



Open Loop Tension Controller

TCD 600

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



DANGER

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	1
INSTALLATION	2
PANEL DIMENSIONS AND MOUNTING INSTRUCTIONS	2
ELECTRICAL CONNECTIONS	4
GLOSSARY OF TERMS	7
SETUP PROCEDURE	8
Machine	9
Job	9
Calibration	11
QUICK REFERENCE SETUP AND CALIBRATION WORKSHEET	13-15
OPERATION	16
Overview	16
Loading a Job	17
Automatic Operation	17
Manual Operation	17
Unwind Application	18
Winding Application	18
SPECIFICATIONS	19
PARTS LIST	19
SERVICE INSTRUCTIONS	19
WARRANTY	20

INTRODUCTION

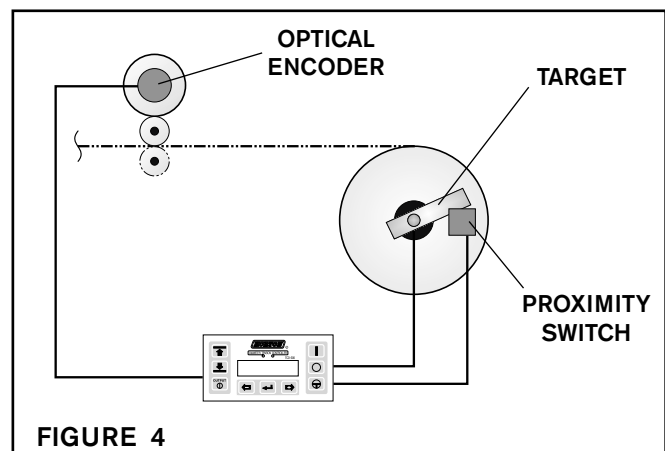
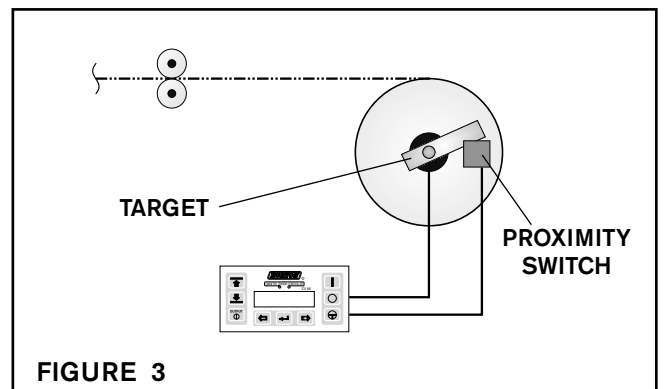
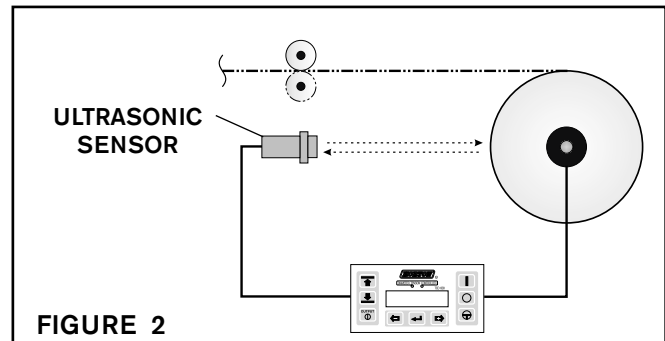
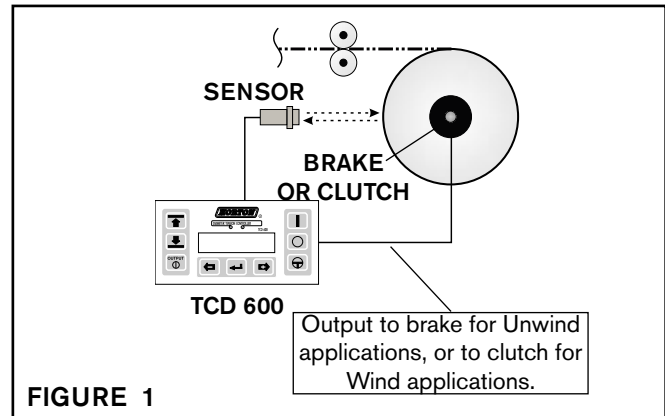
The Nexen TCD 600 is a non-contact open loop tension control system that provides reliable web tension control that's easy-to-use and requires minimum attention by the operator.

The TCD 600 maintains constant tension by varying the brake or clutch torque with the change in roll diameter. When the set point is adjusted for the maximum torque needed at full roll diameter, the TCD 600 applies a correction based on its diameter calculation and proportionately increases clutch torque as a wind roll builds up, or decreases brake torque as an unwind roll becomes smaller.

For example, Figure 1 shows a system that includes a sensor, which measures the diameter of the roll. The sensor sends this information to the TCD 600 Controller. An operator enters into the TCD 600 the maximum and minimum size of the roll, along with other information that applies to the specific job. The TCD 600, using this information, varies the amount of torque applied to a brake or a clutch as the roll diameter changes. As a result, a constant tension is maintained on the web. This example is only one of the many potential control systems that can be built around the TCD 600.

The TCD 600 will work with three different sensor configurations: Ultrasonic Sensor, Proximity Switch, and Proximity Switch - Optical Encoder combination. The Ultrasonic Sensor configuration measures roll diameter directly (See Figure 2). The Proximity Sensor configuration counts the number of roll revolutions. This value, plus the web thickness, enables the TCD 600 to estimate the roll diameter (See Figure 3). The Proximity Switch - Optical Encoder combination accurately calculates the roll diameter by measuring the amount of web paid out for each revolution of the roll.

The TCD 600 provides three output signals: two for control, 4-20 mA and 0-10 VDC, and one for monitoring, 0-5 VDC. The 4-20 mA output signal is typically used with Nexen Electro-Pneumatic Converters to vary the air pressure applied to air actuated tension brakes and clutches. The 0-10 VDC output signal is often used as a speed or torque reference voltage for motor drive controllers or is used with power supplies for electric brakes or clutches. The 0-5 VDC output signal provides a way to remotely monitor roll diameter; 0 VDC corresponds to the roll core, and 5 VDC corresponds to a maximum diameter roll. In addition, two contact outputs are available for use as user specified minimum and maximum roll diameter alarm outputs.



INSTALLATION

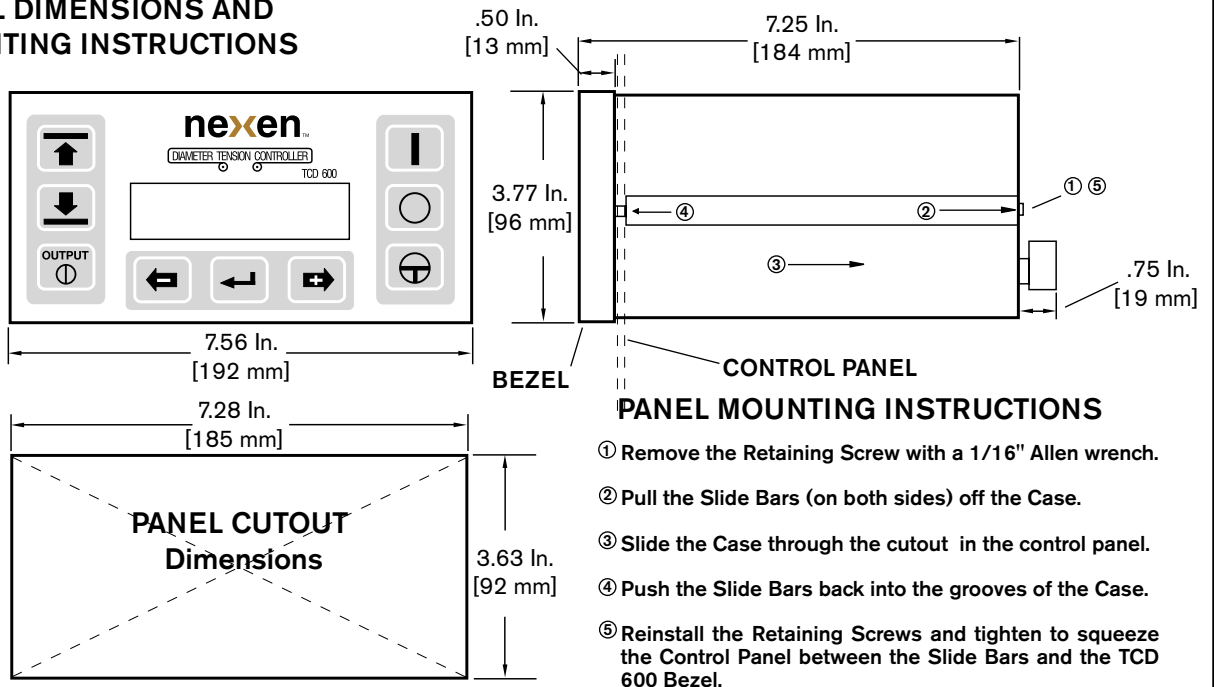
CONTROLLER POSITIONING

The TCD 600 Controller should be mounted in a location that will allow convenient use for the operator.

CAUTION

The TCD 600 is an electronic component and should be mounted in a shock and vibration free area which has an ambient temperature of less than 120° F [50° C] and more than 32° F [0° C].

PANEL DIMENSIONS AND MOUNTING INSTRUCTIONS



MOUNTING BRACKET DIMENSIONS

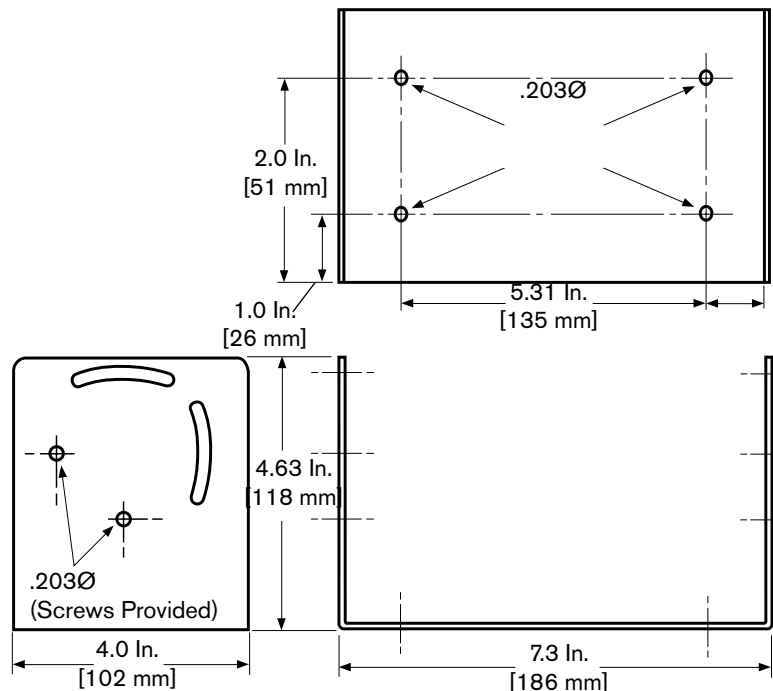


FIGURE 5

(continued...)

SENSOR MOUNTING

An Ultrasonic Sensor can measure the change in roll radius by bouncing soundwaves off the material, enabling the TCD 600 to calculate roll diameter. For calibrations to be accurate, the sensor must be installed perpendicular to the axis of the wind or unwind shaft. Also, the Ultrasonic Sensor must be mounted at least four inches [100mm] away from the maximum diameter roll.

ADJUSTMENT OF THE ULTRASONIC SENSOR

Nexen's Ultrasonic Sensor is factory adjusted for a 4 to 40 inch range and typically does not require re-adjustment prior to use. If a shorter range is desired, then re-adjustment may be performed by connecting a voltmeter to the sensor's output and turning P1 for the near point adjustment and P2 for the far point adjustment. (See figure 6) Adjust P1 and P2 until the output voltage covers as much of the 0 to 10 VDC range as possible over the desired distance.

NOTE: The indicator on the end of an Ultrasonic Sensor shows an indication of signal strength. The indicator will light GREEN when a target is out of range, and fades to RED as a target moves into range, depending on how much reflected signal it receives from a target.

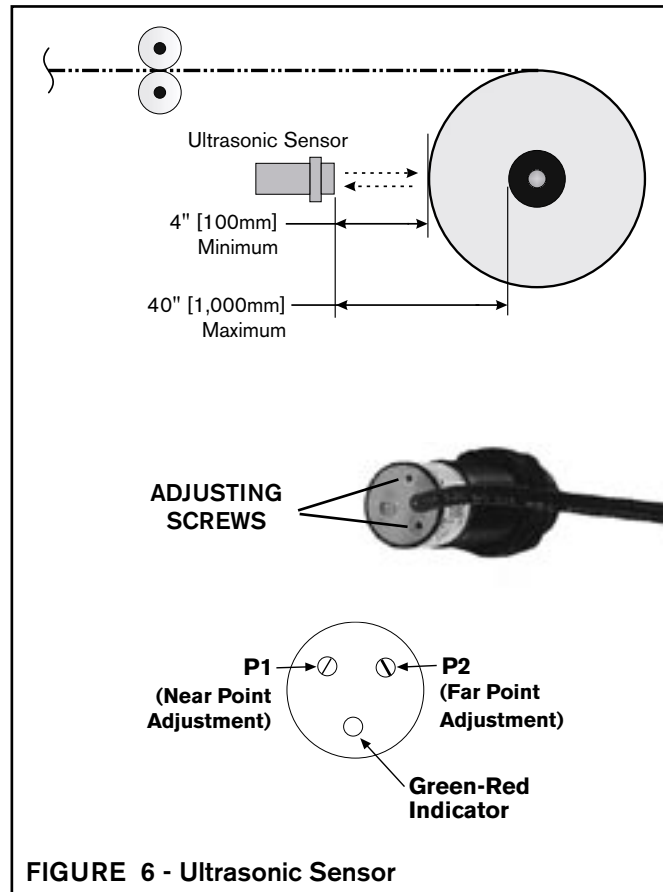


FIGURE 6 - Ultrasonic Sensor

A Proximity Switch (See Figure 7) is designed to count revolutions as the roll turns by sensing an iron or steel target once every revolution. Mount the Proximity Switch to a secure, nonrotating member and set the gap between the Nexen Proximity Switch and the target to .20 to .40 inch (5.1 - 10.3mm).

The target must be large enough to trigger the switch and can be mounted to the roll shaft or any other mechanical component that rotates at the same speed as the roll.

When using an Optical Encoder along with a Proximity Switch (See Figure 8), precise diameter measurement of the roll can be achieved.

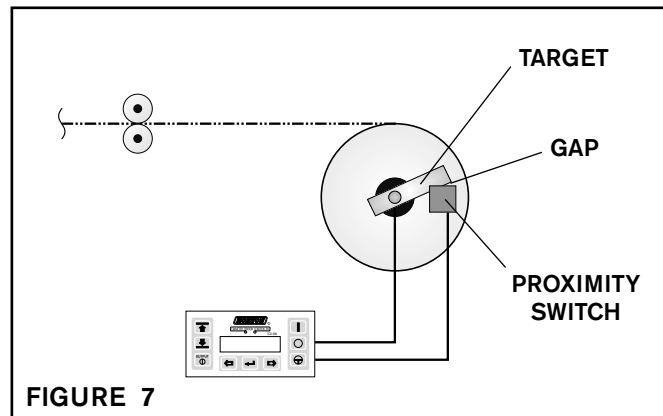


FIGURE 7

The Optical Encoder is coupled to a measuring wheel which, when rotated one full turn, equals 12 inches. The Optical Encoder translates this rotation into 100 pulses per foot. As a result, the Optical Encoder must be mounted so as to ensure that the measuring wheel rotates at the same speed as the web moving through the machine. A good mounting location would have the measuring wheel making contact with one of a pair of nip rollers, because the pressure between these rollers ensures that there will be no slippage between the web surface and the roll surface. However, the wheel should NOT make direct contact with the web as that might scratch or mar the surface of the web.

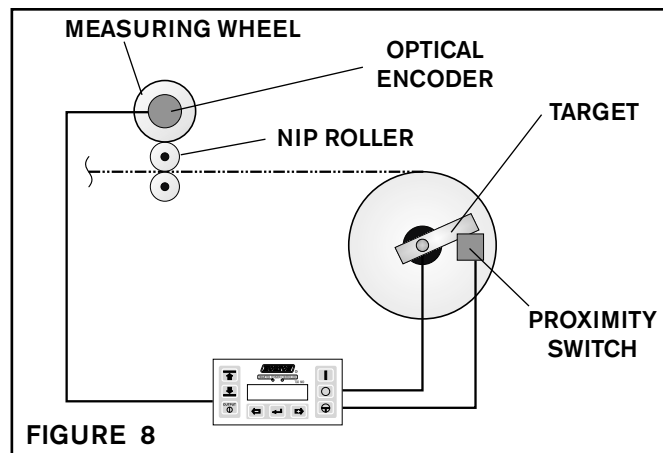


FIGURE 8

ELECTRICAL CONNECTIONS

WARNING

Before connecting any wires, be sure that AC power is turned off, locked and proper signage applied according to safety regulations. All wiring must be shielded or run through conduit. Wire runs are to be no more than 300 feet. Connect all wires to the terminal strip on the back panel of the TCD 600 (See Figure 9). Avoid splicing wires.

CAUTION

Observe polarity when connecting any devices marked + and -.

CAUTION

Make sure the AC Select Switch is in the proper position, or damage could result to the TCD 600 (See Figure 9).

Refer to Figure 10A and 10B for all electrical connections.

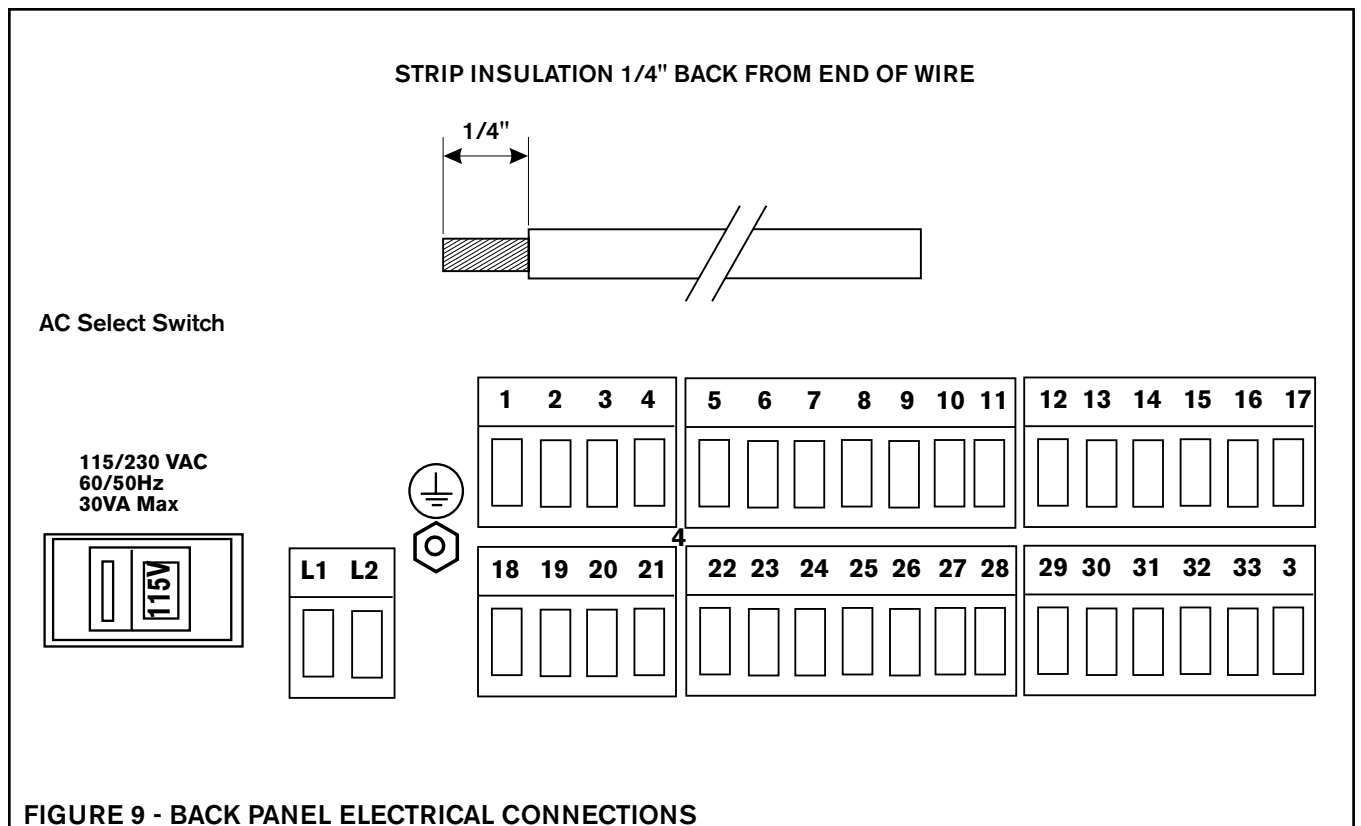
All wires to be inserted into the modular connectors must be prepared ahead of time by stripping the insulation 1/4" from the end of the wire (See Figure 9). Twist the end of each wire to be sure there are no loose or frayed strands. Unplugging the modular connectors will make wiring easier.

CAUTION

Wires must be stripped to the proper length to avoid electrical shorting.

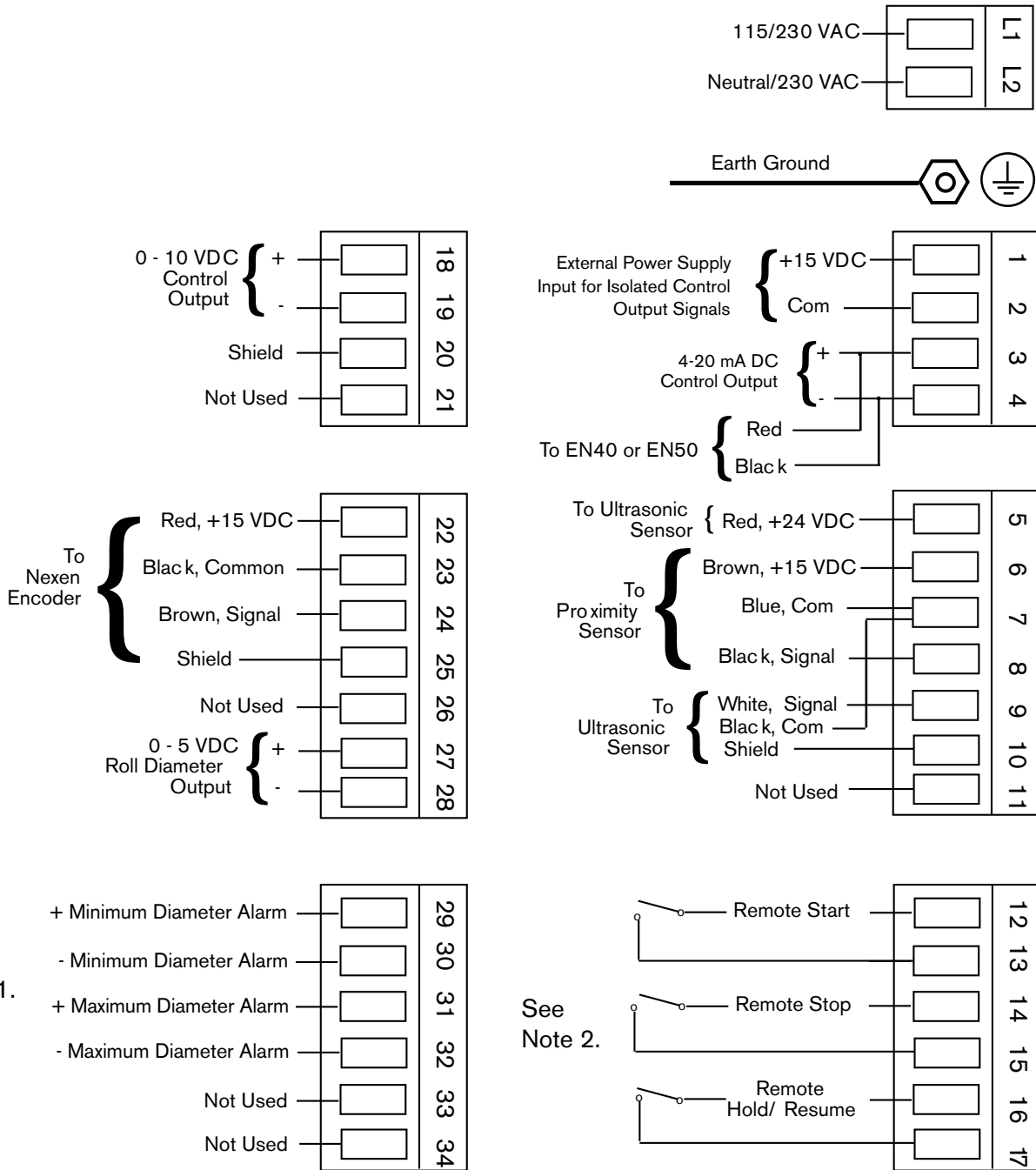
After making all the connections, double-check each one for accuracy and clamping tightness.

Apply AC power.



(continued...)

**ELECTRICAL CONNECTIONS
(TCD 600 Back Panel)**

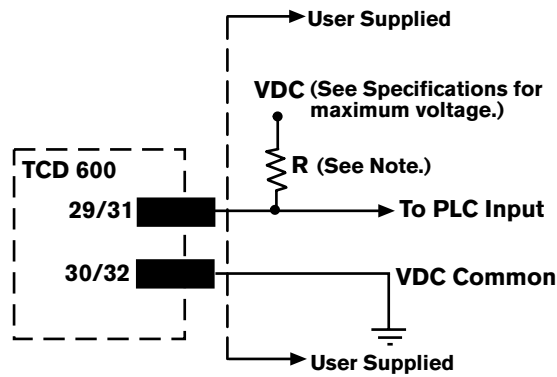


- Notes: 1. See Alarm Output Connection Diagrams on page 6.
 2. Remote contact closures are momentary only.
 3. Shield all signal wiring and keep away from wires carrying heavy loads or AC supply power.

FIGURE 10A

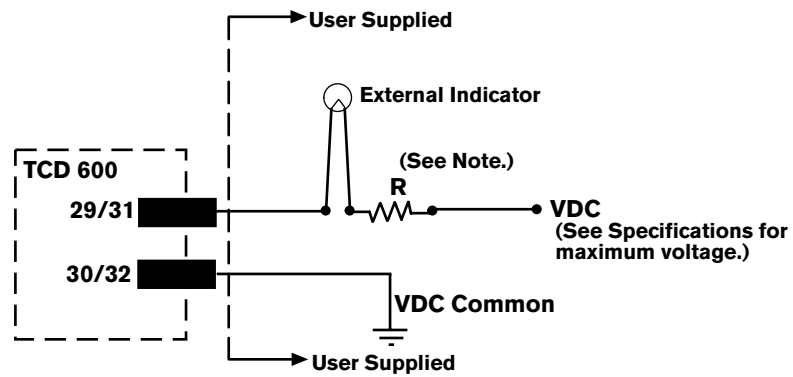
(continued...)

TCD 600 ALARM OUTPUT CONNECTION DIAGRAMS



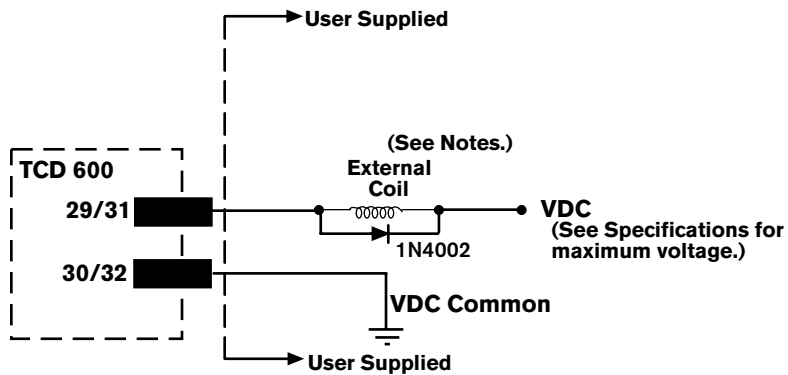
NOTE: The minimum value of resistor (R) is 10 x VDC.

Alarm Output Tied to PLC Input.



NOTE: The minimum value of Resistor (R) is equal to VDC divided by the maximum current limit of the Indicator.

Alarm Output Tied to External Indicator



NOTES: 1. Be sure the current requirement of the External Coil does not exceed the capability of the alarm output ()
 2. Any inductive load, such as a relay coil, must have a 1N4002, or equivalent, diode across it as shown.

Alarm Output Tied to External Inductive Coil

FIGURE 10B

TCD600 ISOLATED OUTPUTS

The 0 -10 VDC and 4 - 20 mA tension control outputs can be isolated from the TCD600's power supply. This is often done when connecting the outputs to a motor drive system or whenever there is a concern about ground loops causing electrical noise problems. A 15 VDC power supply is required and connects to terminal block positions 1 and 2, see figure 10A. The TCD600 is shipped in the non-isolated setting. Two internal jumpers, JP1 and JP2, must be set before the control outputs can be isolated. Refer to the following procedure to change the setting.

Note: Only the tension control outputs can be isolated. The diameter output signal can not be isolated from within the TCD600.

Changing the Output Isolation Setting

1. Disconnect all electrical power from the TCD600.
2. Remove all terminal block plug connectors from the back of the TCD600.
3. Remove six fasteners from the back nomenclature panel.
4. Remove the upper left hand fastener from the front membrane switch panel. (See figure 10C)
5. Pull the top panel of the enclosure toward the back until it is completely removed.
6. Locate JP1 and JP2 on the printed circuit board.
7. Set the jumpers for the desired setting. (See figure 10D.)
8. Replace the top cover, back nomenclature panel and all fasteners.
9. Plug the connectors back into the terminal blocks.
10. Connect the 15 VDC power supply to terminal block terminals 1 and 2.

(Terminal 1: +15 VDC Terminal 2: DC common)

11. Reconnect electrical power to the TCD600.



FIGURE 10C

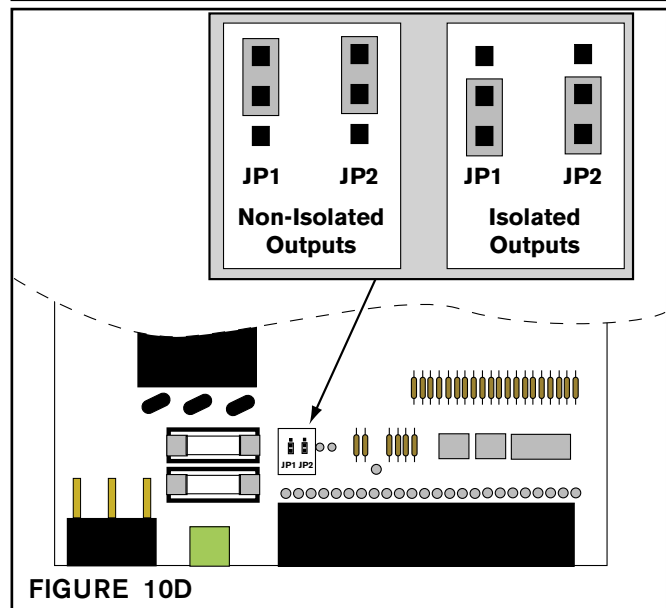


FIGURE 10D

GLOSSARY OF TERMS

Sonic	Ultrasonic Sensor
Prox	Proximity Sensor
Prox Encod	Proximity Sensor-Encoder combination
Counts	For Prox encoder combination only, counts represent the number of pulses generated by the encoder during 100 inches of web travel.
Full Roll	Diameter of the largest roll used within the range of 0 to 70 inches (0 to 1778 mm).
Setpoint	Percentage of controlled output applied to the brake, clutch or drive at full roll diameter; Setpoint adjustment range is 0 to 100%.
Hold Torque	Percentage of controlled output used in several different ways. For Unwind applications, when the web is not moving, it is used to apply a constant output which holds the roll stationary and prevents slack webs. At the beginning of a run, Hold Torque is maintained for the duration of Start Time, enabling the process to have a lower brake torque as the roll is accelerating. For Wind applications, Hold Torque provides sufficient torque during Start Time to enable the winding process to begin. Hold Torque adjustment range is 0 to 100%.
Strt Time	(Start Time) During Start Time, the TCD 600's output is determined by the Hold Torque Value. This value is maintained for the duration of the Start Time period, enabling the process to have a lower torque while the roll is accelerating, thus providing a smooth startup of the process and preventing web breaks. Start Time has an adjustment range of 0 to over 200 seconds.
Taper	Used only in Wind applications, Taper starts the roll, at core, with a higher tension value, then automatically decreases this tension as the roll diameter increases. Taper affects the original Setpoint value by gradually taking away from the Setpoint a percentage of its value. The amount of Taper can be adjusted within a range from 0 to 86.5%.
Stop Mult	(Stop Multiplier) During a stop cycle of an Unwind application, the current output value is multiplied to produce sufficient torque to completely stop a roll. The Stop Multiplier can be adjusted to a value from 1 to 9.9.
Stop Time	Stop Time is the length of time that the Stop Multiplier Torque value is applied, and can be adjusted from 0 to over 200 seconds.
Diam Hyst	(Diameter Hysteresis) This feature is used to enable the TCD 600 to ignore the changes in roll radius created by out-of-round or egg-shaped rolls. The Diameter Hysteresis can be adjusted from 0 to 2.55 inches (0 to 25.5 mm).
Idiam	(Initial Diameter) This is used with Proximity Sensor only systems for both Wind and Unwind applications. This value is the actual diameter of the roll or core at the start of a job, and must be entered to ensure proper operation. The value of Idiam can be adjusted from 0 to 650 inches (0 to 6500 mm).
Thick	Web thickness -- also used with Proximity Sensor only systems. The TCD 600 uses the Initial diameter and the Thickness to estimate the roll's diameter by subtracting or adding one "thickness amount" for every revolution of the roll. Thick can be adjusted from 0 to 1.0 inches (0 to 25.4 mm).
Min Dia Alrm	(Minimum Diameter Alarm) This is used for Unwind applications where an alarm output is triggered when the roll size has decreased to a specified diameter; adjustment range is 0 to 650 inches (0-6500mm).
Min Alarm: [NC] NO	Minimum Alarm Configuration; Minimum Diameter Alarm output can be configured for Normally Closed (NC) or Normally Open (NO) operation.
Min Out	Minimum Output is used only for Wind applications that use a clutch. This feature sets a minimum output level to overcome the mechanical force of the clutch for engaging.
Max dia Alrm	(Maximum Diameter Alarm) This is used for Wind applications where an alarm output is triggered when the roll size has increased to a specified diameter; its adjustment range is 0 to 650 inches (0-6500mm).
Max Alarm: [NC] NO	Maximum Alarm Configuration; Maximum Diameter Alarm output can be configured for Normally Closed (NC) or Normally Open (NO) operation.
Accept Changes Y [N]	After entering in new information, the TCD 600 will ask if the changes should be accepted; select Yes (Y) or No (N).

SETUP PROCEDURE

The front panel of the TCD 600 has nine function buttons and a two-line display (See Figure 11).

The TCD 600 has a feature that locks out access to certain setup and calibration functions. Upon powering up, the operator has access to the Standby Mode, Run Mode, and the Setup Mode. **To gain full access for setting up and calibrating, press the Nexen Logo button while simultaneously pressing the Stop button and hold them until SETUP ENABLE appears on the display.** Full access allows changes to be made to the Machine parameters and sensor calibration. This access is allowed until the unit is powered down or until the same key sequence is repeated.

Pressing the Select Upper button causes the top line of the display to step through the operation modes - Run Mode, Setup Mode, Calibration Mode and back to Standby Mode.

Pressing the Select Lower button, while in the Standby Mode, will enable you to quickly view the parameter settings of the current loaded job. These settings cannot be changed while in the Standby Mode.

Pressing the Select Lower button, while in Automatic Run Mode, will enable you to view and change the following job parameters: Setpoint, Taper %, and Diam Hyst (Diameter Hysteresis).

Pressing the Minus and Plus buttons enables you to select values while in Run Mode, Setup Mode, and Calibration Mode. Selected values are displayed inside brackets ([]). The Enter button is used to enter values (or customized settings) into the TCD 600's memory.

Pressing the Output button toggles on and off the output signal being sent from the TCD 600 to a Motor Controller or a pneumatic device for clutches and brakes. During the Setup and Calibration Modes, you may want to keep the Output turned Off. Also, to allow free movement, the Output should be Off whenever a roll is being changed.

The rest of the buttons will be explained in the RUN MODE section of this manual.

Parameter default settings for Wind and Unwind applications are listed on the Quick Reference Worksheets on Pages 13 - 15. The Worksheets also provide space for you to write in your own settings; this can be useful during Setup.

The parameters for the Setup and Calibration Modes must be set to the specifications of the job to be run: first, in Setup Mode, enter the Machine parameters; next, the Job parameters; and finally in Calibration Mode, enter the Calibration Mode parameters.

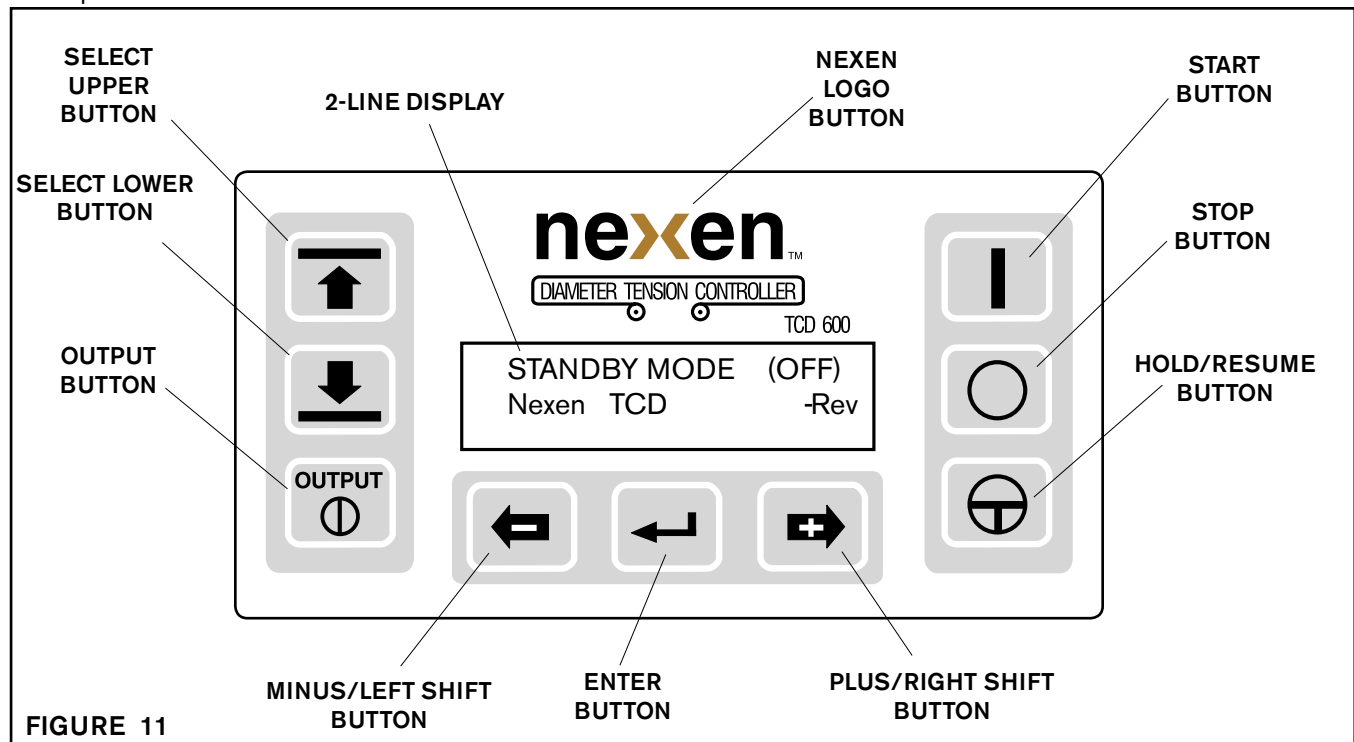


FIGURE 11

(continued...)

SETUP PROCEDURE (continued...)

SETUP MODE - MACHINE SETUP

NOTE: To gain access to Machine setup, press the Nexen logo button while simultaneously pressing the STOP button and hold them until SETUP ENABLE appears on the display.

1. Press the Select Upper button until you reach Setup Mode (See Figure 12). The parameters in Setup Mode are set when the machine is initially installed or when the machine is modified. Press the plus or minus buttons to select Machine. Then press Enter.
2. The lower display line will advance to Language (See Figure 13). Press the plus or minus button to select the desired language, then press Enter.
3. The lower display line will advance, prompting you to select millimeters or inches (See Fig. 14). Press the plus or minus button to select the desired measurement; then press Enter.
4. The lower display line will advance, prompting you to select wind or unwind (See Figure 15). Wind controls tension during the increase in the diameter of a roll, and Unwind controls tension during the decrease in the diameter of a roll. Press the plus or minus button to select WIND or UNWIND, then press Enter.
5. The lower display line will advance, prompting you to select the type of sensor to be used. The selections are Sonic, which stands for Ultrasonic Sensor; Prox, which stands for proximity sensor, or Prox-Encod, which stands for Proximity Sensor - Optical Encoder (See Figure 16). Press the plus or minus button to select the proper type of sensor, then press Enter.

NOTE: When the Prox-Encod combination is selected, the lower display will advance, revealing the following (Counts: 00833/100 in [2540mm]). If you are using a Nexen Optical Encoder this information is the Factory default setting, and you can proceed to the next step by pushing Enter. If you are using another Optical Encoder you will have to calculate the number of pulses per 100 in [2540mm] of web length and replace the default value (00833) with your calculated value.

Example: The Nexen Optical Encoder is attached to a 12in [305mm] circumference wheel. This wheel contacts a roller that is moving at the same speed as the web. For every 12 in [305mm] of web that passes by, the Encoder produces 100 pulses. Use the following formula to calculate the new number: (100 multiplied by number of pulses per revolution of the encoder) divided by the number of inches of web length per revolution of the encoder.

Example: (100 in. [2540mm] x 100 pulses per rev.) / 12 inches [305mm] per rev. = 00833.

Press the plus or minus buttons to change the default value to your calculated value, then press Enter. The upper display line will now return to the Setup Mode.

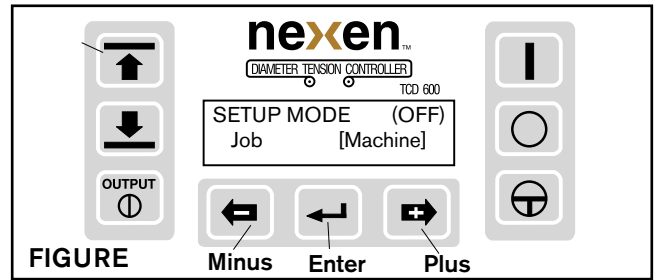


FIGURE 12

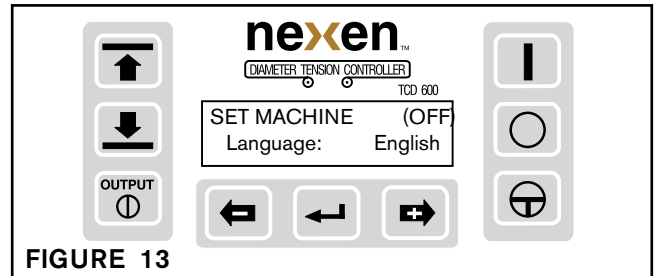


FIGURE 13

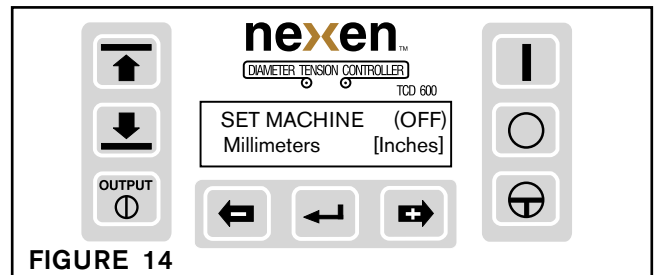


FIGURE 14

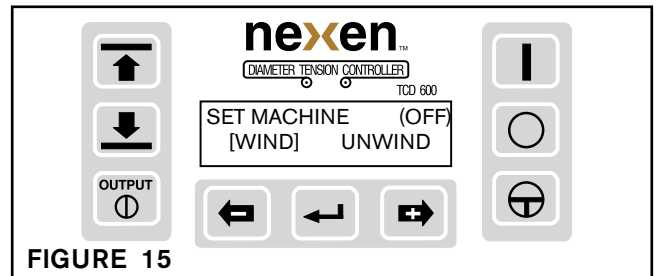


FIGURE 15

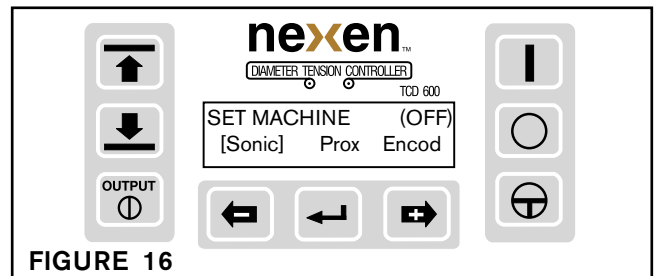


FIGURE 16

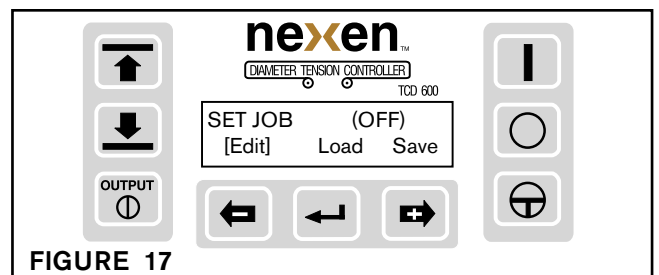


FIGURE 17

(continued...)

SETUP PROCEDURE (continued...)

SETUP MODE - JOB SETUP

1. Press the minus button to select Set Job, then press Enter. The upper display line changes to Set Job and the lower display line allows you to select Edit, Load or Save (See Figure 17). Select Edit and press Enter.
2. The upper line advances to Edit Job. The lower line, displaying Full Roll, will scroll through a list of parameters that can be set for the specific job (See Figure 18). For example, to change the value of the Full Roll parameter, press the plus or minus buttons to set the size of the full roll diameter. Then press Enter and the next parameter will appear on the lower line, which will be Setpoint.

Use the Quick Reference Worksheets on Pages 13 -15 to enter the settings for the rest of the parameters. For explanations of the parameters see the Glossary of Terms.

3. After stepping through and setting all of the parameters, you are then prompted to accept the changes you have made (See Figure 19). If you are not ready to accept them or want to reset the parameters to default values, select N for no and press Enter. You will be returned to the beginning of the Set Job Mode.

If you are ready to accept the changes you have made, select Y for yes and press Enter. The display will return to the Set Job Mode.

4. The TCD 600 can store up to 5 different jobs into memory. Press the plus or minus button to select Save, then press Enter (See Figure 20).
5. Using the plus or minus button, select the number for the job that is to be saved. Choose from Job 1 through Job 5, then press the Enter button (See Figure 21).
6. The display will prompt you to overwrite any previous job you may have entered (See Figure 22).
7. Press the plus or minus button to select Y for yes, then press Enter and the display will confirm the save (See Figure 23).



FIGURE 18

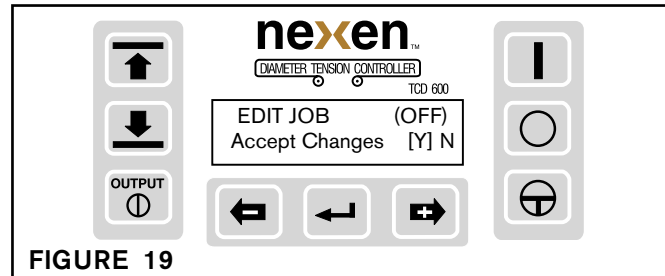


FIGURE 19



FIGURE 20

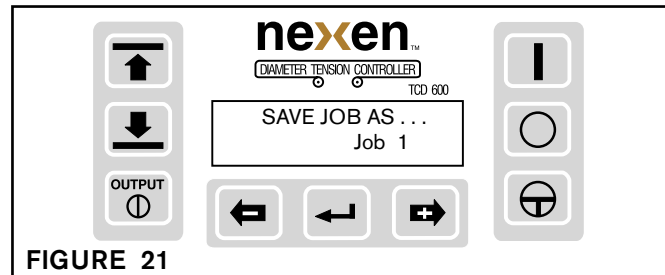


FIGURE 21

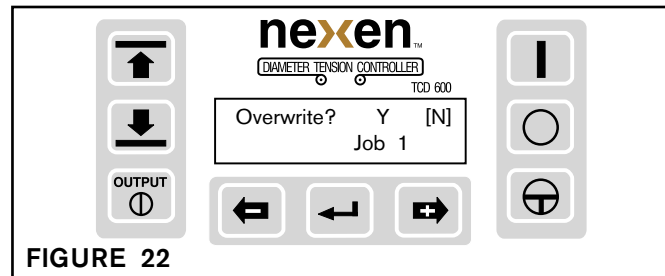


FIGURE 22

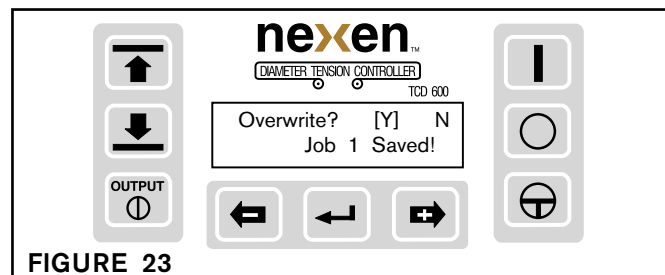


FIGURE 23

(continued...)

SETUP PROCEDURE (continued...)

- The display returns to Set Job. Press EDIT again to edit JOB 2, and repeat this procedure up to JOB 5 if needed. Or, press Load to recall previously saved job settings to use for a job you want to run now. Press the plus or minus button to select Load, then press Enter (See Figure 24).
- You can then choose to load either the default job or any of 5 previously saved jobs. Press the plus or minus button to select the desired job (See Figure 25), then press Enter; the display will confirm that the selected job is loaded, then it will return to the Set Job Mode.

Calibration Mode

NOTE: Diameter calibration for the ultrasonic sensor, is only required for the initial setup of the machine, or if the ultrasonic sensor has been moved.

To gain access to Machine setup and diameter calibration, press the Nexen logo button while simultaneously pressing the STOP button and hold them until **SETUP ENABLE** appears on the display (See Figure 11).

- Using the Select Upper button, advance the top line of the display to Calibration Mode (See Figure 26). Using the plus or minus buttons, select Edit, then press the Enter button.
- Diam will appear in the display (See Figure 27). Press Enter.

NOTE: The following procedure (Steps 3-6) applies only to the Ultrasonic Sensor. Advance to Step 7 to calibrate a Proximity Switch Sensor or Proximity Switch-Encoder sensors.

- Slide an empty core onto the roll shaft, so it is seen by the Ultrasonic Sensor.
- CAL DIAMETER, Core Diam: will appear in the display (See Figure 28). Using the plus or minus button, enter desired core diameter, then press the Enter button. Computing will appear in the display for a few seconds, then the display will advance to the next step (See Figure 29).
- Remove empty core, slide on a maximum-diameter roll so it is seen by the Ultrasonic Sensor.

Rolls of less than the maximum diameter can be used. In these instances, enter the actual diameter when prompted for Max Diam.

- CAL DIAMETER, Max Diam: will appear in the display (See Figure 30). Using the plus or minus button, enter the maximum roll diameter then press the Enter button. Computing will appear in the display for a few seconds (See Figure 29), then the display will return to the CAL MODE (See Figure 26). Advance to Step 11 to enable lockout.

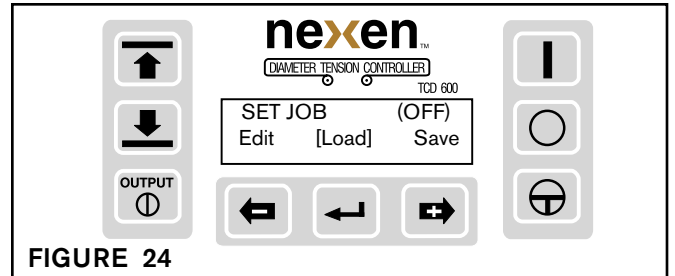


FIGURE 24

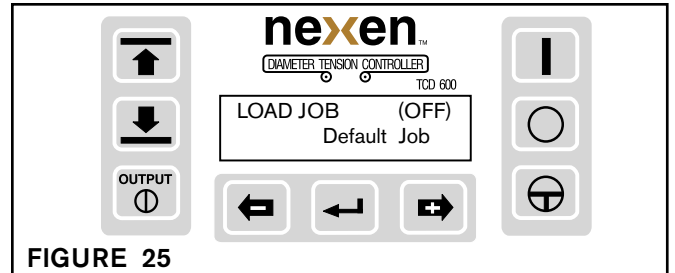


FIGURE 25

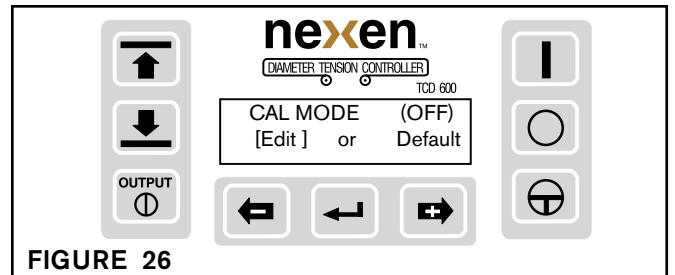


FIGURE 26

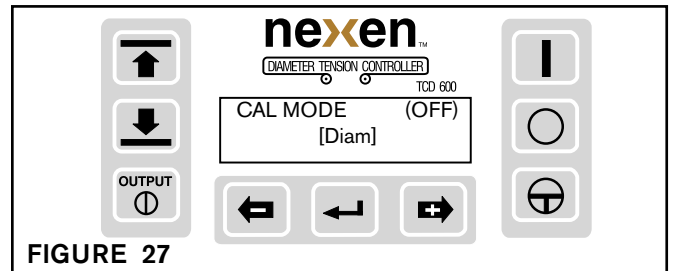


FIGURE 27

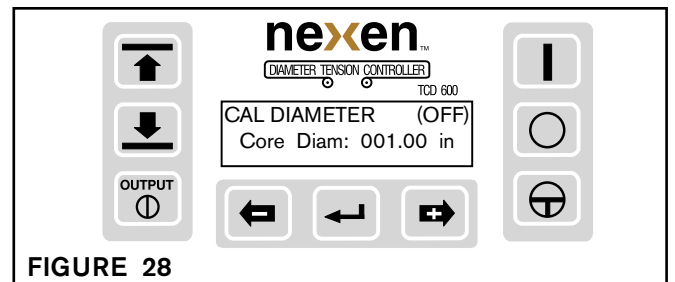


FIGURE 28

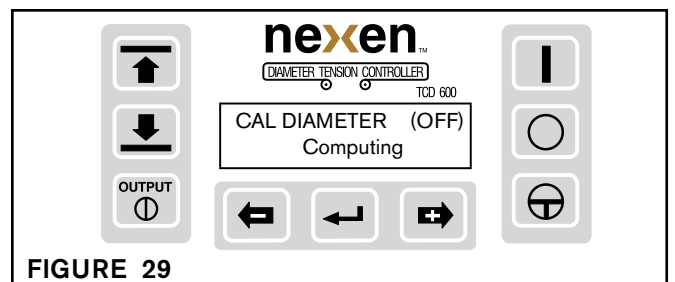


FIGURE 29

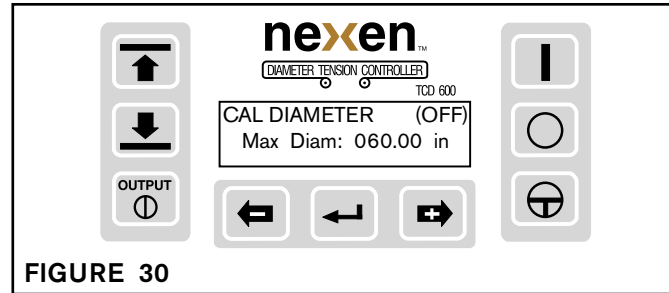
(continued...)

SETUP PROCEDURE (continued...)

CALIBRATION MODE - (continued...)

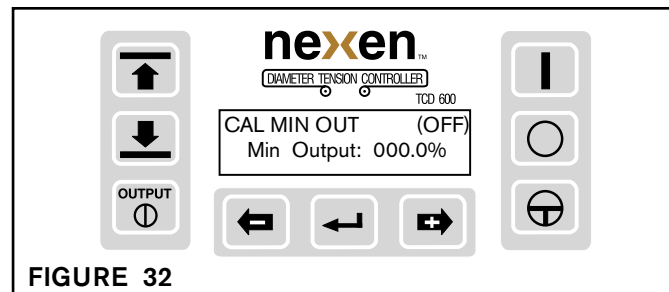
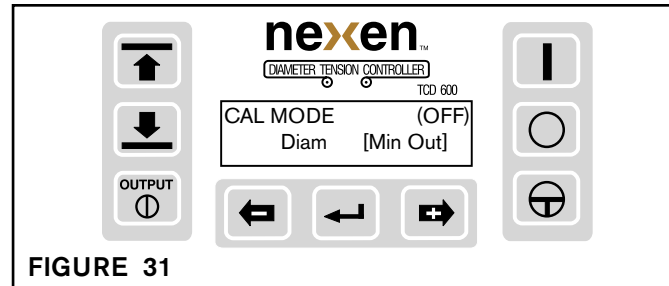
NOTE: The following procedure is for either the Proximity Switch system or the Proximity Switch-Encoder system.

- CAL DIAMETER, Core Diam: will appear in the display (See Figure 28). Using the plus or minus button, enter the desired core diameter then press the Enter button.
- CAL DIAMETER, Max Diam: will appear in the display (See Figure 30). Using the plus or minus button, enter the desired maximum diameter then press the Enter button.



NOTE: Minimum Output is used only for Wind applications that use air-actuated clutches. This feature enables you to adjust the minimum TCD 600 output needed to overcome the mechanical characteristics of the clutch; e.g., a release spring. If not used, advance to step 11 to enable lockout.

- CAL MODE, Diam [Min Out]: will appear in the display (See Figure 31). Using the plus or minus button, select Min Out then press the Enter button.
- CAL MIN OUT, Min Output: will appear in the display (See Figure 32). Using the plus or minus button, adjust the output until the clutch is fully engaged, then decrease the value until the clutch is slightly disengaged and press the Enter button.
- After calibration is completed, simultaneously press and hold the Nexen and Stop buttons for 3 seconds to enable the lockout feature and prevent any unintended changes to the calibration settings.



QUICK REFERENCE SETUP AND CALIBRATION WORKSHEET

	DEFAULT	JOB 1	JOB 2	JOB 3	JOB 4	JOB 5
SETUP MODE [Set Machine]						
Language: English *	English					
Millimeters Inches	Inches					
Wind Unwind	Wind					
Sonic Prox Prox Encod	Sonic					
Counts: <i>(For Prox and Prox Encod Sensors Only)</i>	00833/100 in					
SETUP MODE [Set Job]						
Wind Applications, Sonic Sensor						
[Edit Job] (Parameters)						
Full Roll:	060.00 in					
Setpoint:	010.0 %					
Hold Torque:	010.0 %					
Strt Time:	003.0 sec					
Taper:	000.0 %					
Diam Hyst:	0.10 in					
Min Dia Alm:	006.00					
Min Alarm:	NC					
Max Dia Alm:	050.00					
Max Alarm:	NC					
Accept Changes (Yes or No)	Y [N]					
Wind Applications, Prox Sensor						
[Edit Job] (Parameters)						
Full Roll:	060.00 in					
Setpoint:	010.0 %					
Hold Torque:	010.0 %					
Strt Time:	003.0 sec					
Taper:	000.0 %					
IDiam:	006.00 in					
Thick:	0.0050 in					
Min Dia Alm:	006.00					
Min Alarm:	NC					
Max Dia Alm:	050.00					
Max Alarm:	NC					
Accept Changes (Yes or No)	Y [N]					

* Additional Languages include Spanish and French; other languages may be included later; contact Nexen for details.
Note: Refer to Glossary of Terms for explanations of the parameters.

QUICK REFERENCE SETUP AND CALIBRATION WORKSHEET

	DEFAULT	JOB 1	JOB 2	JOB 3	JOB 4	JOB 5
Wind Applications, Prox Encod Sensor						
[Edit Job] (Parameters)						
Full Roll:	060.00 in					
Setpoint:	010.0 %					
Hold Torque:	010.0 %					
Strt Time:	003.0 sec					
Taper:	000.0 %					
Diam Hyst:	010.0 in					
Min Dia Alarm:	006.00					
Min Alarm:	NC					
Max Dia Alarm:	050.00					
Max Alarm:	NC					
Accept Changes (Yes or No)	Y [N]					
Unwind Applications, Sonic Sensor						
[Edit Job] (Parameters)						
Full Roll:	060.00 in					
Setpoint:	010.0 %					
Hold Torque:	010.0 %					
Stop Mult:	01.0X					
Stop Time:	003.0 sec					
Start Time:	003.0 sec					
Diam Hyst:	0.10 in					
Min Dia Alarm:	006.00					
Min Alarm:	[NC] NO					
Max Dia Alarm:	050.00					
Max Alarm:	[NC] NO					
Accept Changes (Yes or No)	Y [N]					
Unwind Applications, Prox Sensor						
[Edit Job] (Parameters)						
Full Roll:	060.00 in					
Setpoint:	010.0 %					
Hold Torque:	010.0 %					
Stop Mult:	01.0X					
Stp Time:	003.0 sec					
Strt Time:	003.0 sec					
IDiam:	60.0 in					
Thick	0.005 in					
Min Dia Alarm:	006.00					
Min Alarm:	[NC] NO					
Max Dia Alarm:	050.00					
Max Alarm:	[NC] NO					
Accept Changes (Yes or No)	Y [N]					

Note: Refer to Glossary of Terms for explanations of the parameters.

QUICK REFERENCE SETUP AND CALIBRATION WORKSHEET

	<i>DEFAULT</i>	<i>JOB 1</i>	<i>JOB 2</i>	<i>JOB 3</i>	<i>JOB 4</i>	<i>JOB 5</i>
Unwind Applications, Prox Encod Sensor						
[Edit Job] (Parameters)						
Full Roll:	060.00 in					
Setpoint:	010.0 %					
Hold Torque:	010.0 %					
Stop Mult:	01.0X					
Stp Time:	003.0 sec					
Strt Time:	003.0 sec					
Diam Hyst:	0.10 in					
Min Dia Alrm:	006.00					
Min Alrm:	[NC] NO					
Max Dia Alrm:	050.00					
Max Alrm:	[NC] NO					
Accept Changes (Yes or No)	Y [N]					
CAL MODE						
[Edit]						
Diam Min Out	Diam					
Core Diam:	001.00 in					
Max Diam:	060.00 in					
Min Output:	000.0 %					
SETUP MODE [Set Job]						
[Save]		Job 1	Job 2	Job 3	Job 4	Job 5
SETUP MODE [Set Job]						
[Load]	Default Job	Job 1	Job 2	Job 3	Job 4	Job 5

Note: Refer to Glossary of Terms for explanations of the parameters.

OVERVIEW

The TCD 600 is an open loop controller that maintains constant tension by changing its output as the diameter of the roll changes. This controlled output can be used for wind or unwind applications. The TCD 600 can be used to control air-actuated clutches and brakes or as a trim signal to control motor drives. The TCD 600 can calculate the roll diameter by using any of three sensor configurations: Ultrasonic, Proximity, or Proximity-Encoder.

The TCD 600's Setpoint determines the amount of output to be applied to the brake, clutch or drive at maximum roll diameter (See Figure 33). If the Setpoint is adjusted to maximum, 100%, then maximum output will be applied when the roll is at its maximum diameter. When the Setpoint is adjusted for less than maximum, the output at maximum roll diameter will be proportionately less. This Setpoint value can be changed during actual operation by using the plus or minus buttons to increase or decrease the Setpoint to fine tune the tension.

To maintain constant tension, it is necessary to vary the output level with the change in roll diameter. The TCD 600 applies a correction based upon a diameter calculation and proportionately increases the output level as a wound roll builds up, or decreases the output level as an unwind roll becomes smaller.

The Setpoint setting will be different for each type and each width of material run on a specific machine. Therefore, Setpoint must be determined by experimentation. As experience is gained on a particular machine, determining the Setpoint for a given job will become easier.

Output level (as illustrated in Figure 33) is decreased all the way to theoretical zero diameter. Of course, the roll only decreases to core diameter; thus, there is a positive output level applied at the core diameter, allowing constant tension control from maximum roll diameter down to the core.

Some winding operations require taper tension, a relatively higher web tension applied at the core which gradually decreases as the wound roll builds in size (See Figure 34).

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

Taper tension is achieved by adjusting the Taper setting in the Job Edit mode. The Taper range can be adjusted from 0 to 86.5% of the tension Setpoint. Due to the vast variety of applications involving many different materials, the only way to find the right amount of Taper is through experimentation. Too little Taper will yield telescoped rolls, and too much Taper will yield soft rolls.

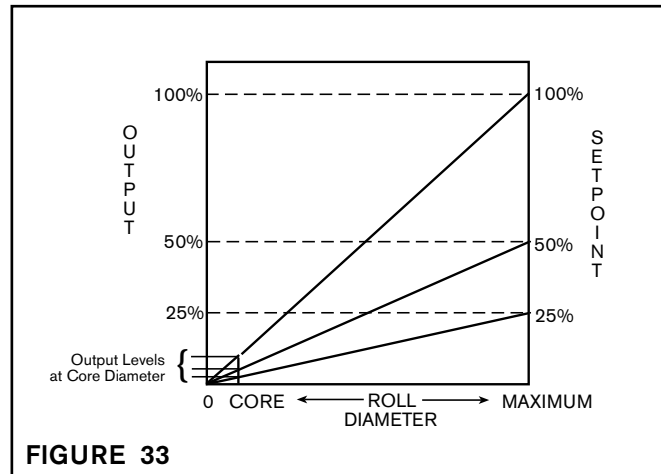


FIGURE 33

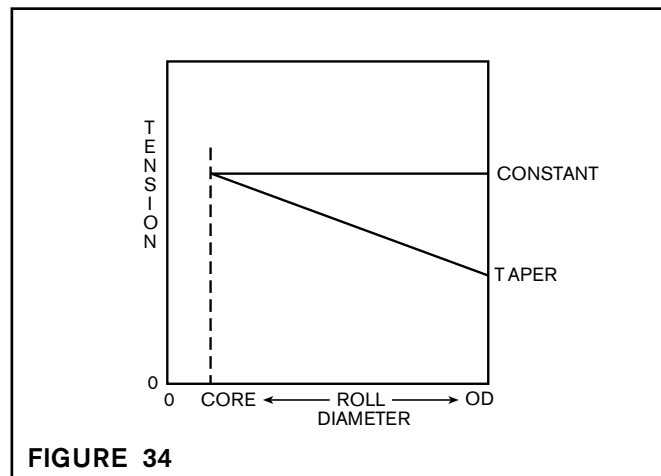


FIGURE 34

(continued...)

NOTE: A Job must be Loaded before operating the TCD 600. Once a Job is Loaded into memory, the TCD 600 will recall this Job on power up.

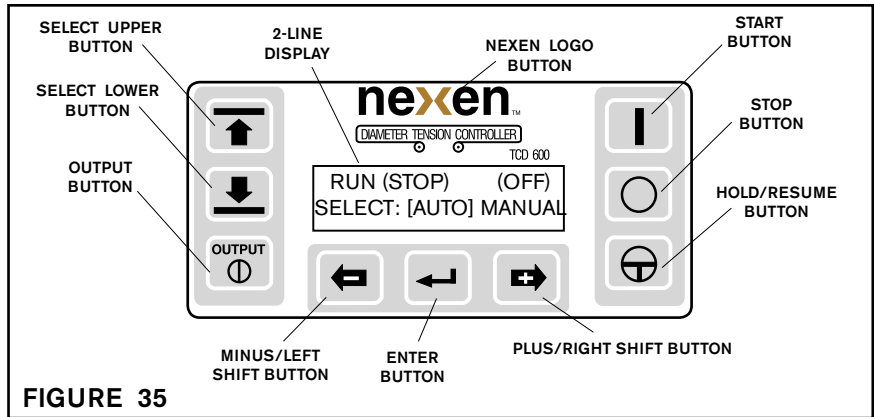


FIGURE 35

LOADING A JOB

Press the Upper Select Button until Set Job is displayed. Next, press the plus or minus button to select Load, then press Enter. Display will advance to Load Job. Now press the plus or minus button to select from Job 1 - Job 5. After selecting a job, press Enter. The display will briefly show Job Loaded, then go back to Set Job.

AUTOMATIC OPERATION

Press the Select Upper button to advance the top line of the display to Run Mode (See Figure 35). Use the plus or minus button to select Auto and press Enter. The display will indicate the currently selected job's hold torque and the current roll diameter (See Figure 36). Make sure that the Output is turned On by pressing the Output button and observing the Output Status Indicator. Press the Start button. The TCD 600 will now automatically run the job using the preset parameters to calculate the roll diameter. The display will indicate the output level and roll diameter.

or

After power up, press the Start button or momentarily close the Start Contact input. The TCD600 will now automatically turn on the output and run the last job that was loaded. The display will indicate the output level and roll diameter (See Figure 37.)

In some situations it is necessary to maintain a steady, unchanging output. By holding down the Hold/Resume button, the output of the TCD 600 will remain constant. When the Hold/Resume button is released, the TCD 600 readjusts the output according to the current roll diameter.

Pressing the Stop button brings the current job to a stop. Press the Hold/Resume button to resume control at the diameter and output levels when the Stop was initiated, as when stopping and restarting in mid-roll. Press the Start button to begin control of a new roll at hold level and start diameter.

NOTE: The Start, Resume, and Stop functions can be controlled remotely using momentary contact closures (See Figure 10a). Using maintained contact closures will prevent the front panel buttons from functioning.

During Automatic mode, the output set point can be adjusted while the process is running (See Figure 37). Use the plus and minus buttons to change the output set point either up or down.

NOTE: The controlled output is represented as a percentage; 100% is full output (i.e., 10 VDC or 20 mA).

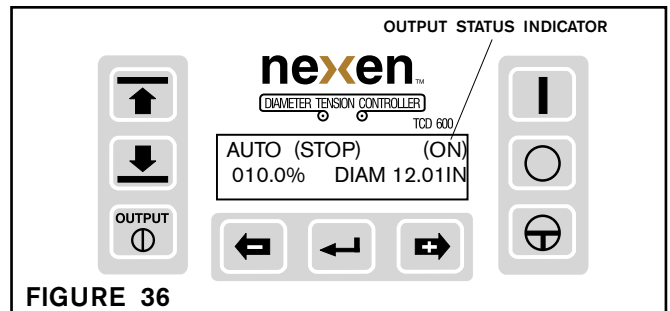


FIGURE 36

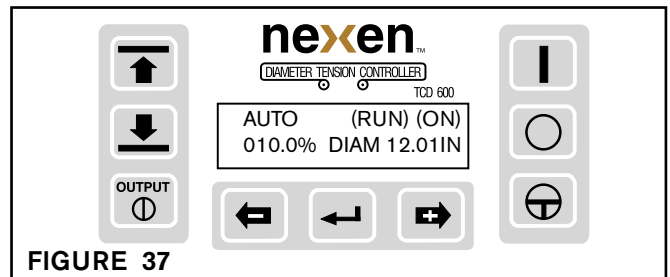


FIGURE 37

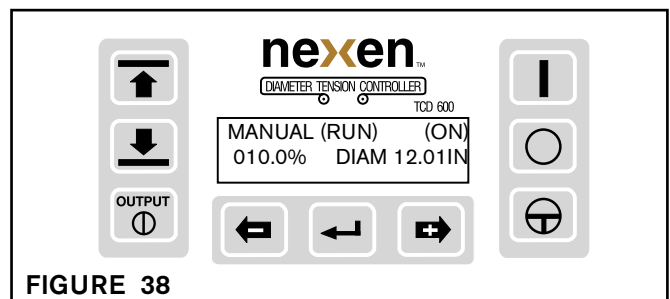


FIGURE 38

MANUAL OPERATION

NOTE: In Manual Mode the output will not change automatically with roll diameter; the operator MUST make all corrections as the roll size changes.

To manually operate the machine, press the Upper Select button to return the top line of the display to the Run Mode (See Figure 37). Use the plus or minus button to select Manual, then press Enter. The display will indicate the set point of the currently selected job and the current roll diameter (See Figure 38). After making sure that the Output is On, press the Start button. While the machine is running, you can vary the output up or down by pressing the plus and minus buttons.

(continued...)

UNWIND APPLICATION

With a full roll on the unwind shaft, the Start contact or button is momentarily closed or pressed to put the TCD600 into Start operation at the same time the machine begins pulling the web. During the Start operation, which lasts for the duration of the Start Time (see figure 39), TCD600's output is at the Hold Torque value that was set as one of the Job parameters. The purpose of the Start value and Timer is to keep the brake torque low while the roll accelerates, thus preventing the web from being over-tensioned during acceleration.

After the Start Timer has expired, the TCD600 enters Automatic Operation. The output level is a function of the roll diameter and the setpoint percentage. As the roll unwinds, the output level will decrease in order to maintain constant tension. If the Hold/Resume contact is closed or the Hold/Resume button is pressed, the output level will remain constant until the contact is opened or the button is released, allowing the TCD600 to return to Automatic Operation.

When the Stop contact is momentarily closed or the Stop button is pressed, the TCD600's output will increase by the number of times set in Stop Mult as one of the Job parameters. This increased level will be maintained for the duration of the Stop Time to provide the additional braking torque needed to decelerate the roll. After the expiration of Stop Time, the output level will return to the value it had before the stop. If the Hold/Resume contact is then closed or the Hold/Resume button is momentarily pressed, the output level will remain at the pre-stop value for the duration of the Start Time. However, if the Start contact is closed or the Start button is momentarily pressed, the output level will change to the Hold Torque value for the duration of the Start Time.

WINDING APPLICATION

NOTE: For winding applications that use a mechanical clutch, the minimum output level can be set to overcome the mechanical characteristics of the clutch, e.g. a release spring. See Calibration Mode CAL MIN OUT for the set up procedure. Otherwise the minimum output level should be set to zero for instances when a mechanical clutch is not used.

When the Start contact is closed or the Start button is momentarily pressed, the TCD 600 goes into Start operation for the duration of the Start Time (see figure 40). The output level changes to the Hold Torque value that was set as one of the Job parameters. The clutch begins to rotate and take up slack from the web. The machine begins to accelerate.

After the Start Time has expired, the TCD 600 will enter Automatic operation and output will increase steadily as a function of the roll's diameter and Setpoint (and Taper setting, if required). As the roll winds, output level will increase in order to maintain constant tension. If taper tension is needed rather than constant tension, use the Taper Tension setting to decrease the tension as the roll increases in diameter. See "Overview" in OPERATION section for a description of Taper Tension. Whenever the Hold/Resume

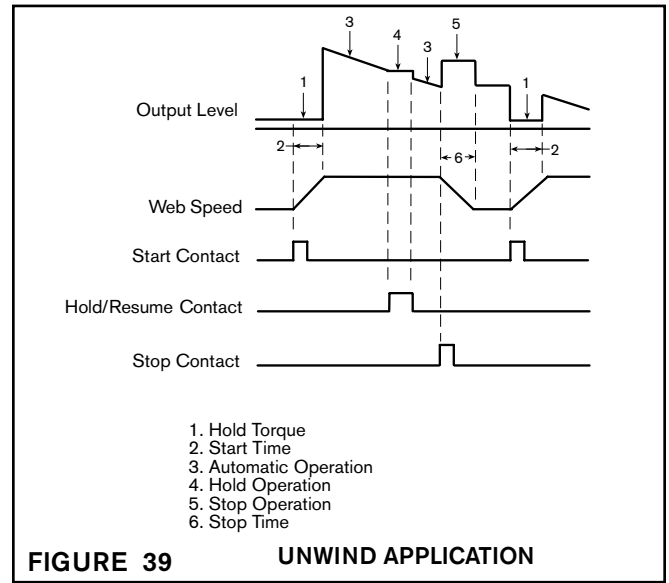


FIGURE 39 UNWIND APPLICATION

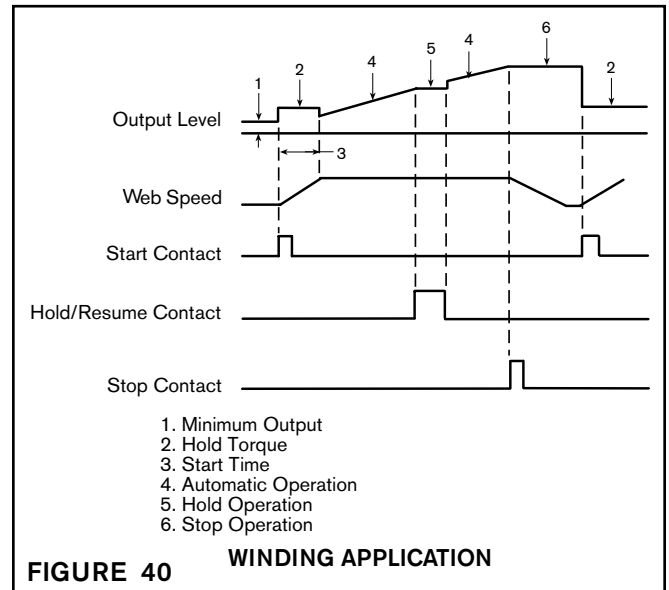


FIGURE 40 WINDING APPLICATION

contact is closed or the Hold/Resume button pressed, the output will remain constant until the Hold/Resume contact is opened or the button is released allowing the TCD 600 to return to Automatic Operation. This is used when winding is interrupted once or several times per roll winding.

When the Stop contact is closed or the Stop button is momentarily pressed, the TCD 600's output will remain constant at its present value. The machine is decelerated to a complete stop. If the Hold/Resume contact is then closed or the Hold/Resume button is momentarily pressed, the output level will remain at the pre-stop value for the duration of the Start Time. If the Start contact is closed or the Start button is momentarily pressed, the output level will change to the Hold Torque value for the duration of the Start Time.

SPECIFICATIONS

AC Power	115VAC/230VAC, 0.3A/0.6A, 50/60Hz, 1 Phase
Torque Control Output.....	0-10VDC@10mA, 4 - 20mA@600Ω max.
Diameter Output	0-5VDC@10mA
Alarm Outputs	30Volts@100mA (optically isolated)
Switch Inputs (Start, Stop, Hold).....	15VDC@1.5mA
Ambient Temperature.....	32°F - 120°F (0°C - 50°C)
Weight	1 pound [1.6kg]
Proximity Switch	+15 VDC, NPN, Normally Closed, Open Collector 40 mA Sink, minimum Logic Level: $V_{LOW} < 1 \text{ VDC}$, $V_{HIGH} > 2.25 \text{ VDC}$ Minimum Pulse Width: 100 Microseconds
Encoder.....	+15 VDC, Open Collector Output, 12 mA Sink, minimum Logic Level: $V_{LOW} < 1 \text{ VDC}$, $V_{HIGH} > 2.25 \text{ VDC}$ Minimum Pulse Width: 600 Nanoseconds
Ultrasonic Sensor	+24 VDC, 0-10 VDC Output

PARTS LIST

TCD 600 Controller - English/Spanish.....	912123
TCD 600 Controller - English/French.....	912145
Ultrasonic Sensor	912127
Optional - Mounting Bracket for TCD 600	912129
Optical Encoder	912140
Optional Encoder Mounting Bracket.....	912141
Proximity Switch	912068

SERVICE INSTRUCTIONS

The TCD 600 has no field serviceable parts and must be returned to Nexen for repair.

WARRANTY

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

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