EMPower™ Meter Plug-in Card & USB RF Power Sensor

Models 7002-001 | -002, -003, -004, -005, -009

Product Manual

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Revision Record

MANUAL, EMPOWER CARD | Part #399345, Rev. E

Revision	Description	Date
A	Initial Release	MAR, 2015
B	Update	SEP, 2019
C	Warranty information removed	FEB, 2022
D	Updated format	SEP, 2022
E	Update; Added Sensor -009	FEB, 2024

Safety Information

High Voltage: Indicates presence of hazardous voltage. Unsafe practice could result in severe personal injury or death.

Protective Earth Ground (Safety Ground): Indicates protective earth terminal. You should provide uninterruptible safety earth ground from the main power source to the product input wiring terminals, power cord, or supplied power cord set.

Waste Electrical and Electronic Equipment (WEEE) Directive: (European Union) At end of useful life, this product should be deposited at an appropriate waste disposal facility for recycling and disposal. Do not dispose of with household waste.

Notes, Cautions, and Warnings

Note: Denotes helpful information intended to provide tips for better use of the product.

CAUTION: Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Included text gives proper procedures.

WARNING: Denotes a hazard. Failure to follow instructions could result in SEVERE personal injury and/or property damage. Included text gives proper procedures.

Table of Contents

Introduction

This manual contains information about **EMPower™** products, the **plug-in card 7002-001** and various model power sensors. Please read this manual carefully and make sure to pay special attention to the chapters regarding your new product(s).

The **EMPower™ USB 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. It provides accurate measurements over a wide frequency range, which enables effective measurements in accordance with the latest EMC standards.

The EMPower sensor excels at these features:

- **Ease of use** — The USB interface makes the EMPower sensor easy to use. Up to four sensors can be connected to a single EMPower card in an EMCenter Modular RF Platform.
- **High speed** — The unprecedented detector technology of the EMPower sensor enables extremely fast accurate power measurements, even at low power levels. EMC immunity measurements are time consuming. The total elapsed time depends 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.
- **Accuracy** — The EMPower sensor allows high precision measurements with a large dynamic range. With a high accuracy of 0.25 dB over the complete band, the EMPower sensor is suitable for measurements in accordance with automotive, military, telecom, wireless, and EMC basic standards.
- **Low measurement uncertainties** — Impedance mismatches contribute to measurement uncertainty. The EMPower sensor has a low Voltage Standing Wave Ratio (VSWR) resulting in low measurement uncertainties compared to other contributions in EMC measurement setups.
- **CW Signals & RF Bursts** — To enable the measurement of RF bursts, the EMPower can also be delivered as a RF pulse power head. The pulse version of the EMPower is able to measure RF bursts as short as a few microseconds. The normal version of the EMPower only supports power measurements for CW signals.

NOTE: To achieve the required speeds for pulse measurements, the sensor needs to be directly connected to a PC USB 2.0 port with the supplied USB cable. **TILE!** does not support pulse mode for models -003 and -005.

Standard Configuration

Standard configuration may vary by model; contact ETS-Lindgren for additional information.

- EMCenter Modular RF Platform and EMPower Plug-In card
    - The Power sensor can be used together with the EMPower plug-in card or connected directly to a PC using a standard USB port and included software
- EMPower USB RF Power Sensor
- 2-meter Shielded USB Cable

Power Meter Sensor Options

This manual describes five of the six versions of the EMPower RF Power Sensors below. The differences between these models is the range that they cover and the measurements that they can perform.

Note that the **Model 7002-006 Power Sensor** has its own separate manual available on the ETS-Lindgren website.

The Power sensor can be used together with the EMPower plug-in card or connected directly to a PC with a cable using a standard USB port and included software.

Contact ETS-Lindgren for ordering information, and please specify model when ordering.

- **Model 7002-002** — Support RMS measurements for CW signals and covers the 9 kHz to 6 GHz range.
- **Model 7002-003** — Measure RF bursts as short as a few microseconds and covers the 9 kHz to 6 GHz range.
- **Model 7002-004** — Support RMS measurements for CW signals and covers the 80 MHz to 18 GHz range.
- **Model 7002-005** — Measure RF bursts as short as a few microsecond and covers the 80 MHz to 18 GHz range.
- **Model 7002-009** — True RMS Power Meter for measurements of (non)-sinusoidal signals. This advanced feature eliminates the need for additional signal processing or waveform assumptions, making it a versatile device for a wide range of applications.

Other Optional Items

- Additional EMPower USB RF Power Sensors (please specify the model when ordering)
- ISO 17025 Accredited Calibration for EMPower USB RF Power Sensor ordered
- EMPower is supported by ETS-Lindgren TILE!™ (Totally Integrated Laboratory Environment), ETS-Lindgren EMQuest™ Data Acquisition and Analysis Software, and other test automation software packages. Contact ETS-Lindgren for additional information.

ETS-Lindgren Product Information Bulletin

See the ETS-Lindgren *Product Information Bulletin* included with your shipment for the following:

- Safety, regulatory, and other product marking information
- Steps to receive your shipment
- Steps to return a component for service
- ETS-Lindgren calibration service
- ETS-Lindgren contact information

Operation

Installation

CAUTION: Before connecting any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.

WARNING: Always unplug the unit before starting maintenance to prevent electrical shock. Maintenance includes removal of the plug-in cards or the top panel.

CAUTION: Leave an empty slot or space 1U in height beneath the EMCenter to allow sufficient cooling through the bottom air inlets of the cabinet.

Changing Plug-In Cards

1. **Before installing and inserting a new plug-in card make sure that the EMCenter is turned OFF and disconnect the AC Mains power cord.**

2. Determine in which empty slot of the EMCenter you want to install the Plug-in Card. Looking at the back of the EMCenter, the slots are numbered 1 through 7 from left to right.

3. Remove the blank panel from the slot by removing the two screws at the top of the blank panel and the two screws at the bottom. Be careful not to lose the screws.

4. Carefully insert the card into the slot of the EMCenter. 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 lock the plug-in card into the backplane socket.

5. Secure the card by tightening the four previous screws using a Pozi type screwdriver head PZ1.

6. Plug the interlock into the connector on the back of the EMCenter.

7. Connect the desired device(s) to the correct plug-in card port.

8. **Optional**: Connect the EMCenter to a computer using Ethernet or GPIB.

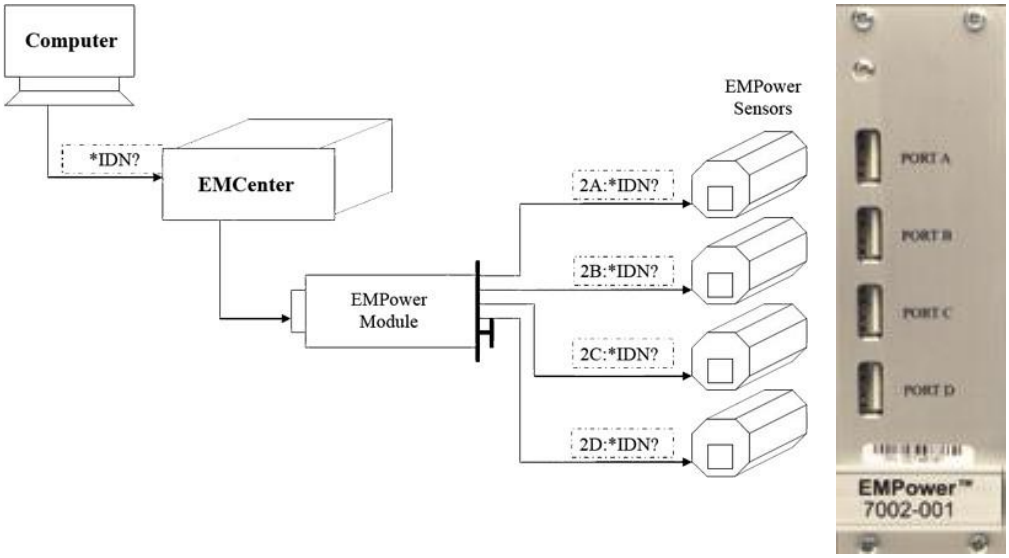
9. Re-connect the AC mains power cord and turn ON the EMCenter. It can now be started by tapping the touch screen. The EMCenter will automatically detect the newly installed card.

10. The card installation is complete and the EMCenter is now ready for use. You can control all cards through the touchscreen or sending remote commands.

Manual Control

Back Panel

To communicate with a specific power meter, please reference both the slot number and port letter. The example image below shows the EMPower card in the 2nd EMCenter slot.



Touchscreen

Home Screen

The large status button on the Home screen will display any detected plug-in card and its sensor measurements as seen below. To monitor the measured power level(s), one can go to the Control screen by pressing the EMPower status button.

EMPower Control Screen

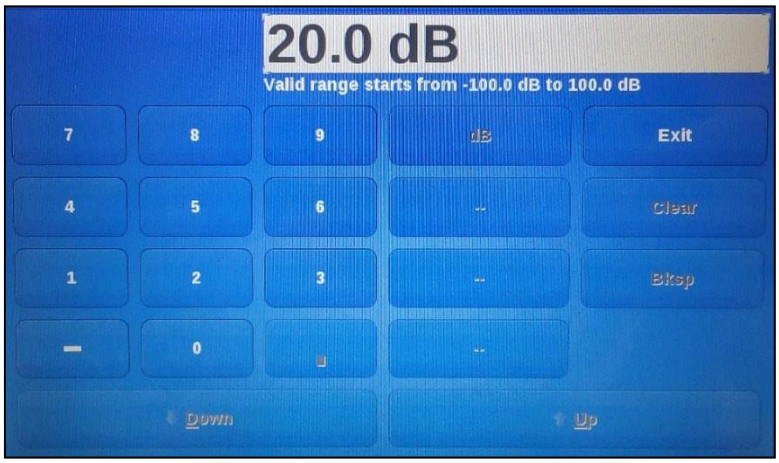
The user can change the frequency, filter, and offset settings on the Control screen. The operator can also use the pre-defined calculations Gain, VSWR, and Net Power to calculate between two different power meter measurements; however, this function is only applicable for mode 0.

Following is a description of each function performed from the EMPower screen:

- **FREQUENCY** — The frequency measurement is set to obtain the correct absolute power level. The frequency selection window will appear after pressing the frequency button. Input the desired number and select the unit to set the frequency setting. See the ‘Command Set’ section in the EMCenter manual for more information about the FREQUENCY<n> command. Note that if the user does not enter the correct measurement frequency, the power sensor will not display the correct absolute power level.

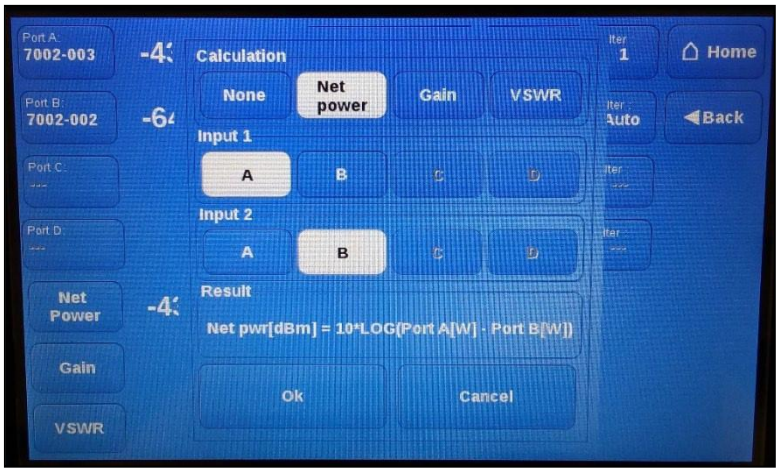
- **FILTER** — The filter sets the number of samples used to calculate the RMS power value. The selection window will appear after pressing the filter button. Select the desired number to set the filter setting. See the ‘Command Set’ section in the EMCenter manual for more information about the FILTER<n> command.

- **Offset** — The offset is used to compensate for a fixed, known value such as 20 dB attenuation. The selection window will appear after pressing the offset button. Input the desired number and select dB to set the offset setting. The offset value will be added to the measured value of the EMPower. See the 'Command Set' section in the EMCenter manual for more information about the POWER_OFFSET<n> command.

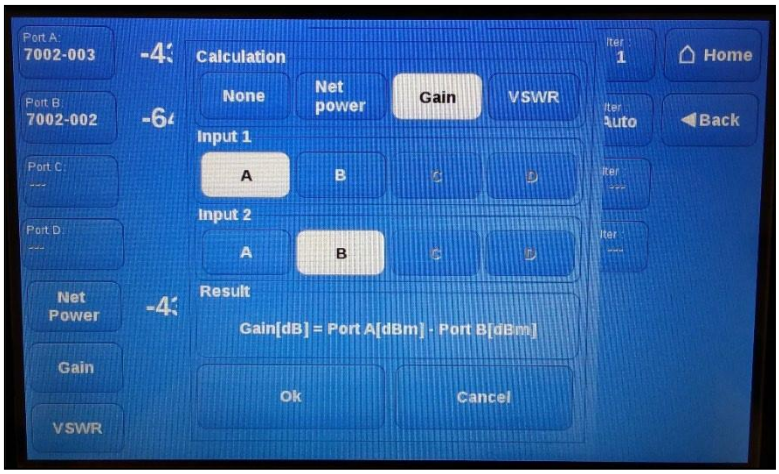


- **Calculation Functions** — Pre-defined calculations on the main screen to calculate between two different power meter measurements.

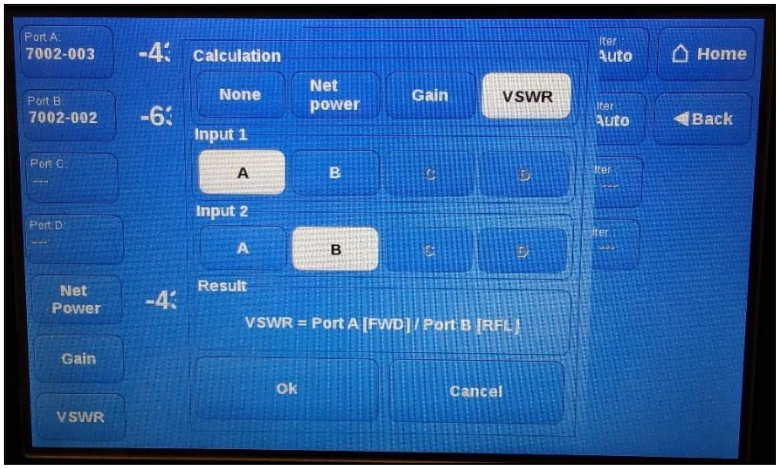
    - **Net Power** — The Net power function calculates the logarithmic difference in dBm between the measured power of Input 1 and Input 2. This window will appear after pressing the Add Calculation button below the power sensor data. Select Net power and the inputs, then select OK. The Add Calculation button will change to Net power and the calculation result will appear next to it.



- **Gain** — The Gain function will calculate the difference in dBm between the measured power of Input 1 and Input 2. This window will appear after pressing the Add Calculation button below the power sensor data. Select Gain and the inputs, then select OK. The Add Calculation button will change to Gain and the calculation result will appear next to it.

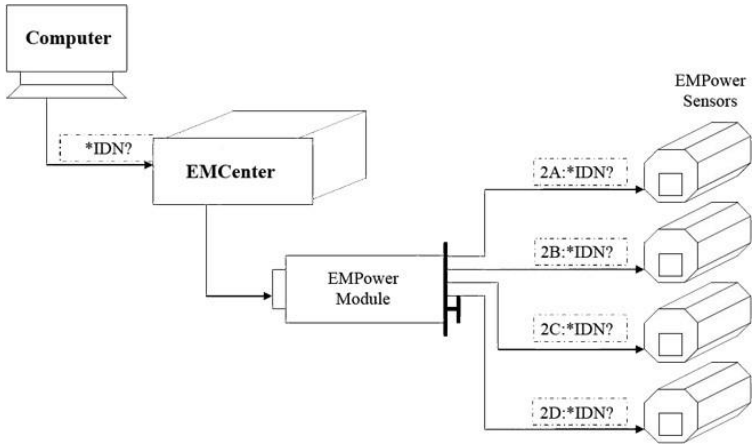


- **VSWR** — The VSWR function will calculate the VSWR based on the measured forward power of Input 1 divided by the measured reflected power of Input 2. This window will appear after pressing the Add Calculation button below the power sensor data. Select VSWR and the inputs, then select OK. The Add Calculation button will change to VSWR and the calculation result will appear next to it.



Remote Control

To use the EMPower remote commands, read the manual document ***399342 EMCenter*** for examples and a full command list.



The picture above shows an example of an EMPower card in slot 2 of the EMCenter.

Description of Different Sensor Modes

The EMPower™ USB RF Power Sensor uses a high-performance demodulating logarithmic amplifier to detect the RF signal. The demodulated signal is sampled at high speed by a powerful DSP, which processes all samples. The burst/pulse versions of the EMPower sensors, 7002-003 and 7002-005, support these four modes of operation.

Commands for All Sensor Modes

In mode 0 (RMS mode), a new power measurement is started after the POWER? command is given. Depending on the filter setting, the EMPower sensor performs the required number of measurements and returns the RMS value.

For power measurements of AM modulated signals, acquisition speed, filter, and VBW settings are important to obtain accurate measurements. For example, if an AM modulated signal is to be measured with a modulation frequency of 1 kHz, the VBW should be set to 0, 1, 2, or AUTO. In general, the VBW should be 10 times smaller than the RF carrier frequency, but higher than the modulation frequency.

The acquisition speed and filter should be set in so that at least one full period of the modulation signal is measured. At 1 MS/sec, the filter should be set to 5 or higher, which results in 1000 or more samples. At lower sampling speeds (for example, 100 KS/sec), the filter should be set to 3 or higher to measure at least one full period of the envelope signal.

In mode 1 (max hold) the POWER? command will return the highest value measured since the previous POWER? command. After reading the power, the stored value will be cleared.

In mode 2 (envelope tracing), temperature readings are not updated as long as the triggering is armed. While armed, temperature readings are still possible, but the actual values are taken before the measurement is armed. As soon as a trigger occurs, the temperatures are updated in the sensor.

MODE 0: RMS POWER

Mode 0 is used to perform RMS power measurements of CW signals. In RMS mode, the EMPower sensor samples the demodulated signal at high speed up to a maximum of 10 MS/sec. 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 the high sampling speed, the number of readings is high even at large filter settings.

MODE 1: PEAK POWER

Mode 1 is used to perform peak measurements on RF signals. In peak mode, the EMPower sensor keeps track of the highest level that has been detected. This can be done for an infinite time. Once the power level has been read, the maximum value is automatically reset.

MODE 2: ENVELOPE TRACING

Mode 2 is used to capture the envelope of an RF signal. Envelope tracing is a unique feature that enables the possibility to visualize; for example, the in-rush phenomena of transmitters or signal generators without the need of an expensive RF analyzer. Due to the extensive trigger possibilities, almost any RF signal can be captured in the buffers of the EMPower sensor.

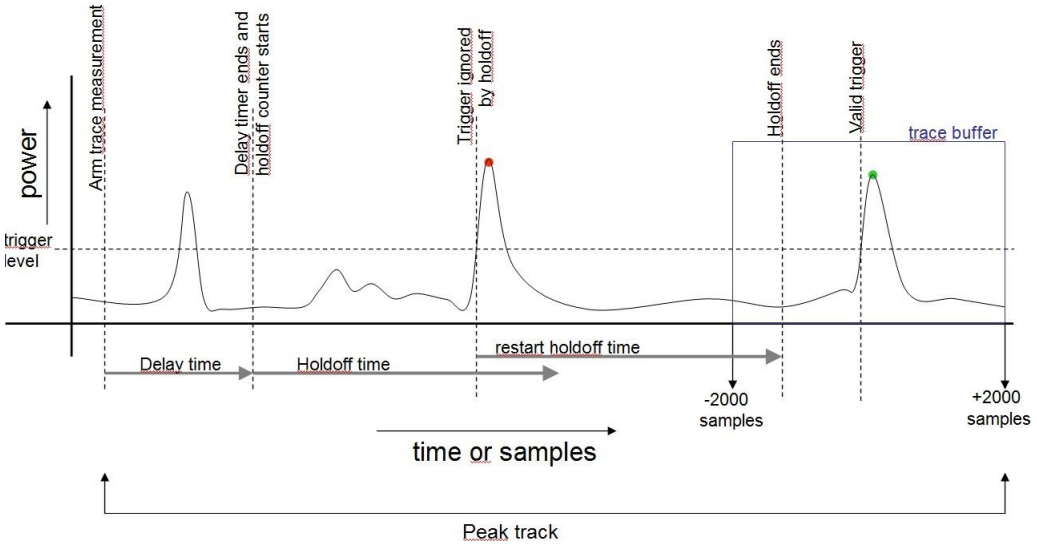
NOTE: This mode is only available when the Power sensor is directly connected to the PC.

GRAPHICAL EXPLANATION OF THE TRIGGER MECHANISM

During tracing mode, the peak value will be tracked and stored in memory from the moment the measurement is armed. The peak value can be read by using the ACQ_LOG_MAX? command, which will also reset the peak value once it has been read.

Peak track will stop as soon as a valid trigger has been found and the buffers are ready to be read from the device (ACQ_LOG_STATUS=1).

A high number of samples for the DELAY or HOLDOFF command at low sampling rates results in long measurement times up to 100 seconds.

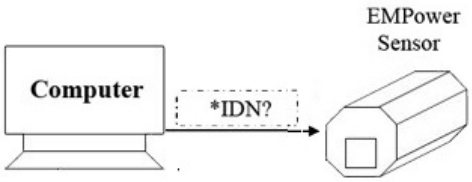


MODE 3: BURST LOGGING

Mode 3 is used to log RF bursts of frequency-hopping devices. For more complex transmitters like frequency-hopping devices, a special burst mode has been implemented. During the observation time, which can be up to 1 second at 1 MS/sec measurement speed, the time and RMS power of each RF burst is logged into memory. These measurements can be used to perform conducted measurements of RF output power according to new version of the ETSI EN 300 328 standard.

NOTE: This mode is only available when the Power sensor is directly connected to the PC.

Stand-alone terminal program controlled sensor

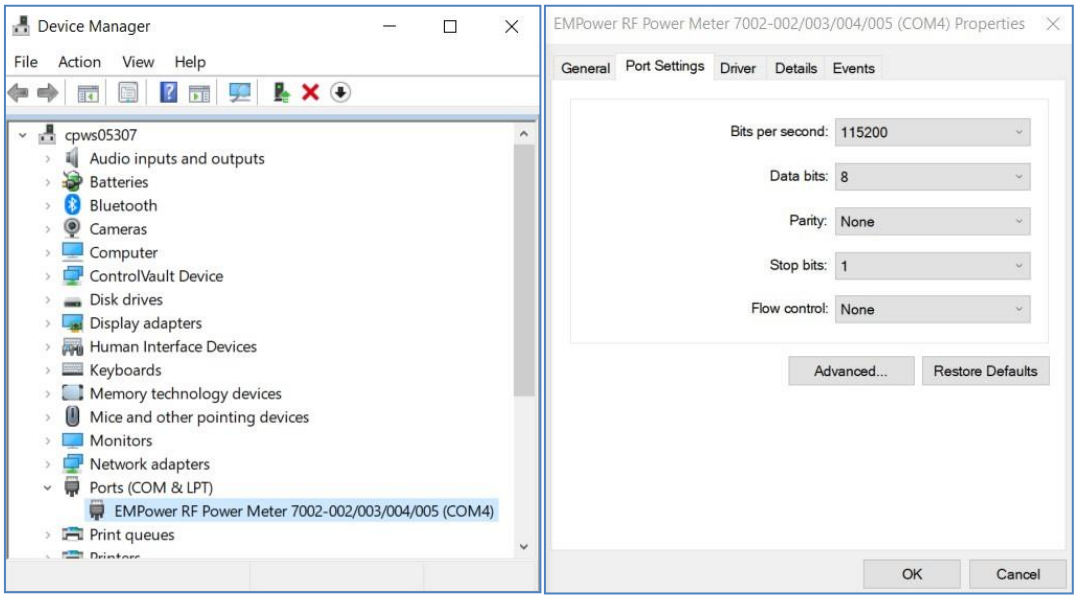


The EMPower sensor can be connected directly to a PC by communicating using a virtual COM-port (VCP). All 4 sensor modes can use this operation method; modes 2 and 3 only operate through a PC and not with the EMCenter.

1. Open the Windows Control Panel and search for the Device Manager.

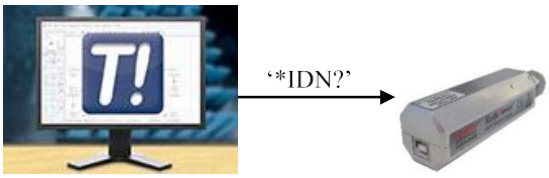
2. Once the device manager is open, connect the EMPower sensor to the computer's USB 2.0 compatible port with the supplied USB cable.

3. Once the cable is plugged into the computer, the EMPower sensor will be shown in the device list. A virtual COM-port (VCP) will be present in the list of Ports. This COM-port can be used to communicate with the EMPower using any terminal program.



TILE! Controlled sensor

NOTE: TILE! does NOT currently support pulse mode in modules -003 and -005.



1. Connect the sensor either to the EMCenter or directly to the PC.
2. Open the TILE! profile and create a new TILE! instrument.
3. On the driver tab, select the required EMPower device driver ETS_EMPower.ins.
    a. If the sensor is connected to the EMCenter, go to the address tab and set the communication to VISA and set the Device ID (EMCenter Slot #) to match the slot of the EMPower card. Then on the settings tab, set the channel letter to match the port letter the sensor is plugged into.
    b. If the sensor is directly connected to the PC, go to the address tab and set the communication to serial and set the correct COM-port. If you don't know what the COM-port is, see section Stand Alone Sensor with PC.
4. Select OK to save the settings.
5. Verify the instrument communication with the *IDN? command in the Instrument Interactive Control window (Hand icon on the TILE! taskbar).

RESET Sensor to Factory Default

Default settings (-002, -003, -004, -005)

Command	Default	Description
ACQ_AUTO_TRIGGER	0	Single trigger
ACQ_LOG_DELAY	0	No delay time before trigger
ACQ_LOG_THRESHOLD	-40.0	-40 dBm
ACQ_LOG_TRIG_HOLDOFF	0	No hold off before trigger.
ACQ_LOG_TRIGGER	0; 1; 2	Rising edge triggering; sample; sample
ACQ_SPEED	1000	1 MS/sec

AUTO_STORE	0	Parameter changes will not be stored automatically
BM_MEASURE_PERIOD	1000	1000 MS
BM_NOISE_TIMER	10	10 samples
BM_TRIG_LEVEL	-40	-40 dBm
FILTER	AUTO	Automatic filter setting
FREQUENCY	1300000 kHz	1300 MHz
MODE	0	RMS power measurement
VBW (mode 0)	3	1kHz VBW in RMS mode for CW signals
VBW (mode 1, 2, and 3)	AUTO	Automatic VBW setting for all other modes

Default settings (-009)

Command	Default	Description
ACQ_SPEED	1000	1 MS/sec
AUTO_STORE	0	OFF, Parameter changes will not be stored automatically
FILTER	12	8192 times average
FREQUENCY	1300 MHz	1.3 GHz
POWER_OFFSET	0 dB	Zero Offset
POWER_UNIT	dB	Decibels

Maintenance

CAUTION: Before performing any maintenance, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.

WARNING: Maintenance of the EMCenter is limited to external components such as cables or connectors. If you have any questions concerning maintenance, contact ETS-Lindgren Customer Service.

To prevent electrical shock, do not remove cover. Always unplug the unit before starting maintenance, such as removing/inserting the plug-in cards.

If you have any questions concerning maintenance, contact ETS-Lindgren Customer Service.

Fiber Optic Maintenance

Fiber optic connectors and cables can be damaged from airborne particles, humidity and moisture, oils from the human body, and debris from the connectors they plug into. Always handle connectors and cables with care, using the following guidelines.

CAUTION: Before performing any maintenance, disconnect fiber optic cables from the unit and turn off power.

- **When disconnecting fiber optic cables, apply the included dust caps to the ends to maintain their integrity.**
- **Before connecting fiber optic cables, clean the connector tips and in-line connectors.**
- **Before attaching in-line connectors, clean them with moisture-free compressed air.**
- **Failure to perform these tasks may result in damage to the fiber optic connectors or cables.**

Service Procedures

Contacting ETS-Lindgren

Note: Please see www.ets-lindgren.com for a list of ETS-Lindgren offices, including phone and email contact information.

Note: ETS-Lindgren is not responsible for service on equipment that has been configured with software other than what is provided by ETS-Lindgren. Support for such configurations requires a secondary charge from ETS-Lindgren.

Replacement and Optional Parts

Note: ETS-Lindgren may substitute a similar part or new part number with the same functionality for another part/part number. Contact ETS-Lindgren for questions about part numbers and ordering parts.

Part	Part Description
7002-001	EMPower Plug-in Card for the EMCenter
7002-002	EMPower USB RF Power Sensor — RMS measurements for CW signals and covers the 9 kHz to 6 GHz range
7002-003	EMPower USB RF Power Sensor — RF bursts and covers the 9 kHz to 6 GHz range
7002-004	EMPower USB RF Power Sensor — RMS measurements for CW signals and covers the 80 MHz to 18 GHz range
7002-005	EMPower USB RF Power Sensor —RF bursts and covers the 80 MHz to 18 GHz range
7002-009	EMPower USB RF Power Sensor —RMS measurements of (non)-sinusoidal signals and covers the 4 kHz to 6 GHz range
Shielded USB Cable	2m Shielded USB Cable used with the power sensor

Sending a Component for Service

For the steps to return a system or system component to ETS-Lindgren for service, see the *Product Information Bulletin* included with your shipment.

Upgrade Policies

Periodically, field probes are upgraded to enhance functionality. Contact ETS-Lindgren Customer Service for the upgrade status of your field probe.

Specifications

EMPower™ Meter Plug-in Card Specifications (Model 7002-001)

Physical Specifications

Data Connector (Card side):	USB type A
Form Factor:	Occupies one slot in EMCenter
Max Number of Sensors per Card:	4

Environmental Specifications

Relative Humidity:	10% to 90% (non-condensing)
Temperature Range (Operating):	0°C to 40°C (32°F to 104°F)
Temperature Range (Storage):	-20°C to 85°C (4°F to 185°F)

Electrical Specifications

Communication:	USB 1.1
Power Consumption (mW):	Less than 200 mW
Supply Voltage:	Through EMCenter

EMPower™ USB RF Power Sensor (Models 7002-002 & -004)

Physical Specifications

Data Connector (Sensor side):	USB-B
USB Communication	USB 1.1
USB Power Consumption	< 200 mA
RF Input Connector	N-type Precision

Environmental Specifications

Relative Humidity:	10% to 90% (non-condensing)
Temperature Range (Operating):	0°C to 40°C (32°F to 104°F)
Temperature Range (Storage):	-20°C to 85°C (4°F to 185°F)

Electrical Specifications

Model	**7002-002**	**7002-004**
Accuracy (23° ± 2° C)	0.25 dB	0.25 dB (≤ 10 GHz) 0.50 dB (> 10 GHz)
Calibrated Frequency Range	9 kHz to 6 GHz	80 MHz to 18 GHz
Detector Type	Diode	Diode
Input Damage Level	>20 dBm	>20 dBm
Maximum Linearity Error (0 dBm ref)	0.05 dB/10 dB	0.05 dB/10 dB
Measuring Speed (Per Second)	20K, 100K or 1 M	20K, 100K or 1 M
Measurement Function	RMS CW Power	RMS CW Power
Measurement Units	dBm	dBm
Power Measuring Range	-55 dBm to +10 dBm	-45 dBm to +10 dBm
Resolution	0.01 dB	0.01 dB
Temperature Effect	< 0.15 dB Over Full Temperature Range	< 0.15 dB Over Full Temperature Range
VSWR	<1.05 @ 10 MHz to 100 MHz <1.15 @ 100 MHz to 2 GHz <1.35 @ 2 GHz to 6 GHz	<1.20 @ 80 MHz to 10 GHz <1.35 @ 10 GHz to 18 GHz

EMPower™ USB RF Power Sensor (Models 7002-003 & -005)

Physical Specifications

Data Connector (Sensor side):	USB-B
USB Communication	USB 1.1
USB Power Consumption	< 200 mA
RF Input Connector	N-type Precision

Environmental Specifications

Relative Humidity:	10% to 90% (non-condensing)
Temperature Range (Operating):	0°C to 40°C (32°F to 104°F)
Temperature Range (Storage):	-20°C to 85°C (4°F to 185°F)

Electrical Specifications

Model	7002-003	7002-005
Accuracy (23° ± 2° C)	0.25 dB	0.25 dB (≤ 10 GHz) 0.50 dB (> 10 GHz)
Calibrated Frequency Range	9 kHz to 6 GHz	80 MHz to 18 GHz
Detector Type	Diode	Diode
Input Damage Level	>20 dBm	>20 dBm
Logging Buffer Record Mode	4,000 Samples 2,000 Pre-trigger 2,000 Post-trigger	4,000 Samples 2,000 Pre-trigger 2,000 Post-trigger
Maximum Linearity Error (0 dBm ref)	0.05 dB/10 dB	0.05 dB/10 dB
Measuring Speed (Per Second)	20K, 100K or 1 M	20K, 100K or 1 M
Measurement Function	Peak Power	Peak Power
Measurement Units	dBm	dBm
Power Measuring Range	-55 dBm to +10 dBm	-45 dBm to +10 dBm
Resolution	0.01 dB	0.01 dB
Temperature Effect	< 0.15 dB Over Full Temperature Range	< 0.15 dB Over Full Temperature Range
VSWR	<1.05 @ 10 MHz to 100 MHz <1.15 @ 100 MHz to 2 GHz <1.35 @ 2 GHz to 6 GHz	<1.20 @ 80 MHz to 10 GHz <1.35 @ 10 GHz to 18 GHz

EMPower™ USB RF Power Sensor (Models 7002-009)

Physical Specifications

Data Connector (Sensor side):	Mini USB
RF Input Connector	N-type Precision

Environmental Specifications

Relative Humidity:	10% to 90% (non-condensing)
Temperature Range (Operating):	0°C to 30°C (32°F to 86°F)
Temperature Range (Storage):	-10°C to 50°C (14°F to 122°F)

Electrical Specifications

Accuracy (23° ± 2° C)	0.20 dB
Frequency Range	4 kHz to 6 GHz
Input Damage Level	>+20 dBm
Measuring Speed	1 MS/s or 5 MS/s
Measurement Function	RMS Power
Measurement Units	dBm or Watt
Power Measuring Range	**Frequency** / **MAX dBm** / **MIN dBm** 4 kHz - 100 MHz / +10 / -70 100 MHz – 1.5 GHz / +10 / -65 1.5 GHz – 3.5 GHz / +10 / -60 3.5 GHz – 4.5 GHz / +10 / -55 4.5 GHz - 6 GHz / +10 / -50
Resolution	0.01 dB
Temperature Effect	0.15 dB Over Full Temperature Range
VSWR	1.05 @ < 100 MHz <1.10 @ 100 MHz to 6 GHz

Appendix A: EC Declaration on Conformity

ETS-Lindgren Inc. declares these products to be in conformity with the following standards and provisions:

Product Models: **EMPower™ Meter Plug-in Card**
EMPower™ USB RF Power Sensor

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

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.

Technical Construction Files are available upon request.