

System 5100-AMC Automation and Monitoring Control (OT806 Operator Terminal)

Installation and Operating Manual

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OmniLink 5100

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1 INTRODUCTION

The OmniLink 5100-AMC Automation and Monitoring Control (referred to in this manual as the “Automation Control”) is a flexible, intelligent, modular system that can be applied to presses with existing clutch/brake and motor controls to provide a wide variety of control, press, die, and process monitoring - as well as management information functions.

The system can be applied to part revolution clutch mechanical power presses and to servo driven presses using a rotational drive system.

NOTE: When press types need to be referenced for differences in operation or configuration of the system, this manual will refer to part revolution clutch mechanical presses as “Mechanical Presses” and servo driven presses as “Servo Presses”

1.1 Base System

The base system hardware package consists of an Operator Terminal, an Automation Control Logic Board, and a resolver or encoder. The Operator Terminal and Automation Control Logic Board are usually mounted together in an enclosure - although the Operator Terminal can be panel mounted separately as well.

There are two different Operator Terminals that can work with this system – the OmniLink II LCD Operator Terminal (referred to in this manual as the “OT802”), and the OmniLink 806 Operator Terminal (referred to in this manual as the “OT806”). See section 2.1 to see how to identify the particular operator terminals.

NOTE: This manual covers operation of the Automation Control with the OT806 Operator Terminal. A separate manual covers operation with the OT802 Operator Terminal.

There are also two different generations of the Automation Control Logic Board. For the most part, operations with the two generations are identical. Where this is not the case, it will be pointed out in the manual. The first generation Automation Control Logic Board will be referred to as the 802-5 and the second generation as the 806-5. Section 2.2 explains how to identify which generation of Automation Control Logic Board a system is using.

1.1.1 Base System Standard Features

- Control reliable time base brake monitor with dual limits for top and mid-stroke stopping for part revolution clutch mechanical power presses.
- Clutch engagement time monitor that can aid in determining when clutch adjustment or disc replacement should be done for part revolution clutch mechanical power presses.
- Auto top stop compensation for variable speed part revolution clutch mechanical power presses.
- Motion detection to detect resolver decoupling from the crankshaft.

- Powerful counting capability with 12 flexibly configured counters.
- R2-232, RS-422, and RS-485 serial ports as well as CAN, Ethernet, and USB.
- Storage for 1000 jobs of settings associated with the standard and optional functions of the system.
- Operator screens are in English or Spanish at the touch of a key, intelligent diagnostics of the base system and all system options in English and Spanish, “Help” in English and Spanish that automatically appears on the display screen for many data entry fields for settings.

1.1.2 Base System Optional Features

- For part revolution clutch mechanical power presses, an optional Speed Control board allows stroking speed to be adjusted and displayed on the operator terminal even when not stroking for variable speed presses. It also allows motor load current to be displayed.
- For Servo presses, an optional input/output card allows operation with the servo drive to support various movement profiles (806-5 Automation Control Logic Board only).
- Serial Feed Interface for most electronic roll feeds.
- MODBUS protocol is available over serial or Ethernet ports for connectivity to PLC’s or data collection programs.
- LinkNet shop floor information collection system. Networks your presses to gather information and provide comprehensive management information database and reporting system.

1.2 Optional Hardware Modules

The system is designed to allow additional hardware modules to be added to the base system package to perform a wide variety of control and monitoring functions. The system uses distributed intelligence - each optional module has its own microprocessor to perform its logic functions. This provides increased computing power and superior performance, allowing more logic functions to be performed at greater speeds. All optional modules communicate to each other and to the operator terminal through a high speed bus cable with only four connections. This eliminates the need to individually wire all inputs and outputs back to the operator terminal. Adding modules is simple and quick; mount the module, wire in power, and wire the communication cable from the last module previously installed to the newly installed module.

Optional hardware modules that are available for the system are:

- Die Protection and Process Monitor modules are available with 8 or 16 sensor inputs per module. Up to five modules may be used with the system, giving a maximum of 80 total inputs for digital die protection and process monitoring.
- PLS/Logic Modules are available with 8 or 16 output relays (electromechanical, solid state ac, and solid state dc relays available) for programmable limit switch (PLS) functions. Each module also has 16 inputs available for logic or sensing applications. Up to twelve PLS modules may be used with the system for a maximum of 96 PLS channels.

- A Tonnage and Analog Signal Monitor measures and displays the force (tonnage) being applied to the frame of a press from up to 4 channels. An optional additional 4 channels can be added that work with strain gages, voltage output sensors, and 4-20 milliamp output sensors to enable in-die on-the-fly analog part measurement and monitoring. Another option adds four standard die protection inputs and 4 solid state PLS outputs to this module.
- The 5100-14 Auto Setup Module can control and monitor shutheight, counterbalance pressure, and cushion pressure. Controlled systems are automatically set up when a job is recalled.

1.3 System Overview

Figure 1 shows the general system layout of a 5100-AMC system.

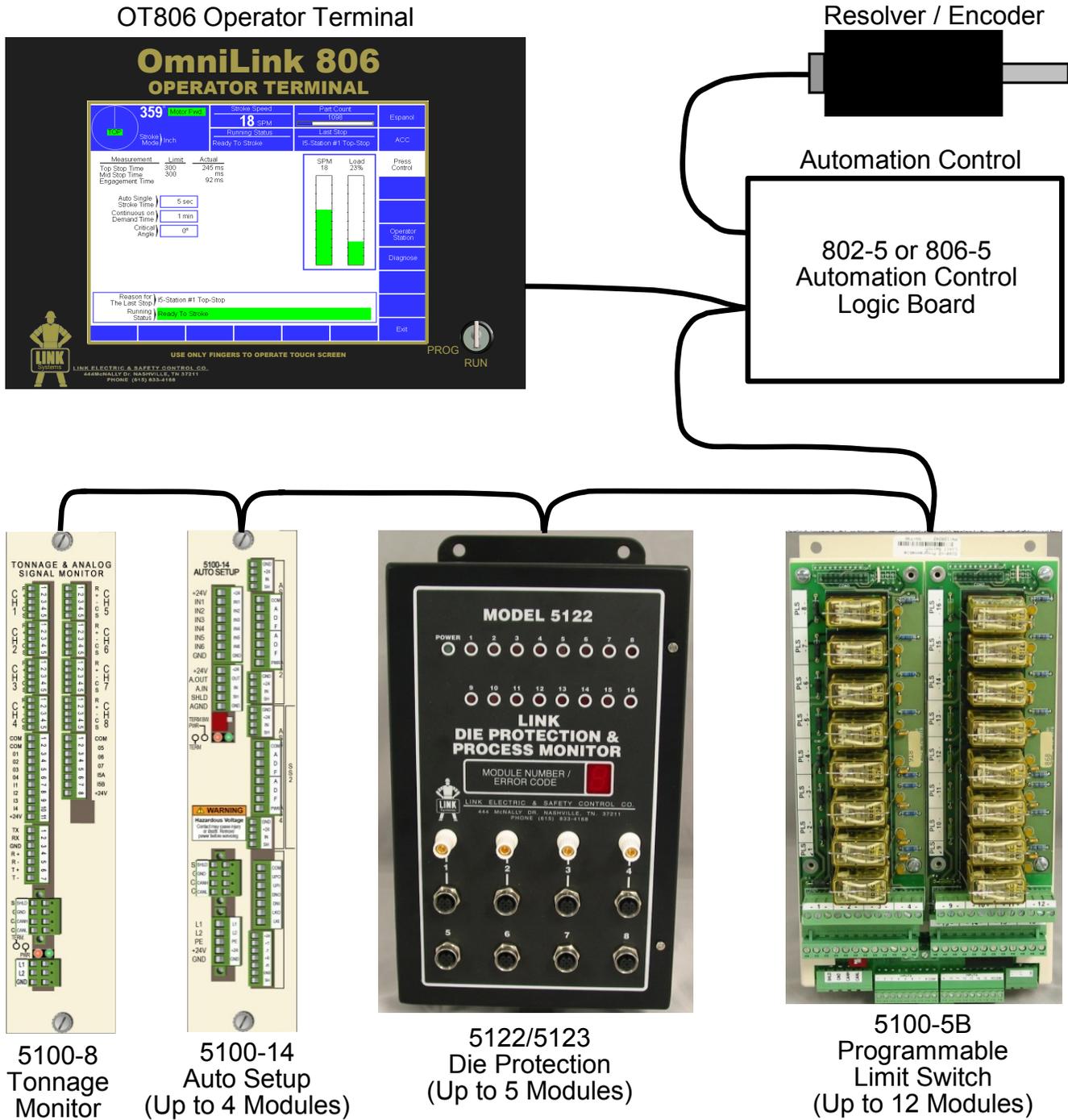


Figure 1: 5100-AMC General System Layout

2 DEFINITIONS AND TERMINOLOGY

2.1 Operator Terminals

The OmniLink 5100-AMC Automation and Monitoring Control is supported by two different operator terminals, the OmniLink II LCD Operator Terminal (OT802) shown in Figure 2, and the OmniLink 806 Operator Terminal (OT806) shown in Figure 3.

The operation and configuration of the system is very similar on both of these terminals as the screen navigation and layout is nearly the same, but does differ in certain areas.

This manual covers operation with the “OmniLink 806 Operator Terminal” (OT806). A separate manual covers operation with the OT802.

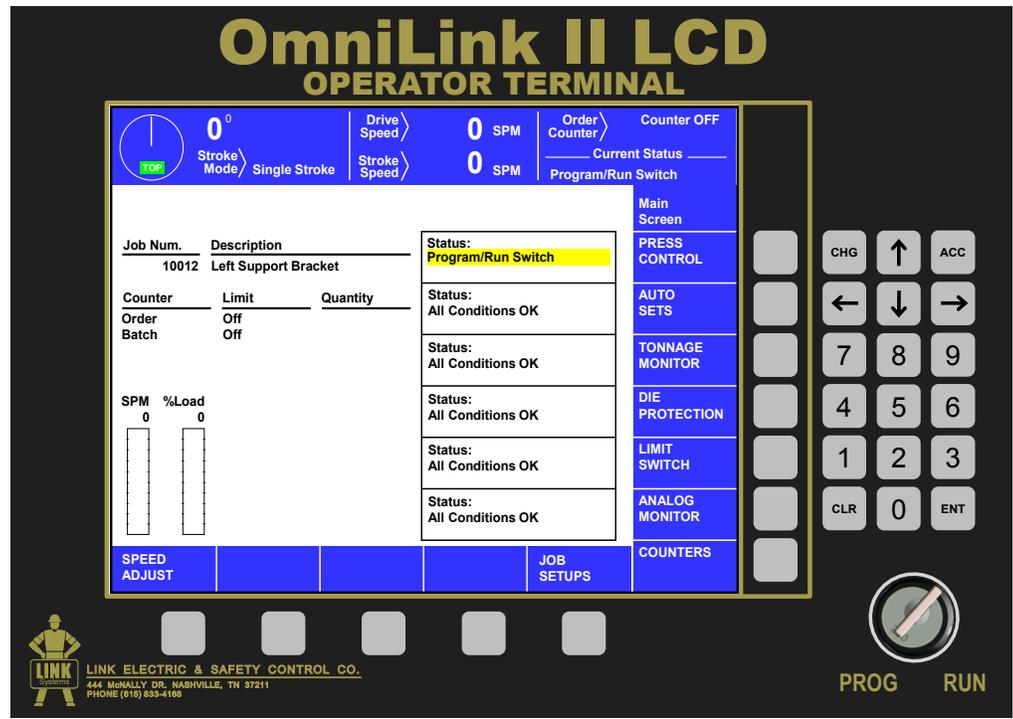


Figure 2: OT802 Operator Terminal

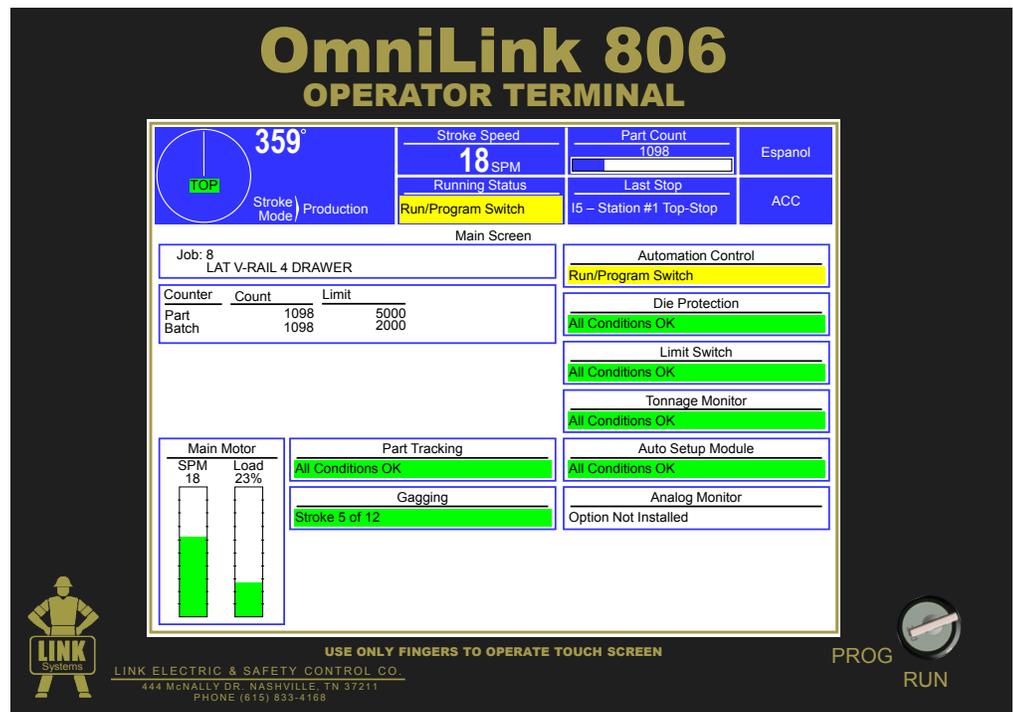


Figure 3: OT806 Operator Terminal

2.2 Automation Control Logic Board Generations

As mentioned in the introduction, there are two generations of Automation Control Logic Boards. For the most part, these boards function identically – but there are a few differences in capabilities that will be pointed out as appropriate throughout the manual. Where these differences occur, the first generation Automation Control will be referred to as the 802-5 and the second generation as the 806-5.

2.2.1 First Generation Logic Board (802-5)

The first generation of Automation Control Logic Board, referred to in this manual as the “802-5”, can be seen in Figure 4.

This board uses socketed EPROMs for its program storage. It has most of the capabilities of the second generation 806-5 Automation Control Logic Board when dealing with part-revolution mechanical power presses, but does not support the advanced movement capabilities of newer servo presses.

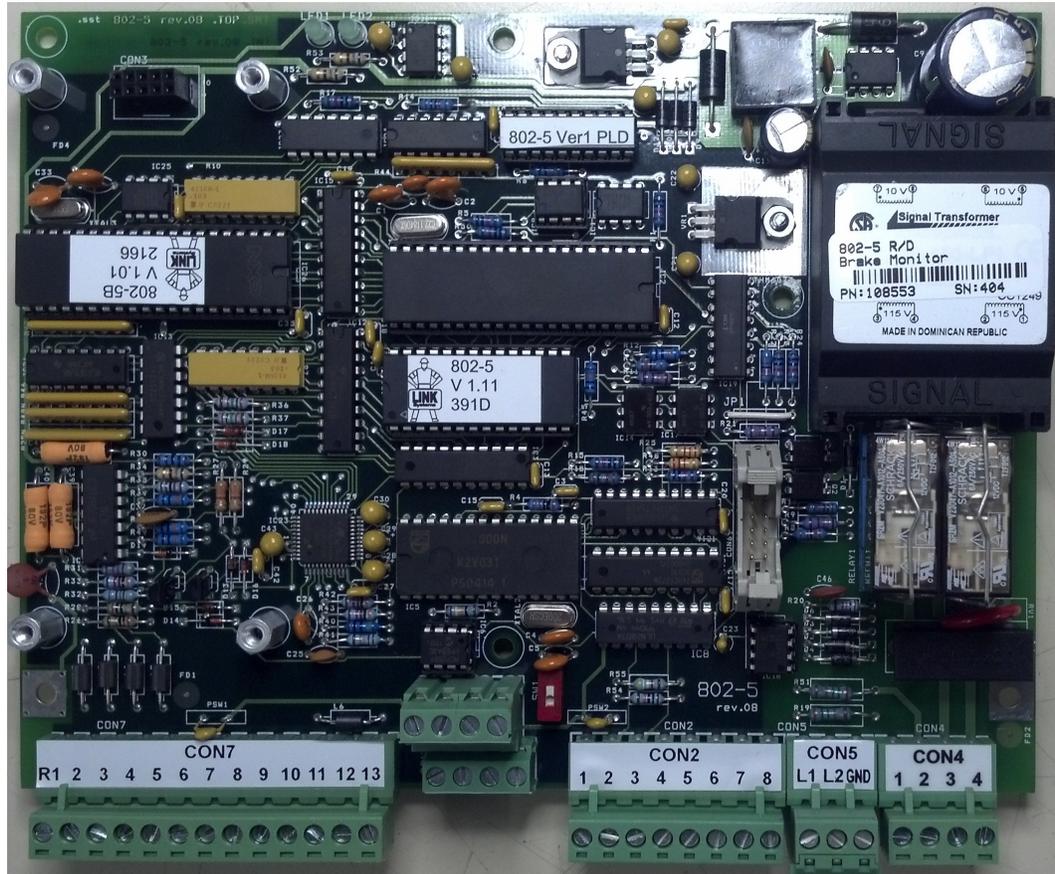


Figure 4: 802-5 Automation Control Logic Board

The circuit board itself is labeled as “802-5” with Link part number 108553. It is distinguished from the second generation board most easily by the program version labels on the socketed chips and the location of the two Immediate Stop relays near the CON4 connector (lower right of the board).

2.2.2 Second Generation Logic Board (806-5)

The second generation of Automation Control Logic Board, referred to in this manual as the “806-5”, can be seen in Figure 5.

This board uses flash memory for its program storage and can be updated from the OIT with a program update card. It has all of the capabilities of the first generation 802-5 Automation Control Logic Board when dealing with part-revolution mechanical power presses, and also supports the

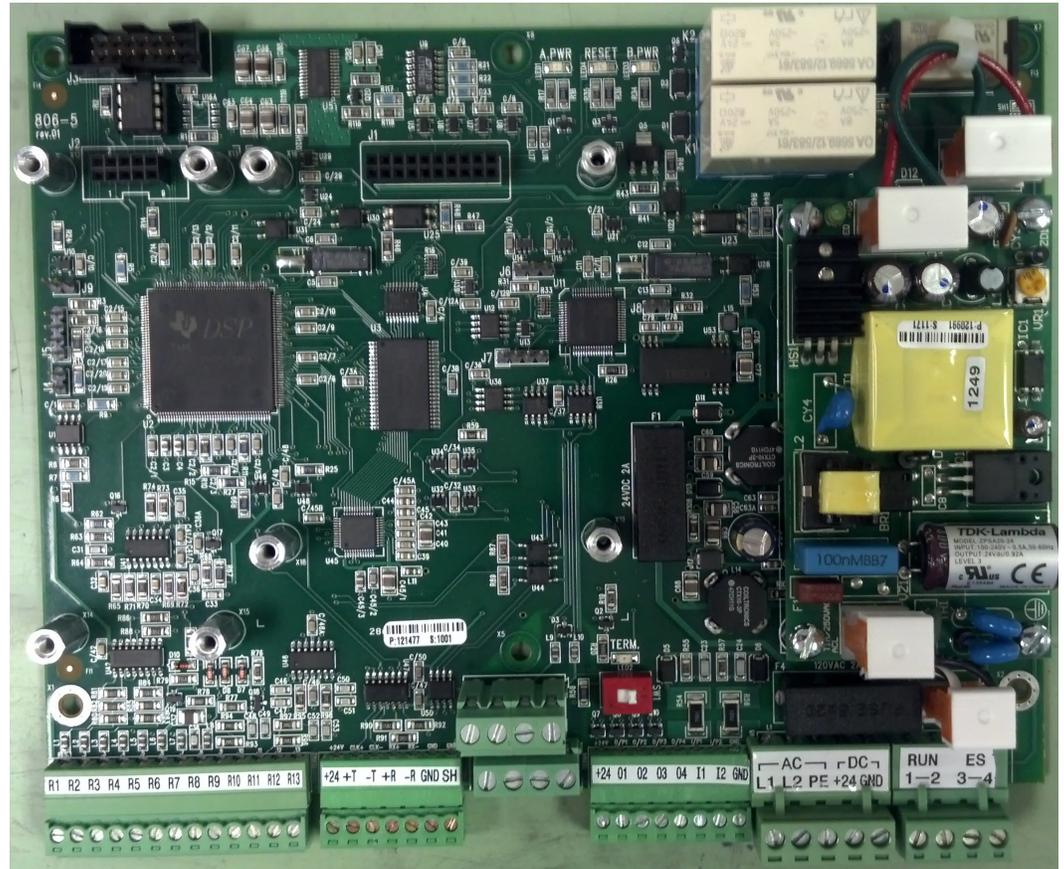


Figure 5: 806-5 Automation Control Logic Board

advanced movement capabilities of newer servo presses. Along with the resolvers supported by the first generation board, this board can also support SSI interface encoders, such as the Link 5100-11 and others – depending upon the application requirements.

The circuit board itself is labeled as “806-5” with Link part number 121477. It is distinguished from the first generation board most easily by the universal power supply located along the right side of the board and the location of the two Immediate Stop relays near the upper right of the board.

2.3 Stops

There are three different kinds of stops that the system can generate. Some conditions always generate a particular kind of stop, while others are programmable by the user.

2.3.1 Immediate Stop

An “Immediate Stop” sends a signal to the control to immediately stop the press, regardless of where it is in the cycle. Note that this does NOT mean that the press will actually stop at the point where the stop was generated, as all presses take some amount of time to drop out the clutch, apply the brake, and come to a stop. For instance, if a decision to stop occurs at 175 degrees, the press may end up stopped at 200 degrees. The number of degrees a press requires to actually stop depends (among other things) on the design of the press and on stroking speed. All other conditions being equal, the faster the press is stroking, the longer it requires to stop.

2.3.2 Top Stop

A “Top Stop” sends a signal to the control to stop the press at the top of the stroke. Note that all presses take some amount of time to stop. If the control determines that it cannot stop at top in the time left when it receives the stop command, it will make an additional stroke. Many high speed presses take more than 1 full stroke to stop regardless of where the stop occurs.

2.3.3 Intelli-Stop

An “Intelli-Stop” sends a signal to the control to “Immediate Stop” if the stop can be accomplished by a certain “Critical Angle”, otherwise it will “Top Stop”. This stop type is used to attempt to prevent sticking the slide on bottom under load. For instance, for a particular job the critical angle might be set to 170 degrees. If the control determines that the press can stop before this angle is reached, it will issue an “Immediate Stop” to attempt to prevent further damage to the machine and/or tooling. If, however, the control determines that the press will not be able to stop before 170 degrees, it will issue a “Top Stop” to minimize the chance of sticking the slide, since the press was going to go through the bottom anyway.

The Intelli-Stop function works by using two pieces of information. The first is a job-related parameter called the “Critical Angle”. The second is the calculated number of degrees it will take to stop the press at its current speed, using the stopping characteristics configured for the top stop calibration performed at the installation of the system.

2.3.3.1 Critical Angle

The Critical Angle for a given die in a given press is the greatest downstroke angle that can occur without upper die parts closing on material or lower die parts. The downstroke angle at which the upper die closes on material depends on the die design. Draw dies will generally close on material at an earlier downstroke crank angle than a blanking die. Any stop signal that results in stopping beyond the critical angle increases risk of sticking the press on bottom. Any stop signal that causes the press to stop before the critical angle will keep the press from sticking on bottom and reduce the risk of a damaged die or press.

Determine the critical angle for a particular job with the dies in the press and adjusted to their proper shutheight. Inch the press slide downward until just before dies close on the material and then stop the inching process. In some cases, it may be preferable to determine where the dies would close on a double thickness or more of material, if that an issue with that particular setup. Once you have inched the slide to the position as described, observe the angle display at the upper left of the operator terminal display. Enter a critical angle setting equal to the angle indicated on the display.

2.3.3.2 Intelli-Stop Angle

The Intelli-Stop angle is the last angle at which an “Immediate Stop” signal may be issued to stop the press at or before the Critical Angle. The Intelli-Stop angle is automatically computed by the system based on the calculated number of degrees to stop at the speed the press is running when the stop is requested. The Critical Angle is “rolled back” by the number of degrees to stop to get the Intelli-Stop Angle. For variable speed presses, this number will change based on speed.

The mechanics of stopping in the downstroke are somewhat different than stopping at top of stroke. Also, gradual clutch/brake wear will increase stopping distance. For this reason, it is advisable to subtract about 10 degrees from the ideal Critical Angle to allow for these factors.

2.4 Servo Press Terms

This section introduces some terms used with Servo Presses that are used in this manual. Different press manufacturers may use terms other than these, so the terminology used in the Automation Control is defined here.

2.4.1 Cycle

A “cycle” when used in the context of a Servo Press represents a complete sequence of motion that constitutes the equivalent of one stroke on a Mechanical Press. For some motion types, this will not be a complete revolution of the crank.

2.4.2 Motion Profile

The “Motion Profile” of a Servo Press, is the particular set of movements, which can include direction changes and speed changes (even pauses) that make up a cycle of motion.

2.4.3 Step

A “step” when used in the context of a Servo Press is one segment of a “Motion Profile”. For instance, consider a motion profile that start at 0 degrees, runs clockwise at 20 SPM until it hits 150 degrees, slows to 10 SPM until it hits 190 degrees, and then runs back to 0 at 30 SPM. This motion profile consists of 3 steps (the speed changes) even though no change of direction took place.

2.4.4 “Normal” Motion

“Normal” motion when used in the context of Servo Press is such that the press ends up making a complete revolution each cycle by running in the forward direction into the Top of Stroke window. The press may stop at the top of the stroke or run continuously. Note that this specifically *Does Not* mean that the press cannot slow down, speed up, or make direction changes through the cycle – only that it ultimately makes a complete revolution as part of its production cycle. See Section 3.10.2.1 on page 53 for more information on motion types including examples and diagrams.

2.4.5 “Pendulum” Motion

Pendulum motion is that which is symmetric about bottom dead center (180 degrees) and does not go through the top of the stroke during continuous operation. See Section 3.10.2.1 on page 53 for more information on motion types including examples and diagrams.

2.4.6 “Asymmetric” Motion

Asymmetric motion is that which ends the cycle back at the motion profile start angle without ever running back into the top of stroke window in the forward direction. See Section 3.10.2.1 on page 53 for more information on motion types including examples and diagrams.

3 OPERATION

3.1 Operator Terminal Basics

Figure 3 on page 13 shows the OT806 operator terminal front panel. This panel consists of a color LCD display with a touch screen and RUN/PROG key switch.

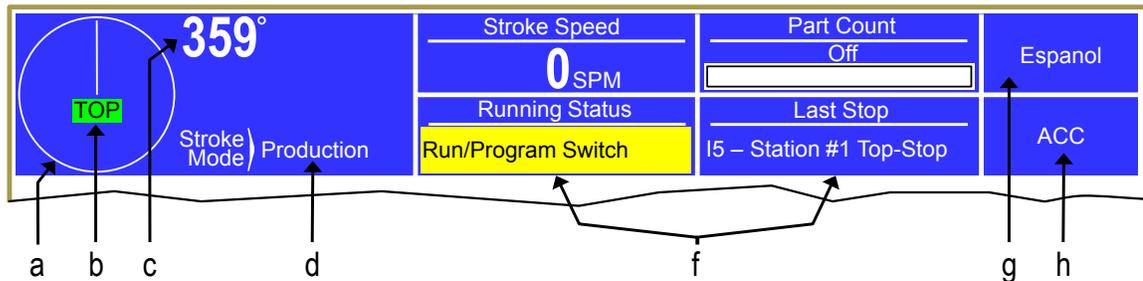


Figure 6: Operator Terminal Top Info Area

The top area of the operator terminal is used to display certain critical information and provide keys that are present regardless of what screen is being displayed. The areas are (refer to Figure 6):

- a) Graphical Display of Crankshaft Angle** For speeds below 70 SPM or so, this will show the crankshaft angle in either a “clock” format (this is the mode shown in Figure 6) or a “traveling dot” format. Press the screen inside the circle to switch between the formats (this can be done at any time, including while the press is in motion). Above 70 SPM, this will change to rotating arrows to indicate crankshaft motion.
- b) Top/Bottom Indicator** When the press is stopped within +/- 5 degrees of the top of the stroke, “TOP” will appear in a green background. When stopped within +/- 5 degrees of bottom, “BOT” will appear in a yellow background. Note that for certain presses (such as link drives) “Top” may not be at 0 degrees.
- c) Numeric Display of Crankshaft Angle** This area provides a numeric readout of the crankshaft angle using larger digits so that they can be read more easily from a distance.
- d) Press Mode** This will display whether the press is in setup or production mode, if the mode input is used. If the mode input is not used, this item will not appear.
- f) Programmable Display Area** These 4 areas can display a variety of information, based on user selection. Some examples items available include press speed, control running status, press control reason for the last stop, part count, and distance to the bottom of the stroke. Press inside these areas to cycle to the next available item. The operator terminal can also be configured to automatically show a particular set of items when the press control mode is switched from a setup mode to a production mode, and vice versa. See Section 4.3.1 for more information on configuring these areas and the information items available.

- g) Language Switching Key** This key is used to switch languages used on the operator terminal see Section 3.1.2 for more information.
- h) Quick Access Key** This key displays the Quick Access screen. See section 3.1.1 for more information.

Areas inside the white portion of the display are shown with a blue border if that area can be selected. For example, pressing the blue bordered jobs area or the blue bordered counters area will take you to screens related to jobs or counters, respectively. Areas usually displayed along the right side and bottom of the display provide softkeys which may be selected by pressing the field. For example, pressing the “Die Protection” bordered area in Figure 6 will select the die protection screen.

3.1.1 ACC Softkey

This is a quick access key. This key will supply direct access from any screen to the Quick Access screen. The quick access screen contains the name of the currently logged in user, the log out softkey, and access to auxiliary communications.

3.1.2 Espanol/English Softkey

This changes the display language from English to Spanish or Spanish to English. If the display is currently in English, touching the **Espanol** softkey will change the display to Spanish. If the display is currently in Spanish, touching the **English** softkey will change the display to English.

3.1.3 RUN/PROG (Run/Program) Switch

This is a keyed selector switch read directly by the operator terminal. The PROG (program) position causes the press to perform a Top Stop, and prevents stroke initiation until the switch is returned to the RUN position. There are several user access modes that will require the operator to turn the keyed selector to PROG position in order to modify parameters. This switch must be in the PROG position for control configuration, as described in Section 3.3 on page 23.

3.1.4 Automatic LCD Turn Off

To increase the life of the display backlight, the backlight will automatically dim ten minutes after the operator terminal detects no user activity. User activity for this purpose is defined as pressing the touch screen or operating the RUN/PROG switch. The backlight is turned back on and the ten minute timer is reset any time the touch screen is pressed on the operator terminal or the RUN/PROG key is operated.

3.2 Parameter Entry

Throughout the operator terminal, a standard form of data entry is employed. Parameters that can be changed are indicated by a blue border surrounding the parameter. Touch inside the blue border to edit the parameter.

3.2.1 Numeric Entries

A numeric parameter to be changed is selected by pressing the area on the screen that displays the parameter (surrounded by a blue border). This will bring up an editing screen similar to Figure 7.

If the parameter contains a decimal point, it will be positioned automatically by the operator terminal. The new number is entered with the numeric keypad.

The **Clear** key will clear the present number being entered, and the **Back** key will go back one number. The up and down arrow keys at the bottom right and bottom left of the numeric keypad will increment and decrement the number, respectively.

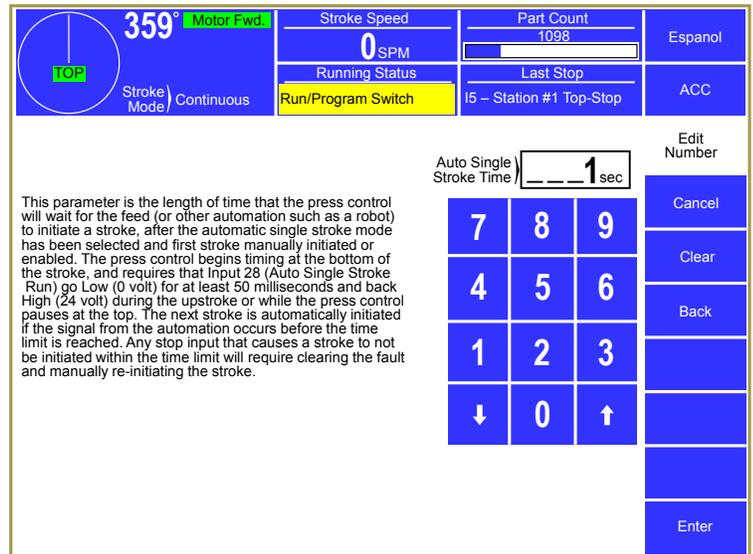


Figure 7: Example Numeric Entry Screen

Press the **Enter** key to accept the new number or abort the change by pressing the **Cancel** softkey. The number will not change from the previous value if the entry process is canceled.

3.2.2 Text Entry

A text parameter to be changed is selected by pressing the area on the screen that displays the parameter (surrounded by a hollow blue box). This will bring up an editing screen similar to Figure 8.

The editing cursor position is shown by a black background on the character the cursor is sitting on. Characters typed on the virtual keyboard will appear at the editing cursor, and the cursor will automatically advance to the next position as characters are “typed”. The cursor can also be moved by pressing the **Cursor Left** and **Cursor Right** softkeys.

To erase characters, position the editing



Figure 8: Example Text Entry

cursor at the start of the characters to erase and hit the **Space** softkey. Likewise, to change a character, position that editing cursor on that character and select the new character. The **Clear** softkey will cause all characters to be erased.

Press the **Lower Case** softkey to display a virtual keyboard with lower case letters. The **Lower Case** softkey will then change to **Numbers & Misc**. Pressing that key will change the virtual keyboard to one that has numbers and other characters on it. The **Numbers & Misc** softkey will then change to **Upper Case**. Pressing **Upper Case** brings the virtual keyboard back to its original configuration with upper case letters.

Once the text is correct, press the **Enter** softkey to keep the changes or press the **Cancel** softkey to abort the changes.

3.2.3 Selection from a List

Some parameters are not numeric or text, but instead are selected from a list of options. As usual, these parameters are displayed inside a hollow blue box. To change the parameter, press inside the blue box to bring up a selection screen that will be similar to that shown in Figure 9.

Note that the listed selection may all fit on one page or may take several pages to display. If more than one page is necessary to display the list, **Next Page** and **Previous Page** softkeys will be displayed as appropriate.

To choose a new selection for the parameters, press inside the blue box of the new selection. This will cause the new parameter to take effect. Press the **Cancel** softkey to exit the selection screen with no change to the parameter.

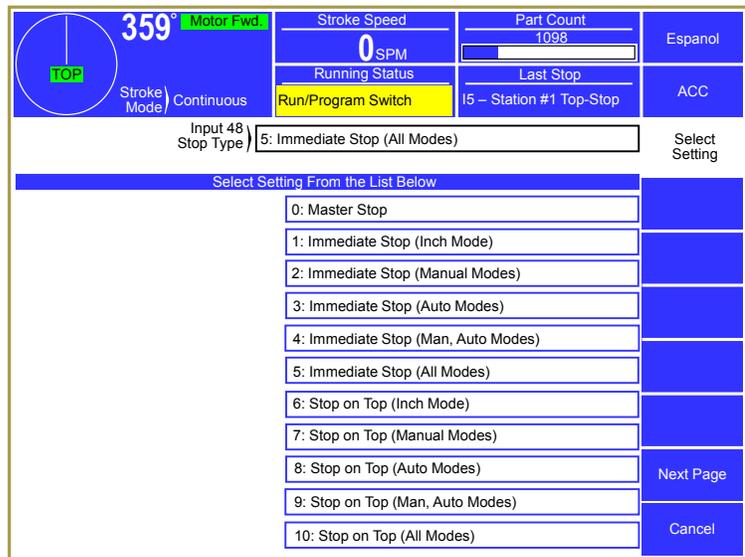


Figure 9: Example List Selection

3.3 Access Control

The System 5100 control has several layers of security relative to configuration of its logical operation of hardware and software and ability to program parameters. The highest level of security is applied to the Factory Configuration items that are used to configure the control before it leaves the factory for the specific press production system requirements and options specified by the purchaser.

In addition, the System 5100 control provides a second level of security - User (Employer) Configuration items that give the user the ability to configure certain aspects of the system to meet his security, information, safety, and production requirements. One of the areas of User Configuration relates to Access Control – a third level of security that allows the person(s) the user designates to make certain parameter settings and reset faults. See Section 4.3.4 for the configuration of the Access Control methods discussed in this section.

The System 5100 control has several parameters or operations that have, or can be configured to have, limited user access, i.e., by employees specified by the user (employer). The ability to perform actions such as job recall, job storage, or changing a tonnage monitor channel limit can be limited to certain personnel. The control provides several means to limit access to these parameters or operations. A complete list of the parameters and operations that can be, or are, limited as to access is listed in the Restricted Items table in Section 3.3.5. The control has the capability to make some of these limited access items available to any operator. Access to these items can be globally un-restricted. The items which can be un-restricted to all users are also listed in the Restricted Items Table shown in Section 3.3.5.

In addition to the restricted items listed in the Restricted Items Table shown in Section 3.3.5 there are other parameters that have limited access. These parameters, such as top stop angles and brake monitor settings that are critical to the correct or safe operation of the press, are not listed in the table of user limited access items. Access to the User Configuration screens and their parameters is protected by the RUN/PROG key and the User Configuration code. Access control will grant access only to the third level security items listed in the Restricted Items Table.

The System 5100 control employs combinations of two different means to limit access to restricted items. These means are the RUN/PROG key switch and a user password system. The user password system assigns names and passwords to up to sixteen users. These two means can be used alone or in combination with each other. When a user employs the proper means to gain access control, he will have the ability to perform the actions and change the parameters which have been designated to his access.

There are four possible modes of operation for the access system. They are the “Key Only” mode, the “Key or Password” mode, the “Password Only” mode, and the “Key and Password” mode. The control can be configured to operate in any one of these four modes.

3.3.1 Key Only Mode

The “Key Only” mode is the least complex of the four modes. This mode employs the RUN/PROG key as the one means of access. Access to restricted items is granted when the RUN/PROG key is in the PROG position.

Although the “Key Only” mode has the advantage of being easy to use, it does have a disadvantage. This mode cannot give a particular user access to only some of the restricted items. When operating in this mode, any user with the RUN/PROG key will have access to all of the restricted items.

3.3.2 Key or Password Mode

The key or password mode allows for either of two means to gain access to the restricted items. Access to restricted items is granted when the RUN/PROG key is in the PROG position. In addition, a user without the RUN/PROG key but with the correct password can access the restricted items that have been designated for the particular user’s access only. The system allows for passwords to be assigned to sixteen users. Each user can be assigned access to any or all of the restricted items.

The following is an example of a “Key or Password” mode operation. The RUN/PROG key is given to the die set-up personnel. A press operator is assigned a user name and password. With the password the operator is assigned permission to reset tonnage monitor faults, reset die protection faults, and reset counters. These are the only three items to which the operator has access. In order to load a die, the set-up personnel must use the RUN/PROG key to recall a job from job storage. The set-up personnel will also be able to make changes to programmable limit switch settings, tonnage monitor settings, and die protection settings. Once the set-up personnel sets the die and verifies its correct operation, the operator is left to run the die. If a tonnage monitor fault occurs, the operator can enter the correct password and then reset the fault. However, the operator cannot change a tonnage monitor limit. This will allow the operator to keep running the job and reset faults that occur. However, if consistent stops occur because a tonnage monitor high setpoint is being exceeded, the set-up personnel must be called to change the tonnage monitor limit, if it has been determined that the limit should be increased.

The example above can be taken one additional step, if two press operators are given different user names and different passwords. One operator can be assigned the ability to change tonnage monitor limits in addition to the ability to reset the tonnage monitor, while the other operator is not assigned the ability to change the tonnage monitor limits. The control will allow for sixteen users each with a user name, password, and access to selected or all restricted items.

3.3.3 Password Only Mode

The “Password Only” mode allows for sixteen users. Each user can be assigned access to some or all of the restricted items. This mode does not use the RUN/PROG key.

The example listed above indicated that setup personnel required access to all restricted parameters. In the “Key or Password” mode, the setup personnel used the RUN/PROG key to gain access to all of the restricted parameters. In the “Password Only” mode, the setup personnel can still have access to all of the restricted parameters, but the system must be configured as such. The setup personnel must be assigned a user name and password. In addition, all restricted items would be assigned access to the setup personnel.

Since there is no access to all restricted items with the RUN/PROG key, every restricted item must be assigned to at least one user. If any restricted item is not assigned to at least one of the users, it cannot be accessed. For example, if Erase Jobs is not assigned to at least one user, it will be impossible to

perform the erase job function. Access to the Erase Jobs must be assigned to at least one user, before the erase job function can be performed.

3.3.4 Key and Password Mode

The “Key and Password” mode requires the user to have the RUN/PROG key, a user name, and a user password. Operation is basically the same as the Password only mode, except that in addition to entering the password the user must switch the RUN/PROG key to the PROG position.

Since there is no access to all restricted items with the RUN/PROG key only, every restricted item must be assigned at least one user. If any restricted item is not assigned to at least one of the users, it can never be accessed.

3.3.5 Restricted Items

The following table lists the restricted items name and function. Some items can be unrestricted. When an item is unrestricted, it is available to any user. Unrestricted items do not require a key or password.

RESTRICTED ITEMS		
NAME	FUNCTION	CAN BE UNRESTRICTED
Reset Brake Monitor	Reset Brake Monitor faults	Yes
Auto SS / COD Time	Change the “Automatic Single Stroke Time”, and the “Continuous on Demand Time” in the Press Control screen.	
Critical Angle Setting	Change the “Critical Angle” in the Press Control screen.	
Drive Speed Adjust	Adjust drive speed	Yes
Store Jobs	Store jobs in memory	
Recall Jobs	Recall jobs from memory	
Erase Jobs	Erase jobs in memory	
Counter Settings	Change counter limits and turn counters off and on	Yes
Counter Change	Change counter values	Yes
Counter Reset	Reset counters that have reached their limit	Yes
Counter Config.	Configure counters	Yes
PLS Settings / Names	Change Programmable Limit Switch set points and names	
PLS Reset	Reset PLS Faults	Yes

RESTRICTED ITEMS		
NAME	FUNCTION	CAN BE UNRESTRICTED
DP Settings	Change the Die Protection settings	
DP Reset	Reset the Die Protection	Yes
DP Bypass Setup	Bypass the Die Protection	Yes
DP System Bypass	Bypass the Die Protection	
DP Limited Bypass	Bypass the Die Protection	
TM Peak High Limits	Change the Tonnage Monitor high limits	
TM Peak Low Limits	Change the Tonnage Monitor low limits	
TM Reverse Limits	Change the Tonnage Monitor reverse limits	
TM Auto Setup	Perform a Tonnage Monitor automatic limit setup	
TM Reset	Reset the Tonnage Monitor	Yes
TM Bypass	Bypass the Tonnage Monitor	
Feed Settings	Change feed settings	

3.3.6 Password System Operation

When selecting a restricted item for editing on an OT806 operator terminal where an access code is needed, the following sequence would be followed:

- 1) After selecting the item to edit as usual, the top line of the screen will show the needed action highlighted in yellow. In the case where an access code is required the top line would read “Access Code Needed – View Only”.
- 2) Press the **Access Code** softkey. This will cause a list of users that have the needed permission to be displayed. Touch the user desired and the system will prompt for the access code for the selected user.
- 3) Once the correct access code is entered, the normal editing screen for the parameter will be displayed.

After performing the steps listed above, the user will be logged in to the password system. The user will have access to all restricted items that have been designated for his access. This access will remain until the user performs a log out or until the user is automatically logged out.

The user can log out by using the **ACC** key. This key will directly switch the display to the Quick Access screen. The **Logout** softkey will appear to the right of “Current Login” near the top of the

screen. If the operator presses this key, he will log out. He will no longer have access to the restricted items, unless he repeats steps 1 through 3.

In addition to the manual log out, the system contains an automatic logout. The intent of automatic log out is to reduce the possibility of users other than the intended user from having access to restricted items. If there were no provisions for automatic log out and a user forgot to manually log out, all restricted items to which the user had been designated for access would be available from the log in time until power was removed from the System 5100 control. This presents the possibility of users other than the intended user having access to restricted items. Automatic log out is based upon both time and press strokes. During system configuration automatic Access Timeout parameters are entered. An automatic access timeout time and automatic access timeout strokes are entered. The time entered is the amount of time after the last keystroke that will be allowed before the system will automatically log out the user. For example, if the automatic access timeout is set to 60 seconds, the user will be logged out 60 seconds after the last keystroke. If the user depresses a key before the 60 seconds have elapsed, a new 60 second cycle will be started. The number of strokes that are entered is the number of press strokes after the last keystroke that will be allowed before the system automatically logs out the user. For example, if the automatic timeout is set to 10 strokes, the user will be logged out when the press completes ten strokes after the last keystroke. If the user depresses a key before 10 strokes have been completed, a new 10 stroke cycle will be started (See Section 4.3.4.2)

3.4 Main Operator Terminal Screen

The operator terminal main screen at right shows the current status of the different options connected to the system (see the column pointed to by “e” in Figure 10). This is the screen displayed when the unit first powers up and provides an overall view of the functions available along with general diagnostic information.

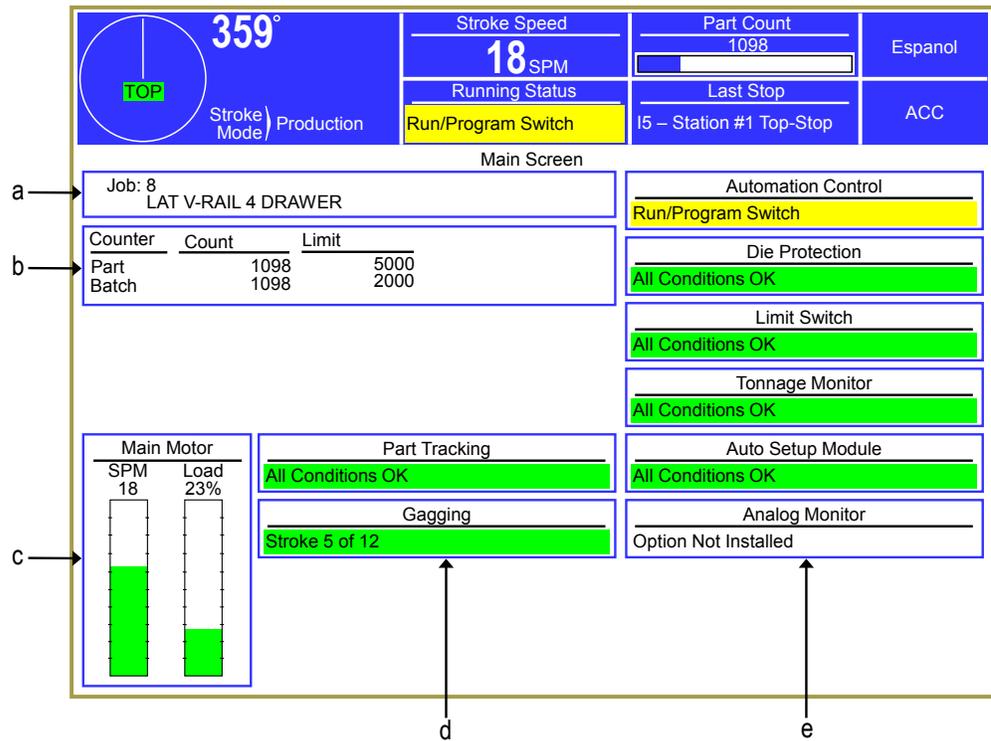


Figure 10: Operator Terminal Main Screen

From this screen the operator may navigate to the Automation Control, Die Protection, Programmable Limit Switch, Tonnage Monitor, Analog Monitor, Job Setups (see “a” in Figure 10), Counters (see “b” in Figure 10), or Motor Control (see “c” in Figure 10) by pressing inside the blue-bordered box of each area. Some of these features are optional and may not be available on some controls.

For each installed optional subsystem (such as Tonnage Monitor, Die Protection, “Limit Switch, etc.), the status for it is shown in the subsystem’s blue-bordered box and will indicate if attention is required.

Part Tracking and Gagging functionality (see column “d” in Figure 10) are not actually hardware components of the system, but can be enabled or disabled in “Device Config” as if they were. If disabled, they will not appear on the screen.

The status of a subsystem could indicate any of the following conditions:

- "All Conditions OK"** No alarms exist and no stop signals are being given by the subsystem.
- "Error Condition Exists"** An alarm or an error has been detected and must be reset before the control will allow stroking.

- "Run Inhibit"*** The subsystem is preventing the press from running because of a condition that does not require a reset. As soon as the condition is resolved, the Inhibit will be automatically removed. An example of this kind of condition is a counterbalance coming up to pressure after a setting change.
- "Option Not Installed"*** The control has not been configured to recognize the subsystem.
- "Communication Failure"*** A problem exists in the communication link between the operator terminal and the subsystem (see section 6.2 on page 137 for details).

3.5 Job Setups

Touch the current Job display area in the Main Screen (see “a” in Figure 10 on page 28) to select the Job Setups screen shown in Figure 11.

The parameters throughout the system consisting of programmable limit switch settings, automatic feed settings, tonnage monitor settings, die protection settings, and other settings for the current job can be stored for later use. In addition, the settings for a job previously stored can be recalled into the current job.

The jobs can be arranged on the display in either alphabetical order by their description or in numerical order by job number by touching the **Sort By Number / Sort By Descrip.** softkey (this softkey toggles between the two descriptions).

This screen allows selections to Recall a job setup, Store a job setup, or Erase a job setup as described in the following sections.

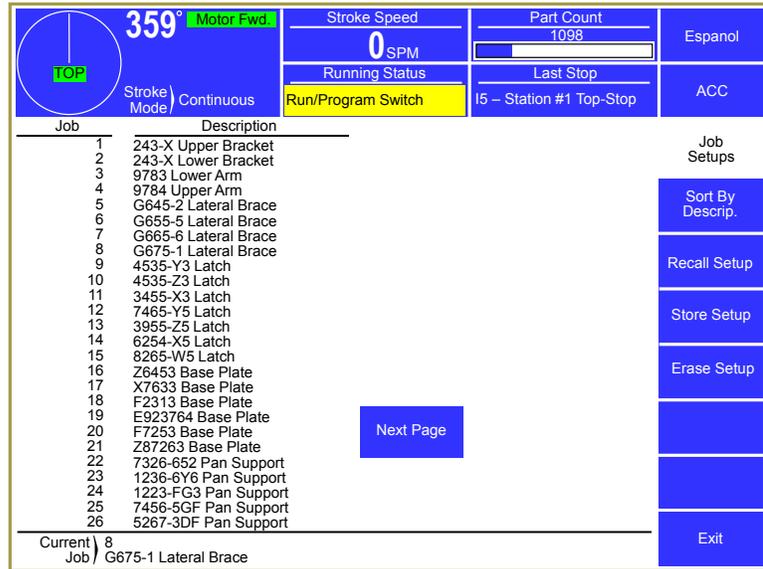


Figure 11: Jobs Screen

NOTE: If new options are installed after the rest of the system has been in operation, any job setups stored in the operator terminal will not have settings for the new option. In this case, when a previously stored job is recalled from memory by the operator, the new option will not be able to find any information stored for it, or the information will consist of default values. The operator **MUST** program the correct settings for the option for that job. Once the settings are set correctly, the operator should store the job. The correct settings will then be available the next time the job is recalled.

3.5.1 Store Setup

From the Jobs screen shown in Figure 11, touch the **Store Setup** softkey to display the screen shown in Figure 12. The Store Setup screen allows the user to place all settings for the job currently in use into the internal file storage area.

The user must have access control to change the parameters on this screen or store the job. Access control is described in Section 3.3 on page 23. If an access control mode is being used that requires a password, a user must be configured to have the “Store Jobs” permission to store a job.

The screenshot shows the 'Store Jobs Screen' with a blue header and a white main area. The header contains a circular gauge with '359' and 'TOP' in green, 'Motor Fwd.' in green, 'Stroke Speed' at '0 SPM', 'Running Status' as 'Run/Program Switch', 'Part Count' at '1098', 'Last Stop' as 'I5 - Station #1 Top-Stop', 'Espanol', and 'ACC'. Below the header, the 'Job Number' is '8' and the 'Job Description' is 'G675-1 Lateral Brace'. A yellow warning box states: 'WARNING! Incorrect setups may cause damage and/ or injury.' Below the warning, instructions for storing a job setup are listed: 'To store a job setup: 1) Program and verify all settings for this job setup. 2) Enter the job number for this setup. 3) Enter a job description for this setup. Press "Store Setup" when ready.' On the right side, there is a vertical column of blue buttons: 'Store Setup', 'Store Setup', 'Store Setup', 'Store Setup', 'Store Setup', 'Store Setup', and 'Exit'.

Figure 12: Store Jobs Screen

The screen shown in Figure 12 allows the user to enter a new number under which the job will be stored by selecting the “Job Number” field. This number must be unique to store to a new job. Entering a number already in use allows the current settings to replace the previous ones for that job number. After entering a job number, the “Job Description” field can be selected to enter an alphanumeric description. Press the **Store Setup** softkey in order to save the current job information in the internal file system under the job number and job description displayed. The operator terminal automatically returns to the Job Setups screen.

NOTE: The “Current Job” is actually a separate job in the operator terminal. Changes made to the current job are **NOT** automatically made to the stored job. The user must intentionally store the new settings over the old job number if those settings are to be saved permanently under that job number. The “Current Job” does keep the changes that are made until a new job is recalled over it. This allows the stored job to keep a set of baseline parameters that may need minor tweaks (for material thickness variation, for example).

3.5.2 Recall Setup

From the Job Setups screen shown in Figure 11, touch the **Recall Setup** softkey to display the Recall Setup screen shown in Figure 13. If enough jobs are stored to take more than one page to display then **Next Page** and **Previous Page** softkeys will allow additional pages of jobs to be displayed to locate the page that the job is on.

Use the up and down arrow keys to move the highlight cursor to the desired job and then touch the **Recall Selected** softkey to recall the job.

If the job number to recall is already known, the **Recall By Job Num** softkey allows the user to enter the desired job number directly into the operator terminal, which automatically searches the file system and, if located, retrieves the job.

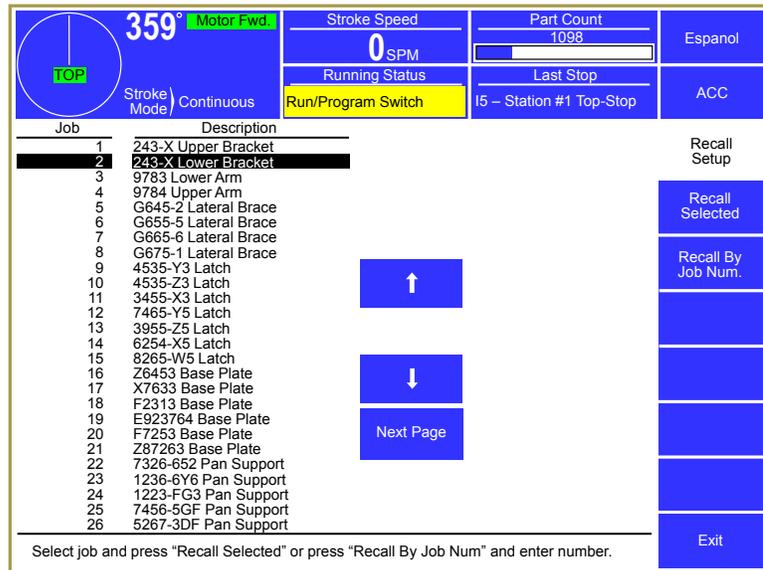


Figure 13: Recall Jobs Screen

For either recall method described above, the operator terminal will ask for confirmation from the user before actually recalling the job.

The user must have access control to perform a job recall. Access control is described in Section 3.3 on page 23. If an access control mode is being used that requires a password, a user must be configured to have the “Recall Jobs” permission to recall a job.

3.5.3 Erase Setup

From the Jobs screen shown in Figure 11, touch the **Erase Setup** softkey to display the Erase Jobs screen. The Erase Jobs screen allows the user to select the job with arrow keys or enter the job number that is to be erased in the same manner as the Job Recall screen does (with **Erase Selected** and **Erase By Job Num.** softkeys).

The operator terminal will ask for confirmation from the user before actually erasing the job.

The user must have access control to perform a job erase. Access control is described in Section 3.3 on page 23. If an access control mode is being used that requires a password, a user must be configured to have the “Erase Jobs” permission to erase a job.

3.5.4 New Die Installation

In normal operating conditions, the job recall function is used to load the system with the correct settings for the die being used. However, when a new die is installed in the machine, the settings may not be

known. After the correct settings are established for the die, along with all other system settings, the present settings should be stored under a job number and description for recall later.

3.6 Counters

Touch the Counter display area in the Main Screen (see “b” in Figure 10 on page 28) to Counter screen shown in Figure 14. The present quantities of the part counter, batch counter, quality counter, and stroke counter can be viewed.

If counters are configured for unrestricted access, anyone can change the counters and reset them. If configured for access control (described in Section 3.3 on page 23), operators must use the access control means to make changes.

This screen shows production information related to the part, batch, and quality counters. The machine “Stroke Count” and “Job Hit Count” is also shown at the bottom of the screen.

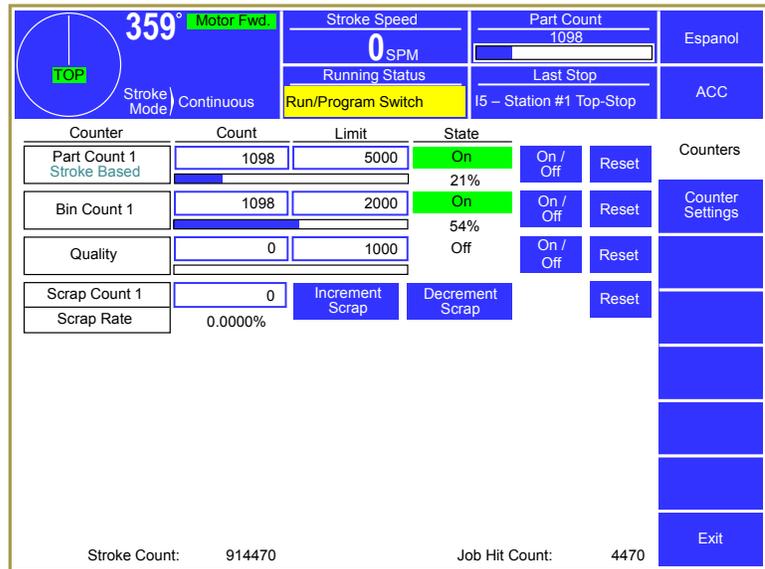


Figure 14: Counter Screen

Up to 12 sets of counters can be configured for use. Each counter set consists of a Part Counter, Bin Counter, and Scrap Counter. Only the first counter set additionally contains a Quality Counter, which is used when it is desired to stop the press every so many strokes for a quality check. Multiple counter groups are most often used in conjunction with multiple output dies, where separate bin counts, separate part counts, or both are desired. If one or two counter groups are enabled, the counter screen will appear similar to Figure 14, with the second counter group (if enabled) shown at the bottom half of the screen. Figure 15 shows what the screen looks like with all 12 counter groups enabled. Press inside each blue bordered group box to show a screen similar to Figure 14 for that counter group.

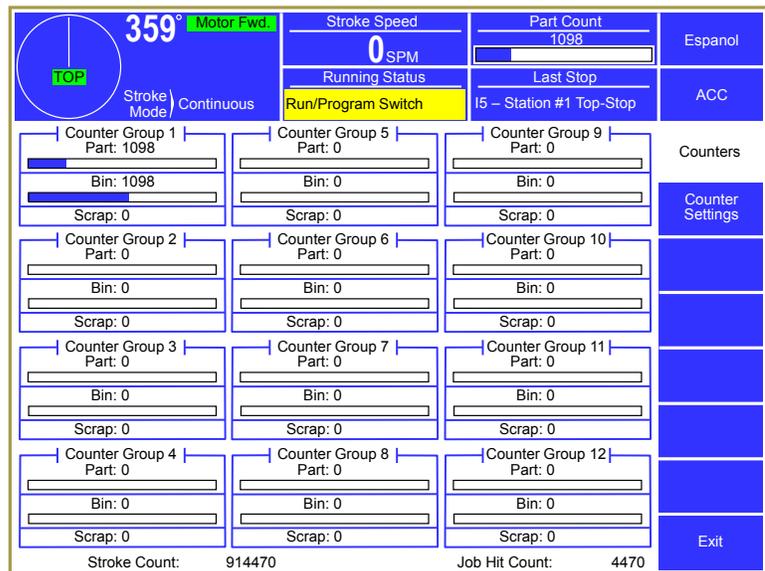


Figure 15: Counter Screen with 12 Groups

Counters can be driven by strokes of the press (Stroke Based counters) or by sensors tied to a die protection channel (Sensor Based counters). The counter drive mode is indicated just below the “Part Count X” label. Stroke based counters can also be configured to count by a set amount every so many strokes. For instance, a job using a two-out die can be set to count by 2 every stroke. A job using a lamination die could be set to count by 1 every 10 strokes. Each counter group is separately configurable for stroke or sensor based counting.

3.6.1 Configuring Production Counters

Up to 12 counter groups can be enabled on a job by job basis. In other words, one job can have one counter group enabled, while a second job can have 3 counter groups enabled. Stroke based counter groups can also be set to increment by a particular value every so many strokes rather than incrementing by 1. To configure the counters, press the **Counter Settings** softkey in the counter screen of Figure 14.

A screen similar to Figure 16 will appear and allows each counter group to be set to stroke based counting, sensor based counting, or not used. Hitting the **Configure System** softkey in this screen will bring up a screen with only two settings – “Maximum Number of Counter Groups” and “Enable True (Sensor Based) Part Counters”.



Figure 16: Counter Configuration Screen

These settings apply to the system as a whole instead of to a job. The maximum number of counter groups can be set from 1 to 12 and will affect how many counter groups are shown in the screen of Figure 16. If “Enable True (Sensor Based) Part Counters” is set to “No”, then “Sensor Based” will NOT be available to choose as counter group type. Both of these settings are present to allow a reduction in the number of settings presented to operators for features that are not used.

Counter groups that are set to “Stroke Based” also have a **Configure** button shown to the right of the group (as seen in Figure 16 for Counter Group 1). When pressed, a screen will appear that allows the “Counter Increment” and “Counter Frequency” to be set. The “Counter Increment” is how much the counter will be increased when a count occurs. For instance, a two out die making a simple part would count by 2 every stroke. The “Counter Frequency” is how often the counter should count. A lamination die might produce a part every 10 strokes. If a lamination die with 10 laminations was also a 2 out die, the “Counter Frequency” would be set to 10, and the “Counter Increment” would be set to 2. The counter would then count by 2 every 10 strokes. For typical one-out dies, both of these values would be 1, which would count by 1 every stroke.

3.6.2 Production Counters

The production counters provided are Part, Bin, and Scrap. In addition, counter group 1 also has a Quality counter. All production counters that are turned “On” and are stroke based will increment as the press strokes, when the press is operating in a production mode.

NOTE: Stroke based Part, Bin, and Quality counters only count in production modes and only if turned “On”. The stroke counter counts in all modes. Production modes are Single Stroke, Continuous, Automatic Single Stroke, Continuous on Demand, and Maintained Continuous modes. Some press controls may not have all these modes. Sensor based counters count whenever the sensor detects a part, regardless of mode, as long as they are “On”.

When the current count reaches the programmed limit, a top stop will be issued. This stop will remain active until the counter is reset or is turned off.

The Part counter usually records the total parts made for a given process setup. The Bin counter usually records a small group of a process run, such as the number of parts that can be put into one container. The Quality counter is typically used to record the number of parts that can be made between quality inspections.

Below each production counter is a bar graph that visually indicates the progress made toward that counter's limit. When the count reaches the limit, the bar graph will change from blue to red. The percentage completion for each counter is shown to the right of the bar graph.

Each counter group also contains a scrap counter. For stroke based counter groups, this counter must be manually set by entering a number, or using the **Increment Scrap** and **Decrement Scrap** softkeys. Sensor based counter groups can have a die protection channel that is assigned to increment the scrap count whenever the sensor detects a part. This is most commonly used in conjunction with Part Tracking.

3.6.2.1 Turning Production Counters On or Off

Production counters can be turned “On” or turned “Off”. When a counter is turned “Off”, it does not increase and cannot issue a stop to the press control. A production counter is toggled “On” or “Off” by pressing the **On / Off** softkey for that counter and will be shown in the “State” column. If an access control mode (see Section 3.3 on page 23) is being used that requires a password, a user must be configured to have the “Counter Settings” permission to change this parameter.

3.6.2.2 Changing the Limit for Production Counters

Each production counter has a limit setting. When this limit is reached, a top stop will be issued. The slide will stop at the top of the stroke and further stroking will be prevented until the counter is reset or until the counter is turned off. If an access control mode (see Section 3.3 on page 23) is being used that requires a password, a user must be configured to have the “Counter Settings” permission to change this parameter.

3.6.2.3 Resetting Production Counters

A counter reset will set a production counter's current count to zero. If an access control mode (see Section 3.3 on page 23) is being used that requires a password, a user must be configured to have the “Counter Reset” permission to change this parameter.

Resetting the Part counter will also reset the Batch and Quality counters.

To reset a production counter, touch the **Reset** softkey to right of the counter to reset. The operator terminal will ask for verification before actually resetting the counter.

3.6.2.4 Changing the Count for Production Counters

The current count value of a production counter can be changed. If an access control mode (see Section 3.3 on page 23) is being used that requires a password, a user must be configured to have the “Counter Change” permission to change this parameter.

The current count is changed by touching the counter field of the desired counter and entering the new value. The numeric entry screen provides softkeys to increment or decrement the counter or a new number can be entered.

3.6.3 Stroke Counter

The stroke counter increments anytime the crankshaft travels from the top of the stroke to the bottom of the stroke. Contact Link Systems service department to reset the stroke counter.

3.7 Drive Speed Adjustment (When Provided)

This section applies only to Mechanical Presses. Servo Presses do not use this option.

If the optional Speed Control board is installed on the Automation Control Logic Board, it allows the drive speed (speed at which the press will stroke when the clutch is engaged) to be displayed when the press is not stroking. It also allows the operator to enter stroking speed from the Motor Control screen.

To get to the Motor Control screen, touch the SPM and Load bar graph area on the Main Screen (see “c” in Figure 10 on page 28) or the similar area in the Automation Control screen (see Figure 24 on page 47).

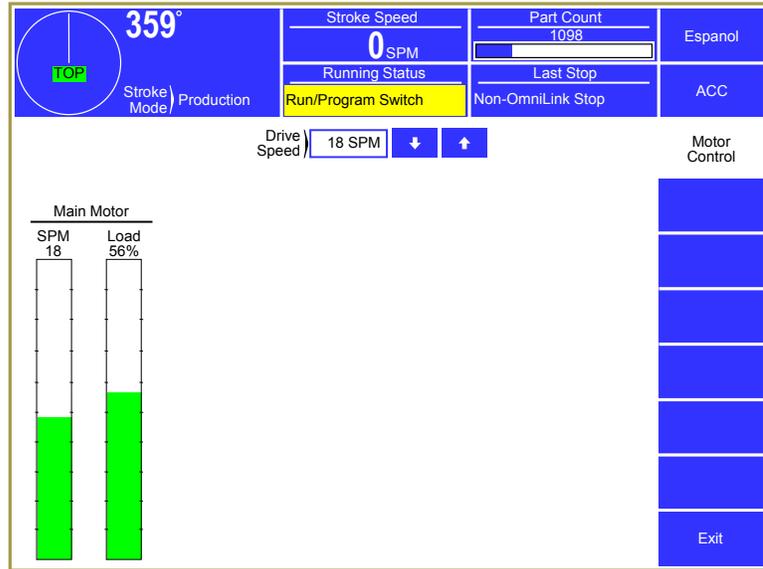


Figure 17: Motor Control Screen

To change the drive speed, touch the blue bordered Drive Speed parameter as shown in Figure 17 or use the up and down arrow softkeys to increment and decrement the value. When using the arrow keys, the value will continue to increment or decrement the value for as long as they are held, or until a speed limit has been reached. The new speed value will be sent (as an analog signal) to the motor drive.

The stroking speed can be set over the entire speed range of the press as determined by the configuration.

As shown in Figure 17, both drive speed (SPM) and motor current (% Load) are displayed in numeric and bar graph formats. The SPM bar graph ranges from 0 SPM to the maximum strokes/minute of the press. The % Load bar graph ranges from 0 to 200%.

If unrestricted by access control configuration, the user can change speed directly on the Speed screen. Otherwise, the user must obtain access by the selected access control means to change the press speed value. If an access control mode (see Section 3.3 on page 23) is being used that requires a password, a user must be configured to have the “Drive Speed Adjust” permission to change this parameter.

3.8 Part Tracking

Part tracking is a process by which individual stations of a multi-station die can be kept track of in regards to the status of the part that is currently in that station – “Good”, “Bad”, or “Empty”. The Operator Terminal enables the configuration and coordination of part tracking functions across the system. Automation and monitoring devices in the system can then act based on the status of the part in the station to which they apply. Part Tracking functions are only available after the Part Tracking system has been turned on in the Device Config screen as described in Section 4.1.

The primary idea behind Part Tracking is to allow the press to deal with the *occasional* bad part without stopping, thus increasing the throughput of the production system. For instance, part tracking might allow the use of a coil of steel that has a material thickness tolerance (due to cost or availability issues) that results in an occasional out of spec part. By putting a material thickness measurement station on the input of the die, tracking the parts made with the out of spec material, and diverting those parts automatically into a scrap bin at the outlet of the die, the coil may be successfully used. In addition, all parts are verified as to their material thickness spec. There are a great many sophisticated applications that can be made with this technology without even modifying the die itself.

The die is divided into “strips” and “stations”. Each station represents the progression the material makes in one stroke - which means that idle stations must be counted. Each strip is a path of stations through the die. A two-out die would usually be considered to have two strips, even if both parts are carried webbed together - if there are sensors that apply to each “side by side” part separately. If, however, every station in the die has only one sensor for both parts in the “two-out” pair (for instance, a strip presence detection sensor), then it may be treated as one strip. The part tracking system can handle dies with up to 12 strips of 32 stations each. Parts are “shifted” as the press goes through 0 degrees (the top of the stroke) or at the beginning of a new cycle in the case of Servo Presses.

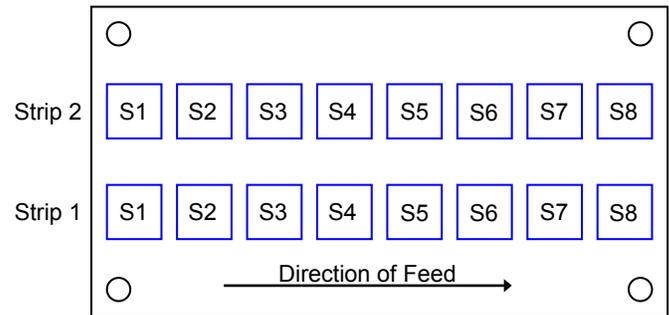


Figure 18: Die Strips and Stations

Once part tracking is enabled and the number of strips and stations is non-zero, then additional settings become available on some of the automation and monitoring device job setup screens. The manual for each option will detail the particulars for that device. The automation and monitoring devices that work with Part Tracking are:

5100-5B-V2 Programmable Limit Switch Modules

PLS channels can be assigned to a strip and station and be made to “fire” or not “fire” based on the status of the part in that strip and station. This could be used to divert parts to a scrap bin using a separate air blow off fired by a PLS channel set to trigger when a part in the last station is “Bad”. It could also selectively gag in a punch to knock out a part from the strip in the die before it can get to a station in which it would hang up or cause other problems.

5122 and 5123 Die Protection Modules

Die Protection channels can be assigned to a strip and station. The “Stop Type” can then be set to “Mark Part” instead of the more usual “Top Stop”, “Immediate Stop”, or “Intelli-Stop”. Instead of stopping the machine, the part in the indicated strip and station is marked as “Bad”. The part can then be tracked through the die for action later by a PLS channel. The Die Protection channel can also be set to bypass itself based on the part status at its station. For instance, if its station is “Empty”, the channel can be set to bypass itself and not stop the press because there is nothing to check.

5100-8 Tonnage Monitor

The tonnage monitor can be set to bypass its low limits when a “Bad” part or an “Empty” part is present in the die. The Tonnage Monitor also has 4 optional Die Protection inputs and 4 PLS outputs that also work with Part Tracking as described for the dedicated PLS and Die Protection modules previously.

5100-8A Analog Measurement Option Board (Option for 5100-8 Tonnage Monitor)

The optional 5100-8A Analog Measurement option for the Tonnage Monitor can mark parts as “Bad” based on the measurements and limits programmed. It can also selectively bypass channels based on the status of the part. A sensor that would stop the press if a part so far out of spec that it will not feed through the die could bypass itself if the part was “Empty” because it was kicked out of the process earlier by a PLS channel. This allows extremely sophisticated in-die measurement and tracking applications operating at full production speeds.

3.8.1 Bad Part Limits

Once the ability is put in place to continue stroking even when making the occasional bad part, some limits must be incorporated into the process. Without these limits, the system runs the risk of becoming a highly efficient mechanism for producing scrap.

Each strip maintains the number of bad parts it has produced in a row. A limit is placed on this value and, if exceeded, a stop is issued. Each time a stroke is made without making a bad part on the strip, the “Bad Parts in a Row” counter for the strip is reset to 0. This counter is abbreviated for some status messages as “BPIR”.

While a limit on the number of bad parts in a row goes some way towards establishing control over the bad part rate, it is not sufficient by itself. Consider that even a relatively restrictive limit of 2 bad parts in a row means that the theoretical scrap rate can be 50%. This would be the case if every other part was bad. An additional limit is placed on the number of bad parts in the last “X” strokes, where “X” is a user configurable parameter with a maximum value of 1000. This could be set to allow no more than 2 out of the last 100 parts to be bad – or no more than 5 out of the last 1000 parts. The system remembers the status of the last “X” strokes and keeps track of how many parts in that sequence are bad. A limit is placed on that value and, if exceeded, a stop is issued. This counter is abbreviated for some status messages as “BPLX”.

The combination of the two bad part limits allows the system to have the flexibility to keep producing parts with a defined maximum scrap rate. The “Bad Parts in a Row (BPIR) Limit” allows a process that has seriously deviated from proper operation to stop quickly while the “Bad Parts in Last X Strokes (BPLX) Limit” limits the overall scrap rate. When either bad part counter exceeds its limit, the press will stop and an operator can make whatever adjustments are needed to bring the system back to an acceptable state.

3.8.2 Virtual Die Stations

In some cases, it may be useful to apply virtual die stations to the entry side, exit side, or both sides of the die. The top of Figure 19 shows a die with 8 physical stations. The bottom of the figure shows the same die as it might be considered with 2 virtual stations on the entry side and 2 on the exit side.

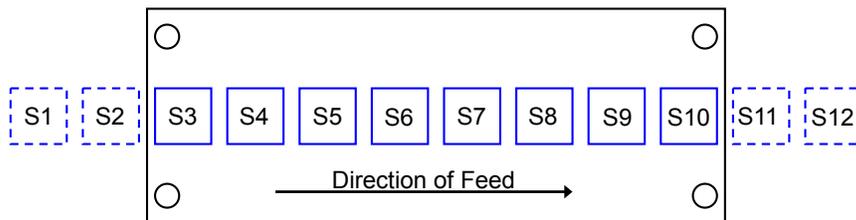
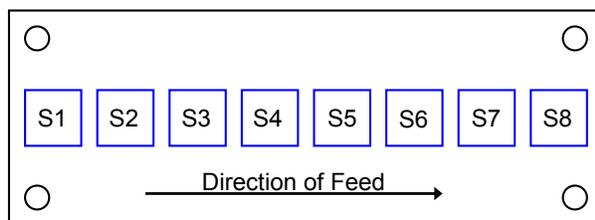


Figure 19: Part Tracking Virtual Stations

It was mentioned earlier that many features of part tracking can be applied without modifying the die itself. An example of such a case was mentioned earlier in regards to a material thickness sensor that would allow the use of material that did not always meet the required specification. It may be difficult or cost prohibitive to modify the die for such a sensor. However, by placing the sensor at a virtual station on the entry side of the die, the material can still be tracked.

Figure 20 shows an example die with 3 virtual stations added at the entry side and no virtual stations on the exit side. A material thickness sensor is placed at Station 2 (a virtual station). This sensor can be tied into a die protection channel that will mark the part “Bad” if it fails the check.

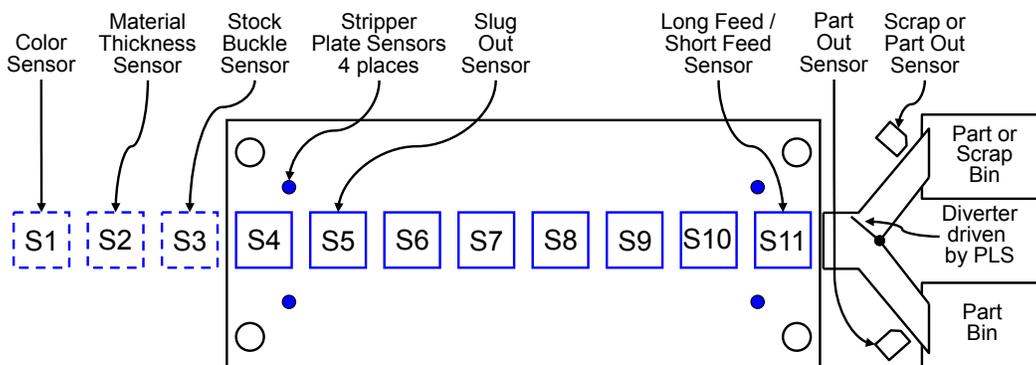


Figure 20: Part Tracking Example Die Application

It may be that the production system uses a multiple coil feeding system where the coils are butt-welded together. The weld areas must be rejected. If the coil supplier spray paints the bad areas, a color sensor at virtual Station 1 could again use a die protection input to mark those areas “Bad”.

The stock buckle sensor at virtual station 3 might have no effect on the Part Tracking system, but needs the room that the virtual station provides.

Parts marked “Bad” by the thickness sensor, the color sensor, or both are then tracked through the die. Finally, at Station 11, a programmable limit switch channel can be set to fire when a part in that station is “Bad”. This triggers a diverter to rout the part to a scrap bin. Sensors on the chutes to each bin are also using die protection channels to generate an accurate count of good and scrap parts (see Section 3.6.1 for information on setting up sensor based counters).

3.8.3 Part Tracking Screen

Figure 21 shows an example of the Part Tracking screen for a die with two strips and 22 stations. This screen is accessed by pressing in the “Part Tracking” box on the main screen (see the column pointed to by “d” in Figure 10).

Each strip is shown graphically on the screen in its own area that shows the status of the part in each station. Parts are “shifted” as the press goes through 0 degrees (the top of the stroke) or at the beginning of a new cycle in the case of Servo Presses. Each strip also individually tracks the number of bad parts in a row (BPIR) and the number of bad parts that have been made in the last so many strokes (the number of strokes being user configurable) for that strip (BPLX). When one of these counters exceeds its limit, a stop is issued and the counter that is over the limit turns red. Use the **Reset** softkey immediately to the right of the counter to reset the counter and clear the stop. The stop will show up in the “Running Status” of the Automation Control screen as *Part Tracking Strip X Stop*, where X is replaced by the strip number with the stop condition. The “Status” line at the bottom of the Part Tracking screen will display *BPIR Strip X Limit Reached* or *BPIX Strip X Limit Reached*.

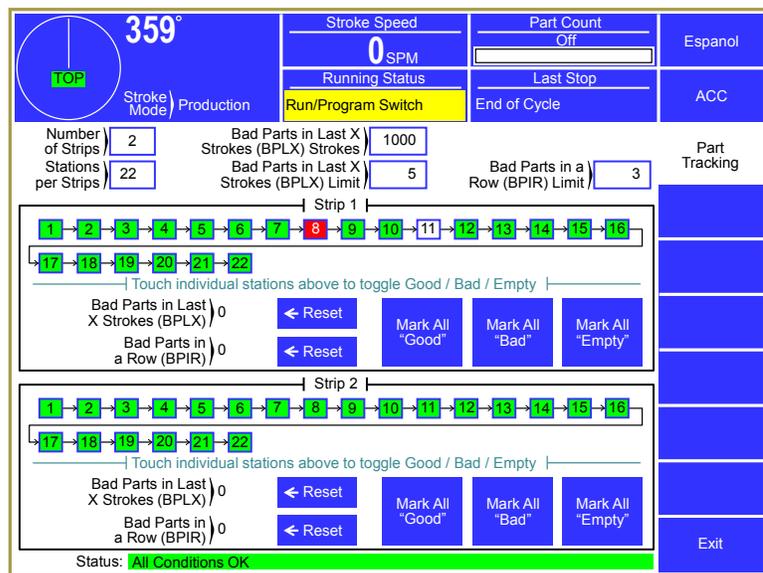


Figure 21: Part Tracking Screen

The status of the parts in each station can also be changed manually in this screen. Pressing a particular blue-bordered numbered station box will toggle the status of the part in that station between “Good”, “Bad”, and “Empty”.

NOTE: When manually changing the status of the part in a station, it is normal for the “Running Status” to momentarily (less than a second) change to *Run Inhibit – Part Tracking*. This happens because the Operator Terminal is sending the updated status of the Part Tracking system out to all devices that need it and will not allow the press to run until the information is sent. This also happens shortly after each time the press stops stroking. While the press is running, manual changes to the part status are locked out.

The color of the box will change based on the type – green for “Good”, red for “Bad”, and white for “Empty”. In the example screen of Figure 21, Station 8 in Strip 1 is “Bad” and Station 11 in Strip 1 is “Empty”. Additional buttons are in each strip area that allows the user to mark all stations for that strip to “Good”, “Bad”, or “Empty”.

3.8.3.1 Number of Strips

This parameter sets the number of strips that the system will track. The maximum is 12. When more than two strips are configured for the job, then **Next Page** and **Previous Page** softkeys allow navigating to the other strips.

3.8.3.2 Stations per Strip

This parameter sets the number of stations in each strip. The maximum is 32. Each station is represented by a numbered box in each strip area. The first station is on the incoming side of the die. As strokes are made, the status of the parts in the stations is shifted to the right as indicated by the arrows connecting the stations.

3.8.3.3 Bad Parts in Last X Strokes (BPLX) Strokes

This parameter sets the number of strokes that will be used to track the bad parts rate in conjunction with the “Bad Parts in Last X Strokes (BPLX) Limit”. See Section 3.8.1 for a discussion of bad part limits.

3.8.3.4 Bad Parts in Last X Strokes (BPLX) Limit

This parameter sets the limit for the number of bad parts that have been produced in the last X strokes (set by the “Bad Parts in Last X Strokes (BPLX) Strokes” parameter). See Section 3.8.1 for a discussion of bad part limits.

3.8.3.5 Bad Parts in a Row (BPIR) Limit

This parameter set a limit to the number of bad parts that can be produced in a row. See Section 3.8.1 for a discussion of bad part limits.

3.9 Gagging

The Automation Control can implement “Gagging” functions that allow certain automation and monitoring devices to function or not function only on a particular stroke or strokes in a sequence. Gagging functions are only available after the “Gagging” system has been turned on in the Device Config screen as described in Section 4.1.

While typical gagging applications involve lamination or fin dies, many other applications can also use these functions. Gagging is set up by defining a “Gag Cycle Count”, which is the number of press cycles that constitute a complete production sequence for the part involved.

Figure 22 shows an example Gag Settings screen for a PLS channel set to fire on strokes 1, 3, 8, and 20 out of a 23 stroke gagging sequence. Most automation and monitoring channels that use gagging use a similar screen to set the strokes they will be active on.



Figure 22: Gag Settings Screen for a Channel

The Gagging system supports Gag Cycle Counts of up to 256 strokes. The automation and monitoring devices that support gagging are:

5100-5B-V2 Programmable Limit Switch Modules

PLS channels can be made to “fire” or not “fire” on any particular stroke or strokes in the gagging sequence. For example, a PLS channel can be set to fire on stroke 1, 3, 8, and 20 of a 23 cycle sequence.

5122 and 5123 Die Protection Modules

Die Protection channels can be bypassed on any particular stroke or strokes in the gagging sequence. This can be used to check on events that only happen on particular strokes in the sequence, often because of things that a PLS channel is causing.

5100-8 Tonnage Monitor

The tonnage monitor can be set to bypass its peak low limits on a particular stroke or strokes in a sequence. Each set of data window limits can also be enabled on a particular stroke or strokes in the sequence. This allows the tonnage monitor to check up to 5 different tonnage characteristics that occur in the sequence. For instance, if an additional punch was enabled on stroke 4 by a PLS channel, the tonnage for that stroke might be different than the other strokes. A separate set of limits can be placed on just that stroke. The Tonnage Monitor also has 4 optional Die Protection inputs and 4 PLS outputs that also work with Gagging as described for the dedicated PLS and Die Protection modules previously.

5100-8A Analog Measurement Option Board (Option for 5100-8 Tonnage Monitor)

The optional 5100-8A Analog Measurement option for the Tonnage Monitor can be bypassed on any particular stroke or strokes in the gagging sequence. This can be used to make measurements only happen on particular strokes in the sequence, often because of things that a PLS channel is causing.

3.9.1 Gagging Screen

Figure 23 shows an example of the Gagging screen for a job that is on stroke 12 of a 23 stroke sequence. This screen is accessed by pressing in the “Gagging” box on the main screen (see the column pointed to by “d” in Figure 10).

The “Status” line at the bottom of the screen shows what stroke in the sequence the press is on, or displays *Gagging Off* if gagging is not used on the current job.



Figure 23: Gagging Screen

3.9.1.1 Gag Mode

This parameter sets the mode of the gagging system. It can be set to the following:

Off

Gagging is not used for this job.

By Stroke

The “Gag Cycle Number” (the current stroke number in the sequence) is incremented each time the press goes through 0 degrees or at the beginning of a new cycle in the case of a Servo Press. When the current cycle is the last cycle in the sequence, it rolls back over to 1.

By Parallel Port

The “Gag Cycle Number” (the current stroke number in the sequence) is set by the parallel port on the back of the Operator Terminal. This is intended to allow outside automation control the gagging sequence. When this mode is used, the cycle changes as soon as the parallel port does, subject to the “Debounce Time”.

3.9.1.2 Debounce Time

This parameters controls how long the parallel port reading must read the same value until the Operator Terminal will actually use the value for the “Gag Cycle Number”. This is needed to prevent false readings when an external device is changing from one number to another. It is only used when the “Gag Mode” is set to “By Parallel Port”.

3.9.1.3 Gag Cycle Count

This parameter sets the length of the gagging sequence for the job.

3.9.1.4 Gag Cycle Number

This parameter is the current cycle in the sequence that the press is on. When the “Gag Mode” is set to “By Stroke”, the operator can key in a new cycle number. This is handy when a sequence must be interrupted and set back to a particular point in the sequence.

3.10 Automation Control

The Automation Control works with both part revolution clutch mechanical power presses (Mechanical Presses) and with servo driven presses (Servo Presses). The operation screen varies depending on the press type on which the system is installed. Part revolution clutch mechanical presses have the option of motor speed control through the use of an optional Speed Control board, and have a brake monitor and clutch engagement time monitor. Servo presses are capable of motion types (such as a pendulum type motion) that require additional information to be entered to handle correctly. They do not have the option of motor speed control since this is handled in a complex way by the servo drive. They also do not display the brake monitor and clutch engagement time as they do use these in any conventional way.

3.10.1 Automation Control Main Screen

Pressing inside the blue bordered “Automation Control” area on the Main Screen in Figure 10 will cause the Automation Control main screen to be displayed.

The Automation Control main screen will differ somewhat in appearance depending on whether the system is installed on a Mechanical Press or a Servo Press. Certain items on these screens will only apply to one press type or another. This will be indicated in the text as necessary.

For Mechanical Presses, a screen similar to that shown in Figure 24 will be displayed.

For Servo Presses, a screen similar to that shown in Figure 25 will be displayed.

These screens provide the following information:

- A brake monitor used when the press stops at the top of the stroke (Top Stop Time). **(Mechanical Presses Only)**
- A brake monitor used when the press stops at any position other than top (Mid Stop Time). **(Mechanical Presses Only)**
- The actual stopping time of the press, measured by the brake monitor. **(Mechanical Presses Only)**



Figure 24: Automation Control Screen (Mechanical Press)



Figure 25: Automation Control Screen (Servo Press)

- The actual clutch engagement time of the press. (*Mechanical Presses Only*)
- The critical (stop) angle, which may be set for each job for use with Intelli-Stop.
- The step mode that sets how the Automation Control can keep track of what step a Servo Press is on in its motion profile. (*Servo Presses Only*)
- The Motion Profile “Running” Timeout determines how the Automation Control detects that a Servo Press has stopped. (*Servo Presses Only*)
- The current step in the motion profile that the press is on. This will not be displayed if the “Step Mode” is “Not Used” (*Servo Presses Only*)
- The event that caused the press to stop (Reason for the Last Stop).
- The event that is keeping the press from stroking, if any exists (Running Status).
- An optional Auxiliary Equipment Message driven by external equipment. If not enabled in the configuration menus (see Section 4.2.9), this area will not appear on the screen.
- If configured, the Motor Speed screen can be accessed from this screen in order to change the stroking speed of the press by pressing on the blue bordered area with bar graphs and numbers for speed and load. See Section 3.7 for information on the Motor Speed adjust screen.
(*Mechanical Presses Only*)

3.10.1.1 Resetting Automation Control Errors

The Automation Control screens of Figure 24 and Figure 25 alert the operator of an error condition by displaying a **Reset** softkey. The reason for the error is shown by the “Running Status”. The press cannot be operated until the problem is corrected and an operator acknowledges the error by pressing the **Reset** softkey.

3.10.1.2 Brake Monitor and Motion Detection

This applies to Mechanical Presses only. Each time the press stops a time based brake (Stopping Time Performance) monitor with 2 millisecond resolution measures the time from deactivation of the clutch/brake valve until crankshaft rotation is less than 1.8 RPM. An additional 8 milliseconds is added to this measured value to compensate for the maximum reaction time of the control. If the actual time exceeds the applicable brake monitor limit it will be displayed in red, the present running status will display *Brake Monitor Alarm*, and the operator is required to press the **Reset** softkey that appears on the right side of the touch screen before any further strokes can be initiated.

The reset of the brake monitor can be restricted by access control configuration if desired. The last measured stopping time is displayed beside the limit (Top Stop or Mid Stop) that applied to the position in the stroke where stop occurred. Separate limits are provided for monitoring the stopping time at the top of the stroke (“Brake Monitor Top Stop Limit”) or at any position other than top (“Brake Monitor Mid Stroke Stop Limit”). These limits can only be changed in the Brake Monitor configuration screen (see Section 4.2.4 for details).

WARNING: When your press is equipped with two-hand control safety devices and/or presence sensing devices for point of operation protection, only qualified personnel with a knowledge of current ANSI (B11.1)



standards and OSHA (CFR 1910.217) regulations or other applicable regulations in a venue that govern the relationship between stopping time and the distance at which two-hand control and/or presence sensing devices are to be located should set or reset stop limits for the brake monitor. These limits must *never* be set for longer times than the time that the safety distance in these standards is based on.

3.10.1.3 Engagement Time

This applies to Mechanical Presses only. The actual clutch engagement time is measured (4 millisecond resolution) each time the clutch/brake valve(s) solenoids are energized to initiate a stroke. This time is measured from valve activation until crankshaft rotation exceeds the “Motion Threshold”. If the measured time exceeds the “Engagement Time Limit”, the stroke is aborted and the reason for the last stop will display *Motion Did Not Start*. Both the “Motion Threshold” and the “Engagement Time Limit” are set in the Clutch Configuration screen (see Section 4.2.3). Monitoring of the engagement time can provide useful diagnostic and preventative maintenance information about clutch wear. Increasing engagement time indicates that clutch wear is causing the air operator that operates the clutch plates to travel further to engage, requiring more (and longer) air flow through the clutch air valve to force the plates together.

3.10.1.4 Critical Angle

This parameter applies to stop signals from automation and monitoring devices (for instance, die protection) that are programmed to generate an “Intelli-Stop” (see Section 2.3.3 on page 16 for information about this stop type and how to determine Critical Angle). When an “Intelli-Stop” is generated, the press control will calculate whether or not it can stop before this angle. If so, it will generate an “Immediate Stop”. If not, it will “Top Stop” in order to avoid the likelihood of sticking the slide on bottom. This parameter is stored and recalled with each job setup. If an access control mode (see Section 3.3 on page 23) is being used that requires a password, a user must be configured to have the “Critical Angle” permission to change this parameter.

3.10.1.5 Step Mode

This applies to Servo Presses only. Servo presses have the ability to use motion sequences in production operations that are more complicated than “going around in a circle”. When these more complicated sequences are used, each change of motion during a cycle of operation is referred to as a “step”. This parameter sets the method the Automation Control will use to partition each cycle of the press into a sequence of clockwise and counterclockwise movements (steps). This allows automation and monitoring devices (such as programmable limit switch and die protection modules) to be activated not only at certain angles, but also on specific steps. This parameter is stored and recalled with each job setup.

The Step Modes are:

Not Used Step functionality is not used by the Automation Control. This is typically the case when the press is set to run in a normal cyclic motion.

Internal The Automation Control determines the step it is on using information programmed into it on the Step Setting screen (see Section 3.10.2) and the position of the crank shaft. No information is needed from the servo control.

External The Automation Control reads the current step from hardware inputs driven by an external controller – typically the servo press control. See Section 5.6.10 for information on using these inputs.

3.10.1.6 Motion Profile “Running” Timeout

This applies to Servo Presses only. This parameter is used to set the method the Automation Control uses to generate an internal “Running” signal that indicates that the servo press is running its programmed motion profile. The Automation Control and its optional components need this signal for proper operation. This parameter is set on a job by job basis to accommodate situations where the normal production process uses a pause or dwell.

If this parameter is ***non-zero***, the Automation Control will use crankshaft velocity to signal that the press is running. If the press speed goes below the “Motion Started Threshold” (see Section 4.2.2.7) and remains below for the timeout period set by this parameter, the “Running” signal will be turned off. The “Reason for the Last Stop” will be set as ***End of Cycle (Timed)*** if the stop was not from the Automation Control or with the specific reason if it was. This method is needed when no information on running status is available from the servo drive.

If this parameter is ***zero***, the Automation Control will assert the “Running” signal when the press indicates that no E-Stop or Top Stop is active (Inputs 11 and 12 are high on the Servo Interface Board – see Section 5.6.10 for information on using these inputs). The “Reason for the Last Stop” will be set as ***End of Cycle*** if the stop was not from the Automation Control or with the specific reason if it was. ***This method is preferred if running status is available from the servo drive.***

3.10.1.7 Auxiliary Equipment Message

The operator terminal supports the option to wire outputs from a PLC (or other device) to its parallel port. This allows auxiliary equipment to display diagnostic messages on the operator terminal. See Sections 4.2.9 and 5.6.12 for information on how this optional capability is configured and wired. This area will not appear unless it is enabled.

3.10.1.8 Reason for the Last Stop

Diagnostic information is provided to show the reason the press stops. Once stroking is initiated, the first stopping action is latched and displayed. This is done to capture transient conditions that may return to their proper state after the press stops. This information remains latched until the press stops again. Additional information concerning press stops is stored in the Event Log (see Section 3.10.3.1).

NOTE: Unlike full Link press controls, the Automation Control does not directly control the clutch/brake or servo drive of the press. This means that things outside of the Automation Control (E-Stop buttons, etc.) can stop the press without the Automation Control knowing why.

When this happens for Mechanical Presses, the “Reason for the Last Stop” will show **Non-OmniLink Stop**.

When this happens for Servo Presses, the “Reason for the Last Stop” will be **End of Cycle** or **End of Cycle (Timed)** depending on the “Motion Profile “Running” Timeout”.

Stops initiated by the Automation Control (such as from die protection, tonnage monitor, etc.) will display specific information on what caused the stop.

3.10.1.9 Present Running Status

Diagnostic information is provided to show any reason why stroking may not be initiated. This information follows the present conditions of the inputs. Any input that prevents stroke initiation is displayed as long as it exists. If multiple stop conditions exist, the clearing of a displayed stop condition will result in the display of another stop condition until no more stop conditions exist. If no stop condition exists, an **OK** message indicates that only the correct run buttons are required to initiate the stroke.

NOTE: Unlike full Link press controls, the Automation Control does not directly control the clutch and brake or servo drive of the press. The actual clutch/brake or servo control will have other stop sources besides the Automation Control (E-Stop buttons, etc.). A “Running Status” of **OK** refers to only the Automation Control itself. Other stop sources applied to the actual clutch/brake or servo control may prevent the press from running.

3.10.1.10 Step Settings Softkey

This applies to Servo Presses only. This softkey will only appear when the “Step Mode” is set to “Internal”. Pressing it will show a screen where the characteristics of the motion profile the servo press will run for this job can be set so that the Automation Control to “follow along” with the servo controller.

3.10.1.11 Diagnose Softkey

Additional detailed diagnostic information is available through the **Diagnose** softkey. See Section 3.10.3 for information on the diagnostic screens and information available.

3.10.1.12 Configure System Softkey

The Automation Control configuration area is available by pressing the **Configure System** softkey. This key only appears when the RUN/PROG key of the operator terminal is in the PROG position. See Section 4 for information on configuring the Automation Control.

3.10.1.13 Module Limit Switch Softkey

The Automation Control provides the logic for two simple programmable limit switch outputs as standard. Since these outputs can only sink 8ma of dc current, enough to operate solid state ac or dc relays, optional solid state relays must be provided to make these two Module Limit Switch channels practical for driving larger loads. Link provides an optional Solid State Relay Module (shown in Figure 5.6.11) that can provide up to 4 solid state relays.

The Module Limit Switch screen can be accessed by pressing the **Module Limit Switch** softkey on the Automation Control screen. If no optional 5100 series Limit Switch Modules are used with the system, the Limit Switch area on the Main Screen will also access the Module Limit Switch screen. If one or more 5100 Limit Switch modules are used with the system, the Limit Switch area on the Main Screen will access the Limit Switch screens for the advanced modules, and only the **Module Limit Switch** softkey on the Automation Control screen will access the Module Limit Switch screen.

The Module Limit Switch screen simply shows the two limit switch channels and the On and Off angles for each. You can view the information in Run mode and make settings in Program mode.

3.10.1.14 Detailed Status

Pressing inside the blue bordered area that contains the “Reason for the Last Stop” and the “Running Status” in the Automation Control main screen will cause a screen similar to Figure 26 to appear. This screen shows the numeric message codes in addition to the messages selected by the codes for the “Reason for the Last Stop” and the “Running Status”. In some cases having the raw codes can aid Link in troubleshooting the system.

Most messages are fairly straightforward and self-explanatory; however, the code numbers can be used to locate more detailed explanations of the fault conditions they represent. Section 6.4 on page 144 contains a list of each code, its meaning, possible causes, and troubleshooting suggestions.

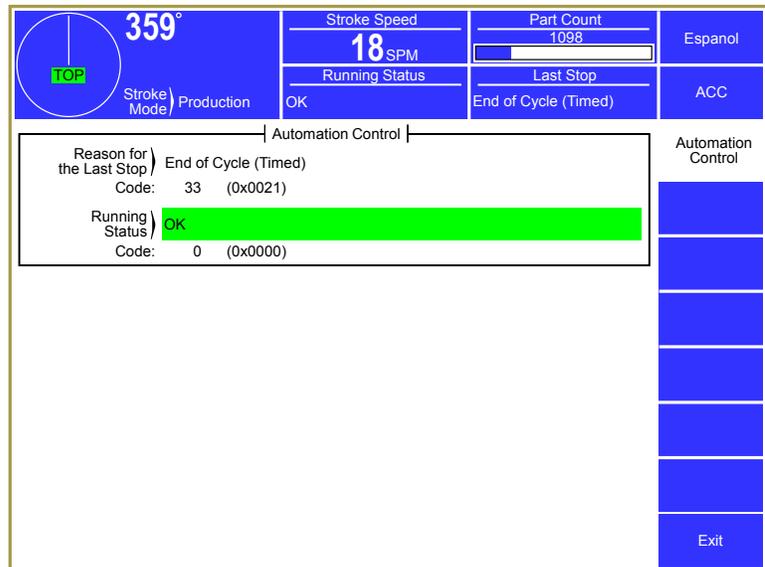


Figure 26: Detailed Status Screen

3.10.2 Step Settings Screen (Servo Presses Only)

The Step Settings screen is only used when the “Step Mode” is set to “Internal” (see Section 3.10.1.5). To get to this screen, Press the **Step Settings** softkey in the Automation Control Main screen as seen in Figure 25.

An example Step Settings screen is shown in Figure 27.

This screen is used to set the Automation Control up for the kinds of complex motions that servo presses can perform. By dividing the press motion into “steps” (if needed), programmable limit switches, die protection

channels, and other automation and monitoring devices can be set to operate correctly even in cases where the press may go back and forth during a single operating cycle. For instance, a press performing multiple restrikes near the bottom of the stroke may be set up to have a programmable limit switch fire only on the first strike, even though the programmable limit switch window is entered multiple times.

Near the top of the screen are parameters that define the basic type of motion that the press will use for the job. Not all of the parameters shown in the example screen are used for all motion types.

Near the bottom the number of steps and where those steps take affect are defined. These steps can be programmed manually or created automatically by “learning” one operating cycle of the process.

3.10.2.1 Motion Type

The “Motion Type” informs the Automation Control of the general type of motion that the press is going to perform. This will determine when one cycle is complete and how the step sequence is learned and executed. Operations during the cycle such as pausing or direction changes will each define a step. Automation and monitoring devices such as die protection, programmable limit switch, etc. can be programmed to function on specific steps.

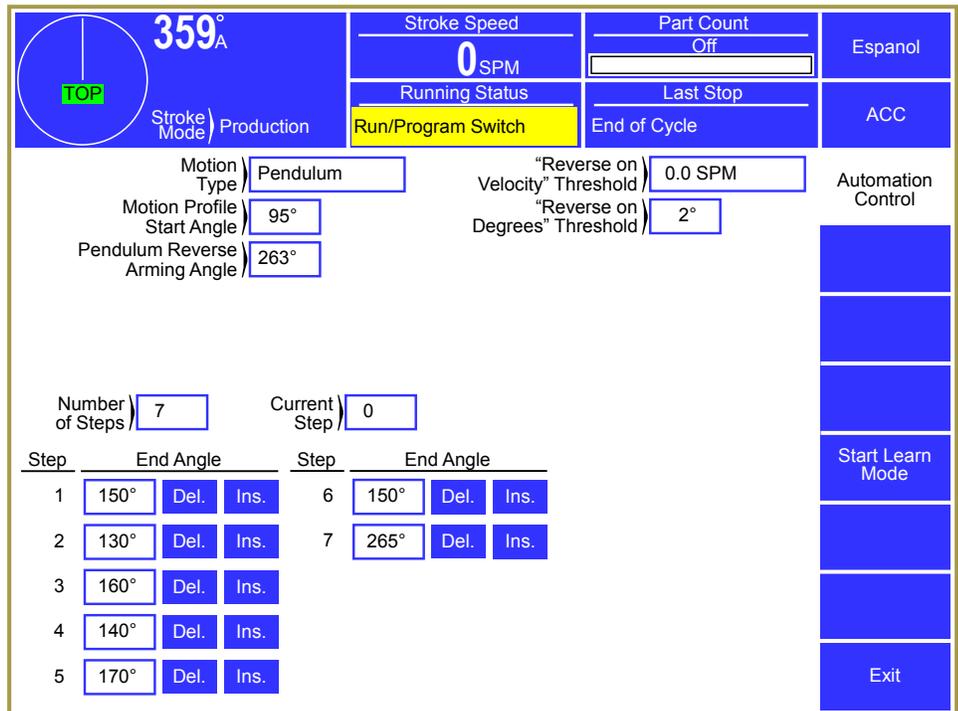


Figure 27: Step Settings Screen (Servo Press Only)

“Normal” Motion Type: Normal motion is such that the press ends up making a complete revolution each cycle by running in the forward direction into the Top of Stroke window. The press may stop at the top of the stroke or run continuously. Steps are allowed in this motion type but are not required.

Figure 28 shows an example of a basic normal motion profile consisting of one step – a complete revolution.

Note that this specifically **Does Not** mean that the press cannot slow down, speed up, or make direction changes through the cycle – only that it ultimately makes a complete revolution as part of its production cycle.

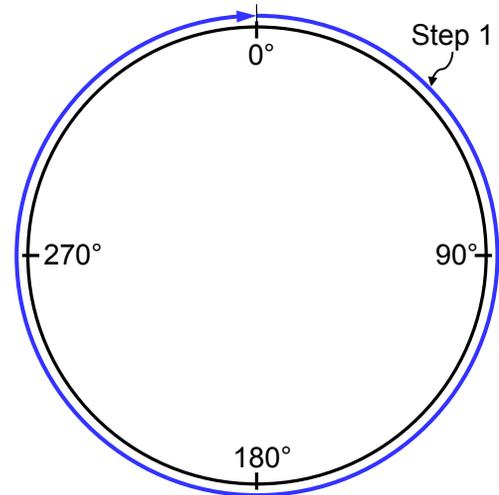


Figure 28: Simple “Normal” Motion

For instance, Figure 29 shows a motion profile consisting of three steps. Step 1 starts at the top of the stroke and goes through the bottom to 200 degrees. Step 2 reverses direction to go back through the bottom for a restrike to 160 degrees. Step 3 reverses direction again to do one more restrike through the bottom on its way back to the top of the stroke.

The motion profiles of Figure 28 and Figure 29 are both “Normal” motion types as defined by the Automation Control.

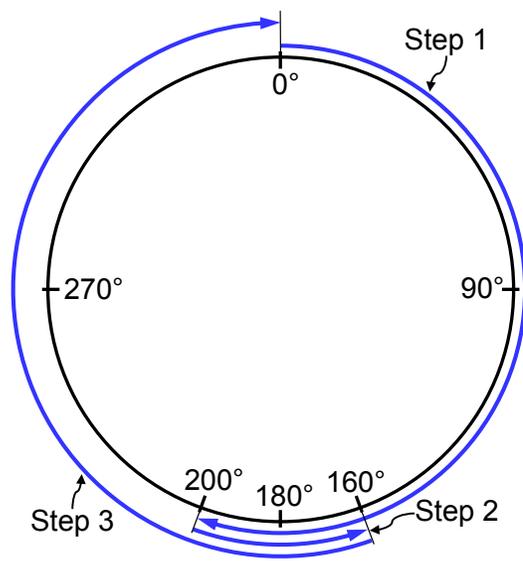


Figure 29: Complex “Normal” Motion

“Pendulum” Motion Type: Pendulum motion is that which is symmetric about bottom dead center (180 degrees) and does not go through the top of the stroke during continuous operation.

As an example, Figure 30 shows a simple pendulum motion profile where the press starts at 100 degrees and runs through the bottom to 260 degrees. Instead of continuing around to the top as “Normal” motion would do, it reverses direction, going back through the bottom, until it returns to 100 degrees. This acts as two complete cycles (a “forward” cycle and a “reverse” cycle, each with a single “step”) – not two steps of a single cycle.

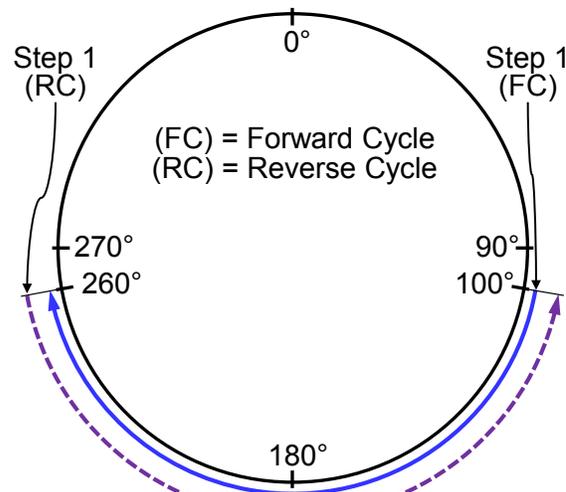


Figure 30: Simple “Pendulum” Motion

A more complex example of pendulum motion with three steps in each cycle can be seen in Figure 31. At first glance, the forward and reverse cycles may not seem symmetrical, but they are from the standpoint of slide motion. When looked at as a number of degrees of travel of each step, it can be seen that the two cycles are, in fact, equivalent. Both cycles start 80 degrees “up” from bottom dead center. Both cycles then go “down” 100 degrees through bottom dead center, change direction and go 30 degrees the other way, and finally change direction again and travel 90 degrees to go back to the “top”.

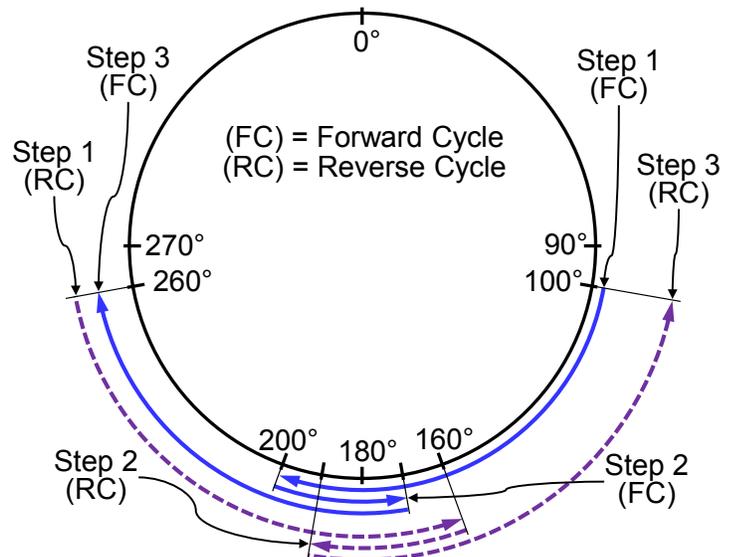


Figure 31: Complex “Pendulum” Motion

In both of these examples, when the press reverses at 260 degrees, the region that would normally be the upstroke becomes the downstroke of the reverse cycle. If a programmable limit switch was programmed to initiate a feed at 220 degrees (40 degrees before the “top” of the cycle at 260 degrees) on the forward cycle, then it would have to initiate at 140 degrees (40 degrees before the “top” of the cycle at 100 degrees) on the reverse cycle. To achieve this, the Automation Control will detect the press reversal and send “virtual angles” to the die protection, limit switches, tonnage monitor, etc. during the reverse cycle that make it look like the press is running a regular forward cycle. The method of detecting reversal can be programmed in different ways to accommodate different speeds, dwells, and motion profiles by using the additional parameters in the “Step Settings” screen. The practical ramification of this action is that all automation and monitoring devices only need to be programmed for a regular “forward” cycle. The Automation Control takes care of the reverse cycle automatically.

“Asymmetric” Motion Type: Asymmetric motion is that which ends the cycle back at the motion profile start angle without ever running back into the top of stroke window in the forward direction. If the start angle is within the top window, the cycle will end when the press runs back into the top window in reverse. Step sequence is required in this motion type.

Figure 32 shows an example asymmetric motion profile performing one restrike and using only a portion of the available stroke to speed up the cycle rate. In Step 1 the press starts at 100 degrees, goes through bottom dead center to 190 degrees, and then goes back through bottom dead center for a restrike on the way back to 100 degrees.

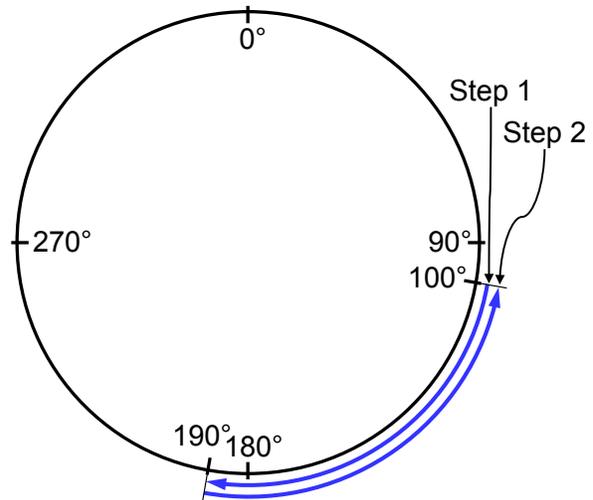


Figure 32: Simple “Asymmetric” Motion

Figure 33 shows another example of a more complex asymmetric motion profile using six steps. In this case, the press does not go through the top or the bottom. This kind of profile might be used for a redraw operation to a programmable depth. Starting at 40 degrees, Step 1 comes down to 120 degrees, Step 2 goes back up to 110 degrees, Step 3 goes down a little further to 130 degrees, Step 4 goes back up to 120 degrees, Step 5 makes the final downward motion to 140 degrees, and Step 6 goes back to the “top” at 40 degrees.

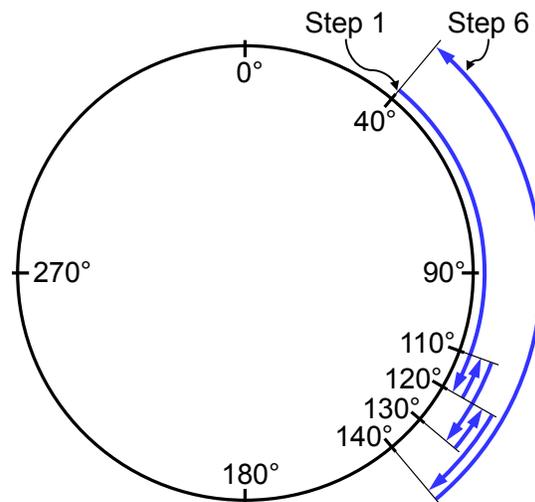


Figure 33: Complex “Asymmetric” Motion

3.10.2.2 Motion Profile Start Angle

This parameter defines the starting point in the downstroke for “Step 1” of a motion profile. The area from the physical top of the stroke to this point is then defined as “Step 0”. All automation and monitoring devices that are “step aware” have “Step 0” as an activation option just like any other step.

Essentially “Step 0” is used as an indicator that the press is not within the operating region of its programmed motion profile, or that the motion of the press is such that it does not match with the motion characteristics programmed into the Automation Control. A programmable limit switch channel can be programmed to give an indication to external equipment that this is the case.

If this parameter is set to a value inside the “Top of Stroke” window (typically 0 degrees for a non-link drive press), the downstroke will start at “Step 1”. This would be the typical case with a “Normal” motion type.

For the “Pendulum” motion type, the “Step 0” region is “reflected” around the top as well. For example, for a motion profile running symmetrically from 100 degrees, to 260 degrees, and back to 100 degrees, setting the “Motion Profile Start Angle” to 80 degrees would cause the Automation Control to enter “Step 0” if the press ran backwards “above” 80 degrees in the downstroke or “above” 280 degrees in the upstroke. This may occur if the press is instructed to run to the top of the press stroke. Figure 34 illustrates this graphically. Note that while the example demonstrates that it is possible for the “Motion Profile Start Angle” to be separated by a large margin from the actual start of the operating region, typically it will only differ by 1 or 2 degrees, to allow the process a small amount of “overshoot” without flagging “Step 0”.

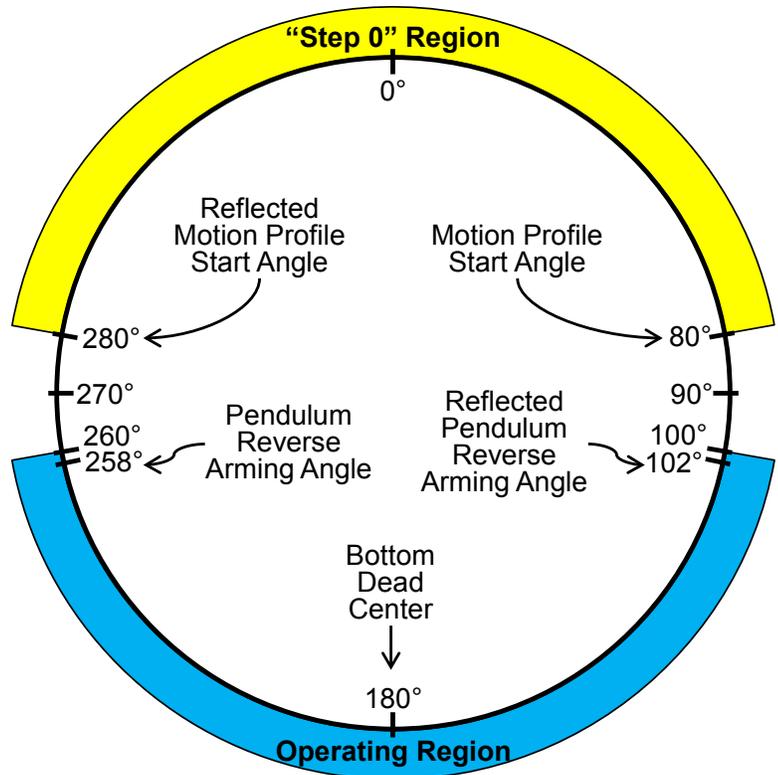


Figure 34: Pendulum Motion Regions

This parameter is also used in Asymmetric motion to indicate the end of the process. For example, a motion profile starts at 90 degrees, runs forward to 200 degrees, and runs back to 90 degrees (i.e. a short stroke that hits the material twice at bottom). Setting the “Motion Profile Start Angle” to 90 degrees will also cause an end of the Learn process when the press returns to the start.

3.10.2.3 Pendulum Reverse Arming Angle

The “Pendulum Reverse Arming Angle” sets the angle in the normal upstroke (the “forward” cycle of a pendulum motion type) where the press is going to stop and reverse directions. This does not have to be set to the precise angle that the press is going to stop and should be set less to allow variation in the stop point. This parameter tells the Automation Control that when the press comes to rest in the upstroke, IF it’s above this angle then the cycle is complete and the next cycle will be in reverse. This angle is important if the press is running steps, as it instructs the Automation Control to reject backwards motions below this point. For example, if a press is running pendulum motion (reversing at 270) but also doing multiple hits at bottom by running to 225 degrees then back to 135 degrees, this parameter is used to prevent the Automation Control from considering the reversal at 225 as a complete cycle. In this example, the parameter could be set to 260 degrees. This is the preferred method of detecting reversal. Setting this parameter to zero instructs the Automation Control to use an alternate detection method and reverse on either backwards velocity or position change.

3.10.2.4 Number of Steps

This parameter sets the number of steps that will be displayed in the step end angle table and used by the Automation Control. The maximum number of steps is 63. If Learn Mode is used, this parameter will

be set automatically. Using the delete and insert keys of the step end angle table will also cause this number to be decremented or incremented as entries are removed or added.

3.10.2.5 Current Step

This parameter shows the current step that the Automation Control has determined is active.

	WARNING: The current step can be overridden by the user by changing this parameter, but this should only be done after careful consideration and with a good understanding of the process. Improperly setting the current step could cause unexpected or incorrect operation of the press or its automation and monitoring devices.
---	--

3.10.2.6 Step “End Angle” Table

For each step, an “end angle” must be configured. These can be manually entered or learned automatically through the Learn Mode function of the Automation Control. This table is programmed to follow the motion of the press. Starting at the “Motion Profile Start Angle”, the Automation Control will be on Step 1 until the Step 1 End Angle is reached. At that point, the control is on Step 2 until the Step 2 End Angle is reached, and so on.

3.10.2.7 “Start Learn Mode” softkey

The **Start Learn Mode** softkey instructs the Automation Control to examine one cycle of the press, detect angles where the press stops, and mark these points as the end of a specific step. When one cycle is complete, learn mode is ended and the new step end angles are displayed. The current step number is reset and will increment through the step sequence table as the press repeats its programmed cycle. While learn mode is active, the softkey will change to **Cancel Learn Mode** and, if pressed, will abort the procedure and leave the old step sequence table intact.

3.10.3 Automation Control Diagnostics

Intelligent diagnostics give operators the reason for the last stop, and any condition controlled by the Automation Control that is keeping the press from stroking, on the Automation Control main screen. The System 5100 AMC also has extensive specific diagnostics available, enabling one to “drill down” into more detailed information. Pressing the **Diagnose** softkey on the Automation Control screen in causes the main diagnostic screen in Figure 35 to be displayed.

Not all of the items seen on the example screen will display on all installations depending on installed options.

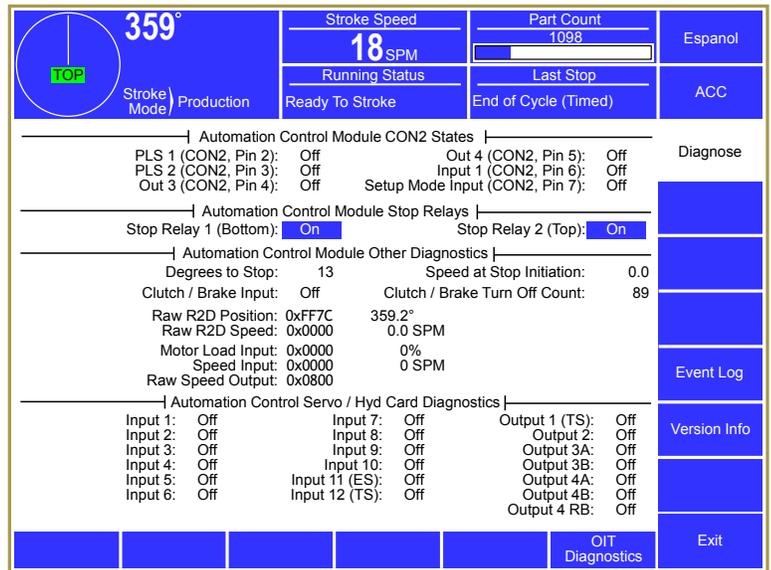


Figure 35: Automation Control Main Diagnostic Screen

Some of the items on this screen give “raw” diagnostic data primarily for use by Link engineers in telephone troubleshooting. Additional items of interest on this screen are:

- The status of most inputs and outputs on the Automation Control Logic Board, including the Immediate Stop relays.
- The number of degrees that the press took to stop.
- The speed that the press was stroking when the last stop was initiated.

The **Event Log** softkey will display the Event Log screen (see Section 3.10.3.1) that shows the last 256 recordable events for the control.

The **Version Info** softkey will display a screen that shows the firmware versions of the Automation Control Logic Board and other optional devices connected to the system (see Section 3.10.3.2).

The **OIT Diagnostics** softkey will bring up a screen that gives diagnostic information for the operator terminal itself (see Section 3.10.3.3).

3.10.3.1 Event Log

The control retains an event log. To see the log, press the **Event Log** softkey in the Automation Control main diagnostic screen (see Figure 35).

This log records the reason for the last 256 stops and certain other events, such as power-up. Each entry in the event log contains the time, date, and the type of stop.

An example event log is illustrated in Figure 36. Stops are displayed in chronological order with the most recent stop displayed first. The **Next Page** and **Previous Page** softkeys can be used to scroll through the event log.



Figure 36: Event Log Screen



Figure 37: Event Log Detail Information Screen

Pressing a specific stop message will display more detailed information about the conditions that existed when the stop occurred as shown in Figure 37.

3.10.3.2 Version Information

The version information screen shown in Figure 38 for the control hardware and software can be viewed by depressing the **Version Info** softkey in the main diagnostic screen (see Figure 35). The three version numbers shown for each installed option are:

Prog. Ver. The software version of the program running on the equipment. This version will change when software updates are installed.

Boot Ver. The version of a special loader program that is put in at the factory. This does NOT change with normal software updates.

Hard. Rev. The hardware revision of the physical electronics.

In addition, the **Device Info** softkey, if displayed, will show a screen with more detailed info on it about the currently highlighted device (such as device serial number, manufacturing date, etc.). The arrow softkeys move the highlight cursor up and down.

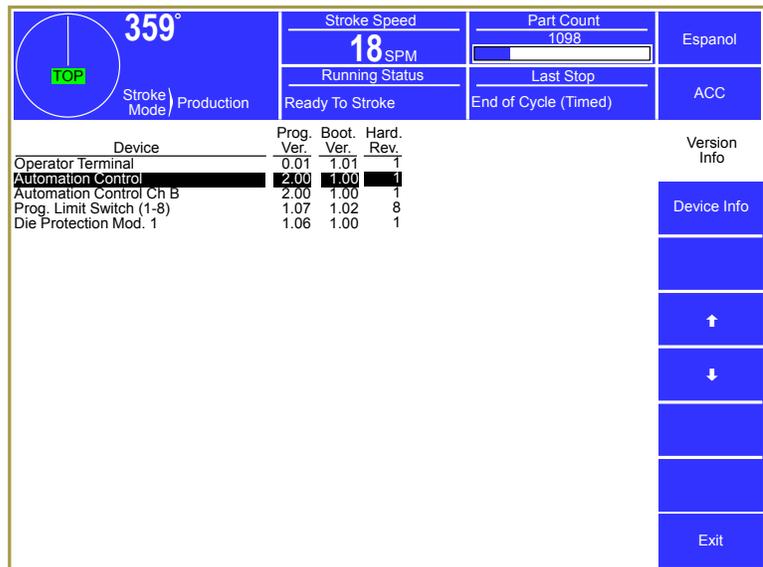


Figure 38: Version Information Screen

3.10.3.3 OIT Diagnostics Screen

The screen in Figure 39 shows diagnostic information for the operator terminal.

To get to this screen, press the **OIT Diagnostics** softkey in the main diagnostics screen (see Figure 35).

Most of this information is used by Link personnel for telephone troubleshooting.

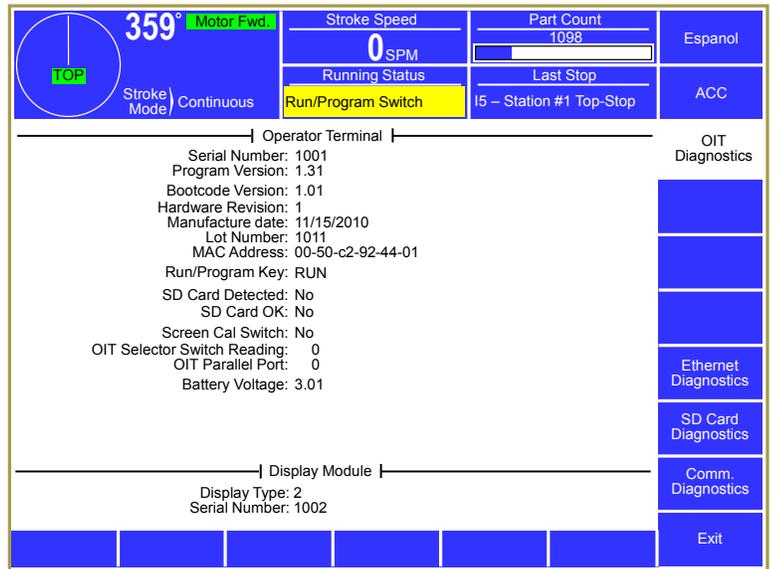


Figure 39: OIT Diagnostics Screen

3.10.3.4 Ethernet Diagnostics Screen

The screen of Figure 40 shows diagnostic information for the Ethernet connection.

To get to this screen, press the **Ethernet Diagnostics** softkey in the OIT Diagnostics screen (see Figure 39).

Most of this information is used by Link personnel for telephone troubleshooting, however, some of items . The screen shows whether or not the Operator Terminal is successfully connected to the network, and what address it is using if it is. The “Use DHCP” line indicates whether or not the Operator Terminal is using the dynamic host configuration protocol to get its settings from the network. If “Yes”, then the settings are coming from the DHCP server on the network. If “No” then these are the settings used in the Ethernet Configuration screen (see Section 4.3.6).

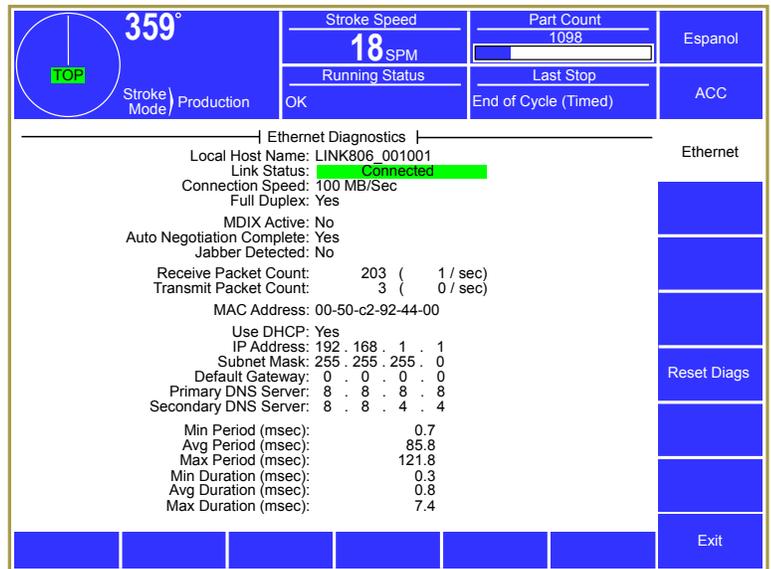


Figure 40: Ethernet Diagnostics Screen

Although not often needed, the hardware MAC address for the Operator Terminal is also shown in this screen if needed for troubleshooting by the Network Administrator.

The “Receive Packet Count” and “Transmit Packet Count” lines give an indication of network loading for the Operator Terminal. The number to the right of the count for each of these lines is the number of packets per second the Operator Terminal is sending and receiving.

4 CONFIGURATION

After the system base and optional components are installed (see Section 5), they must be configured to work with the press. Configuration consists of several steps that depend on the options installed. This system configuration is normally performed at start-up. It is usually not necessary to change the system configuration unless devices are added or removed from the system.

The System 5100 control has multiple layers of security relative to configuration of its hardware and software and the ability to program parameters. System Configuration areas are protected by a “Configuration Code” this code is set to a default value from the factory but can be changed by the user. When entering configuration areas for the Automation Control, Die Protection, and so on, a screen similar to Figure 41 will appear. Enter the correct configuration code to go to the configuration area.

	Stroke Speed 0 SPM	Part Count 1098	Espanol
Run/Program Switch	Last Stop I5 - Station #1 Top-Stop	ACC	
Enter Configuration Code) <input type="text"/>			Edit Number
7	8	9	Cancel
4	5	6	Clear
1	2	3	Back
↓	0	↑	
			Enter

Figure 41: Configuration Code Entry Screen

WARNING:



Care must be used during maintenance and troubleshooting to insure that necessary devices are not removed from or added to the System Configuration. Maintenance should not REMOVE or ADD devices unless the consequences of these actions are fully understood. Removal of necessary devices will mean that these devices will no longer be able to perform their intended function. Addition of devices that are not actually present will result in error conditions that will prevent press operation until the error conditions are removed.

NOTE:

An access code is required to reach the configuration menus. The code is provided separately from this manual for administrative control.

WARNING:



Certain configuration settings affect safety considerations, such as Brake Monitor limits, and others could affect whether elements of your production process are properly controlled or monitored. User configuration should be limited to persons who have read this manual completely and who are authorized by the employer to configure the system. Incorrect settings may indirectly expose an operator to danger at the point of operation. Incorrect sequencing or monitoring caused by incorrect settings may lead to damaged dies, press, or auxiliary equipment. Machine and tool damage may result in injury or death to persons.

4.1 Turning Devices On and Off in the Device Config Screen

Some systems are optional – or optionally used. Before anything can be configured on these devices, the operator terminal must be made aware that they are installed or intended for use. The Device Configuration Menu is used to “tell” the Operator Terminal the specific hardware modules used with the particular system with which it needs to communicate.

You will need to configure the system for the devices used with it initially, and at any time you add modules to or remove modules from the system. Each hardware module used with the system must have power and its high speed bus cable connected during device configuration.

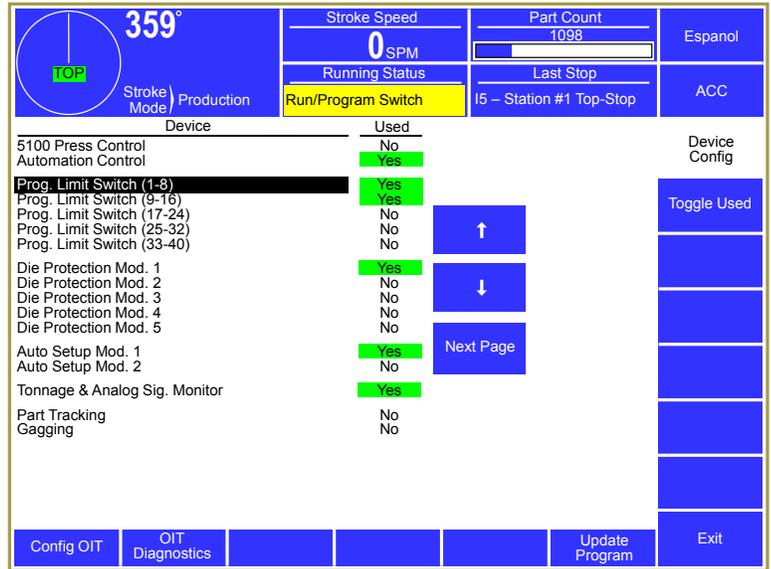


Figure 42: Device Config Screen

- Press the **ACC** softkey (near the upper right corner of the display) to display the “Quick Access” screen. With the RUN/PROG key in the PROG position, the lower left hand softkey should show as **Device Config**. Press this softkey and enter the system configuration code to gain access to the “Device Config” screen as shown in Figure 42. This screen contains a list of the options that can be used with the operator terminal.
- Using the up and down arrow softkeys, highlight the device to be used (or set to unused). Press the **Toggle Used** softkey to change whether or not the highlighted device is “Used”. The most commonly used devices are shown on the first page, but note that the **Next Page** softkey will display additional devices.
- The option name to turn on for the base system is “Automation Control” or, in some older versions of the OT806 software, “R/D - Brake Monitor”. This entry **MUST** have its “Used” column set to “Yes”. Other optional modules and/or functions are also listed with the most commonly used modules on the first page. Press the **Next Page** softkey to see other modules. Set the “Used” status of all installed modules to “Yes”. The example screen of Figure 42 shows a system with the Automation Control, Programmable Limit Switches 1 – 16, Die Protection Module 1, and Auto Setup Module 1 installed.

4.2 Automation Control Configuration

Once the operator terminal has been configured to recognize the Automation Control (See Section 4.1), it must be configured for the specific characteristics of the press on which it is installed. To enter the Automation Control system configuration screen:

- Go to the “Automation Control” screen. This screen is reached by pressing inside the Automation Control status area in the Main Screen (see Figure 10 on page 28).
- With the RUN/PROG key switch in the PROG position, press the **Configure System** softkey and enter the configuration code. Note that the code is provided separately from this manual for administrative control.

The main configuration screen consists of several softkeys. The exact softkeys that are available will depend on the configuration of the system. In particular, the “Press Type” parameter in the Machine Settings screen will affect the available configuration sections as servo presses have far fewer configuration options than mechanical presses (no clutch/brake settings, brake monitor, speed adjusted top stop configuration, etc.). The configuration areas are:

- Machine Parameters – General settings controlling the press type, encoder used, and other general machine settings.
- Clutch Configuration – Settings for the clutch/brake characteristics. (*Mechanical Presses Only*)
- Brake Monitor – Brake monitor limits and setup. (*Mechanical Presses Only*)
- Top Stop Calibration – Settings and calibration for speed adjusted top stop. (*Mechanical Presses Only*)
- Speed Configuration - Settings and calibration for speed, load, and maximum speeds. (*Mechanical Presses Only*)
- Auxiliary Equipment Message – Settings for allowing external equipment to display a message on the Link OIT using the parallel port on the back of the OIT.
- Operator Terminal – Settings for the operator terminal itself, such as auxiliary communications, security setup, and so on.

<p>NOTE: The Machine Parameters screen should be the first screen used when initially configuring the system as it will determine which other screens are displayed.</p>

4.2.1 Temporary Settings for Machine Setup

Certain aspects of initial machine configuration and setup require the press to be able to stroke in order to determine the proper operating value of various parameters. Settings in the Clutch Configuration screen and the Brake Monitor screen, if the press is a Mechanical Press, will need some temporary values to prevent the Automation Control from generating faults that have to reset on each stroke. This sections lists suggested temporary values for the needed parameters

WARNING: These configuration settings affect safety considerations and affect whether elements of your production process are properly controlled or monitored. *After using these temporary parameters for initial machine setup, verify that all these settings have been set to their properly determined operating values!*



In the Clutch Configuration Screen (see Section 4.2.3):

- Engagement Time Limit: 200 milliseconds
- Motion Threshold: 5 SPM
- Loss of Motion Time: 500 milliseconds

In the Brake Monitor Screen (see Section 4.2.4):

- Brake Monitor Top Stop Limit: 500 milliseconds
- Brake Monitor Mid Stroke Stop Limit: 500 milliseconds

4.2.2 Machine Parameters Configuration Screen

Press the **Machine Parameters** softkey in the Automation Control main configuration screen (see Section 4.2) to get to this screen. The exact parameters available on this screen will depend on whether an 802-5 or an 806-5 Automation Control Logic Board is installed (see Section 2.2 for information on this) and, in the case of the 806-5 Automation Control Logic Board, whether the optional Servo/Hyd interface board is installed.

4.2.2.1 Encoder Type

An encoder is provided with each Automation Control to be driven in a one-to-one ratio by the crankshaft of the press (i.e. one stroke of the press should result in one revolution of the encoder) to supply crankshaft angular position information to the system. The angular position display in the upper left corner of the screen displays the angle provided by the encoder.

Link offers two different encoders with the Automation Control. The standard encoder is the 2500 Resolver. An optional 5000 Resolver is also offered that combines a resolver and an optical encoder in the same enclosure to allow cross checking of the angular position information. Set this value to the resolver type supplied with the system.

4.2.2.2 Encoder Offset

The “Encoder Offset” parameter compensates for limited mechanical angular misalignment between the encoder shaft zero and the machine zero. This allows installation of the encoder without having to have perfect mechanical alignment, which is often problematic. The effect of this parameter is to electronically align the encoder and the machine as long as the mechanical misalignment does not exceed plus or minus 10 degrees.

NOTE: The “Encoder Offset” <i>must</i> be properly set or the system will indicate incorrect crank or eccentric shaft angles!
--

Two methods of setting the “Encoder Offset” are described in this section, one with the slide positioned at top dead center (TDC), and one with the slide positioned at bottom dead center (BDC).

For simple eccentric motion mechanical presses (which constitute the vast majority of presses), with slide driven by crankshaft, eccentric shaft, or eccentric gear, the top of stroke position always occurs with the crank at the 0 degree (TDC) angular position and the bottom of the stroke at the 180 degree (BDC) position. You may use either method for simple eccentric motion presses.

For Link Drive presses, the bottom of the stroke still occurs at the 180 degree (BDC) position, but the top of the stroke will generally occur at a crank or eccentric angle between 315 degrees and 335 degrees, depending on the specific design. ***You must use the method that positions the slide at BDC for link drive presses.***

Method 1: Slide at Top of Stroke

- 1) Inch the press to position the crankshaft within plus or minus 1 degree of top dead center (0 degrees - slide at the top of the stroke). This is important because the system uses the crank angle as its

absolute reference and will assume that the crankshaft position is at zero degrees when it calculates the “Encoder Offset”. If the crankshaft is actually 5 degrees from top dead center when you press the **Set Zero** softkey or manually enter an offset, as described in the following steps, you will incorporate a 5 degree error into the crankshaft angle indication of the system. ***Make sure the “Encoder Offset” setting shown on the screen is 0 and, if not, set it to 0.***

- 2) When you have positioned the crankshaft as closely as possible to top dead center, read the angle display on the operator terminal. The number displayed must be between 351 degrees and 10 degrees. This is because a maximum misalignment of encoder to crankshaft of plus or minus 10 degrees can be corrected by this function. If the displayed angle is outside these limits, you must manually decouple the encoder from the crankshaft and recouple it within the required range.
- 3) When Steps 1 and 2 are complete, press the **Set Zero** softkey. The offset angle value will be automatically entered into the “Encoder Offset” parameter. This is the number that must be added to the actual resolver reading to get 0. If the encoder to crank misalignment angle was within the allowable limits when **Set Zero** was pressed, the angular display value on the operator terminal will indicate 0 degrees.

Alternatively, you may enter the “Encoder Offset” manually. The value to enter manually is the number that, when added to the uncorrected crankshaft angle shown on the operator terminal ***when the press crankshaft is at top dead center***, would make the crank angle 360. For a circle, 360 degrees and 0 degrees are really the same point.

The Encoder Offset can be calculated as 360 minus the uncorrected angle. For instance, if the uncorrected angle shown on the operator terminal is 352 degrees, the “Encoder Offset” would be 8 (360-352). Likewise, an uncorrected angle of 3 degrees would result in an “Encoder Offset” of 357 (360-3).

- 4) Verify that the angle displayed on the operator terminal changes to 0 degrees after you press the **Set Zero** softkey or manually enter an offset. If you have manually entered the wrong offset and the angle display does not change to 0 degrees, then go back and repeat Step 3.

Method 2: Slide at Bottom of Stroke

- 1) Inch the press to position the crankshaft within no more than a couple of degrees of bottom dead center (180 degrees - slide at the bottom of the stroke). This is important because the system uses the crank angle as its absolute reference and will assume that the crankshaft position is at 180 degrees when you calculate and manually enter the “Encoder Offset”. If the crankshaft is actually 5 degrees from bottom dead center when you manually enter an offset, as described in the following steps, you will incorporate a 5 degree error into the angle indication of the system. ***Make sure the “Encoder Offset” setting shown on the screen is 0 and, if not, set it to 0.***
- 2) When you have positioned the crankshaft as closely as possible to bottom dead center (use of a dial indicator gage between the bolster and the slide may be useful to accurately determine bottom of stroke), read the angle display on the operator terminal. The number displayed must be between 171 degrees and 190 degrees. This is because the maximum allowed misalignment of encoder to crankshaft is plus or minus 10 degrees. If the displayed angle is less than 171 degrees or more than 190 degrees, you must manually decouple the encoder from the crankshaft and recouple it within the required range.
- 3) You must determine the required “Encoder Offset” to manually enter. The **Set Zero** softkey ***must not be used*** when determining offset at the bottom of stroke position.

For an uncorrected operator terminal crank angle from 171 to 179, the “Encoder Offset” can be calculated as 180 minus the uncorrected reading. For instance, if the operator terminal crank angle display is showing 175 degrees, the “Encoder Offset” would be 5 (180 – 175).

For an uncorrected operator terminal crank angle from 181 to 190, the “Encoder Offset” can be calculated as 540 minus the uncorrected reading. For instance, if the operator terminal crank angle display is showing 182 degrees, the “Encoder Offset” would be 358 (540 – 182).

- 4) Set the “Encoder Offset” to the value calculated in Step 3. The operator terminal angle display should now read 180 degrees. If not, then set the “Encoder Offset” to 0 and repeat Step 3.

4.2.2.3 Use Mode Input

The Automation Control Logic Board provides an input that allows the user to wire in an isolated contact to indicate when the setup mode (usually Inch) is selected. This could come from a press control or even from manually operated switch. When this input is used, it allows certain system devices and functions, such as die protection and counters, to behave differently when setup mode is active (automatically bypass, etc.). It will also result in a “Stroke Mode” display in the upper left area of the operator terminal which will indicate “Production” or “Setup”.

If this input is used (see Section 5.6.8 for wiring instructions), then set this parameter to “Yes”.

4.2.2.4 Top of Stroke Angle

The “Top of Stroke Angle” is the crank angle that represents top dead center for the press. This is used to tell the operator terminal where to display “Top” in the angle display area, and in a few other places (such as counterbalance control on Auto Setup modules) where a system needs to know the physical top of stroke angle.

This parameter comes from the factory set to 0 degrees since most presses have a simple eccentric motion instead of the more complex link drive motion.

If the press does have a link drive system, you must refer to the manual for the press to find what crank or eccentric angle represents top of stroke. This angle will normally be somewhere between 315 degrees and 335 degrees depending on the specific press design.

4.2.2.5 Press Type (806-5 Only)

This parameter selects the type of press the Automation Control is installed on. The press types are:

Mechanical: This selection enables an internal brake monitor and motion detector. Softkeys for Clutch Configuration, Brake Monitor, Top Stop Calibration, and Speed Control will be available in the main configuration screen.

Servo: This selection enables functions such as different type of motion profiles and step sequence programming. Softkeys for Clutch Configuration, Brake Monitor, Top Stop Calibration, and Speed Control will *not* be available in the main configuration screen as this press type does not use those functions.

4.2.2.6 “Motion Stopped” Threshold (806-5 Only)

This parameter applies only to Servo Presses and is used during the Learn process in the Step Settings screen to indicate the completion of a step. It is also used when “Motion Type” is set to “Pendulum” to detect that the press has stopped above the “Pendulum Reverse Arming Angle” and signal that the next cycle will be in the reverse direction. If this parameter is set too low, the press may not remain at rest long enough for the filtered velocity to cross this threshold and indicate motion has stopped (see “Velocity Time Constant”). If set too high, the press may continue to move after the Automation Control detects what it thinks is a stop and the end angle of the step is measured. The parameter can be set to zero and should be set as low as possible.

4.2.2.7 “Motion Started” Threshold (806-5 Only)

This parameter applies only to Servo Presses and is used during the Learn process in the Step Settings screen to indicate the beginning of a step. A step is learned only when velocity indicates the press is running and then indicates that it has stopped. If this parameter is set too high, the press may not run fast enough to indicate a distinct step (see “Velocity Time Constant”). This parameter is also used to detect that the press is “running”. This threshold applies to both clockwise and counter-clockwise motion.

4.2.2.8 Velocity Time Constant (806-5 Only)

This parameter sets the time (in milliseconds) that velocity is filtered. It can be set from 4 milliseconds to 256 milliseconds in 4 millisecond increments. The lower it is set, the more responsive the Automation Control will be to motion changes - but the more effect transients (such as a poor connection to the resolver or gear noise) will have. One characteristic of this would be if the Automation Control detects that the press stops, re-starts, and stops again at the end of a step (i.e. the press appears to bounce at stop). Increasing the time constant will reduce this affect. 64 milliseconds is the suggested default value.

4.2.2.9 Up Motion Step Change Tolerance (806-5 Only)

This parameter applies only to Servo Presses and sets a tolerance to variations in press stops when running clockwise. A step will be detected as complete when the press reaches the programmed step end angle minus this parameter. For example, Step 1 is clockwise motion and ends at 160 degrees. If this tolerance is set to 1 degree, it allows the press to stop minus 1 degree of the programmed end (159 degrees) and still change to the next step. It can be set to zero, and will depend on the repeatability of the press.

4.2.2.10 Down Motion Step Change Tolerance (806-5 Only)

This parameter applies only to Servo Presses and sets a tolerance to variations in press stops when running counter-clockwise. A step will be detected as complete when the press reaches the programmed step end angle plus this parameter. For example, Step 2 is counter-clockwise motion and ends at 140 degrees. If this tolerance is set to 1 degree, it allows the press to stop plus 1 degree of the programmed end (141 degrees) and still change to the next step. It can be set to zero, and will depend on the repeatability of the press.

4.2.2.11 Minimum Step Size (806-5 Only)

This parameter applies only to Servo Presses and can be used to reject false steps, if the press bounces when stopping at the end of a step during the Learn process. The parameter can be set to zero and should be set as low as the press characteristics allow.

4.2.2.12 Top Start Angle (806-5 Only)

This parameter sets the point in the normal upstroke where the “Top of Stroke” window begins. This window is used to reset the current step number back to a starting point, when Step Mode is set to Internal. If the “Motion Profile Start Angle” is set inside the Top Window (i.e. less than the top end angle), the current step number is reset to step 1. If the “Motion Profile Start Angle” is set after the top window (i.e. further in the downstroke), the step number is set to zero.

4.2.2.13 Top End Angle (806-5 Only)

This parameter defines the end of the Top of Stroke window and is typically set to 5 to 10 degrees on a non link drive press. The current step number is re-synchronized to the start of the motion step profile as the press is run clockwise out of the top window. If the press is run counter-clockwise out of the top window (i.e. below the “Stop Start Angle”), the current step is set to zero and the present status will display *Must Synchronize at Top*.

4.2.3 Clutch Configuration Screen (Mechanical Presses Only)

The Clutch Configuration screen is accessed by touching the **Clutch Configuration** softkey in the Automation Control main configuration screen (see Section 4.2).

The Automation Control uses a motion detection system to detect any coupling failure that results in the encoder not being driven by the crankshaft. If encoder decoupling occurred, the system would then be unable to perform its monitoring and control functions that depend on crankshaft angular position. The motion detector generates an immediate stop signal if it senses motion below the SPM (strokes per minute) configured in the “Motion Threshold” setting for a period of time greater than the “Loss of Motion Time”. The Loss of Motion Time setting is used to compensate for erratic motion on some geared presses where the gears cog back and forth as the press strokes, resulting in temporary dips below the Minimum Press Speed SPM setting.

NOTE: For initial setup, it will be necessary for certain parameters to have temporary values in order to allow the press to run. See Section 4.2.1 on page 64 for information. *After using these temporary parameters for initial machine setup, verify that all these settings have been set to their properly determined operating values!*

4.2.3.1 Engagement Time Limit

When the press control sends an electrical signal to the clutch/brake valve(s) to start stroking the press, there is a time delay before the air flow (or hydraulic system on a few presses) can push the clutch plates together and ramp up crank speed. Then the clutch plates slip until the equivalent flywheel SPM is reached. This is illustrated in Figure 43.

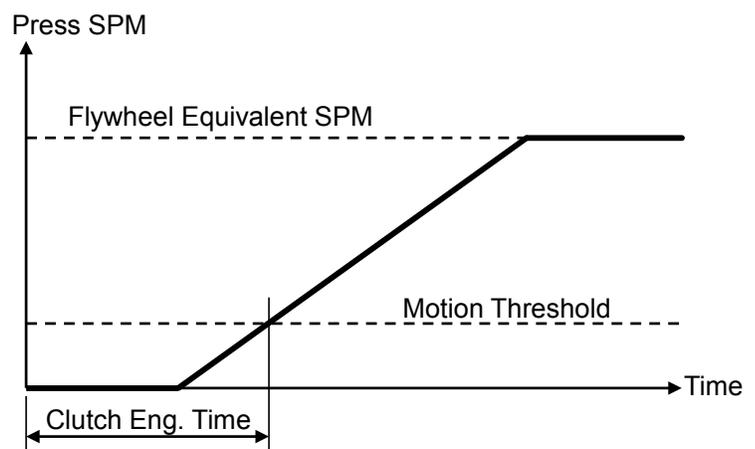


Figure 43: Clutch Engagement Time

Every time a stroke is initiated in the forward direction, the press must establish a stroking speed greater than the “Motion Threshold” within the time set by the “Engagement Time Limit”. Failure to do so will result in an immediate stop and the reason for last stop will display *Motion Did NOT Start*. This parameter can be set from 0 to 996 milliseconds.

In addition to detecting outright faults, the “Engagement Time Limit” provides useful diagnostic information relating to clutch wear. As clutch plates wear, the volume of air that must flow into and be stored in the clutch increases, which also increases the engagement time. The increased volume of air stored in the clutch also takes longer to flow out when the air valve dumps pressure to stop stroking, resulting in longer stopping times for the press. Most presses provide for adjustment or shimming to compensate for clutch wear. Exceeding the clutch “Engagement Time Limit” indicates that clutch adjustment or shimming should be performed. When possible, it is preferable to adjust the clutch

clearance to the press manufacturers recommended setting to determine the clutch engagement time with optimum clearance.

To determine the value to enter as the “Engagement Time Limit”, put the press in Single Stroke Mode and stroke the press several times. The “Last Actual” engagement time is displayed on this screen just to the right of the “Engagement Time Limit”. Some margin for wear must be accommodated so that adjustment on a frequent basis is not necessary. A typical wear margin of 20% is usually sufficient. To determine the number to enter for the “Engagement Time Limit” with a 20% wear margin, take the longest time actual engagement time observed and multiply it by 1.2. For example, if the longest actual engagement time is 100 milliseconds, enter a value of 120 milliseconds ($100 \times 1.2 = 120$) for the “Engagement Time Limit”.

4.2.3.2 Motion Threshold

Press SPM must exceed the “Motion Threshold” at stroke initiation if the main motor is running in the forward direction (see Figure 43 for the relationship between “Engagement Time” and “Motion Threshold”). Failure to establish motion will result in an immediate stop and the reason for the last stop will display *Motion Did NOT Start*.

It must also maintain motion above this limit while the press is stroking (see also “Loss of Motion Time” and Figure 44). Failure to maintain motion above this threshold while stroking will result in an immediate stop and the reason for last stop will display *Motion Stopped*. Whenever slide motion is at rest and the press control is not energizing the clutch/brake valve(s), crankshaft motion must remain below this threshold. If motion above the threshold occurs for greater than 0.1 seconds it will result in the LMC relays turning “Off” to de-energize the drive motor as well as power to the clutch/brake valves. The present running status will display *Motion w/o Clutch Signal*.

This parameter can be set from 0 to 100 SPM and generally should be set 10% to 30% below the slowest normal stroking speed of the press.

4.2.3.3 Loss of Motion Time

The “Loss of Motion Time” is provided because mechanical backlash of drive system components can cause the crankshaft to turn in jerky motion, falling below the motion threshold for very brief periods of time. Figure 44 shows an exaggerated illustration of this. The “Loss of Motion Time” setting is chosen to prevent nuisance stopping by permitting press SPM to drop below the “Motion Threshold” for brief periods of time without the assertion of a stop.

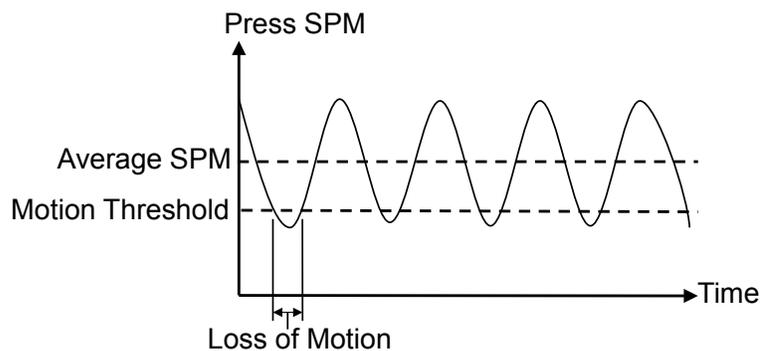


Figure 44: Loss of Motion Time and Motion Threshold

This parameter can be set from 0 to 1020 milliseconds. For typical applications this parameter should be set to:

$$\text{Time (in milliseconds)} = 3500 / \text{Max SPM}$$

NOTE: If the loss of motion time value calculated by the formula is not longer than the time that motion can dip below the “Motion Threshold”, loss of motion faults will result. If these occur, you may increase the time calculated by the formula but, in no case should this time be increased more than 2.5 times the value calculated by the formula.

4.2.4 Brake Monitor Configuration Screen (Mechanical Presses Only)

The Brake Monitor screen is accessed by touching the **Brake Monitor** softkey in the Automation Control main configuration screen (see Section 4.2).

Each time the press stops a time based brake monitor (2 millisecond resolution) measures the time from deactivation of the clutch/brake valve until crankshaft rotation is less than 1.8 RPM. This value is displayed on this screen as the "Brake Monitor Actual Stop Time".

Separate limits are provided for monitoring the actual stopping time at the top of the stroke ("Brake Monitor Top Stop Limit") or at any position other than top ("Brake Monitor Mid Stroke Stop Limit").

 **WARNING:** When your press is equipped with two-hand control safety devices and/or presence sensing devices for point of operation protection, only qualified personnel with a knowledge of current ANSI (B11.1) standards and OSHA (CFR 1910.217) regulations or other applicable regulations in a venue that govern the relationship between stopping time and the distance at which two-hand control and/or presence sensing devices are to be located should set or reset stop limits for the brake monitor. *Both of these limits must never be set for longer times than the time that the safety distance in these standards is based on.*

4.2.4.1 Process to Determine Brake Monitor Limits

NOTE: For initial setup, it will be necessary for certain parameters to have temporary values in order to allow the press to run. See Section 4.2.1 on page 64 for information. *After using these temporary parameters for initial machine setup, verify that all these settings have been set to their properly determined operating values!*

NOTE: Before determining the brake monitor parameters, the Top Stop Calibration settings should be correct so that the press is successfully stopping at top at its operating speed or through its speed range. See Section 4.2.5 for information on this procedure. In addition, if the Automation Control is controlling press speed, the Speed Configuration (see Section 4.2.6) will need to be properly calibrated before doing the Top Stop Calibration.

To determine the appropriate brake monitor limit settings, use the following steps:

- 1) It is advisable to determine the stopping time of the press with the heaviest upper die used in the press and, if the press is a variable speed press, to run at the highest stroking speed for which the die is run in the press. Adjust the press shutoff height so that the upper and lower dies don't close. If the press has a slide counterbalance, it should be set for the weight of the upper die. The stopping time of the press will increase with upper die weight and stroking speed, and will vary with counterbalance pressure. It is also recommended to make adjustments (when adjustment is provided) to set clutch and brake clearance to the minimum value specified by the press manufacturer. This should reduce stopping time.

The worst case stopping time is what needs to be determined so that it is not necessary to repeatedly change the brake monitor stop limit settings as different dies are used in the press. Of course, production jobs may be added at a later time where die weight or stroking speed produces stop times that exceed the initial worst case values, requiring limits to be increased.

- 2) Turn the RUN/ PROG switch to RUN and start the press stroking in continuous mode. After the press has made two or three strokes, press the **Do Top Stop** softkey on the Brake Monitor configuration screen. The Automation Control will top stop the press and the “Brake Monitor Actual Stop Time” will show the stopping time in milliseconds (thousandths of a second). To the right of the stop time “(Top)” should appear, indicating that this is a top stop time measurement. Record this top stop time and repeat this step several times, recording the top stop time each time you stop.
- 3) Take the **longest** stop time recorded in step 2 and add a 10% to 20% margin for wear and other factors that affect this time to determine the “Brake Monitor Top Stop Limit” setting. For example, if your longest recorded stopping time is 170 milliseconds, 20% of this value is 34. A setting of 204 milliseconds ($170 + 34 = 204$) for the “Brake Monitor Top Stop Limit” would allow top stopping time to increase by 34 milliseconds before a brake monitor fault would prevent a successive stroke. A 10 % margin would allow less increase in stopping time before a fault occurred.
- 4) Again start the press stroking in continuous mode. After the press has made two or three strokes, press the **Do Mid Stroke Stop** softkey on the Brake Monitor configuration screen. The Automation Control will initiate a stop signal near mid stroke and the “Brake Monitor Actual Stop Time” will show the stopping time in milliseconds (thousandths of a second). To the right of the stop time “(Mid)” should appear, indicating that this is a “mid stroke” stop time measurement. Record the mid stroke stop time and repeat this step several times, recording the mid stroke stop time each time you stop.
- 5) Take the **longest** stop time recorded in step 4 and add a 10% to 20% margin for wear and other factors that affect this time to determine the “Brake Monitor Mid Stroke Stop Limit” setting. For example, if your longest recorded stopping time is 200 milliseconds, 20% of this value is 40. A setting of 240 milliseconds ($200 + 40 = 240$) for the “Brake Monitor Mid Stroke Stop Limit” would allow mid stroke stopping time to increase by 40 milliseconds before a brake monitor fault would prevent a successive stroke. A 10 % margin would allow less increase in stopping time before a fault occurred. ***Note that because of the characteristics of the reciprocating motion of a mechanical power press, mid stroke stopping time is normally greater than top stopping time.***

4.2.4.2 Brake Monitor Top Stop Limit

This parameter sets the maximum time allowed for the press to come to rest when automatically stopped at the top of the stroke. If the measured stop time exceeds this limit the operator must acknowledge the fault by pressing the **Reset** softkey before any further strokes can be initiated. Since this limit applies only when the press is being automatically stopped at the top of the stroke, it can be set close to the actual top stop time required (which is often less than the time to stop at mid downstroke and can be used to detect a small increase in top stop time. This limit can be set from 20 to 1000 milliseconds. See Section 0 for information on determining the proper value for this limit.

4.2.4.3 Brake Monitor Mid Stop Limit

This parameter sets the maximum time allowed for the press to come to rest when stopped anywhere in the stroke except the top. If the measured stop time exceeds this limit the operator must acknowledge the fault by pressing the **Reset** softkey before any further strokes can be initiated.

NOTE: Since this limit applies to when the press is stopped in the downstroke (and should therefore *always be higher than the “Brake Monitor Top Stop Limit”*), it establishes the maximum allowable stopping time of the press and can be used to determine the minimum safety distance for two hand control and light curtain safety devices as required by OSHA 1910.217 regulations and current ANSI B11.1 standards.

This limit can be set from 20 to 1000 milliseconds. See Section 0 for information on determining the proper value for this limit.

4.2.5 Top Stop Calibration Screen (Mechanical Presses Only)

The Top Stop Calibration screen is accessed by touching the **Top Stop Calibration** softkey in the Automation Control main configuration screen (see Section 4.2).

Both stopping time and stopping distance (in degrees) vary greatly with press speed and, to a lesser degree, on die weight and counterbalance pressure (if the press has a counterbalance). Before performing a top stop calibration, it is advisable to set a die in the press and adjust the counterbalance (if the press has a counterbalance) to the proper pressure for the upper die weight used. It is preferable to use a die that has one of the heaviest upper die weights used in the press, since this can then be used to determine the Brake Monitor settings as described in Section 0. If you do place a die in the press for this calibration procedure, adjust the slide shutheight so that the die doesn't close as you perform the top stop calibration.

The Automation Control must be calibrated for the press to stop at top for both single stroking speed and variable stroking speed presses. The angle at which the press control begins to stop is automatically adjusted to compensate for the speed of the press in order to come to rest at the top of the stroke over the operating speed range of the press. Variable speed top stop calibration will be discussed first in Section 4.2.5.1. Single speed calibration is treated as a special case of variable speed top stop calibration and is discussed in Section 4.2.5.2.

4.2.5.1 Variable Speed Calibration Procedure

Variable speed presses take longer (in time) and further (in crankshaft degrees) to stop as stroke speed is increased. This is not a linear function because the energy stored in the rotating parts and the slide is a function of the square of the stroking speed. Signals that tell the press clutch/brake control when to start stopping so that the slide will stop at top are generated from angular position indicating devices (such as rotating cam limit switches or encoders) that are connected to the press crank or eccentric shaft. These can be adjusted by trial and error to give a stop signal at a crankshaft position in the upstroke that result in the press stopping at top. But as speed increases, the stopping distance will increase, causing the press to overrun its top of stroke position for a fixed setting of the angular position indicating device. Similarly, if the angular position indicating device is set to stop the slide at top at a high speed, the slide will stop short of top at lesser speeds. On presses with a wide speed range, a fixed stop signal may even result in the press stopping at or near bottom at some speeds instead of near top.

The Automation Control provides, as standard, an automatic top stop compensation function for variable speed presses *for top stop commands that it initiates* to the press clutch/brake control in conjunction with faults detected by its production system monitoring functions that require top stop. This function works so that, as speed increases or decreases, the top stop signal is sent at an earlier or later crankshaft angle as necessary to stop the press slide near top position.

In addition, if an optional System 5100 programmable limit switch module is provided with the system, it may be possible to use programmable limit switch relays *in conjunction with the existing hard cams* for some press controls on variable speed presses to automatically compensate the anti-repeat function that stops the press near top in single stroke modes for changes in speed. It is often possible to use the existing cams associated with the clutch/brake control to set a default stop position at the lowest stroking speed and use the PLS outputs to give an earlier stop signal as speed increases. ***This must not be done***

if, when the existing hard cams are adjusted to stop the press at top at the lowest stroking speed, the adjustment would result in a stop past 80 degrees in the downstroke at the highest stroking speed.

WARNING:



Never use the Automation Control programmable limit switch outputs to simply *replace* the cams or other devices that provide the anti-repeat function (which automatically stops the press at the end of each stroke) required by OSHA standards for single stroke mode of a press clutch/brake control. The programmable limit switch outputs *are not control reliable* and may not stop the press if a failure occurs. Serious injury to operators can result if the press fails to stop at the end of a stroke as required in single stroke mode.

NOTE:

The Automation Control *cannot* provide automatic top stop compensation for top stop signals that it does not *initiate* to the press clutch/brake control in automatic modes. Top stop signals from auxiliary equipment or top stop operator controls that are wired directly to the clutch/brake control cannot be compensated.

The *exception* to the above is if the anti-repeat cams used for single stroke are also the cams used to provide top stop in automatic modes. In that case, the programmable limit switch outputs used to automatically top stop compensate the anti-repeat function in single stroke will also compensate top stop signals from auxiliary equipment and top stop operator controls in automatic modes. *If approved by Link engineers*, Link Systems SS501 controls with at least 4 mechanical cam switches available for use with the anti-repeat function may be augmented with programmable limit switch outputs from the Automation Control to provide automatic top stop compensation from all top stop sources.

Variable speed presses require that a calibration procedure be performed when the press control is installed. This process involves running the press at both a low and high speed and adjusting the top stop position (programmed in degrees before top dead center) to stop the press at the top of the stroke at both speeds. The suggested top stop calibration procedure is as follows:

- 1) Put the press in Continuous mode.
- 2) Turn the RUN/PROG switch to the PROG position and enter the low and high operating speeds for the press in the “Low Speed SPM” and “High Speed SPM” parameters. Set both “Low Speed Degrees Before TDC” and “High Speed Degrees Before TDC” to 0. With both low speed and high speed “Degrees Before TDC” set to the same value, the press control will NOT calculate a stopping angle based on speed but will use the programmed setting at all stroking speeds. Set the press speed to stroke at the “Low Speed SPM” value.
- 3) Initiate stroking and press the **Do Top Stop** softkey in the Top Stop Calibration screen after the press has made 2 or 3 strokes (to make sure it has reached full continuous stroking speed). *Do not use a top stop source wired directly to the press control*, such as a top stop button – the top stop *must* come from the Automation Control!

- 4) Examine the results of the stop which are shown at the bottom of the screen under “Last Stop Results”. Verify that the “Speed at Stop Initiation” is approximately equal to the programmed “Low Speed SPM” value. If not, adjust the press speed to closely match the “Low Speed SPM”. If it does match, then enter the value shown for “Degrees to Stop” in **both** the “Low Speed Degrees Before TDC” and “High Speed Degrees Before TDC”.
- 5) Initiate stroking again and verify that a top stop results in the correct “at rest” position. Since the stopping characteristics of the press may be different in the downstroke than in the upstroke, the first programmed top stop position may need to be adjusted by going back to Step 3. If adjustment is needed, the new value **must** be entered into both low and high speed “Degrees Before TDC” in order to prevent the press control from attempting to calculate a stop angle during the calibration process.
- 6) Once adjusted to stop at top at the low speed, set the press speed to the “High Speed SPM” speed.
- 7) Initiate stroking and press the **Do Top Stop** softkey in the Top Stop Calibration screen after the press has made 2 or 3 strokes (to make sure it has reached full continuous stroking speed). **Do not use a top stop source wired directly to the press** control, such as a top stop button – the top stop **must** come from the Automation Control!
- 8) Examine the results of the stop which are shown at the bottom of the screen under “Last Stop Results”. Verify that the “Speed at Stop Initiation” is approximately equal to the programmed “High Speed SPM” value. If not, adjust the press speed to closely match the “High Speed SPM”. If it does match, then enter the value shown for “Degrees to Stop” in **only** the “High Speed Degrees Before TDC”. Leave the “Low Speed Degrees Before TDC” value alone.
- 9) Initiate stroking again and verify that a top stop results in the correct “at rest” position. Since the stopping characteristics of the press may be different in the downstroke than in the upstroke, the first programmed top stop position may need to be adjusted by going back to Step 7.

The press control will use the programmed parameters to calculate coefficients used in an equation that describes the stopping characteristics of the press. From this point on the press control will calculate a stopping angle based on speed throughout the entire speed range of the press. Once programmed for operation at high speed, the press can be operated at any intermediate speed to verify that the calibration procedure has generated the correct stopping curve.

4.2.5.2 Single Speed Calibration Procedure

- 1) Put the press in Continuous mode.
- 2) Turn the RUN/PROG switch to the PROG position and enter the operating speed for the press in both the “Low Speed SPM” and “High Speed SPM” parameters. Set both “Low Speed Degrees Before TDC” and “High Speed Degrees Before TDC” to 0.
- 3) Initiate stroking and press the **Do Top Stop** softkey in the Top Stop Calibration screen after the press has made 2 or 3 strokes (to make sure it has reached full continuous stroking speed). **Do not use a top stop source wired directly to the press** control, such as a top stop button – the top stop **must** come from the Automation Control!
- 4) Examine the results of the stop which are shown at the bottom of the screen under “Last Stop Results”. Enter the value shown for “Degrees to Stop” in **both** the “Low Speed Degrees Before TDC” and “High Speed Degrees Before TDC”.

- 5) Initiate stroking again and verify that a top stop results in the correct “at rest” position. Since the stopping characteristics of the press may be different in the downstroke than in the upstroke, the first programmed top stop position may need to be adjusted by going back to Step 3. If adjustment is needed, the new value *must* be entered into both low and high speed “Degrees Before TDC” in order to prevent the press control from attempting to calculate a stop angle during the calibration process.

4.2.6 Speed Configuration Screen (Mechanical Presses Only)

The Speed Configuration screen is accessed by touching the **Speed Configuration** softkey in the Automation Control main configuration screen (see Section 4.2). If the optional Speed Control board is installed, this screen can be used to configure the press drive speed. This option can be used to display the present speed and percent load of the drive, and control the speed of the drive.

Example connections necessary for motor load and speed interface are shown in Section 5.6.9 on page 130.

Some general configuration parameters are present on this screen, as well as **Input Calibration** and **Output Calibration** softkeys to go to screens specific to input and output calibration settings.

A **Motor Control** softkey is also in this screen for convenience in changing the current speed settings for testing the configuration.

4.2.6.1 Speed Control Type

This parameter allows sets the basic mode that the speed control will use to operate. The speed control types are:

Speed Control Not Used

The speed control is not used and speed and load bar graphs will not be shown on the Main Screen or the Automation Control screen. The Speed screen is not available.

Read Only – No Output

The motor speed control option is set to “Read Only” and the system will not generate command signals to the drive. If this configuration type is selected, the operator will be given access to the Press Speed screen to see the current speed and % motor load, but will not be able to enter a speed parameter. The press speed will be controlled in the same manner as before the Automation Control was installed (potentiometer etc.).

Not Recalled with Job

The speed is controlled by the Automation Control, but the speed setting is not recalled when a job is recalled. The setting will keep whatever value it had, but can be changed in the Speed screen.

Recall with Job

The speed is controlled by the Automation Control, and the speed setting is recalled with a job and the motor will automatically drive to the desired speed when the production mode is selected.

4.2.6.2 Setup Mode Fixed SPM

This parameter is used to configure the system to stroke at a fixed speed in Setup mode – if the “Use Mode Input” parameter (see Section 0) is set to “Yes”. For example, a press that has a maximum

stroking speed of 500 SPM could be configured operate at 50 SPM in setup mode. Each time Setup mode is selected, the output of the speed control will command the drive to run at the selected speed. If a fixed Setup mode SPM is not desired, a setting of 0 will turn this feature off.

4.2.6.3 Minimum Production SPM

This parameter allows the speed control to be configured to reject an operators attempt to run the press below a defined point in Production mode. If the “Use Mode Input” parameter (see Section 0) is set to “No”, the press is always considered to be in Production mode.

4.2.6.4 Maximum Speed

This parameter is used to scale the input of flywheel speed wired to the Speed Control board, for variable speed presses. The maximum strokes/minute value entered should typically be set slightly greater than the actual highest speed at which the variable speed drive is adjusted. The maximum value is 2500 SPM.

If the Speed Control option is being used to set the drive speed, the operator will not be able to enter a speed higher than this value or higher than the “High Output SPM” parameter in the Speed Output Calibration screen.

<p>NOTE: If “Maximum Speed” is changed after the system is calibrated, the “Speed Input Cal. Number” in the Speed Input Calibration screen will also need to be adjusted to get the correct speed readout.</p>

4.2.7 Speed Input Calibration Screen (Mechanical Presses Only)

The Speed Input Calibration screen is accessed by pressing the **Input Calibration** softkey in the Speed Configuration screen (see Section 4.2.6). This screen provides parameters used to calibrate the input on the optional Speed Control board that measures drive speed. If sufficient information is already known about the drive, the parameters may be entered and then adjusted as necessary. If no information is known about the drive, then see Section 4.2.7.4 on for the calibration process.

A **Motor Control** softkey is also in this screen for convenience in changing the current speed settings for testing the configuration.

4.2.7.1 Speed Input Cal. Number

This parameter is used to calibrate the voltage applied to the speed input of the Speed Control board in order to convert it to drive speed in SPM. Calibration is performed by running the motor at maximum speed and adjusting the “Speed Input Cal. Number” until the SPM readout shows the correct speed. This number can be set from 1 to 4095, but since this value defines the resolution it should be set as high as possible within the input voltage range. The drive speed readout will increase as the “Speed Input Cal. Number” is lowered.

4.2.7.2 Low SPM Input Offset

This parameter is used in the calibration procedure of the speed input on the Speed Control board. If needed, this parameter can be used to adjust the SPM reading at low speed (see Section 4.2.7.4 on page 83).

4.2.7.3 Load Input Cal. Number

This parameter is used to calibrate the voltage applied to load input of the Speed Control board in order to convert it to a % Load value. Calibration is done by running the motor and measuring the load current. The measured value (in amps) divided by the rated current specified on the motor is the % Load. The “Load Input Cal. Number” can then be adjusted to get the correct % Load readout. This number can be set from 1 to 4095. The % Load readout will increase as the number is lowered.

4.2.7.4 Speed Input Calibration Procedure

NOTE: If the Automation Control will be controlling the press speed, then an output calibration should be performed before the input calibration procedure. This will allow setting the press speed as necessary to calibrate the input readings.

To calibrate the drive speed output to the input of the Speed Control, use the following procedure. The press control mode should be set to Continuous so the stroking speed can be used to determine the actual speed of the press.

- 1) Set the “Maximum Speed” parameter in the Speed Configuration screen (see Section 4.2.6) slightly above the actual highest stroking speed of the press, typically 10% or so. (This may already have been done as part of an output calibration procedure).
- 2) Use the **Input Calibration** softkey to go to the Speed Input Calibration screen.

- 3) Set the “Low SPM Input Offset” parameter to 0.
- 4) Set the press to stroke at its maximum operating speed and initiate stroking. The “Speed Input Voltage Range” should be set equal to or slightly higher than the voltage on the S1 terminal (with the meter ground lead on the S2 terminal) of the Speed Control board. This voltage may be DC or AC (depending on the type of drive). Once the voltage range is set, the “Speed Input Cal. Number” can be used to set the gain of the speed input. The SPM input will be displayed as “Drive Speed” on the Speed Input Calibration screen. The maximum value of the “Speed Input Cal. Number” is 4095 and lower settings will increase the “Drive Speed” readout. An entry of less than about 1000 indicates that the voltage range is too high. Adjust the “Speed Input Cal. Number” by trial and error until the “Drive Speed” and the “Stroke Speed” match.
- 5) With the press still stroking, adjust the press speed to the lowest operating speed. If the “Drive Speed” readout does not match the “Stroke Speed” at low speed, the “Low SPM Input Offset” parameter can be used to correct it. By trial and error, enter an offset value that causes the “Drive Speed” readout to match the “Stroke Speed” at low speed.

4.2.7.5 Percent Motor Load Calibration Procedure

To calibrate the motor load input of the Speed Control, use the following procedure.

- 1) Turn on the main press drive motor and place an ammeter on a motor lead. Do not stroke the press. This would cause variation in the motor current.
- 2) Read the current being drawn by the ammeter, divide the ammeter current by the full load current of the motor and multiple the result by 100. This is the Percent Load you are drawing while not stroking or stamping and should normally be less than 30%. The full load current of the motor should be on the motor legend plate or available from a table.
- 3) Enter numbers by trial and error into the “Load Input Cal. Number” parameter until the “Load” readout agrees with the number you calculated in step 2. A good starting value is 2000 and lower calibration numbers produce higher “Load” readings.

4.2.8 Speed Output Calibration Screen (Mechanical Presses Only)

The Speed Output Calibration screen is accessed by touching the **Output Calibration** softkey in the Speed Configuration screen (see Section 4.2.6). This screen is used to calibrate the analog output that controls the drive speed on the optional Speed Control board. If sufficient information is already known about the drive, the parameters may be entered and then adjusted as necessary. If no information is known about the drive, see Section 4.2.8.7 on page 86 for more information about calibrating the speed control output.

A **Motor Control** softkey is also in this screen for convenience in changing the current speed settings for testing the configuration.

4.2.8.1 Enter Cal. Mode Softkey

Pressing the **Enter Cal. Mode** softkey will put the system into “Output Calibration Mode”. A yellow bar with “Output Calibration Mode Active” will appear with “Drive Speed” and “Stroke Speed” readouts below it. An “Output Volts” parameter also appears in this mode that is used to tell the Speed Control board to directly apply the entered voltage to the drive for calibration purposes.

When this mode is active, the **Enter Cal. Mode** softkey changes to **Exit Cal. Mode** which, when pressed, will return the system to normal speed control operation.

4.2.8.2 Low Output SPM

This parameter is used to calibrate the drive speed output from the Speed Control board to the motor drive, and to define the low end of the speed range for this press. Operating speeds or configuration speeds (e.g. “Setup Mode Fixed SPM”) cannot be set below this value. See Section 4.2.8.7 on page 86 for more information about calibrating the speed control output.

4.2.8.3 Low Output Volts

This parameter sets the output voltage required to drive the flywheel speed to the “Low Output SPM”. The calibration number is entered in dc voltage (0 to 10.00 VDC).

An example of how this is used would be to set the minimum stroking speed of a press (high speed of 400 SPM) to 50 SPM. After the drive has been calibrated to operate at maximum rated speed with a 10.00 VDC command signal, it is found that 2.0 VDC is required to operate the press at 50 SPM. Setting the “Low Output SPM” to 50 SPM and the “Low Output Volts” to 2.00 will configure the press control to allow operation only from the configured “Low Output SPM” to the configured “High Output SPM”. The analog output will be scaled to vary linearly from 2.0 VDC at 50 SPM to 10.00 VDC at 400 SPM.

4.2.8.4 Mid Output SPM

This parameter sets the mid-range speed of the press and can be used to compensate for non-linear characteristics of the motor drive. If needed, it is used along with the “Mid Output Volts” to adjust the output command signal over the speed range of the press (see Section 4.2.8.7). If not used it should be set to 0.00.

4.2.8.5 Mid Output Volts

This parameter sets the output voltage required to drive the flywheel speed to the “Mid Output SPM”. The calibration number is entered in dc voltage (0 to 10.00 VDC).

An example of how this is used would be after calibrating the low and high speed settings, the press control is programmed to command 225 SPM (1/2 of 50-400 SPM) and outputs 6.00 VDC (1/2 of 2.0-10.0 VDC). However, with this command signal the motor drive only strokes the press at 220 SPM. In this situation the “Mid Output SPM” can be set to 225 SPM and the “Mid Output Volts” can be set to whatever output voltage is required to drive the press to 225 SPM. For example, if 6.10 VDC is required to drive the motor to 225 the “Mid Output Volts” should be set to 6.10. If no adjustment at mid-range is required this parameter along with the “Mid Output SPM” should be set to 0.00.

4.2.8.6 High Output SPM

This parameter sets the high speed of the press. The drive must be calibrated so that the press strokes at this speed when the output of the Speed Control is at 10.00 VDC.

4.2.8.7 Speed Control Output Calibration Procedure

To calibrate the stroking speed of the press to the output of the Speed Control, use the following procedure. The press control mode should be set to Continuous so the stroking speed can be used to determine the actual speed of the press.

- 1) In the Speed Configuration screen (see Section 4.2.6), set the following parameters:
 - Set “Maximum Speed” slightly above the actual highest stroking speed of the press, typically 10% or so.
 - Turn off “Setup Mode Fixed SPM” by entering 0.
 - Turn off “Minimum Production SPM” by entering 0.
 - Set the “Speed Control Type” to “Recall with Job” or “Not Recalled with Job”, as desired.
- 2) Use the **Output Calibration** softkey to go to the Output Calibration screen and set the following parameters:
 - Set the “Low Output SPM” parameter to the lowest operating speed for this press.
 - Set the “Low Output Volts” parameter to 0.
 - Set the “Mid Output SPM” parameter to 0.
 - Set the “Mid Output Volts” parameter to 0.
 - Set the “High Output SPM” parameter to the highest stroking speed for this press.

<p>NOTE: If the SPM settings and Output Volts are already known for this type of press and motor drive, these settings can be entered and then adjusted if necessary.</p>
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- 3) If very little or no information is known about the speed settings for this type of press, an “Output Calibration” mode is provided which allows the Speed Control output to be manually set from 0 to 10 volts. The drive can then be calibrated to stroke at the correct maximum

strokes/minute. In this case, press the **Enter Cal. Mode** softkey. A yellow bar with “Output Calibration Mode Active” will appear with “Drive Speed” and “Stroke Speed” readouts below it. An “Output Volts” parameter also appears in this mode that is used to tell the Speed Control board to directly apply the entered voltage to the variable speed drive for calibration purposes. The “Stroke Speed” readout is the actual true speed of the press when stroking as measured by the Link encoder on the press crankshaft. The “Drive Speed” is the current reading from the speed input of the Speed Control board and will only be correct if a Speed Input Calibration has already been performed.

Calibration starts by calibrating the drive for the “High Output SPM”. However, instead of immediately entering 10 volts for the “Output Volts” parameter, enter 2.5 volts as a starting value to make sure the drive is not set up in such a way that it will exceed the maximum press speed when 10 volts is finally applied. Start the press and verify that the “Stroke Speed” readout is below the maximum operating speed of the press. With the press still stroking, gradually increase the “Output Volts” setting until the maximum operating speed of the press is reached or until 10.0 volts for “Output Volts” is reached (the maximum).

If the maximum press speed is reached before “Output Volts” reached 10 volts, then adjust the variable speed drive input “downward” according to the manufacturer’s instructions and gradually increase the “Output Volts”, making sure not to go above the maximum press speed as adjustments are made. Continue this process until it is possible to set “Output Volts” to 10, and then make final adjustments to the variable speed drive so that the press is running at its maximum stroking speed.

If the press speed does not reach its maximum when “Output Volts” is set to 10, then adjust the variable speed drive input “upward” according to the manufacturer’s instructions until the press is running at its maximum stroking speed.

- 4) With the press still stroking, reduce the setting for the “Output Volts” parameter until the press is stroking at the programmed “Low Output SPM”. The resulting “Output Volts” value should be programmed into the “Low Output Volts” parameter.
- 5) The output for the Speed Control board should now be calibrated to function linearly from the “Low Output SPM” to the “High Output SPM”. Typically, DC and variable frequency drives exhibit linear characteristics and it is not necessary to set mid-range parameters. However, eddy current drives can exhibit nonlinear behavior.

To check for this, enter an “Output Volts” value that is the sum of the “Low Output Volts” and 10 (which is the “High Output Volts”) and then divided by 2. This is the average of the 2 values, and represents the value that should cause the press to stroke at a speed halfway between its lowest and highest operating speed. For instance, if the “Low Output Volts” was 2.5 volts, then the “Output Volts” parameter should be set to 6.25 volts ($[2.5 + 10] / 2 = 6.25$). The “Stroke Speed” readout should then go to the average of the “Low Output SPM” and the “High Output SPM”. For example, if the “Low Output SPM” was 20, and the “High Output SPM” was 100, then the “Stroke Speed” should go to 60 SPM ($[20 + 100] / 2 = 60$). This value is the “calculated mid-range SPM”.

If the resulting “Stroke Speed” differs from the calculated mid-range SPM by more than 2% of the “High Output SPM”, then change the “Output Volts” until the “Stroke Speed” matches the calculated mid-range SPM. Enter the resulting voltage in the “Mid Output Volts” and the calculated mid-range SPM in the “Mid Output SPM” parameter.

- 6) Calibration of the Speed Control output is now complete. Press the **Exit Cal. Mode** softkey to return the speed control to normal operating mode. Press the **Motor Control** softkey to go to the motor control screen and verify that “Drive Speed” settings there operate as expected.

4.2.9 Auxiliary Equipment Message Configuration Screen

The operator terminal makes provision to wire inputs to the parallel port on its back from an intelligent controller (such as a PLC) of auxiliary equipment so that diagnostic messages from auxiliary equipment can be displayed on the Automation Control main operator screen (see Section 3.10.1 on page 47). The operator terminal interprets Pins 2 – 8 on the parallel input port as a binary number with the lowest significant bit being Pin 2 and the highest significant bit being Pin 8. Pin 1 on the parallel port must be connected to a common voltage (either ground or +24VDC) of the controller sending the signals to Pins 2-8. With the 7 “bits” of the parallel port, up to 128 messages can be selected for display. See Section 5.6.12 for information on how to wire the parallel port.

The message codes sent to the parallel port from auxiliary equipment may indicate conditions that prevent stroking the press, such as “Feed Fault”, or may simply give information about the status of auxiliary equipment, such as “Feed Automatic Mode” or “Feed Manual Mode”. In any case, the person that programs the PLC to send the desired message codes may need to prioritize the messages sent to the parallel port in case several conditions that are assigned a message code are present at the same time.

To get to the Auxiliary Equipment Message configuration screen, press the **Auxiliary Equipment Message** softkey in the Automation Control main configuration screen (see Section 4.2 on page 64).

At the top of this screen is an “Auxiliary Equipment Message” parameter that can be set to “Used” or “Not Used”. If “Not Used” is selected, then no auxiliary equipment message area will be displayed in the Automation Control main operator screen.

Each message corresponding to a code from the parallel port has two available lines and a color selection. Use the **Next Page** and **Previous Page** softkeys to page through the available messages. Each line can use up to 40 characters and the colors can be selected from “Normal” (black and white), Green, Yellow, and Red.

At the bottom of the screen beneath the line reading “Parallel Port Status”, the state of each of the parallel port pins can be seen, as well as the message number that the currently active pins select.

The **Set All To Default** softkey, if pressed, will set each message to “Aux Message XXX, Line 1” for line 1 and “Aux Message XXX, Line 2” for line 2, with the XXX replaced with the message number of the message. This can be used as an easy way to test which message numbers are being selected by the auxiliary equipment before the actual messages are set.

The **Clear All Messages** softkey clear every message and the **Clear 2nd Lines** softkey will clear the second line of every message.

In each case, before the **Set All To Default**, **Clear All Messages**, or **Clear 2nd Lines** softkeys will operate, the user will be prompted for the Configuration Code, and then a message asking for confirmation will appear. After confirmation, the operation will take place. This prevents accidental overwrite of the configured messages.

The following pages can be copied or printed as a worksheet for assigning messages to codes.

Auxiliary Equipment Message Table

Code	Pins Active							Message	Color
	2	3	4	5	6	7	8		
0									N G
									Y R
1							X		N G
							X		Y R
2						X			N G
						X			Y R
3						X	X		N G
						X	X		Y R
4					X				N G
					X				Y R
5					X		X		N G
					X		X		Y R
6					X	X			N G
					X	X			Y R
7					X	X	X		N G
					X	X	X		Y R
8				X					N G
				X					Y R
9				X			X		N G
				X			X		Y R
10				X		X			N G
				X		X			Y R
11				X		X	X		N G
				X		X	X		Y R
12				X	X				N G
				X	X				Y R

Auxiliary Equipment Message Table									
Code	Pins Active							Message	Color
	2	3	4	5	6	7	8		
13				X	X			X	N G Y R
13				X	X	X			N G Y R
15				X	X	X	X		N G Y R
16			X						N G Y R
17			X					X	N G Y R
18			X				X		N G Y R
19			X				X	X	N G Y R
20			X			X			N G Y R
21			X			X		X	N G Y R
22			X			X	X		N G Y R
23			X			X	X	X	N G Y R
24			X	X					N G Y R
25			X	X				X	N G Y R

Auxiliary Equipment Message Table

Code	Pins Active							Message	Color
	2	3	4	5	6	7	8		
26			X	X		X			N G
									Y R
27			X	X		X	X		N G
									Y R
28			X	X	X				N G
									Y R
29			X	X	X		X		N G
									Y R
30			X	X	X	X			N G
									Y R
31			X	X	X	X	X		N G
									Y R
32		X							N G
									Y R
33		X					X		N G
									Y R
34		X				X			N G
									Y R
35		X				X	X		N G
									Y R
36		X			X				N G
									Y R
37		X			X		X		N G
									Y R
38		X			X	X			N G
									Y R

Auxiliary Equipment Message Table

Code	Pins Active							Message	Color
	2	3	4	5	6	7	8		
39		X			X	X	X		N G Y R
40		X		X					N G Y R
41		X		X			X		N G Y R
42		X		X		X			N G Y R
43		X		X		X	X		N G Y R
44		X		X	X				N G Y R
45		X		X	X		X		N G Y R
46		X		X	X	X			N G Y R
47		X		X	X	X	X		N G Y R
48		X	X						N G Y R
49		X	X				X		N G Y R
50		X	X			X			N G Y R
51		X	X			X	X		N G Y R

Auxiliary Equipment Message Table

Code	Pins Active							Message	Color
	2	3	4	5	6	7	8		
52		X	X		X				NG YR
53		X	X		X		X		NG YR
54		X	X		X	X			NG YR
55		X	X		X	X	X		NG YR
56		X	X	X					NG YR
57		X	X	X			X		NG YR
58		X	X	X		X			NG YR
59		X	X	X		X	X		NG YR
60		X	X	X	X				NG YR
61		X	X	X	X		X		NG YR
62		X	X	X	X	X			NG YR
63		X	X	X	X	X	X		NG YR
64	X								NG YR

Auxiliary Equipment Message Table									
Code	Pins Active							Message	Color
	2	3	4	5	6	7	8		
65	X						X		N G Y R
66	X					X			N G Y R
67	X					X	X		N G Y R
68	X				X				N G Y R
69	X				X		X		N G Y R
70	X				X	X			N G Y R
71	X				X	X	X		N G Y R
72	X			X					N G Y R
73	X			X			X		N G Y R
74	X			X		X			N G Y R
75	X			X		X	X		N G Y R
76	X			X	X				N G Y R
77	X			X	X		X		N G Y R

Auxiliary Equipment Message Table

Code	Pins Active							Message	Color
	2	3	4	5	6	7	8		
78	X			X	X	X			NG YR
79	X			X	X	X	X		NG YR
80	X		X						NG YR
81	X		X				X		NG YR
82	X		X			X			NG YR
83	X		X			X	X		NG YR
84	X		X		X				NG YR
85	X		X		X		X		NG YR
86	X		X		X	X			NG YR
87	X		X		X	X	X		NG YR
88	X		X	X					NG YR
89	X		X	X			X		NG YR
90	X		X	X		X			NG YR

Auxiliary Equipment Message Table									
Code	Pins Active							Message	Color
	2	3	4	5	6	7	8		
91	X		X	X		X	X		NG YR
92	X		X	X	X				NG YR
93	X		X	X	X		X		NG YR
94	X		X	X	X	X			NG YR
95	X		X	X	X	X	X		NG YR
96	X	X							NG YR
97	X	X					X		NG YR
98	X	X				X			NG YR
99	X	X				X	X		NG YR
100	X	X			X				NG YR
101	X	X			X		X		NG YR
102	X	X			X	X			NG YR
103	X	X			X	X	X		NG YR

Auxiliary Equipment Message Table

Code	Pins Active							Message	Color
	2	3	4	5	6	7	8		
104	X	X		X					NG
									YR
105	X	X		X			X		NG
									YR
106	X	X		X		X			NG
									YR
107	X	X		X		X	X		NG
									YR
108	X	X		X	X				NG
									YR
109	X	X		X	X		X		NG
									YR
110	X	X		X	X	X			NG
									YR
111	X	X		X	X	X	X		NG
									YR
112	X	X	X						NG
									YR
113	X	X	X				X		NG
									YR
114	X	X	X			X			NG
									YR
115	X	X	X			X	X		NG
									YR
116	X	X	X		X				NG
									YR

Auxiliary Equipment Message Table									
Code	Pins Active							Message	Color
	2	3	4	5	6	7	8		
117	X	X	X		X		X		N G Y R
118	X	X	X		X	X			N G Y R
119	X	X	X		X	X	X		N G Y R
120	X	X	X	X					N G Y R
121	X	X	X	X			X		N G Y R
122	X	X	X	X		X			N G Y R
123	X	X	X	X		X	X		N G Y R
124	X	X	X	X	X				N G Y R
125	X	X	X	X	X		X		N G Y R
126	X	X	X	X	X	X			N G Y R
127	X	X	X	X	X	X	X		N G Y R

4.3 Operator Terminal Configuration Screen

There are two ways to get to the Operator Terminal configuration screen; first, by touching the **Operator Terminal** softkey in the Automation Control Configuration screen (see Section 4.2 on page 64); and secondly by touching the **Config OIT** softkey in the Device Config Screen.

The screen shown in Figure 45 can be used to configure the operator terminal to display specific default information in the “top info area” that appears in all operator screens.

The operator can select any of the “Top Area Display” items by pressing one of the top info areas, but the selection made here will be the default at power up. This screen can also be used to set the real time clock if necessary. If desired, the user can enter the press stroke length and the connecting rod length in order to display the distance to bottom of the stroke.

359 Motor Fwd.		Stroke Speed	Part Count	Espanol
TOP		0 SPM	1098	
Stroke Mode) Continuous		Running Status	Last Stop	ACC
		Run/Program Switch	I5 - Station #1 Top-Stop	
Setup Mode Top Area Display		Production Mode Area Display		Operator Terminal
Area 1	Total Tonnage	Area 1	Press Speed	
Area 2	Distance to Bottom	Area 2	Part Count	
Area 3	Current Status	Area 3	Current Status	
Area 4	Reason For Last Stop	Area 4	Reason For Last Stop	
Date: 01/13/2012		Set Date and Time		Access Config
Time: 08:52:18 AM				Auxiliary Comm Setup
Rod/Stroke Units	in	Stroke Length	6.000 in	Aux. Angle Disp. Config
Rod Length	42.000 in			
Display Brightness	70 %			
				Exit

Figure 45: Operator Terminal Configuration Screen

4.3.1 Top Area Display

The 4 center sections of the top display area can be configured to show the following items:

- Press Speed (Drive speed at rest and crankshaft speed when press is stroking)
- Press Control Status
- Press Control Reason for Last Stop
- Current Part Count
- Distance to Bottom
- Total Tonnage
- Gagging and Step Status

The displayed items will change to the configuration selected here when the stroking mode is changed. The user can choose the items that are to be displayed in Setup modes, and the items that are to be displayed in Production modes.

Note also that touching one of the areas will cycle through the available information items that are not currently shown. This allows the operator to conveniently see any of the items without having to change them in this screen. The next time the mode is changed, however, the items will be shown as configured here again.

4.3.2 Rod Length and Stroke Length

The “Rod Length” and “Stroke Length” shown in Figure 45 are used to calculate the distance from the bottom of the stroke. These items can be displayed and entered in either inches or millimeters.

The “Rod Length” is the length of the connection between the center of the crankshaft and the slide connection point.

The “Stroke Length” is the total linear travel of the press slide from top to bottom.

The “Rod/Stroke Units” can be changed at any time between inches and millimeters. The “Rod Length” and “Stroke Length” values are automatically converted when the unit is changed and the “Distance to Bottom”, if displayed in the top info area, is also converted to the new unit that was selected.

4.3.3 Setting the Date and Time

The operator terminal contains a real time clock. To set the time and date, press the **Set Date and Time** softkey shown in Figure 45. The screen of Figure 46 will be displayed. Set the date and time to the desired values and then press the **Enter** softkey to keep the changes. Note that the date and time change only occur at the time the **Enter** softkey is actually pressed. Press the **Cancel** softkey to abandon any changes and keep the current date and time.

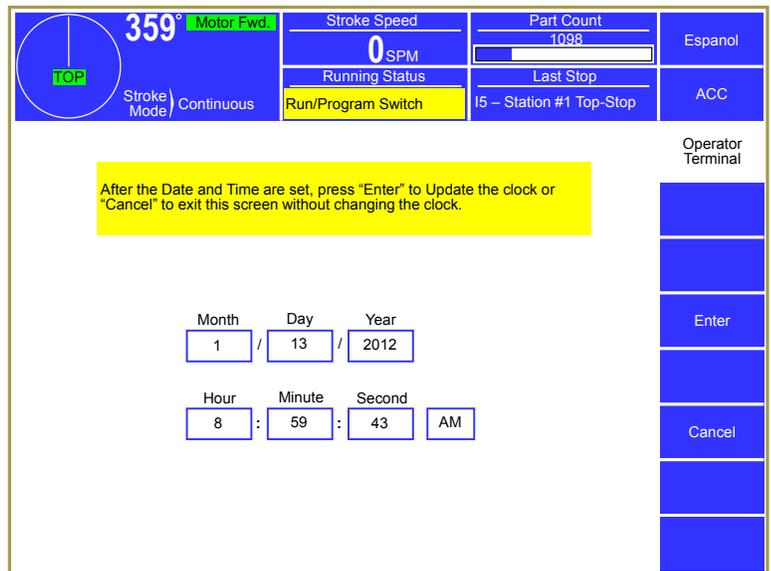


Figure 46: Date and Time Setting Screen

4.3.4 Access Configuration Screen

As described in Section 3.3 on page 23 the user must gain Access Control in order to perform certain operations and change certain parameters. This access control can be obtained by two means, RUN/PROG key or a user password system. These two means can be used alone or in combination with each other.

Press the **Access Config** softkey from the Operator Terminal Configuration screen (see Figure 45) will display the Access Configuration screen shown in Figure 47.

In addition to some basic parameters that determine how access control will work, this screen lists the “Users” that can operate the system. Note that “Users” are ignored if the “Access Mode” is set to “Key Only”. The **Next Page** and **Previous Page** softkeys are used to page through up to 16 possible “Users”.



Figure 47: Access Configuration Screen

The following sections discuss the parameters and features of this screen.

4.3.4.1 Access Mode Configuration

There are four access modes which are: “Key and Code”, “Code Only”, “Key or Code”, and “Key Only”. These modes are explained in Section 3.3 on page 23.

4.3.4.2 Access Timeout and Access Strokes

When users gain access by using a password, they remain logged in until they manually log out or are automatically logged out. See Section 0 on page 26. Automatic log out can be either time based or stroke based.

The timed log out is based upon the time between keyboard activity. If the user does not press any key on the operator terminal within the time programmed, the control will automatically log out the user. The “Access Timeout” parameter sets this time. A time of 0 seconds turns off the timed log out and the system will not automatically log out a user based on time (but manually logging out or stroke based automatic log out will still function).

The “Access Strokes” parameter sets the number of press strokes between keyboard activity that the system will allow before automatically logging out the user. A value of 0 strokes turns off the stroke based automatic log out (but manually logging out or timed based automatic log out will still function).

4.3.4.3 Store Job Code

The “Store Job Code” is an optional access code that can be required before an operator is allowed to store a job and is used ONLY when “Access Mode” is “Key Only”. This allows only trusted operators to overwrite a job setup while still allowing other operators to recall job setups and perform other operations. Since the purpose of this code is primarily the protection of known good job setups, it also applies to job erase operations. A setting of “0” will disable this function, and anyone with the RUN/PROG key will be able to store and erase job setups.

4.3.4.4 Edit User

The control allows for up to sixteen users to have the ability to gain access control. Each user is assigned a name, a password, and various permissions. Touch the **Edit** softkey to the right of a user in the Access Configuration screen (shown in Figure 47) to display the User Configuration screen shown in Figure 48.

This display provides the following information:

- User name/description
- User’s current password
- Whether or not the User is “Used”
- A listing of permissions for this user.

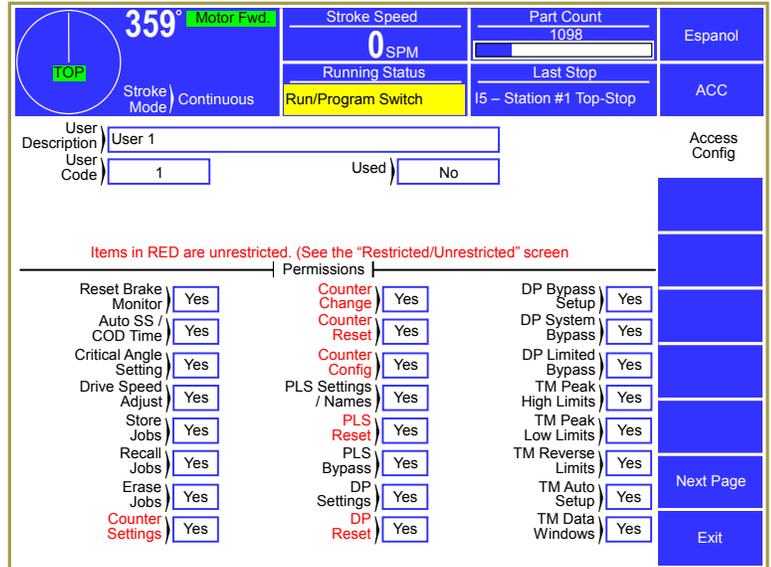


Figure 48: User Access Configuration Screen

The user can be enabled or disabled.

When a user is enabled (“Used” set to “Yes”), the user’s name will appear on a list of possible users that may obtain access control. When a user is disabled (“Used” set to “No”), the user’s name will not appear on a list of possible users that may obtain access control.

Each user can be granted permission to access certain restricted items. A list of these items is shown in Section 3.3.5 on page 25. If a restricted item is configured with a “Yes”, the user can obtain access to that item. If the restricted item is configured with a “No”, the user cannot obtain access to that item.

4.3.4.5 Restrict/Un-Restrict Access

In addition to the user access system, certain items can be made available to any operator as shown in Figure 49. An example of this would be to allow any operator to reset the production counters. Any item marked as “Yes” can be changed by an operator without the RUN/PROG key or an access code. Note that this is true even if the “Access Mode” is in one of the modes that require a code and the user permission for the same setting is marked to deny access. These settings will override any other restriction.

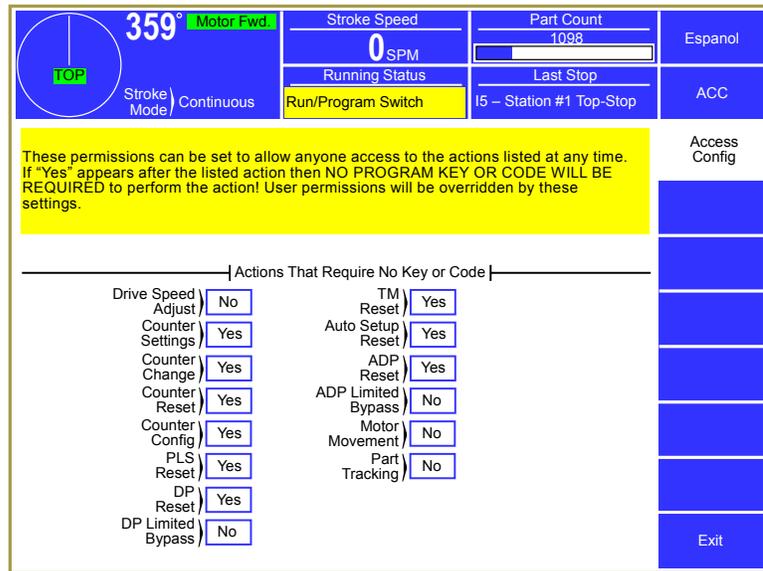


Figure 49: Restrict/Unrestricted Screen

4.3.4.6 Setting the Configuration Code

Selecting the **Set Config Code** softkey in the Access Configuration screen, will display the Configuration Code screen shown in Figure 50. This screen allows the Configuration Code to be changed. This is the configuration code that protects the restricted configuration areas of the system that are used to set up the basic operating characteristics of the system for a particular press. It is imperative that this code be given only to authorized personnel who are familiar with the system and with the consequences of incorrect parameter settings.

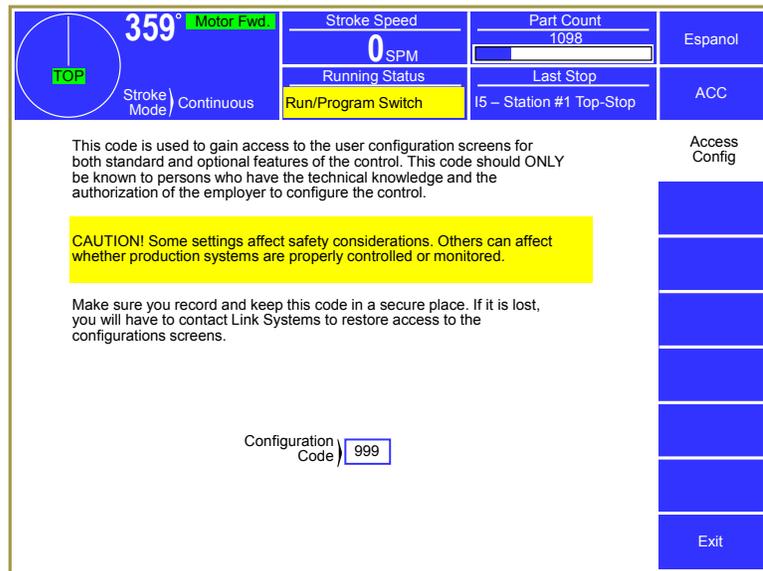


Figure 50: Set Config Code Screen

The configuration code is set at the factory. It is suggested that this code not be changed unless the security of the configuration code has been jeopardized. If a configuration code has been obtained by personnel who do not require access to the configuration parameters, it must be changed. When this code is changed, the previous code will no longer be valid. The value of the new code should be documented and stored in a secure place.

If a current code value is lost, the factory must be consulted.

4.3.5 Auxiliary Comm Setup Screen

The **Auxiliary Comm Setup** softkey provides access to the configuration screens for the communication options. These options include serial communication ports for interfacing to electronic servo feeds, auxiliary equipment (such as PLCs), a laptop interface for downloading messages, and a network interface.

Each serial port for the Operator Terminal can be assigned a function. Pressing the blur bordered box to the right of each port brings up a list of available functions for that port. Once a function is assigned to a port, a box just to the right of the function will indicate the port settings (baud rate, parity, data bits, and stop bits) and a **Configure** softkey may appear, depending on the function selected. See the manual pertaining to the particular function for more information.

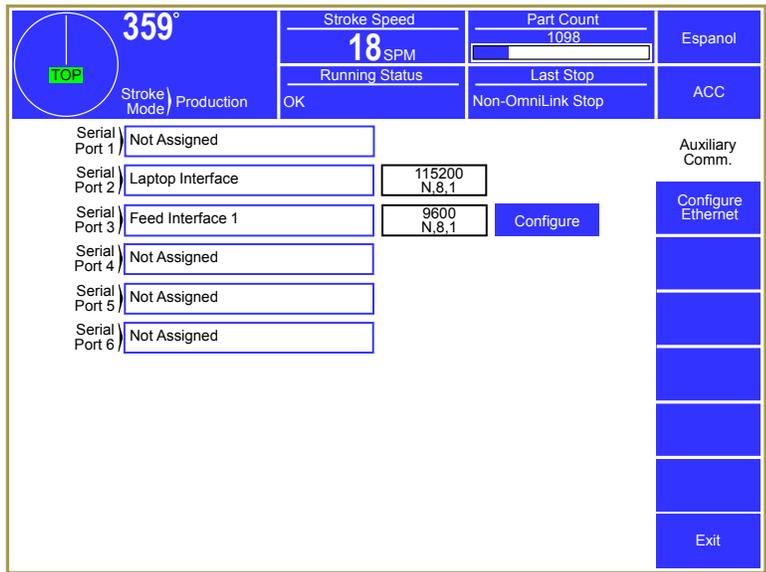


Figure 51: Auxiliary Comm Setup Screen

This screen is also has a **Configure Ethernet** softkey that will display a screen where the various Ethernet parameters can be set.

4.3.6 Configure Ethernet Screen

Pressing the **Configure Ethernet** softkey in the Auxiliary Comm Setup screen will bring up the screen of Figure 52. This screen contains the settings used to configure the Ethernet port on the Operator Terminal to operate on the local plant network.

The **Configure Modbus TCP** softkey only appears if the Modbus interface option has been purchased for the Operator Terminal. If it has, then this will bring up a screen that has parameters for using Modbus over an Ethernet connection.

The parameters on this screen are standard Ethernet networking parameters and are very specific to the network the Operator Terminal is on. A brief description of the parameters follows, but it is important to check with the Network Administrator for the plant before setting these. ***Improper settings could cause communication problem on the entire network – so don't guess.***



Figure 52: Ethernet Configuration Screen

- Local Host Name** A human readable label assigned to identify the networked device on the network without having to use the IP Address. If properly configured, a local Domain Name System (DNS) server can map this name to the actual IP address of the device.
- Use DHCP** This parameter tells the system whether or not to use Dynamic Host Configuration Protocol. If this parameter is set to “Yes”, then none of the other parameters below it will appear, as they are set automatically by the DHCP server on the network. If set to “No”, then the rest of the parameters below it will need to be set manually.
Note that a DHCP server on the network is required to use this function.
- IP Address** This is the network address of the Operator Terminal on the Ethernet network.
Every device on the network must have a unique address. If “Use DHCP” is set to “Yes” this will set automatically by the DHCP server. Get this value from the Network Administrator.
- Subnet Mask** The Subnet mask logically divides the network up into one or more subnets. If “Use DHCP” is set to “Yes” this will set automatically by the DHCP server. Get this value from the Network Administrator.
- Default Gateway** The default gateway is a node on the network that serves as an access point to another network, typically the internet. If “Use DHCP” is set to “Yes” this will set automatically by the DHCP server. Get this value from the Network Administrator.
- Primary DNS Server** The primary domain name system server the Operator Terminal will use to convert host names to IP address. If “Use DHCP” is set to “Yes” this will set automatically by the DHCP server. Get this value from the Network Administrator.
- Secondary DNS Server** A backup DNS Server to use if the primary is not available. If “Use DHCP” is set to “Yes” this will set automatically by the DHCP server. Get this value from the Network Administrator.

Section 3.10.3.4 on page 61 has information on the Ethernet Diagnostics screen which can aid in troubleshooting the Ethernet connection. It also shows the actual IP Address, Subnet Mask, Gateway, and DNS Servers assigned by the DHCP server if DHCP is used.

5 INSTALLATION

NOTE: Before you begin to install your Automation Control, you should read this entire manual carefully. This will help you to understand system functions and plan the installation to save time and the necessity to rework portions of the installation.

5.1 Preliminary Installation Considerations

The Automation Control consists of an operator terminal enclosure (which typically also houses the Automation Control Logic Board) and optional automation and monitoring devices, such as programmable limits switch modules, die protection modules, auto setup modules, etc. These devices communicate over a single high speed bus cable that is connected in a “daisy chain” fashion as shown in Figure 53. Some options, such as die protection modules, act as their own enclosure and can be mounted as needed on the machine. Other options need to be mounted in an enclosure, either an existing enclosure with enough space available, or a new one supplied for the purpose.

Each device in the system needs, at minimum, connection to power and connection to the high speed bus. Power for the optional devices may be run in the same conduit as the high speed bus, but power for other devices should be run separately.

Plan the runs of the high speed bus cable to minimize the total length as much as is reasonably possible. **The total length**

of the high speed bus cable must not exceed 300 feet. Although typical, the OmniLink 806 operator terminal **does not** have to be at one of the daisy chain. This is a change from the OmniLink 802 operator terminal, which does have to be at one end of the chain. Devices at each end of the chain must be terminated using a switch on the device. The manual for each device will give instructions on how this is to be done. **Only the devices at either end of the chain should be terminated!** More information on this is in Section 5.6.4.

The wiring instructions for installation contained in this manual are necessarily generic since the Automation Control may be interfaced with a wide variety of press control systems using multiple relay and electronic components. **If the installer has questions related to the proper installation of the system, contact the service personnel at Link Systems.** Always test each component of the system installation to see that proper function is obtained. **In particular, make certain that all stop outputs from the OmniLink system to the press control are interfaced properly.**

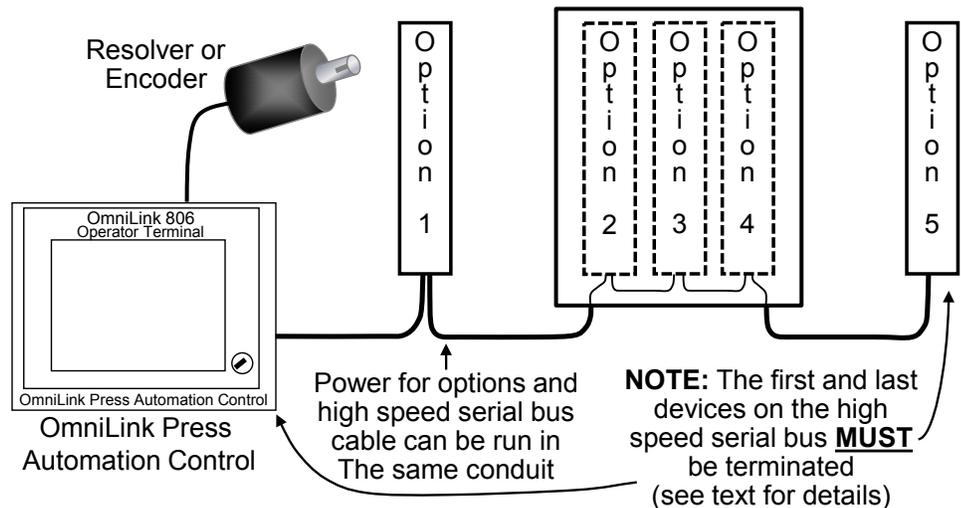


Figure 53: System Wiring Topology

WARNING: Improper system installation or improper interface of stop outputs from the OmniLink system to the press control may result in damage to press, dies or other equipment and increase the possibility of injury to operators and others. Use qualified installers.



Installation of this system should be done in accordance with OSHA’s lockout/tagout regulations (see CFR 1910.147). You will be mounting OmniLink components on the press, and may be exposed to mechanical hazards if press movement should occur during mounting activities. You will also be wiring electrical circuits that will use 115VAC (nominal) voltages. Unless these circuits are de-energized during wiring activities, a serious or even fatal shock may occur. Depending on the options purchased with your OmniLink system, you may also be installing air valves or pressure sensors for air counterbalance or air cushion systems. These air systems could cause serious injury if not depressurized before installation is started. Remove hazardous energy during OmniLink system installation in accordance with CFR 1910.147.

WARNING: Failure to comply with CFR 1910.147 regulations and remove hazardous energy during installation of the Automation Control may result in serious injury or death! Use only qualified installers trained in lockout procedures for installation.



5.2 Mounting the Operator Terminal Enclosure

The Automation Control is usually delivered with the Operator Terminal and the Automation Control Logic Board delivered pre-mounted in an enclosure ready to bolt on to the press. It is also available without the enclosure, when there is space available in an existing enclosure to mount the Automation Control Logic Board and to panel mount the Operator Terminal.

In either case, consideration should be given to the viewing angle of the operator. Figure 54 shows the most usable viewing angles for the LCD display used in the Link OIT - about 30 degrees “above” to 45 degrees below is preferable. Going further in either direction by about 20 degrees is possible, if absolutely necessary. Viewing the operator terminal from slightly “below” it generally results in the best display quality.

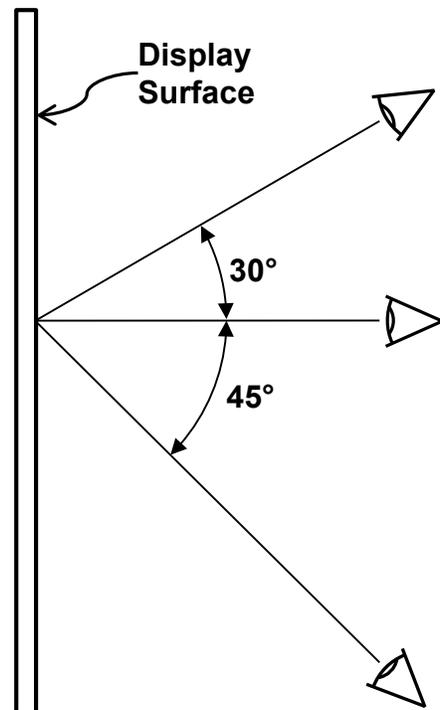


Figure 54: OIT Viewing Angles

Figure 55 shows the mounting dimensions of the operator terminal enclosure when the unit is delivered in its typical configuration – the Operator Terminal and the Automation Control Logic Board pre-mounted in an enclosure ready to bolt on to the machine.

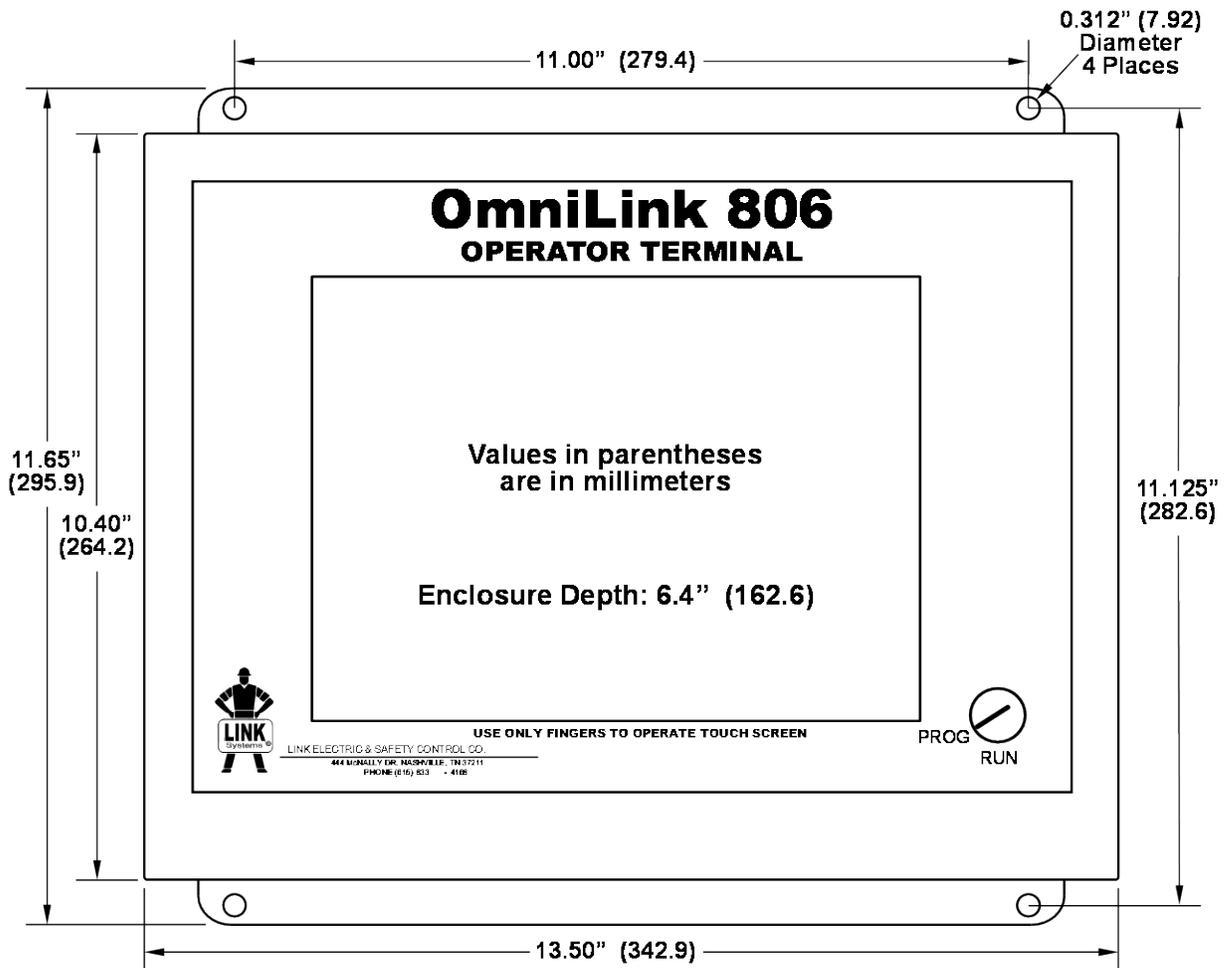


Figure 55: Operator Terminal Enclosure Mounting Dimensions

Figure 56 shows the cutouts and clearances necessary when panel mounting the Operator Terminal itself. This is only needed when the Automation Control is delivered without the typical enclosure as detailed above.

In this configuration it is also necessary to mount the Automation Control Logic Board in an enclosure. It is delivered pre-installed on a mounting plate that can be secured with 4 screws. Figure 57 gives the mounting dimensions and clearances needed to mount the Automation Control Logic Board.

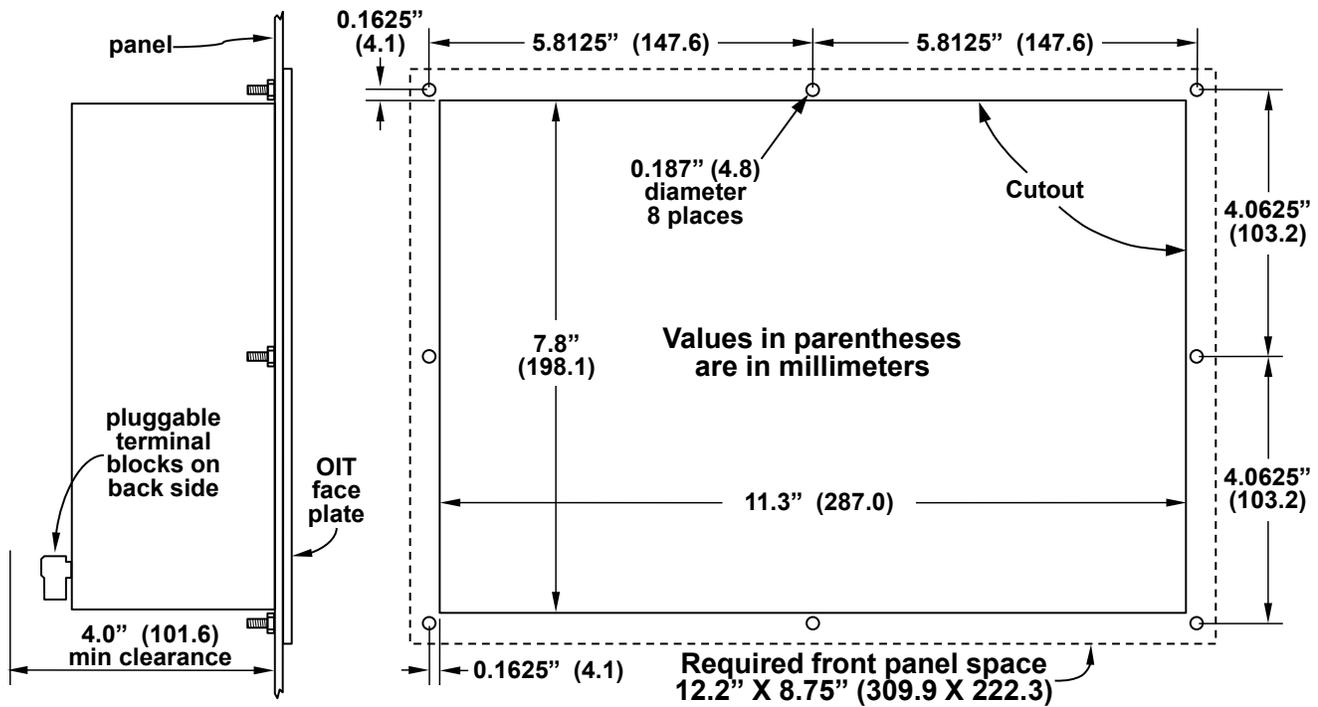


Figure 56: Operator Terminal Panel Mounting Dimensions

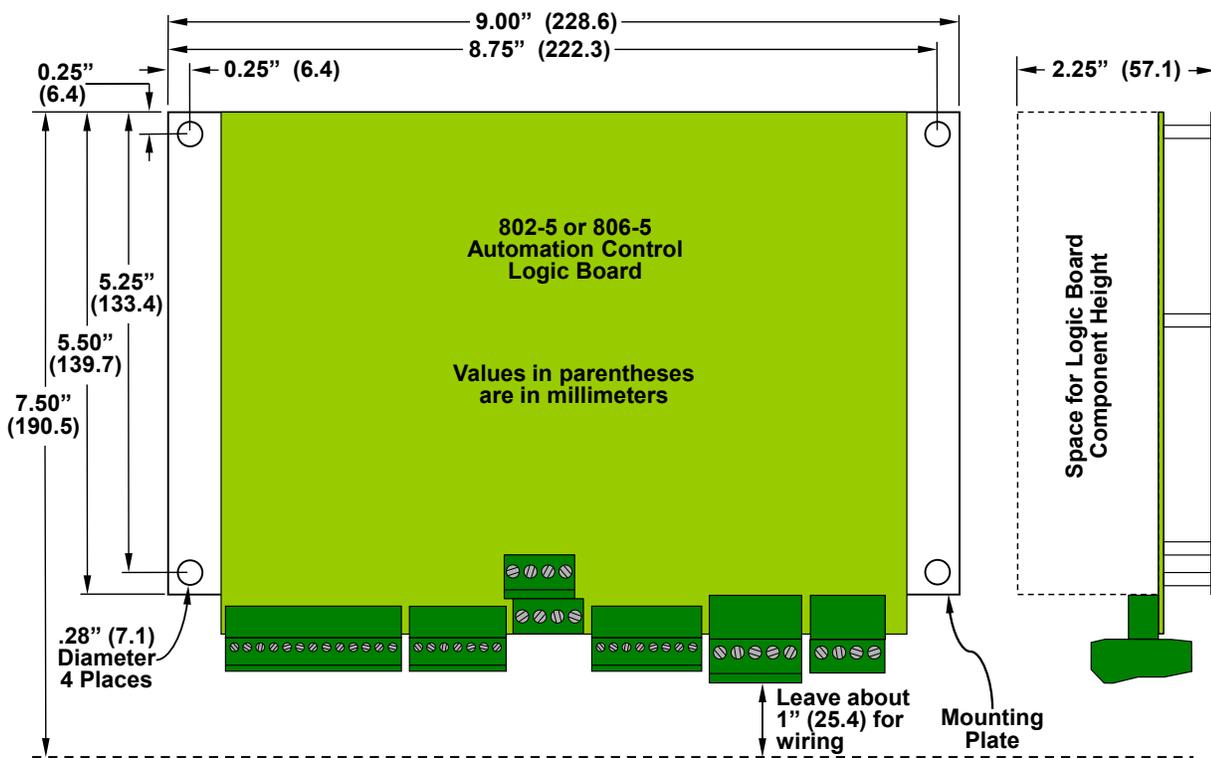


Figure 57: Logic Board Assembly Mounting Dimensions

5.3 Mounting the Resolver or Encoder

The Automation Control can use a Link 2500 resolver, a Link 5000 resolver, or a Link 5100-11 encoder (806-5 Automation Control Logic Board only) to get angle information from the crankshaft or eccentric.

The resolver or encoder may be direct driven by a coupling off the center of the shaft or driven by a chain or timing belt as shown in Figure 58.

Chain and sprockets may have been purchased from Link Systems. If so, the sprockets will be 35B28 (28 teeth) and chain will be size 35 roller chain. Link suggests that, if the customer provides chain and sprocket, the same type be used. The electronic offset capability (see Section 4.2.2.2) during calibration can only correct plus or minus 10 degrees of mechanical misalignment, and 28 teeth make it easier to be within the offset that can be corrected.

A spring loaded mounting base (see Figure 59) will be supplied when the resolver/encoder will be chain driven to maintain chain tension.

NOTE: *The resolver or encoder must be driven on a one-to-one basis with the press.* That is, one stroke of the press must result in exactly one turn of the resolver/encoder. If you have a press that only provides access to an intermediate shaft or back shaft for connection of the resolver/encoder, you will have to determine how many turns this shaft makes for each turn of the crank or eccentric shaft. You must then use sprockets of different size, chosen to provide one turn of the resolver/encoder for one turn of the crank or eccentric shaft.

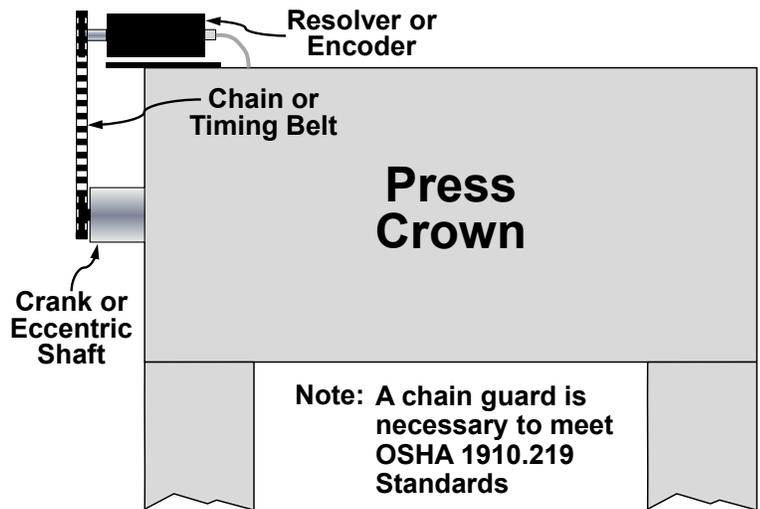


Figure 58: Resolver Mounting to Shaft

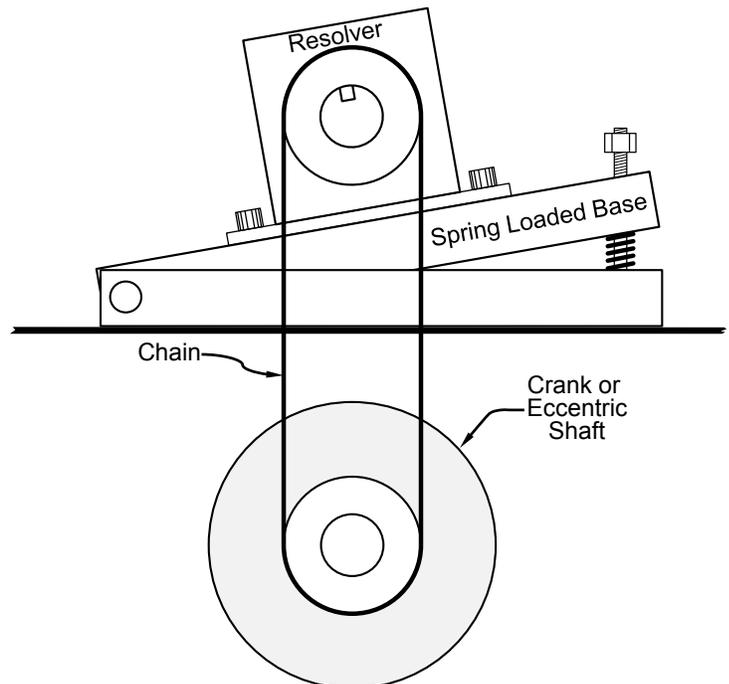


Figure 59: Resolver on Spring Base

All three Link resolver/encoders use the same shaft, which is 3/4 inches in diameter with a 3/16 inch wide by 1 inch long standard keyway. The sprocket attached to the encoder must be bored and keyed to fit. Do not install the sprocket without a proper size key. After installing sprocket and key, the clip ring must be installed in the groove on the end of the resolver shaft.

Another sprocket must be attached to the machine shaft. The proper size hole must be drilled and tapped in the static center of the machine shaft. After attaching the sprocket to the shaft, an additional hole should be drilled approximately 3/4 inch off of the static center. This hole should be drilled through the sprocket and into the machine shaft. The sprocket should be removed and the off center hole in the machine shaft tapped for a 1/4 inch bolt or larger. The off center hole in the sprocket must provide proper clearance for the bolt. Attach the sprocket to the machine shaft with the center bolt and the off center bolt. When attaching the chain to the sprockets, the zero position of the resolver/encoder must be aligned with the top dead center of the machine shaft. The zero position of the resolver/encoder is indicated by the legend on the front of the assembly. When the keyway is aligned with the zero position of the legend, the assembly is at zero. The Automation Control allows the user to program an offset value to make up for minor differences from the machine top dead center and encoder zero. The offset value is limited to plus or minus 10 degrees of resolver zero.

The following pages show dimensions for both the 2500 and 5000 resolvers as well as mounting dimensions when used in conjunction with the spring base.

NOTE: The 5000-11 Encoder has exactly the same dimensions as the 2500 Resolver. It does use a different cable but all mounting dimensions and considerations remain the same.

2500 Resolver

Values in parentheses are in millimeters

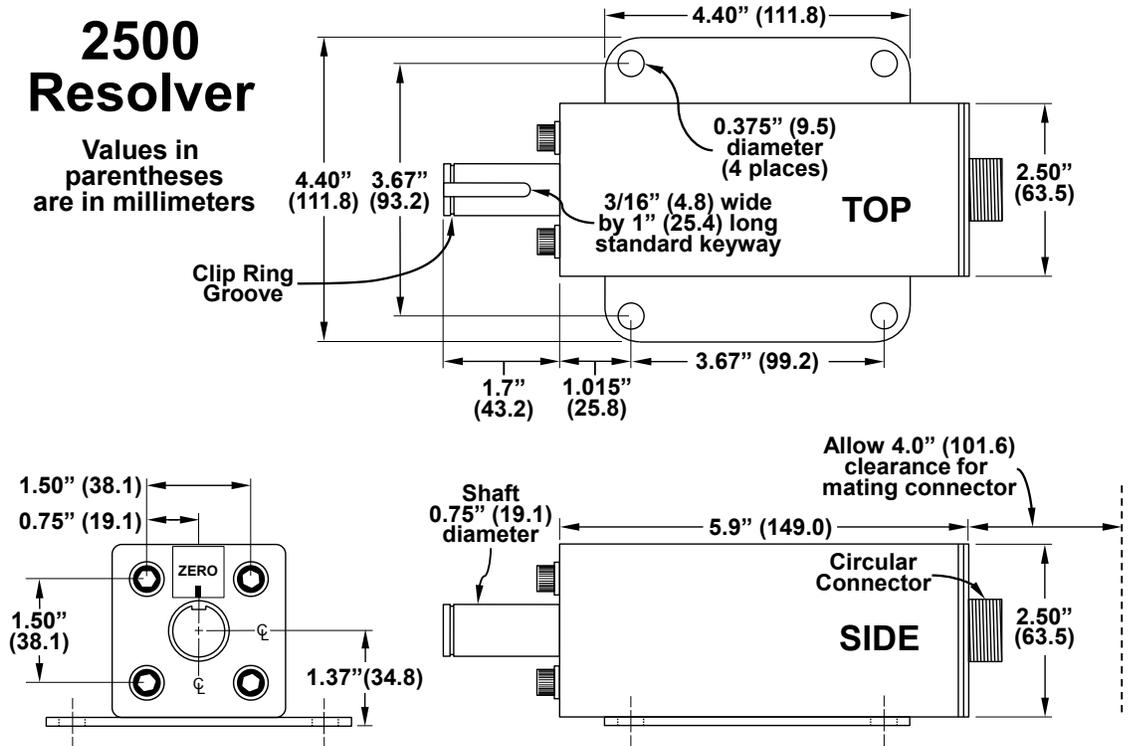


Figure 60: 2500 Resolver Dimensions

5000 Resolver

Values in parentheses are in millimeters

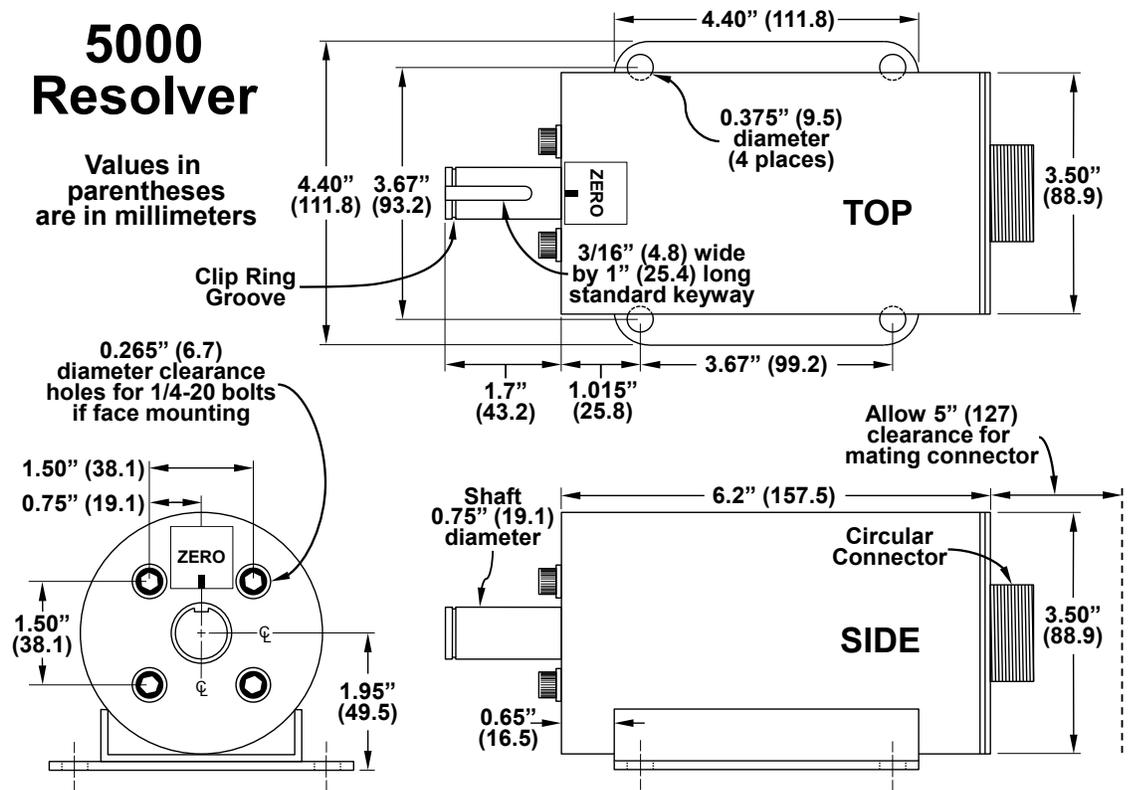


Figure 61: 5000 Resolver Dimensions

Spring Base with 2500 Resolver

Values in parentheses are in millimeters

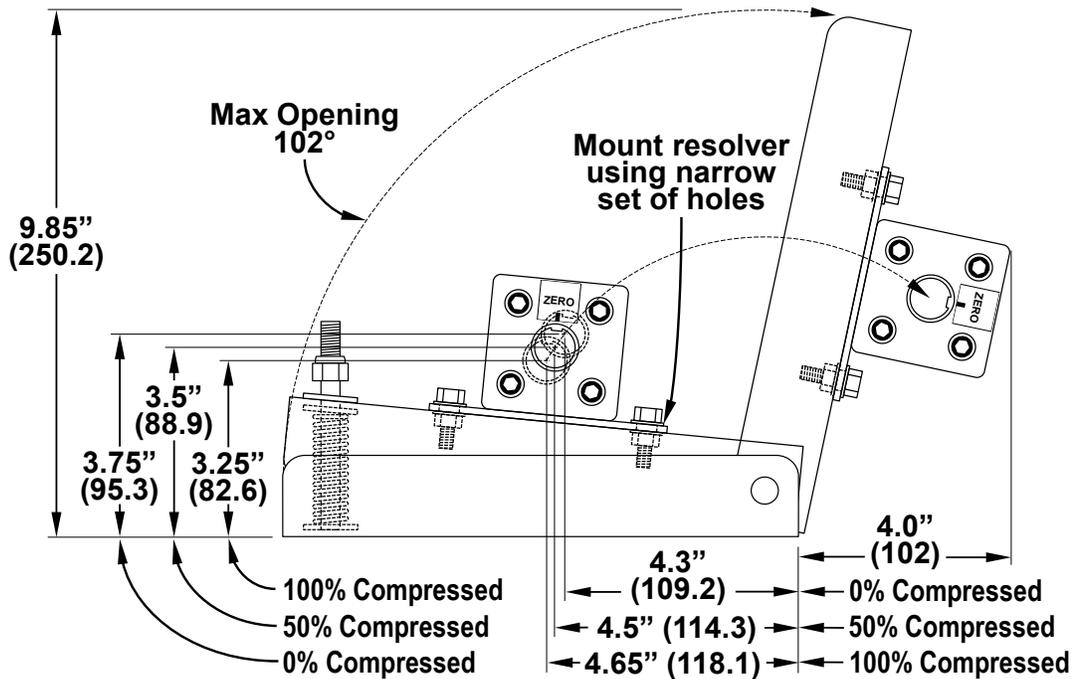
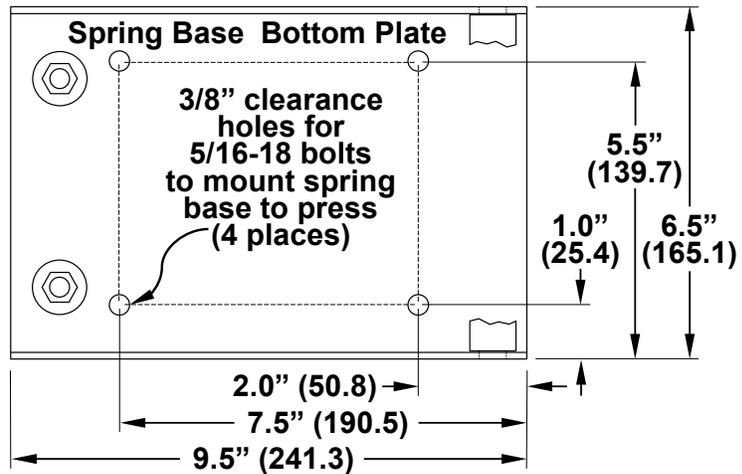
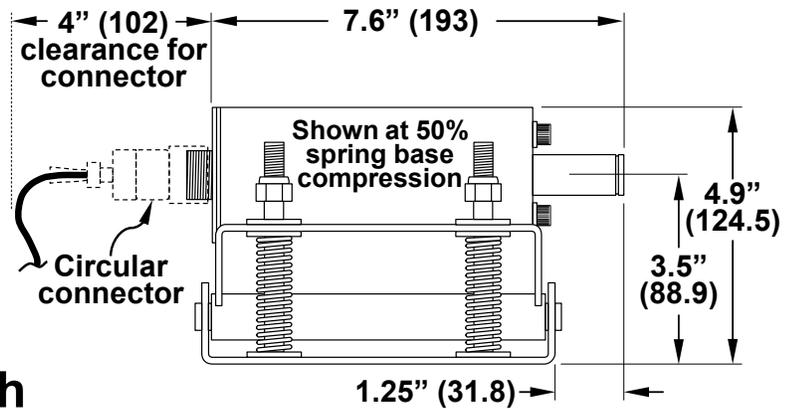


Figure 62: Spring Base with 2500 Resolver Dimensions

Spring Base with 5000 Resolver

Values in parentheses are in millimeters

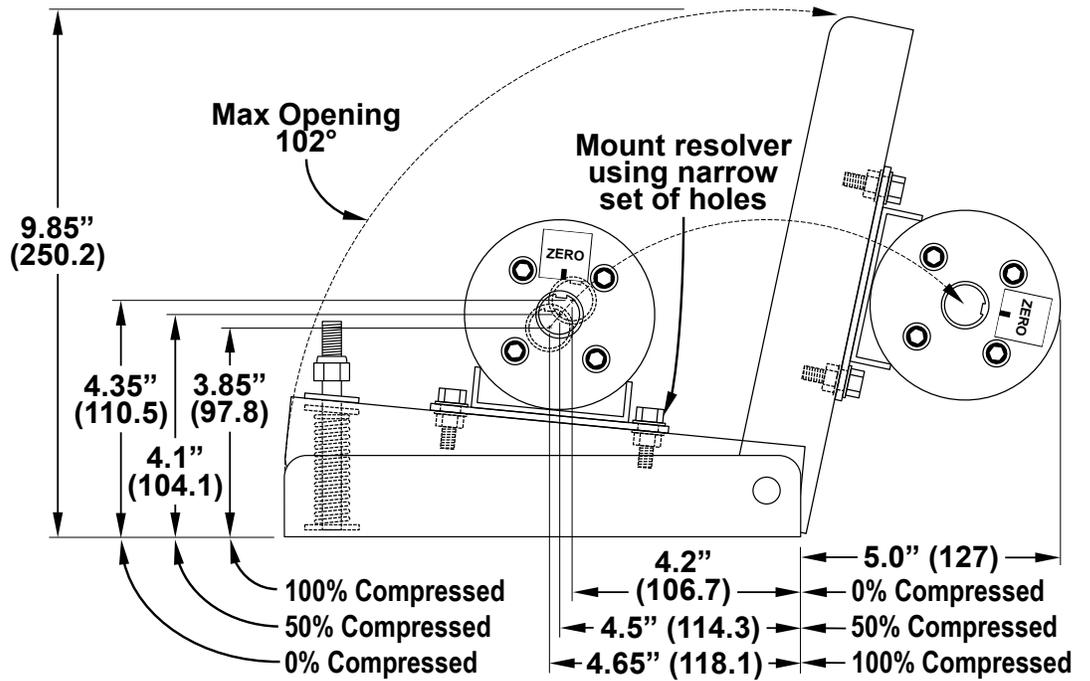
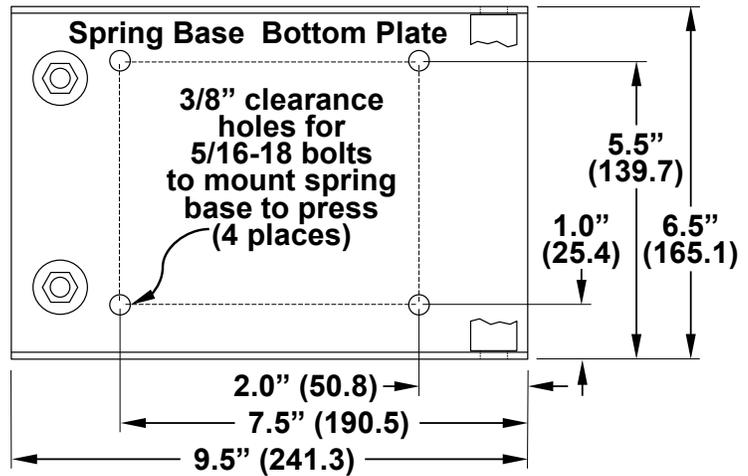
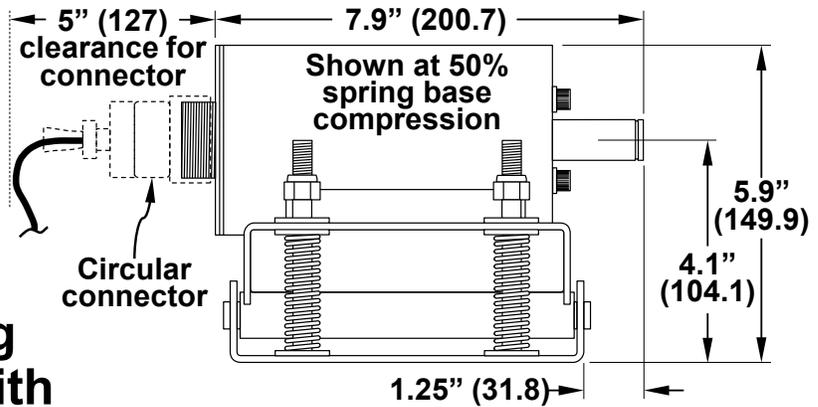


Figure 63: Spring Base with 5000 Resolver Dimensions

5.4 Mounting Optional Solid State Relay Outputs

The Automation Control Logic Board can be equipped with an optional solid state relay module. The module can be populated with a combination of AC or DC solid state relays specified by the customer. If the module is installed, the relays provide the following functions:

- Relay 1 and Relay 2: Automation Control Logic Board programmable limit switches 1 and 2. Simple on at an angle, off at an angle, PLS outputs for limited applications.
- Relay 3: Provides an output to drive an external light that indicates die protection is bypassed.
- Relay 4: Provides an output to drive an external light to indicate that a downtime code has been entered when the optional LinkNet information system software is used.

Figure 64 shows the mounting dimensions of the solid state relay board.

Note that if the Automation Control has been purchased with the standard Operator Terminal enclosure that also contains the Automation Control Logic Board, then mounting standoffs are already present for this board.

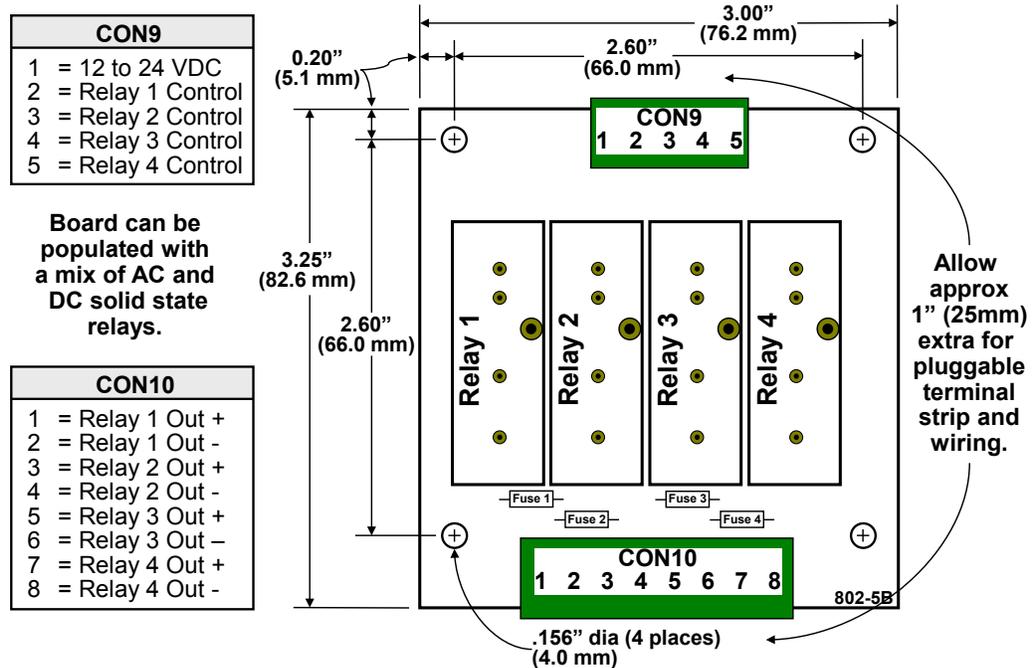


Figure 64: Solid State Relay Module Mounting Dimensions

See Section 5.6.11 for information on wiring this board.

5.5 Mounting Optional Modules

If optional modules such as die protection, programmable limit switch, auto setup, tonnage and signature monitoring, or others are purchased; these may be packaged in separate or combined enclosures, depending on how they were ordered. Refer to the documentation for each type of option for mounting dimensions and instructions. Multiple module enclosures will be shipped with mounting dimensions inside the enclosure.

5.6 System Wiring

There are two generations of Automation Control Logic Board used in the Automation Control. For the most part, these boards function identically – but there are a few differences in capabilities that will be pointed out as appropriate throughout the manual. Where these differences occur, the first generation Automation Control Logic Board will be referred to as the “802-5” and the second generation as the “806-5”.

The wiring for the two generations is the same, but there is an additional connector on the 806-5 for a new encoder type and some of its connectors are more compact. There is also an additional option connector on the 806-5 for the servo/hyd interface board.

A generalized view of the first generation of Automation Control Logic Board (802-5) can be seen in Figure 65. An actual picture of this board can be seen in Figure 4 on page 14.

This board uses socketed EPROMs for its program storage. It has most of the capabilities of the second generation board when dealing with part-revolution mechanical power presses, but does not support the advanced movement capabilities of newer servo presses.

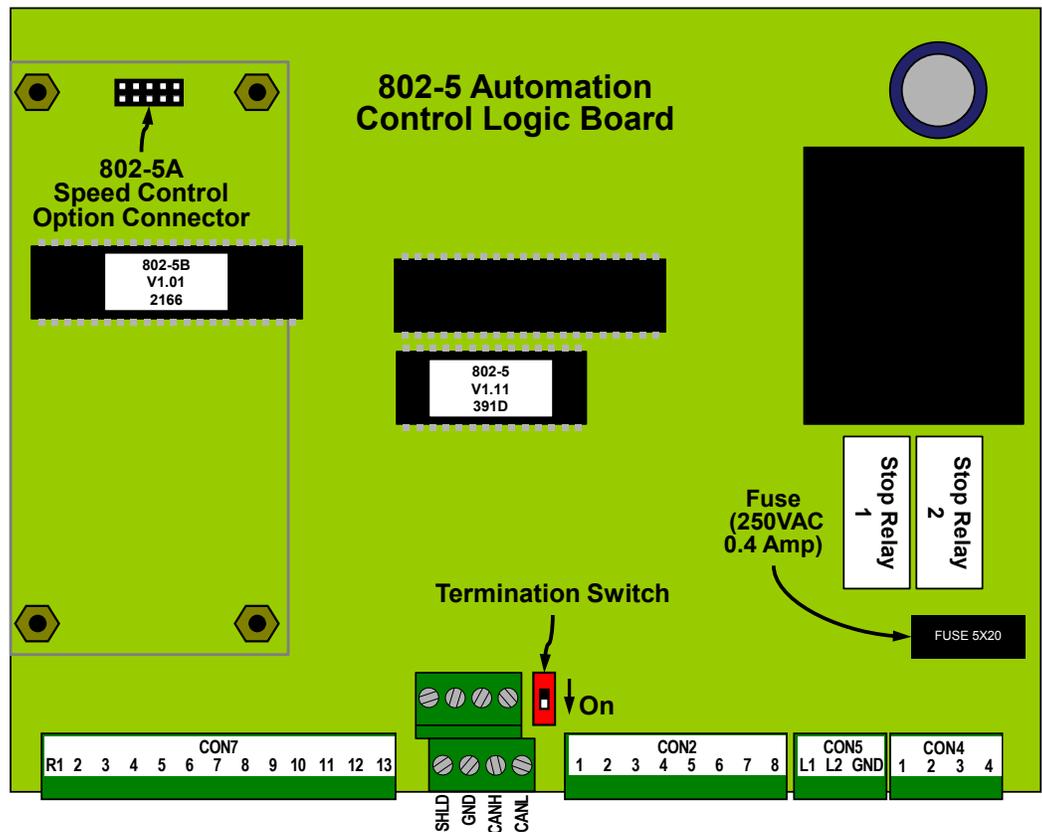


Figure 65: 802-5 Automation Control Logic Board Connectors

The circuit board itself is labeled as “802-5” with Link part number 108553. It is distinguished from the 806-5 board most easily by the program version labels on the socketed chips and the location of the two stop relays near the CON4 connector (lower right of the board).

A generalized view of the second generation of Automation Control Logic Board (806-5) can be seen in Figure 66.

This board uses flash memory for its program storage and can be updated from the OIT with a program update card. It has all of the capabilities of the first generation board when dealing with part-revolution mechanical power presses, and also supports the advanced movement capabilities of newer servo presses. Along with the resolvers supported by the first generation board, this board can also support SSI interface encoders, such as the Link 5100-11 and others – depending upon the application requirements.

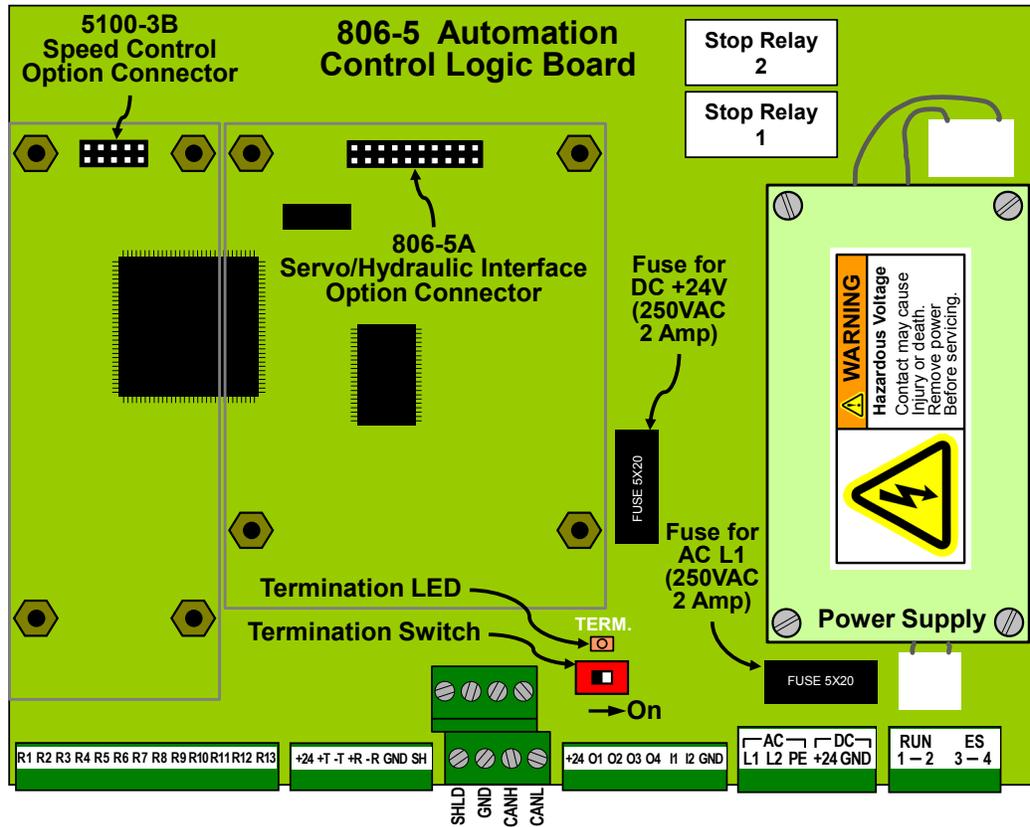


Figure 66: 806-5 Automation Control Logic Board Connectors

The circuit board itself is labeled as “806-5” with Link part number 121477. It is distinguished from the 802-5 board most easily by the universal power supply located along the right side of the board and the location of the two stop relays near the upper right of the board.

Figure 67 shows the connector sections of both boards and how the connectors map to each other. Although the resolver connector and digital I/O connectors are different sizes, the number of pins and the pinout is the same. The power connector on the 806-5 adds two pins for powering the

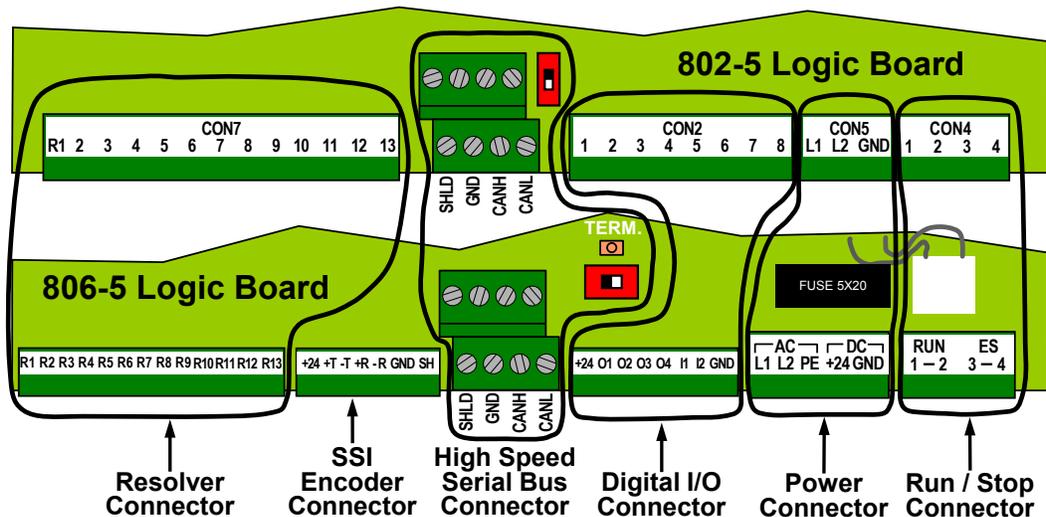


Figure 67: 802-5 and 806-5 Connector Comparison

board from +24VDC instead of 115 VAC. The 806-5 also adds an SSI encoder connector to support use of the 5100-11 encoder in some cases.

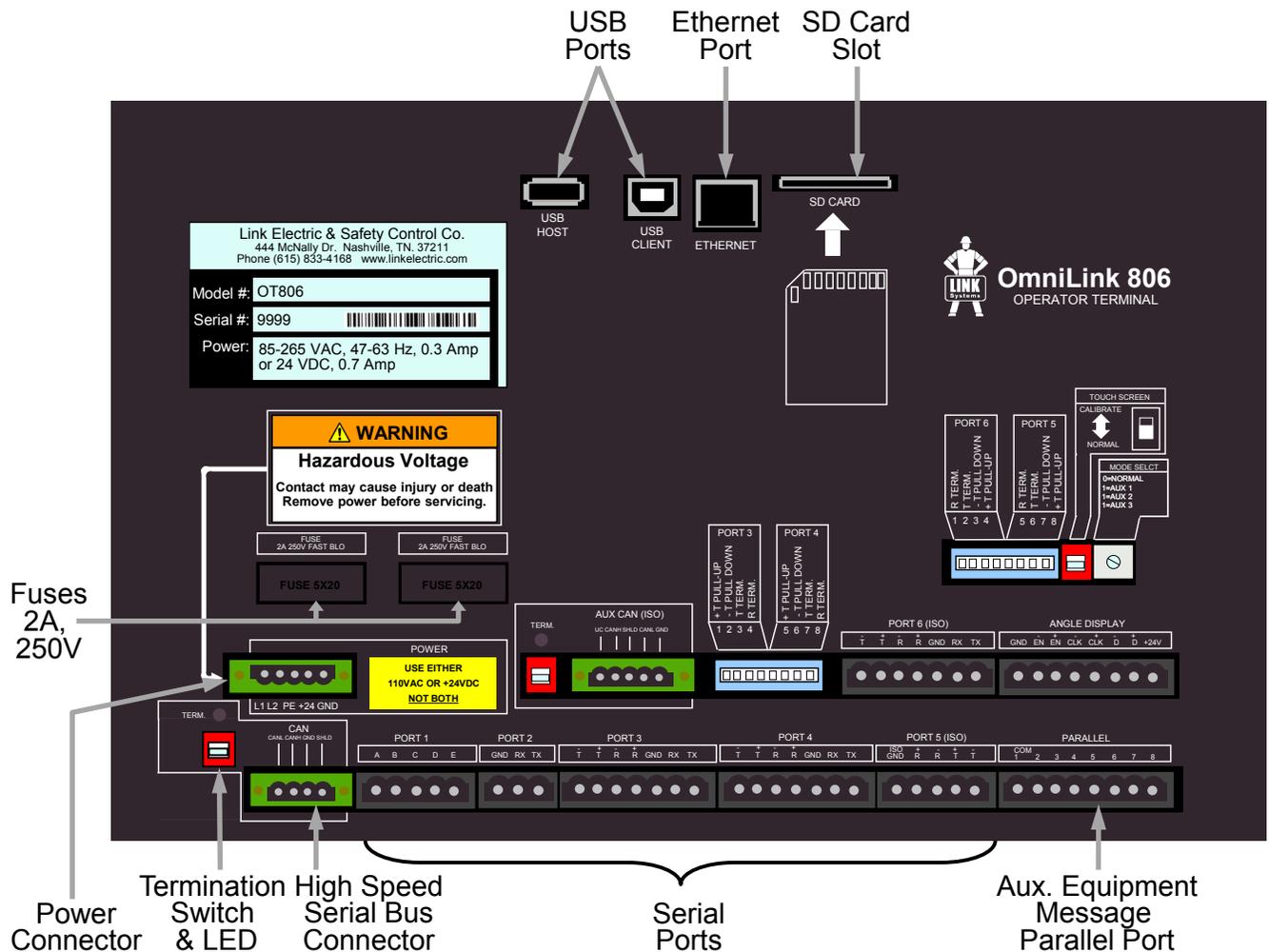


Figure 68: OT806 Operator Terminal Back Panel Connectors

Figure 68 shows a view of the back panel of the OT806 operator terminal. The OT806 provides for extensive connectivity with both Link and other equipment. Multiple serial ports supporting RS-232, RS-422, and RS-485 are available for interface to servo-feeds, lube systems, and other devices over Modbus/RTU and device specific protocols. An Auxiliary Equipment Message parallel port allows simple message display on the operator terminal from intelligent controllers. An Ethernet port supports Modbus/TCP. An SD Card slot is available for backing up and restoring data to the operator terminal, and for updating the firmware in the operator terminal and optional automation and monitoring devices.

5.6.1 Conduit Runs

Wiring between the enclosures for Automation Control components should be run in conduit. The use of flexible liquid tight conduit with ground is suggested, but hard conduit can also be used. Figure 69 shows some of the typical conduit runs that may be required.

The conduit runs that will or may be needed, depending on the options purchased and features used on the Automation Control are:

- Conduit from the resolver or encoder to the Automation Control Logic Board (which is typically in the OmniLink Operator Terminal enclosure).
- Conduit for 115VAC connections between the OmniLink Operator Terminal enclosure and the Press Control.
- Conduit for low voltage connections between the OmniLink Operator Terminal enclosure and the Press Control (only if options or press control circuits require low voltage as set forth in the following sections).
- Conduit for 115VAC power and high speed bus cable from the Operator Terminal to any remote enclosures containing optional module(s), such as Die Protection, PLS, etc., selected to be connected as the first module on the high speed bus.
- Conduit runs from the enclosure containing the first optional module on the high speed bus to successive enclosures containing optional module(s) to be connected on the high speed bus.
- Conduit from the OmniLink Operator Terminal enclosure to the feed control enclosure, if an optional Serial Feed Interface is purchased.
- If optional PLC Interface is purchased, conduit from the OmniLink Operator Terminal enclosure to the enclosure housing the PLC.

NOTE: Do not run both 115VAC and lower voltage circuits in the same conduit from the OmniLink Operator Terminal to the press control. If you have both 115VAC circuits and low voltage circuits, run them in separate conduits as shown in Figure 69. The exception to this is that it is permissible to run 115VAC power wires and the high speed bus cable in the same conduit from the Operator Terminal to the first optional module and any successive modules used.

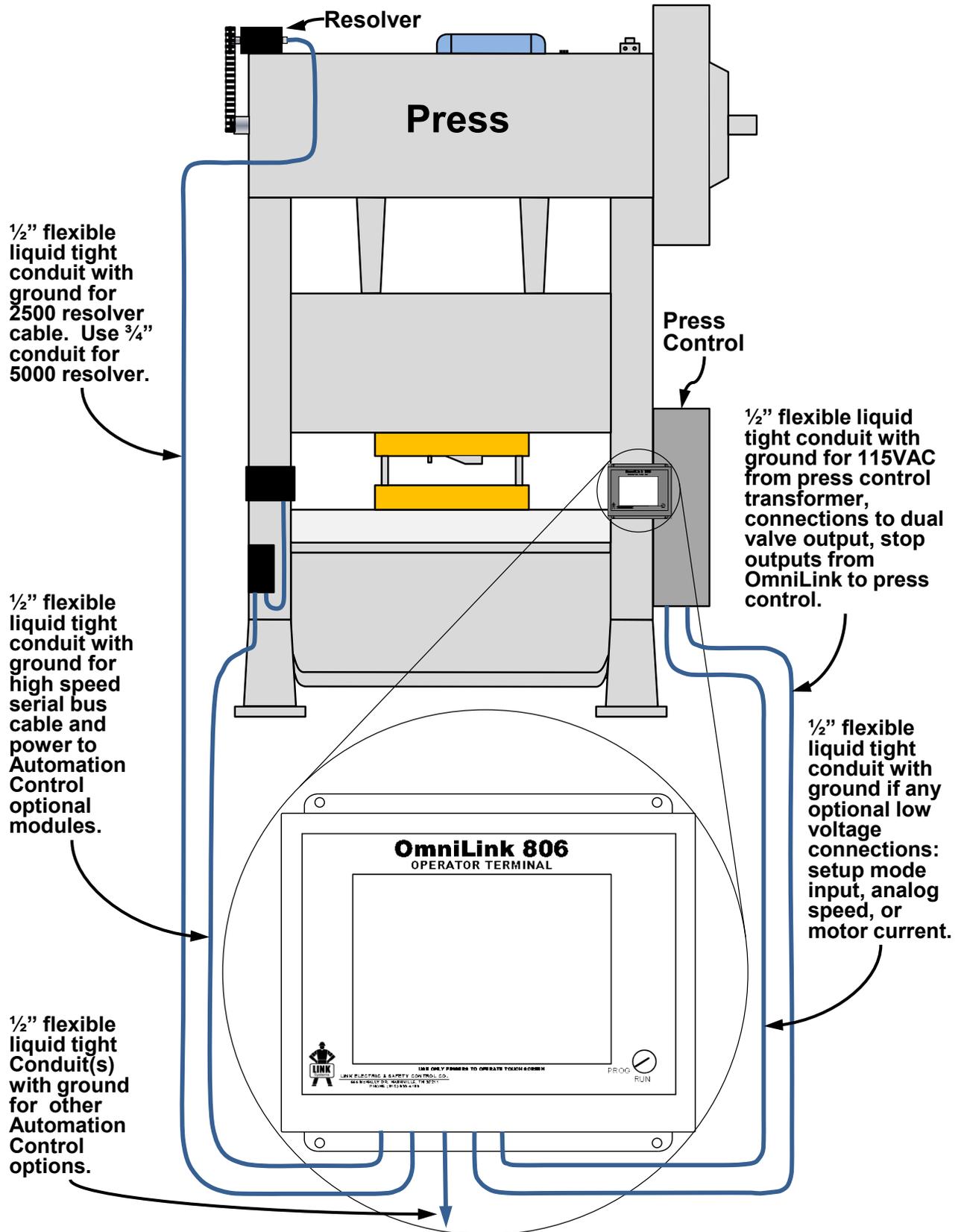


Figure 69: General View of Wiring Runs for Installation

5.6.2 Wiring Power for the System

WARNING: National Codes and standard (NEC, VDE, BSI, etc.) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection, and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.



The Automation Control and all optional Link automation and monitoring devices can, and typically do, run on 115VAC power. The 806-5 Automation Control Logic Board, as well as the OT806 operator terminal, can *optionally* be powered from 115VAC, 230VAC, or +24VDC. +24VDC is sometimes used when building low voltage panels for Arc Flash compliance but, unless this is the case, it is *generally preferable to use 115VAC*.

Many Link optional automation and monitoring devices require 115VAC power and will need a separate power run if the operator terminal and Automation Control Logic Board are powered with other voltages.

Pull wires with the appropriate color code in conduit between the OmniLink Operator Terminal enclosure and the press control. Remember to run high voltage wiring in one conduit and low voltage wiring, if any, in a separate conduit.

The control transformer in the press control will preferably be used to supply the 115VAC power for all the components of the Automation Control. A typical Automation Control with options will draw less than 1 Amp at 115 VAC, but large systems can draw more. Check the documentation for all options used and make sure the control transformer will be able to supply the necessary power. If not, an additional control transformer will be needed.

Power Connector for the OT806 Operator Terminal	
L1	100 – 240 VAC Line 29 VA (0.25 Amp at 115 VAC)
L2	100 – 240 VAC Neutral
PE	Protective Earth (<i>used with both AC and DC input power</i>)
+24	+24 VDC Input Power (0.9 Amps)
GND	Ground - +24VDC Return

Power Connector for 806-5 Automation Control Logic Board	
L1	100 – 240 VAC Line 29 VA (0.25 Amp at 115 VAC)
L2	100 – 240 VAC Neutral
PE	Protective Earth (<i>used with both AC and DC input power</i>)
+24	+24 VDC Input Power (0.9 Amps)
GND	Ground - +24VDC Return

Power Connector for 802-5 Automation Control Logic Board	
L1	100 – 135 VAC Line 24 VA (0.2 Amp at 115 VAC)
L2	100 – 135 VAC Neutral
GND	Protective Earth

WARNING: The 806-5 Automation Control Logic Board and OT806 Operator Terminal can be powered from **EITHER 100-240VAC OR +24VDC**. **Never** hook up both AC and DC power at the same time. The +24VDC power input is provided to allow control enclosures to be configured with only low voltage components for Arc Flash compliance. Some older Link modules operate on 115VAC only. Verify the power requirements of all modules in the system before “daisy-chaining” the power from a different voltage source!



For the OT806 Operator Terminal and 806-5 Automation Control Logic Board when using AC Power, use the L1, L2 and PE terminals (See Figure 70 and Figure 71).

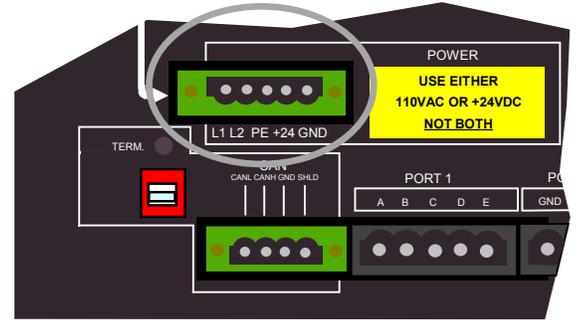


Figure 70: OT806 Power Connector

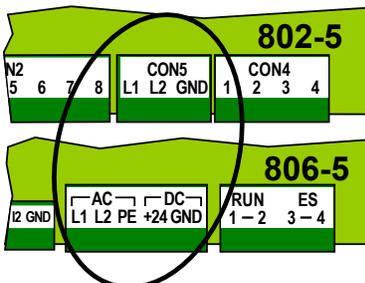


Figure 71: 802-5 and 806-5 Power Connectors

For the OT806 Operator Terminal and 806-5 Automation Control Logic Board using +24 VDC Power, use the +24, GND, and PE terminals.

The 802-5 Automation Control Logic Board can only use AC Power using the L1, L2, and GND terminals.

See Figure 67 and Figure 68 for a high level view of the power connector locations for the 802-5, 806-5, and the OT806 Operator Terminal.

Power does not *have* to be daisy-chained from module to module, but it is often convenient to do so, as the high speed bus *does* have to be daisy-chained (see Section 5.6.3) and can share conduit with the power. To accommodate daisy-chaining, most of the power connectors in the Automation Control optional automation and monitoring devices are dual connectors. Figure 72 shows both 3 pin and 5 pin dual power connectors typically used in the system.

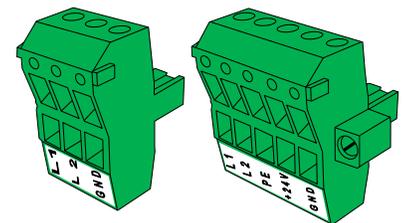


Figure 72: Dual Power Connectors

5.6.3 Wiring High Speed Bus Cable

The high speed bus cable is a critical part of the system. Communications with the operator terminal for settings and status, crank angle and other information from the Automation Control, and stop signals from the automation and monitoring components to the Automation Control Logic Board are all sent through this communications link.

NOTE: *Always* use the cable specified by Link Systems for the high speed bus! This cable has been chosen to optimize communication speed and distance for the high speed bus. Use of any other cable may result in communication faults that cause nuisance stops of your press production system. **DO NOT** splice together cable sections between devices. Use only unbroken runs of cable between devices.

Most option modules have a 4 pin dual connection plug for connection to the high speed bus. As shown in Figure 73, this plug allows for the high speed bus cable to be strung from module to module. Note that this plug has screws on each side for locking into the socket. ***This connector should be screwed down for trouble-free operation.***

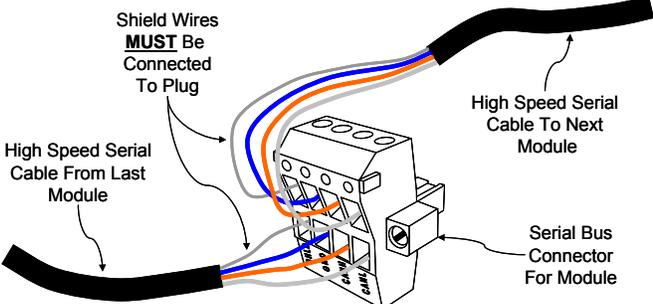


Figure 73: High Speed Bus Connector for Most Option Modules

See the manuals on the option modules for the location of this connector for a given module. All high speed bus connectors will be labeled with the same terminal names – SHLD, GND, CANH, and CANL.

The OT806 operator terminal high speed bus connector is shown in Figure 74 and is located at the lower left corner of the back of the operator terminal. It uses a dual plug as described above.

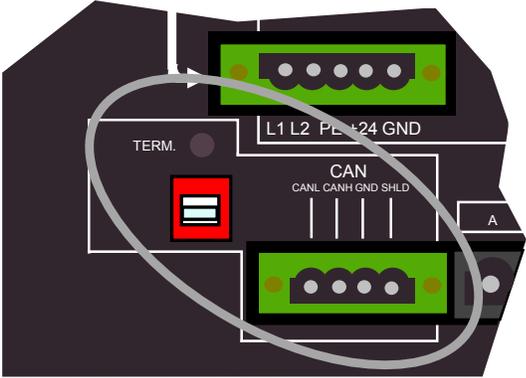


Figure 74: High Speed Bus Connector for OT806

The Automation Control Logic

Board also has a dual connection arrangement for the high speed bus, but it is not pluggable and consists of a dual level terminal strip as shown in Figure 75. See Figure 67 on page 118 to locate this connector.

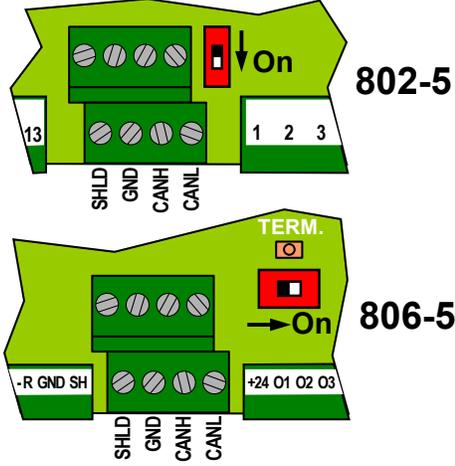


Figure 75: High Speed Bus Connector for Automation Control Logic Board

The table at right shows the color code for the high speed bus connections. This applies to any module connected to the bus.

High Speed Bus Connections	
SHLD	Shield (Bare Wire)
GND	Blue
CANH	Orange
CANL	White

When used with the Automation Control, the high speed bus wiring should be run in a fashion similar to Figure 76.

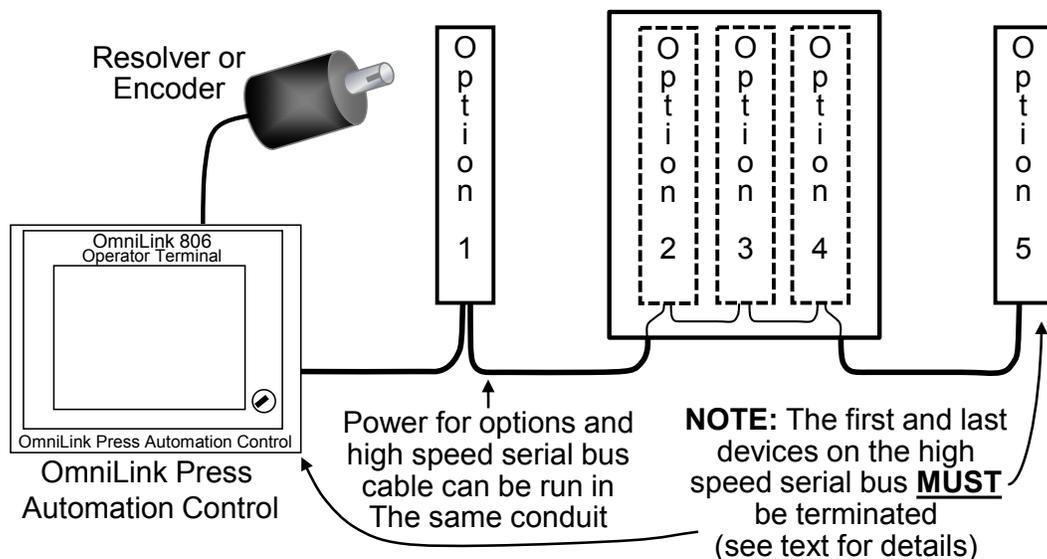


Figure 76: High Speed Bus Wiring Topology

NOTE: Devices do not have to be connected on the high speed bus in any particular order. However, they **MUST BE** connected in “daisy-chain” fashion as shown in Figure 76. Note that OT806 operator terminals do NOT have to be located at one end of the bus, but it is often convenient to have them at one end. It *is* desirable to minimize the length of the high speed bus cable. ***In any case, the maximum allowable total length of the high speed bus is 300 feet (91.4 meters).***

5.6.4 Setting the High Speed Bus Termination Switch

OT806 operator terminals can be located anywhere on the bus but are often at one end as a matter of convenience. Regardless of what type of module it is, whatever device is at either end of the bus **MUST BE** terminated. The devices not at the end of the bus **MUST NOT** be terminated. Each device has a termination switch and most have an indicator LED to display whether or not termination is active. See Figure 74 and Figure 75 for the location of the termination switch for the OT806 operator terminal and the Automation Control Logic Board.

The OT806 Operator Terminal and the 806-5 Automation Control Logic Board both have a termination LED just above the termination switch. The unit is terminated when the LED is lit.

The 802-5 Automation Control Logic Board does not have a termination LED. The unit is terminated when the switch is “down” as shown by the arrow in Figure 75.

A simple method of determining if a device is at the end of the bus is to check the high speed bus connector. If only one cable is wired into this connector, then the unit is at the end of the bus and should be terminated. If two cables are wired into the connector, then the unit is not at the end of the bus and termination should not be made active.

5.6.5 Wiring the Resolver to the Automation Control Logic Board

The Automation Control can use a Link 2500 resolver, a Link 5000 resolver, or a Link 5100-11 encoder (806-5 Automation Control Logic Board only) to get angle information from the crankshaft or eccentric.

The resolver or encoder cable must be wired to the Automation Control Logic Board, typically located on the inside back of the OmniLink Operator Terminal enclosure. The board may be located elsewhere if the Automation Control is ordered as a panel mount version.

The 2500 Resolver comes with a cable that has 3 twisted pairs with a drain (a bare wire) for each pair and a 6-pin MS connector to plug into the resolver. Run a ½” conduit from the 2500 Resolver to the knockout on the bottom left of the Operator Terminal enclosure. Pull the cable through the conduit and wire to the Automation Control Logic Board as shown in Figure 77.

Note the two different hookups depending on the direction of rotation of the crank or eccentric.

The angle display on the Link operator terminal must turn clockwise when the press is running in the forward direction.

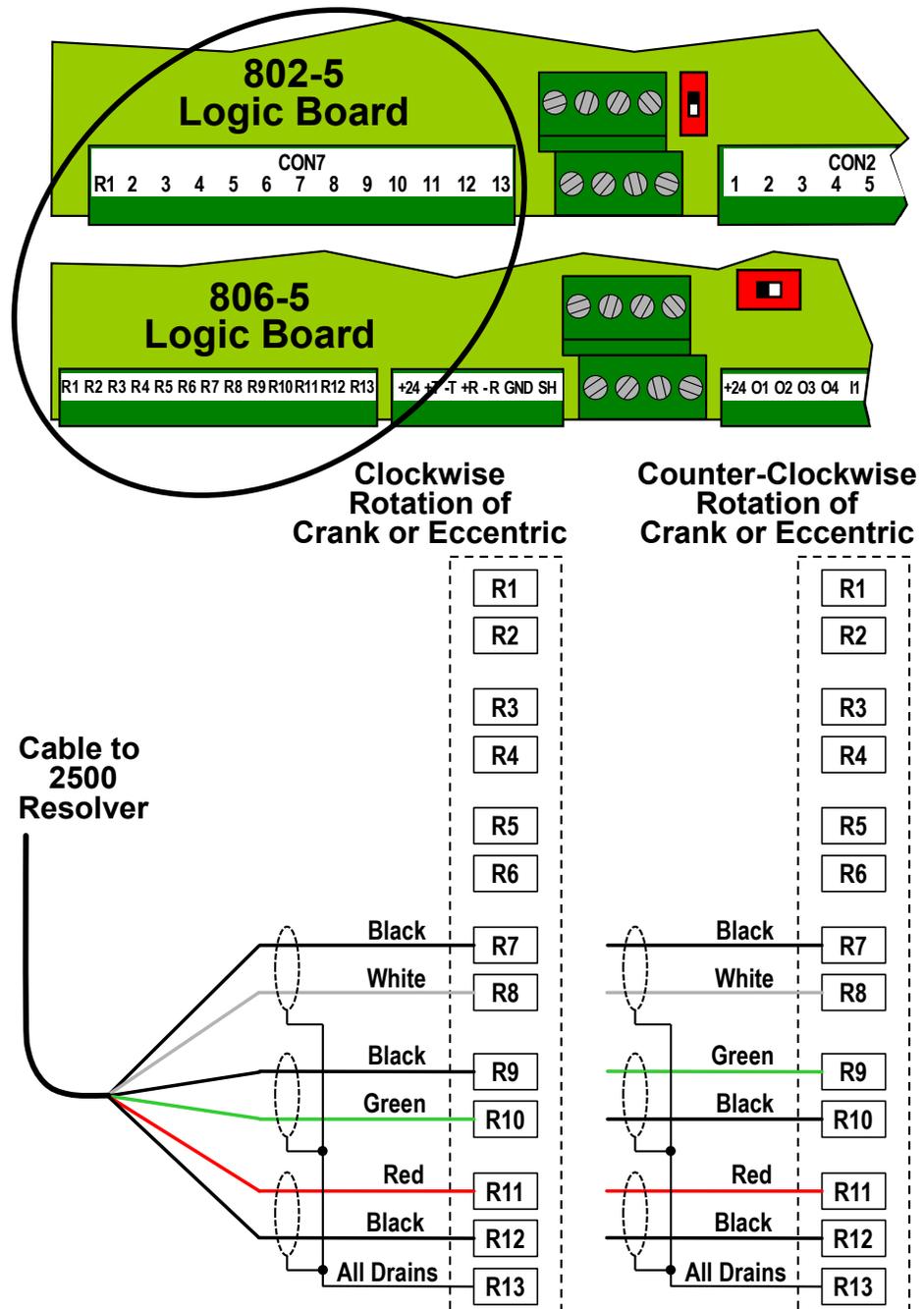


Figure 77: Wiring from 2500 Resolver to Automation Control Logic Board

The 5000 Resolver comes with a cable with 6 twisted pairs with a drain (bare wire) for each pair and a 14-pin MS connector to plug into the resolver. Run a 3/4" conduit from the 5000 Resolver to the knockout on the bottom left of the Operator Terminal enclosure. Pull the cable through the conduit and wire as shown in Figure 78.

Note the two different hookups depending on the direction of rotation of the crank or eccentric.

The angle display on the Link operator terminal must turn clockwise when the press is running in the forward direction.

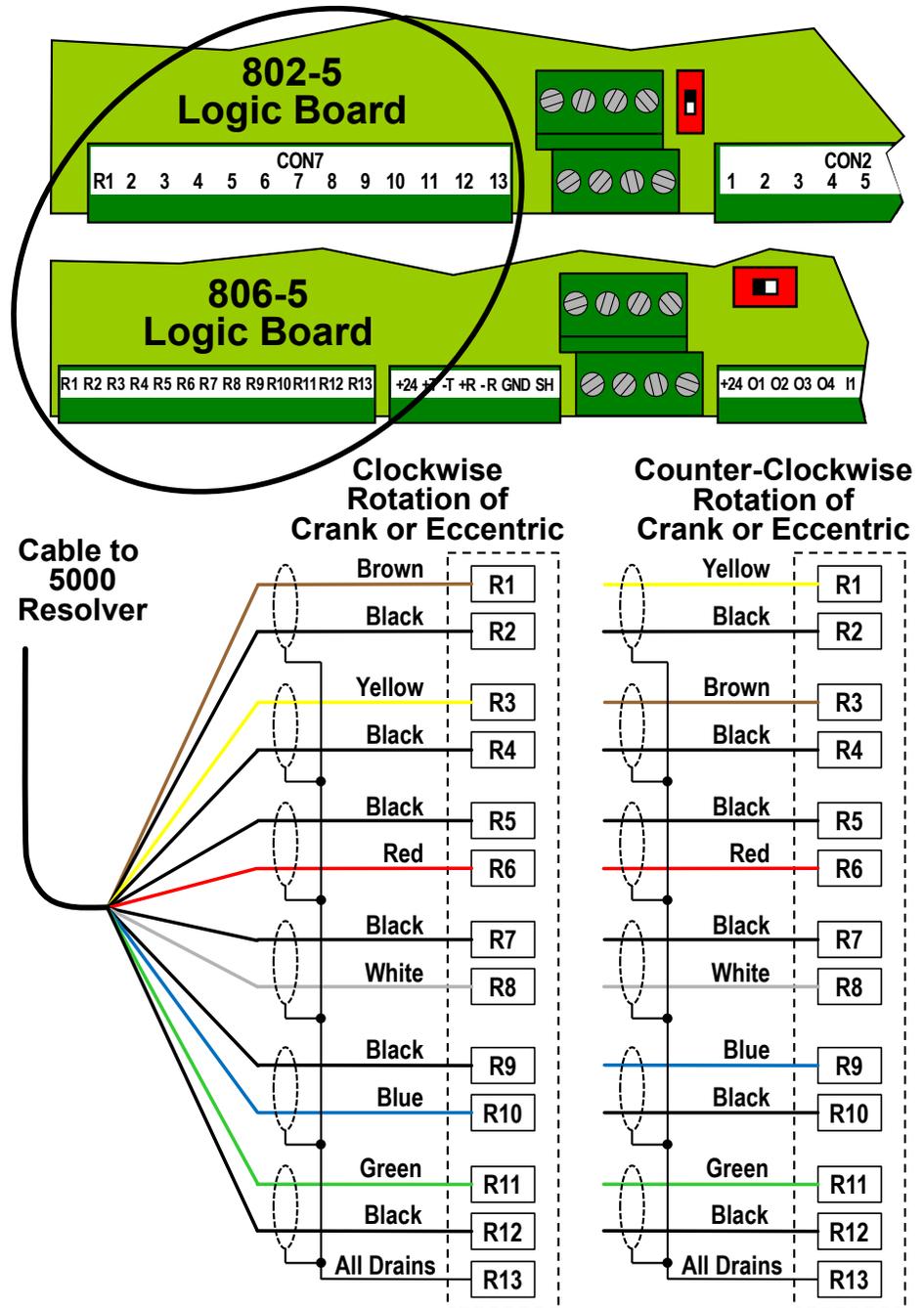


Figure 78: Wiring from 5000 Resolver to Automation Control Logic Board

5.6.6 Wiring the Valve Voltage Circuit (Mechanical Press Only)

In the case of Mechanical Presses, the Automation Control requires a signal from the press clutch/brake control that indicates when the press clutch is engaged (the press is stroking). This signal is derived from the voltage across the dual air valve solenoid (in some cases a hydraulic valve may be used) that controls stroking and may be 24VDC or 115VAC

Two wires must be pulled through the appropriate conduit (low or high voltage depending on valve solenoid voltage) between the press control and the OmniLink Operator Terminal enclosure. On the press control end the wires must be connected to opposite sides of one solenoid of the dual air valve as shown in Figure 79. On the Automation Control end, the wires must be connected to terminals 1 and 2 of the “Run / Stop Connector” (See Figure 67 on page 118 to locate this connector).

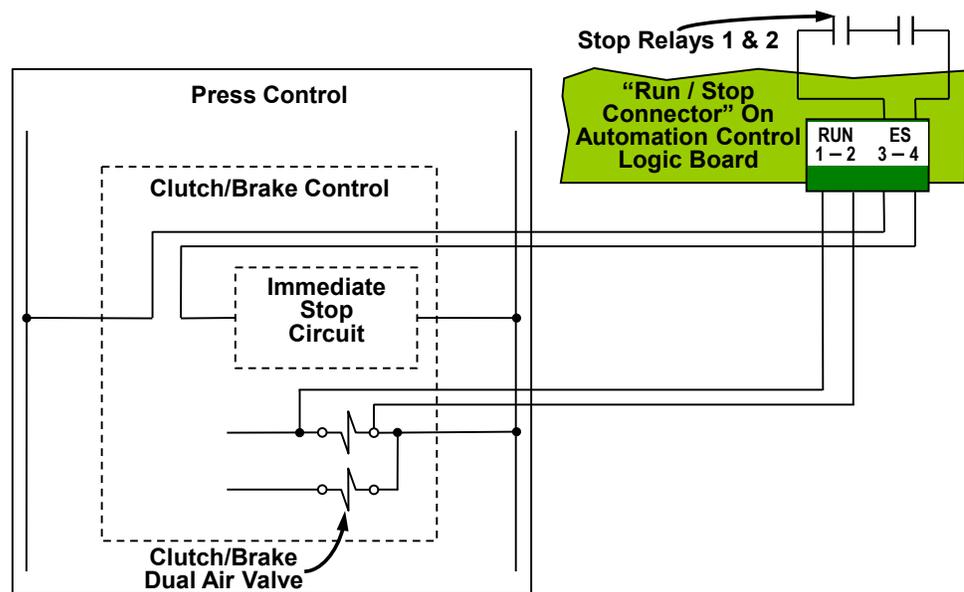


Figure 79: Run / Stop Connector Wiring

Some presses have a single dual air valve that operates both clutch and brake. Others have two dual air valves, one for the clutch and one for the brake. *When two dual air valves are used, always wire to a solenoid for the valve that controls the clutch.*

5.6.7 Wiring the Automation Control Stop Circuit Output

Two cross checked, force guided contacts operated by two separate microprocessors on the Automation Control Logic Board are used to provide both immediate stop and top stop signals to the press clutch/brake control to stop press stroking when faults are detected. These contacts, located between terminals 3 and 4 of the “Run / Stop Connector” (See Figure 67 on page 118 to locate this connector), are normally open and energized closed. They open to give a stop command to the press control. They should be wired into an immediate stop circuit of the press control. An immediate stop circuit is one that can immediately stop stroking of the press and will require use of the operator controls to resume stroking after the stop is removed. On many press controls, placing the contacts in series with the red color stop buttons (often referred to as “Emergency Stop Buttons”) is the desirable wiring method. The circuit used must not drop out motor controls on the press.

NOTE: Link engineers will assist in determining where to wire the contacts into the press control if help is needed.

Pull two wires in the appropriate conduit (low or high voltage depending on the stop circuit voltage) between the OmniLink Operator Terminal enclosure and the press control. Wire terminals 3 and 4 of the “Run / Stop Connector” into the immediate stop circuit of the press control as illustrated in Figure 79.

Figure 80 and Figure 81 illustrate the appropriate stop circuit connections for Link’s SS501 press controls with standard cards and with the 501-16 card option. These are solid state controls with low voltage dc circuits.

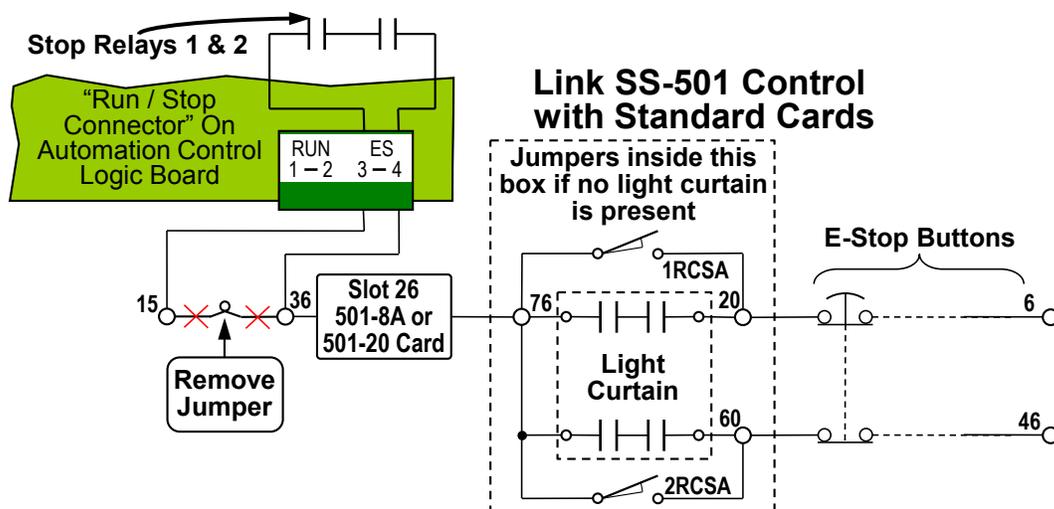


Figure 80: Stop Circuit Connection for Link SS-501 Standard Control

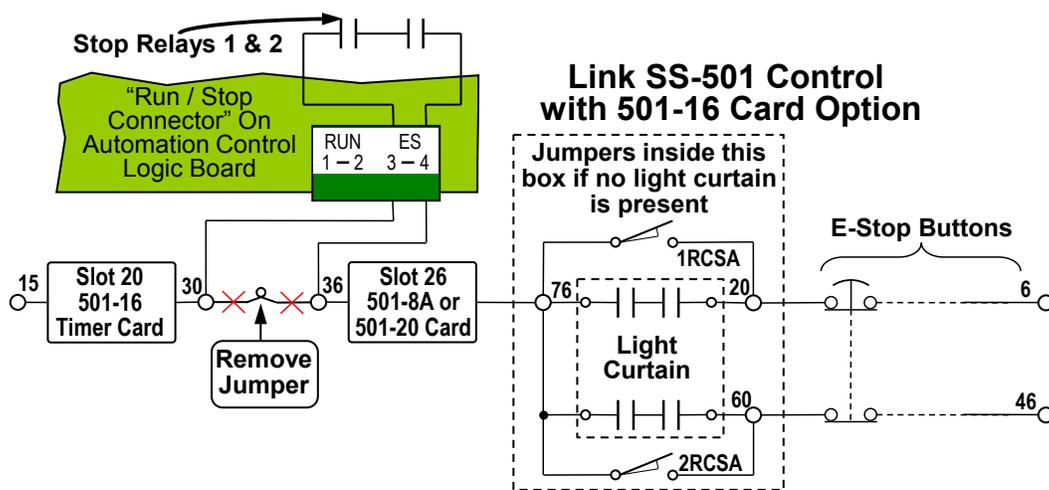


Figure 81: Stop Circuit Connection for Link SS-501 Control with 501-16 Card

5.6.8 Wiring the Optional “Setup Mode” Input

The Automation Control provides an optional setup mode input that can be used to automatically bypass certain die protection and process monitoring functions, counters, and tonnage monitor low limits during setup activities that require stroking the press. This avoids nuisance faults that have to be reset on the die protection and tonnage monitor and false part counts based on stroking during setup activities.

Most presses will use the Inch Mode as the setup mode. It also allows a fixed setup mode speed to be set for variable speed presses when the optional speed control board is used. An isolated contact that closes in the Inch Mode must be used as an input. If a spare Inch Mode contact on the mode selector switch is not available, one solution is to remove an existing switch contact closed only in the Inch Mode from the circuit and add a relay with 2 normally open contacts to the control circuit. Use the contact closed in Inch Mode to energize the relay coil, use one normally open contact of the relay to insert in the control circuit where the Inch Mode contact was previously located, and use the second normally open contact as the Setup Mode input to the Automation Control Logic Board Digital I/O Connector. A selector switch could also be wired into this input for manual selection of Setup Mode. Figure 82 shows the wiring of the setup mode input. Refer to Figure 67 on page 118 for the location of the Digital I/O Connector. Run wiring in a conduit reserved for low voltage circuits between the press control and the Automation Control.

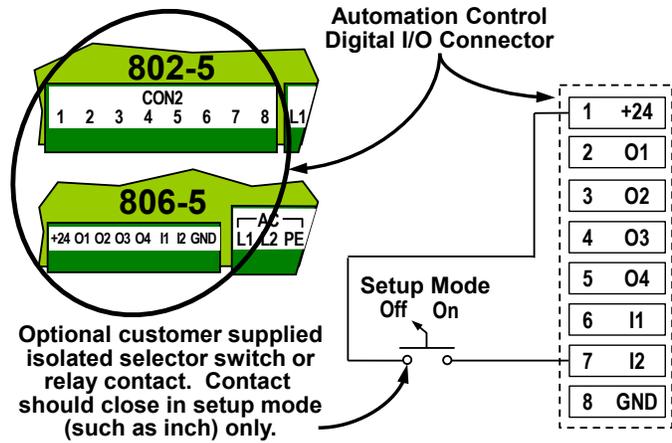


Figure 82: Setup Mode Input Wiring

located, and use the second normally open contact as the Setup Mode input to the Automation Control Logic Board Digital I/O Connector. A selector switch could also be wired into this input for manual selection of Setup Mode. Figure 82 shows the wiring of the setup mode input. Refer to Figure 67 on page 118 for the location of the Digital I/O Connector. Run wiring in a conduit reserved for low voltage circuits between the press control and the Automation Control.

5.6.9 Wiring the Optional Speed Control Board (Mechanical Presses Only)

An optional Speed Control Board is available for the Automation Control Logic Board. This board allows the Automation Control to graphically and numerically display motor load current and flywheel speed on the OmniLink Operator Terminal. It also allows the Automation Control to set the stroking speed of the press. A different Speed Control Board is used with the 802-5 or 806-5 Automation Control Logic Board.

Figure 83 shows the 802-5A Speed Control Board in its location on an 802-5 Automation Control Logic Board. Notice that a dip switch, “SW1”, is present on this board that must be set in certain circumstances as described later in the text.

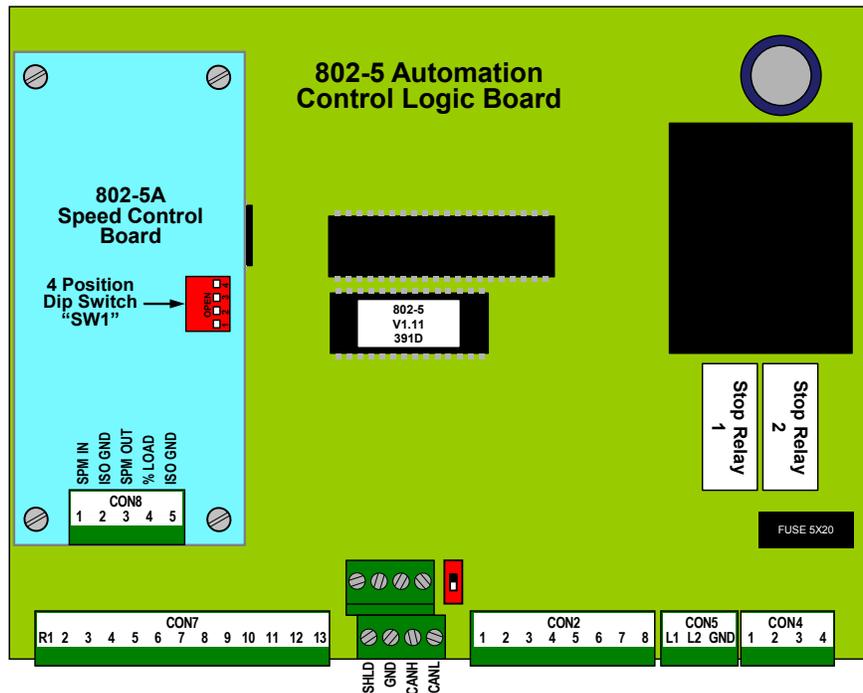


Figure 83: 802-5A Speed Control Board for 802-5 Logic Board

Figure 84 shows the 5100-3B Speed Control Board in its location on an 806-5 Automation Control Logic Board.

Both speed control boards use a 5 pin pluggable terminal strip for field connections with the same function for each terminal number, but do *note that the terminals 1-5 are numbered left to right for the 802-5A board and right to left for the 5100-3B board.*

NOTE: If an 802-5 Automation Control Logic Board is replaced with an 806-5, the speed control board wires must be “reversed”.

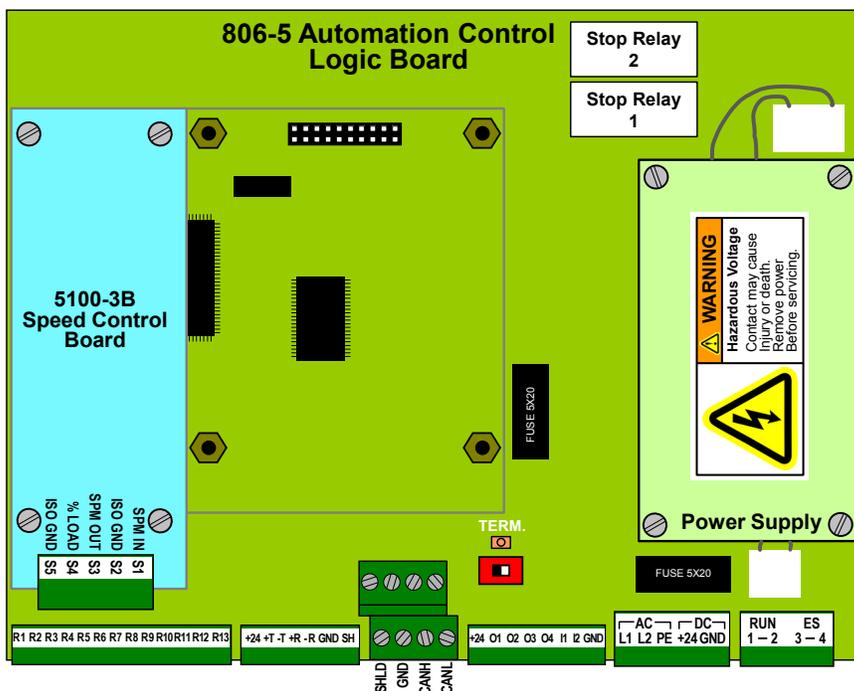


Figure 84: 5100-3B Speed Control Board for 806-5 Logic Board

5.6.9.1 Wiring the Percent Motor Load Input

The Speed Control Board can optionally graphically and numerically display motor load current on the OmniLink Operator Terminal.

In addition to the wiring described here, it will also be necessary to calibrate the percent motor load current displayed on the OmniLink Operator Terminal as described in Section 4.2.7.5.

Refer to Figure 85 for connections for fixed speed presses and presses with eddy current variable speed drives. These presses require a current transformer and an instrument transformer to interface to the Speed Control Board. The transformers will normally be supplied by Link if the order indicates that motor load current display is desired.

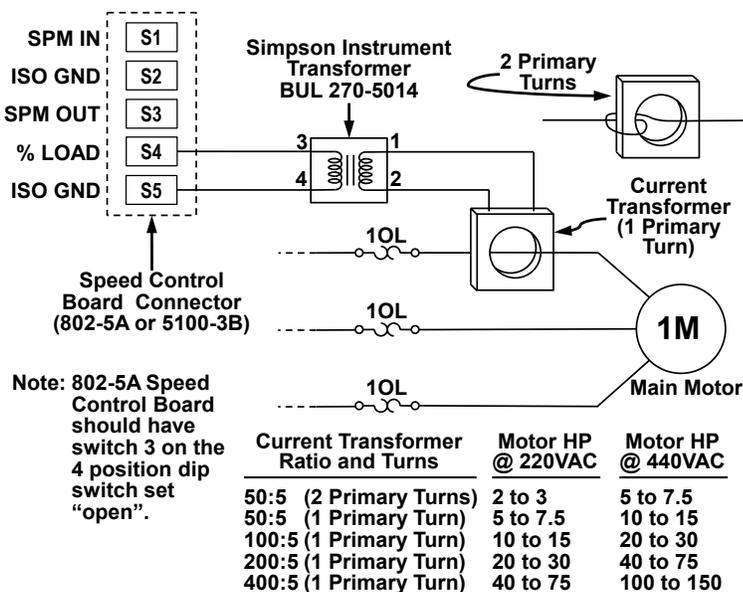


Figure 85: Motor Load Connection with Current Transformer

DC Motor Drives and AC Variable Frequency Motor Drives will usually provide an analog motor load current output of 0-10 volts or 4-20 milliamps. Figure 86 shows the typical connections to these drives. If a 4-20 milliamp output is used with an 802-5A Speed Control Board (See Figure 83), throw switch 3 of the 4 Position Dip Switch on the 802-5A board to the closed position. Otherwise, leave switch 3 open. If a 4-20 milliamp output is used with a 5100-3B Speed Control Board, a resistor must be installed between terminals S4 and S5. Contact Link for details.

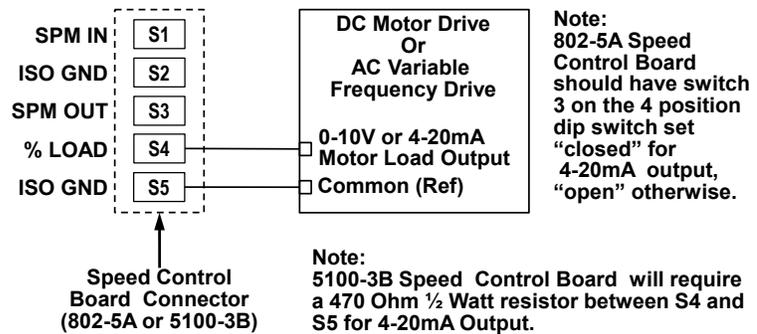


Figure 86: Motor Load Connection to Drive

5.6.9.2 Wiring the Speed Input and Output

The optional Speed Control Board allows the display of the drive SPM for electronic variable speed drives on the OmniLink Operator Terminal, and to set the desired SPM with an analog voltage output controlled from the Operator Terminal rather than with a potentiometer or keypad on the drive itself. Displaying drive SPM tells how fast the press will stroke even when the clutch is not engaged. Without this feature, the stroking speed will only be displayed while the press is actually stroking. If desired, only the SPM input may be wired, leaving control of the speed to an existing potentiometer or keypad.

In addition to the wiring described here, it will also be necessary to calibrate the percent motor load current displayed on the OmniLink Operator Terminal as described in Section 4.2.6.

For presses with eddy current variable speed drives, refer to Figure 87 for an illustration of the speed input and output wiring. For 802-5A Speed Control Boards, if one side of the tach generator is referenced to ground in the eddy current drive circuit, make sure switch 1 of the 4 position dip switch on the 802-5A board (see Figure 83) is closed. If the tach generator drives a bridge rectifier on the eddy current drive, the switch 1 should be open. If controlling speed through the OmniLink Operator Terminal, then the SPM OUT terminal of the Speed Control Board should be wired to the eddy current drive SPM input (the input that sets the desired speed).

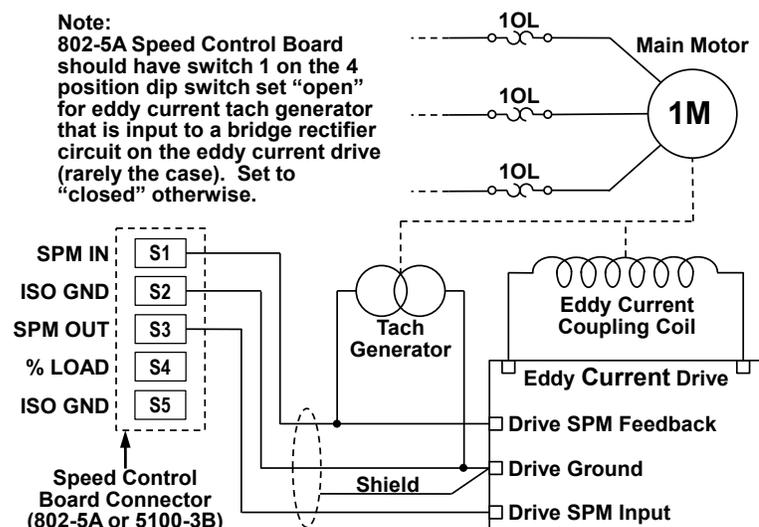


Figure 87: Motor Speed Connections to Eddy Current Drive

To wire a DC Drive or an AC Variable Frequency drive, refer to Figure 88. For these drives when using an 802-5A Speed Control Board, switch 1 of the 4 position dip switch on the 802-5A board (see Figure 83) should be closed.

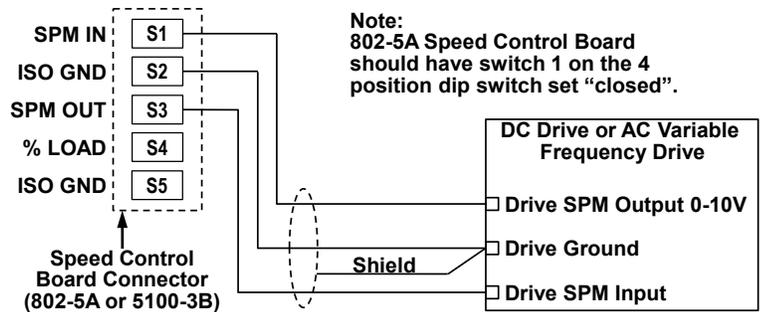


Figure 88: Motor Speed Connections to DC Drive or AC Variable Frequency Drive

5.6.10 Wiring the 806-5A Servo/Hyd Interface Board

The optional 806-5A board can be installed only on an 806-5 Automation Control Logic Board. It allows the Automation Control to work with Servo Presses.

At this time, it provides a Top Stop relay used in conjunction with the Stop Relays on the main 806-5 Board and inputs that allow the Automation Control to determine the status of the servo press stop conditions. There are other inputs and outputs on this board provided for future use as needed.

The separate Top Stop relay is needed because there is no way to generate a consistent stop at top on a servo press using its Immediate Stop circuit due to the more complex characteristics of its control. Terminals 3 and 4 of the “Run / Stop Connector” on the 806-5 Automation Control Logic Board (see Section 5.6.7) must be wired into an Immediate Stop circuit of the Servo Press control. The Top Stop relay on the 806-5B board must be wired into a Top Stop circuit on the Servo Press control. The Automation Control will then trigger the appropriate stop output depending on the stop type it wants to assert.

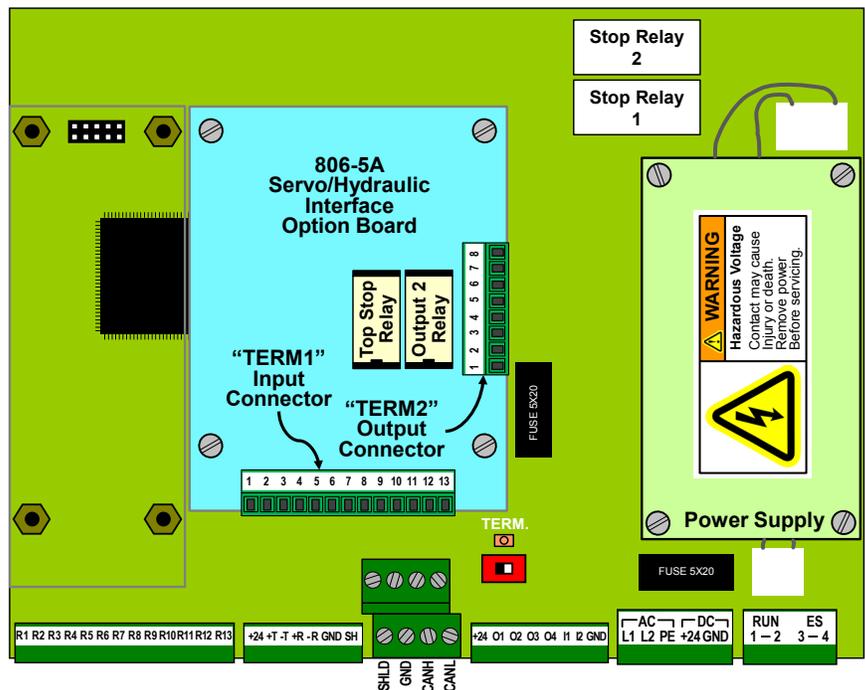


Figure 89: 806-5A Servo/Hyd Interface Board for 806-5 Logic Board

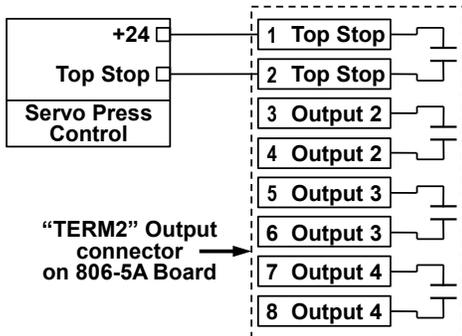


Figure 90: 806-5A Output Wiring

Figure 90 shows a typical case for wiring the Top Stop output relay terminals on the 806-5A board to an auxiliary equipment Top Stop input on the Servo Press control. This figure also shows the logical relay contact to the right of the terminals for clarity.

The Top Stop output relay on the 806-5A is a normally open contact that is held closed when a Top Stop is not being asserted by the Automation Control and opens when a Top Stop is called for.

Whenever possible, a dedicated Top Stop input on the Servo Control should be used. In some controls, this input can be named so that when the Automation Control asserts a stop, the Servo Press control can indicate that directly to the operator. If this is not possible because all Top Stop inputs have been used, then the Top Stop output relay from the 806-5A board will need to be tied in series with an existing Top Stop.

Outputs 2, 3, and 4 are for future use.

Input Terminals 11 and 12 should be tied into Top Stop and Immediate Stop outputs (i.e. outputs that turn “Off” when a Top Stop or Immediate Stop condition exists) on the Servo Press *if they are available*. This lets the Automation Control know that the press has, in fact, stopped and is not simply paused as part of the Servo Press motion profile. This is needed for proper operation and to generate correct diagnostic information since the press can be stopped from sources outside of the Automation Control.

If these outputs are not available, then the Automation Control will need to use the “Motion Profile “Running” Timeout” parameter that is set on a job by job basis to simulate a “running” signal by analyzing crankshaft motion (see Section 3.10.1.6 on page 50).

The Automation Control expects the inputs to be “On” when the Stop is NOT asserted.

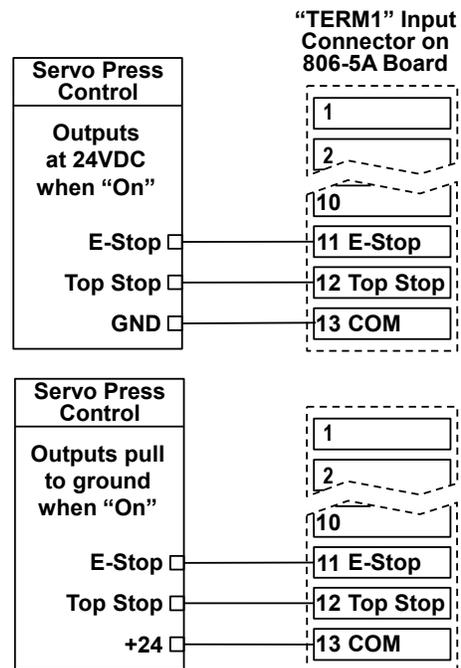


Figure 91: 806-5A Input Wiring

Figure 91 shows two cases for wiring the input terminals on the 806-5A board.

The first case, shown at the top of Figure 91, connects terminal 13, the common, to ground. The inputs on terminals 1 through 12 then turn “On” when +24VDC are applied to them.

In the second case, shown at the bottom of Figure 91, terminal 13 is connected to +24VDC. The inputs on terminals 1 through 12 then turn “On” when they are grounded.

Note that all inputs respond to the “opposite” of the common terminal 13. It is not possible to have some inputs turn “On” when a voltage is applied while others turn “On” when grounded. The common terminal sets the characteristics of all inputs.

Inputs 1 through 10 are for future use.

5.6.11 Wiring the Solid State Relay Module

The Automation Control can be equipped with an optional 802-5B solid state relay module. This module works with both the 802-5 and 806-5 Automation Control Logic Board. The module can be populated with a combination of AC or DC solid state relays specified by the customer. If the module is installed, the relays provide the following functions:

- Relay 1 and Relay 2: Module programmable limit switches 1 and 2. Simple on at an angle, off at an angle, PLS outputs for limited applications.
- Relay 3: Provides an output to drive an external light that indicates die protection is bypassed.
- Relay 4: Provides an output to drive an external light to indicate that a downtime code has been entered when the optional LinkNet information system software is used.

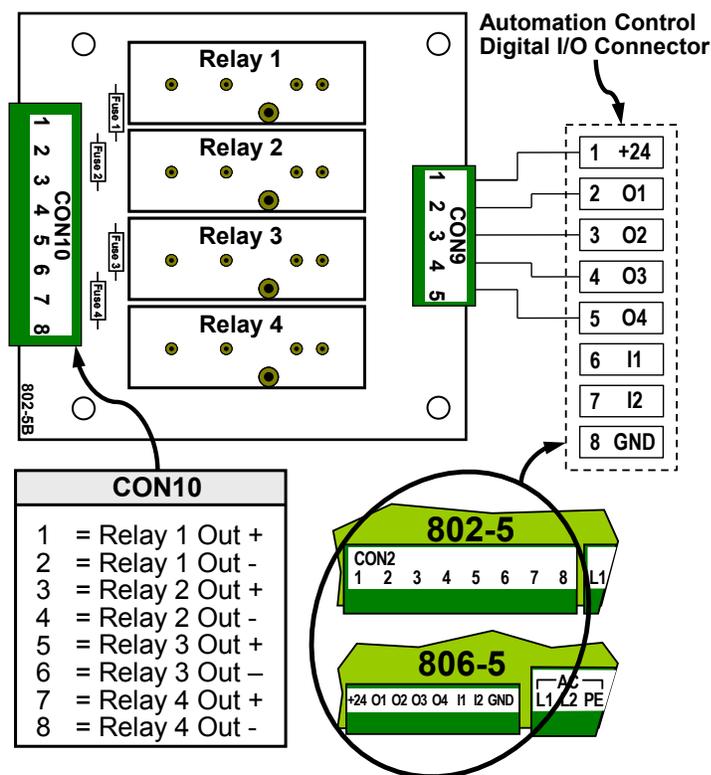


Figure 92: Solid State Relay Module Connections

Figure 92 shows the connections from the Automation Control Logic Board Digital I/O Connector (see Figure 67 on page 118) and the 802-5B Solid State Relay module.

5.6.12 Wiring the OT806 Parallel Port for Auxiliary Equipment Message Display

The OmniLink 806 Operator Terminal has a parallel port on the back that can be wired to auxiliary equipment intelligent controllers so that diagnostic messages can be displayed on the Automation Control screen. Seven isolated signal inputs and an isolated common constitute the parallel port, which can be wired to provide up to 128 message codes.

The OmniLink operator terminal allows entry of a color coded alpha-numeric message for each message code input to the parallel port. Each message can be up to 2 lines of 40 characters each. This is a useful feature when the user wants a simpler solution to diagnostics than having to deal with programming serial port communications between two different intelligent systems. Section 4.2.9 details how these messages are configured and how they relate to the message code selected by the parallel port.

All seven inputs on the parallel port do not have to be used, but the number of messages available will be reduced if they are not. If all the inputs are not used, the lower terminal numbers should be used first. For example, if only 3 inputs are needed for the number of messages used, then the common terminal and terminal 2, 3, and 4 should be used. The table at right shows the number of messages available depending on the number of inputs used.

Number of Input Lines Used	Maximum Number of Messages
1	2
2	4
3	8
4	16
5	32
6	64
7	128

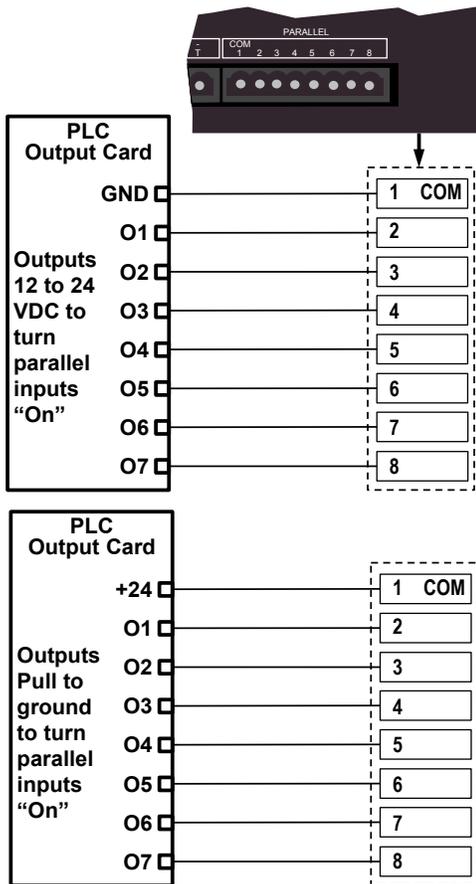


Figure 93 shows two cases for wiring the parallel port.

The first case, shown at the top of Figure 93, connects terminal 1, the common, to ground. The inputs on terminals 2 through 8 then turn “On” when 12 to 24VDC are applied to them.

In the second case, shown at the bottom of Figure 93, terminal 1 is connected to +24VDC (and could be connected to +12VDC). The inputs on terminals 2 through 8 then turn “On” when they are grounded.

Note that all inputs respond to the “opposite” of the common terminal 1. It is not possible to have some inputs turn “On” when a voltage is applied while others turn “On” when grounded. The common terminal sets the characteristics of all inputs.

Figure 93: Parallel Port Wiring

6 TROUBLESHOOTING

Most of the errors generated by the Automation Control are straightforward. However, some of these conditions are a little more involved and bear further discussion.

Link is also happy to assist in diagnosis and troubleshooting of its equipment and can be reached at (615) 833-4168.

6.1 “Communication Failure” in the Automation Control Screen

The message “Communication Failure” in the Present Running Status of the Automation Control screen indicates that the operator terminal cannot communicate with the Automation Control Logic Board. Turn the power off and measure the resistance from CANH to CANL on the high speed bus connector. The resistance should read about 60 ohms regardless of the number of devices connected on the bus. If the reading indicates a short, inspect the connections at all of the high speed bus connectors. A reading of about 120 ohms indicates that only one device is connected or terminated.

The high speed bus must be terminated properly. Refer to Sections 5.6.3 and 5.6.4 for information on wiring the high speed bus and terminating it.

6.2 Communication Errors in Option Module Screens

Most option modules, such as die protection, limit switch, tonnage monitor, and so on report a “Module Status” in their main screen. There are at least three error conditions that are related to communication errors that can show up in this status:

- | | |
|-------------------------------------|--|
| <i>Communication Failure</i> | This message is shown in the “Module Status” line at the bottom of the main screen of the option when communications between the operator terminal and the option module have been lost for 2 or 3 seconds. This is typically because the high speed bus cable has become disconnected from the operator terminal or from the option module. It would also appear if the option module is not powered. |
| <i>XXX F. Comm. Fail</i> | This message is shown in the Automation Control “Present Running Status” where XXX is replaced by an abbreviation for the option module type (CTM for tonnage monitor, DDP for die protection, PLS for programmable limit switch, etc.). It may or may not appear in conjunction with “Communication Failure” in the tonnage monitor screen. If this message occurs without “Communication Failure” in the option module screen, then it indicates a short-term (as little as 80 milliseconds to as much as 3 seconds) loss of communications. While a hardware failure in the option module could cause this, it is unlikely. More likely is an intermittent connection in the high speed bus cable – possibly a loose wire in a connector, or a broken wire somewhere in a cable section. Another condition that can cause this is a momentary power failure in the option module. If a power failure is causing this message, then “Initializing” will appear for four or five seconds in the “Module Status” of the option module as it receives its settings on power-up. |

No Resolver Info This message may be shown in the “Module Status” line at the bottom of the option module main screen. The option modules receive crank angle from the Automation Control over the high speed bus cable at an extremely high rate. Since several aspects of operation are determined by crank angle, the option modules will generate this error if they do not receive valid crank angle on a timely basis. This can be caused by an extremely short-term loss of communications (less than 7 milliseconds). It would also be generated if the Automation Control stopped sending crank angle out altogether (power loss in the Automation Control, or problem with the resolver itself causing the Automation Control to flag the angle as invalid).

While the above is a quick summary of the errors, the following subsections discuss step by step troubleshooting procedures.

6.2.1 “Communication Failure” in an Option Module Screen

If the option module is reporting *Communication Failure* in “Module Status” at the bottom of the option module main screen, then the following process should be followed:

- 1) First, check to see if any other option modules are also reporting *Communication Failure*.
- 2) **If all other modules are reporting communications failure**, then the problem should either be in the operator terminal, or the high speed bus as a whole. Check for broken or disconnected high speed bus cable near the operator terminal and that the wires are properly terminated in the connector. Check that the high speed bus cable is not shorted. Check that the high speed bus cable is properly terminated (see section 5.6.4 on page 125).
- 3) **If some but not all other modules are reporting communication failure**, then the problem is likely with one segment of high speed bus cable. Find the segment of high speed bus cable between the last unit that is working and the first unit that is not. Check that cable segment is plugged in at both ends and that the wires are properly terminated in the connectors. Check this segment for broken wires.
- 4) **If no other modules are reporting communication failure**, then the problem is likely connected to just that option module. Check that the option module has power. Check that the high speed bus cable is connected to the option module and that the wires are properly terminated in the connector. If the option module is at the end of the high speed bus, then verify that the last segment of high speed bus cable to the unit is ok. Check that the high speed bus cable is properly terminated (see section 5.6.4 on page 125).

6.2.2 “No Resolver Info”

If the option module is reporting *No Resolver Info* in “Module Status” at the bottom of the option module main screen, then the following process should be followed:

- 1) Check the Automation Control “Present Running Status” and see if it says “HSB Comm Failure”. If it does, it indicates the Automation Control is not communicating and is therefore not sending crank angle out on the high speed bus. Check for power to the unit and that the high speed bus cable is connected.
- 2) Check the Automation Control “Present Running Status” and see if it says *Resolver Drive Fault*, *Bus Read Fault*, *R/D Read Fault*, *No Sin/Cos*, *Loss of Sin/Cos*, *Resolver/Optic Fault*, or *Resolver/Optic Check Fault*. If it does, it indicates that the Automation Control cannot properly read the resolver on the crank shaft. This could be a problem with the resolver cable, the resolver, or the hardware in the press control or brake monitor.
- 3) The other possibility is a very short duration (less than 80 milliseconds) loss of communications. Check the high speed bus cables carefully. Verify that the wires are properly terminated in the connectors. Gently pull on individual wires where they go into the connectors to check for loose or broken wires.
- 4) If no wires are loose, check the high speed bus cable for damage to the outer jacket. If no damage is found, then flex and bend the high speed bus cable section by section while checking to see if the error returns. This should find most damaged cables with internal intermittently open wires. Replace the entire section of cable if this is found.

6.3 Diagnosing Resolver/Encoder Faults

The Automation Control Logic Board uses signals from a 2500 or 5000 Resolver/Encoder assembly to calculate press angular position. The Resolver/Encoder assembly connects to the press crankshaft in a 1:1 ratio. As the crankshaft rotates, output signals from the Resolver/Encoder assembly vary in response to the current crankshaft angular position.

The 5000 resolver assembly consists of a brushless resolver and an absolute optical encoder. Outputs from the brushless resolver are used to calculate angular position. The angular position information is checked by quadrant data from an absolute optical encoder. The 5000 Resolver/Encoder connections to the Automation Control Logic Board are shown in Figure 78 on page 127.

The 2500 resolver assembly is similar but has no absolute optical encoder. The 2500 Resolver connections to the Automation Control Logic Board are shown in Figure 77 on page 126.

The brushless resolver has three windings; reference, sine, and cosine. The Automation Control Logic Board drives the reference winding with an AC signal of fixed magnitude. The magnitude and phase of the sine and cosine windings vary in relation to the angular position of the press crankshaft. The relationship between the Resolver shaft angular position and the magnitudes of the sine and cosine windings outputs is illustrated in Figure 94 on page 143.

The optical encoder on the 5000 Resolver/Encoder provides two digital outputs. These digital outputs also vary in response to the angular position of the press crankshaft. The Automation Control Logic Board decodes these two digital signals. After decoding the two signals, the Automation Control Logic Board determines that the current encoder position is between 45 and 135 degrees, between 135 and 225 degrees, between 225 and 315 degrees, or between 315 and 45 degrees.

After calculating the angular position of the brushless resolver and decoding the outputs of the optical encoder, the Automation Control Logic Board compares the results. If the calculated angle of the brushless resolver is not within the decoded range of the optical encoder within a $\pm 5^\circ$ tolerance window, the system generates a Resolver/Encoder error and error message. Errors and error messages are also generated if the outputs of the brushless resolver indicate that the brushless resolver or the Automation Control Logic Board is not operating correctly. The possible error messages are listed below.

No Sin/Cos *Static Fault*

Press the **Reset** softkey in the Automation Control screen. If the error message does not reset, the fault is static and the conditions causing the fault are still present on the Automation Control Logic Board.

Measure the AC voltage from R8 to R7 terminals on the Automation Control Logic Board. This is the reference signal to the brushless resolver. The nominal reading is 2.6 VAC and can vary from 2.2 to 3.0 VAC. If the reading is less than 2.2 VAC, remove the wire on terminal R8 and read the voltage from R8 to R7 again. If the reading is still less than 2.2 VAC, replace the Automation Control Logic Board. If the voltage between R8 and R7 is correct with the wire removed, reconnect the wire to R8. Unscrew the connector on the back of the Resolver/Encoder assembly to determine if the problem is in the Resolver/Encoder cable or the Resolver/Encoder assembly. If the voltage is still low with the connector removed, the problem is most likely in the Resolver/Encoder cable. If the voltage is correct with the connector removed, the problem is most likely in the Resolver/Encoder assembly.

If the voltage reading between R8 to R7 is correct, measure the AC voltages from R10 to R9 and from R11 to R12. The correct readings for these voltages depend on the present position of the Resolver/Encoder assembly shaft (see Figure 94 on page 143). For example, if wired for clockwise rotation and the Resolver/Encoder shaft is positioned at 60 degrees, the voltage from R10 to R9 should read about 2.2 VAC and from R11 to R12 should read about 1.3 VAC. If the readings are correct, replace the Automation Control Logic Board.

If the voltage from R10 to R9 and from R11 to R12 both read less than about 0.5 VAC, turn the power off and measure the resistance from R10 to R9 and from R11 to R12. These should each read about 170 ohms. Measure the resistance from R8 to R7. This should read about 85 ohms. If all readings are correct, the problem is most likely in the Resolver/Encoder assembly. If any resistance is drastically greater than that listed above (i.e. open circuit), the problem is most likely in the cable or the cable connection to the Resolver/Encoder assembly. Verify that the connector on the back of the Resolver/Encoder assembly is tight (the connector should be fully seated on the Resolver/Encoder assembly - no threads should be visible) and that the connections on the Automation Control Logic Board terminal strip are secure (no terminals have been tightened down

on the insulation of the wire). High resistance readings could also indicate a Resolver/Encoder assembly fault. If shorted (much less than 170 ohms or 85 ohms), look at the Automation Control Logic Board terminal connections for R7, R8, R9, R10, R11, and R12 for any frayed wires touching other wires or nearby metal. If the connections appear to be correct, remove both wires of the shorted pair from the terminal on the Automation Control Logic Board to see if the short is in the Automation Control Logic Board or external to the module. If the short is external to the Automation Control Logic Board, disconnect the Resolver/Encoder cable from the Resolver/Encoder assembly to determine if the short is in the cable or the Resolver/Encoder assembly.

No Sin/Cos *Dynamic Fault*

Press the **Reset** softkey in the Automation Control screen. If the error message goes away and allows the press to be run again, the fault is dynamic and the conditions causing the fault may occur only at a specific angle or under shock. This could be caused by a bad Resolver/Encoder assembly, an intermittent connection from the Resolver/Encoder assembly to the Automation Control Logic Board that opens under shock, or an intermittent problem with the Automation Control Logic Board. Verify that the connector on the back of the Resolver/Encoder assembly is tight (the connector should be fully seated on the Resolver/Encoder assembly - no threads should be visible) and that the connections on the Automation Control Logic Board terminals are secure (no terminals have been tightened down on the insulation of the wire). If the fault still occurs without the impact caused by the die, and the press comes to rest at a relatively consistent position in the stroke after the fault occurs, the problem is most likely in the Resolver/Encoder assembly.

Resolver/Optic Fault *Static Fault*

Press the **Reset** softkey in the Automation Control screen. If the error message does not reset, the fault is static and the conditions causing the fault are still present on the Automation Control Logic Board R1-R13 terminals.

Measure the DC voltage between terminals R6 and R5. This is the DC supply voltage to the optical encoder. The voltage should read 12 VDC with R6 positive in relation to R5. If the voltage is less than 12 VDC, remove the wire to terminal R6. Measure the voltage again between terminals R6 and R5. If the voltage is still low, replace the Automation Control Logic Board. If the voltage is correct, reconnect the wire to terminal R6. Disconnect the Resolver/Encoder cable connector from the Resolver/Encoder assembly to determine if the problem is with the Resolver/Encoder cable or Resolver/Encoder assembly.

If the DC voltage between terminals R6 and R5 is 12 VDC, measure the DC voltages between terminals R1 and R5, R2 and R5, R3 and R5, and R4 and R5 along with the AC voltage between terminals R8 and R7, R10 and R9, R11 and R12. Note the actual position of the resolver shaft (don't go by the angle display on the operator terminal) and from Figure 94 on page 143 it should be possible to determine which signal is incorrect. For example, if wired for clockwise rotation and the resolver shaft positioned at about 60 degrees the readings should be as shown in the following table.

Example Voltages for Resolver at 60 degrees		
Terminal	Ideal Voltage Reading	Possible Voltage Range
R1 to R5	4 VDC	3.8 to 4.1 VDC
R2 to R5	1 VDC	0.7 to 1.1 VDC
R3 to R5	1 VDC	0.7 to 1.1 VDC
R4 to R5	4 VDC	3.8 to 4.1 VDC
R8 to R7	2.6 VAC	2.2 to 3.0 VAC
R10 to R9	2.2 VAC	1.9 to 2.5 VAC
R11 to R12	1.3 VAC	1.0 to 1.6 VAC

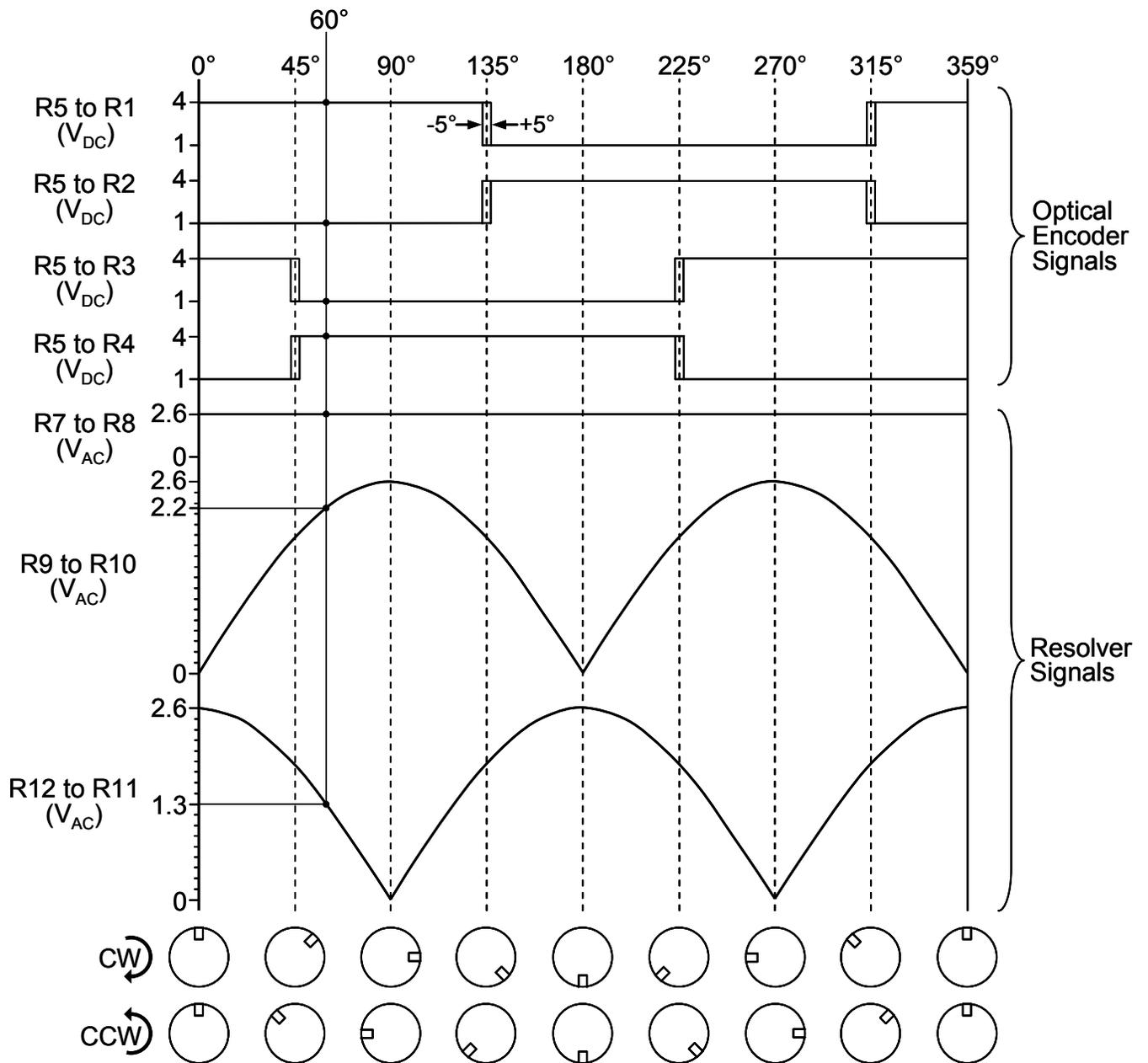
If these readings are correct, replace the Automation Control Logic Board.

A fault in the Resolver/Encoder assembly could result in one or both optical encoders indicating an incorrect quadrant. For example, a reading between R1 and R5 of 1 VDC and between R2 and R5 of 4 VDC is incorrect for a Resolver/Encoder shaft position of 60 degrees.

Acceptable voltage readings for R1 to R5, R2 to R5, R3 to R5, and R4 to R5 are 0.7 to 1.1 VDC and 3.8 to 4.1 VDC. Voltage readings outside these ranges indicate a potentially broken connection between the Automation Control Logic Board and Resolver/Encoder assembly.

Resolver/Optic Fault *Dynamic Fault*

Press the **Reset** softkey in the Automation Control screen. If the error message goes away and allows the press to be run again, the fault is dynamic and the conditions causing the fault may occur only at a specific angle or under shock. This could be caused by excessive clearance in the connection between the resolver and the crankshaft, a bad Resolver/Encoder assembly, an intermittent connection from the Resolver/Encoder assembly to the Automation Control Logic Board that opens under shock, or an intermittent problem with the Automation Control Logic Board. Verify that the connector on the back of the Resolver/Encoder assembly is tight (the connector should be fully seated on the Resolver/Encoder assembly, no threads should be visible) and that the connections on the Automation Control Logic Board terminals are secure (no terminals have been tightened down on the insulation of the wire). If fault still occurs without the impact caused by the die, and the press comes to rest at a relatively consistent position in the stroke after the fault occurs, the problem is most likely in the Resolver/Encoder assembly. Excessive clearance in the connection from the crankshaft to the Resolver/Encoder assembly can create accelerations at the point of impact that appear as a position discrepancy between the brushless resolver and the optical encoder. If driven by a chain and sprocket, the Resolver/Encoder assembly should be mounted on a spring base adjusted to maintain tension on the chain.



Readings shown for R8, R10, and R11 are as measured with an AC Volt Meter

$$V(R7 \text{ to } R8) = 2.6 \text{ VRMS } 2.5 \text{ KHz (nominal)}$$

$$V(R9 \text{ to } R10) = V(R8) \times \text{SIN (angle)}$$

$$V(R12 \text{ to } R11) = V(R8) \times \text{COS (angle)}$$

Figure 94: Resolver/Encoder Signals vs Shaft Position

6.4 Diagnostic Codes

Each message that appears in the reason for the last stop or the present running status is assigned a unique code number. This number is shown by pressing the present running status area to display the screen shown in Figure 26 on page 52. The code numbers and messages are shown below:

NOTE: Codes that are 65280 (0xFF00 hexadecimal) or higher represent stops from the Operator Terminal or from optional automation and monitoring devices, such as programmable limit switches, die protection, tonnage monitor, etc. In these cases, the text of the message should point you to the system that generated the stop. Go to that system's screen for detailed information on why the stop occurred. For example, the "Reason for the Last Stop" might have a description of "Part Count Reached" with a code of 65328 (0xFF30). Go to the counter screen and reset the part counter to clear the stop condition.

Code Number: 0 - "Power Up",

This message appears as a reason for the last stop when power is first applied to the system. After a stroke has been initiated and stopped, the message is replaced with the cause of the last stop and should never appear again until power is turned off and back on. If it does, this would indicate a reset condition has occurred on the Automation Control Logic Board. Loss of incoming power would cause this condition. If the operator terminal resets (i.e. powers up in the main screen) in conjunction with this fault, it would suggest an intermittent shorted condition of system power. If the operator terminal does not reset, the problem is most likely on the Automation Control Logic Board.

Code Number: 1 - "Program/Run Switch",

This message will appear as the reason for the last stop if the RUN/PROG key on the operator terminal is switched to the PROG position while the press is stroking (the system will top stop and display this message even if switched back to RUN, or if an intermittent problem exists with the switch). It will appear in the present running status if switched to PROG prior to initiating a stroke. The switch is internal to operator terminal and the OIT Diagnostics screen can be used to view the state.

Code Number: 2 - "OIT Triggered Top Stop",

This message applies only to Mechanical Presses and will appear as the reason for the last stop if the **Do Top Stop** softkey is pressed in the Top Stop Calibration screen or the Brake Monitor configuration screen.

Code Number: 3 - "OIT Triggered 90 deg Stop",

This message applies only to Mechanical Presses and will appear as the reason for the last stop if the **Do Mid Stroke Stop** softkey is pressed in the Brake Monitor configuration screen.

Code Number: 4 – Not Used

This message number is not used.

Code Number: 5 - "Brake Monitor Alarm",

This message applies only to Mechanical Presses and appears in the present running status after the press stops if the measured stopping time of the press exceeds the programmed limit. Among other reasons, this fault can be caused by a problem with the clutch/brake or incorrectly adjusted counterbalance pressure. The **Reset** softkey must be pressed to clear this fault and allow further stroking. The ability to reset this error may be under access code restriction.

Code Number: 6 - "Motion Did NOT Start",

This message applies only to Mechanical Presses and appears only as a reason for the last stop. It indicates that when the stroke was initiated, the crankshaft motion did not exceed the "Motion Threshold" within the "Engagement Time Limit". Both of these parameters are located in Clutch Configuration screen. This fault can also indicate an external problem with the machine, such as low clutch/brake air pressure, high counterbalance pressure, or excessive clutch plate clearance.

Code Number: 7 - "Motion Stopped",

This message applies only to Mechanical Presses and appears only as a reason for the last stop. It indicates that after initially establishing motion, the crankshaft motion dropped and remained below the "Motion Threshold" for longer than the "Loss of Motion Time". This could be caused by incorrect air pressure, a mechanical problem, or an incorrect setting for either the "Motion Threshold" or the "Loss of Motion Time".

Code Number: 8 - "Motion without Run Signal",

This message applies only to Mechanical Presses and indicates that motion exceeded the "Motion Threshold" while the Clutch/Brake Run Signal was low.

Code Number: 9 - "No Sin/Cos",

This message indicates that both the sine or cosine signals from the resolver (R10 and R11) are low. It can occur if the encoder type is set for a 2500 or a 5000 resolver. This could indicate a resolver failure, a wiring problem from the resolver to the Automation Control Logic Board, or a fault on the Automation Control Logic Board (see Section 6.3 on page 139 for information on diagnosing resolver faults). This fault will turn the E-Stop output off. The condition causing the fault must be corrected and the **Reset** softkey must be pressed before the output will turn back on.

Code Number: 10 - "R/D Read Fault",

A problem occurred in the hardware reading the resolver to digital converter chip. If this problem cannot be reset, then the Automation Control Logic Board must be repaired or replaced.

Code Number: 11 - "Resolver Drive Fault",

A problem occurred in the resolver oscillator drive circuit. Check the wiring from the Automation Control Logic Board to the resolver as described in Section 6.3. If this problem cannot be reset, then the Automation Control Logic Board must be repaired or replaced.

Code Number: 12 - "Resolver/Optic Fault",

This message indicates that the position read from the resolver does not agree with the position read from the optical encoder and will occur only if the "Encoder Type" is set for a 5000 resolver. This could indicate misalignment within the resolver assembly (set by the factory), a wiring problem from the resolver to the Automation Control Logic Board, or a fault on the Automation Control Logic Board (see Section 6.3 on page 139 for information on diagnosing resolver faults). This fault will turn the E-Stop relay off. The condition causing the fault must be corrected and the **Reset** softkey must be pressed before the output will turn back on.

Code Number: 13 - "Speed is Too Fast",

This message indicates calculated press speed exceeded 3700 SPM.

Code Number: 14 - "Relay Off Check Fault",

This message indicates that the Stop Relay 1 is turned "Off", but the normally closed contact is open. The **Reset** softkey will turn the output "On". This could be caused by a bad normally closed relay contact, a relay not installed in the socket, or by a failure on the Automation Control Logic Board.

Code Number: 15 - "Relay On Check Fault",

This message indicates that Stop Relay 1 is turned "On", but the normally closed contact is closed. This fault will turn the Stop Relay 1 output "Off". The **Reset** softkey will turn the output "On", unless the fault still exists. This could be caused by a bad normally closed relay contact or by a failure on the Automation Control Logic Board.

Code Number: 16 - "Cross Communication Fault",

If the **Reset** softkey does not clear this fault, change the Automation Control Logic Board.

Code Number: 17 - "Memory Config Fault",

The memory block holding the brake monitor limits failed a validation check. The Brake Monitor limits must be reentered in the Brake Monitor configuration screen. Cycle power to the unit and, if the error is still present, the Automation Control Logic Board must be repaired or replaced.

Code Number: 18 - "Stop Time > 2 Seconds" or "Stop Time Out of Bounds",

The stopping time of the press is not allowed to exceed a maximum limit. For the older 802-5 Automation Control Logic Board, this limit was 2 seconds and some older versions of software in the Operator Terminal will report "Stop Time > 2 Seconds". This was later changed to a maximum time of 4 seconds, and newer versions of software in the Operator Terminal will report this code as "Stop Time Out of Bounds".

Code Number: 19 - "Speed Advance Fault",

This message can appear in the present running status if crankshaft velocity is detected as being so fast that the speed advance calculation generates a "degrees before top dead center" greater than 1535 degrees.

Code Number: 20 - "System Initializing",

This message will momentarily appear in the present running status when the operator terminal is transferring settings to the Automation Control or to optional automation and monitoring devices in the system. This typically only occurs at power up or when a job is recalled.

Code Number: 21 - "Non-OmniLink Stop",

The message applies only to Mechanical Presses and indicates that the press stopped due to something external to the Automation Control. For instance, pressing a Top Stop button or an E-Stop button would cause this message to appear as long as no stop conditions are also present in the Automation Control. It is basically the Automation Control saying “the press stopped, but it wasn’t me that stopped it”.

Code Number: 22 - "Lost OIT Communications",

This message indicates that communication was lost for more than 90 milliseconds and then restored between the Operator Terminal and the Automation Control Logic Board. The **Reset** softkey must be pressed to clear the message. This condition will occur if a program update is loaded in the operator terminal. It would also occur due to an intermittent power loss to the operator terminal, but in that condition the operator terminal would drop out and power back up. Check the high speed bus lines from the operator terminal to the Automation Control Logic Board to verify a good connection in the screw connectors. The problem could be either on the operator terminal board or the Automation Control Logic Board.

Code Number: 23 - "Ch B Relay On Fault",

This message indicates that Stop Relay 2 is turned “On”, but the normally closed contact is closed. This fault will turn the Stop Relay 2 output “Off”. The **Reset** softkey will turn the output “On”, unless the fault still exists. This could be caused by a bad normally closed relay contact or by a failure on the Automation Control Logic Board.

Code Number: 24 - "Ch B Relay Off Fault",

This message indicates that the Stop Relay 2 is turned “Off”, but the normally closed contact is open. The **Reset** softkey will turn the output “On”. This could be caused by a bad normally closed relay contact, a relay not installed in the socket, or by a failure on the Automation Control Logic Board.

Code Number: 25 - "Ch B Brake Monitor Alarm",

This is the same as Code Number 5 but reported by the “B” Channel of the Automation Control Logic Board.

Code Number: 26 - "Ch B Cross Comm Fault",

If the **Reset** softkey does not clear this fault, change the Automation Control Logic Board.

Code Number: 27- "End of Cycle",

This message will appear only as a reason for the last stop. This message indicates that the servo press asserted an E-Stop (input terminal 11 is Low) or a Top Stop (input terminal 12 is Low) when the press stopped and the Automation Control did not assert a stop itself. This condition will not cause either the E-Stop or the Top Stop relays to turn off.

Code Number: 28- "Boot Info Corrupt",

This message indicates the boot code information block is corrupt. If cycling power to the unit does not clear this message, the Automation Control Logic Board will need to be repaired or replaced.

Code Number: 29- “Boot Program Corrupt”,

This message indicates the boot program code is corrupt. If cycling power to the unit does not clear this message, the Automation Control Logic Board will need to be repaired or replaced.

Code Number: 30- “Boot Version Mismatch”,

This message indicates the boot program internal version does not match the version in the boot information block. If cycling power to the unit does not clear this message, the Automation Control Logic Board will need to be repaired or replaced.

Code Number: 31- “Main Program Corrupt”,

This message indicates the main program code is corrupt. The Operator Terminal in most cases should try to reload this program from the copy it has onboard. If this is unsuccessful, the Automation Control Logic Board will need to be repaired or replaced.

Code Number: 32 - “Module in Boot Mode”,

This message means that Automation Control Logic Board is in a special boot mode that indicates it has detected a corrupt program at power up, or was instructed by the operator terminal to enter boot in order to do a program update. If this occurs at power up, replace the Automation Control Logic Board.

Code Number: 33- “End of Cycle (Timed)”,

This message will appear only as a reason for the last stop. This message indicates that no stop condition exists in the Automation Control, but the press has stopped running for longer than the “Motion Profile “Running” Timeout” parameter. If the servo press does not provide an input to indicate that it is running, the Automation Control detects running by velocity (see “Motion Running Threshold”) and signals the other devices that are connected to the high speed bus. This will occur when the press stops at the normal end of its cycle.

Code Number: 34- “Must Synchronize at Top”,

This message will appear as a present running status, but it will not cause either the E-Stop or the Top Stop relays to turn off. The message indicates that the press is in a region that does not match the current motion profile step sequence. This can occur if the power is turned on or a job is recalled with the crankshaft angle beyond the end angle of Step 1. This could also occur if the press is inched backwards around the stroke. The Automation Control will remain in Step 0 until the press is cycled through the top window to synchronize with the step sequence table.