rotation point (P2) to rotate triangle about vertex (P1).

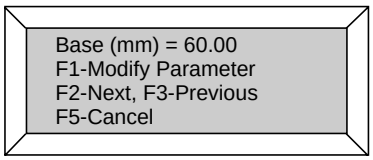


12. Press F1-Teach Rotation to update A1- and B1- axis data.
13. Press F2-Next to save data and move to next screen. Height screen appears.

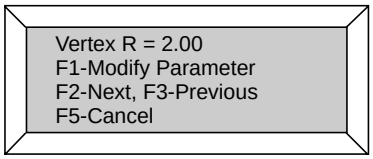


14. Press F1-Modify Parameter and enter desired height using numeric keypad.

15. Press F2-Next. Base screen appears.



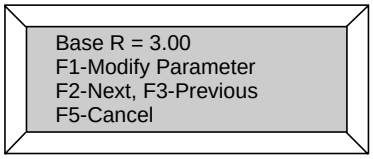
16. Press F1-Modify Parameter and enter desired base length using numeric keypad.
17. Press F2-Next. Vertex angle radius screen appears.



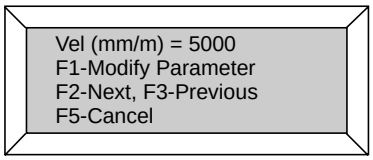
18. Press F1-Modify Parameter and enter desired radius for vertex angle using numeric keypad.

NOTE: 0.1 is the smallest radius allowed.

19. Press F2-Next. Base angle radius screen appears.



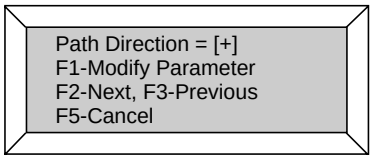
20. Press F1-Modify Parameter and enter desired radius for base angles using numeric keypad.
21. Press F2-Next. Tool velocity screen appears.



22. Press F1-Modify Parameter and enter desired velocity using numeric keypad.

NOTE: Velocity units are in millimeters per minute.

23. Press F2-Next. Path Direction screen appears.



24. Press F1-Modify Parameter and enter desired path direction using **J1–** coordinate key for negative, and **J1+** for positive.

NOTE: Path direction determines the direction, clockwise or counterclockwise, in which the tool will trace the shape; negative - clockwise, positive - counterclockwise.

25. Press F2-Next to save data. Job data is saved and default user screen appears.

Once a job has been programmed, it should be tested by placing the ProfileStar in Auto mode and pressing the *Start* button.

5.1.5 Programming/Editing a Rectangle

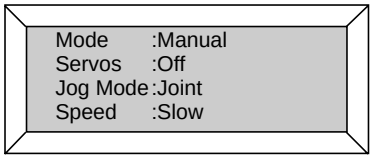
CAUTION!

It is very important to step through all job parameter screens using the F2-Next key until the default user screen appears. Failure to do so will result in loss of all modified data.

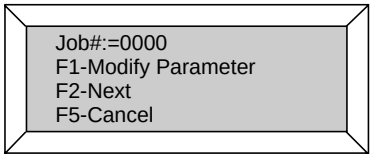
To modify an existing line job, or teach a new one, proceed as follows:

1. Turn power ON. The Power-On screen appears.

2. Press any key. The default user screen appears.

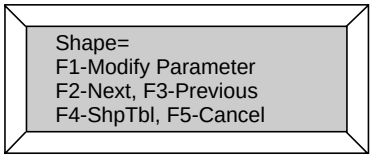


3. Press the Teach key to modify or teach a new job.



4. Press F1-Modify Parameter and enter job number using numeric keypad.
5. Press F2-Next. Shape screen appears.

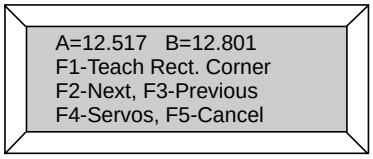
NOTE: When modifying an existing job, skip Step 6. and proceed to Step 7.

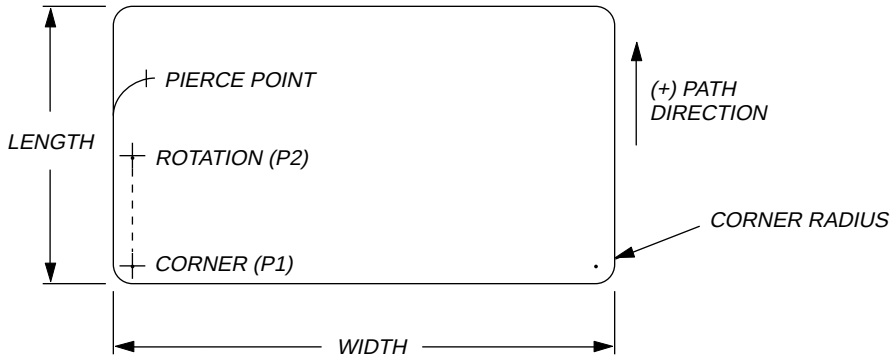


6. Press F1-Modify Parameter and press 1 (circle), 2 (slot), 3 (line), 4 (triangle), or **5 (rectangle)** using numeric keypad. (If necessary, press F4-ShpTbl to view Shape Table.)
7. Press F2-Next to begin creating or modifying selected shape.

NOTE: When editing, the operator may jog the ProfileStar to a previously taught point by pressing and holding the Start button when the Teach Point screen is displayed.

8. Jog tool to rectangle corner (P1).

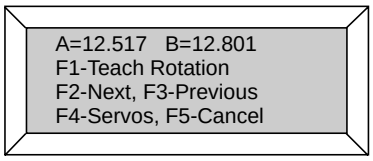




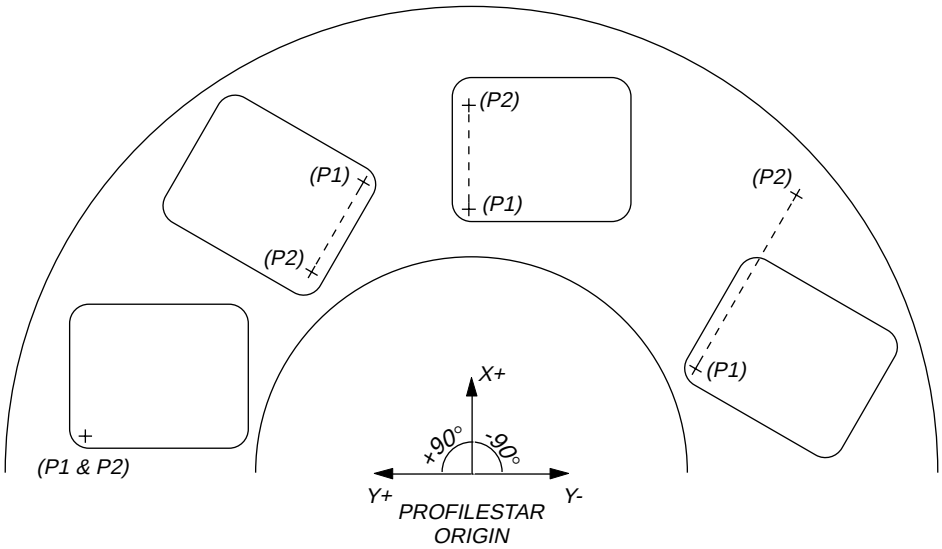
9. Press F1-Teach Rect. Corner to update A1- and B1- axis data.

NOTE: The A1- and B1- axis data does not update automatically. To update the A1- and B1- axis data, press the F1 function key. Use the F1 key in conjunction with the coordinate keys to jog the tool to an exact numeric value.

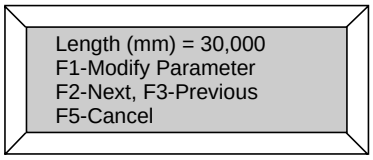
10. Press F2-Next to save data and move to next screen. Rectangle rotation screen appears.



11. Jog tool to rotation point (P2) to rotate rectangle about corner (P1).

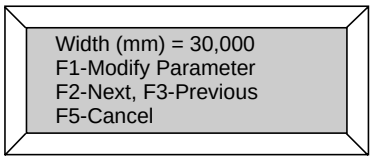


12. Press F1-Teach Rotation to update A1- and B1- axis data.
13. Press F2-Next to save data and move to next screen. Length screen appears.

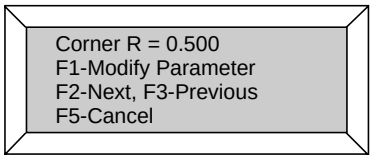


14. Press F1-Modify Parameter and enter desired length using numeric keypad.

15. Press F2-Next. Width screen appears.



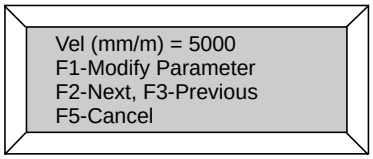
16. Press F1-Modify Parameter and enter desired width using numeric keypad.
17. Press F2-Next. Corner radius screen appears.



18. Press F1-Modify Parameter and enter desired radius using numeric keypad.

NOTE: 0.1 is the smallest radius allowed.

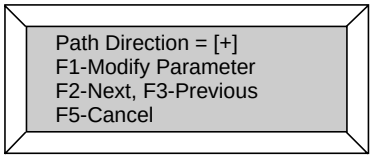
19. Press F2-Next. Velocity screen appears.



20. Press F1-Modify Parameter and enter desired velocity using numeric keypad.

NOTE: Velocity units are in millimeters per minute.

21. Press F2-Next. Path Direction screen appears.



22. Press F1-Modify Parameter and enter desired path direction using **J1–** coordinate key for negative, and **J1+** for positive.

NOTE: Path direction determines the direction, clockwise or counterclockwise, in which the tool will trace the shape; negative - clockwise, positive - counterclockwise.

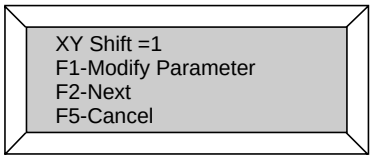
23. Press F2-Next to save data. Job data is saved and default user screen appears.

Once a job has been programmed, it should be tested by placing the ProfileStar in Auto mode and pressing the *Start* button.

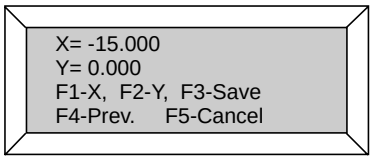
5.2 Offset Function

The Offset function allows the operator to shift any job in the ± X or Y direction. This avoids the reprogramming of similar jobs within the work area and using the robot manipulator to shift the entire ProfileStar work area. To set up an Offset file, proceed as follows:

1. Simultaneously press 2nd and F2 keys.



2. Press F1-Modify Parameter to select desired shift file 1 through 15.
3. Press F2-Next. Axis screen appears.



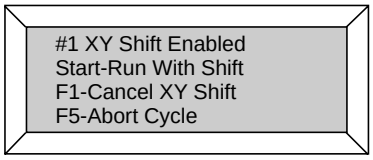
4. Press F1-key to enter shift value in millimeters for the X-axis.
5. Press F2-key to enter shift value in millimeters for the Y-axis.

NOTE: *Use the **J1–** coordinate key to enter negative value for the X- or Y-axes.*

6. Press F3-Save after all modifications have been made to X- or Y-axes shifts.

Running a Job with Offset

When a job is run from the teach pendant with an associated offset file, the following screen appears:



If another Start signal is sent to the ProfileStar, the job is run with the associated offset file. Pressing the F1-Cancel XY Shift key cancels the offset command and the job is run without any offset. Pressing the F5-Abort Cycle key cancels the entire start command and no job is executed. During Auto system run, the host controller must define the shift register.

5.3 Communication with the Robot Controller

The ProfileStar can store up to 98 different jobs. Each of these jobs is called from the robot controller across 8 discrete I/O connections between the robot controller and ProfileStar controller. Tables 5-1 and 5-2 list typical I/O assignments for the ProfileStar. Please refer to the print package provided with your system for more specific information.

Table 5-1 Inputs from Robot Controller

Input	Description
PROGRAM SELECT 1	Job selection in binary, 0 through 100. 1-98 are User-defined Protected Jobs: 0-Home Position 99-Calibration Job 100-Traverse Position (Motoman recommends using the Traverse position when moving from one robot pose to another.)
PROGRAM SELECT 2	
PROGRAM SELECT 4	
PROGRAM SELECT 8	
PROGRAM SELECT 16	
PROGRAM SELECT 32	
PROGRAM SELECT 64	
ROBOT IN TEACH	Robot controller is in Teach mode.
ROBOT IN AUTO	Robot controller is in Auto mode.
ROBOT IN PLAY	Robot controller is in Play mode.
ROBOT SERVO POWER ON	Robot servo power is ON.
CYCLE START (from robot)	Cycle start command from robot controller.
ABORT CYCLE (from robot)	Abort cycle command from robot controller.
X,Y OFFSET 1	Shift selection in binary, 0 through 15. Default=0 (no shift) 1-15= Programmed registers
X,Y OFFSET 2	
X,Y OFFSET 4	
X,Y OFFSET 8	

Table 5-2 Outputs to Robot Controller

Output
PROFILESTAR IN AUTO
PROFILESTAR IN MANUAL
PROFILESTAR IN CYCLE
PROFILESTAR OVERTRAVEL FAULT
PROFILESTAR SERVO FAULT
PROFILESTAR SERVO ON
PROFILESTAR FAULT
PROFILESTAR AT PIERCE POINT
PROFILESTAR AT OVERLAP POINT
PROFILESTAR AT HOME POSITION
PROFILESTAR AT TRAVERSE POSITION

5.4 Sample Robot Jobs

The following jobs **are based on the Motoman XRC robot and controller** and are shown as examples only. Your system may have other features and/or options requiring program changes. Double-check your system before running these jobs. Lines in the Explanation column are comments added for clarification only and do not appear in the actual program listing.

5.4.1 Subroutine

The Subroutine is used to call ProfileStar shape jobs from the robot controller. This job coordinates the cutting process with both manipulator and ProfileStar.

Table 5-3 ProfileStar Subroutine

Line	Step	Instruction	Explanation
000		NOP	
001		B001 = 1	
002		DOUT OG#(2) B001	
003		*REPEAT	
004		DOUT OT#(21) ON	Turn Cycle Start ON, ProfileStar uses rising edge (Transition).
005		WAIT IN#(3)=ON	Wait for ProfileStar in cycle.
006		DOUT OT#(21) OFF	Turn Cycle Start OFF.
007		WAIT IN#(8)=OFF T=0.10	If already at pierce point, Time 0.1 sec. before issuing Cycle Start.
008		WAIT IN#(8)=ON	Wait for ProfileStar at pierce pt.
009		CALL LASER ON	Turn on cutting device (Laser, Plasma).
010		DOUT OT#(21) ON	Turn Cycle Start ON. This Cycle Start initiates cycle to cut shape.
011		TIMER T=0.10	Timer is “timing” while ProfileStar is cutting shape. No additional time is accumulated in overall cycle time.
012		INC B001	Increment counter.
013		DOUT OG#(2) B001	Output counter for next program to run. ProfileStar processes program select at initial Cycle Start.
014		DOUT OT#(21) OFF	Turn Cycle Start OFF.
015		WAIT IN#(9)=ON	Wait for ProfileStar to arrive at overlap point (end of cycle).
016		CALL LASER OFF	Turn off cutting device.
015		JUMP *REPEAT IF B001<=5	Jump to *REPEAT if B001 is less than or equal to 5.
016		END	

5.4.2 Home Job

The Home job places the ProfileStar in the Home Position with the Rotary and Linear axes at 0.

Table 5-4 Home Job

Line	Step	Instruction	Explanation
000		NOP	
001		JUMP *HOME IF IN#(4)=ON	Check for ProfileStar at Home position.
002		B001 = 0	
003		DOUT OG#(2) B001	Program Select 0 for Home job. ProfileStar processes program select at initial cycle start.
004		TIMER T=0.10	Dwell before cycle start.
005		DOUT OT#(21) ON	Cycle Start. ProfileStar uses rising edge (Transition).
006		WAIT IN#(3)=ON	Wait for ProfileStar in cycle.
007		DOUT OT#(21) ON	Turn Cycle Start OFF.
008		WAIT IN#(4)=ON	Wait for ProfileStar at Home Position.
009		*HOME	
010		END	

5.4.3 Traverse Position Job

The Traverse Position job places the ProfileStar in the Traverse Position with the Rotary (A1) at 0 and the Linear Axis (B1) at 50.

Table 5-5 Traverse Position Job

Line	Step	Instruction	Explanation
000		NOP	
001		JUMP *TRAVERSE IF IN#(5)=ON	Check for ProfileStar at Traverse position.
002		B001 = 100	
003		DOUT OG#(2) B001	Program Select 100 for Traverse Position job. ProfileStar processes program select at initial cycle start.
004		TIMER T=0.10	Dwell before cycle start.
005		DOUT OT#(21) ON	Cycle Start. ProfileStar uses rising edge (Transition).
006		WAIT IN#(3)=ON	Wait for ProfileStar in cycle.
007		DOUT OT#(21) ON	Turn Cycle Start OFF.
008		WAIT IN#(4)=ON	Wait for ProfileStar at Traverse Position.

Table 5-5 Traverse Position Job - continued

Line	Step	Instruction	Explanation
009		*TRAVERSE	
010		END	

5.4.4 ProfileStar Ready Job

The ProfileStar Ready job verifies that the ProfileStar is ready (i.e. no fault alarms, servo power on, and system in auto mode).

Table 5-6 ProfileStar Ready Job

Line	Step	Instruction	Explanation
000		NOP	
005		WAIT IN#(6)=OFF	Wait for ProfileStar No Faults.
006		WAIT IN#(7)=ON	Wait for ProfileStar Servos ON
007		WAIT IN#(8)=ON	Wait for ProfileStar in Auto mode.
009		END	

NOTES

APPENDIX A
ALIGNMENT AND CALIBRATION

This section provides calibration procedures for the ProfileStar. To calibrate the ProfileStar, proceed as follows:

A.1 Alignment

The ProfileStar uses a 3.6V DC lithium battery to save position data in case of power interruptions during normal operation. During shipment however, there is no backup power supplied to the ProfileStar. It is therefore necessary to realign the ProfileStar to the Calibration Home position and reset the absolute encoders upon delivery or when the absolute encoder has been left disconnected from a battery for more than two days. To reset the absolute encoders, proceed as follows:

A.1.1 Resetting the Encoders

1. Turn ON power to ProfileStar.
2. Remove all E-Stop conditions and wait at least fifteen minutes to sufficiently charge backup capacitor.
3. Turn OFF power to ProfileStar.
4. Disconnect encoder cables (#142623) at each ProfileStar motor.
5. Using a small wire, short pins R and S for 15 seconds (see Figure A-1).

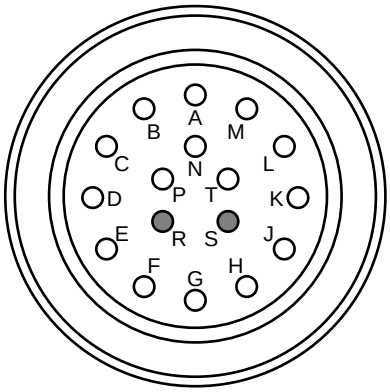


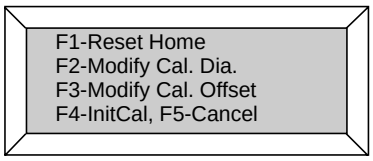
Figure A-1 Encoder Cable

6. Reconnect encoder cables to ProfileStar motors.
7. Turn power ON.

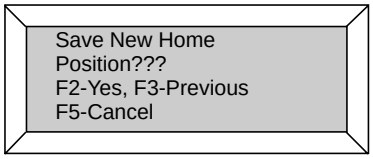
A.1.2 Coarse Calibration

To avoid softlimit errors during calibration, it is recommended that a coarse calibration be performed. To perform a coarse calibration, proceed as follows:

1. Place robot controller in Teach mode and the ProfileStar in Manual.
2. Simultaneously press 2nd and F1 keys. Calibration screen appears:



3. Press F1-Reset Home.



4. Manually jog both the linear and rotary axes into rough alignment.
5. Press F2-Yes to save new Calibration Home position.

A.1.3 Rotary Axis Alignment

1. Locate calibration tool (PN 143276).
2. Jog A1-axis (+J1 key) until calibration tool can be installed
3. Insert calibration tool into aligning holes in T-axis mounting bracket and attach using M6 bolt provided.

CAUTION!

Take care not to drive the calibration tool into the adapter plate as damage to the tool and/or device may occur.

4. With ProfileStar speed set to INCREMENTAL, jog A1-axis (-J1 key) until calibration tool just touches adapter plate (see Figure A-2).

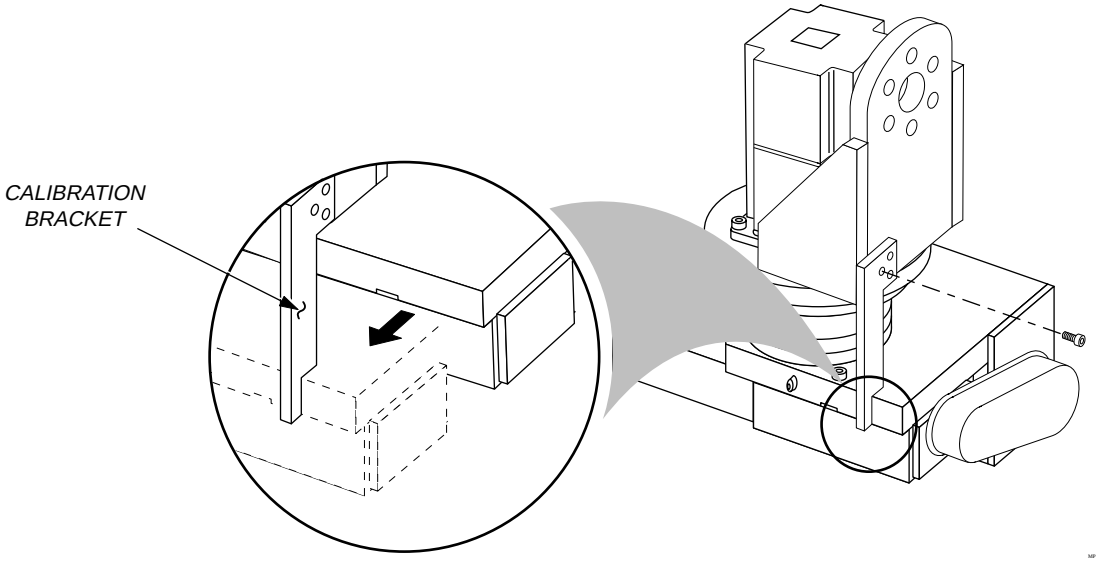


Figure A-2 Rotary Alignment

A.1.4 Linear Axis Alignment

1. Remove linear axis cover by removing four M4 bolts.
2. Set ProfileStar speed at INCREMENTAL.
3. Locate 0.500 inch gauge block (customer-supplied).
4. Place gauge block into base alignment channel on side of ProfileStar.
5. Jog B1-axis until gauge block slips into alignment channel (see Figure A-3).

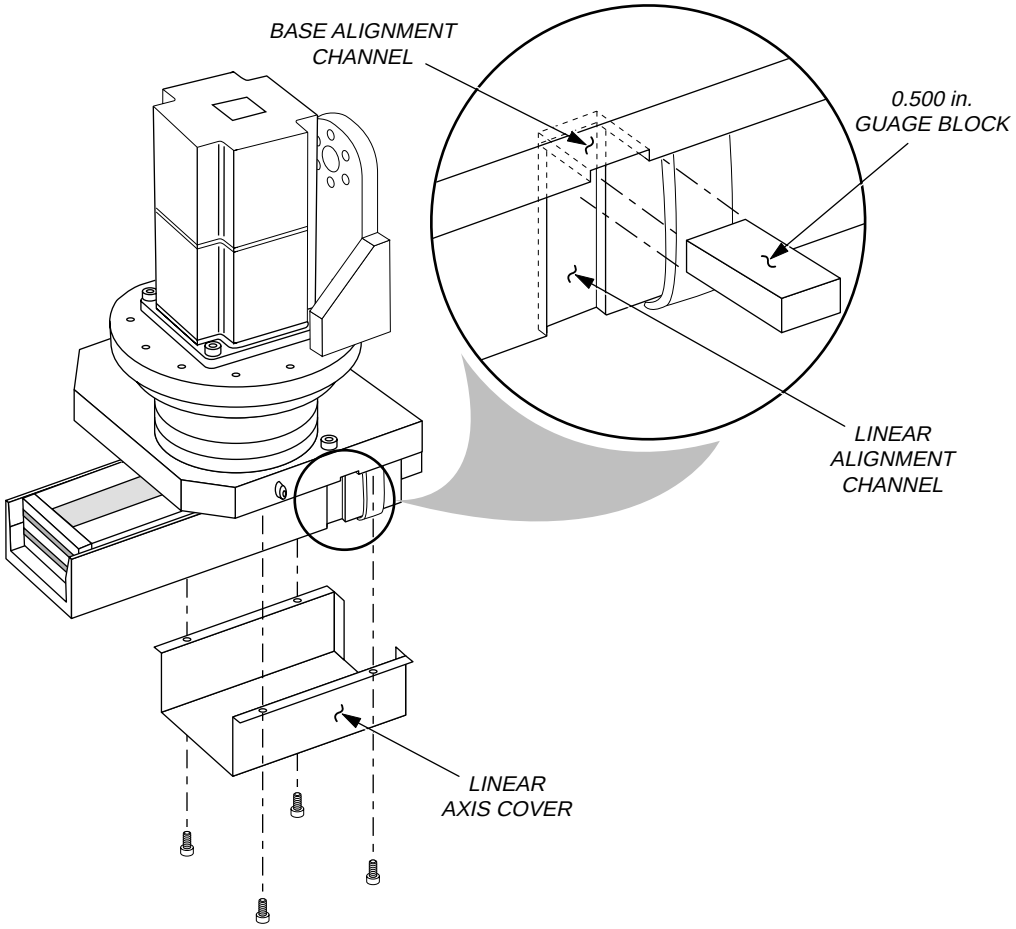
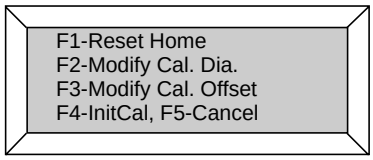


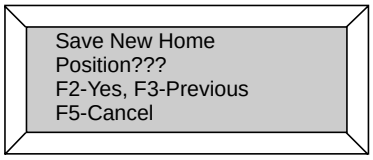
Figure A-3 Linear Alignment

A.1.5 Home Calibration

1. Simultaneously press 2nd and F1 keys. Calibration screen appears:



2. Press F1-Reset Home.



3. Press F2-Yes to save new Calibration Home position.

4. Remove gauge block from linear alignment channel.
5. Carefully jog A1-axis in positive direction (+J1 key) until calibration tool is clear of adapter plate.
6. Loosen M6 bolt and remove calibration tool.
7. Reinstall linear axis cover using four M4 bolts.

A.2 Calibration

The ProfileStar is a precision servo mechanism. However, due to manufacturing tolerances, calibration of the ProfileStar is necessary to ensure cutting accuracy. The A1-axis provides ± 90° rotary motion about the central axis, while the B1-axis provides 100 mm (3.94 in.) radial motion for the tool. The Calibration Home places the ProfileStar in the zero position, Ri on the X-axis and 0 on the Y-axis (A1=0°, B1=0mm). An Offset value is then calculated to compensate for manufacturing tolerances (see Figure A-4).

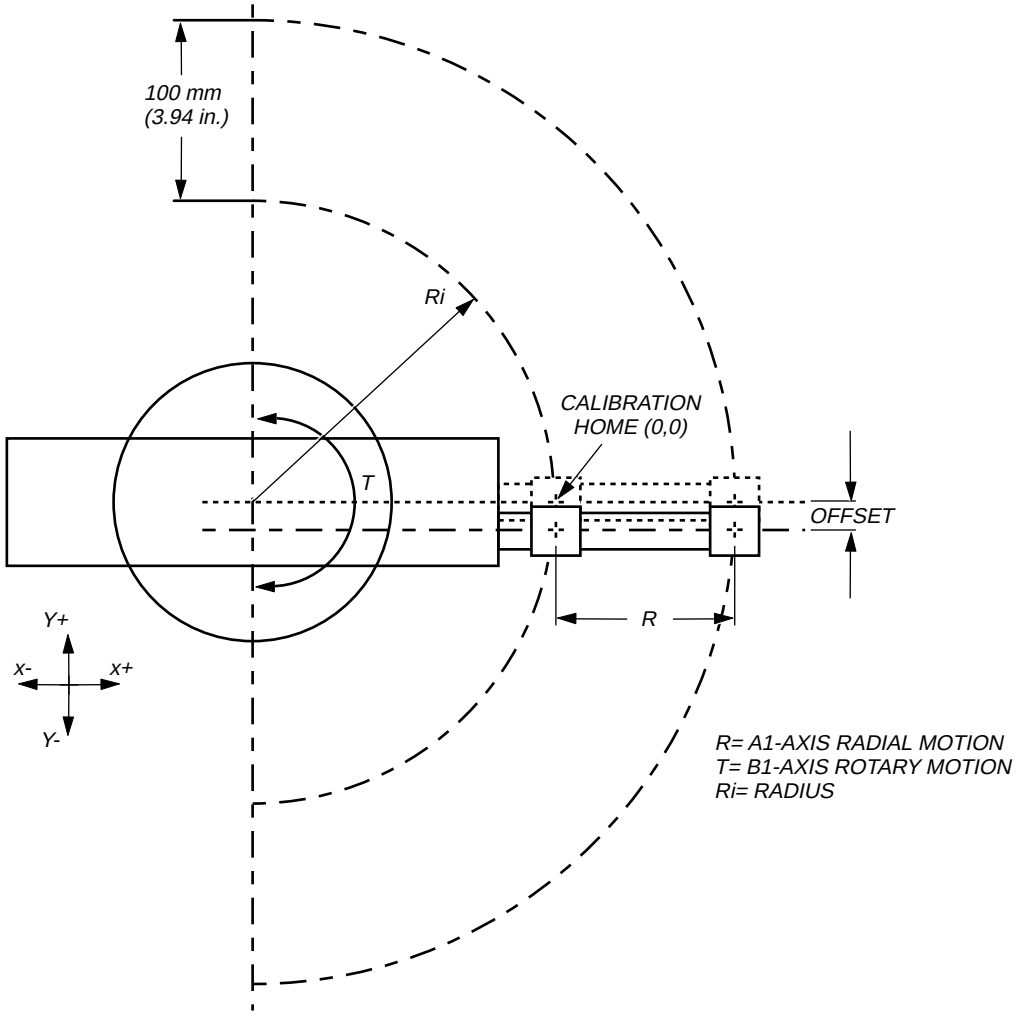
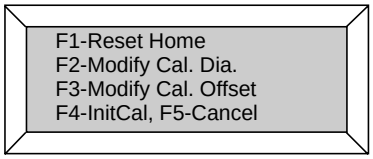


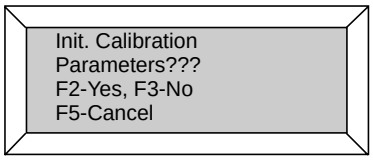
Figure A-4 ProfileStar Calibration Concepts

Calibration Cut Job #99 is provided with your system to determine the Offset value for your system. After the pattern is cut, measurements are made and an offset value determined. To calibrate the ProfileStar, proceed as follows:

1. Verify all Process Control parameters are functional. System should be fully operational, including cutting equipment.
2. Place robot controller in Teach mode.
3. Initialize Calibration Parameters.
   a) Press Manual key on programming pendant.
   b) Simultaneously press 2nd and F1 keys. Calibration screen appears:



   c) Press F4-InitCal to initialize all calibration data. Initialization screen appears:



   d) Press F2-Yes to initialize calibration parameters.
   e) Press F3-No to return to the Calibration screen.
   f) Press F5-Cancel to return to main menu.
4. Teach a Sample Circle job (between 20 and 80 mm diameter).
5. Develop process parameters to achieve suitable cutting results.

CAUTION!

Process control parameters should be fully functional and cutting results acceptable before executing the Calibration job. Poor calibration cut samples may result in inaccurate measurements and poor calibration of the ProfileStar.

6. Execute Calibration job (#99) from robot controller, using calibration cut samples provided.
7. Measure calibration diameter and offset using a Coordinate Measurement Machine (CMM) on calibration cut sample (see Figures 6-2 and 6-3).

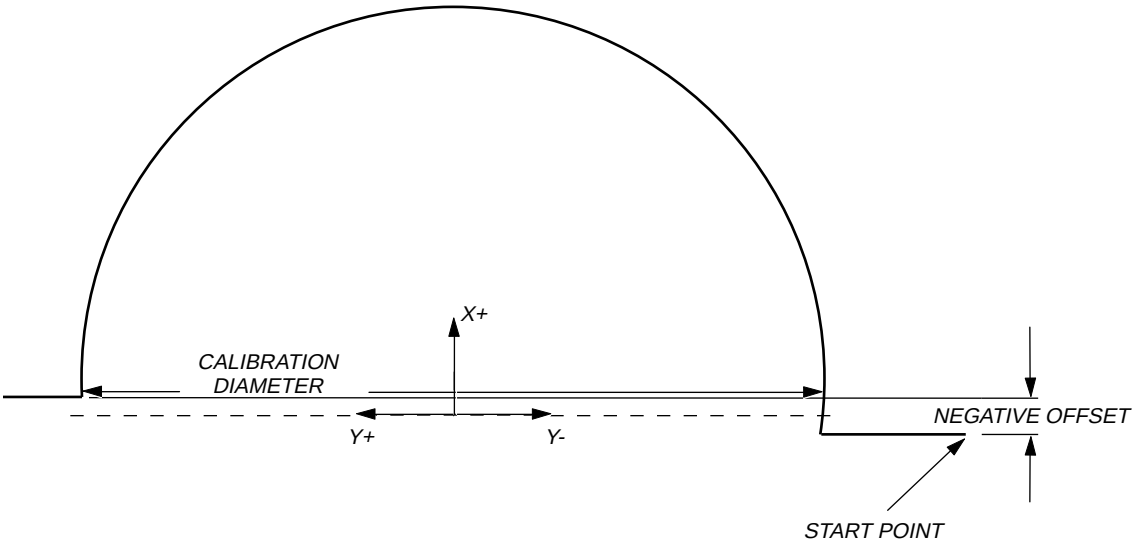


Figure A-5 Negative Calibration Offset

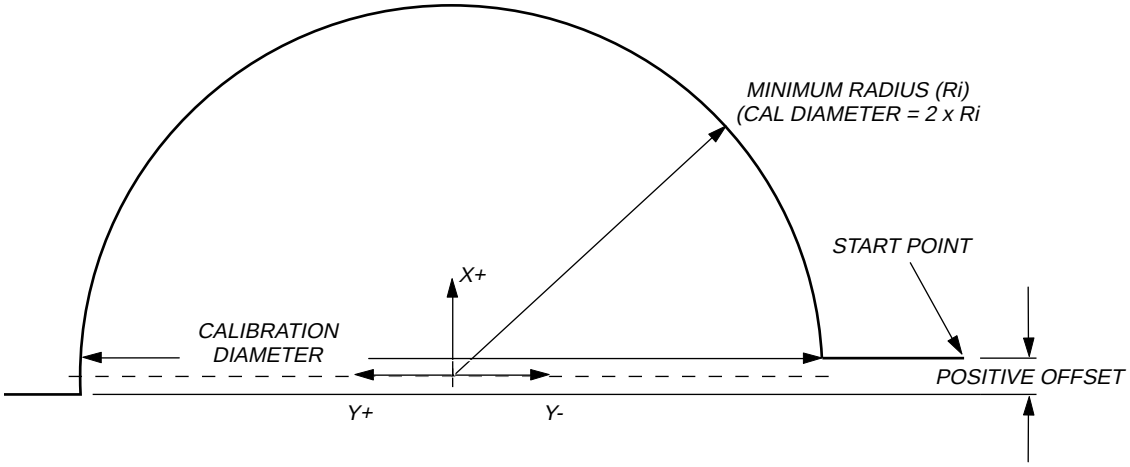
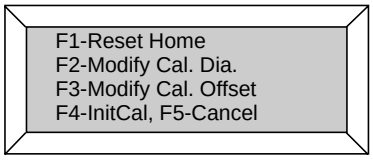
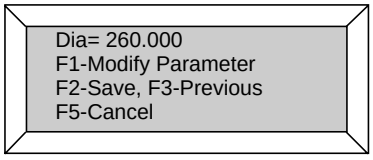


Figure A-6 Positive Calibration Offset

8. Enter diameter and offset (note sign of offset) using programming pendant.
   a) Press 2nd and F1 keys simultaneously. Calibration screen appears.



   b) Press F2 -Modify Cal. Dia. Diameter screen appears:



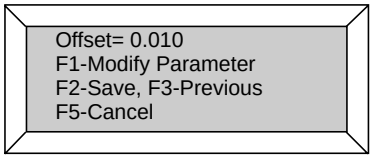
c) Press F1-Modify Parameter and enter calibration diameter measurement using numeric keypad.

NOTE: Use the STOP key to enter decimal points.

d) Press F2-Save.

e) Press F3-Previous to return to the Calibration screen.

f) Press F3 - Modify Cal. Offset. Offset screen appears:



g) Press F1-Modify Parameter and enter offset measurement.

NOTE: Use the -J key to enter a negative sign for negative offset numbers.

h) Press F2-Save.

i) Press F3-Previous to return to the Calibration screen.

j) Press F-5 Cancel to return to main menu.

9. Execute Calibration job again as a check.
10. Remeasure diameter and offset using CMM. New offset should be less than ±0.1 mm.

NOTES

APPENDIX B
TROUBLESHOOTING

This section provides troubleshooting for the ProfileStar.

B.1 Alarms and Errors

Table B-1 Alarms and Errors

Alarm	Explanation
*** SERVO ALARM*** F1-RESET ALARM F4-To Continue	Press *F1-RESET ALARM* to reset system or press *F4-To Continue* without resetting the alarm.
JOB# OUT OF RANGE Job Range from 1-98 F1-To Continue	Invalid job number selected. Press *F1-Continue* and enter a valid job number between 1 and 98.
SHAPE NOT DEFINED F1-To Continue	The number you have selected is not a valid, defined shape. Press *F1-To Continue*. Press *F4-ShpTbl* to view a list of defined shapes.
RADIUS OUT OF RANGE Radius Range From: 0.1 to 50.0 F1-To Continue	You have entered an invalid number for the radius. Press *F1-Continue* and enter a valid number between 0.1 and 50.0.
VELOCITY OUT OF RANGE F1-To Continue	You have entered an invalid number for the velocity. Press *F1-Continue* and enter a valid number.
[A1] -OVERTRAVEL JOG [A1]+ F1-To Continue	You have jogged the A1-Axis into a negative overtravel position. Press the J1+ key to jog the ProfileStar clear.
[A1] +OVERTRAVEL JOG [A1]- F1-To Continue	You have jogged the A1-Axis into a positive overtravel position. Press the J1- key to jog the ProfileStar clear.
[B1] -OVERTRAVEL JOG [B1]+ F1-To Continue	You have jogged the B1-Axis into a negative overtravel position. Press the J1+ key to jog the ProfileStar clear.
[B1] +OVERTRAVEL JOG [B1]- F1-To Continue	You have jogged the B1-Axis into a positive overtravel position. Press the J1- key to jog the ProfileStar clear.

Table B-1 Alarms and Errors

Alarm	Explanation
XY SHIFT OUT OF RANGE Range: 1 to 15 F1-To Continue	Invalid XY Shift number selected. Press *F1-Continue* and enter a valid job number between 1 and 15.
X SHIFT VALUE OUT OF RANGE Range: -1000/+1000 F1-To Continue	You have entered an invalid number for the X-axis shift value. Press *F1-Continue* and enter a valid number between -1000 and +1000.
Y SHIFT VALUE OUT OF RANGE Range: -1000/+1000 F1-To Continue	You have entered an invalid number for the Y-axis shift value. Press *F1-Continue* and enter a valid number between -1000 and +1000.

B.2 Calibration Errors

Incorrect Calibration of the ProfileStar can cause warped or deformed shapes. Often the type of deformation can help determine where the error lies.

B.2.1 Diameter Errors

Incorrect Calibration Diameter values can cause errors in A1 axis positions. Note that the trace corrects as it approaches the B1 principle axis (90° & 270°). Recalibrate the ProfileStar taking particular care when measuring the calibration diameter. Refer to Appendix A for calibration procedures.

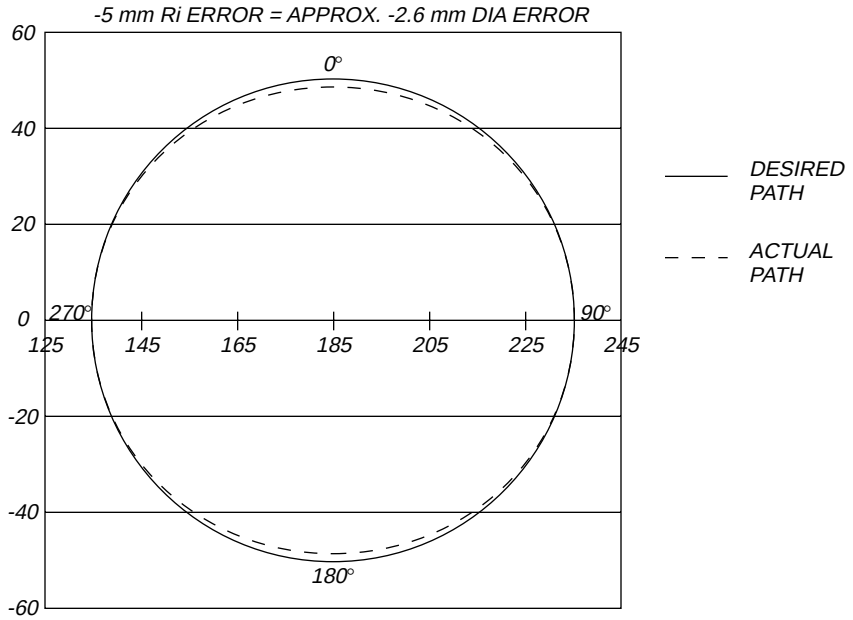


Figure B-1 Diameter Error

B.2.2 Offset Errors

Incorrect Offset values can cause a deflection in the arc of each quadrant. Note that the trace corrects as it approaches the 0°, 90°, 180°, and 270° points. Recalibrate the ProfileStar taking particular care when measuring the calibration offset and entering the sign (+/–) of the offset. Refer to Appendix A for calibration procedures.

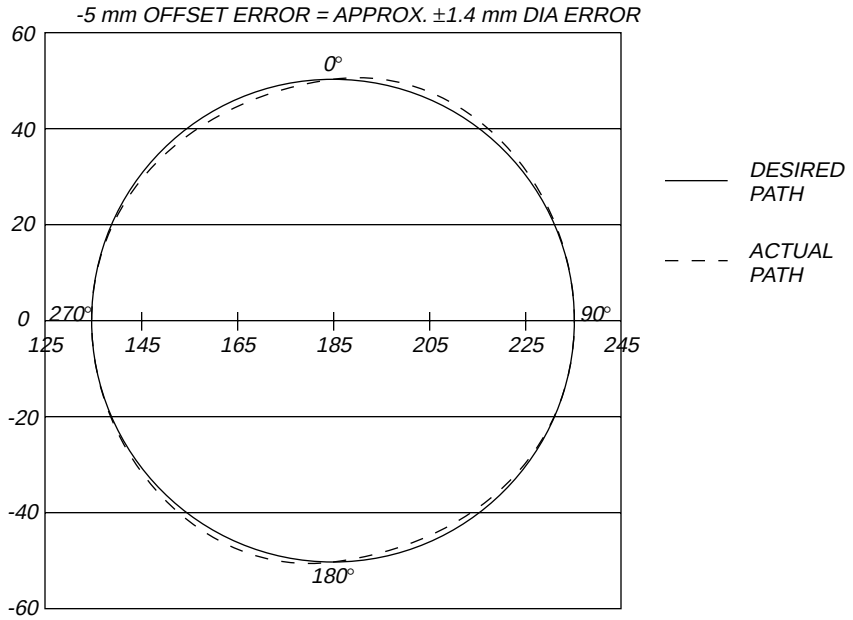


Figure B-2 Offset Error

NOTES

APPENDIX C
SYSTEM DRAWINGS

This section contains the following system drawings:

Drawing Number	Title	Sheet Number
142329	Controller, ProfileStar	1
142329	Power Distribution	3
142329	Controller Elementary	4
142329	MP930 MC Unit I/O	5
142329	I/O Unit IN1 Connector	6
142329	I/O Unit OUT1 Connector	7
142329	I/O Unit IN2 Connector	8
142329	I/O Unit OUT2 Connector	9
142898	Carrier Assembly, Laser, Profiler	1
142978	System, Profiler, 100 mm	1

NOTES

APPENDIX D
BACKUP AND RESTORE USING MOTION WORKS

This section provides procedures backup and restore ProfileStar files using Motion Works software. For more specific information about the Motion Works software package, please refer to the Yaskawa software manual (YEA-SIA-C887-1.4).

D.1 Setup

1. Locate 9-pin communication cable.
2. Connect one end to COM1 port of the computer.
3. Connect other end to Port1 of MP930 unit.
4. Turn on the computer and ProfileStar controller.
5. Start Motion Works software.

The Motion Works software must be set to Standard mode before backup or restoration can be performed.

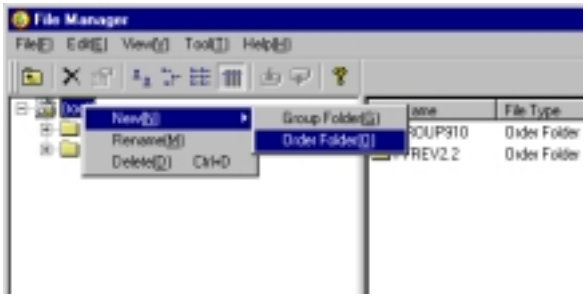
1. Select View → Change Program Mode(P).The Set Mode window appears.

2. Select Standard mode. Click OK.

D.2 ProfileStar Job Backup

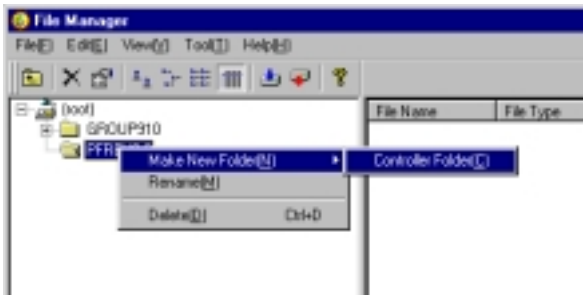
The ProfileStar should be backed up after job editing, and before and after any software upgrades are performed. With the computer and ProfileStar controller power on:

1. Double click on Motion Works desktop icon.
2. From File Manager window, create a new folder to work in.
3. Right click: (root) → New(N) → Order Folder(O).

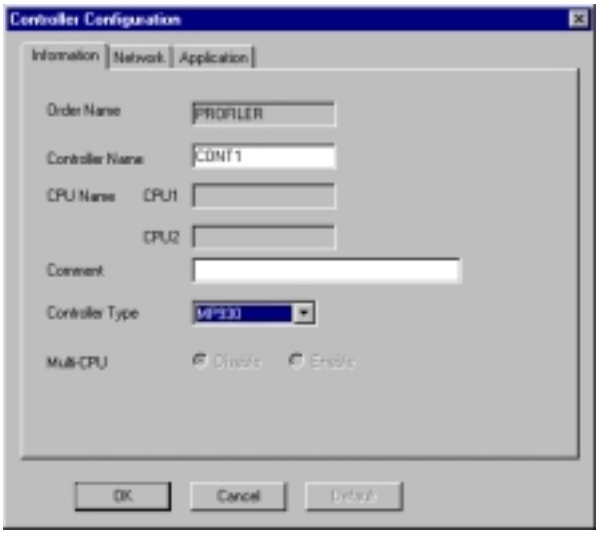


4. Make New Folder window appears.

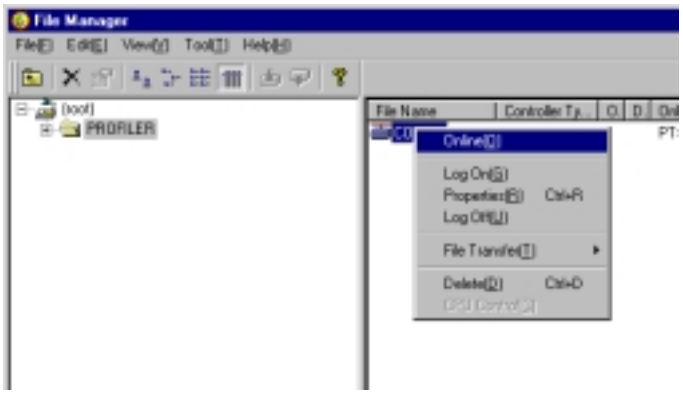
5. Enter name of folder (e.g. Profiler). Click OK.
6. Create new controller folder. Right click: Profiler → Make New Folder(N) → Controller Folder(C).



7. Controller Configuration window appears.



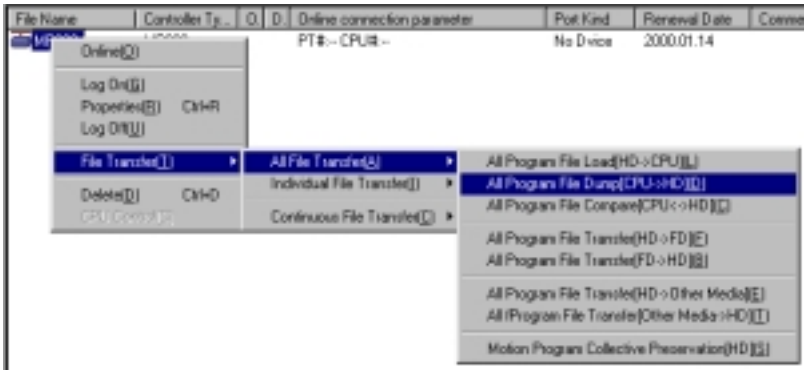
8. Name controller and select controller type MP930. Click OK.
9. Right click: controller → Online(O).



10. File Manager window “The data is changed. OK?” → Yes.

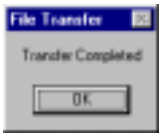
11. Right click: controller → Log on. CPU Log On screen appears.

12. Enter username and password. (User Name: user, Password: 0000) → OK. PC is now connected to controller.
13. Right click: controller → File Transfer(T) → All File Transfer(l) → All Program File Dump[CPU -> HD](D)

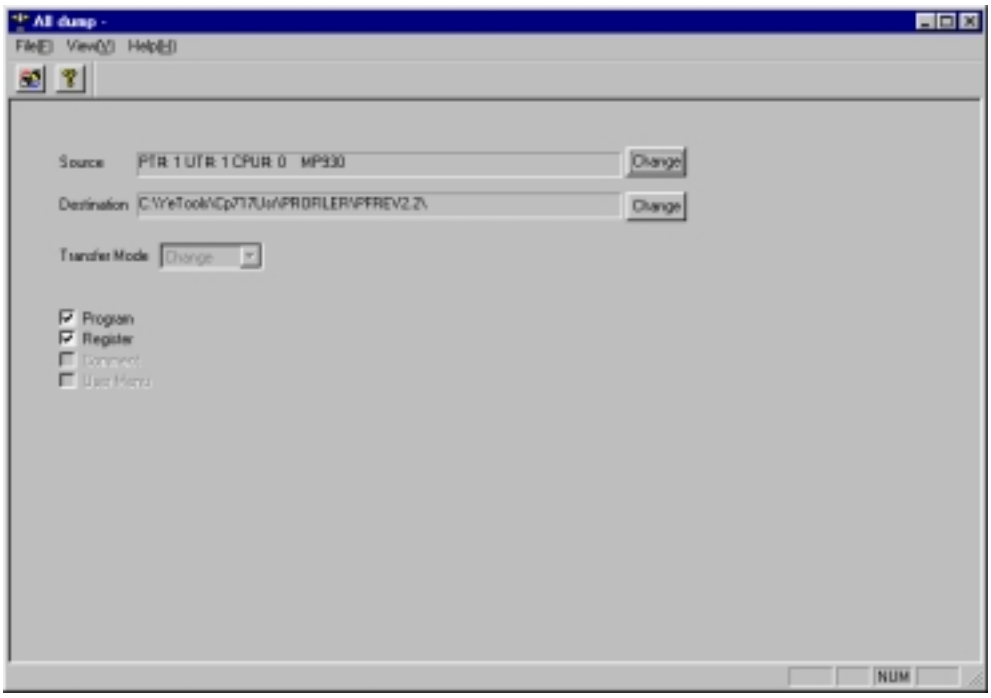


14. Execute window appears. Click OK.

15. File transfer complete window appears. Click OK.



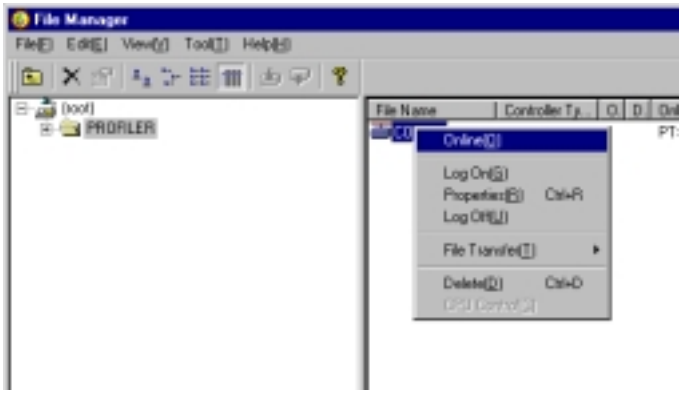
16. Close All Dump window.



D.3 ProfileStar Restore

The ProfileStar files may need to be restored after a hardware or battery failure. To restore the ProfileStar files, proceed as follows:

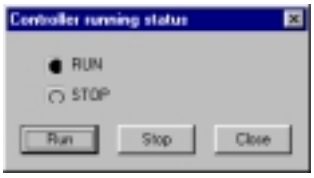
1. Expand Profiler folder.
2. Right click: controller → Online(O).



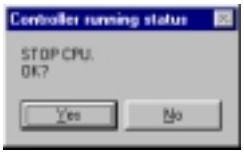
3. Right click: controller → Log on. CPU Log On screen appears.

4. Enter username and password. (User Name: user, Password: 0000) → OK.

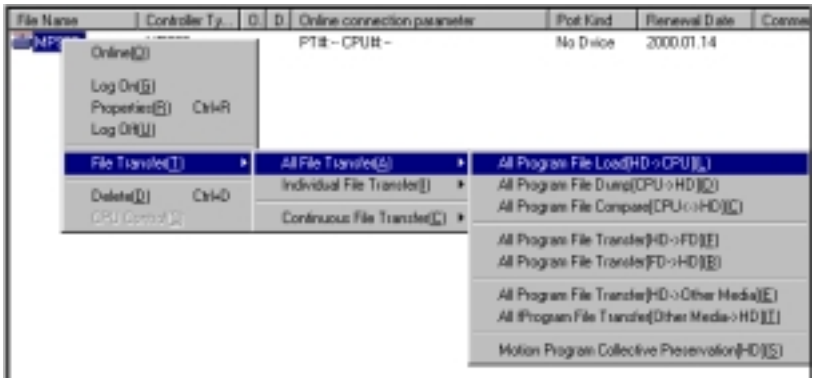
5. Right click: controller → CPU control. The controller running status window appears



6. Select stop.
7. Controller running status window “Stop CPU OK?” appears. Click Yes.



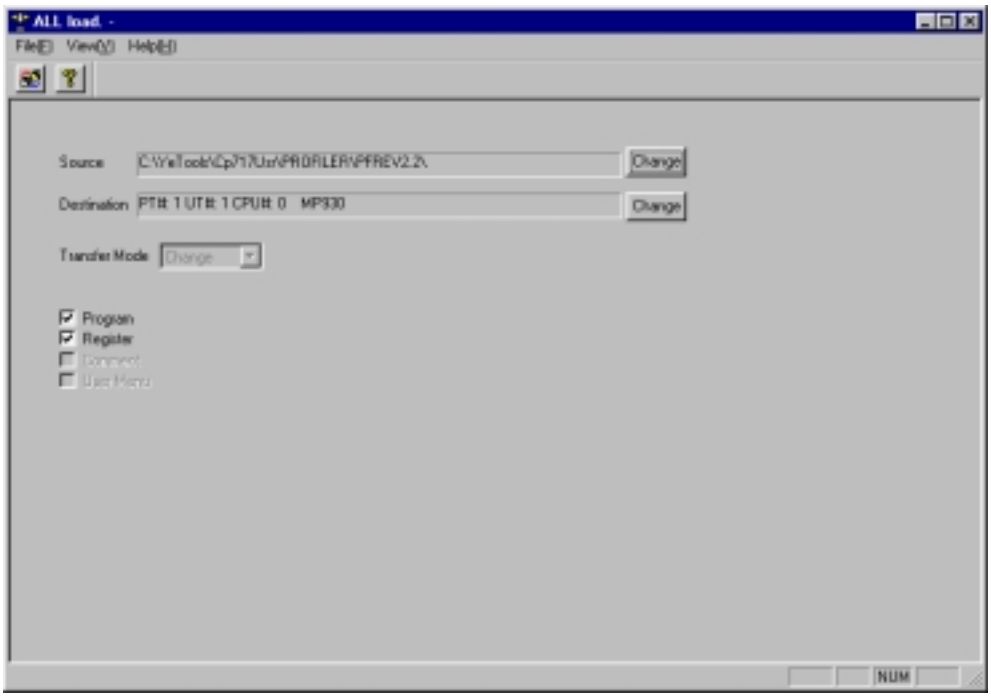
8. Close window.
9. Right click: controller → File transfer → All file transfer → All program file load [HD -> CPU].



10. Execute status window appears.

11. Transfer complete window appears. Click OK.

12. Close All Load window.



13. Cycle power on controller.

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