raditeq

Product Manual

RadiPower®

RF Power Meters

Models:

RPR2006C | RPR2006P | RPR20018C | RPR2018P

www.raditeq.com

RadiPower® product manual

This product manual pertains to the RadiPower®.
Models: RPR2006C | RPR2006P | RPR20018C | RPR2018P - **By Raditeq**
Plug-in card: USB1004A - **By Raditeq**

Read this manual carefully before operating the product and make sure all the safety instructions are strictly followed.

For your convenience, a Quick Start Guide has been added to this product. This Quick Start Guide contains the basic start-up steps and the safety warnings.

Please keep the Quick Start Guide (and this regular manual) close at hand when you operate your new Raditeq product(s).

Please contact your local reseller if you have any questions.

Supplier Information

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The Netherlands

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Email: sales@raditeq.com

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WARNINGS & PRECAUTIONS

Read the contents of this product manual carefully and become familiar with the safety markings, the product instructions and the handling of the system. Please refer to the applicable product manual(s) for further information regarding the operation and control of the product(s).

This product requires a protective earth connection. The mains power source for the equipment must supply an uninterrupted safety ground to the IEC input connector(s).

This equipment is designed to be used as a plug-in card for the RadiCentre® series. Do not use this card on its own or in combination with any other mainframe. Using this product with any other mainframe can cause harm and will void warranty.

Only Raditeq qualified maintenance personnel is allowed to perform maintenance and/or repair service on the equipment.

This product® contains materials that can be recycled and reused to minimize material waste. At the 'end-of-life', specialized companies can dismantle the discarded system to collect the reusable and recyclable materials. If your product is at its 'end-of-life', please return it to your local reseller or to Raditeq for recycling.

For cleaning, use a clean, dry cloth (or a damp cloth where needed) and wipe the surface of equipment.

This product contains no hazardous substances as described in the RoHS Directive (2015/863/EU).

This product contains embedded software, which is field upgradeable from the RadiCentre® using the USB-A connection port on the backside panel of the RadiCentre®. For more information about updating your Raditeq plug-in card, please read the RadiCentre® manual.

Introduction

This manual contains information about the RadiPower® range of RF power meters.

An accurate power meter is indispensable to perform reliable EMC measurements. The RadiPower® is a RF power meter especially designed for power measurements during EMC tests. The RadiPower® is an affordable, accurate and fast power meter. It provides accurate measurements over a wide frequency range, which enables effective measurements in accordance with the latest EMC standards.

Each RadiPower® RF power meter has an USB port that allows direct connection and control from any Microsoft® Windows PC. The RadiPower® models RPR20XX can also be connected and controlled through the four (4) channel USB plug-in card (model USB1004A) in combination with the RadiCentre® modular test system.

Please read this manual carefully and make sure to pay special attention to the chapters regarding your new product(s).

RadiCentre® System

The RadiCentre® is a modular EMC/RF test system that serves as the interface between user and computer for all the RadiCentre® plug-in cards and modules.

RadiMation® Software

RadiMation ® is the EMC software package from Raditeq used for remote control and automated testing of the RadiCentre® plug-in cards and modules and is sold separately.

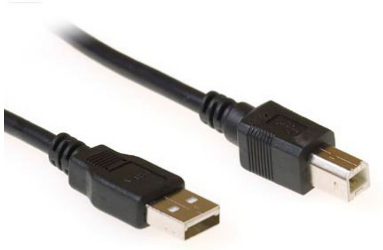
RadiField® Electric Field Generator

The patented RadiField® Triple A is no less than a revolution in EMC immunity testing. A complete paradigm shift involves a combination of high-level integration and a field combining technique, making several discrete components like combiner, coupler, power meters and cabling superfluous. This product is sold separately.

The RadiPower® 2000 Series - overview

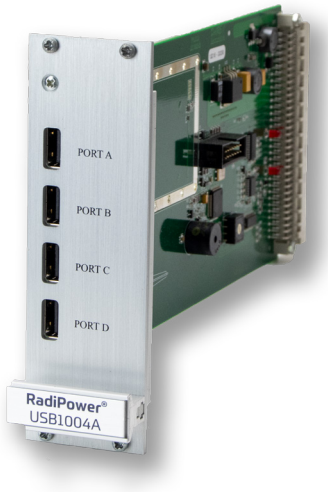
RadiPower® RF power sensor

Model: RPR2006C, RPR2006P, RPR2018C or RPR2018P A RF power sensor to be used together with a RadiPower® plug-in card or directly to a PC.



Shielded USB cable

Model: USB A male to USB mini B5 male.
To connect the RF power sensor with the plug-in card.



RadiPower® plug-in card (purchased seperatly)

Model: USB1004A.
The RadiPower Plug-in card USB1004A provides the ability to combine and incorporate four RadiPower® power meters in a single slot of the RadiCentre®. Doing so provides the means to control the (four) RadiPower® through the touch-screen of the RadiCentre®.

Additionally to controling the RadiPower® the USB1004A gives the option to link and combine the power meter output. Furthermore it can calculate the gain, net power and VSWR.

Supporting documentation in the form of USB stick containing:

- The (digital) User Manual and Quick Start Guide.
- The installation of RadiMation® Free software and drivers.
- Optional - The calibration certificate for the power meter (if a certification was requested).

The RadiPower® 2000 series

Product characteristics

The RadiPower® RF power sensor is optimized for EMC measurements, where a high dynamic range, together with fast measurements, are required even at low power levels. Where most power sensors require long measurement times at low RF levels, the RadiPower® RF power sensor is able to perform accurate power measurements, with a high measurement speed, at power levels close to the noise floor, without the need for zero adjustment!

Fast - EMC immunity measurements are time consuming. This is mainly dependent on the number of frequency points, the dwell time and the speed of the power meter. As the first two parameters are generally prescribed by standards, the only one that can be optimized is the speed of the power meter. The unprecedented detector technology of Raditeq's power meters makes extremely fast and accurate power measurements a reality, even at low power levels.

Accurate - Accuracy is another concern in addition to speed, when performing EMC measurements. The RadiPower® allows for high precision EMC measurements with a large dynamic range. Because the RadiPower® has a high accuracy over the complete band, it is suitable for measurements in accordance to automotive, military, telecom and EMC basic standards such as the IEC61000-4-3/6 standards.

Low measurement uncertainties - Impedance mismatches contribute to the measurement uncertainty. The RadiPower® has a very low Standing Wave Ratio (SWR) as a result, measurement uncertainties are low compared to other contributions in the EMC measurement setups.

Robust housing

The RadiPower® RF power sensor is mounted in a rugged metal housing to ensure a long life and excellent RF shielding. The power sensor is equipped with an N-type precision RF input connector and a mini USB-B connector for communication with a computer.

Easy to use - With the USB interface the RadiPower® is easy to use. In addition, the RadiPower® can be controlled by both the RadiMation® integral EMC measurement software and any other EMC measurement packages, because all the software command codes needed to control the unit are available. For 'stand-alone use' of the RadiPower®, RadiMation® Free measurement software is delivered with the system. By using the USB1004A plug-in card, up to four RadiPower® heads can be connected to a single plug-in card in a RadiCentre®.

CW sgnals & RF bursts - To enable the measurement of RF bursts, the RadiPower® can also be delivered as a RF pulse power head. This P-version of the RadiPower® is able to measure RF bursts as short as a few microseconds. The C-version of the RadiPower® only supports RMS-measurements for CW signals.

Different Models - 2000 Series

The RadiPower® RF power sensor is available in 4 models; the RPR2006C, RPR2006P, RPR2018C and RPR2018P. The differences between these models is the frequency range that they cover and the types of measurements that they can perform.

- C- vs P-models
  The C-models support measurements for CW signals.
  The P-models can measure RF bursts as short as a few microseconds.

- 2006 vs 2018 models
  RPR2006: 9 kHz to 6 GHz -55dBm to + 10 dBm
  RPR2018: 80 MHz to 18GHz -45 dBm to + 10 dBm

- Option2 for 2006 models
  #010 4 kHz extension (-40 dBm to +10 dBm from 4 to 9 kHz)

Theory of operation - RadiPower® 2000 series

The RadiPower® uses a high speed power detector to measure the RF signal, independent of the crest factor of the input signal waveform. The detected signal is sampled, at high speed, by a high speed ADC and the samples are processed by a powerful DSP. The sophisticated software enables unique functions, such as envelope tracing and burst logging. The table below shows which models support the different measurement modes.

Mode	RPR20XXC	RPR20xxP	RPR3006W
0 : CW	√	√	√
1 : Peak		√	√
2 : Envelope tracing		√	
3 : Burst			√

CW Mode

The RadiPower® performs RMS power measurements of CW-signals. In RMS mode the RadiPower® samples the signal at high speed. The RMS value of the power is calculated over the number of samples defined by the filter setting and can be read by a simple command. Due to the high sampling speed the number of readings is high, even at large filter settings.

Peak mode

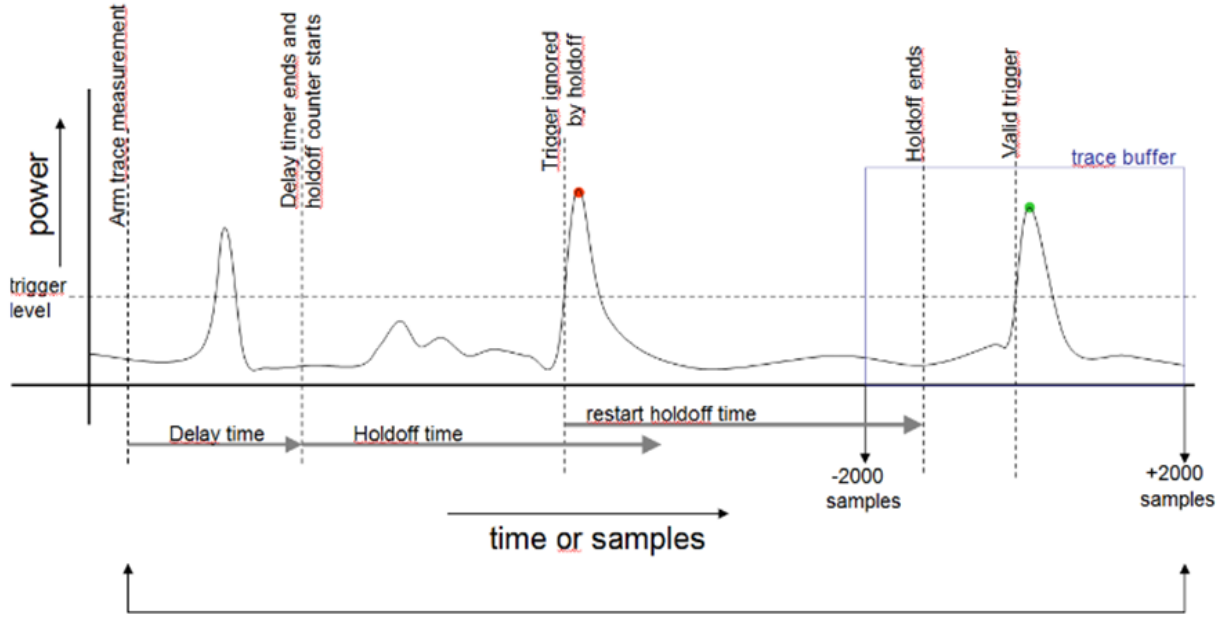
Peak mode keeps track of the maximum power that is measured during a specific time interval. In PEAK mode, the “power?” -command will return the highest value that was measured since the last “power?” -command. After each cycle of the command the previous peak value is cleared,

Envelope tracing

It In this mode, the power meter captures data before and after a trigger event occurred. In conjunction with the extremely fast measurement speed of the power meter. This function excels in analysing switching errors that can occur for example in signal generators or transmitters.

To setup an envelope tracing measurement, the user must set a trigger level (threshold value). This trigger can be rising (power exceeds the threshold value) or falling edge (power drops below the threshold value). When the trigger occurs, the power-meter will store 4000 measurement point, 2000 before the trigger occurs and 2000 after.
v
Besides the trigger, the user can also set a hold off and a delay time. The hold off timer sets a time window, in this window no trigger may occur. If a trigger is detected during this window the timer will reset. If this function is not used the timer must be set to 0. The delay time is a delay before the hold off timer starts. This delay can be used to get the all the (test) equipment in a steady state, before the power meter will capture any trigger.

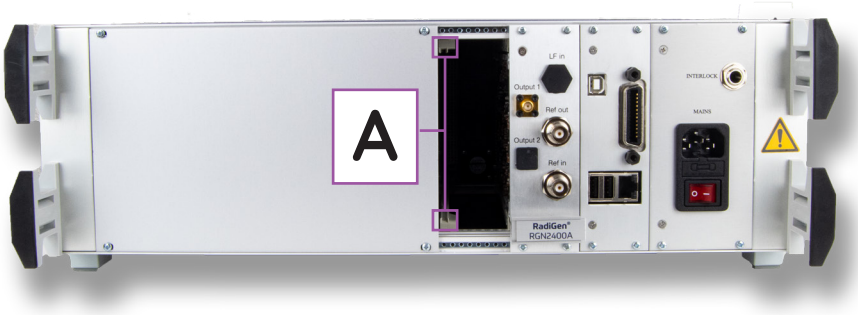
The following figure shows an example.



The X axis represents power and the Y axis is the time and samples. The trigger is set to a rising edge, this is the horizontal dashed line. The measurement starts with a delay time. In this delay time a theoretically trigger occurred but is ignored by the power meter. After the delay time the hold off timer start, in this example there is also a trigger. The power meter will detect the peak and resets the hold off timer. When the (second) hold off timer has ended the power meter will be able to detect a peak. When this peak is detected the power meter will store the 2000 samples before and after the trigger occurred.

Installing the RadiPower® plug-in card (USB1004A only)

Please follow the instructions below on how to install the Raditeq plug-in card into the RadiCentre® correctly. NOTE: Before installing and inserting a new plug-in card make sure that the RadiCentre® is turned OFF.



Step 1

Choose an empty slot in the RadiCentre® in which the plug-in card can be installed.
Remove the blind panel from the slot by unscrewing the four (4) screws on the panel (two at the top and two at the bottom).

Step 2

Insert the plug-in card in the rail of the empty slot as shown in the picture A. Position the plug-in card into the slot and slowly push it, using the lower part of the plug-in card. When it reached the end of the rail, gently push and secure the plug-in card into the backplane socket.

Step 3

When the plug-in card is inserted correctly into the backplane socket, fix it by tightening the four screws at the top and the bottom of the plug-in card (shown at B). For connection of the panels into the RadiCentre® a screwdriver type Pozi, size PZ1 should be used'

Step 4

After installation of the plug-in card, connect the AC mains power cord on the back of the RadiCentre® and switch the ON/OFF button to the ON position. The RadiCentre® can now be started by tapping the touch screen.

When installed properly, the plug-in card should be recognized and shown automatically on the front screen of the RadiCentre® when turned ON.

RadiCentre® & USB1004A - Manual Control

Once the RadiCentre® is switched on, the RadiPower® can be activated from the 'main'- screen on the RadiCentre® touch-screen.

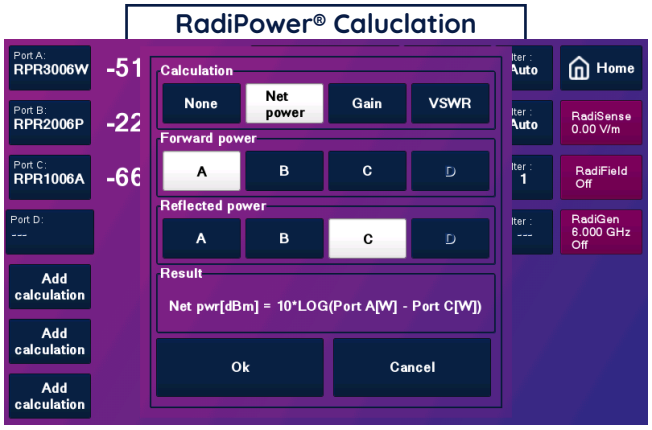
Sensor configuration

The large 'status' button in the 'main' screen of the RadiCentre® will display the detected RadiPower® USB1004A plug-in card and the inserted RadiPower® power meters. To monitor the measured power level(s), one can go to the 'control' screen by pressing the RadiPower® 'status' button.

RadiCentre® home screen

RadiPower® Status Screen

RadiPower® Caluclation



Frequency settings

In order to obtain the correct absolute power level, the user can enter the measurement frequency in the frequency window (see figure below). This window will appear after pressing the frequency button next to the power sensor data.

Note: When the user does not enter the correct measurement frequency, the power sensor will not display the correct absolute power level.

Offset settings

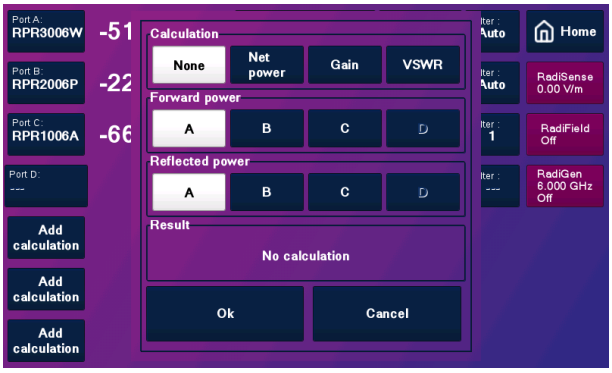
Another function that is available for the RadiPower® is the 'Offset' function. The Offset value can be used to 'compensate' for a fixed – known value, for example 20 dB attenuation. The offset value defined in dB will be subtracted from the measured value of the RadiPower® the user can enter the 'Offset' value by pressing the 'Offset' button on the RadiPower® screen, where a new window will open in which the value can be entered. Please refer to figure on the right where as an example an offset of 20 dB has been entered. The displayed value on Port B will now be the measured value minus the offset value (20 dB lower).

Filter Settings

The user can also enter the filter setting, to select a 'filter time constant'. For more information on the available filter settings, please refer to the 'RadiPower® Specifications' section of this manual.

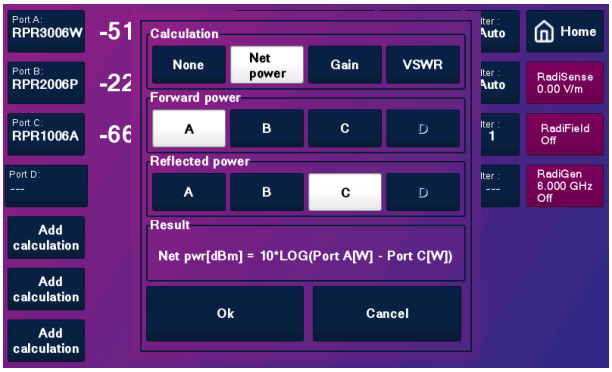
Calculation functions

In situations where multiple RadiPower® USB power heads are connected to the USB1004A plug-in card, the operator can use pre-defined calculations on the main screen to calculate between two different power meter measurements. This function is only applicable for mode 0 (CW)..



Net Power function

The 'Net power' function is shown as an example in figure on the right.This function will calculate the difference (in dBm) between two power meters. The measured power on port A (in Watts) and the measured power on port C (in Watts) will be subtracted resulting in the net power.



Gain function

The 'Gain' function will calculate the difference (in dB) between the measured power of two ports.

VSWR function

The 'VSWR' function will calculate the VSWR based on the measured forward power and reflected power between two ports (in U).

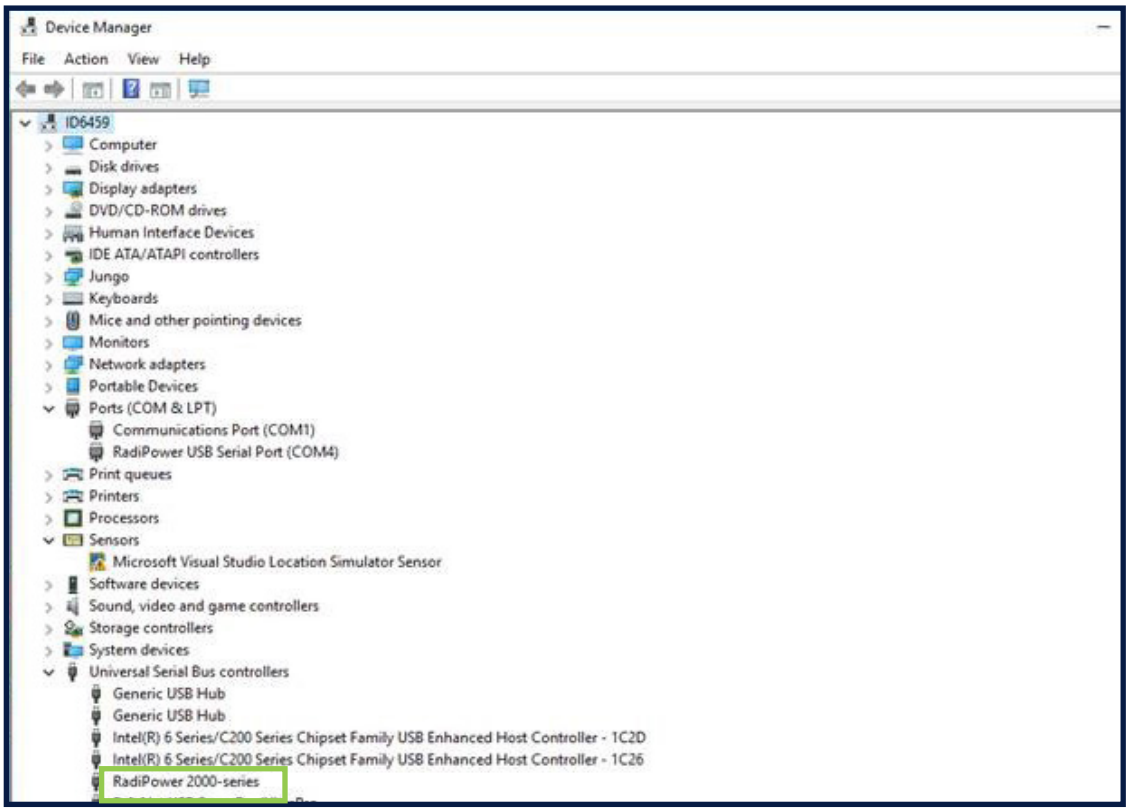
RadiPower® Installation

Stand-alone Configuration

Connect the RadiPower® sensor to a Windows computer with a USB 1.1 compatible port. Use the supplied USB cable to connect the RadiPower® sensor. The hardware installation for the RadiPower® sensor is now complete.

Connect the RadiPower® sensor to a Windows computer with a USB port for 'stand-alone' use. Use the supplied USB cable to connect the sensor to your computer. Windows will prompt that new hardware has been found. The USB-driver for the RadiPower® is Windows certified and will be loaded automatically from the Windows update. If the drivers are not loaded automatically, these can be installed manually from the supplied USB-key. Follow the normal instructions from Windows to install the drivers manually.

Once the drivers are loaded successfully, the RadiPower® will be shown in the device list.



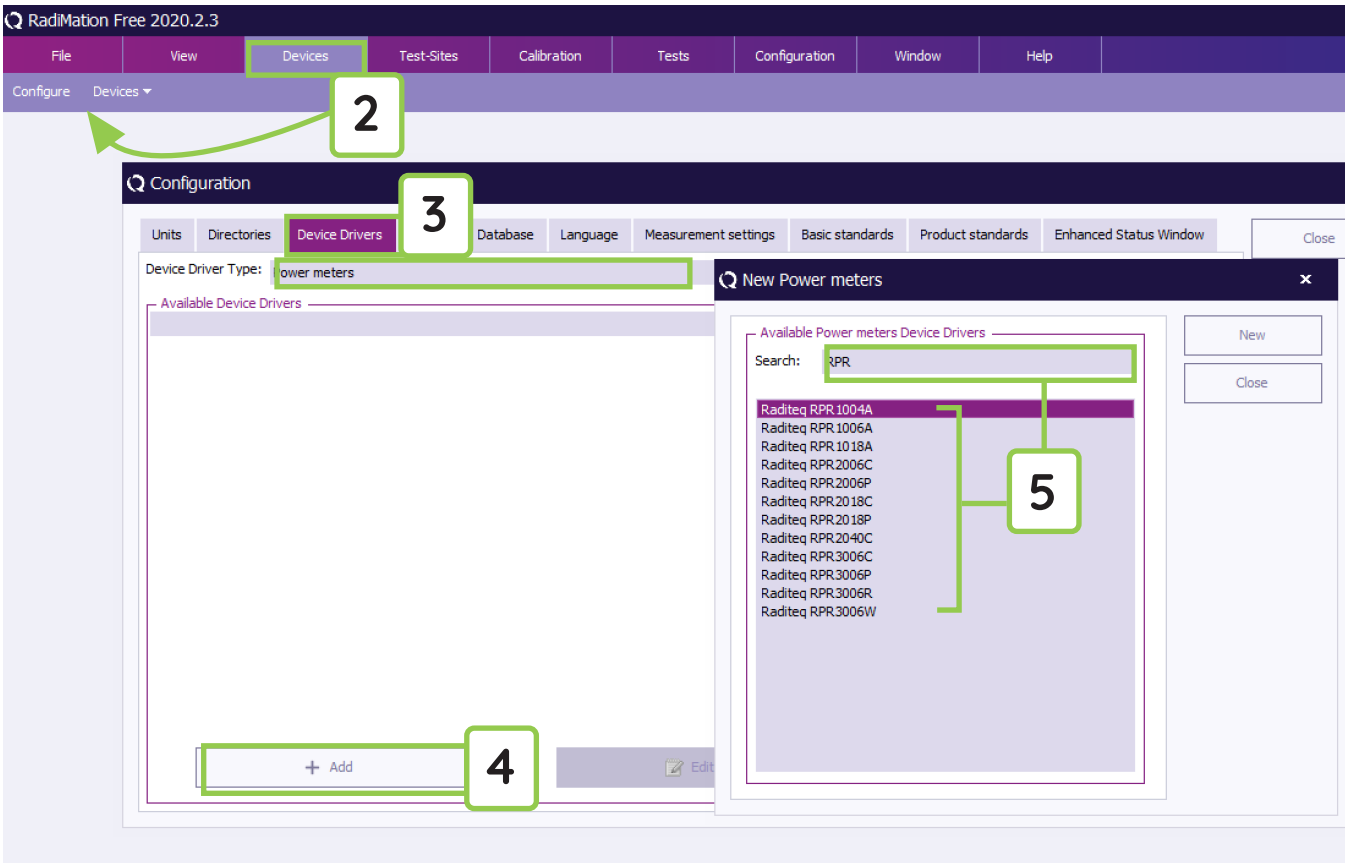
Software Configuration

In order to control the RadiPower® from a computer, the RadiMation® EMC software package can be used. RadiMation® from Raditeq is sold separately. **A free version of RadiMation® is available on:** https://www.raditeq.com/automated-emc-software/radimation-free/. If the RadiPower® is operated manually, this chapter can be skipped.

The RadiPower® device driver is part of the Power Meter Device Driver family

How to configure the RadiPower® in RadiMation®

1. Start the latest version of RadiMation®; **https://www.raditeq.com/radimation-download/**
2. Select the button 'Device' at the top menu bar, followed by clicking 'Configure';
3. In the configuration screen select 'Device Drivers' and Select 'Power meter' or any of the other drivers as driver type;
4. Click the 'Add' button to open the selection of available drivers in RadiMation®;
5. Enter 'RadiPower' in the search bar which will show all available RadiPower® drivers;
6. Select the correct driver, double click it (Optional, rename it) and press 'OK'.

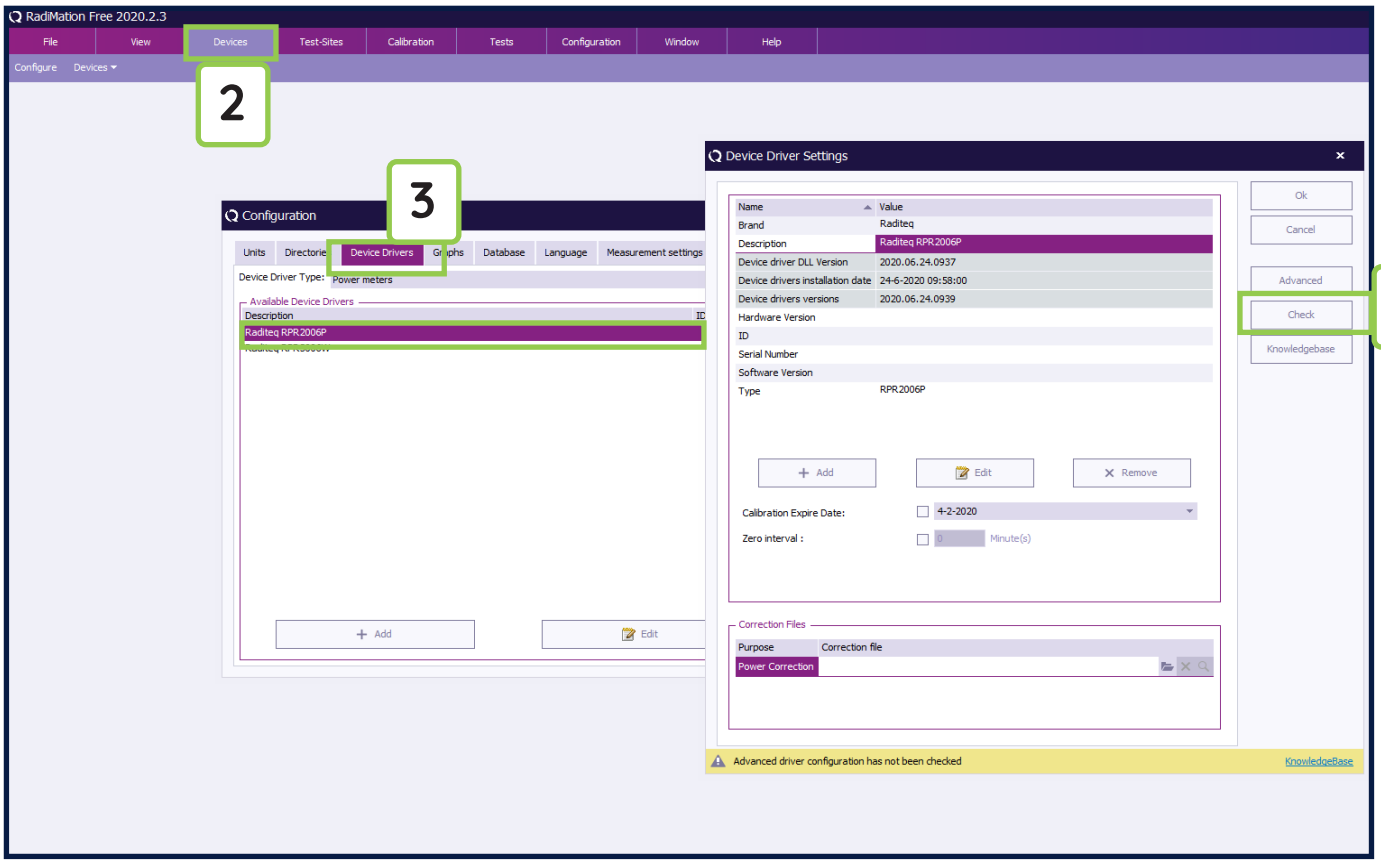


How to connect the RadiPower® to the RadiCentre®

To connect the RadiPower® to the RadiCentre® simply connect the USB cable between the two devices.

How to check whether the RadiPower® is properly connected to RadiMation®

1. Select 'Devices' in the top menu bar
2. Open 'Device Drivers' and select device driver type: 'Power Meter'
3. Double click the recently configured RadiPower® or click 'Edit'.
4. Finally select the 'Check' button on the right side of the opened screen.
5. When correctly configured, RadiMation® will notify you that the device is correctly installed.



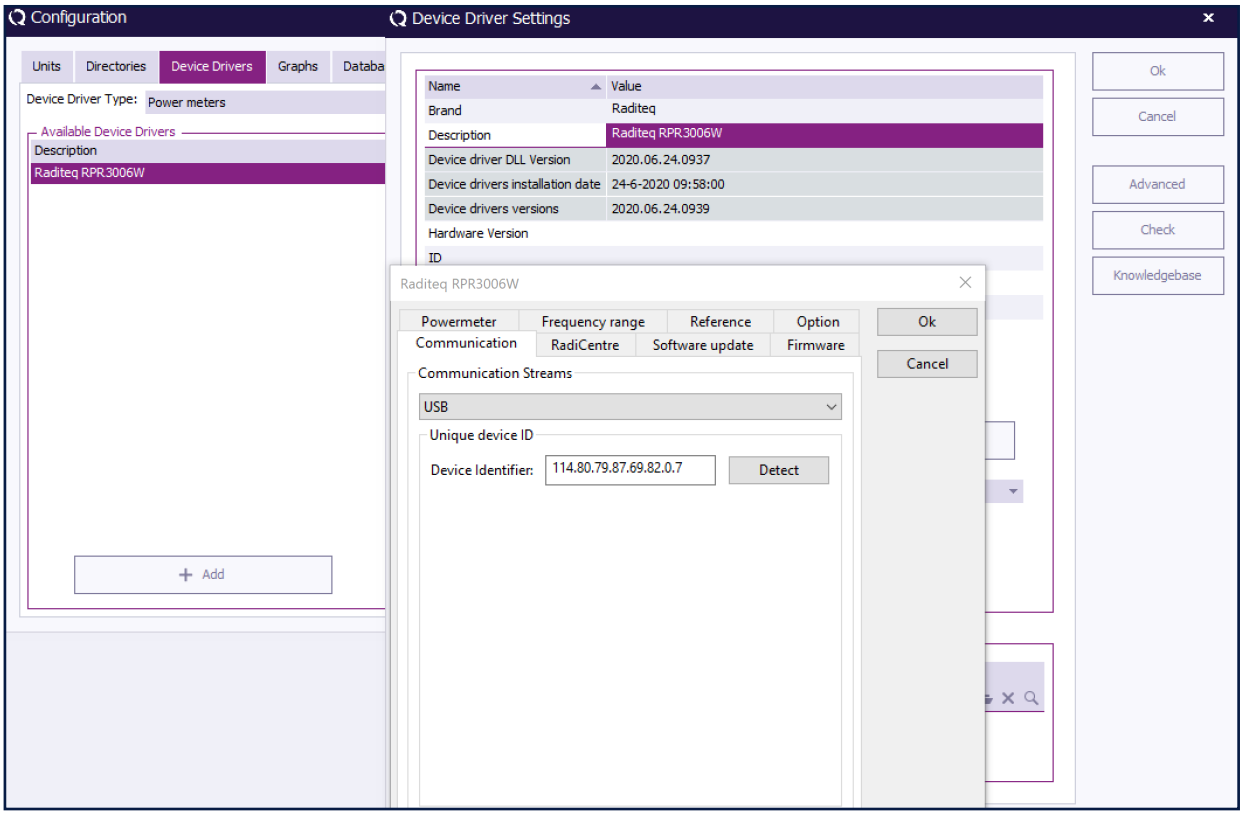
From the configuration list, select the RadiPower® and press “Edit”. A device driver settings window will now appear.

- Press the “Advanced” button.
- Select the “Option” tab and set the desired filter for CW measurements, for example: Filter 5.
- Select the “RadiCentre” tab and select “Directly to PC”.
- Select the “Communication” tab and select “Detect”. Press Configure.

A new window will appear to detect the USB identifier of the RadiPower®. and press “Detect”.

If the device Identifier is detected, press “OK”. Press “OK” again to return to the Configuration window.

Perform a final check to determine whether the RadiPower® is ready to be used. From the configuration windows press the “Check” button.



In case you want to configure multiple RadiPower® power meters, make sure that only one RadiPower® is connected at the same time and repeat the procedure as described above for each RadiPower®. Please be noted that each RadiPower® will have an unique name.

If all necessary power meters are added in the configuration, the measurement can be setup and all RadiPower® can be connected to the USB ports of the PC.

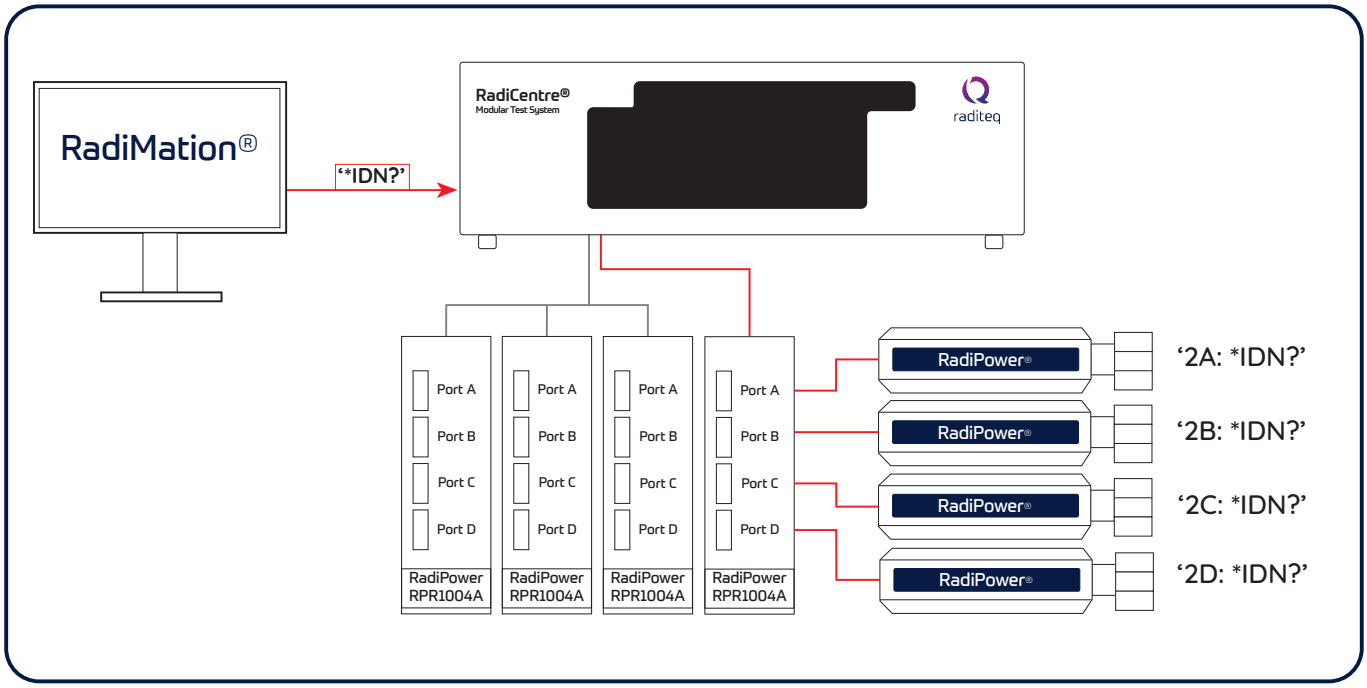
Remote Control

The RadiPower® can be controlled remotely through the interfaces of the RadiCentre®. The exact communication protocol can be found in the RadiCentre® manual. The specific commands for the RadiPower® are shown in 'RadiPower® 2000 series Command Set'.

RadiPower® 2000 Series Command Set

RadiCentre® command set

The commands for the plug-in card of the RadiPower® sensor can be found in the RadiCentre® product manual under the **Programming manual.** Please note that if the the RadiPower® is connected to the USB1004A all the commands must have a prefix consisting of the 'Device number' and the RadiCentre® slot. An example is shown in the picture below and the next page.



Refer to the RadiCentre® manual, for more information on the command sets, error codes and device numbers.

Prefix & Communication example:

Device number message example:

- "2A:POWER?"
  Get the power level of the RadiPower® sensor which is connected to port A of the RadiPower® plug-in card in slot 2.

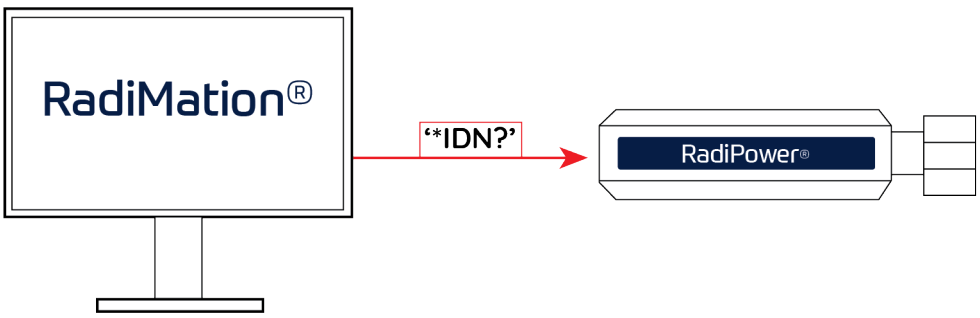
- "2B:FILTER?"
  Get the filter setting of the RadiPower® sensor which is connected to port B of the RadiPower® plug-in card in slot 2.

- "3B:FILTER?"
  Get the filter setting of the RadiPower® sensor which is connected to port B of the RadiPower® plug-in card in slot 3.

"2" = 'board-number' of the RadiPower® plug-in card
"A" & "B" = ports of the RadiPower® RF power sensor
"FILTER?" = message to the RadiPower® RF power sensor

Stand-alone command set

The RadiPower® sensor can also be directly connected to a PC. When the RadiPower® is directly plugged into a PC the prefix is not required or necessary.



Communication with the RadiPower® sensor is possible using a virtual COM-port (VCP)
For more information see chapter 'stand alone configuration'.

Specifications RPR2000 Series

Model	RPR2006	RPR2018
Measuring function	CW power, Peak power, Envelop tracing (P version only)	
Measurement speed	20 kSps, 100 kSps, 1 MSps	
Resolution	0,01 dB	
Measuring units	dBm or Watt	
Zero adjustment	Not required	
Input damage level	> +20 dBm	
Measurement range & accuracy		
Frequency range	(4 kHz) 9 kHz to 6 GHz	80 MHz to 18 GHz
Power measuring range	-55 dBm to + 10 dBm (Usable to -60 dBm)	-45 dBm to + 10 dBm (Usable to -50 dBm)
Frequency response accuracy (at 23° C ± 2° C)	+/- 0,25 dB	+/- 0,25 dB (≤ 10 GHz) +/- 0,50 dB (> 10 GHz)
Linearity error	0,05 dB + 0,005 dB/dB (-50 dBm to +10 dBm)	0,025 dB / dB (-40 dBm to +10 dBm)
Temperature effect	0,15 dB max over full temperature range	
VSWR		
< 100 MHz	1,05	1,20
100 MHz to 2 GHz	1,15	1,20
2 GHz to 6 GHz	1,35	1,20
6 GHz to 18 GHz	n/a	1,35
Power Consumption		
Supply voltage	+5Vdc from USB port (4,75 V to 5,25 V)	
Current consumption (USB)	120 mA	160 mA
Connections & Demensions		
Dimensions of the power sensor (h * b * d)	124 * 32 * 32 mm	152 * 32 * 32 mm
RF input connector	N type precision	
USB connector	USB type B (1.1)	
Enviromental conditions		
Temperature range (operating)	0° to 40° Celsius	
Temperature range (storage)	-20 to 85° C	
Relative humidity	10 – 90% (non-condensing)	
Warranty	3 years* (excluding misuse)	

Model	USB1004A
Supply voltage	12 V
Current consumption (USB)	100 mA max.
Dimensions of the power sensor (h * b * d)	2U * 84TE * 250,4mm
Data connector	USB type A (1.1)
Number of power sensors per card	4 max.
Temperature range (operating)	0° to 40° Celsius
Temperature range (storage)	-20 to 85° C
Relative humidity	10 – 90% (non-condensing)
Standards & Directives	
EMC	EN 61326
Low Voltage	n/a
Warranty	3 years (misuse excluded)*

- All specifications are measured after 10 minutes warm-up time and 0dBm unless specified otherwise.
- Typical specifications indicate that the measured values are met on at least 80% of the points.
- Three years warranty will be granted only after you register your product at www.raditeq.com. Without registration, a 1 year warranty period applies.

For more information about the current and new Raditeq products at:
T: +31 348 200 100 M: Sales@raditeq.com
W: www.raditeq.com

Warranty Conditions

Raditeq B.V. offers a standard warranty term of three (3) years on their products, calculated from the shipping date, under the condition that the product is registered on www.raditeq.com. For registration of the product, the customer should provide the product model, serial number and the responsible reseller (if applicable). If the product is not registered, a limited warranty term of one (1) year will be applicable.

Return Material Authorization (RMA) & Warranty repair

If a defect occurs to our product within the warranty term, a Return Material Authorization (RMA) 'Warranty Repair' request can be issued using the RMA link at www.raditeq.com/support**.** Upon receipt of the request, an RMA number will be provided. Please do not send the product without this RMA number! The defective product should be shipped to our service department at the following address:

Raditeq B.V. – Service Department
Vijzelmolenlaan 3
3447GX WOERDEN
The Netherlands

There will be no charge for repair services (materials or labour) within the (extended) warranty term.
These warranty terms are not applicable to:

- Normal wear and tear
- Fibre optic cables
- Products that have been improperly used
- Products that have been used outside their specified range
- Products that have been improperly installed and/or maintained
- Products that have been modified without approval of Raditeq
- Calibration and/or re-calibration of the product

Repair services on products that are not covered by the Raditeq warranty will be charged to the customer.

Repairs outside warranty

If a defect is not covered under warranty, an RMA fixed-repair can be ordered on the RMA link: www.raditeq.com/support If a re-calibration is needed after repair, this calibration should be ordered separately. The calibration will be performed at the ISO17025 accredited calibration laboratories of DARE!! Calibrations, based on the applicable service code / prices.

Warranty after repair

For repairs outside the original warranty period, a limited warranty of six months is applicable on the performed repair. Shipping conditions are the same as with repairs that are covered within the original warranty period.

Shipping

The customer will need to arrange shipping and cover for the costs (like e.g. transportation costs, duties, taxes) for sending the defect product the service department of Raditeq in The Netherlands. Raditeq will arrange the courier and cover for the costs for the return shipment after repair.

EU Declaration of Conformity

We

Raditeq B.V.

of

Vijzelmolenlaan 3
NL-3447GX Woerden
The Netherlands

declare under our sole responsibility that the

Product:	**RadiPower® Series**
models:	RPR3006W | RPR2006C | RPR2006P | RPR20018C | RPR2018P

are in accordance with the European directives:

EMC Directive 2014/30/EU
Low Voltage Directive 2015/35/EU
RoHS Directive: 2015/863/EU

per the provisions of the applicable requirements of the following harmonized standards:

Emission:	EN 61326-1:2013, Class A1 Electrical equipment for measurement, control and laboratory use.
Immunity:	EN 61326-1:2013, Industrial level, performance criteria A Electrical equipment for measurement, control and laboratory use.
Safety:	EN 61010-1:2010, Safety requirements for electrical equipment for measurement, control, and laboratory use

The technical construction files are maintained at the adress specified above.

Date of issue:	09/06/21
Place of issue:	Woerden, The Netherlands
Authorized by:	P.W.J. Dijkstra
Title of authority:	Director

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