PUMA®

Terminal

Intrinsically Safe Instrument

Technical Manual and User's Guide

D14724300A
(5/00).00

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.

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Worthington, OH 43085
USA

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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 contacting:

METTLER TOLEDO
Training Center
1900 Polaris Parkway
Columbus, OH 43240
Phone: (US and Canada) 614- 438-4511
(All Others) 614-438-4888

FCC Notice

This device complies with Part 15 of the FCC Rules and the Radio Interference Requirements of the Canadian Department of Communications. Operation is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

ORDERING INFORMATION

It is most important that the correct part number is used when ordering parts. Parts orders are machine processed, using only the part number and quantity as shown on the order. Orders are not edited to determine if the part number and description agree.

This manual describes the operation and functionality of the ***PUMA*** intrinsically safe terminal containing software part number **147224** revision level **6.0**. The software part number and revision level are displayed during the self-test sequence and also on power-up on newer units.

PRECAUTIONS

READ this manual BEFORE installing, operating, or servicing this equipment.

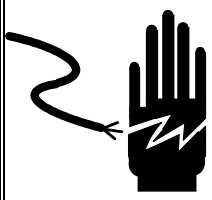
FOLLOW these instructions carefully.

SAVE this manual for future reference.

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

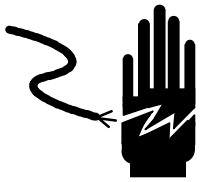
ALWAYS DISCONNECT this equipment from the power source before cleaning or performing maintenance.

CALL METTLER TOLEDO for parts, information, and service.



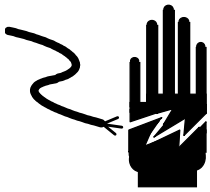
⚠ WARNING

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.

⚠ WARNING

ALL EQUIPMENT MUST BE INSTALLED IN ACCORDANCE WITH THE INSTALLATION INSTRUCTIONS DETAILED IN THIS MANUAL. DEVIATION FROM THE INSTRUCTIONS CAN IMPAIR THE INTRINSIC SAFETY OF THE UNIT AND VOID FACTORY MUTUAL APPROVAL OF THE SCALE.

⚠ WARNING

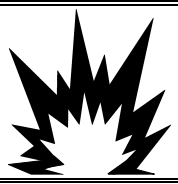
DO NOT INSTALL OR PERFORM ANY SERVICE ON THIS EQUIPMENT BEFORE THE AREA HAS BEEN SECURED AS NON-HAZARDOUS BY PERSONNEL AUTHORIZED TO DO SO BY THE RESPONSIBLE CUSTOMER.

⚠ WARNING

ONLY THE COMPONENTS SPECIFIED IN THIS MANUAL CAN BE USED IN THIS UNIT. INCORRECT, SUBSTITUTE COMPONENTS WILL IMPAIR THE INTRINSIC SAFETY OF THE UNIT AND VOID FACTORY MUTUAL APPROVAL.

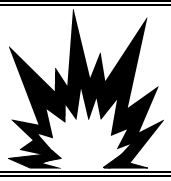
⚠ WARNING

DO NOT ATTEMPT TO OPEN OR REPAIR THE BATTERY PACK OR POWER SUPPLY. THE BATTERY PACK AND POWER SUPPLY ARE NOT FIELD REPAIRABLE. RETURN TO FACTORY OR DISPOSE OF PROPERLY IN CASE OF FAILURE.



⚠ WARNING

DO NOT USE THE BATTERY CHARGER IN THE HAZARDOUS AREA. THE BATTERY CHARGER IS NOT DESIGNED FOR OR INTENDED FOR USE IN HAZARDOUS AREAS.



⚠ WARNING

DO NOT ATTEMPT TO REPLACE BATTERY PACK WITH A BATTERY OR BATTERY PACK OTHER THAN 0964-0083-000 (INTERNAL) or 0964-0078-000 (EXTERNAL).

CONTENTS

1 Introduction

The *PUMA* terminal is a versatile, high performance terminal intended for weighing and setpoint applications in hazardous (classified) locations including: NEC Class I, Division 1 and 2, Applicable Groups A, B, C, and D; Class II, Division 1 and 2, Applicable Groups E, F, and G; Temperature Class T4A Hazardous Locations: Canada CSA Class I, Division I, Groups A, B, C, and D; Class II, Division I, Groups F and G; Temperature Class T4A Hazardous Locations.

The PUMA terminal must be used only with METTLER TOLEDO, agency approved, analog load cells. Refer to control drawings 152949 and 148450R in the Appendix.

General Description

The *PUMA* terminal is intended for use with up to four 350 Ohm, 2mV/V or 3mV/V METTLER TOLEDO agency-approved analog load cells. It must not be used with DigiTOL load cell bases or DigiTOL J-Box scales. The *PUMA* terminal provides a displayed resolution from 1000 to 25,000 increments with analog load cells. Increment size is selectable from 0.001 to 100.

The 1.0 inch high digit liquid crystal display (LCD) displays: **lb**, **kg**, **g**, and **t** weight symbols. Full keyboard tare and setpoint operation are standard. The *PUMA* terminal enclosure is made from stainless steel and is NEMA 4X (IP-65) rated for washdown applications. The desktop enclosure is furnished with optional wall mounting brackets and provisions for column mounting with an optional bracket.

The intrinsically safe external battery pack and hazardous area AC power supply are rated for indoor use only and must not be located in washdown environments or exposed to corrosive liquids or gases.

Standard Features

The *PUMA* terminal is designed with the following standard features:

- Choice of an internally mounted battery pack with a typical life of 50 hours or an optional external battery pack for 200-350 hours of battery life, or from an optional external 120 or 240 VAC power supply.
- A high visibility, 1-inch (25mm) high, six-digit (7-segment), LCD weight display with decimal points or commas. The display includes symbols for **low battery voltage, gross weight (G)**, **tare weight (T or PT)**, **net weight (Net)**, and **zero (Z)**. The display will blank during sleep mode.
- A multi-color, 4 x 5 keypad with domed keys. The keypad has an embossed, polycarbonate overlay with ridges to separate active key areas.
- A 1.6 VDC excitation supply voltage for up to four, 350 Ohm, 2mV/V or 3mV/V analog load cells. This excitation voltage can drive a maximum cable length of 400 feet (121.92 meters) with a 20 gauge load cell cable.
- Keyboard entry of setpoint and tare weights. Setpoint operation is available with the Fiber Optic I/O option and the Model 3015 setpoint controller.
- Keyboard ID up to 6 numeric digits.
- Time and date.

Note: The PUMA terminal is not compatible with the DigiTOL® power cells used in the DigiTOL vehicle scales or the DigiTOL® Power Module used in the DigiTOL floor scales.

- Programmable *Sleep* mode to save battery life.
- Self-test function.
- A configurable filter provides added stability in the presence of vibration.
- Auto Zero Maintenance (AZM) to compensate for small changes in zero over selectable ranges of ± 0.5 increments to ± 3 increments.
- Auto zero capture at power-up selectable at ±2% or ±10% of scale capacity.
- Pushbutton zero capture selectable at ±2% or ±20% of scale capacity.
- Pushbutton switching between pounds and kilograms or conversion units.
- Keyboard calibration and individual zero and span adjust.
- Selectable A/D conversion rate of 7, 8, 9, 10, 12, 14, and 16 updates/sec.
- Selectable, linearity compensated, three point calibration for demanding weighing applications.
- Over-capacity and under-capacity blanking that can be programmed independent of scale capacity for specialized applications.

Optional Accessories

Several optional accessories are available for the *PUMA* terminal.

- Factory Mutual approved, intrinsically safe, rechargeable 7 AH (P/N 0964-0078), 12 VDC battery pack provides a portable power source and can be used in hazardous (classified) locations: Class I, II, and III, Division 1 and 2, Applicable Groups A, B, C, D, E, F, and G. A new fully charged battery pack allows 200-350 hours of operation.
- CSA approved, intrinsically safe, rechargeable 7 AH (P/N 0964-0093), 12 VDC battery pack provides a portable power source and can be used in hazardous (classified) locations: Class I, II, and III, Division 1, Applicable Groups A, B, C, D, E, F, and G. A new fully charged battery pack allows 200-350 hours of operation.
- Factory Mutual approved, 120 VAC power supply (P/N 0919-0044) provides an intrinsically safe output voltage and can be used in hazardous (classified) locations: Class I, II, and III, Division 1 and 2, Applicable Groups C, D, E, F, and G. Groups A and B are permitted with the supply in a safe classified area.
- CSA approved, 120 VAC power supply (P/N 0919-0055) provides an intrinsically safe output voltage and can be used in hazardous (classified) locations: Class I, II, and III, Division 1, Applicable Groups C, D, E, F, and G. Groups A and B are permitted with the supply in a safe classified area.
- Factory Mutual approved 240 VAC power supply (P/N 0964-0071) provides an intrinsically safe output voltage and can be used in hazardous (classified) locations: Class I, II, and III, Division 1 and 2, Applicable Groups C, D, E, F, and G. Groups A and B are permitted with the supply in a safe area.
- One or two (2) bidirectional ASCII Fiber Optic Data I/O Kit(s).
- A Dual Channel fiber optic converter, located in a safe classified area, provides RS-232/20 mA ASCII data (send/receive).

Fiber Optic Data I/O

The *PUMA* Fiber Optic I/O Kit mounts inside the terminal and provides bidirectional ASCII data transfer to peripheral devices, such as the METTLER TOLEDO Dual Channel fiber optics converter described below and a number of peripheral devices with fiber optic I/O

built in (8618 Scoreboard, 8624 Remote Display, 9323 BCD Output option, 9325 Analog Output option, and the 9330 Gross, Tare, Print, Zero Input option).

The Fiber Optic Dual Channel Data I/O Converter receives fiber optic data from the *PUMA* terminal and converts it to bidirectional RS-232C and 20 mA current loop. This allows connection of peripheral devices up to 1000 feet away that do not have built-in fiber optic hardware, Host Computer, DCS System, and printers.) Also refer to the Fiber Optics Cable Specifications in Appendix 12.

Ordering Information

Approval Agencies
FM = Factory Mutual
CSA = Canadian Standards
SA= Standards of Australia

Factory No.	Description	Features/(Agency Approvals)
PXHN1100000 PXHN1100019	Desk/Wall Mount, NEMA 4X Desk/Wall Mount, NEMA 4X	Internal Battery (FM) Internal Battery (CSA)
PXHN1200000 PXHN1200019	Desk/Wall Mount, NEMA 4X Desk/Wall Mount, NEMA 4X	External Power (FM) External Power (CSA)
0961-0090	Fiber Optic Interface Kit	Allows operation with METTLER TOLEDO Scoreboards (8624, 8614, 8616, 8617, 8618), Remote Input from 9330, Data Devices (9323 BCD, 9325 Analog, 9360), Setpoint Controller MD3015, and Printers (8806, 8844, 8845, 8856, 8860, 8861, and 8865.)
0964-0083	Spare Internal Battery 12VDC, 1.2 AH, I.S.	Allows charging while another is in use.
0964-0078	External Battery, 12 VDC, 7 AH, I.S.	External Extended Operation Battery Pack. (FM)
0964-0093	External Battery, 12 VDC, 7 AH, I.S.	External Extended Operation Battery Pack (CSA)
0919-0044	120 VAC I.S. Power Supply	External AC Power Supply (FM)
0919-0055	120 VAC I.S. Power Supply	External AC Power Supply (CSA)
0964-0071	240 VAC I.S. Power Supply	External AC Power Supply (FM)
0964-0084	Battery Charger (Internal Battery), North America Plug	Required for charging the internal 1.2 AH battery pack in a safe area.
0964-0085	Battery Charger (Internal Battery), UK Plug	Required for charging the internal 1.2 AH battery pack in a safe area.
0964-0086	Battery Charger (Internal Battery), Europe/China Plug	Required for charging the internal 1.2 AH battery pack in a safe area.
0964-0087	Battery Charger (Internal Battery), Australia/China Plug	Required for charging the internal 1.2 AH battery pack in a safe area.
0964-0061	Battery Charger (7 AH Battery), UK Plug	Required for charging the external 7 AH battery in a safe area.
0964-0062	Battery Charger (7AH Battery), Europe/China Plug	Required for charging the external 7 AH battery in a safe area.
0964-0063	Battery Charger (7 AH Battery) Australia/China Plug	Required for charging the external 7 AH battery in a safe area.
0964-0064	Battery Charger (7 AH Battery), North America Plug	Required for charging the external 7 AH battery in a safe area.

Table 1-a Ordering Information

Specifications

Temperature and Humidity

Operating:
–10 to +40°C (+14 to +104°F) at 10 to 95% relative humidity, non-condensing.

Storage:
–18 to +60°C (–0 to +140°F) at 10% to 95% humidity, non-condensing.

Hazardous Areas

The *PUMA* terminal with an intrinsically safe battery pack or hazardous area AC power supply is approved for weighing applications in hazardous (classified) locations including NEC Class I, Division 1, Applicable Groups A, B, C, and D; Class II, Division 1, Applicable Groups E, F, and G; Temperature Class T4A; Canada CSA Class I, Division I, Groups A, B, C, and D; Class II, Division I, Groups F and G; Temperature Class T4A.

Reliability

The demonstrated MTBF (Mean Time Before Failure) is a minimum of 20,000 hours.

Servicability

The *PUMA* terminal contains a single easily accessible Logic PCB. The estimated MTTR (Mean Time To Repair) is 1/2 hour or less.

Display Parameters

The *PUMA* terminal is capable of displaying the following:

Increment Range:	0.001 Minimum
	100 Maximum
Increment Size:	1, 2, 5
Capacity:	1.000 Minimum
	999,980 Maximum

Load Cell Data

Note: 3 mV/V cells can be used as long as no more than 2/3 of cell output is used (3.2 mV). (15136100A PCB only.)

Note: (*)15843800A PCB has a 2mV/3mV jumper allowing full range of 3mV cells.

Excitation

1.63 VDC is provided to power up to four 350 ohm approved analog load cells.

Signal

Input amplifier sensitivity will accept 2 mV/V (or 3mV/V with (*)15843800A PCB) analog load cells when at least 25% of the cell(s) are used for span in an NTEP approved application. See Table 3b for allowable sensitivities with other parameters. Up to 100% load cell signal is allowed for combined zero and span.

Cable

Use shielded cable supplied with approved load cell/scale base. Furnish additional 6-conductor shielded cable (if required) as follows:

Maximum Length:	400 feet (122 meters)
Minimum Wire Size:	#22 AWG
Minimum Shielding:	85% coverage
Recommended Cables:	METTLER TOLEDO P/N 510616370 6-Conductor Shielded #16 AWG or METTLER TOLEDO P/N 510620370 6-Conductor Shielded #20 AWG

⚠ WARNING

ONLY LOAD CELLS ON METTLER TOLEDO DRAWING #122502 OR #156305 ARE APPROVED FOR USE WITH THE *PUMA* TERMINAL IN A HAZARDOUS AREA.

⚠ WARNING

THE *PUMA* TERMINAL IS FACTORY MUTUAL APPROVED FOR USE IN HAZARDOUS (CLASSIFIED) LOCATIONS WITH METTLER TOLEDO FACTORY MUTUAL APPROVED LOAD CELLS. THE USE OF OTHER MANUFACTURERS' LOAD CELLS OR LOAD CELLS NOT SPECIFIED IN THESE DRAWINGS WILL VOID AGENCY APPROVAL (SEE METTLER TOLEDO DRAWING #122502 OR #156305 FOR LISTING).

The *PUMA* terminal will operate with the following METTLER TOLEDO approved analog load cell devices:

Bench and Portable Bases:	1985, 2095, 2185, GBx, WBx, HD
Floor Scales:	2156, 2158, 2256, 2885, 2888, 2266
Load Cells:	0951, Flexmount®, Centerline™, Ultramount™, Tension Weigh Mounts
Monorail Scales:	0990, 0991

Power Requirements

Note: "BATT LOW" terminal is displayed with approximately 11 VDC at input connector.

The following power requirements apply to the *PUMA* terminal.

- Input Voltage: +10.5 VDC to +15 VDC
- Minimum Current: 25 mA at 15 VDC (seven updates per second, one load cell, and no optional fiber optic modules)
- Maximum Current: 55 mA at 10.5 VDC (16 updates per second, four load cells, and two optional fiber optic modules)

Physical Dimensions

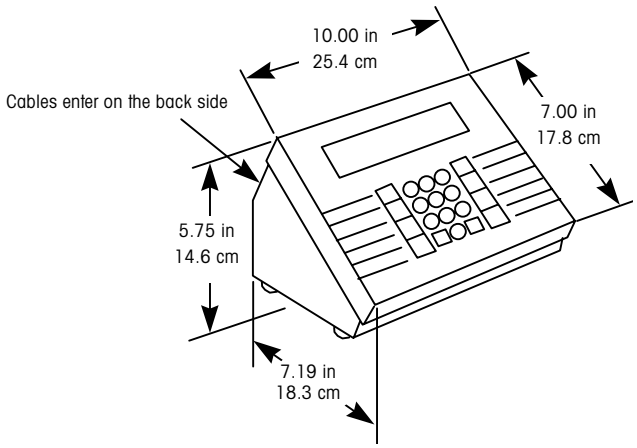


Figure 1-a: Desk Mount Configurations

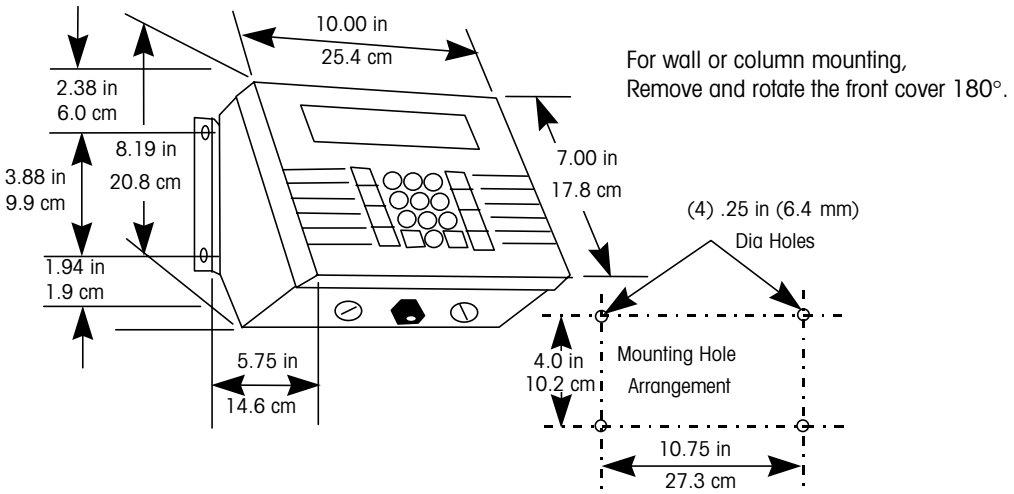


Figure 1-b: Wall Mounting Dimensions

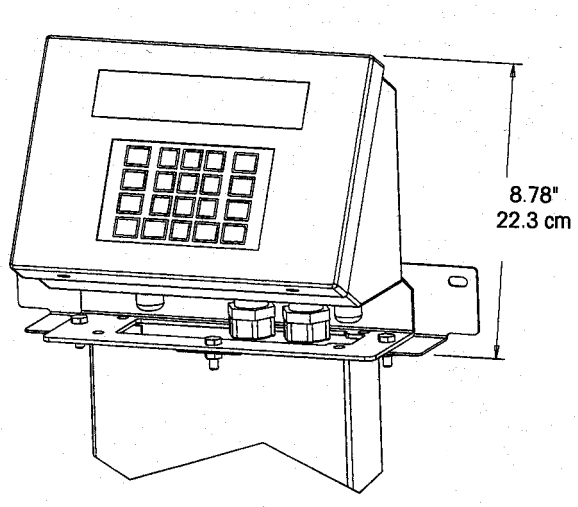


Figure 1-c: Column Mount Configuration

7 AH Battery Pack Enclosure

The external 7 AH battery pack enclosure is constructed of brushed 304L stainless steel and weighs approximately 9 lb (4 kg). Power is supplied through an integral cable attached to the *PUMA* terminal (Figure 1-d).

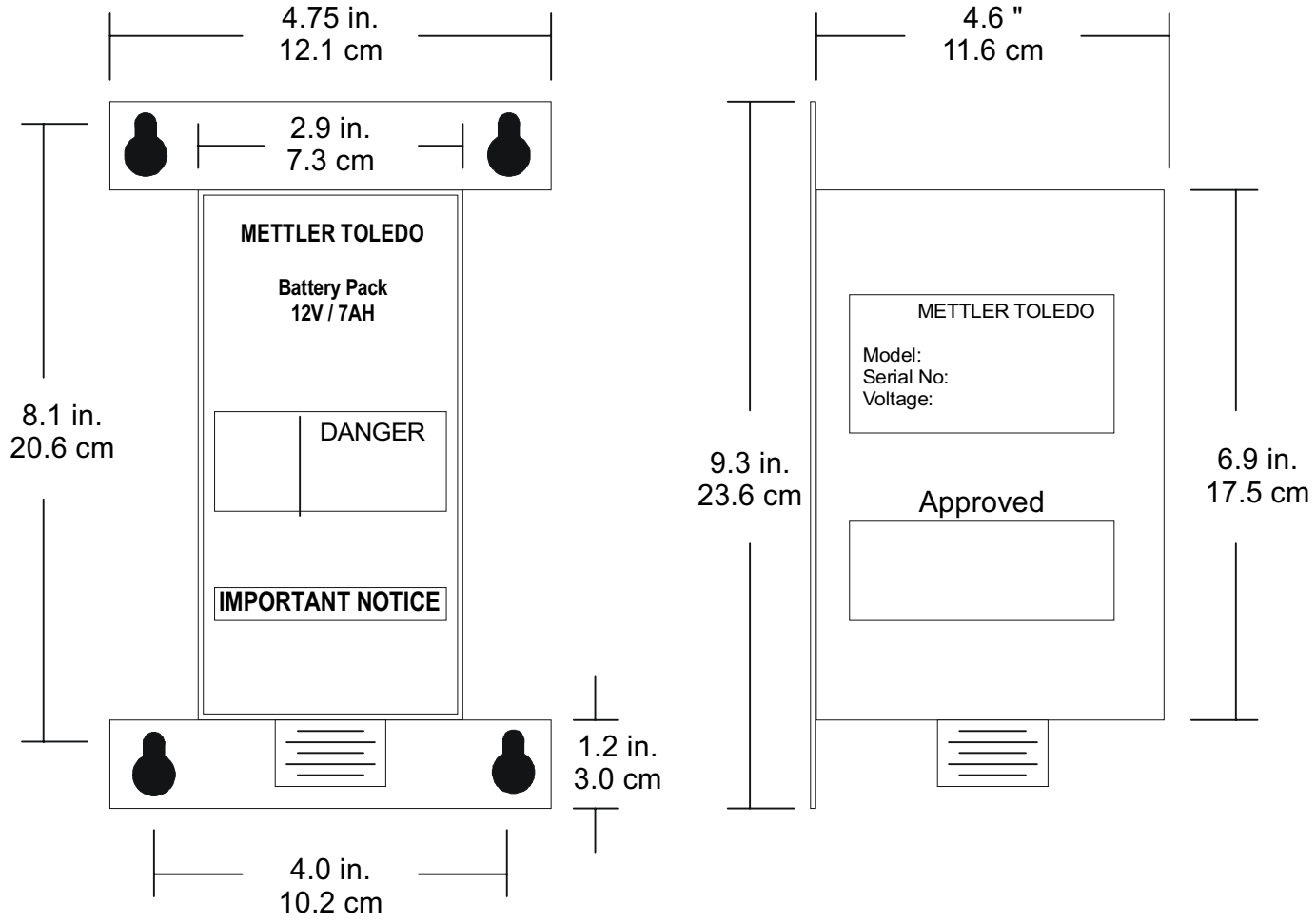


Figure 1-d: PUMA 7AH Battery Pack Dimensions

AC Power Supply

120 VAC Input Model 0919-0044
230 VAC Input Model 0964-0071

The AC power supply enclosure is constructed of zinc-plated cast iron and weighs approximately 8.5 lb (3.9 kg). The AC power supply is designed to be mounted directly to a wall or support column.

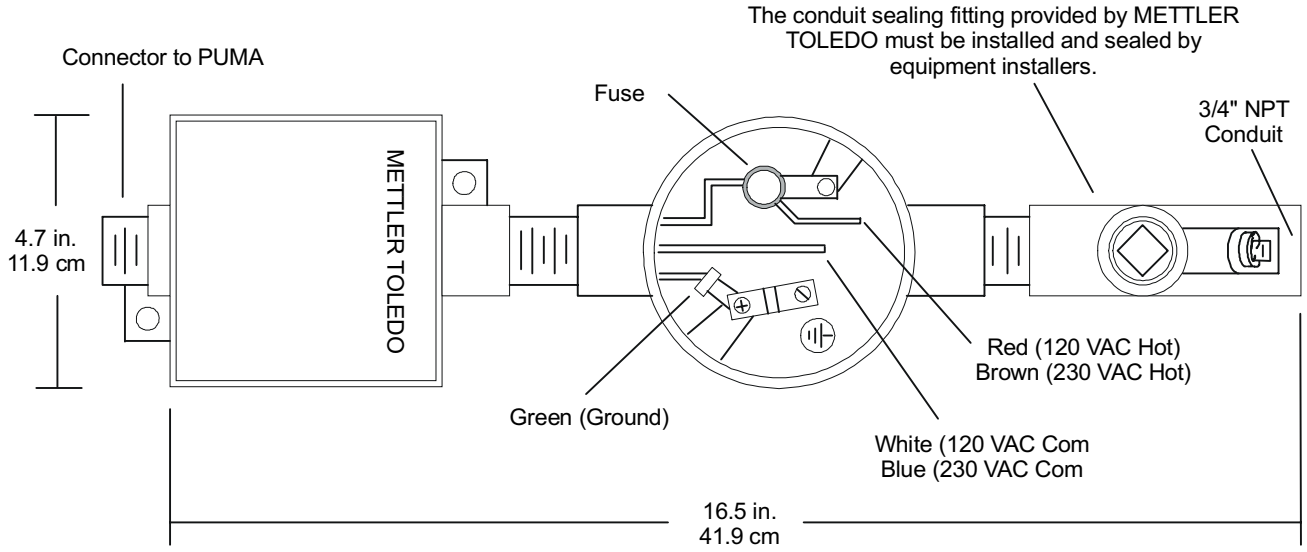


Figure 1-e: AC Power Supply Dimensions

Battery Power Data

For continuous operation, a spare battery pack is recommended so that one can be recharged while the other is in use.

Remove the battery pack if you will be storing the *PUMA* terminal for more than 60 days.

Internal 1.2 AH Intrinsically Safe Battery Pack (0964-0083)

The 1.2 AH intrinsically safe battery pack (used in PXHN1100 units) is located behind the access cover on the right side of the terminal. It must be removed to a non-hazardous area for recharging. Recharge time is typically 32 hours. Only METTLER TOLEDO battery chargers, P/N 14848000A USA (Model 0964-0084), P/N 14848400A Europe (Model 964-0086), P/N 14848500A UK (Model 0964-0085), P/N 14867900A Australia (Model 964-0087)) are to be used to recharge the 1.2 AH battery. **Recharge the battery pack only in a safe area**. **Do not use the battery charger to charge any other batteries except the METTLER TOLEDO 1.2 AH Battery Pack**. The 1.2 AH battery will operate the *PUMA* terminal connected to a single analog load cell platform setup with an update rate of 7 for up to 66 hours. Multiple load cells and fiber optics will reduce battery life.

External 7 AH Intrinsically Safe Battery Pack (09640078/09640093)

A fully charged external battery pack will power the *PUMA* terminal continuously for up to 350 hours before the "Battery Low" symbol is displayed. When a low battery condition exists, the battery still has reserve power to operate from 8 to 10 hours before battery shutdown occurs. Once shutdown has occurred, the battery must be completely recharged before it can be used again.

It takes approximately 12 hours to recharge when the "Battery Low" symbol is displayed. You must use the METTLER TOLEDO battery charger (0964-0005, 0006, 0061, 0062, 0063, or 0064) to recharge the 7 AH intrinsically safe battery pack.

⚠ WARNING

DO NOT USE THE METTLER TOLEDO BATTERY CHARGER IN A HAZARDOUS AREA. THE BATTERY CHARGER IS NOT DESIGNED FOR HAZARDOUS AREA OPERATION.

Battery Life

Table 1-b shows the approximate battery life with various functions enabled. The following estimates are based on a new fully charged battery.

# Load Cells (350 Ω)	Fiber Optics in Continuous Mode	Update Rate	Mode	Displayed Units	Current Draw	Estimated Hours (1.2 AH)	Estimated Hours (7 AH)
1	0	7	Gross	lb	22 mA	55	382
1	0	7	Net	lb	22 mA	54	364
1	0	7	Net	Alt	24 mA	50	344
1	0	7	Gross	kg	22 mA	53	380
1	0	7	Net	kg	23 mA	50	360
1	1	7	Gross	lb	24 mA	49	352
1	1	7	Net	lb	24 mA	48	339
1	1	7	Net	kg	25 mA	46	336
1	1	7	Net	Alt	26 mA	31	319
4	2	7	Gross	lb	39 mA	30	197
4	2	7	Net	lb	39 mA	29	195
4	2	7	Net	Alt	41 mA	25	190
4	2	16	Gross	lb	41 mA	29	190
4	2	16	Net	lb	41 mA	29	185
4	2	16	Net	Alt	44 mA	27	175

Table 1-b: Battery Life Estimates

Either the 1.2 AH or 7 AH battery should be able to support at least 100 recharges before the end-of-life point is reached. However, since many factors alter this estimate, it should only be used as a guide. The end-of-life point is defined as the point where the battery capacity is one half that of a new battery.

AC Power Supply

The AC power supply is intrinsically safe for Class I and II, Applicable Groups A, B, C, D, E, F, and G (**power supply located in safe area**) or intrinsically safe for Class I and II, applicable Groups C, D, E, F, and G (**power supply located in hazardous area**) per Factory Mutual standard class number 3610.

- Output open circuit voltage: 11.78 VDC to 13.0 VDC
- Short circuit output current: 100 mA typical

Power Cable Details (PXHN1200)

- Standard length - 60 inches (152.4 cm) attached to the *PUMA* terminal.
- Maximum Length: 150 feet (45.7 m)
- Conductors: 4 conductor, #20 AWG stranded 19/32 tinned copper
- Shield: Braided tinned copper, 85% minimum coverage
- Finished Outside Diameter: 0.40 inches (1.02 cm) maximum

Fiber Optic Data I/O

The Fiber Optic Data I/O option provides bidirectional serial communication to a remote device. Data is a 10/11 bit frame consisting of 1 start bit, 7/8 data bits with parity, and 1 stop bit. The baud rate is selectable from 300 to 9600 baud. Parity is selectable as even, odd, mark, space, or none. The different mode types are defined in detail in the Appendices.

Output Mode Types

Demand

In demand mode, the *PUMA* terminal sends messages each time a print request occurs. Demand mode output is inhibited if weight on the scale is unstable, under gross zero, or over capacity. If a print request is inhibited due to unstable weight, an output occurs when the weight becomes stable. Demand output is disabled if the *PUMA* terminal is in the expanded weight display mode. Please refer to Chapter 3 for more information on setup parameters including expanded weight display.

Toledo Continuous

In continuous mode, the *PUMA* terminal sends 7 to 16 transmissions each second. It includes displayed weight, tare weight, and status information. Unlike demand mode, continuous output occurs even when weight is unstable, under gross zero, or if the *PUMA* terminal is in expanded weight display mode. (See Appendix.)

Continuous Short

This mode is the same as continuous, except no tare data is sent.

Bi-directional Mode Types

<ENQ> Continuous

In <ENQ> continuous mode, the *PUMA* terminal outputs one continuous formatted transmission each time a remote host sends an ASCII <ENQ> character (hex 05). (Two times per second maximum.)

ASCII Input

ASCII Input accepts characters for clear (C), print (P), tare (T), and zero (Z) in both demand and continuous output mode. The data interface also accepts the <ENQ> character.

Host

The host mode, available on Communication Port One only, is a bi-directional interface intended to be connected to an intelligent host device. The host sends a request, and the requested data is sent.

SICS Level 0 Host Protocol

SICS Level 0 METTLER TOLEDO communication mode is intended for communication with a computer.

Tested Remote Devices

The *PUMA* terminal will communicate with the devices and instrument accessories shown in Table 1-c that are installed in a safe area.

The following METTLER TOLEDO peripherals have a fiber optic converter as a standard feature: 8617, 9323, 9325, and 9330. The 8624 has an optional Fiber Optics Kit of Parts available. Others require use of the remote (safe area) Dual Channel fiber optic converter (printers, host PCs, 3015, etc.)

Equipment Description	Model Designation
Remote Display and Scoreboards	8623, 8624, 8614, 8616, 8617, 8618
Remote Input	9330
Data Devices	9323 BCD, 9325 Analog, 9360
Set Point Control	3015
Drumfiller	9102
Batching	9215
Host Computers	RS-232 Continuous, 8525 ENQ, Host Bi-directional (Channel 1 only), SICS Level 0 (Channel 1 only).
Remote Fiber Optics	Dual Channel Fiber Optic Converter
Printers	8806, 8807, 8844, 8845, 8856, 8860, 8861, 8865

Table 1-c

Standards Compliance

Factory Mutual

The *PUMA* terminal conforms to Factory Mutual Approval Standard 3610 Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I and II, Division 1 and 2, Hazardous (Classified) Locations as specified in METTLER TOLEDO Control Drawing 148450R. The FM label appears on the front of the unit.

Canadian Standards Association

The *PUMA* terminal conforms to the Canadian Standards Association standard for use in Class I and II, Division 1, Hazardous (Classified) Locations as specified in METTLER TOLEDO Control Drawing 152949R. The CSA label appears on the data label.

Legal-For-Trade

The *PUMA* terminal has received the USA National Type Evaluation Program (NTEP) Certificate of Conformance and can be used in legal-for-trade applications as a Class III or IIIL device (5000d). See Document COC#96-160 in Appendix 11.

The *PUMA* terminal has received the Canadian Standards Association approval (AM-5195) and can be used in legal-for-trade applications as a Class III or IIIL device (5000d).

ISO 9001

The *PUMA* terminal is produced and tested in a METTLER TOLEDO facility that has been audited and registered according to international (ISO 9001) quality standards.

Water Penetration (Washdown)

The *PUMA* terminal is rated NEMA 4x (IP-65) (dust-tight, splash proof). **The external intrinsically safe battery pack and hazardous area power supply are not washdown rated and must not be used in washdown areas.**

FCC Regulations

The *PUMA* terminal meets or exceeds FCC docket 80-284 Class A for conducted and radiated emissions. If the *PUMA* terminal is used in residential areas, you are required to correct any interference at your expense.

Radio Frequency Interference (RFI)

The *PUMA* terminal meets the U.S. and Canadian Weights and Measures susceptibility specifications with a maximum change of one displayed increment for the external field strength shown below.

RFI Radiated Emissions		
Country	**Frequencies**	**Field Strength**
U.S.	27, 169, 464 MHz	3 Volts/Meter
Canada	27, 464 MHz	3 Volts/Meter

Electrostatic Discharge (ESD)

This is not to imply ESD is allowed to occur in the hazardous area. No ESD is allowed to occur in a hazardous area!

The *PUMA* terminal has been tested for ESD susceptibility using 6 kilovolts with an energy of 3.6 millijoules for 50 discharges at a repetition rate of one discharge every ten seconds. The *PUMA* terminal sustained no hardware damage, lock-ups, mode change, or memory loss.

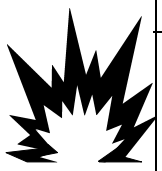
2 Installation

Environment

Before installing the *PUMA* terminal, identify the best location for the equipment. Consider the temperature and humidity specifications listed in Chapter 1 of this manual.

⚠ WARNING

DO NOT INSTALL OR PERFORM SERVICE ON THIS EQUIPMENT BEFORE THE AREA HAS BEEN SECURED AS NON-HAZARDOUS BY PERSONNEL AUTHORIZED TO DO SO.



⚠ WARNING

ONLY THE COMPONENTS SPECIFIED IN THIS MANUAL CAN BE USED IN THE *PUMA* TERMINAL. ALL EQUIPMENT MUST BE INSTALLED IN ACCORDANCE WITH THE INSTALLATION INSTRUCTIONS DETAILED IN THIS MANUAL. INCORRECT COMPONENTS AND/OR DEVIATION FROM THE INSTRUCTIONS CAN IMPAIR THE INTRINSIC SAFETY OF THE UNIT COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

⚠ WARNING

IF USED, DO NOT INSTALL THE EXTERNAL AC POWER SUPPLY IN GROUP A OR B LOCATIONS. THE *PUMA* TERMINAL MAY BE INSTALLED IN GROUP A-G LOCATIONS, BUT THE AC SUPPLY MUST BE INSTALLED ONLY IN C-G OR NON-HAZARDOUS LOCATIONS.

Unpacking and Inspection

Inspect the package when it is delivered by the carrier. If the shipping container is damaged, check for internal damage and file a freight claim with the carrier if necessary. **Shipping damage is not covered under warranty.** If the container is undamaged, unpack and inspect each component. If it is necessary to ship the terminal, use the original shipping container if possible. The *PUMA* terminal must be packed correctly to ensure safe transportation.

Package contents for the wall and desk mount *PUMA* terminal include:

- *PUMA* Terminal
- Technical Manual and User's Guide
- (2) Wall Mount Brackets
- Capacity Label
- Ferrite Toroid
- 1.2 AH Battery (Model PXHN1100 only)

Opening the Enclosure

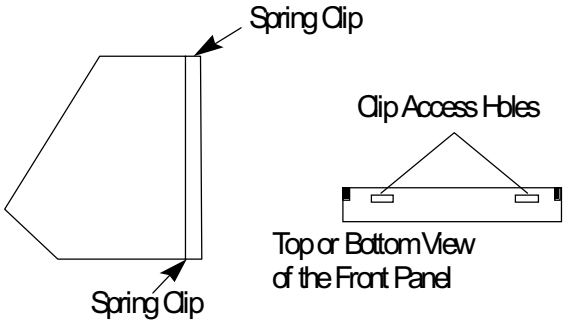


Figure 2-a: Opening the PUMA Enclosure

To access the Main Logic PCB for internal wiring and setting switches, separate the front panel from the enclosure (Figure 2-a).

Squeezing the front panel and the rear enclosure together will release some of the holding force on the clip, making it easier to "pop" the clip.

1. Insert the tip of a flat-blade screwdriver into each slot, one at a time, which are located on the top or bottom of the front panel assembly.
2. Gently push the screwdriver in toward the enclosure until a quiet "pop" is heard.
3. Repeat this process on both clips.
4. After releasing the front panel, lift the front panel until it clears the enclosure.

⚠ CAUTION

THE RELEASE CLIPS BEHIND THE COVER ARE SHARP. DO NOT GRASP THE COVER IN THE VICINITY OF THE (4) SPRING CLIPS. OTHERWISE, CUT FINGERS MAY RESULT WHEN THE COVER IS REMOVED.

Mounting the Enclosure

The *PUMA* terminal may be mounted in three configurations:

Desk Mount No hard mounting provisions.

Wall Mount (2) Wall Mount Brackets are provided in shipping carton.

Column Mount Special Mounting Bracket.

See Chapter 1 for illustrations of each of the above configurations.

Cable Routing

Figure 2-b shows the cable routing locations on the back of the *PUMA* terminal. All cables must be run through a grip bushing that provides a seal to the enclosure.

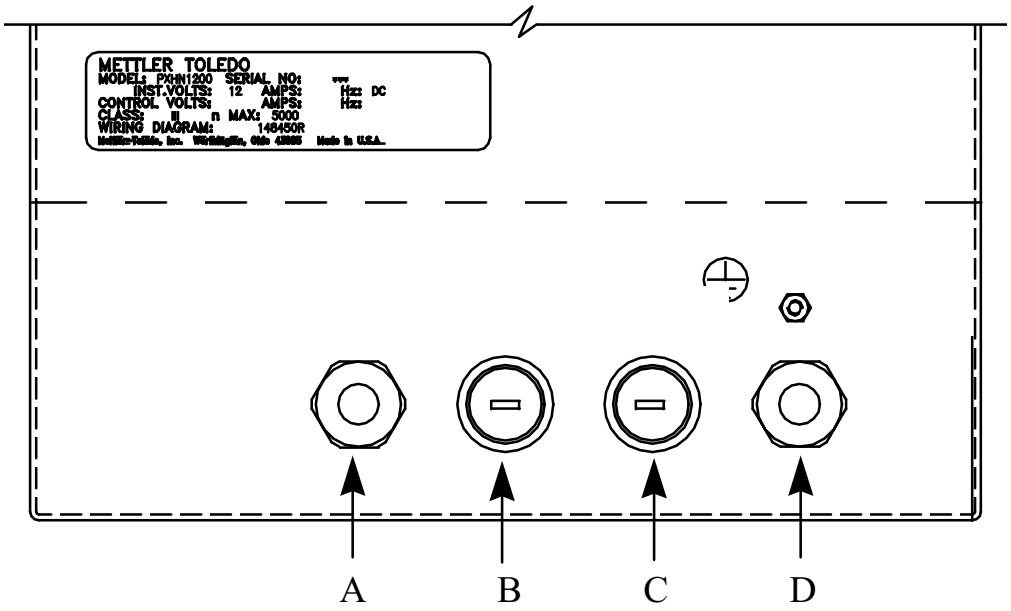


Figure 2-b: Cable Routing

Ref.	Description
A	DC Power (external) (PG11 or Blank (Internal Battery.)
B	Fiber Optic Cable COMM 2 (PG16)
C	Fiber Optic Cable COMM 1 (PG16)
D	Load Cell Cable (PG11)

Terminating the Analog Load Cell

To prevent thermal drift:

Always use a single piece of load cell cable from the load cell to the terminal, and make sure the wire connections are tight.

Refer to the Service and Maintenance troubleshooting section for load cell/signal installation considerations

After the *PUMA* terminal enclosure is mounted, you need to terminate the load cell.

The analog load cell input provides +1.6 VDC excitation for up to four 350 Ohm analog load cells. The maximum length of the home run cable is 400 feet (125 m). Analog load cell cable P/N 540620370 (20 AWG) is available from METTLER TOLEDO and is recommended for this application. Cable P/N 540616370 (16 AWG) may be substituted.

To terminate the analog load cell inside *PUMA* terminal:

1. Prepare the *PUMA* terminal end of the load cell cable as shown below in Figure 2-c. Strip the cable jacket and shield 12 in. (30.48 cm).

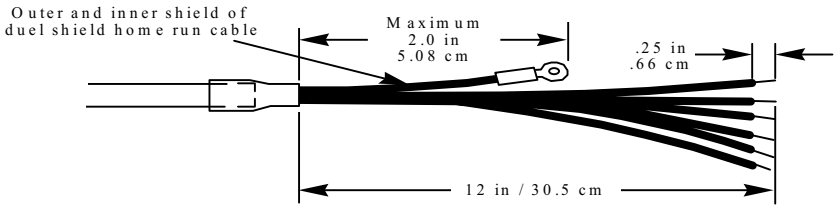


Figure 2-c: Load Cell Cable Preparation

2. Insert the cable into the enclosure through the load cell grip bushing and grommet until the outside jacket end is flush with the inside edge of the grip bushing as shown in Figure 2-d.
3. Tighten the bushing securely.
4. Attach the cable outer and inner shield to the M4 stud beside the grip bushing on the inside of the enclosure. It is important that the shield wire be as short as possible.
5. Wrap the cable wires three times through the Ferrite Toroid (P/N 13492900A). Keep the ferrite ring as close as possible to the grip bushing. **Pass the shield through the Ferrite Toroid, but do not wrap three times (see Figure 2-d).**

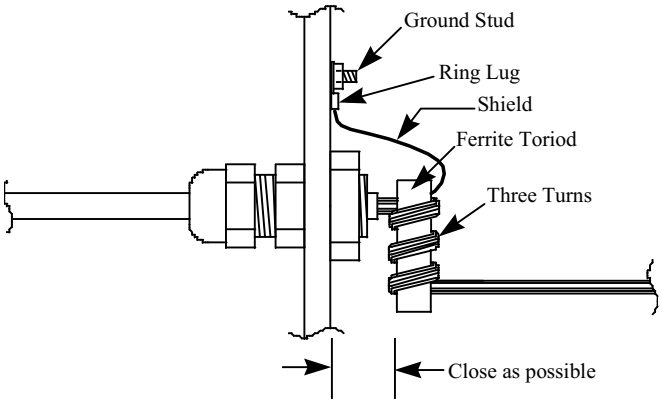


Figure 2-d: Load Cell Cable Installation

6. Terminate the wire ends using the supplied terminal/plug, P/N 14860800A as shown in Figure 2-e and Table 2-a.

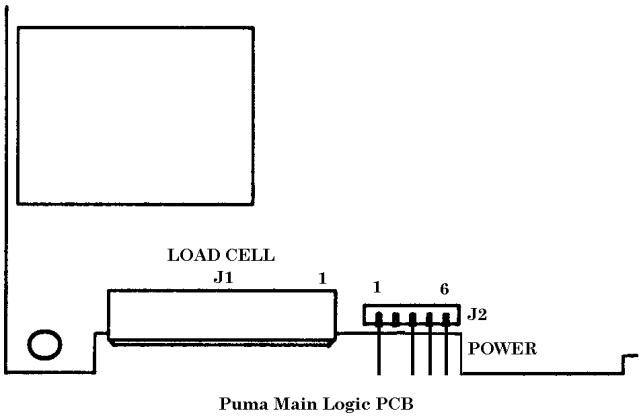


Figure 2-e: Load Cell Connector J1

PUMA J1 Terminal Number	Signal Description	METTLER TOLEDO P/N 540620370 (20 Gauge) P/N 540616370 (16 Gauge) Cable Color Code
1	+Excitation	White
2	+Sense	Yellow
3	+Signal	Green
4	Ground	N/C
5	-Signal	Black
6	-Sense	Red
7	-Excitation	Blue

Table 2-a: Analog Load Cell Wiring

7. Terminate the opposite end of the cable to the analog scale base or load cell. Refer to METTLER TOLEDO control drawing 148450R (Appendix 7) for load cell field wiring instructions for FM applications or control drawing 152949R (Appendix 8) for CSA applications. Match the load cell signal description to the terminal strip description. Wire colors listed are for the standard METTLER TOLEDO 6-wire dual shield load cell cable (P/N 540620370).

Compatibility with 3mV/V Load Cells

An update was made to the PUMA terminal to permit use of 3mV/V load cells in addition to 2mV/V load cells. Only PUMA terminals with Main PCB part number *15843800A are fully compatible with 3mV/V load cells. This new PCB will be in production PUMA terminals beginning in June, 2000.

The PUMA terminal is shipped with the load cell jumper in the 2mV/V position. If a 3mV/V load cell will be used, the jumper position must be changed. The steps to change the jumper position are given below.

1. Remove the PUMA terminal Main PCB from the enclosure.

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

2. On the Main PCB, remove the metal top to the shield can covering the analog circuitry and the W5 jumper by prying it up gently from the base. THE BASE OF THE CAN DOES NOT COME OFF THE PCB – ONLY THE TOP OF THE CAN IS TO BE REMOVED. Refer to Figure 2-f for the position of the metal shield can.

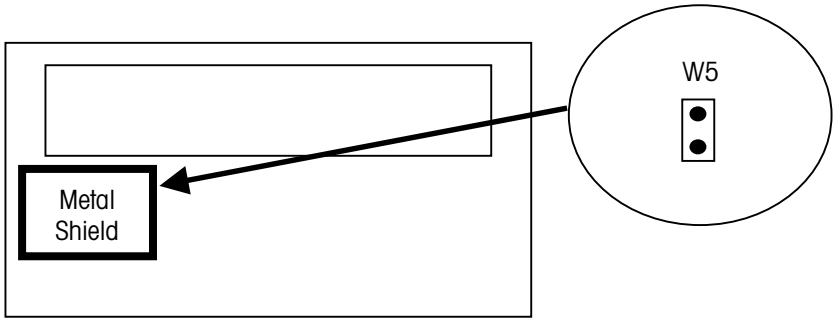


Figure 2-f

3. With the top off, locate the W5 jumper plug and remove the plug from shorting the two pins when 3mV/V load cells are used. The jumper may be left on only one pin for possible use in the future.

   W5 ON (shorting the two pins) - 2mV/V load cells

   W5 OFF (not shorting the two pins) - 3mV/V load cells

4. Reinstall the top cover of the metal shield can making sure it covers the base of the can completely.
5. Reinstall the PUMA terminal Main PCB.

Installing an External Power Source

The *PUMA* terminal (Model PXHN1200 only) can be powered either by an optional METTLER TOLEDO intrinsically safe external 7 AH battery pack or a METTLER TOLEDO intrinsically safe external AC power supply. Proper installation of the power supply includes installing the terminal supply cable, then making the connection to the intrinsically safe battery pack assembly or to the hazardous area AC power supply.

Power Supply Cable

The *PUMA* terminal is supplied with a 60 inch power (152 cm) cable (P/N 14729800A) connected to the instrument which has a plug to connect directly to either the 7 AH battery or AC supply.

The maximum allowable length of the power supply cable when used with the external battery pack is 50 feet (15 m), and 150 ft (46 m) when used with the AC power supply. Refer to Chapter 6 Parts and Accessories for extended length terminal supply cable part numbers.

The installed power cable is 60 in (152 cm) long, but extended lengths are available. To accommodate a longer length, follow the steps below.

1. Remove the standard 60 in (152 cm) cable.

2. Insert the new cable through the power grip clamp and grommet until the outside jacket is flush with the inside edge of the grip bushing.
3. Attach the cable shield and the white wire to one of the M4 studs on the inside bottom of the enclosure.
4. Connect the cable plug to J2 on the *PUMA* terminal Main PCB. Make sure the key in the cable plug aligns with the removed pin in J2.

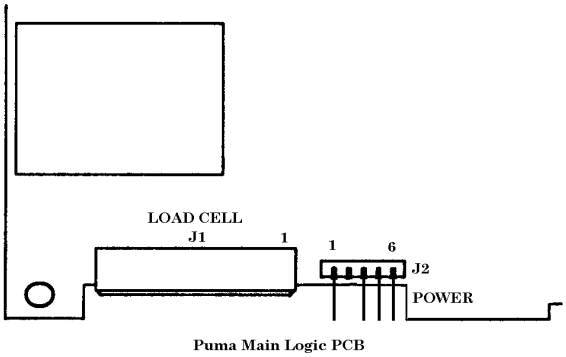


Figure 2-f: PUMA J2 Power Connector On Main PCB

⚠ CAUTION!

MAKE SURE THE POWER CONNECTOR IS WIRED CORRECTLY. IF THE POLARITY IS REVERSED, IT WILL BLOW THE FUSE ON THE MAIN PCB WHICH IS NOT FIELD REPLACEABLE AND WILL REQUIRE A PCB REPLACEMENT. BEFORE APPLYING POWER, DOUBLE CHECK THE WIRE COLORS ON THE PLUG AND MAKE CERTAIN IT IS INSERTED INTO CONNECTOR J2 CORRECTLY!

External Power Termination		
Connection Point	**Description**	**Wire Color**
P2-1	Ground	N/C
P2-2	Key	N/C
P2-3	*Ext. Batt Low	Black
P2-4	+12 VDC	Red
P2-5	Ground	Green
Chassis		White & Shield

* The AC power supply or the 1.2 AH battery does not use Battery Low input.

Table 2-b: PUMA J2 Power Connector

External 7 AH Battery Pack Connection

The 7 AH battery pack has a mating connector attached to the end of the case. The connectors on the power supply cable and on the battery pack are keyed to prevent improper attachment. The keys must line up for the connectors to mate.

To make the battery pack connection:

1. Place the male connector on the power supply cable into the battery pack female connector.
2. Gently press the connectors together while at the same time rotating the connectors until the keys align and the connectors slide together.
3. Rotate the retaining ring on the power supply cable connector clockwise to lock the connectors together.

To disconnect, rotate the retaining ring on the power supply cable counterclockwise, then gently pull apart.

Hazardous Area AC Power Supply Connection

The AC power supply assembly has a female connector on the housing for connection to the power supply cable. The connectors on the power supply cable and on the AC power source are keyed to prevent improper attachment.

To make the AC power supply connection:

1. Place the female connector on the AC power supply into the male connector on the power supply cable.
2. Gently press the connectors together while at the same time rotating the connectors until the keys align and the connectors slide together.
3. Rotate the retaining ring on the terminal supply cable connector clockwise to lock the connectors together.

To disconnect, rotate the retaining ring on the power supply cable counterclockwise, then gently pull apart.

Installing Options

Either one or two Fiber Optic option kits can be ordered for the PUMA terminal. These kits are not installed in the PUMA terminal at the factory.

Fiber Optic Data I/O

The fiber optic cable used is HCS® which has a Hard Clad Silica (glass) core cable that requires special tools to install the connectors. Field terminated connectors are not recommended.

The Fiber Optic Data I/O option allows bidirectional serial interfaces to peripheral devices. The peripheral devices may require a dual channel fiber optic converter, or if a METTLER TOLEDO peripheral device is used, it may have a converter built in. Refer to Appendix 2, Demand and Continuous Output Formats, for more information. Note: Host Mode is available on COMM1 only. See Appendix 4.

The fiber optic option kit does not contain fiber optic cables. You can obtain fiber optic cable from METTLER TOLEDO as pre-terminated cable (available in various lengths). Cable lengths from 50 feet (15 meters) to 1000 feet (300 meters) in 50 foot (15 meter) increments are available from METTLER TOLEDO. Cables can be coupled using a special coupler, but the coupler signal loss is equivalent to 500 feet (150 meters) of cable. When one coupler is used the useable distance is 500 feet (150 meters).

Two fiber optic cables are required for bidirectional communication.

The installation procedure includes electrical connections and jumper settings for configuring the option.

Fiber Optic PCB Kit Installation

The optional Fiber Optic PCB Kit (Model 0961-0090) includes a Single Channel full duplex TTL Logic to Fiber Optic PCB, PCB to PCB Harness, and installation hardware. Two kits can be installed to give the *PUMA* terminal two serial channels. To install the kit:

1. Disconnect power to the *PUMA* terminal by removing the internal battery, or disconnecting the external power source.
2. Remove the top cover assembly.
3. Install the Fiber Optic PCB (1C in Figure 2-h) on one set of the mounting studs in the base using the two supplied screws (1A and 1B in Figure 2-h).
4. Install the PCB to PCB Harness (1D in Figure 2-h) on the Fiber Optic PCB. Connect the other end to J3 for COMM 1, or J4 for COMM 2 on the *PUMA* terminal Main PCB.

Fiber Optic Cable Installation

1. Disconnect power to the *PUMA* terminal by removing the internal battery, or disconnecting the external power source.
2. Remove the top cover assembly.
3. Remove and discard the hole cover for COMM1 (and COMM2 if installing two Fiber Optic PCB's) on the *PUMA* terminal rear panel. See Figure 2-b.
4. Install the split grip bushing adapter into the rear grip bushing mounting hole as shown in Figure 2-g.

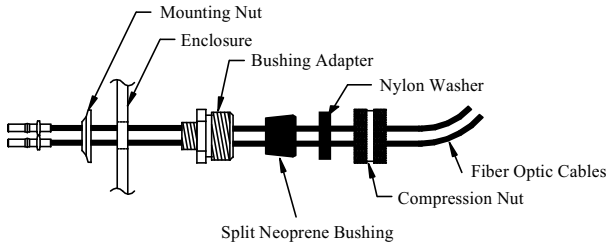


Figure 2-g: Fiber Optic Grip Clamp Installation (Item 1F)

5. Insert the fiber optic cable(s) into the hole(s) of the split bushing and install the bushing, countersunk washer, and compression nut into the bushing adapter. Leave the compression nut loose to allow free movement of the fiber optic cables until installation is complete.

If only one fiber optic cable is used, insert a plastic rivet (P/N 13774300A) into the unused hole in the split bushing.

6. Feed the fiber optic cable through the split bushing until the cable reaches the Fiber Optic PCB (approximately eight inches).

7. Plug in the fiber optic cables. J2 is transmit and J3 is receive.

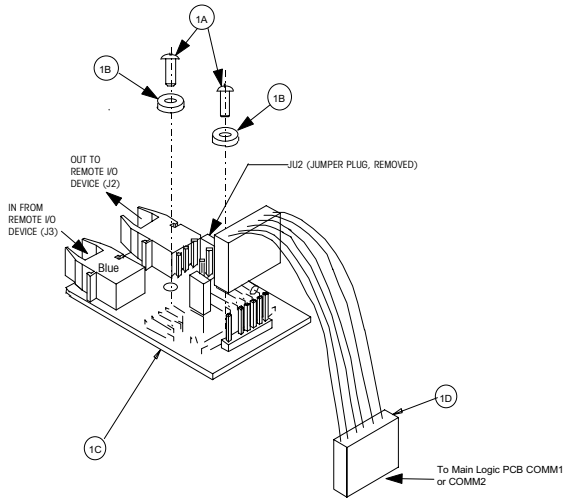


Figure 2-h: Fiber Optic Data I/O PCB

8. Tighten the compression nut on the outside of the grip bushing to secure the fiber optic cables. Be sure the fiber optic cable is not bent to less than a 1/2 in. radius. Any sharp kink in the fiber optic cable will render it useless. Coil excess cable neatly inside the *PUMA* terminal.

9. Reconnect the power source and apply power to the *PUMA* terminal.

Fiber Optics Kit Model 0961-0090 for the PUMA Terminal

Qty	Part Number	Description	Item
2	R0524700A	Screw, M3 x 8	1A
2	(*)14979800A	Washer, Flat Nylon	1B
1	(*)90030100A	PCB Assy, Fiber Optic Scale	1C
2	(*)09591500A	Cable Tie, Small	1E (Not Shown)
1	(*)15215800A	Grip Bushing, Split Dual Hole	1F
1	(*)13774300A	Rivet, Acetal .085 x .5	1G (Not Shown)

*May have a letter prefix representing the latest version

Dual Channel Fiber Optic Converter Module Accessory

A Dual Channel Fiber Optic Converter Module is a separate accessory for the opposite (remote) end(s) of the Fiber Optic Cable(s) that can provide up to two bi-directional channels: each channel has simultaneous 20 mA and RS-232 communications. The *PUMA* terminal uses the fiber optic converter to provide compatibility with various METTLER TOLEDO printers. The converter is also used to communicate with a host computer or other smart devices.

Complete installation and programming details are provided in the Dual Channel Fiber Optic Converter Service Manual supplied with the device.

The model numbers for the fiber optic converter module are:

Model	Description
0964-0043	USA Line Cord, 115 VAC/60 Hz
0964-0058	UK Line Cord, 230 VAC/50 Hz
0964-0059	European Line Cord, 230 VAC/50 Hz
0964-0060	No Power Supply included, 12 VDC @ 500 mA required

Electrical Interconnection Wiring

The Dual Channel Fiber Optic Converter interfaces to METTLER TOLEDO printers and accessories through a DB-25 F connector. The 20 mA current loop interface has superior electrical noise immunity and is recommended for industrial environments where cable runs up to 1000 feet (300 meters) are required. RS232 connections should be used in office environments for lengths up to 50 feet (15 meters).

The following tables give connection information to printers and accessories. A shielded twisted pair cable of at least 24 gauge is recommended.

Pin	Fiber Optic Converter Description	8806, 8860 (Desk)	8860, (Wash Down)	8807, 8844, 8845, 8856, 8861, 8865	3015 (TB1)	8623, 8624	8617 (TB2), 9323, 9325
2	TxD (RS-232)	N/C	N/C	3	5*	2*	2*
3	RxD (RS-232)	N/C	N/C	N/C	N/C	N/C	N/C
7	Logic Ground	N/C	N/C	7	2	3	3
8	+RxD (20 mA)	11	N/C	N/C	3	N/C	N/C
9	+TxD (20 mA)	16	H	N/C	5*	8*	8*
10	–RxD (20 mA)	22	N/C	N/C	4	N/C	N/C
22	–TxD (20 mA)	18	K	N/C	6	10	9
	Jumpers	12-23	None	None	None	12-23	None

* RS-232 or 20 mA, but not both at the same time.

Table 2-c: Channel Fiber Optic PCB to METTLER TOLEDO Printers and Accessories

Fiber Optic Converter		Computer Serial Port	
Pin	Description	DB-25-S	DB-9-S
2	TxD (RS-232)	3	2
3	RxD (RS-232)	2	3
7	Logic Ground	7	5
PC Interface Cable Jumpers		4-5-6	4 & 6
		8 & 20	7 & 8

Table 2-d: Dual Channel Fiber Optic Converter to PC Interface Cable

Apply Power

Following the connection of the load cell, power supply, and the Fiber Optic I/O option (if applicable), you are ready to apply power to the *PUMA* terminal.

⚠ WARNING

DO NOT USE AN UNAPPROVED POWER SOURCE. THE POWER SOURCE MUST BE INTRINSICALLY SAFE AND RATED FOR THE APPLICABLE ENVIRONMENT. FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

For AC powered units, energize the AC power, then press the **ON** key. For battery powered units, connect the battery then press the **ON** key. *PUMA* Terminals produced after May, 1999 will automatically power-up when power is applied without pressing the ON key. If the battery low terminal is visible, the battery needs to be charged in a safe area.

⚠ WARNING

Do not charge battery in a hazardous area. Recharge only in a safe area. Failure to observe this precaution may result in bodily injury and/or property damage.

Power-up Sequence

The *PUMA* terminal goes through a series of self tests when it is turned on. These tests confirm normal internal operation. The power-up sequence is as follows:

1. A diagnostic self-test is performed on the memory and microprocessor. An error message is displayed if any component fails the test.
2. A display test is made by lighting all segments on the display and the decimal point (or comma) moves from the left most position to the right most position.
3. The software program number **[147224]** is displayed next followed by the revision level of software **[L 06.0]**.
4. Next, the *PUMA* terminal displays weight or dashes **[-----]** as it initializes load cell conversion.
5. The power-up sequence requires approximately 9 seconds.

NOTE: Steps 2 and 3 are not automatically performed on units with software prior to revision level 6.0.

3 Setup

Scale Build Determination

Note: Minimum increment size must be determined before calibration.

If a standard scale build is used for your application, you do not need to determine a different scale build. The *PUMA* terminal can display a maximum of 25,000 increments. The minimum increment size (scale build determination) must be calculated if:

- A nonstandard build is desired.
- Analog scale input is used with a lever system conversion.
- A Flexmount or Centerlign analog load cell is used.

When determining a scale build for an application, the following must be considered:

- 1,000 to 25,000 increments can be displayed.
- When installing the terminal with Main PCB *15136100A, only 2mV/V load cells can be used. When installing the terminal with Main PCB r *15843800A, position the W5 jumper on the Main PCB correctly for the load cells used – either 2mV/V or 3mV/v. Refer to Chapter 2 for the position and description of the W5 jumper.
- The number of displayed increments is dependent upon the amount of the cell capacity used for weigh capacity (span), and the update rate.

The following legal-for-trade items must also be considered:

- 1,000 to 3,000 increments are allowed for NMi.
- 1,000 to 5,000 increments are allowed for NTEP.
- Minimum of 25% of cell capacity must be used for span. (Not scale base capacity which is typically one half of cell capacity.)

Minimum Increment Size For Analog Scale Input

The minimum increment size for an analog scale input is determined by calculating the microvolts per increment. Solve the following equation for μV per increment.

$$\mu V \text{ per Increment} = \frac{\text{Increment Size} \times \text{Excitation} \times \text{Load Cell Output} \times 1000}{\text{Load Cell Capacity} \times (\text{Lever Ratio to Cell or Number of Cells})}$$

The increment size and load cell capacity must be measured in the same units. Load cell output is rated in mV/V (millivolts per volt of excitation), and is marked on the load cell data tag. METTLER TOLEDO load cells are typically 2 mV/V. The load cell capacity is the rated capacity marked on the load cell data tag. The load cell capacity is multiplied by the total number of load cells in the system, or the total lever ratio (if scale is a mechanical lever system conversion). Scales used in legal-for-trade applications MUST NOT have an increment SMALLER than the minimum increment size (e-min) listed on the base's data plate. The *PUMA* should never be programmed for less than 0.164 μV per increment when used in NTEP approved applications.

Sample Calculations

Refer to the following examples of μV per increment calculation.

Example 1: Model 2158 Floor Scale.

Working Scale Cap.	5000 lb
Increment Size	1.0 lb
Load Cell Capacity	2500 lb
Number of Cells	4
100% Cell Output	2 mV/V
Excitation Voltage	1.6 VDC

$$\mu V \text{ per Increment} = \frac{1 \text{ lb} \times 1.6 \text{ VDC} \times 2 \text{ mV/V} \times 1000}{2500 \text{ lb} \times 4 \text{ load cells}} = \frac{1 \times 3.2 \times 1000}{10{,}000} = 0.32 \ \mu V/\text{inc.}$$

Example 2: WB60x Bench Scale.

Working Scale Cap.	100 lb
Increment Size	0.02 lb
Load Cell Capacity	220 lb
Number of Cells	1
100% Cell Output	2 mV/V
Excitation Voltage	1.6 VDC

$$\mu V \text{ per Increment} = \frac{0.02 \text{ lb} \times 1.6 \text{ VDC} \times 2 \text{ mV/V} \times 1000}{220 \text{ lb} \times 1 \text{ load cells}} = \frac{0.02 \times 3.2 \times 1000}{220} = 0.29 \ \mu V/\text{inc.}$$

Scale Capacity Table

Scale capacity and increment size are selected during set-up within the selection range shown in the following table.

Notes:

1. The number of full scale increments is determined by dividing the scale capacity entered by the increment. If the combination is not evenly divisible then the next highest round increment value is used. For example if a scale capacity of 5007 lb x 5 lb is chosen, then the division would result with full scale increments of 1001.4 increments. This would be rounded up to 1002 increments, resulting in a capacity of 5010 lb.

Increment Size	Working Scale Capacity	
	1000 Inc. (Min)	25,000 Inc. (Max)
0.001	1	25
0.002	2	50
0.005	5	125
0.01	10	250
0.02	20	500
0.05	50	1250
0.1	100	2500
0.2	200	5000
0.5	500	12500
1	1000	25000
2	2000	50000
5	5000	125000
10	10000	250000
20	20000	500000
50	50000	999950 (19999 Inc. Max.)
100	100000	999900 (99999 Inc. Max.)

Table 3-1: Scale Capacity Table (lb or kg)

Scale Build Chart

The Scale Build Chart is used to determine the minimum load cell(s) percentage required for span to prevent a calibration error. The remaining portion the cell(s) can be used for initial load (back weight) of the scale or not used.

The Scale Build Chart can be used to solve three conditions:

1. Minimum % of load cell or span.
2. Maximum number of increments.
3. Update rate.

A legitimate build will fall in the area of the chart above the line representing the update rate selected. If a selection is made that falls below the update line, a calibration error E32 message will result.

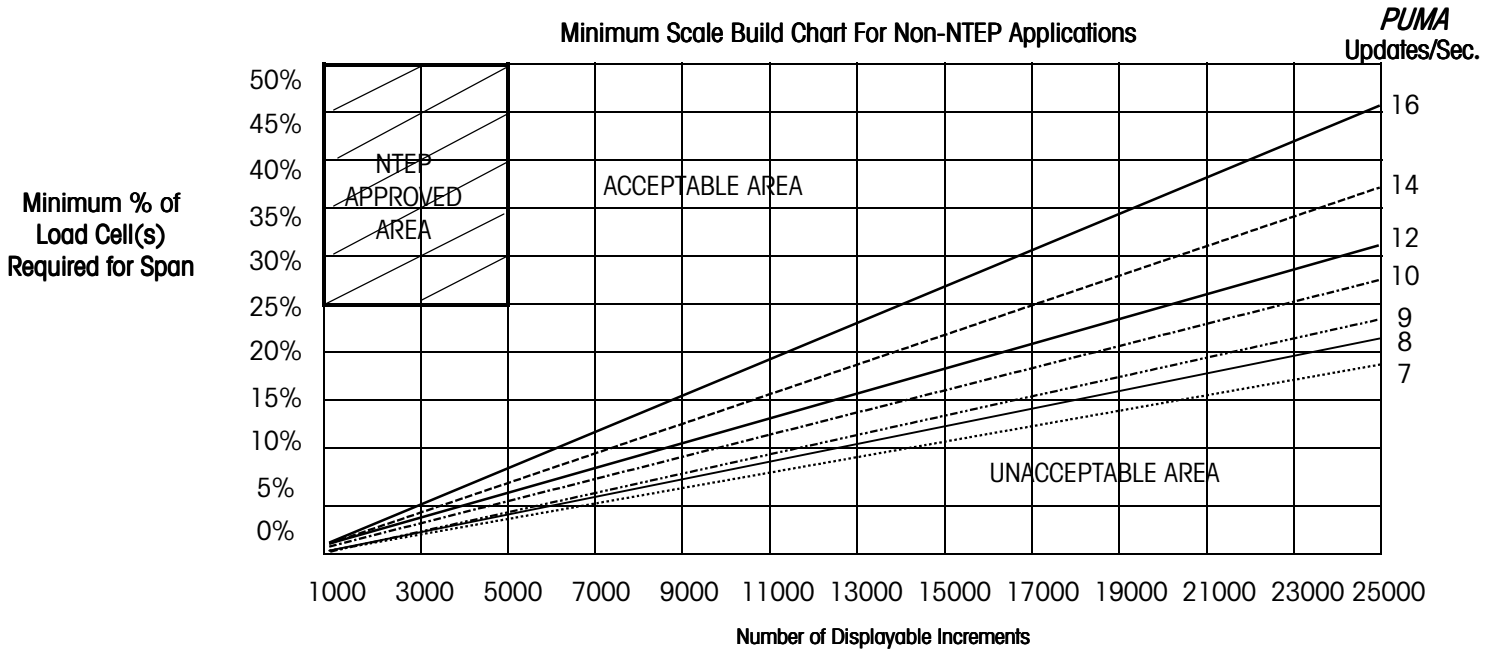


Table 3-b

Example: A given application requires 20,000 increments. Only 25% of the load cell is available for weighing because the scale structure weighs 75% of the cell capacity. The above chart shows that a calibration error (E32) will result for 12, 14, or 16 updates/second. If 7, 8, 9, or 10 updates/second is selected, the scale will calibrate.

Access the Setup Mode

Note: To avoid possible calibration errors and loss of parameters, never enter the setup mode with a ***Battery Low*** condition displayed. Power consumption is the highest in this mode, so chances are good that the unit will automatically power down partially through calibration. If it does, an E3 error will appear at powerup. Clear the error and re-enter all data.

Place the setup jumper W2 into the IN position (shorting the two pins together) to enter the setup mode. Jumper W2 is located on the front right side of the *PUMA* Logic PCB. Refer to Figure A5-1 (Appendix 5).

CAUTION

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

When the setup jumper W2 is placed IN, the terminal will display [--]. To access any group of softswitches, enter in the softswitch number of that group using the numeric keys on the keyboard. To access an individually selectable softswitch, enter in softswitch number instead of the group heading number.

Keyboard Function During Setup

The following keys are redefined in setup.

Key	Function
ENTER	Accepts the displayed selection for a particular step and proceeds to the next prompt.
ZERO	Backs-up to the previous prompt.
CLEAR	Clears the displayed value to permit re-entry of data.
0	Disables the displayed programming selection. This key is also used with the numeric keys for entering values.
1	Enables the displayed programming selection. This key is also used with the numeric keys for entering values.
0-9	Numeric Keys 0-9 select and program certain values. The numeric digits are also used to access the setup steps.

Softswitch Programming

Setup for the *PUMA* terminal is divided into groups of softswitches (SSW). The number of softswitches in a group will vary depending upon which group is selected. The complete group may be accessed to program each of the softswitches within the group, or some of the softswitches may be accessed individually.

The Softswitch Groups are as follows:

00 Calibration
10 Zero and Filtering
20 Tare and Timer
30 COMM 1 Serial Port
50 COMM 2 Serial Port
70 International
80 Setpoints
90 Miscellaneous

All softswitches are summarized in the Quick Reference chart (Appendix #1) and described in detail in the following chart. U.S. default selection for each softswitch is in **bold**. The international default selection is underlined. Softswitches that effect legal-for-trade applications are marked with a (*). Verify each selection, such as calibration in pounds, to be certain it coincides with actual usage before attempting calibration.

Softswitch (SSW) Setup And Calibration

Note: If calibrated in grams or metric Tons, lb/kg switching is disabled.

SSW	Description
00	**CALIBRATION GROUP**
	Softswitches 01 - 09 will be prompted in sequence if Group 00 is selected. Only SSW 08 can be accessed independently.
01	**CALIBRATE IN POUNDS (lb), KILOGRAMS (kg), GRAMS or METRIC TONS?**
	0 = lb 1 = kg 2 = grams 3 = metric tons
02	**LINEARITY COMPENSATION (see Scale Calibration SSW 08).**
	0 = Disabled 1 = Enabled
04	**SCALE CAPACITY.**
	Enter the PUMA maximum capacity (not increments) here. **Example:** For a capacity of 1,000 pounds, enter 1000. The display shows the stored value or a 100 default value. Enter the desired value and press **ENTER**. Valid entries are 1 - 999,980.

05 INCREMENT AND DECIMAL POINT.

The display will show the increment size and decimal point position of the increment size used when the *PUMA* was last calibrated. To change the increment size or decimal point, press the **0** key until the desired decimal point position is displayed, then press the desired increment size digit (1, 2, or 5) on the keyboard to terminate the entry. This selects the decimal position and increment size in one step. Valid entries are 0.001 to 100.

08 SCALE CALIBRATION.

The display will show **[08 0].**

Press **1** to proceed, **ENTER** or **0** to exit.

09 SAMPLE RATE

The display indicates current sample rate **[09 x].**

Press one of the following keys:

Key	Function
0	16 samples/sec.
1	14 samples/sec.
2	12 samples/sec.
3	10 samples/sec.
4	9 samples/sec.
5	8 samples/sec.
6	7 samples/sec.
ENTER	Accept current sample rate (overwrites old rate at this time).
ZERO	Backup to previous selection.

Note: Actual sample rates have been truncated to nearest integer values.

EMPTY SCALE

- Remove all weight on the scale platform.
- Display shows [E SCL].
- Press the **ZERO** key to backup.
- Press any other key to continue.
- Display counts down from [16 CAL] to [01 CAL]. (Old zero value is overwritten at this time.)

LOAD SCALE

If SSW 02 = 0

Place the test weight on the scale platform with **linearity compensation off.**

- Display shows **[Add Ld].**
- Press the **ZERO** key to backup.
- Place the test weight on scale. Enter the numeric value of the test weight, then press the **ENTER** key.
- The display will count down from **[16 CAL]** to **[01 CAL]** while setting span.
- A check is made to see if sufficient counts have been received. If not, an error code will be displayed. Pressing **CLEAR** will return the calibration procedure to SSW 04.
- The display will show **[CAL d]** for 2 seconds if calibration is successful when span has been determined. (Old span value in memory is overwritten at this time.)
- Remove the Calibration Jumper W2 to return to normal operating mode.

If SSW 02 = 1

Place the selected test weight on the scale platform with **linearity compensation on.**

- Display shows **[Add FL]**.
- Press the **ZERO** key to backup, or any other key to continue.
- Place a test weight on the scale using a value that is as close to the full scale capacity as possible (or to the maximum scale capacity that will be used during normal operation). Enter this value on the keyboard, then press the **ENTER** key.
- The display will count down from **[16 CAL]** to **[01 CAL].** A check will be made to see if a sufficient number of counts have been received. If not, an error code will be displayed. Pressing the **CLEAR** key will return the calibration procedure to SSW 04. (Old span value in memory is overwritten at this time.)
- Display shows **[Add LO].**
- Press the **ZERO** key to backup, or any other key to continue.

! WARNING !

The backup key **(ZERO)** will not restore old calibration values once they are overwritten.

- Place a test weight on the scale using a value approximately equal to one half of the scale capacity. Enter this value on the keyboard, then press the **ENTER** key.
- Display counts down from **[16 CAL]** to **[01 CAL].**
- The display will show **[CAL d]** for 2 seconds if calibration is successful. (Old linearity value in memory is overwritten at this time.)
- The display will show **[--]**.
- Remove the Calibration Jumper W2 to return to normal operating mode.

10 ZERO MAINTENANCE AND FILTERING GROUP

Softswitches 11 - 19 will be prompted in sequence if Group10 is selected. SSW 11-19 can also be addressed independently.

Note: SSW11 and SSW12 are not accessible if power up zero capture has not taken place.

11 ZERO ADJUST.

Press the **1** key to store the current gross weight value as a zero offset value in non-volatile memory.

Note: The test weights must be on the scale before entering setup.

12 SPAN ADJUST.

Press the **1** key if span adjust is desired, otherwise press the **0** key. If the **1** key is pressed, the display is blank. Enter the weight value that should be displayed. For example if the display indicates 99.98 and the correct value should be 100.00, then enter 100.00. For x2 and x5 display increments, **value entered must be divisible by 2 or 5.**

Note: AZM will only be saved if parameter 27 is enabled, and the unit goes into sleep mode.

Note: "d" = display increment.

Note: The host mode is disabled until zero is captured.

Note: If SSW14 = 1 or 2, then tare and Zero values are not recalled at power up.

13 AUTO ZERO MAINTENANCE.

When enabled, this function automatically compensates for small changes in Zero resulting from material build-up or temperature effects. The internal logic will change the zero offset to maintain a zero indication during a no motion condition if the displayed weight is within the selected AZM range. When SW13 = 4,5, or 6 AZM will operate while in the gross or net mode but only when the weight is within the Gross Zero range. Example:

Tare = 1000, SSW13 = 6. AZM starts only when display is between -1003 to +997 to maintain a display reading of -1000.

0 = No AZM.
1 = ± 0.5d AZM range (Gross mode only).
2 = ± 1d AZM range (Gross mode only).
3 = ± 3d AZM range (Gross mode only).
4 = ± 0.5d AZM range (Gross or Net mode).
5 = ± 1d AZM range (Gross or Net mode).
6 = ± 3d AZM range (Gross or Net mode).

14 SELECT AUTOMATIC ZERO CAPTURE AT POWER-UP.

If automatic zero capture is enabled (SSW14 = 1 or 2), the display will show ±EEE if the weight on the scale platform is not within the selected capture range (either ±2% or ±10% of calibrated capacity). When the weight is brought within the capture range, an automatic zero is performed and the display will read zero. The zero correction value is stored internally but is lost when Puma is turned off. If zero is not captured, and continuous or short continuous data is enabled, transmitted weight data is spaces. If in ENQ continuous mode the transmitted data is SP, E, SP, E , SP, E. In demand mode, no data is sent.

0 = Auto zero capture off.
1 = ± 2% auto zero capture range enabled.
2 = ± 10% auto zero capture range enabled.

Note: Push-button Zero is saved to non-volatile memory each time it is pressed.

15 PUSH-BUTTON ZERO RANGE.

0 = No push-button zero.
1 = ± 2% scale capacity.
2 = ± 20% scale capacity.

16 MOTION DETECTION.

The *PUMA* includes a weight in motion detector which requires 3 successive weight readings within the selectable range of 0.5 to 3.0 major weight increments for a "no-motion" signal. The motion detector signal inhibits push-button ZERO, TARE, and PRINT. The motion detection sensitivity can be selected in setup mode. The Gross or Net indicator will turn off when the scale is in motion, unless inhibited via tare interlock.

0 = No motion detection
1 = ± 0.5d
2 = ± 1.0d
3 = ± 2.0d
4 = ± 3.0d

17 FILTER SELECTION.

Note: To accept the displayed value press ***Enter***. To change press 0-7.

The "seconds" shown relate to the time required for the display to reach the final value in response to an instantaneous 10% load cell weight change.

0 = 0.25 second filter.
1 = 0.35 second filter.
2 = 0.60 second filter.
3 = 0.75 second filter.
4 = 1.2 second filter.
5 = 1.6 second filter.
6 = 2.0 second filter.
7 = 2.4 second filter.

18 OVERLOAD/UNDERLOAD VALUE.

Note: Press ***CLEAR*** to erase displayed value and enter a new value.

Enter the weight value at which overload will be indicated **[┌------┐]**. This entry must be greater than the scale capacity. The entry must be in the units in which the scale was calibrated. This entry also sets the underload blanking value, indicated by **[└------┘]**. The underload value is computed as follows:

underload_value = scale_capacity - overload_value.

19 GRAVITY ADJUSTMENT (GEO VALUE)

This step provides a means to modify the scale calibration for compensation of gravitational differences between the calibration and destination locations. Worldwide, there are 32 different correction values (GEO values) that are fully defined in appendix 10. By default, calibration and destination values of **16** (Worthington, Ohio USA) are automatically loaded for domestic ***PUMA*** terminals.

If this step is entered during the time a scale calibration is done, the value entered is the calibration value. Any other time it is the destination value. Although it may be entered either preceding or following the calibration step, it is preferred to enter the GEO value first then proceed to calibration.

To change the calibration value:

1. Enter Setup.
2. Enter Step 19, change displayed value, then press **ENTER.**
3. Enter Step Group 00 and calibrate scale.
4. Continue through remaining steps or exit Setup.

To change destination value:

1. Enter Setup.
2. Enter Step 19, change displayed value, then press **ENTER.**
3. Continue to remaining steps (Do not calibrate scale) or exit Setup.

Note: Pushbutton and keyboard tare is saved to memory each time it is entered.

20 TARE AND DISPLAY TIMER GROUP

Softswitches 21-27 will be prompted in sequence if Group 20 is selected. Softswitches 21-27 can also be accessed independently.

21 ENABLE TARE.

0 = No tare permitted.
1 = Push-button tare only.
2 = Push-button and manual tare.

22 **TARE INTERLOCK.** (see chapter 4)

0 = No tare interlocks.
1 = Tare interlock enabled.

24 **AUTOCLEAR OF TARE?** (See chapter 4.)

0 = No autoclear.
1 = Tare will clear upon return to gross zero.

25 **SCALE ID.**

Two digit number from **01** to 99 identifying the scale.

26 **DATE FORMAT.**

Note: To accept the displayed value press *ENTER*. To change press 0-2.

0 = MM:DD:YY
1 = DD:MM:YY
2 = YY:MM:DD

Sets the format that the date is printed, displayed and entered in. MM - month; DD - day; YY - year.

27 **AUTOMATIC POWER-OFF TIMER (SLEEP MODE)**

Note: The Power Off Timer is reset each time the Motion Detector senses motion.

The power-off timer maximizes battery life by powering down the *PUMA* terminal after the preset period of time with no activity on the scale. The *PUMA* terminal will power down automatically after the selected number of minutes of inactivity. When it shuts down, the Tare, Zero, Units and ID information is saved in non-volatile memory for restoration at power-up.

0 = Disabled
1 to 99 = Minutes of inactivity before shut down

30 **COMMUNICATIONS PORT 1 GROUP**

Softswitches 31-45 will be prompted in sequence if Group 30 is selected, or they can be accessed independently. There is no SSW 40. Softswitches 31-45 are accessible in Demand mode [31 = 2] Only Softswitches 31-36 are accessible in all other modes.

Note: To accept the displayed value press *Enter*. To change the displayed value press 0-6.

31 **CONTINUOUS OR DEMAND OUTPUT.** (see Appendix)

0 = Disable COMM1.
1 = METTLER TOLEDO continuous mode.
2 = Demand mode.
3 = <ENQ> continuous mode.
4 = METTLER TOLEDO continuous short mode.
5 = Host mode.
6 = SICS Level 0 mode.

32 **ASCII REMOTE INPUT.** (see Appendix)

0 = Disable
1 = Enable. Allows this port to accept the data and respond appropriately when a print command is received on the other port. Note: Must be enabled for ENQ Continuous mode as well as Z, T, P, and C inputs.

33 **BAUD RATE**.

300 1200 2400 4800 **9600**

Press the **0** key to toggle through possible baud rates. Press the **ENTER** key to accept the displayed baud rate.

34 **PARITY BIT.**

0 = Space parity. **2 = Even parity**. 4 = None.
1 = Odd parity. 3 = Mark parity.

35 **NUMBER OF DATA BITS.**

0 = 7 bits

1 = 8 bits.

36 **CHECKSUM.**

0 = No checksum.
1 = Two's complement checksum will be sent with data.

The checksum is a method of checking each line of data transmitted by adding a check digit character at the end of the string. The receiving device must be able to calculate and compare this character to verify the data is valid. Checksum is defined as the 2's complement of the seven low-order bits of the binary sum of all characters preceding the checksum, including the *STX* and *CR* (carriage return) control characters. Bit 8 of the checksum is the parity bit (if enabled) of the seven low-order bits of the checksum character.

37 **SELECT SIGN CORRECTED NET WEIGHT PRINTING.**

0 = Normal net weight printing.
1 = Sign corrected net weight printing.
2 = Sign corrected net weight printing and display.
(See Appendix Demand Mode.)

38 **ENABLE STX.**
0 = No "STX" will be sent in demand mode.
1 = "STX" will be sent as first character in print string if in demand mode.

To accept the displayed value press **ENTER.**
To change, enter the numeric value in the order to be printed. Fill with "0" to complete the required field if necessary.

39 **LINE FORMAT SELECTION**. (DEMAND MODE)

0 = Single line.
1 = Multiple line.

41 **DATA FIELD SELECTION.**

Display now shows [uvwxyz], where u, v, w, x, y, and z are the codes of the fields to be printed. A maximum of six fields are permitted. All fields will be printed either on a single line (SSW 39=0) or one field per line (SSW 39=1).

The default is **523400**. (see Appendix Demand Mode)

Selection	Data Field
0	Field Turned Off
1	Displayed Weight
2	Gross Weight
3	Tare Weight
4	Net Weight
5	Scale ID Number
6	Blank Line
7	Date/Time
8	Keyboard ID

42 **EXPANDED PRINT.** (see Appendix Demand Mode)

0 = Normal print
1 = Enable expanded print

43 **PRINT WEIGHT UNIT LEGEND.** (see Appendix Demand Mode)

0 = No unit legend printed.
1 = Print lb/kg unit legend. Permitted if calibrated in lb or kg.

44 **PRINTED TIME FORMAT.** (See Appendix Demand Mode)

0 = 24:MM.
1 = HH:MM PM.

Selects the format used for printing the time.
Time is always entered as HH:MM:SS, based 24:00 hours.
HH - hour; MM - minutes; SS - seconds: PM - AM or PM indication.

45 **CONNECTION METHOD.** (see Appendix 4 Host Mode)

0 = Star. Communications are received and acted upon.
1 = Loop Through. Communications are received, retransmitted, then acted upon.

50 COMMUNICATIONS PORT 2 GROUP

Softswitches 51-64 will be shown in sequence if Group 50 is selected, or can be accessed directly. There is no SSW 60. Softswitches 51-64 are accessible in Demand mode [51 = 2]. Softswitches 51-56 are accessible in METTLER TOLEDO continuous mode [51 = 1]. This port is disabled and softswitches 51-56 are not accessible if softswitch 95 is enabled.

Note: To accept the displayed value press **ENTER.** To change press 0-4.

51 **CONTINUOUS OR DEMAND OUTPUT.** (See Appendix)

0 = Disable.
1 = Continuous output.
2 = Demand mode.
3 = <ENQ> continuous mode.
4 = Short Continuous mode.

Note: Must be enabled for ENQ continuous mode as well as Z, T, P, and C inputs

52 **ASCII REMOTE INPUT.** (see Appendix)

0 = Disable.
1 = Enable.

53 **BAUD RATE.**

300 1200 2400 4800 **9600**

Press the **0** key to toggle through possible baud rates. Press the **ENTER** key to accept the displayed baud rate.

Note: To accept the displayed value press **ENTER.** To change press 0-4.

54 **PARITY BIT** .

0 = Space parity.
1 = Odd parity.
2 = Even parity.
3 = Mark parity.
4 = None.

55 **NUMBER OF DATA BITS.**

0 = 7 bits.
1 = 8 bits.

56 **CHECKSUM**

0 = No checksum.
1 = Two's complement checksum will be sent with data.

The checksum is a method of checking each line of data transmitted by adding a check digit character at the end of the string. The receiving device must be able to calculate and compare this character to verify the data is valid. Checksum is defined as the 2's complement of the seven low-order bits of the binary sum of all characters preceding the checksum, including the *STX* and *CR* (carriage return) control characters. Bit 8 of the checksum is the parity bit (if enabled) of the seven low-order bits of the checksum character.

Note: To accept the displayed value press **ENTER.** To change press 0-2.

57 **SELECT SIGN CORRECTED, NET WEIGHT PRINTING.**

0 = Normal net weight printing.
1 = Sign corrected net weight printing.
2 = Sign corrected net weight printing and display.
(See Appendix Demand Mode.)

58 **ENABLE STX.**

0 = No "STX" will be sent in demand mode.
1 = "STX" will be sent as first character in print string if in demand mode.

59 **LINE FORMAT SELECTION (DEMAND MODE).**

0 = Single line output.
1 = Multiple line output.
(See Appendix Demand Mode.)

Note: To accept the displayed value press **ENTER.** To change enter the numeric value in the order to be printed. Fill with "0" to complete the required 6-digit field if necessary.

61 **DATA FIELD SELECTION.**

Display now shows [uvwxyz], where u, v, w, x, y, and z are the codes of the fields to be printed. A maximum of six fields are permitted. All fields will be printed either on a single line (SSW 59=0) or one field per line (SSW 59=1). The default is **523400**. (See Appendix Demand Mode.)

Selection	Data Field
0	Field Turned Off
1	Displayed Weight
2	Gross Weight
3	Tare Weight
4	Net Weight
5	Scale ID Number
6	Blank Line
7	Date/Time
8	Keyboard ID

62 **EXPANDED PRINT**. (See Appendix Demand Mode.)

0 = Normal print
1 = Enable expanded print.

63 **PRINT WEIGHT UNIT LEGEND**. (See Appendix Demand Mode.)

0 = No unit legend printed.
1 = Print LB/kg unit legend. Permitted if calibrated in lb or kg.

64 **PRINTED TIME FORMAT**. (See Appendix Demand Mode.)

0 = 24:MM.
1 = HH:MM PM.

Selects the format used for printing the time.
Time is always entered as HH:MM:SS, based 24:00 hours. HH - hour; MM - minutes; SS - seconds: PM - AM or PM indicator.

70 **INTERNATIONAL GROUP**

Softswitches 71-79 will be prompted in sequence if Group 70 is selected, or Softswitches 71-79 can be accessed directly.

71 **UNITS SWITCHING KEY.**

Note: To accept the displayed value press **ENTER.** To change press 0-2.

This feature is inactive if the *PUMA* terminal is calibrated in grams or metric tons. The scale must be at zero for the switching to be active. When Softswitch 71=2, the **UNITS** key will toggle between the calibrated lb or kg units and the alternate units, as defined in Softswitch 92, 93, and 94. When in alternate units, no units legend will display or print.

Note: If SSW71 = 2, manual tare and setpoint operation is disabled.

0 = Disabled.
1 = lb/kg key enabled.
2 = lb/Alternate Units or kg/Alternate Units enabled.

72 **POWER-UP UNITS.**

If the *PUMA* terminal is calibrated in lb or kg and units switching is disabled, then:

0 = Power up in same units as when powered down
1 = Power up in kg
2 = Power up in lb

Note: If SSW71 = 2 and SSW93 = 0 then units switching is disabled.

If the *PUMA* terminal is calibrated in kg and units switching is or kg/Alt then:

0 = Power up in same units as when powered down
1 = Power up in kg
2 = Power up in Alternate Units

Note: This feature is disabled if the *PUMA* terminal is calibrated in **g** or **t**.

If the *PUMA* terminal is calibrated in lb and units switching isblb/Alt then:

0 = Power up in same units as when powered down
1 = Power up in Alternate Units
2 = Power up in lb

73 **BRACKETED PRINTING.** (See Appendix Demand Mode.)

0 = Normal printing.
1 = The printed weight will be surrounded by <> if the weight value is "truly measured".

74 **PRINT; Hand entered Tare Legend, "PT" or "T".**

0 = Print "T" for metric only hand entered tares.
1 = Print "PT" for metric only hand entered tares.
(See Appendix Demand Mode.)

75 **ENABLE COMMA.**

0 = Decimal point displayed and printed.
1 = Comma displayed and printed.

76 ZERO ANNUNCIATOR SELECTION.

0 = None.
1 = Gross zero only.
2 = Gross or net zero.

This feature selects whether the annunciator lights within ±.25 increments of gross zero only, or gross or net zero.

77 AUTOCLEAR TARE AFTER PRINT.

Note: To accept the displayed value press **ENTER.** To change press 0-3.

0 = Tare not affected by printing.
1 = Tare will be cleared after printing.

78 ENABLE PRINTER INTERLOCKS.

0 = Normal print.
1 = Single print. After a print is made, scale must return to within the minimum print increment range (SSW79) and then upscale to enable printing again.
2 = Autoprint on no motion. After a print is made, scale must return to within the minimum print increment range (SSW79) and then upscale with no motion to automatically print once. The print button is disabled in this mode. Also, motion detection (SSW16) must be enabled. If SSW = 0 then an autoprint will occur once each time motion stops.

79 SELECT MINIMUM PRINT INCREMENTS.

0 = No minimum
1 = 10 increments
2 = 100 increments
3 = 500 increments

Setpoints operate on Displayed Weight Values

80 SETPOINT GROUP

Softswitches 81-84 will be prompted in sequence if Group 80 is selected. Softswitches 82 to 84 are not accessible if SSW 81 = 0. If SSW 81 = 1 or 2, SSW 81-84 can be accessed directly. Also, host mode setpoint requests are ignored with SSW 81 = 0.

Note: Setpoints are disabled while displaying alternate units.

81 SETPOINT MODE.

0 = Disable setpoint feature
1 = 4 discrete setpoints
2 = 2 setpoints with Dribble and Preact

82 TOLERANCE 1.

0 = Zero Tolerance or Setpoint #5
1 = Setpoint #1 Tolerance

83 TOLERANCE 2.

0 = Zero Tolerance or Setpoint #6
1 = Setpoint #2 Tolerance

84 ABSOLUTE VALUE.

0 = The setpoint status bit will transition from a zero to a one only when the positive weight value equals or is greater than the setpoint value.

1 = The setpoint status bit will transition from a zero to a one when the absolute weight value equals or is greater than the setpoint value.

90 MISCELLANEOUS GROUP

Softswitches 92-94 are accessed only sequentially.

91 EXPANDED DISPLAY MODE SELECTION.

Note: If display minors is enabled (SSW 91=1), then pressing the **RECALL** key will switch between minor increments and raw counts. (See also Troubleshooting Section).

0 = Normal display.
1 = Display minor increments.

Important: The AZM function is not automatically disabled in expand mode. If testing the unit for stability in expand mode, be sure to set AZM (SSW13) to 0.

92 ALTERNATE UNITS, CONVERSION FACTOR DECIMAL LOCATION.

Note: Because of conversion factor round offs, alternate units operation is not intended to be used for automatic batching with setpoints. Setpoints are disabled while in alternate units mode.

[92] The display will show this value for 1/2 second.
[0.0001] Conversion Factor Decimal Location. This value determines where the decimal point will be located in the conversion factor entered in SSW 93.

Press:

0 Toggle the display through all valid decimal point locations.
ENTER Accept displayed value.

93 ALTERNATE UNITS, CONVERSION FACTOR DIVISOR VALUE.

[93] The display will show this value for 1/2 second.
[XXXXXX] Enter the conversion factor which is a divisor for converting the weight units to the alternate unit. The decimal point location entered in SSW 92 is used for this value. Selecting a non-zero value will disable the standard LB/KG switching feature and enable switching between weight units and alternate units. When alternate units are displayed, both the *lb* and *kg* cursors will be turned off and no units designators will be sent to the printer. Selecting a value of zero will disable the alternate units feature and enable LB/KG switching.

Press:

Note: If the alternate units calculated value exceeds six digits and cannot be displayed, the ***PUMA*** terminal will show **0.0** value. The conversion factor decimal point location is too small.

0-9 Enter the desired value.
CLEAR Clears value if a mistake is made.
ENTER Accept displayed value.

94 ALTERNATE UNITS, RESULTS DECIMAL LOCATION.

[94] The display will show this value for 1/2 second.
[0.0001] Alternate Units Result Decimal Location. This value determines where the decimal point will be located in the converted alternate units weights value. Converted values will be rounded to the selected decimal place before the value is displayed or printed. The available selections are:

0.0001, 0.001, 0.01, 0.1, 1

Press:

0 Toggle the display through all valid decimal point locations.

ENTER Accept displayed value.

95 COM 2 TILT SWITCH INPUT

This is a special control input used for European functions only. It is not available in the USA. This function is active only on "E" Revision and later software versions.

0=Input Disabled.

1=Input Enabled.

If enabled, softswitches 50-64 are inaccessible; softswitch 95 is set to "0".

96 COM 2 DISCRETE INPUT

This special control input, when enabled, allows ZERO, TARE, or PRINT commands to be entered remotely through the COM 2 softswitches. SS50 to SS64 are inaccessible. If SS95 is enabled, SS96 is disabled and vice versa. This function is available on "E" revision and later software. Option 0917-0272 is required to interface this function.

0 = Disabled

1 = Tare

2 = Zero

3 = Print

99 RESET SCALE TO DEFAULT PARAMETER VALUES.

0 = No action.
1 = Load U.S. default values. The prompt [SUrE] will be displayed. Press the 1 to acknowledge or 0 to abort the action.
2 = Load European default values. The prompt [SUrE] will be displayed. Press 2 to acknowledge or 0 to abort the action.
[Ld Epr] is displayed while values are loaded.

USA Defaults = **Bold**

European Defaults = Underlined

Seal The Enclosure

After the *PUMA* terminal is properly installed, and you have configured the unit, you are ready to seal the enclosure.

1. Remove power from the *PUMA* terminal.
2. Replace the front cover on the enclosure. Press on the cover until all four of the latches catch. Do not pinch the wiring harnesses when reinstalling the front cover.
3. If an internal battery is being used, be sure the battery is fully charged, properly installed, and the battery cover is in place.
4. If a Weights and Measures seal is required, refer to Figure 3-a on the following page.

Weights and Measures Seal

The *PUMA* terminal provides two methods of sealing for Weights and Measures, as shown in Figure 3-a.

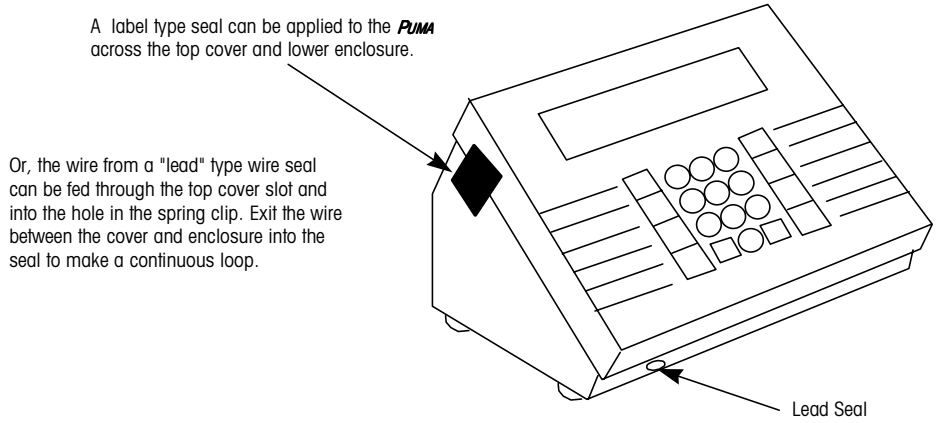


Figure 3-a: Weights and Measures Seal

Setpoint Installation Considerations

To install a *PUMA* terminal utilizing setpoint outputs, please read and take the following precautions to ensure safe and reliable operation. Non-conductive materials such as flour, plastic, and rubber can generate static electricity when fed onto a scale hopper. The scale base, hopper, *PUMA* terminal, and all conductive feeders to the scale (conveyors, chutes, and pipes) must be electrically bonded together and connected to a true-earth ground. See Setpoint Operation in Chapter 4.

WARNING

WHEN THE *PUMA* TERMINAL IS INCLUDED AS A COMPONENT PART OF A SYSTEM, THE RESULTING DESIGN MUST BE REVIEWED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL COMPONENTS IN THE SYSTEM AND THE POTENTIAL HAZARDS INVOLVED. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

WARNING

IF THIS DEVICE IS USED IN AN AUTOMATIC OR MANUAL FILLING CYCLE, ALL USERS MUST PROVIDE A HARD-WIRED EMERGENCY STOP CIRCUIT, WITHIN REACHING DISTANCE OF THE OPERATOR, OUTSIDE THE DEVICE CIRCUITRY. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

4 Operating Instructions

Display

The ***PUMA*** terminal uses a low-power liquid crystal display with six, seven-segment digits. Over-capacity is indicated by "┌-----┐". Under-capacity is indicated by "└-----┘". The center segment of the digit at the far left of the display lights to indicate negative weight. If the ***PUMA*** terminal is displaying negative weight using all six digits, the display alternates between showing net weight and six minus signs.

Battery Symbol
Indicates low-battery condition. The battery should be recharged when the battery symbol appears.

Clock Symbol
Indicates the time/date is being set.

Unit Weight Legends
Weight unit abbreviation according to the selected weight units:

lb - pounds
kg - kilograms
g - grams
t - tons

ID Legend

id - Indicates the ID is being set.

Weight Status Legends
Four weight status legends are available:

PT - Indicates the displayed value represents tare weight. It is visible when you enter a tare weight value manually or if you recall a tare weight.

NET - Indicates the displayed value represents net weight. If the tare interlock is disabled in setup, the net legend blanks when the weight on the scale is unstable.

G - Indicates the displayed value represents gross weight. If tare interlock is disabled, the gross legend is blank when weight on the scale is unstable.

Z - Indicates the ***PUMA*** terminal is within ±0.25 increments of the center of gross or net zero as configured in setup Step 76.

Keypad

The *PUMA* terminal is equipped with a 4 x 5, 20-key keypad as shown in Figure 4-a.

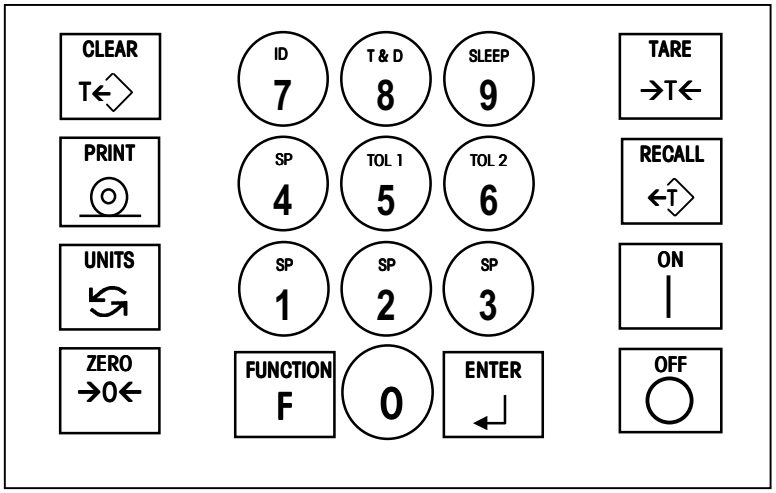
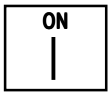
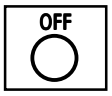


Figure 4-a: Keypad

The keys perform the following functions:



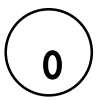
ON — Turns the *PUMA* terminal on.



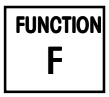
OFF — Turns the *PUMA* terminal off. If enabled, a power-off timer turns the *PUMA* terminal off after a predetermined period of inactivity. Note: Using OFF when Sleep Recall Mode is enabled will cause and error E11 waking up the *PUMA* terminal.

UNITS—switches the displayed value between pound and kilogram weight units when SSW 71=1. This key also switches between the selected calibration units and the alternate unit. The *PUMA* terminal adjusts the increment size and decimal point of the displayed weight to the nearest equivalent when switching units. For example, the *PUMA* terminal adjusts a 1 lb increment to 0.5 kg, or a 2 lb increment to 1.0 kg. The *PUMA* terminal supports unit switching only if the calibrated weight unit is selected as lb or kg in setup. Otherwise the LB/KG key is disabled.

ZERO—captures a new center of zero if the *PUMA* terminal is in gross mode and weight on the scale is stable. Weight on the scale must also be within the pushbutton zero capture range as determined in setup. The center of zero reference captured by the *ZERO* key is temporary and is lost when the *PUMA* terminal is turned OFF. The value is stored during sleep time-out, and when using Function 9, when enabled in setup.



Numeric Keys (0-9)—Numeric keys, used to enter numeric values.



FUNCTION—Used with the numeric keys as follows:

(See Service and Maintenance Troubleshooting-Misc. for additional capabilities.)

FUNC 0—Displays raw counts.

FUNC 1—Selects setpoint/preact #1.

FUNC 2—Selects setpoint/preact #2.

FUNC 3—Selects setpoint/preact #3.

FUNC 4—Selects setpoint/preact #4.

FUNC 5—Zero Tolerance #1.

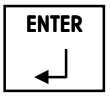
FUNC 6—Zero Tolerance #2.

FUNC 7—Keyboard ID.

FUNC 8—Time then Date.

FUNC 9—Stores sleep data then powers down if sleep mode is enabled.

FUNC Clear—When enabled, transmits Scale ID out COMM 1 for host mode format.

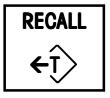


ENTER—accepts data entered from the keypad and responses entered in setup mode.

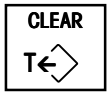
TARE—records the current weight on the scale as tare weight, causing the display to show net weight zero. Tare must be a positive, non-zero, stable weight.

The TARE key also terminates a manual tare entry from the keypad. In this case, the least significant digit of the tare value must equal the scale increment size. If tare interlock is enabled, you can enter keyboard tare only when the scale is at gross zero.

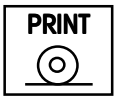
You can enter tare manually using the keypad whenever the *PUMA* terminal is in gross or net mode, for either lb or kg. Manual tare is disabled in alternate units mode. When you press the first numeric key, the tare legend illuminates and the display blanks to accept additional numeric entry. You can enter up to six digits, however, the decimal point is fixed. You must press TARE within five seconds of entering the last digit or the *PUMA* terminal returns to the previous weight display mode.



RECALL—displays the current tare weight for approximately five seconds.



CLEAR—clears the tare weight when the terminal is in net mode; the *PUMA* terminal returns to gross mode. If tare interlock is enabled, you can clear tare only when the scale is at gross zero.



PRINT—transmits data from COMM 1 and/or 2 according to the data output configured in setup. The *PUMA* terminal processes a print command when weight on the scale is stable. If you configured the *PUMA* terminal for continuous data output, bit number 3 in status word C toggles from 0 to 1 with each print request.

Basic Operations

Basic operations are those procedures that can be done by any knowledgeable person with access to the terminal. This section discusses the following basic operations:

- Zero the scale
- Perform tare operations
- Initiate print operations
- Unit switching
- Program/view keyboard ID
- Program/view time and date
- Manually force sleep
- Display raw counts
- Loop through network troubleshooting tool

Zero the Scale

If Pushbutton Zero is enabled, press the **ZERO** key to establish a new zero. Weight on the scale must be within the zero capture range. This new zero value is stored in non-volatile memory.

Tare Operations

The *PUMA* terminal supports the following tare and tare-related functions:

- Semi-auto Tare
- Manual Tare
- Recall Tare
- Auto Clear Tare
- Tare Interlock

Tare operations are configured in Group 20 (Tare and Display Timer Group).

Semi-Auto Tare

Semi-auto tare lets you capture tare and clear the display by pressing the corresponding key.

1. Place a container on the scale and press **TARE**. The terminal displays 0000.0 and displays net weight when a load is placed in the tared container.
2. Press **CLEAR** to clear the tare and net weight display. The terminal returns to gross mode.

Note: Manual or Keyboard Tare is not allowed while Alternate Units are displayed.

Manual or Keyboard Tare (PT)

Manual tare lets you enter the known value of a container or other weight on the scale using the numeric keys on the keypad. To enter manual tare:

1. Place a loaded container on the platform. The display shows gross weight.
2. Use the numeric keys to enter the known weight of the container, then press **TARE**. The *PUMA* terminal displays the net weight of the contents and lights the net legend.
3. Press **CLEAR** to return to gross mode.

Auto Clear Tare

If enabled, the *PUMA* terminal automatically clears tare when the scale returns to the center of zero (within ±0.25 increments) after settling to a no-motion condition at least ten increments above gross zero.

Recall Tare

The *PUMA* terminal lets you view the tare value currently recorded in temporary memory while in net mode. To recall tare, press **RECALL**. The *PUMA* terminal displays the tare value for approximately five seconds before returning to net mode.

Tare Interlock

Tare interlock imposes some restrictions on tare operations. If the tare interlock is enabled, tare may be cleared only at gross zero, keyboard tare is accepted only at gross zero, multiple tares are inhibited, and motion is not indicated by the blanking of the gross and net legends.

Print Operations

Softswitches affecting the print function and data output formats are configured in Group 30 and 50 (COM 1 and COM 2 setup groups). In demand mode, a print command, can be initiated by pressing the **PRINT** key, receiving an ASCII Print command, the auto print feature, or by receiving a host print command. The *PUMA* terminal transmits the data through the serial port, and it is printed according to the data output configuration. Demand printing is disabled while the scale is in motion, while the *PUMA* terminal is in expanded mode, or while the scale is below gross zero.

Unit Switching

The *PUMA* terminal supports unit switching if the weigh unit is calibrated as lb or kg and if unit switching is enabled in Group 70 (International selection group). To switch units, press the **UNITS** key. The *PUMA* terminal switches units and adjusts the increment size and decimal point accordingly. Depending on the softswitch setting and calibrated units, the **UNITS** key allows lb/kg, kg/alternate, and lb/alternate switching.

Keyboard ID

This function lets you enter or edit a keyboard ID that is used by the *PUMA* terminal in the Demand Output print format.

To enter a keyboard ID:

1. Press **FUNCTION** then *7*. The *PUMA* terminal displays the current keyboard ID.
2. Press **CLEAR** to enter a new ID or press **ENTER** to accept the current ID.
3. Use the numeric keys to enter a new 6-digit keyboard ID.
4. Press **ENTER** to save the new keyboard ID and return to normal operating mode.

Time and Date

The *PUMA* terminal time and date are set using the **FUNCTION** then *8* keys. The *PUMA* uses time and date in the Demand print output format.

To set time and date:

1. Press the **FUNCTION** then *8*. The *PUMA* displays the current system time.
2. Press **CLEAR** to clear the time. Alternately, you can press **ENTER** to accept the displayed time.
3. Use the **numeric keys** to enter the correct time using a 24 hour clock. For example, 5:00 PM is 17:00.
4. Press **ENTER** to accept the new time. The *PUMA* automatically displays the current system date.
5. Press **ENTER** to accept the displayed date, or press **CLEAR** to clear the date.
6. The new date must be entered in the format selected in setup. For example, if the date is mm/dd/yy, you would enter **071297** for July 12, 1997.
7. Press **ENTER** to return to normal operating mode.

Note: There is a 5 second time-out between keystrokes. After 5 seconds, ***PUMA*** automatically returns to normal operation. The keyed in data is not used if a time-out occurs before the *ENTER* key is pressed.

Loop Through

Pressing **FUNCTION** then **CLEAR** keys causes the *PUMA* terminal to transmit the Scale ID out COMM 1 in Host Mode Format, when SSW 45 = 1 and SSW 31 = 5. The string sent is as follows:

<STX><ID><ETB><LRC><CR>

This is primarily used when setting up or diagnosing multiple Terminals using Host Mode communication in a loop through (network) connection (Figure 4-c).

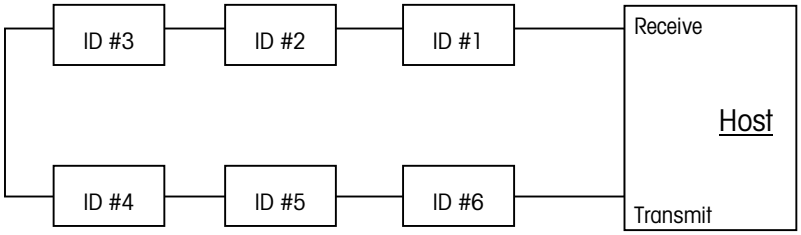


Figure 4-a: Loop Through Network Connection

When setting up, connect the *PUMA* terminal with ID#1 first. Verify connections and SSW setup by transmitting the Scale ID (*Function Clear*). Continue with *PUMA* ID#2 through ID#6.

In the case where the communication communications loop quits functioning, a failed link may be quickly determined by dividing the loop. Use *PUMA* ID#3 to transmit the Scale ID. If the ID is received by the host, move to *PUMA* ID#4 to send scale ID, or if not, move to *PUMA* ID#2. Continue the process of elimination until the failed link is located.

Display Raw Counts

Pressing *Function* then *0* keys displays raw counts generated by the analog to digital conversion. The raw count display will remain for 255 update intervals or until a print command is executed. It is possible to have over 1,000,000 counts at the slower update rates causing the most significant digit (MSD) not to display. The minus sign is displayed when the raw count value is less than the calibration zero's raw count value. Also see descriptions in the Service and Maintenance Troubleshooting-Miscellaneous section for additional capabilities.

Setpoint Operation

The *PUMA* terminal supports single-or dual-speed cutoff operation when used with the 3015 Setpoint Controller. You can configure the setpoint outputs as:

- Four single-speed cutoffs with individual preact selections, and two tolerance selections.
- Two dual-speed cutoffs with individual dribble, preact, and tolerance selections.

The *PUMA* terminal supports two tolerance outputs that you can configure as weight tolerance outputs (dual-speed) or individual zero tolerance outputs (single- and dual-speed). Setpoint outputs can operate on the absolute or positive only value of the displayed weight, and can be used as feed-in or feed-out setpoints. Refer to the 3015 Setpoint Controller manual for wiring and connection details.

⚠ CAUTION

Enabling setpoint in Softswitch 81 without entering setpoint values will generate an E10 error on power up. (See Chapter 5 Error Codes and Actions.)

⚠ WARNING

WHEN THE *PUMA* TERMINAL AND A SETPOINT CONTROLLER ARE INCLUDED AS COMPONENTS IN A SYSTEM, THE RESULTING DESIGN MUST BE REVIEWED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL COMPONENTS IN THE SYSTEM AND POTENTIAL HAZARDS.

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

In addition to the above description and cautions/warnings, the following conditions must be understood.

- Setpoint operation is inhibited if alternate units selection is enabled (SSW71 = 2).
- The setpoint values must always be entered in calibrated units.
- Host setpoint transfers are ignored if setpoints are disabled (SSW81 = 0).

Four Single-Speed Setpoints

Note: ***PUMA*** aborts the setpoint data entry process if more than 5 seconds pass without key entry. The least significant digit (LSD) of the entry must agree with the ***PUMA*** displayed increment or it will be rejected. Incomplete entries will be aborted and the previous value will be used. Setpoints 3 and 4 have no tolerance capability.

To enter data for the four single-speed setpoints:

1. Be sure the 4-setpoint option is selected in Group 80 (SSW81 = 1).
2. Press **FUNCTION**.
3. Press the ***numeric key*** corresponding to the setpoint you wish to use (1, 2, 3, or 4).
4. At the **[SP-x]** prompt, press **ENTER** to view the current cutoff value for the selected setpoint (xxx.x).
5. At the **[xxx.x]** display, press **ENTER** to accept the cutoff value, or use the ***numeric keys*** to enter a new value.
6. At the **[Pr-x]** prompt, press **ENTER** to view the current preact value (xxx.x). Preact refers to the amount of material that may come onto the scale after the material feed has stopped.
7. At the **[xxx.x]** display, press **ENTER** to accept the value, or use the ***numeric keys*** to enter a new value.

   When you press **ENTER** after step 7, the ***PUMA*** terminal advances to normal operating mode if the tolerance is configured as 0 tolerance (SSW82 or 83 = 0) or if setpoint 3 or 4 is selected. If setpoint tolerance is selected (SSW82 or 83 = 1) continue to step 8.
8. At the **[tol-x]** prompt, press **ENTER** to accept the value or use the *numeric keys* to enter a new value. This tolerance value is the ±value that is compared to setpoint.

Pressing **ENTER** after step 8 advances the ***PUMA*** terminal to normal operation.

Two Dual-Speed Setpoints

THE ***PUMA*** terminal aborts the setpoint data entry process if more than 5 seconds pass without key entry. The least significant digit (LSD) of the entry must agree with the ***PUMA*** displayed increment. If the last digit entered is not a multiple of the displayed increment, the entry aborts and the previous value will be used.

To enter data for the two dual-speed setpoints:

1. Be sure the 2-setpoint option is selected in the Setpoint program block in setup.
2. Press **FUNCTION** to access the setpoints.
3. Press the ***numeric key*** corresponding to the setpoint desired (1 or 2).
4. At the **[SP-x]** prompt, press **ENTER** to view the current cutoff value for the selected setpoint.
5. At the **[xxx.x]** prompt, press **ENTER** to accept the displayed value, or use the ***numeric keys*** to enter a new cutoff value.
6. At the **[dr-x]** prompt, press **ENTER** to view the current dribble value (xxx.x). The dribble value determines when the setpoint switches from fast-feed to slow-feed.
7. At the **[xxx.x]** prompt, press **ENTER** to accept the dribble value, or use the ***numeric keys*** to enter a new value.
8. At the **[Pr-x]** prompt, press **ENTER** to view the current preact value (xxx.x). Preact refers to the amount of material that may come onto the scale after the cutoff value has been reached.

9. At the **[xxx.x]** prompt, press **ENTER** to accept the current preact value, or use the *numeric keys* to enter a new value.

   Pressing **ENTER** after step 8, advances the *PUMA* to normal operating mode. If the tolerance is configured as 0 tolerance (SSW82 or 83 = 0). If setpoint tolerance is selected (SSW82 or 83 = 1) continue to step 10.

10. At the **[tol-x]** prompt, press **ENTER** to view the current value for the weight or zero tolerance (xxx.x).

11. At the **[xxx.x]** prompt, press **ENTER** to accept the tolerance value, or use the *numeric keys* to enter a new value.

    Pressing **ENTER** after step 11 advances the *PUMA* to normal operating mode.

Zero Compare Tolerance Setpoints

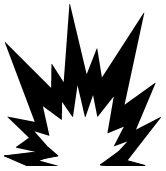
To configure the zero tolerance value for Tolerance #1 and/or Tolerance #2:

1. Be sure the tolerance #1 and/or #2 mode is selected (SSW82, SSW83 = 0).
2. Press **FUNCTION**.
3. Press the *numeric key* corresponding to the Zero Tolerance setpoint you wish to use (5 or 6).
4. At the **[tol-x]** prompt, press **ENTER** to view the current value for the selected tolerance (xxx.x).
5. At the **[xxx.x]** prompt, press **ENTER** to accept the displayed tolerance, or use the *numeric keys* to enter a new value.

   Pressing **ENTER** after step 5 advances the *PUMA* terminal to normal operating mode.

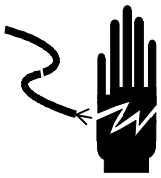
NOTES

5 Service and Maintenance



⚠ WARNING

DO NOT INSTALL OR PERFORM ANY SERVICE ON THIS EQUIPMENT BEFORE THE AREA HAS BEEN VERIFIED AS NON-HAZARDOUS BY PERSONNEL AUTHORIZED TO DO SO BY THE RESPONSIBLE CUSTOMER.



⚠ WARNING

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

Tools and Supplies

⚠ WARNING

DO NOT INSTALL OR PERFORM ANY SERVICE ON THIS EQUIPMENT BEFORE THE AREA HAS BEEN VERIFIED AS NON-HAZARDOUS BY PERSONNEL AUTHORIZED TO DO SO BY THE RESPONSIBLE CUSTOMER.

Keep the following items on hand for service and maintenance of the *PUMA* terminal. Common hand tools may also be required.

- Volt-Ohm meter (not to be used in a hazardous area)
- Analog load cell simulator
- Soft, lint-free cleaning cloth
- Anti-static bag for PCB
- Anti-static wrist strap and mat

Cleaning and Maintenance

Wipe the keyboard and covers with a clean, soft cloth that has been dampened with a mild cleaner. Do not use any type of industrial solvent such as toluene or isopropanol (IPA). These may damage the display lens coating. Do not spray cleaner directly on the terminal. Regular maintenance inspections by a qualified service technician are also recommended.

Warnings and Precautions

Please use extreme caution and observe the following warnings and precautions any time you are working on the ***PUMA*** terminal.

CAUTION

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

WARNING

ONLY THE COMPONENTS SPECIFIED IN THIS MANUAL CAN BE USED IN THE *PUMA* TERMINAL. ALL EQUIPMENT MUST BE INSTALLED IN ACCORDANCE WITH THE INSTALLATION INSTRUCTIONS DETAILED IN THIS MANUAL. INCORRECT COMPONENTS AND/OR DEVIATION FROM THE INSTRUCTIONS CAN IMPAIR THE INTRINSIC SAFETY OF THE UNIT AND COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

WARNING

DO NOT INSTALL OR PERFORM ANY SERVICE ON THIS EQUIPMENT BEFORE THE AREA HAS BEEN VERIFIED AS NON-HAZARDOUS BY PERSONNEL AUTHORIZED TO DO SO BY THE RESPONSIBLE CUSTOMER.

Charging the Internal Battery Pack

The internal battery pack must be removed from the ***PUMA*** terminal and placed in a non-hazardous area to recharge. The battery should be charged soon after the battery low indicator symbol on the display is visible.

WARNING

DO NOT USE THE METTLER TOLEDO BATTERY CHARGER IN A HAZARDOUS AREA. THE BATTERY CHARGER IS NOT DESIGNED FOR HAZARDOUS AREA OPERATION.

Press the ***PUMA*** terminal **OFF** key (or ***Function 9*** if SSW 28=1) on the keypad to turn off power to the terminal. When the battery is removed, you have at least 30 seconds to install a charged battery without losing or corrupting the time/date in the real time clock. Remove the battery cover by loosening the two screws, as shown in Figure 5-a.

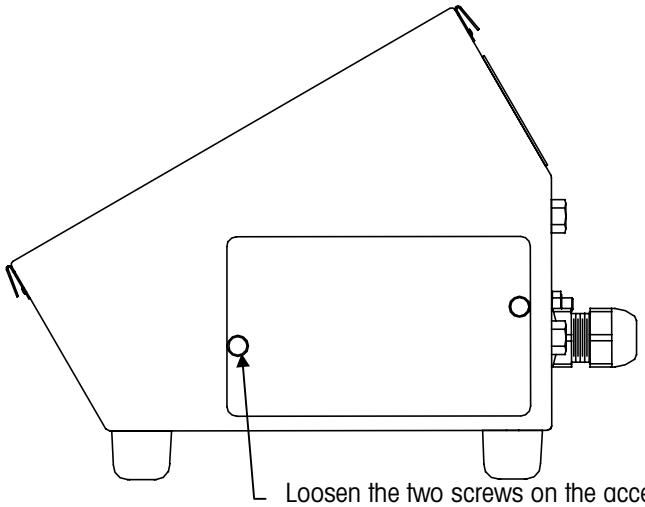


Figure 5-a: Battery Cover

After the battery cover has been removed, grab the battery tab and pull the battery out from the compartment. Reinstall the cover if a replacement battery is not immediately available. Take the battery to a non-hazardous area for recharging. Connect the plug from the battery charger to the jack on the end of the battery pack and plug the charger into an AC outlet.

Use only the following METTLER TOLEDO battery chargers:

14848000A	USA	(Model 09640084)
14848400A	Europe	(Model 09640086)
14848500A	UK	(Model 09640085)
14867900A	Australia	(Model 09640087)

Recharge indoors only in a safe area. Do not use the battery charger to charge any other batteries except the METTLER TOLEDO 1.2 AH Battery Pack.

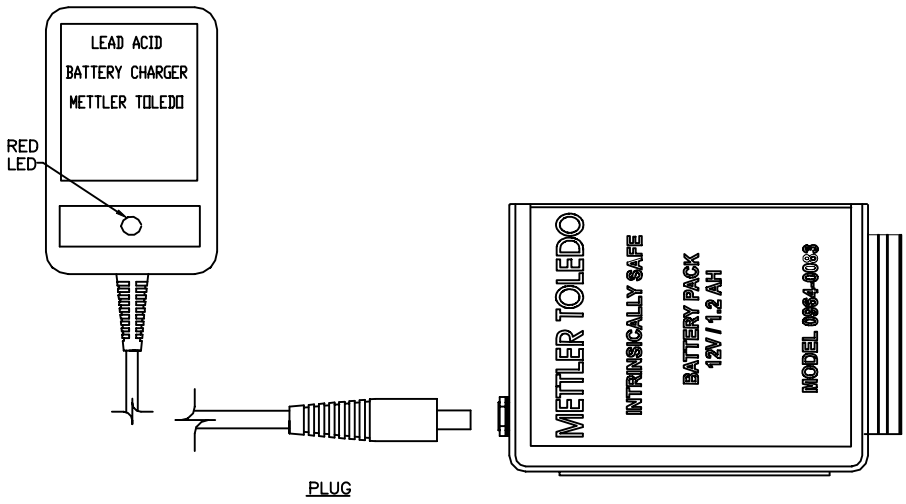
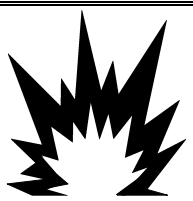


Figure 5-b: Battery Charger

The red LED illuminates while the battery is connected and in the process of charging. If the LED does not illuminate, either the battery is already at full charge, or the AC outlet is not live. The internal battery can take up to 32 hours to recharge when it is at the low charge state. When the battery is recharged, the LED will turn off, indicating charge complete. At this point, the charger will go into a trickle charge state to maintain the battery. It is not necessary to remove the fully charged battery. METTLER TOLEDO recommends that two batteries be utilized. One can remain on the charger while the other is in use. Swap batteries when charging is needed.

Battery Charging Tips



WARNING

DO NOT USE THE METTLER TOLEDO BATTERY CHARGER IN A HAZARDOUS AREA. THE BATTERY CHARGER IS NOT DESIGNED FOR HAZARDOUS AREA OPERATION.

Battery charge capacity is a major factor in estimating the maximum operating time of a charged battery pack. The battery pack uses a lead/acid "gel" cell that is similar to an automobile battery. **Lead/acid batteries lose charge capacity more quickly if they are deeply discharged on a repetitive basis**. There is an inverse relationship between how deep a battery is routinely discharged and how many times the battery can be recharged. A battery is considered to have ended its working life when the fully charged capacity is less than 50% of the original rated capacity.

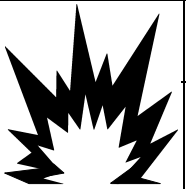
To maximize the working life of a battery pack, recharge when the known operating life (hours) of the battery pack has reached approximately 50% rather than running it down to a low battery condition. For example, if a particular battery pack has a maximum charge life of 180 hours, you should recharge the pack after approximately 90 hours of use. Also, alternating between two battery packs (with one kept on the charger) will

greatly increase the service life of the battery, help prevent premature failure, and ensure continuous operation.

Operating or charging a battery at temperatures higher than 30 °C (86 °F) will shorten the service life of the battery pack. Always recharge the battery within 24 hours after it reaches the low battery condition. Batteries stored in a discharged state will deteriorate rapidly and may not accept a charge later. Batteries should be recharged every six months if in storage at room temperature. Storing batteries at 10 °C (50 °F) or below will extend the shelf-life of a charged battery.

Keyboard/Front Cover Replacement

Follow these steps to replace the *PUMA* terminal keyboard/front cover assembly.



WARNING

DO NOT INSTALL OR PERFORM ANY SERVICE ON THIS EQUIPMENT BEFORE THE AREA HAS BEEN VERIFIED AS NON-HAZARDOUS BY PERSONNEL AUTHORIZED TO DO SO BY THE RESPONSIBLE CUSTOMER.

1. On units with external power, first disconnect power to the *PUMA* terminal. On units with an internal battery, remove the battery from the *PUMA* terminal.
2. Remove the front cover assembly. Refer to "Opening the Enclosure" in Chapter 2.
3. Disconnect the load cell, power, and serial port harnesses from the Main PCB.
4. Remove the nuts holding the tension straps to the front cover, and remove the front cover assembly.
5. Remove the four screws holding the Main PCB to the front panel.
6. Install the new keyboard/front cover assembly reversing the previous steps.

Troubleshooting - General

If problems occur, do not attempt repair before you have determined the source of the problem. Record as much information as possible about what has happened including any error messages and physical responses of the terminal and/or scale. Many problems can be identified and resolved using the following troubleshooting tips:

- **Verify Connections**—Check all wire and cable connections to be sure each is installed securely. If a PCB is suspected as being faulty, remove, then replace the PCB to ensure the problem is not caused by a poor connection.
- **Verify Setup Configuration**—Access setup mode and review all softswitch settings to be sure they are correct for your equipment. Many operational errors can be resolved by changing or correcting the setup configuration. If the setup appears to be correct,

record the current settings first, then reset the ***PUMA*** to factory defaults to see if the problem is resolved.

- **Check Battery Charge**—(Units with internal and external battery packs) If the ***PUMA*** terminal does not respond when power is applied and the unit is turned on by pressing the ***ON*** key, the battery pack may be completely discharged. Install a fully charged battery and retest. Recharge the suspect battery, then re-install and retest. If the problem still persists, the battery pack or charger may be defective. Perform the diagnostic tests described in the section entitled Voltage Tests to determine the problem.
- **Check DC Voltages**—Perform the DC voltage tests described in the section titled Voltage Tests. Use instrument probes carefully to avoid causing short circuits and damage to circuit components.
- **Run the Self Test**—The built-in ***PUMA*** terminal diagnostics includes a Self Test that can verify proper Display, Keyboard, and Serial Channel operation. The self test is described later in this chapter under **Self Test.**
- **Replace Suspected Faulty PCB**—If a PCB is suspected to be faulty, or if you cannot identify the problem elsewhere, remove and replace it with a known good PCB.
- **Power Up Blank Display**—If the battery is known to be good, check the voltage at P2 (see Figure 5-e). If it is OK, press ON and check for the 1.6 VDC Loadcell Excitation at P1-1 and 7 (See Figure 5f.) Also see the section that follows, Troubleshooting – Load Cell/Signal, about the (*)15843800A PCB. If zero with the load cell(s) disconnected, the PCB fuses may be blown. Replace the PCB.

Troubleshooting - Load Cell/Signal

When troubleshooting terminal malfunctions, an understanding of how the instrument acts with various load cell faults and conditions can be very helpful.

- If both signal leads are disconnected, the ***PUMA*** terminal may display a normal number, but act as if it is "frozen". A single broken signal lead will force the ***PUMA*** terminal into an out-of-range condition.
- Because of the low excitation voltage (1.6 VDC), the resulting load cell build may be as low as 0.1 μV/inc. Signal voltages of this magnitude are well below the measuring capability of most digital voltmeters so it may not be possible to connect your meter across the signal lines and see a signal change when loading the scale.
- Beginning with the (*)15843800A PCB, the excitation voltage is gated. Therefore, using a DVM to measure the excitation will not produce valid results. An oscilloscope is needed to determine the exact voltage but a DVM on the AC range will show ≈1.5 VAC here and will vary between different DVMs. See also the section about Load Cell Voltage.
- Performance of the equipment is much more sensitive to disruptions caused by poor connections. ALL CONNECTIONS MUST BE TIGHT. DO NOT SPLICE THE LOAD CELL CABLE. Poor connections will result in significant drifting and erratic operation. THIS EFFECT WILL BE MUCH MORE NOTICEABLE THAN IN ANY OTHER TERMINAL YOU HAVE EVER USED.

- Because of the low load cell signals in the ***PUMA*** terminal, the instrument is susceptible to thermocouple effects. When a junction between two different metals is created, it produces a very small voltage which changes with temperature. In previous instruments, this was not a consideration because the higher load signals effectively masked the effect. With the ***PUMA*** terminal, this effect is significant.

  This undesirable effect is minimized if connections are tight and short. The same number of connections must be made in both the +signal and -signal leads. This has a canceling effect which minimizes drift due to temperature changes.

- If the load cell cable is rapidly moved or rubbed, the display may suddenly experience a change in reading. This is a dynamic effect and the display will return to its previous reading as soon as the cable rubbing or movement stops. This is a voltage charge effect which is similar to what you experience when a static charge causes the hair on the back of your hand to stand up. This effect can be minimized by running the load cell cable in conduit and restricting movement in flexible sections of the run.

- The ***PUMA*** terminal load cell wiring is susceptible to common mode voltage. If the load cell wiring is run near high voltage (>30 volts) or devices that have strong external magnetic fields, it can pick up stray voltages. The display may act sluggish, drift, or have poor response to a reversing load. It is absolutely essential that the load cell cable shield be properly terminated. THE OUTER SHIELD ON DUAL SHIELDED CABLE IS A BONDING CONDUCTOR, NOT A SHIELD. IT MUST BE CONNECTED TO A CONDUCTIVE PART OF THE SCALE BASE AND TO THE CASE OF THE ***PUMA*** terminal.

- If common mode voltage problems are suspected, connect a simulator to the ***PUMA*** terminal, and see if the problem goes away. Remember to keep the cable as short as possible and the terminations tight.

- The ***PUMA*** terminal analog input signal MAXIMUM is 3.2 mV. This is based on the 1.6 VDC *excitation X 100%* of a 2 mV/V cell. If a 3 mV/V cell is used, the ***PUMA*** terminal will not calibrate unless the combined *live* and *dead* load is less than 2/3 of the cell rating.

Example: The combined dead and live load on a 500# 3mV/V cell MUST NOT exceed 333#. (333/500 X 3MV/V X 1.6V = 3.2 mV.)

- Starting with the (*)15843800A PCB, a 2mV/3mV jumper is provided inside the shield can on the PCB. Select the proper jumper position for the load cell in use so that 100% of its range may be used.

- **Load Cell Linearity Problems**. Whenever a load cell is overloaded, a non-linear indication may develop. The load cell signal output may remain linear, but because the ***PUMA*** terminal was not designed to process a signal greater than ≈3.2 mV (100% of a 2 mV/V load cell with 1.6V excitation or ≈4.8 mV when using 3mV/V cells with the (*)15843800A PCB), the internal amplifier becomes non linear. If the system exhibits this symptom near full capacity while remaining linear, check the load cell output. 3mV/V load cells will present this condition when loaded past 2/3 capacity if 2mV/3mV jumper is in 2mV position.

Troubleshooting - Miscellaneous

The following troubleshooting hints may prove useful when working with the ***PUMA***.

Time/Date
The internal ***PUMA*** terminal battery may be removed without loss of clock settings providing it is replaced within 30 seconds. An internal storage capacitor keeps the clock alive at least 30 seconds.

- **Raw Counts**
  A load cell "raw counts" feature is accessed by pressing *Function "0"*. By looking at the cell raw counts, you can determine such conditions as L.C. signal polarity reversed (high negative counts), excessive dead load (high count with no load on the scale), or significant instability in the signal coming from the cell (the count is randomly changing a great deal).

  The number of counts displayed is related to the signal coming in and the number of samples/sec for which the ***PUMA*** terminal is setup. THE ABSOLUTE MAXIMUM SIGNAL INPUT IS 3.2 mV (jumper in 2mV position) or 4.8 mV (jumper in 3mV position). If the signal input is 3.2 mV (2mV position) or 4.8 mV (3mV position), the counts displayed will be approximately as follows:

Samples/Sec	Counts
16	520,000
9	940,000
7	1,150,000

  The ***PUMA*** display is limited to 6 characters so the 1,150,000 counts will display as 150,000. At zero the counts may vary by ± 250 due to internal component differences from unit to unit. After 15-20 seconds, the ***PUMA*** display will return to the normal weight display. The technician should record the zero counts and counts at span when installing a ***PUMA*** terminal. This will provide a baseline for determining if there has been a change in the load cell, stability, or dead weight on the scale.

If a continuous display of raw counts is desired, enter setup and enable expanded data (SSW91 = 1). Exit setup. Press <Recall> to toggle between raw counts and expanded data.

- **Low Battery During Setup**
  DO NOT enter setup with a low battery condition. Power drain is at a maximum during setup. It is possible that automatic battery disconnect will occur during the setup procedure. If this happens an "E3" will be displayed when the *PUMA* terminal is powered up. Enter setup, clear the error, and reenter all parameters.
- **Locked-Up Display**
  If the *PUMA* terminal display appears to be "frozen", determine if part of the electronics is still functional. Look at the [G] in the upper right corner of the display which blanks when motion is detected. The "G" will blank out then reappear when a load is placed on the platform if the analog circuit and the load cell are working. Try cycling power first. If this does not work try recalibration. If neither works, replace the Main Logic PCB.

Error Codes and Actions

The following table lists the *PUMA* terminal error messages, description, and action.

Error Message	Description	Probable Action
E1	Fatal ROM memory error.	1. Replace or re-seat EPROM. 2. Replace Main PCB.
E2	Fatal internal RAM error (U13).	Replace Main PCB.
E3	EPROM Memory error.	1. Press **CLEAR** (go to Step 2 if this does not clear error). 2. Power down, install W2 CAL Jumper, then power up and press the **CLEAR** key to enter setup and reprogram. 3. Replace Main PCB if reprogramming does not work.
E4	Fatal External RAM error (U16).	Replace Main PCB
E10	Setpoint Recall error.	Setpoint mode enabled, but no setpoint values were entered, or setpoint values were not re-entered after calibration. 1. Press **CLEAR** key 2. Enter setpoint value(s) ***or*** Disable setpoint(s) (SSW 81)
E16	Floating Point Error.	Invalid calibration attempted. SSW 08 calibration mode was entered and calibration started. 1. Press **CLEAR** key and enter setup. 2. Setup proper calibration constants in SSW 04 to 07.
E21	Incorrect Scale Capacity.	Press **CLEAR** and enter a correct capacity (setup mode).
E24	Illegal Increment Value.	Press **CLEAR** and enter a valid increment value (setup mode).
E26	Illegal scale build, maximum number of increments exceeded.	Press **CLEAR** and enter increment size to insure number of increments < 25,000.
E27	Illegal overcapacity.	Overcapacity value must be equal to or greater than scale capacity (setup mode).

Error Message	Description	Probable Action
E32	Insufficient Calibration test weight or insufficient signal from load cell	1. Press **CLEAR**, then add additional test weight 2. Check base for mechanical problems 3. Verify scale capacity (in setup) 4. Verify load cell wiring 5. Replace Main PCB 6. Replace load cell
E34	Calibration Test Weight too large	Press **CLEAR.** Use test weight less than 105% of scale capacity.
E35	Illegal Test Weight Build entry.	Press **CLEAR** and Re-calibrate making sure the test weight value entered is a multiple of the setup increment.
E36	Graduation size too small.	Press **CLEAR** key. Recalibrate with larger graduation size.
SP Err	Setpoint entry error.	An error occurred in setpoint value entry. Check the allowed ranges for setpoints entered. Reenter valid setpoint values.
E E E	Scale not zeroed at power up.	Tare interlock and/or Auto Zero on power-up is enabled and the weight is greater than zero. 1. Zero the scale, or remove the weight until zero is captured. 2. Re-calibrate the scale.
-E E E	Scale not zeroed at power up. (Out of range of SSW 14)	Tare interlock and/or Auto Zero on power-up is enabled and the weight is less than zero. 1. Zero the scale, or add weight until zero is captured. 2. Re-calibrate the scale. 3. Increase limits of SSW 14 Auto Zero Capture at Power up.
|------|	Overload indication.	Weight on scale exceeds calibrated capacity. 1. Decrease load on scale.
|------|	Underload indication.	Weight on scale is below gross zero. See SSW18. 1. Increase load on scale. 2. Enter new value in SSW18.

Self Test

The *PUMA* terminal can perform a series of tests to verify proper operation of the display, keyboard, and serial ports.

Use the Self Test for:
- Display Segment Verification
- Software Version Verification
- Keyboard Verification
- Serial Channel Verification

The serial ports can be tested using the *PUMA* Self Test. Install a jumper between pins J3-3 (Transmit) and J3-4 (Receive) on COMM 1, and between pins J4-3 (Transmit) and J4-4 (Receive) on COMM 2. Initiate the Self Test described below. If the *PUMA* terminal fails the local loopback test and the power supply voltage is good, replace the Main PCB. If the *PUMA* terminal passes the local loopback test, install jumpers at the remote device between Transmit/Receive and run the test again. If the *PUMA* terminal fails the remote loopback serial test, the problem is at the remote device or the Internal Fiber Optic PCB (if installed).

To initiate the self-test sequence:

1. Press the **OFF** key or **FUNCTION 9** keys to power the terminal down.
2. Press and hold the **TARE** key while pressing the ***ON*** key. The ***PUMA*** terminal automatically lights each LCD segment and symbol. The software part number will display for one second followed by the version number for one second.
3. The ***PUMA*** terminal keyboard test follows the display test. To complete the keyboard test, press the keys in order, starting at the top row of keys, then following in the sequence shown in Figure 2-h. When **[PrS 30]** is displayed, press the top left key (**CLEAR** in Row 3, Column 0). Follow the sequence by pressing each key in the top row, then down to the next row.

If the W2 jumper is already in place when entering self test the message "test 4" followed by "fail 1" will be displayed. Press the **PRINT** key to return to Setup Mode **[---]**, then power down and remove W2.

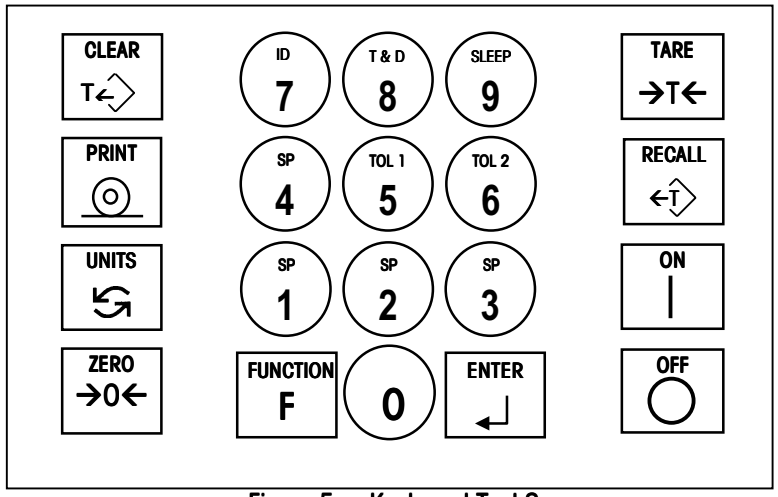


Figure 5-c: Keyboard Test Sequence

4. If a serial loopback test <u>is</u> desired, install Jumper W2 and the jumpers on the serial ports then press **ENTER.** If not, go to step 5.

   During the loopback test the display shows **[test 7]**, followed by the results **x1 x2**, where **x** is **F** (Fail) or **C** (Pass). If both channels pass this test, the display remains for several seconds, then the setup mode indicator appears "- - ". Remove W2 to exit setup. If any channel fails, press **CLEAR** for the setup indicator to appear. This ends the self test.

5. If a serial loopback test is <u>not</u> desired, simply press **ENTER.** The test will terminate and the display will indicate weight.

Voltage Tests

⚠ WARNING

DO NOT INSTALL OR PERFORM ANY SERVICE ON THIS EQUIPMENT BEFORE THE AREA HAS BEEN VERIFIED AS NON-HAZARDOUS BY PERSONNEL AUTHORIZED TO DO SO BY THE RESPONSIBLE CUSTOMER.

+12 VDC Supply

The *PUMA* terminal operates from a nominal +12 VDC supplied by one of the following:

- An internal 1.2 AH battery
- Optional 7 AH External battery pack.
- Optional AC Power Supply.

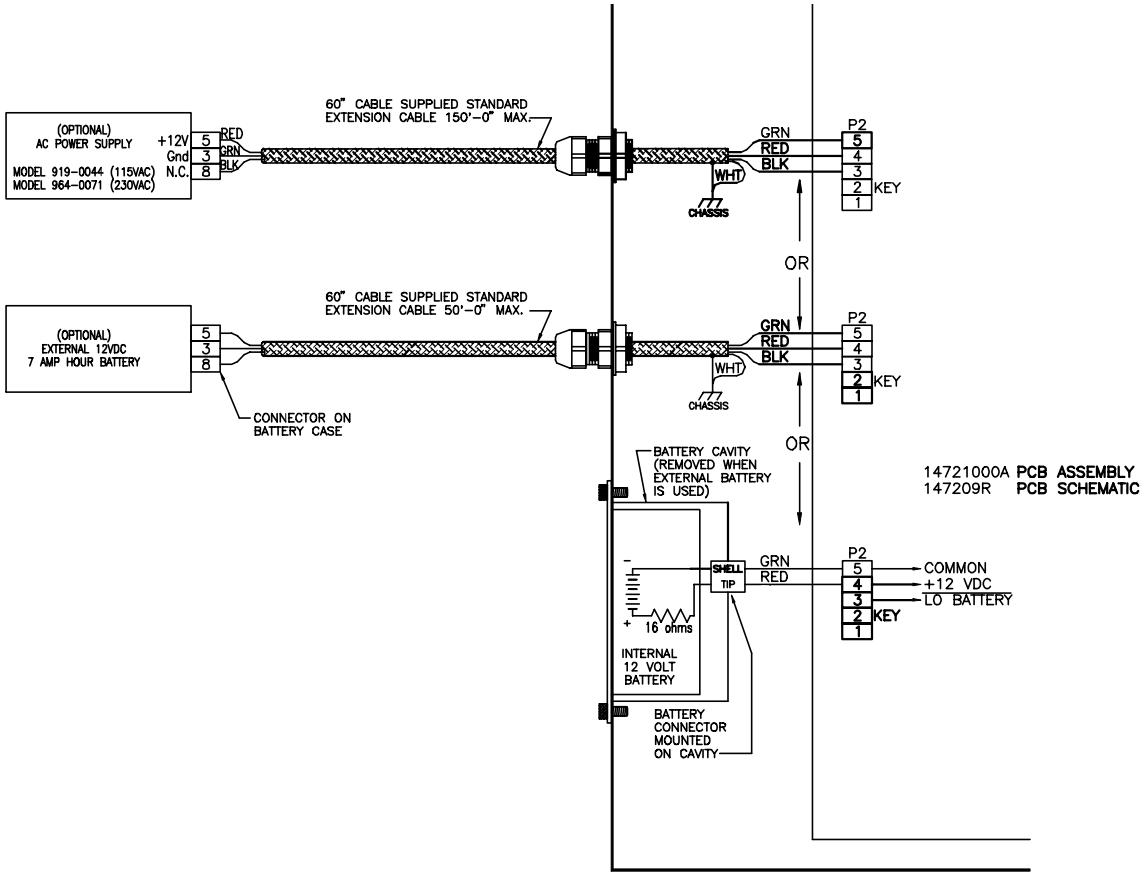


Figure 5-d: +12 VDC Test Points on Main PCB

The +12 VDC supply can be checked at the power input connector J2 on the Main PCB. The test points are shown in Figure 5-1. Check the power between J2-4 (Common) and J2-5 (+12 VDC). The acceptable voltage ranges are shown below.

Notes: Be aware that power saving techniques are employed in the ***PUMA*** software which forces the logic into low power status whenever the CPU is idle (not processing weight information.) Therefore, power is lowest when in the slowest update mode, one load cell is used and no serial outputs are in progress. The power saving move is disabled while in setup so the voltages shown above will be lower in setup mode. Also, when the battery is nearly discharged, entering setup will display Battery Low or may switch off automatically. As a general rule, ***do not*** enter setup with Battery Low displayed.

Internal Battery Pack and Charger

The internal 1.2 AH Intrinsically Safe Battery Pack is located in a sealed compartment inside the ***PUMA*** terminal enclosure. It must be removed to a safe area for recharging. The voltage for this battery is 10.5 VDC. When the low battery indicator symbol displays, recharge the battery. Do not continue operating the ***PUMA*** terminal with a low battery, or the battery will be damaged if allowed to discharge completely.

Operating or charging a battery at temperatures higher than 30 °C (86 °F) will shorten the service life of the battery pack. Always recharge the battery within 12 hours after it reaches the low battery condition. Batteries stored in a discharged state will deteriorate rapidly and may not accept a full charge later. Batteries should be recharged every six months if in storage at room temperature. Storing batteries at 10 °C (50 °F) or below will extend the shelf-life of a charged battery.

The recharge time of the battery is approximately 32 hours with the battery at the fully discharged voltage of ≈+11 VDC. The nominal full charge voltage of this battery is approximately +13.1 VDC measured at P2-4 & 5 while ***PUMA*** is OFF. While the battery is charging, the Charger will illuminate a RED LED. When the LED turns off, the battery is charged, but should remain on the charger, if possible, for an additional 6-8 hours to obtain 100% charge. At this point, the charger will maintain the battery with a trickle charge. The battery voltage must be checked with the battery installed in the ***PUMA*** terminal to override the shutoff switch at the jack in the battery.

Note: Do not attempt to measure the internal battery pack voltage when removed from the ***PUMA***. An internal battery pack switch disconnects voltage when unplugged.

The charger for the internal battery can be tested by measuring the DC voltage at the charger plug. The nominal charging voltage is 14 VDC. If the battery will not maintain a charge, replace the battery. The internal battery is a safety-expendable item. **Do not open or attempt to repair the battery pack.**

WARNING

DO NOT USE THE BATTERY CHARGER IN THE HAZARDOUS AREA. THE BATTERY CHARGER IS NOT DESIGNED FOR OR INTENDED FOR USE IN HAZARDOUS AREAS.

Hazardous Area AC Power Supply

Note: In general, a defective ***PUMA*** Logic PCB that could produce a power supply overload would blow the PCB fuses creating an open circuit and not a short circuit.

With the input AC voltage within prescribed limits, the power supply open circuit output voltage is 11.8 VDC to 13.0 VDC and current is limited to 100 mA into a short circuit. Troubleshoot the hazardous area AC power supply by measuring the DC output voltage.

If the open circuit output voltage is outside the 11.8 to 13.0 VDC range, replace it. The AC power supply is a safety-expendable item. **Do not open or attempt to repair the AC power supply.**

External 7 AH Intrinsically Safe Battery Pack

The Fiber Optic PCB uses the regulated +5VDC from the Main PCB and will not operate correctly if the voltage supply is bad.

The optional extended life 7 AH battery pack can power the *PUMA* terminal for 250-300 hours before recharging. It has a "Battery Low" output which illuminates the symbol on the *PUMA* terminal whenever recharging is needed. It also incorporates a disconnect circuit at 11.1 volts to turn off the *PUMA* terminal, preventing total battery discharge.

- Charge the battery pack for 12 hours and retest with a fully charged battery. **Be sure the charger is in a non-hazardous area.**
- Verify that the battery charger is working. Check the voltage across pins 2 and 3 of the twist lock connector on the end of the battery charger cable.

Replace the battery pack (if the charger is good). The battery pack is a safety-expendable item. **Do not open or attempt to repair the battery pack.**

+5 VDC Regulated Logic Supply Voltage

The +5 VDC logic supply is derived from the +12 VDC supplied by the internal battery, external battery pack, or external AC Power Supply. The Main PCB converts the +12 VDC to a regulated +5 VDC for use on the Main PCB and the optional Fiber Optic PCB.

Measure the logic supply voltage across pin 6 (+5VDC) and pin 2 (Ground) of connector J3 or J4 on the Main PCB. If the voltage is outside the 4.75 to 5.25 VDC range:

- Verify the +12 VDC supply from the power source.
- Disconnect the Fiber Optic PCB and recheck the +5 VDC supply. If removal of the Fiber Optic PCB restores proper +5 VDC, replace the Fiber Optic PCB.
- If the voltage is out of the acceptable range with the proper +12 VDC supply voltage, and the Fiber Optic PCB disconnected, replace the Main PCB.

Load Cell Voltage

WARNING

DO NOT INSTALL OR PERFORM ANY SERVICE ON THIS EQUIPMENT BEFORE THE AREA HAS BEEN VERIFIED AS NON-HAZARDOUS BY PERSONNEL AUTHORIZED TO DO SO BY THE RESPONSIBLE CUSTOMER.

IMPORTANT!

PUMA TERMINALS WITH THE (*)15843800A PCB UTILIZE AN AC SQUARE WAVE LOAD CELL EXCITATION SOURCE. MEASURE THIS VOLTAGE AS DETAILED BELOW WITH A METER ON THE AC RANGE. READINGS TAKEN WITH A METER ON THE DC RANGE WILL PRODUCE A READING NEAR ZERO.

Excitation Voltage

The load cell Excitation voltage from the *PUMA* terminal to the load is 1.63 volts. It can be checked at connector J1 between pin 1 (+EX) and pin 7 (-Ex), as shown in Figure 5-f.

(*)15136100A PCB

The excitation is 1.63VDC and can be measured as 1.63VDC with a DVM on the DC range.

(*)15843800A PCB

The excitation is 1.63V square wave AC. Measure as ≈1.8VAC with a DVM on the AC range. Different meters may produce slightly different readings.

If the voltage is low, check the following:

- Too many load cells connected. Maximum is (4) 350 ohm cells.
- Shorted load cell cable. Disconnect load cell cable and recheck. If OK, troubleshoot cable.

Signal Voltage

The signal voltage is normally too small to be read reliably on most voltmeters, so a given reading may be of little use. However, the positioning of this voltage between 0 and the 5 VDC analog supply voltage is important for correct scale operation. To check for proper position, do the following:

- Measure the voltage from P1-4 (Common Negative) to P1-3 or 5. It will be ≈2.5VDC stable reading with the (*)15136100A PCB and ≈2.4VDC slightly unstable reading with the (*)15843800A PCB with load cell wiring connected.
- If not, check shields for proper grounding. Also check equipment grounding and wiring.
- Check for load cell wiring short circuits. There must be no continuity between any of the load cell wires with respect to ground or cable shield (with P1 connector disconnected.)

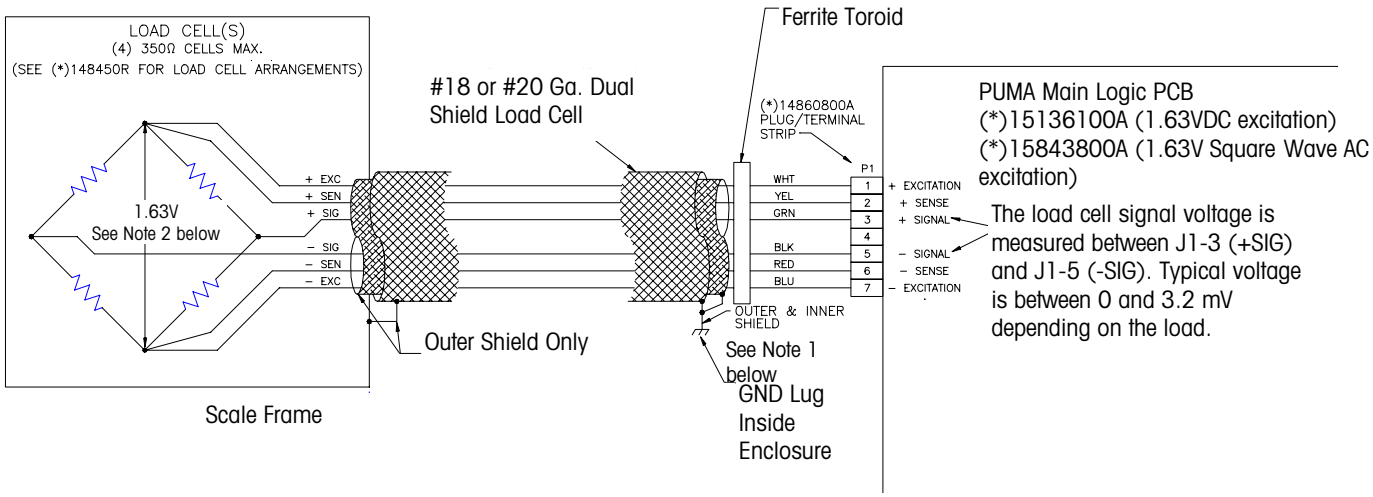
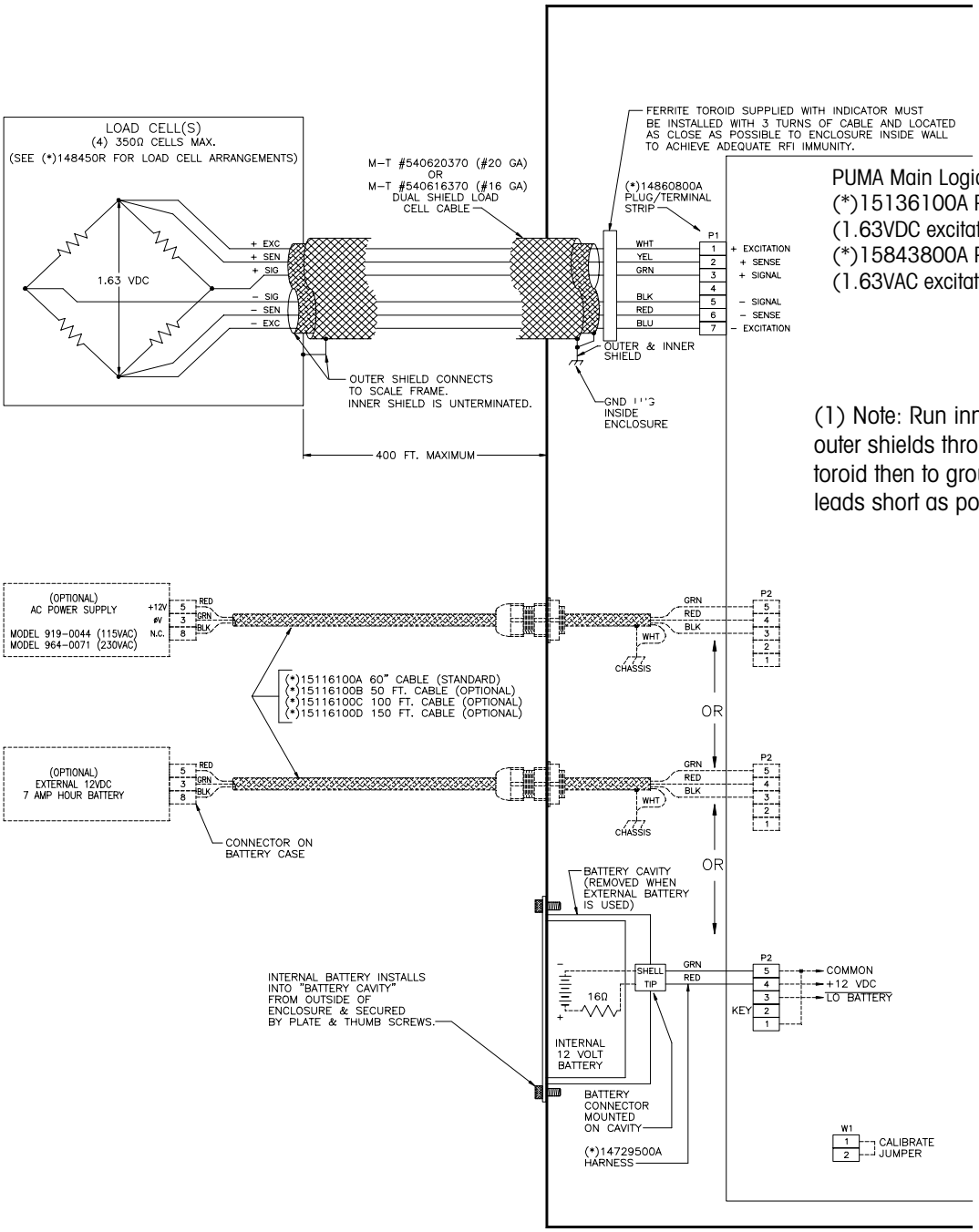
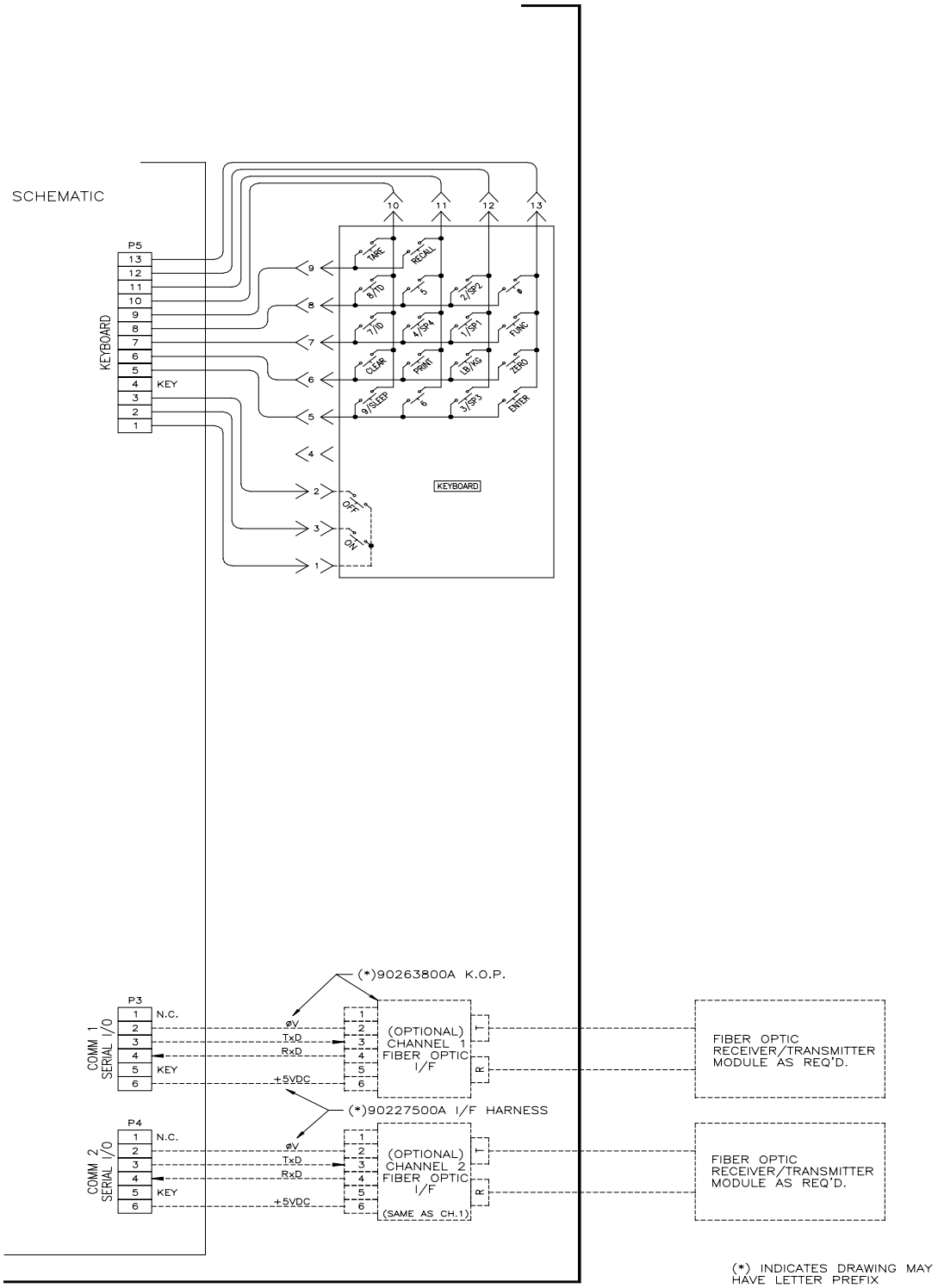


Figure 5-e: Load Cell Voltage Test Points

Note 1: Run inner and outer shields through ferrite toroid, then to ground. Keep leads short as possible.
Note 2: Starting with (*)15843800A PCB, the excitation voltage is a gated square wave AC equivalent signal. The peak-peak value remains at 1.63V but cannot be measured accurately with a digital voltmeter. See the "Excitation Voltage" explanation on the previous page.

Interconnecting Diagram




SCHEMATIC
P5
KEYBOARD
KEY
TARE
RECALL
CLEAR
PRINT
ZERO
ENTER
FUNC
KEYBOARD
OFF
ON
(*)90263800A K.O.P.
P3
COMM 1
SERIAL I/O
N.C.
øV
TxD
RxD
KEY
+5VDC
(OPTIONAL)
CHANNEL 1
FIBER OPTIC
I/F
T
R
FIBER OPTIC
RECEIVER/TRANSMITTER
MODULE AS REQ'D.
(*)90227500A I/F HARNESS
P4
COMM 2
SERIAL I/O
(OPTIONAL)
CHANNEL 2
FIBER OPTIC
I/F
(SAME AS CH.1)
FIBER OPTIC
RECEIVER/TRANSMITTER
MODULE AS REQ'D.
(*) INDICATES DRAWING MAY
HAVE LETTER PREFIX

NOTES

6 Parts and Accessories

Spare Parts

To minimize down-time, keep these spare parts on hand:

(*) May have a letter prefix representing the latest revision.

Part Number	Description
(*)15843800A	Main PCB with EPROM (Replaces 15136100A)
(*)14987300A	Front Cover Assembly (USA and Canada) Includes front cover, overlay, and keyboard.
(*)14987400A	Front Cover Assembly (Australia) Includes front cover, overlay, keyboard, and static shield.

Fiber Optic Option Spare Parts	
Part Number	**Description**
(*)90030100A	Fiber Optic PCB (***PUMA***)
(*)90030600A	Fiber Optic Converter PCB

Hazardous Area Power Supply Spare Parts	
Part Number	**Description**
(*)90105400A	115 VAC Hazardous Area Power Supply
(*)90196400A	230 VAC Hazardous Area Power Supply

(*) May have a letter prefix representing the latest revision.

Intrinsically Safe External Battery Pack Spare Parts	
Part Number	**Description**
(*)90228700A	Intrinsically Safe Battery Pack (7 AH)
(*)90166300A	Battery Charger, (USA/Canada) 120 VAC/60 Hz
(*)90166000A	Battery Charger (UK) 230 VAC/50 Hz
(*)90166100A	Battery Charger (Europe) 230 VAC/50 Hz
(*)90166200A	Battery Charger (China/Aus) 230 VAC/50 Hz

Intrinsically Safe Internal Battery Pack Spare Parts	
Part Number	**Description**
(*)14730000A	Internal Battery (1.2 AH)
(*)14848000A	Battery Charger USA/Canada 120 VAC/60 Hz (Model 0964-0084)
(*)14848400A	Battery Charger Europe 230 VAC/50 Hz (Model 0964-0086)
(*)14848500A	Battery Charger UK 230 VAC/50 Hz (Model 0964-0085)
(*)14867900A	Battery Charger Australia 240 VAC/50 Hz (Model 0964-0087)

Serial I/O Interface Cables

(*) May have a letter prefix representing the latest revision.

The following table lists cables for use with the Fiber Optic Data I/O option only. The adapter plug (included with the 8860 desk version) must be used with the 8860 desk cable listed.

Printer Interface Cables			
Printer	**Cable Length**	**Part Number**	**Factory Number**
8806	6 feet 20 feet	(*)11554400A (*)11554500A	0900-0136 0900-0137
8844, 8845, 8856, 8861, 8865, 8807	6 feet	(*)12822000A	0900-0214
8855	6 feet 20 feet	(*)11972200A (*)11972300A	0900-0197 0900-0198
Computer (9 pin)	15 feet	(*)13605400A	0900-0277
Computer (25 pin)	15 feet	(*)13605300A	0900-0276

Accessories

Part Number	Description	Factory No.
(*)90263800A	Fiber Optic Data I/O Kit (Includes Harness)	0961-0090
(*)90227500A	Fiber Optic Data I/O Harness (only)	N/A
(*)90030700A	Fiber Optic Converter (USA) 115 VAC, 60 Hz	0964-0043
(*)90165600A	Fiber Optic Converter (UK) 230 VAC, 50 Hz	0964-0058
(*)90165700A	Fiber Optic Converter (Europe/China) 230 VAC, 50 Hz	0964-0059
(*)90165800A	Fiber Optic Converter (Australia) No Power Supply	0964-0060
(*)13774500A	Intrinsically Safe Power Supply (U.S.) 115 VAC, 60 Hz	0919-0044
(*)90196400A	Intrinsically Safe Power Supply (Export) 230 VAC, 50 Hz	0964-0071
(*)15116100B	External Power Cable 50 ft (15.2 meters) (7AH Battery and AC Supply only)	0960-0190-050
(*)15116100C	External Power Cable 100 ft (30.5 meters) (7AH Battery and AC Supply only)	0960-0190-100
(*)15116100D	Power Cable 150 ft (45.7 meters) (7AH Battery and AC Supply only)	0960-0190-150
(*) 15356400A	Column Mount KOP (For Bench/Portable 3 and 4 Boot Columns)	0917-0265
88-470001	Column Mount KOP Masstron Single Bolt Floor Scale Columns	N/A
15509900A	Fiber Optic Discrete Input Pushbutton kit. (Includes 0961-0090 kit).	0917-0272

(*) May have a letter prefix representing the latest revision.

Fiber Optic Cable

(*) May have a letter prefix representing the latest revision.

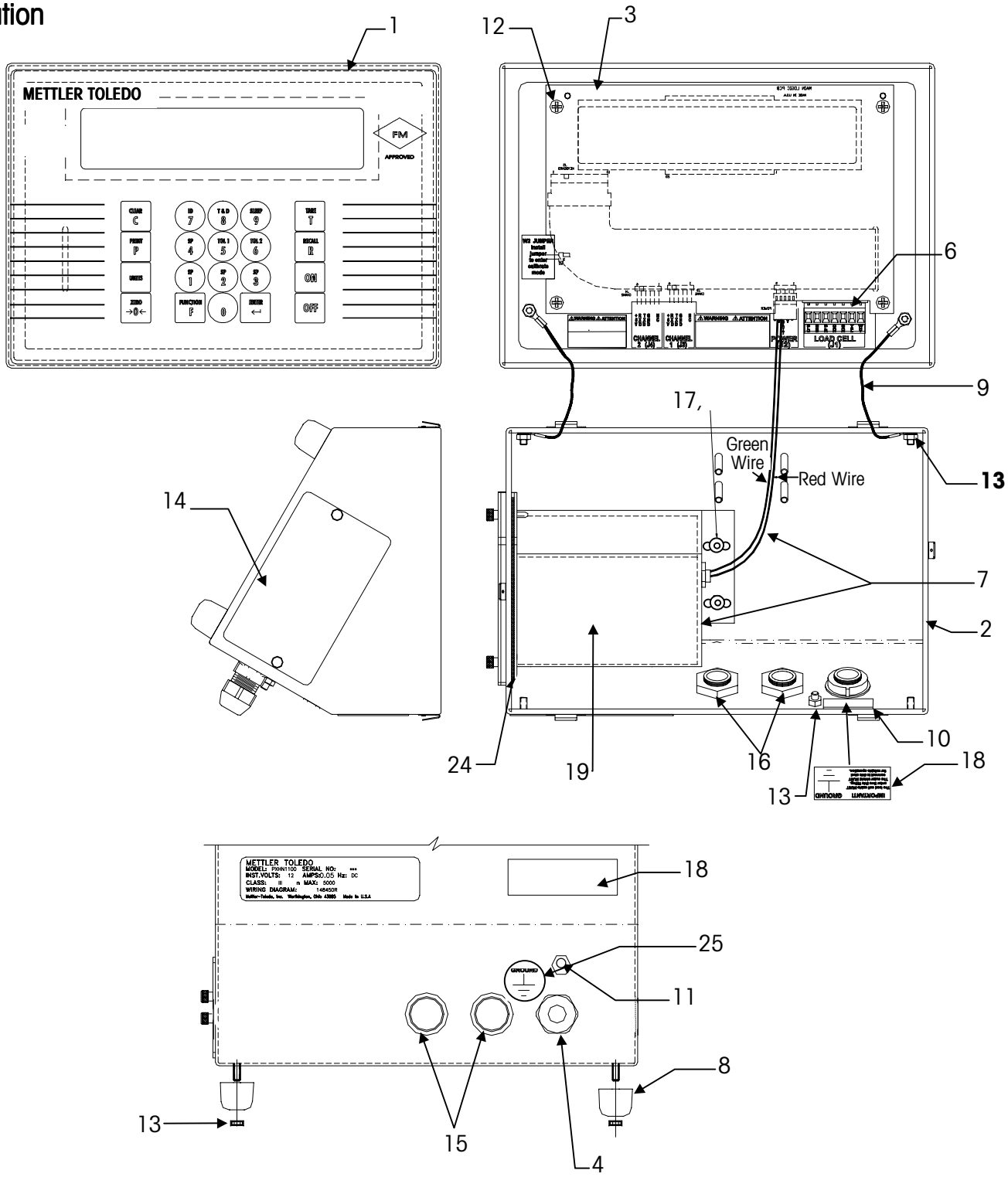
The recommended fiber optic cable is HCS® (Hard Clad Silica) core. Cables can be coupled using a bulkhead connector, however if the bulkhead connector is used, the signal loss is equivalent to 150 meters (500 feet). Subtract this amount from the total distance which leaves a usable distance of 150 meters (500 feet). Two fiber optic cables are required for bidirectional communication. See Appendix 12 for Cable Specifications.

Part Number	Description	Factory Number
(*)14975500A	Fiber Optic Cable, HCS, 50 feet	0960-0189-050
(*)14975500B	Fiber Optic Cable, HCS, 100 feet	0960-0189-100
(*)14975500C	Fiber Optic Cable, HCS, 150 feet	0960-0189-150
(*)14975500D	Fiber Optic Cable, HCS, 200 feet	0960-0189-200
(*)14975500E	Fiber Optic Cable, HCS, 250 feet	0960-0189-250
(*)14975500F	Fiber Optic Cable, HCS, 300 feet	0960-0189-300
(*)14975500G	Fiber Optic Cable, HCS, 350 feet	0960-0189-350
(*)14975500H	Fiber Optic Cable, HCS, 400 feet	0960-0189-400
(*)14975500J	Fiber Optic Cable, HCS, 450 feet	0960-0189-450
(*)14975500K	Fiber Optic Cable, HCS, 500 feet	0960-0189-500
(*)14975500L	Fiber Optic Cable, HCS, 550 feet	0960-0189-550
(*)14975500M	Fiber Optic Cable, HCS, 600 feet	0960-0189-600
(*)14975500N	Fiber Optic Cable, HCS, 650 feet	0960-0189-650
(*)14975500P	Fiber Optic Cable, HCS, 700 feet	0960-0189-700
(*)14975500R	Fiber Optic Cable, HCS, 750 feet	0960-0189-750
(*)14975500T	Fiber Optic Cable, HCS, 800 feet	0960-0189-800
(*)14975500U	Fiber Optic Cable, HCS, 850 feet	0960-0189-850
(*)14975500V	Fiber Optic Cable, HCS, 900 feet	0960-0189-900
(*)14975500W	Fiber Optic Cable, HCS, 950 feet	0960-0189-950
(*)14975500X	Fiber Optic Cable, HCS, 1000 feet	0960-0189-999
KT665009DAH	Splice Connector Fiber Optic (For Plastic or Glass HCS)	N/A
(*)13658400A	Fiber Optic Cable, Plastic (50 ft)	0900-0268
(*)13658500A	Fiber Optic Cable, Plastic (100 ft)	0900-0269
(*)90031300A	Fiber Optic Cable Field Termination Kit (Plastic Only)	0964-0053
(*)90031400A	Bulk Fiber Optic Cable, Plastic (500 ft spool)	0964-0054

PUMA Terminal with Internal Battery

PXHN1100

Illustration



Parts List

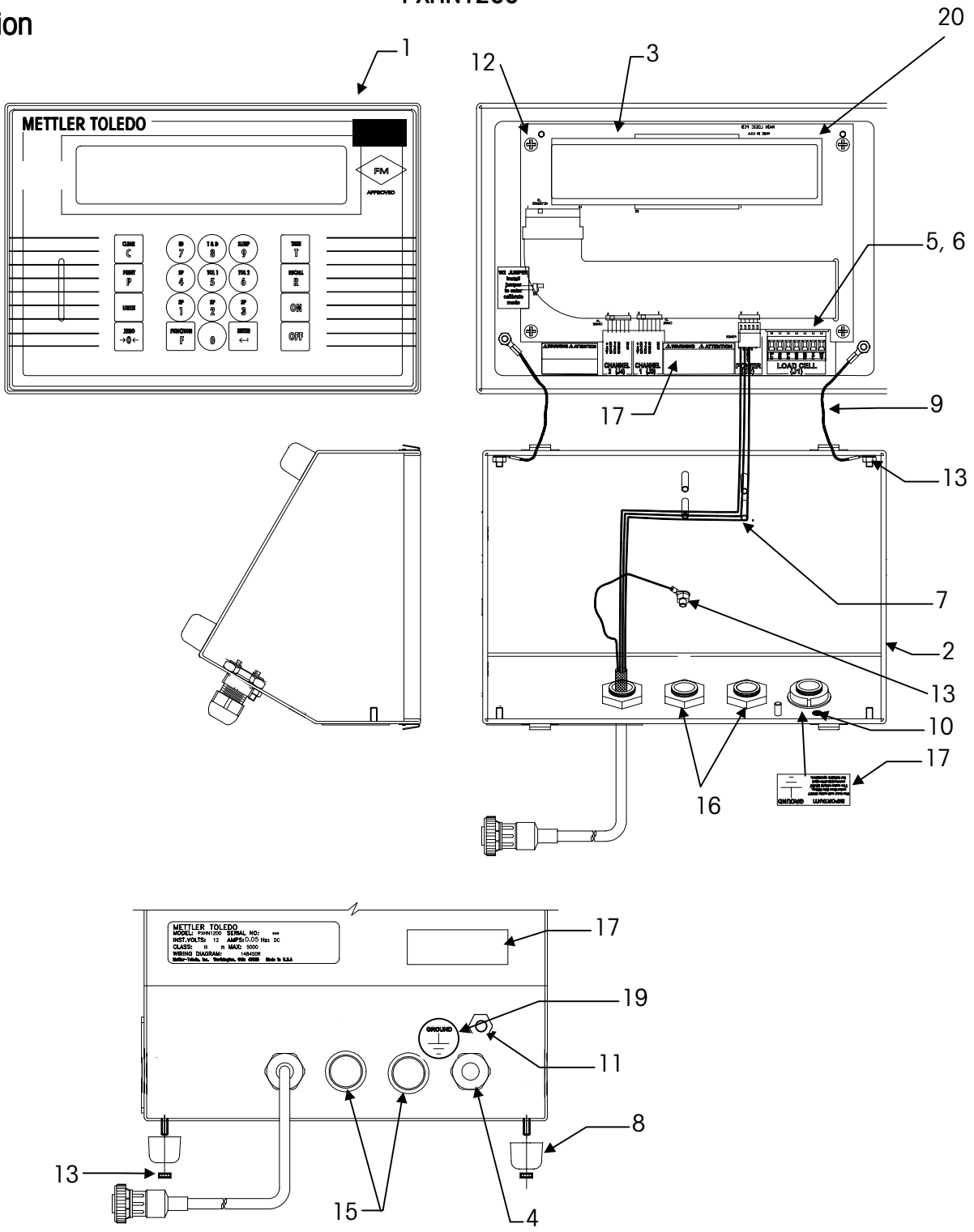
(*) May have a letter prefix representing the latest revision.

Ref.	Part Number	Description	Qty
1	(*)14987300A	Front Cover Assembly (USA and Canada) Includes front cover, overlay, and keyboard.	1
2	(*)14722800A	Enclosure, Base	1
3	(*)15843800A	Main PCB with EPROM (Replaces 15136100A)	1
4	(*)13002300A	Grip Bushing, .230-.394 (with nut) PG11	1
6	(*)14860800A	Connector, Terminal/Plug (load cell)	1
7	(*)14729500A	Harness Assembly, Power (with enclosure)	1
8	(*)14882000A	Mounting Feet, Neoprene	4
9	(*)14467500A	Tension Cable	2
10	R0512000A	Screw, M4 x 6	1
11	(*)15116000A	Ground Lug	1
12	R0511100A	Screw, M4 x 10	4
13	R0519600A	Nut, Hex M4 KEPS	11
14	(*)14722900A	Cover, Battery Housing (w/gasket)	1
15	(*)14724400A	Plug Cover, Nylon	2
16	(*)14724500A	Nut, Nylon	2
17	R0281400A	Washer, Flat #8	2
18	(*)14876000A	Label, Identification (multiple part)	1
19	(*)14730000A	Battery, Intrinsic Safe 12V 1.2 AH	1
21	(*)14723000A	Enclosure, Battery	1
23	(*)12635700A	Ferrite, Toroid (Not Shown)	1
24	(*)15007300A	Gasket, Battery Opening	1
25	(*)14531400A	Label, Safety Ground	1
	(*)14896700A	Bracket, Wall Mount (Not Shown)	2

PUMA Terminal with External Power Supply

Illustration

PXHN1200



Parts List

(*) May have a letter prefix representing the latest revision.

Ref.	Part Number	Description	Qty
1	(*)14987300A	Front Cover Assembly (USA and Canada) Includes front cover, overlay, and keyboard.	1
2	(*)15111800A	Enclosure, Base	1
3	(*)15843800A	Main PCB with EPROM (Replaces 15136100A)	1
4	(*)13002300A	Grip Bushing, .230-.394 (with nut) PG11	1
5	(*)12635700A	Ferrite, Toroid (Not Shown)	1
6	(*)14860800A	Connector, Terminal/Plug (load cell)	1
7	(*)15116100A	Harness Assembly, Power	1
8	(*)14882000A	Mounting Feet, Neoprene	4
9	(*)14467500A	Tension Cable	2
10	R0512000A	Screw, M4 x 6	1
11	(*)15116000A	Ground Lug	1
12	R0511100A	Screw, M4 x 10	4
13	R0519600A	Nut, Hex M4 KEPS	11
15	(*)14724400A	Plug Cover, Nylon PG16	2
16	(*)14724500A	Nut, Nylon PG16	2
17	(*)14876000A	Label, Identification (multiple part)	1
19	(*)14531400A	Label, Safety Ground	1
	(*)14896700A	Bracket, Wall Mount	2

NOTES

7 Appendices

Appendix 1: Quick Reference Chart

00 CALIBRATION GROUP
01 Units Calibration
0 = Pounds
1 = Kilograms
2 = Grams
3 = Metric tons

02 Linearity Compensation
0 = Disabled 1 = Enabled

04 Scale Capacity(*)
(Enter integer portion.)

05 Increment Size(*)
(Press *0* to toggle location.)
(*1*, *2*, 5 for increment size)
(*Enter* to accept)

08 Calibration Procedure
0=Skip Calibration
1=Calibrate

09 Sample Rate
0 =16 / sec 4 =9 / sec
1 =14 / sec 5 =8 / sec
2 =12 / sec 6 =7 / sec
3 =10 / sec
(Calibration continues after sample rate selection.)

10 ZERO AND FILTERING GROUP
11 Zero Adjustment
0 = Skip.
1 = Current weight new zero.

12 Span Adjustment
0 = Skip.
1 = Current weight new span.

13 AZM Range(*)
0 = Disabled
1 = AZM within ± 0.5d,Gross Only
2 = AZM within ± 1.0d,Gross Only
3 = AZM within ±3.0d,Gross Only
4 = AZM within ± 0.5d,Gross or Net
5 = AZM within ±1.0d,Gross or Net
6 = AZM within ± 3.0d,Gross or Net

14 Zero Capture at Power up(*)

0 = Disabled
1 = Zero Capture ± 2% Capacity
2 = Zero Capture ± 10% Capacity

15 Push-button Zero Range

0 = Disabled
1 = Zero within ± 2% of Capacity
2 = Zero within ± 20% of Capacity

16 Motion Detection(*)
0 = Disable
1 = ± 0.5 Increments
2 = ± 1.0 Increments
3 = ± 2 Increments
4 = ± 3 Increments

17 Filtering
0 = 0.25 sec **4 = 1.2 sec**
1 = 0.35 sec 5 = 1.6 sec
2 = 0.60 sec 6 = 2.0 sec
3 = 0.75 sec 7 = 2.4 sec

18 Over/Undercapacity Blanking(*)
(Enter value.)

19 Gravity Adjust (Geo Value)
Enter value 0 to 31
16 = USA
19 = Germany

20 TARE AND TIMER GROUP
21 Tare Enable
0 = Disabled
1 = Push-button Tare Only
2 = Push-button and Manual Tare

22 Tare Interlock(*)
0 = Disabled 1 = Enabled

24 Auto Clear Tare
0 = Disabled 1 = Enabled

25 Scale ID **01**

26 Date Format
0 = MM:DD:YY
1 = DD:MM:YY
2 = YY:MM:DD

27 Automatic Power-off Timer
0 = Disabled
1 - 99 minutes timer

30 COM1 SETUP GROUP
31 Operating Mode
0 = Disabled
1 = Continuous Output
2 = Demand Output
3 = <ENQ> Continuous Output
4 = Continuous Short Output
5 = Host
6 = SICS Level 0

32 ASCII remote input
0 = Disabled
1 = Enabled
33 Baud Rate
(Press *0* to toggle, *Enter* to accept.)
300 1200 2400 4800 **9600**

34 Parity Selection
0 = Space Parity
1 = Odd Parity
2 = Even Parity
3 = Mark Parity
4 = None

35 Number of Data Bits
0 = 7 , 1 = 8

36 Checksum
0 = Disabled 1 = Enabled

37 Net Sign Correction
0 = Disabled
1 = Printed
2 = Printed and Displayed

38 Enable STX Character
0 = Disabled **1 = Enabled**

39 Demand Mode Line Format
0 = Single Line Output
1 = Multiple Line Output

Continued on next page →

41 Print Fields **523400**

0 = Field turned off
1 = Displayed weight
2 = Gross weight
3 = Tare weight
4 = Net weight
5 = Scale ID Number
6 = Blank Field
7 = Date/Time
8 = Keyboard ID

42 Print Weight Expanded
0 = Disabled 1 = Enabled

43 Printed Weight Unit Legend(*)
0 = Disabled **1 = Enabled**

44 Printed Time Format
0 = 24:MM
1 = HH:MM PM

45 Connection Method
0 = Star
1 = Loop Through

50 COM2 SETUP GROUP
51 Operating Mode
0 = Disabled
1 = Continuous Output
2 = Demand Output
3 = <ENQ> Continuous Output
4 = Short Continuous Output

52 ASCII Remote Input
0 = Disabled 1 = Enabled

53 Baud Rate
Press *0* to Toggle, *Enter* to accept.)
300 1200 2400 4800 **9600**

54 Parity Selection
0 = Space Parity
1 = Odd Parity
2 = Even Parity
3 = Mark Parity
4 = None

55 Number of data bits
0 = 7 or 1 = 8

56 Checksum
0 = Disabled 1 = Enabled

57 Net Sign Correction
0 = Disabled
1 = Printed
2 = Printed and Displayed

58 Enable STX Character
0 = Disabled **1 = Enabled**

59 Demand Mode Line Format
0 = Single Line Output
1 = Multiple Line Output

61 Print Fields **523400**
0 = Field turned off
1 = Displayed weight
2 = Gross weight
3 = Tare weight
4 = Net weight
5 = Scale ID Number
6 = Blank Field
7 = Date/Time
8 = Keyboard ID

62 Print Weight Expanded
0 = Disabled 1 = Enabled

63 Printed Weight Unit Legend(*)
0 = Disabled **1 = Enabled**

64 Printed Time Format
0 = 24:MM
1 = HH:MM PM

70 INTERNATIONAL GROUP
71 Unit Switching
0 = Disabled
1 = Lb/Kg
2 = Lb/Alt or Kg/Alt

72 Power-up Units
0 = Power up same as power down
1 = kg/Alt
2 = lb/Alt

73 Bracketed Printing
0 = Disabled 1 = Enabled

74 Print "PT" or "T"
0 = Tare Legend "T"
1 = Tare Legend "PT"

75 Comma or Decimal Point
0 = Decimal Point
1 = Comma

76 Center of Zero Legend
0 = None
1 = Gross Zero
2 = Gross or Net

77 Auto Clear Tare after Print
0 = Disabled 1 = Enabled

78 Auto Print and Print Interlock
0 = Normal Operation
1 = Print Interlock
2 = Auto Print

79 Minimum Print Requirement
0 = 0 Increments
1 = 10 Increments
2 = 100 Increments
3 = 500 Increments

80 SETPOINT GROUP
81 Setpoint Mode
0 = Disabled
1 = 4 Single Speed Setpoint Mode
2 = 2 Dual Speed Setpoint Mode

82 Tolerance #1 Mode
0 = Zero Tolerance
1 = Setpoint #1 Tolerance

83 Tolerance #2 Mode
0 = Zero Tolerance
1 = Setpoint #2 Tolerance

84 Positive or Absolute Setpoint
0 = Positive Weight
1 = Absolute Value

MISCELLANEOUS GROUP
91 Expanded Weight Display
0 = Disabled 1 = Enabled

92 Alt. Units Decimal Location
(Press *0* to Toggle, *Enter* to accept.)

93 Alt. Units Divisor Value (Enter value.)

94 Alt. Units Results Decimal Location
(Press *0* to Toggle, *Enter* to accept.)

95 COM 2"Tilt" Input

0=Disabled
1 =Enabled
96 COM 2 Discrete Input

0 = Disabled
1 = Tare
2 = Zero
3 = Print
99 Reset Default Parameters
0 = Skip Reset
1 = Reset to U.S. Defaults
2 = Reset to Export Defaults

Factory Default Values.
USA defaults are **bold**.
European defaults are underlined.
(*)Used in legal-for-trade applications. For more detailed information see Chapter 3.

Appendix 2: Serial Output Formats

Demand Output

A selectable STX (start of text) character and/or a checksum character can be included in the output data string. The net weight can be printed double width if the printer used accepts ASCII shift out <SO> and shift in <SI> characters to select expanded print. The scale ID number can also be included in the output string.

Demand output is disabled when the scale is "in motion," under gross zero, or in expanded weight display mode. Output requests are buffered when the weight on the scale is unstable then acted upon once it becomes stable. If the terminal receives multiple requests while the scale is in motion, only the last will be executed.

Data fields are transmitted right-justified (padded with leading spaces) to maintain a constant length for each field. Non-significant leading zeroes are transmitted as spaces. If the terminal is programmed to display a comma in place of a decimal point, the leading zeros are not replaced. If the tare and net fields have been selected to print, the tare and net lines are not transmitted when the *PUMA* terminal is in gross mode.

Print Interlock

When print interlock is enabled, only one print of a weight is permitted. The weight on the scale must return to a net weight less than the value selected as the minimum print to reset the interlock. After the interlock is reset, a single print of another weight greater than the minimum print value is permitted.

Autoprint

Autoprint enables the terminal to automatically print when the weight on the scale settles to no-motion. The weight must be greater than the value selected as the minimum print. After an autoprint, the net weight must return to less than the minimum print selection to reset the autoprint feature. The PRINT key remains inactive when autoprint is selected. SSW 16 must be set to a non-zero selection enabling Motion Detection.

Net Sign Correction

Selecting this feature enables the *PUMA* terminal to use a tare value greater than the gross weight on the scale and still print a positive net weight. This is done by switching the positions of the gross and tare values and printing the absolute value of net weight. Net Sign correction allows keyboard entry of a gross weight into the tare register while the actual tare weight is on the scale and then printing gross, tare and net weight.

Example:

Weight entered into tare register:	12000 lb
Actual weight on the scale:	3000 lb
Displayed Weight :	9000 lb
The data printed would be:	12000 lb
	3000 lb TR
	9000 lb NET

Data Format

The *PUMA* terminal can transmit demand mode data in either single or multiple line format. The data fields transmitted are selected in Group 30 and 50 (Print Fields sub-block). From one to six fields of data is output in the order selected in setup. Data fields can be repeated as desired. Refer to the following tables for single line and multiple line demand data formats.

Single Line Demand Format																
Data	STX	DF_1	UF_1	DF_2	UF_2	DF_3	UF_3	DF_4	UF_4	DF_5	UF_5	DF_6	UF_6	CR	CHK	LF
Note	A	B	C	B	C	B	C	B	C	B	C	B	C	D	E	F

DFx and UFx are the first through sixth data fields and unit fields in the total string.

Multiple Line Demand Format						
	Data					
1	STX	DF_1	UF_1	CR	CHK	LF
2		DF_2	UF_2	CR	CHK	LF
3		DF_3	UF_3	CR	CHK	LF
4		DF_4	UF_4	CR	CHK	LF
5		DF_5	UF_5	CR	CHK	LF
6		DF_6	UF_6	CR	CHK	LF
Note	A	B	C	D	E	F

Demand Format Table Notes

A <STX> ASCII start of text character, hex value 02. <STX> is required by the Model 307, 8806 and 8860 printers. The <STX> character can be disabled in setup.

B <DFX> Numeric component of data field. Refer to weight field format notes.

C <UDF> Weight units for data field. May be any of the units selectable in setup.

D <CR> ASCII carriage return, hex value 0D.

E <CHK> Optional Checksum character, 2's complement of the 7 low order bits of the binary sum of all characters on a line, preceding the checksum. Checksum is used by METTLER TOLEDO products to detect transmission errors and can be disabled in setup.

F <LF> ASCII line feed character, hex value 0A.

Field Format Notes

Weight (8 Characters)

The weight field is an eight character field consisting of a sign character (space for positive weights or a minus for negative weights), followed by a seven character weight field. The seven character weight field consists of six digits of weight plus a decimal point. If no decimal point is used then a leading space is inserted.

If Print weight expanded is enabled, an ASCII SO character, hex 0E, will precede the net weight data field, or gross weight. An ASCII SI character, hex value 0F, will follow the corresponding units field.

If bracketed printing is enabled, then any measured weight (opposed to a hand entered value) is preceded by a < character and followed by a > character.

Weight data fields are followed by a units legend (such as "lb" indicating pounds) and also a description (such as "TARE" or "NET"). See the table below. The weight units legend can be disabled in setup, the "TARE" and "NET" descriptions after the tare and net weight fields cannot.

Hand entered tare in metric mode only is indicated by "T."

Demand Mode Weight Units	
Data Field	**Weight Units**
Gross Weight	lb, kg, g, t
Net Weight	lbN, kgN, gN, tN
Tare Weight	lbT, kgT, kgPT, gT, gPT, tT, tPT

Scale ID: 8 characters long. 5 bytes Scale Descriptor, 1 byte space, 2 bytes for ID value. Example: SCALE_01

Date/Time: 17 characters long. 8 bytes in selected format, 1 byte space, 2 bytes hour value, 1 byte colon, 2 bytes minute value, 1 byte space, 2 bytes AM/PM indication.

Keyboard ID: 14 bytes long. 6 bytes spaces, 1 byte #, 1 byte space, 6 bytes keyboard ID value.

Blank Field: 7 characters long. 7 characters of space.

Continuous Output

Continuous output provides compatibility with METTLER TOLEDO products that require real time weight data such as the 3015 Setpoint Controller, 8623/8624 remote display, 8617 Scoreboard, 9323 BCD Output, or the 9325 Analog Output.

Continuous output is transmitted as a fixed format, fixed character length data string, but is selectable in setup for baud rate, parity, and checksum. This message is sent after each display update for 4800 and 9600 baud selections, but may be less than 1 message/update for slower update rates and baud rate selections. (If the time required to send a single message exceeds the time needed for an update, the terminal will produce less than 1 message/update.)

The following table shows the continuous and short continuous format output. Refer to the table on the next page for details.

Continuous and Short Continuous Format																		
Character	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Data	STX	SWA	SWB	SWC	MSD	Indicated Weight				LSD	MSD	Tare Weight				LSD	CR	CHK

This Data Omitted In Short Continuous Mode.

Continuous and Short Continuous Data Output Format Details

High Speed ASCII Data Output Format Decoding Tables

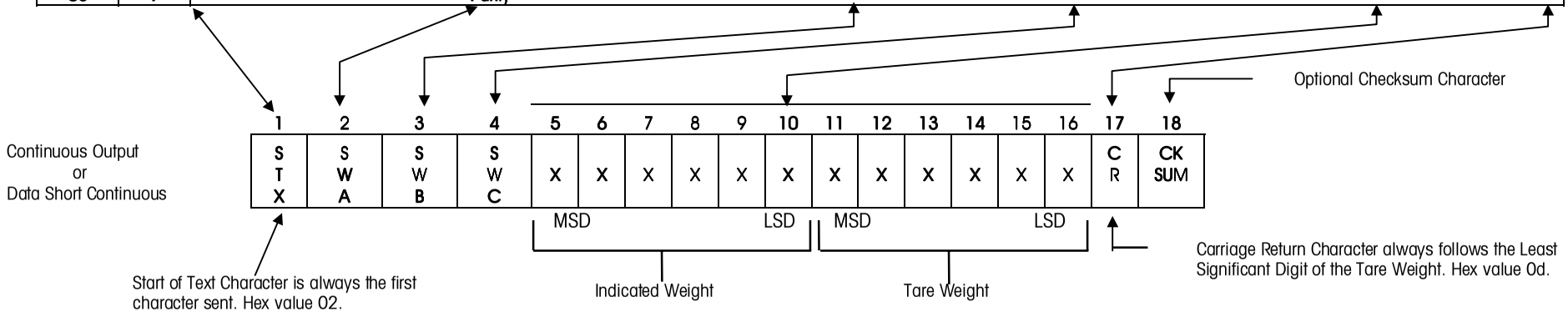
Setpoints Disabled

Hex Value	Bit No.	STX	Status Word A: X 100	X 10	1	.X	.XX	.XXX	.XXXX	.XXXXX	Status Word B	Status Word C: lb or kg	g	t	Alt Units
1	0	0	0	1	0	1	0	1	0	1	Net Mode = 1	0	1	0	1
2	1	1	0	0	1	1	0	0	1	1	Negative Data = 1	0	0	1	1
4	2	0	0	0	0	0	1	1	1	1	Over Cap=1,Normal=0	0	0	1	1
8	3	0	X1 = 1 X2 = 0 X5 = 1								Motion=1,NoMotion=0	Print = 1			
10	4	0	X1 = 0 X2 = 1 X5 = 1								lb=0, kg=1	Expanded Data = 1			
20	5	0	Always 1								Always 1	Always 1			
40	6	0	Always 0								Power Up = 1	See Note 1			
80	7	Parity													

Note 1: If the unit is configured to power up in Kg and units switching is disabled, this bit is set when a keyboard entered tare is in effect.

Setpoints Enabled

Hex Value	Bit No.	STX	Status Word A: X 100	X 10	1	.X	.XX	.XXX	.XXXX	.XXXXX	Status Word B	Status Word C: lb or kg	g	t	Alt Units	Numeric Data 0-9 and Space: SP	0	1	2	3	4	5	6	7	8	9	CR
1	0	0	0	1	0	1	0	1	0	1	Net Mode = 1	0	1	0	1	0	1	1	0	1	0	1	0	1	0	1	1
2	1	1	0	0	1	1	0	0	1	1	Negative Data = 1	0	0	1	1	0	0	0	1	1	0	0	1	1	0	0	0
4	2	0	0	0	0	0	1	1	1	1	Over Cap=1,Normal=0	0	0	1	1	0	0	0	0	0	1	1	1	1	0	0	1
8	3	0	SP1 Feeding = 0								Motion=1,No Motion=0	Print = 1				0	0	0	0	0	0	0	0	0	1	1	1
10	4	0	SP2 Feeding = 0								lb = 0, kg = 1	SP4 Feed/FF2 = 0				0	Always 1										0
20	5	0	Always 1								Always 1	Always 1				1											0
40	6	0	SP3 Feeding or Fast Feed 1 = 0								SP1 in Tolerance=0	SP2 in Tolerance=0				0	Always 0										0
80	7	Parity																									



Short Continuous Output Mode

Same as Continuous Output Mode except the 6 bytes of tare weight data are not sent. See previous tables for details.

Remote ASCII Character Input

The *PUMA* terminal s capable of receiving clear tare, print, auto tare and zero functions equivalent to pressing the Clear, Print, Tare and Zero keys, when specific ASCII uppercase characters are transmitted to it at COM1 or COM2 ports. These functions are subject to the same restrictions as their keyboard equivalents. The parity and baud rate of the data input must be the same as those selected for data output.

Example: COM1 is used to send data to a printer @ 4800 baud. The input of COM1 may be used to accept C,P,T,Z messages as long as they are also 4800 baud.

Note: The ***ENQ*** command does not support the Short Continuous Format.

The *PUMA* terminal also supports the *ENQ* Continuous Output mode. If *ENQ* Continuous and ASCII input modes are selected the *PUMA* will output one continuous format message every time an ASCII *ENQ* character, hex 05, is received. The *ENQ* continuous message format is identical to the standard continuous format.

Note: The ENQ command will not function while PUMA displays ±EEE. A power up zero capture operation must occur to enable data communications.

The external commands that are recognized by the *PUMA* terminal are listed in the table below. All commands sent to the *PUMA* terminal must be upper case. A Carriage Return CR, Line Feed LF may be used to terminate a command but is not required.

Remote ASCII Control Characters	
ASCII Command Character	**Keyboard Equivalent**
C	CLEAR Key
P	PRINT Key
T	TARE Key
Z	ZERO Key
ENQ	None

When a command is received by the *PUMA* terminal, it takes approximately two update intervals to process it. Any command received while the *PUMA* terminal is processing a command is ignored. Command strings should be spaced no closer than two update intervals apart. Any character received that is not listed in the Remote ASCII Control Character table is ignored.

Appendix 3: SICS Level 0 Serial Interface

The *PUMA* terminal supports the METTLER TOLEDO Standard Interface Command Set (SICS) level 0 on COMM 1 only. The SICS lets you expand your system with additional METTLER TOLEDO terminals without changing application programs.

Introduction

What Do the Commands of MT-SICS Level 0 Offer?
You can use the commands of SICS level 0 to perform the following operations:

- Request weighing results
- Tare the terminal and preset the tare weight
- Zero the terminal
- Identify MT-SICS implementation
- Identify the terminal
- Reset the terminal

Additional Documentation on Data Interface
Refer to the documentation and operating instructions for peripheral equipment for information on settings such as baud rate, number of data bits, parity, handshake protocols, and connector pin assignments.

Command Formats

Each command received by the terminal via the data interface is acknowledged by a response of the terminal to the transmitter. Commands and responses are data strings with a fixed format.,

Commands sent to the terminal comprise one or more characters of the ASCII character set. Here, the following must be noted:

- Enter commands only in uppercase.
- The possible parameters of the command must be separated from one another and from the command name by a space (ASCII 32 dec., in this description represented as _).
- Each command must be closed by CR LF (ASCII 13 dec., 10 dec.)

The characters CR and LF, which can be inputted using **ENTER** or **RETURN** of most entry keypads, are not listed in this description, but it is essential they be included for communication with the terminal.

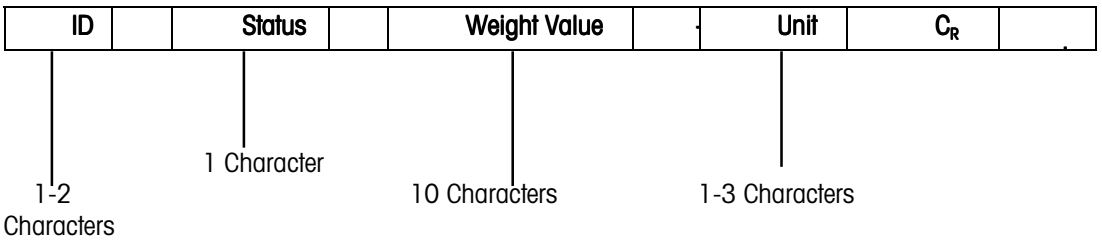
Response Formats

All responses sent by the terminal to the transmitter to acknowledge the received command have one of the following formats:

- Response with weight value
- Response without weight value
- Error message

Format of the Response with Weight Value

A general description of the response with weight value is the following:



- ID—Response identification.
- _— Space (ASCII 32 dec.)
- Status—Status of the terminal, see description of the commands and responses
- Weight Value—Weighing result: shown as number with 10 digits, including sign directly in front of the first digit. The weight value appears right-aligned. Preceding zeroes are not shown with the exception of the zero to the left of the decimal point. With METTLER TOLEDO DeltaRange terminals, outside the fine range the last decimal place is shown as a space.
- Unit—Weight unit displayed after the terminal has been switched on.
- CR—Carriage Return (ASCII 13 dec.)
- LF—Line Feed (ASCII 10 dec.)

Comment—CR LF will not be shown in this description.

Examples

Response with stable weight value of 0.256 g:

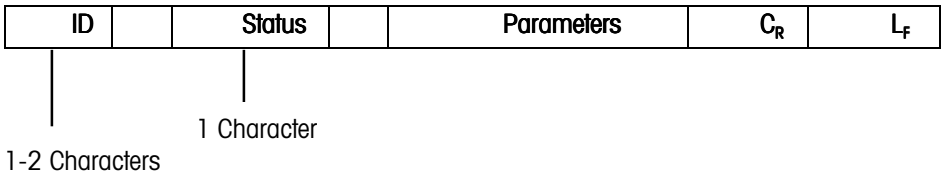
S _ S_ _ _ _ _ _ 0.256 _ g

Response with stable weight value outside the fine range:

S _ S _ _ _ _ 4875.2 _ _ g

Format of the Response Without Weight Value

A general description of the response without weight value is the following:



- ID—Response identification.
- _—Space (ASCII 32 dec.)
- Status—Status of the terminal, see description of the commands and responses
- Parameters—Command-dependent response code.
- Unit—Weight unit displayed after the terminal has been switched on.
- CR—Carriage Return (ASCII 13 dec.)
- LF—Line Feed (ASCII 10 dec.)

Comment—CR LF will not be shown in this description

Error messages

ID	C_R	L_F

ID—Error Identification

There are three different error messages. The identification always comprises two characters.

- ES—Error Syntax
  The terminal has not recognized the received command.
- ET—Error Transmission

The terminal received a "faulty" command, e.g., due to a parity error or interface break.

- EL—Error Logical

The terminal can not execute the received command.

CR—Carriage return (ASCII 13 dec.)

LF—Line Feed (ASCII 10 dec.)

Comment—CR LF will not be shown in this description.

Tips for the Programmer
Command and Response—You can improve the dependability of application software by having the program evaluate the response of the terminal to a command. The response is the acknowledgment that the terminal has received the command.

Reset
To start from a determined stat, when establishing the communication between terminal and system, send a reset command to the terminal. When the terminal or system is switched on or off, faulty characters can be received or sent.

Quotation Marks (" ")
Quotation marks included in the command must always be entered.

Commands and Responses MT-SICS Level 0

The terminal receives commands from the system computer and acknowledges the command with an appropriate response. The following sections contain a detailed description of all commands of the command set in alphabetical order with the associated responses. Commands and responses are terminated with a CR and LF. These termination characters are not shown in the following description, but they must always be entered with commands or sent with responses.

The commands of MT-SICS level 0 are available with even the simplest terminals which support the METTLER TOLEDO Standard Interface Command Set. These include:

- I1 Inquiry of MT-SICS level and MT-SICS versions
- I2 Inquiry of terminal data
- S Send stable weight value
- SI Send weight value immediately
- SIR Send weight value immediately and repeat
- T Tare
- Z Zero
- @ Rest

I1—INQUIRY OF MT-SICS LEVEL AND MT-SICS VERSIONS

Command: I1—Inquiry of MT-SICS level and MT-SICS versions

Response: I1 _ A _ "x1" _ "x2" _ "x3" _ "x4" _ "x5"

- x1 = 0—terminal with MT-SICS level 0 (simplest terminal)
- x1 = 01—terminal with MT-SICS level 0 and 1 (standard terminal)
- x1 = 012—terminal with MT-SICS level 0, 1 and 2 (standard terminal with extensions)
- x1 = 03—terminal with MT-SICS level 0 and 3 (simplest terminal with a special application)
- x1 = 013—terminal with MT-SICS level 0, 1 and 3 (standard terminal with a special application)
- x1 = 0123—terminal with MT-SICS level 0, 1, 2 and 3 (standard terminal with extensions and a special application)
- x1 = 3—Application device with MT-SICS level 3 (not necessarily a terminal)
- X2—Version of the implemented MT-SICS0 commands
- X3—Version of the implemented MT-SICS1 commands
- X4—Version of the implemented MT-SICS2 commands
- X5—Version of the implemented MT-SICS3 commands
- I1 _ I—Command understood, not executable at present.

Example

Command I1—Inquiry of MT-SICS level and versions.

- Response—I1 _ A _ "01" _ "2.00" _ "2.00" _ " " _ " "
- 01 Level 0/1 implemented
- 2.00 Level 0, version V2.00
- 2.00 Level 1, version V2.00

Comments

- In the case of the MT-SICS level, only fully implemented levels are listed. In other words, if it is not possible to implement all commands from a certain level, the level is not specified.
- In the case of the MT-SICS version, all levels are specified even those only partially implemented.

2. I2—INQUIRY OF TERMINAL DATA

Command: I2—Inquiry of terminal type.

Response: I 2 : _ A _ "text"

- terminal data as "text".
- I2 _ I—Command understood, not executable at present.

Example

Command I2—Inquiry of terminal type.

Possible responses—I 2 _ A _ "PR5002DR _ R-Standard _ 5100.90 _ g"

- I 2 _ A _ "AG204 _ G - Standard _ 210.0090 _ g"
- I 2 _ A _ "PB303 _ B - Standard _310.090 _ g"
- I 2 _ A _ "PB3001 _ College _3109.0 _ g"
- I 2 _ A _ "GL8 _ Gastroline _8190 _ g"
- I 2 _ A _ "PZ7001 _ Farbwaage _7109.0 _ g"

Comments

- With DeltaRange balances, the last decimal place is available only in fine range.
- The number of characters of "text" depends on the terminal type.

3. S—SEND STABLE WEIGHT VALUE

Command: S—Send the current stable net weight.

Response:

- S _ S _ WeightValue _ Unit—Current stable weight value in the 1st unit.
- S _ I—Command not executable (terminal is currently executing another command, e.g. taring, or time-out as stability was not reached.)
- S _ + —terminal in overload range.
- S _ - —terminal in underload range.

Example

Command S—Send a stable weight value.

Response: S _ S _ _ _ _ _ 100.00 _ g.—The current, stable weight value is 100.00 g.

Comments

- The duration of the time-out depends on the terminal type.
- First unit is the weight unit displayed after the terminal is switched on.

4. SI—SEND WEIGHT VALUE IMMEDIATELY

Command: SI—Send the current net weight value regardless of scale stability.

Response:

- S _ S _ WeightValue _ Unit—Stable weight value in the first unit.
- S _ D _ WeightValue _ Unit—Non-stable (dynamic) weight value in the first unit.
- S _ I—Command not executable (terminal is currently executing another command, e.g. taring).
- S _ + —terminal in overload range.
- S _ - —terminal in underload range.

Example

Command: SI—Send current weight value.

Response: S _ D _ _ _ _ _ 129.07 _ g—The current weight value is unstable (dynamic) and is 129.07g.

Comments

- The response to the command SI is the last internal weight value (stable or dynamic) before receipt of the command SI.
- First unit is the weight unit displayed after the terminal has been switched on.

5. SIR—SEND WEIGHT VALUE IMMEDIATELY AND REPEAT

Command: SIR—Send the net weight values repeatedly, regardless of terminal stability.

Response:

- S _ S _ WeightValue _ Unit—Stable weight value in the first unit.
- S _ D _ WeightValue _ Unit—Non-stable (dynamic) weight value in the first unit.
- S _ I —Command not executable (terminal is currently executing another command, e.g., taring).
- S _ + —terminal in overload range.
- S _ – —terminal in underload range.

Example

Command: SIR—Send current weight values at intervals.

Response:

- S _ D _ _ _ _ _ 129.07 _ g
- S _ D _ _ _ _ _ 129.08 _ g
- S _ D _ _ _ _ _ 129.09 _ g
- S _ D _ _ _ _ _ 129.09 _ g
- S _ D _ _ _ _ _ 114.87 _ g
- . . .—The terminal sends stable or non-stable weight values at intervals.

Comments

- SIR is overwritten by the commands S, SI, SIR, @ and hardware break and hence canceled.
- The number of weight values per second depends on the terminal type.
- First unit is the weight unit displayed after the terminal has been switched on.

6. T—TARE

Command: T—Tare, i.e. store the next stable weight value as a new tare weight value.

Response:

- T _ S _ WeightValue _ Unit—Taring performed, i.e. stability criterion and taring range complied with. The tare weight value returned corresponds to the weight change in the first unit on the terminal since the last zero setting.
- T _ I—Taring not performed (terminal is currently executing another command, e.g. zero setting, or time-out as stability was not reached.)
- T _ + —Upper limit of taring range exceeded.
- T _ - —Lower limit of taring range exceeded.

Example

Command T—The terminal is tared and has a value of 100.00 g in the tare memory.

Response—T _ S _ _ _ _ _ 100.00 _ g

Comments

- The tare memory is overwritten by the new tare weight value.
- The duration of the time-out depends on the terminal type.
- The function of the combined tare and zero setting key corresponds to the zero setting (Z) command of the interface.
- First unit is the weight unit displayed after the terminal is switched on.

7. Z—ZERO

Command: Z—Zero the terminal.

Response

- Z _ A—The following then holds:
  - Gross = net + tare = 0
  - Zero setting performed, i.e. stability criterion and zero setting range complied with.
- Z _ I—Zero setting not performed (terminal is currently executing another command, e.g. taring, or timeout as stability was not reached.)
- Z _ + —Upper limit of zero setting range exceeded.
- Z _ – —Lower limit of zero setting range exceeded.

Example

Command Z—Zero.

Response—Z _ A—Zero setting performed.

Comments

- The tare memory is cleared during zero setting.
- The zero point determined during switching on is not influenced by this command, i.e. the measurement ranges remain unchanged.
- The duration of the timeout depends on the terminal type.

8. @—RESET

Command: @—Reset the terminal to the condition found after switching on, but without a zero setting being performed.

Response:

- I 4 _ A _ "text"—Serial number of the terminal, the terminal is ready for operation.

Example

Command—@

Response—I 4 _ A _ "0123456789"—terminal is reset and sends the serial number.

Comments

- All commands awaiting responses are canceled.
- Key control is set to the default setting K _ 1.
- The tare memory is reset to zero.
- The "reset" command is always executed.
- All parameters changed via the interface are reset.
- If the terminal is on standby, it is switched on.
- A reset command received by the terminal during the calibration and test procedure can not be processed until the procedure is at an end.

For PR / SR balances, the following also applies:

- The function selection of the SmartBar appears in the bottom line of the display.
- The DeltaTrac corresponds to the display of the selected weighing application (display of remaining range or +/- display).
- The modified parameters BallD, date and time are retained even following the reset command.

Response Time to SICS

Maximum Response Time

Function	Maximum Response Time
I1, I2, I3, and SI:	4 update intervals
S, T, Z and @:	3 update intervals

SSW 09	Update Rate	Interval Length
0	16	59.2 msec.
1	14	71.1 msec.
2	12	82.9 msec.
3	10	94.7 msec.
4	9	106.6 msec.
5	8	118.4 msec.
6	7	130.3 msec.

Total Communication Time

The Total Communication Time can be computed as follows:

Total Time = Command Duration + Response Time + Response Duration

Command Duration The time it takes to transmit the command.

Response Time The maximum time between when the last byte of the command was received and the first byte of the response is sent.

Response Duration The time it takes to transmit the response.

Example

SSW 33 = 9600 SSW 45 = 1

SSW 34 = 2 SSW 09 = 0.

SSW 35 = 1

One transmitted byte consists of:

1 start bit + 8 data bits + 1 parity bit + 1 stop bit = 11 bits.

Time per byte = bits/baud rate = 11/9600 = 1.146 msec.

Inquiry of MT-SICS Level and Version is: I1<LRC><CR> for a total of 4 bytes.

Command duration for read date = 4 x 1.146 msec. = 4.584 msec.

Response Time = 4 x 59.2 msec. = 236.8 msec.

Inquiry response is I1< >A< >"0"< >"2.10"< >""< >""< >""<CR><LF> for total of 26 bytes.

Response Duration = 26 x 1.146 msec. = 29.796 msec.

Total Time = 4.584 msec. + 236.8 msec. + 29.796 msec. = 271.18 msec.

Once this command is issued, the host should wait for 272 msec. before issuing another command.

NOTES

Appendix 4: Host Mode Serial Interface

Note: The host mode is not operational when PUMA is in the "Power up" mode.

The *PUMA* terminal Host Mode is patterned after the METTLER TOLEDO 8141 terminal. The differences between the 8141 and the *PUMA* terminal are: the STATUS command response is changed, the SETUP STATUS command is read only, and no command is available for gross and net mode. **The *PUMA* terminal Host Mode is available on COMM 1 only**. The host interface is a bi-directional serial port intended to be connected to an intelligent device. The host can then perform most of the keyboard functions as well request weight and status information from the unit.

The <LRC> character is defined as the exclusive OR of all previous bytes sent including the <STX>. The <LRC> character is optional received, but always transmitted.

The <ID> is defined as a single ASCII character with an equivalent decimal integer value from 0 to 99 (0 to 63 hex).

Example: ASCII character

NUL = 00 (00 hex)

SOH = 01 (01 hex)

LF = 10 (0A hex)

b = 98 (62 hex)

c = 99 (63 hex)

This is used to determine which of the multiple *PUMA* terminals act upon the command. When <ID> matches the *PUMA* Scale ID, it will respond. When the *PUMA* terminals are set for Star Configuration in Softswitch 45, an <ID> of 0 is a global command and all *PUMA* terminals will respond. When the *PUMA* Terminals are set in Loop Through Mode in Softswitch 45, then a <ID> of 0 is illegal, and will receive no response.

Star Configuration.

The maximum distance of the fiber optic cable between a unit and a fiber optic converter is 1000 feet (300 meters).

The Star Configuration is the standard point to point serial connection. There must be a dedicated serial port and fiber optic converter channel for each *PUMA* terminal. The Star Configuration is setup in SSW 45. When the *PUMA* terminals are set for Star Configuration in Softswitch 45, an <ID> of 0 is a global command and all *PUMA* terminals will respond.

Loop Through Mode

The maximum distance of the fiber optic cable in the Loop Through Mode between any two units is 1000 feet (300 meters).

The Loop Through Mode is available on COMM 1 only. The Loop Through Mode uses fiber optics to implement a low cost solution for accessing multiple units. The HOST transmit is connected to the first *PUMA* receive, first *PUMA* transmit to the second *PUMA* receive, etc. until the last *PUMA* transmit is connected to the HOST receive. The HOST sends a command to the first *PUMA*. As each byte is received it is buffered and sent to the second *PUMA* . When the first *PUMA* has the entire command, it checks the ID to determine if it is to respond. Meanwhile, the command is being passed through the entire loop and "echoes" back to the HOST. If the first *PUMA* is to respond, it passes its response to the second *PUMA*, which passes to the third and eventually gets back to the host. Because of this "baton passing" routine, when the host sent data is received back to the host, it is known that all in the loop received the data. At 9600 baud the delay

Note: Because the PUMA retransmits each character as it is received, any given PUMA will be sending data on to the next PUMA (or back to the host) at the same time the host is sending data to the first PUMA. Therefore any form of half duplex operation is not

introduced into the system by any *PUMA* is ~1 msec. If there are 40 *PUMA* terminals, the command is "echoed" back to the HOST in ~40 msec. The response of any *PUMA* terminal is received at whatever the command processing delay is after that. The maximum distance between any two *PUMA* terminals is 1000 feet (300 meters). Because there are two serial ports, the second can be used to continuously output to the printer or setpoint controller, while allowing a single HOST to send command to all the units.

PUMA Response Time to Host Mode Commands

There is a slight additional delay as each command is echoed through the Fiber Optic Network to each *PUMA* terminal illustrated in the following table.

Maximum Response Time

Command	Maximum Response Time for Acknowledgment
Setpoint command to write data:	~500 msec.
Store data command:	~2800 msec.
Remaining commands:	2 update intervals. (2 x 59.2 @ 16 Updates/Sec)

SSW 09	Update Rate	Interval Length
0	16	59.2 msec.
1	14	71.1 msec.
2	12	82.9 msec.
3	10	94.7 msec.
4	9	106.6 msec.
5	8	118.4 msec.
6	7	130.3 msec.

Total Communication Time

The Total Communication Time can be computed as follows:

Total Time = Command Duration + Loopthru Delay + Response Time + Response Duration

Command Duration The time it takes to transmit the command.

Loopthru Delay The time it takes each terminal to pass a byte to the next times the number of Terminals in the loop.

Response Time The maximum time between when the last byte of the command was received and the first byte of the response is sent.

Response Duration The time it takes to transmit the response.

Example

SSW 33 = 9600 SSW 45 = 1.

SSW 34 = 2 SSW 09 = 0.

SSW 35 = 1 10 *PUMA* Terminals in the loop.

One transmitted byte consists of :

1 start bit + 8 data bits + 1 parity bit + 1 stop bit = 11 bits.

- Time per byte = bits/baud rate = 11/9600 = 1.146 msec.
- Read date command is <STX><ID><D><ETB><LRC><CR> for a total of 6 bytes.
- Command duration for read date = 6 x 1.146 msec. = 6.876 msec.
- Loopthru Delay = 1.146 msec. x 10 = 11.46 msec.
- Response Time = 2 x 59.2 msec. = 118.4 msec.
- Read date response is <STX><ID><D><6 BYTES><ETB><LRC><CR> for total of 12 bytes.
- Response Duration = 12 x 1.146 msec. = 13.752 msec.
- Total Time = 6.876 msec. + 11.46 msec. + 118.4 msec. + 13.752 msec. = 150.488 msec.
- Once this command is issued, the host should wait for 151 msec. before issuing another command.

Date Command

Read Date Command

<STX><ID><D><ETB><LRC><CR>

Response.

<STX><ID><ACK><Date Value><ETB><LRC><CR>

Write Date Command

<STX><ID><D><Date Value><1><ETB><LRC><CR>

Response.

<STX><ID><ACK><ETB><LRC><CR> If valid date received.

<STX><ID><NAK><ETB><LRC><CR> If invalid date received.

<Date Value> is ASCII digits for date format setup in SSW 26. Valid dates are true calendar days, including leap year for 2000.

Time Command

Read Time Command

<STX><ID><F><ETB><LRC><CR>

Response.

<STX><ID><ACK><Time Value><ETB><LRC><CR>

Write Time Command

<STX><ID><F><Time Value><1><ETB><LRC><CR>

Response.

<STX><ID><ACK><ETB><LRC><CR> If valid time received.

<STX><ID><NAK><ETB><LRC><CR> If invalid time received.

<Time Value> - ASCII digits for time in the form of HHMMX.

HH - hours, valid values "01" to "12".

MM - minutes, valid values "00" to "59".

X - "1" = PM, "2" = AM.

Auto Tare Command

Note: SSW21 must be 1 or 2 for this command to be functional.

<STX><ID><T><ETB><LRC><CR>

Response.

<STX><ID><ACK><ETB><LRC><CR> If successful tare performed.

<STX><ID><NAK><ETB><LRC><CR> If unable to tare at this time.

Causes for being unable to tare: scale in motion, over/under capacity.

Keyboard Tare Command

Note: If alternate units are selected (SSW71 = 2) manual tare entry is disabled.

<STX><ID><K><Tare Value><ETB><LRC><CR> Response.

<STX><ID><ACK><ETB><LRC><CR> If successful tare performed.

<STX><ID><NAK><ETB><LRC><CR> If unable to tare at this time.

Causes for being unable to tare: scale in motion, over/under capacity, scale not yet zeroed, tare value not in lower range in multi-range mode, tare value not with range of scale.

<Tare Value> - 8 ASCII digits, containing one (1) decimal point if required. Value must be padded with leading zeroes to complete an 8 character field.

If keyboard lb/kg switching is enabled, it is recommended that the host interrogate the units status before downloading a new tare value.

Digital Zero Command

<STX><ID><Z><ETB><LRC><CR> Response.

<STX><ID><ACK><ETB><LRC><CR> If successful zero.

<STX><ID><NAK><ETB><LRC><CR> If unable to zero.

Causes for being unable to Zero: scale in motion, weight outside pushbutton zero tolerance, scale contains a tare weight.

Print Command

<STX><ID><P><ETB><LRC><CR> Response.

<STX><ID><ACK><ETB><LRC><CR> If print command accepted.

<STX><ID><NAK><ETB><LRC><CR> Print command not accepted
Causes for being unable to print: print interlocked out except by motion. See SSW78.

Setpoint Command

Note: Setup step 81 must be either 1 or 2 to enable a response to setpoint requests.

Note: The setpoint value must always be entered in calibrated units. It is independent of lb/kg switching.

Note: Setpoint operation is inhibited if alternate units selection is enabled (SSW71 = 2).

Read Setpoint Command

<STX><ID><S><#><,><ETB><LRC><CR> Response.

<STX><ID><ACK><Setpoint Value><ETB><LRC><CR>

Write Setpoint Command

<STX><ID><S><#><,><Setpoint Value><ETB><LRC><CR> Response.

<STX><ID><ACK><ETB><LRC><CR> If valid setpoint received.

<STX><ID><NAK><ETB><LRC><CR> If invalid setpoint received.

<#> - ASCII value "0" to "9".

"0" - Setpoint 1.

"1" - Setpoint 2.

"2" - Setpoint 3.

"3" - Setpoint 4.

"4" - Setpoint 1 Preact / Setpoint 1 Dribble.

"5" - Setpoint 2 Preact / Setpoint 2 Dribble.

"6" - Setpoint 3 Preact / Setpoint 1 Preact.

"7" - Setpoint 4 Preact / Setpoint 2 Preact.

"8" - Tolerance 1 Zero/Setpoint 1

"9" - Tolerance 2 Zero/Setpoint 2

<Setpoint Value> - 8 ASCII digits, containing one (1) decimal point if required. Value must be padded with leading zeroes to complete an 8 character field. Setpoints must be entered with proper increment to match scale build. If the scale increment is 2 pounds, a setpoint value with a 1 pound resolution is not allowed.

Mode Command

Note: SSW71 must be set to 1 or 2 for this command to be functional.

<STX><ID><M><#><ETB><LRC><CR> Response.

<STX><ID><ACK><ETB><LRC><CR> If mode accepted.

<STX><ID><NAK><ETB><LRC><CR> If mode not accepted.

<#> - ASCII value "0" to "3"

"0" - Switch to lb.

"1" - Switch to kg/Alt.

"2" - Switch to net. (Not available, always responds with NAK.)

"3" - Switch to gross. (Not available, always responds with NAK.)

Weight Command

Note: If PUMA is either under or over capacity, the weight value will be sent as spaces.

<STX><ID><W><#><ETB><LRC><CR> Response.

<STX><ID><ACK><Type><Units><Weight Value><ETB><LRC><CR>

<#> - ASCII value "0" to "3".

"0" - Net Weight

"1" - Gross Weight

"2" - Tare Weight

"3" - Display Weight

<Type> - ASCII characters identifying the weight.

"G" - Gross.

"T" - Tare.

"N" - Net.

"O" - Over Capacity.

"H" - Hand Tare.

"U" - Under Capacity.

<Units> - ASCII character identifying units.

"L" - Pounds.

"K" - Kilograms.

"A" - Alternate Units.

"G" - Grams

"T" - Tons

<Weight Value> 8 ASCII digits, containing one (1) decimal point if required. Non significant leading zeros will be spaces.

Status Command

<STX><ID><Q><ETB><LRC><CR> Response.

<STX><ID><ACK><S1><S2><S3><S4><S5><S6>><ETB><LRC><CR>

<S1> - Status Byte 1

Bits 2, 1, 0 - Decimal Point/Dummy Zero Location

0 0 0 - xxxx00

0 0 1 - xxxxx0

0 1 0 - xxxxxx

0 1 1 - xxxxx.x

1 0 0 - xxxx.xx

1 0 1 - xxx.xxx

1 1 0 - xx.xxxx

Bit 4, 3 - Increment Size

0 1 - Count by 1

1 0 - Count by 2

1 1 - Count by 5

Bit 5 - Always 0

Bit 6 - 1 = Print Requested

Bit 7 - Parity Bit (When 7 bit data, else 0 when 8 bit data.)

<S2> - Status Byte 2

Bit 0 - 1 = Net, 0 = Gross

Bit 1 - 1 = Lb, 0 = Kg/Alt

Bit 2 - 1 = Alternate Units programmed for non zero value.

Bit 3 - Always 0

Bit 4 - Always 0

Bit 5 - Always 0

Bit 6 - 1 = Tare Enabled, 0 = Tare Disabled

Bit 7 - Parity Bit (When 7 bit data, else 0 when 8 bit data.)

Note: Bit 3 conditions in status byte 3 are independent of SSW76 selection.

<S3> - Status Byte 3

Bit 0 - Always 0

Bit 1 - Always 0

Bit 2 - 1 = Motion

Bit 3 - 1 = Center of Zero

Bit 4 - Always 0

Bit 5 - 1 = Overcapacity

Bit 6 - 1 = Lb/KG,ALT switching enabled

Bit 7 - Parity Bit (When 7 bit data, else 0 when 8 bit data.)

<S4> - Status Byte 4

Bit 0 - 1 = Negative Weight

Bit 1 - Always 0

Bit 2 - 1 = Keyboard Tare entered.

Bit 3 - Always 0

Bit 4 - Always 0

Bit 5 - 1 = Key Board Locked Out

Bit 6 - 1 = Expanded Mode Enabled

Bit 7 - Parity Bit (When 7 bit data, else 0 when 8 bit data.)

<S5> - Status Byte 5

Bit 0 - Always 0

Bit 1 - Always 0

Bit 2 - Always 0

Bit 3 - 1 = Power Up 0 = Zero Captured

Bit 4 - 1 = Setpoints Enabled*

Bit 5 - Always 0

Bit 6 - Always 0

Bit 7 - Parity Bit (When 7 bit data, else 0 when 8 bit data.)

*Note: If setpoints are disabled (SSW81 = 0) then bits 0 - 5 in status byte 6 is set to 1.

<S6> - Status Byte 6

Bit 0 - 0 = Setpoint 1 Feed On*

Bit 1 - 0 = Setpoint 2 Feed On*

Bit 2 - 0 = Setpoint 3/Setpoint 1 Fast Feed On*

Bit 3 - 0 = Setpoint 4/Setpoint 2 Fast Feed On*

Bit 4 - 0 = Setpoint 1/Zero Tolerance 1 Feed On*

Bit 5 - 0 = Setpoint 2/Zero Tolerance 2 Feed On*

Bit 6 - Always 0

Bit 7 - Parity Bit (When 7 bit data, else 0 when 8 bit data.)

Setup Status Command

<STX><ID><C><##><ETB><LRC><CR> Response.

<STX><ID><ACK><Value><ETB><LRC><CR>

<##> - 2 byte ASCII representation of setup parameter reference number.

<Value> - 8 byte ASCII representation of the value of a specific setup parameter. "00000000" valid setup parameter which is an action, not a programmable parameter.

Kb Lock Command

Note: When keyboard is locked, sleep mode will not occur.

<STX><ID><L><#><ETB><LRC><CR> Response.

<STX><ID><ACK><ETB><LRC><CR> If lock is accepted.

<#> - ASCII value "0" or "1"

"0" - Unlock Keyboard.

"1" - Lock Keyboard.

Keyboard Id Command

Read ID.

<STX><ID><I><ETB><LRC><CR> Response.

<STX><ID><ACK><ID Value><ETB><LRC><CR>

Write ID.

<STX><ID><I><ID Value><ETB><LRC><CR> Response.

<STX><ID><ACK><ETB><LRC><CR> If ID received.

<ID Value> - 6 bytes ASCII digits from "0" to "9" and 20h (space).

Store Data Command

<STX><ID><B><ETB><LRC><CR> Response.

<STX><ID><ACK><ETB><LRC><CR> After store complete.

This command stores the current Lb/Kg/Alt status, Tare, Zero, and keyboard ID. These values will be used when restoring the power to the PUMA.

It is useful to ensure that current parameters are saved to non volatile memory if the scale is unattended. Normally, the zero, tare, and lb/kg parameters are saved each time the operator presses the corresponding key.

Error Handling

When a *PUMA* terminal receives a non-matching <ID> it does not respond.

When a *PUMA* terminal receives a valid <ID> with a invalid <LRC> it responds with:

<STX><ID><NAK><ETB><LRC><CR>.

When a *PUMA* terminal receives a valid <ID> with a valid <LRC>, but invalid command it responds with:

<STX><ID><NAK><ETB><LRC><CR>.

When a *PUMA* terminal receives a valid <ID> with a valid <LRC> valid command, but with invalid options it responds with **<STX><ID><NAK><ETB><LRC><CR>.**

NOTES

Appendix 5: Connectors and Jumpers

Main PCB

The following illustration and table shows jumpers and connections for the Main PCB.

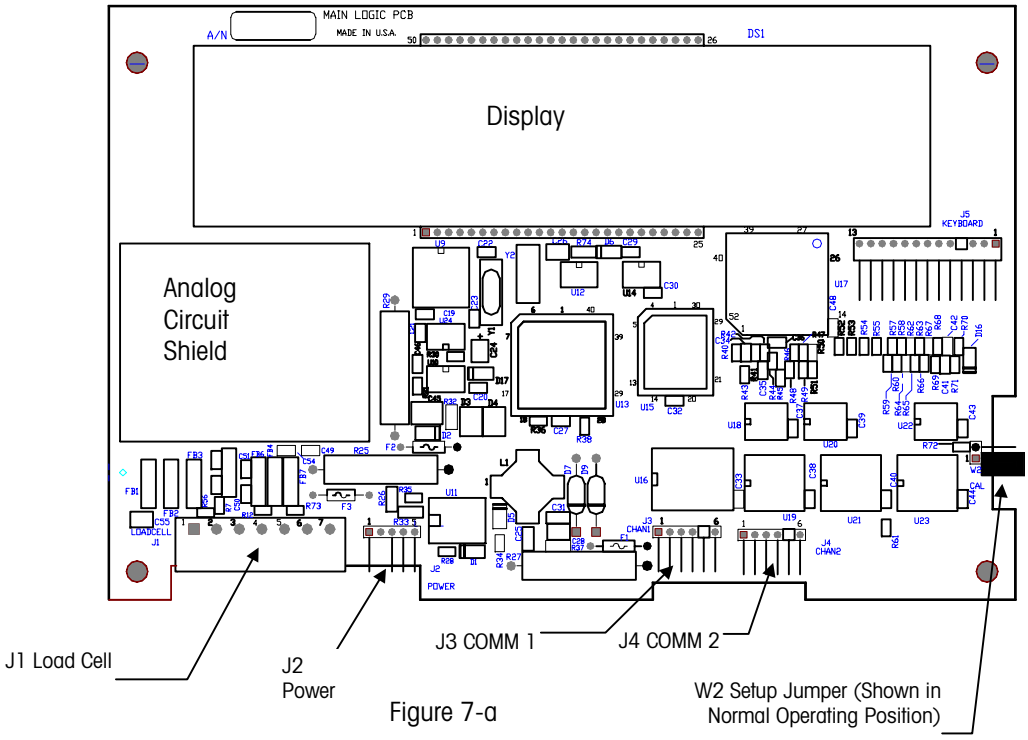
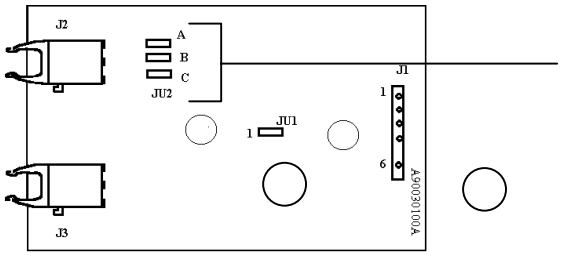


Figure 7-a

Optional Scale Fiber Optic PCB



Must not have jumper(s) installed on JU2-A, B, or C when installed in a ***PUMA*** terminal.

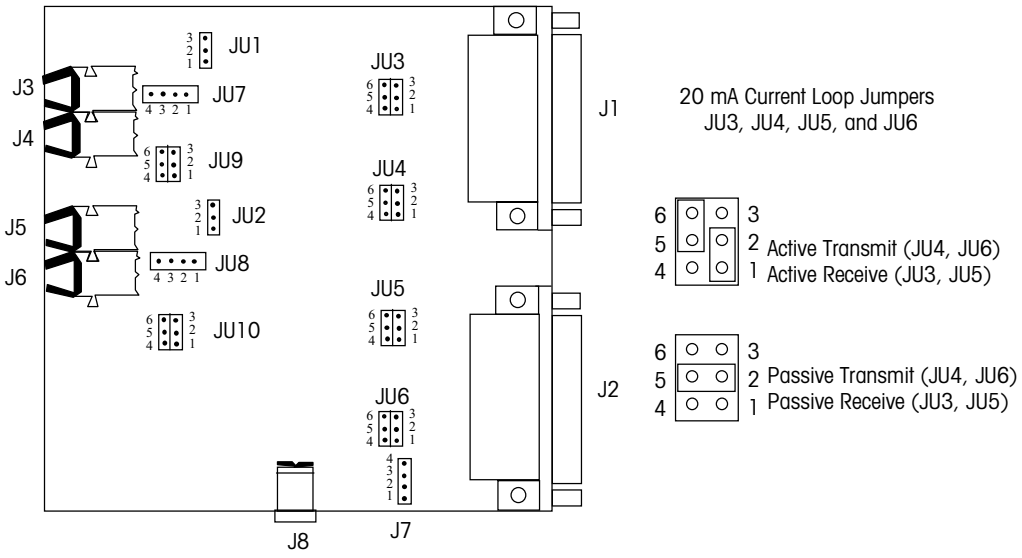
Fiber Optic PCB Connectors

J1— Data I/O

J2— Fiber Optic Transmit

J3— Fiber Optic Receive

Optional Remote Dual Channel Fiber Optic Converter



Fiber Optic Converter Connectors	Fiber Optic Converter Jumpers
J1—Channel 1: RS-232C/20 mA Data I/O	JU3—20 mA Receive Act/Pas (1-2), (5-6) Select Active Receive **(2-5) Select Passive Receive**
J2—Channel 2: RS-232C/20 mA Data I/O	JU4—Channel 1 20 mA Transmit Act/Pas **(1-2), (5-6) Select Active Transmit** (2-5) Select Passive Transmit
J3—Channel 1 Fiber Optic Transmit	JU5—Channel 2 20 mA Receive Act/Pas (1-2), (5-6) Select Active Receive **(2-5) Select Passive Receive**
J4—Channel 1 Fiber Optic Receive	JU6—Channel 2 20 mA Transmit Act/Pas **(1-2), (5-6) Select Active Transmit** (2-5) Select Passive Transmit
J5—Channel 2 Fiber Optic Transmit	JU7—Channel 1 Data/Remote Print Input (1-2), (3-4) ASCII Character Input **(2-3) Remote Print Pulse Input**
J6—Channel 2 Fiber Optic Receive	JU8—Channel 2 Data/Remote Print Input (1-2), (3-4) ASCII Character Input **(2-3) Remote Print Pulse Input**
J7—Not Used	JU9—Channel 1 Fiber Optic Cable Length (OUT) Less than 50 feet **(1-4) 50 to 100 feet**
J8—Power In	JU10—Channel 2 Fiber Optic Cable Length (OUT) Less than 50 feet **(1-4) 50 to 100 feet**

Bold indicates Default Settings

Appendix 6: Static Discharge Precautions

When a product is moved onto and off of scale equipment, as typically seen in batching applications, non-conductive materials such as flour, plastic, and rubber can generate static electricity when fed onto a scale hopper. The scale base, hopper, the ***PUMA*** terminal, and all conductive feeders to the scale (conveyors, chutes, and pipes) must be electrically bonded together and connected to a true-earth ground according to national and local codes.

NOTES

Appendix 7: Factory Mutual Approved Documents

The following control drawing(s) describe how the analog load cells listed on Drawing 122502 must be connected. Connection according to these drawings is required by the National Electric Code (NEC) and Factory Mutual (FM). Failure to comply with the requirements of these drawings may impair the safety of the installation with possible injury to personnel, loss of life or property.

Drawing	Type	System/Indicator
148450R	Control drawings	Intrinsic Safe PUMA (FM Approved)

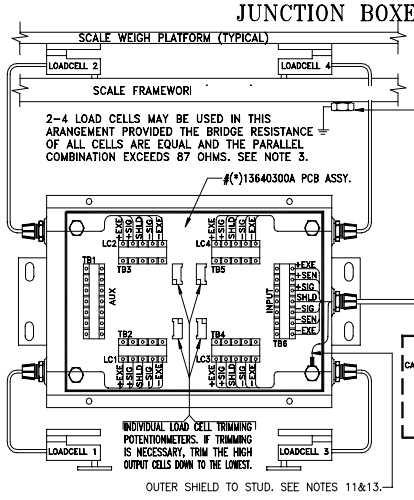
Control Drawings for FM Approval

The approved installation diagrams (control drawings) on the following pages MUST be followed when installing the ***PUMA*** terminal in hazardous (controlled) locations in order to meet the criteria required to have FM approval.

HAZARDOUS AREA

FIGURE 1. 2 TO 4 LOAD CELL INSTALLATION USING THE FOLLOWING JUNCTION BOXES.

TB100395 – 4 LOAD CELLS
TB100393 – 3 LOAD CELLS
TB100391 – 2 LOAD CELLS



⚠ WARNING

REBARS AND/OR STRUCTURE USED IN CONJUNCTION WITH THE LOAD CELLS MUST BE GROUNDED TO A TRUE EARTH GROUND. LOAD CELLS MUST BE ELECTRICALLY CONNECTED TO FRAMEWORK THRU MOUNTING OR BONDED WIRE. SEE NOTES 11 & 13.

J-BOX TO PUMA INDICATOR CABLE COLOR CODE	
TB6	WIRE COLOR
+EXE	WHITE
+SEN	YELLOW
+SIG	GREEN
SHLD	INNER SHIELD
–SIG	BLACK
–SEN	RED
–EXE	BLUE
MTG. STUD	OUTER SHIELD

(OPTIONAL) CABLE SPLICE BOX

SEE FIGURE 3 BELOW

LOAD CELL CABLE COLOR CODE	
LC1 – LC4	WIRE COLOR (**)
+EXCITATION	GREEN
+SIGNAL	WHITE
SHIELD	YELLOW
–SIGNAL	RED
–EXCITATION	BLACK

FIGURE 4.

IMPORTANT!
5-8 LOAD CELLS MAY BE USED IN THIS ARRANGEMENT PROVIDED THE BRIDGE RESISTANCE OF ALL CELLS ARE EQUAL AND THE PARALLEL COMBINATION EXCEEDS 87 OHMS. SEE NOTE 3.

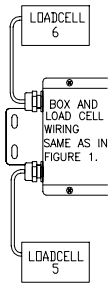
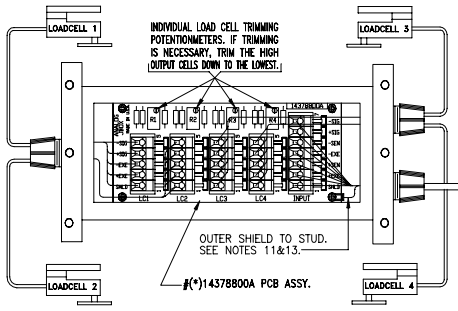


FIGURE 2. 4 LOAD CELL INSTALLATION FOR MODEL 2888 SCALE BASE USING TB100520 J-BOX



J-BOX TO PUMA INDICATOR CABLE COLOR CODE	
INPUT	WIRE COLOR
+EXE	WHITE
+SEN	YELLOW
+SIG	GREEN
SHLD	INNER SHIELD
–SIG	BLACK
–SEN	RED
–EXE	BLUE
MTG. STUD	OUTER SHIELD

LOAD CELL CABLE COLOR CODE	
LC1 – LC4	WIRE COLOR (**)
+EXCITATION	GREEN
+SIGNAL	WHITE
SHIELD	YELLOW
–SIGNAL	RED
–EXCITATION	BLACK

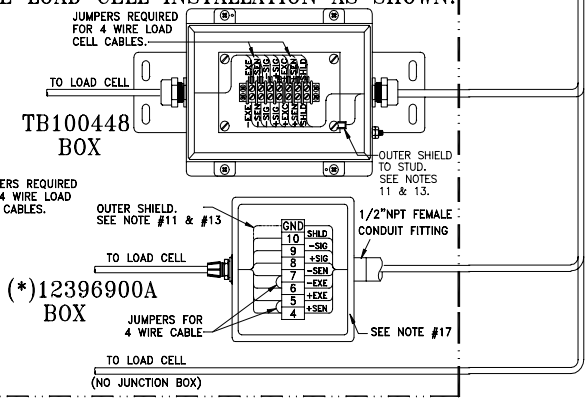
FIGURE 3. SINGLE LOAD CELL INSTALLATION AS SHOWN.

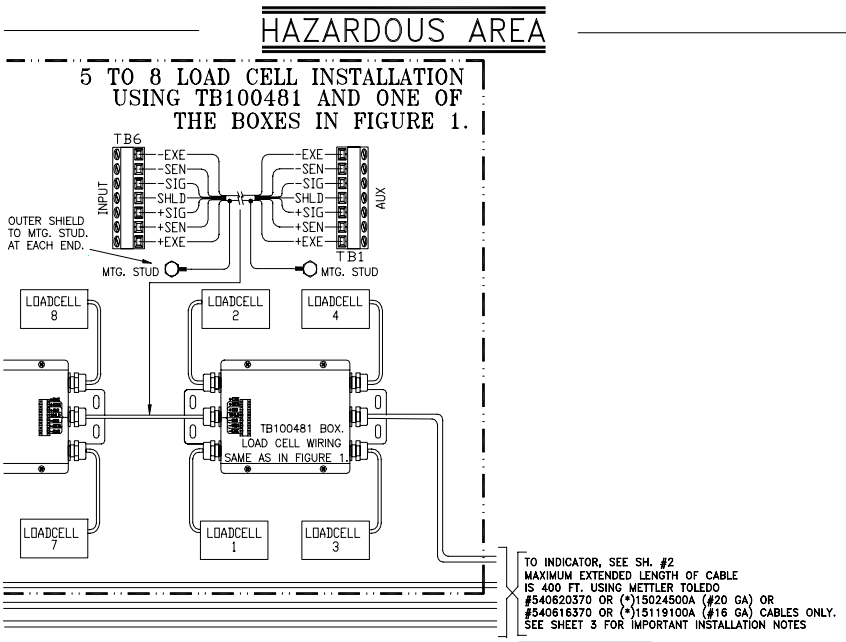
SEE (**) NOTE AT RIGHT.

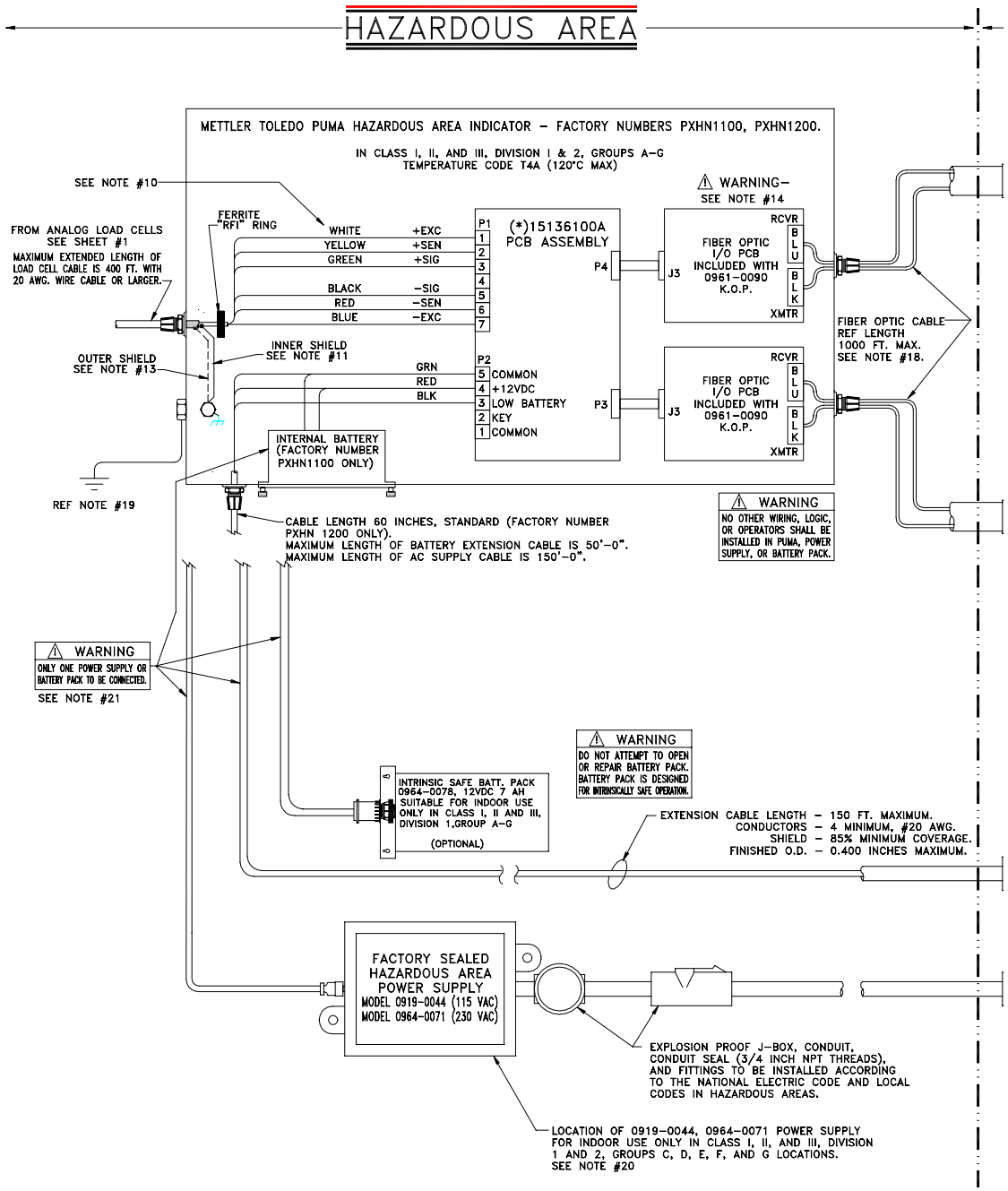
LOAD CELL WIRING DETAILS		6 WIRE	4 WIRE
10	SHLD	SHLD	SHLD
9	–SIG	BLK	RED
8	+SIG	GRN	WHT
7	–SEN	RED	JMP–6
6	–EXE	BLU	BLK
5	+EXE	WHT	GRN
4	+SEN	YEL	JMP–5

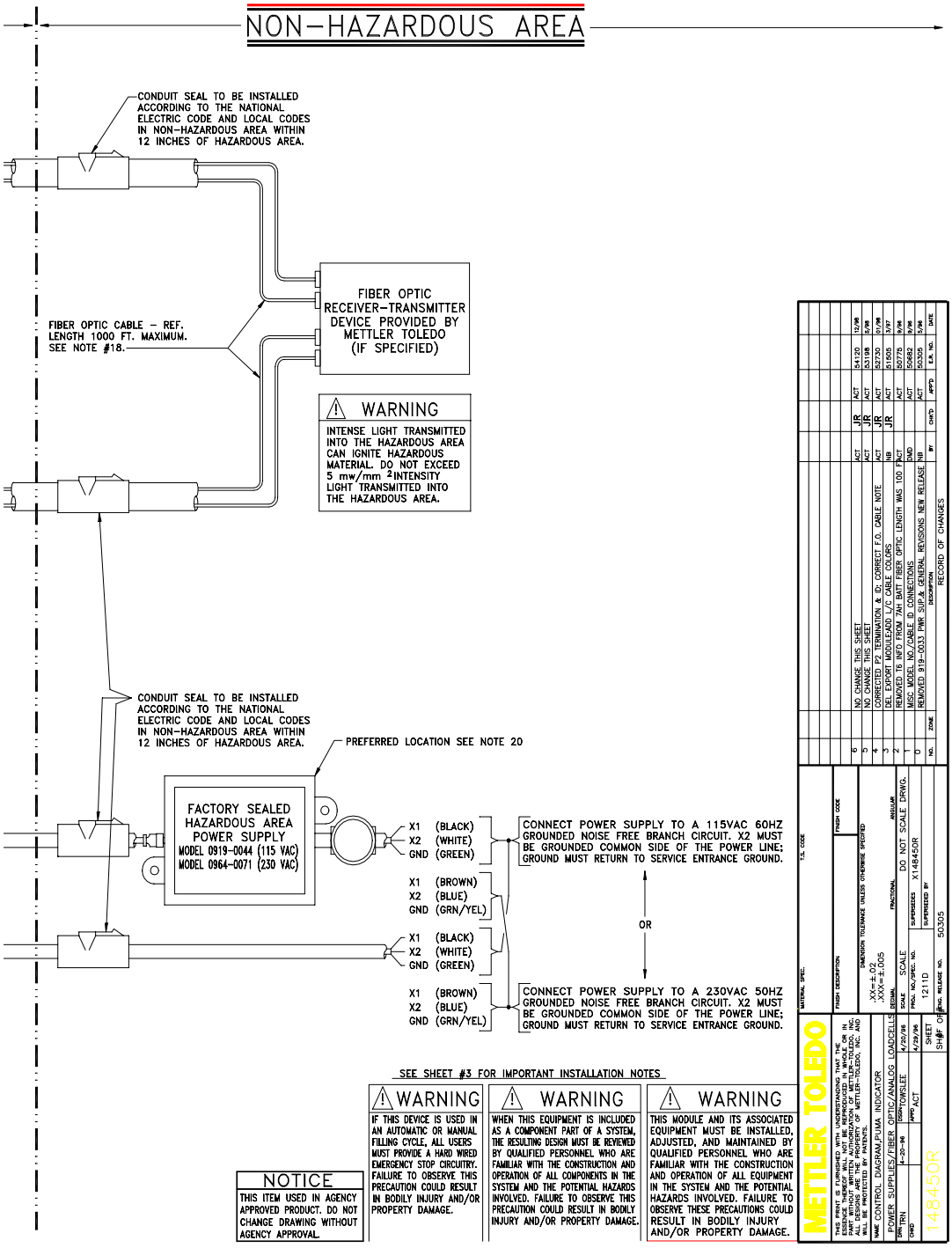
JUMPERS REQUIRED FOR 4 WIRE LOAD CELL CABLES.

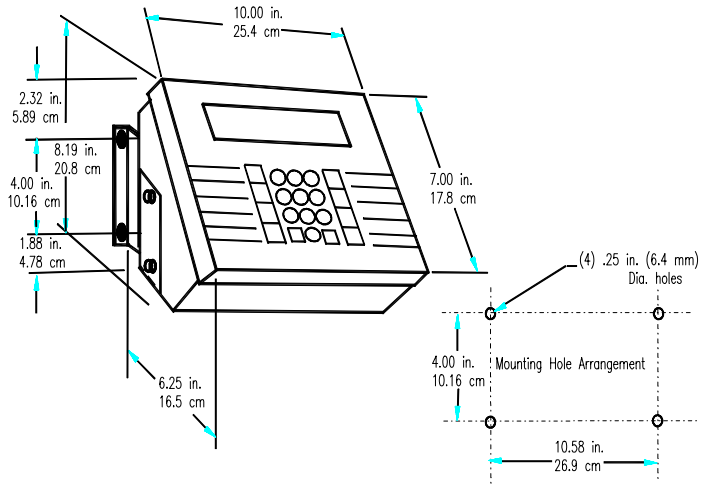
TERMINAL IDENTIFICATION PROVIDED IN (*)12396900A BOX ONLY.



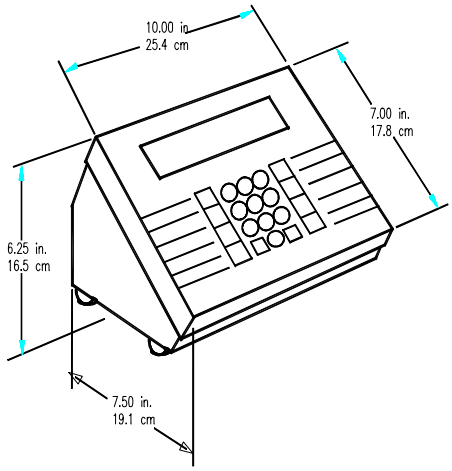

HAZARDOUS AREA
5 TO 8 LOAD CELL INSTALLATION USING TB100481 AND ONE OF THE BOXES IN FIGURE 1.
TB6
INPUT
-EXE
-SEN
-SIG
SHLD
+SIG
+SEN
+EXE
AUX
TB1
OUTER SHIELD TO MTG. STUD. AT EACH END.
MTG. STUD
MTG. STUD
LOADCELL 8
LOADCELL 2
LOADCELL 4
LOADCELL 7
LOADCELL 1
LOADCELL 3
TB100481 BOX. LOAD CELL WIRING SAME AS IN FIGURE 1.
TO INDICATOR, SEE SH. #2
MAXIMUM EXTENDED LENGTH OF CABLE IS 400 FT. USING METTLER TOLEDO #540620370 OR (*)150245OOA (#20 GA) OR #540616370 OR (*)151191OOA (#16 GA) CABLES ONLY.
SEE SHEET 3 FOR IMPORTANT INSTALLATION NOTES
WARNING
ONLY ONE LOAD CELL INSTALLATION TO BE CONNECTED TO INDICATOR
(**) NOTE – SOME 4 CONDUCTOR LOAD CELL CABLES DO NOT CONFORM TO THIS COLOR CODE. CHECK THE MANUFACTURER'S DATA SHEET IF IN DOUBT.
SEE SHEET #3 OF 3 FOR IMPORTANT NOTES
NOTICE
THIS ITEM USED IN AGENCY APPROVED PRODUCT. DO NOT CHANGE DRAWING WITHOUT AGENCY APPROVAL.
WARNING
SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
WARNING
IF THIS DEVICE IS USED IN AN AUTOMATIC OR MANUAL FILLING CYCLE, ALL USERS MUST PROVIDE A HARD WIRED EMERGENCY STOP CIRCUITRY. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.
WARNING
WHEN THIS EQUIPMENT IS INCLUDED AS A COMPONENT PART OF A SYSTEM, THE RESULTING DESIGN MUST BE REVIEWED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL COMPONENTS IN THE SYSTEM AND THE POTENTIAL HAZARDS INVOLVED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.
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 THESE PRECAUTIONS COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.
RECORD OF CHANGES
NO. ZONE DESCRIPTION BY CHK'D APP'D E.R. NO. DATE
6 NO CHANGE THIS SHEET ACT JJR ACT 54130 12/98
5 REVISED FIG 3,ADDED OPTIONAL SPLICE BOX ACT JJR ACT 53198 11/98
4 REVISED ALL JUNCTION BOX FIGURES/REDRAWN ACT JJR ACT 52730 01/98
3 NO CHANGE THIS SHEET NB JJR ACT 51505 11/97
2 NO CHANGE THIS SHEET ACT ACT 50775 9/96
1 DEFINED ACCEPTABLE LOAD CELL CABLES DMD ACT 50682 9/96
0 REMOVED X REVISION FOR RELEASE ACT ACT 50305 5/96
MATERIAL SPEC. U.S. CODE
FINISH DESCRIPTION FINISH CODE
DIMENSION TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL ANGULAR
XX=±.02 XXX=±.005
FRACTIONAL
DO NOT SCALE DRWG.
SCALE SCALE
PROJ. NO./SPEC. NO. SUPERSEDES
1211D
ENG. RELEASE NO. 50305
SUPERSEDED BY
SHEET 1 OF 3
METTLER TOLEDO
THIS PRINT IS FURNISHED WITH UNDERSTANDING THAT THE CONTENTS HEREOF WILL NOT BE REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN AUTHORIZATION OF METTLER-TOLEDO, INC. AND IS LOANED SUBJECT TO RETURN UPON DEMAND. ALL RIGHTS WILL BE PROTECTED BY PATENTS.
NAME EXTERNAL DIAGRAM-PUMA INDICATOR
ANALOG LOAD CELL WIRING
DRN TRN 4/29/98 DSGN TONGLEE 4/29/98
CHKD APPR ACT APPROVE
148450R


HAZARDOUS AREA
METTLER TOLEDO PUMA HAZARDOUS AREA INDICATOR – FACTORY NUMBERS PXHN1100, PXHN1200.
IN CLASS I, II, AND III, DIVISION 1 & 2, GROUPS A–G
TEMPERATURE CODE T4A (120°C MAX)
SEE NOTE #10
FROM ANALOG LOAD CELLS SEE SHEET #1
MAXIMUM EXTENDED LENGTH OF LOAD CELL CABLE IS 400 FT. WITH 20 AWG. WIRE CABLE OR LARGER.
FERRITE "RFI" RING
OUTER SHIELD SEE NOTE #13
INNER SHIELD SEE NOTE #11
WHITE +EXC
YELLOW +SEN
GREEN +SIG
BLACK –SIG
RED –SEN
BLUE –EXC
P1
(*)15136100A PCB ASSEMBLY
P2
GRN 5 COMMON
RED 4 +12VDC
BLK 3 LOW BATTERY
2 KEY
1 COMMON
P4
P3
J3
FIBER OPTIC I/O PCB INCLUDED WITH 0961–0090 K.O.P.
RCVR
XMTR
BLU
BLK
WARNING– SEE NOTE #14
FIBER OPTIC CABLE REF LENGTH 1000 FT. MAX. SEE NOTE #18.
INTERNAL BATTERY (FACTORY NUMBER PXHN1100 ONLY)
REF NOTE #19
CABLE LENGTH 60 INCHES, STANDARD (FACTORY NUMBER PXHN 1200 ONLY).
MAXIMUM LENGTH OF BATTERY EXTENSION CABLE IS 50'–0".
MAXIMUM LENGTH OF AC SUPPLY CABLE IS 150'–0".
WARNING
NO OTHER WIRING, LOGIC, OR OPERATORS SHALL BE INSTALLED IN PUMA, POWER SUPPLY, OR BATTERY PACK.
WARNING
ONLY ONE POWER SUPPLY OR BATTERY PACK TO BE CONNECTED.
SEE NOTE #21
WARNING
DO NOT ATTEMPT TO OPEN OR REPAIR BATTERY PACK. BATTERY PACK IS DESIGNED FOR INTRINSICALLY SAFE OPERATION.
INTRINSIC SAFE BATT. PACK 0964–0078, 12VDC 7 AH SUITABLE FOR INDOOR USE ONLY IN CLASS I, II AND III, DIVISION 1,GROUP A–G
(OPTIONAL)
EXTENSION CABLE LENGTH – 150 FT. MAXIMUM.
CONDUCTORS – 4 MINIMUM, #20 AWG.
SHIELD – 85% MINIMUM COVERAGE.
FINISHED O.D. – 0.400 INCHES MAXIMUM.
FACTORY SEALED HAZARDOUS AREA POWER SUPPLY
MODEL 0919–0044 (115 VAC)
MODEL 0964–0071 (230 VAC)
EXPLOSION PROOF J–BOX, CONDUIT, CONDUIT SEAL (3/4 INCH NPT THREADS), AND FITTINGS TO BE INSTALLED ACCORDING TO THE NATIONAL ELECTRIC CODE AND LOCAL CODES IN HAZARDOUS AREAS.
LOCATION OF 0919–0044, 0964–0071 POWER SUPPLY FOR INDOOR USE ONLY IN CLASS I, II, AND III, DIVISION 1 AND 2, GROUPS C, D, E, F, AND G LOCATIONS. SEE NOTE #20


NON-HAZARDOUS AREA
CONDUIT SEAL TO BE INSTALLED ACCORDING TO THE NATIONAL ELECTRIC CODE AND LOCAL CODES IN NON-HAZARDOUS AREA WITHIN 12 INCHES OF HAZARDOUS AREA.
FIBER OPTIC CABLE - REF. LENGTH 1000 FT. MAXIMUM. SEE NOTE #18.
FIBER OPTIC RECEIVER-TRANSMITTER DEVICE PROVIDED BY METTLER TOLEDO (IF SPECIFIED)
WARNING
INTENSE LIGHT TRANSMITTED INTO THE HAZARDOUS AREA CAN IGNITE HAZARDOUS MATERIAL. DO NOT EXCEED 5 mw/mm 2 INTENSITY LIGHT TRANSMITTED INTO THE HAZARDOUS AREA.
CONDUIT SEAL TO BE INSTALLED ACCORDING TO THE NATIONAL ELECTRIC CODE AND LOCAL CODES IN NON-HAZARDOUS AREA WITHIN 12 INCHES OF HAZARDOUS AREA.
PREFERRED LOCATION SEE NOTE 20
FACTORY SEALED HAZARDOUS AREA POWER SUPPLY
MODEL 0919-0044 (115 VAC)
MODEL 0964-0071 (230 VAC)
X1 (BLACK)
X2 (WHITE)
GND (GREEN)
CONNECT POWER SUPPLY TO A 115VAC 60HZ GROUNDED NOISE FREE BRANCH CIRCUIT. X2 MUST BE GROUNDED COMMON SIDE OF THE POWER LINE; GROUND MUST RETURN TO SERVICE ENTRANCE GROUND.
X1 (BROWN)
X2 (BLUE)
GND (GRN/YEL)
OR
X1 (BLACK)
X2 (WHITE)
GND (GRN/YEL)
X1 (BROWN)
X2 (BLUE)
GND (GRN/YEL)
CONNECT POWER SUPPLY TO A 230VAC 50HZ GROUNDED NOISE FREE BRANCH CIRCUIT. X2 MUST BE GROUNDED COMMON SIDE OF THE POWER LINE; GROUND MUST RETURN TO SERVICE ENTRANCE GROUND.
SEE SHEET #3 FOR IMPORTANT INSTALLATION NOTES
NOTICE
THIS ITEM USED IN AGENCY APPROVED PRODUCT. DO NOT CHANGE DRAWING WITHOUT AGENCY APPROVAL.
WARNING
IF THIS DEVICE IS USED IN AN AUTOMATIC OR MANUAL FILLING CYCLE, ALL USERS MUST PROVIDE A HARD WIRED EMERGENCY STOP CIRCUITRY. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.
WARNING
WHEN THIS EQUIPMENT IS INCLUDED AS A COMPONENT PART OF A SYSTEM, THE RESULTING DESIGN MUST BE REVIEWED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL COMPONENTS IN THE SYSTEM AND THE POTENTIAL HAZARDS INVOLVED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.
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 THESE PRECAUTIONS COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.
METTLER TOLEDO
148450R
RECORD OF CHANGES

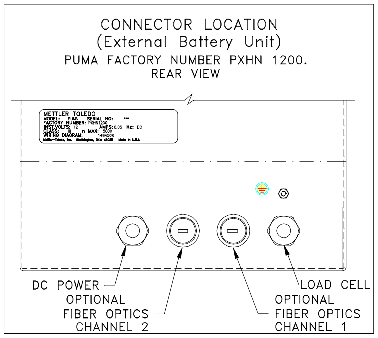


PUMA Wall Mounting Dimensions



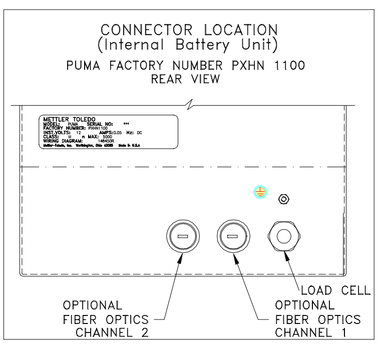
PUMA Desk Enclosure Dimensions

NOTICE
THIS ITEM USED IN AGENCY APPROVED PRODUCT. DO NOT CHANGE DRAWING WITHOUT AGENCY APPROVAL.



INSTALLATION NOTES:

1. ONLY METTLER TOLEDO/MASSTRON LISTED LOAD CELLS AND CABLE LENGTH VARIATIONS SHALL BE USED IN ORDER TO COMPLY WITH FACTORY MUTUAL APPROVAL. THE USE OF ANY OTHER LOAD CELLS OR CABLE LENGTH WILL VOID FACTORY MUTUAL APPROVAL.
2. REFERENCE DRAWINGS: (*)104696 – SCHEMATIC OF 11822800A J-BOX WIRING
   (*)103912 – SCHEMATIC OF 10391000A J-BOX WIRING
   (*)TB100505 – SCHEMATIC OF TB100395 J-BOX WIRING
   (*)122502 – METTLER TOLEDO APPROVED LOAD CELLS
   (*)150411R MASSTRON APPROVED LOAD CELLS
3. UP TO FOUR LOAD CELLS MAY BE USED PROVIDED THE BRIDGE RESISTANCE OF ALL LOAD CELLS IN PARALLEL EXCEEDS 87 OHMS (4–350 OHM LOAD CELLS).
4. THE LOAD CELLS USED WITH THIS SYSTEM WILL BE EXCITED WITH 1.6VDC. DESIGN SENSITIVITY MUST BE SUCH THAT AT LEAST 0.19 MICROVOLT/GRADUATION IS MAINTAINED TO ESTABLISH AN ACCURATE WEIGHING SYSTEM. (5000 INCREMENTS UTILIZING 30% OF LOADCELL CAPACITY)
5. DO NOT MODIFY THE LENGTH OF 4 CONDUCTOR LOAD CELL CABLES UNDER ANY CIRCUMSTANCES; ALL CELLS MUST HAVE EQUAL CABLE LENGTHS.
6. PROVIDE CONDUIT FOR THE LOAD CELL CABLE UP TO AS CLOSE TO THE LOAD CELL AS POSSIBLE.
7. ALL LOAD CELL CABLE CONDUITS SHALL ONLY CONTAIN LOADCELL WIRING SHOWN HERE; NO OTHER WIRES PERMITTED.
8. ALL CONDUIT SEALS ARE TO BE INSTALLED AND SEALED IN COMPLIANCE WITH N.E.C. AND APPLICABLE LOCAL ELECTRICAL CODES BY EQUIPMENT INSTALLER.
9. ALL GROUNDING OF EQUIPMENT SHOWN IS TO BE DONE BY EQUIPMENT INSTALLER IN ACCORDANCE WITH N.E.C. AND APPLICABLE ELECTRICAL CODES.
10. LOAD CELL CABLE COLOR CODE DESIGNATION MUST BE MAINTAINED AS SHOWN FOR PROPER OPERATION.
11. CONNECT INNER SHIELD OF DUAL SHIELD CABLE (AT J-BOX END) TO TERMINAL MARKED 3, 10, OR (SHLD) ONLY AND TO INSTRUMENT CASE AT OPPOSITE END. (CONNECT ALL CASES, ENCLOSURES, HOUSINGS, AND POINTS CONNECTED TO GROUND TOGETHER AND TO A TRUE EARTH GROUND ONLY THROUGH THE OUTER SHIELD.)
12. (*) INDICATES DRAWING MAY HAVE LETTER PREFIX
13. THE DOTTED LINE SHOWN REPRESENTS THE OUTER SHIELD OF DUAL SHIELD CABLES ONLY. IT MUST BE TERMINATED TO THE CONNECTED DEVICE AT EACH END. AT THE LOAD CELL END CONNECT OUTER SHIELD TO CASE OR MTG. BOLT.
14. ONLY SPECIFIED COMPONENTS MAY BE USED IN THIS UNIT. DO NOT SUBSTITUTE COMPONENTS AS THIS WILL IMPAIR INTRINSIC SAFETY OF THE UNIT.
15. DO NOT OPERATE UNTIL YOU HAVE READ AND UNDERSTOOD THE INSTRUCTIONS IN THE PUMA TECHNICAL MANUAL.
16. ALL EXTERNAL WIRING AND INSTALLATIONS MUST CONFORM TO THE NATIONAL ELECTRICAL CODES (N.E.C.) AND TO LOCAL CODES IN EFFECT FOR HAZARDOUS (CLASSIFIED) LOCATION IN WHICH THE ABOVE EQUIPMENT IS INSTALLED.
17. OPTIONAL J-BOX USED ONLY WHEN CABLE SUPPLIED WITH LOAD CELL IS OF INSUFFICIENT LENGTH.
18. USE ONLY UL LISTED AND MARKED (OFNP) FIBER OPTIC CABLE INSTALLED PER NATIONAL ELECTRIC CODE ARTICLE 770. CABLE MAY BE RUN IN RIGID METAL CONDUIT FOR MECHANICAL PROTECTION IF DESIRED BUT IT MUST BE IN CONDUIT WHERE IT PASSES THROUGH THE HAZARDOUS/NON-HAZARDOUS THRESHOLD.
19. ALL SCALES MUST BE STATICALLY GROUNDED BEFORE BEING USED.
20. PREFERRED LOCATION OF POWER SUPPLY IS IN THE NON-HAZARDOUS AREA. POWER SUPPLY OUTPUT IS INTRINSICALLY SAFE FOR GROUPS A, B, C, D, E, F & G WITH POWER SUPPLY IN THE SAFE AREA. POWER SUPPLY IS NOT SUITABLE FOR LOCATING IN GROUP A & B HAZARDOUS AREAS. SUPPLY OPERATES AT LESS THAN 100°C AT 40°C AMBIENT, THEREFORE DOES NOT REQUIRE TEMPERATURE CODE MARKING PER NEC REGULATIONS.
21. EXTERNAL INTRINSIC SAFE BATTERY PACK CONNECTIONS USE POWER, GROUND, AND BATTERY LOW CONNECTIONS AT CONNECTOR P2. THE HAZARDOUS AREA POWER SUPPLY USES ONLY POWER AND GROUND CONNECTIONS AT CONNECTOR P2.



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

⚠ WARNING
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RECORD OF CHANGES

NO.	ZONE	DESCRIPTION	BY	CHK'D	APP'D	E.R. NO.	DATE
6		REVISED MTG DIM 10.58 WAS 10.75 & 26.9WAS 27.3-ERROR	ACT	JR	ACT	54120	12/98
5		NO CHANGE THIS SHEET	ACT	JR	ACT	53198	5/98
4		REMOVED NOTE 18	ACT	JR	ACT	52730	01/98
3		REMOVED COLUMN MTG VIEW DEL(0)TA700001,ADD(0)150411R	NB	JR	ACT	51505	3/97
2		NO CHANGE THIS SHEET	ACT		ACT	50775	8/96
1		CORRECTED NOTES 11 & 13 & MODEL ID	DKD		ACT	50682	8/96
0		ADDED DIMENSIONS,GENERAL REVISIONS,NEW RELEASE	ACT		ACT	50305	5/96

METTLER TOLEDO

THIS PRINT IS FURNISHED WITH UNDERSTANDING THAT THE ESSENCE THEREOF WILL NOT BE REPRODUCED IN WHOLE OR IN PART WITHOUT WRITTEN AUTHORIZATION OF METTLER-TOLEDO, INC. ALL DESIGNS ARE THE PROPERTY OF METTLER-TOLEDO, INC. AND WILL BE PROTECTED BY PATENTS.

MATERIAL SPEC. | T.S. CODE
FINISH DESCRIPTION | FINISH CODE: FINISHCODE
DIMENSION TOLERANCE UNLESS OTHERWISE SPECIFIED: DECIMAL .XX=±.02 .XXX=±.005 | FRACTIONAL | ANGULAR
NAME: EXTERNAL
DESCRIPTIONLINE2
DRN: TRN 4/29/96 | DSGN: TOWSLEE 4/29/96 | SCALE: SCALE | DO NOT SCALE DRWG.
CHKD: CHKDBY CHKDATE | APPD: ACT 5/96 | PROJ. NO./SPEC. NO.: 1211D | SUPERSEDES | SUPERSEDED BY
148450R | SHEET 3 OF 3 | ENG. RELEASE NO. 50305

Approved Load Cells

The following list of load cells (drawing 122502) are "system" approved for use with the *PUMA* terminal in hazardous area applications when connected as shown on METTLER TOLEDO control drawing 148450R.

PART NUMBER		DESCRIPTION
09708400A		0 L/C, 4#, 600 -10+40C
10011900A		0 L/C, 100000LB, COMP,(BLH)
10014900A		0 L/C, 50000LB, COMP,(BLH)
10048600A	NOTE 6	0 L/C, 500LB, TENS,(BLH)
10048700A	NOTE 6	0 L/C,1000LB, TENS,(BLH)
10048800A	NOTE 6	0 L/C, 2000LB, TENS,(BLH)
10048900A	NOTE 6	0 L/C, 5000LB, TENS,(BLH)
10049000A	NOTE 6	0 L/C, 1000LB, COMP,(BLH)
10049100A	NOTE 6	0 L/C, 10000LB, COMP,(BLH)
10049200A		0 L/C, 20000LB, COMP,(BLH)
10049300A		0 L/C, 200000LB, COMP,(BLH)
10479700A		0 L/C,15#, 600 -10+40C
10479700B		0 L/C,15#, 600 -10+40C
10479800A	NOTE 4	0 L/C, 25#, 600 -10+40C
10479800B	NOTE 4	0 L/C, 25#, 600 -10+40C
10479900A		0 L/C 600, 50# -10+40C
10479900B		0 L/C 600, 50# -10+40C
10480800A		0 L/C,15#, 3000 -10+40C
10480800B		0 L/C,15#, 3000 -10+40C
10481000A		0 L/C, 25#, 3000 -10+40C
10481000B		0 L/C, 25#, 3000 -10+40C
10481300A		0 L/C, 100# 3000 OIML
10481300B		0 L/C, 100# 3000 OIML
10481400A		0 L/C, 200# 3000 OIML
10481400B		0 L/C, 200# 3000 OIML
10711000A		0 L/C,100# GP AL 600 OIML
10751400A		0 L/C, 200# GP AL 600 OIML
11048300A		0 L/C, 20000LB, SB,(HBM)
11048400A		0 L/C, 5000LB, SB,(HBM)
11049900A		0 L/C,15000LB, SB,(HBM)
11424100A		0 L/C,100000LB, COMP,(HBM)
11424200A		0 L/C,100000LB, COMP,(REV)

11432600A		0 L/C,1000LB, SB,(HBM)
11432700A		0 L/C, 2000LB, SB,(HBM)
11432800A		0 L/C, 50000LB, SB,(HBM)
11432900A		0 L/C,10000LB, COMP,(REV)
11433000A		0 L/C, 25000LB, COMP,(REV)
11433100A		0 L/C, 50000LB, COMP,(REV)
11433200A		0 L/C,200000LB, COMP,(REV)
11455700A		0 L/C, 200LB, COMP,(REV)
11691400A	NOTE 6	0 L/C, 250LB, TENS PR,(REV)
11691500A	NOTE 6	0 L/C, 500LB, TENS PR,(REV)
11691600A	NOTE 6	0 L/C,1000LB, TENS PR,(REV)
11708100A	NOTE 6	0 L/C,100LB, TENS,(REV)
11708200A	NOTE 6	0 L/C,1000LB, TENS,(REV)
11708400A	NOTE 6	0 L/C,5000LB, TENS,(REV)
11708800A		0 L/C, 200000LB, COMP, (HBM)
11724400A	NOTE 6	0 L/C, 500LB, TENS,(REV)
12010300A		0 L/C, 200LB, USB
12010400A		0 L/C, 500LB, USB
12010500A		0 L/C,1000LB, USB
12010600A		0 L/C, 2000LB, USB
12010700A		0 L/C, 5000LB, USB
12010800A		0 L/C, 20000LB,USB
12563600A		0 L/C, 200LB, SHEARBEAM
12591700A		0 L/C, 5000LB, SHEARBEAM,(REV)
12623100A		0 L/C, 500LB, SHEARBEAM
13078900A		0 LOAD CELL ASSY 5K BHSB
13079300A		0 LOAD CELL ASSY 3K BHSB
13136900A		0 LOAD CELL ASSY 1K BHSB
13158500A	NOTE 6	0 L/C,200LB,(TI)
13158600A	NOTE 6	0 L/C,500LB,(TI)
13158700A	NOTE 6	0 L/C,1000LB,(TI)
13158800A	NOTE 6	0 L/C,2000LB,(TI)
13158900A	NOTE 6	0 L/C,5000LB,(TI)
13159000A	NOTE 6	0 L/C,10000LB,(TI)
13929400A		0 LOAD CELL ASSY, 45K(SS)BHSB
15128900A		0 L/C ASSY, QUALIFIED, SHEAR BEAM, 0759A
15129300A		0 L/C ASSY QUALIFIED, 2500LB,0745A

15129300B		0 L/C ASSY QUALIFIED, 2500LB,0745A
15129300C		0 L/C ASSY QUALIFIED, 2500LB,0745A
15180900A		0 L/C, 22KG, 3000 OIML, FM APVD
15181000A		0 L/C, 45KG, 3000 OIML, FM APVD
15181100A		0 L/C, 100KG, 3000 OIML, FM APVD
15181200A		0 L/C,100KG, ANALOG,FM APVD
15181300A		0 L/C, 200KG, ANALOG,FM APVD
15297300A		0 L/C ASSY, QUALIFIED 20K BHSB, HB44
15297300B		0 L/C ASSY, QUALIFIED 20K BHSB, HB44
15297700A		0 L/C ASSY, QUALIFIED 45K BHSB, HB44
15297700B		0 L/C ASSY, QUALIFIED 45K BHSB, HB44
15297800A		0 L/C ASSY, QUALIFIED 30K BHSB, HB44
15297800B		0 L/C ASSY, QUALIFIED 30K BHSB, HB44
15298200A		0 L/C ASSY, QUALIFIED 13608KG BHSB, C3
15298200B		0 L/C ASSY, QUALIFIED 13608KG BHSB, C3
15355500A		0 L/C ASSY, QUALIFIED,9072KG, C3
15355500B		0 L/C ASSY, QUALIFIED,9072KG, C3
15357400A		0 L/C ASSY, QUALIFIED,20412KG, C3
15357400B		0 L/C ASSY, QUALIFIED,20412KG, C3
15357500A		0 L/C ASSY, QUALIFIED,45K,HB44 10000
A09709100A	NOTE 4	0 L/C, 200# 600 -10+40C
A09709100B	NOTE 4	0 L/C, 200# 600 -10+40C
A10616300A		0 L/C, 5000LB, COMP,(TI)
A10617400A		0 L/C, 1000LB, COMP,(TI)
A10671100A		0 L/C ASSY, 500# 3000 OIML
A10671100B		0 L/C ASSY, 500# 3000 OIML
A10671400A		0 L/C ASSY, 500# 600 OIML
A10671400B		0 L/C ASSY, 500# 600 OIML
A11050100A		0 L/C ASSY, 50K 3000 OIML
A11785300A		0 L/C, NBS HB44 500# IND
A11785700A		0 L/C, HB44 NI 500# IND
A11786100A		0 L/C, 500LB/3000/STD
A11786500A		0 L/C, 500LB/3000/NI
A11786900A		0 L/C, NBS HB44 1000# IND
A11787300A		0 L/C, HB44 NI 1000# IND
A11787700A		0 L/C,1000LB/3000 STD
A11788100A		0 L/C,1000LB/3000/NI
A11788500A	NOTE 4	0 L/C, NBS HB44 2000# IND

A11788900A	NOTE 4	0 L/C, HB44 NI 2000# IND
A11789300A		0 L/C, 2000LB 3000 STD
A11789700A		0 L/C, 2000LB/3000/NI
A12744300A	NOTE 4	0 L/C, HB44 HS 500# IND
A12744500A	NOTE 4	0 L/C, HB44 HS 1000# IND
A12744700A	NOTE 4	0 L/C, HB44 HS 2000# IND
A13077500A		0 L/C ASSY, BHSB
A13077500B		0 L/C, NBS HB44 BHSB 20K
A13077500C		0 L/C, NBS HB44 BHSB 20K
A13078400A		0 L/C 10K BHSB W/10 FT
A13078400B		0 L/C, NBS HB44 BHSB 10K
A13078400C		0 L/C, NBS HB44 BHSB 10K
A13117600A	NOTE 6	0 L/C, 200LB,(TI)
A13117700A	NOTE 6	0 L/C, 500LB,(TI)
A13117800A	NOTE 6	0 L/C, 1000LB,(TI)
A13117900A	NOTE 6	0 L/C, 2000LB,(TI)
A13118000A	NOTE 6	0 L/C, 5000LB,(TI)
A13118100A	NOTE 6	0 L/C,10000LB,(TI)
B09708500A	NOTE 4	0 L/C,100#,600 -10+40C
B09708500B	NOTE 4	0 L/C,100#,600 -10+40C
B10049400A		0 L/C,100000LB, SB(BLH/HBM)
B10671200A		0 L/C ASSY,1000# 3000 OIML
B10671200B		0 L/C ASSY, 1000# 3000 OIML
B10671300A		0 L/C ASSY, 2000# 3000 OIML
B10671300B		0 L/C ASSY, 2000# 3000 OIML
B10671500A		0 L/C ASSY, 1000# 600 OIML
B10671500B		0 L/C ASSY, 1000# 600 OIML
B10671600A	NOTE 4	0 L/C ASSY, 2000# 600 OIML
B10671600B	NOTE 4	0 L/C ASSY, 2000# 600 OIML
B10883600A		0 L/C ASSY, NBS HB44 50K
C10887700A		0 L/C ASSY, 100K NBS HB44
C11050000A		0 L/C ASSY, 100K 3000 OIML
C11102200A		0 L/C ASSY,100# (600) NI
C11103500A		0 L/C ASSY, 200# (600) NI
KB200570020	NOTE 6	0 L/C, 5000LB,COMP
KN713700020	NOTE 6	0 L/C, 2000LB,COMP
KN750666020		0 L/C,10OOOLB,COMP

TA600238	0 L/C, 50LB,3000D,RSC
TA600239	0 L/C, 50LB,10000D,RSC
TC600240	0 L/C, 100LB,3000D,RSC
TA600241	0 L/C, 100LB,10000D,RSC
TA600242	0 L/C, 200LB,3000D,RSC
TA600243	0 L/C, 200LB,10000D,RSC
TA600244	0 L/C, 300LB,3000D,RSC
TA600245	0 L/C, 300LB,10000D,RSC
TA600246	0 L/C, 500LB, 3000D,RSC
TA600247	0 L/C, 500LB, 10000D,RSC
TA600248	0 L/C, 750LB, 3000D,RSC
TA600249	0 L/C, 750LB, 10000D,RSC
TA600250	0 L/C, 1000LB, 3000D,RSC
TA600251	0 L/C, 1000LB, 10000D,RSC
TA600252	0 L/C, 2000LB, 3000D,RSC
TA600253	0 L/C, 2000LB, 10000D,RSC
TA600254	0 L/C, 3000LB, 3000D,RSC
TA600255	0 L/C, 3000LB, 10000D,RSC
TA600256	0 L/C, 5000LB, 3000D,RSC
TA600257	0 L/C, 5000LB, 10000D,RSC
TA600258	0 L/C, 10000LB,3KD,25',RSC
TA600536	0 L/C, 25KG, 3KD, OIML,736
TA600537	0 L/C, 50KG, 3KD, OIML,736
TA600538	0 L/C,100KG, 3KD, OIML,736
TA600539	0 L/C, 200KG, 3KD, OIML,736
TA600540	0 L/C, 500KG, 3KD, OIML,736
TA600541	0 L/C,1000KG, 3KD, OIML,736
TA600542	0 L/C, 2000KG, 3KD, OIML,736
TA600543	0 L/C, 5000KG, 3KD, OIML,736
TB600226	0 L/C, 500LB, 3KD,15', 744
TB600226-1	0 L/C,500LB, 3KD,7.5',744
TB600226-2	0 L/C, 500LB, 3KD, 30',744
TB600227	0 L/C,1250LB, 3KD,15', 744
TB600227-1	0 L/C,1250LB, 3KD, 7.5', 744
TB600227-2	0 L/C,1250LB, 3KD, 30', 744
TB600228	0 L/C, 2500LB, 3KD,15', 744
TB600228-1	0 L/C, 2500LB, 3KD, 7.5', 744
TB600228-2	0 L/C, 2500LB, 3KD, 30', 744

TB600229	0 L/C, 5000LB, 3KD, 15', 744
TB600229-1	0 L/C, 5000LB, 3KD, 7.5', 744
TB600229-2	0 L/C, 5000LB, 3KD, 30', 744
TB600230	0 L/C, 500LB, 5KD,15', 744
TB600230-1	0 L/C, 500LB, 5KD, 7.5', 744
TB600230-2	0 L/C, 500LB, 5KD, 30', 744
TB600231	0 L/C, 1250LB, 5KD, 15', 744
TB600231-1	0 L/C, 1250LB, 5KD, 7.5', 744
TB600231-2	0 L/C, 1250LB, 5KD, 30', 744
TB600232	0 L/C, 5000LB, 5KD,15', 744
TB600232-1	0 L/C, 5000LB, 5KD, 7.5', 744
TB600232-2	0 L/C, 5000LB, 5KD, 30', 744
TB600260	0 L/C, 2500LB, 7.5'
TB600310	0 L/C,1250LB,3KD,15'
TB600311	0 L/C, 2500LB, 3KD,15'
TB600312	0 L/C, 5000LB, 3KD,15'
TB600313	0 L/C, 10000LB, 3KD,15'
TB600342	0 L/C, 2500LB, 5KD, 15'
TB600342-1	0 L/C, 2500LB, 5KD, 7'-6"
TB600342-2	0 L/C, 2500LB, 5KD, 30'
TB600343	0 L/C, 5000LB, 5KD, 15'
TB600363	0 L/C,1250LB, 5KD,15'
TB600363-1	0 L/C,1250LB, 5KD,7'-6"
TB600363-2	0 L/C,1250LB, 5KD,30'
TB600364	0 L/C,10000LB, 5KD,15'
TB600370	0 L/C, 550KG, 3KD, OIML, 744
TB600370-1	0 L/C, 550KG, 3KD, OIML, 744
TB600370-2	0 L/C, 550KG, 3KD, OIML, 744
TB600371	0 L/C,1100KG, 3KD, OIML, 744
TB600371-1	0 L/C,1100KG, 3KD, OIML, 744
TB600371-2	0 L/C,1100KG, 3KD, OIML, 744
TB600372	0 L/C, 2200KG, 3KD, OIML, 744
TB600372-1	0 L/C, 2200KG, 3KD, OIML, 744
TB600372-2	0 L/C, 2200KG, 3KD, OIML, 744
TB600397	0 L/C, 5000LB, 3KD, 15', 744
TB600397-1	0 L/C, 5000LB, 3KD, 7.5', 744
TB600397-2	0 L/C, 5000LB, 3KD, 30', 744

TB600451	0 L/C, 220KG, 3KD, OIML, 744
TB600451-1	0 L/C, 220KG, 3KD, OIML, 744
TB600451-2	0 L/C,220KG,3KD,OIML,744
TB600454	0 L/C, 550KG, 3KD, OIML, 745
TB600454-1	0 L/C, 550KG, 3KD, OIML, 745
TB600454-2	0 L/C, 550KG, 3KD, OIML, 745
TB600455	0 L/C,1100KG, 3KD,OIML,745
TB600455-1	0 L/C,1100KG, 3KD, OIML, 745
TB600455-2	0 L/C, 1100KG, 3KD, OIML, 745
TB600456	0 L/C, 2200KG, 3KD, OIML, 745
TB600456-1	0 L/C, 2200KG, 3KD, OIML, 745
TB600456-2	0 L/C, 2200KG, 3KD, OIML, 745
TB600457	0 L/C, 4400KG, 3KD, OIML, 745
TB600457-1	0 L/C, 4400KG, 3KD, OIML, 745
TB600457-2	0 L/C, 4400KG ,3KD, OIML, 745
TB600488	0 L/C, 250LB, 5KD, 744
TB600488-1	0 L/C, 250LB, 5KD, 744
TB600488-2	0 L/C, 250LB, 5KD, 744
TB600489	0 L/C,1250LB, 3KD, 7.5', 757
TB600489-1	0 L/C,1250LB, 3KD, 15', 757
TB600489-2	0 L/C,1250LB, 3KD, 30', 757
TB600490	0 L/C, 2500LB, 3KD, 7.5', 757
TB600490-1	0 L/C, 2500LB, 3KD, 15', 757
TB600490-2	0 L/C, 2500LB, 3KD, 30', 757
TB600510	0 L/C, 75000LB, 35', 743
TB600524	0 L/C, 2500LB, BEAM, HERM
TB600529-1	0 L/C, 500LB, 3KD, 4', 745
TB600529-2	0 L/C, 500LB, 3KD, 7.5', 745
TB600529-3	0 L/C, 500LB, 3KD, 15', 745
TB600529-4	0 L/C, 500LB, 3KD, 30', 745
TB600531	0 L/C, 2500LB,1KD, 759

Notes On Approved Load Cells

1. Load cells listed are suitable for use in Class I, II, III, Division 1 & 2, Groups A through G areas when interfaced with *PUMA* Scale Terminal and associated accessories specified for use in Hazardous (Classified) Areas. Load cells are rated to a T-4 Temperature Code (135°C, 275°F). See NFPA-70 National Electric Code and NFPA-497 for description of this rating.
2. Load cell cable lengths may be increased up to 100 feet. Modification drawings must reference only approved load cells from this list. Four wire Load Cells must be modified by the manufacturer, as proper load cell calibration is dependent on cable length. These cells are rated for a T-6 temperature code (85°C, 185°F) in addition to the requirements of note (1).
3. Load cell strain gauge resistance shall exceed 325 ohms. Except where indicated, load cell resistance is 350 ohm nominal
4. Rated output for these load cells = 3mV/V, all others are 2mV/V. Do not use more than 2/3 of the cell capacity. See Chapter 5, Service and Maintenance Troubleshooting-Load Cell/Signal for more information.
5. Load cells must be labeled (marked) with the Factory Mutual mark as follows unless shown otherwise:

Temperature Code T4

Inductance - Negligible

Capacitance - Negligible

Obsolete Load Cells

The following load cells are approved for use with the *PUMA* terminal but are **OBSOLETE**.

PART NUMBER	DESCRIPTION
049660020	5000#
049661020	5000#
049665020	10K #
049675020	20K #
10358300A	500 #
10358800A	500 #
10361000A	500 #
10361300A	500 #
10480000A	15 #
10480000B	15 #
10480200A	25 #
10480200B	25 #
10480500A	100 #
10480500B	100 #
10480600A	200 #
10480600B	200 #

10530400A	100K#
10531500A	100K#
10850200A	5000#
10850300A	10K #
10865600A	15 #
10865700A	25 #
10865800A	100 #
10865900A	200 #
10866000A	4 #
11048200A	10,000 #
11101300A	100 #
11101400A	100 #
11101500A	100 #
11101600A	100 #
11101700A	200 #
11101800A	200 #
11101900A	200 #
11102000A	200 #
11102400A	100 #
11103800A	500 #
11103900A	500 #
11104000A	500 #
11104100A	500 #
11104200A	1000#
11104300A	1000#
11104400A	1000#
11104500A	1000#
11114400A	2000#
11114500A	2000#
11114600A	2000#
11114700A	2000#
11115500A	200 #
11370400A	1000#
11370500A	2000#
11370600A	1000#
11370700A	2000#
11390600A	500 #
11390700A	500 #

11436000A	500 #
11436100A	500 #
11436200A	1000#
11436300A	1000#
11436400A	2000#
11436500A	2000#
11436600A	500 #
11436700A	500 #
11436800A	1000#
11436900A	1000#
11437000A	2000#
11437100A	2000#
11599300A	2500#
11599300B	2500#
11599500A	1000#
11599500B	1000#
11599900A	20K #
11599900B	20K #
11785200A	500 #
11785300A	500 #
11785600A	500 #
11785700A	500 #
11786100A	500 #
11786500A	500 #
11786900A	1000#
11787300A	1000#
11787700A	1000#
11788100A	1000#
11788500A	2000#
11788900A	2000#
11789300A	2000#
11789700A	2000#
11919200A	5000#
11919400A	10K #
11962800A	5000#
12744300A	500#
12744500A	1000#

12744700A	2000#
13077500A	20K #
13077500B	20K #
13077500C	20K #
13078900B	5K #
13078900C	5K #
13079300B	3K #
13079300C	3K #
13117600A	200 #
13117700A	500 #
13117800A	1000#
13117900A	2000#
13118000A	5000#
13118100A	10K #
13136900B	1K #
13136900C	1K #
A049680020	50K #
A09622700A	100 #
A09622700B	200 #
A09622700C	500 #
A09622700D	1000#
A09622700E	2000#
A09622700L	500 #
A09622700M	1000#
A09622700N	2000#
A10358500A	2000#
A10358900A	1000#
A10358900B	1000#
A10359000A	2000#
A10361100A	1K #
A10361200A	2K #
A10361400A	1K #
A10361500A	2K #
A10528000A	100K#
A10530300A	50K #
A10531400A	50K #
A10980100A	50K #
A10980200A	100K#

A11102100A	100 #
A11102200A	100 #
A11102300A	100 #
A11102500A	200 #
A11103500A	200 #
A11103600A	200 #
A11103700A	200 #
A11596500A	10K #
A11596500B	10K #
A11598900A	15K #
A11598900B	15K #
A11599800A	5000#
A11599800B	5000#
A11785200A	500 #
A11785600A	500 #
A13329000B	45K #
A13329000C	45K #
B09892900A	100 #
B09892900B	200 #
B09892900C	500 #
B09892900D	1000#
B10523700A	50K #
B10525500A	100K#
B10868400A	50K #
B10887700A	100K#
B11102100A	100 #
B11102200A	100 #
B11102500A	200 #
B11103500A	200 #
C11102100A	100 #
C11102500A	200 #
KN716105020	500 #
KN716144020	5000#
KN716329020	1000#

NOTES

Appendix 8: Canadian Standards Association Approval Documents

The following control drawings describe how the analog load cell models listed on Drawing 156305R must be connected. Connection according to these drawings is required by the Canadian Standards Association (CSA). Failure to comply with the requirements of these drawings may impair the safety of the installation with possible injury to personnel or loss of life or property.

Drawing	Type	System/Indicator
152949R	Control Drawings	Intrinsic Safety PUMA (CSA Approved)

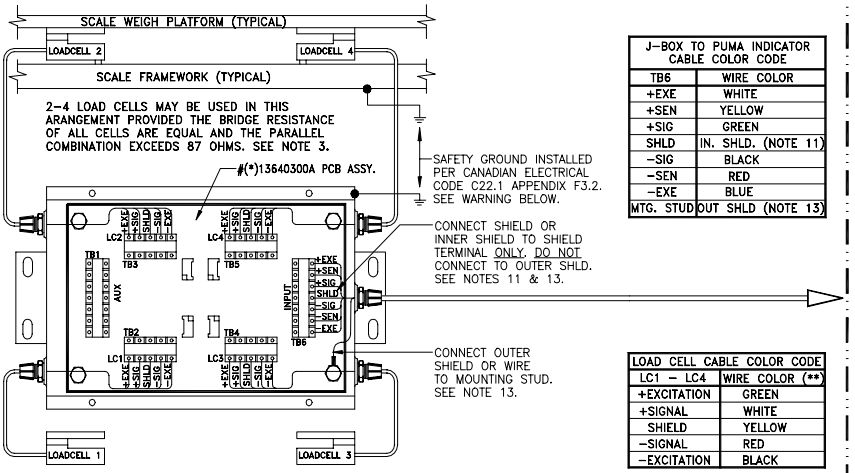
Control Drawings for CSA Approval

The approved installation diagrams (control drawings) on the following pages must be followed when installing the PUMA terminal in hazardous (controlled) locations in order to meet the criteria required to have CSA approval.

LOAD CELL HAZARDOUS AREA

(SEE DRWG. #156305R FOR CSA APPROVED LOAD CELL LIST)

FIGURE 1. 2 TO 4 LOAD CELL INSTALLATION FOR MODELS: 957, 958, 972, 978, 990, 991, 2158, 2256, 2266, MG4500



J-BOX TO PUMA INDICATOR CABLE COLOR CODE	
TB6	WIRE COLOR
+EXE	WHITE
+SEN	YELLOW
+SIG	GREEN
SHLD	IN. SHLD. (NOTE 11)
-SIG	BLACK
-SEN	RED
-EXE	BLUE
MTG. STUD	OUT SHLD (NOTE 13)

LOAD CELL CABLE COLOR CODE	
LC1 - LC4	WIRE COLOR (**)
+EXCITATION	GREEN
+SIGNAL	WHITE
SHIELD	YELLOW
-SIGNAL	RED
-EXCITATION	BLACK

FIGURE 4.

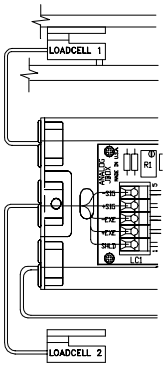
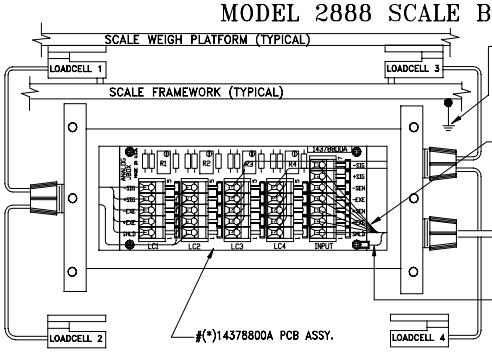


FIGURE 2. 4 LOAD CELL INSTALLATION FOR MODEL 2888 SCALE BASE

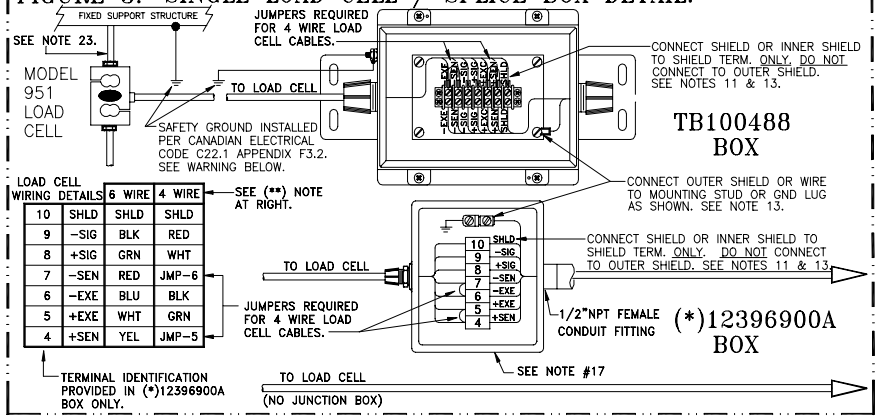


J-BOX TO PUMA INDICATOR CABLE COLOR CODE	
TB6	WIRE COLOR
+EXE	WHITE
+SEN	YELLOW
+SIG	GREEN
SHLD	IN. SHLD. (NOTE 11)
-SIG	BLACK
-SEN	RED
-EXE	BLUE
MTG. STUD	OUT SHLD (NOTE 13)

LOAD CELL CABLE COLOR CODE	
LC1 - LC4	WIRE COLOR (**)
+EXCITATION	GREEN
+SIGNAL	WHITE
SHIELD	YELLOW
-SIGNAL	RED
-EXCITATION	BLACK

FIGURE 5.

FIGURE 3. SINGLE LOAD CELL / SPLICE BOX DETAIL.



LOAD CELL WIRING DETAILS		6 WIRE	4 WIRE
10	SHLD	SHLD	SHLD
9	-SIG	BLK	RED
8	+SIG	GRN	WHT
7	-SEN	RED	JMP-6
6	-EXE	BLU	BLK
5	+EXE	WHT	GRN
4	+SEN	YEL	JMP-5

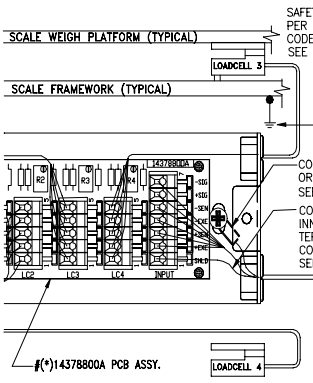
SEE (**) NOTE AT RIGHT.

FIGURE 6.

LOAD CELL HAZARDOUS AREA

(SEE DRWG. #156305R FOR CSA APPROVED LOAD CELL LIST)

4 LOAD CELL INSTALLATION FOR MODEL 2254 BASE.



J-BOX TO PUMA INDICATOR CABLE COLOR CODE	
TB6	WIRE COLOR
+EXE	WHITE
+SEN	YELLOW
+SIG	GREEN
SHLD	IN. SHLD. (NOTE 11)
-SIG	BLACK
-SEN	RED
-EXE	BLUE
MTG. STUD	OUT SHLD (NOTE 13)

LOAD CELL CABLE COLOR CODE	
LC1 - LC4	WIRE COLOR (**)
+EXCITATION	GREEN
+SIGNAL	WHITE
SHIELD	YELLOW
-SIGNAL	RED
-EXCITATION	BLACK

WARNING
ONLY ONE LOAD CELL INSTALLATION TO BE CONNECTED TO INDICATOR

TO PUMA INDICATOR. SEE SH. #2
MAXIMUM EXTENDED LENGTH OF CABLE IS 400 FT.(122M) USING METTLER TOLEDO #540620370 OR (*)150245OOA (#20 GA) OR #540616370 OR (*)151191OOA (#16 GA) CABLES ONLY. SEE SHEET 3 FOR IMPORTANT INSTALLATION NOTES

TO LOAD CELL CONFIGURATION AS SHOWN AT LEFT. USE ONLY ONE CONFIGURATION WITH ABOVE CABLE.

(**) NOTE-SOME 4 CONDUCTOR LOAD CELL CABLES DO NOT CONFORM TO THIS COLOR CODE. CHECK THE MANUFACTURER'S DATA SHEET IF IN DOUBT.

SEE SHEET #3 OF 3 FOR ADDITIONAL IMPORTANT NOTES.

NOTICE
THIS ITEM USED IN AGENCY APPROVED PRODUCT. DO NOT CHANGE DRAWING WITHOUT AGENCY APPROVAL.

BENCH/PORTABLE SINGLE CELL BASE FOR MODELS: GB AND WB SERIES.

PORTABLE SCALE BASE WITH EAGLE LOAD CELL. SIMPLIFIED TOP VIEW WITH PLATTER REMOVED IS ILLUSTRATED BELOW. THIS SCALE BASE IS CLASSIFIED FOR USE IN GAS GROUP ENVIRONMENTS ONLY. SEE FURTHER EXPLANATIONS ON METTLER TOLEDO DRAWING (*)156305R.

EAGLE CELL MOUNTED TO SCALE BASE. CELL HAS 10 FEET (3M) MAXIMUM, OF 6 CONDUCTOR CABLE.

(OPTIONAL) CABLE SPLICE BOX SEE FIGURE 3 AT LOWER LEFT

GROUND LUG ATTACHED TO SCALE BASE ACCEPTS A #14 TO #6AWG WIRE.

SAFETY GROUND INSTALLED PER CANADIAN ELECTRICAL CODE C22.1 APPENDIX F3.2. SEE WARNING AT RIGHT.

SCALE BASE WITH EAGLE CELL CABLE COLOR CODE	
FUNCTION	WIRE COLOR
+IN(+EXE)	WHITE
+SEN	YELLOW
+OUT(+SIG)	GREEN
-OUT(-SIG)	BLACK
-SEN	RED
-IN(-EXE)	BLUE
GND	SHIELD

WARNING
SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

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

BENCH/PORTABLE SINGLE CELL FLEXURE BASE FOR MODELS: HD SERIES.

PORTABLE SCALE BASE WITH CANTILEVER LOAD CELL. SIMPLIFIED TOP VIEW WITH PLATTER REMOVED IS ILLUSTRATED BELOW.

SEE FURTHER EXPLANATIONS ON METTLER TOLEDO DRAWING (*)156305R.

CANTILEVER CELL MOUNTED TO SCALE BASE WITH 4 CONDUCTOR CABLE 30 FEET (MAXIMUM) IN LENGTH.

(OPTIONAL) CABLE SPLICE BOX SEE FIGURE 3 AT LOWER LEFT

GROUND LUG ATTACHED TO SCALE BASE ACCEPTS A #14 TO #6AWG WIRE.

SAFETY GROUND INSTALLED PER CANADIAN ELECTRICAL CODE C22.1 APPENDIX F3.2. SEE WARNING AT RIGHT.

SCALE BASE WITH SHEAR BEAM LOAD CELL CABLE COLOR CODE	
FUNCTION	WIRE COLOR (**)
+IN(+EXE)	GREEN
+OUT(+SIG)	WHITE
-OUT(-SIG)	RED
-IN(-EXE)	BLACK
GND	YELLOW (SHIELD)

WARNING
WHEN THIS EQUIPMENT IS INCLUDED AS A COMPONENT PART OF A SYSTEM, THE RESULTING DESIGN MUST BE REVIEWED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL COMPONENTS IN THE SYSTEM AND THE POTENTIAL HAZARDS INVOLVED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

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 THESE PRECAUTIONS COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

WARNING
FOR SAFETY, REBARS AND/OR STRUCTURE & J-BOX USED IN CONJUNCTION WITH THE LOAD CELLS MUST BE CONNECTED TO TRUE EARTH GROUND. THE CELLS MUST ALSO BE ELECTRICALLY CONNECTED TO THE FRAMEWORK THRU MOUNTING OR BONDING WIRE(S). USE MT#74-600004 OR MT#74-600005 GROUND KIT FOR THIS PURPOSE.

REVISED	ZONE	REVISED GROUND NOTES,ADDED MODEL TABLE	BY	CHK'D	APP'D	E.C.N. NO.	DATE
1		ADDED FLIGHTS & REARRANGED NOTES	ACT		JR	54780	4/98
2						54820	10/98

RECORD OF CHANGES

MATERIAL SPEC. | F.S. CODE | FINISH DESCRIPTION | FINISH CODE | DIMENSION TOLERANCE UNLESS OTHERWISE SPECIFIED: XX=±.02, XXX=±.005 DECIMAL, FUNCTIONAL, ANGULAR | DO NOT SCALE DRWG.

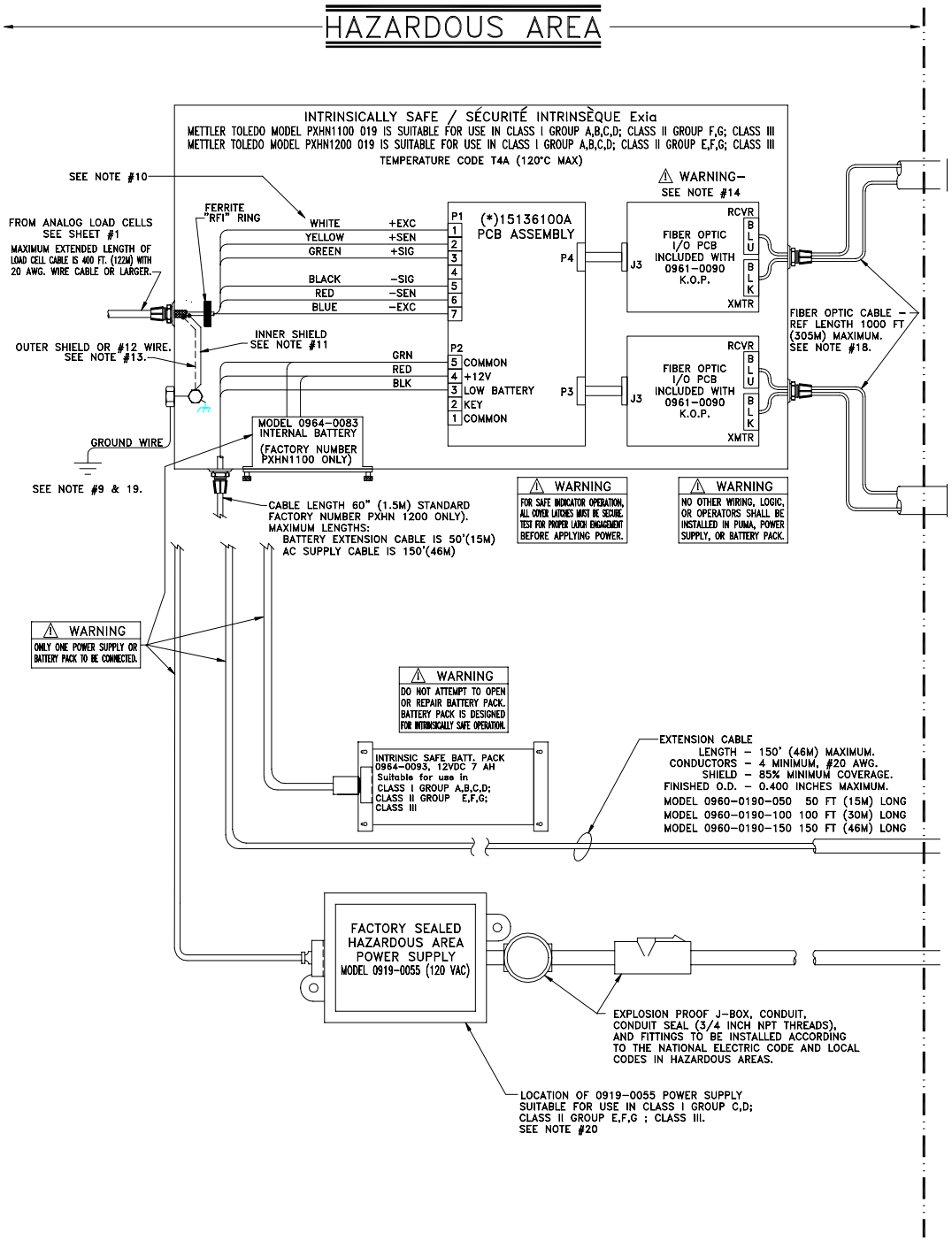
NAME CONTROL DIAGRAM,PUMA INDICATOR
ANALOG LOAD CELL WIRING, CANADA

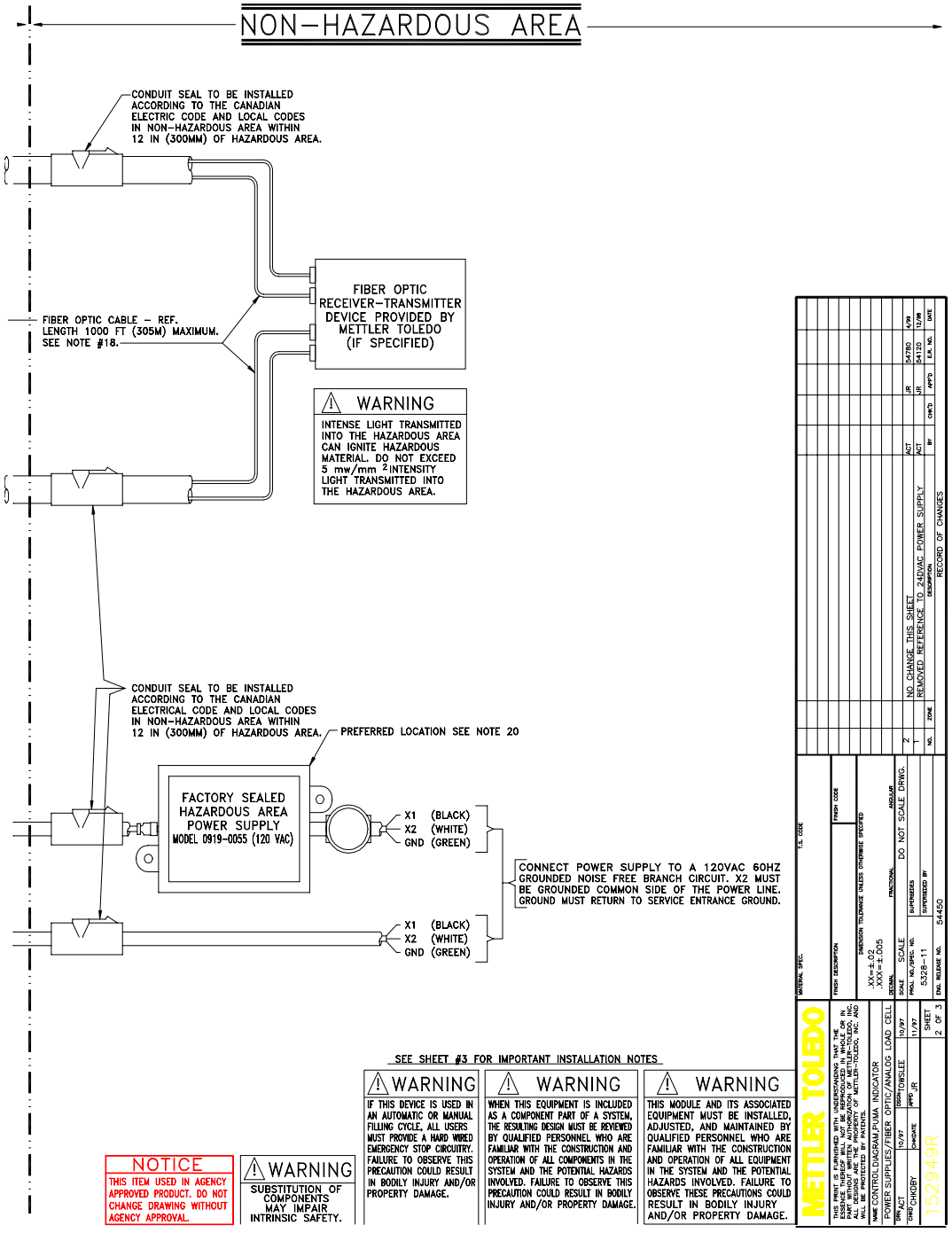
DR	ACT	10/97
CHKD		
DSGR	TOWSLEE	10/97
APP'D	JR	11/97

SCALE | PROJ. NO./SPEC. NO. 5328-11 | ENG. RELEASE NO. 54450 | SUPERSEDES | SUPERSEDED BY | SHEET 1 OF 3

METTLER TOLEDO

152949R


HAZARDOUS AREA
INTRINSICALLY SAFE / SÉCURITÉ INTRINSÈQUE Exia
METTLER TOLEDO MODEL PXHN1100 019 IS SUITABLE FOR USE IN CLASS I GROUP A,B,C,D; CLASS II GROUP F,G; CLASS III
METTLER TOLEDO MODEL PXHN1200 019 IS SUITABLE FOR USE IN CLASS I GROUP A,B,C,D; CLASS II GROUP E,F,G; CLASS III
TEMPERATURE CODE T4A (120°C MAX)
SEE NOTE #10
FERRITE "RFI" RING
FROM ANALOG LOAD CELLS SEE SHEET #1
MAXIMUM EXTENDED LENGTH OF LOAD CELL CABLE IS 400 FT. (122M) WITH 20 AWG. WIRE CABLE OR LARGER.
WHITE +EXC
YELLOW +SEN
GREEN +SIG
BLACK -SIG
RED -SEN
BLUE -EXC
P1
(*)15136100A PCB ASSEMBLY
P4
J3
WARNING- SEE NOTE #14
RCVR
FIBER OPTIC I/O PCB INCLUDED WITH 0961-0090 K.O.P.
BLU
BLK
XMTR
FIBER OPTIC CABLE - REF LENGTH 1000 FT (305M) MAXIMUM. SEE NOTE #18.
OUTER SHIELD OR #12 WIRE. SEE NOTE #13.
INNER SHIELD SEE NOTE #11
GRN
RED
BLK
P2
5 COMMON
4 +12V
3 LOW BATTERY
2 KEY
1 COMMON
P3
GROUND WIRE
MODEL 0964-0083 INTERNAL BATTERY (FACTORY NUMBER PXHN1100 ONLY)
SEE NOTE #9 & 19.
CABLE LENGTH 60" (1.5M) STANDARD FACTORY NUMBER PXHN 1200 ONLY).
MAXIMUM LENGTHS:
BATTERY EXTENSION CABLE IS 50'(15M)
AC SUPPLY CABLE IS 150'(46M)
WARNING
FOR SAFE INDICATOR OPERATION, ALL COVER LATCHES MUST BE SECURE. TEST FOR PROPER LATCH ENGAGEMENT BEFORE APPLYING POWER.
WARNING
NO OTHER WIRING, LOGIC, OR OPERATORS SHALL BE INSTALLED IN PUMA, POWER SUPPLY, OR BATTERY PACK.
WARNING
ONLY ONE POWER SUPPLY OR BATTERY PACK TO BE CONNECTED.
WARNING
DO NOT ATTEMPT TO OPEN OR REPAIR BATTERY PACK. BATTERY PACK IS DESIGNED FOR INTRINSICALLY SAFE OPERATION.
INTRINSIC SAFE BATT. PACK 0964-0093, 12VDC 7 AH
Suitable for use in
CLASS I GROUP A,B,C,D;
CLASS II GROUP E,F,G;
CLASS III
EXTENSION CABLE
LENGTH - 150' (46M) MAXIMUM.
CONDUCTORS - 4 MINIMUM, #20 AWG.
SHIELD - 85% MINIMUM COVERAGE.
FINISHED O.D. - 0.400 INCHES MAXIMUM.
MODEL 0960-0190-050 50 FT (15M) LONG
MODEL 0960-0190-100 100 FT (30M) LONG
MODEL 0960-0190-150 150 FT (46M) LONG
FACTORY SEALED HAZARDOUS AREA POWER SUPPLY MODEL 0919-0055 (120 VAC)
EXPLOSION PROOF J-BOX, CONDUIT, CONDUIT SEAL (3/4 INCH NPT THREADS), AND FITTINGS TO BE INSTALLED ACCORDING TO THE NATIONAL ELECTRIC CODE AND LOCAL CODES IN HAZARDOUS AREAS.
LOCATION OF 0919-0055 POWER SUPPLY SUITABLE FOR USE IN CLASS I GROUP C,D; CLASS II GROUP E,F,G ; CLASS III. SEE NOTE #20


NON-HAZARDOUS AREA
CONDUIT SEAL TO BE INSTALLED ACCORDING TO THE CANADIAN ELECTRIC CODE AND LOCAL CODES IN NON-HAZARDOUS AREA WITHIN 12 IN (300MM) OF HAZARDOUS AREA.
FIBER OPTIC CABLE - REF. LENGTH 1000 FT (305M) MAXIMUM. SEE NOTE #18.
FIBER OPTIC RECEIVER-TRANSMITTER DEVICE PROVIDED BY METTLER TOLEDO (IF SPECIFIED)
WARNING
INTENSE LIGHT TRANSMITTED INTO THE HAZARDOUS AREA CAN IGNITE HAZARDOUS MATERIAL. DO NOT EXCEED 5 mw/mm 2 INTENSITY LIGHT TRANSMITTED INTO THE HAZARDOUS AREA.
CONDUIT SEAL TO BE INSTALLED ACCORDING TO THE CANADIAN ELECTRICAL CODE AND LOCAL CODES IN NON-HAZARDOUS AREA WITHIN 12 IN (300MM) OF HAZARDOUS AREA.
PREFERRED LOCATION SEE NOTE 20
FACTORY SEALED HAZARDOUS AREA POWER SUPPLY MODEL 0919-0055 (120 VAC)
X1 (BLACK)
X2 (WHITE)
GND (GREEN)
CONNECT POWER SUPPLY TO A 120VAC 60HZ GROUNDED NOISE FREE BRANCH CIRCUIT. X2 MUST BE GROUNDED COMMON SIDE OF THE POWER LINE. GROUND MUST RETURN TO SERVICE ENTRANCE GROUND.
X1 (BLACK)
X2 (WHITE)
GND (GREEN)
SEE SHEET #3 FOR IMPORTANT INSTALLATION NOTES
WARNING
IF THIS DEVICE IS USED IN AN AUTOMATIC OR MANUAL FILLING CYCLE, ALL USERS MUST PROVIDE A HARD WIRED EMERGENCY STOP CIRCUITRY. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.
WARNING
WHEN THIS EQUIPMENT IS INCLUDED AS A COMPONENT PART OF A SYSTEM, THE RESULTING DESIGN MUST BE REVIEWED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL COMPONENTS IN THE SYSTEM AND THE POTENTIAL HAZARDS INVOLVED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.
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 THESE PRECAUTIONS COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.
NOTICE
THIS ITEM USED IN AGENCY APPROVED PRODUCT. DO NOT CHANGE DRAWING WITHOUT AGENCY APPROVAL.
WARNING
SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
NO. ZONE DESCRIPTION BY CHK'D APP'D ECR. NO. DATE
2 NO CHANGE THIS SHEET ACT JR 54780 4/98
1 REMOVED REFERENCE TO 240VAC POWER SUPPLY ACT JR 54433 12/97
RECORD OF CHANGES
MATERIAL SPEC. U.S. CODE
FINISH DESCRIPTION FINISH CODE
DIMENSION TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL XX=±.02 XXX=±.005 FRACTIONAL ANGULAR
DO NOT SCALE DRWG.
SUPERSEDES SCALE SCALE
SUPERSEDED BY PROJ. NO./SPEC. NO. 5326-11
ENG. RELEASE NO. 54450 SHEET 2 OF 3
METTLER TOLEDO
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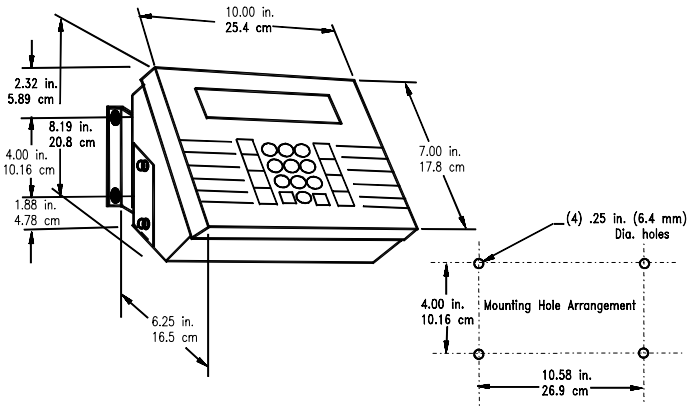
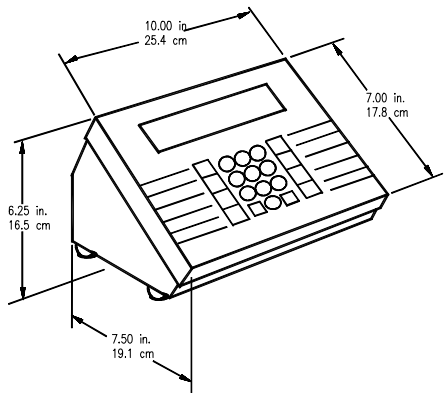
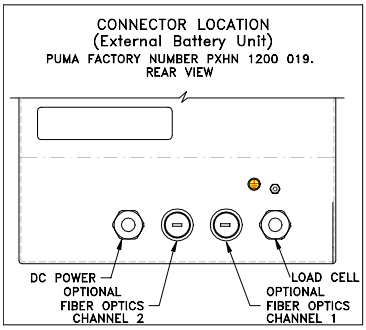
NAME CONTROL DIAGRAM,PUMA INDICATOR
POWER SUPPLIES/FIBER OPTIC/ANALOG LOAD CELL
DRN ACT 10/97 DSGN TOWSLEE 10/97
CHK'D CHK'BY HOUTE APP'D JR 11/97
152949R

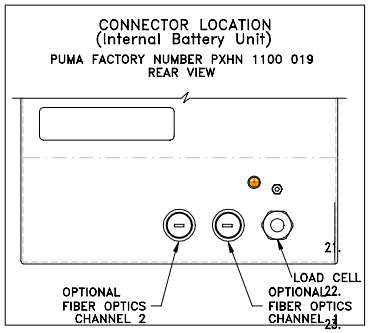


PUMA Wall Mounting Dimensions



PUMA Desk Enclosure Dimensions





INSTALLATION NOTES:

1. ONLY METTLER TOLEDO LISTED SCALE BASES, LOAD CELLS AND CABLE LENGTH VARIATIONS SHALL BE USED IN ORDER TO COMPLY WITH CSA APPROVAL. THE USE OF ANY OTHER LOAD CELL(S) OR CABLE LENGTH WILL VOID CSA APPROVAL.
2. REFERENCE DRAWINGS: (*)136403 – SCHEMATIC OF J-BOX WIRING (FIG1)
   (*)143787R – SCHEMATIC OF J-BOX WIRING (FIG3)
   (*)156305R – CSA APPROVED LOAD CELL SCALE BASES.
3. UP TO EIGHT LOAD CELLS MAY BE USED PROVIDED THE BRIDGE RESISTANCE OF ALL LOAD CELLS ARE EQUAL AND THE PARALLEL COMBINATION EXCEEDS 87 OHMS (4-350 OR 8-750 OHM CELLS).
4. THE LOAD CELLS USED WITH THIS SYSTEM WILL BE EXCITED WITH 1.6VDC. DESIGN SENSITIVITY MUST BE SUCH THAT AT LEAST 0.19 MICROVOLT/GRADUATION IS MAINTAINED TO ESTABLISH AN ACCURATE WEIGHING SYSTEM. (5000 INCREMENTS UTILIZING 30% OF LOADCELL CAPACITY)
5. DO NOT MODIFY THE LENGTH OF 4 CONDUCTOR LOAD CELL CABLES UNDER ANY CIRCUMSTANCES; ALL CELLS MUST HAVE EQUAL CABLE LENGTHS.
6. METTLER TOLEDO RECOMMENDS CONDUIT FOR THE LOAD CELL CABLE UP TO AS CLOSE TO THE LOAD CELL AS POSSIBLE.
7. ALL LOAD CELL CABLE CONDUITS SHALL ONLY CONTAIN LOADCELL WIRING SHOWN HERE; NO OTHER WIRES PERMITTED.
8. ALL CONDUIT SEALS ARE TO BE INSTALLED AND SEALED IN COMPLIANCE WITH THE CANADIAN ELECTRICAL CODE AND APPLICABLE LOCAL ELECTRICAL CODES BY EQUIPMENT INSTALLER.
9. ALL GROUNDING OF EQUIPMENT SHOWN IS TO BE DONE BY EQUIPMENT INSTALLER IN ACCORDANCE WITH CANADIAN ELECTRICAL CODE C22.1 APPENDIX F3.2. (NOTE: THE RESISTANCE OF ALL SAFETY GROUNS BETWEEN INSTRUMENT(S) AND GROUNDING ELECTRODE MUST NOT EXCEED 1 OHM).
10. LOAD CELL CABLE COLOR CODE DESIGNATION MUST BE MAINTAINED AS SHOWN FOR PROPER OPERATION.
11. CONNECT INNER SHIELD OF DUAL SHIELD CABLE (AT J-BOX END) TO TERMINAL MARKED (SHLD) AND TO INSTRUMENT CASE AT OPPOSITE END. IT IS INTENDED TO GROUND THIS SHIELD AT INSTRUMENT END ONLY. DO NOT CONNECT INNER AND OUTER SHIELDS TOGETHER IN THE J-BOX.
12. (*) INDICATES DRAWING MAY HAVE A REVISION LETTER PREFIX
13. THE JUNCTION BOX CHASSIS (OR SCALE FRAME) MUST BE ELECTRICALLY CONNECTED TO THE INSTRUMENT CHASSIS. THIS MAY BE DONE IN ONE OF TWO WAYS:
    A.) USE DUAL SHIELD LOAD CELL CABLE. USE THE INNER SHIELD TO CONNECT LOAD CELL CABLE SHIELDS TOGETHER AND THEN TO INSTRUMENT FRAME. THE OUTER SHIELD CONNECTS J-BOX FRAME TO INSTRUMENT FRAME. DO NOT CONNECT INNER AND OUTER SHIELDS TOGETHER AT J-BOX.
    B.) USE SINGLE SHIELD LOAD CELL CABLE. CONNECT ALL CABLE SHIELDS TOGETHER AND THEN TO INSTRUMENT FRAME. USE A SEPARATE #12AWG OR LARGER WIRE TO CONNECT J-BOX FRAME TO INSTRUMENT FRAME. DO NOT CONNECT WIRE AND SHIELDS TOGETHER AT J-BOX.
14. ONLY SPECIFIED ACCESSORIES ON THIS DRAWING MAY BE USED WITH THIS INSTALLATION. DO NOT SUBSTITUTE COMPONENTS AS THIS WILL IMPAIR INTRINSIC SAFETY OF THE UNIT.
15. DO NOT OPERATE UNTIL YOU HAVE READ AND UNDERSTOOD THE INSTRUCTIONS IN THE PUMA TECHNICAL MANUAL.
16. ALL EXTERNAL WIRING AND INSTALLATIONS MUST CONFORM TO THE CANADIAN ELECTRICAL CODE C22.1 APPENDIX F3.2 AND TO LOCAL CODES IN EFFECT FOR HAZARDOUS (CLASSIFIED) LOCATION WHICH THE ABOVE EQUIPMENT IS INSTALLED.
17. OPTIONAL J-BOX USED ONLY WHEN CABLE SUPPLIED WITH LOAD CELL IS OF INSUFFICIENT LENGTH.
18. USE ONLY UL LISTED AND MARKED (OFNP) FIBER OPTIC CABLE INSTALLED PER U.S.A. NATIONAL ELECTRICAL CODE ARTICLE 770 OR APPLICABLE CANADIAN STANDARD. CABLE MAY BE RUN IN RIGID METAL CONDUIT FOR MECHANICAL PROTECTION IF DESIRED BUT MUST BE IN CONDUIT WHERE IT PASSES THROUGH THE HAZARDOUS/NON HAZARDOUS THRESHOLD.
19. ALL SCALES MUST BE STATICALLY GROUNDED BEFORE BEING USED.
20. PREFERRED LOCATION OF POWER SUPPLY IS IN THE NON-HAZARDOUS AREA. POWER SUPPLY OUTPUT IS INTRINSICALLY SAFE FOR CLASS I GROUPS A, B, C, D; CLASS II GROUPS E,F,G; CLASS III WITH POWER SUPPLY LOCATED IN THE SAFE AREA. WHEN THE POWER SUPPLY IS LOCATED IN THE HAZARDOUS AREA, IT IS ONLY SUITABLE FOR CLASS I GROUP C,D; CLASS II GROUP E,F,G; CLASS III. THIS POWER SUPPLY OPERATES AT LESS THAN 100°C WITH 40°C AMBIENT. TEMPERATURE CODE MARKING IS NOT REQUIRED.

    EXTERNAL INTRINSIC SAFE BATTERY PACK CONNECTIONS USE POWER, GROUND, AND BATTERY LOW CONNECTIONS AT CONNECTOR P2. THE HAZARDOUS AREA POWER SUPPLY USES ONLY POWER AND GROUND CONNECTIONS AT CONNECTOR P2.

    FOR SAFE INDICATOR OPERATION, ALL COVER LATCHES MUST BE SECURE. TEST FOR PROPER LATCH ENGAGEMENT BEFORE APPLYING POWER.

    THE LOAD CELL MUST HAVE A SAFETY GROUND. IF THE LOAD CELL SUPPORT ROD EMPLOYS MECHANICAL ISOLATION WHICH WOULD ELECTRICALLY ISOLATE THE CELL FROM GROUND, A CSA APPROVED BONDING WIRE IS REQUIRED TO ELECTRICALLY BYPASS THE ISOLATION.

NOTICE	⚠ WARNING
THIS ITEM USED IN AGENCY APPROVED PRODUCT. DO NOT CHANGE DRAWING WITHOUT AGENCY APPROVAL.	SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

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

⚠ WARNING
WHEN THIS EQUIPMENT IS INCLUDED AS A COMPONENT PART OF A SYSTEM, THE RESULTING DESIGN MUST BE REVIEWED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL COMPONENTS IN THE SYSTEM AND THE POTENTIAL HAZARDS INVOLVED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

⚠ 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 THESE PRECAUTIONS COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

NO.	ZONE	DESCRIPTION	BY	CHK'D	APP'D	ECR, NO.	DATE
2		NO CHANGE THIS SHEET	ACT	JJR	JJR	54780	4/98
1		CORRECTED DIM.REVISED NOTE 1 & 2	ACT	ACT	ACT	54120	11/98

RECORD OF CHANGES

U.S. CODE — FINISH CODE — MATERIAL SPEC.

FINISH DESCRIPTION

DIMENSION TOLERANCE UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/32
DECIMAL XX=± .02 XXX=± .010
ANGULAR ±0.5°

DO NOT SCALE DRAWING.

METTLER TOLEDO

THIS PRINT IS FURNISHED WITH UNDERSTANDING THAT THE DESIGN AND INFORMATION SHOWN HEREON IS OWNED BY METTLER-TOLEDO, INC. AND WILL BE PROTECTED BY PATENTS.

MADE	DESCRIPTION/LINE1		
DRN	ACT	10/97	
CHKD			
ENGR	ACT	10/97	
APVD	JJR	10/97	
SCALE			
SUPERSEDES			
PANEL NO./SPEC. NO.		5328-11	
SUPERSEDED BY			
DWG. RELEASE NO.		53450	8/98

SHEET 3 OF 3

152949R

Approved Models

The following list of models (drawing 156305R) are approved for use with the PUMA terminal in hazardous area applications when connected as shown on METTLER TOLEDO control drawing 152949R.

Load Cell System		Junction Box	Load Cell	Hazardous area	Ground Kit	152949R
Model Number	Part Number (See notes 1,2)	Part Number	Model Number	Classification (See note 1)	(See note 4)	Control Drawing Fig #
0951	0951xxxx	-none-	736	Groups A,B,C,D only	74-600005	3
0957	0957xxx75-1 0957xxx1X-1 0957xxx2X-1 0957Sxx75xxx 0957Sxx1Xxxx 0957Sxx2Xxxx	TB100391 (3-hole) TB100393 (4-hole) TB100395 (5-hole) TB100481 (6-hole)	743	Groups A,B,C,D only	74-600005	1
	0957xxx20-1 0957xxx45-1 0957Sxx20xxx 0957Sxx45xxx	TB100391 (3-hole) TB100393 (4-hole) TB100395 (5-hole) TB100481 (6-hole)	743	Groups A,B,C,D,E,F,G	74-600004	1
0958	0958xxxX2-1 0958SxxxX2xx	TB100391 (3-hole) TB100393 (4-hole) TB100395 (5-hole) TB100481 (6-hole)	744	Groups A,B,C,D only	74-600005	1
	0958xxxX5-1 0958xxx01-1 0958xxx02-1 0958xxx05-1 0958xxx10-1 0958xxx20-1 0958xxx30-1 0958xxx45-1 0958SxxxX5xx 0958Sxxx01xx 0958Sxxx02xx 0958Sxxx05xx 0958Sxxx10xx 0958Sxxx20xx 0958Sxxx30xx 0958Sxxx45xx	TB100391 (3-hole) TB100393 (4-hole) TB100395 (5-hole) TB100481 (6-hole)	743/745/745A	Groups A,B,C,D,E,F,G	74-600004	1
0972	0972xxxxxx-1	TB100391 (3-hole) TB100393 (4-hole) TB100395 (5-hole) TB100481 (6-hole)	777	Groups A,B,C,D,E,F,G	74-600004	1
0978	097801xxxx	TB100391 (3-hole) TB100393 (4-hole) TB100395 (5-hole) TB100481 (6-hole)	736	Groups A,B,C,D only	74-600005	1
0990	0990xx1xxxx	TB100391 (3-hole)	757	Groups A,B,C,D,E,F,G	74-600004	1
0991	0991xx1xx03 0991xx1xx04 0991xx1xx05 0991xx1xx06 0991xx1xx07 0991xx1xx13	TB100391 (3-hole)	745/745A	Groups A,B,C,D,E,F,G	74-600004	1

Load Cell System		Junction Box	Load Cell	Hazardous area	Ground Kit	152949R
Model Number	Part Number (See notes 1,2)	Part Number	Model Number	Classification (See note 1)	(See note 4)	Control Drawing Fig #
	0991xx1xx14 0991xx1xx15 0991xx1xx16 0991xx1xx17					
2158	2158xx00x0xx 2158Cxxxx0xx	TB100395 (5-hole) TB100481 (6-hole)	744	Groups A,B,C,D only	74-600005	1
	2158xx20xxxx 2158xx40xxxx 2158Cxxxx1xx 2158Cxxxx2xx 2158Cxxxx3xx 2158Cxxxx4xx 2158Cxxxx5xx 2158CxxxxAxx 2158CxxxxBxx 2158CxxxxCxx 2158CxxxxDxx 2158CxxxxExx 2158Exx0xxxx 2158ECxxx	TB100395 (5-hole) TB100481 (6-hole)	745/745A	Groups A,B,C,D,E,F,G	74-600004	1
2254	2254xxx0xx	TA100562	759	Groups A,B,C,D only	74-600005	4
2256	2256xxx0xxxx 2256Cxxx	TB100395 (5-hole)	745/745A	Groups A,B,C,D,E,F,G	74-600004	1
2266	2266x0xx	TB100395 (5-hole)	745/745A	Groups A,B,C,D,E,F,G	74-600004	1
2888	2888xxx0x1 2888xxx0x2 2888xxx0xA 2888xxx0xB 2888Cxx1xx 2888Cxx2xx 2888CxxAxx 2888CxxBxx	TB100520	745/745A	Groups A,B,C,D,E,F,G	74-600004	2
	2888xxx0x0 2888Cxx0xx	TB100520	744	Groups A,B,C,D only	74-600004	2
GB	GBxxxPX019 or GBxxxPX020	-none-	(*)15181200A (*)15181300A	Groups A,B,C,D only	Not reqd.	5
	GBxxPX019 or GBxxPX020	-none-	(*)15180900A (*)15181000A (*)15181100A	Groups A,B,C,D only	Not reqd.	5
HD	HD050xx HD050xx-x	-none-	744	Groups A,B,C,D only	Not reqd.	6
	HD100xx HD100xx-x HD250xx HD250xx-x	-none-	745/745A	Groups A,B,C,D,E,F,G	Not Reqd.	6
MG4500	MG4500x0xxxx MG4500Cxxx	TB100395 (5-hole) TB100481 (6-hole)	743	Groups A,B,C,D,E,F,G	74-600004	1

Load Cell System		Junction Box	Load Cell	Hazardous area	Ground Kit	152949R
Model Number	Part Number (See notes 1,2)	Part Number	Model Number	Classification (See note 1)	(See note 4)	Control Drawing Fig #
WB	WBxxX019 or WBxxX020	-none-	(*)15557900A (*)15180900A (*)15181000A (*)15181100A (*)15181200A	Groups A,B,C,D only	Not reqd.	5
	WBxxxX019 or WBxxxX020	-none-	(*)15181300A	Groups A,B,C,D only	Not reqd.	5

NOTES:

1. "x" can be any alphanumeric character and is a variable size, material, capacity etc. not critical to hazardous approval.
2. "X" is part of the model number and is fixed.
3. (*) may have a letter prefix.
4. Ground kits (with CSA label) are installed by the MTMS facility on the load cell system specified.

NOTICE
THIS ITEM USED IN AGENCY APPROVED PRODUCT.
DO NOT CHANGE DRAWING WITHOUT AGENCY APPROVAL.

Includes change #3 of 156305R.

Appendix 9: Gravity Compensation Factors—GEO Values

Gravitational Acceleration Forces

Since the acceleration due to the earth's gravity depends on the location, the following causes and relations apply:

Because of centrifugal force and the flattening of the earth, the acceleration due to gravity is approximately five parts per thousand less at the equator than it is at the north and south poles. Therefore, a scale calibrated with a 10 kg load at the North Pole will read 50 grams lighter at the equator (same altitude at each location),

The acceleration due to the earth's gravity also decreases with increasing height above sea level by approximately 0.2 parts per thousand for every 1000 meters. Therefore, a scale calibrated with a 10 kg load at sea level will read two grams light on top of a 1000 meter (3281 feet) mountain.

Irregularities such as uneven density distribution in the earth's crust or special surface structures also influence the gravitational acceleration.

Gravitational Force Adjustment

The ***PUMA*** terminal has built in compensation provisions to allow factory calibration any place in the world with destination correction capabilities to compensate for variances on gravitational forces. If the ***PUMA*** terminal is subjected to a different gravitational force at its destination location, this can be compensated electronically by adjusting the GEO value. The GEO value has 32 settings with each increment size equal to 0.2 parts per thousand. The GEO value for any world location can be found in the following GEO value table, as long as the geographical coordinates and elevation above sea level are known.

The GEO value is entered in setup and stored in non volatile memory in the ***PUMA*** terminal.

GEO Value Table

North or South Latitude in Degrees and Minutes	Height Above Sea Level in Meters										
	0 325	325 650	650 975	975 1300	1300 1625	1625 1950	1950 2275	2275 2600	2600 2925	2925 3250	3250 3575
	Height Above Sea Level in Feet										
	0 1060	1060 2130	2130 3200	3200 4260	4260 5330	5330 6400	6400 7460	7460 8530	8530 9600	9600 10660	10660 11730
0° 0′ - 5° 46′	5	4	4	3	3	2	2	1	1	0	0
5° 46′ - 9° 52′	5	5	4	4	3	3	2	2	1	1	0
9° 52′ - 12° 44′	6	5	5	4	4	3	3	2	2	1	1
12° 44′ - 15° 6′	6	6	5	5	4	4	3	3	2	2	1
15° 6′ - 17° 10′	7	6	6	5	5	4	4	3	3	2	2
17° 10′ - 19° 2′	7	7	6	6	5	5	4	4	3	3	2
19° 2′ - 20° 45′	8	7	7	6	6	5	5	4	4	3	3
20° 45′ - 22° 22′	8	8	7	7	6	6	5	5	4	4	3
22° 22′ - 23° 54′	9	8	8	7	7	6	6	5	5	4	4
23° 54′ - 25° 21′	9	9	8	8	7	7	6	6	5	5	4
25° 21′ - 26° 45′	10	9	9	8	8	7	7	6	6	5	5
26° 45′ - 28° 6′	10	10	9	9	8	8	7	7	6	6	5
28° 6′ - 29° 25′	11	10	10	9	9	8	8	7	7	6	6
29° 25′ - 30° 41′	11	11	10	10	9	9	8	8	7	7	6
South ↑ 30° 41′ - 31° 56′	12	11	11	10	10	9	9	8	8	7	7
31° 56′ - 33° 9′	12	12	11	11	10	10	9	9	8	8	7
33° 9′ - 34° 21′	13	12	12	11	11	10	10	9	9	8	8
34° 21′ - 35° 31′	13	13	12	12	11	11	10	10	9	9	8
35° 31′ - 36° 41′	14	13	13	12	12	11	11	10	10	9	9
36° 41` - 37° 50′	14	14	13	13	12	12	11	11	10	10	9
37° 50′ - 38° 58′	15	14	14	13	13	12	12	11	11	10	10
USA RANGE 38° 58′ - 40° 5′	15	15	14	14	13	13	12	12	11	11	10
40° 5′ - 41° 12′	16	15	15	14	14	13	13	12	12	11	11
41° 12′ - 42° 19′	16	16	15	15	14	14	13	13	12	12	11
42° 19′ - 43° 26′	17	16	16	15	15	14	14	13	13	12	12
43° 26′ - 44° 32′	17	17	16	16	15	15	14	14	13	13	12
44° 32′ - 45° 38′	18	17	17	16	16	15	15	14	14	13	13
45° 38′ - 46° 45′	18	18	17	17	16	16	15	15	14	14	13
North ↓ 46° 45′ - 47° 51′	19	18	18	17	17	16	16	15	15	14	14
47° 51′ - 48° 58′	19	19	18	18	17	17	16	16	15	15	14
48° 58′ - 50° 6′	20	19	19	18	18	17	17	16	16	15	15
50° 6′ - 51° 13′	20	20	19	19	18	18	17	17	16	16	15
51° 13′ - 52° 22′	21	20	20	19	19	18	18	17	17	16	16
52° 22′ - 53° 31′	21	21	20	20	19	19	18	18	17	17	16
53° 31′ - 54° 41′	22	21	21	20	20	19	19	18	18	17	17
54° 41′ - 55° 52′	22	22	21	21	20	20	19	19	18	18	17
55° 52′ - 57° 4′	23	22	22	21	21	20	20	19	19	18	18
57° 4′ - 58° 17′	23	23	22	22	21	21	20	20	19	19	18
58° 17′ - 59° 32′	24	23	23	22	22	21	21	20	20	19	19
59° 32′ - 60° 49′	24	24	23	23	22	22	21	21	20	20	19
60° 49′ - 62° 9′	25	24	24	23	23	22	22	21	21	20	20
62° 9′ - 63° 30′	25	25	24	24	23	23	22	22	21	21	20
63° 30′ - 64° 55′	26	25	25	24	24	23	23	22	22	21	21
64° 55′ - 66° 24′	26	26	25	25	24	24	23	23	22	22	21
66° 24′ -67° 57′	27	26	26	25	25	24	24	23	23	22	22
67° 57′ - 69° 35′	27	27	26	26	25	25	24	24	23	23	22
69° 35′ - 71° 21′	28	27	27	26	26	25	25	24	24	23	23
71° 21′ - 73° 16′	28	28	27	27	26	26	25	25	24	24	23
73° 16′ - 75° 24′	29	28	28	27	27	26	26	25	25	24	24
75° 24′ - 77° 52′	29	29	28	28	27	27	26	26	25	25	24
77° 52′ - 80° 56′	30	29	29	28	28	27	27	26	26	25	25
80° 56′ - 85° 45′	30	30	29	29	28	28	27	27	26	26	25
85° 45′ - 90° 0′	31	30	30	29	29	28	28	27	27	26	26

Appendix 10: NTEP, Weights & Measures, Certificate of Conformance

U.S. Department of Commerce
National Institute of Standards and Technology
Gaithersburg, MD 20899

Certificate Number: 96-160
Page 1 of 2

National Type Evaluation Program

Certificate of Conformance

for Weighing and Measuring Devices

For:

Indicating Element
Digital Electronic
Model: Puma
n_{max}: 5000

Accuracy Class: III/III L

Submitted by:

Mettler-Toledo, Inc.
P.O. Box 1705
Columbus, OH 43216
Tel: (614) 438-4393
Fax: (614) 438-4355
Contact: Darrell Flocken

Standard Features and Options

Indicator is designed to be intrinsically safe
Semi-automatic (push-button) zero
Battery saving feature (sleep mode)
Automatic zero setting mechanism (AZSM)
AC to DC power adapter
Initial zero setting mechanism (IZSM)

Fiber optic communication ports
Semi-automatic push button) tare
Liquid crystal display
Pound, ton, kilogram or gram display capability
Gross / net display
Battery power supply

Programmable as either single weighing range or multi-interval indicating element (up to 3 ranges)

Temperature Range: -10 ^{0}C to 40 ^{0}C (14 ^{0}F to 104 ^{0}F)

This device was evaluated under the National Type Evaluation Program (NTEP) and was found to comply with the applicable technical requirements of Handbook 44, "Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices" Evaluation results and device characteristics necessary for inspection and use in commerce are on the following pages

Effective Date: November 26, 1996
Gilbert M. Ugiansky, Ph.D.
Chief, Office of Weights and Measures

Issue Date: January 30, 1997

Note: The National Institute of Standards and Technology does not "approve", "recommend", or "endorse" any proprietary product or material, either as a single item or as a class or group. Results shall not be used in advertising or sales promotion to indicate explicit or implicit endorsement of the product by the Institute. (See NTEP Policy and Procedures.)

Mettler-Toledo, Inc.
Indicating Element
Model: Puma

Application: A general purpose indicating element to be interfaced with an approved and compatible weighing element.

Identification: A foil badge is glued to the top back of the enclosure and is covered with a clear laminate.

Sealing: The device can be sealed by means of a wire seal threaded through a hole on the right side of the face plate cover and a metal tab on the body of the indicator. This secures access to the sealable parameters.

Test Conditions: The emphasis of the evaluation was on device design, operation and compliance with influence factor requirements. The indicator was attached to a Mettler-Toledo Model GB-ISO kg load receiving element for part of the evaluation and to a load cell simulator for the remainder of the evaluation. The indicator was tested over a temperature range of -lO ^{0}C to 40 ^{0}C (14 ^{0}F to 104 ^{0}F). Additionally, tests were conducted using 10.6 volt DC and 13.2 volt DC power supplies.

The results of the evaluation indicate the device complies with the applicable requirements of NIST Handbook 44.

Type Evaluation Criteria Used: NIST Handbook 44, 1996 Edition

Tested By: M. Kelley (OH)

Appendix 11: Glass Fiber Optic Cable Specification

Fiber optic cable is constructed of a multimode step index glass fiber sheathed in a blue plenum PVC jacket with Kevlar strength fibers. This cable is a UL listed and marked component and passes UL 1581 flame retardancy test. It is marked with the UL listing mark as follows: E9635<UL>OFNP. Safe cable properties in flammable environments, along with non-conductive electrical characteristics of the cable make the use of conduit unnecessary.

The glass core fiber optic cable, 149757R, uses a different crimp ring and connector than earlier plastic core fiber optic cables. However, the outside dimensions of the connector are such that they are compatible with all current fiber optic send/receive hardware. (For example, ***PUMA***, 8525, 8141, dual channel converter and accessories.)

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min.	Max.	Unit
Storage/Operating/Installation Temperature	$T_{S, O, I}$	-40	85	°C
Short Term Tensile Force	F_T		55	lb.
Long Term Tensile Force			28	lb.
Short Term Bend Radius	r	9		mm
Long Term Bend Radius	r	15		mm
Breaking Strength	F_T		100	lb.
Flexing			50,000	Cycles
Flammability	Plenum, Riser, Low-Smoke/Zero Halogen			

MECHANICAL/OPTICAL CHARACTERISTICS, TA=-40 TO +85°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Cable Attentuation	α_o	5	7	10	dB	(650nm LED, 0.5NA) 0 to 70°
	α_o	5	7	12	dB/km	-40 to +85°C
Numerical Aperture	NA	0.35	0.37	0.39		1 = 2 meters
Diameter, Core	D_{CORE}	196	200	204	µm	
Diameter, Cladding	D_{CLAD}	220	230	230	µm	
Diameter, Jacket	D J	2.1	2.2	2.3	mm	
Propagation Delay Constant	I/V		4.8		ns/m	
Mass per Unit Length			4.0		kg/km	Without Connectors

NOTES

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