PN10 and PN12

User Manual

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Chapter 1: Introduction

This manual gives information about the installation and operation of the PN10 and PN12 energy & power monitoring and logging devices. The PN10 uses WIFI for connection to the Internet and the PN12 uses GSM/GPRS to connect to the Internet.

This manual is mainly meant for qualified and skilled technicians, authorized to act in accordance with safety standards provided for electrical installations.

Upon receiving your shipment, make sure that the content of the shipment is complete.

The shipment of one PN10 unit consists of:

1) 1x PN10 energy & power monitoring and logging device
2) 1x 12V DIN Rail Power Supply
3) 3x Current Transformers

The shipment of one PN12 unit consists of:

1) 1x PN12 energy & power monitoring and logging device
2) 1x GSM/GPRS antenna
3) 1x 12V DIN Rail Power Supply
4) 3x Current Transformers

A USB cable is needed but it is not included in the kits.

Chapter 2: Product Features

The PN10 and the PN12 are used for measurements on single and three phase electrical power installations. It measures all the relevant electrical parameters in an electrical power distribution installation.

The device logs the measurement data on the device itself (FLASH mode) or on a remote server (WIFI or GPRS mode) for storage and analysis.

PNODE stands for **P**ower **Node**. The PNODE's are deployed to conduct distributed power monitoring at critical nodes in electrical installations. The gathered data is used for analysis. Based on the gathered data, informed decisions can be made.

The PNODE's are designed to operate in 300V CAT IV environments. Measurements category IV corresponds to measurements taken at the source of low voltage installations, for example at low voltage power feeders. However, it can also be used at distribution panels of residential and commercial installations.

The PNODE performs the following measurements:

- Single or Three phase AC voltage measurements op to 300V (CAT IV)
- Single or Three phase AC current measurements using a 1A secondary-current Current Transformer (CT)
- Power measurements: Watt, VA and VAR (4 quadrants)
- Energy measurements: kWh, kVAh, and kVARh (4 quadrants)
- True Power Factor
- Frequency measurements
- Interruption duration time
- Voltage dips and swells
- Temperature and Humidity measurements of the environment

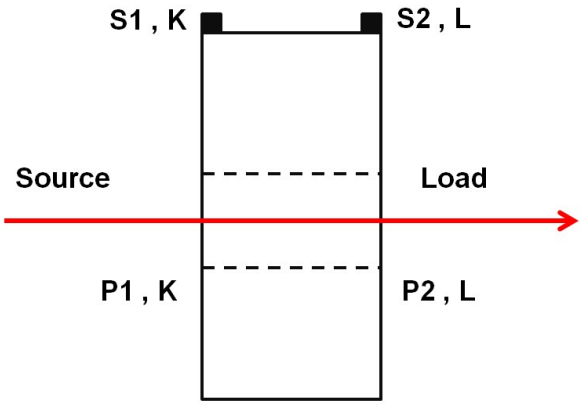
Chapter 3: Installation

Only qualified and skilled technicians, who are authorized to do electrical installations, should install the device.

Installer must comply with local and national safety standards.

Installations steps:

- Make sure the power switch SW1 is turned off.
- Install the 12V DC power supply using 2.5 mm electrical wires. Connect these wires to CN1. Make sure the polarity is correct.
- Install the voltage measurements input wires to VA, VB, VC and VN terminals. VA, VB and VC are the phase/line voltages. VN is the neutral. Use 2.5 mm electrical wires.
- Inline fuses are recommended on the VA, VB and VC input lines. Inline fuses are also recommended on the mains input line of the 12V DC power supply.
- Install the current measurements input wires to IA+, IA-, IB+, IB-, IC+, IC- input terminals. Use 2.5 mm electrical wires and try to keep the length of these wires as short as possible.
- Current Transformers must be connected according to the diagram below:



To install the current transformers correctly, the following must be followed:

- The S1 or K connection of the CT must be connected to the + side of the input current terminal. This is IA+, IB+ or IC+ terminal.

- The S2 or L connection of the CT must be connected to the - side of the input current terminal. This is IA-, IB- or IC- terminal.

- The electrical power cable from the installation power source must enter the opening of the CT at the P1 or K side of the CT and must exit the opening from the P2 or L side of the CT to the installation load.

There is a white cover on part U13 near the DC input power supply. Do not remove this white cover. This white cover is needed for a correct temperature and relative humidity measurements.

Chapter 4: Operation

After the device has been installed correctly, the power switch SW1 can be turned on. LED1 turns on showing that the device is powered on.

A CR2032 3V battery must be used to keep the correct time even when there is a power interruption. Battery can be inserted into CN3 and when this is properly inserted, LED2 turns on showing that the battery power is OK.

The PNODE is a 4-quadrant electrical power measuring device. LED7 to LED12 indicate in which quadrant the electrical power installation is running on each phase. P shows the active power and Q shows the reactive power on each phase. When a P LED or Q LED is turned on, this means the P or Q has a negative power. When these LEDs are turned off, this means that P or Q has a positive power.

LED13 indicates the sequence when a three-wire system is being used. When the sequence is ABC, this LED turns on and when the sequence is ACB, this LED turns off.

LED14 indicates if the PNODE is configured as single phase or three phase. When LED14 turns on, the system is configured as a three-phase system and when off, it is configured as a single-phase system.

Functions of LED5:

- When booting LED5 will blink fast (10 blinks per second)
- When device is disabled LED5 blinks slow (2 blinks per second)
- When the device is configured in the FLASH mode, LED5 will blink very slow (1 blink every 3 seconds)
- When writing new configuration to the device LED5 will blink fast (10 blinks per second)

SW2 is to enable/disable the WIFI on the PN10 or the GPRS on the PN12.

LED3 indicates the status of the WIFI or GPRS connection.

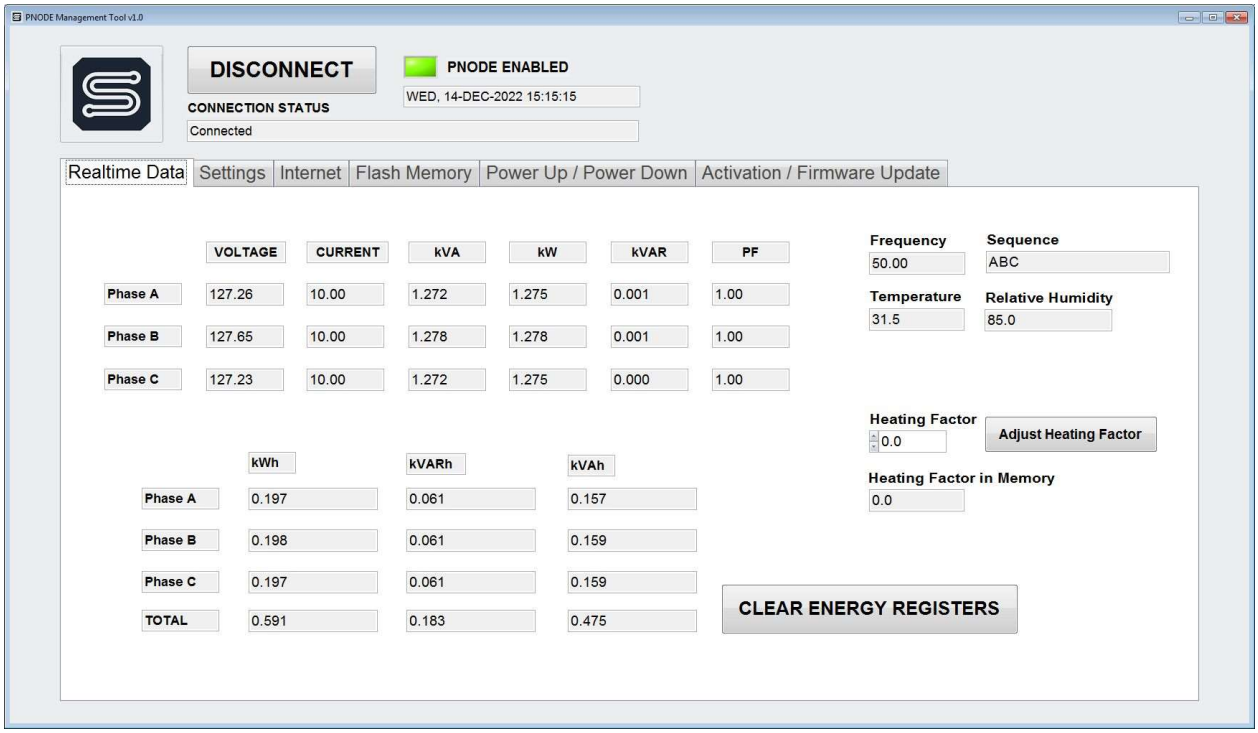
LED4 indicates whether the device is connected to the remote server or not.

LED6 indicates data transmission when data is being sent.

The PNODE management tool is for configuring the device. A USB cable must be connected to CN4. When a USB cable is connected, you can connect to the device by pressing the CONNECT button above.

All the buttons and indicators on the management tool are self-explaining. There are multiple tabs for each section of the management tool.

The heating factor in the first tab is for calibrating the temperature. The PCB gets hot after power up and then settles down. This rise in temperature can be compensated so the temperature measurement is equal to the environment/ambient temperature.



The device has two operation modes, the FLASH memory mode where measurement data is stored locally on a flash memory of PNODE and the GPRS/WIFI mode where data is sent using Internet to a remote server for storage and analysis.

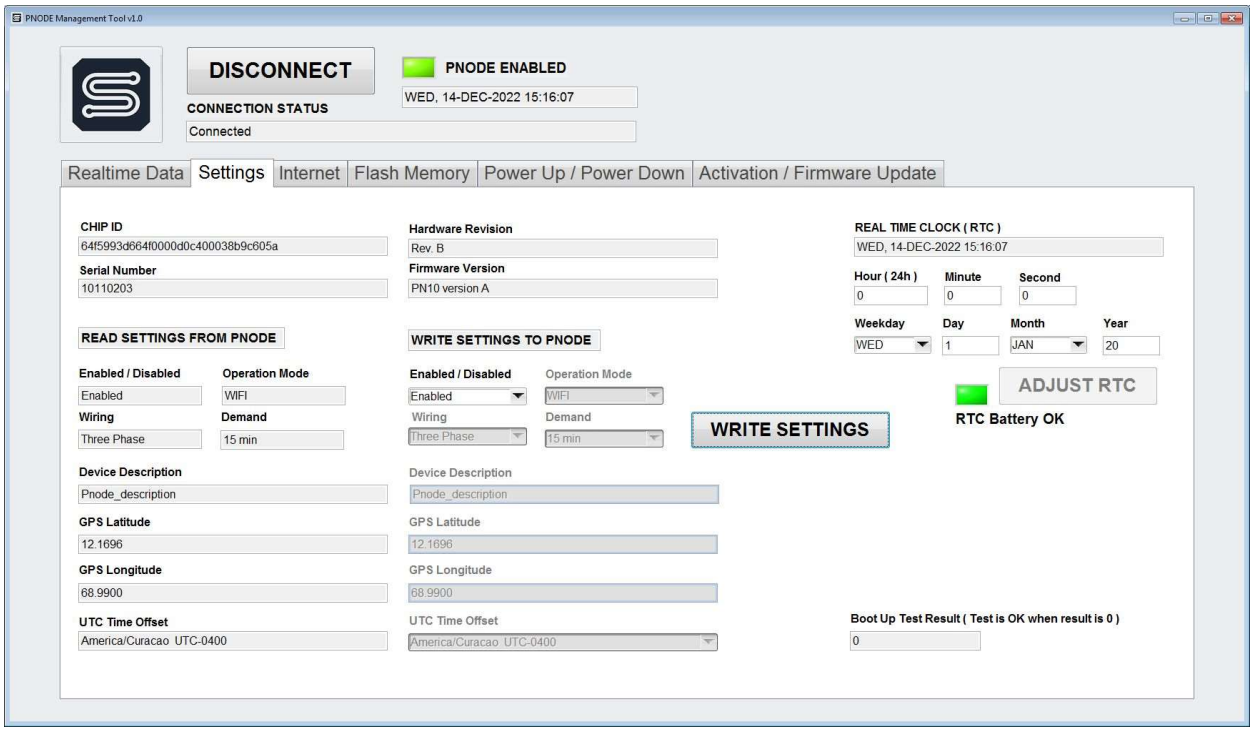
When the FLASH mode is used, logged data can be retrieved from the device and then saved on a computer.

The single wire or the three-wire system measurement mode can be configured using the software. However, this function has no effect on measurements. Its purpose is only as a sign on the device. On the online monitoring website, a specific phase can be selected for analysis. Data of all the three phases are sent to the remote server.

Other information such as the device description, GPS latitude, GPS longitude and UTC time offset can also be configured in the PNODE using the software. Device description is used in the online monitoring website. GPS coordinates are used in customized projects.

To make changes in device configuration, the device must be disabled first. After the configuration changes, the “Write Settings” button makes the changes to the device. Only when the device is enabled, data is logged locally on the FLASH memory or data is being sent to a remote server using the Internet connection.

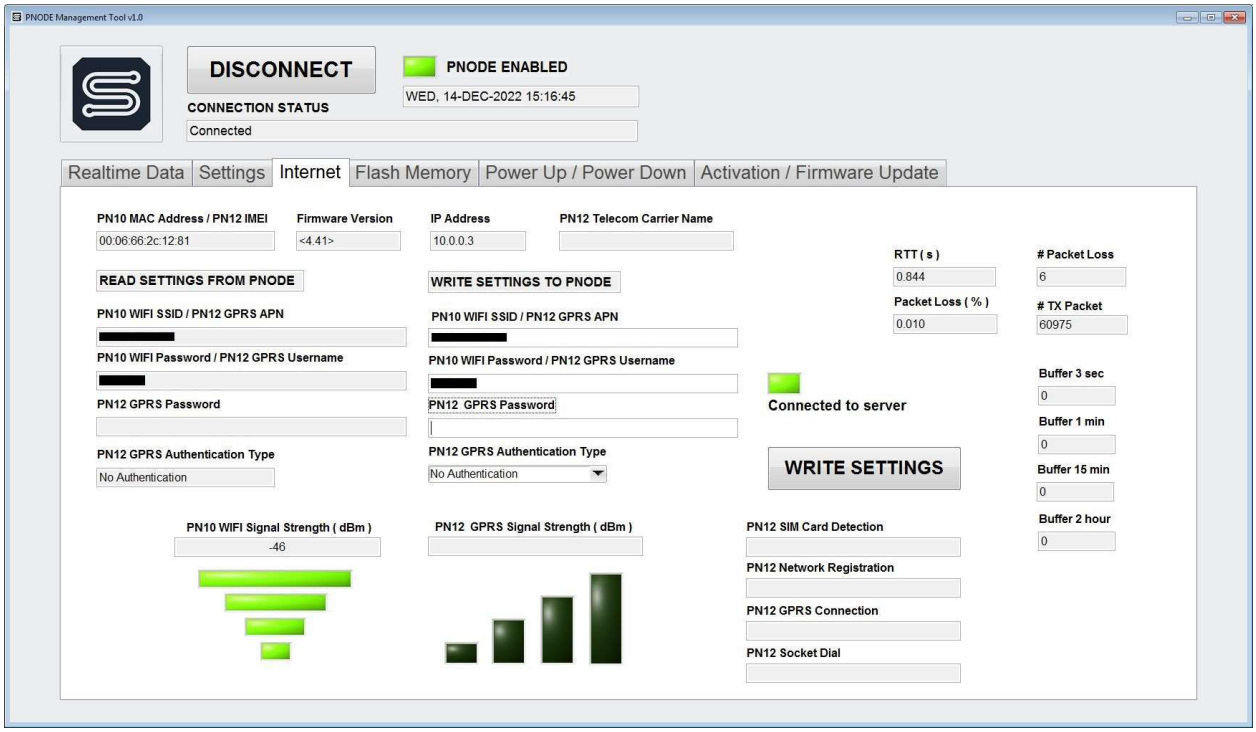
For the power demand period, a period of 10 min, 15 min, 20 min, 30 min or 1 hour can be selected.

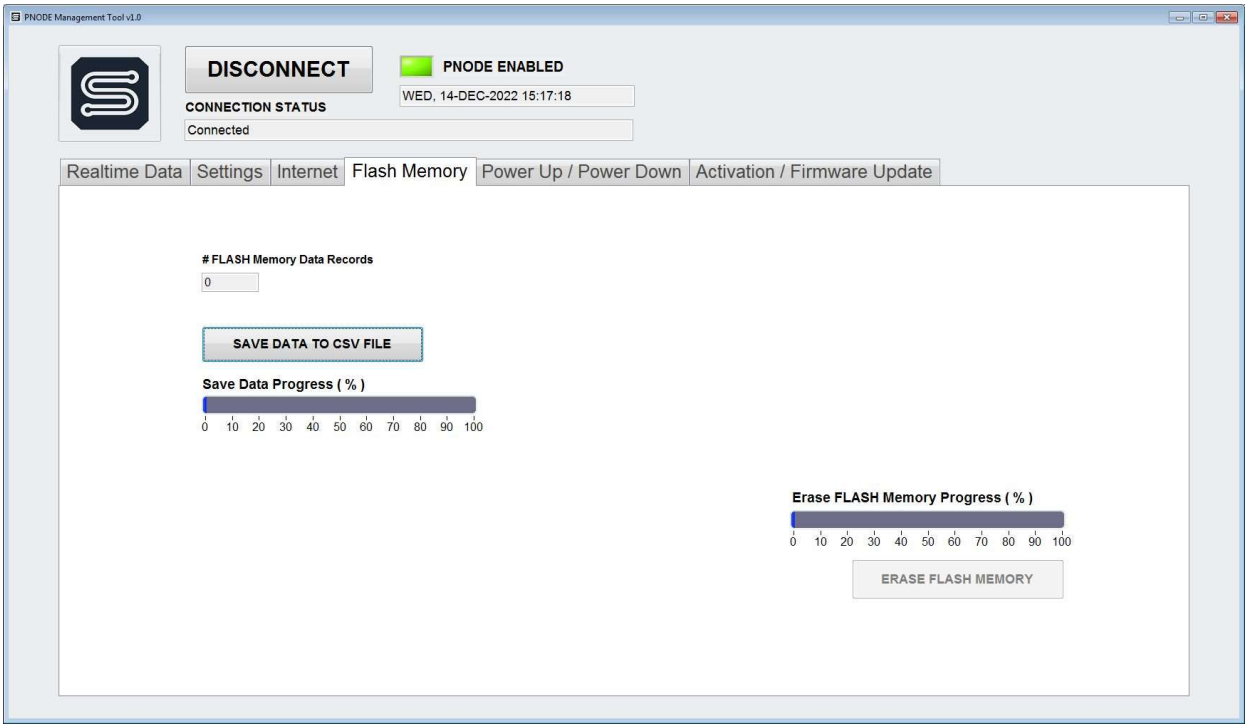


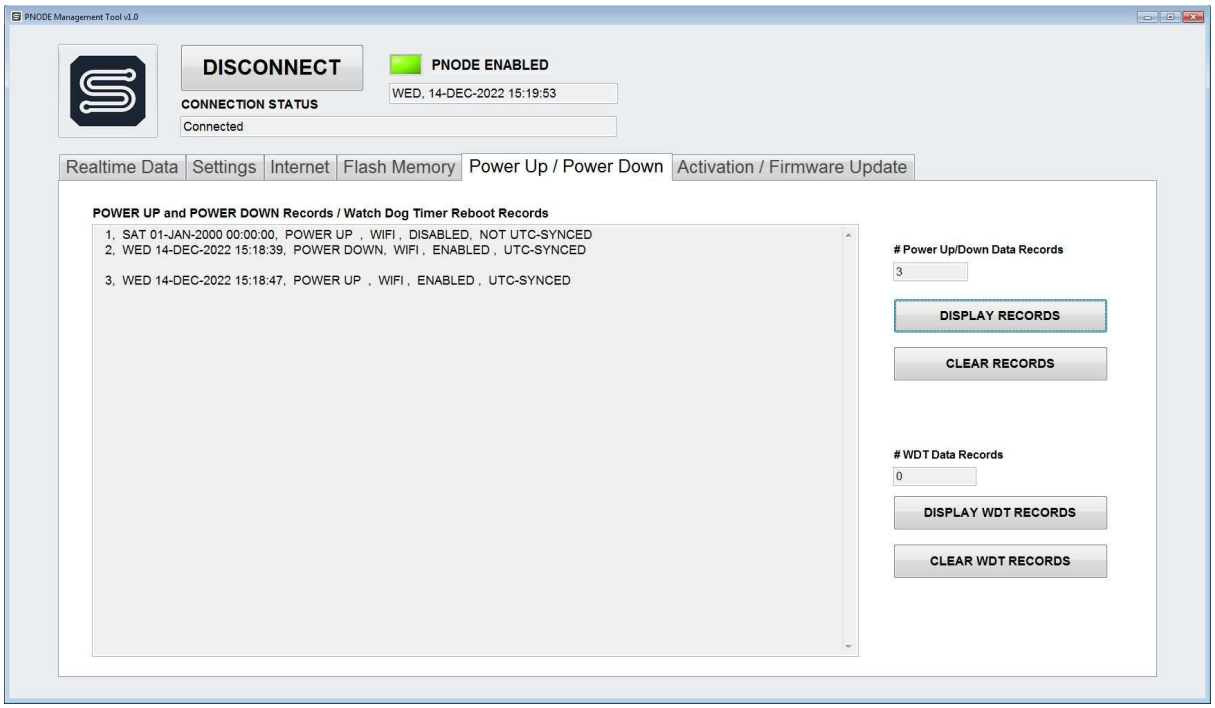
When the GPRS or WIFI mode is used, the necessary settings must be configured properly. These settings are the APN, username, password and the authentication type for the PN12 and SSID and password for the PN10. For the WIFI username and password, the vertical bar or pipe character “|” cannot be used.

For the PN12, an activated SIM card with mobile data must be inserted on the device.

For a reliable Internet connection make sure to have a high-speed Internet connection **and** that signal strength is at least 3 bars for the WIFI or the GPRS mode. When using the device in WIFI-mode make sure to use an Access Point that makes it possible that the PNODE can obtain an unlimited lease time from the Wi-Fi Access Point.

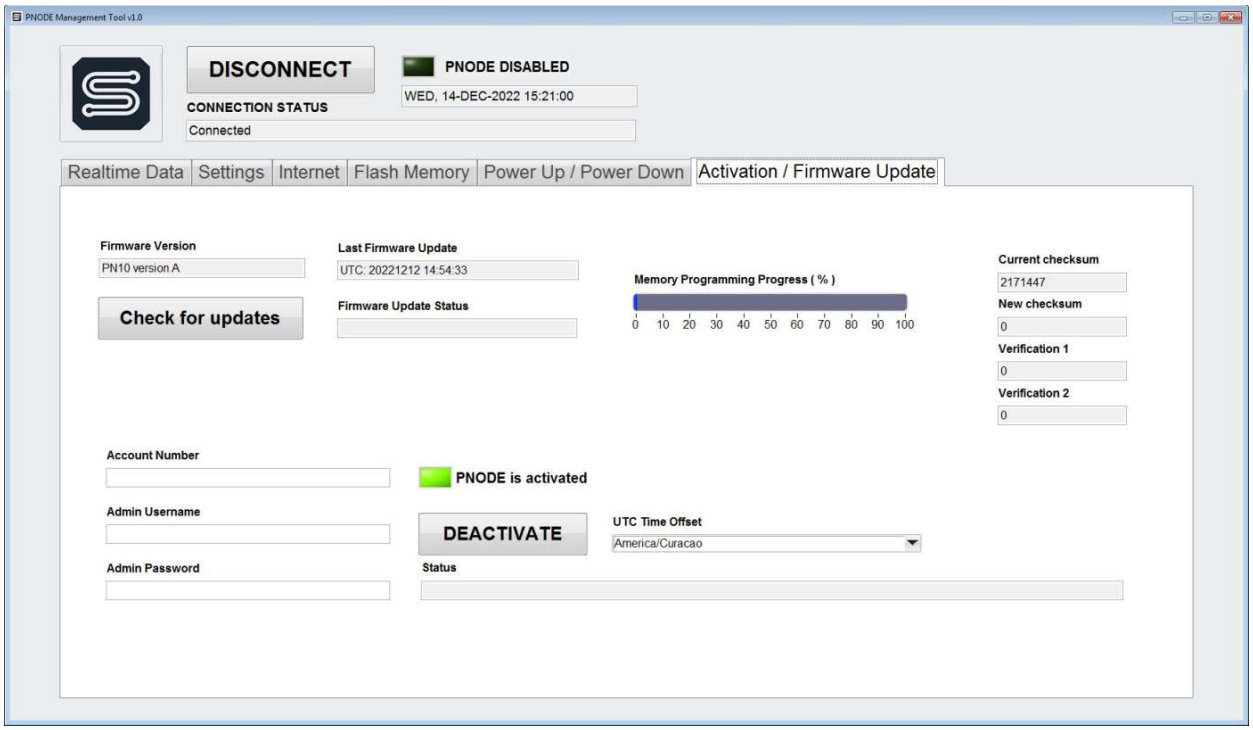

PNODE Management Tool v1.0
DISCONNECT
PNODE ENABLED
WED, 14-DEC-2022 15:16:45
CONNECTION STATUS
Connected
Realtime Data
Settings
Internet
Flash Memory
Power Up / Power Down
Activation / Firmware Update
PN10 MAC Address / PN12 IMEI
00:06:66:2c:12:81
Firmware Version
<4.41>
IP Address
10.0.0.3
PN12 Telecom Carrier Name
RTT (s)
0.844
Packet Loss
6
Packet Loss (%)
0.010
TX Packet
60975
READ SETTINGS FROM PNODE
WRITE SETTINGS TO PNODE
PN10 WIFI SSID / PN12 GPRS APN
PN10 WIFI Password / PN12 GPRS Username
PN12 GPRS Password
PN12 GPRS Authentication Type
No Authentication
Connected to server
WRITE SETTINGS
Buffer 3 sec
0
Buffer 1 min
0
Buffer 15 min
0
Buffer 2 hour
0
PN10 WIFI Signal Strength (dBm)
-46
PN12 GPRS Signal Strength (dBm)
PN12 SIM Card Detection
PN12 Network Registration
PN12 GPRS Connection
PN12 Socket Dial

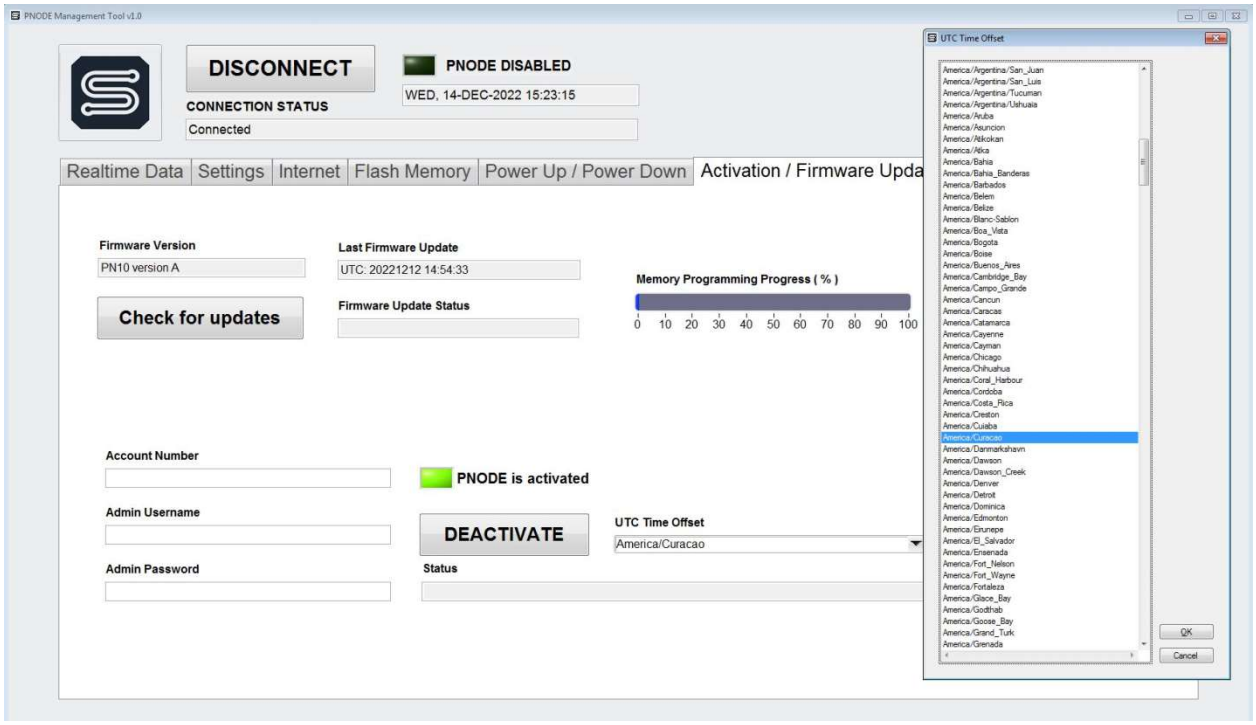

PNODE Management Tool v1.0
DISCONNECT
PNODE ENABLED
WED, 14-DEC-2022 15:17:18
CONNECTION STATUS
Connected
Realtime Data
Settings
Internet
Flash Memory
Power Up / Power Down
Activation / Firmware Update
FLASH Memory Data Records
0
SAVE DATA TO CSV FILE
Save Data Progress (%)
0 10 20 30 40 50 60 70 80 90 100
Erase FLASH Memory Progress (%)
0 10 20 30 40 50 60 70 80 90 100
ERASE FLASH MEMORY



On the last tab the device can be activated so the remote server can receive the measurements data of the PNODE. When updating the firmware, make sure that the device stays powered on otherwise there is a chance that you will brick the device.

For activating and updating the firmware, an Internet connection is needed. When activating the device for the **first time** on an account, a time zone must be chosen. After this, the chosen time zone cannot be changed anymore on the same account.


PNODE Management Tool v1.0
DISCONNECT
PNODE DISABLED
WED, 14-DEC-2022 15:21:00
CONNECTION STATUS
Connected
Realtime Data
Settings
Internet
Flash Memory
Power Up / Power Down
Activation / Firmware Update
Firmware Version
PN10 version A
Last Firmware Update
UTC: 20221212 14:54:33
Memory Programming Progress (%)
0 10 20 30 40 50 60 70 80 90 100
Current checksum
2171447
New checksum
0
Verification 1
0
Verification 2
0
Check for updates
Firmware Update Status
Account Number
PNODE is activated
Admin Username
DEACTIVATE
UTC Time Offset
America/Curacao
Admin Password
Status


PNODE Management Tool v1.0
DISCONNECT
PNODE DISABLED
WED, 14-DEC-2022 15:23:15
CONNECTION STATUS
Connected
Realtime Data
Settings
Internet
Flash Memory
Power Up / Power Down
Activation / Firmware Upda
Firmware Version
PN10 version A
Last Firmware Update
UTC: 20221212 14:54:33
Memory Programming Progress (%)
0 10 20 30 40 50 60 70 80 90 100
Check for updates
Firmware Update Status
Account Number
PNODE is activated
Admin Username
DEACTIVATE
UTC Time Offset
America/Curacao
Admin Password
Status
UTC Time Offset
America/Argentina/San_Juan
America/Argentina/San_Luis
America/Argentina/Tucuman
America/Argentina/Ushuaia
America/Aruba
America/Asuncion
America/Atikokan
America/Atka
America/Bahia
America/Bahia_Banderas
America/Barbados
America/Belem
America/Belize
America/Blanc-Sablon
America/Boa_Vista
America/Bogota
America/Boise
America/Buenos_Aires
America/Cambridge_Bay
America/Campo_Grande
America/Cancun
America/Caracas
America/Catamarca
America/Cayenne
America/Cayman
America/Chicago
America/Chihuahua
America/Coral_Harbour
America/Cordoba
America/Costa_Rica
America/Creston
America/Cuiaba
America/Curacao
America/Danmarkshavn
America/Dawson
America/Dawson_Creek
America/Denver
America/Detroit
America/Dominica
America/Edmonton
America/Eirunepe
America/El_Salvador
America/Ensenada
America/Fort_Nelson
America/Fort_Wayne
America/Fortaleza
America/Glace_Bay
America/Godthab
America/Goose_Bay
America/Grand_Turk
America/Grenada
OK
Cancel

To avoid ground loops when the PNODE management tool is being used while measuring live voltages, a USB Isolator must be used. Otherwise make always sure that the PNODE has no live voltages connected to it.

When a battery powered laptop is being used while measuring live voltages, a USB Isolator is not needed.

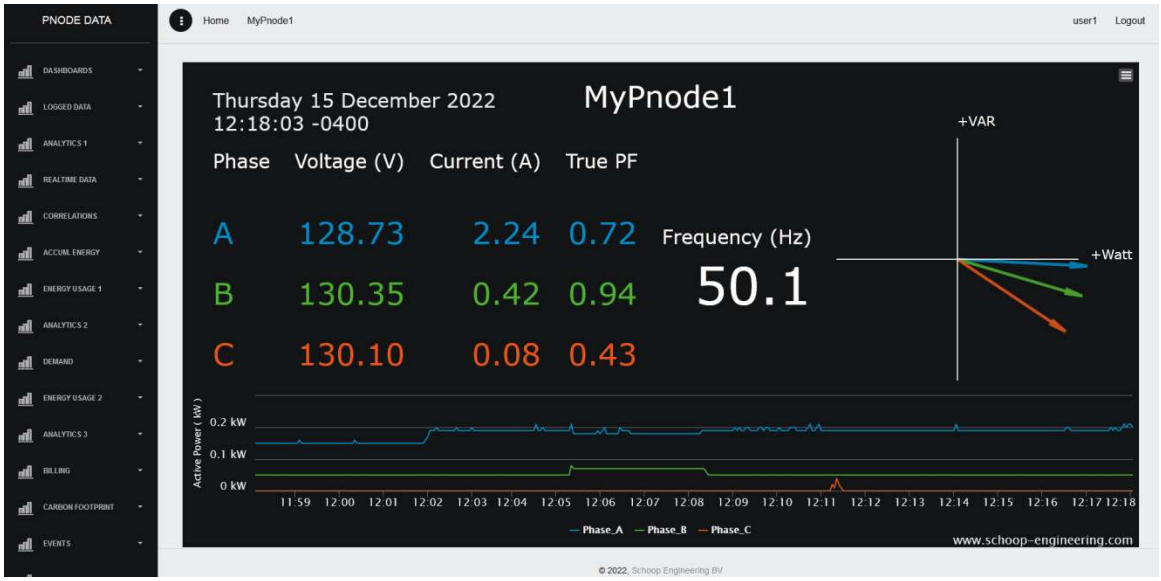
When there is live voltage connected to the PNODE and the top enclosure is open, do not touch the parts between the silkscreen danger signs on the PCB.

Chapter 5: Online Monitoring

When the PNODE is running in WIFI or GPRS mode, the PNODE is sending the data to a remote server for storage and analysis.

By visiting a website, the stored data can be retrieved for analysis or the real time data can be monitored.

Visit www.schoop-engineering.com for more information. It is possible to have access to a live demonstration.



Chapter 6: Maintenance

For protection, the device uses 4 fuses in order to protect against over-current. These fuses have the reference markings FUS1, FUS6, FUS7 and FUS8. They are fast acting fuses rated at 2 Amperes.

The manufacturer is Littelfuse Inc. and the part number is **0453002.MR**.

Make sure that CR2032 3V battery has enough charge to keep the real time clock running in case of a power interruption.

When mounting the PNODE it is highly recommended to have the input terminals at the bottom side. This prevents dust accumulation inside the device from above.

Chapter 7: Warranty

- Schoop Engineering BV provides **a one-year limited** warranty for the PN10 and PN12.

- This warranty begins on the date of shipment.

- This warranty does not apply to fuses and disposable batteries.

- Any damage to the device caused by not following the instructions will make this warranty void and null.

- Any damage to the device caused by modifying the PCBA, components or the case will make this warranty void and null.

- Any damage to the device caused by inappropriate use, for example inappropriate voltage input, hot ambient temperature, dropping in water or on the ground will make this warranty void and null.

Chapter 8: Specifications

Electrical Specifications:

Power supply:	12 V DC ± 1V
Power consumption:	250 mA DC maximum
Voltage Inputs:	300 Vrms maximum.
Current Inputs:	1 Arms maximum from Current Transformers

Accuracy:

Voltage Input rating:	CAT IV 300V
Voltage Measurement:	0.5% with a 20 to 1 dynamic range
Current Measurement:	0.5% with a 500 to 1 dynamic range
Active Energy:	0.1% with a 1000 to 1 dynamic range
Active Energy:	IEC 62053-22
Reactive Energy:	IEC 62053-23
Frequency:	0.1 Hz with a 42 Hz to 69 Hz range

Certifications:

Product Safety:	IEC/EN 61010-1: 2010, IEC/EN 61010-2-030: 2010
EMC:	IEC/EN 61326-1: 2013

Dimensions:

Width x Length x Height:	17 cm x 12 cm x 5.5 cm

Environmental Specifications:

Operating temperature:	-30℃ to 80℃
Storage temperature:	-40℃ to 80℃

Shenzhen BCTC Testing Co., Ltd.
BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road,
Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China

Certificate of Compliance

Certificate Number: BCTC-FY170301292C

Applicant : **Schoop Engineering BV**
Mahuma Kaya-N 232, Willemstad, Curaçao

Manufacturer : **Schoop Engineering BV**
Mahuma Kaya-N 232, Willemstad, Curaçao

Product : **PNODE**

M/N : **PN10**

Test Standard : **EN 61010-1: 2010**
EN 61010-2-030: 2010

The EUT described above has been tested by us with the listed standards and found in compliance with the council LVD directive 2014/35/EU. It is possible to use CE marking to demonstrate the compliance with this LVD Directive. It is only valid in connection with the test report number: BCTC-FY170301292S.

CE

Manager
June 14, 2017

This certificate of conformity is based on a single evaluation of the submitted sample(s) of the above mentioned product. It does not imply an assessment of the whole product and relevant. Directives have to be observed.

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Http://www.bctc-lab.com Http://www.bctc-lab.com.cn

Shenzhen BCTC Testing Co., Ltd.
BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road,
Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China

Certificate of Compliance

Certificate Number: BCTC-FY170301291C

Applicant	:	**Schoop Engineering BV** Mahuma Kaya-N 232, Willemstad, Curaçao
Manufacturer	:	**Schoop Engineering BV** Mahuma Kaya-N 232, Willemstad, Curaçao
Product	:	**PNODE**
M/N	:	**PN10**
Test Standard	:	**EN 61326-1: 2013**

The EUT described above has been tested by us with the listed standards and found in compliance with the council EMC Directive 2014/30/EU. It is possible to use CE marking to demonstrate the compliance with this EMC Directive. It is only valid in connection with the test report number: BCTC-FY170301291E.

CE

BCTC
APPROVED
Manager
Mar. 24, 2017

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Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China

Certificate of Compliance

Certificate Number: BCTC-FY171107708C

Applicant	:	**Schoop Engineering BV** Mahuma Kaya-N 232, Willemstad, Curaçao
Manufacturer	:	**Schoop Engineering BV** Mahuma Kaya-N 232, Willemstad, Curaçao
Product	:	**PNODE**
M/N	:	**PN12**
Test Standard	:	**EN 61010-1: 2010** **EN 61010-2-030: 2010**

The EUT described above has been tested by us with the listed standards and found in compliance with the council LVD directive 2014/35/EU. It is possible to use CE marking to demonstrate the compliance with this LVD Directive. It is only valid in connection with the test report number: BCTC-FY171107708S.

CE

APPROVED

Manager

Nov. 30, 2017

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BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road,
Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China

Certificate of Compliance

Certificate Number: BCTC-FY171107707C

Applicant	:	**Schoop Engineering BV** Mahuma Kaya-N 232, Willemstad, Curaçao
Manufacturer	:	**Schoop Engineering BV** Mahuma Kaya-N 232, Willemstad, Curaçao
Product	:	**PNODE**
M/N	:	**PN12**
Test Standard	:	**EN 61326-1: 2013**

The EUT described above has been tested by us with the listed standards and found in compliance with the council EMC directive 2014/30/EU. It is possible to use CE marking to demonstrate the compliance with this EMC Directive. It is only valid in connection with the test report number: BCTC-FY171107707E.

CE

BCTC APPROVED

Manager

Nov. 30. 2017

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