SENSOR INTERFACE MODULE

MODEL
4421A540-2

OPERATION MANUAL

INSTRUCTION BOOK PART NUMBER 920-4421A540-2 REV. B

Safety Precautions

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 apply to all phases of operation and maintenance.

WARNING

Keep Away From Live Circuits

Operating Personnel must at all times observe general safety precautions. Do not replace components or make adjustments to the inside of the test equipment with the high voltage supply turned on. To avoid casualties, always remove power.

WARNING

Shock Hazard

Do not attempt to remove the RF transmission line while RF power is present.

WARNING

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.

WARNING

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.

WARNING

Resuscitation

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

WARNING

Remove Power

Observe general safety precautions. Do not open the instrument with the power on.

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.

Note: *Calls attention to supplemental information.*

Caution Statements

The following equipment cautions appear in the text and are repeated here for emphasis.

CAUTION
4421A540-2 Sensor Interface Module must be unplugged from the power supply when making connections or disconnections to the power sensor.

On page 5.

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.

On page 6.

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 HACERIO.

WARTUNG

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

ZUR VERMEIDUNG GEFÄHRLICHE, ELEKTRISCHE SCHOCKS, SIND WARTUNGSARBEITEN AUSSCHLIEßLICH VON QUALIFIZIERTEM SERVICEPERSONAL DURCHZUFÜHREN.

ENTRENTIEN

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 EFFETTUARRE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.

About This Manual

This manual covers the operating and maintenance instructions for the following models:

4421A540-2

Changes to this Manual

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

Literature Contents

Introduction — Describes the features of the 4421A540-2, lists equipment supplied and optional equipment, and provides power-up instructions.

Theory of Operation — Describes how the 4421A540-2 works and its functions.

Installation — Describes the how to install the 4421A540-2.

Operation — Describes procedures require for operating the 4421A540-2.

Maintenance — Lists routine maintenance tasks as well as troubleshooting for common problems. Specifications and parts information are also included.

Table of Contents

Chapter 1 Introduction

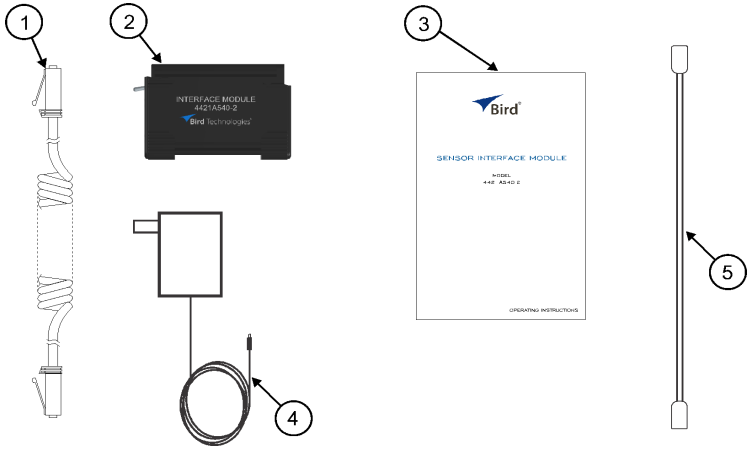
This instruction book is for operators of the Bird 4421A540-2 Sensor Interface Module (SIM). This section contains introductory information including items supplied.

Purpose and Function

The purpose of the 4421A540-2 Sensor Interface Module is to provide a means of communicating with Bird 4020 Series power sensors instead of using the Bird 4421 RF Power Meter.

Items Supplied

Figure 1 Items Supplied



Item	Qty	Name	Description
1	1	Sensor Cable	Used to connect the 4421A540-2 to the power meter
2	1	4421A540-2	Interconnected between computer and Series 4020 power sensor.
3	1	Instruction Book	Instructions on using the 4421A540-2
4	1	Power Supply	+12V Power Supply
5	1	USB Cable	USB A-B Cable

Items Required but not Supplied

A computer running Windows XP or later with the following:

- 200 MB free hard disk space
- SVGA monitor
- Computer Pointing device (mouse)
- Bird 4020 Series Sensor
- NI LabVIEW

Chapter 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 4421A540-2.

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.

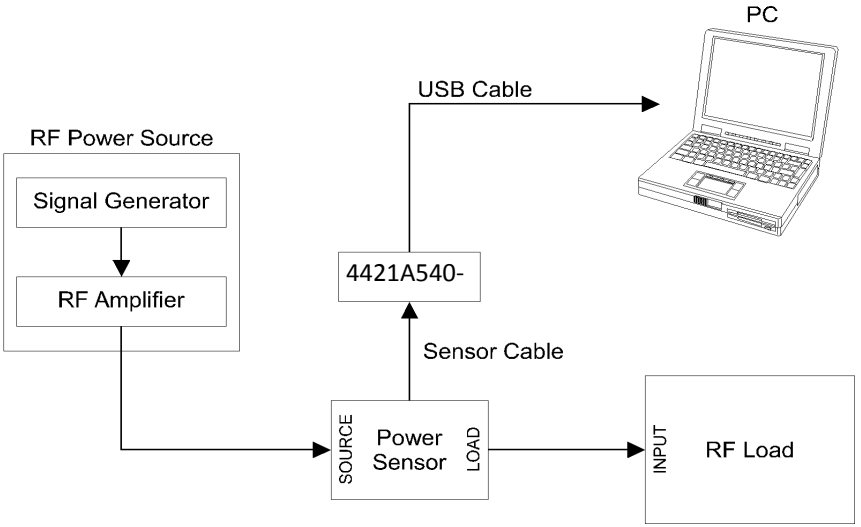
In addition to the linearizion of the diode output, a temperature compensating network is added to counteract drift commonly encountered in other power meters that use diode sensors.

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.

Figure 2 Setup Block Diagram



Chapter 3 Installation

Unpacking and Inspection

1. Inspect the 4421A540-2 shipping package for signs of damage.

   Note: *Use care when inspecting the package.*

2. Do one of the following:
   - **If shipping package is damaged** - Do not unpack the unit.

     Note: *Immediately notify the shipping carrier and Bird Technologies of the damage.*

   - **If shipping package is not damaged** - Unpack the unit.

     Note: *Save all shipping materials.*

3. Check package contents against the items supplied list on page 1.
4. Visually inspect all components for signs of damage.

   Note: *Immediately notify the shipping carrier and Bird Technologies of equipment damage or missing parts.*

Installing LabVIEW Drivers

1. Go to www.birdrf.com/Products/Sensor Solutions/Software-PC-Accessories/Software-PC-Accessories/4421A539-1-Interface-LabVIEW-Driver.
2. Download drivers.
3. Install drivers onto the computer.

   Note: *LabVIEW is a trademark of National Instruments. Neither Bird Technologies, nor any software programs or other goods or services offered by Bird Technologies, are affiliated with, endorsed by, or sponsored by National Instruments.*

Connecting Cable and 4421A540-2 Module

CAUTION

4421A540-2 SIM must be unplugged from the power supply when making connections or disconnections to the power sensor.

1. Connect a USB cable between the 4421A540-2 and the computer.

2. Connect a sensor cable (supplied with sensor) between the 4421A540-2 and the RF power sensor.

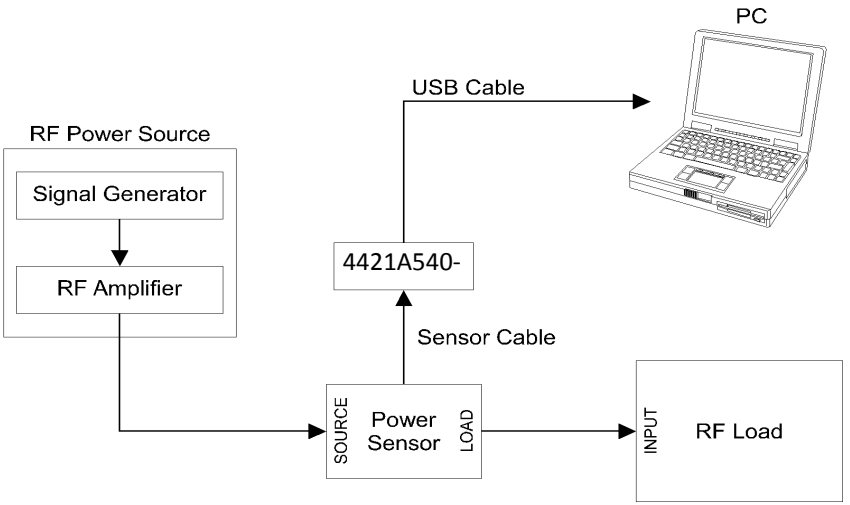
CAUTION

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.

3. Connect the power sensor in an RF transmission line:
   - The Source side connects to the signal source.
   - The Load side connects to a power standard.

Note: *Make this connection as short as possible.*

Figure 3 Operational Setup



Chapter 4 Operating Instructions

Equipment Startup

Equipment connection varies depending on operating mode desired, follow equipment startup procedures for individual equipment connected.

LabVIEW Setup

The 4421A540-2 is compatible with the National Instruments LabVIEW program. The LabVIEW Virtual Instrument (VI) drivers are available from the Bird Technologies website. This allows the user to setup LabVIEW to directly communicate with the 4020 power sensor through the 4421A540-2 module.

> **Note:** *LabVIEW is a trademark of National Instruments. Neither Bird Technologies, nor any software programs or other goods or services offered by Bird Technologies, are affiliated with, endorsed by, or sponsored by National Instruments.*

Troubleshooting

Table 1 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 1 Troubleshooting, Symptom, Cause, Action

Problem	Possible Cause	Corrective Action
No display on computer	Poor connections	Check connections, replace cables as necessary.
	Faulty cables	
	Defective 4421A540-2 (by-pass in read only mode)	Replace 4421A540-2.
Unit will not display power	Defective 4421A540-2 (by-pass in read only mode)	Replace 4421A540-2.
	Open or defective RF cable	Check connections, replace RF cable.
	Defective sensor	Replace sensor.
	Defective Power Supply	Replace Power Supply P/N: 5B2229-1224-G-1
	Defective sensor	Replace sensor.

Preparation for Shipment or Storage

Storage

The Model 4421A540-2 should be stored in a cool, dry area. Ambient temperature of the storage area must be within -20º to +70ºC (-4º 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.

Parts List

The illustrated parts list in this section identifies the major component parts of the Model 4421A540-2. An exploded view (Figure 4 on page 11) 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.

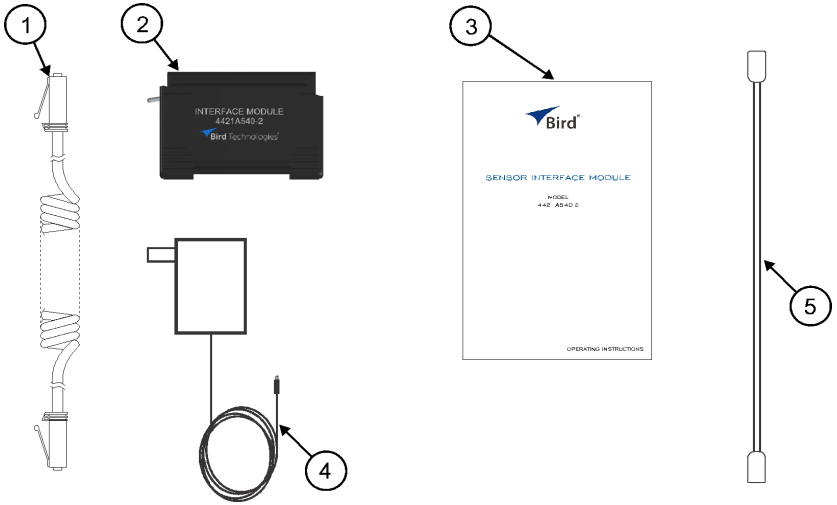
Abbreviation	Term
assy	assembly
ext	external
filh	fillister head
hd	head
int	internal
mscr	machine screw
pc	printed circuit
ph	Phillips
phh	Phillips head
sst	stainless steel
subassy	subassembly

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) - 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 9 for manufacturer/vendor source data applicable to the part.

Figure 4 Sensor Interface Module Parts List



Item No.	Part No.	Description	Qty. Per Assy.	Cage Code
1	4421-038	Interface Cable, Latch-N-Lock	1	70998
2	4421A540-2	Sensor Interface Module	1	70998
3	920-4421A540-2	Instruction Book	1	70998
4	5B2229-1224-G-1	12V Power Supply	1	70998
5	5A2653-GL	USB Cable	1	70998

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.