

Tension Meter

Model TM210

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

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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.

Nexen’s TM210 Tension Meter measures tension in a continuous web, strip, or strand of material as it is being processed. This material can be paper, film, rubber, metal strip, wire, textiles, or any other product used in a continuous process.

The TM210 used together with two Nexen-Nireco MB Tension Sensors (Load Cells), and a sensing roller measures actual material tension during the process. For very narrow webs, wire, stranded material, the Tension Meter may be used with only a single Tension Meter.

The TM210 receives tension data from the Tension Sensors, and displays actual tension with a digital read out on its front panel. There is also a 0 to 10VDC analog signal available on the terminal strip that is proportional to 0 to full scale as defined in the set up of the TM210. This 0 to 10VDC signal can be buffered for use with a remote meter, or as a real time output for control purposes.

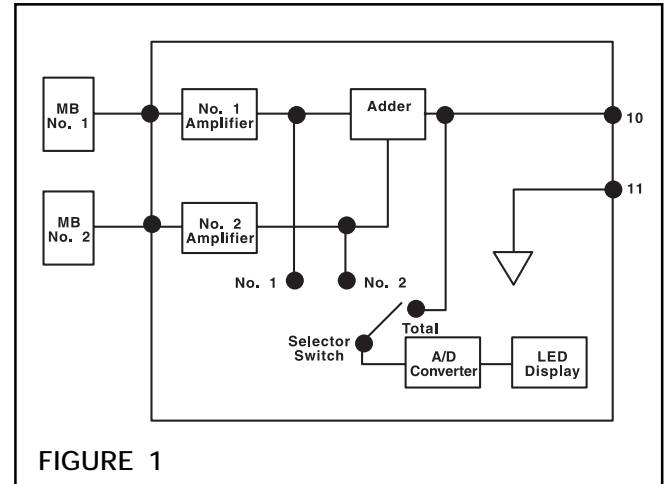
TENSION METER OPERATION

Nexen's "TM210" provides a 6VDC excitation signal to the MB Tension Sensors. The Tension Sensors then provide an output (proportional to a load applied to their load plates), between 0 and 400 millivolts.

Static, or Tare Weight, of the sensor roll and its bearings will cause the Tension Sensors to put out a signal, which must be zeroed out, or negated. Once Tare Weight has been zeroed out, any additional force applied to the sensor roll will cause a proportional increase in the output signal. This signal is then span adjusted to make the digital readout record actual web tension.

The signal from each Tension Sensor is amplified separately, and then added. The result or total tension is available at the Control Output Terminals Number 10, and 11 on the terminal strip (See Fig. 1).

The two amplified signals also go to the Read Out Selector (located on the front panel) where either one, or the sum of the two can be selected to pass through the analog to digital transducer (A/D) for display on the Digital Read Out.

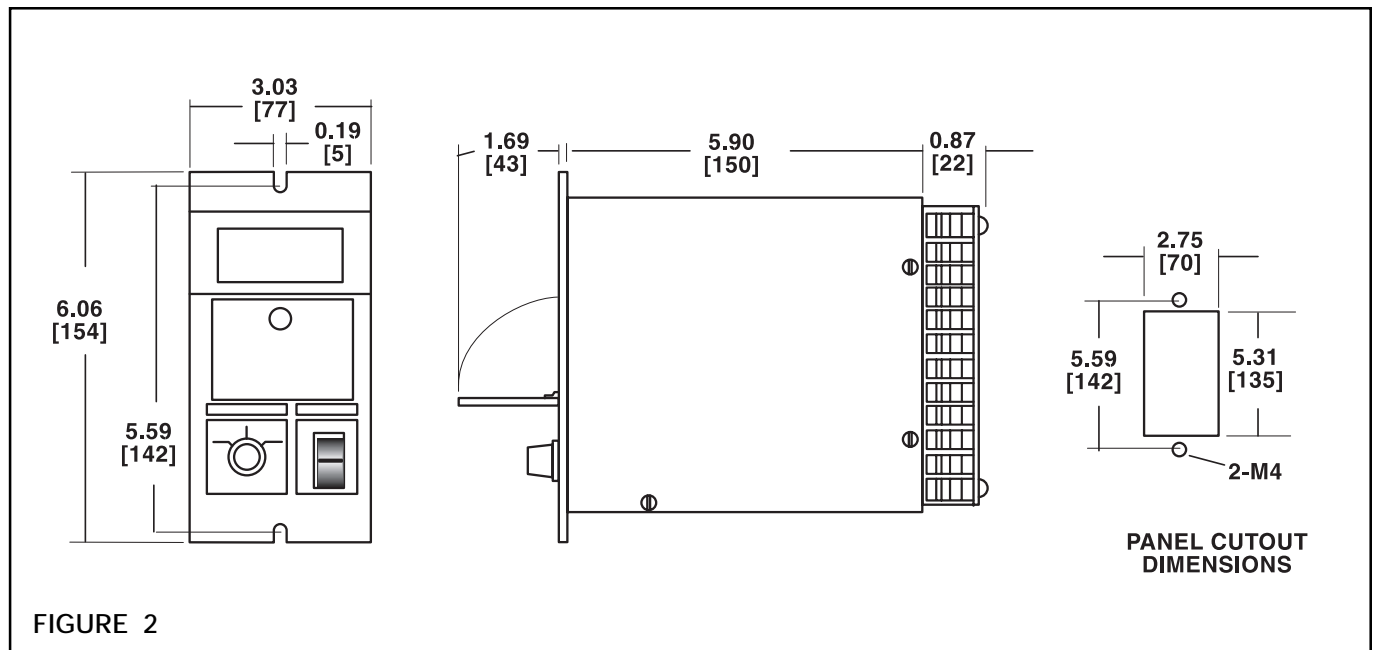


INSTALLATION

1. Install MB Tension Sensors as described in Installation and Maintenance Manual L-20127, provided with the MB Tension Sensors.

2. TM210 may be panel mounted (See Fig. 2)

NOTE: TM210 is an electronic component, and should be mounted in a shock and vibration free area which has an ambient temperature greater than 32°F, but less than 122°F [0° – 50°C].



ELECTRICAL CONNECTIONS

NOTE: All Electrical Connections are made at the Terminal Strip located on the TM210 rear panel.

Ground both Cable Shields (WHITE Terminals on braided cable) to Terminal 9.

1. Connect MB Tension Sensors to Terminal Strip, using cables provided with the MB Tension Sensors (See Fig. 3).

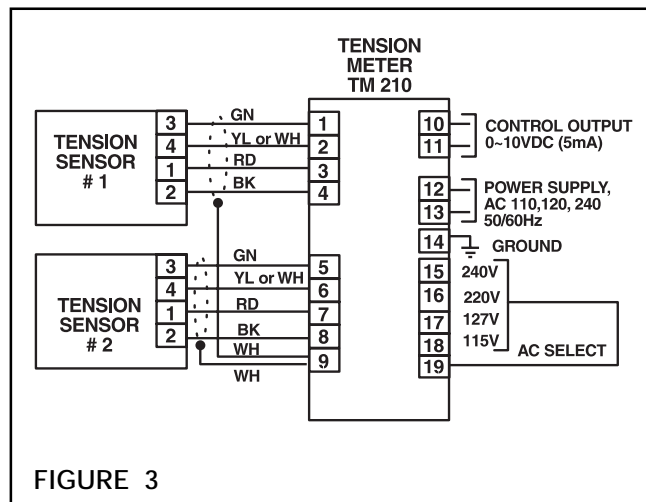
If MB11 or MB25 are used with a reverse wrap (the web tending to pull the sensor roll away from the sensors), reverse the connection of the **GREEN** and **YELLOW or WHITE** wires for both Sensors at the TM210 Terminal Strip.

NOTE: The TM210 AC Select Electrical Connection default setting is 240V AC. Select alternative AC Input Voltage setting to match the AC Power Supply Input Voltage that the unit is to be connected to.

If TM210 is to be used with only one Sensor, connect cable as normal for Number 1, then provide a Jumper Wire to short Terminals 5 and 6.

NOTE: Cables may be extended up to 1,500 feet with 18AWG Shielded Cable.

2. The 0 to 10 volt (5mA) Control Output Signal can be taken from Terminals 10 (PLUS) and 11 (MINUS) load impedance > 2K ohm.
3. Connect the provided Jumper Wire to Terminal 19, and to the correct voltage as applied to Terminals 12 and 13 (See Back of TM210 for Jumper Terminals).
4. Provide Single Phase AC Power to Terminal 12 (POWER), 13 (COMMON), and 14 (GROUND). AC Power can be in the range of 110, 120, 220, or 240 VAC, either 50 or 60 Hertz.



CALIBRATION

DIGITAL INDICATOR RANGE SETTING.

1. Set **Power Switch** to **ON** (See Fig. 4).
2. Rotate the knob in the upper portion of the Front Panel to release the catch, then open the Front Panel (See Fig. 4).
3. Set **No. 2 Dip Switch** to **ON**. This sets the TM210 to the Scaling Mode (See Fig. 5).
4. Rotate Scaling Mode **TEST** variable resistor to full counter clockwise position (See Fig. 5).
5. Set **DECIMAL POINT** switch to the correct position (See Fig. 5 & Table 1).
6. With the **DECIMAL POINT** switch in the correct position (as defined in Step 5), adjust **ZERO** variable resistor until the Digital Display shows "000".
7. Rotate the **TEST** variable resistor to the full clockwise position (See Fig. 5)
8. Adjust the **FS** variable resistor until the Digital Display indicates the desired maximum range (50.0, 200, 500, etc.) (See Fig. 5).
9. Set **No. 2 Dip Switch** to **OFF**. This sets the TM210 to the Normal Operating Mode (See Fig. 5).
10. Close Front Panel.
11. Set **Power Switch** to **OFF** (See Fig. 4).

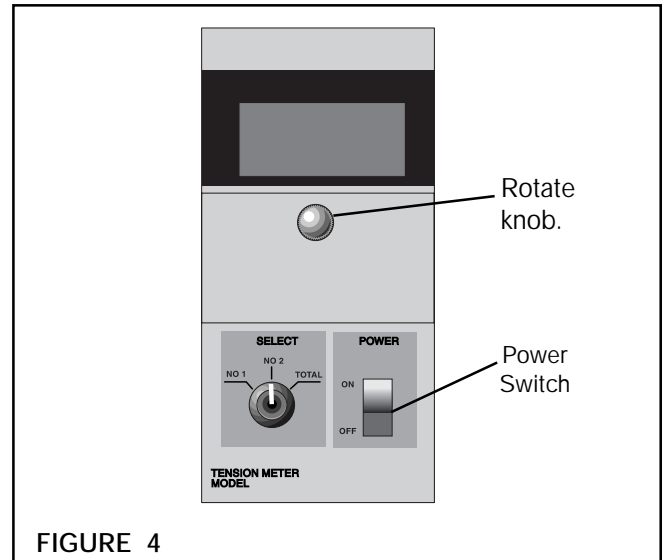


FIGURE 4

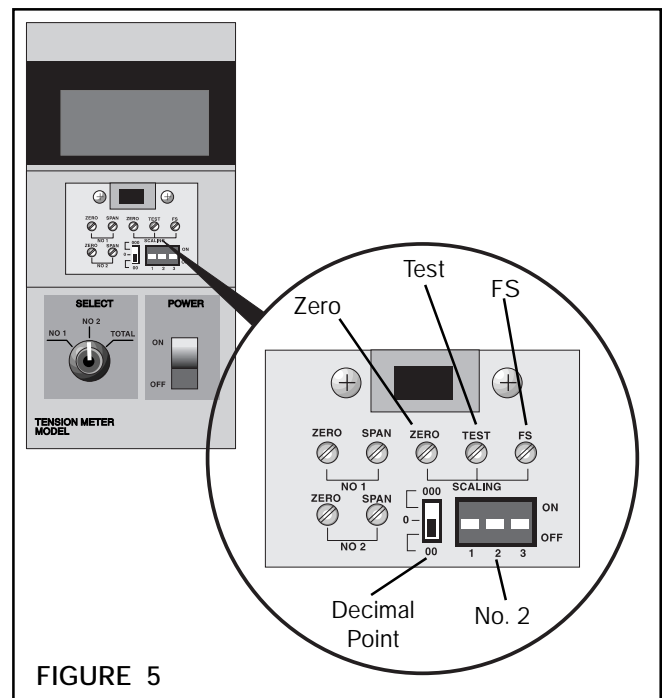


FIGURE 5

TABLE 1

INDICATOR MAX. SCALE	DECIMAL POINT DISPLAY SETTING
1.00 - 9.99	0
10.0 - 99.9	00
100 - 999	000



WARNING

Make sure Sensors, Sensor Roll, and Bearings are correctly mounted (See Installation and Maintenance Manual L-20127), and that no force is being applied to the Sensor, Sensor Roll, or Bearings by an external force, web, etc.

1. Set **Power Switch** to **ON** (See Fig. 6).
2. Rotate the knob in the upper portion of the Front Panel to release the catch, then open the Front Panel (See Fig. 6).
3. Set **No. 1 Dip Switch** to **ON**. This sets the TM210 for **ZERO** and **SPAN** Setting (See Fig. 7).
4. Set the **Readout Selector Switch** to **No. 1** (See Fig. 6).
5. Rotate **No. 1 ZERO** variable resistor to obtain **0** on the indicator (See Fig. 7).
6. Set the **Readout Selector Switch** to **No. 2** (See Fig. 6).
7. Rotate **No. 2 ZERO** variable resistor to obtain **0** on the indicator (See Fig. 7).
8. Set the **Readout Selector Switch** to **TOTAL**, the Indicator must still read **0** (See Fig. 6). If not, repeat steps 4 through 7.
9. Thread a rope or cable through the normal web path in such a way as to duplicate the web wrap angle around the Sensor Roll. Hang a known weight **W** which is less than the full scale of the Indicator to one end of the rope or cable (See Fig. 8).
10. Set the **Readout Selector Switch** to **No. 1** (See Fig. 6).
11. Rotate **No. 1 Span** variable resistor until the Indicator reads one half the weight or $W/2$ (See Fig. 7).
12. Set the **Readout Selector Switch** to **No. 2** (See Fig. 6).
13. Rotate **No. 2 Span** variable resistor until the Indicator reads one half the weight or $W/2$ again (See Fig. 7).

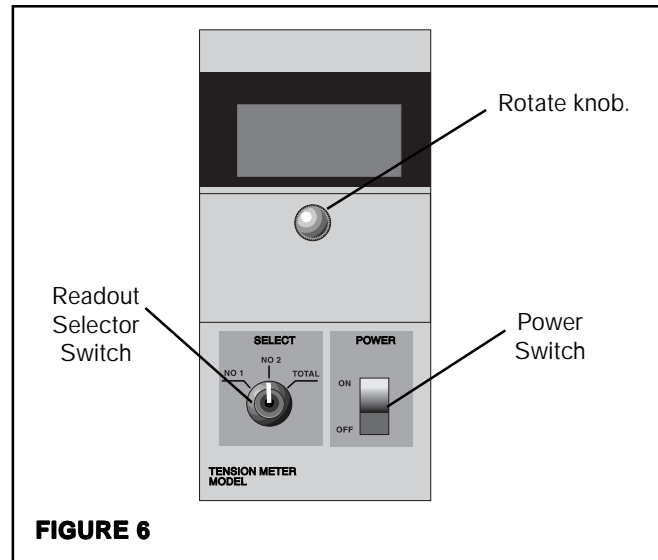


FIGURE 6

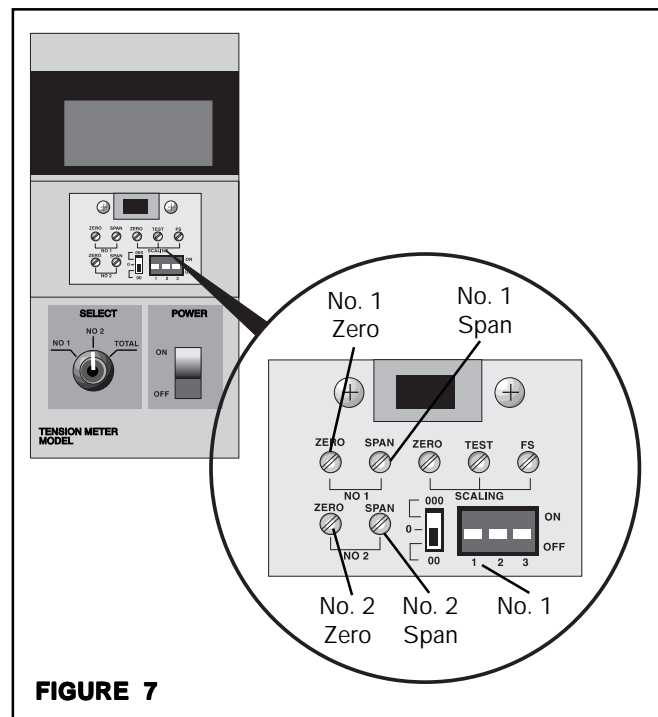


FIGURE 7

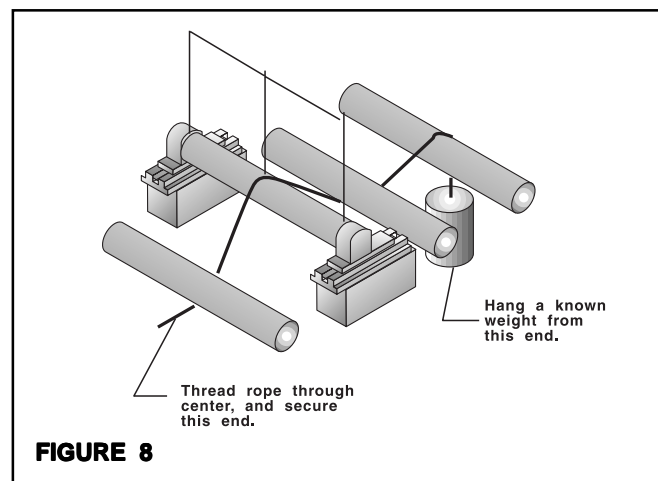


FIGURE 8


14. Set the **Readout Selector Switch** to **TOTAL**. The Indicator must now read the known weight or **W**.

NOTE: The Digital Display must show the known weight **W**. If not, return to Step 1 and recalibrate Span. If calibration is still impossible, return to DIGITAL INDICATOR RANGE SETTING.

15. Remove the rope or weight.
16. Set the **No. 1 Dip Switch** to **OFF**. This sets the TM210 to the Normal Operating Mode (See Fig. 7).
17. Close Front Panel.
18. Set **POWER SWITCH** to **OFF** (See Fig. 6)

TENSION SENSOR TO TM210 CALIBRATION (Single Sensor)

NOTE: Normal operation of the TM210 requires two sensors. Narrow webs, wire, filaments, and other narrow products can often be sensed with only one MB Tension Sensor. Make sure that the Jumper Wire described in ELECTRICAL CONNECTIONS is installed before attempting to calibrate the TM210 with only one sensor.


WARNING

Make sure Sensors, Sensor Roll, and Bearings are correctly mounted (See Installation and Maintenance Manual L-20127), and that no force is being applied to the Sensor, Sensor Roll, or Bearings by an external force, web, etc.

1. Set **Power Switch** to **ON** (See Fig. 9).
2. Rotate the knob in the upper portion of the Front Panel to release the catch, then open the Front Panel (See Fig. 9).
3. Set **No. 1 Dip Switch** to **ON**. This sets the TM210 for **ZERO** and **SPAN** Setting (See Fig. 10).
4. Set the **Readout Selector Switch** to **No. 1** (See Fig. 9)
5. Rotate **No. 1 ZERO** variable resistor to obtain **000** on the indicator (See Fig. 10).
6. Set the **Readout Selector Switch** to **No. 2** (See Fig. 9).
7. Rotate **No. 2 ZERO** variable resistor to obtain **000** on the indicator (See Fig. 9).

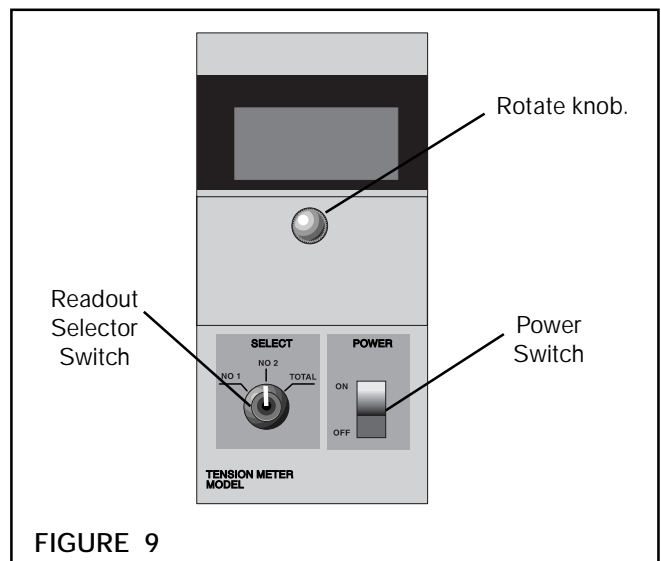


FIGURE 9

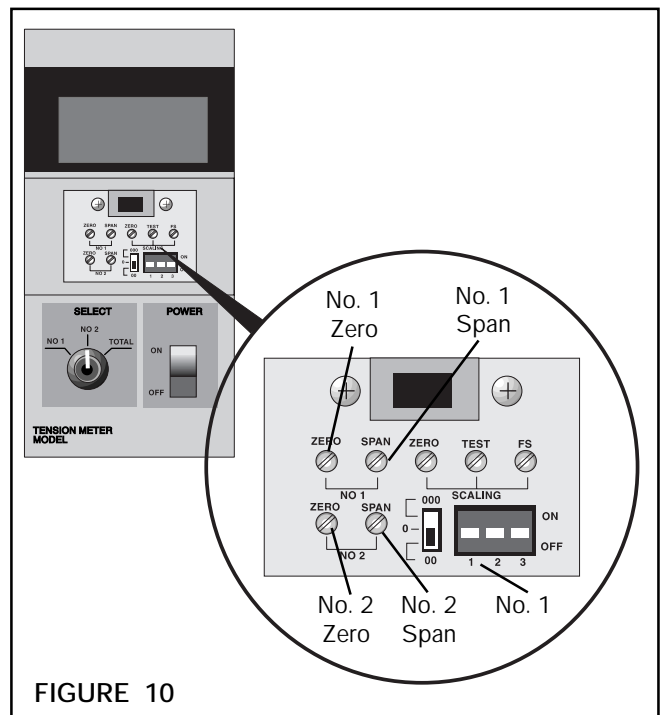


FIGURE 10

8. Thread a rope or cable through the normal web path in such a way as to duplicate the web wrap angle around the Sensor Roll. Hang a known weight **W** which is less than the full scale of the Indicator to one end of the rope or cable (See Fig. 11).
9. Set the **Readout Selector Switch** to **No. 1** (See Fig. 9).
10. Rotate **No. 1 Span** variable resistor until the Indicator reads the known weight or **W** (See Fig. 10).
11. Set the **Readout Selector Switch** to **No. 2** (See Fig. 9).
12. Rotate **No. 2 Span** variable resistor until the Indicator reads **000** (See Fig. 10).
13. Set the **Readout Selector Switch** to **TOTAL**. The Indicator must now read the known weight or **W**.

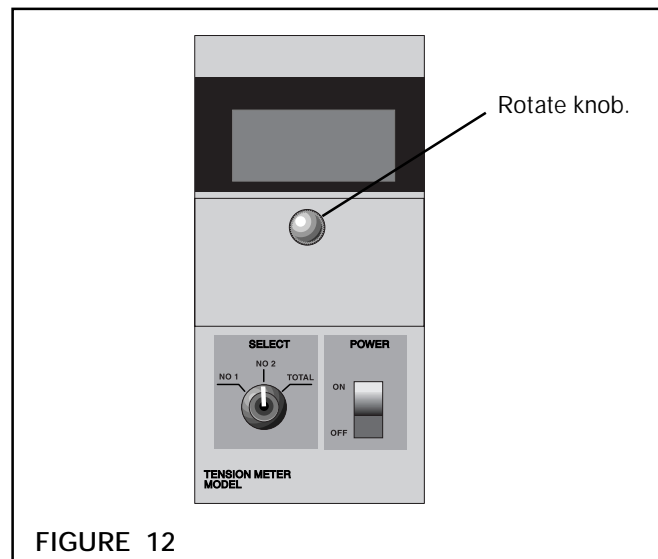
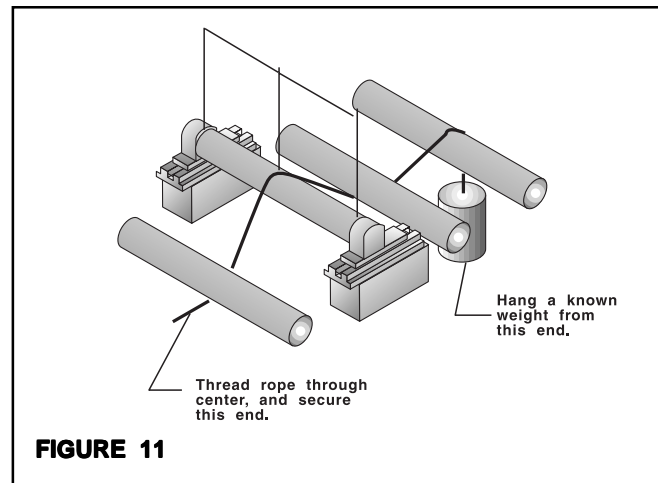
NOTE: The Digital Display must show the known weight **W**. If not, return to Step 1 and recalibrate Span. If calibration is still impossible, return to DIGITAL INDICATOR RANGE SETTING.

14. Remove the rope or weight.
15. Set the **No. 1 Dip Switch** to **OFF**. This sets the TM210 to the Normal Operating Mode (See Fig. 10).
16. Close Front Panel.
17. Set **POWER SWITCH** to **OFF** (See Fig. 9)

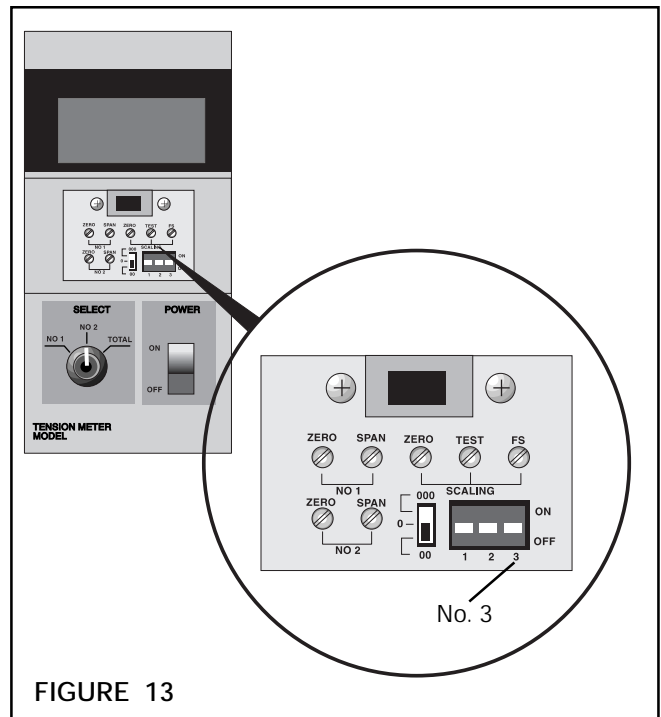
SELECT OUTPUT CONFIGURATION

NOTE: Output of the TM210 is 0 to 10 Volts DC, which is proportional to the Zero to Full Scale maximum range defined in DIGITAL INDICATOR RANGE SETTING. This output can be filtered or buffered for use with meters, and other equipment that might be damaged by electrical spikes, or it can be raw data from the Tension Sensors or Amplifiers.

1. Rotate the knob in the upper portion of the Front Panel to release the catch, then open the Front Panel (See Fig. 12).



2. Set the **No. 3** Dip Switch to **ON** to provide **FILTERED** output, or **OFF** to provide **UNFILTERED** output (See Fig. 13).
3. Close the Front Panel.



OPERATION

The TM210 will constantly read out tension applied to the Sensor Roll as long as the Power Switch is set to the **ON** position. The signal at Terminals **10** and **11** will always be the total signal of Sensor **No. 1**, and Sensor **No. 2**, regardless of Readout Selector Switch position.

The Digital Display will read either tension at Tension Sensor **No. 1**, or Tension Sensor **No. 2**, or the Total of the two as selected with the Readout Selector Switch.

MAINTENANCE

Regular scheduled maintenance is not required for either the TM210 or the MB Tension Sensors. If precise accuracy is required, periodic recalibration of the Zero, and Span Circuits is recommended.

CHECK PIN LOCATIONS & VALUES

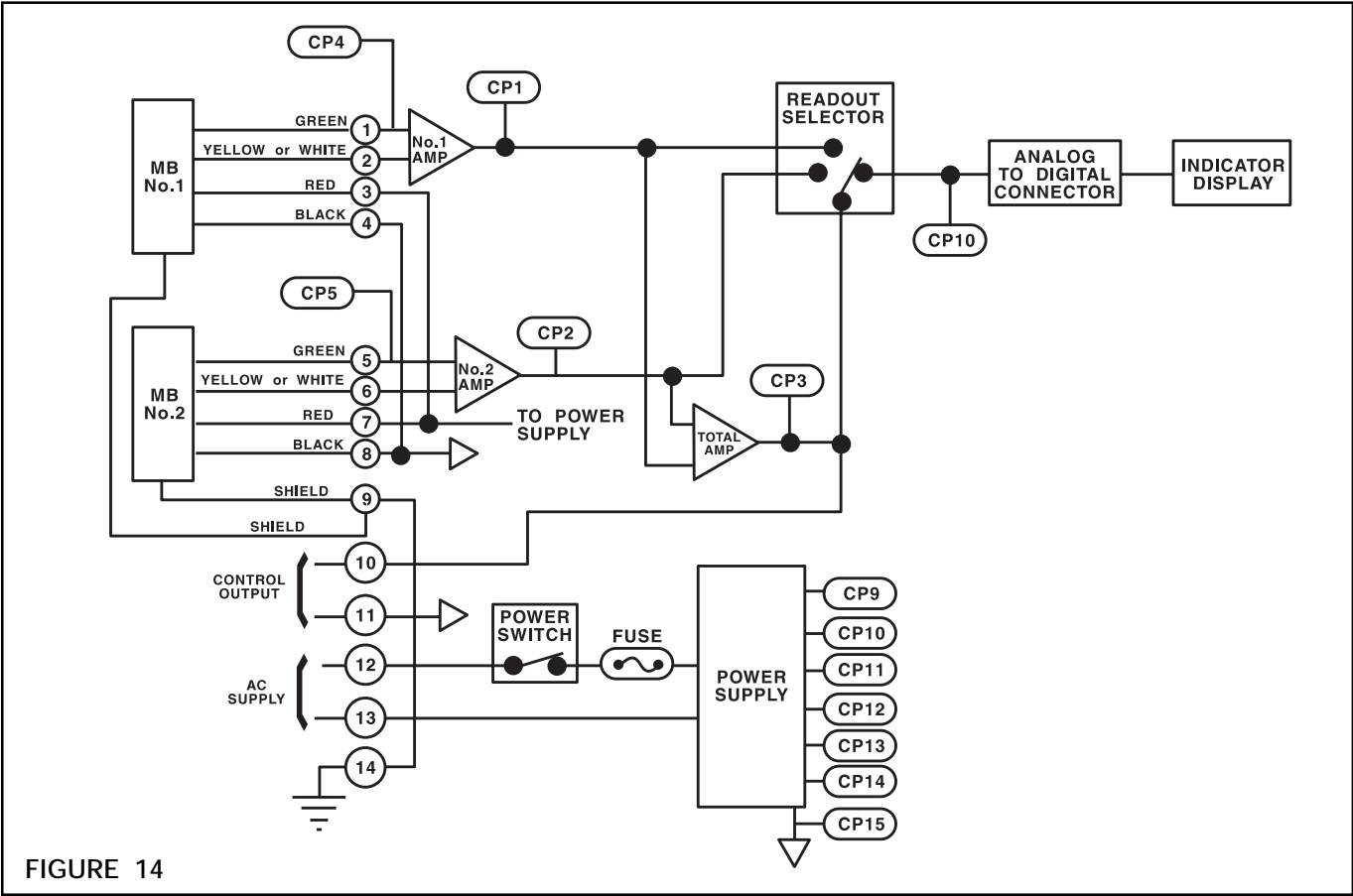


FIGURE 14

LOGIC CIRCUITS

C/P	CIRCUIT TESTED	CORRECT VALUE
1	Amplifier output No.1 Sensor.	0–5VDC (varies with Sensor Load)
2	Amplifier output No.2 Sensor	0–5VDC (Varies with Sensor Load)
3	Summing Amplifier No.1 & No.2	0–10VDC (CP3=CP1+CP2) Unfiltered
4	Input Voltage "No. 1" Sensor	0-400 mV (Varies with Sensor Load)
5	Input Voltage "No. 2" Sensor	0-400 mV (Varies with Sensor Load)
10	Selector Switch output to A/D Converter	0–10VDC (varies with Readout Switch position,ie., No.1 position CP1=Cp4, No.2 position CP2=CP4, Total position CP1+CP2=CP3=CP4) Filtered
15	Common Circuit	0

POWER SUPPLY CIRCUITS

C/P	CIRCUIT TESTED	CORRECT VALUE
6	Input Voltage A/D Converter	1 VDC \pm 0.1
12	Sensor Excitation Voltage	+6VDC
13	Op Amp Supply Voltage	+15VDC
14	Op Amp Supply Voltage	–15VDC
11	A/D Converter & Indicator Voltage	+5VDC
8	A/D Converter & Indicator Voltage	–5VDC

TENSION SENSORS

TERMINALS	CIRCUIT TESTED	CORRECT VALUE
1 & 2	Sensor No.1 output	0–600mV (Varies with Sensor Load)
3 & 4	Sensor No. 1 excitation	6VDC

WARRANTIES

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 damages, 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.

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

800.843.7445
Fax: 651.286.1099
www.nexengroup.com

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