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DESCRIPTION OF THE DUBAT MARK I.(U)
MAY 66 H J CARTER, P A FOLWELL NOBSR-93315

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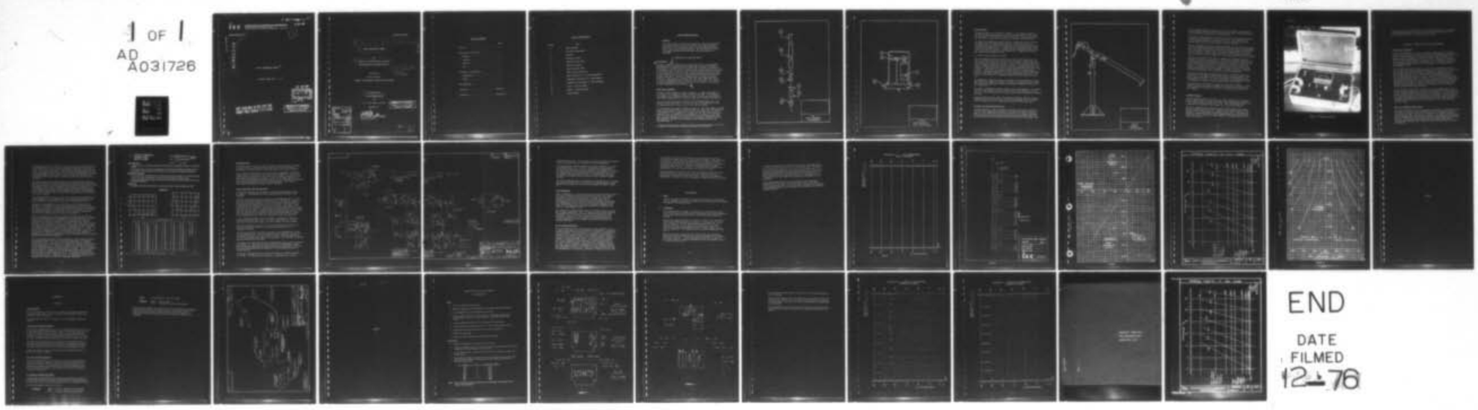

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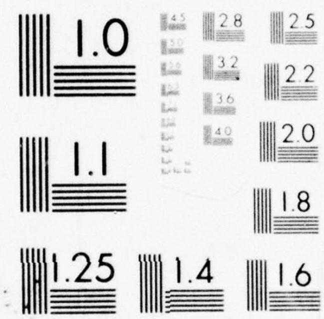

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

MOST Project -2 FG

12 MAY 1966

INTERSTATE ELECTRONICS CORPORATION

Subsidiary of Interstate Engineering Corporation

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OCEANICS DIVISION

FINAL ENGINEERING REPORT

Contract NObsr 93315

OCEANICS DIVISION

(6) Description of the Dubat Mark I.

(9) FINAL ENGINEERING REPORT

by

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Instrumentation Development Branch

(11) 12 May 66

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(15) Prepared under

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for

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ARMetzler for

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OceanicS Division

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FINAL ENGINEERING REPORT

Abstract

This final report is submitted in compliance with the requirements for item 4 of Contract No. NObsr 93315. The report includes a description of the Expendable Bathythermometer designated Dubat Mark I, and its associated equipment. The operation of the overall system is described and the data reduction procedure is tabulated.

DESCRIPTION OF THE DUBAT MARK I

Introduction

The Mark I Dubat* furnished under Contract NObsr 93315 is an Expendable Bathythermometer incorporating both temperature and depth measurement transducers. The construction of the hull and instrument sub-assembly of the expendable unit is suited to standard machine shop production techniques. In its present form the Mark I Dubat is a developmental device which may be easily converted to low cost, high production manufacturing techniques. (A Dubat Mark II version may be easily generated from the same basic redesign of the Mark I. The Mark II Dubat would not contain a pressure transducer; depth would be estimated from time versus depth data taken with fully instrumented Mark I versions of the instrument. The accuracy of depth estimates with the Mark II would not be as good as the accuracy of depth measurements with the Mark I.)

Dubat Mark I Assembly

The Mark I Dubat assembly is shown in Figure 1. A steel nose weight (1) is attached to a cylinder (2) made of extruded PVC tube. An instrument sub-assembly (3) is fastened inside the tube. The base of the instrument sub-assembly forms the end of a cavity containing the Dubat wire spool (4).

The wire in the Dubat spool is spliced to the shipboard spool (5). The shipboard spool is housed in a PVC cup (6) which is slipped over the CYL (2) and secured with a clamp (7) until the time of release.

The instrument sub-assembly is shown in Figure 2. This sub-assembly includes a gas filled Bourdon tube (1) attached to the face plate (2). The upper end of the Bourdon tube is connected to a wiper arm (3) which moves across a commutator (4). A thermistor (5) is mounted on the side of the instrument base in a position which places the thermistor in the high velocity wash when the Dubat instrument is dropping. The electrical connections between the commutator, Bourdon wiper, thermistor, and reference resistor are described below.

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* DUBAT is an acronym for Disposable Underway Bathythermometer

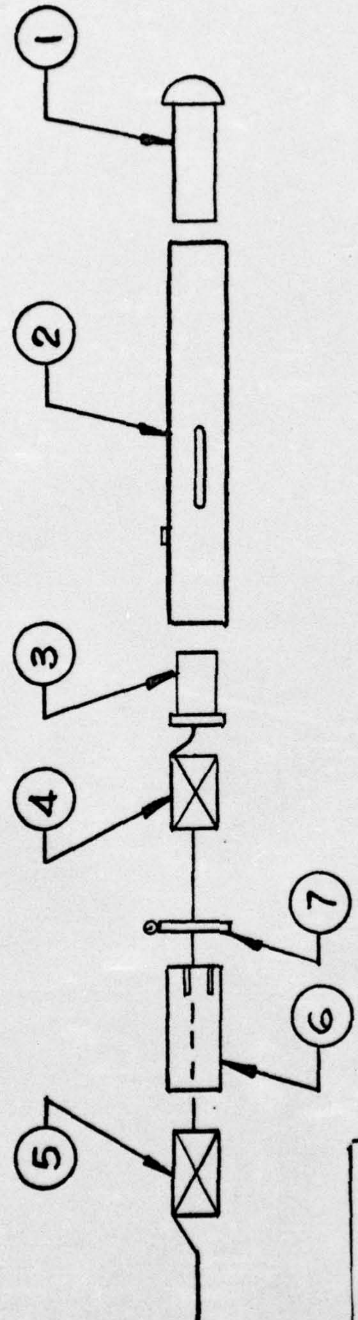


FIG I
MK I - DUBAT
ASSEMBLY

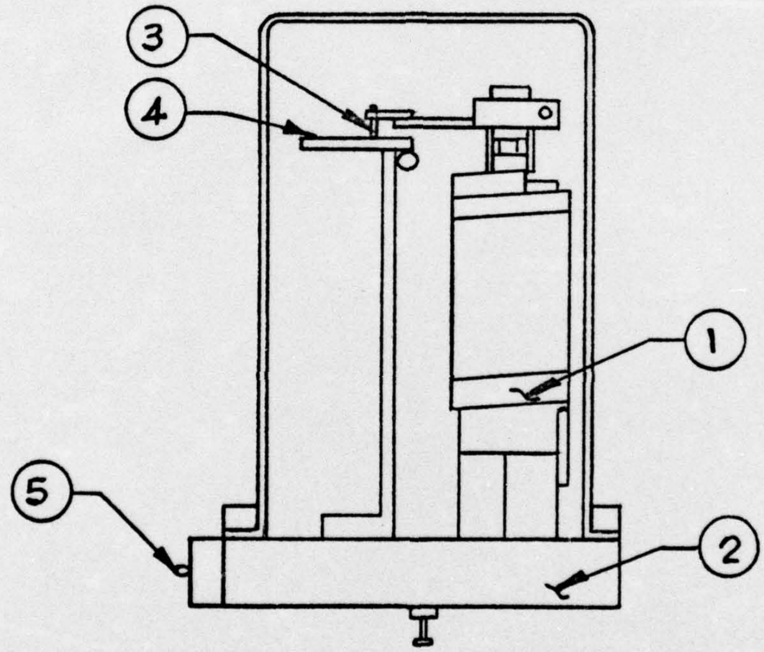


FIG 2
INSTRUMENT
SUB ASSEMBLY

Dubat Launcher

The Dubat launcher is illustrated in Figure 3. The launcher consists of an aluminum alloy tube mounted on a swivel head attached to a steel base. The base may be either bolted or welded to the deck. The launching tube may be stowed in a vertical position on its pedestal when not in use.

To operate the launcher proceed as follows: Remove the lock pin holding the launch tube in stowed vertical position and swing the tube to a horizontal position. Remove the horizontal swivel lock pin and swing the launch tube horizontally until it points aft at approximately 45°. Lock in position with the lock pin. Loosen the pivot clamp and swing the tube down to a depression angle of approximately 30°. Tighten swivel clamp. The launcher is now ready for use.

To launch a Dubat proceed as follows:

Open the hinged rear top plate and place a Dubat in the launch tube. The nose of the Dubat will slide into the tube far enough to permit the ship-board spool cup to drop into position in the receiver. Check to make sure the red protective thermistor shield is on top. (The ship-board wire spool clamp is normally located on top when the Dubat is correctly placed in the launcher). Close the hinged cover to clamp the ship-board wire spool in the receiver. Insure that the launcher release handle is in the vertical position. Release the ship-board wire spool clamp and slide the expendable portion of the Dubat forward until it stops against the release bar. The circuit to the recorder is completed through the contact with the release bar.

The temperature readout is made by the operator of the recorder and console described below. When the equipment is ready, the console operator signals the launcher by energizing a signal lamp indicator located at the rear of the launch tube.

The Dubat is released by manually operating the launch handle to a horizontal position. The release bar which is part of the handle assembly will slip out of the slot in the side of the launch tube and lock outside until manually restored.

During the drop time the signal lamp remains energized. When the console operator observes the wire break, he turns off the signal lamp to indicate that the launcher is to be cleared and re-loaded with the next Dubat.

Recorder and Associated Electronics

The power supplies, signal processing electronics and controls associated with the Mark I Dubat are contained in a portable case which is shown in Figure 4. The electronics case is then connected to a suitable recorder. Any recorder with a constant speed chart drive, high impedance input, and millivolt sensitivity is suitable for this application. The response time

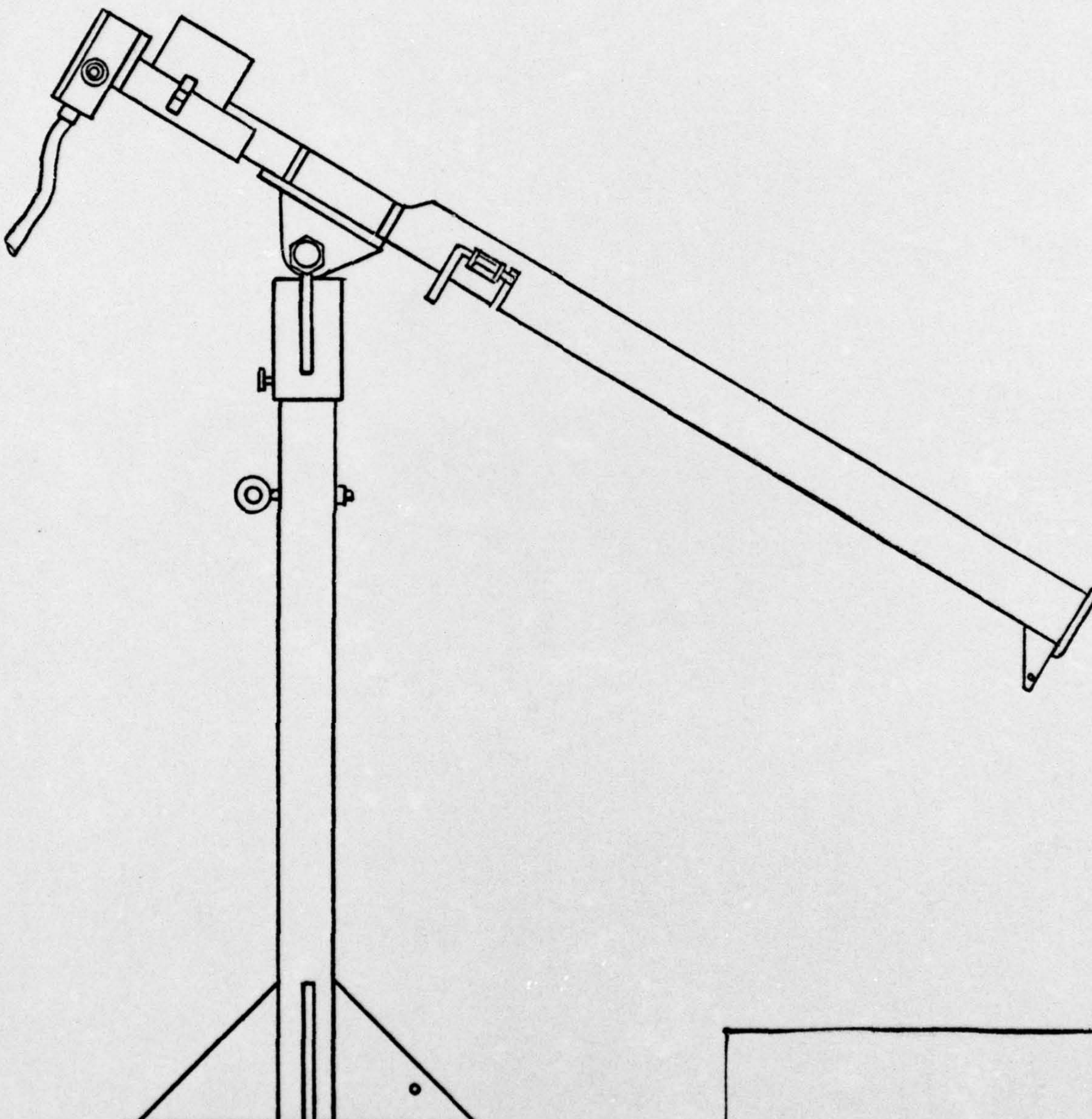


FIG 3
DUBAT
LAUNCHER

of the recorder should be ½ second or less for full scale. Both Moseley and Brush chart recorders have been used with the Mark I Dubat electronics, also a Moseley X-Y recorder with a sweep feature.

In selecting a recorder for routine use in the fleet, consideration should be given to various methods of marking the paper. The semi-solid ink delivered under pressure in the Brush recorder is preferred over fluid systems which rely on capillary forces to deliver the ink.

Another consideration is paper width and stability in the marine environment. The width should be commensurate with the accuracy desired in reading temperature, and should allow for the resolution of ink line width. For example, if a resolution (or reading error) of 0.1°F is allowed, and the ink line width is .008 inch (.2mm), a scale from 29°F to 90°F requires at least 4.9 inch chart paper. A paper width of 8 to 10 inches would allow easier reading.

Controls are provided in the panel to checkout the recording electronics and adjust it prior to making a drop. The function selector switch has two calibrate positions corresponding to thermistor resistances at 0°C and 30°C. A test position is also provided on the function selector to permit the operator to simulate the effect of a broken wire or shorted wire in the Dubat. In the "drop" position the function selector is set for measuring temperature during the drop of the Dubat. A "probe" position is provided for other applications, such as surface temperature measurement.

Connectors are provided for making connections to the launcher and to the ship's hull. An AC power connector and recorder connector together with a power switch and indicator are also included on the control panel of the recorder electronics. The meter on the panel is calibrated in degrees F and degrees C. The Celsius scale extends from -2°C to +33°C.

A toggle switch is provided for signalling the launcher operator. In the "launch" position this switch energizes an indicator on the launcher and also energizes the recorder chart drive, or initiates the sweep of the X-Y recorder.

Telemetering Wire

The wire presently used in the Dubat is a single strand of hard, cadmium-copper, number 30AWG wire with an extruded clear polyethylene jacket having a wall thickness of 5 thousands of an inch. This wire has 80% of the conductivity of commercial grade copper wire of the same diameter.

The wire is machine layer wound into spools and these spools are impregnated and coated with a low shear strength silicon rubber compound. The purpose of the silicon rubber is to form the spool into a self supporting package for easy handling during Dubat manufacturing and at the same time permit the wire to pay off the inside diameter of the spool with a 2 to 4 ounce pull force.

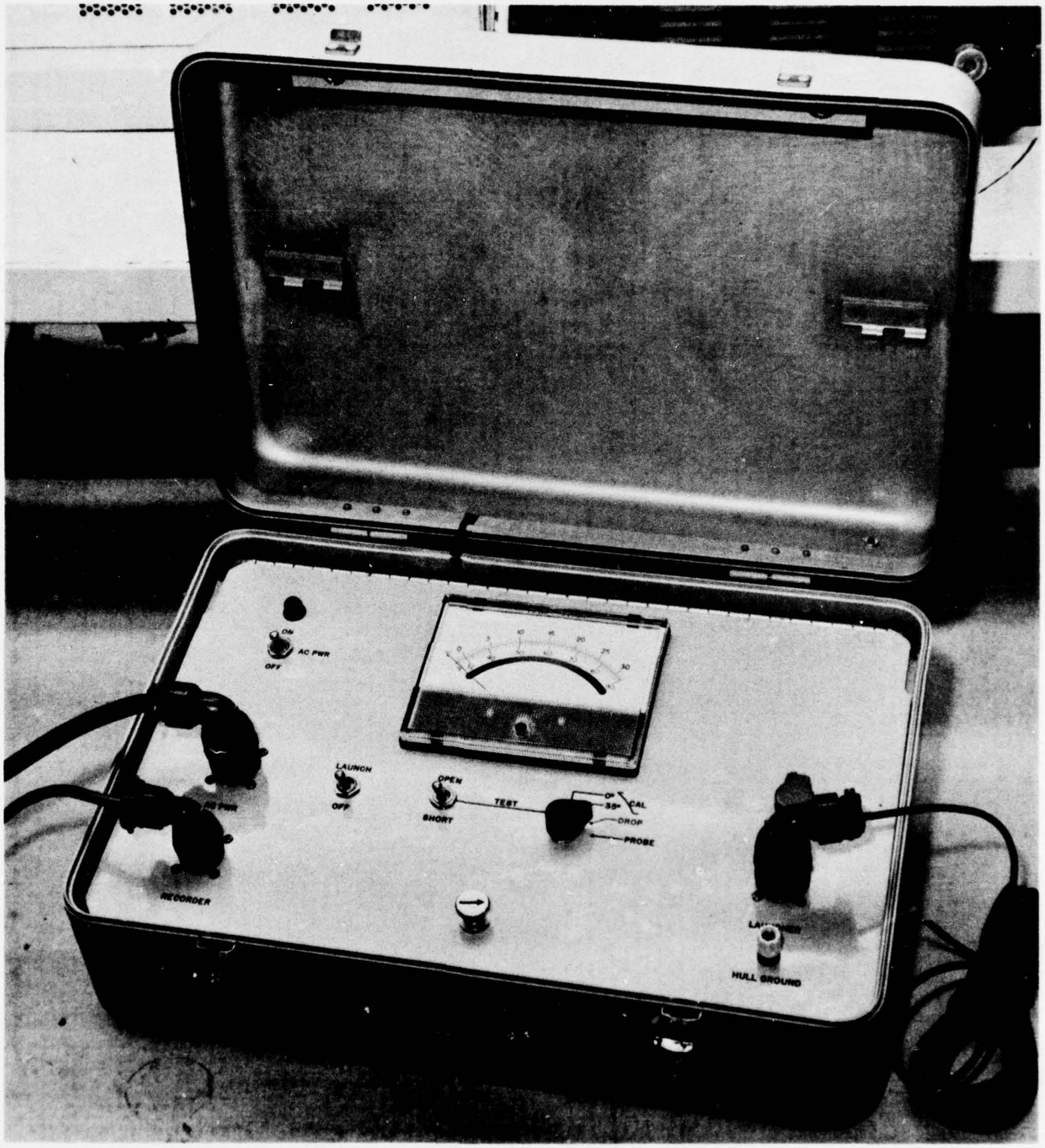


Figure 4. Electronics Panel

Each spool of wire is subjected to a high pressure water test. All spools assembled into the Dubat must pass this test which guarantees that there are no leakage paths in the polyethylene insulation.

PRINCIPLE OF TEMPERATURE AND DEPTH MEASUREMENTS

Temperature Measurement

A precision thermistor is used for temperature measurement in the Mark I Dubat. The thermistor is an epoxy coated disc manufactured by YSI Components Division, Yellow Springs, Ohio (YSI part #44005). This thermistor is manufactured to a resistance tolerance of better than $\pm$ 1% in the range from 0 to 40°C; this tolerance is equivalent to a temperature variation of not more than $\pm$ 0.2°C over this temperature span. A long-term stability test program has established that this thermistor has an annual drift of approximately 0.05°C.

The YSI thermistor was selected for use in small-lot production of the Mark I Dubat. The entire resistance-temperature function of this thermistor is accurately specified throughout the temperature range required for bathythermometer application. For relatively large production lots of Mark I Dubat (greater than 1,000 units) a less expensive thermistor with similar characteristics would be chosen. However, other thermistors which are inexpensive usually have a 1% tolerance only on the R_o resistance value. Variations of 10% or more in the resistance temperature curve at limiting temperature span values are typical, and therefore, the use of such thermistors requires additional calibration and complexity in the measuring circuits associated with the thermistor.

The thermistor is connected as the active arm of a bridge network. The bridge is designed with unequal elements to compensate for the nonlinearity of the resistance-temperature function of the thermistor so that the bridge output voltage is made a linear function of temperature. This technique for linearizing thermistors is most affective when the thermistor resistance-temperature function is controlled within narrow limits. The linearity in bridge output achieved in the Mark I Dubat is $\pm$ 0.1°C over the range from 5° to 30°C.

Errors in Temperature Measurement

The various sources of error in temperature measurement in the Dubat include the effect of sea water temperature variations on the telemetering wire resistance, the effect of insulation resistance and leakage variations in the telemetering wire, thermistor time delay and dissipation (Joule heating) errors, linearization errors, signal processing, and recording errors. Many of these errors are made sufficiently small by design; others may be estimated from reference data transmitted periodically during the descent of the Dubat.

The telemetering wire is chosen with a sufficiently low resistance so that the maximum error for a worst case temperature variation is less than $\pm$ 0.1°C. This error, which is most significant at the high temperature end of the scale, may be reduced an order of magnitude by applying corrections which are computed directly from the data record obtained during the descent. The telemetering-wire resistance of each wire spool is furnished with calibration data for each Dubat so that this correction may be applied if necessary.

Transient errors are a function of the water temperature being measured and the time constant of the thermistor and the dropping rate of the Dubat. The dropping rate of the Dubat is designed to match the time constant of the thermistor so that a water temperature step function is indicated to at least 62% when the Dubat has dropped approximately 3-feet past the step. The thermistor time constant in high velocity sea water is approximately 200 ms. The thermistor lag is electronically reduced with a lead network to a value of 100 ms.

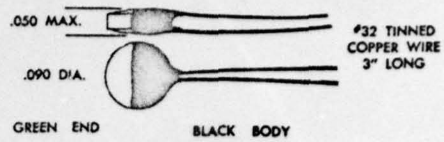
The bridge excitation is chosen so that the worst case self-heating error in the thermistor is less than 0.04°C. The dissipation constant of the Dubat thermistor in high velocity sea water is approximately 12 mw.

Leakage in the telemetering wire insulation appears in shunt with the thermistor in the Dubat. Provided the leakage is not too large (short circuit), it is possible to correct the temperature record for the leakage. The leakage correction is always negative since an increase in current in the thermistor bridge arm is equivalent to an increase in temperature. Correction for leakage is made in the following manner.

During the descent of the Dubat a commutator switches the telemetering line from the thermistor to a momentary open circuit condition to indicate various known depths (and less frequently it also switches from the thermistor to a reference resistor). A displacement of the position position of the recorder stylus for these open circuit conditions (compared with that obtained during the pre-drop checkout phase and while the Dubat is dropping to the water) indicates that a leakage path exists between the wire and the sea water, the greater the stylus displacement, the more severe is the leakage problem. A displacement of the open circuit stylus position may be converted directly to a correction of the indicated temperature by entering a nomogram (or using a sliderule) with the indicated temperature and stylus displacement.

When the commutator switches from the thermistor to the reference resistor the recording stylus moves to a position corresponding to a simulated temperature of 35°C. This position is affected not only by leakage (as is the open circuit condition), but is affected by variations in resistance of the telemetering wire. However, as pointed out previously the effect of wire resistance variation from the nominal is small. It can be separated from the effect of leakage by correlating the reference resistor stylus position with the expected position of the 35°C point after correcting for the effect of cable leakage (if any). A difference between the actual and predicted position is indicative of a wire resistance variation and a nomogram can be used to correct the indicated temperature.

YSI PRECISION THERMISTOR
3000 OHMS AT 25°C
PART No. 44005



TIME CONSTANT:*

1 second maximum. This value was determined with the thermistor suspended by its leads in a "well stirred" oil bath.

10 seconds maximum. This value was determined with the thermistor suspended by its leads in still air.

*Time constant is the time required for the thermistor to indicate 63% of a new impressed temperature.

DISSIPATION CONSTANT:**

8 mw/°C. This value was determined with the thermistor suspended by its leads in a "well stirred" oil bath.

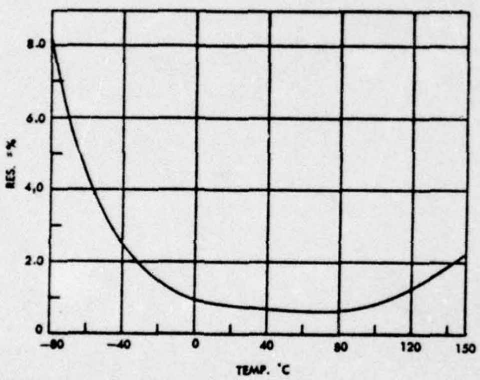
1 mw/°C. This value was determined with the thermistor suspended by its leads in still air.

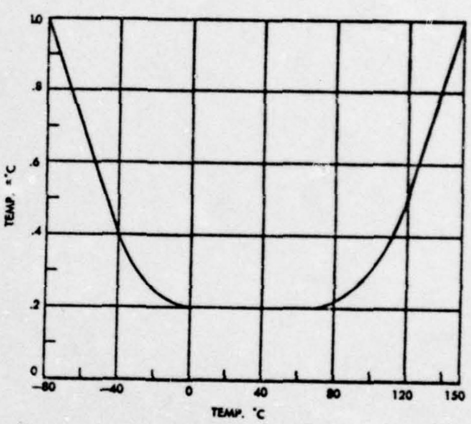
**The dissipation constant is the amount of power in milliwatts required to raise the thermistor 1°C above the surrounding temperature.

COLOR CODE:

Black epoxy on the body of the thermistor with green end. Maximum operating temperature 150°C.

TOLERANCES





RESISTANCE VERSUS TEMPERATURE -80°C to +150°C

TEMP°C	RES.	TEMP°C	RES.	TEMP°C	RES.	TEMP°C	RES.	TEMP°C	RES.	TEMP°C	RES.	TEMP°C	RES.
-80	2211K	-44	132.7K	-8	14.90K	28	2633	64	647.1	100	203.8	136	77.6
79	2022K	43	123.5K	7	14.12K	29	2523	65	624.7	101	197.9	137	75.8
78	1851K	42	115.4K	6	13.39K	30	2417	66	603.3	102	192.2	138	73.9
77	1696K	41	107.9K	5	12.70K	31	2317	67	582.6	103	186.8	139	72.2
76	1555K	40	101.0K	4	12.05K	32	2221	68	562.8	104	181.5	140	70.4
75	1426K	39	94.48K	3	11.44K	33	2130	69	543.7	105	176.4	141	68.8
74	1309K	38	88.46K	2	10.86K	34	2042	70	525.4	106	171.4	142	67.1
73	1202K	37	82.87K	-1	10.31K	35	1959	71	507.8	107	166.7	143	65.5
72	1105K	36	77.66K	0	9796	36	1880	72	490.9	108	162.0	144	64.0
71	1016K	35	72.81K	1	9310	37	1805	73	474.7	109	157.6	145	62.5
70	935.4K	34	68.30K	2	8851	38	1733	74	459.0	110	153.2	146	61.1
69	861.4K	33	64.09K	3	8417	39	1664	75	444.0	111	149.0	147	59.6
68	793.7K	32	60.17K	4	8006	40	1598	76	429.5	112	145.0	148	58.3
67	731.8K	31	56.51K	5	7618	41	1535	77	415.6	113	141.1	149	56.9
66	675.2K	30	53.10K	6	7252	42	1475	78	402.2	114	137.2	150	55.6
65	623.3K	29	49.91K	7	6905	43	1418	79	389.3	115	133.6		
64	575.7K	28	46.94K	8	6578	44	1363	80	376.9	116	130.0		
63	532.1K	27	44.16K	9	6265	45	1310	81	364.9	117	126.5		
62	492.1K	26	41.56K	10	5971	46	1260	82	353.4	118	123.2		
61	455.3K	25	39.13K	11	5692	47	1212	83	342.2	119	119.9		
60	421.5K	24	36.86K	12	5427	48	1167	84	331.5	120	116.8		
59	390.5K	23	34.73K	13	5177	49	1123	85	321.2	121	113.8		
58	361.9K	22	32.74K	14	4939	50	1081	86	311.3	122	110.8		
57	335.7K	21	30.87K	15	4714	51	1040	87	301.7	123	107.9		
56	311.5K	20	29.13K	16	4500	52	1002	88	292.4	124	105.2		
55	289.2K	19	27.49K	17	4297	53	965.0	89	283.5	125	102.5		
54	268.6K	18	25.95K	18	4105	54	929.6	90	274.9	126	99.9		
53	249.7K	17	24.51K	19	3922	55	895.8	91	266.6	127	97.3		
52	232.2K	16	23.16K	20	3748	56	863.3	92	258.6	128	94.9		
51	216.0K	15	21.89K	21	3583	57	832.2	93	250.9	129	92.5		
50	201.1K	14	20.70K	22	3426	58	802.3	94	243.4	130	90.2		
49	187.3K	13	19.58K	23	3277	59	773.7	95	236.7	131	87.9		
48	174.5K	12	18.52K	24	3135	60	746.3	96	229.3	132	85.7		
47	162.7K	11	17.53K	25	3000	61	719.9	97	222.6	133	83.6		
46	151.7K	10	16.60K	26	2872	62	694.7	98	216.1	134	81.6		
-45	141.6K	-9	15.72K	27	2750	63	670.4	99	209.8	135	79.6		

Manufactured by: YSI Components Division, Yellow Springs, Ohio

FIGURE 5

April 15, 1963

Confidence Check

The transmission of reference value information during the drop of a Dubat not only serves to provide temperature correction for wire resistance variations, but also provides a confidence check of the entire operation.

If the reference mark moves to values outside the temperature correction range or moves in a direction indicating a lower temperature, a malfunction elsewhere in the system may be suspected and the record or portions of the record obtained evaluated accordingly. Thus, the IEC Dubat adheres to a basic tenet of instrumentation which requires that an instrument be prevented from furnishing grossly inaccurate or misleading data. The reference values may be considered as signal quality indicators.

Signal Conditions and Data Recording

The complete schematic for the Dubat and recording electronics is shown on Figure 5. The launcher and Dubat connections are also shown on the schematic.

The function selection switch is shown set to the DROP position. In this position a circuit is completed through the Dubat, through the launcher in series with blocking capacitor C_9, the radio frequency choke RFC and the bridge network consisting of R1, R2, R3, R18, and T2. The return circuit is through the hull connection through the sea water to the Dubat. The launcher connector includes a pair of wires for energizing the launch signal and a pair for the Dubat. A signal ground connection is made to the launcher frame to insure circuit continuity through the Dubat prior to the drop. It will be noted that in all positions of the switch except DROP a resistor R17 is switched into the circuit to correspond to the wire resistance.

A small unregulated power supply is provided to energize the 'power on' lamp and the launch signal lamp. The launch signal switch is a double pole switch with one pole connected to the recorder for start purposes.

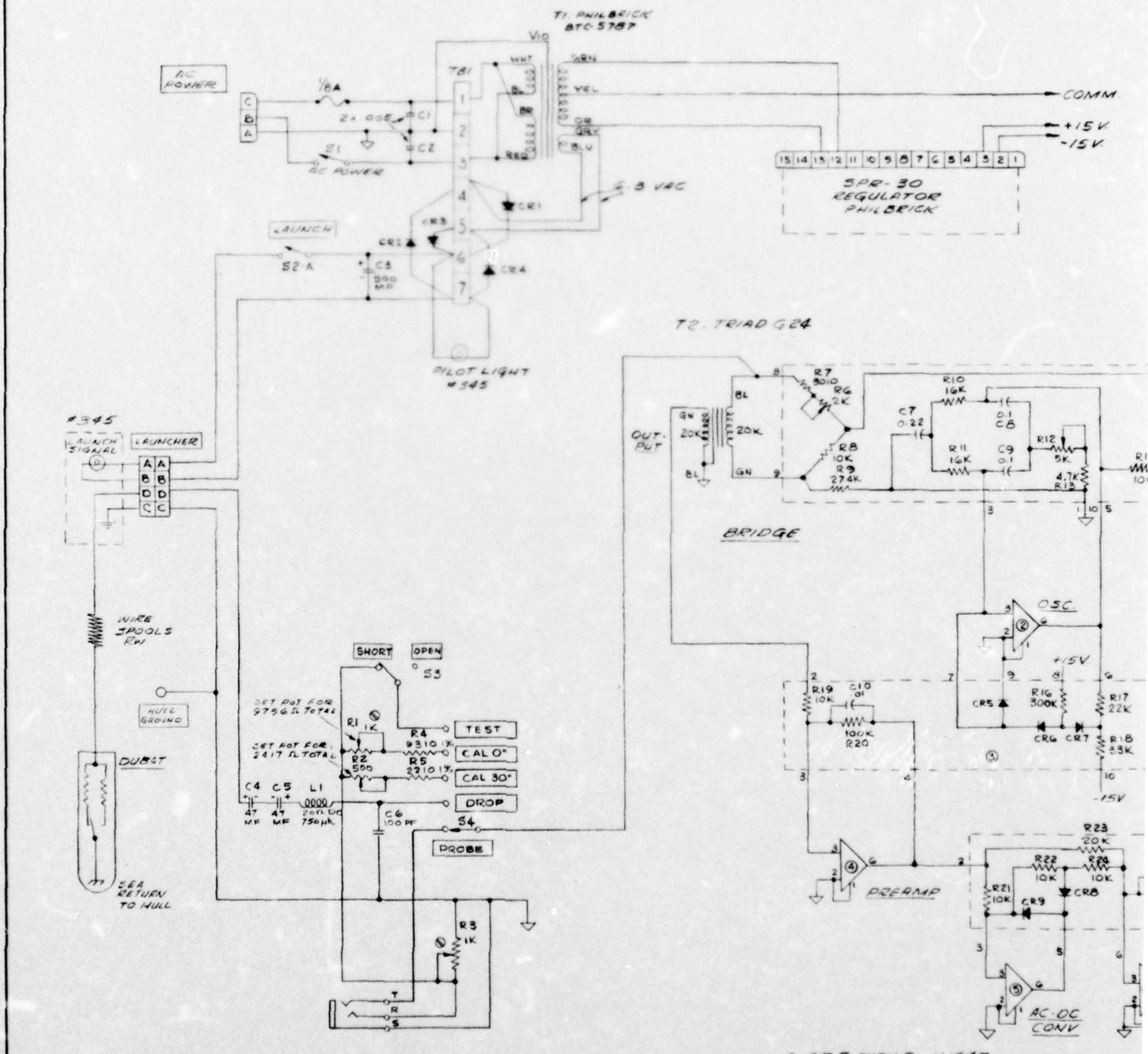
The RFC and capacitor C_7 network form a low pass filter to prevent high frequency common-mode signals from introducing unknown errors in the temperature records.

The other positions of the function selector are self-explanatory, except for the PROBE position. The probe connection is intended for the use with thermistors identical with those used in the Dubat, the cable leading to the probe thermistor should have a low resistance. Air or surface temperature could be monitored by this means.

The bridge is isolated from the signal conditioning circuits with a shielded transformer, T_2. The output of T_2 is grounded to the instrument ground which is carried separately throughout the recorder electronics. Both the hull ground and case ground are connected to the instrument ground at a single location.

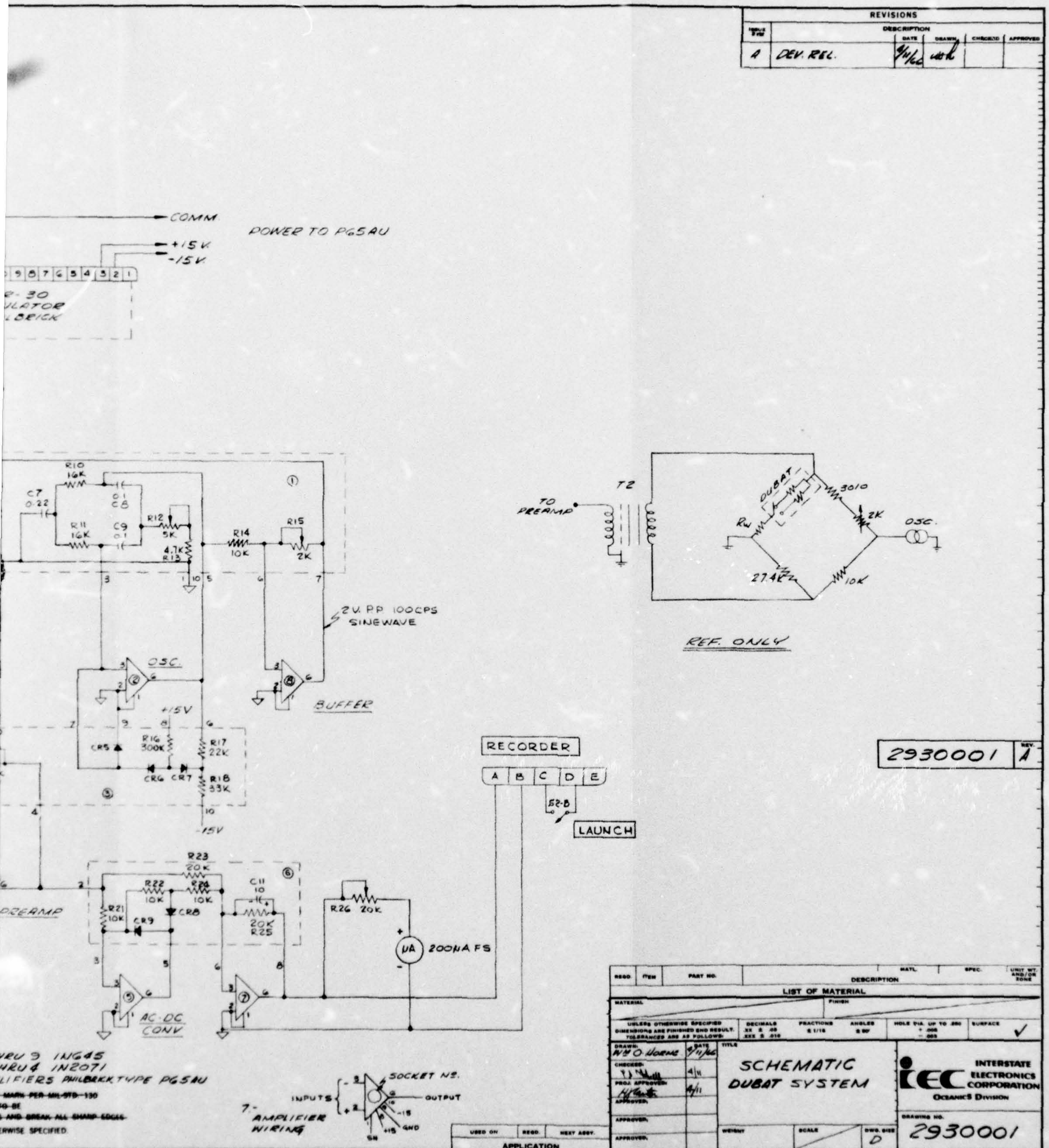
The bridge is energized with an oscillator running at a nominal frequency of 100 cps. The output of the oscillator is regulated with a diode-

PATENT NOTICE



6. CR5 THRU 9 1N645
5. CR1 THRU 4 1N2071
4. ALL AMPLIFIERS PHILBRICK TYPE PG5AU
3. ~~IDENTIFICATION MARK PER MIL-STD-130~~
2. ~~BEND RADIUS TO BE~~
1. ~~REMOVE BURRS AND BREAK ALL SHARP EDGES~~

NOTES: UNLESS OTHERWISE SPECIFIED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DESCRIPTION
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-15V
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LBRICK
R10 16K
C7 0.22
.01 C8
C9 .01
R11 16K
R12 5K
4.7K R13
R14 10K
R15 2K
2V. PP 100CPS SINEWAVE
OSC.
BUFFER
+15V
CR5
R16 300K
R17 22K
CR6 CR7
R18 33K
-15V
T2
TO PREAMP
DUBAT
Rw
3010
2K
OSC.
27.4K
10K
REF. ONLY
RECORDER
A B C D E
S2-B
LAUNCH
R23 20K
R22 10K
R24 10K
C11 10
R21 10K
CR9
CR8
20K R25
R26 20K
μA 200μA FS
PREAMP
AC-DC CONV
2930001
A
HRU 9 IN645
HRU 4 IN2071
LIFIERS PHILBRICK TYPE PG5AU
ERWISE SPECIFIED
INPUTS
SOCKET NO.
OUTPUT
-15
GND
+15
SN
7.- AMPLIFIER WIRING
USED ON
REQD.
NEXT ASSY.
APPLICATION
REQD.
ITEM
PART NO.
DESCRIPTION
MATL.
SPEC.
LIST OF MATERIAL
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TITLE
SCHEMATIC DUBAT SYSTEM
INTERSTATE ELECTRONICS CORPORATION
OCEANICS DIVISION
DRAWING NO. 2930001
WEIGHT
SCALE
DWG. SIZE D

2

controlled bias network. This particular sign-wave oscillator was selected because its output wave-form is practically free from harmonics.

The bridge network is balanced when the thermistor resistance corresponds to a temperature of -2°C. A resistor corresponding to the thermistor resistance at a temperature of 0°C is connected to the bridge network in the CAL 0 position. A resistor corresponding to the thermistor resistance at a temperature of 30°C is connected to the bridge network in the CAL 30 position. The bridge output is then at nearly full scale and may be adjusted to the correct value by setting the bridge excitation voltage with R13.

The bridge transformer output is connected to a precision AC to DC converter. The output of the converter is filtered with a tandem RC network. The DC signal from the filter is connected to the recorder (not shown on Figure 5).

Depth Measurement

Depth is measured in an incremental manner using easily identified events on the chart recording to identify known pressure points on a calibration chart which is included with each Dubat (see Figure 10). When the temperature record is interrupted by the commutator switching at a calibrated pressure point, characteristic marks are made on the record. The temperature at the point where the depth mark was made and the depth value corresponding to that mark are the coordinates (temperature and depth) which are plotted on a standard presentation of temperature and depth in a fourth quadrant graph.

The sequence of calibrated pressure points is arranged so that each point may be uniquely determined. Thus, if a portion of the record is missing, the remainder of the record will still furnish temperature and depth information. When it is desired to know the depth at a point on the temperature record which is not adjacent to the calibrated depth mark a simple interpolation between adjacent depth marks will furnish the required depth value.

Errors in Depth Measurement

The calibration points for each Dubat instrument are determined from an automatic readout made while the instrument is subjected to a continuously increasing ambient pressure generated in a form and rate corresponding to an actual descent. A stripchart record is generated at this time and compared to the commutator readout. The calibration pressure readout is continuous from a strain gage transducer calibrated against a secondary standard .01% Ruska deadweight tester. The pressure at each selected point on the commutator switching pattern is read and transcribed onto the standard calibration chart. These figures are considered accurate to ± .05%. When an individual instrument is cycled repeatedly from 0 to full scale ambient pressure the repeatability of the commutator pressure depth indications is within ± .1%. Since the variation from unit to unit is approximately 2%, an individual calibration is supplied with each unit.

A temperature correction to the depth marks will account for a major portion of the errors indicated by the Bourdon instrument. The correction is required if the Bourdon tube temperature at the time of launch is significantly different from the 25°C calibration temperature. Because of its thermal mass and lag, the Bourdon tube temperature will change negligibly during the drop. Therefore a correction can be based on the temperature of the unit during storage just prior to the drop.

Since the Dubat is a sensitive instrument it should be handled with care and the units should not be exposed to strong sunlight on deck for long periods as the Bourdon tube could reach a high (and also unknown) temperature. Therefore it would be impossible to apply the above correction.

DATA HANDLING

1) Depth

Correct the depth calibration (for sample see Figure 8) to compensate for the temperature at which the Dubat units are stored prior to dropping. Use Figure 9 to accomplish this.

2) Temperature

If telemetering wire leakage is evidenced by a recorder stylus shift for the open circuit positions of the commutator, a corrected temperature scale can be obtained using Figure 10 or its equivalent transparent overlay.

Position the temperature scale on Figure 10 at 90° to the temperature scale on the Dubat recording (see Figure 7). Align the open circuit line on Figure 10 with the indicated open circuit condition shown prior to the drop. If the open circuit marks shift to the left (direction of lowering temperature) during the drop, Figure 10 will show the magnitude of the leakage and the corrected temperature scale to use.

When the corrected temperature scale location has been determined, Figure 10 should be rotated and the nominal temperature scale aligned with that on Figure 7. Corrected temperatures can now be read off the record using the corrected temperature scale, the position of which was previously identified.

A further correction can be applied to account for variations from the 480 ohm nominal resistance of the telemetering wire. The actual wire resistance is tabulated on the name plate of each Dubat. The correction, which varies with the indicated temperature, is read off opposite the actual wire resistance with the aid of Figure 11. In future versions of the system electronics this correction will be eliminated by use of an electrical adjustment corresponding to wire resistance.

Severe temperature extremes can also change the wire resistance appreciably (.4% per ^{o}C). For precise work Figure 11 may also be used to correct for values of wire resistance obtained by an estimate of temperature effects on the tabulated wire resistance value which is measured at 25^{o}C.

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DUBAT Serial No ____________
DROP DATE ____________

FIGURE 7

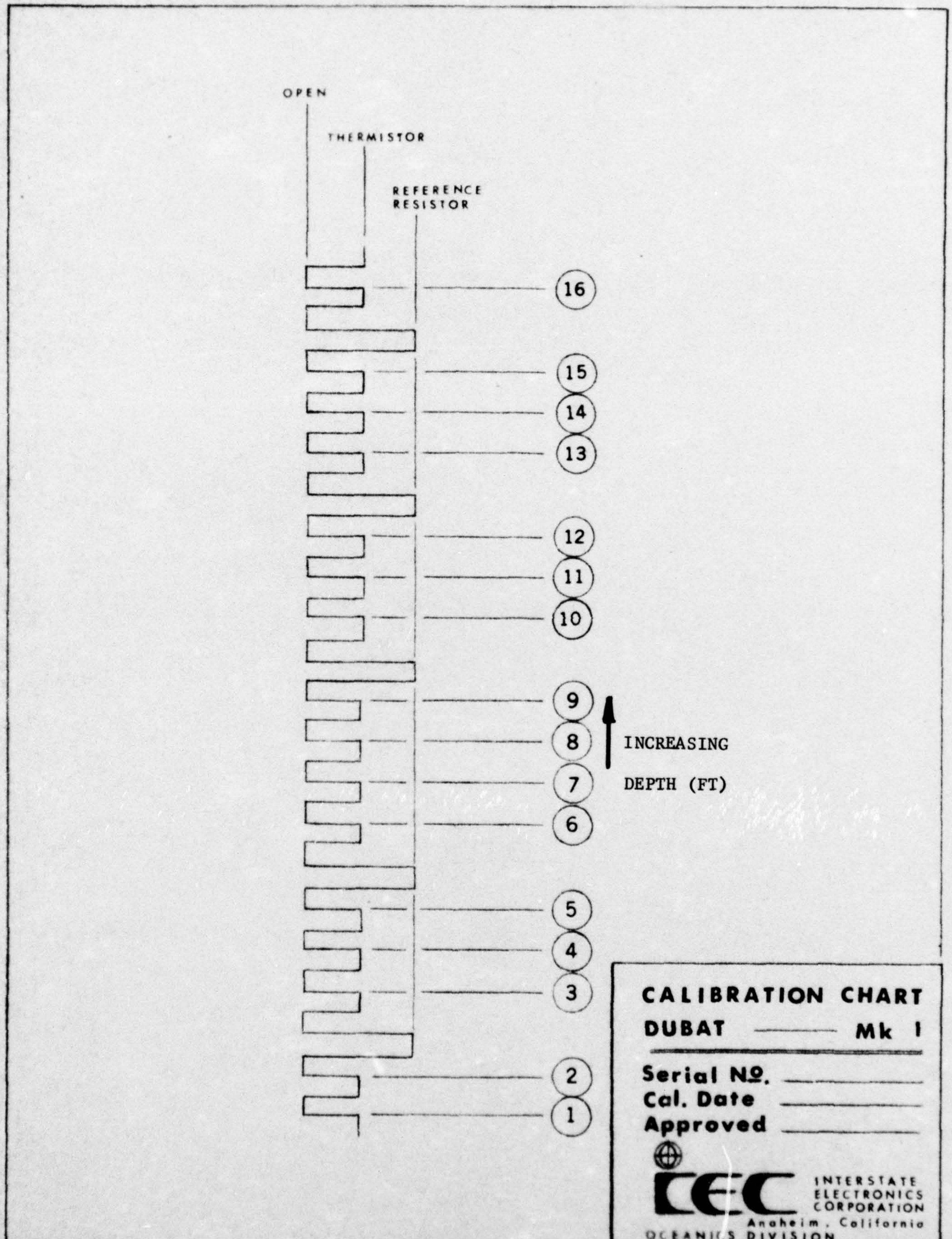
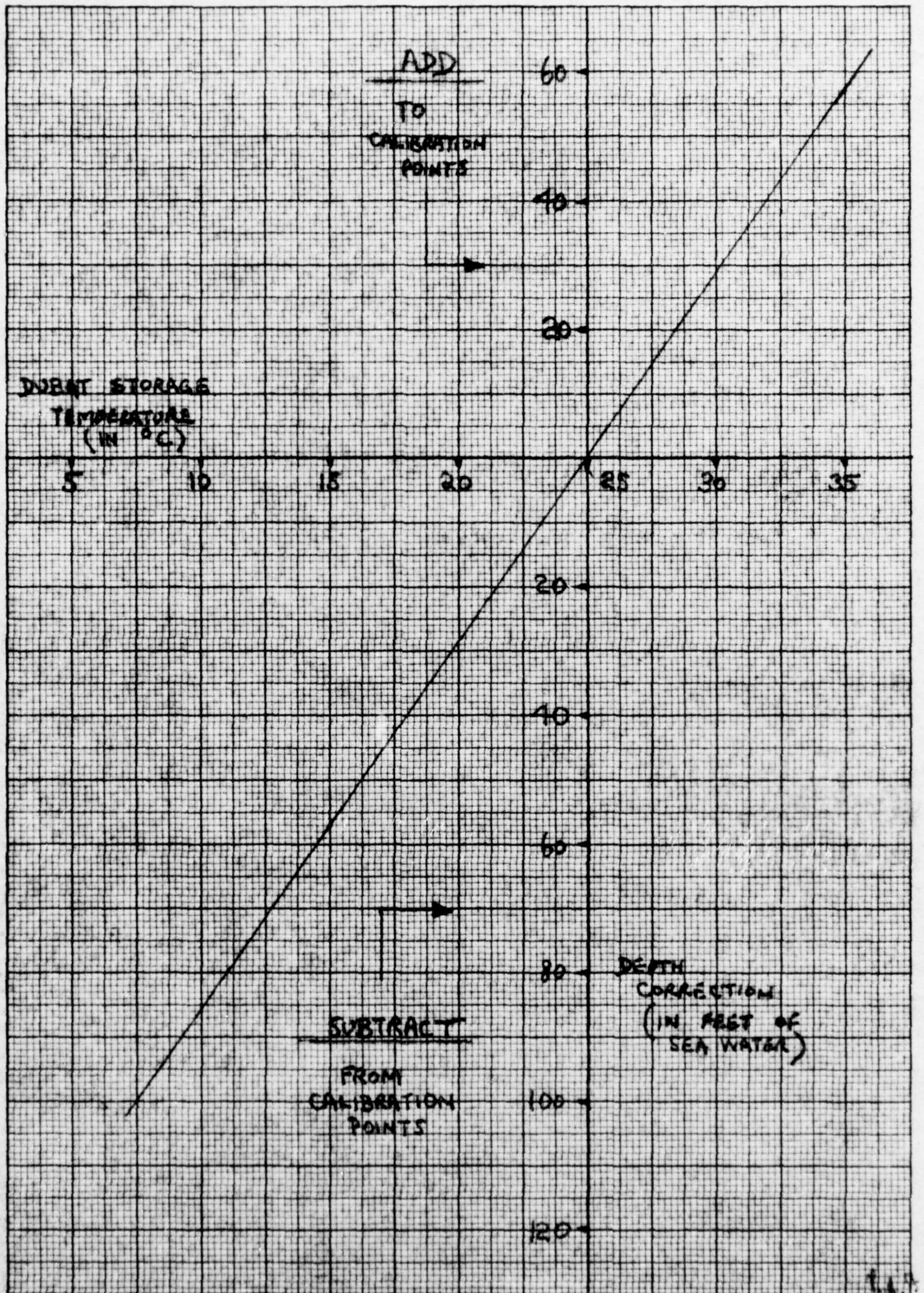

OPEN
THERMISTOR
REFERENCE RESISTOR
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
INCREASING
DEPTH (FT)
CALIBRATION CHART
DUBAT Mk I
Serial No.
Cal. Date
Approved
INTERSTATE ELECTRONICS CORPORATION
Anaheim, California
OCEANICS DIVISION

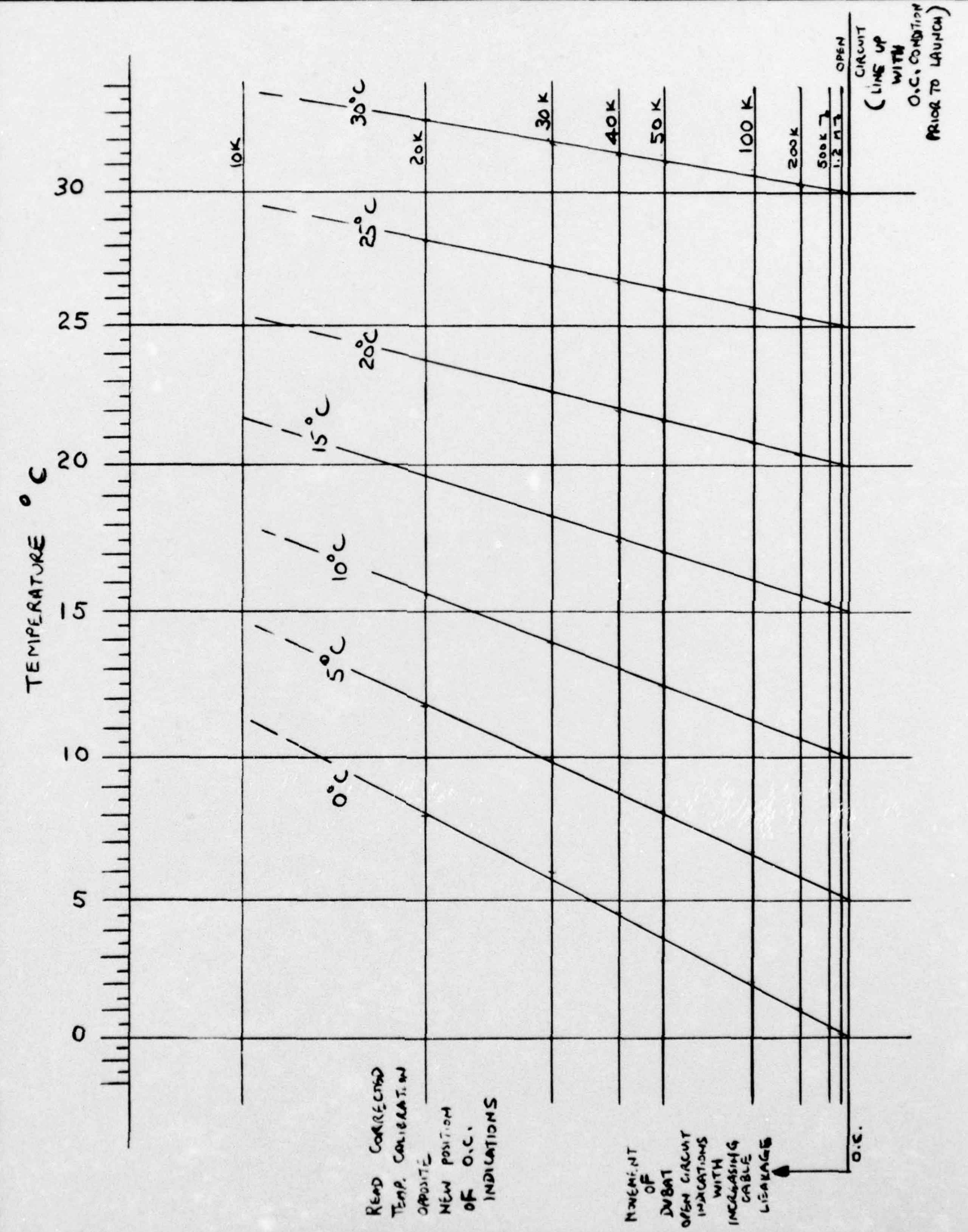
FIGURE 8



ADD
TO CALIBRATION POINTS
60
40
20
DUBAT STORAGE TEMPERATURE (IN °C)
5
10
15
20
25
30
35
20
40
60
80
DEPTH CORRECTION (IN FEET OF SEA WATER)
SUBTRACT
FROM CALIBRATION POINTS
100
120

FIGURE 9

TEMPERATURE CORRECTION VS. CABLE LEAKAGE



IEC INTERSTATE ELECTRONICS CORPORATION OCEANICS DIVISION	DRAWING NO.	REV.	SHEET
	FIGURE 10		

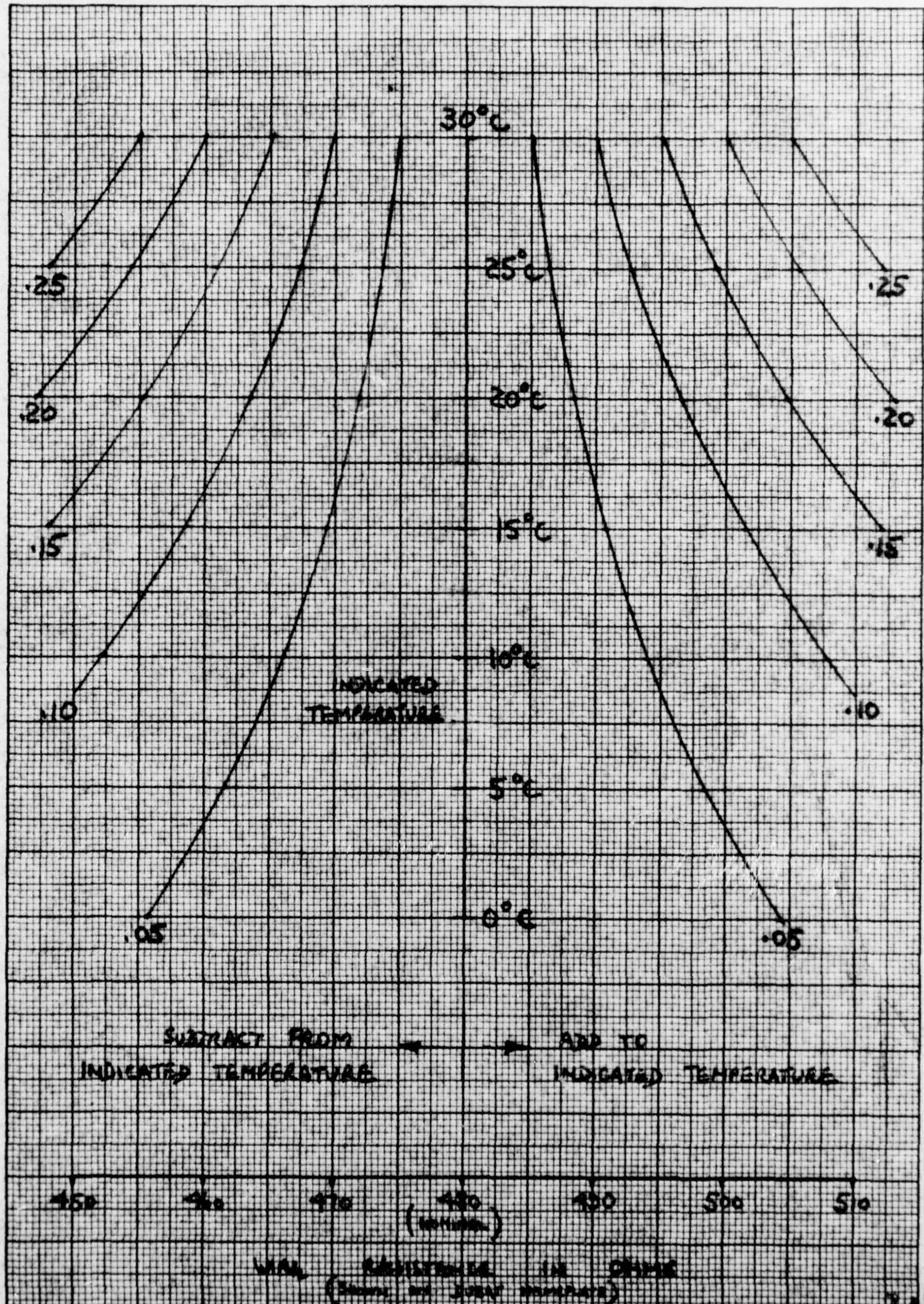

30°C
25°C
20°C
15°C
10°C
5°C
0°C
.25
.20
.15
.10
.05
INDICATED TEMPERATURE
SUBTRACT FROM INDICATED TEMPERATURE
ADD TO INDICATED TEMPERATURE
450
460
470
480 (NOMINAL)
490
500
510
WIRE RESISTANCE IN OHMS

Figure 11.

APPENDIX

A

APPENDIX A

OPERATION

SYSTEM ASSEMBLY

The Dubat System MK I consists of the launcher, the signal conditioning electronics (deck unit), the X-Y recorder, interconnecting cables, and expendable Dubat instruments.

The interconnecting cables are shown on the Cable Diagram, Drawing No. 2930800.

PREPARATION FOR DUBAT LAUNCHING

Place the X-Y recorder and deck unit in a sheltered location with 115 volt 60 cps power outlets located nearby. Place the launcher within 100 feet of the deck unit on the stern or aft deck as close to the railing as possible. The foot of the launcher pedestal should be bolted or tack welded to the deck, making sure that the launch tube is free to swing up to a near horizontal position and swivel out over the side of the ship.

The Dubats to be dropped should be stored in their shipping boxes in a sheltered location convenient to the launcher. The Dubats, although they are massive, are nevertheless precision instruments which should be treated with care if they are to return accurate bathymetric data.

Connect all cables (except the optional surface temperature probe) as shown on Drawing No. 2930800.

DECK UNIT READINESS PROCEDURE

Turn on the AC PWR switch on the deck unit, and set the LAUNCH Switch to the OFF position. Rotate the function selector switch to the CAL positions, 0^{o} and 30^{o}. Observe that the panel meter indicates the correct scale values for each position. If large discrepancies exist, the unit should be returned to the factory for service or readjusted according to Appendix B.

X-Y RECORDER READINESS PROCEDURE

Assuming that the Installation and Inspection procedures in Section II of the Moseley 7030A Operating and Service Manual have been carried out, and that the ink pen is installed and ready to write, proceed as follows:

Set the X-Y Recorder controls as follows:

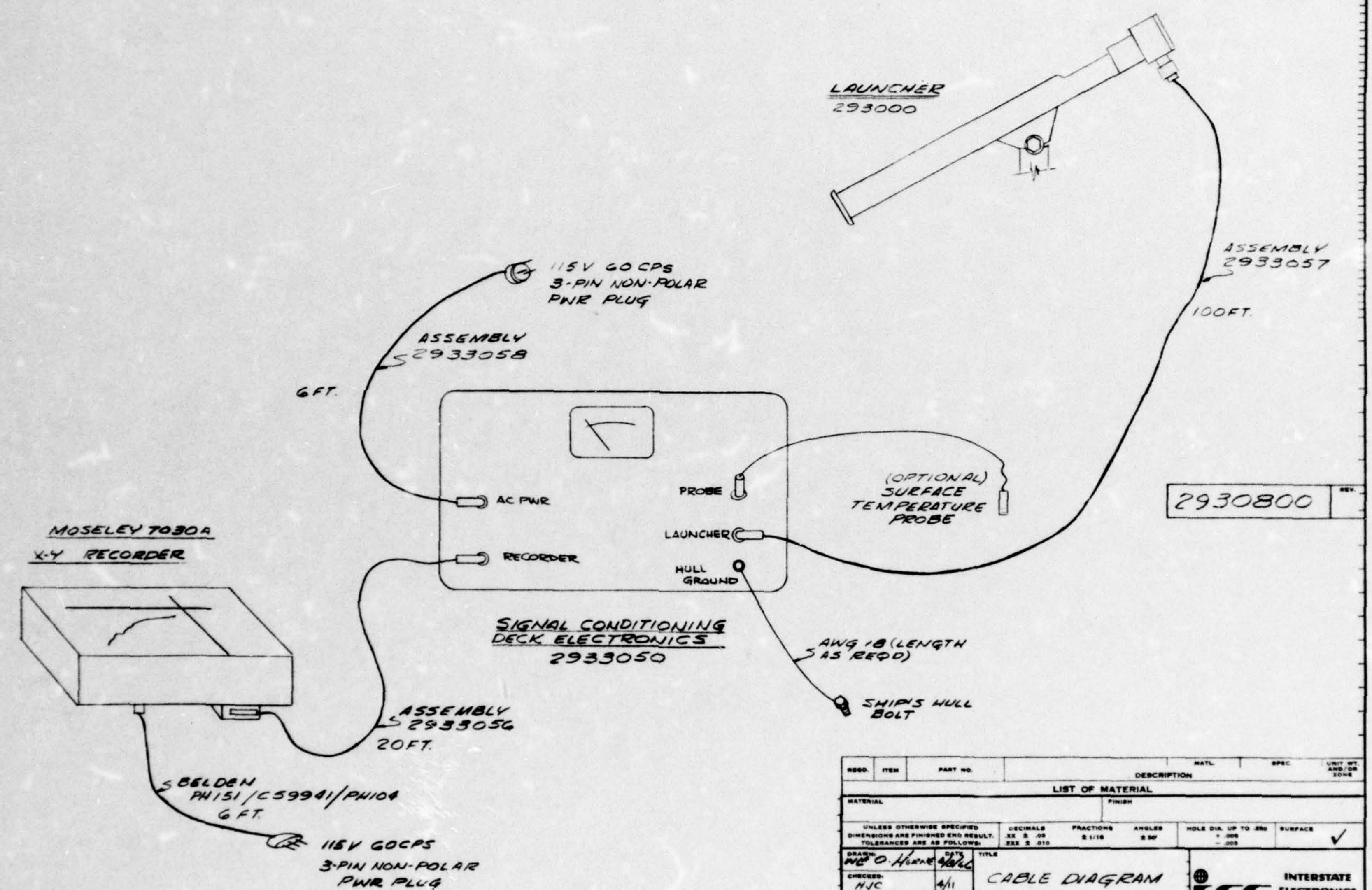
<u>Y-Channel</u>:	Range:	0.1 V/in., VAR Knob to be adjusted.
	Zero:	0 Offset, VAR Knob to be adjusted.

Sweep: 20 seconds/inch, red knob at FULL

X-Channel: Range: Set on sweep
Zero: 5 offset, VAR Knob to be adjusted.

In general the Y-Channel Zero control should be adjusted with the function selector switch in the CAL 0 position and the Range control should be adjusted with the function selector switch in the CAL 30 position. Interaction between the adjustments might necessitate a repeat of the procedure.

REVISIONS						
EFF	ISSUE SYM	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
	A	DEV. REL	4/8/66	wsh		



2930800

PATENT NOTICE

3. IDENTIFICATION MARK PER MIL-STD. 130
2. BEND RADIUS TO BE
1. REMOVE BURRS AND BREAK ALL SHARP EDGES

NOTES: UNLESS OTHERWISE SPECIFIED

REQD.	ITEM	PART NO.	DESCRIPTION	MATL.	SPEC.	UNIT WT. AND/OR ZONE

LIST OF MATERIAL

MATERIAL | FINISH

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE FINISHED END RESULT. TOLERANCES ARE AS FOLLOWS: DECIMALS .XX ± .03, .XXX ± .010; FRACTIONS ± 1/16; ANGLES ± 30'; HOLE DIA. UP TO .250 +.005 −.005; SURFACE ✓

DRAWN: O. Horne	DATE 4/8/66	TITLE: CABLE DIAGRAM DUBAT SYSTEM
CHECKED: HJC	4/11	
PROJ. APPROVED:	4/11	
APPROVED:		
APPROVED:		
APPROVED:		

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DRAWING NO. 2930800

WEIGHT | SCALE 1/1 | DWG SIZE C

USED ON	REQD.	NEXT ASSY.

APPLICATION

LIETZ 1030 TOPFLIGHT 3-66

APPENDIX

B

DUBAT DECK ELECTRONICS INSPECTION

AND CALIBRATION

SETUP

1. R3 set to 480 ohms with ESI box.
2. Adjust DC Balance on P65 amplifiers, using Fluke meter and manifold.
3. Set mechanical zero on panel meter, power off.
4. Set No. 7 P65 amplifier to zero output on panel meter (within one needle width), with No. 1 plugin removed. Switches set to "Test-Short".
5. Adjust oscillator output to .77 RMS volts with R15 trimpot.
6. Adjust R6 for zero output on panel meter with 10.86K in probe input.
7. Adjust R26 to set panel meter on 30°C in Cal 30 position.
8. Check Cal 0 position.
9. Check all cable connectors and mechanical security.

CALIBRATION

1. Connect launcher and X-Y Recorder to Deck Unit.
2. Attach ESI Decade Resistor to contact button on launcher receiver, return connection to lug on launcher connector box.
3. Set up X-Y Recorder zero and "Cal 0" and "Cal 30" points to agree with record chart.
4. Select the following resistance values and record the calibration marks by manually operating the X-channel VAR zero control (red knob) to produce a short line.

Temp.	Resistance, ohms
-2°C	11340
0°	10280
5°	8098
10°	6451
15°	5194
20°	4228
25°	3480
30°	2897

NOTE: **These values of resistance include the Thermistor resistance and the Dubat wire resistance.**

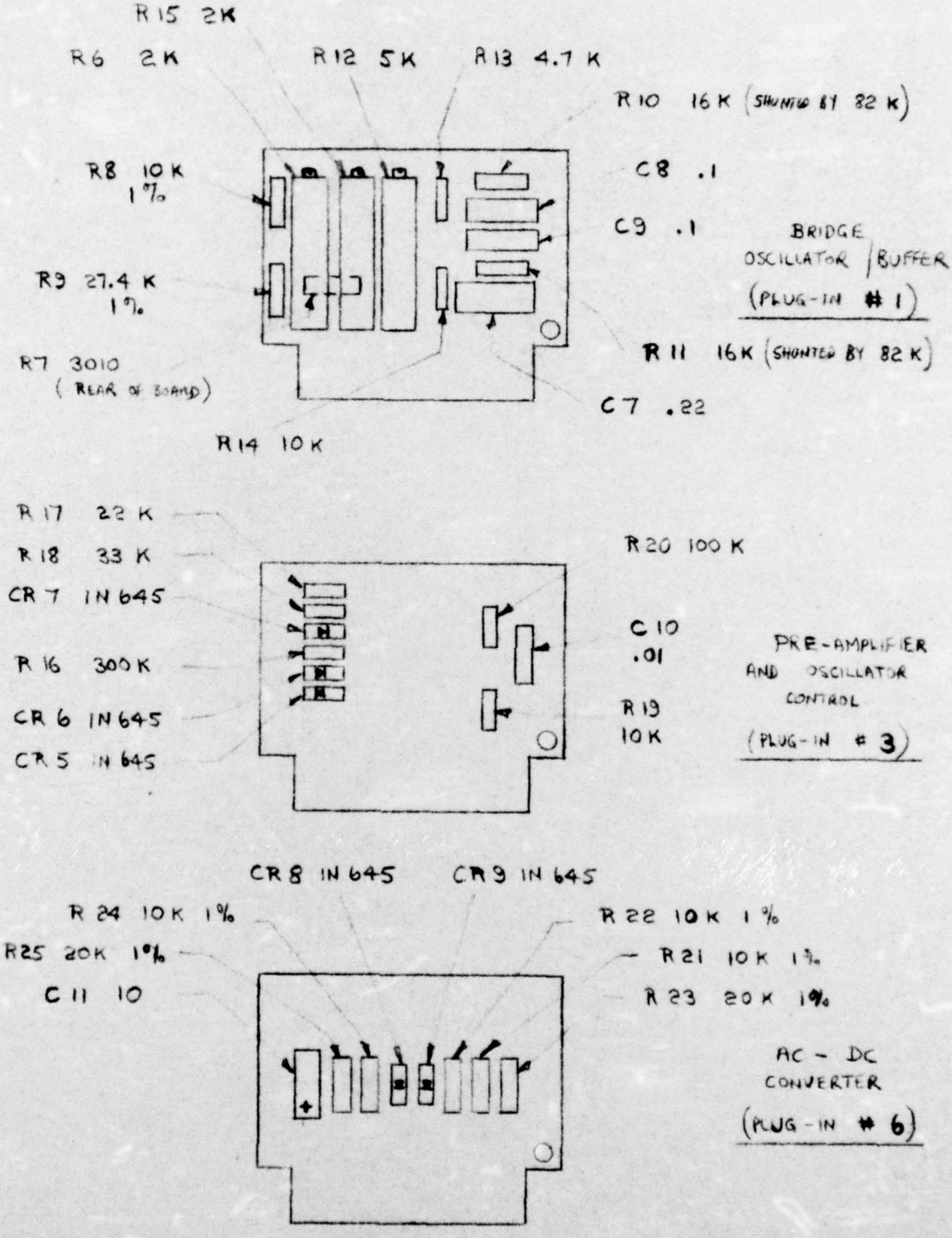
R15 2K
R6 2K
R12 5K
R13 4.7 K
R10 16 K (SHUNTED BY 82 K)
R8 10 K 1%
C8 .1
C9 .1
BRIDGE OSCILLATOR / BUFFER (PLUG-IN # 1)
R9 27.4 K 1%
R11 16K (SHUNTED BY 82 K)
R7 3010 (REAR OF BOARD)
C7 .22
R14 10 K
R17 22 K
R18 33 K
R20 100 K
CR7 IN645
C10 .01
PRE-AMPLIFIER AND OSCILLATOR CONTROL (PLUG-IN # 3)
R16 300K
R19 10K
CR6 IN645
CR5 IN645
CR8 IN645
CR9 IN645
R24 10K 1%
R22 10K 1%
R25 20K 1%
R21 10K 1%
C11 10
R23 20K 1%
AC - DC CONVERTER (PLUG-IN # 6)

FIGURE 12

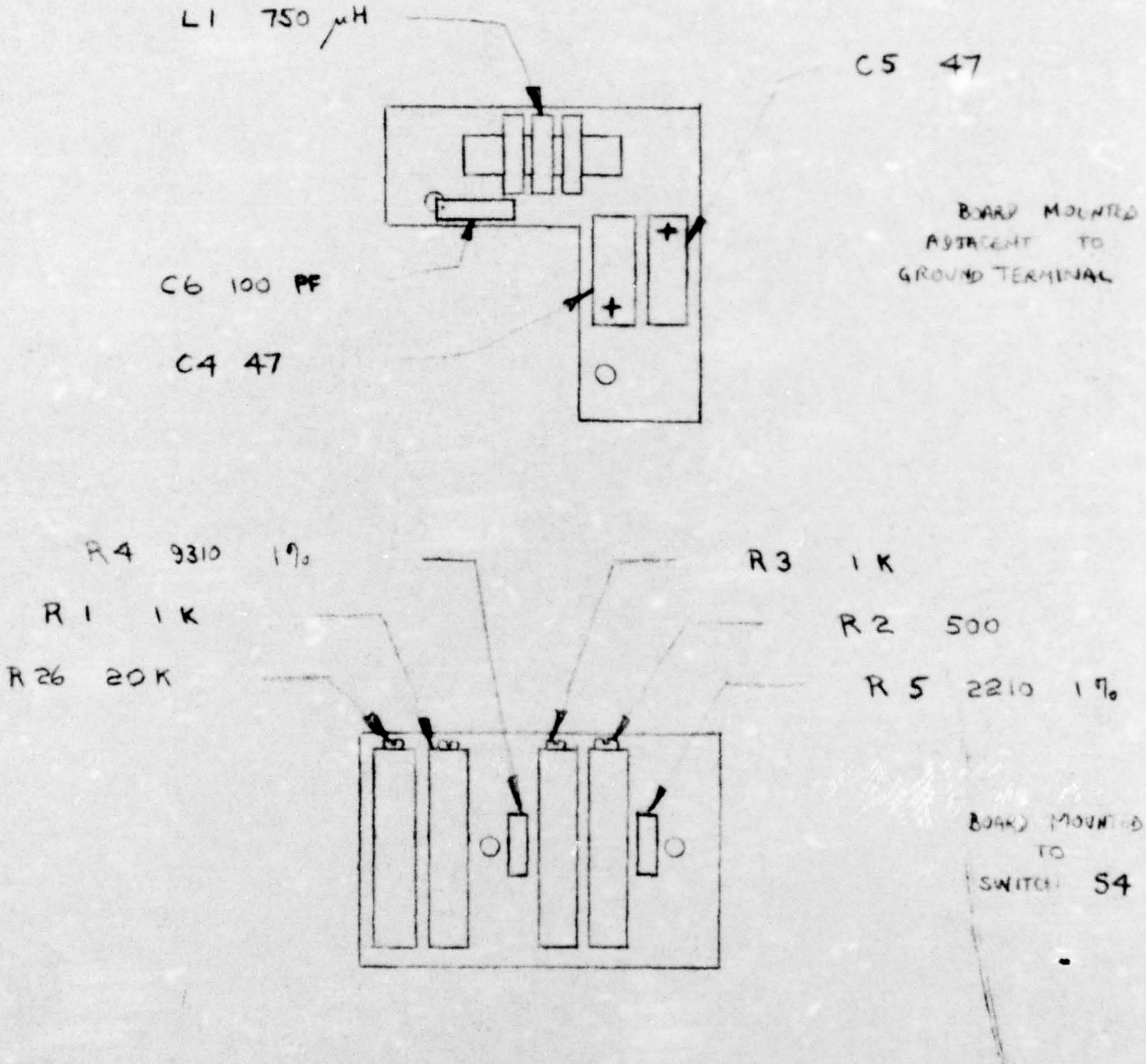
L1 750 μH
C5 47
BOARD MOUNTED
ADJACENT TO
GROUND TERMINAL
C6 100 PF
C4 47
R4 9310 1%
R3 1K
R1 1K
R2 500
R26 20K
R5 2210 1%
BOARD MOUNTED
TO
SWITCH S4

FIGURE 13

The following two data traces illustrate the form of data provided by the X-Y plotter.

The first illustration shows the temperature trace with the depth mark interruptions. The width of the depth interruptions could be reduced on future models of the Dubat if this is objectionable for temperature data assessment.

The second data chart shows a recorded temperature trace without depth interruptions as would be provided by the simplified version of the Dubat.

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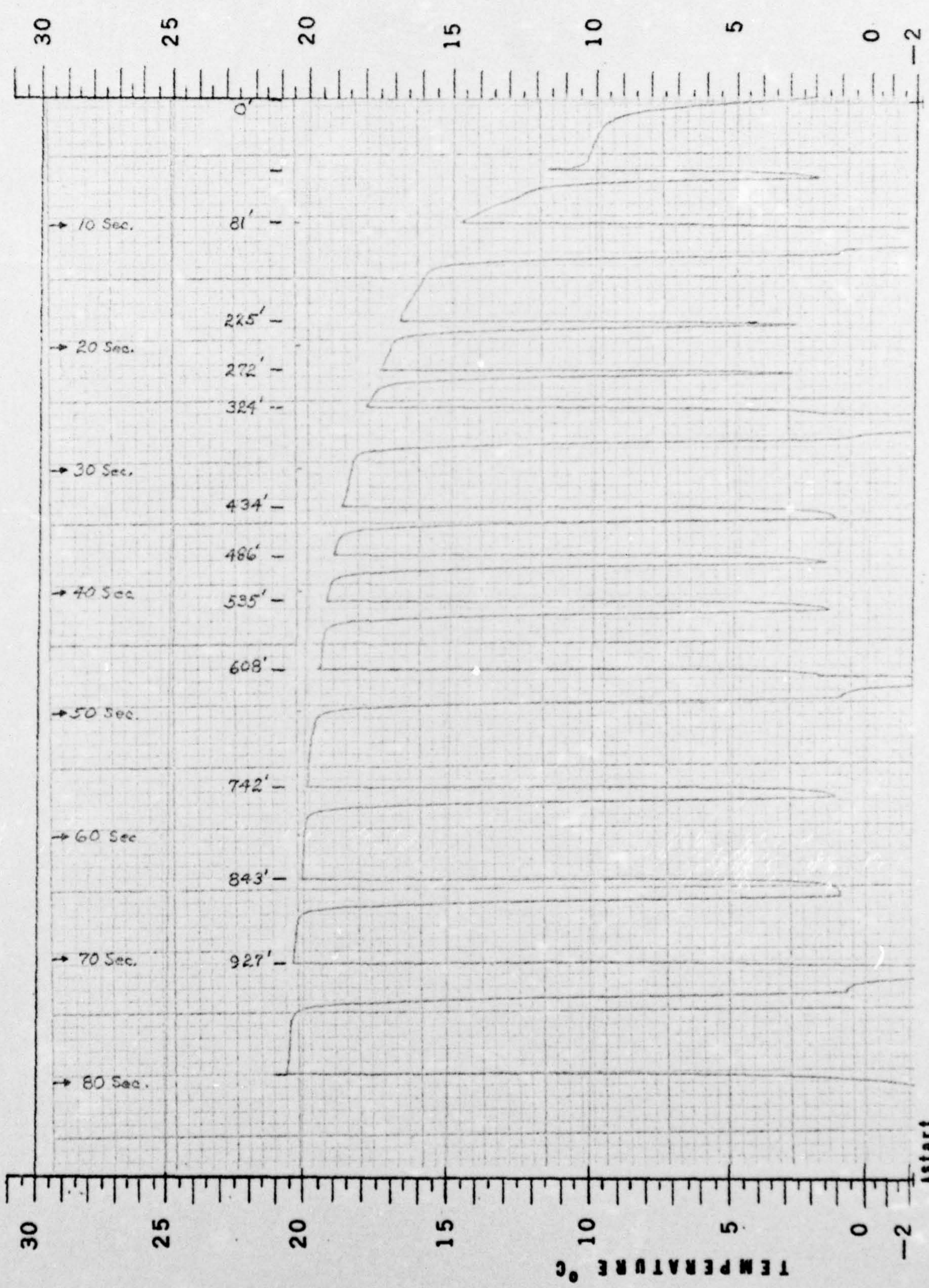
DUBAT Serial No. ____________
DROP DATE ____________



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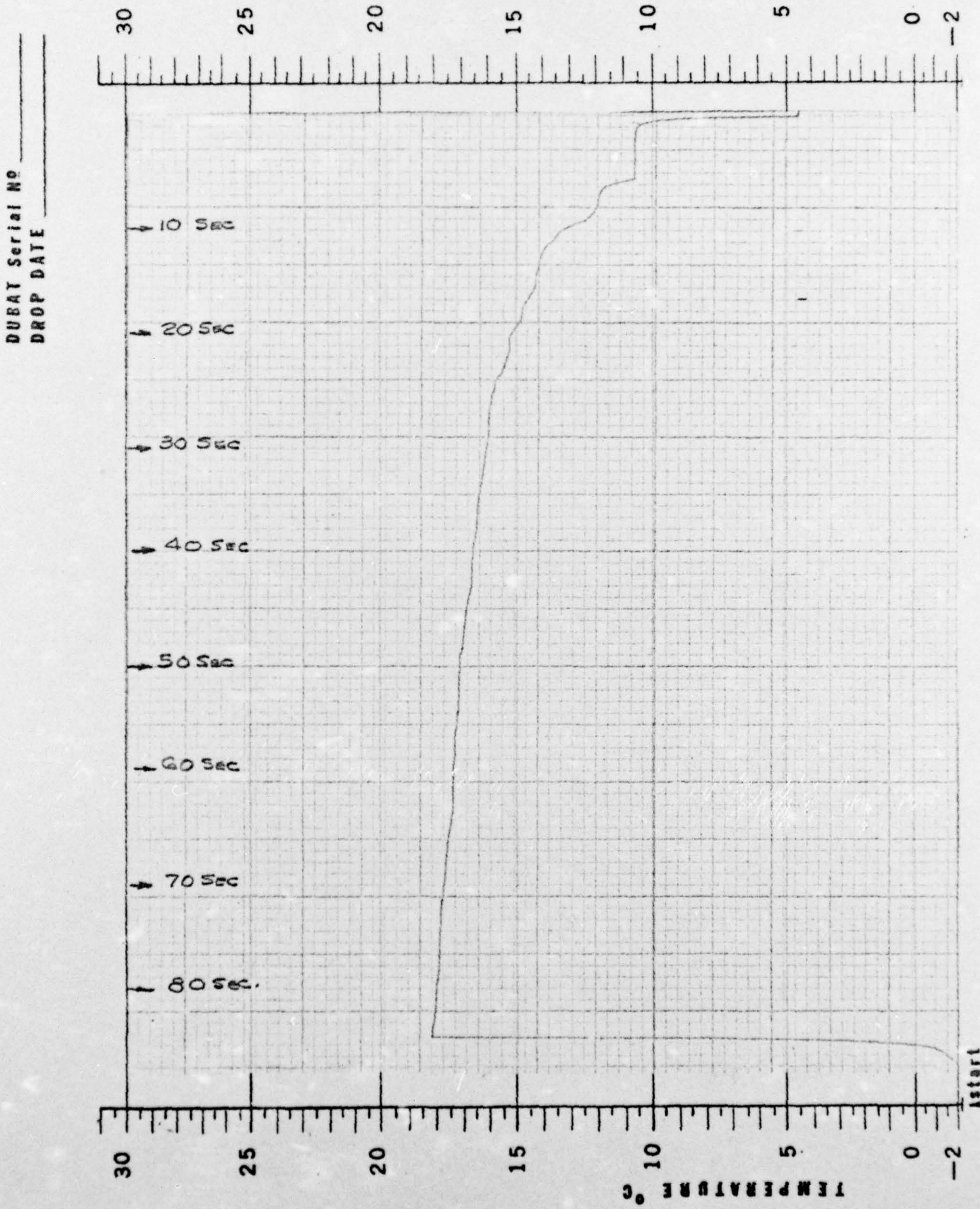

TRANSPARENT OVERLAY FOR----

FINAL ENGINEERING REPORT

CONTRACT NObsr 93315

TEMPERATURE CORRECTION VS. CABLE LEAKAGE

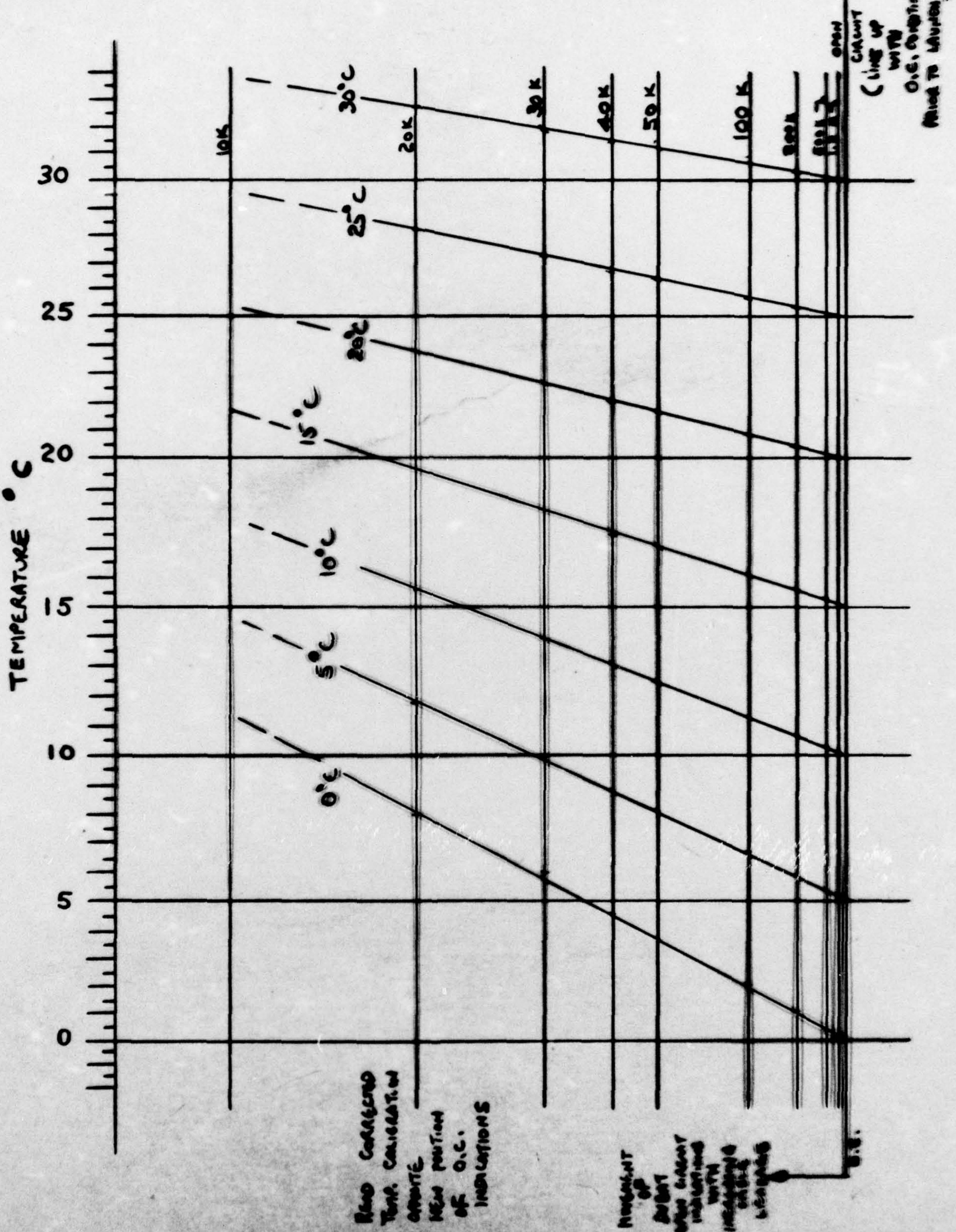

FIGURE 10	REV.	SHEET