Model 1101
Concrete Maturity Meter

USERS GUIDE

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DWS ELECTRONICS
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IMPORTANT NOTICE

Introduction

The Model 1101 Maturity Meter provides accurate, predicable concrete strength determination by monitoring the concrete temperature via a disposable thermocouple wire. Some of the benefits of using this meter on the construction site include:

- Form and Shoring Removal Time Prediction
- Loading and Post-Tensioning Time Prediction
- Control Of Winter Heating and Insulation Requirements
- Accelerated Construction Scheduling

Years of experience using data logging electronics in construction environments are behind the Model 1101 Maturity Meters Design. It is housed in a water-tight, impact resistant enclosure and includes rechargeable batteries and a low battery indicator.

Thermocouple temperature sensing is utilized to enable long or short cable runs and to allow flexibility and ease of placement of the temperature sensor. Low cost, type "T" thermocouple wire is used. Status indicators include transducer open-circuit and over/under range monitors. Connections are made via a quick-connect thermocouple jack.

Temperature and cumulative degree-hour values are displayed simultaneously on a 1/2" high liquid crystal display. There are no switches or buttons to fail or break - the unit power/reset circuit is magnetically operated.

Please familiarize yourself with this manual before using the meter. There are some helpful hints that could save you time and money.

Meter Operation

Introduction

The Model 1101 Concrete Maturity Meter is a very simple instrument to operate. The measured concrete temperature is displayed continuously along with the maturity "temperature-time" factor. Read through the following operational instructions to become familiar with the meter and then use the appendix as required for more details. Fully charge the battery before the meter is initially used.

If you want to know more about applying the maturity concept to concrete strength estimation, please refer to ASTM C1074-87, "Estimating Concrete Strength by the Maturity Method".

Turning The Meter On and Off

The meter power switch is actuated by holding a magnet against the side of the enclosure which is behind the display (at the bottom center). A magnet is included with the Maturity Meter but virtually any magnet will work. The switch has a toggle operation wherein the magnet must be removed and replaced to turn the power back off. The maturity value is reset by turning the meter off and on.

Alarm Conditions

There are 2 alarm indicators that can be seen on the LCD display. They are:

- "open-circuit" All the decimals will stay on if there is a break in the thermocouple cable. Check the cable and plug wiring.

- "low-battery" The colons (between the digits) will stay on if there is less than 10 percent of the battery charge left. Re-charge the battery as soon as feasible.

Field Preparation

Thermocouples

Thermocouple temperature sensors are used because they are economical and rugged. They are ideally suited to maturity meter applications as different length cables, deep sensor placement and complex form work are easily accommodated.

"T" type thermocouples made of copper - constantan are used. They are available in ± 0.5 or ± 1°C accuracies, in a wide range of wire sizes and insulation types, and are inexpensive. Thermocouple wire can be purchased from most wire companies and is available (along with standard connectors) from distributors of this meter.

Cable Preparation

To prepare a thermocouple temperature transducer you will need a length of "T" type thermocouple wire of 24 gauge or larger size and a standard "T" type thermocouple plug. These plugs are included with the meter and they are available through Maturity Meter distributors or any of a number of different manufacturers. For long cable runs use heavier gauge wire and if the situation warrants, consider the use of armoured cable.

The thermocouple wire has a polarity to it, the copper being the (+) side and the constantan (silver in color) being the (-) side. Disassemble the plug, separate the wire pair one inch (1") and strip half an inch (1/2") off of each lead. Making sure that the polarity is correct, connect the wires to the plug and re assemble.

To form the temperature transducer at the other end of the wire, strip the wire end as above but this time twist the two leads together (use a pair of pliers to insure that the connection is solid). The point where the wire leads are twisted together forms the temperature transducer. To make as permanent a connection as possible it is recommended that the wires be soldered as well. To prevent damage or corrosion, plastic dipping using a material such as "PLASTI-DIP" is also recommended.

Thermocouple cables may be prepared at the office so that site installation is accomplished in as efficient a manner as possible. Cables may be reused by cutting off old cables at the concrete interface and following the same procedure as for a new cable.

Meter and Thermocouple Placement

When using the meter on the construction site you should keep the following points in mind:

- the most common cause of Maturity Meter failures is from accidental damage. Secure the meter away from high traffic areas, material that might be moved when you're not around, and take care in transporting them.

- long cable runs can be a problem if routed through high traffic areas or around material that might be moved. Try to keep the cable lengths as short as possible while making it easy to read the meter's display.

- Concrete is very dense and can rip thermocouple wires when being poured. Vibrators are often used which can cause the reinforcing bars and mesh to vibrate violently. To reduce the possibility of transducer failure, carefully place the wires around the reinforcing bars. Make sure the wiring is done before the forms are completed. For critical areas, wire more than one thermocouple so that you have a backup if a transducer "open circuit" occurs.

- The exterior surface of the meter may be kept clean by protecting it in a case. Contact with wet concrete is to be avoided.

To avoid over estimating the concrete strength, try to place the temperature sensor in a cooler section of the concrete placement. See ASTM standard C1074-87 for more information.

Appendix

Battery Charging/Maintenance

The Maturity Meter uses a sealed lead-acid rechargeable battery. It is an excellent battery, which will stand up to rough operating conditions like overcharge and overdischarge. There is no corrosive gas generation and is of leak-proof design. Under normal conditions the battery life expectancy will be 4 years or more.

~~To charge the battery, unscrew the 4 machine screws holding the clear plastic lid and lift it back on its hinges. Clean the outside the the meter before doing this so that no dirt enters the enclosure. To charge the battery just plug the charger cord into the printed circuit board jack~~. The battery should be charged for a minimum of 24 hours after a complete discharge. The battery should be charged before initial use as well. x SEE ADDITION

Two Important Notes: (1) Static voltage can damage electronic equipment so do not touch the INTERNAL **printed circuit board; and (2) Always recharge the battery immediately after use to avoid battery damage caused by self discharge.** The most effective charging temperature range is 10 to 30 degrees C. Charging above 40 degrees or below 0 degrees C is not recommended. x

Meter operation above or below 20°C temperature will reduce the battery capacity. Battery capacity during long term storage decreases to 80 percent in 8 months at 20 degrees C and 80 percent in 2 months at 40 degrees C. Therefore storage at lower temperatures is preferable.

Meter Care and Attention

The Maturity Meter is housed in a polycarbonate enclosure which is an extremely strong material. It resists scratching, maintains its flexibility over a wide range of temperatures and is impervious to most solvents. With occasional washing the enclosure will stay looking good for a long time.

Cement is hydroscopic in nature and contact with the enclosure will eventually cause the lid machine screws to become devoid of lubrication. A drop of oil will make the screws easier to loosen.

The thermocouple jacks should be kept free of any dirt or concrete dust. Electrical contact cleaner is not recommended but alcohol and a small wire brush could clean out stubborn dirt. x

Maturity Concept Theory

In the last few years there has been a good deal of investigative work done in area of concrete strength determination through electronic temperature measurement. This work is based on the findings of J.M. Plowman, who first advanced the time-temperature rate of gain of strength in portland cement concrete in 1947.

There are various methods of relating the concrete time-temperature data to strength, but most methods employ the integrated value of temperature with time. The "maturity value" is given by:

$$M = SUM[t(T + 10)]$$

where M = Maturity (degrees C * hours)
T = Average concrete temperature (degrees C)
t = Duration of curing (hours)

Interpolation of integrated temperature values on pre-determined strength versus time-temperature graphs enables instant strength calculations. Because concrete continues to gain strength down to about -10 degrees Celcius this value is usually used as the integration "datum temperature" and is the value used by the Model 1101 meter for the maturity "temperature-time" factor calculation. This maturity factor can be adjusted to reflect any desired "datum temperature" by using the technique described on the following page.

Although different concrete mix designs exhibit similar curing characteristics, each should be tested to determine its exact strength/maturity relationship.

Maturity Values are converted to strength estimates through the use of prediction equations. **The subject of converting maturity values to concrete strength estimates is dealt with extensively in the ASTM (American Society for Testing and Materials) Standard C1074-87.** Anyone using maturity meters should obtain a copy of this standard either through your local library or directly through ASTM. This standard also provides instructions on how to select maturity function constants (parameters) for different types of concrete and gives clear example calculations.

Shifting the Datum Temperature

In some situations it might be desirable (for accuracy reasons) to shift the datum temperature in prediction calculations from -10 degrees C to some other value. Maturity readings can be converted to the new datum temperature with the following mathematical manipulations:

First calculate the average temperature for each maturity value recorded. The basic Maturity equation:

$$M = SUM[t(T + 10)]$$

can be re-written as:

$$M = d(Ta + 10)$$

where d = duration of curing (hours)
Ta = average temperature over duration d (degrees C)

therefore:

$$Ta = M/d - 10$$

Converting a maturity value to a new datum temperature is then:

$$M = d(Ta + 10 - [Td + 10])$$

Specifications

Temperature Measurement

Sensor Measurement Range	-10°C to +99°C
Accuracy	±1°C
Thermocouple Wire	Type T

Battery

Type	6V 2.4 Amp-hour Lead Acid
Service Life	3 months at 20°C

Mechanical

Dimensions	4.7" x 4.8" x 2.2"
Case Material	Polycarbonate
Weight	1.5 lbs
Thermocouple Connectors	Omega OST-T-F (plug)

Environmental

Operating Temperature	-20°C to +50°C
Enclosure	Splash Resistant, Impact Resistant

Maturity Value Calculations

Maximum Maturity Values Displayed:

Temperature-Time Factor	19999°C hours

Semiconductors

Part Number	Manuf.	Description	Qty	Unit Cost	Source	Designator Numbers
4013		CMOS Dual D Type Flip Flop	2	0.23	ITT-RAE	U9, U15
4018		CMOS Divide by N Counter	1	0.22	ITT-RAE	U2
4020		CMOS 14 Stage Binary Counter	2	0.33	ITT-RAE	U3, U13
4022		CMOS Divide by 8 Counter, Decoded Outputs	1	0.42	ITT-RAE	U10
4030		CMOS Quad Exclusive OR Gates	1	0.18	Arrow	U14
4071		CMOS Quad OR Gates	1	0.23	ITT-RAE	U6
4081		CMOS Quad AND Gates	1	0.24	Arrow	U1
4093		CMOS Quad NAND Gates	1	0.32	Future	U11
4518		CMOS Dual 4 Bit BCD Counter	1	0.42	Zentronics	U4
4543		CMOS BCD to 7 Segment Display Driver	2	0.57	Zentronics	U5, U7
AD595AQ	ADI	K Type Thermocouple Amp	1	13.95	BBD	U17
TLC27L4-CN or -IN or -AIN or -ACN	TI National	Quad Op Amp	2	1.51	Arrow	U12, U19
ICL7663CPA	Intersil Maxim	Micropower Voltage Regulator	1	1.56	Arrow	U20
ICL7663BCPA	Intersil Maxim	DC to DC Converter	1	2.25	Arrow	U18
ICM7224IPL	Intersil Maxim	4-1/2 Digit Counter/LCD Driver	1	6.63	Arrow	U8
AD7523-AD or -JN	Intersil Maxim ADI	8 Bit D/A Converter	1	1.73	Future	U16
1N4148		Signal Diode	1	0.02	Zentronics	D2
1N5817 or 1N5819		Schottky Diode	1	0.27	ITT-RAE	D1
1N5344B	Motorola	8.2V/5W Zener Diode	1	0.30	Electrosonic	D3

Crystals

Part Number	Manuf.	Description	Qty	Unit Cost	Source	Designator Numbers
MMCC-1	Mtron	32.768 KHz. "At" Cut, Series Crystal	1	0.54	ITT-RAE	X1

Capacitors

Part Number	Manuf.	Description	Qty	Unit Cost	Source	Designator Numbers
C315C100K2G5CA	Kemet	10pF/50V mono, radial, 0.1" spacing	3	0.13	Future	C6, C15, C16
C315C221K2G5CA	Kemet	220pF/50V mono, radial, 0.1" spacing	1	0.11	Future	C14
C320C103K1R5CA	Kemet	0.01uF/50V mono, radial, 0.2", Low TC	1	0.11	Future	C8
UFW104M1	Thomson	0.1uF/50V mono, radial, 0.1" spacing	14	0.07	ITT-RAE	C1, C2, C3, C4, C7, C11, C12, C13, C19, C20, C21, C22, C26, C27
NDA104M16S	Kemet/NEC	0.1uF/16V Tantalum, radial, 0.1" spacing	1	0.19	ITT-RAE	C9
NDA105M16S	Kemet/NEC	1uF/16V Tantalum, radial, 0.1" spacing	1	0.19	ITT-RAE	C5
NDA225M16S	Kemet/NEC	2.2uF/16V Tantalum, radial, 0.1" spacing	1	0.19	ITT-RAE	C10
NDA106M16S	Kemet/NEC	10uF/16V Tantalum, radial, 0.1" spacing	2	0.19	ITT-RAE	C17, C18
TAS106K020P1C or T110B106K020AS	Mallory Kemet	10uF/20V Tantalum, Axial	4	0.62	Arrow	C23, C24, C25, C28

Part Number	Manuf.	Description	Qty	Unit Cost	Source	Designator Numbers
Resistors						
4R7		2.0w, 5%, tape on reel (GS3-4.7ohm)	1	0.075	ITT-RAE	R34
10R0		0.25w, 5%, tape on reel	2	0.008	Intek	R22, R24
15R0			1	0.008	Intek	R33
1K0			2	0.008	Intek	R4, R7
51K0			2	0.008	Intek	R2, R6
100K0			4	0.008	Intek	R9, R12, R13, R28
1M0			5	0.008	Intek	R3, R8, R10, R11, R15
2M0			1	0.008	Intek	R1
10M0			1	0.008	Intek	R14
63K4		0.25w, 1%, 50ppm/C, tape on reel	1	0.025	Zentronics	R20
100K0			1	0.025	Zentronics	R17
249K0			1	0.025	Zentronics	R5
324K0			1	0.025	Zentronics	R23
332K0			1	0.025	Zentronics	R31
453K0			2	0.025	Zentronics	R18, R19
499K0			1	0.025	Zentronics	R16
681K0			1	0.025	Zentronics	R25
976K0			1	0.025	Zentronics	R26
1M0			5	0.025	Zentronics	R21, R27, R29, R30, R32
69PR100K	Beckman	100 Kohm, 20 turn potentiometer	3	1.16	ITT-RAE	P1, P2, P3
Battery						
LCR6V2.4P	Panasonic	6V Lead Acid Battery, 2.4 AH	1	11.66	Micropower	
Connectors & Plugs						
JP-T-F	Omega	Panel Jack, Type T, Standard	1	5.40	Omega	
OST-T-F	Omega	Plug, Type T, Male, Standard, 1 Spare	2	?	Omega	
SS-1187	Waldom	Female 0.187" Faston Terminal	2	0.86	ITT-RAE	
22-23-2041	Molex	4x1 Row Straight Pin Contact	1	0.54	Electrosonic	PC1
22-23-2021	Molex	2x1 Row Straight Pin Contact	1	0.33	Electrosonic	PC2
22-01-2041	Molex	Female Housing to mate with above	1	0.36	Electrosonic	
22-01-2021	Molex	Female Housing to mate with above	1	0.25	Electrosonic	
08-50-0114	Molex	Crimp Terminal Pins for above, Tin	6	0.10	Electrosonic	
206430-1	Amp CPC-1	Square Flange Receptacle	1	1.29	ITT-RAE	
206903-1	Amp CPC-1	Sealing Cap with Plastic Strap	1	2.27	ITT-RAE	
206429-1	Amp CPC-1	Plug Housing to mate with above	1	2.13	ITT-RAE	
66105-2	Amp CPC-1	Socket Contacts for Receptacle	4	0.16	ITT-RAE	
66103-2	Amp CPC-1	Pin Contacts for Plug	2	0.22	ITT-RAE	
206062-1	Amp CPC-1	Cable Clamp for Plug	1	2.38	ITT-RAE	

Part Number	Manuf.	Description	Qty	Unit Cost	Source	Designator Numbers
General						
VI-804-DP-RC-W	VL Elect.	8 Digit, 1/2" LCD with Fixed DIL Pins, -20 to +60 Degree C Operating Range	1	?	Memco	LCD1
or 3922-313-010/050	Hamlin					
or 3922-363-020	Hamlin					
or 3922-363-920	Hamlin					
33.121206	Rose	Polycarbonate Enclosure with Rubber Feet, Machined for Connectors	1	23.31	Memco	
Front Label	Sytek	See Spec Sheet	1	6.00	Sytek	
Serial ID Label	Sytek	See Spec Sheet	1	0.05	Sytek	
PCB	Sterling	2 Layer Printed Circuit Board	1	17.58	Sterling Circuits	
3145	Silicon	RTV Silicon Sealant Tube	0.1	15.00	In Stock	
NN-24-T	Watt-Pearson	Type T Thermocouple Wire, 24 gauge	10 ft	0.10	Watt	
Adhesive	Loktite	Black Max Adhesive	0.1	?	In Stock	
WIT-18R	Richco	Nylon Cable Ties, 4"	4	?	In Stock	
8504	Belden	24 Gauge Stranded Hook-Up Wire: Grey	4.0"	0.095	ITT-RAE	
		Yellow	5.0"	0.095	ITT-RAE	
		Red	3.5"	0.095	ITT-RAE	
		Black	5.5"	0.095	ITT-RAE	
		Orange	2.3"	0.095	ITT-RAE	
		Green	2.3"	0.095	ITT-RAE	
BA0633	Armaco	6 VDC, 300 mA, Wall Transformer	1	6.80	Varah's	
49-512	Radio Shack	Proximity Sensor	1	5.31	Radio Shack	PX1
Hardware						
Custom		Brass PCB Mounting Standoff, 1.25", See Spec Sheet	4		Supplied by Assembly House - Link (material costs included in quote)	
G401C or G300C	Waldom	Vinyl Grommet, 3/16" screw size, 3/8" mounting hole size	4			
#6-32 x 3/4"		Machine Screw, Pan Head	4			
#6		Flat Washer	4			
#4-40		Hex Nut	6			
#4		Internal Star Washer	6			
#4-40 x 1/2"		Machine Screw, Flat Head, Black	5			
#4		Flat Washer, Black	3			
#4-40 x 5/8"		Machine Screw, Flat Head, Black	1			
Custom		Battery Strap, 0.040" Aluminum	1	4.00	Candu Manufacturing, Richmond, B.C.	
Packaging Materials						
Custom	Instabox	Cardboard Box	1	?	Instabox	
Custom	A-Z Sponge	Foam Insert	1	?	A-Z Sponge	
Manual		1101 Operating Guide	1	?	office photocopy & bind	

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Model 1101 Concrete Maturity Meter [Revision Level 3.0]

Assembly, Test and Calibration
20 June 1989

Introduction

Full ESD protection must be provided at all times during assembly and testing. This includes the use of wrist straps, mats and proper handling and storage containers.

To assist in the Assembly and Quality Control of the Model 1101 Concrete Maturity Meter, a sample of a working meter should be partially disassembled and made available for reference.

Printed Circuit Board Assembly

Obtain a copy of the parts placement drawing before starting.

1. Mask off holes for the following components:

   - PCB standoff holes (5)
   - LCD1
   - Thermocouple inputs ("CONS")
   - PC1 & PC2 Connectors

* QA all boards for correct masking before stuffing.

2. Stuff all components except those listed above into PCB while taking note of polarity sensitive devices.

* QA all boards for correct component lead forming, placement, position etc. before wave soldering.

3. Wave solder boards. Wash and Dry. Component leads must be clipped to a length no greater than 0.040".

4. Perform any required rework to seat floated components, etc. Hand stuff the following components:

   - LCD1
   - PC1 & PC2 connectors (underside of PCB)

* QA all boards for proper soldering and general assembly workmanship before testing. Serialize each board during inspection.

Printed Circuit Board Testing

1. Attach the JC1 Test Cable (with a 6V battery connected) to the

PC2 mating posts on the PCB.

2. To turn meter on, temporarily short together the PC2 connector posts. The display should turn on the 8 decimals along the bottom.

3. Adjust P3 (the power supply voltage potentiometer) for 5.000 volts output at U18/pin 1.

4. Short together the Thermocouple "CONS" pads on the board. The display should indicate approximately the room temperature.

If the meter does not seem to be functioning properly, place a red dot on the display and give to the repair center.

Printed Circuit Board Repair

Obtain a copy of the schematic and a functional meter before starting. Visually inspect the board for clean solder joints, shorts, opens, correct component placement and polarities etc. before starting.

1. Power up the meter. Check for proper "+V" and "-V" voltage levels.

2. Measure the oscillator frequency on U14/pin 4 (32.768 kHz).

3. Measure the D/A ramp profile on U19/pin 14.

4. Short together Thermocouple pads and measure U17/pin 8 for voltage output (10mV/°C). Measure U12/pin 8 for -3 times this voltage.

5. Look at pulse train for temperature input at U2/pin 14. Look at pulse train for time-temperature input at U3/pin 10.

6. Check LCD backplane and drive signals (originating from U8).

Enclosure Assembly

1. Cut thermocouple (TC) wire to 4" lengths and strip both ends.

2. Attach TC wire to the panel jack (JP-T-F) screw terminals while taking note of the polarity of the wires.

3. Seal screw terminals and "socket tunnel" on the panel jack with

silicone #3145.

4. Push or Tap the custom Brass standoffs into place after dispensing a small drop of Loctite Black Max adhesive in each plastic boss.

5. Assemble the charge port cable/connector as per wiring details provided. Seal contact holes at rear of connector with Silicon 3145.

6. Attach both the TC panel jack and charge port connector (Amp Receptacle) to the machined polycarbonate enclosure:

a. The TC panel jack uses 2 screw brackets.

b. The Amp receptacle uses 4 mounting holes machined in the plastic. Three are counter-sunk to allow flush installation of the #4-40 flat head machine screws. The last uses a washer and #4-40 Pan Head screw to accomodate the installation of the Amp plastic sealing cap. Lock washers and hex nuts are then used to tighten the receptacle to the wall.

7. To provide a watertight barrier, use additional silicon sealant at the connector/enclosure interface and on the mounting screws.

8. Complete the magnetic switch (PX1) assembly as per the details provided.

9. Attach the Panasonic Battery with Silicon 3145. Immediately install the battery strap using the #4-40 flat head screws thru the bottom of the enclosure. These mounting holes must be sealed to retain a watertight barrier. The magnetic switch is also installed using the same #4-40 x 5/8" screw that is used to mount the strap.

Meter Final Assembly

1. Place the PCB into place in the enclosure.

2. Attach the JC2 cable (Molex) from the magnetic switch to the PC2 posts on the underside of the PCB.

3. Attach the charge port cable Faston connectors to the battery then plug the charge port cable into the PC1 position. Check for a firm connection.

4. Pull the TC wire through the hole beside U17 and solder into place while noting the proper polarity (silver wire to the "CONS" hole).

5. Use the #6-32 screws, flat washers and rubber grommets to mount the PCB to the standoffs. Tighten 3-5 ft-lbs.

6. Attach the Top Cover and Bottom Serial # ID labels. Fully charge the battery.

7. Attach the Amp connector to the 6VDC wall transformer cable as per wiring diagram.

Meter Calibration

2 temperature baths are required for this calibration. One bath is to be at 0°C (ice bath) and the other is to be at 30 to 40°C. The "hot" bath must be at a known temperature. **Do not handle the circuit board for 5 minutes before this test is conducted.**

1. Power up the meter. Adjust P3 (the power supply voltage potentiometer) for 5.000 volts output at U18/pin 1.

2. Adjust P2 (offset potentiometer) for 0.000 volts output at U12/pin 1 (offset op-amp).

3. Place the thermocouple sensor in the "hot" bath. Measure the AD595 output voltage at U17/pin 8 and then adjust P1 (gain potentiometer) for a voltage at U12/pin 7 (gain op-amp) of -3 times the AD595 output voltage.

4. Place the thermocouple sensor in the "ice" bath. Adjust P2 (offset potentiometer) to the point where the "-" sign on the display flickers on and off. The display will not necessarily read 0°C - don't worry about this, the meter conversion resolution is 1° and therefore may display ±1°C.

5. Place the thermocouple sensor in the "hot" bath and adjust P1 (gain potentiometer) to the point where the displayed temperature equals the actual temperature. To reduce the calibration error caused by the 1°C resolution of the display, observe the transition point from the correct value to the next lower of higher value (and note the potentiometer position) and turn the potentiometer back to the appropriate position (best estimate).

6. Re-check the "ice" point setting and adjust if necessary. If an adjustment is made then re-check the "hot" point setting.

Technical Note:

After point 3 above, the circuit will be operating with no offset or gain compensation. The difference between the displayed temperature and the AD595 output temperature (10mV/°C) is the circuit measurement error. The difference between the actual temperature and the AD595 output temperature is the AD595 measurement error. By noting these errors (not required for this test) while measuring the "hot" bath temperature and then placing the thermocouple sensor in the "ice" bath and noting the errors, both the AD595 and circuit offset and gain measurement errors can be determined. It is these errors that are be trimmed out using P1 and P2.

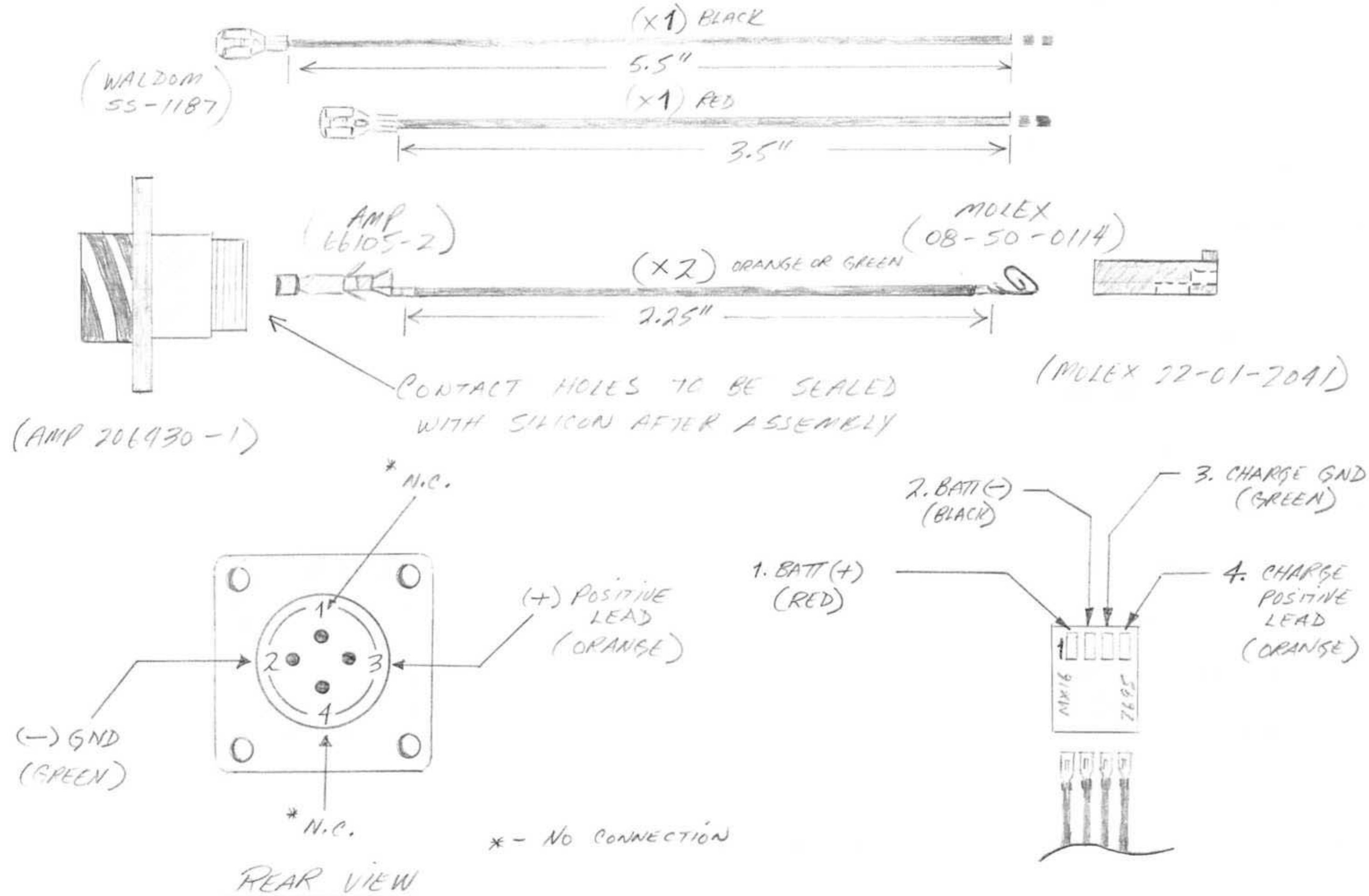
Packaging

The meters are to be shipped with the following accessories:

- 10 feet of TC wire that is prepared as a sensor [soldered and plastic coated on one end, attached to a TC plug (OST-T-F) on the other end]
- 1 spare TC plug
- 6 VDC wall transformer with Amp Plug attached
- Magnet (from internals of 2nd. half of proximity sensor)
- Users Guide
- Warranty Policy/Service Information Card

CMM1101 - CHARGE PORT WIRING DETAILS

June 4/89

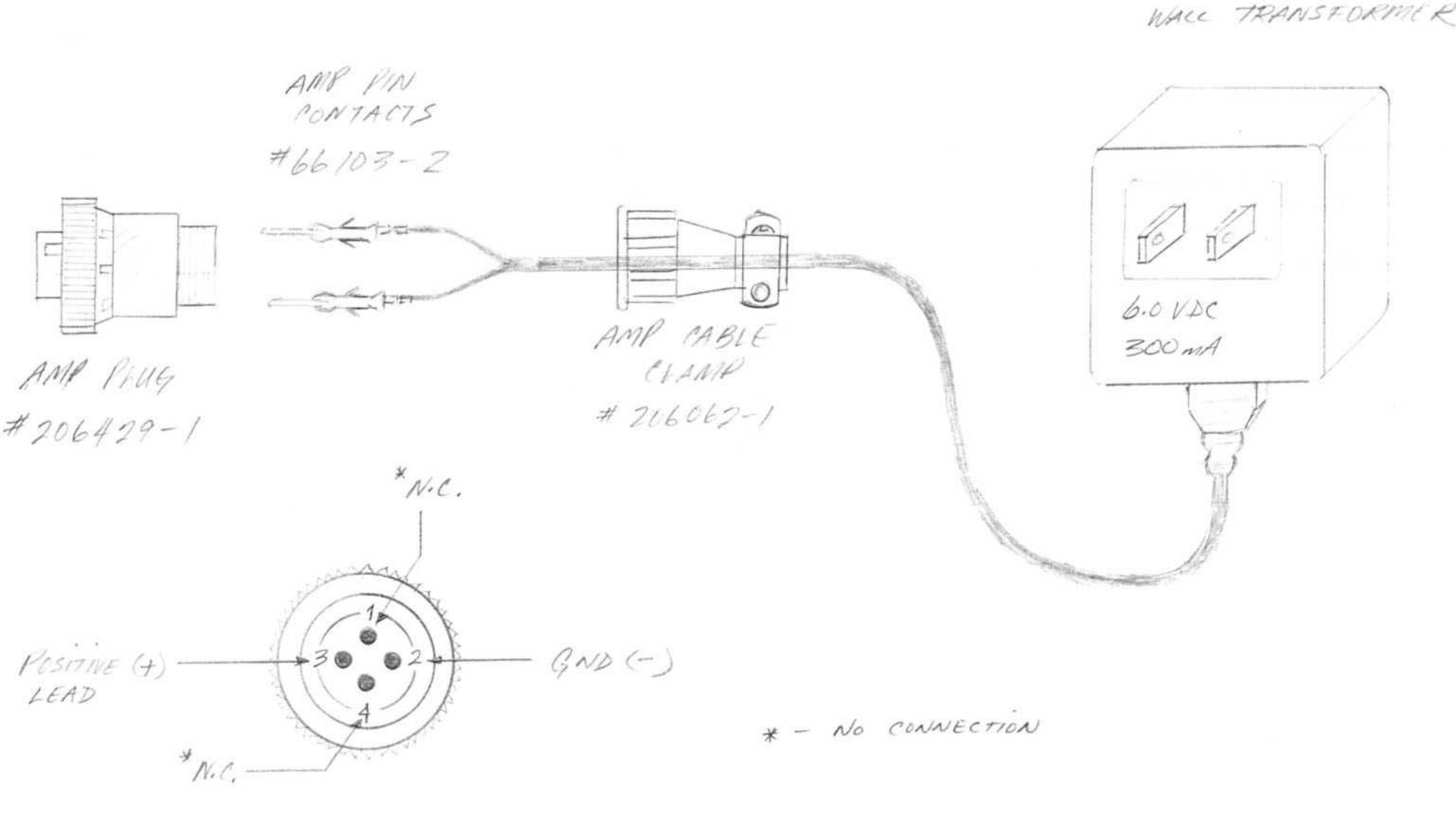


CABLE ASSEMBLY NOTES:

1) CRIMP AMP SOCKET CONTACTS, MOLEX PIN TERMINALS, AND WALDOM FASTON TERMINALS TO THE CORRESPONDING PRE-CUT WIRE LENGTHS:
   - 5.5" BLACK - WALDOM + MOLEX CONTACTS
   - 3.5" RED - WALDOM + MOLEX CONTACTS
   - 2.25" ORANGE - AMP + MOLEX CONTACTS
   - 2.25" GREEN - AMP + MOLEX CONTACTS
2) INSERT AMP SOCKET CONTACTS INTO THE SQUARE FLANGE RECEPTACLE (#206430-1) (THIS INCLUDES TWO UNCONNECTED CONTACTS IN POSITIONS 1+4) AND SEAL THIS END WITH SILICON #3145.

3) TO COMPLETE, INSERT MOLEX PINS INTO THE PIN HOUSING (# 22-01-2041) following THE DIAGRAM. TWIST THE FOUR WIRES TOGETHER OR USE CABLE TIES TO FORM INDIVIDUAL WIRES INTO ONE CABLE.

CMM1101 - MATING CABLE FOR WALL CHARGER.



REAR VIEW-PLUG

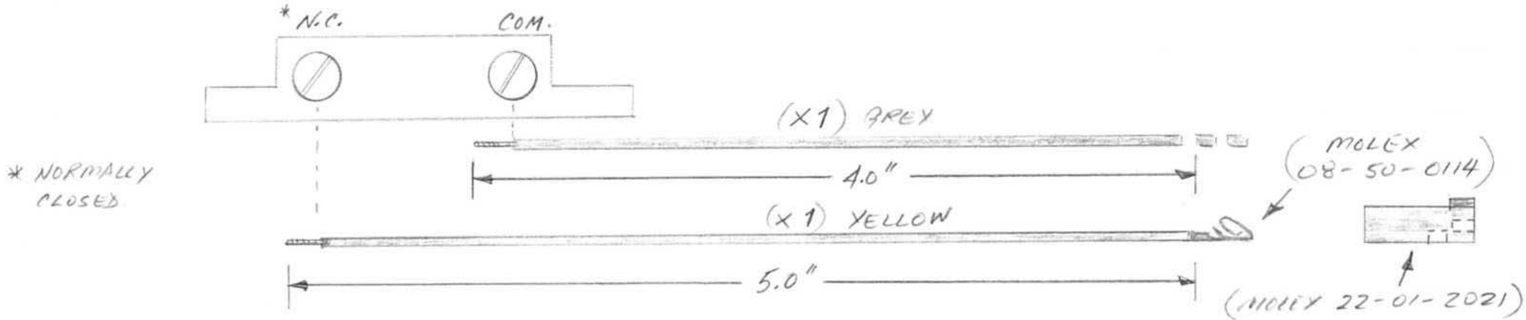
CABLE ASSEMBLY NOTES:

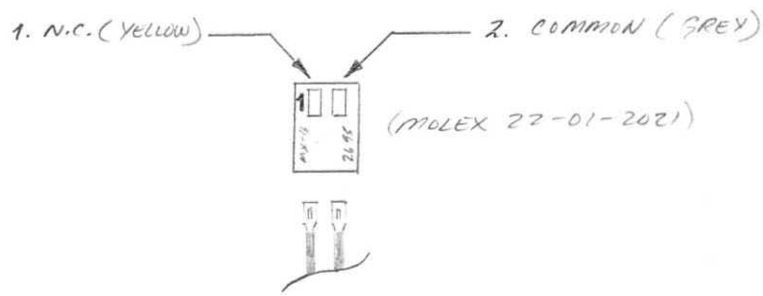
1) CLIP-OFF EXISTING WALL ADAPTER (CHARGER) PLUG AND SPLIT POS. & NEG LEADS APART TO A .75" LENGTH.
2) CRIMP AMP PIN CONTACTS TO EACH LEAD AND THEN FEED THESE THRU THE CABLE CLAMP
3) TO COMPLETE, INSERT PINS INTO THE PLUG AS PER ABOVE DIAGRAM. SCREW CLAMP ONTO PLUG ASSEMBLY AND TIGHTEN CLAMP.

JUNE 5/89

CMM1101 - PX1 SWITCH CONNECTIONS.

(R.S. # 49-512)



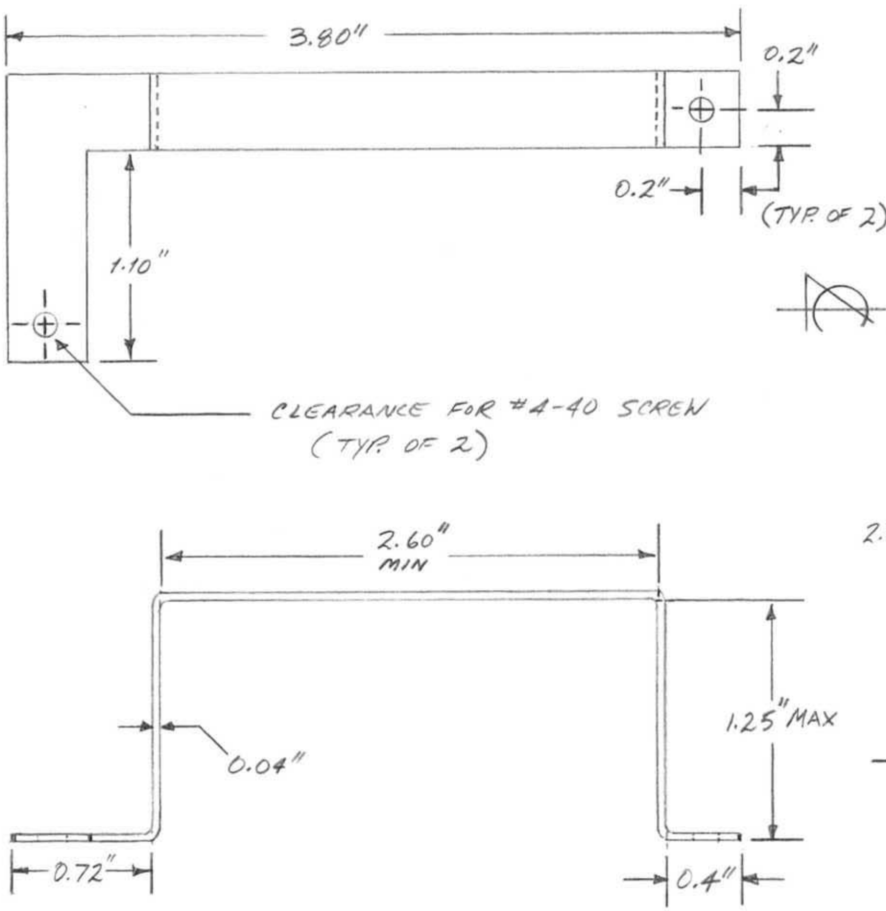


ASSEMBLY NOTES:

1.) CRIMP MOLEX PIN TERMINALS TO THE PRE-CUT & STRIPPED WIRE LENGTHS. (4.0" GREY, 5.0" YELLOW).

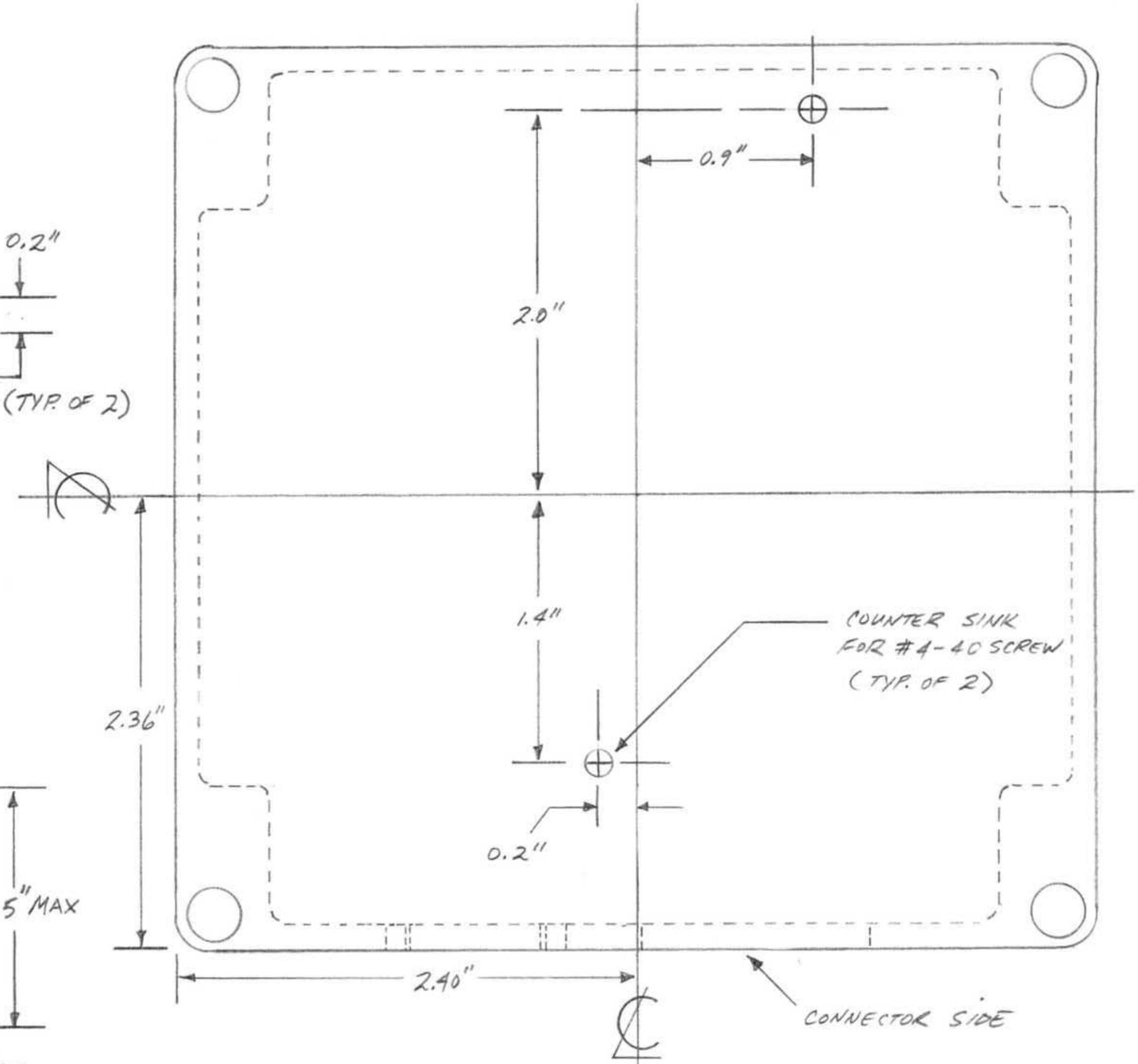
2). ATTACH THE OPEN ENDS OF THE HOOK-UP WIRES TO THE SCREW TERMINAL OF THE MAGNETIC SWITCH. (TIN BARE WIRE ENDS).

3.) TO COMPLETE, TWIST WIRES TOGETHER TO FORM A SINGLE CABLE AND FEED PIN TERMINALS INTO THE PIN HOUSING AS SHOWN ABOVE.



BATTERY STRAP

MATERIAL: Ø.Ø4" ALUMINUM
SCALE: 1 to 1

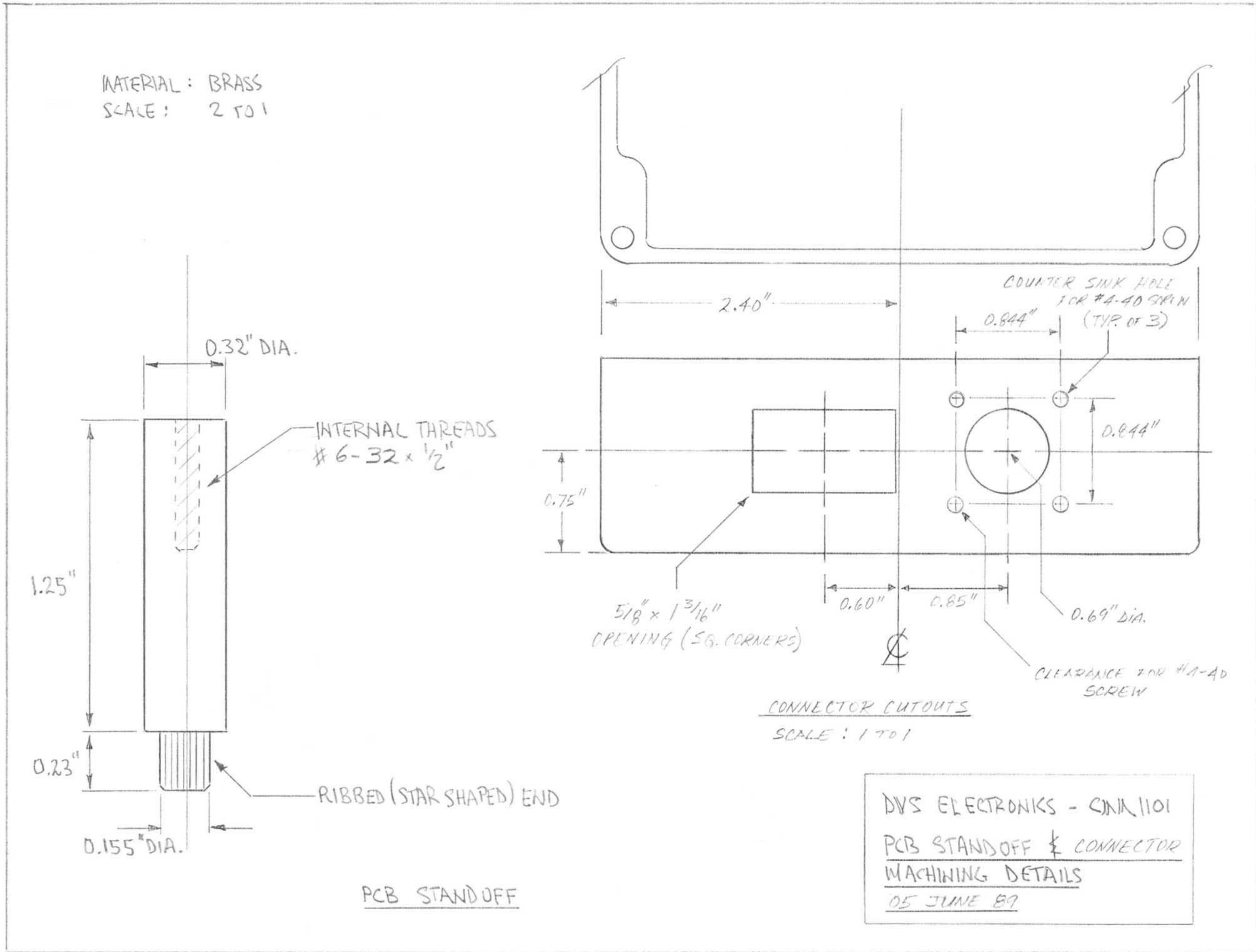


STRAP MOUNTING HOLES
BOTTOM VIEW

DWS ELECTRONICS - CMM1101
BATTERY STRAP & MOUNTING
HOLE MACHINING DETAILS
08 JUNE 89

BATTERY CHARGING / MAINTENANCE CON'T

TO CHARGE BATTERY, UNSCREW PLASTIC SEALING CAP ON THE CHARGE PORT CONNECTOR. (NOTE: THIS SEALING CAP SHOULD BE ON AT ALL TIMES UNLESS THE POWER/CHARGING PLUG IS INSTALLED). INSERT THE AMP MATING PLUG ATTACHED TO THE 6V, 300MA WALL TRANSFORMER AND TWIST TO SECURE.


MATERIAL : BRASS
SCALE : 2 TO 1
0.32" DIA.
INTERNAL THREADS
#6-32 x 1/2"
1.25"
0.23"
RIBBED (STAR SHAPED) END
0.155" DIA.
PCB STANDOFF
2.40"
COUNTER SINK HOLE FOR #4-40 SCREW (TYP. OF 3)
0.844"
0.844"
0.75"
5/8" x 1 3/16" OPENING (SQ. CORNERS)
0.60"
0.85"
0.69" DIA.
CLEARANCE FOR #4-40 SCREW
CONNECTOR CUTOUTS
SCALE : 1 TO 1
DVS ELECTRONICS - CINA 1101
PCB STANDOFF & CONNECTOR
MACHINING DETAILS
05 JUNE 89

ML 1101 Rev 2.0 Sept 20/88