Motoman NXC100 Controller

RoboBar
User’s Manual

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Chapter 1

Introduction

RoboBar features an HPJ3 dual-arm robot with a compact NXC100 controller housed in the base of the robot. The two manipulators arms each have five axes of motion, and the base also rotates to provide an 11th axis of motion. The end-of-arm tooling consists of simple parallel grippers. The robot is capable of vending draft beer, mixed drinks, and soft drinks (soda and juices). After a valid card swipe, the customer uses a touch screen to choose a beverage. The robot then selects a cup, and fills it with the appropriate beverage(s) and ice, if desired. The robot then passes the drink to the customer via an automatic turntable located at the side of the unit.

1.1 About This Document

This manual provides a basic overview for the RoboBar drink dispensing system. You should read and understand this manual before moving on to more detailed documentation included with your system. For detailed information on specific components or peripherals included with your system, please refer to the specific documentation as listed in Section 1.4.

This manual contains the following chapters:

CHAPTER 1 - INTRODUCTION
This chapter provides general information about the structure of this manual, a list of reference documents, and customer service information.

CHAPTER 2 - SAFETY
This chapter provides information regarding the safe use and operation of Motoman products.

CHAPTER 3 - EQUIPMENT DESCRIPTION
This chapter provides detailed descriptions of the major components of the RoboBar system.

CHAPTER 4 - INSTALLATION
This chapter provides detailed information for installing the RoboBar system.

CHAPTER 5 - OPERATION
This chapter provides instructions for basic operation of the RoboBar system. This section also provides procedures for start-up, normal operation, fault recovery, and shutdown.

CHAPTER 6 - TROUBLESHOOTING/MAINTENANCE
This chapter contains periodic maintenance requirements and troubleshooting for the RoboBar cell.
1.2 Overview

The Motoman RoboBar system provides a highly reliable drink dispensing solution in a standard configuration. The system is designed around a Motoman DA9IC robot and NXC100 controller. RoboBar performs much like a traditional bartender. The robot handles cups with one hand and liquor bottles with the other. Tiered racks hold nine different liquor bottles/brands (18 bottles; two of each brand).

The RoboBar system features a total safety environment that meets or exceeds the requirements of the ANSI/RIA R15.06-1999 standard, and is designed to safeguard both personnel and equipment.

Figure 1 illustrates the layout and component location for a typical RoboBar system. Your system may vary depending on options selected.

![Figure 1 RoboBar System](image)

Note: This manual covers a typical RoboBar system. Because Robobar is highly customizable, please refer to the drawings and Bill of Material (BOM) provided with your system documentation package for troubleshooting and parts provisioning.
1.3 System Components

All RoboBar system components are mounted on a common base for ease of installation. Safety fencing completely surrounds the cell. One safety-interlocked access door at the rear of the work cell provides access to the cell for programming and maintenance. Four smaller doors located on each side of the cell provide access to syrup boxes, liquor bottles, cups and other consumables.

1.3.1 Major Components

The RoboBar system includes the following major components:

- Tiered racks for holding liquor bottles
- One mix tower for dispensing juices and soft drinks
  - 8 flavors (4 carbonated and 4 non-carbonated)
  - water and carbonated water
- One beer tower for dispensing draft beers
- One ice dispenser
- One delivery turntable for individual drink delivery
- Three cup dispensers (2 plastic, 1 paper)
- One touch screen order entry system for drink selection
- Safety equipment
  - Safety fencing
  - One dual channel, interlocked cell entry door
  - Three dual channel, interlocked consumables access doors (left, right, and front)

1.3.2 Optional Components

- Coffee maker
- Wine tower
- Sound system
- Lighting system
- AI Personality

1.4 System Requirements

The RoboBar system requires the following utilities:

- Water supply (potable)
- Adequate drainage (for ice melt, drips spills, etc.)
- 220 V, split phase, AC power.
- CO2 (for soft drinks, and/or draft beer)
- Nitrogen (for draft beer)
1.5 Reference to Other Documentation

For additional information refer to the following:

- NXC100 Controller Manual (P/N 1xxxxx-1)
- Motoman DA9IC Manipulator Manual for your robot
- Concurrent I/O Manual (P/N 149230-1)
- Vendor manuals for system components not manufactured by Motoman

1.6 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:

- System (RoboBar)
- Software version
- Robot Serial Number
- Robot Sales Number
- Warranty ID Code
- Description of difficulty (make note of any error messages received from robot or touchscreen software)
Chapter 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 R15.06-1999. The address is as follows:

RoboticIndustriesAssociation
900VictorsWay
P.O.Box3724
AnnArbor,Michigan48106
TEL:(734)994-6088
FAX:(734)994-3338
INTERNET:www.roboticsonline.com

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, Operation, and Maintenance Safety (Section 2.6)

2.2 Standard Conventions

This manual includes the following alerts – in descending order of severity – that are essential to the safety of personnel and equipment. As you read this manual, pay close attention to these alerts to insure safety when installing, operating, programming, and maintaining this equipment.

**DANGER!**
Information appearing in a DANGER 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 in a WARNING 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 in a CAUTION 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 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 R15.06-1999, section 4.2.5, Sources of Energy, 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 R15.06-1999 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 equipment is provided as standard:

- Safety fences and barriers
- Light curtains and/or safety mats
- Door interlocks
- Emergency stop palm buttons located on operator station, robot controller, and programming pendant

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 R15.06-1999 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, Operation, and 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. 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 program, operate, and maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- 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 all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.
- Check the E-STOP button on the programming pendant for proper operation before programming. The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before 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.
• Any modifications to PART 1, System Section, of the robot controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. 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.

• The robot controller allows modifications of PART 2, User Section, of the concurrent I/O program and modifications to controller parameters for maximum robot performance. Great care must be taken when making these modifications. 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 and other parts of the system. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations.

• Check and test any new or modified program at low speed for at least one full cycle.

• This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

• Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.

• Use proper replacement parts.

• 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).
NOTES
Chapter 3

Equipment Description

3.1 DA9IC Robot

The Motoman 12-axis DA9IC robot is a dual-arm robot with controller. Coordinated and independent operation of the two arms provides highly accurate handling. The robot features a payload capacity of 9 kg (19.8 lbs) per arm, and a horizontal reach of 756 mm (29.8 inches). An integrated, built-in controller in the robot base reduces installation space and provides simplified installation.

Figure 2 DA9IC Robot with NXC100 Controller
3.1.1 **Personality Screen and Speakers**

The personality option is designed to enable you to customize your system to its application by either giving Robobar a face and voice or displaying other information. A rugged 10.4” VGA (800x600) color TFT display panel is mounted on the top of the robot. Built specifically for industrial applications, it displays brilliant, crisp and flicker-free images. The chassis is constructed with an aluminum front panel and stainless steel chassis. The audio system features two AN-1000X powered monitors mounted on the top of the cell enclosure. Shielded-magnet speakers prevent interference on video screens.

3.2 **NXC100 Controller**

The integrated, built-in NXC100 robot controller features a Windows CE programming pendant with color touch screen, high-speed processing, built-in Ethernet, and a robust PC architecture. The NXC100 easily handles multiple tasks and can control up to 15 axes. Advanced Robot Motion (ARM) control provides high-performance path accuracy and vibration control.

The NXC100 controls manipulator movement, processes input and output signals. It maintains variable data and performs numeric processing to convert to and from different coordinate systems. In addition, the controller provides main logic functions, servo control, program and constant data memory, cell safety, and power distribution. For more information, refer to the NXC100 controller manual that came with your system.

3.3 **Programming Pendant**

The programming pendant (see Figure 3) is the primary user interface for robot programming and features a cross-shaped navigation cursor that reduces teaching time by 30 percent. The pendant has a 6.5-inch full color touch screen display (640 x 480 VGA) and provides a convenient Compact Flash card slot for easy memory back-ups. The system uses the INFORM robot language and a menu-driven interface to simplify operator interaction with the robot.

By using the pendant, the operator can teach robot motion, and perform programming, editing, maintenance, and diagnostic functions. For detailed information on the programming pendant functions and displays, refer to the operator’s manual included with your system documentation.

*Note: The programming pendant display features a screen saver mode that causes the screen to go dark after a few minutes of inactivity. Press any key to restore screen.*
Mode Selector Switch
The Mode Selector Switch allows the operator to select Remote, Play or Teach mode. When Play or Teach is selected, the programming pendant controls system operation.

Menu Area
The Menu Area contains menu selections for the currently selected screen.

General Purpose Display Area
The General Purpose Display Area displays the currently selected menu choice.

Emergency Stop (E-STOP)
Pressing the E-STOP button puts the controller in Emergency Stop and stops all system operation.

Keypad
The user keypad on the programming pendant serves as an input device. The keys are grouped into different functional sections to simplify operator use.
**Status Area**

The Status Area shows system status via the following symbols:

- Active Robot, External Axis, or Base Axis
  - R1, R2; S1, S2
- Coordinate System
  - Joint, World, Cylindrical, Tool, or User Frame
- Manual Speed Setting
  - Inching, Low, Medium, or High
- Cycle Mode
  - Step, 1-Cycle, or Auto
- System Status
  - E-Stop, Stop, Running/Start, Hold, or Alarm
- Additional Pages (when applicable)

**MAIN MENU Key**

The MAIN MENU key returns the pendant display to the initial start-up menu. Use the cursor key or the touch screen to choose from the following menu options:

- **JOB**
  - This option accesses job selections including: Master Job, Select Job, Job Capacity, and Create New Job while in TEACH mode.
- **ARC WELDING, GENERAL, HANDLING, or SPOT WELDING**
  - This option allows you to select the applications available to the controller.
- **VARIABLE**
  - This option accesses the display and editing menu for the arithmetic variables and display of position variables.
- **IN/OUT**
  - This option accesses DETAIL and SIMPLE displays of all XRC I/O signals. In EDITING or MAINT. mode, Universal Outputs can be forced ON or OFF.
- **ROBOT**
  - This option accesses robot information including: CURR.POS, POWER ON/OFF, POS, COMMAND POS, SECOND HOME POS, OPE ORIGIN POS, and TOOL and USER COORDINATE.
- **SYSTEM INFO**
  - This option provides Version information for both hardware and software, Alarm History, and Monitoring Time.
- **FD/CF**
  - This option accesses menu choices for FD (floppy disk) or CF (compact flash) program backup.
- **SETUP**
  - This allows the user to set up system conditions and assign hot keys.

**AREA Key**

The Area key moves the cursor to the different areas of the display screen.
CURSOR Key
The Cursor key is an 8-way, directional key that moves the up, down, left or right to highlight a desired item that can then be chosen using the SELECT key.

SELECT Key
The SELECT key is used to choose the item currently highlighted by the cursor.

FLASH MEMORY Slot
The compact FLASH MEMORY card slot allows for easy memory backups.

ENABLE Switch
The ENABLE switch (see Figure 3) is a three-position switch located on the left rear of the programming pendant. It is a safety feature that controls servo power while in TEACH mode. When pressed in, this switch enables servo power to be turned on. However, should the operator release the switch, or grasp it too tightly, servo power is immediately removed, preventing further robot movement.

SERVO ON Key
When the pendant is in TEACH mode, The SERVO ON key turns servo power ON when the ENABLE switch is activated. When the pendant is in PLAY mode, the SERVO ON key turns servo power on.

3.4 Bartending Equipment

3.4.1 Draft Beer Tower
RoboBar uses a portion control beer tower for dispensing three different draft beers. Glycol beer line coolers keeps beer cold and prevents foam and spoilage. Each beer tap has a special head to allow metered dispensing of beer. Flow amounts have been pre-programmed. To adjust amounts, refer to Appendix 7.1.2.
3.4.2 Tiered Liquor Racks

Tiered liquor racks are used to hold up to nine different brands of liquor. The second tier holds secondary bottles of each brand. Each bottle rests in a specially oriented puck that is identified by brand of liquor. In addition each tier location is also labeled. This ensures that the bottles are placed in the correct locations. An arrow placed in the well of the puck directs the orientation of the bottles pour spout. Specially designed portion control pourers are used on each bottle to accurately control liquor portions.

3.4.3 Mix Tower

A mix tower is used for dispensing up to ten different mixes, both juices and soft drinks. The mix tower is configured to dispense four carbonated drinks (i.e. Coke®, Pepsi®, etc.) and four non-carbonated drinks/juices (i.e. orange juice, sour mix, etc.).
3.4.4 Ice Dispenser

The manual fill, counter top, ice dispenser holds up to 90 lbs./40.9 kgs of ice and features a stainless steel exterior cabinet and push lever ice dispense mechanism.

Note: The robot does not touch the lever to dispense ice. Instead, robot I/O is used to release a specified amount of ice electronically.

3.4.5 Coffee/Espresso Machine

The espresso machine grinds whole beans, doses, tamps and extracts consistently authentic espresso, complete with a thick, golden crema. The used coffee grounds are then automatically ejected into an internal dump box. The built-in burr grinder is adjustable for a finer or coarser grind. A bypass doser can be used for pre-ground decaf when caffeine is not preferred.

The large removable reservoir holds enough water for 40 espressos or 12 cups of coffee at a time. When the water level is low an indicator light comes on. Up to 30 portions of coffee beans can be ground before refilling. The dump box is located inside the machine and is easily accessed by sliding out the drip tray. An indicator lights when the tray or the dump box need to be emptied. A separate light indicates when the water supply is low. Refer to your vendor documentation for specific information regarding your machine.

3.4.6 Cup Dispenser

The self-adjusting cup dispensers are mounted in the counter and are shipped with three different gaskets to fit any size paper, plastic or foam cup up to 44 ounces (13 cl) or cups with a 2-1/4" - 4-5/8" (57 - 117 mm) lip diameter.
3.5 Delivery Turntable

The delivery turntable uses a servo driven turntable and interlocked safety door to deliver drinks to customers. The table uses sensors to monitor when a drink is present at the robot side and when the drink is ready for the customer.

3.6 Drink Serving Door

The drink serving door is unlocked when either side is in position with a cup at the operator side. When the cup is removed, clearing the sensor, the door can be locked. The table will not rotate until the door is closed and the drink is removed from the operator side.

3.7 Order Entry HMI

The order entry HMI is used to process drink orders. The HMI can be configured to verify customer age and accept payment. A magnetic card swipe is used to verify legal age of customer, accept payment and/or collect other information. The customer then configures a drink order using the touch screen.

3.8 Safety Features

The RoboBar system includes a total safety environment that complies with the ANSI/RIA R15.06-1999 safety standard.

Note: Users are responsible for determining that the safeguards provided with the RoboBar system are adequate for their conditions. Users must also ensure that all safeguards are maintained in working order.

3.8.1 Safety Enclosure

Safety fencing encloses the entire robotic work cell. It forms a physical barrier that prevents the unintentional movement of personnel or objects into the cell during automatic operation. A safety interlocked door at the rear of the cell provides a point of entry for programming and maintenance personnel. The top access doors at the front and sides are integrated into the safety circuit and provide access to consumables. Lower access doors on both sides provide access to BIB syrups and other consumables.

3.8.2 Emergency Stops (E-Stops)

RoboBar incorporates an E-Stop push button on the programming pendant. When this E-Stop push button is activated (pushed in), the controller immediately stops all system operation, activates the robot braking system, and disables all system servo power.
3.8.3 Programming Pendant Enable Switch

The ENABLE switch is a safety feature which controls servo power while in TEACH mode. When pressed in, this switch allows the operator to turn servo power ON. However, should the operator release the switch or grasp it too tightly, servo power is immediately removed, preventing further robot movement. For detailed information about the operation of the ENABLE switch, refer to the controller manual that came with your system.

3.8.4 Interlocked Cell Door

A safety interlock on the cell entrance door and the three upper access doors prevent entry into the cell during PLAY mode. If any of these safety interlock doors are opened when the robot is in PLAY mode, brakes are applied to the robot, all servo power is removed from the system, and all motion is stopped.
Chapter 4
Installation

The RoboBar system can be installed easily in just a short amount of time. Follow established safety procedures at all times throughout the installation process. Failure to use safe work practices can result in damage to the equipment and injury to the workers.

You must comply with all local and federal health and safety regulations. It is your responsibility to research and comply with the regulations for your area.

CAUTION!
Installation of Robobar system is not a task for the novice. The system is not fragile, but it is a highly sophisticated robotic system. Handle components with care. Rough handling can damage system electronic components.

4.1 Materials Required

All system components and most hardware required for installing RoboBar are included with your shipment. The following identifies some typical customer-supplied items and tools required to complete installation.

4.1.1 Customer-Supplied Items

- Running water supply (city water)
- Drain for ice melt, drips, spills, etc.
- CO2 gas supply for the soft drink mixes
- Nitrogen gas supply for the draft beer
- 220 VAC, single-phase power
- Stepladder
- Forklift and/or overhead crane/fork extensions
- Appropriate hand tools
4.2 Site Preparation

To prepare your site, proceed as follows:

1. Clear floor space needed for unit (see Figure 4). Be sure to include adequate room to open access doors.

   Note: To make installation easier, allow an additional 1.2 to 1.5 m (4 to 5 ft) on all sides of cell.

![Figure 4 Area Needed for Installation]

2. Gather all customer-supplied items and required tools listed in Section 4.1.

4.3 Unpacking the Components

The RoboBar system is shipped on a large wooden shipping skid.

CAUTION!

Handle RoboBar components carefully to avoid damage. The shipping skid with all components weighs approximately 1814 kg (4,000 lbs). Be sure that your forklift is capable of handling this much weight, or damage to the equipment or injury to personnel can result.

1. Using a forklift, lift the shipping skid and cell components from the hauler and move to installation location.

2. Carefully remove protective plastic wrapping from all cell components.
3. Inspect cell components for shipping damage.

Note: If damage is found, notify shipper immediately.

4. Unbolt each component from the wooden shipping skid.

5. Using a forklift, carefully lift and remove equipment from shipping skid.

**WARNING!**

Robobar weighs 1814 kg (4,000 lbs). Be sure that your crane is capable of handling this weight or damage to the equipment or injury to personnel can result.

6. Place Robobar in position on a flat and level surface as shown in Figure 4.

Note: Make sure there is adequate room on all sides of the cell for the servicing and maintenance.

### 4.4 Cable Connections

After Robobar is level and securely in place, the cables should be unwrapped from around the equipment and laid out according to the cable diagram included in the system drawing package. Each cable connection is clearly identified for ease of installation.

![Figure 5 Cable Connections](image-url)
4.4.1 Connecting Gas Supplies

**DANGER!**
Gas tanks must be secured according to applicable safety regulations to prevent tipping over. Failure to properly secure gas tanks can cause injury or death and damage to the equipment.

7. Connect Nitrogen regulator to Nitrogen supply.

*Note:* You can use any regulator with any Nitrogen high pressure tank that has a female thread CGA-580 valve. These regulators come with a male thread that screws onto the CGA-580 valve. Double Gauge Regulators Measure PSI, as well as the Volume of Nitrogen in the Cylinder. They are good for indicating how much Nitrogen is left in the cylinder and when you should have it refilled. The screw or handle in the center is used to adjust the output pressure.

**DANGER!**
Gas regulators are under extreme pressure. Make certain you understand the operation of your regulator. Do not connect hoses to high pressure port. Incorrect connections can cause injury or death and damage to the equipment.

8. Locate Nitrogen gas line and connect to Nitrogen regulator.

9. Set regulator to OFF and slowly turn ON Nitrogen cylinder's main output. High pressure gauge should show a reading of hundreds of psi.

10. Use a solution of soapy water to check for leaks.

**DANGER!**
CO₂ compressed gas can cause frostbite when exiting the tank.

11. Connect CO₂ regulator to carbon dioxide supply.

*Note:* Most CO₂ regulators have CGA 320 fittings. Adapters are available if needed.

12. Locate CO₂ gas line and connect to CO₂ regulator.

13. Set regulator to OFF and slowly turn ON CO₂ cylinder's main output. High pressure gauge should show a reading of hundreds of psi.

**DANGER!**
A large CO₂ leak could cause suffocation. Check for leaks and proper ventilation. If you are in a small location or other enclosed space, it is recommended that you vent used CO₂ gas from the syrup pumps outside. Be sure to keep an eye on the CO₂ main gauge, as a significant movement may indicate a large leak.

14. Use a solution of soapy water to check for leaks.

15. Locate draft beer lines and connect to keg using standard US Sankey coupler (“D” System).
4.5 Connecting Power

After all system components have been properly installed, connect power to RoboBar as follows:

DANGER!
Power should be connected by a qualified electrician. Electrical and grounding connections must comply with applicable portions of the national electrical code and/or local electrical codes.

1. Install split phase 220 V AC power wiring to the fused disconnect box located outside the Robobar cell. Table 5 shows size and type of wire needed.
2. Tighten screws to the torque indicated in Table 1.
3. Install an M5 lug on incoming ground wire.
4. Terminate ground wire to frame ground stud with hardware provided.

Note: RoboBar is configured for split-phase 220V AC, unless other voltage was requested. If other voltage is required for your system contact Motoman Service staff for more information.

<table>
<thead>
<tr>
<th>Table 1 Incoming Power Specifications (Decal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lug Data</td>
</tr>
<tr>
<td>Catalog No.</td>
</tr>
<tr>
<td>Wire Size</td>
</tr>
<tr>
<td>Torque</td>
</tr>
</tbody>
</table>

4.6 Conducting a Safety/Operation Check

Before installing the tooling and fixtures for your application, take a few minutes to perform a safety/operation check. To conduct a safety/operation check:

1. Check that the yellow shipping brackets have been removed from the robot.
2. Be sure there is a clearance of at least 2.5 cm (1 in.) on either side of the cell.
3. Check that the cell doors are closed and latched.
4. Check that all cable connections are tight.
5. Verify that incoming line power matches the input power specified.
   - L1 to ground should measure approximately 120 VAC
   - L2 to ground should measure approximately 120 VAC
   - L1 to L2 should measure approximately 240 VAC

RoboBar is now ready for power-up. Turn main power ON, and continue the safety/operation check.

6. Check all system E-STOPs.
7. Check system Hold buttons.
8. Check door interlocks.
4.7 Stocking Consumables

Your Robobar system is now ready for stocking of consumables. Only personnel familiar with the operation of the Robobar system should perform re-stocking tasks.

Note: All consumables for Robobar shall be supplied by the customer.

4.7.1 Stocking Liquor

Each liquor bottle rest in a specially designed puck on the tiered liquor rack and must be replaced with the identical liquor type when empty. All bottle holders are designed for 1 liter size bottles. Each bottle is fitted with a specially designed pourer to accurately control liquor portions. To stock the liquor rack, proceed as follows:

1. Open side access door.

Note: Robobar has been programmed to pour and mix drinks using the Posi-Pour™ 2000 portion control pourer. Do not use different type pourer or free pour style pourer, as drink quality will suffer.

2. Replace bottle cap with Posi-Pour™ 2000 portion control pourer.

3. Locate liquor puck and stock or replace empty liquor bottle.

Note: Each puck has been labeled with liquor type and orientation of bottle topper. It is very important that the bottle is correctly oriented according to the alignment arrow on the puck. Failure to properly align bottle may result in inconsistent pours and/or spillage.

4. Verify bottle is correctly aligned with puck arrow and liquor type matches puck label.

5. Close all access doors.

Figure 6 Bottle Orientation
4.7.2  **Stocking Juice Mixes**

The bag-in-box juice mixes rest on a special rack located under the countertop. To stock the juice mixes, proceed as follows:

1. Open lower side access door (not safety interlocked).
2. Disconnect empty box if restocking.
3. Place new box on box rack and connect hose.
4. If product is needed, the air operated pump engages to draw syrup toward the dispenser tower.

![Figure 7 Stocking Juice Mixes](image)

4.7.3  **Stocking Soda Syrup Mixes**

The bag-in-box soda syrup mixes rest on a special rack located under the countertop. Depending on what soda you are dispensing, there are two different styles of bag-in-box connectors.

- **COKE® STYLE BIB CONNECTOR**
- **PEPSI® (AND EVERYTHING ELSE) STYLE BIB QDC**

Your system is set up at the factory for your choice of soda vendors. To stock the soda syrup mixes, proceed as follows:
1. Open lower side access door.
2. Disconnect empty box if restocking.
3. Place new box on box rack and connect hose.
4. If product is needed, the air operated pump engages to draw syrup toward the dispenser tower.

![Diagram of soda dispenser](image)

**Figure 8** Stocking Soda Syrup Mixes

### 4.7.4 Stocking Cup Dispenser

The two plastic cup dispenser hold approximately 35 cups. The paper cup dispenser holds approximately 57 paper cups. To stock cups, proceed as follows:

1. With the robot E-stopped, open the top, front access door. This door is safety interlocked and will stop all system operation if opened during operation.
2. Place cups face down into spring loaded reservoir.
3. Close access door.

### 4.7.5 Stocking Ice Dispenser

1. With the robot E-stopped, open the top, side access door. This door is safety interlocked and will stop all system operation if opened during operation.
2. Open top of ice dispenser and fill with ice.
3. Close access door.

### 4.7.6 Stocking Optional Coffee/Espresso Machine

Fill coffee maker with coffee beans & check water supply reservoir. Remove any spent coffee grounds at this time. Reset coffee counter integer variables so Robobar knows these supplies are refilled.
Chapter 5
Operation

This chapter provides a brief overview of the operating procedures for your RoboBar system. For detailed information on specific components, refer to the individual component manuals that came with your system documentation package.

RoboBar's DA9IC dual-arm robot serves beer, mixed drinks, and soft drinks (soda and juices). Using a magnetic card swipe, the customer's age and account is verified. After a valid card swipe, the customer uses a touch screen to choose a beverage. The robot then selects a cup, and fills it with the appropriate beverage(s) and ice, if desired. The robot then passes the drink to the customer via an automatic turntable located at the side of the unit.

5.1 Programming

The operation of this system is programming dependent. The following operating instructions are based on one possible configuration of this system. Your system configuration and job structure may differ slightly from that presented here; however, basic operation will be the same. For additional programming instructions, refer to the controller and operator manuals that came with your system.

Any changes made to your system configuration and/or job structure will alter the operation of this cell. Motoman recommends you do not modify the original jobs and system configuration that came with your system. If modifications need to be made, they should be made to copies of these jobs and not to the originals. Modifications should only be performed by personnel who have received operator training from Motoman, and who are familiar with the operation of this Motoman system. If you have questions concerning the configuration of your system please contact the 24 hour Service Hotline, at (937) 847-3200 (see Section 1.4).
5.2 Daily Operation

The procedures below represent the typical operating sequence from power up to shutdown. Your basic operating procedures may vary depending on your situation.

- Stock system consumables
- Perform start-up procedures
- Move robot to Home position
- Select master job
- Perform operation cycle
- Perform shutdown procedures

5.2.1 Stock System Consumables

Note: All consumables for Robobar shall be supplied by the customer.

1. Fill ice dispenser.
2. Fill coffee maker with coffee beans and check water supply reservoir.
3. Check bag-in-box syrup supplies.
4. Add ice to chiller plate ice bin.
5. Check liquor supplies. Verify bottles are in correct locations and pourers are correctly oriented.

Note: If the volume of liquor in a bottle is changed, count variables I001 - I009 must be modified to reflect this in the controller. Refer to Section 6.3.2 for more information.

6. Fill cup dispensers.

5.2.2 Start-Up

To start up cell from a Power-Off condition, proceed as follows:

WARNING!
Water and gas supplies must be turned ON before supplying power to the carbonator. Failure to do this can cause damage to the carbonator.

1. Open regulator valves on gas supplies (CO₂ and N₂).
2. Turn on water supply.
3. Set MAIN POWER switch on service disconnect to ON.
4. Turn on computer.
5. Make sure all enclosure doors are closed.
6. Make sure E-STOP buttons are released.
7. Select TEACH mode on programming pendant.
8. Place robot in Home position.
5.2.3 Robot Home Position

To move the robot to the Home position:
1. Select TEACH mode on the programming pendant.
2. Select MAIN MENU on programming pendant touch screen.
3. Select JOB on programming pendant touch screen.
4. Select SELECT JOB on programming pendant touch screen. A job list appears on the screen.
5. Using cursor keys, move cursor to “HOME” job and press SELECT. Job appears on display.
6. Turn servo power ON by pressing SERVO ON and holding in the ENABLE switch.
7. Use the FWD button on programming pendant to jog the robot to Home position.

5.2.4 Starting the Master Job

With the system powered up and in TEACH mode, call up the Master job:
1. Select MAIN MENU on programming pendant touch screen.
2. Select JOB on programming pendant touch screen.
3. Select CTRL MASTER on programming pendant touch screen. Press SELECT twice to activate the Master job.
4. Select PLAY mode on programming pendant and press the PLAY ENABLE button on the controller door. Job playback operation is enabled.
5. Press SERVO ON button on the programming pendant.
6. Press START button on programming pendant. The Master job cycles, waiting for input from touch screen.

Note: If a drink is not requested, robot may perform “dance” routine to indicate that Robobar is active and ready to serve.
7. RoboBar_SoftPLC should auto run at this time.

RoboBar is now ready for operation.

5.2.5 Shutdown

Use the following procedure to shut down RoboBar after operation is complete:
1. Ensure robot is in Home position. The robot returns to Home after serving or may perform “dance” routine.
2. Turn off system servo power by pressing E-STOP button on programming pendant.
3. Select TEACH mode on the programming pendant.
4. Properly shut down Windows™ from the computer Start menu.
5. Turn OFF computer’s battery back-up supply. This beeps when main power is removed.
6. Set main service disconnect to OFF position.
7. Close regulator valve on gas supplies.
8. Turn off water supply.
9. Perform general cleaning in and around Robobar cell.

RoboBar is now shut down.
5.3 **Robot Recovery**

When a system error or alarm occurs, you must clear the error or alarm to return the system to normal operation. The paragraphs below describe the different types of alarms and errors you may encounter and how to remedy them when you do.

5.3.1 **Alarms and Errors**

Alarms and errors will cause the program to stop. There are three levels of alarms and errors: Error Messages, Minor Alarms, and Major Alarms. For more detailed information about alarm recovery, refer to operator’s manual that came with your system.

5.3.1.1 **Error Messages**

These are simple errors such as pressing the START button when the robot is not in PLAY mode, or enabling the programming pendant when servo power is off. Clear these errors by pressing the CANCEL button on the programming pendant.

5.3.1.2 **Minor Alarms**

Minor alarms are usually programming errors. Minor alarms might occur if a circle has been programmed with fewer than three circular points, etc. Clear these errors by pressing the CANCEL button on the programming pendant.

5.3.1.3 **Major Alarms**

Major alarms are hardware failures. Major alarms might occur because of a servo tracking error or an abnormal speed. To clear these alarms, you must turn off the controller and then turn it on again.

5.3.2 **E-STOP Recovery**

An E-STOP can occur under any of the following conditions:

- Pressing E-STOP button on the operator station, programming pendant, or controller door.
- Opening a cell door when robot is not in TEACH mode.

To restart RoboBar after an E-STOP condition occurs, follow the procedure below.

1. To clear E-STOP condition, perform any of the following actions that apply:
   - Release E-STOP button.
   - Close cell door.
2. Press SERVO ON button on programming pendant.
3. Press START button.

RoboBar is now ready to continue operation.
Chapter 6
RoboBar Command Center

The Robobar HMI not only provides the interface for customers to enter drink orders, but also provides the main access control point for system configuration. Using the Robobar Command Center, you can setup available drink options, view inventory history, troubleshoot gripper malfunctions, and/or other information collection.

The following screen appears after the initial startup of the computer and the Windows operating system.

6.1 Robobar Master Control Panel

The Master Control Panel provides the main system information for diagnosis and setup of the Robobar system.
6.1.1 System I/O

System I/O provides troubleshooting and diagnostic information for the system.

6.1.2 Drink Order Control

The Drink Order Control pane provides customer HMI setup and drink queue views.

- **HMI with Card Reader**
  The HMI with Card Reader button opens the HMI screen that uses the Card Reader.

- **HMI without Card Reader**
  The HMI with Card Reader button opens the HMI screen that does not use the Card Reader.

- **Close Drink Order Form**
  This button closes the main drink selection menu.

- **Drink Queue View**
  The Queue view allows the operator to view what drink is currently being made, as well as drink history and demand.
6.1.3 Gripper Modules

The Gripper Modules button opens the Servo Grippers window, providing diagnostic and setup information for the two grippers. A link to the Schunk gripper manuals is also available on this screen.

The grippers can be controlled from this screen if robot outputs have been turned OFF. A “grayed out” gripper pane indicates a malfunctioning gripper.

6.1.4 Shutdown Robobar

The Shutdown Robobar button provides a way to safely exit the Robobar command center.

**WARNING!**
The ShutdownRoboBar button must be used to safely stop the robobar software!
6.1.5 Bottle Option

The Bottle Option buttons toggle the juice and liquor bottle choices ON and OFF. This provides a fast way to remove these options from the main drink selection screen.

6.1.6 Advanced Diagnostics Options

The advanced diagnostics options check box displays additional testing and diagnostics functions for troubleshooting and robot communications when checked.
6.2 Operation

The following describes the customer’s process for selecting a beverage.

1. From the main drink selection menu, select the language of choice. A short movie plays on the AI screen as the language is changed to the selection.

2. Select one of four beverage choices.

6.2.1 Soda/Juice

1. Select beverage.

2. Select ice option.
6.2.2 Beer

1. Select one beverage.

6.2.3 Bottled Juice

1. Select one juice.
2. Select 100% Juice only or Sparkling Water added.
6.2.4 Espresso/Coffee

1. Select one beverage

6.2.5 Mixed Drink
1. Select liquor. The mixer screen appears displaying the selected liquor and a choice of mixers.

2. Select mixer.
3. Select ice option.

### 6.3 Robot Customization

#### 6.3.1 Jobs

<table>
<thead>
<tr>
<th>Job #</th>
<th>Description</th>
<th>Axis Configuration</th>
<th>Home Job #</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Base to Home Position / Cup</td>
<td>R1+R2+S2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Base to Soda Station</td>
<td>R1+R2+S2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Base to Beer Station</td>
<td>R1+R2+S2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Base to Ice Dispenser / Rack #2</td>
<td>R1+R2+S2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Base to Bottle Rack #1</td>
<td>R1+R2+S2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Base to Opposite / Right Cup</td>
<td>R1+R2+S2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>R2 Base to Outfeed Location</td>
<td>R1+R2+S2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Base to Coffee</td>
<td>R1+R2+S2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Base to Empty Bottle Position</td>
<td>R1+R2+S2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Base to Pour Position (Rack #1)</td>
<td>R1+R2+S2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Job #</td>
<td>Description</td>
<td>Axis Configuration</td>
<td>Home Job #</td>
<td>Comments</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------------------</td>
<td>--------------------</td>
<td>------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>11</td>
<td>R2 Grab Cup - Right Side (opposite)</td>
<td>R2</td>
<td>6</td>
<td>plastic cup racks, alternates automatically between both stacks</td>
</tr>
<tr>
<td>12</td>
<td>R2 Grab Cup - Left Side</td>
<td>R2</td>
<td>1</td>
<td>paper cups</td>
</tr>
<tr>
<td>13</td>
<td>R2 Get Ice</td>
<td>R2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>R2 Position Cup for Soda</td>
<td>R2</td>
<td>2</td>
<td>this job gets PSTART'd with beverage jobs 21-30</td>
</tr>
<tr>
<td>15</td>
<td>R2 Return Cup from Soda Station</td>
<td>R2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Pour Liquor (R1 into R2)</td>
<td>R1+R2</td>
<td>8</td>
<td>pour liquor bottle in R1 to cup in R2, hold for shot to pour, return arms, changes counters Bxx &amp; Ixx</td>
</tr>
<tr>
<td>16J</td>
<td>Pour Juice (R1 into R2)</td>
<td>R1+R2</td>
<td>8</td>
<td>pour juice bottle in R1 to cup in R2, hold for shot to pour, return arms, changes counters Bxx &amp; Ixx</td>
</tr>
<tr>
<td>17</td>
<td>Empty Bottle</td>
<td>R1</td>
<td>9</td>
<td>moves R1 &amp; bottle to bottle chute, opens and releases bottle to collection tube</td>
</tr>
<tr>
<td>18</td>
<td>Pour Beer #1 - Flavor: UNSELECTED</td>
<td>R2</td>
<td>3</td>
<td>uses robot DOUT #25</td>
</tr>
<tr>
<td>19</td>
<td>Pour Beer #2 - Flavor: UNSELECTED</td>
<td>R2</td>
<td>3</td>
<td>uses robot DOUT #26</td>
</tr>
<tr>
<td>20</td>
<td>Pour Beer #3 - Flavor: UNSELECTED</td>
<td>R2</td>
<td>3</td>
<td>uses robot DOUT #27</td>
</tr>
<tr>
<td>21</td>
<td>R1 Select Flavor #1 - UNUSED (M)</td>
<td>R1</td>
<td>2</td>
<td>Button push, adjust timer for various water pressure setups</td>
</tr>
<tr>
<td>22</td>
<td>R1 Select Flavor #2 - OJ</td>
<td>R1</td>
<td>2</td>
<td>Button push, adjust timer for various water pressure setups</td>
</tr>
<tr>
<td>23</td>
<td>R1 Select Flavor #3 - Cranberry</td>
<td>R1</td>
<td>2</td>
<td>Button push, adjust timer for various water pressure setups</td>
</tr>
<tr>
<td>24</td>
<td>R1 Select Flavor #4 - Grapefruit</td>
<td>R1</td>
<td>2</td>
<td>Button push, adjust timer for various water pressure setups</td>
</tr>
<tr>
<td>25</td>
<td>R1 Select Flavor #5 - Tonic</td>
<td>R1</td>
<td>2</td>
<td>Button push, adjust timer for various water pressure setups</td>
</tr>
</tbody>
</table>
### Table 2

<table>
<thead>
<tr>
<th>Job #</th>
<th>Description</th>
<th>Axis Configuration</th>
<th>Home Job #</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>R1 Select Flavor #6 (T) - Diet Coke</td>
<td>R1</td>
<td>2</td>
<td>Button push, adjust timer for various water pressure setups</td>
</tr>
<tr>
<td>27</td>
<td>R1 Select Flavor #7 (C) - Coke</td>
<td>R1</td>
<td>2</td>
<td>Button push, adjust timer for various water pressure setups</td>
</tr>
<tr>
<td>28</td>
<td>R1 Select Flavor #8 (L) - Sprite</td>
<td>R1</td>
<td>2</td>
<td>Button push, adjust timer for various water pressure setups</td>
</tr>
<tr>
<td>29</td>
<td>R1 Select Flavor #9 () - Water</td>
<td>R1</td>
<td>2</td>
<td>Button push, adjust timer for various water pressure setups</td>
</tr>
<tr>
<td>30</td>
<td>R1 Select Flavor #10 () - Soda Water</td>
<td>R1</td>
<td>2</td>
<td>Button push, adjust timer for various water pressure setups</td>
</tr>
<tr>
<td>30J</td>
<td>R1 Select Flavor #10 () - Soda Water</td>
<td>R1</td>
<td>2</td>
<td>Shorter pour time, this is for the bottle juice jobs when sparkling water is to be added</td>
</tr>
<tr>
<td>31</td>
<td>R1 Grab Bottle #1 - Captain Morgan</td>
<td>R1</td>
<td>5</td>
<td>Pick up bottle</td>
</tr>
<tr>
<td>32</td>
<td>R1 Grab Bottle #2 - El Toro</td>
<td>R1</td>
<td>5</td>
<td>Pick up bottle</td>
</tr>
<tr>
<td>33</td>
<td>R1 Grab Bottle #3 - Bacardi</td>
<td>R1</td>
<td>5</td>
<td>Pick up bottle</td>
</tr>
<tr>
<td>34</td>
<td>R2 Grab Bottle #4 - Jack Daniels</td>
<td>R1</td>
<td>5</td>
<td>Pick up bottle</td>
</tr>
<tr>
<td>35</td>
<td>R2 Grab Bottle #5 - Beefeater</td>
<td>R1</td>
<td>5</td>
<td>Pick up bottle</td>
</tr>
<tr>
<td>36</td>
<td>R2 Grab Bottle #6 - Absolut</td>
<td>R1</td>
<td>5</td>
<td>Pick up bottle</td>
</tr>
<tr>
<td>37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>R2 Outfeed Cup</td>
<td>R2</td>
<td>7</td>
<td>Soda/Juice placement</td>
</tr>
<tr>
<td>43</td>
<td>R2 Outfeed Cup with Shake</td>
<td>R2</td>
<td>7</td>
<td>Mixed drink/liquor placement</td>
</tr>
<tr>
<td>44</td>
<td>R2 Outfeed Cup of Coffee</td>
<td>R2</td>
<td>7</td>
<td>Requires cup push to get cup to clear turn table</td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2

<table>
<thead>
<tr>
<th>Job #</th>
<th>Description</th>
<th>Axis Configuration</th>
<th>Home Job #</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
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<td></td>
</tr>
<tr>
<td>47</td>
<td></td>
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<tr>
<td>51</td>
<td>R1 Return Bottle #1 - Captain Morgan</td>
<td>R1</td>
<td>5</td>
<td>Return bottle from robot hand to bottle rack</td>
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<tr>
<td>52</td>
<td>R1 Return Bottle #2 - El Toro</td>
<td>R1</td>
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<td>Return bottle from robot hand to bottle rack</td>
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<td>R1 Return Bottle #3 - Bacardi</td>
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<td>Return bottle from robot hand to bottle rack</td>
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<td>R1 Return Bottle #4 - Jack Daniels</td>
<td>R1</td>
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<td>Return bottle from robot hand to bottle rack</td>
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<td>R1 Return Bottle #5 - Beefeater</td>
<td>R1</td>
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<td>Return bottle from robot hand to bottle rack</td>
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<tr>
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<td>R1 Return Bottle #6 - Absolut</td>
<td>R1</td>
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<td>Return bottle from robot hand to bottle rack</td>
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<tr>
<td>61</td>
<td>R1 Grab 2nd Bottle #1 - Captain Morgan</td>
<td>R1</td>
<td>5</td>
<td>Moves bottle from reserve position forward - if bottle not found alert shown on screen</td>
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<tr>
<td>62</td>
<td>R1 Grab 2nd Bottle #2 - El Toro</td>
<td>R1</td>
<td>5</td>
<td>Moves bottle from reserve position forward - if bottle not found alert shown on screen</td>
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<tr>
<td>63</td>
<td>R1 Grab 2nd Bottle #3 - Bacardi</td>
<td>R1</td>
<td>5</td>
<td>Moves bottle from reserve position forward - if bottle not found alert shown on screen</td>
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### Table 2

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<tr>
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<td>64</td>
<td>R1 Grab 2nd Bottle #4 - Jack Daniels</td>
<td>R1</td>
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<td>Moves bottle from reserve position forward - if bottle not found alert shown on screen</td>
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<td>R1 Grab 2nd Bottle #5 - Beefeater</td>
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<td>Moves bottle from reserve position forward - if bottle not found alert shown on screen</td>
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<td>R1 Grab 2nd Bottle #6 - Absolut</td>
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<td>Moves bottle from reserve position forward - if bottle not found alert shown on screen</td>
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<tr>
<td>71</td>
<td>R2 to Coffee Dispense</td>
<td>R1</td>
<td>8</td>
<td>cup approach</td>
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<td>72</td>
<td>R2 return from Coffee Dispense</td>
<td>R1</td>
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<td>cup retreat</td>
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<td>73</td>
<td>R1 push Small Espresso button</td>
<td>R1</td>
<td>8</td>
<td>button push</td>
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<td>74</td>
<td>R1 push Tall Espresso button</td>
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<td>button push</td>
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<tr>
<td>75</td>
<td>R1 push Large Coffee button</td>
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<td>button push</td>
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<tr>
<td>150</td>
<td>Coca-Cola</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, ice (optional), pours beverage, and outfeeds the cup.</td>
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## Table 2

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<thead>
<tr>
<th>Job #</th>
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<tr>
<td>151</td>
<td>Diet Coke</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, ice (optional), pours beverage, and outfeeds the cup.</td>
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<td>152</td>
<td>Sprite</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, ice (optional), pours beverage, and outfeeds the cup.</td>
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<tr>
<td>153</td>
<td>Orange Minute Maid</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, ice (optional), pours beverage, and outfeeds the cup.</td>
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<tr>
<td>154</td>
<td>Orange Juice</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, ice (optional), pours beverage, and outfeeds the cup.</td>
</tr>
<tr>
<td>155</td>
<td>Grapefruit Juice</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, ice (optional), pours beverage, and outfeeds the cup.</td>
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<tr>
<td>156</td>
<td>Cranberry</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, ice (optional), pours beverage, and outfeeds the cup.</td>
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<tr>
<td>157</td>
<td>Water</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, ice (optional), pours beverage, and outfeeds the cup.</td>
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<td>158</td>
<td>Bottled Juice A</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, ice (optional), pours beverage, and outfeeds the cup.</td>
</tr>
<tr>
<td>159</td>
<td>Bottled Juice B</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, ice (optional), pours beverage, and outfeeds the cup.</td>
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<tr>
<td>160</td>
<td>Beer #3</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, pours beer, and outfeeds the cup to customer.</td>
</tr>
<tr>
<td>161</td>
<td>Beer #2</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, pours beer, and outfeeds the cup to customer.</td>
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<tr>
<td>162</td>
<td>Beer #1</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, pours beer, and outfeeds the cup to customer.</td>
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<tr>
<td>163</td>
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### Table 2

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<tr>
<td>165</td>
<td>Coffee: Espresso Short</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, selects cap. machine options, pours, outfeeds the cup.</td>
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<tr>
<td>166</td>
<td>Coffee: Espresso Tall</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, selects cap. machine options, pours, outfeeds the cup.</td>
</tr>
<tr>
<td>167</td>
<td>Coffee: Large</td>
<td>R1+R2+S2</td>
<td>1</td>
<td>Run from home position - gets cup, selects cap. machine options, pours, outfeeds the cup.</td>
</tr>
<tr>
<td>168</td>
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<td>170</td>
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<tr>
<td>200</td>
<td><strong>Build Your Own Drink</strong></td>
<td>NonGroup</td>
<td>1</td>
<td>Run from home position - the main mixed drink creation program. This job looks for Ice, Mixer, and Liquor selection variables in the robot (B001, B002, B003) to determine correct mixes.</td>
</tr>
</tbody>
</table>

Create Your Own Drink: A job allowing the user to select options:
* Ice
* 1 Liquor
* 1 Mixer
### Table 2

<table>
<thead>
<tr>
<th>Job #</th>
<th>Description</th>
<th>Axis Configuration</th>
<th>Home Job #</th>
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<tbody>
<tr>
<td>MASTER</td>
<td>Main job for all drink creation. Also calls</td>
<td></td>
<td></td>
<td>Main job, this should be started from the Robot's home position, it runs continuously. If interrupted by door opening, it should restart safely.</td>
</tr>
<tr>
<td>MIXER1</td>
<td>Fill cup with Coke</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles cup positioning and button pushing, returning to home position.</td>
</tr>
<tr>
<td>MIXER2</td>
<td>Fill cup with Diet Coke</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles cup positioning and button pushing, returning to home position.</td>
</tr>
<tr>
<td>MIXER3</td>
<td>Fill cup with Sprite</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles cup positioning and button pushing, returning to home position.</td>
</tr>
<tr>
<td>MIXER4</td>
<td>Fill cup with --Available--</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles cup positioning and button pushing, returning to home position.</td>
</tr>
<tr>
<td>MIXER5</td>
<td>Fill cup with OJ</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles cup positioning and button pushing, returning to home position.</td>
</tr>
<tr>
<td>MIXER6</td>
<td>Fill cup with Grapefruit</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles cup positioning and button pushing, returning to home position.</td>
</tr>
<tr>
<td>MIXER7</td>
<td>Fill cup with Cranberry</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles cup positioning and button pushing, returning to home position.</td>
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<tr>
<td>MIXER8</td>
<td>Fill cup with Water</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles cup positioning and button pushing, returning to home position.</td>
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<tr>
<td>LIQUOR1</td>
<td>Pour 1 Captain Morgan shot.</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles bottle grab, pour, eject/restock if needed, and replace.</td>
</tr>
<tr>
<td>Job #</td>
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<td>Home Job #</td>
<td>Comments</td>
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<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>LIQUOR2</td>
<td>Pour 1 El Toro shot.</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles bottle grab, pour, eject/restock if needed, and replace.</td>
</tr>
<tr>
<td>LIQUOR3</td>
<td>Pour 1 Bacardi Morgan shot.</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles bottle grab, pour, eject/restock if needed, and replace.</td>
</tr>
<tr>
<td>LIQUOR4</td>
<td>Pour 1 Jack Daniels shot.</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles bottle grab, pour, eject/restock if needed, and replace.</td>
</tr>
<tr>
<td>LIQUOR5</td>
<td>Pour 1 Beefeater shot.</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles bottle grab, pour, eject/restock if needed, and replace.</td>
</tr>
<tr>
<td>LIQUOR6</td>
<td>Pour 1 Absolut shot.</td>
<td>NonGroup</td>
<td>1</td>
<td>This job handles bottle grab, pour, eject/restock if needed, and replace.</td>
</tr>
<tr>
<td>G1OPEN</td>
<td>Open Gripper #1 / Bottle Gripper</td>
<td>NonGroup</td>
<td>any</td>
<td>Open bottle gripper &amp; soda button flavor selector - looking for DIN #25 (open signal) to turn ON</td>
</tr>
<tr>
<td>G1CLOSED</td>
<td>Close Gripper #1 looking for Bottle</td>
<td>NonGroup</td>
<td>any</td>
<td>Close &amp; get bottle - looking for DIN #17 (Part Present) to turn ON</td>
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<tr>
<td>G2OPEN</td>
<td>Open Gripper #2 / Cup Gripper</td>
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<td>any</td>
<td>Open cup gripper - looking for DIN #28 (open signal) to turn ON</td>
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<td>G2CLOSED</td>
<td>Close Gripper #2 looking for Cup</td>
<td>NonGroup</td>
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<td>Close &amp; get cup - looking for DIN #18 (Part Present) to turn ON</td>
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<td>G1CLOFUL</td>
<td>Close Gripper #1 fully</td>
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<td>any</td>
<td>Close bottle gripper, not looking for part - looking for DIN #26 (closed signal) to turn ON</td>
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<td>G2CLOFUL</td>
<td>Close Gripper #2 fully</td>
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<td>any</td>
<td>Close cup gripper, not looking for part - looking for DIN #30 (closed signal) to turn ON</td>
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<tr>
<td>EJECTCUP</td>
<td>Rotate cup out from robot to customer</td>
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<td>any</td>
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**Table 2**

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<td>DANCE1</td>
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### 6.3.2 Variables

#### Table 3

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<td>B001</td>
<td>Ice Required</td>
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<td>Captain Morgan shot counter</td>
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<td>B002</td>
<td>Current Liquor</td>
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<td>El Toro shot counter</td>
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<td>B003</td>
<td>Current Mixer</td>
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<td>Jack Daniels shot counter</td>
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<td>Cup Alternator Bit</td>
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<td>Beefeater shot counter</td>
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<td>Absolut shot counter</td>
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### Table 3

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Chapter 7
Troubleshooting/Maintenance

7.1 Troubleshooting

7.1.1 Mix Tower (Soda and Juice)

**Syrup runs out:**
Disconnect the fitting and connect new box. If you are changing flavors, be sure to run plenty of syrup out of that line to avoid mixing flavors. Some flavors may leave an aftertaste in the tube; in that case, you will need to replace the 3/8" ID syrup feed line to the pump, as well as the 1/4" ID pressurized line between the pump and the fountain head. Use only reinforced tubing able to withstand over 200 psi. Use appropriate fittings and clamps to ensure a tight connection.

**CO₂ runs out:**
Disconnect power to the carbonator. Turn off water and CO₂ gas supply. Now vend soda until there is no more pressure in the carbonator's tank and the gas lines. Then, disconnect the regulator and replace the cylinder. Be sure to replace the plastic washer between the regulator and the cylinder. Your gas vendor should be able to supply you this.

**Soda Tastes Off:**
Calibrate Wunderbar beverage fountain/tower as follows:

You will need a Brix cup and syrup separator.

1. Remove nozzle from fountain valve.
2. Insert syrup separator into fountain, ensuring a good seal.
3. Determine mix ratio (located on syrup box).
4. Place Brix cup as tight as possible against bottom of valve with separator in correct ration cup.
5. Vend soda until syrup or soda has reached the marked location on the brix cup and stop vending. Let everything settle and examine the relative levels. If the syrup is higher than the soda water, you will need to adjust the syrup concentration.

Note: If soda water is slightly colored (typically brown in the case of root beer, cola, etc), you don’t have a good enough seal on your syrup separator and your ratio will be off. Reseat the separator and try again.

6. Remove front cover of mix tower exposing the syrup concentration controls.

7. Carefully adjust syrup concentrations by 1/5 to 1/6th of a turn.

8. Purge the syrup line after each adjustment to avoid faulty readings of mix ratio.

9. Continue adjusting each line until correct ratio is achieved.

Note: If your water has a lot of chlorine or chemicals in it, it may be coloring the taste of the soda. Recommend filtration. A simple cartridge filter will work for most applications.
### 7.1.2 Beer Tower

**Incorrect flow amount:**
To change beer dispense volume, proceed as follows:

1. Locate beige control box below beer tower.
2. Set “Learn Switch” to ON mode (LED lights).
3. Adjust each tap head by holding the button on each beer tap until the correct volume is dispensed at each tap.
4. Reteach until volumes are set correctly.
5. When finished, set the “Learn Switch” in the OFF position.
6. Test each tap to verify correct dispense volume.
7. Reteach as needed.

**Beer tap stuck open:**
Beer has probably entered the cylinder and fouled the operation of the piston. To fix this, clean and lubricate the piston as follows:

1. Remove circlip from tap head cylinder.
2. Remove cylinder from tap head.
3. Remove piston from tap head cylinder by turning power key to ON and pressing the #1 button. The CO₂ will blow out the piston.

4. Clean cylinder and piston and lubricate O-ring and cylinder (use Dow Corning #111 lubricant).
5. Replace Piston and re-install, reversing steps 1 through 3.
Draft Problems:
Draft problems are usually very simple and easily fixed when you understand the facts. Before you begin troubleshooting, Make sure of the following:

- Is the system balanced? This should not be a problem unless tubing lengths have been altered or tubing has been crushed or damaged. If tubing lengths have been altered, the system will need to be re-balanced. The pressure on the beer regulator gauge must be set equal to the pounds of resistance calculated in the formula below:

Calculate the regulator setting (gauge) pressure as follows:

\[
\text{Pressure} = \text{length of beer line} \times \text{Line Resistance} + \text{Lift} \times 0.5
\]

- length of beer line is its length in feet
- Line Resistance is given in the Line Resistance chart below
- Lift is the height in feet of the faucet above the keg connector or serving tank.

Example 1: faucet is 1 feet above the keg, line is 5 feet of 3/16 beer line. the total resistance is (5 ft * 3.0 lb/ft or 15 pounds) + (1 feet * 0.5 lb/ft or 0.5 pounds) = 15 pounds.

Answer: set regulator to 15 pounds.

Example 2: faucet is 5 feet above the keg, line is 15 feet of ¼ beer line. the total resistance is (15 ft * 0.85 lb/ft or 12.7 pounds) + (5 feet * 0.5 lb/ft or 2.5 pounds) = 15.2 pounds.

Answer: set regulator to 15 pounds.

Table 4  Line Resistance by beer line I.D.

<table>
<thead>
<tr>
<th>Line ID (inches)</th>
<th>Resistance (pounds)</th>
<th>Volumn/foot (ounces)</th>
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<tbody>
<tr>
<td>3/16&quot;</td>
<td>3.0</td>
<td>1/6</td>
</tr>
<tr>
<td>¼&quot;</td>
<td>0.85</td>
<td>1/3</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>0.20</td>
<td>3/4</td>
</tr>
<tr>
<td>½&quot;</td>
<td>0.025</td>
<td>1 1/3</td>
</tr>
</tbody>
</table>
• Is the beer keg internal temperature below 42°F?
• Is your regulator gauge pressure set at the proper pressure for the keg temperature?

| Table 5 Keg Temperature & Pressure Chart (for all 100% CO₂ Systems) |
|---------------------------------|---|---|---|---|---|---|
| **Keg Temperature (°F)**        | **35** | **36-37** | **38-39** | **40** | **41-42** | **43-44** |
| **Internal Keg Pressure (pounds)** | 10 | 11 | 12 | 13 | 14 | 15 |
| **Minimum Applied Pressure (pounds)** | 13 | 14 | 15 | 16 | 17 | 18 |
| **Maximum Pressure (pounds)** | 16 | 17 | 18 | 19 | 20 | 21 |

Cloudy beer:
Causes include:

• Over chilling of the beer keg or beer lines - Beer should be stored at 36°F to 40°F. Excessive low temperatures may cause hazy, cloudy beer, particularly when the beer is kept cold for a long time. Make sure the beer lines are thoroughly cleaned and then raise the temperature of the beer slightly.

• Faucet is damaged or dirty and will not open for full flow due to damaged or worn faucet coupling washer or shaft seals or contamination build up - Disassemble the faucet and check seals. Scour faucet internal metal parts until they are smooth and clean.

• Defective valves in keg coupler - Bacteria may grow as a result of dirty or defective check valves in coupler. Check and replace all vents and thoroughly clean lines. Replace if necessary.

• Yeast growth or other obstruction in the faucet - Clean faucet with a good brush daily. Scour all internal parts at least once a week.

Flat beer:
Causes of flat beer include:

• Not enough gas pressure - If the beer pressure is correct the tap should fill a 10 ounce glass in 4 seconds (approximately 2 ounces per second).
  — Verify gas pressures at “bleeder”. These values should be set at 110 psi CO₂ and 80 psi N₂.
  — Check gas source for obstructions in the pressure line.
  — Check for sluggish or defective regulator.
  — Always apply pressure to the keg before drawing beer.
• Gas is shut off - Turn on gas source and set to the proper psi.
• Pressure is low - Check for gas bottle pressure. When a barrel is tapped, pressure must be applied continuously from start to finish.
• Defective keg coupler - Check vent valves, check valves, line obstructions.
Off-tasting beer:
Causes of foul or sour beer include the following:

- Improper cleaning - Coils, faucets, keg connectors, hoses, rods, fittings, seals and check valves should all be cleaned once a week with approved cleaner.
- Dirty gas lines - Hoses and vents should be inspected and if contaminated, should be replaced.

Wild beer:
Wild beer is a beer that is all or mostly foam when it is drawn. Causes include:

- Yeast build up in faucet - Clean faucet daily with a good faucet brush. Scour all internal parts at least once a week and clean with BLC. Keep faucet cold to prevent yeast growth.
- Kinks, dents, twists in the beer line - Correct lay of beer line as necessary.
- Too much pressure - Pressure should be maintained such that the beer will fill a 10 ounce glass in 4 seconds. Check for proper regulator function.
- Not enough pressure - Check for defective air vents and restrictions caused by dents, kinks and contamination in the pressure line and valves. Always turn on the pressure before drawing beer.

### 7.2 Maintenance

**Table 6** Periodic Maintenance

<table>
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<tr>
<th>Frequency</th>
<th>Component</th>
<th>Procedure</th>
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<tbody>
<tr>
<td>Daily</td>
<td>Consumables</td>
<td>Check and restock consumables as needed.</td>
</tr>
<tr>
<td>Every three months or as needed</td>
<td>Coffee/Espresso Machine</td>
<td>Clean and descale according to vendor recommendations and instructions.</td>
</tr>
<tr>
<td>Monthly or as needed</td>
<td>Robobar Cell</td>
<td>Inspect gas and syrup hoses for leaks and kinks.</td>
</tr>
<tr>
<td>Monthly or as needed</td>
<td>Robobar Cell</td>
<td>Clean entire cell of dirt, and debris.</td>
</tr>
<tr>
<td>As needed</td>
<td>DA9IC Manipulator</td>
<td>Refer to Manipulator Manual</td>
</tr>
</tbody>
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7.2.1 Cleaning

7.2.1.1 Mix Tower (Soda and Juice)

Most public health codes require machines and syrup systems to be cleaned at regular intervals. Follow state and local health codes applicable in your area.

1. Wash out the ice bin.
2. Flush syrup lines and heads with a cleaning solution.
   a. Disconnect the bag in box connector from the end of the syrup line.
   b. Place hose into a bucket of cleaning solution.
   c. Vend until cleaning solution comes out of head.
   d. Let sit for three minutes, and rinse with clean water.
   e. Reconnect syrup.
3. If not using filtered water, clean Y-strainer on fountain pump head.
   a. Shut off incoming water.
   b. Loosen hex nut on inlet side of pump and remove the screen.
   c. Clean off any scaling or mold that has built up. It's a good idea to do this every few months, as a clogged strainer can starve the pump, resulting in cavitation and other permanent damage.

7.2.1.2 Beer Tower

Most states require beer line cleaning once a week. Some states require it twice a week. Dirty lines and faucets are breeding grounds for molds, bacteria, and beer stones which make for off-tasting, smelly, foamy draft beer.

When cleaning the faucet it is important to give special attention to the small hole on the underside of the spout. It is a great place for mold to grow in.

Commercial establishments should clean, or have their taps cleaned, every week to insure fresh clean beer for their customers and compliance with local and state regulations. Most states have laws governing the time allowed to go between cleaning.

7.2.1.3 Coffee/Espresso Machine

Remove and clean spent coffee grounds from internal dump box as required. Please refer to vendor manual and instruction video for more information.
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