



Epic Ladle Controls User Manual

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LADLE USER GUIDE

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Chapter 1

INTRODUCTION

This manual describes the installation, operation, and programming, of the Rimrock Ladle. Please read this user guide and the included product manual before installing or using the Ladle.

This chapter provides an overview of the Rimrock Ladle, including the following:

- Description
- Contact Information
- Replacement Parts
- Training

Description

When properly guarded and interlocked, the Rimrock Ladle is a safe, fast, and accurate automatic pouring system for the foundry industry. The Ladle improves the consistency and quality of castings, resulting in a product that is more marketable for the manufacturer.

This Ladle performs a sequence of functions in conjunction with the operations of a die cast machine, in order to fill, transport, and pour metal into dies as they are processed. The sequence of functions, or cycle, is programmed using Human Machine Interface (HMI). The EPIC control system is used to select the cycle to be implemented and to operate the ladle.

In order to gain access to the ladle controls, a personal identification number (PIN) might be required. PINs are established in the security system in the EPIC controls. Chapter 11, Security System, contains detailed information on how to access the security system and on how to assign security levels and PINS. As a security safeguard, Chapter 11 should be removed and stored in a secure location prior to distributing the User Guide to restricted personnel.

Features

Key attributes of the Ladle:

- Increased safety (when properly guarded and interlocked)
 - Might place furnace away from operator
- Reduced set-up time
 - Twenty memory areas for program storage
 - Autoteach function enables on-the-fly adjustments
- Reduced cycle time
 - Pour Forward enables forward movement while pouring
 - Minimized pot-to-shot times
- Reduced shot variation
 - Low metal warning alerts operator to fill the furnace before metal level is too low
 - Contour pouring and pour forward command eliminate spilling and dripping
- Easy maintenance and operation
 - Changeable to operator or helper side
 - User friendly EPIC Controls
 - Diagnostic displays
 - Interlock status display
 - Off-the-shelf controls
 - Proximity switches
 - Light fiberglass covers

These features will facilitate the production of consistent, high-quality castings, produce less scrap, and provide flexibility to better meet production and customer demands.

Components

The Rimrock Ladle consists of the following components:

- Mechanical Unit(Multi-Link or Dual Arm) (Figure 1-1)
- EPIC Controls (Figure 1-2)

Mechanical Unit

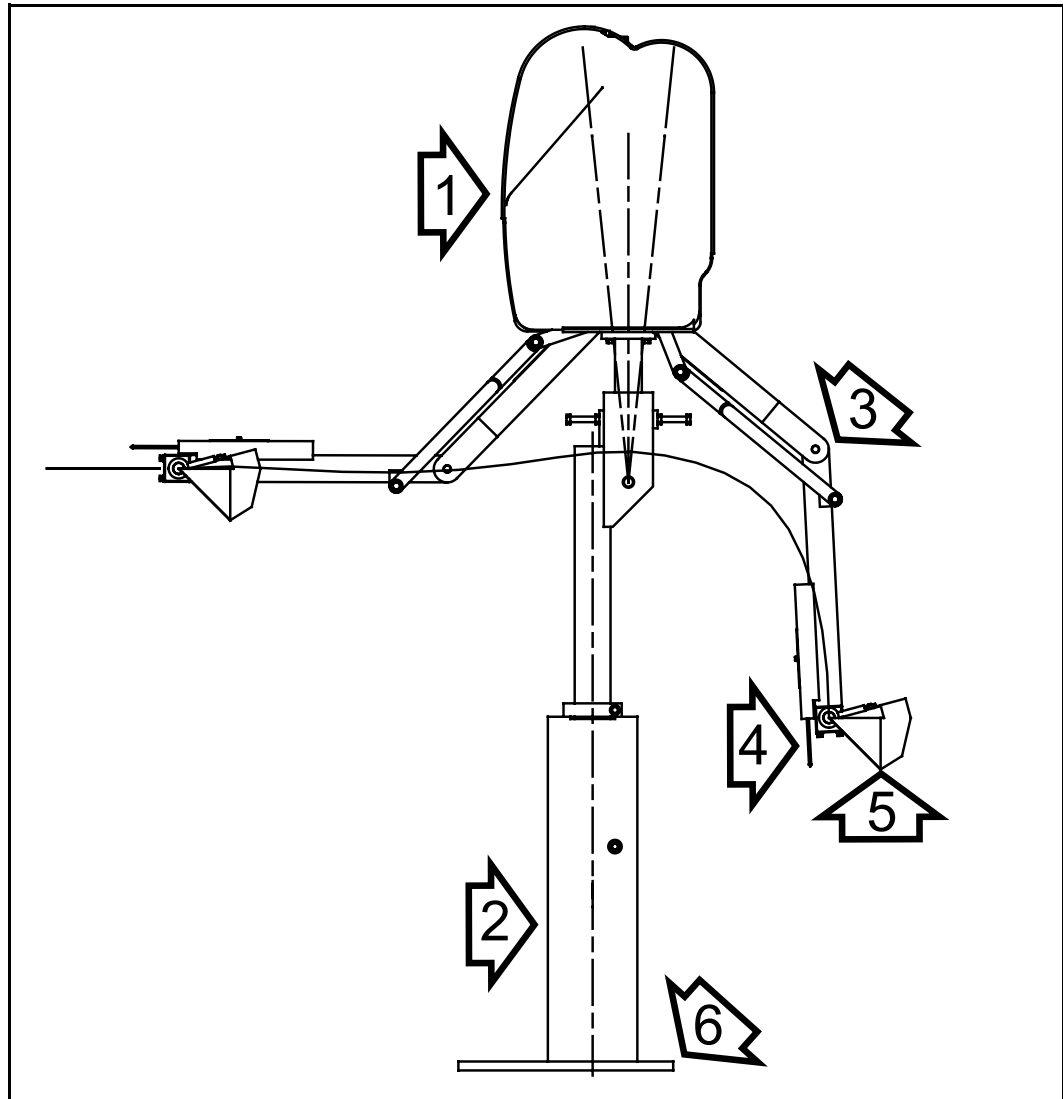


Figure 1-1: Multi-Link Mechanical Unit

The mechanical unit moves the dipper into position to fill, transport, and pour metal. It consists of the following parts:

Item #	Control
1	Ladle Body
2	Pedestal
3	Arm

Item #	Control
4	Sensor Probe
5	Dipper
6	Base Plate

EPIC Controls

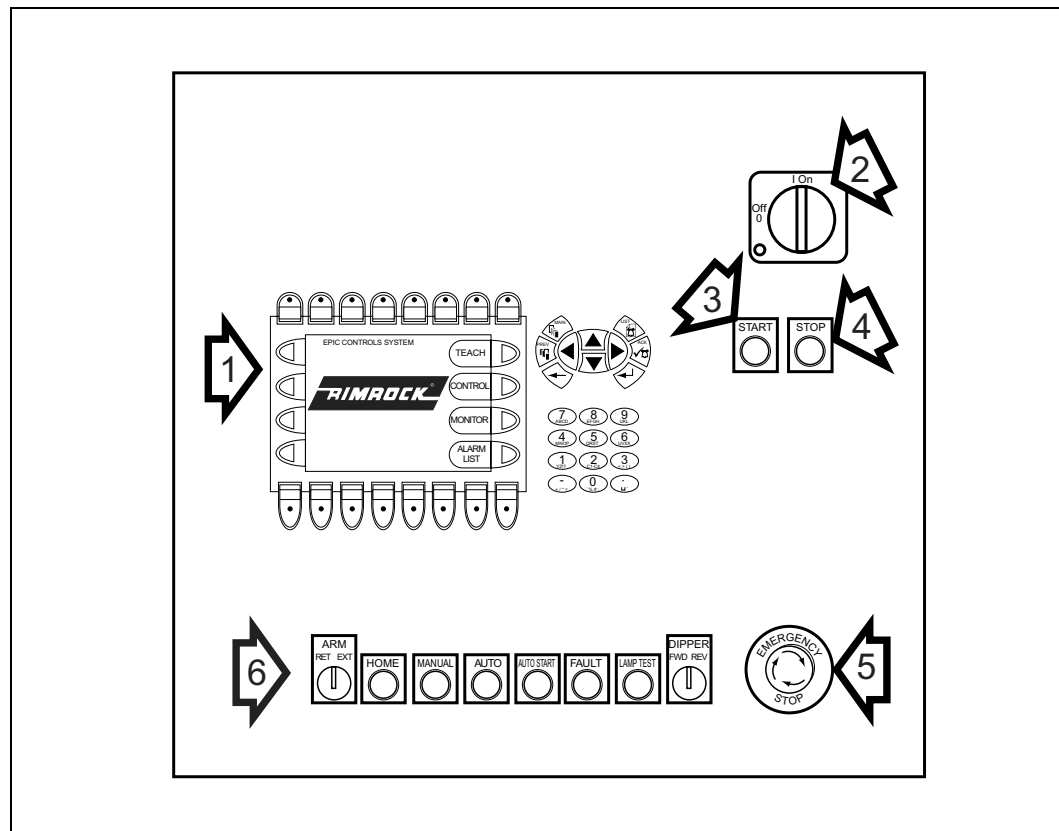


Figure 1-2: EPIC Controls

The EPIC controls enable the user to start, stop, maneuver, program, and troubleshoot the Ladle. The standard control box consists of the following parts:

Item #	Control
1	Human Machine Interface (HMI) Panel
2	Power Control Switch
3	Start Push-button

Item #	Control
4	Stop Push-button
5	Emergency Stop Switch
6	Push-button Panel

Options allow the push-buttons and HMI to be away from the main control enclosure

Contact Information

Rimrock's normal business hours are Monday through Friday 8:00 a.m. to 5:00 p.m. Eastern Standard Time. Contact Rimrock at:

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Rimrock provides:

- Automation Equipment
- Spray Equipment
- Replacement Parts
- Technical Assistance
- Training
- Field Service and Repair
- Preventive Maintenance

Automation Equipment

Rimrock provides a wide range of automated equipment designed to reduce industry costs, improve product quality, and keep pace with changing production and customer demands. For more information on automated equipment available from Rimrock, contact the Rimrock sales department.

Technical Assistance

Rimrock representatives provide start-up assistance for installation and operation of automated equipment. Chapter 3, Installation, details the preliminary steps and procedures required for scheduling start-up assistance with Rimrock. Further technical assistance is available on the Rimrock website, www.rimrockcorp.com, including information on preventive maintenance and technical tips. For more information on technical assistance, contact the Rimrock service department.

Replacement Parts

To order parts, contact the Rimrock sales department at (614) 471-5926.

Serial Number Identification

Knowing the serial number or C# is helpful when ordering replacement parts. This number is located on the machine name plate attached to the side plate of the ladle and on the control panel (Figure 1-3).

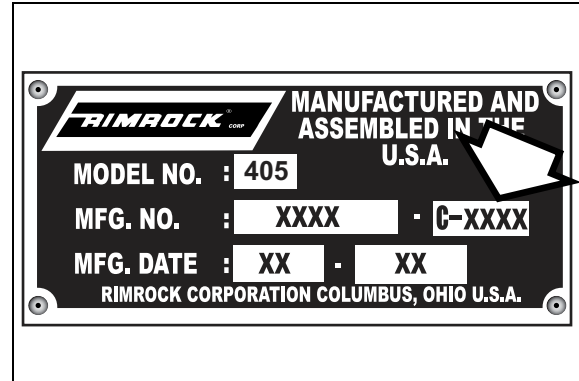


Figure 1-3: Name Plate on machine

Training

Rimrock provides several opportunities for training:

- Classroom training at its facility in Columbus, Ohio
- Training at the customer's facility
- Training videos

Contact the Rimrock training department for more information on training.

Chapter 2

SAFETY

Introduction

Like any type of equipment, the Rimrock Ladle, if not properly used, can be a hazard to people or other machines.

Safety in the plant begins with training personnel to properly operate and maintain equipment. They must understand how the equipment functions in order to operate it safely. While the owner of the Rimrock equipment is responsible for all aspects of safety, Rimrock can help by providing equipment training. See “Training” on page 1-6.



IMPORTANT!

This manual is intended for use by persons having electrical and mechanical training and a level of knowledge of these subjects that is generally considered acceptable in the foundry industry. Rimrock cannot be responsible nor assume any liability for injury or damage of any kind arising from the use of information in this manual.

Safety Alert Symbols

Throughout this manual there are safety alert symbols. Wherever they appear in this manual, the user should be alert to potential for personal injury or accidents. Always observe safety precautions and follow recommended procedures.



SAFETY ALERT SYMBOL



The words “**CAUTION**”, “**WARNING**”, and “**DANGER**” are used throughout this manual to indicate hazards or unsafe practices. Observe the precautions indicated whenever the safety alert triangle is displayed, regardless of which word appears next to the symbol.



CAUTION!

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury. It may also be used to alert against a generally unsafe practice.

 WARNING!
Indicates a hazardous situation that, if not avoided, could result in serious injury or death. It may also be used to alert against a highly unsafe practice.
 DANGER!
Indicates a hazardous situation that, if not avoided, is very likely to cause death or extremely serious injury.
 IMPORTANT!
Indicates an action that could result in damage to the equipment.

Safety Standards

Many codes and standards have been initiated to maintain safety while installing, operating, and maintaining automation equipment. Follow all applicable federal, state, and local regulations at all times. Listed below are some of the most commonly applied standards for automation equipment in die casting. This is not intended to be an all-inclusive list of machine standards information.

- ANSI B152.1 Safety requirements for the design, manufacture, maintenance, and operation of die casting machines
- NFPA 79 Electrical standard for industrial machinery
- ANSI B11.19 Safeguarding when referenced by the other B11 machine tool safety standards; performance criteria for the design, construction, care, and operation
- ANSI B11.20 Safety requirements for construction, care, and use of manufacturing systems/cells
- ANSI/RIA R15.06 Industrial robots and robot system safety requirements
- ANSI Z535 Series Safety color code; environmental facility safety symbols; product safety signs and labels; and accident prevention tags
- NFPA 70 National Electric Code

For additional safety information specific to the Die Casting industry, see the NADCA Die Casting Safety Manual E-908. A copy of this manual is included with the printed materials shipped with the ladle.

General Safety Tips

Machine owners, operators, maintenance personnel, and service personnel must know that safety practices are a vital part of the job. A safety program should be implemented in the plant and should include, but not be limited to:

- Personal protection equipment
- Clean work areas
- Work areas that are free of potential hazards
- Warning labels, signs, and equipment covers
- Guards around equipment
- Proper training
- Equipment maintenance
- Lockout/tagout procedures

Safety During Maintenance or Repair

Whenever maintenance or repair is performed on the ladle, all equipment in the work cell must be in a zero energy state and proper lockout/tagout procedures must be performed.



DANGER!

Tasks related to the ladle can involve working near the furnace and shot end of the die cast machine. This is extremely dangerous. The user must put the ladle and die cast machine in zero energy states and follow lockout/tagout procedures on the die cast machine and other equipment in the work cell. The furnace should be covered.

Follow the instructions from the manufacturer of the die cast machine to put all areas of the die cast machine and other related or connected equipment in a zero energy state.

Zero Energy State

When putting equipment in a zero energy state, the user may encounter the following energy sources:

- Electrical power
- Pressurized air
- Hydraulics
- Hydraulic accumulators that store energy even when the electrical power is off
- Hot surfaces
- Molten metal
- Components that can fall
- Other potential hazards not listed



CAUTION!

When users put equipment in a zero energy state, they must remember that heat is a form of energy too. Dissipate any heat before working on hot surfaces.

Lockout/Tagout Procedures

Follow these steps before performing any maintenance or repair work on the equipment:

1. Shut down the equipment
2. Isolate the equipment from the energy source
3. Release residual energy
4. Apply a lockout/tagout device to the energy-isolating device
5. Verify the isolation of the equipment

There are two types of energy-isolating devices—those that can be locked and those that cannot be locked. If the energy-isolating device cannot be locked with a lockout device, apply a tagout device. In order for the tagout to be effective, the employees should be trained to follow these limitations of tags:

- Tags are warning devices only and do not supply physical restraint
- Tags are not to be removed except by the person who applied them
- Tags are never to be ignored or bypassed
- Tags must be legible
- Tags must be made of materials able to withstand the environmental conditions
- Tags must be attached securely to the energy-isolating device

Additional safety measures may be taken when tagout is used, including:

- Removing and isolating a circuit element
- Blocking a control switch
- Opening a disconnecting device
- Removing a valve handle

Lockout/Tagout Steps

To lockout or tagout the energy-isolating device, disconnect the source of energy and follow the lockout/tagout procedures implemented by the plant. Typically, to lockout or tagout the equipment, the user must:

1. Disconnect the power
2. Put a lock with a lockout tag or a tagout tag (see Figure 2-1 and Figure 2-2) through the door to the source of the power

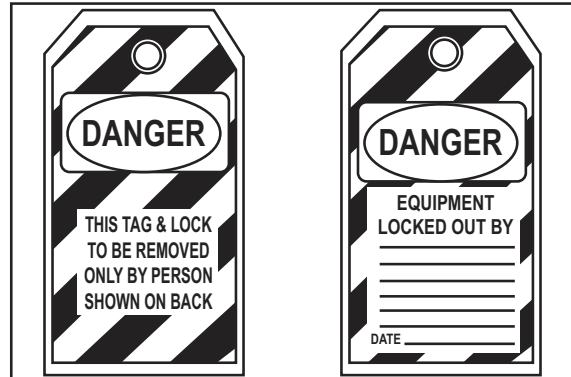


Figure 2-1: Lockout Tag

3. Record on the tag the name of the person working on the equipment



Figure 2-2: Equipment Lockout

Note: The person working on the equipment should be the only person having a key to unlock the equipment. This procedure ensures that another person cannot restore energy to the equipment while someone is working on it.

Lockout/Tagout Removal

To remove the lockout or tagout devices and restore energy to the equipment, follow these steps:

1. Inspect the equipment to verify that all components are intact and operable
2. Inspect the work area to ensure all tools, non-essential parts, and other unnecessary items are removed
3. Check that all personnel are safely removed from the work area
4. Remove the lockout or tagout device from the energy-isolating device



CAUTION!

The lockout or tagout device must be removed only by the person who applied it.

5. Before starting the equipment, notify appropriate personnel that the lockout/tagout has ended

Special Considerations

Special circumstances may exist when lockout/tagout procedures are used while working on the equipment.

Testing or Positioning

If testing or positioning of the equipment requires reenergization of the equipment, OSHA allows temporary removal of locks or tags. Follow these steps to reenergize the equipment:

1. Inspect the work area to ensure all tools, non-essential parts, and other unnecessary items are removed
2. Check that all personnel are safely removed from the work area
3. Remove the lockout or tagout device from the energy-isolating device
4. Energize the equipment
5. Test or position the equipment
6. Deenergize the equipment and reapply the lockout/tagout devices

Outside Personnel

If outside personnel are working in the plant, both the inside plant personnel and the outside personnel must inform each other of their lockout/tagout procedures.

Group Lockout or Tagout

Each plant must be responsible for determining the lockout/tagout procedures to be used when the equipment is worked on by more than one person.

Changes in Shift

When shift changes occur during lockout/tagout, if the person who controls lockout/tagout cannot remain, the oncoming shift personnel must verify that the deenergization and lockout/tagout.

Personal Protective Equipment

Ladle operators should always use the personal protective equipment required by their plants. Safety equipment includes, but is not limited to:

- Safety glasses with side shields
- Steel-toed shoes
- Ear plugs
- Gloves
- Respirators

Arm Safeguard

The arm of the ladle can fall, causing personal injury and equipment damage. Safeguard the arm when performing repairs or maintenance on ladles. This can be accomplished by placing a chain or strap on the ladle arm and securing it with a crane or to an I-Beam for support.



WARNING!

Mechanical parts that can fall (such as the ladle arm) should be brought to a safe and secure position during maintenance and repair.

Safety Barrier

A safety barrier around the ladle portion of the work cell must be in place. The safety barrier must be equipped with interlocking devices connected to the External Safeties interlock to stop ladle movement if the safety barrier is violated.

Path of the Ladle

Do not work in the path of the ladle. A barrier must be present to keep people out of the path of the ladle when the ladle is moving. The unit must be locked out before performing work in the path of the ladle.

Risk Assessment

Since Rimrock ladles are installed in many plants for different applications in different environments, each plant must perform its own risk assessment. Determine the safety precautions that must be applied in each individual plant and insist that all employees follow these precautions.

Operator Safety

Ladle operators should implement the following safety procedures prior to initiating a ladle cycle:

- Pre-heat the dipper before initially submerging it in the metal (especially ceramic or cast iron dippers).
- Be aware of how any ladle adjustments will affect ladle operation including:
 - quantity of metal
 - metal fill point
 - metal pour point
 - speed settings
- Do not allow the dipper to remain submerged in the metal for extended periods of time.

Maintenance and Repair Safety

Properly cover the furnace opening when working on the dipper or any part of the ladle. Do not stand on the furnace cover when working on the ladle. For major mechanical work, the ladle should be removed from the area.

Chapter 3

INSTALLATION

Introduction

This chapter contains general information for successfully installing the Rimrock Ladle. Since each application depends upon the user's die cast machine setup, this chapter does not contain specific instructions for all possible installations. Work with the die cast machine manufacturer and Rimrock to determine the best way to install the ladle for particular configurations.

Please read this chapter thoroughly before starting installation procedures.

Safety Precautions During Installation



CAUTION!

Read this entire user guide before installing the Rimrock Ladle. Pay special attention to the information on safety provided in Chapter 2.

Follow these precautions when installing the ladle:

- Heed all previously listed safety precautions
- Wear appropriate personal protective equipment such as safety glasses, ear plugs, safety harnesses, hard hat, and gloves
- Follow lockout/tagout procedures
- Be sure the personnel involved in the installation have read and understand this manual
- Consult the die cast machine manufacturer before making any changes to circuits
- Follow in-plant safety rules

Document Packing List

The Ladle and this User Manual should also include:

- Machine Product Manual
- NADCA Safety Manual (included in the User Guide)

Utility Requirements

The standard Epic controlled Ladle uses a power supply of:

- 3 kVA
- 115 VAC $\pm 5\%$

Ambient Temperature Considerations

A die cast plant has many sources of heat. The Control box should not be mounted in areas that exceed 120°F or exposed to direct radiated heat.

Consider pointing the heat sinks away from heat sources, air movement within the plant, and install heat shields to protect the controls.

Performing Preliminary Steps

Perform these steps to prepare for the installation of the ladle:

1. Make sure there is an adequate supply of electrical power and that the present electrical system can handle the load. This is especially important if the ladle will be installed in an older building.
2. Confirm with the die cast machine manufacturer that the proper interlock connections, logic changes, and wiring changes to work with the die cast machine have been determined.
3. Read the Machine Product Manual, and perform any Pre-Installation tasks that are outlined in the Installation section of that manual. This includes safe unpacking, handling and transportation of the machine.

Considerations to Reduce Cycle Time

To reduce cycle time, address the following issues prior to placing, positioning, and adjusting the Ladle.

- Position of the furnace in relation to the DCM—Positioning the ladle closer to the DCM allows it to reach the cold chamber faster.
- Determine if the metal can be poured out faster—By changing the angle of the ladle path in relation to the cold chamber, the metal can be poured out of the dipper at a faster rate. Away from the DCM and furnace, experiment with a water-filled dipper and a cold chamber, using different ladle path angles.
- Maximize pour hole size—The dipper can use a faster pour speed if the pour hole is bigger.

Installing The Control Enclosure

The EPIC Controller is usually mounted within a 30x24 enclosure. The enclosure may or may not have operator controls mounted on it. The enclosure will have a disconnect handle mounted on the door, heat sinks along the side, and machine connector below the heat sinks.

1. Choose a mounting location away from heat sources, yet within the range of the necessary machine cables and conducts. Consider the safety of those who may need to walk on the enclosure. The disconnect switch and door should be operable within your codes and safety practices. If the enclosure has operator controls, then consider the view the operator will have when at these controls.
2. The mounting of the enclosure can be done using the four pre-installed holes in the back. The enclosure may be attached to a wall, stand, or column either by directly bolting to them or through the use of channel. Do not weld on this cabinet.
3. Holes must be cut into the box for conduct connections. Rimrock recommends the use of knockout devices which minimize metal shavings within the cabinet. Use extreme care to avoid getting metal shavings on the electrical components. Metal shavings are a significant shock hazard and are very destructive.

Installing the Operator Interface

When mounting the station interface, consider the height of the operator of the equipment. Ideally, the operator should be able to see the ladle when using the controls. When mounting the operator interface, consider radiated heat sources. Do not mount the control box in an area where the operator could be injured or the control box could be damaged.



WARNING!

Do not mount the control box in an area that is not safe for the operator.

Remote HMI Installation

Many EPIC controllers are optionally equipped with remote operator panels or HMIs.

Connections to remote panels is normally made via a flexible conduct cable supplied by Rimrock. This cable is comprised of wires each marked with a number. The installer must punch the appropriate hole for this cable and terminate the wires to the appropriate terminals on the remote and in the control enclosure. Mounting of the remote box is easily done with the four pre-drilled holes in the back of the remote. Care must be taken to ensure no metal shavings are left within the remote or the enclosure.

Connecting the Electrical Power

Rimrock recommends using machine tool transformers for their ladles, rather than general purpose transformers. When turning on the equipment, the current draw peaks for a short period of time and then falls back to normal. This is called inrush. On a general purpose transformer, when the current draw peaks, the voltage drops. A machine tool transformer is constructed to withstand periods of inrush and maintain good voltage regulation on the output of the transformer.



IMPORTANT!

Voltage drops can damage electronic equipment.

Follow these steps to determine the size of machine tool transformer needed:

1. Look up the volt-ampere (VA) requirements in the operating manuals for each machine type.
2. Sum the VA for all the types of machines in the system.
3. Choose a machine tool transformer that can handle the total load of all of the machine types.

Connecting the Transformer and Grounding

Refer to the guidelines found in the current version of the National Electric Code.

It is highly recommended that the neutral and ground be bonded together to the ground bus.

See “Mechanical Drawings” in chapter 15 for proper connection of power to the EPIC Controller. Usually power is connected directly to the top terminals of the disconnected switch.

Connecting the Interlocks

Interlocks interface the ladle with the die cast machine as follows:

- Safety Circuit
 - External stop input - For connection to cell E-stop device.
 - Customer safeties input - For connection to guards
 - E-stop outputs - To signal other equipment that the ladle is E-stopped
- Inputs to the ladle
 - Ladle start - Initiates the cycle in auto mode. Usually connected to die start open contact
 - OK to pour 1 - Allows the ladle to pour into the shot hole. Usually connected to a plunger retracted contact
 - OK to pour 2 - Allows the ladle to pour into the shot hole. Usually connected to a die locked contact
 - Ladle start 2, 3, 4 (optional)- Initiates the cycle in auto mode when using memory area input options. See “Programming” on page 7-4.
- Outputs to DMC
 - Ladle in auto mode - Indicates ladle is in auto
 - Pour complete - Indicates the ladle has finished pouring metal into the shot hole
 - Ladle faulted - Indicates the ladle is faulted
 - Ladle at ready to pour position - Indicates the ladle is at the shot hole
 - Ladle low metal alarm - Indicates the ladle is dipping close to the bottom of the furnace

It is the user’s responsibility to finalize the interlock connections and logic changes required. The die cast machine manufacturer should be contacted to determine where and how input and output signals will be generated. This is especially important if the DCM has never been equipped with an automatic ladle.

General Interlock Connection Guidelines

Do not cross power from the ladle with die cast machine (Figure 3-4). It is important to not cross power because:

- An electrical shock hazard exists if another source of electrical power is connected incorrectly to the Rimrock control system. An improperly connected system allows electrical power to be present on conductors that would not normally be energized when the main disconnect of the Rimrock control is in the off position.
- Transformers can be connected to different phases of the primary voltage supply. A large potential voltage difference between the two machines may exist if they are incorrectly connected.
- AC power could be introduced onto a DC circuit.
- Any noise on the AC line of the die cast machine will be transferred to the Rimrock control system.



IMPORTANT!

Crossing power from the ladle with the DCM can cause an electrical shock hazard.

Use dry contacts to interface the Rimrock control system with other control systems. Dry contacts allow machines to transfer signals while remaining electrically isolated from each other. Dry contacts are usually taken from mechanical relays specifically installed for this purpose. Connect the:

- Inputs to the Rimrock control system through dry contacts powered from the Rimrock control system.
- Outputs from the Rimrock control system (inputs to the DCM) to the appropriate control power and input lines from the die cast machine to the dry contracts provided by the Rimrock control system.

To check for crossed power, visually verify that isolation relays that use dry contacts are installed.

Figure 3-4 shows a properly isolated system and two incorrectly connected systems. In the properly connected system, isolation relays are installed in the die cast machine to provide dry contacts for the Rimrock control system. No electrical connections exist between the two machines.

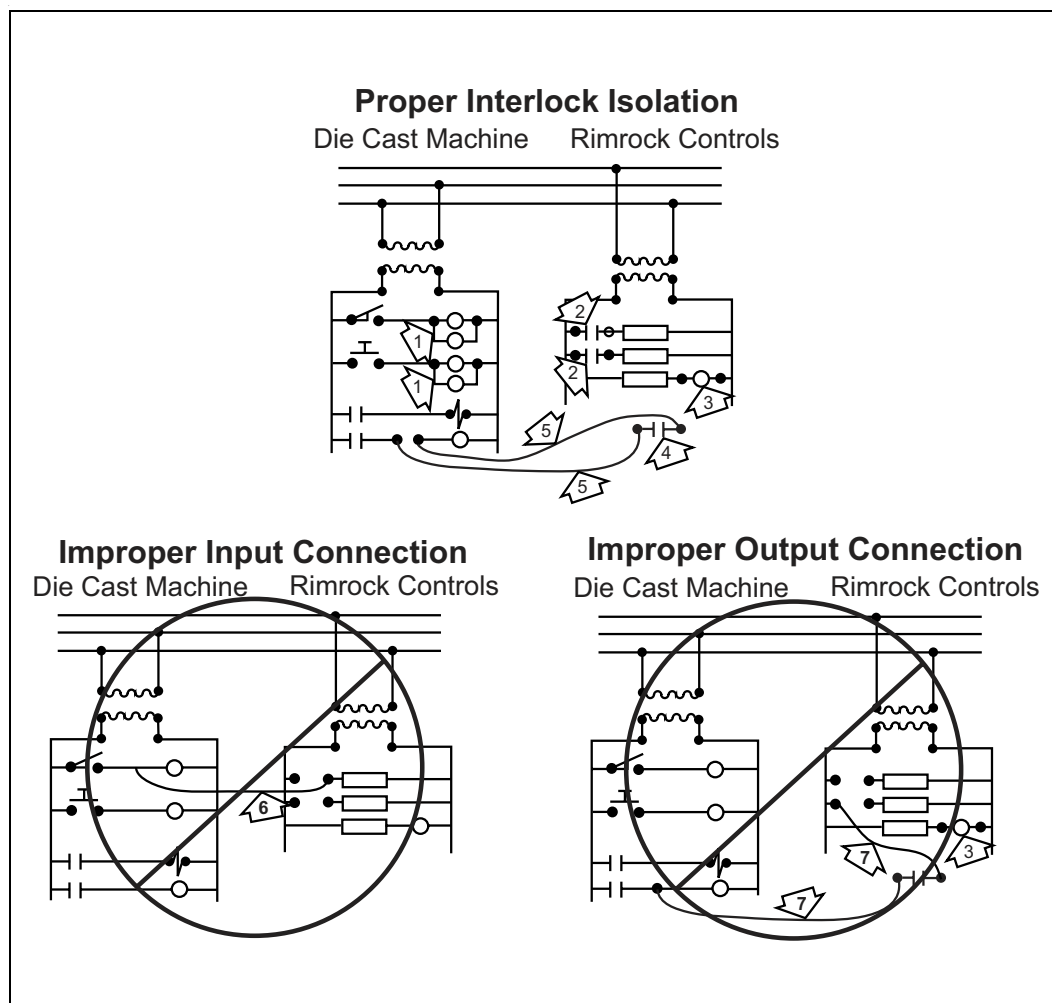


Figure 3-4: Connecting the Interlocks

Item #	Control
1	Isolation relays installed in die cast machine
2	Dry contacts from isolation relays installed in die cast machine
3	Isolation relay (provided by Rimrock)
4	Contact from isolation relay (provided by Rimrock)

Item #	Control
5	Interlock connection wires
6	Improper input connection
7	Improper output connection

In the first incorrectly connected system, a signal is taken directly from a limit switch powered by the die cast machine and is used to power an input on the Rimrock control system.

In the second incorrectly connected system, power from the Rimrock control system is connected to a dry contact in the Rimrock control system and is connected directly to a relay in the die cast machine.

Chapter 4

PUSH-BUTTON OPERATION

Introduction

The EPIC controlled Rimrock Ladle is equipped with push-buttons for easy operation control. These push-buttons are mounted either directly on the control enclosure or on a remote panel. Most push-buttons are duplicated on the HMI as a backup or alternate station. The push-button contains enough functionality to get the into production, but does not provide any teach functions.

If you are installing the please familiarize yourself with this section. It will be necessary to move the in order to setup the ladle for operation. The ladle may move slowly at first, but as settings are made, the operations will become more efficient.

Push-button Controls

The manual push-button controls (Figure 4-1) power up, power down, stop, move, and change the operating modes of the Ladle.

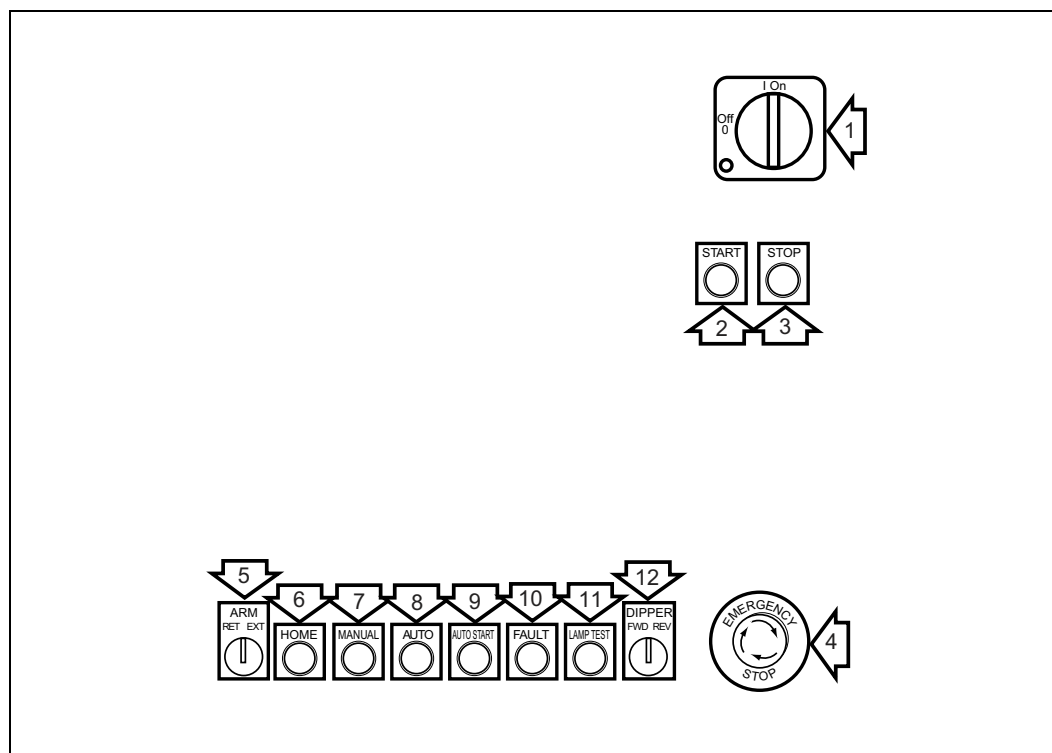


Figure 4-1: Manual Controls

Item #	Manual Control	Function
1	OFF/ON Switch	Applies main power to the control box
2	START Lighted Push-button	Enables the motor and output power
3	STOP Push-button	Disables the motor and output power
4	EMERGENCY STOP (E-Stop) Maintained Push-button	Stops the Ladle. Contacts from this switch can be used to stop other equipment
5	ARM RET/EXT Switch	Retracts or extends the ladle arm
6	HOME Lighted Push-button	Centers the arm and the dipper. To Home the Ladle, this push-button must be held in until both the arm and the dipper are fully retracted and the push-button is continuously lit.
7	MANUAL Lighted Push-button	Places the ladle controls in manual mode
8	AUTO Lighted Push-button	Places the ladle controls in automatic mode
9	AUTO START Push-button	Begins an automatic cycle of the ladle
10	FAULT Lighted Push-button	Acknowledges faults found in the system and resets the ladle
11	LAMP TEST Push-button	Tests all push-button lamps to verify they are functional
12	DIPPER FWD/REV Switch (optional)	Rotates the dipper forward to pour or reverse to fill

Push-button Operation on the EPIC Control System

The push-button operation on the EPIC Control System can be used to operate the Ladle. This system is for easy operator controls.

Starting the Ladle with the Push Buttons

1. Verify that all people and objects are clear from the die cast cell.
2. Pull out the Emergency Stop (E-stop) button (Figure 4-2).

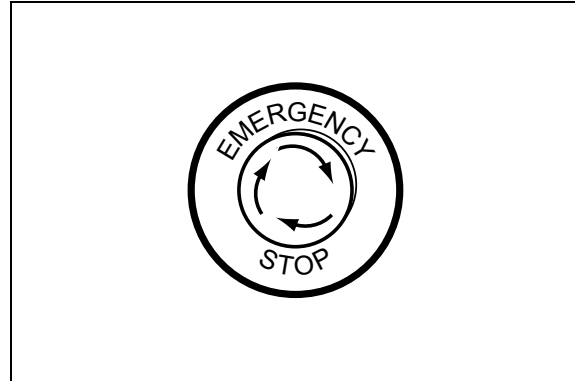


Figure 4-2: Emergency Stop Button

3. Turn the control switch to the "on" position (Figure 4-3). The control box door must be completely closed. The unit begins to power up. Powering up takes approximately 45 seconds. The following error message appears in the upper-left corner of the graphics display window: "Com Err Stn 1." This message will disappear when the controller has finished powering up.

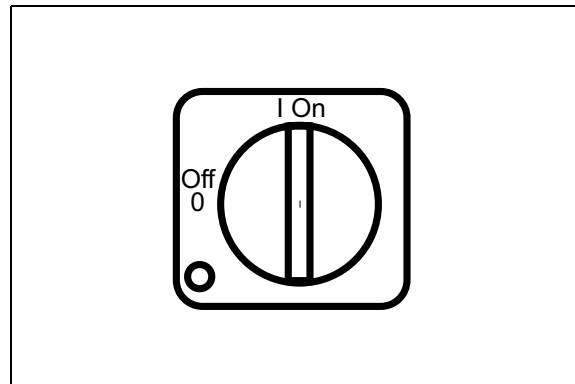


Figure 4-3: Control Switch

4. Press the LAMP TEST push-button (Figure 4-4). All push-buttons will light to verify that all lamps are functioning. If a push-button fails to light, the bulb might need to be replaced, the wiring to the light checked, or the LAMP TEST button needs to be repaired.

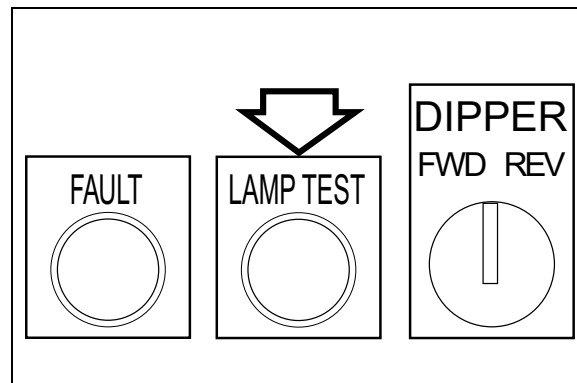


Figure 4-4: Lamp Test Push-button

5. Press the START push-button (Figure 4-5). The START push-button lights indicating that all safeties and power are ready. If it fails to light, then check:
 - a. All E-stops and safeties are made
 - b. Verify lamp with the lamp test push-button
 - c. Check that incoming power is on
 - d. Check for blown fuse in cabinet.

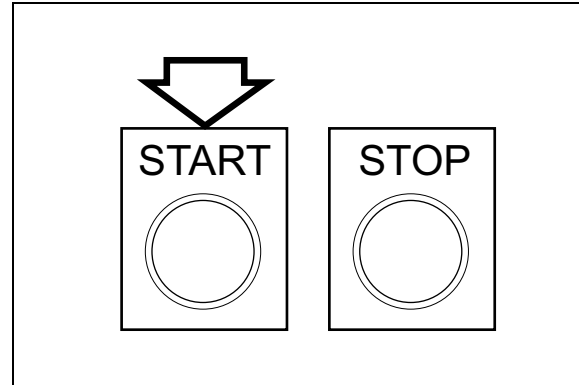


Figure 4-5: Start Push-button

6. Press the MANUAL push-button (Figure 4-6). The MANUAL push-button lights indicating that the machine is ready for manual operation.

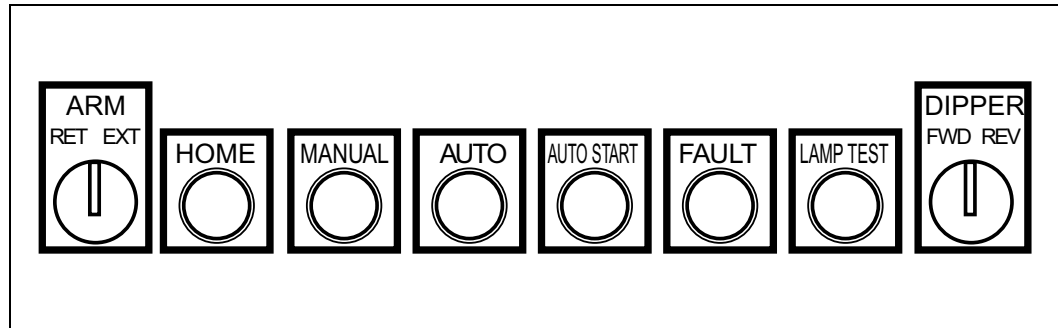


Figure 4-6: Manual Push-buttons

If it fails to light, then check:

- a. Start light is on
 - b. Verify lamp with the lamp test push-button
 - c. Check for blown fuse in cabinet
 - d. Make sure no faults exist
7. Press and hold the HOME push-button (Figure 4-6) until the arm and dipper are centered (at the Home position) and the HOME push-button is lit. This sets the center position for the ladle arm and dipper.
 8. You may now move the arm and dipper manually using the selector switches or, if you have setup the ladle and a program for the die, you may enter and start an auto cycle.

Chapter 5

INITIAL SETUP

Verifying Arm Chain Position

The user must verify that the arm chains are correctly positioned before leveling the dipper as follows:

1. Power up and home the ladle by hitting the home button (Figure 5-1). This will align the arm with the pedestal and position the dipper chains for adjustment.

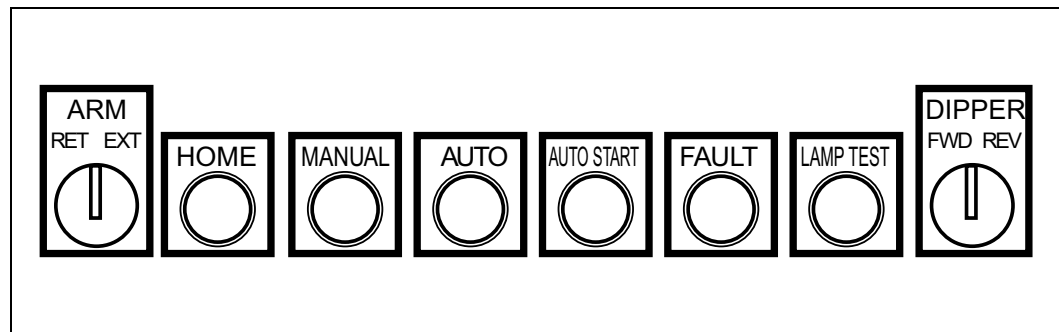


Figure 5-1: Manual Push-button

2. Power down and lockout the ladle
3. Remove the cover plates to view the upper and lower turnbuckles. The turnbuckles should be centered in the inspection windows. (If they are not centered, make the adjustments to the chain positioning. See Chapter 9, Troubleshooting).

Verifying Dipper Size

The user must verify that the dipper size is correct for the required shot weight. Use the following Fill Angle Chart (Table 5-1) to determine size requirements.

Table 5-1: Fill Angle Chart

Fill Angle	Dipper Size											
	2 lb	4 lb	6 lb	8 lb	10 lb	12 lb	16 lb	20 lb	25 lb	30 lb	40 lb	50 lb
	Shot Weights (lb)											
165.0	*	*	*	*	*	*	*	*	*	*	*	*
164.0	*	*	*	*	*	*	*	*	*	*	*	*
163.0	*	*	*	*	*	*	*	*	*	*	*	*
162.0	*	*	*	*	*	*	*	*	*	*	*	*
161.0	*	*	*	*	*	*	*	*	*	*	*	*
160.0	*	*	*	*	*	*	*	*	*	*	*	*
159.0	*	*	*	*	*	*	*	*	*	*	*	51.5
158.0	*	*	*	*	*	*	*	*	*	*	41.4	50.6
157.0	*	*	*	*	*	*	14.3	20.0	*	29.0	40.6	49.8
156.0	*	*	5.5	*	9.8	*	14.0	19.6	22.5	28.5	39.9	48.9
155.0	*	*	5.4	7.1	9.6	*	13.7	19.2	22.1	27.9	39.2	48.1
154.0	*	*	5.3	6.9	9.4	11.2	13.4	18.8	21.7	27.4	38.4	47.2
153.0	*	3.8	5.2	6.8	9.3	10.9	13.1	18.4	21.3	26.8	37.7	46.4
152.0	*	3.7	5.1	6.7	9.1	10.7	12.8	18.0	20.9	26.3	37.0	45.6
151.0	2.9	3.6	5.0	6.5	8.9	10.4	12.5	17.6	20.4	25.7	36.3	44.8
150.0	2.9	3.6	4.8	6.4	8.8	10.2	12.2	17.3	20.0	25.2	35.6	44.0
149.0	2.8	3.5	4.7	6.3	8.6	9.9	12.0	16.9	19.6	24.7	34.9	43.2
148.0	2.7	3.4	4.6	6.2	8.4	9.7	11.7	16.5	19.2	24.1	34.2	42.4
147.0	2.7	3.3	4.5	6.0	8.3	9.4	11.4	16.1	18.8	23.6	33.5	41.6
146.0	2.6	3.2	4.4	5.9	8.1	9.2	11.1	15.8	18.5	23.1	32.8	40.8
145.0	2.5	3.2	4.3	5.8	7.9	8.9	10.9	15.4	18.1	22.6	32.1	40.0
144.0	2.4	3.1	4.2	5.6	7.8	8.7	10.6	15.0	17.7	22.1	31.4	39.3
143.0	2.4	3.0	4.1	5.5	7.6	8.5	10.3	14.7	17.3	21.6	30.8	38.6
142.0	2.3	2.9	4.0	5.4	7.4	8.2	10.1	14.3	16.9	21.1	30.1	37.8
141.0	2.2	2.9	3.8	5.3	7.2	8.0	9.8	14.0	16.5	20.6	29.4	37.1
140.0	2.2	2.8	3.7	5.1	7.1	7.8	9.5	13.6	16.1	20.1	28.8	36.3
139.0	2.1	2.7	3.6	5.0	6.9	7.5	9.3	13.2	15.7	19.6	28.1	35.6
138.0	2.0	2.6	3.5	4.9	6.7	7.3	9.0	12.9	15.4	19.1	27.4	34.8
137.0	2.0	2.5	3.4	4.7	6.5	7.1	8.7	12.5	15.0	18.5	26.8	34.1
136.0	2.0	2.5	3.3	4.6	6.4	6.8	8.4	12.1	14.6	18.0	26.1	33.3
135.0	2.0	2.4	3.2	4.5	6.2	6.6	8.2	11.8	14.2	17.5	25.4	32.5

Leveling the Dipper

The proper alignment of the dipper is for its top edge to be at a 15 degree angle in relation to the floor when in the level position. The front of the dipper and the bottom of the fill window are level with each other in this position.

1. Power up and home the ladle by hitting the home button (Figure 5-1). Do not move the dipper again until this procedure is done.
2. Power down and lockout the ladle.
3. Mount the dipper on the pour shaft and tighten the locking collar just enough for friction to hold it in place.
4. Insert a straight edge through the fill window and across the front lip of the dipper cup.
5. Place a small line level on the straight edge.
6. Rotate the locking collar on the pour shaft until the line level shows that the dipper is level.

Tighten the locking collar to hold the dipper in the level position.

Ladle Adjustments

Use the following adjustments to configure the ladle for different manufacturing situations. These adjustments will change the path of the dipper as it moves into the dip well.

1. Make height adjustments so that the dipper pours at the proper height in relation to the shot sleeve. The height is adjusted by the jack located on the mounting post.
2. Tilt adjustments can also be used to align the ladle with the shot sleeve and dip well height. Use the two tilt adjustment screws on the pedestal. Tilt the ladle backward to make the path more vertical.
3. If additional adjustments are necessary, the ladle body may be moved backward or forward in relation to the pedestal.



CAUTION!

When positioning the ladle body over the pedestal base, keep the largest portion of the body over the offset portion of the base plate. This positioning will keep the center of gravity over the large area of the base plate. Improper positioning can cause machine damage or personal injury.

4. After the ladle height has been properly adjusted:
 - Tighten both outer tube clamp bolts
 - Tighten the lower outer tube securing bolt
 - Lower the pedestal post clamp to its lowest position (against the outer base tube) and tighten

Ladle Adjustments

The following adjustments are used to configure the ladle for different manufacturing situations. These adjustments will change the path of the dipper as it moves into the dip well.



IMPORTANT!

Familiarize yourself with these adjustments prior to using the ladle positioning procedure.

1. Height adjustments are made so that the dipper pours at the proper height in relation to the shot sleeve. The height is adjusted by the jack located on the mounting post.
2. Tilt adjustments can also be used to align the ladle with the shot sleeve and dip well height. Use the two tilt adjustment screws on the pedestal. Tilt the ladle backward to make the path more vertical.

3. If additional adjustments are necessary, the ladle body can be moved by choosing another set of body mounting holes and re-bolting the body to the pedestal.

**CAUTION!**

When positioning the ladle body over the pedestal base, keep the largest portion of the body over the offset portion of the base plate. This positioning will keep the center of gravity over the large area of the base plate. Improper positioning can cause machine damage or personal injury.

4. After the ladle height has been properly adjusted:
 - Tighten both outer tube clamp bolts
 - Tighten the lower outer tube securing bolt
 - Lower the pedestal post clamp to its lowest position (against the outer base tube) and tighten

Ladle Positioning

Follow these steps to position and adjust the ladle:

1. Set the ladle up when the metal is low in the dip well to make sure the dipper and the sensor probes clear the well walls. A low metal level will allow identification of interference points for the entire draw-down stroke.
2. At any time, adjustments are needed, make them with the ladle locked out. Use the power-up and homing procedure to continue after the adjustments are completed (See Chapter 4, Push-button Operation).
3. Line up the ladle with the Die Cast Machine and the furnace. Initially do this by inspection using the ladle adjustments. You will need to move the machine back and forth manually by using the push buttons (#5, Figure 4-1). Enter the furnace carefully and also make sure the shot hole is attainable.
4. Retract the arm back to a point just above where the metal would be when the furnace is full, and rotate the dipper reverse to a 135 degree (45 degree from level) Fill Angle. Preheat the dipper here for a few minutes.
5. Retract the arm down until the probe sensors contact the metal. If the dipper hits the dip well bottom before the sensors contact metal, extend the arm up a few inches. Note the position of the arm at this point. When programming the Ladle, an arm position at or above this point will need to be set for the low metal position (See Chapter 7, Teach by Example). The low metal position is the lowest point the arm will be allowed to travel when sensing metal.
6. Level the dipper and move the arm forward out of the dip well.
7. Extend the arm to the shot sleeve such that when the dipper pours it would pour into the shot holes. If you have to adjust the ladle in any way to achieve proper alignment, then repeat this entire procedure.
8. The ladle should now be lined up with the shot sleeve and the dip well. The dipper should rotate freely with the dip well at both high and low metal levels.

Chapter 6

HMI INTRODUCTION

Introduction

The Rimrock Ladle is controlled by manual controls and the Human Machine Interface (HMI). The HMI uses function and numeral keys to operate, program, and troubleshoot the equipment.

Human Machine Interface (HMI)

The HMI (Figure 6-1) is a graphical user interface that provides a user-friendly means of teaching, operating, and monitoring the ladle.

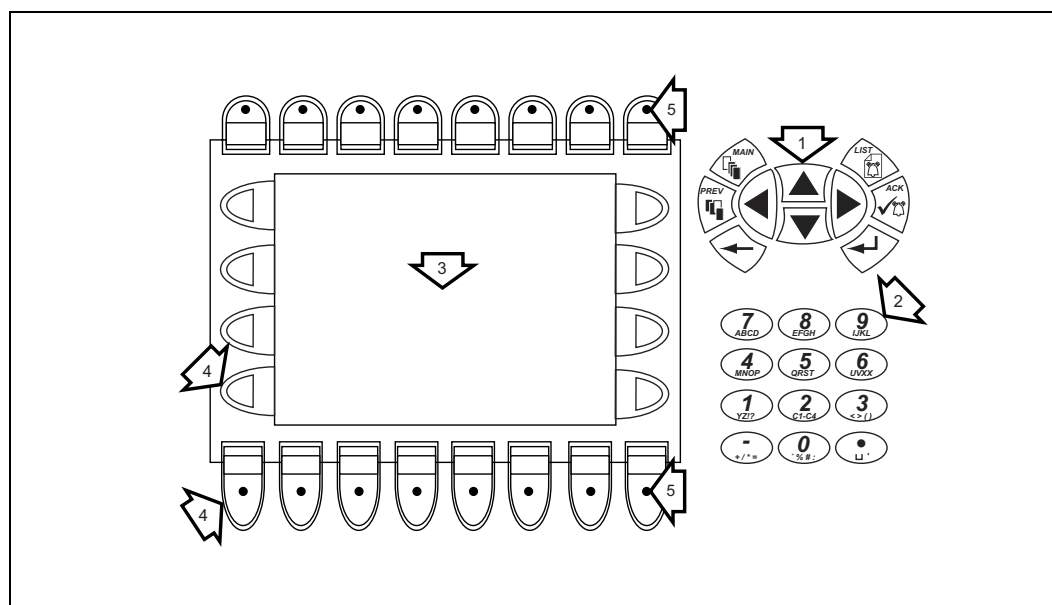


Figure 6-1: Human Machine Interface (HMI)

Item #	Control
1	Built-In Function Keys
2	Alpha/Numeric Keys
3	Graphic Display

Item #	Control
4	Function Keys
5	LED Indicators

Each of the items displayed in Figure 6-1 are explained in detail in this section.

Built-In Function Keys

Use the built-in function keys (Figure 6-2) to navigate through the HMI screens, navigate through the fields on a screen, and enter information into the fields.

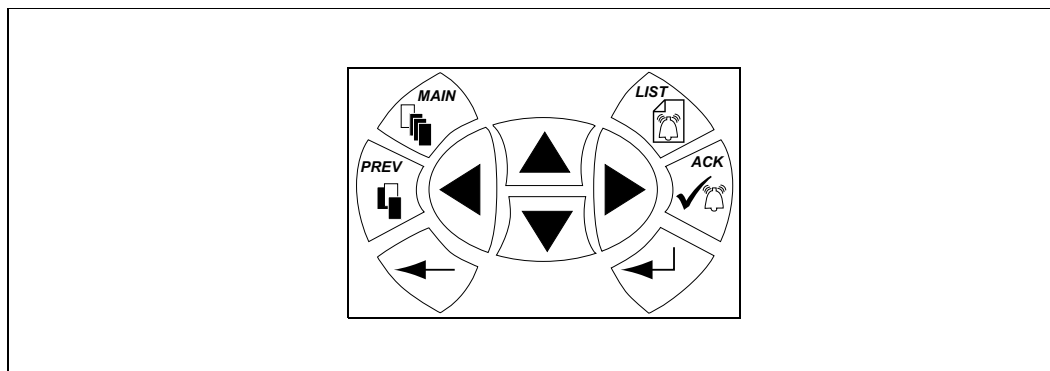


Figure 6-2: Built-In Function Keys

Key	Function
MAIN	Displays the Main Screen (Figure 6-4).
PREV	Displays the previous screen used
LIST	Displays the Alarm Functions Screen (Figure 6-22)
ACK	Acknowledges alarms
Straight Arrow	Backspaces
Backward L-shaped Arrow	Enters information into a field. Equivalent to an “ENTER” key.
Directional Keys	Moves the user from field to field on the screen

Alpha/Numeric Keys

Use the alpha/numeric keys (Figure 6-3) to enter numbers or letters into the fields of the HMI. Press each key repeatedly until the number, letter, or symbol desired appears in the field. For example, pressing the seven key once will display a “7”, pressing it again will display an “A”, pressing it again will display a “B”, and so forth.

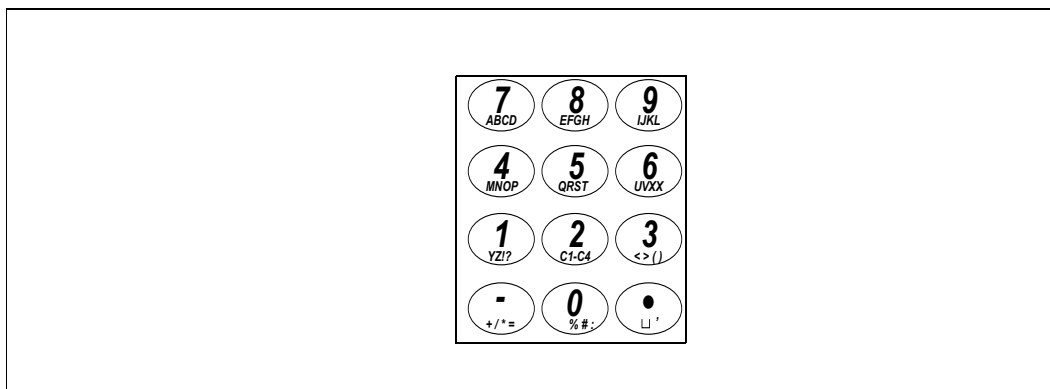


Figure 6-3: Alpha/Numeric Keys

Main Screen

Use the Main Screen (Figure 6-4) to quickly access the major functions that the HMI provides. This screen is a convenient starting point when demonstrating how to navigate the HMI screens. To access the Main Screen, select MAIN from the built-in function keys. This screen initially displays when the ladle is powered up.

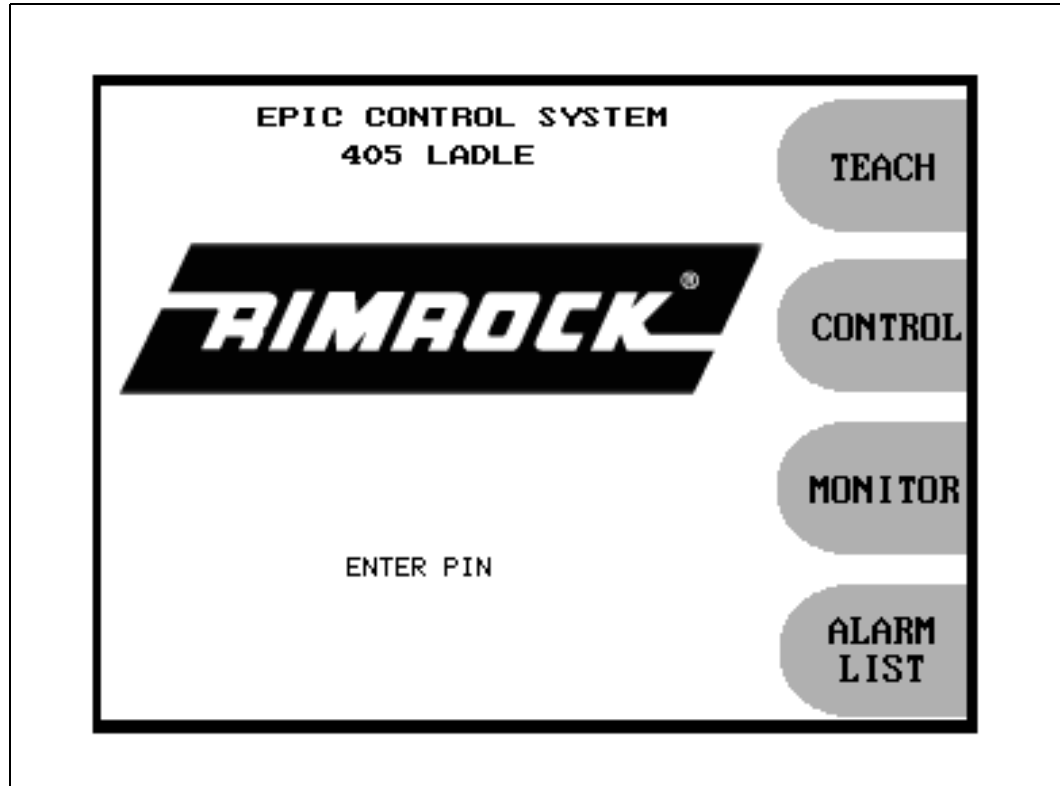


Figure 6-4: Main Screen

Key	Function
TEACH	Displays the Teach and Memory Transfer Screen (Figure 6-6)
CONTROL	Displays the Arm Manual Functions Screen (Figure 6-12)
MONITOR	Displays the Monitor Screen (Figure 6-14)
ALARM LIST	Display the Alarm Functions Screen (Figure 6-22)

Menu Map

All EPIC Control System screens are accessible from the Main Screen. The following menu map (Figure 6-5) illustrates the links from the Main Screen to other system screens.

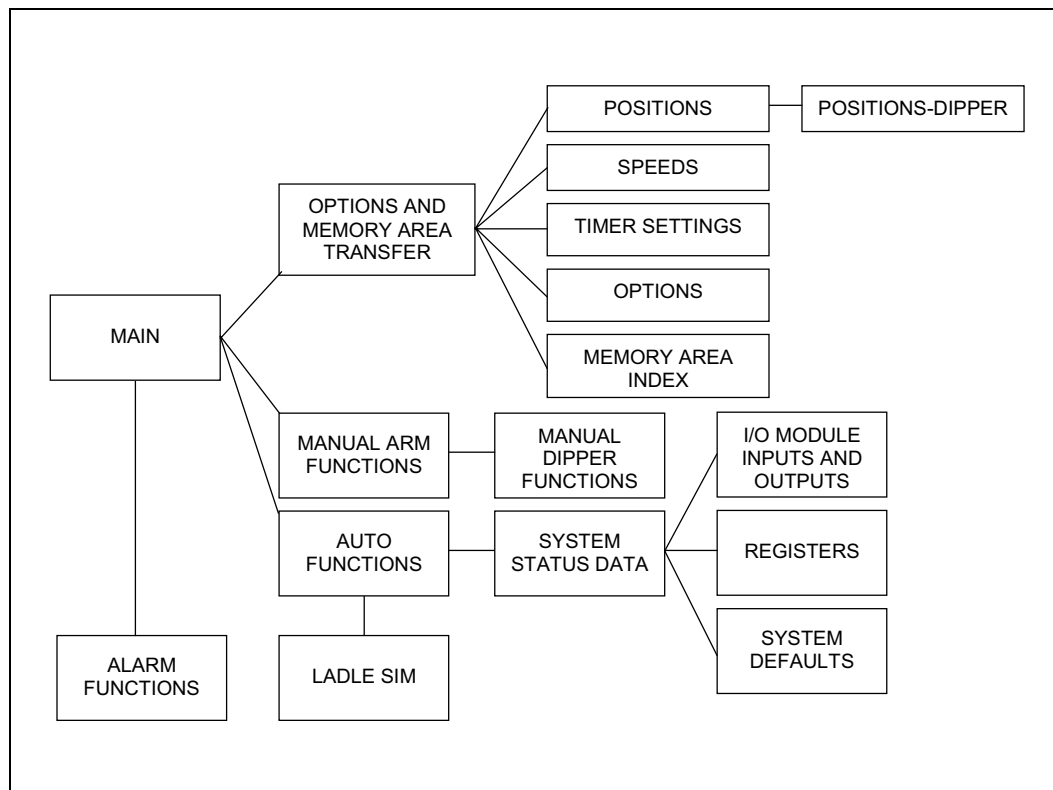


Figure 6-5: Menu Map

Teach and Memory Area Transfer

Use the Teach and Memory Area Transfer Screen (Figure 6-6) to program the operations of the ladle. To access this screen, select **Main>Teach**.

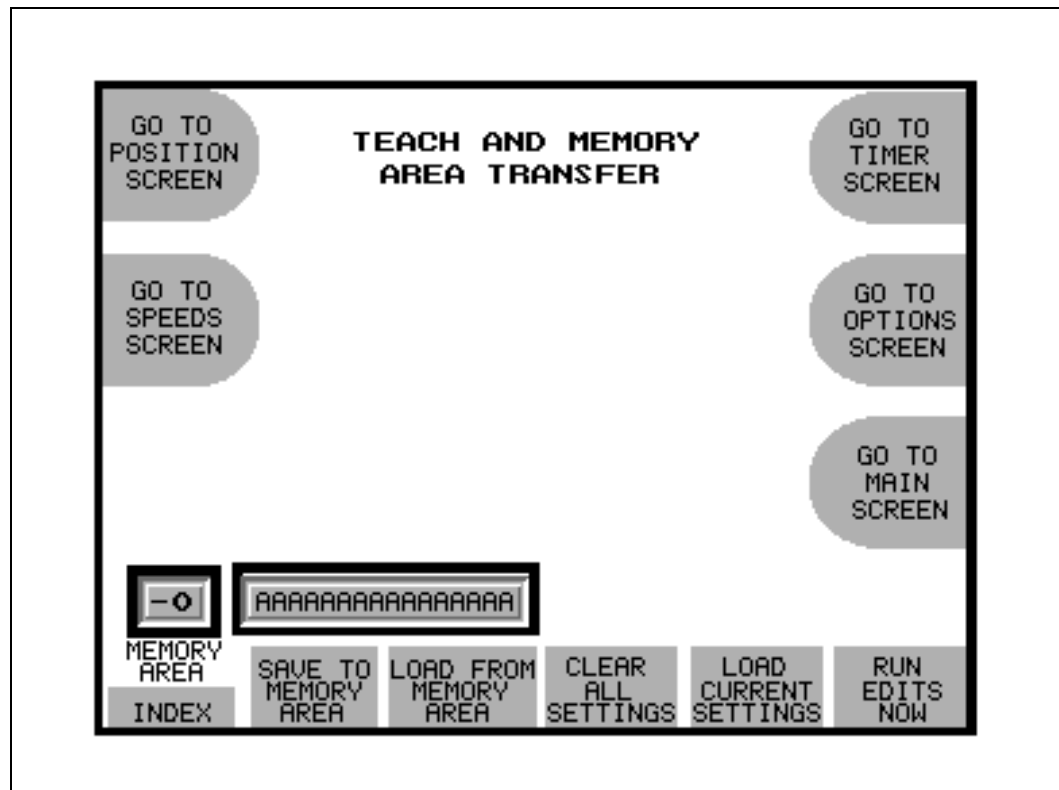


Figure 6-6: Teach and Memory Area Transfer Screen

Key	Function
GO TO POSITION SCREEN	Displays the Arm Positions Screen (Figure 6-7)
GO TO SPEEDS SCREEN	Displays the Speeds Screen (Figure 6-9)
GO TO TIMER SCREEN	Displays the Timers and Counters Screen (Figure 6-10)
GO TO OPTIONS SCREEN	Displays the Options Screen (Figure 6-11)
GO TO MAIN SCREEN	Displays the Main Screen (Figure 6-4)
MEMORY AREA	Determines the number and name of the program in the memory area
INDEX	Displays names of programs stored in 20 memory areas
SAVE TO MEMORY AREA	Saves the settings for a program from the scratchpad to the memory area
LOAD FROM MEMORY AREA	Brings the settings of a program to the scratchpad from a memory area

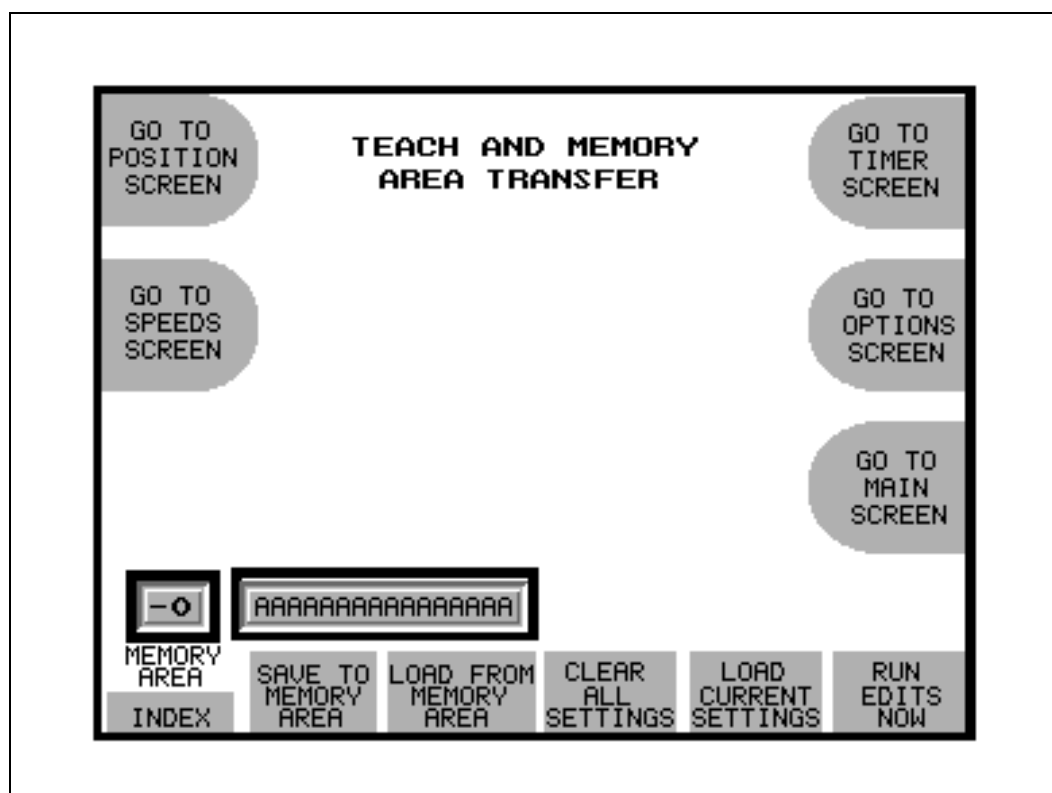


Figure 6-6: Teach and Memory Area Transfer Screen (Cont.)

Key	Function
CLEAR ALL SETTINGS	Deletes all settings from the scratchpad
LOAD CURRENT SETTINGS	Brings the current settings to the scratchpad
RUN EDITS NOW	Saves the scratchpad data back to where it was retrieved from

Note: Changes do not take effect until the **RUN EDITS NOW** key is pressed and acknowledged. If changes are made while in Auto Mode, they will be implemented during the next Auto Cycle.

Position Screens

There are two position screens, the Arm Positions Screen (Figure 6-7) and the Dipper Positions Screen (Figure 6-8). Use these screens to program arm and dipper positions for specific steps in a cycle. Manual arm and dipper movements can also be performed from these screens.

Arm Positions Screen

To access the Arm Positions Screen, select **Main>Teach>Go To Position Screen**.

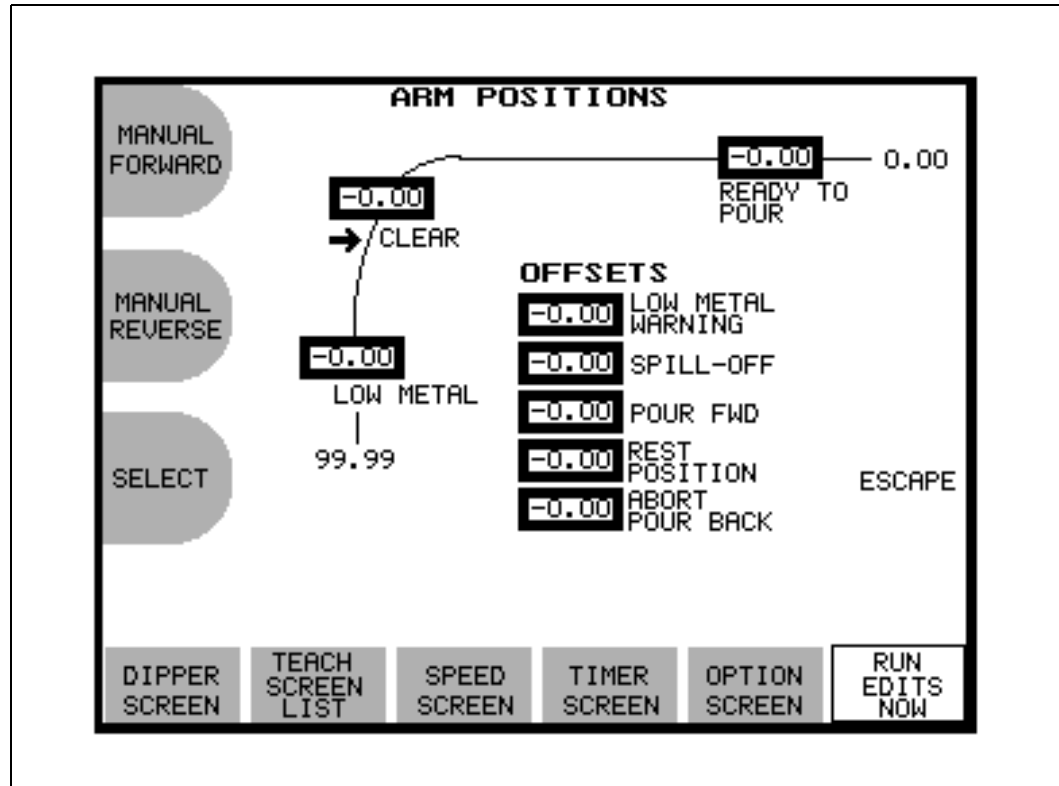


Figure 6-7: Arm Positions Screen

Key	Function
MANUAL FORWARD	Moves the ladle arm forward for Teaching by Example. Press and hold this key until the arm arrives at the desired position
MANUAL REVERSE	Moves the ladle arm in reverse for Teaching by Example. Press and hold this key until the arm arrives at the desired position
SELECT	Selects arm position fields for Teaching by Example
DIPPER SCREEN	Displays Dipper Positions Screen (Figure 6-8)
TEACH SCREEN LIST	Displays Teach and Memory Area Transfer Screen (Figure 6-6)
SPEED SCREEN	Displays Speeds Screen (Figure 6-9)
TIMER SCREEN	Displays Timers and Counters Screen (Figure 6-10)
OPTION SCREEN	Displays Options Screen (Figure 6-11)

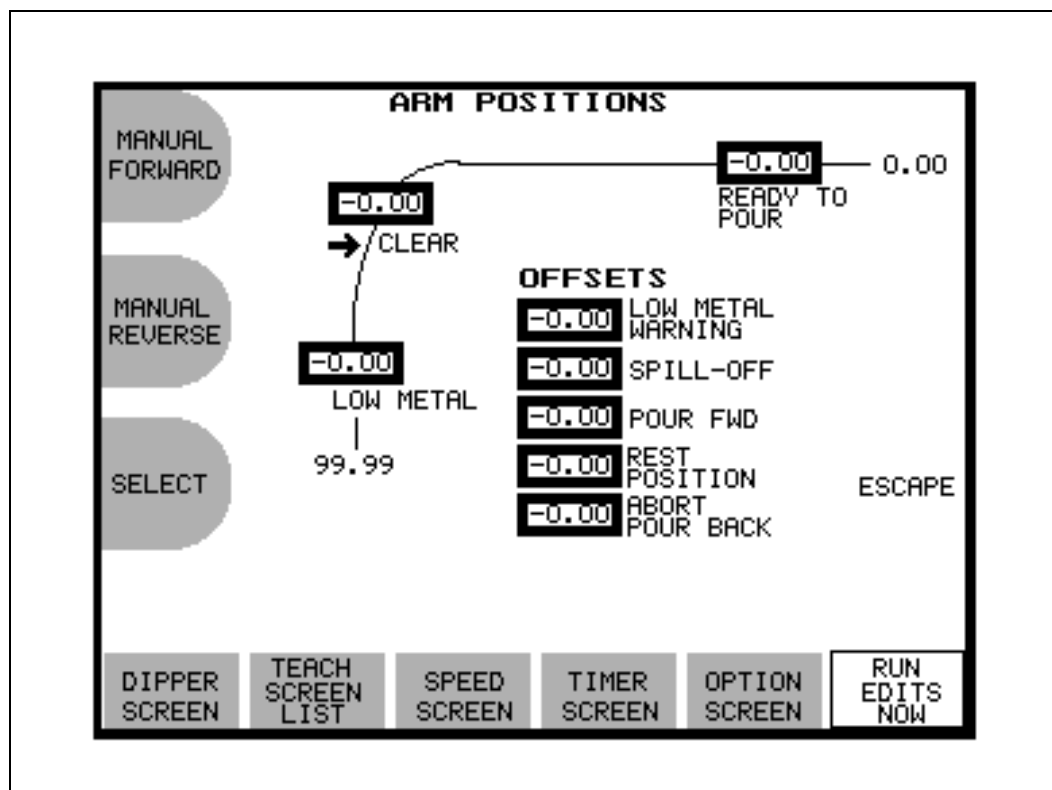


Figure 6-7: Arm Positions Screen (Cont.)

Key	Function
RUN EDITS NOW	Saves the scratchpad data back to where it was retrieved from
ESCAPE	Restores original settings
Arm Positions Screen Indicator	Information
READY TO POUR	Displays current setting for the ready to pour position where the arm is at the shot hole
CLEAR	Displays current setting for the arm in the clear position which is normally just above the furnace
LOW METAL OFFSET	Displays the current setting for the low metal position which is normally at the bottom of the furnace
LOW METAL WARNING OFFSET	Displays the current setting for the low metal warning to occur
SPILL-OFF OFFSET	Displays the current setting for the arm position during spill off which enables the dross to wick off the dipper after it has filled with metal

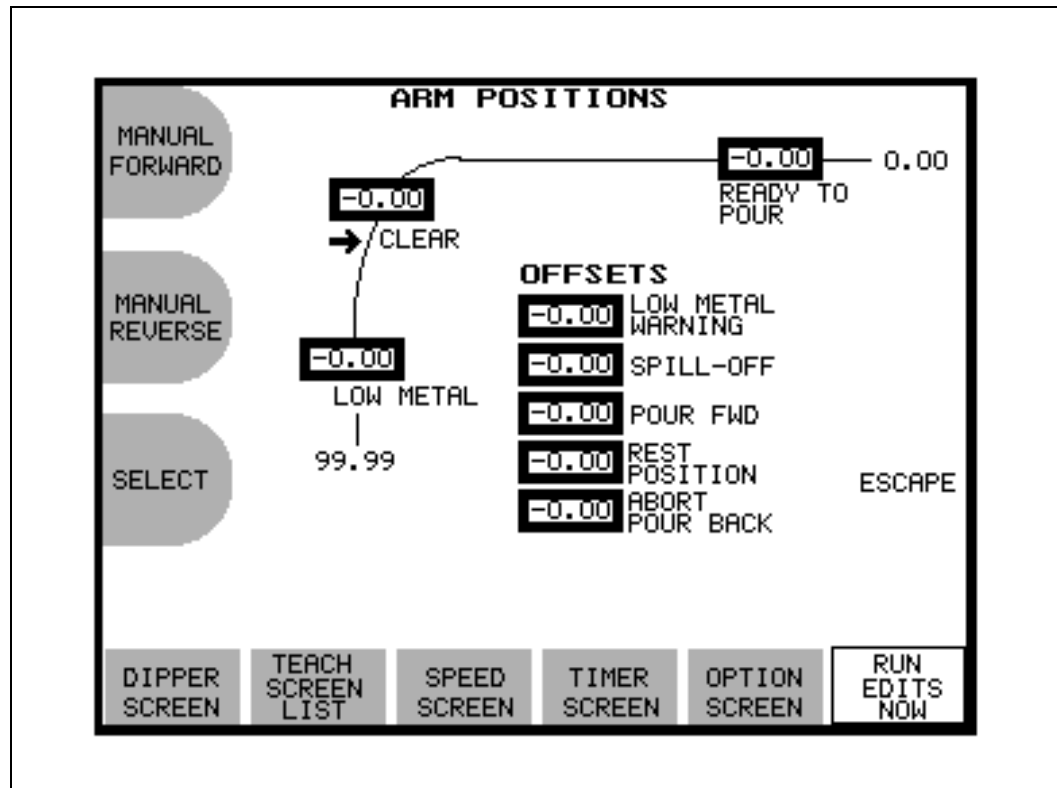


Figure 6-7: Arm Positions Screen (Cont.)

Arm Positions Screen Indicator	Information
POUR FWD OFFSET	Displays the current setting for the forward arm movement during the last pour position to aid in minimizing spills and drips
REST POSITION OFFSET	Displays the current offset from the centered position that will be used as the Rest position in Auto Mode
ABORT POUR BACK OFFSET	Displays the current setting for the arm position above the metal where the abort pour back will take place

Dipper Positions Screen

To access the Dipper Positions Screen (Figure 4-9) press **Main>Teach>Go To Position Screen>Dipper Screen**.

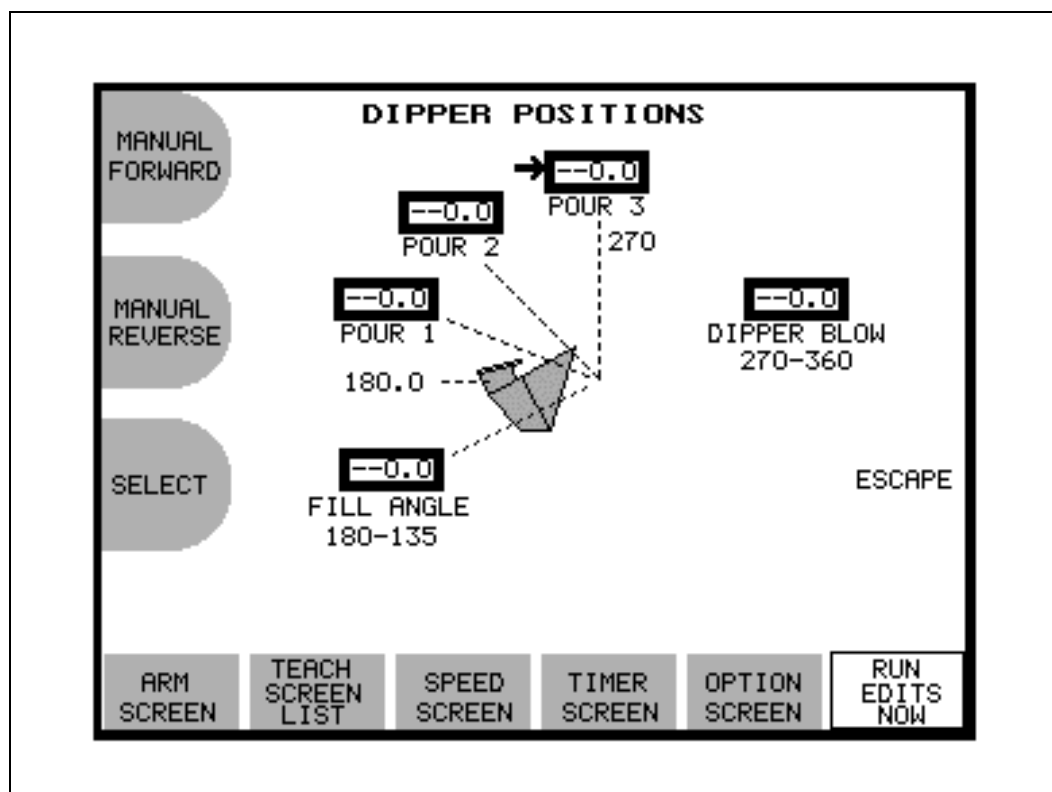


Figure 6-8: Dipper Positions Screen

Key	Function
MANUAL FORWARD	Moves the dipper forward for Teaching by Example. Press and hold this key until the dipper arrives at the desired position
MANUAL REVERSE	Moves the dipper in reverse for Teaching by Example. Press and hold this key until the dipper arrives at the desired position
SELECT	Selects dipper position fields for Teaching by Example
ARM SCREEN	Displays Arm Positions Screen (Figure 6-7)
TEACH SCREEN LIST	Displays Teach and Memory Area Transfer Screen (Figure 6-6)
SPEED SCREEN	Displays Speeds Screen (Figure 6-9)
TIMER SCREEN	Displays Timers and Counters Screen (Figure 6-10)
OPTION SCREEN	Displays Options Screen (Figure 6-11)
RUN EDITS NOW	Saves the scratchpad data back to where it was retrieved from
ESCAPE	Restores original settings

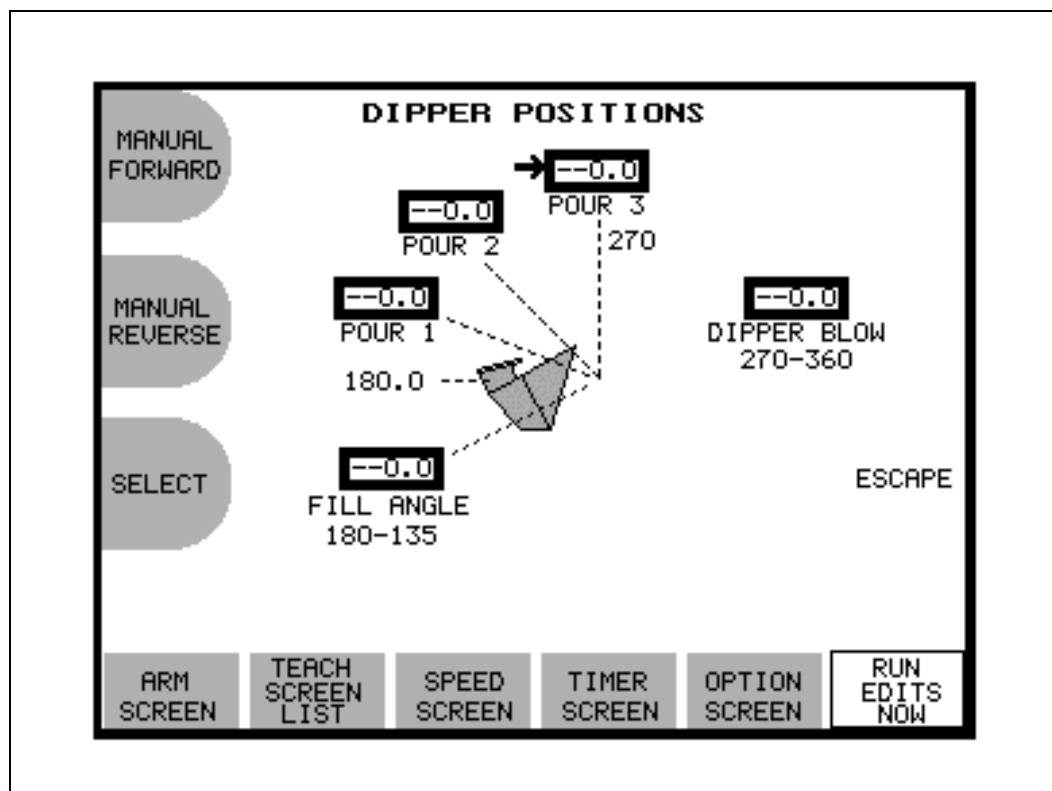


Figure 6-8: Dipper Positions Screen (Cont.)

Dipper Positions Screen Indicator	Information
FILL ANGLE	Displays the current setting for the angle the dipper will maintain in the furnace while filling. The range is 180–135 degrees, with 180 degrees being level.
POUR 1	Displays the current setting for the dipper angle in degrees during the first pour step where the metal just reaches the lip of the dipper cup. The range is 180–360. This setting must be less than the value set for POUR 2.
POUR 2	Displays the current setting for the dipper angle in degrees during the second pour step where the dipper is pouring the metal into the shot tube. The range is 180–360. This setting must be less than the value set for POUR 3.
POUR 3	Displays the current setting for the dipper angle in degrees during the third pour step where the dipper is held to evacuate as much of the metal as possible. The range is 180–360.
DIPPER BLOW	Displays the current setting for the dipper angle in degrees during an optional step where the dipper is held in place to receive air blow to clear residue. The range is 180–360.

Speeds Screen

The Speeds Screen (Figure 6-9) enables the user to program the speeds that the arm and dipper will move as a percentage of total maximum speed. Speeds are programmed for specific steps in a cycle. To access the Speeds Screen, select **Main>Teach>Go To Speeds Screen**.

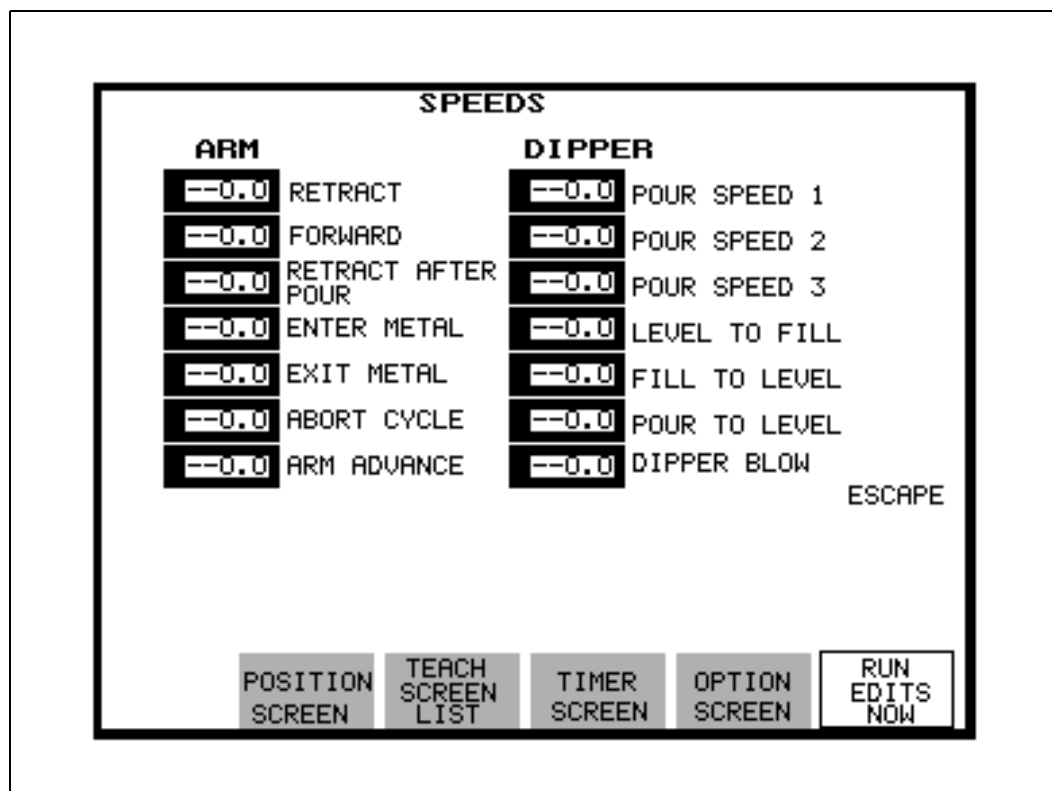


Figure 6-9: Speeds Screen

Key	Function
POSITION SCREEN	Displays Arm Positions Screen (Figure 6-7)
TEACH SCREEN LIST	Displays Teach and Memory Area Transfer Screen (Figure 6-6)
TIMER SCREEN	Displays Timers and Counters Screen (Figure 6-10)
OPTION SCREEN	Displays Options Screen (Figure 6-11)
RUN EDITS NOW	Saves the scratchpad data back to where it was retrieved from
ESCAPE	Restores original settings

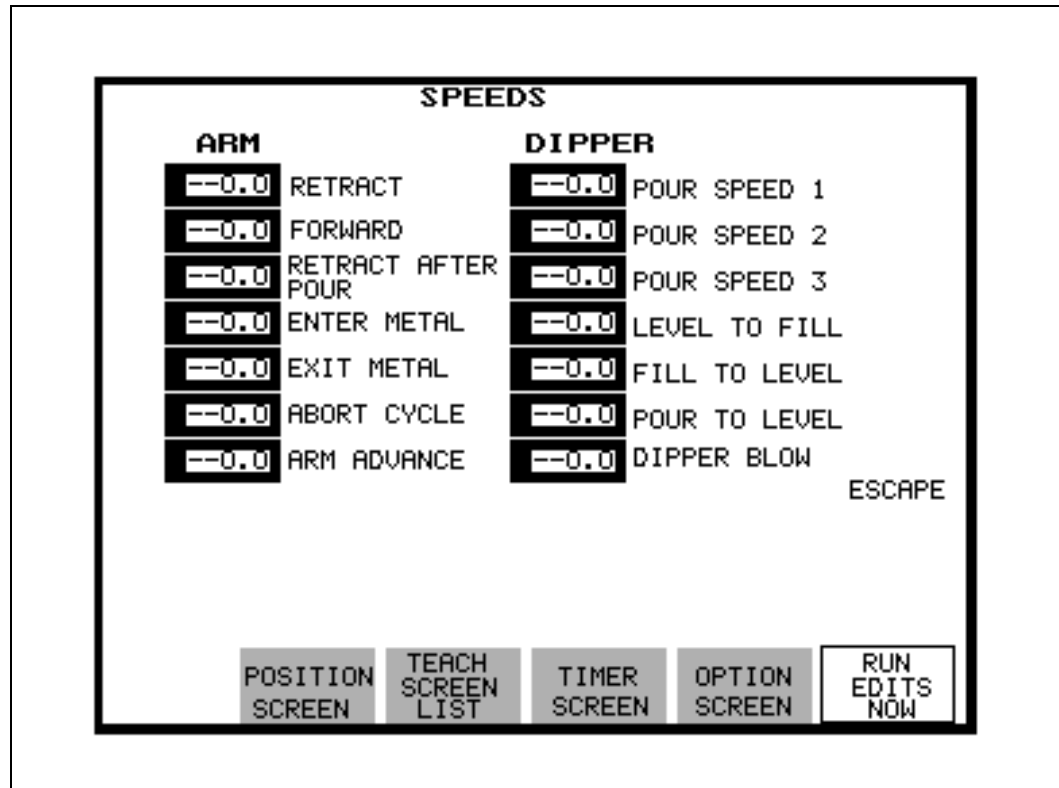


Figure 6-9: Speeds Screen (Cont.)

Arm Speeds Indicator	Information
REST TO CLEAR	Displays current speed setting during reverse (retract) movement of arm. The range is 0–99.9% of the maximum speed.
FORWARD	Displays current speed setting for forward movement of arm. The range is 0–99.9% of the maximum speed.
RETRACT AFTER POUR	Displays the current speed setting for the arm movement when retracting after a pour. The range is 0–99.9% of the maximum speed.
ENTER METAL	Displays the current speed setting for the arm movement when entering the furnace to fill the dipper with metal. The range is 0–99.9% of the maximum speed.
EXIT METAL	Displays the current speed setting for the arm movement when exiting the furnace after filling the dipper with metal. The range is 0–99.9% of the maximum speed.
ABORT CYCLE	Displays the current speed setting for the arm movement when retracting to the furnace to pour back metal following an aborted cycle. The range is 0–99.9% of the maximum speed.
ARM ADVANCE	Displays the current speed for the arm when advancing to the Pour Forward position.

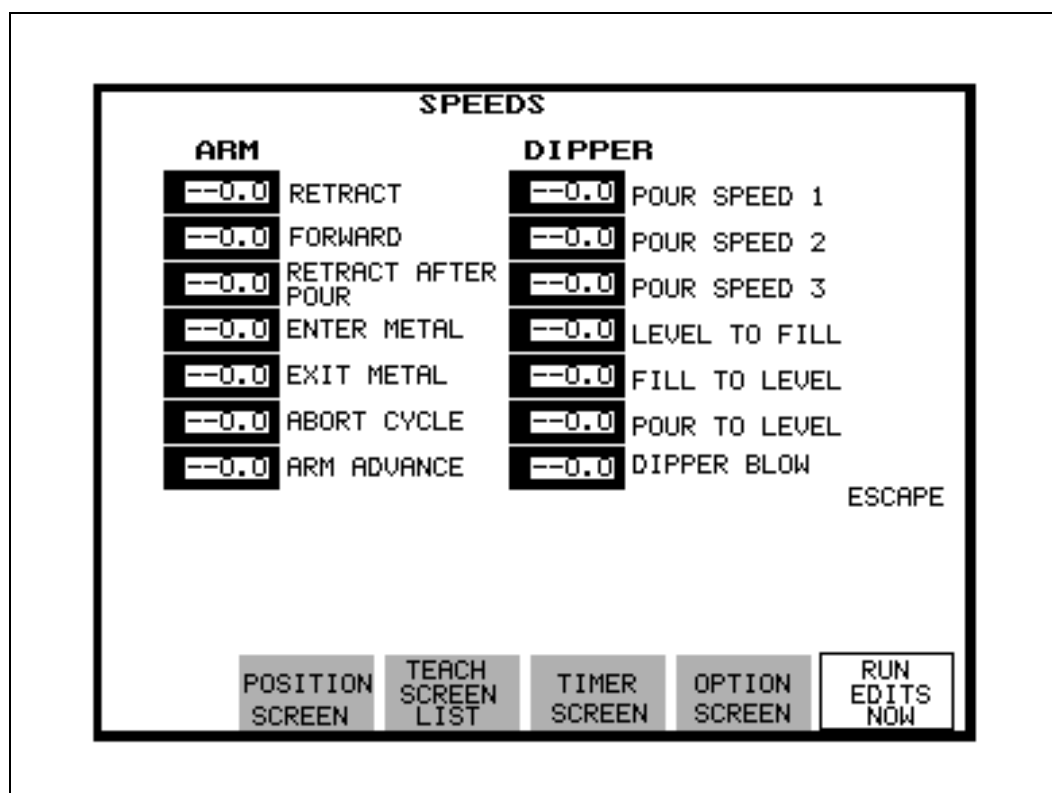


Figure 6-9: Speeds Screen (Cont.)

Dipper Speeds Indicator	Information
POUR SPEED 1	Displays the current speed the dipper will move while level to the first pour position (Pour 1). The range is 0–99.9% of the maximum speed.
POUR SPEED 2	Displays the current speed the dipper will move to the second pour position (Pour 1 to Pour 2). The range is 0–99.9% of the maximum speed.
POUR SPEED 3	Displays the current speed the dipper will move to the third pour position (Pour 2 to Pour 3). The range is 0–99.9% of the maximum speed.
FILL TO LEVEL	Displays the current speed for the dipper to move to level in the furnace during metal fill.
POUR TO LEVEL	Displays the current speed for the dipper to move to level after the pouring sequence (from Pour position to Fill position).
DIPPER BLOW	Displays the current speed for the dipper to move when running the dipper blow sequence.

Timers and Counters Screen

The Timers and Counters Screen (Figure 6-10) enables the user to program the timers used during the sequence of operation. To access the Timer and Counters Screen, select **Main>Teach>Go To Timer Screen**.

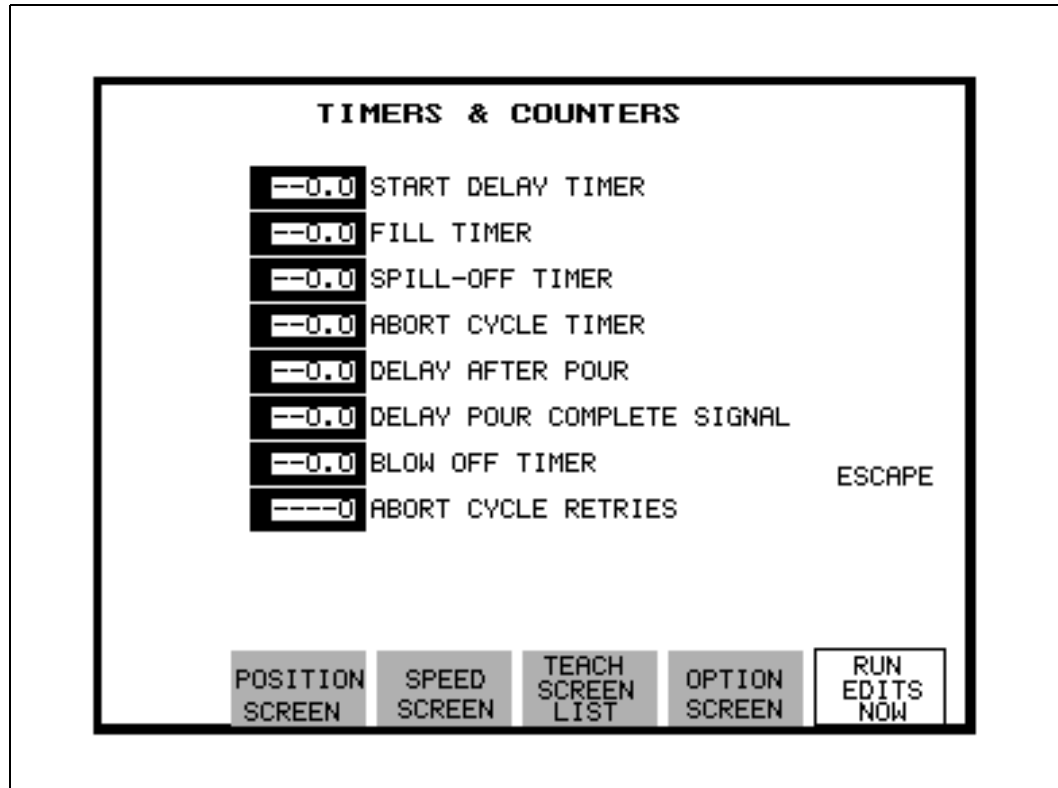


Figure 6-10: Timers and Counters Screen

Key	Function
POSITION SCREEN	Displays Arm Positions Screen (Figure 6-7)
SPEED SCREEN	Displays Speeds Screen (Figure 6-9)
TEACH SCREEN LIST	Displays Teach and Memory Area Transfer Screen (Figure 6-6)
OPTION SCREEN	Displays Options Screen (Figure 6-11)
RUN EDITS NOW	Saves the scratchpad data back to where it was retrieved from
ESCAPE	Restores original settings

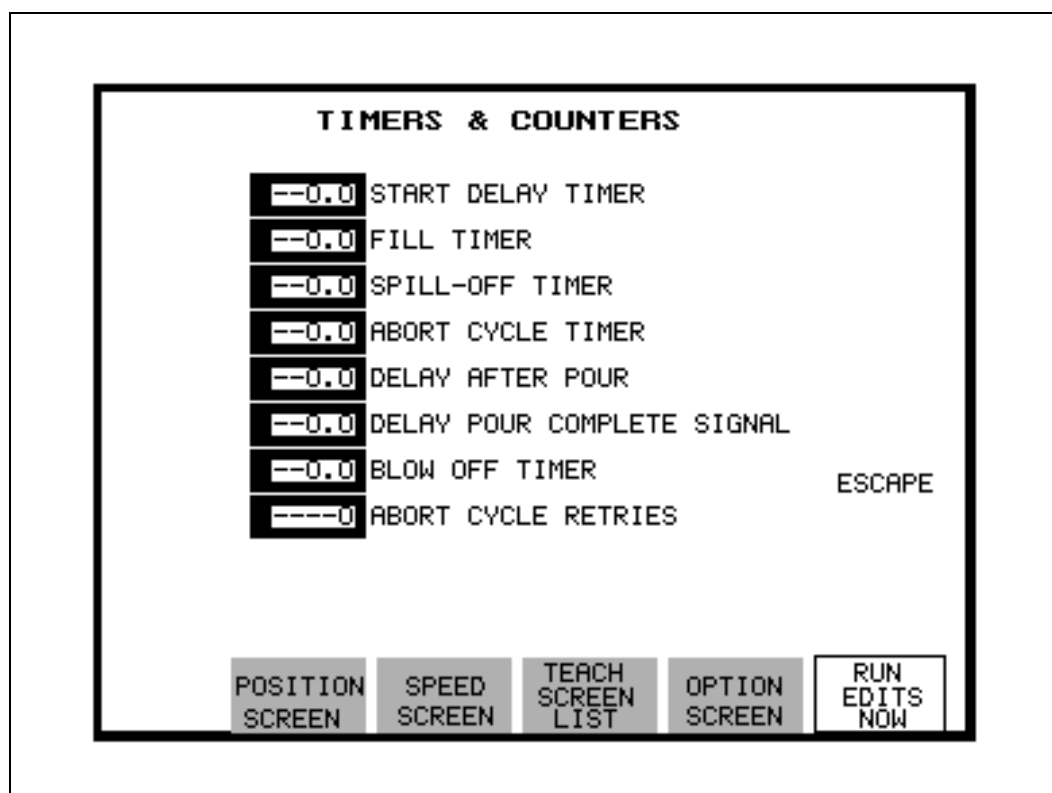


Figure 6-10: Timers and Counters Screen (Cont.)

Timer and Counter Indicator	Information
START DELAY TIMER	Displays the current setting in seconds to delay the start of a cycle after receiving a signal from the DCM to start.
FILL TIMER	Displays the current setting in seconds the dipper remains in the furnace filling with metal.
SPILL-OFF TIMER	Displays the current setting in seconds the dipper is held above the metal in the furnace for spill-off, which allows excess metal to spill from the dipper.
ABORT CYCLE TIMER	Displays the current setting in seconds that the ladle will wait with metal at the ready to pour position for the DCM to give the OK to Pour signal. Once this timer elapses, the arm automatically returns to the furnace for pour back or operator intervention.
DELAY AFTER POUR	Displays the current setting in seconds the arm and dipper are held in position after the last pour position has been met.
DELAY POUR COMPLETE SIGNAL	Displays the current setting in seconds that the controller delays sending the signal to the DCM that the pour is complete.
BLOW OFF TIMER	Displays the current setting in seconds that the optional air blow will occur.
ABORT CYCLE RETRIES	Displays the number of abort cycle retries the machine will automatically attempt before stopping and waiting for another start signal.

Options Screen

The Options Screen (Figure 6-11) enables the user to quickly activate or deactivate procedures. To access the Options Screen, select **Main>Teach>Go To Options Screen**.

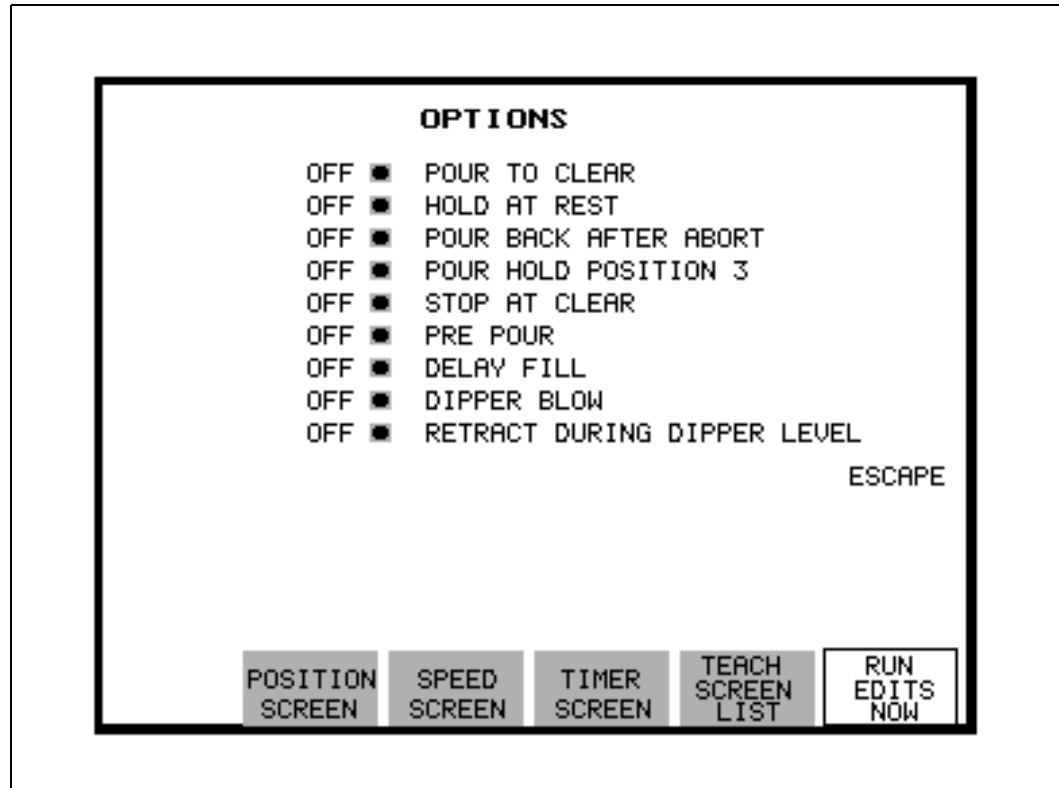


Figure 6-11: Options Screen

Key	Function
POSITION SCREEN	Displays Arm Positions Screen (Figure 6-7)
SPEED SCREEN	Displays Speeds Screen (Figure 6-9)
TIMER SCREEN	Displays Timers and Counters Screen (Figure 6-10)
TEACH SCREEN LIST	Displays Teach and Memory Area Transfer Screen (Figure 6-6)
RUN EDITS NOW	Saves the scratchpad data back to where it was retrieved from
ESCAPE	Restores original settings

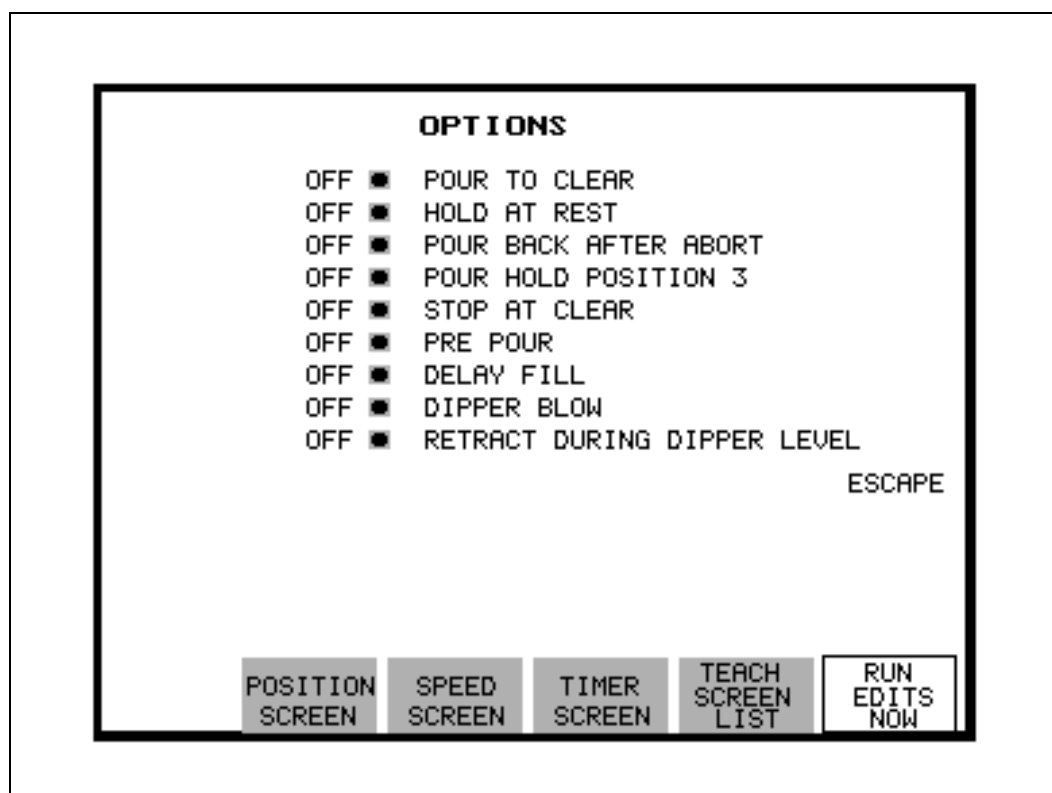


Figure 6-11: Options Screen (Cont.)

Indicator	Information
POUR TO CLEAR	Displays the status of the pour to clear option. This option makes the ladle wait at the clear position for a start signal rather than rest.
HOLD AT REST	Displays the status of the hold at the rest option. This option causes the arm to wait at the rest position instead of the shot hole for the OK to Pour interlocks to complete.
POUR BACK AFTER ABORT	Displays the status of the option to pour the metal back into the furnace during an abort sequence.
STOP AT CLEAR	Displays the status of the option to stop the arm and dipper at the clear position. This option separates the rotate and descend motions of the dipper as it enters the furnace.
PRE POUR	Displays the status of the pre pour option. This option allows the pouring movement to continue up to Pour Position 1 without the OK to Pour signal.
DELAY FILL	Displays the status of the delay fill option. This option keeps the dipper from moving to the fill angle until after it has been submerged in the metal so that the dross can be wiped away.
DIPPER BLOW	Displays the status of the air blow option. This option positions the dipper so that air can be blown into it to remove unwanted residues.

Arm Manual Functions Screen

Use the Arm Manual Functions Screen (Figure 6-12) to perform manual arm movements, to test arm positions, and arm speed at specific programed steps in the pour cycle. The ladle must be in manual mode in order to use the movement keys on the Arm Manual Functions Screen. To access this screen, select **Main>Control**.

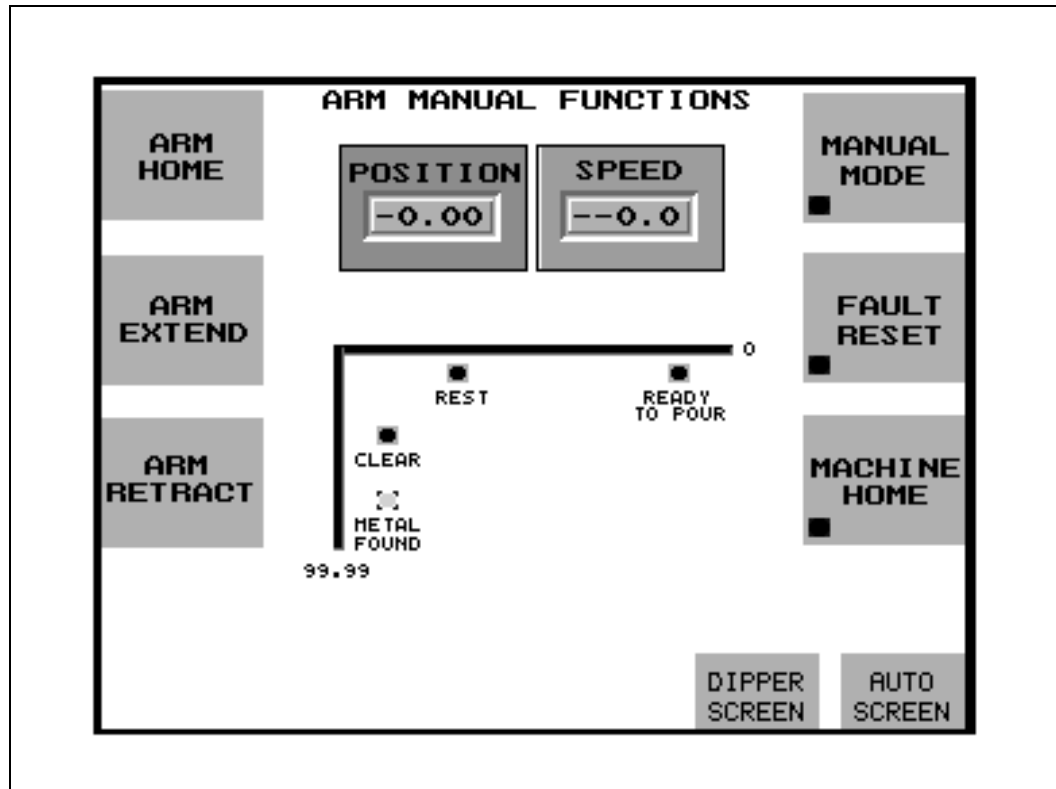


Figure 6-12: Arm Manual Functions Screen

Key	Function
ARM HOME	Moves the ladle arm to the home or rest position. This key must be held for arm movement to complete.
ARM EXTEND	Extends the ladle arm. This key must be held in until the arm has extended to the desired position.
ARM RETRACT	Retracts the ladle arm. This key must be held in until the arm has retracted to the desired position.
MANUAL MODE	Puts the ladle into Manual Mode.
FAULT RESET	Acknowledges faults found in the system and resets the ladle allowing operation to be restarted.
MACHINE HOME	Moves the ladle arm and the dipper to the Home positions and sets the home positions. This key must be held in until homing is complete.

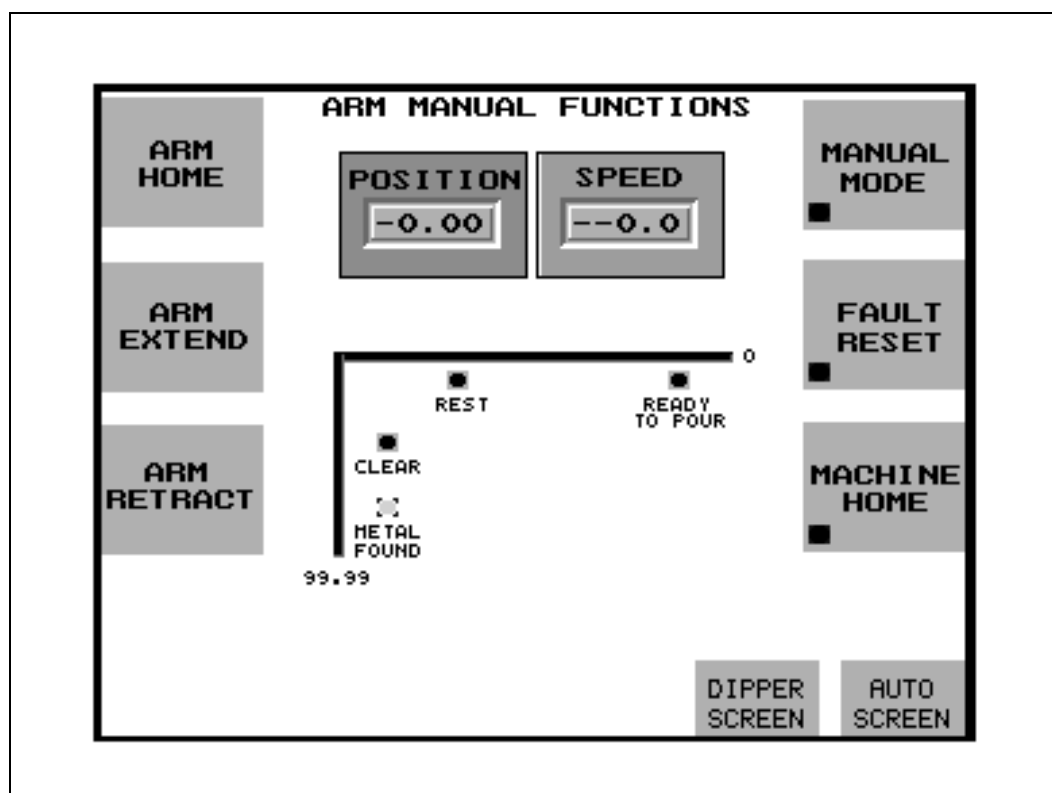


Figure 6-12: Arm Manual Functions Screen (Cont.)

Key	Function
DIPPER SCREEN	Displays the Manual Dipper Functions Screen (Figure 6-13)
AUTO SCREEN	Displays the Monitor Screen (Figure 6-14)
Indicator	Information
POSITION	Displays the current position of the ladle arm.
SPEED	Displays the current speed of the ladle arm as a percentage of maximum speed
ARM GRAPHIC	Displays a simulation of the arm movement and position

Manual Dipper Functions Screen

Use the Manual Dipper Functions Screen (Figure 6-13) to perform manual dipper movements to determine and test position and speed to be programmed for specific steps in the pour cycle. The ladle must be in manual mode in order to use the movement keys on the Manual Dipper Functions Screen. To access this screen, select **Main>Control>Dipper Screen**.

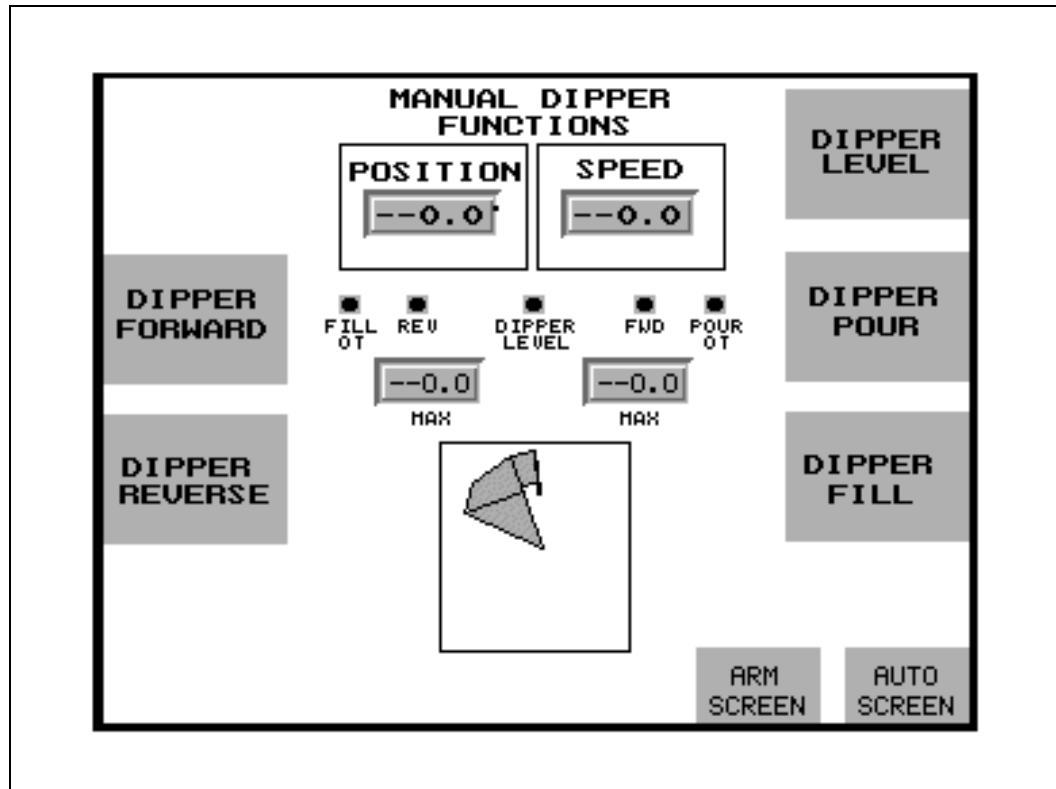


Figure 6-13: Manual Dipper Functions Screen

Key	Function
DIPPER FORWARD	Tilts the dipper forward (toward Pour). This key must be held in until the dipper reaches the desired position.
DIPPER REVERSE	Tilts the dipper in reverse (toward Fill). This key must be held in until the dipper reaches the desired position.
DIPPER LEVEL	Moves the dipper forward or reverse until it reaches the level position (180 degrees).
DIPPER POUR	Rotates the dipper to the Pour 3 position using the current pour profile programmed. This key must be held in until the dipper reaches the desired position.
DIPPER FILL	Rotates the dipper to the fill angle using the current fill angle and fill speed programmed. This key must be held in until the dipper reaches the desired position. Pressing this key will cause the dipper arm to run pour sequence consisting of 1, 2, 3 and pour positions 1,2,3 which will allow the user to see what the actual pour will look like.

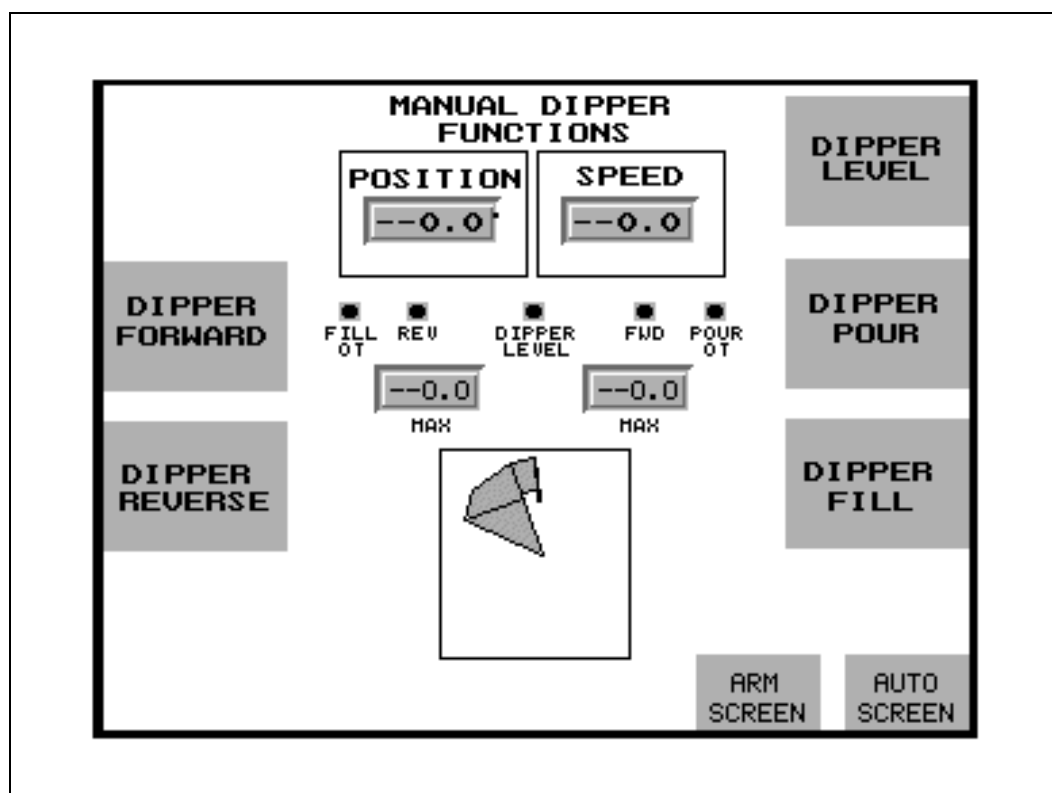


Figure 6-13: Manual Dipper Functions Screen (Cont.)

ARM SCREEN	Displays the Arm Manual Functions Screen (Figure 6-12).
AUTO SCREEN	Displays the Monitor Screen (Figure 6-14).

Indicator	Information
POSITION	Displays the current position of the ladle dipper. For example, dipper level is 180 degrees.
SPEED	Displays the current speed of the dipper as a percentage of maximum speed. The range is 0–99.9% of the maximum speed.
INPUT SIGNALS (OT Indicators)	Displays the input signals that are active.
DIPPER GRAPHIC	Displays a simulation of the dipper movement and position.

Monitor Screen

Use the Monitor Screen (Figure 6-14) to view information about the ladle and its cycle. To access this screen, select **Main>Monitor**.

This screen contains the most useful information during ladle operations. It is recommended to have this screen displayed during normal operations.

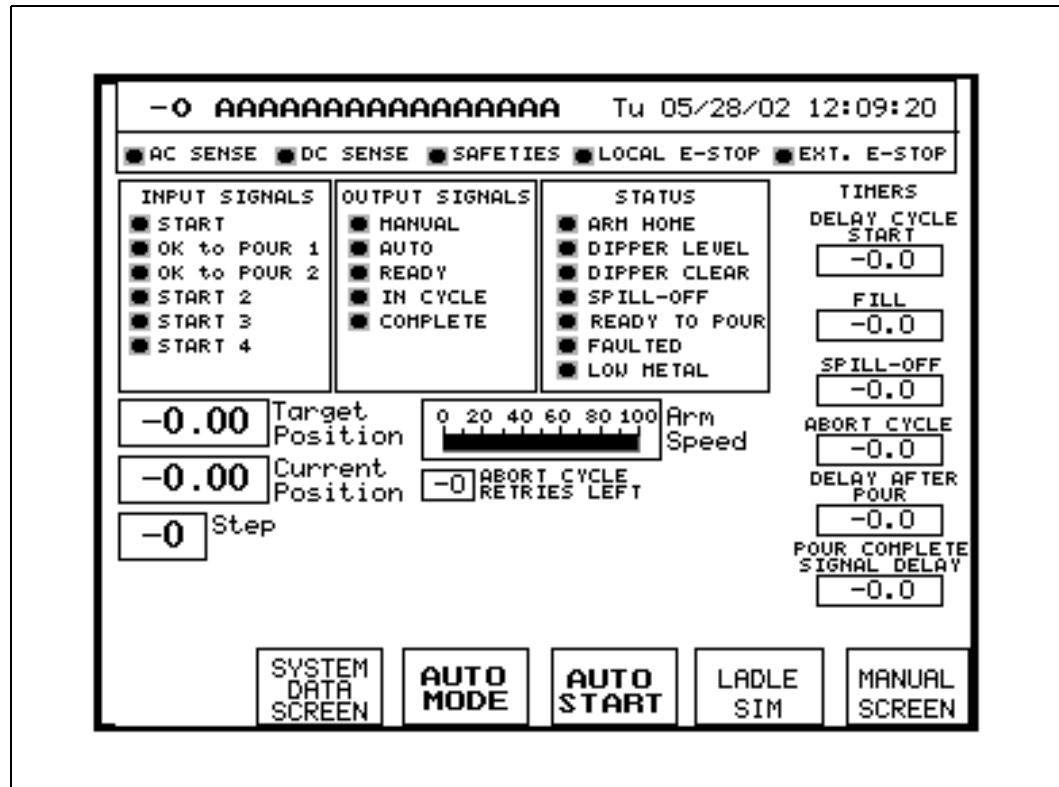


Figure 6-14: Monitor Screen

Key	Function
SYSTEM DATA SCREEN	Displays the System Data Screen (Figure 6-15 on page 6-29)
AUTO MODE	Places the ladle in auto mode
AUTO START	Starts the ladle in auto mode
LADLE SIM	Displays the Ladle Sim Screen (Figure 6-21)
MANUAL SCREEN	Displays the Arm Manual Functions Screen (Figure 6-12)

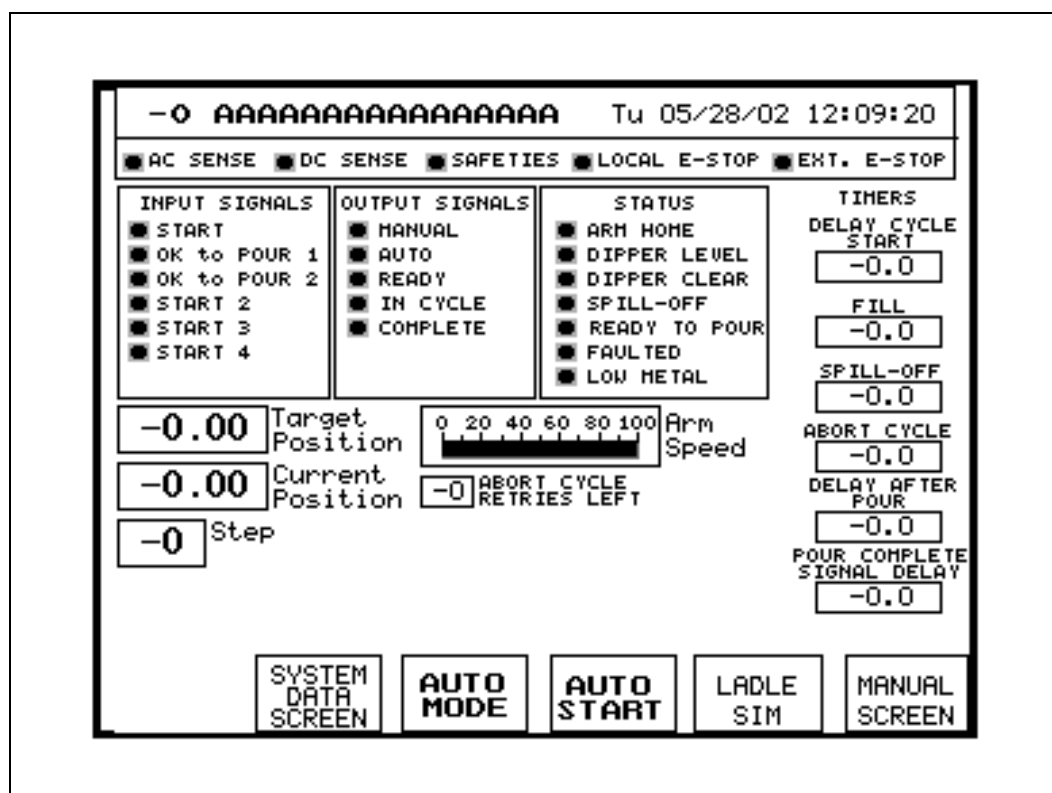


Figure 6-14: Monitor Screen (Cont.)

Indicator	Information
AC Sense	Indicates the ladle senses that AC control power is on
DC Sense	Indicates the ladle senses that DC control power is on
Safeties	Indicates the safeties are made
Local E-Stop	Indicates the status of the emergency stop push-button on the ladle
Ext. E-Stop	Indicates the status of the emergency stops on the external equipment such as the die cast machine
Input Signal	Indicates the status of the interlock inputs into the controller
Output Signal	Indicates the status of the interlock outputs
Status	Indicates the status of critical machine, or positions and fault brake
Timers	Indicates the timer settings and current count status
Target Position	Indicates the final position of the ladle arm for the current move
Step	Indicates the current step of the cycle sequence being executed
Current Position	Indicates the current position of the arm

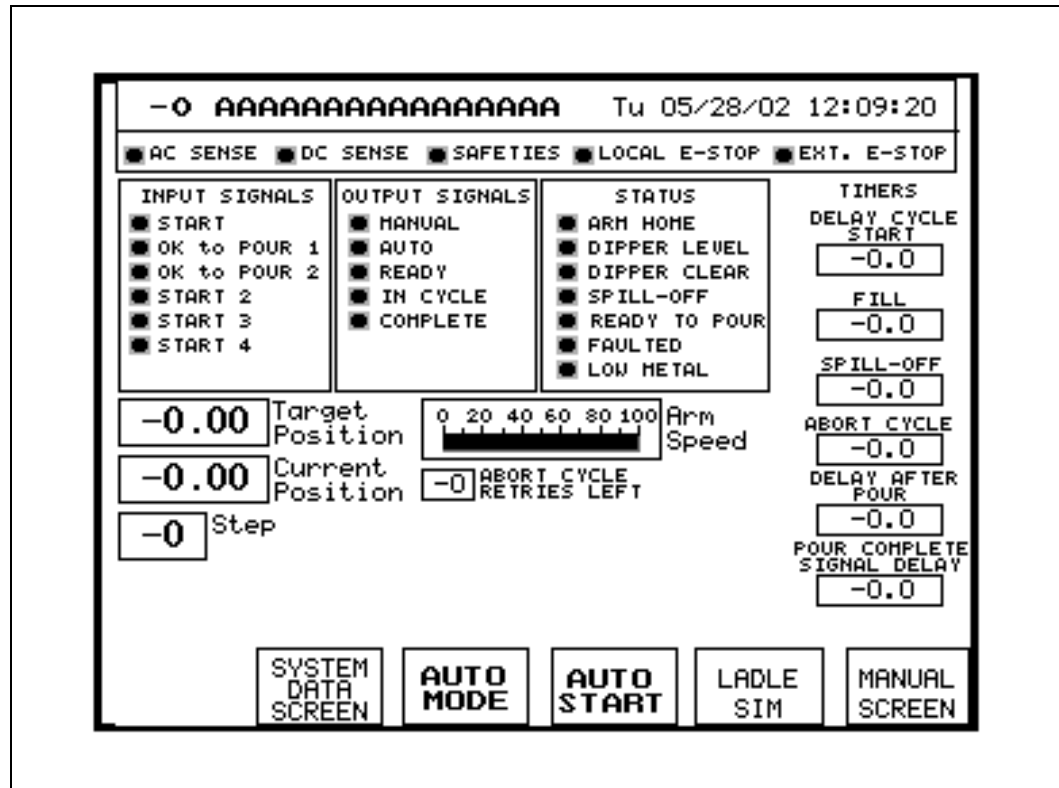


Figure 6-14: Monitor Screen (Cont.)

Arm Speed	Indicates the speed the arm is moving as a percentage of maximum speed
Abort Cycle Retries Left	Indicates the number of automatic abort cycle retries left before the ladle stops and waits for a new start signal

Monitor Screen Operational Messages

The following operational messages display on the Monitor Screen just above the key text boxes to indicate the status of the Ladle.

Operational Message	Indicates
MOVING TO CLEAR	The ladle is beginning the auto cycle and moving towards the programmed CLEAR position (just above the metal) at the RETRACT TO CLEAR speed.
ROTATING DIPPER TO FILL	The ladle is in auto mode and rotating the dipper in reverse to the programmed FILL ANGLE.
FILL	The ladle arm is filling the dipper with metal by first moving it into the metal at the ENTER METAL speed and then timing the programmed FILL time.
SPILL OFF	The ladle arm is moving the dipper out of the metal and allowing the excess metal and dross to spill out of the cup. During this time the arm moves up the appropriate programmed offset (SPILL OFF or ABORT SPILL OFF) at the EXIT METAL speed and then time the SPILL OFF time.

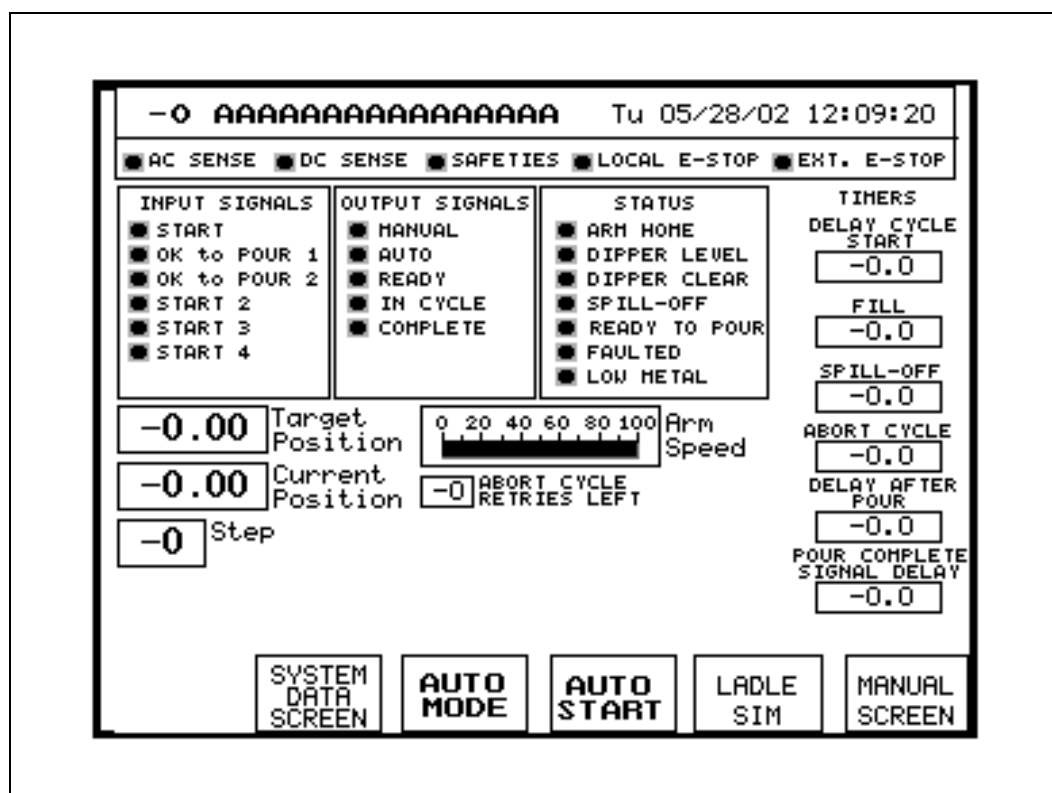


Figure 6-14: Monitor Screen (Cont.)

Operational Message	Indicates
ROTATING DIPPER TO LEVEL	The dipper is rotating to the level position at the FILL TO LEVEL speed.
MOVING TO POUR POSITION	The ladle is transporting metal at the FORWARD TO POUR speed up to the programmed POUR position.
MOVING TO POUR POSITION	The ladle is transporting metal at the FORWARD TO POUR speed up to the programmed POUR position.
POURING	The ladle is executing the pour contour consisting of moving the dipper at through the pour angles at the pour speeds and then timing the DELAY AFTER POUR TIME. Optionally the arm can be programmed to move forward also during the move to POUR 3 by setting a POUR FWD offset and the POUR FWD speed.
LEVEL DIPPER	The dipper is rotating to the level position at the POUR TO LEVEL speed.

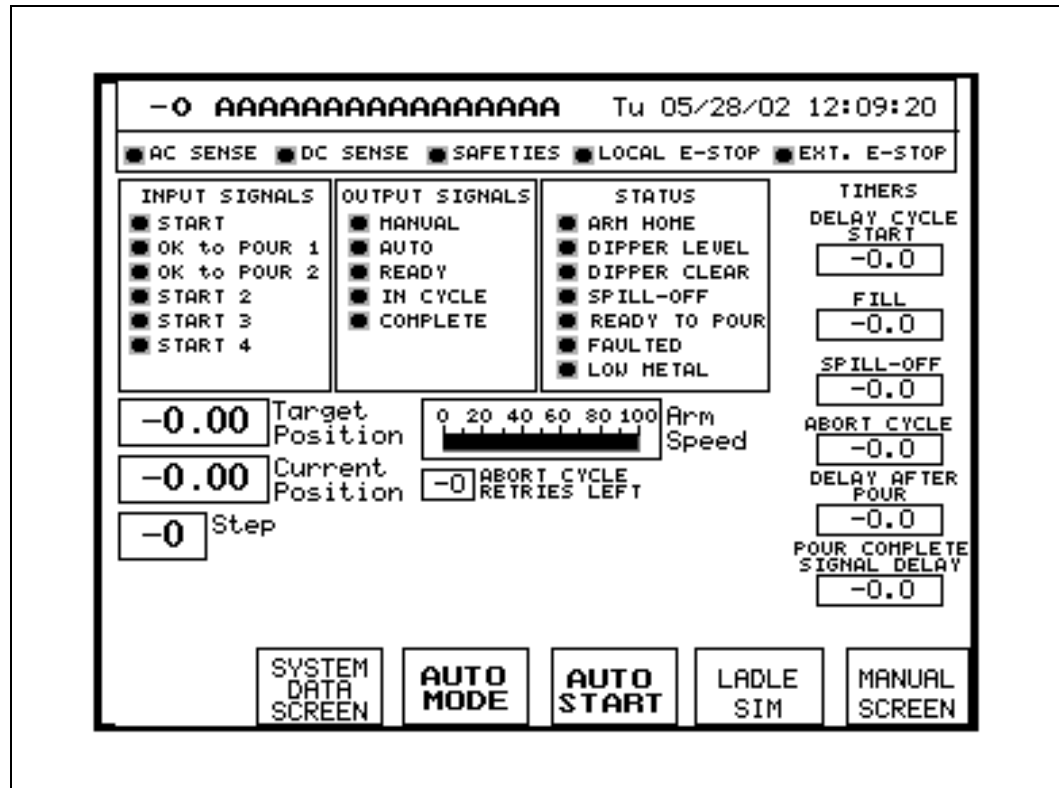


Figure 6-14: Monitor Screen (Cont.)

Operational Message	Indicates
MOVING TO REST POSITION	The ladle has completed the pour and is moving to the rest position at the RETRACT AFTER POUR SPEED. The DELAY POUR COMPLETE timer is started during this step and the POUR COMPLETE signal will be issued when it expires.
DIPPER BLOW OFF CYCLE	Optionally the ladle can perform a blow off cycle. During this message the ladle arm is moved to the rest position, the dipper is rotated to the BLOW OFF position, an output is given and the BLOW OFF timer is timed, and then the dipper is rotated back to the level position. The dipper speed used is the programmed DIPPER BLOW speed.

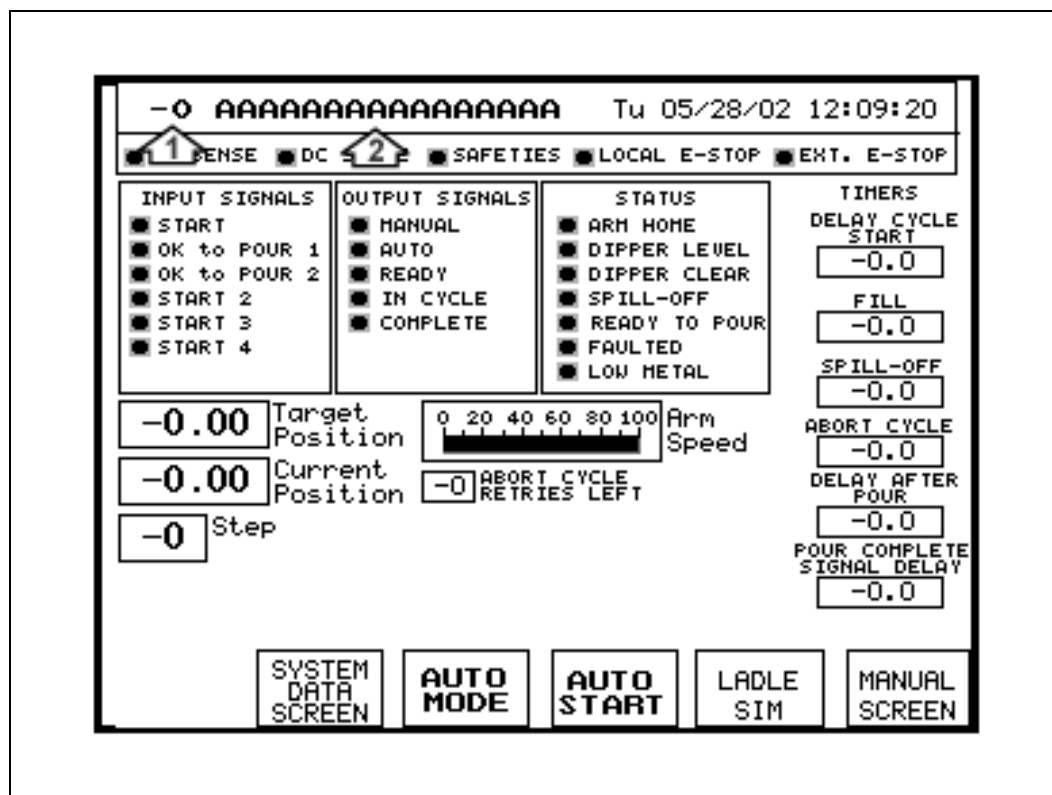


Figure 6-14: Monitor Screen (Cont.)

Parameter	Information
MEMORY NUMBER AREA (1, Figure 6-14 (Cont.))	Tells the user which program is currently being viewed.
DIE NAME (2, Figure 6-14 (Cont.))	Tells the user which die cell is currently being viewed.

System Data Screen

Use the System Data Screen (Figure 6-15) to check the status of the ladle and to set the date, time, auto time out, and screen contrast. To access this screen, select **Main>Monitor>System Data Screen**.

The screenshot displays the System Data Screen with the following elements:

- Top Header:** Tu 05/28/02 12:20:10
- Left Column:**
 - RESET CYCLE COUNTER (button)
 - SET CONTRAST (button)
- Right Column:**
 - RESET DATE/TIME (button)
 - ENABLE DATE/TIME (button)
- Central Data Fields:**
 - Last Cycle Time: -0.00
 - Controller Scan Time: --0.00 msec
 - Cycle Count: 000000000
 - Day of week: 0
 - Month Day Year: 0 0 0
 - Hour Min Sec: 0 0 0
 - Auto Time Out: 0 min
- Status Indicators:**
 - BATTERY OK
 - COMMUNICATION OK
 - SERVO CONTROLLER
 - FIRST I/O MODULE
 - SECOND I/O MODULE
 - THIRD I/O MODULE
 - FOURTH I/O MODULE
- Bottom Navigation Bar:**
 - I/O MODULE SCREEN
 - SYSTEM MONITOR SCREEN
 - REGISTER SCREEN
 - SYSTEM DEFAULT SCREEN
 - HMI DIAGNOSTICS SCREEN
 - HMI TEST BUTTON SCREEN

Figure 6-15: System Data Screen

Key	Function
RESET CYCLE COUNTER	Resets the cycle counts to zero
SET CONTRAST	Enables the user to set screen contrast
RESET DATE/TIME	Enables the user to enter new dates and times into the fields
CHANGE DATE/TIME	Enables the user to change the date and time, only after reset button is selected
I/O MODULE SCREEN	Displays the I/O Module Inputs Screens (Figure 6-16)
SYSTEM MONITOR SCREEN	Displays the Monitor Screen (Figure 6-14)
REGISTER SCREEN	Displays the Register Screen (Figure 6-18)
SYSTEM DEFAULT SCREEN	Displays the System Defaults Screen (Figure 6-19)
HMI DIAGNOSTIC SCREEN	Displays the HMI Diagnostic Screen (Figure 6-20)
HMI TEST BUTTON SCREEN	Displays a screen which allows the user to test the buttons

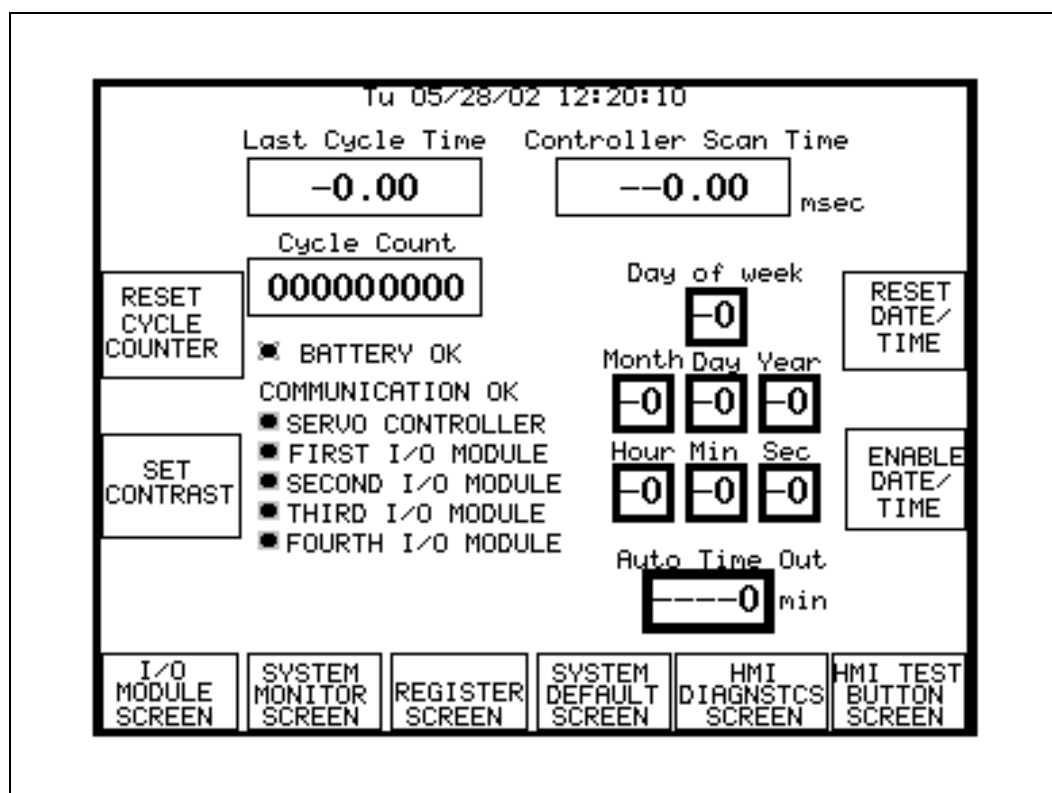


Figure 6-15: System Data Screen (Cont.)

Indicator	Information
Last Cycle Time	The time lapsed during the last cycle
Controller Scan Time	Time spent for the controller to execute one pass through the built-in internal program
Cycle Count	Number of cycles run since the counter was last reset
BATTERY OK	Indicates if the battery on the controller has sufficient charge
COMMUNICATION OK	Indicates that the controller is properly communicating with the I/O modules. Normally, the ladle has only two I/O modules
Parameter	Task
Day of Week*	Displays the current day of the week (SUN=1, MON=2, etc.)
Month Day Year*	Displays the current month/day/year (00/00/00)
Hour Min Sec*	Displays the current hour/minutes/seconds (00:00:00)
Auto Time Out*	Displays the length of time the machine can remain idle in auto mode before it will revert to manual mode. Can be set for 1-9999 minutes

* These can be changed using the arrows and the alpha/numeric keys (Figure 6-1).

To change current settings:

1. Press Reset Date/Time
2. Arrow to the correct parameter and enter in the new number
3. Press Enable Date/Time

I/O Module Inputs Screen

Use the I/O Module Inputs Screens (Figure 6-16) to check the status of the inputs to the system. The inputs shown are a real-time display of what signals are being read by the controller. The controller uses these signals in the internal logic of the machine.

To access this screen, select **Main>Monitor>System Data Screen>I/O Module Screen**.

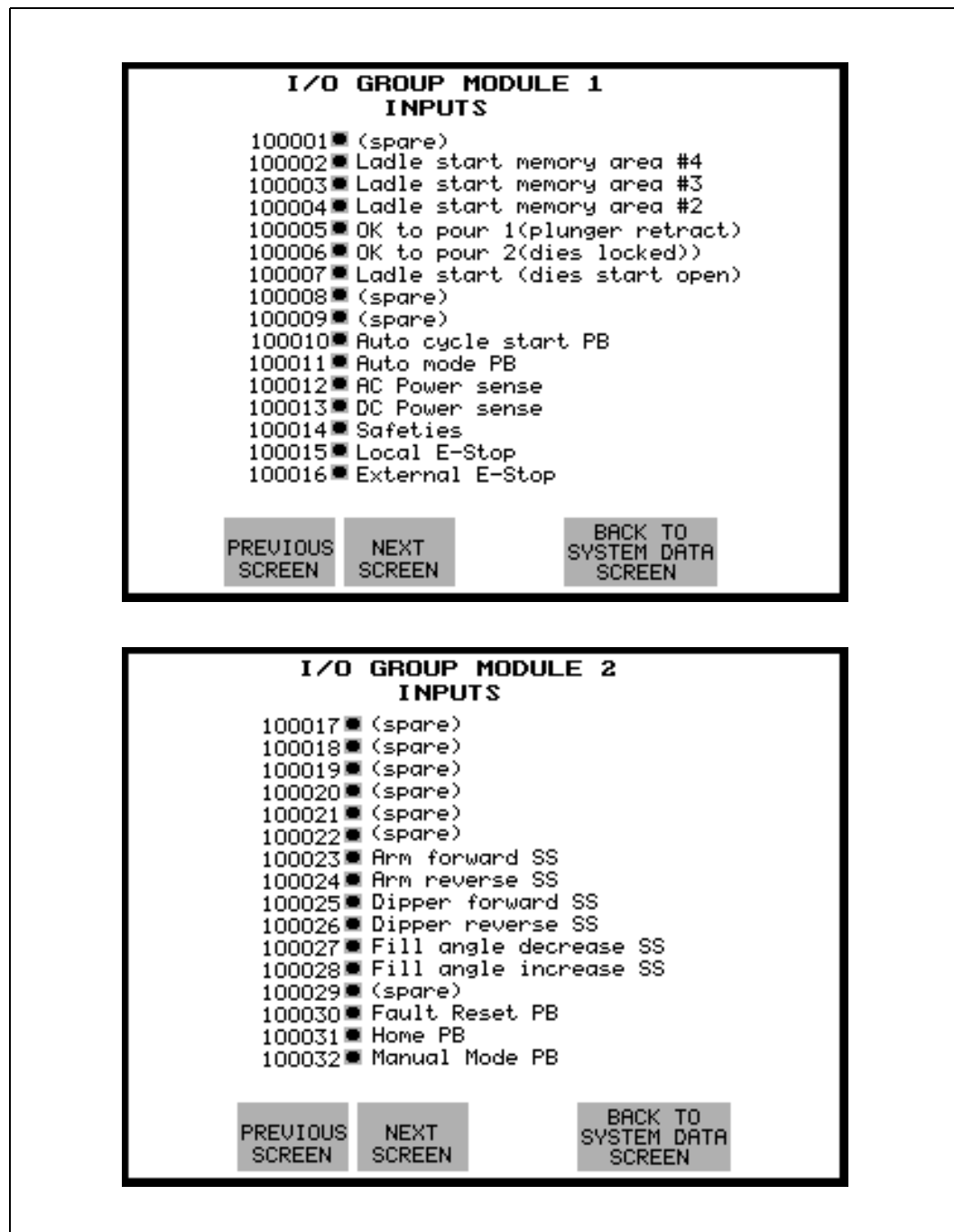


Figure 6-16: I/O Module Inputs Screens (Continued on the next page)

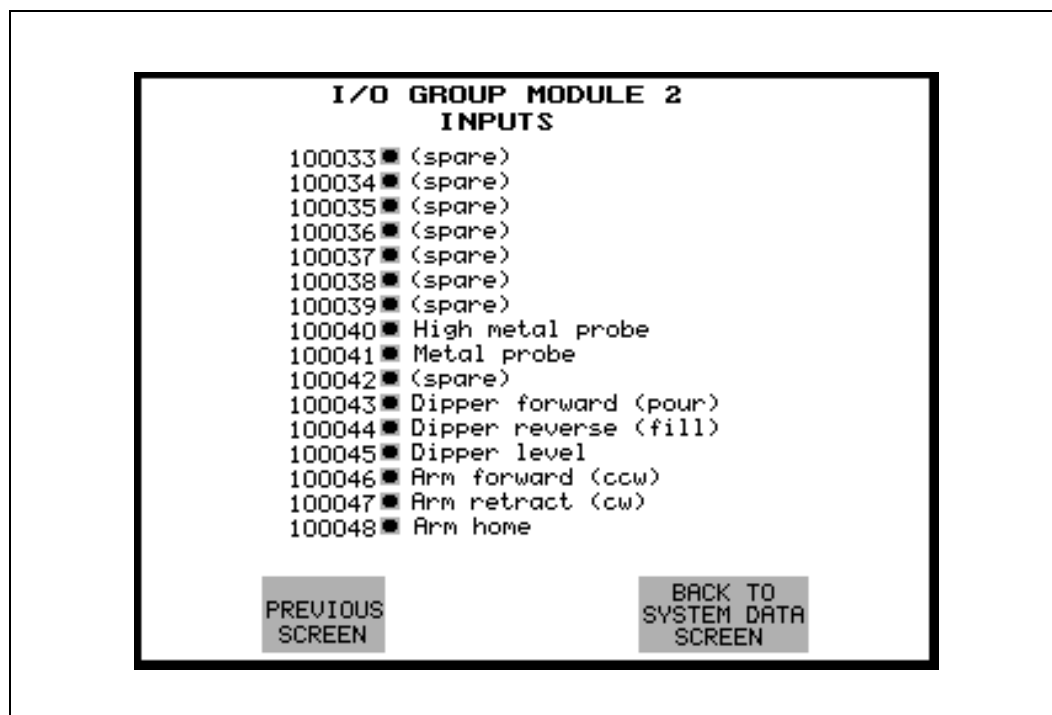


Figure 6-16: I/O Module Inputs Screens (Cont.)

Key	Function
PREVIOUS SCREEN	Displays the previous I/O Group Module Screen
NEXT SCREEN	Displays the next I/O Group Module Screen
BACK TO SYSTEM DATA SCREEN	Displays the System Data Screen (Figure 6-15)

I/O Module Outputs Screen

Use the I/O Module Outputs Screen (Figure 6-17) to check the status of the outputs from the system. The outputs shown are a real-time display of signals or commands being sent from the controller. The internal logic of the controller determines the state of these outputs.

Note: When the screen indicates an output is active, it means that the controller wants to send the signal. It does not mean that the signal is actually being sent.

To access this screen, select **Main>Monitor>System Data Screen>I/O Module Screen**, and then select **Next Screen** on the I/O Group Module 1 Inputs Screen.

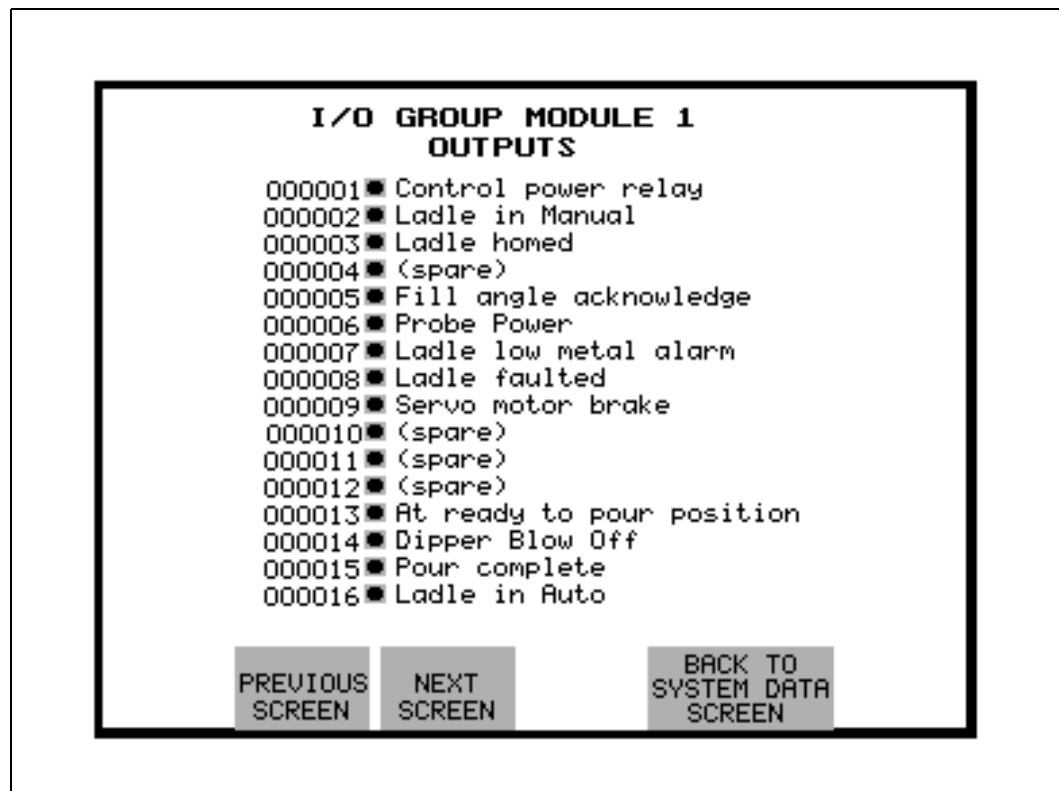


Figure 6-17: I/O Module Outputs Screen

Key	Function
PREVIOUS SCREEN	Displays the previous I/O Group Module Screen
NEXT SCREEN	Displays the next I/O Group Module Screen
BACK TO SYSTEM DATA SCREEN	Displays the System Data Screen (Figure 6-15)

Register Screen

Use the Register Screens (Figure 6-18) as references to check the status of the servo registers. These registers are used by the controller to store the status of the servo and to track critical motion inputs. To access the Register Screen, select **Main>Monitor>System Data Screen>Register Screen**.

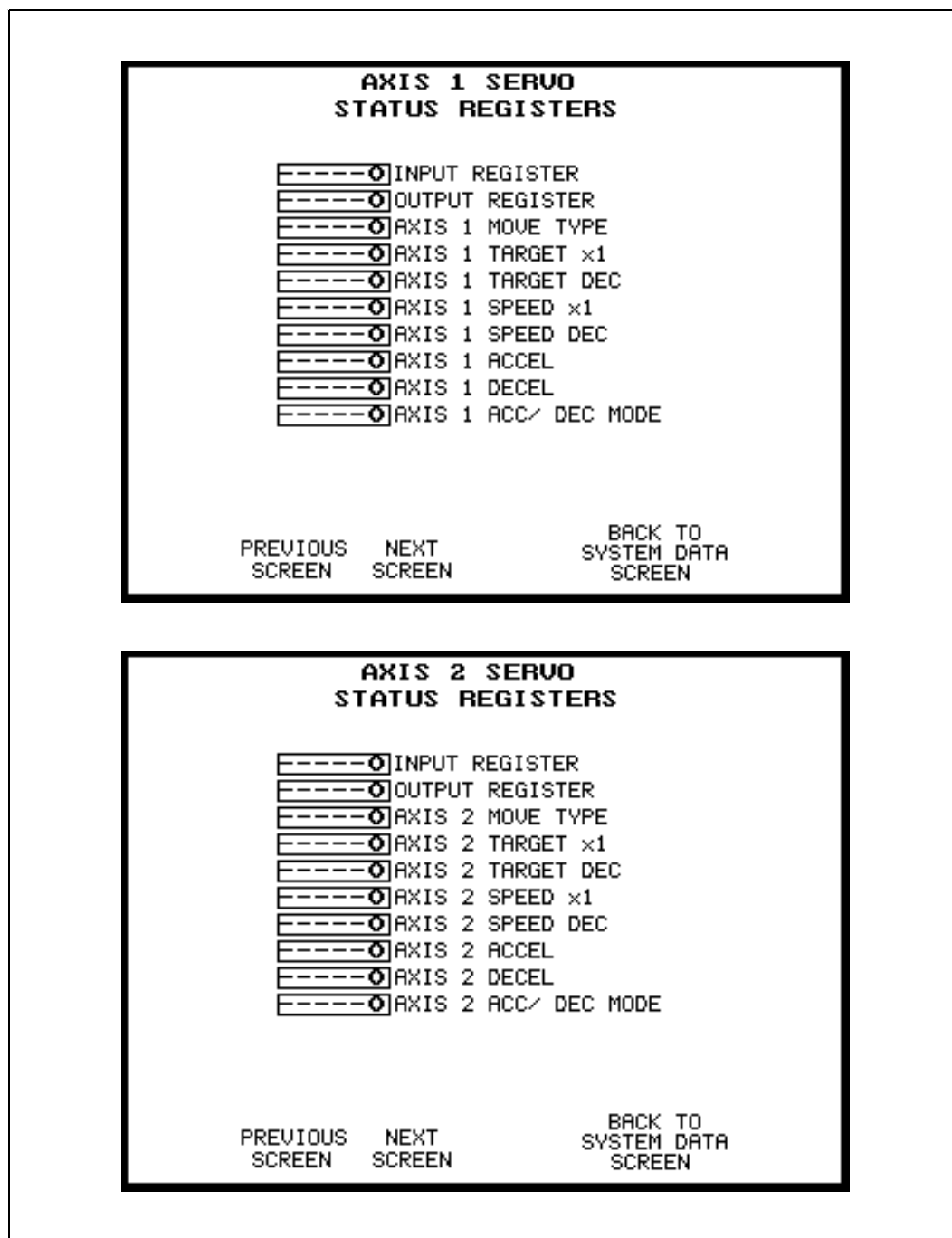


Figure 6-18: Register Screens (Continued on the next page)

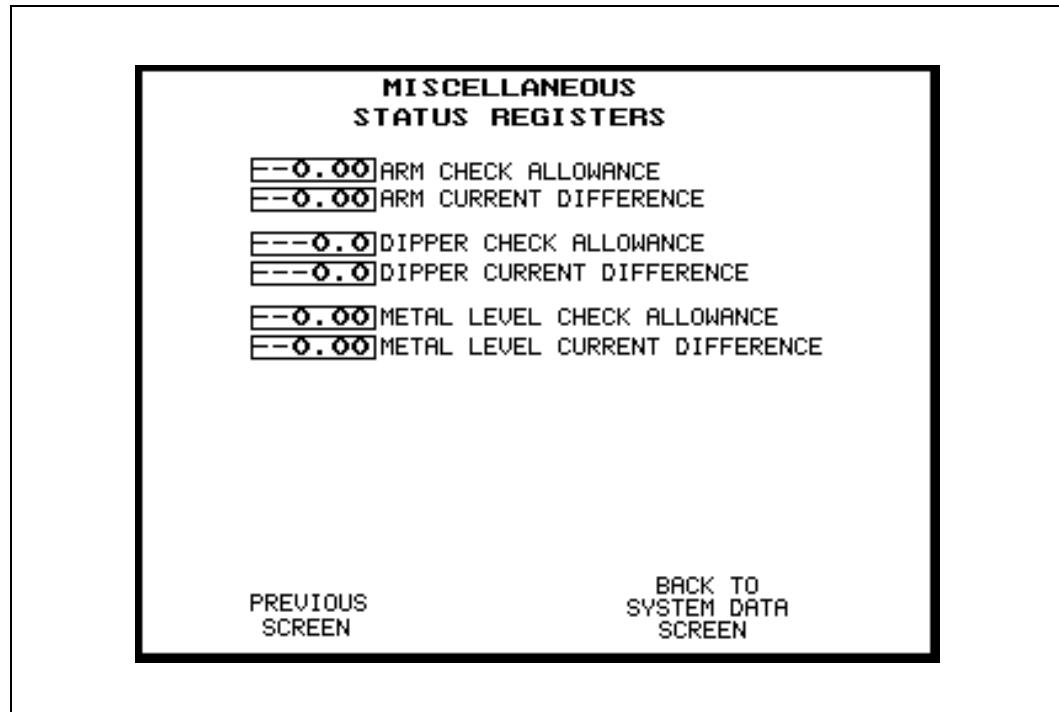


Figure 6-18: Register Screens (Cont.)

Key	Function
PREVIOUS SCREEN	Displays the previous Registers Screen
NEXT SCREEN	Displays the next Registers Screen
BACK TO SYSTEM DATA SCREEN	Displays the System Data Screen (Figure 6-15)

System Defaults Screen

Use the System Defaults Screen (Figure 6-19) to change the default settings. Use the arrow keys to move from field to field. Use the alpha/numeric keys to enter or change settings. To access the System Defaults Screen, select **Main>Monitor>System Data>System Default Screen**.

The screenshot displays the System Defaults Screen with the following parameters and values:

- ARM HOME SPEED: --0.0 %
- ARM MAN. SPEED: --0.0 %
- DIPPER HOME SPEED: --0.0 %
- DIPPER MAN. SPEED: --0.0 %
- MAX LENGTH: --0.0 IN.
- ARM CHECK POS TLRNC.: -0.00 IN.
- DIP. CHECK POS TLRNC.: --0.0 DEG.
- ALLOWABLE FILL CHANGE: -0.00 IN.
- ARM DIPPER ACCEL TIME FACTOR: -0, -0
- ARM DIPPER DECEL TIME FACTOR: -0, -0
- RUN MEMORY AREA: FIRST -0, SECOND -0, THIRD -0, FOURTH -0
- MEMORY AREA SEQUENCE: OFF

Figure 6-19: System Defaults Screen

Key	Function
MEMORY AREA SEQUENCE	Enables use of memory area inputs.
Parameter Field	Function
ARM OR DIPPER HOME SPEED	Sets the speed the ladle arm or dipper travels when the Home key is pressed. Range is 0–99.9% of the maximum speed.
ARM OR DIPPER MAN. SPEED	Sets the speed the ladle arm or dipper travels when operated manually. Range is 0–99.9% of the maximum speed.
MAX LENGTH	Sets the maximum length (inches) the ladle arm is allowed to travel.
ARM CHECK POS TLRNC.	Sets the tolerance around the initial arm stroke limit position for slippage or limit failure testing.
DIP. CHECK POS TLRNC.	Sets the tolerance around the initial dipper level limit position for slippage or limit failure testing.

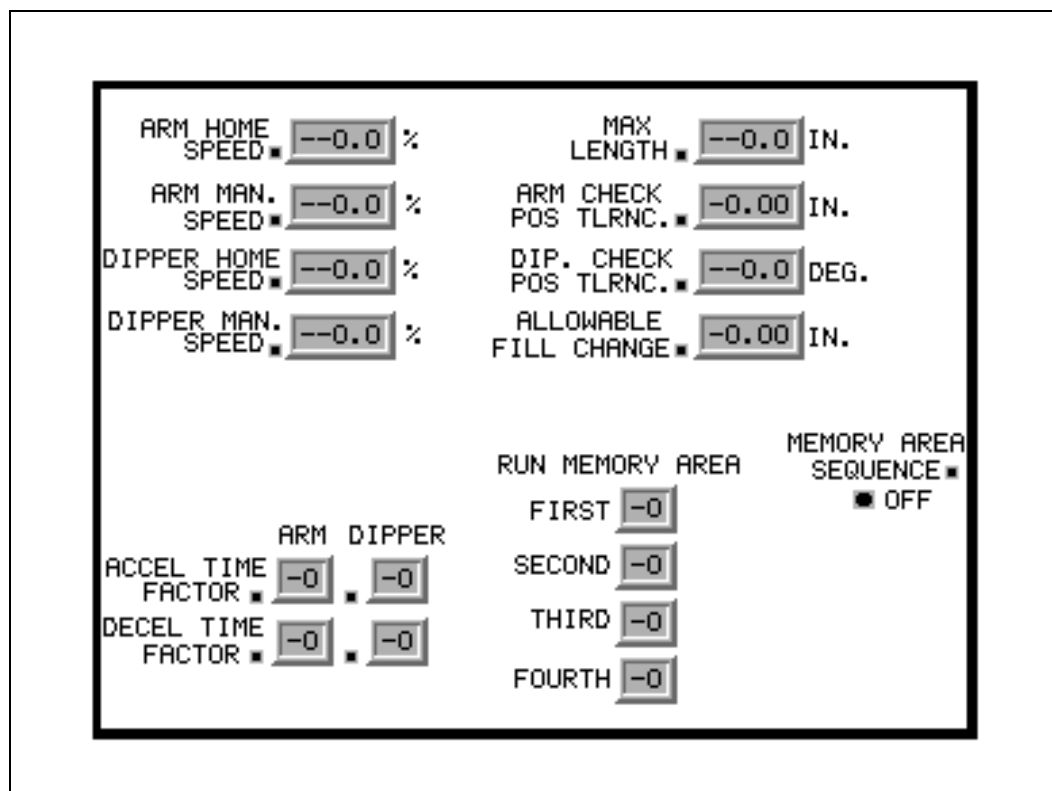


Figure 6-19: System Defaults Screen (Cont.)

Parameter	Function
ALLOWABLE FILL CHANGE	Sets the limit for the maximum depth the metal level in the furnace may vary in inches from cycle to cycle. A fault will be displayed if this parameter is executed.
ACCEL TIME FACTOR	Sets the acceleration of the ladle arm and dipper when moving. A larger number increases the acceleration time from no motion to maximum speed.
DECEL TIME FACTOR	Sets the deceleration of the ladle arm and dipper when moving. A larger number increases the deceleration time from maximum speed to no motion.
RUN MEMORY AREA	Sets the sequence for running memory area programs based on start inputs.

HMI Diagnostic Screen

Use the HMI Diagnostic Screen (Figure 6-20) to find information about the HMI. This information is useful when contacting Rimrock for technical support. To access the HMI Diagnostic Screen, select **Main>Monitor>System Data Screen>HMI Diagnostic Screen**.

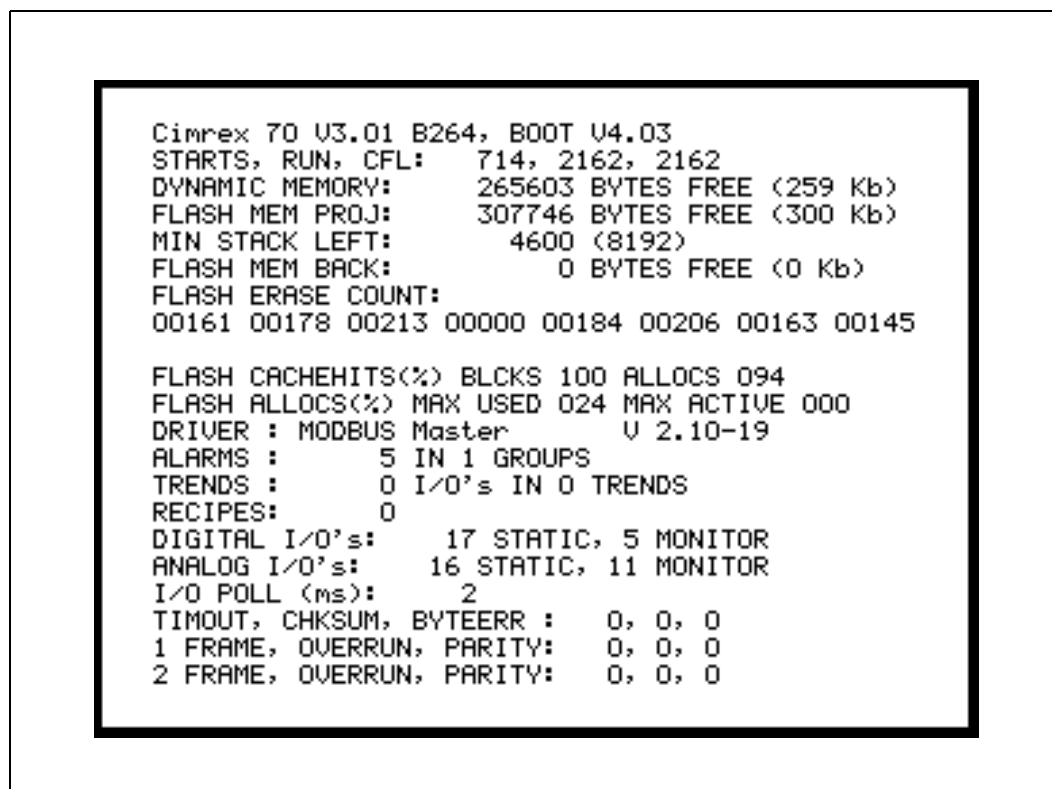


Figure 6-20: HMI Diagnostic Screen

Indicator	Information
STARTS	Number of times the terminal has been started
RUN	Number of hours the terminal has been in operation
CFL	Number of hours the backlighting has been switched on
DYNAMIC MEMORY	Free RAM memory (working memory) in number of bytes
FLASH MEMORY PROJ	Free Flash memory (project memory) in number of bytes
MIN STACK LEFT	Not used
FLASH MEM BACK	Not used
FLASH ERASE COUNT	Number of times each sector of the Flash memory has been erased. The current spare block always shows zero
FLASH CACHEHITS	Percentage of Block/Allocation cache hits in the file system
FLASH ALLOCS	Max percentage of used/active allocations per block in the file system
DRIVER	Identifies the software communication set up and protocol

```

Cimrex 70 V3.01 B264, BOOT V4.03
STARTS, RUN, CFL: 714, 2162, 2162
DYNAMIC MEMORY: 265603 BYTES FREE (259 Kb)
FLASH MEM PROJ: 307746 BYTES FREE (300 Kb)
MIN STACK LEFT: 4600 (8192)
FLASH MEM BACK: 0 BYTES FREE (0 Kb)
FLASH ERASE COUNT:
00161 00178 00213 00000 00184 00206 00163 00145

FLASH CACHEHITS(%) BLCKS 100 ALLOCS 094
FLASH ALLOCS(%) MAX USED 024 MAX ACTIVE 000
DRIVER : MODBUS Master V 2.10-19
ALARMS : 5 IN 1 GROUPS
TRENDS : 0 I/O's IN 0 TRENDS
RECIPES: 0
DIGITAL I/O's: 17 STATIC, 5 MONITOR
ANALOG I/O's: 16 STATIC, 11 MONITOR
I/O POLL (ms): 2
TIMEOUT, CHKSUM, BYTEERR : 0, 0, 0
1 FRAME, OVERRUN, PARITY: 0, 0, 0
2 FRAME, OVERRUN, PARITY: 0, 0, 0

```

Figure 6-20: HMI Diagnostic Screen (Cont.)

Indicator	Information
ALARMS	Number of alarms and alarm groups in the application
TRENDS	Number of trend I/O and trend objects in the application
RECIPES	Number of production methods in the application
DIGITAL I/Os	Number of digital I/Os monitored continuously (static) and number in the current block (monitor)
ANALOG I/Os	Number of analog I/Os monitored continuously (static) and number in the current block (monitor)
I/O POLL	Time in ms between two readings of the same I/O
TIMEOUT	Number of time-outs in the communication
CHKSUM	Number of check sum errors in the communication
BYTEERR	Number of byte errors in the communication
FRAME	Number of framing errors in each port
OVERRUN	Number of overrun errors in each port
PARITY	Number of parity errors in each port First Line for Frame/Overrun/Parity = RS-422 port Second Line for Frame/Overrun/Parity = RS-232 port

Ladle Sim Screen

The Ladle Sim Screen (Figure 6-21) displays an animated graphical representation of ladle movements and provides indicators for refining program steps. Indicators are also provided to show critical points in the cycle sequence.

The Ladle Sim Screen is useful when the operator cannot see the entire travel of the ladle. It can also be helpful when troubleshooting because it shows where the controller believes the arm and dipper are oriented.



IMPORTANT!

The operator must be able to view the entire travel of the ladle during manual operation to verify that it is safe to move the ladle.

The Ladle Sim Screen can be viewed during all modes of operation. To access this screen, select **Main>Monitor>LadleSim**.

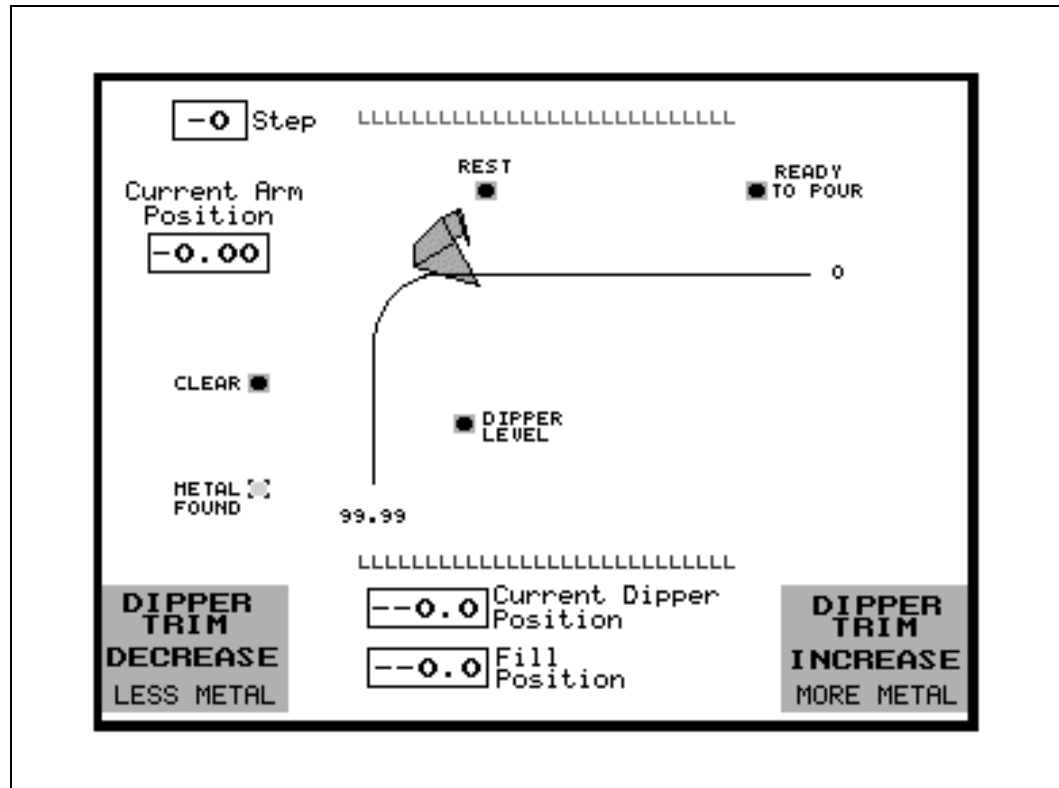


Figure 6-21: Ladle Sim Screen

Key	Function
DIPPER TRIM DECREASE (Less Metal)	Increases the fill angle of the dipper cup (relative to the 180° Level Position) resulting in a more steep slope for the fill angle and less metal entering the cup. Each time this key is pressed, the dipper will move 1/2° in the dipper fill layer. (This key can only be pressed 5 times during one cycle.)
DIPPER TRIM INCREASE (More Metal)	Decreases the fill angle of the dipper cup (relative to the 180° Level Position) resulting in a less steep slope for the fill angle and more metal entering the cup.
Indicator	Information
Lighted Indicators	Indicators light as the motion of the arm and dipper reach critical points of travel in the step such as the Clear, Rest, Ready to Pour, and Dipper Level positions as programmed on the System Defaults Screen.
Step	Displays the step in the program currently being executed.
Current Arm Position	Displays the current position of the ladle arm (how far the arm has traveled from the fully retracted position). Displayed graphically on the bar graph located above the numeric indicator.

Current Dipper Position	Displays the current position of the ladle dipper (how far the dipper has traveled from the full reverse position). Displayed by graphic simulation located below the numeric indicator.
Fill Position	Displays the position of the dipper when it is in the fill position.

Alarm Functions Screen

Use the Alarm Functions Screen (Figure 6-22) to view, acknowledge, and clear faults. When an alarm is triggered, a flashing red bell symbol will appear in the upper-right corner of the screen. This symbol disappears once the fault has been acknowledged. To access this screen, select **LIST** from the Built-In Function Keys or select **Main>Alarm List**.

Chapter 9 Troubleshooting provides detailed information regarding alarms and faults.

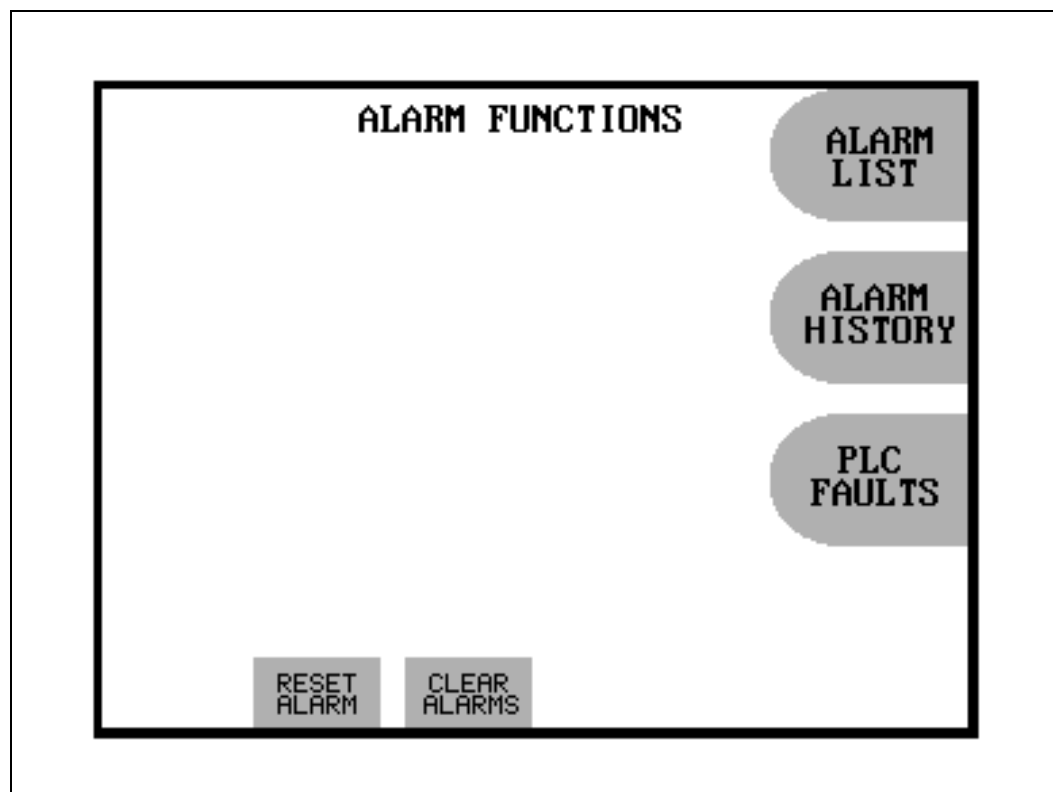


Figure 6-22: Alarm Functions Screen

Key	Function
ALARM LIST	Accesses the Alarm List Screen (Figure 6-23). This list is kept by the HMI.
ALARM HISTORY	Displays a screen with a listing of the last 20 alarms and the time that each occurred. This list is kept by the processor.
PLC FAULTS	Displays a screen with a listing of faults from the programmable logic controller (PLC). This list is kept by the processor.

Key	Function
RESET ALARM	Acknowledges alarms. Pressing the fault button also acknowledges alarms.
CLEAR ALARMS	Clears Alarm List

Alarm List Screen

Access the Alarm List Screen by pressing the **ALARM LIST** key on the Alarm Functions Screen. Each alarm listed on the screen is shaded with a color to indicate its status. The colors indicate:

- Red—Active alarm
- Brown—Alarm acknowledged
- Green—Inactive alarm
- Blue—Normal alarm

This list is kept by the HMI.

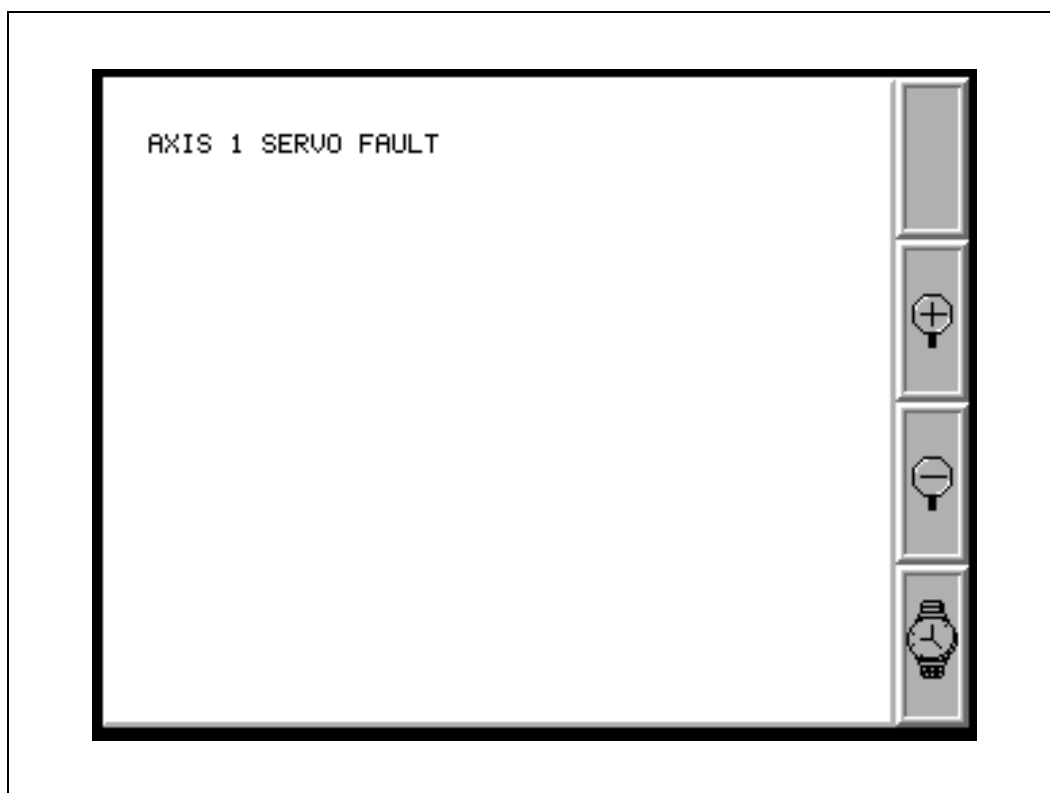


Figure 6-23: :Alarm List Screen

Key	Function
	Enlarges text
	Reduces text
	Displays time and date information

Alarm History Screen

Access the Alarm History screen by pressing the **ALARM HISTORY** key on the Alarm Functions Screen. This screen displays a list of the last 20 alarms and the time that each occurred. This list is kept by the processor.

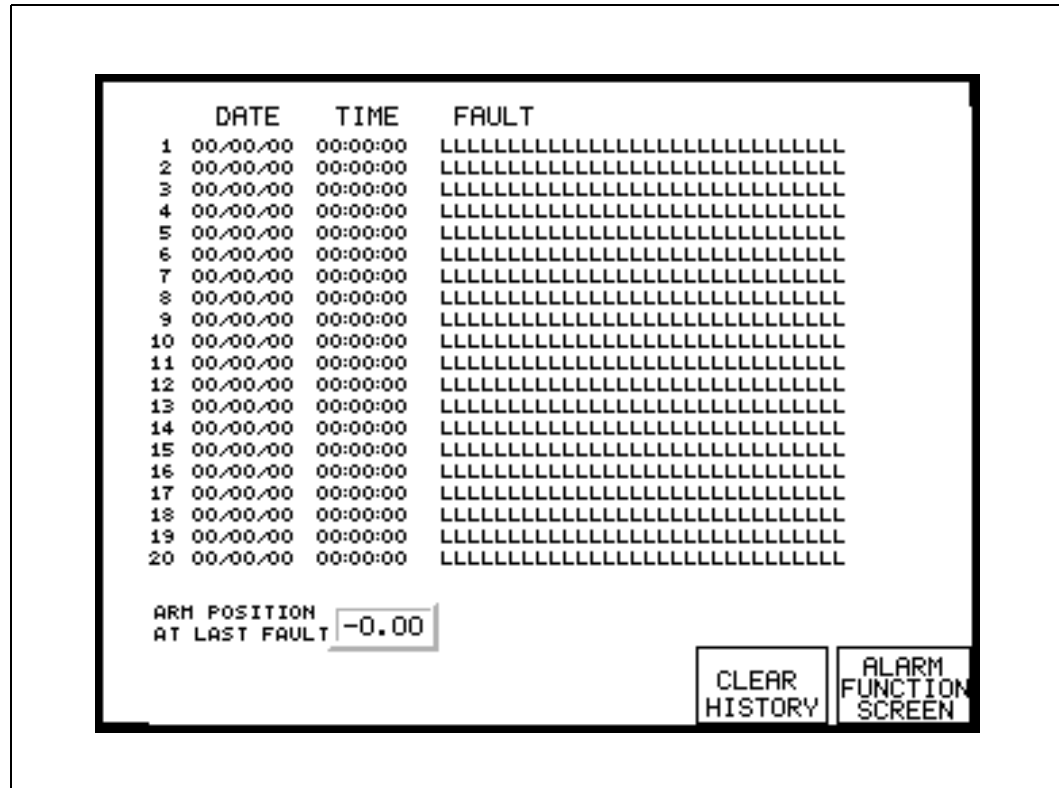


Figure 6-24: Alarm History Screen

Key	Function
CLEAR HISTORY	Clears alarm history list
ALARM FUNCTION SCREEN	Displays the Alarm Functions Screen
ARM POSITION INDICATOR	The arm position where the last fault occurred.

PLC Faults Screen

Access the PLC Faults Screen by pressing the **PLC FAULTS** key on the Alarm Functions Screen. This screen displays a list of faults from the programmable logic controller (PLC). This list is kept by the processor.

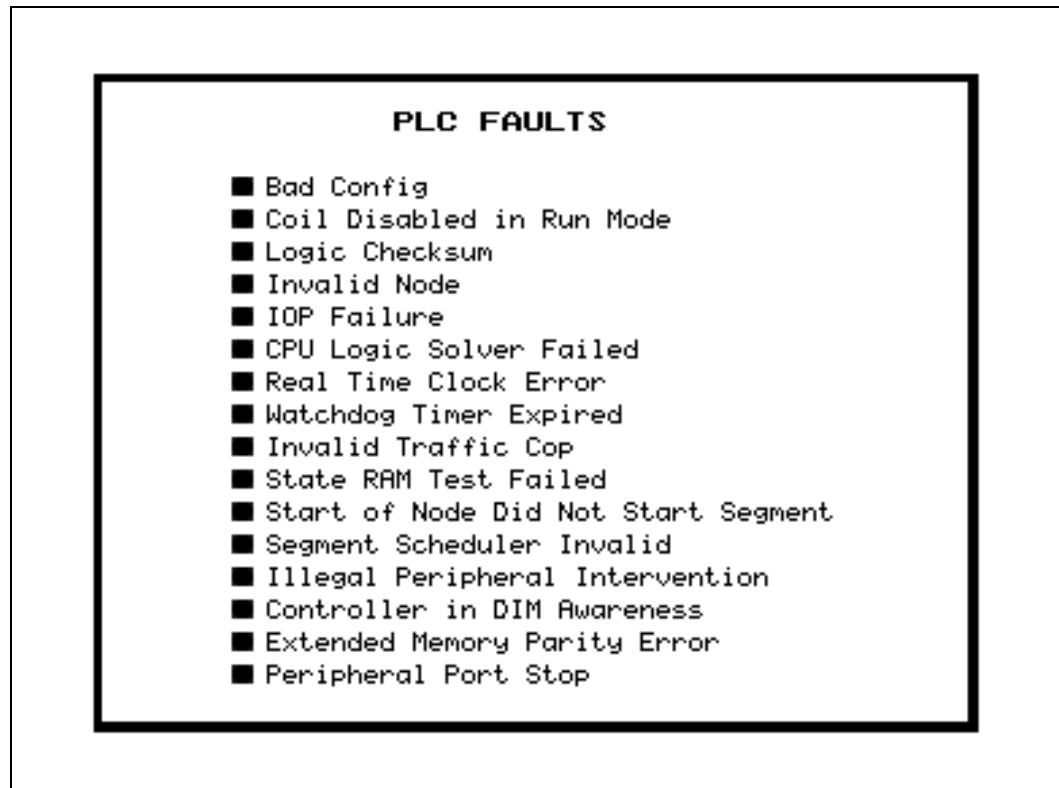


Figure 6-25: PLC Faults Screen

Chapter 7

SET UP AND PROGRAMMING

Introduction

A program instructs the ladle to perform a sequence of functions to accomplish the desired ladling into each die processed. Using the HMI, steps can be programmed and stored in memory for repeated use.

In order to edit any of these instructions, you must be familiar with Chapter 11.

Verifying Proper Installation

After installing the equipment, and before programming, verify the following:

- Ladle is in line with the pour hole and height adjustments have been made
- Furnace is properly aligned with the ladle with no interference points in the dipper path
- Sensor probes are properly adjusted and aligned with the dipper so that the dipper fill slot is not submerged and the arm is not touching metal
- There are no mechanical interferences

After proper installation has been verified, experiment with the positions and speeds using the manual controls to achieve the best cycle possible. Use the Monitor or the Ladle Sim Screen to view the ladle movements and the arm and dipper locations that the controller senses for each programmed step.

Typical Ladle Sequence

During a sequence, the ladle can perform four functions:

- **Fill**—The ladle moves the dipper into the furnace for filling. Clean metal enters the dipper through a rear fill slot that is positioned just below the bath surface. During filling, two metal sensing probes seek the surface of the bath for accurate dipper positioning. A third probe protects the system from furnace recharging while the dipper is in the bath and serves as a backup to the primary sensors.
- **Transport**—The ladle moves the dipper into position to pour. The ladle is easily adaptable to any shot position. The ladle can be placed on either the operator's or the helper's side of the machine.
- **Pour**—Three speed positions can be programmed for complete pour management. The ladle is designed to pour directly into the pour hole. Pour contouring and a POUR FORWARD function that moves the arm forward while the dipper is pouring, eliminate spills and drips.

- **Pour Back**—Automatic pour back is activated when one or more interlocks on the DCM are not satisfied within a preset time. The dipper returns and pours the metal back into the furnace. The empty dipper then returns to the rest position.

A typical ladle sequence is described below. It usually consists of the following steps:

- Cycle Start—Arm at Rest Position
- Arm Moves to Clear Position
- Dipper Rotates to Fill Angle
- Dipper at Fill Position
- Fill Timer
- Arm Moves to Spill-Off Position
- Dipper Rotates to Level
- Arm Moves to Pour Position
- Dipper Runs Pour Sequence
- Dipper Returns to Level
- Cycle Complete
- Arm Moves to Rest Position

Cycle Start—Arm at Rest Position

The ladle cycle is started by one of the following:

- The user pushes the **AUTO START** key.
- The die cast machine gives the ladle a signal to start.

Arm Moves to Clear Position

The arm stops at the Clear position after it has retracted from the Rest position.

Dipper Rotates to Fill Angle

The arm changes speed to the Enter Metal speed and continues retracting as the dipper rotates down to the Fill Angle position. The arm motion stops when the sensor probes contact metal.

Dipper at Fill Position

The Fill position changes relative to the changes in metal level. When the sensor probes contact the metal, the Fill Timer begins and the dipper fills with metal.

Fill Timer

The Fill Timer determines how long the dipper is submerged in the metal. When the Fill Timer expires, the arm moves the dipper out of the metal to the Spill-Off position. The dipper must completely fill with metal to ensure an accurate delivery of metal.

Arm Moves to Spill-Off Position

The arm holds the dipper in the Spill-Off position for the length of time programmed for the Spill-Off Timer. After holding in the Spill-Off position, the dipper rotates back to the Level position for transport. The metal must completely spill from the dipper to ensure an accurate delivery of metal.

Dipper Rotates to Level

The dipper is rotated to the Level position for transport to the Pour position. Once level, the arm will begin to move to the Pour position.

Arm Moves to Pour Position

Once the arm reaches the shot sleeve, the ladle waits for the DCM signal that the dies are locked and the plunger is retracted. If these signals do not occur in a pre-set amount of time, the ladle will abort the cycle. When the signals are received, the dipper will pour.

Dipper Runs Pour Sequence

The ladle uses a three-step pour contouring feature to pour metal. This allows dipper speeds and positions to be programmed so that all metal in the dipper cup is poured into the die. When the dipper reaches the third pour position, the Delay After Pour Timer holds the dipper to allow the metal to completely drain. Once the timer has expired, the dipper will return to level.

Dipper Returns to Level

The dipper rotates back to level and begins the Delay Pour Complete Signal Timer. This timer allows the metal to settle in the shot sleeve before giving the signal that the pour is complete.

Cycle Complete

The ladle arm begins to return to the Rest position. Once the Cycle Complete Timer has expired, the ladle will give the pour complete signal.

Arm Moves to Rest Position

The ladle arm stops at the Rest position and waits for the next start signal.

Programming

The HMI provides an easy way for the user to program the ladle. See Chapter 6 for more information about the HMI. During programming, the user can set up the sequencing of the ladle for a particular job. Once user determines the program for a particular die, the HMI stores the program in a memory area for repeated use. The HMI can store up to 20 different programs.

The user teaches a ladle a die program by setting up a list of parameters that will perform a sequence of operation. The parameters are programmed using the Teach Screens. The parameters include:

- Position for the dipper and arm
- Speed for the arm dipper movements
- Delay times
- Optional procedures

The Teach and Memory Area Transfer Screen provides the interface to begin setting the parameter list for a program (Figure 7-1).

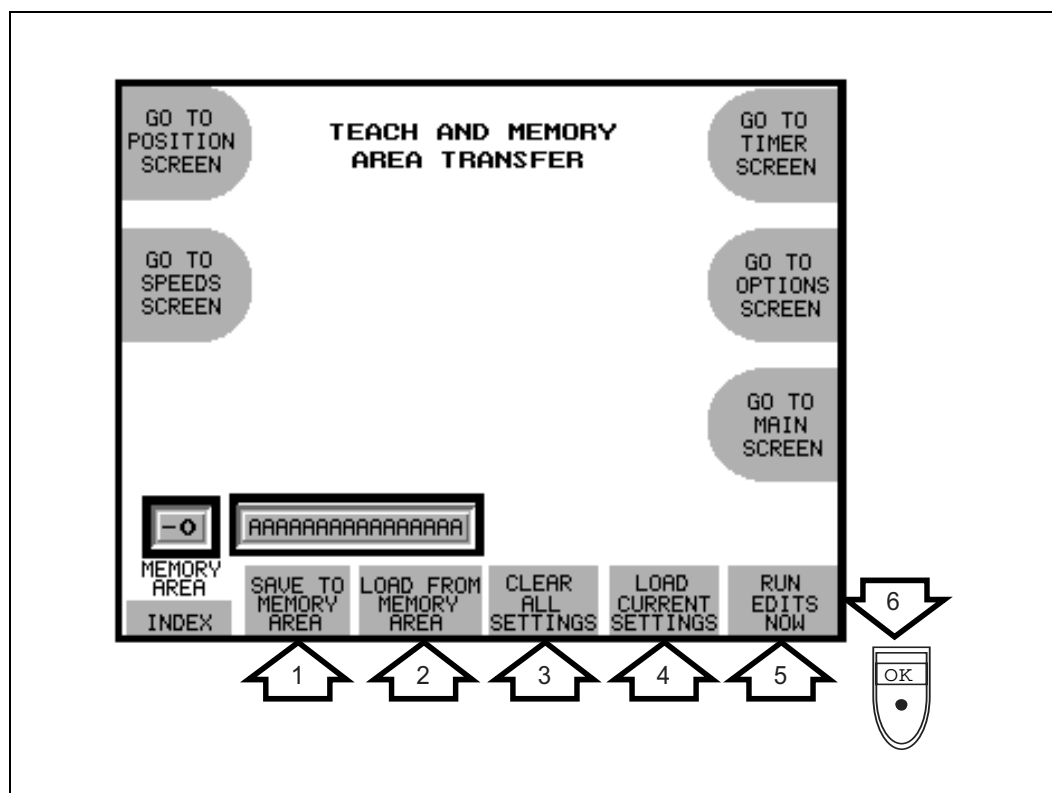


Figure 7-1: Teach and Memory Area Transfer Screen

Scratchpad

The parameter list screens accessible from the Teach and Memory Area Transfer Screen (Position, Speed, Timer, and Options Screens) act as scratchpads. The values on the scratchpads are copies of what is in the controller memory. Use the scratchpads to enter the parameters in each list.

Figure 7-2 illustrates the functions of the scratchpad.

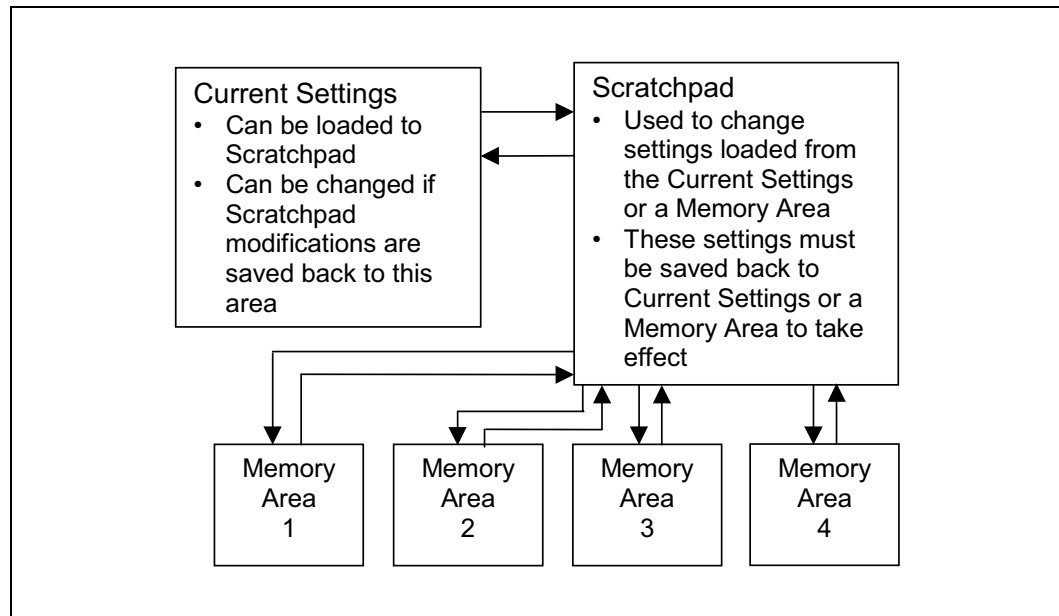


Figure 7-2: Scratchpad Functionality

Use the keys at the bottom of the Teach and Memory Area Transfer Screen (Figure 7-1) to:

- Load the Current Settings onto the Scratchpad (#4 on Figure 7-1)
- Load the settings from a Memory Area onto the Scratchpad (#2)
- Save the settings from the Scratchpad to a Memory Area (#1)
- Clear all settings on the Scratchpad (#3)
- Load the settings from the Scratchpad to the Current Settings (#5)

Note: Parameters put into the scratchpad will not affect the operation of the unit until the **RUN EDITS NOW** or **SAVE TO MEMORY AREA** keys are pressed.

Note: When the Position, Speed, Timer, and Options Screens are first opened, the Current Settings display. The user can use these settings as a starting point when setting up a new program or changing an existing program.

To enter parameters into the scratchpad environment on the Positions, Speeds, Timer, or Options Screens:

1. Highlight a field using the directional arrow keys (#1 on Figure 7-3).
2. Type in a parameter using the alpha/numeric keys (#2). Press each key repeatedly until desired number, letter, or symbol appears in the field.
3. Press **Enter** (#3). The LED on the OK button flashes.
4. Press the **OK** key. The change is saved to the scratchpad.
5. Press the **RUN EDITS NOW** key on the lower-right corner of the parameter screens to update the memory area or current settings from where the Scratchpad data originated.

or

Press the **TEACH LIST**

SCREEN key to return to the

Teach and Memory Area Transfer Screen. Then perform one of the following actions:

- Press the **SAVE TO MEMORY AREA** key (#1 on Figure 7-1) to save the changes in the HMI memory.
 - Press **RUN EDITS NOW** key (#5 on Figure 7-1) to save the scratchpad to the current settings.
6. Confirm the save operation by pressing the **OK** key.

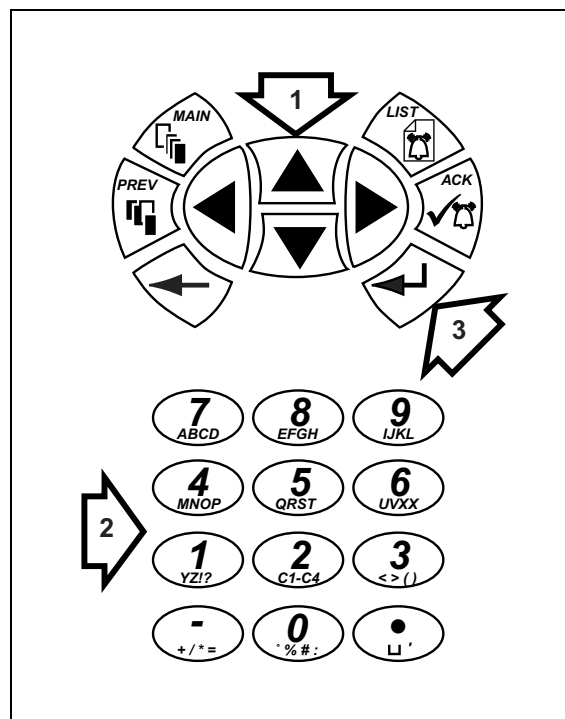


Figure 7-3: Keys

Teaching Using the Scratchpad

When the Ladle is set up for a die, parameters are programmed that will be used during the sequence of operation. Follow these steps to teach a program to the Ladle using the scratchpad:

1. Press the **MAIN** key in the Built-In Function Keys (Figure 7-3). The Main Screen displays.
2. Press the **TEACH** key (Figure 7-4). The Teach and Memory Area Transfer Screen displays (Figure 7-5).

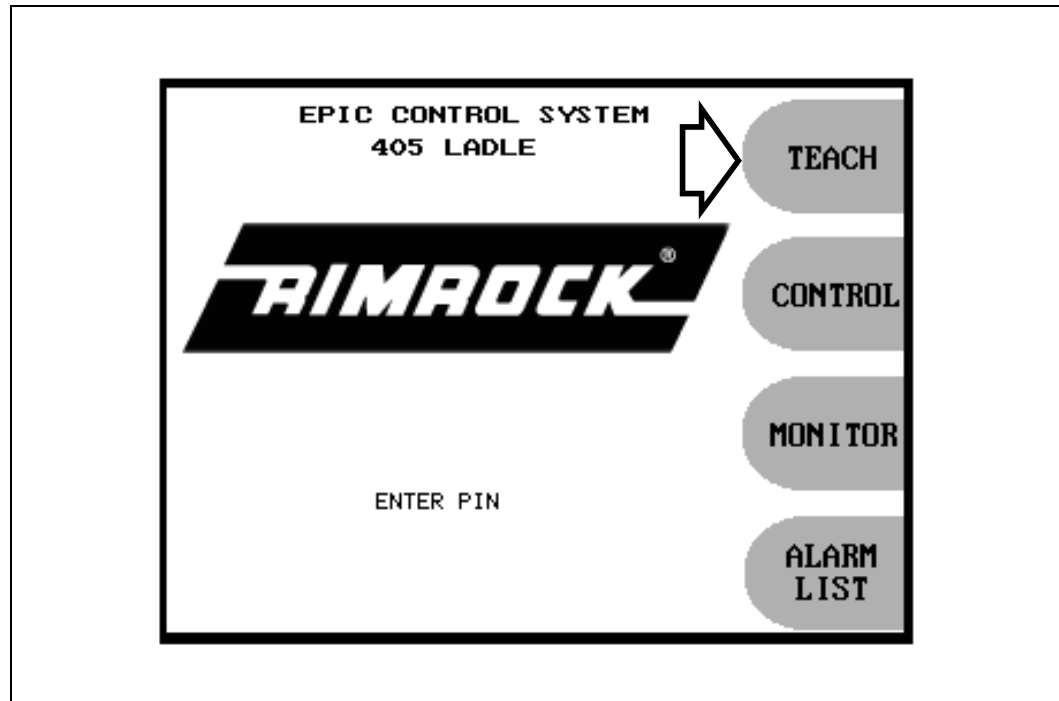


Figure 7-4: Example Teach Key

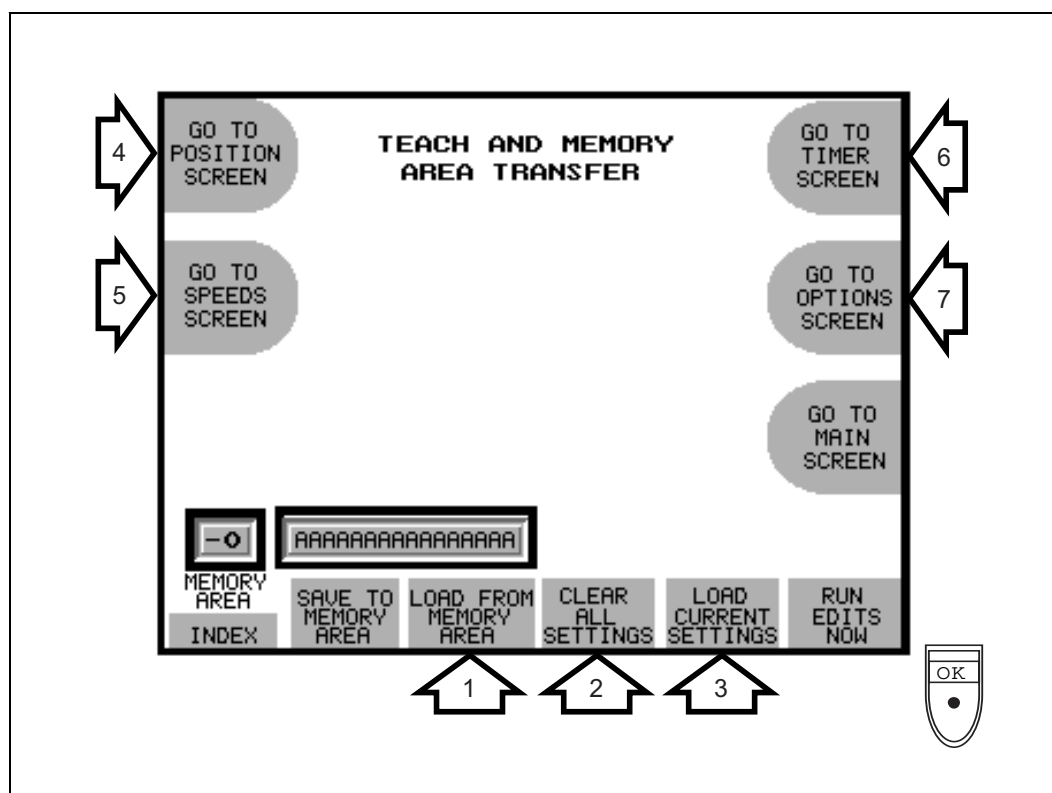


Figure 7-5: Teach and Memory Area Transfer Screen

3. Perform one of the following actions:
 - a. Press the **CLEAR ALL SETTINGS** (#2 on Figure 7-5) to start with blank scratchpads on the Positions, Speeds, Timer, and Options Screens (Figure 7-6 through Figure 7-9).
 - b. Press the **LOAD FROM MEMORY AREA** (#1) to modify a program already in the controller memory.
 - c. Press the **LOAD CURRENT SETTINGS** (#3) to modify the current settings.

Note: It is best to start with parameters from a similar die if one exists rather than starting with a blank scratchpad.

4. Press one of the **GO TO SCREEN** keys for the parameter screen to be programmed (#4, #5, #6, or #7)

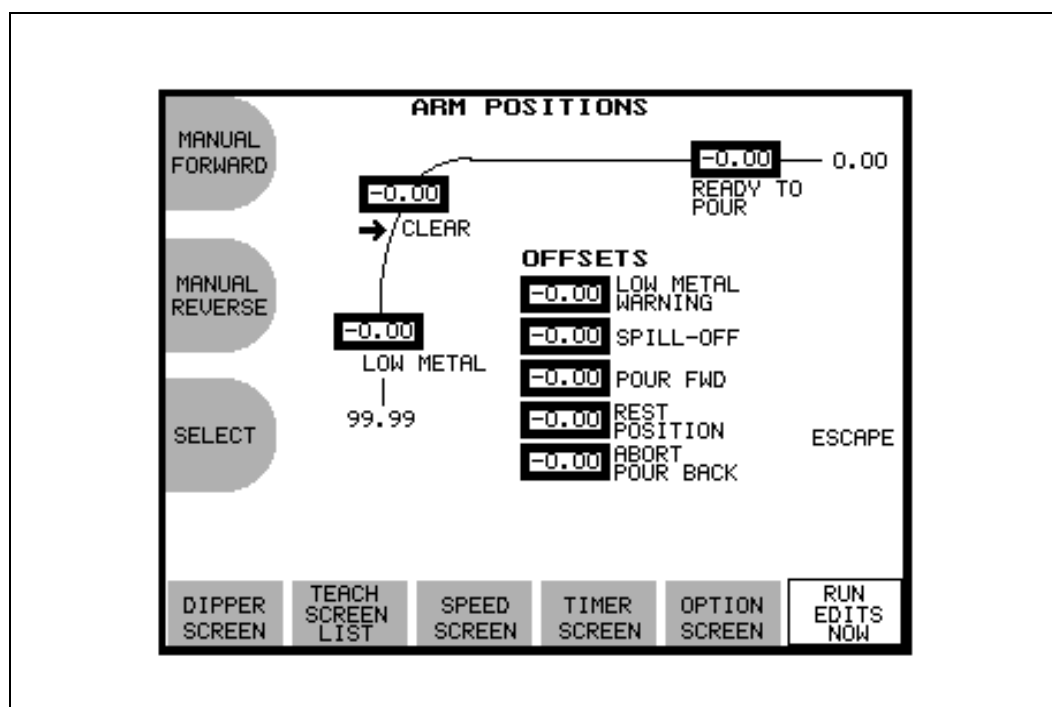


Figure 7-6: Arm Positions Screen

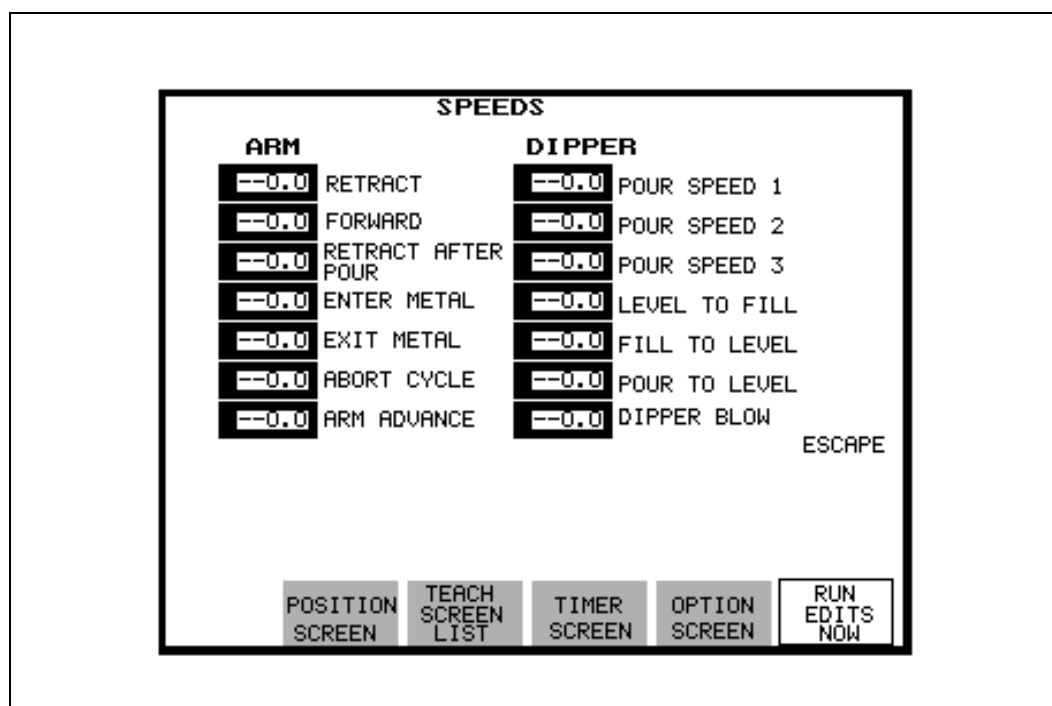


Figure 7-7: Speeds Screen

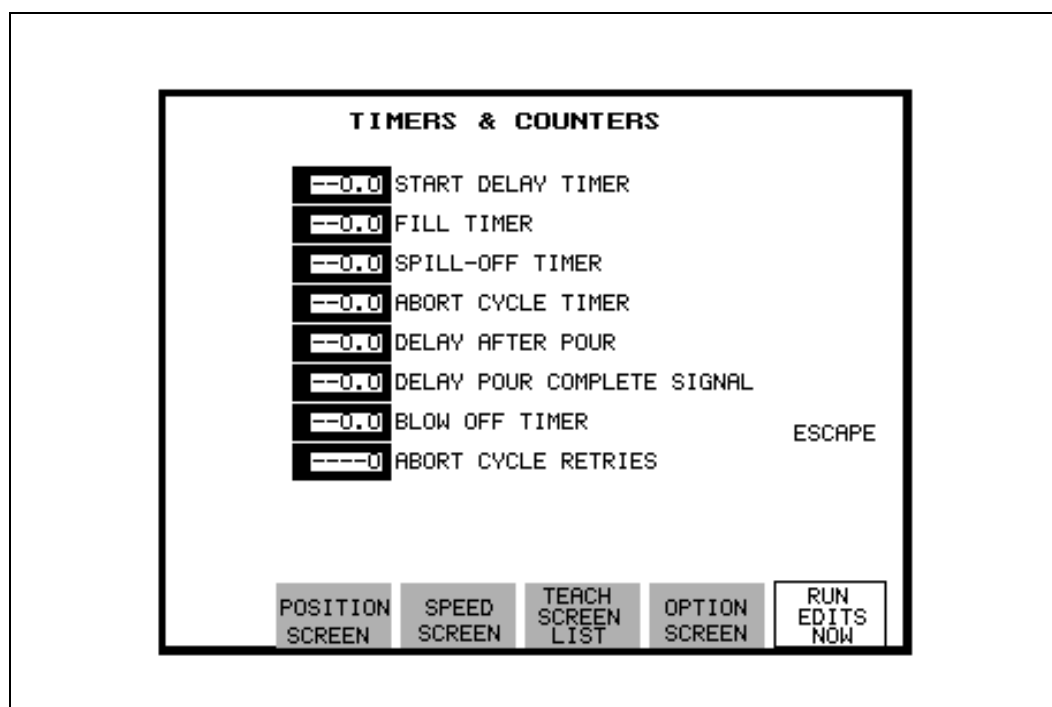


Figure 7-8: Timers & Counters Screen

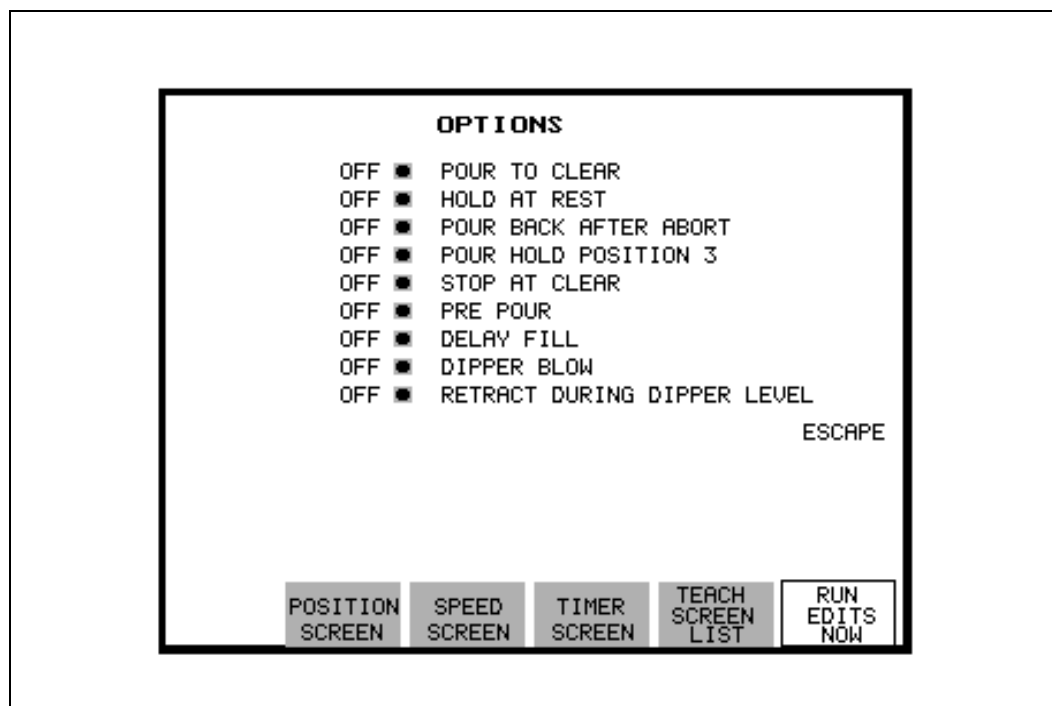


Figure 7-9: Options Screen

5. Press the directional arrow keys (Figure 7-3) to highlight the data field to be added or modified.
6. Use the alpha/numeric keys (Figure 7-3), to enter the setting for the parameter selected.
7. Press the **Enter** key (Figure 7-3).
8. When all information for the data fields has been entered on the active screen, press the **OK** key to accept the edits.

Note: Pressing the **ESCAPE** key will discard settings and re-set them as they originally came in on the scratchpad.

9. Select the next screen to be edited using the screen name keys located at the bottom of each screen. Continue to add or modify data on each screen following steps 5–8.

Note: If a number beyond the range of the ladle is allowed to move to is entered, the number will flip back to the maximum setting.

10. When all parameter screens have been edited, press the **TEACH SCREEN LIST** key to return to the Teach and Memory Area Transfer Screen. Then press one of the following keys:

- **SAVE TO MEMORY AREA**—Saves the program to the memory area selected (#1 on Figure 7-10)
- **RUN EDITS NOW**—Saves the edits to the current settings (#2 on Figure 7-10)

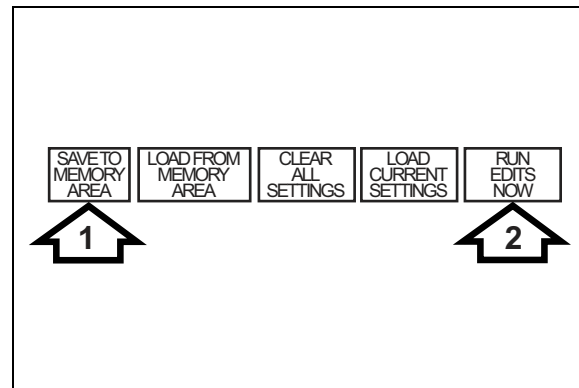


Figure 7-10: Save Keys

Teach by Example

The operator can set the position for each position parameter in the list by using the Teach by Example feature of the HMI. Before entering data in parameter fields when teaching by example, manually take the ladle through the cycle to get an idea of where the position numbers should be. Start with the clear position well above the metal and low speeds. Test and tune these settings for optimal performance as the ladle sequence is tailored for a particular job. One way to set up a die program using the Teach by Example feature is as follows:

1. Press the **MAIN** key in the Built-In Function keys (Figure 7-11). The Main Screen displays.
2. Press the **TEACH** key. The Teach and Memory Area Transfer Screen displays (Figure 7-12).

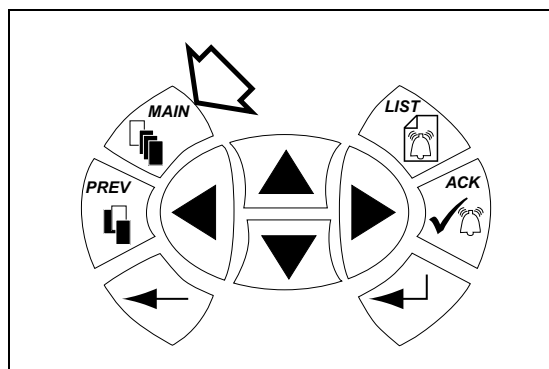


Figure 7-11: Main Key

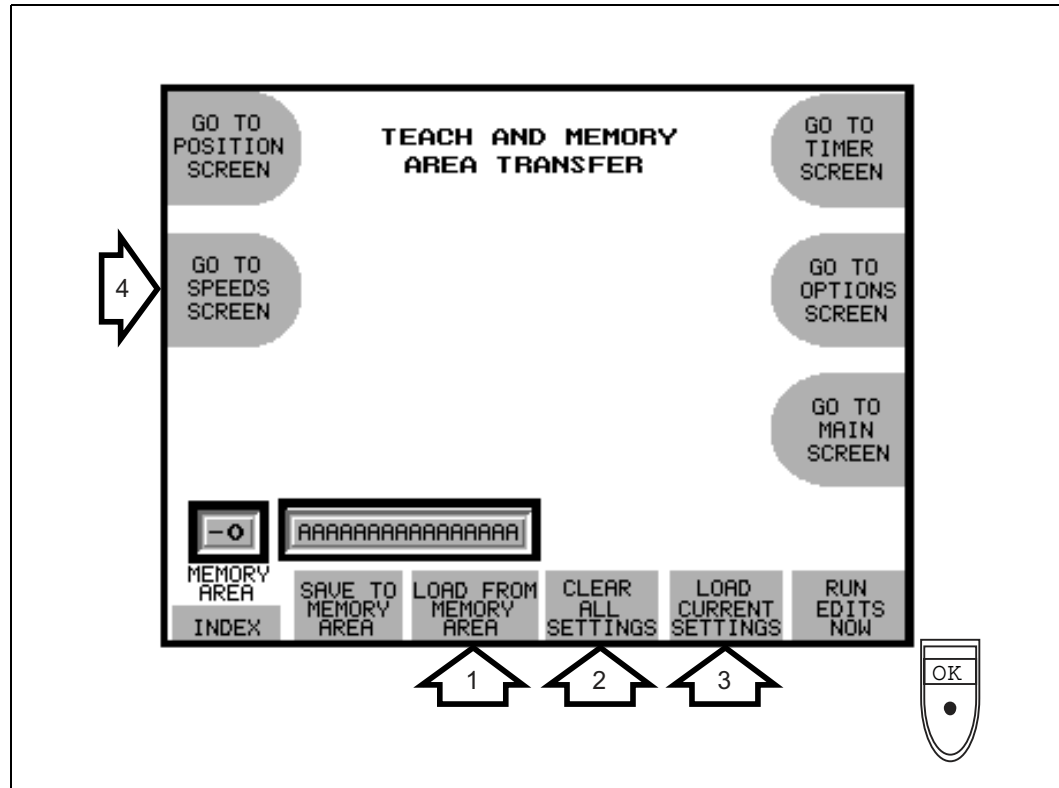


Figure 7-12: Teach and Memory Area Transfer Screen

3. Perform one of the following actions:
 - a. Press the **CLEAR ALL SETTINGS** key (#2 on Figure 7-12) to start with a blank scratchpad.
 - b. Press the **LOAD FROM MEMORY AREA** key (#1) to modify a program already in the controller memory.
 - c. Press the **LOAD CURRENT SETTINGS** key (#3) to modify the current settings.
4. Press the **GO TO SPEEDS SCREEN** key (#4). The Speeds Screen displays (Figure 7-13).

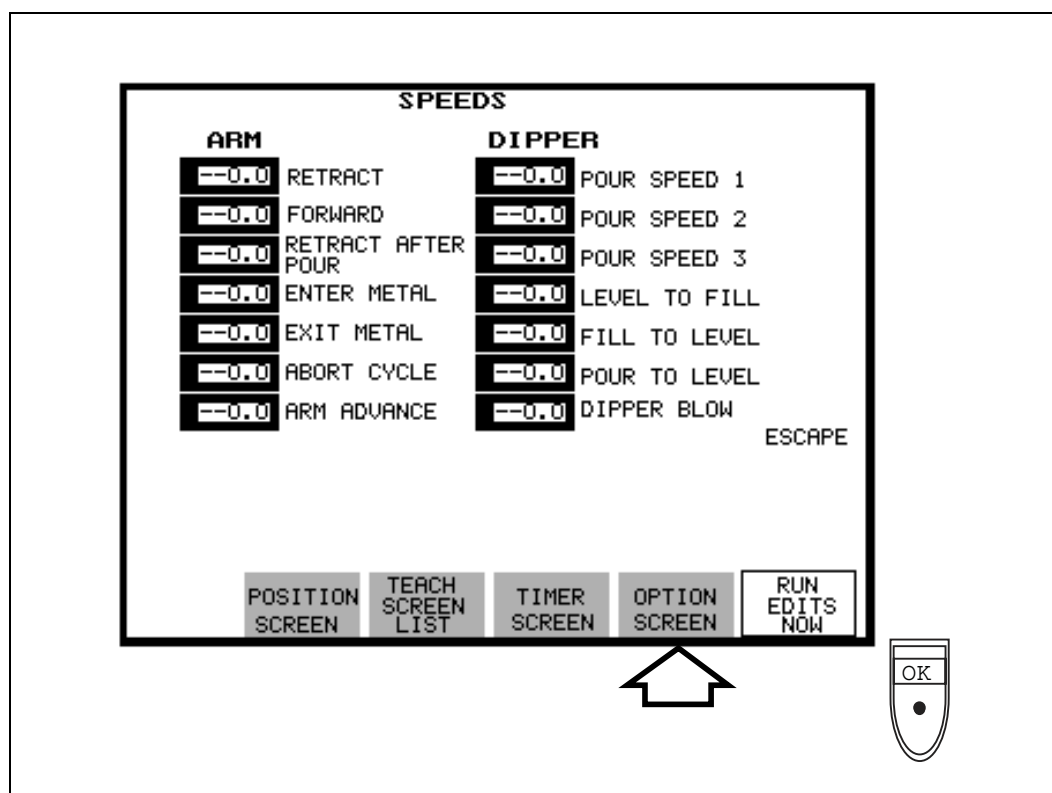


Figure 7-13: Speeds Screen

5. Use the directional arrow keys to highlight the fields to be set. Use the alpha/numeric keys to enter the speeds for the arm and the dipper during various motions.

Note: Speed settings can easily be changed during the operation of the ladle. To start, keep the arm moves around the metal below 5 and keep pour speeds below 10.

6. Press the **OK** key to accept the settings.
7. From the Speeds Screen, press the **OPTION SCREEN** key (Figure 7-13). The Options Screen displays (Figure 7-14).

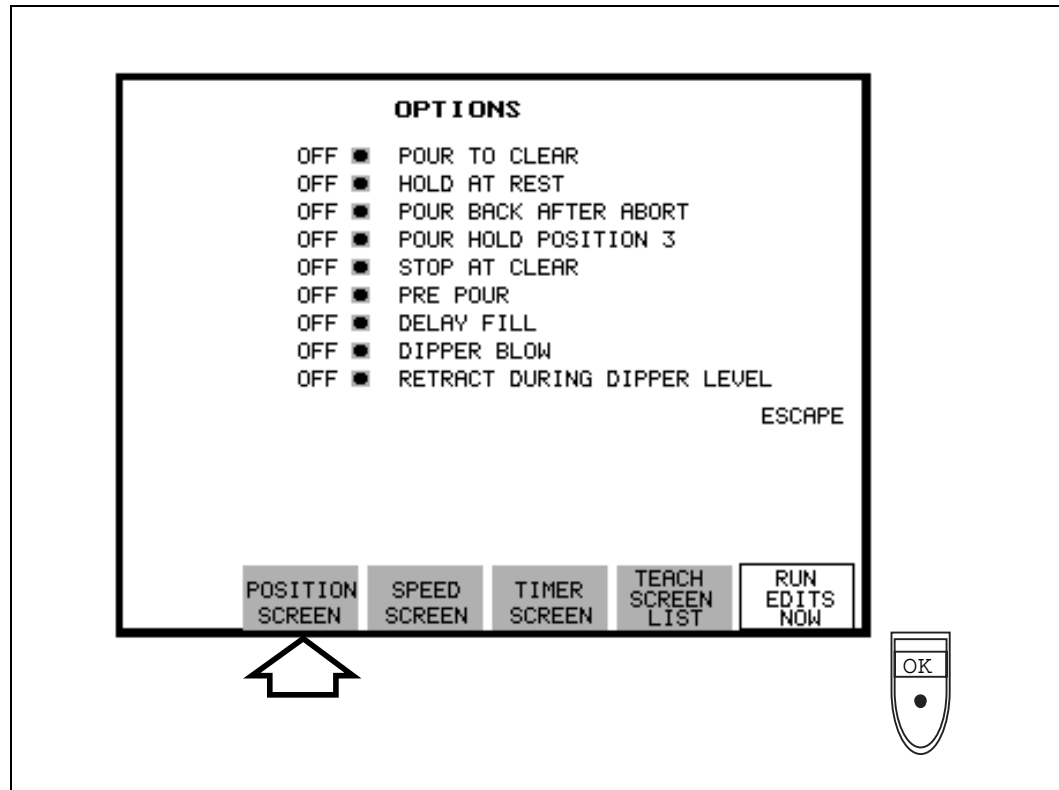


Figure 7-14: Options Screen

8. Steps that can be included in addition to the normal operational sequence of the ladle display on this screen. Use the directional arrow keys to activate the optional steps to be included with the normal sequence. When all settings are acceptable, press the **OK** key.
9. From the Options Screen, press the **POSITION SCREEN** key (Figure 7-14). The Arm Positions Screen displays (Figure 7-15).

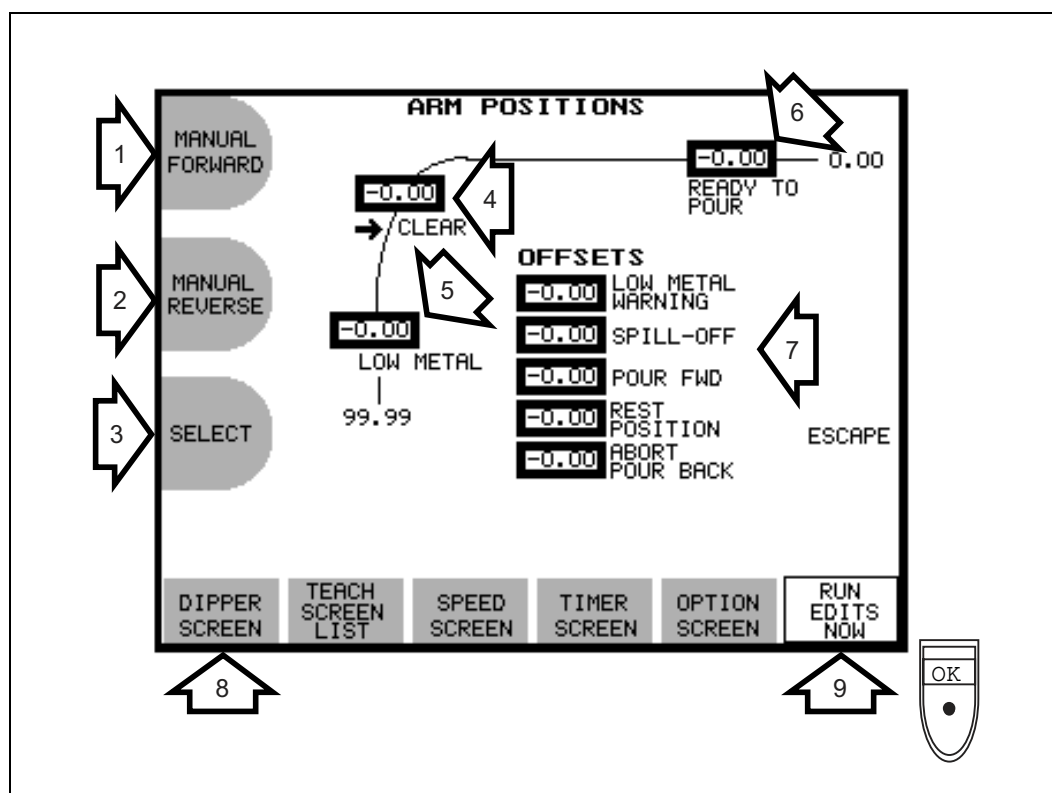


Figure 7-15: Arm Positions Screen

10. To use Teach by Example to set the arm positions, press the **SELECT** key (#3 on Figure 7-15). An arrow will appear beside one of the teachable fields. Each time the **SELECT** key is pressed, the arrow will move to a new field. Move the arrow to the Clear field (#4) and then use the **MANUAL FORWARD** (#1) and **MANUAL REVERSE** (#2) keys to move the arm to the desired Clear position. Press the **OK** key.
11. If the furnace is empty of metal, the Teach by Example feature can be used to teach the Low Metal position. Use the **SELECT** key (#3) to move the arrow to the Low Metal field (#5). Use the **MANUAL FORWARD** (#1) and **MANUAL REVERSE** (#2) keys to move the arm until the dipper is just above the bottom of the furnace. Press the **OK** key.
12. Use the arrow keys to highlight the READY TO POUR field (#6). Move the arm forward to the shot hole. If the pour forward feature will be used, remember that the arm will move forward further while pouring. Set this position in the READY TO POUR field (#6). Press the **OK** key.
13. Use the arrow keys to move to the OFFSETS positions (#7). Enter estimates for the Low Metal Warning, Spill-Off, Pour Forward, and Abort Pour Back positions. A setting of 1.00 in these parameters is a good starting point for most jobs. Leave the Pour Forward position at 0.0 if it will not be used. Press the **OK** key. Press the **RUN EDITS NOW** key (#9).
14. Press the **DIPPER SCREEN** key (#8). The Dipper Positions Screen displays (Figure 7-16).

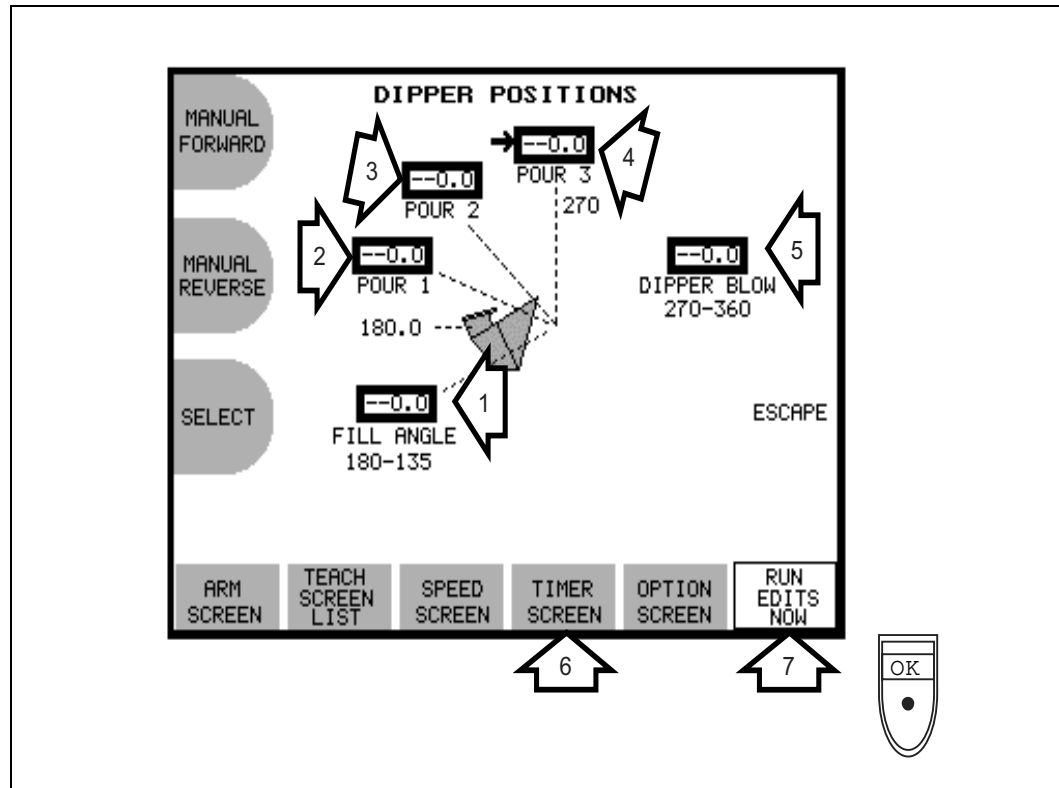


Figure 7-16: Dipper Positions Screen

15. Use the following Fill Angle Chart (Table 7-1: Fill Angle Chart, page 7-18) to determine the fill angle required for the amount of metal to be used in the shot. Enter the value in the Fill Angle field (#1 on Figure 7-16) using the **SELECT** key to obtain an arrow on the field and the alpha/numeric keypad to enter the position numbers. Press the **OK** key.

16. The Teach by Example feature can be used to refine dipper positions by using the **SELECT** key to move between position fields and by moving the dipper with the **MANUAL FORWARD** and **MANUAL REVERSE** keys. When the dipper reaches the exact position for the field selected, press the **OK** key.

Note: The dipper uses 180 degrees as the level position. A setting at less than 180 degrees is used when the dipper is toward the fill positions and more than 180 degrees is used when it is toward the pour positions.

Table 7-1: Fill Angle Chart

Fill Angle	Dipper Size											
	2 lb	4 lb	6 lb	8 lb	10 lb	12 lb	16 lb	20 lb	25 lb	30 lb	40 lb	50 lb
	Shot Weights (lb)											
165.0	*	*	*	*	*	*	*	*	*	*	*	*
164.0	*	*	*	*	*	*	*	*	*	*	*	*
163.0	*	*	*	*	*	*	*	*	*	*	*	*
162.0	*	*	*	*	*	*	*	*	*	*	*	*
161.0	*	*	*	*	*	*	*	*	*	*	*	*
160.0	*	*	*	*	*	*	*	*	*	*	*	*
159.0	*	*	*	*	*	*	*	*	*	*	*	51.5
158.0	*	*	*	*	*	*	*	*	*	*	41.4	50.6
157.0	*	*	*	*	*	*	14.3	20.0	*	29.0	40.6	49.8
156.0	*	*	5.5	*	9.8	*	14.0	19.6	22.5	28.5	39.9	48.9
155.0	*	*	5.4	7.1	9.6	*	13.7	19.2	22.1	27.9	39.2	48.1
154.0	*	*	5.3	6.9	9.4	11.2	13.4	18.8	21.7	27.4	38.4	47.2
153.0	*	3.8	5.2	6.8	9.3	10.9	13.1	18.4	21.3	26.8	37.7	46.4
152.0	*	3.7	5.1	6.7	9.1	10.7	12.8	18.0	20.9	26.3	37.0	45.6
151.0	2.9	3.6	5.0	6.5	8.9	10.4	12.5	17.6	20.4	25.7	36.3	44.8
150.0	2.9	3.6	4.8	6.4	8.8	10.2	12.2	17.3	20.0	25.2	35.6	44.0
149.0	2.8	3.5	4.7	6.3	8.6	9.9	12.0	16.9	19.6	24.7	34.9	43.2
148.0	2.7	3.4	4.6	6.2	8.4	9.7	11.7	16.5	19.2	24.1	34.2	42.4
147.0	2.7	3.3	4.5	6.0	8.3	9.4	11.4	16.1	18.8	23.6	33.5	41.6
146.0	2.6	3.2	4.4	5.9	8.1	9.2	11.1	15.8	18.5	23.1	32.8	40.8
145.0	2.5	3.2	4.3	5.8	7.9	8.9	10.9	15.4	18.1	22.6	32.1	40.0
144.0	2.4	3.1	4.2	5.6	7.8	8.7	10.6	15.0	17.7	22.1	31.4	39.3
143.0	2.4	3.0	4.1	5.5	7.6	8.5	10.3	14.7	17.3	21.6	30.8	38.6
142.0	2.3	2.9	4.0	5.4	7.4	8.2	10.1	14.3	16.9	21.1	30.1	37.8
141.0	2.2	2.9	3.8	5.3	7.2	8.0	9.8	14.0	16.5	20.6	29.4	37.1
140.0	2.2	2.8	3.7	5.1	7.1	7.8	9.5	13.6	16.1	20.1	28.8	36.3
139.0	2.1	2.7	3.6	5.0	6.9	7.5	9.3	13.2	15.7	19.6	28.1	35.6
138.0	2.0	2.6	3.5	4.9	6.7	7.3	9.0	12.9	15.4	19.1	27.4	34.8
137.0	2.0	2.5	3.4	4.7	6.5	7.1	8.7	12.5	15.0	18.5	26.8	34.1
136.0	2.0	2.5	3.3	4.6	6.4	6.8	8.4	12.1	14.6	18.0	26.1	33.3
135.0	2.0	2.4	3.2	4.5	6.2	6.6	8.2	11.8	14.2	17.5	25.4	32.5

Dipper-Sensor Alignment

When the dipper is filling with metal, the fill window located on the back of the dipper should be below the metal surface. The metal should come up to the middle of the cross-bar located above the fill window to allow only clean metal to enter the dipper. To achieve this depth, the sensor probes length must be increased or decreased (see Sensor Probe Length Adjustment).

Loosen the sensor mechanism activating cam on the pour shaft. Raise or lower the probes in the mounting block. Next, adjust the sensor probe length as described in the following section.

Note: Some machines have fixed probes and do not have this adjustment capability. The only method of adjustment on these machines is to raise or lower the probes in the mounting block.

Sensor Probe Length Adjustment

The correct probe length depends on the fill angle used. Refer to Table 5-1: Fill Angle Chart, page 5-2, Fill Angle Chart, to determine the fill angle for the required shot size. Set the Fill Angle as follows:

1. Access the Dipper Positions Screen (Figure 7-17) by pressing **Main>Teach>Go To Position Screen>Dipper Screen**.

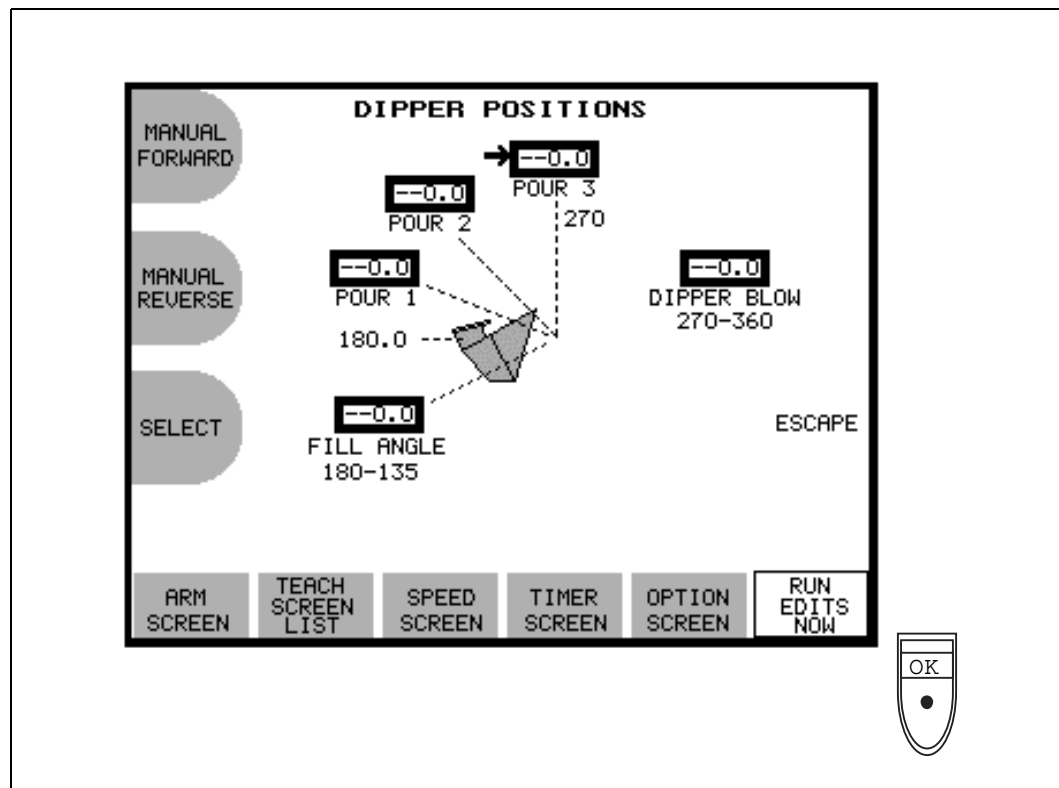


Figure 7-17: Dipper Positions Screen

2. Use the **SELECT** key or the arrow keys located on the Built-In Function Keypad (Figure 7-18) to select the Fill Angle field (Figure 7-17). Set the proper Fill Angle using the Alpha/Numeric keypad (Figure 7-18).
3. Press the **OK** key.

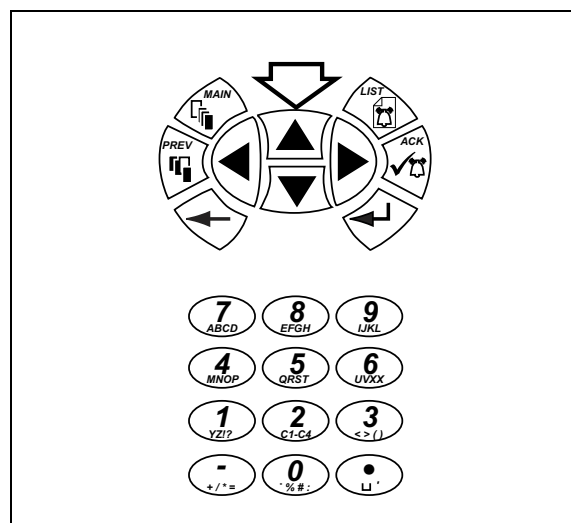


Figure 7-18: Built-In Function Keys and Alpha/Numeric Keys

To adjust the sensor probe length:

1. Use the ARM RET/EXT switch on the Manual Controls (Figure 7-19) to move the arm behind the Clear Position.

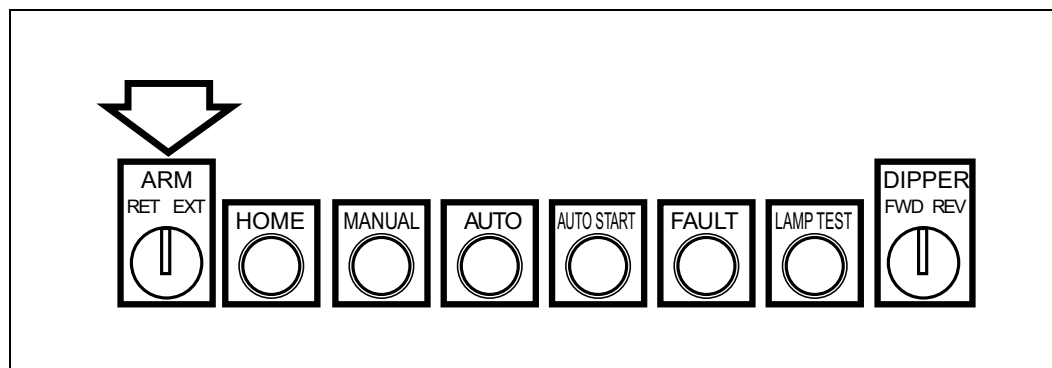


Figure 7-19: Manual Controls

2. Access the Manual Dipper Functions Screen (Figure 7-20) by pressing **Main>Control>Dipper Screen**. Then press the **DIPPER FILL** key to rotate the dipper to the required fill angle.

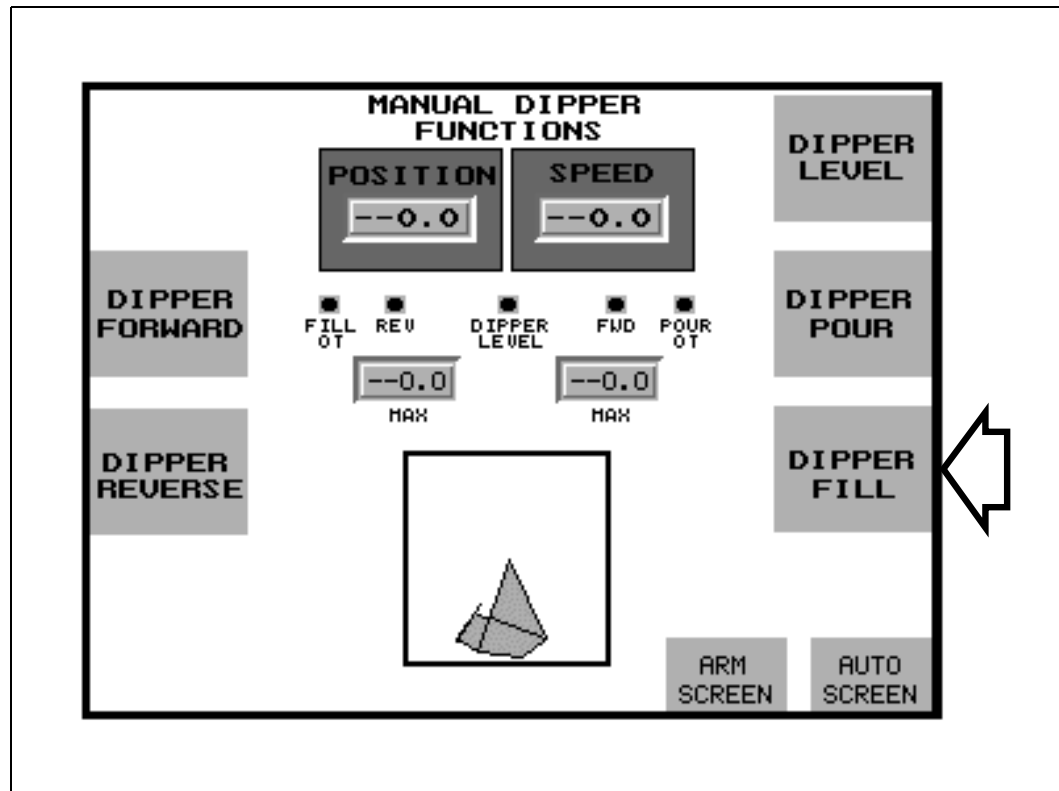


Figure 7-20: Manual Dipper Functions Screen

3. Loosen the two screws in the Probe Isolator Block (Figure 7-21) so the Sensor Cover Slide can be moved. (The user might also need to loosen the two screws in the Probe Guide.)

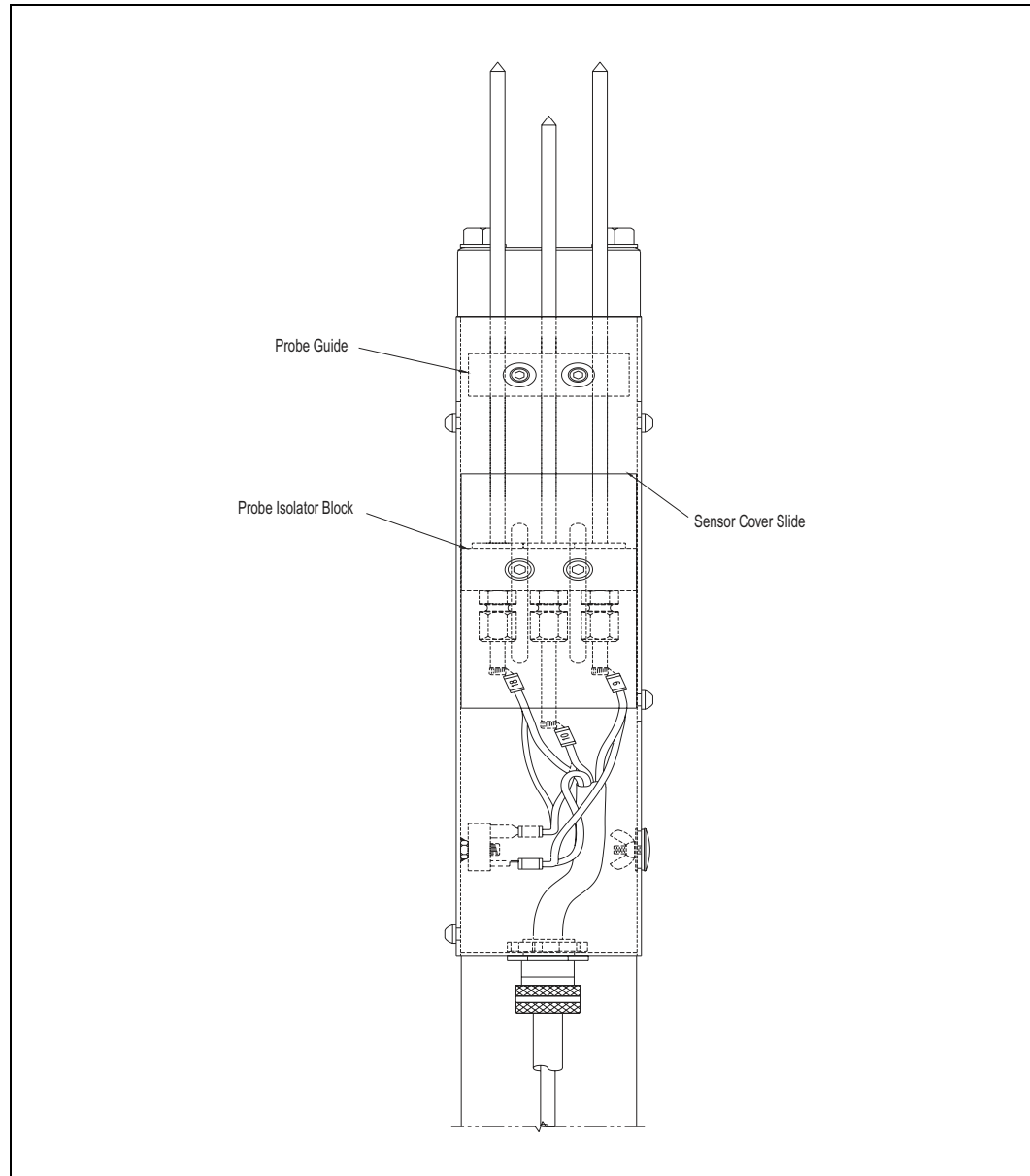


Figure 7-21: Sensor Probe Length Adjustment

4. Place a line level along the side of the dipper so it is positioned on the center of the fill window.
5. Move the Sensor Cover Slide to adjust the probe length until the probe tips slightly touch the line level.
6. Tighten the screws to hold the Sensor Cover in this position.

The probes should be at the appropriate length at this point. Verification will be made during programming of the low metal and clear positions as detailed in, “Teach by Example” on page 7-12, Step 10.

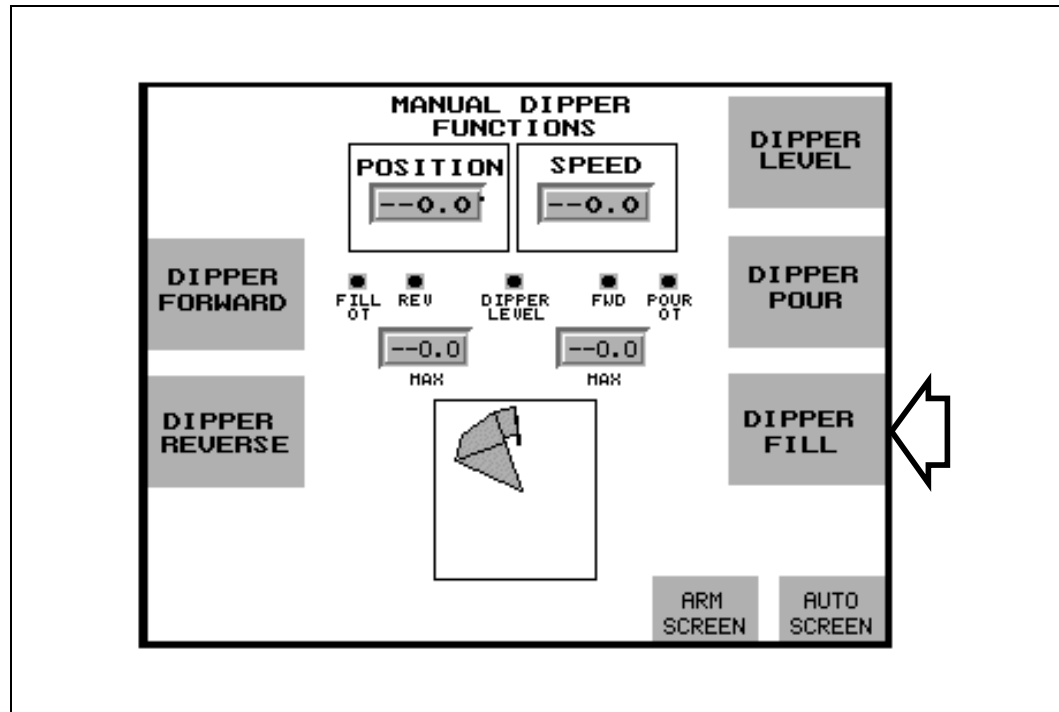


Figure 7-22: Manual Dipper Functions Screen

7. Manually move the arm back to the metal as determined in step 15. Press **Main>Control>DIPPER SCREEN** to access the Manual Dipper Functions Screen (Figure 7-22). Use the **DIPPER FILL** key (Figure 7-22) to fill the dipper with metal. The dipper can also be positioned at the Fill Angle automatically by pressing the **RUN EDITS NOW** key (#7 on Figure 7-16) and then pressing and the **DIPPER FILL** key on the Manual Dipper Functions Screen (Figure 7-22). The dipper cup should now be filled with the proper amount of metal.
8. Use the Manual Controls **ARM RET/EXT** (#1 on Figure 7-23) and **DIPPER FWD/REV** (#2) push-buttons to move the arm up out of the metal (just above the metal) and rotate the dipper forward until the metal just reaches the lip of the cup.

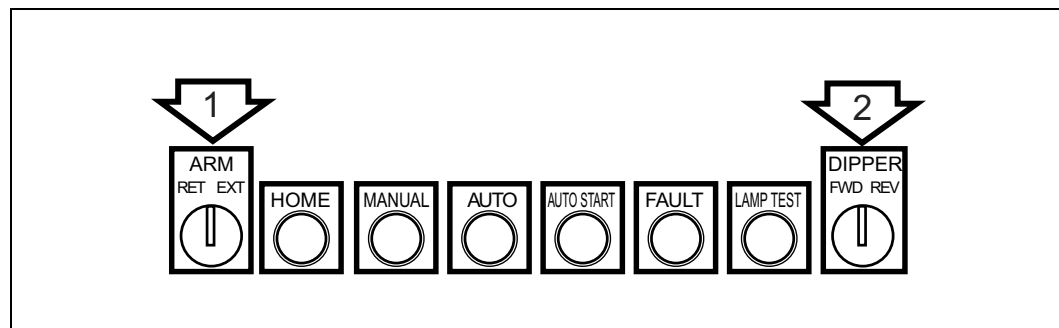


Figure 7-23: Manual Push-buttons

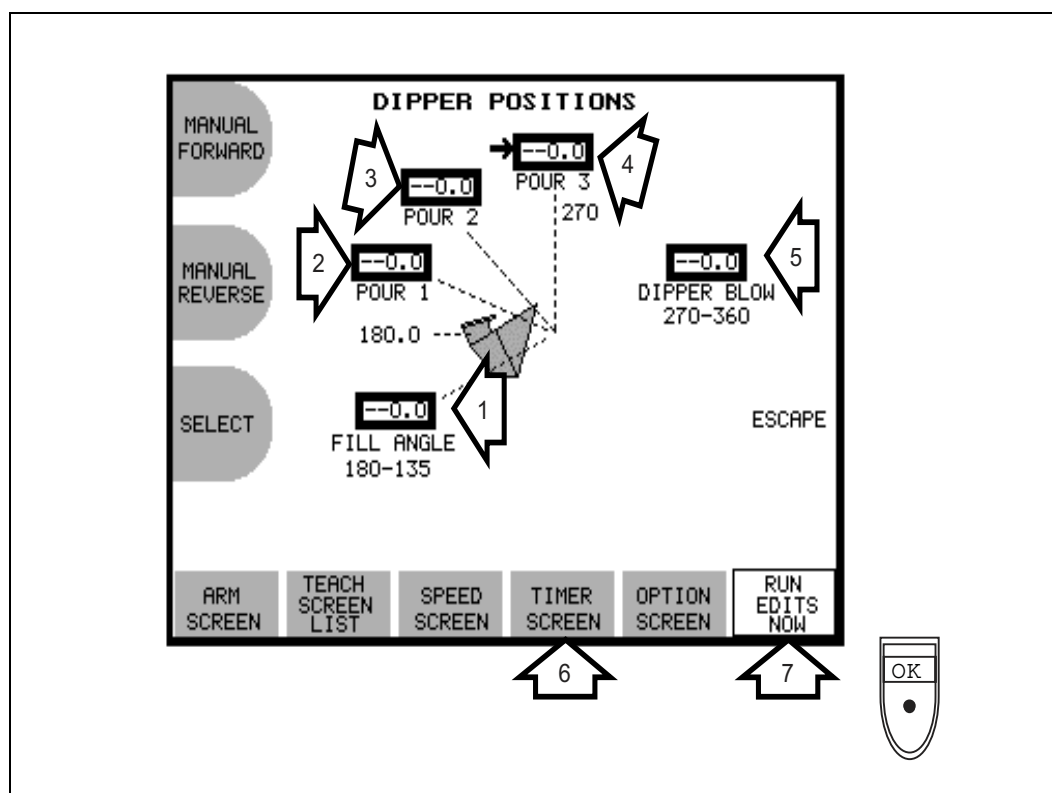


Figure 7-24: Dipper Positions Screen

9. Use the arrow keys to move to the Pour Angle 1 field (#2 on Figure 7-24) on the Dipper Positions Screen. Enter this position as the Pour Angle 1. Press the **OK** key.
 10. Use the arrow keys to move to the Pour Angle 2 field (#3 on Figure 7-24). Use the manual control DIPPER FWD/REV switch (#2 on Figure 7-23) to rotate the dipper until most of the metal (about 80%) pours out. Enter this position as Pour Angle 2. Press the **OK** key.
 11. Use the arrow keys to move to the Pour Angle 3 field (#4 on Figure 7-24). Rotate the dipper cup again until all of the metal is completely poured. Enter this position as Pour Angle 3. This pour position might need to be modified (Step 16 on page 7-17) if the dipper cannot rotate fully when at the DCM. Press the **OK** key.
 12. If the Dipper Blow feature is to be used, select this field (#5 on Figure 7-24) on the screen and use the manual control switches to move the arm and dipper to the desired position to be held while the dipper receives air blow. Enter this position in the Dipper Blow field and then press the **OK** key.
- Note:** An alternate method to set dipper positions for steps 17–22 is Teach by Example. See step 16 on page 7-17 for procedures using this feature.
13. Press the **RUN EDITS NOW** key (#7 on Figure 7-24).

14. Press the **TIMER SCREEN** key (#6 on Figure 7-5). The Timers & Counters Screen will display (Figure 7-25).

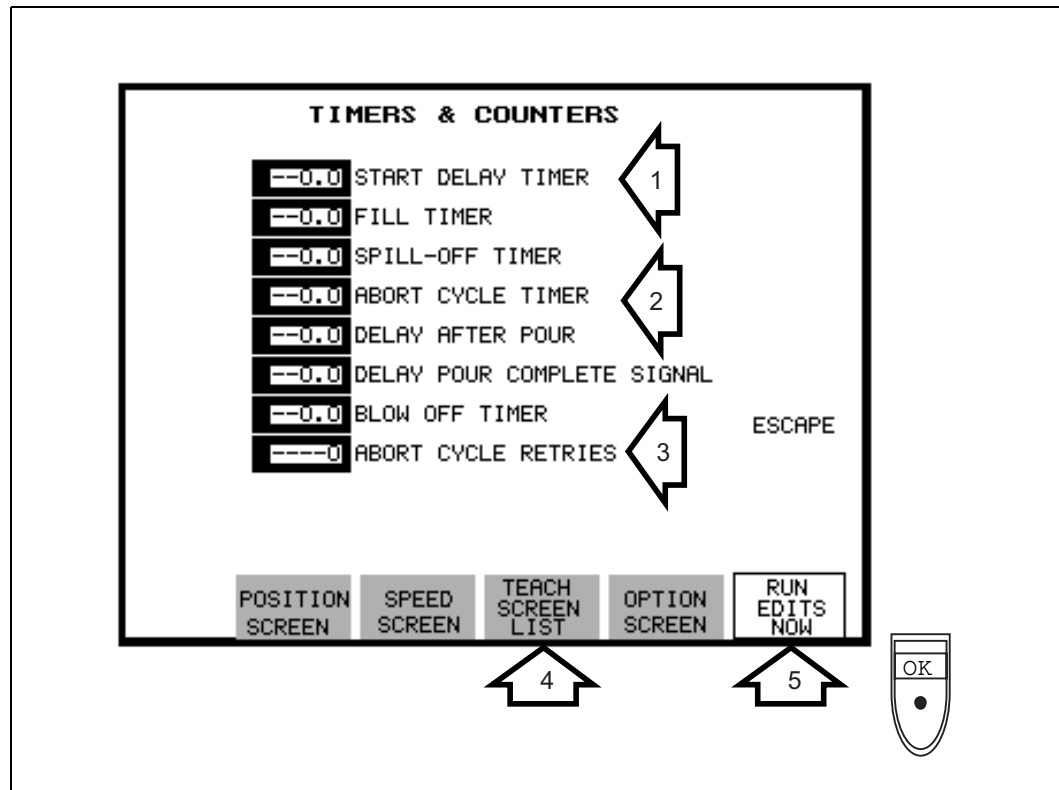


Figure 7-25: Timers & Counters Screen

15. Use the arrow keys to move to the fields to be modified. In general, these times can be set at 10 seconds or less except for the ABORT CYCLE TIMER (#2 on Figure 7-25) and the START DELAY TIMER (#1). The ABORT CYCLE TIMER should be set for the maximum time the ladle is to wait with the shot at the pour hole. In general, this time is set between 20–50 seconds. The START DELAY TIMER is used to fine tune the cycle so that the ladle reaches the DCM just before it is ready to accept it. After setting all timers, highlight the ABORT CYCLE RETRIES (#3) and enter the setting for the number of abort retries the ladle will make before reverting to Manual Mode.
16. Press the **OK** key. Press the **RUN EDITS NOW** key (#5).
17. Press the **TEACH SCREEN LIST** key (#4) to return to the Teach and Memory Area Transfer Screen (Figure 7-26).

Naming the Die Program

Use the MEMORY AREA field (#1 on Figure 7-26) to assign a program to a memory area and to name the program.

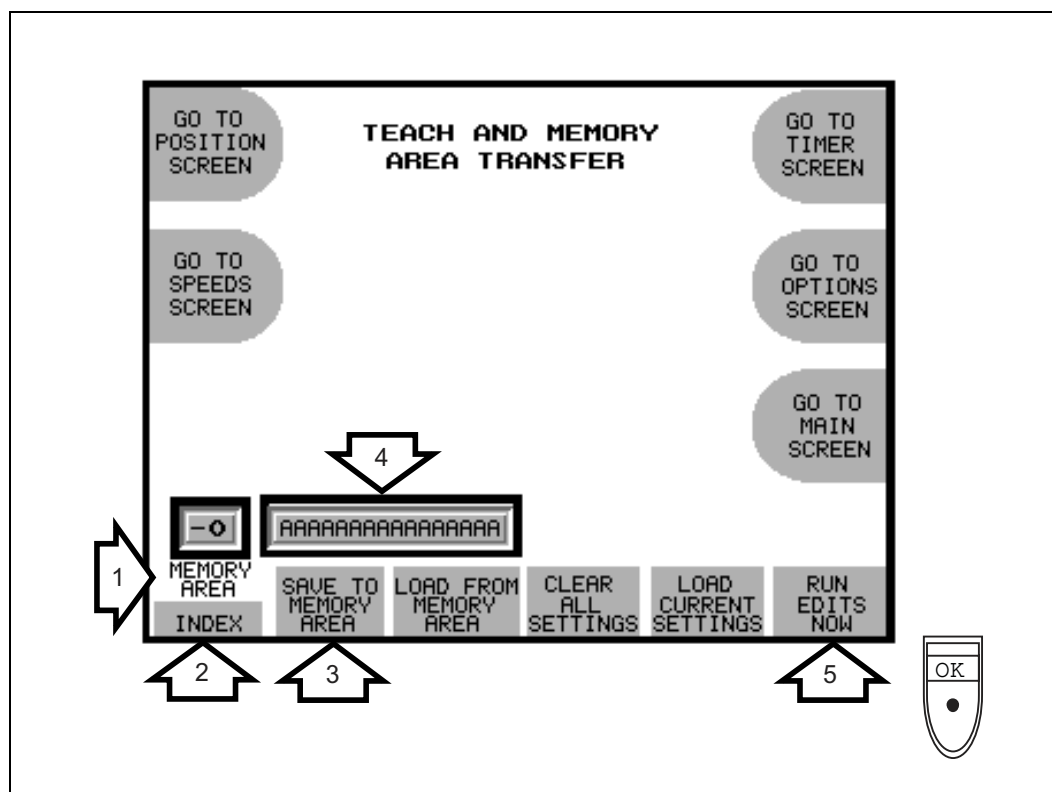


Figure 7-26: Teach and Memory Area Transfer Screen

Follow these steps to store and name a program:

1. Press the directional arrow keys to move to the MEMORY AREA field (#1 on Figure 7-26).
2. Use the alpha/numeric keys to select a memory area identification number from 1–20.

Note: To view a list of memory areas in use, press the **INDEX** key (#2). The Index Screen displays (Figure 7-27).

3. Press the **Enter** key.

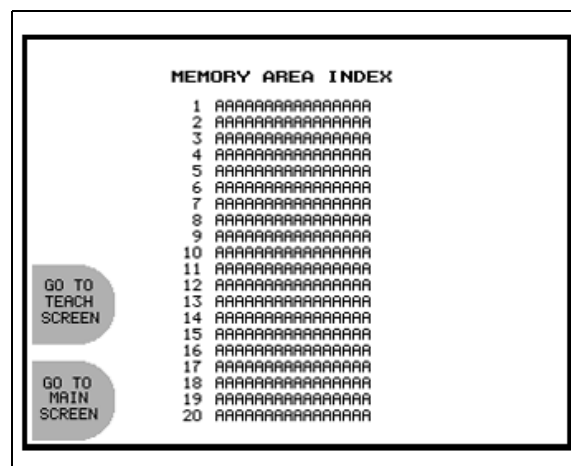


Figure 7-27: Index Screen

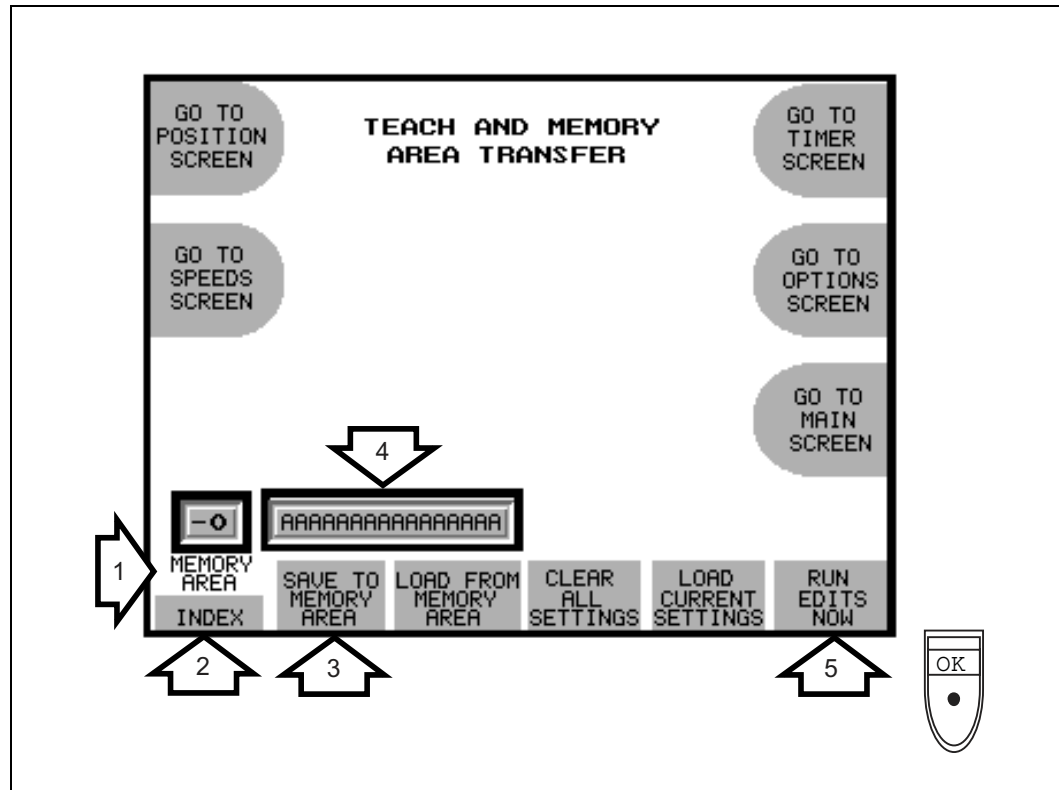


Figure 7-26: Teach and Memory Area Transfer Screen (Cont.)

4. Press the directional arrow keys to move to the second MEMORY AREA field (#4 on Figure 7-26).
5. Use the alpha/numeric keys to enter a number or name to identify the program. Press each key repeatedly until the correct number or letter appears in the field.
6. Press the **SAVE TO MEMORY AREA** key (#3) to update the selected memory area or press the **RUN EDITS NOW** key (#5) to update only the name of the current settings.

Chapter 8

OPERATION

EPIC Control System

The EPIC Control System is used to operate the Ladle. The system utilizes push-buttons or a combination of the push-buttons and the HMI for operations.

Push-button Operation

1. Verify that all people and objects are clear from the die cast cell.
2. Pull out the Emergency Stop (E-stop) button (Figure 8-1).

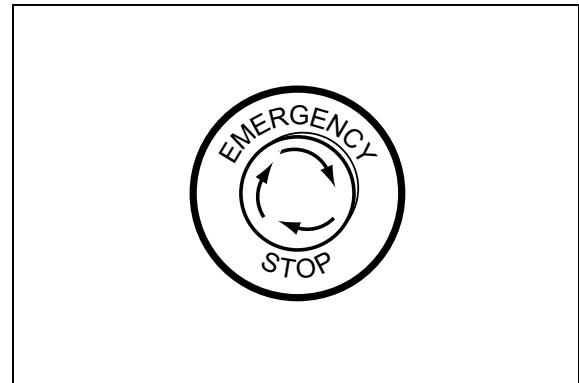


Figure 8-1: Emergency Stop Button

3. Turn the control switch to the "on" position (Figure 8-2). The control box door must be completely closed. The unit begins to power up. Powering up takes approximately 45 seconds. The following error message appears in the upper-left corner of the graphics display window: "Com Err Stn 1." This message will disappear when the controller has finished powering up.

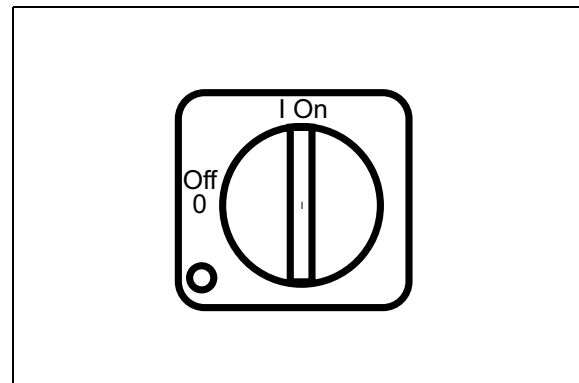


Figure 8-2: Control Switch

4. Press the LAMP TEST push-button (Figure 8-3). All push-buttons will light to verify that all lamps are functioning. If a push-button fails to light, the bulb might need to be replaced, the wiring to the light checked, or the LAMP TEST button needs to be repaired.

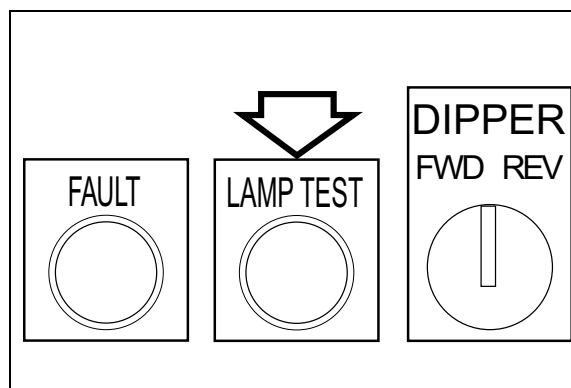


Figure 8-3: Lamp Test Push-button

5. Press the START push-button (Figure 8-4). The START push-button lights indicating that all safeties and power are ready.

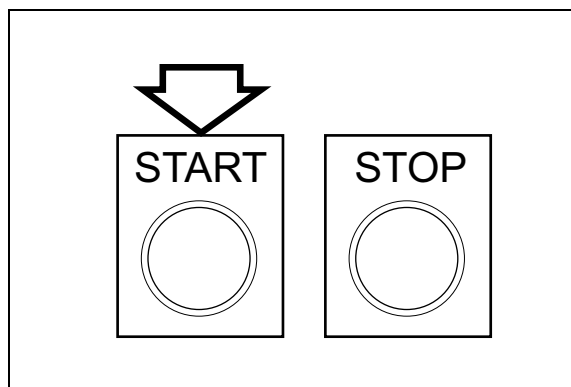


Figure 8-4: Start Push-button

6. Press the MANUAL push-button (Figure 8-5). The MANUAL push-button lights indicating that the machine is ready for manual operation.

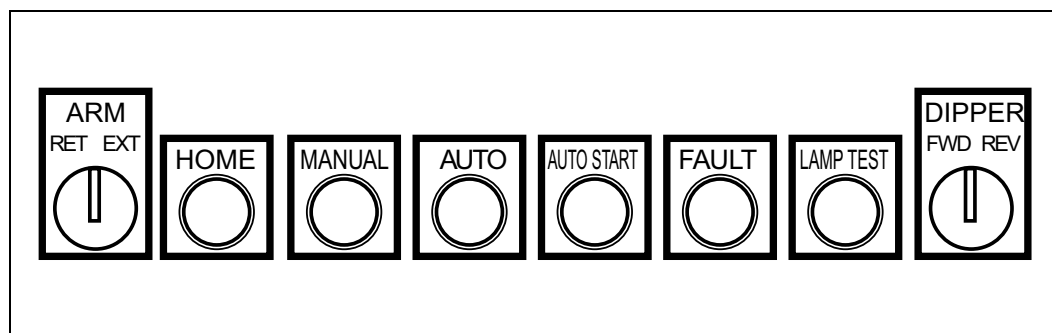


Figure 8-5: Manual Push-buttons

7. Press and hold the HOME push-button (Figure 8-5) until the arm and dipper are centered (at the Home position) and the HOME push-button is lit. This sets the center position for the ladle arm and dipper.
8. Remove the furnace cover.
9. Pre-heat the dipper.
10. Verify that the appropriate program is selected.
The monitor screen will show the current program.
11. Move the arm above the clear position.

12. Press the AUTO push-button (Figure 8-5) to place the machine in automatic mode. The AUTO push-button lights indicating that the machine is in automatic mode.

Note: In automatic mode, the ladle normally receives a signal from the die cast machine to start an automatic cycle. An automatic cycle can also be started by pressing the AUTO START push-button.

Human Machine Interface (HMI)

The EPIC Control System uses the HMI to make the operation of the Ladle easier. Some of the start up procedures must be done using the push-buttons.

Follow these steps to operate the Ladle using the Epic Control System HMI in conjunction with the push-buttons:

1. Verify that all people and objects are clear from the die cast cell.
2. Pull out the E-stop knob (Figure 8-1).
3. Turn the control switch to the “on” position (Figure 8-2). The control box door must be completely closed. The unit begins to power up. Powering up takes approximately 45 seconds. The following error message appears in the upper-left corner of the graphic display window: “Com err stn 1.” This message will disappear when the controller has finished powering up.
4. Press the LAMP TEST push-button (Figure 8-3). All push-buttons will light to verify that all lamps are functioning. If a push-button fails to light, the bulb might need to be replaced, the wiring to the light checked, or the LAMP TEST button needs to be repaired.
5. Press the START push-button (Figure 8-4). The START push-button lights indicating that all safeties and power are ready.
6. If the Main Screen is not visible in the graphic display area, press the **MAIN** key in the built-in function keys (Figure 8-7). The Main Screen displays (Figure 8-8).

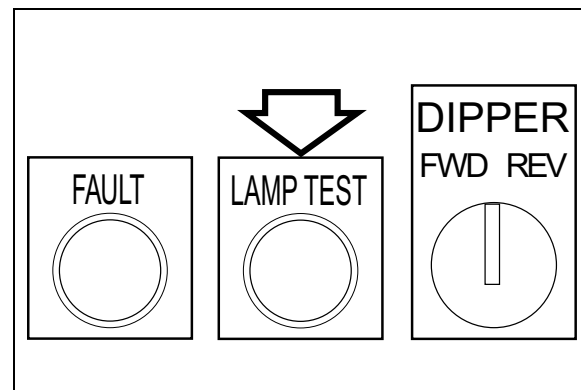


Figure 8-6: Lamp Test Push-button

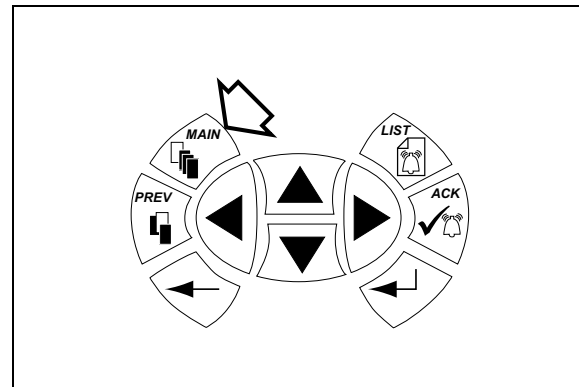


Figure 8-7: Main Key

7. Press the **CONTROL** key (Figure 8-8). The Arm Manual Functions Screen displays (Figure 8-9).

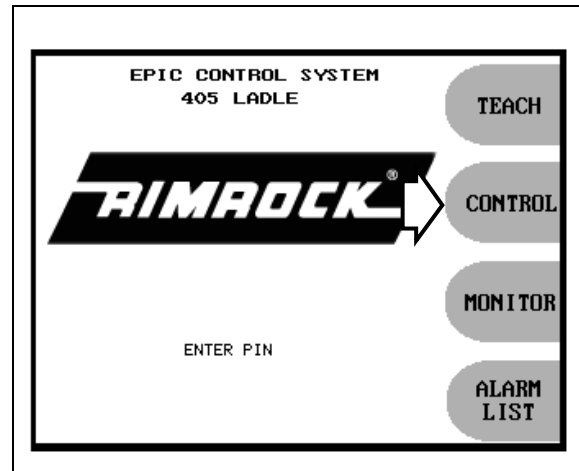


Figure 8-8: Main Screen

8. Press the **MANUAL MODE** key (#1 on Figure 8-9) to place the control in manual mode. The MANUAL push-button lights and the HMI Screen indicates that the unit is in manual mode by lighting a small square by the **MANUAL MODE** key (#2).
9. Press and hold the **MACHINE HOME** key (#3) until the arm and dipper are centered. When both are centered, the HOME push-button lights and the HMI Screen indicates home position by lighting a small square by the **MACHINE HOME** key (#4).

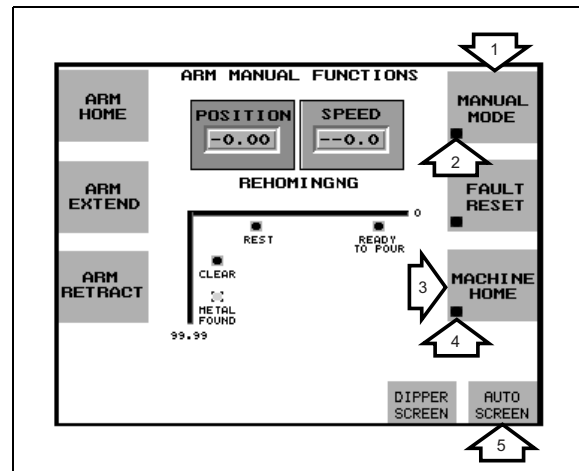


Figure 8-9: Arm Manual Functions Screen

10. Perform one of the following to change to the auto mode:

a. Press the **AUTO SCREEN** key (#5).

or

b. Press the **MAIN** key in the built-in function keys (#1 on Figure 8-7) and then select the **MONITOR** key on the Main Screen (Figure 8-10). The Monitor Screen displays.

11. Pre-heat the dipper.

12. Remove the furnace cover.

13. Verify that the appropriate program is selected.

14. Move the arm above the clear position.

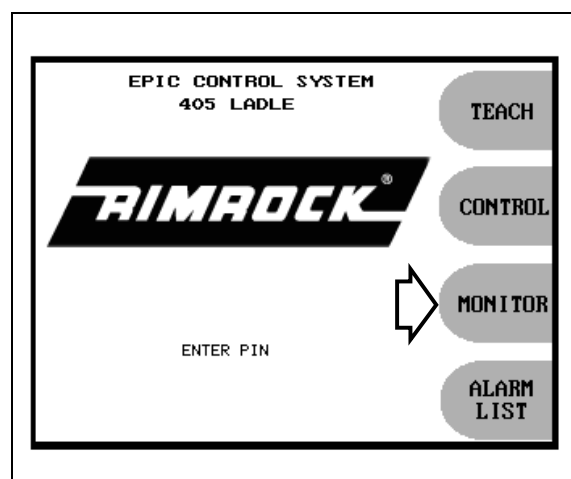


Figure 8-10: Monitor Key

15. On the Monitor Screen, press the **AUTO MODE** key (#1 on Figure 8-11). The AUTO push-button lights and the HMI Screen indicates that the unit is in AUTO mode (#3).

Note: In automatic mode the ladle normally receives a signal from the die cast machine to start an automatic cycle. The automatic cycle can also be started by pressing the **AUTO START** key (#2).

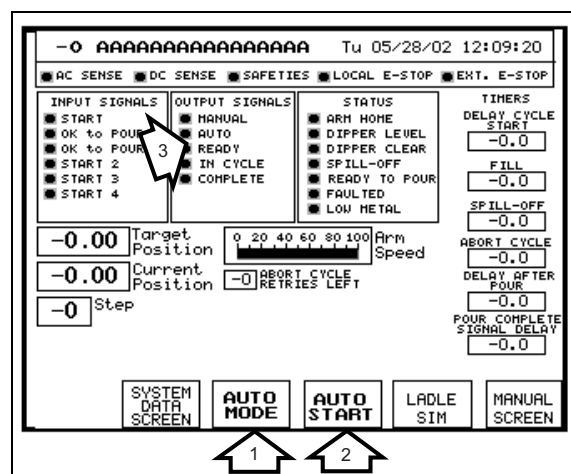


Figure 8-11: Monitor Screen

Programming Considerations to Reduce Cycle Time

After initially programming the Ladle, the following operational dynamics should be evaluated and fine-tuned to reduce cycle time:

Ladle to DCM Time

- A delay is programmed to allow the ladle to operate in step with the cycle of the DCM. Check the delay cycle start timer for this delay. It might be possible to reduce or eliminate the delay time.
- The ladle should be set up so that it is always moving. Try reducing the arm retract speed instead of using a delay in the cycle start.

- A timer is also used to keep the dipper in the metal while filling. Fill time might also be reduced to save cycle time. Be careful when adjusting this timer because incomplete filling of the dipper can cause inconsistent shot size.
- The DCM interface sequence can be changed to signal the ladle to start sooner in the cycle. Before making changes to the DCM wiring or interface, contact the machine manufacturer.

Metal Pour Time

- The setting for the first dipper position and speed can usually reduce the greatest amount of time from the pour. This position is set so that the metal just reaches the lip of the dipper. The speed that drives the dipper to this position should be set as fast as possible without spilling metal. This setting might not be an issue if the pre-pour feature is used.
- The next dipper position and speed settings control the rate that the metal is delivered into the cold chamber. The size of the pour hole and shape of the dipper limit how fast the speed can be set for this position. Experimentation is the best way to determine the optimal speed and position.
- The final dipper position and speed settings are used to expel the remaining metal from the dipper. Because dipper geometry varies, experimentation is the only way to determine the final angle and speed for this setting.

Speed Optimization

- If the ladle is going to wait for a start signal, it is not necessary to set all speeds to maximum. Typically, the maximum speed is used to transport the metal from the furnace to the DCM to prevent metal temperature loss. If time permits, speeds back to the furnace should be slower to prevent undue strain on the unit and lessen unplanned down time. Try to achieve constant movement of the ladle.

Cycle Time Saving Features

- The “Pre Pour” feature brings the dipper to an angle where the metal reaches the lip of the dipper and holds until the DCM is ready to pour. When the DCM is ready, the metal immediately enters the cold chamber.
- The “Pour Forward” feature enables the ladle arm to move forward while the dipper is pouring. This feature reduces the extra time spent during the pour to compensate for smaller pour holes. It also helps prevent build-up around the pour hole.

Chapter 9

TROUBLESHOOTING

Introduction

Rimrock Ladle Diagnostic displays assist users in identifying and correcting system faults or program errors that might occur. This chapter provides troubleshooting information, including identifying and correcting problems using alarm listings and error messages, as well as how to address common operational issues.

The following figures are referenced throughout this section:

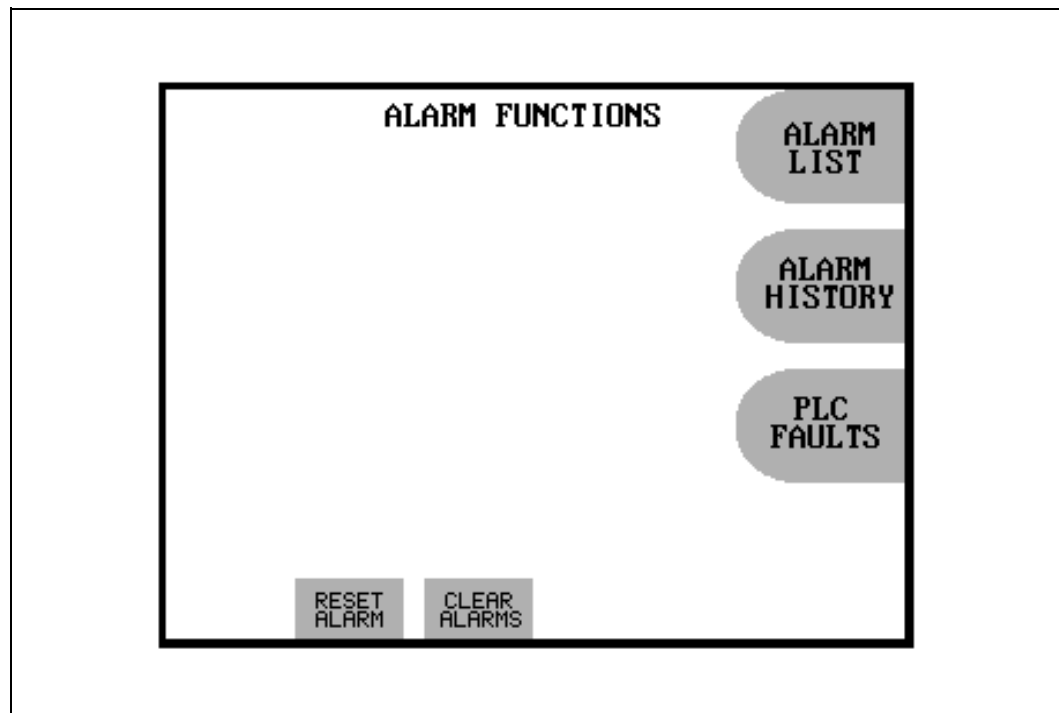


Figure 9-1: Alarm Functions Screen

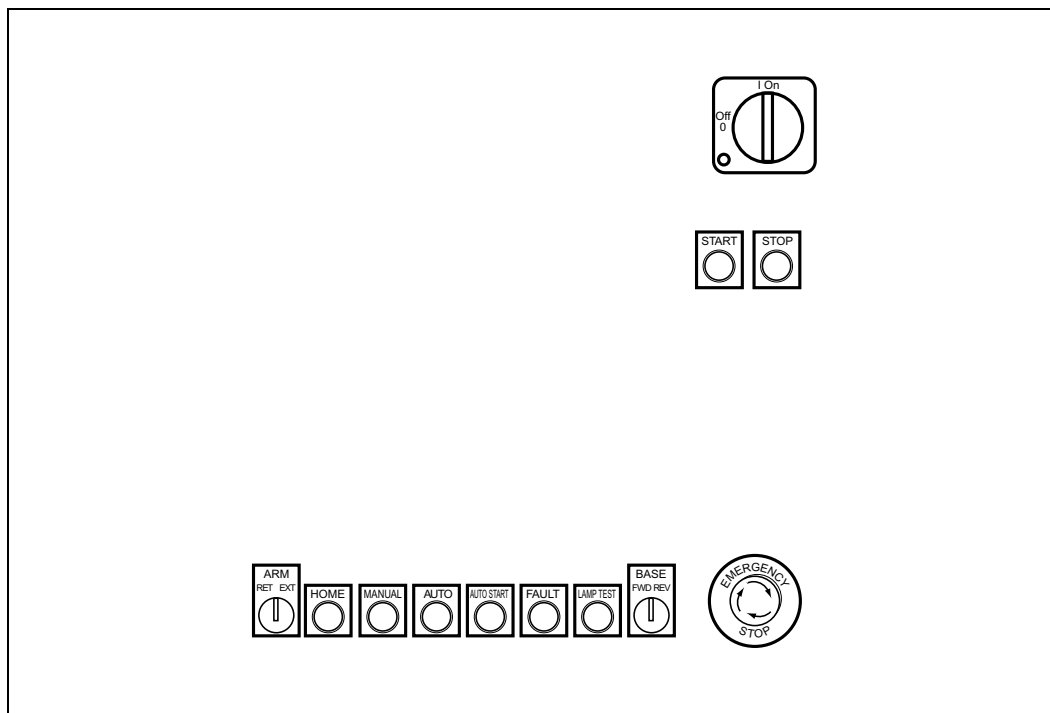


Figure 9-2: Manual Controls

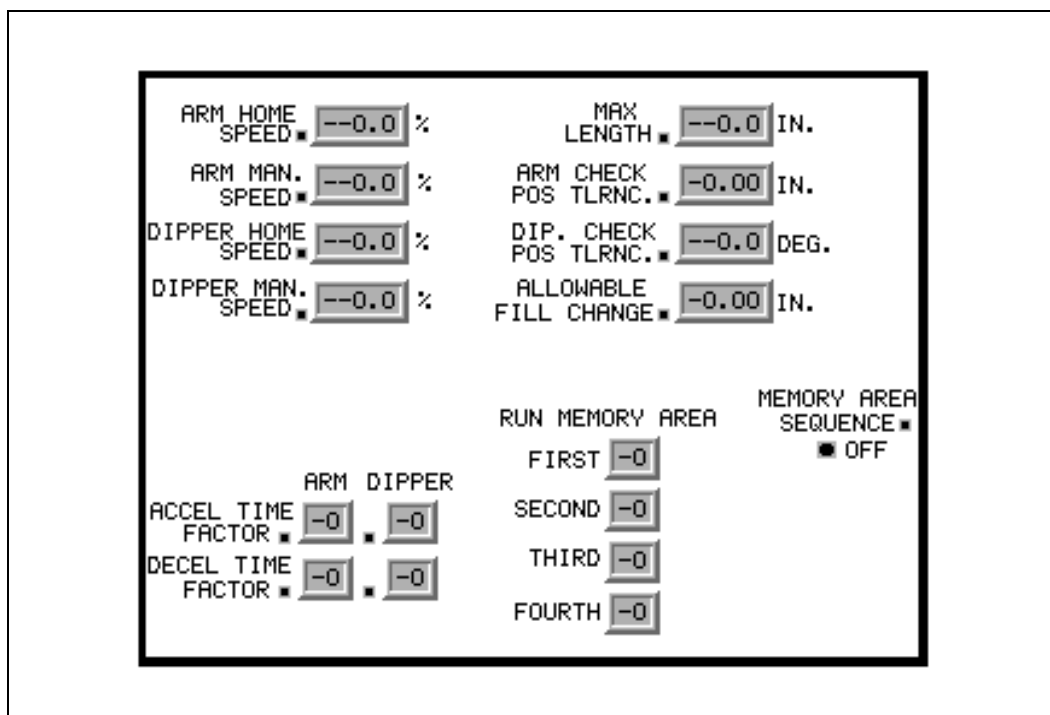


Figure 9-3: System Defaults Screen

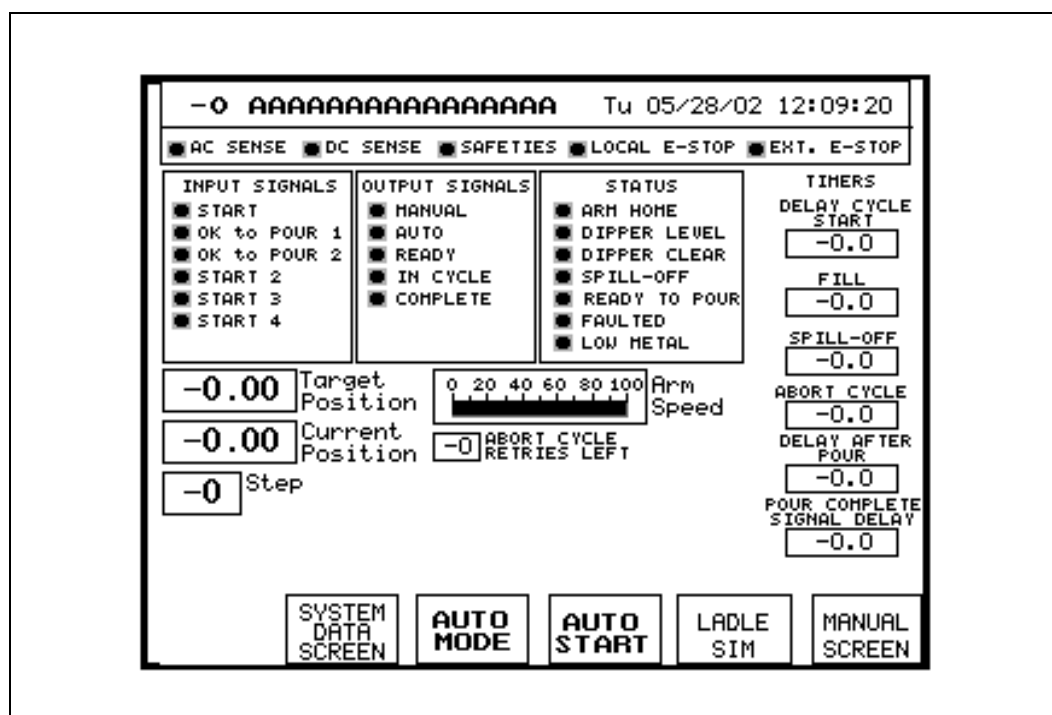


Figure 9-4: Monitor Screen

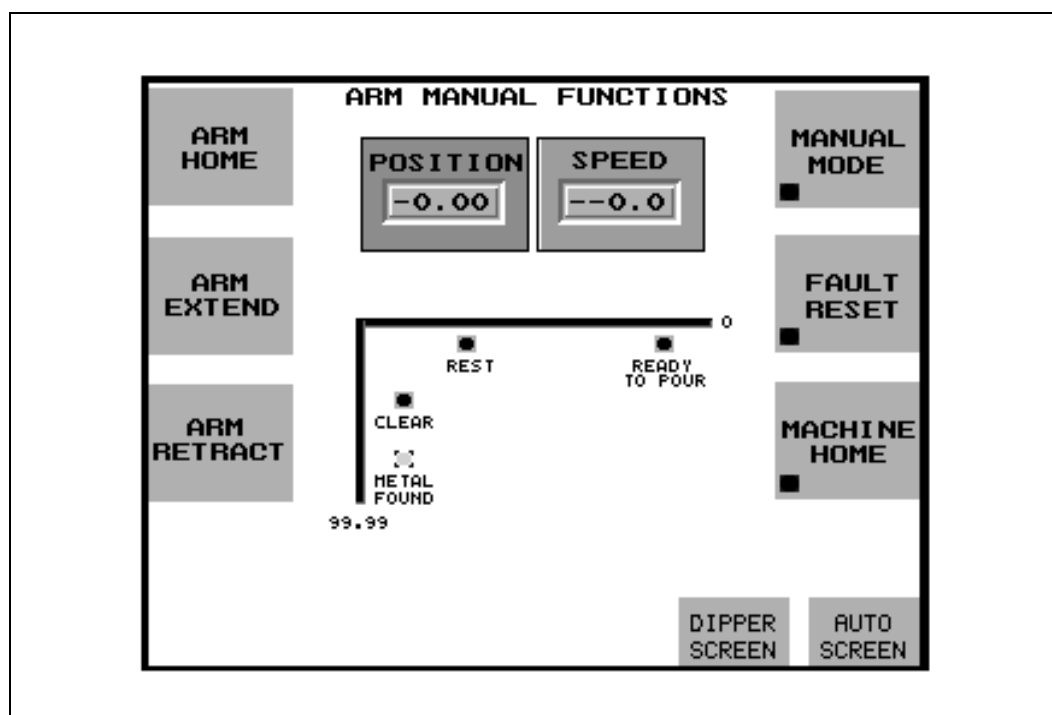


Figure 9-5: Arm Manual Functions Screen

Alarm List

Alarm messages for the EPIC controller that can occur during programming and operation of the Ladle are listed below. When a fault occurs, a flashing red bell symbol appears in the upper-right corner of the screen with the alarm message. Corrective actions are included for each alarm listing.

Arm or Dipper Check Position Error

To verify that the motion of the ladle is in time with the motor, a test is completed during every cycle. If the test fails to verify that timing, an alarm is triggered, indicating that the controller did not sense that the arm stroke or dipper level limit switches came on properly.

Corrective Action

1. Reset the fault by pressing one of the following:
 - **RESET ALARM** key on the Alarm Screen (Figure 9-1).
 - **FAULT** push-button on the Manual Controls (Figure 9-2).
2. Home the machine by pressing the **HOME** push-button (Figure 9-2).
3. Look on the ladle for any signs of mechanical slippage or damage.
4. Look at the value in the **ARM CHECK POS TLRNC** or **DIP CHECK POS TLRNC** fields on the System Defaults Screen to verify that it is set to a reasonable value, about 2.0 inches (Figure 9-3).
5. Auto cycle the machine twice, then determine if the problem still exists.
6. If the controller fault occurs again, check for and correct if necessary:
 - Mechanical slippage on the arm due to a loose belt
 - Loose electrical connections to the servo motor
 - A loose prox limit switch
 - A bad encoder in the servo motor
 - Bad cam lobes

Disabling the Fault

For troubleshooting purposes, the user can disable this fault by setting a value of 99.9 in the **ARM CHECK POS TLRNC** or **DIP CHECK POS TLRNC** fields on the System Defaults Screen (Figure 9-3). It is recommended that this alarm NOT be disabled during normal operation.



IMPORTANT!

If this fault is disabled, the motion of the ladle may not be as expected and may cause damage.

Abort Cycle Retries Exceeded

This alarm indicates that the ladle has attempted to supply the DCM with metal but the DCM was not ready to receive it. The ladle automatically retries to give the DCM metal when this occurs up to a programmable number of retries. When the programmed number of retries is exceeded, the ladle will halt operations and this alarm message will display.

Corrective Action

1. Determine why the DCM cannot accept the metal and correct the problem.
2. Adjust the number of abort cycle retries (see Timers & Counters Screen on 7-25).
3. This fault self-resets when the next Auto Cycle start signal is received.

Disabling the Fault

This fault cannot be disabled.

Allowable Fill Change Exceeded

This alarm means that the ladle has traveled significantly lower into the furnace to find metal than it traveled during the last Auto Cycle. The allowable fill change from cycle-to-cycle is programmed on the Teach Screens. This fault is intended as a backup for the sensor probes and extreme caution is advised when attempting to diagnose the cause of this fault.

Corrective Action

1. Reset the fault by pressing one of the following:
 - **RESET ALARM** key on the Alarm Screen (Figure 9-1).
 - **FAULT** push-button on the Manual Controls (Figure 9-2).
2. Check the condition of the probes and the probe wiring.
3. Manually move the arm back to the metal to make sure the probes are functioning properly.
4. Check to determine if anything might have caused a wave to occur in the metal.
5. Restart the Auto Mode and observe the ladle as it completes several cycles to identify any abnormalities.
6. If the metal waves too much, it may be necessary to adjust the Allowable Fill Change setting (see System Defaults Screen on 6-36).

Disabling the Fault

This fault cannot be disabled.

Metal Probe Fault

High Metal Probe Fault

These two alarm messages indicate that the metal probe input has been activated when the arm is away from the furnace. The ladle senses metal when the probes ground-out in the metal. If this input is activated while the ladle is above the Clear position, one of these faults will occur.

Corrective Action

1. Reset the fault by pressing one of the following:
 - **RESET ALARM** key on the Alarm Screen (Figure 9-1).
 - **FAULT** push-button on the Manual Controls (Figure 9-2).
2. For the METAL PROBE FAULT, check the metal probe wiring for defects and correct if necessary. For the HIGH METAL PROBE FAULT, check the high metal probe wiring for defects and correct if necessary.
3. Check for possible ground sources.
4. Refer to Table 9-1, Troubleshooting Table, Sensor Fault for corrective actions.

Disabling the Fault

These faults cannot be disabled.

Probes Shorted

This fault means that the ladle has sensed a simultaneous occurrence of the metal and high metal probes going off together. The ladle senses metal when the probes ground-out in the metal. The high metal probe is supposed to be a backup to the metal probe and is placed a distance above the metal probe. If the inputs are activated simultaneously, this fault will occur.

Corrective Action

1. Reset the fault by pressing one of the following:
 - **RESET ALARM** key on the Alarm Screen (Figure 9-1).
 - **FAULT** push-button on the Manual Controls (Figure 9-2).
2. Check the metal and high metal probes wiring for defects and correct if necessary.
3. Check for possible ground sources.
4. Refer to Table 9-1, Troubleshooting Table, Sensor Fault for corrective actions.

Disabling the Fault

This fault cannot be disabled.

Dipper Overtravel

This alarm message indicates that one of the dipper overtravel prox switches has tripped during an Auto Cycle. The dipper has a set of cam lobes that are sensed by the prox switches. These are set to prevent turnbuckles on the chains from moving onto the sprockets.

Corrective Action

1. Reset the fault by pressing one of the following:
 - **RESET ALARM** key on the Alarm Screen (Figure 9-1).
 - **FAULT** push-button on the Manual Controls (Figure 9-2).
2. Check the dipper chains, cams, and prox switches for proper setting, operation, and slippage. Correct if necessary.
3. Check the Fill and Pour angle settings to verify that they are set properly (see Dipper Positions Screen on 7-17).
4. Use the manual ARM push-button on the Manual Controls (Figure 9-2) to manually move the arm from overtravel to overtravel location. Use the Arm Manual Functions Screen (Figure 9-5) to ensure proper settings and positions are programmed.
5. Check the Dipper Trim setting on the Ladle Sim Screen (see Ladle Sim Screen on 6-40) to verify that the setting has not pushed the dipper into overtravel.

Disabling the Fault

This fault cannot be disabled.

Control Power Failure

This alarm indicates that control power is not being received correctly. The fault can be caused when power should be on, but is not being sensed, or when power should be off but is being sensed.

Corrective Action

1. Reset the fault by pressing one of the following:
 - **RESET ALARM** key on the Alarm Screen (Figure 7-1).
 - **FAULT** push-button on the Manual Controls (Figure 7-2).
2. Check to make sure power is being applied properly as described in Chapter 3, Installation, Connecting the Electrical Power.
3. Use the Electrical Schematics to locate fuses, breakers, and inputs that make up the Master Control Relay (MCR) circuit and MCR circuit monitoring.
4. Correct any problems identified at the source of the fault.
5. Press the MANUAL push-button (Figure 7-2) to enter Manual Mode.

Disabling the Fault

This fault cannot be disabled.

Ans 1/ans 2 Servo Fault

This alarm means that the servo controller has lost control of the servo motor.

Corrective Action

1. Reset the fault by pressing one of the following:
 - **RESET ALARM** key on the Alarm Screen (Figure 9-1).
 - **FAULT** push-button on the Manual Controls (Figure 9-2).
2. Move the arm away from the furnace.
3. Check for mechanical binds on the ladle.
4. Try retracting the arm or dipper using the manual switches on the Manual Controls (Figure 9-2). If the ladle does not move or falls, check the servo amplifiers for power. A light turns on when there is power to the amp.
5. Check all electrical connections. The electrical connections are on the servo controller (Module 1), the servo amplifiers, the machine connector on the side of the enclosure, and the connectors that are on the servo motors. Make sure a wire or connector does not have intermittent contact.
6. Check the condition of the belts and chains.
7. Perform a servo amp test. Follow these steps to perform the test:



WARNING!

This test causes the servo motor to move. The servo motor must be mechanically disconnected from the machine before the procedure can begin.

- a. Disconnect the servo motors from the ladle.
- b. To test the arm amp, enable it by moving the red wire #5350 (deck 3/12) to the black wire #5100 (deck 3/16) (Figure 9-6).

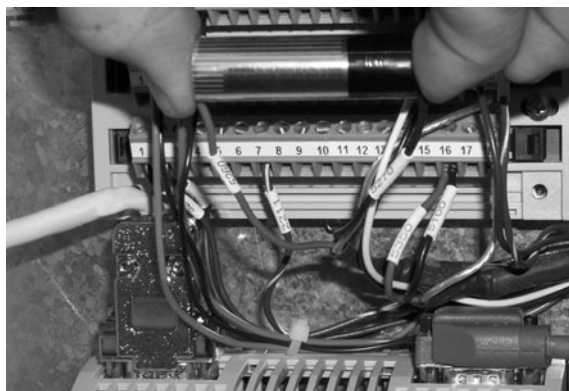


Figure 9-6: Servo Amp Test

- c. Pull the red wire #5260 (deck 2/14) and the black wire #5270 (deck 2/15) from the servo controller card.
- d. Turn on the main power and wait for the system to boot up.

- e. Once the system has come up, press the **ON** push-button located on the front of the control panel. The green light on the servo amp should light. If the amp does not light, there is a problem with the amp or connection to the motor.
- f. Place wire #5260 on one side of a battery and wire #5270 on the other side. The motor should move.



IMPORTANT!

Use only a 1.5 volt battery.

- g. Repeat Step f with the wires switched on the battery. The motor should move in the opposite direction. If the motor does not move as it should, the servo amp, connections to the motor, or the motor might need repaired or replaced.
- h. After the test is complete, press the **STOP** push-button and turn the power off.
- i. Place the red wire #5260 in deck 2/14 and the black wire #5270 in deck 2/15.
- j. Move wire #5350 back to deck 3/12.
- k. Check that all wires are secure.
- l. Reapply power to the system.
8. If the above tests were performed and the source of the problem still cannot be determined, try replacing parts in this order:
 - a. Servo amplifier
 - b. Servo motor
 - c. Servo controller (Module 1)
9. To test the dipper axis amp, repeat steps 7 and 8 using the dipper wires that correspond to the arm wires as follows:

<u>Arm Wire No.</u>	<u>Dipper Wire No.</u>
5350	6350
5260	6260
5270	6270

Disabling the Fault

This fault cannot be disabled.

Error Messages

Error messages for the EPIC Ladle controller that can occur during programming and operation of the Ladle are listed below.

Needs Homed

This message displays when the auto mode is requested without the machine being Homed initially.

Corrective Action

Press and hold the HOME push-button on the Manual Controls (Figure 9-2) until it lights.

Check Arm Stroke Prox

This appears when the arm stroke switch is tripped outside of the allowable checking tolerance (see System Defaults Screen on 6-36).

Corrective Action

Check to see that the switch, cam, or gearbox is not loose, warped, or failing.

Check Dipper Level Prox

This appears when the level switch is tripped outside of the allowable checking tolerance (see System Defaults Screen on 6-36).

Corrective Action

This could indicate that the switch, cam, or gearbox is loose or failing.

Abort-waiting For Operator

The Ladle has aborted and exhausted any automatic retries.

Corrective Action

The operator must initiate a new cycle.

Common Issues

Common issues that can occur during programming and operation of the Ladle are listed below.

Start Push-button Will Not Light

Corrective Action

1. Make sure all personnel are safe and verify that all E-stops and guards have been made.
2. Verify that incoming power is 3 kVA and 120 VAC.
3. Test the lamp with the LAMP TEST push-button (Figure 9-2).
4. Determine if the processor has had time to boot-up. Boot-up takes approximately 45 seconds.
5. Check the control box to determine if any fuses are blown or breakers are tripped.
6. Check if the DC Sense indicator is lit on the Monitor Screen (Figure 9-4).
7. Check the START push-button (Figure 9-2) for proper operation.
8. Check Master Control Relay (MCR) located on the top row of components inside the control enclosure for proper operation. The MCR is a larger-size contactor. To check operation, measure across the coil for 24 VDC. If 24 VDC is present, check the mechanical indicator to determine if the relay has pulled in, which should occur when 24 VDC is present on the coil. If the relay is verified, a voltage measurement should be taken across each contact. If any voltage is present, a contact is not closing properly.
9. Check to see if the processor RUN light is lit inside the control box.

Ladle Will Not Go Into Manual Mode

Corrective Action

1. Make sure the START push-button is lit.
2. Reset any faults by pressing one of the following:
 - **RESET ALARM** key on the Alarm Screen (Figure 9-1).
 - **FAULT** push-button on Manual Controls (Figure 9-2).
3. Try pressing the **MANUAL** push-button on the Manual Controls or the **MANUAL MODE** key on Manual Functions Screen (Figure 9-5).
4. Check in the control box on Module 1 to make sure the controller RUN light is lit.
5. Check the AC sense and the DC sense indicators on the Monitor Screen (Figure 9-4). If either of these indicators are not active, check and, if necessary correct, the following:
 - MCR operation (see step 8 on page 9-11 under Start Push-button Will Not Light)
 - Blown fuses that need replaced

- Tripped breakers that need reset

Ladle Will Not Go Into Auto Mode

Corrective Action

1. Make sure START push-button is lit.
2. Reset any faults by pressing one of the following:
 - **RESET ALARM** key on the Alarm Screen (Figure 9-1).
 - **FAULT** push-button on Manual Controls (Figure 9-2).
3. Make sure arm is fully retracted.
4. Try pressing the **AUTO** push-button on the Manual Controls or pressing the **RUN EDITS NOW** key on the Manual Teach Screen.
5. Check in the control box on Module 1 to make sure the controller RUN light is lit.
6. Check the AC sense and the DC sense indicators on the Monitor Screen (Figure 9-4). If either of these indicators are not active, check, and if necessary, correct the following:
 - MCR operation (see step 8 on page 9-11 under Start Push-button Will Not Light)
 - Blown fuses that need replaced
 - Tripped breakers that need reset
7. Make sure the machine has been Homed by pressing the **MANUAL** push-button and then pressing and holding the **HOME** push-button (Figure 9-2) until it lights.

Cannot Start an Auto Cycle

Corrective Action

1. Make sure the unit is in Auto Mode by pressing the **AUTO** key on the Monitor Screen (Figure 9-4) or by pressing the **AUTO** push-button on the Manual Controls (Figure 9-2).
2. Check that the **AUTO** push-button is on.
3. Verify that the current settings are correct. (See Verifying Proper Installation on 7-1.)
4. Make sure all start signals are off before entering Auto Mode. The Controller has anti-tie-down logic to prevent sudden starts when entering Auto Mode.
5. Make sure a start signal is generated after the system is in Auto Mode. The start signal indicator shows on the Monitor Screen (Figure 9-4). Pressing the **AUTO CYCLE START** push-button on the Manual Controls (Figure 9-2) should start an Auto Cycle.

The Auto Cycle Stalls

Corrective Action

1. Make sure the unit is not faulting. Test the FAULT lamp with the LAMP TEST push-button (Figure 9-2).
2. Make sure the unit is still in Auto Mode by checking that the AUTO push-button is lit on the Manual Controls (Figure 9-2).
3. Verify that the current settings are correct, particularly the speeds. (See Speeds Screen on 7-14.)

System Will Not Respond To Any Commands

Corrective Action

1. Make sure power is on and the START push-button lamp is on.
2. Reset any faults by pressing one of the following:
 - **RESET ALARM** key on the Alarm Screen (Figure 9-1).
 - **FAULT** push-button on the Manual Controls (Figure 9-2).
3. Try to get a response from both the **HMI** keys and the push-buttons.
4. Check to make sure the machine connector on the side of the enclosure is securely fastened.
5. Inside the control box, check for blown fuses or tripped breakers.
6. Inside the control box, make sure the controller RUN light on the processor top hat of Module 1 is lit.
7. Inside the control box, make sure that the BA, RC, and RD lights of Module 2, 3, and 4 are on steady and not flashing. If they are flashing, check the cables that connect Modules 1, 2, 3, and 4 together.
8. Inside the control box, make sure the connectors on the modules are securely fastened.

No Data Appears In Any Memory Area and/or Current Settings

Corrective Action

1. Check in the control box on Module 1 to make sure the controller RUN light is lit.
2. Make sure the controller COM/ACT light is on steady while on the Teach Screen.
3. Make sure blank programs were not downloaded to the controller.
4. Check that the BATTERY OK indicator is lit on the System Data Screen.

The HMI Has a COM ERR Message

This message is normal while the controller boots-up. It should disappear in 45 seconds.

Corrective Action

1. Check in the control box on Module 1 to make sure the controller RUN light is lit.
2. Make sure the cable from the HMI to the middle deck of Module 1 is intact and plugged in.

The Controller Will Not Save the Changes Made to the Program**Corrective Action**

1. Make sure the **Enter** key is pressed after typing in your change.
2. Make sure the **OK** key is pressed before leaving a Teach List Screen.
3. Make sure the changes are downloading to the proper place. To run the changes now, use the **RUN EDITS NOW** key. If saving to a memory area, select the memory area first, and then press the **SAVE TO MEMORY AREA** key. Also press the OK button when the verification prompt is displayed.
4. Check the battery status in the BATTERY OK field on the System Data Screen.

The START Push-button Light Goes Off Without Any Faults

Corrective Action

1. Check for any loss of E-stop or guard safety inputs. Even a momentary loss of one of these inputs will cause the system to shut down. The input indicators can be viewed on the Monitor Screen (Figure 9-4).
2. Check to see if the DC power is momentarily shutting off. If so, the processor will reset without any faults, but will take about 45 seconds to complete booting-up. During that time the HMI will display a “COM ERR”. If the DC power is shutting off, you may have a short circuit on the DC wiring in the control panel or on the machine. The power supply has protection built into it that shuts down the power until the short is gone.
3. Inside the control box, make sure the connectors on the modules are securely fastened.

Electrical Issues

To check for an electrical problem, refer to the Electrical Schematics and find the terminals for the outputs. Above those terminals, locate the LEDs for output status. If the LEDs are lit, check for 24 VDC on the terminals. If 24 VDC is present, locate the buffer relays and observe their LEDs. If lit, check for outgoing power on the buffer relay pin 11 or 14 terminals.



DANGER!

Only qualified technicians following all federal, state, local, and in-plant safety rules should perform these tasks.

Troubleshooting

The following table lists symptoms that might be encountered when troubleshooting the Ladle. Possible causes and remedies are also provided.

Table 9-1: Troubleshooting Table

Symptom	Cause
Sensor Fault	1. Sensors are contacting the metal while the dipper is rotating at CLEAR position 2. Bad resistors 3. Broken or shorted wires between the sensor probes and the control cabinet 4. Flash, oil, cross between probes 5. Bad output point 6. Bad input point 7. Bad I/O module
Biscuit Size Varying	1. Using the Spill-off timer to set the amount of metal poured 2. Dipper slipping on shaft 3. Metal freezing in dipper 4. Dipper not being emptied each cycle 5. Bad dipper encoder 6. Problem with encoder cable in motor 7. Encoder coupling loose in motor 8. Metal building up on probes
Dipper Bobbing Up and Down in Dip Well	Enter metal speed set too high causing waves in the dip well that contact the high metal probe
Incomplete Abort Cycle	Pour back after abort option not set
Arm Stopping Short of the Pour Hole	1. Unit is programmed incorrectly 2. Unit is mechanically bound up
Arm or Dipper not Repeating Position	1. Loose encoder coupling in motor 2. Noise coming in through encoder cable—shielding bad 3. Bad encoder/motor 4. Bad servo module
Arm Diving into Metal	1. Overheating of cabinet 2. Resistors blown 3. Bad servo amplifier 4. Arm brake not functioning

Table 9-1: Troubleshooting Table (Cont.)

Symptom	Cause
Going To Pour Position But Not Making Pour	One or both “OK to Pour” interlocks not present
Will Not Give/Receive I/O Signals	1. Bad fuse 2. Bad I/O module 3. Output shorted (ERR light will be on) 4. Bad cable between I/O modules 5. Bad I/O point 6. Processor not running 7. Prox switch not made or bad 8. Not in proper mode (some work in auto only and under certain conditions. See General Interlock Connection Guidelines on 3-9 for more details)

Chapter 10

PREVENTIVE MAINTENANCE

Introduction

Preventive maintenance (PM) is essential for the Ladle to continue to operate properly. Elements of an effective PM program include documentation, verification of proper ladle set-up, routine maintenance, inspection, spare/replacement parts, and electrical maintenance.



CAUTION!

Do not attempt to perform any maintenance on equipment until all safety instructions have been reviewed and all power sources are locked out as described in Chapter 2, Safety.

Documentation

Document what is done during PM to aid in determining the effectiveness of the program and to help tailor the plan to meet the specific needs of the facility.

Consult the Machine Product Manual for a Comprehensive Maintenance Schedule for your specific machine.

Chapter 11

SECURITY SYSTEM

Introduction

This section details the Watchdog Security System incorporated in every Rimrock EPIC Control system. The security system allows a company to limit which personnel can access and operate the system's various features.

A range of security levels (1–99) can be configured and assigned to up to 100 personal identification numbers (PINs).

This document is intended to be used by the people who set up the system and who will be responsible for managing the operation of the equipment. These people will need full access to all security, programming, and operational functions. They will have the highest security level access (level 99) and are referred to as “super-users.” Only super-users can access the security set-up screens.

Security Safeguard

EPIC controllers are shipped with all functions accessible to any person who can navigate the screen. In some facilities, the security system might not be necessary and will only be set up if the need arises. Other facilities might require complex configurations for security levels in order to protect programming and restrict operation. In any case, the information included in this section should be removed from the User Guide and stored in a separate, secure location. Security information should be accessible only to personnel who are authorized to have full access to all ladle controls and functions.



CAUTION!

Only authorized personnel should be allowed access to the information in this section. Remove this section and store in a secure location prior to distributing the User Guide to restricted personnel.

Log On

A PIN must be entered on the Main Screen to gain access to the EPIC controls. The factory pre-programmed PIN in every system is 5926.

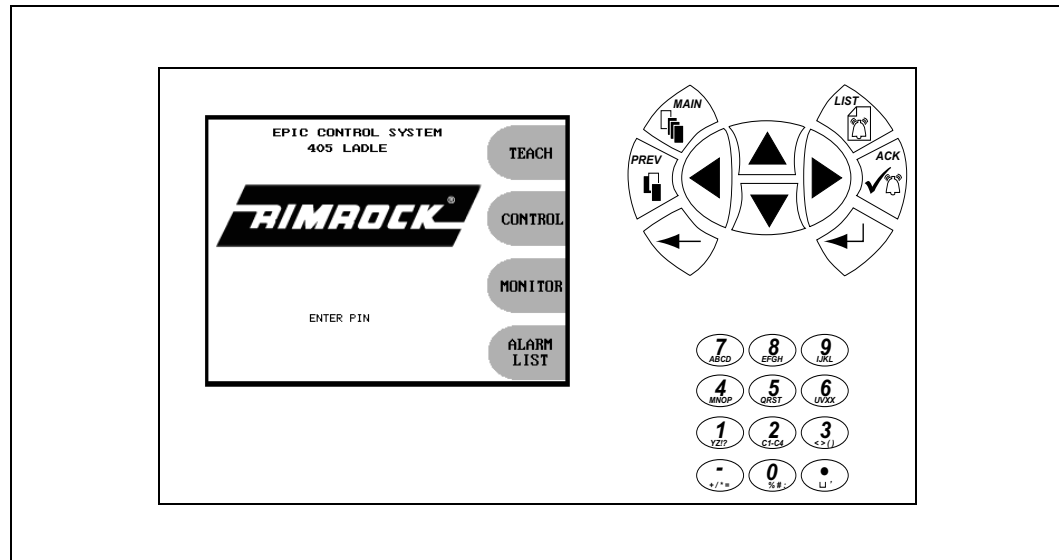


Figure 11-1: Main Screen with Built-In Function Keys and Alpha/Numeric Keys

In order to log on:

1. Access the Main Screen by pressing the **MAIN** built-in function key (Figure 11-1). The screen will display “ENTER PIN”.
2. Use the alpha/numeric keys to type in the PIN and press the **ENTER** (↵) built-in function key. (The PIN will not display on the screen.)
3. If the PIN is correctly matched, the screen will display “PIN ACCEPTED”.
4. If the PIN is not correctly matched, the screen will display “INVALID PIN” and the number will need to be re-entered.

Entering the factory pre-programmed PIN grants super-user status and access to all areas of the controls, including security set-up.

Following logon, press the button located beneath the MASTER SECURITY SCREEN text. (The MASTER SECURITY SCREEN text does not appear if the PIN used for log in does not grant super-user security status.)

Master Security Screen

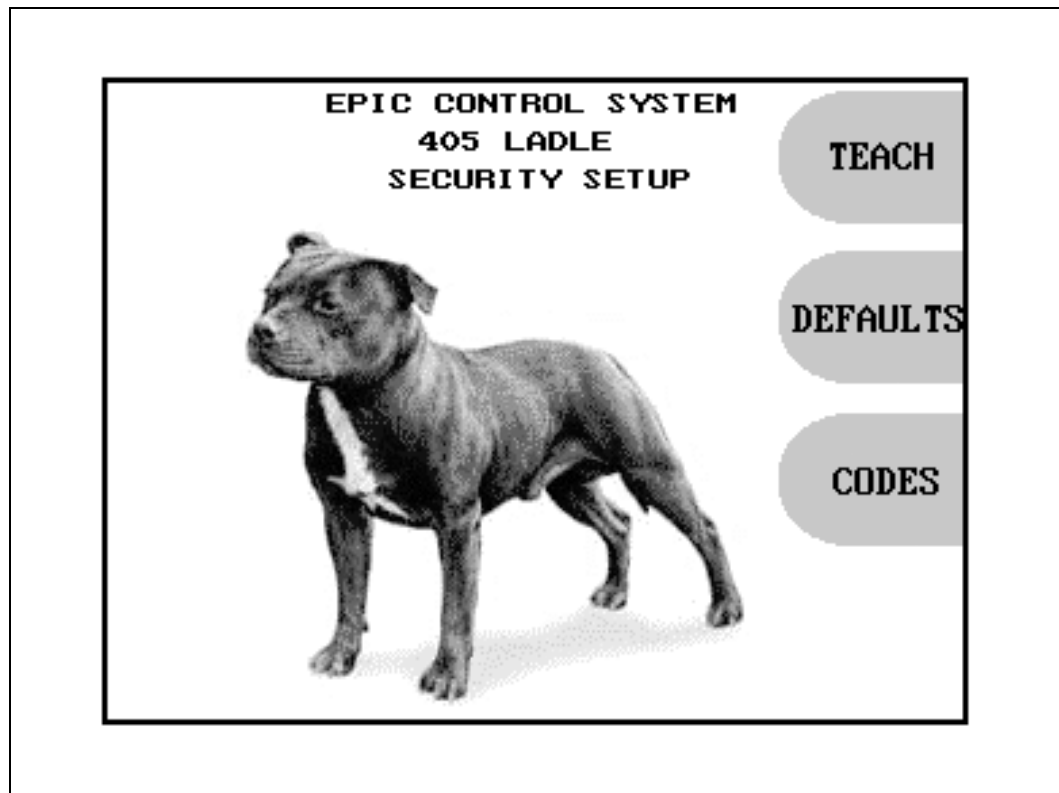


Figure 11-2: Main Screen with Built-In Function Keys and Alpha/Numeric Keys

Add more test here

Function Security Level Set-up

Security level assignment can be customized to meet specific concerns regarding function and control access. For example, security levels can be assigned to memory area storage functions to protect original starting or key programmed values. An operator can be given a security status that will allow changes to be made to current settings, but prevents the operator from saving the changes back to the memory area. This protects the integrity of the program originally developed for a particular production process or other key applications.

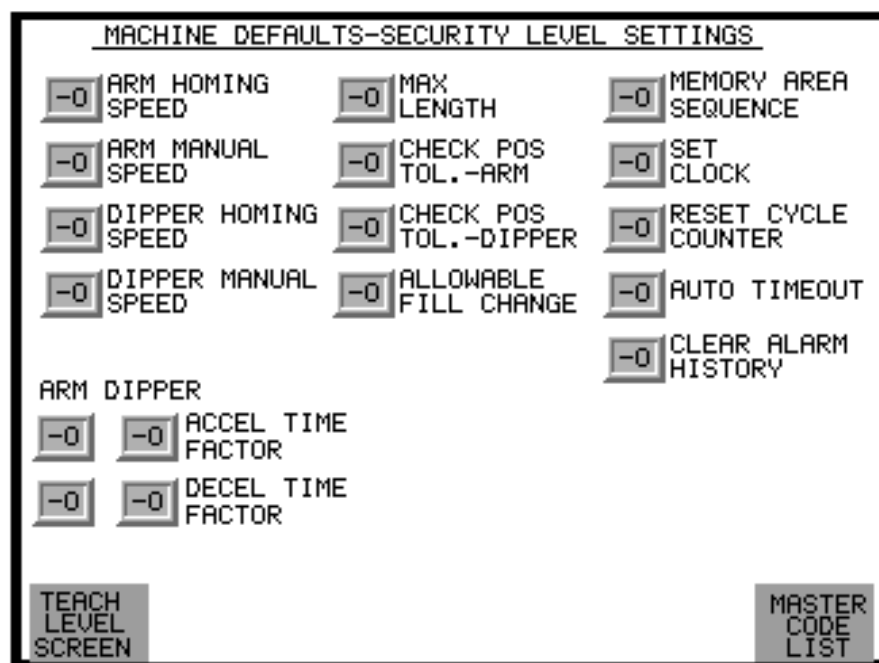


Figure 11-3: Defaults - Security Level Settings Screen

To set up a security level for each function:

1. At the Master Security Screen, press the **DEFAULTS** key to access the Machine Defaults - Security Level Settings Screen (Figure 11-3).
2. Use the arrow keys to move the cursor to the data field for each function.
3. Use the alpha/numeric keys to enter the security level number (0–99) assigned to each function. A security level of 0 will allow access to a function by anyone, even people who are not logged-in on the system.
4. Press **TEACH LEVEL SCREEN** key to return to the Master Security Screen. Then press the **TEACH** key to access the Security Level Settings Memory Area Transfer Screen (Figure 11-4).

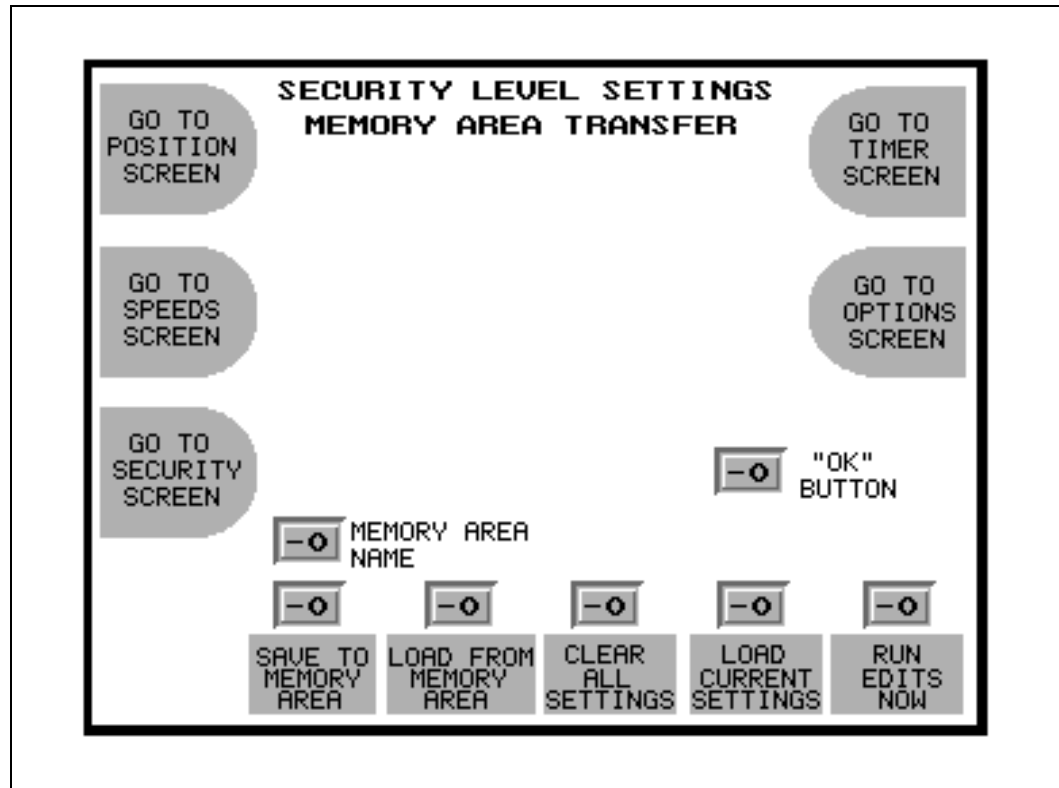


Figure 11-4: Security Level Settings Memory Area Transfer Screen

5. Repeat Steps 2 and 3.
6. Press the **GO TO SCREEN** keys to access the Security Teach screens for assigning security levels to settings for the arm and dipper positions, arm and dipper speeds, timers and counters, and options. Repeat steps 2 and 3 for each function on these screens.
7. Press the **GO TO SECURITY SCREEN** key located in the lower-right corner of each of the function screens to return to the Master Security screen.

After security level numbers have been assigned, tick marks (small yellow circles) are displayed on fields and functions that are not available because the user's security level does not grant access to them. When a field is locked-out, it can be viewed and edited, however the edits will reset immediately to the original values. Functions that are locked-out are inoperable.

Security Level Documentation

Initial security level programming information or changes to security level values should be documented for reference when assigning PIN codes. The table on the following pages can be copied and used to document security level assignments for each field available in the Defaults Security Level Settings and Teach Security Level Settings Screens.

Security Level Settings

Date Programmed:

Name of Programmer:

Defaults—Security Level Settings Assigned

Function	Level (0–99)
Arm Homing Speed	
Arm Manual Speed	
Dipper Homing Speed	
Dipper Manual Speed	
Max Length	
Check Pos. Tol. Arm	
Check Pos. Tol. Dipper	
Allowable Fill Change	
Memory Area Sequence	

Function	Level (0–99)
Set Clock	
Reset Cycle Counter	
Auto Timeout	
Clear Alarm History	
Accel Time Factor-Arm	
Accel Time Factor-Dipper	
Decel Time Factor-Arm	
Decel Time Factor-Dipper	

Teach—Security Level Settings Assigned

Function	Level (0–99)
Arm Positions	
Clear Position	
Low Metal	
Ready to Pour	
Arm Position Offsets	
Low Metal Warning	
Spill-Off	
Pour Fwd	
Abort Pour Back	
Rest Position	
Dipper Positions	
Fill Angle	
Pour 1	
Pour 2	
Pour 3	
Dipper Blow	

Function	Level (0–99)
Arm Speeds	
Retract	
Forward	
Retract After Pour	
Enter Metal	
Exit Metal	
Abort Cycle	
Arm Advance	
Dipper Speeds	
Pour Speed 1	
Pour Speed 2	
Pour Speed 3	
Fill to Level	
Level to Fill	
Pour to Level	
Dipper Blow	

Teach - Security Level Settings Assigned (Cont.)

Function	Level (0–99)
Timers and Counters	
Start Delay Timer	
Fill Timer	
Spill-Off Timer	
Abort Cycle Timer	
Delay After Pour	
Delay Pour Comp Signal	
Blow Off Timer	
Abort Cycle Retries	

Function	Level (0–99)
Options	
Pour to Clear	
Hold at Rest	
Pour Back After Abort	
Stop at Clear	
Pre Pour	
Delay Fill	
Dipper Blow	
Retract During Pour Level	

PIN Code Set-up

Up to 100 PIN codes can be established in the EPIC Control System. Each PIN can consist of numbers ranging from 1 through 32767. After establishing function security levels, PIN codes can be assigned.

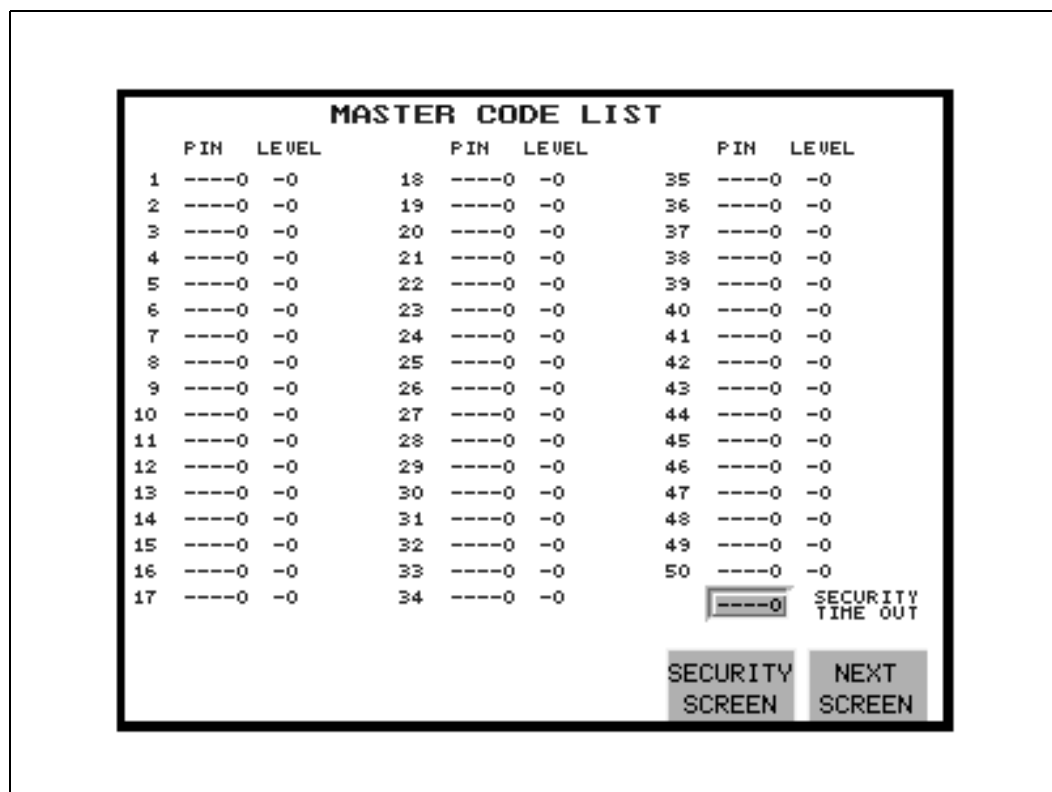


Figure 11-5: Teach - First PIN Set-up Screen

To set-up PIN codes:

1. From the Master Security Screen, press the **CODES** key to access the first PIN Set-up Screen (Figure 11-5).
2. Use the arrow keys to move the cursor to the desired PIN field.
3. Use the alpha/numeric keys to type in the PIN code.
4. Use the right arrow key to move the cursor to the associated level field.
5. Use the alpha/numeric keys to type in the security level (0–99) to be assigned to the user of the PIN.

The first PIN set-up screen allows 50 PIN codes to be entered.

MASTER CODE LIST					
PIN	LEVEL	PIN	LEVEL	PIN	LEVEL
51	----0 -0	68	----0 -0	85	----0 -0
52	----0 -0	69	----0 -0	86	----0 -0
53	----0 -0	70	----0 -0	87	----0 -0
54	----0 -0	71	----0 -0	88	----0 -0
55	----0 -0	72	----0 -0	89	----0 -0
56	----0 -0	73	----0 -0	90	----0 -0
57	----0 -0	74	----0 -0	91	----0 -0
58	----0 -0	75	----0 -0	92	----0 -0
59	----0 -0	76	----0 -0	93	----0 -0
60	----0 -0	77	----0 -0	94	----0 -0
61	----0 -0	78	----0 -0	95	----0 -0
62	----0 -0	79	----0 -0	96	----0 -0
63	----0 -0	80	----0 -0	97	----0 -0
64	----0 -0	81	----0 -0	98	----0 -0
65	----0 -0	82	----0 -0	99	----0 -0
66	----0 -0	83	----0 -0	100	----0 -0
67	----0 -0	84	----0 -0		

PREVIOUS
USER
SCREEN

SECURITY
SCREEN

PREV
SCREEN

Figure 11-6: Teach - Second PIN Set-up Screen

Pressing the **NEXT SCREEN** key can access a second PIN set-up screen (Figure 11-6). This screen will allow the set-up of 50 more PIN codes.

The pre-programmed PIN used to initially access the security system (5926) should be replaced with a new, confidential PIN with super-user (security level 99) status. Use the arrow keys to move the cursor to the first PIN code field where 5926 is displayed. Use the alpha/numeric keys to type in the new confidential PIN.

The second PIN set-up screen includes a **PREVIOUS USER** key. This key displays a screen listing the previous users (a minimum of five) logged on the system most recently, including the user's PIN code, date, and time of system access.

Security Time Out

Security time out is the amount of time that the controls can be left idle before automatically logging off the user. The timer starts upon log on and resets every time a function key is pressed. The timer can be set from 0 to 9999 seconds and is set from the first Master Code List Screen. To set the timer from the Master Security Screen press the **CODES** key. Use the arrow keys to move the cursor to the Security Time Out field. Type in the number of seconds the system can remain idle before the user is logged-off.

When a security time out occurs, the information last entered is retained and the screen being viewed when the time out occurred remains. Tick marks will appear if any fields or functions are now locked out.

Security Settings Back-up

All settings, including security, are saved in battery-backed memory in the EPIC controller processor. Normal power failures will not reset these settings. However, if the batteries fail, the settings will be lost and the system will revert back to the original factory settings.

Additional back-up of settings can be accomplished using the Rimrock ROSCO program. This program uploads, changes, and reloads settings, including security. ROSCO is a Windows-based program that is run on laptop or desktop computers connected to the EPIC controller via ethernet.

Contact Rimrock Sales at (614) 471-5926 for more information about ROSCO.

Chapter 12

GLOSSARY

Auto Cycle - A cycle of the ladle controlled by signals from the die cast machine. In an auto cycle, the ladle runs without operator intervention.

Auto Mode - A mode in which the ladle is ready to be controlled automatically by signals it receives from the die cast machine.

Blow Air - A blast of air that is used for dispersing residue that might build up in the dipper cup. (Usually applied when zinc is being used.)

C# - The ladle identification number located on the machine name plate attached to the side plate of the ladle.

Clear Position - The position where the ladle dipper is just above the furnace.

Crossed power - Crossed power occurs when the ladle power is used to feed the die cast machine inputs and outputs or the die cast machine power is used to feed the ladle inputs and outputs. Do not cross power when installing the ladle.

DCM - An abbreviation for Die Cast Machine.

Disconnect Switch - A switch mounted in the control cabinet that removes all power from the control box.

Dry Contacts - Electrical contacts that allow machines to transfer signals while remaining electrically isolated from each other.

Energy-isolating Device - A device on the equipment that is used to remove the equipment from the energy source.

EPIC Controls - Controls which allow the user to start, program, and stop the Ladle. The controls consist of the HMI and manual controls.

Fault - Indicates there is a problem with the operation of the ladle. When a fault occurs, a bell symbol appears on the HMI Screen with an alarm message.

Field - A rectangle on the HMI Screen in which the user enters a parameter.

Ground - A connection between an electrical circuit or equipment to the earth.

Home - The position in which the ladle arm and dipper are centered in their travel.

HMI - Human Machine Interface.

Human Machine Interface - A graphical user interface that provides the controls the user needs to program the steps the ladle follows during a die cycle.

Indicator - Information on the HMI Screen that displays and cannot be changed. An indicator could be a small circle on the screen that lights when an element of the controls is active. An indicator could also be text or a number displayed on the screen.

Input - An electrical signal that supplies information to the central processing unit (CPU). Examples of inputs include interlocks and limit switches.

Inrush - The spike in the current draw when equipment is initially turned on. The current draw spikes for a short period of time and then falls back to normal.

Interlocks - Electrical connections in the form of inputs and outputs that interface the ladle with the die cast machine.

LED - An abbreviation for Light Emitting Diode. LEDs light up to show status of electrical components.

Lockout - Applying a lock and a tag to the energy-isolating device on the equipment after the equipment has been put in a zero energy state. This physically prohibits others from restoring power to the equipment and identifies who is working on the equipment.

Machine Tool Transformer - A transformer specifically designed to provide power to equipment that uses high current inrush devices such as motors, relays, and solenoids.

Manual - A mode in which the operator has complete control over the functions of the ladle. The machine can be homed, extended, and retracted, in this mode.

Memory Area - Storage for settings taught to the ladle. A program for each die can be determined and saved in the memory area for later use.

Output - A signal turned on by the processor to produce a desired result, such as an interlock signal going from the ladle to the die cast machine.

Parameter - An entry on the HMI. A parameter could be a number, such as a speed or a position, the user enters on the HMI to control the action of the ladle. A parameter could also be text, such as the name of a program, used for identification.

Power Supply - An apparatus that converts an AC voltage to a DC voltage. EPIC-controlled Rimrock machines use a 24-volt power supply.

Rest Position - The home position of the ladle.

Safety Barrier - A device installed to limit access to the ladle path during operation. Rimrock highly recommends the installation of safety barriers.

Scratchpad - The work area on the HMI Screen where the user enters parameters into fields. After users have determined the step parameters, they save the values from the scratchpad into the program memory.

Tagout - Applying a tag to the energy-isolating device on the equipment after the equipment has been put in a zero energy state. The tag warns others not to restore power to the equipment and identifies who is working on the equipment.

Teach - The user programs settings into the ladle controller to tell it when and how to move, fill, and pour.

Zero Energy State - Isolation of the equipment from the energy source. This must be done before any maintenance or repair of the ladle or any other equipment is performed.