

OPERATIONS MANUAL

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SEA/AIR TEMPERATURE SYSTEM

MOD. TW-2A

(For U.S. Coast Guard use only)

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School of Oceanography
Oregon State University

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INTRODUCTION

PURPOSE

The Model TW-2A sea/air temperature system was developed by Oregon State University for the U. S. Coast Guard so that the Grays Harbor station can report local sea temperature via teletype to the National Weather Service forecast center for their use in making coastal weather forecasts. Sea and air temperature can also be displayed on the Harbor Videocable TV weather display at the station.

TYPE

A thermistor probe senses ambient temperature; the change in thermistor resistance with temperature unbalances a D.C. bridge circuit in a converter box and results in a voltage output which is linear with temperature over the range 32 - 68° F. for sea temperature and 0-100° F. for air temperature. The output voltage is read directly as temperature on analog indicator meters at the cable TV display. The TV display is monitored in the station communications room. The system requires 110v, 60 hz, single phase power at 0.1 amp. to the converter box only.

APPLICATION

Because the sea temperature probe will normally be mounted in a bay or boat basin upstream from the river entrance, the surface water at that site may differ from the nearshore ocean surface water. By installing the probe near the bottom of the water column, nearshore ocean surface temperatures can be approximated. The closest comparison will occur at

high slack tides when the sensing site is filled with ocean water.

The air temperature probe should be mounted in a location with good air circulation near the sea temperature probe.

EQUIPMENT

The thermistor probe, Fig. 1, consists of an epoxy encased bead with 50 feet of vinyl covered shielded two wire cable.

The converter box, Fig. 1, is a watertight aluminum box (with a neoprene gasket) that contains the printed circuit board, ON/OFF switch, fuse, and barrier strip. MS connectors are used for the input and output connections. Outside screw holes have been sealed with silicone grease. Conduit can also be used to feed the AC wires into the box.

Temperatures are indicated on 4-1/2 inch meters with scale markings from 30 - 70° F. for sea and 0 - 100° F. for air temperature. A small board on the back of each meter contains a resistor and a 2.5 K potentiometer for calibration purposes. Press-on letters and numbers have been used for the meter dial scale markings. Figures 2 and 3 are schematic diagrams of the converter box.

Figure 1

Sea/Air Temperature System Components

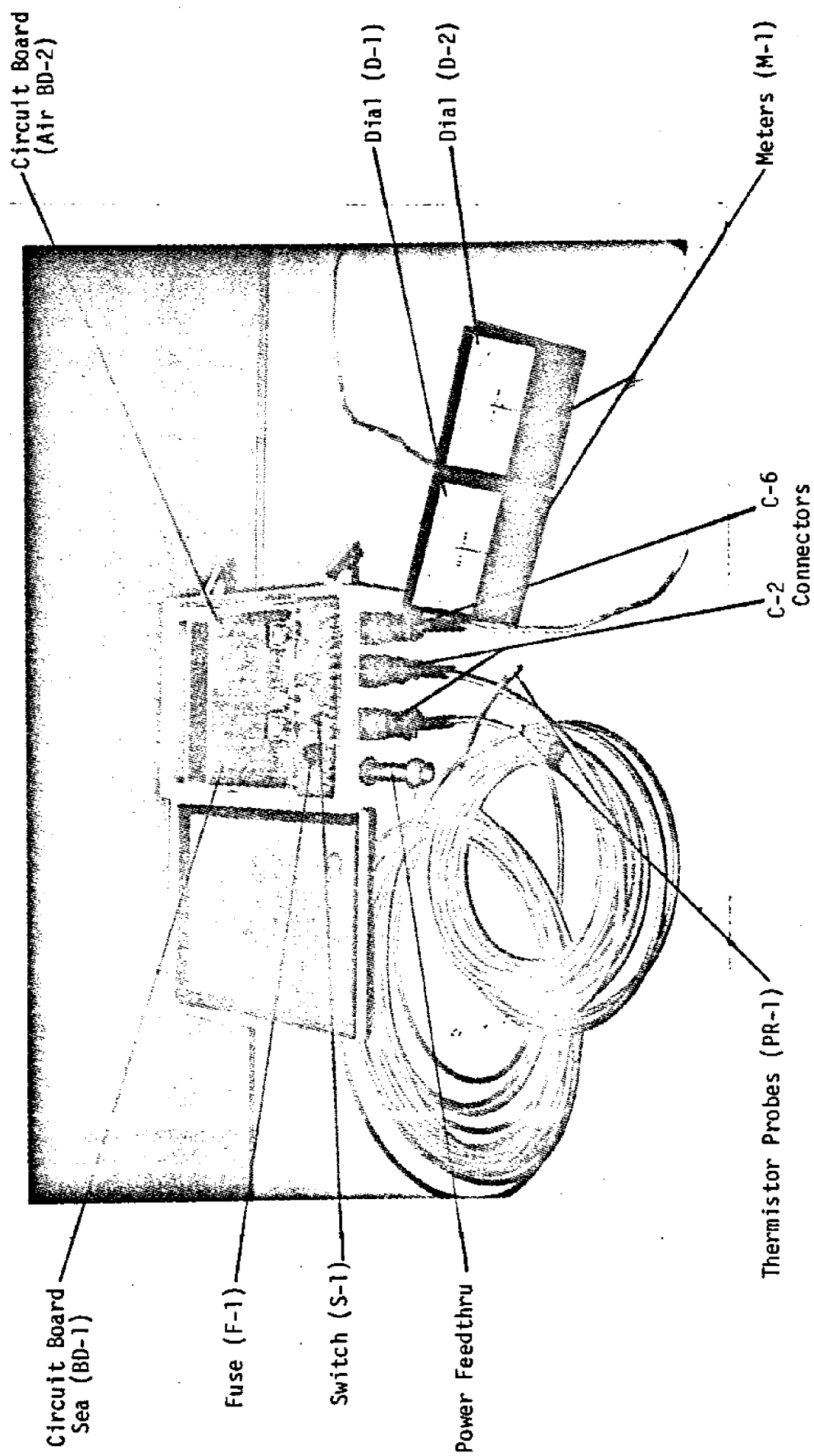


Figure 2
SEA TEMPERATURE

MODEL TW-2A CONVERTER BOX SCHEMATIC

1 July 1976

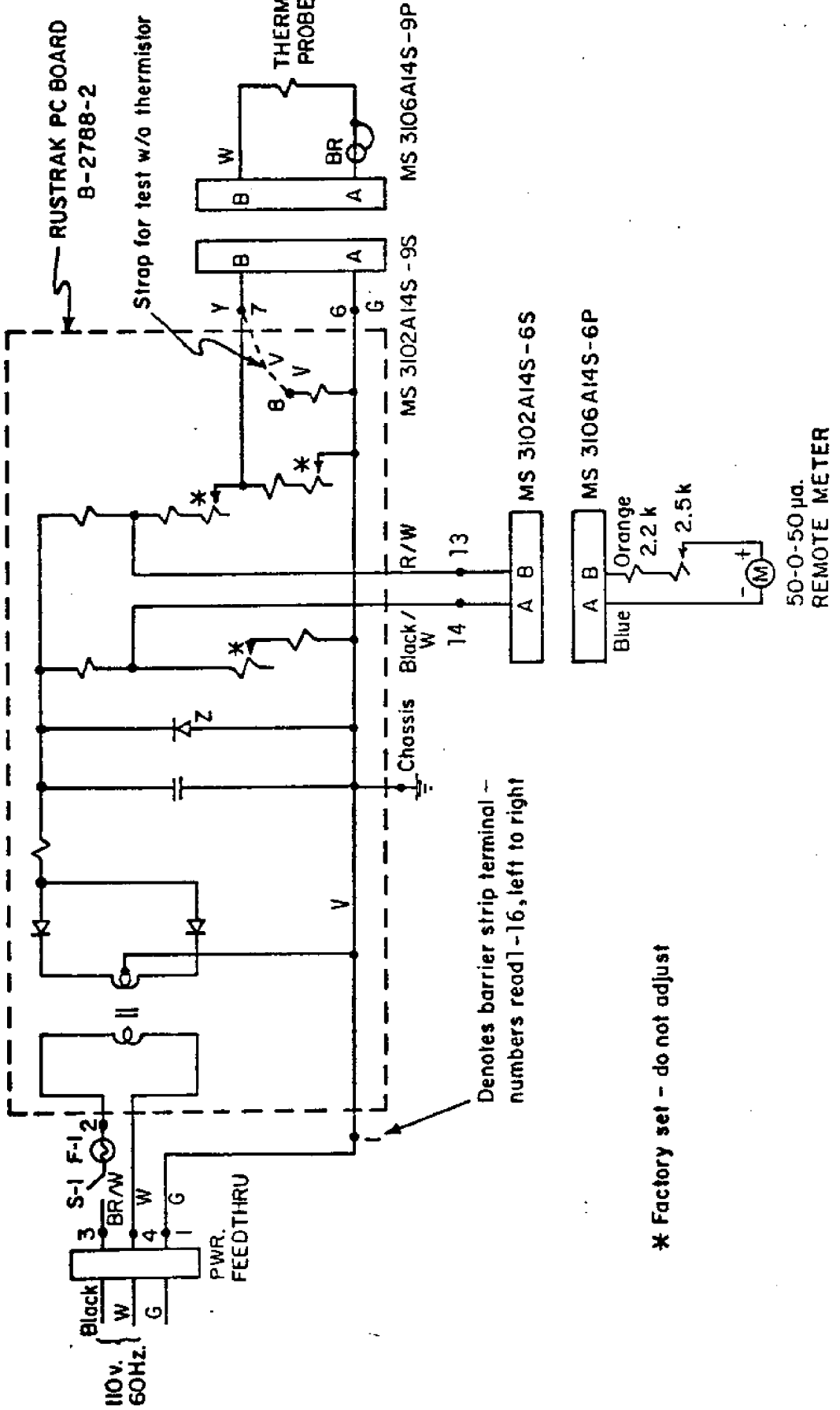
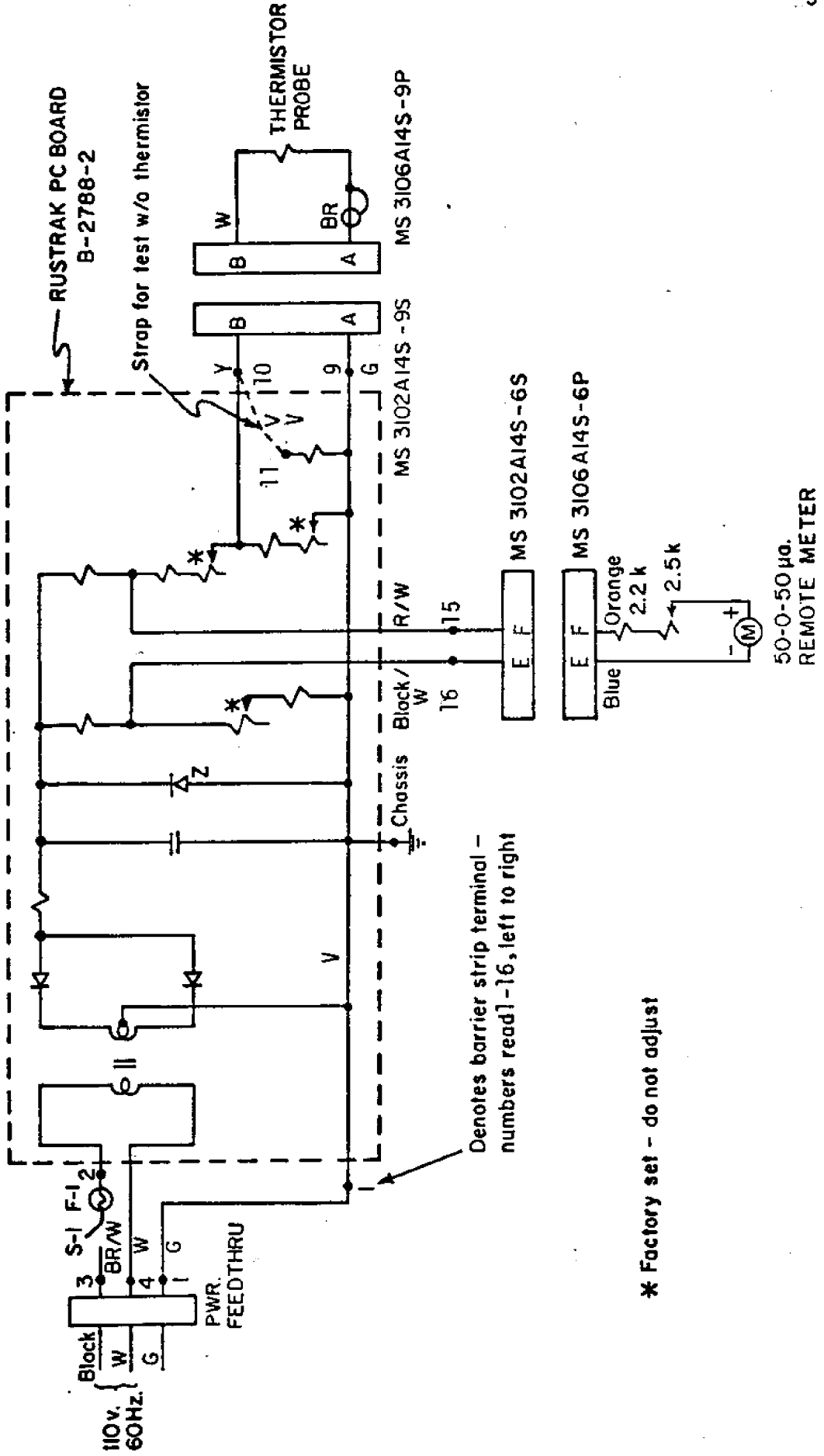


Figure 3

AIR TEMPERATURE

MODEL TW-2A CONVERTER BOX SCHEMATIC

1 July 1976



* Factory set - do not adjust

SEA TEMPERATURE INSTALLATION

PIPE

The thermistor probe should be mounted inside a 1 or 2 inch pipe for protection as illustrated in Fig. 4. Mount the pipe one foot off the bottom as close to the ocean as possible such as on a piling or on the side boards of the covered moorage. Plastic (PVC schedule 80) 2 inch pipe is usually adequate for the upper portion. For unattached spans greater than 15 feet, 1" PVC clamped to and supported by 1/4" thick angle iron should be used. The lower foot of pipe should be brass and sealed with a threaded PVC or brass cap. Attach the brass pipe to the PVC pipe with a threaded coupling (standard pipe threads wrapped with Teflon tape). Upper sections of the plastic pipe can be glued together using socket type couplings. At the top of the pipe install a 90° elbow and a 2 by 3/4 inch reducing coupling. Fill only the brass portion with motor oil for greater conductivity. Anchor the pipe securely.

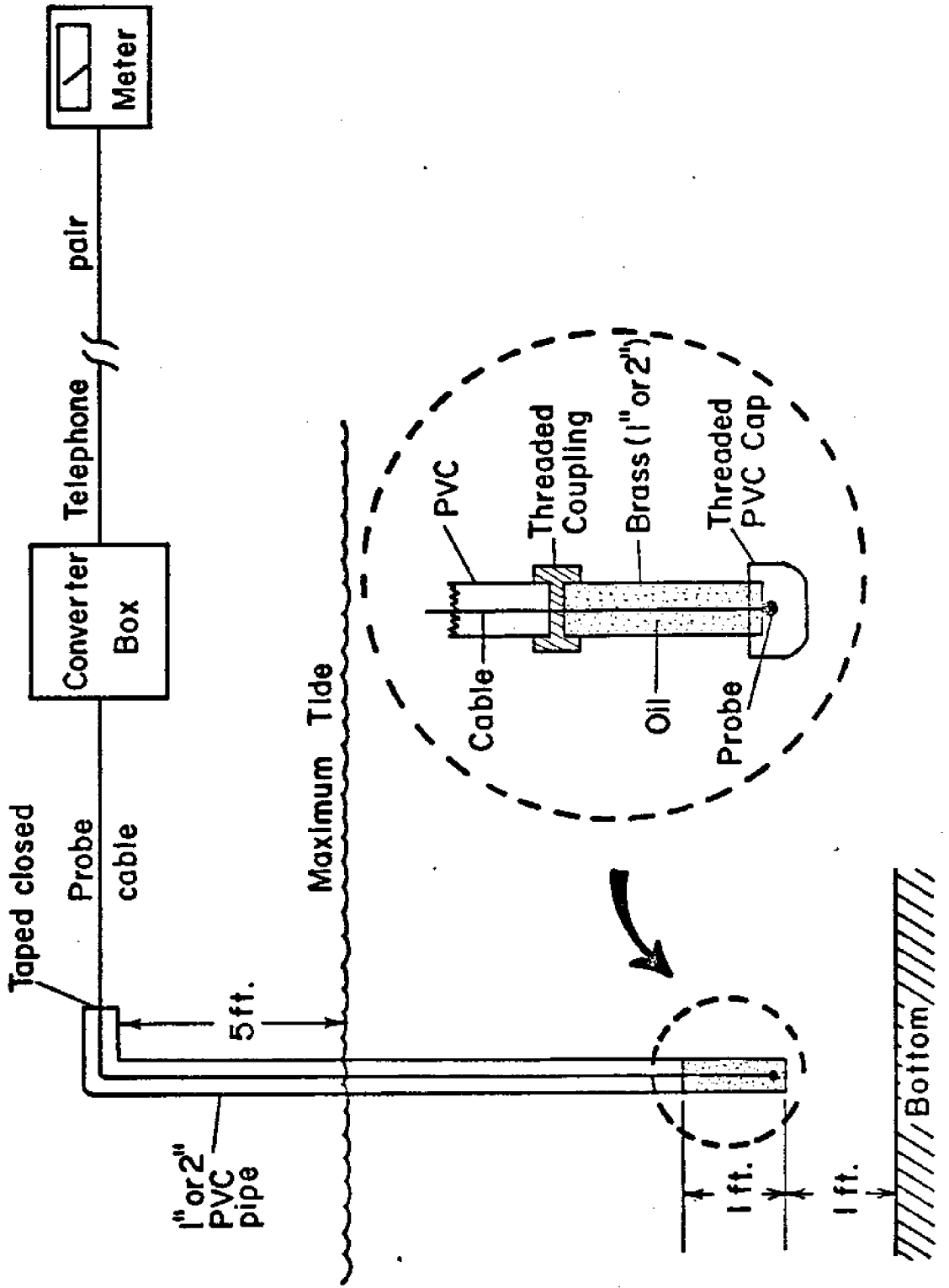
PROBE

Insert the probe into the pipe making sure the probe extends to the bottom of the pipe. Tape the probe cable as it leaves the pipe to minimize moisture condensation from the air inside the pipe. Attach the cable to the converter box using connector, C-2. For distances greater than 50 feet, connect RG58/U coax to the probe cable using BNC connectors UG88/U and straight adapter UG914/U. This additional coax cable will change the resistance of the input side of the bridge slightly, but distances of 100 feet or less will not affect the accuracy desired.

Figure 4
SEA TEMPERATURE

INSTALLATION DIAGRAM

1 July 1976



AIR TEMPERATURE INSTALLATION

PROBE

The probe should be mounted in a well ventilated location such as near the opening to the covered moorage, well above the water and out of direct sunlight and rainfall.

The probe housing consists of a 2" white plastic pipe (PVC, schedule 40) about 10" long for protection as shown in Fig. 5. Drill several 1/4" holes in the pipe to increase air circulation. Glue a plastic fitting or screw a brass bushing into a hole in a cap. Insert the probe and cable through the fitting and 5" into the pipe. Glue the cap. String a stainless steel wire through the pipe near the tip of the probe to keep the cable centered in the pipe. Seal the fitting with silicone rubber if necessary to make the top watertight. Drill a 1/2" drain hole in another cap and glue to the bottom of the pipe.

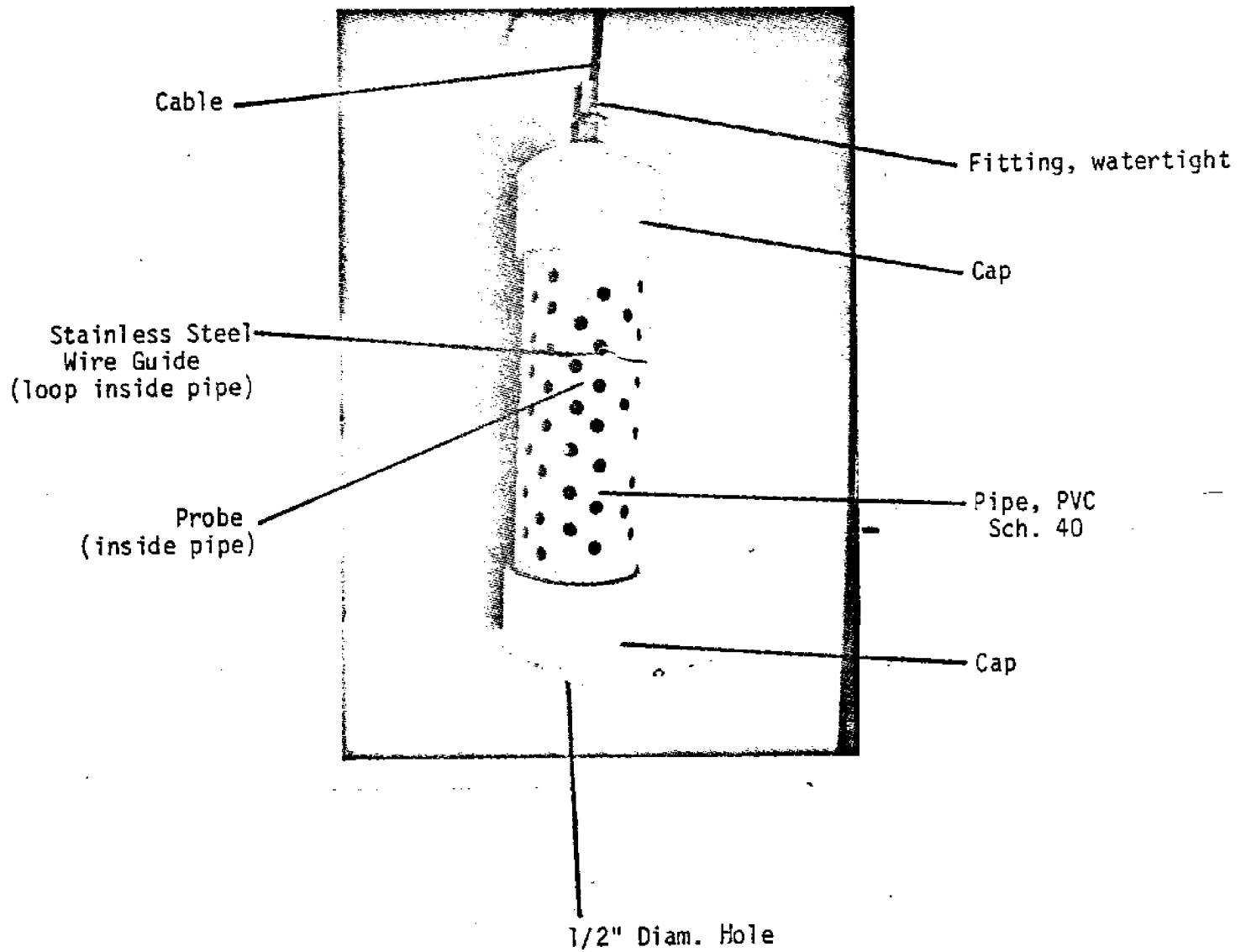
Mount the pipe vertically (cable end up) and securely attach to the side of the moorage. Connect the cable to the converter box.

CONVERTER BOX

The converter box should be mounted within 50 feet of the probe and reasonably close to AC power. Although the converter box is supposed to be water tight, it is best to mount it under cover. An electrical conduit containing 3 wires is recommended for power input, but a cord and 3 pin connectors (MS3106A14S-7P plug and MS3102A14S-7S socket) could also be used. Attach ground wires to terminals 1, 3 and 4 with spade lugs as shown in Figs. 2 and 3. Install a 4 wire telephone cable from the output connector C-6 to the nearest telephone terminal block. Connect telephone wires into TV cable room.

Figure 5

AIR TEMPERATURE PROBE HOUSING



METERS

The meters are mounted in the TV cable display panel (3 inch hole) at the station. Connect the meters to the nearest telephone terminal using coax or short pieces of wire.

CALIBRATION

During the ensuing discussion sea temperature values are followed by air temperature values in parentheses.

The bridge circuit on the printed circuit board has been pre-calibrated for a 50 foot probe at the factory for temperatures between 32 and 68° F. (0-100°F.) DO NOT UNDER ANY CIRCUMSTANCES ADJUST THE 3 POTENTIOMETERS ON THE CIRCUIT BOARD. These silver colored pots are sealed with red glyptol upon factory adjustment.

A calibration field check can be made by turning power OFF, disconnecting lead 7 (10) from the barrier strip (yellow wire) and shunting lead 8 (11) (violet wire) to lead 7 (10) (yellow wire) with the violet wire provided. Turn the power ON and adjust the 2.5K potentiometer on the back of the indicator meter to read 70° F. (100° F.). If it reads 30° F. (0°F.), then the meter input leads are reversed. Reverse leads on back of meter, then adjust to 70° F. (100° F.). This adjustment compensates for the small added resistance due to the station telephone pair. After setting to 70° F. (100° F.), mark the position of the potentiometer with red glyptol or suitable sealant. Turn power OFF, disconnect shunt from terminal 7 (10), tie down (violet wire) to lead 9 (12) and reconnect lead 7 (10) before turning power ON for operation.

OPERATION

After calibration, turn power ON, close cover and tighten two latch screws. The system should operate continuously without adjustment.

The communication watch stander should read the dials to the nearest degree and report sea temperature and air temperature following the wave group on his 3 hourly teletype weather reports. He should also record the temperatures on NOAA form 72-5A in the appropriate columns. Refer to Table 2 if problems occur.

Table 1.

TW-2A SEA/AIR TEMPERATURE SYSTEM REPLACEABLE PARTS

<u>Item</u>	<u>Description</u>	<u>Manufacturer</u>
BD-1	Board Assembly, B-2788-2 calibrated for 32-68° F	Rustrak, Gulton Industries Inc. East Greenwich, RI 02818
BD-2	Board Assembly, B-2788-2 calibrated for 0-100° F	Rustrak
PR-1	Probe, thermistor, 1924- 50 foot	Rustrak
F-1	Fuse, 1/4A	Littlefuse
C-2	Connector, 2 pin MS3102A14S-6S	Amphenol
C-3 (if used)	Connector, 3 pin MS3102A14S-7S	Amphenol
C-6	Connector, 6 pin MS3102A14S-9S	Amphenol
M-1	Meter, 50-0-50 μ A	API, LFE Corporation Waltham, MA 02154
D-1	Dial, meter, 40 divisions 448-1001-40C6	API
D-2	Dial, meter, 100 divisions 448-1001-100A6	API

Table 2
Trouble-shooting Guide

<u>Symptom</u>	<u>Probable Cause</u>	<u>Remedy</u>
Meter needle on 50° F No movement over several hours	Actual temperature is 50° F	None
	110v AC power OFF	Flip station circuit breaker
	Power switch OFF	Turn ON (inside converter box)
	Bad fuse	Replace (inside converter box)
	Open BNC connector on meter enclosure	Resolder
	Open telephone pair	Repair
Water temperature meter needle on 70° F	Actual temperature 70° F	None
	Test shunt connected between terminals 7 & 8 on barrier strip	Remove and attach probe
Water temperature meter needle on 30° F with test shunt connected	Wrong polarity	Reverse input leads to meter
Meter needle off scale left	Input to converter box open	Connect thermistor
	Open connector	Resolder
	Open thermistor cable	Check continuity of thermistor cable, should be 2.5K ohms. If open, replace.

<u>Symptom</u>	<u>Probable Cause</u>	<u>Remedy</u>	
Meter needle off scale right	Input to converter shorted	Check connector, repair Check resistance of thermistor cable, should be 2.5K ohms. If shorted, replace.	
	Output shorted	Check connector, repair Check telephone pair, repair Check meter, replace Check potentiometer on back of meter, replace if shorted	
	Improper readings	Bad power supply	Check bridge voltage across zener diode. Should be $8 \pm 0.2v.$, otherwise replace circuit board.
		Potentiometers on circuit board out of adjustment	Send board to factory for recalibration. DO NOT ATTEMPT FIELD ADJUSTMENT.
Air temperature meter needle on 100° F	Actual temperature 100° F	None	
	Test shunt connected between terminals 10 & 11 on barrier strip	Remove and attach probe	
Air temperature meter needle on 0° F with test shunt connected	Wrong polarity	Reverse input leads to meter	

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