HR2000 Cut-to-Length Pre-Engineered Solution

Adjustment Supplement

VS® DRIVES

Instruction Manual D5-3037
October, 1992

RELIANCE ELECTRIC

Cut-to-Length Pre-Engineered Solution

Drive Rating	Input Requirements		Output Rating		Model Number
	A-C Supply, 3-Phase 50/60 Hz		Output Amps		
	Volts	Amps (RMS)	Continuous	Peak (10 sec.)	
1 HP	230	3.6	3.3	6.6	317C90D
2 HP	230	6.8	6.5	13.0	317C91D
3 HP	230	9.5	9.2	18.4	317C92D
4 HP	230	13.8	13.0	26.0	317C93D
5 HP	230	16.0	16.0	32.0	317C94D
7.5 HP	230	24.0	24.0	48.0	317C95D
10 HP	230	46.0	48.0	96.0	317C96D
15 HP	230	46.0	48.0	96.0	317C97D

Table of Contents

List of Figures

List of Tables

1: Introduction

The products described in this instruction manual are manufactured by Reliance Electric Industrial Company.

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED. SHOULD INSTALL, ADJUST, OPERATE, AND/OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

This supplement is intended as an installation, start-up, and operation guide for the PreEngineered Cut-to-Length Drive Solution.

The following hardware is mounted in a cabinet:

- HR2000 High Performance Drive
- RamPak EX Position Controller
- Data Entry Panel
- Control Transformer (230V/115V)
- Master Circuit Breaker
- Power Supply

The Operator Control Panel consists of pushbuttons, switches and Data Entry Panel.

Dangers, Warnings, and Cautions

Text for **DANGERS**, **WARNINGS**, and **CAUTIONS** point out potential trouble areas. All three of these are enclosed in a box to call attention to them.

- A **DANGER** alerts a person that conditions exist which could result in severe bodily injury or loss of life.
- A **WARNING** alerts a person that conditions exist which could cause bodily injury if procedures are not followed.
- A **CAUTION** alerts a person that damage to, or destruction of, equipment could result if procedures are not followed.

2: Installation

Preliminaries

The Customer must supply the following:

- Incoming Power (208/230 VAC, 3-phase, 50/60 Hz)
- Feed Initiate – An external contact closure is needed before each feed can be executed. This input insures that other parts of the machine are in proper position before a feed is executed. Loss of this signal stops all machine motion. Cycle start input cannot start motor until start feed is activated.
- External Fault – An external contact to halt feed cycle must be interlocked into an E-Stop circuit.

NOTE: Do not couple the HR2000 motor to the load or driven machine until instructed to do so in the SETUP PARAMETERS section of this instruction manual.

Wiring

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING TO THE NATIONAL ELECTRICAL CODE AND OTHER APPLICABLE LOCAL CODES. WIRING, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION ARE OF PARTICULAR IMPORTANCE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Wire the Cabinet per the Sales Order Engineering Drawing (W/D 103690-32A).

- Power to the Cabinet
- Power to the Motor
- HR2000 Encoder
- Feed Initiate Signal from Press or Cutter Knife to input 12
- Motor Thermostat
- Motor Fan (5–15 HP only)
- Snubber Resistors (if applicable)
- Snubber Thermostat (if applicable)

Note: To run the batch, the Feed Initiate Signal must be wired to the 24 volt registration input (I12). Reference W/D 103690-32A for I12.

3: Controls/Indicators/Data Entry Panel

Reference Figure 1 for location of controls and indicators.

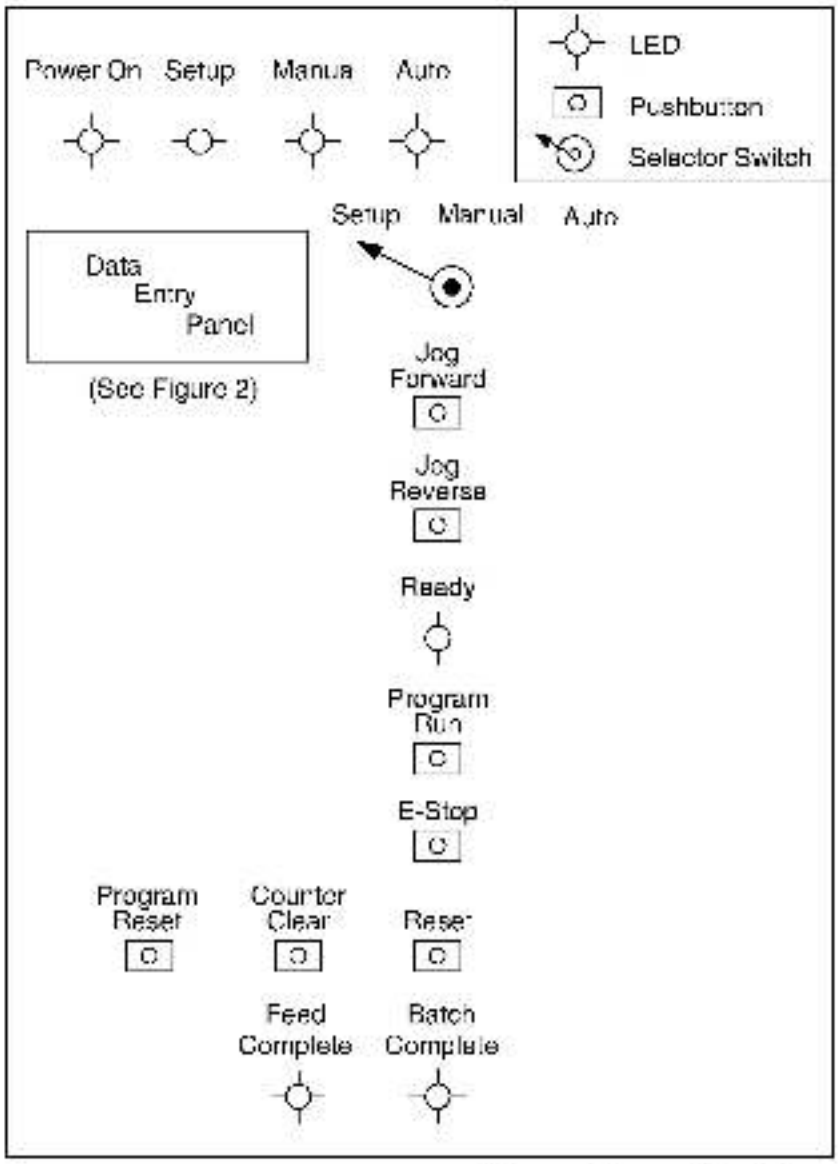


Figure 1. Control Panel

Controls

- CIRCUIT BREAKER – provides power to the RamPak™ and HR2000™ Controller.
- PROGRAM RUN – Starts the Program.
- PROGRAM RESET – Resets the program after a fault has been cleared.
- CLEAR COUNTER – Resets the batch counter to zero.
- E-STOP – Disconnects all power to the RamPak and the HR2000 Controller through master relays via a mushroom pushbutton.
- RESET – Reconnects power to the HR2000 and inputs to the RamPak™ via an illuminated pushbutton after an emergency stop.
- SETUP/MANUAL/AUTO:
  - In the Setup mode, the operator inputs variables for the specific product (length, velocity, accelerator rate and batch count).
  - In Manual mode, pressing the Jog Forward or Jog Reverse pushbutton will cause the drive to jog in the selected direction until the pushbutton is released.
  - In Auto mode, the drive will respond to a feed initiate

signal and rotate the motor shaft as defined by the input variables.

NOTE: The feed initiate signal must be supplied by the customer.

- JOG FORWARD (Manual Mode) – Jogs motor in the forward direction while pressed.
- JOG REVERSE (Manual mode) – Jogs motor in the reverse direction while pressed.
- AUTO LIFT ON/OFF – (Optional) Allows operator to control rolls hydraulically with a user supplied relay contact.

Indicators

- Power on – Indicates power is available to operate the RamPak and the HR2000.
- Ready – Indicates when power is applied to the system and when the RamPak is initialized properly for communications.
- Setup – Indicates the RamPak is in the setup mode and ready to receive input variables.
- Auto – Indicates system is in Auto mode.
- Manual – Indicates system is in Manual mode. Jog Forward and Jog Reverse functions are used in this mode.
- Feed Complete – Indicates when a feed is complete. This output signal is used to activate other functions on the customer's machine.
- Batch Complete – Indicates when the entire batch is complete.

Data Entry Panel

The Data Entry Panel's main function is to access the machine set-up parameters for start-up and for normal operation. It is a stand-alone keyboard entry double line display terminal. Refer to Figure 2 for location of the display and data entry keys.

Data Entry Keys

The Data Entry Panel consists of 8 function keys (F1 thru F8), a 10-key numeric keypad, 2ND key, DEL key, "-" key and an ENTER key.

Function Keys

<F1> SETUPS	This key allows the user to access the Setups menus when accompanied with the proper password and feedback is disabled.
<F2> RUN SET	This key allows the operator to edit the operation parameters sequentially to customize the feeder as products vary. See Table 1.
<F3> HOME	This key homes the axis without running the application program. Note "Servo On" should be displayed if the system is ready for further operation.
<F4> RUN /STOP	This key enables/disables the HR2000. This is indicated with an asterisk (*) on the display as follows:
<F5> thru <F8>	Not Used.

Display	Condition
Servo Off	Servo Off, Program not Running
Servo On	Servo On, Program not Running
*Servo On	Servo On, Program Running

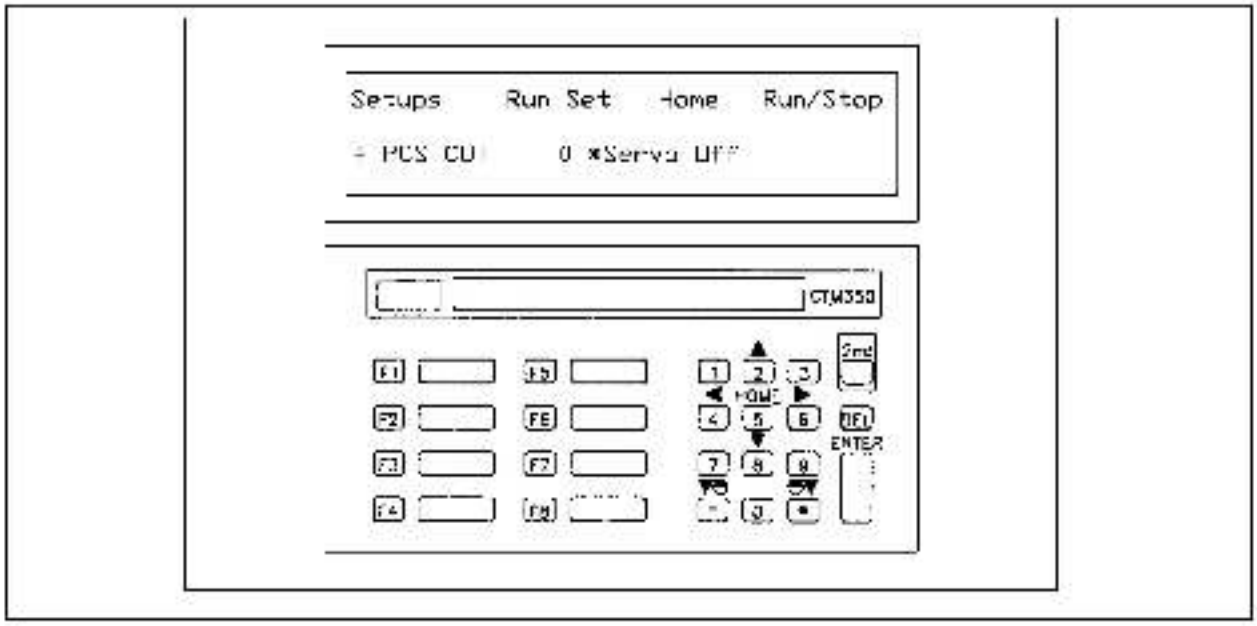


Figure 2. Data Entry Panel

Table 1. Variable Parameter Ranges

PARAMETER	RANGE
Feed Length	.001 to 99.999
Rate of Feed	0–99% of Max Speed
Rate of Accel.	0–99% of Max Acceleration
Rate of Jog	0–99% of Max Speed
Number of prod.	0–9998 (9999 = Continuous Run)

Editing

The following keys are used to help the user edit the parameters accessed by the Main Menu.

<—>	This key steps the program through available selections and allows editing of parameters. Note: Successively pressing this key will cycle through the available selections and repeat. In the case where there are only two selections, pressing this key will toggle between the two selections.
<DEL>	This key allows the user to erase the displayed parameter value.
<ENTER>	This key when pressed will accept the value of the parameter displayed.
<0 thru 9> AND <.>	These keys are used to change values of the selected parameter to be edited.

Display

The menu driven display guides the user through the set-up parameters and provides status and fault information. The user will start up and operate the system via the Main Menu.

Setups Run Set Home Run/Stop
FEED # POS+ Servo On

The Setups Menu option is divided into 4 separate submenus:

Application Setup Menu
Machine Setup Menu
Hookup Diagnostics Menu
Servo Setup Menu

These menus are accessed by sequentially stepping through the program and selecting 'YES' via the <—> key and <ENTER> key when the system asks if you would like to enter that particular menu.

Each of these menus can be used at any time for diagnostic purposes, but normally need to be used only once during installation.

Submenus

- Application Setup Menu
  Establishes application specific parameters in the software Applications Module.

- Machine Setup Menu
  Tailors the programmable parameters to the machine being controlled.

- Hookup Diagnostics Menu
  Checks and verifies connections to external devices. Tests are included for checking encoders, drive and motor, and discrete I/O. It also provides tests to automatically determine correct feedback polarity for proper closed-loop operation.

- Servo Setup Menu
  Tunes the servo loop gains and dynamic parameters. It provides access to the Automatic Setup and Self-Tuning Routines, and also allows manual tuning of all regulator parameters.

4: Setup Parameters

Read and understand sections 2.10 and 2.11 of Instruction manual D5-3036 before proceeding.

The Main Menu is shown on the first line and status information is shown on the second line of the display as follows:

Setups Run Set Home Run/Stop
FEED +___ POS+___ Servo Off

1. Press <F1>. This selects the "Setups" menu for accessing the Machine Setup menus and the automatic tuning of Gains.

Setups RunSet Home Run/Stop
Password?___

2. Enter Password: **123 <ENTER>.**

   Unauthorized access is protected by requesting a password to be properly entered before allowing access to the Setup Menu.

   The Setups password is a fully programmable three character string which is initially set to the default "123". Typing in an incorrect password causes the display to return to the Main Menu. The display reads:

   Password?
   OK to Kill Feedback? NO

3. Press "–" to toggle selection to YES. Press <ENTER> to accept selection. The display reads:

   WARNING: Application Not Write Locked!

4. Press <ENTER>.

   Application Setup Menu?
   NO_

Application Setup Menu

1. Press "+" to toggle selection to YES. The display reads:

   Enter Application Setup Menu? YES

2. Press <ENTER> to accept this selection. The display reads:

   Password?

3. Enter Password: **456 <ENTER>.**

4. Reference Table 2 and configure the Application Setup Menu according to the "USER RESPONSE" column.

5. After the last selection in the Application Setup Menu, the system displays:

   Enter Machine Setup Menu? NO

Table 2. Application Setup Menu

MENU PROMPT	USER RESPONSE	COMMENTS
Edit Operator Interface?	YES	
OCS Motion Lockout?	DISABLE	
Switch Lockout?	ENABLE	
Remote Lockout?	DISABLE	
Password Override?	DISABLE	
Edit Power-up Configuration?	YES	
Power up Running Program?	YES	
Power-up in Remote Mode?	NO	
Edit Communications Configuration?	YES	
Baud Rate?	9600	
Duplex?	FULL	
Suppress Line Feed?	NO	
Suppress Handshake?	NO	
Multidrop?	NO	

Machine Setup Menu

1. Press "-" to toggle selection to YES. The display reads:

   Enter Machine Setup Menu? YES

2. Press <ENTER> to accept this selection.

3. Reference Table 3 and configure the Machine Setup Menu according to the "USER RESPONSE" column.

4. After the last selection in the Machine Setup Menu, the system displays:

   Enter Hook-Up Diagnostics Menu? NO_

Table 3. Machine Setup Menu

MENU PROMPT	USER RESPONSE	COMMENTS
Edit Conversion Constants?	YES	
X Encoder Decode Mode?	AB QUAD 4X	See Note 1
K = .001" (Encoder Counts/User Unit)		See D5 3036 instruction manual section 2.6.3.4 for AB QUAD 4X Decode Mode Calculations Required.
K = (.25< K <100) =	_	
1/K (.100< 1/K <4) =		
Units/Rev	_	See Note 2
Edit Homing Config?	YES	
X Home Position =	+.000	
Use Home L/S	NO	
Use Marker?	NO	
Edit Overtravel Config?	YES	
Overtravel L/S?	NO	
Overtravel L/S Contacts?		
Soft Travel Limits?	YES/NO	
Maximum Positive Travel =	_	
Maximum Negative Travel =		
Soft Travel Fault Action?	STOP/KILL	
Edit Servo Config?	YES	
Drive Interface?	ANALOG	
Servo Type?	CURRENT	
Servo Output Limit (% of Max) =	80	
Drive Fault Input?	NO	
Position Error Fault Action?	STATUS/KILL	
In Position Tolerance =		See Note 3
Backlash Comp?	YES/NO	
Approach Direction?	POS/NEG	
Backlash Offset =		

1> Other options available are: Step/DIR, Count UP/DN, AB QUAD 2X;see IM D5 3036.

2> Only displayed if configured for rotary mode.

3> Note: The value indicated for "In Position Tolerance" is displayed in user units selected.

Hook-up Diagnostics Menu

1. Press "-" to toggle selection to YES. The display reads:

   Enter **Hook-Up Diagnostics Menu? YES**

2. Press <ENTER> to accept this selection.

3. Reference Table 4 and configure the Hook-up Diagnostics Menu according to the "USER RESPONSE" column.

NOTE: If the program detects a problem with motor polarity, the following will be displayed on the terminal – **"WARNING: Motor Polarity May Be Wrong!"** Check wiring and verify motor connections.

4. After the last selection in the Hook-up Diagnostics Menu, the system displays:

   Enter Servo Loop Setup Menu? NO_

Table 4. Hook-Up Diagnostics Menu

MENU PROMPT	USER RESPONSE	COMMENTS
Run X Encoder Test?	YES	
Move Axis in + Direction, Press Return	PRESS <ENTER>	See Note 1.
Run Motor Test?	YES	See Note 1.
Run Discrete I/O Test?	YES	
Check Outputs?	YES	
Output # =	output # (0–11)	
State =	ON/OFF	
Check Inputs?	YES	
Input # =	Input # (0–11)	
State =	ON/OFF	
Run Thumbwheel Test?	NO	See Note 2.

1> Hookup OK and Polarity Set

2> Hardware not supported at this time.

Servo Loop Setup Menu

1. Press "-" to toggle selection to YES. The display reads:

   Enter Servo Loop Setup Menu? YES

2. Press <ENTER> to accept this selection.

3. Reference Table 5 and configure the Servo Loop Setup Menu according to the "USER RESPONSE" column.

4. After the last selection in the Servo Loop Setup, the system displays:

Setups RunSet Home Run/Stop

FEED # POS+ *Servo On

Table 5. Servo Loop Setup Menu

MENU PROMPT	USER RESPONSE	COMMENTS
Tune Gains?	YES	Do Not Touch Mechanics While Tuning! To Abort, Press <ESC> Key
Tuning Increment =	_	See Note 1
Error Tol (units) =	_	See Note 2
Review Gains?	YES/NO	See Note 3
Try Tuning Gains Again?	NO/YES	Tune Gains 3 times to ensure repeat values.
Tune Max Velocity and Accel?	YES	To abort, Press <ESC> Key Routine Produce Positive Travel!
Max Travel (units) =		
Ready?	YES	See Note 4
Review Max Velocity & Accel?	YES	See Note 5
Tune Velocity & Accel Again?	NO/YES	Repeat 3 times to ensure repeat values.
Tune F Gain?	YES	See Note 6
Error Tol (units) =		To abort, Press <ESC> Key Routine Produce Positive Travel!
Max Travel (units) =	_	
Ready?	YES	See Note 7
Edit Gains?	YES	
Edit Max Vel, Accel, or Error Tol?	YES	
Run Step Response Test?	YES	See Note 8
Edit Gains?	NO/YES	
Edit Max Vel, Accel, or Error Tol?	NO/YES	
Run Step Respone Test?	YES/NO	
Run Following Error Test?	YES	See Note 9
Max Travel (units) =	_	
Ready?	YES	See Note 10

1> Following Error Tolerance Initialized!

2> F Gain Set to Zero
Tuning Deadband Comp...
Deadband Tuned!
Tuning V Gain...
V Gain Tuned!
Tuning P Gain!
P Gain Tuned!
Tuning I Gain
I Gain Tuned!

3> Feedback Off
Proportional Gain = gain
Integral Gain = gain
Velocity Gain = gain
Feedforward Gain = gain
Deadband Comp = deadband

4> Tuning Max Velocity & Accel...
Max Velocity & Accel Tuned!

5> Maximum Values:
Velocity (units/sec) = velocity
Accel (units/sec2) = accel
Error (units) = error

6> Following Error Tolerance Initialized!

7> Tuning F Gain...
F Gain Tuned!

8> Test Done!

9> Routine Produces Positive Travel!

10> Accel Error Vel Error Overshoot

Final Tuning

WARNING

TO INSURE THAT THE DRIVE IS NOT UNEXPECTEDLY STARTED, TURN OFF AND LOCKOUT OR TAG POWER SOURCE BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

1. Couple the HR2000 motor to the driven load (equipment).
2. Retune gains. Follow the instructions in section 2.10 or 2.11 of D5-3036 instruction manual to tune gains or repeat the SERVO LOOP SETUP MENU instructions in this instruction manual.

5: Operating Instructions

Begin Operations

1. Press the "RESET" pushbutton. This illuminates the "POWER ON" pilot light. **Service Note**: The "Ready" and "Run" LEDs should be illuminated on the HR2000.
2. Press <F8>. This calls the current axis position home (+.000). Note: no motion occurs.
3. Press <F4> to start the program. The screen displays:

   Press Program Run to Start

4. Move the selector switch to the "SETUP" position
5. Press the "PROGRAM RUN" pushbutton. This energizes the "READY" and "SETUP" pilot lights and enables data to be input from the Data Input Terminal.

   After "PROGRAM RUN" has been pressed, the screen displays

   "Select desired mode – Press any key".

6. If SETUP has been selected, proceed to instructions for SETUP. If MANUAL has been selected, proceed to instructions for MANUAL. If AUTO has been selected, proceed to instructions for AUTO.

Setup Mode

1. Press <F2>. The screen will display:

   Setup Mode – Press Reset

2. Press PROGRAM RESET.
3. Enter the data required to run the machine. **Note**: Press <RETURN> after entering each value.

   The display shows the following parameters for editing sequentially:

   - Feed Length – May be displayed in English or Metric units (as determined in the selection of "K" value).
   - Rate of Feed – Maximum Velocity Value. A two-digit value as a percent of maximum velocity that determines feed rate during feed cycle.
   - Rate of Accel – Maximum Accel or Decel Value. A two-digit value as a percent of maximum acceleration (0–99).
   - Rate of Jog – Determines feed rate during jog. This value is a two digit value as a percent of maximum speed (0–99).
   - Batch Count – This allows the user to run a specific number of pieces by setting the desired quantity (0–9998). NOTE: For continuous operation, enter 9999.

4. Return to Step 4 of <u>BEGIN OPERATIONS</u>.

Running The Program – Manual Mode

1. Once the Manual mode has been selected, press any key. The screen will now display:

   Manual Mode – Press Reset

2. When ready to jog the material into place, press PROGRAM RESET. This energizes the "READY" and "MANUAL" pilot lights.
3. Press the "JOG" Forward or Reverse pushbutton to advance or retract the material.
4. When the material is in place, change the selector switch to either SETUP or AUTO mode. Proceed to instructions for <u>SETUP MODE</u> or <u>RUNNING THE PROGRAM – AUTO MODE</u>.

Running The Program – Auto Mode

1. When ready to begin operation, press PROGRAM RESET. This energizes the "READY" and "AUTO" pilot lights.

   The program will run and count the number of pieces, until it reaches the desired batch count. At this point, the system will stop. If 9999 is selected, the machine will run until either <F4>, <HALT FEED> (separately mounted and not supplied by Reliance), or <E– STOP> is pressed.

   NOTE: If <HALT FEED> is pressed, the feeder will stop motion and the following will be displayed:

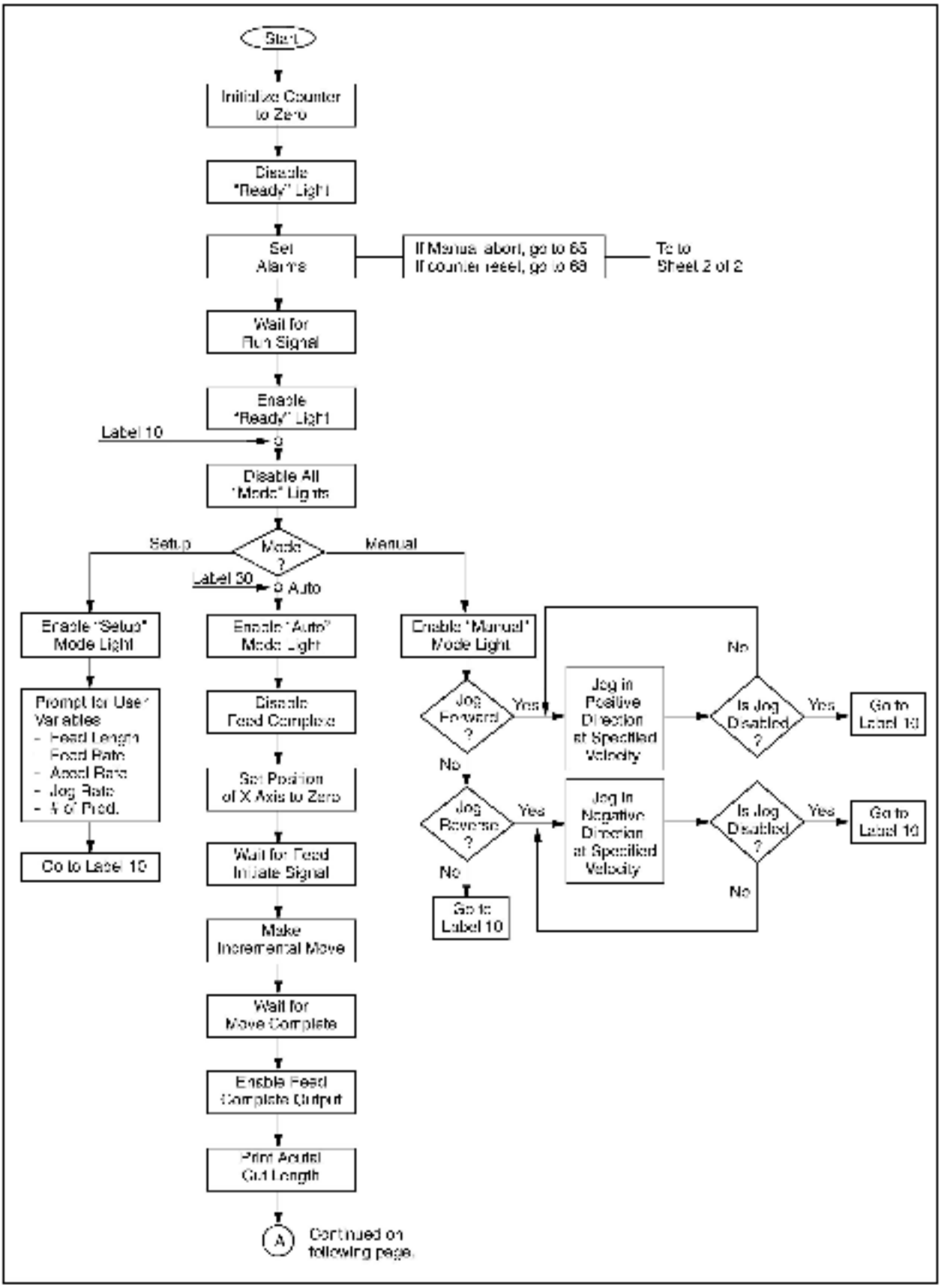
   "Feed Halted – Press Reset"

   When ready to resume Automatic mode of operation, press PROGRAM RESET.

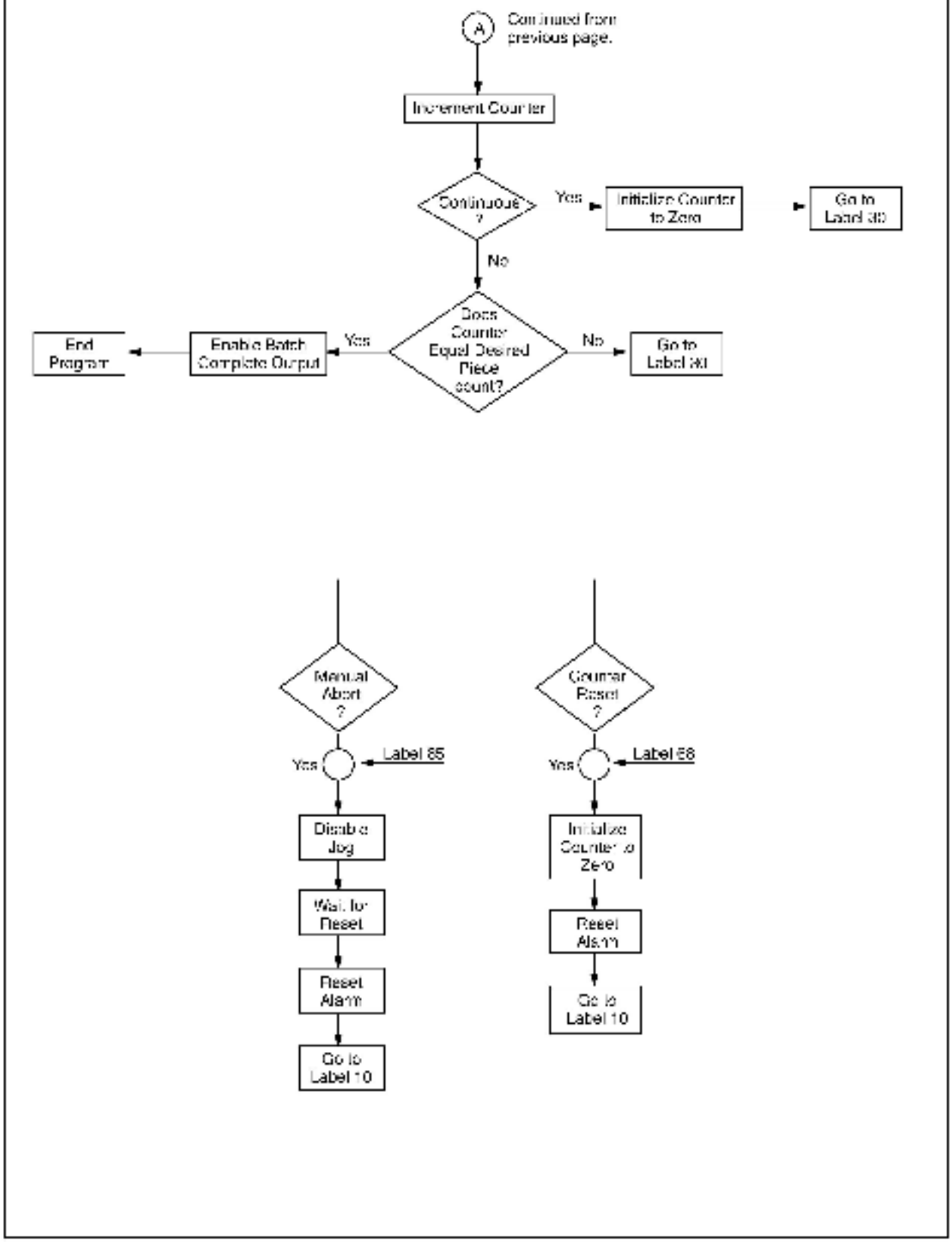
2. Press <F4> to stop the program.
3. Return to Step 4 of <u>BEGIN OPERATIONS</u>.

APPENDIX A

Program Diagram Flowchart (Sheet 1 of 2)



Program Diagram Flowchart (Sheet 2 of 2)



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