

Bird Series 4410 ThruLine® RF Wattmeter Calibration Procedure

REVISIONS		
LTR	DESCRIPTION	DATE
E	REVISED & REDRAWN PER ECN 5869 JW.	10-21-85
F	REVISED PER ECN 7641 J.Y.	4-19-89

SCOPE: THIS PROCEDURE PROVIDES FOR COMPLETE CALIBRATION OF THE BASIC MODELS 4410, 4410A, 4411, 4412 & 4410P INSTRUMENTS. CALIBRATION OF THE PLUG-IN ELEMENTS, HOWEVER, IS NOT INCLUDED.

ENVIRONMENTAL REQUIREMENTS

1. THE WORK SPACE MUST BE FREE FROM ELECTRICAL NOISE AND RADIATED SIGNALS. THE AREA MAY BE CHECKED FOR SPURIOUS RADIATION WITH A BIRD MODEL 4041 RELATIVE FIELD STRENGTH METER OR A BIRD MODEL 4030 RELATIVE FIELD STRENGTH ELEMENT IN A BIRD MODEL 43 WATTMETER. MODEL 4410 CALIBRATION MUST NOT BE PERFORMED WHERE ANY RADIATION IS DETECTED. (GAIN SET AT MAXIMUM).
2. THE WORK SPACE MUST BE AT A UNIFORM AND STABLE TEMPERATURE BETWEEN 20° AND 25° CELSIUS (68° AND 77°F).
3. THE RELATIVE HUMIDITY OF THE WORK SPACE MUST BE NO GREATER THAN 50%.

REQUIRED EQUIPMENT

1. THE BIRD MODEL 4410-070 CALIBRATION ELEMENT.
2. A SINE WAVE GENERATOR CAPABLE OF PRODUCING A STABLE 1000Hz ($\pm 1.00\text{Hz}$) SYMMETRICAL SINE WAVE OUTPUT AT VARIOUS RMS VOLTAGES BETWEEN 0.05 AND 1.6 VOLTS RMS INTO AN IMPEDANCE OF APPROXIMATELY 600 OHMS RESISTANCE. ITS OUTPUT LEVEL ADJUSTMENT MUST BE SUCH THAT THESE VARIOUS SPECIFIC OUTPUT VOLTAGES CAN BE CONVENIENTLY ADJUSTED TO WITHIN 0.03% (300 PPM) OF THEIR STATED VALUES. TOTAL HARMONIC DISTORTION MUST BE LESS THAN 0.2%.
3. A DIGITAL AC VOLTMETER CAPABLE OF MEASURING THE RMS VOLTAGE AMPLITUDE OF THE SINE WAVE (ABOVE) TO WITHIN $\pm 0.1\%$, WITH A RESOLUTION OF AT LEAST 3-1/2 SIGNIFICANT DIGITS.
4. A BNC "T" AND TWO 50 OHM COAXIAL INTERCONNECTING CABLES (SUCH AS RG-58/U) EACH NO MORE THAN 1 METER (3 FEET) LONG. SEE FIGURE 1.
5. A SMALL FLAT-TIPPED ADJUSTMENT SCREWDRIVER (NEED NOT BE NON-INDUCTIVE) SEE FIGURE II.

PROCEDURE

1. ALLOW ALL THE EQUIPMENT AND THE INSTRUMENT TO BE CALIBRATED TO COMPLETELY STABILIZE WITH RESPECT TO THE ENVIRONMENT OF THE WORK AREA (SPECIFIED ABOVE). THE BIRD MODEL 441X INSTRUMENT TO BE CALIBRATED AND THE BIRD MODEL 4410-070 CALIBRATION ELEMENT MAY REQUIRE UP TO 24 HOURS FOR COMPLETE ENVIRONMENTAL STABILIZATION IF BROUGHT FROM THE EXTREME SPECIFIED STORAGE ENVIRONMENT (65°C 90% RELATIVE HUMIDITY) INTO THE EXTREME SPECIFIED WORK-SPACE ENVIRONMENT (20°C, 50% RELATIVE HUMIDITY). REMOVE THE DUST PLUG OR ANY ELEMENT FROM THE 441X'S LINE SECTION DURING THIS ENVIRONMENTAL STABILIZATION PERIOD.
2. INSURE THAT THE 441X IS OFF, THEN CAREFULLY ADJUST THE 441X'S METER TO A REPEATABLE MECHANICAL ZERO USING THE "OFF" AND "BAT" SWITCH POSITIONS. PROPERLY MECHANICALLY UNCOUPLE THE 441X METER'S ZERO-ADJUST SCREW FROM ITS MOVEMENT MECHANISM, THEN CHECK AGAIN FOR REPEATABLE MECHANICAL ZERO USING THE "OFF" AND "BAT" SWITCH POSITIONS. REPEAT THIS ENTIRE STEP (STEP 2) IF NECESSARY.

3. CONNECT THE SINE WAVE GENERATOR TO THE 4410-070 CALIBRATION ELEMENT AND VOLTMETER AS SHOWN IN FIGURE I.
4. TURN ON THE AC VOLTMETER AND THE SINE WAVE GENERATOR AND ADJUST ITS OUTPUT UNTIL THE VOLTMETER READS 1.591 ± 0.0005 VOLTS RMS AT 1000Hz $\pm 1.00\text{Hz}$. MAKE SURE THAT THE GENERATOR'S "SYMMETRY", "OFFSET", AND, "WAVEFORM" CONTROLS ARE SET TO PROVIDE A SYMMETRICAL SINE WAVE WITH ZERO DC OFFSET. LEAVE THE EQUIPMENT IN THIS CONDITION TO STABILIZE FOR THE PERIOD OF THE TIME RECOMMENDED BY THE EQUIPMENT MANUFACTURERS, BUT NOT LESS THAN FIVE MINUTES.
5. TURN THE 441X ON TO IT'S "100" POSITION AND ALLOW IT A MINIMUM OF FIVE MINUTES TO STABILIZE. THE 441X DOESN'T NEED TO BE CONNECTED TO THE CABINATION SET-UP FOR THE FIVE MINUTE WARM-UP PERIOD.
6. AFTER THE EQUIPMENT HAS STABILIZED, CHECK THE BATTERY IN THE 441X BY MOMENTARILY PLACING IT'S SWITCH IN THE "BAT" POSITION. THE METER POINTER SHOULD TRAVEL WELL INTO THE "BATTERY TEST" REGION OF THE METER SCALE. IF NECESSARY, TURN THE UNIT OFF AND REPLACE THE BATTERY. RETURN THE SWITCH TO THE "100" POSITION. ALLOW THE UNIT'S INTERNAL CIRCUITRY TO STABILIZE FOR ANOTHER FIVE MINUTES IF THE BATTERY WAS REPLACED.
7. INSERT THE CALIBRATION ELEMENT INTO THE 441X AND ROTATE IT IN EITHER DIRECTION UNTIL IT STOPS.
8. RECHECK THE SINE WAVE GENERATOR FOR THE PROPER 1000Hz $\pm 100\text{Hz}$ OUTPUT SETTINGS, THEN READJUST THE AMPLITUDE, AS NECESSARY, UNTIL THE VOLTMETER READS A STABLE 1.591 ± 0.0005 VOLTS.

NOTE: STEPS 9 THRU 12 ONLY APPLY FOR THE FOLLOWING MODEL/SERIAL NUMBER COMBINATIONS:

- MODEL 4410 - ALL SERIAL NUMBERS
- MODEL 4410A - SERIAL NUMBERS 2509 AND BELOW
- MODEL 4410P - SERIAL NUMBER 101 AND BELOW
- MODEL 4411 - SERIAL NUMBER 187 AND BELOW
- MODEL 4412 - SERIAL NUMBER 142 AND BELOW

9. ROTATE THE CALIBRATION DEVICE APPROXIMATELY 90° SO AS TO SHORT THE CONTACT IN THE SOCKET TO THE LINE SECTION BODY. IF THE METER NEEDLE DOES NOT COME TO REST AT EXACTLY ZERO, THEN ADJUST R25 COUNTERCLOCKWISE, VERY SLOWLY, JUST UNTIL IT DOES. THE LOCATION OF R25 IS SHOWN IN FIGURE II. IF THE POINTER ALREADY RESTS AT EXACTLY ZERO, THEN GO ON TO STEP 10.

10. ROTATE THE CALIBRATION ELEMENT IN EITHER DIRECTION UNTIL IT STOPS.
11. ADJUST R26 UNTIL THE METER POINTER IS AT EXACTLY "1" (FULL SCALE ON THE UPPER SCALE). THE LOCATION OF R26 IS SHOWN IN FIGURE II.

12. ROTATE THE CALIBRATION ELEMENT APPROXIMATELY 90° SO AS TO SHORT THE CONTACT IN THE SOCKET TO THE LINE SECTION BODY. SIMULTANEOUSLY MEASURE THE TIME REQUIRED FOR THE METER POINTER TO TRAVEL FROM ITS FULL SCALE POSITION TO ZERO. ADJUST R25 SLIGHTLY AND REPEAT STEPS 10 AND 12. UNTIL THE TIME REQUIRED FOR THE METER POINTER TO TRAVEL FROM A FULL SCALE READING TO ZERO IS 4.0 ± 1.0 SECONDS.

13. ROTATE THE 4410-070 CALIBRATION ELEMENT APPROXIMATELY 90° SO AS TO SHORT THE CONTACT IN THE SOCKET TO THE LINE SECTION BODY. SET THE 441X RANGE SWITCH TO THE "1" POSITION. NOW ADJUST THE SINE WAVE GENERATOR'S OUTPUT UNTIL THE VOLTMETER READS 0.1591 ± 0.00005 VOLTS RMS. ROTATE THE CALIBRATION ELEMENT IN EITHER DIRECTION UNTIL IT STOPS, THEN ADJUST R26 UNTIL THE METER POINTER RESTS AT EXACTLY "1" ON THE UPPER SCALE.

14. CHECK ALL THE OTHER RANGES BY APPLYING THE PROPER VOLTAGE FOR EACH RANGE IN ACCORDANCE WITH THE FOLLOWING TABLE. IN EACH CASE, THE METER POINTER SHOULD COME TO REST AT "1" ON THE UPPER SCALE, WITHIN THE TOLERANCE SHOWN.

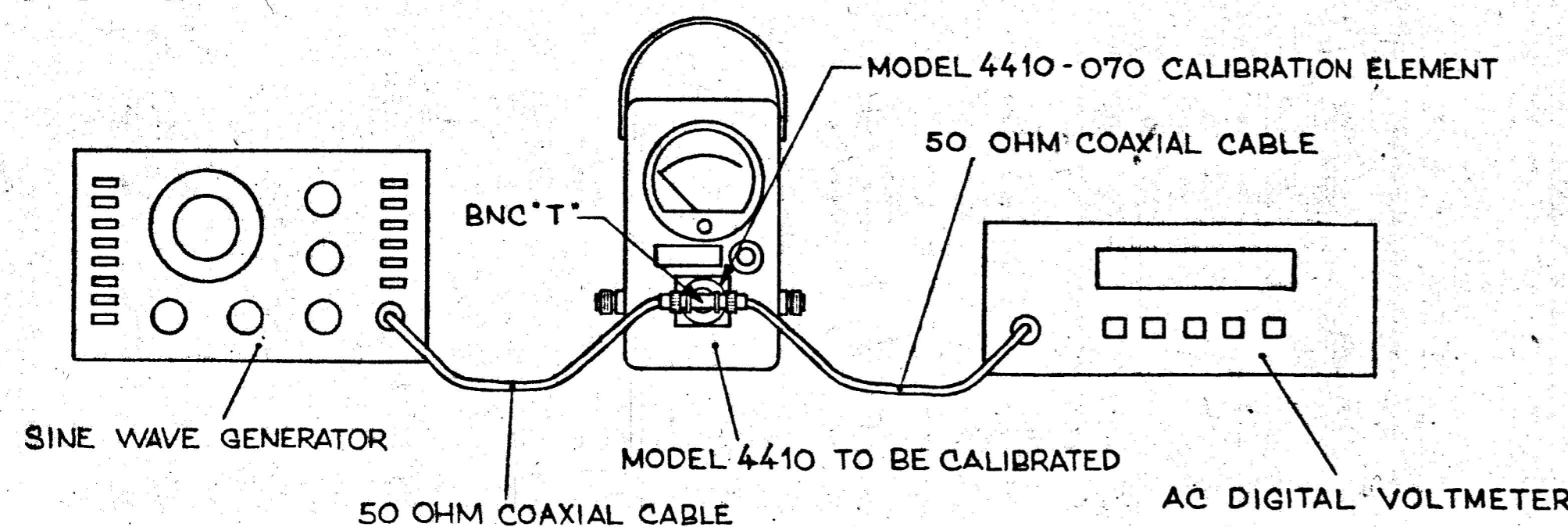
RANGE	RMS VOLTAGE READING	ALLOWABLE ERROR
100	1.591 ± 0.0005	$\pm 1/2$ DIV.
30	0.895 ± 0.0005	$\pm 1/2$ DIV.
10	0.503 ± 0.0005	$\pm 1/2$ DIV.
3	0.283 ± 0.0005	$\pm 1/2$ DIV.
.3	0.0895 ± 0.00005	± 1 DIV.
.1	0.0503 ± 0.00005	± 1 DIV.

*DIV. CORRESPONDS TO A MINOR SCALE DIVISION ON THE UPPER 441X METER SCALE.

15. SET THE RANGE SELECTOR SWITCH TO THE "1" POSITION. ADJUST THE SINE WAVE GENERATOR'S OUTPUT UNTIL THE VOLTMETER INDICATES THE WATTMETER "CALIBRATION VOLTAGE". THE "CALIBRATION VOLTAGE" IS RECORDED ON A LABEL INSIDE THE WATTMETER BACK COVER. IF NO CALIBRATION VOLTAGE IS LISTED ADJUST THE SINE WAVE GENERATOR OUTPUT TO 0.1591 ± 0.00005 VOLTS RMS. ADJUST R26 UNTIL THE METER POINTER RESTS EXACTLY AT "1" ON THE UPPER SCALE. THAT COMPLETES THE CALIBRATION PROCEDURE.

NOTE: THE BIRD MODEL 4410-070 PLUG-IN CALIBRATION ELEMENT REQUIRES NO CALIBRATION ITSELF. HOWEVER, CARE SHOULD BE TAKEN TO AVIOD DAMAGE TO THE UNIT DUE TO ROUGH HANDLING OR EXPOSURE TO VOLTAGES GREATER THAN THOSE SPECIFIED. THE SINE WAVE GENERATOR AND AC VOLTMETER MUST MEET THE SPECIFICATIONS GIVEN IN ORDER FOR THE MODEL 441X TO MEET ITS SPECIFICATIONS AFTER CALIBRATION. IF IT IS NOT POSSIBLE TO CALIBRATE THE MODEL 441X INSTRUMENT ACCORDING TO THE ABOVE THEN IT SHOULD BE RETURNED TO THE FACTORY, OR AN AUTHORIZED, BIRD REPAIR CENTER, FOR SERVICE.

FIGURE 1



NOTICE THE BIRD MODEL 4410 INSTRUMENT ITSELF IS CALIBRATED WITH ITS COAXIAL CONNECTORS OPEN, AS SHOWN IN THE ABOVE ILLUSTRATION. NO REGULAR RF POWER SOURCE IS USED IN ITS CALIBRATION.

FIGURE 2

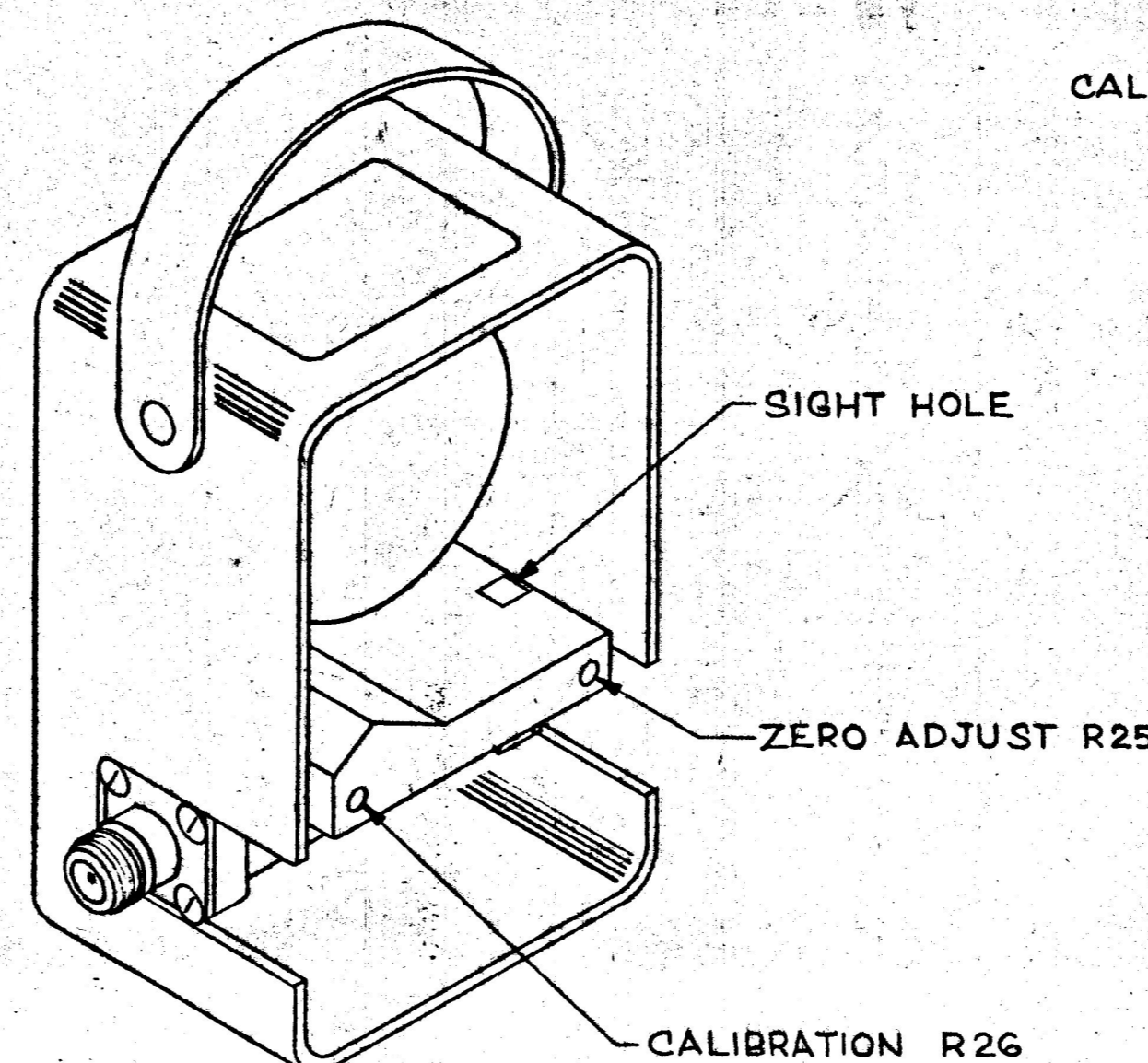
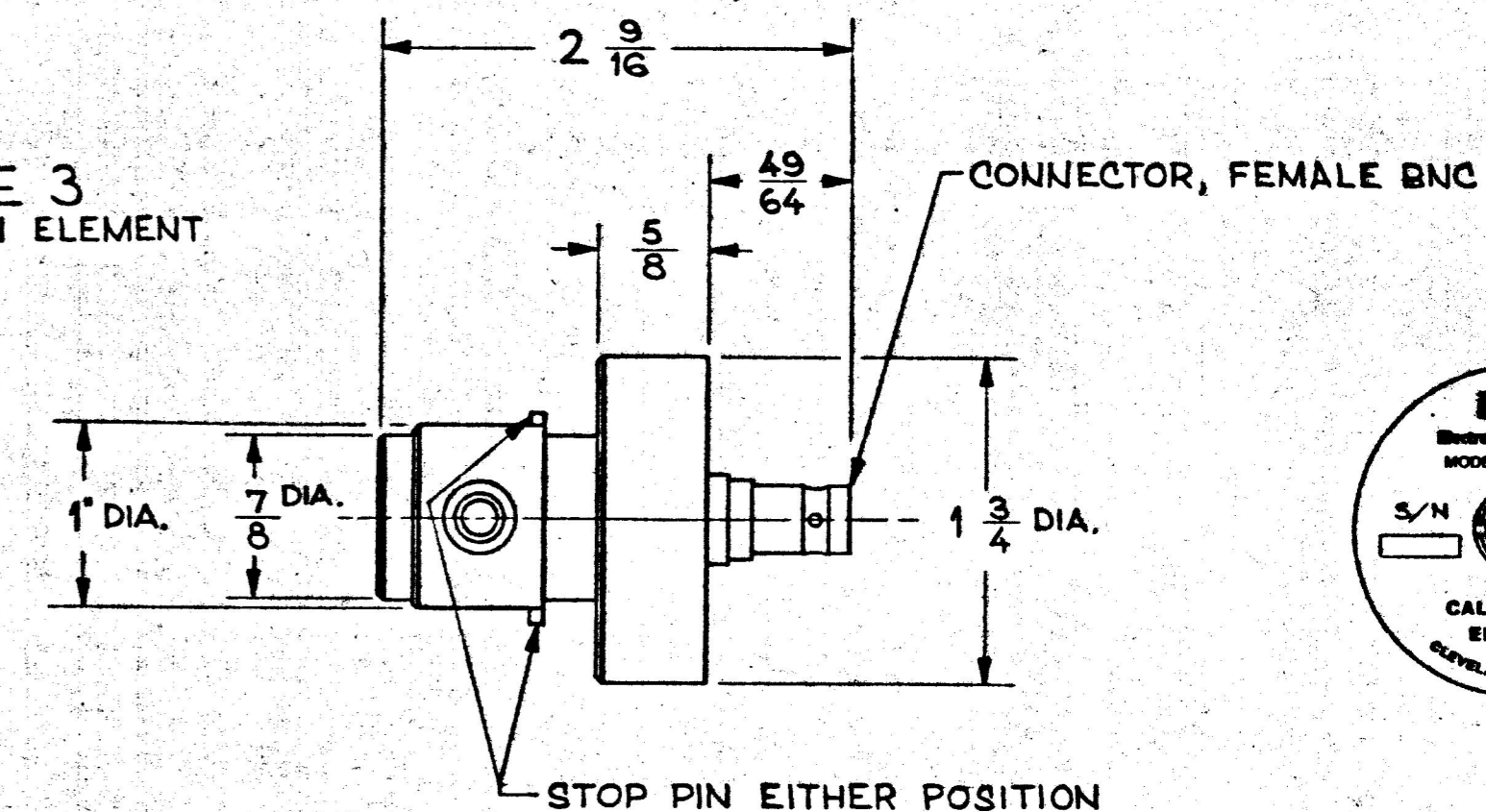
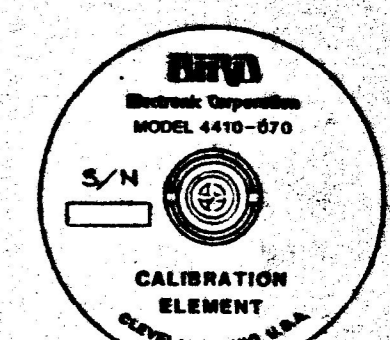


FIGURE 3
CALIBRATION ELEMENT



DIMENSIONS HEREON ARE FOR CUSTOMER CONVENIENCE AND REFERENCE ONLY. TOLERANCE TO BE APPLIED ONLY WHERE INDIVIDUALLY STATED ON THE RESPECTIVE DIMENSION.



USED ON MATERIAL: BRASS	ITEM/REQ	DRAWING NO.	DESCRIPTION
DO NOT SCALE DRAWING			BIRD ELECTRONIC CORPORATION CLEVELAND, OHIO
DRAWN R. KELLEHER			
DATE 10-21-85	FINISH GOLD PLATE		TITLE OUTLINE, MODEL 4410-070 CALIBRATION ELEMENT
APPROVED B. HOWSE 10-25-85	SCALE FULL	CODE IDENT. NO. 70998	SIZE D
APPROVED J. W. L. 10/18/85			DRAWING NO. 4410-070

CONTR. CODE: EL 1