

TB 9-6625-2358-50

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIRECTIONAL POWER SENSORS BIRD MODELS 4021, 4022, AND 4025

Headquarters, Department of the Army, Washington, DC

23 March 2005

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REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, US Army Aviation and Missile Command, AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual. For the World Wide Web, use <https://amcom2028.redstone.army.mil>.

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**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Directional Power Sensors, Bird Models 4021, 4022, and 4025. The manufacturer’s manual was the prime data source in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Variations among models are described in text.

b. Time and Technique. The time required for this calibration is approximately 4 hours, using the microwave frequency technique.

2. Forms, Records, and Reports

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

b. Adjustments to be reported are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) follows the designated adjustment. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Sensor accuracy	Frequency range: Model 4021: 1.8 – 32 MHz Model 4022: 25 MHz – 1 GHz Model 4025: 100 kHz – 2.5 MHz Power range: Model 4021 and 4022: 300 mW – 1 kW Model 4025: 3 W – 10 kW Accuracy: ± 3%

**SECTION II
EQUIPMENT REQUIREMENTS**

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Reference Calibration Standards Set, NSN 4931-00-621-7878. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
BAND PASS FILTER	Cutoff frequency: 0.1 – 1000 MHz Harmonic rejection: > 50 dB down Insertion loss: ≤ 2 dB Impedance: 50 Ω	Rodale Electronics, Model 13589299 (13589299)
CALORIMETER	Frequency range: DC to 2500 MHz Power range: 10 to 200 Watts Accuracy: (10-25 Watts: ± 3%) (25-200 Watts: ± 1.25%)	Bird Electronics, Model 6091 (6091)
RF POWER METER	Frequency range: 100 kHz to 1000 MHz Power range: 7.5 to 85 W Accuracy: ± 1%	Bird, Model 4421 (4421)
SIGNAL GENERATOR	Frequency range: 100 kHz to 1000 MHz Accuracy: ±10 ppm Power output range: 100 mW	(SG-1207/U)

Table 3. Accessories Required

Common name	Description (part number)
INSTRUMENT CONTROLLER	Polywell (MIS-45854) or comparable
POWER METER CALIBRATION KIT	Bird Electronic Corporation, Model 4421A500
RF POWER AMPLIFIER	Antenna Research Associates Inc., Model ARA757LC-CE (757LC)

5. Accessories Required. The accessories listed in table 3 are issued as indicated in paragraph 4 above, and are used in this calibration procedure. When necessary, these items may be substituted by equivalent items, unless specifically prohibited.

SECTION III CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs 6 and 7 are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name as listed in table 2.

c. Unless otherwise specified, verify the results of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturer's manual for this TI.

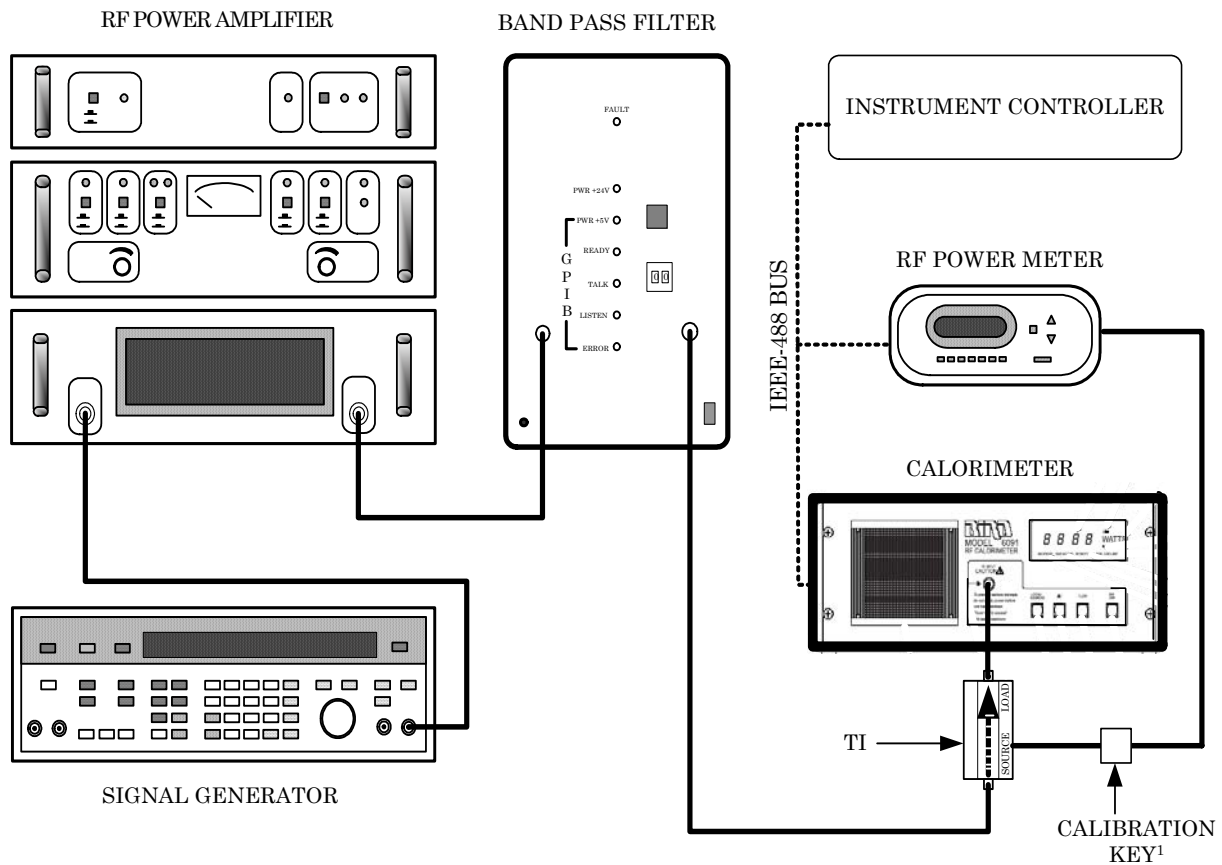
d. Unless otherwise specified, all controls and control settings refer to the TI.

7. Equipment Setup

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe the safety precautions. REDUCE OUTPUT(S) to minimum after each step within the performance check where applicable.

- a. Allow TI to temperature stabilize for a minimum of 12 hours before starting this calibration.
- b. Connect equipment as shown in figure 1.



¹ Part of Power Meter Calibration Kit, Bird Electronic Corporation, Model 4421A500

Figure 1. Equipment setup.

- c. Energize all equipment and allow 15 minutes warm-up.

8. Power Accuracy

a. Performance Check

(1) Insert calibration software disc (p/o Power Meter Calibration Kit, Bird Electronic Corporation, Model 4421A500) in floppy drive.

(2) Run software by left clicking with mouse in the following sequence: Start, Run..., then type "a:\install.exe", then click OK. A dos screen will appear. Type "c:\4421" then press "Enter" on keyboard.

(3) Type "a" when "Install drive= _:" appears then press "Enter" on keyboard.

(4) Press "n" to not modify autoexec.bat file. Calibration software is loaded on the instrument controller.

(5) Click on "Start", click on "Programs", click on "National Instruments", and click "Measurement & Automation".

(6) Click on "Tool", click "NI-488.2", and click "DOS Support".

(7) Check "Enable Support for DOS NI-488.2 Application", and then click "OK".

(8) Click "Start", then click "Run...", type "4421/calib", press "ENTER" on keyboard.

(9) When prompt to open new file, press "Y" on the controller keyboard and follow screen prompts.

(10) Set signal generator frequency and band pass filter band number to the first setting in table 4, 5, or 6 that correspond to the directional power sensor being calibrated.

CAUTION

Ensure that RF power is off before making any band changes to the band pass filter.

(11) Adjust RF power amplifier GAIN and LEVEL SET controls fully clockwise and RF BAND switch to LOW.

(12) Set signal generator amplitude control for an indication of 35 to 50 watts on the RF power meter. RF power meter indication and calorimeter indication differences will be 4 % or less. If not, perform paragraph **b** below.

(13) Repeat steps (4) through (6) above for the remainder of tables 4, 5, or 6 that correspond to the directional power sensor being calibrated.

Table 4. Directional Power Sensor Model 4021

Signal generator frequency setting (MHz)	Band pass filter band	RF power meter / calorimeter difference indication (W)
1.8	5	∠ 4%
2.0	5	∠ 4%
2.5	6	∠ 4%
3.2	6	∠ 4%
4.0	7	∠ 4%
5.0	7	∠ 4%
6.3	8	∠ 4%
7.9	9	∠ 4%
10.0	9	∠ 4%
13.0	10	∠ 4%
16.0	10	∠ 4%
20.0	11	∠ 4%
25.0	11	∠ 4%
32.0	12	∠ 4%

Table 5. Directional Power Sensor Model 4022

Signal generator frequency setting (MHz)	Band pass filter band	RF power meter / calorimeter difference indication (W)
25	11	∠ 4%
30	12	∠ 4%
40	12	∠ 4%
50	13	∠ 4%
70	13	∠ 4%
90	14	∠ 4%
100	14	∠ 4%
110	15	∠ 4%
150	15	∠ 4%
190	16	∠ 4%
270 ¹	16	∠ 4%
400	17	∠ 4%
500	17	∠ 4%
600	17	∠ 4%
710	18	∠ 4%
750	18	∠ 4%
800	18	∠ 4%
900	18	∠ 4%
950	18	∠ 4%
1000	18	∠ 4%

¹Turn off signal generator output and change RF power amplifier band to HIGH.

Table 6. Directional Power Sensor Model 4025

Signal generator frequency setting (MHz)	Band pass filter band	RF power meter / calorimeter difference indication (W)
.100	1	∠ 4%
.135	1	∠ 4%
.300	2	∠ 4%
.500	3	∠ 4%
.600	3	∠ 4%

Table continued on next page.

Table 6. Directional Power Sensor Model 4025 - Continued

Signal generator frequency setting (MHz)	Band pass filter band	RF power meter / calorimeter difference indication (W)
1.0	4	∠ 4%
1.7	5	∠ 4%
2.5	6	∠ 4%

b. Adjustments

- (1) Position cursor on controller screen to “FORWARD FREQ”.
- (2) Press “D” on the controller keyboard and use arrow keys to move cursor to the first data point, press “Enter” to delete the data point and press “Y” to confirm the deletion.
- (3) Add new calibration data point, press “Enter” (R).
- (4) Wait for a stable power level as indicated by the WATTS annunciator on the calorimeter. Press “Enter” again.
- (5) Repeat steps (2) through (4) for the remaining frequencies (R).
- (6) After completing all calibration data points for FORWARD FREQ, turn off RF power. Remove and reinstall the directional power sensor with the RF source connected to the **LOAD** side and calorimeter connected to the **SOURCE** side of the directional power sensor.
- (7) Press RF power meter front panel “RFL” button to display RFL.
- (8) Repeat technique of steps (2) through (5) above for all calibration data points under REFLECTED FREQ.


9. Final Procedure

- a. Deenergize and disconnect all equipment.
- b. Annotate and affix DA label/form in accordance with TB 750-25.

By Order of the Secretary of the Army:

Official:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff


SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army

0502604

Distribution:

To be distributed in accordance with STD IDS RLC-1500, 2 January 2003, requirements for calibration procedure TB 9-6625-2358-50.

INSTRUCTIONS FOR SUBMITTING AN ELECTRONIC 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.milT
To: <2028@redstone.army.mil

Subject: DA Form 2028

1. **From:** Joe Smith
2. **Unit:** home
3. **Address:** 4300 Park
4. **City:** Hometown
5. **St:** MO
6. **Zip:** 77777
7. **Date Sent:** 19-OCT -93
8. **Pub no:** 55-2840-229-23
9. **Pub Title:** TM
10. **Publication Date:** 04-JUL-85
11. **Change Number:** 7
12. **Submitter Rank:** MSG
13. **Submitter FName:** Joe
14. **Submitter MName:** T
15. **Submitter LName:** Smith
16. **Submitter Phone:** 123-123-1234
17. **Problem:** 1
18. **Page:** 2
19. **Paragraph:** 3
20. **Line:** 4
21. **NSN:** 5
22. **Reference:** 6
23. **Figure:** 7
24. **Table:** 8
25. **Item:** 9
26. **Total:** 123
27. **Text**

This is the text for the problem below line 27.

