CLM01.3-M
Flying Cutoff Control

User´s Manual

DOK-CONTRL-CLM01.3*M**-ANW1-AE-P

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Indramat

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FOREWORD

Special Notations:

Special notations are used in this manual to assist the reader in identifying unique conditions or information that is important. Three categories of notations are listed below in ascending order of importance.

Note: *A **NOTE** is a tip, suggestion or emphasized procedure for operating the equipment.*

Caution: *A **CAUTION** appears when a condition exists which could cause operating faults or damage to the equipment.*

Warning: ***WARNING** statements identify conditions which could cause bodily harm and/or severe damage to the eqipment if the operator is not careful. A **WARNING** will typically describe the potential hazard, its possible effect, and measures that must be taken to avoid the hazards.*

Please NOTE that due to variations found in the operating conditions of cerain applications and their working environments, the notations in this manual cannot identify all potential problems or hazards. Caution and discretion must always be used in operating machinery and especially when using electrical power. Equipment should only be installed and operated by trained personnel.

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RECORD OF REVISIONS

Revision Level	Date	Description of Change
A	12/91	Preliminary Release - Limited Distribution
B	9/92	Current Release

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CHAPTER 1. GENERAL DESCRIPTION

The CLM-01.3-M is a microprocessor-based positioning control. The user-programmable unit is intended for precision motion control in one- or two-axis flying cutoff applications. Designed for use with with Indramat brushless AC servo drives, the CLM control provides closed-loop synchronized positioning in an economical, modular package. (Figure 1.1)

Typical flying cutoff applications coil or sheet lines, corrugated materials, pipe cutting and cross-cut sawing.

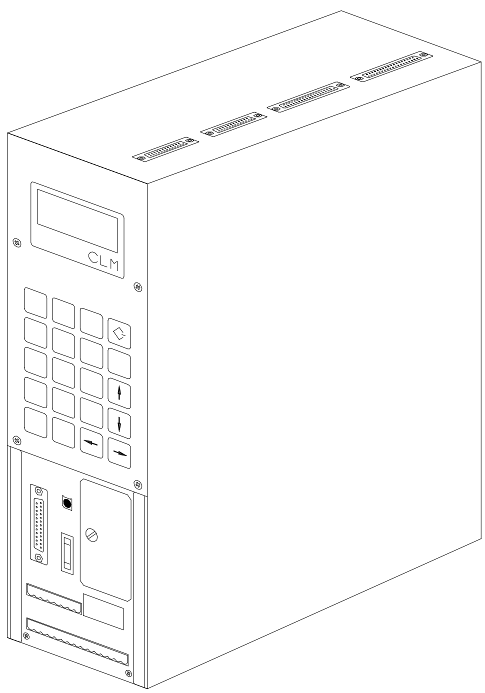


Figure 1.1 CLM Positioning Control Module

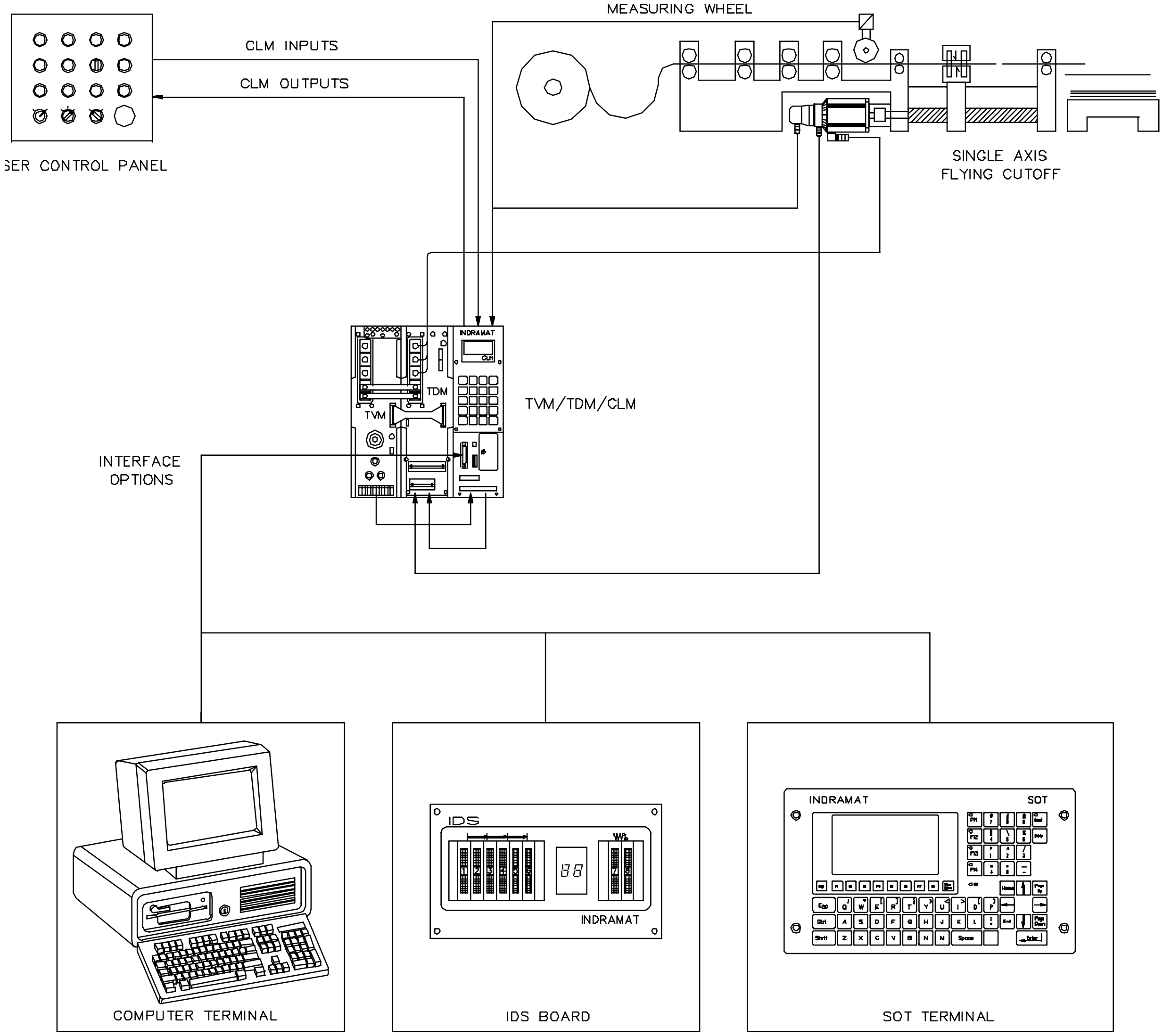


Figure 1.2 Typical CLM-LM Flying Cutoff System with Interface Options

The extensive program command set permits the CLM to perform complex processing tasks. Using its multi-tasking capability, the CLM can control two motion programs and a background I/O program simultaneously. The CLM can be programmed on-line or off-line.

The typical CLM-01.3-LM Flying Cutoff System consists of these components:

* CLM-01.3-M Flying Cutoff Control
* MAC AC servo motor (with tachometer and incremental encoder)
* TDM servo amplifier (motor controller)
* TVM power supply
* Measuring wheel (with incremental encoder)
* Interconnect cable set, available from Indramat

The CLM, TDM (servo amplifier), TVM (servo power supply) and MAC servo motor are combined with a mechanical system for making flying cutoffs. These components are chosen to best fit the required application. Figure 1.2 is a typical CLM-LM system configuration.

The standard CLM control consists of 32 inputs (16 system and 16 auxiliary), 32 outputs (16 system and 16 auxiliary), two encoder ports, and a serial communication port. Options increase the number of auxiliary inputs to 72, and auxiliary outputs to 48.

The CLM-LM system is designed to ensure operating integrity and safety by using the CLM system inputs and outputs to interface with the flying cutoff machine. In many applications, the CLM provides sufficient machine control without the use of an external line control.

The serial port on the CLM allows for RS232/422/485 communication with a host device. The host device can be an Indramat IDS Board, Indramat SOT, or a computer. The serial port allows the operator to view or edit information about the CLM programs, parameters, and system status.

The user enters the system parameters and program, using the CLM keypad or optional interfaces. Operating status messages can be displayed in English, French, or German as selected by the operator. The machine builder or user enters data into the CLM parameters to specify the mechanical and operating characteristics of the system.

The MAC motor which drives the axis has a tachometer and encoder mounted on the back. The tachometer provides velocity feedback to the TDM servo amplifier. The encoder provides position feedback to the CLM, ensuring precise, repeatable positioning of the cutoff carriage. The final accuracy of the flying cutoff system depends on various factors, such as type of material, gearbox backlash and other machine mechanics. The CLM constantly monitors the system and if an error occurs, the CLM will display the proper diagnostic.

The TDM servo amplifier powers the MAC motor. When a desired command voltage is applied to the TDM, the MAC motor rotates in the desired direction.

The TVM power supply provides the 300-volt DC bus and the control voltages (+/- 15V, +24V) to the TDM. The +24V supply on the TVM is also used to power the CLM.

System components are modular, making it easy to install or replace any component. The modular CLM Control mounts to the interior of a control cabinet or electrical enclosure.
It is designed to be mounted side-by-side with the servo amplifiers (one for each axis) and the servo power supply.

The CLM module, servo amplifier and servomotor have quick-connect cabling. The servo amplifier and motor are matched for optimum operation, with a plug-in "personality" module. Should a failure occur, module or motor replacement is accomplished quickly, without the need for electronic fine tuning. This results in a minimum of downtime and lost production.

1.1. About This CLM Manual

This manual describes CLM-01.3-M hardware, used in flying-cutoff applications. It explains how to interface, install, setup and operate the Indramat CLM Positioning Control with LM software. It is written for the machine builder, and for the end user's operating personnel.

1.1.1. Hardware and Software Versions

This manual revision is based on software version LM01.3-003, for use with CLM-01.3-M hardware.

1.1.2. Problem Assistance

Indramat provides assistance for any problems you may encounter with this software. To report a problem or request assistance, call Indramat between 8:00 AM and 5:00 PM Central time. Ask for a CLM Service Engineer.

Chapter 1 - General Description
· CLM hardware, standard features, applications, system configurations, optional features
· Describes LM Software capabilities
· Lists specifications

Chapter 2 - Controls and Indicators
· Keypad functions and symbols
· Use of the LCD display
· I/O connectors on the hardware

Chapter 3 - Description of Inputs and Outputs
· Describes pre-defined and user-definable I/O
· Explains the four operating modes of the CLM
· Interfacing the CLM to the flying cutoff machine
· Information the machine control panel and for troubleshooting.

Chapter 4 - Parameters
· Purpose and use of parameters
· Examples of use and entry

Chapter 5 - Programming
· Introduces the subject of user programming
· Provides a typical flying cutoff program
· Lists and explains all program commands

Chapter 6 - Installation and Start-up
· Presents CLM installation procedure
· Provides procedure for a typical CLM start-up.

Chapter 7 - Serial Interface
· Describes the multi-format RS-232/422/485 port
· Explains the protocol for two-way communication between the CLM and a host device.

Chapter 8 - Diagnostics and Troubleshooting
· Introduces the CLM's self-diagnostic system
· Lists and explains diagnostic, fault and error messages
· Presents recommended troubleshooting procedures

Appendices
· Includes interconnect drawings and parameter record forms.

1.2. Introduction to Flying-Cutoff Applications

In a typical flying-cutoff system, material is fed continuously into a cutoff carriage. The carriage contains the cutting device (shear, saw, etc.) and is driven by the servo motor. (Figure 1.3)

As the material is fed in, it turns a measuring wheel with an incremental encoder. When the desired length of the material has passed (as defined in the user program), the cutoff carriage starts to move, accelerating until its speed is synchronized to the material speed. At a point specified in the user program, the cutoff device is actuated.

The point in the cycle at which cutoff occurs is called the minimum cut point, and is defined in the CLM user program. The CLM user program may also define a minimum stroke. The minimum stroke is commonly used to push small pieces out to the next station. (Refer to 1.3.2)

1.2.1. Basic Sequence of Operation (1-Axis)

a) The desired length of material has been pre-selected by the operator, using the input keyboard of the control unit.

b) The material moves over or under a stationary measuring wheel, turning the wheel and incremental encoder.

c) Once the desired length of material has passed the wheel, the CLM activates the servo motor that drives the carriage or tool slide, accelerating it to match the speed of the material being processed.

d) Once synchronized movement has been achieved, the cutoff actions begin, activated by the CLM.

e) After completing the cutoff, the cutoff carriage or tool slide returns to its home position at a specified maximum velocity.

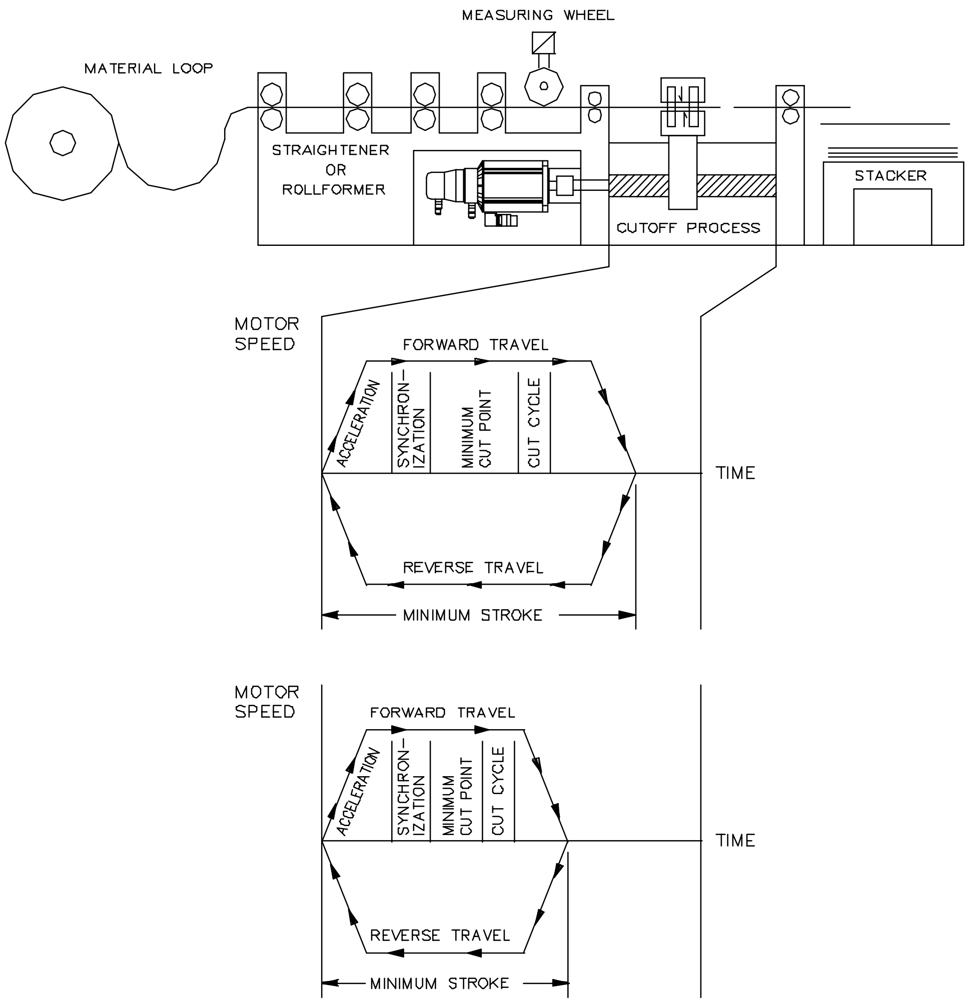


Figure 1.3 Typical Flying Cutoff Application

1.2.2. Two-Axis Operation

The CLM control is capable of two-axis operation, however the expansion I/O board is required.

1.2.3. Synchronous Axis

Two synchronous axes can be used for large die and shear carriages. Large, heavy carriages which would normally require two motors coupled mechanically, can be driven by two motors operating as separate but synchronized axes (Axis 1 and Axis 2).

1.2.4. Flying Saw

Axis 2 can also be used as a flying saw to make a cut at some angle to the direction of material flow. The velocity for axis 2 can be set for different profiles, depending on the material.

For example, if pipe is being cut, the saw's velocity profile starts off slow because of the initial cross-sectional area. The saw can be programmed to speed up until it reaches the other side, at which point the original velocity is maintained until the cut is finished.

1.3. Basic LM Software Features

The use of LM software allows accurate shearing or sawing of the moving material into pieces of specific length. The user enters the desired piece length and the batch size. The control operates according to the speed of the material being fed through the cutoff device. User-entered parameter values permit the LM software to be adapted to almost any size or type flying-cutoff application with associated servo or main drive systems.

The LM software has a number of convenient features which allow for greater flexibility and performance. These features can be classified as parameter-based or program-based.

1.3.1. Parameter-Based Features

These features are defined by user entry of values and data within the CLM Parameters.

1.3.1.1. Minimum and Maximum Travel Limits

Travel limit parameters specify the amount of distance the carriage is allowed to move without initiating a cut. If the carriage and material are not synchronized and the cut cycle has not been initiated, then the CLM stops and issues an error.

1.3.1.2. Cut Width Compensation

The cut width compensation parameter specifies the amount of material lost from a sawing or shearing operation. The value entered, equal to the width of the saw or slug, is automatically added by the CLM to the user-programmed cutoff length.

1.3.1.3. Task 2&3

The Task 2&3 parameter allows running different subroutines of the main program at the same time. The values entered in this parameter enable the task and specify the program block number for the beginning of the task.

Task 2 starts to operate when Automatic mode is selected. Task 3 operates whenever Parameter mode is not selected. Special considerations should be taken into account before using this parameter.

1.3.1.4. Serial Interface

The serial interface parameters are used to set up communication between the CLM and a host device via RS-232/422/485 interface. Any information that can be entered into the CLM using the keypad can be communicated over this port, at transfer rates up to 19200 baud. The host device can be a computer terminal or a Station Operator Terminal (SOT).

1.3.2. User Program-Based Features

These features are defined and executed within the user program.

1.3.2.1. Minimum Cut Point

The minimum cut point is the earliest point at which the cutoff action will be initiated. It ensures that the shear or die is correctly positioned or correctly centered in the carriage for a cutting cycle, depending on mechanical factors determined by the machine builder.

1.3.2.2. Minimum Stroke

The minimum stroke is the minimum distance that the carriage will move in the positive direction after the material has been cut. At the end of the minimum stroke, the carriage reverses direction and returns to the home position.

The minimum stroke can be programmed so that the carriage returns home immediately after the cut, or it may call for the carriage to follow the cut material to a specific point. This "following" action is used to help push the cut piece onto a conveyor or stacker. When a cut cycle is completed, user-programmable batch counters are updated.

1.4. Physical Description of the CLM

The modular CLM control mounts to the panel of a control cabinet (electrical enclosure) using two screws. It is designed to be mounted side-by-side with the TDM, servo amplifiers, (one for each axis) and the TVM power supply. Installation procedures are described in chapter 6.

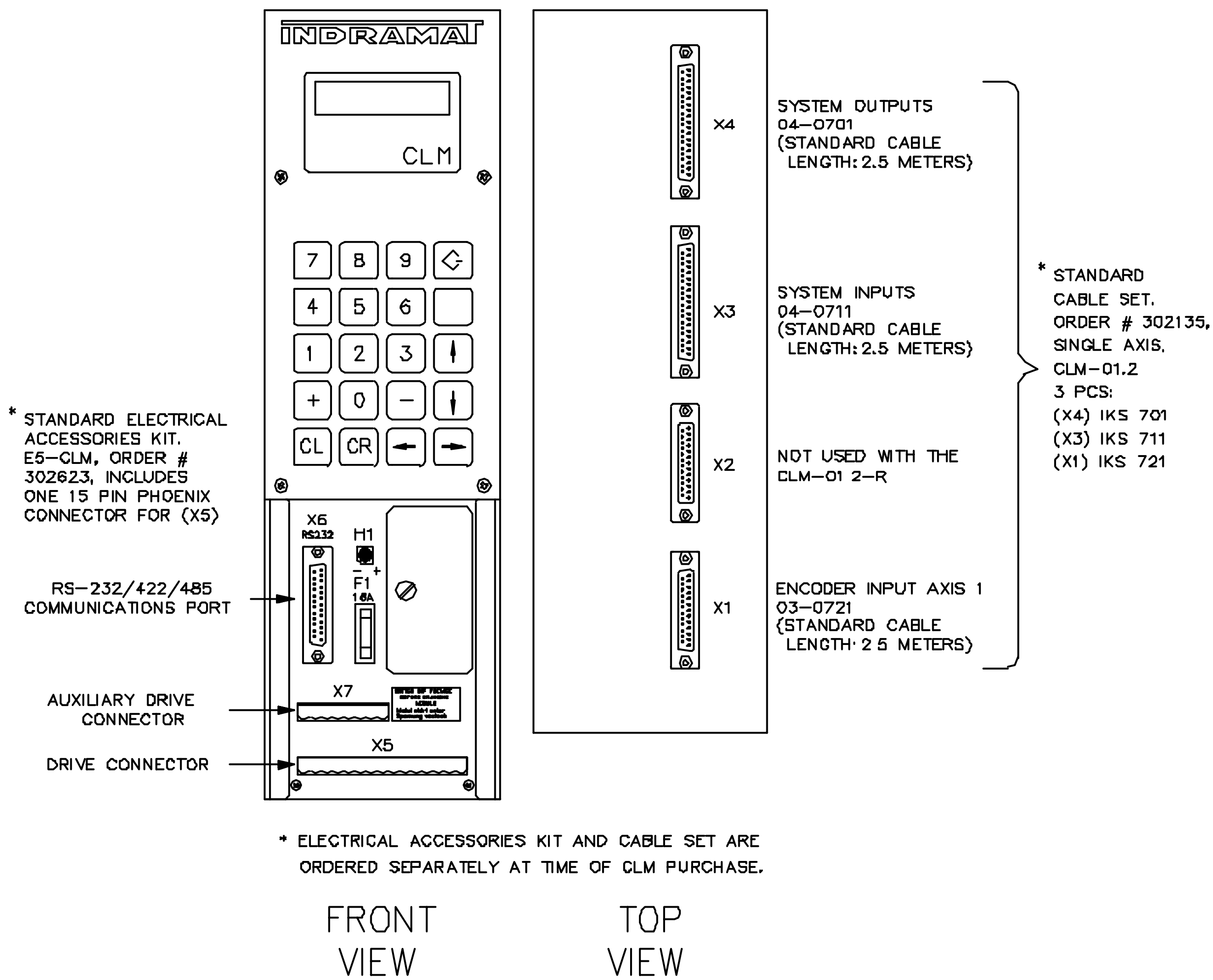


Figure 1.4 Standard CLM Controls and Connections

The CLM control panel includes a keypad for entering data and a liquid crystal display which shows operating status and diagnostics fault conditions. The functions and use of the keypad and display are described in detail in Chapter 2.

The CLM includes a set of auxiliary inputs and outputs which can be defined by the user to control and acknowledge machine functions. The standard CLM, illustrated in Figure 1.4, includes 16 auxiliary inputs and 16 auxiliary outputs The expandsion option adds 64 auxiliary inputs and 32 auxiliary outputs, increasing the total number of auxiliary I/O to 72 inputs and 48 outputs. A functional description of each I/O signal connection is given in Chapter 3.

The Standard CLM Control is illustrated in Figure 1.4. The Expanded version, with additional I/O connections, is illustrated in Figure 1.5.

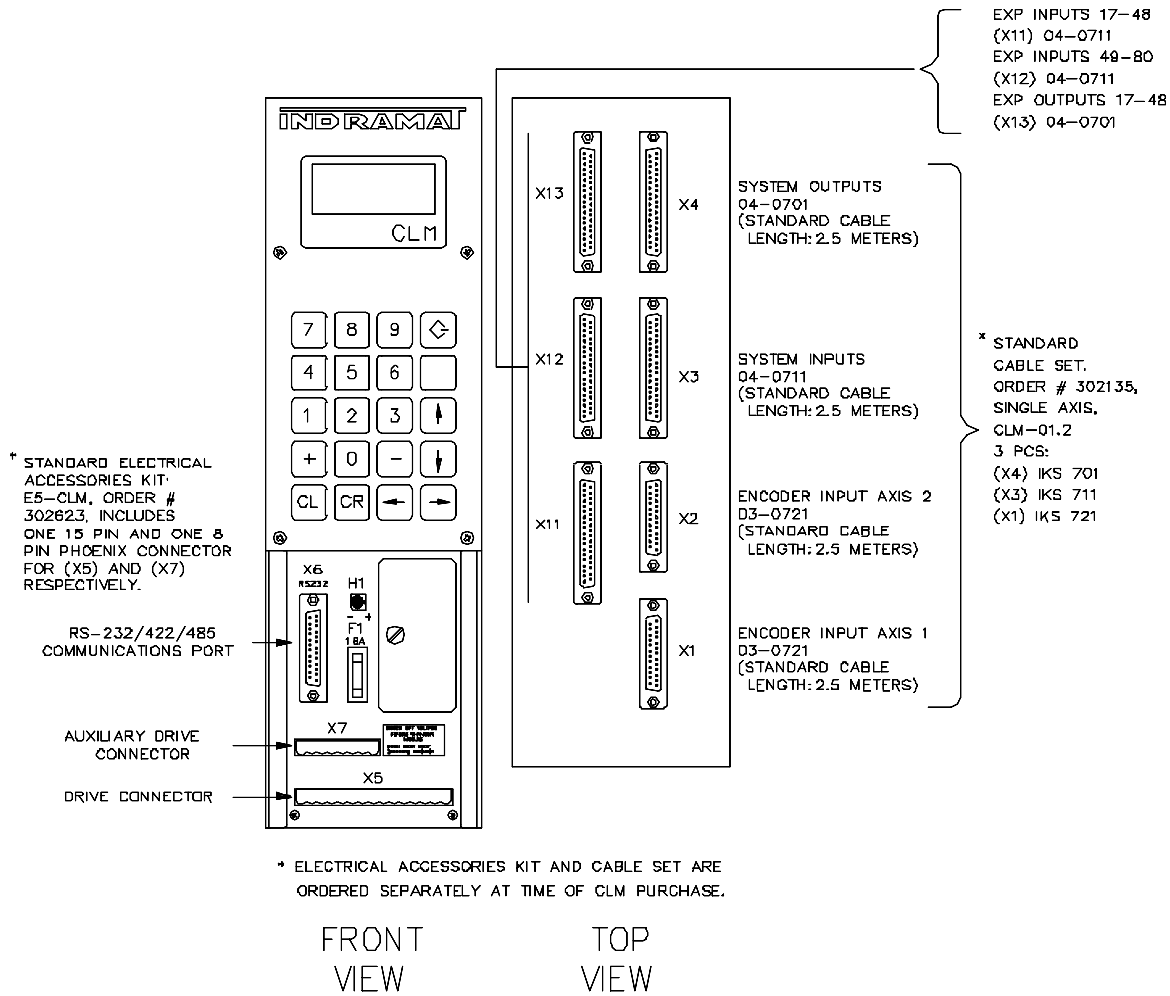


Figure 1.5 Expanded Version CLM Controls and Connections

1.4.1. System Features

The CLM includes a Motorola 68000 microprocessor, and 256K of EPROM containing the executive program, exclusively designed for position control and eliminating the need for complicated system user programming. The executive program cannot be altered or changed by the user.

The CLM also has 128K of RAM, containing the CLM parameters and program. A lithium backup battery is used to store this information, when the power is turned off. The battery is located on the slide-out memory card. (Refer to Figure 2.3)

The CLM system features make setup quick and easy, eliminating time consuming mechanical setup or complex programming when changing parts.

1.4.1.1. Standard and Programmable I/O

The standard CLM has 32 inputs and 32 outputs for use with the CLM/machine interface. The first 16 inputs and 16 outputs are defined by the CLM. The remaining 16 inputs and 16 outputs can be defined by the user for controlling and acknowledging machine functions. The Expanded CLM option increases the total I/O to 96 inputs and 64 outputs, of which 72 inputs and 48 outputs can be assigned by the user. Additional outputs can be programmed as flags.

1.4.1.2. Parameters

The machine manufacturer or the user adapts the CLM to the mechanical and electrical characteristics of an application by entering data into a set of parameters. Parameters are usually entered when the system is first set up, and are changed only if the configuration changes or if a different type of cutoff operation is required.

1.4.1.3. Self-Diagnostics

A complete diagnostic system monitors all inputs, outputs and operating conditions. The CLM detects normal operating status, operator errors, errors in the control itself and machine faults. The system stops if a fault is detected. Diagnostic messages are displayed to aid the operator in troubleshooting problems and quickly getting the system back into production. Fault and status messages are displayed on the CLM control panel in the user-selected language, informing the operator of the system fault or status.

1.4.1.4. Programming

The basic program for standard motions is entered by the user. The user prepares a program of up to 1000 blocks, using pre-defined commands. These commands, represented by three letter mnemonic codes on the CLM display, specify the function. The CLM display assists the user in properly entering the necessary data for each command used, such as axis number, desired position, desired velocity, etc. The program blocks can be down-loaded to the CLM from a host device (computer, PLC, etc.), while the control is operating.

1.4.1.5. Registration

Maintains a consistent cutoff position, based upon a registration mark printed on the material. This ensures that printed patterns are kept in alignment with the finished product.

1.4.1.6. Serial Interface

A multi-format (RS-232/422/485) serial interface allows communication with a programmable logic controller, an Indramat IDS or SOT, a personal computer, or other host device. All information normally entered using the CLM keypad and displayed on the LCD can be communicated at rates up to 19200 baud. Any rate and transmission format can be selected.

1.4.1.7. Remote Keypad/Display Mounting

The keypad can be remotely mounted, on the user's control panel or elsewhere, up to 30 meters from the CLM module. Thus the CLM can be panel-mounted inside a cabinet, with the CLM's front panel separately mounted on the outside of the cabinet. A separate cable is required for this arrangement.

1.4.2. System Options

1.4.2.1. IDS (Indramat Decade Switch)

The IDS is a thumbwheel switch module. It allows the operator to enter the required part length. The IDS connects to the RS-232 serial communications port on the CLM, and can be mounted a maximum of 50 feet from the CLM. (Fig. 1.6)

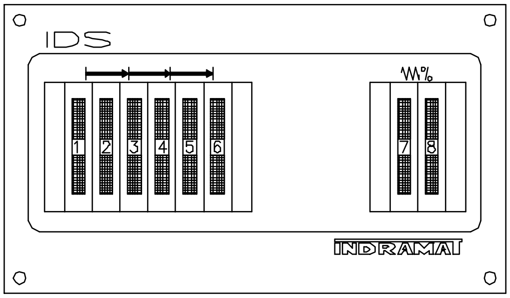


Figure 1.6 Optional IDS

1.4.2.2. Station Operator Terminal & ScreenManager Software

The Indramat Station Operator Terminal (SOT) is a remote-mounted, operator control device for the CLM. It can be programmed to provides the same input functions and displays the same information as the CLM control panel, and several additional features. (Figure 1.7)

The SOT has a backlit, liquid crystal display with 16 lines of 40 characters each. It can display much more information at a time than the standard display on the CLM control panel. The SOT keypad includes "click contact" keys for entering or changing data. The SOT also has 8 outputs which can be defined by the machine builder with ScreenManager software

The SOT connects to the serial communications port of the CLM and can be mounted up to 50 feet away using the RS-232 interface. Use of the RS-485 interface allows for remote mounting up to one (1) kilometer away.

ScreenManager software is a development tool for the SOT. This software package allows the machine builder to create operator interface screens on the SOT, for a specific application. The operator interface screens can be configured to allow the operator to view or edit information in the CLM. This software package is designed to run on a computers that use DOS.

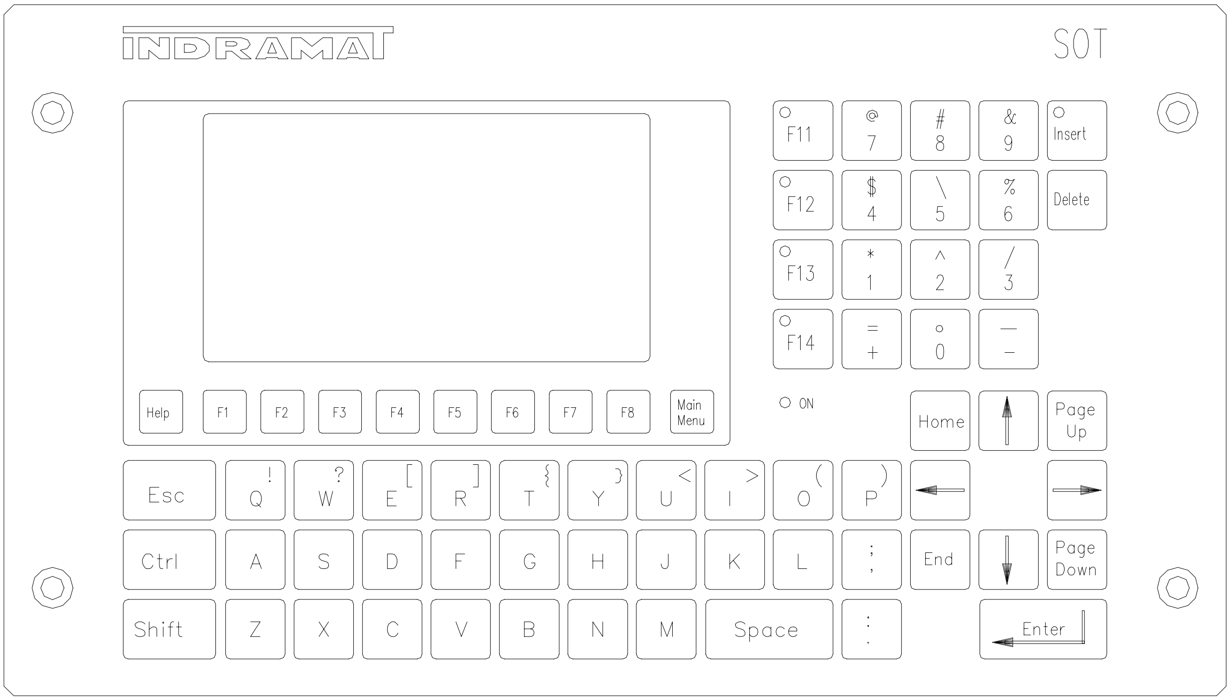


Figure 1.7 SOT - Station Operator Terminal

1.4.2.3. MotionManager Software

The MotionManager software is an efficient method of creating and editing user programs for the CLM control. It provides several benefits over programming the CLM from its control panel. It also includes enhanced features for creating and editing programs that are not available from the CLM control panel. This software is designed to run on a DOS-based computer.

1.4.3. CLM Operating Modes

LM software provides three modes of operation -- Manual, Test, and Automatic -- plus the Parameter entry mode.

1.4.3.1. Manual Mode

The Manual mode is used to jog the cutoff carriage in a forward or reverse direction. The jog speed is a percentage of maximum speed and is set as a parameter value. Also, before starting up a machine, the carriage axis must first be homed. The homing procedure is always completed in the manual mode.

1.4.3.2. Test Mode

This mode uses the values in the system parameters and program blocks to simulate the cutoff operation. It helps cut down on material waste by allowing the carriage mechanical system to cycle normally, while the CLM provides the simulated flow of material. Test mode is selected in a specific parameter.

1.4.3.3. Automatic Mode

The Automatic mode is used to continuously process material through a flying cutoff system. The main user program specifies the material length and the batches being processed. Also, the main program sets the cut cycle, minimum stroke, and the auxiliary I/O used for the specific application.

1.4.3.4. Parameter Entry Mode

Parameter data entries are used to adapt the CLM-01.3-M to the mechanical characteristics of the machine and machine systems. To make the data entries, the CLM must be placed in the parameter entry mode. This is usually done through a hard-wired key-operated selector switch wired to the parameter mode input on CLM connector X3. Access to the parameter mode should be restricted so that unauthorized changes cannot be made.

1.5. Specifications

The following sections provide full specifications for the CLM Control and options.

NOTE: *Performance specifications can vary, depending on the mechanical limitations of the equipment.*

1.5.1. Dimensions

Height	15.35 in. (390 mm)
Width	4.13 in. (105 mm)
Depth	12.80 in. (325 mm)
Weight	14 lbs. (6 kg)

1.5.2. Operating Environment

Cooling	**Convection**
Allowable Ambient Temperature Range	41 to 113 deg. F (5 to 45 deg. C)
Storage/Transport Temperature Range	-22 to 185 deg. F (-30 to 85 deg. C)
Maximum Operating Altitude At Rated Values	3,280 ft. (1,000 m) (higher altitudes permitted with proper cooling)
Protection System	IP 10 - Open Frame Module suitable for mounting in a control cabinet (e.g., NEMA 4, NEMA 12)

1.5.3. Control Specifications

Number of Axes	Two (use either one or both)
Position Feedback	One Incremental or Absolute Encoder per Axis (1 or 2)
Meas. Wheel Feedback	Incremental Encoder only
Part Length Resolution	0.001 inches (0.01 mm)
Programmable Velocity	0.1% - 99.9% of Maximum
Programmable Dwell Time	0.01 - 99.99 seconds in 0.01 steps
Status/Fault Display	Alphanumeric, 16 char./line
CLM command outputs	2 analog outputs +/- 10 volts (resolution 14 bits) for commanding two servo amplifiers.
Analog Override Input	3 analog inputs (+/- 10 volts) 1 differential input (resolution 12 bits)

1.5.4. Power Requirements

Control Voltage:

CLM Control only	24 Vdc, 200 mA +20% (supplied from TVM)
Incremental Encoder	24 Vdc, 50 mA each
Absolute Encoder	24 Vdc, 400 mA each
Bb Contacts	24 Vdc, 150 mA
Optional IDS Module	24 Vdc, 50 mA

Optional Expanded I/O 24 Vdc, 250 mA

NOTE: *Add current listed for each item for total requirements - (also see I/O).*

I/O Interface

Inputs	16 (+24 Vdc @ 10 mA) (pre-defined function)
Aux. Inputs	16 - Standard CLM 80 - Expanded Version CLM (user defined and programmable)
Outputs	16 (+24 Vdc @ 10 mA) (pre-defined function)
Aux. Outputs	16 - Standard CLM 48 - Expanded Version CLM (user defined and programmable)

NOTE: *Inputs draw 10 mA at 24 Vdc. The maximum current available per output is 50 mA. Outputs are thermally protected by a current limiter, to eliminate the need for additional fuses.*

CAUTION: *If the external load (solenoid, relay, etc.) connected to a CLM output draws in excess of 50 mA, the output current will start to drop. The higher the overload, the faster the fade occurs, usually within seconds. The current may drop enough to turn the external device off, which could result in damage to the machine. To prevent such occurrences, make sure that the load on each CLM output does not draw more than 50 mA.*

CHAPTER 2. CONTROLS AND INDICATORS

This chapter contains a general description of the:

- overall layout of the control, including the lower front panel.
- CLM keypad and display functions.
- display screens, and how to scroll through and interpret them.

2.1 CLM Front Panel

The CLM front panel consists of two sections. The upper section of the front panel contains the display/keypad module (Figure 2.1). The lower section of the front panel includes the X5 and X7 connectors and other components (Figure 2.3).

2.2 Keypad and Display Module

This module consists of a keypad with 20 pressure sensitive membrane type keys and a liquid crystal display (LCD) which allows the capability of up to four lines of 16 alphanumeric characters.

NOTE: *LM software uses only the top two lines of the four-line display.*

The keypad and display module (also referred to as the Local Operator Interface) is factory-installed on the front of the CLM. However, the module can be removed from the CLM. Using a special cable, the module can be installed up to 30 meters away, for example on the operator panel supplied by the machine builder.

The keypad contains all of the keys required for data entry, cursor movement, clearing fault/error messages, entering program and parameter data, etc.

The display informs the operator of the operating status of the CLM system and displays all diagnostic messages. It is also used when entering or editing the program or parameters.

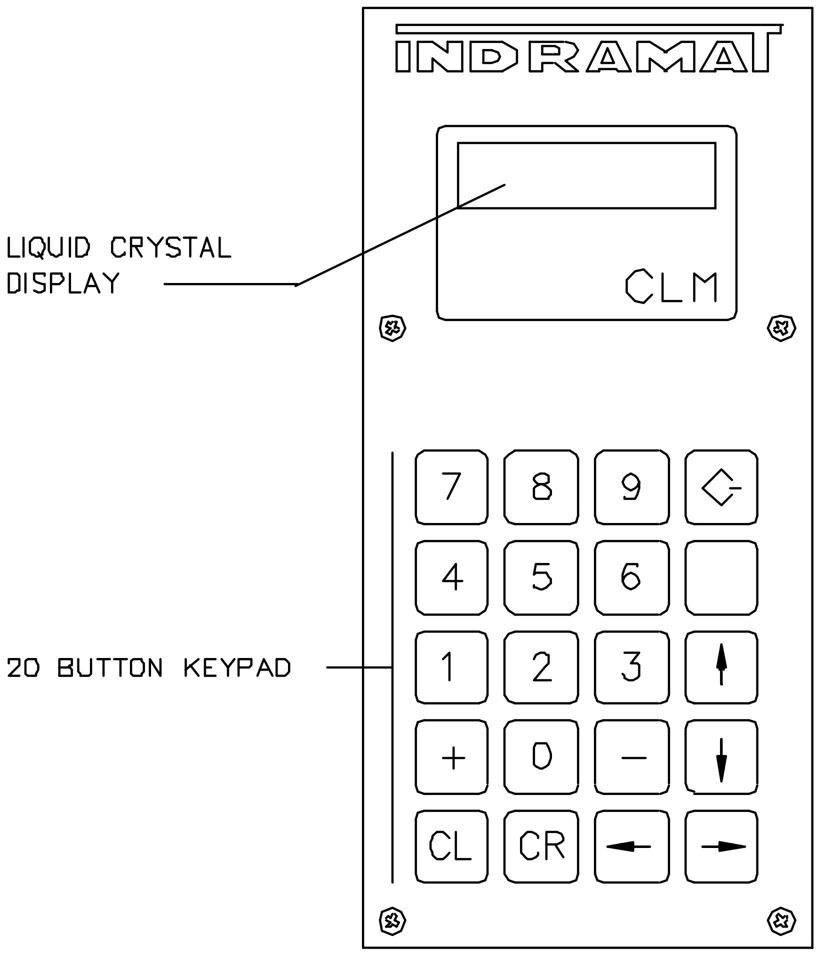


Figure 2.1 Keypad/Display Module

2.3 Data Entry Keys (Refer to Fig. 2.1)

This section describes the function of each key on the keypad. Note that cursor movement functions may vary slightly from earlier versions of the LM software.

CL Clear - The CL key is enabled only if there is an error. Use it to clear the error message displayed, once the error condition has been corrected.

NOTE: *Use Manual mode to clear errors. If the error is cleared in automatic mode, the CLM will issue the error "Axis 1 Not Homed". In that case, you will have to select manual mode, home the axis and go back to the automatic mode.*

CR **Carriage Return** - The CR key is used to position the flashing cursor line. The position it moves to depends on the display screen or operating mode currently being displayed. The CR key is only used on the edit (E) display and counter display screens, or when the CLM is in parameter mode. Pressing the CR key on the edit or counter screen causes the flashing cursor to be positioned to the left of the block number. This position is sometimes referred to as the cursor's "home" position. Do not confuse it with the "axis home" function.

Pressing the CR key in parameter mode positions the flashing cursor at the first digit of the parameter number.

When changing the data on the Edit display screen, press CR key before pressing the Store key to cancel the change and leave the data as previously stored (saved), and remain at the same block number; the cursor moves to the first position of the previous field. Changing to another block number, display screen, etc. without first pressing the Store key also causes loss of a change to a block's data.

→ , ← **Right and Left Arrow Keys** - The right arrow key is used to move the cursor to the right, one character at a time. The left arrow key is used to move the cursor to the left, one character at a time. For display screens that have no cursor, pressing the arrow keys causes additional screens to appear. These screens are described in section 2.4.

+ , - **Plus and Minus Keys -** The plus and minus keys are used in certain program commands to specify axis direction. In Parameter mode, these plus and minus keys are used to step up or down through the parameters. When the Edit display screen or counter display screens are displayed, these keys are used to scroll through the block numbers. The cursor must be on the top line, third position from left.

NOTE: *In Test mode, pressing the plus and minus keys on the material speed display screen increases or decreases the simulated material speed. Refer to Chapter 6 for more information about using this feature to set up the cutoff system.*

0-9 **Numerical Keys** - The 0 through 9 keys are used to enter numerical data into the parameters and the user program.

↑ , ↓ **Up and Down Arrow Keys -** The up and down arrow keys are used to change display screens and to scroll through the program commands while the Edit screen is displayed.

With the cursor positioned to the right of the three-letter command mnemonic (e.g., NOP_), press the up and down arrow keys to step through the program commands in alphabetical order.

◊- **Block Store Key** - Used when programming the CLM from the Edit display screen. When the proper command and program data have been entered, press the block store key to enter the new data into the CLM memory. The display then changes to the next program block, with the cursor positioned on the first line, at the third space from the left.

Pressing the Carriage Return key or changing to another block number or another display screen, without first pressing the Block Store key, causes loss of the previously entered changes. The screen data returns to that which was previously stored in memory.

Pressing the Block Store key in Automatic or Test mode while the Position Lag (LS) Display Screen is displaying the position lag value will "freeze" the screen for 5 seconds. This feature is useful during initial setup of the flying cutoff system. Refer to chapter 6 for more information.

2.4 Display Screens and the Display Map

The CLM uses its liquid crystal display for several screens. The screen appearing at any given time depends on the keyboard entries and the operating mode that has been selected.

When the CLM is in Parameter mode, the data can be viewed, entered or edited. While in Automatic, Test, or Manual mode, display screens show the CLM software version, operating status messages, counters, etc. The Edit display screen allows entry and editing of the user program.

The Display Map shows how the individual screens are related to each other and will help you understand how to move to, and scroll through, the different displays. The same illustration is included in Appendix C. (Fig. 2.2)

Each row of the Display Map is labeled A, B, C, etc. Press the up or down arrow key to scroll up or down through the display screens in the order shown on the map. The left or right arrow keys are used to scroll to the displays on each row. Most rows automatically "wrap" from the last screen on the row, back to the first screen.

From Row G, press the down arrow key to return to the Row A display screen. From Row A, press the up-arrow key to display the Edit screen in Row G.

NOTE: *Some CLM display screens do not use all of the available lines or character spaces. The screen illustrations in this manual are sized according to the information that actually appears.*

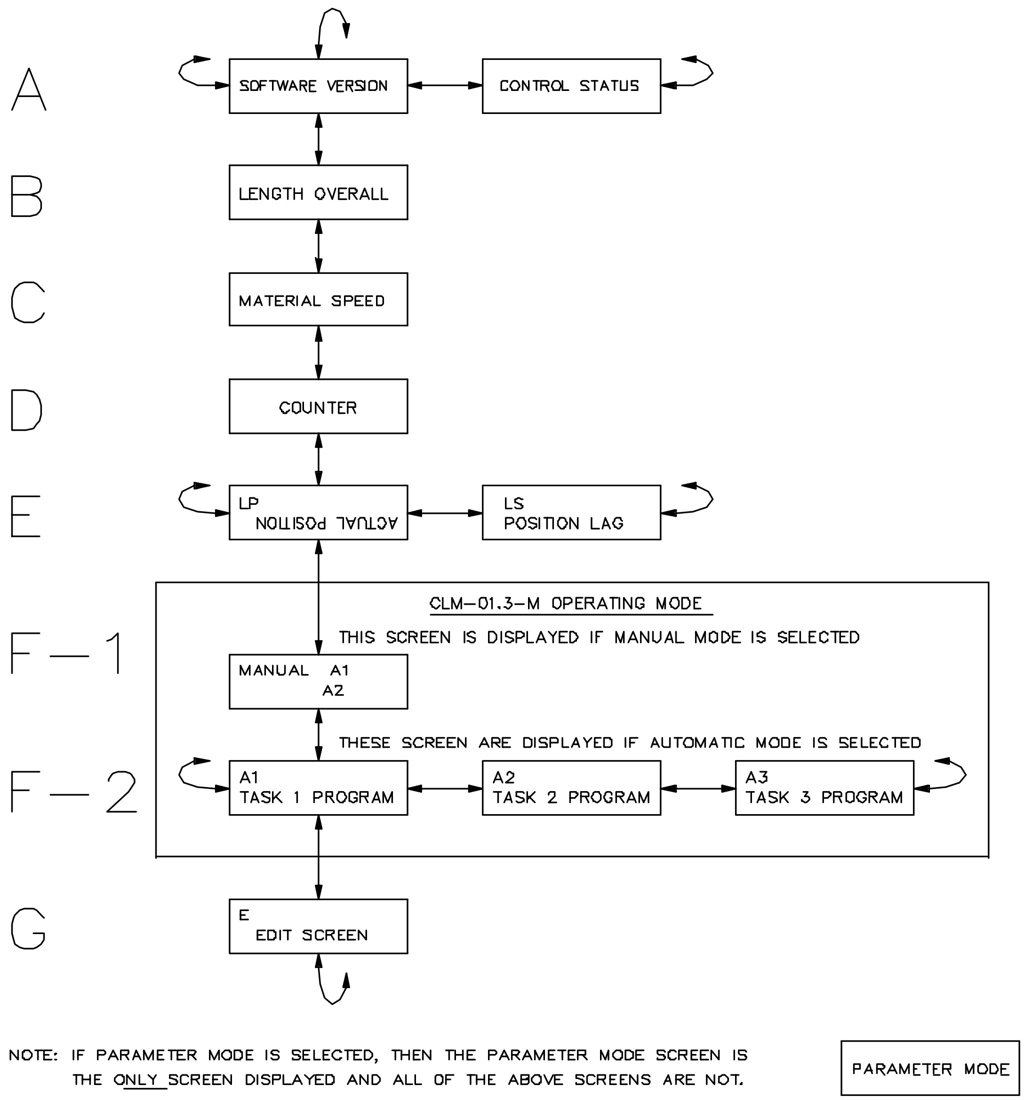


Figure 2.2 Map of CLM–LM Display Screens

Figure 2.2 Map of CLM-LM Display Screens

2.4.1 CLM Hardware & Software Version/Control Status Screen (Row A, Figure 2.2)

The Hardware & Software Version/Control Status Screen is the first screen to appear when power is applied with the CLM in Manual mode. It shows the CLM hardware version being used and the LM software version currently installed.

NOTE: *If the CLM is powered up and Automatic mode has been selected, an error will occur. Refer to Diagnostics, chapter 8.*

The right and left arrow keys are used to toggle between the CLM Hardware/Software Version Screen and the Control Status Screen.

Example:

```
 ________________                                  ________________
|  CLM-01.3-M    |    ___           ___           |System is ready |
| LM01.3-XXX.X   |   |<—|    OR    |—>|           |                |
|________________|   |__|          |__|           |________________|

 Hardware Version                                  Control Status
 Software Version
```

In this example, the CLM hardware version is CLM 01.3-M; the "M" designates the flying cutoff software.

On the second line, "LM01.3-XXX.X" refers to the software version currently installed. LM designates the flying cutoff software, and 01.3 is the related hardware version. "XXX.X" is replaced with the actual version number of the software currently installed.

NOTE: *The CLM Hardware/Software Version information can also be transmitted from the CLM to a host device, by requesting Status 19. Refer to chapter 7 for more information.*

When the left arrow key is pressed, the Control Status Screen is displayed. This screen displays "System is ready" if there are no existing error conditions.

If an error occurs when power is applied to the CLM or while the CLM is operating, the Control Status Screen displays the error message first.

Example:

```
 EMERGENCY STOP        [<-]    OR    [->]       CLM-01.3-M
 EMERGENCY STOP                                LM01.3-XXX.X

Control Status:                                Hardware Version
Emergency Stop Error                           Software Version
```

This example uses the Emergency Stop Error. See Chapter 8 for diagnostic messages and troubleshooting procedures.

NOTE: *The error code and error message that is displayed on the Control Status Screen can be transmitted from the CLM to a host device, by requesting Status 53. Refer to chapter 7 for more information.*

2.4.2 Length Overall Screen (Row B, Figure 2.2)

The Length Overall screen allows the operator to view the total amount of material that has been processed. The Length Overall screen has two parts, the Material Length 1 and 2. Material Length 1 and 2 are displayed in 1000 input units.

```
Length Overall
00100000  001000
 ___|___   ___|___
    |         |
    |         |_____  Material Length 2
    |
    |_______________  Material Length 1
```

The Material Length 1 number cannot be cleared and displays the amount of material that has been processed since the CLM was last powered up.

The Material Length 2 number also displays the amount of material that has been processed since the display was cleared by pressing the CR key. For example, the operator can clear the Material Length 2 screen when a new coil of material is installed.

NOTE: *The Material Length 1 and 2 information can be transmitted from the CLM to a host device by requesting Status 54 Refer to chapter 7, serial interface, for more information.*

2.4.3 Material Speed Screen (Row C, Figure 2.2)

The Material Speed screen displays the speed of the material passing under the measuring wheel in Automatic mode. The screen displays input units per second.

```
Material Speed
    +0100.000
```

The plus sign indicates the direction of measuring wheel rotation. If the direction of the measuring wheel is minus, the flying cutoff will not process material. The direction of the measuring wheel is set according to the second digit in the Direction Axis 1 parameter.

If you wish to display Material Speed in units other than input units per second, use the Special Function A1, parameter 26 to change to the desired unit. Refer to chapter 4, parameter 26.

When Test mode is enabled in parameter 19, the material speed can be simulated while the mechanical parts of the cutoff system run through the cycle. By pressing the plus or minus key when the Material Speed screen is displayed, material speed will increase or decrease. Pressing the plus key 32 times will increment the material speed upward to the value stored in the Velocity Axis 1, parameter 02. Pressing the CL (clear) key when the Material Speed screen is displayed, will immediately set the simulated material speed to zero.

NOTE: *The Material Speed information can be transmitted from the CLM to a host device, by requesting Status 55. Refer to Chapter 7, serial interface, for more information about Status 55.*

2.4.4 Counter Screen (Row D, Figure 2.2)

The Counter Screen displays the actual part count and the preset part count when the block number specified is read. Any count command stored in the CLM program blocks 000-999 can be monitored.

```
┌────────────────┐
|C _014  Counter |
| 0000090 0000100|
└────────────────┘
```

Counter Display

C - indicates counter display

014 - indicates block number of counter

0000090 - actual number of counts

0000100 - preset number of counts

The first three digits indicate the block number of the counter command. The Counter Screen allows the operator to enter the block number of the count command. The second line displays the actual count and preset count. The actual count will increment up by one every time the CLM program encounters the counter command at the specified block number. The preset count is the number stored in the counter command. If the block number entered does not have a count command, then the second line of the display is blank. When power to the CLM is turned off, the actual count is maintained in RAM by a backup battery.

Pressing the CR key will place the cursor to the left of the block number. With the cursor in that position, the plus and minus keys can be used to scroll through the block numbers to the next counter command stored in the user program.

2.4.5 Axis Position Screen (Row E, Figure 2.2)

The Axis Position Screen has two screens, the Current Position Screen and the Position Lag Screen. The Current Position Screen displays the current position of axis 1 and 2. The Position Lag Screen displays the actual position lag for axis 1 and axis 2.

Use the right and left arrow keys to toggle between the Current Position Screen and the Position Lag Screen.

```
┌──────────────────┐                              ┌──────────────────┐
│L P 1A+000010.00│    ┌──┐           ┌──┐    │L S 1A+000002.00│
│012 2 +000000.00│    │<─│    OR     │─>│    │012 2 +000000.00│
└──────────────────┘    └──┘           └──┘    └──────────────────┘
Current Position Display                       Position Lag Display
```

Position lag is the difference between the commanded motor position and the actual motor position. This difference is also referred to as following error.

2.4.5.1 Current Position Screen

```
L P 1A+000010.00
012 2 +000020.00
```

L - indicates axis position screen

P - indicates axis current position

1A+000010.00 - indicates axis 1 direction of travel (plus or minus) and the current position, in input units. The "A" after the axis number indicates that the axis has been homed.

012 - current block number operating in the CLM program.

2 +000020.00 - indicates axis 2 direction of travel (+/-) and the current position in input units (I/U).

2.4.5.2 Position Lag Screen

```
L S 1A+000001.50
012 2 +000000.50
```

L - indicates axis position screen

S - indicates axis position lag

1A+000001.50 - indicates the axis 1 deviation between the axis 1 commanded position and the current axis 1 position in input units (I/U). The "A" after the axis number indicates that the axis has been homed.

012 - current block number operating in the user program.

2 +000000.50 - indicates the deviation between the axis 2 commanded position and the current axis 2 position, in input units (I/U).

The position lag value is directly proportional to the velocity command output to the amplifier. The higher the speed, the higher the lag. The position lag value is zero when the drive is in position. An excess lag caused by binding of the mechanical system will cause a fault.

2.4.6 Operating Mode Screens

The CLM-LM has four operating modes -- Manual, Automatic, Test, and Parameter. The screen displayed depends on the CLM system mode input selected.

2.4.6.1 Manual Mode Screen (Row F1, Figure 2.2)

The Manual mode screen displays the following information, if the axis is enabled and if the axis is homed. In manual mode, the jog forward and reverse inputs are enabled, and are used to position the axis in Manual mode.

```
Manual   A1 Init.
         A2
```

Manual Mode Display

A1, A2 - the indicated axis number amplifier is enabled or "ready" to operate.

Init. - indicates axis has been homed (in the example, axis 1 has been homed, axis 2 has not)

2.4.6.2 Automatic/Test Mode Screen

The Automatic/Test mode screen shows the current CLM program block operating, for each of the three multi-tasking operations.

These screens can be viewed in either Automatic or Test mode. The right and left arrow keys are used to scroll through the program status screen for Task 1, 2, or 3.

```
A1 091  BCE    <—>   A2 500  VCC             <—>   A3  900  AKN
100  01  1           1  000225.00 999              07  1

Task 1 Display       Task 2 Display                Task 3 Display
```

```
A1 091  BCE
100  01  1
```

A - indicates Automatic /Test mode is selected.

1 - indicates which task number screen is displayed.

1 = Task 1
2 = Task 2
3 = Task 3

091 and BCE indicates the block number and program command that are currently being executed in the user program.

100 01 1 - indicates the programmed information for the block number that are currently being executed in the user program.

2.4.6.3 Parameter Mode Display Screens

When Parameter mode is selected, the data field for each parameter can be viewed, entered or edited. The first line displayed contains the parameter title. The second line contains the parameter number and related information.

The following display shows Parameter 00 - Feed Constant for Axis 1.

```
┌────────────────┐
│Feed Constant A1│
│P00    0001.0000│
└────────────────┘
```

P - indicates Parameter mode

00 - parameter number

0001.0000 - data field for the specified parameter.

When Parameter Mode is selected, the parameter display appears with the cursor on the first digit of the parameter data field. Use the right and left arrow keys to move the cursor within the data field.

To select other parameters to display, first move the cursor onto the parameter number by pressing the CR key, or use the left and right arrow keys. With the cursor on the parameter number, use the keypad to enter the number of the parameter to be displayed.

Another method is to press the plus or minus keys, to increment the parameter number up or down, one number at a time. When the desired parameter number is reached, the data field is entered or changed by typing over the existing data. Once the new data is in place, press the block store key to store the new data in memory. When the block store key is pressed, the parameter number will increment up one.

NOTE: *When first entering or changing a parameter's data, an asterisk (*) may appear, meaning the data entered is incorrect. The data field must be correctly entered and stored, otherwise, the "Parameter Lost" error will occur.*

Always maintain an accurate listing of your parameter entries for reference during troubleshooting or when changing parameters for a different application. Use the Parameter Record sheets provided in the Appendix D.

Refer to Chapter 4 for specific parameter description, entry options and requirements.

2.4.7 Program Edit Screen (Row G, Figure 2.2)

The Program Edit Screen is used to enter, edit or review the CLM program that will execute the desired application.

```
E _096  BCE
200  02  1
```

Edit Display

E - indicates program edit screen

096 - indicates block number (000-999) in CLM program

BCE - programmed command stored at block (096 in the example)

200 02 1 - data field for the program command at block (096 in example)

When you first scroll to this screen, a flashing cursor appears in the "home" position, which is the third character position from the far left of the top line. The cursor must be in that position in order for you to use the up or down arrow keys to scroll to different display screens. As with other display screens that include a cursor, use the left or right arrow key to move the cursor within the screen. Pressing the CR key will always move the cursor to the "home" position.

To select a program block, for review or editing, press the right or left arrow key to position the cursor over the first digit of the block number, then enter the number of the desired block over the existing block number. The command and data field in the new program block appears.

NOTE: *When changing data on the Edit display screen, press the CR key before pressing the Store key to cancel the change and leave the data as it was. The block number remains the same and the cursor moves to the first position of the previous field. Changing to another block number, display screen, etc. without first pressing the Store key also cancels any change to a block's data.*

To scroll through the block numbers, press the CR key to position the cursor to the left of the block number. By pressing the plus or minus keys, the program block numbers will scroll up or down accordingly and display the respective data for each block.

To enter or change a program command within a program block, first press the right arrow key until the cursor moves to the right of the three-digit program command mnemonic (e.g., NOP_).

Press the up or down arrow keys to increment or decrement through the commands alphabetically. When the desired command appears on the screen, press the right arrow key. The cursor moves to the beginning of the second line where the data fields appear specifically for the selected command. If this block was not previously programmed with this same command, asterisks (*) appear in the digit positions where data must be entered.

After entering and verifying the program block, press the store key to save the block to memory. The next program block number automatically appears, waiting to be programmed. Continue this process until all lines of user program are entered correctly. The program can also be edited or added to at a later time.

NOTE: *If an asterisk appears on the display when command data is entered, it mean the data entered is incorrect. If the data field is not correctly entered and stored, the "Invalid Program Command" error will occur. Chapter 5 has more information on CLM program commands used to create a user program.*

When changing data from the Edit display screen, press the CR key before pressing the store key to cancel the change and leave the data as previously stored. The display remains at the same block number and the cursor moves to the left of the program block number. Changing to another block number, display screen, etc. without first pressing the Store key also cancels any changes made to data for the current block.

2.5 CLM Lower Front Panel

There are six items located on the lower part of the front panel (Fig 2.3).

- The Ready indicator (labeled H1) is a green LED which indicates that the CLM is powered up, that no CLM system error exists, and that the Bb contacts (connector X5, pins 3 and 4) are closed and the CLM is ready to operate.

- The RS-232/422/485 Communications Port (connector X6) is located in the upper left corner below the keypad. This 25-pin, sub-miniature D-style is used to connect the CLM to an IDS, SOT, PLC or other host communication device.

- Fuse F1 (1.6 amps) protects the CLM from a current surge.

- The MOK-11 card slides into the CLM chassis. The card contains EPROM and RAM, and a lithium battery. The lithium battery provides sufficient power to retain parameter and program data in RAM whenever external power to the CLM is turned off. If the battery power is low, a diagnostic message will appear on the CLM display.

- Connector X5 is located at the bottom of the lower panel. It is used to connect +24 volts from the Indramat power supply (TVM, KDV, etc.) to the CLM. It also provides connection to the Bb contacts included in the "Drive On" interconnection, and to the analog command outputs which connect to the amplifier's command input (TDM, KDS, etc.).

- Connector X7 is located above connector X5. Currently, connector X7 is only used for the RF1 terminal. The RF1 terminal is connected to the axis 1 servo amplifier (controller enable) RF input.Figure 2.3

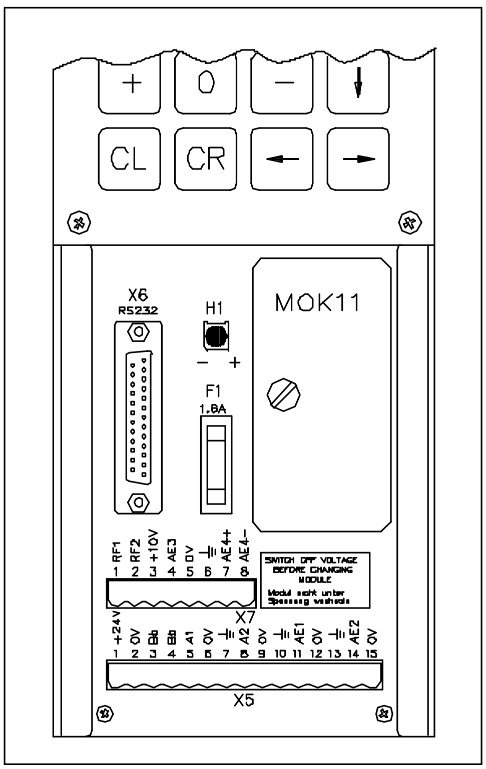


Figure 2.3 Lower Front CLM Panel

CHAPTER 3. FUNCTIONAL DESCRIPTION OF I/O CONNECTIONS

The CLM motion control is designed to function with the mechanical flying cutoff designed by the machine builder. This chapter describes:

- The CLM-LM inputs and outputs
- How inputs and outputs interface with the flying cutoff system
- The functions of the system and auxiliary inputs and outputs
- Parameters that are used to define the functions of auxiliary inputs and outputs

The standard CLM has 32 inputs and 32 outputs. The first set of 16 inputs and outputs are called the "system" inputs and outputs. The second set of 16 inputs and outputs are called "auxiliary" inputs and outputs.

NOTE: *If axis 2 is to be used, the expansion I/O board must be installed on the CLM. Connector X12 on the expansion board provides eight system inputs for axis 2.*

3.1. Signal Definitions

The CLM inputs and outputs should always be powered by an external +24 Volt supply. The state of an input or output in relation to voltage is:

```
+24 V  ┌────────────────┐
       │ 1 = High (On)  │
+18 V  ├────────────────┤
       │                │
       │   UNDEFINED    │
       │                │
  5 V  ├────────────────┤
       │ 0 = Low (Off)  │
       └────────────────┘
```

An input or output is described as "active high" when its associated action is initiated by a high (+24 Vdc) level. It is described as "active low" when its associated function is initiated by a low (zero volts) level.

Active-low signals are shown in this manual (when specifically referred to as a signal) with a line over the input or output name, such as with Emergency Stop. The Emergency Stop input must be high during normal operation. If it goes low, the CLM initiates the actions required for an Emergency Stop function.

3.2. CLM System & Auxiliary Inputs (Connector X3)

This section describes system and auxiliary inputs and how they interface and work with a machine. Auxiliary inputs are defined in the user program or parameters. Figure 3.1 illustrates CLM Connector X3 and its pin designations.

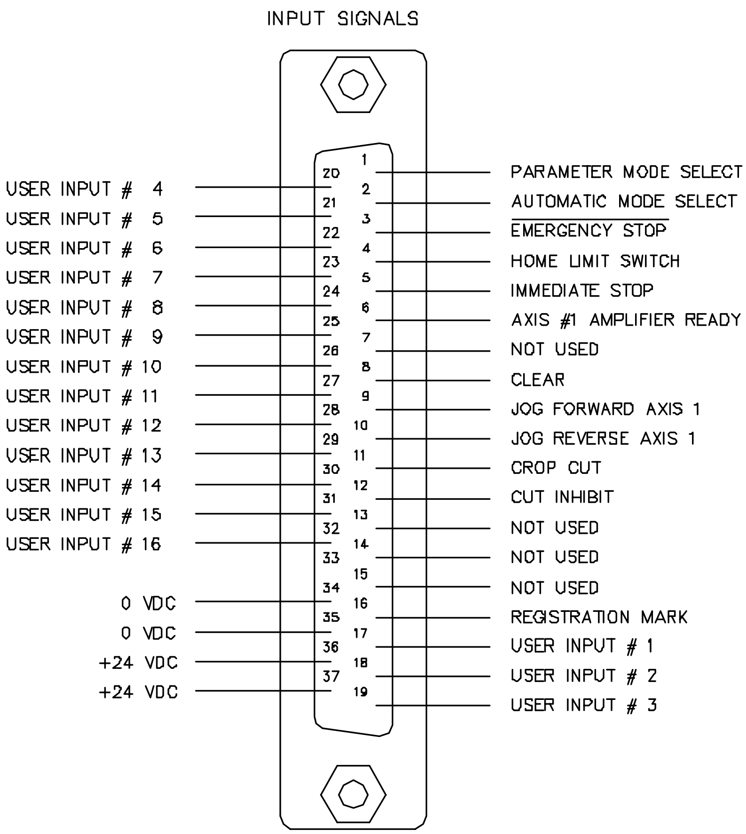


Figure 3.1 X3 Input Connector and Pin Designations

Figure 3.1 X3 Input Connector and Pin Designations

3.2.1. Parameter Mode Select

Connector — X3, pin 1
Function — (Input) Selects Parameter Mode

+24 Vdc = Parameter mode selected.

0 Vdc = Parameter mode is not selected; another mode is selected or the system has defaulted to the Manual mode.

The Parameter Mode Select input will allow entry or verification of the system parameters required to adapt the control for the specific requirements of the application.

Indramat strongly recommends that the Parameter Mode input be wired to a key-operated selector switch, to help prevent unauthorized parameter changes.

The CLM has Parameter mode system output which can be used to verify or acknowledge that Parameter mode is selected. This output is typically wired to indicator lights on the user's control panel.

If +24 Vdc is applied to the Parameter Mode input while the CLM is in Automatic mode, the error message "Invalid Mode" appears.

NOTE: *When Parameter mode is selected, the Task 3 program stops operating in Parameter Mode. When Parameter mode is not selected, the Task 3 program will begin to operate. Refer to chapter 4, parameter 84, for more information on Task 3.*

3.2.2. Axis #1 Automatic / Manual Mode Select

Connector — X3, pin 2
Function — (Input) Selects Axis #1 Automatic or Manual mode

+24 Vdc = Axis #1 Automatic mode selected.

0 Vdc = Manual mode selected.

Placing the CLM in Manual mode enables the jog forward and reverse inputs, for moving axis 1 and 2 forward or backward. If the neither Automatic nor Parameter mode is selected, the CLM will default to Manual mode.

In Manual mode, these system inputs are accepted:

- Axis #1 Jog Forward
- Axis #1 Jog Reverse
- Clear
- Crop Cut

Some auxiliary inputs that are user-defined in the parameters are also accepted in Manual mode. These user-defined inputs are:

- Homing Command (parameter 10/50)
- Manual Cut Vector (parameter 20)
- Manual Vector (parameter 86)
- Axis 2 Jog Forward/Jog Reverse, if axis 2 is programmed as a tooling axis,

The Axis #1 Automatic mode will run the CLM program written by the machine builder. Axis 1 must be homed, before switching into Automatic mode is allowed. If axis 1 is not homed the following error "Axis 1 Not Homed" will appear.

In Automatic mode, the following system inputs will be accepted:

- Immediate Stop
- Clear
- Crop Cut
- Cut Inhibit.

If +24 Vdc is applied to the Parameter Mode input while the CLM is in Automatic mode, the error message "Invalid Mode" appears.

The CLM has system outputs that can be used to verify or acknowledge the current operating mode selection. These outputs are typically wired to indicator lights on the user's control panel.

NOTE: *Task 3 will be running in either Manual or Automatic mode. Refer to chapter 4, parameter 84, for more information on Task 3.*

3.2.3. Emergency Stop

Connector — X3, pin 3
Function — (Input) Emergency Stop Condition Exists

+24 Vdc = No Emergency Stop condition exists

0 Vdc = An Emergency Stop condition does exist

The CLM turns off all auxiliary outputs and issues an "Emergency Stop" diagnostic message.

WARNING: *The Emergency Stop input must be used to ensure safety for the operator and to protect the machine from any damage. The Emergency Stop input is wired through normally-closed contacts of the E-Stop pushbutton. The Emergency Stop input must be included in the Emergency Stop chain.*

The Emergency Stop input must have +24Vdc applied to it before the CLM will operate. When the Emergency Stop input is low (+24Vdc is not applied), the motor is immediately commanded to reach zero velocity in the minimum time possible. The minimum time possible is dependent on the maximum torque available and the inertia of the load connected to the motor. The CLM system and auxiliary outputs will turn off.

If the Emergency Stop input is low, the CLM Bb contacts at connector X5 (pins 3 and 4) open, preventing the drive(s) and motor(s) from being turned on. When the Emergency Stop input is high, and if no other errors exist, the CLM Bb contacts close to allow the drive(s) and motor(s) to operate.

CAUTION: *The Emergency Stop input is the only error that will allow Task 3 to operate. The E-Stop circuit commonly includes the Emergency Stop switch on the user's control panel, E-Stop switches at various locations around the machine, switches on lubrication or coolant pumps, and various safety interlock switches on guards and doors.*

3.2.4. Home Limit Switch

Connector — X3, pin 4
Function — (Input) Reference position for flying cutoff, axis 1

+24 Vdc = Home Limit Switch is closed

0 Vdc = Home Limit Switch is open.

The Home Limit Switch is wired to a normally-open proximity sensor or mechanical limit switch. It is installed on the cutoff machine by the builder, and is used as a fixed reference position for the flying cutoff, axis 1. The home switch is actuated by a home switch "dog" (or a metal "target" in the case of a proximity sensor) mounted on the flying cutoff device. When the switch closes, a low-to-high transition occurs at the Home Limit Switch input. This transition establishes a zero position, unless there is a homing offset in parameter 09. If an offset exists in parameter 09, the cutoff axis will travel that distance in the reverse direction.

Once the axis has homed, auxiliary outputs can be defined in parameter 10, to tell the operator that the axis is at the home position and home is established. In addition, the minimum and maximum travel limits, as defined in parameters 11 and 12, take effect to help prevent damage to axis 1.

WARNING: *In addition to the travel limits set in software, hardware overtravel limit switches must be hard-wired into the Axis #1 Drive Ready Input, as an extra measure to ensure that no damage occurs to the flying cutoff as a result of axis overtravel. Refer to the interconnect drawings in Appendices A and B.*

The CLM-LM has three ways of homing the flying cutoff, axis 1 -- homing by jogging reverse, homing by the command input, and homing by jogging forward or reverse. Refer to Chapter 4, parameters 08 to 12, for more information on the homing setup.

NOTE: *The flying cutoff (axis 1) must be homed in Manual mode, before Automatic mode can be selected.*

3.2.5. Immediate Stop

Connector —	X3, pin 5
Function —	(Input) Immediately stop the axis 1, when Automatic mode is selected.
+24 Vdc =	(Momentary) Immediate Stop is active.
0 Vdc =	Automatic mode is allowed to operate.

The Immediate Stop input is typically wired to a normally-open push-button switch on the user control panel.

WARNING: *The Immediate Stop input is only accepted in Automatic mode.*

The Immediate Stop input used to stop the flying cutoff axis 1 only when Automatic mode is selected. When Manual mode is selected, the condition of the Immediate Stop input has no effect on the CLM. When a low to high transition is applied at the Immediate Stop input in Automatic mode, the flying cutoff axis decelerates to zero velocity and issues the "Immediate Stop" error.

The machine builder can write a CLM program to retract the shear or saw when the Immediate Stop input is applied. This CLM program starting block number is defined in parameter 15, Immediate Stop.

3.2.6. Axis #1 Drive Ready

Connector — X3, pin 6
Function — (Input) Informs the CLM that Axis #1 Amplifier is ready for operation.

+24 Vdc = Axis #1 amplifier has power applied and the Bb contacts have closed telling the CLM that the amplifier is operating properly.

0 Vdc = Axis #1 amplifier has power applied but, an amplifier problem or a problem in the Drive On circuitry exist preventing the amplifier Bb contact from closing.

Certain conditions must be satisfied to allow the servos to operate:

When power is applied, the CLM expects to receive the Axis #1 Drive Ready input through the Bb contacts, indicating the Axis #1 servo amplifier and power supply have properly powered up and the amplifier RF (regulator release) input is ready for the Axis #1 Drive Enable Output (connector X7, pin 1 or connector X4, pin 4).

The normally-open Bb contacts are use to provide a +24Vdc output to the Axis #1 Drive Ready input. These contacts close when the proper amplifier conditions are present. If these conditions are not satisfied, the appropriate diagnostic message is displayed.

When the CLM receives the Axis #1 Drive Ready input, it issues the Axis #1 Drive Enable output to allow the amplifier to operate and Axis #1 Brake Release output to release the motor brake, if the motor has a brake.

For more information, consult the manual for the amplifier (TDM, KDS, etc.) used.

WARNING: *Hard-wired overtravel limit switches must be connected to the Axis #1 Drive Ready input.*

3.2.7. Clear (External)

Connector — X3, pin 8
Function — (Input) Clears the error displayed on the CLM

+24 Vdc = Momentary, clears the error displayed on the CLM and re-initializes the CLM.

0 Vdc = Has no effect.

The Clear input is typically wired to a normally-open pushbutton switch on the user control panel.

When an error occurs, the CLM displays an error message, and all CLM system and auxiliary outputs are turned off. The operator must then correct the error and clear the error message. The CLM will re-initialize when the error message is cleared.

Clear the error message by one of two ways:

- Press the Clear key (CL) on the CLM control panel.
- Press the Clear pushbutton, which is supplied by the machine builder and mounted on the user's control panel. This Clear pushbutton must be wired to the Clear (External) input.

NOTE: *A "program lost" or "'parameter loss" error can only be cleared using the CL key on the CLM keypad.*

WARNING: *Task 3 will start as soon as the error is cleared.*

3.2.8. Axis #1 Jog Forward

Connector — X3, pin 9
Function — (Input) Jogs the axis #1 forward

+24 Vdc = In Manual mode, axis 1 will move in the forward direction at the velocity set in the Velocity Axis 1, parameter 02. (switch held closed)

0 Vdc = In Manual mode, stops axis 1 forward motion (switch opened).

The Axis #1 Jog Forward input is typically wired to a normally- open pushbutton switch on the user control panel.

When +24 Vdc is applied to this input, axis 1 will move in the forward direction. The Velocity Axis 1, parameter 02, specifies the jog velocity as a percentage of maximum. The jog velocity must never exceed the maximum velocity.

NOTE: *The Axis #1 Jog Forward input is disabled when the CLM is in the Parameter or Automatic mode.*

3.2.9. Axis #1 Jog Reverse

Connector — X3, pin 10
Function — (Input) Jogs the axis #1 reverse

+24 Vdc = In Manual mode, axis 1 moves in the reverse direction at the velocity set in the Velocity Axis 1, parameter 03 (switch on user panel held closed)

0 Vdc = In Manual mode, stops axis 1 reverse motion (switch on user panel is open)

The Axis #1 Jog Reverse input is typically wired to a normally-open pushbutton switch on the user control panel.

When +24 Vdc is applied to the Axis #1 Jog Reverse, axis 1 moves in the reverse direction. The Velocity Axis 1, parameter 03, specifies the jog velocity as a percentage of maximum velocity. The jog velocity must never exceed the maximum velocity.

NOTE: *The Axis #1 Jog Reverse input is disabled when the CLM is in the Parameter or Automatic mode.*

3.2.10. Crop Cut

Connector — X3, pin 11
Function — (Input) Used to perform the cutting process in Manual or Automatic mode.

+24 Vdc = Crop Cut is active
0 Vdc = Has no effect

The Crop Cut input is used to perform a sawing or shearing process in Manual or Automatic mode. The input is typically wired to a normally-open pushbutton switch on the user control panel.

When the Crop Cut input goes high in Manual mode, a user-written program is initiated. The starting block number for this program is defined in the Manual Cut Vector, parameter 20. This program must end with the RTS command. While the user-written program is running, the Crop Cut and Jog Forward/Jog Reverse inputs are disabled.

When the Crop Cut input goes high in Automatic mode, the flying cutoff will immediately accelerate and synchronize to the material velocity. When the the two are synchronized, the material will be cut immediately, regardless of the part currently being processed.

The Crop Cut input is only accepted if the flying cutoff is at the home position and is used as the starting point for the parts which are going to be processed.

3.2.11. Cut Inhibit

Connector — X3, pin 12
Function — (Input) Prevents execution of the cut process, in Automatic mode only

+24 Vdc = Cut Inhibit input is active

0 Vdc = Has no effect

The Cut Inhibit input is typically wired to a normally-open pushbutton switch on the user control panel.

When the Cut Inhibit input is pressed in Automatic mode and the flying cutoff is at the home position, the flying cutoff will not synchronize or process the material. The flying cutoff will remain at the home position and the Cut Inhibit output is turned on.

When the Cut Inhibit input is pressed in Automatic mode and the flying cutoff is beginning to synchronize, or is synchronized with the material, the flying cutoff will finish processing the part and return to the home position. It will not synchronize to the next part. The flying cutoff will remain at the home position and the Cut Inhibit output is turned on.

The Cut Inhibit remains in effect until the Crop Cut input is applied. The Cut Inhibit function is disabled by switching from Automatic to Manual mode.

CAUTION: *Cut Inhibit stops the flying cutoff, but does not stop the material line.*

3.2.12. Registration Mark

Connector — X3, pin 16
Function — (Input) Used to provide a registration mark input to the CLM

+24 Vdc = Registration Mark is acknowledged

0 Vdc = Has no effect

A registration device, usually some type of photoelectric sensor, is used to detect a registration mark which appears on the material at precise intervals. When the mark is sensed, a low-to-high transition occurs at the Registration Mark input, and the flying cutoff will synchronize and process the part. Refer to the LMR command, chapter 5 Programming, for more information.

NOTE: *The signal from the sensor must be present at the Registration Mark input for at least 2 milliseconds.*

3.2.13. Auxiliary Inputs (Standard CLM)

Connector — X3, pins 17 through 32
Function — (Inputs) user-defined in the parameters or program

+24 Vdc = Auxiliary input is on.

0 Vdc = Auxiliary input is off.

The standard CLM has sixteen auxiliary inputs which can be used to perform functions as defined in the CLM parameters or user-written program.

3.3. CLM System & Auxiliary Outputs (Connector X4)

This section describes system and auxiliary outputs and how they interface and work with a machine. Auxiliary outputs are defined in the user program or parameters. Figure 3.2 illustrates CLM Connector X4 and its pin designations.

NOTE: *The CLM system and auxiliary outputs have a maximum current capability of 50 ma. Refer to Power Requirements in chapter 1.*

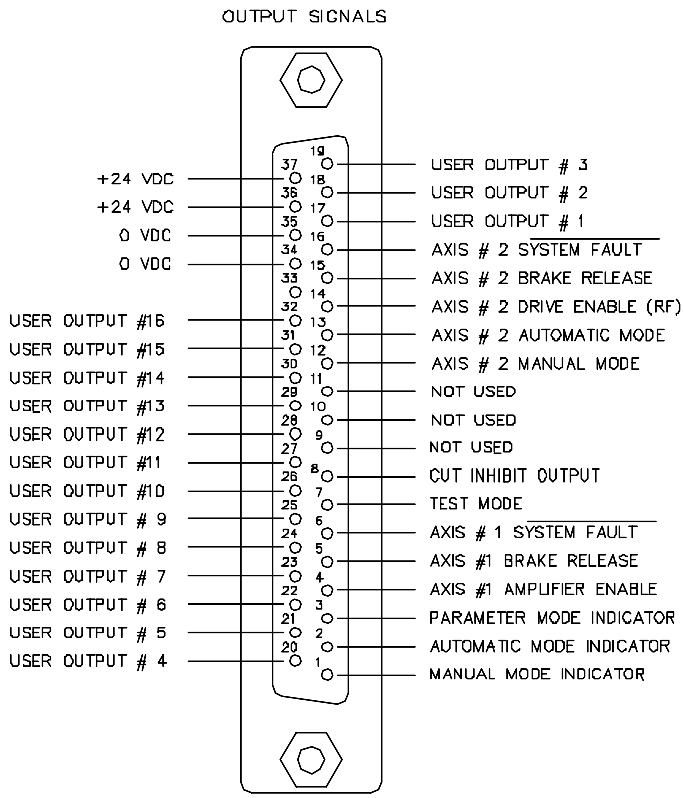


Figure 3.2 X4 Output Connector and Pin Designations

Figure 3.2 X4 Output Connector and Pin Designations

3.3.1. Axis #1 Manual Mode

Connector — X4, pin 1
Function — (Output) Indicates Manual mode is selected.

+24 Vdc = Manual mode is selected.

0 Vdc = Another mode has been selected or an error has occurred.

The Manual Mode Indicator output is typically wired to a light on the user control panel, or to a PLC for additional control functions as determined by the machine builder.

3.3.2. Axis #1 Automatic Mode

Connector — X4, pin 2
Function — (Output) Indicates Axis #1 Automatic mode is selected.

+24 Vdc = Axis #1 Automatic mode is selected.

0 Vdc = Another mode has been selected, or an error has occurred.

The Axis #1 Automatic mode output is typically wired to a light on the user control panel, or to a PLC.

3.3.3. Parameter Mode

Connector — X4, pin 3
Function — (Output) Indicates Parameter mode is selected.

+24 Vdc = Parameter mode is selected.

0 Vdc = Another mode has been selected, or an error has occurred.

The Parameter mode output is typically wired to a light on the user control panel, or to a PLC.

3.3.4. Axis #1 Drive Enable (RF)

Connector — X4, pin 4
Function — (Output) Enables Axis #1 Amplifier

+24 Vdc = Axis #1 Amplifier is enabled for operation.

0 Vdc = Axis #1 Amplifier is not enabled, because either the Axis #1 Drive Ready input is low or a error has occurred.

The Axis #1 Drive Enable output is connected to the RF input of the axis #1 amplifier (regulator release on TDM, KDS, etc.). The RF1 output on the CLM connector X7, pin 1, provides the same output as Axis #1 Drive Enable output. It is recommended that the RF1 output (CLM Connector X7, pin 1) is connected to the axis #1 amplifier's RF input.

When power is applied to the CLM or when switching from Parameter mode to Manual mode, the CLM initializes and verifies that the system is ready for operation. After the CLM system is verified, the Axis #1 Drive Ready Output will turn on, applying RF to the amplifier. If an error occurs, the Axis #1 Drive Ready output turns off immediately.

3.3.5. Axis #1 Brake Release

Connector — X4, pin 5
Function — (Output) Controls the Axis #1 servomotor's brake

+24 Vdc = Axis #1 servomotor's brake is disengaged.

0 Vdc = Axis #1 servomotor's brake is engaged, because either the Axis #1 Drive Ready input is low or a error has occurred.

When power is applied to the CLM or when switching out of Parameter mode to Manual mode, the CLM initializes and verifies that the system is ready for operation. After the CLM system is verified the Axis #1 Drive Ready Output turns on, applying RF to the amplifier. The Axis #1 Brake Release output will turn on 200 milliseconds after the Axis #1 Drive Ready. The Axis #1 Brake Release output will electrically release the servomotor's brake by applying +24 Vdc.

When the +24 Vdc is removed from the motor, the brake will engage. If an error occurs, the Axis #1 Brake Release output will turn off causing the brake to engage immediately.

3.3.6. Axis #1 System Fault

Connector — X4, pin 6
Function — (Output) Indicates an error has occurred

+24 Vdc = The system is functioning properly

0 Vdc = The CLM has detected a fault.

The Axis #1 System Fault is typically wired to an indicator light on the user control panel. This indicator, often labeled System OK, is ON when no fault is present. If an error occurs, then axis #1 will immediately decelerate to a stop. The Axis #1 System Fault output turns off and the error message is displayed on the CLM display. Refer to chapter 8 for a description and possible solutions to correct the error.

WARNING: *This output is a semiconductor that should not be relied upon in the event of an emergency condition. If this signal is used, it should be in conjunction with the CLM Bb contacts (CLM Connector X5, pins 3 and 4).*

3.3.7. Test Mode

Connector — X4, pin 7
Function — (Output) Indicates Test mode is enabled.

+24 Vdc = Automatic mode is selected and Test mode is enabled in Parameter 19.

0 Vdc = Another mode has been selected, or an error has occurred.

Test mode is used to operate the flying cutoff system without having to run material. If Test Mode is enabled in parameter 19 and the proper parameters and CLM program are stored, homing the axis #1 in Manual mode and switching to Automatic mode will turn the Test Mode output on. The Material Speed is simulated by pressing the plus or minus key while the material speed screen is displayed; pressing the CL key will cause the simulated material speed to go to zero.

The Test mode output is typically wired to a light on the user control panel, or to a PLC.

NOTE: *If Test Mode is enabled in parameter 19 and Automatic mode has been selected, switching to Parameter mode will cause the "Invalid Mode" error to occur.*

3.3.8. Cut Inhibit Output

Connector — X4, pin 8
Function — (Output) indicates that the Cut Inhibit input was activated.

+24 Vdc = Cut Inhibit is activated.

0 Vdc = Cut Inhibit is deactivated.

When the Cut Inhibit input is pressed in Automatic mode and the flying cutoff is at the home position, the flying cutoff will not synchronize or process the material. The flying cutoff will remain at the home position and the Cut Inhibit output is turned on.

When the Cut Inhibit input is pressed in Automatic mode and the flying cutoff is beginning or is synchronized with the material, the flying cutoff will finish processing the part and return to the home position and will not synchronize to the next part. The flying cutoff will remain at the home position and the Cut Inhibit output is turned on.

The Cut Inhibit output remains in effect until the Crop Cut input is applied, or until the CLM is switched from Automatic to Manual mode.

The Cut Inhibit output is typically wired to an indicator light on the user control panel, or to a PLC.

3.3.9. Axis #2 Manual Mode

Connector — X4, pin 12

Function — Not available at this time.

3.3.10. Axis #2 Automatic Mode

Connector — X4, pin 13

Function — Not available at this time.

3.3.11. Axis #2 Drive Enable

Connector — X4, pin 14
Function — (Output) Enables Axis #2 Amplifier

+24 Vdc = Axis #2 Amplifier is enabled for operation.

0 Vdc = Axis #2 Amplifier is not enabled, because either the Axis #2 Drive Ready input is low or a error has occurred.

The Axis #2 Drive Enable output is connected to the RF input of the axis #2 amplifier (regulator release on TDM, KDS, etc.).

WARNING: *The RF2 output on the CLM connector X7, pin 2, must not be used as the Axis #2 Drive Enable. If axis #2 is used, then the Axis #2 Drive Enable output must be connected to the RF input of the axis #2 amplifier.*

When power is applied to the CLM or when it is switched out of Parameter mode to Manual mode, the CLM initializes and verifies that the system is ready for operation. After the CLM system is verified, the Axis #2 Drive Ready Output turns on, applying RF to the amplifier.

If an error occurs, the Axis #2 Drive Ready output turns off immediately.

3.3.12. Axis #2 Brake Release

Connector — X4, pin 15
Function — (Output) Controls the Axis #2 servomotor's brake

+24 Vdc = Axis #2 servomotor's brake is disengaged.

0 Vdc = Axis #2 servomotor's brake is engaged, because either the Axis #2 Drive Ready input is low or a error has occurred.

When power is applied to the CLM, or when it is switched out of Parameter mode to Manual mode, the CLM initializes and verifies that the system is ready for operation. After the CLM system is verified, the Axis #2 Drive Ready Output turns on, applying RF to the amplifier. The Axis #2 Brake Release output will turn on 2 milliseconds after the Axis #2 Drive Ready output is energized, applying +24 Vdc to the brake and releasing it.

When the +24 Vdc is removed, the brake engages. If an error occurs, the Axis #2 Brake Release output turns off, causing the brake to engage immediately.

3.3.13. Axis #2 System Fault

Connector — X4, pin 16
Function — Not available at this time.

3.3.14. Auxiliary Outputs (Standard CLM)

Connector — X4, pins 17 through 32
Function — (Outputs) User-defined in the parameters or program

+24 Vdc = Auxiliary output is on.

0 Vdc = Auxiliary output is off.

The standard CLM has sixteen auxiliary outputs which can be used to perform certain functions as defined in the CLM parameters or the user-written program.

3.4. CLM With Expansion I/O Board (Optional)

The CLM with expansion I/O board has three additional connectors:

- Connector X11 - aux. inputs 17 through 48
- Connector X12 - aux. inputs 49 through 72 and system inputs needed for axis 2
- Connector X13 - aux. outputs 17 through 48

The following sections describe these connectors and how each works when interfaced to the machine.

3.4.1. Expansion CLM Auxiliary Inputs (Connector X11)

Figure 3.3 illustrates CLM Connector X11 and its pin designations.

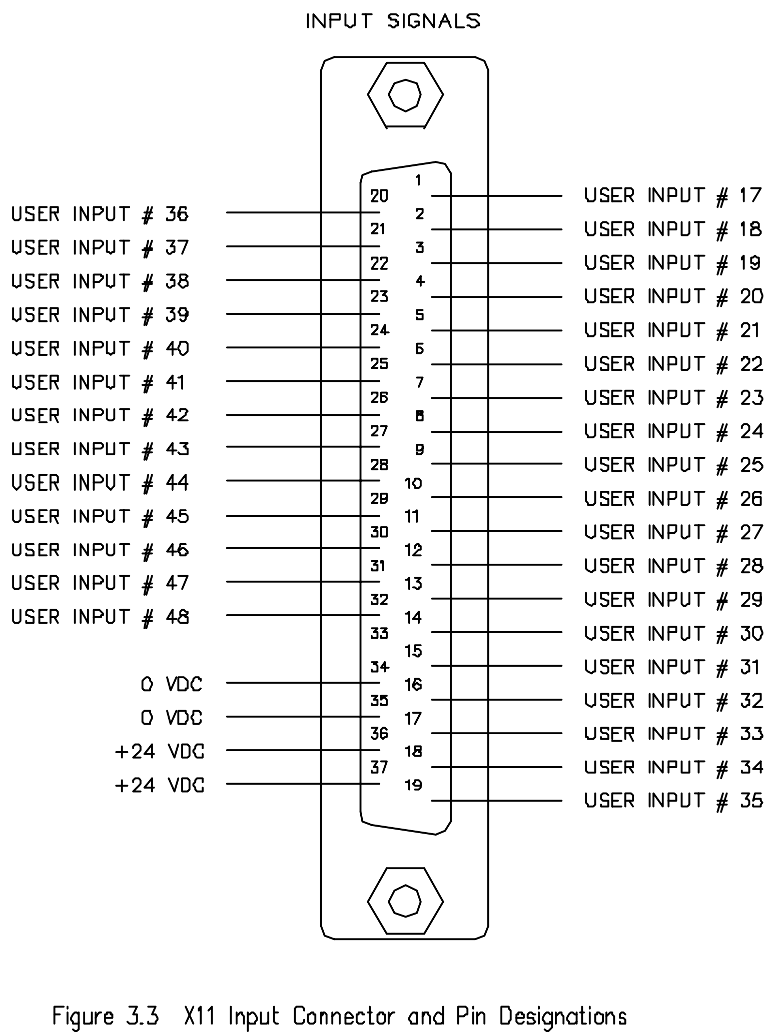


Figure 3.3 X11 Input Connector and Pin Designations

3.4.1.1. Auxiliary Inputs (CLM With Expansion I/O Board)

Connector — X11, pins 1 through 32
Function — (Inputs) user-defined in the parameters or program

+24 Vdc = Auxiliary input is on.

0 Vdc = Auxiliary input is off.

Connector X11 has 32 auxiliary inputs which function as defined in the CLM parameters, or the user program.

3.4.2. Expansion CLM Auxiliary Inputs / Axis 2 System Inputs (Connector X12)

Figure 3.4 illustrates CLM Connector X12 and its pin designations.

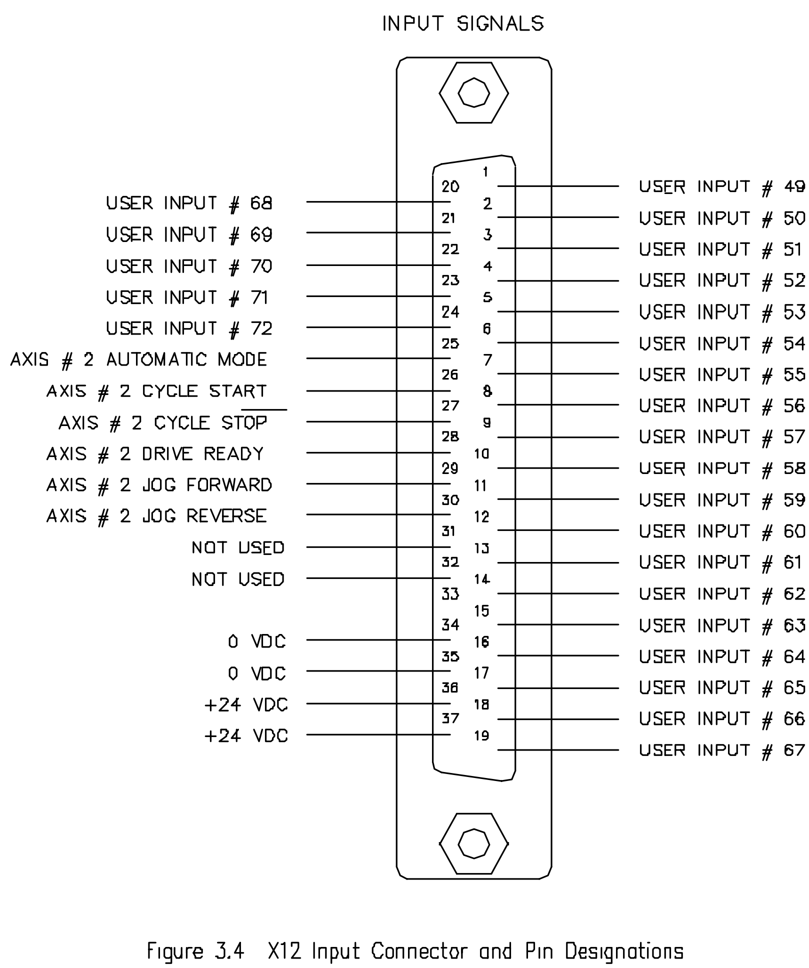


Figure 3.4 X12 Input Connector and Pin Designations

3.4.2.1. Auxiliary Inputs (CLM With Expansion I/O Board)

Connector - X12, pins 1 through 24
Function - (Inputs) User-defined in the parameters or program

+24 Vdc = Auxiliary input is on.

0 Vdc = Auxiliary input is off.

Connector X12 has 24 auxiliary inputs which perform functions as defined in the CLM parameters, or the user program.

3.4.2.2. Axis #2 Automatic Mode

Connector — X12, pin 25
Function — Not available at this time.

3.4.2.3. Axis #2 Cycle Start

Connector — X12, pin 26
Function — Not available at this time.

3.4.2.4. Axis #2 Cycle Stop

Connector — X12, pin 27
Function — Not available at this time.

3.4.2.5. Axis #2 Drive Ready

Connector — X12, pin 28
Function — Informs the CLM that Axis #2 Amplifier is ready for operation.

+24 Vdc = Axis #2 amplifier has power applied and the Bb contacts have closed, telling the CLM that the amplifier is operating properly.

0 Vdc = Axis #2 amplifier has power applied, but an amplifier problem or a problem

in the Drive On circuitry exists, preventing the amplifier Bb contact from closing.

Certain conditions must be satisfied to allow the servos to operate:

When power is applied, the CLM expects to receive the Axis #2 Drive Ready input through the Bb contacts, indicating the Axis #2 servo amplifier and power supply have properly powered up and the amplifier RF (regulator release) input is ready for the Axis #2 Drive Enable Output (connector X4, pin 14).

The normally-open Bb contacts are use to provide a +24Vdc output to the Axis #2 Drive Ready input. These contacts close when the proper amplifier conditions are present. If these conditions are not satisfied, the appropriate diagnostic message is displayed.

When the CLM receives the Axis #2 Drive Ready input, it issues the Axis #2 Drive Enable output to allow the amplifier to operate and Axis #2 Brake Release output to release the motor brake, if the motor has a brake.

Consult the amplifier manual (TDM, KDS, etc.) used in this application for more information.

3.4.2.6. Axis #2 Jog Forward

Connector — X12, pin 29
Function — (Input) Jogs the axis #2 forward

+24 Vdc = In Manual mode, axis will move in the forward direction at the velocity set in the Velocity Axis 2, parameter 42 (switch on user panel held closed)

0 Vdc = In Manual mode, stops axis forward motion (switch on user panel is open)

The Axis #2 Jog Forward input is typically wired to a normally- open pushbutton switch on the user control panel. When a +24 Vdc is applied to the Axis #2 Jog Forward, axis 2 will move forward. The Velocity Axis 2, parameter 42, specifies the jog velocity for axis 2, as a percentage of maximum velocity. The jog velocity must never exceed the maximum velocity.

The Axis #2 Jog Forward input is disabled when the CLM is in Parameter or Automatic Mode.

3.4.2.7. Axis #2 Jog Reverse

Connector — X12, pin 30
Function — (Input) Jogs the axis #2 reverse

+24 Vdc = In Manual mode, axis will move in the reverse direction at the velocity set in the Velocity Axis 2, parameter 42. (switch on panel held closed)

0 Vdc = In Manual mode, stops axis reverse motion. (switch on panel is open)

The Axis #2 Jog Reverse input is typically wired to a normally-open pushbutton switch on the user control panel. When a +24 Vdc is applied to the Axis #2 Jog Reverse, axis 2 moves in the reverse direction. The Velocity Axis 2, parameter 42, specifies the jog velocity for axis 2, as a percentage of maximum velocity. The jog velocity can never exceed the maximum velocity.

The Axis #2 Jog Reverse input is disabled when the CLM is in Parameter or Automatic mode.

3.4.3. Expansion CLM Auxiliary Outputs (Connector X13)

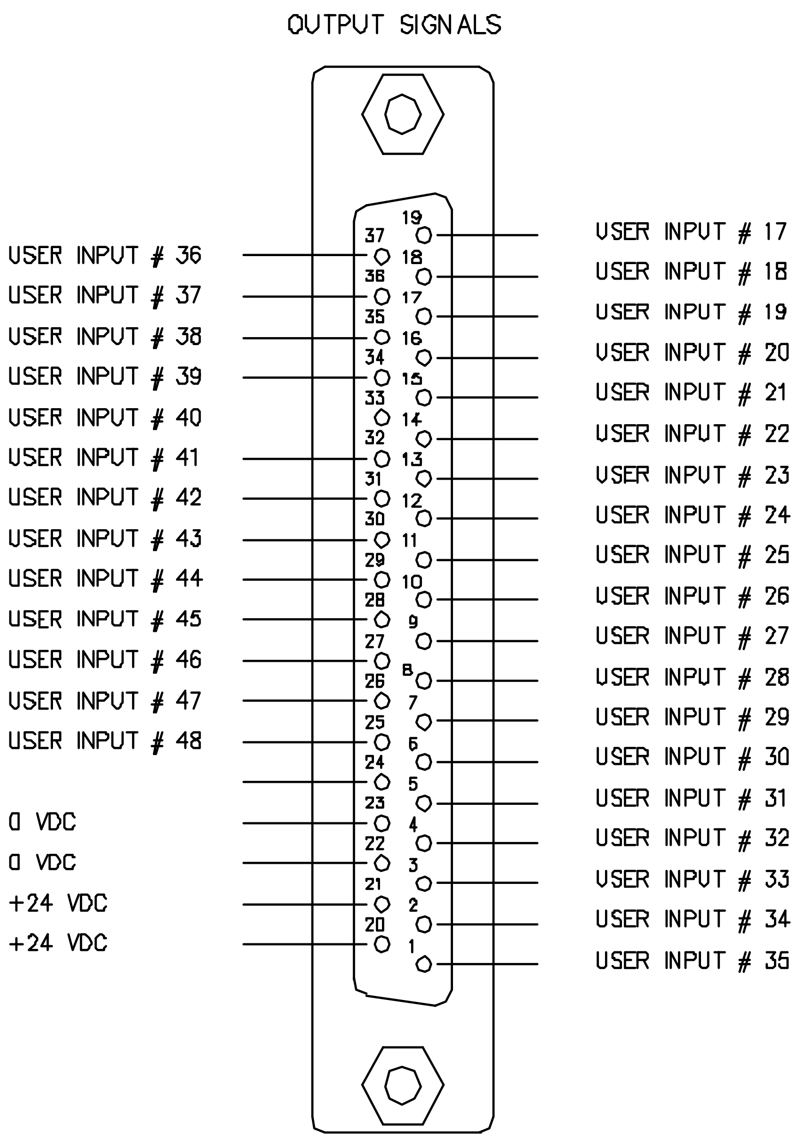


Figure 3.5 X13 Output Connector and Pin Designations

3.4.3.1 Auxiliary Outputs (CLM With Expansion I/O Board)

Connector — X13, pins 1 through 32
Function — (Outputs) User-defined in the parameters or program

+24 Vdc = Auxiliary output is on.

0 Vdc = Auxiliary output is off.

Connector X13 has 32 auxiliary outputs, used to perform functions as defined in the CLM parameters or user program.

3.5. Parameter Programmable Inputs

- Home Command Input Axis #1 - Refer to chapter 4, Parameter 10
- Repeat Last Part Input - Refer to chapter 4, Parameter 22
- Crop Cut Input (Auxiliary Input) - Refer to chapter 4, Parameter 23
- Reversing Hold Input - Refer to chapter 4, Parameter 24
- Tail Out Input - Refer to chapter 4, Parameter 25
- Start At Program Block 000 Input - Refer to chapter 4, Parameter 26
- Home Command Input Axis #2 - Refer to chapter 4, Parameter 50
- Feed Interrupt (Axis 2) - Refer to chapter 4, Parameter 54, Monitoring Axis 2
- Feed Angle Monitoring (Axis 2) - Refer to chapter 4, Parameter 54, Monitoring Axis 2
- Manual Vector - Refer to chapter 4, Parameter 86

3.6. Parameter-Programmable Outputs

- Position Tolerance Output (Axis 1) - Refer to chapter 4, Parameter 7
- At Home Output (Axis 1) - Refer to chapter 4, Parameter 10, Homing Setup
- Home Established Output Axis #1 - Refer to chapter 4, Parameter 10
- Position Presignal Output (Axis 1) - Refer to chapter 4, Parameter 13
- Crop Cut Output (Axis 1) - Refer to chapter 4, Parameter 22
- Repeat Last Part Output (Axis 1) - Refer to chapter 4, Parameter 22, Spec. Function A1
- Meter Pulse Output (Axis 1) - Refer to chapter 4, Parameter 22, Spec. Function A1
- Position Tolerance Output (Axis 2) - Refer to chapter 4, Parameter 47
- Home Established Output Axis #2 - Refer to chapter 4, Parameter 50
- Position Presignal Output (Axis 2) - Refer to chapter 4, Parameter 53

3.7. Flags (Software Outputs)

The CLM allows for the programming of flags, which are used by the machine builder to assign outputs that are not physically accessible. The number of flags available depends on the type of CLM, standard or expanded. Table 3.1 shows the number of flags available and how they are handled in the CLM software when certain conditions occur.

Flags can be used as markers in the CLM users program. For example, if the machine builder didn't need a hardware output stored in the Position Tolerance A1 parameter, a flag (software output) could be stored, saving the hardware output for something else.

Table 3.1 Output Definitions

Standard CLM	16 Hardware Outputs : 1-16 83 Software Flags : 17-99
Expanded CLM	48 Hardware Outputs : 1-48

	51 Software Flags : 49-99

Outputs and Flags 1 - 72 are cleared (set to 0 volts) when:

- the CLM is powered-up initially, or after a loss of power
- there is a system fault (hardware or program)

Output Flags 73 - 80 are cleared when:

- the CLM is powered-up initially, or after a loss of power
- an E-Stop error occurs, or the CLM is switched to Parameter Mode.

Output Flags 81 - 88 are retained in RAM by battery. They can only be cleared:

- if they are turned ON/OFF in the user program
- if the battery is disconnected or fails

Output Flags 89 - 99 are set in firmware, and the state of these outputs can only be requested within the user program.

89 - 1 indicates Manual mode
90 - 1 indicates Automatic mode
91 - currently not used
92 - currently not used
93 - currently not used
94 - 0 indicates a system fault
95 - currently not used
96 - currently not used
97 - currently not used
98 - currently not used
99 - currently not used

CHAPTER 4. SYSTEM AND AXIS PARAMETERS

Prior to programming and operating the CLM control, the user must enter a set of system and axis-related parameters into the CLM memory. These parameters are used to adapt the mechanical characteristics and define key I/O connections between the CLM and the machine being controlled.

All values for parameters must be known before an application program can be written. If a function is programmed or attempted that would exceed the conditions established by the parameters, the control will halt and a diagnostic error will be displayed.

This chapter contains a complete list of all parameters and their required formats, and the procedure for entering system parameters into the CLM-01.3-M Control. Maintain an accurate list of parameter entries for the system. Appendix D contains work sheets for recording the parameter entries.

Loss of parameter entries from power failure is prevented by a battery backup on the MOK 11 card.

4.1. Parameter Entry

Parameter numbers are assigned as follows:

- Parameters 0 to 39 apply to Axis 1.
- Parameters 40 to 79 apply to Axis 2.
- Parameters 80 to 99 apply to general system requirements.

Before parameters can be entered, the CLM must be placed in Parameter mode, and the Emergency Stop signal must be present. The parameters are checked each time the CLM is powered up, as well as each time parameters are read into CLM memory. If any are incorrect or missing, an appropriate error message is displayed. Upon exit from the parameter mode, if any parameters have been changed, internal buffers that are dependent on parameter values are re-calculated. During that time, the message "Please Wait !" is displayed.

If any entries are incorrect, the error message "Invalid Input (Parameter Description)" appears. In that case, switch back to Parameter mode and press the CL (Clear) key to display the invalid parameter.

Enter or change a Parameter's data by writing over any previous data stored. Once the new data have been entered, press the Store key. If the Store key is not pressed, the data will change back to the previously stored data. After the Store key is pressed, the parameter number displayed will increase to the next parameter. An asterisk (*) appears if the parameter information is incorrect.

There are two ways to view or select the parameter information. One way is by pressing the "+" plus or "-" minus keys, to scroll through them, up or down. The other way is to position the cursor on the parameter number, by pressing the carriage return (CR) key and entering the number of the desired parameter. Press the left or right arrow key to position the cursor as desired. Decimal points are present for those parameters dealing with position.
If you change parameter values, all the program blocks that depend on those parameters are recalculated when you leave the parameter entry mode. The message 'please wait' appears on the display while recalculating takes place.

4.1.1. Initial Display Setup

To ensure the display appears as shown in this manual, set Parameter 82 for the English language:

1. Select Parameter mode.
2. Press the carriage return (CR) key.
3. Press the eight and the two key.
4. Enter 2 or 3 in the first digit and a one in the third digit.
5. The display will appear as follows:

```
Language
P82        2 0 1 0
```

Two Decimal Places
English Language

```
Language
P82        3 0 1 0
```

Three Decimal Places
English Language

4.1.2. Auxiliary Inputs/Outputs

Certain parameters require the selection of auxiliary inputs or auxiliary outputs to be used. The auxiliary numbers used must be selected by the machine builder and shown on the interconnect drawings, where applicable. Each auxiliary output selected should be unique to that parameter.

WARNING: *Auxiliary input and output numbers that have been assigned by the machine builder for a specific purpose must not be changed. Personal injury or damage to the machine/drive train could result from such changes.*

4.2. Input Units

The user specifies most parameter data in terms of input units (IU). A unit is defined by the user, and can be feet, inches, millimeter, degrees, radians, etc. Once the user has chosen the unit of measurement, all position and feed rate data must be in accordance to that unit. For example, the input unit could be specified in inches. The Feed Constant parameter P00 is in inches. The Velocity parameter (P02) is in inches per second. The Acceleration Rate parameter (P04) is in inches per second-squared.

The Feed Constant parameters P00 for Axis 1, and parameter 40 for Axis 2, must be determined before the remaining parameters can be entered. These two parameters define the input units (IU) for movement of each axis.

4.3. CLM-01 Parameter List

A listing of parameters available in the CLM-01.3-M software, Version LM01.3-003.X.

NO.	Description	Axis	NO.	DESCRIPTION	Axis
P00	Feed Constant	1	P40	Feed Constant	2
P01	Encoder Data	1	P41	Encoder Data	2
P02	Velocity	1	P42	Velocity	2
P03	Drive Sensit.	1	P43	Drive Sensit.	2
P04	Accel. Rate	1	P44	Accel. Rate	2
P05	Position Gain	1	P45	Position Gain	2
P06	Direction	1	P46	Direction	2
P07	Position Tol.	1	P47	Position Tol.	2
P08	Homing Setup	1	P48	Homing Setup	2
P09	Homing Offset	1	P49	Homing Offset	2
P10	Homing Setup I/O	1	P50	Homing Setup I/O	2
P11	Min. Travel	1	P51	Min. Travel	2
P12	Max. Travel	1	P52	Max. Travel	2
P13	Pos. Presignal	1	P53	Pos. Presignal	2
P14	Monitoring	1	P54	Monitoring	2
P15	Immediate Stop	1	P55	Special Func.	2
P16	Cut Width	1	P56	Rotary Table	2
P17	Knee Point	1	P57	Knee Point	2
P18	Material Speed	1	P58	Synchr. Diff.	2
P19	Test Mode	1			
P20	Man. Cut-Vector	1			
P21	Length Corr.	1			
P22	Special Funct 1	1			
P23	Crop Cut	1			
P24	Reversing Hold	1			
P25	Restende	1			
P26	Special Funct 2	1			
P38	Feed Constant MW	1			
P39	Enc Lines/Rev MW	1			

NOTE: The following parameters are Not Used (Free)

(P27 through P37)
(P59 through P79)
(P88 through P99)

General System Requirements:

NO.	Description
P80	Serial Inteface
P81	Serial Interface
P82	Language
P83	Memory Display
P84	Start Task 2 & 3
P85	Interrupt Vector
P86	Manual Vector
P87	Variation

4.4. Description of the Parameters

This section describes the purpose of each parameter, and how each is used. In many cases, an example is provided to help you better understand how to interpret what you see displayed on the CLM screen.

NOTE: *The inputs and outputs, as well as any values shown in the description of the parameters, are intended as examples only.*

CAUTION: *When assigning outputs in parameter entry, take care to avoid duplicate assignment of inputs and outputs, which can cause machine malfunctions.*

4.4.1. Parameters for Axis 1

Parameters 0 to 39 apply only to Axis 1.

4.4.1.1. Parameter 00 - Feed Constant Axis 1

```
┌────────────────┐
|Feed Constant A1|
|P00    0001.0000|
└────────────────┘
       ────┬────
           |
           └───── Feed Constant in input units per encoder
                      revolution.
```

The Feed Constant is the ratio of material movement per encoder revolution. The number entered equals the distance the axis will travel per one revolution of the encoder.

The value in this parameter is entered in input units. Input units can be millimeters, centimeters, meters, inches, degrees, etc.

NOTE: *The input units used in the Feed Constant parameter must remain consistent throughout the parameters and program.*

The Feed Constant entry may be entered and displayed using four, or five, decimal places. If the first digit in parameter 82 is a "2," then four decimal places are shown. If the first digit in parameter 82 is a "3," then five decimal places are shown.

The limits are:

Parameter 82 (first digit = 2) = 0000.1000 min., 1000.0000 max.
Parameter 82 (first digit = 3) = 000.01000 min., 100.00000 max.

Some of the common calculations of the Feed Constant are:

$$\text{Ball Screw} = \frac{\text{ball screw lead (units/rev)}}{\text{gear ratio}}$$

$$\text{Rack and Pinion} = \frac{\text{pinion pitch diameter * pi}}{\text{gear ratio}}$$

$$\text{Roll Feed Systems} = \frac{\text{roll diameter * pi}}{\text{gear ratio}}$$

4.4.1.2. Parameter 01 - Encoder Data Axis 1 (Incremental)

```
Encoder Data  A1
P01 00 0000 0000

           Not used
           Line counts per revolution
           00 = Incremental encoder enabled
```

The CLM allows an incremental or absolute encoder to be used. When 00 is programmed in the first two digits, the CLM is set for an incremental encoder on axis 1. (See also 4.4.1.3)

The next four digits specify the number of line counts from the incremental encoder, per revolution, which is used in several different computations related to positioning.

The last four digits are not used when an incremental encoder is enabled. In that case, enter four zeros.

The information for this entry is provided on the motor data plate and/or the incremental encoder itself.

The incremental encoder entry has the following limits:

0100 minimum
5000 maximum

Example:

```
Encoder Data  A1
P01 00 1250 0000

           1250 Lines per revolution
           Incremental encoder enabled
```

4.4.1.3. Parameter 01 - Encoder Data Axis 1 (Absolute)

```
┌─────────────────┐
│Encoder Data   A1│
│P01 21 1024 0256 │
└─────────────────┘
     ┌─  ┌───  ┌───
     │   │     └──── Number of revolutions
     │   │
     │   └────────── Resolution of encoder: In steps per 360
     │               degrees revolution of encoder
     │
     └──── 12 = Single-turn absolute encoder with 12 bits
           21 = Multi-turn absolute encoder with 21 bits
           24 = Multi-turn absolute encoder with 24 bits
```

The CLM allows an incremental or absolute encoder to be used. This parameter specifies the type of absolute encoder device used for Axis 1. (See also 4.4.1.2)

The first two digits select the type of absolute encoder being used with the CLM. The CLM will accept three types of absolute encoders. These three types are 12 bit single-turn, 21 bit multi-turn, and 24 bit multi-turn.

The next four digits specify the resolution of the absolute encoder. The resolution is the number of pulses (bit count) per revolution of the encoder.

The last four digits specify the number of revolutions of the encoder for the entire set of data. The number of revolutions is the maximum the absolute encoder will turn before it either physically stops or causes an error by exceeding its range.

The resolution and the number of revolutions must be an even power of 2. The maximum number for the resolution and the number of revolutions is 4096. The information for this entry is provided on the encoder data plate.

Example:

```
┌──────────────────┐
│Encoder Data    A1│
│P01 24 1024 1024  │
└──────────────────┘

     ┌─  ┌───  ┌───
     │   │     └──── 1024 = Number of revolutions
     │   │
     │   └────────── 1024 = Resolution of encoder
     │
     └──────────────24 = Multi-turn absolute encoder with 24 bits
```

4.4.1.4. Parameter 02 - Velocity Axis 1

```
┌──────────────────┐
│Velocity  Axis 1  │
│P02 000050.00 10  │
└──────────────────┘

     ┌────────  ┌─
     │          └─ Jog Velocity: Percentage of max. velocity.
     │
     └──────────── Max. velocity for axis 1 (Input Units/Sec).
```

The first eight digits specifies the maximum velocity for axis 1 in input units per second. The input units are defined in parameter 00 (Feed Constant).

The maximum velocity depends on the Feed Constant (P00) and Drive Input Sensitvity (P03). The CLM will output a command voltage in the positive or negative direction, and at a certain speed, depending on the desired direction and command voltage. The maximum command voltage and the maximum RPM of the motor are defined in the Drive Input Sensitivity parameter (P03). The velocity parameter does not have to be set to maximum. If a slower RPM is desired, calculate the parameter for that RPM.

The last two digits specify the jog velocity for axis 1. The jog velocity is a percentage of maximum velocity.

A formula for calculating maximum velocity:

$$\text{Max. Velocity (Input Units/Sec.)} = \frac{\text{Max. RPM (P03) X Feed Constant (P00)}}{60}$$

Example:

Drive Input Sensitivity (P03) = 1500 RPM at 10V

Feed Constant (P00) = 3.1416 Input Units/Revolution

$$\text{Max. Velocity} = \frac{\text{1500 RPM X 3.1416 Input Units/Rev.}}{60} = \text{78.54 Input Units/sec.}$$

```
Velocity  Axis 1
P03 000078.54 10
```

```
10 = Jog Velocity (10% = 150 RPM)
78.54 = Max. Velocity (1500 RPM)
```

The velocity (axis 1) parameter entry is entered and displayed to two or three decimal places, depending on the first digit in parameter 82. The limits are as follows:

Parameter 82 (first digit = 2) = 000000.10 min., 005000.00 max.

Parameter 82 (first digit = 3) = 00000.100 min., 05000.000 max.

4.4.1.5. Parameter 03 - Drive Input Sensitivity Axis 1

```
┌────────────────┐
│Drive Sensit. A1│
│P03    3000 10.0│
└────────────────┘
        ┌───  ┌───
        │     │
        │     │
        │     └──── Command voltage for maximum motor RPM.
        │
        └────────── Maximum motor RPM for the specified command
                       voltage.
```

This parameter defines the sensitivity of the motor RPM to the drive voltage for axis 1.

The first four digits specify the maximum RPM of the motor. When the command voltage is at maximum, the motor will operate at this RPM. The entry range for maximum RPM is:

0001 minimum
9999 maximum

The last three digits specify the command voltage for maximum RPM. The entry range for command voltage is:

05.0 minimum
10.0 maximum

The information for this parameter can be found on the amplifier's personality module for the drive system (motor, amplifier, etc.). Refer to the manual for the amplifier being used (TDM, KDS, etc.). The CLM uses the differential command input of E1/E2, also found in the manual for the specific drive system.

Example:

```
┌────────────────┐
│Drive Sensit. A1│
│P03    1500 10.0│
└────────────────┘
       ┌────  ┌───
       │      └─── 10 Volts command
       │
       └────────── 1500 maximum RPM
```

When the CLM is commanded to operate at maximum RPM, the CLM outputs 10 volts from connector X5-pin 5 (A1), referenced to connector X5-pin 6 (0V). The 10 volt output will go to the E1/E2 input of the drive, causing the motor to operate at 1500 RPM.

4.4.1.6. Parameter 04 - Acceleration Axis 1

```
Accel. Rate   A1
P04     00386.00
```

Axis 1 accelerates and decelerates at this specified rate (input unit per second^2).

The acceleration parameter defines the rate at which the drive can accelerate, from a zero holding state to a desired speed. This parameter also defines rate at which the drive can decelerate, from a desired speed to a zero holding state.

This parameter provides protection for the machinery, by limiting the amount of torque produced during speed changes. The drive system must be capable of accelerating at the rate specified here, or an error message occurs during the speed change.

The parameter value is specified in input units/ second^2 (units/second/second).

Example:

To program the machine in the force of 1G, assuming your input units are programmed in inches:

1G = 32.160 feet/second^2

Convert to inches, (input units, inches used in this example)

32.160 X 12 = 385.92 inches/second^2

```
Accel. Rate   A1
P04      0385.92
```

385.92 inches/second^2

The number of decimal places, two or three, in the acceleration rate parameter entry is set in the first digit of parameter 82.

4.4.1.7. Parameter 05 - Position Gain, Axis 1

```
┌────────────────┐
│Position Gain A1│
│P05  1.000 1.000│
└────────────────┘
     ──┬──  ──┬──
       │      │
       │      └── Position Gain Factor for Deceleration
       │
       │
       └──────── Position Gain Factor for Acceleration
```

This parameter specifies the position gain of the closed loop positioning control. The proper setting of the position loop gain is essential for the optimum performance of the drive system.

The position gain, axis 1, parameter has the following limits:

minimum 0.500
maximum 1.999

Position Gain is expressed in terms of commanded velocity per .001 units of position error. The position control commands a given velocity (input units/second) per each thousandth (input unit) of position error detected by the control.

There is no established setting for this parameter, because of the many variables that influence the proper gain, such as load interia, friction, motor dynamics and velocity.

However, it is recommended that the user begin with a small number and increase the numeric entry until optimum performance is achieved. The higher the gain the smaller the following error. Position Gain is tuned to achieve the desired performance, without system overshoot or oscillation. Refer to chapter 6, Installation, for more information on tuning the position gain.

A position loop gain setting that is too low results in sluggish operation. Too high a setting causes the system to oscillate.

WARNING: *If the gain is set excessively high, the motor could begin oscillating when power is applied. This condition could result in damage to the machine and/or personal injury.*

NOTE: *Before setting the position gain, make sure the acceleration rate is set correctly for the particular application. Refer to Parameter 04*

4.4.1.8. Parameter 06 - Direction, Axis 1

```
┌────────────────┐
│Direction Axis 1│
│P06        0 0 0│
└────────────────┘
           ┬ ┬ ┬
           │ │ └─ 0 = Motor direction remains unchanged.
           │ │    1 = Motor direction is reversed.
           │ │
           │ └─── 0 = Measuring wheel encoder direction
           │          remains unchanged.
           │      1 = Measuring wheel encoder direction is
           │          reversed.
           │
           └───── 0 = Analog output polarity remains
                      unchanged.
                  1 = Analog output polarity is reversed.
```

The direction parameter allows changing the axis 1 direction of rotation, eliminating the need to make wiring changes for direction and polarity.

WARNING: *Drive Runaway conditions can occur if the phase relationship between motor direction and the analog output polarity is incorrect. This incorrect phase relationship may result in unexpected motor direction movement, which could result in machine damage and/or physical injury.*

To avoid this condition, disconnect the load from the motor when powering up the system. The load can be reconnected once the motor operation and direction are verified.

When a CLM system is powered up, a "Drive Runaway A1" error may occur. The "Drive Runaway A1" error may mean the analog output polarity or the motor encoder are going in opposite directions.

The error may be corrected by changing the condition of the analog output polarity. If the "Drive Runaway A1" error still occurs, consult Diagnostics, chapter 8.

When the CLM system is powered up, the motor may rotate opposite to the desired direction. To correct the problem, change the condition of the motor encoder direction. The motor should then operate in the proper direction.

4.4.1.9. Parameter 07 - Position Tolerance, Axis 1

```
┌────────────────┐
│Position Tol. A1│
│P07   15 0000.05│
└────────────────┘
       ┌─ ───┬───
       │     │
       │     │
       │     └─── Position tolerance (input units) to two or
       │          three decimal places.
       │
       └────── Auxiliary Output to be turned on when axis 1 is
               synchronized with the material, or axis is in
               Position.
```

The position tolerance parameter defines the position window within which the CLM will consider axis 1 synchronized with the material or in position. Adjusting the position tolerance tells the CLM when to read the next command line. Meaning, when axis 1 synchronizes with the material and the synchronization between the axis and the material reached the position tolerance window, the CLM will then read the next program command line.

The first two digits specify the auxiliary output number that turns on when either of these two conditions occur. This output can be used to turn on a light, buzzer, etc.

NOTE: *The auxiliary output number is assigned by the machine builder. This output can only be used for the (Axis 1) Position Tolerance parameter and may not be used in any other parameters.*

Any auxiliary output that is assigned in parameter should only be used for that parameter, and should not be used in the CLM program or in any other parameter, as problems will result. Using the same output for Axis 1 as for Axis 2 will cause serious problems.

The next six digits specify the desired position tolerance window. This window is sometimes called the switching threshold, and is entered in input units.

Example:

```
┌────────────────┐
|Position Tol. A1|
|P07   15 0000.05|
└────────────────┘

       ┌─  ───┬───
       |      └──── .05 input units
       |
       └─────────── Auxiliary output 15
```

When axis 1 is within .05 input units of commanded position, auxiliary output 15 will turn on.

The position tolerance parameter entry is to two or three decimal places, depending on the first digit in parameter 82.

4.4.1.10. Parameter 08 - Homing Setup, Axis 1

```
┌────────────────┐
|Homing Setup  A1|
|P08         0 00|
└────────────────┘

            ┬ ┌─
            | └── Search velocity in percentage of maximum
            |     velocity (Home Command Input Only).
            |
            └──── 0 = Homing by jogging reverse
                  1 = Homing by the homing command input.
                  2 = Homing by jogging forward or reverse.
```

The Homing Setup parameter defines the type of homing routine and the speed of the homing motion. Axis 1 must be homed before switching from Manual mode to Automatic mode. For absolute positioning of axis #1 with an incremental encoder, a homing routine is necessary to establish a reference point. Axis #1 can be homed one of three ways, as selected in Homing Setup, parameter 08.

Homing by jogging in the reverse direction:

When the first digit is a zero, the homing routine is completed by jogging axis 1 in the reverse direction towards the home switch. When the switch is reached, axis 1 stops and the position is set to zero. If the homing offset parameter (P09) is programmed, axis 1 is jogged in the reverse direction, at jog velocity, to the offset distance. The axis then stops, and the "Home Established" and the "At Home" outputs (Homing Setup P10) turn on.

Homing by the home command input:

When the first digit is a one, the homing routine is initiated by pressing a button wired to an auxiliary input. This auxiliary input is assigned by the machine builder in the Homing Setup Axis 1, parameter (P10). When it is applied, axis 1 will run the following homing routine.

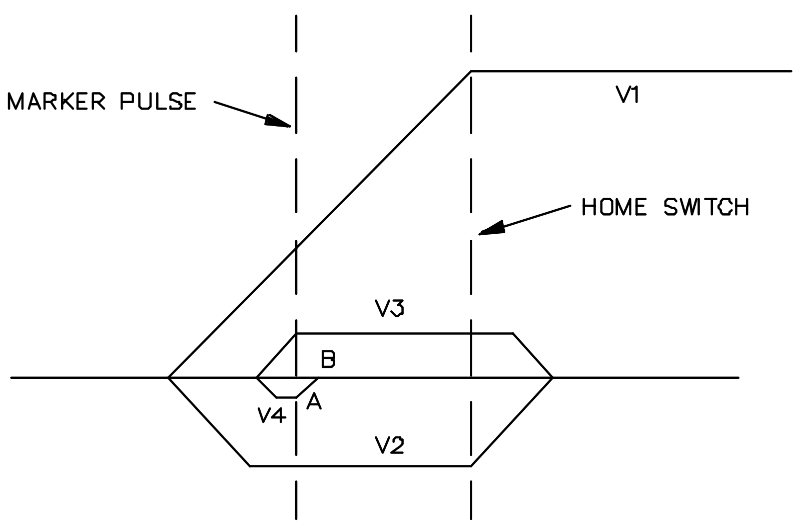


Figure 4.1 Homing Routine

1. When the Homing Command Input is issued (in Manual mode) the axis moves toward the home switch at the home velocity V1, set in the Homing Setup, parameter 08, unless axis 1 is already on the switch.

2. When the home switch closes, axis 1 will decelerate to a stop, reversing direction and moving off the switch at 25 percent of the home velocity V2, until the switch opens.

3. The axis then moves toward the switch at velocity V3 (5000 pulses/sec) until the CLM senses closure of the home switch and the next occurrence of the marker pulse.

NOTE: *When the home switch closes, the home switch must remain closed until the marker pulse has occurred. If the home switch opens or no marker pulse occurs within one revolution, the error "No Marker Pulse 1" will occur. The home switch cam must be at least as long as the reverse travel distance from the home switch.*

4. When the marker pulse is sensed, the axis decelerates to a stop, then returns towards the marker pulse at velocity V4 (500 pulses/sec). The CLM records the next occurrence of the marker pulse as the reference position (a) and ramps to a stop (b) where it will remain until the next command.

5. At that point (b) the "Home Established" and "At Home" outputs (Homing Setup A1, P10) turn on, indicating that axis 1 homing is complete.

NOTES: *After axis 1 has been homed, and if the homing offset parameter (P09) is programmed, axis 1 will travel in the reverse direction at maximum velocity to the offset distance. The axis then stops and the "Home Established" and the "At Home" output (Homing Setup A1, P10) turn on.*

If the Home Switch Closure is within 1/16 of a motor revolution, with respect to the marker pulse, the CLM will not complete the homing procedure and will issue the error "Marker Pulse 1 ?". As a rule of thumb, the Home Switch should be moved a distance of about 1/3 of the axis 1 feed constant.

Homing by jogging forward or reverse:

When the first digit is a two, the homing procedure can be completed by jogging axis 1 in the reverse direction towards the home switch. When the home switch is reached, axis 1 will stop and the position is set to zero. If the homing offset parameter (P09) is programmed, axis 1 is jogged in the reverse direction, at jog velocity to the offset distance. The axis then stops and the "Home Established" and "At Home" outputs (Homing Setup A1, P10) turn on.

Homing can also be accomplished by jogging axis 1 in the forward direction. When the home switch is applied, jogging axis 1 forward off the home switch will result in homing the axis. If the homing offset parameter (P09) is programmed, the offset distance is set as the absolute position and the "Home Established" and "At Home" outputs (Homing Setup A1 P10) will turn on.

4.4.1.11. Parameter 09 - Homing Offset Axis 1

```
Homing Offset A1
P09      00000.00
```

Homing offset distance in input units (only in the reverse direction)

In many cases, some position other than the home position, such as the center-line of the slide, is used as the reference position. This parameter defines the distance from the home switch that you want to use as the reference position. When the home switch is reached, axis 1 travels in the reverse direction to this homing offset distance.

The homing offset distance accepts two or three decimal places, depending on the first digit in parameter 82.

4.4.1.12. Parameter 10 - Homing Setup Input/Output, Axis 1

```
Hom Setup I/O A1
P10      01 05 03
```

- 03: Auxiliary output number to be used for the "Home Established" output.
- 05: Auxiliary input number to be used for homing command input.
- 01: Auxiliary output number to be used for the "At Home" output.

This parameter specifies an auxiliary input and two auxiliary outputs used for the homing routine.

The first two digits specify an auxiliary output that will turn on after axis 1 is homed. This output will turn off when axis moves away from the home position. When the axis returns back to home the output will turn on again. This auxiliary output is assigned by the machine builder. If 00 is entered, the "At Home" output is not used.

The next two digits specify an auxiliary input to perform the homing routine. The homing-by-home-command input is selected in parameter 08, Homing Setup. This auxiliary input is defined by the machine builder. If 00 is entered, the home command input is not used. If the homing by home command input is selected in parameter 08 and auxiliary input is not selected, the error "Invalid Input Homing Setup I/O A1" will occur. If absolute encoders are used, axis 1 must be on the home switch before changing from Manual to Automatic mode.

The last two digits specify an auxiliary output that will turn on when home is established. The "Home Established" output will remain on until an error occurs or the CLM power is turned off. If 00 is entered, the "Home Established" output is not used.

4.4.1.13. Parameter 11 - Minimum Travel Limit, Axis 1

```
┌────────────────┐
│Min Travel    A1│
│P11   -000000.00│
└────────────────┘
      ──────────
           └───── Minimum travel limit in input units.
```

This parameter specifies the travel limit value in the negative direction, with reference to the home switch. The limit is effective only after axis 1 has been homed.

In the manual mode, the corresponding jog key is disabled when this position has been reached. If, in the Automatic mode, the commanded position is smaller than this limit value, the following error message will be displayed "Error Minimum Travel Limit 1".

The travel limit value is measured from the home switch, and is not added to, or subtracted from, the offset distance.

The minimum travel limit entry accepts two or three decimal places, depending on the first digit in parameter 82.

4.4.1.14. Parameter 12 - Maximum Travel Limit, Axis 1

```
┌───────────────┐
│Max Travel   A1│
│P12   +000000.00│
└───────────────┘
       ─────────
           │
           │
           └────── Maximum travel limit in input units.
```

This parameter specifies the travel limit value in the positive direction, in reference to the home switch. The limit is effective only after the axis 1 has been homed.

In the Manual mode, the corresponding jog input is disabled when this position has been reached. If, in the automatic mode, the commanded position is smaller than this limit value, the message "Error Maximum Travel Limit 1" is displayed.

The travel limit value is measured from the home switch, and is not added to, or subtracted from, the offset distance.

The maximum travel limit accepts two or three decimal places, depending on the first digit in parameter 82.

4.4.1.15. Parameter 13 - Position Presignal, Axis 1

```
┌───────────────┐
│Pos Presignal A1│
│P13 00 00 0000.0│
└───────────────┘
     ┌─  ┌─  ┌─────
     │   │   │
     │   │   └──── Measuring wheel distance in input units
     │   │
     │   └──────── Time in 0.1 seconds (0.1-9.9 in 0.1 increments)
     │
     └──────────── Auxiliary output to be turned on
                   (00 = not activated)
```

The Position Presignal feature is used to turn on an auxiliary output at a specified measuring wheel distance.

The first two digits specify an auxiliary output to be turned on. This output will turn on after the position presignal distance is reached.

The next two digits specify the amount of time the auxiliary output will remain on. The output remains on until the carriage begins to decelerate and return to the home position.

The last four digits specify the measuring wheel distance in input units. The auxiliary output turns on after this distance has been measured.

NOTE: *The distance entered in this parameter is relative to the measuring wheel distance. The auxiliary output will turn on when the measuring wheel distance has reached this position.*

The position presignal distance parameter entry is to one or two decimal places, depending on the first digit in parameter 82. If the first digit in parameter 82 is a two then, one decimal place is shown. If the first digit in parameter 82 is a three, then two decimal places are shown.

Example:

```
┌────────────────┐
│Pos Presignal A1│
│P13 17 01 0025.0│
└────────────────┘
```

Auxiliary output #17 turns on for 0.1 seconds after the measuring wheel distance has reached 25 input units.

4.4.1.16. Parameter 14 - Monitoring, Axis 1

```
┌────────────────┐
│Monitoring    A1│
│P14        0 0 0│
└────────────────┘
            ┌ ┬ ┬
            │ │ │
            │ │ └ Not Used
            │ │
            │ └── Not Used
            │
            └──── 0 = Position Feedback Monitoring On
                  1 = Position Feedback Monitoring Off
```

This parameter turns the monitoring of the motor's position feedback on or off. The first digit must always be set to zero, so that the CLM continuously monitors the motor for drive runaway and excessive position lag conditions.

WARNING: *The first digit MUST BE SET TO ZERO to prevent physical injury to personnel and/or machine damage.*

The "Drive Runaway" error occurs if the actual position of the encoder exceeds the expected position by 10%. The "Excessive Pos Lag" error occurs if the actual position of the encoder is less than the position expected by 10%.

Refer to chapter 8, Diagnostics for more information about Drive Runaway and Excessive Position Lag errors and how to solve them.

4.4.1.17. Parameter 15 - Immediate Stop, Axis 1

```
┌────────────────┐
│Immediate Stop 1│
│P15 000 00000.00│
└────────────────┘
    ─┬─ ───┬────
     │     │
     │     └─── Maximum Stroke Limit in input units (IU)
     │
     │
     └───────── Starting Block Number
```

This parameter specifies how the carriage will stop during a synchronized movement. This parameter works with the Immediate Stop input (Connector X3, Pin 5). When +24V is applied to the Immediate Stop input, the CLM program is immediately interrupted and another program is processed. The first three digits are the starting block number for the Immediate Stop program, which can be used to quickly remove tooling from the material. This program must be terminated with a EOS command (refer to chapter 5).

As long as the Immediate Stop program is being processed, the carriage will remain synchronized with the material. When the Immediate Stop program is completed, the carriage will ramp immediately to zero volts, turn all outputs off, and issue an "Immediate Stop" error on the CLM display.

The last five digits are the maximum stroke limit. This limit is programmed in input units (IU). This maximum stroke limit is equal to the Minimum Stroke distance the carriage travels subtracted from the Max. Travel value in parameter 12. If a maximum stroke limit distance is programmed and that distance is exceeded, a "Maximum Stroke" error is displayed and the carriage is immediately stopped.

If all zeros are entered, the maximum stroke limit is not enabled.

If a starting block number and maximum stroke limit are entered, the Immediate Stop program is processed whenever the maximum stroke is exceeded. When the Immediate Stop program is complete, the carriage will ramp immediately to zero volts, turn all outputs off, and issue a "Maximum Stroke" error on the CLM display.

If no starting block number and no maximum stroke limit is programmed and the Immediate Stop input is applied, the carriage will immediately ramp to zero volts, turn all outputs off, and issue an "Immediate Stop" error on the CLM display.

The maximum stroke limit parameter entry accepts two or three decimal places, depending on the first digit in parameter 82.

4.4.1.18. Parameter 16 - Cut Width, Axis 1

```
┌────────────────┐
│Cut Width     A1│
│P16        00.00│
└────────────────┘
            ┌────
            │
            │
            └───── Cut width in input units
```

If the material is sawed, the actual part length is shortened by the width of the saw cut. Loss of material length may also occur when the material is sheared. In order to obtain the correct part length, the saw width is added to the part length in the commands LML and LMD. The cut width is not processed in the LMR command.

The cut width parameter entry accepts two or three decimal places, depending on the first digit in parameter 82.

4.4.1.19. Parameter 17 - Second Position Gain, Axis 1

```
┌────────────────┐
│Knee Point    A1│
│P17  00.00 00.00│
└────────────────┘
     ──┬── ──┬──
       │     │
       │     └─── Second Position Gain in input units
       │
       │
       └────────── Knee Point Distance in input units (IU)
```

This parameter is used to reduce the synchronization time between the carriage and the material. The position gain parameter (P05) can be increased before actually achieving synchronization. The second position gain is useful when short parts are being produced and minimum carriage travel is desired. This second position is also referred to as the "knee point."

The first four digits specify the knee point distance. During the beginning of synchronization, the following error will be larger than the knee point distance and the Position gain P05 will be in effect. When the following error becomes less than knee point distance, the second position gain takes effect for the remaining portion of the synchronized move.

If four zeros are entered for the knee point distance, this parameter is turned off.

The knee point parameter entry accepts two or three decimal places, depending on the first digit in parameter 82.

4.4.1.20. Parameter 18 - Material Speed, Axis 1

```
┌────────────────┐
│Material Speed  │
│P18        0 00.0│
└────────────────┘
          ┌ ┌───
          │ │
          │ └─── Voltage at Maximum Material Speed
          │
          │
          └───── 0 = Voltage Output Disabled.
```

1 = Voltage Output for Material Speed Enabled.

This parameter makes it possible for an external device to be connected to the CLM, for the purpose of indicating the material line speed. The device receives a voltage output from the CLM.

The first parameter digit enables the voltage output to the material speed function. The voltage output comes from analog output A2 (connector X5, pin 8), referenced to zero volts (connector X5, pin 9).

The last three digits specify the voltage at maximum material speed. The voltage value is then scaled according to the material speed. This function is enabled in automatic mode only.

CAUTION: *The Material Speed parameter (P18) can only be used in single axis applications. If the CLM-LM is used as a two-axis control the Material Speed parameter (P18) cannot be used, because the second axis uses the analog output A2. If the Material Speed parameter (P18) and the second axis are enabled, an "Invalid Input Material Speed" error will occur.*

4.4.1.21. Parameter 19 - Test Mode, Axis 1

```
Testmode        A1
P19              0
```

```
0 = Automatic mode
1 = Test mode on
```

This parameter allows the Automatic mode to be simulated by selecting the Test mode function. The Test mode is selected when a "1" is entered. Test mode simulates the operation of the flying cutoff carriage, using the values in the system parameters and program blocks to simulate the cutoff operation. In Test mode, material feed is simulated by the internal clock generator of the CLM.

To test the system, Test mode must be enabled and the carriage must be homed. The system is then switched into Automatic mode at the user panel.

Press the up-arrow key on the CLM keypad until the Material Speed screen appears.

```
Material Speed
    +00000000
```

The material speed can be simulated by pressing the "+" (plus) or "-" (minus) key to increase or decrease the material speed. The material speed will increase to the velocity programmed in the Velocity Axis 1 parameter (P02). The material speed number is programmed in input units per second (IU/s).

The velocity of the material can be set to zero immediately by pressing the CL clear key.

If a zero is entered for this parameter, the CLM will operate in Automatic mode.

4.4.1.22. Parameter 20 - Manual Cut Vector, Axis 1

```
┌────────────────┐
│Man. Cut-Vector │
│P20          000│
└────────────────┘
             ┌─
             │
             └─ Starting Block Number for a Manual Cut Program
```

The Manual Cut-Vector program is used to cycle the shear or saw in Manual mode, and should be separate from the Automatic program. This parameter specifies a starting block number for the Manual Cut-Vector program which will process only in Manual mode. The program starts running when +24 volts is applied to the Crop Cut input; the program must end with an RTS command.

4.4.1.23. Parameter 21 - Length Correction, Axis 1

```
┌────────────────┐
│Length Corr.  A1│
│P21         0 00│
└────────────────┘
            ┌ ┌─
            │ │
            │ └─ 00 = Length Correction Disabled
            │    01 = Length Correction Enabled
            │
            └─── 0 = Index Length Disabled
                 1 = Index Length Enabled
```

This parameter allows two functions to occur, index length and length correction. The length correction parameter applies to the LML command only.

NOTE: *For this parameter to operate properly, the Length Measurement must be enabled, using the FUN command in the user program.*

The first digit enables the index length. When the CLM is powered up, with Manual mode selected and index length enabled, the material that has been passed under the measuring wheel is subtracted from the part length in the LML command to be processed. If the index length is disabled, the material that has passed under the measuring wheel is not subtracted from the LML command. If the material that passed under the measuring wheel is greater than the part length in the LML command, the "Error Index Length" error occurs. This error will occur when switching from Manual to Automatic mode.

Example:

```
Position Lag        |L S 1A+000080.00|
Display Screen      |012 2 +000000.00|
```

For this example, 20 inches of material has passed under the measuring wheel. The part length in the LML command is 100 inches. The carriage is homed and Automatic mode is selected. When switching from Manual to Automatic mode, the distance traveled under the measuring wheel is subtracted from the LML command. The position lag screen displays 80 inches of part length left to travel before the carriage will synchronize and process the part.

The last two digits are for the length correction feature. If length correction is enabled, the current part length in the LML command can be changed at any time. The part length can be changed by typing the new part length, in the current LML command block being processed, via the keypad of the CLM. Also, the new part length can be transmitted to the current LML command block in the CLM, via the serial communication port.

If the new part length is greater than the current part length being processed, then the difference between the new part length and the current part length is added to the current part length being processed.

Example:

The current part length in the LML command is 100 inches, but 50 inches has already passed through the measuring wheel.

```
Position Lag       ┌─────────────────┐
Display Screen     │L S 1A+000050.00│
                   │012 2 +000000.00│
                   └─────────────────┘

          Measuring Wheel Length
          Remaining To Be Traveled = 50 inches
```

If the new part length entered is 300 inches, then the new part length subtracted from the current part length of 100 inches is 200 inches. 200 inches is immediately added to the measuring wheel length remaining to be traveled. The measuring wheel length remaining to be traveled is 250 inches (shown below).

```
Position Lag       ┌─────────────────┐
Display Screen     │L S 1A+000250.00│
                   │012 2 +000000.00│
                   └─────────────────┘

          Measuring Wheel Length
          Remaining To Be Traveled = 250 inches
```

If the new part length is less than the current part length being processed, then current part length will be processed. The new part length is processed after the current part length is processed. If the length correction is disabled, the part length entered will be processed the next time the LML is read in the CLM.

NOTE: *When the length correction and the index length are used, the FUN command with length measurement enabled with Status 30 can be used to view this information. For more information, refer to the FUN command in chapter 4, and Status 30 in chapter 7.*

4.4.1.24. Parameter 22 - Special Function 1, Axis 1

```
┌─────────────────┐
│Spec. Func. 1 A1│
│P22  00 00 00 00│
└─────────────────┘
      ┌─  ┌─  ┌─  ┌─
      │   │   │   │
      │   │   │   └─ Meter Pulse Output
      │   │   │
      │   │   └───── Repeat Last Part Output
      │   │
      │   └───────── Repeat Last Part Input
      │
      └───────────── Crop Cut Output
```

This parameter has four special functions for axis 1 only. The four special functions are crop cut output, repeat last part input, repeat last part output, and the meter pulse output.
These inputs and outputs are assigned by the machine builder.

NOTE: *Zeros must be entered for any output that will not be used.*

The first two digits specify an auxiliary output to be turned on when the crop cut system input (CLM connector X3, pin 11) is turned on. Also, if the crop cut parameter (parameter 23) is enabled, this auxiliary output will also turn on. This output remains on until the carriage begins to decelerate and return to the home position. The auxiliary output is used to tell the operator that this is a bad part. When the STZ command is used as the part counter and the crop cut input is activated (either by system input or parameter), the part counter will not advance.

The second pair of digits specifies an auxiliary input to be used to repeat the last part processed. When the repeat last part input is applied, the last part length read by the CLM will be processed.

The third pair of digits specify an auxiliary output to be used as the repeat last part output. This output will turn on when the "repeat last part" length input is applied. The repeat last part output remains on until the carriage begins to decelerate and return to the home position. When the STZ command is used as the part counter and the repeat last part input is activated, the part counter will not advance.

The last two digits specify an auxiliary output to be turned on after one meter of material has passed the measuring wheel. The meter pulse output is a 100-millisecond pulse which occurs for each meter of material that passes under the measuring wheel. This function is only enabled in Automatic mode.

4.4.1.25. Parameter 23 - Crop Cut, Axis 1

```
┌─────────────────┐
│Cropcut        A1│
│P23 00 0 0000.00 │
└─────────────────┘
    ┌─  ┌  ───┬───
    │   │     │
    │   │     └──── Crop Cut Distance in input units
    │   │
    │   └────────── 0 = No Crop Cut (When switching from Manual to
    │                                Automatic mode)
    │               1 = Crop Cut (When switching from Manual to
    │                             Automatic mode)
    │
    └────────────── Crop Cut Input (Auxiliary input)
```

This parameter specifies an auxiliary input used to initiate a crop cut. The crop cut parameter is valid for Automatic and Test modes only. This auxiliary input is selected by the machine builder. The crop cut parameter performs the same function as the crop cut system input (CLM connector X3, pin 11), with the addition of some special features which are described below. Refer to chapter 3 for more information about the crop cut system input.

The first two digits specify the auxiliary input to be used to perform the crop cut function. When this crop cut input is turned on, the crop cut distance stored in this parameter will be measured by the measuring wheel. When that distance (entered in the last six digits) is reached, the carriage will synchronize and cut the material.

The crop cut distance accepts two or three decimal places, depending on the first digit in parameter 82.

NOTE: *The crop cut is initiated by a low-to-high transition at the crop cut input. The carriage must be at the home position to perform the crop cut. The crop cut input is ignored if input is initiated after the carriage has begun to process a part.*

The single digit specifies whether a crop cut will or will not be initiated when switching from Manual to Automatic mode.

4.4.1.26. Parameter 24 - Reversing Hold, Axis 1

```
┌───────────────────┐
│Reversing hold     │
│P24 00 0 00000.0   │
└───────────────────┘

     ┌─  ┌  ───┬────
     │   │     │
     │   │     └────  Carriage Position in input units
     │   │                (Currently being developed)
     │   │
     │   └──────────  Reversing Hold Input Transition
     │                    (Currently being developed)
     │
     └──────────────  Reversing Hold Input
```

This parameter specifies an auxiliary input to be used to perform a reversing hold. The reversing hold parameter commands the carriage to decelerate to a stop and wait for an input to return home. The reversing hold input is an auxiliary input, selected by the machine builder.

The first two digits specify the auxiliary input used for the reversing hold input. When the carriage synchronizes and processes a part, the CLM program will return to a EOS (End Of Synchronization) command. When the EOS command is read by the CLM, the status of the reversing hold input is checked. If the reversing hold input is on, the carriage will return to home immediately.

If the reversing hold input is off, the carriage will decelerate to a stop and wait for a high to low transition at the reversing hold input. When the reversing hold input is applied, the carriage returns to the home position. Refer to chapter 5 for more information about the EOS command.

WARNING: *The carriage must always return to the home position. If the reversing hold input is on too long, the CLM will cause the carriage, to process another part without returning to the home position. This might damage the carriage or machine. The customer should make sure the maximum and minimum overtravel limit switches are install and work properly.*

The reversing hold input transition and the reversing hold distance are currently being developed.

4.4.1.27. Parameter 25 - Tail Out, Axis 1

```
┌─────────────────┐
│Restende       A1│
│P25  00 00 00 00 │
└─────────────────┘

      ┌─  ┌─  ┌─  ┌─
      │   │   │   │
      │   │   │   └─  Remainder > Maximum Part Length Output
      │   │   │       (LML command in program block 981)
      │   │   │
      │   │   └─────  Remainder < Maximum Part Length Output
      │   │           (LML command in program block 981)
      │   │
      │   └─────────  Remainder < Minimum Part Length Output
      │               (LML command in program block 982)
      │
      └─────────────  Tail Out Input
```

NOTE: *The following description is informational only. The parameter is currently under development. Consult Indramat Applications Engineering for additional information on the status of this parameter.*

The "Restende" (remainder) parameter is used to process the remaining material in the machine when the material coil runs out. The tail out input is acknowledged by a high-to-low transition. When the tail out is acknowledged, the CLM will evaluate the material still in the machine and select how it will be processed. The CLM will turn on auxiliary outputs, specified in this parameter, to let the operator know how much material is left. The tail out input is supported with the LMD and LML command only.

Setting Up The Tail Out Parameter:

1. The distance is measured between the tail out input and the home position of the carriage. This distance is entered in an LML command in block 980.

2. The maximum length the machine can process must be entered in an LML command in block 981.

3. The minimum length the machine can process must be entered in an LML command in block 982.

If there is a high-to-low transition on the end of material input, the CLM determines how much material is left and decides if the part length can be processed. If the part length can be processed, the minimum and maximum lengths are ignored and the part length is processed properly.

If the part length cannot be properly processed, the remaining material length will be processed into parts. These part lengths are determined by taking the minimum length divided by two. Once the remaining material is processed, an internal cut inhibit is initiated. The operator will then begin the next material to be processed by pressing the crop cut system input (CLM connector X3, Pin 11) or the crop cut auxiliary input. The crop cut auxiliary input is defined in parameter 23.

4.4.1.28. Parameter 26 - Special Function 2, Axis 1

```
┌────────────────┐
│Spec. Func. 2 A1│
│P26  0 01.000 00│
└────────────────┘
      ┌ ───┬─── ┌─
      │    │    │
      │    │    └─ Start At Program Block 000 Input
      │    │
      │    └────── Material Speed Multiplication Factor
      │
      │
      └─────────── Type of Length Overall Display
                    0 = Production Length
                    1 = Material Length
```

This parameter specifies a multiplication factor for the material speed display screen, and the auxiliary input to be used for starting the CLM user program over from block 000.

The first digit determines how the Length Overall that has passed under the measuring wheel will be displayed. If Production Length display is enabled and the Cut Inhibit input is pressed in Automatic mode, then the material under the measuring wheel is not added to the Length Overall display.

If the Material Length display is enabled and is used in Manual or Automatic mode, then the material passing under the measuring wheel is alway counted and displayed on the Length Overall display, even if the Cut Inhibit input (button) is pressed.

The next five digits specify a multiplication factor for the material speed display screen. The velocity parameter is entered in input units/second. The material speed screen is also in input units/second. However, it is sometimes desirable to have the material speed display screen shown in different input units/second.

For example, if the parameters are entered in inches and the machine builder would like to have the material speed displayed in feet per minute, a multiplication factor of 05.000 would be entered, as shown below.

$$\frac{\text{input units (inches)}}{\text{sec.}} = \frac{\text{1 ft}}{\text{12 inches}} \times \frac{\text{60 sec.}}{\text{1 min.}} = \text{5.000 ft/min.}$$

If a multiplication factor of 01.000 is entered, the material speed display screen is shown in input units/sec. The input units are specified by the machine builder when parameters are entered.

The last two digits specify an auxiliary input to be used to start the CLM program block 000 when switching from Manual to Automatic mode. This auxiliary input is specified by the machine builder. This function is disable by entering 00 in these digits.

If 00 is entered or the auxiliary input is off, the CLM program will start at the last part length command (LMD, LML, LMR) that was previously being processed.

If an auxiliary input is entered and this auxiliary input is on, then the CLM program will start at block 000 when switching from Manual to Automatic mode.

4.4.1.29. Parameter 38 - Measuring Wheel Feed Constant, Axis 1

```
┌────────────────┐
│Feed Constant A1│
│P38    0060.0000│
└────────────────┘
          │
          └─────     Feed constant of the measuring wheel in input
                     units (IU)
```

The feed constant for the measuring wheel specifies the length of material which will pass through in one revolution of the measuring wheel, based on the diameter of the measuring wheel.

To calculate the measuring wheel feed constant:

$$\text{Measuring Wheel Feed Constant} = \frac{\text{Diam of Measuring Wheel} * \text{pi}}{\text{gear ratio, if any}}$$

This must be specified in the same input units that were selected for the feed constant (parameter 00) for Axis 1.

The measuring wheel feed constant entry is to four or five decimal places, depending on the first digit in parameter 82. If the first digit in parameter 82 is a two, then four decimal places are shown. If the first digit in parameter 82 is a three, then five decimal places are shown. The limits are:

Parameter 82 (first digit = 2) = 0000.1000 min., 1000.0000 max.
Parameter 82 (first digit = 3) = 000.01000 min., 100.00000 max.

4.4.1.30. Parameter 39 - Measuring Wheel Encoder Lines, Axis 1

```
┌────────────────┐
│Enc Lines/Rev MW│
│P39       6 2500│
└────────────────┘

          ┐  ┬───
          │  └──── Incremental encoder lines/rev of the measuring
          │        wheel.
          │
          └─────── Measuring wheel averaging function
```

0 = averaging function disabled.
1 = average every 2 msec.
2 = average every 4 msec.
3 = average every 8 msec.
4 = average every 16 msec
5 = average every 32 msec.
6 = average every 64 msec.
7 = average every 128 msec.
8 = average every 256 msec.
9 = average every 512 msec.

The first digit is for measuring wheel averaging function, which is used to smooth the measuring wheel encoder pulses. If the material is moving at an uneven rate, this function will make the carriage move evenly during synchronized movement.

The last four digits are for the measuring wheel encoder lines per revolution. The measuring wheel must use an incremental encoder.

The measuring wheel encoder limits are:

minimum 100
maximum 5000

4.4.2. Parameters for Axis 2

4.4.2.1. Parameter 40 - Feed Constant, Axis 2

```
Feed Constant A2
P40  0 0010.0000
     |   |
     |   └── Feed constant in input units per encoder
     |       revolution
     |
     └────── 0 = Axis 2 is disabled
             1 = Axis 2 synchronous axis
             2 = Axis 2 tooling axis
```

This parameter specifies the feed constant for axis 2, and selects the type of application for the axis.

The first digit determines the type of application.

If a 1 is entered, axis 2 will be synchronized with axis 1. When the carriage or flying cutoff device has too much inertia for one axis, axis 2 can be synchronized with axis 1 to drive the carriage. Also, the ability to have two axes synchronized might reduce the need for some mechanical interlocking. If axis 2 is used as a synchronized axis, parameter 58 Synchronization Difference must be programmed.

If Axis 2 is used as the synchronous axis, the feed constants for Axis 1 and Axis 2 have to be identical. Otherwise, the message "Invalid Input" appears. Consult an Indramat Application Engineer for additional information.

If a 2 is entered, axis 2 is a tooling axis. The function of the tooling axis depends on CLM program, written by the machine builder. The tooling axis has several different CLM commands that it can use. Refer to chapter 5 for more information on the CLM commands for the tooling axis (Axis 2 Commands Only).

If a zero is entered, axis 2 is disabled.

The next eight digits are for the Feed Constant, which is the ratio of material movement per encoder revolution. The number entered equals the distance the axis will travel per one revolution of the encoder.

The value entered in this parameter is in input units. These input units can be mm, cm, m, inch, degree, etc.

NOTE: *The input units used in the feed constant parameter must remain consistent throughout the axis 2 parameters and program.*

The feed constant entry accepts four or five decimal places, depending on the first digit in parameter 82. If the first digit in parameter 82 is a two, then four decimal places are shown. If the first digit in parameter 82 is a three, then five decimal places are shown.

First digit = 2 = 0000.1000 min., 1000.0000 max.
First digit = 3 = 000.01000 min., 100.00000 max.

Some of the common formulas for calculating the feed constant parameter are:

$$\text{Ball Screw} = \frac{\text{ball screw lead (units/rev)}}{\text{gear ratio}}$$

$$\text{Rack and Pinion} = \frac{\text{pinion pitch diameter * pi}}{\text{gear ratio}}$$

$$\text{Roll Feed} = \frac{\text{roll diameter * pi}}{\text{gear ratio}}$$

4.4.2.2. Parameter 41 - Encoder Data, Axis 2 (Incremental)

```
┌────────────────┐
│Encoder Data  A2│
│P41 00 0000 0000│
└────────────────┘
     ┌─  ─┬──  ─┬──
     │    │     │
     │    │     └──  Not used
     │    │
     │    └───────   Lines counts per revolution
     │
     └───────────    00 = Incremental encoder enabled
```

This parameter specifies the type of encoder device used for axis 2. The CLM works with incremental or absolute encoders.

When 00 is programmed in the first two digits, the CLM is set for an incremental encoder on axis 2.

The next four digits specify the number of line counts from the incremental encoder, per encoder revolution. This data is used in several computations that affect positioning.

The last four digits are not used when incremental encoders are enabled.

The information for this entry is provided on the motor data plate or the incremental encoder mounted on the rear of the servo motor.

CAUTION: *If Axis 2 is used as the synchronous axis, the encoder value for Axis 1 and Axis 2 must be identical. The encoder value stored is not monitored and there is no error message for a condition where the values are no longer identical.*

The incremental encoder entry range is:

minimum	0100
maximum	5000

Example:

```
┌─────────────────┐
│Encoder Data   A2│
│P41 00 1250 0000│
└─────────────────┘

     ┌─  ┌───
     │   └────────── 1250 Lines per revolution
     │
     └────────────── Incremental encoder enabled
```

4.4.2.3. Parameter 41 - Encoder Data, Axis 2 (Absolute)

```
┌─────────────────┐
│Encoder Data   A2│
│P41 21 1024 0256│
└─────────────────┘

     ┌─  ┌───  ┌───
     │   │     └──── Number of revolutions
     │   │
     │   └────────── Resolution of encoder: No. of steps per 360
     │               degrees revolution of encoder
     │
     └────────────── 12 = Single-turn absolute encoder with 12 bits
                     21 = Multi-turn absolute encoder with 21 bits
                     24 = Multi-turn absolute encoder with 24 bits
```

The first two digits specify one of three types of absolute encoder that can be used with the CLM. If an incremental type is used, refer to Parameter 40.

The next four digits specify the resolution of the absolute encoder. Resolution is the number of pulses (bit count) per revolution of the encoder.

The last four digits specify the number of revolutions of the encoder for the entire set of data. The number of revolutions is the maximum the absolute encoder will turn before it either physically stops or causes an error by exceeding its range.

The resolution and the number of revolutions must be an even power of 2. The maximum number for the resolution and the number of revolutions is 4096. The information for this entry is found on the encoder data plate.

CAUTION: *If Axis 2 is used as the synchronous axis, the encoder value for Axis 1 and Axis 2 must be identical. These values are not monitored during operation and there is no error message that will appear for the condition. In other words, no comparison is made; improper operation may result but there will be no error message.*

4.4.2.4. Parameter 42 - Velocity, Axis 2

```
┌────────────────┐
│Velocity  Axis 2│
│P42 000050.00 10│
└────────────────┘
     ┌────────  ┌─
     │          └─ Jog Velocity: Percentage of maximum velocity.
     │
     └──────────── Maximum velocity for axis 2 (Input Units/Sec).
```

The first eight digits specify the maximum velocity for axis 2 in input units per second. The input units are defined in parameter 40 (Feed Constant).

The maximum velocity depends on the Feed Constant (P40) and Drive Input Sensitvity (P43). The CLM will output a command voltage in the positive or negative direction, depending on the desired direction. Depending on the command voltage, the motor will
operate at a certain speed. The maximum command voltage and the maximum RPM of the motor are defined in the Drive Input Sensitivity parameter (P43). The velocity parameter does not have to be set to maximum. If a slower RPM is desired, calculate the parameter for that RPM.

The last two digits specify the jog velocity for axis 2. The jog velocity is a percentage of maximum velocity.

A formula for calculating maximum velocity:

$$\text{Max. Velocity (Input Units/Sec.)} = \frac{\text{Max. RPM (P43) X Feed Constant (P40)}}{60}$$

The velocity axis 2 parameter entry accepts two or three decimal places, depending on the first digit in parameter 82. The limits are:

First digit = 2 = 000000.10 min., 005000.00 max.
First digit = 3 = 00000.100 min., 05000.000 max.

NOTE: *If axis 2 is used as the synchronous axis, the maximum velocity for axis 1 and axis 2 must be identical. If not, the error message "Invalid Input" appears.*

4.4.2.5. Parameter 43 - Drive Input Sensitivity, Axis 2

```
┌─────────────────┐
│Drive Sensit. A2│
│P43    3000 10.0│
└─────────────────┘
        ┌───  ┌───
        │     │
        │     │
        │     └──── Command voltage for maximum motor RPM.
        └────────── Maximum motor RPM for the specified command
                    voltage.
```

This parameter defines the sensitivity of the motor RPM to the drive voltage for axis 2.

The first four digits specify the maximum RPM of the motor. When the command voltage is at maximum, the motor will operate at this RPM. The entry range for maximum RPM is:

minimum 0001
maximum 9999

The last three digits specify the command voltage for maximum RPM. The entry range for command voltage is:

minimum 05.0
maximum 10.0

The information for this parameter can be found on the amplifier's personality module for the drive system (motor, amplifier, etc.). Refer to the manual for the amplifier being used (TDM, KDS, etc.). The CLM uses the differential command input of E1/E2, also found in the manual for the specific drive system.

Example:

```
┌─────────────────┐
│Drive Sensit. A2│
│P43    1500 10.0│
└─────────────────┘
       ┌────  ┌───
       │      └─── 10 Volts command
       │
       └────────── 1500 maximum RPM
```

When the CLM is commanded to operate at maximum RPM, the CLM will output 10 volts from connector X5-8 (A2), referenced to connector X5-9 (0V). The 10-volt output will go to the E1/E2 input of the drive causing the motor to operate at 1500 RPM.

4.4.2.6. Parameter 44 - Acceleration, Axis 2

```
┌──────────────────┐
│Accel. Rate     A2│
│P44       00386.00│
└──────────────────┘
         ────┬────
             │
             │
             └─── Axis 2 accelerates and decelerates at this
                  specified rate (input unit per second²).
```

The acceleration parameter defines the rate of speed the drive can accelerate from a zero holding state to a desired speed. This parameter also defines rate of speed the drive can decelerate from a desired speed to a zero holding state.

This parameter provides protection for the machinery by limiting the amount of torque produced during speed changes. The drive system must be capable of acceleration at the rate specified here, or an error message will occur during a speed change.

The parameter value is specified in input units/second^2.

Example:

To program the machine in the force of 1G, assuming the input units are entered in inches.

$$1G = 32.16 \text{ feet/second}^2$$

Convert to inches, (input units, inches used in this example)

$$32.16 \ X \ 12 = 385.92 \text{ inches/second}^2$$

```
┌──────────────────┐
│Accel. Rate     A2│
│P44        0385.92│
└──────────────────┘
            ┌────
            └──── 385.92 inches/second²
```

The acceleration rate parameter entry accepts two or three decimal places, depending on the first digit in parameter 82.

NOTE: *If axis 2 is used as the synchronous axis, the maximum velocity for axis 1 and axis 2 must be identical. If they are not, the error message "Invalid Input" appears.*

4.4.2.7. Parameter 45 - Position Gain, Axis 2

```
┌──────────────────┐
│Position Gain A2  │
│P45         01.000│
└──────────────────┘
          ───┬───
             │
             └── Position Gain Factor
```

This parameter specifies the position gain of the closed-loop positioning control. The proper setting of the position loop gain is essential for optimum performance of the drive system.

The entry range for the axis 2 position gain parameter is:

minimum 00.001
maximum 19.999

Position Gain is expressed as commanded velocity per .001 units of position (following) error. The position control commands a given velocity (input units/second) per each thousandth (input unit) of position (following) error detected by the control. The higher the gain, the smaller the following error. Position Gain is tuned to achieve the desired performance, without system overshoot or oscillation.

There is no established setting for this parameter, because of the many variables that influence the proper gain, such as load interia, friction, motor dynamics and velocity. However, it is recommended that the user begin with a small number and increase the numeric entry until optimum performance is achieved. A position loop gain setting that is too low results in sluggish operation. Too high a setting causes the system to be sensitive, which results in motor oscillation and an audible buzz or ringing noise.

NOTE: *The Position Gain (P45) and the Acceleration Rate (P44) directly interact with one another. Before setting the position gain, make sure the acceleration rate is set at the correct rate for the particular application.*

WARNING: *If the gain is set excessively high, the motor could begin oscillating the moment power is applied. This condition could result in machine damage or personal injury.*

4.4.2.8. Parameter 46 - Direction, Axis 2

```
┌────────────────┐
│Direction Axis 2│
│P46         0   0│
└────────────────┘
            ┬   ┬
            │   │
            │   └─ 0 = Motor rotation remains unchanged.
            │      1 = Motor rotation is reversed.
            │
            └───── 0 = Analog output polarity remains unchanged.
                   1 = Analog output polarity is reversed.
```

The direction parameter allows changing the axis 2 motor rotation by using the software in the CLM-LM, eliminating the need for wiring changes on direction and polarity.

WARNING: *Drive Runaway conditions can occur if the phase relationship between motor direction and the analog output polarity is incorrect. This incorrect phase relationship will result in unexpected motor direction movement. This condition could result in machine damage and/or physical injury. It is recommended to disconnect the load from the motor when powering up the system. Once the operation and direction are verified, the load can be reconnected.*

When a CLM system is powered up, a "Drive Runaway A2" error may occur. The "Drive Runaway A2" error may mean the analog output polarity or the motor encoder are going in opposite directions. The error may be corrected by changing the condition of the analog output polarity. If the "Drive Runaway A2" error still occurs, consult the Diagnostics, chapter 8.

When the CLM system is powered up, the motor may operate in the opposite direction. To correct this problem, change the condition of the motor encoder direction. The motor should now operate in the proper direction.

4.4.2.9. Parameter 47 - Position Tolerance, Axis 2

```
┌────────────────┐
│Position Tol. A2│
│P47   15 0000.05│
└────────────────┘
       ┌─  ───┬───
       │      │
       │      │
       │      └─── Position tolerance (input units) to two or
       │           three decimal places.
       │
       └────────── Auxiliary output to be turned on when position
                   is reached.
```

The position tolerance parameter defines a position "window," within which the CLM will consider axis 2 to be in position. Adjusting this tolerance does not affect the accuracy of the move. It simply allows the CLM to advance to the next command line in the user program.

The first two digits specify the auxiliary output number that turns on when axis 2 is in position. This output can be used to turn on a light, buzzer, etc.

NOTE: *The auxiliary output number is selected by the machine builder. The selected output can only be used for the (Axis 2) Position Tolerance parameter and may not be used in any other parameters. Also, the selected output should not be forced high or low in the CLM program.*

The next six digits specify the desired position tolerance window. This window is sometimes called the switching threshold, and is entered in input units.

Example:

```
┌────────────────┐
│Position Tol. A2│
│P47   15 0000.05│
└────────────────┘
       ┌─  ───┬───
       │      └──── .05 input units
       │
       └─────────── Auxiliary output 15
```

When axis 2 is within .05 input units of commanded position, auxiliary output 15 will turn on.

The position tolerance parameter entry accepts two or three decimal places, depending on the first digit in parameter 82.

4.4.2.10. Parameter 48 - Homing Setup, Axis 2

```
┌─────────────────┐
│Homing Setup   A2│
│P48          0 00│
└─────────────────┘
             ┬ ┌─
             │ └── Search velocity in percentage of maximum
             │     velocity.
             │
             └──── 0 = Homing in the reverse direction
                   1 = Homing in the forward direction
```

The Homing Setup parameter specifies the direction of homing and the speed of the homing motion. The first digit specifies the homing direction for axis 2. When the homing command is acknowledged, the motor rotates (forward or reverse) toward the home switch. The homing command can be accomplished by an auxiliary input in Manual mode. The homing command in Manual mode is specified in parameter 50. The homing command can also be programmed in the CLM program, using the HOM command, described in chapter 5.
The next two digits specify the velocity for the homing routine. Homing velocity is set as a percentage of the Velocity Axis 2, parameter 42.

Axis #2 Homing Routine (Figure 4.2)

For absolute positioning of axis #2 with an incremental encoder, a homing routine is necessary to establish a reference point. Axis #2 can be homed in Manual or Automatic mode. When homing axis 2, an auxiliary input must be assigned to the axis 2 home switch. This auxiliary input is defined in the Homing Setup I/O, parameter 50.

When homing axis 2 in Manual mode, an auxiliary input must be assigned as the "homing-in-Manual mode" input (Homing Setup I/O A2)

For homing axis 2 in Automatic mode, the HOM command can be used. After the CLM has read this command for axis 2, the next program block is immediately read. The "Home Established" auxiliary output is assigned by the machine builder in Homing Setup I/O A2, parameter 50.

1. The homing routine begins when a pushbutton wired to the auxiliary input is pressed in Manual, or when the user program reads the HOM command in Automatic mode.

2. Axis 2 will move toward the home switch at the home velocity (V1) set in the Homing Setup A2, parameter 48, unless axis 2 is already on the switch.

3. When the home switch closes, axis 2 decelerates to a stop, then reverses direction and moves off the switch at 25 percent of the home velocity (V2) until the switch opens.

4. The axis then moves toward the switch at velocity V3 (5000 pulses/sec) until the CLM senses the closure of the home switch and the next occurrence of the marker pulse.

NOTE: *Once the home switch closes, it must remain closed until the marker pulse has occurred. If the home switch opens or no marker pulse occurs within one revolution, the error "No Marker Pulse 2" occurs. The home switch cam must be at least as long as the reverse travel distance from the home switch.*

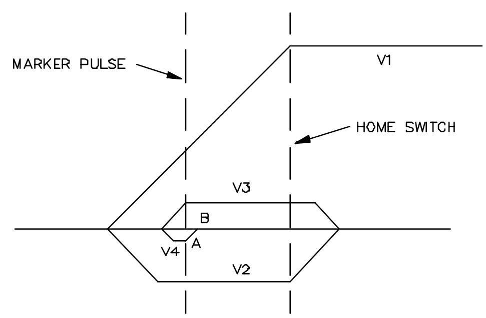


Figure 4.2 Homing Routine, Axis 2

5. When the marker pulse is sensed, the axis decelerates to a stop, then returns towards the marker pulse at velocity V4 (500 pulses/sec). The CLM records the next occurrence of the marker pulse as the reference position (a) and ramps to a stop (b) where it remains until the next command.

6. The "Home Established" output (Homing Setup A2, P10) turns on, indicating that axis 2 homing is complete.

NOTES: *After axis 2 has been homed and if the homing offset parameter (P49) is programmed, the offset distance is inserted as the axis 2 position. Axis 2 does not physically move to the offset position. The "Home Established" output will then turn on. If the Home Switch closure is within 1/16 of a motor revolution, with respect to the marker pulse, the CLM will not complete the homing procedure and will issue the error "Marker Pulse 2 ?". As a rule of thumb, the Home Switch should be moved a distance of about 1/3 of the axis 2 feed constant.*

4.4.2.11. Parameter 49 - Homing Offset, Axis 2

```
┌────────────────┐
│Homing Offset A2│
│P49   0 00000.00│
└────────────────┘
     ─┬─   ───┬────
      │       │
      │       └─── Homing offset distance in input units,
      │            to two or three decimal places
      │
      │
      └──────────── 0 = Offset distance in the forward direction
                    1 = Offset distance in the reverse direction
```

The Homing Offset, Axis 2 specifies an offset from the home position and the direction of the offset.

The first digit determines the direction of the offset, after the home switch is reached.

The next seven digits define the distance from the home switch, to be use as the reference position. When the homing routine is complete, the offset distance is inserted as the axis 2 position.

NOTE: *The offset distance is inserted as (substituted for) the axis 2 position. Axis 2 does not physically move to the offset position.*

The homing offset distance entry accepts two or three decimal places, depending on the first digit in parameter 82.

4.4.2.12. Parameter 50 - Homing Setup Input/Output, Axis 2

```
┌──────────────────┐
│Hom Setup I/O A2│
│P50      01 05 03│
└──────────────────┘

         ┌─  ┌─  ┌─
         │   │   │
         │   │   │
         │   │   └─── Auxiliary output number to be used for the
         │   │        "Home Established" output.
         │   │
         │   └─────── Auxiliary input number to be used for Axis 2
         │            home switch.
         │
         └─────────── Auxiliary input number to be used to initiate
                      a homing in Manual mode.
```

This parameter specifies two auxiliary inputs and one auxiliary output used for axis 2 homing. In Manual mode, homing can take place by means of an auxiliary input. In Automatic, homing can take place by means of the HOM command. Refer to chapter 5 for more information about the HOM command.

The first two digits specify an auxiliary input to be used to home axis 2 in manual mode. This auxiliary input is defined by the machine builder. When this auxiliary input detects a low-to-high transition in manual mode, axis 2 will perform the homing sequence. The homing sequence is explained in parameter 48.

The second two digits specify an auxiliary input to be used as the axis 2 home switch. This input is assigned by the machine builder. When the home switch auxiliary input detects a low-to-high transition, axis 2 will preform the homing routine and all axis 2 position commands will be referenced from this switch.

The last two digits specify an auxiliary output that will turn on when home is established. This output is assigned by the machine builder. The "Home Established" output will remain on until an error occurs or the CLM power is turned off. If two zeros are entered, the "Home Established" output is not used.

4.4.2.13. Parameter 51 - Minimum Travel Limit, Axis 2

```
┌──────────────────┐
│Min Travel      A2│
│P51    -000000.00 │
└──────────────────┘
       ──────────
             └───── Minimum travel limit in input units.
```

This parameter specifies the travel limit value, in the negative direction, in reference to the home switch. The limit is effective only after axis 2 has been homed.

In the manual mode, the corresponding jog key is disabled when this position has been reached. If, in the Automatic mode, the commanded position is smaller than this limit value, error message "Error Minimum Travel Limit 2" appears.

The travel limit value is measured from the home switch. It is not added to or subtracted from the offset distance.

The minimum travel limit accepts two or three decimal places, depending on the first digit in parameter 82.

4.4.2.14. Parameter 52 - Maximum Travel Limit, Axis 2

```
┌──────────────────┐
│Max Travel      A2│
│P52    +000000.00 │
└──────────────────┘
        ─────────
             │
             └───── Maximum travel limit in input units.
```

This parameter specifies the travel limit value in the positive direction, in reference to the home switch. The limit is effective only after the axis 2 has been homed.

In the Manual mode, the corresponding jog key is disabled when this position has been reached. If, in the Automatic mode, the commanded position is greater than this limit value, the error message "Error Maximum Travel Limit 2" is displayed.

The travel limit value is measured from the home switch. It is not added to or subtracted from the offset distance.

The maximum travel entry accepts two or three decimal places, depending on the first digit in parameter 82.

4.4.2.15. Parameter 53 - Position Presignal, Axis 2

```
┌─────────────────┐
│Pos Presignal A2│
│P53 00 00 0000.0│
└─────────────────┘

     ┌─  ┌─  ┌────
     │   │   │
     │   │   └──── Axis 2 presignal distance in input units
     │   │
     │   └──────── Time in 0.1 seconds
     │
     └──────────── Auxiliary output to be turned on
                   (00 = not activated)
```

The position presignal parameter is used to turn on an auxiliary output at a specified distance prior to the axis 2 positioning. Typically, the position presignal is used when anticipation of the end of a feed is needed, so other processes can be initiated ahead of time. The position presignal applies to following positioning commands: POI, PSI, POA, POM, PSA, PSM.

The first two digits specify an auxiliary output to be turned on. This output will turn on after the axis 2 presignal distance is reached.

The next two digits specify the amount of time the auxiliary output will remain on. This output will remain on until the time is up. If 00 is entered, the auxiliary output will remain on until the next positioning command. Also, the auxiliary output can be turned off with an AEA command. Refer to chapter 5 for more information about the AEA command.

The last four digits specify the axis 2 presignal distance in input units. The auxiliary output turns on prior to the target position. If the target position is equal to or less than the position presignal distance, the position presignal output turns on for the period of time set in parameter, or until the next move.

In the example shown, the CLM encounters a position command of 100 inches and the position presignal parameter is programmed to turn on output 14 for 2 seconds at a distance of 25 inches before the end of the positioning.

```
|<──────────────────────────  100 inches  ─────────────────────>|
|<──────────────  75 inches  ─────────────────>|<── 25 inches ──>|
|──────────────────────────────────────────────|─────────────────|
|              Presignal Output                |Presignal output |
                     OFF                               ON
                                              (For Programmed Time)
```

The position presignal distance parameter entry accepts one or two decimal places, depending on the first digit in parameter 82. If the first digit in parameter 82 is a two, then one decimal place is shown. If the first digit is a three, then two decimal places are shown.

4.4.2.16. Parameter 54 - Monitoring, Axis 2

```
┌─────────────────┐
│Monitoring     A2│
│P54      0 0 00 00│
└─────────────────┘
         ┌ ┌ ┌─ ┌─
         │ │ │  │
         │ │ │  └─ Auxiliary Input Number for Axis 2 Feed Angle
         │ │ │     Monitoring.
         │ │ │
         │ │ └──── Auxiliary Input Number for Axis 2 Feed
         │ │       Interruption (Feed Hold).
         │ │
         │ └────── 0 = Drive Runaway Monitoring On
         │         1 = Drive Runaway Monitoring Off
         │
         └──────── 0 = Excessive Position Lag Monitoring On
                   1 = Excessive Position Lag Monitoring Off
```

This parameter specifies the monitoring of the motor's position feedback. Also, this parameter can specify an auxiliary input for feed monitoring and an auxiliary input for interrupting a feed.

Excessive Position Lag and Drive Runaway Monitoring:

The first and second digits must always be set to zero (0). When the first digit is a zero, the CLM continuously monitors the motor for "Excessive Position Lag" conditions. When the second digit is a zero, the CLM continuously monitors the motor for "Drive Runaway" conditions.

WARNING: *The first and second digits must be set to zero, to prevent physical injury to personnel and/or machine damage.*

The "Drive Runaway" error occurs if the actual position of the encoder exceeds the expected position by 10%. The "Excessive Pos Lag" error occurs if the actual position of the encoder is less than the position expected by 10%.

Refer to chapter 8, Diagnostics for more information about the Drive Runaway and Excessive Position Lag errors and how to solve these problems.

Feed Interrupt (Feed Hold):

The next two digits specify an auxiliary input used to interrupt the feed command. This auxiliary input is assigned by the machine builder. If "00" is entered in these digits, then the feed is not interrupted. If an auxiliary input number is entered and the interrupt is present at the input, no feed commands will be executed.

The CLM continues to process all blocks not containing feed commands. When the CLM program comes to a block containing a feed command, the CLM stops in that block until the auxiliary input detects a low-to-high transition. During the feed command, the auxiliary input must remain high until the feed is completed. If the auxiliary input detects a high to low transition during the feed, the feed stops. No error message is issued.

Feed Angle Monitoring:

The last two digits specify an auxiliary input for monitoring the axis 2 feed. The auxiliary input is defined by the machine builder. If "00" is stored in these digits, then the feed is not monitored. If an auxiliary input number is stored in these digits and if no signal is present at the input, no feed will be executed.

The CLM will continue to process all blocks not containing any feed commands. As soon as the program processing comes to a block containing a feed command, the CLM will stop in this block until the auxiliary input detects a low to high transition. During the feed command, the auxiliary input must remain high until the feed is completed. If the auxiliary input detects a high-to-low transition during the feed, the feed stops and an error message is displayed on the CLM.

4.4.2.17. Parameter 55 - Special Function, Axis 2

```
Special Funct.A2
P55        00 00
```

Development of this parameter is not complete. The Special Function, Axis 2 parameter must have a zero entered for each digit.

4.4.2.18. Parameter 56 - Rotary Table, Axis 2

```
Rotary Table   A2
P56   0 0000 0000
```

Development of this parameter is not complete. The Rotary Table, Axis 2 parameter must have a zero entered for each digit.

4.4.2.19. Parameter 57 - Second Acceleration Rate, Axis 2

```
Knee Point     A2
P57  00 000000.00
```

Second Acceleration Rate
(input units per second^2)

Axis 2 Velocity Change Point
(Percentage of Velocity Axis 2, Parameter 42)

The second acceleration rate parameter allows axis 2 to change its acceleration and deceleration during a feed. This function is effective in either Automatic or Manual mode.

The only limitation for the second acceleration parameter is in the CLM user program. When using the second acceleration rate parameter, the ACC command is not effective. The machine builder must decide which to use.

The first two digits set up the axis 2 velocity change point. The velocity change point is a percentage of the axis 2 velocity (Velocity, Axis 2, P42). This velocity percentage determines where the acceleration and deceleration will change during the feed.

The next eight digits specify the second acceleration rate. When a feed is commanded to move, the axis will accelerate at the rate specified in parameter 44 (Accel. Rate A2). When the axis 2 velocity change point is reached, the acceleration will then be changed to the second acceleration rate in parameter 57.

When a feed is commanded to stop, the axis will decelerate at the second acceleration rate. When the axis 2 velocity change point is reached, the deceleration will then change to the acceleration rate specified in parameter 44 (Accel. Rate A2).

The second acceleration rate entry accepts two or three decimal places, depending on the first digit in parameter 82.

The acceleration and deceleration of a feed can be set up in one of two ways, as illustrated in Fig. 4.3. First, axis 2 Second Acceleration Rate (Parameter 57) is higher than the Axis 2 Acceleration (Parameter 44). Next, axis 2 Second Acceleration Rate (Parameter 57) is lower than axis 2 Acceleration (Parameter 44).

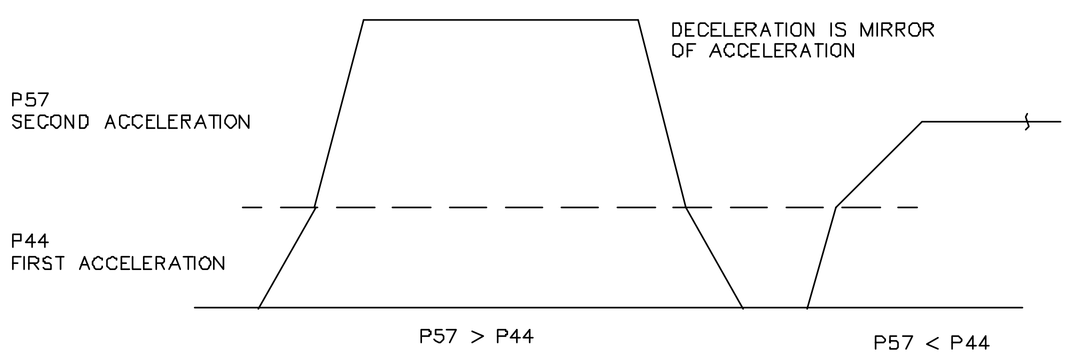


Figure 4.3 Second Acceleration Rate

4.4.2.20. Parameter 58 - Synchronization Difference, Axis 2

```
┌────────────────┐
│Synchr. Diff  A2│
│P58      0 00.00│
└────────────────┘

          ┌   ┌────
          │   │
          │   └──── Maximum permissible synchronization
          │         difference in input units
          │
          └──────── 0 = Compensation for Synchronization
                        Difference

                    1 = Compensation Immediately for
                          Synchronization Difference
```

This Axis 2 Synchronous function is currently not supported. Consult an Indramat Application Engineer for additional information.

The purpose of Parameter 58 is to define the maximum allowable difference between the synchronization of axis 2 to axis 1. When two motors are operating simultaneously as separate axes to drive the same carriage or cutoff device, one axis might have a tendency to lead the other and cause skewing of the carriage.

NOTE: *This parameter is in effect only if axis 2 is programmed as a synchronous axis. If the first digit of parameter 40, Feed Constant Axis 2 is a one, then axis 2 will be synchronized with axis 1. The purpose for Axis 2 being synchronized with axis 1 is, if the carriage or flying cutoff device is too large and has too much inertia for one axis to control. Also, the ability to have two axis synchronized might reduce the need for some mechanical interlocking.*

The first digit specifies how to compensate for the synchronization difference. If the first digit is a 0, the CLM will smoothly compensate for the difference, during the move. If the first digit is a 1, the CLM will immediately command axis 2 to compensate for the difference.

The next four digits specify how large the synchronization difference can be between the two motors. If the positioning difference between the two axes becomes greater than the values programmed here, the CLM will immediately command the axis to a stop, turn off all outputs, and issue the message "Error Synchronization Difference A2".

4.4.3. General Parameters

4.4.3.1. Parameter 80 - Serial Interface

```
Serial Interface
P80 1920 0 1 8 1
```

```
┌───   ┌  ┌  ┌  ┌
│      │  │  │  └ Stop Bit(s)
│      │  │  │
│      │  │  └─── Word Length
│      │  │
│      │  └────── Parity
│      │
│      └───────── Interface Mode
│
└──────────────── Baud Rate
```

The serial interface parameter specifies how the CLM will communicate with a host device. The interface is described in chapter 7 of this manual.

The first four digits of this parameter defines the baud rate. Baud rate specifies the rate of communication between the CLM and a host device. If "0000" is entered, the serial interface is not enabled. The CLM can communicate at these rates:

Parameter Entry		Baud Rate
0030	=	0300
0120	=	1200
0240	=	2400
0480	=	4800
0960	=	9600
1920	=	19200

The fifth digit in this parameter specifies the interface mode the CLM will be using with the host device. The interface modes are:

0	=	Standard RS-232/422 (full duplex)
1	=	IDS, decade switch option
2	=	Standard RS-232/422 (full duplex)
3	=	Serial port for SOT (Station Operator Terminal); RS-232/422, half duplex, one station ONLY

4 = Serial bus for SOT; RS-485, half duplex, station 1 through 15
When selecting the IDS decade switch option, the other data in this parameter does not have to be entered.

When RS-485 mode is enabled, the user must enter a station number in the Serial Interface Functions, parameter 81. The RS-485 mode has a transmission range of 1000 meters.

The sixth digit specifies the parity the CLM will be using with the host device. The CLM parity modes are:

1 = no parity
2 = even parity
3 = odd parity

The seventh digit specifies the word length the CLM will be using with the host device. The CLM uses the following word lengths:

7 = 7-bit word length
8 = 8-bit word length

The eighth digit specifies the number of stop bits the CLM will be using with the host device. The CLM uses the following stop bits.

1 = 1 stop bit
2 = 2 stop bits

4.4.3.2. Parameter 81 - Serial Interface Functions

```
┌────────────────┐
│Serial Interface│
│P81      0 00 0 0│
└────────────────┘

         ┌  ┌─   ┌  ┌
         │  │    │  └ 0 = Transmission Acknowledge Disabled
         │  │    │    1 = Transmission Acknowledge Enabled
         │  │    │
         │  │    └─── 0 = Checksum On/Hardware Handshaking Off
         │  │         1 = Checksum Off/Hardware Handshaking Off
         │  │         2 = Checksum On, RTS/CTS On
         │  │         3 = Checksum Off, RTS/CTS On
         │  │
         │  └──────── Station Number (01-15)
         │
         └─────────── 0 = Error Transmission Disabled
                      1 = Error Transmission Enabled
```

This parameter provides some special functions for communicating with the CLM. Chapter 7 of this manual describes the use of the CLM serial interface in detail.

The first digit is used to allow error transmission through the RS-232 communication port (CLM connector X6). If the first digit is a one, the error code and error message are immediately transmitted over the RS-232 to the host device when the error occurs. Error codes and messages are described in Diagnostics, chapter 8.

The second and third digit assign the station number in RS-485 mode only. If parameter 80 has a four in the interface mode digit, then a station number must be entered. The station number can be any number between 01 and 15.

The fourth digit specifies the checksum/hardware handshaking used by the CLM with the host device. The checksum determines if the information transmitted is correct. The hardware handshaking determines when it is clear to send (CTS) and ready to send (RTS).

The fifth digit is used for a transmission acknowledgement. When transmitting program blocks and parameters to the CLM, the CLM sends a "Y CRLF" message to the host device if the information is received and accepted.

4.4.3.3. Parameter 82 - Language

```
┌─────────────────┐
│Language         │
│P82       2 0 1 0│
└─────────────────┘

          ┌ ┌ ┌ ┌
          │ │ │ │
          │ │ │ └ 0 = Program Lockout Disabled
          │ │ │   1 = Program Lockout Enabled
          │ │ │
          │ │ └── Language
          │ │     0 = German
          │ │     1 = English
          │ │     2 = French
          │ │
          │ └──── Error Code Number
          │       0 = no error code via the outputs
          │       1 = error code via outputs 01-08
          │       2 = error code via outputs 09-16
          │       3 = error code via outputs 17-24
          │       4 = error code via outputs 25-32
          │       5 = error code via outputs 33-40
          │       6 = error code via outputs 41-48
          │
          └────── Decimal Point Location
                  2 = two decimal places
                  3 = three decimal places
```

The first digit specifies how many digits are to the right of the decimal point for positioning commands and certain parameters. The machine builder will make the selection depending on the resolution required. The following table shows the number of decimal places (resolution) resulting from entering a 2 or 3 in parameter 82.

Parameters # affected: 1st digit of P82 =	2 =	3
P00, P38, P40	4	5
P02, P04, P07, P09, P11, P12 P15, P16, P17, P23, P26, P42, P44 P47, P49, P51, P52, P57, P58	2	3
P13, P24, P53	1	2

The second digit is for the Error Code Number, which sends a BCD error code to eight auxiliary outputs. This digit selects which 8 auxiliary outputs are used.

The third digit specifies which language the text will be displayed in, on the CLM.

The last digit is used to prevent changes from being made to the user program via the key pad.

NOTE: *The user program can still by changed by the serial interface. The program lockout feature prevents accidental or unauthorized changes.*

4.4.3.4. Parameter 83 - Memory Display

```
Memory Display
P83      0 FF0000
```

Note: This parameter is for Indramat Service use only. The standard input value is: 0 F F 0 0 0 0.

4.4.3.5. Parameter 84 - Task 2 & 3

```
┌─────────────────┐
│Start Task 2 & 3│
│P84  0 000 0 000│
└─────────────────┘

      ┌ ─┬─ ┌ ─┬─
      │  │  │  └─ Task 3 Program Block Number
      │  │  │
      │  │  │     Task 3
      │  │  └──── 0 = Disabled
      │  │        1 = Enabled
      │  │
      │  └─────── Task 2 Program Block Number
      │
      │           Task 2
      └────────── 0 = Disabled
                  1 = Enabled
```

When Task 2 is enabled, a separate program is allowed to operate only in automatic mode. The Task 2 program block number specifies the starting block number for this program.

WARNING: *When Automatic mode is selected, the Task 2 program starts to operate immediately. When Task 3 is enabled, a separate program is allowed to operate. The Task 3 program block number specifies the block number for this program. When switching out of Parameter mode, the Task 3 program will start immediately.*

The Task 3 user program must be installed before Task 3 is enabled. Positioning commands must not be used in Task 3. The Task 3 program continues to operate in Manual mode and during E-Stop. A subroutine may not be called up by more than one Task at a time, or a system fault will occur.

4.4.3.6. Parameter 85 - Program Interrupt Vector

```
┌─────────────────┐
│Interrupt Vector│
│P85   00 0 0 000│
└─────────────────┘
```

Development of this parameter has not been completed. The Program Interrupt Vector parameter must have zeros entered for each digit.

4.4.3.7. Parameter 86 - Manual Vector

```
┌────────────────┐
│Manual - Vector │
│P86     00 0 000│
└────────────────┘

         ┌─  ┌  ─┬─
         │   │   └─ Starting block for the Manual Vector program
         │   │
         │   └──── Manual Vector Operating Mode
         │
         └──────── Manual Vector Input
```

The Manual Vector allows a subroutine to operate in Manual mode. The Manual Vector program will not operate during a homing sequence or while the jog (forward or reverse) inputs are on.

The first two digits specify an auxiliary input to be used to initiate the manual vector program. The program has to end with an RTS command. If the operating mode is changed from Manual to Parameter, the manual vector routine that is currently running is terminated. If a manual vector subroutine is currently being processed, a change from Manual mode to Automatic mode is accepted only when that routine has finished running.

The third digit defines when the manual vector program will operate. If a zero is entered, the manual vector program operates only when Manual mode is selected and the manual vector input is turned on. If a "1" is entered, the manual vector program operates as when a zero is selected, and will also operate when the CLM is switched from Automatic to Manual mode.

The 'manual vector' function is not activated if 'start via input signal' has been selected and '00' is programmed for the input.

The last three digits specify the starting block number for the manual vector program.

4.4.3.8. Parameter 87 - Variations

```
┌─────────────────┐
│Variations       │
│P87             0│
└─────────────────┘
             ┌
             │
             └── Velocity Override (Axis 2 Only)
                 0 = Velocity Override Disabled
                 1 = Velocity Override Via Analog Command
                     Voltage Input
                 2 = Velocity Override Via Gray Code Inputs
```

The Variations parameter allows for a velocity override for axis 2 only. The Velocity Override can occur either via an analog command input or gray code input. When the digit is a zero, the Velocity Override is disabled.

When the digit is a one, an analog command voltage input is used to override the axis 2 velocity. The velocity override for axis 2 is accomplished by applying a zero to ten volt command input to the AE2 (connector X5, pin 14), with reference to the 0 V (connector X5, pin 15). Figure 4.4 shows how to connect the velocity override for axis 2 via an analog command.

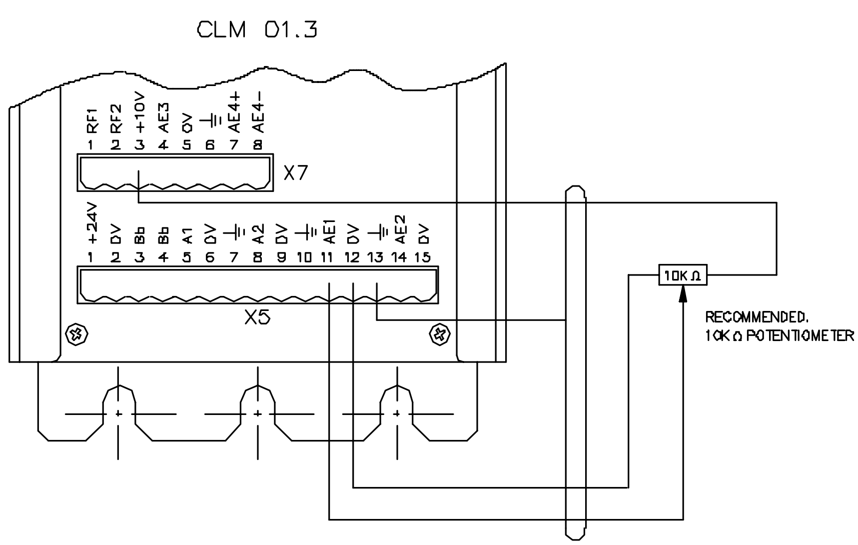


Figure 4.4 Feed Rate Override Command Input

If ten volts is applied as the analog command voltage input, then axis 2 velocity will operate at 100 percent of the velocity commanded. If zero volts is applied as the analog command voltage input, then axis 2 velocity will operate at 5 percent of the velocity commanded.

When the digit is a two, gray code inputs are use to override the axis 2 velocity. The auxiliary inputs 13 through 16 are used as the gray code inputs. The following table describes the auxiliary input significance and the resulting percentage of maximum velocity for axis 2. The maximum velocity for axis 2 is defined in the Velocity Axis 2, parameter 42.

Table 4.1 Gray Code Inputs, Feed Rate Override

Auxiliary Input Number	13	14	15	16	Velocity
Input Significance	2^0	2^1	2^2	2^3	in %
	0	0	0	0	0
	1	0	0	0	1
	1	1	0	0	2
	0	1	0	0	4
	0	1	1	0	6
	1	1	1	0	8
	1	0	1	0	10
	0	0	1	0	20
	0	0	1	1	30
	1	0	1	1	40
	1	1	1	1	50
	0	1	1	1	60
	0	1	0	1	70
	1	1	0	1	80
	1	0	0	1	90
	0	0	0	1	100

CHAPTER 5. PROGRAMMING

The application program, which defines and directs the operation of the cutoff system, is written and entered by the machine builder or the end user. It can be entered directly via the CLM-01.3-M keyboard, or from a remote terminal device through the CLM serial interface port.

Optional MotionManager™ programming software provides an efficient method of creating and editing the user program. It runs on a DOS-based personal computer, and offers several benefits not available when programming the CLM from the keypad. Indramat Publication IA74733 provides more information on MotionManager.

This chapter explains:

- basic considerations for creating a user program.
- how to enter the user program using the CLM keypad.
- the programming commands and their function in the program.
- a typical flying cutoff program.

5.1. Positioning

All positioning is done in the units of your choice and are referred to as Input Units (IU). Input Units are the user's desired units of measure (inches, mm, radians, degrees, etc.).

The type of positioning for axis 1 is always absolute. In absolute positioning, all axis movements are referenced from the axis home position. So, if the axis is at +2 inches from home, and an absolute position command to move +3 inches is executed, the result is a one-inch feed in the positive direction.

Axis 1 must always be homed in Manual mode before switching into Automatic mode. The LM software is designed for flying cutoff applications and the only position commands used for axis 1 are LMD, LML, and LMR.

If axis 2 is used, absolute or incremental positioning may be used. In incremental positioning, all axis 2 movements are made in the commanded direction to the distance specified, starting from the current position. If a slide were at +2 inches, an incremental command to move +3 inches would result in the slide being positioned +5 inches from home.

WARNING: *The position command for axis 1 or the flying cutoff must always be one of the following either the LMD, LML, or LMR. All positioning is done in the units of your choice and are referred to as Input Units (IU). If any other position command is used on axis 1, personal injury or damage to the machine may occur.*

5.2. Auxiliary Inputs/Outputs

The standard CLM has 32 inputs and 32 outputs; with an expansion I/O board, the numbers increase to 72 inputs and 64 outputs. The first 16 inputs and 16 outputs are the "system" inputs and outputs. The second group of 16 inputs and 16 outputs are the "auxiliary" inputs and outputs, which can be used to control certain machine functions. Auxiliary inputs are also known as acknowledgments.

The machine builder defines the functions of the inputs and outputs in the system parameters or within the user program. Certain CLM commands are used to address these inputs and outputs. The commands are listed in Table 5.2 as I/O Commands.

Auxiliary inputs or outputs assigned within the system parameters must not be used in the user program. The user program should only monitor the inputs and outputs assigned to system parameters.

WARNING: *Auxiliary input and output numbers that have been assigned by the machine builder to a specific purpose must not be changed. Personal injury or damage to the machine could result from such changes.*

5.2.1. Programming Inputs/Outputs

The CLM system inputs and outputs are predefined in the CLM internal (Indramat) program and cannot be changed by the user program. When the CLM is powered on, it sets certain outputs to a default position, according to its internal program. Likewise, when a fault occurs, the CLM turns all outputs off.

Outputs are re-established, either through hardware or software, e.g., the Automatic mode indicator turns on after that mode is selected by input, assuming all other conditions are met. A software flag is turned on or off as the user program executes the block containing the command.

Chapter 3 describes the purpose and use of each system input and output, as well as many programming and parameter entries used to specify input or output connections. Several I/O are available for use as flags in the user program. Certain output flags are set in firmware and can be queried by the user program.

Table 5.1 list the hardware outputs that can be used in the program to electrically control an external component. It also lists the output software flags that can be used internally in the program. Refer to this table when programming an output.

5.2.2. Inputs/Outputs Signal Definition

System inputs/outputs and auxiliary inputs/outputs are always in either of two states, on or off. In the on, or "high" state, there is a +24-volt DC signal present at the input/output. The off, or "low" state, means that there is a zero-volt DC signal at the input/output. A signal line is described as "Active High" when its associated action is initiated by a High (+24 volts) signal level. It is described as "Active Low" when its function is initiated by a Low signal (zero volts). An Active Low signal must be held in the high state to allow normal system operation.

Table 5.1 Output Definitions

Standard CLM	16 Hardware Outputs: 80 Software Flags:	1-16 17-99
Expanded CLM	48 Hardware Outputs: 51 Software Flag:	1-48 49-99

Outputs and Flags 1 to 72 are cleared (set to zero volts) when the CLM is first powered-up or if there is a loss of power, or if there is a system fault (hardware or program).

Output Flags 73 to 80 are cleared when the CLM is first powered-up or there is a loss of power, or an E-Stop error occurs, or the CLM is switched to Parameter mode.

Output Flags 81 to 88 are retained in battery-backed RAM, can be cleared only if they are turned ON/OFF in the user program, or if the back-up battery fails or is disconnected.

Output Flags 89 to 99 are set in firmware and can be queried by the user program.

89	- 1 indicates Manual mode
90	- 1 indicates Automatic mode
91	- currently not used
92	- currently not used
93	- currently not used
94	- 0 indicates a system fault
95	- currently not used
96	- currently not used
97	- currently not used
98	- currently not used
99	- currently not used

5.3. Start of the Program

When the CLM is first powered up or an error is cleared, the CLM program block pointer is set to the last axis 1 position command (LMD, LML, LMR) for Task 1. The Special Function, parameter 26, can be set to start the CLM program at block 000. Refer to chapter 4 for more information on parameter 26. If Tasks 2 and 3 are used, they will start at their assigned starting block numbers as defined by the user, in parameter 84. The CLM program block numbers will follow sequentially, unless a jump or branch instruction is encountered.

5.4. Multi-tasking

The CLM is capable of operating two motion programs and a background PLC program simultaneously. This allows a single CLM to operate two independent processes at the same time or to utilize multi-tasking in a single process. Refer to Task 2 & 3, parameter 84, for more information and precautions when using this parameter.

5.5. End of the Program

Controlling the flow of the program is extremely important, especially when using multi-tasking. Most programs are designed to loop back to the start of each task and wait for the proper sequence of events before starting again. Make sure that each task will not interfere with any other task. If block 999 is executed and it is not a jump command, all motions are stopped, and an error code is displayed.

5.6. Programming Mode

The CLM accepts program entry or editing from the front panel in either Automatic or Manual mode. Program entries made while the control is in Automatic mode (while the unit is in operation) will be accepted as soon as the block store key is depressed. The next time the block is scanned in the program, the updated data will be executed. However, it is safer and therefore recommended that the CLM be placed in Manual mode when editing the program, especially when this involves changing a command or several blocks. Complete and verify the program changes before returning to Automatic mode.

It is also important to have an accurate listing of the program and parameters when editing, to reduce the possibility of errors.

WARNING: *If Task 3 is used, the Task 3 program must be entered before enabling Task 3 in parameter 84. Task 3 will begin operating when switching out of Parameter mode.*

5.7. General Format

There is a general display format, seen on the CLM control panel display when programs are being entered or edited:

```
E  000  ABC
      (DATA)
```

E = shows the display is in the program edit mode

000 = block number displayed; command or data can be viewed or edited.

You can select any block number 000-999 to display. To scroll through the block numbers, first press the <CR> key twice to locate the cursor in the top line (or use the left/right arrow keys). Then use the "+" and "-" keys to scroll up or down through the block numbers. You can also type the block number desired directly over the existing number.

ABC = three-letter mnemonic of command programmed in the displayed block

To scroll through the commands, position the cursor to the right of the displayed three-letter command. Use the up or down arrow key to scroll alphabetically through commands. When the desired command appears, press the right arrow key once. Now the cursor should be on the second line, in the data field for that specific command.

(DATA) = Each command may require entry of specific data, as described in the following sections.

NOTE: *The CLM display provides four lines of 16 character positions each. The CLM-LM uses only the top two lines.*

5.8. Description of User Program Commands

This manual principally describes hardware version CLM 01.3-M with software version LM01.3-003.X. The software allows selection, by parameter, of two- or three-place decimals in those commands that involve positioning and position-related parameters (See Parameter 82).

Any places for required data in a user program block that contain illegal characters (a space or an undefined character - not a number or the +/- sign) are replaced by the asterisk (*) in the display. This enables the user to easily recognize which part of the command data must be reprogrammed. A program block has the correct syntax when it contains no asterisk in the display.

The various commands can be classified into categories by function, as listed in Table 5.2. Use this table to select the specific command desired from this general functional listing. Then refer to that command description in the following section for further details on how it works and requirements for its entry.

Axis 1 must be used as the flying cutoff axis. Some commands that pertain only to the axis 1 (flying cutoff) axis:

EOS End Of Synchronization
FAK Correction Factor For The Measuring Wheel Feed Constant
FUN Functions
LMD Part Length Via The IDS Board (Decade Switches)
LML Part Length
LMR Part Length With Registration
MLT Material Length Test
STZ Counter With Predefined Jump

The section following Table 5.2 provides a full description of each command, listed in alphabetical order.

Table 5.2 Commands by Function

Axis 1 (Flying Cutoff) Position Commands Only:

LMD	Part Length Via The IDS Board (Decade Switches)
LML	Part Length
LMR	Part Length With Registration

Axis 2 Position Commands Only:

CON	Continuous Operation
HOM	Homing
POA	Absolute Feed
POI	Incremental Feed
POM	Incremental Feed Via The IDS Board (Decade Switches)
PSA	Absolute Feed with Position Acknowledgment
PSI	Incremental Feed with Position Acknowledgment
PSM	Incremental Feed Via The IDS Board (Decade Switches)
REF	Detect Registration Mark
REP	Maximum Search Distance

Position Support Commands:

ACC	Acceleration Change (A2 Only)
CLA	Clear Absolute Position Reference (A2 Only)
FAK	Correction Factor / MW Feed Constant (A1 Only)
MLT	Material Length Test (A1 Only)
PST	Position Test (A1 or 2)
SAC	Set Absolute Counter (A2 Only)
SO1	Scanning Inputs & Modifying a Length (A1 or A2)
VEO	Velocity Override Command (A2 Only)
VCC	Velocity Change (A2 Only)

Branch / Jump Commands:

BAC	Branch with Count
BCA	Output-Dependent Conditional Branch
BCB	Binary Input Dependent Conditional Branch
BCD	BCD Input Dependent Conditional Branch
BCE	Input-Dependent Conditional Branch
BIO	Branch Input/Output Compare
BMB	Binary Output Dependent Conditional Branch
BPA	Branch on Parallel Outputs
BPE	Branch on Parallel Inputs
BPT	Branch if Position Has Been Reached
JMP	Unconditional Jump
JSR	Jump to Subroutine
RTS	Return from Subroutine
STZ	Counter With Predefined Jump

Input / Output Commands:

AEA	Output ON/OFF
AKN	Acknowledge Single Input
APE	Parallel Output ON/OFF
ATS	Output Monitor

Timer/Counter, Other Commands:

CLC	Clear Counter
COU	Counter
EOS	End Of Synchronization (Axis 1 Only)
FUN	Functions (Axis 1 Only)
NOP	No Operation
STH	Send to Host (Communication)
WAI	Time Delay

ACC Acceleration Change (Axis 2 Only)

```
E   001   ACC
2   750
```

2 - Axis 2

750 - Acceleration change in percentage of the acceleration rate set in parameter P44.

Min. = 00.1%
Max. = 99.9%

One decimal place precision (i.e. 750 = 75.0%).

The ACC command allows the acceleration rate to be changed in the user program *for axis 2 only*. The desired rate is programmed as a percentage of the acceleration entered in Accel. Rate A2, parameter 44.

Stepping to the next block takes place immediately after the block is read in. If you change this rate "on the fly" it will take effect starting with the next positioning command. The change does not affect a feed currently in progress.

The acceleration rate remains in effect for every positioning command until it is changed via another ACC command. If the CLM is taken out of Automatic Mode, the acceleration rate resets to the value programmed in the axis 2 acceleration parameter 44.

NOTE: *You can use the ACC command or Parameter 57 (Second Acceleration, Axis 2), but not both. When one is used, the other does not function.*

Example:

000 JMP 500	; Jump to block 500
500 ACC 2 750	; Change the acceleration rate to 75.0% of P44 (Axis 2)
501 PSI 2 +00100.000 999	; Axis 2, incremental feed, with acknowledgment, of +100.000 IU* at max speed
502 ACC 2 999	; Change the acceleration back to max. (the value set in P44)
503 JMP 000	; Jump to block 000

* IU= Input Units (desired unit of measure for positioning)

AEA Auxiliary Output On/Off

```
E   002   AEA
07   0
```

07 - Auxiliary Output Number

0 - Output State
0= Turn Output Off
1= Turn Output On

The AEA command is used to set the state of any one auxiliary output. Stepping to the next block occurs immediately after this program block is read.

The auxiliary outputs retain their status when the CLM exits Automatic Mode into Manual Mode.

If a fault condition occurs, or the CLM is switched to Parameter Mode, the auxiliary outputs are automatically set to the Off (0) state. When the fault is cleared, or Parameter mode is exited, the auxiliary outputs remain in the Off state until their status is changed when the user program begins running in Automatic Mode.

NOTE: *See Table 5.1 for more information on auxiliary outputs that serve as status markers (flags)*.

Example:

Auxiliary Output #7 continues to turn on for one second and off for one second.

```
000  JMP  020          ; Jump to program block 020
020  AEA   07   1      ; Turn auxiliary output 07 on
021  WAI  01.00        ; Dwell for 1 second
022  AEA   07   0      ; Turn auxiliary output 07 off
023  WAI  01.00        ; Dwell for 1 second
024  JMP  020          ; Jump to 20 (repeat cycle)
```

AKN Acknowledge Input

```
E   003   AKN
11   1
```

11 - Auxiliary Input Number

1 - Input Status
0= Input Status Off
1= Input Status On

NOTE: *Input 00 does not exist. AKN commands containing Input 00 result in an Invalid Program Command diagnostic.*

When the CLM reads an AKN command in the program, it scans the status of the programmed auxiliary input for the specified state. It does not step to the next block until the desired status is present at the specified auxiliary input.

Example:

When auxiliary input #2 is on, auxiliary output 11 is on. When auxiliary input #2 is off, auxiliary output 11 is off.

```
000  JMP  860         ; Jump to program block 860
860  AKN  02  1       ; Acknowledge Input #2 is on
861  AEA  11  1       ; Turn On auxiliary output 11
862  AKN  02  0       ; Acknowledge Input #2 is off
863  AEA  11  0       ; Turn Off auxiliary output 11
864  JMP  860         ; Unconditional Jump to 860
```

APE Parallel Output On/Off

```
E   004   APE
1      2100122011
```

1 = Auxiliary output bank number 0-9 (group of 10 aux. outputs)

Bank 0 = auxiliary outputs 01 - 09 **
Bank 1 = auxiliary outputs 10 - 19
Bank 2 = auxiliary outputs 20 - 29
Bank 3 = auxiliary outputs 30 - 39
Bank 4 = auxiliary outputs 40 - 49
Bank 5 = auxiliary outputs 50 - 59
Bank 6 = auxiliary outputs 60 - 69
Bank 7 = auxiliary outputs 70 - 79
Bank 8 = auxiliary outputs 80 - 89
Bank 9 = auxiliary outputs 90 - 99

** **NOTE:** *Auxiliary Output 00, of Bank 0, does not exist. Program this auxiliary output with "2" status (will not be changed.) No error diagnostic occurs if this output is programmed with anything besides a not-changed condition.*

2100122011 = auxiliary output status as defined by:

0 = Auxiliary output will be set to an Off condition
1 = Auxiliary output will be set to an On condition
2 = Auxiliary output will not be changed

The APE command sets the state of any programmed bank, or group, of ten auxiliary outputs. The desired bank of auxiliary outputs to be set is first selected, indicated by the single display digit. The ten-digit entries set the status of each individual auxiliary output in the bank. Stepping to the next block takes place immediately after the APE command is read. The standard CLM has auxiliary output numbers 1-16. The auxiliary outputs number 17 through 99 are flags (bit memory).

WARNING: *The manipulation of aux. outputs 89 through 99 can have unexpected results. Refer to Table 5.1 for more information.*

NOTE: *The standard CLM-01.3-M has a maximum of 16 auxiliary outputs that are physically accessible to the user. The CLM-01.3-M-E has expanded auxiliary output capability of 48 outputs.*

Example:

The auxiliary outputs in Bank 1 which consists of auxiliary outputs 10-19, will be programmed to the states designated in the data field "2100122011" respectively.

```
┌────────────────┐
|E  044  APE     |
|1     2100122011|
└────────────────┘
```

```
Bank 1 Selected

Prog. State  = 2    1    0    0    1    2    2    0    1    1
               |    |    |    |    |    |    |    |    |    |
Aux. Output# = 10   11   12   13   14   15   16   17   18   19
```

Aux. Outputs 12, 13 and 17 are programmed for an "OFF" state.
Aux. Outputs 11, 14, 18, and 19 are programmed for an "ON" state.
Aux. Outputs 10, 15 and 16 are programmed with a not changed condition.

ATS Output Monitor

```
┌────────────────┐
|E  005  ATS     |
|05  1           |
└────────────────┘
```

```
 05  -  Auxiliary Output Number

  1  -  Auxiliary Output Status
        0 = output status Off
        1 = output status On
```

The ATS command scans the status of the programmed auxiliary output. Stepping to the next program block does not take place until the desired status is present at the programmed auxiliary output.

All auxiliary outputs can be monitored and used in the execution of an ATS command. Auxiliary outputs 81 through 99 function differently from other auxiliary outputs. See Table 5.1 for more information.

Example:

The "In Position" output, programmed in Position Tol. A2, (parameter 47 for Axis 2) is auxiliary number 16. Auxiliary output 16 is Off while Axis 2 is in motion, until the axis is considered "In Position"; at this point the output turns on.

```
000  JMP  500                ; Jump to block 500
500  POI  2 +00100.00 39.5 ; Incremental position command, Axis 2,
                             +100.00 IU at 39.5% of max. velocity
501  ATS  16  1              ; Check and wait in this block until the status of auxiliary
                             output 16 is On. (Axis 2 has reached position).
502  JMP  000                ; Jump to Block 000.
```

BAC Branch With Count

```
E   006   BAC
150  +0000 00500
```

150 - Target Block (000-999)

+0000 - Offset Count Value

00500 - Preset Count

Each time this block is executed, the Actual Count increments by one. Program branching to the Target Block occurs until the Actual Count equals the Preset Count. The Actual Count is then set to zero and stepping to the next program block number occurs. See Counter Display screen example.

Information about the Offset Value:

+1234 - Add Offset Number to the Actual Number

-1234 - Subtract Offset Number from Actual Number

00000 - Delete Actual Number

+0000 - Actual Number unchanged

-0000 - Actual Number unchanged

This is an example of the Counter Display screen for information how to view the Counter Display screen. (See section 2.3.4)

```
┌────────────────┐
│C  150  Counter │
│ 0000056 0000500│
└────────────────┘
 _______  _______
    │        │
    │        └──── Preset Count
    │
    └───────────── Actual Count
```

Immediately after this block is stored in memory, the Offset Value entered is summed with the Actual Count to become the new Actual Count. The Offset Value in the BAC program block display is then set to "+0000." This ensures that the Actual Number is not affected when this block is put into memory again (for instance, if block store is pressed again). The jump to the Target Block continues until the programmed Preset Count is reached. After that, the CLM steps to the next block and the Actual Counter is set to zero. The Actual Count can also be set to zero by using the program command "CLC".

Example:

Assume the Preset Count desired is normally 100. At this time, the Actual Count is 50. However, you desire only 20 more pieces, for a total of 70. Program the BAC block as follows:

The Offset Number data field should be programmed with a "+0030".

```
┌────────────────┐
│E  060  BAC     │
│150  +0030 00100│
└────────────────┘
```

When you press the block store key, the Actual Count is set to 80 (when viewing the Counter Display screen). Therefore, the Preset Count is reached after 20 counts, resulting in 70 total parts. All times after that, the counter starts at 000000, resulting in 100 increments.
The same holds true if a negative number is entered in the Offset Number data field of the BAC program block. Using the same example as above, if an Offset Number of <-0030> was entered, the Actual Count starts at 20. Therefore, 80 increments are encountered before the 100 Preset Count is achieved. Thereafter, the Actual Count begins at 000000.

If a negative Offset Number entered is greater than the Actual Count, the Actual Count will be set to zero. The Actual Count cannot be set to a negative value (set to do less than zero increments).

A typical use for Offset Value is to make up for bad parts. Let's say you had a jam, reached the end of the roll of material, or for some other reason you have five defective parts. Now, instead of 100 parts, you need 105 parts to make your production quota. There are two things that can be done to the program block containing the BAC command. The Preset Count can be changed from 100 to 105 parts, or <-0005> can be entered as an Offset Value to yield five extra parts (by decrementing the Actual Count by five parts). If the Preset Count is modified, a new Preset Count may need to be entered for proper quantity of parts per quota.

NOTE: *When a power loss or E-Stop condition occurs, the actual count is maintained in RAM by battery backup.*

BCA Output-Dependent Conditional Jump

```
E  007  BCA
345  22  0
```

345 - Target Block (000-999)

22 - Auxiliary Output Number (01-99)

0 - Jump Condition

0 = Jump if auxiliary output is Off
1 = Jump if auxiliary output is On

The jump to the target block is executed if the programmed auxiliary output meets the preselected condition (0=Off or 1=On). If the condition is not met at the programmed output, the program steps to the next block, instead of branching to the target block.

Example:

```
000  JMP  500              ; Jump to block 500
500  BCA  600  10  1       ; Jump to block 600 if auxiliary output 10 is on.
501  BCA  700  11  1       ; Jump to block 700 if auxiliary output 11 is on.
502  BCA  800  12  0       ; Jump to block 800 if auxiliary output 12 is off.
503  JMP  500              ; Jump to block 500 and scan outputs 10 through 12 and jump
                             if any condition occurs.
```

BCB Binary Input Dependent Conditional Jump

```
E   008   BCB
100   12    1
```

100 - 0ffset

12 - Length of jump

1 - Auxiliary Input Bank Selection
(Can be 1, 2, or 3. This determines the location of the Binary inputs)

The BCB command executes a jump which has been defined by means of the Binary Inputs at the auxiliary inputs 1 to 8, relative to input bank selection.

The target block is calculated as follows:

Target Block = Offset + (Binary Input Value x Length of Jump)

The Binary Input Value should be converted to a decimal value to calculate the target block.

The Binary input location can be selected from the following:

Input Bank Selection 1 - use auxiliary inputs 1-4				
Auxiliary Inputs	4	3	2	1
Binary Significance	2^3	2^2	2^1	2^0
Decimal Significance	8	4	2	1

Input Bank Selection 2 - use auxiliary inputs 5-8				
Auxiliary Inputs	8	7	6	5
Binary Significance	2^3	2^2	2^1	2^0
Decimal Significance	8	4	2	1

With input bank selection 1 or 2, a total of 15 targets is possible.

Input Bank Selection 3 - use auxiliary inputs 1-8								
Auxiliary Inputs	8	7	6	5	4	3	2	1
Binary Significance	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Decimal Significance	128	64	32	16	8	4	2	1

With input bank selection 3, a total of 256 targets is possible.

NOTE: *There is no "Invalid Program Command" diagnostic if this command is programmed to exceed block 999, because the destination block is dependent on the value determined from aux. inputs (relative to the Binary Input Value selected). However, an "Invalid Block #" diagnostic is issued when the BCB command is executed and the destination block exceeds program block 999.*

BCD BCD-Dependent Conditional Jump

```
E  009  BCD
100  12
```

100 - Offset

12 - Length of jump

The BCD command executes a jump which has been defined by means of BCD (Binary Coded Decimal) inputs at the auxiliary inputs 1 to 8.

The target block is calculated as follows:

Target Block = Offset + (BCD Input Value x Length of Jump)

The BCD Input Value should be converted to a decimal value to calculate the target block.

If a parallel input is not sensed in the BCD format, this will result in "BCD Input Error" diagnostic.

Auxiliary Inputs	8	7	6	5	4	3	2	1
BCD Significance	80	40	20	10	8	4	2	1

Example:

For this example, the offset is 100 and the length of the jump is 12.

Auxiliary Inputs	8	7	6	5	4	3	2	1
BCD Input	0	1	0	1	0	0	1	1
Decimal Equivalent	= 40 + 10 + 2 + 1 = 53							

Target Block = 100 + (53 x 12) = 736

In the example, a jump to program block 736 takes place.

Any type of program can be stored at the target block. A total of 100 target blocks is possible using the BCD command.

NOTE: *There is no "Invalid Program Command" diagnostic if this command is programmed to exceed block 999, because the destination block is dependent on the value determined from auxiliary inputs (relative to the BCD value selected). However, an "Invalid Block #" diagnostic is issued when the BCD command is executed and the destination block exceeds program block 999.*

BCE Input Dependent Conditional Jump

```
E   010   BCE
234   01    0
```

234 - Target Block

01 - Auxiliary Input Number (1-16)

0 - Jump Condition:

0 = Jump if auxiliary input is OFF/low
1 = jump if auxiliary input is ON/high

A conditional jump to the target block will be executed if the auxiliary input meets the preselected condition (0 or 1). If the condition is not met at the programmed input, the program steps to the next block.
One use of this command is to allow selecting programs to run different parts, using a switch on the control panel. In the following example, the main program runs, then branches and executes a specific program indicated by the first input that is on (high). The last block of the specific program can jump back to the first block of the main program (block 000) and scan for another auxiliary input to turn on (high).

Example:

```
000  NOP                  ; No Operation
001  BCE  010  01   1     ; Branch to block 10 if auxiliary input 1 is on.
002  BCE  020  02   1     ; Branch to block 20 if auxiliary input 2 is on.
003  BCE  030  03   1     ; Branch to block 30 if auxiliary input 3 is on.
004  BCE  040  04   1     ; Branch to block 40 if auxiliary input 4 is on.
005  JMP  000             ; Jump to block 000 and scan aux. inputs 1 through 4.
```

BIO Branch Input/Output Compare

```
E  011  BIO
321 4 1111222222
```

321 - Target Block Number

4 - Auxiliary output bank number 0-9 (group of 10 aux. outputs)

Bank 0 = auxiliary outputs 01 - 09 **
Bank 1 = auxiliary outputs 10 - 19
Bank 2 = auxiliary outputs 20 - 29
Bank 3 = auxiliary outputs 30 - 39
Bank 4 = auxiliary outputs 40 - 49
Bank 5 = auxiliary outputs 50 - 59
Bank 6 = auxiliary outputs 60 - 69
Bank 7 = auxiliary outputs 70 - 79
Bank 8 = auxiliary outputs 80 - 89
Bank 9 = auxiliary outputs 90 - 99

1111222222 - Auxiliary input/output states for comparison. States are defined below:

0 = Auxiliary output will be set to an Off condition
1 = Auxiliary output will be set to an On condition
2 = Auxiliary output will not be change

** **NOTE:** *Auxiliary Output 00, of Bank 0, does not exist. Program this auxiliary output with "2" status (will not be changed.) No error occurs if this output is programmed with anything besides a not changed condition.*

This command is used to check the auxiliary inputs identified with "1" for the level input "1" if the auxiliary outputs of the same number have been set to "1". The jump to the target block takes place when the condition is met.

The inputs in the BIO data marked with "0" or "2" will not be checked. The only com-parison that will cause a jump is if each respective BIO data = "1", output = "1" and input = "1".

Example:

```
E  801  BIO
040 1 1111000000
```

Inputs and outputs from 10 to 13 will be compared

BIO Dat	10="1"	11="1	12="1"	13="0"	14="0"
Outputs	10="1"	11="1	12="1"	13="0"	14="1"
Inputs	10="1"	11="1"	12="0"	13="1"	14="1"
Condition	met	met	not met	not check	not check

Since the condition is not being met at one point (input 12), the jump will not be executed. Instead, the program steps to the next program block.

WARNING: *The manipulation of aux. outputs 89 through 99 can have unexpected results. Refer to Table 5.1 for more information.*

BMB Branch on Multiple Binary Outputs

```
E  012  BMB
123 45 67 8
```

123 - Block Offset

45 - Length of Jump

67 - Starting Output Number (01-99)

8 - Number of Consecutive Outputs Being Used

This command causes a jump to occur, which is determined by means of the output defined in the command. The target block is calculated as follows:

Target Block = Block offset + (output value x length of jump)

Example:

```
E  012  BMB
100 02 05 8
```

Outputs	12	11	10	09	08	07	06	05
Significance	128	64	32	16	08	04	02	01
Output value	0	0	1	1	0	0	1	1

Output value (Decimal) = 32 + 16 + 2 + 1 = 51

The target block is calculated as follows:

Block offset + (output value x length of jump)

100 + (51 x 02)

Target block = 202

In this example, a jump to program block 202 takes place.

NOTE: *The standard CLM-01.3-M has a maximum of 16 auxiliary outputs that are physically accessible to the user. The CLM-01.3-M-E has expanded auxiliary output capability of 48 outputs.*

BPA Branch on Parallel Outputs

```
E  013  BPA
234 5 1111000022
```

234 - Target Block

5 - Auxiliary output bank number (0-9) (group of 10 aux. outputs)

Bank 0 = auxiliary outputs 01 - 09 **
Bank 1 = auxiliary outputs 10 - 19
Bank 2 = auxiliary outputs 20 - 29
Bank 3 = auxiliary outputs 30 - 39
Bank 4 = auxiliary outputs 40 - 49
Bank 5 = auxiliary outputs 50 - 59
Bank 6 = auxiliary outputs 60 - 69
Bank 7 = auxiliary outputs 70 - 79
Bank 8 = auxiliary outputs 80 - 89
Bank 9 = auxiliary outputs 90 - 99

1111000022 - Output State (for each of the 10) as listed below:

0 = the output will be checked for condition Off
1 = the output will be checked for condition On
2 = the output will not be checked

** **NOTE:** *Auxiliary Output 00, of Bank 0, does not exist. Program this auxiliary output with "2" status (will not be changed.) No error occurs if this output is programmed with anything besides a not changed condition.*

This command can be used to check if a condition is being met at 10 auxiliary outputs of the CLM. The condition can be specified separately for each of the 10 outputs.

The jump to the target block takes place only if all 10 aux. outputs meet their programmed condition. If not, stepping to the next block takes place.

WARNING: *The manipulation of aux. outputs 89 through 99 can have unexpected results. Refer to Table 5.1 for more information.*

One use of this command is to select different programs to run, according to the condition of 10 auxiliary outputs. In the following example, the main program runs a loop, until an auxiliary output condition causes a branch or jump to the target block. The branch or jump to the target block will execute a specific program. The last block of the specific program can jump back to the first block of the main program (block 000) and scan for another auxiliary output condition to occur.

Example:

000 JMP 500	; Jump to program block 500
500 BPA 600 1 1002222222	; Jump to program block 600 if aux. output 10 is on (high) and 11 and 12 are off (low).
501 BPA 700 1 0102222222	; Jump to program block 700 is auxiliary output 11 is on (high) and 10 and 12 are off (low).
502 BPA 800 1 0012222222	; Jump to program block 800 if auxiliary output 12 is on and 10 and 11 are off.
503 JMP 500	; Jump to block 500

BPE Branch on Parallel Inputs

```
E  014  BPE
345 6 1111000022
```

345 - Target Block

1 - Auxiliary input bank number (0-8) (group of 10 aux. input)

Bank 0 = auxiliary inputs 01 - 09
Bank 1 = auxiliary inputs 10 - 19
Bank 2 = auxiliary inputs 20 - 29
Bank 3 = auxiliary inputs 30 - 39
Bank 4 = auxiliary inputs 40 - 49
Bank 5 = auxiliary inputs 50 - 59
Bank 6 = auxiliary inputs 60 - 69
Bank 7 = auxiliary inputs 70 - 79
Bank 8 = auxiliary input 80

1111000022 - Input State (for each of the 10) as listed below:

0 = the input will be checked for condition Off.
1 = the input will be checked for condition On.
2 = the input will not be checked.

This command represents an expansion of the command "BCE". It can be used to check simultaneously if a condition is being met at 10 CLM inputs. The condition can be specified separately for each input. The jump to the target block takes place only if all 10 inputs meet the programmed condition.

NOTE: *If bank number 8 is used, then only auxiliary input 80 can be checked. The maximum number of auxiliary inputs available is 80; only the CLM-01.3-M-E makes these inputs accessible to the user.*

One use of this command is to select different programs to operate by the conditions of 10 auxiliary inputs. In the following example, the main program runs a loop, until an auxiliary input condition causes a branch or jump to the target block. The branch or jump to the target block will execute a specific program. The last block of the specific program can jump back to the first block of the main program (block 000) and scan for another auxiliary input condition to occur.

Example:

000 JMP 500	; Jump to program block 500
500 BPE 600 1 1002222222	; Jump to program block 600 if auxiliary input 10 is on (high) and 11 and 12 are off (low).
501 BPE 700 1 0102222222	; Jump to program block 700 if auxiliary input 11 is on (high) and 10 and 12 are off (low).
502 BPE 800 1 0012222222	; Jump to program block 800 if auxiliary input 12 is on (high) and 10 and 11 are off (low).
503 JMP 500	; Jump to block 500

BPT Branch If Position Has Been Reached

```
E  015  BPT
456 2 +123456.78
```

456 - Target Block

2 - Axis Number (1 or 2)

+123456.78 - Absolute Position (2 or 3 decimal places, as set in P82)

This command can be used to check absolute position of the specified axis number. If the axis is in this position (+/- position tolerance, (P07,P57)), the jump to the target block will take place. If the axis is not in this position then stepping to the next block takes place.

NOTE: *BPT functions only after the axis has been homed. Prior to homing, the block is scanned but is not executed.*

CLA Clear Absolute Encoder Value (Axis 2 Only)

```
E  016  CLA
2
```

2 - Axis 2 Only

The CLA command is used to set the axis 2 position to zero and allow the absolute position commands to operate. When the CLA command is encountered in the user's program the position display is set to zero and the "Home Established" output in the Homing Setup I/O, parameter 50, is turned on. If the Homing Offset distance is programmed in parameter 49, that distance is inserted as the position. To use this command, it must be programmed for use with an incremental encoder. Otherwise, the message "illegal command" will appear when the command CLA is called up.

CLC Clear Counter

```
E  017  CLC
123
```

123 - Counter Block Number (000-999)

Use this command to clear (set to zero) the actual value of the counter at the indicated block number. If the counter block number does not contain one of the counter commands BAC, COU, or STZ, then this block is only scanned.

CON Continuous Operation (Axis 2 Only)

```
E  018  CON
2  1  +345
```

2 - Axis 2 Only

1 - Continuous Operation (0=off, 1=on)

+/-345 - Continuous Velocity as percentage of Vel. Axis 2, parameter 42. (1 decimal place)

+/- direction (relative to Direction of Operation Parameter 46, Axis 2)

The CON command is used for continuous operation of the axis 2 motor. When the CON command is encountered and turned on, in the CLM, the axis 2 motor will rotate in the direction specified. The CON command will continue to rotate until another CON command is given to turn it off. Also, if an error occurs, the CON command will turn off. The continuous velocity is programmed as a percentage of the Velocity Axis 2, parameter 42.

The plus and minus sign before the velocity determines the direction of axis 2 motor's rotation. Stepping to the next block takes place immediately after the block is read.

WARNING: *The CON command is for axis 2 positioning only. If the CON command is programmed for axis 1, unexpected positioning may occur resulting in personal injury or damage to the machine.*

WARNING: *Subsequent commands relating to the axis 2 programmed here may be affected by the continuous operation. If the axis has limited travel (ie. ballscrew), safeguards should be taken to assure the axis will be stopped before travel limit is exceeded.*

NOTE: *Axis 2 position commands should not be used while continuous operation is on.*

Example:

If auxiliary input 10 is turned on, axis 2 will move in the positive direction at 25 % of the Velocity, Axis 2 parameter. If auxiliary input 10 is turned off, axis 2 will stop. If auxiliary input 11 is turned on, axis 2 will move in the negative direction at 25 % of Velocity, Axis 2 parameter. If auxiliary input 11 is turned off, axis 2 will stop.

```
000  BCE  010  10   1      ; If auxiliary input 10 is on, the program at block 10 is
                             selected.
001  BCE  020  11   1      ; If auxiliary input 11 is on, the program at block 20 is
                             selected.
002  JMP  000              ; Jump to program block 000 and scan auxiliary inputs 10 and
                             11.
010  CON  2  1  +250       ; Axis 2 continuous positioning in the positive direction at 25
                             % of the Velocity Axis 2 (P42).
011  AKN  10   0           ; Acknowledge auxiliary input 10 is off (low).
012  CON  2  0  +000       ; Axis 2 will stop positioning.
013  JMP  000              ; Jump to program block 000.
020  CON  2  1  -250       ; Axis 2 continuous positioning in the negative direction at 25 % of
                             the Velocity Axis 2 (P42).
021  AKN  11   0           ; Acknowledge auxiliary input 11 is off (low).
022  CON  2  0  -000       ; Axis 2 will stop positioning.
023  JMP  000              ; Jump to program block 000.
```

COU Counter

```
┌─────────────────┐
│E  019  COU      │
│+12345 12 123456 │
└─────────────────┘
```

+12345 - Offset count value

12 - Auxiliary output number

123456 - Preset count

When the COU command is read in the user program, the actual count on the Counter display is incremented by 1. When the preset count is reached, the auxiliary output programmed in this command is turned on. The actual count is subsequently cleared. The actual count can be also set to zero by using the CLC command.

Example:

The Counter Display screen, shown below, has the counter (COU command) programmed at block 014. The preset count is 500 and the actual count is 56.

```
┌─────────────────┐
│C  014  Counter  │
│ 0000056 0000500 │
└─────────────────┘
  ───┬───  ───┬───
     │        └─── Preset Counter Value
     │
     └──────────── Actual Count
```

When the COU command is read in program block 014, the actual count will increment to 57. For a description and example of using the offset count value, refer to the BAC command.

NOTE: *If a power loss or E-Stop condition occurs, the actual count is maintained in RAM by battery backup.*

EOS End Of Synchronization (Axis 1 Only)

```
E  020  EOS
```

The flying cutoff program must always end with the EOS command. The EOS command is used to tell the flying cutoff device that the processing cycle (sawing or shear) has been completed. The EOS command tells the flying cutoff device that synchronization has ended and the next LMD,LML, or LMR will return the flying cutoff device to the home position. If the EOS command is not programmed and the CLM program encounters an LMD, LML, or LMR command, the "EOS Command Missing" error will occur. Refer to section 5.9, Typical Flying Cutoff Program.

FAK   Correction Factor For The MW Feed Constant (Axis 1 Only)

```
E  021  FAK
1  1.99999
```

1 - Axis 1

1.99999 - Correction Factor, 0.00000 to 1.99999

The FAK command applies a multiplication factor to the measuring wheel feed constant. Adjusting the correction factor in the FAK command provides better part length accuracy. When the FAK command is used, parameter 38 (Measuring Wheel Feed Constant) does not have to be changed to compensate for the inaccuracy of part lengths.

When the correction factor is less than 1.00000, the part length being processed will be adjusted longer.

When the correction factor is greater than 1.00000, the part length being processed will be adjusted shorter.

At the start of the automatic operating mode the correction factor is 1.00000 until it is changed by the FAK command in the CLM program. The correction factor will remain in effect until a new correction factor is entered and read with the FAK command, in the user program.

A new correction factor has no effect on the part length currently being processed.

FUN Functions (Axis 1 Only)

```
E  021  FUN
0  1  2
```

0 - Time Measurement 1
- 0 = Store time and turn off time measurement 1
- 1 = Clear and turn on time measurement 1
- 2 = Time Measurement 1 is not used

1 - Time Measurement 2
- 0 = Store time and turn off time measurement 2
- 1 = Clear and turn on time measurement 2
- 2 = Time Measurement 2 is not used

2 - Length Measurement
- 0 = Clear and store temporarily
- 1 = Clear length measurement and restart
- 2 = Length Measurement is not used

The FUN command allows for two time-measurement functions and one length function, for axis 1 only. When the FUN command is used in the program to turn any or all of the functions on, another FUN command must be used to turn any or all of the functions off. When a 2 is stored in any of these digits, that function is not used.

Time Measurement 1

When the time measurement 1 is turned on, the time is measured in milliseconds, until the next FUN command turns the time measurement 1 off. When the FUN command turns the time measurement 1 off, the time is stored and can be requested by status 80. The time measured will remain stored, until the next cycle of turning the time measurement on and off occurs.

Time Measurement 2

When the time measurement 2 is turned on, the time is measured in milliseconds, until the next FUN command turns the time measurement 2 off. When the FUN command turns the time measurement 2 off, the time is stored and can be requested by status 81. The time measured will remain stored, until the next cycle of turning the time measurement 2 on and off occurs.

Length Measurement

When the length measurement is turned on, the length is measured in input units, until the next FUN command turns the length measurement off. When the FUN command turns the length measurement off, the length is stored and can be requested by status 31. The length measured will remain stored, until the next cycle of turning the length measurement on and off occurs.

NOTE: *The length measurement function must be enabled when using the index length or length correction in Parameter 21, Length Correction. Refer also to Typical Flying Cutoff Program in section 5.9.*

HOM Homing (Axis 2 Only)

```
E  023  HOM
2
```

2 - Axis 2

The HOM command is used for axis 2 only and uses parameters 48 through 52. Stepping to the next program block takes place immediately after the block has been read in. The next program block after the HOM command should be a ATS command. The "Home Established" output should be stored in the ATS command's auxiliary output number.

The "Home Established" output is specified in the Homing Setup I/O A2, parameter 50. The ATS command will monitor the "Home Established" output and prevent stepping to the next block until the homing sequence is finished. An error will be issued if the program sequence encounters an absolute position command (POA, PSA) before the homing sequence is completed.

If the homing offset parameter (P49) is programmed, the homing offset distance is inserted as the new position after the homing sequence. Refer to chapters 4, Homing Setup Parameter 48 for more information about the homing sequence.

If the HOM command is used and axis 2 is using an absolute value encoder, an error message will appear.

WARNING: *The HOM command is for axis 2 positioning only. If the HOM command is programmed for axis 1, unexpected positioning may occur resulting in personal injury or damage to the machine.*

Example:

The Homing Setup I/O A2, parameter 50 has auxiliary output #3 as the "Home Established" output. This program will continuously perform position moves between +0 and +10 input units. After each move, a one-second dwell occurs.

```
000  JMP  500                      ; Jump to program block 500

500  HOM  2                        ; Home axis 2
501  ATS  03  1                    ; Acknowledge "Home Established"
502  JMP  510                      ; Jump to program block 510

510  PSA  2 +000010.00 250         ; Position axis 2 to +10 inches at 25% of max. velocity
511  WAI  01.00                    ; Dwell for 1 second
512  JMP  515                      ; Jump to program block 515

515  PSA  2 +000000.00 250         ; Position axis 2 to +0 inches at 25% of max. velocity
516  WAI  01.00                    ; Dwell for 1 second
517  JMP  510                      ; Jump to program block 510
```

JMP   Unconditional Jump

```
E  024  JMP
123
```

123 - Target Block (000-999)

When this command is encountered, the user program will immediately jump to the specified target block. The JMP command can also be used in Task 2 and/or Task 3, but the JMP command should not be used for jumping from one task to another. The JMP should only be used to jump within the specified program blocks of Task 2 and/or Task 3.

NOTE: *When using Task 2 and 3, the program blocks used for each task must remain separate from each other.*

JSR Jump to Subroutine

```
E  025  JSR
567
```

567 - Target block (starting block of the subroutine)

The JSR command allows for an unconditional jump to a subroutine. When the JSR command is read in the program, the program will jump to a subroutine at the specified target block. The subroutine program must end with an RTS command (Return From Subroutine). When the RTS command is encountered, the program returns to the program block immediately following the block containing the JSR command, and the program continues. If an RTS command is not programmed at the end of a subroutine, the program blocks following the end of the subroutine will be executed. This can result in unexpected axis movement, "Invalid Program Command" diagnostic, etc.

A maximum of 127 nested subroutines is allowed.

LMD Part Length Via The IDS Board (Axis 1 Only)

```
E  026  LMD
```

The LMD command allows the part length to be entered on the Indramat IDS board. The IDS board has six decade switches, used by the operator to set part length. The part length entered contains two or three decimal places, depending on the setting of Parameter 82.

The IDS board transmits the part length via RS-232 serial communications to connector X6 on the CLM. Once the part length entered has passed the measuring wheel, the carriage (axis 1) will synchronize. After the carriage synchronizes, the CLM program moves to the next program block.

The Serial Interface parameter 80 is used to enable the IDS option. If the IDS board is not enabled, this program block is scanned, but no positioning takes place.

NOTES: *If a cut width is programmed in parameter P16, then the cut width distance is taken into consideration when this part length is processed.*

After a part has been processed and EOS command has been reached in the CLM program, the next LMD command will tell the carriage (axis 1) to return to home position.

There is only a single memory location, and only one position value can be stored at one time. When using the LMD command for axis 1, the POM or PSM commands must not be used for axis 2.

LML Part Length (Axis 1 Only)

```
┌─────────────────┐
|E  027  LML      |
|       000100.00 |
└─────────────────┘
```

000100.00 - Part Length, in input units

The LML command allows the operator to enter the part length via the CLM keypad. The part length entered contains two or three decimal places, depending on the setting of Parameter 82.

When the length of material passing the measuring wheel equals the part length entered, the carriage (axis 1) will synchronize. Once the carriage synchronizes, the program moves to the next program block.

NOTES: *If a cut width is programmed in parameter P16, then the cut width distance is taken into consideration when this part length is processed.*

After a part has been processed and an EOS command has been reached in the CLM program, the next LML command will tell the carriage (axis 1) to return to the home position.

LMR Part Length with Registration (Axis 1 Only)

```
E  028  LMR
00010.00 0004.00
```

00010.00 - Bypass Length, in input units

0004.00 - Offset Length, in input units

The LMR command allows the operator to enter the offset and bypass lengths for parts being processed by a registration mark. The part lengths are determined by the registration marks on the material. The bypass and offset lengths entered contain two or three decimal places, depending on the setting of Parameter 82.

The offset length is the distance from the registration device (sensor) to the cutting device (shear, saw, etc.). The offset length must be larger than the acceleration distance. If necessary, the offset length can be adjusted to locate the cut in the middle of the registration mark. (Refer to Fig. 5.1)

$$\text{Acceleration Distance} = \frac{\text{Vmax (P02)} * \text{Vmax (P02)}}{2 * \text{Acceleration (P04)} * \text{Position Gain (P05)}}$$

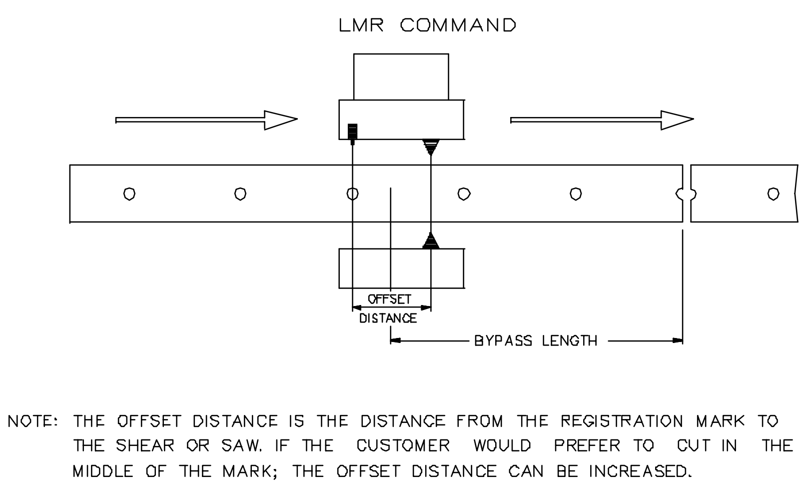


Figure 5.1 LMR Command, Offset and Bypass Distances

If the registration mark is detected when the carriage (axis 1) returns to home position, the offset length must be greater than four times the acceleration distance. It is recommended that the registration device be mounted to the carriage (axis 1).

The bypass length is used to blank out the registration marks on the material that are not supposed to be registered. If the part being processed does not have multiple registration marks, the bypass length can be zero.

Once the bypass length has passed under the measuring wheel, then the next registration mark is anticipated. When the next registration mark is detected and the offset distance has passed, the carriage (axis 1) will synchronize. After the carriage synchronizes, the CLM program moves to the next program block.

NOTE: *After a part has been processed and an EOS command has been reached in the CLM program, the next LMR command will tell the carriage (axis 1) to return to the home position.*

MLT Material Length Test (Axis 1 Only)

```
E  029  MLT
   05  000100.00
```

05 - Auxiliary Output Number

000100.00 - Material Length Test Position

The MLT command is used to check the length of the processed part. For this command to work properly, the MLT must be programmed in the CLM user's program or the manual cut vector and the length measurement function in the FUN command must be enabled.

When the processed part is less than the material length test position, the auxiliary output specified in this command will turn on.

When the processed part is equal to or greater than the material length test position, the auxiliary output specified in this command will turn off.

The material length test position entered contains two or three decimal places, depending on the setting of Parameter 82.

NOTE: *The MLT command is currently under development. Consult Indramat Application Engineering.*

NOP No Operation

```
┌────────────────┐
│E  030  NOP     │
│                │
└────────────────┘
```

The NOP command is used to describe a "no-operation" program block. During processing in the automatic mode, this blank block is scanned only; processing then continues with the next program block.

NOP's are used to reserve program block space for future program change and expansion. They can also be used in the program wherever it might be necessary or advantageous to add commands "on the fly" during production.

NOP's may also be used to provide a 2ms delay. Note that the WAI command offers a 10 ms delay period.

POA Absolute Feed (Axis 2 Only)

```
┌────────────────┐
│E  031  POA     │
│2 +123456.78 999│
└────────────────┘
```

2 - Axis 2 only

+/-123456.78 - Plus or minus absolute target position, in input units. (2 or 3 decimal places, depending on parameter 82)

999 - Feed rate in percentage (0.1-99.9) of the Velocity Axis 2, parameter 42.

NOTE: *Axis 2 must be homed (HOM 2 or CLA 2) prior to execution of this command. Otherwise, an "Axis 2 Not Homed" error will occur.*

The POA command is used to perform an absolute feed (position) for axis 2. When the POA command is read in the CLM program, the absolute target position is stored in the position buffer and stepping to the next block takes place immediately. Since this POA command does not wait for axis 2 to be in position, the command(s) following the POA command will be executed. This allows other functions to be executed while the axis is moving toward the target position.

If multiple POA commands are executed in a sequence, the target position will be the last POA issued.

The ATS command can be used to prevent the CLM program from executing any more program blocks until axis 2 is in position. The auxiliary output used in the ATS command is the same output specified as the Position Tolerance Axis 2 output in parameter 47

NOTE: *Stepping to the next program block takes place immediately after the POA command has been read in the CLM program.*

Example:

Auxiliary output #16 is used in the Position Tolerance Axis 2, parameter 47.

```
500  POA 2 +000010.00 999        ; Axis 2 will absolute feed +10 inches at 99.9% of
                                   Velocity A2.
501  VCC 2  000005.00 500        ; Axis 2 position equals +5 inches change velocity to 50%
503  ATS 16  1                   ; Wait in this block until Axis 2 is in position
                                   (Auxiliary output #16 is on)
```

The ATS command on auxiliary output #16 will prevent the execution of the CLM program until axis 2 is in position.

POI Incremental Feed (Axis 2 Only)

```
┌──────────────────┐
|E   032   POI      |
|2 +123456.78 999|
└──────────────────┘
```

2 - Axis 2 only

+/-123456.78 - Plus or minus incremental target position, in input units.
(2 or 3 decimal places, depending on the setting in parameter 82)

999 - Feed rate in percentage (0.1-99.9) of the Velocity Axis 2, parameter 42.

The POI command is used to perform an incremental feed (position) for axis 2. When the POI command is read in the CLM program, the incremental target position is stored in the position buffer and stepping to the next block takes place immediately. Since this POI command does not wait for axis 2 to be in position, the command(s) following the POI command will be executed. This allows other functions to be executed while the axis is moving toward the target position.

If multiple POI commands are executed in a sequence, the resulting position will be the addition of all incremental feeds. The ATS command can be used to prevent the CLM program from executing any more program blocks until axis 2 is in position. The auxiliary output used in the ATS command is the same output specified as the Position Tolerance Axis 2 output in parameter 47.

NOTE: *Stepping to the next program block takes place immediately after the POI command has been read in the CLM program.*

Example:

The auxiliary output #16 is used in the Position Tolerance Axis 2, parameter 47.

```
500  POI 2 +000010.00 999        ; Axis 2 will incremental feed +10 inches at 99.9% of
                                       Velocity A2.
501  VCC 2  000005.00 500        ; Axis 2 position equals +5 inches change velocity to 50%
503  ATS 16  1                         ; Wait in this block until Axis 2 is in position
                                       (Auxiliary output #16 is on)
```

The ATS command on auxiliary output #16 will prevent the execution of the CLM program until axis 2 is in position.

POM Position On Memory (Axis 2 Only)

```
E   033   POM
2   1
```

2 - Axis 2 Direction
2 = Axis 2, forward (+) direction
4 = Axis 2, reverse (-) direction

1 - Type Of Positioning
0 = Incremental
1 = Absolute

The POM command is an incremental or absolute positioning command. The programmed feed length and speed are stored in a single memory location, either by use of the optional IDS board, or by multiplexing a set of inputs (See program command SO1, Scanning of Inputs and Modifying a Length).

Use parameter 80 to enable the IDS board. If the IDS board is not enabled, this program block is scanned but no positioning takes place.

If Axis 2 absolute positioning is selected, the axis 2 must be homed before POM is read in the program.

The feed length entered contains two or three decimal places, depending on the setting of Parameter 82.

NOTES: *Stepping to the next program block takes place immediately after the POM command has been read in the CLM program.*

When using the POM command for axis 2, do not use the LMD command for axis 1.

PSA Absolute Feed (With In-Position Signal) (Axis 2 only)

```
E  034  PSA
2 +123456.78 999
```

2 - Axis 2 only

+/-123456.78 - Plus or minus absolute target position, in input units. (2 or 3 decimal places, depending on the setting in parameter 82)

999 - Feed rate in percentage (0.1-99.9) of the Velocity Axis 2, parameter 42.

NOTE: *Axis 2 must be homed (HOM 2 or CLA 2) prior to execution of this command. Otherwise, an "Axis 2 Not Homed" error will occur.*

The PSA command is used to perform an absolute feed (position) for axis 2. When the PSA command is read in the CLM program, the absolute target position is stored in the position buffer and stepping to the next block takes place only after the positioning has been completed. The Position Tolerance A2, parameter 47, defines when axis 2 is considered in position.

NOTE: *Stepping to the next program block takes place when the feed (positioning) has been completed.*

PSI Incremental Feed (With In-Position Signal) (Axis 2 only)

```
E  035  PSI
2 +123456.78 999
```

2 - Axis 2 only

+/-123456.78 - Plus or minus incremental target position, in input units. (2 or 3 decimal places, depending on the setting in parameter 82).

999 - Feed rate in percentage (0.1-99.9) of the Velocity Axis 2, parameter 42.

The PSI command is used to perform an incremental feed (position) for axis 2. When the PSI command is read in the CLM program, the incremental target position is stored in the position buffer and stepping to the next block takes only after the positioning has been completed. The Position Tolerance A2, parameter 47, defines when axis 2 is considered in position.

NOTE: *Stepping to the next program block takes place when the feed (positioning) has been completed.*

PSM Position On Memory, With In-Position Signal (Axis 2 Only)

```
E  036  PSM
2  1
```

2 - Axis 2 Direction
- 2 = Axis 2, forward (+) direction
- 4 = Axis 2, reverse (-) direction

1 - Type Of Positioning
- 0 = Incremental
- 1 = Absolute

The PSM command is an incremental or absolute positioning command. The programmed feed length and speed are stored in a single memory location, either by use of the optional IDS board, or by multiplexing a set of inputs (See program command SO1 - Scanning of Inputs and Modifying a Length).

Use parameter 80 to enable the IDS board. If the IDS board is not enabled, this program block is scanned, but no positioning takes place.

If Axis 2 absolute positioning is selected, the axis 2 must be homed before the PSM command is read in the program.
The part length entered contains two or three decimal places, depending on the setting of Parameter 82, Language.

NOTES: *Stepping to the next program block takes place when the feed (positioning) has been completed.*

When using the PSM command for axis 2, do not use the LMD command for axis 1.

PST Position Test

```
E  037  PST
1  05 +123456.78
```

1 - Axis number (1 or 2)

05 - Auxiliary output number

+123456.78 - Test position (2 or 3 decimal places, depending on parameter 82 setting).

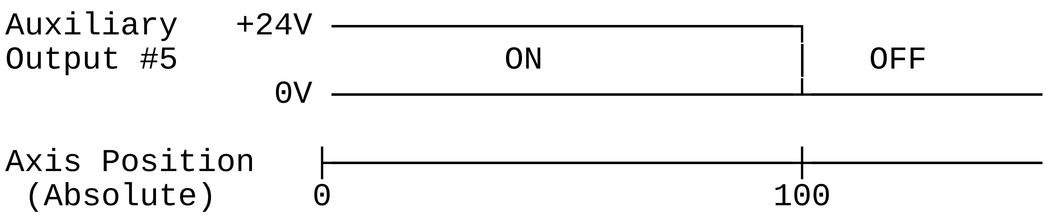
The PST command is used to check for a position and control a output based on current position status. At the execution of this block, the designated auxiliary output is turned ON if the actual position of the axis is less than the test position. If the actual position is equal to or greater than the test position, the auxiliary output is turned OFF. Stepping to the next block takes place immediately after the block has been read in CLM program.

NOTE: *The axis must be homed (HOM or CLA) prior to execution of this command. If the axis is not homed, the block is scanned only and no execution takes place.*

Example:

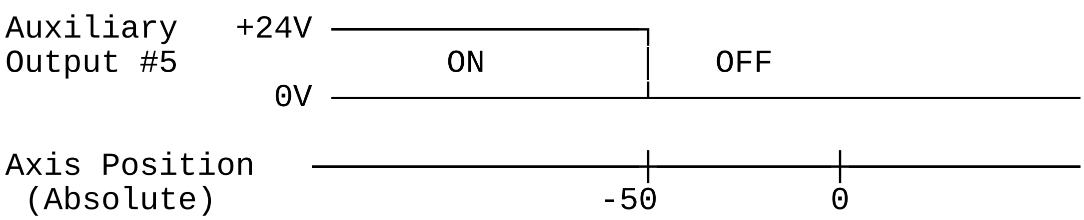
1)

```
E   037   PST
1   05 +000100.00
```



2)

```
E   037   PST
1   05 -000050.00
```



REF Detect Registration Mark Input (Axis 2 Only)

```
E  038  REF
2 0 123 11
```

2 - Axis 2 Only

0 - Direction
 0= forward
 1= reverse

123 - Search speed in % (0.1 - 99.9)

11 - Registration auxiliary input number

The REF command is used to search for a registration (reference) mark for axis 2 only. It is also used to determine the direction, search speed and registration input number used for registering.

When the REF command is read in the CLM program, axis 2 moves at the specified search speed until a positive edge occurs on the registration auxiliary input. Stepping to the next block takes place only after the registration mark has been detected. If the next block is a REP command, the two blocks are run simultaneously. Refer also to REP command.

When the registration mark is detected, the axis decelerates and travels in reverse to the position at which detection occurred. If it is not desirable to have the axis back up in this manner, the REF (or REF/REP) can be followed by a PSI command. Set the PSI feed length to the distance required to decelerate the axis from the search speed.

REP Registration Search Limit Branch (Axis 2 Only)

```
E  039  REP
370      123456
```

370 - Target block number (000-999)

123456 - Search length (to one or zero decimal places, depending on setting in P82)

The REP command is used to limit the maximum distance traveled while searching for the registration mark input. It will cancel the registration search in the REF command, and jump to the target block. REF and REP are run simultaneously; the REP command cannot be run by itself.

At the start of the REF/REP commands, the axis moves at the search speed until either the registration mark is detected, or the search length has passed.

If the registration mark is detected, the axis decelerates (as described for the REF command) and the CLM steps to the next program block.

If the registration mark is not detected, the axis decelerates to a stop at the end of the search length. The actual length traveled will be the search length plus the distance it takes to decelerate the axis to a stop. A jump is executed to the target program block at the end of the search length, as the axis starts decelerating.

The target block should be the start of a recovery routine written to restore operation from a missed mark. It will need to be customized for each application.

RTS Return from Subroutine

```
E  040  RTS

```

The RTS command is used to return from a subroutine which has been called by using the JSR command. When the RTS command is encountered in a subroutine program, the CLM program returns from subroutine to the program block that follows the JSR command, and continue processing.

An "RTS Nesting" error occurs if the CLM program encounters an RTS command without a JSR command; the JSR command must occur first.

SAC Set Absolute Counter (Axis 2 Only)

```
E  041  SAC
2 0   +123456.78
```

2 - Axis 2 Only

0 - Absolute offset (offset change)
  1 = Set absolute position with position error
  2 = Set absolute position without position error

+/-123456.78 - Absolute position or offset

The SAC command is used to set or change the value of the absolute position counter. Axis 2 must be homed before this command can be used. The axis 2 travel limits are changed according the direction of the absolute offset position.

Example:

Axis 2 travel limits before SAC command:

```
Minimum Travel -40 inches    |----------|---------------------|
Maximum Travel +90 inches   -40         0                    +90
```

Axis 2 travel limits after a SAC command with absolute offset of +30 inches:

```
Minimum Travel -70 inches    |-----------------|---------------|
Maximum Travel +60 inches   -70                0              +60
```

SO1 Scanning of Inputs and Modifying a Length

```
E  042  SO1
1 1 10 000
```

Length Entry Mode (1st digit)

0 = Read decade switches (Axis 1 or 2)
1 = Store length and speed (axis 2 only)

Only values up to the Y value are considered; higher values will be set to "0"

1 - Decimal Position (Y value): (2 or 3 decimals, depending on setting in P82)

For 3 decimal places	For 2 decimal places
1 = 10^3	1 = 10^2
2 = 10^2	2 = 10^1
3 = 10^1	3 = 10^0
4 = 10^0	4 = 10^1
5 = 10^1	5 = 10^2
6 = 10^2	6 = 10^3
7 = 10^3	7 = 10^4
8 = 10^4	8 = 10^5

10 - Starting Input Number XX, with the BCD value:

XX = 10
XX+1 = 11

XX+2 = 12
XX+3 = 13

000 - Velocity (Axis 2 Only)- to be used after the length has been stored.

The SO1 command is used to read in length information via decade switches or from a programmable logic controller (PLC).

NOTE: *If the IDS decade switches option is selected in parameter 80, the SO1 command will cause the error message Illegal Command.*

Example:

Aux. input 10 is the least significant digit. Enter 10 for the XX entry. Input 11 is 10+1 (XX+1). Input 13 is the most significant digit (XX+3). The CLM must read in all decimal places, one after the other. A SO1 command is required for each decimal place. The resulting information is stored in the same CLM memory where information from IDS decade switches would be stored. The information is evaluated with either the LMD command (Axis 1 only) or the POM and PSM commands (Axis 2 only).

Figure 5.2 is an example of an external decade switch group connection (4 decade switches), using the SO1 command, uses APE command to switch outputs:

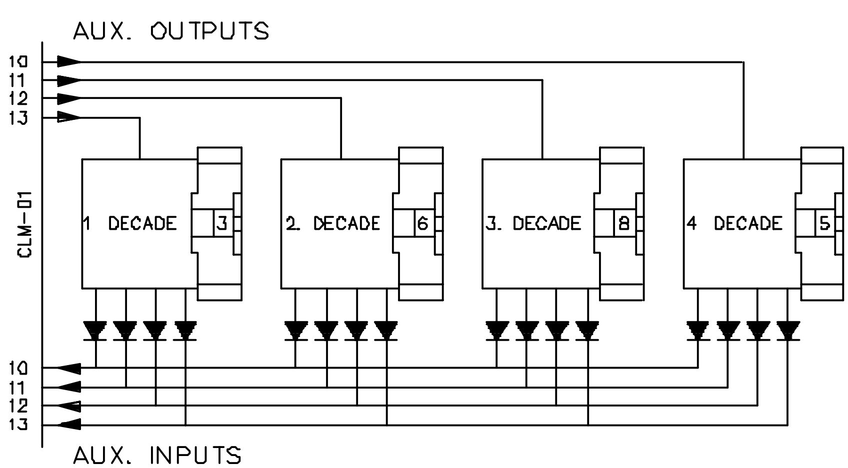


Figure 5.2 SO1 Decade Group Connection

BLOCK#	COMMAND	COMMAND DATA		
900	APE	1 1000222222	=	Fourth Decade
901	WAI	00.02		
902	SO1	0 2 10 000		
903	WAI	00.02		
904	APE	1 0100222222	=	Third Decade
905	WAI	00.02		
906	SO1	0 3 10 000		
907	WAI	00.02		
908	APE	1 0010222222	=	Second Decade
909	WAI	00.02		
910	SO1	0 4 10 000		
911	WAI	00.02		
912	APE	1 0001222222	=	First Decade
913	WAI	00.02		
914	SO1	0 5 10 000		
915	WAI	00.02		
916	SO1	1 5 10 500	=	Read in as Length

The fourth decade is read in via output 10, the third via output 11, the second via output 12, and the first via output 13. In the example, inputs 10 to 13 are programmed as an input. The length is then read.

NOTE: *It is useful to program the SO1 command in Task 3. All numbers which are not read in (pseudo-nibbles) are assumed to be 0.*

STH Send to Host

```
E  043  STH
0  000
```

0 - Type of information to be sent to the host device
- 0 = Status Code
- 1 = Counter status of preset and actual number of pieces.

The counter's program block number must be entered in the status/counter code.

000 - Status Code / Counter Information, options as below:
- 000 = Current Position, Axis 1 & 2
- 001 = RS Transmission Error # And Text
- 002 = Current Program Block (Task 1 only)
- 003 = Current Position, Axis 1 & 2 (Hexadecimal)
- 004 = Counter Status
- 005 = Software Version
- X06 = Input Status
- X07 = Output Status
- 008 = Current Program Block (Task 1, 2, and 3)
- 019 = Hardware & Software Version
- 030 = Current Material Length Information
- 031 = Last Material Length Processed
- 032 = Current Operating Information
- 050 = System Inputs / System Outputs (Hexadecimal)
- 051 = Auxiliary Inputs Status (1-80) (Hexadecimal)
- 052 = Auxiliary Outputs Status (1-96) (Hexadecimal)
- 053 = Error Code And Error Message
- 054 = Material Length Run Out
- 055 = Material Velocity
- 056 = Total Piece Number Counter
- 080 = Time Measurement 1
- 081 = Time Measurement 2
- XXX = Counter Program Block Number (if first digit is a 1)

In x06 and x07, x = Input/output bank number, 0-9

The STH command is used to transmit or send information from the CLM to a host device, connected to the front of the CLM via connector X6. Stepping to the next block takes place immediately after the block has been read.

The Serial Interface parameters 80 and 81 must be configured properly to communicate with the host device. Refer to Chapter 7, Serial Interface, for more information on the status codes and counter information.

NOTE: *The STH command cannot be programmed when using the SOT with ScreenManager.*

STZ Counter With Predefined Jump

```
E  044  STZ
+0000010 0000500
```

+0000010 - Offset Count Value

0000500 - Preset Count

The STZ command, like the BAC command, is a counter command that will cause the program to execute a predefined jump of three blocks back, until the preset count is reached. Each time the STZ program block is executed, the actual count increments by one. If the actual count equals the preset count, the actual Count is set to zero and stepping to the next program block number takes place. If the actual count is less than the preset count, then the backward jump occurs again. This sequence continues until the preset count is reached.

The offset count value is used to change the actual count. The offset count value is changed by entering the offset in the STZ command and pressing the store key. Some of the ways the offset count value can be changed are described below.

+1234567 - Add offset count value to the actual count

-1234567 - Subtract offset count value from actual count

00000000 - Set actual count to zero

+0000000 - Actual count unchanged
or
-0000000 - Actual count unchanged

For a description of the offset count value, refer to the BAC command. The actual count can be set to zero by issuing a CLC command in the CLM program.

NOTE: *If a power loss or E-Stop condition occurs, the actual count is maintained in RAM by battery backup.*

VCC Velocity Change (Axis 2 Only)

```
E  045  VCC
2  123456.78 100
```

2 - Axis 2 Only

123456.78 - Velocity Change Distance (2 or 3 decimal places, depending on parameter 82)

100 - Speed in percentage (0.1-99.9) of the Velocity Axis 2, parameter 42.

The VCC command is used to change the current velocity rate for axis 2. The VCC command is used in conjunction with axis 2 position commands POA, POI, and POM. The VCC command should be programmed after the position commands. Stepping to the next block takes place after the velocity change distance has been traveled.

NOTE: *If the velocity change distance specified is longer than the previous position command, the CLM will step to the next block after axis 2 reaches position tolerance. See Parameter 47.*

Example:

Axis 2 will move 100 inches in the positive direction. The velocity changes when axis 2 has reached 50, 75 and 90 inches. For this example to work properly, auxiliary output 16 must be stored in the axis 2 position tolerance, parameter 47.

```
000  JMP  500                    ;Jump to program block 500
500  POI     2 +000100.00 999    ;Axis 2 moves to +100 inches at 99.9 %.
501  VCC     2  000050.00 250    ;Axis 2 reaches 50 inches, velocity changes to 25.0 %.
502  VCC     2  000075.00 500    ;Axis 2 reaches 75 inches, velocity changes to 50.0 %.

503  VCC     2  000090.00 100    ;Axis 2 reaches 90 inches, velocity changes to 100%

504  ATS     16      1           ;Acknowledge axis 2 is in position
505  WAI  01.00                  ;Dwell for 1 second.
506  JMP  500                    ;Jump back to program block 500 and repeat cycle.
```

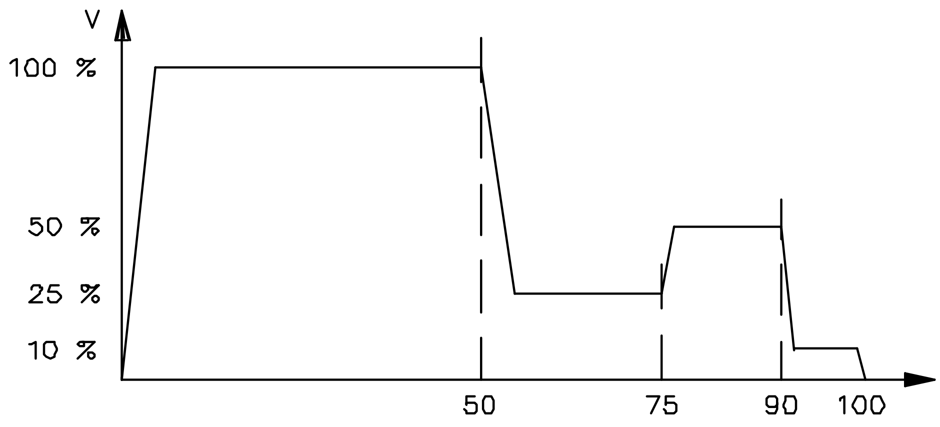


Figure 5.3 Velocity Change Command

VEO Velocity Override (Axis 2 Only)

```
E  045  VEO
2 1 3 111 0
```

2 - Axis 2 (Only)

1 - Override Input Selection
0 = VEO command is turned off or override as set in Variations, parameter 87. 1 = Override via an analog input (AE2)
2 = Override via Binary inputs (Auxiliary Inputs #8-16)
3 = Override via Gray Code (Auxiliary Inputs #13-16)
4 = Programmed Override (Requires Velocity Factor entry)

3 - Override Update
0 = Read the Override value every 2 ms.
1-9 = Read the Override value only when VEO command appears in the program.

111 - Velocity Factor to 3 decimal places (.001-.999)
(Requires Override Input Selection = 4)

0 - Override Input Value
0 = Represents a factor to determine the resulting velocity.
1-9 = Represents a limiting factor.

The VEO command is used to override the velocity for axis 2 only. The maximum velocity is defined in the Velocity Axis 2, parameter 42 and will limit the maximum velocity override. Also, the axis 2 position command (POA, PSI, CON..etc) can be used to limit the axis 2 maximum velocity override by changing the percentage of maximum velocity in the command.

The first digit in the VEO command is for the axis number. The axis number must always be two when using the VEO command.

Override Input Selection

The second digit determines the type of override to be selected. If the second digit is a zero then the velocity override is disabled. If the velocity override is enabled in the Variations, parameter 87, then the velocity override selected in parameter 87 will be in affect.

If the second digit is a 1, then the velocity override via an analog input is selected. When an analog command voltage of zero to ten volts is applied to the AE2 (connector X5, pin 14), with reference to the 0 V (connector X5, pin 15), axis 2 velocity will be overridden. Refer to Chapter 4, Variations, parameter 87 for more information and how to connect the analog input voltage to the CLM.

If the second digit is a 2, then the velocity override via binary inputs is selected. Auxiliary inputs 8 through 16 are used to provide a binary input to select the percentage of maximum velocity for axis 2. Auxiliary input 8 is the least significant digit (2^0) through the most significant digit, auxiliary input 16 (2^7).

If the second digit is a 3, then the velocity override via gray code inputs is selected. Auxiliary inputs 13 through 16 are used to provide a gray code input to select the percentage of maximum velocity for axis 2. Auxiliary input 13 is the least significant digit (2^0) through the most significant digit, auxiliary input 16 (2^3). Refer to Chapter 4, Variations parameter 87, for an input table and more information on how the gray code inputs operate.

If the second digit is a 4, then the programmed override is selected. The programmed override must have some value entered into the velocity factor. When the second digit is a 4 and a velocity factor is programmed, the velocity override can be scaled or limited to the value programmed in the velocity factor. The velocity factor scaling or limiting is determined by the override input value programmed in the VEO command.

Override Update

The third digit specifies when the velocity override will be updated.

When the third digit is a 0, the velocity override will be checked and updated every two milliseconds. When the third digit is a 1 through 9, the velocity override will be checked and updated only once or every time the VEO command is encountered in the user program.

Velocity Factor

The fourth through sixth digits specify the velocity factor. The velocity factor is to three decimal places (.001-.999). The velocity factor is only used when the override input selection is a 4. The velocity factor can be scaled or limited depending on the override input value programmed in the VEO command.

Override Input Value

The seventh digit specifies the override input value. The override input value must be a 4 and a velocity factor must be programmed in the VEO command.

When the seventh digit is a 0, the override input value will scale the axis 2 velocity. This scaling will remain in effect until it is changed by another VEO command in the user program.

When the seventh digit is a 1 through 9, the override input value will limit the axis 2 velocity. This limit is determined by the velocity factor programmed in the VEO command. Position commands that have a lower velocity than this limit will not be affected. This limit will remain in effect until it is changed by another VEO command in the user program.

WAI Time Delay

```
E  046  WAI
00.50
```

00.50 - Dwell time (00.00-99.99 seconds)

The WAI command is used to set up a dwell time in the CLM program. When the CLM program encounters a WAI command, the CLM waits in this program block until the specified time has elapsed, then steps to the next block.

5.9. Typical Flying Cutoff Program for Axis 1

The following program is an example of a typical flying cutoff operation. It defines the part length, the minimum cut point, cut cycle, and minimum stroke.

000 - 011 NOP; Program NOPs in these blocks (000 through 011) for future use.

Part Length:

```
012   LML  000060.00              ; Part Length is 60 inches
013   JSR  500                    ; Jump to subroutine at block 500
014   STZ  +0000000 0000100       ; Part counter is set to 100 parts
015   JMP  000                    ; Jump to block 000
```

Sequence:

```
500   JSR  510                    ; Jump to subroutine at block 510
501   JSR  520                    ; Jump to subroutine at block 520
502   JSR  530                    ; Jump to subroutine at block 530
503   FUN  0 0 0                  ; Function command off
504   FUN  1 1 1                  ; Function command on
505   EOS                         ; End of synchronization
506   RTS                         ; Return from subroutine
                                    (Program block 014)
```

Minimum Cut Point:

```
510   PST  1  02 +000010.00       ; Minimum cut point is 10 inches
511   BCA  510  02  1             ; Conditional jump to block 510 if aux. output #2 is on.
512   RTS                         ; Return from subroutine
                                    (Program block 501)
```

Cut Cycle:

```
520     AEA  1  1              ; Turn on auxiliary output #1, fire (energize) shear/saw.
521     WAI  00.30             ; Shear time is .3 seconds (300 ms)
522     AEA  1  0              ; Turn off auxiliary output #1, retract shear/saw.
523     RTS                    ; Return from subroutine
                                 (Program block 502)
```

Minimum Stroke:

```
530     PST 1  03 +000040.00   ; Minimum stroke is 40.00 inches
531     BCA 530 03 1           ; Conditional jump to block 530 if aux. output #3 is on.
532     RTS                    ; Return from subroutine
                                 (Program Block 503)
```

CHAPTER 6. INSTALLATION AND START UP

This chapter covers installation and initial start up procedures for the CLM control system. In addition to the CLM control module, a system is made up of servo amplifier(s), a power supply and servomotor(s). The instructions in this chapter primarily describe how to install the CLM Control Module. Instructions for the other components (TVM or KDV power supply, TDM or KDS servo amplifiers, etc.) are explained in detail in their respective manuals.

Tools and equipment required:

· small standard-tip screwdriver, 1/8" blade
· wrench for 1/4" machine type bolts (for mounting modules)
· 8 mm and 10 mm nutdrivers
· multi-meter (VOM)
· oscilloscope with memory, or a chart recorder (required only for system tuning).

6.1. Unpacking and Parts Inventory

The CLM system is shipped in reinforced cardboard cartons and is sufficiently packed to withstand normal shipping activity. Upon receiving equipment, inspect shipping carton for any evidence of external damage, such as rips, punctures or water marks. If a carton shows any sign of damage, immediately inspect contents and contact the carrier to make a damage claim if necessary.

Open the cartons and remove the packing material from around the equipment. Remove the equipment and place on a firm level surface.

6.1.1. CLM Standard Parts

The standard system contains the following items:

· The CLM module
· CLM cable set which contains:
  - 1 ea IKS 711 (CLM Input cable)
  - 1 ea IKS 701 (CLM Output cable)
  - 1 ea IKS 731 (Incremental Encoder/Measuring Wheel cable)
  - 1 ea IKS 721 (Axis 2 Incremental Encoder cable)

NOTE: *IKS 721 is not needed if axis 2 is not used.*

· CLM Electrical Accessory Kit (E-5 CLM):

- 1 ea 15-pin Phoenix connector
- 1 ea 8-pin Phoenix connector
- Wire tie wraps

6.1.2. CLM Optional Equipment

· Remote Keypad - Accessories include:

- 1 ea Remote keypad extension cable (typically 2 meters)
- 2 ea Dual side adhesive foam gaskets for the keypad
- 1 ea CLM face plate cover

· IDS Assembly, with Electrical accessory kit:

- 1 ea 5-pin Phoenix connector
- 1 ea IKS 742

NOTE: *IKS 742 is a serial interface cable. It has an RS-232 connector at one end, and ferrule connectors at the other.*

6.2. Mounting Cabinet

The CLM and its associated modules are designed for side-by-side mounting, using two screws per module. They should be installed in a cabinet or enclosure that offers protection from contaminants, water and oil, etc. Indramat recommends a NEMA 4 or 12 enclosure or equivalent. (Fig. 6.1).

NOTE: *If axis 2 is used, install the axis 2 TDM amplifier between the axis 1 TDM amplifier and the CLM control.*

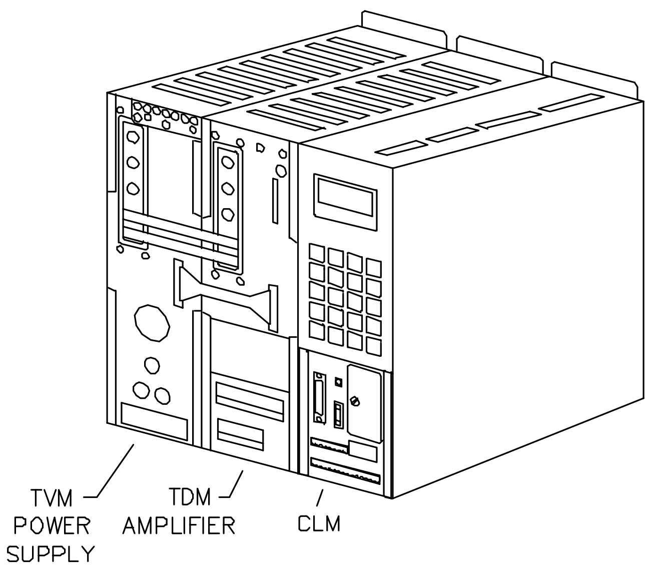


Figure 6.1 CLM System Modules

6.3. Power Requirements and Connections

The CLM requires +24 Vdc, supplied from the TVM (or KDV), or from an external +24 Vdc supply. Refer to section 1.4.4 for power specifications for the CLM and its options.

6.4. Cable Routing

For higher operating reliability, and to reduce interference from electrical noise, use shielded feedback cables and route them away from high voltage power.

Do not route the CLM cables near machines that draw high amperage, such as welding equipment. They produce strong magnetic fields and can cause interference.

Suppress inductive loads (such as solenoids and motors) that are switched on and off during CLM operation; use R-C networks for A.C. or diodes for D.C.

Correct grounding is essential for trouble free operation. The ground connection must be made exactly as described by the branching conditions shown in the wiring diagram.

6.5. Transformer - Heat Dissipation

The incoming 3-phase power must be ground referenced. Use an isolation transformer with a "Y" secondary if the ground reference cannot be confirmed. Refer to TVM/KDV manual or other Indramat documentation for additional information.

If a transformer is needed for operation, select a location carefully. Do not install the transformer in the same cabinet as the CLM modules unless a sufficient method of cooling is applied.

6.6. Hardware Installation

The CLM and its associated modules mount to the back wall of the equipment enclosure. The module mounting brackets are pre-drilled in two places to accept 1/4-inch machine screws.

Refer to Appendix E for mounting hole dimensions and location of the CLM module, the cut-out dimensions for the remote keypad, keypad gasket, keypad replacement panel (face plate cover), and mounting holes and cutout dimensions for the optional IDS

The mounting dimensions and cabinet cutout data for the TVM (KDV) and the TDM (KDS) are located in each unit's support manual.

The method for mounting the MAC servomotor is dependent upon the application. Additional information and a drawing package are available on request from Indramat.

6.7. Electrical Installation

There are many variations of wiring techniques used to connect the CLM to the machine builder's equipment. The Interconnect Drawings supplied with this manual show an example of the recommended CLM connections to a typical flying cutoff machine. Appendix A contains drawings for single axis (axis 1-only) CLM interconnects (Drawing BE-1136); refer to Appendix B for 2-axis CLM interconnects (Drawing BE-1135).

6.8. CLM Connectors

This section describes the connectors on the CLM module. Refer to Figure 1.4 (Standard Version CLM) or Figure 1.5 (Expansion Version CLM) in chapter 1 for an illustration of the CLM module and its connectors.

Connector X1: Axis 1/Measuring Wheel Incremental Encoder Input

Female Db25 connector is located on the top of the CLM.

The typical encoder used is a 5-volt, quadrature type incremental encoder; one for the axis 1 and a second unit for the measuring wheel. The axis 1 encoder is always mounted on the back of the motor. The measuring wheel encoder should be installed so that the measuring wheel rides flat on the material being processed.

Connector X2: Axis 2 Incremental Encoder Input

Female Db25 connector is located on the top of the CLM.

The typical encoder used is the 5-volt, quadrature type. The axis 2 encoder is always mounted on the back of the motor.

Connector X3: System Inputs/Auxiliary Inputs

Male Db37 connector is located on the top of the CLM.

The CLM system inputs and auxiliary inputs require +24-volts. Refer to chapter 3, Functional Description of I/O Interconnections, for more information.

Connector X4: System Outputs/Auxiliary Outputs

Female Db37 connector is located on the top of the CLM.

The CLM system outputs and auxiliary outputs supply +24 volts D.C., 50-milliamps to external devices. Refer to chapter 3, Functional Description of I/O Interconnections, for more information.

Connector X5: Command Connector

This 15-pin Phoenix connector is located on the lower front panel of the CLM and is used for various inputs and outputs, including: +24-volts from the Indramat power supply (TVM, KDV, etc.), the Bb contacts which are included in the "Drive On" interconnection, and the analog command outputs to the amplifier's command inputs (TDM, KDS, etc.).

NOTE: *To prevent a ground loop condition, connect the shields from the command cable to the servo amplifier only. Refer to Appendix A (Drawing No. BE 1136) or Appendix B (Drawing No. BE 1135), sheet 3 for more information.*

Connector X6: RS232/422/485 Serial Communication Port (Interface)

Female Db25 connector is located on CLM lower front panel.

It is used for serial communication between the CLM and a host device, such as personal computer, SOT or IDS option. Refer to chapter 7 for description of multi-functional, two-way communications port.

Connector X7:

An 8-pin Phoenix connector located above connector X5 on the lower front panel of the CLM.

The CLM-LM uses only pin 1, labeled RF1, which is connected to the servo amplifier's RF input. Consult the servo amplifier manual for more information about the RF input. Figure 2.3 illustrates the lower front connector panel.

6.9. Preliminary Startup Procedure

The following sections are intended to provide the user with an example of a CLM start-up. They provide an example of a single axis application which can be use to verify proper CLM system operation.

WARNING: *The information given in the following sections may not be suitable for your specific application. To prevent any injury to personnel or damage to the machine, the motor must first be mechanically disconnected from the actual load of the machine, prior to attempting the preliminary steps.*

6.9.1. Connections

CAUTION: *DO NOT apply power until all connections have been made. Refer to Appendix A for axis 1-only CLM interconnects (Drawing BE 1136) or Appendix B for 2-axis CLM interconnects (Drawing BE 1135).*

1. Install the TVM (or KDV) power supply and the TDM (or KDS) amplifier, according to their respective support manuals.

2. Make connections to the CLM Command Connectors X5 and X7 (24 Vdc supply, Bb motor contacts, analog command for each servo amplifier, RF1 output).

3. Make the proper motor connections. Consult the servo amplifier manual and the motor manual for more information.

4. Connect the axis 1 encoder and measuring wheel encoder cable (IKS 731) to connector X1. If axis 2 is used, connect the axis 2 encoder cable (IKS 721) to connector X2.

6.9.2. Inputs

The connections in this example are minimized for simplicity (see Fig. 6.2). Refer to the interconnect drawings in Appendix A or B for additional details. Connect the incoming side of each switch to a +24 Vdc source.

1. Connect a 2-position selector switch to provide a +24 Vdc signal to pin 2 (Automatic mode input). The second position is not wired; it is used for Manual mode (default mode).

2. Connect a key switch to provide +24 Vdc to pin 1 (Parameter mode input).

3. Connect a Normally Closed pushbutton switch to pin 3 (Emergency Stop) of CLM system input connector X3.

4. Connect a normally open limit switch (mechanical, proximity, or photoelectric) to pin 4 of connector X3 (Home Limit Switch). The Home Limit Switch will provide the home position input signal for axis 1.

5. Connect a normally open pushbutton switch to pin 5 (Immediate Stop) of connector X3.

6. Connect the Bb contact of the drive amplifier to pin 6 (Axis #1 Drive Ready) of connector X3.

CAUTION: *Hardware overtravel switches must also be installed in the circuit to the Axis #1 Drive Ready input.*

7. Connect a normally open pushbutton switch to pin 9 (Jog Forward) of connector X3.

8. Connect a normally open pushbutton switch to pin 10 (Jog Reverse) of connector X3.

9. Connect a normally open pushbutton switch to pin 11 (Crop Cut) of connector X3.

10. Connect a normally open pushbutton switch to pin 12 (Cut Inhibit) of connector X3.

11. Connect an external power supply to pins 34 and 35 (0 VDC) and pins 36 and 37 (+24 VDC) of connector X3.

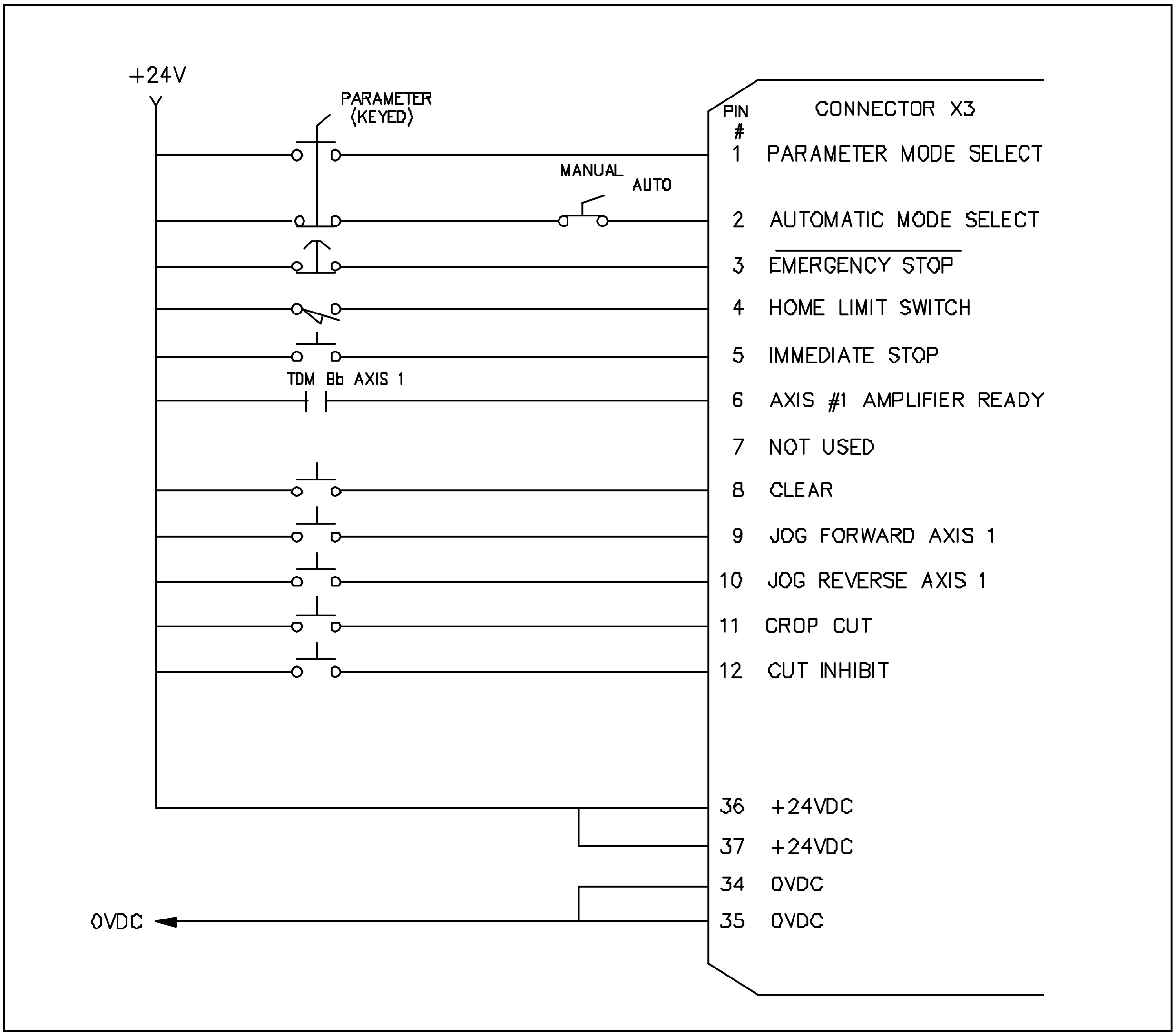


Figure 6.2 Example System Input Diagram

6.9.3. Overtravel Limit Switches

Forward and reverse overtravel switches should be installed on applications that have limited axis travel, such as a slide or a ball-screw driven axis. The switches should be wired to the Axis #1 Drive Ready input of the CLM. Always reserve distance beyond each limit switch, sufficient for the axis to decelerate to a complete stop.

6.9.4. Outputs

The output for Amplifier Enable (RF Connector X7, pin 1) must be connected to the RF input of the servo amplifier. Connector X4, pins 34 and 35 must be connected to 0 VDC of the external supply. Connector X4, pins 36 and 37 must be connected to +24 VDC of the external supply. Refer to the interconnect drawings in Appendix A or B.

6.10. Power-up

If all of the steps in section 6.9 have been completed, the system can now be powered up. All voltages should be checked by a qualified electrician to ensure proper signals and connections.

6.11. Parameter Entry

The parameters given here are the minimum required to operate the CLM for this example. Turn the key switch to the Parameter Mode to enable parameter entry. Refer to chapter 4 for more information on parameter entry.

WARNING: *The parameters given below are for example only, and may not be suitable for your specific application. To prevent any injury to personnel or damage to the machine during the initial power-up, the motor must first be mechanically disconnected from the actual load of the machine.*

CLM-LM Sample Parameters:

P82, Language 2 0 1 0 (2 Decimal Places, English Language)

P00, Feed Constant A1 0 0 0 1.0 0 0 0 (1.0 inches/rev.)

P01, Encoder Data A1 Refer to motor encoder nameplate:

The two most common encoders are:

625	Enter	0 0 0 6 2 5 0 0 0 0
1250	Enter	0 0 1 2 5 0 0 0 0 0

P02, Velocity Axis 1

This parameter depends on the value of the Feed Constant, parameter 00 and Drive Sensitivity, parameter 03. See example entries following P03.

P03, Drive Sensit. A1

Refer to Amplifier personality module nameplate for E1/E2 rating.

Three examples for P02 and P03 input:

E1/E2 Sensitivity	P03 Entry	P02 Entry
1500/10	1 5 0 0 1 0.0 0 0 0 0 2 5.0 0	0 5
2000/10	2 0 0 0 1 0 0 0 0 0 0 3 3.3 3	0 5
3000/10	3 0 0 0 1 0 0 0 0 0 0 5 0.0 0	0 5

Refer to the Velocity Axis 1, Parameter 02 in Chapter 4 for more information.

P04, Accel. Rate A1 0 0 2 5 0.0 0 (250 in/sec^2)

P05, Position Gain A1 0.9 0 0 0.9 0 0

(Accel=.9in/min/mil)
(Decel=.9in/min/mil)

P06, Direction Axis 1 0 0 0

If a Drive Runaway Error occurs, this parameter might change.

P07, Position Tol. A1 1 5 0 0 0 0.2 0

(Output 15, pos. tol.=.200 in.)

P08, Homing Setup A1 0 0 0

Homing by jogging reverse to the home switch is selected.

P11, Min Travel A1 - 0 0 0 0 0 1.0 0

(Min. Travel=-1 in.)

P12, Max Travel A1 + 0 0 0 0 5 0.0 0

(Max. Travel=+50 in.)

P19, Test Mode A1 1 (Test Mode Selected)

P20, Manual Cut-Vector 5 2 0

The Cut Cycle in block 520 will operate, when the Crop Cut Input is pressed in Manual Mode only. Refer to the Sample Program in section 6.12.

P26, Spec. Func. 2 A1 0 5.0 0 0 0 0

(Material Speed screen = ft/min)

P38, Feed Constant MW 0 0 1 2.0 0 0 0

(Measuring Wheel Feed Constant=12 in/rev.)

P39, Enc Lines/Rev MW 0 1 2 5 0

(Refer to Measuring Wheel nameplate)

NOTE: *Zeros should be entered in the parameters not listed above.*

6.12. Program Entry (Sample Program for System Checkout)

A typical flying cutoff user program, for use in Automatic or Test mode, is presented in section 5.9 of chapter 5, Programming. It defines a part length, minimum cut point, cut cycle, and minimum stroke, and may be used to check out system operation.

6.13. Axis 1 Jogging In Manual Mode

To verify proper hook-up and control of the motor:

1. Verify that the CLM is ON and no errors exist (H1 LED on lower front of CLM is ON).

2. Turn the selector switches for Parameter and Automatic modes to the OFF position; the CLM defaults to Manual Mode.

3. Press the Jog Forward pushbutton (X3, pin 9). The axis should jog in the forward direction. If axis 1 jogs in reverse, use Direction, parameter 06 to change direction.

4. Press the Jog Reverse pushbutton (X3, pin 10). The axis should jog in the reverse direction.

   In the sample parameters, the homing routine selected in the Homing Setup, parameter 08 is "homing by jogging reverse" to the home limit switch. When the home limit switch detects a low-to-high transition, axis 1 will establish that point as home position.

5. Should either the forward or reverse motor movement fail to react, check all cable connections and verify that the CLM is in Manual mode and the Axis 1 Drive Ready is enabled.

6. After axis 1 has been homed, press the jog forward pushbutton and hold it until the maximum travel limit is reached.

7. Press the jog reverse pushbutton and hold it until the axis 1 has reached home position.

NOTE: Axis 1 must be homed and at the home position before switching into Automatic or Test mode. If axis 1 is not homed, the "Axis 1 Not Homed" error occurs. If axis 1 is not at the home position, the "Not Home Position" error will occur. Refer to chapter 4, Parameters 08 and 48 for more information on selecting the proper routine.

6.14. Test Mode Operation

To run the sample program in Test mode, using the sample parameters, following these steps:

1. Select Test mode by entering a "1" in Test Mode, parameter 19.

2. After homing axis 1 in Manual mode, turn the selector switch to Automatic Mode (X3, pin 2). Even though the Automatic mode input is selected, Test mode will be in effect, because of the setting of parameter 19.

3a. To simulate the material passing under the measuring wheel, the material speed screen must be displayed. Press the up arrow until the material speed screen appears.

3b. Press the plus or minus key to increase or decrease the simulated material speed. Pressing the plus key a maximum of 32 times will increment the material speed up to the value stored in the Velocity Axis 1, parameter 02, multiplied by the multiplication factor in the Special Function A1, parameter 26.

3c. Pressing the CL key when the Material Speed screen is displayed immediately sets the simulated material speed to zero.

In Test mode, the sample parameters and programs are used to simulate material passing under the measuring wheel. When the simulated material has passed, the flying cutoff will synchronize with the material. When synchronization occurs, the minimum cut point, cut cycle and minimum stroke are each executed, after which the flying cutoff returns to home position.

6.15. Tuning The Flying Cutoff System

When tuning the flying cutoff system, use Test mode to reduce material waste. There are two steps to tuning a CLM-LM flying cutoff system. First, tune the position gains until the servo system performs the proper velocity profile. Next, adjust the axis 1 position lag for best accuracy.

6.15.1. Tuning Position Gains for Optimum Performance

Tuning the position gains (accel and decel) requires an oscilloscope with memory or a chart recorder. When the flying cutoff is tuned for optimum performance, the motor's velocity profile at maximum operating speed appear as shown in Figure 6.3.

Figure 6.3 Position Gains Adjusted for Optimum Performance.

To perform the tuning:

1. Attach the oscilloscope probe or chart recorder leads to the Tachometer Sense output (labeled Tsense) of the servo amplifier being tuned. The reference for the probe or leads should be the zero volts terminal (labeled 0VM), also found on the front of the servo amplifier. The Tsense output supplies the velocity profile of the motor.

2. Follow the instructions for operating the flying cutoff system in Test mode, as presented in section 6.14.

3. Pressing the plus key slowly while the Material Speed screen is displayed will simulate the material speed, and the programmed part length will be processed. The programmed part length should be the length to be processed at maximum operating speed of the flying cutoff system.

4. Observe the Tsense output as the material speed screen is slowly incrementing. If the motor begins to overshoot on the acceleration (Fig. 6.4) or deceleration (Fig. 6.5) while incrementing the Material Speed, then the values in the Position Gain, parameter 05, should be decreased. Refer to parameter 05 in chapter 4.

Figure 6.4 Acceleration Gain Is Too High

Figure 6.5 Deceleration Gain Is Too High

5. When the Material Speed screen has been incremented to the maximum operating speed of the flying cutoff system, observe the motor's velocity profile. If the acceleration gain (Fig. 6.6) or deceleration gain (Fig. 6.7) is too low, then the value in the Position Gain, parameter 05 can be increased. It may be necessary to adjust one or the other slightly, once the cutoff system is operating in Automatic mode.

Figure 6.6 Acceleration Gain Is Too Low

Figure 6.7 Deceleration Gain Is Too Low

6. When the programmed part length is processed at a material speed less than the maximum operating speed, the motor's velocity profile appears as seen in Fig. 6.8. The dashed line indicates the maximum speed.

Figure 6.8 Material Speed Is Less Than Max. Operating Speed

6.15.2. Adjusting The Position Lag

The position lag, also referred to as following error, is the difference between the commanded motor position and the actual motor position. Before adjusting the position lag, the position gain for the flying cutoff system must be set up properly.

1. Press the up arrow until the Axis Position Screen is displayed. When the Axis Position Screen is displayed, press the right or left arrow once to view the Position Lag Screen. Refer to chapter 2, section 2.3.5 for more information on how to view the Position Lag Screen.

```
L P 1A+000010.00                        L S 1A+000000.09
012 2 +000000.00    <--   OR   -->      012 2 +000000.00
```

Current Position Display   Position Lag Display

2. Follow the instructions for operating the flying cutoff system in Test mode in section 6.14.

3. Press the plus key until the maximum operating speed of the flying cutoff system is achieved. Observe the Position Lag Screen.

NOTE: *Pressing in the block store key in Automatic or Test mode while the Position Lag (LS) Display Screen is displayed will cause the position lag value to "freeze" on-screen for 5 seconds. This feature allows the person setting up the flying cutoff system to view the position lag.*

4. When the flying cutoff system synchronizes with the material, the position lag should be a relatively small value. By adjusting the maximum motor rpm of the Drive Input Sensitivity Axis 1, parameter 03, the value of the position lag can be reduced to zero. If the position lag is in the minus direction, increase the maximum rpm. If the position lag is in the plus direction, decrease the maximum rpm. The amount that the maximum rpm will have to be increased or decreased will depend on the flying cutoff system and the drive input sensitivity.

In this example, the position lag is -0.09 inches and the maximum RPM in parameter 03 is 3000.

```
L S 1A-000000.09                        Drive Sensit. A1
012 2 +000000.00                        P03    3000 10.0
```

Position Lag Screen   Drive Input Sensitivity Axis 1

The position lag is in the minus direction, so the maximum RPM is increased. Increasing the maximum RPM in steps of 10 RPM the position lag slowly decreases until the maximum RPM reaches 3070. The Position Lag Screen displays zero.

```
L S 1A-000000.00
012 2 +000000.00
```

Position Lag Screen

```
Drive Sensit. A1
P03    3070 10.0
```

Drive Input Sensitivity Axis 1

NOTE: *The Position Lag may require a slight adjustment, once the flying cutoff system is operating in Automatic mode.*

6.16. Automatic Mode Operation

To run the sample program in Automatic mode, using the sample parameters:

1. Select Automatic mode by entering a zero in the Automatic Mode, parameter 19.

2. After homing axis 1 in manual mode, turn the selector switch to Test Mode (X3, pin 2).

3. At this point, the operator will typically start the line or material to be processed.

   The material is measured by passing under the measuring wheel. When the programmed part length has passed, the flying cutoff will synchronize with the material. After synchronization, the flying cutoff will travel to the minimum cut point. The cut cycle then processes the part and the minimum stroke assists movement of the part to the next station. At the end of the minimum stroke, the flying cutoff returns to the home position.

4. If the part lengths being processed are too big or too small, use the Measuring Wheel Feed Constant, parameter 38 to adjust the parts to the proper length.

CHAPTER 7. SERIAL INTERFACE

The CLM Control includes a multi-format RS-232/422/485 port for two-way communication of programs, parameters and system status between the CLM and a host device. The interface protocol is designed to easily transmit and receive data to and from the CLM. This chapter describes the protocol and other communication requirements.

To achieve proper communication, the host device must follow the CLM communications format exactly as described in this chapter. If the communication format is not exactly as shown, one of several "RS Format Errors" will occur, indicating that the information was not properly formatted.

User programs (block information) can be downloaded to the CLM when it is in any mode of operation (Auto, Manual, or Parameter). The same is true for system status. System parameters can be downloaded to the CLM only when it is in Parameter mode. If the CLM is in any other mode, the host receives an "Invalid Mode" error message through the port. Parameters can be read from the CLM in any mode.

Optional Indramat CLM programming software (MotionManager) allows you to write and edit user programs and parameters on any DOS-based computer. You can download these into the CLM control through the serial interface port (Connector X6). You can also receive information from the CLM and print a copy of your program and parameter files.

The optional Indramat SOT (Station Operator Terminal) is a remote mounted, operator control device for the CLM. It is used to communicate program and parameter information between the CLM and SOT. The software in the SOT includes Help screens to assist the operator in using the SOT and entering information correctly. The Indramat ScreenManager software option allows the user to create screens for a specific application. These screens can be used by the operator to edit or view information about the application.

Contact Indramat for additional information on the SOT, ScreenManager™ and MotionManager™ options.

7.1. Connector Wiring (Db-25)

The serial interface connector (standard Db25), is located on the lower front of the CLM Control Module (see Figure 2.3 in chapter 2).

Figure 7.1 is a diagram of the multi-function port (connector X6), showing the pin numbers and definitions of signal connections for each type of communication.

CAUTION: *Do not connect to any pin numbers other than those shown in Figure 7.1. Some pins are used for Indramat options and factory diagnostics.*

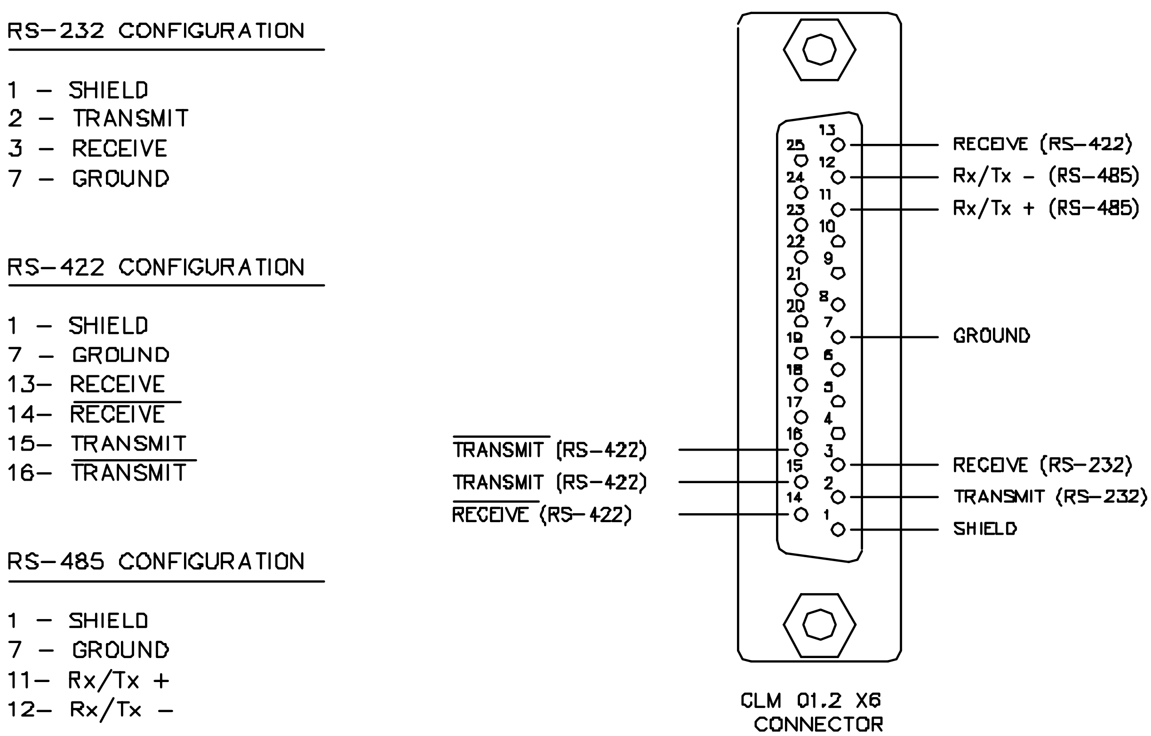


Figure 7.1 CLM X6 Connector

7.1.1. Signal Level Requirements

Figure 7.2 illustrates the signal level requirements for the different communications (RS-232/422/485) for the CLM. To minimize signal degradation over long cable runs, the serial device driver should provide the following levels:

RS-232 +/- 15 Vdc (50-ft maximum run)
RS-422 +/- 5 Vdc (1000-ft maximum run)
RS-485 +/- 5 Vdc (3000-ft maximum run)

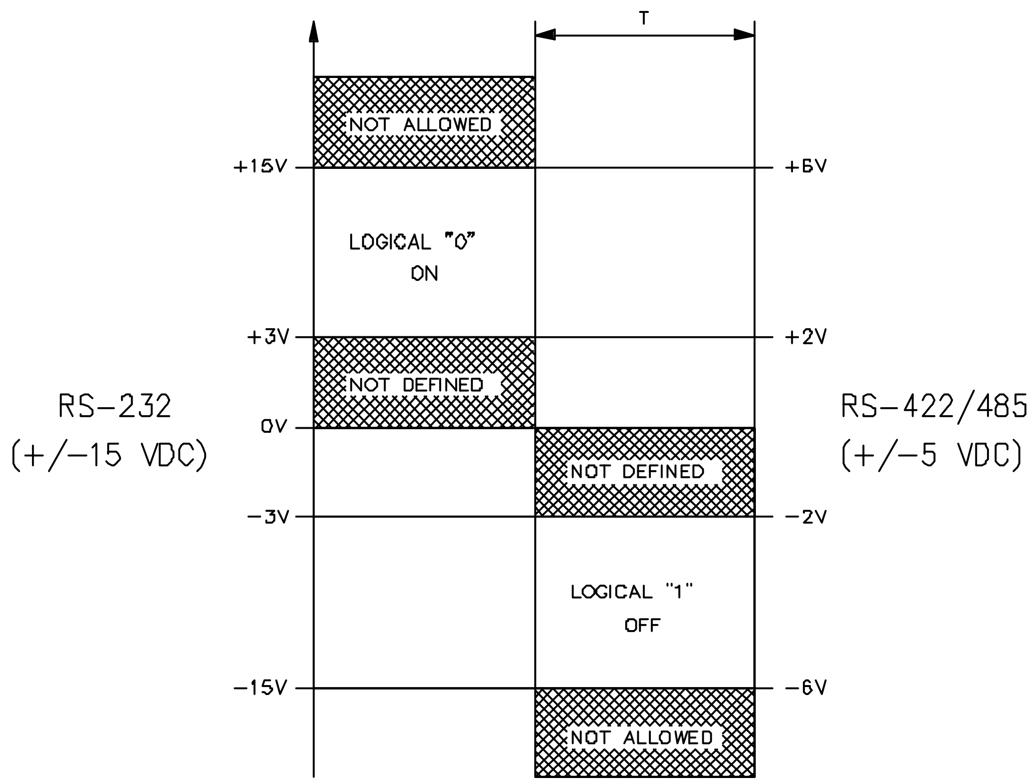


Figure 7.2 Signal Interface Level Requirements

7.1.2. Serial Cable Configurations

For RS-232 serial communications, you should note that the connector on the serial card in your computer can vary in configuration. There are two common serial connections for interfacing from the RS-232 port of a computer to the CLM.

1. CLM (25-pin D) to Computer (25-pin D)

Pin 2 ·————· Pin 3
Pin 3 ·————· Pin 2
Pin 7 ·————· Pin 7

2. CLM (25-pin D) to Computer (9-pin D)

Pin 2 ·————· Pin 2
Pin 3 ·————· Pin 3
Pin 7 ·————· Pin 5

The CLM requires only three lines of the standard 25 pin connector for RS-232 communication.

Pin 2 - TxD (Transmitted Data)
Pin 3 - RxD (Received Data)
Pin 7 - GND (Data Signal Ground)

Typically, pin 1 connects the cable shield to ground on one end only. The "transmit data" connection from one device connects to the "receive data" connection of the other device, and vice versa. Signal ground connection must be common on both devices. This often requires a Null Modem cable, to connect pin 3 of one end to pin 2 on the other end.

Consult the information supplied by the manufacturer of the serial card for the specific pin configuration. Many common cable configurations can be purchased locally, or you may prefer to buy the required connectors and assemble the cable yourself. The maximum communication cable length is 50 feet.

7.2. Data Format

A character is transmitted and received in the following format. (Fig. 7.3)

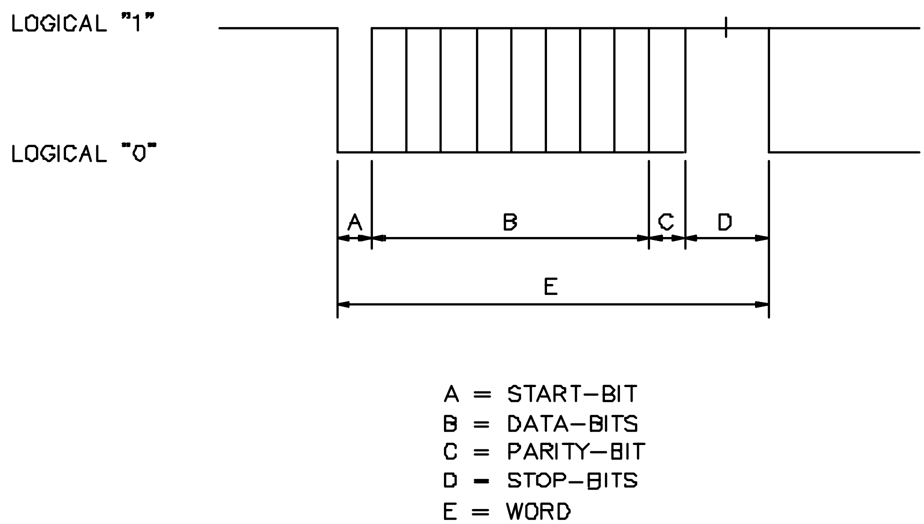


Figure 7.3 Data Format

7.3. CLM Serial Communication Configuration (Parameter 80 & 81)

To achieve proper communications, configure the communication parameters 80 and 81 to match between your computer and the CLM.

```
Parameter 80:                      Parameter 81

┌─────────────────┐                ┌─────────────────┐
│Serial Interface │                │Serial Interface │
│P80 1920 0 1 8 1 │                │P81      0 00 0 0│
└─────────────────┘                └─────────────────┘

     ┌───  ┌ ┌ ┌ ┌                      ┌ ┌─  ┌ ┌
     │     │ │ │ └ Stop Bit(s)          │ │   │ └ Transmission
     │     │ │ │                        │ │   │   Acknowledgement
     │     │ │ └── Word Length          │ │   │
     │     │ │                          │ │   └── Checksum
     │     │ └──── Parity               │ │
     │     │                            │ └────── Station Number
     │     └────── Interface Mode       │
     │                                  └──────── Error
     └──────────── Baud Rate                      Transmission
```

7.3.1. Baud Rate

The baud rate is set in parameter number 80. See Parameter 80, chapter 4, for more information.

You may choose from the following:

Parameter Entry		Baud Rate
0030	=	0300
0120	=	1200
0240	=	2400
0480	=	4800
0960	=	9600
1920	=	19200

7.3.2. Interface Mode

The interface mode is set in parameter 80. See chapter 4, for more information.

Choose one of the following:

0 = Standard RS-232/422 (full duplex)
1 = IDS, decade switch option
2 = Standard RS-232/422 (full duplex)
3 = Serial port for SOT; RS-232/422, half duplex, one station ONLY
4 = Serial bus for SOT; RS-485, half duplex, station 1 - 15

7.3.3. Parity

Parity is set in parameter 80. See chapter 4, for more information.

1 = No parity
2 = Even parity
3 = Odd parity

7.3.4. Word Length

The word length is set in parameter 80. See chapter 4, for more information.

7 = 7-bit word length
8 = 8-bit word length

7.3.5. Stop Bit(s)

The stop bit(s) is set in parameter number 80. See Parameter 80, chapter 4, for more information.

1 = 1 stop bit
2 = 2 stop bits

7.3.6. Error Transmission

When a transmission error occurs, the error message is immediately transmitted over the RS-232 to the host device. See Parameter 81, chapter 4, for more information.

0 = Error Transmission Disabled
1 = Error Transmission Enabled

7.3.7. Station Number

The station number is only used in RS-485 mode. If parameter 80 has a four in the interface mode digit, then a station number must be entered. The station number can be any number between 01 through 15. See Parameter 81, chapter 4, for more information.

7.3.8. Checksum / Hardware Handshake (CTS/RTS)

The checksum/hardware handshaking allows for the checksum and hardware handshaking to be utilized. The checksum determines if the information transmitted is correct. Hardware handshaking determines when it is clear to send (CTS) and ready to send (RTS). See Parameter 81, chapter 4, for more information.

0 = Checksum On, RTS/CTS Off
1 = Checksum Off, RTS/CTS Off
2 = Checksum On, RTS/CTS On
3 = Checksum Off, RTS/CTS On

7.3.9. Transmission Acknowledgement

The transmission acknowledgement will send a "Y CRLF" from the CLM to the host device when the information is received and accepted. See Parameter 81, chapter 4, for more information.

0 = Transmission Acknowledgement Disabled
1 = Transmission Acknowledgement Enabled

7.4. CLM Control String Protocol

The following sections describe each control character requirements for proper protocol.

7.4.1. First (1) Control String Character (Transmission Type)

All data transmissions to the CLM must start with one of the following control characters to identify what type of transmission is to follow:

? Question Mark (Hexadecimal 3F)

The CLM interprets the question mark (received via the RxD channel) as a "Request For Information" character. When the question mark is followed by the proper codes, it causes the CLM to transmit the desired data via the TxD channel. The question mark is used to request system parameters, program blocks, and status information.

Pound Sign (Hexadecimal 23)

The CLM interprets the pound sign as an "Information To Be Stored" character. The data following the sign will be stored in a specified CLM program block. The specified program block will overwrite the existing program block. The pound sign is only used when transmitting program blocks to the CLM.

! Exclamation Mark (Hexadecimal 21)

The CLM interprets the exclamation mark as an "Information To Be Stored" character. The data that follows will be stored in a specified CLM system parameter, and will overwrite the existing system parameter. The exclamation mark is only used when transmitting system parameters and control commands (chapter 7, section 7.7.4).

NOTE: *To transmit system parameters to the CLM from a host device, parameter mode must be selected. If parameter mode is not selected, the CLM will send an "Invalid Mode" error to the host device.*

7.4.2. Second (2) Control Character (CLM Station Number Identifier)

This character is only present if communicating in the RS-485 mode. It is used to identify the CLM station that will receive information. If communicating in RS-232/422 mode, this character will be a space.

RS-232 Mode Selected: Space (Hexidecimal 20)

RS422 Mode Selected: Space (Hexidecimal 20)

RS-485 Mode Selected:

1 = Station Number 1
2 = Station Number 2
3 = Station Number 3
4 = Station Number 4
5 = Station Number 5
6 = Station Number 6
7 = Station Number 7
8 = Station Number 8
9 = Station Number 9
A = Station Number 10
B = Station Number 11
C = Station Number 12
D = Station Number 13
E = Station Number 14
F = Station Number 15

7.4.3. Third (3) Control String Character (Information Type)

This character is used to identify the type of information to be sent.

N (Capital N) (Hexadecimal 4E)

The "N" character is the identifier used for requesting or storing information in a specific CLM program block number (000-999).

K (Capital K) (Hexadecimal 4B)

The "K" character is the identifier used for requesting or storing information in a specific CLM system parameter number (00-99).

X (Capital X) (Hexadecimal 58)

The "X" character is the identifier used for requesting CLM system status. The requested status code is sent back to the host device.

7.4.4. Other Important Control Characters

The following are additional control characters required for proper protocol.

$ (Dollar Sign) (Hexadecimal 24)

The "$" character is the identifier for the beginning of the checksum. The two characters following this character represent the checksum of the information transmitted. If the checksum is enabled in parameter 81, then it must be transmitted along with every parameter and program block transmission. When requesting information, the checksum is not needed.

CR	(Carriage Return)	(Hexadecimal OD)
LF	(Line Feed)	(Hexadecimal OA)

CR (Carriage Return) and LF (Line Feed) must be transmitted at the end of every transmission.

X-ON	(Hexadecimal 11)
X-OFF	(Hexadecimal 13)

Serial transmission can be controlled using software handshaking.

If the CLM is sending data via the TxD channel and receives the "X-OFF" signal (Hexadecimal 13) via the RxD channel, the CLM will interrupt the transmission until the "X-ON" signal (Hexadecimal 11) is received again via the RxD channel.

If the CLM is receiving data via the RxD channel, and an interruption of the data transmission becomes necessary, the CLM will send the "X-OFF" signal (Hexadecimal 13) via the TxD channel. When the transmission can be resumed, the CLM will send the "X-ON" signal (Hexadecimal 11) via the TxD channel.

7.4.5. Information Characters

All information characters are coded in hexadecimal. The following characters are used for exchange of information:

0	(Hexadecimal 30)
through	through
9	(Hexadecimal 39)
A	(Hexadecimal 41)
through	through
Z	(Hexadecimal 5A)

The numbers "0" through "9" and the letters "A" through "Z" are used in CLM program commands. The letters "A" through "Z" must be uppercase.

(Space) (Hexadecimal 20)

Spaces are used to create the desired transmission format.

NOTE: *In this manual, the underline character is used to show the number of spaces needed to transmit or receive information.*

+ (Plus Sign) (Hexadecimal 2B)

— (Minus Sign) (Hexadecimal 2D)

This operational sign must be transmitted, if the operational sign is present in the CLM program command. The operational sign is not needed when transmitting a CLM parameter.

. (Decimal Point) (Hexadecimal 2E)

The decimal point character must be transmitted, if the decimal point is present in the CLM program command or parameter.

7.5. Checksum Calculations

If checksum is enabled in parameter 81, all characters are added together, the High-byte is added to the Low-byte, then the 2's compliment is taken. This number should immediately follow the "$" character. (Fig. 7.4)

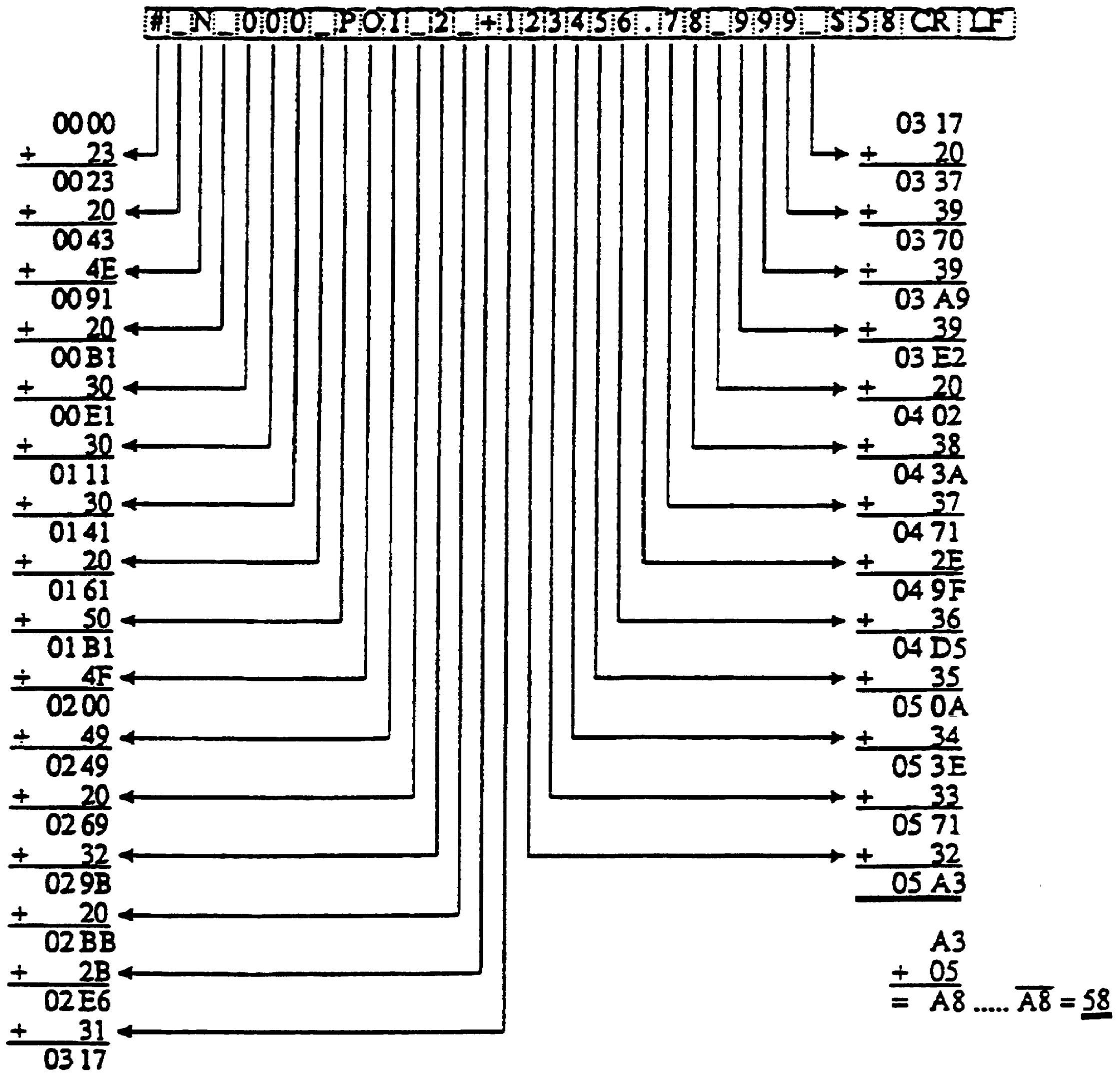


Figure 7.4 CHECKSUM Example Calculation

7.6. Sending Information to the CLM

The CLM is capable of receiving new program block and parameter data from a host device, using the set of protocols described in the following sections. They use the key characters defined in sections 7.3 to 7.5, and a set data field to transfer the required information. To accomplish an acceptable transmission, it is very important that all characters, including all spaces, are used in the exact described format when sending to the CLM. If there is any discrepancy, the CLM responds with an error message describing the type of format error that was found, but the current data is not changed.

7.6.1. Sending Program Blocks to the CLM

A program block sent to the CLM must follow this format:

_ N _ b b b _ c c c _ d d d d d d d d d d d d d d d d _ $ h h CR LF (RS-232)

S N _ b b b _ c c c _ d d d d d d d d d d d d d d d d _ $ h h CR LF (RS-485)

S = station number location for RS-485 mode only.

The following describes each part of the command string:

# _ N	-	Send program block to CLM
b b b	-	Block Number
c c c	-	Command Mnemonic
d d --> d d	-	Data, 16 characters in the proper format for a given command
$	-	End of block (checksum may follow)
h h	-	Checksum (if enabled in parameter 81)
CR LF	-	Carriage Return, Line Feed

All transmissions must contain 16 characters. Send trailing spaces to fill the data block. The following provides example of command strings for program blocks with different size data fields.

CLM Display Screens

```
E  100  AEA
07  1
```

```
E  000  PSI
1 +123456.78 999
```

Serial Data To Transmit

_ N _ 1 0 0 _ A E A _ 0 7 _ _ 1 _ _ _ _ _ _ _ _ _ _ _ _ _ $ 5 B CR LF

_ N _ 0 0 0 _ P S I _ 1 _ + 1 2 3 4 5 6 . 7 8 _ 9 9 9 _ $ 5 3 CR LF

Table 7.1 and 7.2 illustrate the two decimal and three decimal point program command send format, respectively. Refer to chapter 5 for description of each command and its data field requirements.

NOTE: *The checksum will vary with the information being transmitted, or if RS-485 mode is being used.*

Table 7.1 LM01.3-003.X Program Command, RS-232 Send Format, 2 Decimals

```
# _ N _ 0 0 1 _ ACC _ 1 _ _ 9 9 9 _ _ _ _ _ _ _ _ _ _ _ $ 3 7   (ACC Command)
# _ N _ 0 0 2 _ AEA _ 0 7 _ _ 1 _ _ _ _ _ _ _ _ _ _ _ _ $ 5 A   (AEA Command)
# _ N _ 0 0 3 _ AKN _ 0 7 _ _ 1 _ _ _ _ _ _ _ _ _ _ _ _ $ 4 6   (AKN Command)
# _ N _ 0 0 4 _ APE _ 0 _ _ _ _ _ 0 0 0 1 1 1 2 2 2 0 _ $ C 7   (APE Command)
# _ N _ 0 0 5 _ ATS _ 0 7 _ _ 1 _ _ _ _ _ _ _ _ _ _ _ _ $ 3 6   (ATS Command)
# _ N _ 0 0 6 _ BAC _ 3 4 5 _ _ + 1 2 3 4 _ 1 2 3 4 5 _ $ 9 E   (BAC Command)
# _ N _ 0 0 7 _ BCA _ 3 4 5 _ _ 0 7 _ _ 1 _ _ _ _ _ _ _ $ 1 A   (BCA Command)
# _ N _ 0 0 8 _ BCB _ 3 4 5 _ 2 0 _ _ 1 _ _ _ _ _ _ _ _ $ 1 D   (BCB Command)
# _ N _ 0 0 9 _ BCD _ 3 4 5 _ 2 0 _ _ _ _ _ _ _ _ _ _ _ $ 2 B   (BCD Command)
# _ N _ 0 1 0 _ BCE _ 3 4 5 _ _ 0 7 _ _ 1 _ _ _ _ _ _ _ $ 1 C   (BCE Command)
# _ N _ 0 1 1 _ BIO _ 3 4 5 _ 1 _ 0 0 0 1 1 1 2 2 2 0 _ $ 8 8   (BIO Command)
# _ N _ 0 1 2 _ BMB _ 1 0 0 _ 1 0 _ 0 4 _ 8 _ _ _ _ _ _ $ F 8   (BMB Command)
# _ N _ 0 1 3 _ BPA _ 3 4 5 _ 1 _ 0 0 0 1 1 1 2 2 2 0 _ $ 8 D   (BPA Command)
# _ N _ 0 1 4 _ BPE _ 3 4 5 _ 1 _ 0 0 0 1 1 1 2 2 2 0 _ $ 8 8   (BPE Command)
# _ N _ 0 1 5 _ BPT _ 3 4 5 _ 2 _ + 1 2 3 4 5 6 . 7 8 _ $ 6 3   (BPT Command)
# _ N _ 0 1 6 _ CLA _ 1 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 7 3   (CLA Command)
# _ N _ 0 1 7 _ CLC _ 3 4 5 _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 4 5   (CLC Command)
# _ N _ 0 1 8 _ CON _ 1 _ _ 1 _ + 9 9 9 _ _ _ _ _ _ _ _ $ F 9   (CON Command)
# _ N _ 0 1 9 _ COU _ + 1 2 3 4 5 _ 1 2 _ 1 2 3 4 5 6 _ $ 6 7   (COU Command)
# _ N _ 0 2 0 _ EOS _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 7 2   (EOS Command)
# _ N _ 0 2 1 _ FAK _ 1 _ _ 1 . 2 3 4 5 6 _ _ _ _ _ _ _ $ F 1   (FAK Command)
# _ N _ 0 2 2 _ FUN _ 1 _ 1 _ 1 _ _ _ _ _ _ _ _ _ _ _ _ $ 3 B   (FUN Command)
# _ N _ 0 2 3 _ HOM _ 1 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 6 1   (HOM Command)
# _ N _ 0 2 4 _ JMP _ 3 4 5 _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 3 2   (JMP Command)
# _ N _ 0 2 5 _ JSR _ 3 4 5 _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 2 9   (JSR Command)
# _ N _ 0 2 6 _ LMD _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 7 6   (LMD Command)
# _ N _ 0 2 7 _ LML _ _ _ _ _ _ _ _ 1 2 3 4 5 6 . 7 8 _ $ B A   (LML Command)
# _ N _ 0 2 8 _ LMR _ 1 2 3 4 5 . 6 7 _ 1 2 3 4 . 5 6 _ $ 4 8   (LMR Command)
# _ N _ 0 2 9 _ MLT _ _ _ _ 0 0 _ _ 1 2 3 4 5 6 . 7 8 _ $ 9 0   (MLT Command)
# _ N _ 0 3 0 _ NOP _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 6 B   (NOP Command)
# _ N _ 0 3 1 _ POA _ 1 _ + 1 2 3 4 5 6 . 7 8 _ 9 9 9 _ $ 5 D   (POA Command)
# _ N _ 0 3 2 _ POI _ 1 _ + 1 2 3 4 5 6 . 7 8 _ 9 9 9 _ $ 5 4   (POI Command)
# _ N _ 0 3 3 _ POM _ 1 _ 0 _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 4 8   (POM Command)
# _ N _ 0 3 4 _ PSA _ 1 _ + 1 2 3 4 5 6 . 7 8 _ 9 9 9 _ $ 5 6   (PSA Command)
# _ N _ 0 3 5 _ PSI _ 1 _ + 1 2 3 4 5 6 . 7 8 _ 9 9 9 _ $ 4 D   (PSI Command)
# _ N _ 0 3 6 _ PSM _ 1 _ 0 _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 4 1   (PSM Command)
# _ N _ 0 3 7 _ PST _ 1 _ _ 0 1 _ + 1 2 3 4 5 6 . 7 8 _ $ 6 A   (PST Command)
# _ N _ 0 3 8 _ REF _ 1 _ 0 _ 9 9 9 _ 1 2 _ _ _ _ _ _ _ $ E 3   (REF Command)
# _ N _ 0 3 9 _ REP _ 3 4 5 _ _ _ _ _ _ _ 1 2 3 4 5 6 _ $ B 6   (REP Command)
# _ N _ 0 4 0 _ RTS _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 5 E   (RTS Command)
# _ N _ 0 4 1 _ SAC _ 1 _ 0 _ _ _ + 1 2 3 4 5 6 . 7 8 _ $ A 0   (SAC Command)
# _ N _ 0 4 2 _ SO1 _ 1 _ 1 _ 0 7 _ 9 9 9 _ _ _ _ _ _ _ $ E D   (SO1 Command)
# _ N _ 0 4 3 _ STH _ 0 _ _ 0 0 1 _ _ _ _ _ _ _ _ _ _ _ $ 2 4   (STH Command)
# _ N _ 0 4 4 _ STZ _ + 1 2 3 4 5 6 7 _ 1 2 3 4 5 6 7 _ $ 2 E   (STZ Command)
# _ N _ 0 4 5 _ VCC _ 1 _ _ 1 2 3 4 5 6 . 7 8 _ 9 9 9 _ $ 6 7   (VCC Command)
# _ N _ 0 4 6 _ VEO _ 2 _ 1 _ 1 _ 9 9 9 _ 0 _ _ _ _ _ _ $ D 7   (VEO Command)
# _ N _ 0 4 7 _ WAI _ 0 1 . 0 0 _ _ _ _ _ _ _ _ _ _ _ _ $ 2 0   (WAI Command)
```

Table 7.2 LM01.3-003.X Program Command, RS-232 Send Format, 3 Decimals

```
# _ N _ 0 0 1 _ ACC _ 1 _ _ 9 9 9 _ _ _ _ _ _ _ _ _ _ _ $ 3 7   (ACC Command)
# _ N _ 0 0 2 _ AEA _ 0 7 _ _ 1 _ _ _ _ _ _ _ _ _ _ _ _ $ 5 A   (AEA Command)
# _ N _ 0 0 3 _ AKN _ 0 7 _ _ 1 _ _ _ _ _ _ _ _ _ _ _ _ $ 4 6   (AKN Command)
# _ N _ 0 0 4 _ APE _ 0 _ _ _ _ _ 0 0 0 1 1 1 2 2 2 0 _ $ C 7   (APE Command)
# _ N _ 0 0 5 _ ATS _ 0 7 _ _ 1 _ _ _ _ _ _ _ _ _ _ _ _ $ 3 6   (ATS Command)
# _ N _ 0 0 6 _ BAC _ 3 4 5 _ _ + 1 2 3 4 _ 1 2 3 4 5 _ $ 9 E   (BAC Command)
# _ N _ 0 0 7 _ BCA _ 3 4 5 _ _ 0 7 _ _ 1 _ _ _ _ _ _ _ $ 1 A   (BCA Command)
# _ N _ 0 0 8 _ BCB _ 3 4 5 _ 2 0 _ _ 1 _ _ _ _ _ _ _ _ $ 1 D   (BCB Command)
# _ N _ 0 0 9 _ BCD _ 3 4 5 _ 2 0 _ _ _ _ _ _ _ _ _ _ _ $ 2 B   (BCD Command)
# _ N _ 0 1 0 _ BCE _ 3 4 5 _ _ 0 7 _ _ 1 _ _ _ _ _ _ _ $ 1 C   (BCE Command)
# _ N _ 0 1 1 _ BIO _ 3 4 5 _ 1 _ 0 0 0 1 1 1 2 2 2 0 _ $ 8 8   (BIO Command)
# _ N _ 0 1 2 _ BMB _ 1 0 0 _ 1 0 _ 0 4 _ 8 _ _ _ _ _ _ $ F 8   (BMB Command)
# _ N _ 0 1 3 _ BPA _ 3 4 5 _ 1 _ 0 0 0 1 1 1 2 2 2 0 _ $ 8 D   (BPA Command)
# _ N _ 0 1 4 _ BPE _ 3 4 5 _ 1 _ 0 0 0 1 1 1 2 2 2 0 _ $ 8 8   (BPE Command)
# _ N _ 0 1 5 _ BPT _ 3 4 5 _ 2 _ + 1 2 3 4 5 . 6 7 8 _ $ 6 3   (BPT Command)
# _ N _ 0 1 6 _ CLA _ 1 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 7 3   (CLA Command)
# _ N _ 0 1 7 _ CLC _ 3 4 5 _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 4 5   (CLC Command)
# _ N _ 0 1 8 _ CON _ 1 _ _ 1 _ + 9 9 9 _ _ _ _ _ _ _ _ $ F 9   (CON Command)
# _ N _ 0 1 9 _ COU _ + 1 2 3 4 5 _ 1 2 _ 1 2 3 4 5 6 _ $ 6 7   (COU Command)
# _ N _ 0 2 0 _ EOS _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 7 2   (EOS Command)
# _ N _ 0 2 1 _ FAK _ 1 _ _ 1 . 2 3 4 5 6 _ _ _ _ _ _ _ $ F 1   (FAK Command)
# _ N _ 0 2 2 _ FUN _ 1 _ 1 _ 1 _ _ _ _ _ _ _ _ _ _ _ _ $ 3 B   (FUN Command)
# _ N _ 0 2 3 _ HOM _ 1 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 6 1   (HOM Command)
# _ N _ 0 2 4 _ JMP _ 3 4 5 _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 3 2   (JMP Command)
# _ N _ 0 2 5 _ JSR _ 3 4 5 _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 2 9   (JSR Command)
# _ N _ 0 2 6 _ LMD _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 7 6   (LMD Command)
# _ N _ 0 2 7 _ LML _ _ _ _ _ _ _ _ 1 2 3 4 5 . 6 7 8 _ $ B A   (LML Command)
# _ N _ 0 2 8 _ LMR _ 1 2 3 4 . 5 6 7 _ 1 2 3 . 4 5 6 _ $ 4 8   (LMR Command)
# _ N _ 0 2 9 _ MLT _ _ _ _ 0 0 _ _ 1 2 3 4 5 . 6 7 8 _ $ 9 0   (MLT Command)
# _ N _ 0 3 0 _ NOP _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 6 B   (NOP Command)
# _ N _ 0 3 1 _ POA _ 1 _ + 1 2 3 4 5 . 6 7 8 _ 9 9 9 _ $ 5 D   (POA Command)
# _ N _ 0 3 2 _ POI _ 1 _ + 1 2 3 4 5 . 6 7 8 _ 9 9 9 _ $ 5 4   (POI Command)
# _ N _ 0 3 3 _ POM _ 1 _ 0 _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 4 8   (POM Command)
# _ N _ 0 3 4 _ PSA _ 1 _ + 1 2 3 4 5 . 6 7 8 _ 9 9 9 _ $ 5 6   (PSA Command)
# _ N _ 0 3 5 _ PSI _ 1 _ + 1 2 3 4 5 . 6 7 8 _ 9 9 9 _ $ 4 D   (PSI Command)
# _ N _ 0 3 6 _ PSM _ 1 _ 0 _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 4 1   (PSM Command)
# _ N _ 0 3 7 _ PST _ 1 _ _ 0 1 _ + 1 2 3 4 5 . 6 7 8 _ $ 6 A   (PST Command)
# _ N _ 0 3 8 _ REF _ 1 _ 0 _ 9 9 9 _ 1 2 _ _ _ _ _ _ _ $ E 3   (REF Command)
# _ N _ 0 3 9 _ REP _ 3 4 5 _ _ _ _ _ _ _ 1 2 3 4 5 6 _ $ B 6   (REP Command)
# _ N _ 0 4 0 _ RTS _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $ 5 E   (RTS Command)
# _ N _ 0 4 1 _ SAC _ 1 _ 0 _ _ _ + 1 2 3 4 5 . 6 7 8 _ $ A 0   (SAC Command)
# _ N _ 0 4 2 _ SO1 _ 1 _ 1 _ 0 7 _ 9 9 9 _ _ _ _ _ _ _ $ E D   (SO1 Command)
# _ N _ 0 4 3 _ STH _ 0 _ _ 0 0 1 _ _ _ _ _ _ _ _ _ _ _ $ 2 4   (STH Command)
# _ N _ 0 4 4 _ STZ _ + 1 2 3 4 5 6 7 _ 1 2 3 4 5 6 7 _ $ 2 E   (STZ Command)
# _ N _ 0 4 5 _ VCC _ 1 _ _ 1 2 3 4 5 . 6 7 8 _ 9 9 9 _ $ 6 7   (VCC Command)
# _ N _ 0 4 6 _ VEO _ 2 _ 1 _ 1 _ 9 9 9 _ 0 _ _ _ _ _ _ $ D 7   (VEO Command)
# _ N _ 0 4 7 _ WAI _ 0 1 . 0 0 _ _ _ _ _ _ _ _ _ _ _ _ $ 2 0   (WAI Command)
```

7.6.2. Sending Parameters to the CLM

Parameters sent to the CLM must begin with the following format:

! _ K _ X X _ _ d d d d d d d d d d d d _ $ h h CR LF (RS-232)

! S K _ X X _ _ d d d d d d d d d d d d _ $ h h CR LF (RS-485)

S = Station number location for RS-485 mode only.

The following describes each part of the command string:

! _ K- Send parameter to CLM
X X- Parameter Number
d d --> d d - Data, 12 characters in the proper format for a given parameter
$ - End of block (checksum may follow)
h h - Check sum (if enabled in parameter 81)
CR LF - Carriage Return, Line Feed

NOTE 1: *All transmitted data must be comprised of 12 characters. Send trailing spaces to fill the data block.*

NOTE 2: *The CLM must be in Parameter Mode before sending parameter information or an "Invalid Mode" error will be issued.*

The following are examples of parameter strings with different size data fields. Note the information as it appears on the CLM display, then the format required to send the information, filling all 12 characters position of the data field.

```
CLM Display Screens

┌────────────────┐
|Feed Constant A1|
|P00    0001.0000|
└────────────────┘

┌────────────────┐
|Encoder Data  A1|
|P01 00 1250 0000|
└────────────────┘
```

Serial Data To Transmit

! _ K _ 0 0 _ _ _ _ _ 0 0 0 1 . 0 0 0 0 _ $ 8 2

! _ K _ 0 1 _ _ 0 0 _ 1 2 5 0 _ 0 0 0 0 _ $ 6 8

The parameter checksum is calculated the same way the program block checksum is calculated in Section 7.5, except the format is different.

Refer to chapter 4 for description of each parameter and its data requirements. Tables 7.3 and 7.4 list the parameter send format for two and decimal points.

NOTE: *The checksum specified with a $hh is only used to show the location of the checksum. The checksum will vary with the information being transmitted. Refer to section 7.5 to calculate the checksum.*

Table 7.3 LM01.3-003.X Parameter (Send) Format (Two Decimal Points)

Axis 1 Parameters:

```
! _ K _ 0 0 _ _ _ _ _ 0 0 0 1 . 0 0 0 0 _ $ h h   Feed Constant, Axis 1
! _ K _ 0 1 _ _ 0 0 _ 1 2 5 0 _ 0 0 0 0 _ $ h h   Encoder Data, Axis 1
! _ K _ 0 2 _ _ 0 0 0 0 5 0 . 0 0 _ 1 0 _ $ h h   Velocity, Axis 1
! _ K _ 0 3 _ _ _ _ _ 3 0 0 0 _ 1 0 . 0 _ $ h h   Drive Sensitivity, Axis 1
! _ K _ 0 4 _ _ _ _ _ _ 0 0 3 8 6 . 0 0 _ $ h h   Acceleration, Axis 1
! _ K _ 0 5 _ _ _ 0 . 9 0 0 _ 0 . 8 5 0 _ $ h h   Position Gain, Axis 1
! _ K _ 0 6 _ _ _ _ _ _ _ _ _ 1 _ 1 _ 1 _ $ h h   Direction, Axis 1
! _ K _ 0 7 _ _ _ _ 1 5 _ 0 0 0 0 . 0 1 _ $ h h   Position Tolerance, Axis 1
! _ K _ 0 8 _ _ _ _ _ _ _ _ _ _ 0 _ 0 0 _ $ h h   Homing Setup, Axis 1
! _ K _ 0 9 _ _ _ _ _ _ 0 0 0 0 0 . 0 0 _ $ h h   Homing Offset, Axis 1
! _ K _ 1 0 _ _ _ _ _ _ 1 0 _ 1 2 _ 1 3 _ $ h h   Homing Setup I/O, Axis 1
! _ K _ 1 1 _ _ _ _ - 0 0 0 0 0 1 . 0 0 _ $ h h   Minimum Travel, Axis 1
! _ K _ 1 2 _ _ _ _ + 0 0 0 1 0 0 . 0 0 _ $ h h   Maximum Travel, Axis 1
! _ K _ 1 3 _ _ 0 0 _ 0 0 _ 0 0 0 0 . 0 _ $ h h   Presignal, Axis 1
! _ K _ 1 4 _ _ _ _ _ _ _ _ _ 0 _ 0 _ 0 _ $ h h   Monitoring, Axis 1
! _ K _ 1 5 _ _ 0 0 0 _ 0 0 0 0 0 . 0 0 _ $ h h   Immediate Stop, Axis 1
! _ K _ 1 6 _ _ _ _ _ _ _ _ _ 0 0 . 0 0 _ $ h h   Cut Width, Axis 1
! _ K _ 1 7 _ _ _ 0 0 . 0 0 _ 0 0 . 0 0 _ $ h h   Knee Point, Axis 1
! _ K _ 1 8 _ _ _ _ _ _ _ _ 0 _ 0 0 . 0 _ $ h h   Material Speed
! _ K _ 1 9 _ _ _ _ _ _ _ _ _ _ _ _ _ 1 _ $ h h   Test Mode, Axis 1
! _ K _ 2 0 _ _ _ _ _ _ _ _ _ _ _ 0 0 0 _ $ h h   Manual Cut-Vector
! _ K _ 2 1 _ _ _ _ _ _ _ _ _ _ 0 _ 0 0 _ $ h h   Length Correction, Axis 1
! _ K _ 2 2 _ _ _ 0 0 _ 0 0 _ 0 0 _ 0 0 _ $ h h   Special Function, Axis 1
! _ K _ 2 3 _ _ 0 0 _ 0 _ 0 0 0 0 . 0 0 _ $ h h   Crop Cut, Axis 1
! _ K _ 2 4 _ _ 0 0 _ 0 _ 0 0 0 0 0 . 0 _ $ h h   Reversing hold
! _ K _ 2 5 _ _ _ 0 0 _ 0 0 _ 0 0 _ 0 0 _ $ h h   Restende
! _ K _ 2 6 _ _ _ _ _ 0 0 . 5 0 0 _ 0 0 _ $ h h   Special Function, Axis 1
```

Parameters 27 through 37 are reserved for future development.

```
! _ K _ 3 8 _ _ _ _ _ 0 0 1 2 . 0 0 0 0 _ $ h h   Measuring Wh. Feed Constant
! _ K _ 3 9 _ _ _ _ _ _ _ _ 0 _ 1 2 5 0 _ $ h h   Measuring Wheel Encoder LPR
```

NOTE: *The checksum specified with a $hh is only used to show the location of the checksum. The checksum will vary with the information being transmitted. Refer to section 7.5 to calculate the checksum.*

Table 7.3 (cont'd)

Axis 2 Parameters:

```
! _ K _ 4 0 _ _ _ 2 _ 0 0 0 1 . 0 0 0 0 _ $ h h   Feed Constant, Axis 2
! _ K _ 4 1 _ _ 0 0 _ 1 2 5 0 _ 0 0 0 0 _ $ h h   Encoder Data, Axis 2
! _ K _ 4 2 _ _ 0 0 0 0 5 0 . 0 0 _ 1 0 _ $ h h   Velocity, Axis 2
! _ K _ 4 3 _ _ _ _ _ 3 0 0 0 _ 1 0 . 0 _ $ h h   Drive Sensitivity, Axis 2
! _ K _ 4 4 _ _ _ _ _ _ 0 0 3 8 6 . 0 0 _ $ h h   Acceleration, Axis 2
! _ K _ 4 5 _ _ _ _ _ _ _ _ 0 1 . 0 0 0 _ $ h h   Position Gain, Axis 2
! _ K _ 4 6 _ _ _ _ _ _ _ _ _ 0 _ _ _ 0 _ $ h h   Direction, Axis 2
! _ K _ 4 7 _ _ _ _ 1 6 _ 0 0 0 0 . 0 1 _ $ h h   Position Tolerance, Axis 2
! _ K _ 4 8 _ _ _ _ _ _ _ _ _ _ 0 _ 0 0 _ $ h h   Homing Setup, Axis 2
! _ K _ 4 9 _ _ _ _ 0 _ 0 0 0 0 0 . 0 0 _ $ h h   Homing Offset, Axis 2
! _ K _ 5 0 _ _ _ _ _ _ 1 0 _ 1 2 _ 1 3 _ $ h h   Homing Setup I/O, Axis 2
! _ K _ 5 1 _ _ _ _ - 0 0 0 0 0 1 . 0 0 _ $ h h   Minimum Travel, Axis 2
! _ K _ 5 2 _ _ _ _ + 0 0 0 1 0 0 . 0 0 _ $ h h   Maximum Travel, Axis 2
! _ K _ 5 3 _ _ 0 0 _ 0 0 _ 0 0 0 0 . 0 _ $ h h   Presignal, Axis 2
! _ K _ 5 4 _ _ _ _ _ 0 _ 0 _ 0 0 _ 0 0 _ $ h h   Monitoring, Axis 2
! _ K _ 5 5 _ _ _ _ _ _ _ _ _ 0 0 _ 0 0 _ $ h h   Special Function, Axis 2
! _ K _ 5 6 _ _ _ 0 _ 0 0 0 0 _ 0 0 0 0 _ $ h h   Rotary Table, Axis 2
! _ K _ 5 7 _ _ 0 0 _ 0 0 0 0 0 0 . 0 0 _ $ h h   Knee Point, Axis 2
! _ K _ 5 8 _ _ _ _ _ _ _ 0 _ 0 0 . 0 0 _ $ h h   Synchronization Diff. Axis 2
```

Parameters 59 through 79 are reserved for future development.

Miscellaneous Parameters:

```
! _ K _ 8 0 _ _ 1 9 2 0 _ 0 _ 1 _ 8 _ 1 _ $ h h   Serial Interface
! _ K _ 8 1 _ _ _ _ _ _ 0 _ 0 0 _ 0 _ 0 _ $ h h   Serial Interface
! _ K _ 8 2 _ _ _ _ _ _ _ 2 _ 0 _ 1 _ 0 _ $ h h   Language
! _ K _ 8 3 _ _ _ _ _ _ 0 _ F F 0 0 0 0 _ $ h h   Memory Display
! _ K _ 8 4 _ _ _ 0 _ 0 0 0 _ 0 _ 0 0 0 _ $ h h   Start Task 2 & 3
! _ K _ 8 5 _ _ _ _ 0 0 _ 0 _ 0 _ 0 0 0 _ $ h h   Interrupt Vector
! _ K _ 8 6 _ _ _ _ _ _ 0 0 _ 0 _ 0 0 0 _ $ h h   Manual Vector
! _ K _ 8 7 _ _ _ _ _ _ _ _ _ _ _ 0 _ _ _ $ h h   Variations
```

Parameters 88 through 99 are free for future development.

Refer to chapter 4 for description of each parameter and its data requirements. Table 7.4 illustrates the parameter "send" format using three decimal places.

NOTE: *The checksum specified with a $hh is only used to show the location of the checksum. The checksum will vary with the information being transmitted. Refer to section 7.5 to calculate the checksum.*

Table 7.4 LM01.3-003.X Parameter (Send Format, 3 Decimals)

Axis 1 Parameters:

```
! _ K _ 0 0 _ _ _ _ _ _ 0 0 1 . 0 0 0 0 0 _ $ h h   Feed Constant, Axis 1
! _ K _ 0 1 _ _ 0 0 _ 1 2 5 0 _ 0 0 0 0 _ $ h h   Encoder Data, Axis 1
! _ K _ 0 2 _ _ 0 0 0 1 0 . 0 0 0 _ 1 0 _ $ h h   Velocity, Axis 1
! _ K _ 0 3 _ _ _ _ _ 3 0 0 0 _ 1 0 . 0 _ $ h h   Drive Sensitivity, Axis 1
! _ K _ 0 4 _ _ _ _ _ _ 0 3 8 6 . 0 0 0 _ $ h h   Acceleration, Axis 1
! _ K _ 0 5 _ _ _ 0 . 9 0 0 _ 0 . 8 5 0 _ $ h h   Position Gain, Axis 1
! _ K _ 0 6 _ _ _ _ _ _ _ _ _ 1 _ 1 _ 1 _ $ h h   Direction, Axis 1
! _ K _ 0 7 _ _ _ _ 1 5 _ 0 0 0 . 0 1 0 _ $ h h   Position Tolerance, Axis 1
! _ K _ 0 8 _ _ _ _ _ _ _ _ _ _ 0 _ 0 0 _ $ h h   Homing Setup, Axis 1
! _ K _ 0 9 _ _ _ _ _ _ 0 0 0 0 . 0 0 0 _ $ h h   Homing Offset, Axis 1
! _ K _ 1 0 _ _ _ _ _ _ 1 0 _ 1 2 _ 1 3 _ $ h h   Homing Setup I/O, Axis 1
! _ K _ 1 1 _ _ _ _ - 0 0 0 0 0 . 1 0 0 _ $ h h   Minimum Travel, Axis 1
! _ K _ 1 2 _ _ _ _ + 0 0 0 1 0 . 0 0 0 _ $ h h   Maximum Travel, Axis 1
! _ K _ 1 3 _ _ 0 0 _ 0 0 _ 0 0 0 . 0 0 _ $ h h   Presignal, Axis 1
! _ K _ 1 4 _ _ _ _ _ _ _ _ _ 0 _ 0 _ 0 _ $ h h   Monitoring, Axis 1
! _ K _ 1 5 _ _ 0 0 0 _ 0 0 0 0 . 0 0 0 _ $ h h   Immediate Stop, Axis 1
! _ K _ 1 6 _ _ _ _ _ _ _ _ _ 0 . 0 0 0 _ $ h h   Cut Width, Axis 1
! _ K _ 1 7 _ _ _ 0 . 0 0 0 _ 0 . 0 0 0 _ $ h h   Knee Point, Axis 1
! _ K _ 1 8 _ _ _ _ _ _ _ _ 0 _ 0 0 . 0 _ $ h h   Material Speed
! _ K _ 1 9 _ _ _ _ _ _ _ _ _ _ _ _ _ 1 _ $ h h   Test Mode, Axis 1
! _ K _ 2 0 _ _ _ _ _ _ _ _ _ _ _ 0 0 0 _ $ h h   Manual Cut-Vector
! _ K _ 2 1 _ _ _ _ _ _ _ _ _ _ 0 _ 0 0 _ $ h h   Length Correction, Axis 1
! _ K _ 2 2 _ _ _ 0 0 _ 0 0 _ 0 0 _ 0 0 _ $ h h   Special Function, Axis 1
! _ K _ 2 3 _ _ 0 0 _ 0 _ 0 0 0 . 0 0 0 _ $ h h   Crop Cut, Axis 1
! _ K _ 2 4 _ _ 0 0 _ 0 _ 0 0 0 0 . 0 0 _ $ h h   Reversing hold
! _ K _ 2 5 _ _ _ 0 0 _ 0 0 _ 0 0 _ 0 0 _ $ h h   Restende
! _ K _ 2 6 _ _ _ _ _ _ 0 1 . 0 0 0 _ 0 1 _ $ h h   Special Function, Axis 1
```

Parameters 27 through 37 are free for future development.

```
! _ K _ 3 8 _ _ _ _ _ _ 0 1 2 . 0 0 0 0 0 _ $ h h   Measuring Wh. Feed Constant
! _ K _ 3 9 _ _ _ _ _ _ _ _ 0 _ 1 2 5 0 _ $ h h   Measuring Wheel Encoder LPR
```

NOTE: *The checksum specified with a $hh is only used to show the location of the checksum. The checksum will vary with the information being transmitted. Refer to section 7.5 to calculate the checksum.*

Table 7.4 (cont'd)

Axis 2 Parameters:

```
! _ K _ 4 0 _ _ _ 0 _ 0 0 1 . 0 0 0 0 0 _ $ h h   Feed Constant, Axis 2
! _ K _ 4 1 _ _ 0 0 _ 1 2 5 0 _ 0 0 0 0 _ $ h h   Encoder Data, Axis 2
! _ K _ 4 2 _ _ 0 0 0 1 0 . 0 0 0 _ 1 0 _ $ h h   Velocity, Axis 2
! _ K _ 4 3 _ _ _ _ _ 3 0 0 0 _ 1 0 . 0 _ $ h h   Drive Sensitivity, Axis 2
! _ K _ 4 4 _ _ _ _ _ _ 0 3 8 6 . 0 0 0 _ $ h h   Acceleration, Axis 2
! _ K _ 4 5 _ _ _ _ _ _ _ _ 0 1 . 0 0 0 _ $ h h   Position Gain, Axis 2
! _ K _ 4 6 _ _ _ _ _ _ _ _ _ 0 _ _ _ 0 _ $ h h   Direction, Axis 2
! _ K _ 4 7 _ _ _ _ 1 6 _ 0 0 0 . 0 1 0 _ $ h h   Position Tolerance, Axis 2
! _ K _ 4 8 _ _ _ _ _ _ _ _ _ _ 0 _ 0 0 _ $ h h   Homing Setup, Axis 2
! _ K _ 4 9 _ _ _ _ 0 _ 0 0 0 0 . 0 0 0 _ $ h h   Homing Offset, Axis 2
! _ K _ 5 0 _ _ _ _ _ _ 1 0 _ 1 2 _ 1 3 _ $ h h   Homing Setup I/O, Axis 2
! _ K _ 5 1 _ _ _ _ - 0 0 0 0 0 . 1 0 0 _ $ h h   Minimum Travel, Axis 2
! _ K _ 5 2 _ _ _ _ + 0 0 0 1 0 . 0 0 0 _ $ h h   Maximum Travel, Axis 2
! _ K _ 5 3 _ _ 0 0 _ 0 0 _ 0 0 0 . 0 0 _ $ h h   Presignal, Axis 2
! _ K _ 5 4 _ _ _ _ _ 0 _ 0 _ 0 0 _ 0 0 _ $ h h   Monitoring, Axis 2
! _ K _ 5 5 _ _ _ _ _ _ _ _ _ 0 0 _ 0 0 _ $ h h   Special Function, Axis 2
! _ K _ 5 6 _ _ _ 0 _ 0 0 0 0 _ 0 0 0 0 _ $ h h   Rotary Table, Axis 2
! _ K _ 5 7 _ _ 0 0 _ 0 0 0 0 0 . 0 0 0 _ $ h h   Knee Point, Axis 2
! _ K _ 5 8 _ _ _ _ _ _ _ 0 _ 0 . 0 0 0 _ $ h h   Synchronization Diff. Axis 2
```

Parameters 59 through 79 are reserved for future development.

Miscellaneous Parameters:

```
! _ K _ 8 0 _ _ 1 9 2 0 _ 0 _ 1 _ 8 _ 1 _ $ h h   Serial Interface
! _ K _ 8 1 _ _ _ _ _ _ 0 _ 0 0 _ 0 _ 0 _ $ h h   Serial Interface
! _ K _ 8 2 _ _ _ _ _ _ _ 3 _ 0 _ 1 _ 0 _ $ h h   Language
! _ K _ 8 3 _ _ _ _ _ _ 0 _ F F 0 0 0 0 _ $ h h   Memory Display
! _ K _ 8 4 _ _ _ 0 _ 0 0 0 _ 0 _ 0 0 0 _ $ h h   Start Task 2 & 3
! _ K _ 8 5 _ _ _ _ 0 0 _ 0 _ 0 _ 0 0 0 _ $ h h   Interrupt Vector
! _ K _ 8 6 _ _ _ _ _ _ 0 0 _ 0 _ 0 0 0 _ $ h h   Manual Vector
! _ K _ 8 7 _ _ _ _ _ _ _ _ _ _ _ 0 _ _ _ $ h h   Variations
```

Parameters 88 through 99 are reserved for future development.

7.7. Information Request

CLM program blocks, parameters and system status can be requested by a host device. Each request is described in the following sections.

7.7.1. Requesting a Program Block from the CLM

A request for a program block begins with "?_N" and ends with "CRLF" -- a checksum is not required. Request format is as follows:

? _ N _ b b b _ CR LF (RS-232)

? S N _ b b b _ CR LF (RS-485)

S = Station number location for RS-485 mode only.

The following describes each part of the command string:

? _ N - Send program block information to host device
b b b - Block Number
CR LF - Carriage Return, Line Feed

The CLM sends the requested program block to the host device, in the following format (refer to Table 7.1 or 7.2 for an illustration of the data format for each command):

_ N _ b b b _ c c c _ d d d d d d d d d d d d d d d d _ $ h h CR LF (RS-232)

S N _ b b b _ c c c _ d d d d d d d d d d d d d d d d _ $ h h CR LF (RS-485)

S = Station number location for RS-485 mode only.

The following describes each part of the command string:

_ N - Sending program block information to host device
b b b - Block Number
c c c - Command Mnemonic
d d --> d d - Program block Data
$ - End of block (check sum may follow)
h h - Check sum (if enabled in parameter 81)
CR LF - Carriage Return, Line Feed

7.7.2. Requesting a System Parameter from the CLM

It is not necessary to be in Parameter mode to request parameter data. Request format is as follows:

? _ K _ _ X X _ CR LF (RS-232)

? S K _ _ X X _ CR LF (RS-485)

S = Station number location for RS-485 mode only.

The following describes each part of the command string:

? _ K - Send parameter to host device
X X - Parameter Number
CR LF - Carriage Return, Line Feed

The CLM sends the requested parameter to the host device, in the following format:

K _ X X _ _ y y y y y y y y y y y y _ $ h h CR LF (RS-232)

K S X X _ _ y y y y y y y y y y y y _ $ h h CR LF (RS-485)

S = Station number location for RS-485 mode only.

The following describes each part of the command string:

K _ - Sending parameter to host
X X - Parameter Number
d d --> d d - Parameter Data
$ - End of block (check sum may follow)
h h - Check sum (if enabled in parameter 81)
CR LF - Carriage Return, Line Feed

7.7.3. Requesting System Status from the CLM

The following System Status Information can be requested from the CLM.

00 = Current Position, Axis 1 & 2
01 = RS Transmission Error # And Text
02 = Current Program Block (Task 1 only)
03 = Current Position, Axis 1 & 2 (Hexidecimal)
04 = Counter Status
05 = Software Version
06 = Input Status
07 = Output Status
08 = Current Program Block (Task 1, 2, and 3)
19 = Hardware & Software Version
30 = Current Material Length Information
31 = Last Material Length Processed
32 = Current Operating Information
50 = System Inputs / System Outputs (Hexidecimal)
51 = Auxiliary Inputs Status (1-80) (Hexidecimal)
52 = Auxiliary Outputs Status (1-96) (Hexdecimal)
53 = Error Code And Error Message
54 = Material Length Run Out
55 = Material Velocity
56 = Total Piece Number Counter
80 = Time Measurement 1
81 = Time Measurement 2

Status 00 = Current Position, Axis 1 & 2 (Decimal)

When status 00 is requested, the CLM responds with the information on the current axis position display screen. The status 00 response will be in two or three decimal places, depending on the decimal position selected in parameter 82.

Request format:

? _ X _ _ 0 0 _ CR LF

Response format:

X _ 0 0 _ e d 1 1 1 1 1 1 . 1 1 _ e d 2 2 2 2 2 2 . 2 2 _ $ h h CR LF

e	=	"_" for Incremental, "A" for absolute (Axis has been homed)
d	=	Direction (+/-)
1	=	Current position Axis 1
2	=	Current position Axis 2

Example:

Current Axis Position Display Screen

```
L P 1A+000008.75
000 2A+000003.13
```

For this example, axis 1 position is 8.75 input units and axis 2 position is 3.13 input units. Both axis have been homed. When status 00 is requested,

? _ X _ _ 0 0 _ CR LF (RS-232 Mode)

? S X _ _ 0 0 _ CR LF (RS-485 Mode, see note)

the CLM will respond in the following format:

X _ 0 0 _ A + 0 0 0 0 0 8 . 7 5 _ A + 0 0 0 0 0 3 . 1 3 _ $ 7 4 CR LF (RS-232)

X S 0 0 _ A + 0 0 0 0 0 8 . 7 5 _ A + 0 0 0 0 0 3 . 1 3 _ $ h h CR LF (RS-485)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 01 = RS Transmission Error # and Message

This information is sent automatically by the CLM when there is a RS communication format error on the port. This information cannot be requested. If a RS transmission error occurs, the CLM will transmit the RS error number and RS error message in the following format:

Transmission format:

X _ 0 1 _ e e _ t t t t t t t t t t t t t t t t t t t t _ $ h h CR LF

e	=	RS Error Number
t	=	RS Error Message

Example:

_ N _ NOP _ $ 5 4 CRLF (Incorrect checksum)

For example, transmitting an incorrect checksum to the CLM (as shown above) will cause a response in the following:

X _ 0 1 _ 0 4 _ R S _ C h e c k s u m _ E r r o r _ _ _ _ $ 5 3 CR LF (RS-232)

X S 0 1 _ 0 4 _ R S _ C h e c k s u m _ E r r o r _ _ _ _ $ h h CR LF (RS-485)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 02 = Current Program Block (For Task 1 Only)

When status 02 is requested, the CLM responds with the current program block number being processed (Task 1 only). If a jump to subroutine (JSR command) is being processed, then when the return from subroutine (RTS command) is issued, the program returns to this program block number. The current program block number is also transmitted to the host device.

Request format:

? _ X _ _ 0 2 _ CR LF

Response format:

X _ 0 2 _ N N N _ n n n _ $ h h CR LF

N	=	Current Program Block Number
n	=	Return to Main Program Block Number, if in a subroutine

Example:

Operating Mode Display Screen

```
A1 030  PST
1  09 +000010.00
```

In this example, task 1 is currently operating in program block number 030 and subroutine (JSR command) began at block 013. The return from subroutine (RTS) would return to block 014. When status 02 is requested,

? _ X _ _ 0 2 _ CR LF (RS-232 Mode)

? S X _ _ 0 2 _ CR LF (RS-485 Mode, see note)

the CLM responds in the following format:

X _ 0 2 _ 0 3 0 _ 0 1 4 _ $ D 1 CR LF (RS-232 Mode)

X S 0 2 _ 0 3 0 _ 0 1 4 _ $ h h CR LF (RS-485 Mode, see note)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 03 = Current Position Axis 1 & 2 (Hexidecimal)

When status 00 is requested, the CLM responds with the information on the current axis position display screen. The status 03 response will be in hexidecimal.

Request format:

? _ X _ _ 0 3 _ CR LF

Response format:

X _ 0 3 _ z z z z z z z z _ y y y y y y y y _ _ _ _ _ _ _ _ $ h h CR LF

z	=	Current position, Axis 1 (Hexidecimal)
y	=	Current position, Axis 2 (Hexidecimal)

Example:

```
Current Axis Position Display Screen
                        ┌─────────────────┐
                        │L P 1 +000003.23│
                        │000 2 +000004.02│
                        └─────────────────┘
```

In the example, axis 1 position is 3.23 input units and axis 2 position is 4.02 input units. When status 03 is requested,

? _ X _ _ 0 3 _ CR LF (RS-232 Mode)

? S X _ _ 0 3 _ CR LF (RS-485 Mode, see note)

the CLM will respond in the following format:

X _ 0 3 _ 0 0 0 0 3 F 1 9 _ 0 0 0 0 4 E 9 B _ _ _ _ _ _ _ _ $ A 9 CR LF (RS-232)

X S 0 3 _ 0 0 0 0 3 F 1 9 _ 0 0 0 0 4 E 9 B _ _ _ _ _ _ _ _ $ h h CR LF (RS-485)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter*

81, then the request format must include the station number.

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 04 = Counter Status

When status 04 and a counter block number is requested, the CLM responds with the information in the specified counter block number.

Request format:

? _ X _ _ 0 4 _ N N N _ CR LF

Response format:

X _ 0 4 _ N N N _ a a a a a a a _ t t t t t t t _ _ _ _ _ $ h h CR LF

N	=	Counter block number
a	=	actual count
t	=	target count

Example:

Counter Display Screen

```
C  014  Counter
 0000010 0000500
```

The CLM has three count commands, the COU (Count), BAC (Branch With Item Count), and STZ (Counter with Predefined Jump).

For this example, the count command is program in block 014. The preset count is 500 and the actual count is 10. When status 04 is requested,

? _ X _ _ 0 4 _ 0 1 4 _ CR LF (RS-232 Mode)

? S X _ _ 0 4 _ 0 1 4 _ CR LF (RS-485 Mode, see note)

the CLM responds in the following format:

X _ 0 4 _ 0 1 4 _ 0 0 0 0 0 1 0 _ 0 0 0 0 5 0 0 _ _ _ _ _ $ E 4 CR LF (RS-232)

X S 0 4 _ 0 1 4 _ 0 0 0 0 0 1 0 _ 0 0 0 0 5 0 0 _ _ _ _ _ $ h h CR LF (RS-485)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 05 = Software Version

When status 05 is requested, the CLM responds with the software version installed in the CLM. The hardware/software version display screen is the first screen displayed when the CLM is powered up.

Request format:

? _ X _ _ 0 5 _ CR LF

Response format:

X _ 0 5 _ _ v v v v v v v v v v v v v v v v v _ $ h h CR LF

v = Software version

Example:

`Hardware/Software Display Screen`

```
CLM-01.3-M
LM01.3-003
```

For this example, the CLM software version is LM01.3-003. When status 05 is requested,

? _ X _ _ 0 5 _ CR LF   (RS-232 Mode)

? S X _ _ 0 5 _ CR LF   (RS-485 Mode, see note)

the CLM will respond in the following format:

X _ 0 5 _ _ _ _ _ L M 0 1 . 3 - 0 0 3 _ _ _ _ $ E 4 CR LF   (RS-232 Mode)

X S 0 5 _ _ _ _ _ L M 0 1 . 3 - 0 0 3 _ _ _ _ $ h h CR LF   (RS-485 Mode)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 06 = CLM Input status

When status 06 is requested, the CLM responds with the status of 16 CLM inputs (0 = Off, 1 = On). When requesting status 06, the bank number (0 - 5) for the 16 CLM inputs must also be in the request format.

Request format:

? _ X _ _ 0 6 _ b _ CR LF

Response format:

X _ 0 6 _ b _ e e e e e e e e e e e e e e e e _ $ h h CR LF

b	=	0 - System Inputs 1-16 1 - Aux. Inputs 1-16 2 - Aux. Inputs 17-32 3 - Aux. Inputs 33-48 4 - Aux. Inputs 49-64 5 - Aux. Inputs 65-80	
e	=	State of each of 16 inputs:	0 = OFF (0 Vdc) 1 = ON (24 Vdc)

Example:

System I/O Display Screen

```
System Inputs
.111.1..........
```

When status 06 in bank number 0 is requested, the state (on/off) of the following 16 CLM inputs (shown above) will be requested in the following format:

? _ X _ _ 0 6 _ 0 _ CR LF (RS-232 Mode)

? S X _ _ 0 6 _ 0 _ CR LF (RS-485 Mode, see note)

The CLM responds in the following format:

X _ 0 6 _ 0 _ 0 1 1 1 0 1 0 0 0 0 0 0 0 0 0 0 _ $ 8 A CR LF (RS-232)

X S 0 6 _ 0 _ 0 1 1 1 0 1 0 0 0 0 0 0 0 0 0 0 _ $ h h CR LF (RS-485)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 07 = CLM Output status

When status 07 is requested, the CLM responds with the status of 16 CLM outputs (0 = Off, 1 = On). When requesting status 07, the bank number (0 - 7) for the 16 CLM outputs must also be in the request format.

Request format:

? _ X _ _ 0 7 _ b _ CR LF

Response format:

X _ 0 7 _ b _ a a a a a a a a a a a a a a a a _ $ h h CR LF

b = 0 - System Outputs 1-16
1 - Aux. Outputs 1-16
2 - Aux. Outputs 17-32
3 - Aux. Outputs 33-48
4 - Aux. Outputs 49-64
5 - Aux. Outputs 65-80
6 - Aux. Outputs 81-96
7 - Aux. Outputs 97-99

a = State of each of 16 outputs: 0 = OFF (0 Vdc)
1 = ON (24 Vdc)

Example:

```
System I/O Display Screen      System Outputs
                               .1.111..........
```

When status 07 , bank number 0 is requested, the state (on/off) of the following 16 CLM outputs (shown above) will be requested in the following format:

? _ X _ _ 0 7 _ 0 _ CR LF (RS-232 Mode)

? S X _ _ 0 7 _ 0 _ CR LF (RS-485 Mode, see note)

The CLM responds in the following format:

X _ 0 7 _ 0 _ 0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 _ $ 8 9 CR LF (RS-232)

X S 0 7 _ 0 _ 0 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 _ $ h h CR LF (RS-485)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 08 = Current Block (All 3 Tasks)

When status 08 is requested, the CLM responds with the current program block number being processed (all three tasks). If a jump to subroutine (JSR command) is being processed in any task, then when the return from subroutine (RTS command) is issued, it will return to this program block number. This program block number is also transmitted to the host device. If no subroutine is commanded, the current block number is repeated. If a task has not been enabled, spaces will be returned in the appropriate locations.

Request format:

? _ X _ _ 0 8 _ CR LF

Response format:

X _ 0 8 _ 1 0 0 _ 2 0 0 _ 3 0 0 _ 4 0 0 _ 5 0 0 _ 6 0 0 _ $ h h CR LF

100 = Task 1 - Current block number

200 = Task 1 - Return to Task 1 Program Block Number, if in a subroutine

300 = Task 2 - Current block number

400 = Task 2 - Return to Task 2 Program Block Number, if in a subroutine

500 = Task 3 - Current block number

600 = Task 3 - Return to Task 3 Program Block Number, if in a subroutine

Example:

Operating Mode Display Screen

```
      Task   ┌────────────────┐         Task   ┌────────────────┐
       1     │A1 030   PST    │          2     │A2 130   AKN    │
             │1  09 +000010.00│                │01  1           │
             └────────────────┘                └────────────────┘
```

For this example, task 1 is currently operating in program block number 030, and a subroutine (JSR command) began at block 013. The return from subroutine (RTS) would return to block 014. Task 2 is currently operating in block 130 with no subroutine and task 3 is disabled. When status 08 is requested,

? _ X _ _ 0 8 _ CR LF   (RS-232 Mode)

? S X _ _ 0 8 _ CR LF   (RS-485 Mode, see note)

the CLM will respond in the following format:

X _ 0 8 _ 0 3 0 _ 0 1 4 _ 1 3 0 _ 1 3 0 _ _ _ _ _ _ _ _ _ _ $ 2 C CR LF (RS-232)

X S 0 8 _ 0 3 0 _ 0 1 4 _ 1 3 0 _ 1 3 0 _ _ _ _ _ _ _ _ _ _ $ h h CR LF (RS-485)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 19 = Hardware And Software Version

When status 19 is requested, the CLM responds with the hardware and software version installed in the CLM. The hardware/software version display screen is the first screen displayed when the CLM is powered up.

Request format:

? _ X _ _ 1 9 _ CR LF

Response format:

X_1 9 _ _ a a a a a a a a a a a a _ _ _ _ v v v v v v v v v v v v _ _ $hh CRLF

a = Hardware Version
v = Software Version

Example:

Hardware/Software Display Screen

```
CLM-01.3-M
LM01.3-003
```

In this example, the CLM software version is LM01.3-003. When status 19 is requested,

? _ X _ _ 1 9 _ CR LF (RS-232 Mode)

? S X _ _ 1 9 _ CR LF (RS-485 Mode, see note)

the CLM responds in the following format:

X_ 19 _ _ _ C L M - 0 1 . 3 - M _ _ _ _ _ _ L M 0 1 . 3 - 0 0 3 _ _ _ $ 3 8 CRLF

XS 19 _ _ _ C L M - 0 1 . 3 - M _ _ _ _ _ _ L M 0 1 . 3 - 0 0 3 _ _ _ $ 3 8 CRLF

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 30 = Current Material Length Information (Axis 1)

When status 30 is requested, the CLM responds with information about the current material length being processed for axis 1 only. This information is only correct if used in automatic mode and the length measurement in the FUN command is enabled.

The status 30 response will be in two or three decimal places, depending on which decimal position has been selected in parameter 82.

Request format:

? _ X _ _ 3 0 _ CR LF

Response format:

X _ 3 0 _ d A A A A A A . A A _ d B B B B B B . B B _ $ h h CR LF

d = Direction (+/-)
A = Material length which has not passed under the measuring wheel.
B = Material length which has passed under the measuring wheel.

Example:

`Current Axis Position Lag Display Screen`

```
L S 1A+000077.82
030 2A+000000.00
```

For this example, the part length is 120 input units. The current axis position lag display will count down from 120, depending on the material which has passed, until it reaches zero. When it reaches zero, the axis 1 will synchronize and process the part. In this example, 42.18 input units have passed and 77.82 are left to pass under the measuring wheel. When status 30 is requested,

? _ X _ _ 3 0 _ CR LF (RS-232 Mode)
? S X _ _ 3 0 _ CR LF (RS-485 Mode, see note)

the CLM responds in the following format:

X _ 3 0 _ + 0 0 0 0 4 2 . 1 8 _ + 0 0 0 0 7 7 . 8 2 _ $ E 7 CR LF (RS-232)
X S 3 0 _ + 0 0 0 0 4 2 . 1 8 _ + 0 0 0 0 7 7 . 8 2 _ $ h h CR LF (RS-485)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 31 = Last Material Length Processed

When status 31 is requested, the CLM responds with the material length that was last processed. This length information is only correct if used in Automatic mode and the length measurement in the FUN command is enabled. Refer to the FUN command in chapter 4 for more information. The status 31 response will be in two or three decimal places, depending on which decimal position has been selected in parameter 82.

Request format:

? _ X _ _ 3 1 _ CR LF

Response format:

X _ 3 1 _ d A A A A A A . A A _ $ h h CR LF

d	=	Direction (+/-)
A	=	Last Material Length Processed

Example:

The last part length processed was 120 input units. When status 31 is requested,

? _ X _ _ 3 1 _ CR LF (RS-232 Mode)

? S X _ _ 3 1 _ CR LF (RS-485 Mode, see note)

the CLM responds in the following format:

X _ 3 1 _ + 0 0 0 1 2 0 . 0 0 _ $ 0 6 CR LF (RS-232 Mode)

X S 3 1 _ + 0 0 0 1 2 0 . 0 0 _ $ h h CR LF (RS-485 Mode, see note)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 32 = Current Operating Information

When status 32 is requested, the CLM responds with the current operating information. The information will include the current part length block number, piece count of that part, the operating mode, and material speed.

Request format:

? _ X _ _ 3 2 _ CR LF

Response format:

X _ 3 2 _ N N N _ z z z z z z z _ b b _ y y y y y y y y _ $ h h CR LF

N = Current part length block number
z = Current piece count
b = Operating Mode

00 = Manual mode
01 = Automatic mode
02 = Parameter mode
03 = Test operation
FF = CLM error or CLM is initializing

y = Material Speed

Example:

The Automatic mode is selected, the current part length is in program block number 012, the current piece count is 70, and the current material speed is 10.279 feet per minute. When status 32 is requested,

? _ X _ _ 3 2 _ CR LF (RS-232 Mode)

? S X _ _ 3 2 _ CR LF (RS-485 Mode, see note)

the CLM responds in the following format:

X _ 3 2 _ 0 1 2 _ 0 0 0 0 7 0 _ 0 1 _ 0 0 1 0 . 2 7 9 _ $ A 2 CR LF (RS-232)

X S 3 2 _ 0 1 2 _ 0 0 0 0 7 0 _ 0 1 _ 0 0 1 0 . 2 7 9 _ $ h h CR LF (RS-485)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 50 = System Inputs / System Outputs (Hexidecimal)

When status 50 is requested, the CLM responds with the status of the CLM system inputs and system outputs in hexidecimal. Each hexidecimal digit corresponds to the state of four system inputs or four system outputs.

Request format:

? _ X _ _ 5 0 _ b _ CR LF

Response format:

X _ 5 0 _ e e e e a a a a _ $ h h CR LF

e = Four System Inputs (Hexidecimal)
a = Four System Outputs (Hexidecimal)

Example:

```
System I/O Display Screens
```

```
System Inputs
.111.1..........
```

```
System Outputs
.1.111..........
```

For this example, when status 50 is requested, the state (on/off) of the following CLM system inputs and system outputs (shown above) will be requested in the following format:

? _ X _ _ 5 0 _ CR LF (RS-232 mode)

? S X _ _ 5 0 _ CR LF (RS-485 mode, see note)

The CLM will respond in the following format:

```
           X _5 0 _ 0 0 2 E 0 0 3 A $ 5 6 CR LF   (RS-232 mode)

0000   0000     0010     1110      0000    0000      0011   1010
|                          |        |                        |
16 --- System Inputs ------ 1      16 ---- System Outputs ---- 1
```

X S 5 0 _ 0 0 2 E 0 0 3 A $ h h CR LF RS-485 mode)
(See note)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 51 = Auxiliary Inputs Status (1-80) (Hexidecimal)

When status 51 is requested, the CLM responds with the status of the CLM auxiliary inputs (1 - 80) in hexidecimal. Each hexidecimal digit corresponds to the state of four auxiliary inputs.

Request format:

? _ X _ _ 5 1 _ CR LF

Response format:

```
X _ 5 1 _ e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  $ hh CRLF
          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
```

80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4	=2^3
79	75	71	67	63	59	55	51	47	43	39	35	31	27	23	19	15	11	7	3	=2^2
78	74	70	66	62	58	54	50	46	42	38	34	30	26	22	18	14	10	6	2	=2^1
77	73	69	65	61	57	53	49	45	41	37	33	29	25	21	17	13	9	5	1	=2^0

e = Four Auxiliary Inputs (Hexidecimal)

Example:

System I/O Display Screens

```
Aux. Inputs 1-16
11111111........
```

In the example shown, the first eight auxiliary inputs are on. When status 51 is requested, the state (on/off) of the following CLM system inputs (shown above) will be requested in the following format:

? _ X _ _ 5 1 _ CR LF (RS-232 Mode)

? S X _ _ 5 1 _ CR LF (RS-485 Mode, See note)

The CLM responds in the following format:

X _ 5 1 _ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 F F $ 1 2 CR LF (RS-232 Mode)
X S 5 1 _ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 F F $ h h CR LF (RS-485 Mode)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 52 = Auxiliary Outputs Status (1-80) (Hexidecimal)

When status 52 is requested, the CLM responds with the status of the CLM auxiliary outputs (1 - 96) in hexidecimal. Each hexidecimal digit corresponds to the state of four auxiliary outputs.

Request format:

? _ X _ _ 5 2 _ CR LF

Response format:

```
X _ 5 2 _ e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  e  $ hh CRLF
```

80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4	=2^3
79	75	71	67	63	59	55	51	47	43	39	35	31	27	23	19	15	11	7	3	=2^2
78	74	70	66	62	58	54	50	46	42	38	34	30	26	22	18	14	10	6	2	=2^1
77	73	69	65	61	57	53	49	45	41	37	33	29	25	21	17	13	9	5	1	=2^0

e = Four Auxiliary Outputs (Hexidecimal)

Example:

System I/O Display Screens

```
CLM Outputs 1-16
11111111........
```

In the example, the first eight auxiliary outputs are on. When status 52 is requested, the state (on/off) of the following CLM auxiliary outputs (shown above) will be requested in the following format:

? _ X _ _ 5 2 _ CR LF (RS-232 Mode)

? S X _ _ 5 2 _ CR LF (RS-485 Mode, see note)

The CLM responds in the following format:

X _ 5 2 _ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 F F $ 1 1 CR LF (RS-232 Mode)

X S 5 2 _ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 F F $ h h CR LF (RS-485 Mode)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 53 = Error Code And Error Message

When status 53 is requested, the CLM responds with a two-digit error code and a error message. The error message transmitted is the same as the error message shown on the hardware/software display screen. For more information about the error codes and error messages, refer to chapter 8, Diagnostics.

Request format:

? _ X _ _ 5 3 _ CR LF

X _ 5 3 _ f f _ t t t t t t t t t t t t t t t t _ $ h h CR LF

f = Error Code
t = Error Message

Example:

```
Hardware/Software Display Screen
```

```
EMERGENCY STOP
EMERGENCY STOP
```

In the example, the EMERGENCY STOP error is used. When status 53 is requested,

? _ X _ _ 5 3 _ CR LF   (RS-232 Mode)

? S X _ _ 5 3 _ CR LF   (RS-485 Mode, see note)

the CLM responds in the following format:

X _ 5 3 _ 0 3 _ _ E M E R G E N C Y S T O P _ _ $ 1 3 CR LF (RS-232 Mode)

X S 5 3 _ 0 3 _ _ E M E R G E N C Y S T O P _ _ $ h h CR LF (RS-485 Mode)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 54 = Material Length 1 & 2

When status 54 is requested, the CLM responds with the overall material length that has been processed. The response will show the same information as the length overall display screen. The material lengths are in increments of 1000 input units. The material length 1 cannot be cleared. The material length 2 can be cleared by pressing the CR key while the length overall screen is displayed or by transmitting the CLL control command (chapter 7, section 7.7.4.2).

Request format:

? _ X _ _ 5 4 _ CR LF

X _ 5 4 _ a a a a a a a a _ b b b b b b _ $ h h CR LF

a = Material length 1 in 1000 input units
b = Material length 2 in 1000 input units

Example:

`Length Overall Display Screen`

```
┌────────────────┐
│Length Overall  │
│00000645  000005│
└────────────────┘
```

The length overall display screen (shown above) is used for the example. Material Length 1 is 645 thousand input units. Material Length 2 is 5 thousand input units. When status 54 is requested,

? _ X _ _ 5 4 _ CR LF (RS-232 Mode)

? S X _ _ 5 4 _ CR LF (RS-485 Mode, see note)

the CLM responds in the following format:

X _ 5 4 _ 0 0 0 0 0 6 4 5 _ 0 0 0 0 0 5 _ $ 0 9 CR LF (RS-232 Mode)
X S 5 4 _ 0 0 0 0 0 6 4 5 _ 0 0 0 0 0 5 _ $ h h CR LF (RS-485 Mode)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 55 = Material Speed

When status 55 is requested, the CLM responds with the current material speed. The material speed response will depend on the material speed multiplication factor in parameter 26. Refer to chapter 4, parameter 26. The response will be in two or three decimal places, depending on which decimal position has been selected in parameter 82.

Request format:

? _ X _ _ 5 5 _ CR LF

X _ 5 5 _ a a a a a a a a _ $ h h CR LF

a = Material Speed

Example:

```
Material Speed Display Screen
```

```
Material Speed
   +00023.43
```

For this example, the material speed display screen (shown above) is used. The material speed is 23.43 input units per second. When status 55 is requested,

? _ X _ _ 5 5 _ CR LF (RS-232 Mode)

? S X _ _ 5 5 _ CR LF (RS-485 Mode, see note)

the CLM will respond in the following format:

X _ 5 5 _ 0 0 0 2 3 . 4 3 _ $ 5 2 CR LF (RS-232 Mode)
X S 5 5 _ 0 0 0 2 3 . 4 3 _ $ h h CR LF (RS-485 Mode)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 56 = Total Piece Counters

When status 56 is requested, the CLM responds with the total piece counter information. When the STZ command is processed by the program, the total piece counters, 1 and 2, are both incremented by 1. The total piece counter 1 cannot be cleared. The total piece counter 2 can be cleared by transmitting the CLZ control command (section 7.7.4.3).

Request format:

? _ X _ _ 5 6 _ CR LF

X _ 5 6 _ z z z z z z z _ y y y y y y y _ $ h h CR LF

z = Total piece counter 1
y = Total piece counter 2

Example:

For this example, the total piece counter 1 has counted 3160 parts and the total piece counter 2 has counted 184 parts. When status 56 is requested,

? _ X _ _ 5 6 _ CR LF (RS-232 Mode)

? S X _ _ 5 6 _ CR LF (RS-485 Mode, see note)

the CLM responds in the following format:

X _ 5 6 _ 0 0 0 3 1 6 0 _ 0 0 0 0 1 8 4 _ $ 0 3 CR LF (RS-232 Mode)
X S 5 6 _ 0 0 0 3 1 6 0 _ 0 0 0 0 1 8 4 _ $ h h CR LF (RS-485 Mode)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 80 = Time Measurement 1

When status 80 is requested, the CLM responds with a time measurement in milliseconds. This time measurement is enabled and disabled, in the first digit, of the FUN command (See chapter 5, FUN command). The time measured is determine from when the FUN command is enabled, until the FUN command is disabled.

Request format:

? _ X _ _ 8 0 _ CR LF

X _ 8 0 _ t t t t t t _ $ h h CR LF

t = Time measurement 1

Example:

The time measured from when the FUN command was enabled, until the FUN command is disabled is 8954 milliseconds (8.954 seconds). When status 80 is requested,

? _ X _ _ 8 0 _ CR LF (RS-232 Mode)

? S X _ _ 8 0 _ CR LF (RS-485 Mode, see note)

the CLM responds in the following format

X _ 8 0 _ 0 0 8 9 5 4 _ $ A 4 CR LF (RS-232 Mode)

X S 8 0 _ 0 0 8 9 5 4 _ $ h h CR LF (RS-485 Mode)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

Status 81 = Time Measurement 2

When status 81 is requested, the CLM responds with a time measurement in milliseconds. This time measurement is enabled and disabled, in the second digit, of the FUN command (see chapter 5, FUN command). The time measured is determine from when the FUN command is enabled, until the FUN command is disabled.

Request format:

? _ X _ _ 8 1 _ CR LF

X _ 8 1 _ t t t t t t _ $ h h CR LF

t = Time measurement 2

Example:

For this example, the time measured from when the FUN command was enabled, until the FUN command is disabled is 8954 milliseconds (8.954 seconds). When status 81 is requested,

? _ X _ _ 8 1 _ CR LF (RS-232 Mode)

? S X _ _ 8 1 _ CR LF (RS-485 Mode)

the CLM responds in the following format:

X _ 8 1 _ 0 0 8 9 5 4 _ $ A 3 CR LF (RS-232 Mode)

X S 8 1 _ 0 0 8 9 5 4 _ $ h h CR LF (RS-485 Mode)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, then the request format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

7.7.4. LM Control Commands

7.7.4.1. Start The Main Program At Block 000

When this control command is transmitted to the CLM *in Manual mode only,* the starting block number will begin at block 000.

Control Command Format:

! _ C L 0 _ $ D F CR LF   (RS-232 Mode)

! S C L 0 _ $ h h CR LF   (RS-485 Mode, see note)

The main program will normally start at the last part length (LML,LMR, or LMD command) block number that was processed when switching from manual to automatic.

If the CLM is in Automatic mode, and if this control command is transmitted, the CLM will respond with an "Invalid Mode" error to the host device.

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, the send format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

7.7.4.2. Clear Overall Material Length

When this control command is transmitted to the CLM, the overall material length 2 is cleared. The material length 2 is on the right side of the Length Overall display.

Control Command Format:

! _ C L L _ $ C 3 CR LF   (RS-232 Mode)

! S C L L _ $ h h CR LF   (RS-485 Mode, see note)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, the send format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

7.7.4.3. Clear Total Piece Counter

When this control command is transmitted to the CLM, the status 56, total piece counter 2 is cleared. Refer to Status 56 in this chapter for more information.

Control Command Format:

! _ C L Z _ $ B 5 CR LF (RS-232 Mode)

! S C L Z _ $ h h CR LF (RS-485 Mode)

NOTE: *If RS-485 mode is selected in parameter 80 and a station number is selected in parameter 81, the send format must include the station number.*

S = denotes station number location
h h = Checksum will vary depending on the station number used.

CHAPTER 8. DIAGNOSTICS AND TROUBLESHOOTING

This chapter is divided into two sections. The first, beginning at 8.1, lists the system error codes, explains the meaning of the error messages displayed on the CLM display module, and suggests possible solutions to the error conditions.

The second section, beginning at 8.2, lists and explains the serial communication errors and suggests possible solutions to those error conditions.

8.1. System Error Codes And System Error Messages

When the CLM detects a system error, all outputs are turned off and the error message appears on the CLM display module. After the error has been corrected, the message must be cleared by pressing the CL key on the CLM keypad, or by providing a +24 volt input to the external Clear input (Connector X3, pin 8).

Typically, the word "Error" appears on the top line of the display. The second line displays one of the following messages:

NOTE: *By requesting Status Code 53 from a host device to the CLM, the CLM will send the system error code and error message to the host device. Refer to chapter 7, Serial Interface for more information.*

CODE # ERROR MESSAGE

00 (No Error Message is Displayed)

When the CLM is operating properly, with no system errors present, requesting the Status Code 53 from a host device causes the CLM to transmit the error code "00." No error message will be displayed.

CODE # ERROR MESSAGE

01 System Failure

Check the wiring in the CLM cabinet. Wiring should be as shown in the installation instructions. This error can also occur during startup or battery replacement, if the parameters have not yet been entered.

CODE #	ERROR MESSAGE
02	**Invalid Input**

This message appears when the value stored in a CLM-LM parameter exceeds the minimum or maximum limits. The message appears on the first line of the display; the second line displays the number of the affected parameter.

1. The parameter containing the invalid input can be displayed by switching into Parameter mode and pressing the CL key on the CLM keypad, or by providing +24 Vdc to the external Clear input (connector X3, pin 8).

2. Consult chapter 4 for the minimum and maximum limits of the parameter in which the error occurred.

CODE #	ERROR MESSAGE
03	**EMERGENCY STOP**

The "EMERGENCY STOP" error occurs when +24 Vdc signal to the CLM Emergency Stop input is interrupted (connector X3, pin 3).

1. The Emergency Stop pushbutton has been pressed.

2. The Emergency Stop circuit has been broken. Consult the machine builder's wiring diagrams to determine what could have caused the break in the E-Stop circuit.

3. +24 Vdc has been applied to CLM connector X5, pins 1 and 2, but CLM connector X3 is not installed.

4. +24 Vdc must be applied to CLM connector X3, pins 36 and 37. Also, the reference (0 Vdc) must be applied to the CLM connector X3, pins 34 and 35.

CODE #	ERROR MESSAGE
04	**Invalid Mode !**

This error occurs when Parameter mode (+24 Vdc applied to connector X3, pin 1) is selected while the CLM is in Automatic mode (+24 Vdc applied to the CLM connector X3, pin 2).

Select Manual mode (remove +24 Vdc from the CLM connector X3, pin 2) and press the CL key on the CLM keypad; Parameter mode will be selected.

CODE #	ERROR MESSAGE
05	**Axis 1 Not Homed**

This error occurs when Automatic mode is selected but axis 1 has not yet been homed.

Axis 1 must be homed in Manual mode before Automatic mode can be selected. Refer to chapter 4, Parameters for more information about the homing routines available for axis 1.

CODE #	ERROR MESSAGE
06	**Not Home Position**

The error occurs if Automatic mode is selected but axis 1 is not at the home position.

Jog axis 1 to the home position using Manual mode, then select Automatic mode.

CODE #	ERROR MESSAGE
07	**Drive Not Ready**

This condition occurs if Automatic mode is selected but +24 Vdc is not present at Axis #1 Drive Ready input (connector X3, pin 6).

The recommended interconnects for the CLM-LM, BE 1135 or BE 1136, show that the Axis #1 Drive Ready input is supplied with +24 Vdc through the servo amplifier's Bb contacts. These contacts close when the servo amplifier has the proper condition and 3-phase power is applied. For more information about the Bb contacts, consult the manual for the servo amplifier being used.

CODE #	ERROR MESSAGE
08	**Marker Pulse 1 ?**

The error occurs if the marker pules of the axis 1 encoder is closer than 1/16 revolution to the homing switch cam. Refer to chapter, Parameters 08 and 10.

Move the axis 1 home limit switch a distance equal to or greater than 1/3 of the axis 1 Feed Constant.

CODE #	ERROR MESSAGE
09	**No Marker Pulse1**

The marker pulse was not detected within one rotation of the encoder during the homing cycle, or there is a continuous marker pulse present.

Switch the Marker Pulse wires at connector X1, pins 3 and 4.

CODE #	ERROR MESSAGE
10	**Min Travel Lmt 1**

The error occurs in Automatic Mode if the value stored in the Minimum Travel Limit A1, parameter 11, is exceeded.

1. Verify that the axis 1 minimum travel limit in parameter 11 is correct.
2. Axis 1 might be overshooting when decelerating to the home position causing axis 1 to reach the minimum travel limit. If axis 1 is overshooting, then decrease the material speed.
3. If axis 1 overshooting is a problem, consult chapter 6 for proper tuning of the axis 1 position gains.

CODE #	ERROR MESSAGE
11	**Max Travel Lmt 1**

This error occurs in Automatic Mode if the value stored in the Maximum Travel Limit A1, parameter 12, is exceeded.

1. Verify that the axis 1 maximum travel limit in parameter 12 is correct.

2. If a Minimum Stroke is programmed in the CLM, verify that it does not exceed the Maximum Travel limit.

3. Axis 1 did not synchronize with the material speed. Consult chapter 6 for proper adjustment of the position lag.

CODE # ERROR MESSAGE

12 Maximum Stroke

This error occurs in Automatic mode, if the maximum stroke value stored in the Immediate Stop, parameter 15, is exceeded.

1. If a Minimum Stroke is programmed in the CLM, verify that it does not exceed the maximum stroke.

2. Axis 1 did not synchronize with the material speed. Consult chapter 6 for proper adjustment of the position lag.

CODE # ERROR MESSAGE

13 Immediate Stop

The error occurs when +24 Vdc is applied from the CLM Immediate Stop input (connector X3, pin 5).

1. The Immediate Stop pushbutton has been pressed.

2. Consult the machine builder's wiring diagrams to determine how the Immediate Stop input is used in the flying cutoff system.

CODE # ERROR MESSAGE

14 Invalid Block #

The program contains a jump or branch command that causes the CLM user program to jump to a program block greater than 999.

NOTE: *If Task 3 is being used, enter the Task 3 program in the appropriate program block location, before enabling the Task 3 program in parameter 84.*

1. The BCB, BCD, and BMB program commands can result in a jump or branch to a target block greater than 999. This jump is caused by a combination of an offset, jump distance, or binary input. If either of these commands are used, refer to chapter 5 to determine if the program command is used properly.

2. The branch or jump command contains an asterisk (*) in the target block. Refer to chapter 5 to determine if the program command is used properly.

CODE #	ERROR MESSAGE
15	**Invalid Prg Cmd**

The error occurred because the CLM program encountered an invalid program command.

NOTE: *If Task 3 is being used, enter the Task 3 program in the appropriate program block location, before enabling the Task 3 program in parameter 84.*

1. The program command contains asterisks (*). Refer to chapter 5 to determine if the program command is used properly.

2. The auxiliary input or output programmed in the CLM program is zero.

CODE #	ERROR MESSAGE
16	**BCD Input**

This error will occur if a BCD command is encountered in the user program and the auxiliary inputs are not in a BCD format. Refer to chapter 5 for information on the BCD command.

1. The BCD program commands is programmed incorrectly.

2. Verify auxiliary inputs 1 through 8 are in a BCD format.

CODE # ERROR MESSAGE

17 JSR Nesting

This nesting error occurs if the nesting depth of the programmed subroutines is greater than 127.

Change the user program so that the number of nested subroutines does not exceed 127.

CODE # ERROR MESSAGE

18 EOS Cmd Missing

The "EOS Command Missing" error occurs if the CLM user program does not contain an EOS command where required. The cutoff program must encounter an EOS command at the end of every flying cutoff cycle. If the CLM program encounters a LMD, LML, or LMR before the EOS command, this error will occur.

1. Verify that the EOS command is programmed correctly. Refer to chapter 5 for information on the EOS command and a typical flying cutoff program.

2. Verify that the EOS command is encountered on every flying cutoff cycle before the LMD, LML, or LMR is encountered.

CODE # ERROR MESSAGE

19 RTS Nesting

This nesting error occurs when an RTS command is encountered in the CLM program without a matching JSR command. Refer to chapter 5 for information on the JSR and RTS commands.

Verify in the CLM user program that a JSR command appears before the RTS command is encountered.

CODE # ERROR MESSAGE

20 Invalid Axis Nr.

This error occurs if the CLM program encounters a program command used with an invalid axis number.

NOTE: *If Task 3 is being used, enter the Task 3 program in the appropriate program block location, before enabling the Task 3 program in parameter 84.*

The axis number in the CLM program command contains an asterisk (*). Refer to chapter 5 for information on how to enter the program command correctly.

CODE # ERROR MESSAGE

21 Drive Runaway A2

The "Drive Runaway Axis 2" error will occur if the direction of the axis 2 encoder and direction of the the axis 2 command polarity are not the same.

1. The Direction Axis 2 parameter (P46) must be compatible with the wiring of the encoder or with the command inputs E1/E2.

2. The data entered in Encoder Data A2 parameter (P41) does not correspond to the encoder used on the back of the Axis 2 motor. Check that the lines per revolution entered in the parameter matches the data on the encoder.

3. The RPM/Volts in the Drive Sensit. A2 parameter (P43) does not correspond to the RPM/Volts on the axis 2 amplifier's command input (E1/E2).

4. The axis 2 moved without a command voltage being applied to the amplifiers command input (E1/E2), i.e., the axis was physically moved by means other than the motor.

CODE # ERROR MESSAGE

22 Excess Pos Lag A2

This error occurs when axis 2 is commanded to a position but the axis 2 servo system has excessive position lag.

1. The axis 2 servo amplifier does not have power applied. Verify that the Bb contacts on the axis 2 servo amplifier are closed. For more information on conditions that are needed to apply power, consult the manual for the servo amplifier being used.

2. The Encoder Data A2, parameter (P41) does not correspond to the encoder used on the back of the Axis 2 motor. Verify that the encoder value stored in parameter 41 corresponds to the encoder mounted on the motor.

3. The RPM/Volt in the Drive Sensit. A2 parameter (P43) does not correspond to the RPM/Volts on the axis 2 servo amplifier command input (E1/E2).

4. The Accel. Rate A2 parameter (P44) value is too large. The motor is unable to accelerate at this rate.

5. The Axis 2 Amplifier Enable output (CLM connector X4, pin 14) is not connected to the Amplifier Enable (RF) input on the amplifier.

6. The axis 2 encoder cable is not connected to the CLM connector X2, or the axis 2 motor encoder cable is not connected.

7. The axis 2 encoder cable is wired incorrectly or is defective.

8. The axis 2 encoder is defective.

9. The motor cannot turn because of a mechanical bind.

CODE # ERROR MESSAGE

23 Abs. Encoder 1

The condition occurs if the axis 1 absolute encoder is not connected, or the data transmission to the CLM is interrupted or incorrect.

1. The absolute encoder value stored in the Encoder Data A1, parameter (P01) does not correspond to the encoder used on the back of the Axis 1 motor. Verify that the absolute encoder value stored in parameter 01 corresponds to the absolute encoder value.

2. The axis 1 absolute encoder cable is not connected to the CLM connector X1 or the axis 1 absolute encoder cable is not connected to the axis 1 motor.

3. The axis 1 absolute encoder cable is defective or wired incorrectly.

4. The axis 1 absolute encoder is defective.

CODE #	ERROR MESSAGE
24	**Abs. Range 1**

This error occurs if the maximum number of turns of the absolute encoder is exceeded.

1. The absolute encoder value stored in the Encoder Data A1 parameter (P01) does not correspond to the encoder used on the back of the Axis 1 motor. Verify that the absolute encoder value stored in parameter 01 corresponds to the value shown on the absolute encoder.

2. The axis 1 absolute encoder cable is defective or is wired incorrectly.

3. The axis 1 absolute encoder is defective.

CODE #	ERROR MESSAGE
25	**Abs Encoder 2**

This encoder error occurs if the axis 2 absolute encoder is not connected, or the data transmission to the CLM is interrupted or incorrect.

1. The absolute encoder value stored in the Encoder Data A2 parameter (P41) does not correspond to the encoder used on the back of the Axis 2 motor. Verify that the absolute encoder value stored in parameter 41 corresponds to the value found on the absolute encoder.

2. The axis 2 absolute encoder cable is not connected to the CLM connector X2, or the axis 2 absolute encoder cable is not connected to the axis 2 motor.

3. The axis 2 absolute encoder cable is defective or is wired incorrectly.

4. The axis 2 absolute encoder is defective.

CODE #	ERROR MESSAGE
26	**Abs. Range 2**

The error occurs if the maximum number of turns of the absolute encoder is exceeded.

1. The absolute encoder value stored in the Encoder Data A2, parameter (P41) does not correspond to the encoder used on the back of the Axis 2 motor. Verify that the value stored in parameter 41 corresponds to the value on the absolute encoder.

2. The axis 2 absolute encoder cable is defective or is wired incorrectly.

3. The axis 2 absolute encoder is defective.

CODE #	ERROR MESSAGE
27	**RS Break-Error**

The error will occur if the optional IDS board is enabled but the CLM does not detect the connection of the IDS board. The IDS board is enabled in the Serial Interface, parameter 80.

1. The connection of the IDS board to CLM connector X6 is made using the IKS 742 cable. The maximum length of this cable is 10 meters.

2. The IKS 742 cable is defective.

3. The CLM serial communication port is defective.

CODE # ERROR MESSAGE

28 Division By Zero

The error is an internal software fault in the CLM. If this error occurs, contact the Indramat Service Department.

CODE # ERROR MESSAGE

29 Parameters Lost

This error will occur when the back-up battery, which stores the CLM parameters when power to the CLM is turned off, is disconnected or the battery voltage is low.

1. If this error occurs every time the CLM is turned off and on, replace the back-up battery. This error might also occur if the firmware is removed or a different CLM firmware is installed.

2. Verify that every CLM-LM parameter has valid numbers stored in each parameter. The CLM-LM parameters might contain asterisks (*), indicating invalid data has been entered. Refer to chapter 4 for information on how to enter the CLM-LM parameters.

CODE # ERROR MESSAGE

30 Program Lost

The error will occur when the back-up battery, which stores the CLM program when power to the CLM is turned off, is disconnected or the battery voltage is low.

1. If this error occurs every time the CLM is turned off and on, replace the back-up battery. This error might also occur if the firmware is removed or a different CLM firmware is installed.

2. Verify that every CLM-LM program has valid numbers stored in each program block. The CLM-LM parameters might contains asterisks (*). Refer to Chapter 5 for information on how to enter the CLM-LM program commands.

CODE #	ERROR MESSAGE
31	**FeedAngle Loss 2**

This error occurs if the feed angle auxiliary input, stored in the Monitoring A2 parameter 54, goes low while axis 2 is moving. Refer to chapter 4 for more information on the feed angle auxiliary input.

1. Verify that the feed angle auxiliary input is properly connected.

2. If the feed angle is attached to a press that operates continuously, either the press speed must be slowed down or the part length being processed must be shorter.

CODE #	ERROR MESSAGE
32	**Marker Pulse 2 ?**

The error occurs if the marker pulse of the axis 2 encoder is closer than 1/16 revolution to the homing switch cam. Refer to chapter, Parameters 48 and 50.

Move the axis 2 home limit switch a distance equal to or greater than 1/3 of the axis 2 Feed Constant.

CODE #	ERROR MESSAGE
33	**No Marker Pulse2**

The error occurs if the axis 2 marker pulse was not detected within one rotation of the encoder during the axis 2 homing cycle, or if there is a continuous marker pulse, most likely as the result of a defective encoder.

Switch the marker pulse wires at connector X2, pins 3 and 4.

CODE # ERROR MESSAGE

34 Min Travel Lmt 2

This minimum travel error occurs in Automatic mode, if the value stored in the Minimum Travel Limit A2, parameter 51, is exceeded.

1. The axis 2 commanded position has exceeded the axis 2 minimum travel limit.

2. Verify that the axis 2 minimum travel limit in parameter 51 is correct.

CODE # ERROR MESSAGE

35 Max Travel Lmt 2

This maximum travel error occurs in Automatic mode, if the value stored in the Maximum Travel Limit A2, parameter 52, is exceeded.

1. The axis 2 commanded position has exceeded the axis 2 maximum travel limit.

2. Verify that the axis 2 maximum travel limit in parameter 52 is correct.

CODE # ERROR MESSAGE

36 Axis 2 Not Homed

The error occurs if the user program encounters an absolute position command for axis 2, but that axis has not yet been homed.

1. Verify that the axis 2 parameters are correct. Axis 2 can be homed in Manual or Automatic mode. Refer to chapter 4, Parameters for more information on axis 2 homing.

2. Verify that the axis 2 position command in the CLM user program is correct. Refer to chapter 5 for more information on the axis 2 position commands.

CODE # ERROR MESSAGE

37 Drive Runaway A1

This error will occur if the direction of the axis 1 encoder and direction of the the axis 1 command polarity are not the same.

1. Verify that the Direction Axis 1 parameter (P06) is compatible with the wiring of the encoder or with the command inputs E1/E2.

2. The Encoder Data A1, parameter (P01) is too small, and does not correspond to the encoder being used for Axis 1.

3. The RPM/Volts in the Drive Sensit. A1 parameter (P03) does not correspond to the RPM/Volts on the axis 1 amplifiers command input (E1/E2).

4. Axis 1 moved without a command voltage being applied to the amplifier's command input (E1/E2), i.e., the axis was physically moved by means other than the motor.

CODE # ERROR MESSAGE

38 Synchr. Diff. A2

The "Synchronization Difference A2" error occurs when the difference between the axis 1 motor and the axis 2 motor exceeds the value entered in Synchr. Diff. A2, parameter 40. This parameter is used to enable axis 1 and 2 to perform as a synchronized axis. When the synchronized axis is enabled, the synchronization difference factor must also be programmed in the parameter 58. Refer to chapter 4 for more information on synchronizing axis 1 and 2.

1. Verify that the parameter entries for axis 1 and axis 2 are identical.

2. Verify that axis 1 or 2 is not skewing or binding.

CODE # ERROR MESSAGE

39 Index Length

The error occur when switching from Manual to Automatic mode, if the amount of material that has passed under the measuring wheel is greater than the part length.

Verify that the index length is correct before switching from Manual into Automatic mode. Refer to the Length Correction, parameter 21 in Chapter 4 for more information on the index length.

CODE #	ERROR MESSAGE
40	**Battery Is Low**

This condition occurs when the lithium battery which retains CLM memory (programs, parameters, counter status, etc.) during power OFF, is below minimum voltage level.

A battery test is made at CLM power-up. If the battery is low, the error message is displayed; press Clear to continue. The diagnostic message reappears every ten minutes as a reminder. During normal operation, in any of the three CLM operating modes, a battery test is made every four hours. If the battery is still low, the diagnostic message appears but a fault is not issued.

Replace the battery within two weeks of the first appearance of the diagnostic message. Turn power OFF to the CLM, remove the Memory and Battery Module (refer to Figure 2.3), and replace the 3.5-volt lithium battery. Call the Indramat Service Department if you have any questions concerning battery replacement.

8.2. Serial Communication Errors

Serial communications errors are not displayed on the CLM display module, but the serial communication error code and error message will be transmitted from the CLM to a host device (SOT, computer, etc.).

The correct format must be used when information is transmitted to the CLM from a host device. If the format is not correct, the CLM will transmit an error code and message from the CLM serial communication port (CLM connector X6) to the host device. The error code and message are transmitted with the status number 01. Refer to the Serial Interface, chapter 7, for information on formats and how status 01 operates.

The CLM-LM serial communication errors are as follows:

CODE #	ERROR MESSAGE
01	**RS Block # Wrong**

The program command being transmitted to the CLM has a invalid block number. The block number must be between 000 and 999.

Verify that the proper program block number being transmitted is between 000 and 999. Refer to the Serial Interface, chapter 7, for the correct program command format.

CODE #	ERROR MESSAGES
02	**RS Format Error**

The information transmitted contains more characters than is allowed, or a carriage return/line feed is not transmitted at the end of the information.

Verify that the information transmitted is in the proper format with a carriage return/line feed. Refer to the Serial Interface, chapter 7, for information on the correct format.

CODE # ERROR MESSAGE

03 RS Block Data Error

The format of the program command was transmitted incorrectly to the CLM.

Verify that the program command format is transmitted correctly to the CLM. Refer to the Serial Interface, chapter 7, for the correct program command format.

CODE # ERROR MESSAGE

04 RS Checksum Error

Information transmitted to the CLM with a checksum must agree with the checksum calculated by the CLM. The checksum is used to verify that the information transmitted is correct and complete. The checksum can be enabled or disabled in the Serial Interface Functions, parameter 81. Refer to chapter 4 for information about the Serial Interface functions.

Verify that the checksum being transmitted is calculated correctly. Refer to the Serial Interface, chapter 7, for information about calculating the checksum.

CODE # ERROR MESSAGE

05 Invalid Mode

An attempt was made to transmit parameter information without first selecting Parameter mode. Also, if the LM Control Command "! CLO $DF" was transmitted in Automatic mode.

1. Verify that Parameter mode is selected before transmitting parameter information to the CLM.

2. Verify that Manual mode is selected before transmitting the LM Control Command (! CLO $DF) to the CLM. Refer to the Serial Interface, chapter 7, for information on the LM Control Commands.

CODE # ERROR MESSAGE

06 RS Para # Wrong

The parameter number being transmitted to the CLM is invalid, i.e., the parameter number must be in a two-digit format between 00 and 99.

Verify that the parameter number being transmitted is between 00 and 99. Refer to the Serial Interface, chapter 7, for the correct parameter format.

CODE # ERROR MESSAGE

07 RS Para # Too Big

The parameter number transmitted to the CLM is greater than 99.

Verify that the proper parameter number being transmitted is between 00 and 99. Refer to the Serial Interface, chapter 7, for the correct parameter format.

CODE # ERROR MESSAGE

08 RS Stat # Wrong

An incorrrect format was used to transmit to the CLM.

Verify that the status number is being transmitted to the CLM in the correct format to the CLM. Refer to the Serial Interface, chapter 7 for the correct status request format.

CODE # ERROR MESSAGE

09 Invalid Status #

This error occurs if the status number being transmitted to the CLM is invalid, i.e., not included in the list of status numbers in chapter 7, Serial Interface.

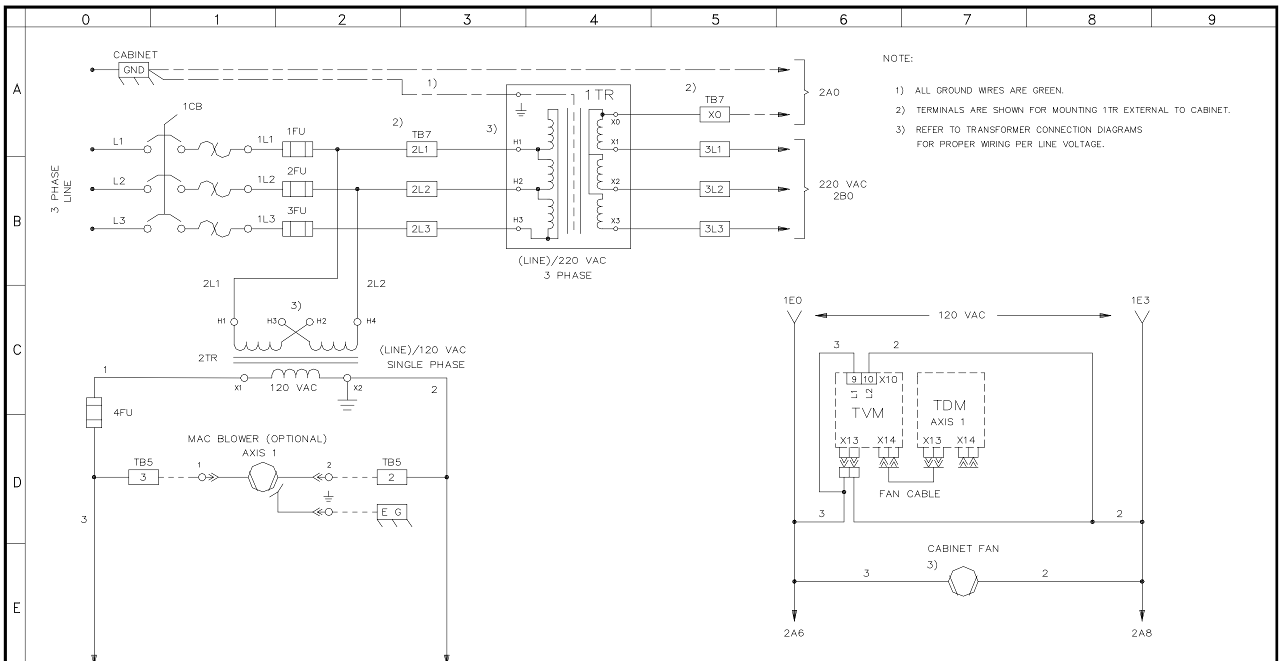
Verify that the proper status number is being transmitted to the CLM.

CODE #	ERROR MESSAGE
10	**Invalid Prg Command**

The program command being transmitted to the CLM is invalid; it is not included in the list of program commands found in chapter 5, Programming.

Verify that the program command being transmitted to the CLM is listed in chapter 5 and is used correctly.

APPENDIX A: BE 1136
SINGLE AXIS INTERCONNECT DRAWINGS



THIS DRAWING SET IS OFFERED AS A GUIDE ONLY. IT MAY OR MAY NOT CONTAIN ALL OF THE WIRING INFORMATION NEEDED FOR A SPECIFIC CUSTOMER APPLICATION.
THE SELECTION AND SIZING OF ALL NON–INDRAMAT COMPONENTS ARE ULTIMATELY THE RESPONSIBILITY OF THE MACHINE BUILDER.

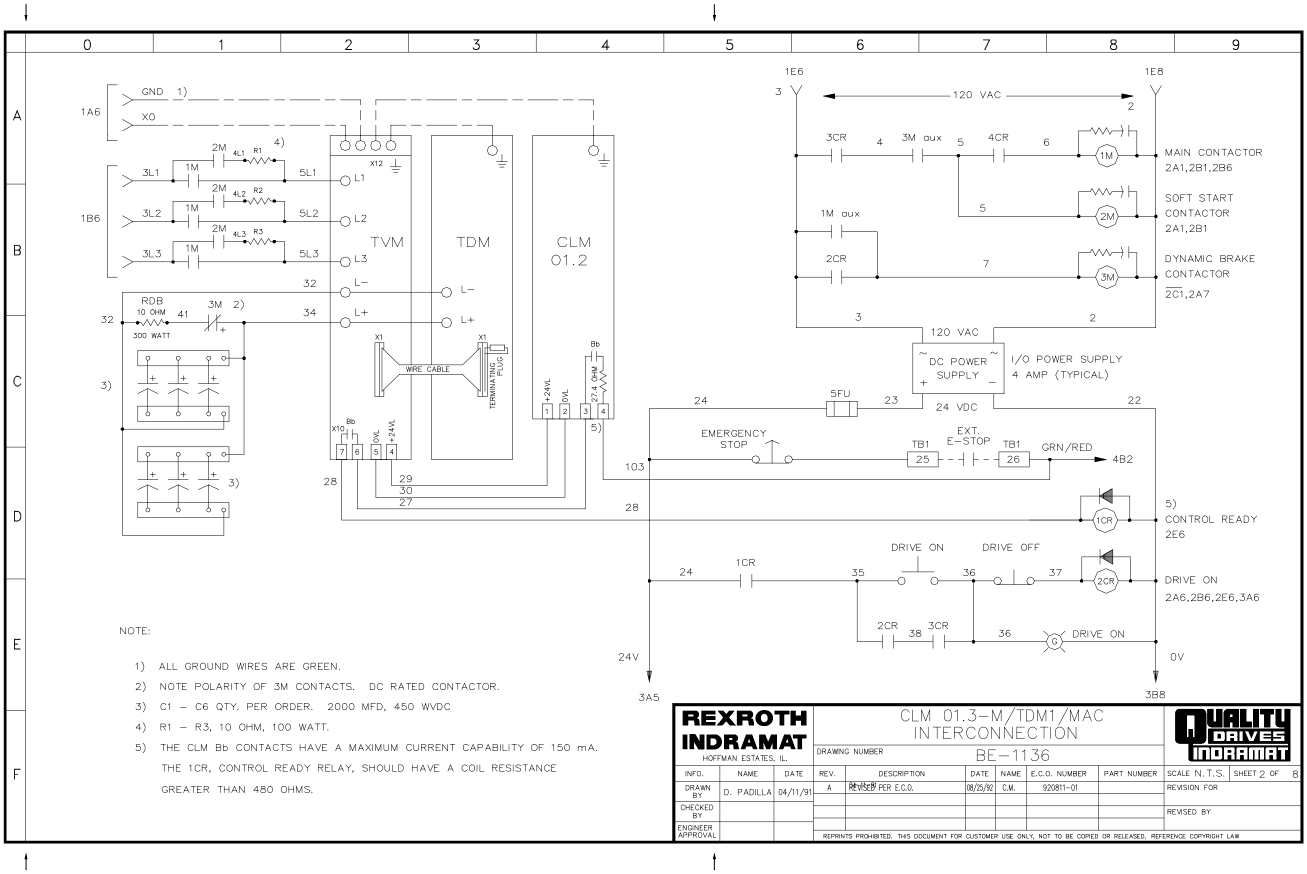
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.

CLM 01.3–M/TDM1/MAC INTERCONNECTION

DRAWING NUMBER BE–1136

INFO.	NAME	DATE	REV.	DESCRIPTION	DATE	NAME	E.C.O. NUMBER	PART NUMBER
DRAWN BY	D. PADILLA	04/11/91	A	REVISED PER E.C.O.	08/25/92	C.M.	920811–01	
CHECKED BY								
ENGINEER APPROVAL								

SCALE N.T.S. SHEET 1 OF 8
REVISION FOR
REVISED BY


GND 1)
X0
1A6
1B6
3L1
3L2
3L3
5L1
5L2
5L3
1M
2M
4L1 R1
4L2 R2
4L3 R3
4)
TVM
TDM
CLM
01.2
L1
L2
L3
L−
L+
X12
RDB
10 OHM
300 WATT
41
3M 2)
32
34
3)
X1
WIRE CABLE
TERMINATING PLUG
+24VL
0VL
27.4 OHM
Bb
X10
5)
28
29
30
27
103
1E6
1E8
120 VAC
3CR
3M aux
4CR
1M aux
2CR
MAIN CONTACTOR
2A1,2B1,2B6
SOFT START
CONTACTOR
2A1,2B1
DYNAMIC BRAKE
CONTACTOR
2C1,2A7
DC POWER
SUPPLY
I/O POWER SUPPLY
4 AMP (TYPICAL)
5FU
24 VDC
EMERGENCY
STOP
EXT.
E−STOP
TB1
25
26
GRN/RED
4B2
CONTROL READY
2E6
DRIVE ON
DRIVE OFF
1CR
2CR
3CR
DRIVE ON
2A6,2B6,2E6,3A6
24V
0V
3A5
3B8
NOTE:
1) ALL GROUND WIRES ARE GREEN.
2) NOTE POLARITY OF 3M CONTACTS. DC RATED CONTACTOR.
3) C1 − C6 QTY. PER ORDER. 2000 MFD, 450 WVDC
4) R1 − R3, 10 OHM, 100 WATT.
5) THE CLM Bb CONTACTS HAVE A MAXIMUM CURRENT CAPABILITY OF 150 mA.
THE 1CR, CONTROL READY RELAY, SHOULD HAVE A COIL RESISTANCE
GREATER THAN 480 OHMS.
REXROTH
INDRAMAT
HOFFMAN ESTATES, IL.
CLM 01.3−M/TDM1/MAC
INTERCONNECTION
DRAWING NUMBER
BE−1136
QUALITY DRIVES INDRAMAT
DRAWN BY D. PADILLA 04/11/91
REV. A REVISED PER E.C.O. 08/25/92 C.M. 920811−01
SCALE N.T.S. SHEET 2 OF 8
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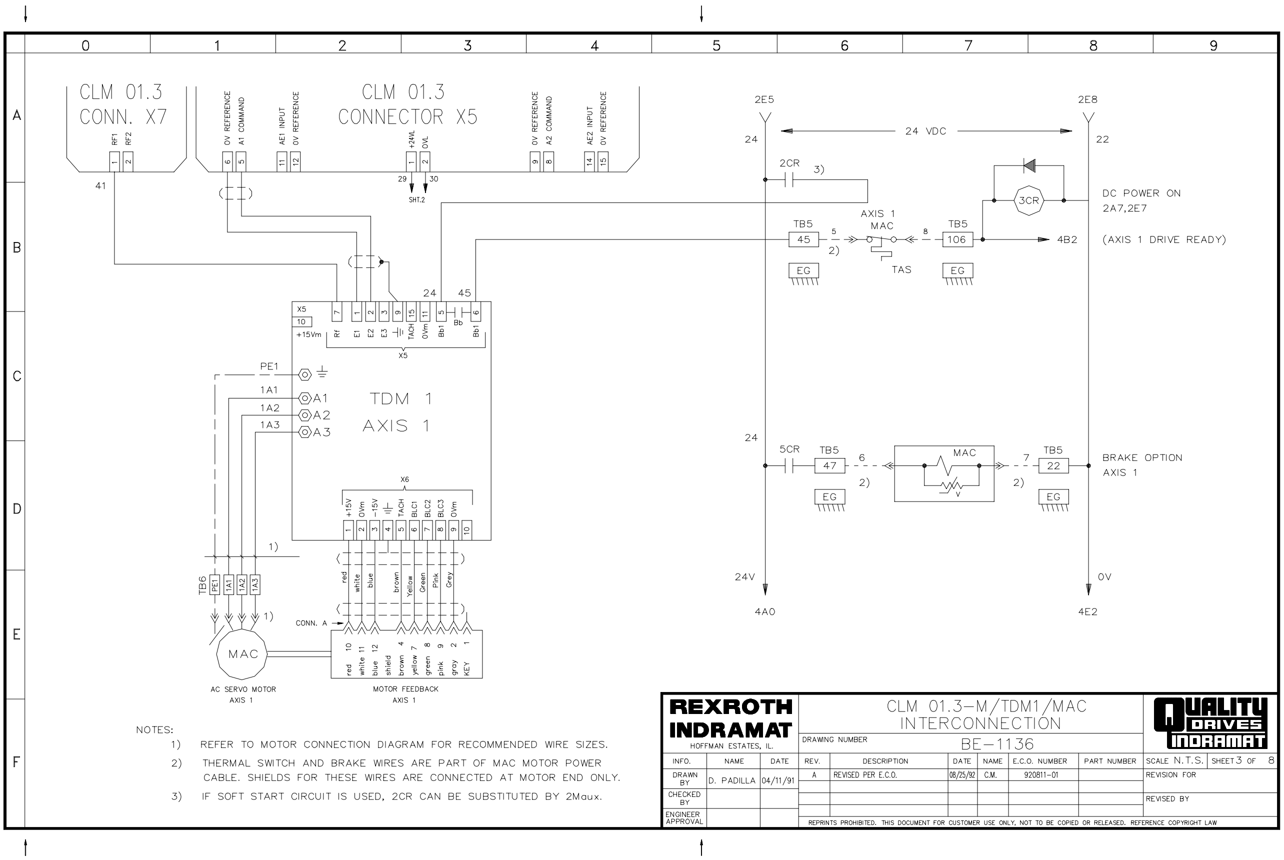
CLM 01.3
CONN. X7
CLM 01.3
CONNECTOR X5
TDM 1
AXIS 1
MAC
AC SERVO MOTOR
AXIS 1
MOTOR FEEDBACK
AXIS 1
24 VDC
DC POWER ON
2A7,2E7
(AXIS 1 DRIVE READY)
BRAKE OPTION
AXIS 1
NOTES:
1) REFER TO MOTOR CONNECTION DIAGRAM FOR RECOMMENDED WIRE SIZES.
2) THERMAL SWITCH AND BRAKE WIRES ARE PART OF MAC MOTOR POWER CABLE. SHIELDS FOR THESE WIRES ARE CONNECTED AT MOTOR END ONLY.
3) IF SOFT START CIRCUIT IS USED, 2CR CAN BE SUBSTITUTED BY 2Maux.
REXROTH
INDRAMAT
HOFFMAN ESTATES, IL.
CLM 01.3–M/TDM1/MAC
INTERCONNECTION
DRAWING NUMBER
BE–1136
DRAWN BY D. PADILLA 04/11/91
A REVISED PER E.C.O. 08/25/92 C.M. 920811-01
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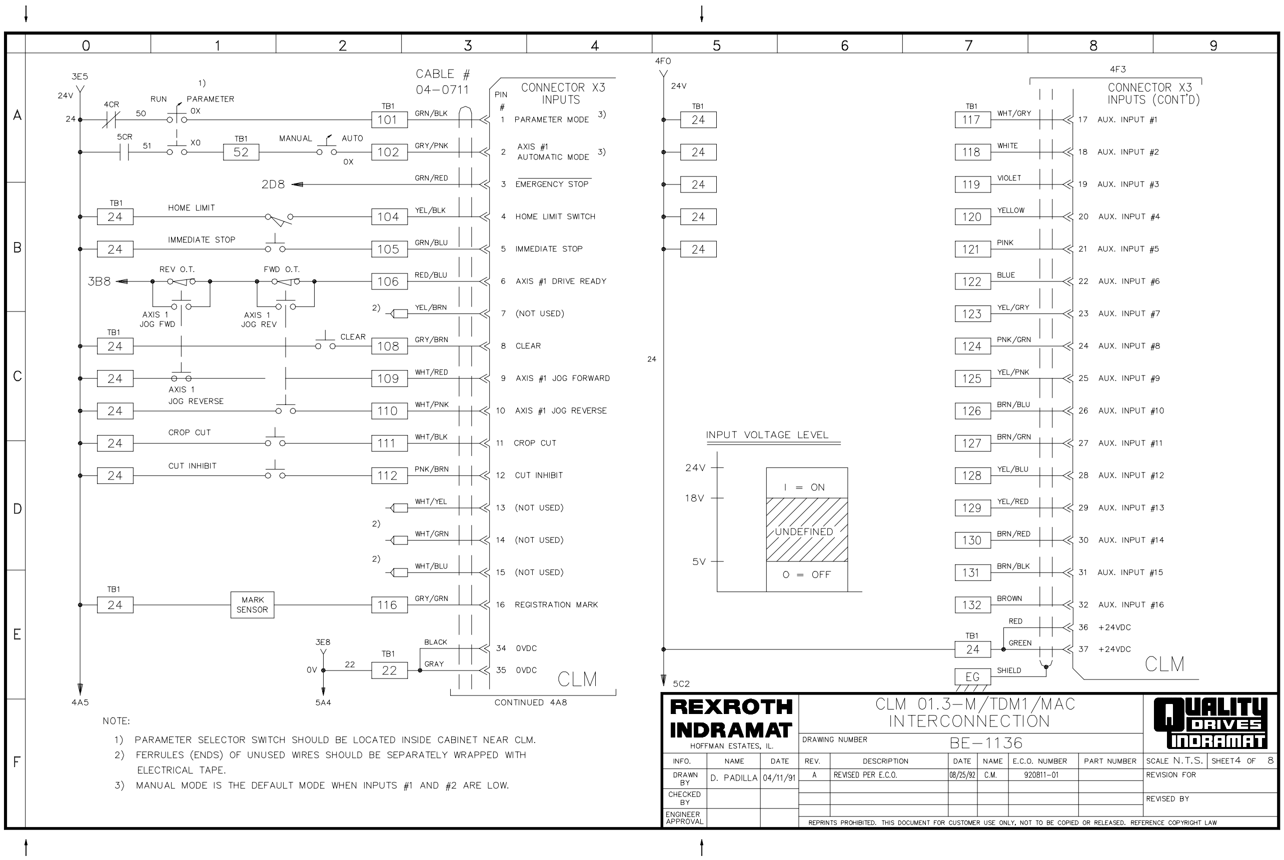
CABLE # 04-0711
CONNECTOR X3 INPUTS
PIN #
1 PARAMETER MODE 3)
2 AXIS #1 AUTOMATIC MODE 3)
3 EMERGENCY STOP
4 HOME LIMIT SWITCH
5 IMMEDIATE STOP
6 AXIS #1 DRIVE READY
7 (NOT USED)
8 CLEAR
9 AXIS #1 JOG FORWARD
10 AXIS #1 JOG REVERSE
11 CROP CUT
12 CUT INHIBIT
13 (NOT USED)
14 (NOT USED)
15 (NOT USED)
16 REGISTRATION MARK
34 0VDC
35 0VDC
CLM
CONTINUED 4A8
RUN
PARAMETER
MANUAL
AUTO
HOME LIMIT
IMMEDIATE STOP
REV O.T.
FWD O.T.
AXIS 1 JOG FWD
AXIS 1 JOG REV
CLEAR
AXIS 1 JOG REVERSE
CROP CUT
CUT INHIBIT
MARK SENSOR
INPUT VOLTAGE LEVEL
24V
18V
5V
1 = ON
UNDEFINED
0 = OFF
CONNECTOR X3 INPUTS (CONT'D)
17 AUX. INPUT #1
18 AUX. INPUT #2
19 AUX. INPUT #3
20 AUX. INPUT #4
21 AUX. INPUT #5
22 AUX. INPUT #6
23 AUX. INPUT #7
24 AUX. INPUT #8
25 AUX. INPUT #9
26 AUX. INPUT #10
27 AUX. INPUT #11
28 AUX. INPUT #12
29 AUX. INPUT #13
30 AUX. INPUT #14
31 AUX. INPUT #15
32 AUX. INPUT #16
36 +24VDC
37 +24VDC
CLM
NOTE:
1) PARAMETER SELECTOR SWITCH SHOULD BE LOCATED INSIDE CABINET NEAR CLM.
2) FERRULES (ENDS) OF UNUSED WIRES SHOULD BE SEPARATELY WRAPPED WITH ELECTRICAL TAPE.
3) MANUAL MODE IS THE DEFAULT MODE WHEN INPUTS #1 AND #2 ARE LOW.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
CLM 01.3-M/TDM1/MAC INTERCONNECTION
DRAWING NUMBER BE-1136
DRAWN BY D. PADILLA 04/11/91
A REVISED PER E.C.O. 08/25/92 C.M. 920811-01
SCALE N.T.S. SHEET 4 OF 8
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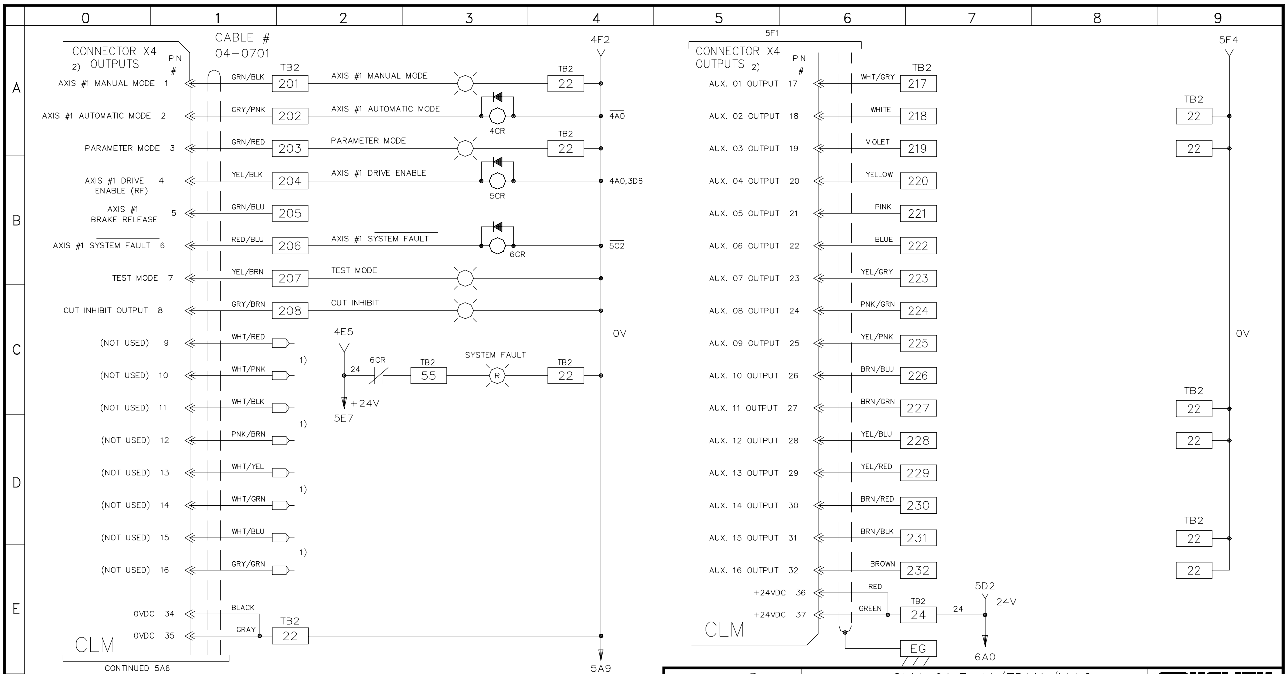

NOTES:
1) FERRULES (ENDS) OF UNUSED WIRES SHOULD BE SEPARATELY WRAPPED WITH ELECTRICAL TAPE.
2) THE CLM OUTPUTS HAVE A MAXIMUM CURRENT CAPABILITY OF 50mA. LOAD MUST BE GREATER THAN 480 OHMS.

REXROTH INDRAMAT
HOFFMAN ESTATES, IL.

CLM 01.3-M/TDM1/MAC INTERCONNECTION

DRAWING NUMBER: BE-1136

INFO.	NAME	DATE	REV.	DESCRIPTION	DATE	NAME	E.C.O. NUMBER	PART NUMBER	SCALE N.T.S.	SHEET 5 OF 8
DRAWN BY	D. PADILLA	04/11/91	A	REVISED PER E.C.O.	08/25/92	C.M.	920811-01		REVISION FOR	
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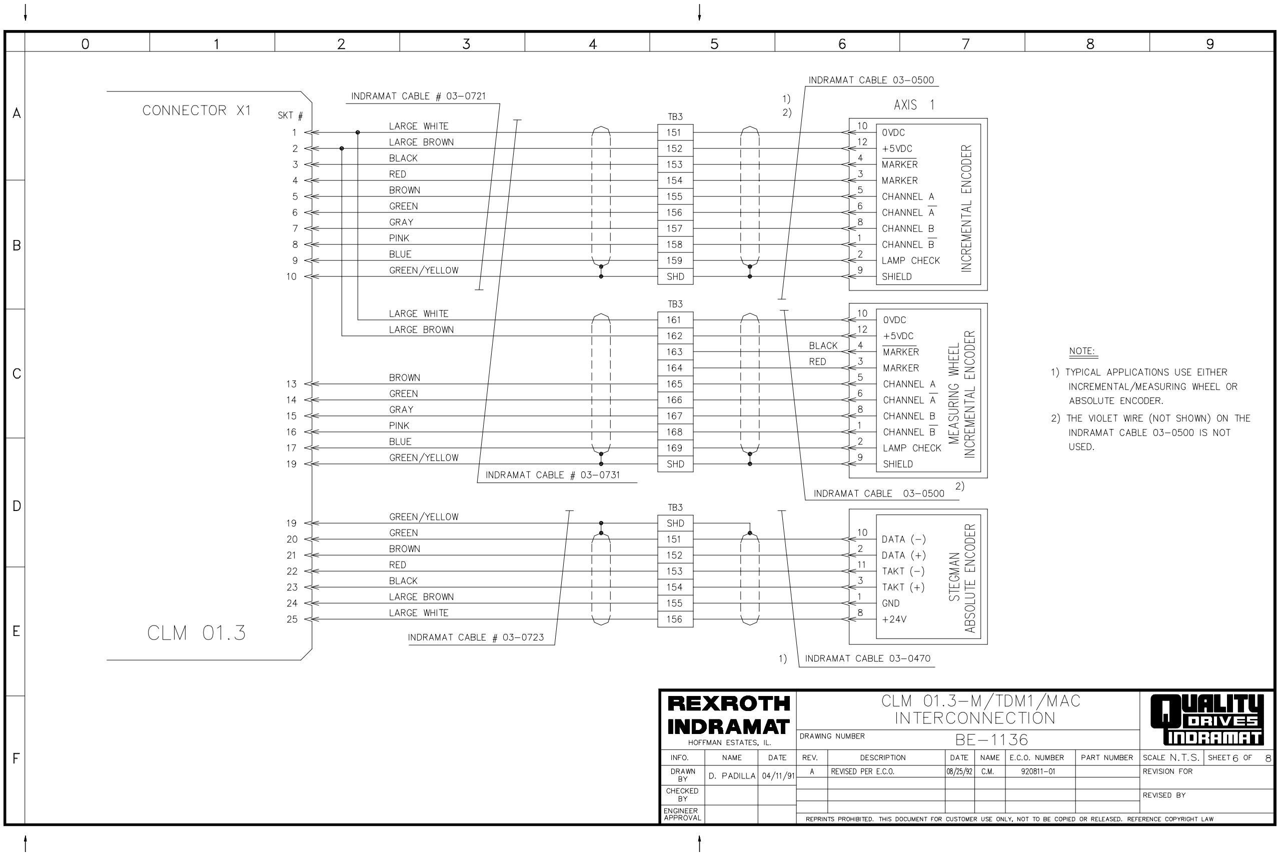
CONNECTOR X1
SKT #
INDRAMAT CABLE # 03-0721
INDRAMAT CABLE 03-0500
AXIS 1
LARGE WHITE
LARGE BROWN
BLACK
RED
BROWN
GREEN
GRAY
PINK
BLUE
GREEN/YELLOW
TB3
0VDC
+5VDC
MARKER
CHANNEL A
CHANNEL B
LAMP CHECK
SHIELD
INCREMENTAL ENCODER
MEASURING WHEEL INCREMENTAL ENCODER
INDRAMAT CABLE # 03-0731
INDRAMAT CABLE 03-0500
DATA (-)
DATA (+)
TAKT (-)
TAKT (+)
GND
+24V
STEGMAN ABSOLUTE ENCODER
INDRAMAT CABLE # 03-0723
INDRAMAT CABLE 03-0470
CLM 01.3
NOTE:
1) TYPICAL APPLICATIONS USE EITHER INCREMENTAL/MEASURING WHEEL OR ABSOLUTE ENCODER.
2) THE VIOLET WIRE (NOT SHOWN) ON THE INDRAMAT CABLE 03-0500 IS NOT USED.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
CLM 01.3-M/TDM1/MAC INTERCONNECTION
DRAWING NUMBER BE-1136
DRAWN BY D. PADILLA 04/11/91
REV. A REVISED PER E.C.O. 08/25/92 C.M. 920811-01
SCALE N.T.S. SHEET 6 OF 8
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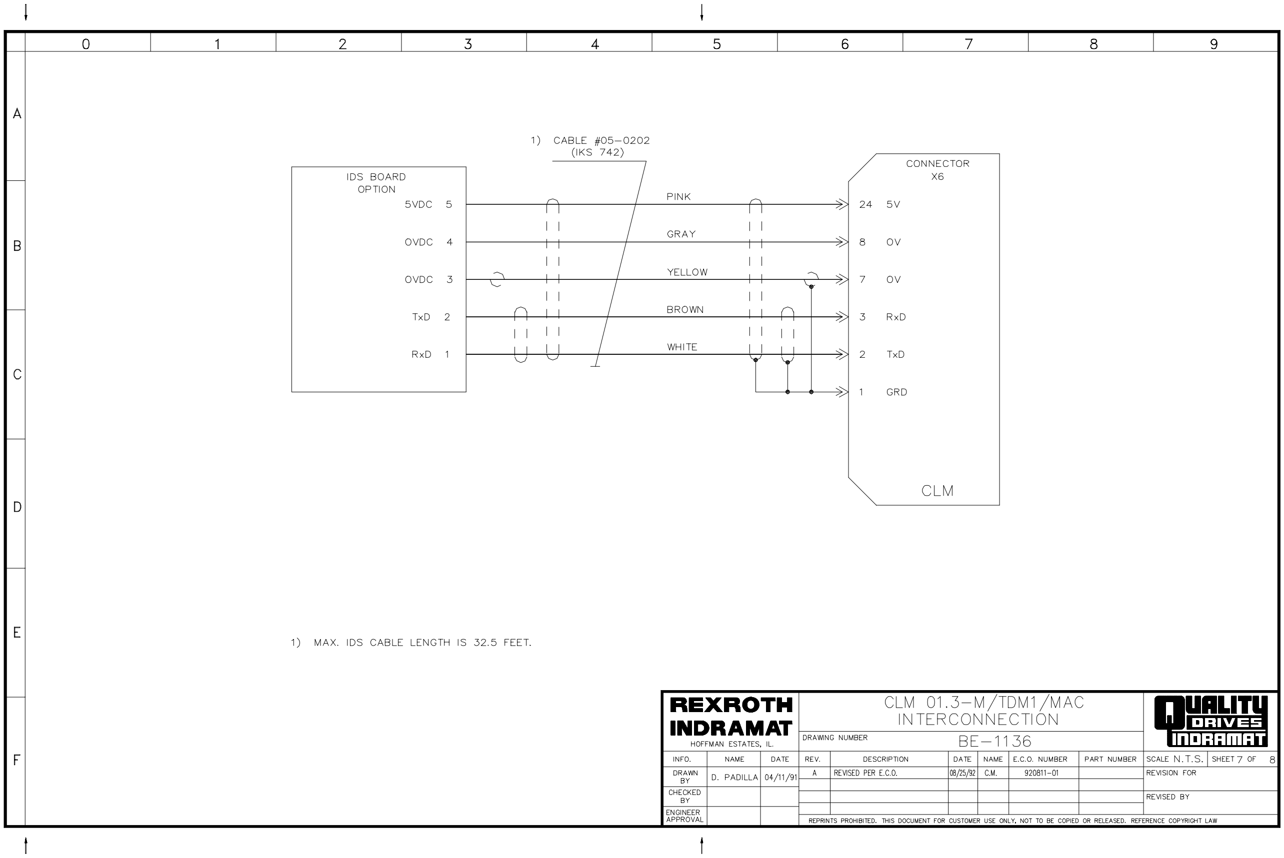
0
1
2
3
4
5
6
7
8
9
A
B
C
D
E
F
1) CABLE #05-0202
(IKS 742)
IDS BOARD
OPTION
5VDC 5
OVDC 4
OVDC 3
TxD 2
RxD 1
PINK
GRAY
YELLOW
BROWN
WHITE
CONNECTOR
X6
24 5V
8 OV
7 OV
3 RxD
2 TxD
1 GRD
CLM
1) MAX. IDS CABLE LENGTH IS 32.5 FEET.
REXROTH
INDRAMAT
HOFFMAN ESTATES, IL.
CLM 01.3-M/TDM1/MAC
INTERCONNECTION
DRAWING NUMBER
BE-1136
QUALITY DRIVES INDRAMAT
INFO.
NAME
DATE
DRAWN BY
D. PADILLA
04/11/91
CHECKED BY
ENGINEER APPROVAL
REV.
DESCRIPTION
DATE
NAME
E.C.O. NUMBER
PART NUMBER
A
REVISED PER E.C.O.
08/25/92
C.M.
920811-01
SCALE N.T.S.
SHEET 7 OF 8
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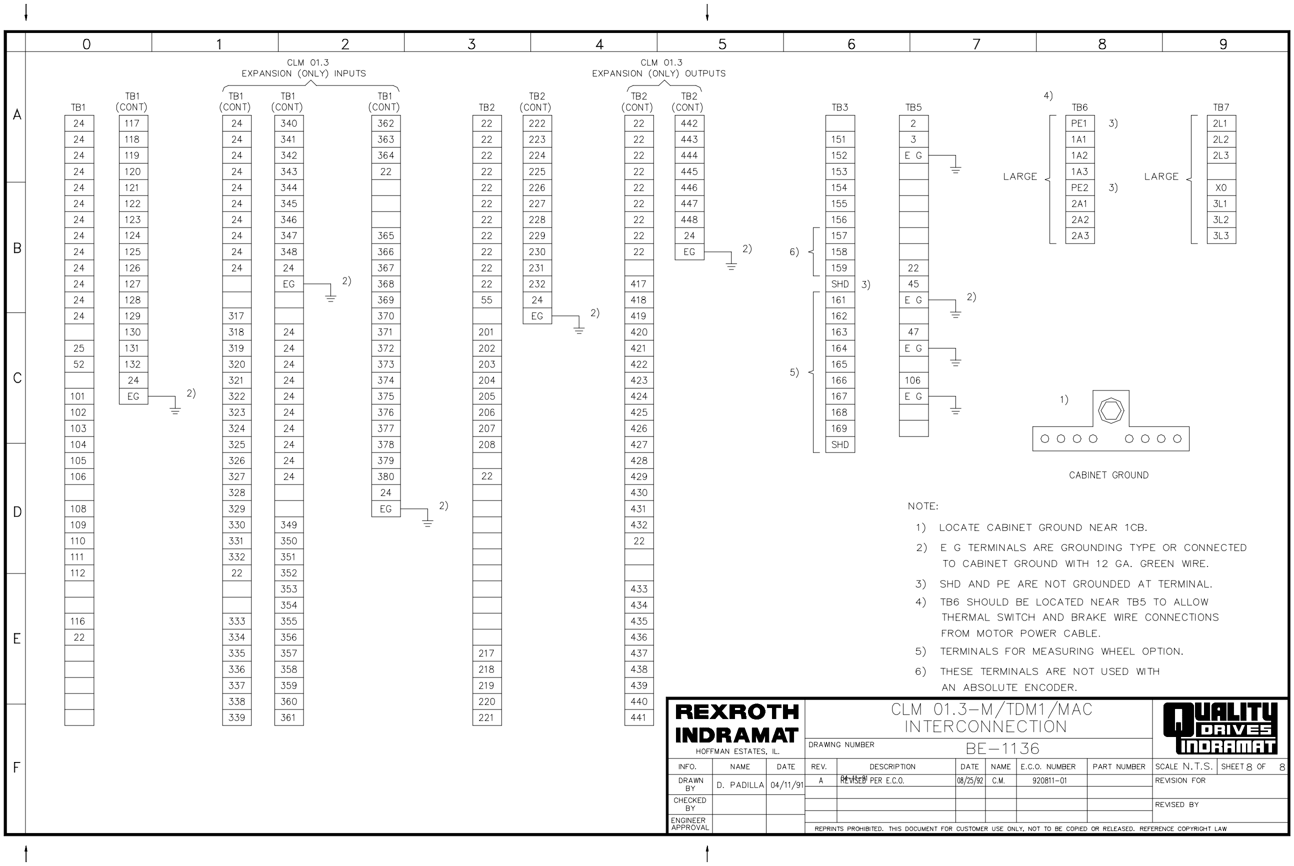
CLM 01.3
EXPANSION (ONLY) INPUTS
CLM 01.3
EXPANSION (ONLY) OUTPUTS
TB1
TB1 (CONT)
TB2
TB2 (CONT)
TB3
TB5
TB6
TB7
LARGE
CABINET GROUND
NOTE:
1) LOCATE CABINET GROUND NEAR 1CB.
2) E G TERMINALS ARE GROUNDING TYPE OR CONNECTED TO CABINET GROUND WITH 12 GA. GREEN WIRE.
3) SHD AND PE ARE NOT GROUNDED AT TERMINAL.
4) TB6 SHOULD BE LOCATED NEAR TB5 TO ALLOW THERMAL SWITCH AND BRAKE WIRE CONNECTIONS FROM MOTOR POWER CABLE.
5) TERMINALS FOR MEASURING WHEEL OPTION.
6) THESE TERMINALS ARE NOT USED WITH AN ABSOLUTE ENCODER.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
CLM 01.3-M/TDM1/MAC
INTERCONNECTION
DRAWING NUMBER
BE-1136
QUALITY DRIVES INDRAMAT
INFO. NAME DATE
DRAWN BY D. PADILLA 04/11/91
CHECKED BY
ENGINEER APPROVAL
REV. DESCRIPTION DATE NAME E.C.O. NUMBER PART NUMBER
A REVISED PER E.C.O. 08/25/92 C.M. 920811-01
SCALE N.T.S. SHEET 8 OF 8
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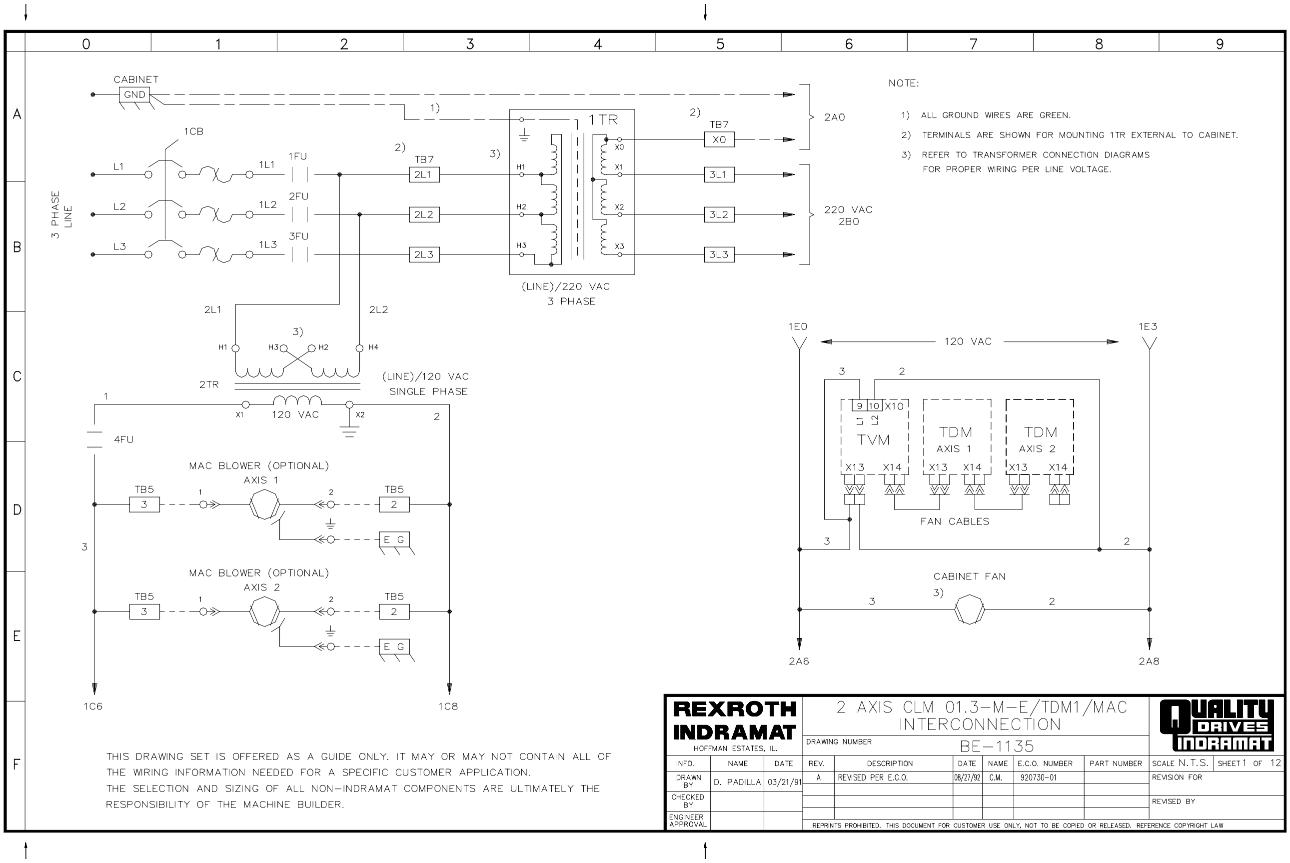
APPENDIX B: BE 1135
TWO-AXIS INTERCONNECT DRAWINGS


CABINET
GND
1CB
L1
L2
L3
3 PHASE LINE
1L1
1L2
1L3
1FU
2FU
3FU
TB7
2L1
2L2
2L3
1TR
H1
H2
H3
X0
X1
X2
X3
3L1
3L2
3L3
2A0
220 VAC
2B0
(LINE)/220 VAC
3 PHASE
NOTE:
1) ALL GROUND WIRES ARE GREEN.
2) TERMINALS ARE SHOWN FOR MOUNTING 1TR EXTERNAL TO CABINET.
3) REFER TO TRANSFORMER CONNECTION DIAGRAMS FOR PROPER WIRING PER LINE VOLTAGE.
2TR
(LINE)/120 VAC
SINGLE PHASE
120 VAC
4FU
MAC BLOWER (OPTIONAL)
AXIS 1
MAC BLOWER (OPTIONAL)
AXIS 2
TB5
E G
1C6
1C8
1E0
1E3
120 VAC
TVM
TDM
AXIS 1
TDM
AXIS 2
X10
X13
X14
FAN CABLES
CABINET FAN
2A6
2A8
THIS DRAWING SET IS OFFERED AS A GUIDE ONLY. IT MAY OR MAY NOT CONTAIN ALL OF THE WIRING INFORMATION NEEDED FOR A SPECIFIC CUSTOMER APPLICATION.
THE SELECTION AND SIZING OF ALL NON-INDRAMAT COMPONENTS ARE ULTIMATELY THE RESPONSIBILITY OF THE MACHINE BUILDER.
REXROTH
INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC
INTERCONNECTION
DRAWING NUMBER
BE-1135
QUALITY DRIVES INDRAMAT
INFO. NAME DATE
DRAWN BY D. PADILLA 03/21/91
CHECKED BY
ENGINEER APPROVAL
REV. DESCRIPTION DATE NAME E.C.O. NUMBER PART NUMBER
A REVISED PER E.C.O. 08/27/92 C.M. 920730-01
SCALE N.T.S. SHEET 1 OF 12
REVISION FOR
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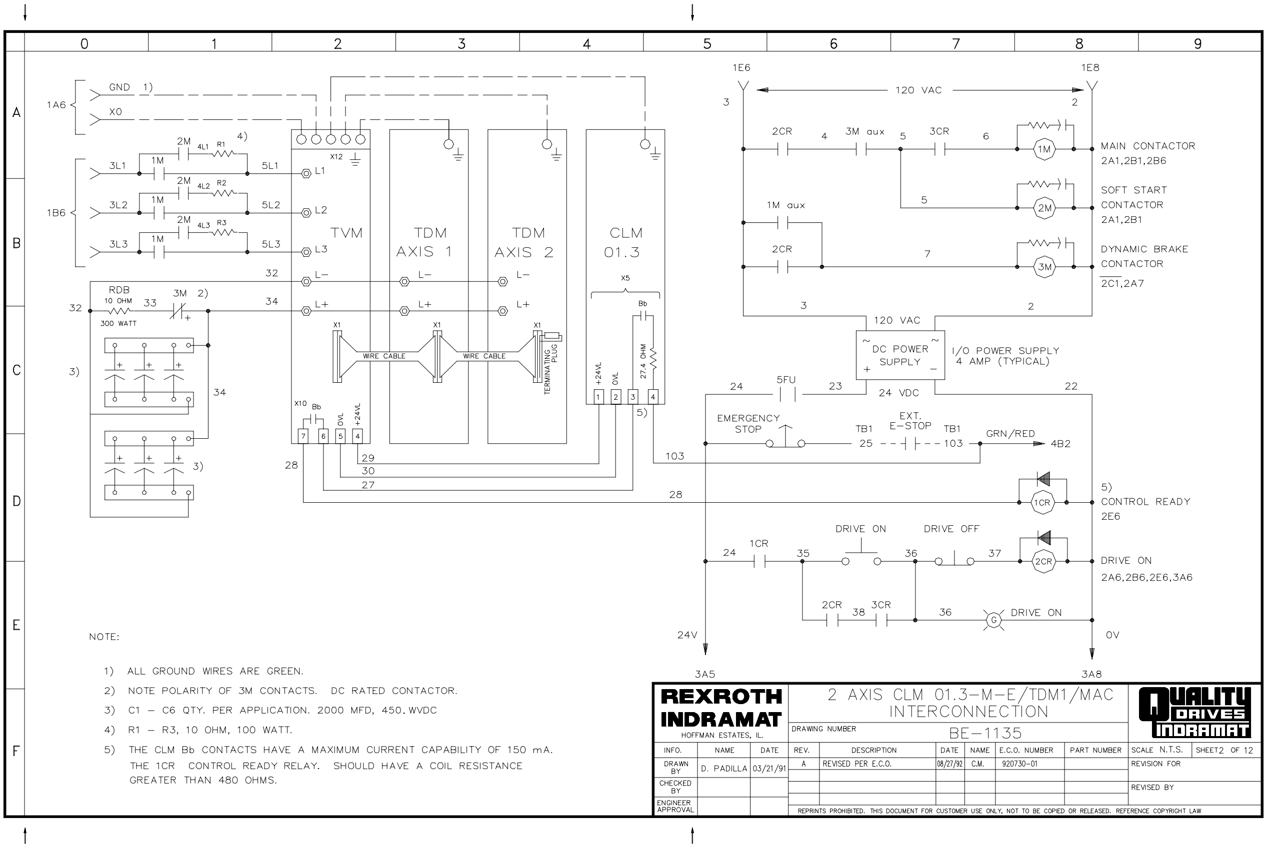
GND 1)
X0
1A6
1B6
3L1
3L2
3L3
5L1
5L2
5L3
2M
1M
R1
R2
R3
4L1
4L2
4L3
4)
RDB
10 OHM
300 WATT
33
3M 2)
32
34
3)
X12
L1
L2
L3
L–
L+
TVM
TDM
AXIS 1
TDM
AXIS 2
CLM
01.3
X5
Bb
X1
WIRE CABLE
TERMINATING PLUG
+24VL
0VL
27.4 OHM
5)
X10
28
29
30
27
103
1E6
1E8
120 VAC
2CR
3M aux
3CR
1M aux
MAIN CONTACTOR
2A1,2B1,2B6
SOFT START
CONTACTOR
2A1,2B1
DYNAMIC BRAKE
CONTACTOR
2C1,2A7
DC POWER
SUPPLY
I/O POWER SUPPLY
4 AMP (TYPICAL)
24 VDC
5FU
EMERGENCY
STOP
TB1
EXT.
E-STOP
GRN/RED
4B2
CONTROL READY
2E6
DRIVE ON
DRIVE OFF
1CR
2A6,2B6,2E6,3A6
DRIVE ON
24V
0V
3A5
3A8
NOTE:
1) ALL GROUND WIRES ARE GREEN.
2) NOTE POLARITY OF 3M CONTACTS. DC RATED CONTACTOR.
3) C1 – C6 QTY. PER APPLICATION. 2000 MFD, 450. WVDC
4) R1 – R3, 10 OHM, 100 WATT.
5) THE CLM Bb CONTACTS HAVE A MAXIMUM CURRENT CAPABILITY OF 150 mA.
THE 1CR CONTROL READY RELAY. SHOULD HAVE A COIL RESISTANCE
GREATER THAN 480 OHMS.
REXROTH
INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3–M–E/TDM1/MAC
INTERCONNECTION
DRAWING NUMBER
BE–1135
INFO. NAME DATE
DRAWN BY D. PADILLA 03/21/91
CHECKED BY
ENGINEER APPROVAL
REV. DESCRIPTION DATE NAME E.C.O. NUMBER PART NUMBER
A REVISED PER E.C.O. 08/27/92 C.M. 920730–01
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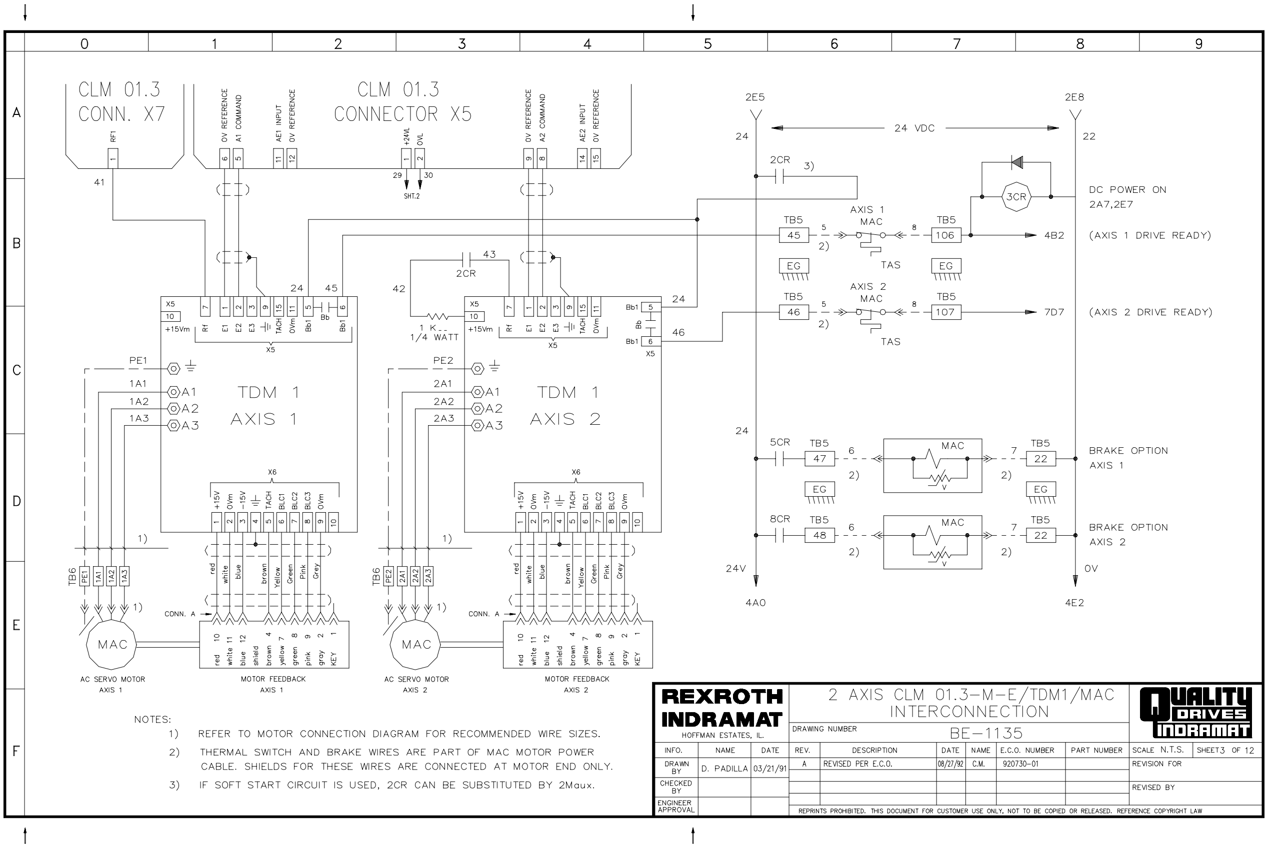
CLM 01.3
CONN. X7
CLM 01.3
CONNECTOR X5
0V REFERENCE
A1 COMMAND
AE1 INPUT
0V REFERENCE
+24VL
OVL
A2 COMMAND
AE2 INPUT
SHT.2
24 VDC
2E5
2E8
2CR
3CR
DC POWER ON
2A7,2E7
AXIS 1
MAC
TAS
(AXIS 1 DRIVE READY)
AXIS 2
(AXIS 2 DRIVE READY)
TB5
EG
1 K
1/4 WATT
TDM 1
AXIS 1
TDM 1
AXIS 2
5CR
8CR
BRAKE OPTION
AXIS 1
BRAKE OPTION
AXIS 2
24V
0V
4A0
4E2
TB6
CONN. A
MAC
AC SERVO MOTOR
AXIS 1
MOTOR FEEDBACK
AXIS 1
AC SERVO MOTOR
AXIS 2
MOTOR FEEDBACK
AXIS 2
NOTES:
1) REFER TO MOTOR CONNECTION DIAGRAM FOR RECOMMENDED WIRE SIZES.
2) THERMAL SWITCH AND BRAKE WIRES ARE PART OF MAC MOTOR POWER CABLE. SHIELDS FOR THESE WIRES ARE CONNECTED AT MOTOR END ONLY.
3) IF SOFT START CIRCUIT IS USED, 2CR CAN BE SUBSTITUTED BY 2Maux.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC
INTERCONNECTION
DRAWING NUMBER
BE-1135
QUALITY DRIVES INDRAMAT
DRAWN BY D. PADILLA 03/21/91
A REVISED PER E.C.O. 08/27/92 C.M. 920730-01
SCALE N.T.S.
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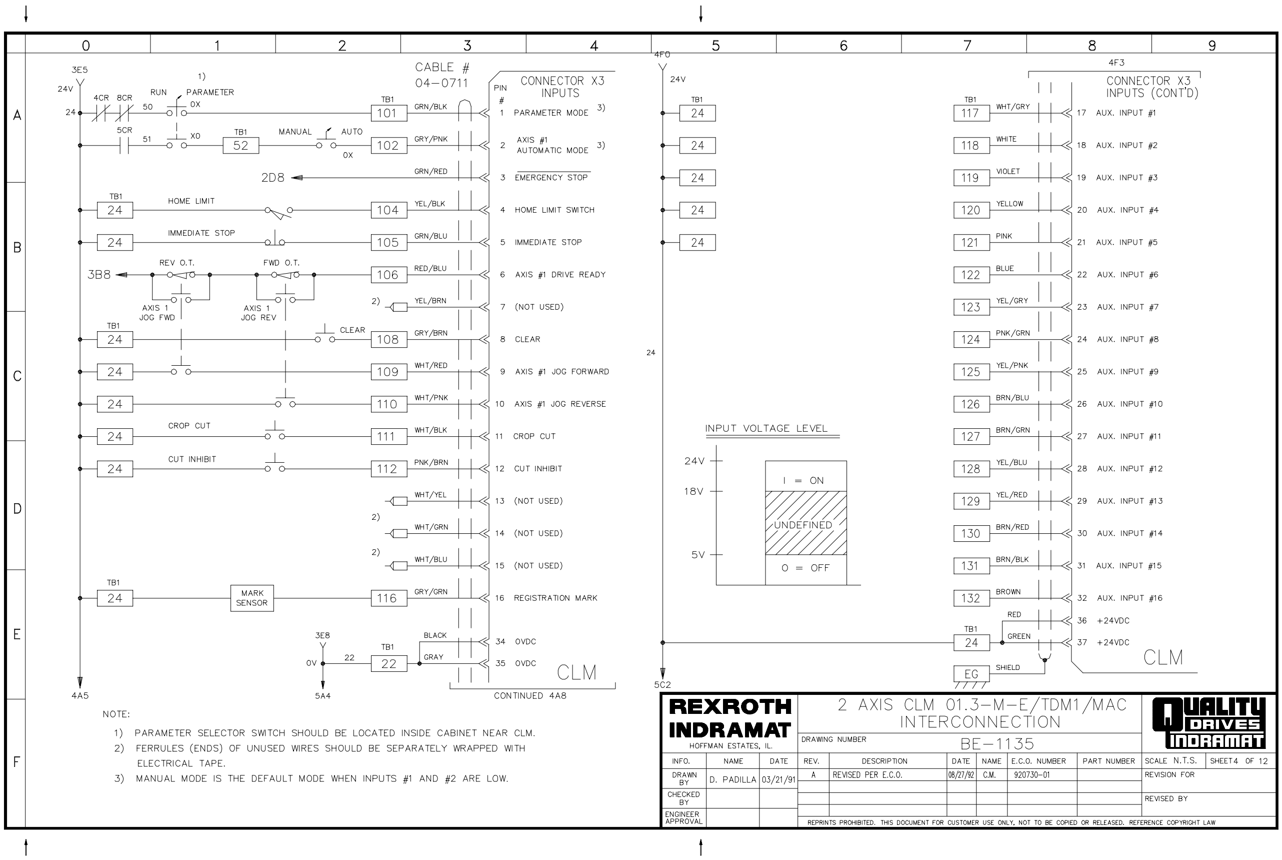
CABLE # 04-0711
CONNECTOR X3 INPUTS
PIN #
1 PARAMETER MODE 3)
2 AXIS #1 AUTOMATIC MODE 3)
3 EMERGENCY STOP
4 HOME LIMIT SWITCH
5 IMMEDIATE STOP
6 AXIS #1 DRIVE READY
7 (NOT USED)
8 CLEAR
9 AXIS #1 JOG FORWARD
10 AXIS #1 JOG REVERSE
11 CROP CUT
12 CUT INHIBIT
13 (NOT USED)
14 (NOT USED)
15 (NOT USED)
16 REGISTRATION MARK
34 OVDC
35 OVDC
CLM
CONTINUED 4A8
CONNECTOR X3 INPUTS (CONT'D)
17 AUX. INPUT #1
18 AUX. INPUT #2
19 AUX. INPUT #3
20 AUX. INPUT #4
21 AUX. INPUT #5
22 AUX. INPUT #6
23 AUX. INPUT #7
24 AUX. INPUT #8
25 AUX. INPUT #9
26 AUX. INPUT #10
27 AUX. INPUT #11
28 AUX. INPUT #12
29 AUX. INPUT #13
30 AUX. INPUT #14
31 AUX. INPUT #15
32 AUX. INPUT #16
36 +24VDC
37 +24VDC
INPUT VOLTAGE LEVEL
24V
18V
5V
1 = ON
UNDEFINED
0 = OFF
HOME LIMIT
IMMEDIATE STOP
REV O.T.
FWD O.T.
AXIS 1 JOG FWD
AXIS 1 JOG REV
CLEAR
CROP CUT
CUT INHIBIT
MARK SENSOR
RUN
PARAMETER
MANUAL
AUTO
NOTE:
1) PARAMETER SELECTOR SWITCH SHOULD BE LOCATED INSIDE CABINET NEAR CLM.
2) FERRULES (ENDS) OF UNUSED WIRES SHOULD BE SEPARATELY WRAPPED WITH ELECTRICAL TAPE.
3) MANUAL MODE IS THE DEFAULT MODE WHEN INPUTS #1 AND #2 ARE LOW.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC INTERCONNECTION
DRAWING NUMBER
BE-1135
DRAWN BY D. PADILLA 03/21/91
A REVISED PER E.C.O. 08/27/92 C.M. 920730-01
SCALE N.T.S. SHEET4 OF 12
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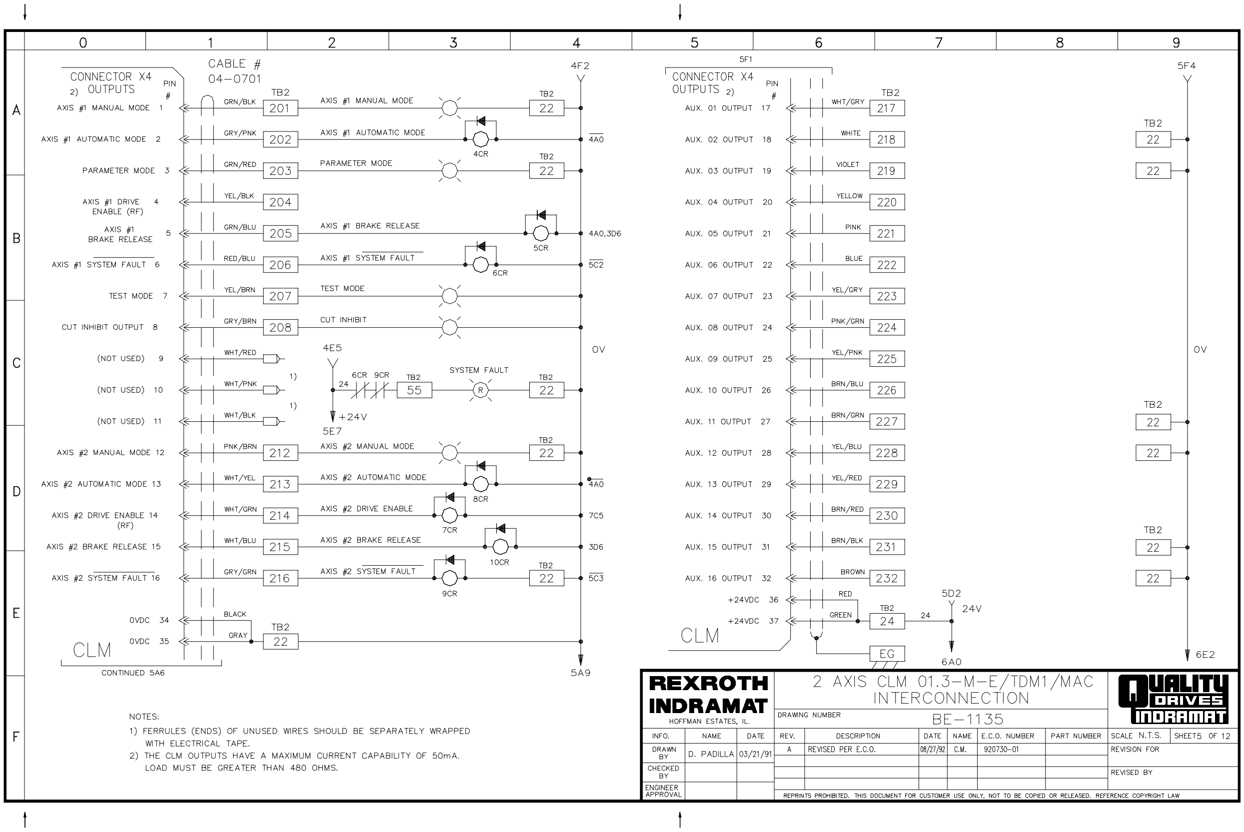
CONNECTOR X4
2) OUTPUTS
PIN #
CABLE # 04-0701
TB2
AXIS #1 MANUAL MODE 1
AXIS #1 AUTOMATIC MODE 2
PARAMETER MODE 3
AXIS #1 DRIVE ENABLE (RF) 4
AXIS #1 BRAKE RELEASE 5
AXIS #1 SYSTEM FAULT 6
TEST MODE 7
CUT INHIBIT OUTPUT 8
(NOT USED) 9
(NOT USED) 10
(NOT USED) 11
AXIS #2 MANUAL MODE 12
AXIS #2 AUTOMATIC MODE 13
AXIS #2 DRIVE ENABLE 14 (RF)
AXIS #2 BRAKE RELEASE 15
AXIS #2 SYSTEM FAULT 16
0VDC 34
0VDC 35
CLM
CONTINUED 5A6
CONNECTOR X4
OUTPUTS 2)
AUX. 01 OUTPUT 17
AUX. 02 OUTPUT 18
AUX. 03 OUTPUT 19
AUX. 04 OUTPUT 20
AUX. 05 OUTPUT 21
AUX. 06 OUTPUT 22
AUX. 07 OUTPUT 23
AUX. 08 OUTPUT 24
AUX. 09 OUTPUT 25
AUX. 10 OUTPUT 26
AUX. 11 OUTPUT 27
AUX. 12 OUTPUT 28
AUX. 13 OUTPUT 29
AUX. 14 OUTPUT 30
AUX. 15 OUTPUT 31
AUX. 16 OUTPUT 32
+24VDC 36
+24VDC 37
CLM
NOTES:
1) FERRULES (ENDS) OF UNUSED WIRES SHOULD BE SEPARATELY WRAPPED WITH ELECTRICAL TAPE.
2) THE CLM OUTPUTS HAVE A MAXIMUM CURRENT CAPABILITY OF 50mA. LOAD MUST BE GREATER THAN 480 OHMS.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC INTERCONNECTION
DRAWING NUMBER BE-1135
DRAWN BY D. PADILLA 03/21/91
A REVISED PER E.C.O. 08/27/92 C.M. 920730-01
SCALE N.T.S. SHEET5 OF 12
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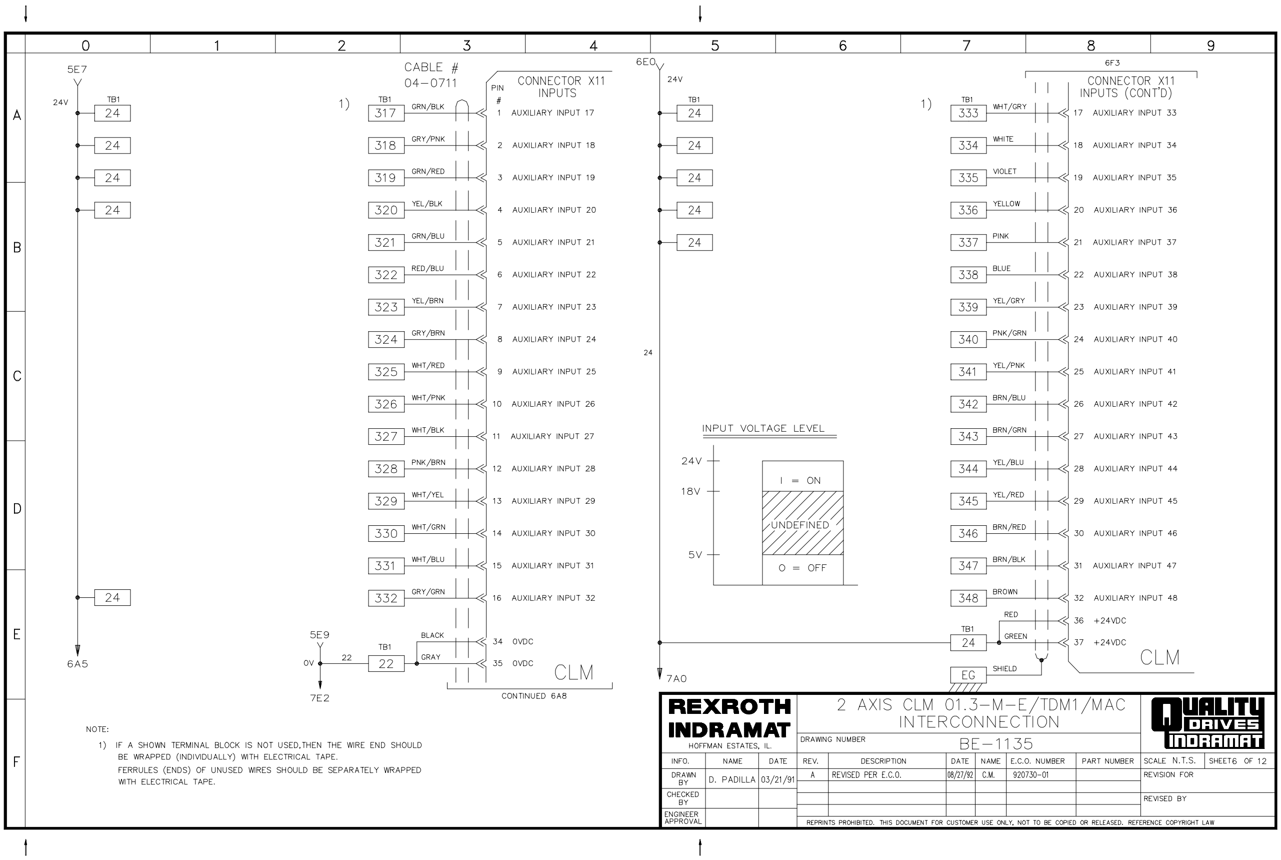
CABLE # 04-0711
CONNECTOR X11 INPUTS
CONNECTOR X11 INPUTS (CONT'D)
INPUT VOLTAGE LEVEL
I = ON
UNDEFINED
O = OFF
CLM
CONTINUED 6A8
NOTE:
1) IF A SHOWN TERMINAL BLOCK IS NOT USED,THEN THE WIRE END SHOULD BE WRAPPED (INDIVIDUALLY) WITH ELECTRICAL TAPE.
FERRULES (ENDS) OF UNUSED WIRES SHOULD BE SEPARATELY WRAPPED WITH ELECTRICAL TAPE.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC INTERCONNECTION
DRAWING NUMBER
BE-1135
DRAWN BY D. PADILLA 03/21/91
A REVISED PER E.C.O. 08/27/92 C.M. 920730-01
SCALE N.T.S.
SHEET 6 OF 12
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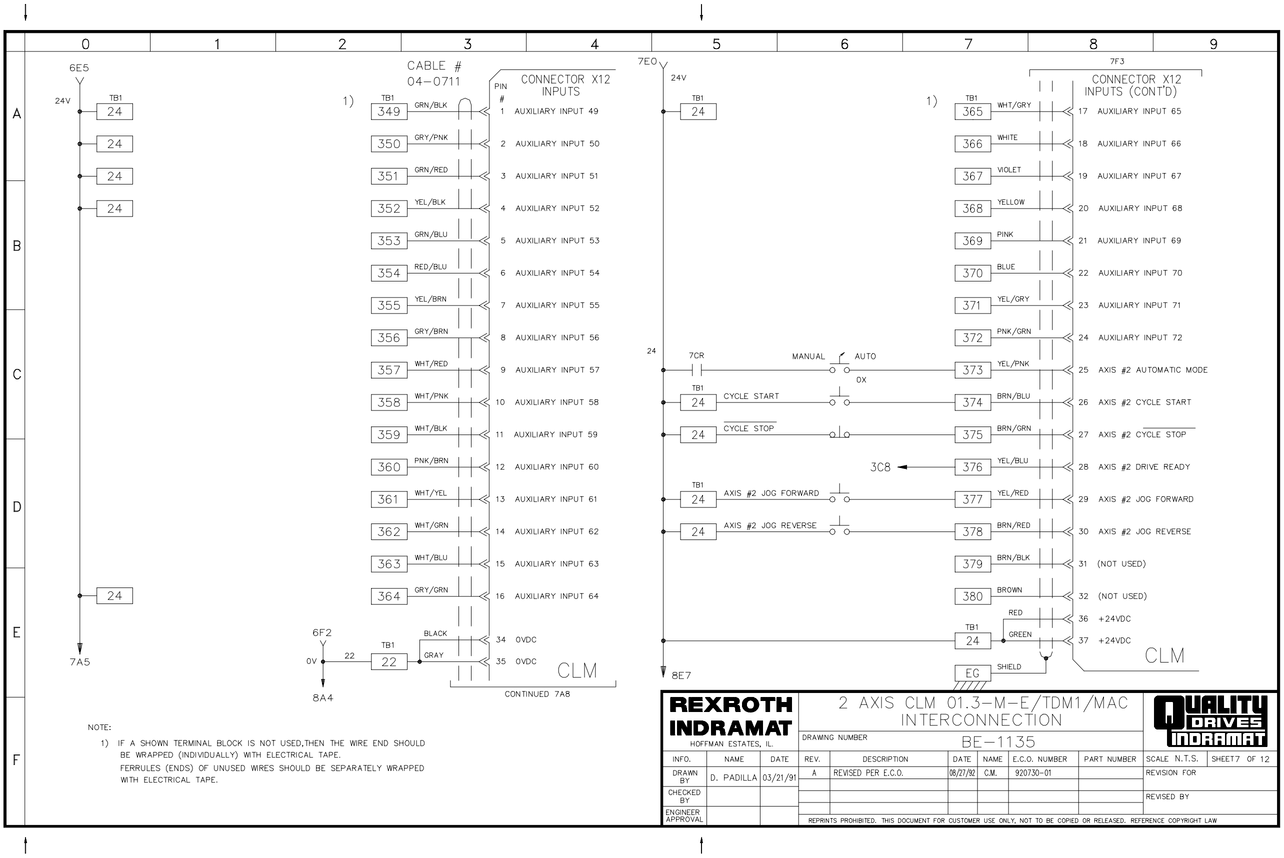
CABLE # 04-0711
CONNECTOR X12 INPUTS
CONNECTOR X12 INPUTS (CONT'D)
1 AUXILIARY INPUT 49
2 AUXILIARY INPUT 50
3 AUXILIARY INPUT 51
4 AUXILIARY INPUT 52
5 AUXILIARY INPUT 53
6 AUXILIARY INPUT 54
7 AUXILIARY INPUT 55
8 AUXILIARY INPUT 56
9 AUXILIARY INPUT 57
10 AUXILIARY INPUT 58
11 AUXILIARY INPUT 59
12 AUXILIARY INPUT 60
13 AUXILIARY INPUT 61
14 AUXILIARY INPUT 62
15 AUXILIARY INPUT 63
16 AUXILIARY INPUT 64
34 0VDC
35 0VDC
17 AUXILIARY INPUT 65
18 AUXILIARY INPUT 66
19 AUXILIARY INPUT 67
20 AUXILIARY INPUT 68
21 AUXILIARY INPUT 69
22 AUXILIARY INPUT 70
23 AUXILIARY INPUT 71
24 AUXILIARY INPUT 72
25 AXIS #2 AUTOMATIC MODE
26 AXIS #2 CYCLE START
27 AXIS #2 CYCLE STOP
28 AXIS #2 DRIVE READY
29 AXIS #2 JOG FORWARD
30 AXIS #2 JOG REVERSE
31 (NOT USED)
32 (NOT USED)
36 +24VDC
37 +24VDC
CLM
CONTINUED 7A8
MANUAL AUTO
CYCLE START
CYCLE STOP
AXIS #2 JOG FORWARD
AXIS #2 JOG REVERSE
NOTE:
1) IF A SHOWN TERMINAL BLOCK IS NOT USED, THEN THE WIRE END SHOULD BE WRAPPED (INDIVIDUALLY) WITH ELECTRICAL TAPE. FERRULES (ENDS) OF UNUSED WIRES SHOULD BE SEPARATELY WRAPPED WITH ELECTRICAL TAPE.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC INTERCONNECTION
DRAWING NUMBER BE-1135
DRAWN BY D. PADILLA 03/21/91
A REVISED PER E.C.O. 08/27/92 C.M. 920730-01
SCALE N.T.S. SHEET7 OF 12
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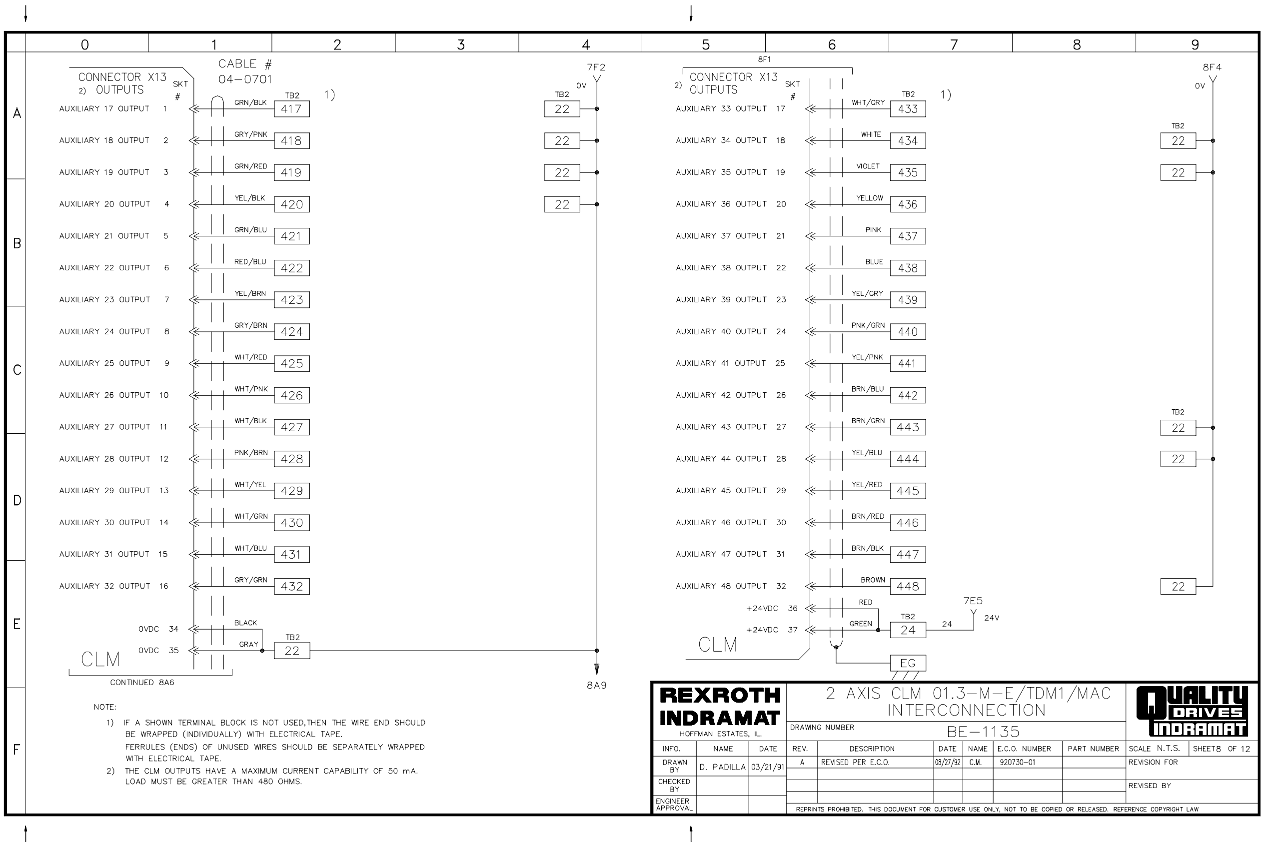
CONNECTOR X13
2) OUTPUTS
SKT #
CABLE #
04-0701
TB2
1)
AUXILIARY 17 OUTPUT 1 GRN/BLK 417
AUXILIARY 18 OUTPUT 2 GRY/PNK 418
AUXILIARY 19 OUTPUT 3 GRN/RED 419
AUXILIARY 20 OUTPUT 4 YEL/BLK 420
AUXILIARY 21 OUTPUT 5 GRN/BLU 421
AUXILIARY 22 OUTPUT 6 RED/BLU 422
AUXILIARY 23 OUTPUT 7 YEL/BRN 423
AUXILIARY 24 OUTPUT 8 GRY/BRN 424
AUXILIARY 25 OUTPUT 9 WHT/RED 425
AUXILIARY 26 OUTPUT 10 WHT/PNK 426
AUXILIARY 27 OUTPUT 11 WHT/BLK 427
AUXILIARY 28 OUTPUT 12 PNK/BRN 428
AUXILIARY 29 OUTPUT 13 WHT/YEL 429
AUXILIARY 30 OUTPUT 14 WHT/GRN 430
AUXILIARY 31 OUTPUT 15 WHT/BLU 431
AUXILIARY 32 OUTPUT 16 GRY/GRN 432
0VDC 34 BLACK
0VDC 35 GRAY 22
CLM
CONTINUED 8A6
7F2
0V
22
8A9
8F1
AUXILIARY 33 OUTPUT 17 WHT/GRY 433
AUXILIARY 34 OUTPUT 18 WHITE 434
AUXILIARY 35 OUTPUT 19 VIOLET 435
AUXILIARY 36 OUTPUT 20 YELLOW 436
AUXILIARY 37 OUTPUT 21 PINK 437
AUXILIARY 38 OUTPUT 22 BLUE 438
AUXILIARY 39 OUTPUT 23 YEL/GRY 439
AUXILIARY 40 OUTPUT 24 PNK/GRN 440
AUXILIARY 41 OUTPUT 25 YEL/PNK 441
AUXILIARY 42 OUTPUT 26 BRN/BLU 442
AUXILIARY 43 OUTPUT 27 BRN/GRN 443
AUXILIARY 44 OUTPUT 28 YEL/BLU 444
AUXILIARY 45 OUTPUT 29 YEL/RED 445
AUXILIARY 46 OUTPUT 30 BRN/RED 446
AUXILIARY 47 OUTPUT 31 BRN/BLK 447
AUXILIARY 48 OUTPUT 32 BROWN 448
+24VDC 36 RED
+24VDC 37 GREEN 24
7E5
24V
EG
8F4
NOTE:
1) IF A SHOWN TERMINAL BLOCK IS NOT USED,THEN THE WIRE END SHOULD BE WRAPPED (INDIVIDUALLY) WITH ELECTRICAL TAPE.
FERRULES (ENDS) OF UNUSED WIRES SHOULD BE SEPARATELY WRAPPED WITH ELECTRICAL TAPE.
2) THE CLM OUTPUTS HAVE A MAXIMUM CURRENT CAPABILITY OF 50 mA. LOAD MUST BE GREATER THAN 480 OHMS.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC
INTERCONNECTION
DRAWING NUMBER
BE-1135
QUALITY DRIVES INDRAMAT
INFO. NAME DATE
DRAWN BY D. PADILLA 03/21/91
CHECKED BY
ENGINEER APPROVAL
REV. DESCRIPTION DATE NAME E.C.O. NUMBER PART NUMBER
A REVISED PER E.C.O. 08/27/92 C.M. 920730-01
SCALE N.T.S.
SHEET 8 OF 12
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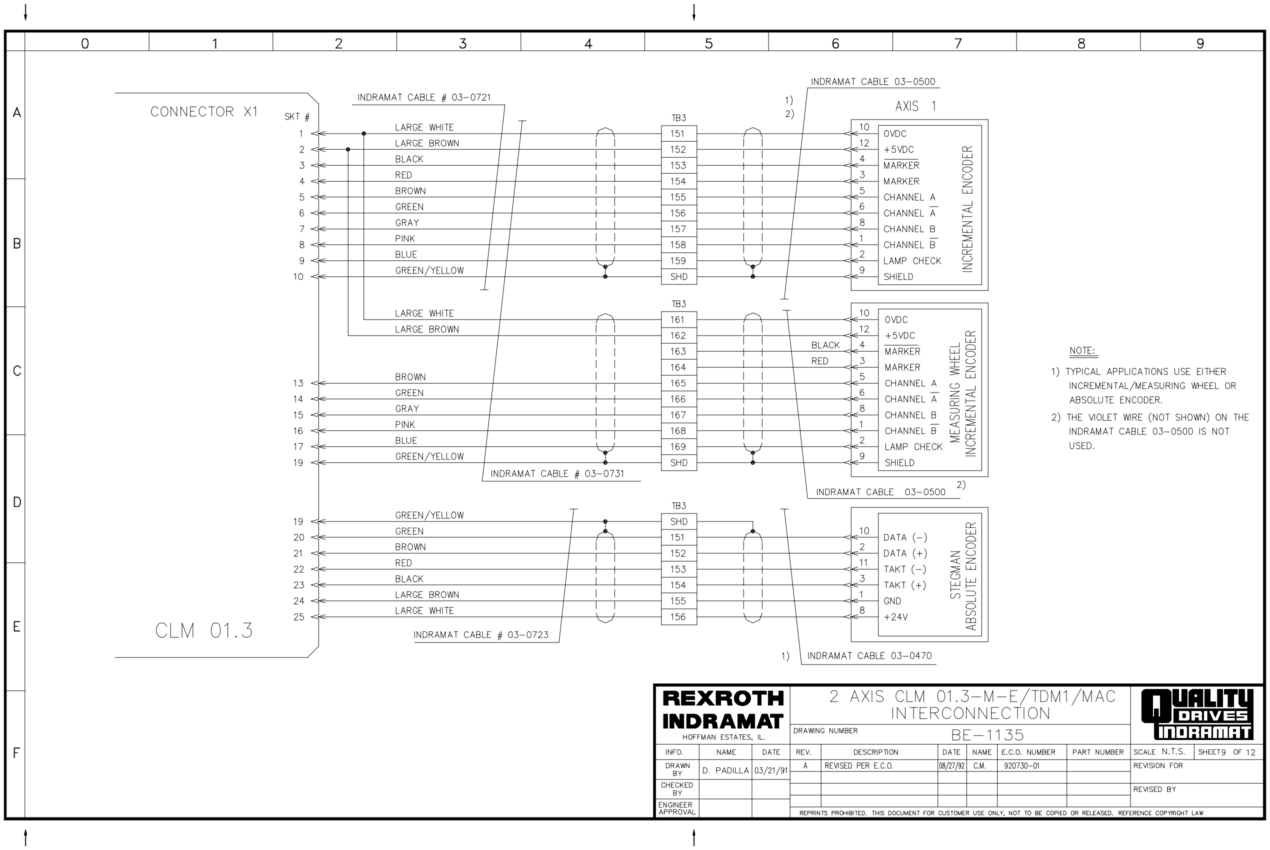
CONNECTOR X1
SKT #
INDRAMAT CABLE # 03-0721
INDRAMAT CABLE # 03-0731
INDRAMAT CABLE # 03-0723
INDRAMAT CABLE 03-0500
INDRAMAT CABLE 03-0470
LARGE WHITE
LARGE BROWN
BLACK
RED
BROWN
GREEN
GRAY
PINK
BLUE
GREEN/YELLOW
TB3
AXIS 1
0VDC
+5VDC
MARKER
CHANNEL A
CHANNEL B
LAMP CHECK
SHIELD
INCREMENTAL ENCODER
MEASURING WHEEL INCREMENTAL ENCODER
DATA (-)
DATA (+)
TAKT (-)
TAKT (+)
GND
+24V
STEGMAN ABSOLUTE ENCODER
CLM 01.3
NOTE:
1) TYPICAL APPLICATIONS USE EITHER INCREMENTAL/MEASURING WHEEL OR ABSOLUTE ENCODER.
2) THE VIOLET WIRE (NOT SHOWN) ON THE INDRAMAT CABLE 03-0500 IS NOT USED.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC INTERCONNECTION
DRAWING NUMBER
BE-1135
DRAWN BY D. PADILLA 03/21/91
A REVISED PER E.C.O. 08/27/92 C.M. 920730-01
SCALE N.T.S.
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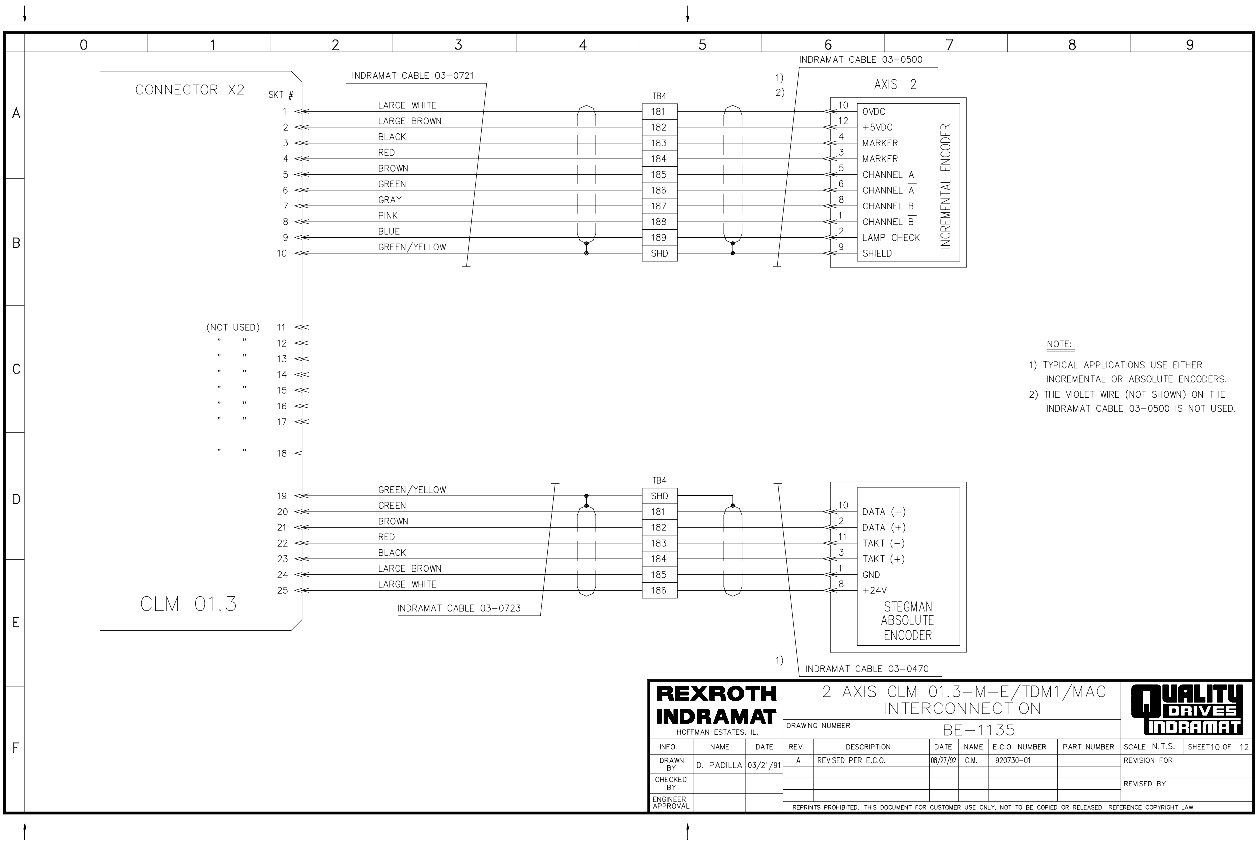
CONNECTOR X2
SKT #
INDRAMAT CABLE 03-0721
LARGE WHITE
LARGE BROWN
BLACK
RED
BROWN
GREEN
GRAY
PINK
BLUE
GREEN/YELLOW
TB4
181
182
183
184
185
186
187
188
189
SHD
INDRAMAT CABLE 03-0500
AXIS 2
0VDC
+5VDC
MARKER
MARKER
CHANNEL A
CHANNEL A
CHANNEL B
CHANNEL B
LAMP CHECK
SHIELD
INCREMENTAL ENCODER
(NOT USED)
NOTE:
1) TYPICAL APPLICATIONS USE EITHER INCREMENTAL OR ABSOLUTE ENCODERS.
2) THE VIOLET WIRE (NOT SHOWN) ON THE INDRAMAT CABLE 03-0500 IS NOT USED.
GREEN/YELLOW
GREEN
BROWN
RED
BLACK
LARGE BROWN
LARGE WHITE
INDRAMAT CABLE 03-0723
DATA (-)
DATA (+)
TAKT (-)
TAKT (+)
GND
+24V
STEGMAN ABSOLUTE ENCODER
INDRAMAT CABLE 03-0470
CLM 01.3
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC INTERCONNECTION
DRAWING NUMBER
BE-1135
QUALITY DRIVES INDRAMAT
INFO.
NAME
DATE
DRAWN BY
D. PADILLA
03/21/91
CHECKED BY
ENGINEER APPROVAL
REV.
DESCRIPTION
A
REVISED PER E.C.O.
08/27/92
C.M.
E.C.O. NUMBER
920730-01
PART NUMBER
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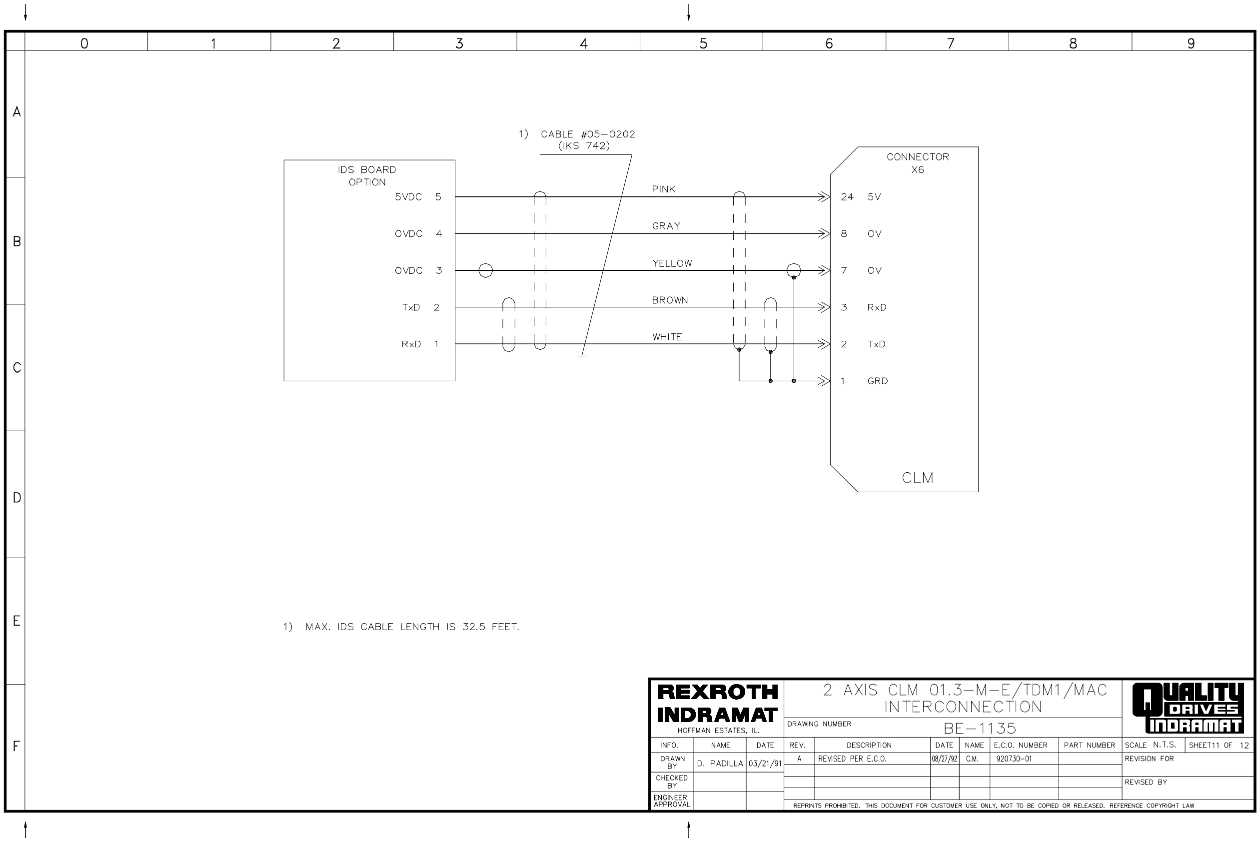
1) CABLE #05-0202
(IKS 742)
IDS BOARD
OPTION
5VDC 5
OVDC 4
OVDC 3
TxD 2
RxD 1
PINK
GRAY
YELLOW
BROWN
WHITE
CONNECTOR
X6
24 5V
8 OV
7 OV
3 RxD
2 TxD
1 GRD
CLM
1) MAX. IDS CABLE LENGTH IS 32.5 FEET.
REXROTH
INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC
INTERCONNECTION
DRAWING NUMBER
BE-1135
INFO.
NAME
DATE
DRAWN BY
D. PADILLA
03/21/91
CHECKED BY
ENGINEER APPROVAL
REV.
DESCRIPTION
DATE
NAME
E.C.O. NUMBER
PART NUMBER
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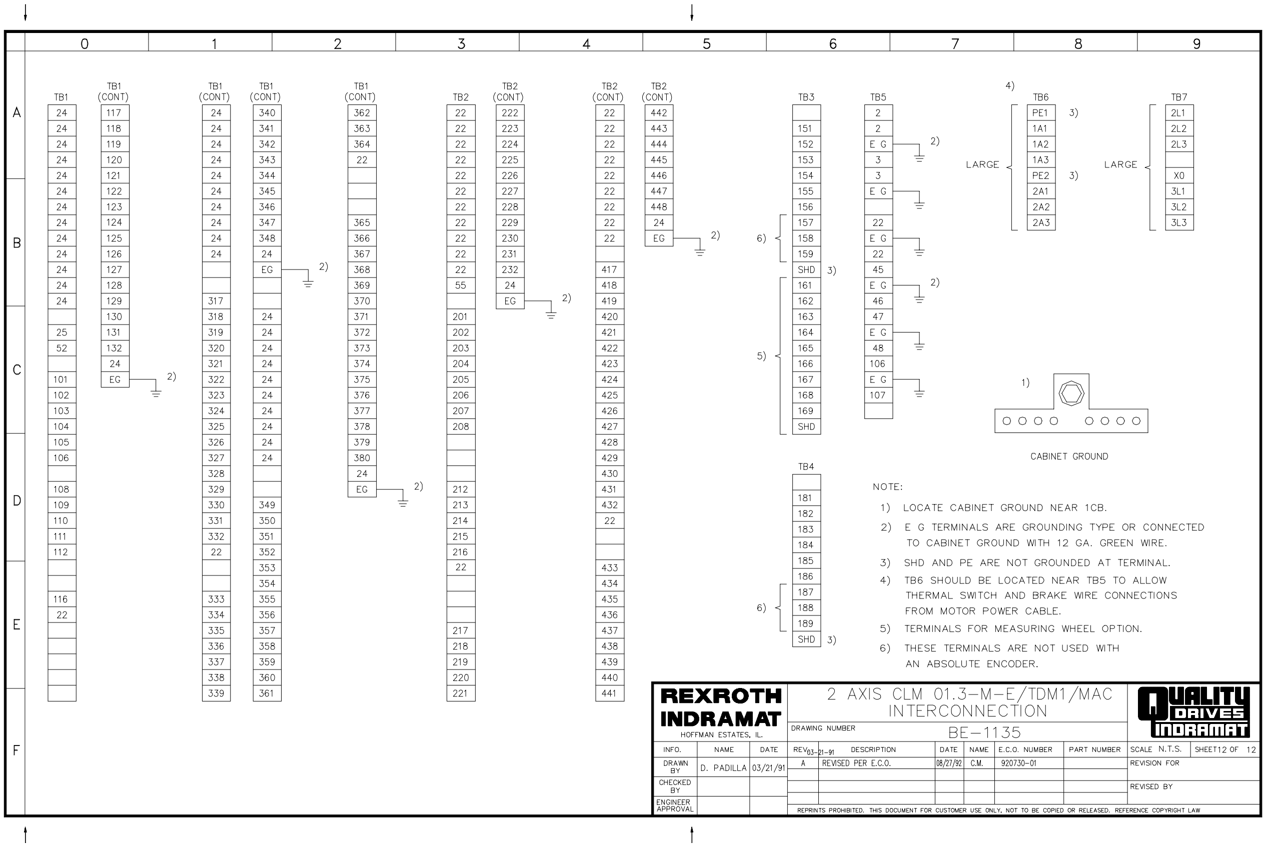
TB1
TB1 (CONT)
TB2
TB2 (CONT)
TB3
TB4
TB5
TB6
TB7
LARGE
CABINET GROUND
NOTE:
1) LOCATE CABINET GROUND NEAR 1CB.
2) E G TERMINALS ARE GROUNDING TYPE OR CONNECTED TO CABINET GROUND WITH 12 GA. GREEN WIRE.
3) SHD AND PE ARE NOT GROUNDED AT TERMINAL.
4) TB6 SHOULD BE LOCATED NEAR TB5 TO ALLOW THERMAL SWITCH AND BRAKE WIRE CONNECTIONS FROM MOTOR POWER CABLE.
5) TERMINALS FOR MEASURING WHEEL OPTION.
6) THESE TERMINALS ARE NOT USED WITH AN ABSOLUTE ENCODER.
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.
2 AXIS CLM 01.3-M-E/TDM1/MAC INTERCONNECTION
DRAWING NUMBER BE-1135
QUALITY DRIVES INDRAMAT
DRAWN BY D. PADILLA 03/21/91
A REVISED PER E.C.O. 08/27/92 C.M. 920730-01
SCALE N.T.S.
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APPENDIX C: CLM DISPLAY MAP

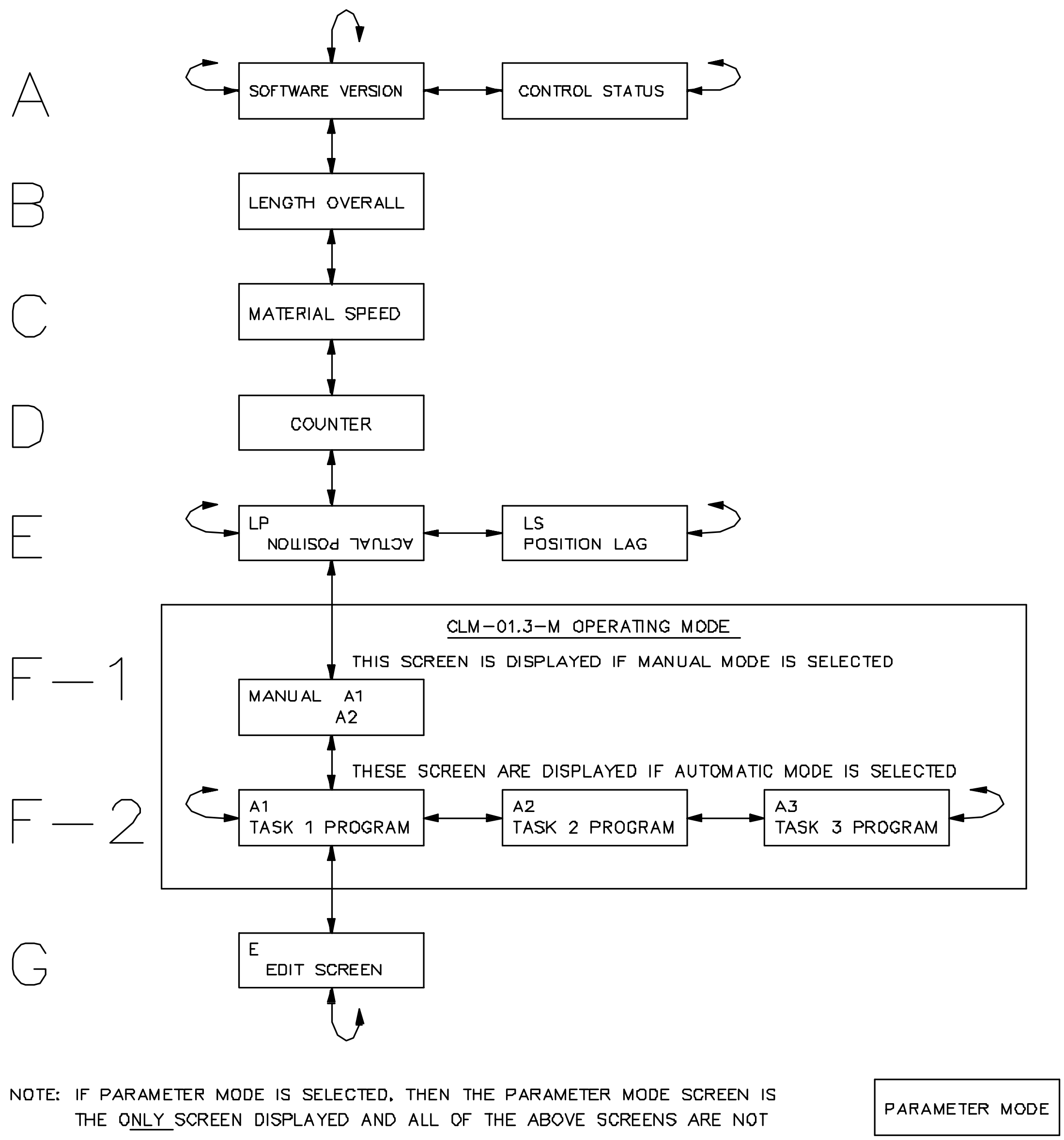


Figure 2.2 Map of CLM-LM Display Screens

APPENDIX D: PARAMETER INPUT SHEETS

CLM-01.3-M
LM-01.3-003.X
FLYING CUTOFF SOFTWARE (AXIS 1, TWO DECIMAL POINT)

Feed Constant A1	P00	_ _ _ _._ _ _
Encoder Data A1	P01	_ _ _ _ _ _ _ _ _
Velocity Axis 1	P02	_ _ _ _ _ _._ _ _
Drive Sensit. A1	P03	_ _ _ _ _ _.
Accel. Rate A1	P04	_ _ _ _ _._
Position Gain A1	P05	_._ _ _ _._ _
Direction Axis 1	P06	_ _
Position Tol. A1	P07	_ _ _ _ _ _._
Homing Setup A1	P08	_ _
Homing Offset A1	P09	_ _ _ _ _._
Homing Setup I/O A1	P10	_ _ _ _ _
Min Travel A1	P11	- _ _ _ _ _ _._
Max Travel A1	P12	+ _ _ _ _ _ _._
Pos Presignal A1	P13	_ _ _ _ _ _ _ _.
Monitoring A1	P14	_ _
Immediate Stop 1	P15	_ _ _ _ _ _ _ _._
Cut Width A1	P16	_ _._
Knee Point A1	P17	_ _._ _ _ _._
Material Speed	P18	_ _ _.
Test Mode A1	P19	
Manual Cut-Vector	P20	_ _
Length Corr. A1	P21	_ _
Spec. Func. 1 A1	P22	_ _ _ _ _ _ _
Cropcut A1	P23	_ _ _ _ _ _ _._
Reversing Hold	P24	_ _ _ _ _ _ _ _.
Restende A1	P25	_ _ _ _ _ _ _
Spec. Func. 2 A1	P26	_ _ _._ _ _ _
Free	P27	
Free	P28	
Free	P29	
Free	P30	
Free	P31	
Free	P32	
Free	P33	
Free	P34	
Free	P35	
Free	P36	
Free	P37	
Feed Constant MW	P38	_ _ _ _._ _ _
Enc Lines/Rev MW	P39	_ _ _ _

CLM-01.3-M
LM-01.3-003.X
FLYING CUTOFF SOFTWARE (AXIS 2, TWO DECIMAL POINT)

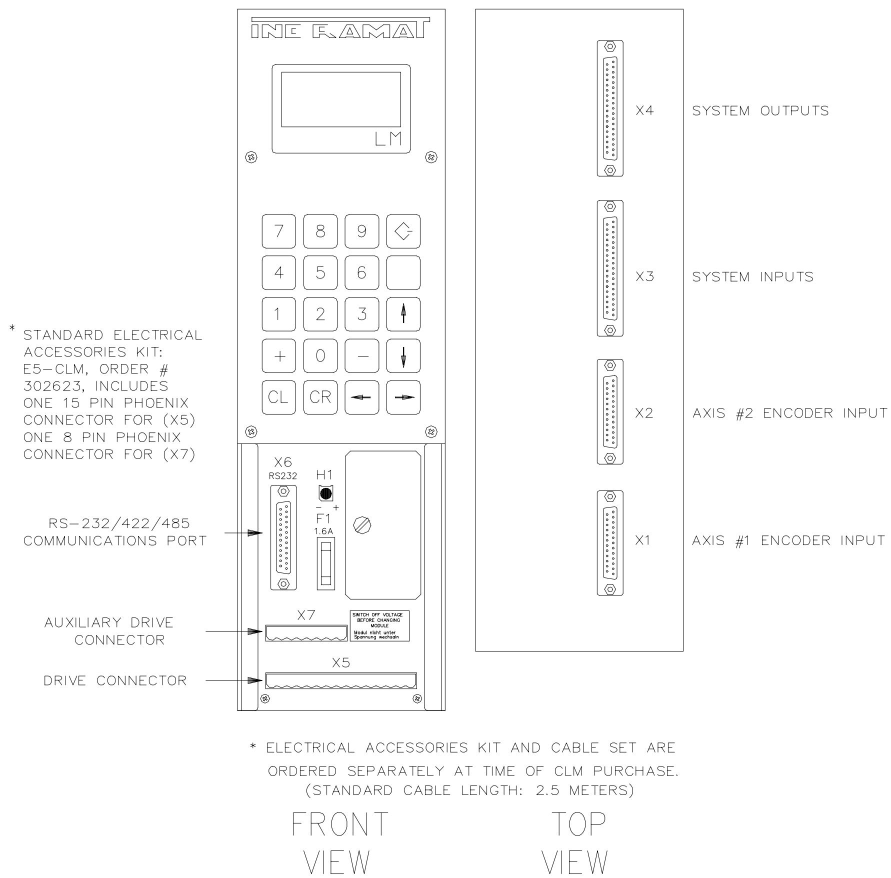
Feed Constant A2	P40	_ _ _ _ _._ _ _
Encoder Data A2	P41	_ _ _ _ _ _ _ _ _
Velocity Axis 2	P42	_ _ _ _ _ _._ _ _
Drive Sensit. A2	P43	_ _ _ _ _ _.
Accel Rate A2	P44	_ _ _ _ _._
Position Gain A2	P45	_ _._ _ _
Direction A2	P46	_
Position Tol. A2	P47	_ _ _ _ _ _._
Homing Setup A2	P48	_ _
Homing Offset A2	P49	_ _ _ _ _ _._
Homing Setup I/O A2	P50	_ _ _ _ _
Min Travel A2	P51	-_ _ _ _ _ _._
Max Travel A2	P52	+ _ _ _ _ _ _._
Pos Presignal A2	P53	_ _ _ _ _ _ _ _.
Monitoring A2	P54	_ _ _ _ _
Special Func. A2	P55	_ _ _ _
Rotary Table A2	P56	_ _ _ _ _ _ _ _
Knee Point A2	P57	_ _ _ _ _ _ _ _._ _
Synchro. Diff. A2	P58	_ _ _._ _
Free	P59	
Free	P60	
Free	P61	
Free	P62	
Free	P63	
Free	P64	
Free	P65	
Free	P66	
Free	P67	
Free	P68	
Free	P69	
Free	P70	
Free	P71	
Free	P72	
Free	P73	
Free	P74	
Free	P75	
Free	P76	
Free	P77	
Free	P78	
Free	P79	

CLM-01.3-M
LM-01.3-003.X
FLYING CUTOFF SOFTWARE - MISCELLANEOUS

Serial Interface	P80	_ _ _ _ _ _ _
Serial Interface	P81	_ _ _ _
Language	P82	2 _ _
Memory Display	P83	_ F F _ _ _
Start Task 2 & 3	P84	_ _ _ _ _ _ _
Interrupt Vector	P85	_ _ _ _ _ _
Manual Vector	P86	_ _ _ _ _
Variations	P87	
Free	P88	
Free	P89	
Free	P90	
Free	P91	
Free	P92	
Free	P93	
Free	P94	
Free	P95	
Free	P96	
Free	P97	
Free	P98	
Free	P99	

APPENDIX E: INSTALLATION DRAWINGS

Caution: *Drawings in this Appendix are included for illustrative purposes only and are subject to change without notice. Check with Indramat to be sure you are working with the latest drawings prior to installing, wiring, and powering equipment.*



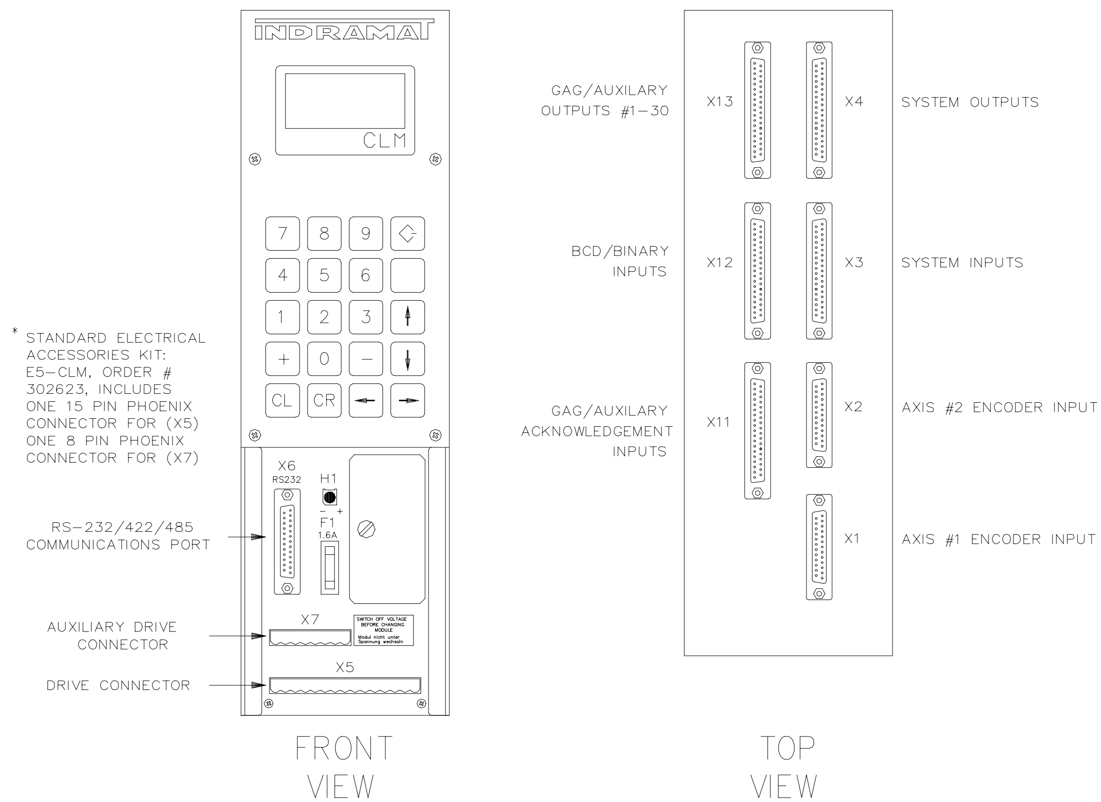
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.

CLM INTERFACE TERMINAL LOCATIONS
STANDARD MODEL

DRAWING NUMBER AG−1028

QUALITY DRIVES INDRAMAT

INFO.	NAME	DATE	REV.	DESCRIPTION	DATE	NAME	E.C.O. NUMBER	PART NUMBER	SCALE N.T.S.	SHEET 1 OF 1
DRAWN BY	C.MARTINEZ	3−23−92							REVISION FOR	
CHECKED BY									REVISED BY	
ENGINEER APPROVAL										



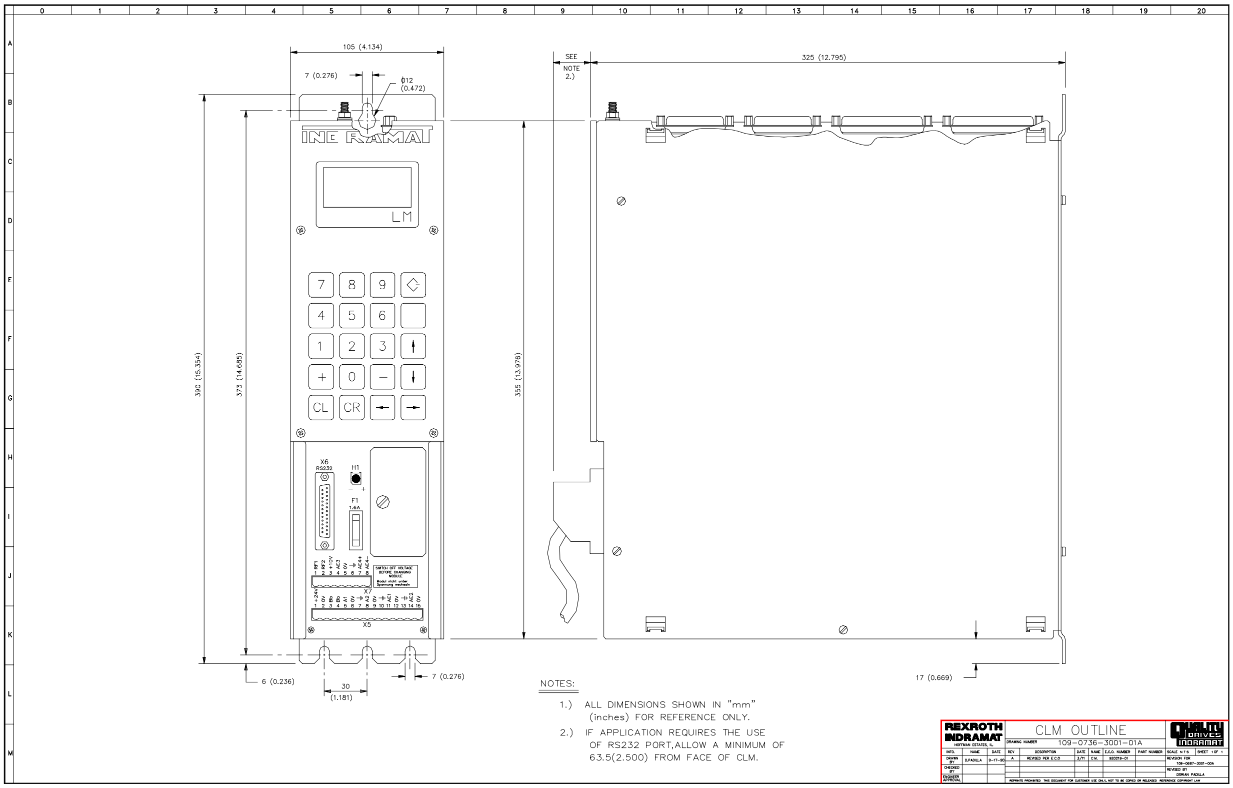
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.

CLM INTERFACE TERMINAL LOCATIONS
EXPANSION I/O MODEL

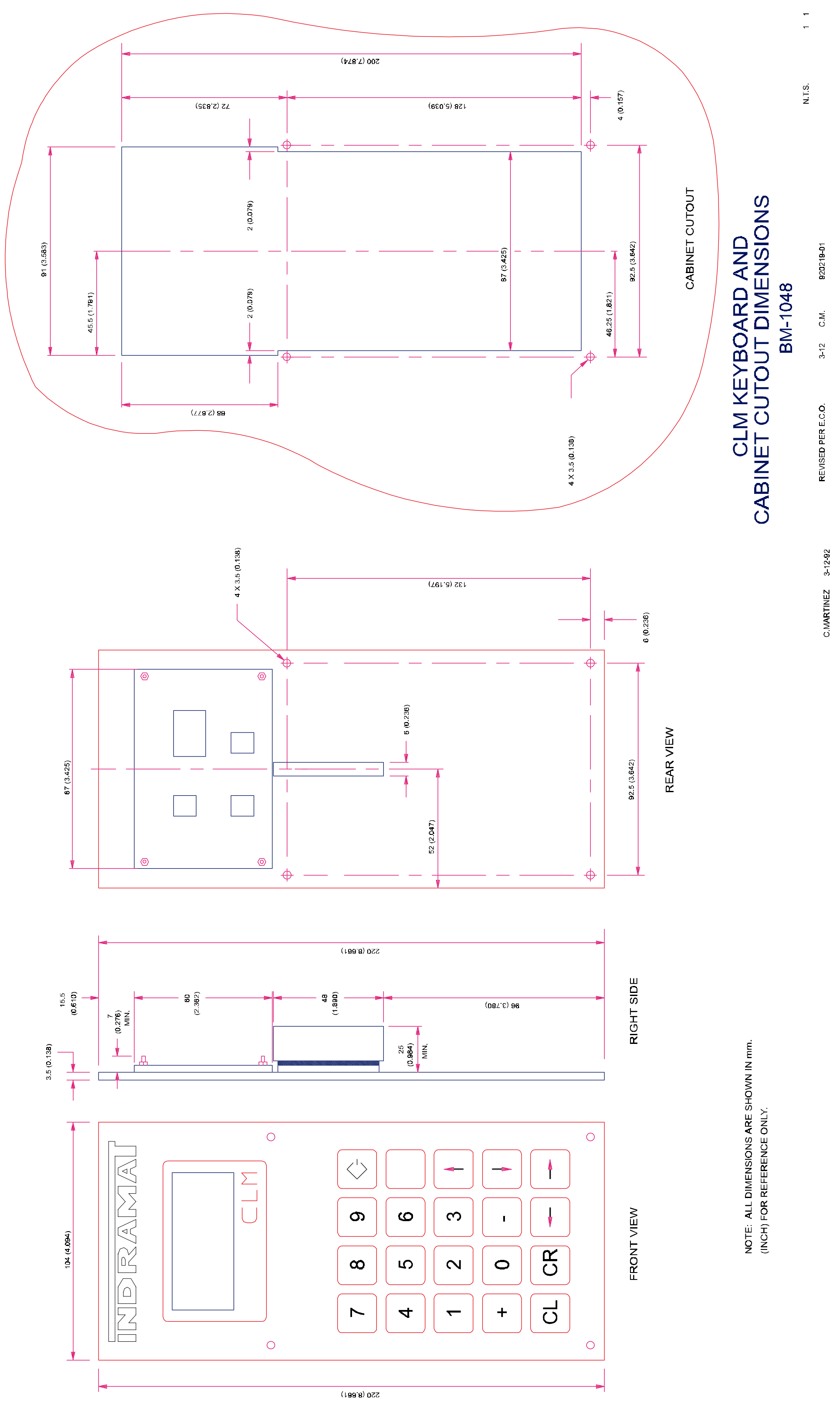
DRAWING NUMBER AG−1029

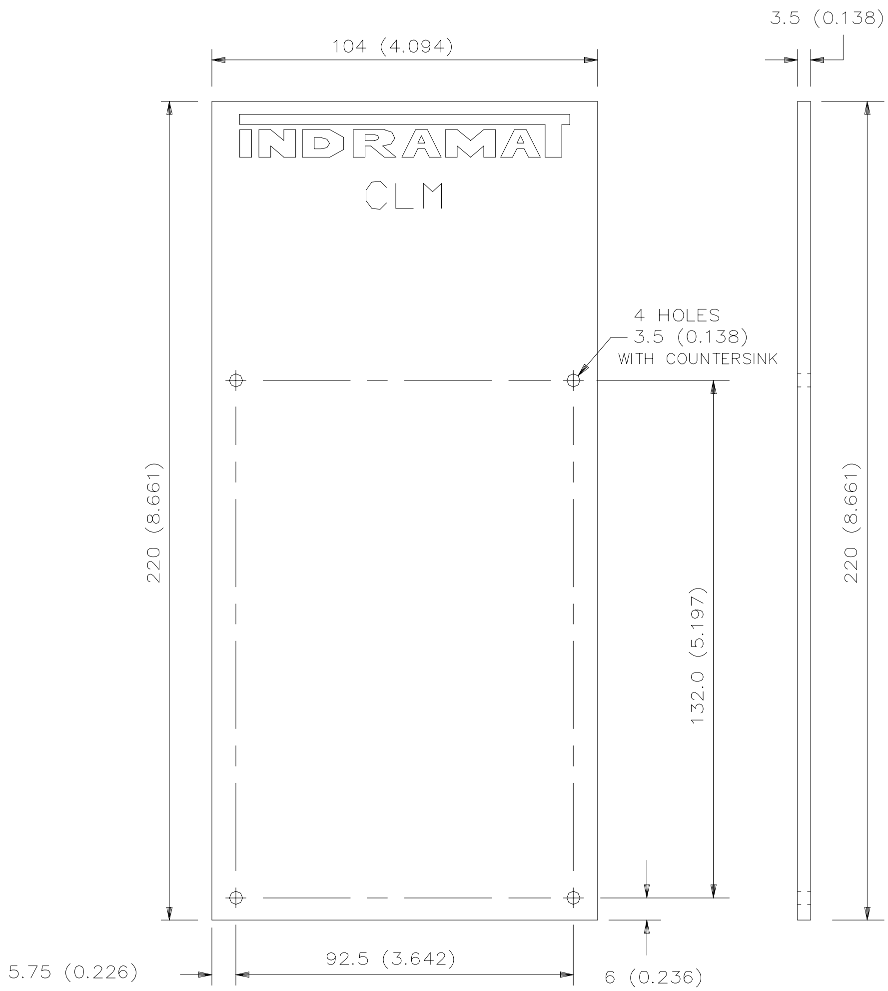
QUALITY DRIVES INDRAMAT

INFO.	NAME	DATE	REV.	DESCRIPTION	DATE	NAME	E.C.O. NUMBER	PART NUMBER	SCALE N.T.S.	SHEET 1 OF 1
DRAWN BY	C.MARTINEZ	4−09−92							REVISION FOR	
CHECKED BY									REVISED BY	
ENGINEER APPROVAL										


105 (4.134)
7 (0.276)
Ø12 (0.472)
SEE NOTE 2.)
325 (12.795)
390 (15.354)
373 (14.685)
355 (13.976)
LM
X6 RS232
H1
F1 1.6A
X5
6 (0.236)
30 (1.181)
7 (0.276)
17 (0.669)
NOTES:
1.) ALL DIMENSIONS SHOWN IN "mm" (inches) FOR REFERENCE ONLY.
2.) IF APPLICATION REQUIRES THE USE OF RS232 PORT, ALLOW A MINIMUM OF 63.5(2.500) FROM FACE OF CLM.
REXROTH INDRAMAT
CLM OUTLINE
109-0736-3001-01A

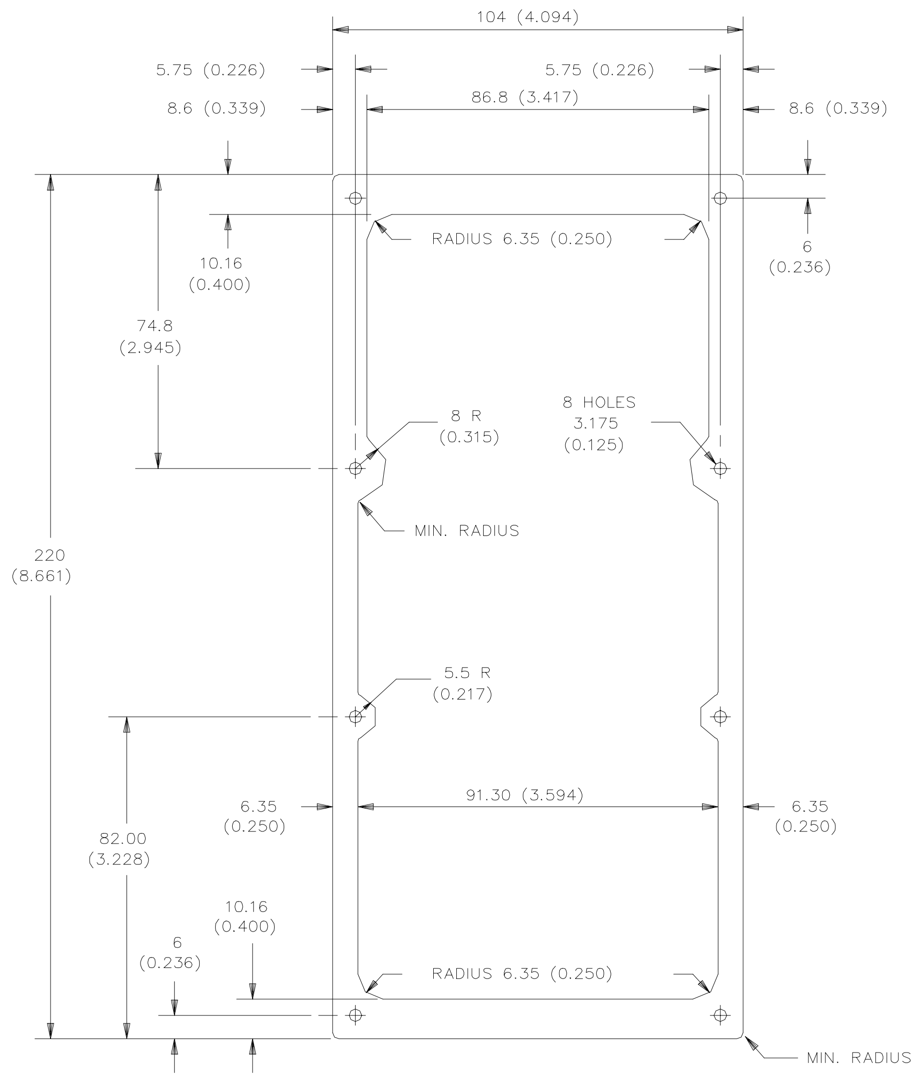
CLM Keypad Remote Installation Drawings





NOTE: ALL DIMENSIONS ARE SHOWN IN mm.
(INCH) FOR REFERENCE ONLY.

REXROTH INDRAMAT HOFFMAN ESTATES, IL.			CLM01.3 KEYPAD REPLACEMENT PANEL DRAWING NUMBER AM–1052						QUALITY DRIVES INDRAMAT	
INFO.	NAME	DATE	REV.	DESCRIPTION	DATE	NAME	E.C.O. NUMBER	PART NUMBER	SCALE N.T.S.	SHEET 1 OF 1
DRAWN BY	D. PADILLA	5–15–92	A	REVISED PER E.C.O.	5/92	D.P.	920515–01		REVISION FOR	
CHECKED BY									REVISED BY	
ENGINEER APPROVAL			REPRINTS PROHIBITED. THIS DOCUMENT FOR CUSTOMER USE ONLY, NOT TO BE COPIED OR RELEASED. REFERENCE COPYRIGHT LAW							



NOTES:
1.) ALL DIMENSIONS ARE SHOWN IN mm, (INCH) FOR REFERENCE ONLY.
2.) GASKET THICKNESS = 3/16"
3.) GASKET MATERIAL = CLOSED CELL NEOPRENE BLEND FOAM
4.) BOTH SIDES OF GASKET HAVE APPLICATION OF PRESSURE SENSITIVE ADHESIVE

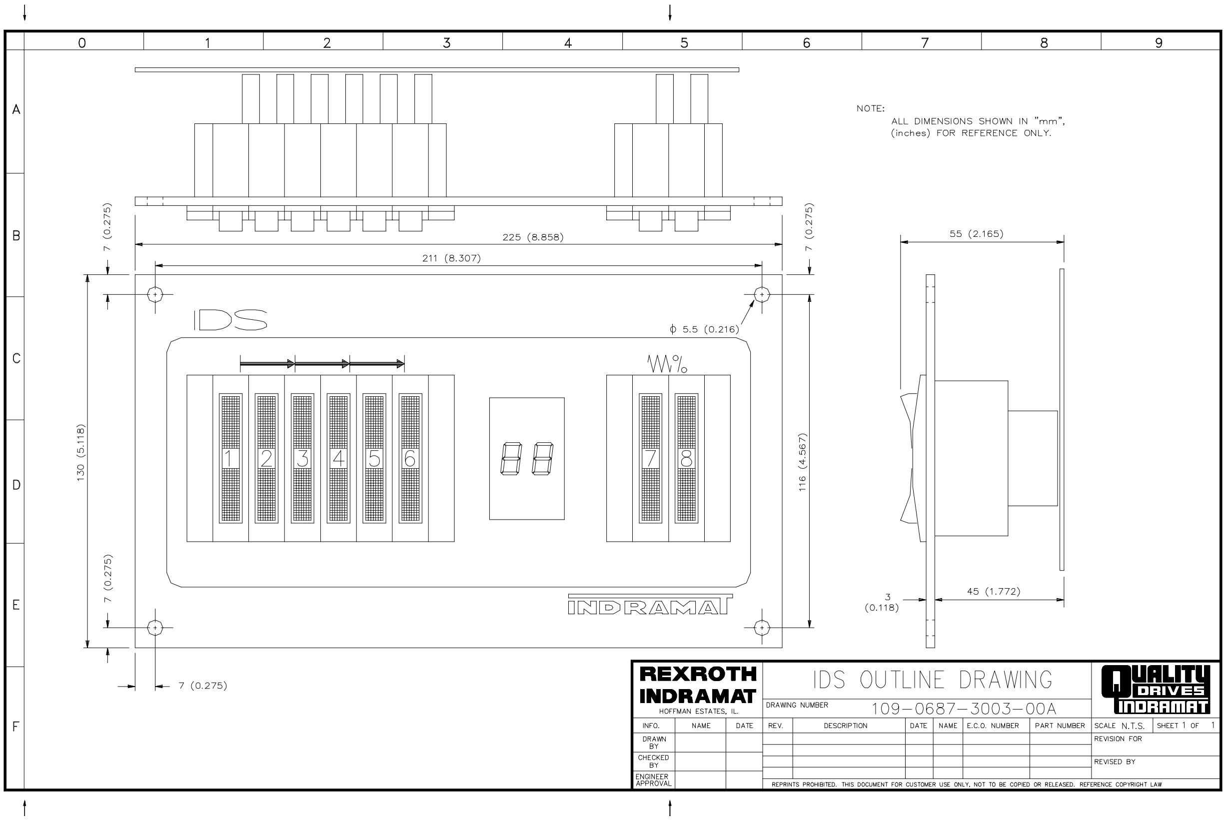
REXROTH INDRAMAT
HOFFMAN ESTATES, IL.

CLM/CTA KEYPAD REMOTE INSTALLATION GASKET

DRAWING NUMBER AM–1035

QUALITY DRIVES INDRAMAT

INFO.	NAME	DATE	REV.	DESCRIPTION	DATE	NAME	E.C.O. NUMBER	PART NUMBER	SCALE N.T.S.	SHEET 1 OF 1
DRAWN BY	D. PADILLA	6/16/89	A	CORRECTED NOTES 2 & 3, ADDED 4	07/17/89	D.P.			REVISION FOR	
			B	MODIFIED GASKET FOR BOTH CLM'S	06/04/91	D.P.				
CHECKED BY			C	REVISED PER E.C.O.	03/18/93	C.M.	940218–03		REVISED BY	
ENGINEER APPROVAL										


NOTE:
ALL DIMENSIONS SHOWN IN "mm",
(inches) FOR REFERENCE ONLY.
225 (8.858)
211 (8.307)
7 (0.275)
130 (5.118)
116 (4.567)
ϕ 5.5 (0.216)
55 (2.165)
45 (1.772)
3
(0.118)
IDS
INDRAMAT
REXROTH
INDRAMAT
HOFFMAN ESTATES, IL.
IDS OUTLINE DRAWING
DRAWING NUMBER
109-0687-3003-00A
QUALITY DRIVES INDRAMAT
INFO.
NAME
DATE
REV.
DESCRIPTION
DATE
NAME
E.C.O. NUMBER
PART NUMBER
SCALE N.T.S.
SHEET 1 OF 1
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