Note: This manual is intended to provide general installation, setup, and calibration procedures for the Comptrol M415 Tension Indicator. For more specific wiring and configuration information for a specific model, refer to the engineering data and drawings provided with this manual.

PART I - GENERAL INFORMATION

The M415 Tension Indicator is designed for applications utilizing up to six Comptrol loadcells to measure tension on a common roll. The segmented roll illustrated in Figure 1 is a typical example of this type of application.

During operation, each loadcell LVDT output is fed into the M415, conditioned, amplified, and summed to produce a single isolated control output and an analog meter output. Depending on the position of the Cell Readout Selector Switch on the front panel, the analog meter will indicate either the control output (total tension), or the individual loadcell outputs. This allows monitoring of each individual loadcell without affecting the control output.

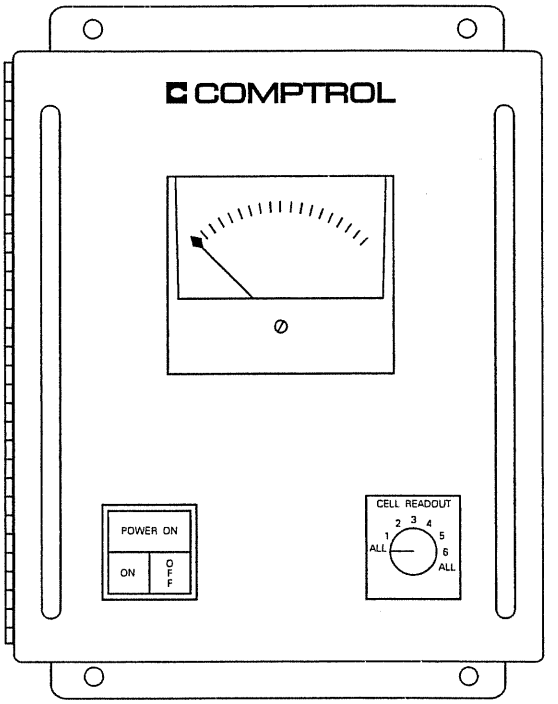
The M415 is available in 12 standard models based on the number of loadcells and the control output required. The M415V Series provides a 0-10 volt DC output. The M415C has a 4-20 milliamp DC output. All models work equally well with Comptrol Superloadcells, Monocells, or Tensioncells.

COMPTROL M415 TENSION INDICATOR		
Number of Cells	Model Number & Isolated Output	
	0 - 10 Volts	4 - 20 mA
1	M415-V1	M415-C1
2	M415-V2	M415-C2
3	M415-V3	M415-C3
4	M415-V4	M415-C4
5	M415-V5	M415-C5
6	M415-V6	M415-C6

PART II - INSPECTION UPON DELIVERY

Upon receipt:

1. Examine the exterior of the container for obvious damage or tampering.



2. Check the contents against the packing list.
3. Promptly report any damage or shortage to both the carrier and Comptrol Incorporated.

PART III - INSTALLATION

The M415 is assembled in a 16" high x 14" wide x 8" deep enclosure for wall mounting. It requires a 115 volt AC, 1 Phase, 60Hz power supply that should include a system ground.

NOTE: The system ground should be connected to the metal enclosure not to the signal ground.

The wiring from the loadcell(s) to the M415 should be 4-conductor twisted shielded Belden Number 8723 (or equivalent) in grounded steel conduit. The shield connections at the terminal board are connected to the cabinet ground, and should not be grounded at the loadcell(s). The feedback cable should be 2-conductor shielded Belden Number 9462 or equal. Loadcells mounted on the outside ends of the roll assembly are usually set-up starting with Cell 1. (See Figure 1.)

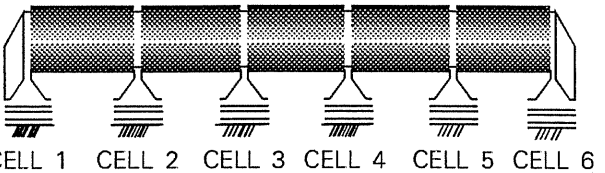


Figure 1

PART IV- SET-UP

The M415 has a seven-slot card rack. Slots 1 through 3 are reserved for the DUAL AMPLIFIER card(s); Slot 4 for the SUMMER/SELECTOR card; and Slots 5 through 7 for any other cards that may be required. (See Figure 3.)

DUAL AMPLIFIER CARD

The M415 may have up to three Comptrol 80-146-7 Dual Amplifier cards depending on the number of loadcells being monitored. Each two-channel card can receive and amplify two independent LVDT signals to generate a 0-10 volt DC signal for each loadcell. Channel A components are mounted on one half of the card, and Channel B components on the other half. (See Figure 2.)

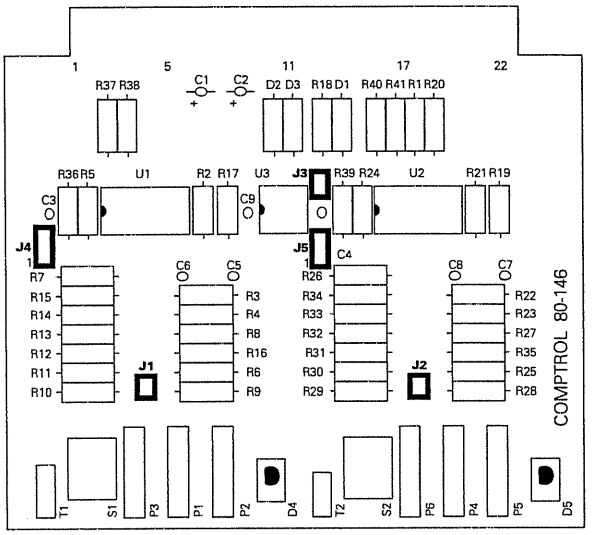


Figure 2

The card has two testpoints, T1 (Channel A) and T2 (Channel B), for measuring the output voltage for each loadcell to the SUMMER/SELECTOR card. These testpoints are designated CELL 1 through CELL 6 on the rack coverplate.

CONNECTION TABLE 1						
LVDT	TERM *	CONNECTOR	CABLE	FUNCTION		WIRE *
RED	1	A	RED	+	SUPPLY	10
BLACK	2	B	BLACK	-		11
GREEN	3	C	GREEN	-	SIGNAL	12
BLUE	4	D	WHITE	+		21-26
* Connection Supplied depends on individual order or application.						

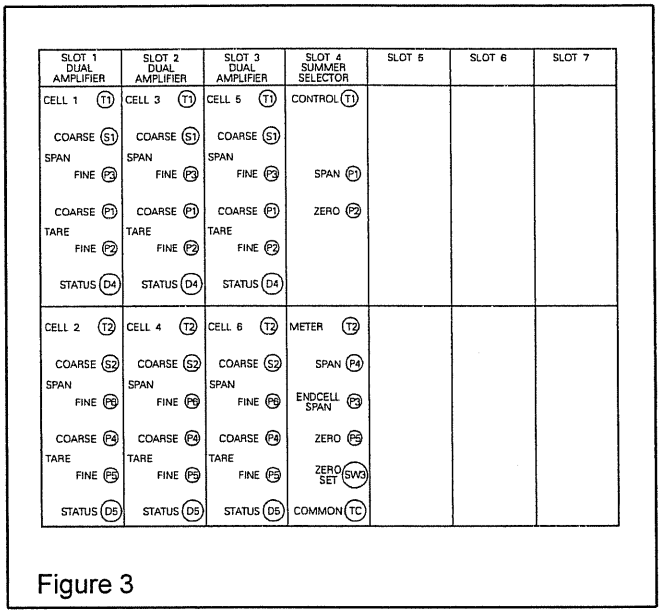


Figure 3

Each LVDT input has a zero offset between 0 and 5 volts and span between 1 and 5 volts. Both coarse and fine adjustment is provided for zero and span. Two-stage lowpass filters are used to attenuate signal above 47 HZ.

The DUAL AMPLIFIER card has five jumper locations (J1 through J5) which configure the card for the type of loadcells being used, and the number of LVDT inputs to the card. Note that if there is an odd number of loadcells one card will have only one input which means Channel B on the card will not be used. In these types of applications the J5 jumper is removed from the card receiving only one input.

Jumpers	J1	J2	J3	J4	J5
Superloadcell or Monocell	OUT	OUT	IN	1-2	1-2
Tensioncell in Compression	IN	IN	OUT	1-2	1-2
Tensioncell in Tension	IN	IN	OUT	2-3	2-3

The DUAL AMPLIFIER card also includes a fault circuit to aid in troubleshooting. The STATUS LED (D4 and D5) for each channel is green under normal operating conditions. If the power supply, or the LVDT input from a loadcell, drops to 0 volts, the respective LED(s) will turn to red. A relay is also included in the circuit to allow for an external or remote "alarm" warning system.

NOTE: The fault circuit is not functional for Superloadcell or Monocell applications. For these types of applications the STATUS LED is always green.

SUMMER/SELECTOR CARD

The Comptrol 80-147-1 Summer/Selector card, figure 4, performs several functions. It sums signals from up to six 0-10 volt DC inputs and feeds the resulting control output through the damping module to the isolation module to produce a single 0-10 volt DC (or 4-20 mA) control output.

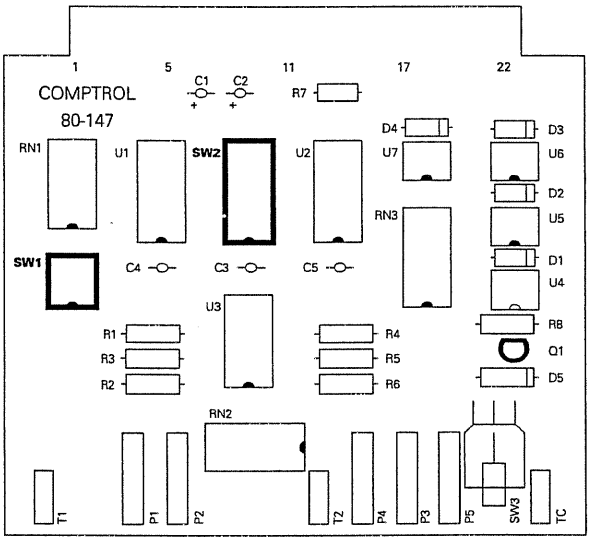


Figure 4

The Summer/Selector card also allows remote readout of the sum total or the individual outputs. The readout signal can be 0-10 volts, 0-2 volts, or 0-100 μA.

Both the control and meter circuits have zero and span adjustment. A fault circuit is provided to monitor the fault line of the system and the ±15 volt supply. The fault output is an optically isolated open collector output with protection diode.

There are three testpoints on the SUMMER/SELECTOR card.

1. The CONTROL testpoint (T1) of the card is used to measure the control output (0-10 volt DC or 4-20 milliamp) to the isolation module.
2. The METER testpoint (T2) is used to measure the voltage output to the meter.
3. The testpoint marked COMMON (TC) is the system common testpoint. The voltmeter (-) negative lead should be plugged into this testpoint when measurements are made in the system.

The SUMMER/SELECTOR card has two switches which are used to set the gain for the control output, doubling the endcell signals, and determining the meter output.

Switch 1 (SW1) is a 4-position dip switch sets the gain for the control output. One position is turned on for each "unity" signal input over two. These inputs are those which see the full load output (0-10 volts) from the amplifier card. Two endcells, which each produce half the normal output, would comprise one unity input.

For example, Figure 5 illustrates a three cell system used on a two-roll array. It would have two endcells and one center cell. The total number of inputs is 1/2 + 1 + 1/2 = 2, thus no switches would be turned on.

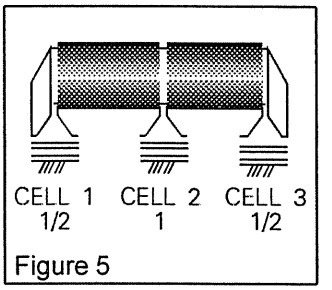


Figure 5

Figure 6 illustrates a four cell system used with a five roll array. There are no endcells. Therefore, the total number of inputs is 1 +1 + 1 + 1 = 4 and two switches would be turned on.

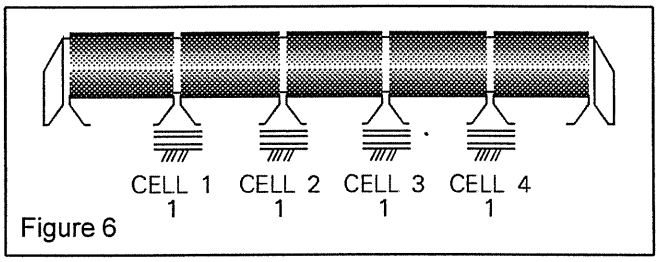


Figure 6

Switch 2 (SW2) is an 8-position dip switch. Positions 1 through 6 determine which input signals will be doubled when selected for individual readout. This feature is used for the endcells on a split roll array which normally see half the load of other cells in the system. Doubling the endcell signals allows all cells to read the same with an evenly distributed load.

For example, Figure 7 shows a five cell system used on a four-roll array, Cell 1 and Cell 5 would be the endcells. To "double" the inputs from these cells, Positions 1 and 5 on Switch 2 would be off (open), all other positions would be on (closed).

(Continued on next page)

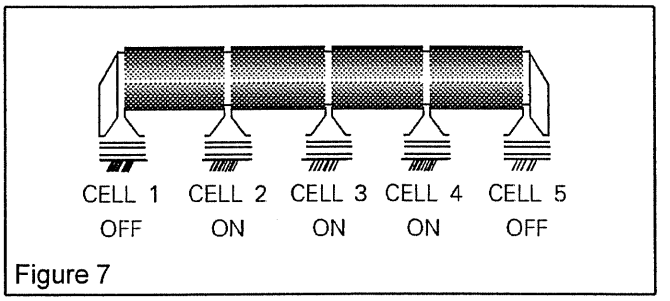


Figure 7

Switch 2, Position 7 and 8 are used to select the meter output for the type of meter being used.

RANGE	POSITION 7	POSITION 8
0-100 μA	Open (Off)	Open (Off)
0-2 Volt	Close (On)	Close (On)
0-10 Volt	Open (Off)	Close (On)

The first range is used for the standard M415 0-100 μA analog meter. The other ranges are for digital meters or input to programmable controls or other process control devices.

PART IV - CALIBRATION

Before calibrating the M415:

1. Insure that the enclosure is securely mounted.

2. Check that the loadcells and equipment are properly installed, connected and wired. Refer to the engineering drawings for the specific model to verify wiring connections and the arrangement of the cards in the card rack.

3. Insure that loadcell are properly calibrated. Refer to installation and calibration procedures in the appropriate loadcell instruction manual.

4. Set the front panel analog meter to zero by means of the mechanical adjustment screw.

5. Apply power.

6. Press the power ON pushbutton on the front panel. The POWER ON indicator light should illuminate.

7. Open the front panel door.

NOTE: The Door Interlock switch turns OFF when the door is open. To turn the unit ON, pull the switch plunger forward.

8. Allow the unit to warm up for at least 20 minutes before taking the first reading to insure accurate readings.

9. On the inside panel is an electronic damping module (DPM) with a 10 turn potentiometer. Set the damping to minimum (00) during alignment so that you do not have to wait for the output to stabilize after each adjustment. Changing the damping setting does not disturb the system alignment, except for a small change in the zero offset.

SLOT 1 DUAL AMPLIFIER	SLOT 2 DUAL AMPLIFIER	SLOT 3 DUAL AMPLIFIER	SLOT 4 SUMMER SELECTOR
CELL 1 (T1)	CELL 3 (T1)	CELL 5 (T1)	CONTROL (T1)
COARSE (S1)	COARSE (S1)	COARSE (S1)	
SPAN FINE (P3)	SPAN FINE (P3)	SPAN FINE (P3)	SPAN (P1)
COARSE (P1)	COARSE (P1)	COARSE (P1)	ZERO (P2)
TARE FINE (P2)	TARE FINE (P2)	TARE FINE (P2)	
STATUS (D4)	STATUS (D4)	STATUS (D4)	
CELL 2 (T2)	CELL 4 (T2)	CELL 6 (T2)	METER (T2)
COARSE (S2)	COARSE (S2)	COARSE (S2)	SPAN (P4)
SPAN FINE (P6)	SPAN FINE (P6)	SPAN FINE (P6)	ENDCELL SPAN (P3)
COARSE (P4)	COARSE (P4)	COARSE (P4)	ZERO (P5)
TARE FINE (P5)	TARE FINE (P5)	TARE FINE (P5)	ZERO SET (SW3)
STATUS (D5)	STATUS (D5)	STATUS (D5)	COMMON (TC)

Figure 8

10. Apply a tare load to the system (completely unload the rolls). If Comptrol Superloadcells are being used, adjust the loadcell mechanical zero adjust for zero volt output (±.05 volt).

PART IV-A ZERO ADJUST

NOTE: Perform Steps 1-5 for each loadcell, starting with CELL 1, using the corresponding CELL testpoint (T1 or T2) and adjustments. See Figure 8.

1. Plug the digital voltmeter (-) negative lead into the system COMMON testpoint (TC, Slot 4) and the (+) positive lead into the CELL testpoint (T1 or T2) for the loadcell being calibrated.

2. Set the Cell COARSE SPAN (S1 or S2) to zero. With tare weight applied and no load on the roll, a tare voltage will be produced on the loadcell output.

3. Set the Cell FINE TARE potentiometer (P2 or P5) to Mid-Travel by rotating the potentiometer 20 full turns clockwise, then counterclockwise 10 full turns.

4. Adjust the Cell COARSE TARE potentiometer (P1 or P4) until the output reads ± .05 volt.

5. Adjust the Cell FINE TARE (P2 or P5) for 0.00 volt.

Repeat steps 1-5 for the remaining loadcells before continuing.

Skip Steps 6 & 7 for one loadcell applications.

6. Plug positive voltmeter lead into the CONTROL testpoint (T1, Slot 4).

7. Adjust the control ZERO potentiometer (P2, Slot 4) for 0.00 volt output.

8. Plug the (+) positive voltmeter lead into the METER testpoint (T2, Slot 4).

9. Rotate the CELL READOUT selector switch on front panel to the ALL position.

10. Adjust the meter Zero (P5, Slot 4) for 0.00 volt, or zero reading on front panel meter.

11. Press ZERO SET (SW3, Slot 4) momentarily. The reading should remain at zero. If it changes, recheck steps 9-11 as required. This will not affect the CONTROL output.

12. Connect the (-) negative voltmeter lead to terminal 31 and the (+) positive lead to terminal 30.

13. Adjust the isolation module ZERO potentiometer for 0.00 volt output (M415V Series) or 4 mA (M415C Series).

NOTE: For current loop outputs, the meter must be in the loop. Remove the wire on terminal 31 and attach it to the voltmeter (-) negative lead. Attach the (+) positive lead of the voltmeter to terminal 30.

PART IV-B FULL LOAD ADJUSTMENT

1. Apply a tension load to the roll assembly equal to the rated full load of the system, taking care that the load is evenly distributed across the rolls. Loadcells located between two rolls will see the load of two halves of a roll, while those at the ends of the roll assembly (if used), only see the load of half of a roll.

NOTE: Perform Steps 2-7 for each loadcell, starting with CELL 1, using the corresponding CELL testpoint (T1 OR T2). Remember, the amplifiers for the center rolls should be adjusted to produce 10.0 volts at full load, while the endcells should be adjusted for only 5.00 volts. All amplifiers will then have the same approximate gain and tare adjustment.

2. Plug the voltmeter (-) negative lead into the system COMMON testpoint (TC, Slot 4) and the positive (+) lead into the cell testpoint (T1 or T2) for the loadcell being calibrated.

3. Set the Cell FINE SPAN (P3 or P6) for mid-travel. To do so, rotate the potentiometer 20 full turns clockwise, then counterclockwise 10 full turns.

4. Adjust the Cell COARSE SPAN switch (S1 or S2) until the output is closest to 10 volt (5 volt for endcell).

5. Adjust the Cell FINE SPAN potentiometer (P3 or P6) for 10 volts (5 volts for endcell).

Skip Step 6 for Monocell and Superloadcell applications. For these types of applications, the CELL STATUS LED will always be green.

6. For Tensioncell applications, lower the input voltage to zero volts and verify that the Cell's STATUS LED (D4 OR D5) changes from green to red. The input voltage may also be lowered to zero volts by opening the Cell's input connection. (terminal block connection 21, 22, 23, 24, 25, or 26 respectively).

Skip Steps 7 and 8 for one loadcell applications.

7. Plug the (-) negative voltmeter lead into system COMMON testpoint (TC, Slot 4) and (+) positive lead into the CONTROL testpoint (T1, Slot 4).

8. Adjust the control SPAN (P1, Slot 4) for 10 volt output. If 10.0 volts can not be obtained, recheck "PART IV-A, ZERO ADJUST", Steps 7 through 11, then repeat this step.

9. Disconnect the voltmeter (+) positive lead and plug it into the METER testpoint (T2, Slot 4).

10. Adjust the meter SPAN (P4, Slot 4) for full scale voltage output, or full scale reading on the front panel meter.

Skip Steps 11 & 12 for one or two loadcell applications.

11. Rotate the CELL READOUT selector switch on the front panel to select one of the endcells.

12. Adjust the meter ENDCELL SPAN (P3, Slot 4) for full scale voltage output, or full scale reading on the front panel meter.

(Continued on next page)

Skip Step 13 for Superloadcell or Monocell applications.

13. If utilizing the fault output, verify that the output turns off under any of the following conditions:
    a. Removal of +15 or -15 volt supply
    b. Activation of fault input at the card edge connector 10. (Pulled down to 0.0 volts)

14. When the control output has been calibrated, adjust the isolation module for full scale output (M415V Series) or 20 mA (M415C Series). This output can be monitored at terminals 30 & 31.

NOTE: For current loop outputs, the meter must be in the loop. Remove the wire on terminal 31 and attach it to the (-) lead of the voltmeter. Attach the (+) lead of the voltmeter to terminal 30.

15. Remove the load from the system and recheck the tare setting for each CELL (Part IV-A ZERO ADJUST, Steps 3 through 9).

16. Adjust the damping module to reduce the amount of signal oscillations being fed back to the drive. The module will not reduce the output, but may cause a slight shift of the zero or tare output. This adjustment is more easily done when the process is running.

    The damping module allows the response time of a measurement system to be extended by up to 10 seconds. This may be useful for simulating other, less responsive transducers, or for removing vibration and noise from a display signal.

    The only adjustment for the damping module is a 10-turn potentiometer which should be set to the customer's preference after the rest of the system is aligned.

17. The fault circuit may be tested by momentarily opening the (+) or (-) 15 volt supply line to the card rack assembly. The relay should de-energize. Also in Tensioncell systems, the circuit can be tested by opening up one of the inputs. The relay should de-energize and STATUS LED for that cell should change from green to red.

This completes the calibration procedures.

PART V - TROUBLESHOOTING

If trouble occurs:

1. Check line voltage, fuses or circuit breakers, and power switches.

2. Check for continuity and make sure all connections are secure.

3. For Tensioncell applications, if status LED on dual amplifier card is red:

    a. Check power supply PS1 for 24 volt DC at terminals 10 and 11.

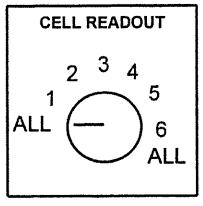
    b. Check power supply PS2 for $\pm$ 15 volt DC at terminals 13, 14, and 15.

4. Check output of LVDT. Deflection of the load supporting member toward the base is defined as the "Compression Mode", while the opposite is defined as the "Tension Mode". Refer to the calibration sheet for direction of load. Tension and Compression Modes have opposite polarity. Deflect each loadcell in the direction of the load. Refer to Jumper Table on Page 2.

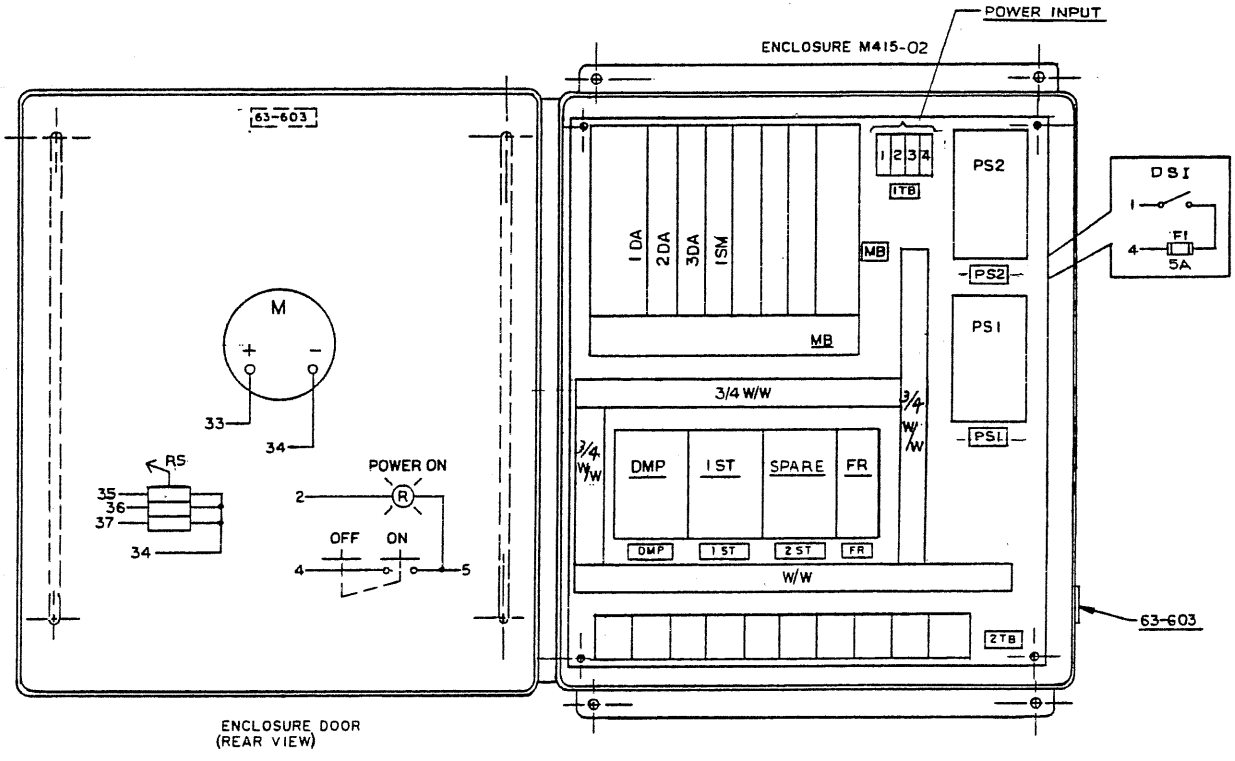
If no faults are found in the above steps, repeat calibration procedures.

MULTI-CELL CONTROL M415

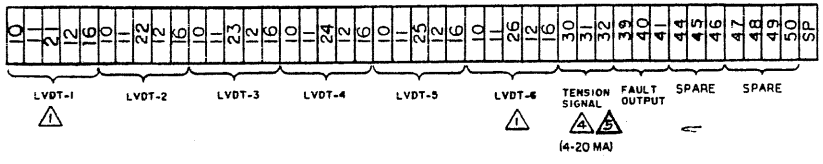
TABLE 2			X = ON — = OFF
CHANNELS SELECTED	A (35) 48 (TERM)	B (36) 49	C (37) 50
ALL	—	—	—
1	X	—	—
2	—	X	—
3	X	X	—
4	—	—	X
5	X	—	X
6	—	X	X



RS LEGEND PLATE



ENCLOSURE DOOR (REAR VIEW)



2TB DETAIL

Notes

1 Use Shielded Cable-Belden 8723 or equal.

2 Connect Common Side of Ac Input to Terminal 2

3 For Tensioncells in Compression, Terminal 4 (LVDT blue lead) is positive with respect to Terminal 3 in Tension. Terminal 3 is positive with respect to Terminal 4. Connections shown are for Tensioncells in Compression. See Table 1 for Connections.

4 Isolated Tension Signal is for Feedback to Customer's Drive.

5 Use Shielded Cable - Belden 9462 or equal.

COMPTROL MANUFACTURED PRODUCTS

BALLSCREW PRODUCTS

- Inch and metric rolled thread ballscrews
- Precision ground ballscrews
- Single and preloaded ballnuts for base, flange, cut-off flange, or trunnion mounting
- Base, flange, or cut-off flange mounted end bearing supports
- Custom and modified units also available

COMPLETE BALLSCREW PACKAGES

Comptrol complete ballscrew packages feature standard pre-engineered Comptrol products to provide ready-to-install ballscrew "package" consisting of the ballscrew, ballnut, and end mounting bearing supports. Custom and modified standard assemblies are also available.

HIGH SPEED LINEAR POSITIONERS

Comptrol industrial linear positioners for applications requiring stroke lengths up to 36 inches, load capacities up to 5,000 pounds, and speeds up to 50 inches per second.

QUALITY VERIFICATION SYSTEMS

Comptrol Rod and Piston Systems

An industry standard for over 20 years in reciprocating engine plants around the world, Comptrol Connecting Rod and Piston Balancing Systems provide an accurate, high speed method of weighing and balancing connecting rods and pistons on automatic engine transfer lines.

Comptrol Weighcells Systems

Ideal for automatic assembly and packaging systems, Comptrol weighcells provide a high speed, continuous method of monitoring of process quality. These systems can detect weight deviations within 0.1 gram of the ideal weight in 0.8 seconds.

TENSION MONITORING SYSTEMS

Comptrol tension monitoring systems are designed to measure and control strip or web tension of continuous process lines. Available in over 30 models with capacity ranges from 4 to 20,000 pounds, these units are ideal for new, replacement and retrofit applications.

COMPTROL TECHNICAL SUPPORT

ENGINEERING

- Application Assistance
- Mechanical Design
- Electrical Design
- Software Design

CUSTOMER SUPPORT

- Field Service Support
- Project Planning
- Installation Supervision and Assistance
- Installation Inspection
- Documentation

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- Electrical and Mechanical Assembly
- In-house Machining

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