PRICE $50.00

USER'S MANUAL

SL-1200

FOR

Madison Precision Products, Inc.

S/N: 32256-06
July 7, 2006

Robotic Servo Metal Ladling System

Your "Window to the World"® of Die Casting Automation and Consumable Products

Advance Products Corporation - 2527 M-63 Benton Harbor, Michigan 49022
Phone (269) 849-1000 - Fax (269) 849-2200 - www.advanceproductscorp.com

Please refer to the second half of this book for more products available from Advance!

Advance®

- Features
- Technical Specifications
- Unpacking and Setup
- Programming
- Maintenance and Adjustments
- Troubleshooting
- Technical Documentation
- Replacement Parts

Features

FEATURES

The Advance Robotic Servo Ladler, **Model SL-1200** is designed to be used with 600-1200-ton diecast machines. It features a control assembly that houses the electronic circuitry and operator station, a remote operator panel that houses the switching and status indicators, a mechanism assembly, and two 30-foot cables with connectors.

The Ladlers use servo motors and gear boxes so that no belts, pulleys, or cams are needed on the internal mechanisms. The drive system uses brushless servo motors with encoders that use closed-loop feedback to assure consistent shot-size repeatability and arm positioning from shot-to-shot, as well as smooth acceleration and deceleration through all speed changes.

The heavy-duty arm assembly uses a double reduction worm-gear reducer that direct-drives the crank arm. The cup assembly uses a heavy-duty worm-gear reducer that drives chain linkage for smooth pouring.

The Ladler can simultaneously rotate the ladle cup while moving the arm. This dual action provides two benefits:

- It ensures that the pouring metal will always accurately flow into the shot-sleeve pour hole (referred to as the "drip move").
- It allows the operator to program the cup to rotate to the horizontal position while the arm is returning home after pouring, thus reducing the overall cycle time.

Advance Products "quick-change" ladle cups need no tools to install. Simply slide the cup onto the pivot shaft, and secure it with a steel pin.

The Ladler is controlled by a Mitsubishi PLC that is standard on all Advance products. The operator station uses an easy-to-read LCD (liquid-crystal display) with the MVA PC or a 1/4 VGA touch screen. Each program is easy to set up, and is menu-prompted, so that no previous programming experience is necessary. The unit can store up to five hundred programs for touch screens and two hundred programs for the MVA PC.

The remote operator panel features rotary switches to operate the ladler. The controls will:

- Select an automatic or manual operation.
- Control forward or backward arm movement.
- Adjust the shot-size during manual and automatic cycles with "on the fly" changes.

Pushbuttons are used to start an "auto cycle" and a "homing" sequence. An array of status indicators light to show the operator when:

- There is no metal in the pot.
- The metal in the pot is low.
- An automatic cycle is in progress.
- An automatic cycle has been aborted.
- The 2nd metal probe is in use, or the probes are defective.

There are also indicators that light to show the positions of the ladler arm and the ladle cup.

The Advance Robotic Servo Ladler uses state-of-the-art technology, and is designed for safe, reliable service. It is the ideal product for those who want to achieve top performance from a ladler.

Technical Specifications

SYSTEM TECHNICAL SPECIFICATIONS -1-

ADVANCE ROBOTIC SERVO LADLER - MODEL 1200

Shot-Size Repeatability	99+%.
Mechanical Stroke	72 inches
Pouring Capacity (excludes cup)	25 pounds
Programmable Speed	40 inches-per-second.
Positioning Repeatability	.050 inches.
Maximum Number of Stored Programs	500.
Power Requirements	208-230 VAC, 3-phase 60Hz, 20-ampere feeding a transformer in a standard
Transformer Requirements	3 KVA.

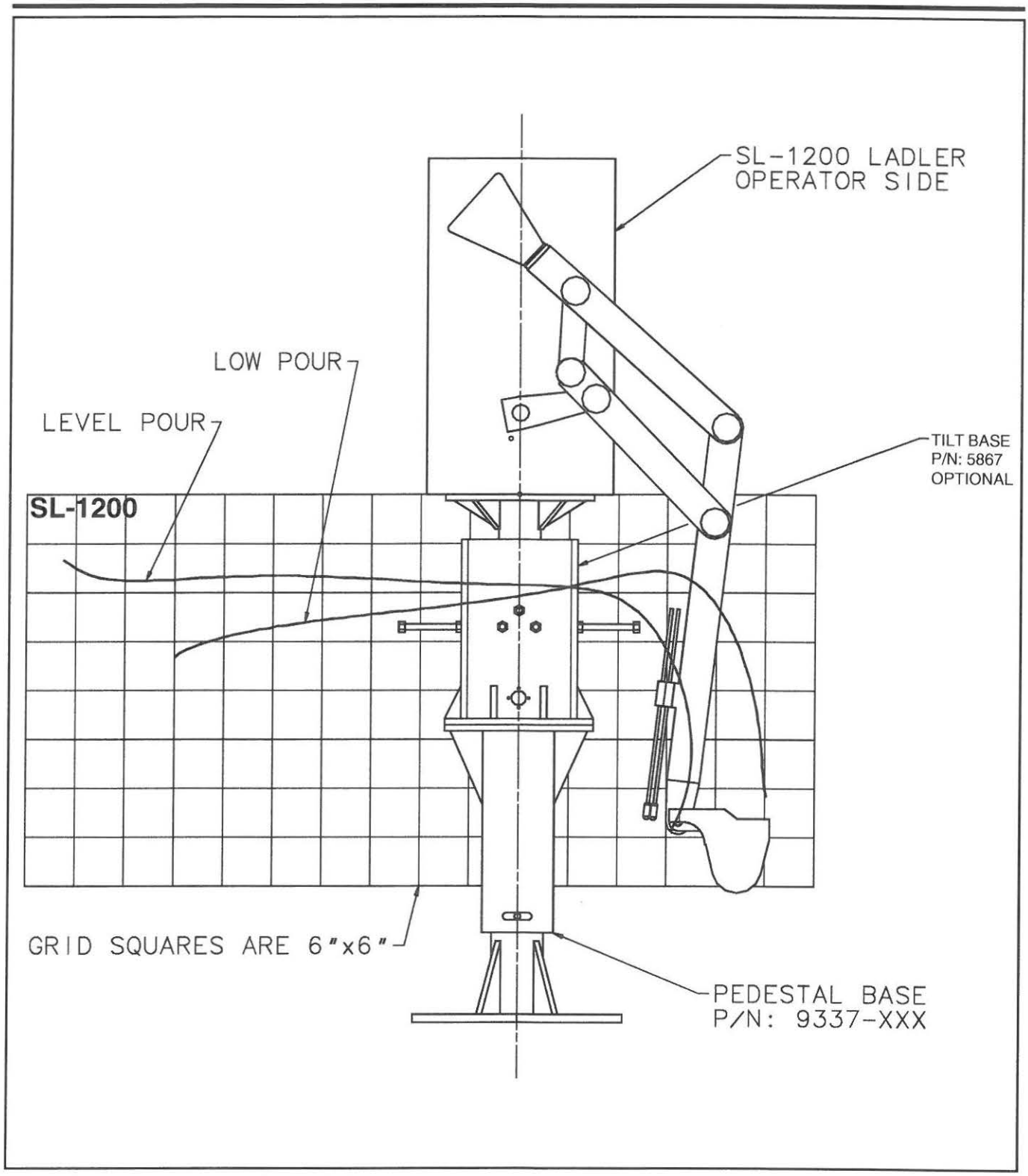
Dimensions:

Control Box	See page 1-3.
Ladler Dimensions	(See illustrations on pages 1-2).

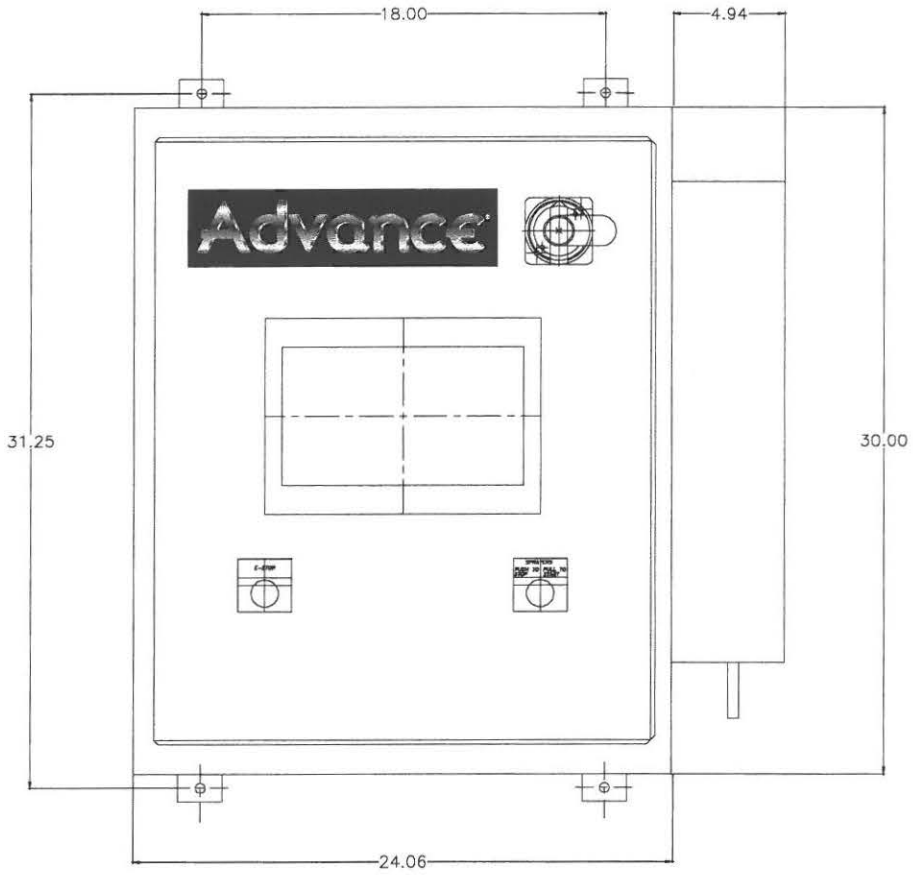
Weight:

Mechanism	750 lbs.
Control Assembly	250 lbs.

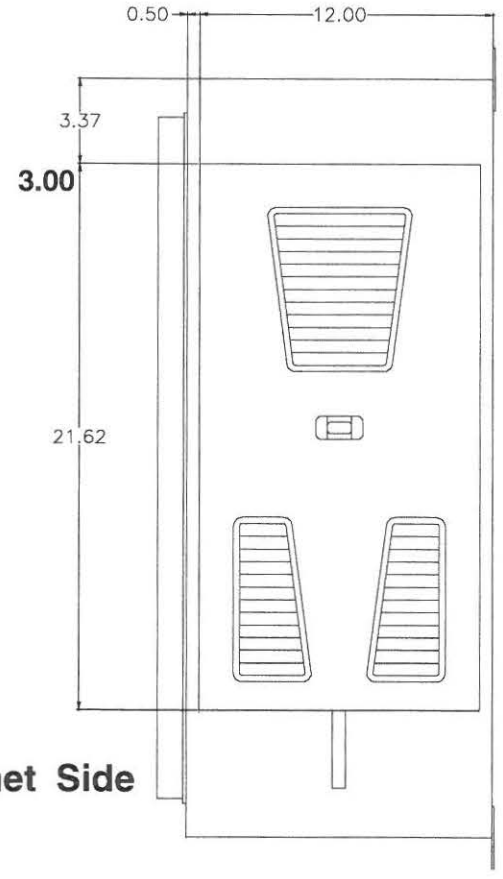
Advance Products Corporation reserves the right to change specifications at any time without incurring any obligation to incorporate changes in products previously sold.


SL-1200 LADLER
OPERATOR SIDE
LOW POUR
LEVEL POUR
TILT BASE
P/N: 5867
OPTIONAL
SL-1200
GRID SQUARES ARE 6"x6"
PEDESTAL BASE
P/N: 9337-XXX

SL-1200



Cabinet Front



Cabinet Side

SL-1200 Electrical Cabinet

— NOTES —

Unpacking and Setup

UNPACKING AND SETUP -2-

UNPACKING

The Advance Ladler system consists of:

- The ladler mechanism
- The control box
- The remote operator's panel
- Two 30' cables with connectors
- Technical manual
- Optional pedestal
- Electrical schematic

WARNING: THE LADLE MECHANISM IS VERY TOP HEAVY. MAKE SURE THAT A HOIST IS ATTACHED TO THE EYELETS AT THE TOP OF THE MECHANISM BEFORE REMOVING THE BASE PLATE MOUNTING BOLTS. DO NOT LIFT THE MECHANISM BY THE ARMS OR DAMAGE TO THE GEARBOX WILL OCCUR.

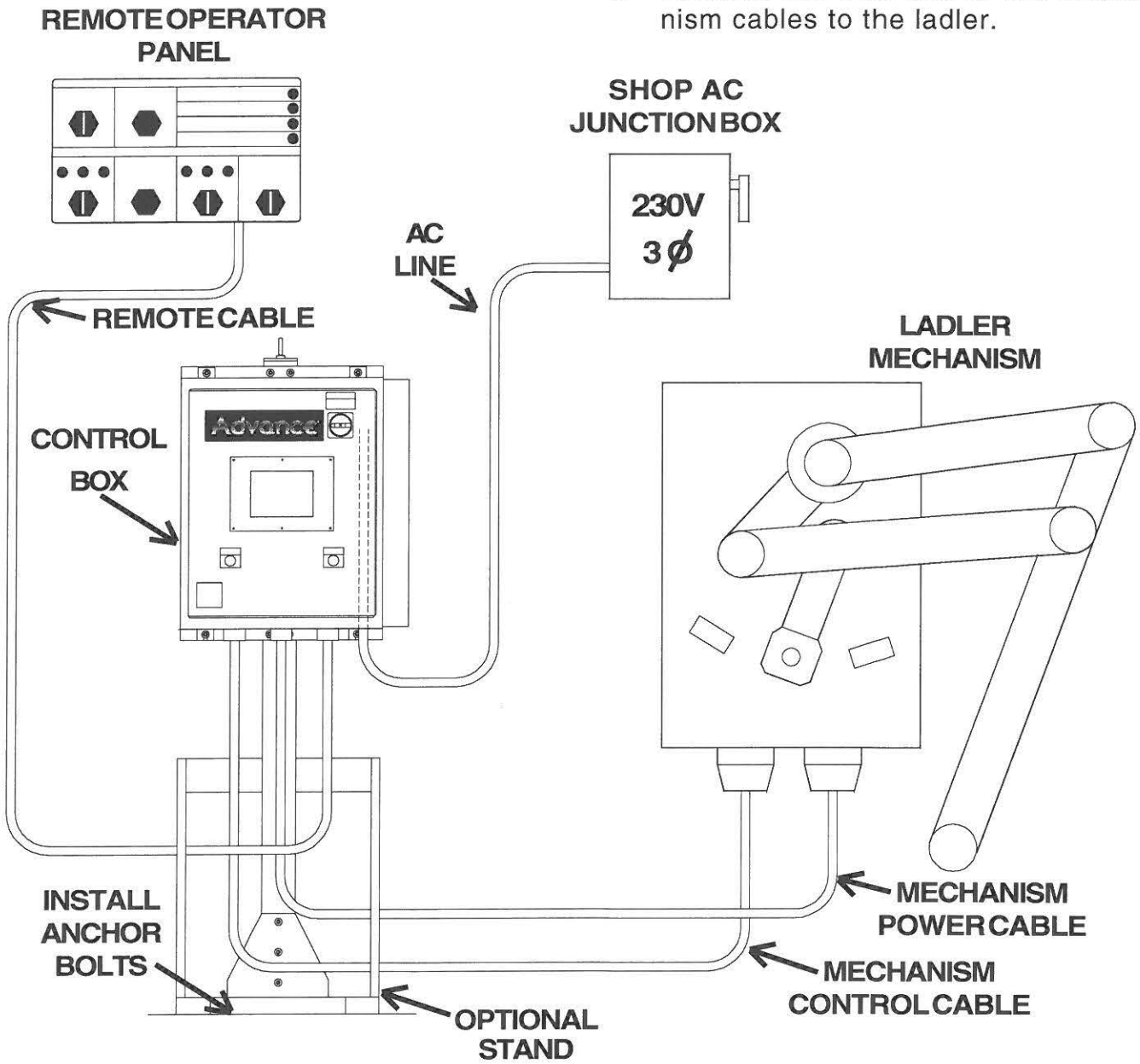
1. Carefully unpack the shipping crates and cardboard boxes and lay the contents out so that you can easily identify and access them.
2. Move the control box to the desired location.
3. Place the remote operator's panel at its desired location. NOTE: You can hang the panel on a wall, or mount it to a stationary support. Use the mounting holes that are provided in the back of the case for this purpose.
4. Set up the pedestal near the metal container. You will anchor the pedestal after you set up the ladler mechanism and position the assembly.
5. Use a hoist and hook a chain through the eyelets provided in the top of the ladler mechanism. Lift the mechanism and set it on the pedestal so the mounting holes align, then secure the mechanism to the pedestal with the appropriate size bolts, lockwashers, and nuts.
6. Bolt the pedestal to the floor.

WARNING: DO NOT ALLOW THE MECHANISM AND PEDESTAL ASSEMBLY TO FREE-STAND. IT IS VERY TOP HEAVY. UNTIL THE PEDESTAL IS ANCHORED TO THE FLOOR, USE SOME SORT OF SUPPORT AT THE TOP OF THE MECHANISM TO PREVENT IT FROM FALLING OVER.

CONNECTING THE CABLES

Refer to Figure 2-1 for the following steps.

1. **Locate control and bolt stand to the floor.**
2. On the control box, raise the locking arms on the remote cable connector. Insert the male end of the remote cable into the connector as far as possible. Lower the locking arms to secure the connectors.
3. Similarly connect the male end of the mechanism cables to the other control box connector.
4. Connect the free end of the mechanism cables to the ladler.



Connecting The Cables
FIGURE 2-1

CONNECTING THE AC POWER

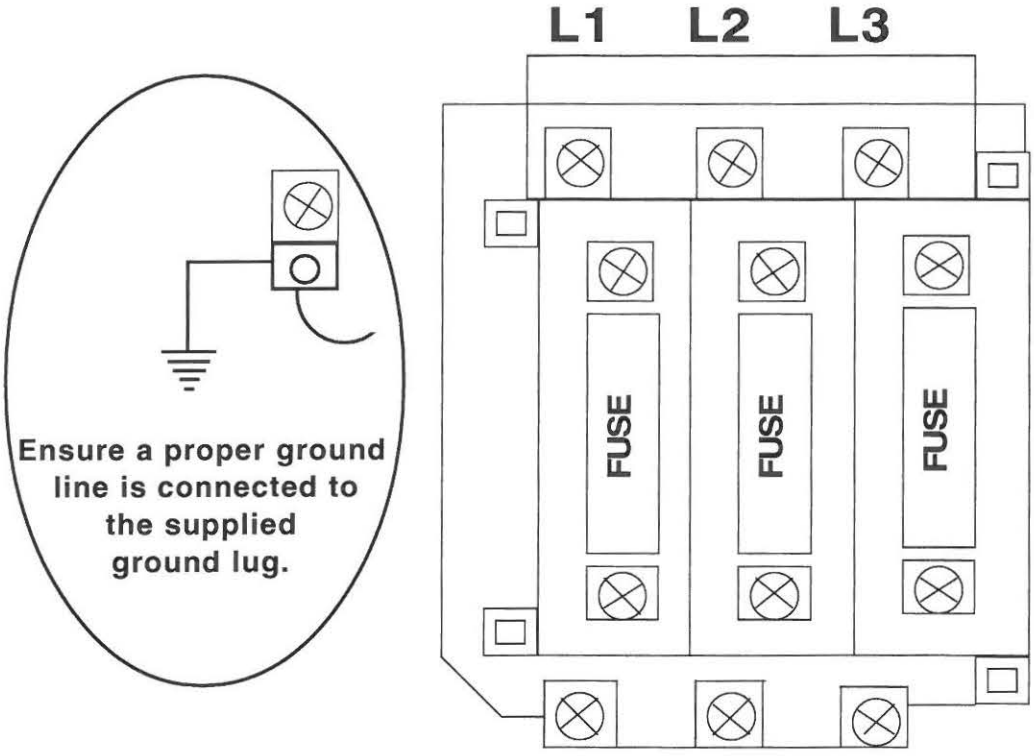
WARNING: BEFORE WIRING THE LADLER'S CONTROL BOX, TURN OFF AC POWER AT THE THE SHOP'S JUNCTION BOX. FAILURE TO DO THIS COULD RESULT IN ELECTRICAL SHOCK, OR EQUIPMENT, OR SHOP DAMAGE.

1. Refer to Figure 2-2 and connect the wires from a power cable coming from the shop's junction box to the screw terminals of the ac disconnect terminal block inside the control box, as shown.

NOTE: The control panel is factory wired for 208-230 VAC, 3-phase standard. Optional transformers for 480 VAC -(US). 380/415 VAC (CE), 600 VAC (CAN) are available upon request.

If the red LED on the phase monitor is not on, reverse L1 & L2 or L2 & L3 to correct the incoming phase.

208 TO 230 VAC
3 PHASE ONLY!!!!



POWER WIRING

Connecting The Power Cable
FIGURE 2-2

CONNECTING THE ELECTRICAL INTERFACE

The electrical interface is shown in the "Technical Documentation" section.

The terminal block interface points for these relays are located in the lower left section of the control box.

The factory-standard coil voltage for isolation relays is 120VAC. The actual relays that are installed may be different, if requested by the customer. Before making connections to interface terminals, verify the voltage of the installed relays.

The following abbreviated terms are used in the electrical interface. A description of each term is also included.

COM - COMMON

This is the common side of the coils of the isolation relays. The neutral side of the source should be connected here.

DC - DIE CLOSED

This is an input from the die cast machine indicating that the die is closed and locked. It must be present to enable the ladle to pour, and also break and remake before the ladle will pour on the next cycle.

RB - ROD BACK

This is an input from the die cast machine indicating that the shot rod is fully retracted. It must be present to enable the ladle to pour, and also break and remake before the ladle will pour on the next cycle.

AE - AUTOMATIC ENABLE

This is an input from the die cast machine enabling the ladle to move past the home position during a cycle. Normally, this comes from a ladle on/off switch located on the die cast machine's control panel. However, if the installation requires, this interface signal may be used during each cycle to prevent a collision by keeping the ladle from moving into the shot sleeve area until signaled to do so.

CS - CYCLE START

This is an input from the die cast machine which may be used to start each cycle of the ladle. Normally, the Cycle Delay timer is used to start each new cycle. If the Cycle Start input is used, this timer should be disabled. If this timer is not disabled, the ladle will start a new cycle before the die cast machine signals it to do so. Refer to page 3-13.

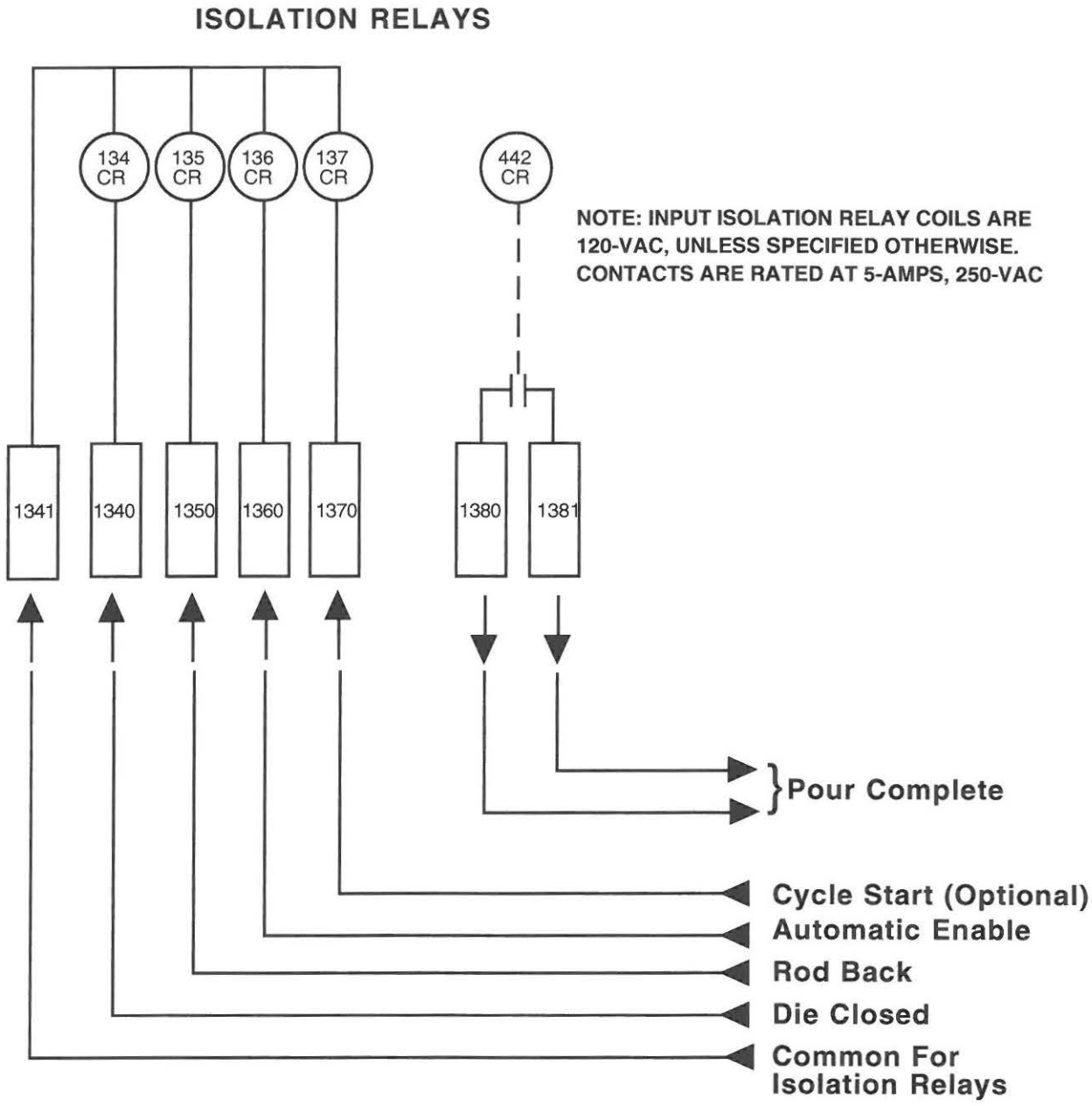
SG - SAFETY GATE

This is an input from the die cast machine which should be used to stop any movement of the ladle if the input is **inactive**. This input **must be active** to allow normal operation. If the installation does not use this feature, this relay should be removed.

PC - POUR COMPLETE

This is a set of dry contacts that close at the end of the pour sequence. It should be used as the input to the die cast machine to make the shot. The contact closure is delayed from the time the cup reaches the third pour angle by the Pour Drain and Shot Delay timers. The length of time the contacts remain closed is controlled by the Pour Complete Timer.

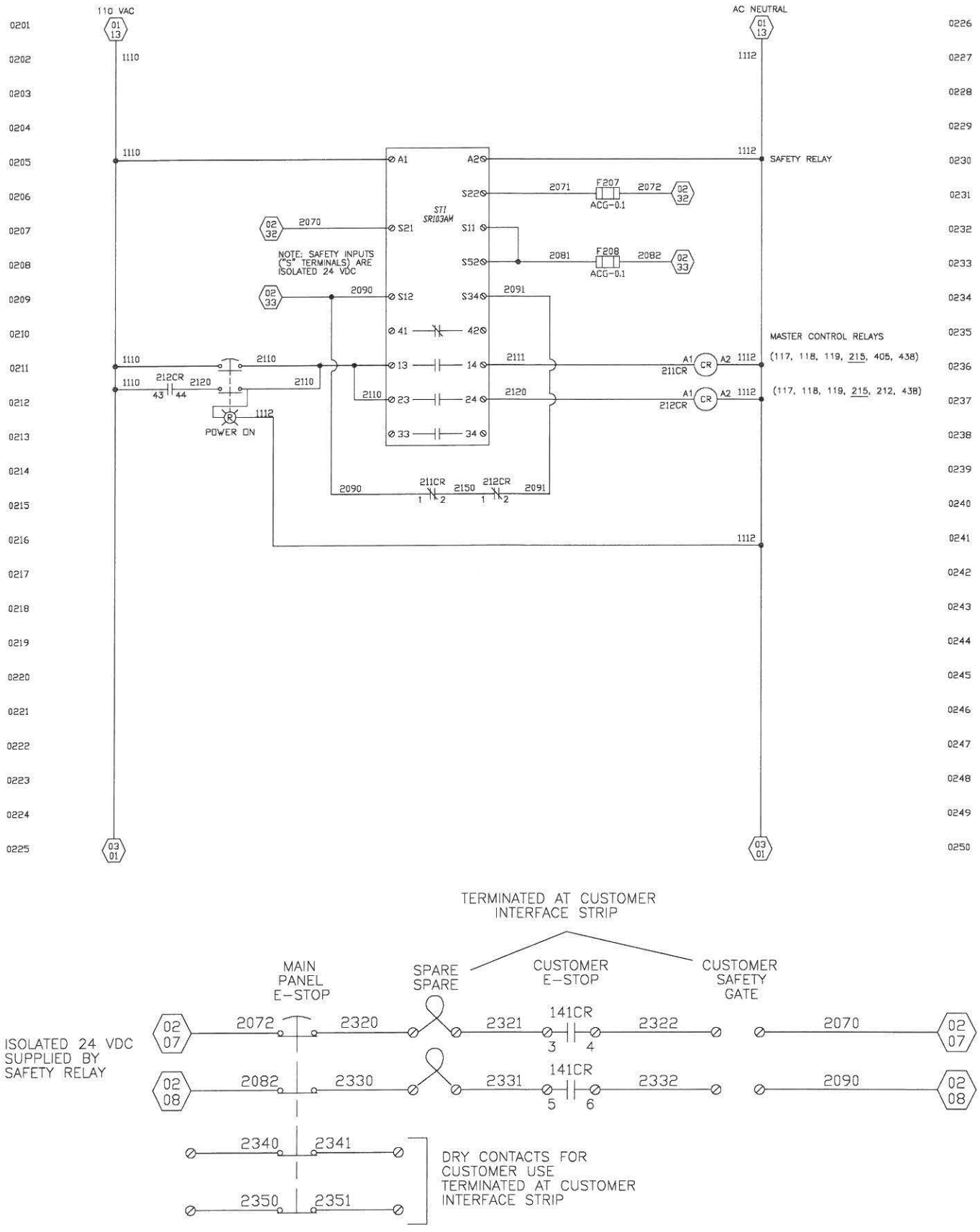
LADLER CUSTOMER INTERFACE



Ladler Customer Interface

FIGURE 2-3

NOTE: See pages 6-5 and 6-6 for optional interface wiring options.

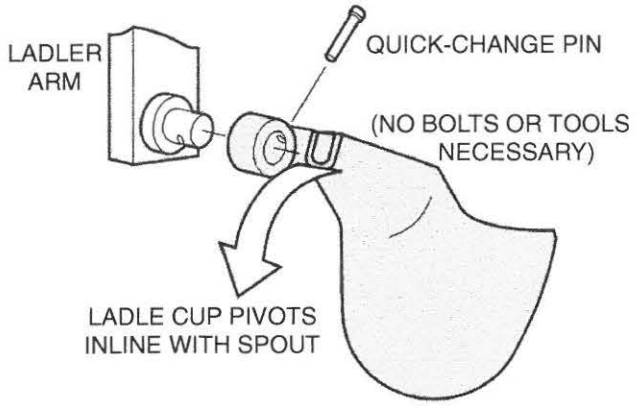


E-Stop Circuit

FIGURE 2-4

INSTALLING THE LADLE CUP

Slide the ladle cup over the end of the arm shaft and align the mounting holes (see Figure 2-5). Install the pin through the mounting holes to hold the cup in place.



Installing The Ladle Cup

FIGURE 2-5

FINAL INSPECTION

Before powering up the ladler, inspect the following items.

1. Make sure each end of both the remote and mechanism cables are locked to their jacks.
2. Check all cables inside the control box for loose connections that may have occured during shipping or the connecting of power/interface wiring.
3. Check cable connections inside the cabinet at the bottom for loose strands of wire that may cause shorts between wire terminations.
4. **Make sure ladler is bolted to the floor.**

INITIAL POWER-UP

NOTE: Be sure to perform final inspection before powering up the ladle. During the initial power-up, be prepared to immediately turn off the power in the event the mechanism trys to "run away" due to possible damage during shipment or the connecting of power/interface wiring. Also, be sure that there are no personnel in the path of the ladle arm.

1. At the control box, turn the power disconnect switch to **ON**.
2. Apply power.
3. After power-up, the Mitsubishi touch screen will show the initial power up screen shown on page 3-2.

— NOTES —

Programming

PROGRAMMING & SOFTWARE - 3 -

The software used by the Mitsubishi touch screen in the ladle system is an application oriented program that is used as an operator interface. By using this operator interface, the operator can change several variables, or parameters, involved in the ladle system to modify it's behavior as desired.

The software system uses different menus as options to change the variables or parameters of the ladle. These menus are shown in Figure 3-1 below:

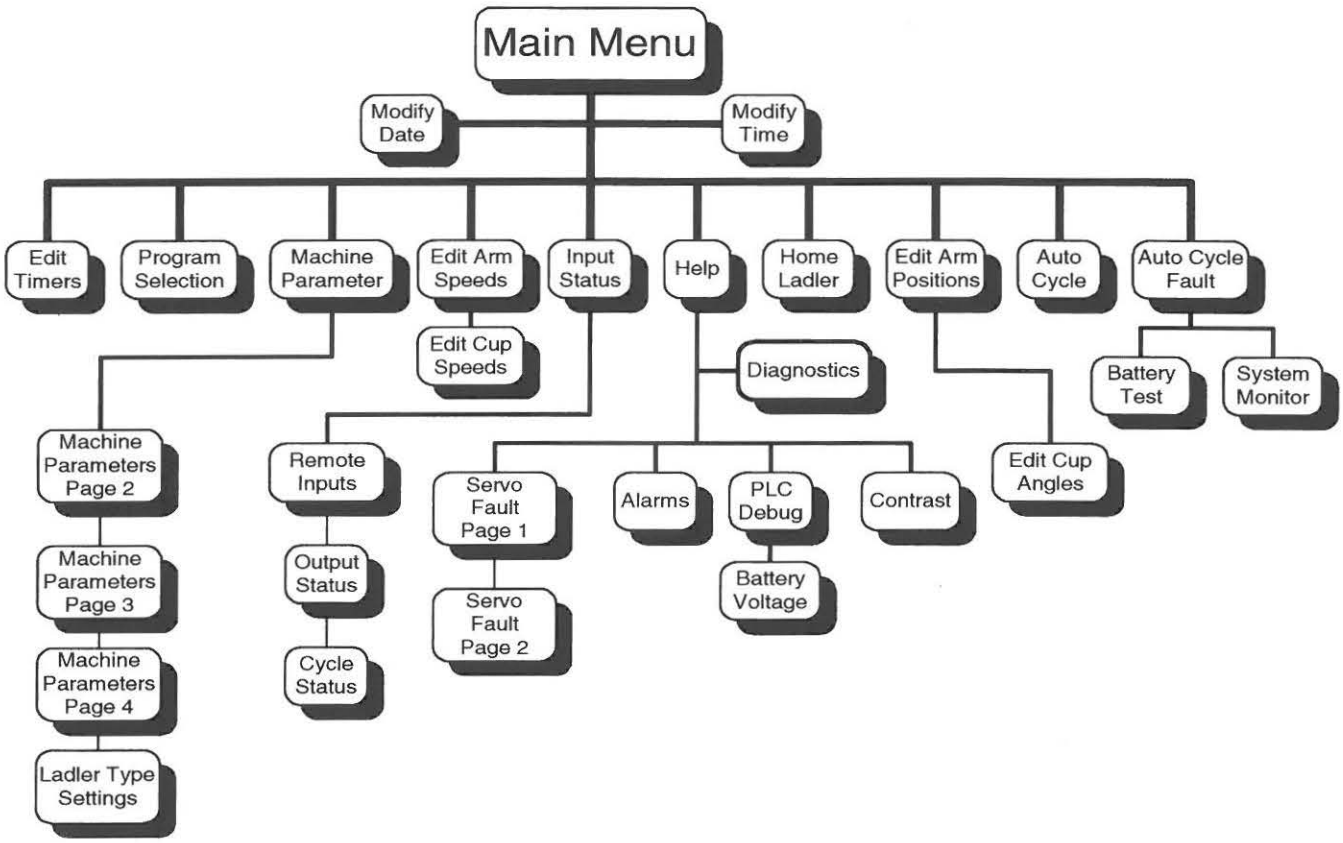


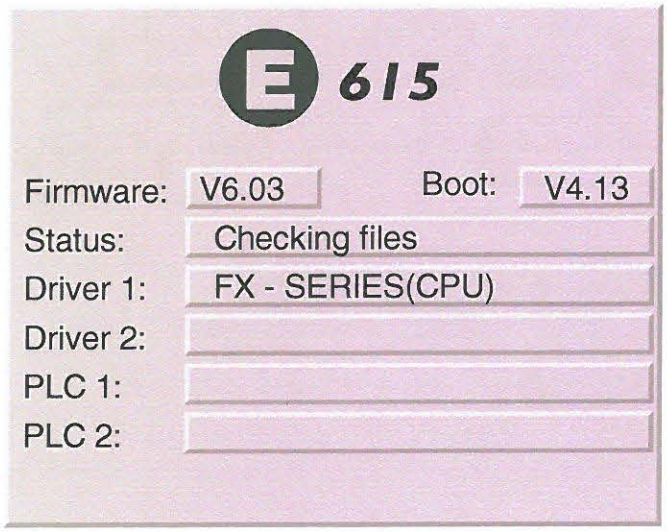
Figure 3-1 APC Ladle software diagram

To change any program or machine parameter of the ladler system, use the operator panel and its different sections on the touch screen. A general procedure of how the operator interacts with the ladler system, via the operator panel, will be explained below and before entering the software menus explanation.

To select a menu, touch the desired choice. Once selected, a menu for the corresponding screen will be displayed.

INITIAL AND NORMAL RUNNING MENUS

Apply power. The display on the operator interface screen will show the startup screen shown in Figure 3-2.

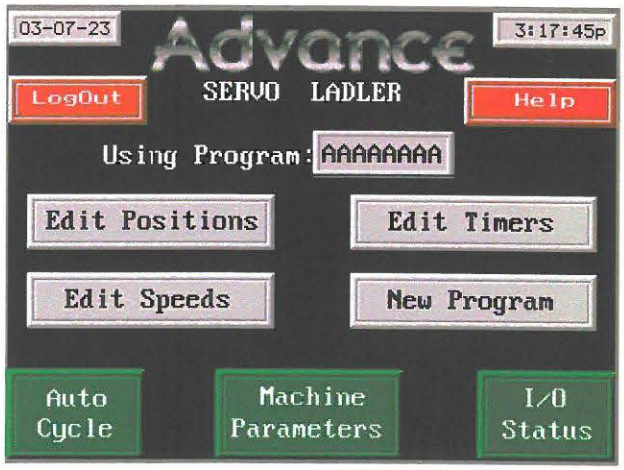


Power-up Screen Figure 3-2

After the power-up screen is displayed, the Main Menu screen is displayed.

MAIN MENU

This is the first screen as shown in Figure 3-1 on page 3-1. From this screen all other screens may be reached.



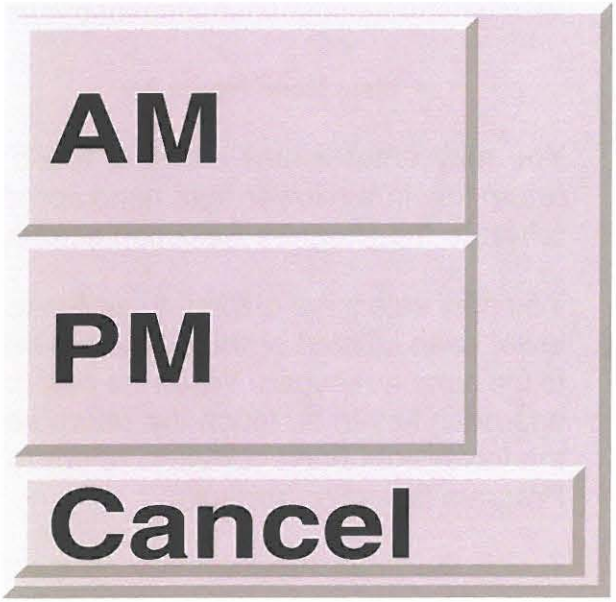
Main Menu Figure 3-3

This screen shows the actual ladler program that is loaded into memory. The ladler program is identified by the *"Using Program:"* on the display, followed by the program name. In the example, the program name used is: *AAAAAAAA*.

The date is displayed in Standard Date Format in the upper left hand corner with the month listed first followed by the day and then the year. In this case, the year is 2023, the month is March and the day is the 7th.

The time is displayed in the upper right hand corner. Either the date or the time may be modified by touching the desired selection. At that time the following menu, Figure 3-4 is displayed. Enter the date or time. If a time entry is being made, then an AM/PM selection screen is displayed for input as shown in Figure 3-5.

Numeric Entry Screen Figure 3-4

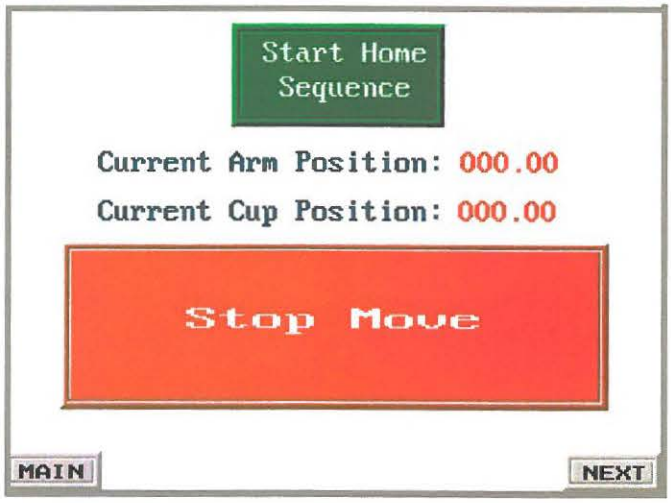


AM/PM Entry Screen Figure 3-5

HOME

Performing a Home Sequence is required after power is applied and before running an auto cycle. This allows setting a zero reference position, relative to a programmed move in a user program. The home key is used to perform a ladler home sequence. After touching the HOME LADLER key on the touch screen, or pushing the PUSH TO "GO HOME" button on the remote operator panel, the following screen appears.

Note: The switch on the Remote Operator Station must be in the MANUAL position to start a homing cycle.



Home Screen Figure 3-6

Once the Start Home Sequence key is touched, the ladler cup will go to its home position then the arm will begin moving back to the home position. During that time, the current cup and arm positions are displayed next to *Current Arm Position* and *Current Cup Position*.

The Stop Move key should be pressed if it is necessary to abort the move.

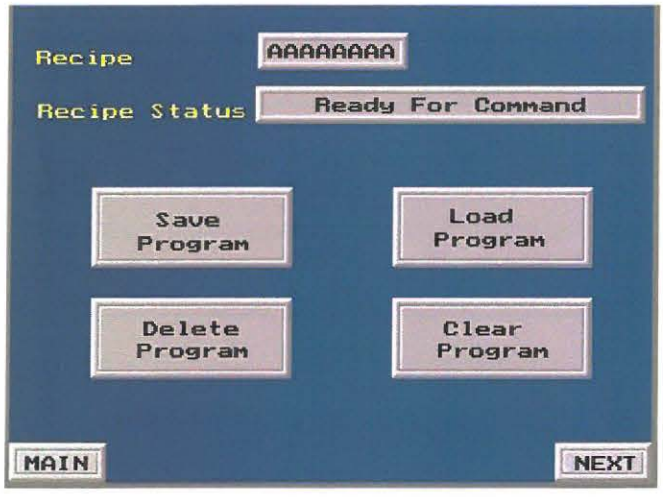
Press the MAIN key when you are ready to return to the Main Menu.

The NEXT key is inactive at this time.

PROGRAM SELECTION

Main Menu Figure 3-7

Program selection can be initiated by touching either the New Program key or the current program name in the Using Program box on the Main Menu as shown in Figure 3-7. Then the program selection screen, similar to the one in Figure 3-8 is displayed.



Program Selection Screen Figure 3-8

Touch the Save Program key and the program that was being edited is saved with the name listed in the Recipe box. (This is automatic and not really required.) To change the name of the program, touch the name, then enter a new name on the keypad similar to Figure 3-9.

Touch the Clear Program key and the program that was being edited is erased.

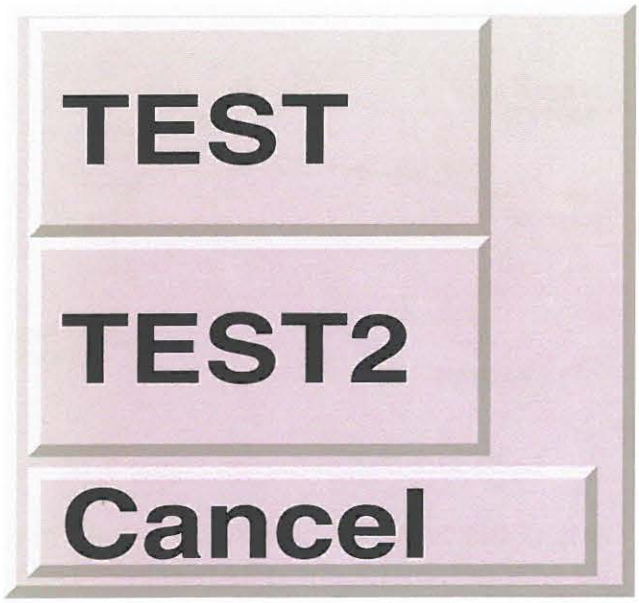
Touch the name in the Recipe box and the screen similar to the one shown in Figure 3-9 is displayed.

Main Menu Figure 3-9

You may enter a new name or touch the return key in the lower right hand corner to return to the Program Selection screen.

You may select the a-z key to switch to the lower case keypad or the 0-9 key to switch to the numeric keypad. When the new name has been keyed in, touch the return key in the lower right hand corner to return to the Program Selection screen.

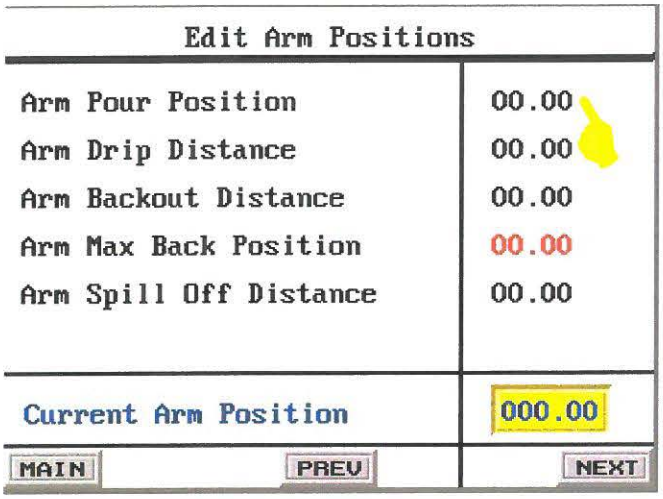
Touch the Load Program key on the Program Selection screen as shown in Figure 3-8 and a screen similar to the one in Figure 3-10 is displayed. Touch the desired program name or touch the Cancel key. This will bring you back to the Program Selection screen depicted in Figure 3-8.



Program List Screen Figure 3-10

EDIT ARM POSITIONS

Editing arm positions may be initiated by pressing the "Edit Positions" key on the Main Menu as shown in Figure 3-7. Then the Edit Arm Positions screen, similar to the one in Figure 3-11, is displayed.



Edit Arm Positions Screen Figure 3-11

Refer to Figures 3-11 and 3-12 for the parameter descriptions listed below.

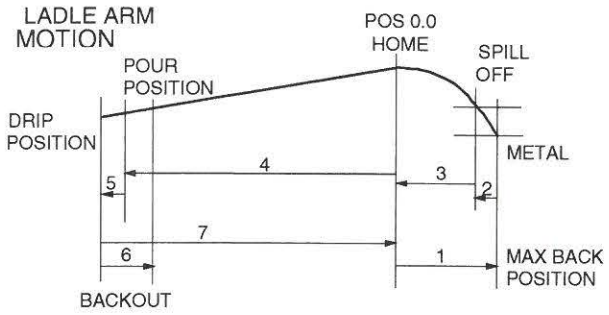
The **Pour Position** is the distance in inches from the home position in which to pour the metal into the sleeve.

The **Drip Distance** is the distance in inches from the pour position to the drip position.

The **Backout Distance** (optional) is the distance in inches for the ladler to move the arm back away from the shot sleeve before the cup levels back to home.

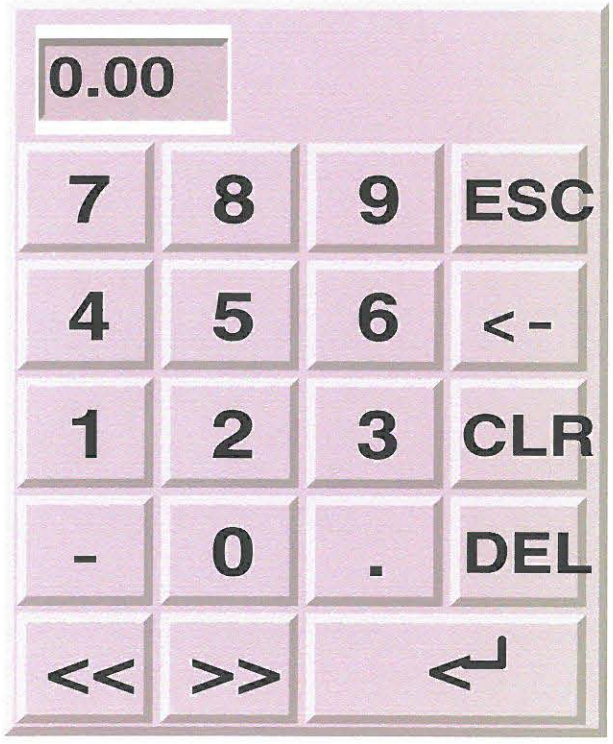
The **Max Back Position** is the distance in negative inches (red) from home that the arm can travel into the pot.

The **Spill Off Distance** is the returning distance in inches that the arm moves from the metal during Fill to spill off excess metal.



Ladle Arm Motion Screen Figure 3-12

Any of the previous parameter values may be changed by touching its number. Doing so will cause the screen shown in Figure 3-13 to be displayed.



Numeric Keypad Figure 3-13

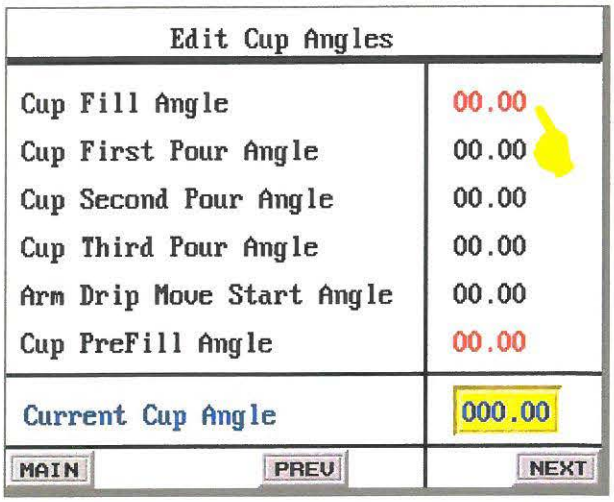
To change the current value, enter the new number using the numeric keypad, followed

by the <ENTER> key to save the new value.

Refer again to Figure 3-11, Edit Arm Positions screen. Notice the Current Arm Position with its value shown on a yellow field. This value may be changed by jogging the arm using the Remote Operator Panel as described on page 3-26.

Touching the "Next" key will cause the Edit Cup Angles screen to be displayed as shown in Figure 3-14.

EDIT CUP ANGLES SETTINGS



Edit Cup Angles Figure 3-14

The **Cup Fill Angle**, as shown in Figure 3-17, is the angle in negative degrees (red) from horizontal that the cup should be filled in the furnace dip well.

To maximize performance in your pouring operation, 3 different pour angles are offered. Note that Figure 3-16 shows the 1st, 2nd and 3rd pour Angles.

The **Cup First Pour Angle** is the angle in degrees from horizontal that the cup should be at to begin the pour. This angle should be slight to prevent spillage of the metal all over the sleeve.

The **Second Pour Angle** is the angle in degrees from horizontal that the cup should be at in the middle of the pour.

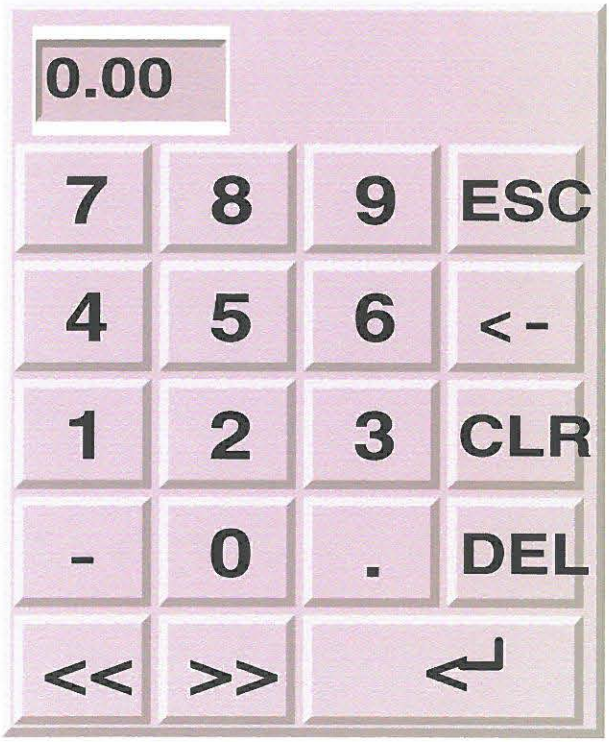
The **Third Pour Angle** is the angle in degrees from horizontal that the cup should be at when near the end of the pour. As shown in Figure 3-16, it should be at its greatest angle for this part of the cycle.

The **Arm Drip Move Start Angle** is the angle in degrees from horizontal that the cup is in at the end of the pour and at the beginning of the arm drip move to finish dripping the last of its payload into the sleeve.

The **Cup PreFill Angle** is the angle that the cup is from horizontal as it is moved into the furnace dip well. This angle in negative degrees should be such to reduce the wave action into the molten metal to prevent splashing on the cell equipment and operator.

The current Cup Angle is displayed at the bottom of the screen and can be modified by placing the switch on the Remote Operator Panel to MANUAL and jogging the ladler.

Any of the previous parameter values may be changed by touching its number. Doing so will cause the screen shown in Figure 3-15 to be displayed.



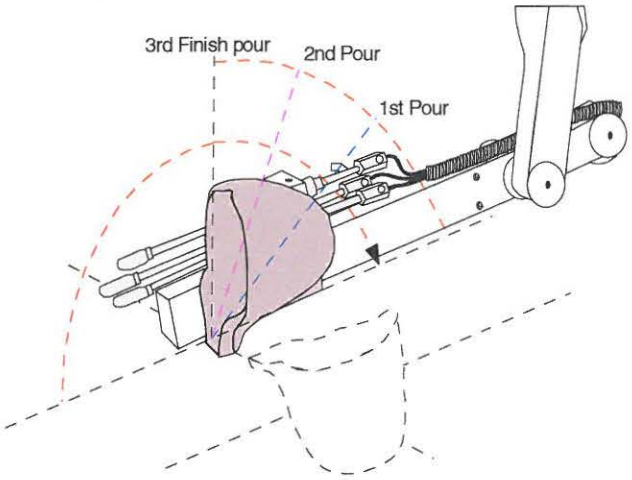
Numeric Keypad Figure 3-15

To change the current value, enter the new number using the numeric keypad, followed by the <ENTER> key to save the new value.

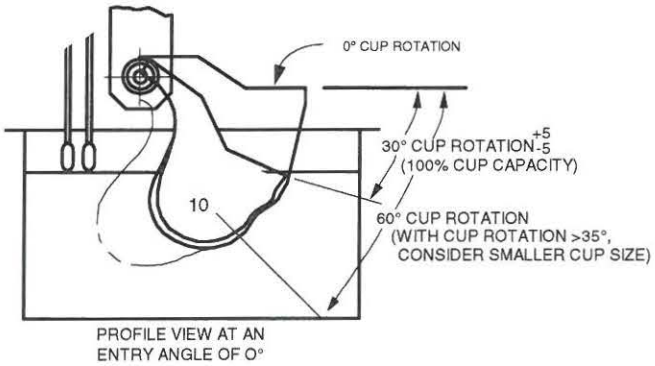
Refer again to Figure 3-14, Edit Cup Angles screen. Notice the Current Cup Angle with its value shown on a yellow field. This value may be changed by jogging the cup using the Remote Operator Panel as described on page 3-26.

Touch the PREV key to return to the Edit Arm Position screen.

Touch the NEXT key go to the Arm Speed Settings screen as shown in Figure 3-18.



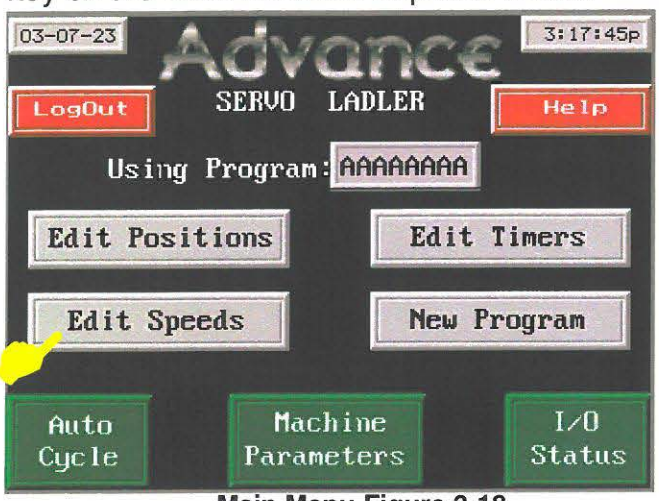
Pour Angles Figure 3-16



Fill Angle Figure 3-17

SPEED SETTINGS

To enter Arm Speed Setting, touch the Edit Speeds key on the Main Menu as depicted below.



Main Menu Figure 3-18

Arm Speed Settings	
Arm Move To Metal	00.00
Arm Move To Spill Off	00.00
Arm Move To Home/Wait	00.00
Arm Move To Pour Position	00.00
Arm Move To Drip Position	00.00
Arm Move To Backout	00.00
Arm Move Back To Home	00.00

MAIN PREV NEXT

Arm Speed Settings Figure 3-19

All speeds in Figure 3-19 are in inches per second.

Any speed of the ladle cycle can be changed in this menu. This cycle is shown in Figure 3-21.

Refer to Figures 3-19 and 3-21 for the following parameter descriptions.

The **Arm Move To Metal** speed is the speed of the arm during step 1.

The **Arm Move To Spill Off** speed is the speed of the arm during step 2.

The **Arm Move To Home/Wait** speed is the speed of the arm during step 3.

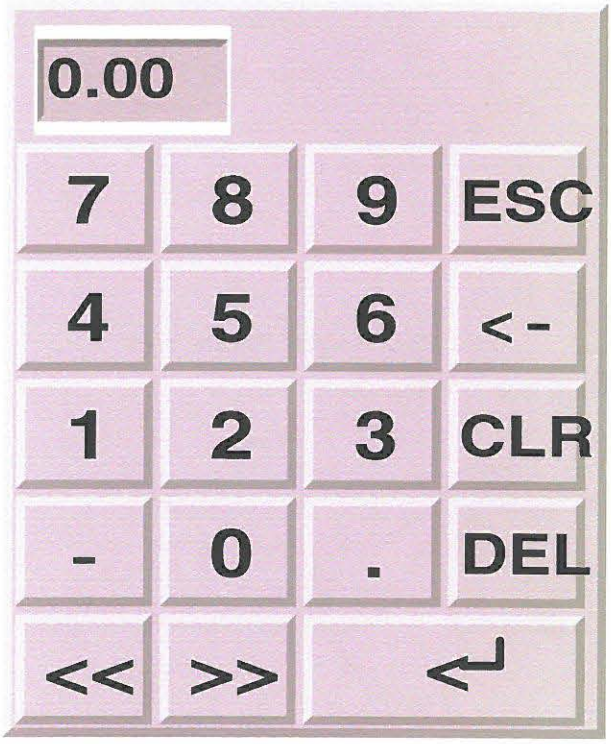
The **Arm Move To Pour Position** speed is the speed of the arm during step 4.

The **Arm Move To Drip Position** speed is the speed of the arm during step 5.

The **Arm Move To Backout** (optional) speed is the speed of the arm during step 6.

The **Arm Move To Back To Home** speed is the speed of the arm during step 7.

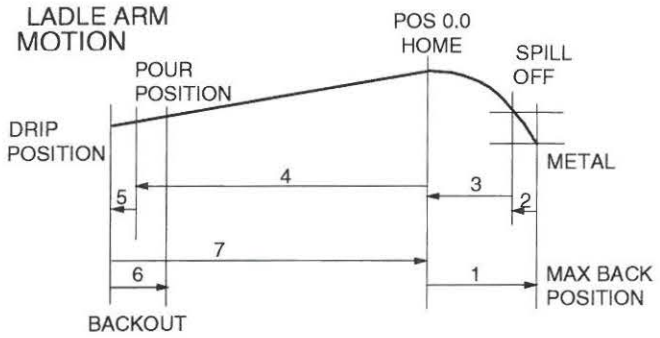
Any of the previous parameter values may be changed by touching its number. Doing so will cause the screen shown in Figure 3-20 to be displayed.



Numeric Keypad Figure 3-20

To change the current value, enter the new number using the numeric keypad, followed by the <ENTER> key to save the new value.

After the Enter Key or the ESC key is pressed as shown in Figure 3-20, the Arm Speed Settings screen reappears for further selections.



Ladle Arm Motion Figure 3-21

Touch MAIN or PREV to return to the Main Menu.

Touch NEXT to display the Cup Speed Settings as shown in Figure 3-22.

Cup Speed Settings	
Cup Move To PreFill Angle	00.00
Cup Move To Fill Angle	00.00
Cup Move To Home From Fill	00.00
Cup Move To 1st Angle	00.00
Cup Move To 2nd Angle	00.00
Cup Move To 3rd Angle	00.00
Cup Move To Home From Pour	00.00
MAIN PREV	NEXT

Cup Speed Settings Figure 3-22

All speeds in Figure 3-22 are a value from minimum to a maximum of 100%. Due to different gear ratios, this is not in degrees per second.

Refer to Figures 3-21 and 3-22 for cup speed settings descriptions.

The **Cup Move To PreFill Angle** speed is the speed of the cup rotation during step 1.

The **Cup Move To Fill Angle** speed is the speed of the cup rotation during step 2.

The **Cup Move To Home** From Fill speed is the speed of the cup rotation during step 3.

The **Cup Move To 1st Angle** speed is the speed of the cup rotation during step 4.

The **Cup Move To 2nd Angle** speed is the speed of the cup rotation during step 4.

The **Cup Move To 3rd Angle** speed is the speed of the cup rotation during step 4.

The **Cup Move To Home From Pour** speed is the speed of the cup rotation during step 7.

Any of the previous parameter values may be changed by touching its number. Doing so will cause the screen shown in Figure 3-20 to be displayed.

To change the current value, enter the new number using the numeric keypad, followed by the <ENTER> key to save the new value. After the Enter Key or the ESC key is pressed as shown in Figure 3-20, the Cup Speed Settings screen reappears for further selections.

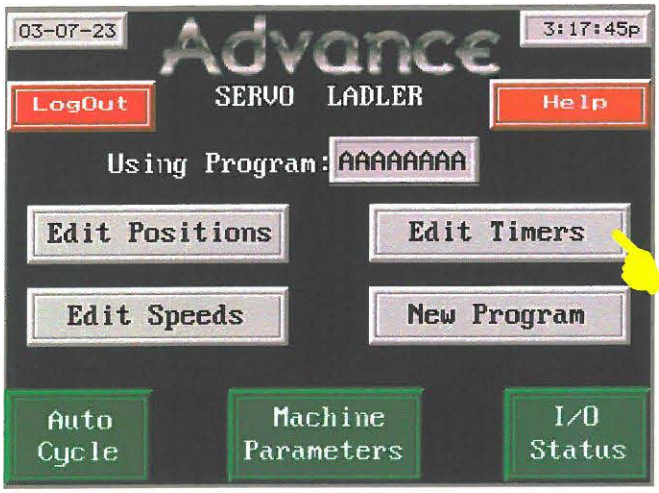
Touch MAIN in the lower left hand corner of the screen to return to the Main Menu.

Touch PREV to return to the Arm Speed Settings screen as shown in Figure 3-19.

Touch NEXT to display the Edit Timer Settings screen as shown in Figure 3-24.

TIMER SETTINGS

To enter the Timer Setting screen, touch the Edit Timers key on the Main Menu as shown in Figure 3-23.



Main Menu Figure 3-23

Edit Timer Settings	
Cup Soak Time	00.0
Cup Spill Off Time	00.0
Auto Abort Time	00.0
Pour Abort Time	00.0
Cup Drain Time	00.0
Shot Delay Time	00.0
Backout Move Time	00.0
Cycle Delay Time	00.0
Delay After Cycle Start	00.0
MAIN PREV	NEXT

Edit Timer Settings Screen Figure 3-24

All times in the Edit Timer Settings Screen are in seconds.

The **Cup Soak Timer** determines how long the cup remains in the metal while it is filling. An excessive value in this timer can cause premature bearing wear at the arm cup end due to prolonged exposure at high temperatures.

The **Cup Spill Off Timer** determines how long the cup remains above the furnace to spill off excess metal before moving to the next home or pour position.

Auto Abort Timer permits temporary process delays to occur during a cycle. If the timer runs out before the auto enable signal is present, an AUTO ABORT CYCLE sequence occurs. The ladle will recycle to the metal and return to the home position.

This Abort sequence will occur three times by default values. After 3 Abort cycles, the ladle will do a Full Abort and empty the metal back at the furnace and return Home with the cup at the 90 Pouring Angle.

The **Pour Abort Timer** permits a wait time after the ladle has reached the pour position. It will wait for the Rod Back and Die Closed interface signals. If the timer runs out before both signals are present, a POUR ABORT sequence occurs. Excessive values set in this timer may affect the casting quality due to decreased metal temperature.

The **Cup Drain Timer** permits the metal to stop dripping from the cup at the end of a pour sequence before starting the Shot Delay Timer. It is started when the cup reaches the third pour angle.

The **Shot Delay Timer** starts when the Cup Drain Timer runs out. The arm will start its move back to the home position after the Cup Drain Timer elapses. When the Shot Delay Timer ends, the Pour Complete output will energize. This timer will allow the arm to start moving back before sending the Pour Complete.

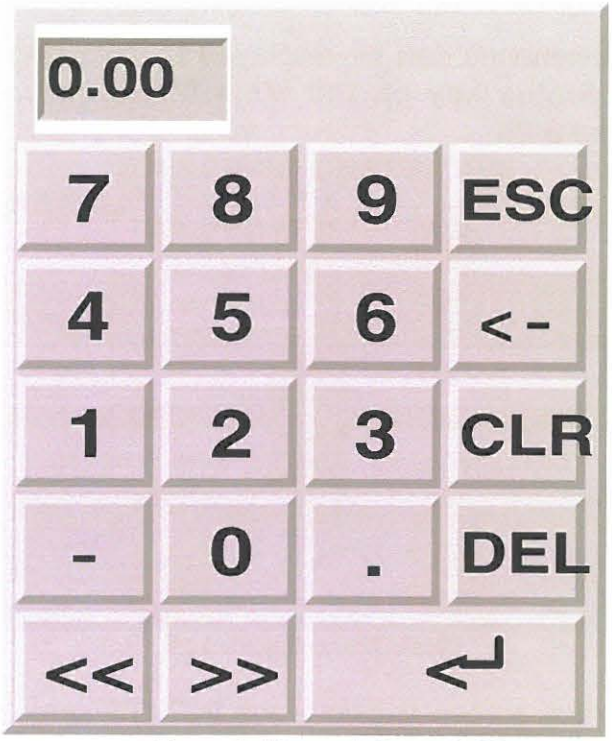
The **Backout Move Timer** specifies the time in seconds that the arm will wait after the arm has completed a backout move.

The **Cycle Delay Timer** is used to synchronize the operation of the ladle with the normal cycle time of the die cast machine (DCM). This timer determines how long the ladle waits at home after completing a cycle before beginning the next cycle. The best setting would be the value that causes the ladle to reach the pour positions just as the Die Cast Machine is ready to make the next shot.

The Cycle Delay Timer can be disabled (See Machine Parameter List). Each new cycle would then be started by a Cycle Start (CS) input. This would be a single cycle mode of operation. The default setting of the Machine Parameter uses the Delay Timer.

The **Delay After Cycle Start Timer** specifies the total amount of time to wait at the beginning of a cycle start. This may be because of some special function that the operator or other machine must do.

Any of the previous parameter values may be changed by touching its number. Doing so will cause the screen shown in Figure 3-25 to be displayed.



Numeric Keypad Figure 3-25

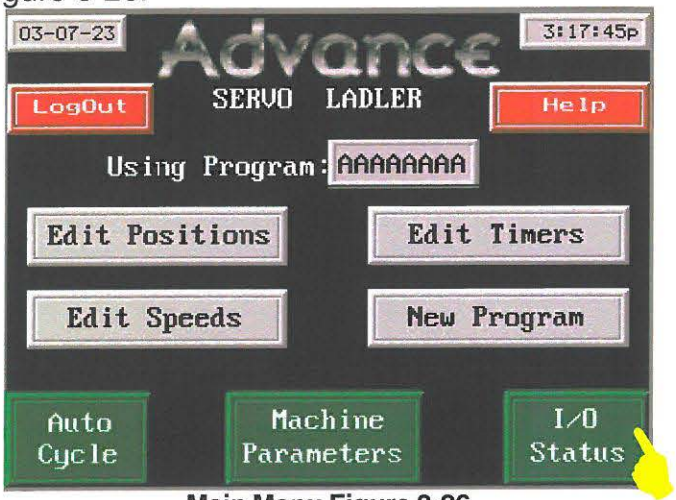
To change the current value, enter the new number using the numeric keypad, followed by the <ENTER> key to save the new value.

Touch PREV to return to the previous screen.

Touch NEXT to go to the Edit Arm Positions screen as shown in Figure 3-11.

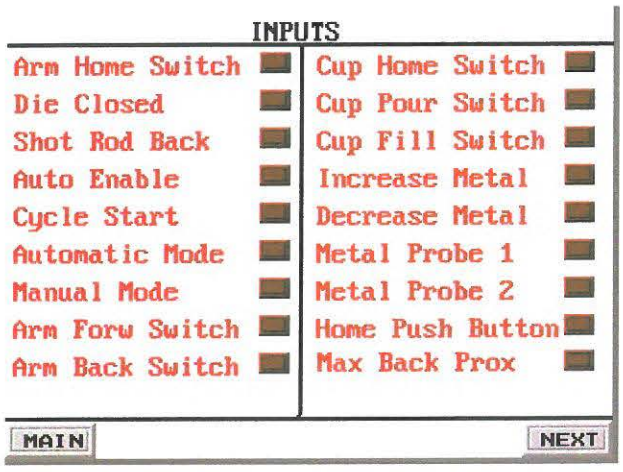
I/O STATUS

These menus can be displayed by choosing the I/O Status key on the Main Menu shown in Figure 3-26.



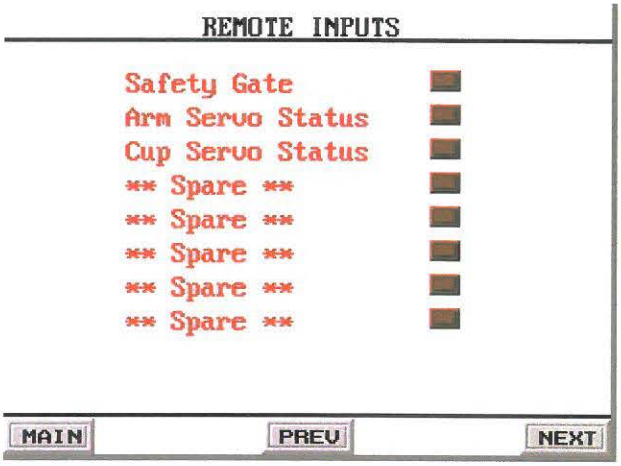
Main Menu Figure 3-26

The first screen shown is the INPUTS screen as shown in Figure 3-27. This screen shows the status of the digital inputs to the ladler system; for example, prox. switches, push buttons and some incoming signals from the customer. **If the status box is red, this means this input is off. If a green status box is displayed, it means the digital input or output is on.**



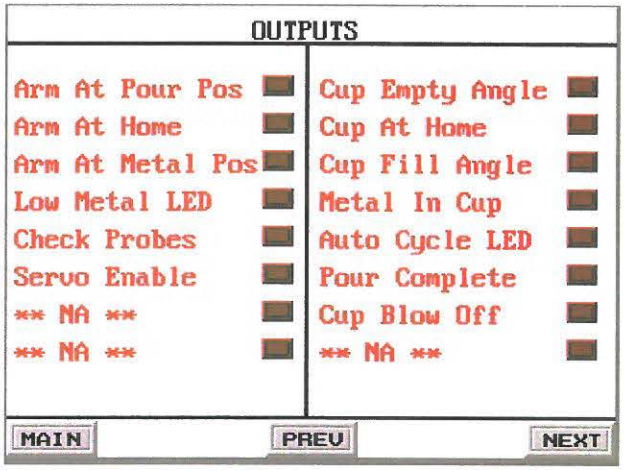
INPUTS Screen Figure 3-27

Touch the NEXT key to display the REMOTE INPUTS screen shown in Figure 3-28.



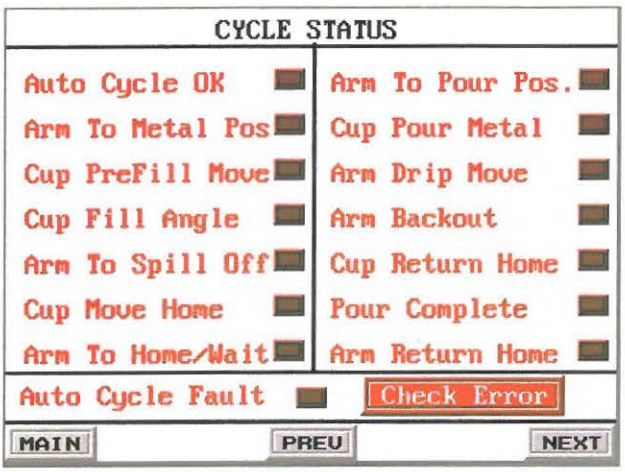
REMOTE INPUTS Screen Figure 3-28

Touch the NEXT key to display the OUTPUTS screen shown in Figure 3-29.



OUTPUTS Screen Figure 3-29

Touch the NEXT key to display the CYCLE STATUS screen shown in Figure 3-30.



CYCLE STATUS Screen Figure 3-30

Touch PREV to return to previous screens.

Touch MAIN to return to the Main Menu.

MACHINE PARAMETERS (Caution!)

In this section there are several menus containing the main machine parameters. By changing these parameters you can change the complete behavior of the ladler system. Great care must be taken in changing any of these parameters. ***These parameters should only be modified by qualified technical personnel.***

This section allows the user to change any of the parameters on the ladler system.

IMPORTANT: These parameters are set at the factory and are critical for proper machine operation. Modifying these parameters may cause machine damage and/or injury to personnel operating the ladler. Do not make any changes to these settings without a thorough understanding of each parameter. (See page 3-18.)

Before changing parameters, the Remote Operator Station must be in MANUAL and an authorization code must be entered and recognized by the system. Touch the Machine Parameter key on the Main Menu as depicted in Figure 3-31.

Main Menu Figure 3-31

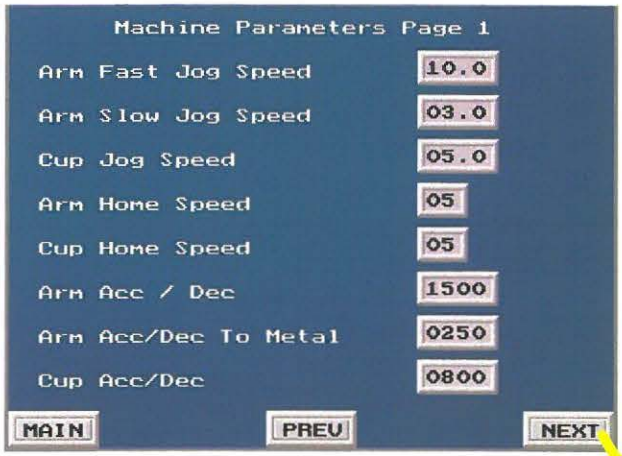
The following Screen will be displayed for entry of the password.

Password Screen Figure 3-32

Touch the 0-9 key to switch to the numeric keypad.

Touch the 3 key, the 0 key and the 3 key. Touch the enter key in the lower right hand corner. The system returns to the main menu as shown in Figure 3-31 and displays LEVEL 1 OK. The system is now unlocked and Machine Setting modifications are possible. See page 3-18.

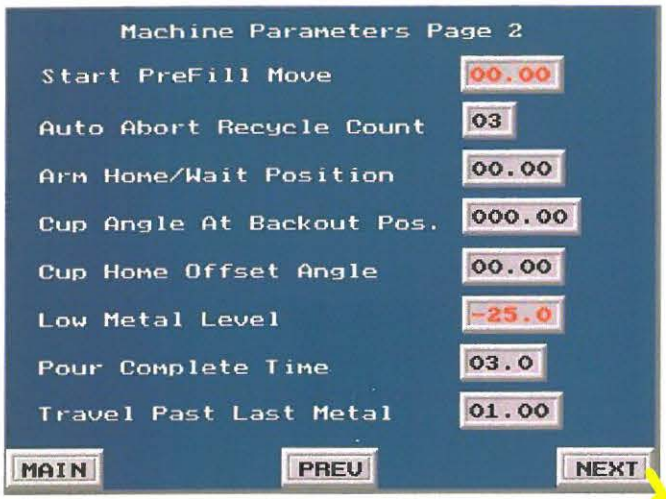
Touch the Machine Parameter key again and the first machine parameter screen similar to Figure 3-33 is shown.



Machine Parameters Page 1 Figure 3-33

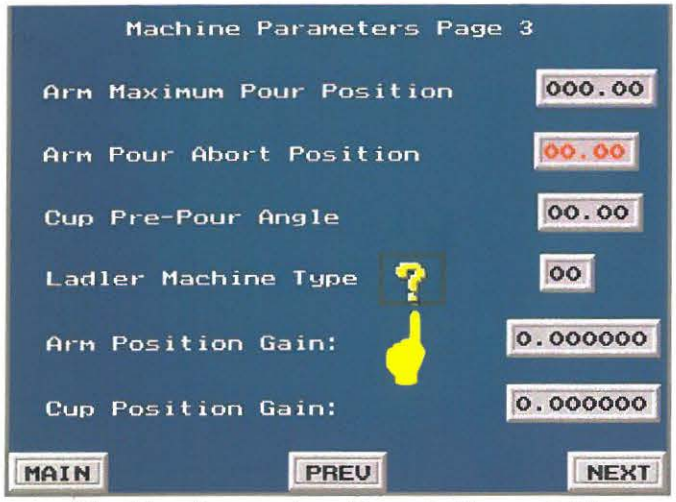
Any entry may be changed by touching its gray box, which will display the appropriate alpha or numeric keypad. To change a parameter value, enter a new value and press the <ENTER> key to accept it. If the selected value is out of range when entered, the parameter value will not be changed.

Touch the NEXT key to display the second machine parameters screen as shown below.



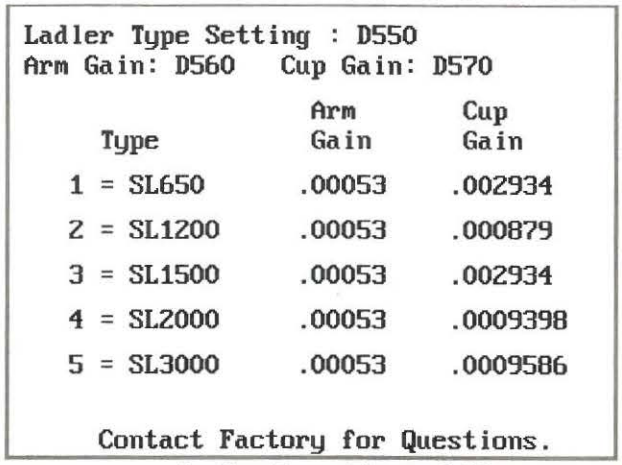
Machine Parameters Page 2 Figure 3-34

Touch the NEXT key to display the third machine parameters page as shown in Figure 3-35.



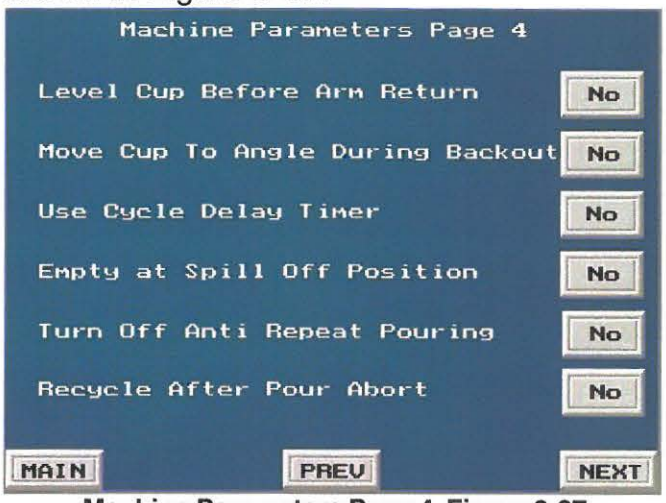
Machine Parameters Page 3 Figure 3-35

Note the big yellow question mark. For the MMI to run the correct program, the ladler type must be accurate. To see the different ladler types, touch the question mark which will cause the following screen to be shown. Consult Advance Products for access code to change type and gain values. The gain value as shown in Figure 3-36 is used to calculate the position based on the current gear reduction which is based on the ladler model.



Ladler Type Figure 3-36

To select a different ladler type, just touch the appropriate ladler model number.
Machine Parameter Page 4 is accessed from Machine Parameters Page 3 as shown in Figure 3-35. Simply touch the NEXT key to display the fourth machine parameters page as shown in Figure 3-37.



Machine Parameters Page 4 Figure 3-37

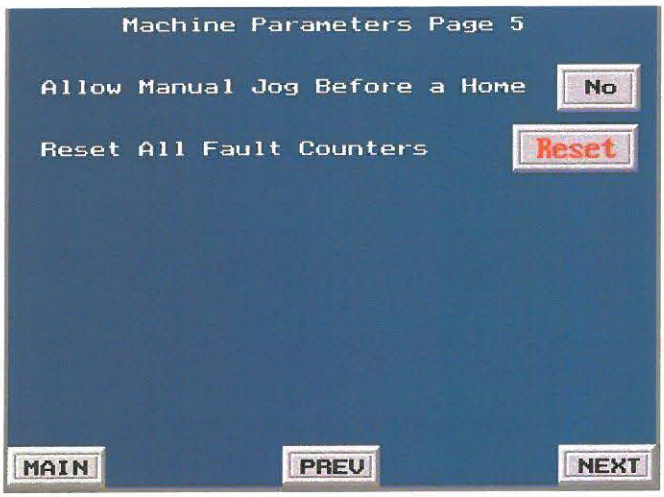
(Continued on Page 3-20.)

MACHINE PARAMETER DEFINITIONS

Parameter Description	Parmeter Definition	Default Values
Arm Fast Jog Speed	The speed the arm moves when being jogged manually in fast mode.	10.0
Arm Slow Jog Speed	The speed the arm moves when being jogged manually in slow mode.	5.0
Cup Jog Speed	The speed the cup is moved in manual jog.	10.0
Arm Home Speed	The speed at which the arm moves during a home sequence after power up.	5.0
Cup Home Speed	The speed at which the cup moves during a home sequence after power up.	5.0
Arm Acc / Dec	The acceleration value used when the arm moves to all positions except to metal.	1500
Arm Acc / Dec To Metal	The acceleration value used when the arm moves to the metal.	200
Cup Acc / Dec	The acceleration and deceleration speed for the cup during all operations.	200
Start Prefill Move	The distance in inches from home where the cup will start its move to the prefill angle.	-5.0
Auto Abort Recycle Count	The number of times the arm will recycle and refresh the metal if the Auto Enable input is off. After this count occurs the arm will abort the cycle.	3.0
Arm Home / Wait Position	If a value greater than 0 is entered the arm will move to this position instead of the home position from the Spill Off position.	0.0
Cup Angle At Backout Pos.	The angle the cup will move to during the backout distance move unless the Move Cup To Angle During Backout parameter is set to "YES".	0.0
Cup Home Offset Angle	The difference in degrees from horizontal that the cup is in while at the home position.	0.0
Low Metal Level	Indicates how low in inches the arm will travel in the furnace before turning on the “Low Metal” indicator.	-25.0
Pour Complete Time	The time in seconds that the pour complete output will remain energized.	3.0

Arm Pour Abort Position	The ladle witll move to this position to empty metal on an aborted cycle.	0
Travel Past Last Metal	This is the maximum travel past the last [point metal was detected that the arm will move in to the furnace.	1.0
Arm Maximum Pour Position	The maximum distance from home to pour position in inches. This is the limit that can be entered in a User Program.	60.00
Cup Pre-Pour Angle	This parameter is not used at this time.	0.0
Ladler Machine Type	The ladler type is set in the Ladler Type Setting screen. For the MMI to run the correct program, the ladler type must be accurate.	2
Arm Position Gain	Manufacturer's use. (Do not change without consulting factory.)	.00053
Cup Position Gain	Manufacturer's use. (Do not change without consulting factory.)	.000879
Level Cup Before Arm Return	The default option is to level the cup before returning to HOME. If this is set to "NO" the cup will level while the arm is moving home from the pour .	NO
Move Cup to Angle During Backout	The cup will remain at the last pour angle during tthe backout distance move unless this parameter is set to "YES", then it will rotate to "cup Angle at Backout"> See "Cup Angle at Backout".	NO
Use Cycle Delay Timer	This will cause ladler to recycle after the first Cycle Start, after timer has timed out. If off, a cycle start input is required each cycle.	YES
Empty At Spill Off Position	When the ladle aborts an auto cycle the metal will be poured back in the furnace at the last spill off position. If this is set to "NO" the arm will move back to the metal and empty the cup.	NO
Turn Off Anti Repeat Pouring	This is used for testing only. consult factory. If "YES" the Die Closed and Rod Back do not need to toggle on to off for next cycle. Used for dry runs only. This will reset to "OFF" when power is applied each time.	NO
Recycle After Pour Abort	This will cause the ladle to recycle if a pour abort timer times out. The number of times to recycle is the same as Auto Abort Recycle Count.	NO
Allow Manual Jog Before a Home	This will allow Manual Jog Fuctions for the arm and cup before doing a Home sequence.	NO
Reset All Fault Counters	This will clear all Auto Fault errors from memory. Please consult with APC. Pass code is required.	Reset

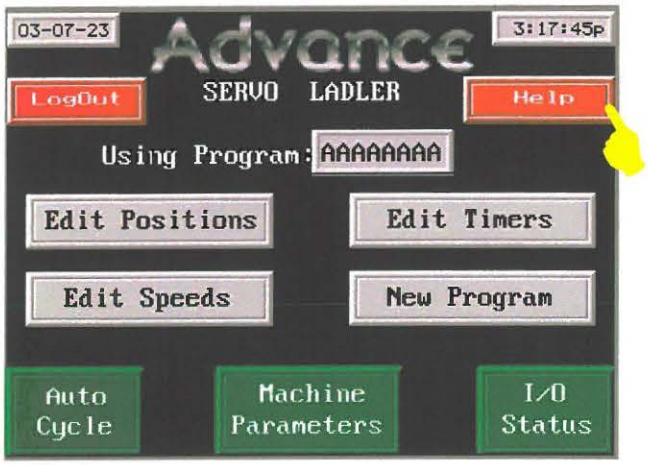
Machine Parameter Page 5 is accessed from Machine Parameters Page 4 as shown in Figure 3-37. Simply touch the NEXT key to display the fourth machine parameters page as shown in Figure 3-38.



Machine Parameters Page 5 Figure 3-38

HELP

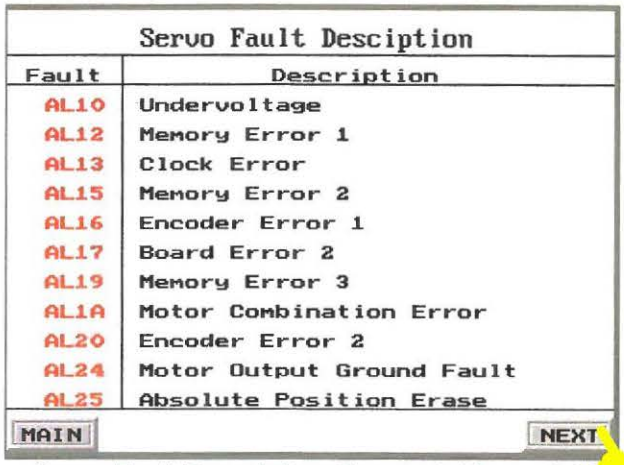
Touch the red Help key, in the upper right hand corner of the MMI shown in Figure 3-39, to display the screen shown in Figure 3-40.



Main Menu Figure 3-39

Help Screen Figure 3-40

To See the Servo Fault Screen as shown in Figure 3-41, touch the Servo Fault List key.



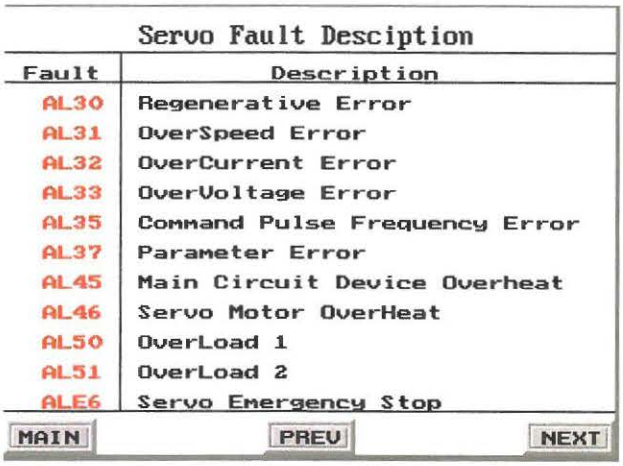
Servo Fault Desciption

Fault	Description
AL10	Undervoltage
AL12	Memory Error 1
AL13	Clock Error
AL15	Memory Error 2
AL16	Encoder Error 1
AL17	Board Error 2
AL19	Memory Error 3
AL1A	Motor Combination Error
AL20	Encoder Error 2
AL24	Motor Output Ground Fault
AL25	Absolute Position Erase

MAIN NEXT

Servo Fault Description Screen 1 Figure 3-41

To see the next servo fault description screen displayed in Figure 3-42, touch the NEXT key.



Servo Fault Desciption

Fault	Description
AL30	Regenerative Error
AL31	OverSpeed Error
AL32	OverCurrent Error
AL33	OverVoltage Error
AL35	Command Pulse Frequency Error
AL37	Parameter Error
AL45	Main Circuit Device Overheat
AL46	Servo Motor OverHeat
AL50	OverLoad 1
AL51	OverLoad 2
ALE6	Servo Emergency Stop

MAIN PREV NEXT

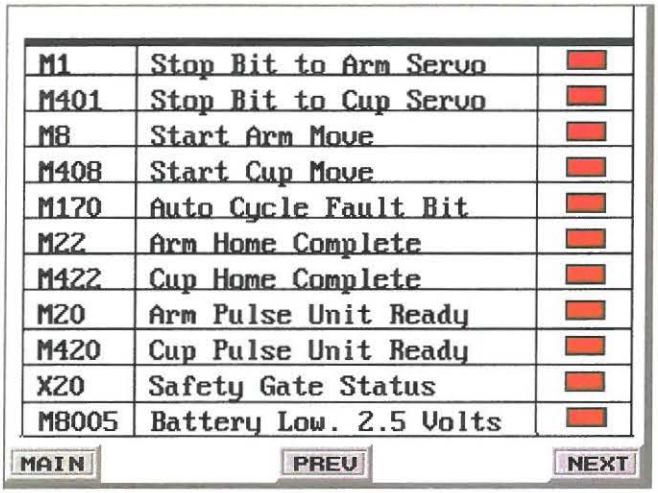
Servo Fault Description Screen 2 Figure 3-42

You can use the PREV and NEXT keys to switch back and forth between the two Servo Fault Description screens.

Touch the MAIN key to return to the Main Menu as shown in Figure 3-39.

Touching PREV on Servo Fault Description Screen 1 will return you to the Help Screen as shown in Figure 3-40.

To see the PLC Diagnostics Screen as depicted in Figure 3-43, touch the PLC Diagnostics key as shown in Figure 3-40.



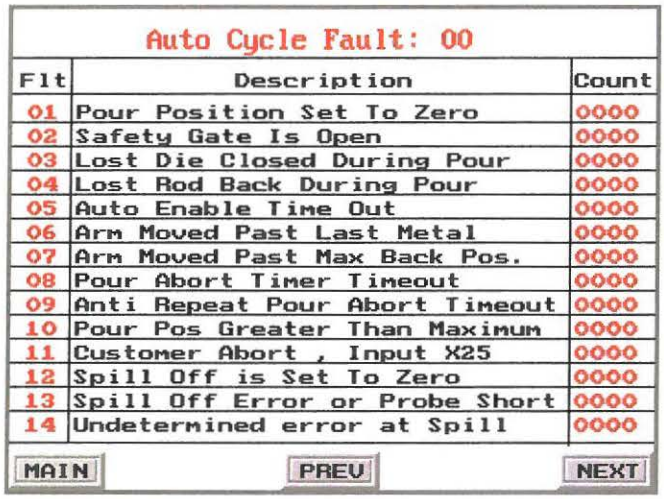
M1	Stop Bit to Arm Servo	
M401	Stop Bit to Cup Servo	
M8	Start Arm Move	
M408	Start Cup Move	
M170	Auto Cycle Fault Bit	
M22	Arm Home Complete	
M422	Cup Home Complete	
M20	Arm Pulse Unit Ready	
M420	Cup Pulse Unit Ready	
X20	Safety Gate Status	
M8005	Battery Low. 2.5 Volts	

MAIN PREV NEXT

PLC Diagnostic Screen Figure 3-43

The PLC Diagnostic Screen displays the current fault status during a cycle.

Touch the PREV key to return to the Help Screen as shown in Figure 3-40 or touch the NEXT key to display the Auto Cycle Fault screen as shown in Figure 3-44.



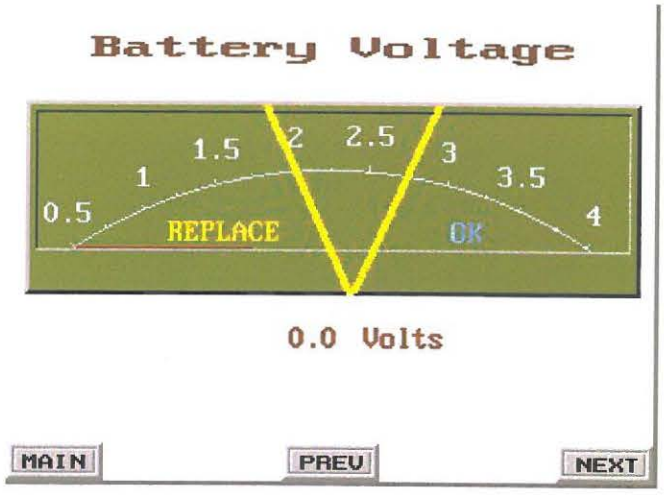
Auto Cycle Fault: 00

Flt	Description	Count
01	Pour Position Set To Zero	0000
02	Safety Gate Is Open	0000
03	Lost Die Closed During Pour	0000
04	Lost Rod Back During Pour	0000
05	Auto Enable Time Out	0000
06	Arm Moved Past Last Metal	0000
07	Arm Moved Past Max Back Pos.	0000
08	Pour Abort Timer Timeout	0000
09	Anti Repeat Pour Abort Timeout	0000
10	Pour Pos Greater Than Maximum	0000
11	Customer Abort , Input X25	0000
12	Spill Off is Set To Zero	0000
13	Spill Off Error or Probe Short	0000
14	Undetermined error at Spill	0000

MAIN PREV NEXT

Auto Cycle Fault Figure 3-44

Touch the PREV key to return to the PLC Diagnostic Screen as shown in Figure 3-43 or touch the NEXT key to display the Battery Voltage screen as shown in Figure 3-45.



Battery Voltage Screen Figure 3-45

Note the thin red line under the word REPLACE. This line indicates how much voltage is left in the battery. If the red line is on the left hand side, like now, then REPLACE THE BATTERY in the PLC. If it is in the middle section, then the battery is OK but should be monitored. If the red line is on the right hand side of the dial, then it is still good. Refer to page 6-12 for battery location.

To see the Display Settings screen or the Alarm Status Screen, the Remote Operator Station must be in MANUAL and an authorization code must be entered and recognized by the system. Touch either the Display Settings key or the Alarm Status key as shown on the Help Screen as depicted in Figure 3-46.

Help Screen Figure 3-46

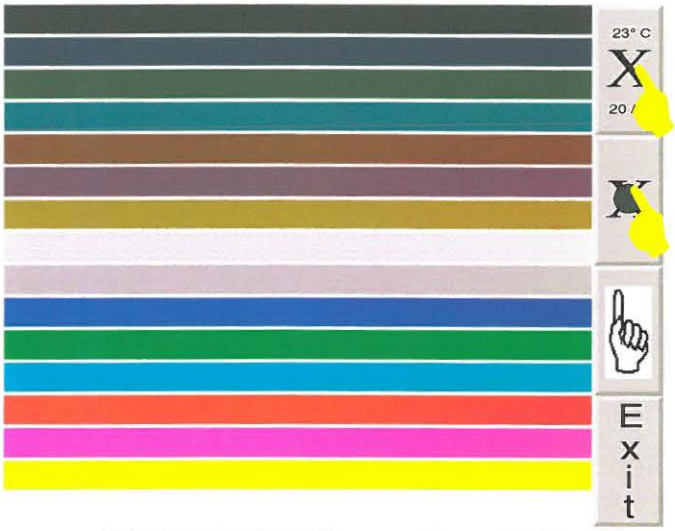
The following Screen will be displayed for entry of the password.

Password Screen Figure 3-47

Touch the 0-9 key to switch to the numeric keypad.

Touch the 3 key, the 0 key and the 3 key. Touch the enter key in the lower right hand corner. The system returns to the help screen as shown in Figure 3-47 and displays LEVEL 1 OK. The system is now unlocked and the Display Settings screen or the Alarm Status Screens may be accessed.

To see the Display Settings Screen as shown in Figure 3-48, touch the Display Settings key on the Help Screen.



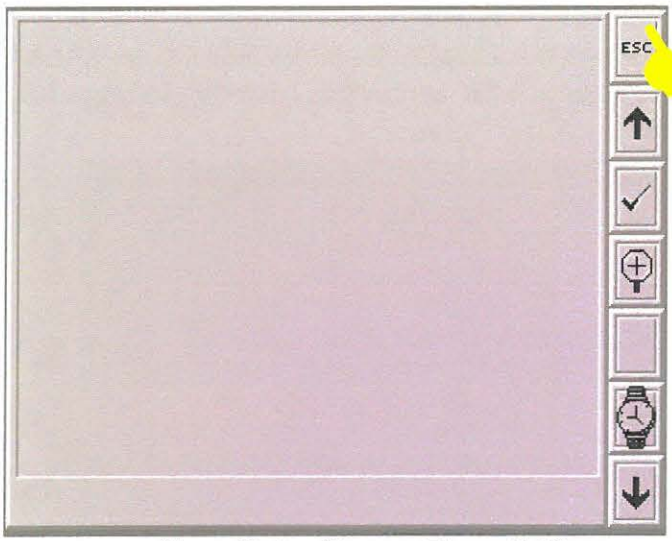
Display Settings Screen Figure 3-48

Note: The tempertuare displayed is the temperature inside the E-Terminal.

To adjust the brightness, touch the light and dark circle keys. Touch the Exit button to return to the Help Screen shown in Figure 3-49.

Help Screen Figure 3-49

To see the Alarm Screen as shown in Figure 3-50, touch the Alarm Status key as shown in Figure 3-49.



Alarm Status Screen Figure 3-50

Touch the alarm to select it and then the flashing alarm bell. then press the check key to clear the alarm.

The up and down arrow keys are used to scroll up and down the alarm list.

Touch the magnifying glass key to see the alarm messages displayed in a larger font.

Touch the small i key (if displayed) for any other information.

Touch the ESC key as shown in Figure 3-50 to return to the Help Screen as depicted in Figure 3-51.

Help Screen Figure 3-51

To display the MMI Diagnostics Screen similar to Figure 3-52, touch the NEXT key on the Help Screen as shown in Figure 3-51.

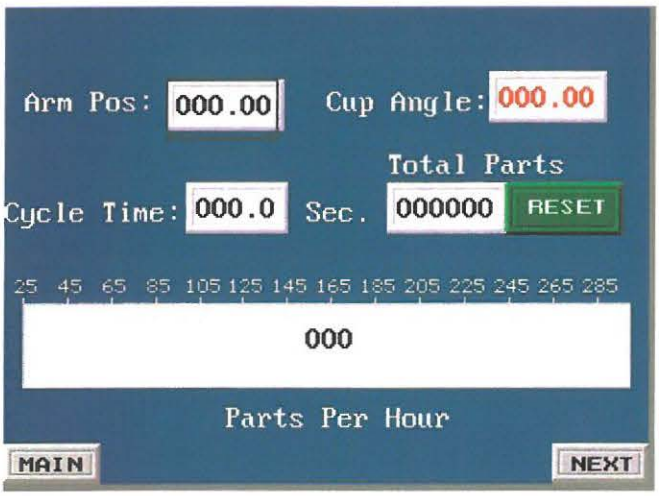
```
E615 V6.03c B515, BOOT V4.13

STARTS, RUN, CFL:  48, 119h, 119h
34°C MIN:22 MAX:37
DYNAMIC MEMORY:    300077 BYTES FREE (2
FLASH MEM PROJ:    337635 BYTES FREE (32
FLASH CACHEHITS(%) BLOCKS 099 ALLOCS (
FLASH ALLOCS(%) MAX USED 000  MAX ACTI
DRIVER 1: FX-SERIES  (CPU)   V 3.04.1
DIGITAL I/O's:  1 STATIC, 1 MONITOR
ANALOG I/O's:   1 STATIC, 2 MONITOR
I/O POLL (ms):  82    PKTS:   4
TOUT1, CSUM1, BYER:       0, 0, 0
1FRAME, OVERRUN, PARITY   0, 0, 0
2FRAME, OVERRUN, PARITY   0, 0, 0
```

MMI Diagnostics Figure 3-52

AUTO CYCLE

Auto Cycle is started by a customer installed switch. While in Auto Cycle, a screen similar to the one below is displayed.



Auto Cycle Figure 3-53

The Auto Cycle screen shows the cycle time, Parts per hour, and total parts.

As the ladler arm and cup move, the current arm position and cup angle of the ladler are updated in the Arm Pos box and the Cup Angle box.

The Auto cycle screen lights the pour complete light at the end of each cycle.

To edit lines in the currently running program, touch the box next to Arm Pos.

Touch Reset to set the counters back to zero.

Touch the MAIN key to return to the Main Menu.

REMOTE OPERATOR PANEL

Refer to figure at the bottom of this page as you read this section.

The remote operator panel is used to:

- Select the mode of operation.
- Start a home sequence.
- Manually move the ladle arm and cup.
- Start an auto cycle.
- Make minor changes to the shot size.
- Show some conditions of the ladle using LEDs.

The remote operator panel switch functions are divided into two sections, "Automatic Functions," and "Manual Functions." The switches and their functions are as follows:

SYSTEM FUNCTIONS

OPERATION MODE SWITCH

Manual — Selects the manual mode of operation for the ladler.

Off — Switches the operating mode off and will clear pending faults on the display.

Auto — Selects the automatic mode of operation for the ladler.

These are both arm and cup PLC inputs.

AUTO CYCLE PUSH TO START SWITCH

Starts the automatic ladler cycle. This is an arm PLC input.

SYSTEM FUNCTION INDICATORS

A. LED flashes when there is no metal in the pot. This LED is activated by the "Max Back Travel" proximity switch for this function.

LED is on continuously when the metal in the pot is low. This LED is activated by a parameter for this function.

B. LED flashes when the automatic cycle is aborted with metal in the cup.

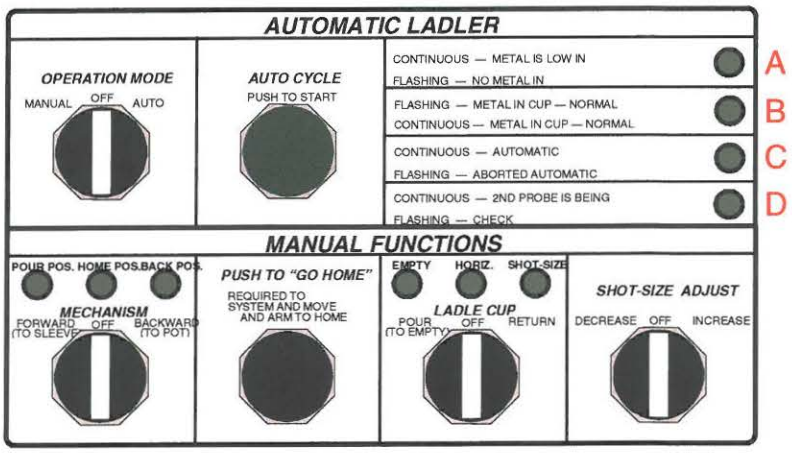
LED is on continuously whenever there is metal in the cup while in the "Automatic" or "Manual" mode, and no errors have been detected.

C. LED is on continuously during the automatic cycle.

LED flashes when the automatic cycle is aborted for any reason.

D. LED stays on if the 2nd probe is used.

LED flashes if the probes are shorted.



Remote Operator Panel Figure 3-54

Note: Pour Position LED will flash if no pour position has been entered, Cup Horiz LED will flash if no cup angles have been entered after a home sequence.

MANUAL FUNCTIONS

MECHANISM SWITCH (MUST HAVE "OPERATION MODE" SWITCH IN "MANUAL")

The following are arm PLC inputs and outputs.

Forward (to sleeve) — Moves the arm forward. *If the stored pour position for the current program is zero, the arm can be extended to its maximum reach.* If the pour position is not zero, the arm will stop at the stored position, and the "Pour Pos." indicator will light.

Off — Switches the arm manual functions off.

Backward (to pot) — Moves the arm back to the pot. The "Back Pos." indicator will light when metal is detected.

Indicators

Pour Pos. — Lights when arm is at the pour position.

Home Pos. — Lights when the arm is at the home position.

Back Pos. — Lights when the probes sense metal.

LADLE CUP SWITCH (MUST HAVE "OPERATION MODE" SWITCH IN "MANUAL")

The following are cup PLC inputs and outputs.

Pour (to empty) — Pours out the metal from the ladle cup. The "Empty" indicator will light when the cup rotates to the empty position. This switch also rotates the cup from the fill angle and levels it.

Off — Switches off the ladle cup manual functions.

Return — Rotates the cup to the fill angle if the cup is level and the probe is sensing metal. Also rotates the cup from the Empty position and levels it.

Indicators

Empty — Lights when the cup reaches the third pour angle.

Horiz. — Lights when the ladle cup reaches the horizontal position.

Shot-Size — Lights when the ladle cup reaches the fill angle.

PUSH TO "GO HOME" BUTTON (MUST HAVE "OPERATION MODE" SWITCH IN "MANUAL") — Starts a home sequence which levels the cup, then moves the arm to the home position. The ladle cup "Horiz" indicator and the mechanism "Home Pos" indicator will light when the cup reaches horizontal and the arm reaches its home position. This is an arm PLC input.

NOTES:

1. Whenever the AC power has been turned off and back on, this button should be pressed first.
2. In order to prevent a collision from occuring during the initial setup, make sure that there is clearance between the arm/cup, furnace wall, and any other obstacle before starting a home sequence.

SHOT-SIZE ADJUST SWITCH (AUTO OR MANUAL—MAY BE CHANGED WHILE RUNNING AUTO CYCLE)

The following are cup PLC inputs.

Decrease — Decreases the amount of metal. Each time the selector is toggled, the cup angle increases by 1/2°.

Off — Switches off the Shot-Size Adjust functions.

Increase — Increases the amount of metal. Each time the selector is toggled, the cup angle decreases by 1/2°.

PROGRAMMING THE LADLE

POUR POSITION ADJUSTMENT

To change the pour position, first do a home sequence. Then follow this procedure:

- Using the remote operator panel, manually move the ladle arm to the desired pour position by turning the MECHANISM switch counter-clockwise..
- At the operator panel, touch the <Edit Positions> key. (See Pour Position description for further information.)
- Touch the <Arm Pour Position> number. The display will show the current position of the ladle arm, and also the pour position that had been saved for this program.
- Enter the current position using the number pad; then, touch the <ENTER>.

DRIP DISTANCE ADJUSTMENT

To change the drip distance, first do a home sequence. Next:

- At the operator panel, touch the <Edit Positions> key. Touch the <Arm Drip Distance> field. Enter the desired value with the numeric keypad, then press ENTER to store setting.
- Press the <ABORT> key to return to the run screen.

To program the ladle, use the Edit Positions, Edit Speeds and Edit Timers screens to make the changes to the default values in the selected program. If necessary, refer to the software system section to review each function.

ADJUSTING THE QUANTITY OF METAL

To set the quantity of metal at the remote operator panel:

1. Rotate the SHOT SIZE ADJUST switch to INCREASE or DECREASE. This step can be performed "on the fly" and operates in either the "Manual" or "Auto" mode. Any changes will be shown on the run screen at the operator panel display. A value of .5 degree will be added or subtracted from the current fill angle each time the toggle switch is flipped

STARTING AN AUTO CYCLE

Two actions are required before starting an auto cycle:

1. At least one home sequence must be done since the last time the AC power to the ladle was turned on.
2. The ladle must be programmed with a Pour Position.
3. Perform the following steps only after the above items have been completed.
4. At the control box operator panel, select the desired program using New Program.
5. At the remote operator panel, place the ladle in AUTO MODE.
6. Press the AUTO CYCLE button.

7. The ladle will begin the programmed cycle.

8. If the ladle is left in AUTO MODE, subsequent cycles may be started in one of two ways.

    a) Using the CYCLE DELAY timer: the next cycle starts when the timer runs out. The timer begins counting when the ladle returns home after pouring.

    b) Using the optional CS (CYCLE Start) input: the next cycle starts when voltage is momentarily applied to this input.

    To use this method, the CYCLE DELAY timer should be disabled in the machine parameter.

If at any time during a cycle the Operation Mode switch is turned to OFF, or to MANUAL, the ladle will stop immediately. To restart the cycle, switch back to the Auto mode, and press AUTO CYCLE. It is not necessary for the mechanism arm to be at home to start a cycle. An auto cycle can be started from any position except with the probes in contact with the metal. Manually move the arm forward until the probes are clear of the metal's surface, then return to Auto Mode and press AUTO CYCLE.

— NOTES —

Maintenance and Adjustments

Ladler Preventaive Maintenance Schedule

	Monthly	3 Months	4 Months	12 Months	24 Months
Check gearbox oil level. Fill as required.	X				
Inspect proximity switches. Replace as required.		X			
Inspect Home and Max. Back cams to verify that they are tight. Tighten as required. If they are found loose, verify they are in the correct locations.		X			
Inspect Metal probes to verify they are tight. Tighten as required.		X			
Inspect metal probe wiring for damage and that connections are tight. Replace or tighten as required.		X			
Inspect chain tensions. Tighten as required. There are 2 chains to tighten.		X			
Check all tapered bearings for grease. Grease as required.			X		
Change oil in both gearboxes.				X	
Replace hi-temperature cup end bearings				X	
Replace chain in the cup arm.				X	
Replace metal probe insulators.				X	
Replace all bearings.					X
Replace upper chain.					X
Replace both motor couplings.					X

The ladle maintenance procedure is done at certain periods of time or periods of cycles the ladle has executed. The maintenance covers two sections:

- Mechanical preventive and corrective adjustments
- Lubrication inside the mechanism speed reducers.

The first section covers the mechanical preventive and corrective adjustments. The second section contains gearbox oil options.

MECHANICAL PREVENTIVE AND CORRECTIVE ADJUSTMENTS

The mechanical preventive procedures covers the ladle mechanism, the gear reduction boxes for the link arm and cup rotation and some electrical interface devices mounted in the ladle mechanism. The maintenance procedures are suggested to be done within predefined periods of time or within a range of ladle cycles completed. This maintenance must be done as follows:

90-DAY MAINTENANCE

Once every three months or every 100,000 cycles, perform the following maintenance:

- Check the **proximity switches** for:
  - ☑ Wear in sense and cable connections are in good condition.
  - ☑ If the proximity switch is damaged or has a faulty sense, replace it.
  - ☑ If the switch is OK, reassemble and remount it on the right position.
- Check the **cup** and **arm cams**.
  - ☑ Verify the cams are tight.
  - ☑ If any cam is found loose, tighten it or adjust following the procedures and using the corresponding clamp bolts.
- The **home prox. switch cam adjustment** procedure for the cup or arm, must be done in *very small increments*, a *small change in the cam* results in a relatively *large change in position*.

1. Move the ladle arm to the desired home position.
2. Slightly loosen the bolts holding the cam and move the cam in the desired direction. Retighten the bolts after the cam lights the switch light.
3. Turn off the power. This is necessary because the prox. switches are used to established the home position after the power has been turned on.
4. Power up the ladle and do a home sequence to check the new position. If the cam adjustment is made while the power is applied, the ladle **must** be turned off then back on before doing the home sequence.

After a home position adjustment has been done there is an additional procedure that must be to followed.

- If the arm home was moved back toward the metal the Maximum Pour Position parameter must be increased. See Steps 5 thru 8 to set this parameter.

- If the arm home was moved forward toward the sleeve the Maximum Pour Position parameter must be decreased. See Steps 5 thru 8 to set this parameter.

After any cam position adjustments to the arm cams have been made, the next procedure must be done.

5. Set the Pour Position to 0 to allow maximum movement of the arm, then return to the main menu.
6. Manually move the arm forward until the main crank arm is within ¼" of the forward stop block.
7. Select the Pour Position, and read the current arm position.
8. Enter the current arm position as the new Maximum Pour Position parameter.

The maximum back travel adjustment for the arm cam must be done in very small increments, a small change in the cam results in a relatively large change in position. This limit switch can only be adjusted accurately if the holding furnace is empty or nearly empty.

1. Turn the ladle power off.
2. To move the arm deeper into the pot (to chase more metal), loosen the cam clamp bolts and rotate the cam away from the prox switch. Then retighten the clamp bolts.
3. To move the arm further away from the bottom of pot (to chase less metal), loosen the cam clamp bolts and rotate the cam toward the prox switch. Then retighten the clamp bolts.
4. Turn the power on.
5. Manually move the arm toward the pot to verify the new position.

- Check each **probe**.

  - ☑ Make sure that probes are mechanically tight.
  - ☑ If any is found loose, tighten it using the jamnut on the mounting screws.
  - ☑ Check that the wire connections at each probe are in good condition, and each wire is tight.
  - ☑ If the cable wire or the wire holder is broken, replace it.
  - ☑ Check the visible part of each probe wire for worn insulation.
  - ☑ If the wire insulation is worn, replace it.
  - ☑ Verify the probes position is the correct one.
  - ☑ If the detection position of the probes is not correct, follow the adjustment procedure below.

- To adjust the probes or metal sensors, follow the next procedure:

1. Loosen the appropriate jamnuts that position the primary probe rods. (The ones set at the same depth position.)
2. Move the threaded shaft in the required direction until the desired position is obtained.
3. Once the probes have the right sense position, retighten the jamnuts.

The secondary probe or metal follower probe should be adjusted to just below the arm end to prevent submersion while filling the cup. This position must be higher than the other two probes.

Figure 4-1 shows the desired metal sense position for the primary probes.

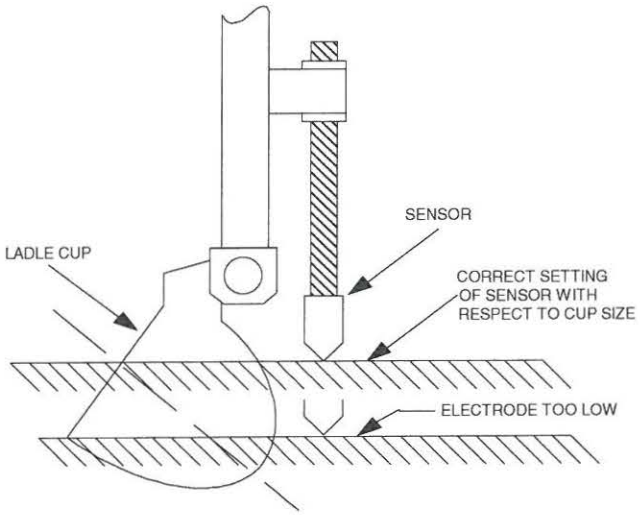


Figure 4-1 Metal sensors adjustment

- Verify the cup-rotate chain tension. (The chains should not be too loose.)
  - ☑ To check the cup chains, remove the external covers in the upper arm as well as the 3x12 cover in the cup arm near the probes.
  - ☑ If any cup chain is found loose, tighten it using the following procedure. **Note:** Over-tightening on any of these chains may result in erratic cup rotation and inconsistent metal quantity. It will also cause premature wear in the cup shaft bearings.

☐ The **tightening procedure** for the cup chains consist of:

1. Move the ladle arm to a safe place or as far as possible from any furnace or other heat source.
2. Turn off the power to the ladle mechanism.
3. Remove the cover for the chain to be tightened.

Note: There are 2 turnbuckles in the external chain and only one inside the Cup Arm.

4. Inside the Cup Arm
   a. Loosen the Jam Nut on the turn buckle.
   b. Rotate the turnbuckle until the slack is out of the chain.
   c. Retighten the jam nut.
   d. Replace the cup arm access cover.
5. External chain
   a. Loosen the Jam Nuts on both turnbuckles.
   b. Rotate one of the turnbuckles until the slack is out of the chain.
   c. Check to see if cup is level.
   d. If cup is level, retighten Jam Nuts and replace cover.
   e. If cup is not level, loosen one turnbuckle and tighten the other an equal amount to make cup level
   f. Retighten Jam Nuts and replace cover.

Figure 4-2 (next page) shows the chains and the tighten mechanism.

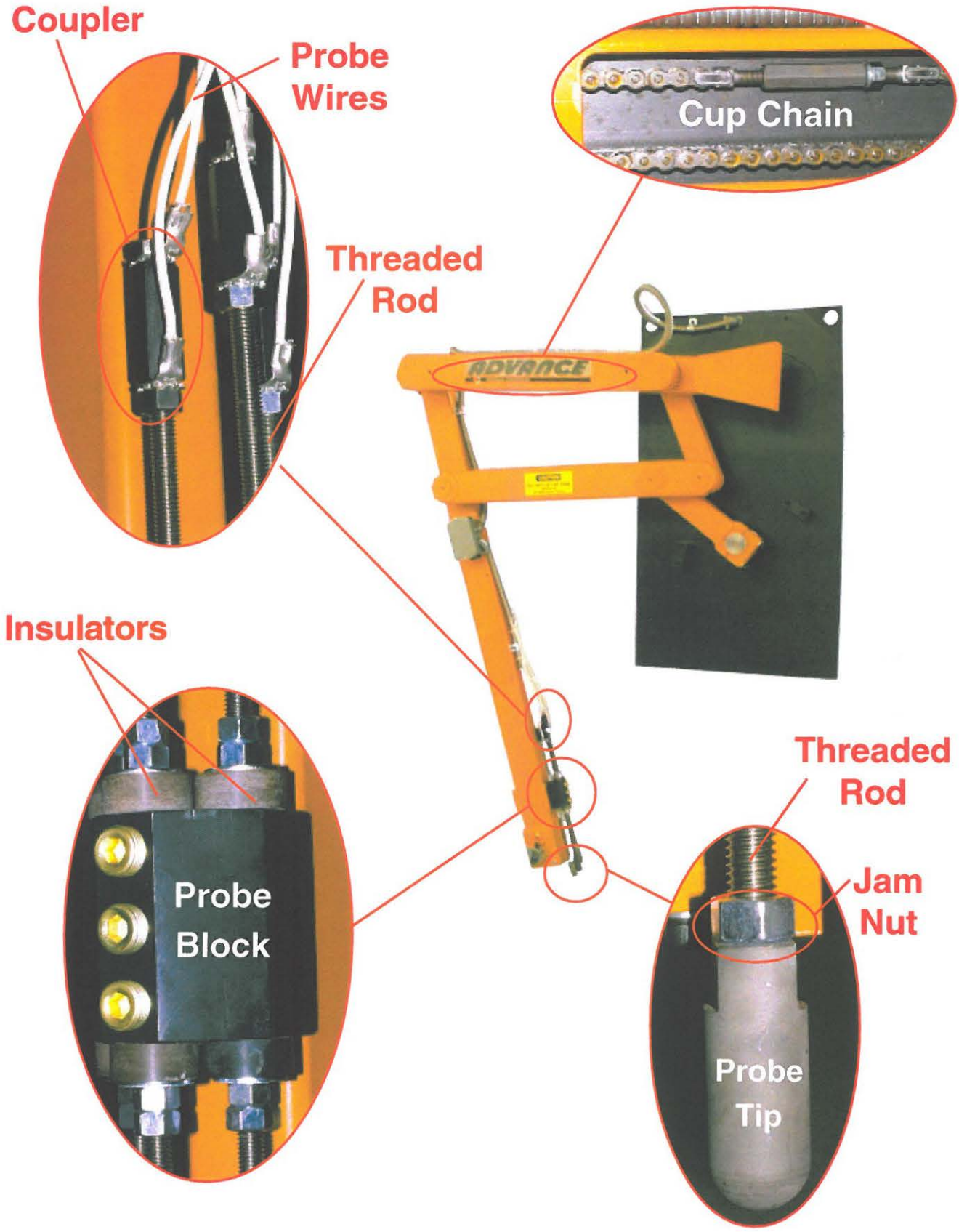


Figure 4-2 Maintaining the chain, probe cable and probes

120 DAY MAINTENANCE

Once every four months perform the following maintenance:

- Check the tapered bearings at all arm pivots for grease.
- Check the oil level in both arm and cup reducers of each gear box.

1 YEAR MAINTENANCE

Once every year or every 500,000 cycles perform the following maintenance:

- Check, and if necessary, clean the bearings, seals, switches, control relays, etc.
- Change the oil on both gearbox sets.

LUBRICATION INSIDE THE MECHANISM SPEED REDUCERS

It is very important to keep the gearbox lubricated. Without adequate lubrication, increased power consumption, added maintenance, and gearset failure can result. Use the following information to maintain your gearset. **USE ONLY SYNTHETIC OILS.**

GEARS

Gear units should have the oil changed every 5,000 hours or 1 year. If synthetic lubricant is used it should be changed every 10,000 hours or 2 years. For adverse operating conditions the interval should be shorter. DO NOT MIX SYNTHETIC & MINERAL BASE OILS.

OIL CHANGE

See oil types and amounts on following page. The oil in a **NEW UNIT** should be drained at the end of two weeks operation, and the case thoroughly flushed with light flushing oil. The original oil can be used for refilling if it has been filtered; otherwise, new oil must be used. Check the oil after approximately 1000 hours of operation, or every four months, whichever occurs first.

Where operating conditions are severe, such as with large variations in temperature, the gear case can sweat inside its walls and form sludge. Also, if the gearset operates under moist or dusty conditions, or in the presence of concentrated chemical fumes, it may be necessary to change the oil every one to three months.

OIL LEVEL

Drive reducers are furnished with either a "bull's eye" type sight glass or a pipe plug to indicate the oil level. In either case, an oil level tag is affixed to the unit near the oil level indicator. Always check the oil level with the unit stopped.

AMBIENT TEMPERATURE

The oil listing, shown on the list of approved lubricants shipped with all speed reducers, are for use in an ambient temperature range of approximately 0° to 130°. If the ambient temperature is below or above this range, please contact Advance Products for specific recommendations on the type of lubricant to use, as well as for oil seal and shim materials.

SLUDGE

The oil in the gearset must be clean and free of sludge at all times.

Sludge that forms in gearsets can be caused by excessive heat, dust, dirt, and other contaminates, and by the presence of moisture and chemical fumes. Use caution to prevent water and foreign particles from entering the gear case.

Advance recommends the following types of oil:

Main Arm Gearbox

Manufacturer	Brand Name Synthetics
Henkel Corp./Emery Group	Emery-2843 Synthetic Lubricant
Keystone/Atochem	Keystone KSL-367 Synthetic Lubricant
Mobil Oil Co.	Mobil SHC634 Synthetic Lubricant
Texaco Lubricant Co.	Primmacle 460 Synthetic Lubricant

Cup Arm Gearbox

Manufacturer	Brand Name Synthetics
Mobil	Glygoyle HE-680

Bearing Grease:

Lithium base NLG #2 or NLGI #3

DOUBLE REDUCTION REDUCERS

These units utilize separate housings and are furnished with separate isolated oil sumps. It is important that both sumps of each gearbox are filled to the proper oil level.

SINGLE REDUCTION REDUCERS

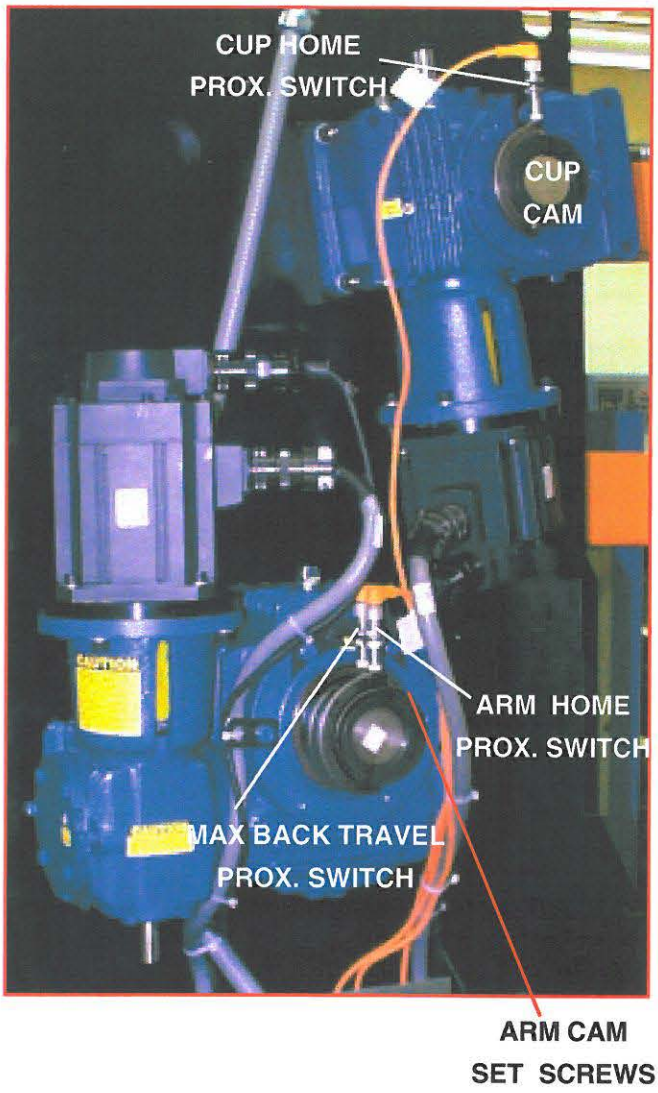
These units utilize a single housing and are furnished with one oil sump. It is important that the sump of the gearbox is filled to the proper oil level.

ADJUSTING MAX BACK TRAVEL SWITCH CAM (See Figure 4-3)

NOTE: When changing the max back travel switch cam, always adjust the cam in very small increments. A small change in the cam results in a relatively large change in position. This prox switch can only be adjusted accurately if the holding furnace is empty, or nearly empty.

To change the "Max Back Travel" limit, use the following procedure:

1. Turn the ladler power off.
2. To make the arm to move deeper into the pot, loosen the cam setscrew, and slide the cam away from the prox switch arm, then retighten the setscrew.
3. To make the arm stop further away from the bottom of the pot, loosen the cam setscrew, and slide the cam toward the prox switch arm, then retighten the setscrew.
4. Turn on the ladler power.
5. Manually move the arm toward the pot to check the new position.



Adjusting The Prox. Switch Cams

FIGURE 4-3

— NOTES —

— NOTES —

Troubleshooting

TROUBLESHOOTING -5-

GENERAL

This part of the manual will help you locate and correct problems that may occur in the ladler operation. You will need an **AC/DC voltmeter** to troubleshoot some of the circuitry.

Advance servo ladlers are the most accurate and reliable on the market. Proper maintenance will help your equipment work at peak performance. Please refer to Chapter 4 for regular maintenance schedules.

The following chart lists specific problems, possible conditions that could cause each problem, and corrective measures you can perform.

Please refer to electrical and mechanical drawings in this manual (Chapter 6) to help you.

If you need replacement parts, refer to the "Replacement Parts" lists in Chapter 7 for part numbers.

In an extreme case where you are unable to resolve a difficulty, please contact an Advance Products technical support representative. Our address and telephone number are on the front of this manual. Most of the time, the tech support rep will be able to talk you through the problem and corrective measures. On-site repair is available. Refer to service rates in your contract.

SHIPPING

If it becomes necessary to ship any part to Advance Products for repair, please call our Service Department for a Return Materials Authorization prior to shipment. Be ready to give a detailed description of the problem(s) you are having with the equipment. Please also have the model & serial number of the ladler on hand as well.

PROBLEM	CAUSES	SOLUTIONS
• All LEDs flashing on the remote.	• Safety gate relay is not energized. No voltage to SG terminal at interface. • Safety gate open.	• Check for voltage at SG terminal, (check Safety gate relay for correct voltage). Repair open circuit. • Close Safety gate. • If a safety gate is not used, remove safety gate relay.
• Ladler will not power up.	• Disconnect switch not on. • Missing 3-phase power. • Missing 120VAC control power. • Phase monitor not sequenced.	• Pull the red master control all the way out to the momentary "start" position, then release. It will return to the stationary "ON" position. Power is now applied. • Check incoming 3-phase power and main fuses. • Check 120VAC line fuse, if blown check 120VAC circuit for a short and repair. • Check for phase sequence LED on monitor, if not present, switch any two phases. Check Adjustment on front of phase monitor should be about 1/4 turn from min.
• Ladler appears to power up, but no display on MMI.	• Power plug to MMI not connected. • Missing DC power to MMI. • Defective MMI. • Defective DC power supply. • Defective power cable to MMI. • RAM SIMM module not seated securely.	• Reconnect power plug. • Check for both primary and secondary voltage at MMI power supply. • If present, replace MMI. • If missing, check for an open circuit on primary side of power supply. If primary voltage is present but on secondary voltage, adjust or replace power supply. • Check at MMI end of power cable of voltage. If no voltage present, replace cable. • Reseat SIMM memory.
• Ladler powers up, but can not move arm in manual mode.	• Auto/Manual switch not in manual position on remote. • Defective Auto/Manual selector switch on remote.	• Place Auto/Manual switch in manual position. • Replace switch. • Verify no fault is displayed on either Servo Amp. See pages 6-14 and 6-15 for list.

PROBLEM	CAUSES	SOLUTIONS
• Ladler powers up, but won't run in Auto mode.	• Auto/Manual switch is not in the Auto position. • Defective Auto/Manual selector switch. • No pour position entered in program. • No cycle start received.	• Place Auto/Manual switch in Auto position. • Replace switch. • Enter a pour position other than zero. (If no Pour Position 1, the Pour Position LED will flash.) • Press Auto cycle button on remote or send syscle start from DCM.
• Ladler won't do a home sequence.	• Auto/Manual selector switch is not in manual. • Auto/Manual selector switch is defective. • Cup chain too tight. • Mechanical linkage bound up. • Problems with cup shaft end. • Defective cup Servo Amp. • Defective cup motor.	• Place Auto/Manual selector switch in manual. • Replace switch. • Adjust or replace chain. Check to insure that chain turnbuckles are not running into sprockets. • Remove motor from gearbox, (**CAUTION: with arm motor removed, arm is free to move).** Check gearbox, chain, and nose bearings, if bad, replace. • Check and replace nose bearings, sprocket and shaft if defective. • Check and Replace Servo Amp or Servo Motor if defective. • Check and replace motor coupler if bad.
• Ladler won't complete a Home Sequence, but has completed the Cup Home sequence.	• Check for Servo Faults. • Arm motor brake is not disengaging. • Defective arm Servo Amp. • Defective motor coupler.	• Correct any faults. • If motor brake is not releasing check brake circuit and fuse. If circuit is OK, replace motor. • Check and replace Servo Amp if defective. • Check and replace arm motor coupler if defective.
• Ladler starts Auto Cycle, but won't go past Home positon, (Auto Cycle Abort).	• Missing Auto Enable Interface signal.	• Auto Enable siganl must be present in order for arm to go to pour position.
• Lalder goes to Pour Position, but does not pour, (Pour Abort).	• Missing Shot Rod back and/or Die Closed signals.	• Both signals must be present and remain on throughout the pour sequence.

PROBLEM	CAUSES	SOLUTION
• Ladler completes cycle, but won't restart.	• No cycle start received. • Shorted probes on return to Home Position. • Cup does not return Home before arm returns Home.	• Press Auto Cycle button on remote or send cycle start from DCM. • Fix short. • Adjust cup or arm speed so that cup returns home before arm.
• Inconsistent shot size	• Too short of a soak time, ladle cup is not being allowed to fill. • Cup chain is loose. • Ladle cup or shaft is worn or sloppy. • Too short of a pour drain time. • Cup mounting pin getting sloppy in its mounting hole. • Cup is creating a wave going into the metal.	• Adjust parameter to allow ladle cup to fill either using more soak time or use the prefill option. • Check, replace worn and sloppy cup components. • Adjust parameter to allow more drain time. • Change mounting pin. • Reduce arm "speed to metal" parameter value. • Turn on parameter "cup prefill" so cup is at fill angle when going into metal. Parameter "Prefill angle" may need to be adjusted.
• Ladler "Dunks" into metal.	• Probe check was not done on initial power-up. • Probe wired broken.	• Always check probe circuit on initial startup. • Check probe wires for shorts or breaks.
• Arm goes and touches the metal and then lifts back up.	• Second probe is touching metal. • Defective first probe.	• Check the first probe for proper operation and adjustment. If the first probe is working, the second probe may be touching the side of the furnace or a wave from the cup going into the metal is hitting the probe. If so, turn on the cup prefill parameter.
• At power up, Servo Amp has alarm "AL1A" (motor combination error).	• Arm and cup resolver cables have been switched around.	• Switch Arm and Cup resolver cables around at motor end.

Servo Drive Errors		
AL10 Undervoltage AL12 Memory error 1 AL13 Clock Error	AL24 Motor output ground fault AL25 Absolute position erase AL30 Regenerative error	
AL15 Memory error 2 AL16 Encoder error 1 AL17 Board error 2	AL31 Overspeed AL32 Overcurrent AL33 Overvoltage	
AL19 Memory error 3 AL1A Motor combination error AL20 Encoder error 2	AL35 Command pulse frequency error AL37 Parameter error AL45 Main circuit device overheat	

Servo Drive Warnings	
ALE0	Excessive regenerative warning
ALE1	Overload warning
ALE3	Absolute position counter warning
ALE5	ABS time-out warning
ALE6	Servo emergency stop
ALE9	Main circuit off warning
ALEA	ABS servo on warning

CAUTION: When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur.

When any of the following alarms has occurred, always remove its cause and allow about 30 minutes for cooling before resuming operation. If operation is resumed by switching control circuit power off, then on to reset the alarm, the servo amplifier and servo motor may become faulty.

- Regenerative error (AL30)
- Overload 1 (AL50)
- Overload 2 (AL51)

The alarm can be deactivated by switching power off, then on or by turning on the reset signal (RES).

When an alarm occurs, the trouble signal (ALM) switches off and the dynamic brake is operated to stop the servomotor. At this time, the display indicates the alarm number.
The servo motor comes to a stop. Remove the cause of the alarm in accordance with this section. The optional Servo Configuration Software may be used to refer to the cause.

Alarms and Warning List

When a fault occurs during operation, the corresponding alarm or warning is displayed.

		(Note 2) Alarm Code				Alarm Deactivation		
	Display	CN1B-19 pin	CN1A-18 pin	CN1A-19 pin	Name	Power OFF→ON	Press "SET" on current alarm screen.	Alarm reset (RES) signal
Alarms	AL10	0	1	1	Undervoltage	O	O	O
	AL12	0	0	0	Memory error 1	O		
	AL13	0	0	0	Clock error	O		
	AL15	0	0	0	Memory error 2	O		
	AL16	1	1	1	Encoder error 1	O		
	AL17	0	0	0	Board error 2	O		
	AL19	0	0	0	Memory error 3	O		
	AL1A	1	1	1	Motor combination error	O		
	AL20	1	1	1	Encoder error 2	O		
	AL24	1	0	0	Motor output ground fault	O		
	AL25	1	1	1	Absolute position erase	O		
	AL30	0	0	0	Regenerative error	O		
	AL31	1	0	0	Overspeed	O	O	O
	AL32	1	0	0	Overcurrent	O	O	O
	AL33	0	0	0	Overvoltage	O	O	O
	AL35	1	0	0	Command pulse frequency error	O		
	AL37	0	0	0	Parameter error	O	O	O
	AL45	0	1	1	Main circuit device overheat	O		
	SL46	0	1	1	Servo motor overheat	O	O	O
	AL50	0	1	1	Overload 1	O (Note 1)	O (Note 1)	O (Note 1)
	AL51	0	1	1	Over load 2	O (Note 1)	O (Note 1)	O (Note 1)
	AL52	1	0	0	Error excessive	O	O	O
	AL8A	0	0	0	Serial communication time-out	O	O	O
	AL8E	0	0	0	Serial communication error	O	O	O
	8.8.8.8.8	0	0	0	Watchdog	O		
Warnings	AL92				Open battery cable warning	Removing the cause of occurrence deactivates the alarm automatically.		
	AL96				Zero setting error			
	AL9F				Battery warning			
	ALE0				Excessive regenerative warning			
	ALE1				Overload warning			
	ALE3				Absolute position counter warning			
	ALE5				ABS time-out warning			
	ALE6				Servo emergency stop			
	ALE9				Main circuit off warning			
	ALEA				ABS servo on warning			

Note 1. Deactivate the alarm for about 30 minutes for cooling time after removing the cause of the occurrence.

Note 2. 0:OFF, 1:ON

Display	Name	Definition	Cause	Action
AL10	Undervoltage	Power supply voltage dropped. MR-J2S uA: 160V or less.	1. Power supply voltage is low.	Inspect the power supply.
			2. Power failed instantaneously for 15 ms or longer.	
			3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
			4. Power switched on within 5s after it had switched off.	
			5. Faulty parts in the servo amplifier Checking method Alarm (AL10) occurs if power is switched on after all connectors are disconnected.	Change the servo amplifier.
AL12	Memory error	RAM, memory fault	Faulty parts in the servo amplifier Checking method Alarm (any of AL12,13 and 15) occurs if power is switched on after all connectors are disconnected.	Change the servo amplifier
AL13	Clock error	Printed board fault		
AL15	Memory error	EEP-ROM fault		
AL16	Encoder error 1	Communication error occurred between encoder and servo amplifier	1. CN2 connector disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Encoder cable faulty (Wire breakage or shorted)	Repair or change cable.
			4. Wrong combination of servo amplifier and servo motor.	Use correct combination.
AL17	Board error 2	CPU/parts fault	Faulty parts in the servo amplifier Checking method Alarm (AL17 or AL19) occurs if power is switched on after all connectors are disconnected.	Change the servo amplifier.
AL19	Memory Error	ROM memory fault		
AL1A	Motor combination error	Wrong combination of servo amplifier and servo motor.	Wrong combination of servo amplifier and servo motor connected.	Use correct combination.
AL20	Encoder error 2	Communication error occurred between encoder and servo amplifier.	1. Encoder connector disconnected.	Connect correctly.
			2. Encoder cable faulty (Wire breakage or shorted)	Repair or change the cable.
AL24	Motor output ground fault	Ground Fault occurred at the servo motor outputs (U,V and W phases) of the servo amplifier.	1. Power input wires and servo motor output wires are in contact at main circuit terminal block (TE1).	Connect correctly.
			2. Servo motor power cable insulation deteriorated.	Change the cable.
AL25	Absolute position erase	Absolute position data in error	1. Reduced voltage of super capacitor in encoder.	After alarm has occurred, hold power on for a few minutes, and switch it off once, then on again. Make home position return again.
			2. Battery voltage low	Change battery. Make home position return again.
			3. Battery cable or batter is faulty.	

Display	Name	Definition	Cause	Action
AL30	Regenerative alarm	Permissible regenerative power of the built-in regenerative brake resistor or regenerative brake option is exceeded.	1. Wrong setting of parameter No. 0	Set correctly.
			2. Built-in regenerative brake resister or regenerative brake option is not connected.	Connect correctly.
			3. High-duty operation or continuous regenerative operation caused the permissible regenerative power of the regenerative brake option to be exceeded. Checking method Show the status display and check the regenerative load ratio.	1. Reduce the frequency of positioning. 2. Use the regenerative brake option of larger capacity. 3. Reduce the load.
			4. Power supply voltage is abnormal. 260V or more.	Inspect power supply.
		Regenerative transistor fault.	5. Regenerative transistor faulty. Checking method 1) The regenerative brake option has overheated abnormally. 2) The alarm occurs even after removal of the built-in regenerative brake resistor or regenerative brake option.	Change the servo amplifier.
AL31	Overspeed	Speed has exceeded the instantaneous permissible speed.	1. Input command pulse frequency exceeded the permissible instantaneous speed frequency.	Set command pulses correctly.
			2. Small acceleration/deceleration time constant caused overshoot to be large.	Increase acceleration/deceleration time. constant.
			3. Servo system is unstable causing overshoot.	1. Re-set servo gain to proper value. 2. If servo gain cannot be set to proper value: 1) Reduce load inertia moment ratio: or 2) Reexamine acceleration / deceleration time constant.
			4. Electronic gear ratio is large (parameters No.3, 4)	Set correctly.
			5. Encoder faulty.	Change the servo motor.
AL32	Overcurrent	Current that flew is higher than the permissible current of the servo amplifier.	1. Short occurred in servo amplifier. output phases U, V and W.	Correct the wiring.
			2. Transistor (IPM) of the servo amplifier faulty. Checking method Alarm (AL32) occurs if power is switched on after U,V and W are disconnected.	Change the servo amplifier.
			3. Ground fault occurred in servo amplifier output phases U, V and W.	Connect the wiring.
			4. External noise caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.

Display	Name	Definition	Cause	Action
AL33	Overvoltage	Converter bus voltage exceeded 400V.	1. Lead of built-in regenerative brake resistor or regenerative brake option is open or disconnected.	1. Change lead 2. Connect correctly.
			2. Regenerative transistor faulty.	Change servo amplifier.
			3. Wire breakage of built-in regenerative brake resistor or regenerative brake option.	1. For wire breakage of built-in regenerative brake resistor, change servo amplifier.
				2. For wire breakage of regenerative brake option, change regenerative brake option.
			4. Capacity of built-in regenerative brake resistor or regenerative brake option is insufficient.	Add regenerative brake option or increase capacity.
AL35	Command pulse frequency error	Input pulse frequency of the command pulse is too high.	1. Pulse frequency of the command pulse is too high.	Change the command pulse frequency to a proper value.
			2. Noise entered command pulses.	Take action against noise.
			3. Command device failure.	Change the command device.
AL37	Parameter error	Parameter setting is wrong.	1. Servo amplifier fault caused the parameter setting to be rewritten.	Change the servo amplifier.
			2. Regenerative brake option not used with servo amplifier was selected in parameter No. 0.	Set parameter No. 0 correctly.
AL45	Main circuit device overheat	Main circuit device overheat	1. Servo amplifier faulty.	Change the servo amplifier.
			2. The power supply was turned on and off continuously by overloaded status.	Review the drive method.
AL46	Servo motor overheat	Servo motor temperature rise actuated the thermal protector.	1. Ambient temperature of servo motor is over 40°C.	Review environment so that ambient temperature is 0 to 40°C.
			2. Servo motor is overloaded.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.
			3. Thermal protector in encoder is faulty.	Change servo motor.
AL50	Overload 1	Load exceeded overload protection characteristic of servo amplifier. Load ratio 300%: 2.5s or more Load ratio 200%: 100s or more	1. Servo amplifier is used in excess of its continuous output current.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.
			2. Servo system is unstable and hunting.	1. Repeat acceleration/ deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			3. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
			4. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			5. Encoder faulty. Checking method When the servo motor shaft is rotated slowly with the servo off, the cumulative feedback pulses should vary in proportion to the rotary angle. If the indication skips or returns midway, the encoder is faulty.	Change the servo motor.

Display	Name	Definition	Cause	Action
AL51	Overload 2	Machine colision or the like, caused max. output current to flow successively for several seconds. Servo motor locked: 1s or more	1. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
			2. Wrong connection of servo motor. Servo Amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			3. Servo system is unstable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			4. Encoder faulty. Checking method When the servo motor shaft is rotated slowly with the servo off, the cumulative feedback pulses should vary in proportion to the rotary angle. If the indication skips or returns midway, the encoder is faulty.	Change the servo motor.
AL52	Error excessive	Droop pulse value of the deviation counter exceeded 80k pulses.	1. Acceleration/deceleration time constant constant is too small.	Increase the acceleration/deceleration time constant.
			2. Torque limit value (parameter No. 28) is too small.	Increase torque limit value.
			3. Motor cannot be started due to torque shortage caused by power supply drop.	1. Review the power supply capacity. 2. Use servo motor which provides larger output.
			4. Position control gain 1 (parameter No. 6) value is small.	Increase set value and adjust to ensure proper operation.
			5. Servo motor shaft was rotated by external force.	1. When torque is limited, increase the limit value. 2. Reduce load. 3. Use servo motor that provides larger output.
			6. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
			7. Encoder faulty	Change the servo motor.
			8. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
AL8A	Serial communication time-out	RS-232 or RS-422 communication stopped for longer than the time set in parameter No. 56.	1. Communication cable breakage.	Repair or change communication cable.
			2. Communication cycle longer than parameter No. 56 setting.	Set correct value in parameter.
			3. Wrong protocol.	Correct protocol.
AL8E	Serial communication	Serial communication error occurred between servo amplifier and communication device (e.g. personal computer).	1. Communication connector is disconnected.	Connect correctly.
			2. Communication cable fault. (Open cable or short circuit)	Repair or change the cable.
			3. Communication device (e.g. personal computer) faulted	Change the communication device (e.g. personal computer).
8.8.8.8.8	Watchdog	CPU, parts faulty	Fault of parts in servo amplifier. Checking method Alarm (8.8.8.8.8) occurs if power is switched on after all connectors are disconnected.	Change servo amplifier

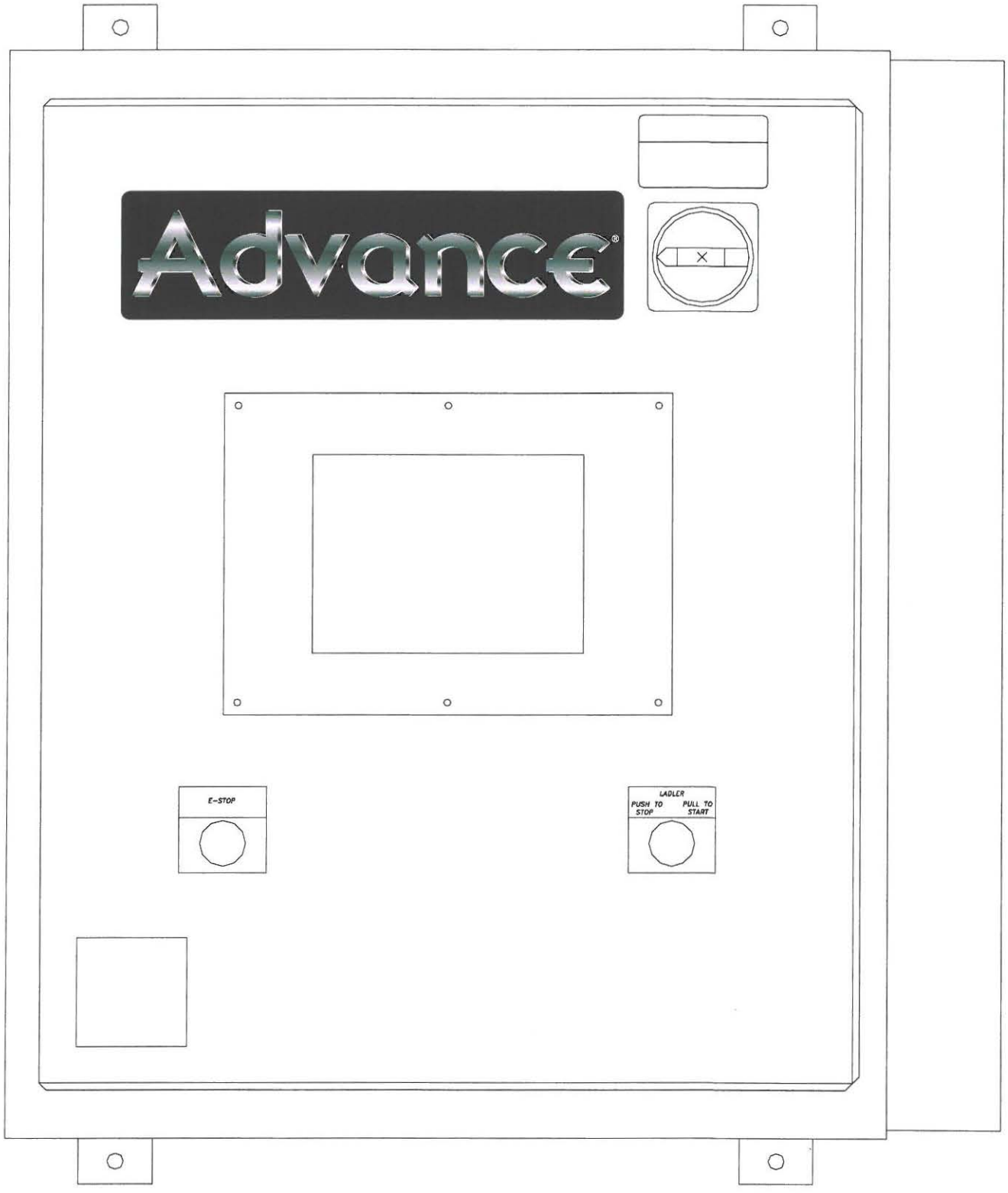
Warnings:
If ALE1 (overload warning) occurs, operation may be continued but an alarm may take place or proper operation may not be performed. If another warning (ALE6 or ALE9) occurs, the servo smplifier will go into a servo-off status. Eliminate the cause of the warning according to this section. Use the optional Servo Configuration software to refer to the cause of warning.

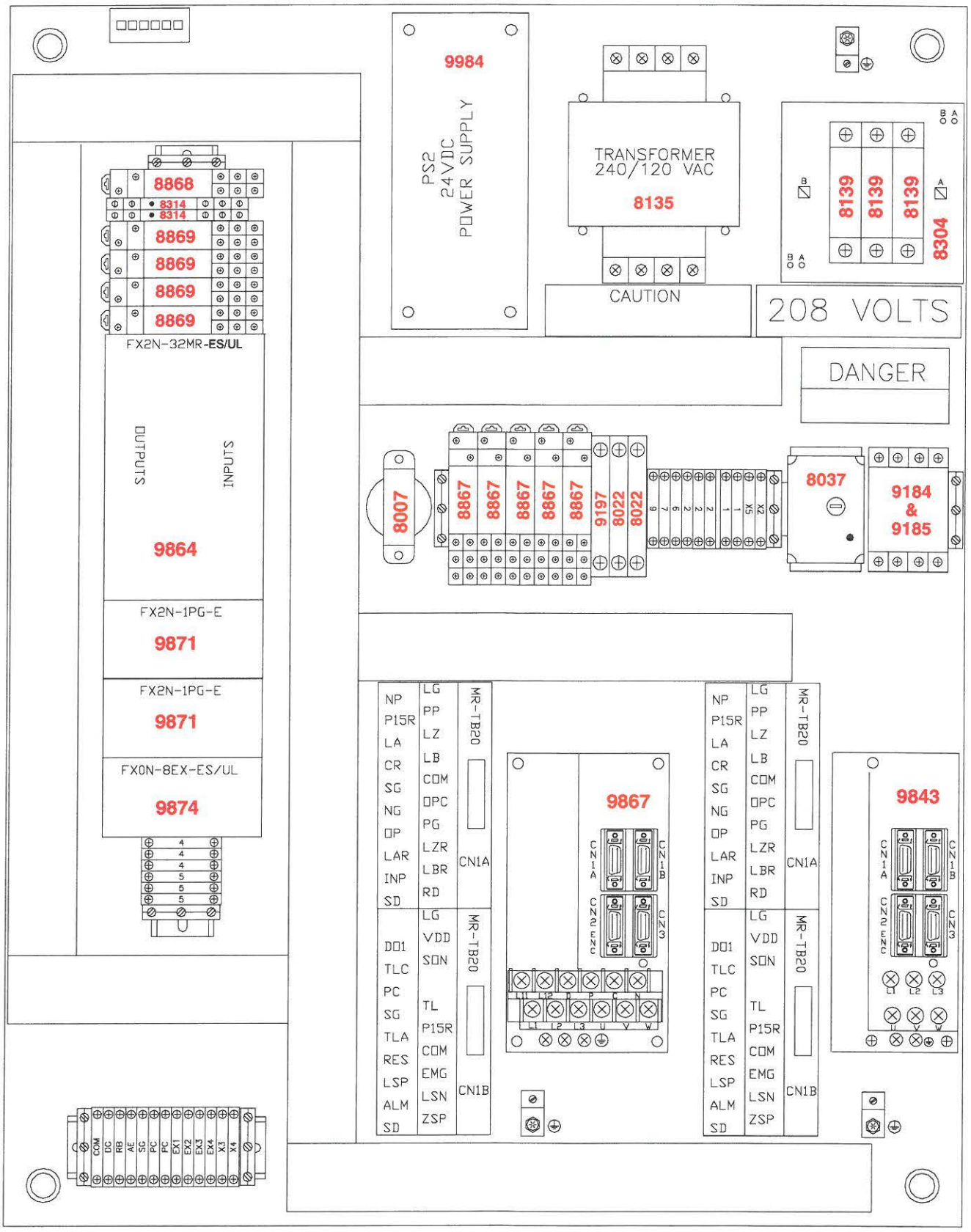
Display	Name	Definition	Cause	Action
AL92	Open battery cable warning	Absolute position detection system battery voltage is low.	1. Battery cable is open.	Repair cable or replace.
			2. Battery voltage dropped to 2.8V or less.	Change battery.
AL96	Zero setting error	1. In incremental system: Zeroing could not be made. 1. In absolute position detection system: Zero setting could not be made.	1. Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurance.
			2. Command pulse entered after the clearing of droop pulses.	Do not enter command pulse after clearing of droop pulses.
			3. Creep speed high.	Reduce creep speed.
ALE0	Excessive regenerative warning	There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative brake resistor or regenerative brake option.	Regenerative power increased to 85% or more of permissible regenerative power of built-in regenerative brake resistor or regenerative brake option. Checking method Invoke the status display and check the regenerative load ratio.	1. Reduce frequency of positioning. 2. Change regenerative brake option for the one with larger capacity. 3. Reduce load.
ALE1	Overload warining	There is a possibility that overload alarm 1 or 2 may occur.	Load increased to 85% or more of overload alarm 1 or 2 occurance level. Cause, checking method Refer to AL50, AL51.	Refer to AL50, AL51
ALE3	Absolute position counter warning	Absolute position encoder pulses faulty.	1. Noise entered the encoder.	Take noise suppression measures.
			2. Encoder faulty.	Change servo motor.
ALE5	ABS time-out warning		1. PC ladler program wrong.	Contact APC for program correction.
			2. ST2 - TLC signal mis-wiring	Connect properly.
ALE6	Servo emergency stop	EMG-SG are open.	External emergency stop was made valid. (EMG-SG opened.)	Ensure safety and deactivate emergency stop.
ALE9	Main circuit off warning	Servo was switched on with main circuit power off.		Switch on main circuit power.
ALEA	ABS servo on warning	Servo on signal (SON) turned on more than 1s after servo amplifier had entered absolute position data transfer mode.	1. PC ladder program wrong.	1. Contact APC for program correction.
			2. SON signal mis-wiring	2. Connect properly.

— NOTES —

Technical Documentation

TECHNICAL DOCUMENTATION - 6 -





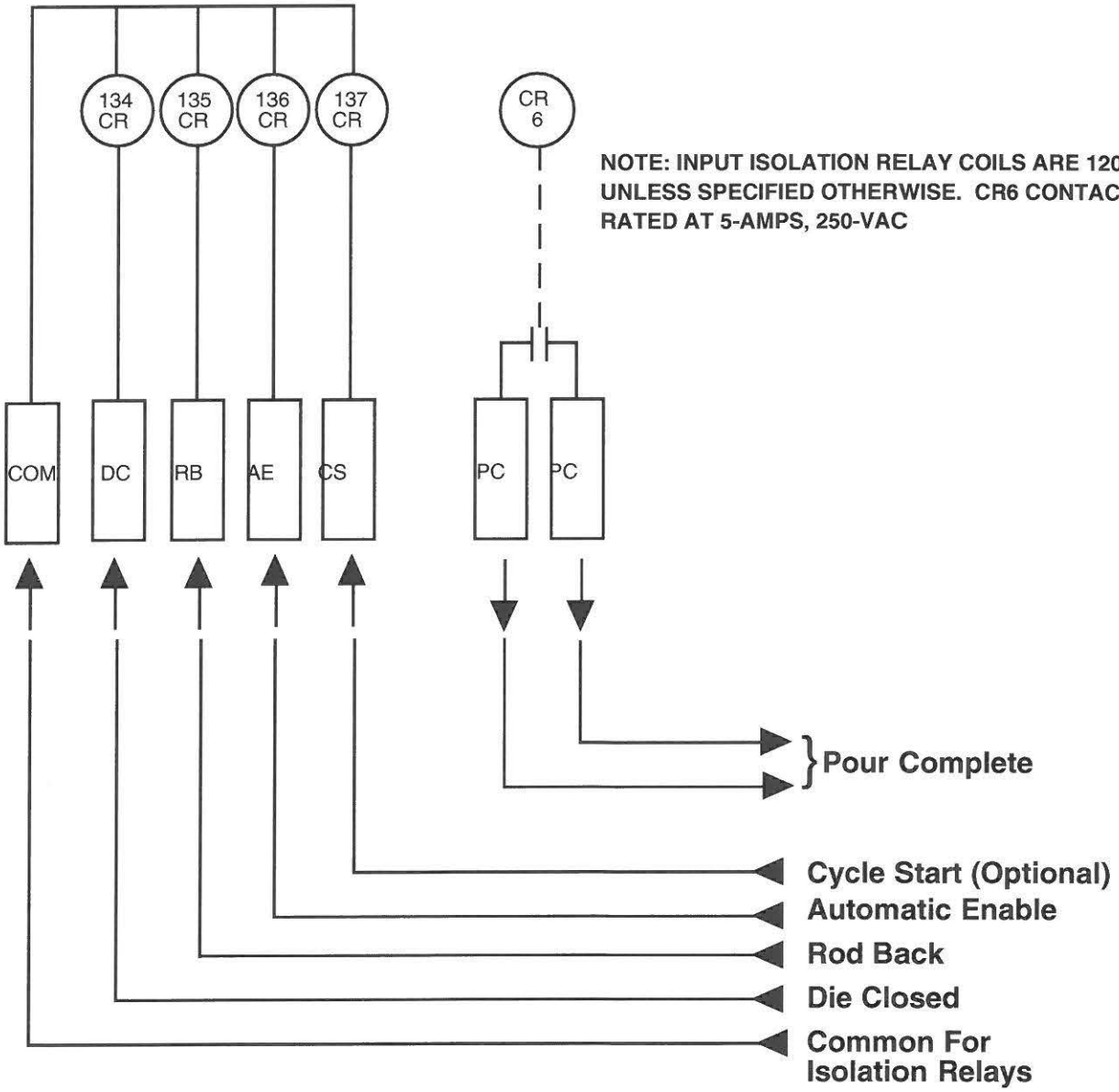
Ladler Sub-Panel

Pounds of Aluminum **Pounds of Aluminum**

CupAngle	Cup#8.0	Cup#6.0	Cup#4.0	Cup#3.5	Cup#3.0	Cup#2.5	Cup#2.0	Cup#1.5
25.00	21.883	17.213	12.923	10.656	8.688	6.543	5.579	4.263
26.00	21.489	17.023	12.706	10.480	8.512	6.367	5.471	4.181
27.00	21.163	16.738	12.570	10.290	8.376	6.204	5.362	4.100
28.00	20.865	16.575	12.299	10.113	8.213	6.068	5.213	4.018
29.00	20.512	16.385	12.095	9.950	8.050	5.905	5.077	3.937
30.00	20.186	16.181	11.892	9.801	7.914	5.756	4.968	3.855
31.00	19.724	15.951	11.688	9.584	7.778	5.606	4.860	3.774
32.00	19.426	15.761	11.525	9.407	7.588	5.457	4.738	3.665
33.00	19.059	15.530	11.349	9.285	7.453	5.281	4.588	3.584
34.00	18.720	15.313	11.077	9.122	7.263	5.131	4.466	3.502
35.00	18.394	15.082	10.901	8.973	7.168	4.982	4.358	3.421
36.00	18.028	14.865	10.711	8.797	7.005	4.846	4.235	3.326
37.00	17.675	14.647	10.493	8.620	6.869	4.697	4.113	3.244
38.00	17.227	14.403	10.317	8.444	6.733	4.548	3.991	3.122
39.00	16.833	14.159	10.100	8.254	6.557	4.358	3.855	3.041
40.00	16.439	13.901	9.855	8.077	6.380	4.222	3.692	2.959
41.00	16.019	13.656	9.638	7.914	6.217	4.073	3.570	2.864
42.00	15.652	13.399	9.435	7.724	6.054	3.923	3.434	2.756
43.00	15.177	13.154	9.204	7.548	5.905	3.774	3.299	2.674
44.00	14.770	12.910	8.987	7.331	5.742	3.638	3.177	2.579
45.00	14.362	12.625	8.783	7.140	5.579	3.489	3.041	2.484
46.00	13.928	12.367	8.430	6.937	5.403	3.339	2.891	2.389
47.00	13.439	12.068	8.118	6.747	5.186	3.190	2.756	2.294
48.00	12.991	11.824	7.887	6.557	4.996	3.041	2.634	2.213
49.00	12.503	11.552	7.656	6.353	4.833	2.864	2.511	2.104
50.00	12.027	11.254	7.412	6.122	4.643	2.715	2.389	2.023
51.00	11.607	10.996	7.195	5.932	4.480	2.579	2.267	1.928
52.00	11.145	10.724	6.950	5.729	4.290	2.444	2.158	1.846
53.00		10.439	6.652	5.539	4.127	2.294	2.023	1.765
54.00		10.141	6.407	5.349	3.923	2.172	1.901	1.670
55.00		9.855	6.149	5.131	3.747	2.050	1.792	1.588
56.00		9.543	5.919	4.941	3.570	1.928	1.683	1.507
57.00		9.245	5.661	4.711	3.407	1.805	1.575	1.425
58.00		8.932	5.362	4.507	3.217	1.683	1.466	1.344
59.00		8.688	5.118	4.303	3.068	1.561	1.371	1.262
60.00		8.335	4.887	4.113	2.891	1.466	1.276	1.195

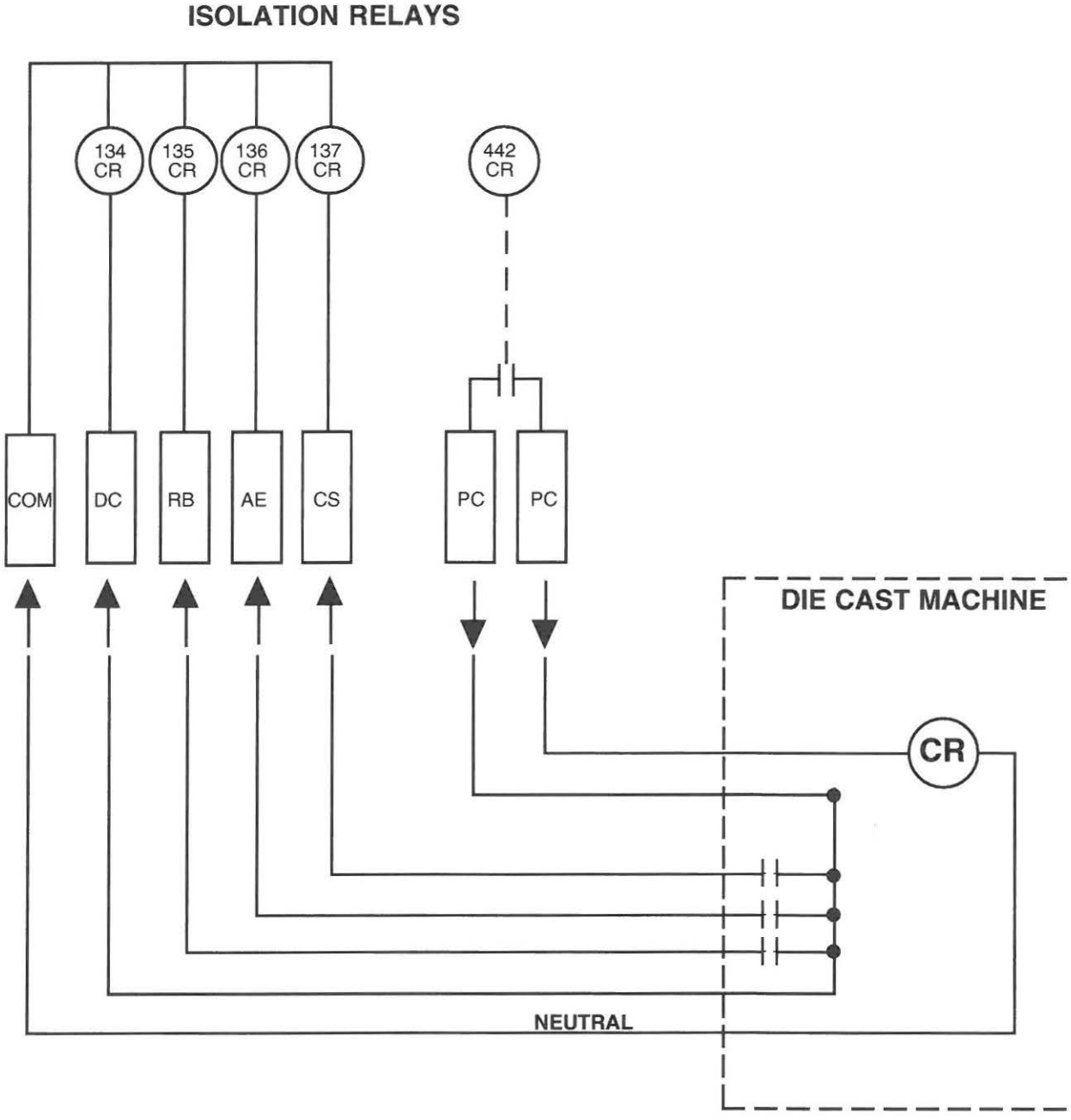
LADLER CUSTOMER INTERFACE

ISOLATION RELAYS

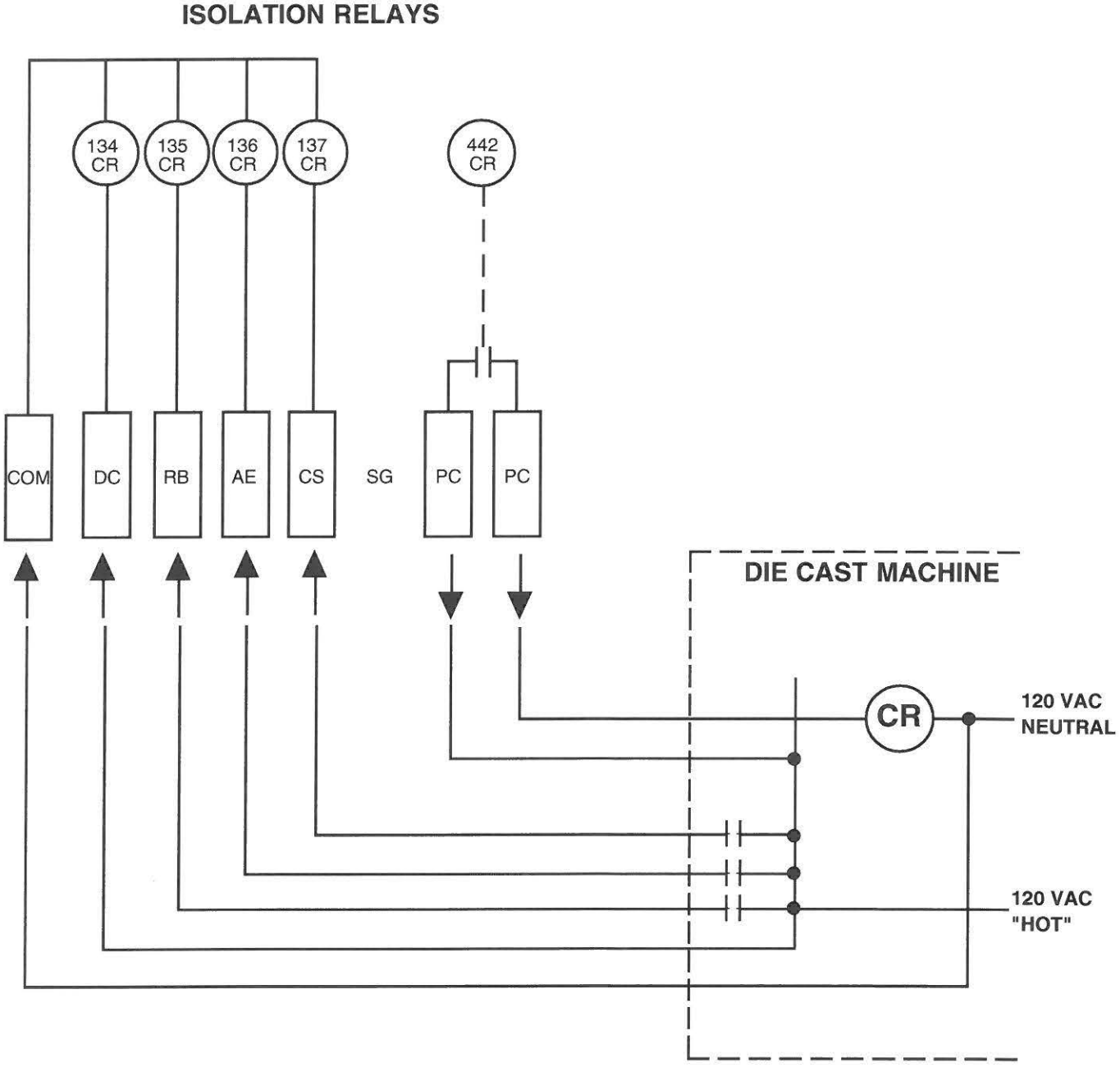


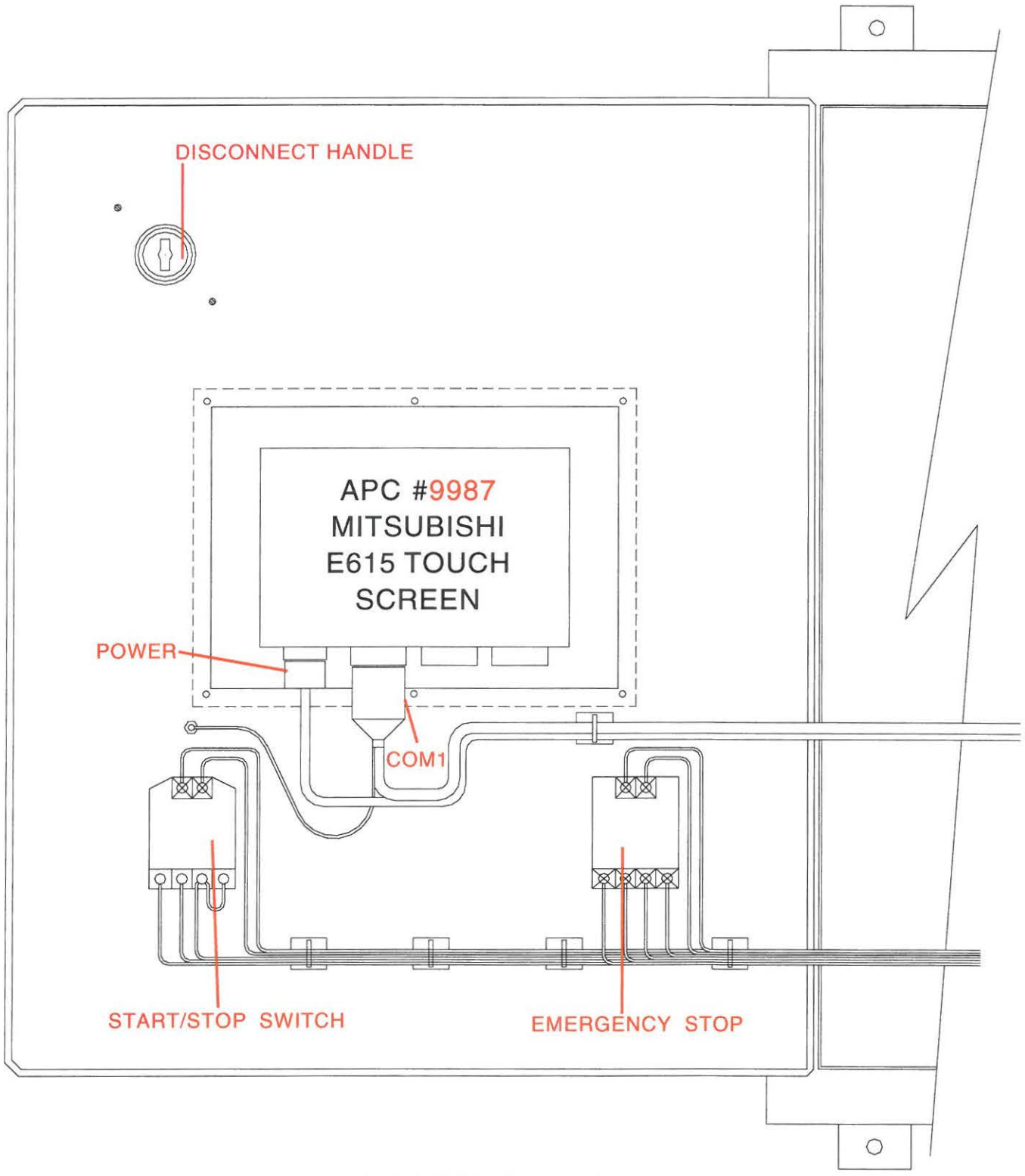
NOTE: See the following two pages for typical interface wiring options.

LADLER ELECTRICAL INTERFACE USING INTERNAL LADLE POWER



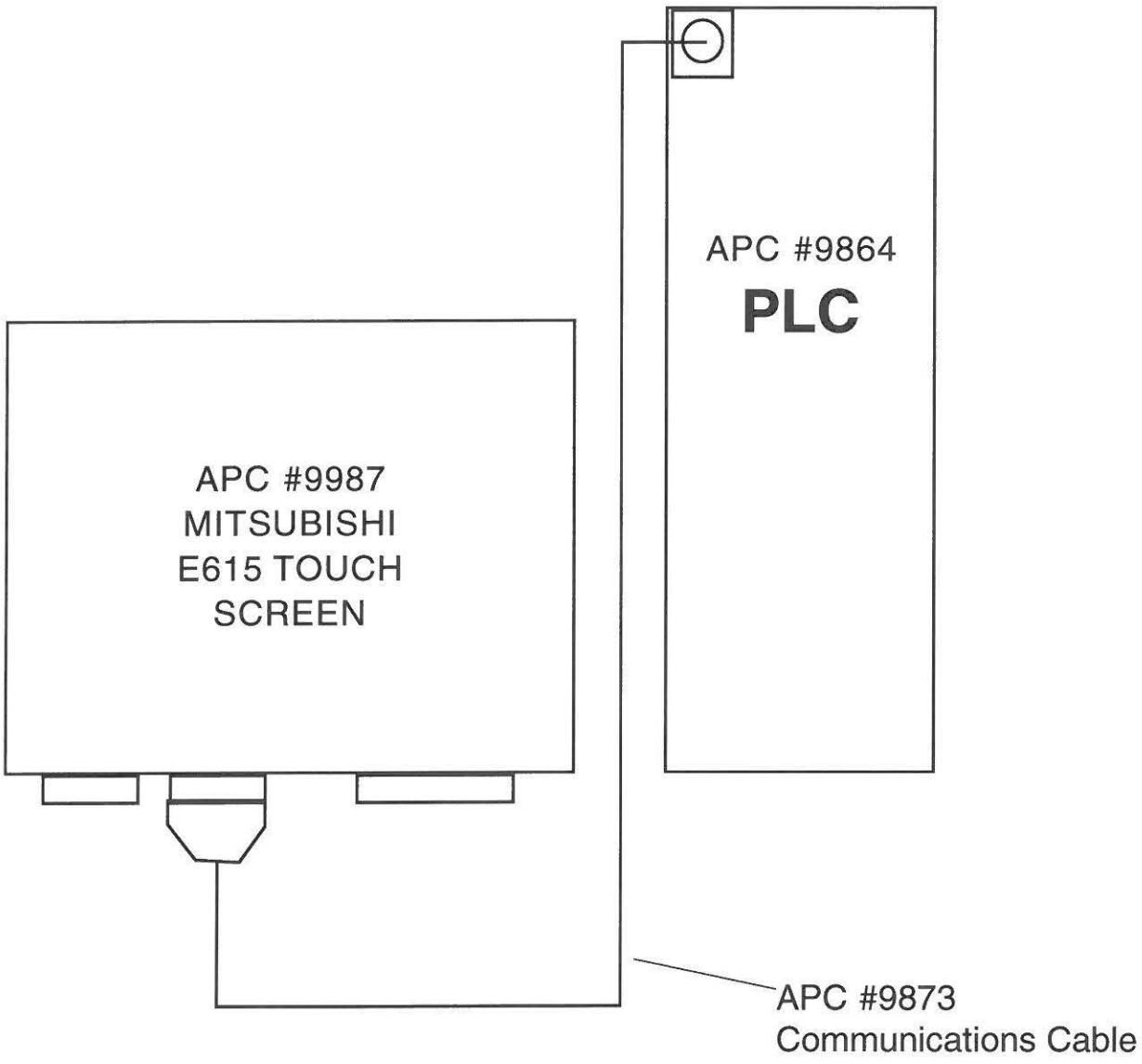
LADLER ELECTRICAL INTERFACE USING CUSTOMER SUPPLIED POWER



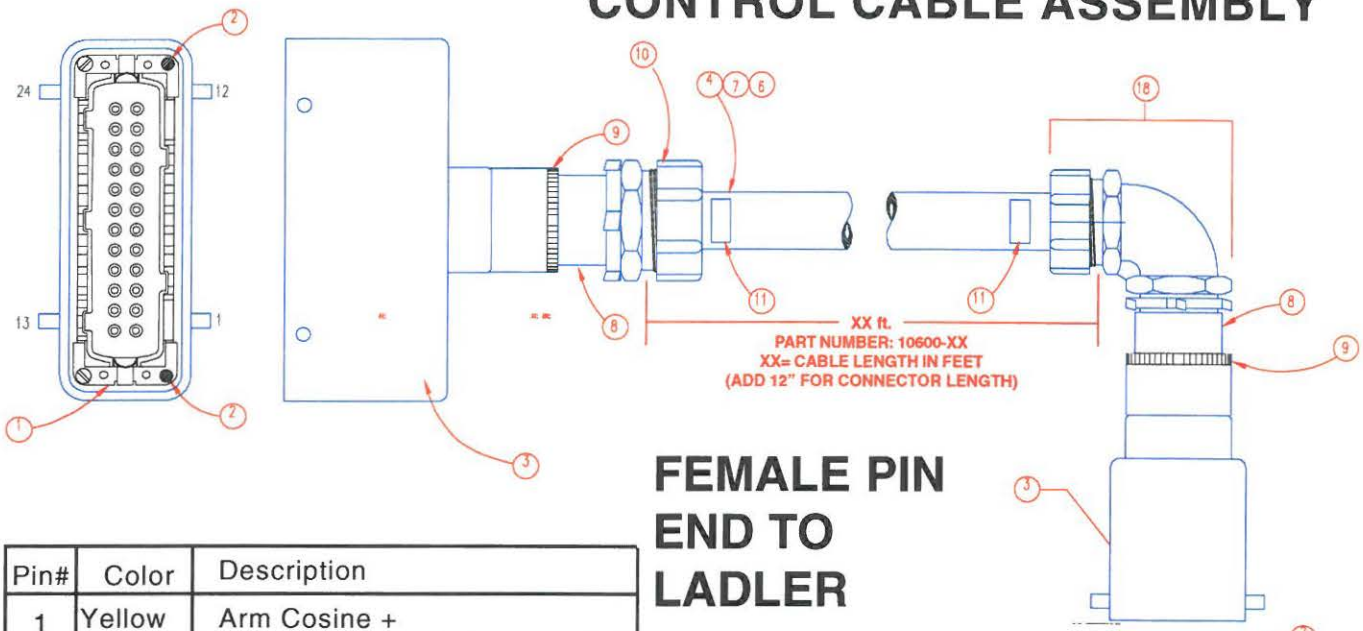


CONTROL BOX -- INSIDE FRONT COVER

PLC RS422 CABLING

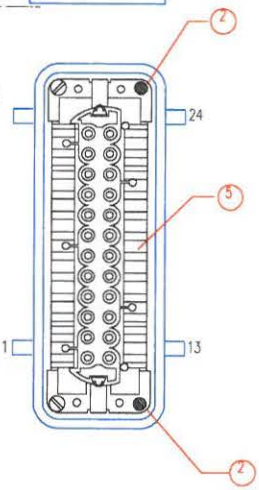


P/N 10600-030
CONTROL CABLE ASSEMBLY



FEMALE PIN END TO LADLER

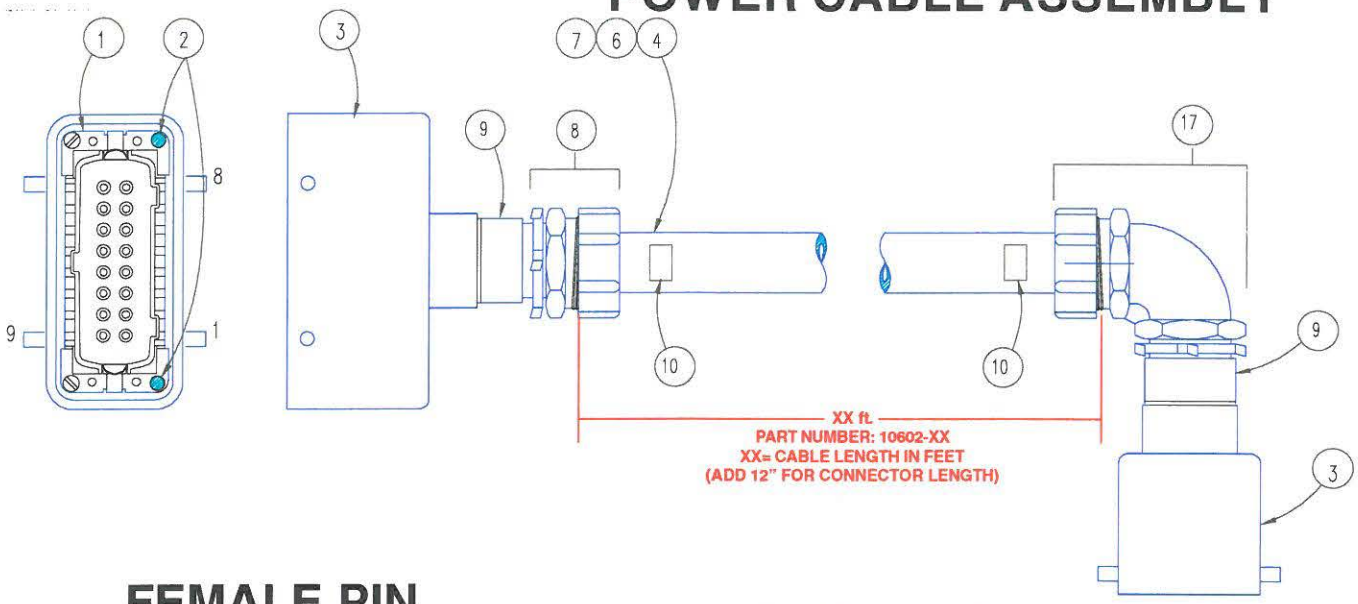
MALE PIN END TO CONTROL BOX (SEE OTHER END FOR PIN CALLOUTS)



Pin#	Color	Description
1	Yellow	Arm Cosine +
2	Red	Arm Sine +
3	Black	Arm Sine -
4	Orng/Blk	spare
5	Wht/Blk	Arm Home Limit Switch
6	Grn/Blk	Arm Max Back Limit Switch
7	Blue/Blk	Cup Home Limit Switch
8	Blue	+24v dc
9	Shield	Shield
10	Orange	Cup Carrier
11	Green	Cup Signal Common
12	Brown	Cup Cosine -
13	Brown	Arm Cosine -
14	Green	Arm Signal Common
15	Orange	Arm Carrier
16	Shield	Arm Shield
17	Orange	-24v dc
18	Red	Metal Probe Common
19	Red/Blk	Metal Probe 1
20	Green	Metal Probe 2
21	Blk/Wht	spare
22	Black	Cup Sine -
23	Red	Cup Sine +
24	Yellow	Cup Cosine +

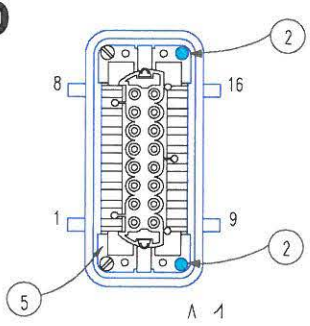
Item#	Part #	Qty	Description
1	7505	1	24Pole Plug (Male) Insert Connector
2	7504	4	Coding pins
3	10620	2	24 Pole Hood Assembly
4	1865	1	3/4" Ø Flex Conduit
5	7546	1	24 Pole Socket (Female) Insert Conn.
6	7550	2	22 Gauge 6 Conductor Shielded Wire
7	7549	1	18 Gauge 12 Conductor
8	8551	2	Reducer, PG21-3
9	7553	2	Reducer, PG29, PG21
10	8384	1	Connector, LQT, 3/4", st
11	8388	1	3/4" Dia. Rt. Angle Conn.

P/N 10602-030
POWER CABLE ASSEMBLY



FEMALE PIN END TO LADLER

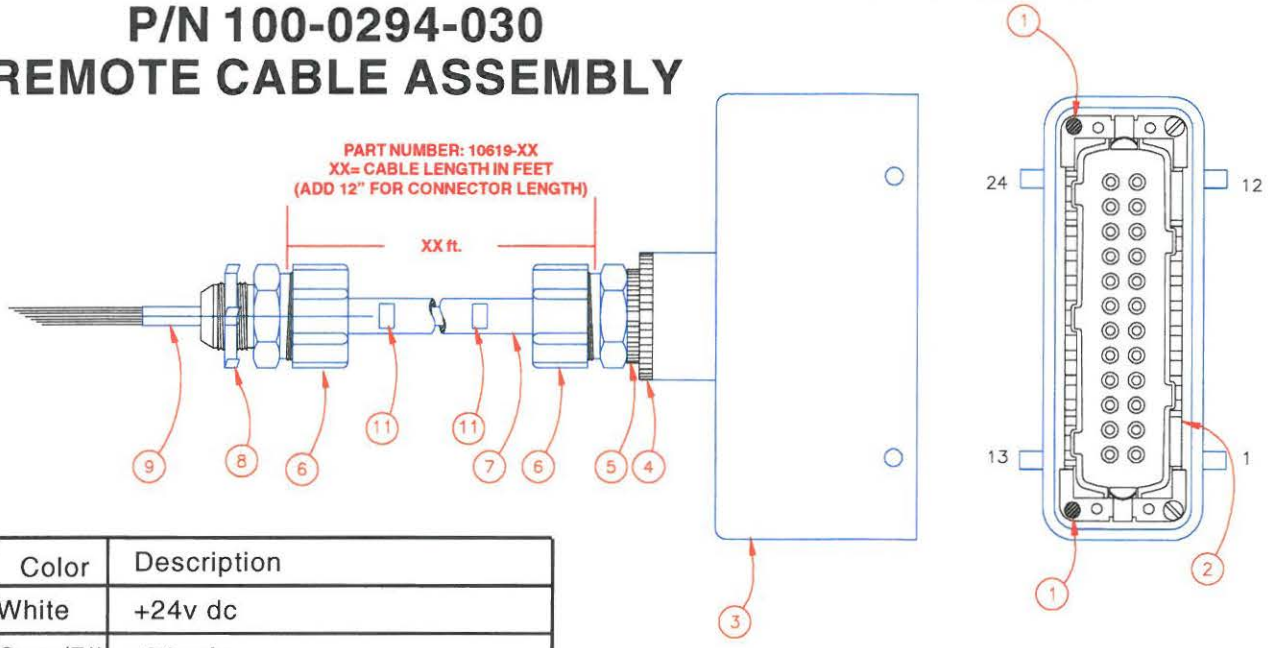
MALE PIN END TO CONTROL BOX (SEE OTHER END FOR PIN CALLOUTS)



Pin#	Color	Description
1	Green	Ground
2	Red	U. Arm Servo Motor
3	White	V. Arm Servo Motor
4	Black	W. Arm Servo Motor
5	Shield	Ground
6	Blue	Brake +24
7	Orange	Brake com
8	Red	Arm Temp Sensor 1
9	Black	Arm Temp Sensor 2
10	Wht or Yw	Cup Temp Sensor 1
11	O/Bk or Brn	Cup Tem Sensor 2
12	Bk/W or Prpl	Ground
13	Red	U. Cup Servo Motor
14	White	V. Cup Servo Motor
15	Black	W. Cup Servo Motor
16	Green	Ground

Item#	Part #	Qty	Description
1	7329	1	16 Pole Plug (Male) Insert Connector
2	7504	4	Coding Pin
3	10621	2	16 Pole Connector Hood Assembly
4	1865	1	3/4" Ø Flex Conduit
5	7548	1	16 Pole Socket (Female) Insert Conn.
6	7549	1	18 Gauge, 12 Conductor Unshld Wire
7	7551	2	14 Gauge 3 Conductor Shlded Wire
8	8384	1	3/4" Straight LQT Connector
9	8551	2	Reducer, PG-21
10	8388	1	Right angle LQT Connector

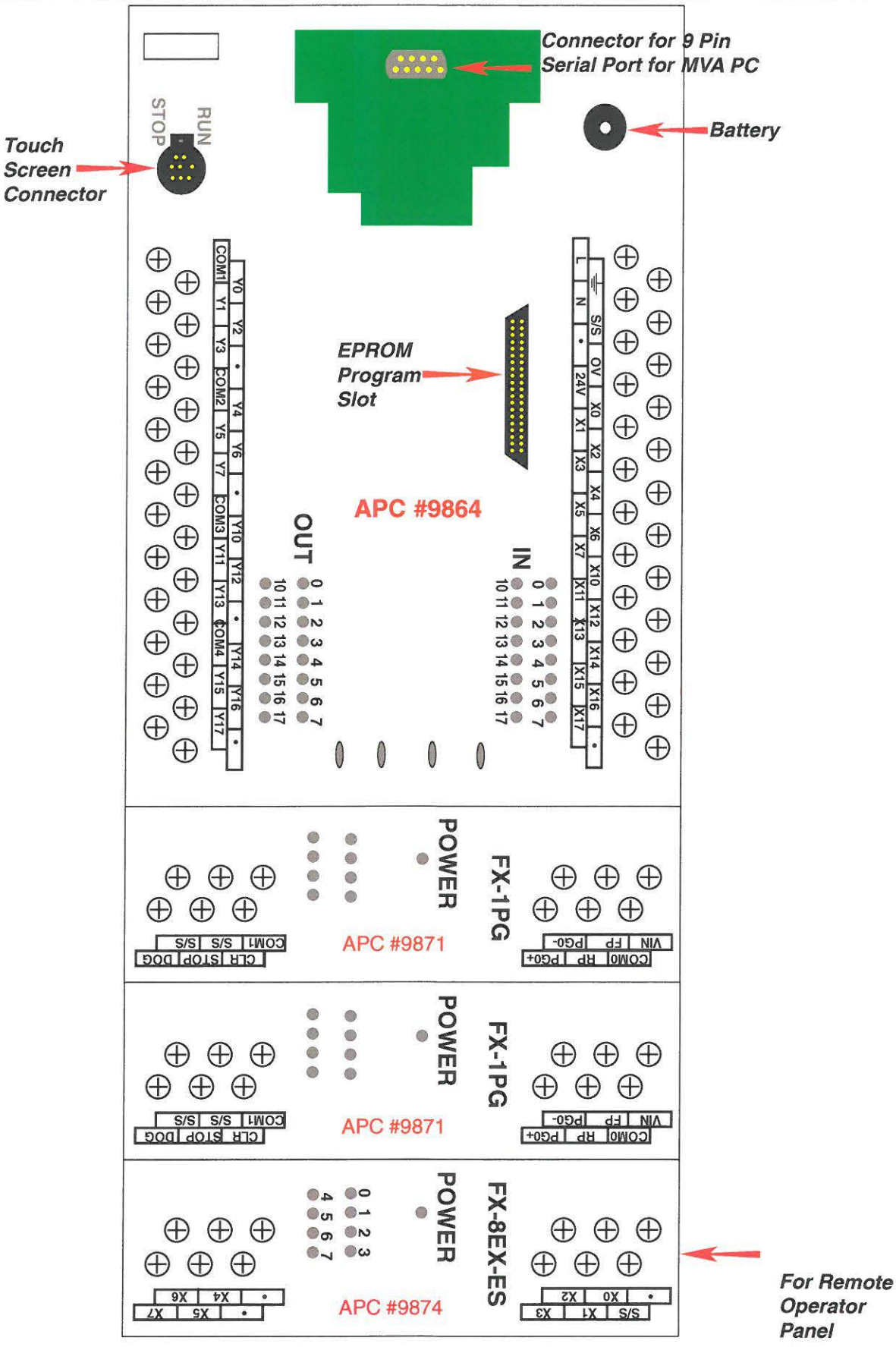
P/N 100-0294-030
REMOTE CABLE ASSEMBLY



Pin#	Color	Description
1	White	+24v dc
2	Orng/Blk	-24v dc
3	Blue/Blk	Home
4	Blk/Wht	Auto
5	Grn/Wht	Manual
6	Blu/Wht	Arm Forward
7	Blk/Red	Arm Backward
8	Wht/Red	Auto Cycle
9	Org/Red	LED - Pour Position
10	Blu/Red	LED - Home Position
11	Org/Grn	LED - Back Position
12	Red/Blk	LED - Auto Cycle
13	Bl/Rd/Wt	Cup Pour
14	Wt/Rd/B	Cup Empty
15	Rd/Wt/B	Shot Increase
16	Red	Shot Decrease
17	Gr/Wt/Bl	LED - Cup Empty
18	Blue	LED - Cup Horizontal
19	Red/Wht	LED - Shot Size
20	Orange	LED - Low / No Metal
21	Wht/Blk	LED - Cycle Abort / Normal
22	Red/Grn	LED - Probes
23	Blk	Spare
24	Grn/Blk	Spare
25	Green	Ground

MALE PIN END TO CONTROL BOX (SEE OTHER END FOR PIN CALLOUTS)

Item#	Part #	Qty	Description
1	7504	2	Coding Pin
2	7505	1	24 Pole Plug (Male) Insert Connctor
3	10620	1	24 Pole Connector Hood
4	8525	1	Reducer
5	8599	1	Reducer
6	8383	2	1/2" Ø Con. Straight Connector
7	8863	1	1/2" Ø Flex Conduit
8	8393	1	Nut
9	7552	1	10 Gauge, 25 Conductor Wire



PLC APC P/N 9864

PLC Specifications *APC P/N 9864*

Power Supply

Current Repeatability ..... 720mA, 100V AC.
Current Typical ..... 300 mA, 100V AC.
Max. Allowable Momentary Power Failure Period - 10msec.
Fuse (size) rating 3.15A

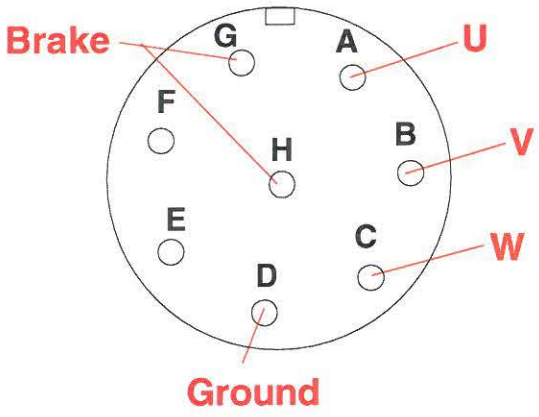
Inputs

Input Current ..... 24V DC, 5mA.
Response Time ..... 10 msec.
Circuit Isolation / Operation Indication .... Photocoupler / LED is lit.
Input voltage ..... 85-132V AC 50/60Hz.
Input Impedence ..... 21kΩ/50Hz or 18kΩ/60Hz

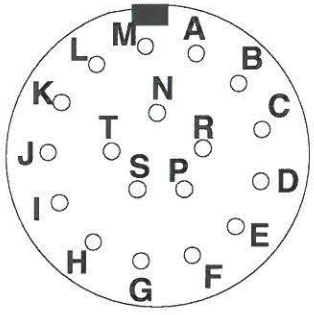
Relay Outputs

Switched Voltages ..... ≤ 240V AC, 30V DC.
Rated current / N points ..... 2A / 1 Point, 8A / Com.
Max. Inductive Load ..... 80 VA, 120 / 240 VAC.
Max Lamp Load (tungsten load) ..... 100W (1.17 A / 85VAC, 0.4A / 250VAC).
Circuit Isolation ..... By Relay.
Operation Indication ..... LED is lit when coil is energized.

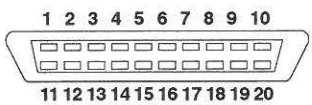
SERVO MOTOR POWER

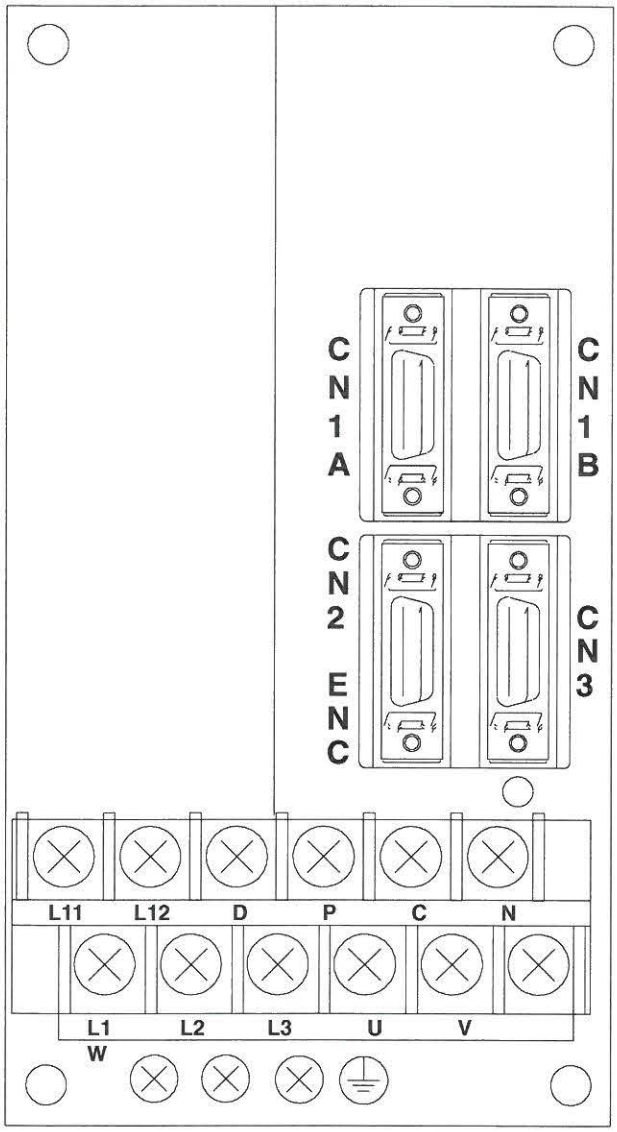


SERVO MOTOR ENCODER



CN2 ENCODER CABLE





Servo-Amp APC P/N 9867 & 9843

Servo-amp Specifications *APC # 9867 & 9843*

Power Supply

Voltage/frequency	3-phase, 200 to 230V AC 50/60Hz.
Permissible voltage fluctuation	3-phase 170 to 253V AC 50/60 Hz.
Permissible frequency fluctuation	± 5% max.

GENERAL

Control System	Sine-wave PWM control/current control system.
Dynamic brake	Built-in.
Speed frequency response	550Hz or more.
Safety Features	Overcurrent shutdown, regeneration, overvoltage shutdown, overload shutdown (electronic thermal), servomotor overheat protection, encoder fault, protection, regeneration fault protection, under-voltage/sudden power outage protection, overspeed protection, excess error protection.

Structure

Fan cooling, open (IP00).

Environment

Ambient temperature	0 to 55°C(32 to 131°F)(non freezing), storage: -20 to 65°C(-4 to 149°F)(non freezing).
Ambient humidity	90% RH max. (non condensing), storage: 90% RH max. (non condensing).
Atmosphere	Inside control panel; no corrosive gas, inflammable gas, oil mist, or dust.
Elevation	1000 meters or less above sea level.
Oscillation	5.9 m/s^2 max.

Servo-Motor APC P/N 9868 & 9842

Servomotor Specifications *APC # 9868 (Arm Motor)*

Power facility capacity ..... 2.5kVA.

Continuous Running Duty

Rated output ..... 1.5 kW.
Rated torque ..... 7.16Nm (1013.8 oz-in).

Specifications Continued

Maximum torque ..... 21.6Nm (3058.5 oz-in).
Rated rotation speed ..... 2000 r/min.
Maximum rotation speed ..... 3000 r/min.
Permissible instantaneous rotation speed-3450 r/min.
Power rate at continuous rated torque ... 25.6 kW/s.
Rated current ..... 9 A.
Maximum current ..... 27 A.
Speed/Position encoder ..... Resolution per encoder/servomotor rotation: 131072 pulses/revolution.

Environment

Ambient temperature ..... 0 to 40°C(32 to 104°F)(non freezing), storage: -15 to 70°C(-5 to 158°F)(non freezing).
Ambient humidity ..... 80% RH max. (non condensing), storage: 90% RH max. (non condensing).
Atmosphere ..... Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist, or dust.
Elevation ..... 1000 meters or less above sea level.

Servomotor Specifications *APC # 9842 (Cup Motor)*

Power facility capacity ..... 1.7kVA.

Continuous Running Duty

Rated output ..... 1.0 kW.
Rated torque ..... 4.78Nm (676.8 oz-in).

Specifications Continued

Maximum torque ..... 14.4Nm (2039.0 oz-in).
Rated rotation speed ..... 2000 r/min.
Maximum rotation speed ..... 3000 r/min.
Permissible instantaneous rotation speed-3450 r/min.
Power rate at continuous rated torque ... 16.7 kW/s.
Rated current ..... 6 A.
Maximum current ..... 18 A.
Speed/Position encoder ..... Resolution per encoder/servomotor rotation: 131072 pulses/revolution.

Environment

Ambient temperature ..... 0 to 40°C(32 to 104°F)(non freezing), storage: -15 to 70°C(-5 to 158°F)(non freezing).
Ambient humidity ..... 80% RH max. (non condensing), storage: 90% RH max. (non condensing).
Atmosphere ..... Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist, or dust.
Elevation ..... 1000 meters or less above sea level.

NOTES

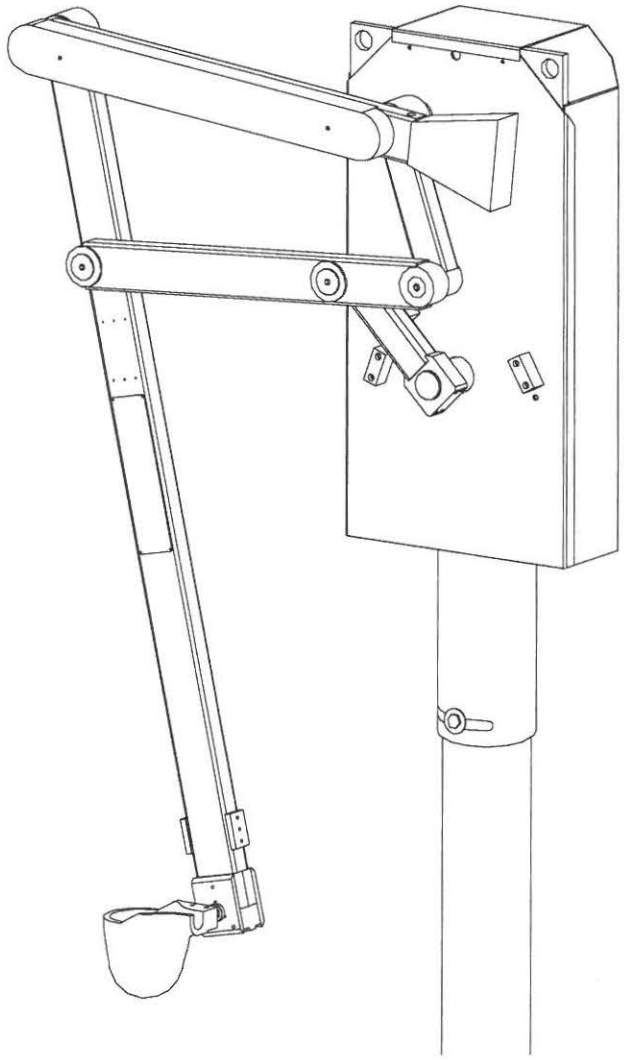
NOTES

Replacement Parts

REPLACEMENT PARTS -7-

This section lists the major user-replaceable components in the SL-1200 Auto Ladle System, and shows locations for the major components. A Replacement parts list follows. Please see the "Technical Documentation" section of this manual for more information.

When you place an order for a part, please give us the "Part Number," "Quantity," and "Description" of the part. You can call or write Advance Products and we will ship the part to you as soon as possible. Our address and telephone number are listed at the bottom of the front page of this Manual.



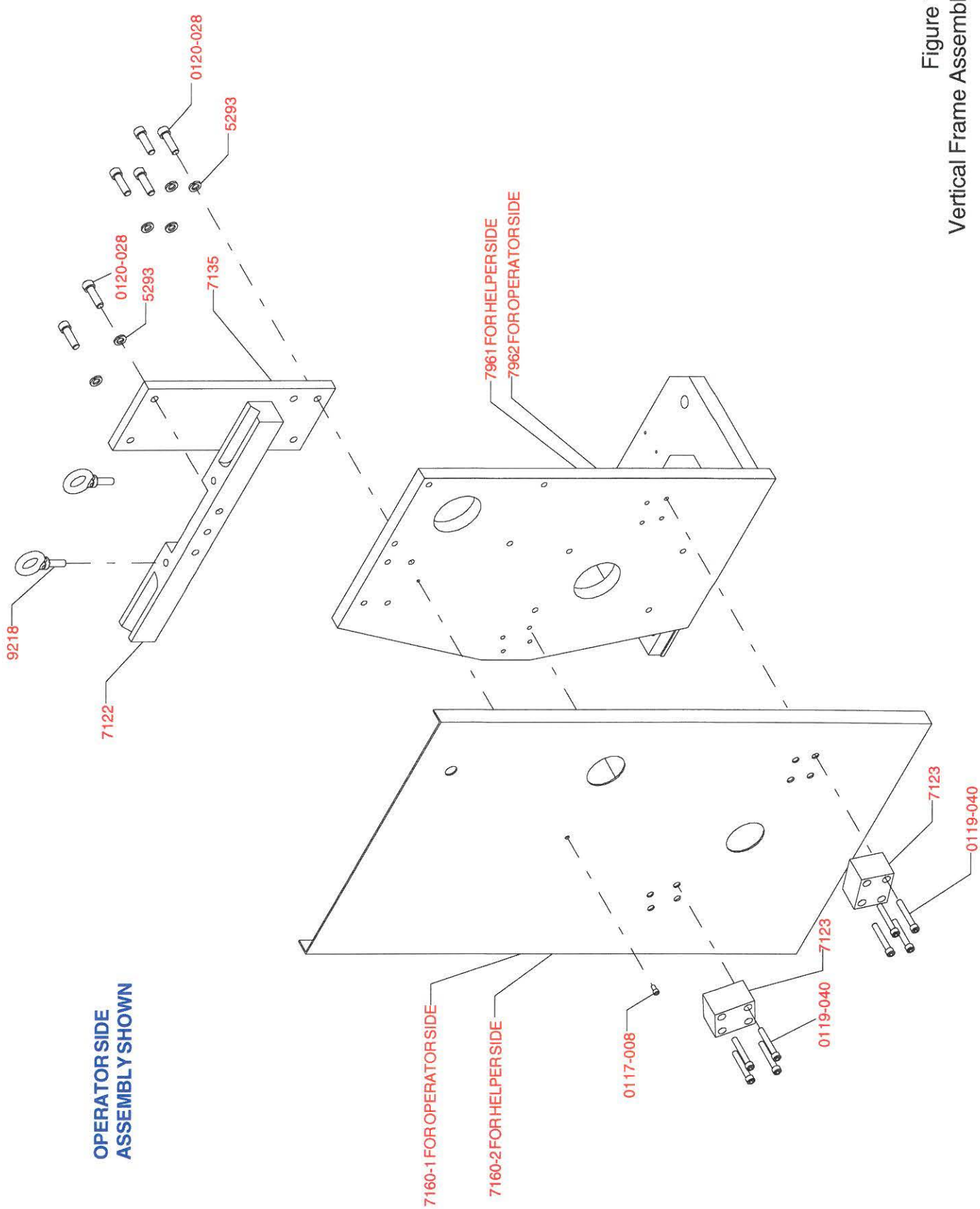
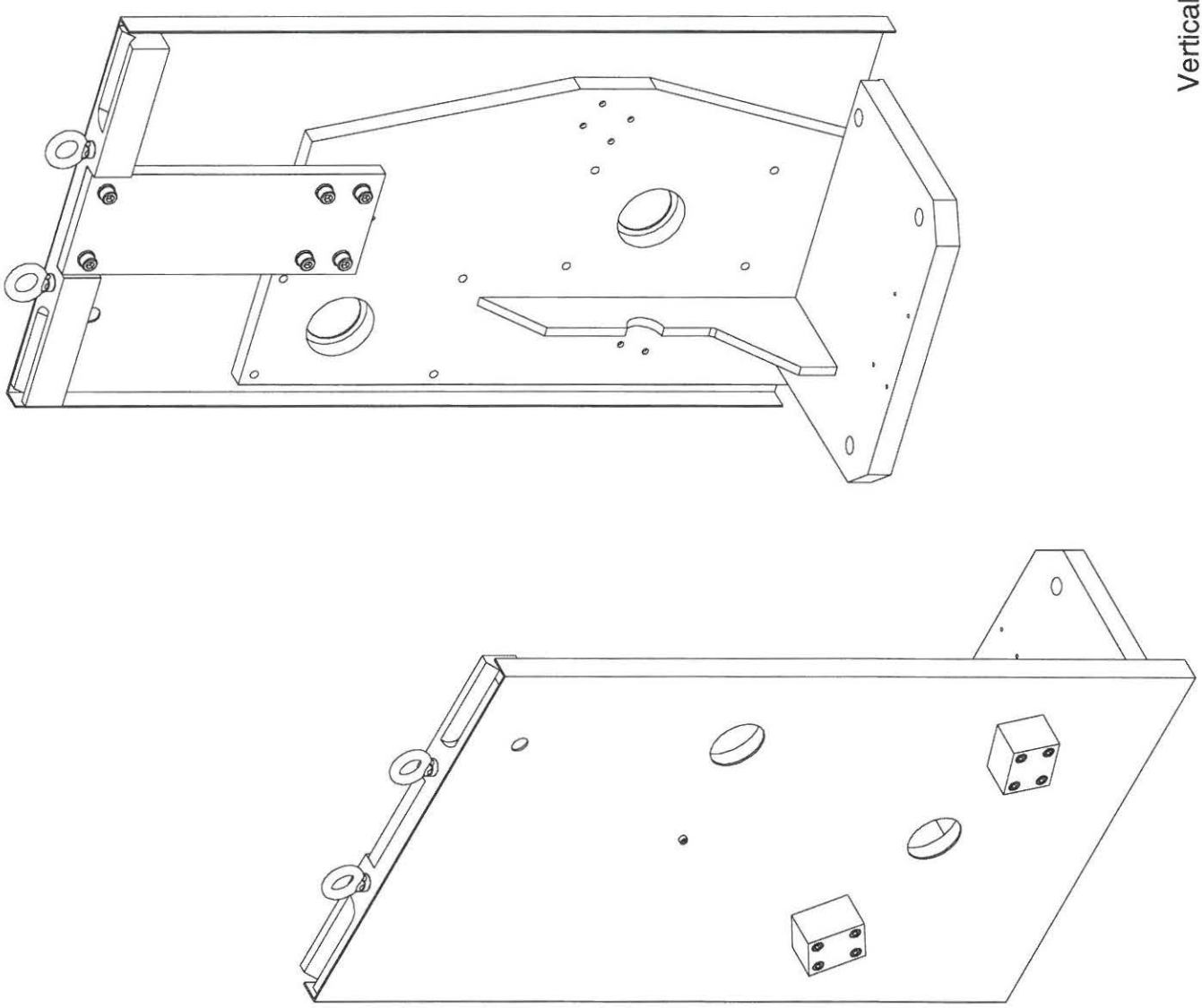


Figure 7-1
Vertical Frame Assembly 1

Figure 7-2
Vertical Frame Assembly 2



OPERATOR SIDE
ASSEMBLY SHOWN

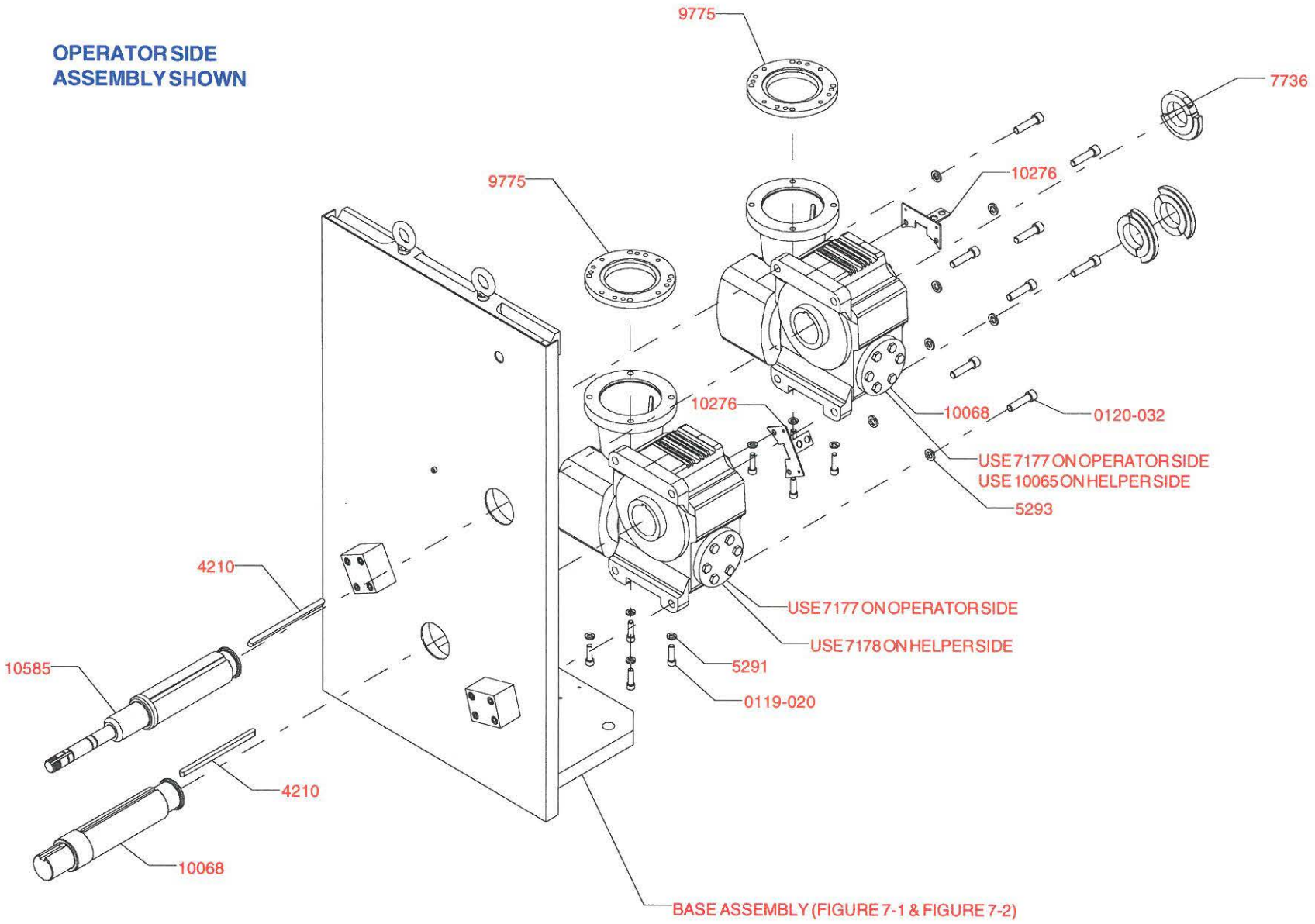
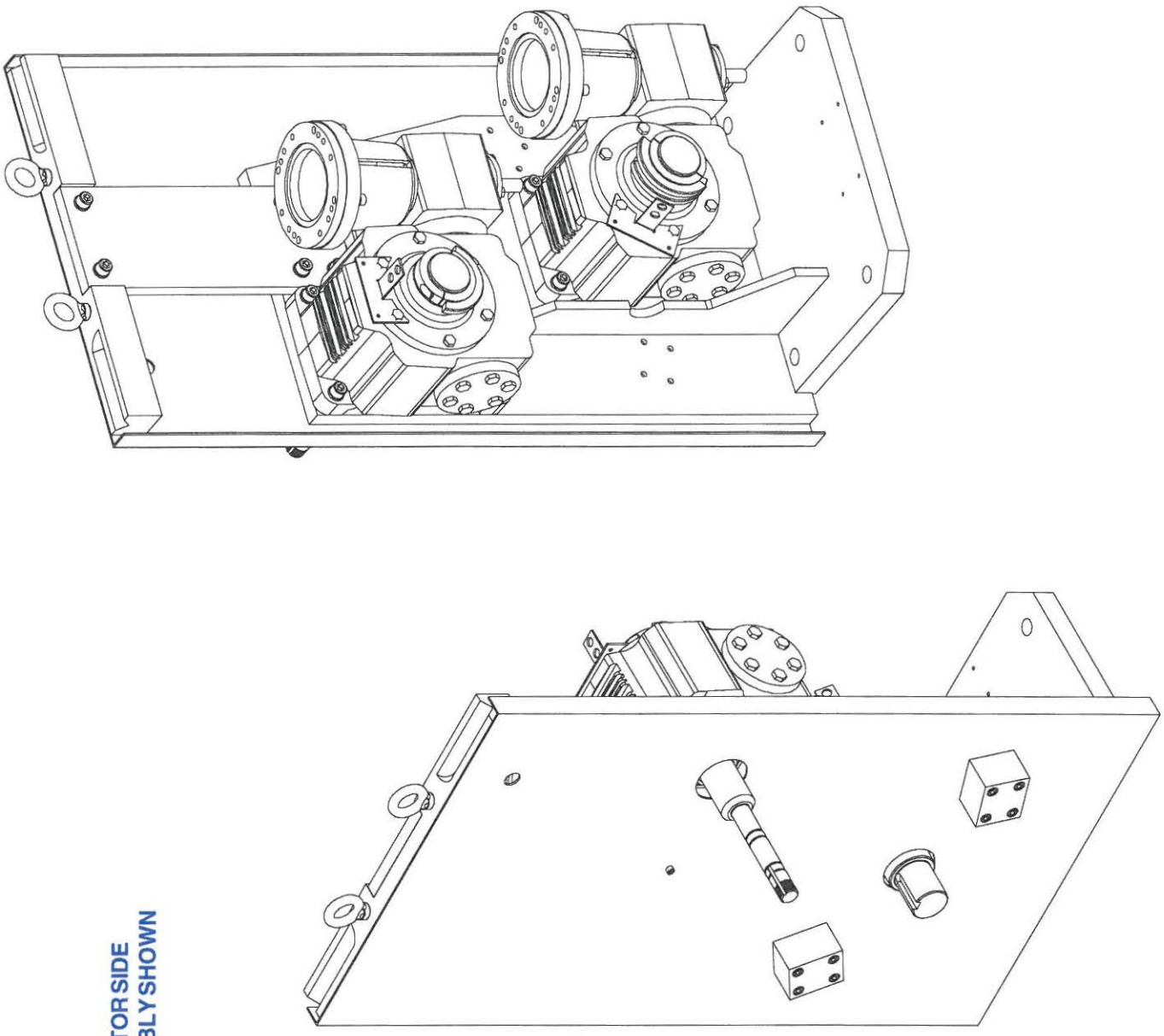


Figure 7-3
Gear Reducer Placement

Figure 7-4
Gear Reducer Assembly



OPERATOR SIDE
ASSEMBLY SHOWN

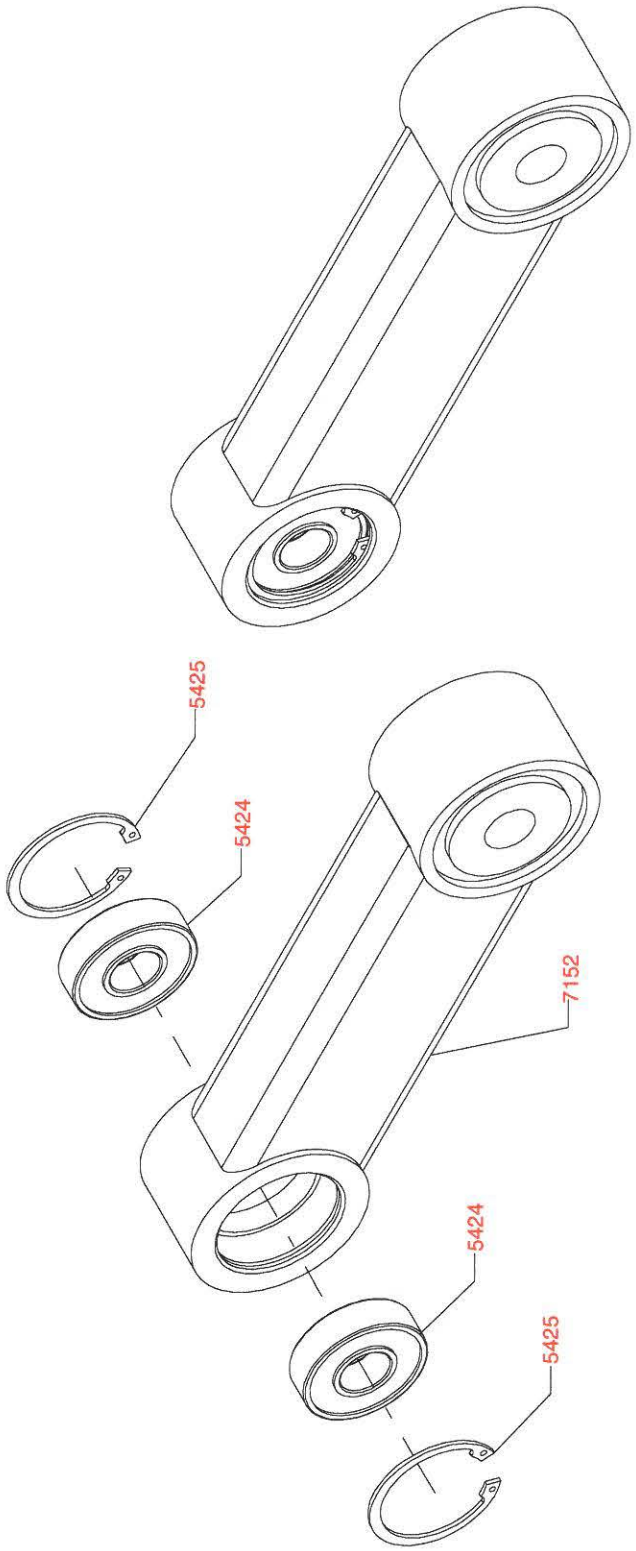


Figure 7-5
"Dog Bone" Arm Assembly

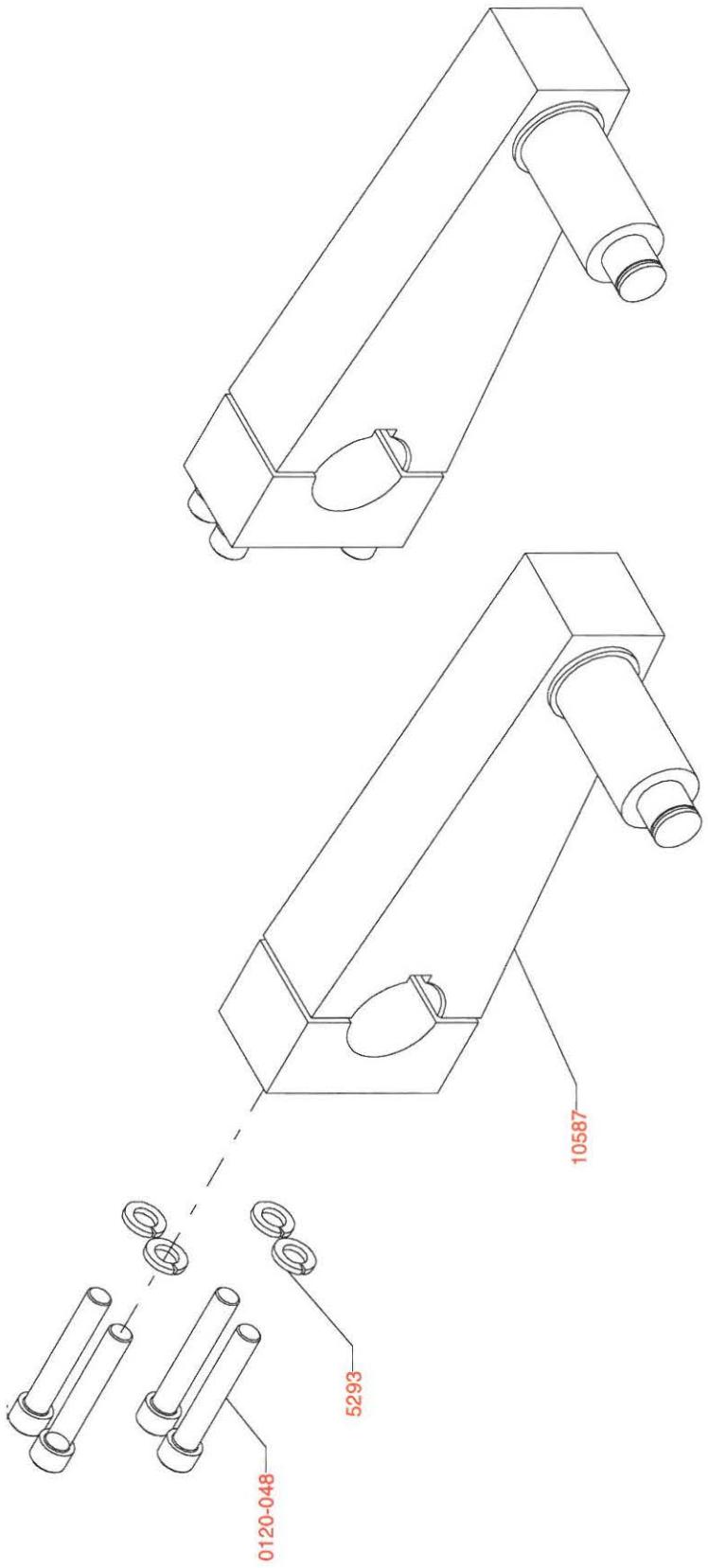


Figure 7-6
"Crank" Arm Assembly

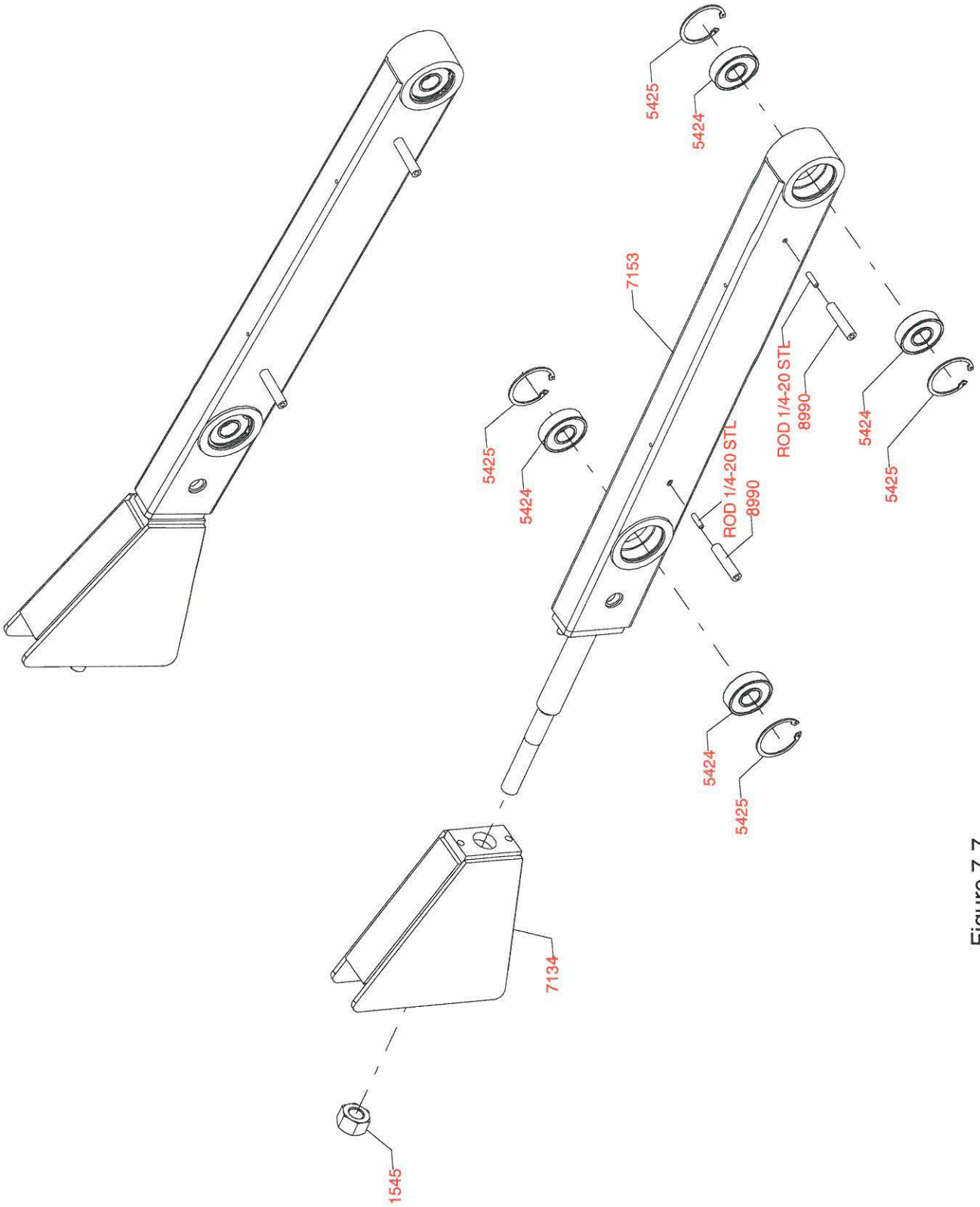


Figure 7-7
"Counterweight" Arm Assembly

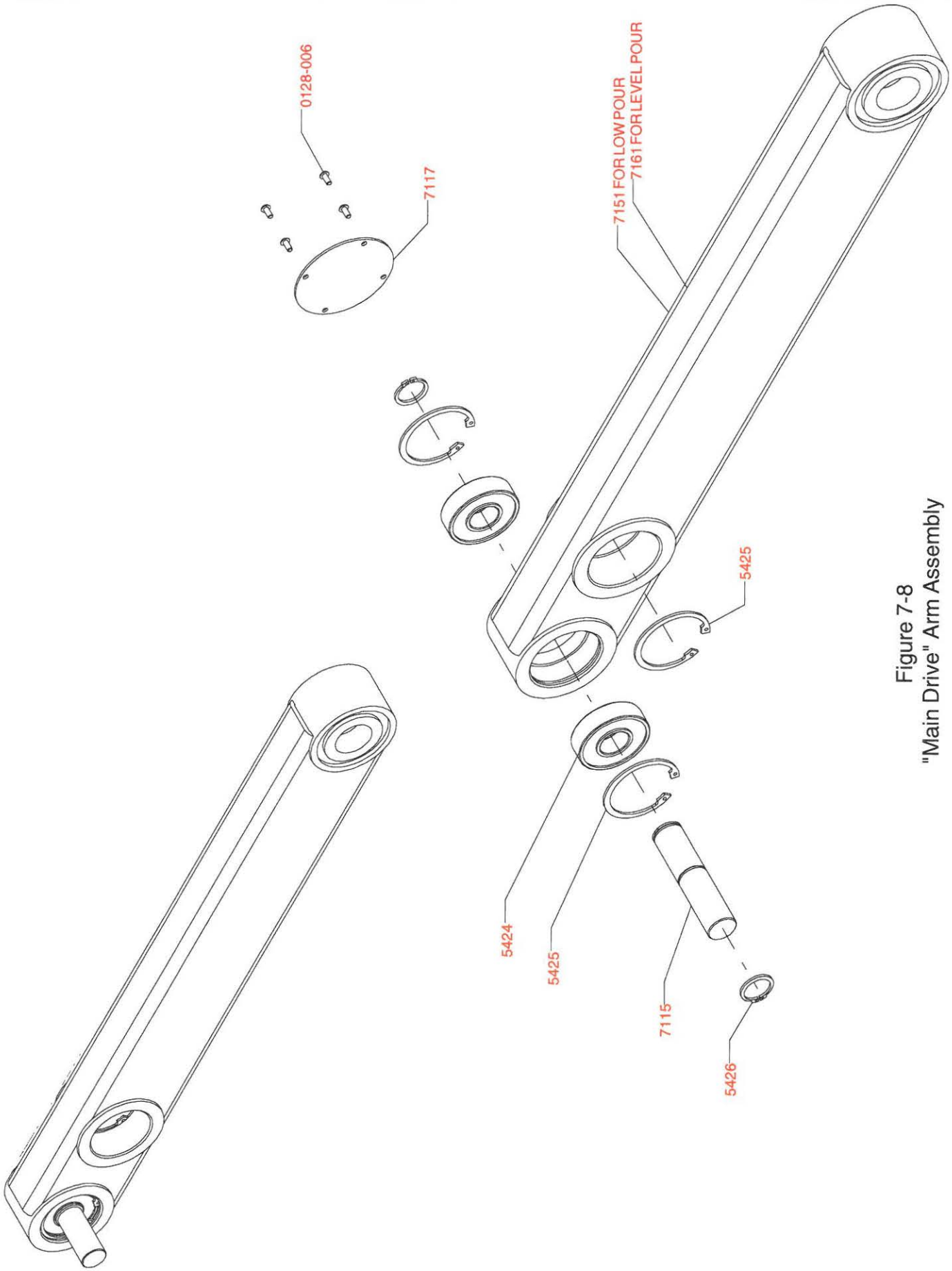


Figure 7-8
"Main Drive" Arm Assembly

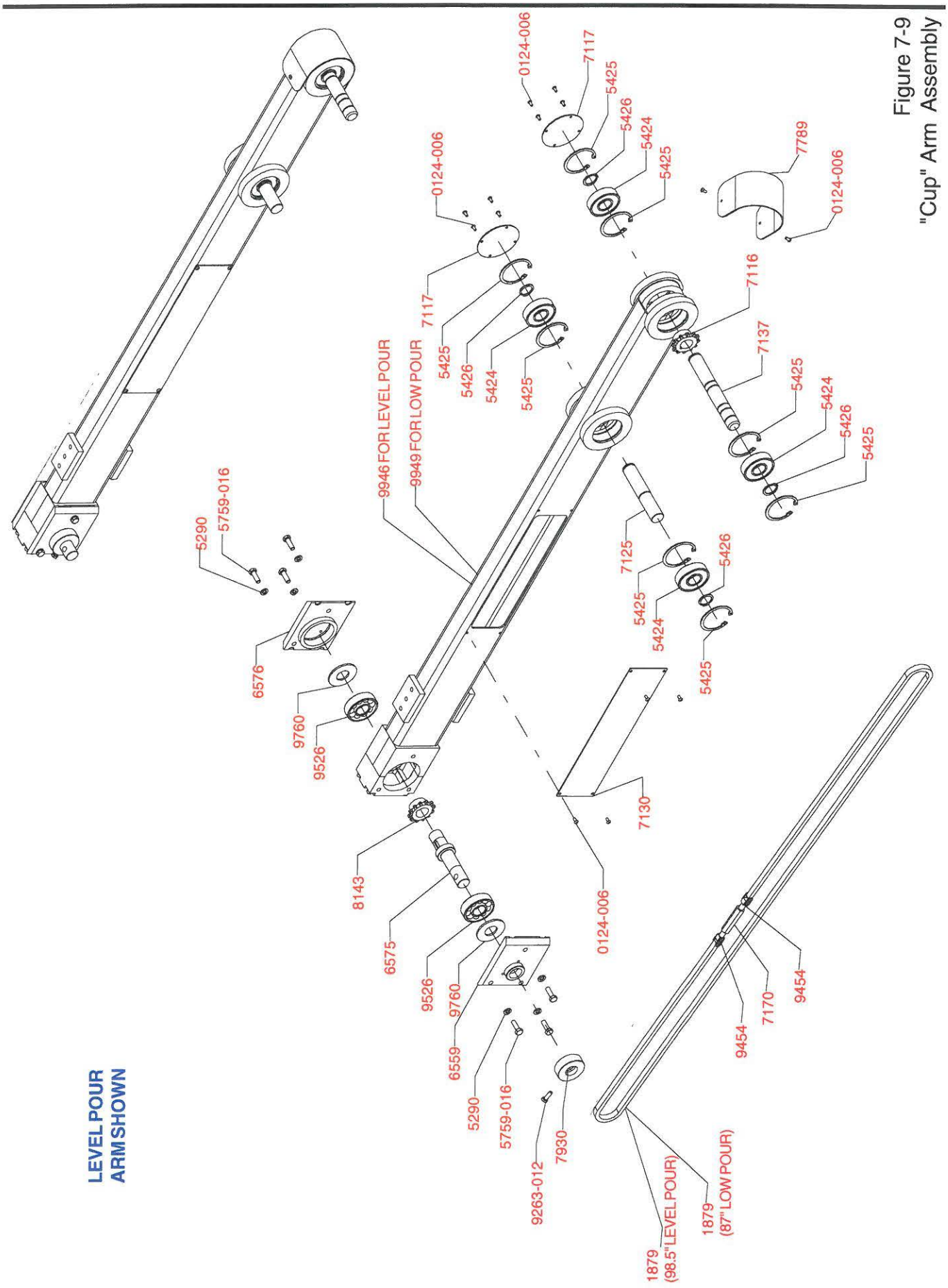


Figure 7-9
"Cup" Arm Assembly

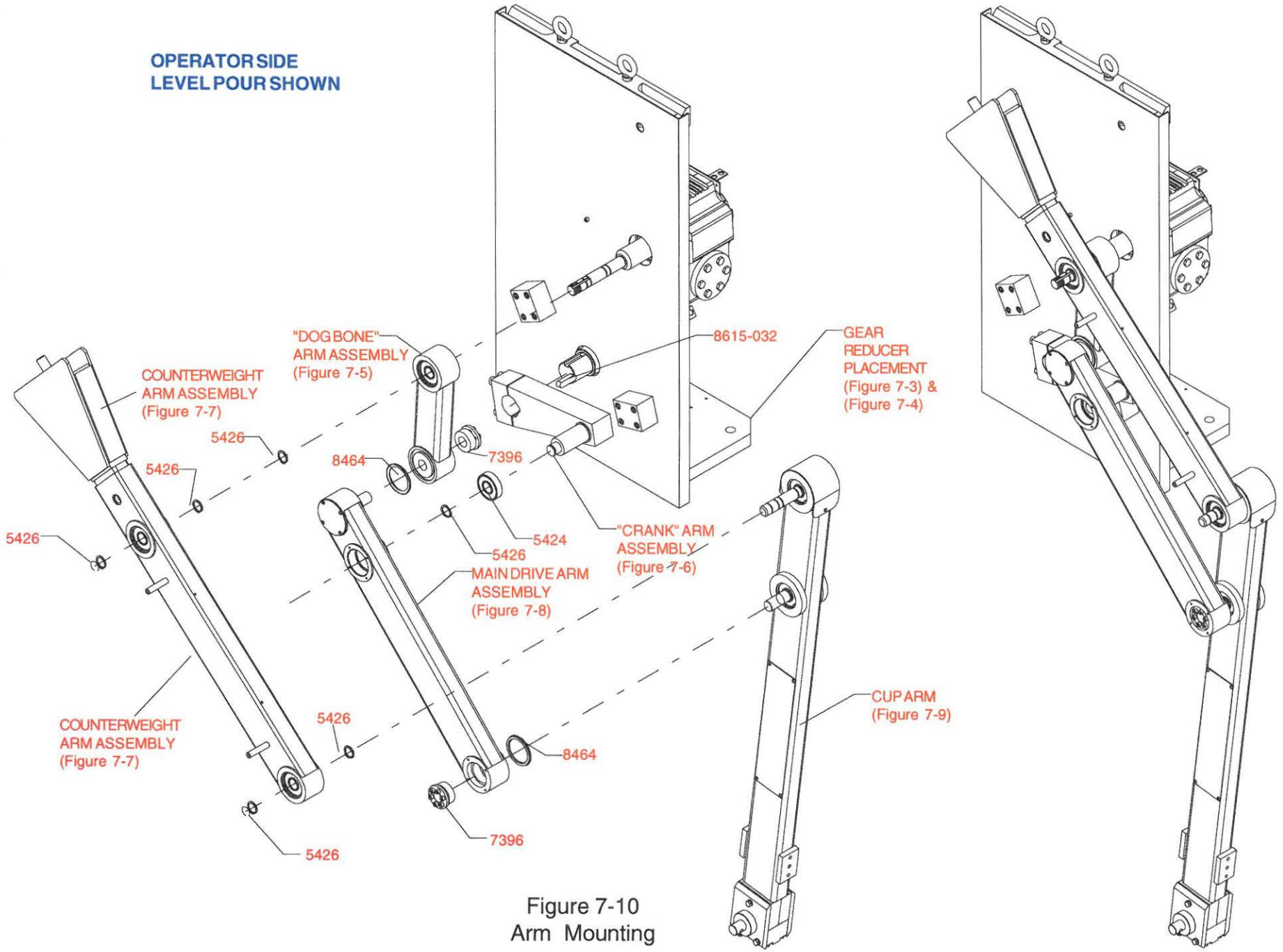


Figure 7-10
Arm Mounting

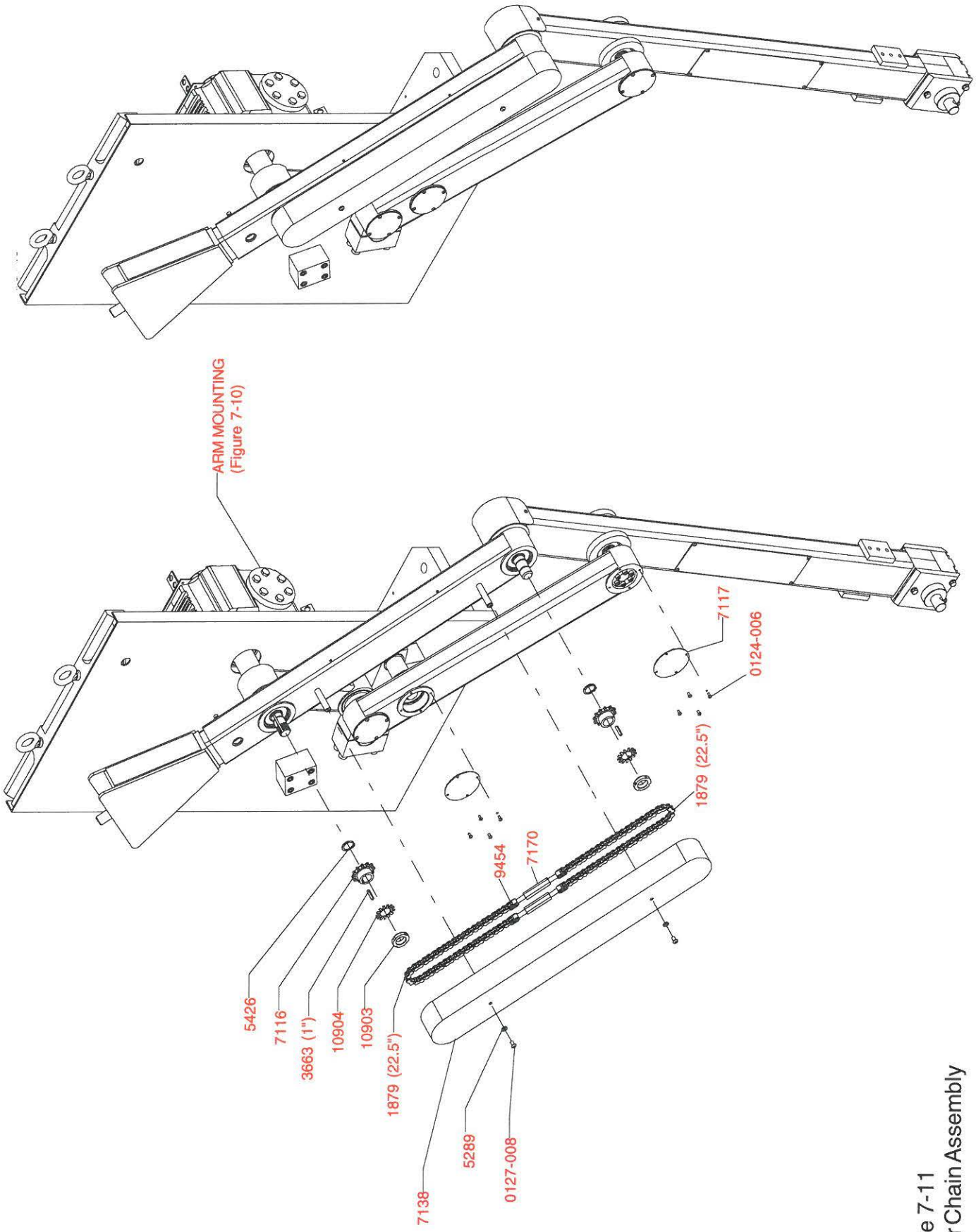


Figure 7-11
Outer Chain Assembly

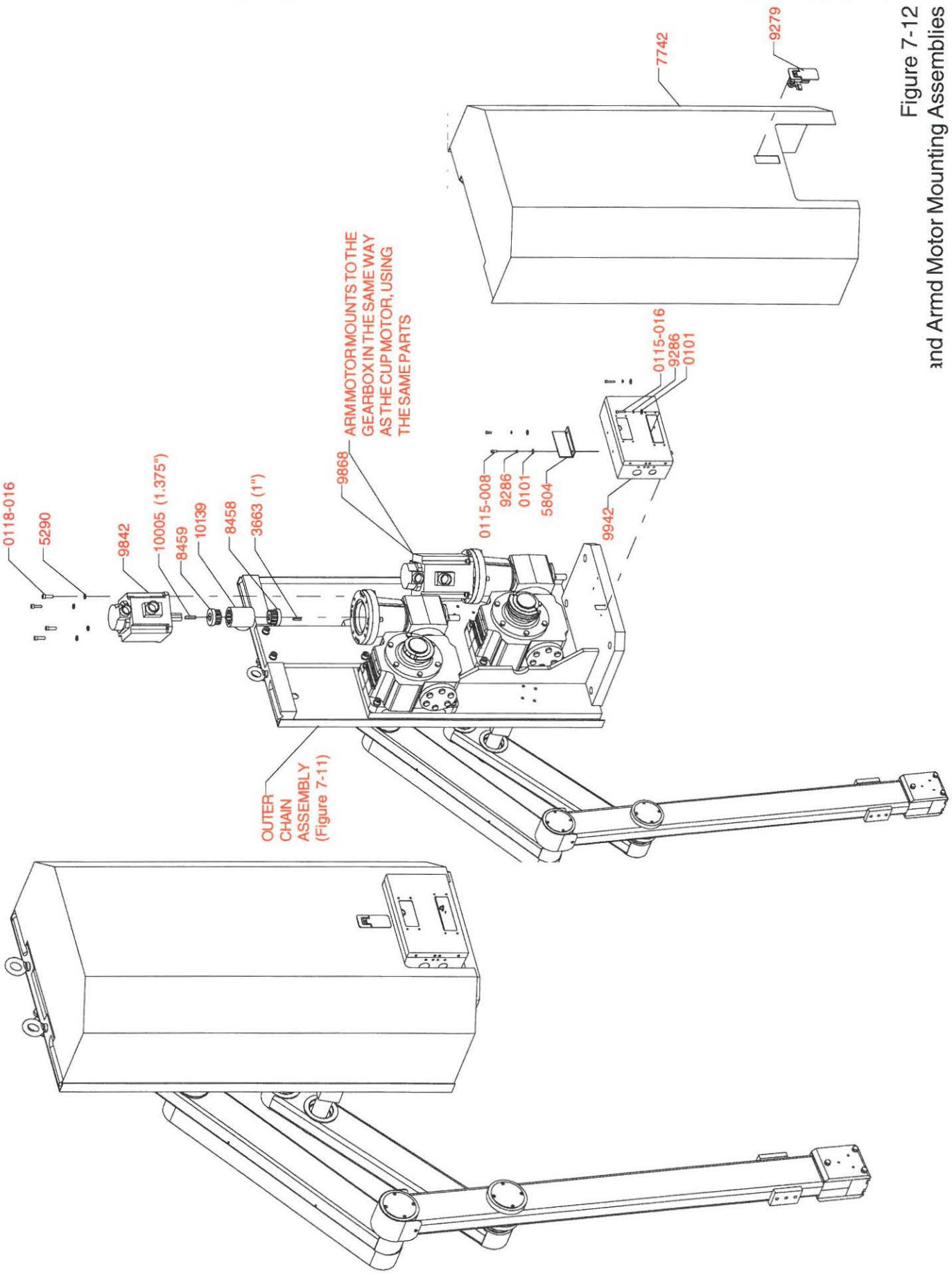


Figure 7-12
and Armd Motor Mounting Assemblies

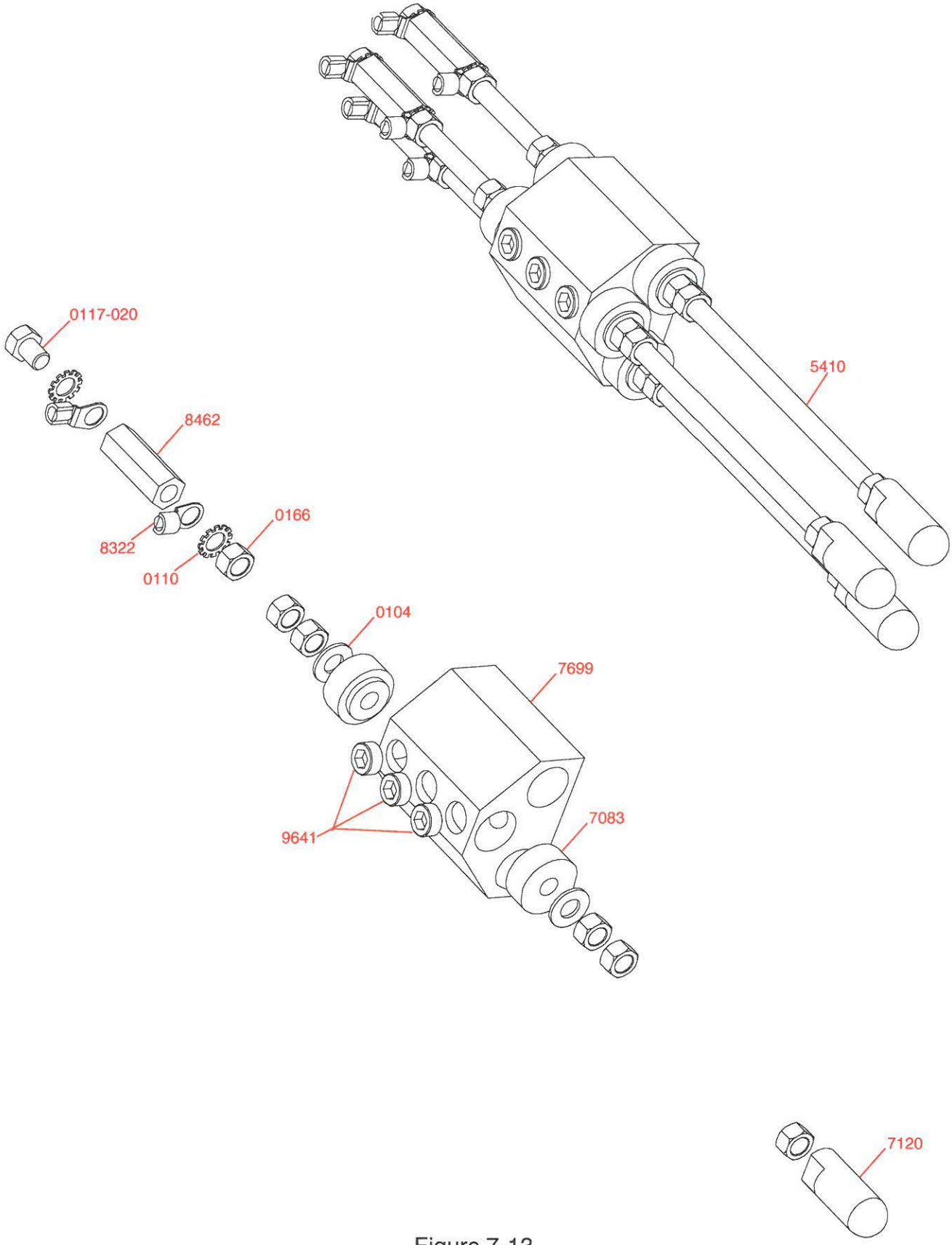


Figure 7-13
Probes Assembly

SL-1200 PARTS DESCRIPTIONS

PART#	QTY	TYP	DESCRIPTION
1545	1	EA	NUT, 7/8-9, HEX, FLANGE
1879	19	FT	CHAIN,#40 PRE-STRETCHED-single
1880	6	EA	LINK, CONNECTING, #40 CHAIN
3663	2	IN	KEY, 3/16 SQ (STEEL)
4210	2	EA	KEY, 3/8 SQ X 7.500, 55EP
5290	4	EA	WASHER, 5/16, LOCK, COIL
5294	8	EA	WASHER, 3/4, LOCK, COIL
5379	1	EA	CONNECTOR, 1/2" ARMORED CABLE,
5410	3	EA	ROD, THREADED, 3/8-16 X 17
5424	11	EA	BEARING,RADIAL,305KDD Standard
5425	16	EA	SNAP RING, INTERNAL, HO-244
5426	14	EA	SNAP RING, EXTERNAL, SHR-98
5804	1	EA	BAR, LATCH
5842	1	EA	PIN, LADLE CUP, 2.750 LONG
7083	6	EA	INSULATOR, PROBES, ALL LADLERS
7115	1	EA	SHAFT SHORT PIVOT
7116	4	EA	SPROCKET, 12 TOOTH SPROCKET
7117	5	EA	CAP BEARING 4 HOLE MOUNT
7120	3	EA	PROBE, TIP, ALL LADLERS
7122	1	EA	BAR, EYEBOLT
7123	2	EA	BLOCK POSITIVE STOP ARM
7125	1	EA	SHAFT LONG PIVOT
7126	1	EA	SHAFT, CUP
7130	1	EA	COVER, PLATE, TURNBUCKLE ARM
7134	1	EA	COUNTERWEIGHT ASSY COMPLETE
7135	1	EA	PLATE, EYEBOLT SUPPORT
7137	1	EA	SHAFT PIVOT - UPPER CUP ARM
7138	1	EA	COVER, COUNTERWEIGHT ARM CHAIN
7151	1	EA	ARM MAIN DRIVE LINK, SL1200
7152	1	EA	ARM, SMALL LINK, "DOG BONE"
7153	1	EA	ARM, COUNTERWEIGHT
7160-1	1	EA	COVER, ARM SIDE - OPERATOR
7160-2	1	EA	COVER, ARM SIDE, HELPER
7161	1	EA	ARM MAIN DRIVE 3 HOLE, SL1200
7170	3	EA	TURNBUCKLE, FOR #40 CHAIN
7177	1	EA	GEARBOX, 300:1, CONE DRIVE
7178	1	EA	GEARBOX, 300:1, CONE DRIVE
7396	2	EA	Locking Assy, .984 dia shaft
7699	1	EA	Probe Block - 3 Hole
7736	3	EA	CAM-SPLIT CAM FOR PROX SWITCH
7742	1	EA	COVER, MOTOR SIDE, 1200, BLUE
7789	1	EA	COVER, CUP ARM END
7930	1	EA	SPACER - CUP 650/1400/1500
7961	1	EA	VERTICAL PLATE ASSY. HELPER
7962	1	EA	VERTICAL PLATE ASSY. OPERATOR
8143	1	EA	Sprocket - #40 Chain 12 teeth
8322	6	EA	TERMINAL, RING, 8AWG, 3/8
8378	65	FT	WIRE, 16AWG, WHITE, PROBES
8462	3	EA	Coupler, 3/8-16 X 1.750, Hex
8464	2	EA	Seal, V-ring, CR, 400600
8504	2	EA	LABEL, TEMP,140-190F,TELETEMP
8613	2	EA	COUPLING, ASSY, 1400, GUARDIAN
8764	2	EA	LABEL, ADVANCE labels
8822	3	EA	SWITCH,PROXIMITY,AB,872C-D3NP
8827	5	FT	CONDUIT,FLEX,1/2",ALUMINUM
8846	5	EA	CLIP, CONDUIT, 1/2 RIGID
8851	1	EA	CONNECTOR,FLEX,REGAL,672,1/2"
8854	1	EA	CONDUIT COUPLING,1/2",GALV,
8990	2	EA	Standoff, 2.330" LG.
9001	2	EA	BRACKET, ARM PROX SWITCH
9218	2	EA	EYEBOLT, 1/2-13 X 1.50
9279	1	EA	LATCH, LADLE COVER
9379	2	EA	CLAMP COLLAR, 11/16ID X 1.50D
9497	1	EA	LABEL, MULTILINGUAL, YELLOW ON
9498	1	EA	LABEL, MULTILINGUAL, YELLOW ON
9526	2	EA	BEARING, HI TEMP
9775	2	EA	MOTOR ADAPTOR, MITSUBSHI TO
9842	1	EA	MOTOR, SERVO, 2000RPM, 1000W
9868	1	EA	MOTOR, SERVO, W/BRAKE, 2000RPM
9925	2	EA	KEY, 5/16 X 9/32 X 1-1/2, CRS
9946	1	EA	CUP ARM LINK, MACH'D, COMPLETE
9949	1	EA	CUP ARM LINK, MACH'D, COMPLETE
9950	1	EA	CAP, SPROCKET
9951	1	EA	CUP END INTERFACE
10065	1	EA	GEARBOX, 200:1, CONE DRIVE
10068	1	EA	GEARBOX, 200:1, CONE DRIVE
10141	1	EA	SHAFT, MOUNTING SHAFT FOR MAIN
10142	1	EA	SHAFT, MOUNTING SHAFT FOR CUP
10584	1	EA	SHAFT, MAIN, ARM, SL-1200
10585	1	EA	SHAFT, CUP ROTATE DRIVE
10587	1	EA	ARM, MAIN CRANK, WELDMENT
10617	6	EA	PIPE STRAP, 1/2", ONE HOLE
10903	2	EA	Nut,bearing Pt# N05
10904	2	EA	Washer, Bearing, PW05

ELECTRICAL CABINET PARTS DESCRIPTIONS

10119	1	EA	TRANSFORMER, 1PH, 240V, TO 120V, 250V, SQ-D 9070TF250D1
10124	2	EA	FUSE, 1 AMP, PRIMARY OF .25KVA
10125	1	EA	FUSE, 2 AMP, SECONDARY OF .25KVA TRANSFORMER
10235	1	EA	LABEL, "ADVANCE", CORPORATE, FOR COVERS AND ARMS
10237	1	EA	LABEL, CAUTION, MAIN POWER DISCONNECT
10305	1	EA	LABEL, WARNING, FOR CANADA
10385-002	2	EA	MITSUBISHI SERVO ENCODER CABLE SPRAYERS & LADLERS
10409	1	EA	ELECTRICAL CABINET, EMPTY W/SUBPANEL
10445	2	EA	24 POLE BASE, SHELL ILME CHI-24
10446	1	EA	16 POLE BASE, SHELL ILME CHI-16
10493	1	EA	LEGEND PLATE, EMERGENCY STOP LADLERS & SPRAYERS
10499	1	EA	SWITCH MECHANISM W/ RED PUSH BUTTON,E-STOP
10500	3	EA	CONTACT BLOCK W/ N.C. CONTACTS, E-STOP
10578	2	EA	FINGERSAFE TERMINAL COVER FOR SWITCH CONTACT BLOCKS
10581	1	EA	SWITCH, 12" SHAFT, DISCONNECT KIT FORM
4864	3	EA	FUSE BLOCK,INDICATING,110-250V
8007	1	EA	TRANSFORMER, 1PH, 120V X 24VCT 0.2A, 60HZ, PROBE
8026	1	EA	PUSHBUTTON, 3POS, MUSH, ILLUMINATED, 120V
8037	1	EA	RELAY, 230VAC, 3PHASE MONITOR
8129	1	EA	CONNECTOR,16PIN,FEMALE,(TERMINAL)
8131	2	EA	CONNECTOR,24PIN FEMALE,(TERMINAL)
8139	3	EA	FUSE, 6AMP, TIMEDELAY, 600V, 13/32 x 1.5
8314	2	EA	RELAY, SPDT, 24VDC/AC, 6A W/BASE
8371	1	EA	RELAY BASE, 8 PIN, OCTAL
8505	1	EA	LABEL, TEMP,100-130F,5DEG INCREMENTS
8586	1	EA	FUSE, 2AMP, FAST BLOW, 250V 5X20MM, GLASS
8803	4	EA	END ANCHOR
8839	60	EA	TERMINAL BLOCK
8840	8	EA	END BARRIER
8843	6	EA	TERMINAL BLOCK, GROUNDING
8867	5	EA	RELAY ASSY, BASE+RELAY+LED
8868	1	EA	RELAY ASSY, RELAY+BASE+LED
8869	4	EA	RELAY ASSY, RELAY+BASE+LED
9184	1	EA	RELAY, 120 COIL
9185	1	EA	CONTACT BLOCK,AUX
9197	1	EA	FUSE, 1AMP, FAST BLOW, 250V, .25X1.25, GLASS
9440	1	EA	LABEL, 2 7/16 SQ, RED, LADLER START
9843	1	EA	SERVO AMP, ANALOG, 1000W
9864	1	EA	PLC, 16 INPUT, 16 OUTPUT RELAY
9865	4	EA	CABLE, SERVO AMP TO TERMINAL BLOCK, 0.5 METER
9866	4	EA	TERMINAL BLOCK, USED WITH 9867
9867	1	EA	SERVO AMP, ANALOG, 2000 WATT

ELECTRICAL CABINET PARTS DESCRIPTIONS CONTINUED

9871	2	EA	MOTION CONTROLLER MODULE SGL. AXIS STEP/DIR CONT.#
9873	1	EA	CABLE, COMMUNICATIONS, PLC TO TOUCH SCREEN
9874	1	EA	EXPANSION MODULE,8 INPUT
9901	1	EA	HEAT EXCHANGER, 115VAC, LADLER 30 WATTS
9977	1	EA	IDENTIFICATION PLATE, SPRAYERS AND LADLERS
9983	1	EA	PLATE, DISPLAY ADAPTER, MITS. 610 OR 615 SCREEN
9984	1	EA	POWER SUPPLY, 24VDC, 3.12A
9986	1	EA	MOUNTING PLATE, 24 VDC POWER SUPPLY
9987	1	EA	MMI, TOUCH SCREEN, E615, MITS.

— NOTES —