CIECO

PCI-100LS

Programmable Limit Switch

Programming and Installation Manual

V2.6

TABLE OF CONTENTS

PROGRAMMABLE LIMIT SWITCH COMPONENTS

Programmable Limit Switch control in a 8x6x6 enclosure

PCI-100

LS1 F100-T200

● *Interrupted Stroke*

MENU RESET ENTER → ↑ ↓

CIECO Inc
Industrial Electronic Controls

Resolver cable with connector
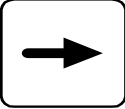
Industrial resolver
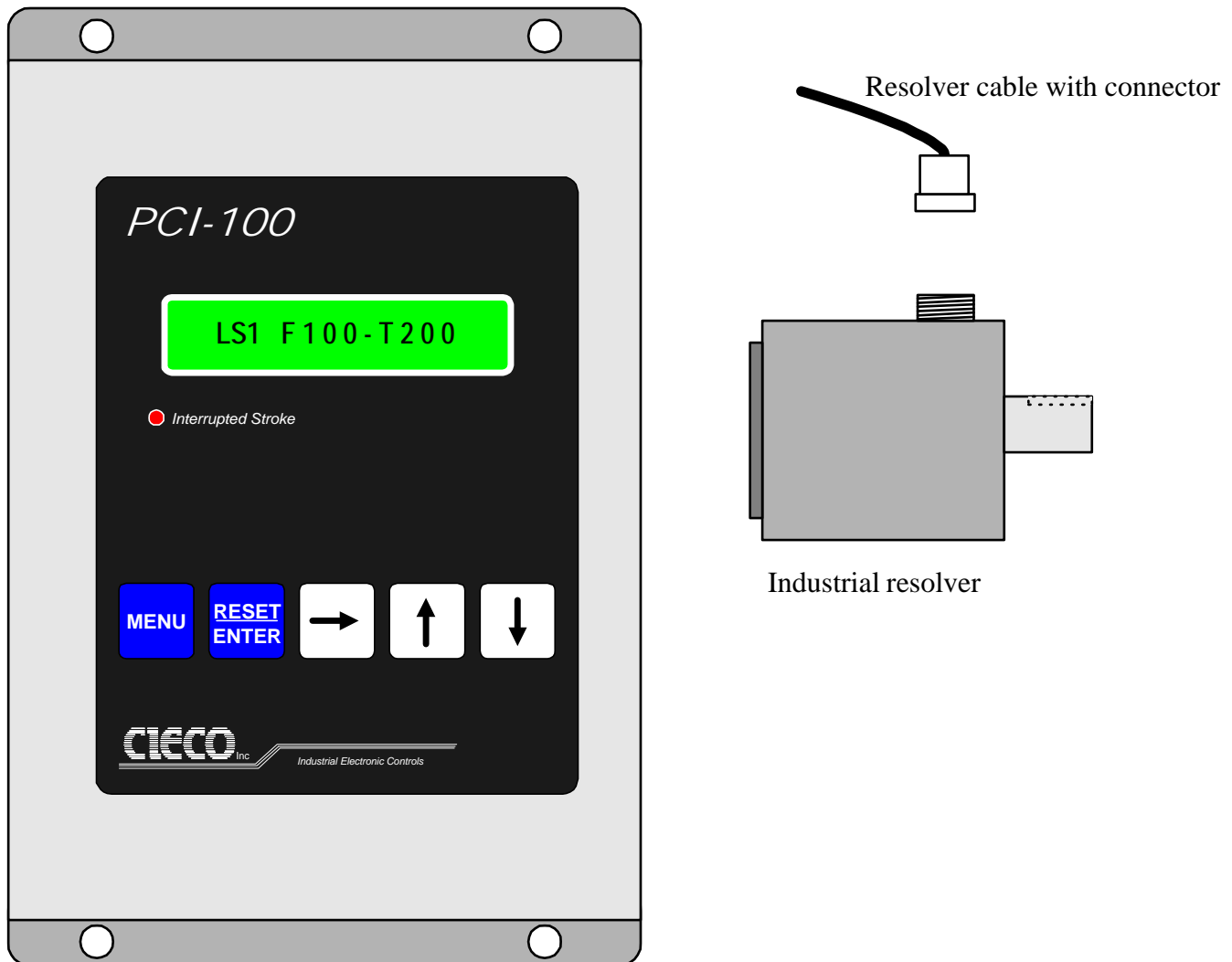
The PCI-100LS Programmable Limit Switch receives position and motion feedback from the resolver. The resolver is attatched to the main shaft of the press. The PLS knows when the press is engaged, how fast it is running, the position of the crank shaft, and when the clutch is disengaged.

Many safety features are included such as:

- •Motion detect
- •Resolver decouple/slippage detect
- •Resolver cable brake detect
- •Key and Coded security
- •Rugged Quality design
- •Clutch monitor
- •Zero motion cable break detect

KEYPAD

Helpful display codes

>   When this symbol is displayed the [→] key enables that function to be programmed

∧   When this symbol is displayed the [↑] key causes the program to select the next function

(ENT)   When (ENT) is displayed, pressing the ENTER key will perform the function shown.

■   When a **blinking cursor** is shown, use the arrow keys to change the data and the ENTER key to save the data.

### KEYPAD SUMMARY

[MENU] **MENUS:**
There are 5 menus to choose from. Under each menu there may be several different functions or screens.

POS/TACH   displays the position and speed
INITIAL   one time setup functions
LIMIT SWITCHES program limit switch functions
COUNTERS   view/pgm counter functions
SUPERVISOR   enable/disable programming
The MENU key will toggle to the next menu regardless of what function you are currently viewing.
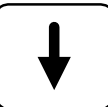
[RESET ENTER] Resets faults or Saves (enter) data
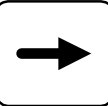
[→] **>** Goes into a function, then once in a function will move the cursor if applicable.

[↑] **^** Selects functions within a Menu or increments numbers if applicable.

[↓] **^** Selects functions within a Menu *(in the opposite direction of the up arrow)* or decrements numbers if applicable.

MENUS and FUNCTIONS
There are 5 menus. Four of them have other functions.

1 POS/TACH shows the current real time position and speed of the press in strokes per minute. There are no additional functions under this menu.

2 INITIAL contains 4 functions. These are only set when the control is initially installed.

- ^ZERO SET (ENT) zeroes the resolver to the mechanical position of the press. Press enter to zero the resolver position.
- ^MDET >L000-H999 *Motion DETect* sets the low and high SPM limits. Press >, then use the arrow keys to program the low and high SPM limits for the press. Press ENTER to save. If during normal operation the press goes below or above the limits a **motion fault** will occur and the fault output will de-energize until reset.
- ^MDLY >D999 *Motion DeLaY* sets the delay before a low motion fault will occur so that the press can get up to speed. Press >, then use the arrow keys to adjust the setting in milliseconds. Press enter to save.

- ^TSTOP >A310 *Top STOP* sets the Angle that the Fault/Batch output will open when a batch count is reached. Press >, then use the arrow keys to adjust the setting in degrees. Press enter to save.

3 LIMIT SWITCHES contains 5 functions.
- ^LS1 >F000-T000 *Limit Switch 1* programming output ON at (From *degrees* - To *degrees*) Press > then use the arrow keys to program a From-To window. Press enter to save.

- ^LS2 >F000-T000 *Limit Switch 2* programming output ON at (From *degrees* - To *degrees*) Press > then use the arrow keys to program a From-To window. Press enter to save.

- ^LS3 >F000-T000 *Limit Switch 3* programming output ON at (From *degrees* - To *degrees*) Press > then use the arrow keys to program a From-To window. Press enter to save.

- ^LS4 >F000-T000 *Limit Switch 4* programming output ON at (From *degrees* - To *degrees*) Press > then use the arrow keys to program a From-To window. Press enter to save.

- ^SCOMP >S000-A000 Speed COMPensation adds the programmed angle $A*(SPM/100)$ to the limit switch settings. Compensation does not begin until the press SPM (strokes per minute) is equal to or greater than the programmed speed S. (See speed compensation, optional)

Menus and Functions continued

4 COUNTERS contains 5 counter functions

- ^STROKE S000000   keeps a running total of the strokes count. The strokes counter will
                          increment every stroke of the press. It can be used with the batch to
                          stop the press when the required number of parts have been made.

- ^BATCH> B000000   BATCH count programming. Press > then use the number keys to pro-
                          gram the number of parts/strokes. When the strokes count is equal to
                          the Batch, the counter output will de-energize and a Batch Count
                          message will be displayed.

- ^ZeroStrks (ENT)   Zeros the Strokes count. Press enter to zero the strokes count

- ^THITS   T00000000   keeps count of the Total HITS . Counts every stroke of the press. This
                          can be an excellent tool to schedule press mantainance.

- ^Zero TOTAL(ENT)   Zero the TOTAL hits counter. Press enter to zero the total hits count.

5 SUPERVISOR contains one function to enable or disable programming

- SETUP>DISABLED
         OR   displays whether programming is enabled or disable. Press>
  SETUP>ENABLED   then use the arrow keys to enable or to toggle to disable.
                          See programming quick reference guide.

INSTALLATION STEPS

1. Mount the controller in an area that can be easily viewed by the operator.

2. Install the resolver

3. Install the resolver cable

4. Make all the electrical connections and double check the connections to make sure they are correct

5. Apply power

6. Enable programming by entering the Supervisory Code

7. Zero the resolver at TDC.

8. Program the motion delay and motion detect.

9. Program the batch count as needed

10. Program the Programmable Limit Switch outputs as needed.

11. Program speed compensation (optional)

12. **Disable programming to prevent unauthorized changes.**

CAUTION: Do not use Programmable Limit Switch outputs for press control functions unless the press control checks for proper PLS operation every stroke of the press.

CHAIN BREAK DELAY

The motion delay is used to compensate for starting delays caused by clutch slippage.

> **^MDLY >D999**

1. The motion delay is factory set at 999. Decrease the delay until motion fault occur.

2. Slowly increase the delay until motion faults are eliminated.

3. Add some delay to allow for clutch wear.

The motion delay is only used when the clutch is engaged. It delays before the low SPMs are checked to allow for clutch slippage. The motion delay works in conjunction with the low speed limit. When the clutch is engaged the press speed must reach the low speed limit before the motion delay times out.

SPM - Strokes Per Minute

HIGH and LOW SPEED LIMITS

Monitors the press SPM during normal operation.

> **^MDET >L000-H999**

1. Program the Low speed for the minimum allowable speed of the press in SPM during normal operation.

2. Program the High speed for the maximum allowable speed of the press in SPM during normal operation.

Durring normal operation of the press if the speed should fall outside the programmed limits a Motion Fault message will be displayed and the fault output will de-energize. The fault is cleared by pressing RESET. See MOTION FAULT under fault messages for a complete explanation of possible motion fault problems.

SPEED COMPENSATION

Speed compensation offset angle is the number of degrees of advance per 100 SPM increase in press speed over the programmed starting speed.

Example 1: Top Stop

1. Program the speed compensation starting speed **S** to the slowest operating speed of the press. eg. 50spm

2. Set the speed compensation offset angle **A** to zero.

3. Run the press at its slowest operating speed and program the top stop output so the press stops at the top.

4. Set the press to its maximum operating speed.   eg. 125 spm

5. Run the press at its maximum operating speed (keeping the top stop window the same) and note the number of degrees over top that the press stops. eg. 23°

6. Divide the difference in stopping degrees (23°) by the difference in speed (75spm) and multiply by 100. This is your speed compensation offset angle per 100 spm. Round off if necessary.
                    eg.   (23 / 75) x 100 = 31° per 100spm

7. Program the angle **A** to 31°

Example 2: Servo Feed Initiate

Follow steps 1 and 2 above

3. Run the press at the slowest operating speed and program the feed initiate PLS output to feed properly.
                                                            eg. F240-T270
4. Set the press to its maximum operating speed. eg. 125spm

5. Advance the feed initiate PLS output to feed properly at this speed. eg. F217-T253

6. Divide the difference in PLS output settings (F240 - F217 = 23°), by the difference in speed (125 - 50 = 75spm)

7. Program the angle **A** to 31°.

8. Reprogram the feed initiate PLS output for the slowest press speed. eg. F240-T270

TROUBLESHOOTING
fault messages

MESSAGE

MOTION FAULT　　Resolver shaft speed equals or exceeds the boundaries of the programmed SPM limits while the brake solenoid input is at 115VAC (brake off)

A broken resolver to machine shaft coupling or chain.

Excessive clutch slippage or the motion delay is set to short.

An attempt is made to run the machine with the brake solenoid input disconnected.

ANGLE FAULT　　The resolver cable becomes disconnected.

The line voltage momentarily drops below minimum.

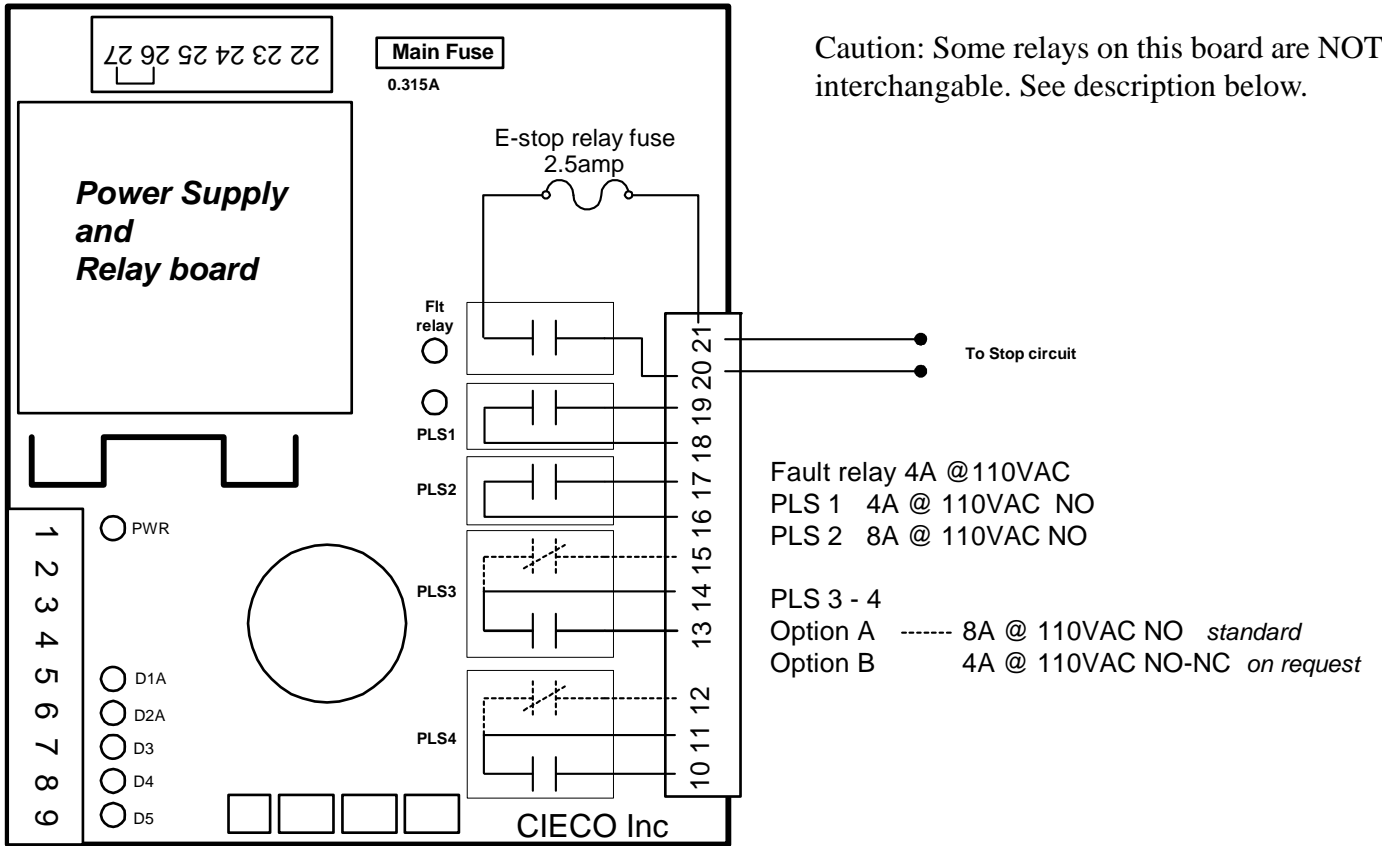Noise on the line voltage, the brake input, or the resolver input.

The resolver speed exceeds 999spm

BATCH COUNT　　Although not a fault the Fault relay will de-energize when the strokes count is equal to or greater than the programmed batch and the programmed top stop angle is exceeded.

TROUBLE-SHOOTING

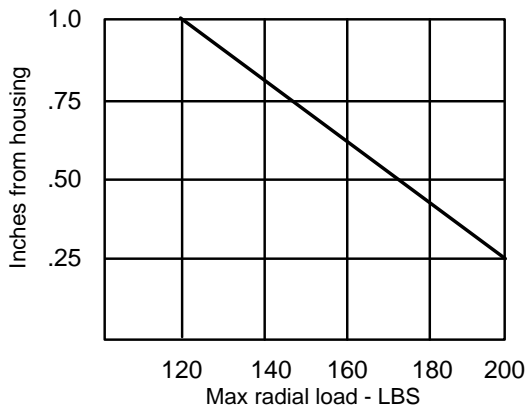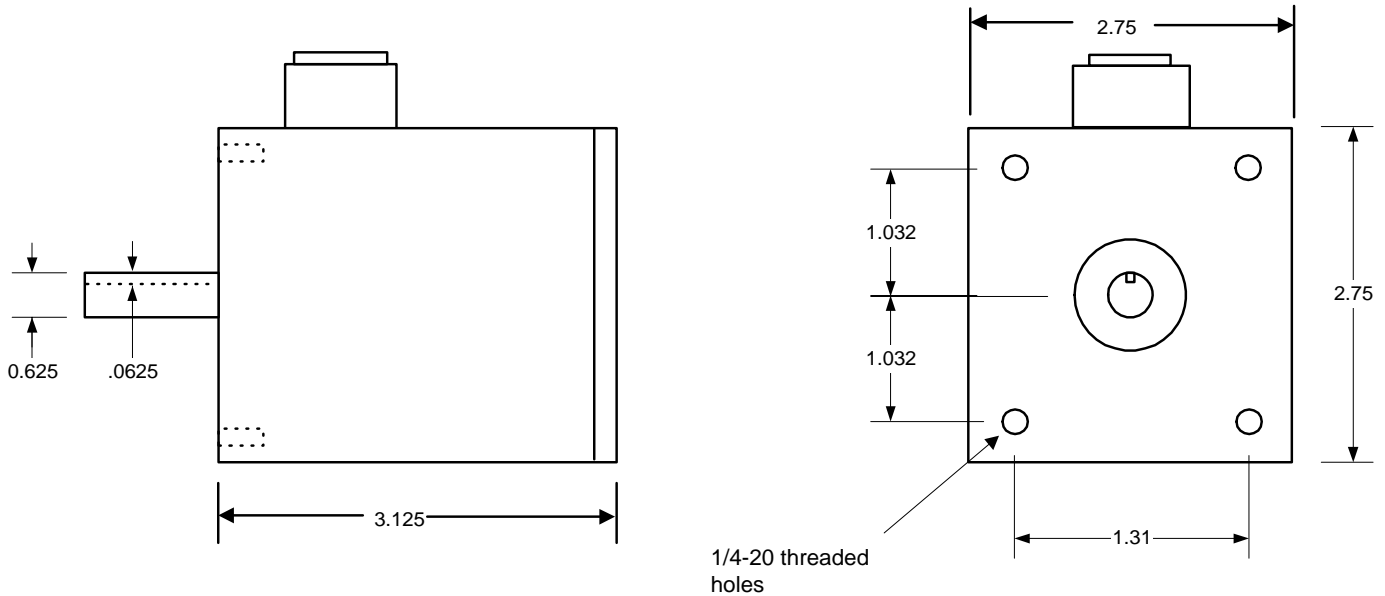*power supply and relay diagnostics*

POWER SUPPLY BOARD

Caution: Some relays on this board are NOT interchangable. See description below.

Power Supply and Relay board

Main Fuse 0.315A

22 23 24 25 26 27

E-stop relay fuse 2.5amp

Flt relay

PLS1

PLS2

PLS3

PLS4

19 20 21

17 18

16

14 15

13

10 11 12

To Stop circuit

PWR

1 2 3 4 5 6 7 8 9

D1A
D2A
D3
D4
D5

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Fault relay 4A @110VAC
PLS 1   4A @ 110VAC NO
PLS 2   8A @ 110VAC NO

PLS 3 - 4
Option A   ------- 8A @ 110VAC NO   *standard*
Option B   4A @ 110VAC NO-NC *on request*

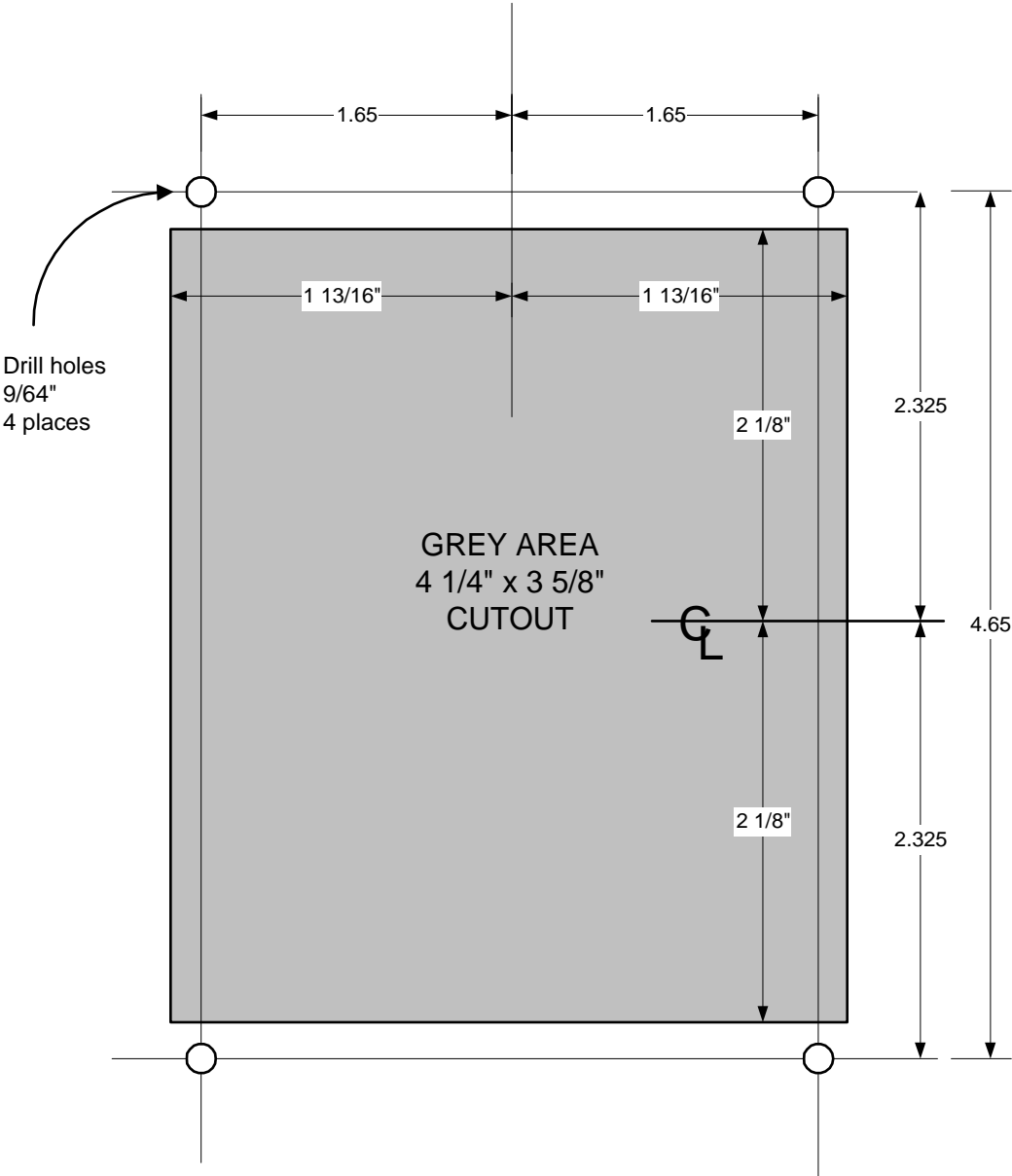| LEDs	Color	Indication
D1A	Green	FAULT/BATCH energized
D2A	Green	Limit Switch 1 energized
D3	Green	Limit Switch 2 energized
D4	Green	Limit Switch 3 energized
D5	Green	Limit Switch 4 energized
D6	Red	Power on

RESOLVER MOUNTING

The resolver shaft and stator should NEVER be rigidly coupled to the machine shaft and stator. Either the shafts or the stators should have a flexible member which will allow freedom of movement in all planes except rotation. **(No two shafts ever have equal runout regardless of their precision. Even if individual shaft assemblies have the same "amount" of runout, these assemblies will have different patterns which result in different magnitudes at various rotational positions. This applies regardless of bearing types.)**

If a pulley or sprocket is to be mounted to the resolver shaft, DO NOT hammer or force fit it onto or off the shaft. If the resolver is belt or chain driven, DO NOT overtighten the drive belt or chain. To much side loading can destroy the resolver bearings.

If these mounting rules are ignored, *(warranty will be void)* the machine shaft assembly will "fight" the resolver shaft assembly and the final result will be failure of the weakest bearing.
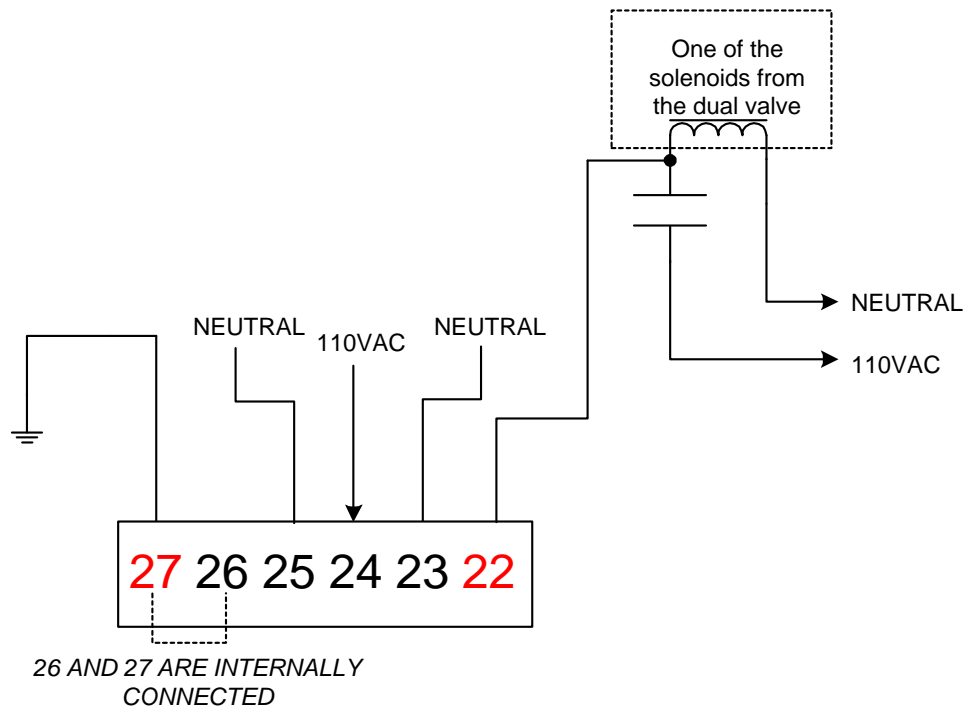
PCI PANEL CUTOUT

1.65

1.65

1 13/16"

1 13/16"

Drill holes
9/64"
4 places

2.325

2 1/8"

GREY AREA
4 1/4" x 3 5/8"
CUTOUT

C
L

4.65

2 1/8"

2.325

WIRING
Power supply terminals 22-27

One of the
solenoids from
the dual valve

NEUTRAL

110VAC

NEUTRAL   110VAC   NEUTRAL

27 26 25 24 23 22

*26 AND 27 ARE INTERNALLY
CONNECTED*

TERMINAL#	DESCRIPTION
27	Must be earth grounded, *machine ground is not sufficient.*
26	Internally connected to 27
25	Neutral
24	110VAC
23	Neutral
22	Brake Sol feedback input

NOTES:

GROUNDING: To avoid noise problems the earth ground input must be connected directly to earth ground or to the earth ground of the electrical panel.
Machine ground is not sufficient.

BRAKE SOLENOID INPUT: is used by the PCI-100LS to sense when the clutch is engaged (110VAC) and when the brake is applied (0 VAC). Incorrect wiring of this input will result in nuisance motion faults.
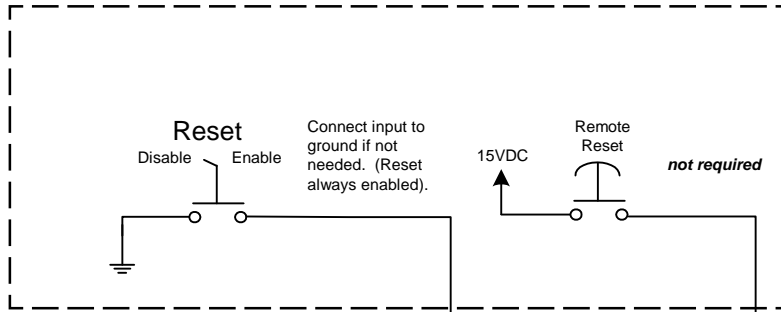
WIRING

PCI main terminal

RESET ENABLE/DISABLE:
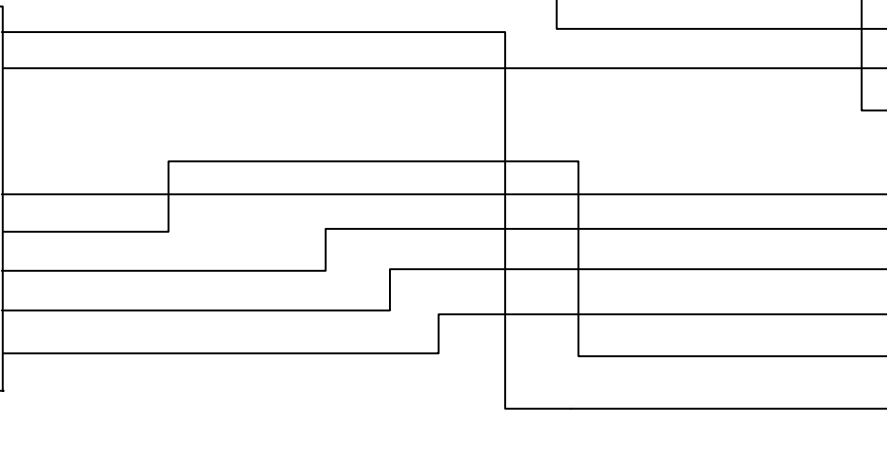Disable - will *not* allow any fault to be reset.
Enable - any fault can be reset from the keypad or the remote reset button.

Connections 1 and 3 of the PCI main terminal are to be connected in the field as needed. All other main terminal connections are factory wired when ordered in a NEMA enclosure.

Reset

Disable — Enable

Connect input to ground if not needed. (Reset always enabled).

15VDC

Remote Reset

not required

POWER SUPPLY
LOW VOLTAGE I/O TERMINAL
FACTORY CONNECTED

1 2 3 4 5 6 7 8 9

1 2 3 4 5 6 7 8 9 10

PCI MAIN TERMINAL

PCI TERMINAL	DESCRIPTION
1	reset supervisory input
2	clutch/brake status input
3	remote reset input
4	not connected
5	fault/batch output
6	limit switch 2 output
7	limit switch 3 output
8	limit switch 4 output
9	limit switch 1 output
10	+15VDC input

WIRING

PCI resolver terminal

PCI
7 pin Resolver terminal

| 1 2 3 4 5 6 7 |

To terminal 27 of the power supply
and resolver cable shield.
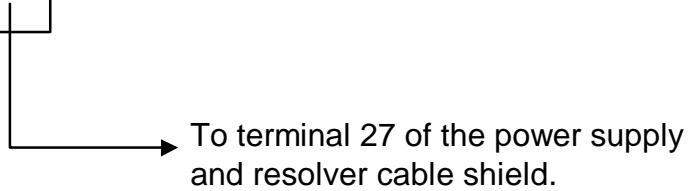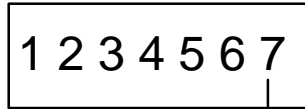
1 - R1: BLUE/WHITE STRIPE
2 - R2: WHITE/BLUE STRIPE
3 - S3: WHITE/GREEN STRIPE
4 - S1: GREEN/WHITE STRIPE
5 - S4: WHITE/ORANGE STRIPE
6 - S2:ORANGE/WHITE STRIPE
7 - G: SHIELD

**Reversing S1 and S3 will change
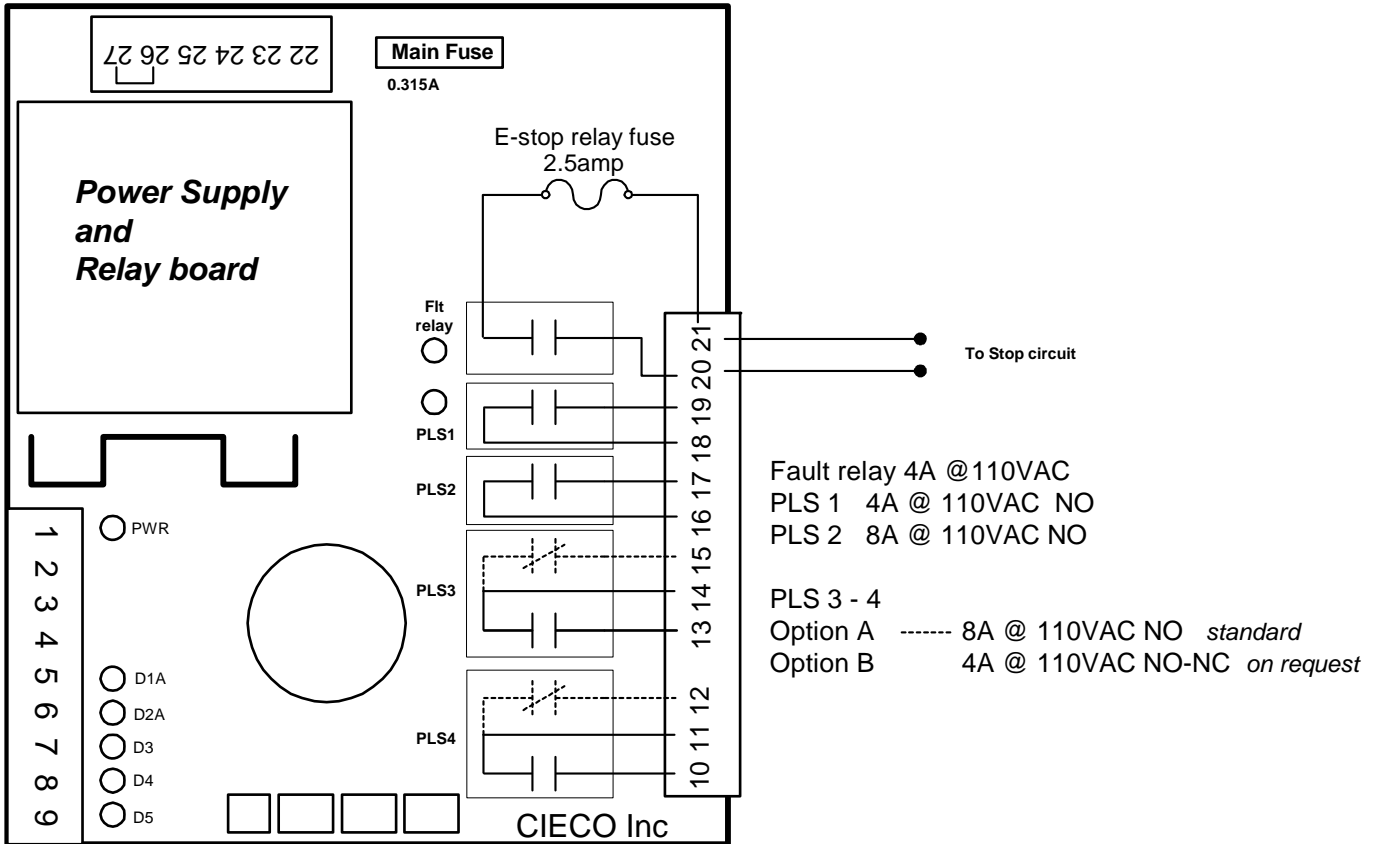the ascending count direction.**
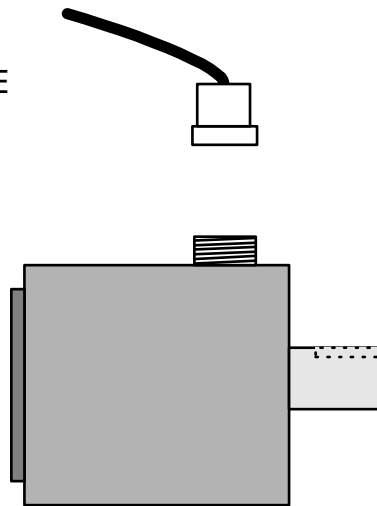
CAUTION: To avoid noise problems, install the resolver cable away from any high power lines or motors.
Do not run the resolver cable in the same conduit with 110VAC or higher voltages. Any cables or wires that switch noise producing loads such as solenoid coils and motors should kept away from the resolver cable.

•Install the resolver cable in its own grounded conduit.
•Keep noisy lines as far from the resolver cable as possible.
- 2" from 110VAC
- 12" from motors and motor wires
•Never install the resolver cable directly next to a high power line or motor.

WIRING
Relay outputs

22 23 24 25 26 27

Main Fuse
0.315A

**Power Supply
and
Relay board**

E-stop relay fuse
2.5amp

**Flt
relay**

PLS1

PLS2

PLS3

PLS4

21 20 19 18 17 16 15 14 13 12 11 10

To Stop circuit

Fault relay 4A @110VAC
PLS 1   4A @ 110VAC NO
PLS 2   8A @ 110VAC NO

PLS 3 - 4
Option A   ------- 8A @ 110VAC NO   *standard*
Option B   4A @ 110VAC NO-NC   *on request*

PWR

D1A
D2A
D3
D4
D5

1 2 3 4 5 6 7 8 9

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Fault/Batch relay

Is energized (closed) during normal operation and will open in a fault or batch condition
The fault/batch relay is rated for 8 amps @ 110VAC and is fused for 2.5 amps

PLS relays

•NO
•PLS 1, 4A @ 110VAC max
•PLS 2-4, 8A @ 110VAC max