225NEST Operation Manual
For Smart and Analog Scale Systems

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DISCLAIMER

While every precaution has been taken in the preparation of this manual, the Seller assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained herein. All instructions and diagrams have been checked for accuracy and ease of application; however, success and safety in working with tools depend primarily upon individual accuracy, skill, and caution. For this reason, the Seller is not able to guarantee the result of any procedure contained herein. Nor can they assume responsibility for any damage to property or injury to persons occasioned from the procedures. Persons engaging in the procedures do so entirely at their own risk.

FCC COMPLIANCE STATEMENT

This equipment generates, uses, and can radiate radio frequency and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been designed within limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case the user will be responsible for taking whatever measures necessary to correct the interference.

You may find the booklet "How to Identify and Resolve Radio-TV Interference Problems" prepared by the Federal Communications Commission helpful. It is available from the U.S. Government Printing Office, Washington, D.C. 20402. Request stock No. 001-000-00315-4.

PRECAUTIONS

Before using this product, read this manual and pay special attention to all "NOTIFICATION" symbols:

⚠ **IMPORTANT**	⚡ **ELECTRICAL WARNING**	**STATIC SENSITVE**

SERIAL NUMBER _____

DATE OF PURCHASE _____

PURCHASED FROM _____

_____

RETAIN THIS INFORMATION FOR FUTURE USE

PROPER DISPOSAL

When this device reaches the end of its useful life, it must be properly disposed of. It must not be disposed of as unsorted municipal waste. Within the European Union, this device should be returned to the distributor from where it was purchased for proper disposal. This is in accordance with EU Directive 2002/96/EC. Within North America, the device should be disposed of in accordance with the local laws regarding the disposal of waste electrical and electronic equipment.

It is everyone's responsibility to help maintain the environment and to reduce the effects of hazardous substances contained in electrical and electronic equipment on human health. Please do your part by making certain that this device is properly disposed of. The symbol shown to the right indicates that this device must not be disposed of in unsorted municipal waste programs.

CAUTION

CAUTION: RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE. DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS.

ATTENTION: RISQUE D'EXPLOSION SI LA BATTERIES EST REMPLACE'E PAR UN TYPE INCORRECT. REJETEZ LES BATTERIES UTILISE'ES SELON LES INSTRUCTIONS.

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INTRODUCTION

The 225NEST is a diagnostic tool for use with Cardinal ARMOR Digital Truck Scales with SMARTCELL load cells and ARMOR Truck Scales with analog load cells and junction boxes. The NEST provides fast, accurate, and ultra-portable truck scale diagnostics. Quickly test individual load cells, the load cell cables, and check the home run and weight indicator connections. Unique to the weighing industry, the NEST provides a service technician the toolkit to see where a scale's potential issues may exist within seconds.

Features

- Rechargeable Battery Power
- Weatherproof Outdoor-Grade Rugged Carrying Case
- Wi-Fi Standard for Connectivity with Free 225NEST Mobile App

ARMOR Digital Truck Scale with SMARTCELL Load Cells

When used on a digital truck scale, the NEST will perform tests on the digital load cells, the load cell cables, and the homerun cable.

On a digital load cell, the NEST will test both communication loops, the analog section, and check the load cell for internal drift. In addition, it will display the milliamps current the load cell is pulling. When the load cell test has been completed, it will display Pass or Fail on the screen.

The NEST will conduct a voltage test on the load cell and homerun cables. The cable test can be performed in an automatic mode or a manual testing mode. When started, the automatic test mode steps through each voltage level continuously until stopped by the technician. The manual mode allows the technician to step through the voltage levels and observe the test voltage and voltage drop across the cable.

Both cable test modes will display a Pass or Fail result on the screen.

ARMOR Truck Scale with Analog Load Cells

On a Cardinal Armor truck scale with junction boxes and analog load cells, the NEST plugs directly into the trim board of a scale universal section seal trim box and displays millivolts and pounds readings for up to 12 load cells, and the reading from the junction box summing circuitry. In addition, the NEST can provide a millivolt output signal for the home run cable to the digital weight indicator's analog input.

There are two units of display: millivolts or pounds. The pounds display is a rough approximation of the weight corresponding to the millivolts reading. At startup, the NEST assumes the load cells have a rated capacity of 75000 lb and rated output of 2 mV/V. It may be necessary to change the cell parameters to match the scale being tested. See the ANALOG SCALE DIAGNOSTICS section, CELLS KEY in the KEYPAD FUNCTIONS section to see how to change the load cell parameters.

NEST SMART AND ANALOG SCALE TESTER

The 225NEST Smart and Analog Scale Tester is a diagnostic tool for use with Cardinal ARMOR Digital Truck Scales with SMARTCELL load cells and ARMOR Truck Scales with analog load cells and junction boxes.

TESTER MENU – Selecting the Test Mode

1. Press the **ON/OFF** key to apply power to the NEST.

2. The display will show the Cardinal Logo, the model number, the software revision, and then change to the TESTER MENU screen.

```
             TESTER MENU
1. SMART SCALE TEST / CALIBRATE      15.16
2. CABLE / CELL TESTER
3. CELL UPDATER
4. CELL SIMULATOR
5. ANALOG TESTER
Enter Selection:   0
```

3. Press a numeric key and then the **ENTER** key to select a test procedure.

4. After entering a selection, the display will change to the selected test procedure screen. Note that additional selections and functions will be displayed on the individual test screens.

NOTE: The upper right side of the TESTER MENU screen will be showing status information about the NEST. For example, in the illustration above, 15.16 is shown. This is the NEST power supply voltage (in VDC).

DISPLAY CONTRAST ADJUSTMENT

The NEST uses a combination of the **SHIFT**, **ENTER,** and **SPACE** keys to adjust the contrast of the LCD display.

To Increase the LCD Contrast

1. Press and hold the **SHIFT** key and then press the **ENTER** key.

2. Repeatedly press the **ENTER** key to increase the contrast to the desired level.

3. When the LCD contrast is at the desired level, stop pressing the **ENTER** key and release the **SHIFT** key to save the setting.

To Reduce the LCD Contrast

1. Press and hold the **SHIFT** key and then press the **SPACE** key.

2. Repeatedly press the **SPACE** key to reduce the contrast to the desired level.

3. When the LCD contrast is at the desired level, stop pressing the **SPACE** key and release the **SHIFT** key to save the setting.

SMART SCALE TESTER

NEST DIGITAL PORTS AND CABLE TEST REMOTE

The NEST has three (3) digital ports next to the analog cable gland connectors that are used when testing the load cells, load cell cables, homerun cable, the CAN bus, and all other components and functions of the digital scale. A single wire with a clip is also provided to connect to the outer metal portion of the cable connector to check if an internal wire is shorted to the cable shield.

When testing the homerun and load cell cables, a provided CABLE TEST REMOTE is used to complete the circuit for testing. The CABLE TEST REMOTE serves as a termination for the cable allowing checks for shorts and continuity.

DIGITAL 1 Port (CAN Bus 1)

DIGITAL 2 Port (CAN Bus 2)

CABLE TEST Digital Cable Test Port

CABLE TEST Cable Outer Metal Cover Clip

CABLE TEST Cable Outer Metal Cover Clip Wire

Digital Cable Test Port

Homerun Cable Test Port

CABLE TEST REMOTE

Digital Ports
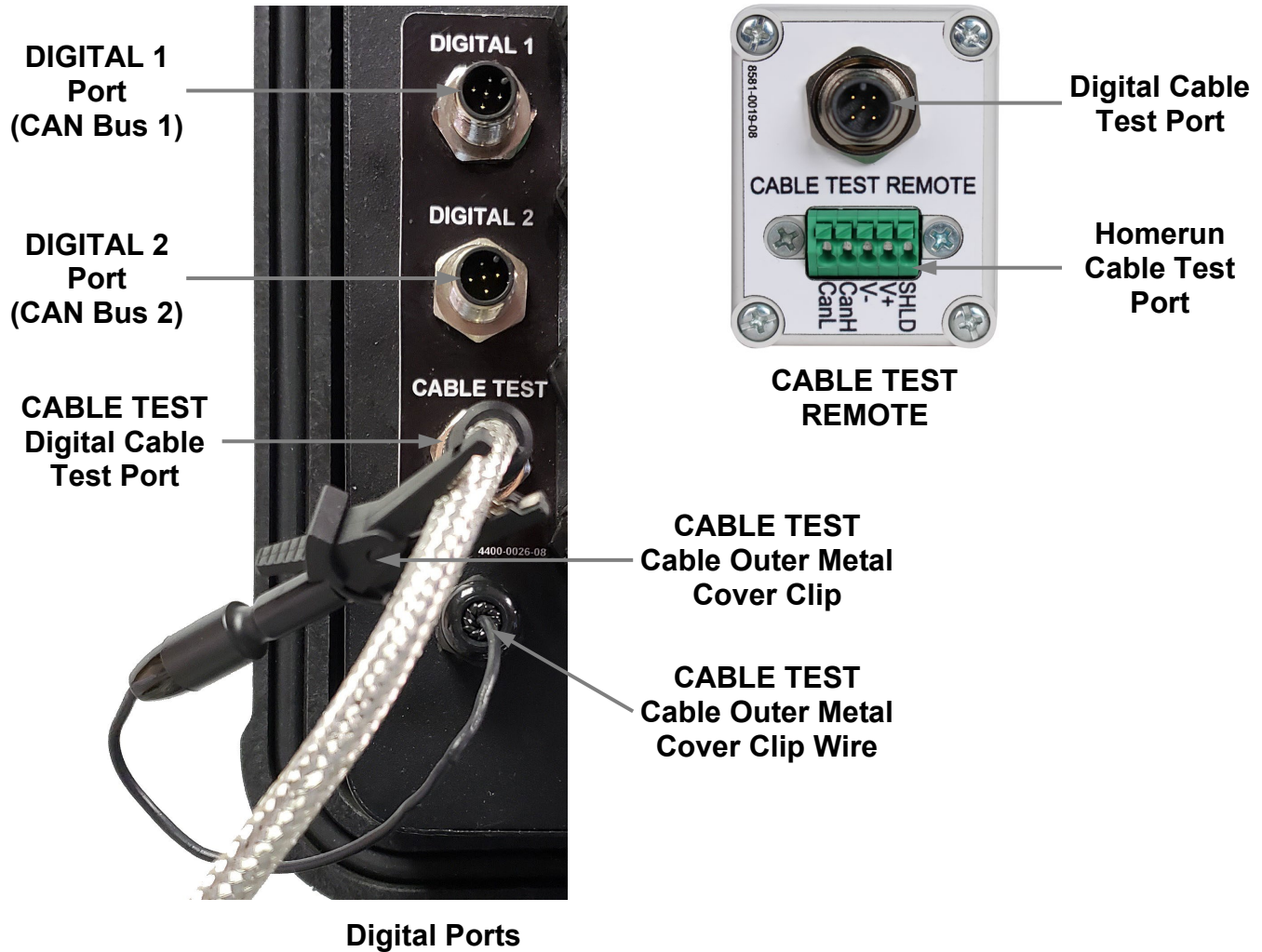
1. SMART SCALE TEST / CALIBRATE

This selection is used to test a single scale, a multiple scale, or to calibrate the scale.

If the indicator is not sealed, the NEST can perform the following calibration tasks: SmartCal, Zero Cal, and Span Adjust.

```
              TESTER MENU
1. SMART SCALE TEST / CALIBRATE        15.16
2. CABLE / CELL TESTER
3. CELL UPDATER
4. CELL SIMULATOR
5. ANALOG TESTER
Enter Selection:    0
```

1. Connect the NEST to an ARMOR Digital Scale or a SmartCAN by removing the End Node and connecting the NEST to the home run cable. Alternatively, you can connect the NEST using a "T" connector to the home run cable.

2. The NEST will show the scale weight from the indicator.

NOTE: Ensure the indicator has the current software.

Single Scale Test

With the TESTER MENU displayed, press the **1** key and then the **ENTER** key to select SMART SCALE TEST / CALIBRATE. The display will change to show the following screen on a single scale.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    200




SMART CAL ZERO CAL    SPAN ADJ
```

Example of Single Scale Test Screen

The **ZERO** key on the NEST may be used as the zero key function on the scale. Note it may take a few seconds for the NEST display to update to show zero.

Multiple Scale Test

The 225D can be configured for up to 3 scales. The 825D can have up to 10 scales. (it will show the first five scales on the top row and up to five more scales on the second row. The NEST navigation keys may be used to select the scale.

With the TESTER MENU displayed, press the **1** key and then the **ENTER** key to select SMART SCALE TEST / CALIBRATE. The display will change to show the following screen on a multiple scale.

```
SMART SCALE TEST / CALIBRATE
SCALE 1  SCALE 2  SCALE 3
   -20      -20       00




SMART CAL ZERO CAL   SPAN ADJ
```
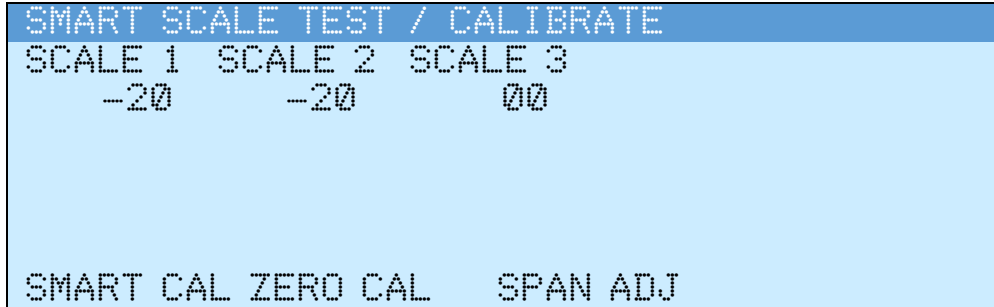
Multiple Scale Test / Calibrate Screen

The **ZERO** key on the NEST may be used as the zero key function on the selected scale. Note it may take a few seconds for the NEST display to update to show zero.

SmartCal®

With Cardinal's SmartCal® calibration, the calibration and trimming can be performed in one application of the test load to the scale. This is accomplished by applying the test load to the load cells down one side of the scale and then back along the opposite side. For example, on a ten (10) load cell scale, instead of applying the test load from one side to the other side (load cell 1, load cell 2, load cell 3, load cell 4, load cell 5, etc.), with SmartCal®, the odd-numbered load cells (1, 3, 5, 7, and 9) are checked first, then in reverse order, the even-numbered load cells (10, 8, 6, 4 and 2). Refer to the figure below. This requires a minimal amount of maneuvering the test cart, resulting in a much quicker calibration.
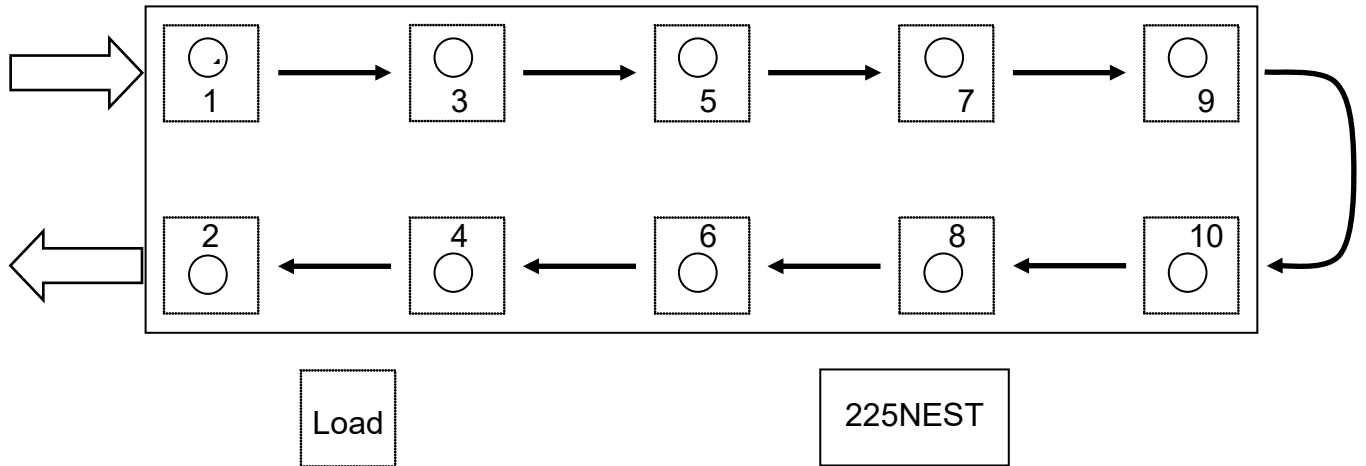
SmartCal® Load Cell and Load Placement

1. With the SMART SCALE TEST / CALIBRATE screen shown, press the **SMART CAL** key.
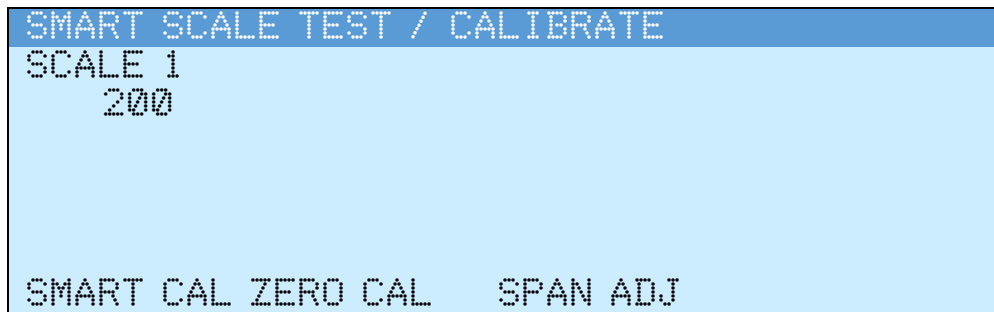
2. The display will change to show a prompt to enter the calibration weight.
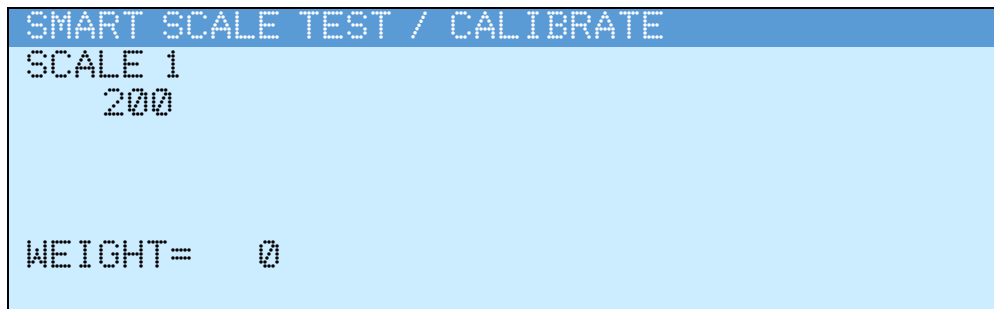
3. Enter the calibration weight and then press the **ENTER** key.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    200



WEIGHT=    20000
```
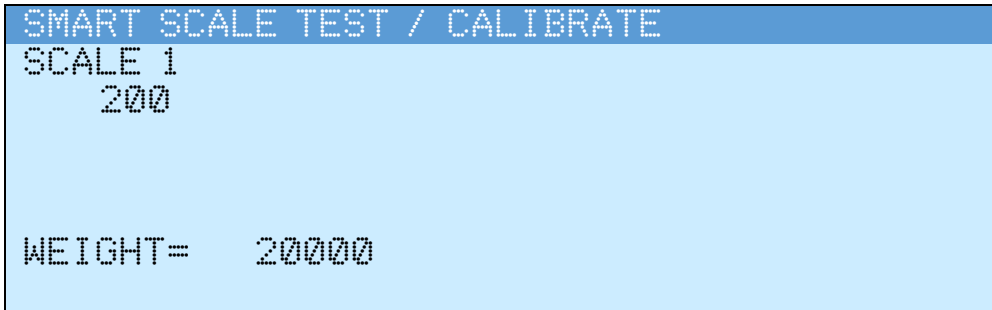
4. Make sure the scale is empty and stable, and then press the **OK** key. This will capture the calibrated dead load weight of the scale.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    200



SMART CAL  -  EMPTY SCALE 1
                         OK          CANCEL
```
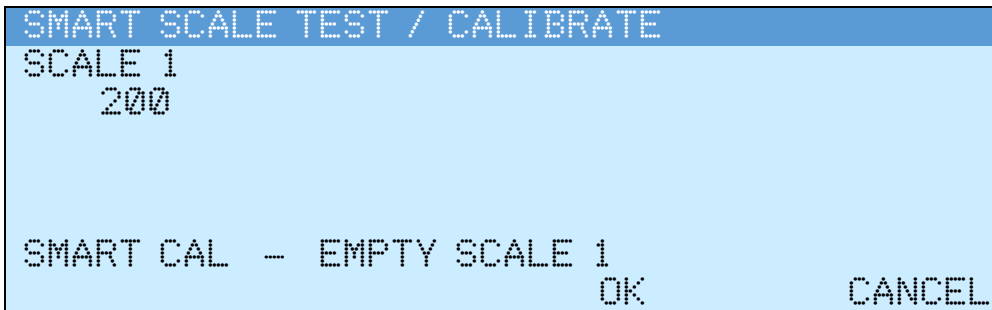
5. The display will change to show that SmartCAL is verifying the scale is empty, and then change to the prompt to place the weight on the first load cell.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    200



SMART CAL  -  READING EMPTY
                         OK          CANCEL
```

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    200



PLACE WEIGHT ON CELL 1
                         OK          CANCEL
```
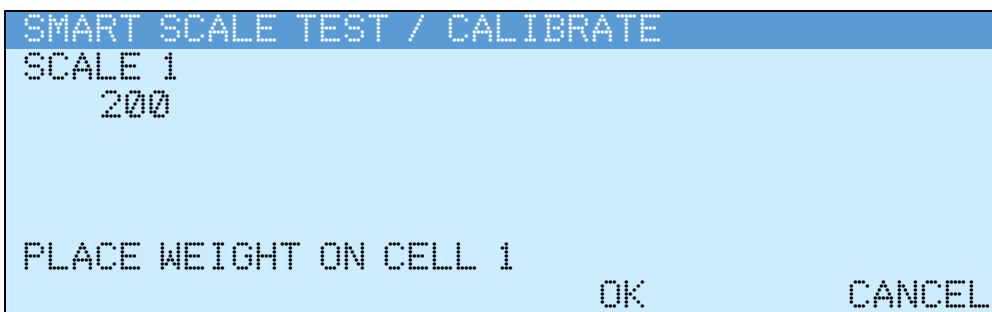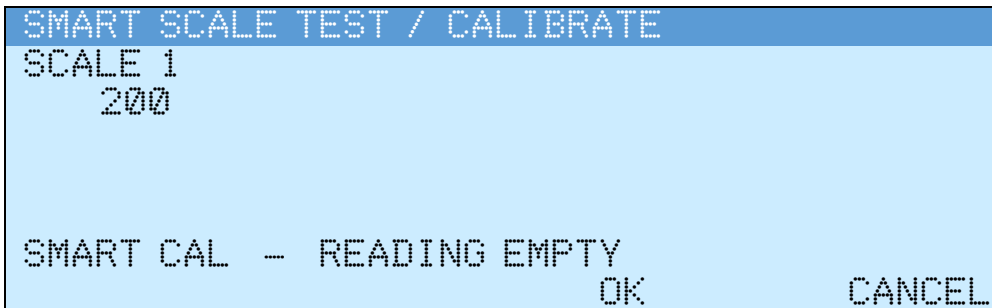
6. Place the weight on (center it over) the first load cell and make sure the scale is stable, then press the **OK** key.

7. The display will change to show that SmartCal is reading the weight on the first load cell and then change to the prompt to place the weight on the second load cell.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
  20200



READING WEIGHT 1
```

```
SMART SCALE TEST / CALIBRATE
SCALE 1
  20200



PLACE WEIGHT ON CELL 2
                    OK        CANCEL
```
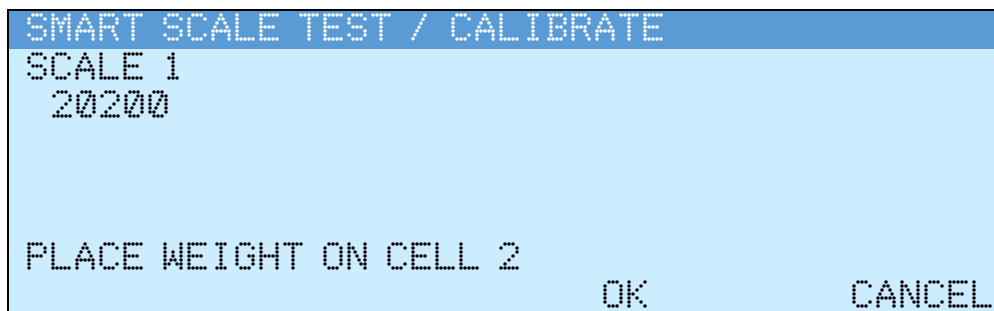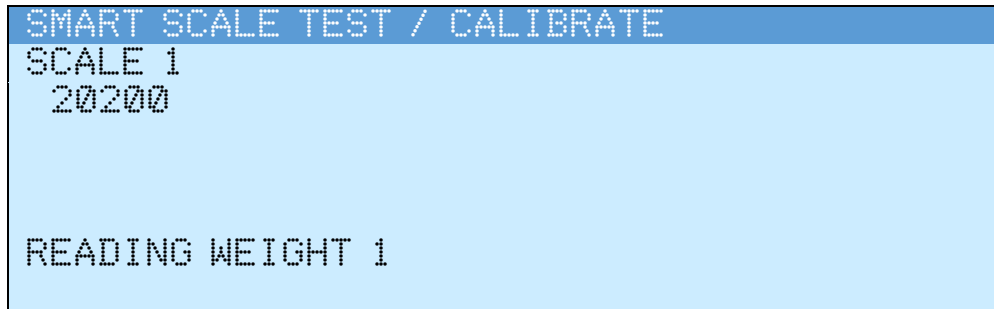
8. Place the weight on (center it over) the second load cell and make sure the scale is stable, then press the **OK** key.

9. The display will change to show that SmartCal is reading the weight on the second load cell and then change to the prompt to place the weight on the third load cell.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
  20200



READING WEIGHT 2
```

```
SMART SCALE TEST / CALIBRATE
SCALE 1
  20200



PLACE WEIGHT ON CELL 3
                    OK        CANCEL
```
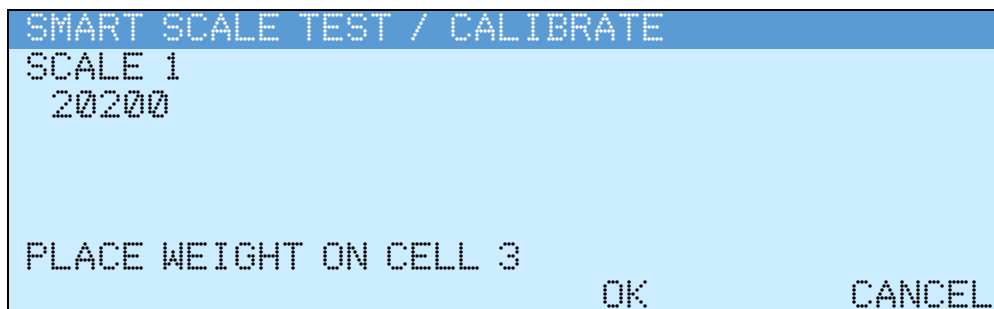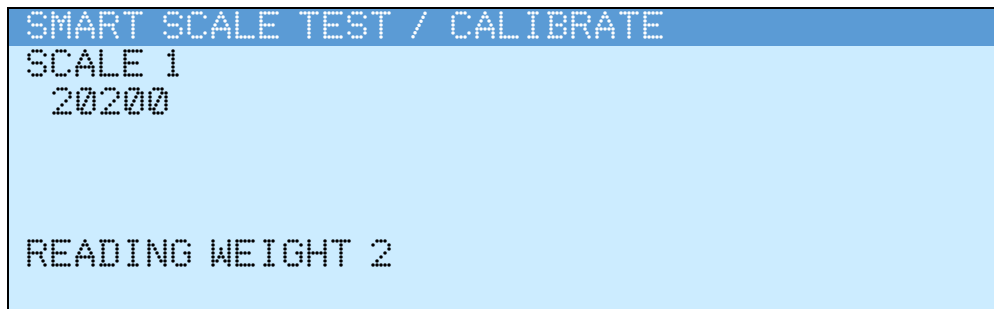
10. Repeat for each load cell in the order the display prompts for.

For example, if the scale has 10 cells, you will first apply weight to the odd cells 1, 3, 5, 7, and 9 up to the end of the scale, and then apply weight back down the even cells 10, 8, 6, 4 finishing on load cell 2.

11. When SmartCal has finished reading the weight on the last load cell, the display will momentarily show that SmartCal has been completed (see the screen example below) and then return to the SMART SCALE TEST / CALIBRATE screen.
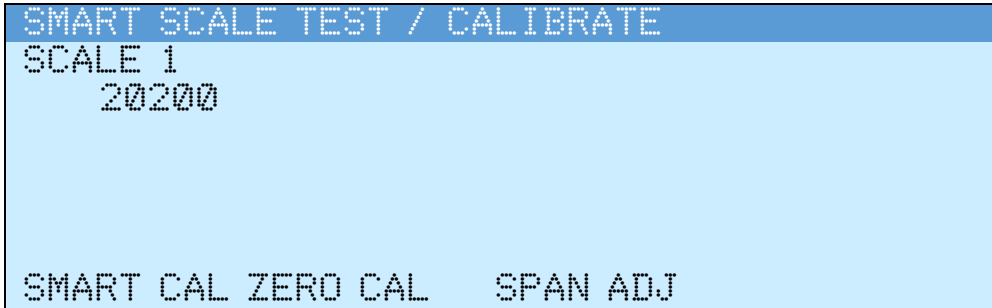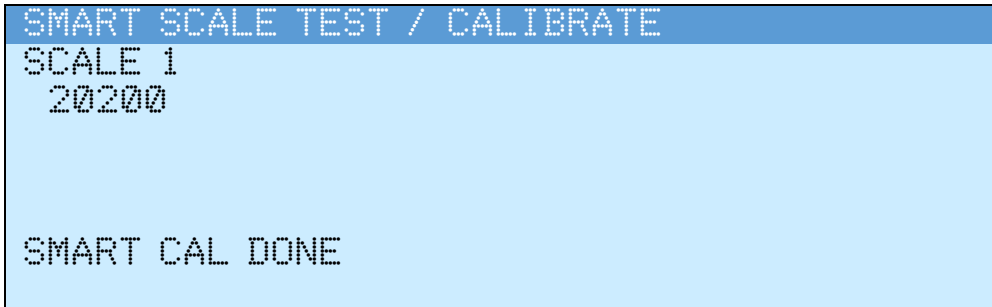
```
SMART SCALE TEST / CALIBRATE
SCALE 1
  20200




SMART CAL DONE
```

```
SMART SCALE TEST / CALIBRATE
SCALE 1
     20200




SMART CAL ZERO CAL    SPAN ADJ
```

12. Press the Navigation Keys △ UP Arrow to exit the SMART SCALE TEST / CALIBRATE screen and return to the TESTER MENU.

Zero Calibration

Zero Calibration does not affect the trimming of the cells or affect the span. It simply sets the dead load weight of the scale.

1. With the SMART SCALE TEST / CALIBRATE screen shown, press the **ZERO CAL** key.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    200




SMART CAL ZERO CAL    SPAN ADJ
```
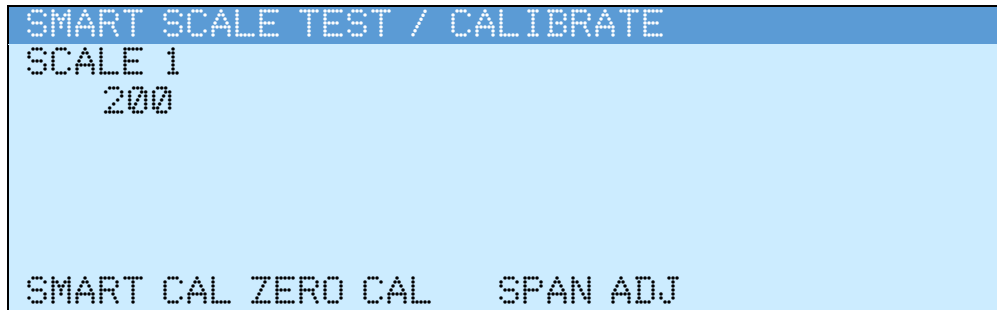
2. The display will change to show a prompt to empty the scale.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    00



ZERO CAL  -  EMPTY SCALE 1
                      OK        CANCEL
```

3. Make sure the scale is empty and stable, and then press the **OK** key.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    00



ZERO CAL STARTED
```
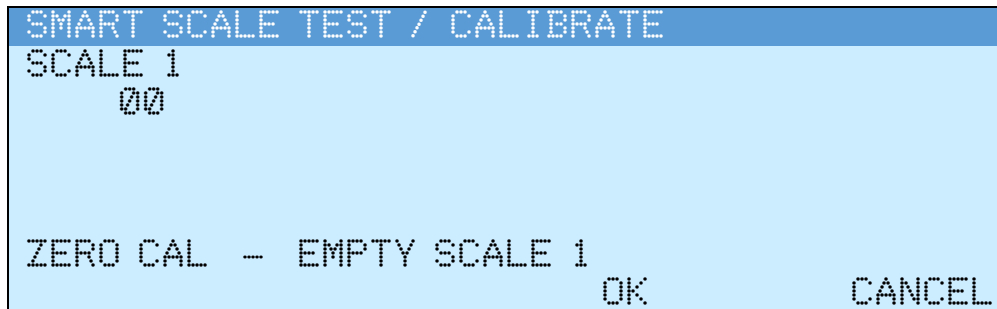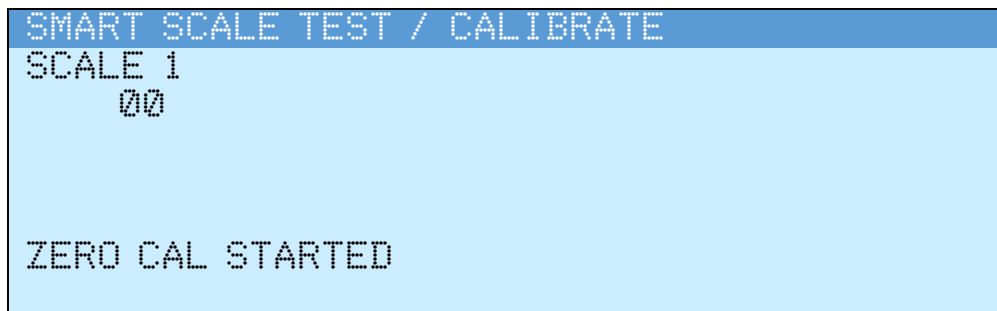
4. The dead load weight will be recorded, and the display will change to show zero weight.
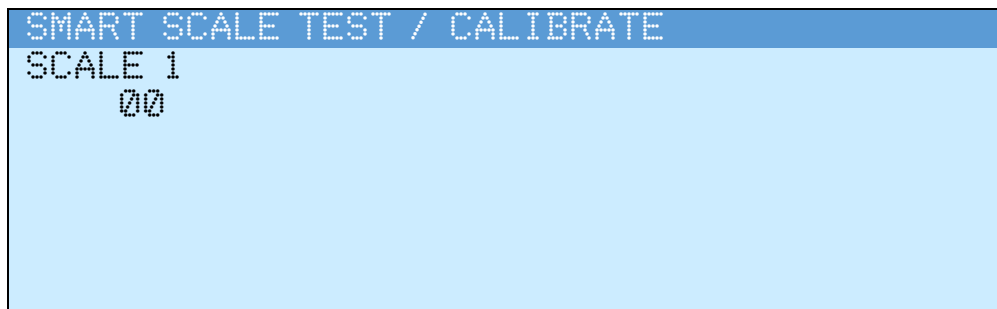
```
SMART SCALE TEST / CALIBRATE
SCALE 1
    00




```

5. Press the Navigation Keys △ UP Arrow to exit the SMART SCALE TEST / CALIBRATE screen and return to the TESTER MENU.

Span Adjustment

Span Adjustment allows the user to modify the span of the entire scale at once.

1. With the SMART SCALE TEST / CALIBRATE screen shown, press the **SPAN ADJ** key.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    200



SMART CAL ZERO CAL   SPAN ADJ
```
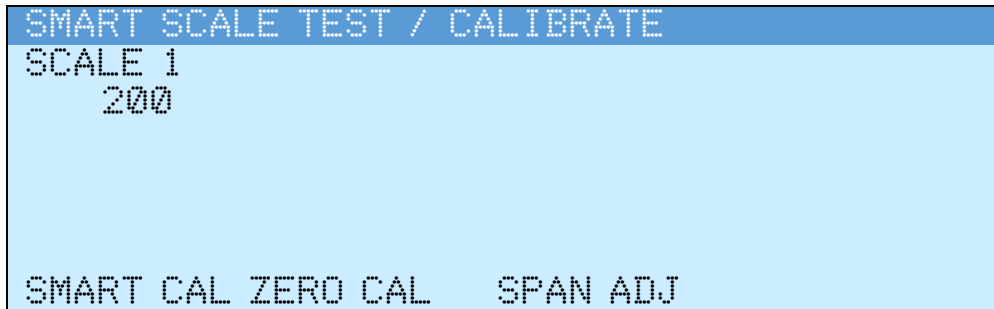
2. The display will change to show a prompt to enter the value of the weight.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    00



WEIGHT=   0
```
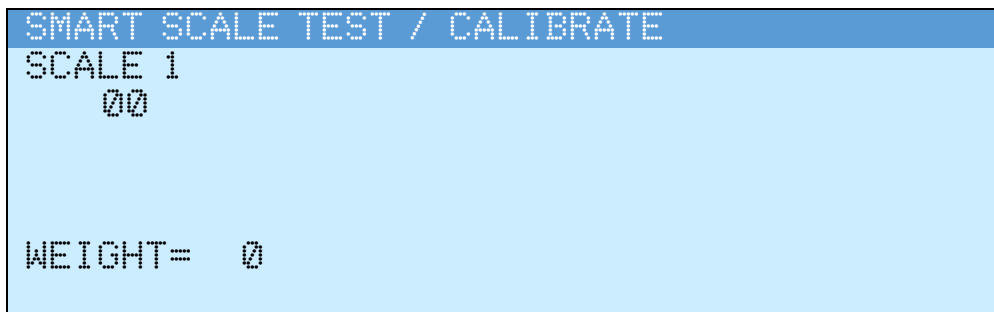
3. Make sure the weight is on the scale (at any location on the scale), enter the value of the weight, and then press the **ENTER** key.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    00



WEIGHT=   24000
```
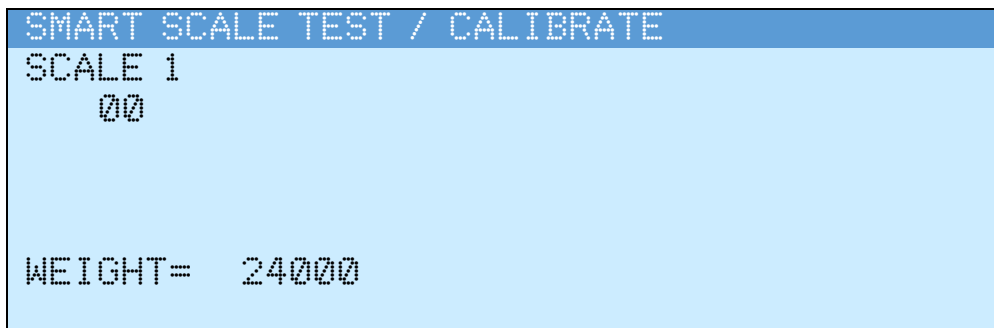
4. The display will change to show the span adjustment has started.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
  24000



SPAN ADJUST STARTED
```
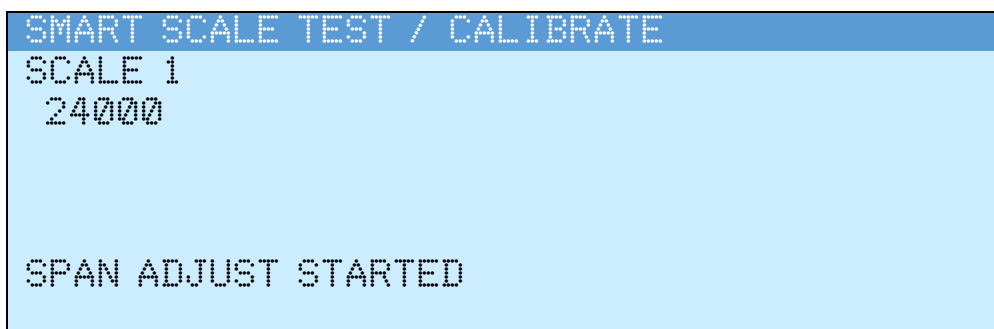
5. When the span adjustment has been completed, the display will momentarily show SPAN ADJUST DONE, change to show the new span weight, and then return to the SMART SCALE TEST / CALIBRATE screen. **NOTE:** It may take a few seconds for the new weight to show.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    24000



SPAN ADJUST DONE

```

```
SMART SCALE TEST / CALIBRATE
SCALE 1
    24000



SMART CAL ZERO CAL   SPAN ADJ
```
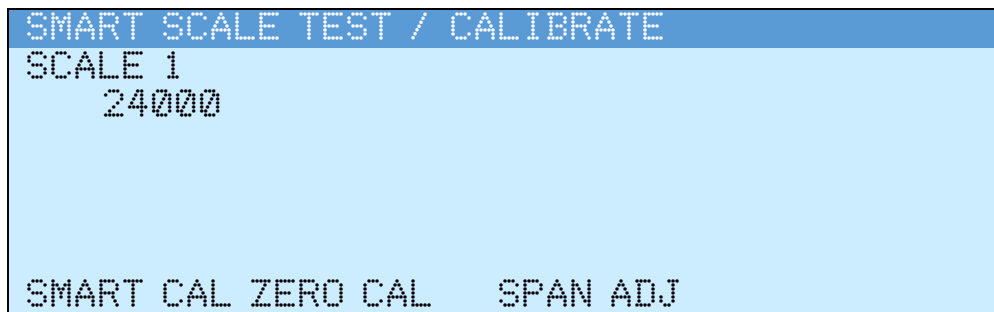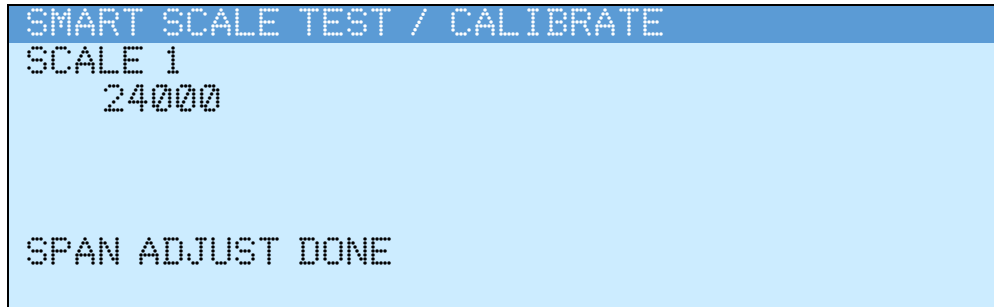
6. Press the Navigation Keys △ UP Arrow to exit the SMART SCALE TEST / CALIBRATE screen and return to the TESTER MENU.

Cell Diagnostics / Trim

View Diagnostic Screens

1. With the SMART SCALE TEST / CALIBRATE screen displayed, select the desired scale and then press the **ENTER** key.

```
SMART SCALE TEST / CALIBRATE
SCALE 1
     24000




SMART CAL ZERO CAL    SPAN ADJ
```

2. The display will change to the DISPLAY CELL – WEIGHT screen.

3. With the DISPLAY CELL – WEIGHT screen displayed, press the **PREV** key or **NEXT** key to cycle through the Diagnostics screens. **NOTE:** Some Diagnostic screens have additional keys and functions.

```
DISPLAY CELL — WEIGHT
2:    5888          1:    6714
4:    5671          3:    5741
6:    5712          5:    5899
8:    5917          7:    5910

Scale 1 Weight    24000
   PREV       NEXT        TRIM
```

```
DISPLAY CELL  —  CELL IDs
2: 1D6BFF0F         1: 15D64531
4: 0B5B616F         3: 101BA5C1
6: 115DC621         5: 049AED9F
8: 0B2E2ECF         7: 0AF79DC0


   PREV       NEXT
```

```
DISPLAY CELL  —  VERSION
2: 1.00.016        1: 1.00.016
4: 1.00.016        3: 1.00.016
6: 1.00.016        5: 1.00.016
8: 1.00.016        7: 1.00.016


   PREV       NEXT
```

```
 DISPLAY CELL  —  POWER VOLTAGE
2:  14.132 V          1:  14.663 V
4:  14.413 V          3:  14.660 V
6:  14.418 V          5:  14.610 V
8:  14.476 V          7:  14.977 V


    PREV        NEXT
```

```
 DISPLAY CELL  —  TEMPERATURE
2:    25.3C          1:    25.2C
4:    25.2C          3:    25.1C
6:    24.9C          5:    24.8C
8:    24.7C          7:    24.6C


    PREV        NEXT
```

```
 DISPLAY CELL  —  MAX/MIN TEMPERATURE
2: -49.0C /-49.0C    1: -41.0C /-41.0C
4: -41.0C /-41.0C    3: -41.0C /-41.0C
6: -41.0C /-41.0C    5: -41.0C /-41.0C
8: -41.0C /-41.0C    7: -41.0C /-41.0C


    PREV        NEXT        RESET
```

NOTE: Press the **RESET** key to reset the MAX/MIN temperature values.

```
 DISPLAY CELL  —  MILLIVOLTS
2:  8.629 mV          1:  9.964 mV
4:  9.277 mV          3:  8.580 mV
6:  9.725 mV          5:  9.484 mV
8:  8.049 mV          7:  8.635 mV


    PREV        NEXT
```

```
DISPLAY CELL  -  COMM ERR COUNT
2:          0          1:          0
4:          0          3:          0
6:          0          5:          0
8:          0          7:          0


   PREV         NEXT         CLEAR
```

NOTE: Press the **CLEAR** key to clear the COMMUNICATION ERROR COUNTS.

```
DISPLAY CELL  -  ANALOG ERR COUNT
2:          0          1:          0
4:          0          3:          0
6:          0          5:          0
8:          0          7:          0


   PREV         NEXT         CLEAR
```

NOTE: Press the **CLEAR** key to clear the ANALOG ERROR COUNTS.

```
DISPLAY CELL  -  RAW COUNT
2:   2397018      1:   2767944
4:   2577037      3:   2383406
6:   2603603      5:   2634546
8:   2713488      7:   2764001


   PREV         NEXT
```

```
DISPLAY CELL  -  MAX WEIGHT/COUNT
2: 77480 /    1307  1: 85080 /     561
4: 84016 /     407  3: 83263 /     415
6: 90073 /     355  5: 89354 /     607
8: 90588 /     473  7: 89057 /     506


   PREV         NEXT         RESET
```

NOTE: Press the **RESET** key to reset the MAX WEIGHT/COUNT values.

```
 DISPLAY CELL — UNTRIMMED WEIGHT
2:    34876            1:    33558
4:    33470            3:    34178
6:    33462            5:    38612
8:    35973            7:    33311



    PREV        NEXT
```

```
 DISPLAY CELL — CAL/WORK DEADLOAD
2: −9285 /      37   1:  5630 /      −1
4: 29375 /    −112   3: 29303 /      12
6: −1760 /      −4   5:   127 /      −0
8:  1423 /      46   7: −1431 /     −10



    PREV        NEXT
```

Cell Diagnostics / Trim

Trim Cells

IMPORTANT! If the indicator is not CAL sealed, individual cells or pairs of cells may be trimmed. Note that this requires a test load weight.

1. With the DISPLAY CELL – WEIGHT screen displayed, press the **TRIM** key.

```
 DISPLAY CELL — WEIGHT
2:     361            1:      −3
4:    5871            3:    8835
6:    2172            5:     899
8:    1718            7:      10

Scale 1 Weight    19860
   PREV        NEXT        TRIM
```

2. The display will change to the DISPLAY CELL – WEIGHT screen and show the weight and trim adjust (Coarse and Fine) values.

```
 DISPLAY CELL — WEIGHT          24000
2:   5888 / 0.17940  1:   6714 / 0.17823
4:   5671 / 0.16804  3:   5741 / 0.17983
6:   5712 / 0.17459  5:   5899 / 0.16798
8:   5917 / 0.17762  7:   5910 / 0.17523



    CELL        ENTER WT     ADJUST
```

3. Next, you must select the Cell or Section to trim. **NOTE:** Section is the default selection with both cells in the selection shown high-lighted (white numbers on dark background).

   1. To select the Section to trim, use the Navigation Keys △ UP Arrow or ▽ Down Arrow to select the section with weight on it.

   2. To select a specific cell to trim, press the **CELL** key and then use the Navigation Keys △ UP Arrow, ▽ Down Arrow, ◁ Left Arrow, or ▷ Right Arrow to select the cell with weight on it.

Section Trim

1. With the DISPLAY CELL – WEIGHT screen displayed, use the nav keys to select (highlight) the section to trim.

```
DISPLAY CELL  -  WEIGHT          1980
2:    122 / 1.00000   1:       0 / 1.00000
4:    639 / 1.00000   3:    1024 / 1.00000
6:     84 / 1.00000   5:      18 / 1.00000
8:    104 / 1.00000   7:     -16 / 1.00000


    CELL         ENTER WT      ADJUST
```

2. With the section selected (highlighted), press the **ENTER WT** key to enter a weight value to adjust the trim and press the **ENTER** key.

```
DISPLAY CELL  -  WEIGHT          1980
2:    122 / 1.00000   1:       0 / 1.00000
4:    639 / 1.00000   3:    1024 / 1.00000
6:     84 / 1.00000   5:      18 / 1.00000
8:    104 / 1.00000   7:     -16 / 1.00000


WEIGHT=   2000
```

3. After entering the weight value and pressing the **ENTER** key, the trim values will be adjusted for the selected cells.

```
DISPLAY CELL  -  WEIGHT          1980
2:    122 / 1.00000   1:       0 / 1.00000
4:    638 / 1.00000   3:    1023 / 1.00000
6:     84 / 1.00000   5:      18 / 1.00000
8:    104 / 1.00000   7:     -16 / 1.00000


    CELL         ENTER WT      ADJUST
```

4. Select ADJUST to adjust the trim values by Coarse (ADJ UP / ADJ DN) or Fine (FINE UP / FINE DN) adjustments.

```
DISPLAY CELL - WEIGHT        1980
2:     122 / 1.00000    1:       0 / 1.00000
4:     630 / 1.00000    3:    1057 / 1.00000
6:      84 / 1.00000    5:      18 / 1.00000
8:     104 / 1.00000    7:     -16 / 1.00000


   ADJ UP      ADJ DN      FINE UP    FINE DN
```

NOTE: The amount of weight that changes will depend upon several factors:
- Coarse (ADJ UP / ADJ DN) should be several grads.
- Fine (FINE UP / FINE DN) should be less than a grad.

5. Press the ⟵/**ESC** key to exit the ADJUST screen and return to the DISPLAY CELL – WEIGHT screen.

Cell Trim

1. With the DISPLAY CELL – WEIGHT screen displayed, press the **CELL** key and then use the Navigation Keys △ UP Arrow, ▽ Down Arrow, ◁ Left Arrow, or ▷ Right Arrow to select the cell with weight on it.

```
DISPLAY CELL - WEIGHT        1980
2:     122 / 1.00000    1:       0 / 1.00000
4:     639 / 1.00000    3:    1024 / 1.00000
6:      84 / 1.00000    5:      18 / 1.00000
8:     104 / 1.00000    7:     -16 / 1.00000


   SECTION     ENTER WT    ADJUST
```

2. With the cell selected (highlighted), press the **ENTER WT** key to enter a weight value to adjust the trim and press the **ENTER** key.

```
DISPLAY CELL - WEIGHT        1980
2:     122 / 1.00000    1:       0 / 1.00000
4:     639 / 1.00000    3:    1024 / 1.00000
6:      84 / 1.00000    5:      18 / 1.00000
8:     104 / 1.00000    7:     -16 / 1.00000

WEIGHT=    2000
```

3. After entering the weight value and pressing the **ENTER** key, the trim values will be adjusted for the selected cell.

```
DISPLAY CELL  -  WEIGHT           1980
2:     122 / 1.00000    1:       0 / 1.00000
4:     638 / 1.00000    3:    1023 / 1.00000
6:      84 / 1.00000    5:      18 / 1.00000
8:     104 / 1.00000    7:     -16 / 1.00000


   CELL          ENTER WT    ADJUST
```

4. Select ADJUST to adjust the trim value by Coarse (ADJ UP / ADJ DN) or Fine (FINE UP / FINE DN) adjustments.

```
DISPLAY CELL  -  WEIGHT           1980
2:     122 / 1.00000    1:       0 / 1.00000
4:     630 / 1.00000    3:    1057 / 1.00000
6:      84 / 1.00000    5:      18 / 1.00000
8:     104 / 1.00000    7:     -16 / 1.00000


   ADJ UP        ADJ DN      FINE UP    FINE DN
```

NOTE: The amount of weight that changes will depend upon several factors:
- Coarse (ADJ UP / ADJ DN) should be several grads.
- Fine (FINE UP / FINE DN) should be less than a grad.

5. Press the ⟵ /**ESC** key to exit the ADJUST screen and return to the DISPLAY CELL – WEIGHT screen.

```
DISPLAY CELL  -  WEIGHT           1980
2:     122 / 1.00000    1:       0 / 1.00000
4:     639 / 1.00000    3:    1024 / 1.00000
6:      84 / 1.00000    5:      18 / 1.00000
8:     104 / 1.00000    7:     -16 / 1.00000


   SECTION       ENTER WT    ADJUST
```

6. Press the ⟵ /**ESC** key to return to the SMART SCALE TEST / CALIBRATE screen.

5. Press the Navigation Keys △ UP Arrow to exit the SMART SCALE TEST / CALIBRATE screen and return to the TESTER MENU.

2. CABLE / CELL TESTER

This selection is used to test the load cell cables, the Homerun cable (from the scale to the indicator DLC card or from the scale to the POWER-DLC), and to test the digital load cells.

> **NOTE:** The CELL TEST can be performed on a digital load cell while it is still installed in the scale or after it has been removed.

```
┌─────────────────────────────────────────────┐
│               TESTER MENU                     │
│ 1. SMART SCALE TEST / CALIBRATE      15.16    │
│ 2. CABLE / CELL TESTER                        │
│ 3. CELL UPDATER                               │
│ 4. CELL SIMULATOR                             │
│ 5. ANALOG TESTER                              │
│ Enter Selection:   0                          │
│                                               │
└─────────────────────────────────────────────┘
```

1. With the TESTER MENU displayed, press the **2** key and then the **ENTER** key to select the CABLE / CELL TESTER MENU. The display will change to show the following screen:

```
┌──────────────────────────────────┬──────────┐
│        SMART SCALE TESTER        │   PWR     │
│ 1. CABLE TEST                       15.16    │
│ 2. CELL TEST                        0.000    │
│                                              │
│                                              │
│ Enter Selection: 0                           │
│                                              │
└─────────────────────────────────────────────┘
```

2. Press a numeric key and then the **ENTER** key to select a test procedure.

3. After entering a selection, the display will change to the selected test procedure screen.

> **NOTE:** Additional selections and functions will be displayed on the individual test screens.

PWR

This section of the SMART SCALE TESTER display shows the power supply voltage (in VDC) for the NEST and the amps the load cell is drawing.

The upper number is the power supply voltage for the NEST, and the lower number is the amps the load cell is drawing shown to the nearest milliamp.

1. CABLE TEST

This selection is used to test the load cell cables and the Homerun cable between the first load cell (start node) in the truck scale and the indicator (or the POWER-DLC) in the scale house.

How to Test Load Cell Cables

1. Disconnect both ends of the load cell cable you want to test from the digital load cells.

   NOTE: You do not have to remove the load cell cable from the truck scale.

2. Connect one end of the load cell cable to be tested to the digital cable test port on the CABLE TEST REMOTE and the other end to the CABLE TEST port on the NEST.

3. Next, connect the wire with the clip from the NEST to the metal portion of the cable connector. This allows the test to check for an internal wire shorted to the cable shield.

4. Press the **1** key, and then the **ENTER** key.

5. The display will change to show the cable test screen.

```
        NOM.      ACTUAL    PASS/FAIL    PWR
0       0.00V     0.00V        PASS      15.16
                                         0.000




     AUTO          NEXT                  EXIT
```

Auto Load Cell Cable Test

6. Press the **AUTO** key to test the load cell cable automatically at all voltages. Note that the AUTO test will display a count of tests (Pass:) and a count of any failures (Fail:).

```
        NOM.      ACTUAL    PASS/FAIL    PWR
1       0.41V     0.42V        PASS      11.30
                                         0.000
Pass:   314              Fail:  0



     MANUAL        START                 EXIT
```

7. Press the **START** key to begin the AUTO test or press the **MANUAL** key to return to the previous screen and manually test the load cell cable.

8. Press the **STOP** key to stop the AUTO test.

9. Press the **EXIT** key to return to the SMART SCALE TESTER screen.

Manual Load Cell Cable Test

1. Press the **NEXT** key to test the load cell cable manually at various voltages. See the table below for the test voltages and acceptable actual voltages.

2. Continue to press the **NEXT** key to step through each voltage test.

```
        NOM.      ACTUAL    PASS/FAIL    PWR
1       0.41V     0.42V       PASS      15.27
                                        0.002




     AUTO          NEXT                  EXIT
```

NOTE: Actual voltages should be within ±0.05V of the test voltage.

Test Step	Test Voltage	Actual Voltage
0	0.00V	-0.05V to 0.05V
1	0.41V	0.36V to 0.46V
2	0.83V	0.78V to 0.88V
3	1.24V	1.29V to 1.29V
4	1.65V	1.60V to 1.70V
5	2.06V	2.01V to 2.11V
6	2.48V	2.43V to 2.53V
7	2.89V	2.84V to 2.94V

3. Press the **EXIT** key to exit the manual load cell cable test and return to the SMART SCALE TESTER screen.

How to Test the Homerun Cable

1. Disconnect the Homerun cable from the digital load cell. **NOTE:** You do not have to remove the Homerun cable from the conduit between the truck scale and scale house.

2. Connect the end of the Homerun cable disconnected from the digital load cell to the CABLE TEST port on the NEST.

3. Next, connect the wire with the clip from the NEST to the metal portion of the cable connector. This allows the test to check for an internal wire shorted to the cable shield.

4. Remove the indicator (or POWER-DLC) power cord from the wall outlet.

5. Loosen the gland connectors on the indicator for the I/O cables to allow enough slack in the cable and wires to avoid stretching them, and then remove the indicator rear panel from the main housing and lay it next to the indicator.

   NOTE: If using a POWER-DLC, remove the top cover and set it aside.

6. Using a small flat-blade screwdriver, press down on the release bars on the terminal block of the DLC card (or SCALE terminal block of the POWER-DLC), and remove all five Homerun cable wires from the terminal block.

7. Referring to the table below (or the label on the CABLE TEST REMOTE) for terminal connections, connect each wire from the Homerun cable to the terminal block on the CABLE TEST REMOTE.

CABLE TEST REMOTE Terminal Block

Terminal Label	Wire Color
V- (minus)	RED
CAN L	YELLOW
SHLD	BLACK
CAN H	ORANGE
V+ (plus)	BROWN

8. To terminate a wire, use a small flat-blade screwdriver, and press down on the release bar for the terminal. Insert the wire into the opening, and then remove the screwdriver. The release bar will return to its original position, locking the wire in place.

9. Repeat the procedure until all five wires are in place.

10. Next, on the NEST keypad, press the **1** key and then the **ENTER** key.

11. The display will change to show the cable test screen.

```
        NOM.      ACTUAL    PASS/FAIL    PWR
 0     0.00V      0.00V        PASS      15.16
                                        0.000




      AUTO          NEXT                 EXIT
```

Auto Homerun Cable Test

1. Press the **AUTO** key to test the Homerun cable automatically at all voltages. Note that the AUTO test will display a count of tests (Pass:) and a count of any failures (Fail:).

```
          NOM.      ACTUAL     PASS/FAIL     PWR
1         0.41V     0.42V         PASS      11.30
                                            0.000
Pass:   314                    Fail:  0



     MANUAL        START                    EXIT
```

2. Press the **START** key to begin the AUTO test or press the **MANUAL** key to return to the previous screen and manually test the Homerun cable.

3. Press the **STOP** key to stop the AUTO test.

4. Press the **EXIT** key to return to the SMART SCALE TESTER screen.

Manual Homerun Cable Test

1. Press the **NEXT** key to test the Homerun cable manually at various voltages. See the table below for the test voltages and acceptable actual voltages.

2. Continue to press the **NEXT** key to step through each voltage test.

```
          NOM.      ACTUAL     PASS/FAIL     PWR
1         0.41V     0.42V         PASS      15.27
                                            0.002




     AUTO          NEXT                     EXIT
```

NOTE: Actual voltages should be within ±0.05V of the test voltage.

Test Step	Test Voltage	Actual Voltage
0	0.00V	-0.05V to 0.05V
1	0.41V	0.36V to 0.46V
2	0.83V	0.78V to 0.88V
3	1.24V	1.29V to 1.29V
4	1.65V	1.60V to 1.70V
5	2.06V	2.01V to 2.11V
6	2.48V	2.43V to 2.53V
7	2.89V	2.84V to 2.94V

3. Press the **EXIT** key to exit the manual Homerun cable test and return to the SMART SCALE TESTER screen.

Reconnect the Homerun Cable

After the cable test has been completed on the Homerun cable, and it has passed, reconnect the Homerun cable to the terminal block of the DLC card (or the SCALE terminal block of the POWER-DLC).

1. Using a small flat-blade screwdriver, press down on the release bars on the CABLE TEST REMOTE terminals, and remove all five Homerun cable wires from the CABLE TEST REMOTE.

2. Remove the clip from the metal portion of the cable connector of the Homerun cable.

3. Disconnect the Homerun cable from the CABLE TEST port on the NEST.

4. Referring to the table below (or on the circuit board) for terminal connections, connect each wire of the Homerun cable to the terminal block on the DLC card.

DLC Terminal Block

Board Label	Wire Color
V-BUS	RED
CAN L	YELLOW
SHLD	BLACK
CAN H	ORANGE
V+BUS	BROWN

5. To terminate a wire, use a small flat-blade screwdriver, and press down on the release bar for the terminal. Insert the wire into the opening, and then remove the screwdriver. The release bar will return to its original position, locking the wire in place.

Press Down Here

Insert Wire Here
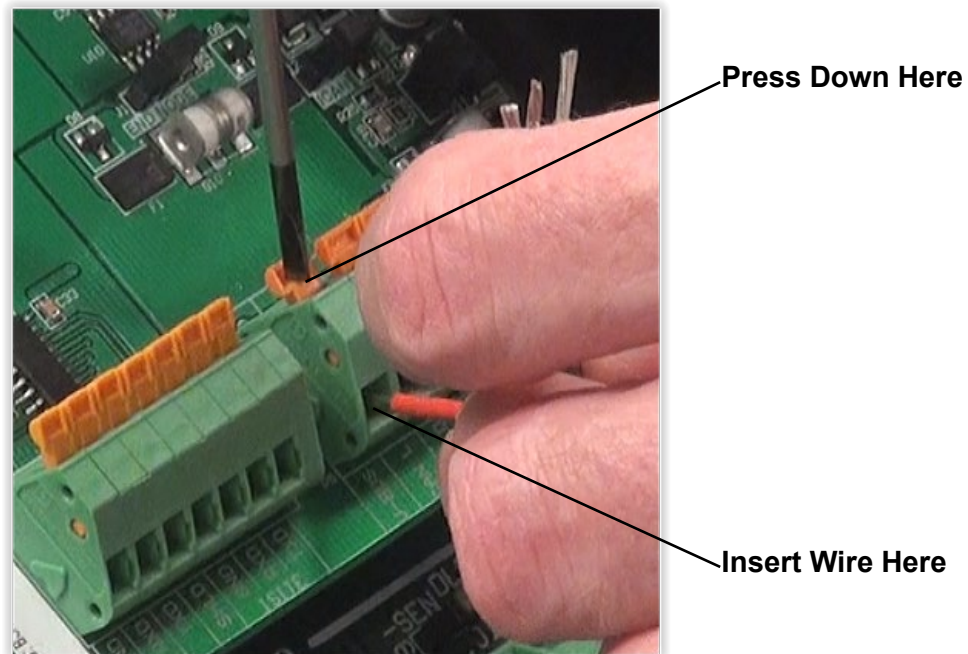
Terminal block of DLC card shown. POWER-DLC terminal block is similar.

6. Repeat the procedure until all five wires are in place.

7. After all connections to the terminal block have been made, install the indicator rear panel or the POWER-DLC cover, ensuring that no cables or wires are exposed between the main housing and the rear panel of the indicator (or top cover and enclosure of the POWER-DLC).

8. Using a torque wrench, tighten the plastic gland connectors to 15 in-lb (1.7 Nm).

9. Using a torque wrench, tighten the metal gland connector to 33 in-lb (3.7 Nm).

10. Re-insert the indicator or POWER-DLC power cord into the wall outlet.

11. Press the **ON/OFF** key on the keypad to turn on the indicator.

12. The indicator is ready for normal operations.

2. CELL TEST

This selection is used to test the digital load cell. The test can be performed on the load cell while it is still installed in the scale or after it has been removed.

1. Connect the two cables that ship with the NEST to the DIGITAL 1 and DIGITAL 2 ports on the NEST.

2. If the load cell is out of the scale, connect the other end of the two cables that ship with the NEST to the load cell.

   NOTE: If the load cell is still in the scale, disconnect both cables going to the load cell and connect the other end of the two cables that ship with the NEST to the load cell in the scale that is to be tested.

3. Press the **2** key, and then the **ENTER** key.

   NOTE: The test will start as soon as you press the **ENTER** key.

4. The display will change to show the CELL TEST screen and power up the load cell.

CELL TEST	PWR
	15.16
Powering Up Cell	0.021
	EXIT

5. The NEST will then check both communication loops.

CELL TEST	PWR
	15.16
Testing CAN bus 1	0.021
	EXIT

CELL TEST	PWR
	15.16
Testing CAN bus 2	0.021
	EXIT

6. The NEST will display the load cell temperature.

```
        CELL TEST                    PWR
                                    15.16
Testing CAN bus 2                   0.021


Temperature 20.6 C 69.1 F
                                     EXIT
```

7. Next, it will test the analog section.

```
        CELL TEST                    PWR
                                    15.16
Testing analog                      0.022


Temperature 20.6 C 69.1 F      Volts 14.2
                                     EXIT
```

8. And finally, it will test the load cell for internal drift. **NOTE:** The drift test is 180 seconds (3 minutes) in length.

```
        CELL TEST                    PWR
                                    15.16
Testing drift                       0.022

Time Remaining 178

Temperature 20.6 C 69.1 F      Volts 14.2
                                     EXIT
```

9. While the NEST is testing the load cell for drift, check the bottom number displayed in the upper right corner of the screen under the PWR label. This is the amps (shown to the nearest milliamp) that the load cell is drawing.

NOTE: This reading should be between 20 to 40 milliamps of current.

```
        CELL TEST                    PWR
                                    15.16
Testing drift                       0.020

Time Remaining 103

Temperature 20.6 C 69.1 F      Volts 14.2
                                     EXIT
```

10. When the load cell test has been completed, it will display Pass or Fail on the screen.

```
┌─────────────────────────────────────────────┐
│          CELL TEST                   PWR      │
│                                    15.16      │
│                                     0.025     │
│  Cell Test:  Pass                             │
│                                               │
│                                               │
│  Temperature 20.6 C 69.1 F       Volts 14.2   │
│     START                               EXIT  │
└─────────────────────────────────────────────┘
```

11. Press the **EXIT** key to return to the SMART SCALE TESTER menu.

12. Press the Navigation Keys △ UP Arrow to exit the SMART SCALE TESTER screen and return to the TESTER MENU.

3. CELL UPDATER

This selection is used to update the software (firmware) in a digital load cell.

⚠ The CELL UPDATER process can be performed without removing the load cell from the scale. *However, both scale cables to the load cell must be disconnected, and the load cell must be connected directly to the NEST* using the two cables that ship with the NEST.

1. Disconnect both scale cables going to the load cell to be updated.

2. Connect the two cables that ship with the NEST to the load cell.

3. Connect the other end of the two cables that ship with the NEST to the DIGITAL 1 and DIGITAL 2 ports on the NEST.

```
                    TESTER MENU
1. SMART SCALE TEST / CALIBRATE        15.16
2. CABLE / CELL TESTER
3. CELL UPDATER
4. CELL SIMULATOR
5. ANALOG TESTER
Enter Selection:   0
```

4. With the TESTER MENU displayed, press the **3** key and then the **ENTER** key. The display will change to show the CELL UPDATER screen and prompt to apply voltage (power up) to the load cell.

```
                    CELL UPDATER
Cell image version 1.0.16              15.26
Blocks 8478 CRC 572DBD5C



APPLY VOLTAGE?
    YES                                  NO
```

⚠ **IMPORTANT! Select YES only if the load cell is directly connected to the NEST, without any POWER-DLC or other power connected to it.**

5. Select the **YES** key. The display will change to show the **START** key on the screen.

```
                    CELL UPDATER
Cell image version 1.0.16              15.26
Blocks 8478 CRC 572DBD5C




    START
```

6. Select the **START** key. The CELL UPDATE process will begin.

7. When the CELL UPDATE process has started, the display will change to show the load cell ID and a percentage of completion (i.e., 6%) of the cell update process. Note that the display will also show that only one load cell (1 / 1) is being updated.

```
              CELL UPDATER
Cell image version 1.0.16              15.26
Blocks 8478 CRC 572DBD5C

ID 0E06488F   6 % 1/1
```

NOTE: The CELL UPDATE process may take a couple of minutes to update the load cell. During this time, the display will be updated with the percentage of the process completed.

```
              CELL UPDATER
Cell image version 1.0.16              15.26
Blocks 8478 CRC 572DBD5C

ID 0E06488F  70 % 1/1
```

```
              CELL UPDATER
Cell image version 1.0.16              15.26
Blocks 8478 CRC 572DBD5C

ID 0E06488F 100 % 1/1
CELL UPDATE COMPLETED

                                        EXIT
```

8. When the CELL UPDATE process is finished, the display will show 100 % 1/1 and CELL UPDATE COMPLETED.

9. Press the **EXIT** key to return to the TESTER MENU.

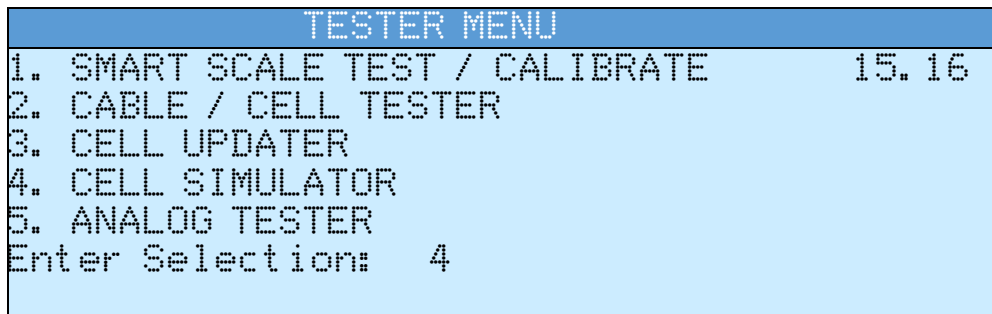**10.** Disconnect the cables to the load cell and reconnect the scale cables to the load cell.

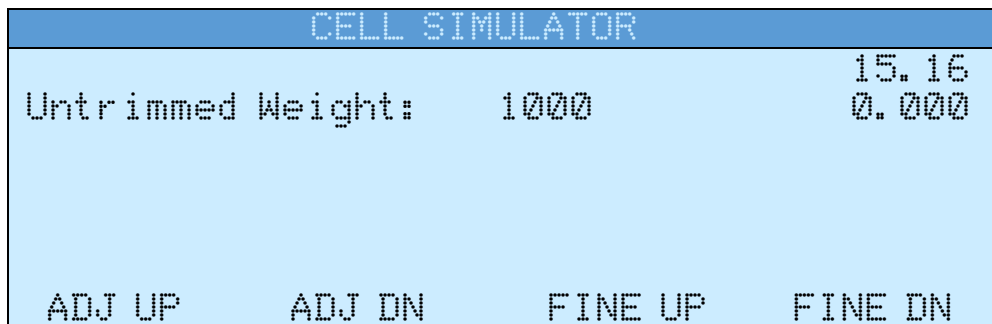**11.** Repeat the procedure for any additional load cells to be updated.

4. CELL SIMULATOR

This selection is used to simulate the output of one digital load cell used in a scale system. The output range is adjustable using the coarse keys (ADJ UP / ADJ DN) or fine keys (FINE UP / FINE DN) to simulate the changing signal from the load cell(s) as the weight varies. It can be used to replace the load cells in a system allowing the scale technician to simulate various weights that trigger output setpoints for activating valves, gates, traffic lights, etc.
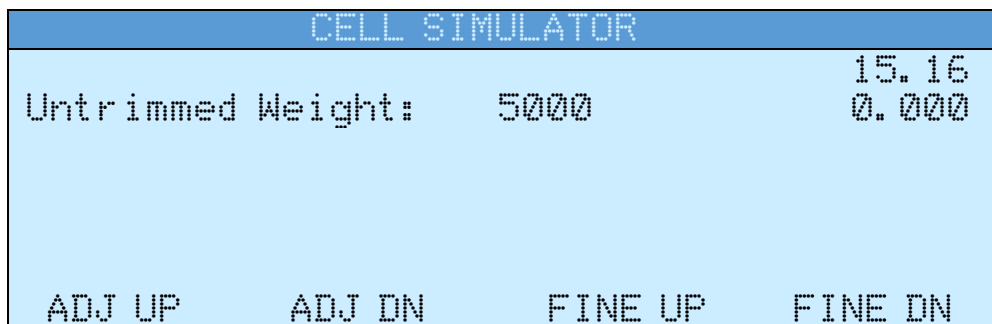
The Cell Simulator is particularly useful for troubleshooting the Homerun cable and scale communications. At the scale, it can be connected to the end of the Homerun cable to check the cable, and when using the Digital Weight Simulator Pigtail, CPN: 8581-0088-0A adapter cable, it can be wired directly to the 225-DLC or 825-DLC card to ensure the DLC card is functioning properly and to verify the indicator setup.

```
              TESTER MENU
1. SMART SCALE TEST / CALIBRATE          15.16
2. CABLE / CELL TESTER
3. CELL UPDATER
4. CELL SIMULATOR
5. ANALOG TESTER
Enter Selection:    4
```

1. With the TESTER MENU displayed, press the **4** key and then the **ENTER** key to select the CELL SIMULATOR. The display will change to show the following screen:

```
              CELL SIMULATOR
                                         15.16
Untrimmed Weight:      1000              0.000




    ADJ UP       ADJ DN       FINE UP    FINE DN
```

2. Press the ADJ UP / ADJ DN to change the weight in 1000 lb increments up or down.

```
              CELL SIMULATOR
                                         15.16
Untrimmed Weight:      5000              0.000




    ADJ UP       ADJ DN       FINE UP    FINE DN
```

3. Press the FINE UP / FINE DN to adjust the weight in 20 lb increments up or down.

```
┌──────────────────────────────────────────────┐
│             CELL SIMULATOR                     │
│                                       15.16    │
│  Untrimmed Weight:      5060          0.000    │
│                                                │
│                                                │
│                                                │
│    ADJ UP      ADJ DN      FINE UP    FINE DN   │
└──────────────────────────────────────────────┘
```
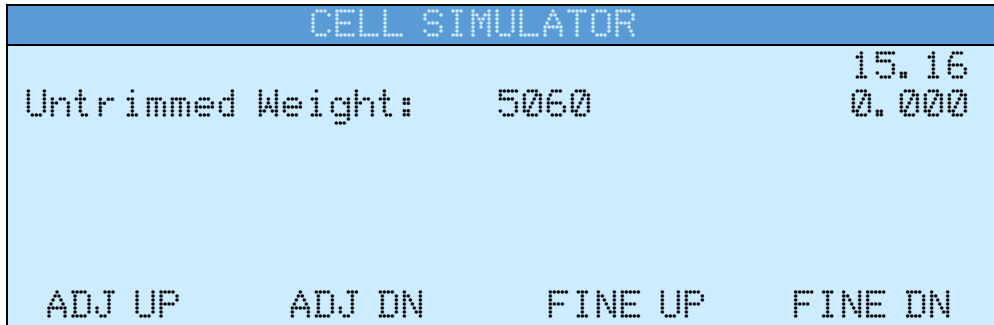
NOTE: If the indicator is configured with a TRIM value of 1.0000 and zeroed to the simulator zero, the weight on the indicator should match up.

4. Press the Navigation Keys △ UP Arrow to exit the SMART SCALE TESTER screen and return to the TESTER MENU.

ANALOG SCALE DIAGNOSTICS
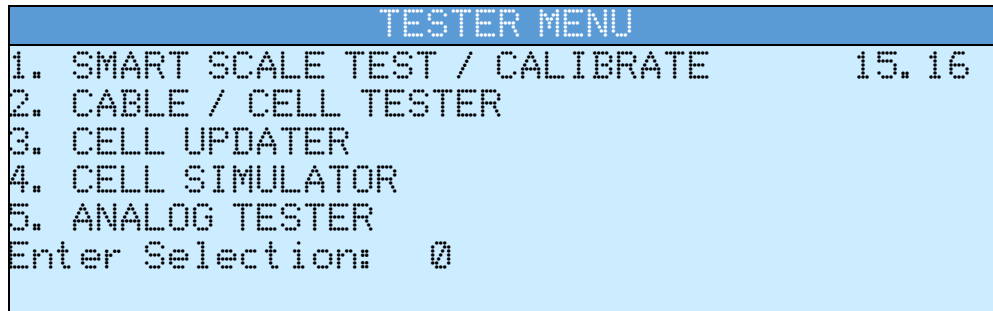
NEST ANALOG TESTING CABLES

The NEST has four (4) cables that are used when testing the analog scale junction box section trim board and load cells. One cable is plugged into the section trim board where the homerun is usually plugged in. The second cable is plugged into P13 (to the weight indicator). The remaining two cables connect to load cells 1-6 and load cells 7-12 (if necessary).

a. Connect to the Homerun Cable

b. Connect to P13 (to the Weight Indicator)

c. Connect to Load Cells 1-6

d. Connect to Load Cells 7-12 (if necessary)
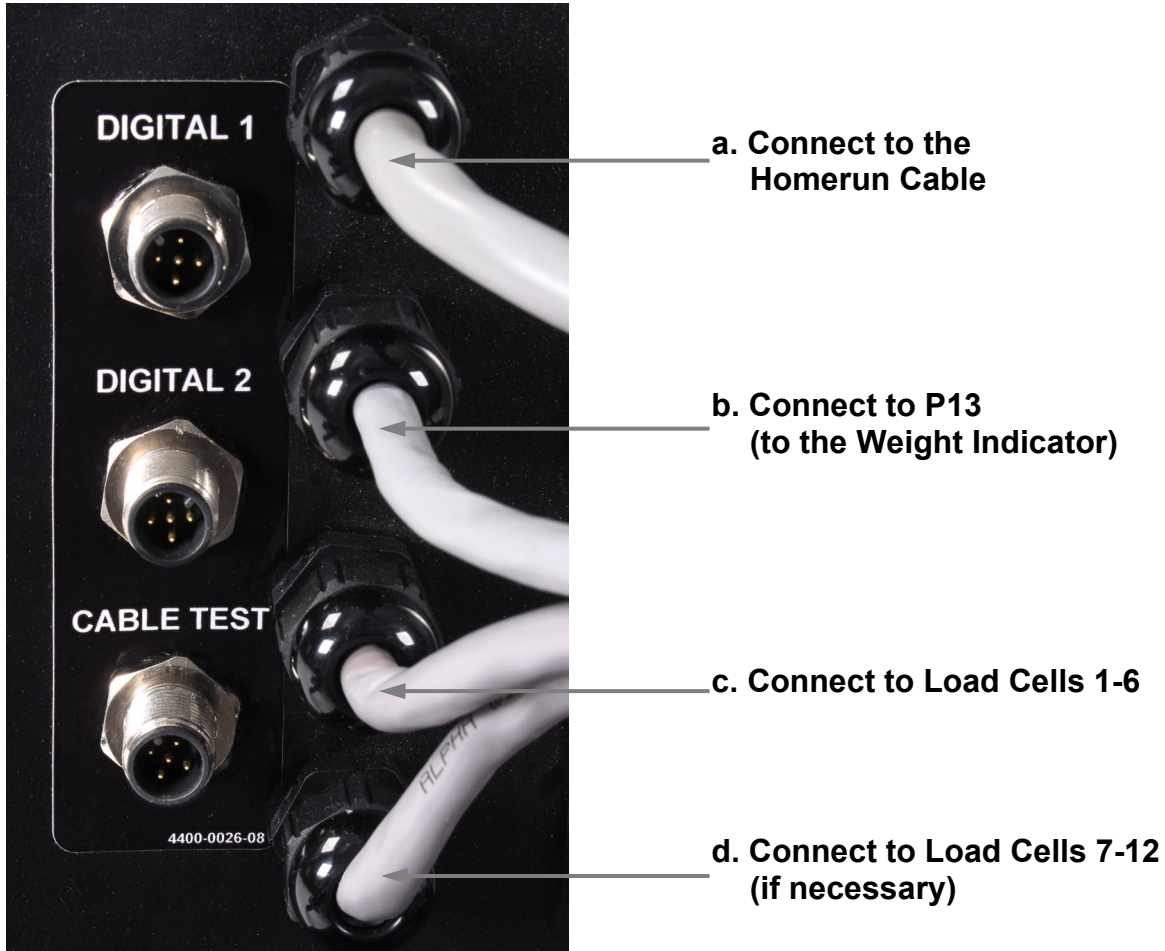
Analog Testing Cables

5. ANALOG TESTER

This selection is used to test an analog scale junction box section trim board and the analog load cells.

```
TESTER MENU
1. SMART SCALE TEST / CALIBRATE          15.16
2. CABLE / CELL TESTER
3. CELL UPDATER
4. CELL SIMULATOR
5. ANALOG TESTER
Enter Selection:   0
```

1. On the section trim board in the scale, unplug the home run cable, which will interrupt the connection between the scale and the indicator.

2. Plug the applicable NEST cable connectors into the section trim board:

   a. The 7-pin receptacle cable should be connected to the Homerun cable.

   b. The 7-pin plug cable should be connected to connector P13 (the weight indicator connector on the section trim board).

   c. Connect this cable to Load Cells 1-6.

   d. Connect this cable to Load Cells 7-12 (if necessary).

3. Press the **ON/OFF** key to apply power to the NEST.

4. The display will show the Cardinal Logo, the model number, the software revision, and then change to the TESTER MENU screen.

5. Press the **5** key, and then the **ENTER** key to select ANALOG TESTER.

6. The display will change to show the ANALOG TESTER SIGNALS DISPLAY screen.

7. Proceed with performing the ANALOG SCALE DIAGNOSTICS on the scale.

SIGNALS DISPLAY

With the ANALOG TESTER selected, the display will show the SIGNALS DISPLAY screen. If the display units are millivolts, the NEST will display the following:

```
SG   mV      SG   mV      SG   mV            PWR
 1  X.XXXX    6  X.XXXX   11  X.XXXX        15.21
 2  X.XXXX    7  X.XXXX   12  X.XXXX
 3  X.XXXX    8  X.XXXX    T  X.XXXX
 4  X.XXXX    9  X.XXXX   EX  X.XXXX
 5  X.XXXX   10  X.XXXX

       DAC          MODE         CELLS
```

When the display units are pounds, the SIGNALS DISPLAY will show:

```
SG   lb      SG   lb      SG   lb            PWR
 1  XXXXXXX   6  XXXXXXX  11  XXXXXXX       15.21
 2  XXXXXXX   7  XXXXXXX  12  XXXXXXX
 3  XXXXXXX   8  XXXXXXX   T  XXXXXXX
 4  XXXXXXX   9  XXXXXXX  EX  X.XX V
 5  XXXXXXX  10  XXXXXXX
Y YYY
       DAC          MODE         CELLS
```

The columns labeled SG indicate the signal source for the millivolt readings shown in the columns labeled mV or the pound readings shown in the columns labeled lb . Signals 1 through 12 correspond to the load cell signals SIG1 through SIG12. T is the signal from the junction box summing circuitry. EX is the NEST's excitation voltage.

The right side of the display gives status information about the NEST The value shown below PWR is the NEST power supply voltage (in VDC).

If the message ISO ERR is displayed, it indicates a problem with the voltage regulator for the circuitry, which provides a millivolt signal for the digital weight indicator. Check the excitation voltage from the home run cable.

If the message BOOST is displayed, it indicates the battery charger is operating in boost mode.

At the bottom of the display, the soft key label DAC indicates which soft key should be pressed to set the digital-to-analog converter to adjust the output to the home run cable to the digital weight indicator. The number displayed above the label indicates the current setting, from 0 to 3.000 mV/V.

The soft key label MODE indicates which soft key should be pressed to change between the three display modes.

The soft key label CELLS indicates which soft key should be pressed to change the number of cells to be displayed and the cell parameters.

MINIMUM-MAXIMUM DISPLAY

In minimum-maximum display mode, the NEST will display the following when the display units are millivolts:

```
SG   mV        MIN        MAX        MAX-MIN
 1  X.XXXX    X.XXXX     X.XXXX     X.XXXX
 2  X.XXXX    X.XXXX     X.XXXX     X.XXXX
 3  X.XXXX    X.XXXX     X.XXXX     X.XXXX
 4  X.XXXX    X.XXXX     X.XXXX     X.XXXX
 5  X.XXXX    X.XXXX     X.XXXX     X.XXXX
 Y  YYY
     DAC        MODE       CELLS     ^SCROLLv
```

When the display units are pounds, the minimum-maximum display will be:

```
SG   lb        MIN        MAX        MAX-MIN
 1  XXXXXX    XXXXXX     XXXXXX     XXXXXX
 2  XXXXXX    XXXXXX     XXXXXX     XXXXXX
 3  XXXXXX    XXXXXX     XXXXXX     XXXXXX
 4  XXXXXX    XXXXXX     XXXXXX     XXXXXX
 5  XXXXXX    XXXXXX     XXXXXX     XXXXXX
 Y  YYY
     DAC        MODE       CELLS     ^SCROLLv
```

Once again, the column labeled SG indicates the signal source for the millivolt readings shown in the column labeled mV or the pounds readings shown in the column labeled lb . The column labeled MIN indicates the minimum reading for that signal since this display mode was entered. The column labeled MAX indicates the maximum reading for that signal since this display mode was entered. The column labeled MAX-MIN indicates the difference between the maximum and minimum readings.

The DAC, MODE, and CELLS soft keys have the same function as on the signals display. The ^SCROLLv key is used to scroll the display when there are more signals than can be displayed on the screen. The **ZERO** key is used to set a new starting point for minimum-maximum readings.

SIGNALS MINUS ZERO REFERENCE DISPLAY

In signals minus zero reference display mode, the NEST will display the following when the display units are millivolts:

```
SG    mV          DL              mV-DL
 1   X.XXXX    X.XXXX          X.XXXX
 2   X.XXXX    X.XXXX          X.XXXX
 3   X.XXXX    X.XXXX          X.XXXX
 4   X.XXXX    X.XXXX          X.XXXX
 5   X.XXXX    X.XXXX          X.XXXX
 Y  YYY
       DAC        MODE           CELLS       ^SCROLLv
```

When the display units are pounds, the signals minus zero reference display will be:

```
SG    lb          DL              lb-DL
 1   XXXXXX    XXXXXX          XXXXXX
 2   XXXXXX    XXXXXX          XXXXXX
 3   XXXXXX    XXXXXX          XXXXXX
 4   XXXXXX    XXXXXX          XXXXXX
 5   XXXXXX    XXXXXX          XXXXXX
 Y  YYY
       DAC        MODE           CELLS       ^SCROLLv
```

Once again, the column labeled SG indicates the signal source for the millivolt readings shown in the column labeled mV or the pounds readings shown in the column labeled lb . The column labeled DL indicates the zero-reference reading for that signal established when this display mode was entered. The column labeled mV-DL or lb-DL indicates the difference between the signal and the zero reference.

The DAC, MODE, and CELLS soft keys have the same function as on the signals display. The ^SCROLLv key is used to scroll the display when there are more signals than can be displayed on the screen. The **ZERO** key is used to set a new zero reference.

KEYPAD FUNCTIONS

The NEST has 8 standard function keys (not all are used in this application), a full "QWERTY" alphanumeric keypad, 4 soft keys (below the display), and 4 navigation keys with an **ENTER** key. A description of the keypad functions follows.

STANDARD KEYS

ON/OFF Key
Pressing this key when the NEST is off will apply power and turn it ON. If the NEST is already on, pressing this key will turn it OFF.

UNITS Key
Press this key to change the display units from millivolts to pounds and from pounds to millivolts.

ZERO KEY
This key is only used on the minimum-maximum display or the signals minus zero reference display. Press this key to set a new starting point for the minimum-maximum display or to set a new zero reference for the signals minus zero reference display.

Navigation △ UP Arrow key
Press this key to increase the DAC output by 0.001 mV/V.

Navigation ▽ Down Arrow Key
Press this key to decrease the DAC output by 0.001 mV/V.

SOFT KEYS

DAC Key
Press this key, and the display will change to show:

        DAC (0 TO 3.000)= X.XXX

Where:

X.XXX is the current setting. If the setting is acceptable, press the **ENTER** key to return to display mode. Otherwise, use the numeric keys to enter a new value, with 0.000 providing the lowest possible output and 3.000 providing the highest possible output. As each number key is pressed, the previously entered digits will scroll to the left. When the display shows the desired setting, press the **ENTER** key to return to the display mode.

MODE Key
Press this key to change the display mode.

^SCROLLv Key
This key only appears on the minimum-maximum display. This key is used to scroll the displayed signals up or down when there are more signals than can be displayed on the screen. Press this key to scroll the displayed signals up. Hold down the **SHIFT** key and press this key to scroll the displayed signals down.

CELLS Key

Press the CELLS key. The display will change to show the Cells Menu screen.

```
            Cells Menu
1. NUMBER OF CELLS
2. CELL CAPACITY
3. CELL mV/V
4. INTERVAL

Enter Selection: 0  ^EXIT
```

1. NUMBER OF CELLS

To change the number of cells displayed, press the **1** key and then the **ENTER** key. The display will change to show:

```
            Cells Menu




NUMBER OF CELLS (1 TO 12)=XX
```

Where:

XX is the current setting. If the setting is acceptable, press the **ENTER** key. Otherwise, use the numeric keys to enter a new number of cells. As each number key is pressed, the previously entered digits will scroll to the left. When the display shows the desired number of cells, press the **ENTER** key, and the display will return to the Cells Menu.

2. CELL CAPACITY

To change the cell capacity, press the **2** key and then the **ENTER** key. The display will change to show:

```
            Cells Menu




CELLS CAPACITY=XXXXXX
```
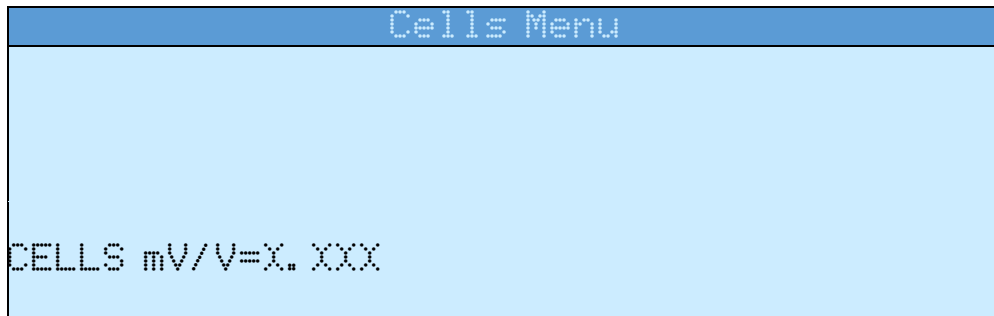
Where:

XXXXXX is the current setting. If the setting is acceptable, press the **ENTER** key. Otherwise, use the numeric keys to enter a new cell capacity. As each number key is pressed, the previously entered digits will scroll to the left. When the display shows the desired cell capacity, press the **ENTER** key, and the display will return to the Cells Menu.

3. CELL mV/V

To change the cell mV/V, press the **3** key and then the **ENTER** key. The display will change to show:
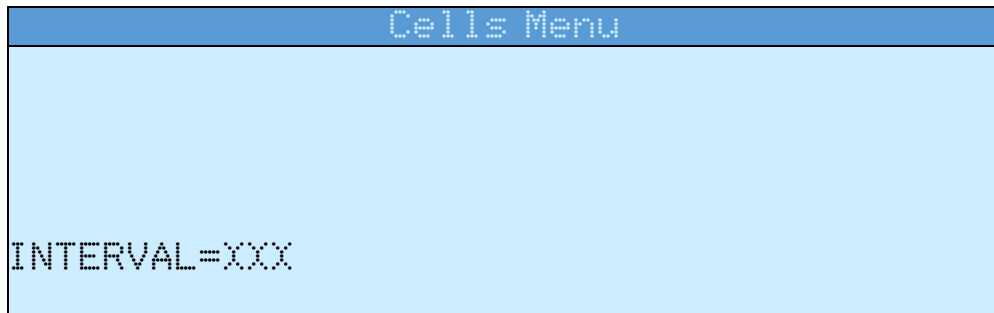
```
            Cells Menu




CELLS mV/V=X.XXX

```

Where:

X.XXX is the current setting. If the setting is acceptable, press the **ENTER** key. Otherwise, use the numeric keys to enter the new cell mV/V. As each number key is pressed, the previously entered digits will scroll to the left. When the display shows the desired cell mV/V, press the **ENTER** key, and the display will return to the Cells Menu.

4. INTERVAL

To change the interval used for displaying weight, press the **4** key and then the **ENTER** key. The display will change to show:

```
            Cells Menu




INTERVAL=XXX

```

Where:

XXX is the current setting. If the setting is acceptable, press the **ENTER** key. Otherwise, use the numeric keys to enter the new interval. As each number key is pressed, the previously entered digits will scroll to the left. When the display shows the desired interval, press the **ENTER** key, and the display will return to the Cells Menu.

Press the (Navigation Keys △ UP Arrow) to exit the Cells Menu and return to the previous analog testing screen.

SERIAL COMMANDS
Digital Scale Commands

In the following descriptions:

<lf> represents an ASCII LF (0A hexadecimal)

<cr> represents an ASCII CR (0D hexadecimal)

<enq> represents an ASCII ENQ (05 hexadecimal)

<esc> represents an ASCII ESC (1B hexadecimal)

Get Tester Card Rev Level

Command: `<lf>X0<cr>`

Response (if card is installed): `<lf>Card Rev=x.x.xx<cr>`

(`x.x.xx` represents the version of the NEST smart scale tester card firmware)

Response (if card is not installed or 225 NEST software does not support digital scale): `<lf>?<cr>`

Get Displayed Readings

Command: `<lf>Xm<cr>`

Response (if display mode is display mode selection options):

`<lf>D0,CABLE TEST,CONFIGURATION,CELL ID'S,MILLIVOLTS,`
`WEIGHT,COUNTS,TEMPERATURE,VERSION,MAX WEIGHT, MORE<cr>`

Response (if display mode is cable test, manual mode):

`<lf>D1,M,a,b.bb,c.cc,d,e,f`

Response (if display mode is cable test, auto mode stopped):

`<lf>D1,S,a,b.bb,c.cc,d,e,f`

Response (if display mode is cable test, auto mode running):

`<lf>D1,R,a,b.bb,c.cc,d,e,f`

(`a` is cable test binary output, `b.bb` is the proper voltage return, `c.cc` is the actual voltage return, `d` is 'P' for pass or 'F' for fail, `e` is the pass count for the latest auto mode run, `f` is the fail count for the latest auto mode run)

Response (if the display mode is configuration):

`<lf>D2,VP1=xx,CAN BUS 1=xx,CAN BUS 2=xx,TERMINATION 1=xx,`
`TERMINATION 2=xx<cr>`

(`xx` is 'ON' if the given item is on or 'OFF' if the given item is off)

Response (if display mode is CELL ID's): `<lf>D3,aaaaaaaa,bbbbbbbb,...<cr>`

(`aaaaaaaa,bbbbbbbb,...` are the cell IDs)

Response (if display mode is cell millivolts):

`<lf>D4,aaaaaaaa,bbb.bbbb,cccc,...<cr>`

(`aaaaaaaa` is the cell ID, `bbb.bbbb` is the cell millivolts, and `cccc` is the cell status)

BIT	STATUS
0	Not used
1	Analog error
2	Calibration required
3	Power low error
4-7	Not used
8	Cell response did not match request sent to cell
9-15	Not Used

Response (if display mode is cell weight):

`<lf>D5,aaaaaaaa,bbbbbbbb,cccc,...<cr>`

(aaaaaaaa is the cell ID, bbbbbbbb is the cell weight, and cccc is the cell status)

Response (if the display mode is cell counts):

`<lf>D6, aaaaaaaa,bbbbbbbb,cccc,...<cr>`

(aaaaaaaa is the cell ID, bbbbbbbb is the cell counts, and cccc is the cell status)

Response (if display mode is cell temperature):

`<lf>D7, aaaaaaaa,bbbbb.b,cccc,...<cr>`

(aaaaaaaa is the cell ID, bbbbb.b is the cell temperature, and cccc is the cell status)

Response (if display mode is cell software version):

`<lf>D8,aaaaaaaa,x.x.xxm<cr>`

(aaaaaaaa is the cell ID, x.x.xx is the cell software version, and m is 'B' if the cell is in boot loader mode or space if the cell is in application mode)

Response (if the display mode is cell maximum weight):

`<lf>D9, aaaaaaaa,bbbbbbbb,cccc,...<cr>`

(aaaaaaaa is the cell ID, bbbbbbbb is the cell maximum weight, and cccc is the cell status)

Response (if the display mode is more display mode options):

`<lf>D10,MAX WT COUNT,ANLG ERR COUNT,MAX TEMP,MIN TEMP,`
`mV MAX-MIN,WT MAX-MIN,mV-DL,WT-DL<cr>`

Response (if display mode is cell maximum weight count):

`<lf>D11, aaaaaaaa,bbbbbbbb,cccc,...<cr>`

(aaaaaaaa is the cell ID, bbbbbbbb is the cell maximum weight count, and cccc is the cell status)

Response (if display mode is cell analog error count):

`<lf>D12, aaaaaaaa,bbbbbbbb,cccc,...<cr>`

(aaaaaaaa is the cell ID, `bbbbbbbb` is the cell analog error count, and `cccc` is the cell status)

Response (if the display mode is cell maximum temperature):

`<lf>D13, aaaaaaaa,bbbbb.b,cccc,...<cr>`

(aaaaaaaa is the cell ID, `bbbbb.b` is the cell maximum temperature, and `cccc` is the cell status)

Response (if display mode is cell minimum temperature):

`<lf>D14, aaaaaaaa,bbbbb.b,cccc,...<cr>`

(aaaaaaaa is the cell ID, `bbbbb.b` is the cell minimum temperature, and `cccc` is the cell status)

Response (if display mode is cell millivolts maximum-minimum):

`<lf>D15,aaaaaaaa,bbb.bbbb,ccc.cccc,ddd.dddd,eee.eeee,...<cr>`

(aaaaaaaa is the cell ID, `bbb.bbbb` is the cell millivolts, `ccc.cccc` is the minimum cell millivolts since the display mode was started, `ddd.dddd` is the maximum cell millivolts since the display mode was started, and `eee.eeee` is the cell millivolts maximum minus the cell millivolts minimum)

Response (if the display mode is cell weight maximum-minimum):

`<lf>D16,aaaaaaaa,bbbbbbbb,cccccccc,dddddddd,eeeeeeee,...<cr>`

(aaaaaaaa is the cell ID, `bbbbbbbb` is the cell weight, `cccccccc` is the minimum cell weight since the display mode was started, `dddddddd` is the maximum cell weight since the display mode was started, and `eeeeeeee` is the cell weight maximum minus the cell millivolts minimum)

Response (if the display mode is cell millivolts-zero reference):

`<lf>D17, aaaaaaaa,bbb.bbbb,ccc.cccc,ddd.dddd,...<cr>`

(aaaaaaaa is the cell ID, `bbb.bbbb` is the cell millivolts, `ccc.cccc` is the cell millivolts zero reference established when the display mode was started, and `ddd.dddd` is the cell millivolts minus the cell millivolts zero reference)

Response (if the display mode is cell weight-zero reference):

`<lf>D18, aaaaaaaa,bbbbbbbb,cccccccc,dddddddd,...<cr>`

(aaaaaaaa is the cell ID, `bbbbbbbb` is the cell weight, `cccccccc` is the cell weight zero reference established when the display mode was started, and `dddddddd` is the cell weight minus the cell weight zero reference)

Get Displayed Readings Alternate Command

Command: `<enq>`

Response: same as for `<lf>Xm<cr>`

Set Display Mode

Command: `<lf>XEDn<cr>`

n is a number used to select the display mode, as shown in the table below.

n	Display Mode
0	Display mode selection options
1	Cable test
2	Configuration
3	Cell ID's
4	Cell millivolts
5	Cell weight
6	Cell counts
7	Cell temperature
8	Cell software version
9	Cell maximum weight
10	More display mode options
11	Cell maximum weight count
12	Cell analog error count
13	Cell maximum temperature
14	Cell minimum temperature
15	Cell millivolts maximum-minimum
16	Cell weight maximum-minimum
17	Cell millivolts-zero reference
18	Cell weight-zero reference

Response (valid mode): `<lf>MODE=Dn<cr>`

n is the selected display mode.

Response (invalid mode): `<lf>?<cr>`

Get Display Mode

Command: `<lf>Xe<cr>`

Response: `<lf>MODE=Dn<cr>`

n is a number indicating the display mode as shown in the table below.

n	Display Mode
0	Display mode selection options
1	Cable test
2	Configuration
3	Cell ID's
4	Cell millivolts
5	Cell weight
6	Cell counts
7	Cell temperature
8	Cell version
9	Cell maximum weight
10	More display mode options
11	Cell maximum weight count
12	Cell analog error count
13	Cell maximum temperature
14	Cell minimum temperature
15	Cell millivolts maximum-minimum
16	Cell weight maximum-minimum
17	Cell millivolts-zero reference
18	Cell weight-zero reference

Set New Starting Point for Minimum-Maximum Millivolts or Weight Display or New Zero Reference for Millivolts or Weight Minus Zero Reference Display

Command: `<lf>XZ<cr>`

Response (if the display is in millivolts or weight minimum-maximum mode or millivolts or weight minus zero reference mode):

`<lf>OK<cr>`

Response (if the display is not in millivolts or weight minimum-maximum mode or millivolts or weight minus zero reference mode):

`<lf>?<cr>`

Get Cable Tester Analog Return Value

Command: `<lf>X1<cr>`

Response: `<lf>CABLE RETURN=x.xx<cr>`

(`x.xx` represents the voltage read by the cable tester)

Binary Out	Proper Voltage Return, ±0.05v
0	0.00V
1	0.41V
2	0.83V
3	1.24V
4	1.65V
5	2.06V
6	2.48V
7	2.89V

Get VP1 Analog Reading

Command: `<lf>X2<cr>`

Response: `<lf>VP1 ANALOG=x.xx<cr>`

(`x.xx` divided by 1.65 is the amperage for V+ BUS)

Send CAN Bus Message

Command: `<lf>X3iiiiiiii,nn,aa,bb,...<cr>`

(`iiiiiiii` is the message ID in hexadecimal, `nn` is the number of data bytes in hexadecimal, `aa,bb,...` are the data bytes in hexadecimal. For the DLC protocol, the number of data bytes is fixed at 8)

Response: `<lf>SEND=iiiiiiii,nn,aa,bb,...<cr>`

Get CAN Bus Message

Command: `<lf>X4<cr>`

Response, no message available:

`<lf>RECEIVE=00,00000000,00,00,00,00,00,00,00,00,00<cr>`

Response, message available:

`<lf>RECEIVE=01,iiiiiiii,nn,aa,bb,cc,dd,ee,ff,gg,hh<cr>`

(`iiiiiiii` is the message ID in hexadecimal, `nn` is the number of data bytes in hexadecimal, `aa,bb,...` are the data bytes in hexadecimal. For the DLC protocol, the number of data bytes is fixed at 8. The most significant bit of the message ID will be 1, indicating a 29-bit ID. The cell ID can be determined by "anding" the message ID with 1FFFFFFF, hexadecimal)

Get CAN Bus Message Count

Command: `<lf>X5<cr>`

    Response: `<lf>MSG COUNT=nn<cr>`

        (nn is the number of CAN bus messages in the buffer)

Get CAN Bus Control

Command: `<lf>Xbn<cr>`

        (n is 1 for CAN bus 1 or 2 for CAN bus 2)

    Response: `<lf>CANBUSn=x<cr>`

        (x is 0 for CAN bus disabled or 1 for CAN bus enabled)

Set CAN Bus Control

Command: `<lf>XBn,x<cr>`

(n is 1 for CAN bus 1 or 2 for CAN bus 2, x is 0 to disable the CAN bus or 1 to enable it)

    Response: `<lf>CANBUSn=x<cr>`

Get CAN Bus Termination Control

Command: `<lf>Xin<cr>`

        (n is 1 for CAN bus 1 or 2 for CAN bus 2)

    Response: `<lf>CANTERMn=x<cr>`

        (x is 0 if bus termination is disabled or 1 if bus termination is enabled)

Set CAN Bus Termination Control

Command: `<lf>XIn,x<cr>`

        (n is 1 for CAN bus 1 or 2 for CAN bus 2, x is 0 to disable bus termination or 1 to enable bus termination)

    Response: `<lf>CANTERMn=x<cr>`

Get VP1 (V+ Bus) Control

Command: `<lf>Xj<cr>`

    Response: `<lf>VP1=n<cr>`

        (n is 1 if VP1 is enabled, 0 if VP1 is disabled)

Set VP1 (V+ Bus) Control

Command: `<lf>XJn<cr>`

        (n is 1 to enable VP1, 0 to disable VP1)

    Response: `<lf>VP1=n<cr>`

Toggle Cable Test Auto/Manual Mode

Command: `<lf>X6<cr>`

Response: `<lf>CABLE TEST=mode<cr>`

(`mode` is "MANUAL" if the test is in manual mode, "STOPPED" if the test is in auto mode stopped, or "RUN" if the test is in auto mode running)

Toggle Cable Test Auto Mode Run/Stop

Command: `<lf>X7<cr>`

Response: `<lf>CABLE TEST=mode<cr>`

(`mode` is "STOPPED" if the test is in auto mode stopped, or "RUN" if the test is in auto mode running)

Get Cable Test Mode

Command: `<lf>X8<cr>`

Response: `<lf>CABLE TEST=mode<cr>`

(`mode` is "MANUAL" if the test is in manual mode, "STOPPED" if the test is in auto mode stopped, or "RUN" if the test is in auto mode running)

Get Cable Tester Binary Out

Command: `<lf>Xt<cr>`

Response: `<lf>CABLE=n<cr>`

(`n` is 0 through 7)

Set Cable Tester Binary Out

Command: `<lf>XTn<cr>`

(`n` is 0 through 7)

Response: `<lf>CABLE=n<cr>`

SERIAL COMMANDS
Analog Scale Commands

In the following descriptions:

<lf> represents an ASCII LF (0A hexadecimal)

<cr> represents an ASCII CR (0D hexadecimal)

<enq> represents an ASCII ENQ (05 hexadecimal)

<esc> represents an ASCII ESC (1B hexadecimal)

Get Displayed Readings

Command: <lf>Xm<cr>

Response when display is in millivolt mode:

<lf>M,nn,uu,sig1,sig2,sig3,sig4,sig5,sig6,sig7,sig8,sig9,sig 10,sig11,sig12,sigT,exc<cr>

Where:

M is the ASCII letter M, indicating the display is in signals display mode.

nn is the number of load cells.

uu is the display units (mV or lb).

sig1 is load cell SIG1 reading.

sig2 is load cell SIG2 reading.

sig3 is load cell SIG3 reading.

sig4 is load cell SIG4 reading.

sig5 is load cell SIG5 reading.

sig6 is load cell SIG6 reading.

sig7 is load cell SIG7 reading.

sig8 is load cell SIG8 reading.

sig9 is load cell SIG9 reading.

sig10 is load cell SIG10 reading.

sig11 is load cell SIG11 reading.

sig12 is load cell SIG12 reading.

sigT is junction box summing circuitry reading.

exc is excitation voltage reading.

Response when the display is in minimum-maximum mode:

```
<lf>X,nn,uu,sig1,sig1min,sig1max,sig1max-min,
sig2,sig2min,sig2max,sig2max-min,
sig3,sig3min,sig3max,sig3max-min,
sig4,sig4min,sig4max,sig4max-min,
sig5,sig5min,sig5max,sig5max-min,
sig6,sig6min,sig6max,sig6max-min,
sig7,sig7min,sig7max,sig7max-min,
sig8,sig8min,sig8max,sig8max-min,
sig9,sig9min,sig9max,sig9max-min,
sig10,sig10min,sig10max,sig10max-min,
sig11,sig11min,sig11max,sig11max-min,
sig12,sig12min,sig12max,sig12max-min,
sigT,sigTmin,sigTmax,sigTmax-min<cr>
```

Where:

X is the ASCII letter X, indicating the display is in minimum-maximum mode.

nn is the number of load cells.

uu is the display units (mV or lb).

sig1 is load cell SIG1 reading.

sig1min is load cell SIG1 minimum reading.

sig1max is load cell SIG1 maximum reading.

sig1max-min is load cell SIG1 maximum reading minus minimum reading.

sig2 is load cell SIG2 reading.

sig2min is load cell SIG2 minimum reading.

sig2max is load cell SIG2 maximum reading.

sig2max-min is load cell SIG2 maximum reading minus minimum reading.

sig3 is load cell SIG3 reading.

sig3min is load cell SIG3 minimum reading.

sig3max is load cell SIG3 maximum reading.

sig3max-min is load cell SIG3 maximum reading minus minimum reading.

sig4 is load cell SIG4 reading.

sig4min is load cell SIG4 minimum reading.

sig4max is load cell SIG4 maximum reading.

sig4max-min is load cell SIG4 maximum reading minus minimum reading.

sig5 is load cell SIG5 reading.

sig5min is load cell SIG5 minimum reading.

`sig5max` is load cell SIG5 maximum reading.

`sig5max-min` is load cell SIG5 maximum reading minus minimum reading.

`sig6` is load cell SIG6 reading.

`sig6min` is load cell SIG6 minimum reading.

`sig6max` is load cell SIG6 maximum reading.

`sig6max-min` is load cell SIG6 maximum reading minus minimum reading.

`sig7` is load cell SIG7 reading.

`sig7min` is load cell SIG7 minimum reading.

`sig7max` is load cell SIG7 maximum reading.

`sig7max-min` is load cell SIG7 maximum reading minus minimum reading.

`sig8` is load cell SIG8 reading.

`sig8min` is load cell SIG8 minimum reading.

`sig8max` is load cell SIG8 maximum reading.

`sig8max-min` is load cell SIG8 maximum reading minus minimum reading.

`sig9` is load cell SIG9 reading.

`sig9min` is load cell SIG9 minimum reading.

`sig9max` is load cell SIG9 maximum reading.

`sig9max-min` is load cell SIG9 maximum reading minus minimum reading.

`sig10` is load cell SIG10 reading.

`sig10min` is load cell SIG10 minimum reading.

`sig10max` is load cell SIG10 maximum reading.

`sig10max-min` is load cell SIG10 maximum reading minus minimum reading.

`sig11` is load cell SIG11 reading.

`sig11min` is load cell SIG11 minimum reading.

`sig11max` is load cell SIG11 maximum reading.

`sig11max-min` is load cell SIG11 maximum reading minus minimum reading.

`sig12` is load cell SIG12 reading.

`sig12min` is load cell SIG12 minimum reading.

`sig12max` is load cell SIG12 maximum reading.

`sig12max-min` is load cell SIG12 maximum reading minus minimum reading.

`sigT` is junction box summing circuitry reading.

`sigTmin` is junction box summing circuitry minimum reading.

`sigTmax` is junction box summing circuitry maximum reading.

`sigTmax-min` is junction box summing circuitry maximum reading minus minimum reading.

Response when display is in signals minus zero reference mode:

```
<lf>L,nn,uu,sig1,sig1zero,sig1-zero,sig2,sig2zero,sig2-
zero,sig3,sig3zero,sig3-zero,sig4,sig4zero,sig4-zero,
sig5,sig5zero,sig5-zero,sig6,sig6zero,sig6-zero,
sig7,sig7zero,sig7-zero,sig8,sig8zero,sig8-zero,
sig9,sig9zero,sig9-zero,sig10,sig10zero,sig10-zero,
sig11,sig11zero,sig11-zero,sig12,sig12zero,sig12-zero,
sigT,sigTzero,sigT-zero<cr>
```

Where:

L is the ASCII letter L, indicating the display is in signals minus zero reference mode.

nn is the number of load cells.

uu is the display units (mV or lb).

sig1 is load cell SIG1 reading.

sig1zero is load cell SIG1 zero reference.

sig1-zero is load cell SIG1 reading minus SIG1 zero reference.

sig2 is load cell SIG2 reading.

sig2zero is load cell SIG2 zero reference.

sig2-zero is load cell SIG2 reading minus SIG2 zero reference.

sig3 is load cell SIG3 reading.

sig3zero is load cell SIG3 zero reference.

sig3-zero is load cell SIG3 reading minus SIG3 zero reference.

sig4 is load cell SIG4 reading.

sig4zero is load cell SIG4 zero reference.

sig4-zero is load cell SIG4 reading minus SIG4 zero reference.

sig5 is load cell SIG5 reading.

sig5zero is load cell SIG5 zero reference.

sig5-zero is load cell SIG5 reading minus SIG5 zero reference.

sig6 is load cell SIG6 reading.

sig6zero is load cell SIG6 zero reference.

sig6-zero is load cell SIG6 reading minus SIG6 zero reference.

sig7 is load cell SIG7 reading.

sig7zero is load cell SIG7 zero reference.

sig7-zero is load cell SIG7 reading minus SIG7 zero reference.

`sig8` is load cell SIG8 reading.

`sig8zero` is load cell SIG8 zero reference.

`sig8-zero` is load cell SIG8 reading minus SIG8 zero reference.

`sig9` is load cell SIG9 reading.

`sig9zero` is load cell SIG9 zero reference.

`sig9-zero` is load cell SIG9 reading minus SIG9 zero reference.

`sig10` is load cell SIG10 reading.

`sig10zero` is load cell SIG10 zero reference.

`sig10-zero` is load cell SIG10 reading minus SIG10 zero reference.

`sig11` is load cell SIG11 reading.

`sig11zero` is load cell SIG11 zero reference.

`sig11-zero` is load cell SIG11 reading minus SIG11 zero reference.

`sig12` is load cell SIG12 reading.

`sig12zero` is load cell SIG12 zero reference.

`sig12-zero` is load cell SIG12 reading minus SIG12 zero reference.

`sigT` is junction box summing circuitry reading.

`sigTzero` is junction box summing circuitry zero reference.

`sigT-zero` is junction box summing circuitry reading minus junction box summing circuitry zero reference.

The millivolt readings are eight characters wide, including the embedded decimal point.

The pounds readings are eight characters wide with no decimal point.

The excitation voltage reading is six characters wide, including the embedded decimal point.

If the NEST analog to digital converter is not functioning, the readings will be replaced by:

`ERROR.`

Get Displayed Readings Alternate Command

Command: `<enq>`

Response: same as for `<lf>Xm<cr>`

Get Status

Command: `<lf>Xs<cr>`

Response: `vvv.vv,iiiiiii,bbbbb`

`vvv.vv` is the voltage being provided to the NEST.

`iiiiiii` is `ISO ERR`, if the isolated voltage regulator indicates an error condition. Otherwise, it is seven spaces.

`bbbbb` is `BOOST` if the battery charger is in boost mode. Otherwise, it is five spaces.

Send Readings Continuously

Command: `<lf>Xr<cr>`

Response: sends same response as `<lf>Xm<cr>` command continuously.

Stop Sending Readings Continuously

Command: `<lf>XR<cr>`

Response: none

Set Number of Cells to Be Displayed

Command: `<lf>XCxx<cr>`

`xx` represents the number of cells whose millivolt reading will be displayed (in the range 1 to 12).

Response (number of cells in range): `<lf>CELLS=xx<cr>`

`xx` represents the number of cells that will be displayed (in the range 1 to 12).

Response (number of cells out of range): `<lf>?<cr>`

Get Number of Cells Being Displayed

Command: `<lf>Xc<cr>`

Response: `<lf>CELLS=xx<cr>`

`xx` represents the number of cells being displayed (in the range 1 to 12).

Set Display Mode
Command: `<lf>XEx<cr>`

> x is the letter M if the display is to be set to signals mode. x is the letter X if the display is to be set to minimum-maximum mode. x is the letter L if the display is to be set to signals minus zero reference mode.

Response (valid mode): `<lf>MODE=x<cr>`

> x is the letter M if the display is in signals mode. x is the letter X if the display is in minimum-maximum mode. x is the letter L if the display is in signals minus zero reference mode.

Response (invalid mode): `<lf>?<cr>`

Get Display Mode
Command: `<lf>Xe<cr>`

Response: `<lf>MODE=x<cr>`

> x is the letter M if the display is in signals mode. x is the letter X if the display is in minimum-maximum mode. x is the letter L if the display is in signals minus zero reference mode.

Set DAC Output Value
Command: `<lf>XDxxxxx<cr>`

> xxxxx represents the value the DAC will be set to (in the range 0 to 16383).

Response (DAC value in range): `<lf>DAC=xxxxx<cr>`

> xxxxx represents the value the DAC is set to (in the range 0 to 16383).

Response (DAC value out of range): `<lf>?<cr>`

Get DAC Setting
Command: `<lf>Xd<cr>`

Response: `<lf>DAC=xxxxx<cr>`

> xxxxx represents the value the DAC is set to (in the range 0 to 16383).

Set DAC Output Percentage

Command: `<lf>XPxxx.xxx<cr>`

> `xxx.xxx` represents the percentage to set the DAC output to (in the range 0% to 100%).

> Response (percentage in range): `<lf>DACP=xxx.xxx<cr>`

> `xxx.xxx` represents the percentage the DAC output is set to (in the range 0% to 100%).

> Response (percentage out of range): `<lf>?<cr>`

Get DAC Percentage

Command: `<lf>Xp<cr>`

> Response: `<lf>DACP=xxx.xxx<cr>`

> `xxx.xxx` represents the percentage the DAC output is set to (in the range 0% to 100%).

Set DAC mV/V

Command: `<lf>XVx.xxx<cr>`

> `x.xxx` represents the mV/V to set the DAC output to (in the range 0 to 3 mV/V).

> Response (mV/V in range): `<lf>DACV=x.xxx<cr>`

> `x.xxx` represents the mV/V the DAC output is set to (in the range 0 to 3 mV/V).

> Response (mV/V out of range): `<lf>?<cr>`

Get DAC mV/V

Command: `<lf>Xv<cr>`

> Response: `<lf>DACV=x.xxx<cr>`

> `x.xxx` represents the mV/V the DAC output is set to (in the range 0 to 3 mV/V).

Set New Starting Point for Minimum-Maximum Display or New Zero Reference for Signals Minus Zero Reference Display

Command: `<lf>XZ<cr>`

> Response (if the display is in minimum-maximum mode or signals minus zero reference mode): `<lf>OK<cr>`

> Response (if the display is not in minimum-maximum mode or signals minus zero reference mode): `<lf>?<cr>`

SERIAL COMMANDS
Commands Common to Both Digital and Analog Scales

In the following descriptions:

> `<lf>` represents an ASCII LF (0A hexadecimal)
>
> `<cr>` represents an ASCII CR (0D hexadecimal)
>
> `<enq>` represents an ASCII ENQ (05 hexadecimal)
>
> `<esc>` represents an ASCII ESC (1B hexadecimal)

Get Status

Command: `<lf>Xs<cr>`

> Response: `vvv.vv,iiiiiii,bbbbb`
>
> > `vvv.vv` is the voltage being provided to the NEST.
> >
> > `iiiiiii` is `ISO ERR`, if the isolated voltage regulator indicates an error condition. Otherwise, it is seven spaces.
> >
> > `bbbbb` is `BOOST` if the battery charger is in boost mode. Otherwise, it is five spaces.

About 225NEST

Command: `<lf>A<cr>`

> Response: `<lf>SMA:2/1.0<cr>`

Command: `<lf>B<cr>`

> Response: `<lf>MFG:Cardinal Scale Mfg. Co.<cr>`

Command: `<lf>B<cr>`

> Response: `<lf>MOD:225NEST<cr>`

Command: `<lf>B<cr>`

> Response: `<lf>REV:x.x.xx<cr>`
>
> > (`x.x.xx` represents the version of the 225NEST firmware)

Command: `<lf>B<cr>`

> Response: `<lf>END:<cr>`

Get Information

Command: `<lf>I<cr>`

> Response: `<lf>SMA:2/1.0<cr>`

Command: `<lf>N<cr>`

> Response: `<lf>TYP:<cr>`

Command: `<lf>N<cr>`

> Response: `<lf>CAP:<cr>`

Command: `<lf>N<cr>`

> Response: `<lf>CMD:INX<cr>`

Command: `<lf>N<cr>`

Response: `<lf>END:<cr>`

Reset Serial

Command: `<esc>`

> Response: none

Unrecognized Command

> Response: `<lf>?<cr>`

STATEMENT OF LIMITED WARRANTY

WARRANTY TERMS

Cardinal Scale Manufacturing Company warrants the equipment we manufacture against defects in material and workmanship. The length and terms and conditions of these warranties vary with the type of product and are summarized below:

PRODUCT TYPE	TERM	MATERIAL AND WORKMAN-SHIP	LIGHTNING DAMAGE See note 9	WATER DAMAGE See note 7	CORROSION See note 4	ON-SITE LABOR	LIMITATIONS AND REQUIREMENTS
WEIGHT INDICATORS	90 DAY REPLACEMENT ---------- 1 YEAR PARTS	YES	YES	YES	YES	NO	1, 2, 3, 5, 6 A, B, C, D
LOAD CELLS (Excluding Hydraulic)	1 YEAR	YES	YES	YES	YES	NO	1, 2, 3, 5, 6 A, B, C, D
HYDRAULIC LOAD CELLS (When purchased with Guardian Vehicle Scale)	LIFETIME	YES	YES	YES	YES	90 DAYS	1, 5, 6, 8 A, B, C, D
HYDRAULIC LOAD CELLS (When purchased separately)	10 YEARS	YES	YES	YES	YES	NO	1, 5, 6, 8, 9 A, B, C, D
VEHICLE SCALE (Deck and Below Excl. PSC Series)	5 YEARS	YES	YES	YES	YES	90 DAYS	1, 2, 3, 5, 6 A, B, C, D, E
LSC SCALE (Deck and Below)	3 YEARS	YES	YES	YES	YES	90 DAYS	1, 2, 3, 5, 6, 11 A, B, C, D
GUARDIAN FLOOR SCALES	10 YEARS	YES	YES	YES	YES	NO	1, 2, 3, 5, 6, 9, 10 A, B, C, D
ALL OTHER CARDINAL PRODUCTS	1 YEAR	YES	YES	YES	YES	NO	1, 2, 5, 6 A, B, C, D, E
REPLACEMENT PARTS	90 DAYS	YES	YES	YES	YES	NO	1, 2, 4, 5, 6 A, B, C, D
SWIM AND 760 SERIES VEHICLE SCALES	1 YEAR	YES	YES	YES	YES	90 DAYS	1, 2, 5, 6 A, B, C, D
SOFTWARE	90 DAYS	YES	N/A	N/A	N/A	NO	1, 6 B, C, D
CONVEYOR BELT SCALES (including Belt-Way)	1 YEAR	YES	YES	YES	YES	NO	1, 2, 3, 5, 6 A, B, C, D, E, F

CARDINAL®

Ph. (800) 441-4237
E-mail: cardinal@cardet.com
102 E. Daugherty
Webb City, MO 64870

04/24
Printed in USA
315-WARRANTY-CAR-M

APPLICABLE LIMITATIONS AND REQUIREMENTS

1. This warranty applies only to the original purchaser. The warranty does not apply to equipment that has been tampered with, defaced, damaged, or had repairs or modifications not authorized by Cardinal or has had the serial number altered, defaced or removed.
2. This warranty is not applicable to equipment that has not been grounded in accordance with Cardinal's recommendations.
3. This equipment must be installed and continuously maintained by an authorized Cardinal / Belt-Way dealer.
4. Applies only to components constructed from stainless steel.
5. This warranty does not apply to equipment damaged in transit. Claims for such damage must be made with the responsible freight carrier in accordance with freight carrier regulations.
6. Warranty term begins with date of shipment from Cardinal.
7. Only if device is rated NEMA 4 or better or IP equivalent.
8. Lifetime warranty applies to damages resulting from water, lightning, and voltage transients and applies only to the hydraulic load cell structure itself (does not include pressure transducers, rubber seals, o-rings, and associated wiring).
9. 10-Year prorated warranty on hydraulic load cells.
10. 1-Year warranty for scale structure.
11. PSC models' warranty coverage applies only to agricultural installations on farms up to 3,000 acres (LSC models not limited in this manner).
12. Load cell kits MUST be installed in accordance with Cardinal Scale instructions. Failure to follow these instructions will void the warranty.

EXCLUSIONS

A.) This warranty does not include replacement of consumable or expendable parts. The warranty does not apply to any item that has been damaged due to unusual wear, abuse, improper line voltage, overloading, theft, fire, water, prolonged storage or exposure while in purchaser's possession or acts of God unless otherwise stated herein.

B.) This warranty does not apply to peripheral equipment not manufactured by Cardinal. This equipment will normally be covered by the equipment manufacturer's warranty.

C.) This warranty sets forth the extent of our liability for breach of any warranty or deficiency in connection with the sale or use of our product. Cardinal will not be liable for consequential damages of any nature, including but not limited to loss of profit, delays or expenses, whether based on tort or contract. Cardinal reserves the right to incorporate improvements in material and design without notice and is not obligated to incorporate said improvements in equipment previously manufactured.

D.) This warranty is in lieu of all other warranties expressed or implied including any warranty that extends beyond the description of the product including any warranty of merchantability or fitness for a particular purpose. This warranty covers only those Cardinal products installed in the forty-eight contiguous United States and Canada.

E.) This warranty does not cover paint coatings due to the variety of environmental conditions.

F.) Do not cut load cell cables on load cells returned for credit or warranty replacement. Cutting the cable will void the warranty.

G.) Software is warranted only for performance of the functions listed in the software manual and/or the Cardinal proposal.

H.) The software warranty does not cover hardware. Warranties on hardware are provided from the hardware vendor only.

I.) The software warranty does not cover interfacing issues to non-Cardinal supplied hardware.

J.) The software warranty does not include automatic software upgrades unless purchased separately.

CARDINAL®

Ph. (800) 441-4237
E-mail: cardinal@cardet.com
102 E. Daugherty
Webb City, MO 64870

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