

**Customer Manual**  
**Digital C-Level**  
**Model Mini 11-100**  
**Continuous Level Indicator**  
REC 3866 Rev J, Part No. 046637

## Revision History

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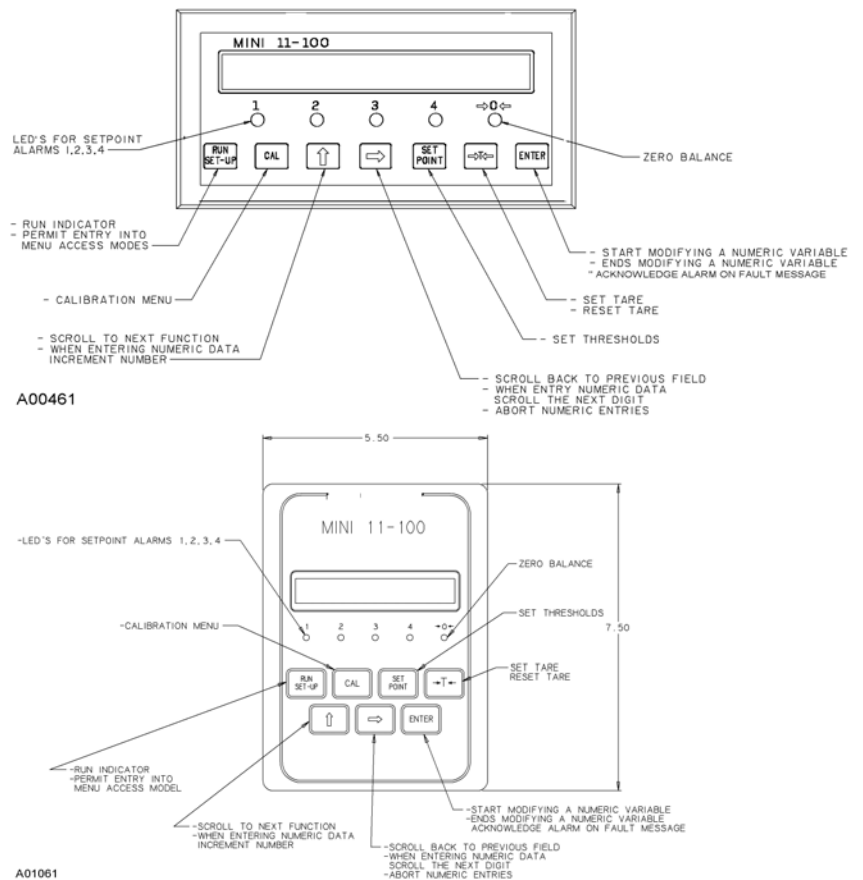
# Chapter 1 Introduction

## General

This instruction manual contains information on the installation, operation, and maintenance of your Thermo Scientific Model 11-100 Digital Continuous Level Indicator (Digital C-Level) for non-hazardous applications.

The Digital C-Level is a micro-processor based, continuous level indicator. It monitors one to eight strain sensor(s), located in the support legs of a bin or storage vessel, and displays the level of material in them. The Digital C-Level has four customer adjustable setpoints, which are programmable as over or under alarms/control contacts (see **Figure 1-1**)

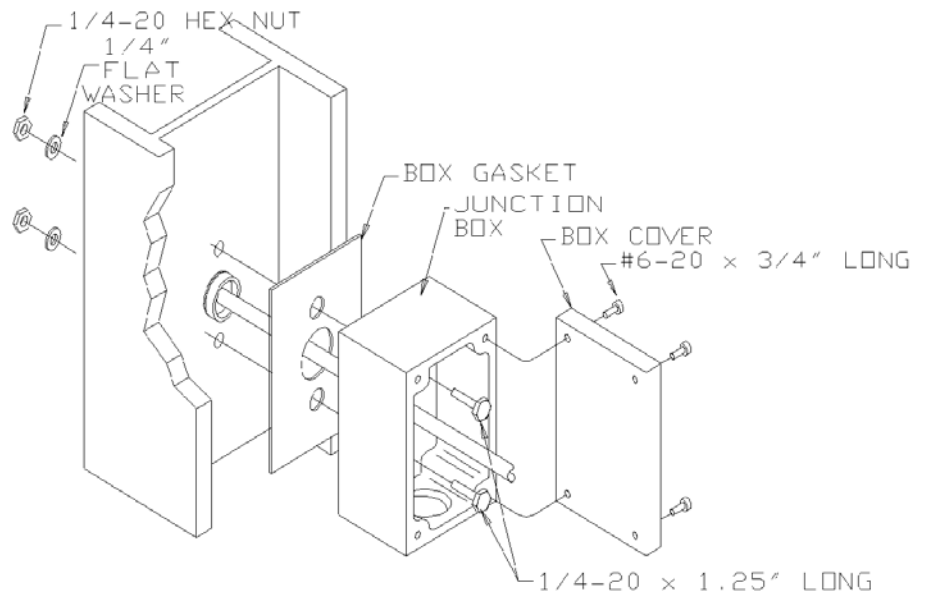
**Figure 1-1. Front Panel Configuration**



# Junction Box and Strain Sensor

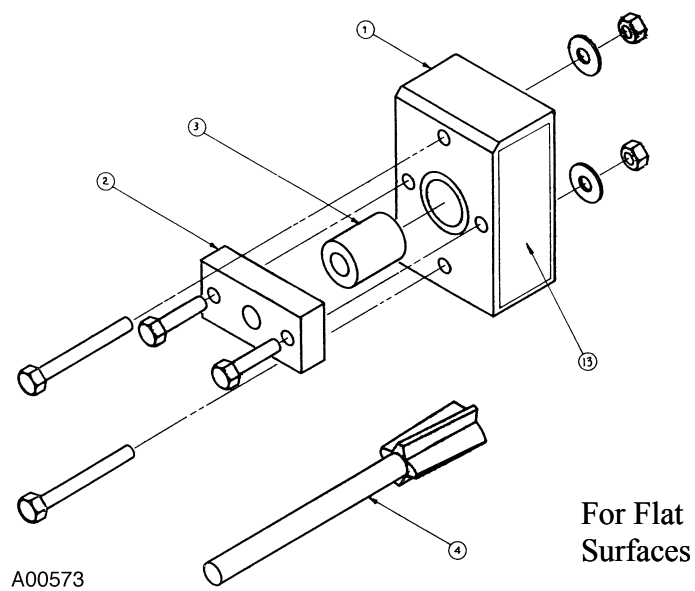
The typical C-Level system consists of up to eight strain sensors (U.S. Patent No. 4530245). Each strain sensor comes with an individual foam polystyrene junction box (see **Figure 1-2**)

**Figure 1-2.** Strain Sensor Junction Box, Non-Hazardous Area

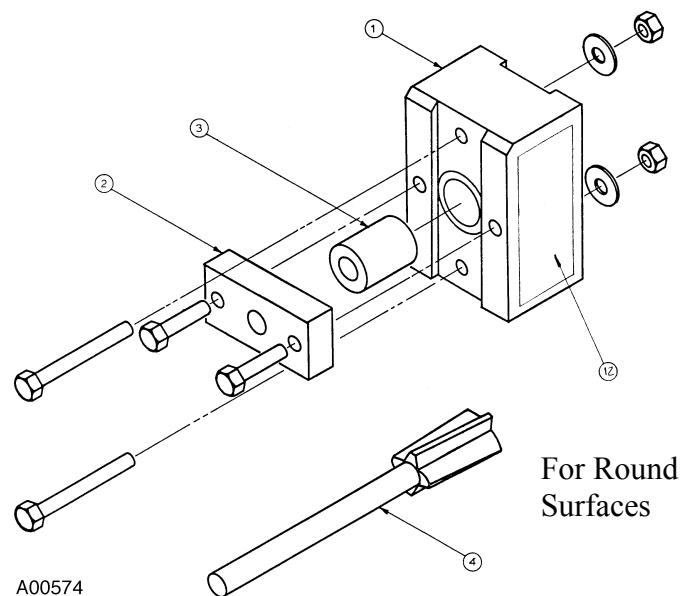


A strain sensor mounting/installation tool (U.S. Patent No. 4738135) is included with each system. The mounting tool assures correct sensor installation (see **Figure 1–3**)

**Figure 1–3. Sensor Installation Tool**



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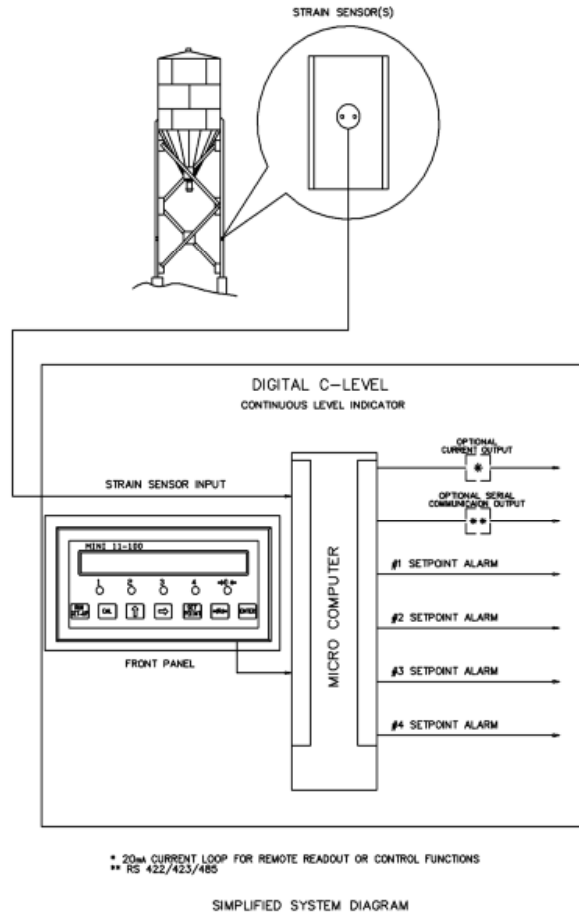


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# Current Output (Option)

An optional current output board (0-20mA, 4-20mA) can be installed in the electronic package to provide remote level indication (see **Figure 1-4**).

**Figure 1-4.** Simplified System Diagram



**Table 1-1.** Digital C-Level Model 11-100 Technical Specifications

Specifications	
<b>Power Requirements:</b>	
Voltage	120 VAC or 240 VAC – 15% to +10% (Switch Select)
Frequency:	48 to 62 Hz
Consumption:	Less than 15 watts
Fusing/Switching:	Internal 0.3 amp slo-blo for the VAC line power. Fuse holder accepts 5 x 20 mm fuse. Fuse breaks H side of line.
<b>Outputs:</b>	
Alarm Outputs:	All four outputs are 1 form c dry contact rated at 0.5 amp at 240 VAC/28 VDC.
Current Output:	Optional. Selectable 0-20 mA or 4-20 mA output into 500 ohms maximum; 0.1% minimum resolution (10 bit).
<b>Mounting Type:</b>	
	Panel mount 5.51" x 2.68" cutout.
	Overall size: 5.67"W x 2.83"H x 7.83"D.
	Maximum panel thickness: .50"
	Field mount IP65, gray polyester.
	Overall size: 9.84"W x 11.81"H x 6.3"D.
<b>Non-Hazardous Junction Box:</b>	
Type:	Field, Surface Mount
Construction:	Structural foam polystyrene; conforms to IP64, per British Standard S490:1966, IEC 529:1976 and DIN4005D (weather-tight, splash-proof, dust-tight).
Finish:	Textured surface, Thermo Scientific blue.
Size: (Overall)	10.0"H x 8.4"W x 5.6"D
Material:	UL Listing 94HB
<b>Environment:</b>	
Temperature Range:	<u>Control</u> storage –20° to +70° C Operating 0° to +40° C
Humidity:	Up to 95% relative humidity, non-condensing sensor; <u>Sensor</u> is hermetically sealed; storage/operation –40° to +70° C

## Specifications

**Strain Sensor Interface**

Excitation Voltage:	10 VDC
Excitation Cable Length:	3000 ft. maximum with Beldon 9553 cable or equivalent (6 conductor, 18 gauge).
Number of Sensors:	Up to 8 – 700 ohm strain sensors
Signal Input:	Full scale $\pm 10.0$ mV

Max. zero offset  $\pm 10.0$  mV  
 Max. usable input  $\pm 20.0$  V

Stress Range: 1500 to 14,300 PSI

**Display:**

High contrast LCD with backlighting. 16 digit alphanumeric 8 mm digit height.

**Electronics/Accuracy:**

Accuracy: Sum of all electronic system errors is less than 2.0% of full scale

**Shipping Weights:**

Digital C-Level with Tool:	15 lbs.
Sensor with Junction Box:	3 lbs.
Optional Current Output Board:	2 lbs.

---

## Chapter 2

# Installation

### General

This chapter contains information necessary to locate and install the strain sensor and electronics. Correct location and installation of the strain sensor is important for optimum performance.

### Sensor Location

The strain sensor must be installed in the correct location for best C-Level performance. This chapter discusses sensor location requirements, mounting areas to avoid, multiple sensor advantages, locations on vertical supports, and locations on horizontal supports.

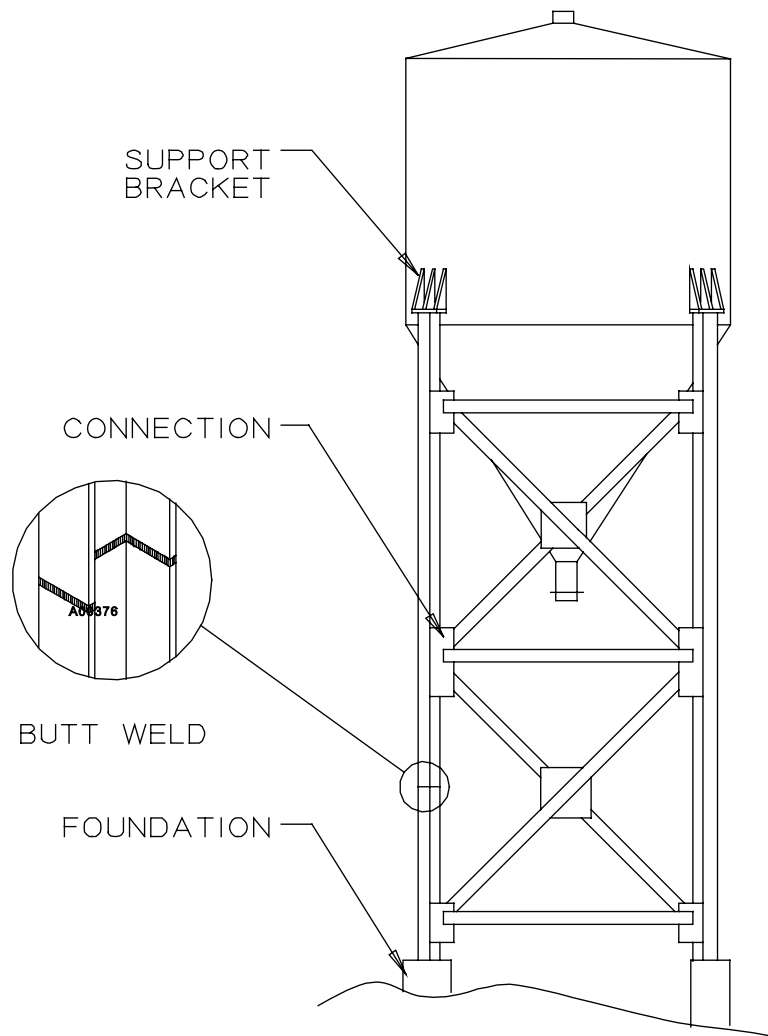
### General Mounting Rules

The following mounting rules should be adhered to:

1. Physical Constraints
  - A. Support members must be made of structural steel.
  - B. Bin contents of relatively uniform density.
  - C. Bin has one compartment only.
  - D. Avoid shock loading.
  - E. Avoid sources of high electrical noise.
2. General Mounting Rules: (**Figure 2-1**)
  - F. Avoid foundations.
  - G. Avoid vessel support brackets.
  - H. Avoid structural connections.
  - I. Avoid welded supporting members.
  - J. Stay above or between horizontal leg braces.
  - K. Stay away from welded or bolted joints if skirted bins.

- L.
- 3. Multiple Sensor Advantages:
  - M. Allows for strain averaging.
  - N. Eliminates uneven loading errors.
  - O. Eliminates wind loading errors.
  - P. Reduces thermal gradient effects.
  - Q. Improves overall system accuracy.

**Figure 2-1. General Mounting Rules**



R.

## Bin Support Stress Level

The strain sensor must see a pounds per square inch (PSI) stress change, between 0 and 100% bin full, of more than 1500 PSI but less than 14,300. The sensor accuracy is limited if 1500 PSI change is not seen. Damage due to overloading can occur on stress levels or more than 14,300 PSI.

### 1. Vertical Structure Stress Levels:

S. For vertically supported structures, normal stress is found using the following formula: ( **Figure 2-2**

T.  
U. 
$$\text{Normal Stress} = \frac{P}{(N)(A)}$$

V. Where P = Total Bin Material Capacity (lbs.)

W. N = Total Number of Supports

X. A = Cross-Section Area for Each Leg (sq. in.)

### 4. Horizontal Structure Stress Levels:

For horizontally supported structures, shear stress is found using the following formula: (See **Figure 2-3**

Y. 
$$\text{Shear Stress} = \frac{P}{2(N)(D)(TW)}$$

Z. Where: P = Total Bin Material Capacity (lbs.)

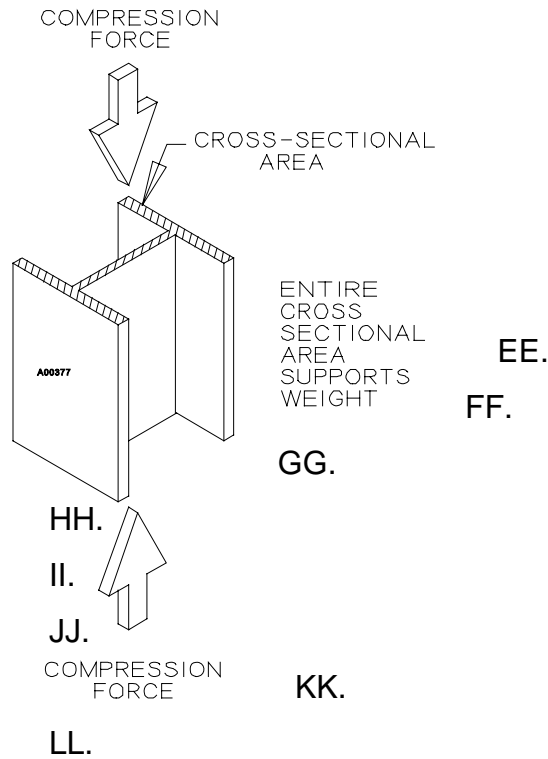
AA. N = Number of Bin Support Gussets

BB. D = Depth of Beam (in.)

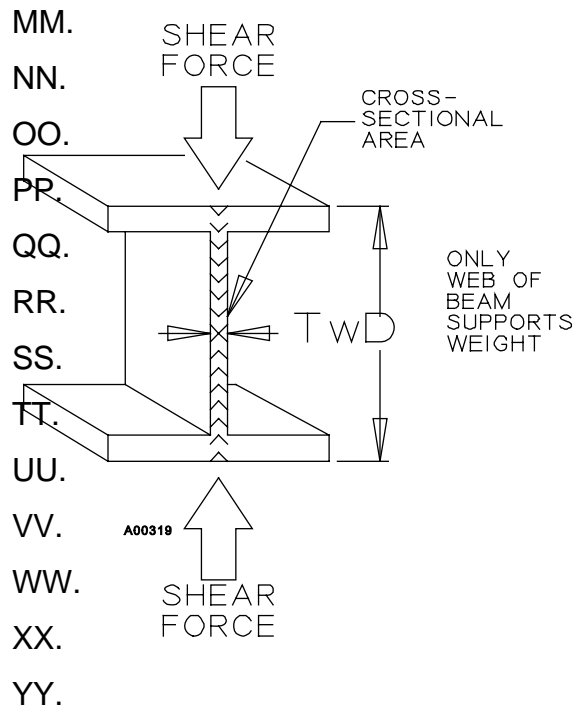
CC. TW = Web Thickness (in.)

DD.

**Figure 2-2. Vertical Normal Stress**



**Figure 2-3. Horizontal Shear Stress**



5. Skirt Supported Stress Levels

$$Stress = \frac{P}{(12)(\pi)(d)(sf)}$$

Where: P = Total Bin Capacity (lbs.)

D = diameter in feet

$\pi = 3.14$  (Pi)

St = skirt thickness (in.)

EXAMPLE #1

Find the normal stress in the supports of **Figure 2-4** given the bin has a capacity of 100,000 lbs and W6 x 15 legs.

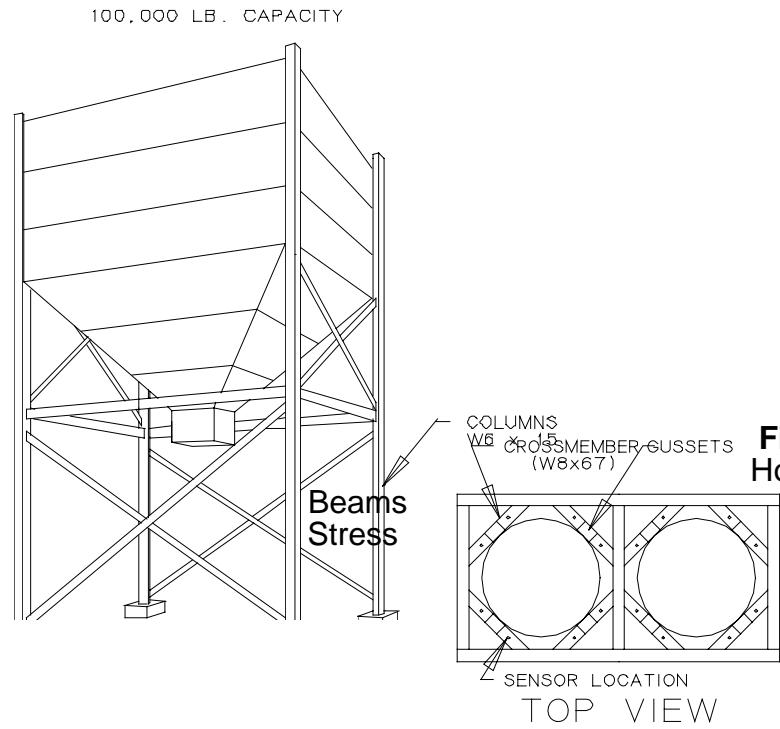
This structure has four legs and a capacity of 100,000 lbs.

Normal Stress = 5643 PSI

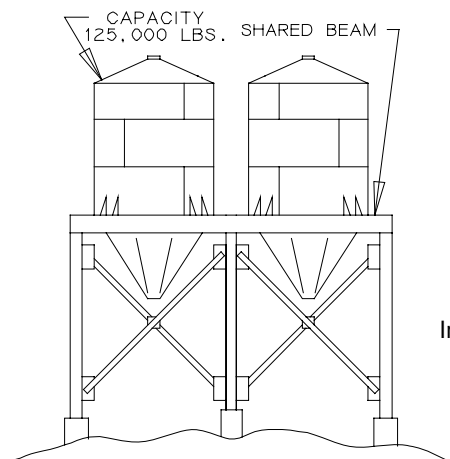
$$Normal\ Stress = \frac{100,000\ lbs.}{(4)(4.43\ sq.\ in.)}$$

**Figure 2-4. Vertical Supports**

Normal Stress



**Figure 2-5. Horizontal Shear**



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**EXAMPLE #2:**

Find the shear stress in the horizontal beam supports of the bin on the left in given the bin has W8 x 67 cross-members and a capacity of 125,000 lbs.

This structure has four gusset supports and a capacity of 125,000 lbs.

$$\text{Shear Stress} = \frac{125,000 \text{ lbs.}}{2(4)(9.00 \text{ in.})(0.57 \text{ in.})}$$

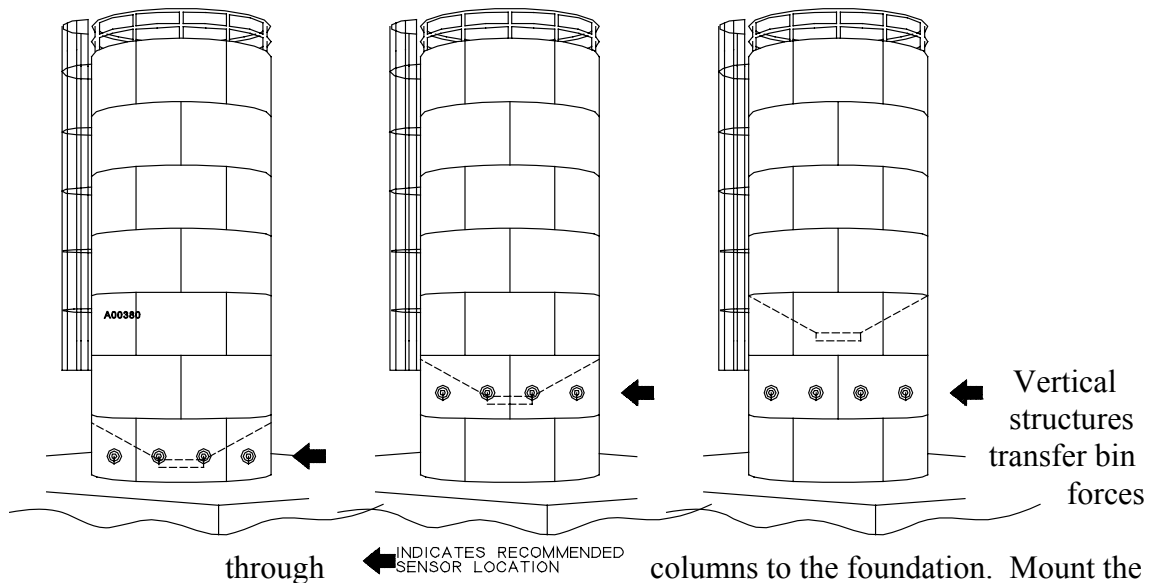
Shear Stress = 3046 PSI

**EXAMPLE #3:**

Find the stress in a skirted silo which holds 100 ton of material. Skirted silo ( **Figure 2-6** ) is 12 feet in diameter with 3/16 skirting.

$$\text{Stress} = \frac{200,0000}{(12)(\pi)(12)(.187)} = 3,267 \text{ psi}$$

**Figure 2-6. Skirted Silo**



## On Vertical Supports

sensor in the center of the longest free-standing section of the column. If cross bracing or diagonal members are present, mount the sensor between the bracing connection on the column web (Figure 2-7 and Figure 2-8)

Figure 2-7. Vertical Application - No Bracing

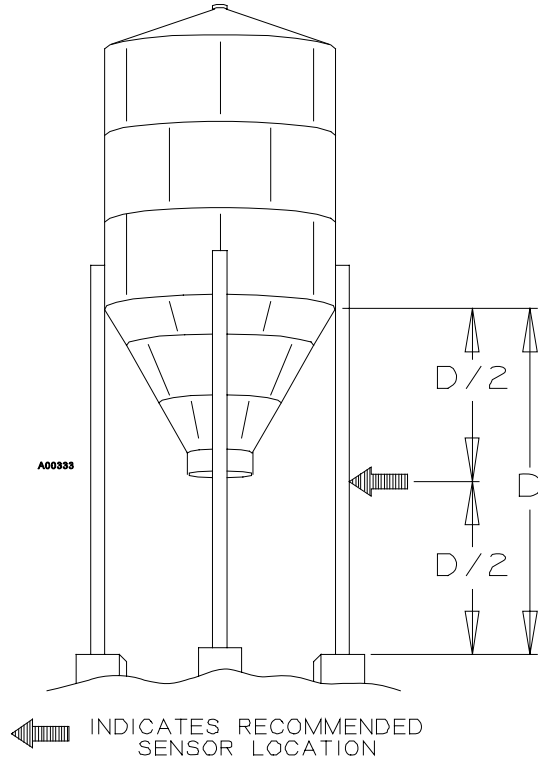
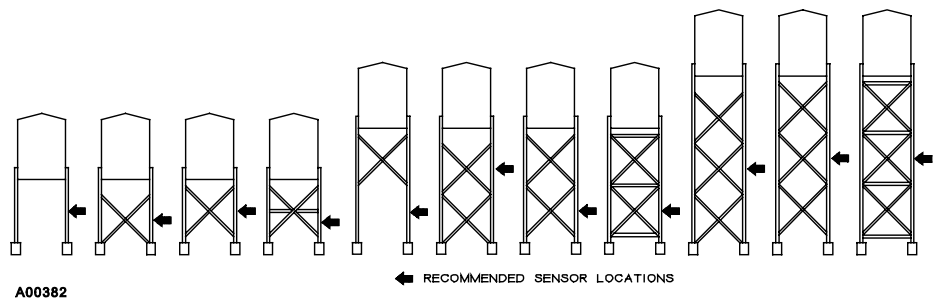


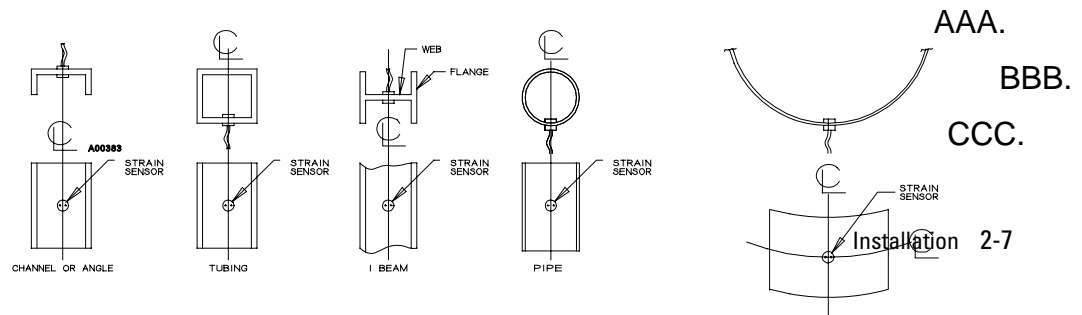
Figure 2-8. Typical Sensor Locations – Vertical



1. Always mount the strain sensor in the middle of the column web. Never place the sensor in the column flange (Figure 2-9)

Figure 2-9. Strain Sensor Mounting

ZZ.



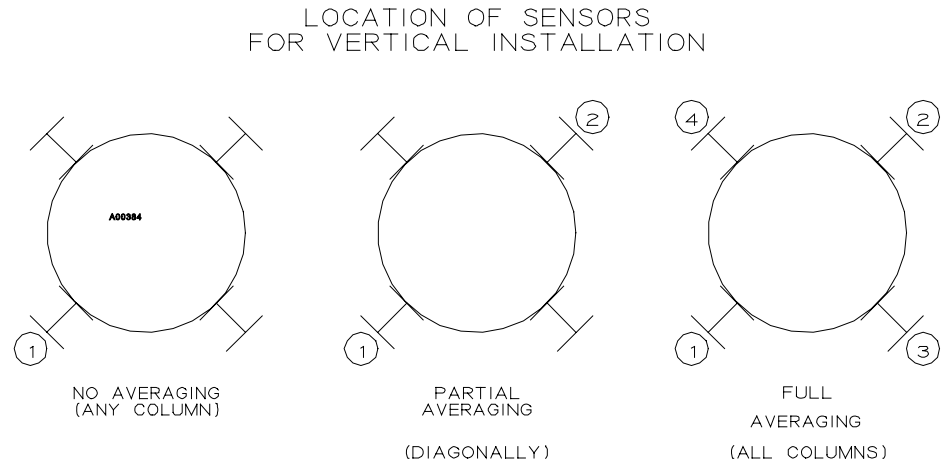
DDD.

EEE.

FFF.

- Using multiple sensors lets the sensor average uneven loads, wind, and improves accuracy (**Figure 2–10**)

**Figure 2–10. Multiple Sensor Configuration – Columns**



## Location on Horizontal Supports

Horizontal structures transfer bin forces through beams. Vessels that share common columns and beams normally require horizontal member installations. Do not install the sensor on multiple vessel structures that share common columns and beams unless the vessel support brackets rest on corner braces. Consult your Thermo Scientific representative regarding horizontal support structure layouts not illustrated in **(Figure 2-11 and Figure 2-12)**.

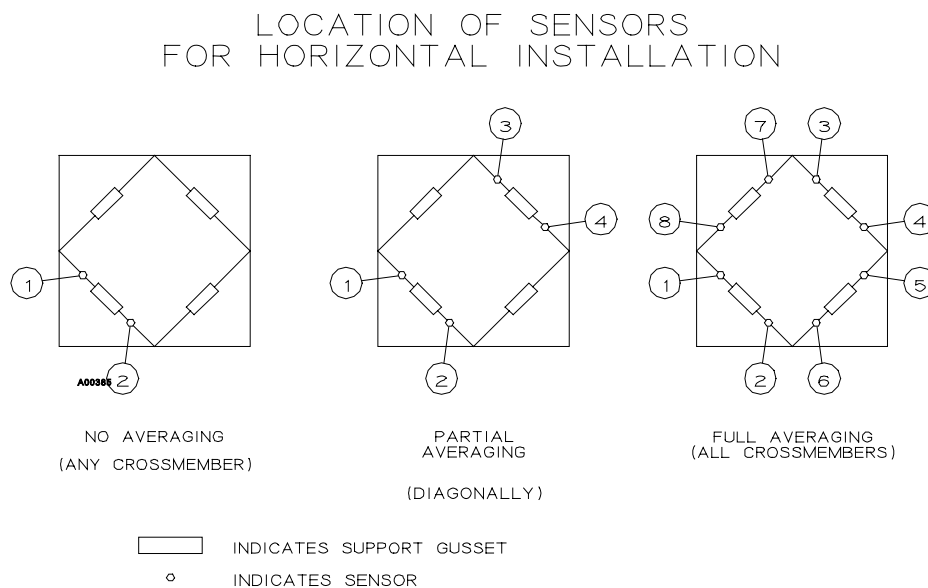
The sensors are mounted on the support beam or corner braces, located in pairs, one on each side of the support bracket or gusset. The sensors are aligned at a 90 degree angle with stress force line **(Figure 2-12)**. Mount the sensor in the center of the longest free-standing section of the support beam or corner bracing between the bracket and fixed.



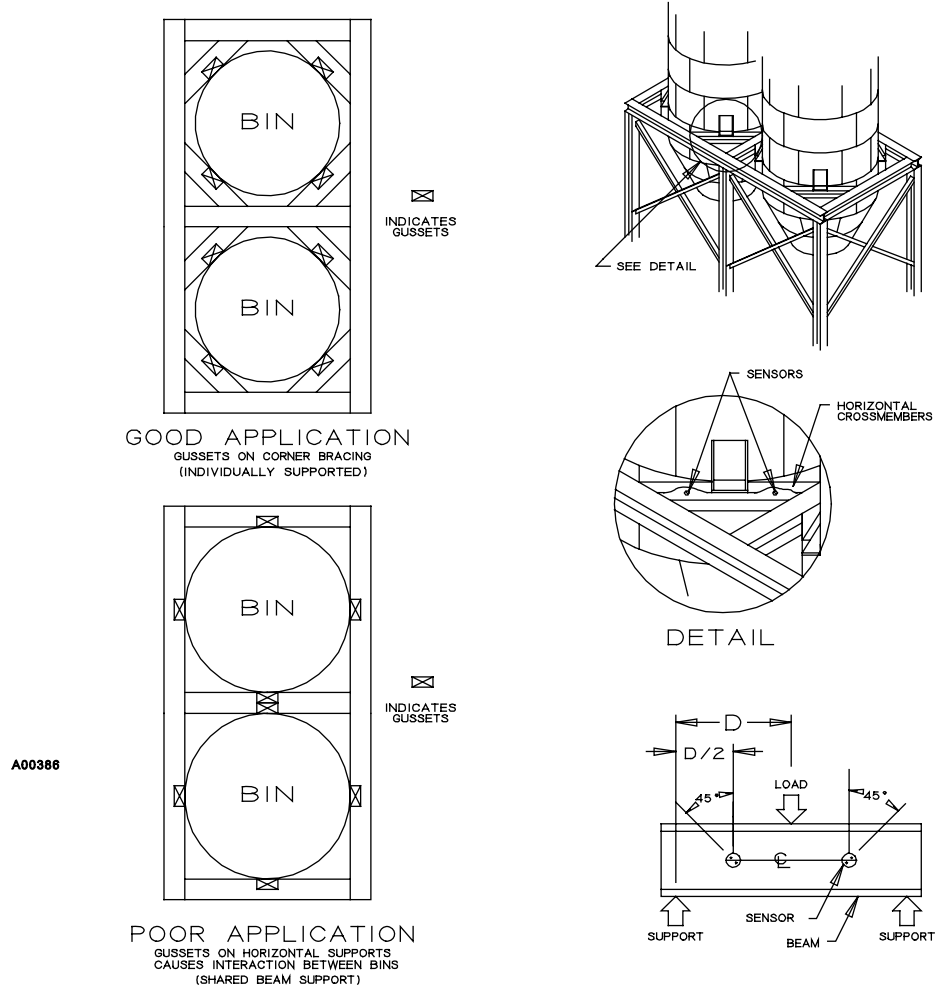
**Note** Always mount the sensor in the middle of the beam web. NEVER place the sensor in the beam flange **(Figure 2-9)**. □

1. Using multiple sensors lets the sensor average uneven loads, wind, and improves accuracy **(Figure 2-11)**.

**Figure 2-11. Strain Sensor Placement**



**Figure 2–12. Horizontal Applications and Location**



## Sensor Installation

The strain sensor must be installed correctly for best C-Level system performance. Proper installation requires the following steps.

1. Selecting the best column or beam location see **On Vertical Supports** or **Location on Horizontal Supports**
2. Properly drilling the precision hole.
3. Correctly installing the strain sensor (for horizontal or vertical beams).

## Tools Required

Several tools are required to install the strain sensor properly. Special tools are included in the installation package and several common hand tools are provided by the customer.

1. Installation Package Tools

The following items are included in the single sensor installation tool package.

- 1-1/4 inch 1/4"-20 bolts (4)
- 2 Inch 1/4"-20 Bolts (2)
- 2-3/4 Inch 1/4"-20 Bolts (2)
- 3/4 Inch Installation Bushing
- 3/4 Inch Counterbore Drill Bit
- Installation Tool for Curved Surface or Flat Surface ( )
- Electrical Junction Box
- Electrical Junction Box Cover
- Electrical Junction Box Gaskets (2)
- Open Gear Lubricant – NOTE: DO NOT use as cutting oil.
- 1/4"-20 Nuts (4)
- Pushplate
- Strain Sensor
- Sensor Location Template
- 1/4" Flat Washers (4)

#### 7. Customer Provided Tools

The following items must be provided by the customer.

- Cutting oil
- Hammer
- 1/2 Inch Drill Motor – 300-400 RPM
- 1/8 Inch Drill Bit
- 17/64 Inch Drill Bit
- 3/8 Inch Drill Bit
- Center Punch
- Putty Knife (or Screwdriver))
- Scratch Awl (or Pencil)
- Straight Edge
- 7/17 Inch Socket & Handle
- Tape Measure (as needed)



**Note** The list of customer supplied tools serves as a guide where substitutions can be made. However, for best results, use the suggested tools. □

## Using The Strain Sensor Template

The strain sensor template is used to mark the location of the installation tool mounting holes correctly. The correct strain sensor mounting location must be selected before sensor installation. Review Sensor Location if needed.

The following procedure describes how to locate the template.

1. Locate the column web area where the sensor is to be placed. Clean any accumulated material from the column web area using a putty

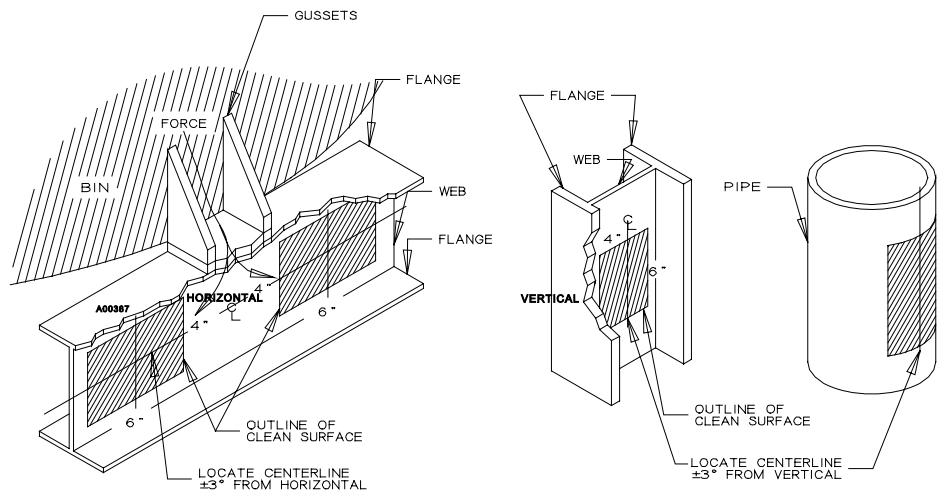
knife or screwdriver. A 4 inch by 6 inch area is recommended (Figure 2-13).



**Note** The beam surface does NOT have to be prepared by grinding.

8. Locate the center of the column web in the approximate location where the sensor is to be placed. Using a scratch awl and straight edge, make a vertical line, about 6 inches in length, in the center of the column web. This is the vertical centreline (Figure 2-13).

**Figure 2-13. Web Surface Preparation**



## Drilling Tool Mounting Holes

Place the sensor location template on the column web so its notches are aligned with the vertical centerline. Be sure that the middle hole of the template is placed over the approximate location where the sensor is to be placed.

1. Center punch through the three holes in the sensor location template (Figure 2-14).

**CAUTION BE CAREFUL TO PUNCH THE HOLES ACCURATELY** □

Drill the tool mounting holes using the following procedure.

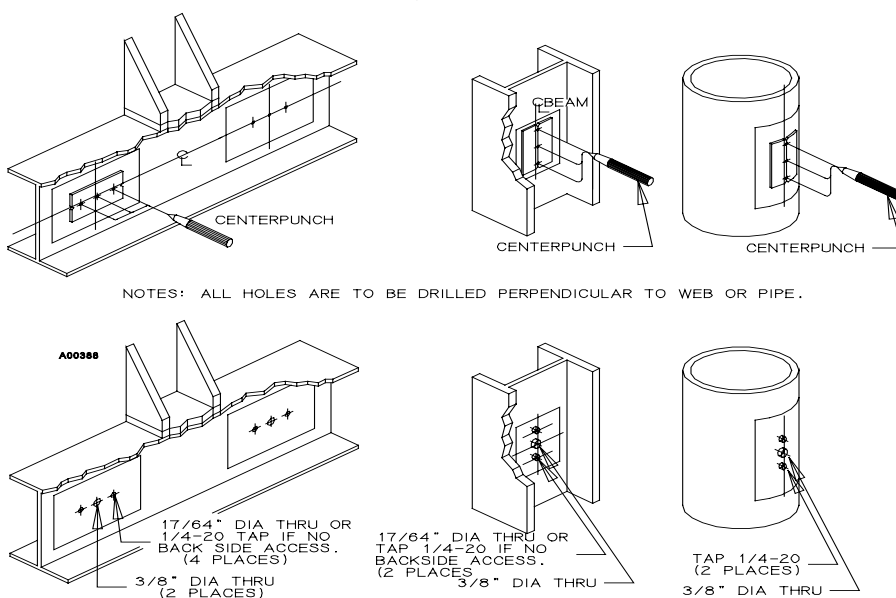
9. Drill three 1/8 inch pilot holes through the column web at the location of the punch marks.

GGG. A. If you do not have access to the back side of the column (pipe or tubing), drill the holes out using a 13/64 inch drill bit and then tap the two outside holes (tool mounting holes) to 1/4-20.

HHH. B. If you have access, drill the two outside holes using a 17/64 inch drill bit. The center hole should be drilled out to 3/8 inch.

III. C. If the beam is more than 1/2 inch thick, drill out center hole to 1/2 inch.

**Figure 2–14. Tool Mounting Holes**



## Drilling Sensor Hole

Mount the installation tool on the column web (**Figure 2–15**)



**Note** The installation tool must be mounted with the chamfered or notched side against the column web. □

Make sure that the tool is bolted down tightly. A loose tool will produce holes that are too large for the strain sensor.

A precision counterbore is used to drill the sensor hole because the hole must be round and the right size.

Drill the sensor hole using the following procedure.

1. With the tool bolted securely against the column web, lubricate the inner bushing of the installation tool with cutting oil.



**Note** Do not use GEAR LUBRICANT provided with installation kit as cutting oil.

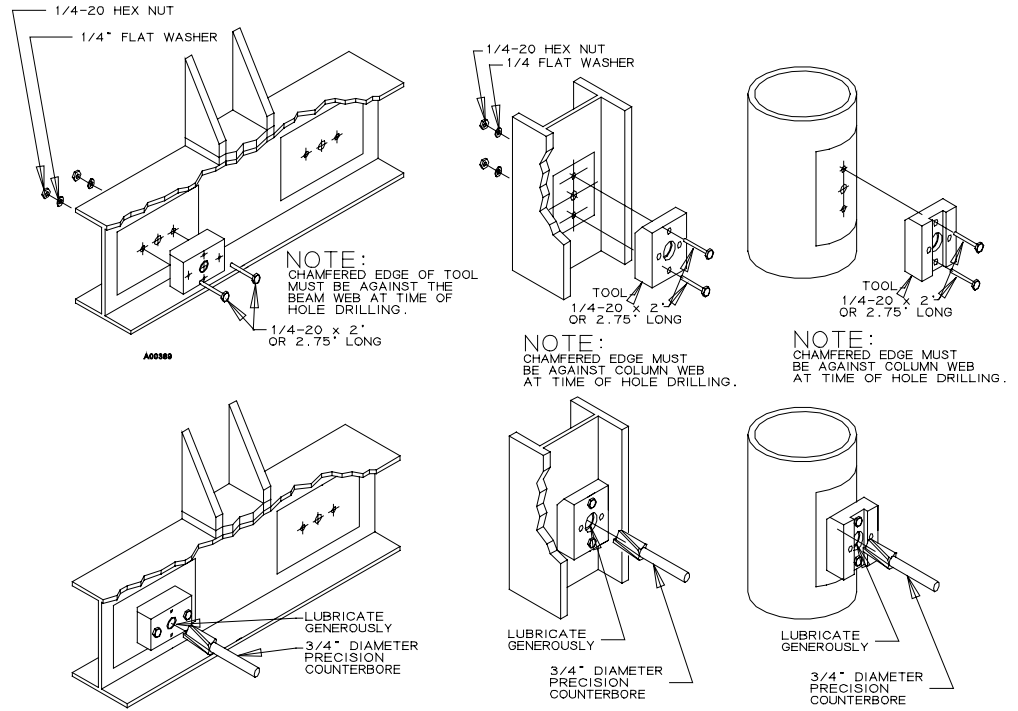
10. Carefully insert the 3/4 inch counterbore drill bit into the inner bushing of the installation tool. A drill speed of 300-400 RPM is recommended.
11. About every 15 to 20 seconds, remove the drill from the installation tool. Clear the drill bit and installation tool of excess metal shavings and use cutting oil. Be sure drill bit is completely reset in the hole before restarting drill.



**CAUTION** REDUCE DRILL PRESSURE AND BE CAREFUL AS THE DRILL BREAKS THROUGH THE OTHER SIDE OF THE COLUMN WEB. THIS WILL PROTECT THE PRECISION HOLE FROM DAMAGE DUE TO DRILL BINDING. □

12. unbolt and remove the installation tool from the column web.
13. Using a cloth or paper towel, thoroughly clean the hole, installation tool and column web of oil and metal shavings.

**Figure 2–15. Mounting Installation Tool**



## Sensor Alignment Mark

Make a strain sensor alignment mark on the beam using a pencil or scratch awl. The strain sensor must be installed so the strain sensor dimple is at a right angle with the force change. If the sensor is out of angular alignment, maximum stress cannot be measured. Mark both sides of web if possible (**Figure 2–16**).

**Figure 2–16. Sensor Alignment**



A00390

## Sensor Installation

The installation tool is used to press-fit the sensor into the beam web. It aligns and installs the strain sensor without damaging it (**Figure 2-17**).

Install the sensor using the following procedure.

1. Position the installation tool so the chamfered or notched side is away from the beam web.
2. Place the installation tool pushplate over the installation tool holes. Insert the 1.25 inch 1/4-20 bolts through the pushplate into the installation tool about two turns.
3. Insert the 3/4 inch bushing into the inner bushing of the installation tool from the rear.
4. Brush the entire knurled surface of the sensor with the open gear lubricant supplied with the tool.
5. Draw the cable of the strain sensor through the center of the installation tool including the 3/4 inch bushing and pushplate.

### Align the sensor imprint with the alignment mark

6. Sensor Alignment Mark.
7. Mount the installation tool on the beam web and tighten the bolts that hold the tool to the beam. Alternate 1/4"-20 x 2.75" tool mounting bolts are used for thicker beams.

**Note** Make sure that the installation tool is bolted down tightly. Incorrect strain sensor seating will result if the bolts are not tight. □



14. Look at the opposite side of the column web. Align the sensor imprint with alignment mark. Then finger tighten the pushplate bolts until they are snug.



**Note** Keep the strain sensor imprint within 3 degrees of the alignment mark. If the sensor is out of angular alignment, maximum stress levels cannot be measured. □



**Note** On a structure where you cannot see the back side to check sensor alignment, this alignment check must be used. □

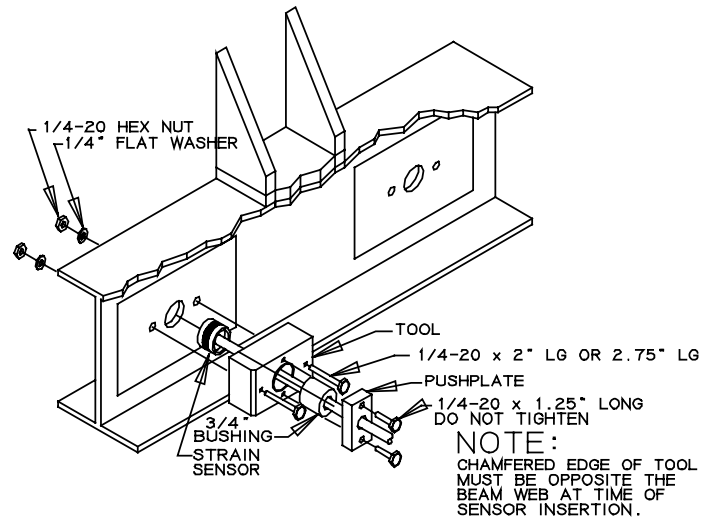
JJJ. Align the sensor imprint with the alignment mark and seat into the hole by pushing it in with your fingers.

KKK. Mount the installation tool and press the sensor in .02 to .04 inch (about 1/2 turn of the bolts on the pushplate).

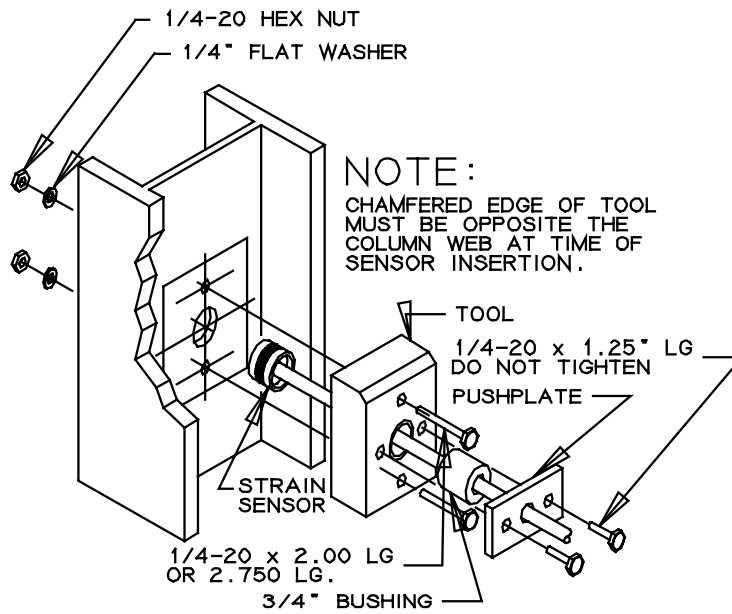
LLL. Check alignment by removing pushplate and bushing. If not correct, pull sensor out by the metal case and re-seat. When the sensor imprint is within 3 degrees of alignment, finish inserting the sensor.

15. Tighten one pushplate bolt one quarter turn. Then tighten the other pushplate bolt one quarter turn.
16. Repeat above step until the bolts cannot be tightened further.
17. The strain sensor must now be pushed into the center of the beam (**Figure 2-18**). Measure the beam's wall thickness and determine from **Table 2-1** the number of washers needed for the centering push.
18. Remove the pushplate and add the washers.
19. Tighten one pushplate bolt on-quarter turn, then tighten the other pushplate bolt one-quarter turn.
20. Repeat until the bolts cannot be tightened further.
21. If a second centering push is required because of beam thickness, add washers are required by and repeat.
22. Remove the installation tool from the column web. The strain sensor should now be press-fit into the structural member.
23. Brush both sides of the column web around the sensor with lubricant to prevent corrosion.
24. Repeat the sensor installation procedure for each additional strain sensor.

Figure 2-17. Strain Sensor Mounting



A00391



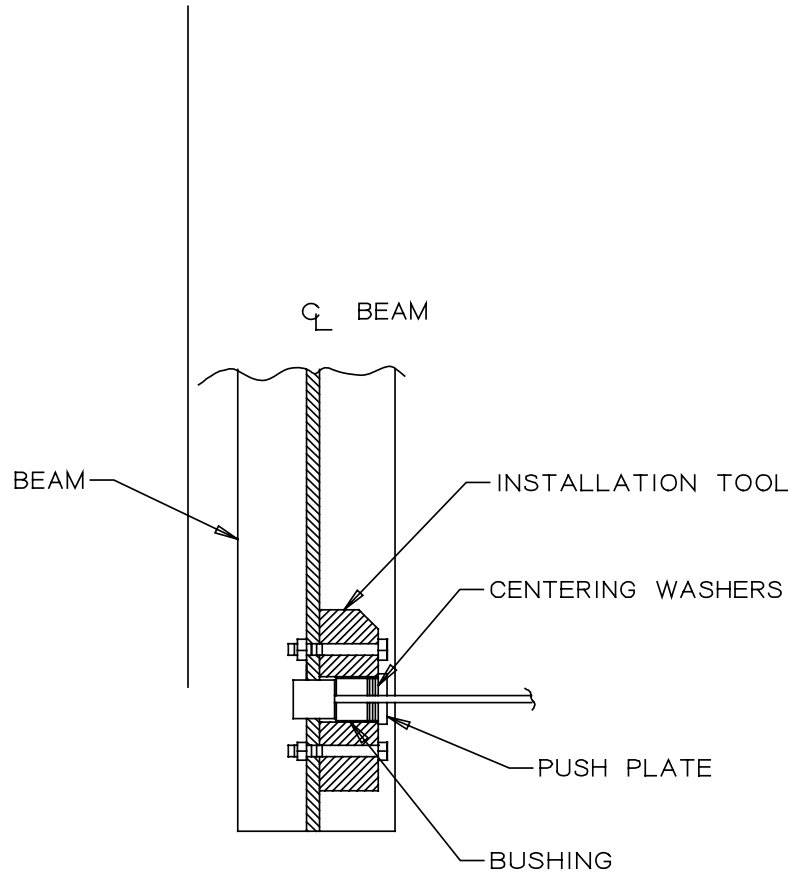
A01035

**Table 2-1.** Centering Washers

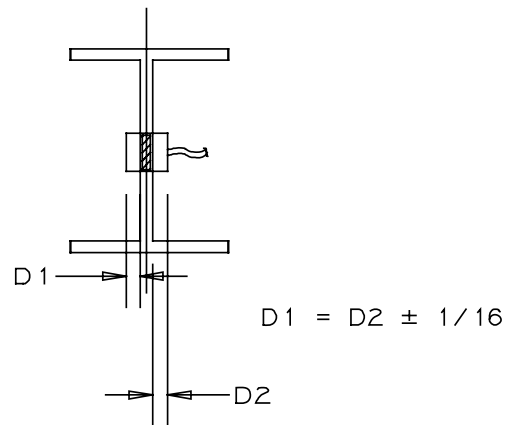
Beam Web Thickness	Amount of 1/4" SAE washers .062 required for centering push
1/8 - 5/16"	0
3/8 - 7/17"	1
1/2 - 9/16"	2
5/8 - 11/16"	3
3/4 - 13/16"	4
7/8 - 5/16"	5
1 - 1-1/6"	6

\* Installation tool can only push 38 inch at a time. More than 6 washers will require two or more centering pushes.

Figure 2-18. Centering Strain Sensor



A00392



## Junction Box Installation

The junction box is mounted directly to the beam protecting the sensor and wiring connections. Use the following procedure to install the junction box.

1. Clean drill residue from the cable side of the beam web.
25. Mount the junction box and junction box gasket firmly to the beam web. Make sure that the 3/4 inch conduit connector is pointing sideways, beams or down, columns (**Figure 2–19**).



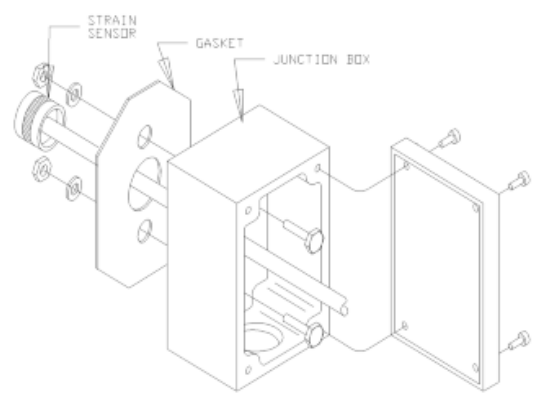
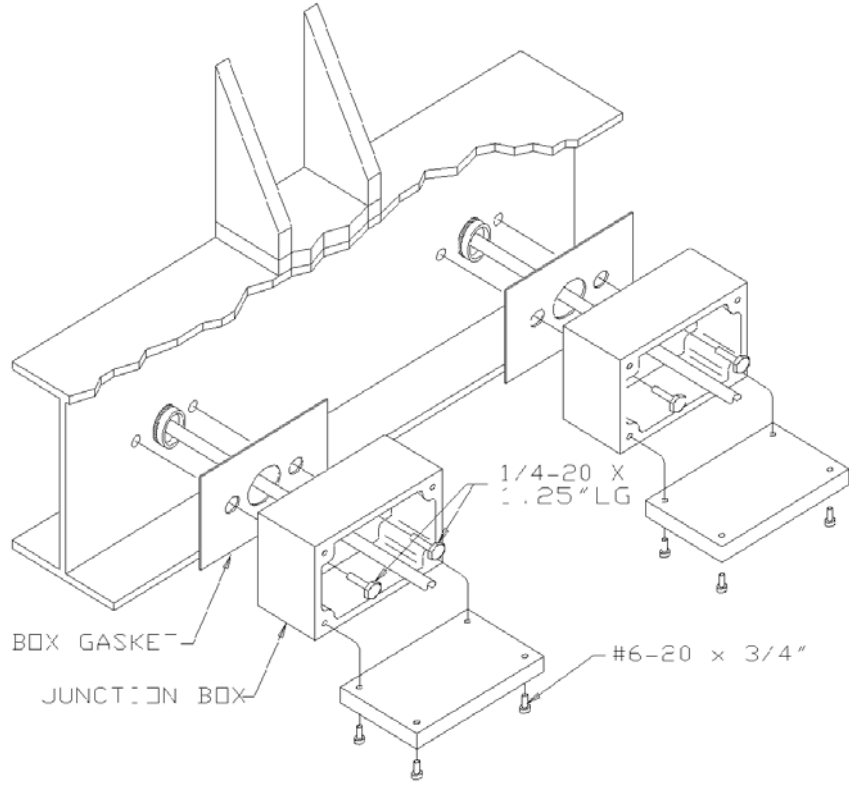
**Note** The junction box uses the same mounting holes as the installation tool. □

26. Coil the strain sensor cable into the junction box. Conduit and connecting cable will be run to the box after the remaining strain sensors are installed.
27. Repeat the junction box installation procedure for each additional strain sensor in the system.
28. The terminal strip floats loose in the box.

**CAUTION** JUNCTION BOXES MOUNTED ON SURFACES THAT ARE NOT FLAT SHOULD BE CAULKED TO PREVENT MOISTURE ENTRY.. □

**Figure 2–19.** Junction Box Installation, Non-Hazardous Area.

Installation

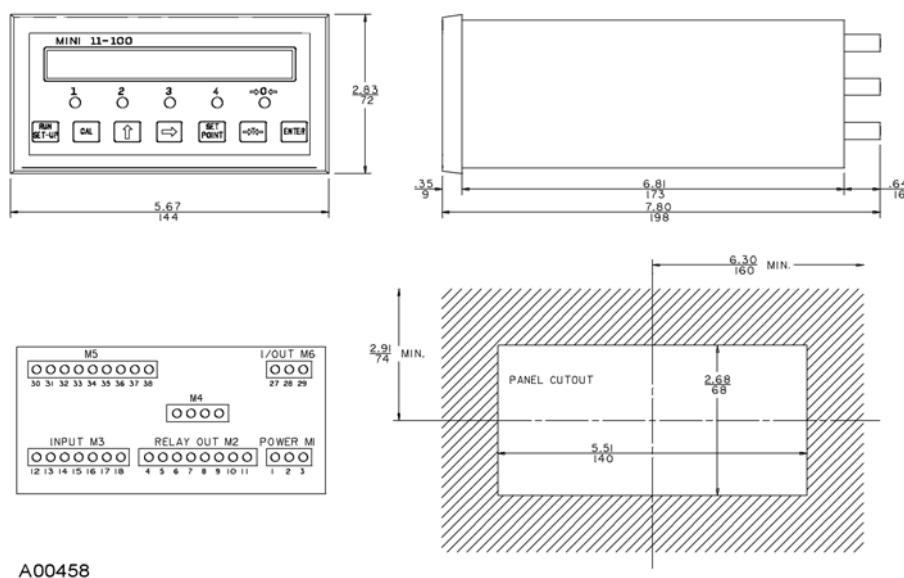


COLUMNS

# C-Level Electronics Installation

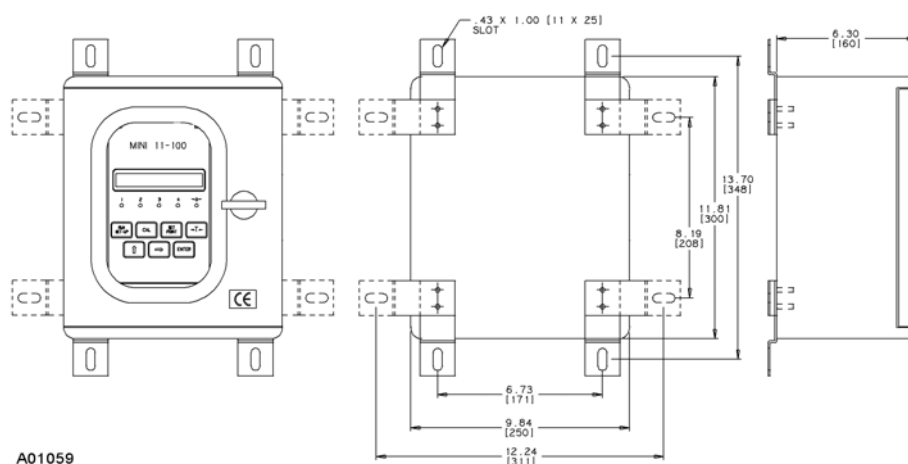
The panel mount version shall be mounted in a vibration free cabinet or control panel. In a typical bin-weigh application, this may be up to 3000 feet from the strain sensors (using the remote sense lines, 6 conductor shielded cable). Signal wires and power wires must be kept separate. Reference **Figure 2-20** for cutout dimensions. Maximum panel thickness is .5". Reference **Figure 2-21** for field mount version.

**Figure 2-20.** Electronics Outline and Mounting - Panel Mount



A00458

**Figure 2-21.** Electronics Outline and Mounting - Field Mount



A01059

## Field Wiring

Use the typical field wiring diagram (**Figure 2–22** and **Figure 2–23**) as a guide if you do not have a specific wiring diagram for your system. Follow local electrical codes and regulations for minimum wire size and routing.

Other critical wiring considerations:

Make sure that the power is OFF.

Do not route signal cables in the same conduit with power lines.

Terminate the cable shields ONLY where illustrated.

Earth ground all enclosures and conduit.

Remote excitation sense lines must be used when sensors are farther than 200 feet from the electronics. When using remote sense in the panel mount version, you must remove the device from the chassis, and then remove the shorting jumpers S1, S2 as shown on drawing C07259H-Y006. For the field mount version, remove S1, S2 jumpers on the mother board directly above the field terminal strip.

### 1. Main Power Wiring

Main power connections are made to the terminal strip M1 located below the power slide switch. The terminals are labelled 1, 2 and 3 signifying the normal hot, neutral and earth ground, respectively, of most systems.

### 29. Strain Sensor/Junction Box Wiring

The sensors are wired in parallel using the terminal strip provided with the installation kit (**Figure 2–21**).

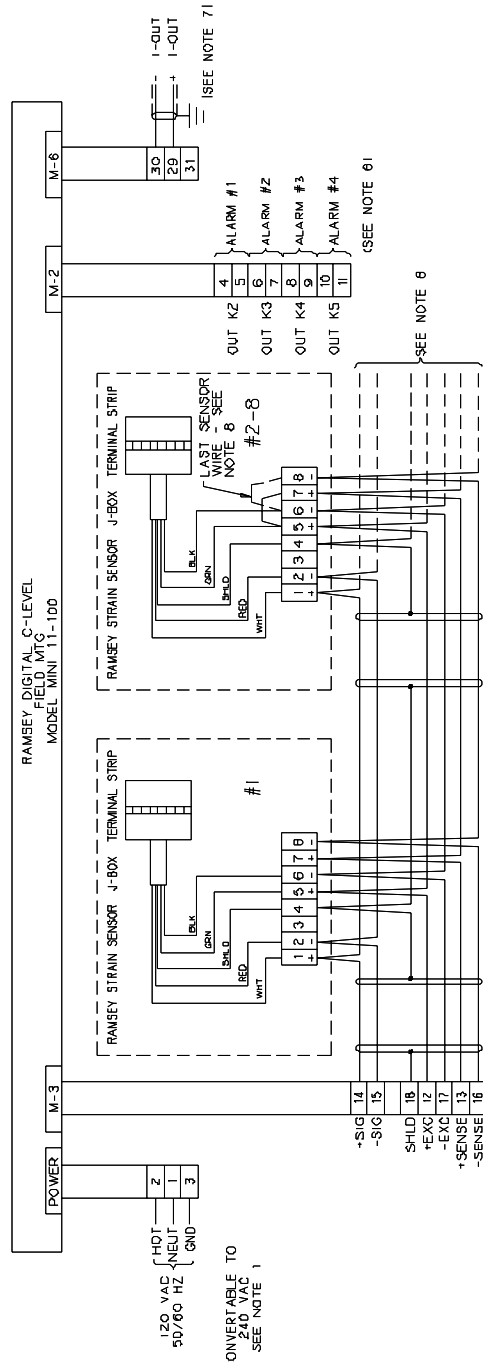
The junction box terminal strip floats loose in the box.

Remote excitation sense lines are required for all installations. Use 22 - 24 gauge if less than 200 ft. and 18 gauge if farther than 200 feet away from the electronics package. Always connect the remote sense lines to the furthest sensor away from the electronics package.

If the junction box is mounted on curved or rough surfaces, a sealant should be applied to the back to prevent moisture entry.

### 30. Wire your remote indicator to M-6 if equipped with the optional current output board.





- NOTES:**
1. THE MINI 11-100 DIGITAL C-LEVEL IS SHIPPED CONFIGURED FOR USE WITH 120/240 VAC. A MANUAL SWITCH FOR 204-264 VAC.
  2. CONNECT SHIELDS ONLY WHERE INDICATED
  3. DO NOT RUN SIGNAL LINES IN SAME CONDUIT AS POWER LINES
  4. EARTH GROUND ALL ELECTRICAL ENCLOSURES.
  5. STRAIN SENSOR FIELD WIRING CABLE - 6 CONDUCTOR SHIELDED. LESS THAN 200 FT. USE ZW-275 Belden 9533 OR EQUIVALENT. MORE THAN 200 FT. USE 18 AWG Belden 9533 OR EQUIVALENT AND REMOVE \$1.32 SENSE JUMPERS INTERNAL TO 11-100
  6. N.P. ALARM CONTACTS RATED .5 AMP @ 240 VAC.
  7. MAXIMUM LOOP RESISTANCE = 500 OHMS. CABLE - 2 COND. 18 AWG Belden 8160 OR EQUIVALENT
  8. CONTINUE TO LOOP STRAIN SENSOR FIELD WIRING THRU EACH JUNCTION BOX/SENSOR UNTIL YOU COME TO THE LAST ONE. WHEN THE LOOP SLIPS ON THE LAST SENSOR TIE THE SENSE LINE TO THE EXCITATION LINE. JUMPER 7 TO 5 AND JUMPER 8 TO 6.

UT1060

# Chapter 3

## Calibration

The 11-100 (DCL-100) must be calibrated correctly for proper system operation. Calibration allows the unit to show the correct value of level. The device always displays the contents of the bin, without an operator action required. See Menu Tree for a layout of the options within each menu.

**Figure 3-1. Front Panel Configuration**

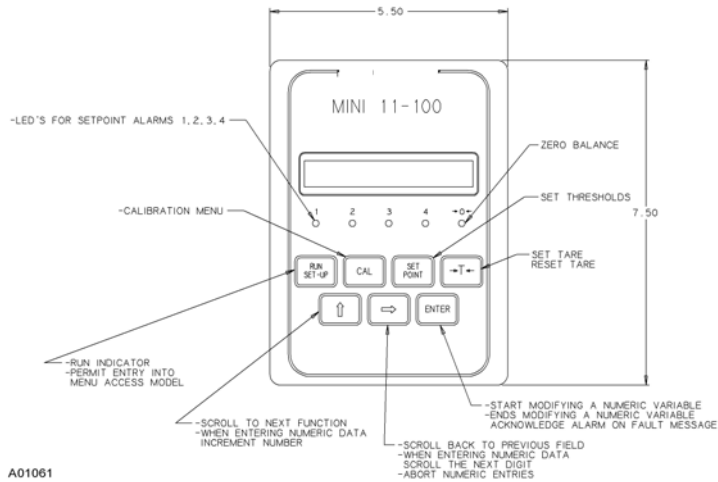
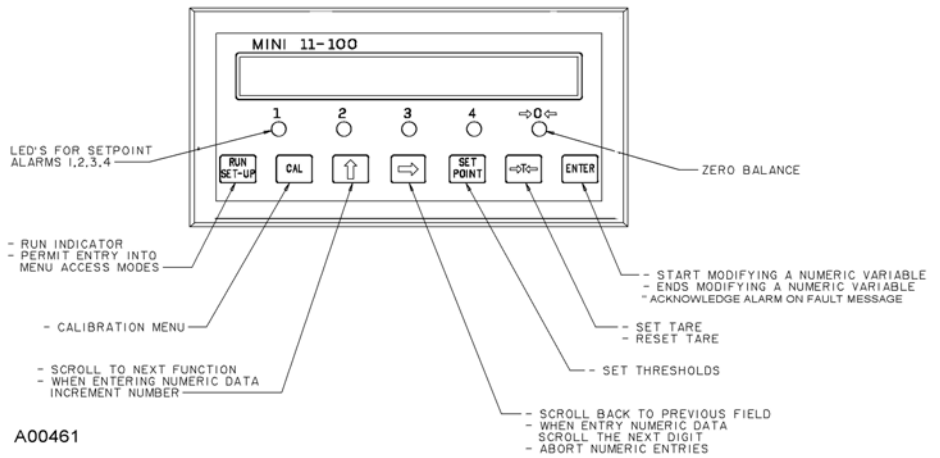


Table 3-1 Front Panel Scrolls

DESCRIPTION		MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE
<u>SETUP KEY</u>				
Protection (Active, Not Active)		N/A	N/A	N/A
Scale Data				
Decimal Point		0	0,0000	0,0
Scale Capacity		0	9999999	100.0%
Scale Divisions (1, 2, 5, 10, 20, 50, 100)		N/A	N/A	5
Measurement Units (Tons, Long Tons, Grams, Kilograms, Q, Percent, Lb)		N/A	N/A	5
Autozero Track		0.0%	20.0%	0.0%
AZT Time		1.0 sec	999.9 sec	5.0 sec
AZT Limited		0.0%	20.0%	2.0%
Option				
Current Output (Yes/No)		N/A	N/A	NO
Select Mode Tare (Acquire/Enter)		N/A	N/A	ACQUIRE
Serial Comm (Yes/No)		N/A	N/A	NO
Peak Sensor (Yes/No)		N/A	N/A	NO
Totalization (Yes/No)		N/A	N/A	NO
Language (English/Italian)		N/A	N/A	ENGLISH
Input/Output				
Input 1 (None, Set Tare, Reset Tare, Update Total, Reset Total, Hold Weight, Clear Peak, Reset Alarms)		N/A	N/A	SET TARE
Input 2 (None, Set, Tare, Reset Tare, Update Total, Reset Total, Hold Weight, Clear Peak, Reset Alarms)		N/A	N/A	RESET TARE
Input 3 (None, Set Tare, Reset Tare, Update Total, Reset Total, Hold Weight, Clear Peak, Reset Alarms)		N/A	N/A	RESET ALARMS
Output 1 (Threshold ½/3/4, Not Used, Alarm Cumulative, Ready, Weight Stable, Total Updated, Total Cleared)		N/A	N/A	THRESHOLD 1
Output 2 (Threshold ½/3/4, Not Used, Alarm Cumulative, Ready, Weight Stable, Total Updated, Total Cleared)		N/A	N/A	THRESHOLD 2
Output 3 (Threshold ½/3/4, Not Used, Alarm Cumulative, Ready, Weight Stable, Total Updated, Total Cleared)		N/A	N/A	THRESHOLD 3
Output 4 (Threshold ½/3/4, Not Used, Alarm Cumulative, Ready, Weight Stable, Total Updated, Total Cleared)		N/A	N/A	THRESHOLD 4
Clock (Field Only)		N/A	N/A	FACTORY SET
Current Output				
mA Range (4-20, k 0-20, 20-4, 20-0)		N/A	N/A	4-20 mA
mA Value (Gross, Net, Peak)		N/A	N/A	GROSS

DESCRIPTION	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE
mA Zero Level (% of Scale Capacity)	0.0%	100%	0.0%
mA 100% Level (% of Scale Capacity)	0%	100.0%	100.0%
mA Absolute Value (Yes/No)	N/A	N/A	NO
<b>Alarms (Display)</b>			
Threshold 1 (Alarm, Not Used)	N/A	N/A	NOT USED
Threshold 2 (Alarm, Not Used)	N/A	N/A	NOT USED
Threshold 3 (Alarm, Not used)	N/A	N/A	NOT USED
Threshold 4 (Alarm, Not Used)	N/A	N/A	NOT USED
Cold Start (Alarm, Not Used)	N/A	N/A	ALARM
Load Cell Fail (Alarm Not Used)	N/A	N/A	ALARM
<b>Serial Communication</b>			
Protocol (PC Master, Siemens 3964R, DF1, Modbus)	N/A	N/A	PC MASTER
Baud Rate (1200, 2400, 4800, 9600, 19200, 38400)	N/A	N/A	
Bit Di Stop (1, 2)	N/A	N/A	1
Parity (Not Used, None, Odd, Even)	N/A	N/A	NONE
Handshake (Yes/No)	N/A	N/A	NO
Word Length (7 bit, 8 bit)	N/A	N/A	8
Address (0 through 16)	N/A	N/A	
<b>Test</b>			
Set Password	00,000,000	99,999,999	20,000,000
Visual Setup (Full, Part)	00,000,000	99,999,999	PARTIAL
A/D Gross Output	N/A	N/A	A/D COUNTS
A/D Net	N/A	N/A	AD COUNTS
LC Sup	N/A	N/A	mv.
E2prom	N/A	N/A	N/A
C Zero	0	30,000	N/A
c span	0	99,999,999	N/A
Software Version	N/A	N/A	
RAM Memory Test	N/A	N/A	
Input Test	N/A	N/A	
Output Test	N/A	N/A	
Lamp Test	N/A	N/A	N/A
Force Value (Q)	N/A	N/A	N/A
<b>CAL KEY</b>			
Low Weight	0%	100% Scale CAPACITY	N/a
HIGH WEIGHT	0%	100% SCALE CAPACITY	N/A
CAL LOW WEIGHT	N/A	N/A	N/A
Cal High Weight	N/A	N/A	N/A
Auto Span Res	N/A	N/A	200.0 R CAL
Filter	0.0	10.0	10 SEC
Zero	0	30,000	2 mV

## Calibration

DESCRIPTION	MINIMUM VALUE	MAXIMUM VALUE	DEFAULT VALUE
Span	0	9,999,999	10 mV
<b>SETPOINT KEY</b>			
Set Threshold 1	0.0	SCALE CAPACITY	3.0
Set Threshold 2	0.0	SCALE CAPACITY	200.0
Set Threshold 3	0.0	SCALE CAPACITY	300.0
Set Threshold 4	0.0	SCALE CAPACITY	350.0
Var Threshold 1 (Gross, Net, ABS Net, ABS Gross)	N/A	N/A	GROSS
Var Threshold 2 (Gross, Net, ABS Net, ABS Gross)	N/A	N/A	GROSS
Var Threshold 3 (Gross, Net, ABS Net, ABS Gross)	N/A	N/A	GROSS
Var Threshold 4 (Gross, Net, ABS Net, ABS Gross)	N/A	N/A	GROSS
Hysteresis Threshold 1	0.0	100%	(Units
Hysteresis Threshold 2	0.0	100%	(Units
Hysteresis Threshold 3	0.0	100%	(Units
Hysteresis Threshold 4	0.0	100%	(Units
Type Threshold 1 (Low, High)	N/A	N/A	LOW
Type Threshold 2 (Low, High)	N/A	N/A	HIGH
Type Threshold 3 (Low, High)	N/A	N/A	HIGH
Type Threshold 4 (Low, High)	N/A	N/A	HIGH
Delay Threshold 1	0	999.9 SEC	0.5 Sec
Delay Threshold 2	0	999.9 SEC	0.5 Sec
Delay Threshold 3	0	999.9 SEC	0.5 Sec
Delay Threshold 4	0	999.9 SEC	0.5 Sec

## Setup

The control panel of the 11-100 (DCL-100) must be configured to each application. As shipped, the instrument is programmed to read from 0.0 to 100.0%. If desired, the instrument can be reconfigured to read in common engineering units. This is done from the front panel. Refer to the Menu Tree in for the locations of settings

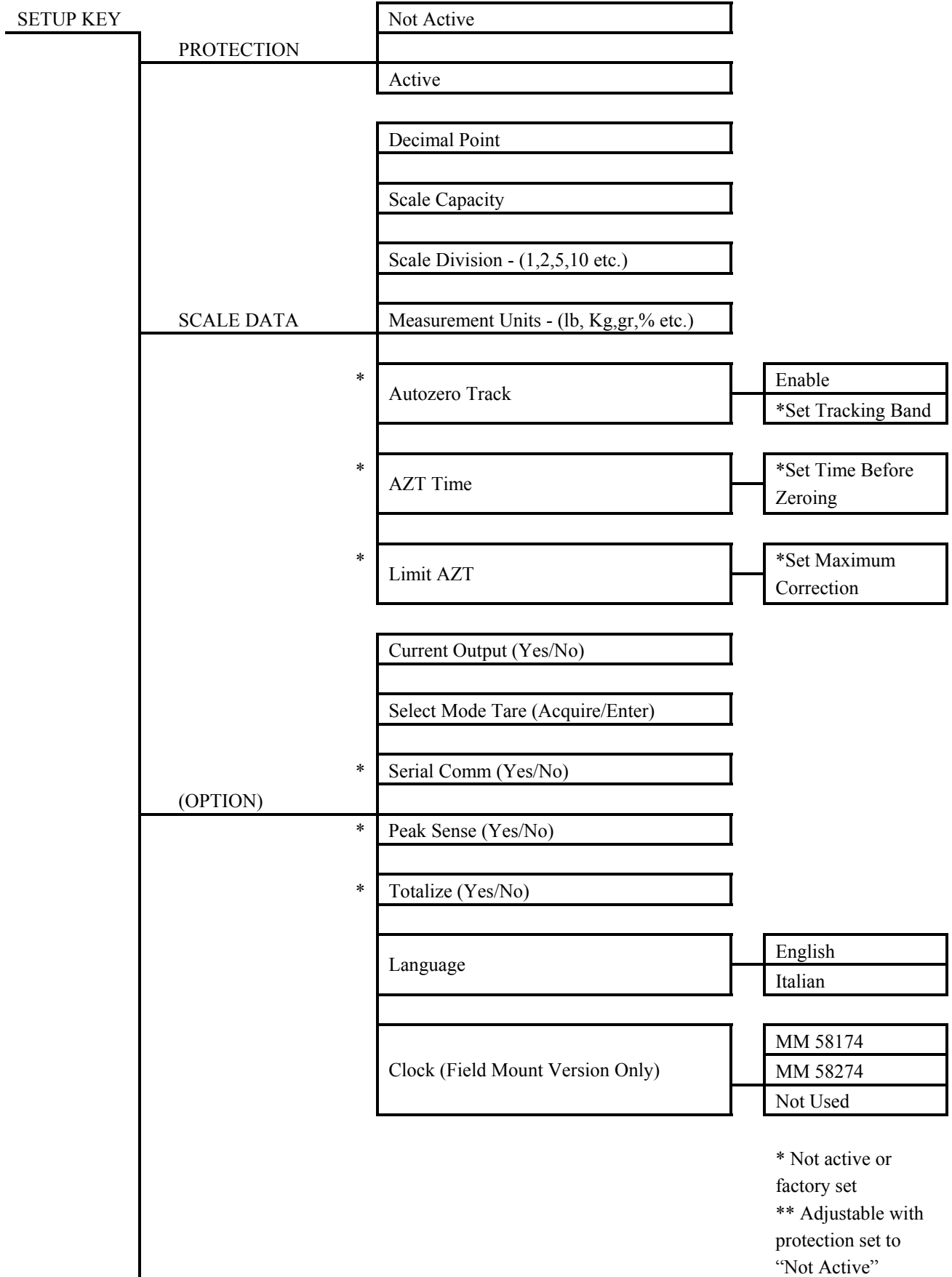
Depressing the **SETUP** key brings up the Menu Tree. The display shows “Protection” which signifies the location in the Menu Tree. Pressing the **UP ARROW** (↑) key indexes through the menu. Pressing the **RIGHT ARROW** (→) key allows backing up through the menu if the operator has indexed beyond the desired point.

Pressing the **ENTER** key at any of the menu locations advances the menu tree one level deeper; i.e., pressing the **ENTER** key when at the “Scale Data” location displays the menu location “Decimal Point”. Using the **UP ARROW** (↑) now allows selection of any of the tree locations under “Scale Data”.

After selection of the desired location, pressing **ENTER** displays the current setting of the instrument at that point. Pressing the **ENTER** key now advances the display to the next set, the actual manipulation of the setting. This is shown by the flashing of the display. For numeric values, the left most digit flashes. By pressing the **UP ARROW** (↑) key, the affected digit can be incremented up to the desired level. Other digits are selected by pressing the **RIGHT ARROW** (→) key until the desired digit is displayed. The digit is selected by pressing the **UP ARROW** (↑) key. Pressing the **ENTER** key installs the changes.

In menu tree locations where selections are required instead of values, current selections are displayed with the **ENTER** key is pressed. Pressing the **ENTER** key again causes the displayed setting to flash. Now press the **UP ARROW** (↑) key to reach the desired setting, and then press the **ENTER** key to install the new selection.

Figure 3–2. Menu Tree



\* Not active or factory set  
 \*\* Adjustable with protection set to "Not Active"



Calibration

SETUP KEY  
Continued

(OPTION) SERIAL COMMUNICATION	Protocol (PC Master, Siemens 3964R, DF1, Modbus)
	Baud Rate (1200, 2400, 4800, 9600, 19200, 38400)
	Stop Bits (1, 2)
	Parity (Not Used, None, Odd, Even)
	Word Length (7 bit, 8 bit)
	Handshake (Yes, No)
	Address (1 through 16)
	Set Password (00,000,000 - 99,999,999)
	Visual Setup
	A/D Gross Output
	A/D Net
	LC Sup (mv.)
	*E2prom
	C Zero
	C Span
	Software Version
	RAM Memory Test
Input Test	
Output Test	
Lamp Test	
Force Value (Q)	

CAL KEY

**LOW WEIGHT	Install Low Calibration Value
**HIGH WEIGHT	Install High Calibration Value
**CAL LOW WEIGHT	
**CAL HIGH WEIGHT	

\* Not Active or  
Factory Set  
\*\* Adjustable with  
Protection set to  
"Not Active"

CAL KEY Continued		Acquire R Cal
	AUTO SPAN RES	Calibration Res
		Weight Unloaded?
	FILTER	
	ZERO	
	SPAN	

SETPOINT KEY	SET THRESHOLD (1, 2, 3, AND 4)	
	*VAR THRESHOLD (1, 2, 3, AND 4)	Set Variable of Threshold (Net, Gross, ABS Net, ABS Gross)
	TYPE THRESHOLD (1, 2, 3, AND 4) (Used/Not Used)	
	*HYST THRESHOLD (1, 2, 3, AND 4)	Set Hysteresis of Threshold (Number of Units)
	*DEL THRESHOLD (1, 2, 3, AND 4)	Set Delay of Threshold (Number of Seconds)

\* Not Active or Factory Set

## Calibration Procedure

The calibration procedure consists of two steps: zero and span.

In most scale applications, this means the scale must be calibrated in the completely empty condition and the full condition. The program in this device allows calibration at levels other than full and empty.

1. Zero: The bin is emptied and the zero is set, or the bin is emptied to a level below 30%. This known level is then entered into memory during calibration.
2. Span: The bin is filled to some known amount, above 70% capacity and the is set by entering this amount into memory.

The calibration must be completed in order - always zero first.



**NOTE:** Failure to observe the rules of less than 30% for zero and greater than 70% for span causes resolution problems during operation.

After the calibration has been completed, the zero and span settings are stored in the permanent memory of the unit. The Mini 11-100 D C-Level does not need to be recalibrated if a power outage occurs.

You may wish, although not required for calibration, to measure and record sensor signal levels at empty and full bin level calibration points. These reference levels would be helpful if a troubleshooting need should arise.

Using the built-in Test menu, measure the empty and full bin signal levels. This signal is accessed in the Test menu by pressing **SETUP**, **using the up arrow to the Test menu, pressing ENTE**, and then up arrow 3 times to the LC SUP XX mv. screen. Typical empty bin level would be between minus (-) 10 and Plus (+) 10 millivolts. Full bin level must be more positive than empty level by at least 0.8 millivolts.

## Protection Scroll

Changing the calibration requires setting the Protection Scroll to “Not Active”.

1. Depressing the **SETUP** key brings up the Menu Tree. The display says “Protection”.
2. Press the **ENTER** key once. The display says “Active” (calibration protected) or “Not Active” (calibration allowed).
3. If “Not Active” is displayed, press the **CAL** key and proceed to Step 5. If “Active” is displayed, change the display to “Not Active” by following Step 4.
4. To toggle the protection from “Active” to “Not Active” (or vice versa), press the **ENTER** key once. When “Active” or “Not Active” is displayed, the display reads 0. Press the **ENTER** key again. The display shows 00000000 with the eight zero flashing. Press the up arrow key twice. The display says 20000000. Press **ENTER** and the display changes from “Active” to “Not Active” (or vice versa).
5. Calibration can be changed when protection is not active. To protect the calibration constant, change the protection to “Active” when calibration is complete.

### Zero or Low Level Calibration Value Entry

The first step of the calibration procedure is zero adjustment.

1. The electronics should be on at least 30 minutes before calibration.
2. Empty the bin or vessel complete, or reduce the level to less than 30% to a known level.
3. Press **CAL ENTER**. The display shows LOW WEIGHT. Press **ENTER**. The instrument prompts the operator by displaying the current low value. Press **ENTER** and use the [**>**] to select the digits and the [**^**] to select the new value. Then press **ENTER** to move the entered value into memory. Press **RUN**.

### Zero or Low Weight Calibration

1. Set **CAL** [^] [^] **ENTER**. The display shows CAL LOW WEIGHT.
2. Press **ENTER**. The display shows WAIT.
3. Wait until the message disappears. At the end, the instrument shows the actual value of low weight. The corresponding A/D counts are stored at LOW WEIGHT CONV.

### Span or High Level Calibration Value Entry

Press **CAL** [^] **ENTER**. The display shows the HIGH WEIGHT. Press **ENTER**. The instrument displays the current value. Press **ENTER** and use the [>] to select the individual digits and the [^] to set the value. Press **ENTER** to insert the value into memory. Press **RUN**.

### Span or High Weight Calibration

1. Press **CAL** [^] [^] [^] [^] **ENTER**. The display shows CAL HIGH WEIGHT.
2. Press **ENTER**. The display shows WAIT. WAIT until the message disappears. AT the end, the display shows the value of HIGH WEIGHT. The corresponding number of A/D counts are stored in the location HIGH WEIGHT CONV.



#### NOTE

If ever during the calibration procedure you desire to quit or start over, press the RUN/SETUP key. The device will be returned to the normal operating mode.

This calibration has produced a readout in percent of bin full with a resolution of 0.5 percent. The % sign at the right of the display denotes percentage of full scale.

There are many ways the display of this device can be customized. If it is desired to have the display read in engineering units, or have other application specific details, see Calibration Procedure for optional setup details.

## Relay Output Alarms

The 11-100 has four sets of relay output contacts that are programmed to close at predetermined levels. They are used for control points and/or high/low alarms. The contact rating is 0.5 amps at 240 VAC maximum. The relay activation status is displayed on the front panel by small indicator lights numbered 1 through 4. Refer to the field wiring diagram **Figure 2–21** for alarm connections. The front panel display can also flash an alarm see Optional Setups

## Setting Relay Trip Points

The following sequence describes the setting of the relay trip points.

1. Press the **SETPOINT** key. The display reads THRESHOLD 1. This is relay 1. The other relays (2 through 4) are selected by pressing the up arrow key.
2. Once you have selected the desired threshold (relay), press the **ENTER** key. The display shows the current value at which the selected relay will start.
3. If you wish to change the setting, press the **ENTER** key. The left digit will flash, showing the digit is selected. Press the right arrow key to select the desired digit. Then by pressing the up arrow key, change the digit to the desired value.
4. After the digits are set to the desired values, enter them by press the **ENTER** key.
5. To return to the Run mode, press the **RUN/SETUP** key. The display shows the current amount of material in the bin.
6. To set another relay, select the desired relay and repeat the sequence from Step 1.



**NOTE** The relays are used in the “fail safe” more. This means that the contacts close upon loss of power and they could activate an alarm

## Relay Function Setup (Net, Gross, ABS Net, ABS Gross, Trip High, Low, Not Used)

The functions of the setpoint/alarm relay can be changed to trip on Display Net, Gross, ABS Net, or ABS Gross. The standard setting is Gross. To change these function, press the **SETPOINT** key. Press the up arrow key four times. At the VAR (variable) THRESHOLD 1 screen, press **ENTER**. The display shows the setting to change the setting, press **ENTER** and then up arrow to desired function. Press **ENTER** to install it.

Pressing the up arrow key brings the menu to TYPE THRESHOLD 1. Press the **ENTER** key, The display shows HIGH, LOW, or NOT USED. HIGH or LOW shows if the relay will activate above or below the setpoint. NOT USED shows the function is turned off. To change

the setting, press **ENTER**. Use the up arrow key to select the desired function. Press **ENTER** to install the desired setting.

## Optional Setups

The Mini 11-100 can be customized to fit your application, such as having the display read in engineering units. The following section outlines the programming instructions for specific applications.

### Display Panel Programming

To change the front panel display to engineering units rather than percentages, follow the instructions listed below.

1. To set the decimal point:
  - a. Press **SETUP**, up arrow key to the Decimal Point Menu.
  - b. Press **ENTER** three times. The current setting is flashing.
  - c. Press the up arrow key until the desired setting is reached.
  - d. Press **ENTER** to set the new value into memory.
  - e. Press **RUN**. This completes the operation and returns the device to the Run mode.
  
31. To set capacity:
  - a. Press **SETUP**, up arrow key to the Scale Capacity Menu.
  - b. Press **ENTER** twice. Left digit is flashing. (This shows which digit is ready to be set).
  - c. Press right arrow key as needed to select the desired digit.
  - d. Press the up arrow key as needed to set the digit to the desired setting.

- e. Press the right arrow to select the next lower digit to be set.
- f. Repeat above instructions until all digits are set to the desired level.
- g. Press **ENTER** to set new values into memory.
- h. Press **RUN**. This completes the capacity setup and returns the device to the Run Mode.

## Setting Divisions (Display Increments)



### NOTE

The Mini-100 is set at the factory to provide 2-1/2 digits on the display. Thermo Scientific does not recommend having more than 3 active digits. Excessive active digits cause instability of the display.

Available settings for units per division are: 1, 2, 5, 10, 20, 50 and 100. Select a number that will allow only the 3 most significant digits functional. For example, for a capacity setting of 40,000, use 100 units per division. The display will then increment in 100's.

- a. Press the **SETUP** key, up arrow key, **ENTER** and up arrow key twice to the Scale Division Menu.
- b. Press **ENTER** twice. The current setting is now displayed and flashing.
- c. Press up arrow as many times as needed to select the required number of divisions.
- d. Press **ENTER** to set the new value into memory.
- e. Press **RUN** to return the device to the RUN MODE.

## Setting the Measurement Units

Setting measurement units causes the display to show t (tons), LT (long tons), g (grams) kg (kilograms), Q or %.

- a. Press **SETUP**, up arrow, **ENTER**, up arrow three times to the Unit of Measure Menu.
- b. Press **ENTER** twice. The current setting is displayed.
- c. Press up arrow as many times as needed to select the desired symbol.
- d. Press **ENTER** to install the symbol into memory.
- e. Press **RUN** to return the device to the Run Mode.

## Display Alarms

The relay activation status is displayed on the front panel by small indicator lights numbered from 1 through 4. They light when the alarm/setpoint is active. In addition, the display flashes a message that one of the alarms (i.e., THRESHOLD 1) is or has been activated.

## Alarm List

The list of alarms is as follows:

### THRESHOLD 1 THROUGH 4

These indicate the level at which they were set has been exceeded. The continue to flash even after the level has returned to normal. To acknowledge, press **ENTER** during the time that the message is flashing. This removes the message from the display.

### COLD START

This alarm indicates if the setup data was lost during a power outage. If this message appears, it is necessary to recalibrate. After calibration, press **ENTER** to acknowledge if necessary.

### LOADCELL FAIL

This alarm indicates failure of the loadcell or its wiring. After repairing the problem, press **ENTER** during the time the message is flashing.

### MAX ZERO CORR

This alarm function is a part of Auto Zero Tracking which is not used in the Digital C-Level.

These alarm messages may be enabled/disabled from the front panel. To access this area of the program, press **SETUP** [^] [^] [^]. The display reads ALARMS. Press **ENTER**, then [^] as many times as required to access the alarm desired. Press **ENTER**. The display shows either ACTIVE or NOT USED. To change the status, press **ENTER**. The display flashes the current message. Press [^] to obtain the desired status, then press **ENTER** to confirm the selection. Press **RUN**.

## Above/Below Tonnage Key (>T<)

This key only is used to subtract tare weight when the device is used as a loadout. If the key is pressed, the display immediately goes to zero. The display shows a negative number when the level falls below this point. A positive number is displayed when the bin level is above this point. **THIS KEY IS ALWAYS ACTIVE!** If you did press this key and need to recover, press it again and the display returns to normal.

## Chapter 4

# Maintenance

### General

The Thermo Scientific C-Level Model 11-100 continuous level indicator is one hundred percent solid-state and should require little, if any, maintenance.

To assist you in servicing your C-Level, information in this section includes:

- A preventative maintenance plan with recommended cleaning and sensor protection schedule.

- Diagnostic and trouble shooting procedures.

- Factory service and repair information.

### Service and Repair

The maintenance information in this manual is adequate to meet your service needs. However, if you run into problems requiring technical assistance, please call (612) 783-2500 and ask for C-Level technical service.

When returning parts for repair, please use the Return Material Authorization form located in the parts section of this manual.

### Preventive Maintenance

The Digital C-Level requires a minimum amount of maintenance, but this maintenance is important to insuring the best performance of your level control.

### Electronics

The front panel can be wiped clean with a damp cloth and, if necessary, a mild detergent should be used. To prevent scratches or damage to the front panel, never use abrasives or solvents.

### Strain Sensor

As a preventive measure, brush the sensor installation location yearly with the open gear lubricant provided with the unit. This will inhibit corrosion between the structural member and sensor.

## Diagnostic Procedures

The C-Level has several built-in diagnostic features to help you in isolating problems in the electronics. One of the diagnostic features is called Load Cell Fail. This message is displayed if the device detects a failure in the excitation or weight signals. It is always active and does not need operator intervention. Other diagnostic tools are accessed by manipulating the front panel switches. The procedures outlined below explain how to use the diagnostic menus.

A DC voltmeter capable of reading millivolts will be necessary for isolating strain sensor or field wiring problems.

### Test

This menu is used to test any calibration problems.

1. Press the **SETUP** key, up arrow seven times until the display reads TEST.
2. Press the **ENTER** key, up arrow key to display the total input analog to digital converter output counts.
3. Press the up arrow key again and the display will show the net analog to digital converter counts. This is the number after the zero calibration value has been subtracted from the previous number. If this is a negative number, there is a calibration problem.
4. Press the up arrow key again. The display reads LC SUP. This is the sensor input signal level from the sensors in millivolts. The reading must never exceed +/- 20.00 mV.
5. Press the up arrow key. Display shows E2PROM. This is a non-used function.
6. Press the up arrow key. The display reads SOFTWARE VER. Press the **ENTER** key displays the revision level of the software.
7. Pressing the up arrow again displays the message MEMORY TEST. To check memory, press the **ENTER** key. Press **ENTER** if OK or call the factory if the test fails.

32. Pressing the up arrow key again displays INPUT TEST. This is a test of the digital control inputs. These inputs are never used in bin level applications. Pressing the **ENTER** key shows three digits at the right side of the display. They are normally zeros. A one in any position shows that the input line is active.
33. Pressing the up arrow key again displays OUTPUT TEST. This is a test of the output drive to the setpoint/alarm relays. Pressing **ENTER** will cause four digits to appear at the right of the display. They are either one's or zero's. If a one appears, the associated output relay is closed. The arrangement of the digits is from left to right, like the indicator lights on the front panel. These are used to troubleshoot the system and to show if a particular relay has been activated or not. If a relay shows activated and the appropriate function fails, check the relay contact and the wiring for a problem.
34. Press the up arrow key displays LAMP TEST. Pressing the **ENTER** key causes the entire display to flash to confirm all lights are in working order. The test is ended by pressing the **ENTER** key again.
35. Press the up arrow key to display FORCE VALUE Q. This function is not used

## Troubleshooting

The most common C-Level problems and causes are outlined in this section. Thermo Scientific Technology suggests all field wiring and connections be verified before replacement parts are used.

## Visual Inspection

Often a quick visual inspection leads to the source of trouble. If a problem does develop, check the following before proceeding to more specific troubleshooting procedures:

1. Check Power:
  - a. Check that the power is ON.
  - b. Check that the fuse is NOT blown.
2. Check Field Wiring and Connections:
  - a. Check that all field wiring is complete and correct.
  - b. Check that all field wires are tight in their field terminals or connections.

## Faulty Calibration

1. A display reading of asterisks (\*) signifies the calibration constants of the unit are out of normal limits. If the zero and span numbers are the same, a calibration was performed without changing the level in the bin. Recalibrate zero and span.
36. A display reading of "T" in the left most position signifies the >T< (tare) key is activated. The tare key zeros out the display and is normally used for loadout applications only. Press the >T< key to restore the display to normal. See Section 3.6 for more information.
37. Setpoint alarms that are misaligned with the display are due to the >T< (tare) switch or setpoint alarm calibration. Setpoint alarms that are used for bin level can be misaligned by the >T< (tare) switch because the switch zeros out the material in the bin. Pressing the >T< (tare) switch if the display does not read "T" allows the bin level alarms to function correctly. Setpoint alarms can be set to alarm only after a time delay, or after a certain number of numbers past the setpoint. See Section 3.3 and the Menu Tree for more information on setpoint alarms.

## System Drifts

Symptom:

Level indication is unstable when bin level is constant.

Probable Cause:

1. Strain sensor(s) are not being stressed under load due to improper loading, location, installation or orientation of the strain sensors (Chapter 2.0).
2. Moisture or loose connections in the wiring systems. TB1-1 (+) and TB1-2 (-) should show a positive increase of more than 0.8 millivolts at 100% level with respect to 0 level.

Symptom:

Level indicator drifts to more than 6 percent with sunlight.

Probable Cause:

1. Understressed strain sensors .
2. Interaction between bins because of shared structural connections.
3. Being too close to or below a single horizontal brace.
4. Cells not centered into the web of the beams.

Less than a fully averaged system:

5. Normally a (4 leg - 4 sensor) system is twice as accurate as a (4 leg - 2 sensor) system. A (4 leg - 2 sensor) system is  $\pm 5$  percent total movement from nominal reading.

## Strain Sensor Test

If calibration or drifting problems still prevail, it will be necessary to check each strain sensor for possible failure.

Test all strain sensors using the following procedure:

1. Leave power applied to the system.
2. Disconnect the red and white wire in the junction box coming from each strain sensor.
3. With the bin empty, at zero level, check the millivolt reading of each strain sensor by measuring the signal output. White is positive and red is negative lead. The reading can range between  $\pm 10$  mV.
4. After all the strain sensors are read at 0 level, add the actual millivolt readings together and divide by the total number of strain sensors.

Example:

Sensor #1 =-(0.7) mV

Sensor #2 =+ 2.3 mV

Sensor #3 =-(1.1) mV

Sensor #4 =+ 4.2 mV

Sensor #5 =+ 0.2 mV

Sensor #6 =+ 0.7 mV

$$\frac{-0.7 + 2.3 - 1.1 + 4.2 + 0.2 + 0.7}{6} = \frac{+5.6}{6} = +0.93mV$$

rounded up to +1.0 mV

38. The above calculation should match the reading obtained during initial zero calibration across M3-14 and 15. If not, one sensor was not connected to the system or the wiring between sensors has a problem.
39. Repeat the above procedure with the bin at 100% level.
40. If each sensor shows a positive increase of more than 0.8 millivolts, the problems likely are structural.

Check current output span using the following procedure:

1. While in the RUN mode, add a material to produce a known level signal.
2. The meter on the current output should indicate the same percentage of its range as the known signal level. The current output board is factory set for 20.0 mA full scale.

EXAMPLE:

If the current output zero selection was set to 4 mA and the bin level was set to 50%, the meter should indicate:

$$\text{Meter} = 0.50 (20 \text{ mA} - 4 \text{ mA}) + 4 \text{ mA}$$

$$\text{Meter} = 12 \text{ mA}$$

If the meter does not indicate correctly, the current output board is faulty and must be replaced.

**Figure 4–1.** Mini 11-100 / DCL-100  
Jumpers and Pots Configuration

<b>Bus Board</b>			
<u>Function</u>	<u>Pot/Jumper</u>	<u>Status</u>	<u>Description</u>
Display Contrast	P1		Display Contrast Control

<b>Mother Board</b>			
<u>Function</u>	<u>Pot/Jumper</u>	<u>Status</u>	<u>Description</u>
Coarse Zero	P1		Coarse Zero Trimmer
	J1	<u>OPEN</u>	Disable Coarse Zero Trimmer
		<u>CLOSE</u>	Enable Coarse Zero Trimmer
IC9 Converter	J2	<u>OPEN</u>	Factory configured, do not change
Load Cell Sensing	S1, S2	OPEN	External Sensing
		<u>CLOSE</u>	Internal Sensing

<b>Microprocessor Board</b>			
<u>Function</u>	<u>Pot/Jumper</u>	<u>Status</u>	<u>Description</u>
Reset circuit	J6	<u>CLOSE</u>	Factory configured, do not change
	J7	<u>OPEN</u>	Factory configured, do not change
Debug serial Port	J10	<u>CLOSE</u>	19,200 Baud
	J11	<u>OPEN</u>	
	J10	<u>OPEN</u>	38,400 Baud
	J11	<u>CLOSE</u>	
Line Power Reset	S1	<u>CLOSE</u>	Factory configured, do not change
Filter Cut Out Frequency	J2	<u>OPEN</u>	10 Hz
	J2	<u>CLOSE</u>	20 Hz
Line Frequency	J1	<u>OPEN</u>	60 Hz
		<u>CLOSE</u>	50 Hz
Force Cold Start	J4	<u>CLOSE</u>	Retain data at power up
		<u>OPEN</u>	Force Cold Start at power up
Display selection	J3	<u>OPEN</u>	Select display AMEL mod. 013231160803135
		<u>CLOSE</u>	Select old type display
Digital Output K5 (Out 4)	J8	<u>OPEN</u>	Output is software controlled
	J9	<u>CLOSE</u>	
	J8	<u>CLOSE</u>	Output is hardware controlled (Watch Dog function)
	J9	<u>OPEN</u>	
Converter IC5	J12	<u>OPEN</u>	Factory configured, do not change
	J13	<u>OPEN</u>	Factory configured, do not change
Analog Output	J1 A	<u>OPEN</u>	0-10 VDC
	J1 B	<u>CLOSE</u>	
	J1 A	<u>CLOSE</u>	0-20 mA or 4-20 mA
	J1 B	<u>OPEN</u>	
P2		Analog output span adjust	
P1		Analog output zero adjust	
Serial Port	J5	<u>OPEN</u>	Disable CTS (Factory configured, do not change)
	J4 A	<u>OPEN</u>	Factory configured, do not change
	J5 A	<u>CLOSE</u>	Factory configured, do not change
	J5 B	<u>OPEN</u>	Factory configured, do not change
	J4 B	<u>CLOSE</u>	Factory configured, do not change
	J2 – J11 A	<u>CLOSE</u>	RS422
	J2 – J11 B	<u>OPEN</u>	
	J2 – J11 A	<u>OPEN</u>	RS232
	J2 – J11 B	<u>CLOSE</u>	

# Chapter 5

## Replacement Parts

### General

This chapter provides information about service, repair, and replacement parts for your Thermo Scientific product. It includes the telephone numbers for various departments at Thermo Scientific, the procedure for ordering replacement parts, a Return Material Authorization Form, and the parts list for the product are also included in this chapter.

The maintenance information in this manual is designed to meet your service needs. If you should encounter a problem that requires technical assistance, you may call Thermo Scientific Product Service at (800) 227-8891.

Thermo Scientific also provides on-site service technicians to assist customers with installation, setup, initial calibration, customer training, maintenance, and repair. Contact the Thermo Scientific Field Service department at the number given below for current rates and scheduling.

Thermo Scientific has repair centers located at the plant in Minneapolis, Minnesota. Products that need system checkout or repair can be returned to the plant with the Return Material Authorization (RMA) Form. Contact our Repair and Return department (800) 227-8891 to get an RMA number to use on the form.



**Note:** Have your machine model number and serial number available when you call.

Main Switchboard	(800) 227-8891
FAX	(763) 783-2525
Service	(800) 227-8891
Return Material Authorization & Repair	(800) 227-8891

Or any local Thermo Scientific office.

## Parts Ordering Information

For the fastest service when ordering parts, telephone or FAX the Thermo Scientific Parts Department at the numbers given below. Your regional field service representative can also assist you with parts orders.

The recommended procedure for ordering parts is:

1. Determine the broken or faulty part.
41. Locate the part in the Parts List.
42. Find the part number(s) for the item(s) you need.
43. Before you contact Thermo Scientific for your parts, make sure you have the following information:
  - 1 Machine model and serial number
  - 1 Purchase Order number
  - 1 Date Required
  - 1 Preferred shipping method
  - 1 Part number(s), description, and quantity needed.
  - 1 Telephone or FAX:

*Thermo Fisher Scientific*

Customer Service Department

501 90th Ave. NW

Minneapolis, MN 55433

FAX: (763) 783-2525

Phone: (800) 227-8891

Return Material Authorization and Repair: (800) 227-8891

# ThermoFisher SCIENTIFIC

501 90<sup>th</sup> Avenue N.W.  
Minneapolis MN 800-227-8891

Return Material Authorization  
RMA \_\_\_\_\_

(This RMA Number Must Be Marked On All Paperwork And On Outside Of Package)

Req'd. By: \_\_\_\_\_

Date: \_\_\_\_\_

Customer \_\_\_\_\_

Contact: \_\_\_\_\_

Phone: \_\_\_\_\_ ( ) \_\_\_\_\_

Area Code

Return, Freight Prepaid To:

Thermo Scientific

501 90<sup>th</sup> Avenue N.W.

Minneapolis, MN 55433

Bill To Customer #: \_\_\_\_\_ Ship To \_\_\_\_\_

Returned From: \_\_\_\_\_ Return To: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Description Of Material Being Returned:

\_\_\_\_\_

Describe Equipment Malfunction Or Defect, If Any; Symptoms:

\_\_\_\_\_

Minimum Charge

Informed Customer of

Inspection Charge Per Item

Service Requested:

Repair & Return

Estimate P.O. Required No.: \_\_\_\_\_

Return for Credit

Original P.O. or Thermo Scientific Order No.: \_\_\_\_\_

Warranty Repair or Replacement

Serial No: \_\_\_\_\_

Return Warranty/Exchange Unit

Shipped on Thermo Scientific Order No.: \_\_\_\_\_

Other: \_\_\_\_\_

Disposition/Comments: (Thermo Scientific Internal Use Only)

\_\_\_\_\_

\_\_\_\_\_



501 90<sup>th</sup> Avenue NW Minneapolis, MN 55433  
(763) 783-2500 Fax (763) 780-1537

**Foreign Customer Repair Authorization**

**Please complete the following regarding equipment that will be returned for repair**

Contact Name: \_\_\_\_\_ Telephone 011- \_\_\_\_\_  
(country code) (telephone number)

Company Name: \_\_\_\_\_

Fax 011- \_\_\_\_\_ - \_\_\_\_\_ E-mail: \_\_\_\_\_  
(country code) (fax number)

Billing Address: \_\_\_\_\_  
\_\_\_\_\_

Purchase Order No. (required): \_\_\_\_\_

Equipment Type: \_\_\_\_\_ Serial No. \_\_\_\_\_

Description of problem: \_\_\_\_\_

**Shipping Method (Please check one option):**

Thermo Scientific sends good direct to customer. Thermo Scientific determines shipping method and carrier. Charges will be prepaid by Thermo Scientific and customer will be invoiced for charges. Truck and/or air freight will always be utilized unless customer arranges shipment

Thermo Scientific sends goods to customer's designated freight forwarder. Charges for inland freight to U.S. port will be prepaid by Thermo Scientific and customer will be invoiced for charges.

Shipping Address: \_\_\_\_\_ Freight forwarder?  Yes  No

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Attn: \_\_\_\_\_ Telephone \_\_\_\_\_

Copies of shipping documents should be sent to the following individual via e-mail or fax. Originals will be sent to the billing address above via regular mail

Contact Name: \_\_\_\_\_

Fax 011- \_\_\_\_\_ - \_\_\_\_\_ E-mail: \_\_\_\_\_  
(country code) (telephone number)

**Important Notice:**

Shipment requests will be processed according to this document, which must be fully completed prior to issuance of a Return Material Authorization (RMA) number. Shipping documents will be sent as requested to the individual above upon shipment of goods from Thermo Fisher Scientific plant in Minneapolis, MN. Thereafter, Thermo Scientific bears no responsibility for charges associated with customs clearance or warehouse charges due to customer failure to liberate goods from customs.

**This completed form should be faxed to: Attn: Customer Service fax (763) 780-1537**

**Phone/Fax for  
Thermo  
Scientific  
Offices****Argentina**

+54 (0) 11 4 334 3827  
+54 (0) 11 4 334 9159 fax

**Australia**

+61 (0) 8 8150-5300  
+61 (0) 8 8234-5882 fax

**Canada**

+1 (905) 888-8808  
+1 (905) 888-8828 fax

**Chile**

+56 (0) 2 335 3388  
+56 (0) 2 335 1590 fax

**China**

+86 (0) 21 5465 7588  
+86 (0) 21 6445 7830 fax

**France**

+33 (0) 1 60 92 48 00  
+33 (0) 1 60 92 49 00 fax

**Germany**

+49 (0) 208-824930  
+49 (0) 208-852310 fax

**India**

+91 (0) 20-4011245  
+91 (0) 20-26125739 fax

**Italy**

+39 02-959514-1  
+39 02-953200-15 fax

**Malaysia**

+60 (0) 3 2300 1626  
+60 (0) 3 2300 1636 fax

**Mexico**

+52 (01) 55 5638 0237  
+52 (01) 55 5639 2227 fax

**Netherlands**

+31 (0) 33-454-9000  
+31 (0) 33-454-9009 fax

**Poland**

+48 (0) 22848 3708 phone and  
fax

**South Africa**

+27 (0) 11-609-3101  
+27 (0) 11-609-3110 fax

**Spain**

+34 91-484-5949  
+34 91-661-5572 fax

**United Kingdom**

+44 (0) 1788-820300  
+44 (0) 1788-820301 fax

**United States**

+1 (877) 290-7422  
+1 (763) 783-2525 fax

## Parts List

<u>Equipment</u>	<u>Part Number</u>
Strain Sensor, .5 M	083042
Fuse, .3 Amp Slo Blo	046636
Control Digital C-Level, Panel Mount, Model 11-100 without Input/Output	046633
Control, Digital C-Level, Panel Mount, Model Mini 11-100 with Input/Output	046634
Current Output Board, Panel Mount	046635
Control, Digital C-Level, Field Mount, Model 11-100F without Serial Output	051031
Control, Digital C-Level, Field Mount Model 11-100F-07 with Serial Output	051032