

QUARTER-TROL INSTRUCTIONS

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Quick Reference

Programming / Setup Functions

Press Button 1 / PRG Program display will prompt “P”
Data display will prompt: “1 2 3 _ 5”
Digits in the data display select functions

#1 – Selects programming setup functions (requires lockout code for protection)

Enter lockout code: 1 – 3 – 5 – 2 – 4 by pushing these buttons in sequence.

11 – Differential motor run time factor (xxxx.x milliseconds). Example: 35.00

12 – PIV motor run time (xxxxxx. milliseconds). Example 100

13 – Registration Tolerance Setting (xxxxx.x encoder pulses) Example: 2.4

14 – Out of Registration Alarm (xxxxx.x encoder pulses) Example: 6.2

15 – Registration Setpoint – no entry required. This value will be determined automatically. See section 2.

16 – Lower Window Setting (xxxxxx. encoder pulses, or 60 for clear path)

17 – Upper Window Setting (xxxxxx. encoder pulses, or 60 for clear path)

18 – PIV count number (x number of consecutive corrections before adjustment)
Example: 3

#2 Locating Registration Mark to Function (Automatic Set Point Learning)

Step 1: Press PRG / 1 button.

Step 2: Place Auto/Manual switch in **manual** position.

Step 3: Press ENTER/2 button. The data display will prompt: **POS**

Step 4: Manually bring the machine into registration.

Step 5: When the machine is running slowly, in register, as the registration mark approaches the scanner, turn the Auto/Manual switch to **auto**. This will automatically lock on to the mark and enter set point # 15.

#3 Selects Window Mode (Section 10) 1 selects windows on, 0 selects windows off.

#5 Returns to operating mode

QUARTER-TROL INSTRUCTIONS

The Quarter-trol System allows proportional control of a function (cutting, printing, die-cutting, etc) on a web moving through a machine. Registration control is achieved by measuring mark position within a repeat length and generating phase correction, typically on the function operator (knife, print cylinder, rotating die, etc.). In addition length compensation may be achieved with a motor drive installed on the PIV. (If a motor drive is not installed see section II.)

Installation

These are summary steps to installation. Look at the referenced section for more details if necessary.

1. Attach the rotary shaft encoder to a one-revolution-per-repeat shaft to determine the relative position of the function and the registration mark on the web.

IMPORTANT NOTE: This must be a one-to-one ratio for proper operation.

2. Place the scanner over the web in a position where it will see the registration mark and in a manner that will eliminate web flutter. It should be as close as possible to the point where the function occurs.

See the section “Scanner Setup” starting on page 19 for information on setting up the scanner.

3. Install the proper noise suppression devices (different for AC and DC outputs).

See Figure 5, page 18 for details.

4. Wire correction motors to amphenol connectors (or if not using amphenol connectors, to the screw terminals on the Quarter-trol output module). See the section “Motor Connections” and Figures 2, 3 and 4 for details.

5. Enter program control variables as described starting on page 4. Note: the Quarter-trol is shipped with default control variables entered.

Program Control Variables

The *lower left window* is the program prompt window. It indicates which variable is being entered. The *middle window* is the data display where values are shown and edited.



Figure 1: Quarter-trol Front Panel

Selecting and editing values is done using the five front panel switches. The upper row of three switches are 1, 2 and 5. The lower row of two switches are 3 and 4. They are designated as:

1. Program Button – 1 / Prg
2. Enter Button – 2 / Ent
3. Increase Button – 3 / Inc
4. Decrease Button – 4 / Dec

5. Decimal point Button – 5 /DP

Press Button 1 / PRG

Program display will prompt “P”. Data display will prompt: “1 2 3 _ 4”. Digits in the data display select functions.

To view or edit program control variables, push button 1/Prg. The display becomes “blank”.

Lock-out Code - values are protected from accidental change by a lockout code sequence. Enter the following sequence”

Enter lockout code: 1 – 3 – 5 – 2 – 4 by pushing these buttons in sequence.

“11” – Differential motor run time factor. The value entered is multiplied by the measured registration error (in encoder pulses) to determine the time that the correction motor runs. Use this value to tune corrections.

Too large a value will generate over-corrections. A positive error will generate too large a correction resulting in a negative error on the next repeat, and vice versa.

Too small a value will generate under-corrections. A positive error will generate too small a correction resulting in a repeating positive error.

Factory value: 35

This value is adjustable from 0.001 to 9999. milliseconds. The factory value, 35 milliseconds, is typical.

Edit this number by adjusting the digit that is blinking using the 3/Inc or 4/Dec buttons. Set the decimal point to the right of the blinking digit using the 5/DP button. When the digit is edited, advance to the next digit by pressing the 2/Ent button. Continue until all four digits are entered. Press 2/Ent to stop digit blinking, making all digits display steady.

Check the value displayed and if correct, press 2/Ent one more time to save it to memory and advance to program “12”.

If not correct, press 1/Prg to start program “11” over again.

“12” – PIV motor run time – The value entered is the time in milliseconds that the PIV output will be energized when a PIV correction is required. The PIV correction effectively changes the repeat length in response to repeating phase corrections.

Factory value: 100

This value is adjustable from 1 to 9999 milliseconds. The factory value, 100 milliseconds, is typical (one-tenth second).

If you are not using a PIV, set the run time to 0.

Edit this number by adjusting the digit that is blinking using the 3/Inc or 4/Dec buttons. When the digit is edited, advance to the next digit by pressing the 2/Ent button. Continue until all four digits are entered. Press 2/Ent to stop digit blinking, making all digits display steady.

Check the value displayed and if correct, press 2/Ent once more to save it to memory and advance to program "13".

"13" – Registration Tolerance Setting – The dead band or acceptance band, the distance that the function will be allowed to "wander" before a correction is made. If the registration mark is in-phase with the function within this acceptance band, no correction will be generated during this repeat. This value represents a band, half before and half after the registration mark target.

Factory value: 1.2

Use this formula to determine the value:

$$\text{Value} = \frac{\text{Tolerance} \times 600}{\text{Repeat Length}}$$

Example:

To hold a +/- .010" tolerance on a 10" repeat:

$$\text{Value} = (.010 + .010) \times 600 / 10 = .02 \times 600 / 10 = 1.2$$

The tolerance entry should be 1.2.

Edit this number by adjusting the digit that is blinking using the 3/Inc or 4/Dec buttons. Set the decimal point to the right of the blinking digit using the 5/DP button. When the digit is edited, advance to the next digit by pressing the 2/Ent button. Continue until all four digits are entered. Press 2/Ent to stop digit blinking, making all digits display steady.

Check the value displayed and if correct, press 2/Ent once more to save it to memory and advance to program "14".

“14” – Out of Registration Alarm – Registration Error greater than this value will generate an Out-of-Registration alarm – front panel light and alarm relay energized. This value represents a band, half before and half after the registration mark target.

Factory value: 5.0

To determine this value, use the same formula as used for item 13.

$$\text{Value} = \frac{\text{Out-of-register-band} \times 600}{\text{Repeat Length}}$$

Example:

To set a +/- .015” out-of-registration-band on a 10” repeat:

$$\text{Value} = (.025 + .025) \times 600 / 10 = .05 \times 600 / 10 = 3.0$$

The out-of-registration entry should be 3.0.

Edit this number by adjusting the digit that is blinking using the 3/Inc or 4/Dec buttons. Set the decimal point to the right of the blinking digit using the 5/DP button. When the digit is edited, advance to the next digit by pressing the 2/Ent button. Continue until all four digits are entered. Press 2/Ent to stop digit blinking, making all digits display steady.

Check the value displayed and if correct, press 2/Ent once more to save it to memory and advance to program “15”.

“15” – Registration Set Point – no entry required.

The registration set point is the point in the rotation of the function where the registration mark should be visible to the scanner. The “15” prompt will display the current value of the set point.

This value can be determined automatically. See section 2. Press the 1/Prg button to advance to program “16”.

If the value of the set point is known, as from a previous job, it may be entered by editing the value displayed at the “15” prompt. Edit this number by adjusting the digit that is blinking using the 3/Inc or 4/Dec buttons. Set the decimal point to the right of the blinking digit using the 5/DP button. When the digit is edited, advance to the next digit by pressing the 2/Ent button. Continue until all four digits are entered. Press 2/Ent to stop digit blinking, making all digits display steady.

Check the value displayed and if correct, press 2/Ent once more to save it to memory and advance to program “16”.

Enter Window Settings

Window settings allow marks in the scanner track to be ignored for distances before and after the registration target. The window function can be turned off and on in operating mode. Program prompts “16” and “17” set the size of the windows.

“16” – Lower Window Setting

If the registration mark is in a clear path (no other marks are visible to the scanner during web movement), set this value at 60.

Factory value: 60

If there is not a clear path, measure the clear path length from the mark forward in the direction of web travel. Use the following formula to determine the lower window:

$$\text{Value} = \frac{\text{Forward clear path length} \times 600}{\text{Repeat Length}}$$

Edit this number by adjusting the digit that is blinking using the 3/Inc or 4/Dec buttons. When the digit is edited, advance to the next digit by pressing the 2/Ent button. Continue until all four digits are entered. Press 2/Ent to stop digit blinking, making all digits display steady.

Check the value displayed and if correct, press 2/Ent once more to save it to memory and advance to program “17”.

“17” – Upper Window Setting

If the registration mark is in a clear path (no other marks are visible to the scanner during web movement), set this value at 60.

Factory value: 60

If there is not a clear path, measure the clear path length from the mark backward in the direction of web travel. Use the following formula to determine the lower window:

$$\text{Value} = \frac{\text{Backward clear path length} \times 600}{\text{Repeat Length}}$$

Edit this number by adjusting the digit that is blinking using the 3/Inc or 4/Dec buttons. When the digit is edited, advance to the next digit by pressing the 2/Ent button. Continue until all four digits are entered. Press 2/Ent to stop digit blinking, making all digits display steady.

Check the value displayed and if correct, press 2/Ent once more to save it to memory and advance to program “18”.

Enter PIV Count

“18” – PIV Count Number - this value is the number of consecutive corrections in one direction before adjustment of the PIV.

Factory value: 5

The range of values is 1 to 9. Only the right-most digit in the display is used. Edit this number by adjusting the digit that is blinking using the 3/Inc or 4/Dec buttons. Press 2/Ent to stop digit blinking, making the digits display steady.

Check the value displayed and if correct, press 2/Ent once more to save it to memory.

On completion of PIV Count Entry, the data display and program display are blank.

If you have entered a registration set point at program “15” then you are ready to run. Go to the Operations section of these instructions.

If you have not entered a registration set point, let the system learn the set point in the next section.

Verify Program Settings

It is good practice to verify program settings from time to time against a setup sheet or job log. Consider doing so at power-up or after making program changes.

This can be done quickly with a few button pushes:

Step 1: Press Button 1 / P

Program display will prompt “P”. Data display will prompt: “1 2 3 _ 4”.

Step 2: To view program values, push button 1/Prg. The display becomes “blank” waiting for the entry of the lock-out code.

Step 3: Enter lockout code: 1 – 3 – 5 – 2 – 4 by pushing these buttons in sequence.

On entry of the lockout code, the display will show the Program Prompt and data. Compare the display with the setup sheet or job log.

Press Button “1 / Prg” to display the next program control variable. Continue to check and advance until Program value “18” has been displayed.

Locate Registration Mark to Function – Automatic Set Point Determination

Step 1: Press PRG / 1 button.

Step 2: Place Auto/Manual switch in **manual** position.

Step 3: Press ENTER/2 button.

The data display will be: **POS.**

Program display will be blank.

Step 4: Manually bring the machine into registration.

Step 5: When the machine is running slowly, in register, as the registration mark approaches the scanner, turn the Auto/Manual switch to **auto**. The system goes through a sequence to learn the proper mark/function position. Progress will be in the program displayed: “2” when the encoder reference is found; “20” when the registration mark is detected. This sequence automatically locks on to the mark and enters set point # 15.

Selecting Window Mode

Press Button 1 / PRG

Program display will prompt “P”. Data display will prompt: “1 2 3 _ 4”.

Push button 3/Inc. Program Prompt will be “31”

The display will be “-0” if windows are off, “-1” if windows are on.

To change the setting, press 3/Inc. When the desired setting is displayed, press 2/Ent. The display will be blank.

Operating Mode

When running, the data display will report the registration error in units of encoder pulses, minus for forward error, no sign for reverse errors.

If the error exceeds the registration tolerance setting (program # “13”) the program displays will also report “H” for higher than the set point (forward correction required) or “L” for lower than the set point (reverse correction required).

Motor Connections

Standard Motor Connections

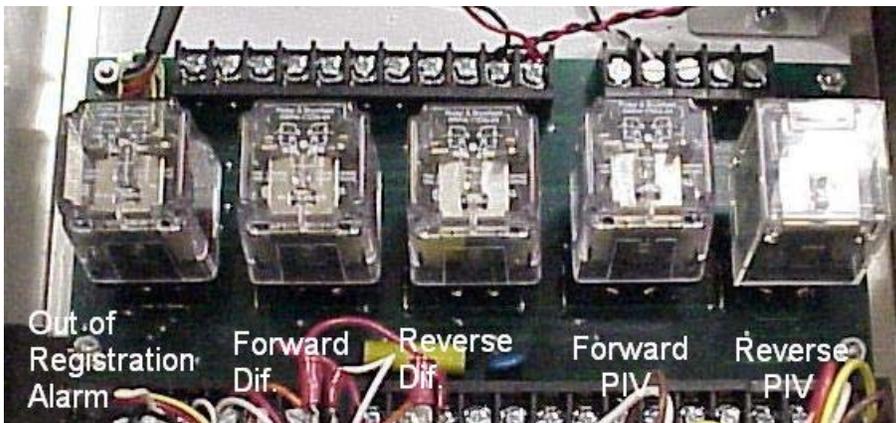
See wiring diagrams starting on page 16 for reference.

The Quarter-trol is factory-wired for dry-contacts unless otherwise ordered. These provide switching to externally powered motors. *The Quarter-trol does not provide motor power in this configuration.*

The Quarter-trol can accommodate 3- or 4-wire motors. A wiring diagram shows the following connections:

Dry Contact outputs for differential and PIV Amphenol Connections.

- A – Forward
- B – Common
- C – Reverse
- D – No Connection



The Quarter-trol output panel has four relay positions. From left to right as viewed from the front:

1. Alarm
2. Differential Forward
3. Differential Reverse
4. PIV Forward
5. PIV Reverse

Converting from Dry Contact to 120 VAC Outputs

Make these changes on the 15-terminal strip inside the control box or on the panel system plate (see figure 2).

For Differential Motors:

1. Move the white wire from terminal #6 to terminal #5.
2. Install a wire jumper from terminal #4 to terminal #6.

For PIV Motors:

1. Move the white wire from terminal #12 to terminal #11.
2. Install a wire jumper from terminal #10 to terminal #12.

120 VAC Motor Connections

3-Wire Motor Connections

A – Forward (Yellow)
B – Common (Black)
C – Reverse (Brown)

4-Wire Motor Connections

A – Armature (Black)
B – Field (Brown)
C – Armature (Red)
D - Field (Yellow)

To reverse direction:

Reverse Yellow and Brown Motor Leads

To reverse direction:

Reverse Red and Black Motor Leads

Out of Registration Alarm Connections

The Out-of-Registration Alarm is energized when the registration error exceeds the value entered in program “14”. The output is a set of dry contacts. Connections are made to terminal strips:

- #1 – Normally closed
- #2 – Common
- #3 – Normally open.

Operations

Operating Narrative

Objective of control is to maintain a constant phase relationship between the function, (for example, a rotary knife) and a moving web. The web is represented by a registration mark. The position of the rotary knife is represented by a rotary shaft encoder rotating one revolution for each revolution of the knife. The rotary shaft encoder divides each repeat into 6000 segments (resolution units).

The control unit keeps track of the position of the knife by counting segments generated by the knife's rotation. When the registration mark is detected, the controller compares the knife's position (segment count) with the target position and computes an error if any. Depending on the computed error and the values entered in the controller, it generates an output to be used to alter (correct) the phase for subsequent cycles.

Setup

In setting up any machine, several definite steps must be taken.

The cut or function must be stabilized so that it is staying in the same relative position with no registration control action. This may be accomplished by adjusting the PIV or other mechanism that is performing this function. The controller will eventually do this after setup is complete.

Observe the yellow scanner LED on the control panel. The LED should come on when the registration mark is detected by the scanner. If the LED is on all the time and goes out when the mark is detected, reverse the light/dark switch on the scanner. (The factory setting for scanners is set for a dark mark on light background.)

When the cut position is stable, use the manual differential control to adjust the position of the cut.

Differential Setup

Place the Auto/Manual switch in Auto.

Place the PIV switch in the Off position.

Observe the differential LED's on the panel to adjust the differential correction value (Program Prompt "11").

If the differential LED's are alternating between Forward and Reverse, the value is set to high (time is too long). Decrease the number.

If the differential LED's are blinking on one side constantly, Forward only or Reverse only, the time is too short. Increase the number.

If the differential LED's are occasionally going from side to side, the value is set properly.

To change the number in response to observations, enter program mode:

Button sequence 1 - 1 then lockout password 1 - 3 - 5 -- 2 - 4 to reach prompt "11".

Edit this number by adjusting the digit that is blinking using the 3/Inc or 4/Dec buttons. Set the decimal point to the right of the blinking digit using the 5/DP button. When the digit is edited, advance to the next digit by pressing the 2/Ent button. Continue until all four digits are entered. Press 2/Ent to stop digit blinking, making all digits display steady.

Check the value displayed and if correct, press 2/Ent one more time to save it to memory and advance to program “12”. Press the 1/Prg button repeatedly to progress through the other values without changing and return to operating mode.

Repeat this process if necessary to achieve the correct value of the differential time factory.

Once the machine seems to be maintaining registration, turn the PIV switch on.

PIV Setup

(Applies to control with motor driven PIV only)

Ideally, the web repeat length will constant and advance one repeat for each rotation of the function tool. However many factors can cause deviation from the ideal situation.

The PIV controls the material feed during one machine cycle. If the registration control is constantly correcting in one direction or the other, the web movement is not feeding the proper or expected length. Corrections are adding to or subtracting from material. If the registration is constantly calling for forward corrections, not enough material is being fed with each cycle. If the registration control is constantly calling for reverse corrections, too much material is being fed with each cycle.

To tune PIV time, observe the PIV LED's. If they are constantly adjusting in one direction, increase the time in prompt “12” and then observe again.

The correct value of prompt “12” depends on many factors including the type of motor and motor control. We hesitate to predict a typical value. Some trial and error is expected in setting the PIV time.

Adjusting While Running – On the Fly Adjustment

To adjust the machine function while running, use Button 3/Inc or Button 4/Dec to increase or decrease the registration set point. The set point is changed by .1 unit for each rotation/cycle of the machine while holding Button 3/Inc or Button 4/Dec depressed.

For longer moves or to move faster, depress button 5/DP and Button 3/Inc or Button 4/Dec. With two buttons pressed, the set point is changed by 1 unit (10 times more). Hold the 5/DP button until the set point is close to the desired target and then advance at the lower rate.

Quarter-trol Wiring Diagrams

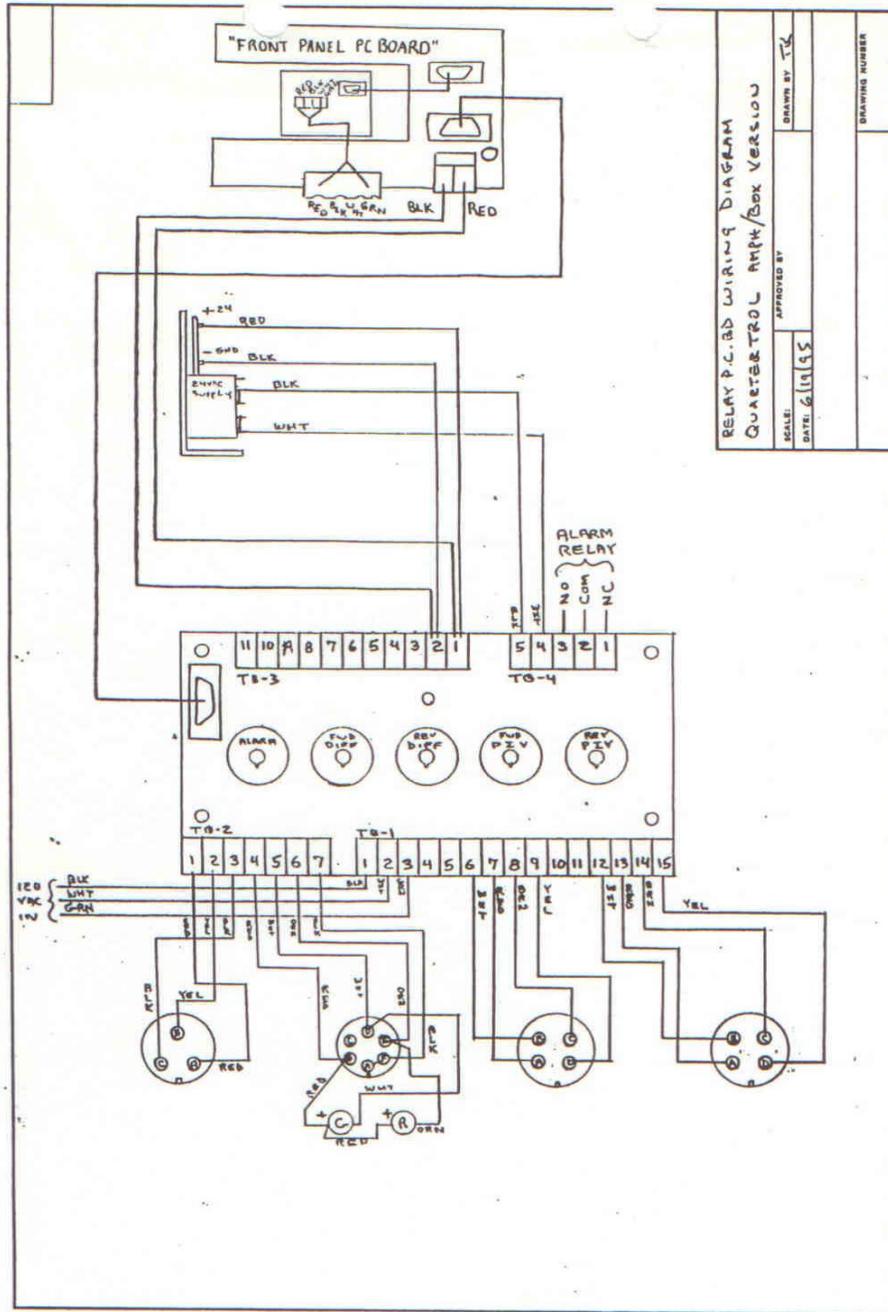
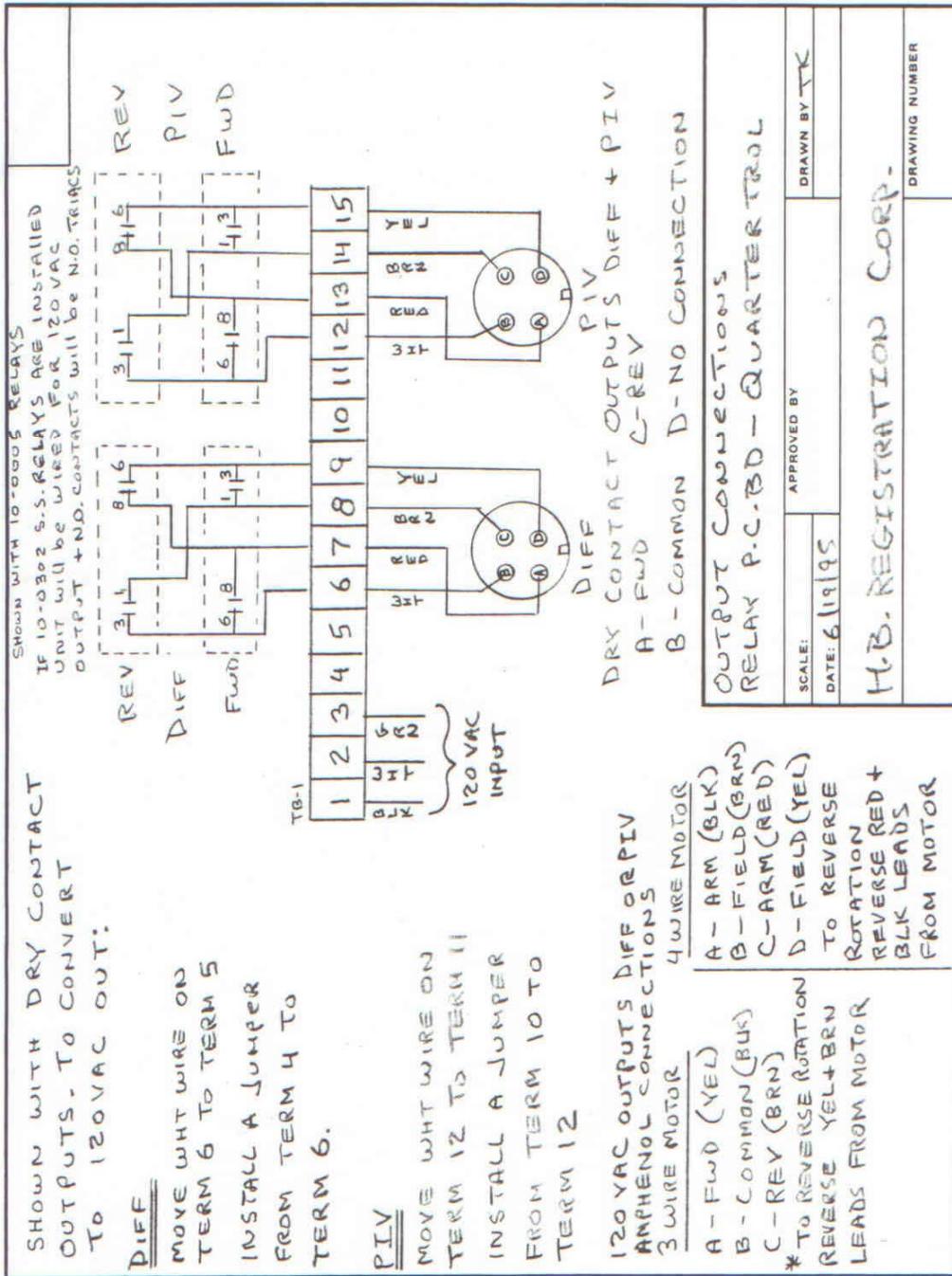
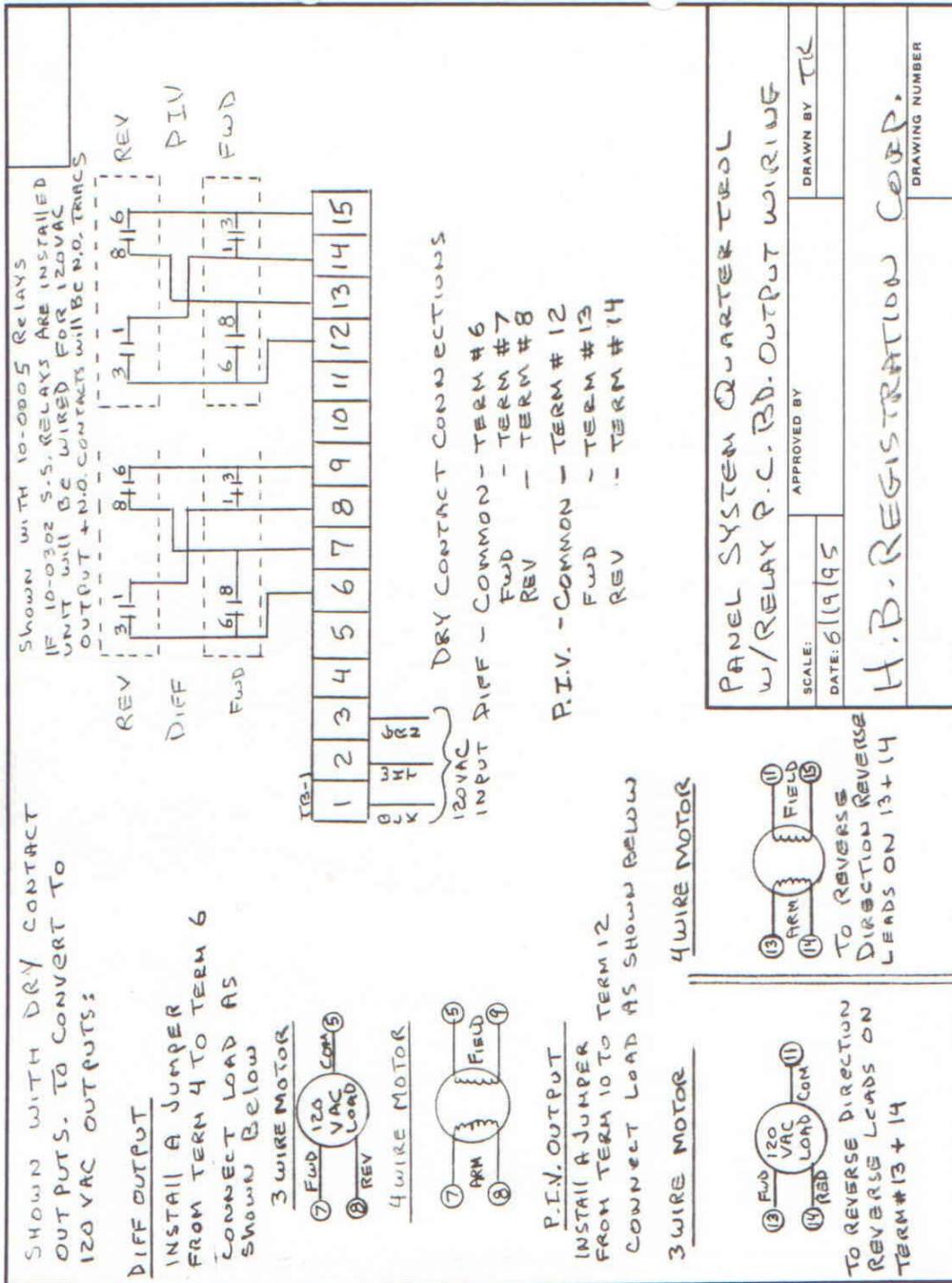


Figure 2: Quarter-trol Output Module – Screw Terminal Connections



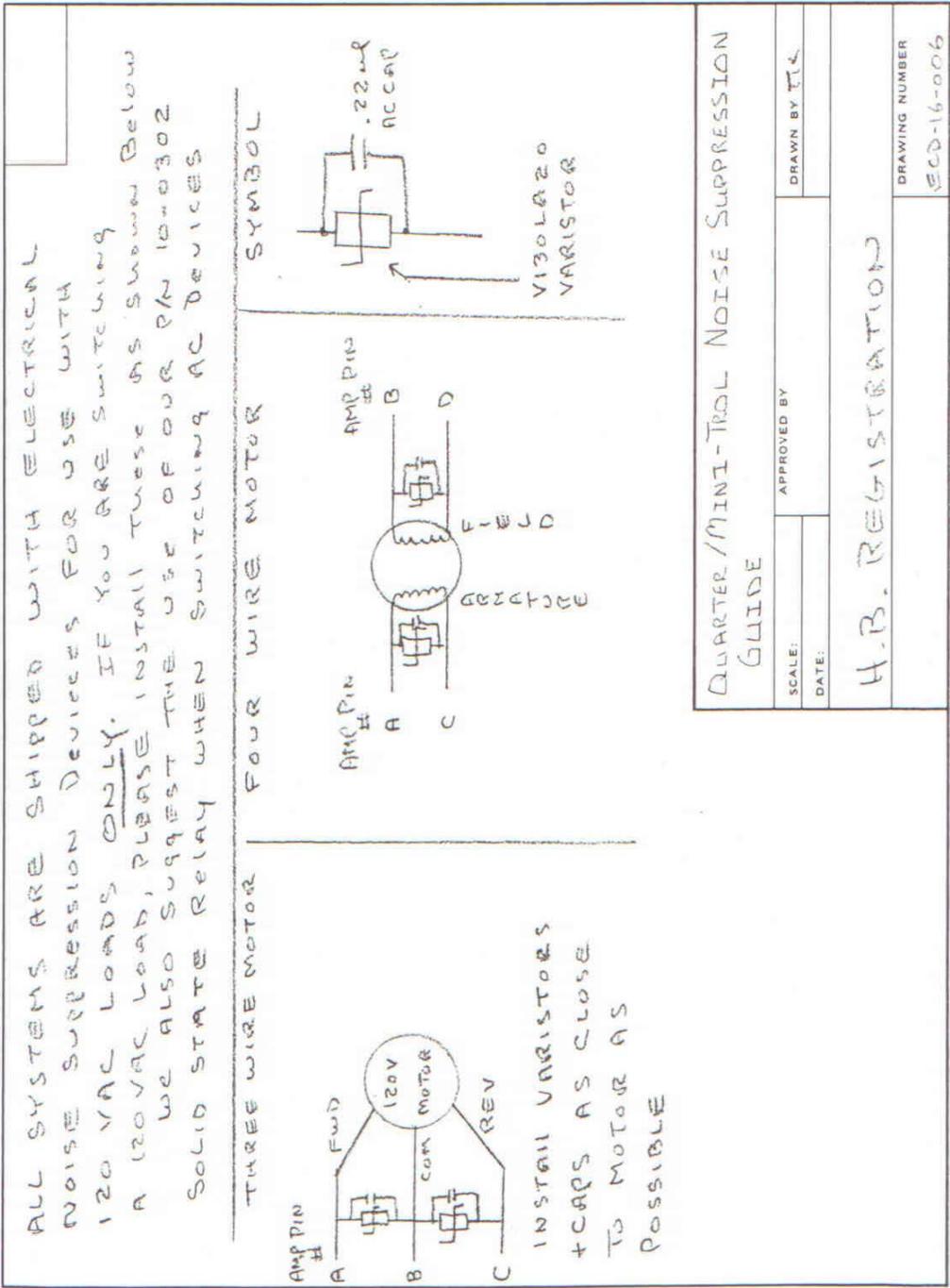
DIETZEN NO. 198 MF AGEPROOF MASTER FORM

Figure 3: Output Module Motor Relay Configuration



DIETZEN NO. 198-MF AGEPROOF MASTER FORM

Figure 4: Quarter-trol Output Module – Direct Connection to Correction Motors



DIETZEN NO. 198-MF AGEPROOF MASTER FORM

Figure 5: Quarter-trol Noise Suppression Techniques

Scanner Setup

The CX6A scanner lens mount can be changed from end to side mount by unscrewing the lens and exchanging it with the moisture detector.

CX8 Fiber optic scanner accepts a number of different scanning end tips and light guides of several lengths. These can be used to address complex or difficult to access registration marks. Contact Scanning Devices / H.B. Registration for more information.

1. Mount the Scanner so that the lens is 3/8" from the web. The unit should be installed where vibration will be minimized and web flutter will be avoided (over a roller, for example).
2. See Scanner photo, next page. Select the proper switch position for light/dark operation consistent with the type of web in use. For example, if the scanner is to detect a dark mark on a light background select dark operation. Standard CX6A and CX7 Scanners use green light as the sensing media. CX8 Fiberoptic sensors use Red and Green light, selected by a switch accessible under the sensor's cover. See table 1 for advice on the light color best for the web in use.

Caution: the light/dark selection switch travels less than one full turn as indicated by the white arc on the panel. Do not attempt to turn the sensitivity beyond the L or D markings.

3. Set the sensors sensitivity with the small screwdriver adjustment knob on the back of the scanner. Clockwise is more sensitive, counter clockwise is less sensitive.

For a dark mark on a light background:

3A. Illuminate the registration mark with the scanner. One of the two Green LED's should be on to indicate the scanner's light or dark state. Find the sensitivity point that just detects the mark (the minimum point). If the Output Indicator (Amber) is ON, turn the sensitivity adjustment in the direction of the arrow next to the Green indicator that is on. If the Output Indicator (Amber) is OFF, rotate in the opposite direction until it goes off, then rotate until it comes on.

3B. Move the web to illuminate the background. The Output Indicator (Amber) should be off. Find the sensitivity point that does not detect the background (the maximum point). Turn and count rotations of the sensitivity adjustment until the LED indicator is on.

3C. Rotate the sensitivity half the number of turns back toward the minimum point. This is the mid-point and the optimum setting.

For a light mark on dark background, reverse the light/dark references.

4. Check the action with web movement to be sure the scanner's LED action indicator is on for marks and off for background.

Scanner lens should be kept clean with a soft cloth. Mounting should be checked periodically for loose mounts or movement from installed position.

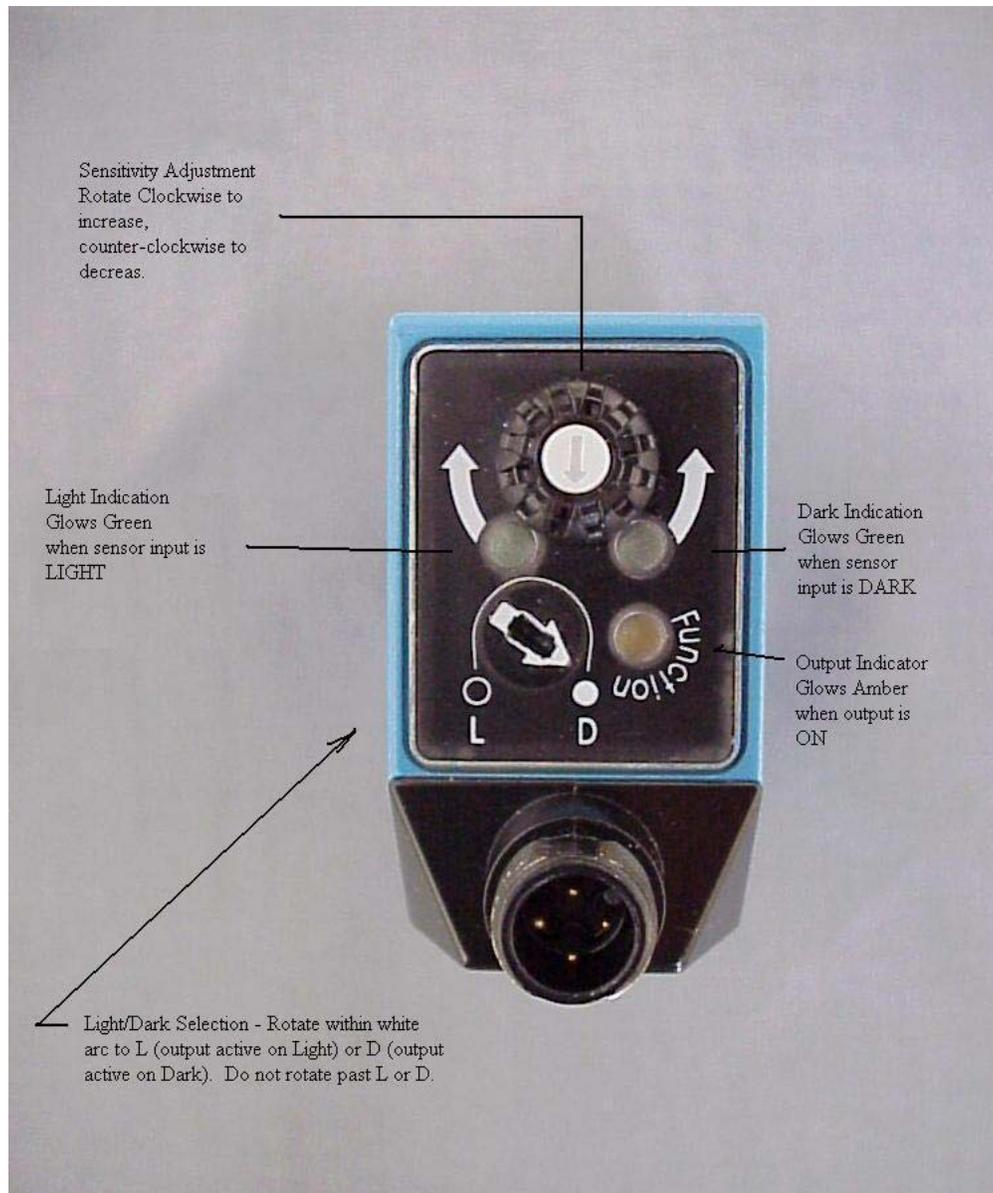


Figure 6: Scanner Back Panel with Adjustments

Trouble Shooting

This section describes common operating problems and suggests action.

The most common problem is incorrect or incomplete installation and setup. The first action is to read the instruction manual to be sure that the installation is consistent with the advice in this manual.

For help beyond this troubleshooting guide, contact Scanning Devices/H. B. Registration for advice:

On the internet: www.scanningdevices.com

By phone: 800-323-3347

1. **Sympton:** Always correcting, not keeping in registration.

Action: Check all mechanical connections from encoder to function. Check scanner mounting bracket. Make sure nothing is slipping or loose.

2. **Sympton:** Control calling for very large corrections, not consistent with observations.

Action: Make sure there is no web flutter creating erroneous signals for the scanner.

Check scanner sensitivity, observe scanner LED to be sure it is lighting on the registration mark.

Check web for marks in the clear path that should not be present. There should be only one registration mark per cycle of the machine function (one revolution of the encoder). If the machine uses a dual cutter or rotates the function more than once per repeat, use windows to bracket the target registration mark.



3. **Sympton:** Control is calling for correction larger than the window programmed.

Action: Turn windows ON. See selecting windows mode in the main instructions.

4. **Sympton:** Control is calling for corrections that appear unrelated to machine/registration status. OR, the display window returns to the program mode on its own (without pushing buttons).

Action: Install noise suppression. For AC switching, install varistor/capacitor noise suppressors to eliminate noise caused by motor switching. For DC switching, install reverse EMF diodes across the relay contacts.

Contact Scanning Devices / H. B. Registration for advice on noise suppression.

5. **Sympton:** Control always calling for forward correction equal to the size of the window setting.

Action: Check that the scanner light/dark switch is set so that the indicator light on the back of the scanner and the Yellow scanner indicator on the Quarter-trol front panel are lighting when the mark is visible to the scanner and are off and remain off when the background is in view.

6. **Sympton:** Control “hangs up” in the “POS” mode.

Action: Check encoder inputs (Green and Red LED's on the bottom of the control enclosure). The green LED should be flashing 600 times per machine revolution (It appears to be always on) and the red LED should flash once per machine revolution.



Check the scanner input (Yellow light on the Quarter-trol Panel). It should flash once per machine revolution.

7. **Sympton:** Control stops correction and display shows all dashes “-----“.

Action: The control generates this display when no registration mark is detected within one complete encoder revolution.

Check scanner and encoder inputs (See #6 above).

Check Auto/Manual switch position. Switch should be in Auto.

8. **Sympton:** Control display goes blank, all LED's are off, manual correction does not work.

Action: Power failure.

Check AC power, fuse and power switch.

Check DC power supply for 24 Volts DC.

9. **Sympton:** System is walking out of registration, but the control is not making any corrections.

Action: Check for loose encoder coupling.

Check programming values to be sure that prompts 11 – 14 are correct.