installation instructions

D-3000ce

DANCER CONTROLLER

montalvo

Contents

1 *General Description*

The Montalvo D-3000 PID analog controller provides precise automatic control of a dancer when it is used to control web tension. The progressive PID regulator automatically compensates for roll diameter. The D-3000 is used in a closed loop, of which the dancer roll and brake (or other tension-affecting device) are a part.

In order to properly set up and operate the D-3000, as well as be able to take advantage of all of the available features, it is important to have a general understanding of the controller and how it fits into the tensioning system. Please refer to the diagram below. A typical pneumatic system is shown; however, the same principles apply to any closed loop control system. The control outputs of 4 to 20 mA and 0 to 10 volts DC enable the D-3000 to interface with a variety of output devices to control web tensioning brakes, clutches and motors.

Functions

Dancer Function

A dancer with one or more rollers can be used. Depending on the application, it may be necessary to dampen the movement of the dancer arm by installing a hydraulic shock absorber or throttled, flow control valves on the air cylinder. The web tension is a function of the mass of the dancer assembly and the pressure applied to the air cylinder. Dancer position indicates the difference in speed between the machine and the unwind roll. The dancer roll potentiometer provides feedback of the dancer position. The dancer potentiometer is supplied with ± 2.5V DC. When the dancer moves, the dancer pot rotates, resulting in a voltage change. This signal is amplified and calibrated at the regulator card.

Converter Function

The I/P converts the 4 to 20 mA regulator output to a proportional 0 to 75 PSI (0 to 6 bar) to control the brake. Other converters may be used depending on the application.

Brake Function

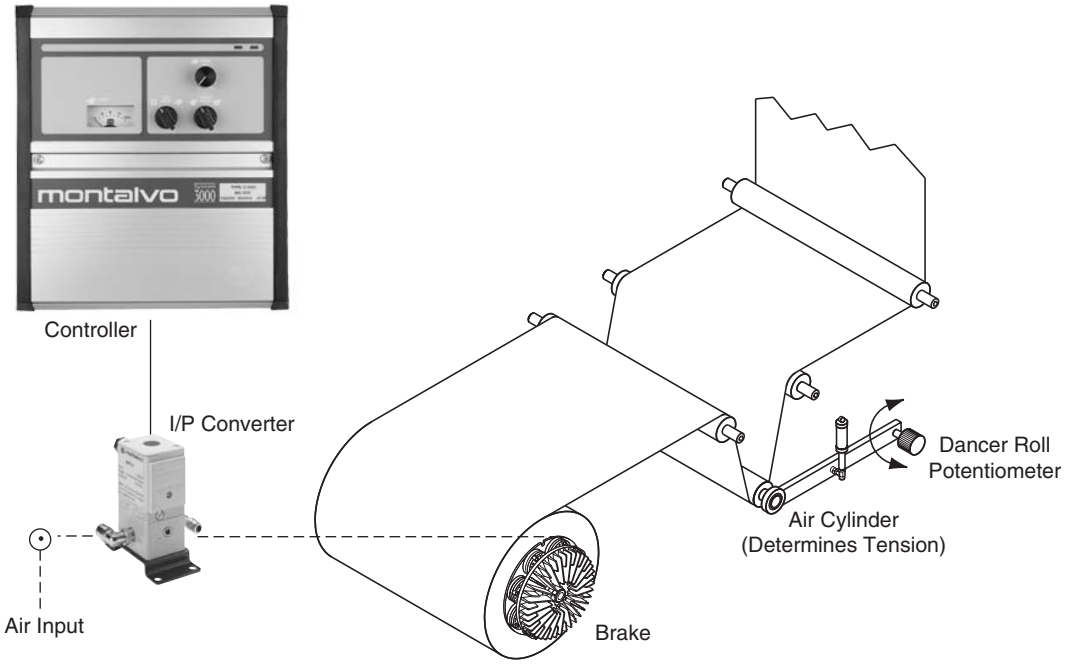
One or more brakes may be controlled, converting the pneumatic output pressure from the I/P into torque. This torque in turn varies the speed of the unwind roll.

Auto Mode Function (closed loop)

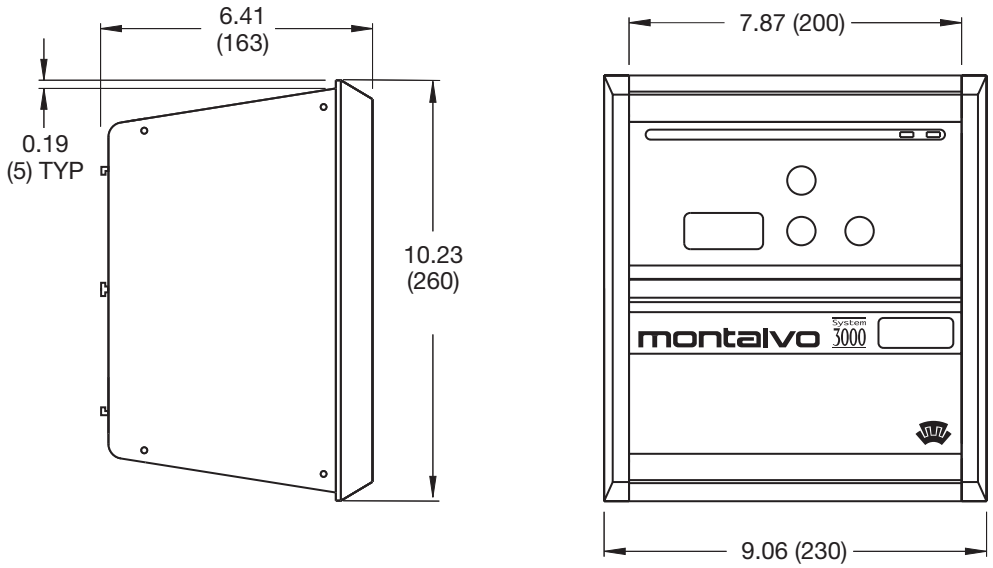
The operator sets the desired tension by varying the pressure applied to the air cylinder. Web tension is determined by the force that the dancer exerts on the web. The D-3000 controls only the position of the dancer. The regulator receives the feedback from the dancer potentiometer and automatically adjusts the output of a torque device to keep the dancer in the center position. The dancer provides shock absorption and storage of web in order to dampen tension changes caused by out of round rolls, speed changes or other factors that may affect tension during the process.

Manual Mode Function (open loop)

The operator sets the desired brake pressure using the manual potentiometer. No automatic regulation is done in this mode. The operator must make constant adjustments to maintain dancer position.



2.1 D-3000 Mechanical



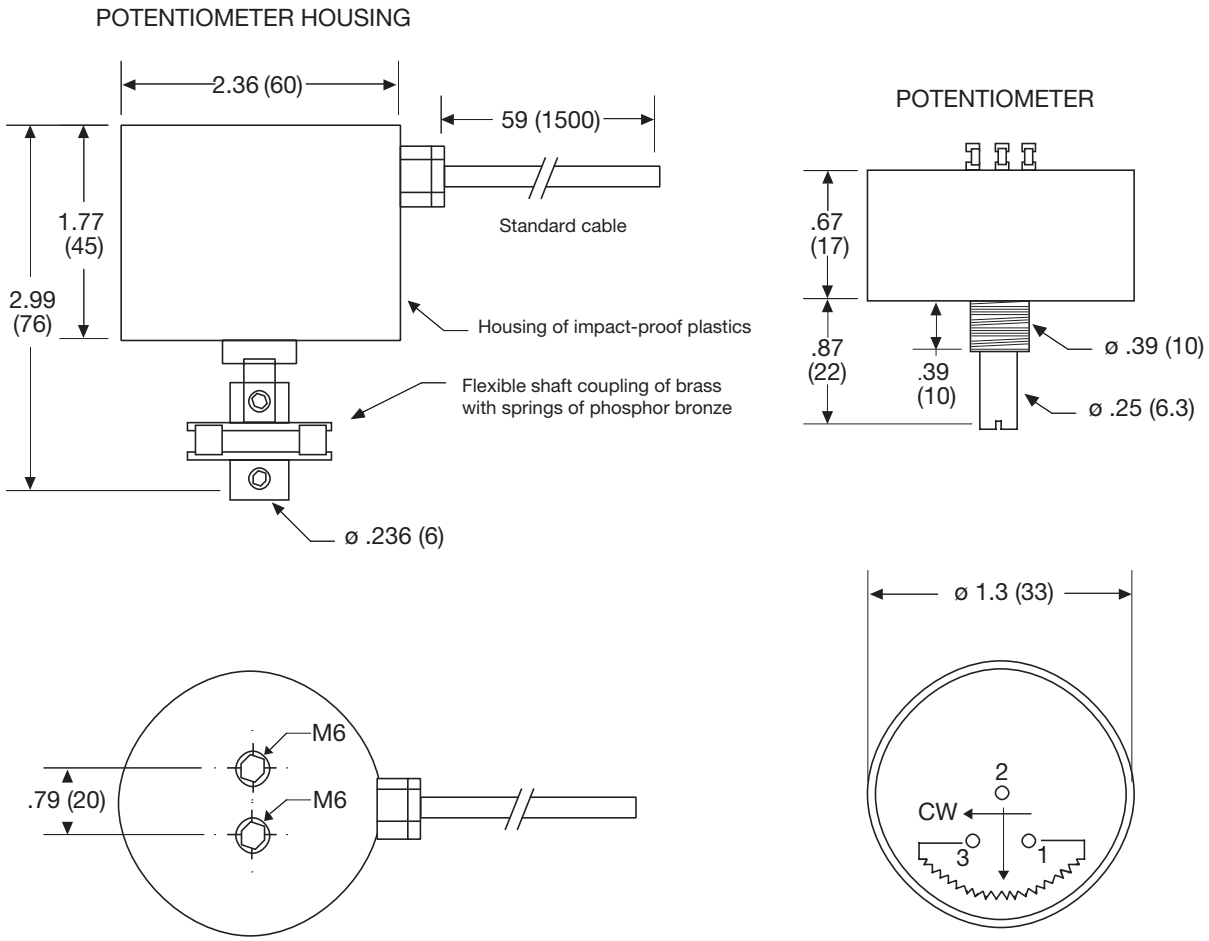
Dimensions in inches (mm)

2.2 D-3000 Electrical

AC Input .....115 or 230 VA. ± 10%
50 or 60 Hz
Fuse Size .....115 V - 160 mA T (slow-blowing type)
230 V - 80 mA T
Dancer Potentiometer Supply ..... ± 2.5 VDC
Dancer Potentiometer Input ..... ± 2.5 VDC, maximum
Temperature Range.....0 to 50ÞC (32 to 122ÞF)
Degree of Protection.....IP 54
Regulator Outputs .....0 to 10 VDC
Maximum load - 5 mA
4 - 20 mA
R_L = 0 to 500
Meter Outputs .....0 to 100 µA
R_O = 100 K
Analog Input Voltage.....0 to 10 VDC
R_I = 100K
Digital Input Voltage .....15 to 30 VDC
R_I = 2.2K
Standards .....Designed to meet UL 508 and EN 60204

2 *Technical Data*

2.3 Dancer Roll Potentiometer Mechanical



2.4 Dancer Roll Potentiometer Electrical

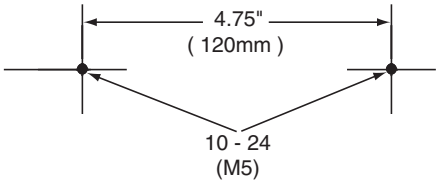
Supply	± 2.5VDC
Resistance	10 K ± 10%
Linearity	± 1%
Linearity Tolerance	0.1%
Power Rating at Max. 70ÞC	1.5W
Temperature Range	-65ÞC to + 125ÞC
Eff. Electrical Angle	340Þ ± 3Þ
Mechanical Angle	360Þ Continuous

3.1 Controller Mounting

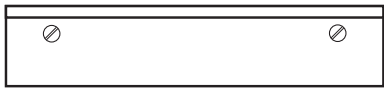
The D-3000 should be mounted in a dry place, away from any source of heat. The mounting surface should be free of any excessive vibration. If possible, the controller should be mounted at eye level and in a location that is accessible to the operator. If an I/P converter is used, it should be mounted as close to the brake as possible.

For the printed circuit board version of the controller, use the supplied drilling template to locate the mounting holes. The minimum distance between the PCB (printed circut board) and any other conductive surface is 15 mm (0.6inches). Avoid mounting the circuit card close to drive controllers or any other equipment that produces large amounts of EMI.

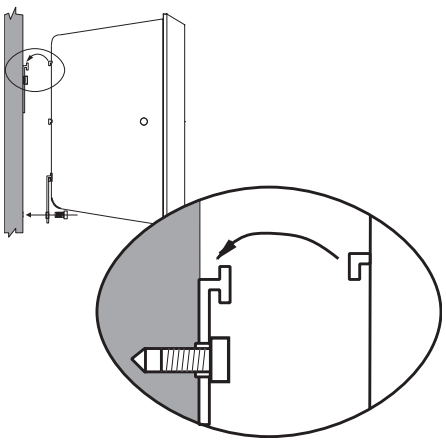
Rail Mount



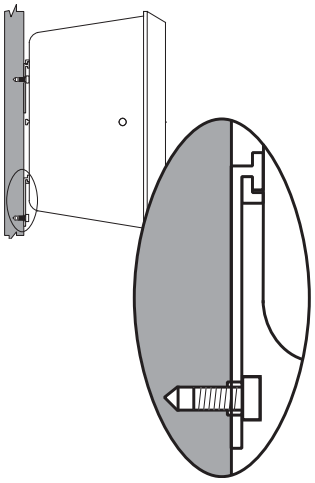
1 Drill 2 holes in the mounting surface, 4.75" apart.



2 Secure large bracket to the mounting surface using appropriate pan head or flat head fasteners.



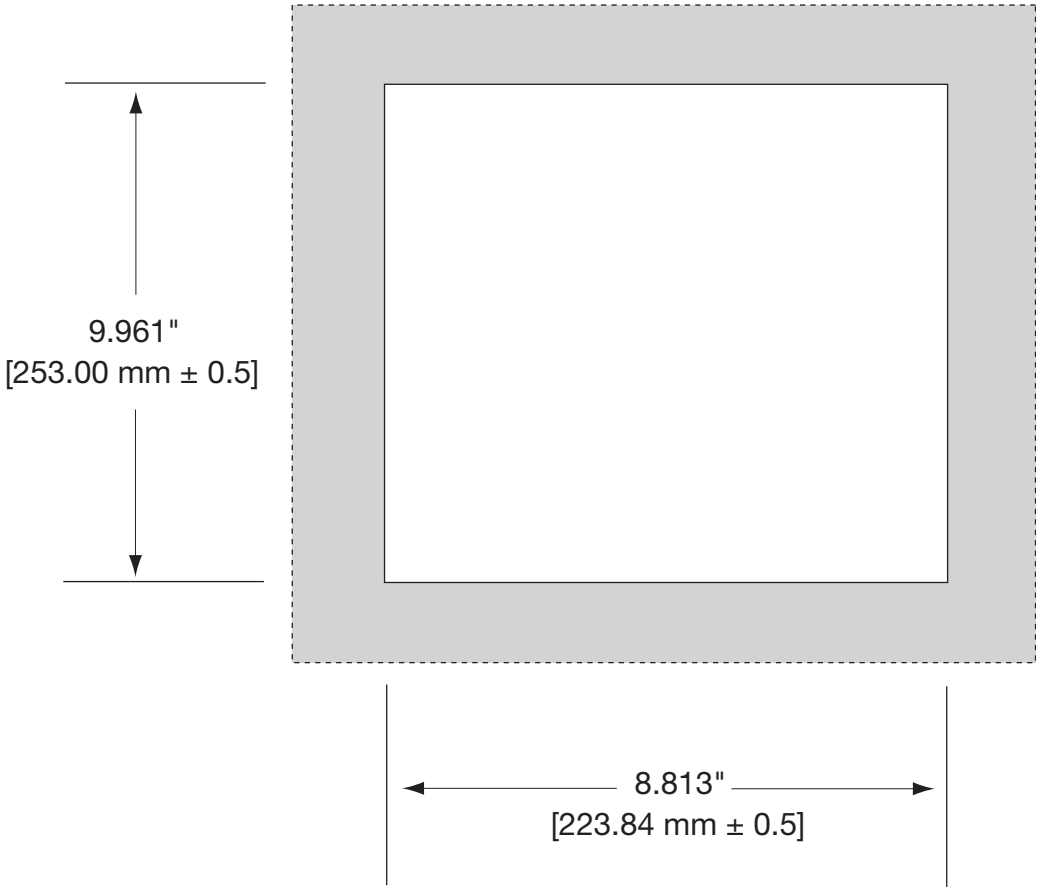
3 Place small bracket in the bottom slot on the back of the controller. Place controller on large bracket on the mounting surface. Slide the small bracket to the center of the controller and mark the mounting surface through the hole in the bracket.



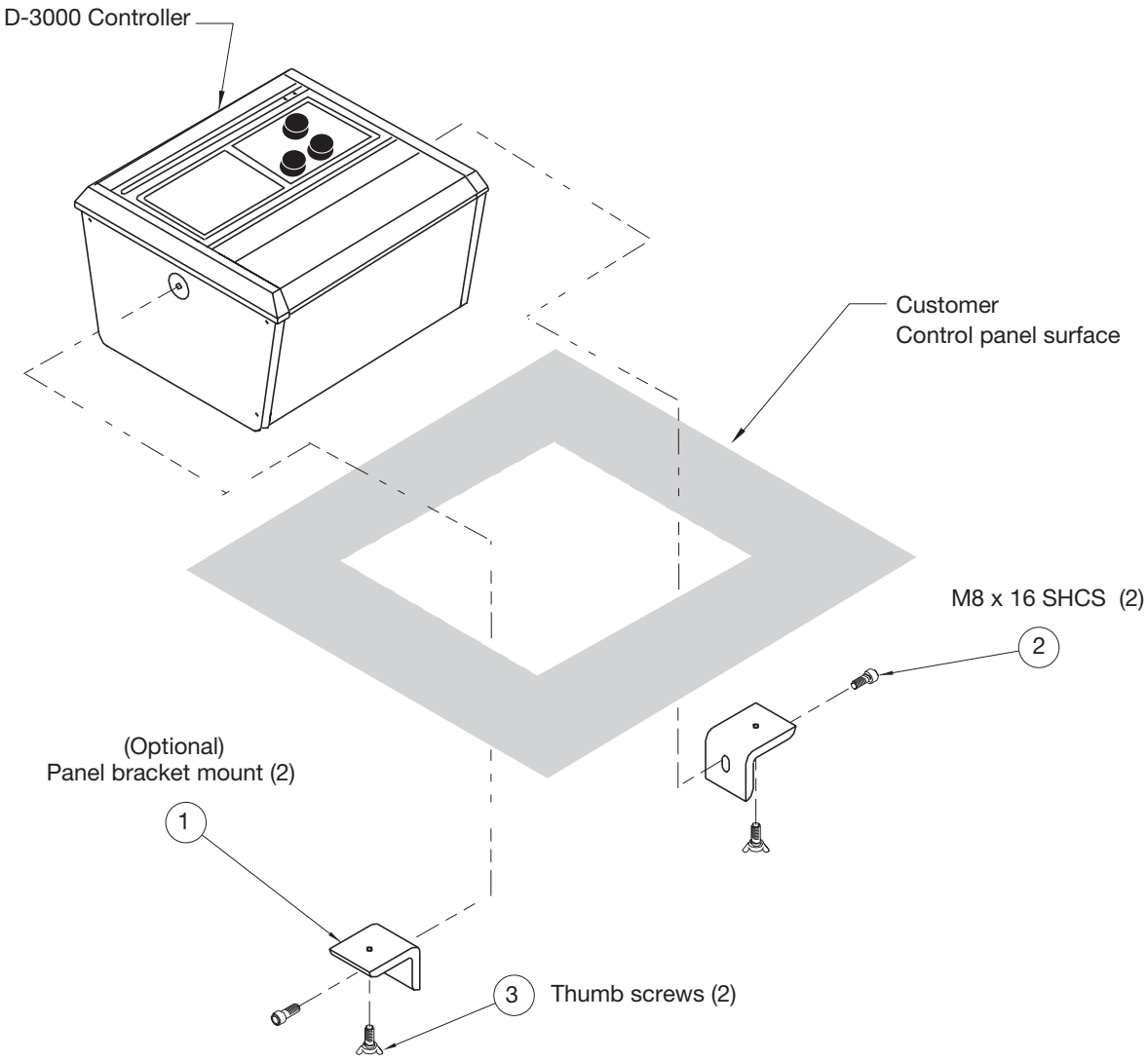
4 Slide the small bracket to one side. Drill a mounting hole for the small bracket as marked in step 3. Slide the small bracket back into place and secure, using appropriate pan head or flat head fastener.

3 *Installation*

Panel Cut Out



Panel Mount


D-3000 Controller
Customer
Control panel surface
M8 x 16 SHCS (2)
2
(Optional)
Panel bracket mount (2)
1
3
Thumb screws (2)

3 Installation

3.2 Electrical Installation

Warning: The electrical installation must be done by skilled personnel. Wiring must meet all applicable codes and standards.

Refer to the appropriate wiring and terminal descriptions for external connections.

Be sure the **voltage selector** on the regulator PCB is in the correct position for the voltage supplied.

The PCB **fuse** size must be selected according to the input voltage selected. The maximum external fuse on the input is 10 A.

Please note: Double check the accuracy of all wiring connections before applying power to the controller. Damage caused by improper wiring is not covered under warranty.

EMC Requirements

The protective ground wire must be connected to the terminal marked PE. Ground wires should be as short as possible. For printed circuit board versions, PE, the mounting plate and the cabinet must be connected to a common ground.

Shielded cable must be used for all external connections, and the shield terminated at the controller end *only* for analog signals and at both ends for digital signals. For enclosure versions, the shield may be connected to the cabinet at the point where the cable enters, either to a buss bar or to the connector housing. Keep the shield as short as possible (not to exceed 10 mm or 0.4 inches).

Keep signal cables away from supply cables or any wires that conduct high current. For best noise immunity, run signal cables close to the machine frame, mounting plates or other grounded structures.

3.3 Terminal Block Descriptions

Basic Connections - Required For All Applications

115 / 230 VAC Supply

The controller must be supplied with the voltage indicated on the voltage selector switch on the printed circuit board.

X1.1 PE - Ground: For protective conductor

X1.2 Supply Voltage - N

X1.3 Supply Voltage - L

Regulated Outputs

X4.2 Common (GND): Regulated voltage or current signal common. Connects to input ground of the converter.

X4.3 Regulated Voltage: 0 to 10 V output corresponding to 0 to maximum output from the regulator. Used for recorder or output meter. May also be used to control variable speed drives operating in the torque mode. Maximum load = 5 mA.

X4.4 Regulated Current: Regulated current signal to the I/P or other converter.

X4.1 Regulated Meter Output: 0-100 µA output proportional 0 to maximum output to the I/P or other converter.

X3.2, 4, 6, 8, 10 +24 V Supply: Unregulated 22 to 28 volt DC supply for external use. Maximum load - 100 mA.

X2.1, 4, 7 & X4.2, 5, 9 Common (GND): Common for signal and contact inputs and outputs.

Dancer Potentiometer Connections

X4.10 - 2.5 V Supply: Connects to pin 1 of the dancer potentiometer.

X4.11 +Potentiometer Input: 0 to ± 2.5V signal input. Connects to pin 2 (wiper) of the dancer potentiometer.

X4.12 +2.5 V Supply: Connects to pin 3 of the dancer potentiometer.

Optional Connections - Used For Unwind Applications

X3.1 Soft Start

When activated by a 24 V input or contact to X3.2, the controller switches to the manual mode after a predetermined time set by the adjustment of the soft start delay potentiometer R11. In soft start, the desired output is set by the MANUAL potentiometer. The soft start output is typically set for 5 to 15 % of the maximum output. This function is used to prevent starting up with maximum output when the web is slack.

X3.3 Anticoast

When activated by a 24 V input or a contact to X3.4, the output increases by a level set by the anticoast ratio potentiometer R13. This function is used to prevent the roll from overrunning at deceleration. It is normally required only for short deceleration times or high inertia rolls.

X3.7 Fast Stop

When activated by removing the 24 volt input or opening the contact to X3.8, maximum output is applied. This function can be used for a fast or emergency stop on unwinds only. The appropriate signal must be supplied externally. To insure safety, other safeguards must be provided as part of the machine controls. The D-3000 is normally shipped with a jumper between X3.7 and X3.8.

X3.9 Splice

When activated by a 24 V input or a contact closure to X3.10, the output switches immediately to the new roll starting pressure determined by the setting of the splice level potentiometer R10. This function is used for flying splice automatic roll changes and is normally activated by the knife firing circuit. Unwind splice level is typically set for 60-80% of maximum to provide the correct torque for the full roll diameter, but the actual setting depends on the application. The splice level is held constant for a time determined by the setting of the splice time potentiometer R12.

Optional Connections - Unwind, Printed Circuit Board Version

X2.1 Common

Connects to the CCW terminal (1) of the MANUAL potentiometer.

X2.2 Manual & Soft Start Input

0 to 10 volt input which corresponds to 0 to maximum output from the controller when in the manual or soft start modes. Connects to the wiper (2) of the MANUAL potentiometer.

X2.3 10 V Reference

Reference voltage applied to the CW terminal (3) of the MANUAL potentiometer.

X2.7 Common

Connects to the CCW terminal (1) of an optional external splice level potentiometer.

X2.8 Splice Level

Input for external signal used to set output during splice mode. A 0 to 10 volt input corresponds to 0 to maximum output. Also, wiper of optional external splice level potentiometer.

X2.10 10V Reference

Reference voltage applied to the CW terminal (3) of an optional external splice level potentiometer.

X3.5 Manual

When activated by a 24 V input or a contact closure to X3.6, the controller switches to the manual mode. Output is set by the potentiometer marked MANUAL. When de-activated, the controller regulates from the manual value.

X3.11 Output Off

When activated by a 24 V input or a contact closure to X3.10, the output goes to zero and the regulator is reset. This function is used at roll change.

3 Installation

Optional Connections - All Applications

X3.12 High Calibration

When activated by a 24 V input or a contact closure to X3.10, the second calibration range is used. Zero and calibration for this range are adjusted by potentiometers R3 and R4. This feature is only used for special applications.

X4.1 Regulated Meter Output

0 to 100 mA regulated output corresponding to 0 to maximum output. May be used for an output meter or external monitoring of controller output.

X6.1-X6.7 Optional Connections

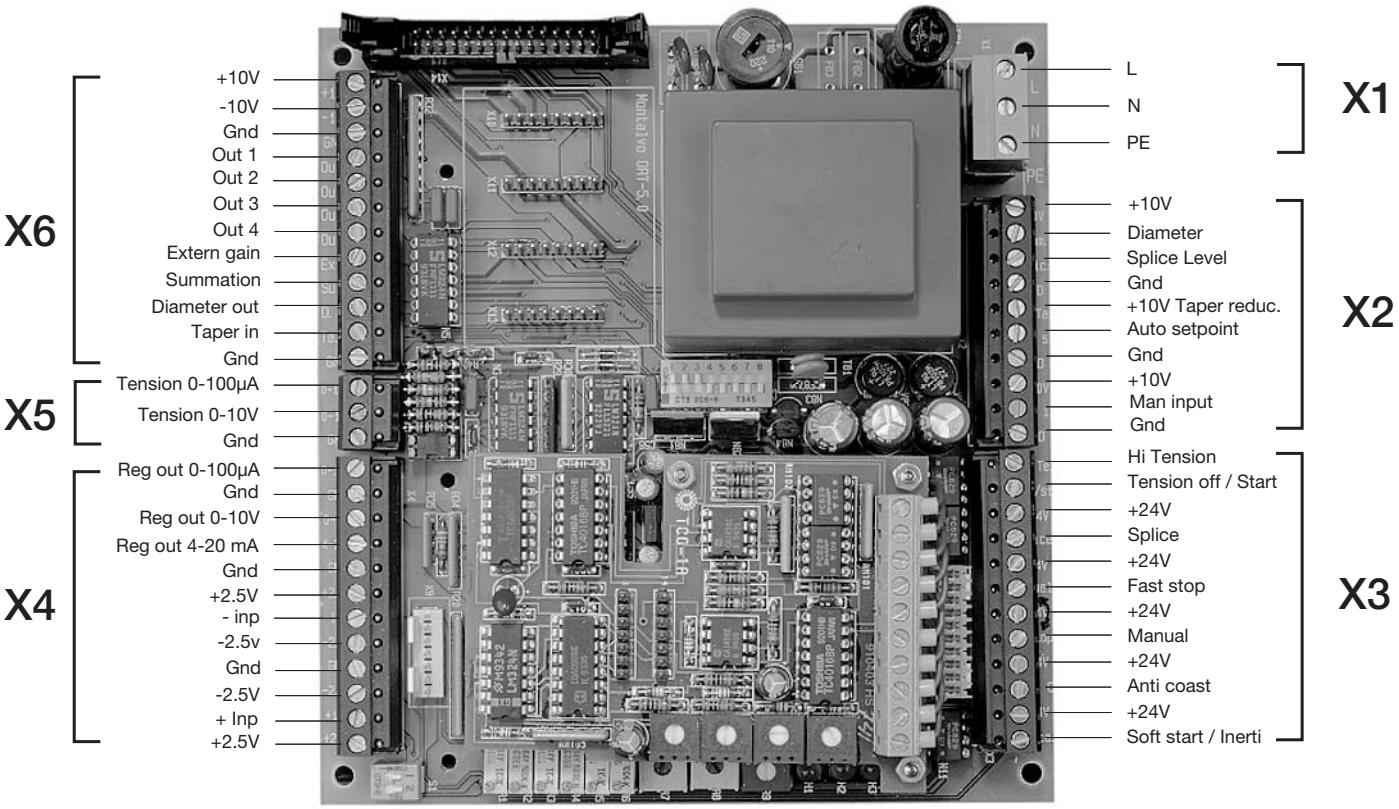
Use of these connections may vary according to the application and option boards installed in X10 - 13. Not used for most applications.

X6.8 External Gain

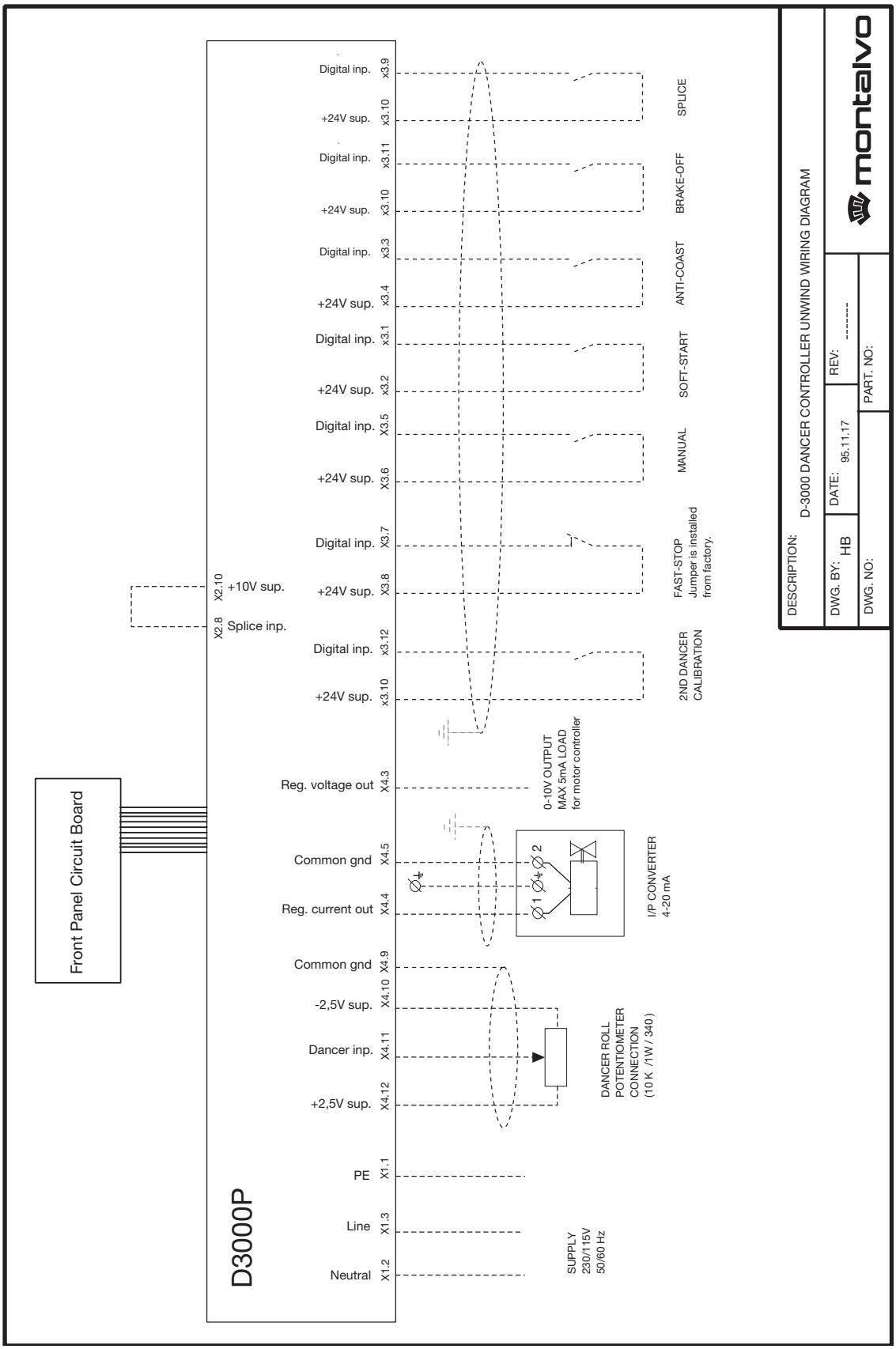
Input for external gain reference to the regulator. May be input from diameter calculator or other source. Not used for most applications.

X6.9 Summation

Extra summing input to regulator circuit. Used for special applications only.

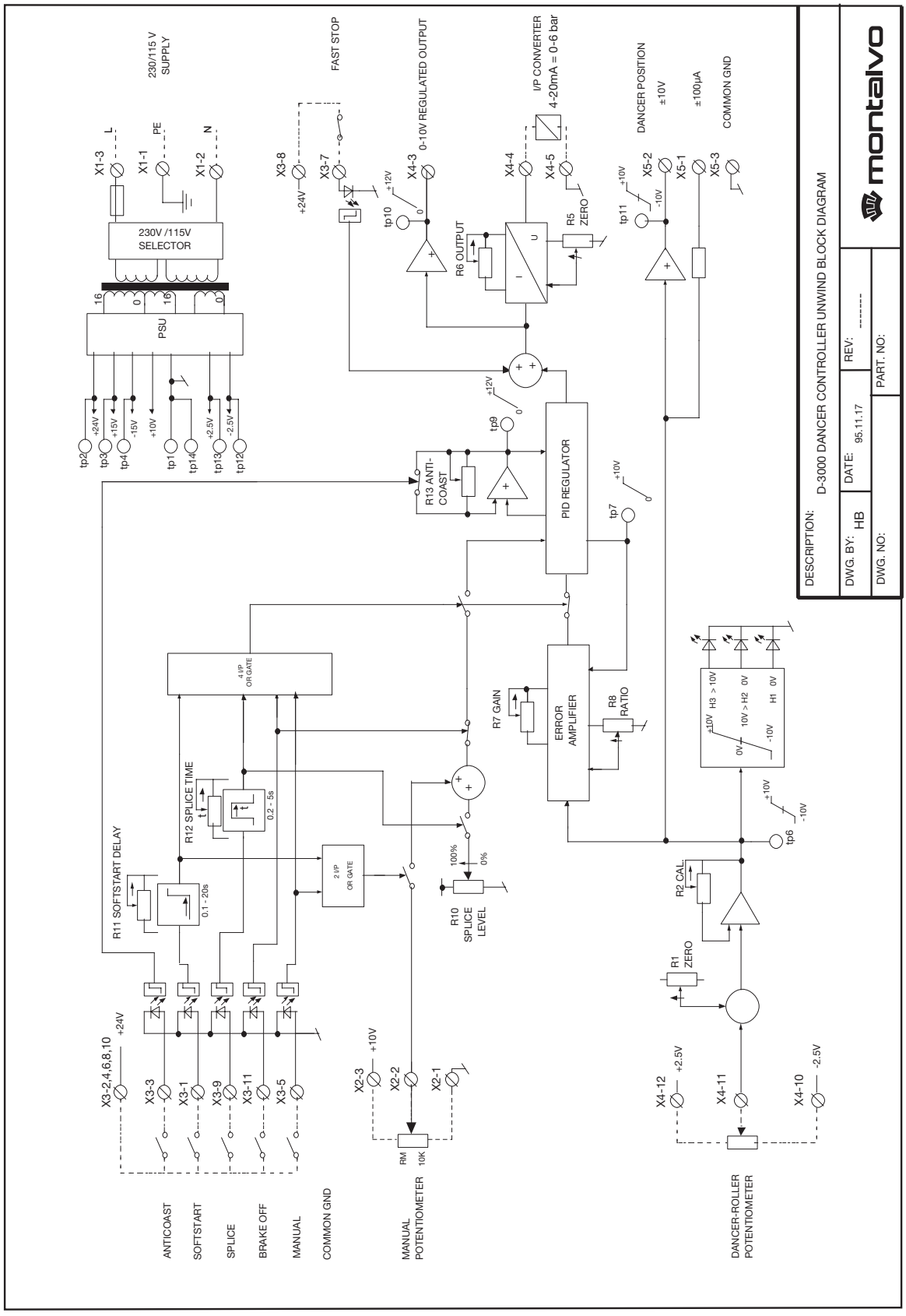


3.4 D-3000 Unwind Wiring Diagram



3 *Installation*

3.5 D-3000 Unwind Block Diagram



4.1 Description of Adjustments - Unwind

R1 **Zero Range**

Adjusts the dancer potentiometer input to zero when the dancer is in the center of its travel. Refer to the calibration procedure in Section 4.3.

R2 **Calibration Range**

Adjusts the sensitivity of the dancer input. Normally adjusted for maximum when the dancer is in the maximum position (web too tight).

R3 **Zero Range - High**

Adjusts the dancer potentiometer input to zero when the dancer is in the center of its travel and a second calibration range is used.

R4 **Calibration Range**

Adjusts the sensitivity of the dancer input when a second calibration range is used.

R5 **Output Zero**

Adjusts the minimum regulated output current to 0 or 4 mA. Factory set to 4 mA.

R6 **Output Span**

Adjusts the maximum regulated output current. Factory set for 20 mA. May also be used to limit the maximum current output.

R7 **System Gain**

Sets how much the controller should change the output when the dancer is not centered. Turning the potentiometer CW increases the gain.

R8 **Roll Ratio**

Adjusts how quickly the controller responds at maximum roll diameter. Turning the pot CW makes the system more responsive.

NOTE: The recommended starting adjustment for both R7 and R8 is 50% CW. Refer to Section 4.3 for the adjustment procedure.

R10 **Splice Level**

Adjusts the output applied to the new roll during flying splice operations. Refer to terminal block descriptions in Section 3.3.

R11 **Soft Start Delay**

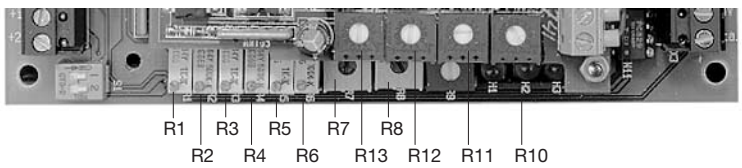
Adjusts the delay time from soft start activation until the controller switches to the soft start (manual) mode. Refer to the terminal block descriptions in Section 3.3. Used to prevent the controller from switching into soft start before the machine has come to a complete stop. Adjustable from approximately 1 to 25 seconds.

R12 **Splice Time**

Adjusts the amount of time the output remains at the splice level during flying splice operations. Typically set for 2 to 3 seconds.

R13 **Anticoast Ratio**

Adjusts the amount the output will be increased when the anticoast is activated. Turning the pot clockwise increases the ratio. The recommended starting adjustment is 25%. Run the machine at maximum line speed, largest diameter roll. Stop the machine and observe the dancer roll. If the dancer goes too high, decrease the setting of R13. If the dancer goes too low, turn R13 clockwise until dancer remains centered while stopping.



4 Calibration

4.2 Calibration

1. Verify that the dancer potentiometer is installed properly.
2. Disconnect wires from terminals X4.10 and X 4.11.
3. Move the dancer roll to the center of its travel. Loosen the potentiometer coupling and turn the pot shaft until it is in the center of its rotation (5K W between wire 1 and 2). Tighten the coupling.
4. Reconnect wires to terminal strip.
5. Apply power to the controller and let it warm up for at least 10 minutes.
6. Move the dancer roll back to its center position. Observe the LEDs along the bottom edge of the board. Adjust potentiometer R1 until both H1 and H2 are illuminated. If only H1 lights up, turn R1 clockwise. If H2 lights up, turn R1 counterclockwise.

   NOTE: R1 and R2 are 25 turn potentiometers, so many rotations may be required.
7. Place the dancer roll in its maximum position (web too tight). If H2 or H3 light up, the dancer potentiometer is wired correctly for the application. If H1 lights up, reverse wires 1 and 3 which are connected to terminals X4.10 and X4.12.
8. With the dancer roll in its maximum position, turn R2 clockwise until only H3 lights up. Then turn R2 slowly CCW until both H2 and H3 light up.
9. Verify that both H1 and H2 light up when the dancer is centered and that H2 and H3 light up when the dancer is in the maximum position. If not, repeat steps 4 through 7.
10. If a second calibration range is used, repeat steps 4 - 7, using potentiometer R3 for zero and R4 for calibration.

4.3 Tuning

The factory settings of the D-3000 offer a good compromise between responsiveness and stability for most applications. To tune for maximum performance, follow the procedure below.

Potentiometer R7 adjusts the total system gain. R8 adjusts the gain at full roll diameter. The recommended starting adjustment for both R7 and R8 is 50% clockwise.

1. Install a small diameter roll and web up the machine. With the controller in the AUTO mode, run the machine at a slow speed. Observe the dancer roll and adjust the System Gain pot R7 for stable operation.
2. Stop the machine and install a large roll. Run the machine again at slow speed and observe the dancer. Adjust the Roll Ratio potentiometer until the desired regulating response time is achieved, then accelerate and decelerate the machine to be sure the controller remains stable. This test should also be performed at small roll diameters.
3. Please note that the dancer controller cannot compensate for mechanical problems. If the controller cannot be stabilized in the AUTO mode, run the machine with the controller in MANUAL and observe the dancer. If it still fluctuates, the problem may be due to out of round rolls, bad bearings, surging drives or other mechanical factors.

   If the dancer roll cannot be stabilized, the mechanical damping of the dancer roll may be insufficient. If loaded by an air cylinder, install flow control valves on the inlet and outlet as shown in the drawing on page 2. The check valves must be in the direction shown. If the dancer is loaded by weights, a hydraulic shock absorber may be required.

   Note: The PID parameters supplied with the controller allow sufficient adjustment range for most applications. Other PID parameter blocks are available to suit special applications. Refer to the Parameter Setting page in the Appendix or consult Montalvo for more information.

1- Output Meter

Displays the regulated output. For best controller performance, output should be as high as possible at maximum roll size. With Montalvo brakes, activate or deactivate friction pads to adjust the torque capacity.

2- Mode Switch - Auto / Manual

Used to select either the AUTOmatic (closed loop) or MANUAL (open loop) mode of operation.

3- Tension Switch

Used to turn the regulator output off and on.

4- Manual Potentiometer

Sets the output of the controller when in the MANUAL or SOFT START mode. No automatic regulation is done while in manual, so the operator must make constant adjustments to maintain the correct tension level.

Auto Mode

In the AUTO mode, the output is regulated according to the position of the dancer roll. The output is automatically adjusted to keep the dancer in the center position. Web tension is determined by the weight and loading of the dancer roll. As long as the dancer stays in the center, the web tension remains constant. The D-3000 output changes proportionally with roll diameter and other factors which may affect dancer position.

Auto / Manual Switching

When going from MANUAL to AUTO, the controller starts at the manual output, then regulates to the output required for automatic control. When switching from AUTO to MANUAL, the controller immediately changes from the AUTO to the MANUAL set value. This may cause large changes in dancer position. To avoid this, note the output while running in automatic. Set the MANUAL potentiometer to the approximate percentage of the auto output. For example, if the auto output is 50% of the maximum, set the manual output potentiometer to 50%.

Soft Start (unwind only)

When the controller receives a signal for machine stop, after the "soft start delay time," it switches into the soft start mode. The output is set by the manual potentiometer. When the machine is started, the controller automatically switches into the auto mode. Soft start prevents having to start the machine with the output at maximum if the web has gone slack while stopped.

5

Taper Percentage (optional, rewind)

Adjusts the amount of taper tension (setpoint reduction) as the roll diameter increases. If taper is not required, set to 0%.

Splice Output Potentiometer (optional)

Sets the new roll starting output during flying splice.

Low / High Scale Switch (optional)

Selects the dancer calibration range in use.

6 *Troubleshooting*

Symptom	Cause	Check For
The dancer is unstable in both MANUAL and AUTO modes.	Mechanical problem	Bad or deformed roll, bad bearings, bent shafts, worn gears, missing teeth, loose chains or belts, line speed variations, brake, clutch or drive problem.
	Pneumatic problem	Fluctuating air input, air leaks, water or oil in air lines.
Dancer and output are stable in MANUAL, but unstable in AUTO.	Tuning problem	Check regulator tuning. Refer to section 4.5.
	Regulator problem	Check terminal points - if faulty, consult factory or replace circuit board.
	Converter problem	If signal voltage OK, replace converter.
	Dancer problem	Excessive friction in dancer assembly, insufficient damping of dancer roll.
	Potentiometer problem	Loose dancer pot coupling, defective dancer potentiometer.
Dancer too low in both AUTO and MANUAL modes.	Pneumatic problem	Check input air pressure and for air leaks. I/P converter may be defective.
	Regulator problem	Check terminal points - if faulty, consult factory or replace circuit board.
	Brake, clutch or drive problem	Brake/clutch too small, not enough pads activated, motor too small, drive current limit set too low.
Unwind - Web tension increases at small roll diameters in both AUTO and MANUAL modes.	Mechanical problem	Bearings in unwind defective, too much friction.
	Pneumatic problem	I/P converter may be defective.
	Regulator problem	Check terminal points, replace regulator if defective.
	Brake problem	Brake too large, too many pads activated.
Dancer too high or too low in AUTO mode.	Adjustment problem	Check zero adjustment of dancer roll.

If the use of the D-3000 controller is no longer required, dispose of it according to the regulations in force at the time.

For service, please contact:
The Montalvo Corporation, 200 Riverside Industrial Parkway, Portland Maine, 04103 USA
Tel: (207)797-8710, Toll Free Tel: (800)226-8710, Fax: (207)797-0356, Toll Free Fax: (800)644-5097
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