

0031449

Date Received: 12-22-92

INFORMATION RELEASE REQUEST

Reference: WHC-CM-3-4

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	101-T (92-029)	10/30/92	

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Title of Journal N/A

CHECKLIST FOR SIGNATORIES

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			Name (printed)	Signature	
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Information conforms to all applicable requirements. The above information is certified to be correct.

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Steve Szendre	12-17-92	

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B.G. Erlandson	12/18/92

Date Cancelled	Date Disapproved
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- Project or program manager concurs with the issuance of this report.
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- Product comparisons
- Inventions
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- Information meets environmental compliance.

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- All reviews are complete and this publication or presentation is approved for release (after resolution of mandatory comments).

CERTIFIED VENDOR INFORMATION

CVI 21533		EQUIPMENT TITLE <i>F.I.C. LIQUID LEVEL MONITOR SYSTEM</i>				EQUIPMENT NO. <i>N/A</i>		COST CODE		
DATE <i>7/11/84</i>		VENDOR <i>DCI/ALPHA ISSAQUAH, WA.</i>						PROJECT NO. -		
P. O. NUMBER <i>W3W-666-301658</i>		EQUIPMENT MANUFACTURER <i>F.I.C. INDUSTRIES</i>						BLDG. NO. <i>211-U (UO3 PLANT)</i>		
SHEET NO.	VENDOR DWG.	SUPERSEDED BY HAN. DWG.	REV.	HAN. MODIFIED DWG.	CURVES	VENDOR SPEC.	INSTR.	PARTS LIST	MISC.	
<i>ITEM #1</i>	<i>P.O. W3W-666-301658</i>									
<i>ITEM #2</i>	<i>FIC IND. INSTRUCTION MANUAL</i>									
	<i>1-14</i>									
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CVI. 21533 SHT. 2
P.O. No. W3W-BBB-301658
DATE 7-11-84 Bldg. 211-11
E.P.N. _____

INSTRUCTION MANUAL

"PRECISION LIQUID LEVEL MONITOR SYSTEM" CONDUCTIVE, NON-CONDUCTIVE AND DUAL

<u>Table of Contents</u>	<u>Page</u>
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ROCKWELL P.O.

W3W-BBB-301658

I. DESCRIPTION

For description of system, principle of operation, sensor transmitter types, receiver types, specifications and model numbers, see F.I.C. Industries "Precision Level Measurements" brochure.

II. UNPACKING AND PREPARATION FOR INSTALLATION

All pieces are well packaged in cartons with suitable packing material, bracing, etc. There may be one or more pieces in a carton, depending on the weight and the material ordered. Usually there is a packing slip on the outside of the carton to tell what to expect. It is a good idea to make sure all major parts ordered are available before installation is begun.

Before removing from the carton, provide a suitable place with a table or bench so that the material may be inspected under the best conditions. Whenever possible, especially where personnel have not worked with this equipment, it is recommended that the system be operated in the shop where it can be checked, calibrated and operated in comfort, instead of having to run up and down a tank ladder or walking long distances from the transmitter to the receiver. This procedure will save time in the long run. A suitable bench or table, 115V AC power and ordinary electricians tools are the only things required to completely check out and calibrate the system.

Place the transmitter on the table with the plummet pipe down. Refer to installation drawing attached.

1. Open probe housing by loosening captive thumb screws or clamps as provided. Remove packing material around probe. Check that:
 - a. Tape is threaded properly.
 - b. Tape is aligned properly on sprocket wheel.
 - c. Is routed between insulated studs (hi-pressure model).
2. Open control box door.
 - a. Check that drive motor gear mesh is proper-check by feeling the backlash while relieving weight on tape. If not, loosen motor bracket holding screws and reposition till proper mesh is made.
 - b. Check that sprocket gear meshes with a minimum of backlash with selsyn and/or counter gears. Make sure that counter masks are properly positioned.
 - c. Check that control printed circuit board is fully engaged in mating plug.
3. Preliminary testing of instruments.
Instruments for conductive liquids
 - a. Place a metal plate or a container of water under the probe. Connect a ground wire from the plate or the water to the housing.
 - b. Connect 115V AC per hookup diagram attached.
 - c. Turn on power switch with raise-lower switch in DN position. Plummet will lower to plate and stop. If plummet doesn't move, push jam release switch (conductive liquid only). If the probe is grounded, this switch will disconnect ground until probe is free to come down. The "Up" switch will raise the plummet. After the probe reaches the plate (or the "Up" switch is operated) a time circuit is initiated and after 60 seconds the probe will rise, until it breaks contact with the ground. It will then reverse and go down until it makes contact and then repeat the cycle. This cycling allows the probe to follow a rising or falling level. As long as the probe is grounded it will rise (after 60 seconds).

Instruments with non-conductive media—float equipped

- a. Place a container filled with water under probe.
- b. Connect 115V AC per hookup diagram attached.
- c. Make sure that the float is installed with the normally open designation on the upper part of the float. Turn on power switch with raise-lower switch in DN position. Plummet will lower to liquid, float will move and stop. The "Up" switch will raise the plummet. After the probe reaches the media (or the "Up" switch is operated) a time circuit is initiated and after 60 seconds the probe will rise. It will then reverse and go down until it makes contact and then repeat the cycle. This cycling allows the probe to follow a rising or falling level.

Instruments with dual sensing — float & conductivity

NOTE: The dual probe system can measure by conductivity or by float when a switch position is made (A) In the case of a non-conductive and a conductive liquid (oil & water) the float will measure the top oil level and the water interface by conductivity. (B) In the case of a light conductive material and a heavier material (water and water-solids interface) the top (water) level will be measured by conductivity and the solids layer by a calibrated float. The minimum layer must be at least 3 1/2".

C.V.I. 21533 SHT. 3

P.O. No. 0302 - BBB - 30/658

DATE 7-11-84 Bldg. 211-26

E.P.N.

- a. Place a container filled with the two medias to be measured under the probe. Make sure that there is at least 3½" of the heavier media and 2½" of the lighter media. Connect a ground wire from both medias in container to the housing.
- b. Connect 115V AC per hookup diagram attached.
- c. Make sure that the float is installed in the "normally open" position on the upper part of the float. Turn on power switch with raise-lower switch in DN position. Start by having media selector switch on "F" (float). The probe will lower itself to the container and stop when float is activated by the first liquid whose density is lower than the buoyancy of the probe. A time circuit is then initiated and after 60 seconds the probe will rise, until the float returns to its lower position. It will then reverse and go down until the float moves again on its shaft and repeats the cycle. With the media selector switch on "COND" the probe will lower to the container and stop when probe tip touches the first conductive media. If the probe gets electrically grounded to the housing, switch selector switch to "F" (float). The open probe switch will then permit the plummet to go down.

Units with remote station have a conductivity-float switch in the remote station. To conveniently test both modes there is also a "normal-test" momentary switch in the transmitter.

Operation is controlled by as above by the remote station switch. The test switch in the transmitter can be used for convenience to perform the same functional tests. In "Normal" position the probe senses the mode as established in the remote station. To test the second mode, depress the lever to "Test" and hold it. The probe will seek the other mode. By releasing the lever the operation is reverted to the remote station setting.

All units have a low limit switch. When probe reaches O level, a switch disables lowering circuit and stops. This is to prevent the tape from dragging at the bottom or to reverse on the reel. If level increases, or "up" switch is activated, unit will go up.

Some units also have a hi limit switch, which acts similarly as the low limit switch. When probe reaches, factory set, hi limit, it stops. If the level goes down, probe will follow. To let the probe go up for storage or inspection, actuate the up switch. This will overrun the hi limit switch action.

III. INSTALLATION

Use a proper 2" pipe flange fitting (2½" pipe flange for 150 psi rated wheel housings). Insure that the housing mounting tube is vertical within 1° to avoid tape or probe touching side walls misalignment on sprocket. Consult installation drawing for special requirements, if any.

Use support bracket, if desirable. Insure against pivoting of unit in pipe flange fitting by proper set screw type locking system, or positive flanging. Recheck for proper tape feed.

Open control box door. Select proper power input with appropriate circuit breaker (2 pole). Install wire conduit and connect all wiring per W/D. Make sure that all wires are out of the way of boards and mechanical parts.

Install air purge piping and cleaning (½") pipe to spray head (optional)

Insure that proper ground is established. Ground should be connected to metal in tank in contact with fluid (conductive probes). Calibrate to tank as per Paragraph IV.

NOTE:

- a) On intrinsically safe models, components are selected to insure safe current levels. "No substitution of components is permitted as it may jeopardize the intrinsically safe feature."
- b) On explosion-proof models—these models are in general intrinsically safe units and the paragraph above applies. In addition, all power must be disconnected before unscrewing and lifting the transmitter control housing cover. Conduit connections must be watertight and be of the explosion-proof application type, similar to crouse hinds eyes.

Install air purge piping and cleaning (1/2") pipe to spray head (optional)

Insure that proper ground is established. Ground should be connected to metal in tank in contact with fluid (conductive probes). Calibrate to tank as per Paragraph IV.

NOTE:

- (a) On intrinsically safe models, components are selected to insure safe current levels. "No substitution of components is permitted as it may jeopardize the intrinsically safe feature."
- (b) On explosion-proof models—these models are in general intrinsically safe units and the paragraph above applies. In addition, all power must be disconnected before unscrewing and lifting the transmitter control housing cover. Conduit connections must be watertight and be of the explosion-proof application type, similar to Crouse Hinds EYS.

IV. CALIBRATION

The calibration is determined by the spacing of the holes (1" centers) on the tape and the measuring sprocket and the gears on the counter. Therefore, the unit cannot get out of calibration. The probe is calibrated in reference to the following:

- (a) Conductivity only — tip of probe
- (b) float probe only — to 3/4 of float height
- (c) hybrid float & conductivity probe —
 - conductivity — to the tip of probe
 - float — to the float height (about 3")In this case if the counter is calibrated to the conductive probe, to find the absolute level value one should add 3" to the reading when float "F" measurement is taken.

1. Zero setting for transmitters with integral counter. The counter should be zeroed to the bottom of the tank, reading 0000.

- (a) With an empty tank — lower plummet until the tip of the probe reaches the bottom or a level slightly above the bottom, by feeling a slight slack in the tape. Turn off the power. Loosen counter sprocket set screw. Set the counter to 0000. It is recommended that the low limit be set above the bottom in order to insure its proper operation. A micro-switch is activated to stop the down movement when counter indication is 0000. Otherwise, if the bottom has a coating or electrical insulation, the probe will not stop and the tape will reel out and become slack and jam. It is to be noted that with a float probe, the float will not be activated unless there is 3" of liquid at the bottom. In this case let the probe slacken for 3" before turning off the power and setting the counter.
- (b) With a filled tank — calibration must be done to a reference point, with known value of height from bottom of tank (at the location). With the plummet at the top, set the counter to read the correct height from the bottom. For conductive or hybrid dual probes bring tip of probe to the reference point by using the up-down switch. Turn off the power when tip is aligned with the desired mark. Loosen counter set screw. Set the counter manually until it reaches the height of the reference marking. Retighten the set screw. ~~For float only type probe, proceed as above except that the top of the probe has to be brought to the reference point.~~

2. Zero setting for transmitter without integral counter, with remote indication

Connect the transmitter and receiver as shown in attached hookup diagram. Note that the power switch and the up-down switch are duplicated on the receiver. The receiver master power switch controls all power including the power to the selsyn, whereby the transmitter switch controls only the power of the transmitter circuitry, exclusive of the selsyn. Therefore, unless the master power switch or fuse is off, the selsyns are always powered. For calibration, loosen the set screw of the counter in the receiver. Turn on master power switch. Adjust counter setting per previous procedure. Tighten set screw.

3. Zero setting for systems with local and remote indication

Follow procedure No. 1 and then reset remote counter to match receiver counter. Have only remote station power on during this operation.

4. Where the alarm counter is used, the upper and lower preset counter may be used for hi and low limits and the other alarms (SPDT) closures for alarming, sequencing and other functions. This counter is set in the same manner. The power switch and hi-low manual switches are also provided. (See brochure).

5. Retransmitting slidewire calibration

Slidewires are factory set to cover the full span of the installed transmitter tape, with proper zero. However, if readjustment of the zero is necessary loosen slidewire shaft gear set screw or potentiometer mounting position, as the case may be, and adjust extreme stop of one end of slidewire to coincide

with the bottom position of probe or 0000 setting of the counter. Span and zero adjustment can be done within $\pm 20\%$ at the R/I unit when provided. In this case it is adjusted on the R/I by electrical adjustment.

V. MAINTENANCE

No maintenance is required except periodic by-yearly checks and cleaning. Slightly oil, with light machine oil, the drive gear teeth. Periodic cleaning or wash cycles should be established for the reel housing, wheels, sprockets, tapes and probes, based on application. For chemical or sanitary application, use optional wash head system.

VI. SERVICE REPLACEMENTS

All replacements are made with external power circuit breaker off.

- a. Counter — Proceed as in Paragraph II, 2b.
- b. Drive Motor — Disconnect motor leads. Loosen take-up wheel gear. Unscrew motor bracket. Replace motor as required. To reinstall, follow steps in reverse. Adjust position of motor bracket and gear on motor to insure proper mesh and backlash. Make sure that takeup wheel gear is properly installed on shaft. Insure that brush connection wire is routed properly away from moving parts.
- c. Control Panel — Disconnect control panel. Unscrew two holding screws. Reinstall by following steps in reverse order, making sure first that mounting studs are properly secure on base.
- d. Printed Circuit Board — Electronic board can be lifted from plug. To reinstall, make sure that board is properly plugged and follow steps in reverse order.
- e. Takeup Wheel — To remove, open probe housing cover. Loosen shaft collar and gear set screw. Remove all guards and holding screws. Lift tape from sprocket. Pull out wheel assembly, sliding gear and collar out. For reinstallation, follow steps in reverse. Pay attention not to damage brushes. Make sure that O rings on shaft are not damaged. Lubricate with light silicon grease (Dow Corning 33, or other) before insertion. Insure that wheel is properly seated against bearing. Make sure there is no lateral play of shaft in bearing housing.
- f. Sprocket Wheel — Make sure tape is on sprocket wheel. Loosen sprocket wheel collar and sprocket chain gear. Open cover on reel housing. Remove sprocket guard. Lift tape from sprocket and let tape rest free, hanging from takeup wheel. Pull out sprocket wheel. For reinstallation, follow steps in reverse. Make sure the O rings on shaft are not damaged. Lubricate per (e) before insertion. Insure that wheel is properly seated against bearing, with minimum or no play. Proper alignment of sprocket wheel with takeup wheel is essential. Align sprocket gear to mesh to counter or selsyn gear.

VII. THEORETICAL REVIEW

1. Level detected by conductivity

When the plummet touches the liquid, a circuit is completed between the probe, the liquid and the tank, which is grounded to the instrument. This triggers the silicon controlled rectifier (SCR) Q1 (01-1220) which in turn drives Q2 and the emitter follower stage Q3 close to ground potential. Consequently, triac Q9 (motor down mode driver) is turned off while SCR Q10 (motor electronic brake) is turned on to lock motor motion. When Q3 is at ground potential the timing cycle (60 sec.) is initiated. The source of FET Q5 follows the potential buildup of timing capacitor Q5. When this potential reaches a value of 10V Zener Z3 will turn Q6 on, which will turn Q8 on through inverter Q7. At this point Q8 turns triac Q11 (motor up mode driver) on and SCR Q10 off, which results in a plummet raising motion. As soon as the plummet loses contact with the liquid, Q1 and Q2 will be turned off. Q3 will turn on, which will cause Q4 and triac Q9 to switch to the on stage. Q4 will now discharge timing capacitor Q5 and hence remove the drive from Q8. Under these conditions, a down motion is initiated and the above mentioned cycle is repeated.

2. Level detected by float action

The support tape in this case has two insulated conductors. The action is similar to above except that the circuit is completed through the switch action in the float and the second wire in the probe tape.

3. Intrinsic safe circuit option

The circuitry within the reel housing is designed for intrinsic safety to meet ISA-RP-12.2, dated 1965 and NFPA 483 dated 1969. In the reel is potted two metal film 50K OHM resistors in series.

The leads from the printed circuit board, which is enclosed in a plastic cover, are in a metal conduit and the slip rings are covered. This is done to prevent unauthorized personnel from tampering with the circuit. There is a 24V A.C. across leads 24 and 28. This will allow $2 \times 24 = 100,000$; $I = 48$ micro amperes. If the shields were removed and 110V directly placed across the leads, which is highly unlikely, $I = 23 \mu A$. The allowable current per RP12.2 for the circuit, which has .047 mf is .2 amps which is considerably below that allowed. This circuit is operating in Hydrogen and Butadiene atmospheres. As an alternate, an approved barrier can be installed in the probe circuit.

VIII. TROUBLE SHOOTING (ELECTRICAL)

1. No Power — check input terminals 11 and 12 of TB-1 (Dwg. 01-1201) for 115V. Check terminals 11 and 12 for 115V, if no power — replace the fuse.
2. Plummet does not move down —

Possible Causes	Solution
Low limit switch closed.	Readjust switch.
Motor failure.	Replace motor.
PC card failure — to check, disconnect plummet input wire (yellow) from plummet terminal and measure the voltage at card test point TP-4 (yellow) with respect to ground TP-0 (black). A voltage less than 7V will indicate a card failure.	Replace card.

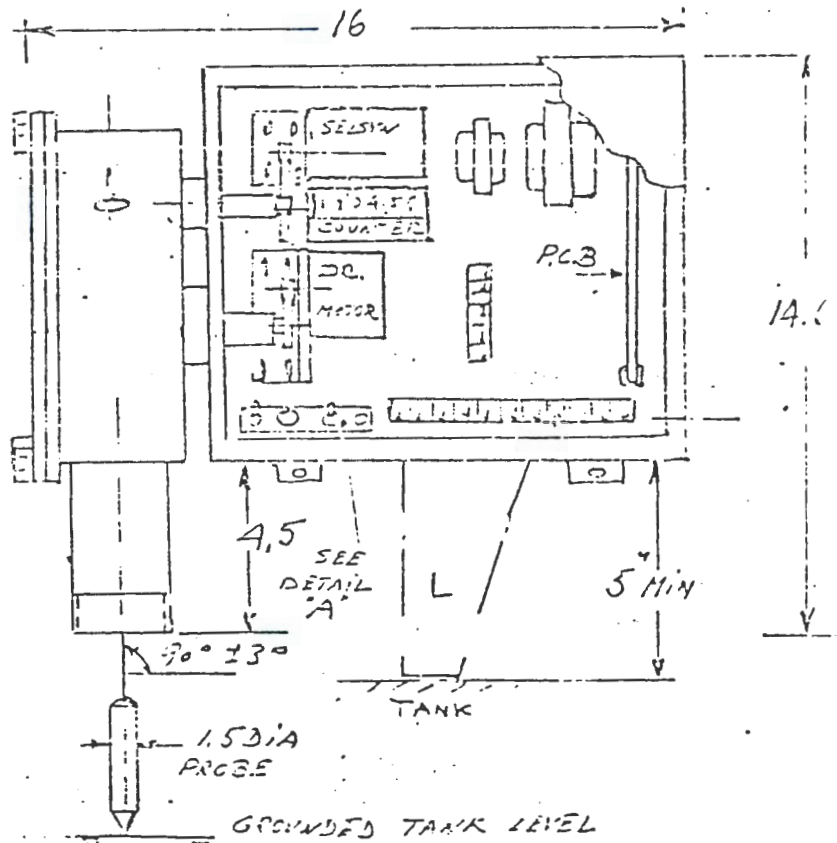
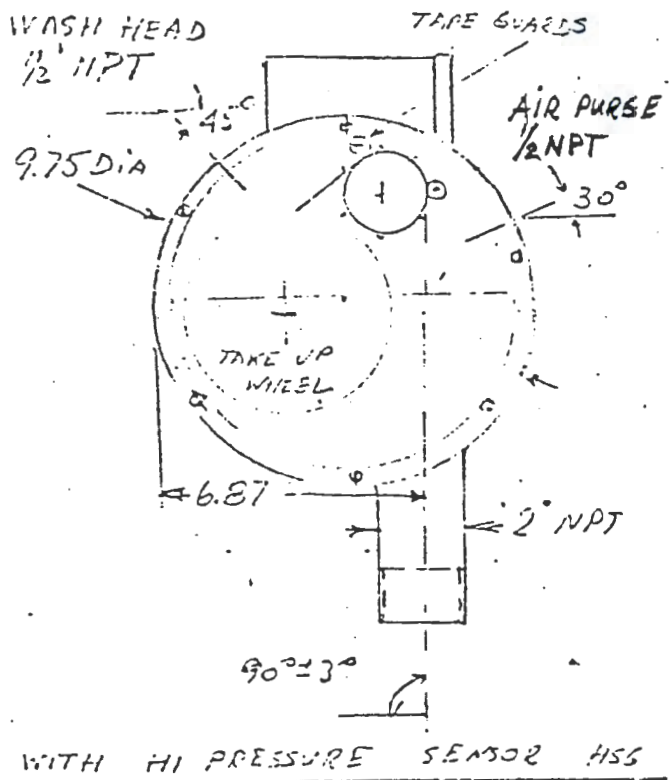
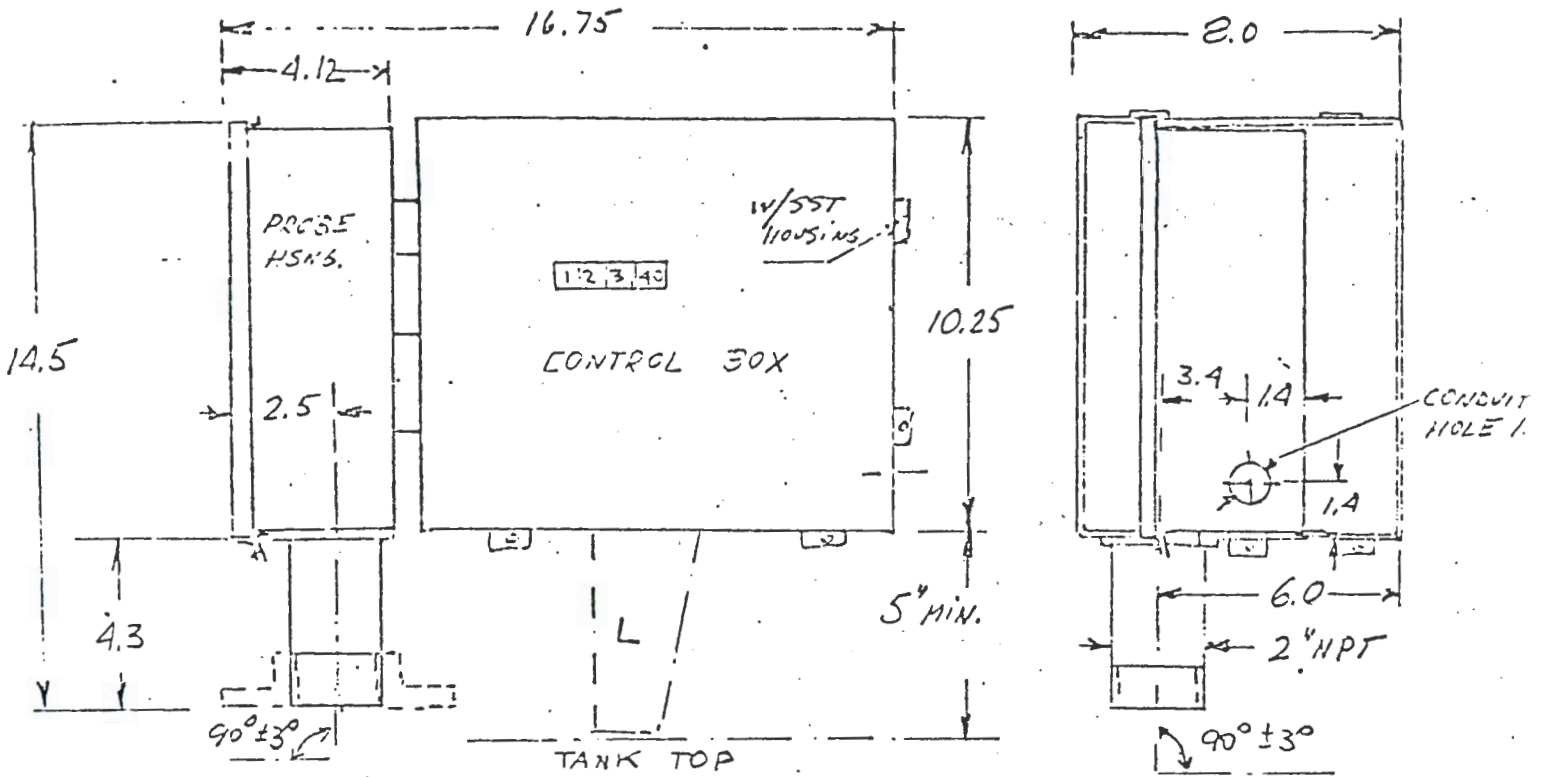
3. Plummet does not go up —

Possible Cause	Solution
Loose connection — to check, connect a jumper lead between TP-3 (black) and TP-1 (brown) and wait for 60 sec. If plummet goes up - - - .	Repair loose connection to plummet.
Motor failure.	Replace motor.
PC card failure — to check repeat 3-1 and measure the voltage at TP-3 (orange) with respect to TP-0. A voltage less than 7V will indicate card failure.	Replace card.
Hi limit (if provided) is on	Level is too high or readjust switch

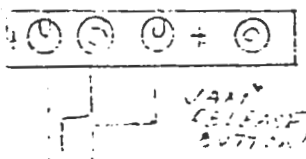
IX. RECOMMENDED SPARE PARTS

	No.	Conductive	Float	Dual
Fuse	1A	x	x	x
Drive Motor	01-1278-01	x	x	x
Takeup wheel (specify length of tape & wheel material)	01-1073-x	x	N/A	N/A
Takeup wheel probe assy. (specify length of tape & wheel material)	01-1262-x	N/A	x	x
Conductive Probe — w/o tape	01-1222-01	x	N/A	N/A
Wheel Shaft O Rings		(2)	(2)	(2)
Sprocket Shaft O Rings		(2)	(2)	(2)
Brush	01-1027-01	x	x	x
PCB Assy. — 60 sec. delay	01-1155-01	x	x	x
Others-as required per model no.				

WITH 14 CASE SENSOR HSS.



DETAIL A



TOLERANCE UNLESS NOTED

ONE PLACE (.01)	0.01
TWO PLACE (.001)	0.001
THREE PLACE (.0001)	0.0001
ANGLES	1°

SCALE

NONE

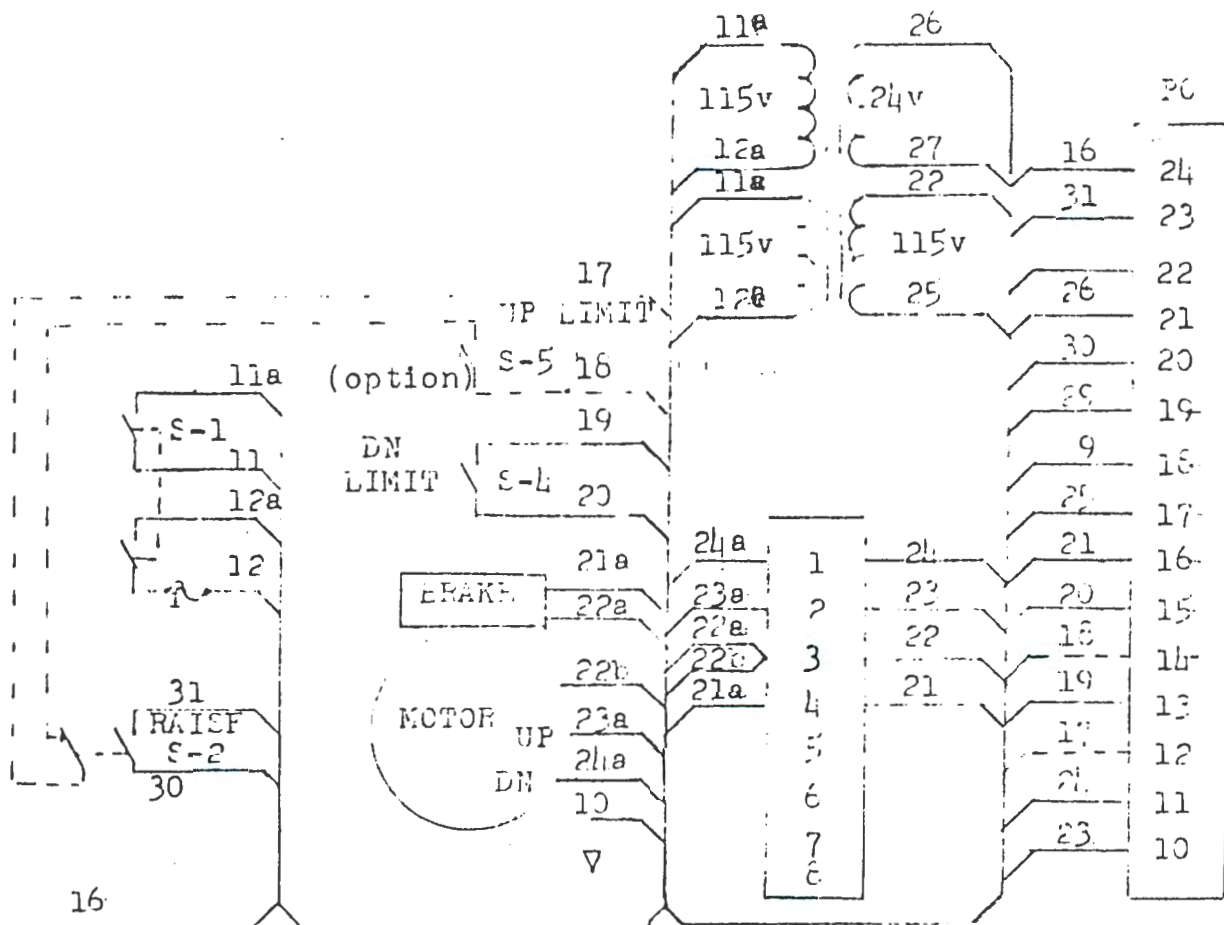
TRANSMITTER ST.
CONDUIT L100

UN-SCAN SKI
PROBE

DATE	BY	CHKD

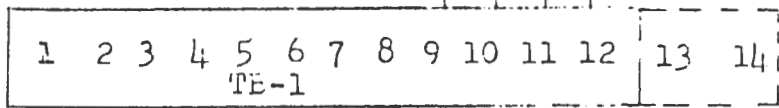
PROJECT

DRAWING NO
01-1219



WIRE NO.	COLOR
9	green
10	green
11	white
12	black
13	yellow
14	yellow
15	yellow
16	yellow
17	grey
18	green
19	brown
20	green
21	green
22	red
23	orange
24	white
25	red
26	blue
27	blue
28	black
29	red
30	white
31	green
32	purple

See Probe Detail

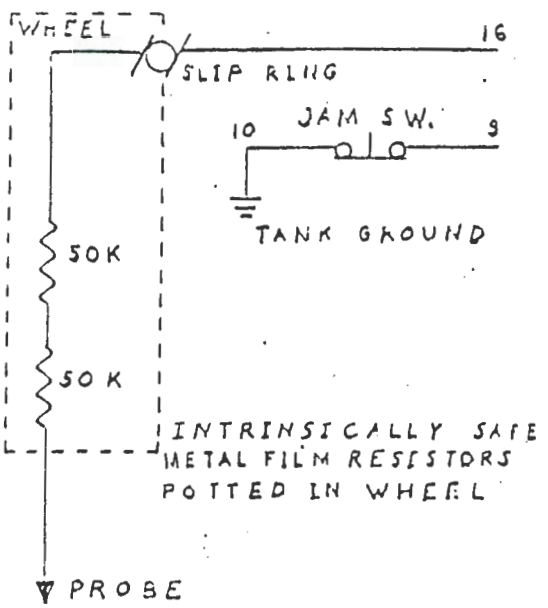


N H
115 vac when local mounting only

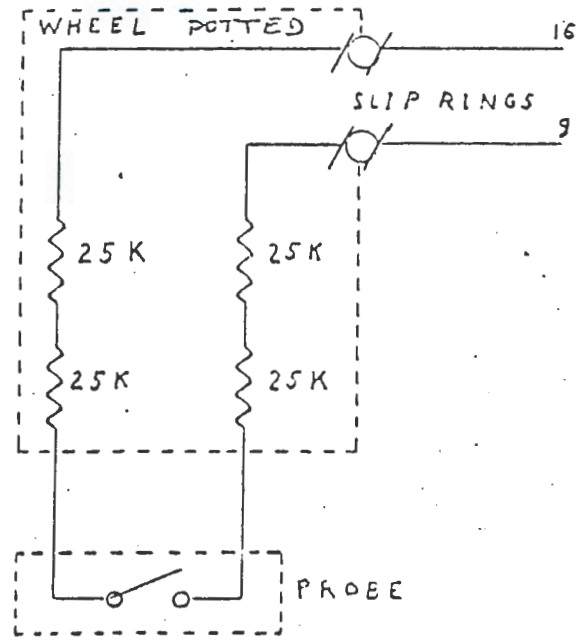
All wires #22 Belden Type 8501 or 852h.

			E.I.C. INDUSTRIES, INC. LERCUMALL, PA. USA	
			LEVEL DETECTOR WIRING DIAGRAM STANDARD	
			Dwg. No. 01-1338	

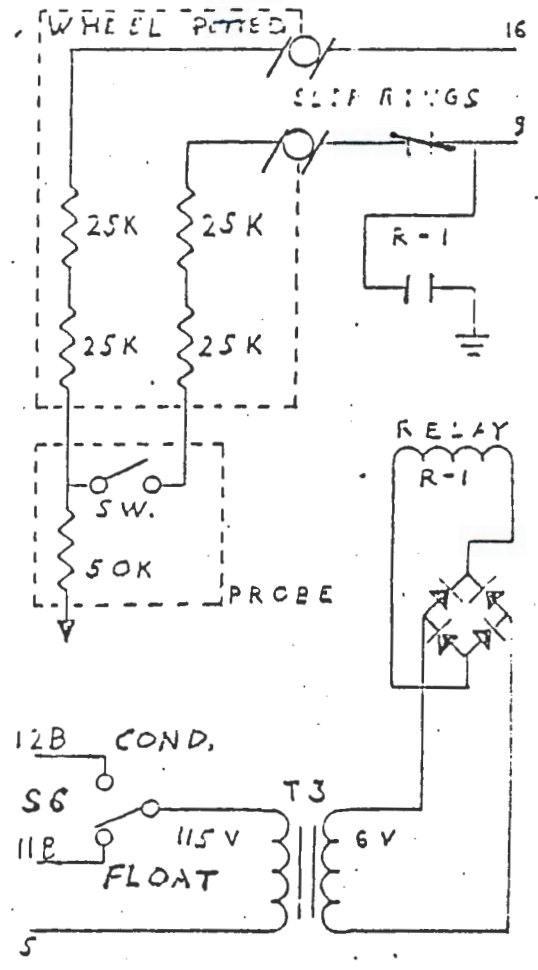
CONDUCTIVE



FLOAT

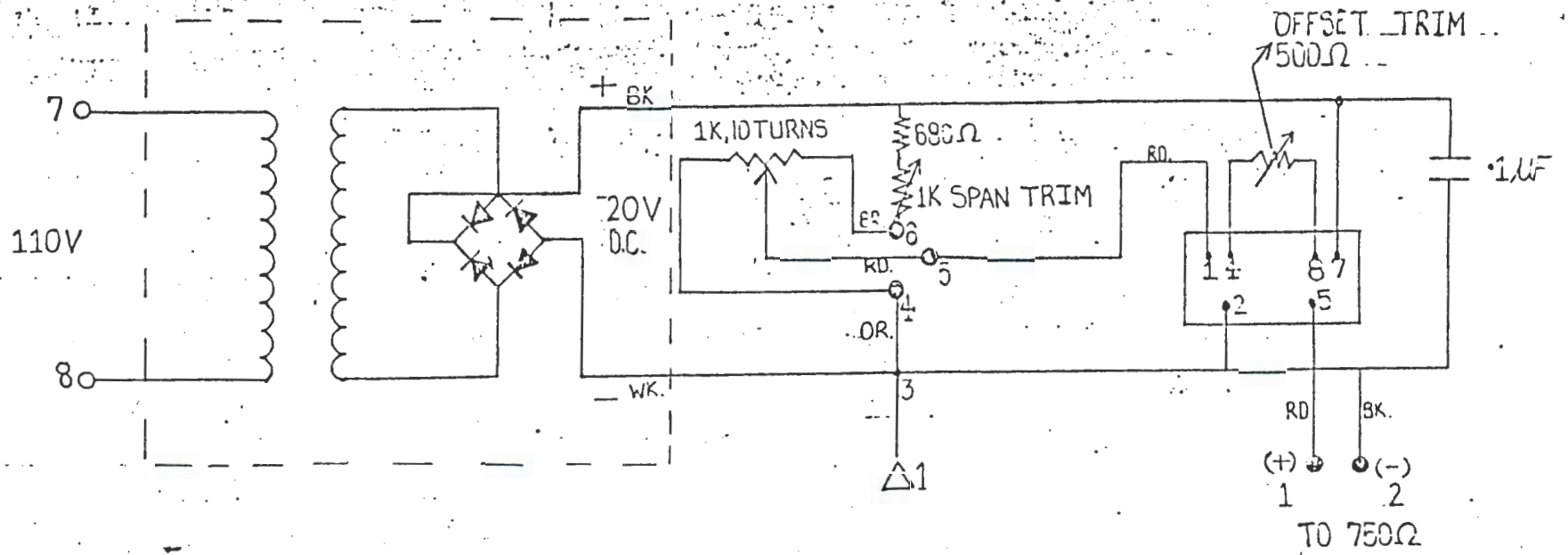


DUAL

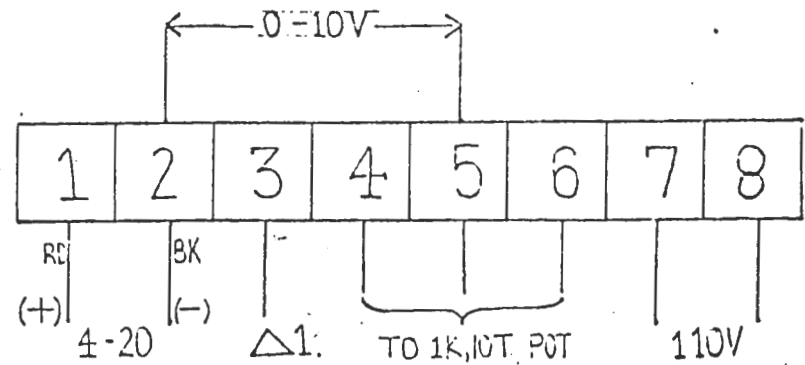


FOR LOCAL OPERATION
JUMP 5 TO 11 ON T3-1

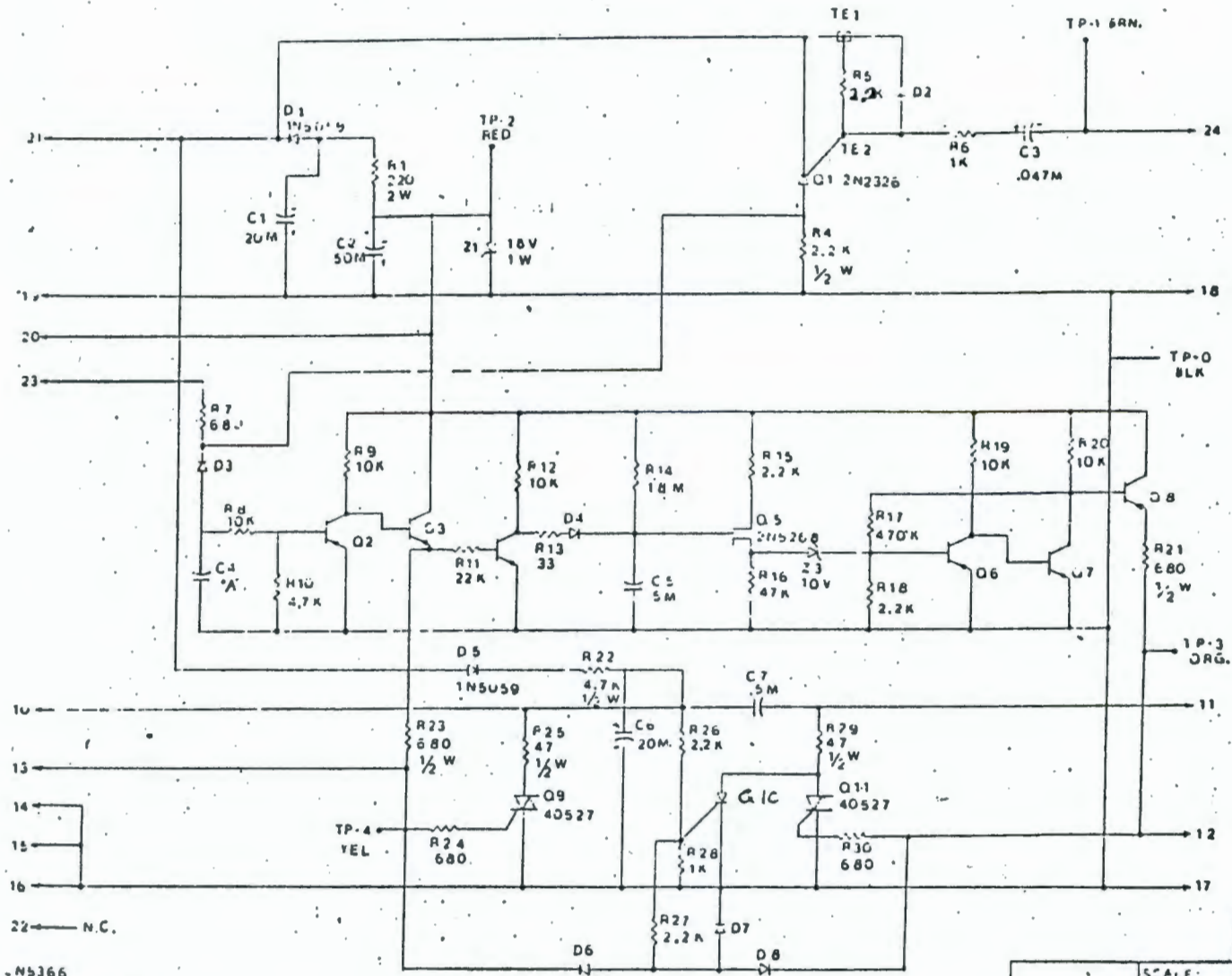
		SCALE	F. I. C. INDUSTRIES INC BROOMALL, PA. U.S.A.
		WST 1-16-78	PROBE DETAILS WIRING DIAGRAM
			DWG NO. 01-1339



Δ1. CONNECT TO TERMINAL 3
ON TB-1



TOLERANCE UNLESS NOTED ONE PLACE (.01) ± .030 TWO PLACE (.001) ± .015 THREE PLACE (.0001) ± .005 ANGLES ± 1°	SCALE		E.I.C. INDUSTRIES, INC. BROOMALL, PA. USA
	MOUNTED	WIRING DIAGRAM FOR R TO 4-20MA P.C. BOARD. (01-1420)	
MATERIAL		DR. NO.	
FINISH		01-1431	



A. PNP TRANSISTORS - 2N5366
 A. DIODES 1N454 UNLESS SPECIFIED
 ALL RESIST. AS 1/4 W UNLESS SPECIFIED

DIFF. 1/4" CYCLE	IBM	Q2
STANDARD 1/4" CYCLE	.60M	Q1
	"A"	ITEM

SCALE:	NONE	FIC INDUSTRIES, INC
		BROCKWAY, PA. USA
		STD. LEVEL GAUGE SCHEMATIC
		OF PCB BOARD
		01-1221-IT

121

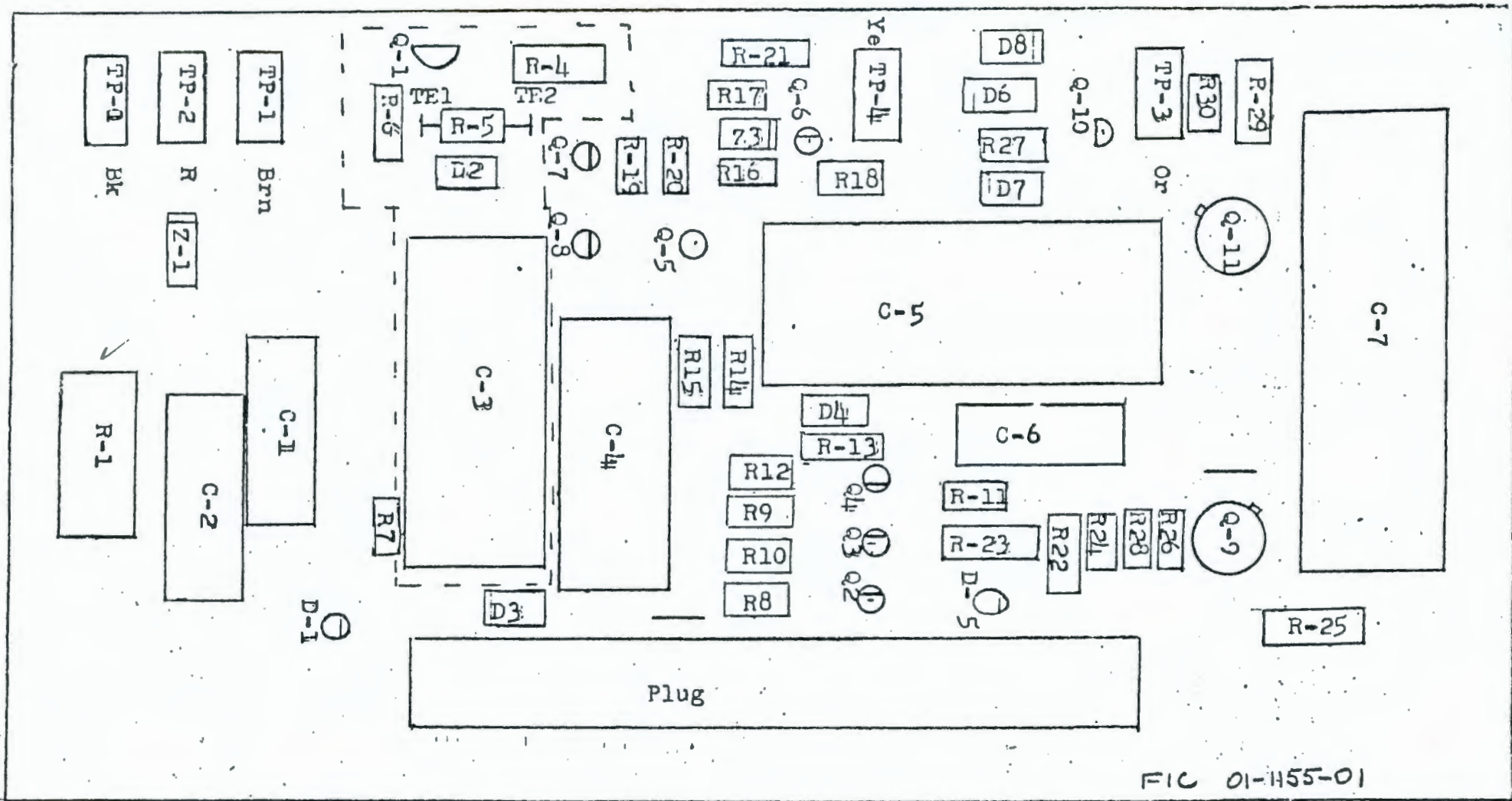


FIG 01-1155-01

These parts are removed when low energy amplifier is used.
 FOR 01-1155-02

		SCALE NONE	F.I.C. INDUSTRIES, INC. Chroomatt, Pa, USA
		USED 01-1200	P.C. BOARD ASSY SH-1
FNCR	W.T.	5-16-72	01-1155-IT

255

BILL OF MATERIAL

DETECTOR- Drawing 01-1155-01 (Printed Circuit Board Assy.)

<u>Item</u>	<u>Description</u>
	PC Board 6.83 x 3.5 x5 1/16
	Schematic AM 112, CU-1006
	Plug 01-015-013-5200
R1	220 ohms, 5%, 2W
R7, R24, R30	680 ohms, 5%, 1/4W
R4	2.2k, 5%, 1/2W
R5	2.2k, 5%, 1/4W
R6, R28	1K, 5%, 1/4W
R8, R9, R12, R20, R19	10K, 5%, 1/4W
R10	4.7K, 5%, 1/4 W
R11	22K, 5%, 1/4W
R13	33 ohms, 5%, 1/4W
R14	18M, 5%, 1/4 W
R15, R18, R26, R27	2.2K, 5%, 1/4W
R16	4.7K, 5%, 1/4W
R17	470K, 5%, 1/4W
R21, R23	680 ohms, 5%, 1/2W
R22	4.7K, 5%, 1/2W
R25, R29	47 ohms, 5%, 1/2W
C1, C6	20mf, 50v, TE-1305 Sprague
C2	50mf, 50v, TE-1307 Sprague
C3	0.047mf, + 10%, 400v, 192P47394 Sprague
C4	0.68mf, 100v, Mylar WMF-1P68, CDE
C5	5mf, 50v, Mylar, Wmf-05W5, CDE
C7	0.5mf, 400v, PKM4P5, CDE
D1, D5	Rectifier, 1N5059, G.E.
D2	Diode
D3, D4, D6, D7, D8	Diode 1N4454 G.E.
Z1	Zener, 18v, 1W, 1N4746 Motorola
Z3	Zener, 10v, 1/2W, 1N5240B Motorola
Q10	SCR C103B, G.F.
Q2, Q3, Q4, Q6, Q7, Q8	Transistor, PNP, 2N5366, G.F.
Q5	PNT, 2N5268
Q9, Q11	Triac, 40527, R.C.A. or T2 300 D
TP-0	Test Point (Horizontal jack) , 105-0753-001 E.F. Johnson
TP-1, TP-2	Test Point, 105-0758-001 & 105-0752-001
TP-3, TP-4	Test Point, 105-0756-001 & 105-0757-001
TE-1, TE-2	Terminals , 200B, Useco
Q1	SCR 2N2326 Motorola

+R5 0-10k, 00-100 Micro Mhos = 3.6 k
 0-100k, 00-10 Micro Mhos = 6.2 k
 0-200k, 00- 5 Micro Mhos =10.0 k

F.I.C. INDUSTRIES, INC.
 BROCKMALL, PENNSYLVANIA