PureBB 3 phases
User manual

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1. General

1.1 Introduction

The PureBB is an advanced Class A power quality analyzer embedded with PQZIP Technology. It is an easy to use plug and play device that continuously records all power quality parameters without the need to set up thresholds setting or recording configuration.

When using the PureBB any installation error, such as wrong phase order, can be fixed during post-processing. The Pure BlackBox has a ride through super capacitors technology to enable continuous recording during short supply interruptions.

Power quality post recording processing and analysis are available using the free PQSCADA Sapphire Express Edition software via drag and drop of recorded PQZ data files.

Recorded information is saved in a non-volatile memory SD card which is accessed either via the device USB slot, connected to a PC, or by inserting the SD card in a reader connected to a PC.

Key Features

- Light weight, hand-held portable PQ Analyzer
- Continuous waveform recording at 256 Sample/Cycle 50/60Hz
- Class A devices IEC61000-4-30
- Configuration FREE Device
- Easy USB connectivity to PC
- SD card slot hot swap

Please refer to the PQSCADA Sapphire's users manual, located on the PureBB Manual USB drive, for more information. The manual provides instruction for installation and use, as well as general instructions for connecting to Elspec power quality analyzers.

1.2 Limited Warranty & Limitation of Liability

Each Elspec product is under warranty to be free from defects in material and workmanship under normal use and service. The warranty period is for one year and commences on the date of shipment. Parts, product repairs, and services are under warranty for 90 days. This warranty extends only to the original buyer or end-user customer and it does not apply to fuses, disposable batteries, or to any product which, in Elspec's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions in the operation or handling of the product. Elspec guarantees that the software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Elspec does not guarantee that the software will be error free and operate without interruption. Elspec authorized re-sellers shall extend this warranty on new and unused products to end-user customers only, but do not have authority to extend a greater or different warranty on behalf of Elspec. Warranty support is available only if the product is purchased through an Elspec authorized sales outlet or Buyer has paid the applicable international price. Elspec reserves the right to invoice the Buyer for any importation costs for the repair/replacement of parts when the product purchased in one country is submitted for repair in another country. Elspec's warranty obligation is limited, at Elspec's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to Elspec within the warranty period. For warranty service, contact Elspec directly to obtain a return-authorization. On receipt of the authorization, return the product to Elspec with a description of the problem, including prepaid postage and insurance (FOB destination). Elspec assumes no risk for damage in transit. Following warranty repair, the product will be returned to the Buyer, transportation prepaid (FOB destination). If Elspec determines that the failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation of handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, Elspec will provide an estimate of repair costs and obtain authorization before commencing work. Following repair, the product will be returned to the Buyer, transportation prepaid, and the Buyer will be billed for the repair and return postage transportation charges (FOB Shipping Point). This warranty is the Buyer's sole and exclusive remedy and is in lieu of all other warranties, express or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. Elspec shall not be liable for any special, indirect, incidental, or consequential damages or losses, including loss of

data arising from any cause or theory. Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

1.3 NOTICE REGARDING PROPRIETARY RIGHTS

This publication contains information proprietary to Elspec. By accepting & using this manual, you agree that the information contained herein will be used solely for the purpose of operating equipment developed & manufactured by Elspec.

1.4 Safety Precautions

We, Elspec Engineering Ltd. Conduct the following Routine tests as part of the production line: -Dielectric strength test between mains and ground, test voltage 2120Vdc or 1500Vac -Grounding continuity between earth pin of the appliance inlet and earth pin of the appliance outlet

Kindly review & take all the necessary safety precautions prior to proceeding.

⚠WARNINGS⚠
Protection provided by the equipment can be impaired if used in a manner not specified by the manufacturer
Review the entire manual before using the instrument and its accessories
Observe all warnings and cautions
Do not operate the instrument around explosive gas or vapor
Avoid working alone
Before use, inspect the instrument, leads and accessories for mechanical damage, and replace when needed
Pay special attention to the insulation surrounding the connectors and plugs
Remove all accessories that are not in use
Make sure the instrument is properly grounded to a protective earth ground
Do not insert power or any other connectors above the rating of the instrument as shown on the name plate
During installation, ensure that the device is completely disconnected from any live points and\or plugs
Do not insert metal objects into connectors and openings
Never open the instrument's enclosure during operation; Dangerous voltages are present
Do not expose the instrument to extreme moisture and or rain
do not operate the instrument or its accessories when found wet for any reason

1.5 Unpacking Components & Accessories

The following items are included in your Analyzer Kit:

Figure 1-1. Contents of Analyzer Kit

#	Description
1	Pure 3 Phase BlackBox Power Quality Analyzer
2	Customized lexan according to country's requirements
3	5 Voltage Cord with Crocodile Clip + Fuse (3M)
4	USB Cable type A male to type B male 1.5m black
5	Power Cable for Europe 10A/230V, straight, 1.8M, Black / Power Cable for America 10A/125V, straight, 1.8M, Black
6	Elspec BlackBox Installation USB drive
7	4GB Micro SD card
8	2 Pin Terminal Block Connector

2. Analyzer Overview

2.1 Introduction

This chapter deals with a number of general aspect of the analyzer's operation:

- Physical layout of the controls & indicators
- Led indications
- Powering the analyzer

2.2 Connections & Plugs

The PureBB 3 phases has the following connections & Plugs:

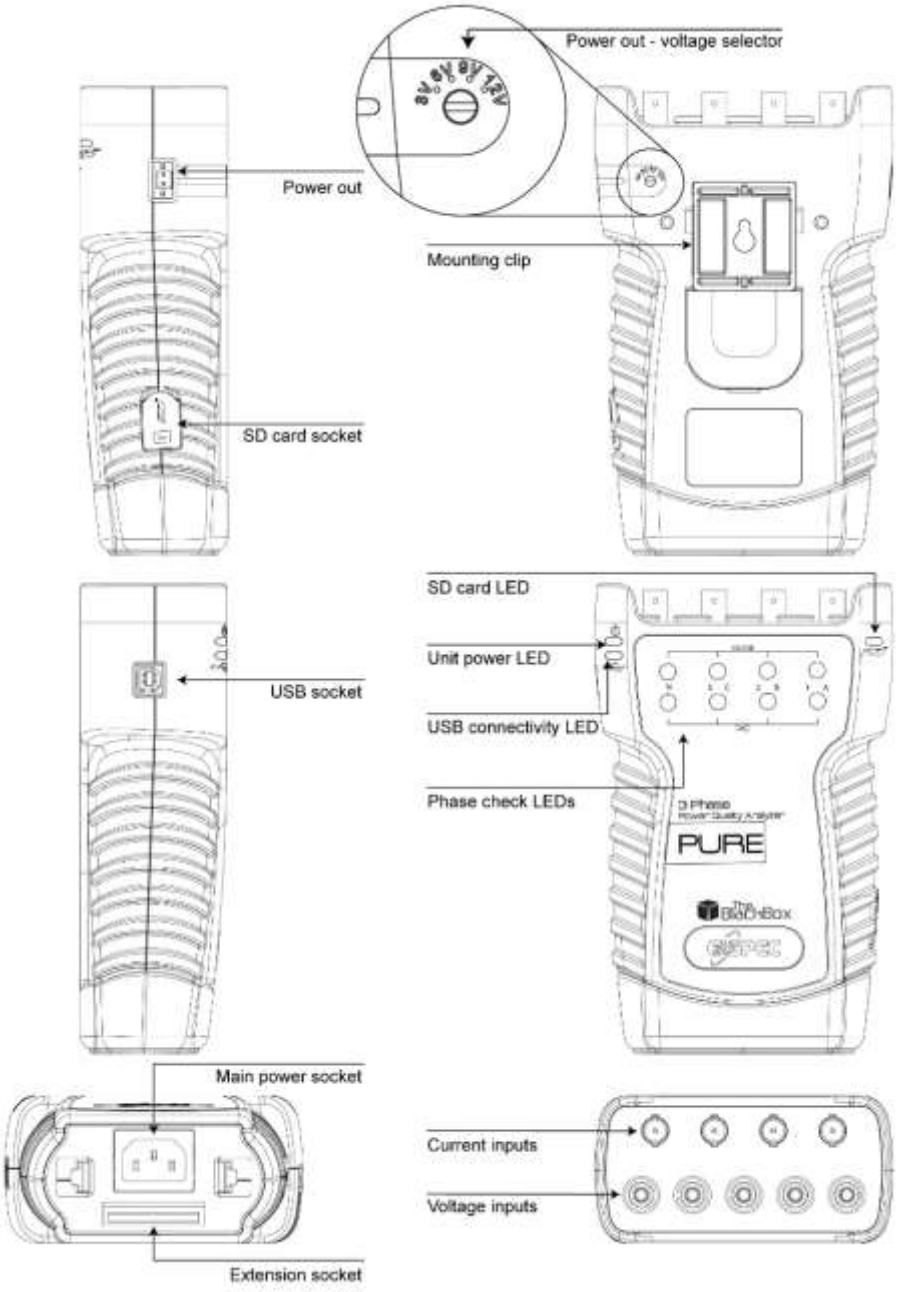


Figure 2-1. The analyzer connection & plugs

- Voltage inputs – 5 X banana female sockets for voltage inputs.
- Current input – 4 X BNC connectors. These inputs accept LV signals of $\pm 10V_{Peack}$. Only SELV circuits can be connected to these inputs.
- Power out – The PureBB can supply 3-12V DC at up to 100mA/1W to an external device. To adjust the output voltage level, switch the voltage selector to the required voltage level as defined in the device's data sheet. Only SELV circuits can be connected to this input.
- SD card socket – insert the micro SD card supplied with the analyzer. The PureBB support any standard microSD card at a size of up-to 32GB.
- Main power socket – insert the power cable supplied with the analyzer to power up the analyzer.
- Extension socket – 50 pins connector used to extend the PureBB communication capabilities and battery power supply.

2.3 LEDs Indications

2.3.1 Operational LEDs

The PureBB have 3 operational bi-color (green/red) LEDs – Unit Power, USB connectivity and SD card. These LEDs provide the following information:

Power LED:

Led Status	Description
Solid Green	The analyzer in powered-up and working well
Blinking Green	N/A
Solid Red	• Carnell is initializing (during analyzer initializing process). • DSP Error.
Blinking Red	• System is initializing (during analyzer initializing process). • FW Upgrade is in process (SD LED will be blinking as well)

USB connectivity LED:

Led Status	Description
Solid Green	USB connection detected
Blinking Green	N/A
Solid Red	N/A
Blinking Red	N/A

SD card LED:

Led Status	Description
Solid Green	N/A
Blinking Green	Recording is O.K
Solid Red	• No micro SD card • Corrupted micro SD card
Blinking Red	Not recording, USB connected

2.3.2 Phase check LEDs

The PureBB have 8 bi-color phase check LEDs, one green/red LED for each current/voltage input. These LEDs provide the following information:

LED is off – The corresponded input measures a THD value that is higher than 200% or RMS value that is less than 0.4% of its full scale. Current full scale – $10V_{Peak}$. Voltage full scale – $2{,}000V_{Peak}$.

LED is green – the corresponded input measures a THD value that is less than 200% and RMS value that is greater than 0.4% of its full scale. Current full scale – $10V_{Peak}$. Voltage full scale – $2{,}000V_{Peak}$.

2.4 Powering the Analyzer

Connect the female end of the Power Cable to the Main Power Supply socket of the unit.

Connect the male plug end of the Power Cable to the electrical supply outlet.

Wait for approx. 1min for the analyzer to be initialized. At the end of the initializing process the unit power led should be solid green and the SD card led should be blinking green.

3. Input Connections

3.1 Introduction

This chapter explains how to make connection to the system under test. Check that the Analyzer setup meets the characteristics of the system under test and the accessories that are used. The PureBB doesn't required any setups or configuration on site.

3.2 Input connections

The Analyzer has 4 BNC-inputs for current clamps and 5 banana-inputs for voltages. Customized lexans are supplied corresponding to wiring color codes used in the USA, Canada, Continental Europe, the UK, and China. Stick the lexan that fit to your local wiring codes around the current and voltage inputs as shown in Figure 3-1.

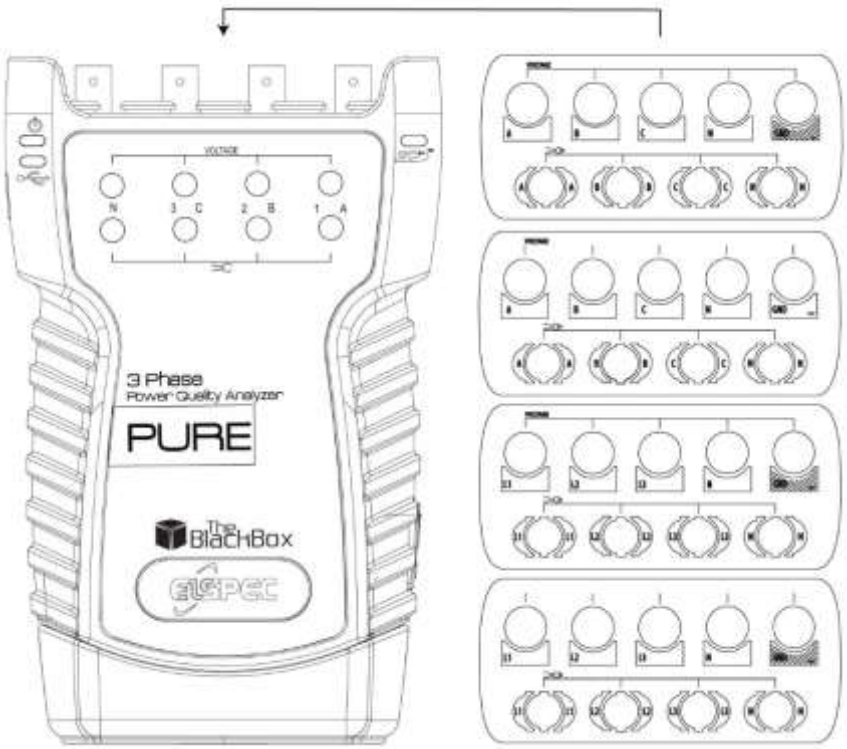


Figure 3-1. Mounting the lexan for voltage and current inputs.

De-energize power systems before making connections whenever possible. Always use appropriate equipment for personal protection. Avoid working alone and work according to the warnings listed in Chapter 1, Safety Precautions.

For a 3-phase system make the connections as shown in Figure 3-2.

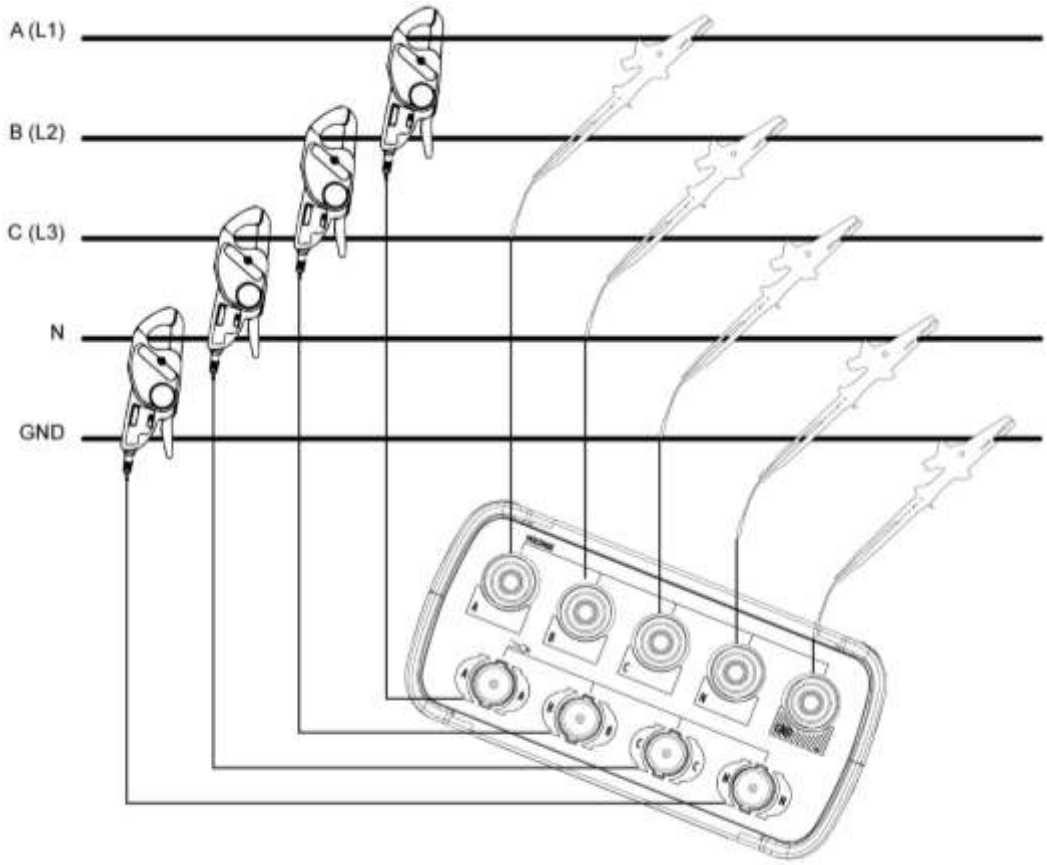


Figure 3-2. Connection of analyzer to 2-phase system

Notes:

- For single phase L-N measurements, use current input A (L1) and the voltage inputs Ground, N (neutral), and phase A (L1). For correct measuring results, connect the ground to B (L2), and C (L3).
- For single phase L-L measurements, use current inputs A (L1), B (L2) and the voltage inputs Ground, N (neutral), phase A (L1) and B (L2). For correct measuring results, connect the ground to C (L3).
- For DC measurement, use current inputs A (L1) with DC current clamp, and the voltage inputs Ground and phase A (L1). For current measuring results, connect the ground to N(neutral), B (L2, and C (L3).

3.2.1 Plugin the current clamps

You may use any clamp (either Elspec / Custom clamps). The clamps convert current to low voltage ($\pm 10V_{Peak}$).

First put the current clamps around the conductors of phase A (L1), B (L2), C (L3), and N (neutral). The clamps are marked with an arrow indicating the correct signal polarity.

Plug in the Current clamps into the applicable sockets located on the upper panel.

Make sure that current clamps are secured and completely closed around the conductors.

The PureBB supports various current clamps and can supply 3-12V DC at up to 100mA/1W to these devices. To adjust the output voltage level, switch the voltage selector at the back of the analyzer to the required voltage level as defined in the clamp's data sheet.

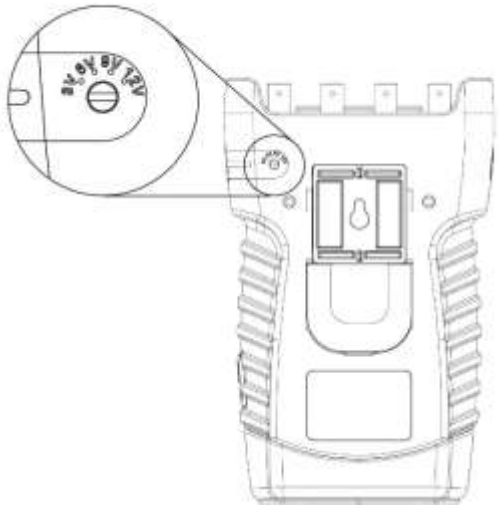


Figure 3-3. Power out voltage selector

Specification	PureBB 3 phase
Maximum Voltage Input (continuous)	$7V_{Peak}$ from clamp
Nominal Voltage Range	$3V_{Peak}$ from clamp
Maximum Peak Measurement Voltage	$10V_{Peak}$ from clamp
Burden	0.05VA (Typical) @ 5 IRMS
Bandwidth (50Hz/60Hz)	6.4kHz/7.68kHz
Nominal Frequency	40-70Hz

3.2.2 Plugin the Voltage leads

Next make the voltage connections: start with Ground and then in succession N, A (L1), B (L2), and C (L3). For correct measuring results, always connect the Ground input.

Always double-check the connections.

Specification	PureBB 3 phase
Voltage Input	600VAC CAT IV, 1000VAC CAT III
Nominal Voltage Range	110/230/690 V
Maximum Peak Measurement Voltage	2kV
Input Impedance	10MΩ
Bandwidth (50Hz/60Hz)	6.4kHz/7.68kHz
Nominal Frequency	40-70Hz

4. Mounting the PureBB

The PureBB analyzer must be installed in an approved electrical panel or enclosure, following proper installation practices according to the local electrical codes.

Adjust the mounting clip to the analyzer

The mounting clip has two sides: Din rail mounting and screw mounting hole as shown in figure 4-1.

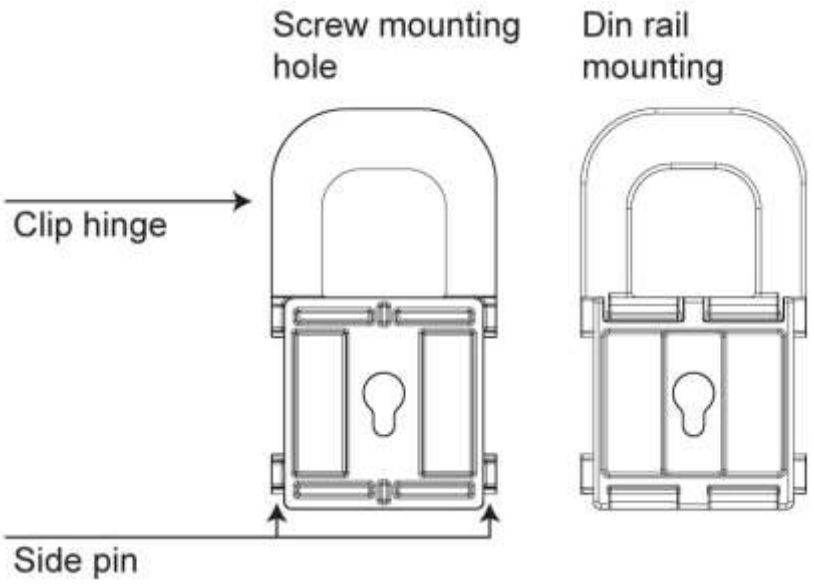


Figure 4-1. Mounting clip

To detach the mounting clip, lift the clip hinge outside the analyzer surface and pull backward as shown in figure 4-2.

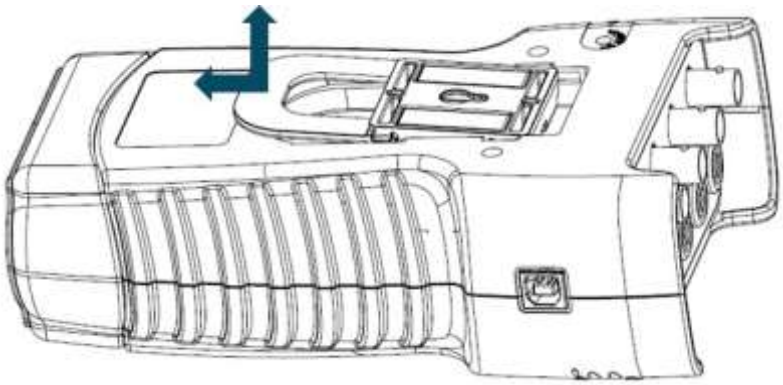


Figure 4-2. Unfasten the mounting clip

To attach the mounting clip, insert the clip's side pins in the designated notches. Then Push the mounting clip down and forward as shown in figure 4-3.

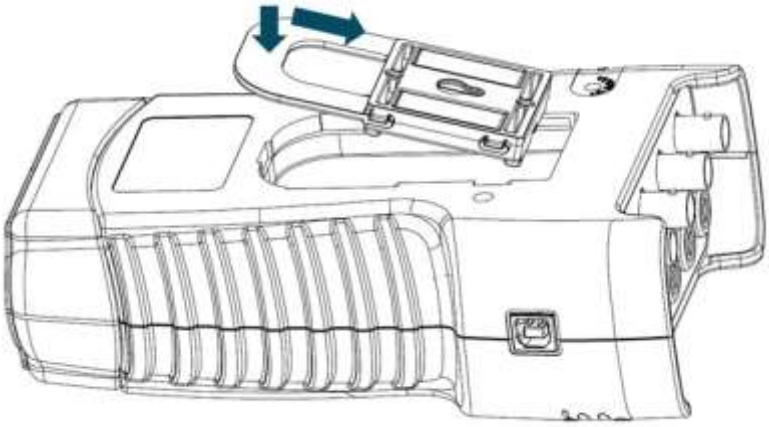


Figure 4-3. Fasten the mounting clip.

Din rail mounting

To mount analyzer to DIN rail, first locate the approximate position you would like to place the analyzer on the DIN-rail, then hook upper end of mounting clip to edge of DIN-rail. Then lower the opposite end (latch end) of the clip onto the rail. Press down on the module until the latch end snaps in place.

Screw mounting hole

Hang the analyzer on the screw and let it settle into place by pushing it slightly downwards. Please ensure that it is firmly in place.

5. PQZ Recording

The PureBB is able to continuously record & store all the electrical waveforms at 256 sample/cycle, on board for more than a year, with no gaps in the data. The innovation behind this capability is the PQZIP compression technology. The patented PQZIP enables you to store up to a 1000 times more information than typical formats, allowing for storage of complete & precise data over extended periods of time.

The PQZ recording is enabled by default. The analyzer start recording once the initializing process has finished and the SD card LED is blinking green.

PQZ files are stored on the PureBB's micro SD card based on the FIFO (First In First Out) concept. As such, when the on-board memory becomes full, the oldest files are deleted automatically to free required space for the newest data.

6. Using the USB cable

This section describes how to connect the analyzer to a computer when importing PQZ files to the computer or to PQSCADA Sapphire.

1. Plug in the supplied USB cable into the USB socket on the computer.
2. Connect the other end of the USB cable to the analyzer's USB socket.
3. Wait for the analyzer to complete initialization.
4. The message that appears on the screen differs depending on the computer's operating system or software installed in the computer. If a window to select a program or application appears, select Open Device to view files.
5. If the AutoPlay window does not pop-up automatically, click the Start button, go to “My Computer,” and select the PureBlackBox driver.
6. Click on the PQZ_ folder. Folder are sorted by year/month/day.
7. Drag and drop the files/folder into PQSCADA Sapphire Investigation module.

7. PureBB extension module

The PureBB extension module has two main functionalities:

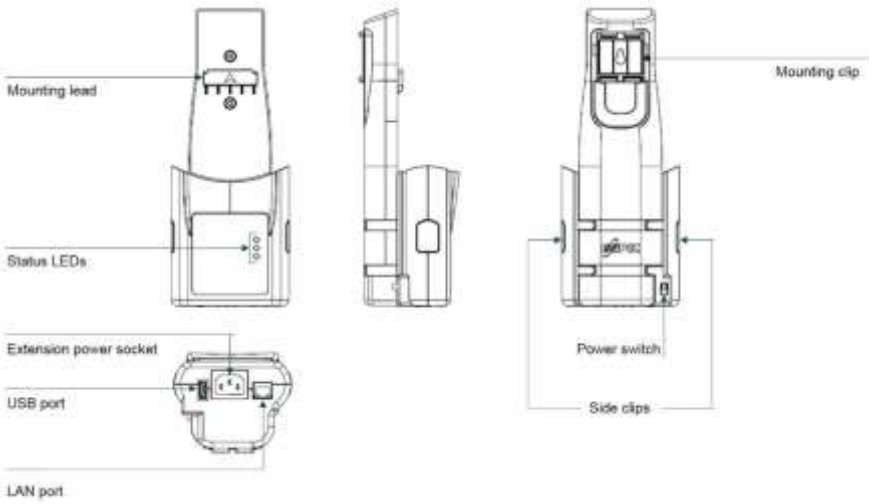
1. Extend the device communication capabilities
2. Battery backup power

This chapter deals with a number of general aspect of the extension module operation:

- Physical layout of the extension module
- Powering the analyzer
- Charging the extension module battery
- Attaching the extension module to the analyzer

7.1 Connections & Plugs

The PureBB extension module has the following connections & Plugs:



7.2 Attach the PureBB extension module

1. Detach the mounting clip from the analyzer as describe in *chapter 4* of this manual
2. Attach the mounting clip to the PureBB extension module as describe in *chapter 4* of this manual.
3. Detach the connector cover from the bottom of the analyzer by pooling it backward.
4. To attach the extension module, place the extension module on top of the analyzer and let the mounting lead settle into place, then push forward until the extension module snaps in place as shown in figures 7-2.

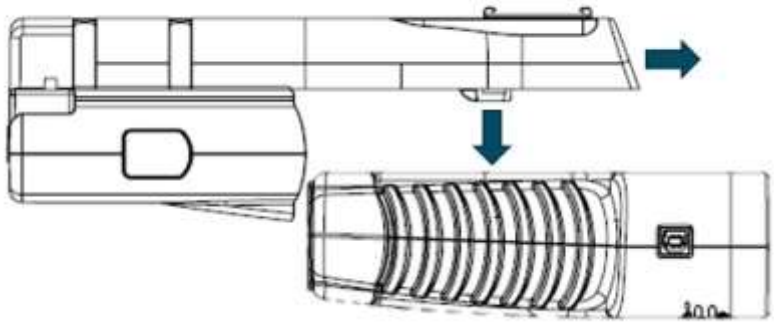


Figure 7-2. Attach the extension module

7.3 Detach the PureBB extension module

1. Press the side clips and pull backward the extension module.
2. Reattach the connector cover.
3. Reattach the mounting clips.

7.4 Powering the analyzer with the extension module

The extension module is equipped with a built in rechargeable battery that allows 5-8 hours of continuous operation without the need to connect it to an electrical supply outlet.

Attach the extension module to the analyzer as describe in *chapter 7.2* of this manual.

Switch on the extension power switch.

Wait for approx. 1min for the analyzer to be initialized. At the end of the initializing process the unit power led should be solid green and the SD card led should be blinking green.

7.5 Charging the extension module battery

The extension module battery can be charged while the analyzer is attached, or detached.

Connect the female end of the Power Cable to the Extension Power Supply socket.

Connect the male plug end of the Power Cable to the electrical supply outlet.

Battery charging starts once the Power Cable is connected.

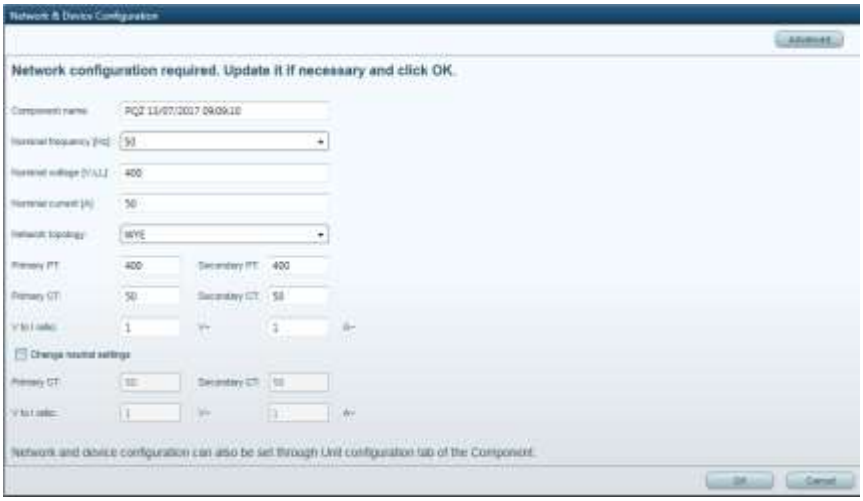
8. Using the PQSCADA Sapphire

When PQSCADA Sapphire starts at the first time, the Investigation module is opened on the home screen.

To start new Investigation, Drag and drop supported files into the *Drag file to create new investigation* folder.

Multiple files can be opened if you hold down the SHIFT or CTRL keys and click on another filename(s).

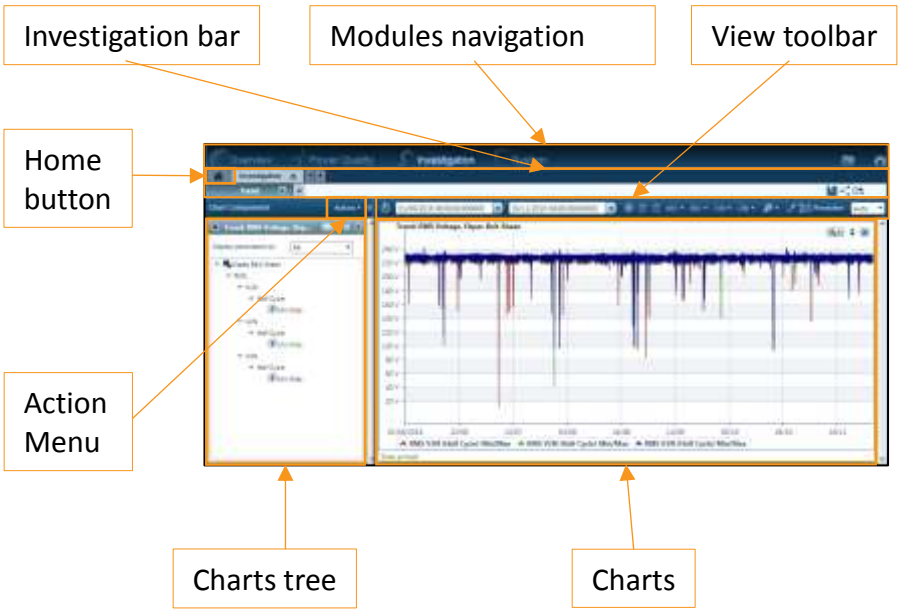
On the *Network & Device Configuration* window, set the required configurations.



The following window displays with the PQSCADA Sapphire menus and buttons for accessing frequently used features.

New Investigation is opened based on predefined templates (For templates editing, refer to PQScada Sapphire manual).

The following window displays with the PQSCADA Sapphire menus and buttons for accessing frequently used features.



The *Investigation module* screen is divided into two main sections: the left section displays the *Charts tree*, and the right section displays charts - in the selected view. These sections are divided by the splitter control (a vertical line between the sections).

The position of the splitter control can be changed by clicking and dragging the splitter control to the left or right with a pointing device. The *Charts tree* section can be hide by clicking *Hide parameters tree* on the upper right corner of the *Charts tree* section.

Investigations and Views are displayed as Tabs in the *Investigation bar*.

9. Upgrading the Firmware

1. Turn off the PureBB analyzer.
2. Unplug the SD card from the analyzer and plug it to your PC using an SD card reader.
3. Upload the FW upgrade file (Pure_fs_UX.XX.XX.img) into the main SD card partition.
4. Unplug the SD card from the PC and insert it back into the PureBB device.
5. Turn on the analyzer and wait for the Unit Power and SD card LEDs to blink red alternately– this means that the upgrade process has begun.
6. Once the upgrade process is done, the LED's will stop blinking and the device will reboot itself.
7. An additional reboot might occur as well after the first reboot is completed.
8. In order to make sure the new FW version was actually installed, take a *.pqz file recorded by the device after the FW upgrade and open it using the PQSCADA Sapphire.
9. Go to System window, select the relevant investigation on the left and check in General tab that the Product Version is the same as the FW version you installed.

10. PQSCADA Sapphire Installation

Download

Download PQSCADA Sapphire set-up file from Elspec *website*.

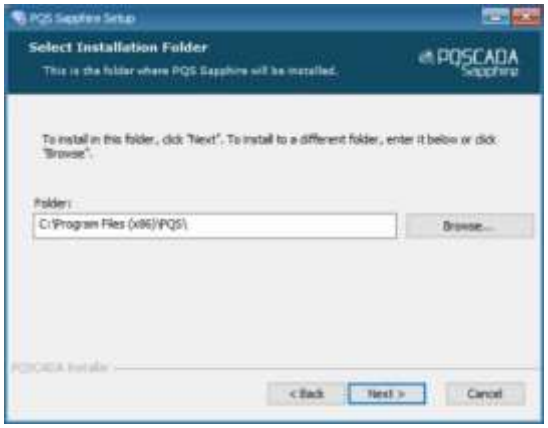
Double click on *Elspec Sapphire Setup v1.x.x.xx* file to run the setup wizard.

Welcome page

Click *Next* to start the installation.

Installation folder

Select the installation folder and click *Next*.



License agreement

Once the license agreement is read and approved, select *I accept the terms in the license agreement* option and click *Next*.

Install

Click *Install* to start the installation process.

Wait while the program is installing

Finish

Check the *Launch sapphire* box and click *Finish* to start working.

10.1 License Activation

10.1.1 On-line activation

Step 1: Select License Activation Mode

On the *License Activation Mode*, select On-line by downloading the license.

Click *Next* to go to the *License Key* page.

Step 2: License Key

On the *License Key* page, enter your license ID in the field provided. It is recommended to copy and paste the ID to avoid problems distinguishing letters and numbers.

Click *Next* to run the activation.

On a successful license activation, click *Close*.

Step 3 (enterprise edition only): service installation

With Enterprise edition license ID, PQSCADA Sapphire service installation wizard will open automatically. On the PQSCADA Sapphire service installation wizard, do the following:

1. On the welcome page Click *Next*
2. Read and agree to the End-User license agreement
3. Select the installation folder and click *Next*.
4. Click *Install* to start the installation process. Wait while the program installs.
5. Click *Finish* to close the installation wizard.

Step 4 (enterprise edition only: create Instance DB)

1. Open PQSCADA Sapphire
2. On the System module, right click the server Instance and select create server.
3. On the Database page, configure the following options:

   DB Type – SELECT the database type in which PQSCADA Sapphire will store the data. PQSCADA Sapphire supports two DB types:

   - SQLite.
   - MS SQL server (MSSQL).

   If MSSQL was selected, configure the following options:

   - DB URL – enter the DB URL, or click *Browse*, to search for SQL service in your network.
   - DB user name: enter you DB user name.
   - Password: enter your DB password.
   - Check the *save as default* to keep these settings as default. You can use *set default*, to fill in the default settings in the future.
   - Click *Test*, to verify the connection with the DB.
4. Click *add* to close the wizard.

10.1.2 Off-line activation

Launch *Upgrade License* wizard by clicking *on the Setup menu then select Install/Upgrade* license.

Activation for enterprise edition must run on the server machine.

Step 1: Select License Activation Mode

On the *License Activation Mode*, select *by email (No internet connection)*.

Click *Next* to go to the *License Key* page.

Step 2: License Key

On the *License Key*, enter your license ID in the field provided. It is recommended that you copy and paste your ID to avoid problems distinguishing letters and numbers.

Click *Next* to go to *Create License Request File*.

Step 3: Create License Request File

On the *Create License Request Files* page, select one of the following:

- *Save* – To open Windows explorer to select a place to store the *license request file*.
- *Send By Email* – To open your default email client to send the *license request file*.

Click *Finish* to close the wizard.

Step 4: create license file

1. Copy the license request file to computer with internet connection.
2. Browse to Elspec *licensing website*.
3. On Elspec licensing website, click *ACTIVATE LICENSE* on the top right corner of the screen.
4. Drop the license request file into the designated window.

5. Download the license file to your local computer.

Step 5: activate the license file

Copy the license file into the PQSCADA Sapphire computer.

Launch *Upgrade License* wizard by clicking the *Setup menu* and select *Install/Upgrade* license.

On the *License Activation Mode*, do the following:

1. Select *By email (No internet connection)*.
2. Click *I have a license file* to open Windows explorer and select the license file.

Click *Close*.

Step 6 (enterprise edition only): service installation

With Enterprise edition license, PQSCADA Sapphire service installation wizard will open automatically. On the PQSCADA Sapphire service installation wizard, do the following:

1. Click *Next* on the welcome page
2. Select the installation folder and then click *Next*.
3. Click *Install* to start the installation process. Wait while the program is installing.
4. Click *Finish* to close the installation wizard.

Step 7 (enterprise edition only): create Instance DB

1. Open PQSCADA Sapphire
2. On the System module, right click the server Instance and select create DB.
3. On the Database page, configure the following options:

   DB Type – SELECT the database type in which PQSCADA Sapphire will store your data. PQSCADA Sapphire supports two DB types:

   - SQLite.
   - MS SQL server (MSSQL).

   If MSSQL was selected, configure the following options:

   - DB URL – enter the DB URL, or click the *Browse button*, to search for SQL service in your network.
   - DB user name: enter you DB user name.
   - Password: enter your DB password.
   - Check the *save as default checkbox* to keep these settings as default. You can use the *set default button*, next time to fill in the default settings.
   - Click the *Test button*, to verify the connection with the DB.
4. Click *add* to close the wizard.

11. Specifications

SPECIFICATIONS	
Voltage Inputs	4 channels, 600VAC CAT IV, 1000VAC CAT III
Current Channels	4 channels Voltage output CTs (0-10V peak)
Line Frequency	40-70Hz
Waveform Sampling	256 Sample/Cycle at 50/60Hz
Measurements	Continuous PQZ file
Accuracy	IEC 61000-4-30 Class A
LED Indicators	11 Bi-color LEDs
COMMUNICATION	
USB	PQZ file download, FW upgrade & clock setting
LAN	Available in extension module
POWER	
Power Supply	100-240VAC 50/60Hz 10W 5VDC over USB
Battery	Available in extension module
Ride through	15sec
MECHANICAL	
Operating Temperature	-20 to + 65 °C (*)
Humidity	5% to 95% non-condensing
Maximum Operation Altitude	2,000m (1.24Mi)
IP protection	IP 40 (**)
Weight	0.4kg
Dimensions	180 x 115 x 60
STORAGE	
Nonvolatile memory	SD card supporting hot swap
SYNCHRONIZATION	
Internal clock	10 ppm
External synchronization	NTP available in extension module

(*) T>60°C requires an external power supply

(**) The product is intended for indoor use