# 0970

## Ringmount™ Weigh Modules

Installation and Service Manual

A16104400A
(3/01).00

**METTLER TOLEDO**

# Publication Revision History

**An overview of this manual's revision history is compiled below.**

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| A16104400A | 3/01 | Changed product name to Ringmount™ Weigh Modules. Added Ex approval information and control drawing for FM approval. |

## INTRODUCTION

This publication is provided solely as a guide for individuals who have received Technical Training in servicing the METTLER TOLEDO product.

Information about METTLER TOLEDO Technical Training can be obtained by writing, calling, or faxing:

**METTLER TOLEDO**
1900 Polaris Parkway
Columbus, Ohio 43240 USA
phone: (614) 438-4511
fax: (614) 438-4958
www.mt.com

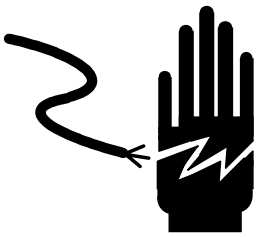
## WARNING!

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used properly, i.e., in accordance with the instructions manual, may cause harmful interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device, pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference to radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

## METTLER TOLEDO RESERVES THE RIGHT TO MAKE REFINEMENTS OR CHANGES WITHOUT NOTICE.

# Precautions

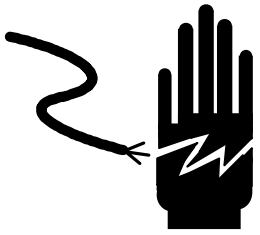
READ this manual BEFORE operating or servicing this equipment.



**⚠ WARNING**

**PERMIT ONLY QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS, AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.**

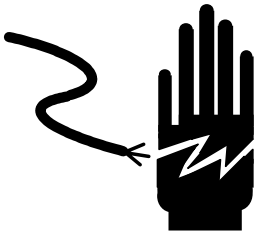
FOLLOW these instructions carefully.



**⚠ WARNING**

**FOR CONTINUED PROTECTION AGAINST SHOCK HAZARD, CONNECT TO PROPERLY GROUNDED OUTLET ONLY. DO NOT REMOVE THE GROUND PRONG.**

SAVE this manual for future reference.



**⚠ WARNING**

**DISCONNECT ALL POWER TO THIS UNIT BEFORE INSTALLING, SERVICING, CLEANING, OR REMOVING THE FUSE. FAILURE TO DO SO COULD RESULT IN BODILY HARM AND/OR PROPERTY DAMAGE.**

DO NOT allow untrained personnel to operate, clean, inspect, maintain, service, or tamper with this equipment.

**⚠ CAUTION**

**BEFORE CONNECTING/DISCONNECTING ANY INTERNAL ELECTRONIC COMPONENTS OR INTERCONNECTING WIRING BETWEEN ELECTRONIC EQUIPMENT, ALWAYS REMOVE POWER AND WAIT AT LEAST 30 SECONDS. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY HARM OR DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT.**

ALWAYS DISCONNECT this equipment from the power source before cleaning or performing maintenance.

**⚠ CAUTION**

**OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.**

CALL METTLER TOLEDO for parts, information, and service.

## ⚠ CAUTION

**<u>DO NOT</u> PASS WELDING CURRENT THROUGH THE LOAD CELLS! WHEN WELDING ON A SCALE, ALWAYS GROUND THE WELDING DEVICE AS CLOSE TO THE WORK AS POSSIBLE. NEVER WELD CLOSER THAN WITHIN 4 FEET (1.2 METERS) OF ANY LOAD CELL WITHOUT REMOVING THE LOAD CELL.**

## ⚠ WARNING

**DO NOT USE THE RAAD JUNCTION BOX OR IDNet JUNCTION BOX IN LOCATIONS CLASSIFIED AS HAZARDOUS BY THE NATIONAL ELECTRICAL CODE (NEC) ARTICLE 500.**

## ⚠ CAUTION

**BE SURE TO BLOCK THE SCALE WHEN IT IS IN THE RAISED POSITION. OBSERVE ALL APPROPRIATE SAFETY PROCEDURES WHEN INSTALLING AND SERVICING THE WEIGH MODULES.**

## ⚠ WARNING

**IF USED IN A HAZARDOUS AREA, THE HAZARDOUS AREA MUST BE MADE SAFE PRIOR TO INSTALLATION, REPLACEMENT, OR TROUBLESHOOTING. FAILURE TO COMPLY COULD RESULT IN PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.**

# Contents

# 1 Introduction

## 0970 Weigh Modules

Model 0970 Ringmount™ weigh modules are used to convert tanks, hoppers, and other structures into scales. Each weigh module consists of a torsion ring load cell and the mounting plates needed to attach it to a structure. The weigh modules are available in capacities of 250 kg to 5,000 kg.

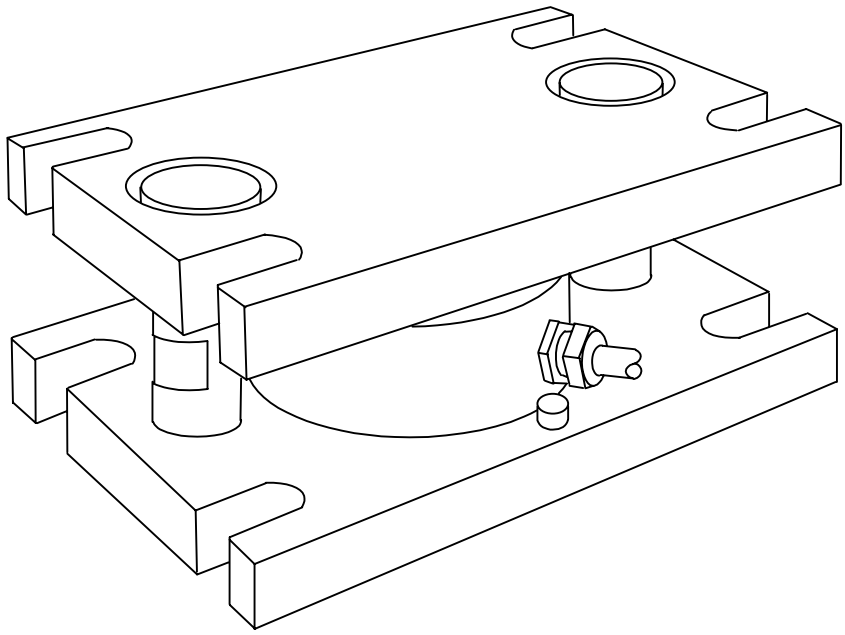


**Figure 1-1: Model 0970 Ringmount Weigh Module**

This manual explains how to install and service Model 0970 weigh modules. If any information is incorrect or missing from the manual, please use the Publication Suggestion Report at the back of the manual to tell us about it.

# Model Number

Table 1-1 shows how to determine the correct model number for an application using Model 0970 weigh modules.

| Model Number Configuration | | | | | |
|---|---|---|---|---|---|
| **XXXX** | **X** | **X** | **XX** | **X** | **-XX** |
| **Model** | **Weigh Module Type** | **# of Modules** | **Load Cell Capacity** | **Metrology** | **Junction Box** |
| 0970 | 0 = Standard<br>C = Custom | 1 to 9 | X2 = 250 kg<br>X5 = 500 kg<br>01 = 1,000 kg<br>02 = 2,000 kg<br>03 = 3,500 kg<br>05 = 5,000 kg | 4 = C3 Ex, 5Kd NTEP, FM<br>6 = C6 Ex, FM | -1 = Analog Junction Box<br>-2 = No Junction Box<br>XX = Custom |

**Table 1-1: Load Cell Configuration**

# Accuracy

Scale accuracy depends on:

- The design of the support steel for the module and of the receiving structure (tank, hopper, conveyor, etc.) mounted to the modules
- The design and number of dead-to-live connections attached to the scale
- The total load cell capacity
- Environmental factors: wind, vibration, temperature variations, etc.

Refer to METTLER TOLEDO *Weigh Module Systems Handbook* (Part Number *15598500A) for assistance.

* May have an alphabetical prefix.

# Power Supply Requirements

A METTLER TOLEDO digital indicator is used to power the analog load cells in Model 0970 weigh modules. The type of digital indicator that is used determines which type of junction box (Analog, RAAD, or IDNet) is required for the weigh modules.

Refer to the digital indicator's service manual for the indicator's power requirements.

# Load Cell Specifications

| | |
|---|---|
| Model: | RLC |
| Capacities ($E_{max}$): | 250 kg, 500 kg, 1,000 kg, 2,000 kg, 3,500 kg, 5,000 kg |
| Rated output (RO): | 2 mV/V (1.75 mV/V for 250-kg load cells) |
| Maximum excitation voltage: | 30 VDC maximum |
| Input terminal resistance: | 1,110 ± 50 ohms (1,100 ± 50 for 250 kg) |
| Output terminal resistance: | 1,025 ± 25 ohms (1,025 ± 50 for 250 kg) |
| Sealing: | Hermetically sealed, IP66 and IP68 |
| Material: | Stainless steel |
| Cable length: | 5 meters (16.5 feet) |
| Temperature range (compensated): | -10°C to +40°C (+14°F to +104°F) |
| Safe side load: | 100% of $E_{max}$ |
| Safe overload: | 150% of $E_{max}$ |
| Combined error (linearity and hysteresis): | ± 0.02% of rated output |
| Zero balance: | ± 1.0% of rated output (1.5% for 250 kg) |

# Approvals

### NTEP Certification

Model RLC load cells (except 250-kg load cells) meet or exceed NIST Handbook-44 requirements for Class III 5000 divisions/multiple cell (minimum). Certificates of Conformance were issued under the National Type Evaluation Program (NTEP) of the National Conference of Weights and Measures for these load cells.

### OIML Certification

Model RLC load cells meet or exceed OIML requirements for R60 C3 3000 divisions. An optional RLC load cell is available to meet C6 6000-division accuracy.

### Ex Approval

Model RLC load cells have European Approval for use in hazardous areas. Approval is to EEx ib IIC T6 (certification number Ex-94.C.2142).

### Factory Mutual Approval

Model RLC load cells have Factory Mutual entity approval for use in hazardous areas. Refer to Figure 1-2 for the control drawing.

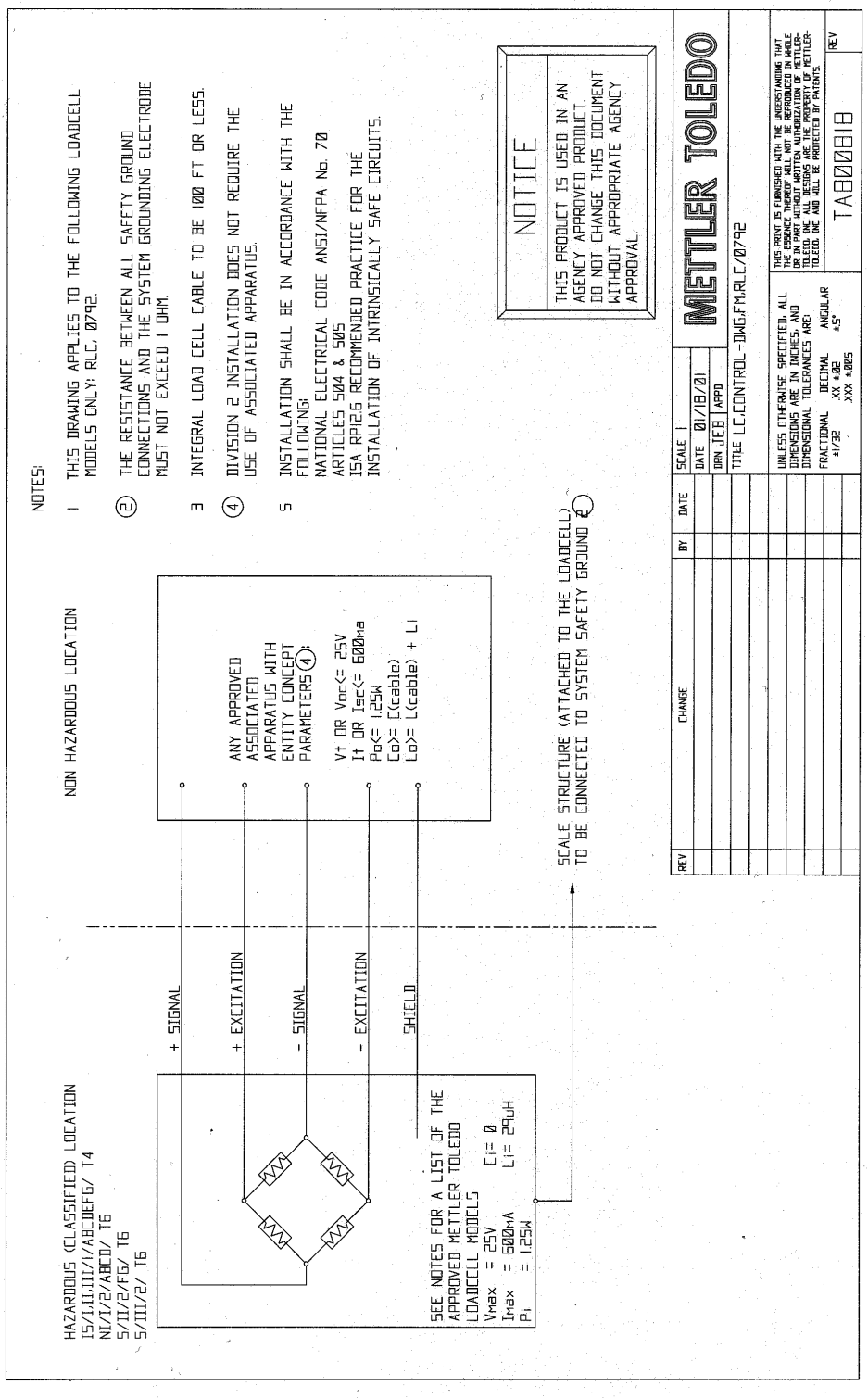
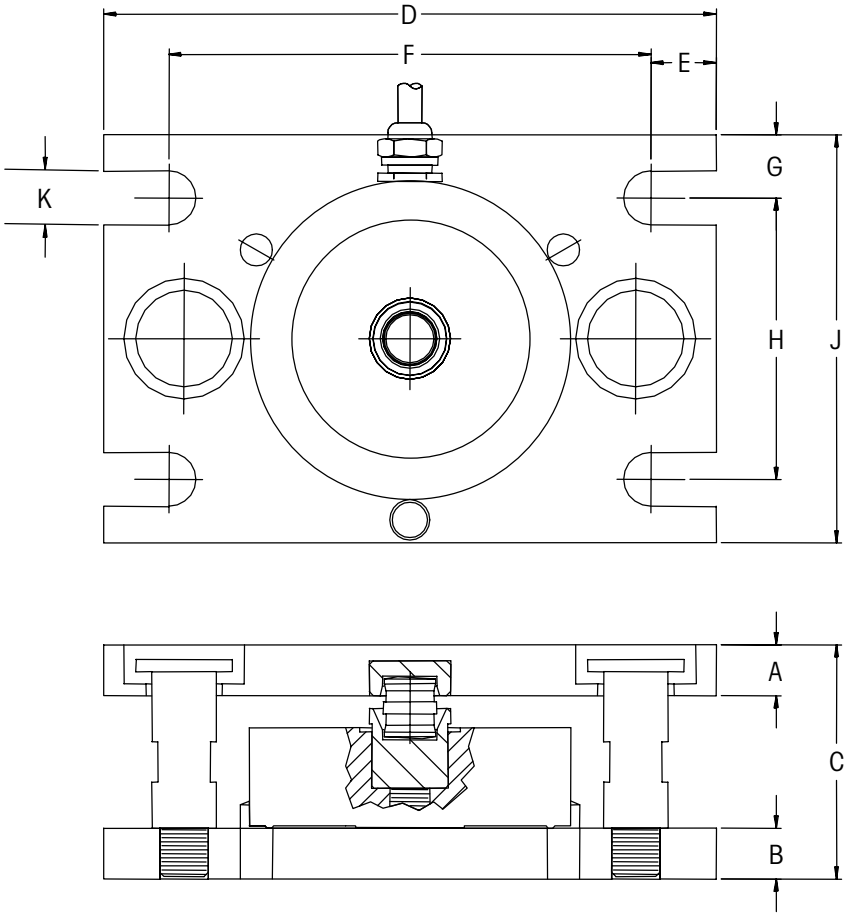



**Figure 1-2: Control Drawing for RLC Load Cell**

# Dimensions




| Load Cell Capacity | A | B | C | D | E |
|---|---|---|---|---|---|
| 250-5,000 kg | 12.7 mm (0.5 inches) | 12.7 mm (0.5 inches) | 58.4 mm (2.3 inches) | 152.4 mm (6.0 inches) | 16.2 mm (0.64 inches) |

| Load Cell Capacity | F | G | H | J | K |
|---|---|---|---|---|---|
| 250-5,000 kg | 120 mm (4.72 inches) | 15.8 mm (0.62 inches) | 70 mm (2.75 inches) | 101.6 mm (4.0 inches) | 13.5 mm (0.53 inches) |

**Table 1-2: 0970 Ringmount Weigh Module Dimensions**

# 2 Inspection and Site Selection

## Inspection

When you receive your weigh modules, inspect the packing containers and modules for freight damage. Inspect:

1. Load cell and suspension assemblies
2. Load cell cables and junction box
3. Overall assembly

If you find damage, contact your freight carrier immediately. Fill out the enclosed warranty card and return the weigh module to the address indicated.

## Site Selection

Problems installing weigh modules are often caused by inappropriate site conditions. Before installing the weigh modules, make sure the site meets the following criteria:

- All support surfaces should be level.
- Adequate support, where each module meets the floor or structure, throughout the scale's weighing capacity.
- Uniform deflection of the weigh module supports (top and bottom), maintaining less than one-half degree out of level at gross capacity.
- Proper drainage away from each of the weigh modules.
- No heavy vibrations or wind currents at or near the scale.
- Access around each weigh module for installation and service.
- Locations on the scale to add test weights for calibration.
- Access to the scale for moving test weights to the scale's loading locations.
- A position near the scale to mount the junction box.
  (Do not mount the junction box on the live portion of the scale.)
- No excessive or unusual loading caused by the site or type of equipment mounted to the weigh modules.
- Shared foundation: Does the vessel to be weighed have an exclusive, isolated support foundation? Does it share supports with other vessels? If the vessel shares a foundation, the scale's accuracy might be affected by the weight of other structures on the foundation.

If the site meets the criteria listed here, proceed with the installation. Otherwise, make necessary adjustments before installing the modules.

# 3 Installation

## General Guidelines

**⚠ WARNING**

**IF USED IN A HAZARDOUS AREA, THE HAZARDOUS AREA MUST BE MADE SAFE PRIOR TO INSTALLATION, REPLACEMENT, OR TROUBLESHOOTING. FAILURE TO COMPLY COULD RESULT IN PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.**

Each application has its own unique requirements and should be planned by a qualified structural engineer. This manual is meant to serve only as a general guide for installation.

### Use the Right Number of Weigh Modules

A typical system uses either three or four weigh modules. The exact number is usually determined by the structure that they will support. Each weigh module in a system should support the same amount of weight (within 20%). We do not recommend using more than eight weigh modules in a system. With more than eight modules, the structure's weight will not be distributed evenly at the support points.

### Provide Adequate Structural Support

Tank legs or structural support lugs should be rigid enough to prevent the support points from deflecting under load.

### Connect Piping Properly

Piping connected to a tank can affect weighing accuracy by exerting unwanted forces on the scale. Keep piping connections to a minimum and make sure they are flexible enough to allow the tank to deflect freely as weight is added.

### Protect Load Cells from Damage

- Load cells can be damaged if too much weight is placed on them. To protect against damage, make sure that the hold-down bolts and shipping blocks are positioned properly during installation.
- Do not pass welding current through the load cells.

# Installation

If the weigh modules are to be mounted to a concrete floor, locate and anchor the base plates to the concrete before setting the weigh structure (tank, hopper, etc.) on the modules. Make sure that you will be able to adjust the weigh structure to align it correctly with the weigh modules.

Before you begin installation, make sure that the top plate of each weigh module is locked into position so that it will not transfer any load to the load cell. During installation, the shipping blocks should be in position (see Figure 3-1) and clamped to the hold-down bolts with U-bolts.

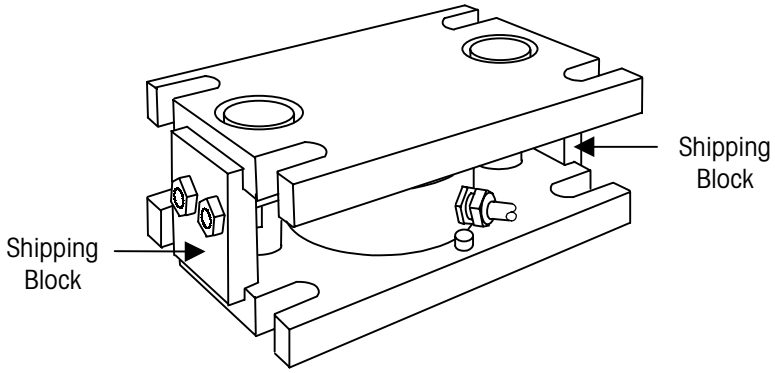



**Figure 3-1: Weigh Module with Shipping Blocks in Position**

1. Position the weigh modules so that each will support an equal portion of the total load and so the load on any module will not exceed the load cell capacity.
2. Level each weigh module so that each mounting plate (top and base plate) is within 1/2° of level in both longitudinal and lateral directions (see Figure 3-2).

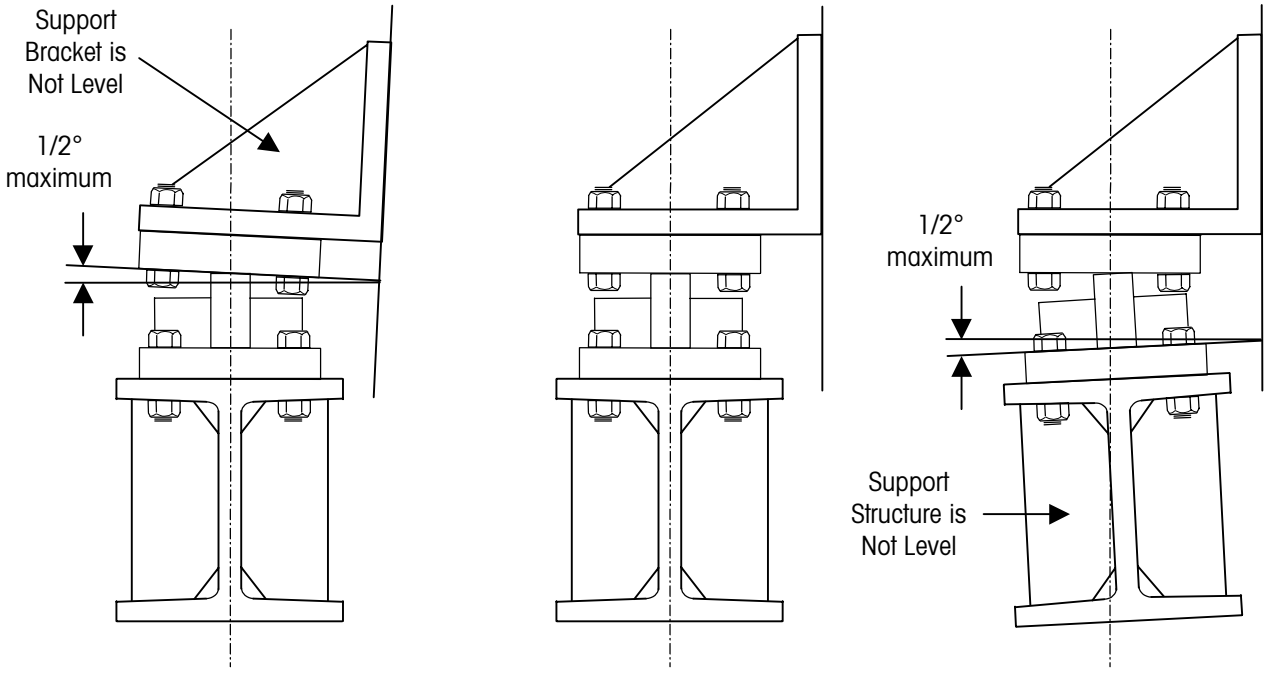



**Figure 3-2: Maximum Amount that a Mounting Plate can be out of Level**

3. Slowly lower the weigh structure onto the weigh modules.
4. Add stainless steel shims between the structure and top plates if needed, so that each top plate is within 1/2° of level in both longitudinal and lateral directions.
5. Bolt or weld the weigh module top plates to the weigh structure supports, and the base plates to the foundation or support steel. See Table 3-1 for bolt sizes.

Note: Mounting plate bolts are not supplied by METTLER TOLEDO.

| 0970 Weigh Module | Base Plate Bearing psi (K Pascal) | Top Plate Bolts (Metric) | Base Plate Bolts (Metric) |
|---|---|---|---|
| 250 to 5,000 kg | 460 (3,150) | 1/2-13 UNC (M12 x 1.75) | 1/2-13 UNC (M12 x 1.75) |

**Table 3-1: 0970 Bearing Support and Mounting Bolt Sizes**

6. If the top plates are to be welded to the weigh structure or the base plates welded to a structural steel support, the weld should be 3/8 inch fillet, 1 inch long, and 3 inches pitch (2 inches between welds).

**⚠ CAUTION**

**DO NOT PASS WELDING CURRENT THROUGH THE LOAD CELLS! WHEN WELDING ON A SCALE, ALWAYS GROUND THE WELDING DEVICE AS CLOSE TO THE WORK AS POSSIBLE. NEVER WELD CLOSER THAN 4 FEET (1.2 METERS) TO ANY LOAD CELL WITHOUT REMOVING THE LOAD CELL.**

7. After securing all the top and base plates, remove the shipping blocks and U-bolts.

Note: Consider calibrating the scale before connecting any piping to the scale. The scale can then be used as a meter to determine if a proper live-to-dead connection was made.

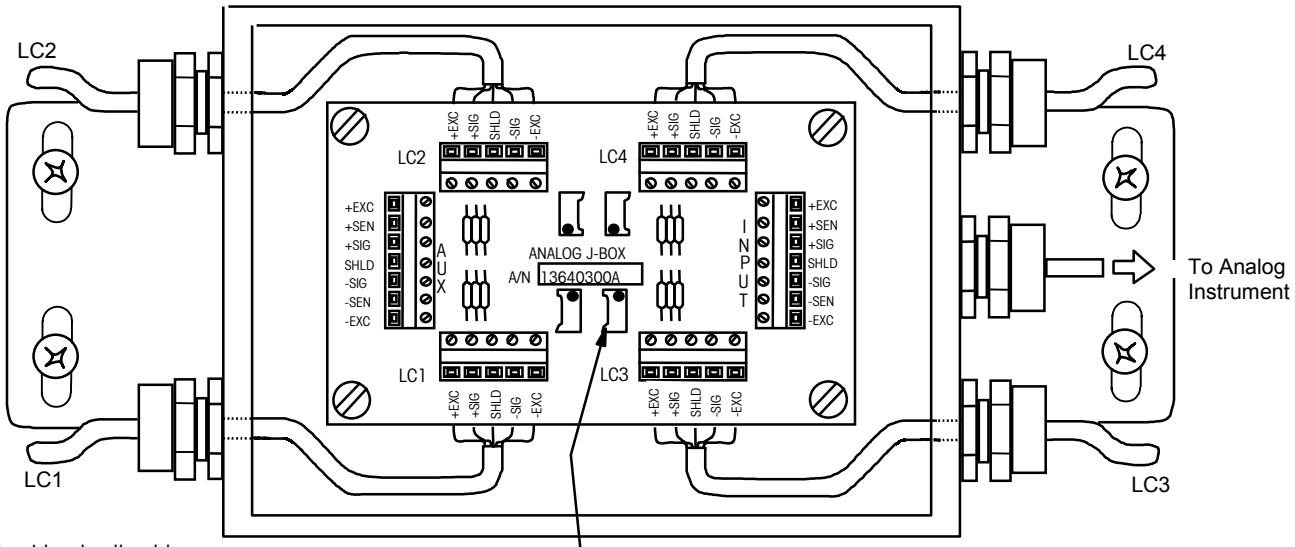
8. Mount the junction box in a location where the load cell cables can be properly terminated in the junction box. Do not mount the junction box on the scale.

   **Note:** Each load cell is supplied with a standard length of cable. Do not lengthen or shorten load cell cables in the field! Changing the length of a load cell cable will affect compensation and void the warranty. If a cable is too long, simply coil the excess cable and place it in or near the junction box. Nonstandard lengths of cable can be ordered for applications that require them.
9. Connect the load cell cables to the junction box and terminate wires according to the wiring and color code decal on the underside of the junction box lid.
10. Connect the junction box to the scale indicator with an appropriate cable.
11. Confirm that all live-to-dead connections are flexible and securely anchored at both the scale and dead connection point.

# Modes of Operation

## Analog Mode

Model 0970 weigh modules can be used with an analog junction box for summing the load cell outputs. Only analog-compatible indicators work with an analog junction box. See Figure 3-3 and Table 3-1 for cable connections.




Note: Do not cut load cell cables. Cutting a cable will eliminate its shield wire and affect performance.

Individual Load Cell Trimming

Note: Turn all potentiometers fully clockwise prior to calibration.

**Figure 3-3: Analog Junction Box Detail**

| Load Cell Wiring | | Instrument Cable Wiring | |
|---|---|---|---|
| **Function** | **Wire Color** | **Function** | **Color** |
| + Excitation | Pink | + Excitation | White |
| + Sense | — | + Sense | Yellow |
| + Signal | Brown | + Signal | Green |
| Shield | Bare | Shield | Orange |
| - Signal | White | - Signal | Black |
| - Sense | — | - Sense | Red |
| - Excitation | Gray | - Excitation | Blue |
| | | Based on METTLER TOLEDO cable no. 510624370 | |

**Table 3-1: Analog Junction Box Wiring Codes**

## RAAD Mode

Model 0970 weigh modules can be used with a RAAD junction box for summing load cell outputs. A JAGUAR® or JAGXTREME™ indicator must be used with the RAAD junction box. The indicator serves as the host for the RAAD junction box, allowing you to use the indicator's keypad to adjust scale parameters. See Figure 3-4 and Table 3-2 for cable connections. Load cell wiring for RAAD mode is the same as for analog mode.


Note: For 2 mV/V load cells, jumpers W1, W2, W3, and W4 must be ON (shorting the pins). The jumpers must also be ON for 250-lb load cells.

Note: If more than one junction box is used, connect the junction boxes in a daisy chain. Connect Terminal TB5 on the first junction box to Terminal TB2 on the next junction box in the series.

**Switch Positions**
SW1: On if Load Cell 1 is used
SW2: On if Load Cell 2 is used
SW3: On if Load Cell 3 is used
SW4: On if Load Cell 4 is used
SW5: On if last J-box in series

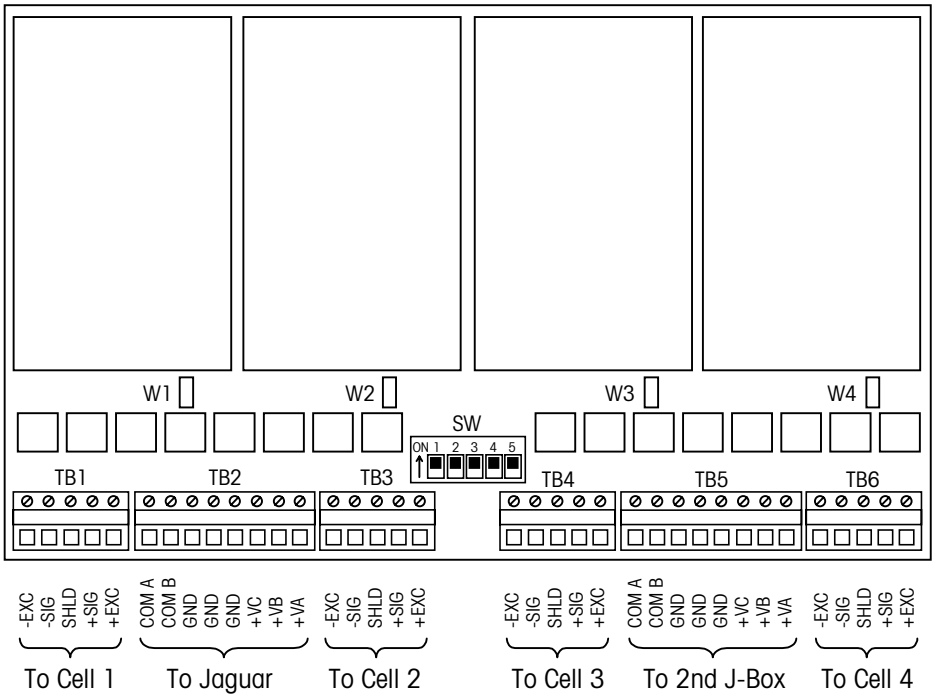



**Figure 3-4: RAAD Junction Box Detail**

| RAAD TB2 Terminal | Function | Jaguar Terminal |
|---|---|---|
| 1 | +20 VDC (+VA) | 8 |
| 2 | +20 VDC (+VB) | 7 |
| 3 | +20 VDC (+VC) | 6 |
| 4 | Ground | 5 |
| 5 | Ground | 4 |
| 6 | Ground | 3 |
| 7 | COM B | 2 |
| 8 | COM A | 1 |

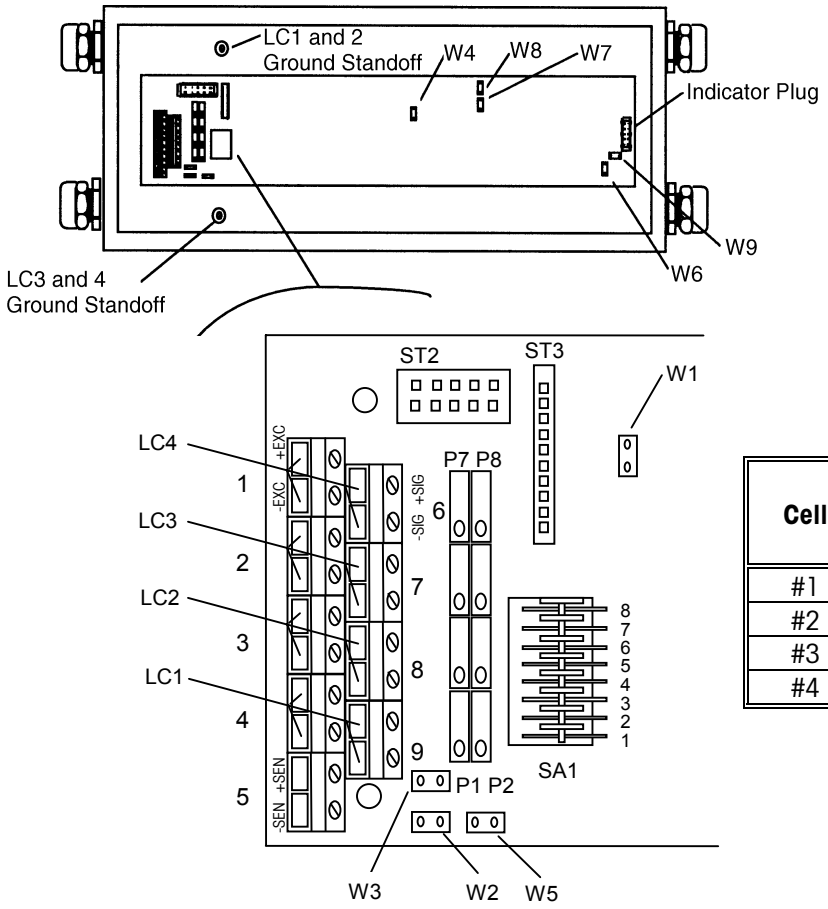
**Table 3-2: RAAD Junction Box Wiring**

## IDNet Mode

The IDNet junction box can output an IDNet data format compatible with the METTLER TOLEDO ID1 and ID5 weight displays or the Jaguar Industrial Terminal. See Figure 3-5 and Table 3-3 for cable connections. For detailed information about the indicator capabilities and operating instructions, refer to the appropriate service manual.

**⚠ WARNING!**

**DO NOT USE THE IDNet JUNCTION BOX IN LOCATIONS CLASSIFIED AS HAZARDOUS BY THE NATIONAL ELECTRICAL CODE (NEC) ARTICLE 500.**




| Cell | Terminal | | | |
|---|---|---|---|---|
| | + Exc. Pink | - Exc. Gray | + Sig. Brown | - Sig. White |
| #1 | 4 | 4 | 9 | 9 |
| #2 | 3 | 3 | 8 | 8 |
| #3 | 2 | 2 | 7 | 7 |
| #4 | 1 | 1 | 6 | 6 |

**Figure 3-5: IDNet Junction Box Detail and Wiring**

Note: For 2 mV/V load cells, jumpers W1, W2, W3, and W4 must be ON (shorting the pins).

| Jumper | Status | Description |
|---|---|---|
| W1 | Closed (ON) | Matching the gain at 2 mV/V load cells |
| W2 | Closed (ON) | No external sensing (-SEN) |
| W3 | Closed (ON) | No external sensing (+SEN) |
| W4 | Closed (ON) | Internal reference voltage = 3.5 Volts |
| W5 | Open (OFF) | Excitation voltage for load cells = 4.0 Volts |
| W6 | Closed (ON) | Internal supply voltage = 7.1 Volts |
| W7 | 2-3 | Protocol IDNet |
| W8 | 1-2 | Interface 20 mA |
| W9 | Open (OFF) | Supply voltage IDNet |
| SA1 | Closed (ON) | Trim potentiometers circuit disabled |

**Table 3-3: IDNet Default Factory Settings**

# Home Run Cable Connection

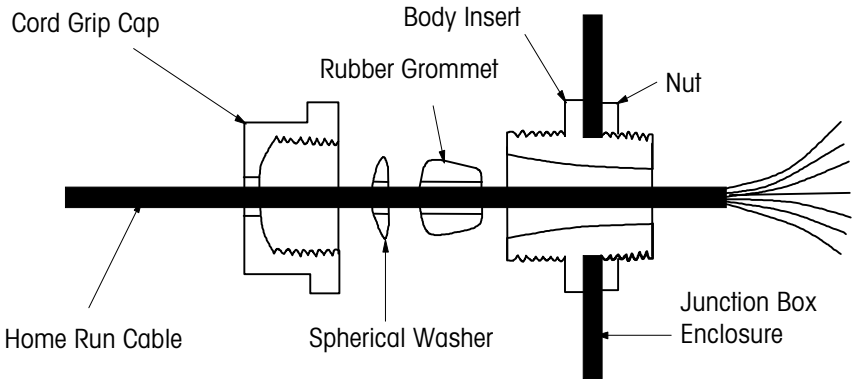



**Figure 3-6: Cord Connection Details**

Connect the home run cable from the scale indicator to the junction box (refer to Figure 3-6):

1. Wire the home run cable to the PCB according to Figure 3-3 for Analog, Figure 3-4 for RAAD, or Figure 3-5 for IDNet.
2. Place the desiccant bag inside the junction box.
3. Reinstall the junction box lid. Make sure that the rubber gasket is clean and correctly positioned. Tighten all screws and make sure all cord grip caps are secure.

# 4 Calibration

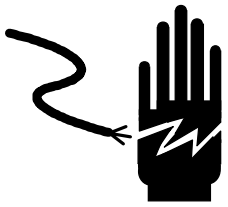
## Shift Adjust

Before making calibration adjustments, check all mechanical parts and make sure that the scale provides repeatable weight readings. To check repeatability, repeatedly place a test weight in the same position on the scale and confirm that you get the same weight reading each time.

Then perform a shift adjust so that the weight reading at or near each weigh module is the same for the same test weight.

The test weight used for the shift test should equal at least 10 percent of the rated scale capacity. Test weights should be concentrated directly (or as close as possible) over the weigh modules.

## Analog Junction Box Shift Adjustment



**⚠ WARNING**

**PERMIT ONLY QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS, AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.**

Perform a shift adjust using the load cell trim potentiometers mounted on the PCB inside the analog junction box.

1. Successively place the test weight at each of the designated locations (at or near the weigh modules). Record the displayed weight readings.
2. Determine the location with the lowest weight reading.
3. Proceeding clockwise, place the test weight at each designated location. If necessary, adjust the trim potentiometer corresponding to that location to obtain the weight reading recorded in Step 2.
4. Repeat this procedure until all weight readings at the designated locations are the same or within the tolerances specified by the local weights and measures authority.
5. Make sure all cable connectors and cord grip caps are tight, place the desiccant bag in the box, and reinstall the junction box lid.

# RAAD Junction Box Shift Adjustment

Perform the shift adjust procedure at the indicator, with the indicator in Setup mode. For shift adjustment instructions, refer to the manual for the weight indicator you are using.

# IDNet Junction Box Shift Adjustment

Perform the shift adjust procedure using the load cell trim potentiometers mounted on the PCB inside the IDNet junction box (see Figure 4-1).

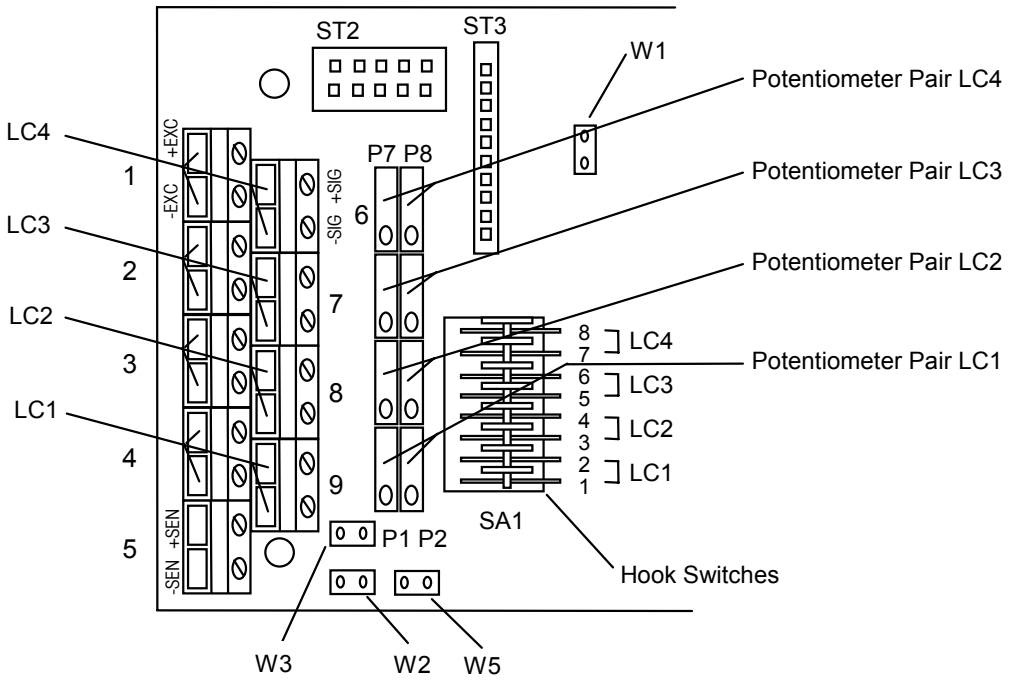



**Figure 4-1: IDNet Potentiometer Adjustment**

1. Successively place the test weight(s) at the designated locations and record each weight reading. If the readings are within the desired tolerance, no shift adjustment is needed. If the readings are not within the desired tolerance, perform Steps 2 to 6.
2. Activate the trim potentiometers by opening the eight hook switches (if they are not already open) on the PCB (see Figure 4-1). Once activated, the switches remain open. Do not close the latches, even after completing the shift adjustment.
3. Start the adjustment at the load cell having the highest positive reading. This process trims the load cells to match the value of the lowest recorded value.
4. To make minor adjustments, turn the trim potentiometers (each load cell has two) clockwise to increase the reading or counterclockwise to decrease the reading.

5. If the scale needs further adjustment, turn all potentiometers counterclockwise. Stop turning the potentiometers when the indication on the instrument or meter stabilizes.
6. Reapply the test weight(s) to the location that has the highest recorded weight reading. Then adjust the load cell potentiometers to match the reading of the location that has the lowest recorded value. Repeat this step until the readings at all locations are the same or within the specified scale tolerances. Repeat Step 1 to verify shift tolerances.
7. Make sure all cable connectors and cord grip caps are tight. Then place a desiccant bag in the box, leave all hook latches open, and reinstall the junction box lid.

# Scale Calibration (Span)

METTLER TOLEDO recommends calibrating the scale using test weights equal to the scale's capacity. With the proper test weight, continue calibrating the weighing system according to the instructions provided in your digital indicator manual.

## Options for Calibration

### Calibration with Test Weights

The most accurate, reliable way to calibrate a scale is to hang test weights from the tank. This method is useful when accuracy is extremely important and in tanks holding less than 10,000 kg.

Take readings as you add and remove weights. This yields a graph of the scale's performance from zero to maximum, and back to zero.

### Calibration with Test Weights and Material Substitution

The substitution method is recommended for larger installations where it is physically impossible to hang test weights equal to the tank's maximum capacity. When performed correctly, this method yields a reliable performance graph.

1. Record the weight reading for the empty tank before you hang test weights. Hang the test weights (for example, 1,500 kg) and record the weight reading of the tank with the test weights attached. Then remove the test weights and record the weight reading of the empty tank to make sure that it is the same as the first reading.
2. Add enough water to the tank to equal the weight reading obtained with the test weights, and record this weight reading.
3. Leave the water in the tank. Hang the same test weights again, and record the combined weight of the tank (with both water and test weights). Then remove the test weights, and record the weight reading.
4. Add enough additional water to the tank to equal the combined weight, and record the weight reading.
5. Repeat steps 3 and 4 until the tank is full.

## Calibration with Material Transfer

When calibrating with material transfer, weigh a material (usually water) on an existing scale and transfer it to the tank scale being calibrated. You can do this in a single transfer or in stages until you reach the tank's maximum capacity. This method provides only a rough calibration. It is only as accurate as the existing scale and the integrity of the transfer process. Even under the best circumstances, you cannot tell if allowable errors are cumulative or compensating.

## Electronic Calibration

When using the electronic calibration method, replace the load cell cables with leads from a load cell simulator. The simulator sends out a signal equal to the signal the load cells should produce. Electronic calibration is noted for its speed and simplicity; however, it calibrates only the electronics. It does not verify the scale performance because it assumes that the tank and all mechanical connections are in perfect working order.

1. With the simulator adjusted to zero output, set the indicator to zero.
2. Adjust the simulator to full output, a signal equal to that which all the load cells should produce at their rated capacity.
3. Adjust the indicator to show the total capacity of all load cells in the system.
4. Attach the load cell input to the indicator.
5. "Zero off" the empty weight of the tank.

# 5 Routine Care and Maintenance

## General

Once you have installed your scale, you should have an authorized METTLER TOLEDO representative periodically inspect and calibrate it. If the scale is used for legal-for-trade purposes, consult the local weights and measures authorities for minimum inspection requirements. Contact your local authorized METTLER TOLEDO service representative for information on periodic inspection and calibration services.

## Site Inspection

Make sure that the scale site remains in good condition. Check for changes in the dead-to-live connections, changes in support for the weigh modules, overloading and excessive vibration conditions, and debris or material build-up under or around the scale that could prevent the scale from moving freely.

## Weigh Module and Junction Box Inspection

During periodic inspections of the weigh modules, check the following:

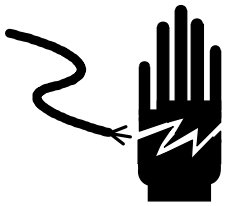
- Load cells and rocker pins for signs of unusual wear
- Clearance between the hold-down bolts and the top plate
- Floor drain for adequate drainage away from the weigh modules
- Junction box lid: Is it properly sealed? Are all cord grips tight?
- Moisture or foreign material present around or inside the junction box assembly
- Instrument cable: Is it damaged? Does it bind the scale?
- Repeatability and shift of the scale

# 6 Troubleshooting

## General

**⚠ WARNING**

**IF USED IN A HAZARDOUS AREA, THE HAZARDOUS AREA MUST BE MADE SAFE PRIOR TO INSTALLATION, REPLACEMENT, OR TROUBLESHOOTING. FAILURE TO COMPLY COULD RESULT IN PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.**



**⚠ WARNING**

**PERMIT ONLY QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS, AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.**

**⚠ CAUTION**

**BEFORE CONNECTING/DISCONNECTING ANY INTERNAL ELECTRONIC COMPONENTS OR INTERCONNECTING WIRING BETWEEN ELECTRONIC EQUIPMENT, ALWAYS REMOVE POWER AND WAIT AT LEAST 30 SECONDS. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY HARM OR DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT.**

If a scale is not working properly, find out as much about the problem as possible. Try to determine whether the problem is constant or intermittent. Mechanical and electrical influences can cause malfunctions, so be patient and use sound logic when troubleshooting.

Check the instrument cable for damage and check all connections for any loose/incorrect wiring. Examine the physical location of the scale, checking for the following:

- Water
- Corrosive materials
- Unlevel floors
- High vibrations
- Air currents
- Physical damage to the scale platform or frame

## Isolate the Problem

To determine whether the problem is in the scale or the digital indicator:

1. Remove power from the system.
2. Disconnect the digital indicator from the scale, and connect the indicator to a load cell simulator (analog load cell simulators are available from METTLER TOLEDO).
3. Reapply power. If the problem persists, consult the digital indicator manual for further troubleshooting assistance.
4. If the problem is NOT present with the load cell simulator attached to the indicator, remove power, disconnect the simulator, and reconnect the scale. If the problem persists, continue troubleshooting the scale.

## Check Wiring

1. Remove power from the system.
2. Remove the lid from the junction box and check the interior for moisture and foreign material.
3. Make sure that all wiring connections are tight and that no insulation material is touching the terminal contacts.
4. Check all cable connections for correct wiring. The wiring color codes are given in Table 6-1.
5. Make sure that the trim resistor is still installed on the white (- Signal) load cell wire.
6. Check all cable connectors and cord grip caps on the junction box. Tighten any loose connectors.

*See Figure 3-4 and Table 3-2 for RAAD box instrument cable wiring.

| Load Cells | | Analog Instrument Cable* | |
|---|---|---|---|
| **Function** | **Wire Color** | **Function** | **Wire Color** |
| + Excitation | Pink | + Excitation | White |
| + Sense | — | + Sense | Yellow |
| + Signal | Brown | + Signal | Green |
| Shield | Bare | Shield | Orange |
| - Signal | White | - Signal | Black |
| - Sense | — | - Sense | Red |
| - Excitation | Gray | - Excitation | Blue |
| | | Instrument cable color code based on METTLER TOLEDO cable no. 51062037 | |

**Table 6-1: Load Cell Wiring Color Codes**

# Check Load Cells

1. Remove power from the system. Fully disconnect each load cell and check for proper input/output resistances (see Table 6-2).

| Measuring Points | Resistance |
|---|---|
| Any lead to shield or ground | Infinity |
| +Exc (Pink) to -Exc (Gray) | 1,060 to 1,160 ohms<br>(1,050 to 1,150 ohms for 250-kg load cells) |
| +Sig (Brown) to -Sig (White) | 1,000 to 1,050 ohms<br>(975 to 1,075 ohms for 250-kg load cells) |

**Table 6-2: Load Cell Measuring Points**

2. If resistance is within specification, perform a shorted-signal symmetry test.
   - Short the signal leads together and place one multimeter lead on the shorted signals and one lead on the +Excitation wire. Note the resistance value.
   - Remove the lead from the +Excitation wire and place it on the –Excitation wire. The two resistance values should be approximately equal.
3. If the load cells pass the shorted-signal test, reconnect them and reapply power to the scale. Confirm that the proper excitation voltage is reaching the load cells by placing multimeter leads on the excitation positions of each load cell terminal.
4. If proper excitation voltage is reaching the load cells, check the output signal from each cell by disconnecting the signal leads and measuring voltage output. If one cell has a particularly high or low dead-load output, it is suspect. The maximum output possible from any cell is 30 mV at 15 VDC excitation and loaded to gross capacity (26.25 mV for 250-kg load cells).
5. If any load cell has an unusual signal, remove all load from that cell.
   - With the power on, measure the output from the suspect load cell. The no-load zero output should be ± 1.0% of the full scale output (± 1.5% for 250-kg load cells). For example, if the excitation voltage is 15 VDC, then the full scale output would be 30 mV and the no-load zero output should be within ± 0.3 mV (within ± 0.45 mV for 250-kg load cells).
6. If a load cell fails any of the above tests, replace it.

# Check Mechanical Components

Because the 0970 weigh module design is so simple, only a few mechanical components require troubleshooting. Make sure that the scale can move freely.

Check the following:

- Is the scale rocking? Reshimming may be required.
- Check the rocker pins for unusual wear. Replace unevenly worn pins or pins with flattened bearing surfaces.
- Check new or modified dead-to-live connections on the scale.
- Does rigid piping or poor structural support result in mechanical binds?

# Load Cell Replacement Procedure

## Remove Load Cell

1. Remove power to the digital indicator and disconnect the instrument cable.
2. Remove the junction box cover and locate the defective load cell terminal.
3. Disconnect the defective load cell cable from its terminal on the summing PCB.
4. Loosen the watertight cable connector on the junction box and remove the cable from the enclosure.
5. If the load cell cable runs through a conduit, attach a string to the end of the defective load cell cable. The string should be both strong enough and long enough to pull the new load cell cable through the conduit.
6. Loosen the weigh module's hold-down bolts, using an open-end wrench (13 mm) at the flats on the shaft of each bolt.
7. Carefully jack up the weigh structure 5 mm (0.2 inch).
8. Remove the load cell retaining screw from the base plate, and keep it for reinstallation. Remove the load cell from the weigh module assembly.

**⚠ CAUTION**

**BE SURE TO BLOCK THE SCALE WHEN IT IS IN THE RAISED POSITION. OBSERVE ALL APPROPRIATE SAFETY PROCEDURES WHEN INSTALLING AND SERVICING THE WEIGH MODULES.**

9. Carefully pull the defective load cell cable through the conduit while feeding the string through the junction box opening. Once the string is at the load cell location, detach it from the load cell cable.
10. Remove the rocker pin and load cell receiver from the defective load cell.

## Install New Load Cell

1. Install the rocker pin and load cell receiver in the new load cell.
2. Center the new load cell on the base plate, making sure that the rocker pin fits into the receiver in the underside of the top plate.
3. Attach the new load cell cable to the string and carefully thread it through the conduit into the junction box opening.
4. Thread the load cell cable through the connector on the junction box. When the cable length inside the box is sufficient, tighten the box connector.
5. Wire the new load cell cable to the proper terminal on the PCB, according to the wiring code.
6. Make sure that the rocker pin is properly aligned with the receiver in the top plate. Then, slowly lower the top plate until the rocker pin is properly seated.
7. Tighten the weigh module's hold-down bolts to the lowered position.
8. Insert the load cell retaining screw into the base plate.
9. Reattach the instrument cable and power-up the indicator. Perform a shift adjust if required, and recalibrate the scale.

# 7 Service Parts

Refer to the following drawing and table when ordering parts for Model 0970 weigh modules.

# 0970 Weigh Module

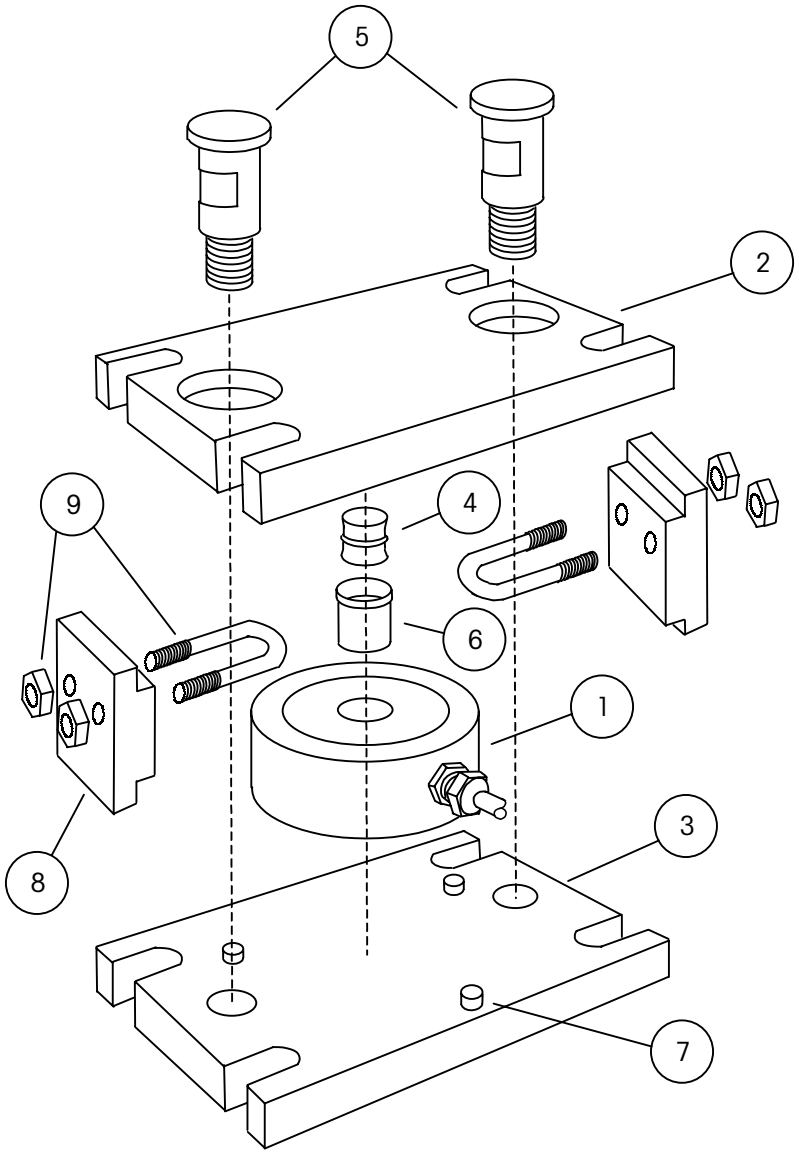



**Figure 7-1: 0970 Weigh Module Assembly**

| Ref. No. | Part Number | Description | Qty. |
|---|---|---|---|
| 1 | TB600935-050 | 250-kg Load Cell, OIML C3, Ex, FM | 1 |
| | TB600941-050 | 500-kg Load Cell, OIML C3, Ex, NTEP/FM | |
| | TB600947-050 | 1,000-kg Load Cell, OIML C3, Ex, NTEP/FM | |
| | TB600953-050 | 2,000-kg Load Cell, OIML C3, Ex, NTEP/FM | |
| | TB600959-050 | 3,500-kg Load Cell, OIML C3, Ex, NTEP/FM | |
| | TB600965-050 | 5,000-kg Load Cell, OIML C3, Ex, NTEP/FM | |
| | TB600949-050 | 1,000-kg Load Cell, OIML C6, Ex, FM | |
| | TB600955-050 | 2,000-kg Load Cell, OIML C6, Ex, FM | |
| | TB600961-050 | 3,500-kg Load Cell, OIML C6, Ex, FM | |
| | TB600967-050 | 5,000-kg Load Cell, OIML C6, Ex, FM | |
| 2 | TA600978-S6 | Top Plate with Receiver, SS | 1 |
| 3 | TA600976-S6 | Base Plate, SS | 1 |
| 4 | TA800776 | Rocker Pin, SS | 1 |
| 5 | TN600975 | Hold-Down Bolt, M12 x 1.75, SS | 2 |
| 6 | TN600980 | Load Cell Receiver | 1 |
| 7 | MZ0901010543 | Load Cell Retaining Screw, M6x1, SS | 1 |
| 8 | TN600987 | Shipping Block | 2 |
| 9 | MZ0901010544 | U-Bolt with Hex Nuts, 1/4-20, 0.75 x 1.75 | 2 |
| – | TB100680 | Analog Junction Box, 4 hole, 316L SS | – |
| | TB100550 | Analog Junction Box, 5 hole, 316L SS | |

**Table 7-1: 0970 Weigh Module Assembly**

# 8 Reference Material

## Reference Drawings

- *Weigh Module Systems Handbook,* Part Number *15598500A (may have a letter prefix)
- *Do-It-Yourself Guide To Building Tank Scales,* Part Number TH3100.0E

| General Dimensions | Analog Wiring Diagram | RAAD Box Wiring Diagram | IDNet Wiring Diagram |
|---|---|---|---|
| TA600986 | TB100505 | 15962700A | TB100600 |

**Table 8-1: Reference Drawings**

## Recommended Spare Parts

For part numbers, refer to Chapter 7.

| Qty. | Description |
|---|---|
| 1 | Load cell |
| 1 | Junction box circuit board (type of board is per model of scale) |
| 1 | Junction box desiccant bag |
| 1 | Rocker pin |

**Table 8-2: Recommended Spare Parts**

**METTLER TOLEDO**

# Publication Suggestion Report

**If you have suggestions concerning this publication, please complete this form and fax it to (614) 841-7295**

**Publication Name: METTLER TOLEDO 0970 Ringmount Weigh Modules Installation and Service Manual**

**Publication Part Number: A16104400A** **Publication Date: 3/01**

| PROBLEM(S) TYPE: | DESCRIBE PROBLEM(S): | *INTERNAL USE ONLY* |
|---|---|---|
| ☐ **Technical Accuracy** | ☐ Text ☐ Illustration | |
| ☐ **Completeness**<br>**What information is missing?** | ☐ Procedure/step ☐ Illustration ☐ Definition<br>☐ Example ☐ Guideline ☐ Feature<br>☐ Explanation ☐ Other (please explain below) | ☐ *Info. in manual*<br>☐ *Info. not in manual* |
| ☐ **Clarity**<br>**What is not clear?** | | |
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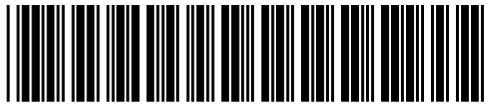

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