4027F Series Power Sensors

4027F2M, 4027F10M, 4027F60M

- +/-1% accuracy at specified calibration frequencies and power levels
- Direct plug-in operation with the industry standard Bird® 4421 RF Power Meter
- True average responding detector scheme reduces errors from harmonics and amplitude modulation.

Birds new 4027F Series Power Sensors represents a family of sensors for use in semiconductor processing and other precision process applications where the effects of amplitude modulation and harmonics need to be eliminated from the measurement.

Application:

The potential measurement error contributions from amplitude modulation and harmonics are very important to consider when making precision measurements. In most cases the Bird® 4020 Series non filtered sensors have been used directly on the output of the RF generator, with the output terminated in a high quality Bird® load. In these cases, the measurements are quite reliable and accurate, provided the RF generator has low harmonic content and minimal amplitude modulation. In some cases however, the sensor is located at a point in the RF delivery system where it may be exposed to energy reflected from the process reactor, which typically contains much higher harmonic levels, as well as line related amplitude modulation. In these cases significant errors are possible with the un-filtered sensors.

Bird® Electronic corporation has developed the new 4027F series of filtered power sensors to address these concerns. This new product is intended to be used with our existing 4421 RF Power Meters and will provide an added benefit of being essentially immune to the effects of high harmonic levels present in the output of RF generators. In addition, this new sensor incorporates a true average responding detector scheme, where the entire dynamic range of the sensor is contained within the square law region of the detector operating range.

Using this technique the sensor will average the effects of amplitude modulation of the signal. Applying the above techniques, the sensor will afford a more universal application within the RF delivery system and will be much more forgiving in terms of its ability to provide accurate, reliable power measurement at the output of RF generators.

Ordering Information:

Order these new power sensors according to the frequency range and operating power level of your fabrication system. See the specification table for frequency ranges and power levels.

Electronic Corporation

RF Measurement and Management in Your World

www.bird-technologies.com **440.248.1200/866.695.4569** sales@bird-technologies.com

4027F Series Power Sensors
Specifications

VSWR, Max:	1.05:1
Insertion Loss, Max:	0.05 dB (with female "N" connectors)
Directivity, Min.:	28 dB
Connectors:	Customer specifies from QC list, appropriate for frequency and power.
Impedance, Nominal:	50 Ohms
Max. Allowable Terminating VSWR:	2.00:1
Calibration Technique:	Frequency-specific calibration factors stored in nonvolatile memory in each sensor. Sensor output corrected for frequency and temperature within specified ranges.
Calibration Cycle, Nominal:	6 months
Accuracy, RFL:	= Forward Accuracy + [FWD Power/10^(Directivity/10)]
Accuracy, VSWR:	Calculated from FWD and RFL Power VSWR = [1 + sqrt (P_R/P_F)] / [1 - sqrt (P_R/P_F)]
Sampling Rate, Nominal:	2 Readings/Seconds
Operating Power:	Supplied by power meter via sensor cable
Operating Temp:	0°C to 50°C (32°F to 122°F) (Derate accuracy outside 25°C ± 5°C)
Storage Temp:	-20°C to 70°C (-4°F to 158°F)
Humidity Max.:	95% (non-condensing)
Altitude, Max:	10,000 Ft. (3,000m)
CE:	CE complaint. Refer to declaration of conformity for specific standards.
Repeatability, Multiple Measurements Single Sensor:	± 0.3% (95% c.l.) (With female "N" connectors)
Dimensions, Nominal:	5.2"L x 2.5"W x 3.25"H (137 x 64 x 83 mm) (With female "N" connectors)
Weight:	1 lb. 13 oz. (0.8kg) (With female "N" connectors)

	4027F2M	4027F10M	4027F60M
Frequency Range:	1.8 MHz - 2.2 MHz	12 MHz - 15 MHz	57-63 MHz
RF Power Range:	0.1-10 kW	0.1-10 kW	0.1-3 kW
Calibration Frequencies, Typical:	1.8, 2.0, 2.17 MHz other calibration frequencies available upon request	12.0, 12.5, 13.56, 14.0, 15.0 MHz other calibration frequencies available upon request	57.0, 58.5, 60.0, 61.5, 6.3 MHz other calibration frequencies available upon request
Calibration Power, Typical:	1.7 kW	1.7 kW	1.7 kW
Harmonic Rejection, Min.:	26 dB @ 3.6-3.8 MHz, 30 dB @ >3.8 MHz	30 dB @ >25 MHz	30 dB @ >114.0 MHz
LF Rejection:	Not Specified	30 dB @ <1 MHz	30 dB @ < 15.0 MHz
Max. Error Induced By 10% AM:	0.2% @ <5 kW, 1% @ 5-10 kW	0.2% @ <5 kW, 1% @ 5-10 kW	0.2% @ <1.5 kW, 1% @ 1.5- 3 kW
Accuracy, FWD, Best Case:	±1.0% of Reading (2σ)	±1.0% of Reading (2σ)	±1.0% of Reading (2σ)
Uncertainty Budget (All values 2σ)			
Frequency Error...			
... at cal freq	± 0.1%	± 0.1%	± 0.1%
... not at cal freq	± 0.5%	± 1.5%	± 0.5%
Power Linearity...			
... at cal power	± 0.1%	± 0.1%	± 0.1%
... not at cal power	± 1.0%	± 0.5%	± 1.0%
Temperature Uncertainty...			
... within 20 to 30°C	± 0.65%	± 0.6%	± 0.5%
... outside 20 to 30°C	± 3.2%	-3.0, +0.75%	± 2.9%
Calibration Uncertainty	± 0.6%	± 0.6%	± 0.6%
Resolution Uncertainty...			
... at cal power	± 0.06%	± 0.06%	± 0.06%
... not at cal power*	± 0.34%	± 0.34%	± 0.34%
Other	± 0.4%	± 0.5%	± 0.6%
Best Case RSS Uncertainty	± 1.0%	± 1.0%	± 1.0%

* Resolution uncertainty is error due to limited display digits. Actual uncertainty can be calculated as ± (1 in least significant digit) / Reading. For a 3.5-digit display, worst case is at 300W. Least significant digit is one watt, uncertainty is ±1W out of 300W or 0.34%. For a 4.5-digit display, least significant digit is 0.1W, so the uncertainty is 0.034%

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