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INSTRUCTION BOOK

**CALIBRATION KIT  
MODEL 4421A530**

**BIRD<sup>®</sup>**  
**Electronic Corporation**  
**Cleveland (Solon) Ohio USA**



## **Safety Precautions**

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The following are general safety precautions that are not necessarily related to any specific part or procedure, and do not necessarily appear elsewhere in this publication. These precautions must be thoroughly understood and applied to all phases of operation and maintenance.

### ***Keep Away From Live Circuits***

Operating personnel must at all times observe normal safety regulations. Do not replace components or make adjustments to equipment with high voltage turned on. To avoid casualties, always remove power.

### ***Do Not Service Or Adjust Alone***

Under no circumstances should any person reach into an enclosure for the purpose of service or adjustment of equipment except in the presence of someone who is capable of rendering aid.

### ***Safety Earth Ground***

An uninterruptible earth safety ground must be supplied from the main power source to test instruments. Grounding one conductor of a two conductor power cable is not sufficient protection. Serious injury or death can occur if this grounding is not properly supplied.

### ***Chemical Hazard***

Coolant may contain ethylene glycol. Avoid ingestion, inhaling of vapors and eye and skin contact. Dry cleaning solvents for cleaning parts may be potentially dangerous. Avoid inhalation of fumes or prolonged contact with skin.

### ***Resuscitation***

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

## **Safety Symbols**

### **WARNING**

Warning notes call attention to a procedure, which if not correctly performed could result in personal injury.

### **CAUTION**


Caution notes call attention to a procedure, which if not correctly performed could result in damage to the instrument.



The caution symbol appears on the equipment indicating there is important information in the instruction manual regarding that particular area.



This symbol appears on the equipment and indicates the requirement for separate collection of discarded electrical and electronic equipment in accordance with the European Union Directive 2002/96/EC. Refer to the Bird web site for more information.

 **NOTE:** Calls attention to supplemental information.

## **Warning Statements**

The following safety warnings appear in the text where there is danger to operating and maintenance personnel and are repeated here for emphasis.

### **WARNING**

Never attempt to connect or disconnect the equipment from the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.

### **WARNING**

To avoid electrical shock disconnect AC mains power when servicing the RF power meter.

## **Caution Statements**

The following equipment cautions appear in the text whenever the equipment is in danger of damage and are repeated here for emphasis.

### **CAUTION**

Before connecting the power sensor to a transmission line, refer to the power sensor instruction book. Note the potential hazard when working with RF power.

**CAUTION**

4421 Series RF power meter must be turned off when making connections or disconnections between power meter and power sensor.

**CAUTION**

This equipment contains static sensitive parts. Handle items only in ESD protected areas. Failure to observe this precaution can cause permanent damage to the components.

**CAUTION**

Only use the Calibration Kit with Model 4021, 4022, 4024, and 4025 Sensors. Do not use it with any other Bird Power Sensors.

**CAUTION**

Individual components of Model 4421A500 contain static sensitive parts. Handle items only in ESD protected areas. Failure to observe this precaution can cause permanent damage to the components.

**Safety Statements**



**USAGE**

ANY USE OF THIS INSTRUMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR THE INSTRUMENT'S SAFETY PROTECTION.

**USO**

EL USO DE ESTE INSTRUMENTO DE MANERA NO ESPECIFICADA POR EL FABRICANTE, PUEDE ANULAR LA PROTECCIÓN DE SEGURIDAD DEL INSTRUMENTO.

**BENUTZUNG**

WIRD DAS GERÄT AUF ANDERE WEISE VERWENDET ALS VOM HERSTELLER BESCHRIEBEN, KANN DIE GERÄTESICHERHEIT BEEINTRÄCHTIGT WERDEN.

**UTILISATION**

TOUTE UTILISATION DE CET INSTRUMENT QUI N'EST PAS EXPLICITEMENT PRÉVUE PAR LE FABRICANT PEUT ENDOMMAGER LE DISPOSITIF DE PROTECTION DE L'INSTRUMENT.

**IMPIEGO**

QUALORA QUESTO STRUMENTO VENISSE UTILIZZATO IN MODO DIVERSO DA COME SPECIFICATO DAL PRODUTTORE LA PROZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.



#### SERVICE

SERVICING INSTRUCTIONS ARE FOR USE BY SERVICE - TRAINED PERSONNEL ONLY. TO AVOID DANGEROUS ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

#### SERVICIO

LAS INSTRUCCIONES DE SERVICIO SON PARA USO EXCLUSIVO DEL PERSONAL DE SERVICIO CAPACITADO. PARA EVITAR EL PELIGRO DE DESCARGAS ELÉCTRICAS, NO REALICE NINGÚN SERVICIO A MENOS QUE ESTÉ CAPACITADO PARA HACERLO.

#### WARTUNG

ANWEISUNGEN FÜR DIE WARTUNG DES GERÄTES GELTEN NUR FÜR GESCHULTES FACHPERSONAL.

ZUR VERMEIDUNG GEFÄHRLICHER, ELEKTRISCHER SCHOCKS, SIND WARTUNGSARBEITEN AUSSCHLIEßLICH VON QUALIFIZIERTEM SERVICEPERSONAL DURCHZUFÜHREN.

#### ENTRETIEN

L'EMPLOI DES INSTRUCTIONS D'ENTRETIEN DOIT ÊTRE RÉSERVÉ AU PERSONNEL FORMÉ AUX OPÉRATIONS D'ENTRETIEN. POUR PRÉVENIR UN CHOC ÉLECTRIQUE DANGEREUX, NE PAS EFFECTUER D'ENTRETIEN SI L'ON N'A PAS ÉTÉ QUALIFIÉ POUR CE FAIRE.

#### ASSISTENZA TECNICA

LE ISTRUZIONI RELATIVE ALL'ASSISTENZA SONO PREVISTE ESCLUSIVAMENTE PER IL PERSONALE OPPORTUNAMENTE ADDESTRATO. PER EVITARE PERICOLOSE SCOSSE ELETTRICHE NON EFFETTUARE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.

This instruction book covers the following model(s):

4421A530

This instruction book is arranged so that essential information on safety is contained in the front of the book. Reading the Safety Precautions Section before operating the equipment is strongly advised.

The remainder of this Instruction Book is divided into Chapters and Sections. At the beginning of each chapter, a general overview describes the contents of that chapter.

### ***Operation***

First time operators should read “Introduction” on page 1, “Theory of Operation” on page 3, and “Installation” on page 7, to get an overview of equipment capabilities and how to install it. An experienced operator can refer to “Operating Instructions” on page 11. All instructions necessary to operate the equipment appear in this chapter.

### ***Maintenance***

All personnel should be familiar with preventive maintenance found in “Maintenance” on page 17. If a failure should occur, the troubleshooting section will aid in isolating and repairing the failure. Parts lists and repair instructions are also in this chapter.

### ***Changes To The Manual***

We have made every effort to ensure this manual is accurate at the time of publication. If you should discover any errors or if you have suggestions for improving this manual, please send your comment to our factory. This manual may be periodically updated. When inquiring about updates to this manual, refer to the part number and revision level on the title page.





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This instruction book is for operators of the Bird 4421A530 Calibration Kit. This section contains introductory information including items supplied.

**Note:** This calibration kit is for use only with the Bird Thruline RF Power Meter 4421 that is designed with a single board computer.

#### CAUTION

Only use the Calibration Kit with Model 4021, 4022, 4024, and 4025 Sensors. Do not use it with any other Bird Power Sensors.

#### Purpose and Function

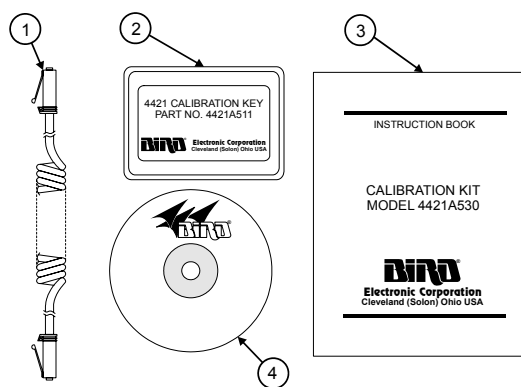
The purpose of the 4421A530 Calibration Kit is to provide a means of calibrating Bird 4020 Series power sensors used with the Bird 4421 RF Power Meter. It also helps maintain calibration histories of the individual power sensors, making it friendly to various quality standards.

#### Capabilities and limitations

The 4421A530 Calibration Kit is intended to be used with the Bird 4421 power meter for calibration of the Bird power sensor models 4021, 4022, 4024, and 4025. It is not compatible with or intended for calibration of any other instruments.

**Items Supplied** Figure 1 on page 1 illustrates items supplied with the 4421A530.

Figure 1 Items Supplied



Item #	Qty	Name	Description
1	1	Sensor Cable	Used to connect the calibration key to the power meter
2	1	Calibration Key	Interconnected between Model 4421 power meter and Series 4020 power sensor to be calibrated. Enables access to calibration data.
3	1	Instruction Book	Instructions on using the 4421A530
4	1	Software CD	CD containing the calibration software.

**Items Required but  
not Supplied**

You will need a computer running Windows 95 or later with the following:

- 4 MB free hard disk space
- SVGA monitor
- CD-ROM drive
- Computer Pointing device (mouse)
- One of the following National Instrument GPIB cards, with the necessary GPIB cables:
  - GPIB-PCII
  - GPIB-PCIIA
  - AT-GPIB
  - MC-GPIB

In addition to these items, you will also need the RF instruments and accessories necessary to produce and accurately measure RF power in the required frequency bandwidth and power ranges of the sensors. The following is a list of recommended equipment.

- An RF source that will cover the required frequencies and power ranges.
- RF low pass filters.
- Bird 4020 Series sensor to be calibrated.
- RF calibration standard. A Bird 6091 Calorimeter is recommended.
- Bird 4421 power meter.



## Section 2

## Theory of Operation

Theory of operation is included to provide a level of understanding needed to avoid potential errors. The following paragraphs describe the operation of the 4020 power sensors, the equipment needed to calibrate them, and the 4421A530.

### Program Control Overview

The IEEE-488 interface is used to connect the Bird 4421 and programmable sensor to an IBM compatible computer equipped with a National Instruments GPIB-PC 488.2 controller card.

The computer is the means to control, calibrate and store data from the 4421 power meter and its power sensor.

### Sensor Operation

Inherent to the operation of the power sensor is the linearization circuitry of the diode. With this proprietary method the power sensor is able to linearize the otherwise nonlinear response of the diode. This enables the sensor to be calibrated at relatively low power with less cost and effort and still maintain accurate measurements at higher power levels.

In addition to the linearization of the diode output, a temperature compensating network is added to counteract drift commonly encountered in other power meters that use diode sensors.

Since all coupling devices exhibit variations in coupling over a wide bandwidth, calibration must take place to normalize the frequency response of the 4020 power sensor. Each power sensor has a unique, but repeatable, frequency versus amplitude response. This information is stored in memory in the sensor and used by the microprocessor to assign a correction factor to the measured frequency.

The RF signal is sampled by a detector circuit. Each sensor has at least two detectors, one for each direction i.e. forward and reflected. Some sensors have two detectors for each power direction to cover the frequency bandwidth. The sensors automatically select which detector to use, with the aid of the frequency counter.

Since the calibration is stored in memory within the sensors, a calibration key is necessary to unlock the memory and allow a change in calibration to take place. This calibration key is required only when the sensor's calibration needs to be corrected.

### Calibration Signal

The proprietary method of linearizing the output of a diode is very beneficial in many respects, however, by its design, the RF signal being measured must be a high quality sine wave for accurate measurements to be made. This means that amplitude modulation must be less than 1% and all harmonics and spurious signals need to be at least 50 dB below the CW signal.

An unwanted AM signal can be introduced in the signal generator or the RF power amplifier. A good signal generator and RF amplifier will easily control AM problems but sometimes a malfunctioning power supply or noisy power line can cause unwanted AM interference even with excellent RF amplifiers.

All RF power amplifiers create some amount of harmonics, therefore low pass filters should always be used to remove these unwanted signal components.

#### **Calibration Software**

This software is designed to simplify the operation of the system by making most of the GPIB functions automatic and invisible to the operator. Because of this, the software automatically senses the presence or absence of the 4421 power meter and 6091 calorimeter, and reads their GPIB addresses.

To simplify the operation, the commands available at any given time are displayed along with a message box. This allows the operator to know what is currently happening within the calibration process.

Complete information is always displayed on one screen, letting the operator view all calibration points of both the forward and reflected directions with all previous calibration data readily available. Single key commands make operation fast and simple allowing fast and accurate calibration.

#### **Calibration Setup**

The recommended setup for calibration is shown in Figure 2. The signal generator/RF amplifier/low pass filter combination must be able to produce a clean signal as described above. For forward calibration, the sensor is connected with load side attached to the calibration standard and source side connected to the RF source. For reverse calibration the load side is attached to the RF source and the source side is attached to the calibration standard. The sensors are bidirectional, therefore, there is no need to be concerned if the sensors reflected direction is pointed towards the load.

The sensor should be directly connected to the RF power standard, preferably a Bird 6091 Calorimeter since it has the high accuracy and wide bandwidth needed to calibrate the power sensors. The 4421A530 software communicates directly with the calorimeter. If any other standard is used, make sure the total uncertainty of the entire standard, including any coupling and signal reduction devices, combine to less than  $\pm 1.25\%$ .


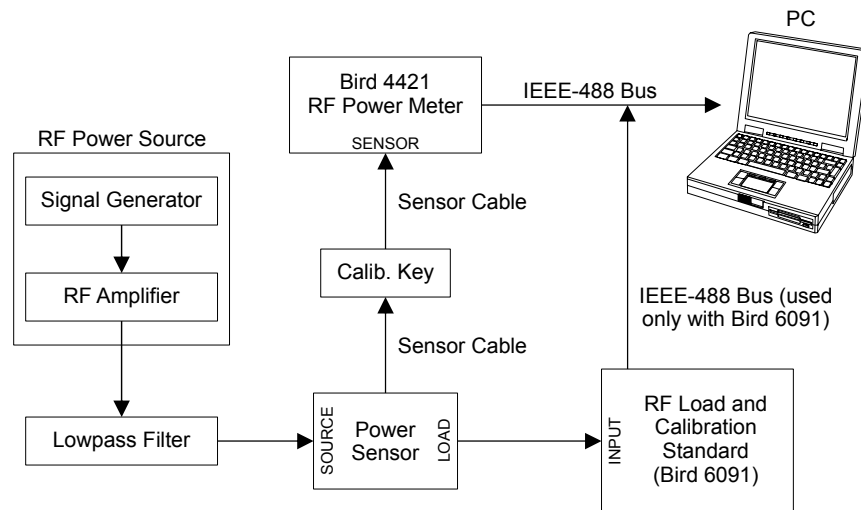
 **Note:** The calibration reference plane is on the sensor's output side. This means that calibration will include any insertion loss due to the sensor.

Figure 2 Calibration Setup Block Diagram



The power sensor can be connected to a Bird 4421 through a regular sensor cable or through the calibration key. Without the calibration key, sensor calibration cannot be performed, it can just be viewed. Use the calibration key to change the sensor's calibration.

Calibration equipment is connected through the IEEE-488 interface bus and controlled by a PC with a National Instruments GPIB Card. Calibration data can be stored on the computer and track individual power sensors.

## Sensor Calibration

The sensors have their frequency response data stored in non-volatile memory within the sensor. This data consists of two sets of frequency and correction factor data. One is for the forward plate(s) and the other for the reflected plate(s).

Calibration points can be added at any frequency within the limit of the power sensor. When adding a point, only the frequency of the signal generator and the RF power level need to be set by the operator. The sensor, when given the actual power level as measured by the standard, can then automatically calculate the correction factor. If a Bird 6091 Calorimeter is the calibration standard, the 4421A530 software will automatically use the 6091's power reading and send it to the sensor. Each sensor can store up to 40 calibration points, 20 forward and 20 reverse.

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## Section 3

## Installation

### Unpacking and Inspection

1. Carefully inspect the 4421A530 shipping package for signs of damage. If damage is noticed, do not unpack the unit. Immediately notify the shipping carrier and Bird Electronics of the damage.
2. If shipping package is not damaged, unpack the unit. Save all shipping materials.
3. Check package contents against the items supplied list on page 1. Visually inspect all components for signs of damage. Immediately notify the shipping carrier and Bird Electronics of equipment damage or missing parts.

### Installing Calibration Software

1. Insert the software CD into the CD drive of your computer. The installation utility should start automatically. If not, use Windows Explorer to navigate to the drive that contains the installation CD (e.g. D:\) and run the file named Index.htm.
2. At the opening screen (Figure 3, page 7) select Install Calibration Kit Software from the options list.

**Note:** You can also copy the user's manual and Adobe's Acrobat viewer from the install list. You must have Adobe Acrobat or the free Acrobat viewer to view the user's manual file.

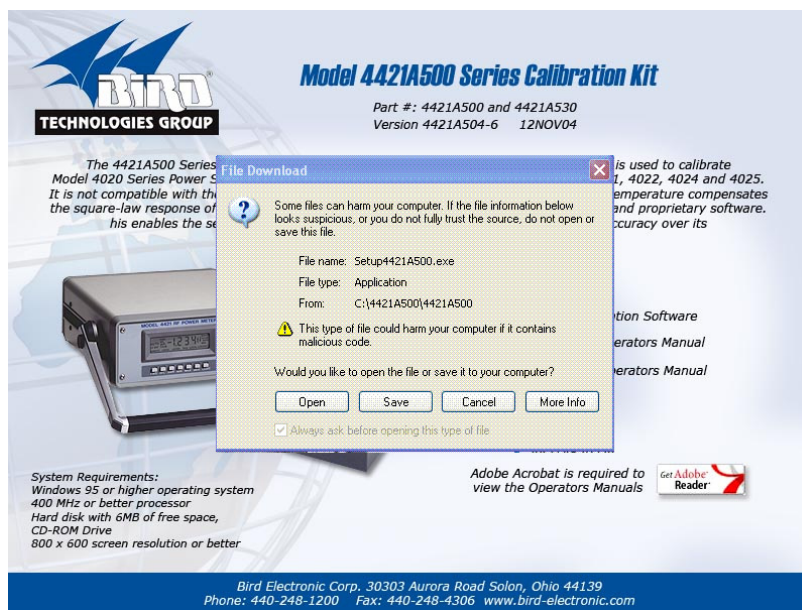
Figure 3 Software Installation Main Screen



3. At the option screen (Figure 4, page 8), you can save the install file to your hard drive or begin the installation by selecting the Open option (recommended).

4. Select the Open option and follow the on-screen instructions to complete the installation of the calibration software.

Figure 4 Software Installation Option Screen



### Connecting Cable and Calibration Key

**Note:** Figure 5 shows the setup required for the Calibrate and No Save modes of operation. Other available modes and setups are described in Section 4, page 11.

#### CAUTION

4421 Series RF power meter must be turned off when making connections or disconnections between power meter and power sensor.

1. Connect the IEEE-488 bus cable from the back of the Model 4421 power meter to the bus card installed in the computer.
2. Connect a sensor cable between the 4421 power meter and the calibration key.
3. Connect a sensor cable (supplied with sensor) between the calibration key and the RF power sensor to be calibrated.

#### CAUTION

Before connecting the power sensor to a transmission line, refer to the power sensor instruction book. Note the potential hazard when working with RF power.

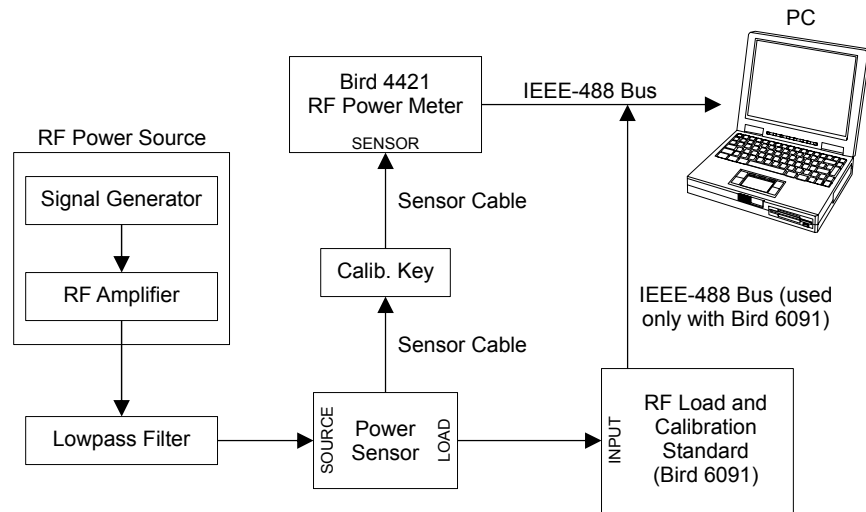
4. Connect the power sensor in an RF transmission line with the source side to the signal source. Connect the load side to a power standard such as the recommended Bird Model 6091. Make this connection as short as possible.

**Note:** To measure reflected power, connect the source side to the standard and the load side to the source.

5. If a Model 6091 is used, connect IEEE-488 bus cable from the back of the 6091 to the bus card installed in the computer.

**Note:** The 4421 and 6091 must have different address settings.

Figure 5 Calibration Setup



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## Section 4

## Operating Instructions

This section describes the four operating modes of the calibration software and provides instructions for calibrating 4020 series power sensors. The operating mode is determined by equipment connected and operator selection.

### Starting the Calibration Software

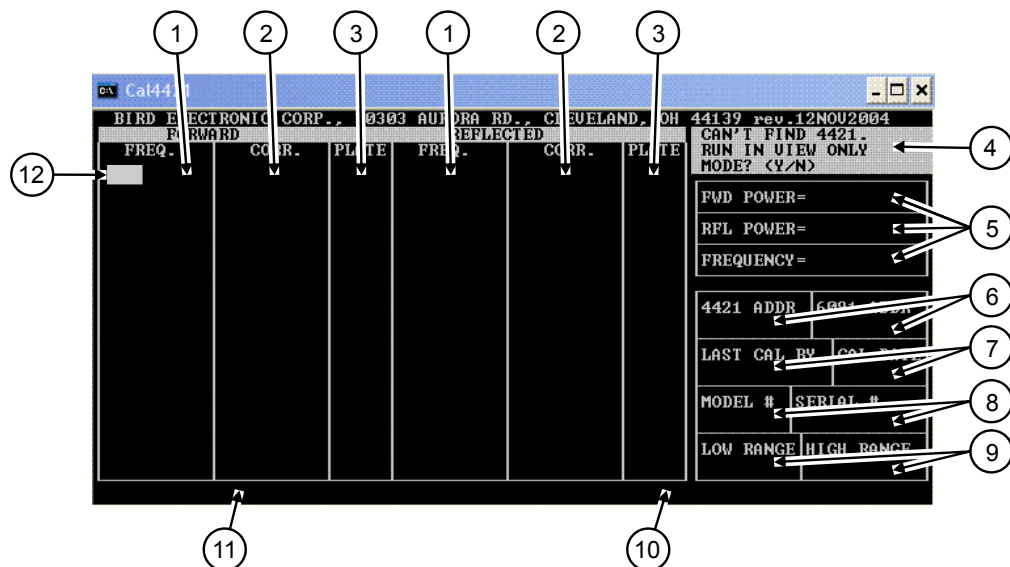
To start the calibration software, use Window Explorer to navigate to the folder that contains the calibration program (the default location is C:\Program Files\Bird 4421A500) and run the file named Cal4421.

**Note:** As a convenience, you can create a shortcut on the desktop to run Cal4421.

### Software Display Screen

All software modes operate from a single screen that is divided into several sections (Figure 6, page 11).

Figure 6 Calibration Software Display Screen



KEY	FEATURE	FUNCTION
1	FREQ.	Contains frequency of the calibration points.
2	CORR.	Correction factor at the corresponding frequency.
3	PLATE	Indicates low or high frequency plate if there are two plates per direction in the sensor.  L=Low Frequency Plate; H=High Frequency Plate; - = Only one plate is used.
4	Message Box	Displays operating information, error messages and other program dialog.

5	Data Window	Three user defined display areas which operate independently to provide real time measurement results from the 4421.
6	6091 ADDR 4421 ADDR	Displays address of the 4421 and 6091 (if present). The address can be changed or equipment initialized when the cursor is in this box.
7	CAL DATE LAST CAL BY	Displays date and operator of last calibration. If BIRD is displayed, calibration was performed by BIRD personnel. Information can be changed or updated when the cursor is in this box.
8	Model # / Serial #	Displays the model and serial number and can not be changed.
9	Low / High Range	Displays the lowest and highest full scale power range of the sensor and can not be changed.
10	Status Section	Indicates calibration information has been saved, and if calibration of the sensor is possible.  <b>S</b> =Saved; <b>CAL ENABLE</b> =Calibration possible; <b>CAL DISABLED</b> =Calibration not possible.
11	Command Box	Displays context sensitive commands which will change as the cursor is moved.
12	Cursor	Highlighted area. Can be moved to different sections of the screen with keyboard arrow keys, providing access to different software commands.

### Commands

At any given point during a calibration process, the available commands are displayed at the bottom of the screen. Type the letter or key in the brackets to execute the command. Different commands will be available when the cursor is moved around the screen. Continually check message box for program instructions. Table 1, page 12, contains command availability and Table 2, page 13, contains a functional description of each command.

**Table 1 Command Availability**

SCREEN SECTION	AVAILABLE COMMANDS			
	No Calibration Mode	View Only Mode	Calibration Mode	No Save Mode
FORWARD	P Q S	P Q	<ENT> P Q S D	<ENT> P Q D
REFLECTED	P Q S	P Q	<ENT> P Q S D	<ENT> P Q D
DATA WINDOW	<ENT> P Q S	P Q	<ENT> P Q S	P Q
4421 ADDR	<ENT> P Q S	P Q	<ENT> P Q S	P Q
6091 ADDR	<ENT> P Q S	P Q	<ENT> P Q S	P Q
LAST CAL BY BOX	P Q S	P Q	<ENT> P Q S	P Q
CAL DATE BOX	<ENT> P Q S	<ENT> P Q	<ENT> P Q S	P Q

<ESC> will generally escape from any operation currently in progress.

**Table 2 Command Description**

<b>COMMAND</b>	<b>CURSOR POSITION</b>	<b>FUNCTION</b>
<ENT>	FORWARD	Add a point in the forward direction or if sensor is measuring reflected power, in the reflected direction.
<ENT>	REFLECTED	
<ENT>	DATA WINDOW	Change the data display function.
<ENT>	4421 ADDR	Initialize the 4421 / 6091 or change 4421 / 6091 address. When executed, all GPIB communication is halted until the command is again executed. This allows the operator to change 4421; 6091; sensors or bus address.
<ENT>	6091 ADDR	
<ENT>	LAST CAL BY BOX	Identify the person performing the calibration.
<ENT>	CAL DATE BOX	Cycle between current and previously stored calibration data.
P		Print data to printer or file.
Q		Quit calibrating. The 4421A530 calibration software will not let the operator leave the program without saving the data, and entering the name of the person having done the calibration. The program will let you leave without saving your data if you start the program in the "no save mode".
S		Save data. The 4421A530 calibration software will not save data without a "LAST CAL BY" name entered. If a save command is entered without a name entered, than the cursor will move to the "LAST CAL BY" box and wait for a name to be entered.
D		Delete point. Unlike the add point command, the delete point command, once invoked, will let you choose which direction and point to delete. Care must be taken in using this command, as there is NO 'undelete' command.

**Equipment Startup** Equipment connection varies depending on operating mode desired and is outlined in normal operation. Follow equipment startup procedures for individual equipment connected.

**Calibrate Mode** Perform calibration of power sensor. Calibration data can be stored on disk, maintaining a history of individual sensors calibrated. Histories are stored in the calibration directory determined by the CALPATH registry key. The default CALPATH is the path where the software was installed on the hard disk drive. Filenames are derived from the sensor model and serial number. Stored calibration data can be viewed but not changed making the software friendly to various quality standards such as ISO-9000. The calibration data can be printed providing a hard copy backup.

1. Setup the equipment as described in Section 3, page 7.
2. Start the calibration program (refer to “Starting the Calibration Software” on page 11).
3. Apply the desired power level within the specifications of the power sensor.
4. Add the desired forward and reflected points. See Table 3, page 14 for recommended frequencies for each sensor model.
5. Enter <S> to save data. Follow program prompts to enter name.
6. Enter <Q> to quit.

**WARNING**

Never attempt to connect or disconnect the equipment from the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.

7. Remove RF power, follow normal shutdown procedures for connected equipment.

**Table 3 Recommended Frequencies**

<b>Sensor Model</b>	<b># of data points per side</b>	<b>frequencies</b>
4021	14	1.8, 2.0, 2.5, 3.2, 4.0, 5.0, 6.3, 7.9, 10, 13, 16, 20, 25, 32 MHz
4022	19	25, 30, 40, 50, 70, 90, 100, 150, 190, 270, 400, 500, 600, 710, 750, 800, 900, 950, 1000 MHz
4024	15	1.5, 1.8, 2.0, 2.5, 3.2, 4.0, 5.0, 6.3, 7.9, 10, 13.56, 16, 20, 25, 32 MHz
4025	8	100, 135, 300, 500, 600, 1000, 1700, 2500 kHz

**No Save Mode**

The No Save Mode allows changes to the sensor calibration without recording the data to the disk. Care must be taken when operating the 4421A530 in this mode as there will be no records available to track sensor. The No Save Mode is entered from the Calibrate Mode when there is no prior calibration data found for the sensor and the operator selects “no” when prompted to create calibration file. Equipment set up and operation is the same as the Calibrate Mode, however the save command will not be available.

**No Calibration Mode**

This mode allows you to view the calibration data of the attached sensor, however, no calibration changes can be made. The No Calibration Mode can also be used to view stored calibration data.

1. Setup the equipment as described in Section 3, page 7, with the exception of the calibration key. Connect the power sensor directly to the 4421.
2. Start the calibration program (refer to “Starting the Calibration Software” on page 11).

3. The data displayed is the latest calibration data. To view previous data, highlight the CAL DATE box.
4. Press enter and follow the prompts in the message box to cycle between previous data.
5. Enter <Q> to quit.
6. Follow normal shutdown procedures for connected equipment.

### **View Only Mode**

The software will display calibration data previously stored on the disk. If the equipment is connected, turn off the 4421 to enter the View Only Mode. Without equipment connected, the program starts in the view only mode.

1. Start the calibration program (refer to “Starting the Calibration Software” on page 11).
2. Enter the model and serial number when prompted.
3. The data displayed is the latest calibration data. To view previous data, highlight the CAL DATE box.
4. Press <ENTER> and follow the prompts in the message box to cycle between previous data.
5. Enter <Q> to quit.
6. Follow normal shutdown procedures for connected equipment.

### **Printing**

Data can be sent to the Windows default printer or to a file. Data “printed” to a file can be carried to a different PC and “copied” to that PC’s printer port. For more information on copying files to a printer port refer to your operating system documentation.

1. Enter <P>
2. Use the cursor keys to highlight the appropriate printer port or “FILE” on the command line.
3. Press <ENTER>. If FILE was selected, enter the path and file name.

### **Normal Shutdown**

Complete any function in process. Enter command Q, follow program prompts to save data and enter name. When operating system prompt is displayed follow normal shutdown procedures for connected equipment.

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## Section 5

## Maintenance


**General** Any maintenance or service procedure beyond the scope of those provided in this section should be referred to a qualified service center. Bird Electronic Corporation maintains complete repair and calibration facilities at the following address:

Bird Technologies Group  
30303 Aurora Road  
Cleveland (Solon), Ohio 44139-2794

Phone: +1 440 519-2298  
Fax: +1 440 519-2326  
Email: bsc@bird-technologies.com

**Preventive Maintenance** Preventive maintenance is limited to storage and back-up schedule for the program CD and calibration data. It is advisable to make a copy of the program CD. The CD should be stored in a cool dry cabinet. Routinely back up calibration data.

**Troubleshooting** Table 4, page 17 contains troubleshooting information for problems which can occur during normal operation. Locate the problem, review the possible causes and perform corrective action listed.

 **Note:** When a corrective action lists replace sensor, return the sensor to a qualified service center for repair.

Only those functions within the scope of normal maintenance are listed. This manual cannot list all malfunctions or corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify a qualified service center.

**Table 4 Troubleshooting, Symptom, Cause, Action**

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
No display on 4421 or computer	-Poor connections -Faulty cables -Defective calibration key (bypass in read only mode)	-Check connections, replace cables as necessary -Replace calibration key
Unit will not display power or calibrate	-Defective calibration key (bypass in read only mode) -Open or defective RF cable -Defective sensor	-Replace calibration key -Check connections, replace RF cable -Replace sensor

**Table 5 Error Messages**

MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
Sensor Problems Add point; Delete Point or Sensor not responding	-Defective Sensor	Replace Sensor
Add Point Failure Calibration table Full	- Max. Number of points are entered	-Delete a point to add another
Add Point Failure Power Too Low to Calibrate	-Power is set too low	-Increase Power
Add Point Failure Frequency Unmeasurable	-No Power to Sensor -Defective Sensor	-Check RF Power -Replace Sensor
Add Point Failure Check Set up	-Calibration key not properly connected	-Check all connections
Fatal Error (n) not enough memory	-Other applications are using RAM	-Close any other memory resident programs
Printer Error Can't Continue Printing	-Printer off or out of paper	-Check printer power, check paper supply
Lost Communication with Instrument	-Loose GPIB Connection	-Check GPIB Interface Bus cable



**Section 6****Preparation for Shipment or Storage**

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- General** This section provides the special instructions needed to prepare the instrument for shipment or storage.
- Storage** The Model 4421A530 should be stored in a cool, dry area. Ambient temperature of the storage area must be within -20° to +70°C (-4° to 158°F). If storage period is expected to exceed 30 days, package the unit as described below to keep it free of dust and dirt, and protect it against rough handling.
- Packaging** Package instrument using the original shipping container. If the original shipping container is not available, use a corrugated box. Place shock absorbing material around all sides of the instrument to prevent movement during handling or shipment. Equipment packaging shall be in accordance with best commercial practices.

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**General** The illustrated parts list in this section identifies the major component parts of the Model 4421A530. An exploded view (Figure 7 on page 22) is used to illustrate the component parts and indicate their relation to each other. Each part is identified by an index number that cross references to the parts list.

**Manufacturer Codes** Below is a listing of commercial and government entity (CAGE) codes for component manufacturers and vendors.

CAGE CODES	MANUFACTURER
70998	Bird Electronic Corp.

**Abbreviations** Below is a listing of the abbreviations that may be used throughout the part lists.

ABBREVIATION	TERM
assy	assembly
ext	external
filh	fillister head
hd	head
int	internal
mscr	machine screw
pc	printed circuit
ph	phillips
phh	phillips head
sst	stainless steel
subassy	subassembly

**Parts List** The information contained in each column is described as follows:

Column (1) - Item No. This column contains the figure number of the illustration referenced and the item numbers of the illustrated component parts.

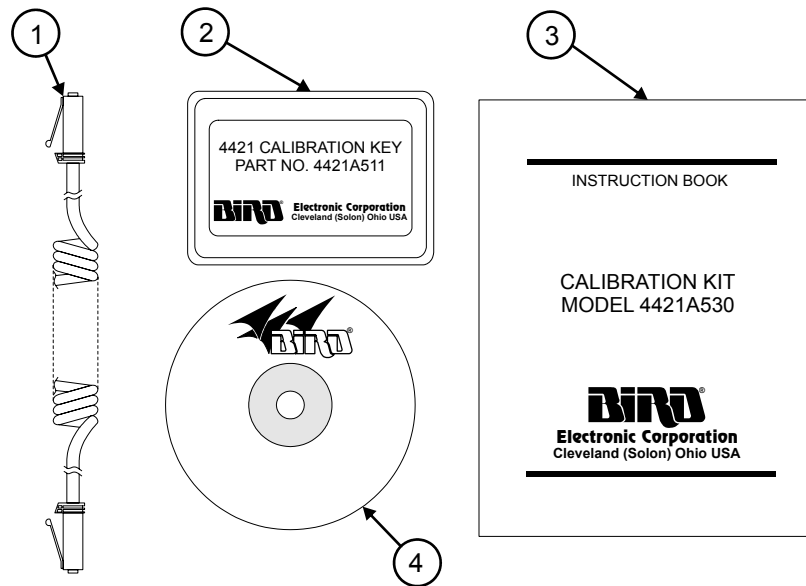
Column (2) - Bird Part No. This column lists the Bird Electronic Corporation part number for the part.

Column (3) - Description. This column provides a component name and description for each part. The last entry for each item lists the Bird Electronic Corporation part number and CAGE code in parentheses, if not already listed in columns (2) and (3). Item listings are indented to show the assembly-subassembly relationship of components.

Column (4) - Qty Per Assy. This column indicates the quantity of the itemized parts used in the assembly or subassembly.

Column (5) - CAGE Code. This column identifies the commercial and government entity code for the original manufacturer of the part. Refer to the CAGE code listing in “Manufacturer Codes” on page 21 for manufacturer/vendor source data applicable to the part.

Figure 7 Calibration Kit Parts List



ITEM NO.	PART NO.	DESCRIPTION	QTY. PER ASSY.	CAGE CODE
	4421A531	Calibration Kit	REF.	70998
1	4421-038	• Interface Cable, Latch-N-Lock	1	70998
2	4421A511	• Calibration Key	1	70998
3	920-4421A530	• • Instruction Book	1	70998
4	5A2609-2	• • Compact Disk (CD) programmed disk	1	70998

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## **Limited Warranty**

All products manufactured by Seller are warranted to be free from defects in material and workmanship for a period of one (1) year, unless otherwise specified, from date of shipment and to conform to applicable specifications, drawings, blueprints and/or samples. Seller's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by Seller.

If Seller's products are claimed to be defective in material or workmanship or not to conform to specifications, drawings, blueprints and/or samples, Seller shall, upon prompt notice thereof, either examine the products where they are located or issue shipping instructions for return to Seller (transportation-charges prepaid by Buyer). In the event any of our products are proved to be other than as warranted, transportation costs (cheapest way) to and from Seller's plant, will be borne by Seller and reimbursement or credit will be made for amounts so expended by Buyer. Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing within ten (10) days from the date of discovery of the defect.

The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's request and/or to Buyer's specifications. Routine (regularly required) calibration is not covered under this limited warranty. In addition, Seller's warranties do not extend to the failure of tubes, transistors, fuses and batteries, or to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to Seller.

The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR SELLER ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.