9321

Load Cell Signal Converter

Factory Numbers 9321-0001, 0002, 0003

Service Manual

A90154700A
(8/97).02

Declaration of conformity
Konformitätserklärung
Déclaration de conformité
Declaración de Conformidad
Verklaring de overeenstemming
Dichiarazione di conformitá

We/Wir/Nous/WIJ/Noi: **Mettler-Toledo, Inc.**
1150 Dearborn Drive
Worthington, Ohio 43085
USA

declare under our sole responsibility that the product,
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dichiariamo sotto nostra unica responsabilitá, che il prodotto,

Model/Type: 9321-0001, 9321-0002 **Signal Converter**

to which this declaration relates is in conformity with the following standard(s) or other normative document(s).
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Auquel se réfère cette déclaration est conforme à la (aux) norme(s) ou au(x) document(s) normatif(s).
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Waarnaar deze verklaring verwijst, aan de volende norm(en) of richtlijn(en) beantwoordt.
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CE Conformity / CE-Konformität / Conformité CE
90/384/EU Nonautomatic Balances and Scales / Nichteselbsttätige Waagen / Balances à Functionnement non automatique
Article 1.2.b.
89/336/EU EMC Directive / EMU-Richtlinie / Directive concernant la CEM*
EN55022, B 01.04.87 Emissions / Funkstörungen
EN50081-1 Immunity
73/23/EU Low Voltage / Niederspannung / basse tension
EN61010 el. Safety / el. Sicherheit / sécurité el.

* When install per manufactures specifications detailed in the Technical Manual

Other Directives and Standards / Andere Richtlinien und Normen / Autres documents
corresponding to local requirements / entsprechend lokalen Anforderungen / correspondant aux exigences locales

UL	1950	el. Safety / el. Sicherheit / sécurité el. (if UL mark is applied)
CSA	C22.2 No. 950-M89	el. Safety / el. Sicherheit / sécurité el. (if CUL mark is applied)
FCC	Part 15, class A	Emissions / Funkstörungen (if FCC mark is applied)

Darrell Flocken, Manager - Weights & Measures
Office of Weights and Measures
Worthington, Ohio USA
November, 1995
Revised July, 1997 (added compliance to LVD Directive)

according to EN45014

INTRODUCTION

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

Information regarding METTLER TOLEDO technical training may be obtained by writing, calling, or faxing to:

METTLER TOLEDO
1900 Polaris Parkway
Columbus, Ohio 43240
Phone: (614) 438-4511
Fax: (614) 438-4158

CUSTOMER FEEDBACK

If you have a problem with this product, or just a suggestion on how we can serve you better, please fill out this form and send it to us. Your feedback will help us to improve product performance, quality and service. Mail to the address on the reverse, or fax to (614) 438-4355.

Your Name:	Date:
Organization Name:	Mettler Toledo Order Number
Address:	Part / Product Name:
	Part / Model Number:
	Serial Number:
Phone Number: ( ) Fax Number: ( )	Company Name of Installation:
E-mail Address:	Contact Name:
	Phone Number:

How well did this product meet your expectations in its intended use?	Comments:
☐ Met and exceeded my needs	
☐ Met all needs	
☐ Met most needs	
☐ Met some needs	
☐ Did not meet my needs	

PROBLEM:

UNACCEPTABLE DELIVERY:

- ☐ Shipped late
- ☐ Shipped early
- ☐ Shipped to incorrect location
- ☐ Other (Please Specify)

OUT OF BOX ERROR:

- ☐ Wrong item
- ☐ Wrong part
- ☐ Missing equipment
- ☐ Equipment failure

- ☐ Wrong documentation
- ☐ Missing documentation
- ☐ Incorrectly calibrated
- ☐ Other (Please specify)

Comments:

DO NOT WRITE IN SPACE BELOW; FOR METTLER TOLEDO USE ONLY

☐ Retail ☐ Light Industrial ☐ Heavy Industrial ☐ Systems

RESPONSE: Include Root Cause Analysis and Corrective Action Taken.

FOLD THIS FLAP FIRST

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Mettler-Toledo, Inc.
Quality Manager - MTWI
1150 Dearborn Drive
Worthington, OH 43085
USA

Please seal with tape.

PRECAUTIONS

READ this manual BEFORE operating or servicing this equipment.

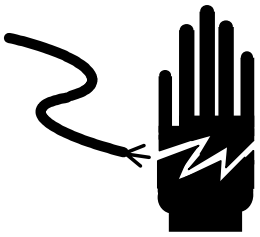
FOLLOW these instructions carefully.

SAVE this manual for future reference.

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

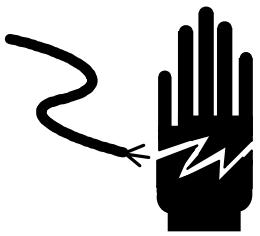
ALWAYS DISCONNECT this equipment from the power source before cleaning or performing maintenance.

CALL METTLER TOLEDO for parts, information, and service.



WARNING

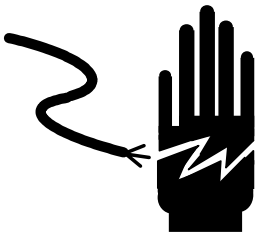
ONLY PERMIT QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.



WARNING

FOR CONTINUED PROTECTION AGAINST SHOCK HAZARD CONNECT TO PROPERLY GROUNDED OUTLET ONLY.

DO NOT REMOVE THE GROUND PRONG.



WARNING

DISCONNECT ALL POWER TO THIS UNIT BEFORE REMOVING THE FUSE OR SERVICING.

CAUTION

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

CAUTION

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

1 Introduction

The Mettler Toledo model 9321 load cell signal converter module is intended to be the electrical interface between a load cell (or group of cells) and the customer's process control equipment. Its purpose is to convert the load cell DC millivolt signal to a normalized 0 to 10 VDC or 4/20 mA signal fed into a remote analog input such as a programmable controller or chart recorder. As an option, up to two (2) setpoint control circuit boards may be added to provide two (2) relay dry contact "cutoffs" for process control. Typical cutoff applications include overload or low level signaling as well as low accuracy batch control.

The external power source may be either 120 VAC or 240 VAC internally converted to a load cell excitation voltage and 0-10 VDC and 4/20 mA power sources. This eliminates the need for an additional power source.

Models

Three basic models are offered, all with the same electrical characteristics, to satisfy various environments. They are 9321-0001 (NEMA 1), 9321-0002 (NEMA 4X), and 9321-0003 (NEMA 7/9).

Option Availability - Setpoints

The only standard option offered is setpoint control. There are two (2) setpoint control circuits provided on the standard PCB but each optional setpoint KOP provides a relay, label, hardware and installation instructions for mounting the relay to the rear of the standard PCB. Up to two (2) setpoint KOP’s can be accommodated.

	WARNING
	IF THIS DEVICE IS USED WITH AUTOMATIC OR MANUAL FILLING CYCLE EQUIPMENT, ALL USERS MUST PROVIDE A HARD WIRED EMERGENCY STOP CIRCUIT OUTSIDE DEVICE CIRCUITRY. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Service Training Information

	WARNING ONLY PERMIT QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS, AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON.

2 System Description

General

The 9321 logic is totally contained on a single printed circuit board and packaged three different ways:

- Sheet metal general purpose box.
- NEMA 4X waterproof box.
- NEMA 7/9 explosion proof cast aluminum box.

Printed Circuit Board

All logic is contained on a 5" (127mm) wide x 5½" (140mm) long circuit board. It consists of a power supply, input amplifier, span/zero amplifier, post amplifier active filter, 4/20 mA current loop output driver, 0-10 VDC output driver and setpoint control logic.

The power supply has a universal input that accepts either 120VAC or 240 VAC @ 50/60 Hz by changing the position of the plug-in fuses. It generates +26 VDC for the 4/20mA current loop, +12 VDC for the setpoint relay circuit and load cell excitation, +15 VDC regulated for all op-amps and ±5 VDC regulated for the reference logic.

The input amplifier is a differential, chopper stabilized circuit accepting the millivolt load cell signal and minimizing offset drift, thermal EMF effect and common mode noise disturbance.

The span/zero amplifier circuitry, comprised of US and ½ of U6, is a DC offset amplifier designed to inject a DC signal to "zero" the dead load signal. The zeroing is controlled by S1 and R11 which can zero up to 15mV of input signal (100% of a 2mV/V or 3mV/V cell @ 5V excitation or 50% of a 3mV/V cell @ 10 V excitation). The U6 span amplifier provides variable gain to accommodate a zero to full capacity net output from 10 to 100% of a 3mVN load cell @ 5V excitation. The normalized output range of this amplifier is 0 to +4 VDC which is then fed to the active filter.

The post amplifier active filter, comprised of the second half of U6, has a total circuit gain of 1. It does not amplify as such but instead acts as a 2 pole low pass filter to smooth out high frequency vibration that may be transmitted through the weighing mechanism to the load cell(s). A bypass is provided for

applications requiring vibration analysis. The filter output is then passed on to the four output circuits.

The current loop driver logic is a voltage to current converter with a sensitivity of 4mA output change/input volt from the filter. Therefore, an input change of 4 volts will produce an output change of 16mA. Combined with a zero offset of 4mA, a 4mA to 20mA output is achieved.

Note: This 0-10 VDC output should be used as the calibration reference because of offset cancellation circuit accuracy. Also many meters have reduced resolution for current input modes.

The 0-10 VDC output driver has a gain of 21 to produce a 10VDC output from the internal 4 VDC signal. It is referenced to circuit common and is zener clamped to prevent damage from external noise.

The setpoint control amplifiers provide two comparators with hysteresis to drive optional setpoint relays. Each of the two circuits are identical and operate in the following manner: The input voltage is compared to a variable reference voltage established by the setpoint potentiometer. When the input is less than the reference, the output energizes the relay. When the input is equal to, or exceeds the reference, the output de-energizes the relay. Hysteresis is built in to eliminate erratic threshold operation. (The drive control logic is built into the PCB logic but the relays themselves are optional and provided only when setpoint control is desired).

3 Specifications

Environment

Temperature Limits (Ambient)

Operating:	-10° to + 45°C -14° to +113°F)
Storage:	-40° to + 70°C (-40° to +158°F)
Relative Humidity:	Operating and Storage - 10% to 95% (non-condensing)

Atmospheric Classification

Model 9321-0001	NEMA 1 dust resistant
Model 9321-0002	NEMA 4X water proof/corrosion resistant
Model 9321-0003	NEMA 7/9 explosion proof Class I and 11 Division 1, Applicable Groups C, D, E, F, and G with an AIT rating of T6.

Electrical

Power Required

120 VAC + 1.0% 50/60 Hz .2 Amp
or
240 VAC + 10% 50/60 Hz .1 Amp

Fuses:	(2) .1 Amp slow blow 250V for 120V operation
	(1) .1 Amp slow blow 250V for 240V operation
Fuse Type:	Wickman type TR5-T #1 9374K

Strain Gage Parameters

Excitation:	5 VDC ± .1 V or 10 VDC + .2V (jumper selectable) 115 mA max.
	(8 - 350 cells @ 5V or 4 - 350 cells @ 10 V)
	(5 V operation **Mandatory** for hazardous area applications)
Regulation:	Differential constant excitation via remote sensing.

Remote Sense

Compensation Range:	Less than .1% of full scale span shift for 5 resistance change.
Signal Span Limits:	1 mV to 15 mV.
Signal Zero Balance Range:	0 to 15 mV.

Current Signal Output

Range:	4 to 20 mA with 150% overload limit (30 mA)
Load:	0 to 500 Ohms.
Configuration:	Internal 21 VDC source - output common to isolated circuit common.
Isolation:	4/20 mA common is part of logic common but the entire circuit “floats”, allowing ungrounded or grounded operation.
Noise:	Less than 1 mV RMS.

Voltage Signal Output:

Range:	0 - 10 VDC.
Load:	10,000 Ohms minimum.
Configuration:	Common connected to an isolated circuit common.
Noise:	Less than 500 µV.
Output Error Limits: (fixed temp. and AC line)	< .01% of full scale. (combined linearity, repeatability, hysteresis)
Warm-up Time:	10 minutes minimum.
Stability: (@ fixed input)	Span → < 40 PPM/ºC (temp.), < 40 PPM/V (AC line) Zero → < 100 PPM/ºC (temp.), < 500 PPM/V (AC line)

Standard Compliance

RFI Susceptibility:	Less than 200 PPM change for an RFI signal as follows: 3V/meter signal strength @ frequencies 27 and 460 MHz.
Static Discharge:	Less than 200 PPM change for 6 KV discharges to external surfaces.
MTBF:	17,500 hours minimum

Physical

Dimensions

9321-0001	6” (152 mm) high x 3 1/8” (79 mm) wide x 6” (152 mm) long (sheet metal box).
9321-0002	6” (152 mm) high x 3 1/8” (79 mm) wide x 6” (152 mm) long (sheet metal box (gasketed)).
9321-0003	7” (178 mm) high x 7 ¾” (197 mm) wide x 10 ½” (267 mm) long (cast aluminum box).
PCB Only	5” (127 mm) wide x 5 ½” (140 mm) long (excluding pot shafts and connector).

Weight

9321-0001	3.5 Ib (1.59 kg) - 5 lb (2.3 kg) Shipping
9321-0002	5 lb (2.27 kg) - 7.5 lb (3.4 kg) Shipping
9321-0003	14 lb (6.35 kg) - 20 lb (9.07 kg) Shipping

Factory Numbers

Model - Ram	NEMA Rating	Description
9321-0001	1	Sheet metal open type enclosure
9321-0002	4X	Waterproof enclosure
9321-0003	7/9	Cast aluminum explosion proof enclosure

4 Installation

Preliminary Inspection

Inspect the shipping container for loose and/or damaged parts. If any damage is found, notify the freight carrier immediately. Open the 9321 shipping carton and verify that all internal components are intact. The carton will contain the following:

Qty	Description
1	9321 Signal Converter Assembly
1	9321 Technical Manual
1	Warranty Card
3	3/4" (19 mm) Conduit Seal Fitting (9321-0003 Units only)

Opening Sheet Metal Enclosure Unit (9321-0001)

Turn the two ¼ turn fasteners counterclockwise (CCW) to release the cover from the base. Lift it straight up to remove. Inspect PCB and related parts for any signs of damage. Look for any loose parts or hardware within the enclosure. Take appropriate action.

Opening Stainless Enclosure Unit (9321-0002)

Turn the slotted fasteners on each end CCW ¼ turn until the catch is released. Remove the lid by lifting straight up. Inspect the PCB and enclosure bottom for loose or broken items.

Opening Cast Aluminum Unit (9321-0003)

Note: The threads will seize if not lubricated. It is important not to force removal or insertion. Always be sure that threads are lubricated before re-assembly. Inspect the interior for signs of damage. Take appropriate action.

Rotate (unscrew) the lid CCW until it comes off. Lightly tap the lid protrusions to start it if necessary. **Do Not Force It Off**. If the lid does not start to unscrew with light tapping, further “pounding” will only make it worse - return the assembly for a replacement.

Internal Fuse Arrangements

Be sure to check the internal fuse arrangement on the PCB. All units, unless specified otherwise by special order, are shipped with fuses F1 and F2 installed for 120 VAC, 50/60 Hz operation. If 240 VAC, 50/60 Hz operation is desired, remove F1 and F2. Then install one of the removed fuses in the location for F3. Keep the extra fuse for a spare. **Do not install in either F1 or F2 locations on the PCB**. All fuses are 0.1 amp Slo-Blo 250V units and are interchangeable.

CAUTION

DO NOT APPLY POWER TO THE **9321** UNTIL THE AC SUPPLY VOLTAGE DETAILS ARE KNOWN AND PROPER FUSE SELECTION HAS BEEN MADE

Options

The setpoint KOP(s) is the only option available and is identical for all three models. Follow in detail the instructions provided with the kit. Each kit (maximum 2) is installed to the rear of the PCB on the studs provided. The external wiring is made directly to the terminals on each setpoint PCB. If service of the main PCB is required, it is suggested to remove the setpoint PCB from the main PCB leaving the setpoint PCB external wiring in tact. See the Service/Maintenance section for details.

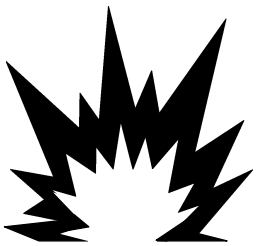
WARNING

IF THIS DEVICE IS USED WITH AUTOMATIC OR MANUAL FILLING CYCLE EQUIPMENT, ALL USERS MUST PROVIDE A HARD WIRED EMERGENCY STOP CIRCUIT OUTSIDE THE DEVICE CIRCUITRY. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Mounting

Each of the three different models has its own mounting requirements. Follow the guidelines below for each different model installed.

Sheet Metal Enclosure (0921-0001)



WARNING

DO NOT MOUNT THIS MODULE IN A HAZARDOUS ENVIRONMENT. THIS ENCLOSURE IS NOT RATED TO OPERATE IN EXPLOSIVE ENVIRONMENTS. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

This unit is intended to be mounted within another enclosure along with other items in a system or as a stand alone device in a controlled non-hazardous dust free environment. The compact design allows mounting in confined locations as long as temperature rise is taken into account. Avoid locating this unit in close proximity to other heat producing equipment for high reliability and performance. An ambient environment of 25°C (77°F) or less will provide the longest life expectancy.

Humidity considerations are important also. Levels below approximately 30% RH tend to increase the risk of static charge damage by handling along with abnormal dust accumulation. On the other hand, humidity levels above approximately 80% will increase corrosion contamination when small amounts of sulfides or chlorides are present in the atmosphere. Repeated temperature cycling under high RH conditions will cause small amounts of condensation to form on the PCB reducing its insulating properties over time. Frequent recalibration efforts may result.

In general, for best overall results:

- Keep ambient temperature below 25°C (77°F).
- Keep humidity between 30% and 80% RH.
- Minimize vibration.
- Minimize environmental contaminants.

To mount the unit, remove cover and gently rock PCB while pulling firmly away from the connector to remove it. Place PCB in a bag and set it and the cover aside in a safe location.

The base may be mounted in any desired plane. However, vertical mounting with connector pin #1 at the top (external wiring to the right) is preferred. The base is provided with (4) teardrop holes 1 ½" x 45/8" (30.5 mm x 117.5 mm) apart for #8 or #10 screws. See Figure 4-a for details.

All external wiring and installation practices must conform to the latest version of National Electrical Code(s) or local code(s) whichever is more stringent. Use #14 AWG 300V(minimum) wire if individual wires are used or at least #20 AWG cable.

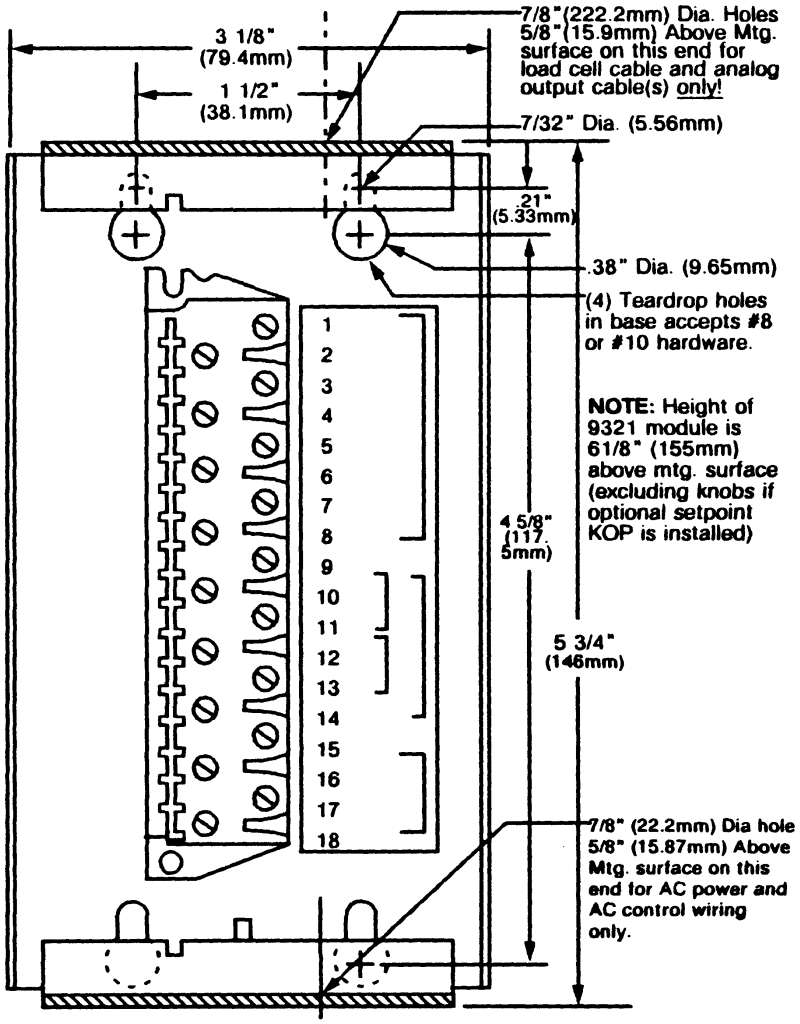
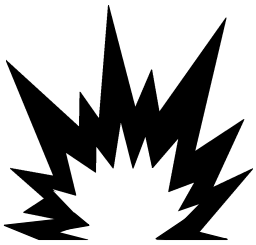


Figure 4-a: Sheet Metal Base Mounting Details (Inside view with cover and PCB removed)

Stainless Steel NEMA 4X Enclosure (9321-0002)

This gasketed stainless steel box withstands the harsh industrial environments encountered in washdown and/or corrosion atmospheres corresponding to NEMA specifications for types 4, 4X, and 12.



WARNING

DO NOT MOUNT THIS MODULE IN A HAZARDOUS ENVIRONMENT. THIS ENCLOSURE IS NOT RATED TO OPERATE IN EXPLOSIVE ENVIRONMENTS. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

It is intended to be surface (wall) mounted. Temperature, humidity, and atmospheric considerations mentioned in 4.3.1 above are important but, because of the sealed nature of this enclosure, they become minor considerations.

To mount the unit, use #8 to ¼"(6 mm) mounting hardware to hold the flange to the intended mounting surface. See Figure 4-b below for dimensional details.

All external wiring and installation practices must conform to the latest version of the National Electrical Code or Local Codes) whichever is more stringent. Use at least #14 AWG, 300V (minimum) wire if individual wires are used for power and AC control or at least A20 AWG cable.

Note: Height of 9321 module is 6.25" (16 mm) above mounting surface.

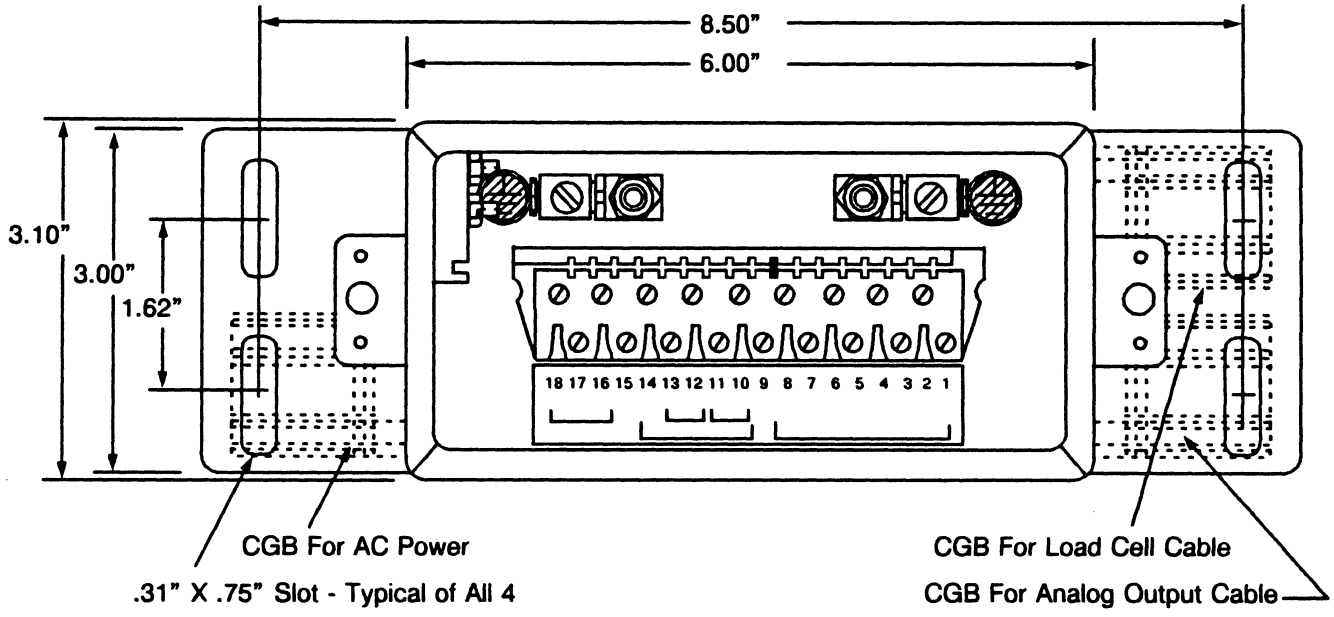


Figure 4-b: Stainless Steel Enclosure Mounting Details (Inside view with cover removed)

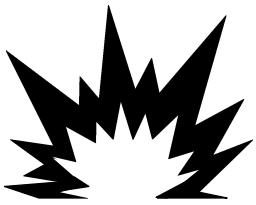
Cast Aluminum Enclosure (9321-0003)

This is an explosion proof cast aluminum box with a screw type circular lid specifically designed for operation within a hazardous environment as qualified per NEMA 7 or NEMA 9 specifications.

Location

The NEC (National Electrical Code) recommends that every effort be made to keep dangerous parts out of hazardous areas where practical. Therefore locate this module outside of the hazardous location or in a Division 2 area (hazard not normally present) if possible. When it is necessary to locate this module within the hazardous area be absolutely certain that the intended location is within the following parameters.

This module is approved for use in Class I and Class 11, Division 1, applicable Groups C, D, E, F, and G hazardous locations only. The AIT temperature rating is To. Do not mount this module In an environment more severe than the above qualification.



WARNING

DO NOT PERFORM INSTALLATION OR SERVICE BEFORE THE HAZARDOUS AREA HAS BEEN SECURED BY THE RESPONSIBLE CUSTOMER OR HIS AUTHORIZED PERSONNEL.

WARNING

THIS MODULE AND ITS ASSOCIATED EQUIPMENT MUST BE INSTALLED, ADJUSTED, AND MAINTAINED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL EQUIPMENT IN THE SYSTEM AND THE POTENTIAL HAZARDS INVOLVED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

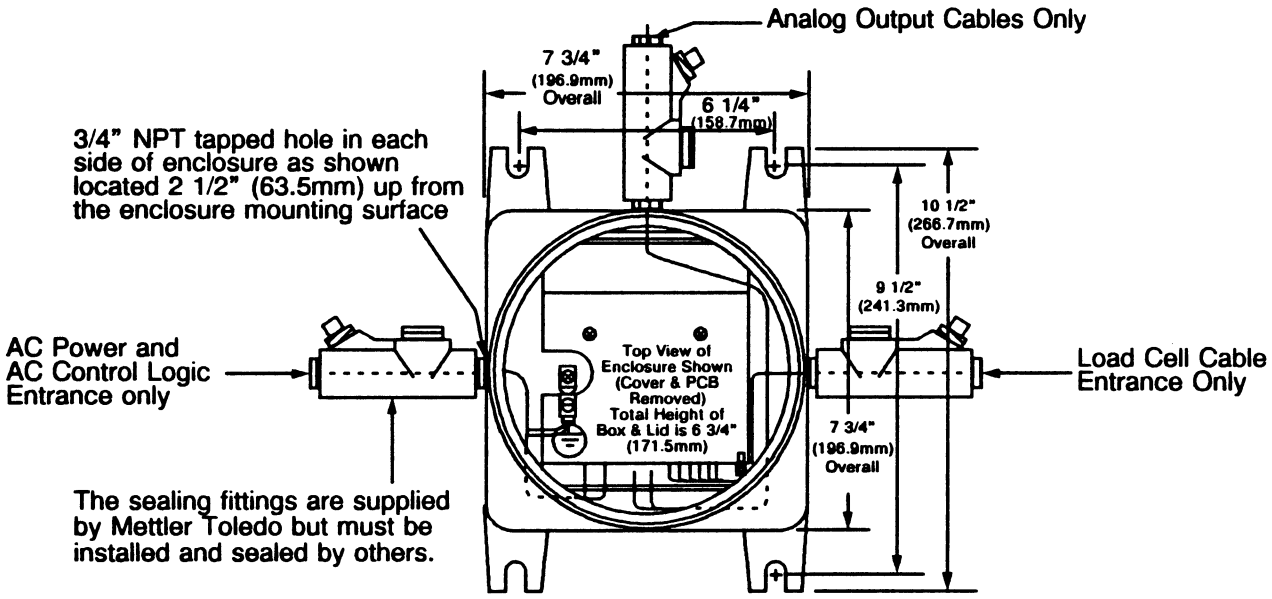


Figure 4-c: Explosion Proof Enclosure Mounting Details

Mounting

After the area is classified as non-hazardous, mount the unit to an electrically conductive surface with 3/8" mounting hardware. All electrical connections must be made with approved explosion proof conduit for the intended application. 3" NPT conduit sealing fittings provided by Mettler Toledo must be installed in each conduit going to the enclosure. Each sealing fitting must be located within 18" (0.46 m) of the enclosure and properly sealed by equipment installer. See Figure 4-c for details.

Power Wiring

Remove cover and PCB same as detailed in Section 4.1.3. Store in a protected location. After installation of conduits, connect the AC power using (2) #14 AWG, 300V (minimum) wires to terminal strip lugs 16 and 18 inside the enclosure and a #14 AWG (minimum) green or green/yellow wire from distribution box ground lug to enclosure ground lug provided.

Environment

*Note: The environment illustrated in the table applies to the 9321 module only. If load cells are located in a hazardous area, an intrinsic safe barrier (HAP module) is always required.

Below is a summary of the applicable environments that are acceptable for a given 9321 model type for reference only.

Non-Hazardous Environment*		
NEMA Type	**Brief Description**	**Signal Converter Applicable Model-Ram**
1	Indoor - General purpose protection against limited falling dust/dirt	9321-0001
2	Indoor - Protection against limited falling water and dirt	9321-0002
3	Outdoor - Protection against falling rain, splashing, or host directed water	
4	Indoor/Outdoor - Protection against falling rain, splashing, or hose directed water	
4X	Same as Type 4, plus corrosion resistant	
12	Indoor - Protection against dust, dirt, flying fiber, dripping water, non-corrosive liquids	
Hazardous Environment*		
7	Indoor - NEC Class I, Groups C and D. Hazardous/vapor proof	9321-0003
9	Indoor - NEC Class II, Groups E, F, & G. Hazardous dust.	

Table 4-a: NEMA Enclosure Reference

Load Cell Connections

The load cells must be connected to the input terminals 1-8. Up to (8) 350 Ohm full bridge strain gages may be connected in parallel (5V excitation with non-intrinsic safe installations). If load cell operation within a hazardous area is anticipated, an intrinsic safe barrier between the signal converter and the load cells **MUST** be utilized (4 load cells maximum). The excitation voltage supplied by the signal converter is **NOT** intrinsic safe. Mettler Toledo recommends using the Hazardous Area Protection Module (HAP) for intrinsic safe applications.

Load Cell Selection

Before any load cells are connected, first determine if the intended load cells will work correctly. Listed below are the main selection criteria for a stable system.

- Select the excitation voltage - 5 VDC or 10 VDC.
- **Use 5V** for all applications where the net full scale load cell signal is greater than 2 mV.
- Use 10V only when the load cell signal is between 1 and 2 mV (with 5V excitation) and the cells are **NOT** in a hazardous area.

CAUTION
DO NOT USE 10V EXCITATION IN CONJUNCTION WITH THE METTLER TOLEDO HAP MODULE. DAMAGE TO THE HAP MODULE MAY RESULT

Calculate load cell signal output.

Step 1) First find:

a) Full scale system capacity.

Example: If 0-10,000 = lb for 0-l0 VDC output, then 10,000 = Capacity

b) Capacity of each load cell (from nameplate)

c) Output rating of each load cell in mV/V (from nameplate)

d) Excitation voltage (5V or 10V).

e) Bridge resistance of each load cell (from nameplate)

Step 2) Calculate parallel resistance of load cells):

a) Divide bridge resistance by number of cells.

Example: $\frac{350 \quad /\text{cell} = 43.75}{\text{cells}}$

b) If resistance 43.7S for 5V excitation or
87.50 for 10V excitation, proceed to Step 3.

If not, select different load cells.

Step 3) Calculate full scale mV output with the following formula:

mV = System Capacity X Cell Cutout Rating X Excitation Voltage
Load Cell Capacity X Number of Cells

Example: Weighing Range = 1 0,000 lb
Cell output Rating = 2 mV/V
Capacity of Each Cell = 5000 lb
Number of Cells = 4
Excitation Voltage = 5V

mV = 10,000 lb X 2 mV/V X 5V = 100.000 = 5 mV
5000 lb X 4 Cells 20,000

Step 4) Refer to chart below for acceptance guide.

(5 mV is acceptable proceed).

Number of 350 Bridge Load Cells	Total Load Cell Capacity (%)		Use Excitation Voltage	Net Load Cell Signal Obtained For:		Notes
	Initial	Span		2 mV/V Cell	3 mV/V Cell	
1 - 4	0 - 90%	10%	10V Only	2.0 mV	3.0 mV	Non-HAP Only
1 - 8	0 - 90%	10%	5V	1.0 mV	1.5 mV	HAP or Non-HAP Use
1 - 8	0 - 80%	20%	5V	2.0 mV	3.0 mV	HAP or Non-HAP Use
1 - 8	0 - 70%	30%	5V	3.0 mV	4.5 mV	HAP or Non-HAP Use
1 - 8	0 - 60%	40%	5V	4.0 mV	6.0 mV	HAP or Non-HAP Use
1 - 8	0 - 50%	50%	5V	5.0 mV	7.5 mV	HAP or Non-HAP Use
1 - 8	0 - 40%	60%	5V	6.0 mV	9.0 mV	HAP or Non-HAP Use
1 - 8	0 - 30%	70%	5V	7.0 mV	10.5 mV	HAP or Non-HAP Use
1 - 8	0 - 20%	80%	5V	8.0 mV	12.0 mV	HAP or Non-HAP Use
1 - 8	0 - 10%	90%	5V	9.0 mV	13.5 mV	HAP or Non-HAP Use
1 - 8	0%	100%	5V	10.0 mV	15.0 mV	HAP or Non-HAP Use

Table 4-b: Load Cell Capacity Chart

Load Cell Cable Requirements

All load cell cables must be shielded to prevent foreign electrical noise and RF signals from disturbing the microvolt signals generated by load cells. Mettler Toledo has found that the use of dual shielded cables dramatically improves the overall system performance and reliability. Therefore, the following diagrams make reference only to dual shielded cables. If the customer chooses to use single shield cables, performance will be degraded, but the extent will be highly dependent upon the conditions at each installation. If single shield cable is used, treat the shield as the inner shield on the following diagrams. Also, if possible, run an extra wire with single shielded cables and treat this extra wire as the outer shield.

Mettler Toledo has basically two (2) different cabin types for all systems: 20 AWG and 16 AWG conductors where the conductor color and quantity remain the same. Use the table below as a guide to proper cable use.

Mettler Toledo Part Number	**Cable Type**	**Outer Jacket**		**Wire Color**	**Assigned Designation**	**Maximum Recommended Length**
		Diameter	**Type**			
540620370	6 Conductor #20 Gauge Dual Shield	.375 ± .015	Polyurethane	Green Black White	+Signal -Signal +Excitation	300 ft. (1-8 350 Cells) 1500 ft. (4 350 Cells)
540616370	6 Conductor #16 Gauge Dual Shield	.434 ± .015	Polyurethane	Blue Yellow Red	- Excitation +Sense -Sense	750 ft. (8 350 Cells)

Table 4-c: Cable Types

Single Load Cell Wiring (Non-Hazardous)

If a single load cell is wired to the signal converter, follow the diagrams below.

Note: When a four wire load cell is used, jumper the 9321 terminals 5-6 and 7-8 as shown in Figure 4-d to insure correct operation.

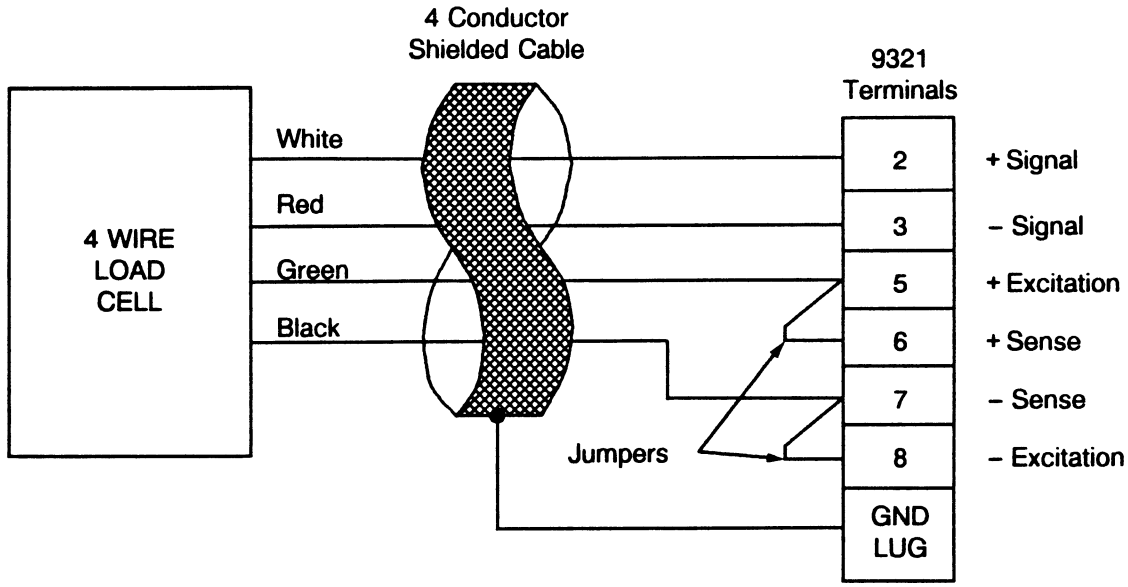


Figure 4-d: Four Wire Load Cell

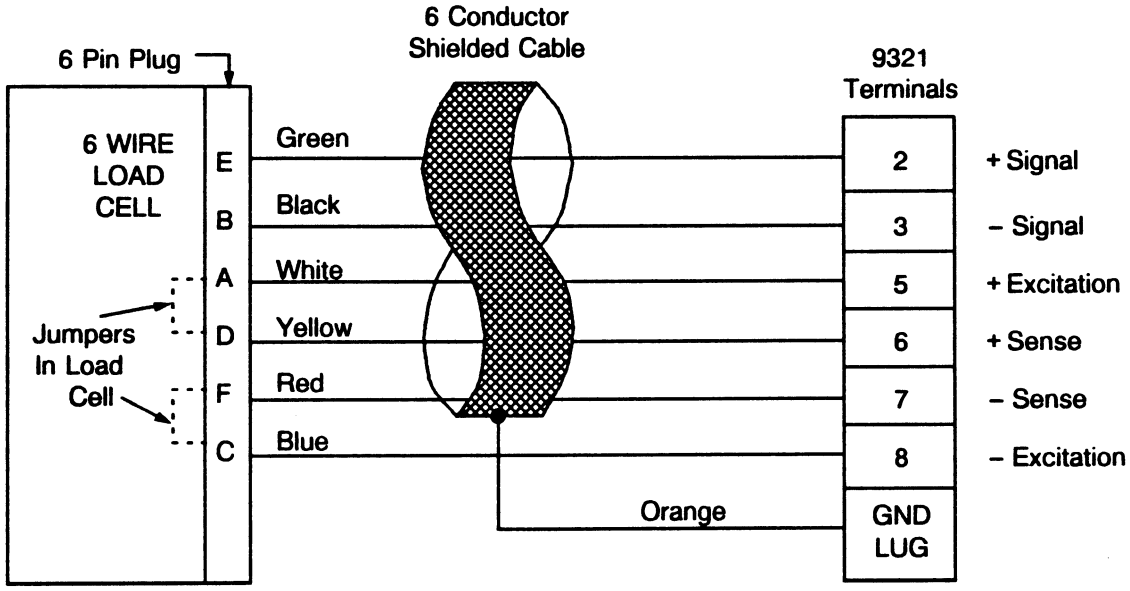


Figure 4-e: Six Wire Load Cell

Single Load Cell Junction Box Wiring (Non-Hazardous)

Situations exist for which the cable length supplied with a given load cell is insufficient to reach to the 9321. In most cases it is impractical to buy a load cell with the exact cable length. Therefore, a junction box is required to connect standard load cell cable(s) to a custom length of cable to the 9321. Mettler Toledo offers a small junction box with a single set of terminals for this purpose which is detailed below.

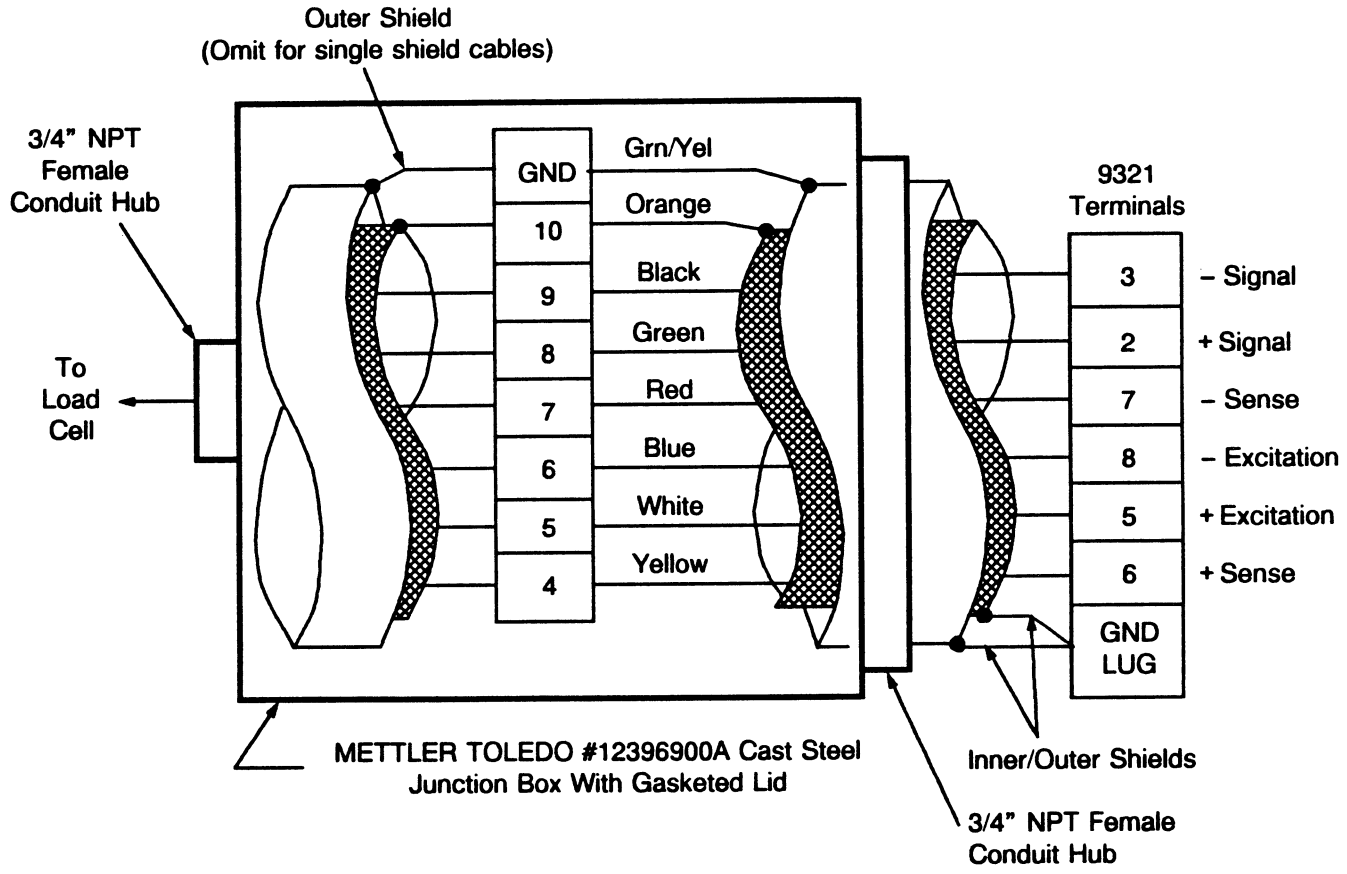


Figure 4-f: Single Load Cell Junction Box Wiring

Multiple Load Cell Junction Box Wiring (Non-Hazardous)

If multiple load cells are wired into the 9321, make sure that the total parallel resistance of all cells in the system is not less than 43.75 (5V excitation) or 87.50 (10V excitation). Since all cells must be wired in parallel, a junction box is needed. Mettler Toledo manufactures a number of these boxes to conveniently connect all load cell wires. In general, all combinations are wired like this:

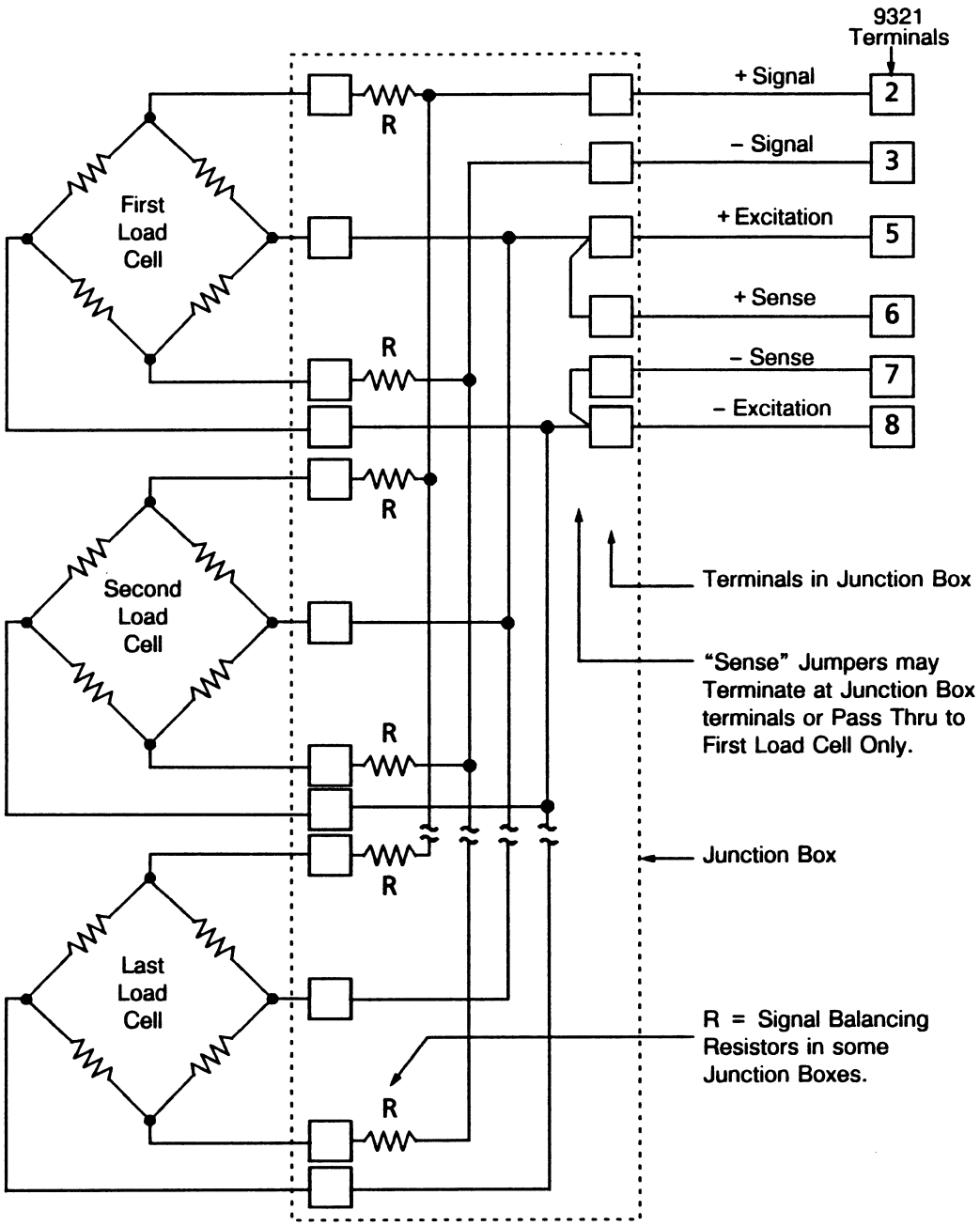


Figure 4-g: Multiple Load Cell Wiring

Low Profile Junction Box (Old Type - 4 Cells Maximum)

Terminal strip TB1 is the output terminal strip to the 9321 wired as shown below.

Terminal strips TB2 and TB3 are the connections for the load cells wired as described in Table 4-d.

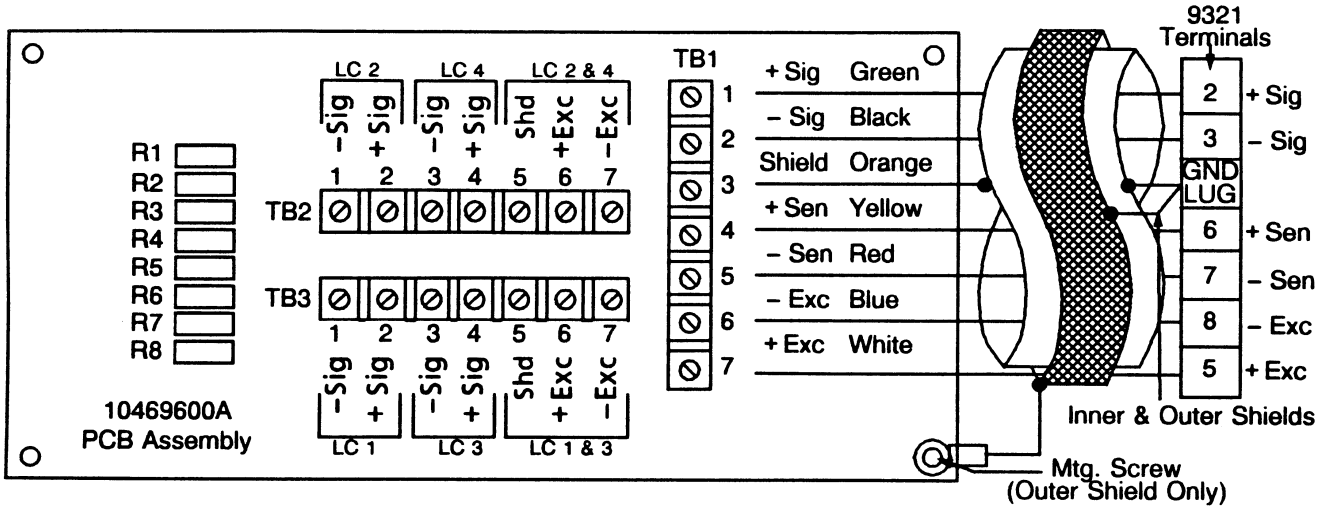


Figure 4-h: Low Profile Style Junction Box (Old Type)

Terminal	TB2 Description	TB3 Description
1	- Signal L/C 2	- Signal L/C 1
2	+Signal L/C 2	+Signal L/C 1
3	- Signal L/C 4	- Signal L/C 3
4	+Signal L/C 4	+Signal L/C 3
5*	Shield Wires	Shield Wires
6**	+Excitation L/C 2 and 4	+Excitation L/C 1 and 3
7**	- Excitation L/C 2 and 4	- Excitation L/C 1 and 3

Table 4-d: TB2/TB3 Terminal Descriptions

* A load cell shield connection is not required when all load cells are contained within one steel understructure.

** Terminals 6 and 7 will each have two wires connected to them. one wire will go to each load cell supplied.

Note: Mettler Toledo uses a dual shield cable for most installations. The outer shield (green with yellow stripe) connects to chassis ground in the junction box, and to chassis ground on the 9321. The inner shield (orange wire) is connected as shown in Figure 4.8. Note that sense leads are not connected.

Low Profile Style Junction Box (New Type - 8 Cells Maximum with 2 Boxes)

The new style junction box illustrated below is used in the Model 2158 floor scale and various Flexmount assemblies offered by Masstron division. It is very similar to the old style box and is electrically interchangeable. The main differences are:

1. There are no jumpers on the new style PCB. If shift compensation is not required, simply rotate all potentiometers to the full COW position.
2. The new PCB has an added terminal strip (TB1) to allow connection of an additional junction box if required.
3. The old PCB required combining load cells 2 and 4 on TB2 and load cells 1 and 3 on TB3. The new PCB has terminal strips for each of up to four (4) load cells.

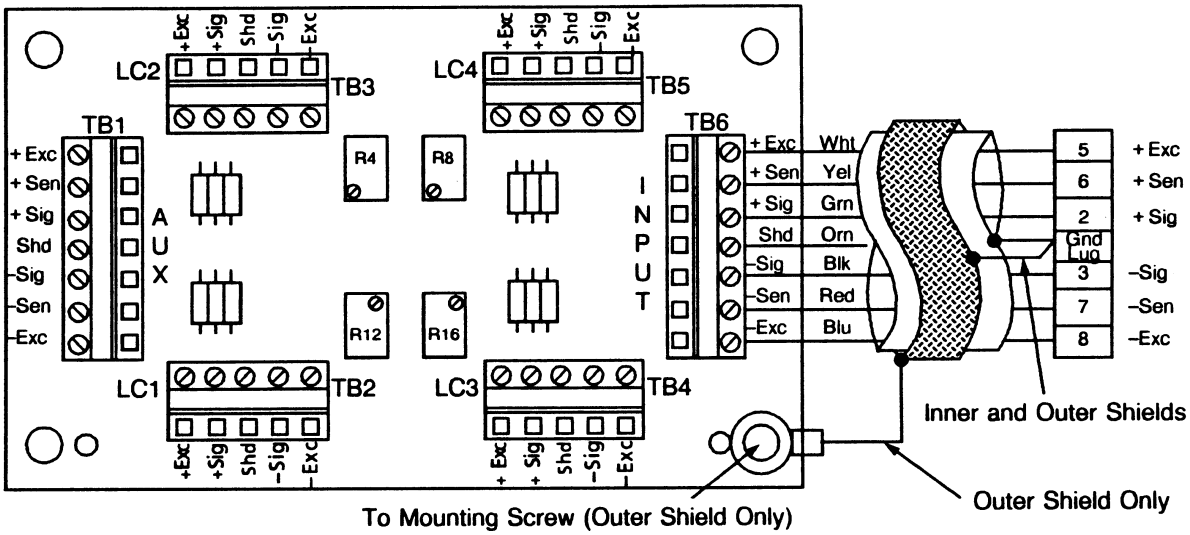


Figure 4-i: Low Profile Style Junction Box (New Type)

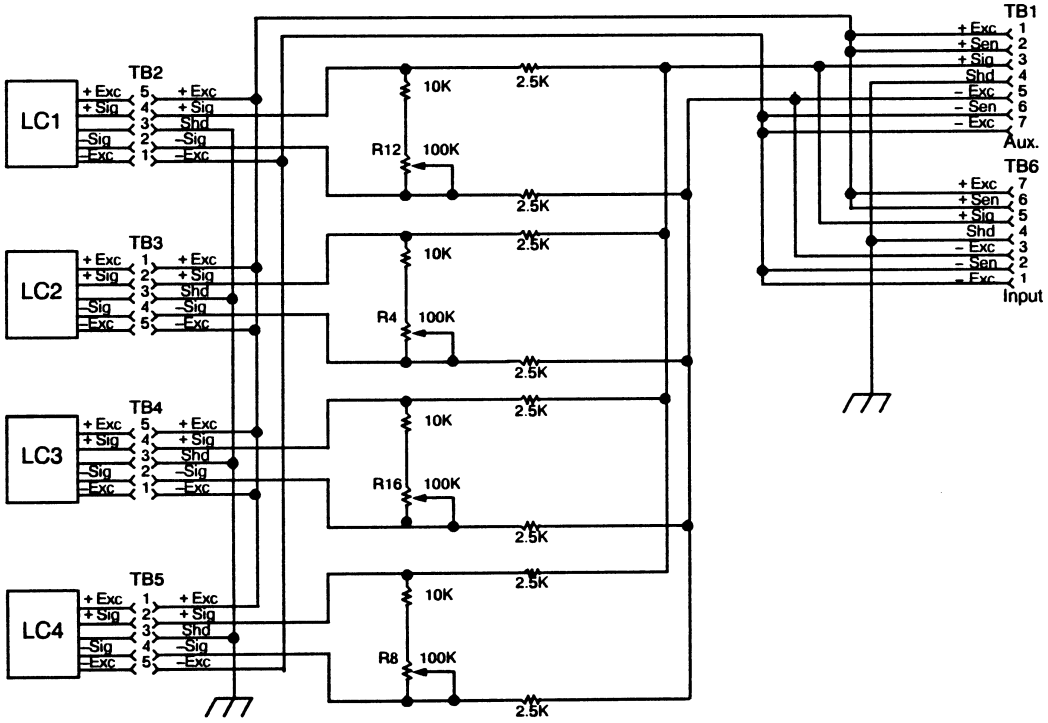


Figure 4-j: New Load Profile Junction Box Schematic

Vehicle Junction Box (8 Cells Maximum with 2 Junction Boxes)

TB105 is the input terminal strip that another junction box output would connect to if multiple junction boxes were required. The wiring is the same as TB101 - TB104.

TB106 is the output terminal strip to the 9321.

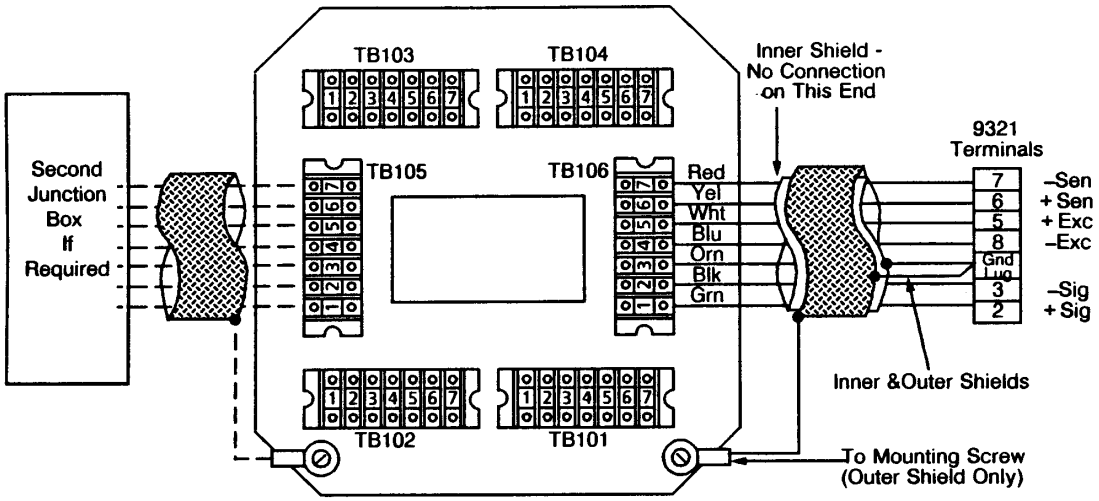


Figure 4-k: Vehicle Style Junction Box

TB101 Jumpers

Terminal TB101-104	Signal Description	Load Cell Cable Wire Color	
		6 Conductor	4 Conductor
1	+Signal	Green	White**
2	-Signal	Black	Red**
3	Shield	Orange	Orange
4	-Excitation	Blue	Black
5	+Excitation	White	Green
6*	+Sense	Yellow	N.C.
7*	-Sense	Red	N.C.

Table 4-e: TB101-104 Load Cell Connections

*If four wire load cells are used, install two jumpers on TB101. They must be placed from terminal 4-7 and from terminal 5-6 (not required with 6 wire cells). If four wire load cells are used, no wires will be connected to terminals 6 and 7 on TB102 - TB104.

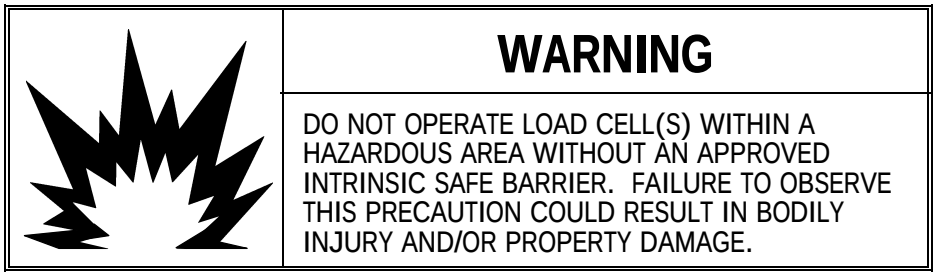
**Some load cells have reversed polarity signal leads if the cell is designed for either compression or tension operation. Reverse leads if signal decreases with applied load.

Load Cell Wiring (Hazardous Areas)

The load cell excitation source from the 9321 **IS NOT INTRINSIC SAFE**. If load cell operation in a hazardous area is desired, an approved intrinsic safe barrier must be employed.

Mettler Toledo recommends that the Hazardous Area Protection (HAP) module be used. The following details describe the HAP module wiring. Refer to intrinsic safety module Model 0901-0148 (USA) or 0901-0197 (Canada) publication #B11816400A installation instructions. Contained in the above publication is a complete installation diagram for load cell(s) to instrument connections. The figure below is a brief summary of the connection details to the 9321 instrument. Refer to drawings 103998 and 103997 for complete details.

Important! Sense wiring must be connected as shown below to prevent possible damage to a the HAP module.



WARNING

DO NOT OPERATE LOAD CELL(S) WITHIN A HAZARDOUS AREA WITHOUT AN APPROVED INTRINSIC SAFE BARRIER. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

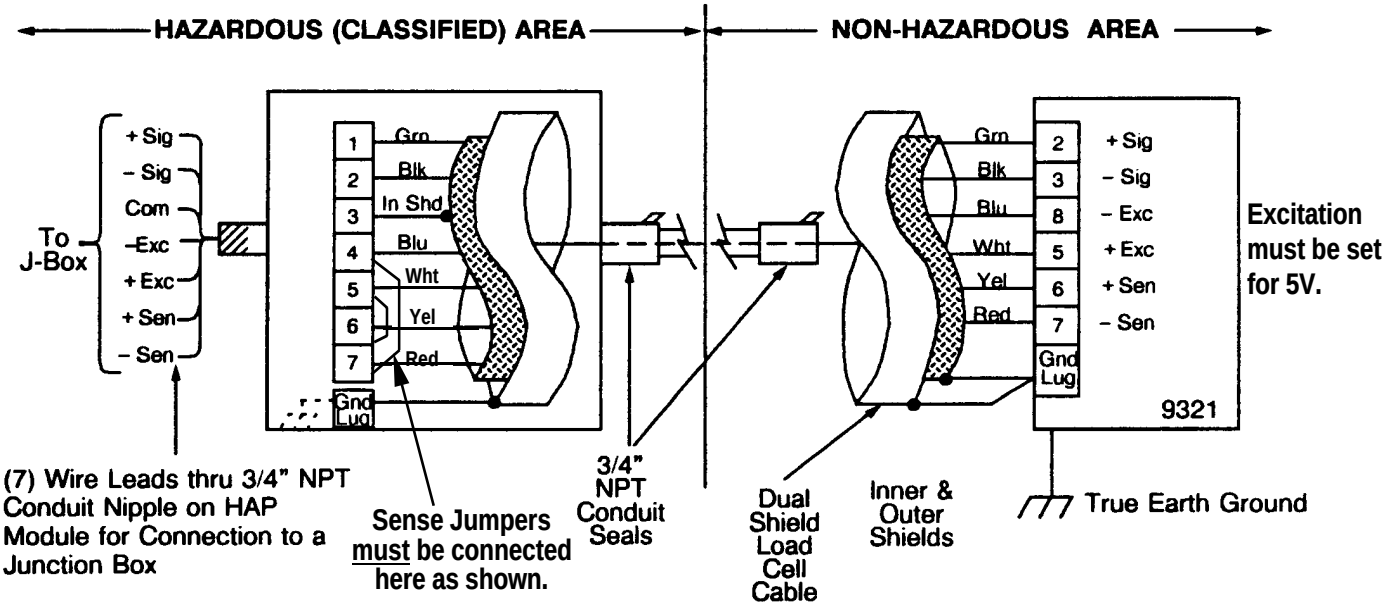
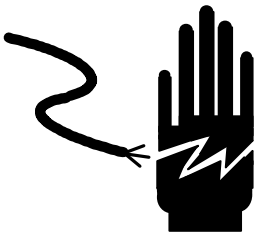


Figure 4-I: HAP Module Wiring to 9321

AC Power Requirements

The 9321 can be powered from either 120 VAC 50/60 Hz or 240 VAC 50/60 Hz by changing the fuse placement. All fuses are 0.1 Amp slow blow plug in types, arranged to provide either series or parallel transformer primary connections to accommodate either 120V or 240V operation.



WARNING

DISCONNECT ALL POWER TO THIS UNIT BEFORE REMOVING THE FUSE OR SERVICING.

Plug in Fuses F1 and F2 for 120 VAC operation or remove F1 and F2 and plug in F3 for 240 VAC operation. See Figure 7-a for fuse location details.

Incoming Power

The incoming power source must be clean and free from electrical noise bursts, line spikes and voltage excursions normally found in industrial environments. Although the amplifier circuitry contained within the 9321 does not contain digital electronics or memory elements which are typically susceptible to poor incoming power, a clean noise free power source adds considerable reliability to the 9321. Exceptionally noisy or poorly regulated power lines may require a dedicated circuit or power line conditioner.

Line Voltage Variation Limits

The Model 9321 meets NIST H-44, Canada Gazette Part 1, and OIML-SP7/SP2 line voltage variation specifications as listed in Table 4-d.

Line Voltage Variation Specification	AC Line Voltage			Line Frequency in Hz		
	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
NIST H-44	100	120	130	59.9	60	60.5
Canadian	108	120	132	58.8	60	61.2
OIML-SP7/SP2	102 187 204	120 220 240	132 242 264	58.8 49.0 49.0	60 50 50	61.2 51.0 51.0

Table 4f: AC Line Power Voltage Variation Specification

Grounding

The 9321 requires a true earth ground for reliable operation. In addition to the green (or green/yellow) power line circuit ground wire from the distribution box to the 9321 chassis ground lug, a separate ground wire from the 9321 to a separate earth ground (ground stake or steel support member tied to a ground grid or equal) must be run. First, test the quality of the existing ground system by measuring the AC voltage between neutral (white wire) and ground at the source. If it's greater than 1.0 VAC it is inadequate and must be corrected before the separate earth ground connection is made.

Output Signal Connections

There are two (2) analog outputs available; 4/20 mA and 0-10V. Both may be used at the same time but keep in mind that they share the same circuit common potential. Therefore if the 4/20 mA line goes to a differential input in the connected device, the 0-10 VDC output may not be usable. The output signals are isolated only to the extent that the circuit common is not grounded allowing the customer to establish the ground reference in his equipment. To preserve this isolation, the load cell wiring which also shares the circuit common must not be grounded in any way (other than cable shields).

The output wiring must be kept separate from the AC power and control wiring. To accommodate this the 9321 is designed with AC/output terminations and load cell connections at opposite ends of the terminal strip. In addition, separate enclosure openings are provided to preserve separation. Don't violate this provision. Keep wires separate.

Important! Do not combine AC power and output signal wiring. The NEC prohibits AC power and low level signals sharing the same conduits. Reliability will be severely impaired.

Current Loop Wiring

The 4-20 mA current loop external wiring must be made with two conductor #20 AWG (min.) shielded cable. Use Mettler Toledo #51 0220160 (Belden #8759 or equal) and connect as illustrated below.

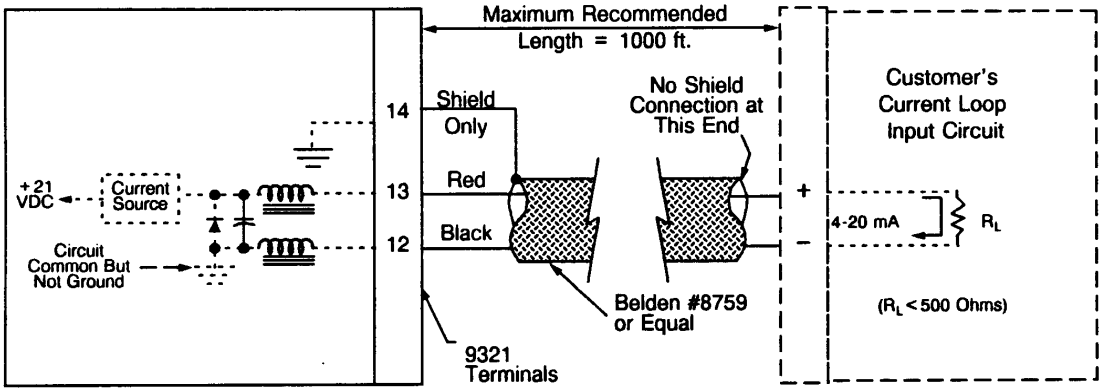


Table 4-m: 20 mA Current Loop Connections

Voltage Output Wiring

The 0-10 VDC external wiring must be made with two (2) conductor #20 AWG (min.) shielded cable. Use Mettler Toledo #510220160 (Belden #8759 or equal) and connect as illustrated below.

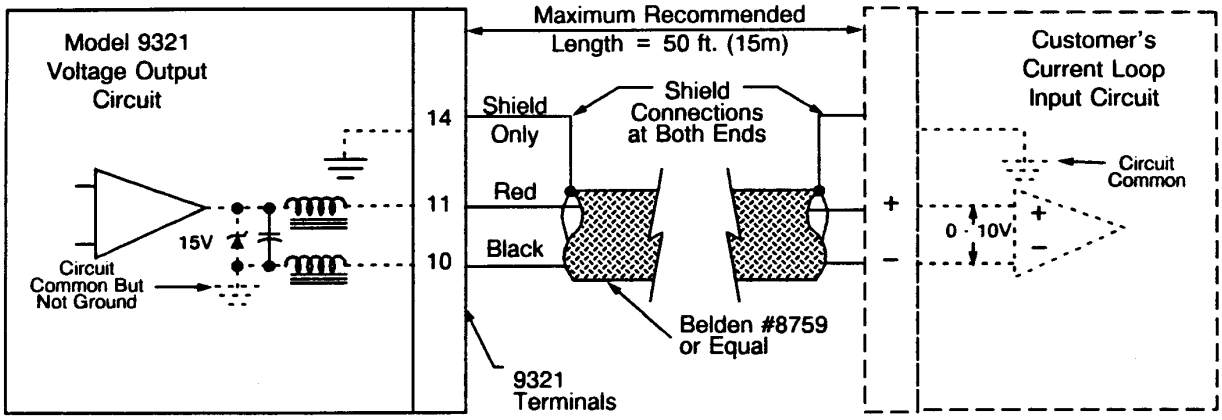


Figure 4-n: 0-10 VDC Voltage Connections

The voltage output is influenced more easily by poor grounds and/or voltage potential differences between chassis. If this output is used, pay particular attention to these factors.

Initial Settings

Before calibration is attempted, all jumpers must be properly configured to minimize total calibration effort. Below is a listing of jumpers, their functions, and recommended positions for a typical installation. It is up to the installer to evaluate the recommendations and decide upon proper positions for a specific installation.

Jumpers

W1—Filter Disable Jumper

Out—Enable low pass filter.

In—Disable low pass filter (bypass mode).

Recommendation—Leave in the "out" position unless it is desired to analyze high frequency vibration phenomena. Most process control equipment will not respond to the fast response of the signal converter in the filter bypass mode.

W2—Load Cell Excitation Jumper

Out—5 VDC load cell excitation.

In—10 VDC load cell excitation.

CAUTION

DO NOT USE 10 V EXCITATION IN CONJUNCTION WITH THE METTLER TOLEDO HAP MODULE. DAMAGE TO THE HAP MODULE MAY RESULT.

Recommendation—Leave in the "OUT" position unless the net load cell signal required to produce a 0 to 10 VDC output signal change is less than 2 mV and the intrinsically safe barrier HAP Module) is not used. (The HAP Module requires only 5 VDC excitation.

J2 Pin 1-2 and Pin 7-8 Jumpers.

These jumpers are removed and a plug/harness inserted for custom applications requiring remote setpoint adjustments.

Recommendation—Leave the jumpers in place. They have no effect if the setpoint options) are not used.

Switches

It is desirable to start out with an amplifier set for maximum gain and minimum initial offset. The following switch settings accomplish this.

S1—Coarse Initial Switches

Note: Early PCB versions of this circuit reverse S1 order. Start at S1-1 instead of S1-6.

Turn the switches ON to increase initial (drive the output in the negative direction). S1-1 has the most effect and S1-6 has the least effect.

Recommendation—Start with all switches “OFF” (minimum initial). See calibration section.

S2—Coarse Span Switches

Turn the switches ON to decrease span (decrease gain or make amplifier less sensitive). S2-1 has the most effect and S2-6 has the least effect.

Recommendation—Start with all switches "OFF" (maximum sensitivity). See calibration section.

Potentiometers

R11—Fine Initial Potentiometer

Rotate this pot counter clockwise (CCW) to increase initial (drive the output in negate direction). This is a 15 turn pot with a total range approximately equal to S1-6 switch.

Recommendation—Rotate pot fully clockwise (CW) to produce a minimum initial starting point.

R12—Fine Span Potentiometer

Rotate this pot counter clockwise (CCW) to decrease span (decrease gain or make amplifier less sensitive). This is a 15 turn pot that has a total range approximately equal to S2-6 switch.

Recommendation—Rotate pot fully clockwise (CCW) to produce a maximum gain starting point.

Grounding Requirements

AC Power

The NEC (and local wiring codes) require the AC power source to also have a third wire grounding conductor. This conductor shall be at least #14 AWG if a 15 amp branch circuit is used or #12 AWG if a 20 amp branch circuit is used. It shall be connected to the branch circuit grounding conductor at the source and to the ground lug supplied inside the 9321.

Load Cell Cables

The load cell wiring is connected to circuit common by means of the internal amplifier circuitry but is not grounded. For proper operation, do not ground any load cell wires. However, for proper shielding of the load cell signals, all shields must be connected as shown in other sections of this manual and per external wiring diagrams. Dual shield cables are preferred, and where used, should conform to the following two guidelines:

- Connect Inner shield to the 9321 ground lug. The other end is not connected.
- Connect outer shields to the J-Box or scale frame at one end and to the 9321 ground lug at the other end.

If a single shield load cell cable is used, connect it to the 9321 ground lug. The other end is not connected.

Output Signal Cables

The output signals are referenced to the ungrounded internal amplifier circuit common. The 4/20 mA and/or the 0-10 V common line may be grounded if desired but this ground must occur at the customer's equipment ground or circuit common point - not at the 9321. The shielded cable (single shield cable is sufficient) is connected differently than the load cell cable shields. The load cell outer shields connect to chassis ground whereas the output signal shields connect to circuit common don't confuse the two. Connecting these cables to circuit common at the 9321 end allows termination to chassis ground at the customer end without creating ground loops. See figure 4-o for correct connections.

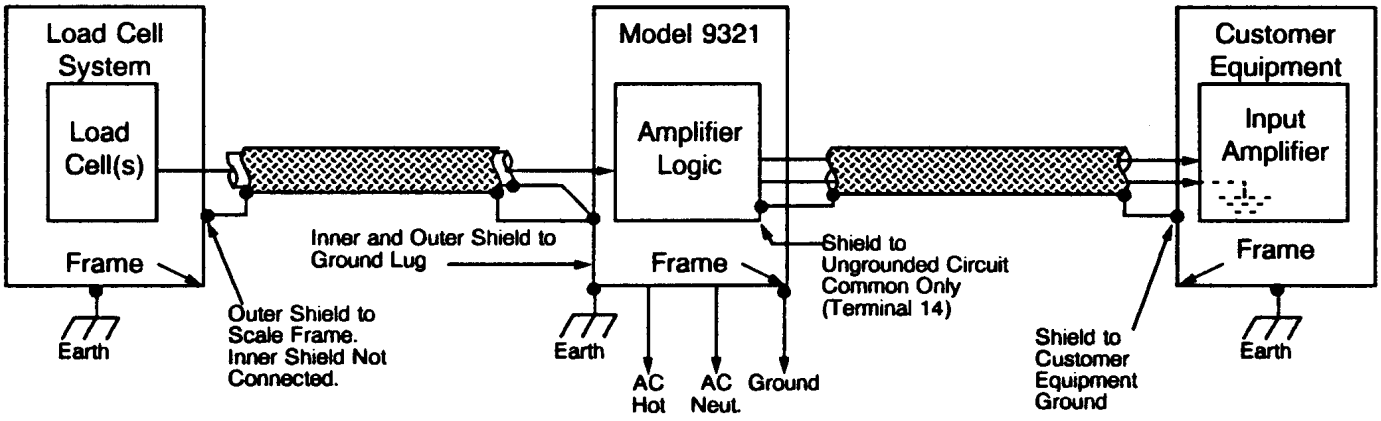


Figure 4-o: System Ground Interconnections

5 Calibration

The calibration procedure described below assumes that it is a first time calibration and the preliminary steps for initial settings have been made. If properly done the amplifier will be set for maximum gain (span) and minimum initial (offset). If recalibration of a working system is performed, the existing settings will be closer to optimum, so only fine trimming may be required.

Equipment Needed

- Load cell simulator or system load cells (for strain gauge input).
- Analog or digital voltmeter (for 0-10 VDC output).
- Small 1/8" (3 mm) screwdriver (for span and zero pots).

Excitation Voltage

Determine voltage requirement as described in Chapter 4, Jumpers.

CAUTION

IF THIS SYSTEM CONNECTS TO A METTLER TOLEDO HAP MODULE, W2 MUST BE REMOVED (5V). FAILURE TO OBSERVE THIS PRECAUTION MAY DAMAGE THE HAP MODULE, THE 9321 OR BOTH.

WARNING

THE EXCITATION VOLTAGE FOR THIS MODULE IS NOT INTRINSICALLY SAFE. IF LOAD CELL OPERATION IN A HAZARDOUS AREA IS UTILIZED, A METTLER TOLEDO HAP MODULE MUST BE CONNECTED BETWEEN THIS MODULE AND THE LOAD CELL(S). FAILURE TO OBSERVE THIS WARNING COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

Set Initial (Amplifier Offset)

With the load cell(s) connected to the input (S1 and S2 switches all OFF), and a voltmeter connected across the 0-10 VDC output, unload scale and note voltmeter reading. If there is initial load on the cell(s) it should be positive. The object is to set S1 and adjust R11 until zero voltage is obtained. If negative voltage, (-.1 to -1.0V) check voltmeter and/or load cell wiring for errors. If negative voltage (> -1 .0V) check voltmeter polarity. Also see the Service/Maintenance section.

Note: Early PCB versions of this circuit reversed the order of S1. Start at S1-1 instead of S1-6.

Progressively close S1 switches starting with S1-6 one at a time until polarity reverses.

Example: If turning on S1-4 reversed the polarity, turn it OFF and turn ON S1-5. Finally, use R11 for fine adjustment.

Set Span (Amplifier Gain)

Apply a load to the scale equal to full capacity. Progressively close S2 switches to decrease the gain starting with S2-6 until the output drops below l0 VDC. Then adjust R12 for 10 VDC. Remove the load, check zero and adjust if required, reapply the load and correct span if necessary. (The necessity to re-correct span depends upon how accurately zero was set).

Filter Selection

A low pass filter is incorporated to smooth out any abrupt scale fluctuations and provide a steady analog output. The W1 jumper is left disconnected for this purpose. If, for any reason, rapidly changing load cell signals must be reflected in the output, place the W1 jumper across the two pins to disable the filter.

6 Options

There is only one option available. The Setpoint option KOP is the same for all versions of the 9321.

Setpoint Option (0961-0065 Kit Of Parts)

This option consists of:

Quantity	Part Number	Description
1	KB17036300A	PCB, Setpoint Relay
2	R0381800A	Screw, 6-32 x ¾”
1	90136600A	Label, Setpoint Overlay
1	12472300A	Clamp, Plastic Cable 3/8”
1	R0328200A	Nut, 6-32 with Lockwasher
1	90153500A	Insulator, Fishpaper PCB
1	90135500A	Knob, Setpoint Control*

*Note: The 9321-0002 unit does NOT have provisions to utilize the knob controls. Two holes exist in the cover that may be opened through the main overlay for viewing only the LED status when used with the Setpoint overlay provided. DO NOT DRILL HOLES FOR THE KNOBS. They cannot be used with the NEMA 4 unit.

WARNING

IF THIS DEVICE IS USED IN AN AUTOMATIC OR MANUAL FILLING CYCLE, ALL USERS MUST PROVIDE A HARD WIRED EMERGENCY STOP CIRCUIT OUTSIDE THIS DEVICE CIRCUITRY. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

The purpose of this option is to provide a Setpoint relay contact signal triggered at a specific point between zero and full capacity set by the Setpoint potentiometers on the PCB. Each KOP contains parts to install (1) setpoint relay onto the PCB. A maximum of (2) relays are accommodated. Each KOP also contains an overlay and knob *for external adjustment of each Setpoint (9321-0001 models only).

Setpoint PCB Specifications

Each setpoint has the following:

Contact Configuration:	Two (2) normally open and two (2) normally closed.
Contact Rating:	1 Amp continuous at 120/240 VAC (PF > 0.8) 1 Amp continuous at 24 VDC.
Adjustability:	1% to 100% of full span.
Hysteresis:	1% fixed deadband.

Example: At point where relay de-energizes going up scale, a load decrease of 1o/o FS is required to re-energize.

Setability/Repeatability:	.5% of FS or better.
Polarity:	Relay is held energized when load is setpoint and de-energizes for all loads above setpoint. The LED on the 9321 PCB is illuminated when relay is energized.
Termination:	Single terminal strip accepts (1) #14 AWG wire per terminal maximum.

Setpoint PCB Installation

1. Disconnect and lockout any AC power to the 9321.
2. Disconnect and lockout any power source feeding interlock circuitry to an existing setpoint relay (if any).
3. Open the enclosure.
4. Remove single 6-32 screw at bottom of 9321 PCB holding it onto bracket (model 9321-0003 only).
5. Remove the 9321 PCB. Set it aside on a static free surface.
6. 9321-0001 only-Install plastic 3/8” cable clamp on side of enclosure chassis (next to ground lug) with the 6-32 nut provided. Route all setpoint wiring through this cable clamp.
7. Connect external wiring to setpoint PCB before mounting to 9321 PCB. Use wiring practices consistent with requirements of national and local electrical codes. See schematic at right to aid correct termination.

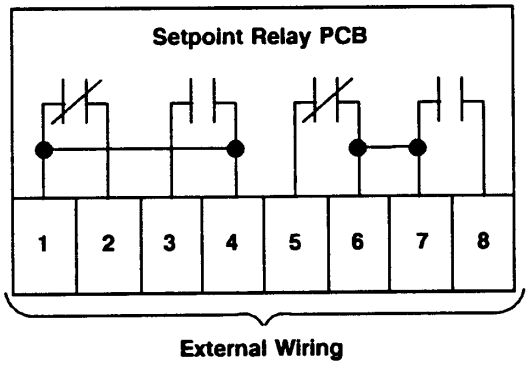


Figure 6-a: Setpoint External Wiring

8. Neatly dress external wires so that they allow easy PCB mounting to 9321 PCB.

Important! Allow enough wire slack for PCB maneuverability. Do not allow excess wiring that would rest against the load cell cable wiring. Dress setpoint and power wiring away from load cell cable wiring.

Important! Do not allow any spare wires to be led un-terminated. Connect all spare wires to the ground lug or conduit at point of entry.

9. Reinstall the 9321 PCB into its socket.
10. Place fishpaper insulator (90153500A) on beck of PCB so that the setpoint PCB mounting spacers protrude through the insulator holes.
11. Remove the two existing 6-32 screws that are on the setpoint PCB (+) and (-) terminals.
12. Install the setpoint PCB (KB17036300A) onto the spacers. Use the (2) 6-32 x ¾" screws provided. Install them from the 9321 PCB component side through the spacers and into the setpoint PCB threaded spacers. See Figure 6-b.

Important! Place the setpoint PCB so that the label on the bottom of the 9321 PCB is covered (first setpoint PCB). Install the second one (if used) next to the first one.

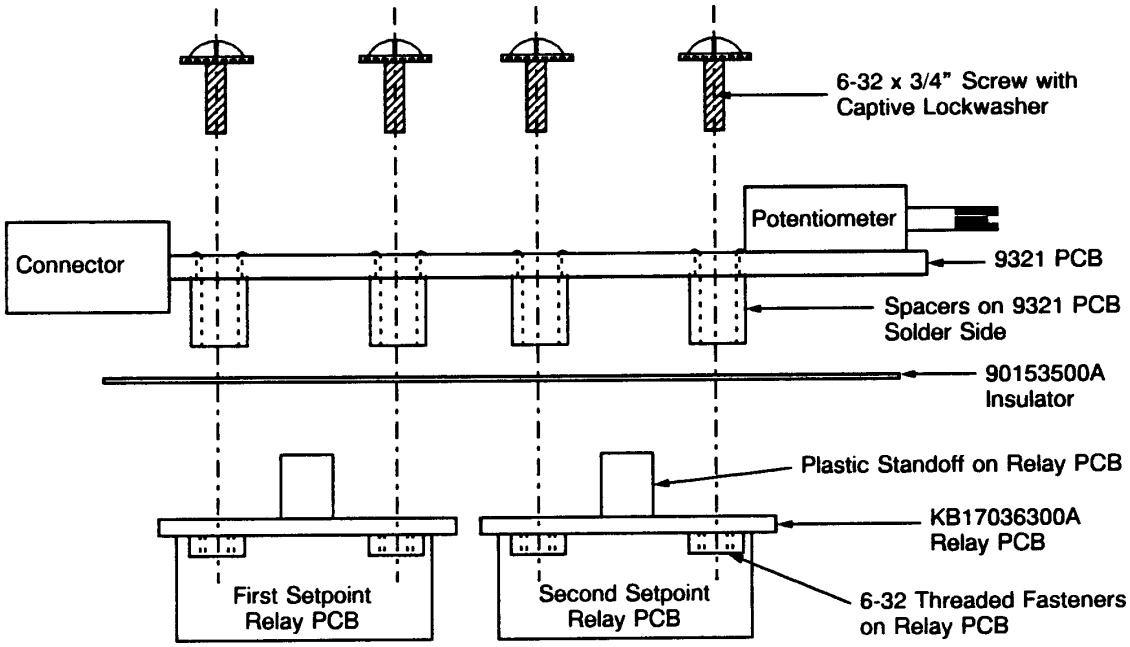


Figure 6-b: Setpoint PCB Installation

13. Reinstall the single 6-32 mounting screw (9321-0003 only) holding the 9321 PCB onto the bracket.
14. Install setpoint overlay (9321-0001 and 0002 only) and knobs (9321-0001 only) see next section, Knob Installation.
15. Close enclosure and reapply power.

Setpoint Overlay and Knob Installation (Model 9321-001)

Note: This feature is NOT intended to be used for frequent adjustments to the setpoint. For those applications requiring more than one adjustment per week, it is recommended that remote controls be utilized. Contact Mettler Toledo for details. The internal potentiometers are not rated to have end-to-end adjustments exceeding 100 in their lifetime.

A knob and overlay is provided for use with the 9321-0001 sheet metal converter to allow occasional Setpoint adjustment without removing the cover.

1. Disconnect and lock out any power source feeding this module.
2. Remover cover by turning ¼ turn fasteners CCW. Lift off cover.
3. View cover from inside. There are four (4) holes in the sheet metal covered by the front overlay. All four (if 2 setpoints are used) of the holes must be cut out to allow the knobs to protrude through the cover.

Important! If only one setpoint is used, cut out only two of the four holes. The setpoint overlay has holes already in it for 2 setpoints and if all holes are cut out an unfilled hole will result.

4. Cut out the required holes. See figure 6-c below. The overlay will cover irregular cuts but the surface must be smooth and clean.

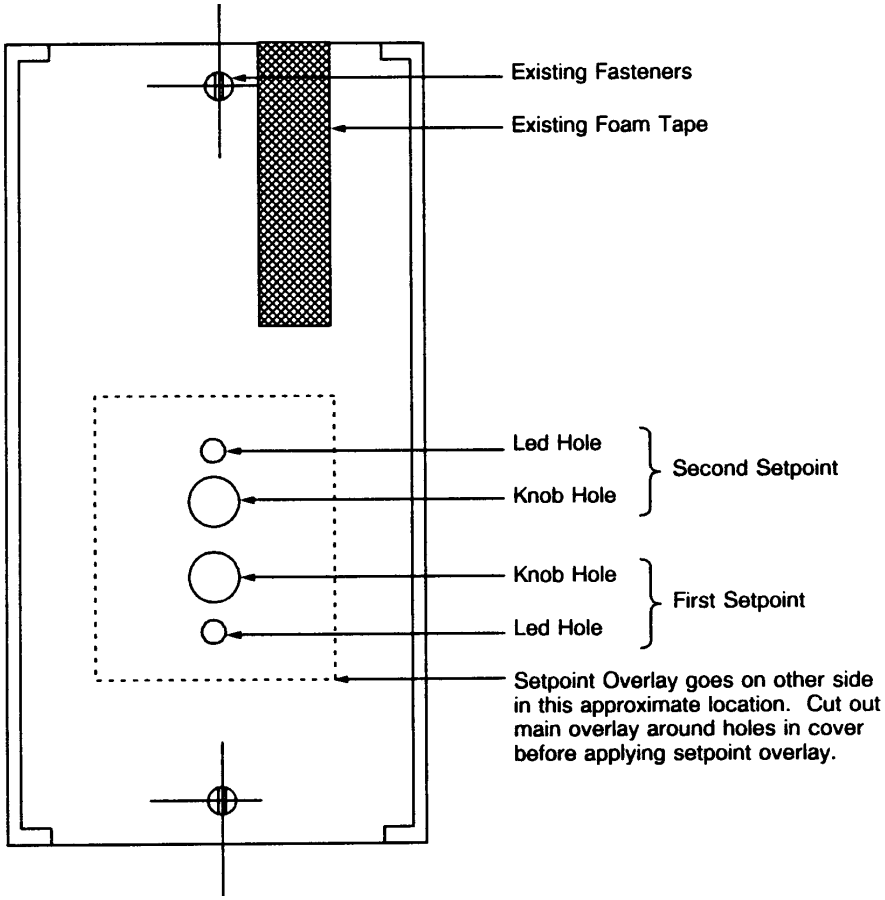


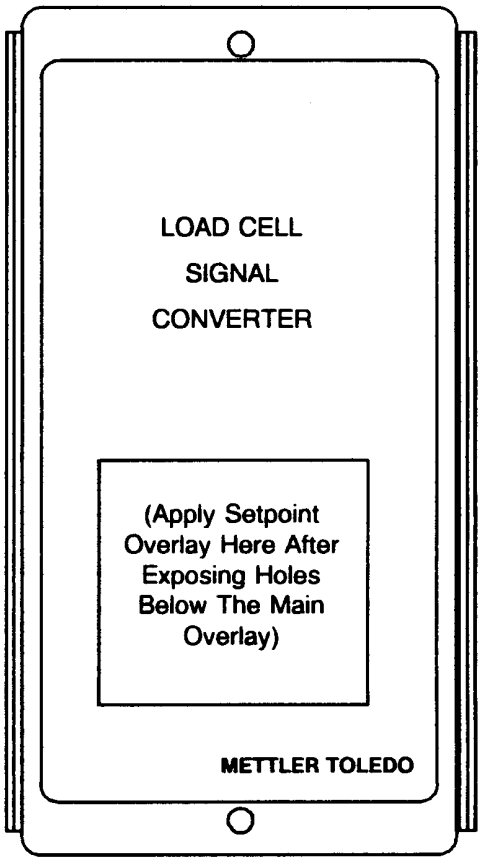
Figure 6-c: Setpoint Holes (Inside Cover)

1. Apply Setpoint overlay in the position illustrated below. Peel off the protective backing and press in place. **Be sure surface is clean and free of burrs before applying. Once** the surfaces mate, they are difficult to remove. Hint: Use a pencil poking through from inside to align holes.
2. Install knobs onto pot shaft(s). Press firmly but **DO NOT FORCE - DON'T USE PLIERS OR ANY OTHER TOOLS.** The back of the knob must seat directly on the pot body.
3. Straighten LEDS on the 9321 PCB if necessary.
4. Replace cover. Carefully slide it over knobs. The clearance is tight. It may be required to guide the knobs through holes with a small screw driver.
5. Restore power.

WARNING

ALWAYS TEST THIS OPTION FOR CORRECT OPERATION BEFORE CONNECTING TO ANY CONTROL EQUIPMENT.

FAILURE TO OBSERVE THIS WARNING COULD CAUSE BODILY INJURY AND/OR PROPERTY DAMAGE.



Setpoint Overlay Installation (Model 9321-0002)

The Setpoint overlay is applied to the 9321-0002 in the same manner as for the 9321-0001 except that only 2 holes are cut through the main overlay. The knobs supplied with the kit must be discarded. DO NOT CUT ANY HOLES FOR THE KNOBS. Only LED status viewing is possible. After cutting out the 2 holes, apply the overlay as detailed on the previous page.

Setpoint Calibration

Each of the two available setpoint controls are identical and independent of each other. In operation, the circuit compares the voltage at the output with a reference voltage determined by the setpoint potentiometer setting. When the

output voltage is less than the setpoint, the relay is energized and the LED is on. When the output voltage exceeds the setpoint, the relay is energized and the LED is off. Set the threshold as follows:

Note: A hysteresis of approximately 1% of full scale is built into the logic.

1. Apply a load to the scale equal to the desired setpoint or, use a load cell simulator until the analog output value equals the desired setpoint.
2. Turn the setpoint potentiometer shaft clockwise (CW) until the LED turns on then counterclockwise (CCW) until it goes off.
3. Repeat the above step but this time turn the shaft CCW very slowly until the LED goes off.
4. Verify the proper threshold by reducing the input enough to turn the LED on. Now increase the load slowly until it goes off. That will be the setpoint threshold. Readjust the setpoint potentiometer if necessary.

Example: If the setpoint value is 5.00V, the LED will go off when an increasing load equals 5.00V. If the load is then reduced, the LED will come back on at 4.90V (1% of 10V = 0.1V). This represents about 1/8 turn of the setpoint potentiometer.

7 Service and Maintenance

The following sections provide in depth detail about the circuit functionality, troubleshooting guidelines, replaceable parts and applicable diagrams to assist the service technician maintain this equipment.

Theory of Operation

The 9321 signal converter is simply an analog DC amplifier with an excitation power supply for strain gages. The block diagram is shown below.

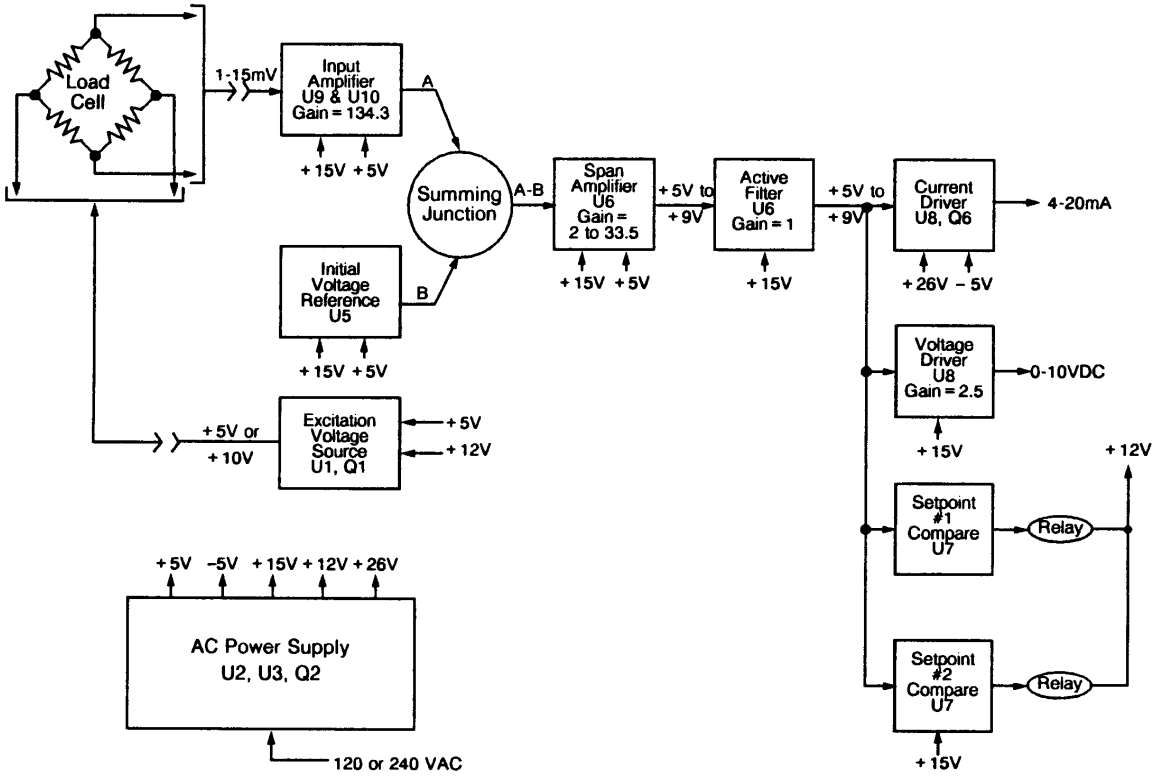


Figure 7-a: Signal Converter Block Diagram

The following discussion is provided for a better understanding of circuit function to produce better and faster troubleshooting. It is intended to aid troubleshooting but not serve as the basis for circuit design or repair. Detailed circuit analysis of individual components is intentionally omitted.

IC's U9 and U10 together from a true differential chopper stabilized amplifier with a fixed gain of 134.33. It accepts the load cell full span signal range of 1 to

15 mV, amplifies it, stabilizes it and subtracts the no-load load cell offset signal from the initial voltage reference.

The variable initial voltage reference is designed to generate a DC signal equal but opposite to the no-load output signal. It can be varied, via S1 and R11, from 0 to 2 VDC so it can offset a load cell signal of 0 to 15 mV (1S mV x amp. gain of 134.33 = 2 volts). Therefore the initial balance circuit can compensate a load cell output range of up to 100% load. The difference of the two signals is then passed on to the span amplifier.

The span amplifier has a variable gain which is set by S2 and R12 to amplify the signal from 2 to 33.5. Because of this gain range, a load cell full load span range of 16 to 1 is accommodated (1 mV to 16 mV load cell input). The output of the span amplifier produces a normalized zero to full span voltage change of 0 to + 4 V on top of a 5 VDC reference voltage (+5V to +9V) which is then passed on to the active filter.

The active filter is a 2 pole low pass filter with a cutoff frequency of approximately ½ Hz. The DC signal is passed straight through and any AC component with a frequency of greater than ½ Hz. is blocked if W1 jumper is out. If W1 is inserted, only minimal filtering is done so rapid weight excursions can be analyzed. The output of this amplifier (gain of 1), is also +5 V to +9 VDC which is passed on to four (4) different output circuits. They are current source amp for 4/20 mA, voltage amp for 0-10 VDC and two (2) setpoint control comparator amplifiers.

The current source amplifier accepts the voltage input of +5 V to +9 V and converts it to a corresponding 4 to 20 mA current. The gain of this stage is defined as 4 mA/volt of input change. In addition, this stage effectively removes the ±5 VDC reference by using it as the 0 reference point of the differential amplifier input. The 4 mA minimum output required for the 4 to 20 mA output is established in the stage by R39 and R43, while Q5 limits the maximum output to approximately 29 mA.

operating from the same + 5 V to + 9 V input that the 4/20 mA does is the 0 to 10 VDC output circuit. This circuit is a simple non-inverting differential voltage amplifier with a stage gain of 2½ to produce a 10 VDC output from a 4 V input. Notice that output protection is provided to prevent amplifier damage from external extraneous voltage excursions. (The D8 Zener Diode will clamp the output at +15 VDC if backfed from external noise.)

Also operating from the same +5 V to +9 VDC input are two comparator circuits that drive the setpoint relays. Each circuit is identical and operates in the following manner. The amplifiers operate under open loop conditions which keeps the output fully positive until the 5V to 9V signal equals the voltage set at the setpoint potentiometer wiper. At this point, the output goes negative rapidly turning the output transistor off and de-energizing the relay. Resistors R33 and R29 are positive feedback resistors which cause the output to stay off once turned off until the input voltage is reduced about 1%. This produces a small amount of hysteresis preventing an oscillatory condition at the switching point thus eliminating relay chatter.

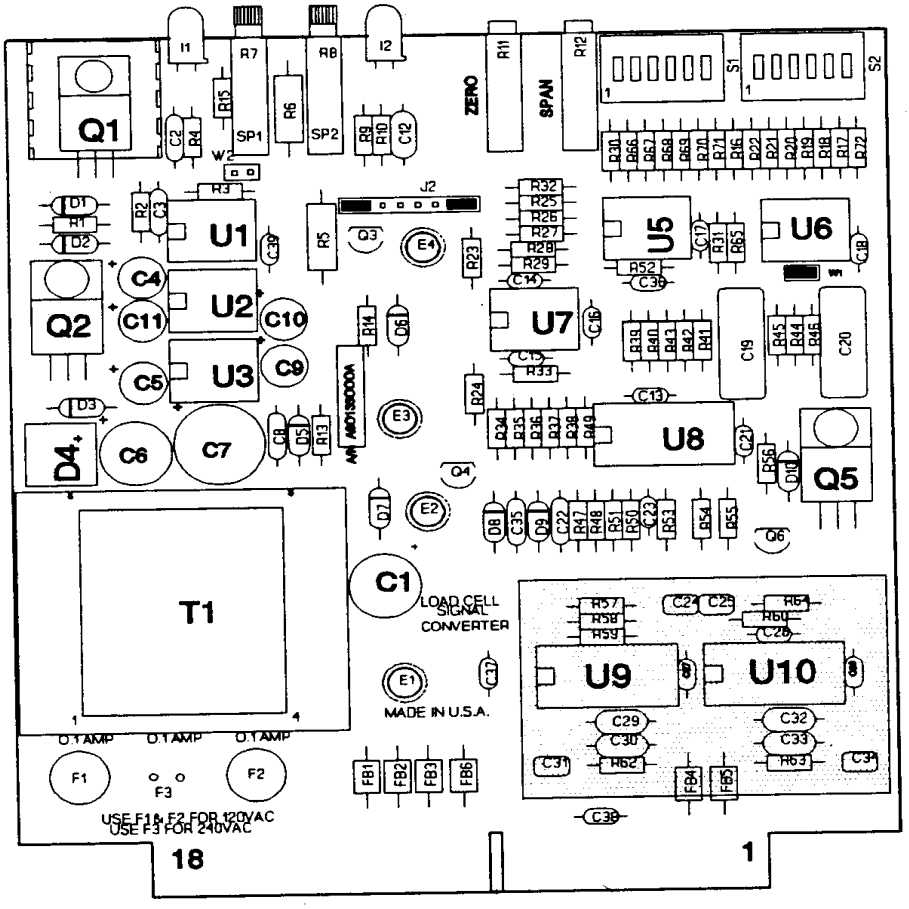


Figure 7-b: PCB Component Layout

Troubleshooting

Before an attempt is made troubleshoot this unit the reader must first read and understand the basics of the theory of operation. Study the block diagram to become familiar with the circuit elements.

Tools Required

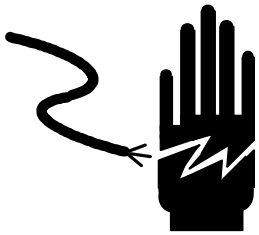
- Digital or analog voltmeter capable of reading down to at least 10 millivolts (.01 volts) DC.
- Load Cell simulator.
- Small 1/8” (3 mm) straight blade screwdriver.
- Static wrist strap.
- Static protection bag for PCB.

Preventive Maintenance

The unit should be inspected at regular intervals (at least once a year) for signs of abuse, dirt accumulation and (or) corrosion. Common sense should be applied as what to service but pay attention to the following:

- Clean any noticeable dirt away from unit.
- When the cover to the explosion proof unit is removed, be sure the threads are kept clean.
- Grease them with petroleum jelly or equal before replacing cover.
- Visually inspect PCB connector for signs of dirt and (or) loose wires.

Voltage Checks

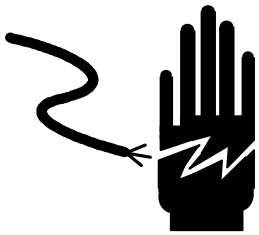


WARNING

ONLY PERMIT 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

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.



WARNING

BEFORE CONNECTING OR DISCONNECTING ANY INTERNAL ELECTRONIC COMPONENTS OR INTERCONNECTING WIRING BETWEEN ELECTRONIC EQUIPMENT, ALWAYS REMOVE POWER AND WAIT AT LEAST THIRTY (30) SECONDS BEFORE ANY CONNECTIONS OR DISCONNECTIONS ARE MADE. FAILURE TO OBSERVE THESE WARNINGS COULD RESULT IN DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT.

AC Power and Ground Tests

First check the AC input power. Input power must be within ±10% of 120 or 240 VAC.

If the AC line voltage is correct, then check for excessive voltage between neutral and ground on the AC input. Neutral to ground voltages greater than 1 VAC indicate that the 9321 does not have an adequate ground. It may suffer from unstable weight readings if there is excessive neutral to ground voltage.

If the AC line voltage is incorrect or if there is excessive neutral to ground voltage then have a qualified electrician correct the AC power. In some cases a power line conditioner may be required to correct an adverse power condition.

Load Cell Excitation Tests

If AC power is checked and verified to be OK and the internal fuses are OK check the following internal voltages.

With a load cell connected measure the DC voltage across terminals 5 and 8 per Table 7-a. Leave W2 in desired position and test for the corresponding voltage. (If system is set for 5V excitation test only for presence of 5V. There is no need to test for 10V and vice versa.)

If the excitation voltage is not within the limits of Table 7-a move the (+) meter lead from terminal 5 to one of the setpoint mounting studs E1 or E3. +12 VDC should be measured here as long as the setpoint relay PCBs are not installed or LEDs are off. If not the main PCB is defective. If there is +12V check the external load cell wiring for shorts for excessive load.

Load Cell Signal Tests

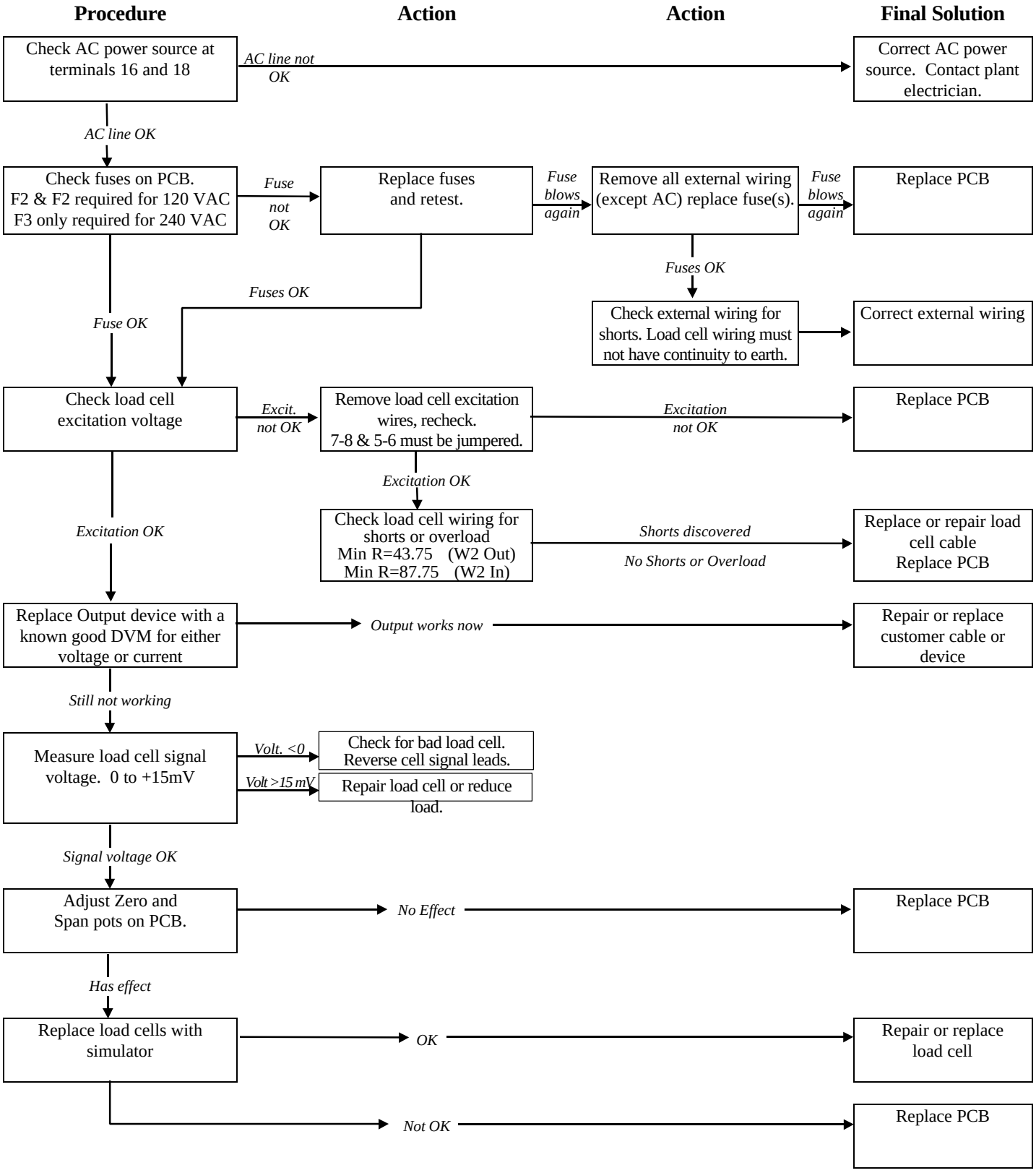
The PCB will accept an input voltage of 0 to +15m VDC. Because of the balanced bridge of the load cellist this 0-15 mV signal will be biased halfway between O and the excitation source. If the meter (-) lead is put on terminal 8 (excitation) and the (+) lead on terminal 3 (-signal) 2.5 VDC will be obtained (with 5V excitation). The (+) lead on terminal 2 (+ signal) will also produce a voltage of 2.5 VDC. It’s important to have this offset close to the halfway point between 0 and excitation for proper input amplifier operation. Also the signal polarity is important. Terminal 2 must be positive with respect to terminal 3. If not the load cell signal leads are reversed.

(+) Meter Lead	(-) Meter Lead	Voltage Reading		Function	Notes
		Minimum	Maximum		
Term 5	Term 8	9.8 VDC	10.2 VDC	Load Cell Excitation	W2 In. Term 5-6 Jumpered & Term 7-8 Jumpered.
Term 5	Term 8	4.9 VDC	5.1 VDC	Load Cell Excitation	W2 Out. Term 5-6 Jumpered & Term 7-8 Jumpered.
Term 2	Term 3	0	+15 VDC	Load Cell Signal	If opposite polarity voltage is obtained, reverse Term 2-3 wires.
Term 2 or 3	Term 8	+2 VDC	+3 VDC	Load Cell Signal Offset	W2 Out
Term 2 or 3	Term 8	+4 VDC	+6 VDC	Load Cell Signal Offset	W2 In
E1 or E3	Term 8	1.0 VDC	1.0 VDC	Excitation & Relay Internal Power Source	Neither LED maybe ON for this test.

Table 7-a: Voltage Limits

If any of the above voltages are beyond the limits shown above replace PCB. Do not attempt to troubleshoot the PCB voltages further. Simply replace it if the fault is suspected to be within the PCB. The above voltage measurements are given only as a guide to external problems and not for purposes of component level troubleshooting of the PCB.

The following flow chart should be used as a guide to the order of troubleshooting. Individual conditions and symptoms may dictate a different approach.


Procedure
Action
Action
Final Solution
Check AC power source at terminals 16 and 18
AC line not OK
Correct AC power source. Contact plant electrician.
AC line OK
Check fuses on PCB. F2 & F2 required for 120 VAC F3 only required for 240 VAC
Fuse not OK
Replace fuses and retest.
Fuse blows again
Remove all external wiring (except AC) replace fuse(s).
Fuse blows again
Replace PCB
Fuses OK
Check external wiring for shorts. Load cell wiring must not have continuity to earth.
Correct external wiring
Fuses OK
Fuse OK
Check load cell excitation voltage
Excit. not OK
Remove load cell excitation wires, recheck. 7-8 & 5-6 must be jumpered.
Excitation not OK
Replace PCB
Excitation OK
Check load cell wiring for shorts or overload Min R=43.75 (W2 Out) Min R=87.75 (W2 In)
Shorts discovered
No Shorts or Overload
Replace or repair load cell cable Replace PCB
Excitation OK
Replace Output device with a known good DVM for either voltage or current
Output works now
Repair or replace customer cable or device
Still not working
Measure load cell signal voltage. 0 to +15mV
Volt. <0
Check for bad load cell. Reverse cell signal leads.
Volt >15 mV
Repair load cell or reduce load.
Signal voltage OK
Adjust Zero and Span pots on PCB.
No Effect
Replace PCB
Has effect
Replace load cells with simulator
OK
Repair or replace load cell
Not OK
Replace PCB

Replacement Parts

CAUTION

REMOVE POWER FROM 9321 AND WAIT AT LEAST 30 SECONDS BEFORE CONNECTING OR DISCONNECTING ANY CABLES, WIRES, OR PCB'S. FAILURE TO OBSERVE THIS PRECAUTION MAY DAMAGE THE PCB OR EXTERNAL COMPONENTS.

CAUTION

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

The following list identifies the replacement parts for the respective models. The items marked with an asterisk* are recommended spare parts.

System Qty	Part Number	Description	Model(s) Used In
1	90138300A	Enclosure, Cover and Base (NEMA 1)	9321-0001
1*	A90133000A	PCB Assembly	9321-0001, 0002, 0003
1*	90136400A	Connector, Right Angle	9321-0001, 0002, 0003
1	90136500A	Overlay, Enclosure Front	9321-0001
1	90154000A	Label, Wiring Connections	9321-0001, 0002, 0003
2*	13875600A	Fuse, .1 amp 250V Slo-Blo	9321-0001, 0002, 0003
1	90136700A	Enclosure, Cover and Base (NEMA 4X)	9321-0002
2	13785400A	Cord Strain Relief, CGB Type	9321-0002
1	10399500A	Enclosure, Cast Aluminum (NEMA 7/9)	9321-0003
3	12478300A	Conduit Seal, ¾"	9321-0003
2*	KB17036300A	PCB, Setpoint Relay	Setpoint KOP Option
1	90133600A	Label, Setpoint Overlay	Setpoint KOP Option
1	90135500A	Knob, Setpoint Control	Setpoint KOP Option

Connection Diagrams

The diagrams on the following pages are intended to serve as installation and service aids for the standard product offering illustrated on the previous pages.

Custom units and (or) custom installations may dictate additional diagrams. Always refer to any supplemental material before relying on the following pages in their entirety.

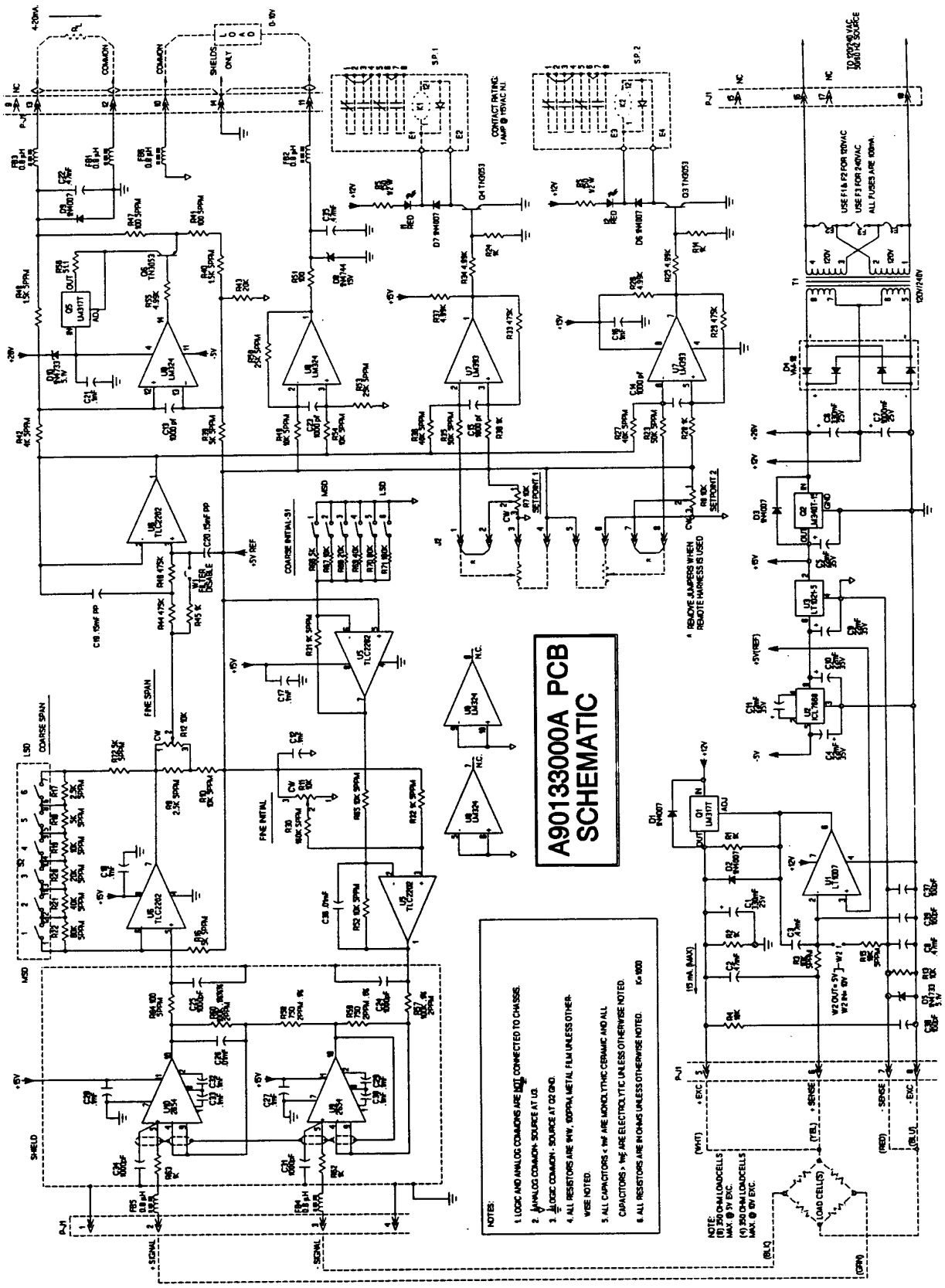


Figure 7-c: A90133000A PCB Schematic

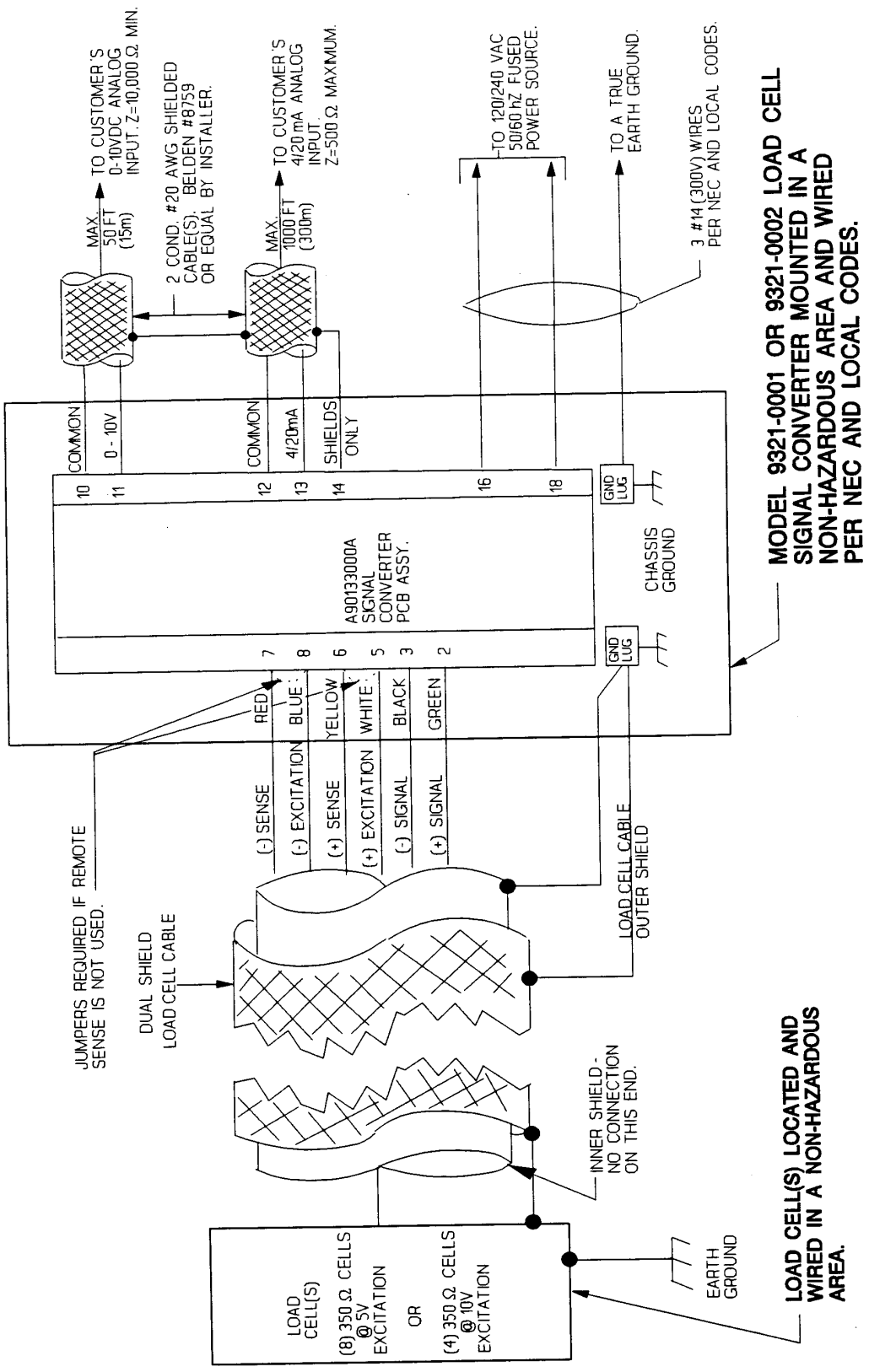


Figure 7-d: Model 9321-0001 and 0002 Connections (All in Non-Hazardous Area)

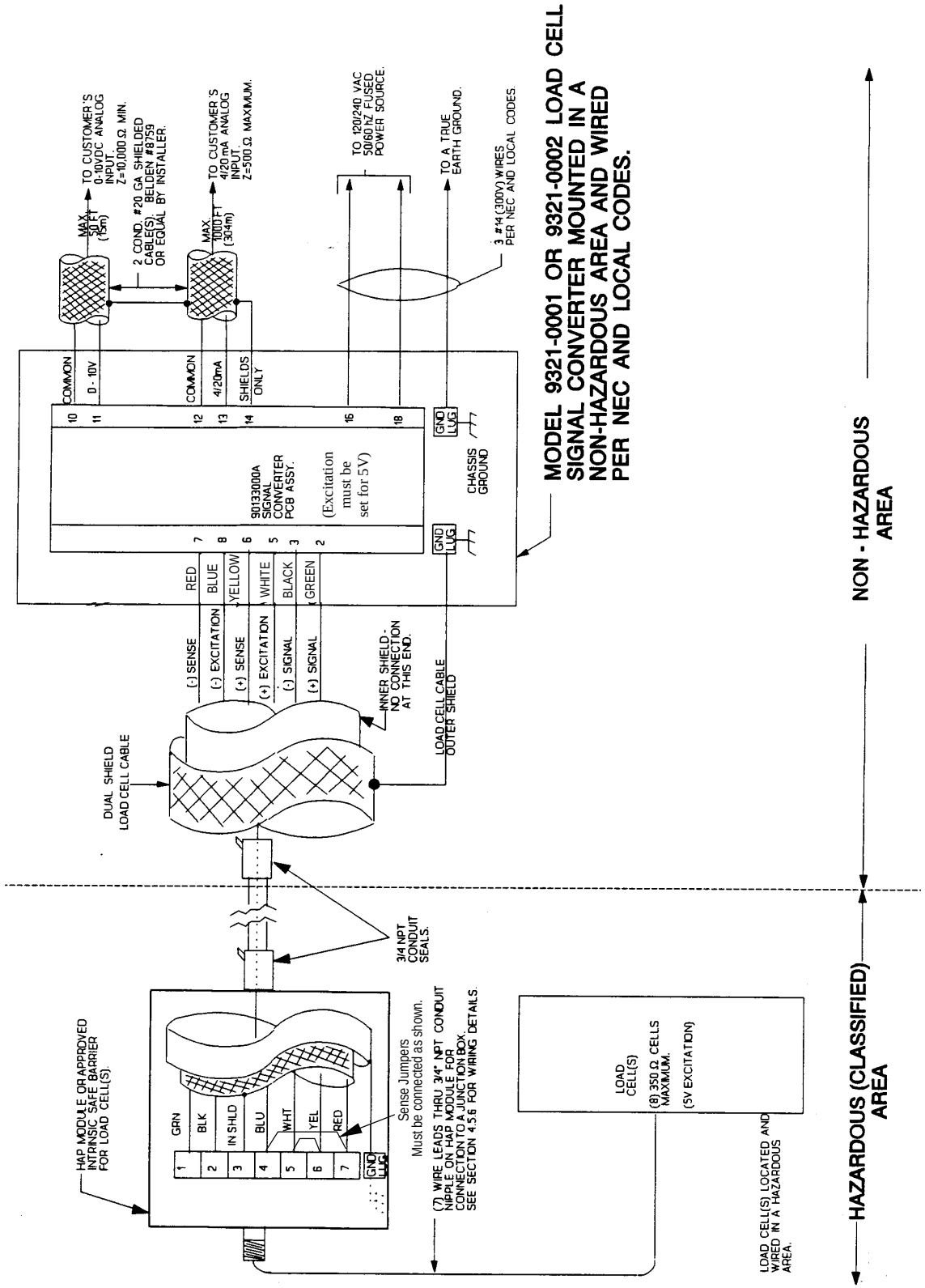


Figure 7-e: 9321-0003 Connections (Load Cells and 9321 in Hazardous Area)

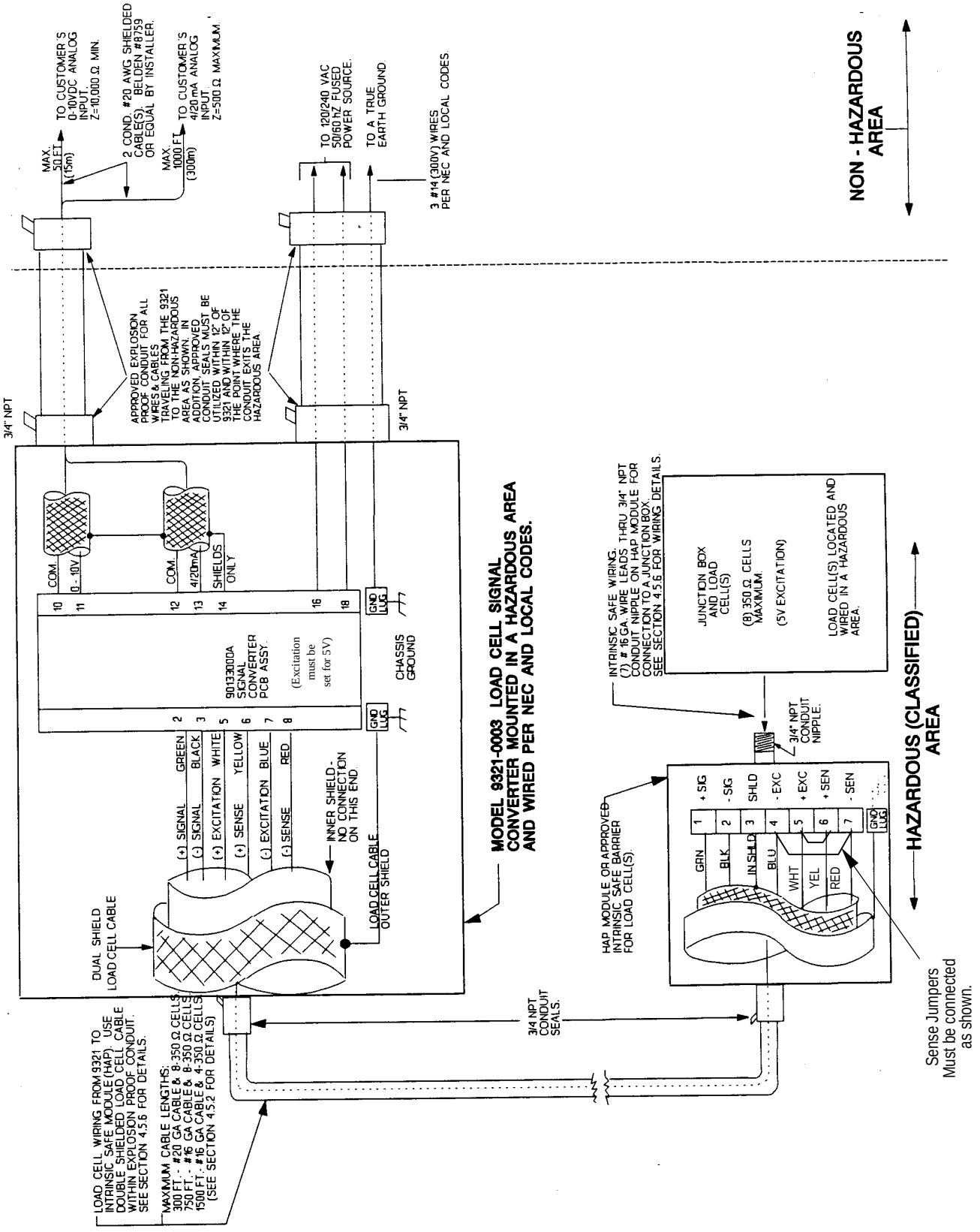


Figure 7-f: 9321-0001 and 0002 Connections (Load Cells in Hazardous Area)

Maintenance Log

Maintenance Description	Performed By	Date

METTLER TOLEDO

Publication Problem Report

If you find a problem with our documentation, please complete and fax this form to (614) 438-4783

Publication Name: 9321 Load Cell Signal Converter Service Manual

Publication Part Number: A90154700A **Publication Date:** 8/97.02

PROBLEM(S) TYPE:	DESCRIBE PROBLEM(S):	INTERNAL USE ONLY
☐ **Technical Accuracy**	☐ Text ☐ Illustration	
☐ **Completeness** What information is missing?	☐ Procedure/step ☐ Illustration ☐ Definition ☐ Example ☐ Guideline ☐ Feature ☐ Explanation ☐ Other (please explain below)	☐ Info. in manual ☐ Info. not in manual
☐ **Clarity** What is not clear?		
☐ **Sequence** What is not in the right order?		
☐ **Other Comments** Use another sheet for additional comments.		

Your Name: _____ **Location:** _____

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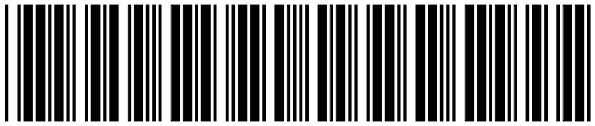

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