nexen

WEB CONTROL PRODUCTS

User Manual

Open Loop Tension Controller

Model TCD 050

FORM NO. L-20125-C-0501

In accordance with Nexen's established policy of constant product improvement, the specifications contained in this manual are subject to change without notice. Technical data listed in this manual are based on the latest information available at the time of printing and are also subject to change without notice.

Technical Support:
800-843-7445
(651) 484-5900

www.nexengroup.com

WARNING

Read this manual carefully before installation and operation.

Follow Nexen's instructions and integrate this unit into your system with care.

This unit should be installed, operated and maintained by qualified personnel ONLY.

Improper installation can damage your system or cause injury or death.

Comply with all applicable codes.

Nexen Group, Inc.
560 Oak Grove Parkway
Vadnais Heights, Minnesota 55127

ISO 9001 Certified

TABLE OF CONTENTS

INTRODUCTION

Read this manual carefully, making full use of its explanations and instructions. The “Know How” of safe, continuous, trouble-free operation depends on the degree of your understanding of the system and your willingness to keep all components in proper operating condition. Pay particular attention to all NOTES, CAUTIONS, and WARNINGS to avoid the risk of personal injury or property damage. It is important to understand that these NOTES, CAUTIONS, and WARNINGS are not exhaustive. Nexen cannot possibly know or evaluate all conceivable methods in which service may be performed, or the possible hazardous consequences of each method. Accordingly, anyone who uses a procedure that is not recommended by Nexen must first satisfy themselves that neither their safety or the safety of the product will be jeopardized by the service method selected.

CONTROLLER OPERATION

The TCD 050 measures line speed with an optical encoder, also referred to as Pulse Generator 1 (PG1). This encoder is mounted in such a way as to ensure the encoder rotates at the same speed as the web moves through the machine. PG1 is provided with a sensing wheel which has a circumference of one foot. PG1 puts out 100 pulses per revolution of its shaft; therefore, 100 pulses equal one foot. Web speed can thus be determined as feet per minute equal to pulses per minute divided by 100.

The Proximity Switch or Pulse Generator 2 (PG2) is mounted to the roll stand and senses a target mounted to the roll shaft or any other piece of shafting that rotates at the same speed as the roll shaft. As the target appears it breaks the magnetic field at PG2, and PG2 signals a gate to open in the TCD 050. The next time the target appears (next revolution) the PG2 signal closes the gate. TCD 050 counts the pulses from PG1 that occur while the gate is open (one revolution of unwind or rewind).

TCD 050 now knows the speed or pulse count from PG1 and the amount of web passing PG1 during the gate period of PG2. It can now calculate roll diameter and display it on the Diameter Meter on the face of the TCD 050.

The Set Point Knob can be used to determine the amount of output to be applied to the brake or clutch at full roll diameter. If the Set Point Knob is adjusted to maximum, 100 percent of the available clutch or brake torque will be applied when roll diameter is equal to the maximum diameter reading on the Diameter Meter. When the Set Point is adjusted for less than maximum, the output at full roll diameter will be proportionately less.

To maintain constant tension, it is necessary to vary the brake or clutch torque with the change in roll diameter.

With the Set Point adjusted for maximum torque needed at full roll diameter, the TCD 050 applies a correction based upon its diameter calculation and proportionately increases clutch torque as a wound roll builds up, or decreases brake torque as an unwind roll becomes smaller.

The Set Point Knob setting will be different for each type of product run or each width of material run on a specific machine with a specific clutch or brake. Set Point adjustment must be determined by experimentation. As experience is gained on a particular machine, it will become easier to correctly estimate the Set Point for any given job.

Torque as illustrated in Figure 1 is decreased all the way to theoretical zero diameter. Of course the roll only

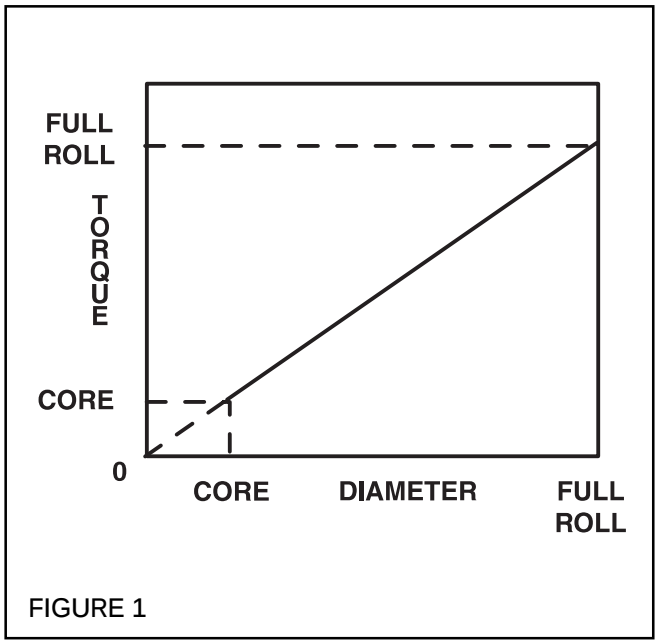


FIGURE 1

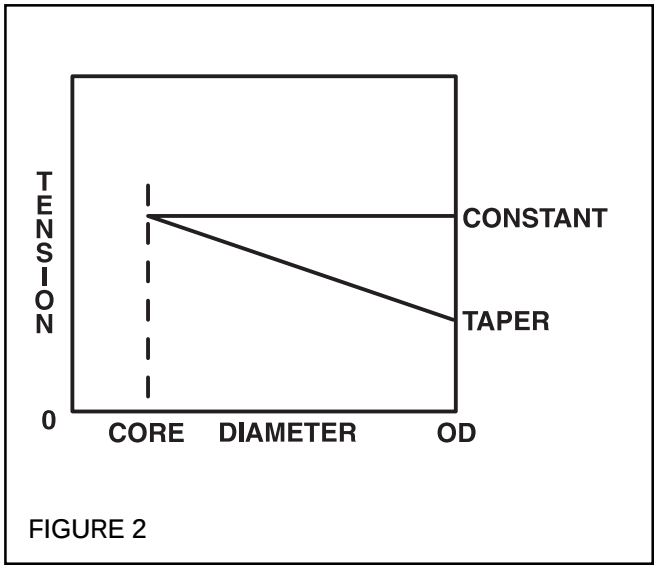


FIGURE 2

decreases to core diameter, thus there is a positive torque applied at the core. This allows constant tension control from the outside diameter right to the core.

Some winding operations require taper tension, a relatively high web tension applied at the core which gradually decreases as the wound roll builds in size (See Figure 2).

In order to have taper tension, the torque of the winding clutch must still increase with roll diameter, but not as much as would be required to maintain constant tension.

Taper tension can be achieved by adjusting the Taper Knob located on the TCD 050 front panel. For unwind or constant tension winding, this knob is adjusted to its zero taper position (fully counterclockwise). To obtain taper tension, move the Taper Knob from its zero position. The correct amount of taper is found through experimentation. Too little taper will yield telescoped rolls and too much will yield soft rolls (See Figure 3).

The front panel of the TCD 050 also has a Mode Switch to select Automatic Control or Manual Mode. In Manual Mode, the Manual Knob controls output to the brake or clutch and must be corrected by the operator as the roll changes diameter. The Diameter Meter will still indicate roll diameter, but the output will not automatically change with roll diameter in Manual Mode.

The Manual Knob is also used to set the stall torque applied by the unwind brake or winding clutch when the web is at zero speed and the machine is waiting to be started. This stall torque prevents slack in the web which will be drawn tight during a machine start and could break the web.

The Output Meter located on the front panel displays output signals being sent to the clutch or brake.

The Diameter Meter indicates roll diameter when the web is moving. If the diameter of the roll is greater than the meter on the controller, i.e., a 44 inch roll on a TCD 050 whose meter reads 0-40 inches, the Diameter Meter will read 40 inches until the unwind roll becomes less than 40 inches or after the wound roll has exceeded 40 inches. In both cases, the output will still vary with the roll diameter even though the diameter is beyond the limits of the meter.

Other components on the front panel are a Power Switch to turn the Tension Controller on and off, and a Power Light to indicate when power is applied to the TCD 050. The PG1 and PG2 indicator lights glow when PG1 and PG2 are operating correctly.

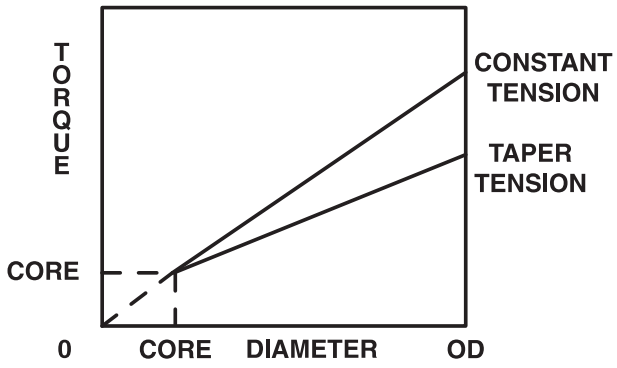


FIGURE 3

INSTALLATION

VOLTAGE SELECTION

1. Remove the four screws securing the top panel and remove the top panel.
2. Set Voltage Jumper to corresponds to AC line voltage being applied to the unit (See Figure 4). For 110-120 VAC, connect to 115V position rather than the 127V position.
3. Make sure SW1 is set correctly for winding or unwinding operation (See Figure 5).
4. Replace the top panel and reinstall the screws.

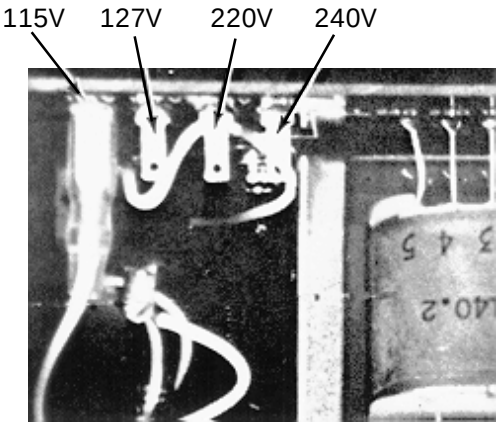


FIGURE 4

MOUNTING

1. The TCD 050 is panel mountable. Refer to Figure 6 for panel cutout and mounting screw dimensions.

   NOTE: The TCD 050 is an electronic component and should be mounted in a shock and vibration free area which has an ambient temperature of more than 32° F [0°C] and less than 122° F [50° C].

2. The Proximity Switch PG2 senses a customer supplied ferrous material (iron or steel) target. Minimum gap between PG2 and target is 0.20 inches; maximum gap is 0.40 inches. The target must be of sufficient mass to trigger PG2 and may be mounted to the roll shaft or any other mechanical component which rotates at the same speed as the roll shaft, brake, rotor, etc., (See Figure 7).

   NOTE: Target duration may be from 22-45° of shaft rotation.

3. Mount PG2 to a non-rotating member using the mounting bracket provided (See Figure 8).

   NOTE: PG2 must be mounted in such a position as to maintain the correct gap as defined in Step 2.

4. The roll selected for line speed measurement via PG1 must turn exactly at line speed. There must not be any slippage between the web surface and the surface of this measuring roll. One pair of nip rolls is often a good choice for a measuring roll as the nip pressure ensures there will be no slip between web surface and roll surface.

5. Using the provided set screw, securely attach the provided Measuring Wheel with PG1 to shaft of PG1 (See Figure 9).

6. Using customer supplied mounting bracket, mount PG1 in such a way as to bring the wheel into contact with measuring roll selected in Step 4 (See Figure 10).

   NOTE: Contact between wheel and measuring roll must be firm enough to prevent slippage.

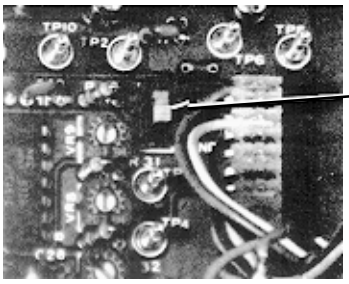


FIGURE 5

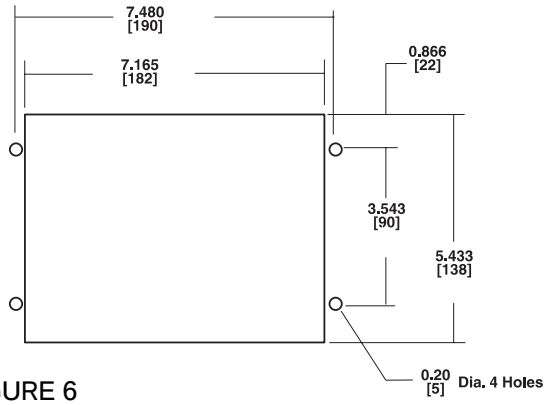


FIGURE 6

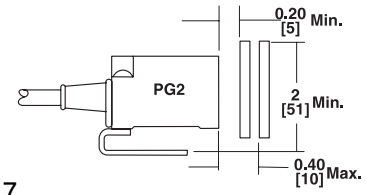


FIGURE 7

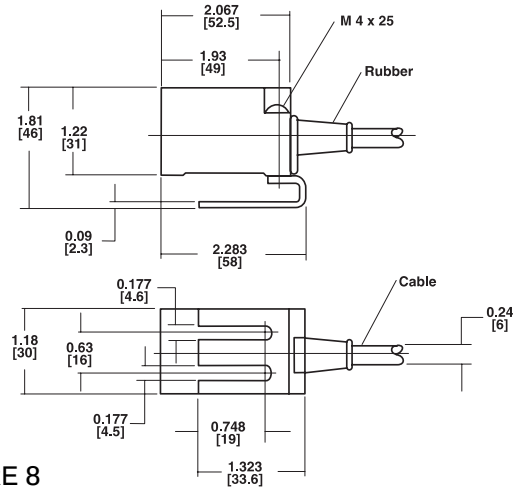


FIGURE 8

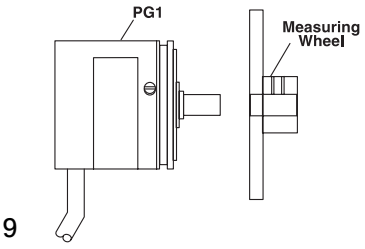


FIGURE 9

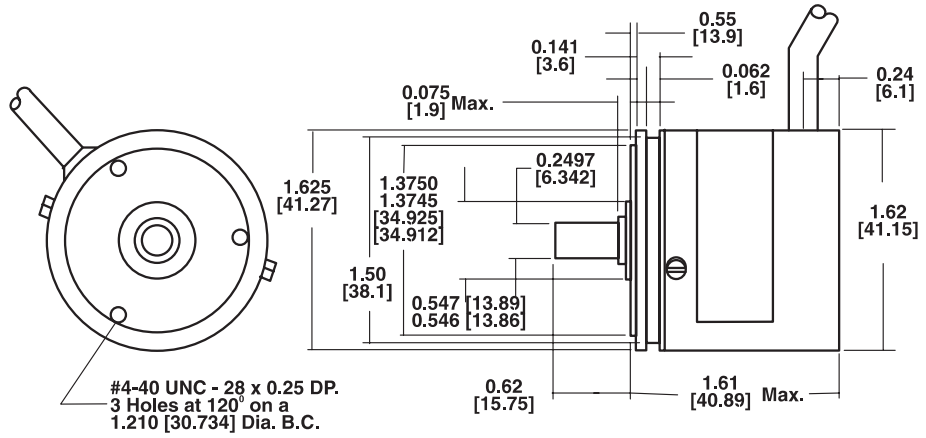


FIGURE 10

ELECTRICAL CONNECTIONS

1. Wire Stop Circuit, Terminals 1 and 4, using customer supplied normally open momentary contact switch. This switch is held in its closed position during line deceleration to stop unwind roll inertia when used with an unwind brake (a relay may be equipped with a timer to perform the same function). This contact timing is not required when the TCD 050 is used to control a winding clutch.

2. Wire Reset Circuit, Terminals 2 and 4, using customer supplied normally open momentary contact switch. This switch is used to return the Tension Controller to its stall torque level. It must be held closed for at least one second. The one second time is required for both unwind and rewind controls.

3. Wire the Hold Circuit, Terminals 3 and 4, using a customer supplied normally open momentary contact switch.

   NOTE: This is an optional switch (See OPERATION, Page 8 for usage).

4. Wire PG2 to Terminals 5, 6, and 8.

   a. Signal wire (black) to Terminal 5.

   b. Positive voltage (brown) to Terminal 6.

   c. Common (blue) to Terminal 8.

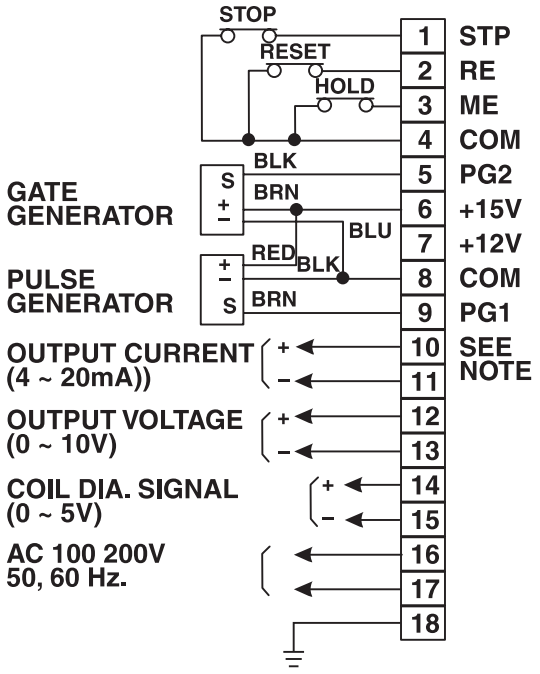
5. Wire PG1 to Terminals 6, 8, and 9.

   a. Positive voltage (red + 15) to Terminal 6.

   b. Common (black) to Terminal 8.

   c. Signal (brown) to Terminal 9.

   NOTE: The signal wire is solid brown.



NOTE: When using 0-10 volt output, Terminals 10 and 11 must be jumpered. When using 4-20mA signal, remove the jumper from Terminals 10 and 11.

FIGURE 11

6. Select output required for control device, either 4-20mA at Terminals 10 and 11 or 0-10V at Terminals 12 and 13. Wire correct signal to output device.

> CAUTION
> Observe wiring polarity for either output (See Figure 11).

7. If a remote roll diameter meter is to be used, the 0-5V signal to operate the meter is available at Terminals 14 and 15.

> CAUTION
> Observe polarity when connecting these leads to prevent damage to the remote meter.

8. Connect AC line voltage Terminals 16, 17, and ground to Terminal 18.

> CAUTION
> Verify Tension Controller has been set to the correct voltage range (See INSTALLATION, Page 3).

CALIBRATION

NOTE: Calibrations are made with the trimming resistors located on the front panel of the Tension Controller. VR1 and VR2 are factory adjusted and should not require field adjustment.

DIAMETER METER

If the Diameter Meter does not read correctly at maximum roll diameter or at core diameter, it may be necessary to recalibrate VR1 and VR2.

To recalibrate meter circuit:

1. Check Pulse Set Rotarty Digital Switches located on back panel of TCD 050. When viewed from the back of the unit, the switch furthest to the left is the most significant digit. It should be set to 500 for 20 inches, 1000 for 40 inches, or 1500 for 60 inches Diameter Meter.
2. Set Check Switch to ON.
3. Set Power Switch to ON; meter will move to the right.
4. Adjust VR1 until meter reads maximum, 20 inches, 40 inches, or 60 inches.
5. Set Digit5al Switch to 0001. The meter will move to the left.
6. Adjust VR2 until meter reads the outside diameter of the smallest core to be used on the machine.
7. Repeat Steps 1-7 to ensure settings have not drifted during calibration.
8. Set Check Switch of OFF.

SPG-STOP GAIN

Torque applied with a brake to maintain tension on an unwind roll must be multiplied during a web stop to prevent coasting or run-on which will spill web onto the floor. The Stop Gain controls the amount of brake torque increase during a stop. Set full counterclockwise, the torque remains the same as was applied at the moment the Stop Button was pushed. Full clockwise rotation of the SPG Pot will triple the brake torque during the stop phase. Intermediate points will yield proportional increases. Because Stop Gain is based upon the torque required to maintain tension at a given roll diameter, it will always be proportional to roll diameter and one setting will work on any size roll.

To adjust SPG:

1. Rotate SPG fully counterclockwise (no increase).
2. Set TCD 050 Power Switch to ON. Start and run the machine in Auto Mode until it reaches operating speed, then stop the machine.
3. Depress Stop Button until unwind roll comes to a complete stop. If unwind roll stops with no web spillage, SPG is properly set. If run-on is observed, rotate SPG clockwise and try another stop.
4. Continue this process until the unwind roll comes to a complete stop with no web spillage.

> CAUTION
> Do not adjust SPG any higher than required to yield a smooth stop; increased web tension during a stop could break the web.

5. For winding clutches, SPG must be set to 0 (fully counterclockwise).
6. Set TCD 050 Power Switch to OFF.

MLS MECHANICAL LOSS

All clutches display a hysteresis or mechanical loss between the time they initially receive a control signal and the signal builds up high enough to cause the clutch to exert torque on the roll. The MLS pot compensates for this mechanical loss.

To adjust MLS:

1. Apply drive to the input member of the clutch.
2. Rotate Set Point Knob counterclockwise to 0.

   NOTE: The winding shaft should have only an empty core installed and no web attached.

3. Set MLS pot to 0 (full counterclockwise).
4. Set Power Switch to ON and increase MLS pot (clockwise) until winding shaft begins to rotate.
5. Back off MLS setting until winding shaft stops. This is the correct setting for the winding clutch.
6. Set Power Switch to OFF.
7. For unwind brakes, adjust MLS pot to its midpoint.

SPAN ADJUSTMENT OUTPUT

NOTE: Span adjustment for the output should only be made if you need maximum or a higher output at a diameter that is within the scale range of the diameter meter.

Span adjustments are made with trimming resistors on front panel of the Tension Controller. VR3, VR4, and VR5 are factory set and should not require field adjustment.

Maximum Tension Controller output is obtained when Set Point is set to maximum, the Taper Knob is set to 0, and a roll of maximum diameter (20 inches, 40 inches, or 60 inches as indicated on the Diameter Meter) is being run. The only reason field adjustment is required is to provide maximum output at less than maximum diameter. If field adjustment of output span is required, follow this procedure:

1. Substitute maximum roll diameter for d using the formula:

   100/4 X d = pulse setting

2. Set Power Switch to ON.

3. Set Pulse Set digital wheel (located on TCD 050 back panel) to read pulse setting from formula shown above.

4. Set Check Switch to ON. Diameter Meter will indicate roll diameter (d from formulat in Step 1).

5. Rotate Taper Knob and Manual Knob (located on front panel to 0 (counterclockwise).

6. Rotate Set Point Knob (located on front panel) to maximum (clockwise).

7. Set Mode Switch (located on front panel) to AUTO.

8. Rotate VR3 (located on front panel) until Output Meter displays maximum output.

9. Set Mode Switch to MANUAL.

10. Rotate VR4 (located on front panel until Output Meter displays minimum output.

11. Set Mode Switch to AUTO and check output. If output is less than maximum, repeat Steps 8-10. (It may take a few repraed attempts to obtain maximum and minimum output as adjusting VR3 and VR4 interact with each other.)

12. Set Mode Switch to MANUAL.

13. Rotate Manual Knob to maximum (fully clockwise).

14. Rotate VR5 (located on front panel) until Output Meter displays maximum output.

15. Set Check Switch (located on back panel) to OFF.

OPERATION

UNWIND BRAKE (See Figure 12)

1. The stall torque, which is used to hold back on the web and prevent web sag while the machine is not running, is controlled with the Manual Pot when the Mode Switch is in Auto (See No. 1). Stall torque should be set just high enough to prevent web sag. Too much stall torque will make the machine difficult to start and could cause web break during start up.

2. As the machine is started, the Tension Controller stays in its stall mode during the first four rotations of the unwind roll (See No. 2). This period of time allows the machine to accelerate without the drag of the unwind brake.

3. When four rotations have elapsed, the Tension Controller goes into its automatic control cycle and controls the brake relative to roll diameter and the set point. As the roll continues to decrease in size, the output also decreases.

4. If a Hold Switch has been installed, the output may be held at any point by pushing the Hold Switch and maintaining if for the desired period of time (See No. 3). This hold function can be very useful when trying to salvage a poorly wound roll with soft spots. When the Hold Switch is released, the Tension Controller returns to its normal operation.

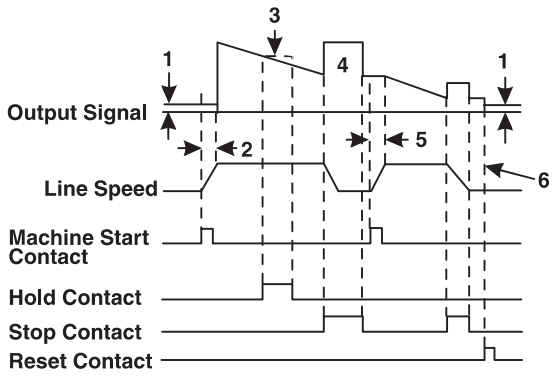


FIGURE 12
TCD 050 When Controlling an Unwind Brake

5. Mid-wind stops require an increase in brake torque to stop the inertia of an unwind roll without web spillage. Pushing the Stop Button will initiate this Stop Gain. The Stop Gain will continue as long as the Stop button is depressed (See No. 4).

6. The Tension Controller output returns to the level it was at when the stop was initiated as soon as the Stop Button is released. The machine can now be restarted with the same brake force applied as when it was stopped.

7. If this level of brake output is too high to allow a smooth restart, the reset button can be depressed for at least one second and the output will return to the stall level.

8. In either case, the machine will return to its automatic cycle after four rotations of the unwind roll upon restart (See No. 5).

9. Upon completion of the unwind, the Stop Button is engaged to bring the core and roll shaft to a stop.

10. When the Stop Button is released, the output level will return to its level when the button was depressed.

11. The Reset Button is now held for at least one second to return the output to it stall torque setting (See No. 6).

CAUTION

If the Reset Button is actuated during a normal unwind, the output will return to the value set by the Manual pot and remain there for four revolutions of the unwind shaft after the button is released. This can cause serious changes in the unwind tension.

WINDING CLUTCH (See Figure 13)

1. The dead band or mechanical loss which is present in all clutches must be compensated with the MLS system in the TCD 050 before attempting to use the system with a winding clutch (See MLS Mechnical Loss, Page 6).

2. To remove slack in the web before winding begins, a small amount of torque must b applied (See No. 1). This stall torque function is controlled with the Manual Knob in Automatic Control Mode.

3. When the machine is started, the Tension Controller will maintain its stall torque output for the first four rotations of the winding shaft (See No. 2).

4. At the end of four rotations, the controller enters its automatic cycle and controls output to the clutch based upon the set point and roll diameter (See No. 3).

5. If the machine is stopped in mid-wind, the output to the clutch must remain the same. After the stop signal has been momentarily given to the TCD 050, the output will go to the level it was at when the stop was begun. The Tension Controller will stay at this output level until the machine is restarted (See No. 4). If web tension must be decreased while the machine is stopped, the Reset Button must be held for one second, then tension may be controlled with the Manual Knob.

   NOTE: SPG pot must be set to 0 when controlling a winding clutch (See CALIBRATION).

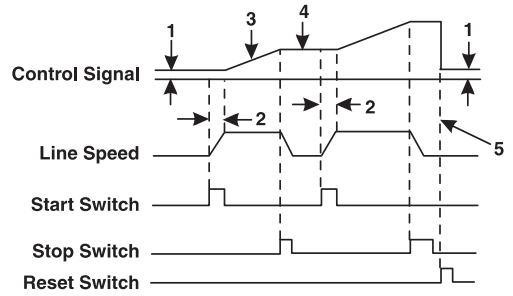


FIGURE 13
TCD 050 When Controlling a Winding Clutch

6. When the machine is restarted, the output will maintain for four revolutions before the controller returns to its automatic control cycle.

7. Upon completion of the wind, a stop signal is given to the Tension Controller. When the machine has come to a full stop, the Reset Button must be pushed and held for at least one second (See No. 5). This returns the output to its stall level output (See No. 1).

8. The stall output level can now be reduced to zero with the Manual Pot to facilitate full roll removal and replacement with a new core.

CAUTION

If the Reset Button is actuated at any time during winding of a roll, the output will go to the value set by the Manual Pot and remain there for four revolutions of the winding shaft after the button is released. This may cause soft spots in the wound roll.

MAINTENANCE

There is no required maintenance as the TCD 050 has no parts subject of mechanical wear. Operating elements– brakes, clutches, motors, etc., must be maintained according to the manufacturer's specifications.

TESTING

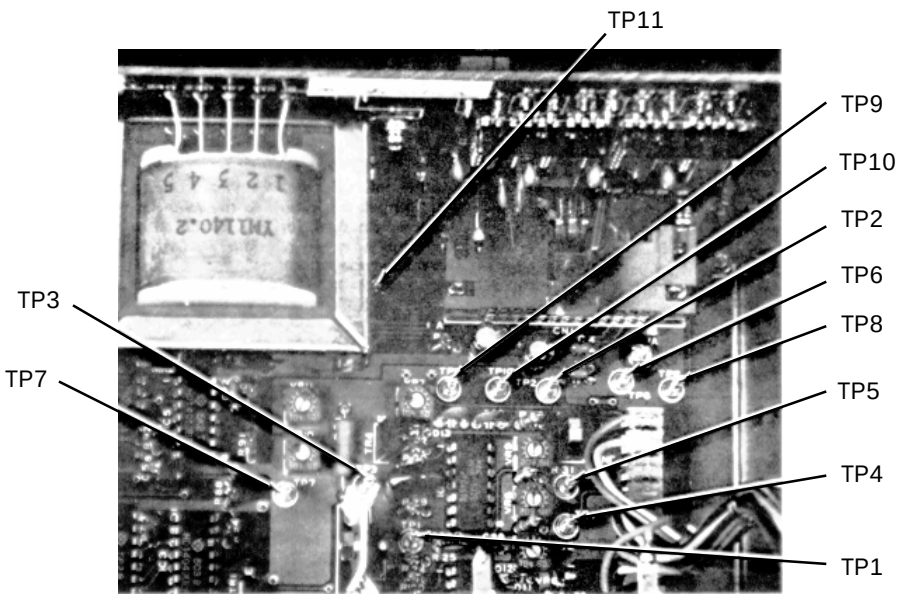


FIGURE 14
Test Pin Locations

C/P	CIRCUIT TESTED	CORRECT VALUE
TP1	Maximum Input Signal to Diameter Amplifier Circuit	+5 at Maximum Diameter (adjust VR1)
TP2	Minimum Input Signal to Diameter Amplifier Circuit	Approx. +0.5VDC at Minimum Diameter (adjust VR2)
TP3	Span of Diameter Amplifier Circuit	Approx. -4.5VDC at Maximum Diameter (adjust VR6)
TP4	Output of Diameter Amplifier Circuit in Unwind Mode	+5VDC at Maximum Diameter, SW1 Unwind (adjust VR8)
TP5	Output of Diameter Amplifier Circuit in Winding Mode	+0.5VDC at Maximum Diameter, SW1 Winding (adjust VR9)
TP6	Set Point Reference	Approx. +1.8VDC at Maximum Diameter and Taper 0.0 (no adjustment)
TP7	MLS Reference	-0.8~+0.8VDC (varies with MLS Pot)
TP8	Manual Reference	Approx. +1.8VDC (adjust VR5)
TP9	Power Supply for Op. Amps.	+15VDC (nonadjustable)
TP10	Power Supply for Op. Amps.	-15VDC (nonadjustable)
TP11	Circuit Common	Common

SPECIFICATIONS

TCD 050

Power Supply
115, 127, 200, 220VAC, 50/60 Hz
Control Output
0-10VDC and 4-20mA
Diameter Output
0-5VDC
Pulse Generator Input

0	0-2V
1	12-15V, 120mA

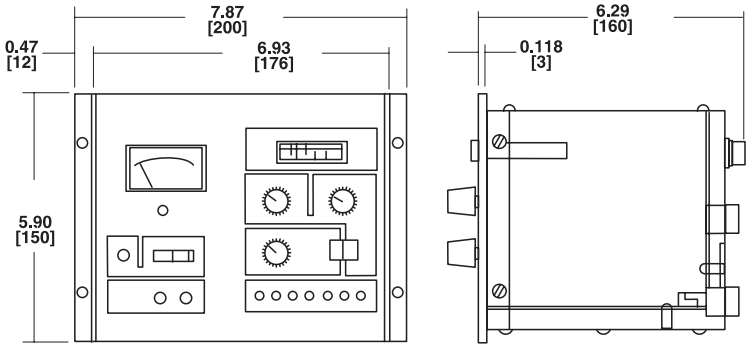


FIGURE 15

PG1

Supply Voltage
15VDC ± 10%
Current Draw
100mA
Output Signal

1	10VDC
0	1VDC

Frequency Response
2.5 KHz

PG2

Supply Voltage
15VDC ± 10%
Current Draw
10mA
Output Signal

1	10VDC
0	1VDC

Frequency Response
500 Hz

REPLACEMENT PARTS

The item or balloon number for all Nexen products is used for part identification on all product parts lists, product price lists, unit assembly drawings, bills of materials, and instruction manuals.

When ordering replacement parts, specify model designation, item number, part description, and quantity. Purchase replacement parts through your local Nexen Distributor.

PARTS LIST

ITEM	DESCRIPTION	P/N
1	P.C.B. Power Board 1188.2	2801
2	P.C.B. Main Board 1187.2	2802
3	Output Meter % Scale 0-10V	2803
4	Diameter Meter 0-20"	2804
5	Diameter Meter 0-40"	2805
6	Diameter Meter 0-60"	2806
7	Manual Potentiometer RV16YN105B 10K	2788
8	Set Point Potentiomenter RV16YN105B 10K	2788
9	Taper Potentiometer RV16YN105B 10K	2788

Warranties

Nexen warrants that the Products will be free from any defects in material or workmanship for a period of 12 months from the date of shipment. NEXEN MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. This warranty applies only if (a) the Product has been installed, used and maintained in accordance with any applicable Nexen installation or maintenance manual for the Product; (b) the alleged defect is not attributable to normal wear and tear; (c) the Product has not been altered, misused or used for purposes other than those for which it was intended; and (d) Buyer has given written notice of the alleged defect to Nexen, and delivered the allegedly defective Product to Nexen, within one year of the date of shipment.

Exclusive Remedy

The exclusive remedy of the Buyer for any breach of the warranties set out above will be, at the sole discretion of Nexen, a repair or replacement with new, serviceably used or reconditioned Product, or issuance of credit in the amount of the purchase price paid to Nexen by the Buyer for the Products.

Limitation of Nexen's Liability

TO THE EXTENT PERMITTED BY LAW NEXEN SHALL HAVE NO LIABILITY TO BUYER OR ANY OTHER PERSON FOR INCIDENTAL DAMAGES, SPECIAL DAMAGES, CONSEQUENTIAL DAMAGES OR OTHER DAMAGES OF ANY KIND OR NATURE WHATSOEVER, WHETHER ARISING OUT OF BREACH OF WARRANTY OR OTHER BREACH OF CONTRACT, NEGLIGENCE OR OTHER TORT, OR OTHERWISE, EVEN IF NEXEN SHALL HAVE BEEN ADVISED OF THE POSSIBILITY OR LIKELIHOOD OF SUCH POTENTIAL LOSS OR DAMAGE. For all of the purposes hereof, the term "consequential damages" shall include lost profits, penalties, delay images, liquidated damages or other damages and liabilities which Buyer shall be obligated to pay or which Buyer may incur based upon, related to or arising out of its contracts with its customers or other third parties. In no event shall Nexen be liable for any amount of damages in excess of amounts paid by Buyer for Products or services as to which a breach of contract has been determined to exist. The parties expressly agree that the price for the Products and the services was determined in consideration of the limitation on damages set forth herein and such limitation has been specifically bargained for and constitutes an agreed allocation of risk which shall survive the determination of any court of competent jurisdiction that any remedy herein fails of its essential purpose.

Limitation of Damages

In no event shall Nexen be liable for any consequential, indirect, incidental, or special damages of any nature whatsoever, including without limitation, lost profits arising from the sale or use of the Products.

Warranty Claim Procedures

To make a claim under this warranty, the claimant must give written notice of the alleged defect to whom the Product was purchased from and deliver the Product to same within one year of the date on which the alleged defect first became apparent.

nexen

Nexen Group, Inc.
560 Oak Grove Parkway
Vadnais Heights, MN 55127

800.843.7445
Fax: 651.286.1099
www.nexengroup.com

ISO 9001 Certified