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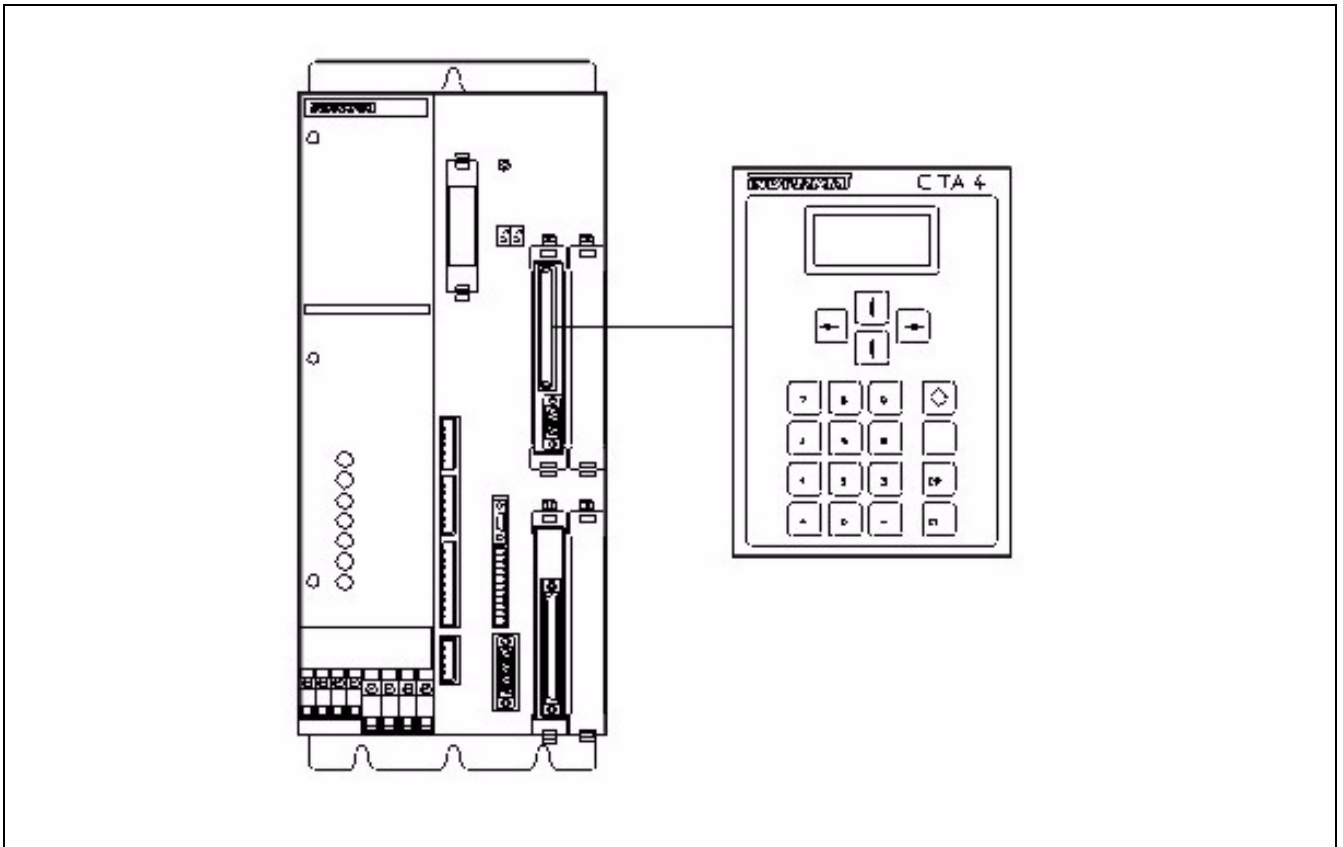
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DLC-R Feed-to-Length Control With SOT Supplement

User's Manual

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Purpose of this document This document is written for both operating personnel and the machine builder. It explains how to interface, install, set up and operate the Indramat DLC Positioning Control with DR software.

Course of modifications

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Chapter 1. General Description

The DLC is a single axis positioning control card which plugs into the Indramat Digital AC Servo Drives, such as the DKS (Digital Compact Servo Drive) or DDS (Digital AC Servo Drive) products. The DKS is a self-contained power supply and digital servo drive. The DDS is a digital servo drive which operates with the TVD (AC Power Supply). The DLC requires a DEA 4 Input/Output card to provide the system inputs and outputs to operate the Digital AC Servo System. The DLC plugs into the U1 slot and the DEA 4 plugs into the U2 slot of the Indramat Digital Servo Drives. The DLC controls and Indramat maintenance-free MDD Digital AC Servo Motor to drive feed rolls or some other positioning device. This is a closed-loop feedback system which provides precise control of speed and position at all times. The DLC/DEA 4 installed in the Indramat DKS, Digital Compact AC Servo Drive, is illustrated in *Figure 1-1: DKS/DLC-R Feed-To-Length Positioning Control System*.

The DLC/servo system is used for material positioning applications. It controls the feeding of metal, foil, film and similar materials through a shear, punch press, bagmaking machine, thermoforming machine or similar production machine. Complete interconnect cable sets are also available from Indramat. The components are chosen to best fit the specific application. *Figure 1-2: Block Diagram* is a block diagram of a typical system configuration.

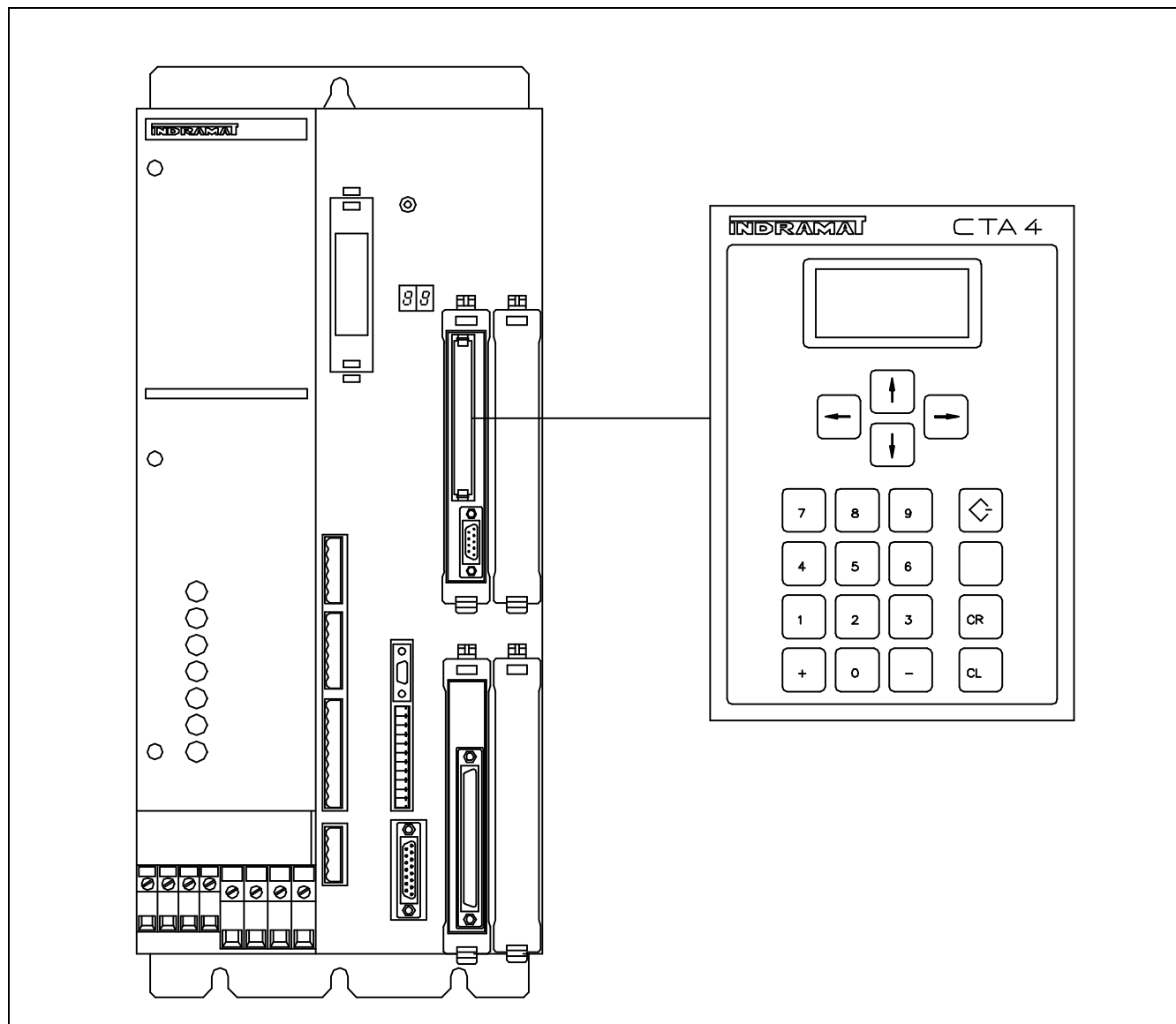


Figure 1-1: DKS/DLC-R Feed-To-Length Positioning Control System

The DLC requires a DEA 4 card to be plugged into the U2 slot of the DKS. The DEA 4 card provides 15 system inputs and 16 system outputs. Other information, such as batch programs, parameters, and system status can be communicated (two way) between the DLC and a host device, such as a computer, or Indramat SOT, via a multi-format serial communications port.

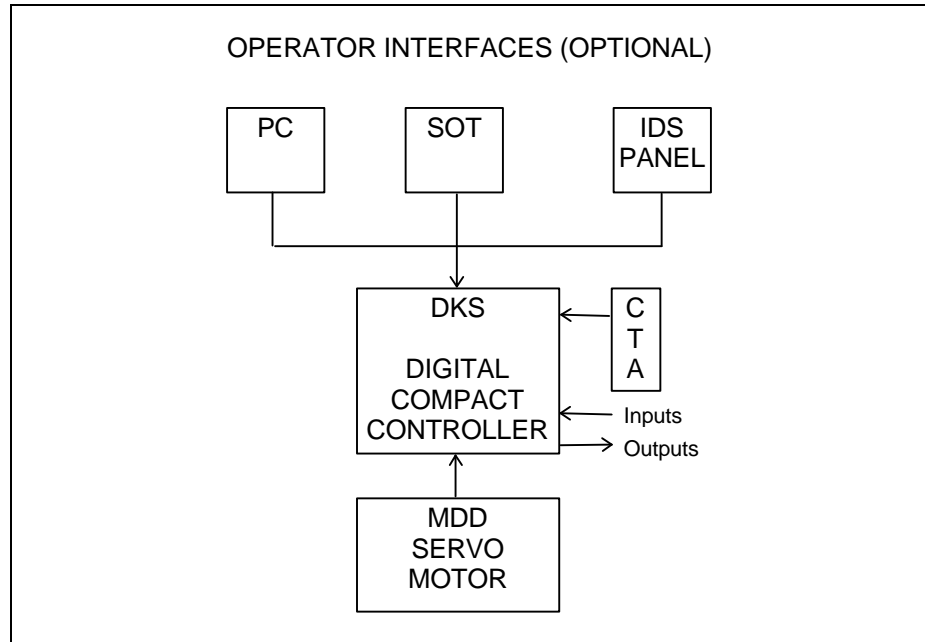


Figure 1-2: Block Diagram

The DLC Digital AC Servo System configuration consist of

- * DLC control card
- * DEA 4 Input/Output card,
- * Digital Controller (DKS/DDS)
- * MDD Digital AC Servo Motor.

The machine builder or user enters data into the DLC parameters to specify the mechanical and operating characteristics of the system. Based on this data, plus the feed length and feed rate entered by the operator, the DLC issues positioning commands to the digital controller, a DKS (Digital Compact Controller) or DDS (Digital Controller), which controls the current driving the MDD AC Servo Motor, which drives the mechanical feed mechanism.

The MDD AC Servo Motor includes a high resolution feedback, which provides velocity and position feedback to the digital servo drive, ensuring precise, repeatable positioning of the material being fed. The final accuracy of the feed system depends on various factors, such as type of material, gearbox backlash and other machine mechanics.

System components are modular, thus installation and replacement of any component of the system is fast and easy. The Indramat Digital AC Servo Drive and the MDD AC Servo Motor have quick-connect cabling. The drive and MDD Servo Motor are matched for optimum operation using a plug-in DSM module. Thus, should a failure occur, replacement of the digital drive is accomplished quickly without the need for electronic fine tuning. This results in a minimum of lost production.

The system is designed to ensure operating integrity and safety, using various inputs and outputs for handshaking to assure that the feeder and subsequent processing station or device operate in harmony. A complete diagnostic system monitors all inputs/outputs and operating conditions and stops the system if a fault is detected. Diagnostic messages are displayed to aid the operator in troubleshooting problems and quickly getting the system back into production.

1.1 About this Manual

This document is written for both operating personnel and the machine builder. It explains how to interface, install, set up and operate the Indramat DLC Positioning Control with DR software.

Hardware and Software Support

This manual describes the DLC1.1 hardware, used with software version DR1-02VRS.

Indramat provides assistance for any problems you may encounter with this system. Your first source of information should be this manual. To report a problem or request assistance, call Indramat at [847] 645-3600, between 9:00 AM and 5:00 PM Central time. Ask for a Service Engineer. You may also write or FAX to the following:

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1.2 How To Use This Manual

The manual is organized such that Chapters 1 and 2 describe the DLC control and its operation. These chapters, plus Chapter 8 on diagnostics, will be sufficient for most operating personnel. Chapters 3-8 provide functional description, installation, set up, parameter entry, and diagnostic and troubleshooting information required by the machine builder and set up personnel.

Chapter 1.

General Description

Describes the DLC control and the features which make it well suited for motion control. Describes and illustrates various options. Lists specifications.

Chapter 2.

Controls & Indicators

Describes the CTA keypad and displays interfaced with the DLC control card.

Chapter 3.

Functional Description of Standard Features

Describes all pre-defined input and output signals and the various interfacing and operating modes of the DLC. This information is necessary for interfacing the DLC to the machine builder's equipment, control panel design and troubleshooting.

Chapter 4.

Functional Description of Special Features

Provides same type of information as Chapter 3 for enhanced features which include: Batching, multi-format RS-232/485 interface, Measuring Wheel and Single Step using Start and Stop Inputs.

Chapter 5.

Parameters

Describes all user-entered parameters required to adapt the DLC to the mechanical and electrical characteristics of each application.

Chapter 6.

Installation

Describes procedures for installing a DLC control system.

Chapter 7.

Start-up

Provides an example of a DLC start-up.

Chapter 8.Diagnostics &
Troubleshooting

Describes the DLC's self-diagnostic system, lists and explains all diagnostic messages and describes troubleshooting procedures.

Appendices**Appendix A -**

Display Map (DLC display screens which appear on the CTA control panel)

Appendix B -

Blank parameter record forms for use in documenting your system parameters

Appendix C -

Drawings and schematics of the DKS/DLC.

Appendix D -

Installation drawings & details for the DLC and options: IDS Thumbwheel Switch Panel and Remote Display Module

Appendix E-

Index

Supplement

User's Guide for the Station Operators Terminal (SOT), an optional operator interface terminal for the DLC

1.3 System Features

Superior Performance and Ease of Operation

The system offers press rates up to 1200 strokes per minute and feed resolution of 0.001 inch, which minimizes scrap and lowers cost. Note that maximum system performance depends on the mechanical characteristics of the user's system.

The user simply and easily operates the feed control system by entering feed rate and feed length using front panel controls. Operating status messages appear on the display in English, German, French or Spanish - as selected by parameter. Other input and display options are described later in this section. The DLC system includes features to make set up quick and easy, eliminating time consuming mechanical set up or complex programming when changing parts. System operation is described in detail in Chapter 3.

Parameter-adaptable to Multiple Machines

The feeder manufacturer or the user easily adapts the DLC to the mechanical and electrical characteristics of an application by entering data into a set of parameters, using the CTA 20 digit keypad and liquid crystal display (LCD), or from a host via the serial port. These parameters define the characteristics of the machine, such as: maximum and minimum feed lengths, jog, acceleration and deceleration rates, units of feed measurement, communications port characteristics, etc. This allows one single type of DLC control to handle the mechanics of various roll feed units. Thus, plant personnel need be familiar with only one feed control system.

Generally, parameters are entered once when the system is set up, then changed only if the configuration changes or if different types of materials are fed. The factory installed DLC executive program interprets the parameters to match the DLC to the machine, and translates operator-entered commands into motion control signals, coordinating the feed motion with the press or other machinery. Complicated system programming is not required.

Parameters are described in Chapter 5.

Fully Self-Diagnostic

System protection is paramount. The DLC detects normal operating status, operator errors, errors in the control itself and machine faults. For example, in a metalforming application, the DLC monitors the press crank angle and halts the system if the selected feed cannot be made without damaging the press, tooling or material. If a feed is not completed during the allowable press feed angle, a diagnostic error message is displayed and the feed and press automatically stop. If necessary, the ram can be inched back, the press speed can be reduced and press/feed operation can be resumed without loss of material or damage to the tool or die. An indicator informs the operator when the speed can be increased without causing this problem and when the speed is set so high that it may cause the problem.

Both fault and normal status messages are displayed on the DLC control panel (or host device via the serial port) in the user-selected language. Thus, the operator is informed of the current operating status of the system and is alerted to any condition that causes a fault. This helps the operator quickly locate and correct problems.

The DLC processor models and predicts the motion profile and continuously compares it with the actual response of the servo drive, thereby detecting irregularities in drive conditions, such as drive runaway or stalled conditions. Parameters allow the user to set the magnitude of certain variations, as required for the application, before a deviation error is considered a fault condition.

Diagnostics are described in detail in Chapter 8.

Jerk Limited Acceleration

Parameters allow the user to generate a jerk limited (S-shaped) acceleration profile, which increases machine life and allows handling difficult, slippery, compliant or delicate materials at increased production rates.

Independent Accel/Decel Ramps

Parameters allow different acceleration and deceleration rates for linear profiles. This allows the user to most effectively accommodate differing material characteristics, such as stretching susceptibility, in various applications.

Batching

The user can program the control for the sequence required to make different parts. Then, through simple keyboard entry, select the quantity of one or several different parts to be made automatically. The program allows multiple feed lengths for each part. It also allows branching from one part program to another, to make different parts, and looping to continuously make the same part. Up to 99 parts and 594 feeds can be entered and stored in the battery protected memory of the DLC.

RS-232/485 Serial Interface

A multi-format serial interface allows communication with a programmable logic control, a Indramat IDS or SOT, a personal computer or other host device. Every function (and more) that can be entered with the keypad and displayed on the LCD can be communicated between the DLC and host device at rates of up to 19200 Baud.

Optional Thumbwheel Switch Panel And Alphanumeric Display

An optional thumbwheel switch module (IDS) and an optional alphanumeric display, *illustrated in Figure 1-3: Optional Thumbwheel Switch & Alphanumeric Display Modules*, are available for the DLC. The IDS connects to the serial port of the DLC. The remote display is available only with the IDS option. These units are remotely mounted, up to fifteen (15) meters from the DLC. The operator selects the required feed length and a feed rate on different sets of thumbwheel switches. The decimal place (resolution) for the feed length is set by parameter. The feed rate is selected as a percentage of the maximum feedrate set in parameter. Status and diagnostic messages appear on the alphanumeric vacuum tube fluorescent display or status and diagnostic message codes appear on the two digit LED numeric display on the IDS.

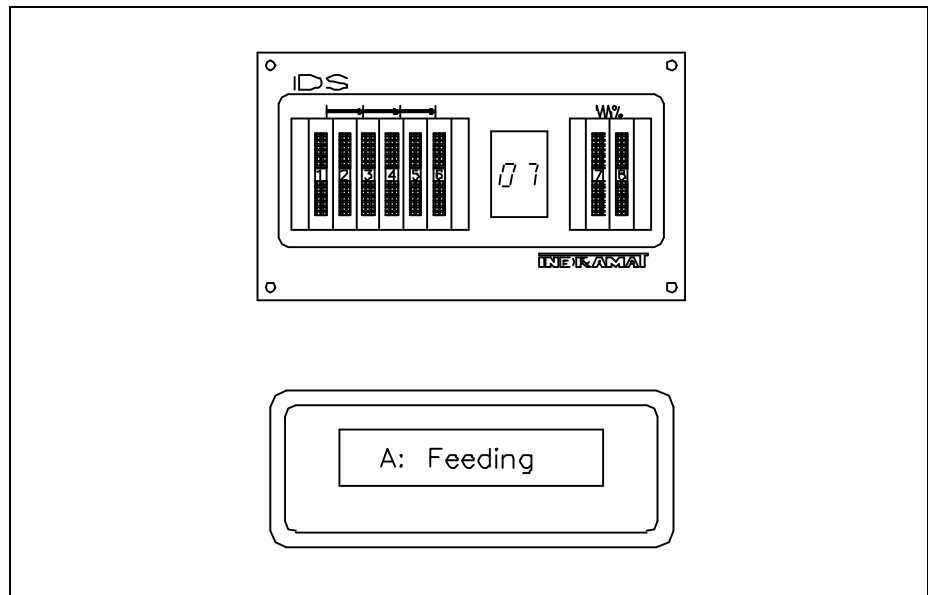


Figure 1-3: Optional Thumbwheel Switch & Alphanumeric Display Modules

Optional Station Operator Terminal (SOT)

The Indramat SOT is a remote mounted, operator control device for the DLC. See *Figure 1-4: SOT - Station Operator Terminal*. It allows for the same input functions and displays the same information as the DLC control panel, but provides several additional features.

The SOT has a viewing area that measures 4-7/8" by 2-3/4" and can display 16 lines of 40 characters per line. The SOT screen is a non-glare LCD with cold cathode fluorescent lamp backlighting for high black and white contrast. The level of contrast is user adjustable for optimum viewing. It can display much more information at a time than the standard four line by 16 character display on the DLC control panel. The software in the SOT provides Help screens to assist the operator in using the SOT and for entering information correctly.

The SOT is pre-programmed with appropriate screens for DLC-R type applications. The SOT can also be programmed using Indramat's ScreenManager™ when further customized screens are desired. This command line editor software package runs on a DOS based computer. This program can be used to customize/write information and prompt lines for the operator that will appear on the SOT display. When downloaded to the SOT, these lines cannot be changed from the SOT keypad but data can be entered in response to the prompts.

The SOT keypad includes "click contact" keys for entering/changing data in the DLC, as well as several inputs normally provided on the user's control panel by the machine builder. These include the mode selection, axis jog - forward/reverse, and cycle start-stop-resume.

The SOT connects to the serial communications port of the DLC and can be mounted up to 1000 meters away with an RS-485 cable. An SOT User's Guide is provided at the end of this manual as a supplement.

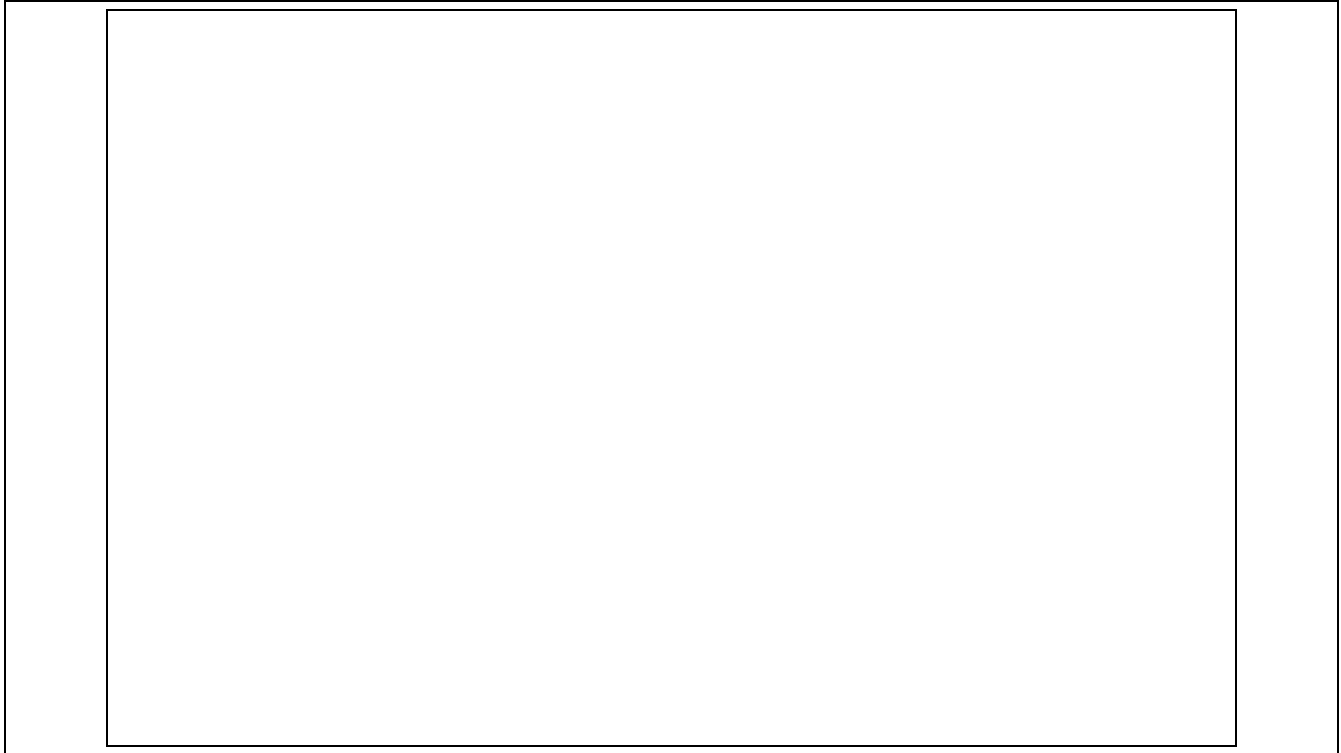


Figure 1-4: SOT - Station Operator Terminal

1.4 Standard Configuration Of DKS With DLC Control Card/DEA 4 Input/Output Card

The DLC Control Card plugs into the U1 slot and the DEA 4 Input/Output Card plugs into the U2 slot of the the Indramat Digital AC Servo Controller. The Indramat Digital Controller being used mounts to the panel of a control cabinet (electrical enclosure). Installation procedures are described in Chapter 6.

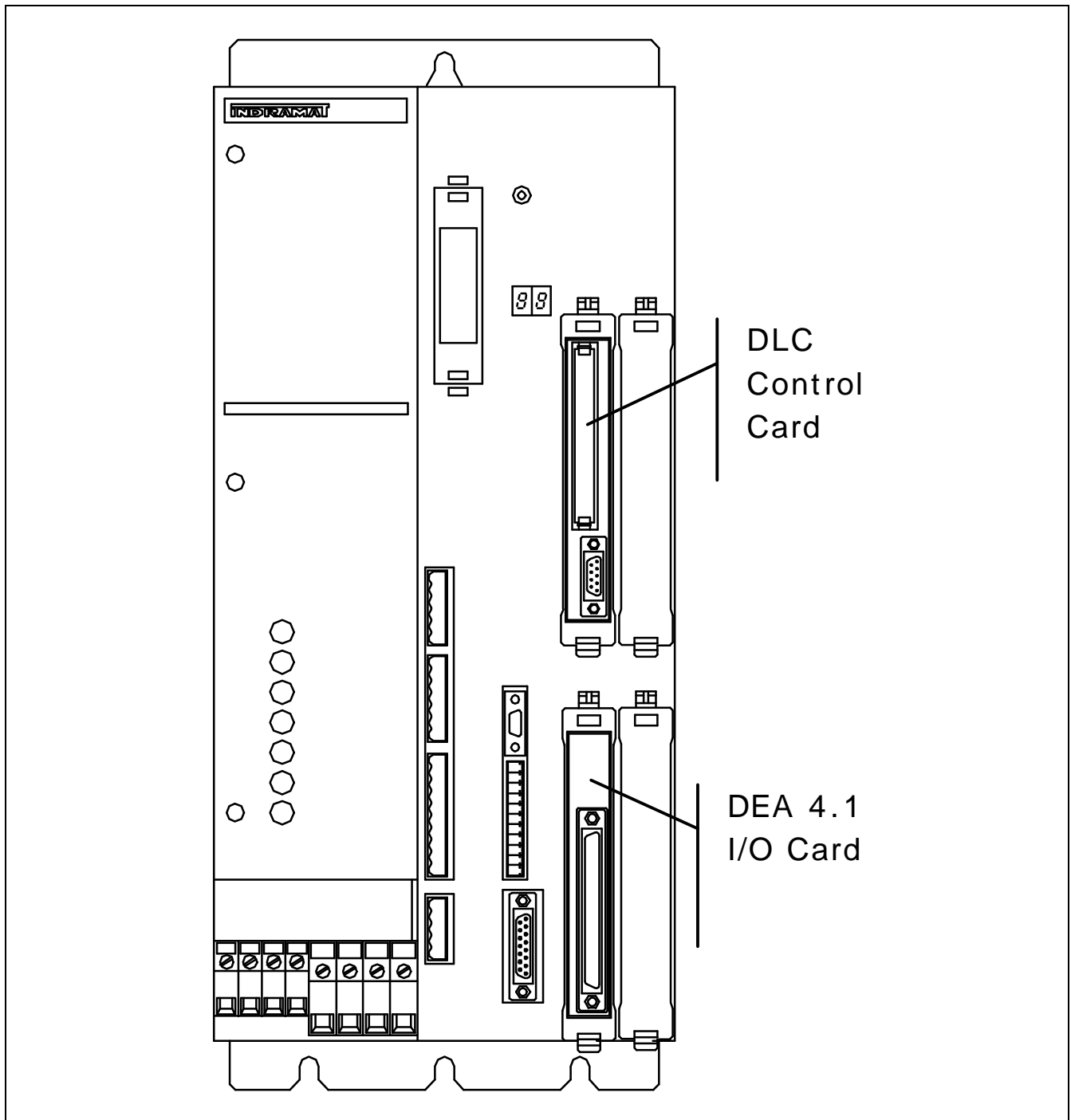


Figure 1-5: Standard Configuration Of DKS With DLC Control Card and DEA 4 I/O card

The standard configuration for the DLC/DEA 4 with DKS (Digital Compact Controller), is illustrated in *Figure 1-5: Standard Configuration Of DKS With DLC Control Card and DEA 4 I/O card*. The DLC with DEA 4 Input/Output card has 15 system inputs and 16 system outputs. The functional description of the I/O signal connections is described in Chapter 3.

1.5 Brief Operational Description

The DLC, servo amplifier, servo power supply and servomotor are designed into a mechanical feed system, which feeds some type of material into another processing station, such as a punch press, thermoforming station, etc.

The machine builder or user enters data into the DLC parameters to specify the mechanical and operating characteristics of the system. Based on this data, plus the feed length and feed rate entered by the operator, the DLC issues velocity commands to the servo amplifier, which controls the current driving the servomotor, which drives the mechanical feed mechanism.

The servomotor includes a tachometer and encoder which provide velocity and position feedback to the control, ensuring precise, repeatable positioning of the material being fed. The final accuracy of the feed system depends on various factors, such as type of material, gearbox backlash and other machine mechanics.

System components are modular, thus installation and replacement of any component of the control system is fast and easy. The DLC card, servo amplifier and servomotor have quick-connect cabling. This results in a minimum of lost production.

The system is designed to ensure operating integrity and safety, using various inputs and outputs for handshaking to assure that the feeder and subsequent processing station or device operate in harmony. A complete diagnostic system monitors all inputs / outputs and operating conditions and stops the system if a fault is detected. Diagnostic messages are displayed to aid the operator in troubleshooting problems and quickly getting the system back into production.

1.6 Specifications

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

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

Physical

Operating Environment

Cooling	Convection
Allowable Ambient Temperature Range	41 to 113 deg. F (5 to 45 deg. C)
Storage and Transport Temperature Range	-22 to 185 deg. F (-30 to 85 deg. C)
Maximum Operating Altitude at Rated Values	3,280 ft. (1000 meters), higher altitudes permitted with proper cooling

Control Specifications

Position Feedback	Indramat high resolution single turn encoder
Feed Length Resolution	0.0001 inches (0.001 mm)
Feed Rate	
Normal -	0.1 - 99.9% of Maximum Feed Rate (Operator Selected)
Jog -	0.1 - 99.9% of Maximum Feed Rate (Parameter Selected)

NOTE: Maximum Feed Rate will vary, depending on the mechanical design of the system.

Jogging	Forward/Reverse (Manual / Set up Modes only)
Status/Fault Display	LCD, Four lines, Alphanumeric, 16 Characters/ Line, optional backlit version available
Entry Keypad	20 membrane switch keys

Power Requirements

Optional IDS Module -	50 mA @ 24 Vdc (additional)
-----------------------	--------------------------------

I/O Interface

Inputs	15 (+24 Vdc @ 10 mA) (pre-defined function)
--------	--

Outputs	16 (+24 Vdc @ up to 100 mA sourcing) (pre-defined function)
---------	---

Interface Options

RS-232/485	This interface allows remote operation and other data transfer between the DLC and a host device, such as a computer, programmable controller, the IDS / Remote Display or SOT,
IDS Module	A remote thumbwheel switch assembly used for entering feed length and feed rate for operation; displays status and fault codes
Remote Display	A remote mounted, vacuum florescent tube display (requires the IDS option)
SOT	Station Operator Terminal - Used for displaying diagnostics, entering feed length, feed rate, etc. It also contains Cycle Start, Stop, Jog, Mode, Micro-adjust and other control pushbuttons.

Chapter 2. Controls and Indicators

The DLC-R uses the CTA keypad and display module which consists of a keypad with 20 pressure-sensitive membrane type keys and a liquid crystal display (LCD) that has four lines of up to 16 alphanumeric characters each.

The display informs the operator of the operating status of the DLC system. It displays all status and diagnostic messages. It is used when entering or editing parameters, batch programming or other operations from the DLC keypad.

The keypad contains all the keys used for data entry, cursor movement, clearing fault/error messages, entering feed length and feed rate data, and storing entries.

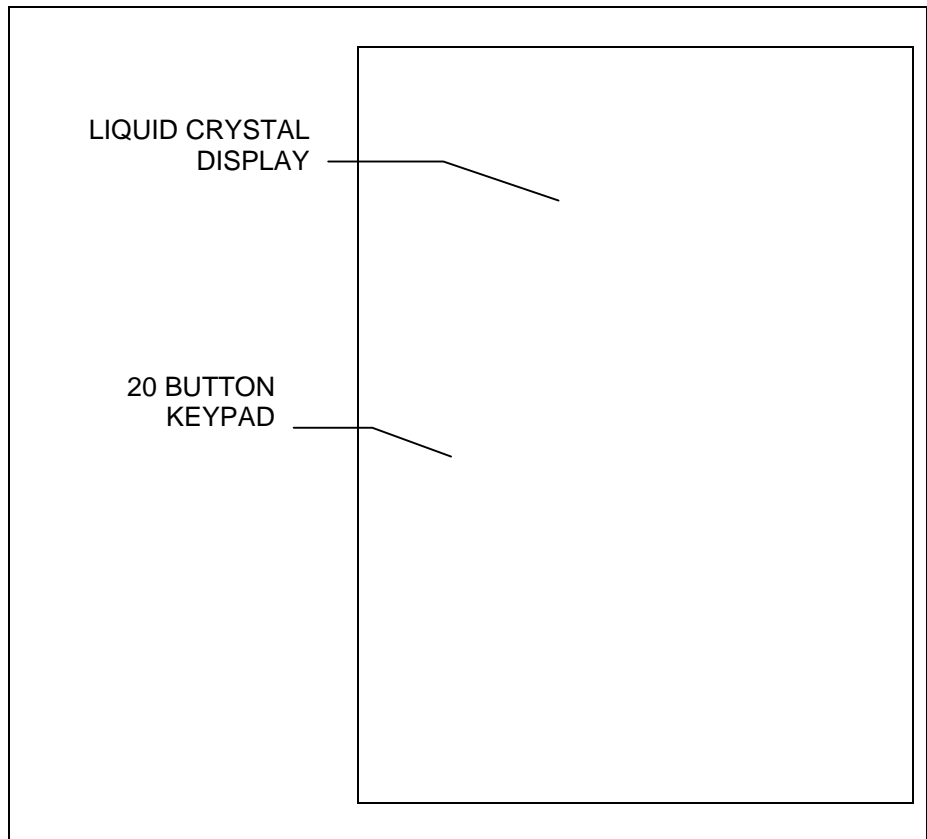



Figure 2-1: CTA Display/Keypad Module

2.1 Data Entry Keys

This section describes the general function of each key on the CTA keypad. Their use is further described throughout the manual for specific functions.

- CL** Clear -- Use to clear the a displayed fault message, if the fault can be cleared. It also clears parameter entry errors. (See Store key for additional uses.)
- CR** Carriage Return -- When changing data values, press this key before pressing the Store key to cancel the change and leave the data as previously stored (clear entry).

In Parameter Mode, use this key to change between parameter sets A1, A2 and B1.
-  Store -- Press to store (save) values entered while in Parameter Mode or feed rate, feed length and batch program values while in other modes.

In other modes, use to move the cursor to the home position of the particular display. Use to toggle between certain displays (see next section).

When on the respective display: press this key to freeze the Total Length value for two seconds or to change state of Jog Step Mode; press the CL key and the Store key together to reset the Piece Count or to clear the Total Length value to zero.
- + & -** Plus and Minus -- Use to specify the feed length direction; micro-adjust data fields.
- 0 - 9** Numerical Keys -- Use for entering data values.
- ← →** Left and Right Arrow -- Use to move the cursor to the left or right one position at a time when in Parameter Mode, when editing the feed length and feed rate, or when entering batch data. Press the key to change between display pages on the same row of the display map (see next section).
- ↑ ↓** Up and Down Arrows -- Use to scroll through display pages (see next section), or parameters (see Chapter 5).
- ∅∅** Blank Key (unlabeled) -- Press from any other page displaying to cause the Status Page to display. Press before typing-over a parameter number to change displays.

2.2 Display Screens

The operating mode and keyboard selections determine the resulting display. When in Parameter Mode, data for each parameter can be viewed, entered or edited. Refer to Chapter 5 for procedures to scroll through parameter displays. While in Automatic, Set up or Manual Mode, display screens show operation status messages, status of each input and output, etc., and allows entry of feed length, feed rate, etc.

The following section describes procedures for scrolling through each of these display screens. Refer to the "Display Map" in *Figure 2-2: Map of CTA Control Panel Display Pages*, for a full illustration of the display access procedure. The same illustration is included in Appendix A for convenience. This section describes the basic procedures for reading this "map" to scroll through the different display screens and describes the information on each screen. Following sections in this manual further describe the information provided, procedures to edit the screens data, etc. as required for a specific function.

To allow easier description, each row of the map is labeled A, B, C, etc. In general, use the up or down arrow keys to change to the "home" display screen of the proceeding or following row. Use the left or right arrow keys to scroll through the displays on each row. Screens that allow editing data have a cursor. Use the right/left arrow key to move the cursor in the data field and type-over data to change. Continue pressing the arrow key to change to the next display screen on the row. Rows allow wrapping from the last screen on the row back to the first screen. Certain displays on the same row have alternate pages, such as Total Piece and Total Length. Use the CR key to toggle between them. Batching display screens require the CR key and the +/- keys for scrolling. Procedures are described below for each screen.

The example displays shown in the following descriptions show the batching feature (enabled by parameter). If the feature is not enabled, its respective display pages do not appear when scrolling through the screens. Pressing the down arrow key from a screen on row C will scroll back to row A or to the first enabled option in row D, E, or F.

NOTES:

- *The current DLC display provides four lines with 16 character spaces on each line. However, all screens do not require all the lines or character spaces. For simplicity, this manual typically illustrates the example displays at the size required for the screens data.*
- *All displays illustrated in this manual use an underline character () to represent the cursor.*
- *The cursor must be in home position of the display to scroll up/down to different rows.*

The following display appears only at power-up, when clearing a hard fault, or when exiting from Parameter Mode. It shows the internal software version while the "Initializing Sys" message is displayed (during system initialization).

<p>Initializing Sys</p> <p>DLC1.1-DR1-02V06</p>

DLC Initializing System Display

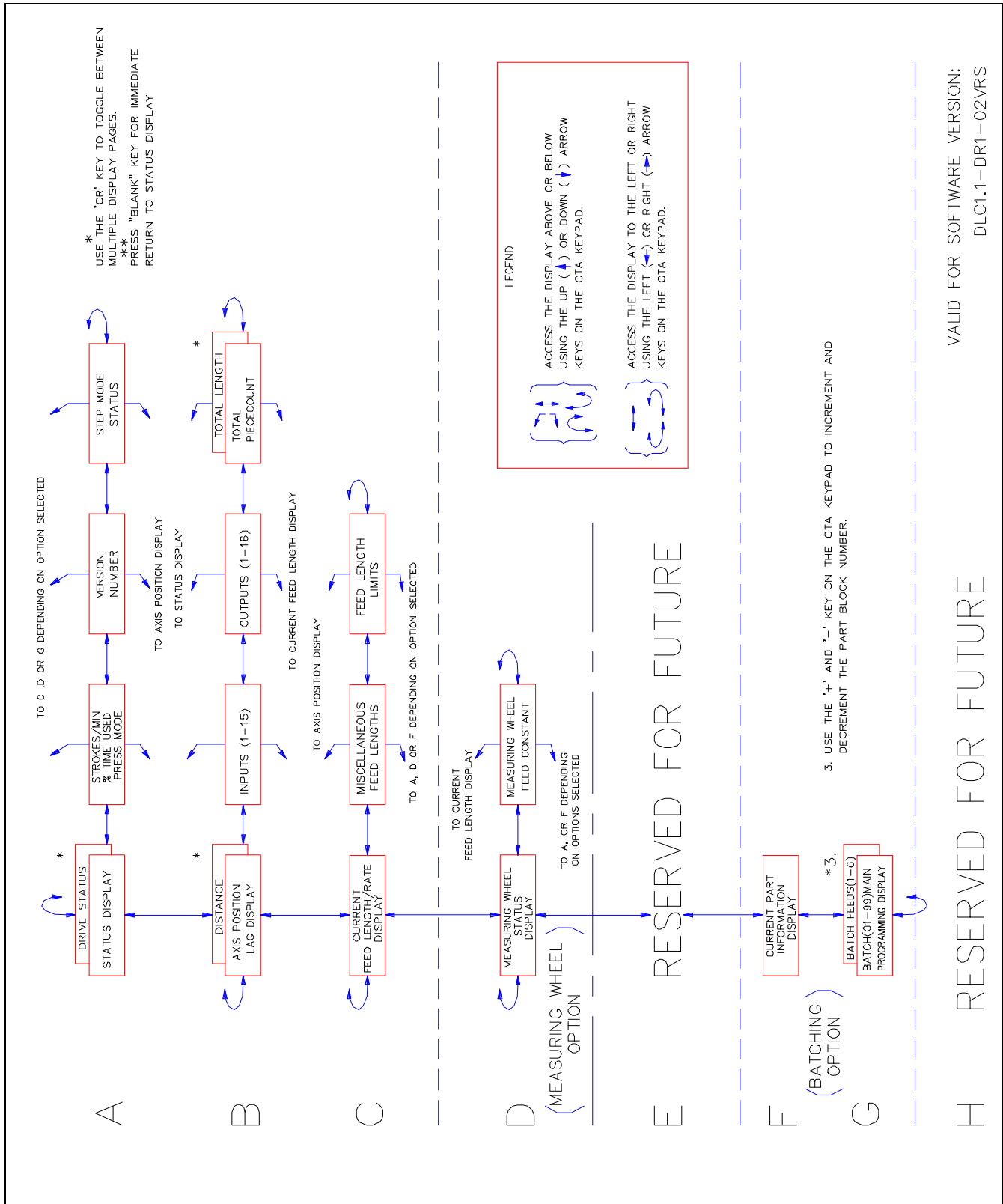


Figure 2-2: Map of CTA Control Panel Display Pages

Row A (Refer to the "Display Map" in *Figure 2-2: Map of CTA Control Panel Display Pages*)

After system initialization, the display shows the current operating condition of the DLC control, including fault diagnostic messages. The following example indicates that the DLC is ready for automatic operation - awaiting a Cycle Start input to begin automatic cycling.

<p>A: No Cycl Start</p>

Example Status Display

This **Status Display** is the home display of the first line (Row A on display map). Each status display page is described in Chapter 8, along with corrections for fault/error diagnostic status display messages.

*Pressing the **CR** key toggles between the Status Display and the Drive Diagnostic Page.*

<p>Drive Diagnostic 102 Drive Enabled</p>
--

Drive Diagnostic Page

The **drive diagnostic display** shows the current status of the digital servo drive. Refer to the drive manual for description of diagnostics.

Press the right arrow key once. The display changes to the **Strokes/Minute Display**, which also shows the time used and current press mode selection. Each line of the display is described below.

<p>Strokes/Min 200 Time Used 80% PBF Continuous</p>
--

Strokes/Minute Display

The Strokes/Minute display page shows the current stroke rate of the press during an Automatic Mode cycle. The DLC measures the time between press strokes and updates the Strokes per Minute display when the feed angle signal goes from high to low.

The display page also shows Time Used. Time Used is the amount of time during a high feed angle that is used by the programmed feed. The percent value displayed provides an estimate of the maximum press stroke rate that can be used with the current feed length, feed rate, and feed angle. For example, if the current hit rate is 100 strokes/min. and the time used is 75%, the maximum hit rate would be approximately $100/0.75 = 133$ strokes/min. (SPM).

When the time used approaches 100%, the soft fault 'Feed Angle Lost During Feed' will be issued, because the press rate is too fast and the feed angle will go low before the feed is complete. In Press Intermittent mode, the maximum Strokes/Minute is limited by the minimum cycle time specified in the Press Interface Parameter. The Time Used display does not go above 99 percent. A Time Available output can be used to indicate when the stroke rate can be safely increased without loss of the feed angle. A light can indicate when the feed time is within 90% of the maximum hit rate allowed. See Chapter 3 for further description.

When an Automatic mode cycle is not in progress, the last Strokes per Minute/ Time Used values will be displayed. After a cycle stop, the data can be read even though the press is not cycling. The page is not updated in Manual, Set up, and Parameter modes. Hard faults, soft faults, and minor errors also will not affect the Strokes per Minute value. At power-up, the values are reset to zero. Pressing the Store key freezes the display for two seconds.

The current press mode selection is displayed in the bottom line of the Strokes/Min. display. These modes of operation are described in Chapter 3.

- Press Interface Mode: PBF=Press Before Feed, FBP=Feed Before Press.
- Press Cycle Mode: Intermittent or Continuous. This is changed whenever the corresponding input is changed. It may be changed during a cycle.

Press the right arrow key once. The display changes to the **Software Version Display**. The following display shows the current hardware version and the current internal software version.

<p>Version Numbers DLC1.1-R DLC1.1-DR1-02V06 DSM 2.1-C11-03V02</p>

Software Version Display

Press the right arrow key once. The display changes to the **Jog Step Mode Display**. This feature allows defining the distance that the DLC will feed when the Jog button is pressed in Manual Mode. Jog velocity is set in parameter.

Jog Step Mode ON

Jog Step Mode Display

With normal jog (Jog Step Mode set to OFF), the DLC will feed as long as the forward or reverse jog button is pressed, and stops when the button is released. With Jog Step Mode set to ON, the DLC will feed a parameter-defined distance when a jog button is pressed.

To change the jog mode from Normal Jog to Step Jog, press the STORE key while on the Jog Step Mode page. The display will indicate the Step Mode is ON or OFF. Jog Step mode is enabled in Manual Mode only.

The DLC feeds material at jog velocity until the jog input goes low (jog button released) or until the step length has been reached. Once the step length is nearing completion, the motor(s) will be ramped down to zero velocity and a 1.5 second delay occurs to provide time to release the jog button. After the delay, another feed will start if the jog button has not been released. If the jog button is released before the step feed has completed, the DLC will complete the parameter set feed length.

Any time the motor is ramped down to zero velocity the Feed Complete output will go high. If the step mode ON/OFF is toggled while the motors are in motion, the motors will be ramped down and "Jog Input Active" will be displayed.

Row B (Refer to the "Display Map" in *Figure 2-2: Map of CTA Control Panel Display Pages*)

*Pressing the down arrow key from any of the displays on the top row, changes to the **Axis Position Displays**. This is the "home" display set of the second row (Row B) of displays. Use the left or right arrow keys to scroll through the input / output status and total piece count displays on this row. Use the CR key to toggle between certain pages, as described below.*

The Position Display shows either axis lag or distance moved.

The Distance Moved Display shows the distance moved by the axis during each feed (the actual position read from the encoder).

Axis Position Dist +00123.456
--

Axis Position Distance Moved Display on DLC-R

The Lag Display shows the following error - the difference between actual and commanded position - used by the DLC to calculate the command voltage to the servo amplifier.

Axis Position	
Lag	-00001.234

Axis Position Lag Display on DLC-R

*Pressing the **CR** key toggles between the Lag Display and the Distance Moved Display pages. The "Lag" or "Dist" indicates the Lag or Distance page of the position display respectively.*

A (+) or (-) indicates direction. Both display pages have eight (8) digits and are shown in the unit of measurement selected by parameter for the application (inches, millimeters, degrees, etc.).

The Distance Moved Display has the same number of decimal places as the feed length resolution (set in Parameter A100). In Manual Mode, the total distance jogged displays. In Automatic and Set up Modes, the distance moved during each feed displays. At the start of a feed in Automatic or Set up Modes, the display is cleared to zero (0). Pressing the **CL** key will also clear the display to zero (when this page is showing on the display).

The Lag Display has the same number of decimal places as the feed constant (one more decimal place than the Distance). When the axis is not moving, a small lag value will display. In order for the axis to be "in-position," the In-Position Threshold (set in Parameter A110) must be greater than this lag value. When the axis is moving at maximum velocity, the display lag should be within 10% of the calculated maximum lag.

*Press the right arrow key once. The display changes to the **System Inputs Display**. Press the right arrow key again to see the System Outputs Display. The numbers in the top row of the display indicates which of the lines of connector X17 of the DEA4 card are being monitored. These displays are helpful to verify wiring during start up or troubleshooting. They also provide a quick summary of system I/O status during normal operation. The first line of these displays also show the system status.*

A: No Cycl Start	
Sys Inputs	1-15
.11..1....11.11	

System Inputs Display

The status of each of the input or output signal lines are represented by a character in the bottom row of the display. A Low signal (0 volts) is represented by a decimal (.). A High signal (+24 volts) is indicated by a one (1). The signal lines count from left to right on the display.

Press the right arrow key to see the **System Outputs Display**. Interpret the information displayed the same as described for inputs.

```
A: No Cycl Start
Sys Outputs 1-16
..1.11...1..1...
```

System Outputs Display

Press the right arrow key to see the **Total Piececount Display**.

```
Total Piececount
000123
```

Total Piececount Display

Press the **CR** key to toggle between Total Piececount Display and the **Total Length Display**.

```
Total Length
+1234567.890
```

Total Length Display

The total number of pieces and length of material run through the feeder are displayed on these Length and Piece Accumulator Displays. These totals may be reset at any time.

The piece count is incremented when one full cycle of the press is completed in the Automatic mode or after each part is completed when batching mode is selected. Normally, 6 digits are displayed, but up to 8 can be shown as they are needed. The count is retained in memory at power-down.

To reset the counter to zero:

1. Press the CL key. The count display is replaced by a prompt.

```
Total Piececount
RESET DATA?
```

2. If you wish to reset the counter to zero, press the STORE key to clear the count. The added step of pressing the STORE key prevents the count from being reset inadvertently.
3. If you do not wish to reset the counter to zero, press any other key or leave the page. This action will restore the original count.

Note: *The Total Length value is generated from the motor encoder and not from the Measuring Wheel function.*

The Total Length Display is accessed by pressing the CR key while in the Total Piececount display. The length is accumulated in Automatic mode only, and includes all batching and auxiliary feed lengths. The DLC displays from 6 to 10 digits of data with a floating decimal point. The display may be frozen for 2 seconds by pressing the STORE key. The total length is retained in memory at power-down.

To clear the length, press the CL key, then the STORE key, as described in the steps above for the Total Piececount.

Row C (Refer to the "Display Map" in *Figure 2-2: Map of CTA Control Panel Display Pages*)

Pressing the down arrow key from any display in the B row changes to the **Feed Length Display**, the home display of the C row. Other displays on this row show relevant parameter settings. The parameter data display pages are for information only. Parameter data can be edited/changed only in Parameter Mode.

The feed length display allows entering the feed length and feed rate desired for system operation. The display looks and functions differently, depending on the interface option set in Parameter B102. This parameter selects the method of entering the feed length and feed rate into the DLC.

Feed Length and Feed Rate on a DLC with *Standard Interface Option*

The standard option setting allows entering/editing the feed length and feed rate directly from the keypad on the DLC control panel. Use the left/right arrow keys to position the cursor on the data line. Type over an existing entry to edit. Press the STORE key to save the new value. The cursor returns to home position.

Current Feed:	
Length	Rate
_001.234	12.2%

Feed Length and Feed Rate Display - Standard Interface, DLC-R

To scroll up or down to the previous or next row of displays from this display page, note that the cursor must be in the home position. It automatically returns to home after storing new data. Press the CR key or use the left/right arrow keys to properly position. Micro-adjust (explained later in this section) is allowed only when the cursor is in home or the first digit position.

When changing the feed length or feed rate value while the DLC is in cycle (on-the-fly), this new value typically takes effect on the next cycle. If you press the CR key, or leave the keyboard inactive for 30 seconds before pressing the STORE key, the cursor returns to home position and the program (and display) returns to the last stored information (data).

The decimal placement in the feed length depends on the setting in Parameter A100. The feed rate is a percentage of the Maximum Feed Rate set in Parameter A104.

If you press the CR key, or leave the keyboard inactive for 30 seconds before pressing the STORE key, the cursor returns to home position and the program (and display) returns to the last stored information (data).

Feed Length and Feed Rate on a DLC with the *IDS Interface Option*

When using the IDS option, the feed length and feed rate are entered into the DLC using the IDS thumb-wheel switches. This display shows IDS in the first line, indicating the option is selected. It does not contain a cursor or allow editing from the keypad. The display is only for information of the settings made through the IDS (connected to the RS-232 connector of the DLC). The display shows the last data entry processed after a two second delay from when the thumb-wheel switch is changed. If the serial port transmits an invalid character, a (*) will display instead of a digit (or digits). Enter the settings again, check connections, etc., until the display data is valid.

IDS Feed	
Length	Rate
001.234	12%

Feed Length and Feed Rate Display - DLC-R, with the IDS Interface Option

Feed Length and Feed Rate on a DLC with the *Batching Option Enabled*

The batching option allows setting multiple feed lengths and feed rates for each part and up to 99 different parts. The Current Part feed length display on Row C shows information for the current feed of the part currently executing or ready to be executed.

Procedures for entering/changing data (feed lengths, feed rates, etc.) for the batching option are described in this section under Rows G and H.

Current Feed	
Length	Rate
+001.234	12.2%

Feed Length and Feed Rate Display - DLC-R with Batching Option Selected

No cursor appears on this display for the DLC-R. However, micro-adjust (described later in this section) is allowed.

Additional Information Pages on Row C

From the DLC feed length / feed rate display, you can view additional information pages. These show settings made in different parameters. You cannot edit the parameter values from these pages. They are for information only.

Press the left (or right) arrow key from the feed length / feed rate display, until the desired Parameter Information page displays. The following summarizes the lines of information on these displays. Refer to Chapter 5 for further information on parameter entries.

Aux Fd	-010.000
Jog Step	000.500
Fd Incr.	000.050
Slug Cmp	000.650

Parameter Information Display

Auxiliary Feed Length - is a secondary feed length - entered in Parameter B103. Use an external switch to trigger the DLC to use this feed length instead of the standard one entered.

Jog Step - setting is entered in Parameter B108. This function is enabled/disabled from a display on Row A. In Manual Mode, pressing a jog key will cause the DLC to feed the length entered in the parameter, then stop (if the function is enabled, as further described under Row A).

Feed Length "micro-adjust" Increment - is set in Parameter B107. It allows you to fine tune (micro-adjust) the programmed feed length by adding or subtracting the value entered in the parameter.

To use this **micro-adjust** feature

- Press the arrow keys to display the main feed length / feed rate page (home display of this row). Simply pressing the (+) or (-) key on the keyboard adds or subtracts the increment to or from the previously programmed feed length and automatically stores the new value. The micro-adjust feature works from this display page for both the standard DLC and batching interface options, and on the Batch Feed Programming display (row G), and other pages as noted.
- A (+) key will add the value entered in Parameter B107 to the programmed feed length and store the new value. If the Feed Length Maximum Limit (B104) or the Maximum Change (B106) are exceeded, a minor error is issued. A (-) key will subtract the value entered in Parameter B107 from the programmed feed length and store the new

value. If the Feed Length Minimum Limit (B105) or the Maximum Change (B106) are exceeded, or the change results in a zero feed length, a minor error is issued. Micro-adjust will not cause the digits to roll-over (past 000000 to 999999) or a change in feed direction (past 000000 to negative).

- If one of the limits is exceeded (Maximum Limit, Minimum Limit, Maximum Change), the respective error occurs. The error may be cleared while the Batch Feed Programming page displays by entering a correct feed length and pressing the Store key, or by pressing the (+), or (-) keys until a correct feed length is entered. A Feed Length Limit minor error can be cleared also by storing a legal value while in the Batch Feed Length / Feed Rate Programming page (Row F).

Slug Width Compensation - value is entered in parameter B122. This is used in applications that remove a slug from the material being fed. This value is added to the feed length to compensate for the material removed.

Press the left (or right) arrow key from the feed length / feed rate display, until the desired Parameter Information page displays. These displays are for information only.

Min Feed	000.500
Max Feed	100.000
Max Chg.	010.000
Units	in.

Parameter Information Display

Minimum and Maximum Feed Length Limits - are set in Parameters B105 and B104 respectively. These limit the range of the feed length entry that the DLC will accept.

Maximum Change - setting is made in Parameter B106. This parameter limits the amount that the programmed feed length can change during an Automatic Mode cycle before causing a fault to occur.

Units Setting - selection is set in Parameter B101, as desired for the application. It can be set for inches (in), feet (ft), millimeters (mm), degrees (deg), etc.

Row D (Refer to the "Display Map" in *Figure 2-2: Map of CTA Control Panel Display Pages*)

Pressing the down arrow key from any display in Row C, changes to the Measuring Wheel (M.W.) Display (Row D), if enabled in Parameter B112. The Measuring Wheel Select input must be high to enable Length Compensation in Automatic Mode, or parameter B112 has an option to enable it without an input.

The Measuring Wheel position page shows the current position of the measuring wheel and the Axis being used for Length Compensation. The STORE key will freeze the display for two seconds.

Axis 1	+001.234
M.Wheel	+001.240

M.W. Position Display

The M.W. position display is active in all modes regardless of the M.W. Select input so that deviation can always be checked.

Pressing the right or left arrow key will cause display of the axis and measuring wheel feed constants, as set by parameter. These are useful when fine-tuning the system. Editing of parameters is allowed only in Parameter Mode.

A101	0001.0000
B116	0001.0020

M.W. Parameter Display

Refer to Chapter 4, and to the Parameters B112, B116, and B117 in Chapter 5 for further information on the Measuring Wheel feature.

Row F (Refer to the "Display Map" in *Figure 2-2: Map of CTA Control Panel Display Pages*)

*Press the down arrow key from any page in Row C to see the Batch **Current Part Information Display** (if Batching option is selected). This section overviews the display pages used in batching. Refer to Chapter 4 for additional information on batch programming options.*

INFO_01	11111111
Qty	000100
Count	000001
Feed 1	Cnt 001

Current Part Information Display

This is a real-time display that shows most current information for the current part (part currently executing or selected to execute next). The part block and part ID number will change as each part executes in the batch program. The part quantity and count show the quantity of the current part to execute and the number executed. The count mode can be selected in parameter to count up or count down. The current feed number changes with each feed. The current feed count increments or decrements, depending on the count mode selected. The current feed length and feed rate display on the Feed Length page (Row C).

If the part is programmed to execute continuously, FREERUN will display in place of quantity and count will always increment. If the part is linked to use more than six feeds, quantity is replaced by "+++++" or "Linking Part" until feeds execute to the page which includes the quantity for the part. Then, the quantity displays and "INFO" changes to "LINK" on this display.

In addition to displaying real-time part information, the selection of the starting part number and micro-adjustment of the current part count are done from this page.

Use the arrow keys to move the cursor in the data fields. Type over the part block number or the part ID number to select the starting part to execute (can start with any of the up to 99 parts programmed). Press the STORE key. If the current part is selected as the starting part, the batching program will be reset to the start of the current part. The starting part entry is allowed only when the DLC is not in an Automatic Mode cycle. Note that batching information must be programmed into pages on the following rows before using this page to start the batching program.

The current part count can be micro-adjusted from this page. Press the right arrow key to move the cursor out of home position, then press the down arrow key to move the cursor to the first digit of the Count data field. Press the + key to add to the count; press the - key to subtract from the count. Key use for increasing/decreasing the total number of parts to execute is dependent on the count mode selected (count up or count down).

Row G (Refer to the "Display Map" in *Figure 2-2: Map of CTA Control Panel Display Pages*)

Press the down arrow key to see the **Batch Main Programming Display** page.

Main_01	11111111
Jump to Block	02
Quantity	000010
Early Warn	002

Batch Main Programming Display

Batching programs are entered on this page using part data entered on the following related pages. This section summarizes the programming procedures. Refer to Chapter 4 for more specific information on entry procedures and options available.

From this page, enter the Part ID number, the next block to jump to, the part quantity, and the Early Warning count for each part.

Within the page, use the right and left arrow keys to move the cursor through the data fields. The cursor will wrap from row to row within the page. Other than home position, pressing the up or down arrow keys causes the cursor to move to the first position of the next or preceding row in the display. Type over data to change. Press the STORE key to save any changes (saves all data as currently displayed) and return the cursor to home position. Press

the CR key before pressing STORE to clear any changes to data (reverts to data previously saved) and return the cursor to home position.

Press the + / - keys to scroll through batch main programming pages and enter information for each part, numbers 01 to 99.

Press the CR key to toggle between the Batch Main Programming page and the **Batch Feed Programming Display** page for each part.

Part_01	11111111
Feed 1	Cnt 001
Length	Rate
+012.345	67.8

Batch Feed Programming Display

There can be up to six Batch Feed Programming pages associated with each Batch Main Programming page. From these pages, enter data for up to six feeds per part, including *feed quantity, length, and rate*.

Press the + / - keys to scroll through feed programming pages (with the cursor next to "Feed" in the display) and view/enter information for each feed required for the part (feed 1 up to feed 6).

Enter data for part 01 on the main programming page. Press CR and enter data for the first feed required for part 01. Press +, enter data for the second feed for part 01, etc. Return to the main programming page. Press +, enter data for part 02. Press CR and enter data for the first feed required for part 02. Press + and enter data for each feed required for part 02. Continue this process for each part

Chapter 3. Functional Description - Standard Features

Several input / output signals of the DLC control provide communication with the other components of the machine. This chapter describes the functional operation of the interfacing inputs and outputs of the DLC.

The first sections of this chapter describe the various interface functions in terms of the inputs / outputs involved with each. This section is followed by an individual description of each pre-defined I/O signal, including name, pin assignments, and functional description. The machine designer utilizes these signals as necessary to implement the DLC for his application, including the design of his system control panel. Also refer to the appendix for example system wiring of these and other optional signals.

3.1 Signal Definitions

The states of the input and output signals described in this manual are:

High = +24 Vdc

Low = 0 Vdc

A signal line is described as "active high" when its associated action is initiated by a high (+24 Vdc) signal level. It is described as "active low" when its function is initiated by a low signal (0 volts). This chapter describes the function with the active state of each I/O connection.

3.2 Interface Descriptions

The DLC interfaces with a feed device of some type. The DLC system is designed for control of a continuous indexing process, such as a press feeder. The DLC input and output signals provide communication to/from the machine builder's equipment, and should be considered as functional groups of signals, working in concert. These functions include:

- Operating Mode Selection
- Servo System Operation Enables
- Safety Interlocks
- Normal Operation Signals
- Handshaking, or Press (or Processing Station) Permissive Interface
- Jogging Inputs
- Set up Mode
- Fault/Diagnostic Circuitry

The following functions are further described in Chapter 4.

- Batching
- RS-232/485 Multi-format Communications Interface
- Measuring Wheel
- Single Step Using Start and Stop Inputs

The following sections describe the basic operation theory of the DLC. They group signals by interface function, listing the I/O signals involved (and section where each signal is individually described), then describe the general function of the signals. These signal descriptions apply to the DLC-R except where specifically noted. Later sections in this chapter describe the I/O connections/signals individually, as required by the machine builder and for troubleshooting.

Figure 3-7: X17 Input/Output Connector Showing Input Pin Designations illustrates the X17 I/O connector and the signal designation for each pin.

Operating Mode Selection

Input Signal Descriptions (See Page 3-15)

- Parameter Mode Select
- Automatic Mode Select
- Set up Mode Select

Output Signal Descriptions (See Page 3-23)

- Manual Mode Indicator
- Automatic Mode Indicator
- Parameter Mode Indicator
- Set up Mode Indicator

The DLC will always be in one of four operating modes:

Parameter Mode	- Allows entry/verification of the parameters required to set the control for the specific requirements of the application.
Automatic Mode	- Either continuous or intermittent feeding operations occur (automatically cycles).
Set up Mode	- Used to set up for the automatic material feed. Especially useful in a metalforming system with progressive dies.
Manual Mode	- Default mode when none of the above are selected. Used to jog the material forward or reverse through the system.

Parameter, Automatic and Set up Modes are selected by bringing the appropriate signal line high (+24 Vdc). A fault is diagnosed and an "Invalid Mode Selection" error message is issued if both Automatic and Set up Mode signal lines are high simultaneously. However, the Parameter Mode input overrides any other mode presently selected.

The suggested interface design is to wire the Parameter Mode signal to a key-switch, where a key is required to enter Parameter Mode, and/or mount the switch inside the electrical cabinet. This helps to prevent unauthorized parameter changes. Wire the Automatic and Set up Mode input signals to a three-position selector switch, where Manual Mode is selected when the switch is set to an open contact position. This method prevents selecting Automatic and Set up Mode at the same time.

The DLC has outputs to verify the currently selected mode. These are typically wired to indicator lights on the user's control panel (or to a PLC for total system control).

Safety Interlock

Input Signal Descriptions (See Page 3-15)

- Emergency Stop

Output Signal Descriptions (See Page 3-23)

- NA

As described above, the DLC and its servo must perform operational checks and provide the proper signals to enable operation.

Emergency Stop -- The Emergency Stop input must remain high for the DLC to operate. The system incorporates an Emergency Stop (E-Stop) chain, which is a circuit connected in series to both the DLC and the user's machine. Should any sensor in the E-stop chain open, all press and feed operations immediately stop. Note that the time taken to stop depends on the wiring method used, inertia of the machine, press clutch/brake retaining circuit, etc.

Elements connected in the E-stop chain commonly include the Emergency Stop switch on the user's control panel; E-stop switch(es) on the press or feeder; switches on lubrication or coolant pumps; and various die guards and safety interlock switches.

Normal Operation Signals

Input Signal Descriptions (See Page 3-15)

- Cycle Start
- Cycle Stop
- Feed Interrupt

Output Signal Descriptions (See Page 3-23)

- Feed In Progress Indicator
- Feed Complete Indicator
- Axis #1 In Position Indicator
- Feed Interrupt Indicator

The automatic feed cycle begins when the Cycle Start line goes high (momentary) with the DLC in Automatic Mode. Once the automatic feed cycle begins, it is normally stopped by a Cycle Stop input (line goes low, momentary). Feed will stop after completing the current cycle. The system will also stop if a fault is detected, either immediately, as an Emergency Stop, or after the cycle, as a Cycle Stop, depending on the level of the fault.

In Automatic Mode, a Single Step can be performed by activating the Cycle Stop + Cycle Start simultaneously. The DLC will step one feed and one press stroke. With batching enabled, activating Part Stop + Cycle Start simultaneously causes the DLC to perform the feeds and press strokes for one part.

Several outputs are issued by the DLC during normal system operation. They include:

- Feed in Progress Indicator - Indicates that a feed is in progress and the feed axis is not within the position threshold specified in parameter A110.
- Feed Complete Indicator - Indicates that the commanded feed is complete and the axis is within the position threshold.
- Axis In Position Indicator(s) - Indicates that the feed axis has stopped within the position threshold specified in Parameter A110.

A feed interrupt can occur as a normal part of an automatic cycle. A high on the Feed Interrupt input indicates normal operation. If this signal goes low, the feed cycle is interrupted, the Feed Interrupt Indicator output goes high and an appropriate status message appears in the display. When the signal is restored high, the feed cycle immediately resumes.

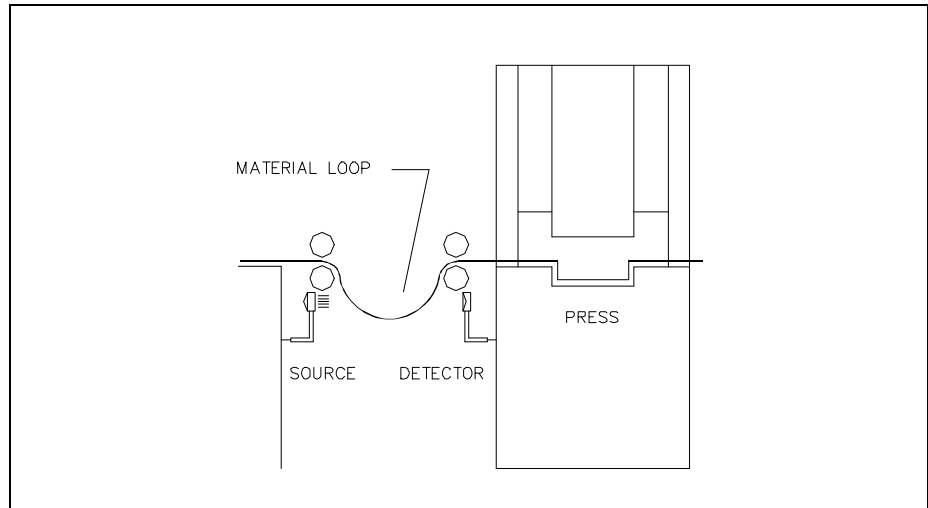


Figure 3-1: Use of Feed Interrupt Input

This signal is often used in conjunction with a material loop, as illustrated in *Figure 3-1: Use of Feed Interrupt Input*. Material is fed through a leveler or straightener into a looping pit, with an optical sensor in the pit tied to the feed interrupt line. If the material pulls too tight, Feed Interrupt goes low and the feed cycle is interrupted. As soon as an adequate amount of material is fed into the looping pit, the signal returns high and the feed cycle immediately resumes.

Warning: *If the automatic cycle is interrupted by a low on the Feed Interrupt line, all feed motion is suspended. Once this signal is restored high, the feed cycle will **immediately** resume. Personnel should use extreme caution when entering the work area if the feed has stopped as a result of this signal.*

Normally a Feed Interrupt is of short duration, so it only stops the feed momentarily; it does not stop the press (ram) operation. Should the feed remain interrupted too long, the Feed Angle input from the press will drop (before the feed cycle is completed) and the system will be halted with a diagnostic error message displayed.

Press Permissive Interface

Note that the following description refers to the operation of a press and press feeder. These descriptions are equally valid for a feed system with other types of processing station, such as a seal-shear station or a thermoforming station.

Input Signal Descriptions (See Page 3-15)

- Feed Angle
- Press Continuous/Intermittent Select

Output Signal Descriptions (See Page 3-23)

- Press Immediate Stop
- Permit Press

The control system is designed such that feeder operation can occur only when a series of permissive conditions are true. This is accomplished by a group of handshaking inputs/outputs between the DLC and the press interface. They are described below in the general order of occurrence.

- Press Continuous/Intermittent - Input from the user's control panel which selects the press operating mode. Continuous specifies continuous press cycling, synchronized with the material feed. Intermittent specifies that the press will be cycled one time at the end of, or just previous to each feed cycle.
- Cycle Start - Momentary input signal from the user's control panel that starts the automatic feed cycle *see Normal Operation Signals*.
- Permit Press - Output from DLC used to permit engagement of the press clutch (if all other safety logic circuitry on the press is satisfied). This output allows press operation differently when Continuous or Intermittent mode is selected, as described in the following sections.
- Feed Angle - Input, generally from a limit switch or sensor on the press or processing station, indicating that material can safely be fed. For a punch press this signal would come up shortly after the ram clears the material on its upstroke. *See Figure 3-2: Generation of Feed Angle Signal*. The signal would drop (go low) on the ram downstroke, allowing some safety margin before the ram reaches the material. The material feed must have stopped before this signal drops or the feed will stop immediately and an error will display.
- Press Immediate Stop - Output from the DLC, issued when a Feed Angle Lost During Feed! or other various faults are detected. *See Press Immediate Stop, page 3-28 for details*. This signal commands the user's circuitry to stop the press (or other machine) as soon as mechanically possible, rather than stopping after the current cycle is complete (as with a Cycle Stop).

Warning: *The Press Immediate Stop signal must be incorporated into the safety logic circuitry of the machine. Note that safety design of the system is the responsibility of the machine tool builder.*

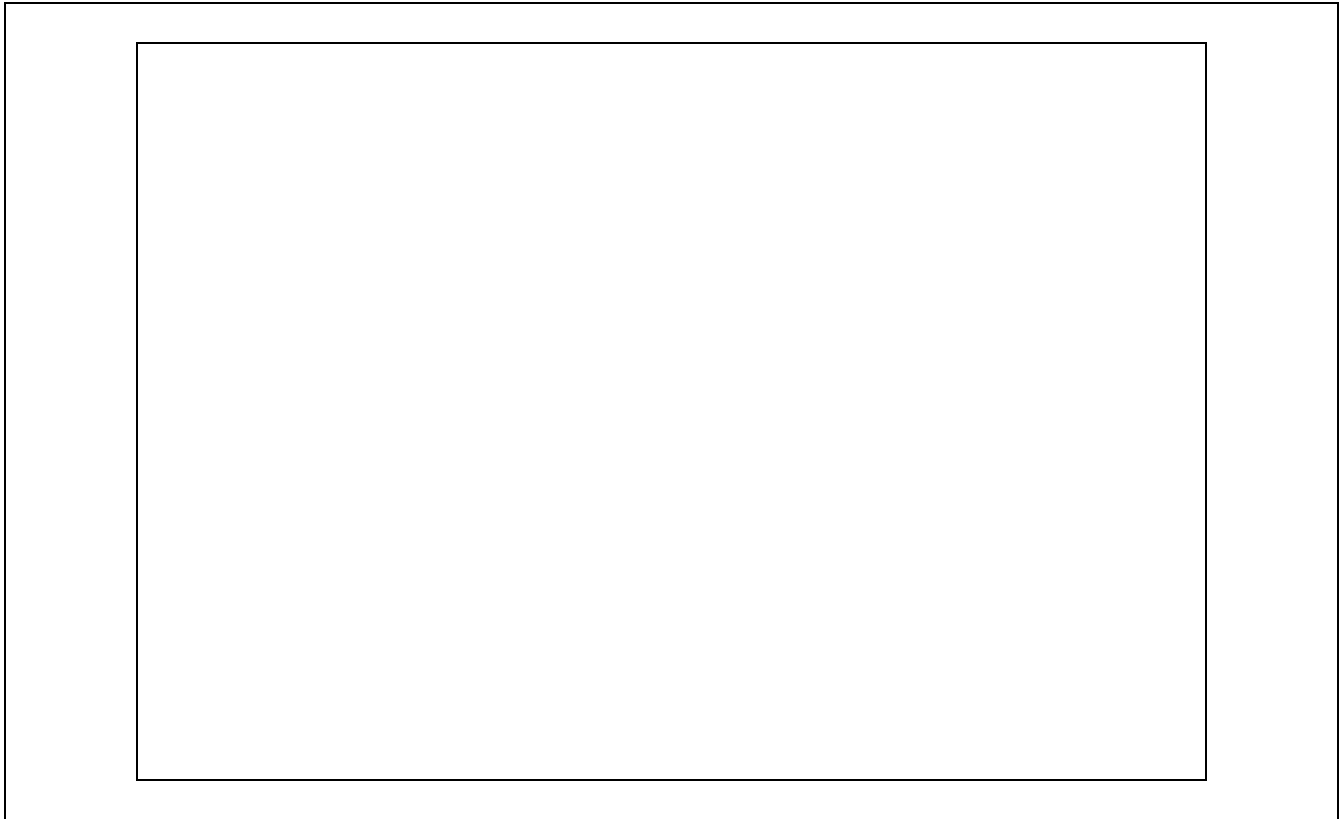


Figure 3-2: Generation of Feed Angle Signal

Press Continuous Operation

Conditions: Automatic Mode input high
 Press Continuous/Intermittent input high

1. Cycle Start input (momentary) goes high.
2. DLC issues the Permit Press output at the appropriate point and maintains it until the automatic cycle ends. Permit Press should be used by the press system to engage the press clutch for automatic cycling - IF all other press safety logic circuitry is satisfied.

Parameter B109 allows selecting one of two continuous modes, Press Before Feed or Feed Before Press. Figure 3-3: Continuous Mode - Press Before Feed and Figure 3-4: Continuous Mode - Feed Before Press are timing charts which illustrate these operations.

3. When the Feed Angle input from the user interface goes high, the DLC commands the servos to operate, feeding material to the length and at the feed rate specified by the operator.

During the cycle, the DLC issues various outputs, which are normally wired to indicators on the user's control panel.

- a. Feed In Progress output is issued while the feed is occurring.
- b. Feed Complete output is issued when the feed is complete and the axis is within the position threshold.
- c. Axis #1 In Position output is issued once the axis has arrived within the parameter-specified in-position threshold window.

If Feed Angle is lost during a feed, the DLC decelerates the feeder to a stop and issues a diagnostic message. This typically indicates that the press cycle is too fast. It does not allow sufficient time for a complete feed to occur between when the ram leaves the material on its upstroke (Feed Angle goes high - feed begins) and when the ram approaches the material on its downstroke (Feed Angle drops low - is lost).

If Feed Angle is lost, or the automatic cycle is ended, the Permit Press output is dropped. The machine builder typically employs a press clutch engagement retaining circuit that retains clutch engagement until the press ram reaches Top Dead Center and is stopped. The timing for stopping the press depends on whether Press Before Feed or Feed Before Press is selected. See *Figure 3-3: Continuous Mode - Press Before Feed* and *Figure 3-4: Continuous Mode - Feed Before Press for timing details*.

The Press Immediate Stop output is also dropped low when Feed Angle is lost during a feed or various faults are detected. If this signal from the DLC is wired to the press, it should attempt to stop as soon as mechanically possible.

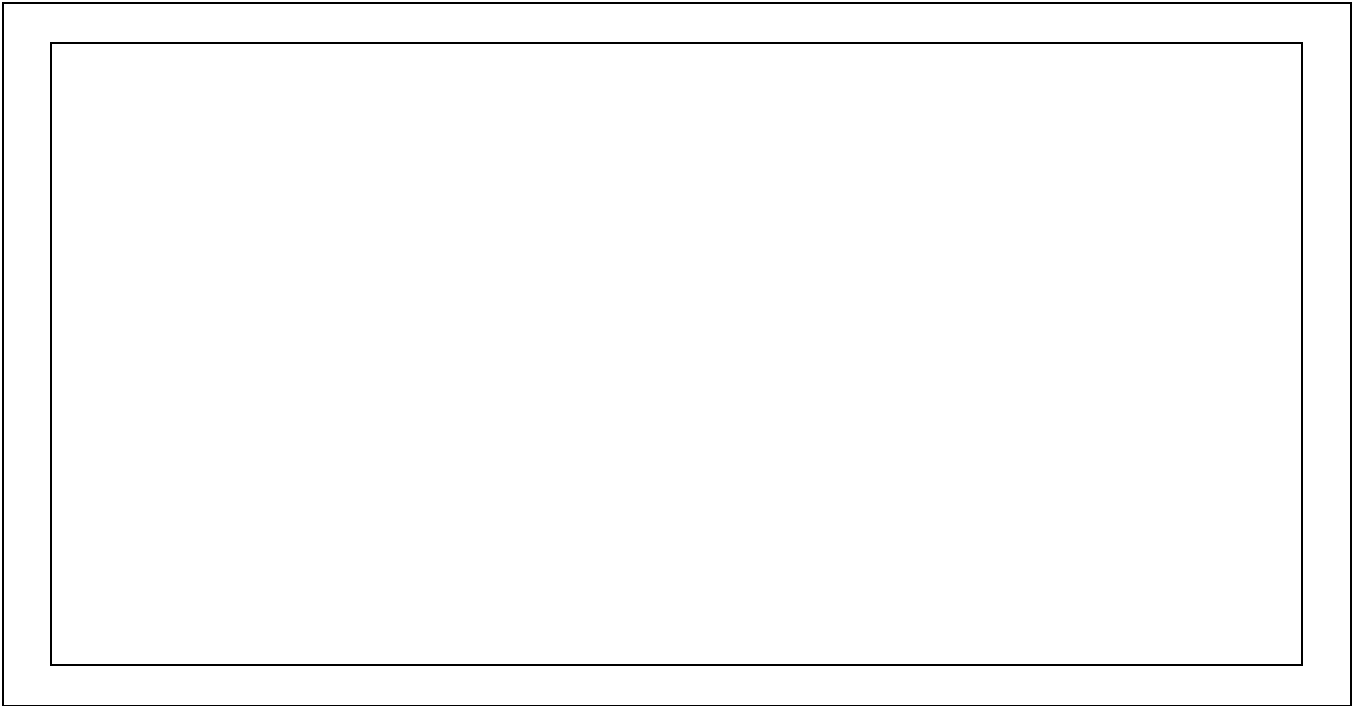


Figure 3-3: Continuous Mode - Press Before Feed

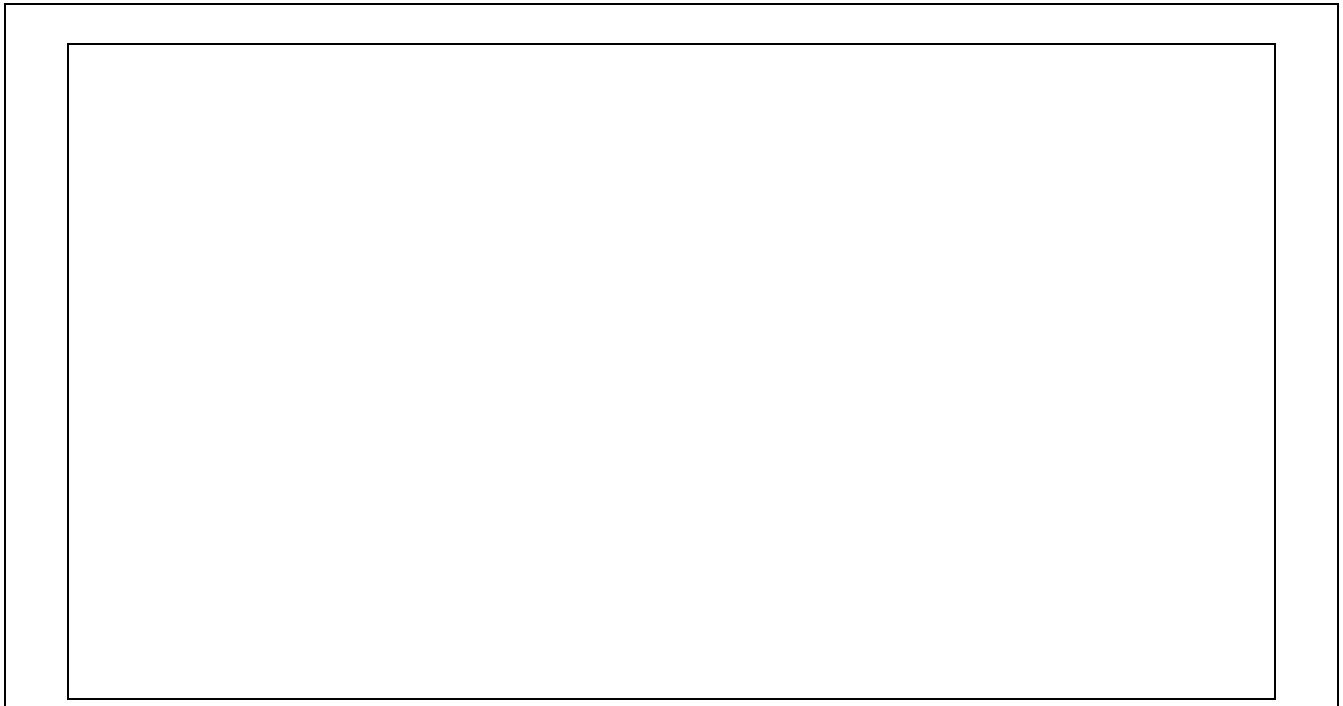


Figure 3-4: Continuous Mode - Feed Before Press

Press Intermittent Operation

Conditions: Automatic Mode input high
 Press Continuous/Intermittent input low

1. Cycle Start input goes high.
2. The DLC issues the Permit Press output to initiate engagement of the press clutch on a per cycle basis. The Permit Press signal is dropped when the Feed Angle goes low.

The system typically operates as described below. Refer to Figure 3-5: Intermittent Mode - Press Before Feed and Figure 3-6: Intermittent Mode - Feed Before Press for timing charts which further explain intermittent Press Before Feed and Feed Before Press Modes.

3. When the Feed Angle input from the press goes high, the next feed movement is initiated. At the completion of the feed, the Permit Press output is issued, if and only if the Minimum Cycle Time has elapsed. These actions occur at the appropriate time, depending on the selection of Press Before Feed or Feed Before Press.

During the cycle, the DLC issues various outputs, as described under continuous operation above.

When Feed Angle goes low, Permit Press output is also pulled low. Because of the press clutch retaining circuitry that most press builders employ, the press completes one cycle. The press clutch engagement retaining circuit releases the clutch and sets the brake such that the ram stops at Top Dead Center (TDC). The press then waits (dwells) until the DLC initiates the next press cycle.

The minimum amount of dwell time at TDC is controlled by the time value entered in Parameter B109. If the minimum cycle time is less than the sum of the press cycle time plus the feed time, the Permit Press will be issued immediately (output high) at the end of the feed.

The Press Immediate Stop output is also pulled low when Feed Angle is lost during a feed, or other various faults occur. See *Press Immediate Stop Page 3-28*. If the user has wired this signal to his press, it will attempt to stop as soon as mechanically possible.

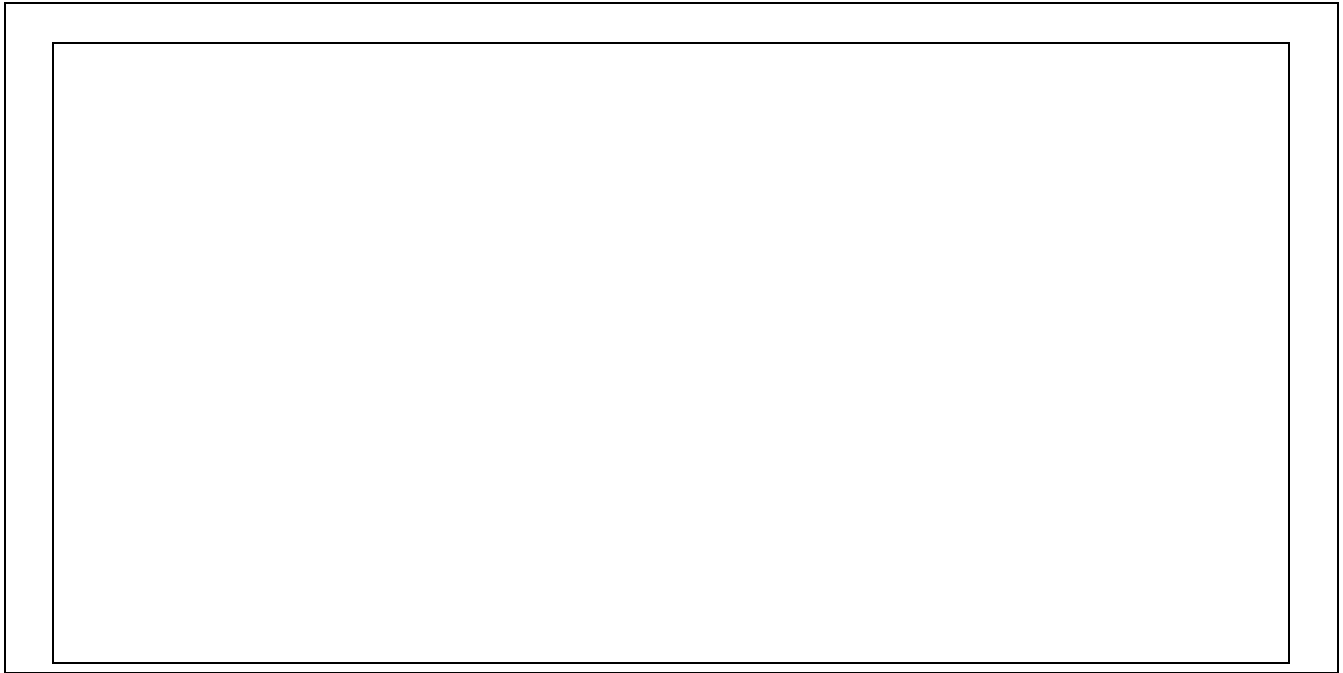


Figure 3-5: Intermittent Mode - Press Before Feed

T=Minimum cycle time specified by Parameter B109 when the press is in intermittent operation. S=Stroke

* T is longer than the cycle time needed by the press and feed sequence, therefore it limits the stroke rate.

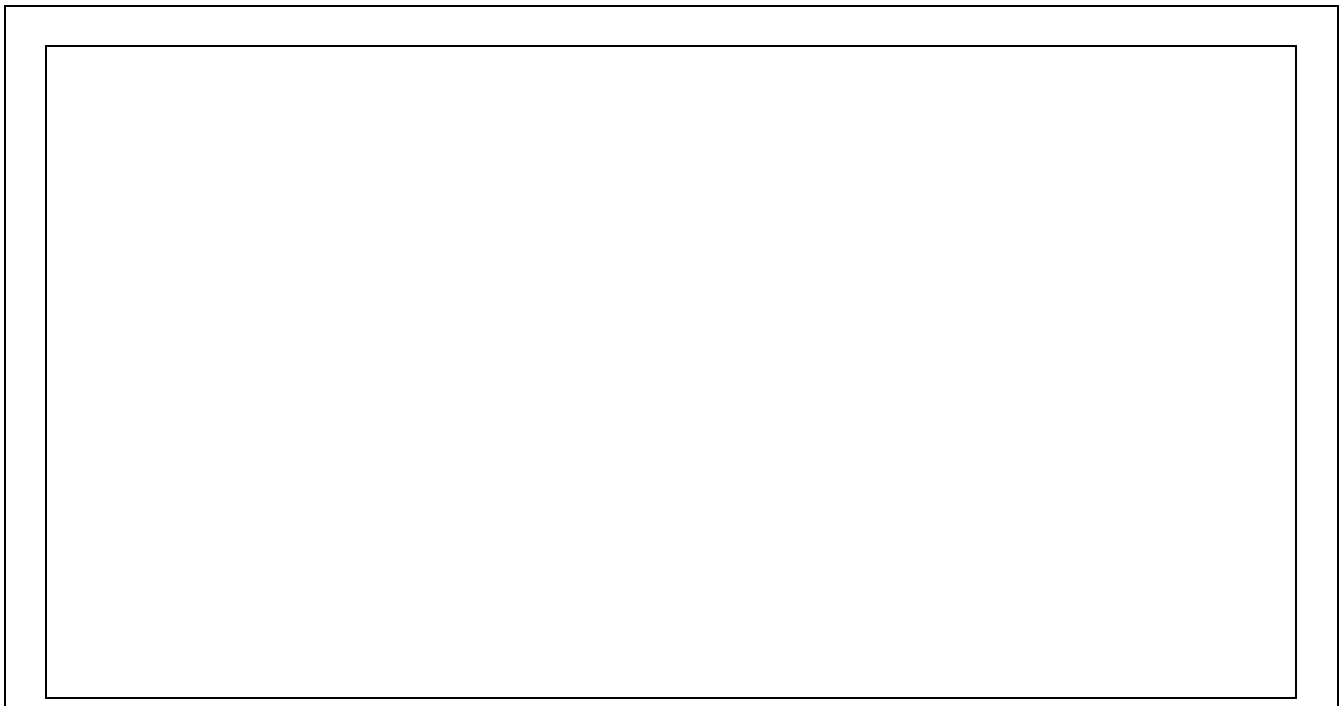


Figure 3-6: Intermittent Mode - Feed Before Press

T=Minimum cycle time specified by Parameter B109 when the press is in intermittent operation. S=Stroke

* T is shorter than the cycle time needed by the press and feed sequence, therefore it has no effect on the stroke rate.

Jogging Inputs

Input Signal Descriptions (See Page 3-15)

- Axis 1 Jog Forward
- Axis 1 Jog Reverse

Output Signal Descriptions (See Page 3-23)

- NA

The DLC's Jog inputs allow jogging the material forward and reverse. Parameter A105 specifies the jog feed rate. It usually is set to approximately 10% of the maximum feed rate. It can never be more than the maximum feed rate.

In Manual Mode, a high on the Jog Forward (Reverse) input causes the axis to feed forward (reverse) at the velocity set in Parameter A105, as long as the respective jog input is high. If Jog Step is set ON (from DLC control panel display), the DLC feeds material at the jog velocity until the jog input goes low (jog button released) or the step length (set in Parameter B108) has been reached.

The Jog inputs are not functional in Parameter or Automatic Modes. The effect of these inputs in Set up Mode is described in the following section.

Set up Mode

Set up Mode is normally used to jog the material through the feeder for set up in progressive die applications. A progressive die application has multiple stations. A series of feeds and press strokes, moves the material through multiple stations in a single die to produce a finished part.

It is often necessary to manually thread the leading edge of the material through the die to set up the operation. In order to avoid damaging expensive dies during set up, in most cases it is critical to cycle the press only after a full feed has been made for each progression. The press must be cycled, before the feed for the next progression can occur.

The DLC Set up Mode ensures this sequence. It allows the user to set up his feeder by running several progressive feeds (using the jog inputs) and manually cycling the press after each feed.

When Set up Mode is selected, the jog inputs function differently than in Manual Mode. As in Manual Mode, a high on the Jog Forward input causes the axis to feed forward at the parameter-specified jog velocity. However, unlike Manual Mode, no matter how long the Jog Forward is maintained, the axis will feed only the feed length entered on the DLC control panel, then stop. If Jog Forward is released before the feed is

complete, the feed will again continue (until feed length is complete) when Jog Forward is pressed again.

The DLC will allow the press to be manually cycled only when the user-selected feed length is complete. *See notes below.* Another feed will not be allowed until the press has cycled (DLC sees Feed Angle drop, then return). Once this occurs, the jogging process described above can be repeated (after changing the feed length entry, when required) until the material has been threaded through all stations in the die.

Note that an error will be detected if Set up Mode is exited prior to completing the feed and cycling the press. However, selecting Set up Mode again clears the error and allows completion of the set up operation.

In Set up Mode, if the Jog Reverse signal is high, the axis feeds in reverse at the parameter-specified jog velocity. However, Jog Reverse will only function if the feeder had previously been jogged forward, and the reverse jog can only be as far back as the starting point of the feed. If the feeder is already at the beginning of a feed length, reverse feed in Set up Mode is not possible.

NOTES:

- *The Set up Mode is sensitive to Press Before Feed (PBF) and Feed Before Press (FBP) Interface Modes.*
- *When using FBP, the first action required is for the axis to be fed the commanded length. The sequence is completed by the press being cycled manually.*
- *When using PBF, the first action required is the press being cycled manually, followed by the axis being fed the commanded length.*
- *The Permit Press output will be turned ON at the appropriate point in the cycle, depending on the Press Interface Mode selected (PBF or FBP).*
- *If batching is enabled, Set up Mode can only use the current feed length. For multiple feed lengths, set up can be simulated by using Single Step (Cycle Stop + Cycle Start) in Automatic Mode, although this causes an automatic press cycle, not manually cycled.*

Fault/Diagnostic Monitoring

Input Signal Descriptions (See Page 3-15)

- Resume Cycle
- Clear

Output Signal Descriptions (See Page 3-23)

- System Fault Indicator

The DLC includes extensive diagnostic monitoring circuitry, detecting normal operating status, operator errors, errors in the control itself and machine faults.

There are several categories of faults, as described in Chapter 8. In general, once a fault is detected, an error message is displayed on the DLC display and the feeder and press are halted (either immediately or after the cycle is complete - depending on the type of fault).

The fault recovery procedure is to first troubleshoot and remedy the problem. Then, press the Clear key (or external Clear input) to clear the DLC fault status and diagnostic message on the display.

For a Soft Fault or Minor Error, a momentary high on the Resume Cycle input will continue Automatic Mode cycling. For a Hard Fault, the system must be restarted.

Diagnostics and fault troubleshooting procedures are described in Chapter 8.

3.3 Input Signal Descriptions

This section describes the Inputs to the DLC control from external sources.

The connector and pin numbers of these signals are described in the following sections and shown in Figure 3-7: X17 Input/Output Connector Showing Input Pin Designations.

Each section indicates the connector and pin number, the general function of the input signal, and the results when the signal level is in the active state, high and/or low.

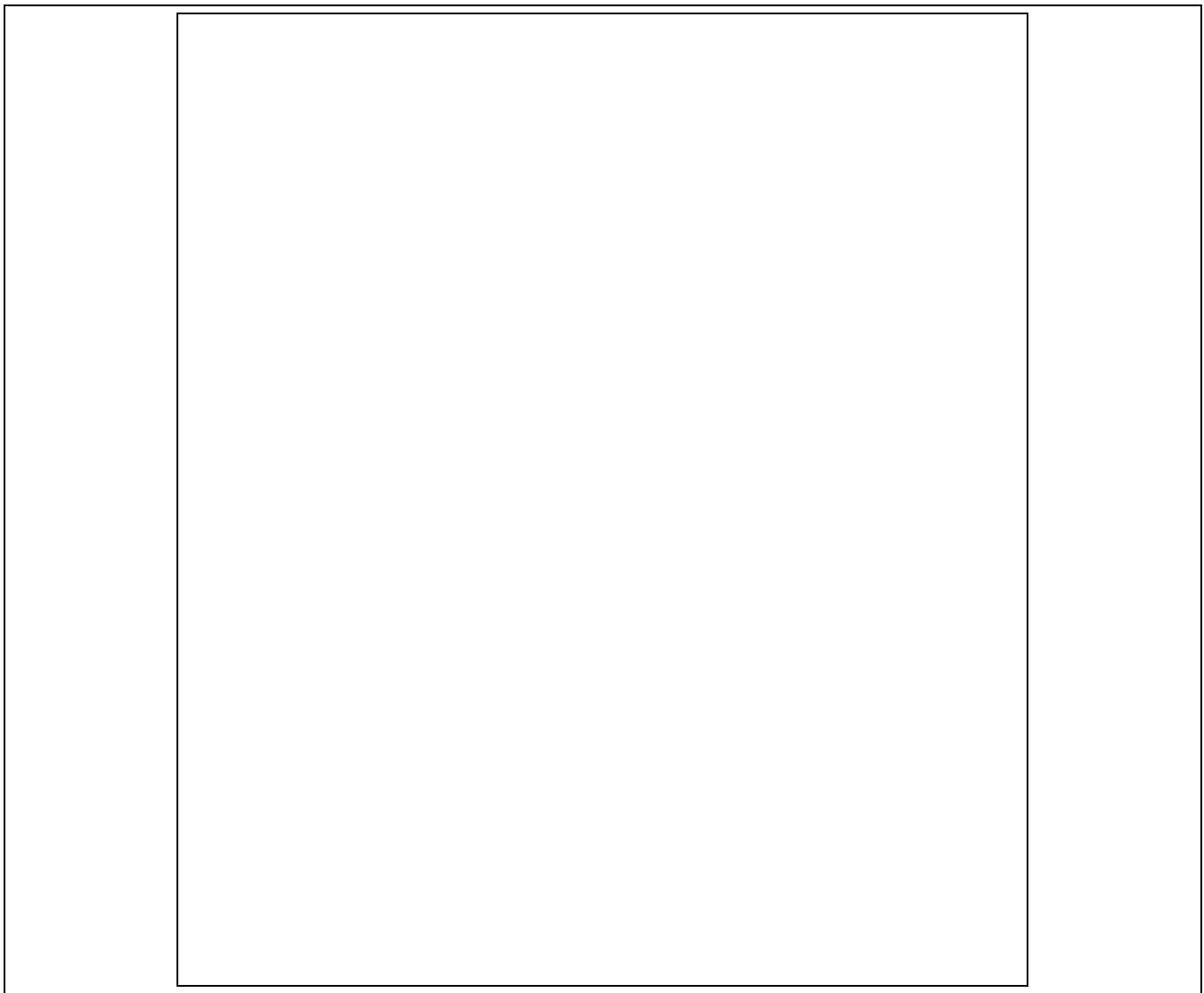


Figure 3-7: X17 Input/Output Connector Showing Input Pin Designations

Parameter Mode Select

Connector	-	X17, pin 1
Function	-	(Input) Selects Parameter Mode
High	=	Parameter Mode selected.

The Parameter Mode Select overrides any other mode selection input. Selecting Parameter Mode while either Automatic or Set up Mode is already selected, does not cause an error. When Parameter Mode is de selected, the DLC returns to the previously selected mode - Automatic, Set up, or Manual (default when no other modes are selected).

Automatic Mode Select

Connector	-	X17, pin 2
Function	-	(Input) Selects Automatic Mode
High	=	Automatic Mode selected (Parameter Mode can override selection).

Emergency Stop

Connector	-	X17, pin 3
Function	-	(Input) Commands Motor Drive to immediate stop
High	=	Allows the DLC to operate.
Low	=	The motor drive is commanded immediately to zero velocity. Drive reaches zero speed in the minimum time possible - given the inertia and maximum torque available. The DLC issues an "Emergency Stop" diagnostic message.

WARNING: *This signal must be used to ensure safety.*

Conditions which warrant pressing the E-Stop include:

- Any condition posing an immediate danger to personnel.
- A jam in the machinery or any other condition that poses an immediate harm to the system equipment.

Cycle Start

- Connector - X17, pin 4
- Function - (Input) Starts automatic feed cycle
 - High = (momentary) Starts the automatic feed cycle when the DLC is in the Automatic Mode.

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

Resume Cycle

- Connector - X17, pin 5
- Function - (Input) Used to resume the automatic cycle after a soft fault or minor error is cleared (refer to section 3.3.8)
 - High = (momentary) Causes the automatic cycle to resume from its point of interruption.

This input is typically wired to a normally open (momentary) push-button switch on the user control panel.

Feed Angle

- Connector - X17, pin 6
- Function - (Input) Controls the DLC feed cycle. *See Normal Operation Signals.*
 - High = Indicates that material can be fed safely. When this signal goes high in Automatic Mode, it initiates the next feed cycle.
 - Low = Indicates that material cannot be fed. In a metal forming application, a low signal indicates the press ram is into or too close to the material to allow feeding.

In a metal forming application, after the press leaves the material on its upstroke, a switch or sensor is activated. *See Figure 3-8: Feed Angle Switch Layout.* This switch provides a high signal to the DLC during the rotation angles that the ram is clear of the material and it is permissible to feed.

If Feed Angle goes low during a feed, the DLC issues the Press Immediate Stop output in an effort to avoid processing an incorrectly fed length. The soft fault diagnostic message "Feed Angle Lost During Feed" is issued. This fault typically indicates that the press cycle is too fast. It does not allow sufficient time for the feed cycle to complete before the ram is too close to the material to allow feeding.

If the material slips out of the position window (set in Parameter A113 as the Low FA Threshold) after/while the Feed Angle is low, the soft fault diagnostic message "Movement While FA is Low" is issued.

This input is typically wired to a limit switch or sensor on the press. See *Figure 3-8: Feed Angle Switch Layout*.

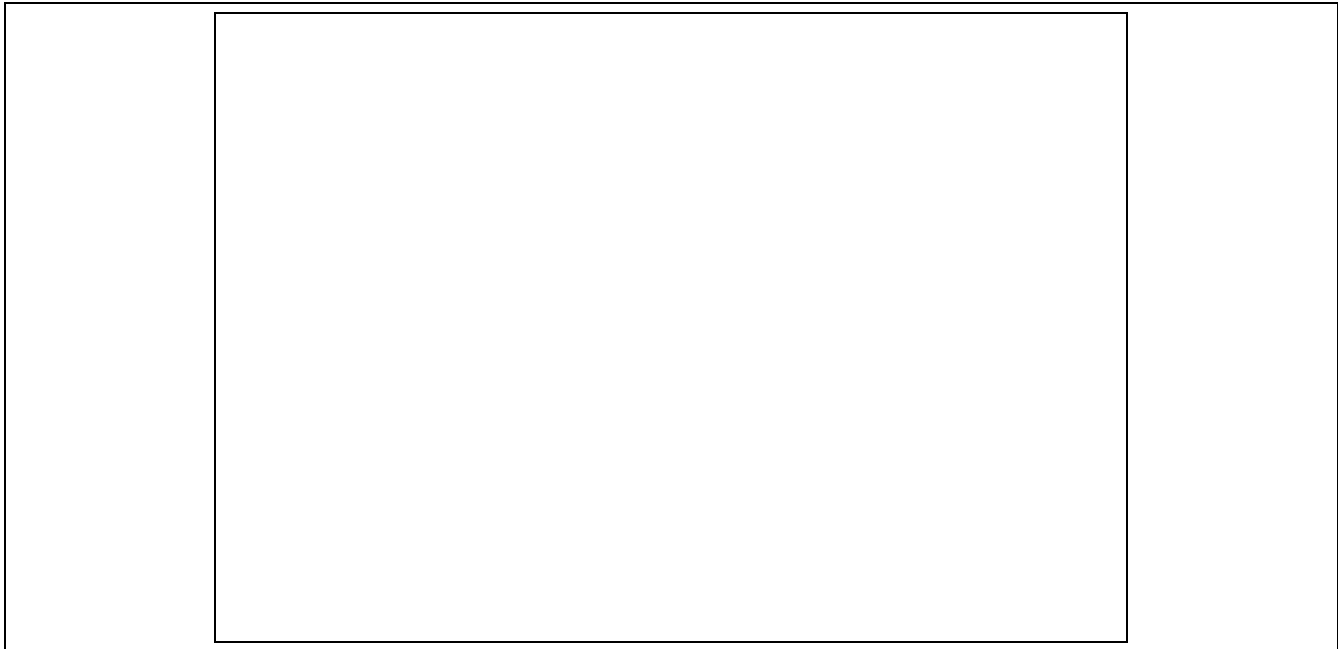


Figure 3-8: Feed Angle Switch Layout

Feed Interrupt

Connector - X17, pin 7

Function - (Input) Used to interrupt the feed cycle

High = Indicates normal operation. If not using this function, this signal line must remain high for the DLC to operate.

Low = Loss of a high signal interrupts the feed cycle (feed decelerates). The DLC displays a "Stop Due to Interrupt Input" diagnostic message and turns on the **Feed Interrupt Indicator output**. Once the signal is restored, the feed cycle resumes automatically in Automatic Mode. In Manual or Set up Modes, jogging is interrupted. When restored, jogging will resume if commanded.

This input is typically wired to a normally closed switch or optical sensor for material loop detection. If a feed interrupt occurs, it typically means you should slow the system so it is not tugging material (causing loss of loop/tight loop), or you should increase the speed of the uncoiler.

WARNING: *If the automatic cycle is interrupted by a low (0 Vdc) on the Feed Interrupt line, all feed motion is suspended. Once this signal is restored (+24 Vdc), the feed cycle will **immediately** resume. Personnel should use extreme caution when entering the work area if the feed has stopped as a result of this signal.*

It is recommend to use the **Feed Interrupt Indicator output** to advise operating personnel when this condition exists.

Clear

- Connector - X17, pin 8
- Function - (Input) Clears the Hard or Soft Fault status of the DLC
 - High = (momentary) - Clears the Soft Fault status of the DLC, or Clears the Hard Fault status and re-initializes the DLC.

Once a fault occurs, the DLC displays a diagnostic message (refer to Chapter 8).

The operator must then physically correct the problem. Next, the operator must press the Clear button to clear the diagnostic message.

For a soft fault or minor error, press Resume to restart operation in Automatic Mode (message "Resume Req'd" on display). With a hard fault, the system must now be restarted.

This signal is typically wired to a normally open push-button switch on the user control panel.

Jog Forward

- Connector - X17, pin 9
- Function - (Input) Jogs axis 1 forward
 - High = In Manual Mode, the axis feeds forward at the velocity set in Parameter A105. The axis will feed forward as long as the high signal is present (switch held closed). With Jog Step set ON (from DLC control panel), the axis will feed forward until reaching the feed length set in parameter B108.

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

High = In Set up Mode, the axis feeds forward at the velocity set in Parameter A105. The axis will only feed forward the current commanded feed length, then stop.

Jog Reverse

Connector - X17, pin 10

Function - (Input) Jogs axis 1 in the reverse direction

High = In Manual Mode, the axis feeds in the reverse direction at the velocity set in Parameter. The axis will feed in reverse as long as the high signal is present (switch held closed). With Jog Step set ON (from DLC control panel), the axis will feed in reverse until reaching the feed length set in Parameter B108.

High = In Set up Mode, the axis feeds in the reverse direction (if it was jogged forward previously) at the velocity set in Parameter A105. In Set up Mode, Jog Reverse only functions if the feeder has been jogged forward previously. The axis can be jogged back only as far as the starting point of the feed. If the feeder is already at the starting point, reverse feed is not possible.

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

Auxiliary Feed Length Select / Measuring Wheel Enable

Connector - X17, pin 11

Function - (Input) Used to enable/disable *Auxiliary Feed Length* or *Measuring Wheel (MW)* operation depending on the selected setting of **Parameter B112**.

High = Enables the selected option.

Low = Disables the selected option.

Note: See Chapter 5. Parameters for more information on Parameter B112.

The **Auxiliary Feed Length** option can only be selected in Automatic Mode. When this option is selected, the primary feed length value is ignored and the DLC operates using the feed length value entered in Parameter B103.

This option allows selection of a feed length different from that used in normal operation. It can be used to feed scrap material from the end of the roll, to easily change to a second operation that requires a different feed length, etc.

The **Measuring Wheel (MW)** feature is used to base the feed length on the measuring wheel encoder rather than the axis position (servo encoder). If this input is toggled during an Automatic Mode cycle, MW

length compensation won't be enabled or disabled. The state of the input is only read at Cycle Start or Resume Cycle.

Press Continuous/Intermittent Select

Connector	-	X17, pin 12
Function	-	(Input) Used to select press operating mode.
High	=	Selects continuous operation.
Low	=	Selects intermittent operation.

During Continuous Mode operation, the press stroke is continuous. When the press ram is on the upstroke, away from the material (Feed Angle goes high), the DLC feeds. The feed should finish before the press ram nears the material on its down stroke (Feed Angle goes low). This operation continues in either Press Before Feed or Feed Before Press Modes until a Cycle Stop is issued (or a fault or error occurs).

During Intermittent Mode operation, the DLC issues a Permit Press output signal, the press clutch engages and the stroke begins. When the press ram nears the material on its down stroke, the Feed Angle goes low and the DLC drops the Permit Press output. The press clutch retaining circuit (normally employed) keeps the press operating one cycle. When the press ram is on the upstroke, away from the material (Feed Angle goes high), the DLC feeds. At the end of the feed, and the end of the dwell time (need both conditions), the DLC again issues the Permit Press to start the next cycle. This operation continues in either Press Before Feed or Feed Before Press Modes until a Cycle Stop is issued (or a fault or error occurs).

The press cycle mode may be changed on-the-fly using this input, at any time during an automatic mode cycle.

See **Press Permissive Interface, page 3-5** for a description of handshaking using this and other DLC I/O signals.

Set up Mode Select

Connector	-	X17, pin 13
Function	-	(Input) Selects Set up Mode
High	=	Set up Mode selected (Parameter Mode can override selection).

See **Set up Mode, page 3-12** for description of operation in this mode.

Cycle Stop

- Connector - X17, pin 14
- Function - (Input) Used to stop the automatic cycle
 - High = (Continuous) Allows Automatic Mode operation.
 - Low = (Momentary) Stops Automatic Mode cycling at the completion of the current cycle.

The ending point of the automatic cycle depends on the selection entered in Parameter B109 (Press Before Feed or Feed Before Press). See **Press Permissive Interface, page 3-5**.

This input is typically wired to a normally closed push-button switch on the user control panel.

Part Stop

- Connector - X17, pin 15
- Function - (Input) Used to stop Automatic Mode cycling, after completing the current part (only functional when using the batching feature)
 - High = Indicates normal operation, allows continued batching operation.
 - Low = Loss of a high causes the DLC to stop automatically cycling, after all feeds are complete for the current part executing.

This input is typically wired to a normally closed, momentary switch. Refer to Chapter 4 for additional information on the batching function.

3.4 Output Signal Descriptions

This section describes the outputs from the DLC control system to external devices. The connector and pin numbers of these signals are described in the following sections and shown in *Figure 3-9: X17 Input/Output Connector Showing Output Pin Designations*.

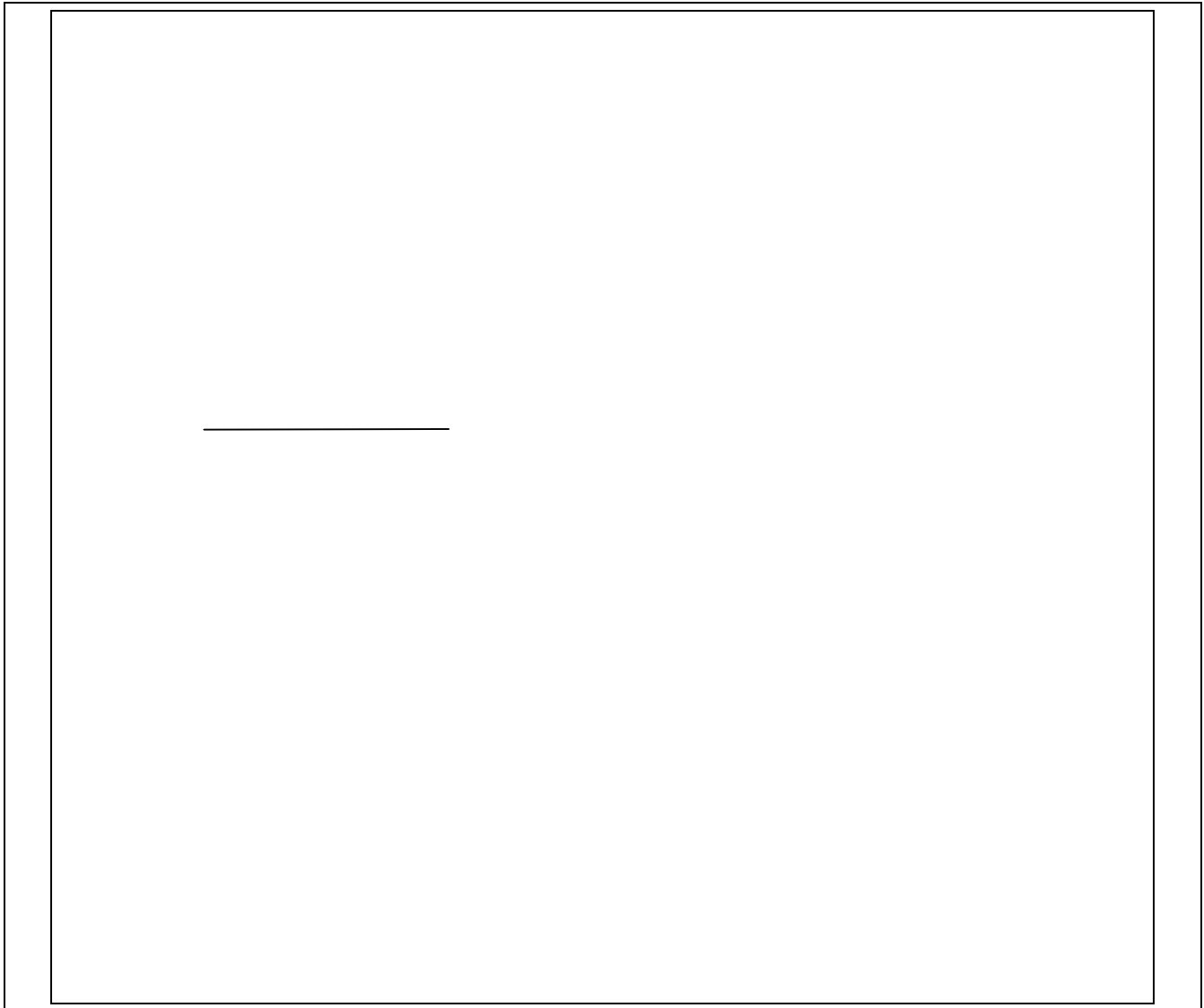


Figure 3-9: X17 Input/Output Connector Showing Output Pin Designations

Manual Mode Indicator

- Connector - X17, pin 16
- Function - (Output) Indicates that Manual Mode is active
 - High = No other modes are selected. The DLC defaults to Manual Mode.

This output signal is typically wired to an indicator light on the user control panel.

Automatic Mode Indicator

- Connector - X17, pin 17
- Function - (Output) Indicates that Automatic Mode is active
 - High = Automatic Mode is selected.

This output signal is typically wired to an indicator light on the user control panel.

Parameter Mode Indicator

- Connector - X17, pin 18
- Function - (Output) Indicates that Parameter Mode is active
 - High = Parameter Mode is selected. This overrides any other mode selection.

This output signal is typically wired to an indicator light on the user control panel.

Cycle Time Available Indicator

- Connector - X17, pin 19
- Function - (Output) Used to indicate when the stroke rate can be safely increased
 - High = Indicates the time used by the feed is less than 90% of cycle time available.

Low = Indicates the time used by the feed exceeds 90%, or when not in Automatic Mode cycle or before the first cycle time measurement.

A light can be used as a visual indication to the operator that the press stroke rate can be increased without causing loss of feed angle, which would cause a fault. If the light is OFF during a cycle, the stroke rate (time for each press stroke) should be increased or the feed rate decreased to assure the feed completes before the feed angle input goes low.

Permit Press

Connector - X17, pin 20

Function - (Output) Used to permit engagement of the press clutch.

High = Permits clutch engagement for press cycle operation.

Low = Disengages the clutch and press operation halts.

Permit Press is issued when the control is ready to begin cycling. In continuous Mode, it remains high during the automatic cycling. It goes low if the control sees a fault or error, or a Cycle Stop is issued. In Intermittent Mode, Permit Press is issued after the feed cycle is complete (or before the feed cycle in Press Before Feed Mode) and dropped during the actual feed cycle.

The timing of this signal stopping the press depends on the four possible mode combinations. See *Press Permissive Interface for a complete discussion of this signal (and other I/O's) in the Press Permissive interface. See the timing charts (Figure 3-3, Figure 3-4, Figure 3-5 and Figure 3-6) for specific timing of this signal.*

WARNING: *The machine builder should tie this signal into the other "Safety Logic Circuitry" for the press system. Do Not use this signal to fire the press without regard for other safety conditions (interlocks open, machine E-Stop, etc.).*

The following is a list of faults which will cause the Permit Press signal to go low causing the press cycle to stop:

All Hard Faults

All Soft Faults

Minor Errors:

- Zero % Feedrate Entered
- Zero Feed Length Entered
- Change in Feedlength Exceeds Limit
- Feedlength Exceeds Maximum
- Feedlength Less than Minimum

Note: See Chapter 8 for more specific information on faults.

System Fault Indicator

- Connector - X17, pin 21
- Function - (Output) Indicates a fault has occurred
 - High = The DLC has detected a fault.
 - Low = The system is functioning properly, or the DLC is experiencing a power loss or its microprocessor is defective.

This output is typically wired to an indicator light on the user control panel.

NOTE: Any Hard Fault, Soft Fault or Minor Error will turn on this output. See Chapter 8 for a description of faults.

Feed Interrupt Indicator

- Connector - X17, pin 22
- Function - (Output) Used to indicate an interrupted feed cycle
 - High = Indicates the DLC has lost the Feed Interrupt input signal and drive motion is decelerating or stopped. See *Feed Interrupt*, page 3-18.
 - Low = Indicates the DLC has not lost the Feed Interrupt signal.

Typically, this output is wired to an indicator light on the user control panel.

WARNING: If the automatic cycle is interrupted by a low on the Feed Interrupt input, all feed motion is suspended. However, when the input returns high, the feed cycle will immediately resume. Use this output to alert personnel of the condition so they can use proper caution.

Feed Complete Indicator

- Connector - X17, pin 23
- Function - (Output) Used to indicate commanded feed is complete

- High = Indicates the axis is in position (within the In-Position Threshold set in Parameter A110) and the commanded feed is complete.
- Low = Indicates that a feed is commanded, but is not presently complete.

Typically, this output is wired to an indicator light on the user control panel.

Feeder In Cycle

- Connector - X17, pin 24
- Function - (Output) Used to indicate Automatic feed cycle operation
 - High = Indicates Automatic feed cycle operation is in progress.
 - Low = Indicates a Cycle Stop, a fault/error condition is present, or the Feed Interrupt signal is not present (is low).

This signal is issued (high) only in Automatic Mode, after Cycle Start. It remains in this state until the Cycle Stop is activated or a fault or error is detected.

Feed In Progress Indicator

- Connector - X17, pin 25
- Function - (Output) Used for feed progress status
 - High = Indicates feeding is **in progress** or the feed axis is **not** in position as specified in Parameter A110.
 - Low = Indicates feeding has stopped as a result of reaching position or a fault/error exists which has stopped the feed.

This signal is operational in Automatic, Set up, or Manual Modes.

Typically, this output is wired to an indicator light on the user control panel.

Axis #1 In Position Indicator

Connector	-	X17, pin 26
Function	-	(Output) Used to indicate axis 1 is in position
High	=	Indicates the axis is in position (within the In-Position Threshold set in Parameter A110).
Low	=	Indicates the axis is not in position (not within the In-Position Threshold).

Typically, this output is wired to an indicator light on the user control panel.

Press Immediate Stop

Connector	-	X17, pin 27
Function	-	(Output) Used to immediately stop the press
High	=	The normal state during operation. Wire so this signal must be high for the press to operate.
Low	=	Immediately stops the press stroke.

NOTE: Due to various factors, such as inertia and press stroke speed, the ram will not be able to stop instantaneously. However, if wired as described in this section, the DLC will attempt to stop the press ram as soon as mechanically possible if an Emergency Stop or other various faults occur.

This signal goes low at the occurrence of the following faults (refer to Chapter 8 for fault descriptions):

All Hard Faults

Soft Faults:

- Feed Angle Lost During Feed
- Movement While Feed Angle Low
- Press Cycle Without Feed
- Zero % Feedrate Programmed
- Press Timeout has Expired

Minor Error:

- Feed Angle is Missing

This output signal is wired to the machine builder's press engagement clutch/brake retaining circuitry.

Upon receiving a Cycle Stop signal, the press engagement clutch/brake retaining circuit is designed to retain clutch engagement until the press returns to the Top Dead Center position.

However, with the Press Immediate Stop signal wired to the clutch retaining circuit, when this signal goes low, the press attempts to stop the ram regardless of where it may be in the press stroke.

WARNING: *The Press Immediate Stop signal must be incorporated into the safety logic circuitry of the machine. Note that safety design of the system is the responsibility of the machine tool builder.*

Set up Mode Indicator

Connector	-	X17, pin 28
Function	-	(Output) Indicates the Set up Mode is active
High	=	Indicates the Set up Mode is selected.

This output signal is typically wired to an indicator light on the user control panel.

Part Early Warning Indicator

Connector	-	X17, pin 29
Function	-	(Output) Used in batching to indicate when this part run is nearing completion
High	=	Indicates the batch has the user specified number of this part (or less) remaining to be executed.
Low	=	Indicates the part count has not reached the user specified number of parts remaining, or the entry is set to 0, disabling the output.

When using the batching function, the user enters this "Early Warning" number on a page of the DLC display. *See Chapter 2, Display Screens.* The output turns ON when the "parts remaining" count reaches this number. It remains ON as the remaining parts are completed. It turns OFF when the next part begins to execute. Refer to Chapter 4 for further information on the batching feature.

Part Complete Indicator

- Connector - X17, pin 30
- Function - (Output) Used in batching to indicate all feeds are complete for a single part
- High = (Momentary) Indicates a single part just completed. Remains high about two seconds, then returns low.

When using the batching function, this output pulses momentarily as each part completes execution, whether executing a single part or several different parts in the Batching Program. It remains ON when the Batching Program Complete output turns ON, and remains ON until the next cycle start. Refer to Chapter 4 for further information on the batching feature.

Batch Program Complete Indicator

- Connector - X17, pin 31
- Function - (Output) Used in batching to indicate the batching program is completed
- High = Indicates all parts in the batching program are completed.

When using the batching function, this output turns ON at the end of a batching program (when the last part is programmed with a jump to 00). It remains ON until the next cycle start. Refer to Chapter 4 for further information on the batching feature.

Chapter 4. Function Description - Special Features

This chapter describes special features available, and provides the general information required to use these features.

- Batching
- RS-232/485 Interface
- Measuring Wheel
- Single Step Using Start and Stop Inputs

4.1 Batching

If the application requires making different parts, use batching to reduce the set up time and eliminate possible entry errors by entering the required data for each part into a separate batch memory. The batching option allows multiple feed lengths for each part. It allows program branching to automatically execute different parts.

The DLC can store up to 99 different parts, each with unique set of feed lengths, feed rate, number of pieces to execute, and a user's part number. Up to 594 Feeds can be stored in the DLC'S battery-protected memory.

You can select to sequentially execute several or all different parts, or to execute any single part from the DLC control panel. You can externally select a part to execute from an SOT, a PLC or similar host device, through the communications port to the DLC.

The DLC display can show a running piece count display, user part number assignment plus outputs to indicate when the part is nearing completion, when each part is complete and when all parts in the batch run are complete. All information assigned in batching can be viewed and edited in any mode, even while the press is in operation. Automatic Mode, however, is the only mode in which parts are counted as they are made.

Selecting Batch Option

Parameter B102 (interface option) allows you to select the method of entering the feed length and feed rate into the DLC. With the "batching" interface option selected, you typically enter the data for each part ahead of time. Then, simply select the part or batch of different parts to execute automatically, from the DLC keypad, or from an SOT or other host (via the serial interface). Note that you cannot use the IDS option with the batching option.

Batch Entry and Status Displays

Section 2.2 describes the procedures for scrolling through the display screens, movement of the cursor within the display page and how to enter data into fields. The following sections further describe the entry procedures and options for batch programming.

Current Part Information Display

The Current Part Information Page has three functions: 1) select the starting part number, 2) micro-adjust the current part count, 3) display real-time part information. Before using this page to start the batching program, the part information must be programmed on the other batching pages, as described in the following sections.

INFO	nn	iiiiiii
Qty	qqqqqq	
Count	cccccc	
Feed	f	Cnt xxx

Current Part Information Page

Starting Part Selection

Before starting automatic operation, enter a starting part of the batch on this page. A batching program may start with any of the 99 parts. This allows the storage of several batching programs, each having a unique starting part and set of parts to execute automatically.

Select the starting part by either the part block number (nn) or part ID (iiiiiii). To avoid an accidental part change, starting part entry is allowed only when the DLC is not in an Automatic Mode cycle.

With the desired part number showing on the page, press the STORE key to select it as the starting part. If the current part is entered as the starting part, the batching program will be reset to the start of the current part by pressing the STORE key.

Micro-adjustment of Current Part Count

Move the cursor into the first digit of the current part count (cccccc) for an on-line adjustment of this count. Press the '+' key to add a part to the count. Press the '-' key to subtract a part from the count.

Real-Time Part Information

This page provides a real-time display of the current part information while the DLC is cycling. The displayed part block and Part ID will change as the current part changes (begins executing the next part in the batch program).

The part quantity (qqqqqq) is displayed along with the current part count (cccccc), to show the quantity of parts to be produced and the current number of parts. The current part count will be increased or decreased depending on the count mode selected in Parameter B111 (count up or count down). If a part is a free run (described in next section), "FREERUN" is displayed in the part quantity and the counter counts up, regardless of the count mode. A linked part is indicated with a different display. **See Part Linking, page 4-6.**

The current feed data is displayed in the bottom row. The current feed number (f) changes with each change in feed. The current feed count (xxx) is shown, and counts up or down according to the count mode parameter. The current feed length and rate are displayed in the Feed Length Page, as described in **Chapter 2. Controls and Indicators.**

Batch Main Programming Display Page

Batching programs are entered in the Batch Main Programming Page. Data fields for a part may be accessed by typing either the Part Block or Part ID number.

The Batch Main Programming Page allows branching, free run, or single part operation. A part quantity is entered to set the number of times the part is executed. An Early Warning count is provided to turn ON an output when a part is near completion. If more than six feed lengths are desired, part blocks may be linked together to add up to six feeds per linked block. You can create a single part with up to 594 different feed lengths and one part quantity.

Main nn iiiiiiiii Jump to Block pp Quantity qqqqqq Early Warn eee
--

Batch Main Programming Page

Part Block Number (nn)

This number, from 01 through 99, is associated with feed and gagging data for a part. The display of part block and its data can be changed by typing-over with another part number. The information on the display will be updated as the keys are pressed. The part number may also be incremented or decremented using the '+' or '-' key.

Part ID Number (iiiiiii)

The user can assign a Part ID to be associated with each Part Block number. This is any eight digit number that has meaning to the user (a part number, die number, customer number, etc.). It is stored in the DLC as a matched set with the part block number. Each part's data may be accessed by entering either the Part Block or the Part ID number. A unique Part ID must be selected for each block when using the DLC keypad. The numbers 1 to 9, '+' and '-' may be entered through the keypad. Alpha characters may be used when entered from an SOT or other host device, but are not available from the DLC keypad.

Jump to Block (pp)

Batching allows automatically executing several different parts. Enter in the Jump To Block the next part block to be executed after completion of the entered part quantity of the starting or previous part block. A jump to any of the 99 part blocks can be executed. Each part block can jump to another after it is completed. This allows executing several different parts automatically. Different batches of parts can be programmed to execute together. Enter the starting number of the batch to select the desired batch program to execute.

If a part jumps back to itself (if pp = nn), it is a free run part. The part will run continuously until a cycle stop or part stop input is activated. The part quantity display is replaced with the word "FREERUN" and the Early Warning count with all stars.

If "00" is entered here, no jump is performed, and the cycle will be stopped after the part quantity is completed. Enter "00" for the jump to block in the last part block to be executed in the batch.

Part Quantity (qqqqqq)

The part quantity is the number of times each part is repeated before jumping to the next part or stopping. If a zero is entered in every digit, the current count for the part will be cleared without affecting the part quantity.

Parts may be linked together to create a part with more than six feed lengths by entering a '+' in the part quantity. **See Part Linking, page 4-6** for a detailed description.

Early Warning Count (eee)

The Early Warning count allows an output to be turned ON near the end of a part run. The output is turned ON when the number of parts remaining reaches this number. The output is turned OFF at the start of a new part.

Batch Feed Programming Display

There are six Feed Programming Pages associated with each Batch Main Programming Page. Feed lengths, rates, and gag sets may be edited for each feed, which may be executed up to 999 times.

Part nn	iiiiiii
Feed f	Qty xxx
Length	Rate
+mll.lll	rr.r

Batch Feed Programming Page

The displayed Part Block Number and Part ID are being programmed by entries on this page.

Feed Number (f)

The feeds are executed in order from 1 to 6 within each part. Data fields for feeds 1 to 6 can be accessed sequentially by pressing the '+' and '-' keys or access a feed directly by typing-over the number.

Feed Quantity (xxx)

The feed quantity is the number of times the feed will be executed before starting the next feed or the next part. If a '-' is entered here, the part is completed after the previous feed. For example, if only two feeds are desired for a Part, a '-' must be entered in the feed quantity of Feed 3. The display will show "---" in the feed quantity for the end of the part.

A "---" in the feed quantity is not allowed in Feed 1 since each part must have at least one feed. An entry of "000" is not allowed in any feed quantity.

Feed Length (+mll.lll) and Feed Rate (rr.r)

A unique feed length, rate, and direction can be selected for each feed. The feed length can be micro-adjusted by pressing '+' or '-' while in the first digit position, indicated by 'm'.

A minor error is issued immediately if feed length limits are exceeded (set in parameter) while the DLC is not in an automatic mode cycle. The display changes to the status page (first display on the DLC display map). The current feed page is automatically displayed when you scroll to the batch main programming page. During a cycle, only the current feed is checked against the feed length limits.

Part Linking

The DLC normally provides up to six feeds per part. If a part requires more than six feeds, up to 99 parts may be linked together to create one part with up to 594 feeds.

To link a part to another part, enter a '+' in the part quantity in the Main Page. The '+' characters will be displayed in place of the part quantity and Early Warning, and the part will be linked with the next block.

The feeds programmed in the current block will be completed, followed by those in the "jumped to" block. The part quantity, jump to block, and early warning are defined in the last part block (the last link in the chain).

To select a linked free run part, set the part quantity to "999999".

In the example below, a linked part is entered in blocks 10 and 20. After the six feeds in block 10 are completed, the six feeds in block 20 are executed. Part block 20 is defined as the end of the part by entering a valid part quantity. The linked part in blocks 10 and 20 with 12 feeds will execute 100 times, then execution will continue at the next part in block 30.

Linked Part Programming Example (12 feeds)

```

Main 10 *****10
Jump to Block 20
Quantity ++++++
Early Warn  +++

```

Part Block 10

```

Main 20 *****20
Jump to Block 30
Quantity 000100
Early Warn 002

```

Part Block 20

Linked Part on Information Page

The Current Part Information Page will indicate a linked part to distinguish it from a normal part. The linking process is also indicated since the DLC does not find the Part Quantity until the last link in the chain is found. There is the possibility of an infinite loop if no part quantity is found. These displays will aid the programmer in detecting this error condition.

When two or more parts are linked together, the Current Part Info Display will indicate that the part is being linked by displaying "Linking Part" in place of the part quantity. As soon as the count is found, "INFO" in the upper left

corner is replaced by "LINK", and the count of the total part entered at the end of the chain is always displayed.

```
INFO 10 *****10
Qty    ++++++
Count  000000
Feed   1   Cnt  000
```

Current Part Information Display before linked part is executed

```
INFO 10 *****10
Linking Part
Count  000000
Feed   1   Cnt  001
```

When executing linked part but count has not been found

```
LINK 20 *****20
Qty    000100
Count  000001
Feed   1   Cnt  000
```

After part quantity has been found for linked part

Batching in Automatic Mode

This section describes the operation of the DLC in Automatic Mode when using the batching option. It begins after the part information has been programmed into the batching pages.

Pressing Cycle Start

If the DLC has just been powered up or a new starting part has been entered, execution begins at the starting part entered in the Batch Part Information Page or selected through the Binary/BCD inputs.

If the cycle has been stopped during part execution (by a Cycle Stop, Part Stop or a Fault), the program will be continued with its current part, feed, and count values, until a "Jump to Block 00" is encountered, as programmed to end the current batching program.

Part Execution Sequence

The current feed count is incremented upon each high-to-low transition of the feed angle signal. The feed number is incremented when the target feed quantity is reached. The DLC checks if the current feed number is 6 or the new feed has a stop on feed ("---") programmed. If either condition is met, the current part count is incremented and the feed number is reset to 1. If it is a linked part with more than six feeds, the part continues with the feeds in the next block programmed as "jump to."

If the part quantity is reached and a Jump to Block is programmed, execution starts at the part block jumped to and the feed number is reset to 1. If the part quantity is reached and a stop at end of part is programmed (by entering a "00" jump), the cycle is stopped and the status message "A: Part Stop" is displayed.

Notes on Automatic Mode Operation

The Press Before Feed/ Batch Complete parameter option causes an overlap of feeds between parts to maintain the proper tool sequence.

Cycle Stop and Part Stop

The DLC provides a second cycle stop input for batching. The Cycle Stop input stops the automatic cycling immediately after the current cycle completes. The added Part Stop input stops the cycle at the end of the part, after all feeds in the part have been completed. When Part Stop is used, the cycle won't be stopped in the middle of a part.

The status message "A: Cycle Stop" is displayed when the Cycle Stop input has been activated or a fault has caused a Cycle Stop. This message indicates that the part may be incomplete. The status message "A: Part Stop" is displayed when the Part Stop input has been activated or a Part Stop has been executed in the Batching program. This message indicates that the part is complete.

Batching in Set up Mode

This section describes the operation of the DLC in Set up Mode when using the batching option. It begins after the part information has been programmed into the batching pages.

In set up mode, the first feed of the current part is performed. The current part can be changed through the same procedure that the starting part in Automatic Mode is selected.

NOTE: *Set up mode is provided for single-feed applications. For set up of multiple feeds, use the single step feature with the start and stop inputs or enter a set up sequence in the Batching program. The feed and part counts are not updated in Set up Mode.*

Interface Options

Parameter B102 (Interface Option) allows you to select the method of entering the feed length and rate into the DLC. Refer to Chapter 5 for description of parameter entry. The batching parameter options are summarized in this section.

Count Mode This option allows the display of the number of parts created or parts remaining (count up or down). It applies to both the current part count and the feed count.

Press Before Feed/ Batch Complete This option specifies whether the last feed in a single part or sequence of parts is performed when Press Before Feed Operation is selected in the Press Interface Parameter (end after feed or after press). It does not apply to Feed Before Press operation. See parameter description in Chapter 5 for an illustration of this function.

Default Batch Program Values

The DLC loads default values if data has been lost due to battery failure or at initial shipment. The soft fault "Batching Program Was Lost" is issued after DLC initialization if default values are loaded in any of the parts. The following lists the default values. Reprogram or verify data for each part and press the STORE key to save the data to DLC battery-protected memory.

<u>Data</u>	<u>Default Value</u>
Part ID Number	6 stars followed by Part Block #
Jump to Block	"00" for stop at end of part
Part Quantity	"000001"
Early Warning	"000"
Current part and feed counts	Zero
Current Feed Number	1
Feed quantity, Feed 1	"001"
Feed quantity, Feeds 2-6	"---" for end of part
Feed length and rate	Both zero
Starting part	Block 01

4.2 RS-232/485 Serial Interface Operation

The DLC Control includes a multi-format RS-232/485 port for two-way communication between the DLC and a host. The interface protocol is designed to easily transmit and receive data to and from the DLC. It can communicate with a Personal Computer, SOT, IDS, PLC or other devices at rates of 150 up to 19200 baud, using RS-232 or RS-485 format. This chapter describes the protocol and other communication requirements.

The host device must strictly adhere to the communications format as described in this chapter to achieve proper communication, or one of several "RS Format Errors" will be returned through the port (or indicated on the control status display) indicating that the information was not properly formatted or understood.

Any parameter may be uploaded from the DLC at any time. Parameters may be downloaded to the DLC only while it is in Parameter Mode. If attempted in any other mode, the host receives a "Invalid Mode" error message through the port. Parameters can be read from the DLC in any mode.

To ensure that the correct data is being sent and received, a checksum is calculated and checked by the DLC. If the host software does not calculate a checksum, it can be disabled.

Special cabling is required for use with RS-485 communications, as described in the following section. The DLC and the optional Indramat SOT (Station Operator Terminal) can communicate in half-duplex to facilitate using the RS-485 interface. RS-485 uses a single twisted pair of wires to provide superior noise immunity at distances of up to 1000 meters. The DLC can also communicate with the SOT using the RS-232 interface, without any parameter changes. However, the maximum distance allowed for an RS-232 cable is 15 meters.

The optional Indramat SOT (Station Operator Terminal) is a remote mounted, operator control device for the DLC. It is used to communicate commands, status and parameter information between the DLC and SOT. The software in the SOT includes Help screens to assist the operator in using the SOT and for entering information correctly. Refer to the supplement included with this manual for complete information on using the SOT.

The RS-485 interface is primarily used with the SOT, which provides the special hardware and software needed for proper operation. Contact Indramat Applications Engineering for assistance if you wish to use this interface format with any other device. The RS-485 interface can be used to network up to 15 DLC-R and DLC-A units. Each unit must have a unique station number from 01 to 15, which is defined in parameter for each unit. Each DLC unit will accept and send strings that have its station number in the second set of characters in the string. For normal RS-232 operation, a space is used instead of the station number.

Connector Wiring (X31)

The serial interface connector (X31), is located on the front of the DLC Card.

Refer to *Figure 4-1: DLC X31 Connector* for a pin-out diagram of the multi-function port (X31 connector). It shows 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 4-1: DLC X31 Connector*. Some pins are used for Indramat options and factory diagnostics.

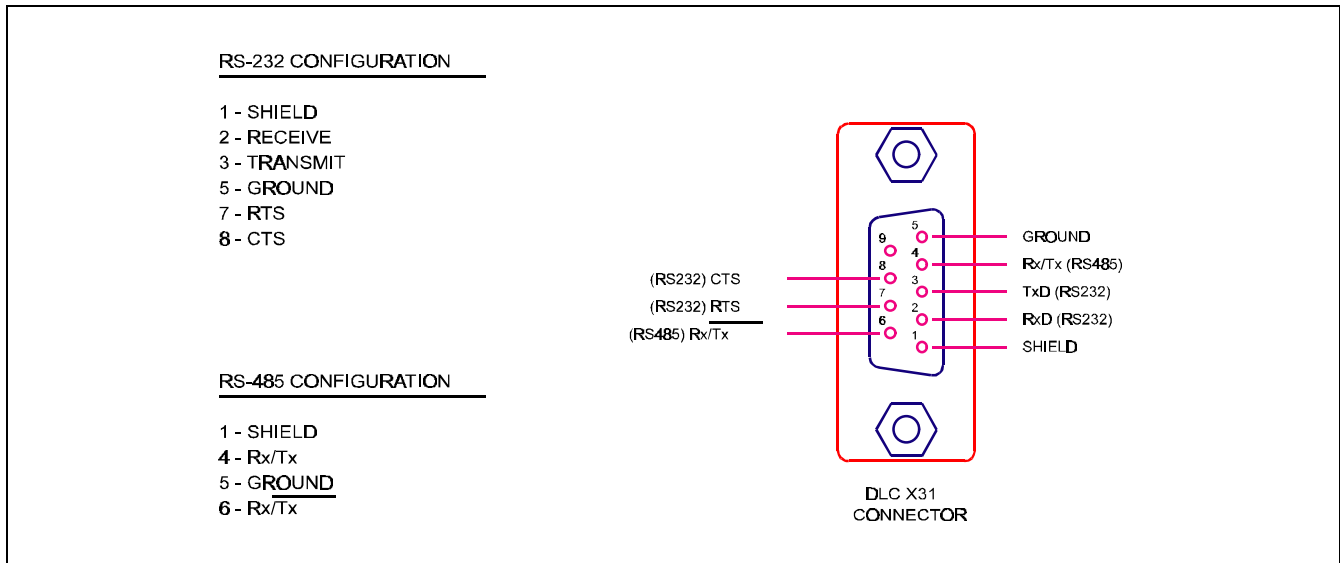


Figure 4-1: DLC X31 Connector

Signal Level Requirements

Figure 4-2: *Signal Level Requirements* illustrates the signal level requirements for the different communication formats (RS232/485) for the DLC. To minimize signal degradation over long cable runs, the serial device driver should provide the following levels:

RS-232 +/- 15 Vdc (15 m maximum run)

RS-485 +/- 5 Vdc (1000 m maximum run)

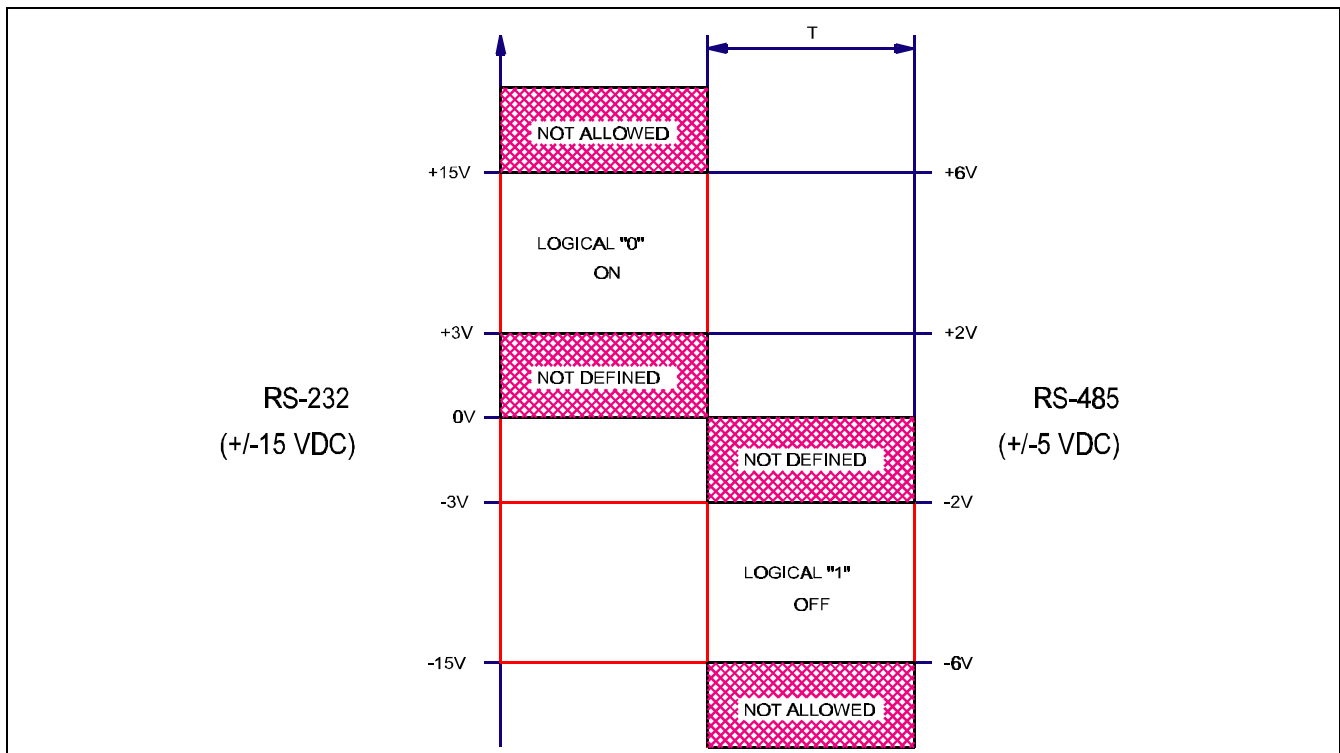


Figure 4-2: Signal Level Requirements

Serial Cable Connection to Computer

For RS-232 serial communications, you should note that the connector on the serial card in your computer can vary in configuration. *Figure 4-3: RS-232 Serial Cable Configurations* illustrates two common serial connections for interfacing from the RS-232 port of a computer to the DLC.

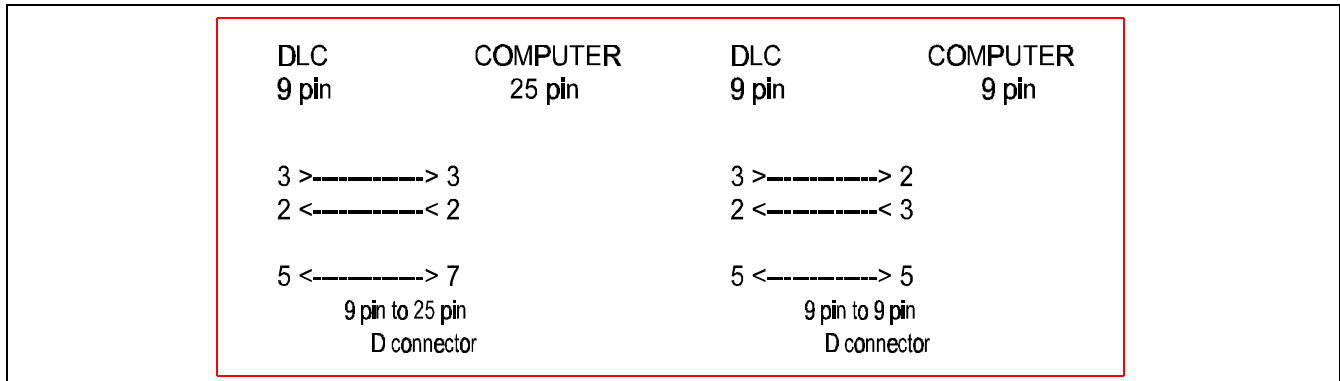


Figure 4-3: RS-232 Serial Cable Configurations

The DLC requires only three lines of the standard 9 pin connector for RS-232 communication. Pin 3 is for Transmitted Data, pin 2 for Received Data, and pin 7 is the 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 of the other device, and vice versa. Signal ground connection must be common on both devices. This often requires a Null Modem cable. It connects pin 3 of one end to pin 2 on the other end. Consult the manufacturers information for the serial card in your computer for its specific pin configuration.

Data Format

To achieve proper communications, configure the communication parameters to match between your computer and the DLC. *Figure 4-4: Data Format* illustrates the data format.

Refer to Chapter 5 for specific parameter entry options and procedures.

Note that when you set the interface option Parameter B102 for the IDS, the port is automatically configured (2400, 8, 1, 00) to work with the IDS board. Configuration data in the Serial Port Parameters (B118/B119) are then ignored. When the Interface Option Parameter B119 is set for the SOT, the proper entry in Serial Port Operation Parameter B119 is (1920, 8, 1, 00).

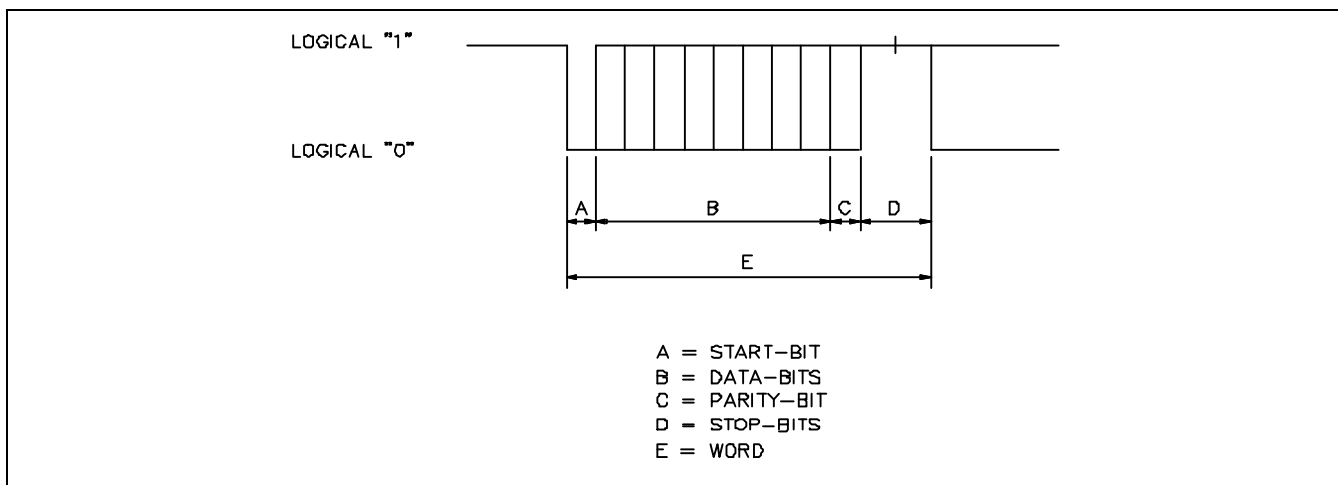


Figure 4-4: Data Format

Message Format

This section describes the message format required for the RS-232 Interface. A message is divided into six sections, as illustrated below and described on the next page.

#_	x_	_00_	012.345_67.8	\$8E	<cr><lf>
1.	2.	3...	4.....	5..	6.....

Legend

<cr> = Carriage return
 <lf> = Linefeed
 _ = Space

1. The first two characters in each message are a command, which specifies the type of information requested.

First (1) Control String Character (Transmission Type)

All data transmissions to the DLC must start with one of the following control characters to identify what type of transmission is to follow:

<u>Command</u>	<u>Request</u>
----------------	----------------

- | | |
|---|---|
| ? | The DLC interprets this character (received via the RxD channel) as a "Request for Information" - when followed by the proper requesting codes, the DLC will transmit the desired data via the TxD channel. |
| # | This character signifies a block of "Information to be Stored" into memory. The data that follows will be read into the proper memory location. |
| ! | This character signifies a "Control Command" is to follow. |

Second (2) Control String Character (DLC Unit # Identifier)

This character is only present if communicating in the RS-485 mode. It is used to identify the DLC unit # to receive the current message. If communicating in RS-232 mode, this character will be a space (Hex 20).

Space ()	=	RS-232 Mode
1	=	DLC#1 RS-485 Mode
2	=	DLC#2 RS-485 Mode
3	=	DLC#3 RS-485 Mode
4	=	DLC#4 RS-485 Mode
5	=	DLC#5 RS-485 Mode
6	=	DLC#6 RS-485 Mode
7	=	DLC#7 RS-485 Mode
8	=	DLC#8 RS-485 Mode
9	=	DLC#9 RS-485 Mode
A	=	DLC#10 RS-485 Mode
B	=	DLC#11 RS-485 Mode
C	=	DLC#12 RS-485 Mode
D	=	DLC#13 RS-485 Mode
E	=	DLC#14 RS-485 Mode
F	=	DLC#15 RS-485 Mode

2. These characters are format characters, which tell the DLC the information to be uploaded or downloaded (Information Type):

<u>Format</u>	<u>Information</u>
X_	Status (messages, feed length, feed rate, etc.)
B_	Batching information
K_	Parameters
S_	Action Request (jog step, etc.)
U_	Upload Request (message tables)
XD, BD, KD, UD	With '?' only, will send diagnostic code at the end of the string (before the checksum).

3. These characters are identifiers, which are specific to each format. They may include decimal digits, alphabetic characters, or spaces. Identifiers are described in the section pertaining to each format.
4. This is the data to be sent. The length of this string depends upon the information requested.
5. When downloading or requesting action (#_ or !_) the data section must end with a checksum if checksum is enabled. A '\$' character indicates the start of a 2-digit ASCII checksum. A checksum isn't needed with a '?' command.
6. Each transmission must end with a carriage return followed by a linefeed (CR = ASCII 0D hex, LF = 0A hex). Note that spaces aren't required or sent between the end of data and the checksum. Any characters between the end of data and the '\$' are ignored by the DLC, so that longer strings may be sent for compatibility with other software.

Status Request (?_X_)

Information may be requested from the DLC with a status request command. Status identifiers consist of a space, a status number, and a space. The host should send the following string to request most status information:

?_X_ nn_<cr><lf> Note that there must be 2 spaces between X and nn, unless '? XD' is used.

Status No. (nn) Information

00	Position error in input units/min/.001iu
01	Diagnostic message (32 characters)
02	System Information (mode, in-cycle, step))
03	Distance moved in input units
04	Measuring Wheel Data
05	Feed length and feed rate Axis 1
07	Diagnostic code (2 characters)
08	Hardware and Software version numbers (32 char.)
09	Press strokes per minute
10	Inputs 1-15 in hexadecimal (LSbit = input1)
11	Outputs 1-16 in hexadecimal (LSbit = output1)
12	Total Piececount and Total Length
14	Diagnostic Text
15	DLC Inputs in Binary (16 at a time, left to right)
16	DLC Outputs in Binary
19	DLC Version Number
21	System Flags
22	Throughput in Units/Minute
25	Current Status Message
28	Drive Status
29	DSM Firmware Version

The DLC allows decimal points to be sent in feed length and feed rate strings for both standard interface and batching. One decimal point for feed length and one for feed rate may be placed anywhere in the string, independent of the feed length resolution. The PC or SOT may then echo the string format sent from the DLC.

Example strings, with/without decimals:

#_X_ 00_012.345_67.8\$hh<cr><lf>

Sending feed length and rate for standard interface, decimal points included.

#_X__00_012345_678\$8E<cr><lf>

Sending the same data without decimal points.

Data sent to the DLC-R may be selectively stored within a string. When data is replaced by star (*) characters, its current value is retained. This allows the PC or SOT to change feed length without affecting feed rate, for example.

Examples:

#_X__00_012.345_.*\$hh<cr><lf>**

Feed length is changed but feed rate is not.

#_B_W99_***_***_01\$hh<cr><lf>**

Jump to Part is the only information that is changed.

Each status request is described in the following pages.

Position Error Request: ? X 00

If an axis is disabled, stars will be sent in place of that axis.

DLC-R Response:

X_00__-0000.1000_***\$hh<cr><lf>**

Current Status Message Request: ? X 01 (also see ? X 25)

The DLC will send the current status message as it appears on the LCD. The 32-character message is in the current language and is centered for 16 characters.

X_01__Axis 1 Motor__Has Overheated!\$hh<cr><lf>

```

|_____line 2 of display
|_____line 1 of display

```

System Information Request: ? X 02

The DLC will respond with a code that corresponds to the current mode and other operating information.

X_02_mx\$hh<cr><lf>

m = Current mode:
 0 = manual
 1 = automatic
 2 = parameter

3 = set up

x = Other information

0 = Step jog off, not in-cycle

1 = Step jog enabled in manual mode
In-cycle in automatic mode

Distance Moved Request: ? X_03

If an axis is disabled, stars will be sent in place of that axis.

DLC-R Response:

x_03__+00123.456__***\$hh<cr><lf>**

Measuring Wheel Data Request: ? X_04

If measuring wheel is not enabled by parameter, an error message will be sent.

X_04_xys_+mmm.mmm_+aaa.aaa\$hh<cr><lr>

x = Selected axis for M.W. compensation (1 for DLC-R)

y = Free for future use (always zero)

s = status: 0 = M.W. compensation off

1 = M.W. compensation on (in auto mode & input high)

mmm.mmm = Actual position of Measuring Wheel

aaa.aaa = Actual position of corrected Axis

Current Feed length Request for Axis 1: ? X_05

x_05_+012.345_67.8\$hh<cr><lf>

If B100 = 00, always includes a + sign

Diagnostic Code Request: ? X_07

The DLC will respond with the current diagnostic code (see diagnostic code section).

x_07_8B\$hh<cr><lf>

Software and Hardware Version Request: ? X_08

The DLC will respond with a copy of the information that appears on the Version Number screen on the LCD.

x_08__DLC01.1____DLC1.1-DR1-02V06_\$hh<cr><lf>

|

|_Note one extra space than "? X 19".

Strokes/Min and Time Used Request: ? X 09

The first four digits of the data string will be the current Strokes/Min. value. The next two digits following a space will be the percent of feed angle used (see Time Optimization document).

X_09_0123_45_\$hh<cr><lf>

System Inputs Request in Hexadecimal: ? X 10

The DLC will respond with the hex. values of inputs 1-15. The Least significant (rightmost) bit corresponds to input #1.

X_10_00006064\$hh<cr><lf>
<---increasing input #

System Outputs Request in Hexadecimal: ? X 11

The DLC will respond with the hex values of outputs 1-16. The Least significant (rightmost) bit corresponds to output #1.

X_11_00000D81\$hh<cr><lf>
<---increasing output #

Total Piece count and Total Length Request: ? X 12

The first eight digits of the data string will be the total number of pieces. The next 12 characters following a space will show the total amount of material.

X_12_00001234_+0123456.789\$hh<cr><lf>

Diagnostic Text Request: ? X 14 cc (cc = diagnostic code)

This is a request for the text message corresponding to the selected diagnostic code. The DLC will respond with a 40 character string in the parameter-selected language.

For minor errors, soft faults, and hard faults, the text is the same as the DLC LCD message, but without the spaces used for centering, unlike '? X 01'. For status messages, a more specific response than the DLC LCD will be sent. For example, instead of

'M: Wait Fd Angle', the response is 'M: Waiting for Feed Angle'.

These messages are compatible with the SOT.

Response format:

X_14_cc---40 character message---\$hh<cr><lf>

Examples:

X_14_8BAxis_1_Motor_Has_Overheated!_____ \$hh<cr><lf>

X_14_01M:_No_Jog_Command_____ \$hh<cr><lf>

The DLC is also able to send all the messages in each fault table at once after an upload request. **See *Block Uploads, page 4-35 and Serial Diagnostic Codes, page 4-36 for a current listing of status, error and fault messages.***

DLC Inputs in Binary Request: ? X 15 n

The DLC will send the value of fifteen inputs as a '1' or a '0' (+24V or 0V) from left to right.

n = 0: Inputs 1-15

Example Responses:

```
x_15_0_1010011000000110$hh<cr><lf> - Inputs 1-15
n --->increasing input #
```

DLC Outputs in Binary Request: ? X 16 n

The DLC will send the value of sixteen outputs as a '1' or a '0' (+24V or 0V) from left to right.

n = 0: Outputs 1-16

```
x_16_0_0010000100100000$hh<cr><lf> - Outputs 1-16
n --->increasing output #
```

DLC Version Number: ? X 19

The DLC will send the hardware and software version number. This is the same as DLC-R status "? X 08" except that there is not a space between the "X 19" and the start of the string. This corresponds exactly to the "? X 19" request in the DLC-DA firmware.

```
x_19_DLC01.1____DLC1.1-DR1-02V06_$hh<cr><lf>
|           |_____Software version
|_____Hardware version
```

System Flags: ? X 21

The DLC sends back 8 flags that are set depending on the condition they represent. Currently, only the first flag is used to indicate press cycle mode.

```
x_21_10000000$hh<cr><lf>
|__0=press intermittent
    1=press continuous
```

The other 7 flags are set to 0, and are reserved for future use.

Throughput in Units/Min: ? X 22

The DLC will send the throughput measured in the last automatic mode cycle. Throughput=Feed length * Strokes/min. This data is always available from the DLC.

X_22__0001234\$hh<cr><lf>

Current Status Message (in 40 character format): ? X 25

The DLC will send the current status in a 40 character format. This expanded format status request is a revision of ? X 01, where the status is returned with the message centered in a 16 character (32 character string) format. The text is sent in the currently selected language.

Response format:

X_25_cc-----40 character message-----\$hh<cr><lf>

cc = Current status code

Examples:

X_25_8BAxis 1 Motor Has Overheated **\$hh<cr><lf>**

X_25_01M: No Jog Command **\$hh<cr><lf>**

Current Drive Status Message Request: ? X 28

The DLC will send the current Drive Status Message as it appears on the CTA4 display. The 32-character message is in the current language and is centered for 16 character lines.

Response format:

?_X_28_-----32 character message-----\$hh<cr><lf>

Examples:

X_28_-Drive Enabled-----\$hh<cr><lf>

DSM Version Number: ? X 29

The DLC will send the firmware version of the drive's DSM module.

Examples:

X_29_DSM2.1-C11-03V02_\$hh<cr><lf>

Status Input

Status Input Requests are used to download values to the DLC or to reset counters and accumulators. Batching information may not be accessed by these requests but have their own set of identifiers (see following sections for batching information, requests and input information).

Status No. (nn) Input Request

00	Feed length and feed rate Axis 1 when batching not enabled
02	Reset Distance Moved display
03	Reset Total Piece count
04	Reset Total Length

Feed length/rate Input when Batching not enabled (# X 00)

Feed length and feed rate may be downloaded to the DLC. The length can also be micro-adjusted by a parameter-defined value.

Axis 1 Feed length/Feed rate Entry:

```
#_X__00_0123.45_67.8$hh<cr><lf>
      | |      | |
      | |      | |  _Checksum
Axis 1 | |      |
      | |      |__% Feed rate
      |
      |__Feed length
```

Feed length Micro-Adjust:

If an "M+" is sent to the DLC, the feed length will be increased by the value stored in Parameter B107.

```
#_X__00_M+$hh<cr><lf>
```

If an "M-" is sent to the DLC, the feed length will be decreased by the value stored in Parameter B107.

```
#_X__00_M-$hh<cr><lf>
```

Reset Distance Moved: (# X 02)

The Distance Moved Display for both axes will be cleared when this string is received.

```
#_X__02$hh<cr><lf>
```

Reset Total Piece count: (# X 03)

The Total Piece count accumulator is cleared when this string is received.

```
#_X__03$hh<cr><lf>
```

Reset Total Length: (# X 04)

The Total Length accumulator is cleared when this string is received.

```
#_X__04$hh<cr><lf>
```

Batching Information

All batching information may be uploaded from the DLC and downloaded to the DLC. Each identifier includes a letter to indicate the type of information and a part block number. Feed data also includes a feed number.

#_B_F011

```
|| |_Feed 1
|| |_Part block 01
|_Feed data
```

The part block numbers 01 to 99 will send the information to the corresponding part. If a 00 is in the string, the information will be entered into the current part. If '*' is sent, the working part is accessed. **See *Batching Input - Working Part and Wild Card, page 4-29.***

The feed number is only needed when feed data is accessed (?_B_F and ?_B_Z). If a space is sent instead of the feed number, the data from feed 1 will be accessed. If a zero is sent as the feed number, information from the current feed will be sent.

Unless otherwise noted, the strings correspond to the DLC keypad and display. Refer to the batching section in this chapter for additional information.

Batching Requests

The requested information corresponds to that displayed on the DLC. Data may be echoed back to the DLC in the same format by adding a "#_" and a checksum.

Part ID, Early Warning, and Jump to Part

```
?_B_W02<cr><lf>
```

The alphanumeric part ID number, early warning count, and jump to part will be sent.

```

B_W02_1234ABCD_012_03$hh<cr><lf>
      |           | | _Jump to Part
      |           | _Early Warning
      | _Part ID number

```

Part Quantity, Current Part Count, Current Feed Number and Count

```
?_B_C01<cr><lf>
```

The part quantity and current count for this part are sent back by the DLC. The current feed number and feed count are also sent in this string. The feed number and count will be the same regardless of which part is selected. If a B_C00 is requested and the part is a linked part, the counts defined in the end block will be sent.

```

B_C01_000123_000012_2_012$hh<cr><lf>
      |           |           | _Current feed count
      |           |           | _Current feed number
      |           | _Current part count
      | _Part quantity

```

Axis 1 feed length, feed rate, and feed quantity

```
?_B_F031<cr><lf> (e.g. for Part 03, Feed 1)
```

The feed number must be sent after the part identifier, and the DLC sends the sign of the feed length after the feed number without a space between them. The feed length and feed rate are sent from the DLC with the decimal points in the proper positions. The target count for the selected feed are sent after the length and rate.

```

B_F031+001.234_56.7**_012$hh<cr><lf>
      ||           |           | _Feed quantity
      ||           | _Axis 1 Feed rate
      || _Axis 1 Feed length
      | _Axis 1 Feed direction

```

Current Part Block and Program Status:

```
?_B_A<cr><lf>
```

When part linking is performed, program status is also included in the string sent from the DLC. If a linked part is being executed, the starting block of the linked part is sent. When the end of the part is found, its corresponding part block is sent. The status "Linking Program" and "Link" on the DLC display can be decoded from this string, as well as the location of the current part counter.

DLC Response when part is not linked (Normal response):

```

B_A__12_**_**$hh<cr><lf>
      | _Current part block

```

At start of a linked part, no count found:

```
B_A__13_12_**$hh<cr><lf>
|  |_Start of linked part
|_Current part block
```

During a linked part:

```
B_A__14_12_15$hh<cr><lf>
|  |  |_End of linked part(where count and jump are found)
|  |_Start of linked part
|_Current Part block
```

Look Up Part Block - Given Part ID

```
?_B_N0123ABCD<cr><lf>
|_Part ID
```

The DLC will look up the part ID it receives and send back the corresponding block number. If a block number that matches the ID is not found, the DLC will send back stars (**) in place of the part number. Note that the active part, working part, and jump to part downloads may also be accessed by part ID.

```
B_N0123ABCD_01$hh<cr><lf>
|          |_Part block number
|_Part ID requested
```

Working Part Number

```
?_B_P
```

The DLC sends the current working part number used for wild card part access. When wild card characters are used, the information from this part is sent or received.

```
B_P__01$hh<cr><lf>
|_Current working part block number
```

Current Part Number by Part ID

```
?_B_AN<cr><lf>
```

DLC Response:

```
B_A_N01234567$hh<cr><lf>
|_____Current part number
```

The DLC will respond with the current part number. Note that the ?_B_A request is used for current part block and linking information.

Working Part Number by Part ID

```
?_B_PN<cr><lf>
```


DLC Response:

```
B_P_N01234567$hh<cr><lf>
  |_____Working part number
```

The DLC will respond with the working part number. *See **Batching Input - Working Part and Wild Card, Page 4-29.***

Batching Input

The input requests correspond wherever possible to the output from the DLC. Extraneous information is discarded so that the strings received from the DLC may be sent back to the DLC without causing any errors. Data may be also be accessed by part block in some cases. Selective storage of any of the information in the string may also be done by sending stars in place of the data.

Part ID, Early Warning, Jump to Part

```
#_B_W02_1234ABCD_012_90$hh<cr><lf>
  |          | | _Jump to Part Block
  |          | | _Early Warning
  |_____Part ID number
```

The Jump to Part may also be entered as a Part ID number. The DLC looks up the number, and if a matching part block isn't found it sends back the error "E Part # Not Found".

```
#_B_W02_1234ABCD_012_N0090-000$hh<cr><lf>
  |_____Jump to Part ID (N + Part ID
  |_____number)
```

A free run part may be selected either by jumping to the same part or by sending an 'F' in place of the Jump to Part.

```
#_B_W02_1234ABCD_012_F$hh<cr><lf>
  |_____alternate way of selecting Free
```

Part Quantity, Current Part Count micro-adjust

```
#_B_C01_012345_M+$hh<cr><lf>
  |          | | _Current Part count micro-adj. flag
  |_____Part Quantity
```

Sending a zero in the part quantity will zero the current part count. Sending a plus in the first digit of the quantity will select a linked part, as it does on the display.

If "M+" or "M-" are sent in the part count micro-adjust flag, the count will be increased or decreased by 1. If the flag is any other character or is omitted, the count will stay the same. An echo of information received from the DLC will not affect the current count.

Axis 1 feed length, feed rate, and feed quantity

#_B_F021+012.345_67.8__010\$hh<cr><lf>**

```

| |           |           |__Feed quantity ("---" = end of part)
| |           |__Axis 1 feed rate
| |_____Axis 1 feed length (with +/- feed direction sign)
|__Selected feed number (1-6)

```

Data may be sent with or without decimal points.

The feed length may also be micro-adjusted up or down using the flags "M+" and "M-".

#_B_F021M+\$hh<cr><lf>

Positive feed length micro-adjust

#_B_F021M-\$hh<cr><lf>

Negative feed length micro-adjust

Change Starting Part Number

#_B_A01

|_Change by part block number

#_B_AN111-1111

|_____Change by part ID number (send "N" and Part ID)

#_B_AM+

#_B_AM-

|_Micro-adjust starting part block number

#_B_A00

|_When not cycling, reset program to the start of the current part.

The starting part can be selected by block number, part ID, or micro-adjust as shown above. A change of the starting part is done only at cycle start. If there is no block number found when selecting by Part ID, the message "E: Part # Not Found" is sent from the DLC.

Change Working Part Number

#_B_P01

|_Change by part block number

#_B_PN111-1111

|_____Change by part ID number (send "N" and
Part ID)

#_B_PM+

#_B_PM-

|_Micro-adjust working part block number

The working part can be selected by block number, part ID, or micro-adjust as shown above.

When wild card characters are used, the information from this part is sent or received.

Current Feed Length / Feed Rate Input

#_X__00+001.234_56.7\$hh<cr><lf>

|_If sign isn't included, positive value
is stored.

The feed length can be input using the #_X__00 and #_X__01 commands when batching is enabled. These commands can be used to download the current feed length and feed rate for Axis 1 (X 00).

Batching Input - Working Part and Wild Card

A batching string may be sent with a wild card part number designated by two stars (**). When two stars are sent, the data is stored or received from the working part.

To change the working part, the string "#_B_P" is used. The working part may be changed by part block number, part ID, or micro-adjust (see string descriptions in this document).

Accessing Working Part with Wild Card Characters

Any batching data may be sent or received to or from the working part by using wild card characters.

Examples:

?_B_F**1<cr><lf> (requests Feed 1 data for the working part)

#_B_C**_001234\$hh<cr><lf>

(sends a part quantity of 1234 to the working part)

Using Working Part and Wild Card

The working part and wild card are useful for reducing communication program logic, since only one set of strings needs to be sent for all information. It is also useful when accessing data by Part ID rather than Part block number.

Example: Access data by Part ID without knowing Part Block

```
#_B_P_NPart#001$hh<cr><lf>      ;Change working part to ID "Part#001"
?_B_C**<cr><lf>                  ;Request part info for Part#001
B_C01_001234_000001_1_001$hh<cr><lf>      ;DLC response
?_B_F**1<cr><lf>                  ;Request Feed 1 info for Part#001
B_F011+012.345_67.8_**_001$hh<cr><lf>      ;DLC response
#_B_W**_*****_***_N222-2222$hh<cr><lf>
                                         ;Store a jump to Part ID 222-2222 froPart#001
```

Parameter Request

There are two types of parameter requests and responses. The extended parameter format string includes the digits exactly as they appear on the DLC display with parameter text, and is requested from the DLC with "?_KF". The "#_K_" input string allows either format, so that strings sent from the DLC can be echoed back.

Request to DLC for Condensed format: ?_K_A101<cr><lf>

Response from DLC: K_A101_00012345___\$hh<cr><lf>
 |<12 digit>|
 unformatted string

Request to DLC for Extended format: ?_KFA101<cr><lf>

Response from DLC:

K_A101__0001.2345__Feed Constant__\$hh<cr><lf>
 |<----->|<----->|
 | **Formatted** | **Parameter Text** |
Parameter | **in current language**
 (16 char.) | (16 char.)

Note: The "C" Parameter Text response will be 32 characters long.

Request to DLC for an Extended format for a "C" Parameter:

?_KFC003<cr><lf>

Response from DLC:

K_C003__000360.0__Position Data Scaling A-Output__\$hh<cr><lf>
 |<---16 digit--->|<----->|
 | **Parameter Text** |
in current language
 (32 char.)

Send to DLC:

#_K_A101_00012345\$hh<cr><lf>

or

#_K_A101___001.2345__FeedConstant__\$hh<cr><lf>
|___Remaining characters discarded by DLC

#_K_B111_101101\$hh<cr><lf>

or

#_K_B111_1_0_G=110_1___Batching Option__\$hh<cr><lf>

Dimensional Units Parameter

The DLC will send both the code and the text for Parameter B101, Dimensional Units, but uses the code to select the dimensional unit. These codes are listed below.

K_B1010020_____ft_____Dimensional Unit\$hh<cr><lf>
|___4-digit Unit Code

#_K_B1010020_____ft_____Dimensional Unit\$hh<cr><lf>

or

#_K_B101_0010\$hh<cr><lf>

Dimensional Unit Legend

<u>Text</u>	<u>Code</u>
in.	0000
ft.	0010
mm	0020
cm	0030
m	0040
rad.	0050
deg.	0060
rev.	0070

Parameter Input

Most parameters may be downloaded to the DLC only while the DLC is in Parameter Mode (See **Serial Port** below). The strings to send the DLC correspond to those sent from the DLC after a (? K) command. If a parameter is detected as invalid after it is input, the DLC will send back an error message (**E_K_nnnn_INVALID**).

#_K_nnn_XXXXXXXX\$hh<cr><lf> variable data length

<u>Store:</u>	<u>String sent to DLC:</u>
Feed Constant	#_K_A101_00012345\$CD<cr><lf>
Batching Option	#_K_B110_01110\$69<cr><lf>
Interface Option	#_K_B102_02\$F9<cr><lf>
Dimensional Unit	#_K_B101_0030\$99<cr><lf>

Note that extra digits may be added to the end of the string, which may make the sending software easier to write. For example, all 8 digits may be sent for feed length resolution, although it is a 2-digit parameter. They may also be echoed back formatted.

Serial Port

Parameter **B103 - Auxiliary Feed Length** can be changed on-line from the serial port.

Action Requests

Action requests to the DLC include Step Mode ON and Step Mode OFF commands. All action requests must include a checksum if enabled.

Step Mode On Request

!_s__01\$hh<cr><lf>

This string will put the DLC into Step Jog Mode for manual mode jogging.

Step Mode Off Request

!_s__00\$hh<cr><lf>

This string will turn off the Step mode and cause the DLC to jog normally (i.e. as long as the jog inputs are high).

Step Mode Toggle Request

!_s__02\$hh<cr><lf>

This string will toggle the DLC from jog step ON to jog step OFF and vice-versa.

Operating Mode Requests

The operating mode of the DLC may be changed through the serial port if the set up and automatic mode inputs are low. Otherwise, the DLC will issue a serial port error. The parallel system inputs take precedence over the serial input strings once they are toggled from high to low. Parameter mode can only be selected by DLC input.

Select Manual Mode:

!_s__03\$hh<cr><lf>

Select Automatic Mode:

!_s__04\$hh<cr><lf>

Select Set up Mode:

!_s__05\$hh<cr><lf>

Press Cycle Mode Toggle Request

!_s__07\$hh<cr><lf>

The Press Cycle Mode is toggled between Press Intermittent and Press Continuous if the corresponding DLC input is low. The notes for the mode inputs above also apply to this request.

Clear Fault Request

!_CLEAR\$hh<cr><lf>

This string functions the same as the CL key or the Clear input and clears a soft fault or hard fault.

Cycle Stop and Part Stop Requests

Note that for safety reasons, an operator Cycle Stop or Part Stop push-button should always be wired to the DEA 4. These strings can provide a secondary method of stopping the cycle from a remote site.

!_STOP\$hh<cr><lf>

This string functions the same as the Cycle Stop input.

!_STPT\$hh<cr><lf>

This string functions the same as the Part Stop input.

Polling Request

A polling request may be used to see if the DLC is on-line. The SOT on the RS-485 bus periodically sends this request to ensure the integrity of bus communications. This response is compatible with DLC-A and DLC-R and consists of a colon, a station number, diagnostic code, a carriage return, and a linefeed (no checksum).

Polling Request

:1<cr><lf>

1 = Request to station number 1.

Polling Response :snn (s=station, nn = diag. code)

:101<cr><lf>

The DLC Responds to the SOT with the station number and the current status diagnostic code. In this example the station number is 1 and the diagnostic code is 01.

Checksum

To ensure that the correct data is being sent and received, a checksum is calculated and checked by the DLC. It is recommended that the checksum be enabled. However, if the host software doesn't calculate a checksum, checksum can be disabled in the Interface parameter. To compute the checksum, add together the hexadecimal ASCII values of all of the characters before the '\$'. Then add the most significant digit of the checksum to the two least significant digits. Then, negate ('+/' on a calculator) this value to form the two's complement. Take the last 2 digits of this number. The result is a 2-digit checksum to be transmitted to the DLC.

Example:

#_B_A03\$B6<cr><lf>

Checksum on #_B_A03:	23 hex
	20
	42
	20
	41
	30
	+ 33
	149
	49
	+ 1
	4A

Checksum = -(4A) = B6

RS-232 Flow Control

The DLC supports both hardware and software flow control (handshake). The device communicating with the DLC must have either or both types of handshake, or characters may be missed during high-speed transmission. The method of flow control is selected in the Serial Port Operation parameter (B119). The options are described below.

Software handshake uses the XON (ASCII \$11) and XOFF (ASCII \$13) characters to provide flow control. When an XOFF is sent to the DLC transmission is interrupted until an XON is sent. The DLC will send an XOFF when an interruption in transmission is necessary because of buffer overflow, due to a high transmission rate. Software handshake is always enabled.

Hardware handshake uses the RTS (Request To Send) and CTS (Clear To Send) lines on the RS-232 cable to provide flow control. When the host lowers the CTS line, transmission from the DLC will be interrupted until the CTS is raised. The DLC will lower the RTS when an interruption in transmission from the host is necessary. If the host does not support hardware handshake, the RTS/CTS lines are not connected, or the use of RTS/CTS is inconsistent with the DLC, select software handshaking only (no hardware handshake).

XON/XOFF and RTS/CTS are provided to keep the DLC's buffers from overflowing and should be used the same way by the host software. The communicating device should employ some other type of internal flow control (e.g. sending one message at a time) to prevent the ports from

reaching a handshake state.

Block Uploads

When a Block Upload is requested, the DLC will send a block consisting of a header and several messages. The header will contain the identifier and the number of messages that will be sent. Currently, the Block Upload feature allows each of the Status, Minor, Soft, and Hard tables in the current language to be uploaded. A table listing the current status, error and fault messages is included as the next section (*Serial Diagnostic Codes*). A checksum is not required in the request string.

Status Message Block Upload

?_U__00<cr><lf>

Minor Error Block Upload

?_U__40<cr><lf>

Soft Fault Block Upload

?_U__60<cr><lf>

Hard Fault Block Upload

?_U__80<cr><lf>

The DLC will respond with a header block that has the identifier and the length of the block: **U \60.23\$EF** indicates that the soft fault table is being sent and that there are 23 (decimal) messages. Each message in the block will start with a 'U' and the message number and end with **<cr><lf>**. The text string is 40 characters long and corresponds to the DLC's LCD but with spaces removed. If the status table is requested, the DLC will send a 40-character message that is more descriptive than that of the LCD. The following is an abbreviated example of a response from the DLC when the hard fault table is requested:

```

U \80.10$EA
U 80DLC SYSTEM ERROR Code #HRD00           $CD
U 81Parameters Lost! Clear to Cont.         $ED
U 82Axis 1 Drive Runaway!                   $6A
U 84DLC SYSTEM ERROR Code #PL001           $DA
U 85DLC SYSTEM ERROR Code #FXPM0001        $6A
U 86Parameters Lost! Select P - Mode!      $57
U 87DLC SYSTEM ERROR Code #UPRG01          $85
U 88EMERGENCY STOP! EMERGENCY STOP!        $60
U 89Axis 1 Amplifier Hardware Fault!        $BE
U 8BAxis 1 Motor Has Overheated!           $C5

```

Serial Diagnostic Codes

This section lists the current status messages, minor errors, soft faults and hard faults that will be issued by the DLC. The maximum message length is 40 characters. When these same messages appear as the status page on the DLC control panel display, they are abbreviated to fit within two lines of 16 characters each.

Serial Diagnostic Code	Serial Port Message (? X 14 xx/ ? U xx)	
	<u>Status Messages</u>	
00	System Is Ready	\$
01	M: No Jog Command	\$
02	M: Feeding Forward	\$
03	A: No Cycle Start	\$
04	A: Cycle Stop	\$
05	A: Feeding	\$
06	A: Waiting for Feed Angle	\$
07	A: Cycle Delay	\$
09	S: Feeding Forward	\$
0A	S: Feed Incomplete	\$
0B	S: Waiting for Feed Angle	\$
0C	S: Waiting for Press	\$
0D	S: Start of Feed	\$
0E	DLC PARAMETER MODE	\$
12	S: Release Jog	\$
13	Both Jogs High	\$
14	M: Waiting for Feed Angle	\$
15	A: Resume Required	\$
16	S: Feeding Reverse	\$
17	M: Feeding Reverse	\$
18	Initializing System	\$
19	A: Waiting for Press	\$
1A	A: Cycle Stop Input Active	\$
1B	A: Cycle Start Input Active	\$
1C	A: Resume Input Active	\$
20	Jog Input Active	\$
22	A: Part Stop Input Active	\$
23	A: Part Stop	\$

Serial Diagnostic Code	<u>Serial Port Message (? X 14 xx/ ? U xx)</u>	
	<u>Minor Errors</u>	
40	DLC SYSTEM ERROR Code #MNR00	\$
41	Zero Feedlength Entered	\$
43	Zero % Feedrate Entered	\$
44	Drive Is Not Enabled!	\$
46	Axis 1 Has Not Reached Position	\$
48	Stop Due To Interrupt Input!	\$
49	Feed Angle Is Missing!	\$
4C	Change in Fdlgth Exceeds Limit	\$
4D	Feedlength Exceeds Maximum	\$
4E	Feedlength Less Than Minimum	\$
53	Auto Mode Exit Required	\$
	<u>Soft Faults</u>	
60	DLC SYSTEM ERROR Code #SFT00	\$
61	Serial Com Port Disconnection!	\$
62	Serial Com Port Overrun Error!	\$
63	Serial Com Port Framing Error!	\$
64	Serial Com Port Parity Error!	\$
65	Serial Com Port IDS Format Error!	\$
66	Feed Angle Lost During Feed!	\$
67	Serial Com Port RS485 Bus Error!	\$
68	Movement While Feed Angle Low	\$
69	Press Timeout Has Expired	\$
6A	Invalid Mode Selection!	\$
6B	Press Cycle Without Feed!	\$
6D	Zero % Feedrate Programmed!	\$
6E	Set Up Mode Cycle Incomplete	\$
70	DLC SYSTEM ERROR Code #UPRG02	\$
71	DLC SYSTEM ERROR Code #FLPM0001	\$
72	DLC SYSTEM ERROR Code #FLPM0002	\$
73	Aux. Feedlength Is Zero!	\$
74	Count Exceeds Part Quantity	\$
76	Battery is Low! Replace it Soon	\$
77	Para. Invalid! Select P-mode!	\$
78	Batching Program was Lost!	\$
7D	Motor Overtemp Warning	\$
7E	Amp Overtemp Warning	\$

Serial		
Diagnostic	<u>Serial Port Message (? X 14 xx/ ? U xx)</u>	
Code		
	<u>Hard Faults</u>	
80	DLC SYSTEM ERROR Code #HRD00	\$
81	Parameters Lost! Clear to Cont.	\$
82	Axis 1 Drive Runaway!	\$
84	DLC SYSTEM ERROR Code #PL001	\$
85	DLC SYSTEM ERROR Code #FXPM0001	\$
86	Parameters Lost! Select P - Mode!	\$
87	DLC SYSTEM ERROR Code #UPRG01	\$
88	EMERGENCY STOP! EMERGENCY STOP!	\$
89	Axis 1 Amplifier Hardware Fault!	\$
8B	Axis 1 Motor Has Overheated!	\$
8C	Axis 1 Drive Stalled!	\$
8E	DLC SYSTEM ERROR Code #FLPM0003	\$
90	Measuring Wheel Encoder Fault	\$
92	Invalid Drive Configuration	\$
93	Drive Watch Dog Error	\$
94	DPR Not Readable	\$
96	Drive Error Press the CR Key	\$
97	Invalid Drive Software	\$

Serial Interface Errors

There are two types of interface errors: transmission errors and format errors.

Transmission Errors:

Transmission errors are cycle stop soft faults since they indicate that the serial cable or port is faulty.

code #: 62

**Serial Com Port
Overrun Error!**

Overrun occurs when the baud rate of the host is greater than the baud rate of the DLC. It is also issued when the DLC has missed data due to a faulty cable or port.

code #: 63

**Serial Com Port
Framing Error!**

This error occurs when the baud rate of the DLC is greater than the baud rate of the host, or if the start and stop bit parameters are not the same at both ends of the communication line. It is also issued when the DLC has missed data due to a faulty cable or port.

code #: 64

**Serial Com Port
Parity Error!**

This error occurs when the parity type of the DLC doesn't match that of the host. It also is issued during transmission if the parity check fails, indicating a faulty serial cable.

code#: 67

**Serial Com Port
RS485 Bus Error!**

This error is issued when data is being sent and received at the same time when SOT operation is selected in Parameter B118. If the device communicating with the DLC is not a DR1-02VRS compatible SOT, the Interface mode in B118 should be set to 1. If the DLC is talking to an SOT, this error indicates a faulty cable or port.

code#: 61

**Serial Com Port
Disconnection!**

This error is issued when the IDS decade switch is not communicating with the DLC when Parameter B102 is set to 01. The time for disconnect detection is automatically set to 2 seconds when IDS is enabled.

**Serial Com Port
IDS Format Error**

This error is issued only when the IDS interface option is selected and indicates a faulty serial port or cable.

Format Errors:

Every format error sent from the DLC includes a code number. It is also sent in the currently selected language and in both upper and lower case. Otherwise, the text for the existing errors have not been changed since LR01.2-005.1. The format error string has the following format:

```
E_nn_16-char. message$hh<cr><lf>  
:_Format error code
```

Format errors are issued only over the serial interface and do not cause a DLC fault. An 'E' followed by a two digit error code, followed by a 16-character string is sent from the DLC. Each message starts with a different error code number for error detection by the host, as shown in the following list.

List of Format Errors With Codes

E_00_Format_Error____
E_01_Identifier Error
E_02_#_Out_Of_Bounds_
E_03_Checksum_Error__
E_04_String_Invalid__
E_05_Batch_Disabled__
E_06_K_Xnnn_Invalid__ (xnnn replaced by para number)
E_07_Para_Not_Allowed
E_0E_!!Flp_Err_0001!!
E_0F_Part # Not Found
E_11_Not_Implemented_
E_12_DLC Input High__

Each format error is individually described on the following pages.

E_00_Format_Error____\$hh<Cr><Lf>

This error is sent when the format characters (chars 3 and 4) are invalid. It is also a generic error that is issued when a message isn't being received properly due to improper handshaking or no carriage return or linefeed.

E_01_Identifier_Error\$hh<Cr><Lf>

This error is issued when an identifier character (e.g. the lowercase c in ?_B_c01) is invalid.

E_02_#_Out_Of_Bounds_\$hh<Cr><Lf>

This error is sent when the number in the identifier is greater than the maximum number of batches, status messages, or parameters.

E_03_Checksum_Error__\$hh<Cr><Lf>

This error occurs when the checksum computed by the DLC doesn't match the one transmitted, which could result from a faulty serial cable or port. It also is issued when the checksum is invalid or missing.

E_04_String_Invalid__\$hh<Cr><Lf>

This message is sent when the received data is invalid. (e.g. if the feed length data is not decimal characters)

E_06_K_A100_Invalid_\$\$hh<Cr><Lf> 'A100'=Parameter Downloaded To DLC

This message is sent when a downloaded parameter exceeds its limits. It corresponds to the 'is invalid' message on the DLC display.

E_07_Para_Not_Allowed\$\$hh<Cr><Lf>

This message is sent when a parameter download is attempted when the DLC is not in parameter mode.

Note: *If an error is detected when exiting parameter mode, the status code (X_07 or at end of string if ? XD) from the DLC will be a generic 'Parameter is Invalid'. The DLC will send the message "Knnn Invalid" the next time a parameter is requested.*

E_0E_!!Flp_Err_0001!!\$\$hh<cr><lf>

This is an internal DLC system error. Call the Indramat service department if this error is received from the DLC.

E_0F_Part_#_Not_Found\$\$hh<cr><lf>

This error is sent when no match is found for the part ID received by the DLC for starting part, working part, or Jump to Part.

Message Acknowledgment:

Y_<cr><lf> if B118 mode is 1 (RS-232)

Yn<cr><lf> n=station number, if B118= 2 or 3 (single SOT or SOT on RS-485 bus)

This message is an acknowledgment of correctly stored data when the Serial Interface Mode (Parameter B118) is 2 or 3 (or 1 or if acknowledgment is enabled).

SOT ScreenManager™ Notes

The SOT is preprogrammed using Indramat ScreenManager™. This software package runs on any PC computer using MS-DOS. This program was used to write the information and prompt lines that appear on the SOT display. The command lines are downloaded to the SOT. From the SOT keyboard, data can be entered in response to these command line prompts.

The SOT for the DLC-R is preprogrammed with prompts for its general application. Use this program if desired to further customize the screen for a specific application.

This section provides a short note about an easy access to the batching data over the serial port. The working part can be used for easy access to all Batching data while conserving SOT memory. Alternately, the Part Blocks may be treated as program blocks. For example, instead of Part Block 10, the Block in the Screen manager can be set up in the command file as Block 100. To facilitate this, the DLC ignores the character after the Part block. Also, each feed can be accessed as a program block. Part 10, feed 1 can be called Block 101.

Example

```
#_B_C100001234_001000_1_001$hh<cr><lf>
    bbbqqqqqq
```

bbb=Block number (Part Block 10), qqqqqq=part quantity

Most data can be echoed "as is" from the DLC and back, including the parameters, which are always 12 characters long when unformatted, and 32 characters (including text) when formatted. All data that isn't needed in the send string is discarded by the DLC.

4.3 Measuring Wheel

This feature can be used when slippage of the feed rolls or stretch of material causes inaccurate feed lengths. A measuring wheel, which rides on the surface of the material, can be used with the DLC to correct any deviation in length that may occur between the feed rolls and the point at which the material is measured.

The DLC offers three different methods for position correction using a measuring wheel. When Measuring Wheel is selected by input (or enabled in parameter B112 to be active without the input), every feed in automatic and setup mode will be length-compensated. The dynamic position correction mode continuously measures the difference between the motor encoder and MW encoder. Correction to the feed length is made throughout the entire feed. Position is maintained by the motor encoder. The second method uses the MW encoder to measure the feed, but when the feed angle transitions to a low signal, position is maintained by the motor encoder. The third method is for the MW encoder to measure the feed and maintain position continuously. All three methods still provide safety by monitoring the deviation between the motor encoder and MW encoder.

If the Measuring Wheel Enable is turned ON or OFF during a cycle, none of the feed lengths (positive, negative, auxiliary, batching) will be affected. Operation in or out of the Length Compensation mode continues until a Cycle Stop is issued (or a fault or error occurs). The MW Enable Input is only read at Cycle Start or Resume Cycle.

4.4 Single Step Using Start and Stop Inputs

A single step may be performed by activating the Cycle Start input and the Part Stop or Cycle Stop input simultaneously. The Part Stop input can be used for single step only when batching is enabled.

If the Cycle Stop + Cycle Start are activated, the DLC will step one feed and press stroke at a time. The status message "A: C.Stop Active" will be displayed by default indicating that the cycle stop input is active. A single feed will take place when the cycle start input is activated. If the Part Stop and Cycle Start are activated in batch mode, the DLC will step one part at a time and the status message "A: P.Stop Active" will be displayed.

Chapter 5. Parameters

This chapter describes the user entered parameters required for the DLC to perform the motion control operation. The user adapts the DLC to his machine and the mechanical characteristics of the application by entering values for various parameters. This permits a standard control system to conform to different but similar applications.

Note: *The DLC requires that all parameters be correctly entered before operation is possible.*

5.1 Parameter Set Description

The DLC includes the following sets of parameters.

Parameter Set A1:

This parameter set includes the axis operating values for Automatic, Manual and Set up Mode operation. These parameters allow the user to configure the DLC for the motor and drive package that the DLC is controlling. They also allow the user to set the various factors of the motion profile, as required for the material and application. These include the resolution of the feed, acceleration and deceleration rates, feed rates in different modes, etc.

Parameter Set B1:

This parameter set establishes the operating arrangement of the DLC. It allows the user to configure the DLC for various options such as the language that shows on the display (English, German, Spanish, French or Italian); selecting control interface options, such as the IDS or SOT; selecting and configuring other optional features like Batching.

Parameter Set C0:

This parameter set allows drive tuning through the DLC. Drive parameters can be set using CTA keypad or RS232 serial interface. Standard drive parameters are set using CTA keypad only. In both cases, processing must not occur simultaneously over the CTA keypad and RS232 serial drive interface. Drive parameters are viewed and edited in the same manner as for A and B parameters. C parameters are administered in the drive. With each new power-up, the C parameters are sent from the drive to the DLC.

5.2 Parameter List

The following table lists all of the parameters for the DLC with software version DR. Only the parameters available for your type of control will show on your DLC display for entry.

Parameter Set A1

Parameter A100: Feed Length Resolution
Parameter A101: Feed Constant
Parameter A102: Drive Max RPM
Parameter A103: Not Used
Parameter A104: Maximum Feed Rate
Parameter A105: Jog Feed Rate
Parameter A106: Maximum Acceleration Rate
Parameter A107: Maximum Deceleration Rate
Parameter A108: Maximum Allowable Jerk
Parameter A109: Position Gain
Parameter A110: In-Position Threshold
Parameter A111: Direction of Operation
Parameter A112: Monitoring Window for Drive Diagnostics
Parameter A113: Low Feed Angle Threshold
Parameter A114: Not Used

Parameter Set B1

Parameter B100: Language
Parameter B101: Dimensional Units
Parameter B102: Interface Option
Parameter B103: Auxiliary Feed Length
Parameter B104: Feed Length Maximum Limit
Parameter B105: Feed Length Minimum Limit
Parameter B106: Feed Length Maximum Change During Cycle
Parameter B107: Feed Length Micro-Adjust Increment
Parameter B108: Jog Step Parameter
Parameter B109: Press Interface Mode
Parameter B110: Not Used
Parameter B111: Batching Option
Parameter B112: Measuring Wheel (MW) Selection
Parameter B113: Not Used
Parameter B114: Not Used
Parameter B115: Not Used
Parameter B116: Measuring Wheel Feed Constant
Parameter B117: Measuring Wheel Encoder
Parameter B118: Serial Interface
Parameter B119: Serial Port Operation
Parameter B120: Not Used
Parameter B121: Not Used
Parameter B122: Slug Width Compensation

Parameter Set C0

Parameter C000 - Analog Output: Channel 1

Parameter C001 - Analog Output: Channel 2

Parameter C002 - Overload Factor

Parameter C003 - Position Data Scaling at Analog Outputs AK1 and AK2

Parameter C004 - Velocity Data Scaling at Analog Outputs AK1 and AK2

Parameter C005 - Velocity Loop Monitoring

Parameter C006: Not Used

Parameter C007: Not Used

Parameter C008 - Error Reaction

Parameter C009 - Current Loop Proportional Gain

Parameter C010 - Velocity Loop Proportional Gain

Parameter C011 - Velocity Loop Integral Reaction Time

Parameter C012 - Smoothing Time Constant

Parameter C100 - Set Standard Drive Tuning Parameters Over CTA

5.3 Entering the Parameters

The DLC must be in Parameter Mode to enter or edit parameters. The Parameter Mode is normally selected via a switch on the user control panel. This selector switch will typically require a key to enter this mode to prevent unauthorized changes to the parameter values.

Parameters are entered or changed by writing over any previous data stored. These changes are made through the DLC keypad (or via a serial interfaced host). After you correctly enter the desired value of each parameter, press the STORE key to save the new value in memory. A Lithium backup battery assures this memory is retained when the DLC is powered down or if the system experiences a power loss.

In Parameter Mode, the DLC display shows the parameter name, number and data value of the parameter selected, as illustrated below.

Feed Length Res.	
A100	02

When selecting Parameter Mode, the display shows the first parameter of the **A1** set of parameters (A100), unless a fault exists, as described below.

Note: *Should the displayed message appear in a language other than the language desired by the user, enter the **B1** Parameter Set as described in the section, "Entering the **B1** Parameter Set". Set Parameter B100 to change the display to the desired language, as explained in the section, "**Parameter B100: Language**".*

Two conditions exist which can result in a parameter "Is Invalid" fault message.

1. The DLC software checks the parameter input value limits when you press the STORE key. If you have entered a value higher or lower than

the limits of the parameter, a diagnostic message appears in the display after you press the STORE key. The parameter description and number remain on the display. In place of the data, the message "Is Invalid" appears.

**Feed Length Res.
A100 Is Invalid!**

Press the CL key to clear the fault status message. The display returns to the normal parameter entry display. Enter correct values for the parameter (within limits) and press STORE.

2. The DLC checks the parameters each time power is applied to the unit. It also does secondary calculations, based on entered parameter data, when you switch out of Parameter Mode. In either case, if required parameter's data is missing or incorrectly entered, the DLC detects the error and displays the "Parameter Is Invalid" diagnostic message.

**Parameter A105
Is Invalid!**

Switch back into Parameter Mode. The first "invalid" parameter automatically displays. Enter the data correctly and press STORE for each parameter that appears as invalid.

To advance or scroll forward through the parameter set, press the up arrow key on the DLC keypad. Each time you press the key, the parameters on the display advance from the first to last. Use the down arrow key to scroll backwards through the parameter set.

Press the CR key to toggle between the A, B and C Parameter sets. Press the left or right arrow key to move the cursor left or right within the display. Each parameter can be accessed directly without scrolling. Press the "Hot" (blank) key on the keypad to move the cursor to the parameter number. Type over the number to directly select the desired parameter to display.

The parameter displays are visible in the DLC's control panel display and on the optional SOT or other host, via the RS-232/485 serial interface, when used.

Note: The optional remote florescent tube display, available with the IDS option, will only display the message **Parameter Mode** while the DLC is in this mode. The two digit display on the IDS shows code number 17 when this mode is selected.

Perform the following steps to change or edit the value of a parameter (from the DLC control panel; see Chapter 4 for procedures to download from a PC or SOT via the serial interface):

1. Move the cursor (arrow keys) over the digit you want to change.

2. Enter the desired number from the DLC keypad (type over existing entry).
3. Verify data changes are correct in the display.
4. Press the STORE key to save the new parameter values (displayed data) into memory.
5. Maintain a current list of parameter entries. Appendix C provides work sheets which show the organization of each parameter and provide spaces to list each entry.

5.4 Unit of Measurement/Input Unit

The Unit of Measurement, also referred to as Input Unit (IU), is the type of measurement category selected that best suits the application. Categories include: inches, feet, millimeters, degrees, etc.

Parameter B101 displays the dimensional (input) unit category currently selected. This parameter is designed only as a memory aid for the user. The settings in this parameter will in no way affect the computation or operation of the DLC. All calculations are based on the feed length resolution (A100). The unit of measurement is typically determined by the number of decimal places of resolution required for the application, as described in the section, "**Parameter A100: Feed Length Resolution**".

5.5 Parameter Set A1

The following sections describe the parameters in set A1, required for the DLC to command motion. Each parameter description includes an illustration of the DLC display and the formula required to obtain the parameter value, where applicable. For easy reference, this section describes each parameter in numerical order (A1 set, then the B1 set).

Parameter A100: Feed Length Resolution

Feed Length Res.
A100 02

Input value limits: between 01 and 04

This parameter controls the decimal point placement for most of the parameters shown in the DLC display. The number of decimal places determines the level of resolution or exactness of a parameter value.

The level of resolution is relative to the input unit or dimensional unit. Typically, the number of decimal places indicates the category of the unit of measurement. Table 5-2 shows the typical relationship of decimal placement (resolution) to unit of measurement commonly used.

Decimal Placement	Unit of Measurement
.X	Angular Measurement (e.g., Degrees, Radians)
.XX	International System (Metric) (e.g., Millimeters, Centimeters)
.XXX	US Customary System (e.g., Inches, Feet)
.XXXX	High Resolution Usually Used With US Customary System

Table 5-1 Typical Decimal Placement

Note: The decimal placement relationship to unit of measurement, as shown in Table 5-2, is **typically** used in the Motion Control industry. However, this relationship is not restricted to the categories shown. Any of the four levels of decimal placement can be used with any unit of measurement desired. The final selection is dependent on the level of resolution required.

Although Parameter A100 affects most of the other parameters, not all the parameters are affected in the same way. All velocity and acceleration parameter displays have one less decimal place than the feed length parameters. The Feed Constant and Position Tolerance parameter displays have one more decimal place than the feed length parameters (refer to Table 5-2 Decimal Placement).

For example, if 02 is entered as a value in Parameter A100:

- The Feed Length Limit = 2 decimal places.
- The Acceleration Rate = 1 decimal place.
- The Feed Constant = 3 decimal places.

The following table summarizes the decimal places that result from the four possible values of Parameter A100.

A100 Parameter Entry Value	Feed Length Parameters	Max. Jerk Accel/Velocity	Feed Constant and In-Pos. Threshold
01	1	0	2
02	2	1	3
03	3	2	4
04	4	3	5

Table 5-2 Decimal Placement

The remainder of the parameters either do not use number values or have fixed decimal places. The parameters that have fixed decimal places are:

- A102 - Drive Input Sensitivity
- A109 - Position Gain
- A112 - Monitor Window
- B109 - Press Interface, Minimum Cycle Time

Note: When A100 is changed, the numerical digits in other parameters remain in place but the decimal point shifts. As an example, with A100 set to 03, and the value entered in A101 = 1.2345, if A100 is changed to 02, then A101 data becomes 12.345. If you change parameter A100, you then need to verify and change other parameters, as required.

Note: For simplicity and consistency, all parameter display illustrations in this manual reflect the decimal placement when A100 is set to 02.

Parameter A101: Feed Constant

Feed Constant
A101 01234.567

Units: Input units per motor revolution

Input Value Limits: from 00000100 to 10000000 (regardless of decimal pos.)

Decimal Places: A100 + 1 (figure shown A100=02)

The Feed Constant is the ratio of material movement per motor revolution. The feed roll diameter and the gear ratio are two of the values needed to determine the Feed Constant value. The DLC uses this constant value in several mathematical computations in order to command axis motion. This parameter defines the Input Units (IU) used in other parameters. Use the formula below to obtain the feed constant value required for your application. Enter the feed roll diameter in the Input Unit value that you want to use (inches, millimeters, etc.).

$$\text{Feed Constant} = \frac{\text{feed roll diameter} \times \pi}{\text{gear ratio}}$$

Parameter A102: Drive Max RPM

Drive Max RPM
A102 01500

This parameter defines the Maximum RPM of the motor. This value is found on the motor nameplate.

Parameter A103: Not Used

Not Used A103 Disabled
--

Parameter A104: Maximum Feed Rate

Max Feedrate A104 0123456.7

Input Unit: Input Units (IU [Unit of Measurement]) per minute

Input Value Minimum: 00000100 (regardless of decimal point)

Input Value Maximum: Max. RPM (A102) x Feed Constant (A101)

Decimal Places: A100 - 1 (figure shown A100=02)

This parameter defines the maximum feed rate at which material can be fed and is expressed in units per minute. The feed rate in Automatic Mode is expressed as a percentage of the Maximum Feed Rate entered in this parameter. This percentage is entered through the DLC keypad, or through the thumb-wheel switches of the optional IDS assembly, optional SOT keyboard or other host via the serial port.

Use the following formula to calculate the maximum feed rate.

$$\text{Maximum Feed Rate} = \text{Maximum Motor RPM} \times \text{Feed Constant}$$

(from A102) (from A101)

The entry in A104 should reflect the maximum feed rate desired for the application. This is not necessarily the same as the maximum the system is capable of performing.

Note: *Maximum Feed Rate is specified in units of measurement per minute. Convert seconds to minutes when required.*

CAUTION: *If the motor employed with this system is overrated for the application, feeding at the maximum feed rate may damage the feed rollers or its associated hardware. Adjust the entry in A104 to reflect the maximum feed rate desired for the application.*

Parameter A105: Jog Feed Rate

Jog Feedrate A105 0123456.7

Input Unit: Input Units per minute

Input Value Minimum: 00000100 (regardless of decimal point)

Input Value Maximum: less than or equal to maximum feed rate entered in parameter A104.

Decimal Places: A100 - 1 (figure shown A100=02)

This parameter specifies the maximum jog feed rate in Manual and Set up Modes. The jog feed rate is typically a much slower speed than the maximum feed rate.

It is recommended to start with a Jog Feed Rate at 10% of the Maximum Feed Rate (A104). Adjust higher or lower as desired for the application.

Example:

$$\text{Jog Feed Rate} = \text{Maximum Feed Rate (A104)} \times 10\%$$

Parameter A106: Maximum Acceleration Rate

Accel Rate A106 0123456.7

Input Unit: Input Units per second²

Input Value Minimum: 00000100 (regardless of decimal point)

Input Value Maximum: 99999999 (regardless of decimal point)

Decimal Places: A100 - 1 (figure shown A100=02)

When Constant Acceleration is selected (A108=0), this parameter specifies the constant acceleration rate used to reach peak velocity.

When Jerk Limiting (trapezoidal) Acceleration is selected (A108 not =0), acceleration is ramped up to the value specified in A106, and then ramped down to zero until peak velocity is reached.

You select the shape of the acceleration profile in Parameter A108 (refer to the section, "**Parameter A108: Maximum Allowable Jerk**").

Note: It is absolutely necessary to balance the Position Gain and the Maximum Acceleration Rate in order to avoid position overshoot.

Parameter A107: Maximum Deceleration Rate

Max Decel Rate A107 000012.3

Input Units: Input Units per second²
 Input Value Limits: If A108=0, Limits are the same as A106
 If A108 not =0, A107 must be equal to A106
 If A107=0, Default is A107=A106
 Decimal Places: A100 - 1 (figure shown A100=02)

When Constant Acceleration is selected, this parameter specifies the constant deceleration rate used to ramp down from peak velocity to zero velocity. The deceleration rate is not required to equal the acceleration rate.

When Jerk Limiting (trapezoidal) Acceleration is selected, the value stored in Parameter A106 or zero must be stored in this parameter (so A107=A106). The deceleration rate is required to equal the acceleration rate.

You select the shape of the acceleration profile in Parameter A108 (refer to the section, "**Parameter A108: Maximum Allowable Jerk**").

Note: *It is absolutely necessary to balance the Position Gain and the Maximum Deceleration Rate in order to avoid position overshoot.*

Parameter A108: Maximum Allowable Jerk

Maximum Jerk A108 0000123.4
--

If A108 = 0, constant acceleration rate is selected.

If A108 is not = 0:

Units: Input units per second³

Decimal places: A100 - 1 (figure shown A100=02)

Low Limit: $(60 \times A106^2) / A104$

High Limit: 99999999

This parameter selects the shape of the acceleration profile. If A108 is set to zero, Constant Acceleration Rate is selected. If A108 is not set to zero, the jerk rate is selected. Jerk is defined as the rate of acceleration change. The

value stored in this parameter is used to ramp up the acceleration to the value stored in Parameter A106 (Maximum Acceleration Rate).

When this value is set to the lowest level, a triangular acceleration profile will result. This profile produces the smoothest starts and stops but increases the time required to reach maximum acceleration. To decrease acceleration time and maintain the smoothest profile, the jerk should be increased. By increasing jerk, the acceleration profile will approach trapezoidal and acceleration time approaches that of constant acceleration. Due to the earlier mechanical method of Jerk Limiting (primarily cams), some users may refer to Jerk Limiting as a Modified "S" Curve.

In applications where stretch or slip are a problem, Jerk Limiting will improve performance. The profiles shown in *Figure 5-1: Profile without Jerk Limiting* and *Figure 5-2: Profile with Jerk Limiting* illustrate the effect of Jerk Limiting. The Velocity Profile in *Figure 5-2* has much smoother "S" shaped ramps than the ones in *Figure 5-1*. The Acceleration Profile in *Figure 5-1* is a near square, while the profile in *Figure 5-2* is a trapezoid shape. The Jerk profile in *Figure 5-2* is far less severe than the one in *Figure 5-1*.

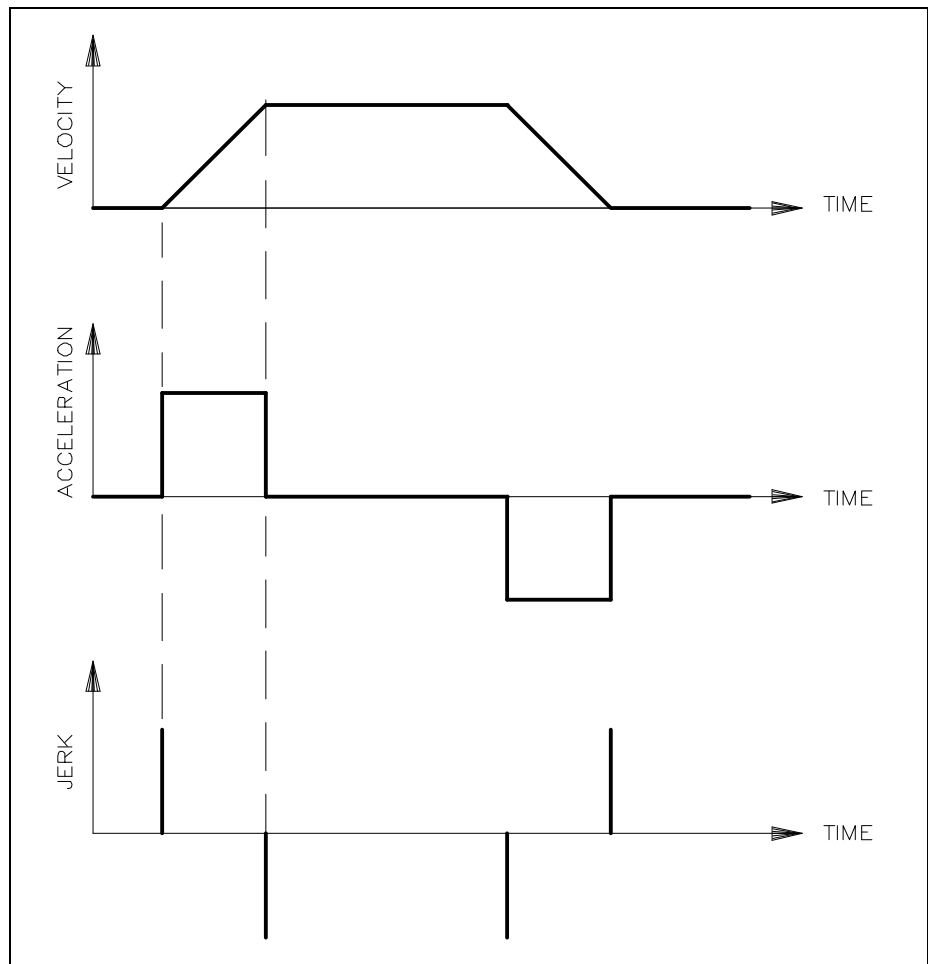


Figure 5-1: Profile without Jerk Limiting

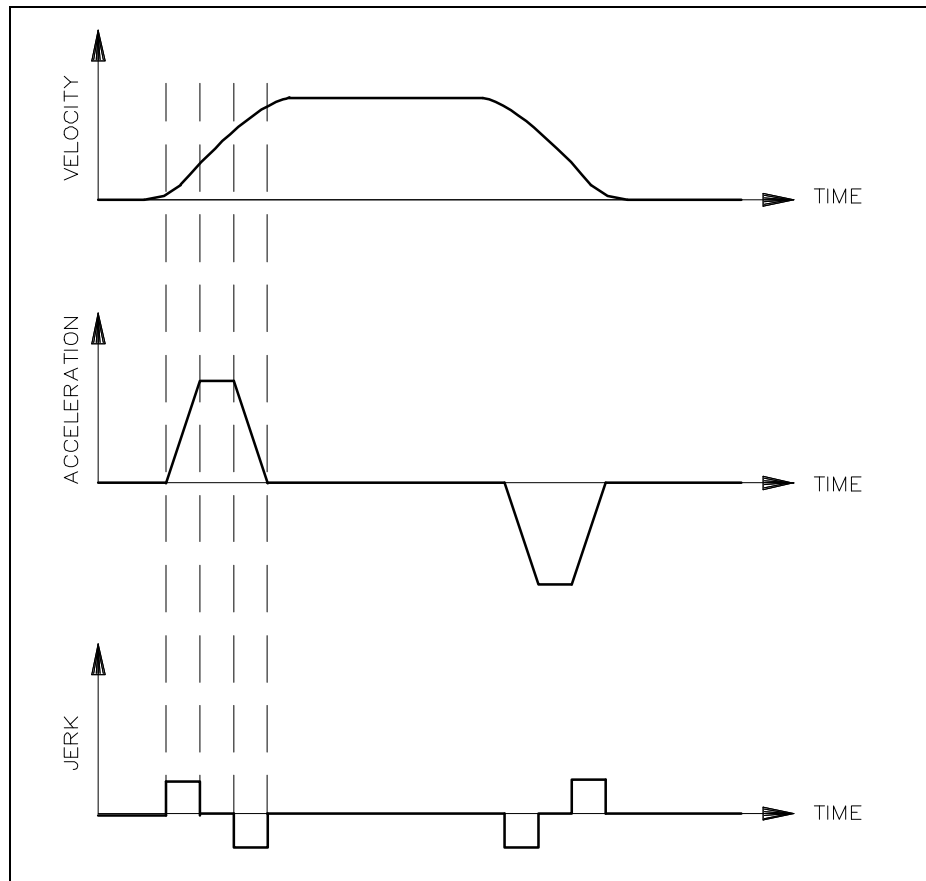


Figure 5-2: Profile with Jerk Limiting

Parameter A109: Position Gain

Position Gain	
A109	01.23

Input Units: Input Units per minute per 0.001 input units

[IU in inches] inches per minute per mil (.001 inch)

[IU in meters] meters per minute per millimeter (.001 m)

Decimal Places: 2, not affected by A100 setting

Input Value Limits: 00.01 to 10.00

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

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

Position Gain is represented by the expression Kv. Use the formulas below to determine Kv.

<u>US Customary</u>	<u>International (Metric)</u>
in/min	m/min
Kv = ----- 0.001 in	Kv = ----- 0.001 m

The higher the gain the smaller the position error. Position Gain is tuned to achieve the desired performance of the system. Gain should not be so high as to cause system overshoot or oscillation.

Note: A position loop gain set too low will result in sluggish operation. Too high a setting causes the system to be too sensitive. This results in motor oscillation. A by-product of motor oscillation is an audible buzz or ringing noise.

Load inertia, friction, motor dynamics, and velocity, are just some of the elements which affect gain. Because of the many variables that influence the proper gain, there is no established setting for this parameter. However, it is recommended that the user begin with a small number (such as 00.50) and increase the numeric entry until optimum performance is achieved.

Note: The Position Gain (A109), the Acceleration Rate (A106), the Deceleration Rate (A107) and Maximum Jerk (A108) directly interact with one another. Before operating, after setting the position gain, insure the acceleration rate is set correctly for the application.

WARNING: If the gain is set too high, the motor could begin oscillating the moment power is applied. This condition could result in damage to the machine and/or personal injury. Disconnect the motor from the machine for initial testing.

Parameter A110: In-Position Threshold

In-Pos Threshold
A110 000.123

Units: Input Units

Decimal Places: A100 + 1 (figure shown A100=02)

Input Value Limits: from 000.000 to 999.999

This parameter sets the in-position threshold window for Axis 1. This is the defined window or area in which the DLC will consider the axis in position. A close or tight threshold requires more time for the axis to reach position (within threshold window).

Enter the value in the unit of measurement common to the rest of the parameters (inches to inches or millimeter to millimeter).

The DLC should always make the exact feed (within feed length resolution) as shown in Figure 5-3: In-Position Threshold. This parameter is used to determine when the axis is not feeding and, if set small enough, will not affect the accuracy of the feed. This parameter should **not** be misinterpreted as "feed accuracy."

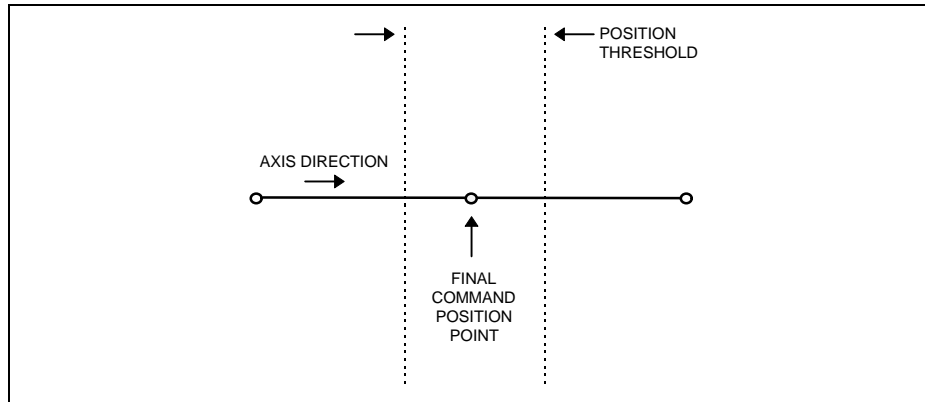


Figure 5-3: In-Position Threshold

Parameter A111: Direction of Operation

Direction A111 Enc=0 Cmd=0

Input Value Limit: 0 or 1

This parameter allows changing the axis direction (+/-) by software in the DLC. Direction and polarity changes are provided by this parameter without the need for wiring changes.

Enc = 0 - Direction of operation remains unchanged (as wired)
 = 1 - Reverse direction of operation (inverts operating polarity of the motor encoder)

Cmd = 0 - Direction of operation remains unchanged (as wired)
 = 1 - Reverse direction of operation
 (inverts the polarity of the DLC velocity command output)

WARNING: Runaway conditions can occur if this parameter is changed so that the phase relationship between feedback and command is incorrect. Incorrectly defined velocity command/encoder polarity will result in unexpected motor direction movement. This condition could result in machine damage and/or personal injury. It is recommended to disconnect the load from the motor when altering this parameter. Once operation and direction are verified, the load can be reconnected.

Parameter A112: Monitoring Window for Drive Diagnostics

Monitor Window
A112 10.0%

Units: Input Units

Decimal Places: 1, unaffected by A100

Input Value Limits: 00.1%-20.0%

This parameter selects an error detection monitoring window for "Drive Stalled" and "Drive Runaway" hard faults. The DLC uses a mathematical model of the system to calculate the expected position error (lag). Drive Runaway occurs when the motor is moving too far ahead of the expected lag. Drive Stalled occurs when the motor is moving too far behind the expected lag. Parameter A112 defines the amount of input units the drive can deviate from its expected position error.

- If the position read from the encoder is greater than the expected position, plus the amount of the monitoring window, the DLC detects a "Drive Runaway" condition.
- If the position read from the encoder is less than the expected position, plus the amount of the monitoring window, the DLC detects a "Drive Stalled" condition.

The suggested value for this parameter is 10%.

The allowed deviation of the motor's Lag is computed as follows:

$$\text{Lag} = \text{Velocity} / (\text{KV} \times 1000)$$

$$\text{MAX_LAG} = \text{A102 (max RPM)} / (1000 \times \text{A109})$$

$$\text{Allowed Deviation from computed Lag} = \text{A112 \%} \times \text{MAX_LAG}$$

Notes:

1. *If A112 is too small, a normal feed will cause "Drive Runaway" or "Drive Stalled."*
2. *For quicker error detection, A112 may be entered as less than 10%, as long as the condition noted above does not occur.*
3. *A112 may be made larger than the suggested value if desired. An upper limit of 20% is placed on the parameter.*
4. *If the position tolerance is set to a high value (larger than allowed deviation from max lag), the DLC may not be able to distinguish stalled from runaway, although a hard fault will still be issued. See Chapter 8 for description of fault diagnostics.*

Parameter A113: Low Feed Angle Threshold

Low FA Threshold
A113 00.0100

The DLC can use this parameter while the feed angle is low to determine if the material is in position. It uses Parameter A110 (In-Position Threshold) when the feed angle is high.

If the position error is greater than this value (material slipped out of position) while the feed angle is low, the soft fault "Movement While Feed Angle Low" is issued.

Typically, the machine builder will cause the feed rolls to open during the actual press operation, then close to feed material. If the rolls are closed, and the press low feed angle causes the material to pull (turning the feed rolls, causing feedback to the DLC), the DLC will issue a fault. This parameter allows setting a tolerance that will allow the feed rolls to move some amount before causing the DLC to issue a fault.

This parameter should not affect the accuracy of the feed because it is used only after the feed is complete. The in-position, feeding, and feed complete signals all depend on the value in this parameter.

If all zeros are entered in this parameter, the DLC uses the Position Tolerance (A110).

Parameter A114: Not Used

Not Used
A114 Disabled

5.6 Parameter Set B1

The following section describes the B1 set of parameters. They are used to configure or structure the DLC to a particular environment or application. Some of these parameters determine the language the display will use, the units of measurement employed, and options selected, if any.

Entering the B1 Parameter Set

To enter the B1 Parameter Set, the DLC must first be in the Parameter Mode. Upon selecting the Parameter Mode, the DLC normally displays A100, the first parameter in the A1 set (*refer to Parameter A100: Feed Length Resolution*).

Once in the Parameter Mode, press the CR key on the CTA keypad to change between the A1 and B1 set of parameters, from any parameter within any set. Parameter B100: Language is the first B1 parameter that appears in the DLC display (B100).

Note: *The user may exit the Parameter Mode from any parameter set at any time. The DLC returns to the selected operating mode (Manual, Automatic or Set up).*

The following sections describe each of the B1 parameters in detail.

Parameter B100: Language

Language	
B100	01

Input Value Limit: 00, 01, 02, 03 or 04

All displayed text messages appear in the language selected.

The language choices are as follows:

- 00 = German
- 01 = English
- 02 = French
- 03 = Spanish
- 04 = Italian

Parameter B101: Dimensional Units

Dimensional Unit B101 in.

Use this parameter only as a memory aid (electronic note pad) for the user. The operator's selection of input units has no effect on the computation or operation of the DLC. The selected dimensional unit displays with data on the SOT display.

Use the left or right arrow keys to scroll through the selection of dimensional units available. Press the STORE key when the desired selection displays. The following is a list of abbreviations which will display for available dimensional units:

in. = inches
ft. = feet
mm = millimeters
cm = centimeters
m = meters
deg. = degrees
rad. = radians
rev. = motor revolutions

Parameter B102: Interface Option

Interface Option B102 XX
--

Input Value Limit (XX) : 00, 01, 02, 03

This parameter selects the method of entering the Feed Length and Feed Rate in the DLC.

Viewing of the DLC Feed Length / Feed Rate display is performed differently with each option selected. They are described in **Chapter 2. Controls and Indicators**.

The following possible input values for B102 are further explained below:

- 00 - Standard DLC
 - 01 - Standard DLC with IDS (option)
 - 02 - Enable Batching Operation
 - 03 - Enable Batching without Part ID number (Auto Indexing)
- **If B102 is set to 00**, the standard DLC is selected. Feed Rate and Feed Length are entered directly through the DLC keypad or through a host terminal via the serial interface port.

Note: 02 and 03 are the only selections that allow the use of the batching function.

- **If B102 is set to 01**, the IDS option is selected. Feed Length and Feed Rate are entered through the IDS thumb-wheel switches. The serial interface port is automatically configured for the IDS and is not available for a separate host terminal input.
- **If B102 is set to 02**, the Batching option is selected. The Feed Length and Feed Rate are entered for different parts in the batching program. The part or parts to execute (with preprogrammed feed lengths, feed rate, etc.) are selected through the DLC keypad or through a host terminal via the serial interface port.
- **If B102 is set to 03**, the Batching option is selected with Auto Indexing disabled. This will disable the selection of a batch by using the Part ID Number. With this feature enabled a unique Part ID Number is no longer required. With this interface option enabled, entry of new batch data is easier if entering new Part ID Numbers.

Refer to the Batching operational description in **Chapter 4** for further information.

Parameter B103: Auxiliary Feed Length

Note: The value stored in this parameter is usable only in Automatic Mode.

Aux. Feed Length
B103 +1234.56

Units: Input Units (with +/- feed direction sign)

Decimal Places: See Parameter A100 (figure shown A100=02)

Input Value Limit: none

This parameter specifies an auxiliary (secondary) feed length. The Auxiliary Feed Length is triggered by an external signal from a device such as a PLC, a counter/buffer, selector switch, or another type of control device (**See Chapter 3**). Upon energizing this external signal, the feed length originally stored in the DLC, by the DLC keypad, the IDS or from a host via the serial interface port, is ignored and the value stored in this parameter is used. For example the Auxiliary Feed Length could be used with a Feed to Shear operation or to feed damaged material off the end of the roll, or any other operation which requires a secondary feed length.

If auxiliary lengths are requested during Batching, they will be produced but not counted in the batch.

Note: The Measuring Wheel (MW) enable input replaces "Aux Feed Length" input when MW is enabled. **See Parameter B112: Measuring Wheel (MW) Selection.** When the "B" value of Parameter B112 is set to 00, this also forces the Aux Feed Length Parameter value to 00.

Note: This Parameter can be changed on-line from the serial port.

Parameter B104: Feed Length Maximum Limit

Feed Length Max.
B104 1234.56

Units: Input Units

Decimal Places: See Parameter A100 (figure shown A100=02)

Input Value Limit: none

This parameter sets the maximum limits for feed length that the DLC will accept from the DLC keypad (or the IDS, SOT or other RS-232/485 host option, if so equipped).

If this parameter is set to all zeros (0000.00) there is no software limit on feed length.

CAUTION: *When you set this parameter to 0000.00, exercise caution to insure that you always enter the correct desired feed length. An accidental or incorrectly entered feed length could result in damage to the machine or material.*

Should the feed length entered be larger than the maximum limit set in this parameter, the diagnostic message "Feed Length Limit Exceeded!" will appear in the display.

Parameter B105: Feed Length Minimum Limit

Feed Length Min.
B105 1234.56

Units: Input Units

Decimal Places: See Parameter A100 (figure shown A100=02)

Upper Limit: Value stored in Parameter B104 (maximum limit)

This parameter sets the minimum feed length limit that the DLC will accept from the DLC keypad (or the optional IDS, SOT, or a host terminal, via the RS-232/485 port).

If this parameter is set to all zeros (0000.00) there is no software minimum limit on feed length.

If the value entered in Parameter B105 is greater than the maximum feed length value stored in Parameter B104, the DLC issues an invalid parameter entry message "B105 Is Invalid!" when the Store key is pressed. Reenter the parameter data for B105.

If the value entered in Parameter B105 is equal to the value stored in Parameter B104, only one programmed feed length is permitted in each direction.

Should the feed length entered be less than the minimum limit set in this parameter, the diagnostic message "Feedlength Less Than minimum!" will appear in the display. Reenter a feed length within value limits.

Parameter B106: Feed Length Maximum Change During Cycle

Feed Max. Change
B106 1234.56

Units: Input Units

Decimal Places: See Parameter A100 (figure shown A100=02)

Limits: None

This parameter limits the amount the programmed feed length can change during an Automatic Mode cycle.

Should the difference in the old and the newly entered feed length be greater than the maximum limit set in this parameter, the diagnostic message "Change in Fdlgth Exceeds Limit!" will appear in the display. Reenter the new feed length correctly.

If this parameter is set to all zeros (0000.00) there is no software maximum change limit on a feed length entry.

Parameter B107: Feed Length Micro-Adjust Increment

Feed Increment
B107 0123.45

Units: Input Units

Decimal Places: See Parameter A100 (figure shown A100=02)

Upper Limit: B104 (feed length maximum limit)

This parameter specifies a length that will be added or subtracted from the feed length each time the + or - key is pressed - while the current feed length is displayed and the cursor is in home position. This parameter is designed to allow fine tuning of the feed length in both the standard feed length operation or when the Batching option is selected.

The micro-adjustment can be entered from the DLC keypad or from an SOT or other host option via the RS-232/485 serial interface port.

Refer to **Chapter 2. Controls and Indicators** for procedures to perform the micro-adjust from the DLC control panel for axis 1 (and for axis 2 on the DLC-Z).

As an example, if the current feed length is 4.050 inches and Parameter B107 is set to the value of 0.005 inches, the feed length will increase by 0.005 each time the + key is pressed. Each change in the micro-adjustment is reflected in the DLC display. The "adjusted" feed length is automatically stored as the new feed length value.

The micro-adjustment feature is disabled when 0000.00 is entered and stored in this parameter.

Parameter B108: Jog Step Parameter

Jog Step	
B108	0000.50

Unit: Input units

Decimal Places: See Parameter A100 (figure shown A100=02)

Limits: None

Use this parameter to set the incremental distance that will be fed with a jog forward or reverse input, when Jog Step Mode is set ON from the DLC control panel (or from SOT or other host via the serial interface port). If this parameter is set to zero, jog step operation is not allowed.

Parameter B109: Press Interface Mode

Press Interface			
B109	01	1.0s	02
	A)	B)	C)

- A) Press interface mode:
 00 = Press before feed
 01 = Feed before press
 02 = Press before feed for Set-Up mode
- B) Minimum cycle time in press intermittent mode
 0.0 - 9.9 = time in seconds
- C) Permit Press Timeout in Automatic Mode
 00 = disable timeout fault
 01 - 99 = timeout in minutes
- Select one of the feed/press modes:
 Input Value Limit: 00, 01 or 02

Press Before Feed - At Cycle Start the DLC allows the press to complete a press cycle. At the end of that cycle, the DLC feeds the material into position. Once in position, the press cycle repeats. At Cycle Stop, the cycle will end at the completion of the feed.

Feed Before Press - At Cycle Start the DLC feeds the material until it is in position. Once the material is in position, the press begins the press cycle. At Cycle Stop, the cycle will end at the completion of the press cycle.

Press Before Feed for Set-Up mode - Entry into Set-Up mode does not require the Feed Angle Input transition before jogging (i.e., Permit Press output is not high upon entry to Set-Up Mode).

Notes:

1. *Once the DLC detects a Cycle Stop, it must detect the high to low transition of the Feed Angle input before the final cycle is complete.*
2. *For more specific information, refer to Chapter 3. Standard Features and refer to the Cycle Timing Charts.*

Minimum cycle time:

Input Unit: seconds

Decimal Places: 1 (fixed), not affected by A100

Input Value Limit: 0.0 to 9.9

Set the minimum delay time from the start of a press cycle to the start of the next press cycle during Intermittent Mode operation. This setting is used primarily for press brake/clutch protection. The user sets the minimum cycle time to minimize the duty cycle of the press brake/clutch assembly. This reduces brake/clutch overheating and premature failure.

Example Operating Conditions:

- Press cycle time and feed cycle time are equal to eight (8) seconds.
- Parameter B108 is set to nine (9) seconds.
- The press would delay for one second (at top of its stroke) before starting a new cycle.

Note: *Setting Minimum cycle time for 0.0 indicates no delay time is required.*

Permit Press Timeout:

Permit Press Timeout is set from 1 to 99 minutes.

The DLC issues a soft fault "Press Timeout Has Expired" if the press hasn't cycled (high-to-low Feed Angle transition) in the specified time period during an automatic mode cycle. After this fault is cleared, a resume input is required to continue the cycle.

If this fault is not desired, set the digits to 00.

Parameter B110: Not Used

<p>Not Used B110 Disabled</p>
--

Parameter B111: Batching Option

<p>Batching Option B111 1 1 G=111 0</p>
<p style="text-align: center;">A B CDE F</p>

- A) Count Mode
 0 = Up
 1 = Down
- B) PBF Batch Complete
 0 = Do not end on feed
 1 = End on feed
- C) Must be set to 0
- D) Must be set to 0
- E) Must be set to 0
- F) Must be set to 0

If using this batching option, the Interface Option Parameter B102 must be set for 02 or 03 (Batching). Otherwise, the values in this parameter are ignored.

Note: *The following pages describe the entry options and procedures for this parameter. Refer to Chapter 4 for detailed information on the batching function.*

B111-A: Count Mode

This option allows the display of the number of parts created or parts remaining. It applies to both the current part count and the feed count. To count up from 1 to the selected quantity, enter a 0 in this digit. To count down from the quantity to 0, enter a 1.

B111-B: Press Before Feed/ Batch Complete

This digit specifies whether the last feed in a single part or sequence of parts is performed when Press Before Feed Operation is selected in the Press Interface Parameter. It does not apply to Feed Before Press operation. The following shows examples of press/feed cycle conditions.

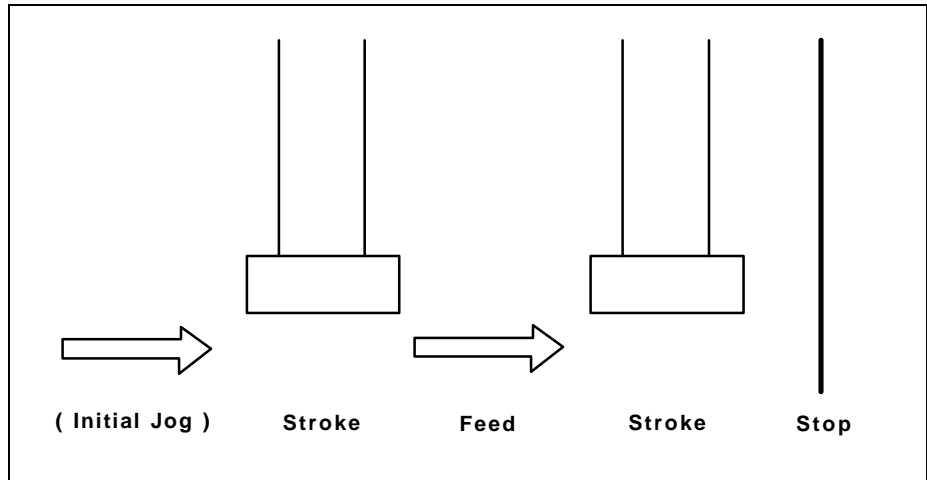


Figure 5-4: PBF Batch Complete = 0 (end with press cycle)

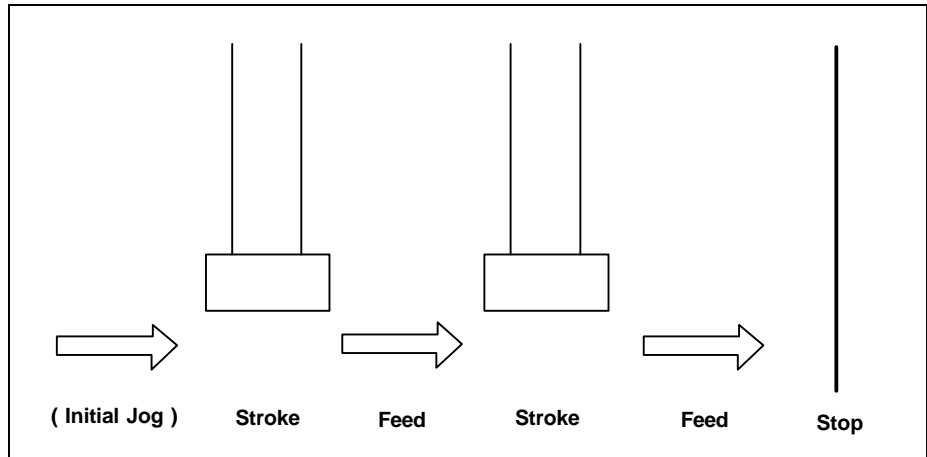


Figure 5-5: PBF Batch Complete = 1 (end with feed cycle)

If PBF Batch Complete is set to 0, the batching program will end with a press cycle. The end of a program is indicated on the DLC display with the "A: Part Stop" status message. This option assumes that the first feed of the part executed at cycle start has been jogged into the machine. The feed count is incremented with each press stroke, resulting in the jogged-in material being counted as one feed. The press operator is responsible for jogging the material over the die to avoid a double hit of the press. The DLC will not inhibit a cycle start if the material is not jogged in.

If PBF Batch Complete is set to 1, the part program will end with a feed. The feed it ends with at a Part Stop state is the next feed to be executed. For example, if another part is jumped to and the part stop input is activated, the first feed of the next part will be performed at the end of the cycle. The machine is then ready for operation at the next cycle start without the danger of a double hit of the press.

Parameter B112: Measuring Wheel (MW) Selection

Note: The MW feature requires the DEF1.1 hardware option.

Measuring Wheel B112 11 00 25.0%

A) B) C)

- A) 00 = Disable Measuring Wheel
 10 = Measuring wheel is used to dynamically correct feed length variations during the feed
 11 = Position loop closed on MW encoder when Feed Angle is high; closed on motor encoder when Feed Angle is low.
 12 = Position loop is continuously closed on Meas. Wheel encoder.

- B) B=00, Parameter B103: Auxiliary Feed Length is zeroed and the Auxiliary input is used as MW enable.

B=01, MW mode is enabled as if the enable input was high 100% of the time

- C) Allowed deviation between measuring wheel and motor encoders (defined in percent of one motor revolution) before encoder fault occurs.

The Measuring Wheel function is active only in Auto and Setup modes; displays are active in all modes. The Axis Position display is updated with data from whichever encoder closes the position loop.

The Total Length display is updated only by the motor encoder.

Refer to Chapter 4. Function Description - Special Features for information on the Measuring Wheel option.

Parameter B113: Not Used

Not Used B113 Disabled

Parameter B114: Not Used

Not Used B114 Disabled

Parameter B115: Not Used

Not Used B115 Disabled
--

Parameter B116: Measuring Wheel Feed Constant

M.W. Feed Const. B116 0012.3456

Units: Input units per measure wheel revolution

Input Value Limits: from 00000100 to 10000000 (regardless of decimal pos.)

Decimal Places: A100 + 1 (figure shown A100=02)

This parameter scales input units to measure wheel revolutions. Refer to *Parameter B112: Measuring Wheel (MW) Selection* and *Parameter B117:* for additional entries required for use of the measuring wheel.

Parameter B117: Measuring Wheel Encoder

M.W. Encoder B117 L=1250 D=0

L = Measuring wheel encoder lines/revolution (from data plate on encoder)

Units: Encoder Lines per Revolution

Input Value Limits: from 0100 to 5000

D = Measuring wheel encoder direction

0 = Direction as wired

1 = Reverse direction - as a convenience, in place of reversing the wiring for direction

Parameter B118: Serial Interface

Serial Interface B118 M=1 S=00 00
--

A) B) C)

A) Serial Interface Mode

0 = Serial port off

1 = RS-232 (full duplex) communication with PC or other external host device

2 = Communication with a single SOT via RS-232/485 (half duplex)

3 = Operation with Indramat SOT via RS-485 Bus (half duplex), station 01 through 15

- B) Station number
 If M = 1: All stored data is acknowledged with "Y <cr><lf>" if S = 10
 If M = 2: S values are ignored
 If M = 3: Enter the Station number of the DLC on the RS-485 bus;
 assign a different number for each DLC on the bus (01 through 15)
- C) Not Used

Select the mode of communication required to interface the DLC control to a host device. Also select the communication requirements from Parameter B119: Serial Port Operation.

Refer to Chapter 4 for additional information on the RS-232/485 Interface operation and communication requirements.

Parameter B119: Serial Port Operation

Serial Operation				
B119	1920	8	1	00
A	B	C	D	E

- A) Baud Rate: 19200 [enter 1920], 9600, 4800, 2400, 1200, 0600, or 0300
- B) # of Data Bits: 8, 7
- C) # of Stop Bits: 1, 1.5 [enter 3], or 2
- D) Parity
 0=none
 1=odd
 2=even
- E) Flow Control / Checksum
 0=Software (XON/XOFF) Handshake with Checksum
 1=Software and Hardware (RTS/CTS) Handshake with Checksum
 2=Software Handshaking with no Checksum
 3=Software and Hardware Handshake with no Checksum

Enter the data required for proper transmission between the DLC and a host device. Select the mode of communication in Parameter B118. Refer to Chapter 4 for additional information on the RS-232/485 Interface operation and communication requirements.

When interfaced to the SOT, the values required for this parameter are: 1920, 8, 1, 0 0. When the interface option Parameter B102 is set for the IDS, the port is automatically configured to work with the IDS board. This serial interface parameter is then ignored.

Parameter B120: Not Used

Not Used
B120 Disabled

Parameter B121: Not Used

Not Used
B121 Disabled

Parameter B122: Slug Width Compensation

Slug Width Cmp
B122 000.050

A)

- A) 000.000 = No Slug Width Compensation will be added to feed.
 000.050 = Every feed in Automatic and Set up mode will have 000.050 (inches, mm, etc.) added. For example, if the commanded feed length is 10.000 inches, the actual length fed will be 10.050 inches. This will be shown on the Axis Position Dist display, as well as the Total Length and MW display.

5.7 Parameter Set C0

This parameter set allows drive tuning through the DLC. Drive parameters can be set using CTA keypad or RS232 serial interface. Standard drive parameters are set using CTA keypad only. In both cases, processing must not occur simultaneously over the CTA keypad and RS232 serial drive interface. Drive parameters are viewed and edited in the same manner as “A” and “B” parameters. C parameters are administered in the drive. With each new power-up, the C parameters are sent from the drive to the DLC.

When entering the C parameters, If Row 4 of the CTA displays “Not Accepted” after the store key is pressed, clear the error and try re-storing the value.

Parameter C000 - Analog Output: Channel 1

Analog Output 1	
C000	02

02 - Output type

- 0 = Current command
- 1 = RPM command
- 2 = RPM actual value from feedback
- 3 = Position - Actual value from feedback
- 4 = Motor encoder: Sinusoidal feedback
- 5 = Motor encoder: Cosinusoidal feedback

Parameter C001 - Analog Output: Channel 2

Analog Output 2	
C001	05

05 - Output type

- 0 = Current command
- 1 = RPM command
- 2 = RPM actual value from feedback
- 3 = Position - Actual value from feedback
- 4 = Motor encoder: Sinusoidal feedback
- 5 = Motor encoder: Cosinusoidal feedback

Parameter C002 - Overload Factor

Overload Factor
C002 0400

00000 - Not used, must be set to 00000

400 - Overload factor in percent (000-400)

Parameter C003 - Position Data Scaling at Analog Outputs AK1 and AK2

Position Data
Scaling A-Output
C003 0000360.0

0000360.0 - Degrees/10V (0000000.1 -1474560.0)

Parameter C004 - Velocity Data Scaling at Analog Outputs AK1 and AK2

Velocity Data
Scaling A-Output
C004 02000

02000 - RPM/10V (00001 - 65000)

Parameter C005 - Velocity Loop Monitoring

Velocity Loop
Monitoring
C005 01

01 - Monitoring Circuit for Velocity Loop

0 = OFF

1 = ON

Parameter C006: Not Used

Parameter Not Used C006 Disabled
--

Parameter C007: Not Used

Parameter Not Used C007 Disabled
--

Parameter C008 - Error Reaction

Error Reaction C008 02
--

02 - Error Reaction

0 = The drive switches itself to rotational speed control and defaults to a RPM setpoint of 0.

The brake engages after maximum 400 msec. and it disengages after another 100 msec.

DDS: Error report to the power supply (package reaction).

DDS: Error report to the internal power supply (Failure of power system protection).

1 = Same as error reaction 0, but no error report to the power supply (package reaction), or to the power supply.

2 = The drive disengages immediately.

If there is a brake, it engages immediately.

No error reaction (no package reaction). The drive switches itself to rotational speed control and defaults to a RPM setpoint of 0.

Parameter C009 - Current Loop Proportional Gain

Current Loop P_Gain C009 000120.00
--

000 = Not used, must be set to 000

120.00 = Volts/Amp (000008.00 - 000127.47)

Parameter C010 - Velocity Loop Proportional Gain

Velocity Loop P_Gain C010 00800

000 = Not used, must be set to 000
00800 = mAsec/rad (00000 - 65000)

Parameter C011 - Velocity Loop Integral Reaction Time

Velocity Loop I_Reaction Time C011 2500.0

000 = Not used, must be set to 000
2500.0 = msec (0000.1 - 6500.0)

Parameter C012 - Smoothing Time Constant

Smoothing Time Constant C012 00600
--

000 = Not used, must be set to 000
00600 = μ s (00250 - 65000)

Parameter C100 - Set Standard Drive Tuning Parameters Over CTA

<pre>Set to Standard Param. C100 0000</pre>
--

This menu consists of only the parameter C100.

The standard parameters are set after entering the number 5301 and pressing the block store key. After pressing the block store key this menu item exits to the "A" parameter set.

If the entry is made incorrectly, the menu exits to "Drive Parameters" without setting the standard parameters, i.e. there is no control monitoring of the entry.

Chapter 6. Installation

This Chapter covers the installation of the DLC control system. The typical DLC Control system consists of the following components:

DLC Control Module
DEA 4 System/I/O Card
CTA Keypad & Display
Power Supply
Digital AC Servo Drive
MDD Digital AC Servo Motor

The instructions in this chapter primarily describe the installation of the DLC Control Module. The installation particulars of the other components (such as a TVD, TVM or KDV power supply, the DDS Digital AC Servo Drive, or DKS self-contained power supply and digital servo drive module) are explained in detail in their respective manuals.

Tools required:

- A small 1/8" blade, standard screwdriver
- A multi-meter (VOM meter)
- An appropriate wrench for 1/4" machine type bolts (use for mounting module(s) to cabinet).
- VT 100 terminal or PC with VT 100 terminal emulation software
- IN 391 Cable, PC to Indramat Digital AC Servo Amplifier

6.1 Mounting Cabinet

The enclosure should be sufficient to protect the equipment from contaminants, such as water, oil, etc. Indramat recommends a NEMA 4 or 12 enclosure or equivalent.

6.2 Power

The DLC receives its power from the controller being used. Refer to separate manuals for power requirements of the other modules (power supply, servo drive, etc.).

6.3 Cable Routing

For higher reliability, the high resolution feedback cables must be shielded and routed away from high voltage power sources to reduce electrical noise.

Do not route the cables near high amperage type machines, like welding equipment, which produce strong magnetic field interference.

Suppress inductive loads (such as solenoids and motors) that are switched ON and OFF during DLC operation, with R-C networks (AC) or diodes (DC).

Correct grounding is essential for trouble-free operation. The ground connection must be made by observing strictly the branching conditions shown in the wiring diagram.

6.4 Transformer - Heat Dissipation

The incoming 3-Phase power must be ground reference. Use an isolation transformer with a "Y" secondary if this cannot be confirmed.

If a transformer is needed for operation, exercise caution on its location. Do not install the transformer in the same cabinet as the modules unless a sufficient method of cooling is applied.

6.5 Hardware Installation

See Appendix E for mounting hole dimensions and location of the CTA keypad and display module, the cut-out dimensions for the remote keypad, keypad gasket, and mounting holes and cut-out dimensions for the optional IDS.

The mounting dimensions and cabinet cut-out data for the TVD/DDS or DKS are located in the units respective support manuals.

The method of mounting the MDD Digital AC servomotor is dependent upon the application. Additional information and a drawing package for the MDD servomotor is available on request from Indramat.

6.6 Electrical Installation

There are many variations of wiring techniques used to connect the DEA 4/System I/O Card to the machine builder's equipment. The Interconnect Drawings supplied with this manual (see Appendix D) show an example of the DLC connections to a typical machine.

6.7 DLC/DEA 4 Connectors

This section describes the connectors on the DLC/DEA 4 plug-in cards. Refer to Figure 1.5 in Chapter 1 for an illustration of the DLC/DEA 4 card and its connector locations in the Digital servo drive.

X17: DEA 4 System/Input/Output Cable

X30: CTA Keypad & Display

Female, 34 pin shielded ribbon cable connected to the front panel of the DLC. The standard length for the cable is 2 meters. It connects from the DLC to the back of the CTA. Refer to the DKS/DLC interconnects in Appendix D for the proper orientation of the cable.

X31: RS-232/485 Communications Port (Interface)

Female, DB 9 connector is located on the lower front panel of the DLC. It is used for serial communication between the DLC and a host terminal, SOT or the IDS option. Refer to Chapter 4 for description of this multi-functional, two-way communications port.

Chapter 7. Start-Up

The following sections are intended to provide the user with an example of a DLC Digital AC Servo System start-up. They provide an example of a single axis application that will verify proper function of the system.

WARNING: *The information given in the following sections may not be suitable for a specific application. If you use this example for testing, do not mechanically connect the servomotor to the actual load.*

Refer to the drawings in the Appendixes D and E for additional mounting and connection information.

7.1 Connections

NOTE: Do NOT apply power until all connections have been made.

1. Install the TVD/DDS (Power Supply/Digital AC Servo Drive) or DKS (Digital Compact AC Servo Drive) per their respective support manuals.
2. Connection the MDD motor power cable and high resolution feedback cable to the DDS or DKS per interconnect drawings in Appendix D, or refer to the DDS or DKS support manuals.
3. Connect the CTA Keypad/Display to the DLC Connector X30 via ribbon cable. Refer to the interconnect drawings in Appendix D.

7.2 DEA 4 Input Connections

The DEA 4 input connections used in this example are minimized for the sake of simplicity (see *Figure 7-1: Example Input Diagram*). Refer to the interconnect drawings in Appendix D for any additional details. Connect the incoming side of each switch to a external +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 (0 Vdc), and is used for Manual Mode (default mode). Connect a key switch to provide +24 Vdc to Pin 1 (Parameter Mode input).

2. Connect a Normally Closed pushbutton switch to Pin 3 (Emergency Stop) of the DEA 4, connector X17.
3. Connect a Normally Open momentary pushbutton to Pin 4 (Cycle Start) of the DEA 4, connector X17.
4. Connect a Normally Closed momentary pushbutton to Pin 14 (Cycle Stop) of the DEA 4, connector X17.
5. Connect a Normally Open momentary pushbutton to Pin 9 (Jog Forward) of the DEA 4, connector X17.
6. Connect a Normally Open momentary pushbutton to Pin 10 (Jog Reverse) of the DEA 4, connector X17.
7. Connect a Normally Open momentary pushbutton to Pin 8 (Clear) of the DEA 4, connector X17.
8. Connect the +24 Vdc external power supply to pins 34 and 35 (0 Vdc) and pins 36 and 37 (+24 Vdc) of the DEA 4 connector X17.

7.3 DEA 4 Output Connections

For the purpose of a sample start-up, the connections for the DEA 4 outputs are not necessary. The ends of the unused wires in the cable should be wrapped in electrical tape to prevent any damage to the outputs. Refer to the interconnect drawings in Appendix D for properly interfacing the DEA 4 system outputs with the machine.

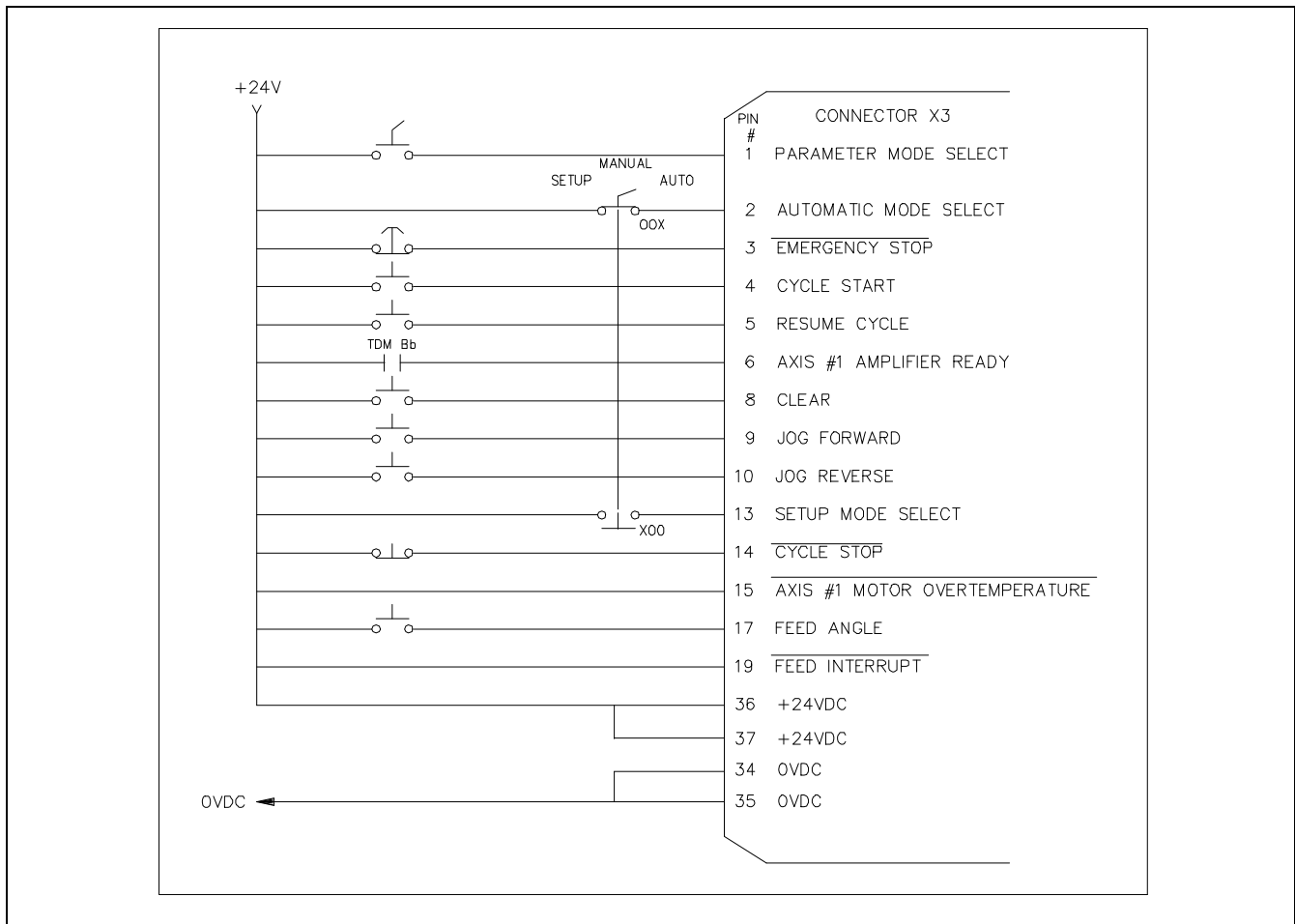


Figure 7-1: Example Input Diagram

7.4 Power-up

The system can now be powered up. All voltages should be checked by a qualified electrician to ensure proper signals and connections.

The digital servo drive being used has two 7 segment LED's, H1, which displays the current operating status of the drive. If all connections are correct the H1 status will be "bb". If the diagnostic is not "bb", consult the drive's manual for information on how to correct the problem.

The CTA display should also display no errors. Consult Chapter 8, Diagnostics And Troubleshooting for more information on how to correct the problem.

The DLC Digital Servo System is ready for drive & system parameters to be installed.

7.5 Digital AC Servo Amplifier Parameter Entry

The Indramat Digital AC Servo Drive contains an RS232 interface, Connector X2. This interface gives you information regarding the status of the drive and allows you to read and adjust all the drive's system parameters. The RS232 interface provides screens and menus which are accessible via a VT100 terminal or a PC computer with a VT 100 emulator, (e.g. Procomm, Windows 3.1, etc.). The communication settings are as follows:

Baud rate:	9600
Parity:	None
Data Bits:	8
Stop Bits:	1

Connect the VT 100 terminal or PC with VT 100 terminal emulation software to the servo drive's connector X2 via an IN 391 cable and press the <Enter> key. This will bring up the Main Menu screen.

Changing The Display Language

In order to change the language displayed on the screen, press the number 3 from the Main Menu.

German Text = Press the number 1

English Text = Press the number 2

After the selection, the Main Menu screen will be displayed.

7.6 Main Menu

The Main Menu allows you to view the following information:

- 1) Drive Status
- 2) Parameters
- 3) Language Selection

ESC Exit Program

In order for the DLC to operate properly, the servo drive's parameters must coincide with the parameters programmed in the DLC. To check or adjust the parameter currently in the amplifier, press the number 2 from the Main Menu screen.

The Drive Parametrization screen will be displayed. Consult the amplifier's manual for a description and the proper parameter values for the amplifier/motor combination being used, press the letter "c" to continue.

The Parameter Menu screen will display the following selection list, application parameters, drive parameters, and parameter management. When setting up a servo drive with the DLC, the application and drive parameters must be set correctly.

Setting The Drive's Parameters To Operate With The DLC Control Card

- 1) Press the number 6, Motor & Drive Data.

This will display the current amplifier/motor combination. Look under the Motor Parameters and make a note of the Maximum Velocity Of Motor (RPM). Press <ESC> to return to the Parameter Menu.

- 2) Press the number 1, Operation Mode, Scaling.

The Operation Mode allows the user to configure the following amplifier parameters;

Analog Outputs

Bipolar Velocity Limit Value

Overload Factor

Analog Output - Position Data Scaling

Analog Output - Velocity Data Scaling

Analog Outputs

The Indramat Digital AC Servo Drive has two analog outputs, AK1 (Connector X3, pin 1, referenced to OVm, pin 2) and AK2 (Connector X3, pin 3, referenced to OVm, pin 4). These outputs can be configured to output following items:

Velocity Command Value

Velocity Feedback Value

Position Feedback Value

Motor Encoder - Sine

Motor Encoder - Cosine

Current Command Value

Press the up or down arrow keys to position the cursor on the proper channel. Then press the left or right arrow keys to select the desired output. Continue pressing until the desired output is selected.

Bipolar Velocity Limit Value

The Bipolar Velocity Limit Value sets the motor's maximum velocity limit in the forward or reverse direction.

Position the cursor to the right if the Bipolar Velocity Limit Value and type in the desired velocity in revolutions per minute (RPM).

Note: The value entered should not exceed the maximum velocity of the motor. If an operating velocity of less than maximum is desired enter that value here.

Overload Factor

The Overload Factor is determined based on the desired intermittent torque and duty cycle of the system. Consult the Indramat Digital AC Servo Drive Selection List for the proper Overload Factor Value.

For the purpose of testing the DLC with the servo drive, set the Overload Factor to 100%. Position the cursor to the right of the Overload Factor and type 100.

Position Data Scaling At The Analog Output (Degrees/10V)

When the position values are selected for either of the analog outputs, the Position Data Scaling defines a zero to ten volt linear scaling based upon the angle of the motor's rotor position. For an example, if 360 degrees were entered, one revolution of the motor would provide on linear voltage ramp from 0 to 10V.

Position the cursor to the right of the Position Data Scaling and type in the desired degrees. Typically, 360 degrees is entered.

Velocity Data Scaling At The Analog Output (RPM/10V)

When the velocity values are selected for either of the analog outputs, the Velocity Data Scaling defines a zero to ten volts linear scaling based upon the velocity of the motor in RPM. For example, if the

Bipolar Velocity Limit is 3000 RPM, then when the motor is operating at 1500 RPM, 5 Volts will be outputted.

Position the cursor to the right of the Velocity Data Scaling and type in the desired velocity per 10 Volts. Typically the value entered here is the same value entered in the Bipolar Velocity Limit Value.

Press <ESC> to return to the Parameter Menu.

- 3) The Absolute Encoder Parameters are automatically set by the amplifier. When power is applied, the amplifier reads the type of motor connected and sets the Absolute Encoder Parameters based on a single or multi-turn feedback. Press the number 3, Error Reaction.

There are three types of Error Reaction to select. The Error Reaction selected determines how the amplifier will react when a shutdown error occurs. Typically, 0 is selected as the Error Reaction.

Press <ESC> to return to the Parameter Menu.

- 4) The Torque Limits are currently not available. Press the number 5, Gain Parameters.

The Gain Parameters allow the user to adjust the velocity/current loop gains of the amplifier. To set the amplifier/motor combination to standard values, position the cursor to Reset To Standard Parameters and press the <Enter> key.

The following question will be displayed: Are You Sure? Yes -> Y, Press the <Y> key on your computer to reset to standard parameters.

Press <ESC> to return to the Parameter Menu.

The amplifier's parameters entry has been completed. The parameter management section allows the user to save and load the parameters to and from diskette. Consult the servo drive's manual for more information.

The next step is to configure the DLC Control Card to operate with the parameters entered in the digital amplifier.

7.7 Parameter Entry

The parameters given here are the minimum required to operate the DLC for this example. Turn the key switch to the Parameter Mode and enter the following parameters (see Chapter 5 for procedures):

A100	Feed Length Resolution	03
A101	Feed Constant	0001.0000
A102	Max Motor RPM	03000
A104	Maximum Feed Rate	001500.00
A105	Jog Feed Rate	000300.00
A106	Maximum Acceleration Rate	000100.00
A107	Maximum Deceleration Rate	000000.00
A108	Maximum Allowable Jerk	000000.00
A109	Position Gain (KV)	03.00
A110	In-Position Threshold	00.0100
A111	Direction of Operation	Enc=0 Cmd=0
A112	Monitor Window for Drive Diagnostics	10%
B102	Interface Option (IDS)	00 (or 01 for
B104	Feed Length Max Limit	000.000
B109	Press Interface Mode	01

7.8 Axis Jogging In Manual Mode

With "bb" displayed on the servo drive and no errors displayed on the CTA, press the Drive On pushbutton. The H1 status should display "AF" and torque should be applied to the MDD servomotor. If problems exist, consult the servo drives manual or Chapter 8 of the DLC manual, to correct the problems.

To verify proper motor hook-up, and control of the motor, jog the axis in Manual Mode. Turn the selector switches to the OFF position so that Automatic nor Parameter Mode inputs are high (defaults to Manual Mode).

1. Press the Forward Jog pushbutton (connected to X17, Pin 9). The axis should jog in the forward direction, until the button is released.
2. Press the Reverse Jog pushbutton (connected to X17, Pin 10). The axis should jog in the reverse direction, until the button is released.
3. Should either the forward or reverse motor movement fail to react, check all cable connections and verify the DLC is in Manual Mode.

7.9 Automatic Operation

To check Automatic operation:

1. Turn the selector switch to Automatic Mode (wired to connector X17, Pin 2).
2. Press the Cycle Start pushbutton (connected to X17, Pin 4).

NOTE: The DLC should follow the feed length and velocity settings entered from CTA keypad (with Parameter B102 set to 00) or the decade switches on the IDS (if connected, and Parameter B102 set to 01).

3. Manually activate the Feed Angle switch (pushbutton connected to X17, Pin 6) each cycle, to simulate the ram movement and allow the next feed cycle.
4. Press the Cycle Stop pushbutton to stop operation (connector X17, Pin 14, Active low). The cycle stops after a feed in "Press Before Feed Mode" or after the feed angle signal input in "Feed Before Press Mode" (the latter was selected for Parameter B109).

Chapter 8. Diagnostics and Troubleshooting

This chapter describes some typical states of the Indramat Digital AC Servo Drive as well as the diagnostic messages that are issued and displayed by the DLC, and suggests troubleshooting procedures or recommended actions for each display. These messages provide the user with information on faults, hardware status, and operational status of the system. When needed, request assistance from Indramat (See *Chapter 1*).

8.1 Digital Servo Drive Normal Operating Diagnostics

The two digit diagnostic display on the front of the servo drive shows the current state of the drive. The following briefly describes the most typical diagnostic codes encountered during power up and normal operation. For more information consult the digital servo drive's users manual.

<u>CODE #</u>	<u>Drive State</u>
93	DLC Watch Dog Error

There is a communication error between the drive and DLC. Press the clear key or input. If this does not clear the error, power off the drive.

<u>CODE #</u>	<u>Drive State</u>
bb (100)	Operation Ready

The drive is ready for 3 phase main power to be applied.

<u>CODE #</u>	<u>Drive State</u>
Ab (101)	Drive Ready

Control voltage and main power are present, (DC bus voltage is present). The drive is ready to be enabled. If the DLC Control Card has an error, the drive is typically displaying this diagnostic. Check the CTA display to determine the DLC error detected, then consult the *Diagnostic Display Categories* section, for a description of the error and how to correct the problem.

<u>CODE #</u>	<u>Drive State</u>
Af (102)	Drive Enabled

The drive has powered up properly and the DLC Control Card has enabled the servo system. The DLC Servo System can now be operated in Automatic, Set Up, or Manual mode.

8.2 Status / Diagnostic Display Alphabetical Index

This section is an alphabetical index listing of the DLC diagnostic message displays. It provides a quick reference for locating and identifying displays in question. Following sections describe the meaning and recommended action for each display.

Note that when using the SOT or other host, the diagnostics may be requested through the serial interface port in full text format or as a corresponding diagnostic number. The following index lists the displays in alphabetical order. A similar index in section 8.7 of this chapter correlates the displays in order of the numeric, diagnostic code equivalents.

When using the IDS, its two digit display will show numeric codes for diagnostic messages. The code list index for the IDS is in section 8.8 of this chapter.

<u>DLC Display</u>	<u>Page</u>
A: C.Stop Active	8-20
A: Cycle Delay	8-20
A: Cycle Stop	8-19
A: Feeding	8-19
A: No Cycle Start	8-19
A: P.Stop Active	8-21
A: Part Stop	8-21
A: Resume Active	8-20
A: Resume Req'd	8-20
A: Start Active	8-20
A: Wait Fd Angle	8-19
A: Waiting Press	8-20
Amp Overtmp Warning	8-20
Auto Mode Exit Required	8-18
Aux Feedlength is Zero!	8-13
Axis 1 Drive Runaway!	8-8
Axis 1 Drive Stalled!	8-7
Axis 1 Amplifier Hardware Fault!	8-8
Axis 1 Amplifier Is Not Ready!	8-16
Axis 1 Has Not Reached Position	8-16
Batching Program was Lost!	8-14
Battery is Low! Replace it Soon	8-14
Change in Fdlgth Exceeds Limit	8-17
DLC SYSTEM ERROR Code #HRD00.....	8-6
DLC SYSTEM ERROR Code #MNR00	8-15
DLC SYSTEM ERROR Code #SFT00	8-10
DPR Not Readable	8-10
Drive Diagnostic	8-9
Drive Error Press the CR Key	8-9

<u>DLC Display</u>	<u>Page</u>
Drive is not Enabled.....	8-16
Drive Watch Dog Error.....	8-9
Count Exceeds Part Quantity	8-14
EMERGENCY STOP!.....	8-7
Feed Angle Is Missing!	8-17
Feed Angle Lost During Feed!	8-11
Feedlength Exceeds Maximum	8-17
Feedlength Less Than Minimum	8-17
Initializing Sys	8-18
Invalid Drive Configuration.....	8-9
Invalid Drive Software.....	8-9
Invalid Mode Selection!	8-12
Jog Input Active	8-19
M: Feed Forward	8-21
M: Feed Reverse	8-21
M: No Jog Command.....	8-21
M: Wait Fd Angle	8-21
Measuring Wheel Encoder Fault!.....	8-9
Motor Overtemp Warning	8-15
Movement WhileFeed Angle Low	8-12
Parameter Invalid! Select P-Mode!	8-14
Parameters Lost! Clear to Cont.	8-6
Parameters Lost!Select P - Mode	8-7
PARAMETER MODE	8-18
Press Cycle Without Feed!	8-12
Press Timeout Has Expired	8-12
S: Fd Incomplete	8-22
S: Feed Forward	8-22
S: Feed Reverse	8-22
S: Release Jog	8-22
S: Start of Feed	8-22
S: Wait Fd Angle	8-22
S: Waiting Press	8-22
Serial Com Port Framing Error!	8-11
Serial Com Port Overrun Error	8-10
Serial Com Port Parity Error!	8-11
Serial Com Port Disconnection!	8-10
Serial Com Port IDS Format Error!	8-11
Serial Com Port RS485 Bus Error!	8-11
Set Up Mode Cycle Incomplete	8-13
Stop Due To Interrupt Input!	8-16
Zero % Feedrate Entered	8-16
Zero % Feedrate Programmed!	8-13
Zero Feedlength Entered	8-15

8.3 Diagnostic Display Categories

The faults, errors and diagnostic status messages are separated into four (4) categories:

1. Hard Fault
2. Soft Fault
3. Minor Errors
4. Status Messages

Hard Fault

A hard fault is the indication of a condition that could result in damage to equipment or harm to personnel. It halts all machine operation by dropping the 3-phase power to the motor (single phase on some motors).

The motor is generally stopped as soon as possible, by regenerative braking. At the occurrence of a Hard Fault, the system zeroes out all reference to position. Material in the machine is typically scrapped. The DLC system must be restarted after the fault is corrected.

Upon the detection of a hard fault, or the loss of the EMERGENCY STOP input (causing a hard fault), the following occurs:

- The E-Stop chain is broken
- The 3-phase power is dropped (drive stops)
- All outputs are switched off (except "System Fault" indicator)
- A diagnostic fault message is issued (displays)

To clear a hard fault:

1. Determine and correct the fault causing condition.
2. Initiate the Clear input (from the user control panel), or the CL key (on the CTA keypad), to initialize the control (the DLC will verify inputs, parameter data, etc. and will clear the fault status and diagnostic message).
3. Restart the DLC control system.

Soft Fault

A soft fault is an indication of a condition that is inhibiting normal operation of the system.

At the occurrence of a soft fault, the following occurs:

- If feeding, the axis decelerates to a stop (the DLC commands zero velocity, axis decelerates at the rate set in parameter for deceleration)
- Outputs remain in the last state they were in (high or low) at the moment of fault detection
- Position value of the axis is maintained by the DLC (remembers position within feed)
- The appropriate fault diagnostic message is issued (displays)

To clear a soft fault:

1. Determine and correct the fault causing condition.
2. Initiate the Clear input, or the CL key, to clear the fault status and diagnostic message.
3. If in Auto Mode and "A: Resume Req'd" is displayed, press Resume Cycle to continue automatic operation. Some faults are issued after the DLC stops the cycle.

Minor Errors

Minor Errors are messages which indicate that a condition required to continue has not been met.

Upon the detection of a Minor Error the following occurs:

- If feeding, the axis decelerates to a stop (the DLC commands zero velocity, axis decelerates at the rate set in parameter for deceleration)
- Outputs remain in the last state they were in (high or low) at moment of error detection
- Position value of the axis is maintained by the DLC (remembers position within feed)

- The appropriate error diagnostic message is issued (displays)

A Minor Error is automatically cleared when the error condition is corrected.

WARNING: *Once the Minor Error condition "Feed Interrupt" is corrected, the DLC immediately returns to operation. A Minor Error condition does not require a Clear input signal to continue operation. See description in **Hard Fault Messages** for further information.*

Status Messages

These information messages indicate the current status of the DLC system, such as: "System Is Ready" or "A: Feeding". A fault or error message will override a status message on the display.

Status messages, as well as fault and error messages, are each described in the following sections.

8.4 Hard Fault Messages

This section provides a complete list of hard fault diagnostic messages, and an explanation of the potential cause(s).

**DLC System Error
Code #HRD00**

An internal system fault has occurred in the DLC. The following hard fault system errors can occur: code #HRD00, #PL001, #FXPM0001, #UPRG01, #FLPM0003.

NOTE: *For any DLC system error display, call Indramat home office. Advise them of the error code number displayed.*

**Parameters Lost!
Clear to Cont.**

This message indicates the parameters were lost when the DLC was powered up in the Parameter Mode. It is also displayed after installing new firmware. Press the Clear push-button on the user control panel to continue with parameter entry. Check the memory backup battery if parameters were previously entered.

All parameter entries must be reentered and/or Stored again, regardless of the parameter values shown in the DLC display. If/when the data on the display is correct for the parameter, press the STORE key to store/save the data to memory. Repeat this process for each parameter.

NOTE: Maintain a current log of parameter settings for your system (see Appendix C for an entry form).

Parameters Lost! Select P - Mode

Indicates the parameters were lost when the DLC was powered up in the Automatic, Manual or Set up Mode. It is also displayed after installing new firmware. Select Parameter Mode and re-enter parameter values. Check the memory back-up battery condition if parameters were previously entered. Note that after the "Battery is Low" fault first displays, the battery needs to be replaced within two weeks.

All parameter entries must be reentered and/or stored again, regardless of the parameter values shown in the DLC display. If/when the data on the display is correct for the parameter, press the STORE key to store the data to memory. Repeat this process for each parameter.

NOTE: Maintain a current log of parameter settings for your system (see Appendix C for an entry form).

EMERGENCY STOP! EMERGENCY STOP!
--

This indicates the E - Stop chain is broken (X17 - Pin 3). Check the E - Stop chain to determine the reason for the Emergency Stop condition.

Axis 1 Drive Stalled!
--

Indicates the position feedback is not being controlled within the tolerance of the position command. The DLC uses a mathematical model of the system to calculate the expected position error (lag). Drive Stalled occurs when the motor is moving too far behind the expected lag. The Monitoring Window Parameter (A112) must be set to a value that is greater than the deviation in position error caused by normal mechanical and electrical characteristics (see Chapter 5 for parameter description).

The following items should be checked:

1. There is a velocity command but no axis motion - check for a disconnected encoder cable and for a faulty encoder feedback cable.

2. Max. RPM in Parameter A102 (Drive Max RPM) is not the correct entry for the motor being used.
3. Acceleration rate is too high - correct in Parameter A106.
4. Position Gain is too high for system inertia - correct in Parameter A109.
5. Drive Enable (RF) signal from DLC is not reaching the drive - check cable connections.

Axis 1 Drive Runaway!

Indicates the position feedback is not being controlled within the tolerance of the position command. The DLC uses a mathematical model of the system to calculate the expected position error (lag). Drive Runaway occurs when the motor is moving too far ahead of the expected lag. The Monitoring Window Parameter (A112) must be set to a value that is greater than the deviation in position error caused by normal mechanical and electrical characteristics (see Chapter 5 for parameter description).

The following items should be checked:

1. Axis motion is detected without a velocity command - ensure that signal feedback and command cables are properly installed.
2. Parameter A111: Direction of Operation is inconsistent with wired polarity - verify the settings correspond to the feedback and polarity of the drive / motor.
3. Deceleration rate is too high when Acceleration is okay - correct in Parameter A107.
4. Monitoring Window is too small for calculated Max. lag - correct entry in Parameter A112.

Axis 1 Amplifier Hardware Fault!

Issued when the Drive dropped out of its "Drive Enable" state in Auto Mode or when motion is commanded. Check the wiring from the amplifier to the DLC, and verify proper amplifier operation. Check the two digit diagnostic display on the front of the drive and consult the drive's manual for additional information.

**Drive Error
Press the CR Key**

Issued when the digital servo drive is not in the Drive Enable State. Determine drive error and correct the problem. Check the two digit diagnostic display on the front of the drive and consult the drive's manual for additional information.

**Invalid Drive
Configuration**

The DLC-R software verifies a valid drive hardware configuration at power up. Only the DLC, DEA4.1, and DEF1.1 are allowed. Any other cards in the drive will result in this fault.

**Drive Diagnostic
102
Drive Enabled**

The drive diagnostic display shows the current status of the digital servo drive. Refer to the drive manual for description of diagnostics.

**Drive Watch Dog
Error**

The communication between the DLC card and the Indramat servo drive has faulted. Clear the error with the CL key or clear input, or power cycle the servo drive. If this error reoccurs, contact Indramat Service for further assistance.

**Measuring Wheel
Encoder Fault**

With the measuring wheel (MW) feature enabled, the DLC monitors the deviation between the motor encoder and MW encoder in automatic and set-up modes. The percentage of deviation that is allowed is set in Parameter B112. This fault occurs when the deviation exceeds that setting. Check cable connections and tracking on material.

**Invalid Drive
Software**

The combination of software in the Indramat servo drive and DLC card is not compatible.

DPR Not Readable

The Dual Port Ram memory between the Indramat Servo Drive and the DLC card has faulted. Clear the error with the CL key or clear input, or power cycle the servo drive. If this error reoccurs, contact Indramat Service for further assistance.

8.5 Soft Fault Messages

This section provides a list of soft fault diagnostic messages and an explanation of the potential cause(s).

**DLC System Error
Code #SFT00**

An internal system fault has occurred in the DLC. The following soft fault system errors can occur: code #SFT00, #UPRG02, #FLPM0001, #FLPM0002.

NOTE: For any DLC system error display, call Indramat home office. Advise them of the error code number displayed.

**Serial Com Port
Disconnection!**

This indicates the IDS is not properly connected to the RS-232 port of the DLC when the IDS is selected for the Interface Option in Parameter B102. Check the cable connection of the IDS to the DLC front panel connector. The time for disconnect detection is automatically set to 2 seconds when IDS is enabled.

**Serial Com Port
Overrun Error**

This indicates the baud rate of the host is greater than the baud rate of the DLC via the RS-232/485 communications port. Check and verify settings are same. Also issued if DLC has missed data due to a faulty cable or port. Chapter 4 describes the serial port communication settings and error diagnostics.

**Serial Com Port
Framing Error!**

This occurs when the baud rate of the DLC is greater than the baud rate of the host, or if the start/stop bit parameters are not the same for both. Check and verify settings are same. Also issued if DLC has missed data due to a faulty cable or port. Chapter 4 describes the serial port communication settings and error diagnostics.

**Serial Com Port
Parity Error!**

This indicates the parity type of the DLC does not match that of the host. It is also issued during RS-232/485 communication if the parity check fails, indicating a faulty serial cable. Chapter 4 describes the serial port communication settings and error diagnostics.

**Serial Com Port
IDS FormatError!**

This indicates the serial communication is not functioning properly for the IDS. Check the cable and connections between the IDS and the RS-232 port of the DLC.

**Serial Com Port
RS485 Bus Error!**

This error is issued when data is being sent and received at the same time when SOT operation is selected in Parameter B118. If the device communicating with the DLC is not a DLC-R compatible SOT, or is communicating in full duplex, the Interface mode in B118 should be set to 1. If the DLC is talking to an SOT, this error indicates a faulty cable or port. Verify that you are using an RS485 cable.

**Feed Angle Lost
During Feed!**

This indicates the feed angle input went low before the DLC had completed the current feed.

- Check the input connection from the feed angle switch.
- Ensure the mechanical functions and timing are sequenced properly.
- Decrease the feed length or increase the feed rate.

- Increase speed/decrease cycle time of the press (external to DLC).
- If Parameter A113=0, then the material was tugged out of position due to press contact.

**Movement While
Feed Angle Low**

Displayed when the axis (material) slips out of the position window after (while) the Feed Angle is low. The setting in Parameter A113 (Low Feed Angle Threshold) is used to determine if the material is tugged out of position due to press contact. To correct this fault condition, raise the Low Feed Angle Threshold, check for other parameters that may be causing instability, check cables or system mechanics for cause of axis movement.

**Press Timeout
Has Expired**

Occurs when the press has not cycled (high-to-low feed angle transition) in Automatic Mode, for a period defined in Parameter B109. Set the time in the parameter, as required for the application. The limits are from 1 to 99 minutes. Set time to 00 to disable. After this fault is cleared, a resume input is required to continue the cycle.

**Invalid Mode
Selection!**

This indicates that the Auto and Set up modes are both selected (both inputs high). Check the following inputs:

X 17 Pin 2	Automatic Mode
X 17 Pin 13	Set up Mode

NOTE: *The Parameter Mode can override any other mode when selected. When de-selected, the DLC returns to the previously selected mode: Auto, Set up or Manual (defaults to Manual Mode when other modes de-selected).*

**Press Cycle
Without Feed!**

Indicates a double hit of the press. Fault occurs if there is more than one press cycle when the Feed Interrupt input is active.

**Zero % Feedrate
Programmed**

The feed rate programmed for the part selected to execute in batching (or value downloaded through the serial port from a host) is set to zero. Scroll to the feed programming display page and correct the feed rate (or correct in host device).

**Set Up Mode
Cycle Incomplete**

This indicates the user has tried to exit the Set up Mode without completing the cycle.

Verify the Press Interface Mode ("Press Before Feed" or "Feed Before Press") setting is selected as desired (Parameter B109).

The user has the following two (2) options:

1. Reenter Set up Mode and complete the cycle (press jog key until the entered feed length is complete, and/or cycle the press, if required, to complete the cycle).
2. Press the Clear push-button on the user's control panel or press the CL key on the DLC keypad. This will clear the diagnostic message, and recognize any mode change selection.

**Aux. Feedlength
is Zero!**

Indicates the Auxiliary Feed Length option was selected but Parameter B103 is set at zero. To correct:

1. Turn OFF the Auxiliary Feed Length selection (input).
2. Press Clear and enter the Parameter mode.
3. Enter the desired "Auxiliary Feed Length" in Parameter B103.
4. Verify that the *Parameter B112: MW Selection* is not enabled to use the Auxiliary Feed Input.

**Count Exceeds
Part Quantity**

This cycle stop, soft fault is issued if the part quantity entered is less than the current part count. To correct this error, clear the current count by entering a zero in the part quantity, then press the clear key or input.

**Battery is Low
Replace it Soon**

Indicates the RAM Backup Battery is low. Fault will not be issued if an Automatic Mode cycle is in progress or if an axis is feeding. After clearing the fault, it will be issued every 60 minutes as a reminder.

To prevent loss of parameters and batch programming, replace the battery within two weeks of when the fault is first issued. Turn power OFF to the DLC, remove the Memory and Battery Module and replace the 3.5 volt Lithium battery. Before disconnecting the old battery, connect the new battery to the second connector (other side of battery).

NOTE: *If the battery voltage gets too low, all RAM data (parameters, feed length and rate, batch programming) will be lost and needs to be re-entered after replacing the battery.*

**Para Invalid!
Select P-mode**

Fault is displayed when power is applied to the DLC or when you switch out of Parameter Mode. In either case, this fault indicates that required parameter's data is missing or incorrectly entered. Switch to Parameter Mode. The display shows the first sequential number of the parameter requiring correction. Enter the data correctly and press STORE for each parameter that appears as invalid. Refer to section 5.3 for added information on this and related "Parameter Is Invalid" fault conditions.

**Batching Program
was Lost!**

This fault is issued if batching data is invalid upon power-up (lost due to battery failure or at initial installation). Default values are loaded for any part in which data is invalid (See "Default Batch Program Values" in section 4.1).

**Amp Overtemp
Warning**

The Indramat Servo Drive has issued this warning diagnostic. The DLC latches this warning and will issue a cycle stop if cycling in Automatic Mode. Check the two digit diagnostic display on the front of the drive and consult the drives manual for additional information.

**Moter Overtemp
Warning**

The Indramat Servo Drive has issued this warning diagnostic. The DLC latches this warning and will issue a cycle stop if cycling in Automatic Mode. Check the two digit diagnostic display on the front of the drive and consult the drives manual for additional information.

8.6 Minor Error Messages

This section provides a complete list of Minor Error diagnostic messages, and an explanation of the potential cause(s).

**DLC System Error
Code #MNR00**

An internal system fault has occurred in the DLC.

NOTE: For any DLC system error display, call Indramat home office. Advise them of the error code number displayed.

**Zero Feedlength
Entered**

This indicates the feed length is set to zero (0) on the DLC (or from the IDS, etc.). If in the Automatic Mode, enter the desired feed length and press the Resume Cycle button to continue the automatic cycle operation.

If in Set up Mode, select the desired feed length and the diagnostic message will clear.

Note: *This message does not apply when in Set up Mode, as the feed rate used is the predetermined jog velocity (set in parameter).*

**Zero % Feedrate
Entered**

The feed rate entered is set to 0% on the DLC (from the IDS, etc.). If in Automatic Mode, select the desired feed rate % and press the resume button to continue the cycle.

**Drive
Is Not Enabled!**

The Digital Servo Drive is not in a "Drive Enabled" state.

Check/perform the following to correct:

1. Apply Power to the amplifier.
2. Check the amplifier connection.
3. Check the amplifier for a fault.

**Axis 1 Has Not
Reached Position**

This indicates the input to select Automatic Mode or Set up Mode is high, but the axis is not stopped within the position threshold. To correct:

1. Check the "In-Position Threshold" setting in Parameter A110. Setting may be too tight.
2. Check for amplifier failure.
3. Verify Encoder (and cable) is functioning properly.

**Stop Due To
Interrupt Input!**

The Feed Interrupt input (X17 - Pin 7) has gone low, causing the axis motion to halt.

WARNING: *In Automatic Mode, the feed will resume automatically when this signal returns. Use the Feed Interrupt output to advise operating personnel of this condition.*

**Feed Angle
Is Missing!**

This error is issued in three different situations:

1. Appears upon entry into Automatic or Set up Mode, if the DLC detects the Feed Angle input is low.
2. After either soft fault "Feed Angle Lost During Feed" or "Movement While Feed Angle Low" is cleared and the Feed Angle input is low.
3. If a Cycle Start is actuated while the Feed Angle input is low.

Check the feed angle switch or sensor and its connections. This error will clear when the Feed Angle input goes high.

**Change in Fdlgth
Exceeds Limit**

The "limit" is set in Parameter B106 (Feed length Maximum Change). It is the maximum amount that the programmed feed length can change during a cycle. This limit is checked only during an Automatic Mode cycle. The maximum change window is based upon the first programmed feed length after a Cycle Start or Resume. A new Maximum Change limit will be accepted on the next cycle after it is changed and STORED. The limit may be disabled by entering a zero (0) in the parameter.

**Feedlength
Exceeds Maximum**

The feed length "Maximum Limit" is set in Parameter B104. This error is immediately displayed if the programmed feed length exceeds this limit while not in an Automatic Mode cycle. While an Automatic Mode cycle is in progress, the programmed feed length is checked only when a feed is about to begin (change not recognized until start of next cycle). This prevents a feed from being interrupted by an erroneous feed length entry (during the current cycle). An erroneous entry will cause the error to display and turn off the Permit Press output. Change length to within limits and press Resume Cycle to continue.

**Feedlength Less
Than Minimum**

The feed length "Minimum Limit" is set in Parameter B105. This error is immediately displayed if the programmed feed length is less than this limit while not in an Automatic Mode cycle. While an Automatic Mode cycle is in progress, the programmed feed length is checked only when a feed is about

to begin (change not recognized until start of next cycle). This prevents a feed from being interrupted by an erroneous feed length entry (during the current cycle). An erroneous entry will cause the error to display and turn off the Permit Press output. Change length to within limits and press Resume Cycle to continue.

**Auto Mode Exit
Required**

This diagnostic is issued when a fault occurs while in automatic mode. To continue you must exit automatic mode, perform any necessary alignment feed manually, and then re-enter automatic mode.

8.7 System Status Messages

This section provides a complete list of status messages provided by the DLC. Certain messages are dependent on the selected mode of operation. These are described separately in this section.

General Messages

The following messages are not exclusive to a particular operating mode.

Initializing Sys

This message indicates the DLC is performing the system self test following a power up. It performs computations based on the parameter values. If all conditions are correct, a mode specific status report message will display. Should any condition not be met, the DLC will display the appropriate diagnostic message.

Note: The SOT displays "PARAMETER MODE" as acknowledgment of the DLC mode of operation.

PARAMETER MODE

This indicates the DLC is in Parameter Mode and appears only in the optional vacuum florescent tube remote display. The DLC control panel display shows the actual parameter and its data (A100, etc.).

Jog Input Active

This indicates the Jog Forward or the Jog Reverse input X17 pin 9 & 10 is high when entering the Manual or Set up Mode. Inputs should be wired into normally-open, momentary, push-button switches (input signal drops when button released). Also, if toggled between Step Mode and Jog Mode while the motors are in motion, the motors will ramp down and this message will be displayed.

1. Check both Jog buttons for proper operation.
2. Check Jog switch wiring.

Automatic Mode Messages

The following status messages are displayed in Automatic Mode.

A: No Cycle Start

This message indicates the system is ready and waiting for a momentary Cycle Start input. This message appears only after the DLC is powered up and initialized or upon entry into Automatic Mode.

A: Cycle Stop

This indicates the CYCLE STOP button was pressed to cause the DLC to stop automatic cycling at the completion of the current cycle.

A: Feeding

Indicates the axis is feeding. This may display if the Position Threshold parameter setting is too small.

A: Wait Fd Angle

Indicates the DLC is waiting for the Feed Angle input to go high. This signal indicates when the press ram is away from the material and the DLC can safely feed.

A: Cycle Delay

Indicates the cycle is complete, and the DLC is currently waiting for the "Minimum Cycle Time" delay (set in Parameter B109 for Press Intermittent mode of operation) to expire before starting the next automatic feed cycle.

A: Resume Req'd

Displayed after clearing a fault to indicate a "Resume Cycle" input is required. Pressing the Resume button causes the DLC to continue the automatic feeding cycle from where the axis stopped.

A: Waiting Press

Indicates the DLC is waiting for the press to continue its stroke cycle until the Feed Angle (input) is available, indicating it is safe to feed material.

A: C.Stop Active

Displayed if the Cycle Stop input is low (active) while in Automatic Mode, but not cycling. This message also displays when single-stepping during batching (pressing Cycle Stop and Cycle Start together causes the DLC to step one feed and press stroke at a time).

If the Cycle Stop button was not pressed as described for either case above, check the push-button switch, connectors and wiring for an electrical open.

A: Start Active

Displayed if the Cycle Start input was high upon entering Automatic Mode. This message could indicate the Cycle Start input is wired incorrectly, or the Normally Open push-button is not functioning properly.

A: Resume Active

Displayed if the Resume Cycle input was high upon entering Automatic Mode.

If the button was not pressed, check for a malfunction of the normally open push-button or a wiring error to the input.

A: P.Stop Active

Displayed if the Part Stop input is low (active) at cycle start when batching is enabled. It is also displayed when single-stepping in batching (pressing Part Stop and Cycle Start together will cause the DLC to step one complete part at a time).

A: Part Stop

Displayed when the Part Stop input has gone high and the DLC stopped the cycle after the current part was complete or when the Batching program (last part executes) is complete.

Manual Mode Messages

The following status messages are displayed in Manual Mode.

M: No Jog Cmd

Indicates that neither the Jog Forward nor the Jog Reverse inputs are high (in Manual Mode).

M: Feed Forward

Indicates the axis is feeding in the forward direction (Jog Forward active in Manual Mode).

M: Feed Reverse

Indicates the axis is feeding in the reverse direction (Jog Reverse active in Manual Mode).

M: Wait Fd Angle

Indicates that the Feed Angle input (X 17 - Pin 6) is low. The DLC will not allow the axis to jog until the feed angle is available, indicating that the press ram is clear of the material.

Set up Mode Messages

The following messages are displayed in Set up Mode.

S: Feed Forward

Indicates the axis is feeding in the forward direction (Jog Forward input active in Set up Mode causes the DLC to feed the entered feed length, then stop).

S: Feed Reverse

Indicates that the axis is feeding in the reverse direction.

S: Fd Incomplete

Indicates that the jog button has been released before the end of the feed (entered feed length) for set up. Press and hold the jog button until set up feed is complete.

S: Wait Fd Angle

Indicates that the Feed Angle input is low, (X17 - Pin 6). The DLC will not allow the axis to jog until the feed angle is available, indicating that the press ram is clear of the material.

S: Waiting Press

Indicates the DLC is waiting for the press to complete its stroke cycle before allowing the next feed cycle to start (after completing the jog feed length, manually initiate a press cycle, then initiate the next jog feed).

S: Start of Feed

Indicates that the axis is at the start of the feed position.

S: Release Jog

Indicates the DLC is ready to start the next feed, but the jog button has not been released since the previous feed.

If the Jog button is not pressed, check push-button switch operation and wiring.

8.8 SOT Status / Diagnostic Codes Index

When using the SOT or other host, the diagnostics may be requested through the RS-232/485 serial port in expanded text format or as a corresponding diagnostic code number (refer to Serial Interface in Chapter 4). The index at the beginning of this chapter lists the DLC displays in alphabetical order. The following index correlates the DLC displays in order of the numeric, diagnostic code equivalents. Diagnostic codes on the IDS are listed in the next section.

SOT Code Display Page

System Messages

01	M: No Jog Command	8-21
02	M: Feed Forward	8-21
03	A: No Cycle Start	8-19
04	A: Cycle Stop	8-19
05	A: Feeding	8-19
06	A: Wait Fd Angle	8-19
07	A: Cycle Delay	8-20
09	S: Feed Forward	8-22
0A	S: Fd Incomplete	8-22
0B	S: Wait Fd Angle	8-22
0C	S: Waiting Press	8-22
0D	S: Start of Feed	8-22
0E	PARAMETER MODE	8-18
12	S:Release Jog	8-22
14	M: Wait Fd Angle	8-21
15	A: Resume Req'd	8-20
16	S: Feed Reverse	8-22
17	M: Feed Reverse	8-21
18	Initializing Sys	8-18
19	A: Waiting Press	8-20
1A	A: C.Stop Active	8-20
1B	A: Start Active	8-20
1C	A: Resume Active	8-20
20	Jog Input Active	8-19
22	A: P.Stop Active	8-21
23	A: Part Stop	8-21

Minor Errors

40	DLC SYSTEM ERROR	
	Code #MNR00	8-15
41	Zero Feedlength Entered	8-15
43	Zero % Feedrate Entered	8-16
44	Drive Is Not Enabled!	8-16
46	Axis 1 Has Not Reached Position	8-16
48	Stop Due To Interrupt Input!	8-16

49 Feed Angle Is Missing! 8-17
 4C Change in Fdlgth Exceeds Limit 8-17
 4D Feedlength Exceeds Maximum 8-17
 4E Feedlength Less Than Minimum 8-17
 53 Auto Mode Exit Required 8-18

Soft Faults

60 DLC SYSTEM ERROR
 Code #SFT00 8-10
 61 Serial Com Port Disconnection! 8-10
 62 Serial Com Port Overrun Error 8-10
 63 Serial Com Port Framing Error! 8-11
 64 Serial Com Port Parity Error! 8-11
 65 Serial Com Port IDS Format Error! .. 8-11
 66 Feed Angle Lost During Feed! 8-11
 67 Serial Com Port RS485 Bus Error! 8-11
 68 Movement WhileFeed Angle Low..... 8-12
 69 Press Timeout Has Expired..... 8-12
 6A Invalid Mode Selection!..... 8-12
 6B Press Cycle Without Feed!..... 8-12
 6D Zero % Feedrate Programmed!..... 8-13
 6E Set Up Mode Cycle Incomplete 8-13
 7D Motor Overtemp Warning..... 8-15
 7E Amp Overtemp Warning 8-15
 73 Aux Feedlength is Zero! 8-13
 74 Count Exceeds Part Quantity 8-14
 76 Battery is Low! Replace it Soon 8-14
 77 Para. Invalid! Select P-mode! 8-14
 78 Batching Program was Lost! 8-14

Hard Faults

80 DLC SYSTEM ERROR
 Code #HRD00..... 8-6
 81 Parameters Lost! Clear to Cont. 8-6
 82 Axis 1 Drive Runaway!..... 8-8
 86 Parameters Lost!Select P - Mode..... 8-7
 88 EMERGENCY STOP! 8-7
 89 Axis 1 Amplifier Hardware Fault! 8-8
 90 Measuring Wheel Encoder Fault 8-9
 8C Axis 1 Drive Stalled..... 8-7
 92 Invalid Drive Configuration..... 8-9
 93 Drive Watch Dog Error..... 8-9
 94 DPR Not Readable..... 8-10
 95 Drive Diagnostic..... 8-9
 96 Drive Error Press the CR Key..... 8-9
 97 Invalid Drive Software..... 8-9

8.9 IDS Status / Diagnostic Codes Index

When using the IDS, the diagnostics appear on the two digit display in a corresponding diagnostic code number. The index at the beginning of this chapter lists the displays in alphabetical order. The following index correlates the DLC displays in order of the numeric, diagnostic code equivalent display on the IDS.

IDS Code Display.....Page

System Messages

00	Initializing Sys	8-18
01	M: No Jog Command	8-21
02	M: Feed (Jog) Forward.....	8-21
	S: Feed Forward	8-22
03	M: Feed (Jog) Reverse.....	8-21
	S: Feed Reverse	8-22
04	A: No Cycle Start	8-19
05	S: Waiting Press (Waiting for Press)	8-22
	A: Waiting Press	8-20
06	M: Wait Fd Angle (Waiting Feed Angle)	8-21
	S: Wait Fd Angle.....	8-22
	A: Wait Fd Angle	8-19
07	A: Feeding.....	8-19
08	A: Cycle Delay.....	8-20
09	A: Cycle Stop	8-19
10	A: Resume Required	8-20
14	S: Start of Feed (Set up Mode Feed).....	8-22
15	S: Fd Incomplete (Set up Mode feed inc).....	8-22
16	S: Release Jog (Set up Mode feed done).....	8-22
17	DLC PARAMETER MODE	8-18
18	DLC Input Active(see display for type)	

Minor Errors

40	Zero Feedlength Entered.....	8-15
41	Zero % Feedrate Entered	8-16
42	Feedlength Less Than Minimum	8-17
43	Feedlength Exceeds Maximum	8-17
44	Change in Fdlgth Exceeds Limit.....	8-17
45	Drive Is Not Enabled	8-16
47	Axis 1 Has Not Reached Position	8-16

49 Stop Due To Interrupt Input!..... 8-16
 50 Feed Angle Is Missing!..... 8-17
 57 Auto Mode Exit Required 8-18

Soft Faults

60 Feed Angle Lost During Feed!..... 8-11
 61 Movement While Feed Angle Low..... 8-12
 62 Press Cycle Without Feed!..... 8-12
 63 Press Timeout Has Expired..... 8-12
 64 Invalid Mode Selection!..... 8-12
 65 Aux Feedlength is Zero! 8-13
 66 Set Up Mode Cycle Incomplete 8-13
 70 Para Invalid! Select P-Mode! 8-14
 71 Battery is Low! Replace it Soon..... 8-14
 75 Motor Overtemp Warning..... 8-15
 76 Amp Overtemp Warning 8-15

Hard Faults

80 EMERGENCY STOP! 8-7
 81 Axis 1 Drive Runaway!..... 8-8
 83 Axis 1 Drive Stalled!..... 8-7
 85 Axis 1 Amplifier Hardware Fault! 8-8
 89 Measuring Wheel Encoder Fault! 8-9
 90 Parameters Lost! Select P - Mode..... 8-7
 92 Invalid Drive Configuration..... 8-9
 93 Drive Watch Dog Error..... 8-9
 94 DPR Not Readable..... 8-10
 96 Drive Error Press the CR Key..... 8-9
 97 Invalid Drive Software..... 8-9
 99 Communications or System Error: See DLC Display

Appendix A. Display Map

Refer to Chapter 2, section 2.2 for a description of how to use this map to scroll through the display screens on the DLC control panel display (CTA).

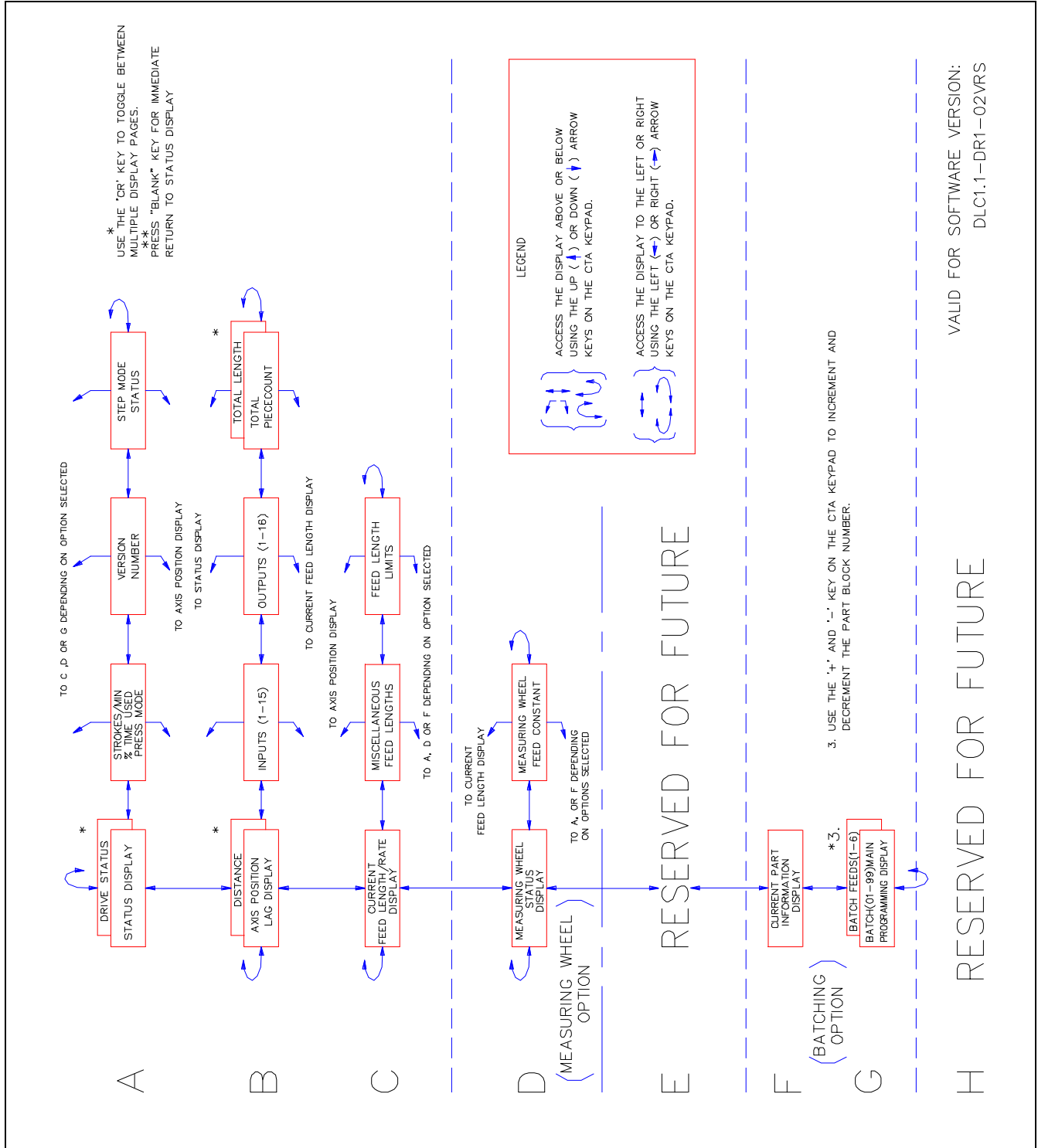


Figure A-1: DLC Display Map

Appendix B. Blank Parameter Worksheets

The following pages include blank Indramat parameter worksheets. Make copies of the sheets that are applicable to your system. Use these sheets to record the parameter settings entered for your application.

B 1.1 DLC-R, A1 Parameter Set

DLC1.1-DR1-02VRS "A1" Parameter Set for Axis 1

FEEDLENGTH RES.	A100	__ (0-4)
FEED CONSTANT (INPUT UNITS/REV)	A101	_____
DRIVE MAX RMP	A102	_____/____.
MAX FEEDRATE (INPUT UNITS/MINUTE)	A104	_____
MAX FEEDRATE = (MAX RPM [A102] X FEED CONSTANT [A101])		
JOG FEEDRATE (INPUT UNITS/MINUTE)	A105	_____
MAX ACCEL RATE (INPUT UNITS/SEC ²)	A106	_____
MAX DECEL RATE (INPUT UNITS/SEC ²)	A107	_____
MAXIMUM JERK	A108	_____
MAX JERK lower limit = (60 X A106 ² /A104)		
POSITION GAIN	A109	__.
IN-POS THRESHOLD	A110	_____
DIRECTION	A111	Enc= _ cmd= _
MONITOR WINDOW	A112	__.
The recommended percentage for the Monitor Window is 10.0%		
LOW FA THRESHOLD	A113	_____

B 1.2 DLC-R B1 Parameter Set

DLC1.1-DR1-02VRS

LANGUAGE	B100	_ 00 GERMAN _ 01 ENGLISH _ 02 FRENCH _ 03 SPANISH _ 04 ITALIAN
DIMENSIONAL UNIT	B101	_IN _FT _MM _CM _M _RAD _DEG _REV
INTERFACE OPTION	B102	_ 00 STANDARD DLC _ 01 IDS BOARD _ 02 BATCH OPTION _ 03 BATCH OPTION w/out AUTO INDEX
AUX FEEDLENGTH	B103	(+/-)_____
FEEDLENGTH MAX	B104	_____
FEEDLENGTH MIN	B105	_____
FEED MAX CHANGE	B106	_____
FEED INCREMENT	B107	_____
JOG STEP	B108	_____
PRESS INTERFACE	B109	__ . _SEC __
BATCHING OPTION	B111	__ G= _____
MEASURING WHEEL ENABLE	B112	_____
MW FEED CONSTANT	B116	_____
MW ENCODER	B117	_____
SERIAL INTERFACE	B118	M= _ S= _____
SERIAL OPERATION	B119	_____
SLUG WIDTH COMPENSATION	B122	_____

B 1.3 DLC-R C0 Parameter Set

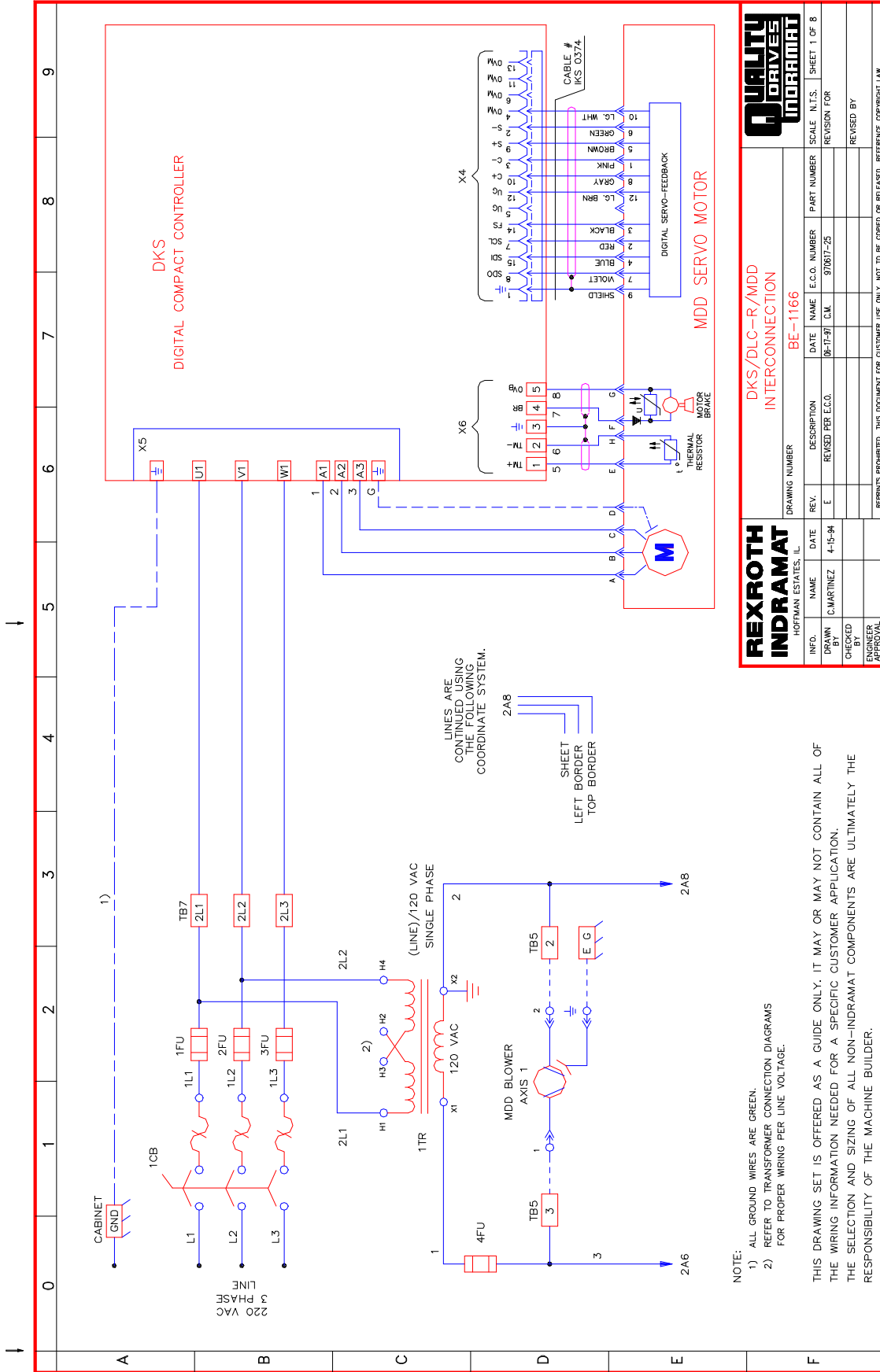
DLC1.1-DR1-02VRS

ANALOG OUTPUT 1	C000	___0 = Current command ___1 = RPM command ___2 = RPM actual value from feedback ___3 = Position - Actual value from feedback ___4 = Motor encoder: Sinusoidal feedback ___5 = Motor encoder: Cosinusoidal feedback
ANALOG OUTPUT 2	C001	___0 = Current command ___1 = RPM command ___2 = RPM actual value from feedback ___3 = Position - Actual value from feedback ___4 = Motor encoder: Sinusoidal feedback ___5 = Motor encoder: Cosinusoidal feedback
OVERLOAD FACTOR	C002	_____ %
POSITION DATA	C003	_____ Degrees/10V
VELOCITY DATA	C004	_____ RPM/10V
VELOCITY LOOP	C005	___0 = Monitoring Circuit OFF ___1 = Monitoring Circuit ON
ERROR REACTION	C008	___0 = The drive switches itself to rotational speed control and defaults to a RPM setpoint of 0. ___1 = Same as error reaction 0, but no error report to the power supply. ___2 = The drive disengages immediately.
CURRENT LOOP GAIN	C009	_____ Volts/Amp
VELOCITY LOOP GAIN	C010	_____ mAsec/rad
VELOCITY LOOP TIME	C011	_____ msec
SMOOTHING TIME	C012	_____ μ s

Appendix C. Schematics

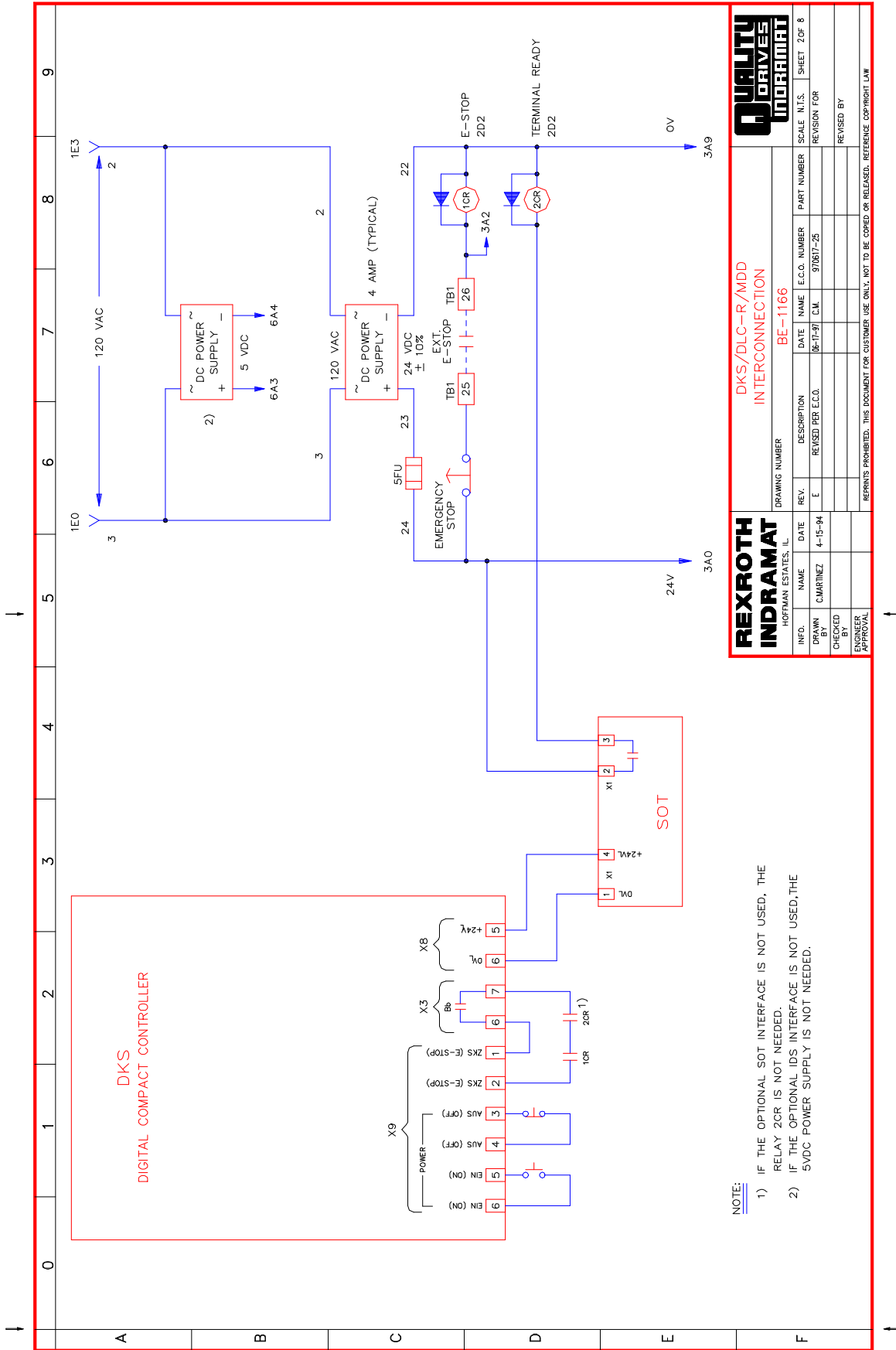
CAUTION: Drawings in this appendix are included for illustrative purposes only and are subject to change without notice. Check with Indramat to be sure you are working with the latest drawings, prior to installing, wiring and powering equipment.

NOTE: This appendix includes a separate set of interconnect drawings for:
DLC1.1-R DLC1.1-DR1-02VRS Drawing #BE1166



REXROTH INDRAMAT		HOFMANN ESTABLISHMENT		DRAWING NUMBER		D.K.S./D.L.C.-R/MDD INTERCONNECTION		BE-1166		SCALE N.T.S.		SHEET 1 OF 8	
INFO.	NAME	DATE	REV.	DESCRIPTION	DATE	NAME	E.C.O. NUMBER	PART NUMBER	REVISION FOR	REVISION FOR	REVISION FOR	REVISION FOR	REVISION FOR
	C. MARTINEZ	4-15-94	E	REVISED PER E.C.O.	06-17-97	C.M.	970617-25						
	ENGINEER			APPROVAL									

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**REXROTH
INDRAMAT**

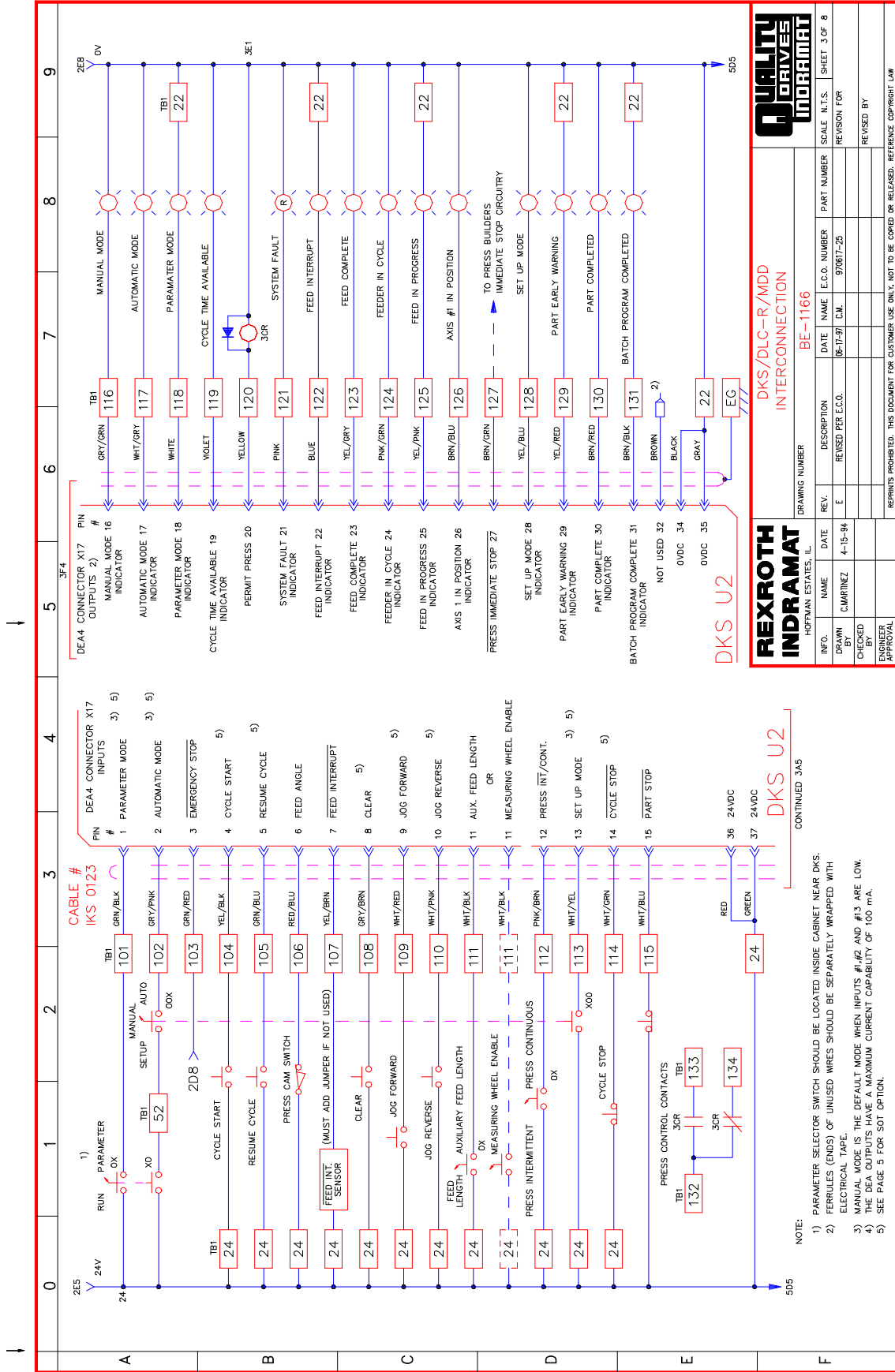
DKS/DLC-R/IDD
INTERCONNECTION

DRAWING NUMBER: BE-1166

INFO.	NAME	DATE	DESCRIPTION	SCALE	N.I.S.	SHEET	2 OF 8
DRAWN BY	C. MARTINEZ	4-15-94	REVISED PER E.C.O.	06-17-97	C.M.	970617-25	
CHECKED BY							
APPROVED BY							

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- NOTE:**
- 1) IF THE OPTIONAL SOT INTERFACE IS NOT USED, THE RELAY 2CR IS NOT NEEDED.
 - 2) IF THE OPTIONAL IDS INTERFACE IS NOT USED, THE 5VDC POWER SUPPLY IS NOT NEEDED.



REXROTH INDRAMAT
HOFFMAN ESTATES, IL.

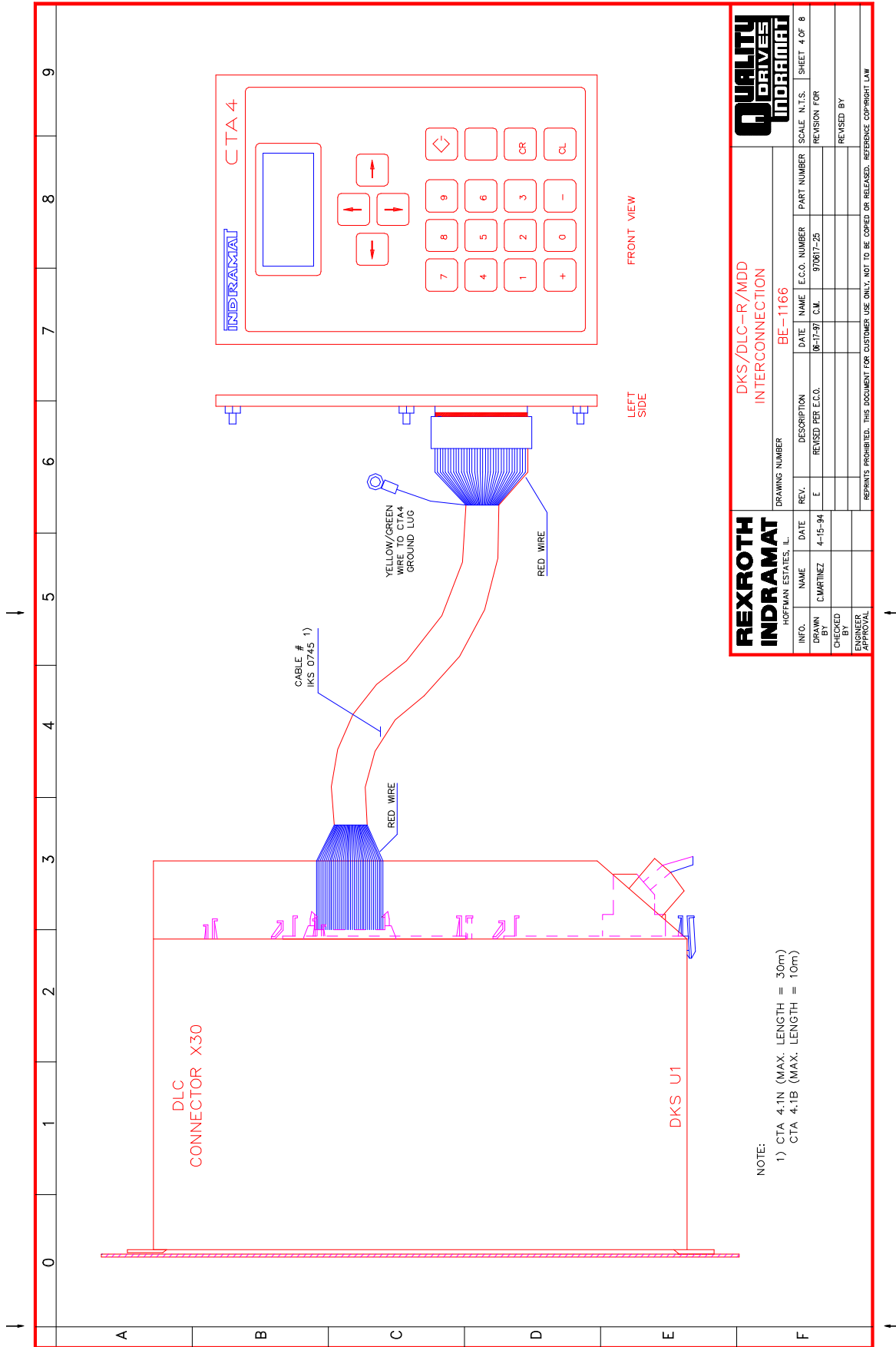
DKS/DLC-R/MDD INTERCONNECTION
DRAWING NUMBER: BE-1166

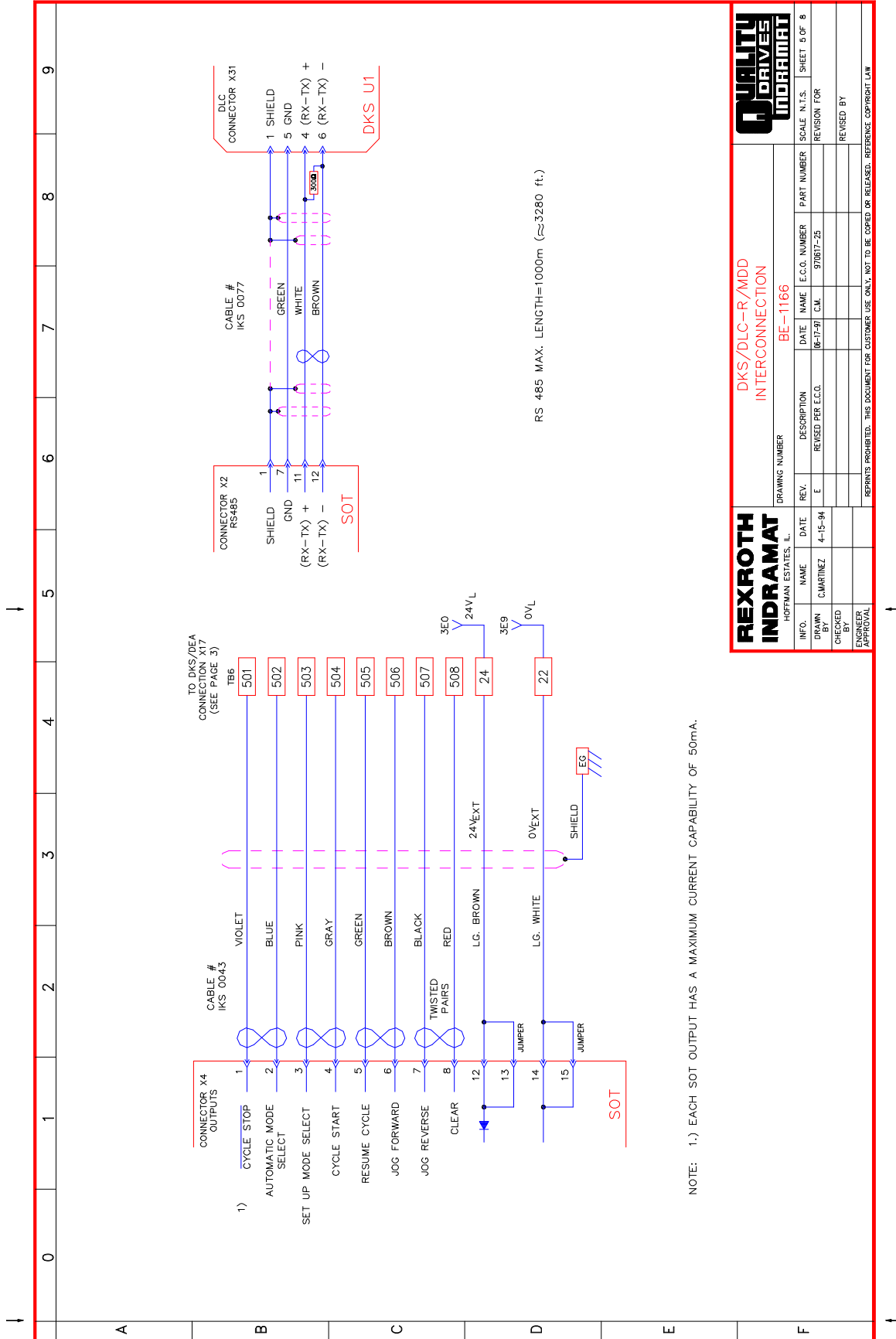
INFO.	NAME	DATE	DESCRIPTION	REV.	REVISED PER E.C.O.	E.C.O. NUMBER	PART NUMBER	SCALE	N.T.S.	SHEET 3 OF 8
DRAWN	CMARTINEZ	4-15-94		1						
CHECKED BY										
ENGINEER APPROVAL										

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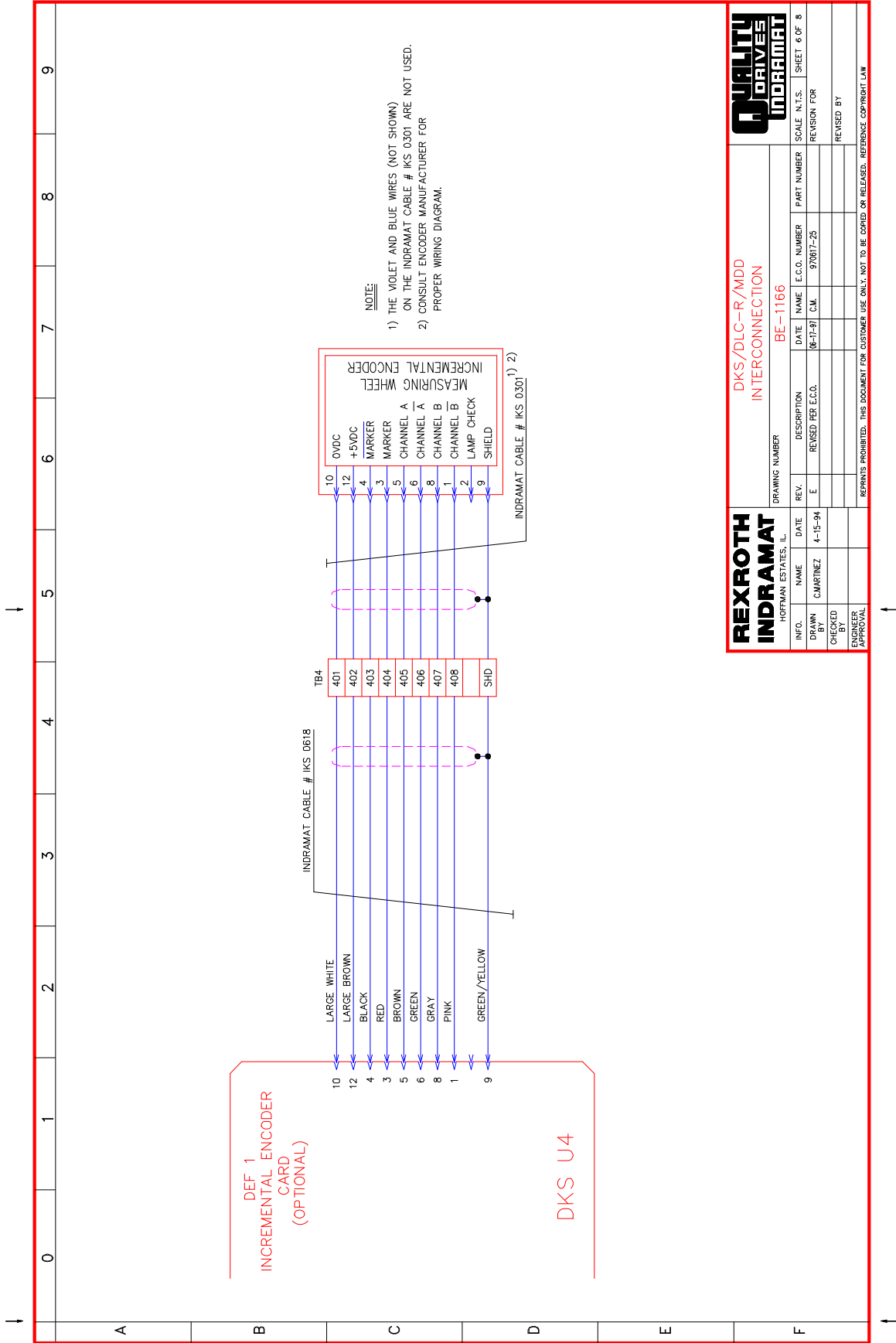
NOTE:

- PARAMETER SELECTOR SWITCH SHOULD BE LOCATED INSIDE CABINET NEAR DKS.
- FERRULES (ENDS) OF UNUSED WIRES SHOULD BE SEPARATELY WRAPPED WITH ELECTRICAL TAPE.
- MANUAL MODE IS THE DEFAULT MODE WHEN INPUTS #1, #2 AND #3 ARE LOW.
- THE DE44 OUTPUTS HAVE A MAXIMUM CURRENT CAPABILITY OF 100 mA.
- SEE PAGE 5 FOR S0T OPTION.

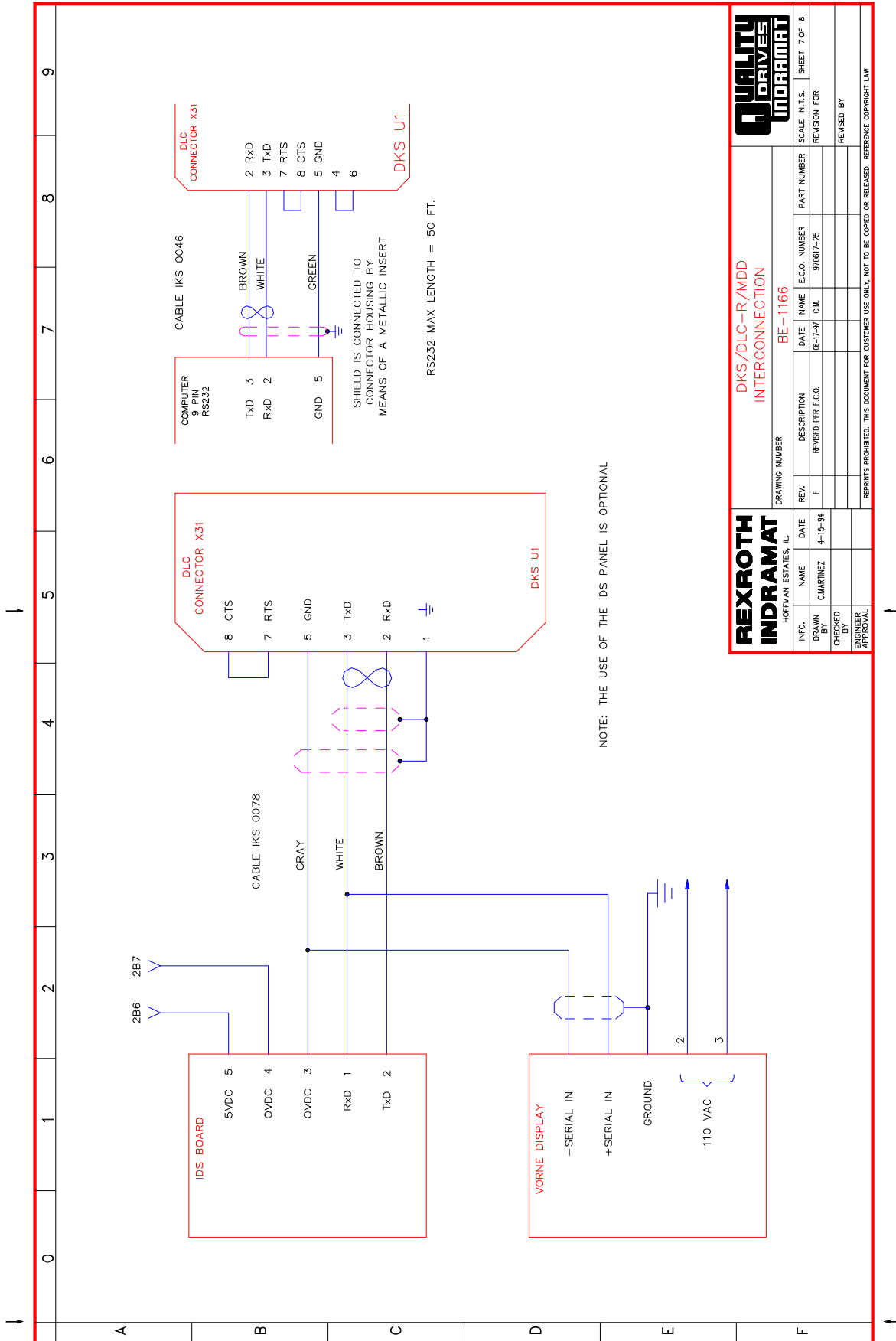




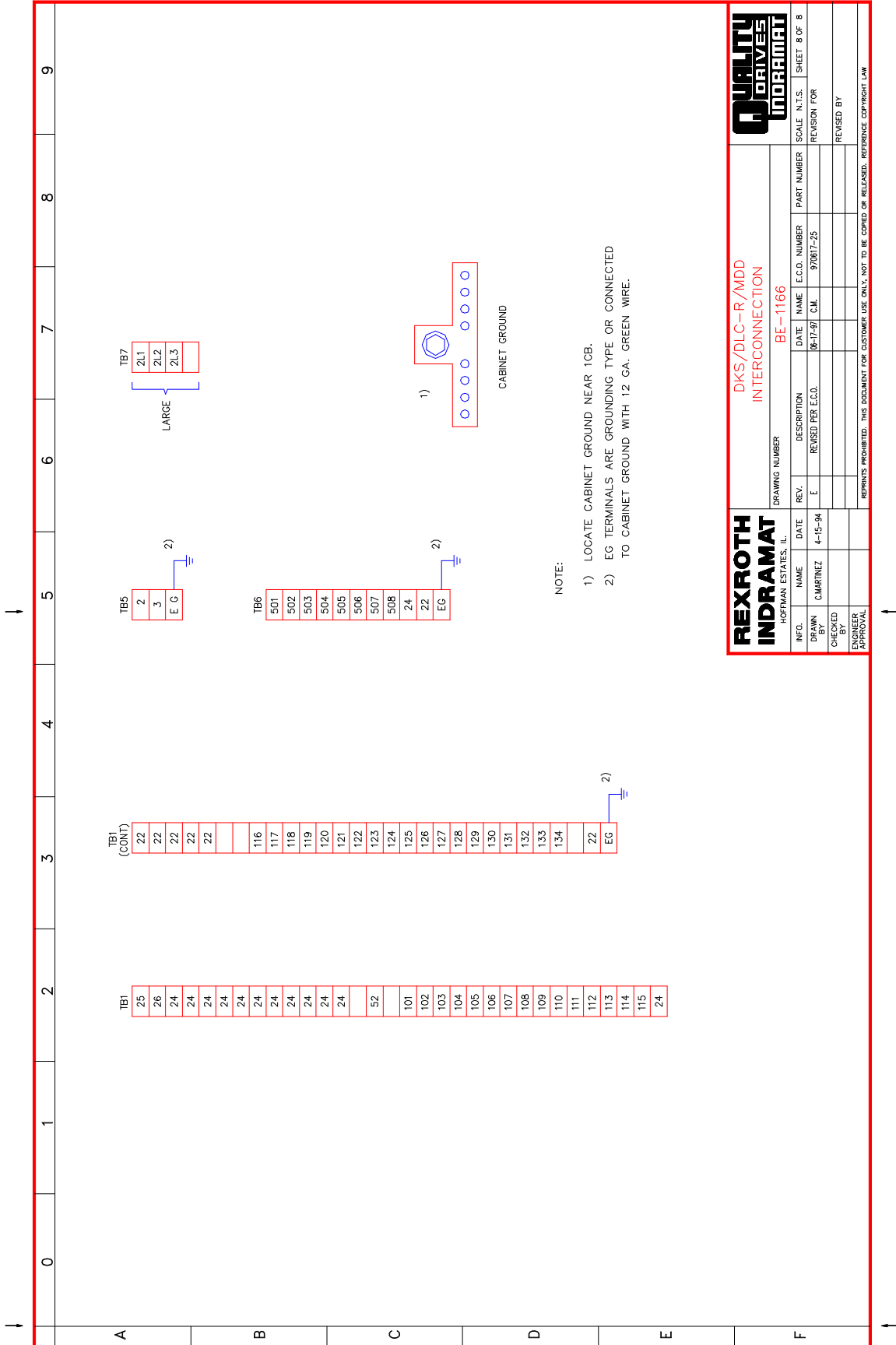
REXROTH INDRAMAT		QUALITY DRIVES INDRAMAT	
DKS/DLC-R/AMDD INTERCONNECTION			
DRAWING NUMBER		BE-1166	
INFO. NAME	DATE	DESCRIPTION	SCALE N.T.S.
HOFFMAN ESTATES, L.L.	4-15-94		SHEET 5 OF 8
DRAWN BY	C. MARTINEZ	REVISED PER E.C.O.	PART NUMBER
CHECKED BY		REVISED PER E.C.O. C.M.	970817-25
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REXROTH INDRAMAT		HOFFMAN ESTATES, ILL.		DKS/DLC-R/MDD INTERCONNECTION				QUALITY DRIVES INDRAMAT	
				DRAWING NUMBER BE-1166		SCALE N.T.S.		SHEET 6 OF 8	
INFO.	NAME	DATE	DESCRIPTION	DATE	NAME	E.C.O. NUMBER	PART NUMBER	SCALE	N.T.S.
DRAWN	C MARTINEZ	4-15-94	REVISED PER E.C.O.	06-17-97	C.M.	970617-25		REVISION FOR	
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REXROTH INDRAMAT		DOKMAN ESTATES, L.L.C.		DOKS/DLC-R/MDD INTERCONNECTION				QUALITY DRIVES INDRAMAT	
DRAWING NUMBER		BE-1166		SCALE N.T.S.		SHEET 7 OF 8			
INFO.	NAME	DATE	REV.	DESCRIPTION	DATE	NAME	E.C.O. NUMBER	PART NUMBER	SCALE N.T.S.
	CAMARINEZ	4-15-94	E	REVISED PER E.C.O.	08-17-97	C.M.	970817-25		REVISION FOR
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NOTE:
 1) LOCATE CABINET GROUND NEAR 1CB.
 2) EG TERMINALS ARE GROUNDING TYPE OR CONNECTED TO CABINET GROUND WITH 12 GA. GREEN WIRE.

REXROTH INDRAMAT			QUALITY DRIVES INDRAMAT		
DKS/DLC-R/MDD INTERCONNECTION					
DRAWING NUMBER		BE-1166		SCALE N.T.S.	
HOFFMAN ESTATES, IL.		REV.	DESCRIPTION	DATE	E.C.D. NUMBER
		E	REVISED PER E.C.O.	06-17-97	970817-25
DRAWN BY		C.MARTINEZ		PART NUMBER	
CHECKED BY				REVISION FOR	
ENGINEER APPROVAL				REVISED BY	
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Appendix D. Installation Drawings

CAUTION: Drawings in this appendix are included for illustrative purposes only and are subject to change without notice.

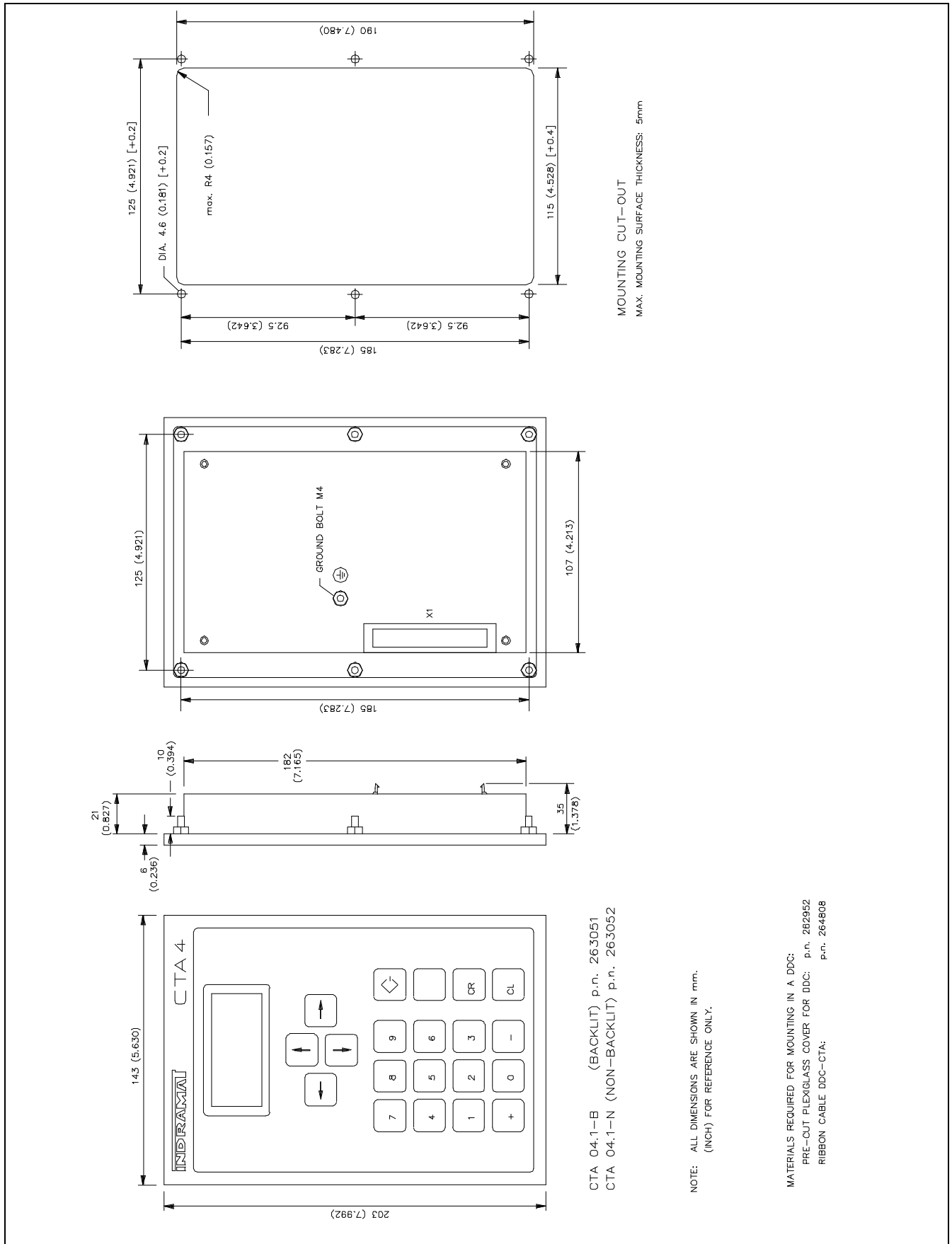


Figure D-1: CTA4 Keyboard and Cabinet Cutout Dimensions

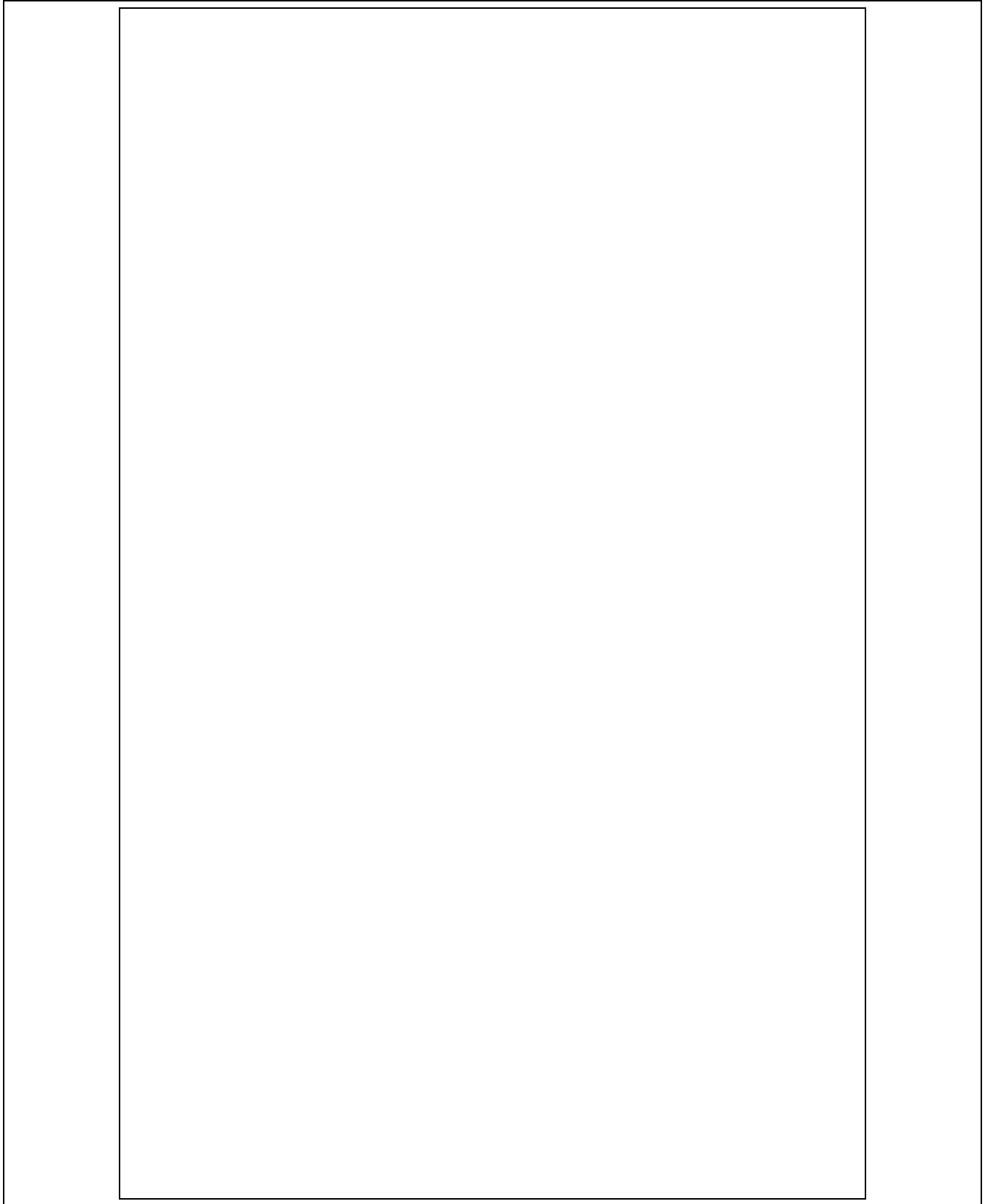


Figure D-2: IDS Outline Drawing

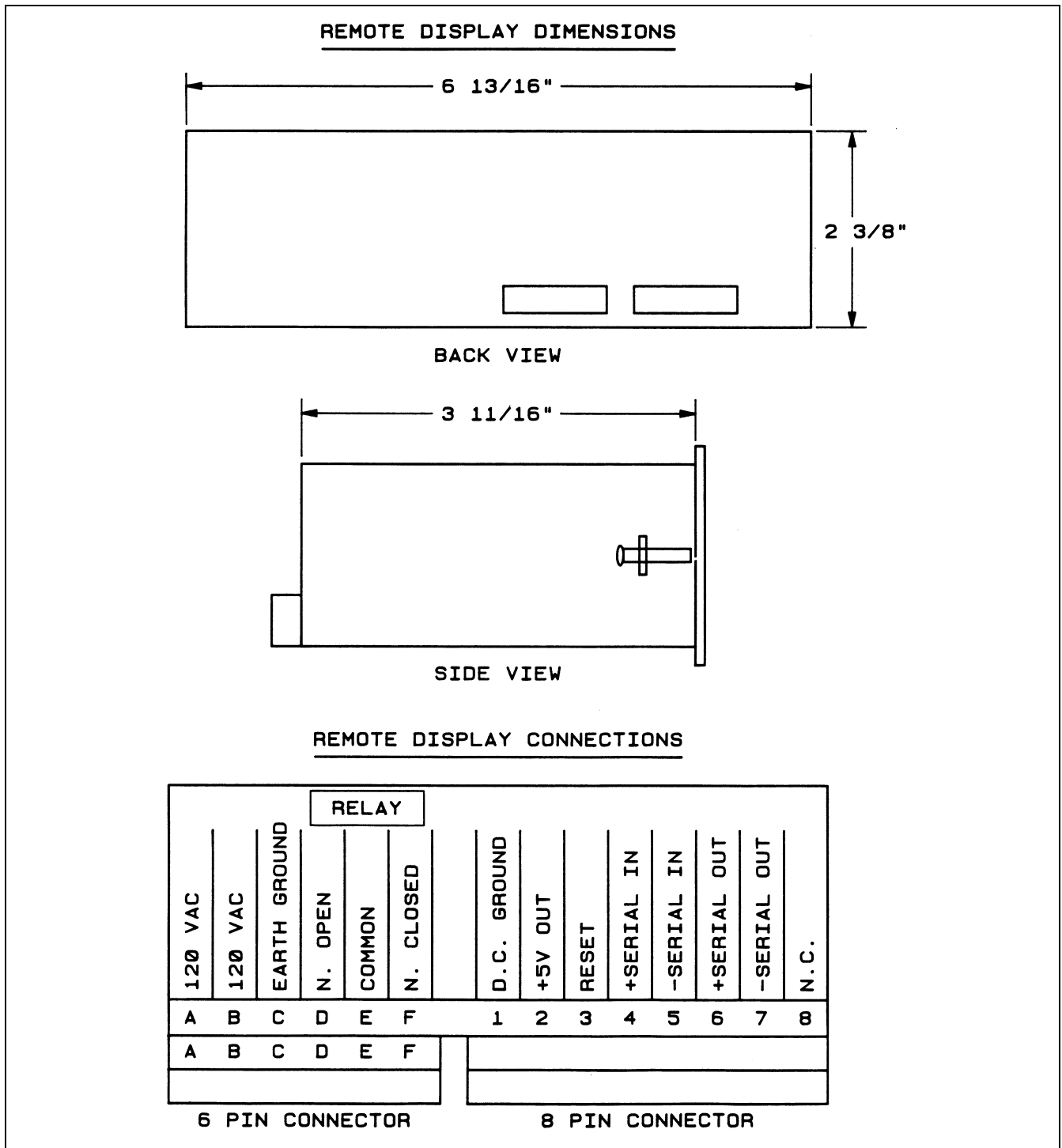


Figure D-3: Vorne Display Dimensions and Connections

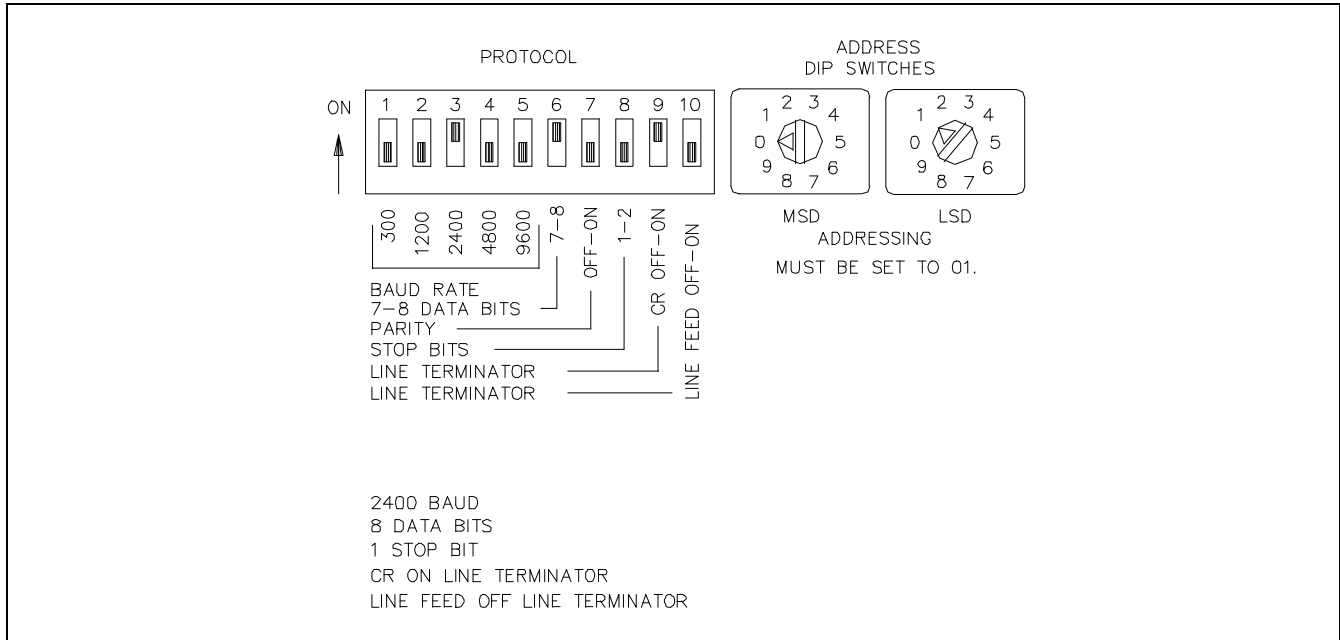


Figure D-4: Vorne Display DIP Switch Configuration

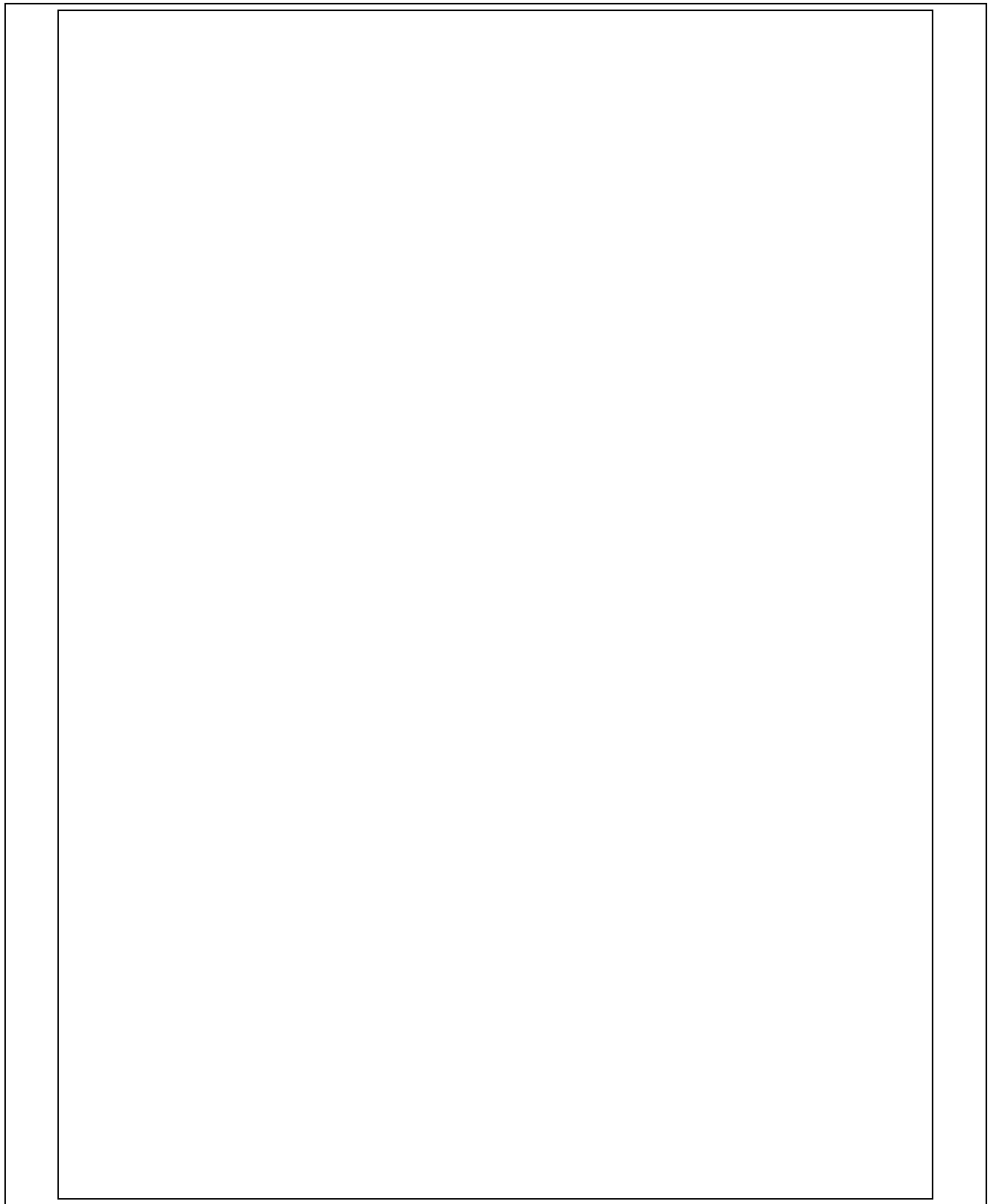


Figure D-5: Station Operator Terminal SOT 02 for Rollfeed

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Publication No. IAE 68003

Revision B, June, 1997

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