Pulse Power Sensor

7023 Series

Operation Manual

Instruction Book Part Number 920-7023S 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 uniterruptible 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.*

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 RF equipment from the transmission line while RF power is being applied.
Leaking RF energy is a potential health hazard.

On page 3.

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:

7023 Series

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

Chapter Layout

Introduction — Describes the features of the Bird 7023 Series Power Sensor.

Installation — Describes how to connect Bird 7023 Series Power Sensor to the user's system, and software requirements.

Operation — Describes the power measurement process.

Maintenance — Lists routine maintenance tasks as well as a specifications and model features identification.

Table of Contents

Chapter 1 Introduction

The Bird 7023 Series Power Sensor is a Thruline sensor capable of measuring pulse average power within the power sensor frequency range at user defined intervals. See "Specifications" on page 6.

Description

The Bird 7023 Series Power Sensor is a portable unit contained in an aluminum housing. The input and output of the Bird 7023 Series Power Sensor are Bird Quick-Change type RF connectors, which allow the sensor to be quickly with any other Bird “QC” connectors. A USB cable is used to connect the Power Sensor to a PC. Bird’s Virtual Power Meter (VPM3) software must be installed on the PC to allow interaction with sensor. See Figure 1 on page 2.

Controls and Indicators

A status indicator is provided to inform the user of the power sensors operating mode.

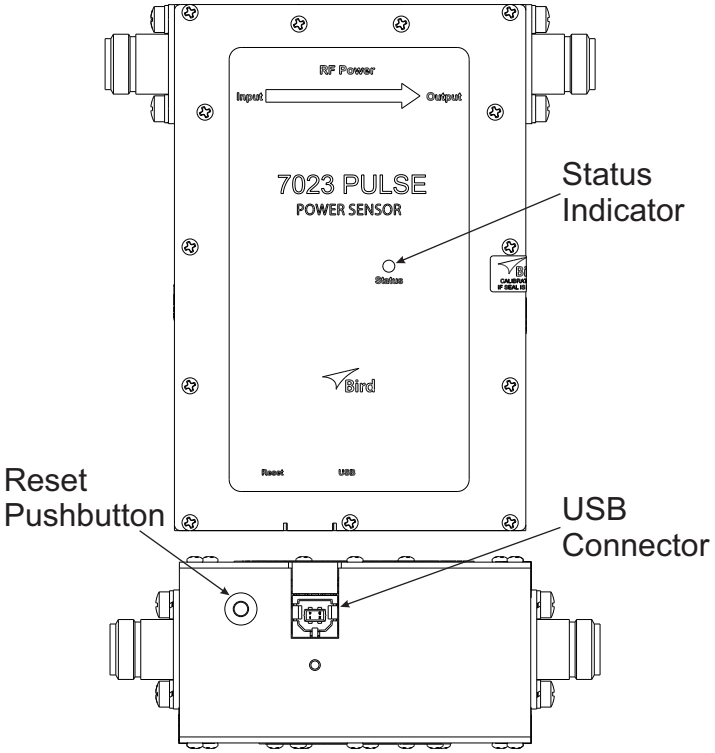
Indicator Color	Definition
Green	Sensor is operating normally.
Blue	Sensor is booting up.
Violet	Sensor is in programming mode.

A reset pushbutton is provided to enable programming mode.

Power Requirements

The Bird 7023 Series Power Sensor operates on power provided by the USB cable connection, no other power source is required.

Figure 1 7023 Power Sensor



Software

Bird's VPM3 software is required to operate the Bird 7023 Series Power Sensor. The software must be installed before operation.

Connecting the 7023 Power Sensor

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

1. Insert the 7023 Power Sensor into coaxial transmission lines of 50 ohms nominal impedance.

   Note: *Connect the 7023 Power Sensor to the RF line so that the arrow on the sensor points towards the load.*

2. Connect the USB Type A (flat) connector to the PC.
3. Connect the USB Type B (square) connector to the power sensor.
4. Open Devices and Printers dialog box. (\\Control Panel\Hardware and Sound\Devices and Printers).
5. Verify the Power Sensor's device drivers are installed correctly.

Note: *Refer to the VPM3 operation manual for detailed descriptions of menus and displays. The VPM3 software and manual are available on the Bird Technologies website (http://www.birdrf.com*).

Measurement Process

The 7023 sensor measures the average power of a pulse in a user defined interval referenced from the rising and falling edges of the pulse.

When the measurement is initiated 2.23 ms of the signal is sampled. The envelope of the signal must contain at least 3 edges within the acquisition window in order for pulse parameters to be measured. The edges can be rise-fall-rise or fall-rise-fall. The pulse repetition rate is measured between two rising edges or two falling edges, depending on which edge is detected first.

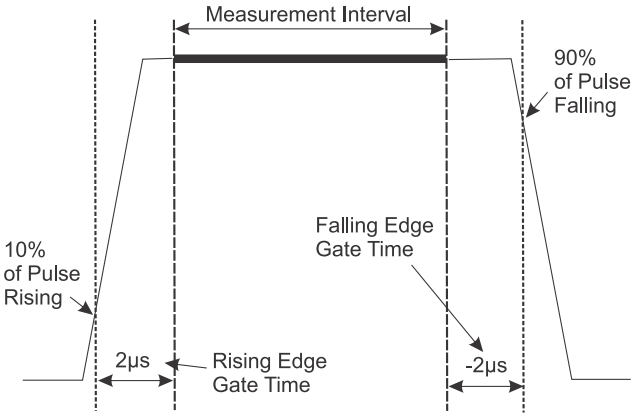
The measurement interval (Figure 2) for the average pulse power begins at the user specified delay after the rising edge and ends at the user specified time interval before the falling edge. The rising edge of the pulse is identified at the point where the power envelope rises to 10% of the pulse top amplitude. The falling edge of the pulse is identified at the point where the power envelope drops to 90% of the pulse top amplitude.

The sensor is capable of averaging measurements from pulse to pulse. The average is an exponential where:

$$AVG_n = \frac{1}{k}X_n + \frac{k-1}{k}AVG_{n-1}$$

The Averaging Value parameter sets the k factor.

Figure 2 Bird Pulse Power Measurement Interval



Chapter 4 Maintenance

The 7023 Series Power Sensor is of very rugged construction and requires little care and maintenance.

Maintenance of the power sensor is normally limited to cleaning. Protect the RF connectors against the entry of dust and dirt by keeping them covered when the unit is disconnected from the transmission line.

Customer Service

Any maintenance or service procedure beyond the scope of those in this chapter should be referred to a qualified service center.

If the unit needs to be returned for any reason, request an Return Material Authorization (RMA) through the Bird Technologies website. All instruments returned must be shipped prepaid and to the attention of the RMA number.

Bird Service Center
30303 Aurora Road
Cleveland (Solon), Ohio 44139-2794
Fax: (440) 248-5426
E-mail: *bsc@birdrf.com*

For the location of the Sales Office nearest you, visit our Web site at:

http://www.birdrf.com

Shipment

Should you need to return the power sensor, use the original shipping package if possible. If the original package is not available, use a heavy duty corrugated box with shock-absorbing material around all sides of the unit to provide firm cushion and to prevent movement in the container. The container should be properly sealed.

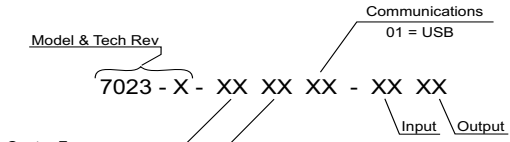
Specifications

Frequency Range	Varies by model, See “Model Identification” on page 8.
Power Range (Continuous Average Power)	Varies by model, See “Model Identification” on page 8.
Peak Power @ 60% Duty Cycle	Varies by model, See “Model Identification” on page 8.
Measurement Type	Thru-Line Power
Impedance, nominal	50 Ohms
Average Power Range Accuracy	Varies by model, See “Model Identification” on page 8. 1% at calibrated frequency and power level 2% at all other points
VSWR Range	1.0:1 to 2.0:1
Gated Average Power Accuracy Burst width Repetition Rate Duty Cycle	 1% at calibrated frequency and power level 2% at all other points 2 µs to 900 µs 1 kHz to 50 kHz 10 to 90%
Insertion loss, Max	<0.05 dB
Insertion VSWR, Max	1.05
RF Connectors	QC (Overall power will be limited by connector selection.) See “Model Identification” on page 8 for QC connectors supplied by model number.
Directivity, Min	28 dB
Factory Calibration	NIST Traceable
Recommended Calibration Cycle	6 Months
Field Calibration	None
Interface	USB 2.0
Power Supply	Via USB (less than 0.5A at 5V)
Physical and Environmental	
Operating Temperature	+15 to +35 C (+59 TO +95 F)
Storage Temperature	-20 to +70 C (-4 to +158 F)
Humidity	95% maximum (non-condensing)
Altitude, Max	10, 000 ft. (3,000 m)
Dimensions, Nominal	6” x 2.0” x 3.7” (140 x 51 x 94 mm) not including RF connectors

Weight, Max	Less than 2 lbs
Mechanical Shock and Vibration	Designed to meet MIL-PRF-28800F class 3
Compliance	Designed to Comply with: EMC Directive (2014/30/EU) European Standard: EN 61326—Electrical Equipment for measurement, control and laboratory use; EMC Requirements Test Spec (for radiated immunity): EN 61000-4-3—Testing and measurement techniques - 10V/meter
RoHS	Compliant
Compatible Devices	VPM3, Bird 4422 Power Meter
Standard Accessories	USB Cable, VPM3 software
Computer Requirements	
Operating System	Windows 7; 32 or 64 bit
.NET	4.0 or greater
National Instruments Visa	14.0
USB	High Power USB 2.0 Port

Model Identification

Note: *The Model Identification guide is provided to allow existing model numbers to be understood. However, not all combinations are available. Please contact Bird for more information on new model number requests.*



Center Frequency

51 = 250 kHz
52 = 400 kHz
53 = 800 kHz
54 = 2.0 MHz
55 = 3.2 MHz
56 = 4.0 MHz
57 = 6.0 MHz
58 = 8.0 MHz
59 = 13.56 MHz
60 = 27.12 MHz
61 = 40.68 MHz
62 = 60.00 MHz
63 = 100.00 MHz
64 = 162.00 MHz

Power Range

40 = 25 W to 25 kW
41 = 90 W to 20 kW
42 = 15 W to 15 kW
43 = 10 W to 10 kW
44 = 9 W to 9 kW
45 = 8 W to 8 kW
46 = 5.5 W to 5.5 kW
47 = 4 W to 4 kW
48 = 1 W to 3 kW
49 = 30 W to 6 kW

Connectors

01 = 4240-062	N-female
02 = 4240-063	N-male
03 = 4240-090	SC-female
04 = 4240-100	C-female
06 = 4240-125	BNC-female
07 = 4240-156	TNC-female
08 = 4240-160	TNC-male
09 = 4240-165	Adapter QC to QC
10 = 4240-194	Adapter 3 1/8" flanged to QC
11 = 4240-260	Adapter 1 5/8" flanged to QC
12 = 4240-268	HN-female
13 = 4240-278	HN-male
14 = 4240-344	7/16-female, IEC type 169-4
15 = 4240-363	7/16-male, IEC type 169-4
16 = 4240-370	SQS-male
17 = 4240-371	SQS-female
18 = 4240-372	SQS-male, polarized
19 = 4240-376	QRM-female
20 = 4240-374	QDS-UL-male
21 = 4240-375	SQS-female, polarized
22 = 4240-373	QDS-UL-female
23 = 4240-377	QRM-male (silver contacts)
24 = 4240-377-2	QRM-male (gold contacts)
25 = 4240-378	QRM-male (gold contacts), polarized
26 = 4240-376-20	GQL-female
27 = 4240-377-20	GQL-male
28 = 4240-376-10	GQM-female
29 = 4240-377-10	GQM-male

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.