



10920 Madison Avenue • Cleveland, Ohio 44102
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INSTRUCTIONS FOR MERI-CAL®: PORTABLE DIGITAL MANOMETER/CALIBRATOR

The Meri-Cal is a portable digital device designed for very precise pressure or differential pressure measurements. It is also capable of voltage and current measurements. This dual (*simultaneous*) measurement and display capability, high accuracy and traceability to the N.I.S.T. (*formerly NBS*) uniquely qualify it for calibration of electronic transducer / transmitters as well as mechanical gauges and recorders.

The product employs a piezoresistive pressure sensor, CMOS digital technology and advanced computer calibration techniques that provide superior performance characteristics.

		APPLICATIONS
		Units are limited to clean, non-condensing air or non-corrosive gases.
MODELS	RANGES	
LP200I	0/200" H ₂ O	Gauge Pressure, General Calibrations
LP2000I	0/2000" H ₂ O	Gauge Pressure, General Calibrations
DP200I	0/200" H ₂ O	Differential, Gauge Pressure and Vacuum
DP2000I	0/2000" H ₂ O	Differential, Gauge Pressure and Vacuum
LP200C *	0/200" H ₂ O	Gauge Pressure, CSA Approved-Intrinsically Safe
LP2000C *	0/2000" H ₂ O	Gauge Pressure, CSA Approved-Intrinsically Safe
DP200C *	0/200" H ₂ O	D/P, Gauge Pressure and Vacuum, CSA Approved-Intrinsically Safe
DP2000C *	0/2000" H ₂ O	D/P, Gauge Pressure and Vacuum, CSA Approved-Intrinsically Safe
* See specifications on page 8 for details on CSA approval.		

All units are computer calibrated and certified traceable to the N.I.S.T. Records are maintained and available from Meriam Instrument upon request. Annual recertification is recommended. Consult factory for return material authorization prior to return. Refer to File No. 010:500 for terms and conditions of sale.

Due to continual product review and improvements, all information herein is subject to change without notice.

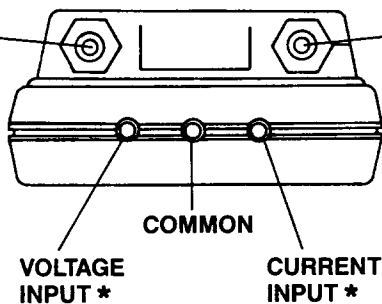
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MERI-CAL[®] FUNCTIONS

P1: HIGH PRESSURE INPUT *

P2: LOW PRESSURE INPUT *
DP Models Only



PRESSURE DISPLAY

VOLTAGE DISPLAY

PRESSURE ANNUNCIATORS:
Indicates unit of pressure being displayed.

VOLTS/CURRENT ANNUNCIATORS:
Indicates which electrical input is being used.

NUMERIC KEYS:
Enters numeric values for user units and conversion function.

USER KEY *:
Allows pressure measurement in units other than those on keypad.

OFF KEY *:
Turns unit off (press any key to turn unit on).

UNIT KEYS:
Selects pressure units to be displayed.

ZERO SET *:
Will zero the unit with all inputs removed.

CLEAR KEY:
Clears numbers entered into

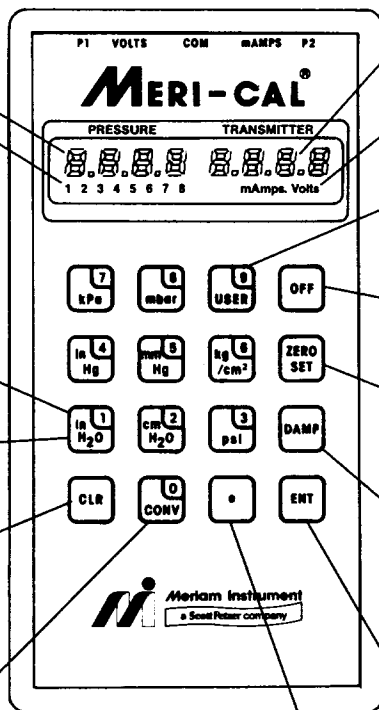
units or function.

DAMP KEY *:
Provides a one second time constant to filter unstable inputs.

CONVERSION FUNCTION: *
Converts a pressure value from one unit to another.

ENTER KEY:
Used with zero set, user units or conversion modes, also switches electrical inputs between current and voltage.

DECIMAL:
Decimal point for numeric entries.



* SEE ADDITIONAL DESCRIPTION ON PAGE 3.

INTRODUCTION

The Meri-Cal digital pressure calibrator achieves its high accuracy and stability through the use of a Microprocessor. There are no user adjustable calibration controls since all calibration data is stored in the internal memory. All Meri-Cals are calibrated on a computer controlled system that applies the various input variables at several different temperatures. The resultant data is used to generate a 25 point calibration table for each range. This system insures that every Meri-Cal shipped is within its stated accuracy. All standards are traceable to the National Institute of Standards and Technology.

OPERATION

PRESSURE INPUTS

LP models are equipped with only a P1 input while DP models are equipped with a P1 and P2 input. LP models can only measure positive pressures applied to the P1 input. The DP models can also measure vacuum by applying the pressure to the P2 input. When measuring differential pressures make sure that the pressure at the P1 input is greater than that at the P2 input. The pressure input fittings are Parker "Presto-lok" fittings. Connections are made to these fittings by inserting a 1/8" nylon or soft copper tube directly into the fitting. The pressure seal is achieved by an "O" ring seal around the outside diameter of the tube and the tube is held in place by a set of metal fingers. The tubing is removed by pressing in on the gray plastic ring, which releases the fingers, and pulling on the tube at the same time.

CURRENT/VOLTAGE INPUT

The current and voltage input jacks accept 0.08 mm pin jacks. The Meri-Cal will automatically switch to the input in use when the input signal exceeds 1 percent of full scale (0.3 mA or 0.3 volts). If the input signal is too low to switch the input, pressing the ENT key will toggle the input between current and volts. The volts and mA annunciator indicates which input is active.

USER KEY

The user key allows the user the capability of displaying the pressure in any desired units within the instrument's range. Pressing the USER key displays the previously stored value. If this is the desired value, press the ENT key and the Meri-Cal will display pressure in the users units. Note that in this mode none of the numeric annunciators are on. If the previously stored value is not desired, merely enter the new value with the number keys followed by the ENT key. This value will be retained until changed. The value to be entered is the full scale range in the desired units. For example, if you wanted to display millimeters of water on a 200 inch range Meri-Cal you would enter 5080 in the users units function, since 5080 millimeters of water equals 200 inches of water.

The Meri-Cal displays water columns referenced to 20°C (68°F). The two other popular reference temperatures for water columns are 15.6°C (60°F) and 4°C (39.2°F). The user's units function can be used to display water column at these different references by multiplying the full scale range by the ratio of the specific gravity at 20°C to that at the desired reference temperature. On a 200 inch range Meri-Cal at 15.6°C use 199.8. For inches of water at 4°C use 199.6.

For example: To determine the constant required to indicate inches of water referenced to 15.6°C you would need the following information:

Sp. Gr. water @ 20°C	=	0.99823
Sp. Gr. water @ 15.6°C	=	0.999
Range of Meri-Cal	=	200 inches of water

Multiplying the range by the ratio of the specific gravities yields the following constant:

$$(0.99823/0.999) \times 200 = 199.8$$

OFF KEY

OFF Key turns unit off (*press any key to turn the unit on*). If no keystrokes occur over a 15-minute period, the unit automatically shuts off to conserve batteries. All programmed values/modes are retained and will function when unit is turned on.

ZERO SET

The ZERO SET key is used to zero the instrument with all inputs removed. Zeroing the instrument is accomplished by pressing the ZERO SET key followed by the ENT key. The ZERO SET key can also be used to hold the displayed value. Pressing the ZERO SET key will freeze the display. Pressing the key a second time will return the unit to normal operation.

DAMP KEY

Pressing this key will provide a 1-second time constant to filter unstable inputs. Flashing annunciators indicate this mode. To return to normal operation press the DAMP key again.

CONV KEY

The CONV function can be used to convert values between any of the engineering units available. Press the CONV key, enter the value to be converted with the number keys followed by the ENT key. Press the units key corresponding to the units being converted. Pressing any other units key will display the value in the selected units. To enter another value press the CLR key and enter the new value. To exit this function press the CONV key.

OTHER FUNCTIONS/DISPLAYS

- "EEEE" is displayed if zero error is beyond range of auto-set capability. Confirm there is no applied pressure, vacuum or electrical input. This display also occurs in conversion mode if overranged.
- "HELP" is displayed if any input is 10% beyond the maximum range of the instrument. (*see page 8 for limits*)
- "Flashing" display (*pressure and transmitter values*) indicates low battery power. Recharge before use.
- "-POL" is displayed if pressure or electrical input is more than 5% of span negative. Check for correct connections. Remove all inputs and reset zero.
- Auto-range feature selects full range (*see page 8*) for 1/10th of full range span for optimum display accuracy. This applies to both pressure and electrical input displays.

For maximum accuracy, zero unit in final operating position at operating ambient temperature before taking measurements.

NOTE:

- Units should be charged before initial use.
- Full charge requires 14 hours.
- Use of Meri-Cal with charger plugged in may cause unstable readings.
- Annual recalibration / recertification recommended.




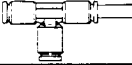







MECHANICAL ACCESSORIES:

BASIC TEST KIT P/N A34477 is an optional accessory for basic pressure connection to Meri-Cal unit. This optional kit includes:

- (1PC) P/N A34103-2
- (1PC) P/N A34102

CALIBRATION KIT P/N A34386 is a standard accessory when the Meri-Cal is supplied in a "kit" format (optional when units are purchased separately). This kit includes:

- (3PC) P/N A34103-3
- (4PC) P/N A34102
- (2PC) P/N A34112
- (1PC) P/N A34141-2
- (2PC) P/N A34099-1

Meriam Part No.	Style	Description
A34103-3		Nylon tube, 6 ft.
A34103-2		Nylon tube, 10 ft.
A34102		Quick connect, tube to 1/8" MNPT
A34112		Quick connect tee fitting
A34141		3/16" Hose barb to 1/8" FNPT
A34099-1		1/8" FNPT to 1/4" MNPT adapter
A34099-2		1/8" FNPT to 1/2" MNPT adapter
DI560		1/4" MNPT plug fitting
A34607-1		Quick connect to 1/8" MNPT adapter
A34606-1		Quick connect to 1/8" FNPT adapter
A34387		Nylon tube cutter

AIR SUPPLY ACCESSORIES:

ASPIRATOR BULB P/N 961AB3

with bleed and check valves and 2 feet hose.

Can produce 20 psi (*dead end service*).

HAND PUMP P/N B34686 with integral bleed and check valves and vernier adjustment is a standard accessory when the Meri-Cal is supplied in a "kit" format.

Can produce 145 psi (*dead end service*).

VACUUM PUMP/VARIATOR P/N B34700

with integral bleed and check valves and vernier adjustment.

Can produce 650 mm Hg (867 mBars) (*dead end service*).

PRESSURE REGULATOR P/N C7117

with integral filter and gauge.

0/125 psig gauge, maximum SWP is 150 psig.

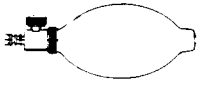

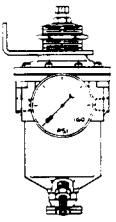
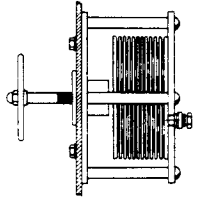
PRESSURE-VACUUM VARIATOR P/N 971A3

Can produce 20 inches (500 mm) Hg. vacuum to 20 psi (*dead end service*).

REPAIR PARTS KIT P/N A34744-1 (For B34686)

A34744-2 (B34700) (*not shown*)

for hand pump no. B34686 or vacuum pump no. B34700 (*above*).

961AB3		Aspirator bulb
B34686		Pressure pump
B34700		Vacuum pump
C7117		Pressure regulator
971A3		Pressure-vacuum variator

ELECTRICAL ACCESSORIES:

*** TEST LEAD KIT P/N A900529-00004**

is a standard accessory when Meri-Cal is supplied in a "kit" format.

Supplied with adapters to connect Meri-Cal voltage/current feature to transmitter/transducer.

*** AC CHARGER P/N B900615-00004**

is a standard accessory when Meri-Cal is supplied in a "kit" format.

Switchable 120/220 Vac; 50/60 Hz.

*** CIGARETTE LIGHTER CHARGER P/N A900529-00003**

12 Vdc. 6ft. wire.

*** LOOP POWER SUPPLY P/N A900005-90300**

24 Vdc. battery powered (*rechargeable*).

Requires battery charger and additional test lead kit (*above*);

For current loop power.

*** LOOP POWER SUPPLY P/N A900005-90400**

24 Vdc. 120 Vac powered.

Requires additional test lead kit (*above*);

For current loop power to transmitter.

*** ADAPTER PLUG KIT P/N A900441-00001**

4 adapter plugs in a vinyl case.

Adapts charger, Part No. B900615-00004, to most outlets around the world.

MISCELLANEOUS ACCESSORIES:

HANGER BRACKET P/N A34517

Stainless steel bracket designed to hold Meri-Cal unit during field use.

SOFT SIDED POUCH P/N B900950-0001

Padded vinyl storage case for Meri-Cal unit.

Standard accessory when Meri-Cal is purchased separately.

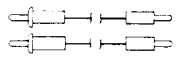
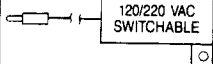
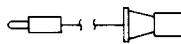
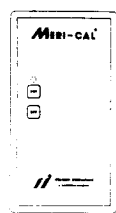
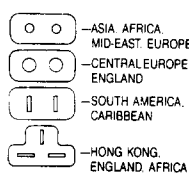
INJECTION MOLDED CASE P/N A34491

Injection molded hard-sided carrying case with die-cut foam insert. Holds Meri-Cal and all standard kit accessories.


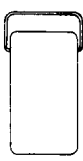
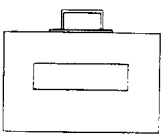
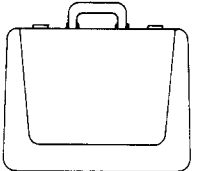
Standard accessory when Meri-Cal is purchased in a "kit" format.

INDUSTRIAL CARRYING CASE P/N D34122

Rugged, single wall injection molded carrying case with die-cut foam insert. Holds Meri-Cal, loop power supply and all standard kit accessories.

Meriam Part No.	Style	Description
A900529-00004		Electronic test lead kit
B900615-00004		AC switchable battery charger
A900529-00003		Cigarette lighter style battery charger
A900005-90300		Rechargeable 24 Vdc. loop power supply
A900005-90400		120 Vac powered 24 Vdc. loop power supply
A900441-00001		Outlet adapter kit

*** CAUTION: DO NOT USE THE CHARGER WITH ANY OTHER PRODUCT. DO NOT ATTEMPT TO CHARGE THE MERI-CAL WITH ANY CHARGER OTHER THAN THOSE ABOVE. DO NOT USE THESE ACCESSORIES IN HAZARDOUS AREAS. REFER TO PAGE 8 FOR DETAILS.**

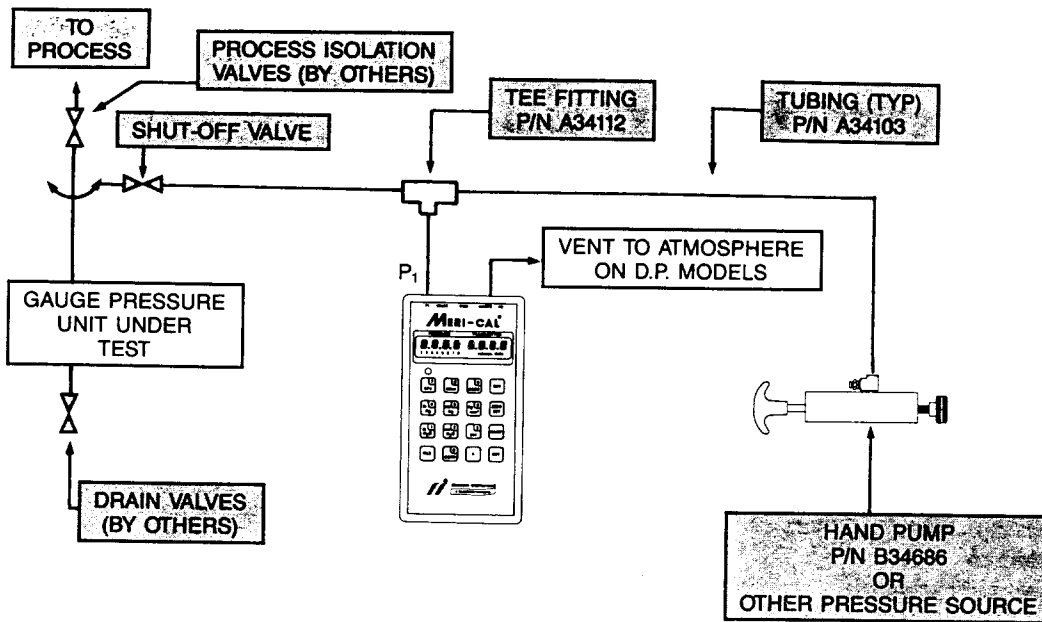
A34517		Hanger bracket
B900950-00001		Soft-sided carrying case approximately 4" x 9" x 2 1/4"
A34491		Injection molded hard-sided case approximately 13 1/4" x 10" x 3 1/2"
D34122		Industrial, injection molded carrying case approximately 18 3/8" x 14 1/4" x 7 1/2"

PNEUMATIC CONNECTIONS

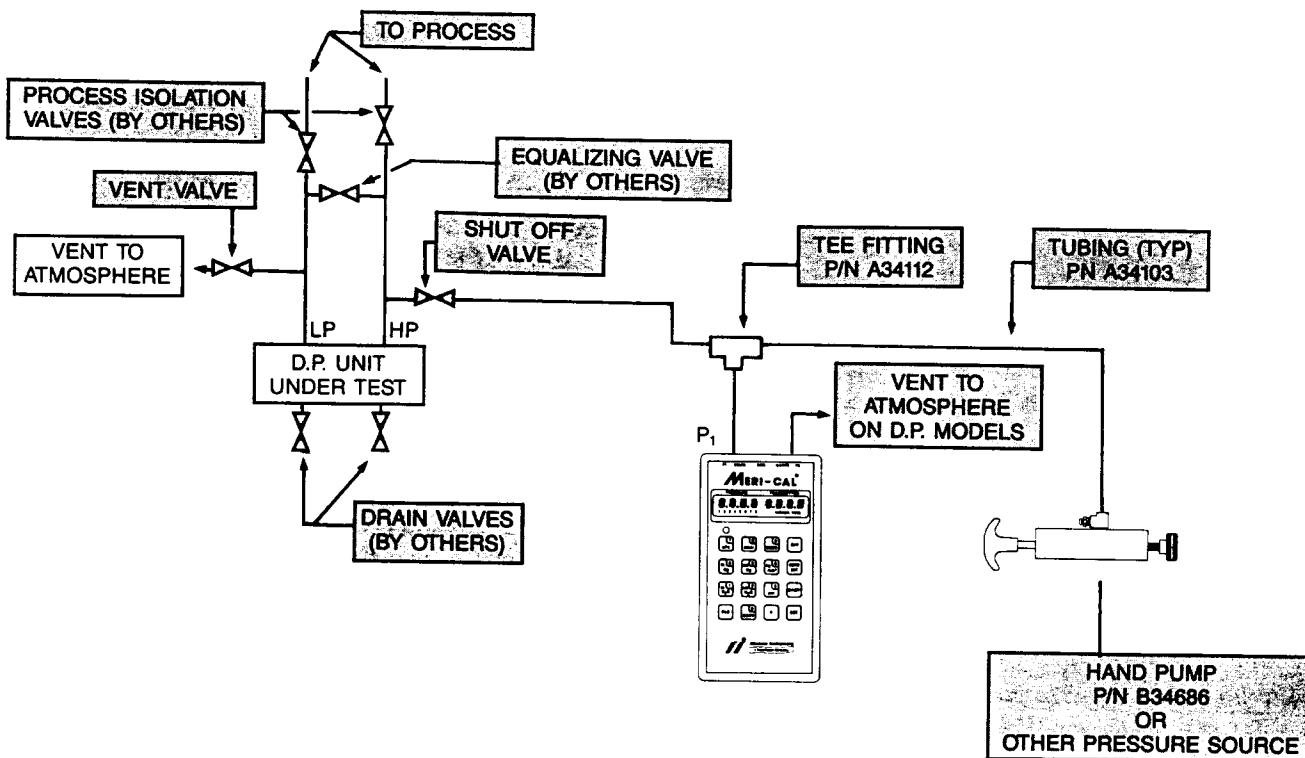
IMPORTANT: FOR USE WITH CLEAN, DRY, NON-CORROSIVE AIR OR GAS ONLY.

Although the following diagrams illustrate calibration set-up, the Meri-Cal can be used for direct process measurements. Refer to page 8 for limitations.

GAUGE PRESSURE SET-UP:

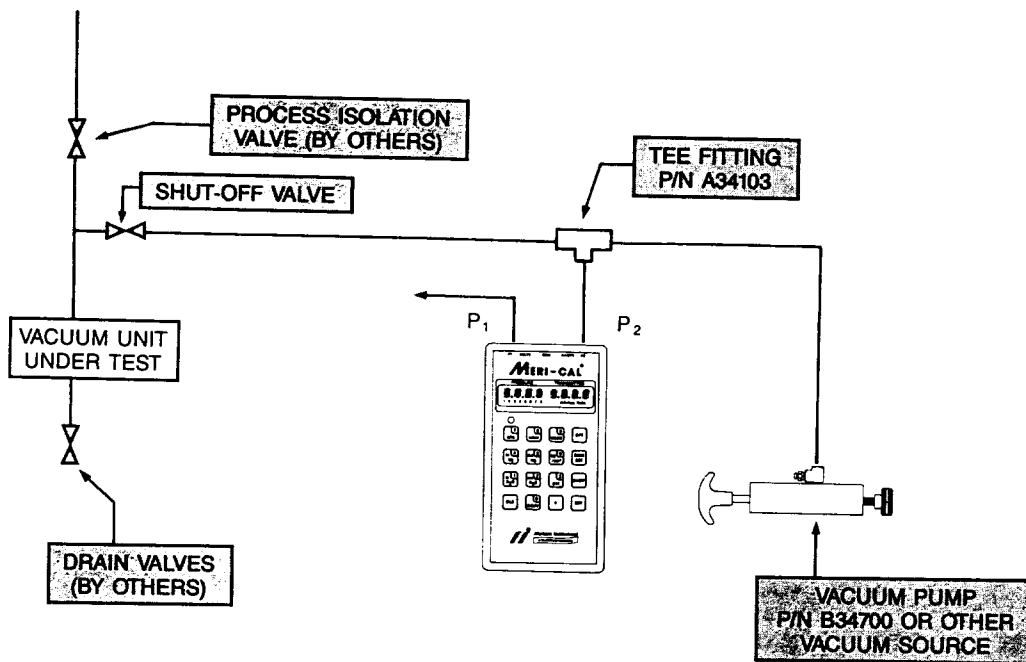


DIFFERENTIAL PRESSURE SET-UP:



PNEUMATIC CONNECTIONS *(continued)*

VACUUM SET-UP: (D.P. MODELS ONLY)

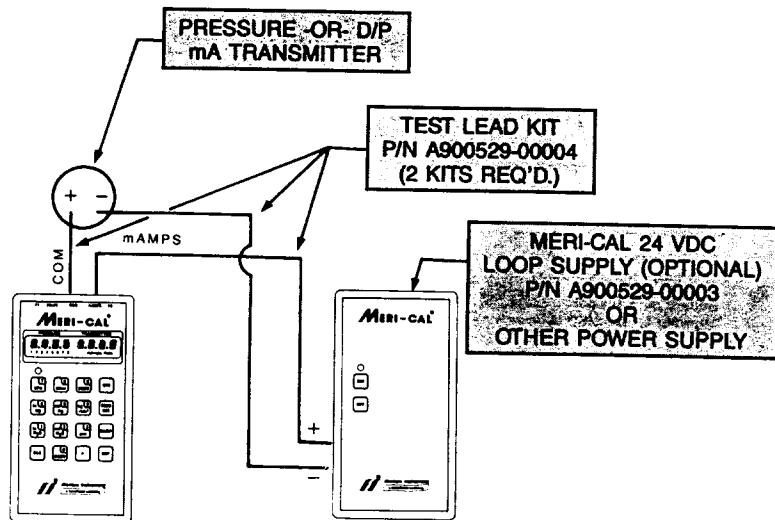


NOTES:

1. CLOSE ALL process valves
2. Open drain valves -or- remove drain plugs and drain ALL liquid from unit under test.
3. Close drains. Seal all threaded connections to prevent leaks.
4. Connect tubing as shown.
5. Turn Meri-Cal on by pressing any key. Open bleed valve on hand pump.
6. Press "zero set" and "enter" key.
7. Close bleed valve and SLOWLY apply pressure. If readings drift down, carefully check all connections for leaks.

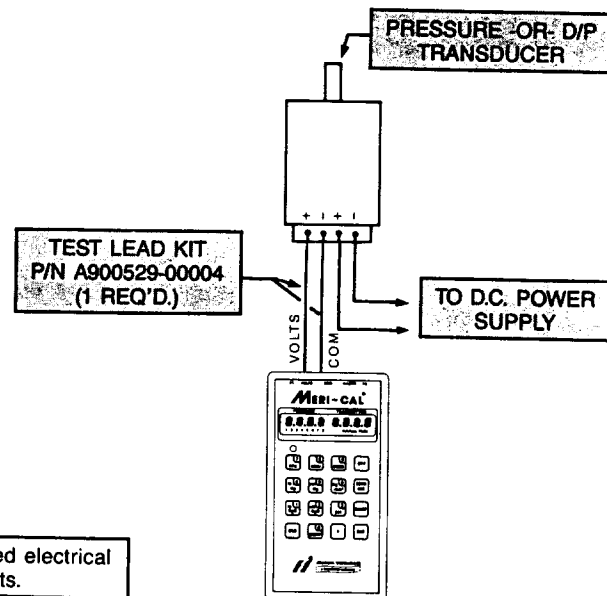
ELECTRICAL CONNECTIONS

MILLIAMP TRANSMITTER CONNECTIONS



CAUTION: Refer to page 8 for recommended electrical connection to CSA approved units.

VOLTAGE TRANSDUCER CONNECTIONS



TECHNICAL DATA

Pressure Range¹: See table below for ranges and standard engineering units provided.

Accuracy: **Pressure**, $\pm 0.1\%$ reading, ± 1 count (includes the combined effects of linearity, hysteresis, repeatability, and temperature over calibrated range). $\pm 0.05\%$ accuracy optional.

Electrical Input, $\pm 0.1\%$ reading (0 to 30 Vdc or 0 to 30 mA), ± 2 counts.

Pressure Limits²: 15 psig (1 bar) for 200" H₂O range units. 150 psig (10 bar) for 2000" H₂O units.

Electrical Limits² ³: 120 Vac or Vdc

Temperature Range: **Operating**, -20° to +122°F (-29° to +50°C). No effect within calibrated range of -4° to +104°F (-20° to +40°C).

Storage, -40° to +140°F (-40° to +60°C).

Wetted Parts: Do not expose sensor to media which is not compatible with nickel, brass, Buna-N, polyurethane, silicone gel and methacrylate ester. **FOR USE WITH CLEAN DRY GAS ONLY. NOT FOR USE ON LIQUID SERVICES.**

Batteries³: Rechargeable Ni-Cad type. When fully charged with Meriam-supplied accessories, operating time is 40 hrs. (continuous) at 70°F or a minimum of 20 hrs. at -20°F. Unit will automatically shut off if any key is not pressed within a 15 min. period.

Loop power Supply (P/N A900005-90300), operates 10 hrs. continuously (2 hr. auto shutoff)

Display: 4 Digit LCD type for pressure and simultaneous 4 Digit LCD type for voltage/current. Digits are 0.3" (7.6mm) high.

Keyboard: Sealed membrane type with chemically resistant polyester surface. Keys are positive tactile feed back type.

Pressure Connections: Quick connect type, accepts most 1/8" O.D. nylon, polyethylene or soft copper tubing. Soft wall tubing such as polyurethane or rubber is not recommended. Tubing must be clean and free of O.D. scratches or sharp burrs to avoid damage to connectors.

Housing: Black, impact resistant injection molded ABS.

Notes: ¹Autorangeing (10:1 turndown) is included. see pg. 3.e). ²Exceeding these limits may cause damage and necessitate repair and/or recalibration and recertification. ³Refer to Meriam DWG A900005-60007 use in hazardous locations.

CAUTION: Calibration checks may be made with suitably accurate/corrected devices. Aside from auto-zero feature (see pg. 3), there are no external adjustments possible. Opening the case assembly voids the warranty.

MAXIMUM RANGES INCLUDED BY MODELS

MODEL	INCHES H ₂ O	CM H ₂ O	PSIG	INCHES HG	MM HG	KG/CM ²	kPa	mBar
LP200 or DP200	200.0	508.0	7.21	14.68	373.0	0.507	49.70	497.0
LP2000 or DP2000	2000.	5080.	72.10	146.8	3730.	5.070	497.0	4970.

NOTE: Conversion factors from National Standards as published in ASTM E-380. Referenced temperature (to define density used) for water column is 68°F (20°C) and for mercury column 32°F (0°C). Consult Meriam for units not listed or for other base temperature conversion factors.

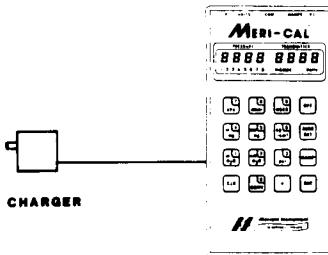
DISPLAY RESOLUTION OF LP/DP200

Unit of Measure	Display Range	Maximum Resolution
Inches H ₂ O	0 to 20.00 20.0 to 200.0	± 0.01 ± 0.1
cm H ₂ O	0 to 50.80 50.8 to 508.0	± 0.03 ± 0.3
PSI	0 to 0.721 0.721 to 7.212	± 0.001 ± 0.004
Inches Hg	0 to 1.468 1.47 to 14.68	± 0.001 ± 0.01
mm Hg	0 to 37.30 37.3 to 373.0	± 0.02 ± 0.2
Kg/cm ²	0 to 0.507	± 0.001
kPa	0 to 4.973 4.97 to 49.73	± 0.002 ± 0.02
MBar	0 to 49.73 49.7 to 497.3	± 0.02 ± 0.2

DISPLAY RESOLUTION OF LP/DP2000

Unit of Measure	Display Range	Maximum Resolution
Inches H ₂ O	0 to 200.00 200 to 2000	± 0.1 ± 1
cm H ₂ O	0 to 508.0 508 to 5080	± 0.3 ± 3
PSI	0 to 7.212 7.21 to 72.12	± 0.004 ± 0.04
Inches Hg	0 to 14.68 14.7 to 146.8	± 0.01 ± 0.1
mm Hg	0 to 373.0 373 to 3730	± 0.2 ± 2
Kg/cm ²	0 to 0.507 0.507 to 5.070	± 0.001 ± 0.003
kPa	0 to 49.73 49.7 to 497.3	± 0.02 ± 0.2
MBar	0 to 497.3 497 to 4973	± 0.2 ± 2

**NON-HAZARDOUS LOCATION
WARNING
CHARGE ONLY IN
NON-HAZARDOUS LOCATION**



CHG.	REVISION	DATE	APPD. BY
C	CHNG.DRWG/CSA	10-8-88	RLW

**HAZARDOUS LOCATION
CLASS I DIVISION 1 GROUPS A, B, C, D
V_{max} = 30VDC I_{max} = 30mA**

To CSA Certified Intrinsically Safe Circuits Only. 30Vdc max, 30mA max.

Warning: To prevent ignition of a hazardous atmosphere, batteries must only be charged in an area known to be nonhazardous.

Advertisement. Pour eviter tout risque d'explosion, les batteries ne doivent être rechargées que dans un emplacement non dangereux confirme.

Exia

Intrinsically Safe. Warning: Substitution of components may impair intrinsic safety.

Securite Intrinsicque. Advertisement: La substitution de composants peut compromettre la securite intrinseque.

Battery pack voltage 4.8Vdc, factory replaceable only.


Battery pack not field replaceable, must be returned to Meriam Instrument for service.

Notice to persons receiving this drawing: Meriam Instrument claims proprietary rights in the material disclosed hereon. This drawing is issued in confidence for engineering information only and may not be reproduced or used to manufacture anything shown hereon without direct written permission from Meriam Instrument.

Unless otherwise specified

1. Shall be free of all burrs and sharp corners
2. All surfaces 125
3. Do not scale drawing
4. Tolerances on machining dimensions are fractional $\pm 1/32$

**INTRINSICALLY SAFE
DIAGRAM**



Meriam Instrument
a Scott Specialty company

CLEVELAND, OHIO, U.S.A.

DRAWN BY RW	DATE 5/12/87
CHECKED BY RW	SCALE
APPROVED BY LL	APPROX. WT. LBS
DWG. SIZE A	900005-60007

NEXT ASSY.	MODEL NO.
USED ON	

DWG AT LEFT IS APPLICABLE TO UNITS WITH CSA LOGO ONLY.