ENERGY STORAGE INVERTERS

PQstorI

Installation, operation and maintenance instructions

Table of contents

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This instruction manual is intended to assist users in installing, commissioning, operating and maintaining the PQstorI range of products. It is not backward compatible with previous generations of ABB inverters.

01 IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

DANGER: These safety instructions are intended for all work on the PQstorI range of products. Neglecting these instructions will cause physical injury or death. All electrical installation and maintenance work inside these products must be carried out by a qualified electrician.
Do not attempt to work on a powered module.

WARNING: Before manipulating current transformers, make sure that the secondary is short-circuited. Never open the secondary of a loaded current transformer. Make sure to always wear insulating gloves and eye-protection when working on electrical installations, and to meet local safety regulations.

WARNING: This equipment contains capacitors that are connected between the phase lines and the earth. A leakage current will flow during normal operation. Therefore, a good earth connection is needed and must be connected before supplying power to the module.

WARNING: Prior to servicing, disconnect the module from the power supply, wait 20 minutes to discharge capacitors and check the voltage between terminals. Never discharge the capacitors through a short-circuit. Instead, use a current limiting resistor of at least 100 Ω.

DANGER: If the system is not properly grounded, a fault in the module or in a multi-module system connected in parallel would result in full line voltage between the chassis and earth, leading to severe injury or death if both are touched simultaneously.

WARNING: The neutral current of the device may be as high as 1.5 times the line current. If a 4-pole is being used to make connections, make sure all its poles are suitably rated.

WARNING: The PQstorI is generally operated with a battery at high voltage levels. Follow safety instructions provided by your battery manufacturer.

WARNING: The equipment terminals are marked with the following symbols. Please make the connections accordingly. Refer to relevant sections in this manual for detailed information.

Symbol	Interpretation	Section
	Alternating current/ voltage (AC)	4.5.2
	Direct current/ voltage (DC)	4.5.3
	Grounding	4.5.1
	Phase connection	4.5.2

02 Getting to know your product

2.1 Product components

The PQstorI is a product of the Advanced Inverter Platform (AIP) range. Its external connection terminals and signalling features are listed in Table 1 and depicted in Figures 1 and 2. Figure 3 depicts the internal components of this product.

Table 1: External connection terminals and signals on PQstorI

Item	Component	Manual section
1	AC power supply terminal (mandatory)	Section 4.5.2
2	Main earth connection point (mandatory)	Section 4.5.1
3	CT connection terminal (optional)	Section 4.5.5
4	Manual button (start/ stop/ acknowledge fault)	Section 2.5
5	System LEDs	Section 2.4
6	Micro-USB connection for firmware update and troubleshooting	n/a
7	DIP switch to set the address of modules operated in parallel	Section 4.6.1
8	RJ12 terminals (RJ12 #1 and #2) for CAN communication between modules and to connect to the PQconnecT (CAN/ Modbus converter)	Section 4.6
9	DC power supply terminal (mandatory)	Section 4.5.3
10	Black start board	Section 4.5.4
11	Measurement of the AC voltage across 1 pole of the islanding contactor/ breaker (not functional at present)	Section 4.5.4
12	Output to control the islanding contactor/ breaker	Section 4.5.4
13	Input for the 24Vdc signal of the Emergency Stop function of the Battery Energy Storage System	Section 4.5.4
14	Input for external auxiliary 24 Vdc power supply (optional)	
15	Connector to be used for future functionalities	

Figure 1: Back connections

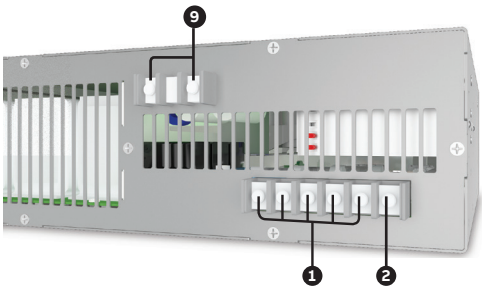
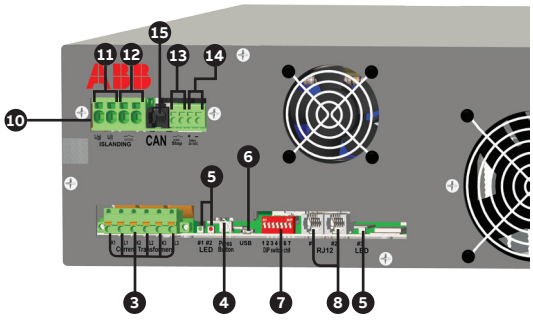


Figure 2: Front connections



2.2 Internal components

Figure 3 provides a block diagram illustrating the internal components of the PQstorI product.

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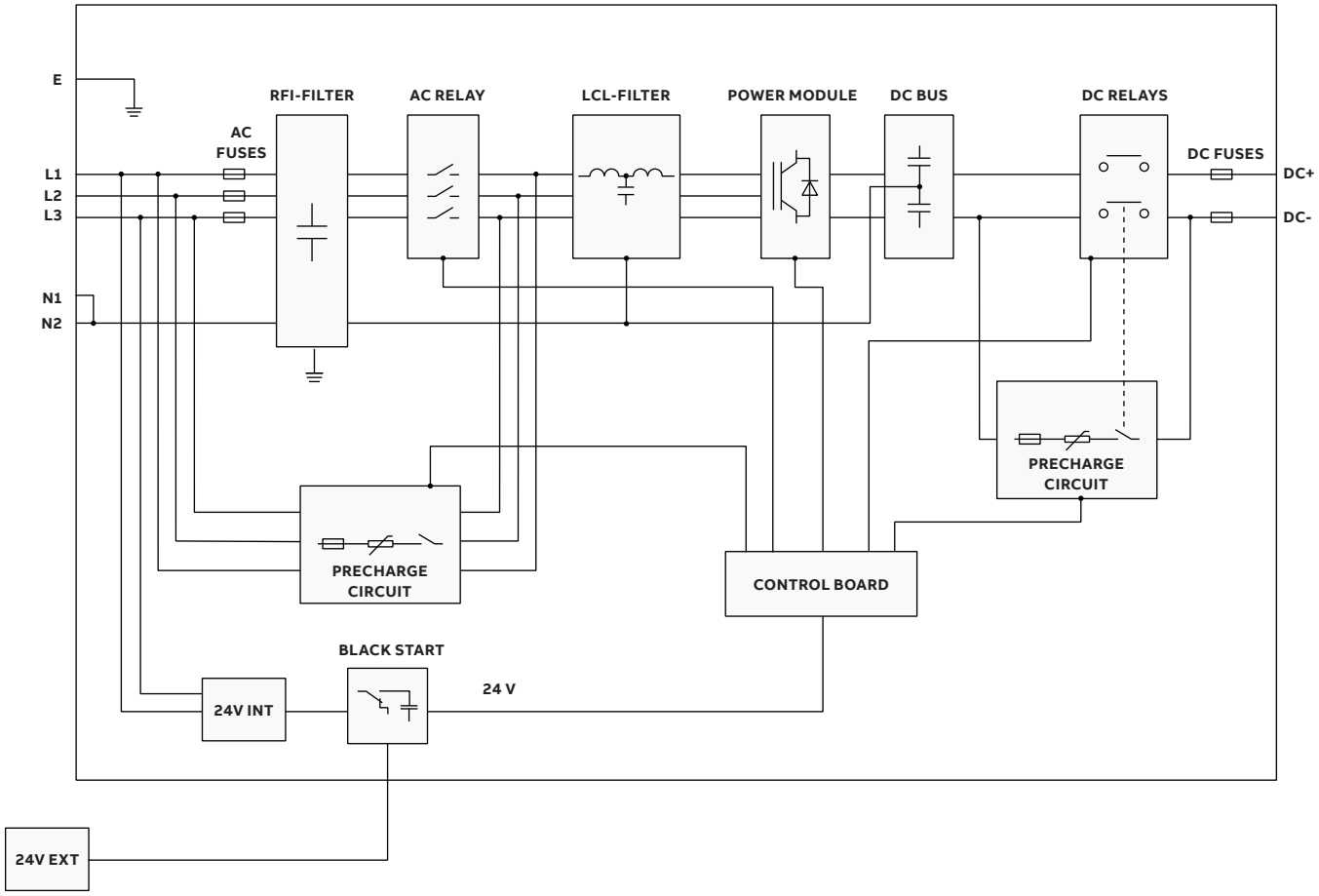
Figure 3: Block diagram of main PQstorI components



2.3 Connection diagram

Figure 4 provides a schematic overview of external connections to the PQstorI range of products. Connection terminals are detailed in Table 1 above. Mandatory connections (depicted in solid lines) are necessary for the product to operate. Non-mandatory connections (dashed lines) enhance basic functionalities.

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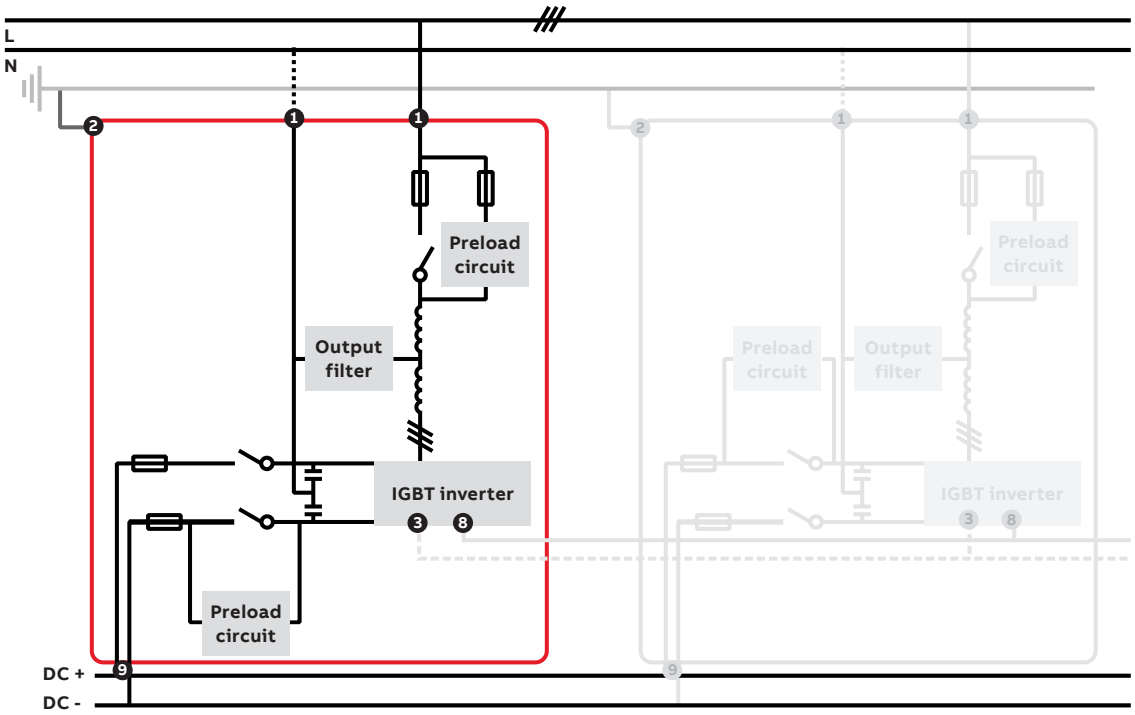
Figure 4: Schematic of PQstorI connections



2.4 LEDs

The green, red and yellow LEDs on the front of the module (❺ in Figure 2) indicate the status of the system:

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Table 2: LED signals ❺ in Figure 2

Item	Input/ output connections
Red LED on and steady	Module is off
Green LED on and steady	Module is on or starting up
Red LED blinking	Module has encountered a critical error
Green and red steady	Firmware is updating
Yellow LED blinking	Wi-Fi traffic

2.5 Button operation

The button on the front of the Module (❹ in Figure 2) starts and stops the system, acknowledges faults and resets Wi-Fi user interface settings:

- Press the button once to start the Module, stop the Module or acknowledge a system fault (see Section 3.7.3)
- Hold the button for 2 seconds to reboot the Module (simulating a power outage)
- Hold the button for 10 seconds to switch ON or OFF Wi-Fi module
- Hold the button for 15 seconds to reset the Wi-Fi user interface settings (see Section 3.8.3)

03 User interface

Users can interact with the PQstorI range of products through the standard issue Wi-Fi user interface (Section 3.1), or using Modbus commands (Section 3.2).

3.1 Connecting to the Wi-Fi user interface

Sign in to the Wi-Fi network emitted by the PQstorI using a Wi-Fi enabled device such as a computer, a tablet or a smart phone:

SSID: ABB-AIP-DEVICE [DEVICE IP ADDRESS]
Default password: AIPPASS123

Once connected to the Wi-Fi network, open an internet browser on your device and navigate to:
http://192.168.3.1/

3.2 Navigating the Wi-Fi user interface

Figure 5 shows the Wi-Fi user interface. Each page displays the status button of the system (❶ in Figure 5 - see Section 3.3), gray navigation buttons for monitoring and operating the system (❷ in Figure 5), and a table summarizing the data called by the gray navigation buttons (❸ in Figure 5).

Figure 5: Navigating the Wi-Fi user interface

To enter commands through the Wi-Fi user interface, click the '**Edit**' button at the bottom of a settings page (❹ in Figure 5), input your changes in the Value column of the settings table (❺ in Figure 6) and click the '**Save**' button (❻ in Figure 6).

Figure 6: Entering commands through the Wi-Fi user interface

WARNING: The Wi-Fi user interface will not ask for confirmation. When you click '**Save**', it will immediately send the command to the Module. Beware that inappropriate settings could hinder optimal management of the network.

3.3 Status button

The status button at the top left of the screen indicates the status of the PQstorI system. Clicking on it will turn the module on, turn the module off or acknowledge a system fault as described in Table 3.

Table 3: Status button in the Wi-Fi user interface

Item	Description
	The system is currently off, click on the status button to turn it on.
	The system is currently on, click on the status button to turn it off.
	The system has run into a fault. Click on the status button to resume its operation. Refer to 3.7.3 for details.

3.4 Measurements

3.4.1 Overview

By default, the homepage displays an **Overview** of network properties and system settings:

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Table 4: Overview of electrical network properties and system settings

Item	Description	Section
Vrms (L1-3)	RMS value of all line-to-neutral (4-wire mode) and line-to-line (3-wire mode) voltages	3.4.2
THDv (L1-3)	Total harmonic distortion on all line-to-neutral (4-wire mode) and line-to-line (3-wire mode) voltages	3.4.2
V1 (L1-3)	RMS value of the fundamental component of all line-to-neutral (4-wire mode) and line-to-line (3-wire mode) voltages	3.4.2
Frequency	Network frequency	
V dc bus	Voltage of the DC capacitor in the Module	3.4.2
Irms (L1-3)	RMS value of all line currents measured at the position of the CT	3.4.3
Irms (N)	RMS value of the neutral current (4-wire mode)	3.4.3
THDi (L1-3)	Total harmonic distortion on all line currents	3.4.3
I1 (L1-3)	RMS value of the fundamental component of all line currents	3.4.3
AIP Irms (L1-3)	RMS value of the 3 phase inverter current	3.4.4
AIP Irms (N)	RMS value of the neutral inverter current (4-wire mode)	
P	Active power on the network at the location of the CTs	3.4.5
Q	Reactive power on the network at the location of the CTs	3.4.5
S	Apparent power on the network at the location of the CTs	3.4.5
Power Factor	Ratio of true power over apparent power on the network taking into account the fundamental and harmonic values of the measurements	3.4.5
cos ϕ	Displacement power factor based on only the fundamental values of the measurements	3.4.5
T control	Temperature of the main control board in the monitored module	3.4.6
T control max	Temperature of the hottest main control board in a system of multiple modules connected in parallel	3.4.6
T IGBT	Temperature of the IGBT in the monitored module	3.4.6
T IGBT max	Temperature of the hottest IGBT in a system of modules connected in parallel	3.4.6

To examine the properties of the electrical network or the system in closer detail, or to change any of the settings displayed in Over view, click on the navigation buttons (❷ in Figure 5) and refer to the sections below.

3.4.2 Voltages
Vrms reports the RMS value of all line-to-neutral (4-wire mode) and line-to-line (3-wire mode) voltages. **THDv** is the total harmonic distortion on all line-to-neutral (4-wire mode) and line-to-line (3-wire mode) voltages. **V1** is the RMS value of the fundamental component of all line-to-neutral (4-wire mode) and line-to-line (3-wire mode) voltages. **Frequency** indicates the network frequency. **Imbalance** indicates the imbalance in the supply voltage. **V dc bus** refers to the voltage of the DC capacitor in the module and **Vdc bus max** to the highest DC capacitor voltage in a system of multiple modules connected in parallel.

Spectrum L1-3 tracks the spectrum of the voltage on each phase line. Each row of the table presents the voltage on a separate harmonic with spectral components up to the 49th order expressed in volts.

3.4.3 Line Currents
(valid only if line CTs are installed)
Irms reports the RMS value of each line current as measured at the location of the current transformers (CT). **Irms (N)** reports the RMS value of the neutral current. **THDi** is the total harmonic distortion on all line currents.

Spectrum L1-N tracks the spectrum of the current on each phase line. Each row of the table presents the current read by the module on a separate harmonic in a similar way to the table for the voltage spectrum.

3.4.4 Device Currents
AIP Irms (L1-3) reports the RMS value of the current injected into each phase line of the network and **AIP Irms (N)** reports the current injected into the neutral line.

Spectrum L1-N tracks the spectrum of the current injected into the network. Each row of the table presents the current on a separate harmonic in a similar way to the table for voltage spectrum.

3.4.5 Powers (valid only if line CTs are installed)
True power **(P)**, reactive power **(Q)**, apparent power **(S)** and the **Power Factor** module measures the power on the electrical network at the location of the current transformers.

3.4.6 Temperatures
The PQstorI measures the temperature of internal components to prevent damage from overheating. **T control** displays the temperature of the main control board, and **T IGBT** is the temperature of the IGBT in the module.

3.5 User settings

3.5.1 Start/ Stop
You can enable your module to automatically enter and come out of standby mode by modifying the Value column of the **Start/ Stop page.** Standby mode will turn off mechanical components and power electronics in the module when they are no longer needed, saving energy and prolonging the lifespan of the equipment.

Stdby status defines whether automatic standby mode is activated. **Stdby level** and **Standby hyst** define the load on the module (as a percentage) at which the module will enter and come out of standby mode. **Stdby del on** defines the interval over which the load must exceed **Stdby level** to bring the module out of standby mode. **Stdby del off** defines the interval over which the load on the module must remain below the value defined in **Stdby level** for the module to enter standby mode.

Enabling **Auto start** will allow your module to restart automatically in the event of a power outage (or any event that causes the inverter to trip). **Auto st. Del.** sets how long the module will remain off before it attempts to restart. If **Auto start** is disabled, the module will not restart automatically after a power outage.

3.5.2 Clock

Set the Clock to your local time to calibrate the time signature of events and faults when they are recorded in Events Logging (Section 3.7.3).

3.5.3 PQstorI

Define **P set point** and **Q set point** to target the real and reactive power desired on the network. The PQstorI will inject power onto the network in efforts to meet these targets.

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Figure 7: User settings for the PQstorI

AIPSettings / PQstorI

Name	Value	Unit
P set point	0	kW
Q set point	0	kvar

Edit

3.6 Installation settings

3.6.1 Network Characteristics

Set **V nominal** to the nominal phase-phase voltage on the grid and set Frequency to either 50 or 60 Hz.

3.6.2 AIP Characteristics

Set the **Connection type** to **3-wire. I Nominal** displays the current capacity of the PQstorI module.

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Figure 8: User settings for the PQstorI

InstallationSettings / PQstorISettings

Name	Value	Unit
Enable Black Start	Disabled	

Edit

The nominal power is the rated module power. Even when operating multiple modules in parallel, enter the rating for a single module (i.e. 30 kW for smaller PQstorI units).

3.6.3 CT Settings

PQstorI can measure the line currents in the main feed of the grid. These signals will be used for functionalities to be released in the future. When adopting this option, the CT Settings page of the Wi-Fi user interface will attribute each single-phase lines from the CT to a connection terminal on the module. By default, line 1 connects to **CT input [0],** line 2 to **CT input [1]** and line 3 to **CT input [2].** CT Ratio L1-3 displays the ratio of primary current on your electrical network to the secondary current running through the module.

3.6.4 Auto CT Detection

To determine the ratio and position of the CT automatically, set **StartAutoCT** to Start. Low battery voltage can reduce the Auto CT detection capability of the PQstorI.

3.6.5 Derating

At high altitude or under high temperature, you can maintain safety standards and the lifespan of your equipment by reducing its power. Set Derating to the percentage calculated in Section 5.6.

3.7 Monitoring

3.7.1 Status

Node Status[0] displays the operation status of the module. The status is described as either Ready (no action required), Fault (Section 3.7.3) or not present.

3.7.2 AIP Load

These percentages express the module load with respect to nominal ratings for the inverter DC bus bar voltage **(Udc),** the peak current of the IGBT modules **(Ipeak),** the RMS current of the IGBT modules **(Irms)** and the temperature of the IGBT **(Temperature).**

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Figure 9: PQstorI Status summarizes the state of the battery and operations of the module

AIPMonitoring / PQstorIStatus

Name	Value	Unit
Islanding Status	Connected to grid	
Battery voltage	0	V
Battery current	0	A
Black Started	No	
ESI active power	0	kW
ESI reactive power	0	kvar
ESI apparent power	0	kVA

3.7.3 PQstorI Status

Islanding Status displays shows the grid topology that the PQstorI inverter is operating. For actual version of the PQstorI only operation on grid connected is available, so that will be status shown in the AIP Monitoring window. **Battery Voltage** is the DC voltage across the battery terminals and **Battery Current** is DC current per module. **Battery Current** is displayed in **negative** numbers when **charging** and **positive** numbers when **discharging.**

Please ignore this status Black Started because the Black Start functionality is not available. **ESI active power, ESI reactive power** and **ESI apparent power** report on the power injected onto the grid by each module of the PQstorI.

Observation: Black start functionality is yet not available in this version of PQstorI.

3.7.4 Event Logging

The PQstorI log events and errors arising during their operation. The latest event to have occurred is displayed under Event error (❶in Figure 10) and its time signature (❷in Figure 10). To calibrate this time signature, refer to Section 3.5.4.

To browse through errors logged by the Wi-Fi user interface:

- Click Edit at the bottom of the table (❸in Figure 10)
- Enter an Event ID from 1-200 (❹in Figure 11)
- Click Save (❺in Figure 11)
- Read the new event and error message (❶& ❷in Figure 10)

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Figure 10: Error display in the Wi-Fi user interface

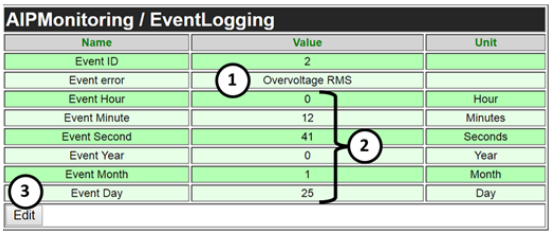

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Figure 11: Browsing through errors with the Wi-Fi user interface

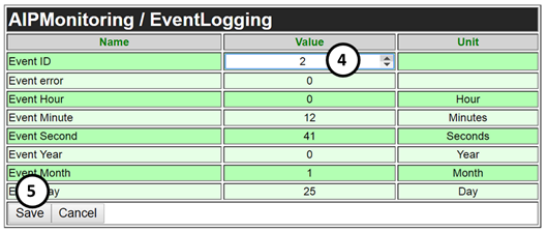

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Table 5: Overview of events

Event	Description
No event	No storable event has yet occurred
Energization	The power has been switched on
System reset	The system controller has been reset
Start request	The system has been requested to start
Stop request	The system has been requested to stop
Fault (DSP)	The DSP controller has reported a fault
Fault (uC)	The µcontroller has reported a fault
Fault cleared	A user attempted to clear a fault (by validating the 'ACK. FAULT' option on the Wi-Fi user interface)
No more fault	The system detects no more faults
Power outage	The system detected a power outage

The DSP controller and the µcontroller can both record system faults. Most faults reported by the µcontroller relate to control board failure, whereas the DSP mainly reports faults related to the installation. Table 6 and Table 7 offer an overview of faults recorded by the DSP controller and µcontroller respectively:

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Table 6: Overview of events

Name	Description	Action
Over voltage RMS	The RMS value of the supply voltage is higher than the acceptable maximum value	Disconnect from grid
Over voltage Peak	The peak valud of the supply voltage is too high	Disconnect from grid
Under voltage RMS	The RMS value of the supply voltage is lower than the acceptable minimum value	Disconnect from grid
Loss of phase	The system detected a loss of supply on at least one phase	Disconnect from grid
Wrong phase rotation	The module is fed by a supply system, which has the wrong phase rotation	Inverter trips/ reset required
Unbalanced supply	The supply imbalance is out of range	Disconnect from grid
Island detected	Unit was grid connected initially, but has detected it is currently in island while island operation is forbidden	Disconnect from grid
Bad CT connection	The automatic CT detection procedure encountered a problem during the identification process	Continue
Over frequency	The system detected that the network frequency above limit	Disconnect from grid
Unstable mains frequency	The network frequency is fluctuating too fast	Disconnect from grid
No synchronization	The system cannot synchronize with the network	Disconnect from grid
DC over voltage (SW)	The DC software over voltage protection was triggered	Inverter trips/ reset required
DC over voltage (HW)	The DC hardware over voltage protection was triggered	Inverter trips/ reset required
DC under voltage (SW)	The DC software under-voltage protection was triggered	Inverter trips/ reset required
Preload problem	The DC capacitors could not be preloaded. The voltage increase on the DC capacitors during the preload phase is not high enough	Inverter trips/ reset required
DC Top over voltage	The DC over-voltage protection of the capacitors in the positive stack was triggered	Inverter trips/ reset required
DC Bot over voltage	The DC over-voltage protection of the capacitors in the negative stack was triggered	Inverter trips/ reset required
Over current peak (SW)	The software peak current protection was triggered	Inverter trips/ reset required
Over current RMS	The system detected an RMS over-current	Inverter trips/ reset required
Global battery voltage error	The battery voltage exceeds the maximum DC voltage of PQstorI, the battery connections (+/-) are inverted or the AC voltage is high and the battery voltage (SoC) is too low, preventing the DC contactor from closing	Inverter trips/ reset required
Ground fault	Valid only in 3W, when common mode current it too high	Inverter trips/ reset required
IGBT temporary	The IGBT modules report a transient error that could be cleared by the system, possibly due to peak over-current or a control voltage too low for the IGBT drivers	Inverter trips/ reset required
IGBT permanent	The IGBT modules report an error that cannot be cleared by the system, possibly due to peak over-current or a control voltage too low for the IGBT drivers	Inverter trips/ reset required
IGBT check cooling	Software reported an IGBT over-temperature	Inverter trips/ reset required
SPI error	The DSP received no response from the SPI port	Inverter trips/ reset required
Mismatch between units	Modules in a multiple module system have different settings (e.g. 3-wire and 4-wire setting) or are connected in different ways	Inverter trips/ reset required
Under frequency	The system detected that the network frequency under limit	Disconnect from grid
Bad sequence	The DSP detected an inadequate behavior in the sequence	Inverter trips/ reset required
Bad ratings	Inconsistent set of commissioning parameters	Inverter trips/ reset required
Emergency stop	Emergency stop input has been activated	Inverter trips/ NO reset required

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Table 7: Faults reported by the microcontroller

Name	Description	Action
CAN bus off	CAN is in Bus Off mode	Continue
Ctrl over temperature	Over-temperature in the main controller board	Inverter trips/ reset required
Real time clock problem	Date or time information is corrupted	Continue
No more unit on CAN	Unit didn't receive any CAN message for 7.5 seconds while it did before	Continue
Emergency stop	External protection triggered an emergency stop (wIN24V_0Enabled=1 and digital input low)	Disconnect from grid
Preload time-out	Not existing any more	Inverter trips/ reset required
Power supply fault	Occurs each time the control board is de-energized or if for internal reason the board is not energized properly	Inverter trips/ reset required
Internal uC fault	Internal system error	Inverter trips/ reset required
µController watchdog	Internal system error	Inverter trips/ reset required
DSP timeout	DSP didn't give any feedback within 2 seconds after a start/stop request command was sent to it	Inverter trips/ reset required
Heart beat timeout	AIP has stopped upon receiving no heartbeat update for 20 seconds. The heart beat check is by default disabled but will be enabled as a heartbeat signal is first written by an external controller (EMS) on register HeartBeat (46229)	Disconnect from grid
Corrupted uC code	Internal system error	Inverter trips/ reset required
Corrupted DSP code	Internal system error	Inverter trips/ reset required
Different firmware	Different firmwares between units connected in parallel	Inverter trips/ reset required
DSP watchdog	Internal system error	Inverter trips/ reset required
SPI time-out	Internal system error	Inverter trips/ reset required
Several units same ID	Two or more modules connected in parallel have the same DIP switch address	Inverter trips/ reset required

To solve technical issues,
contact your ABB service provider at
be.bess.services@hitachi-powergrids.com.

As listed in the Table 6 and 7 there are 5 different trip modes in the case of an error.

1. Continue
2. Disconnect from grid
3. Inverter trips/ reset required
4. Inverter trips after multiple tries/ reset required
5. Inverter trips/ no reset required

For the errors identified as causing “Disconnection from grid”, the PQstorI islanding dry contact will be driven HIGH for a preset amount of time (default is 6 sec). This will cause the main BESS breaker to OPEN. When the error has cleared, the PQstorI will be in the position to power-up again once the main breaker has closed. This requires that the PQstorI has had “auto-restart” enabled.

In the case of a multiple module installations, due to the fact that the islanding dry contact is active high, it is required to connect all islanding dry contacts terminals in parallel.

For the errors identified as causing “Inverter trips/ no reset required”, the emergency stop trips the Inverter but does not require a reset.

An emergency stop can be the result of either:

- A physical action of pressing an E-stop button
- Error identified by the NS protection relay
- Other safety related functions (as required as part of the installation)

This will trip the inverters until the error has been cleared or E-Stop has been released. If “auto-restart” has been enabled, the system will start producing power again. Otherwise the start command will need to be initiated. By default, the “Auto-restart” function is disabled. It will need to be enabled during commissioning.

- Internal system errors are most likely due to faulty hardware. Before replacing components, please contact your ABB service provider
- ‘IGBT check cooling’ signals that the system stopped because it over-heated. Check the cooling fans and environmental conditions (e.g. air conditioning system). After solving the problem, acknowledge the fault and reset the system to resume operation
- Transient faults generally raise no problem for the proper operation of the system. When a fault becomes ‘critical’, action must be taken

If several grid events occur without having the inverter running normally for at least 30s, after 5 times of retries, no restart is possible until the event is permanently cleared.

Critical errors will be highlighted by the word **'Critical'** in the **'Event logging'** window. When encountered, they will cause the status button to turn yellow, requiring the user to acknowledge the fault by either clicking on the status button of the Wi-Fi user interface (Section 8) or pushing the manual button on the front panel of the module (❺ in Figure 2) before the system resumes operation.

3.7.5 Operation

AIP operation and **Fan operation** track the hours over which the equipment has run in view of maintenance operations described in Section 7.1.

3.8 System settings

3.8.1 Manufacturer Settings

AIP Size displays the current capacity of your module and **V maximum** the maximum line voltage that it tolerates.

3.8.2 About AIP

When troubleshooting, ABB may ask you for the hardware details of your product. **AIP function** indicates the model of the product in the PQStorI range. **AIP Size** displays its current capacity. **AIP Segment, Serial number, Article Number** and **Article Group** are ABB product references. **uC version[0], DSP version[0]** and **Wi-Fi version** describe the version of the microcontroller, the digital signal processor and the Wi-Fi module in the module.

When communicating with an ABB representative, please provide the data shown in About AIP.

3.8.3 User

Personalizing the Wi-Fi connection and setting up separate user profiles offer additional layers of cybersecurity to your equipment.

The User page allows system administrators to set the **Hostname, Realm, IP Address** and **Network Mask** of the Wi-Fi network emitted by the module to connect to the user interface. Set the **Wi-Fi mode** to Access Point to connect directly to the module and **Station** to connect through a router.

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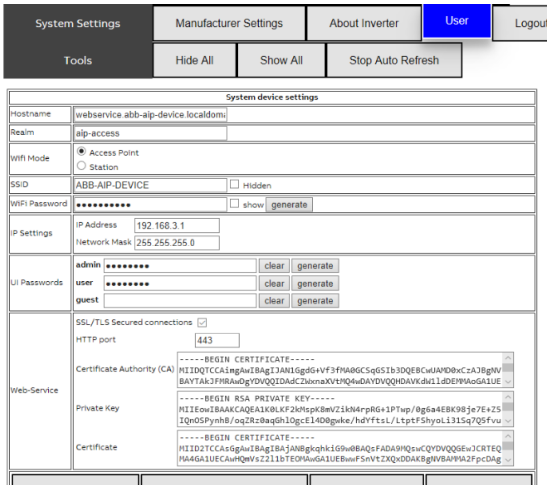
Figure 12: User settings of the Wi-Fi user interface



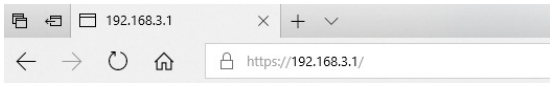
SSID modifies the name of the network displayed to nearby computers and mobile devices. For security reasons, we recommend changing the **Wi-Fi Password.** If you lose your new password, reset the Wi-Fi user interface settings by holding the button on the front panel of the module for 10 seconds (Section 2.5).

UI Passwords allow system administrators to tailor rights for different users. **Admin** can see and modify all pages in the Wi-Fi user interface. User can see everything but only modify PQStorI settings. **Guest** can only see pages but cannot modify them. By default, there is no password and all users have **Admin** rights upon connecting to the Wi-Fi network.

We recommend the admin to protect the inverter with **suitable password** during commissioning.

For an additional layer of cybersecurity, tick **SSL/TLS Secured connections** and copy the corresponding fields in the CA, private key and certificate. Once it is done , save Settings, restart Wi-Fi connection. Then the AIP can be accessed on a secured encrypted connection as shown by the https in the URL

—
Figure 12: URL to access the Wi-Fi settings



Refresh Settings will cancel user changes. **Restore Factory Settings** will revert Wi-Fi user settings to their default value. **Save Settings** will incorporate changes made on the current page. **Restart Wi-Fi** will reboot the Wi-Fi user interface.

3.8.4 Logout

Logout will terminate the connection between the Wi-Fi user interface and your computer or mobile device. The interface also logs out automatically upon closing the browser.

3.9 Modbus commands

An external controller (e.g. an Energy Management System) can be used to operate the PQstorI remotely, provided that it can communicate with the PQstorI over Modbus. Section 4.8 provides guidance on cabling the Modbus connection. The tables in this section highlight key Modbus commands used to install and run the PQstorI.

—

NOTE: All parameters with an address **starting in 3** are “Read Only”. Addresses starting in 4 point to “Read & Write” parameters.

3.9.1 Measurements

Table 8 lists Modbus commands to check the electrical network properties and system settings described in Section 3.1.4.

—

Table 8: Modbus commands for PQstorI measurements

Name	Address	Unit	Type	Register length	Range		Description
					Min.	Max.	
Ip rms L1	30621	A	Float	2	0	3000	The rms value of the inverter current measured in phase L1
Ip rms L2	30623	A	Float	2	0	3000	The rms value of the inverter current measured in phase L2
Ip rms L3	30625	A	Float	2	0	3000	The rms value of the inverter current measured in phase L3
VrmsL1L2	30501	V	Float	2	0	3200	The rms voltage measured between the phases L1 and L2 (L1 and Neutral when connected in 4 wire mode)
VrmsL2L3	30503	V	Float	2	0	3200	The rms voltage measured between the phases L2 and L3 (L2 and Neutral when connected in 4 wire mode)
VrmsL3L1	30505	V	Float	2	0	3200	The rms voltage measured between the phases L3 and L1 (L3 and Neutral when connected in 4 wire mode)
Frequency	30519	Hz	Float	2	45	75	Frequency of the supply system
Temperature Control	30703	°C/°F	Float	2	-50	300	Temperature of the main controller board
Max Temp.	30705	°C/°F	Float	2	-50	300	Highest temperature observed on control board amongst all units connected in parallel
Temperature IGBT	30707	°C/°F	Float	2	-50	300	Highest temperature observed on all phases of the IGBT
Max T IGBT	30709	°C/°F	Float	2	-50	300	Highest temperature observed on IGBT amongst all units connected in parallel

3.9.2 System monitoring

Table 9 lists Modbus commands to monitor the state of the PQstorI system. These functions are described further in Sections 3.7.1 and 3.7.3.

Table 9: Modbus commands to monitor the PQstorI

Name	Address	Unit	Type	Register length	Range		Description
					Min.	Max.	
Node Status[0]	31102	-	Word	16	0	2	NodeStatus 1 to 16: Reports the status of the unit
AIP State	31118	-	Byte	1	0	2	Status of the unit
Output Status	31123	-	Byte	1	0	0xFF	Reporting the status of 4 outputs (For instance if DC contact and DC preload closed, report 10)
Current UC Error	32801	-	Dword	2	0	0xFFFFFFFF	The current error was detected by the UC. Please refer to the description of "CurrentUCError" for the list of possible UC errors, corresponding bit is set in register
Current DSP Error	32803	-	Dword	2	0	0xFFFFFFFF	The current error was detected by the DSP. Please refer to the description of"CurrentDSPError" for the list of possible DSP errors
Islanding Status	36201	-	Dword	2	0	2	When set (1) means that unit is in Islanding mode, when cleared (0), it is in grid-connected mode (Available in the future)
Black Started	36207	-	Dword	2	0	1	When set (1), the unit is in black start condition; once it has reached the "running" state, it is cleared (0), (Available in the future)
Fault Stop Error	32866	-	Dword	2	0	0xFFFFFFFF	Stores the latest error code that has prevented the unit from restarting. If MSBit is set (0x80000000), error was detected by DSP and decoding must be taken from "CurrentDSPError", if MSBit not set, then error was detected by UC and decoding must be taken from "CurrentUCError"

3.9.3 Power monitoring

Table 10 lists Modbus commands to monitor the power on the network and injected by the PQstorI. These function are described further in Sections 3.4.5 and 3.7.3.

Table 10: Modbus commands to monitor the power injected by the PQstorI onto the grid

Name	Address	Unit	Type	Register length	Range		Description
					Min.	Max.	
ESI Active Power	30811	kW	Float	2	-3200	3200	Inverter active power
ESI Reactive Power	30813	kvar	Float	2	-3200	3200	Inverter active power
ESI Apparent Power	30815	kVA	Float	2	-3200	3200	Inverter active power

3.9.4 Battery monitoring

Table 11 lists Modbus commands to monitor the energy storage system operated by the PQstorI. These function are detailed further in Section 3.7.3.

Table 11: Modbus commands to monitor the state of the battery

Name	Address	Unit	Type	Register length	Range		Description
					Min.	Max.	
Battery Voltage	36203	V	Float	2	-3200	3200	DC voltage (V) on DC output of inverter (= Battery voltage)
Battery Current	36205	A	Float	2	-3200	3200	DC current (A) on DC output of one unit inverter (= Battery current), positive when discharging the battery
Udc (Inverter DC voltage)	30523	V	Float	2	0	3200	The DC voltage present on the inverter DC bus

3.9.5 PQstorI commands

Table 12 lists Modbus commands to operate the PQstorI. These functions are described in further detail in Section 3.5.5.

Table 12: Modbus commands for operating the PQstorI

Name	Address	Unit	Type	Register length	Range		Description
					Min.	Max.	
Start request	44611	-	Word	1	0	1	Must be set (1) to start unit, provided no error is currently present
Stop request	44612	-	Word	1	0	1	Must be set (1) to stop the unit or prevent if from restarting as soon as the error has disappeared
Reset fault	44613	-	Word	1	0	1	Must be set (1) to acknowledge the fault that has caused the unit stop
Set P	46201	kW	Float	2	-3200	3200	Active power (kW) to be injected into the grid (when in current source mode). Positive target means discharging
Set Q	46203	kvar	Float	2	-3200	3200	Reactive power (kvar) to be injected into the grid (when positive, inverter behaves like a capacitor)
Heart beat timeout	46229	-	Word	1	0	0xFFFF	Heart beat signal: Once modbus client has set it to non-zero value, it must change it every 20 seconds at least otherwise the inverter will stop and generate a heartbeat fault. By default heartbeat is not active

NOTE: For grid code related parameters, please refer to the PQstorI Grid Code Functionality Manual and PQstorI Modbus table.

04 Installation

4.1 Upon reception

Before installing the PQstorI make sure that:
- The packaging used for delivery is in good condition
- There are no signs of transportation damage
- Your package also contains a communication cable to operate modules in parallel

Notify any loss or damage to these items immediately to your ABB representative.

4.2 Location

Make sure that you transport, store and operate the product within the range of temperature, humidity and environmental contaminants set out in Table 13. Install the module in a location free of conductive dust that may damage the equipment.

4.3 Identification tag

Each PQstorI is fitted with identification nameplates on its front panel detailing the product model, nominal voltage range, network frequency, serial number and ABB internal article code.

Table 13: Ambient conditions for operation and storage

Name	Storage	Operation
Altitude		Nominal output at 0 to 1000 m (3300 ft) above sea level
Temperature	-25 to 70°C (-13 to 158°F)	-10 to 40°C (23°F to 104°F)[a]
Relative humidity	Max. 85%	Max. 95% non-condensing
Contamination levels (IEC 60721-3-3)	Chemical class 3C3	Chemical class 3C1[b]
	Mechanical class 3S3	Mechanical class 3S1[c]

[a]Up to 50°C (122°F) with auto-derating
[b]Locations with normal levels of contaminants, experienced in urban areas with scattered industrial activity or heavy traffic.
[c]Locations with no special precautions taken to minimize the presence of sand or dust.
The product weighs approximately 20 kilograms and can be lifted by hand by two people. It must be installed indoors under IP20 standard protection class when fitted in cabinets. Its operation emits below 61 dBA of noise at one meter of the module.

4.4 Mechanical installation

The PQstorI range of products can be installed either in a cabinet or mounted on a wall as illustrated in Figure 14.

—
Figure 14: Mounting modules on the wall

Fix the mounting kit by tightening 12 screws to the side panels of the module and screw the mounting kit to a wall that can support over 20 kilograms of electrical equipment. You can order wall installation kits from your ABB supplier.

For cabinet assembly the clearances below must be followed:

- Front of the inverter: minimum of 600mm (radius of the front door of the cabinet/ minimum corridor width for passage of personnel)
- Rear: 200mm if no forced air flow in place (horizontal air flow)
- Air flow requirement: 266m³/h per unit needed when using forced airflow (vertical airflow)

4.5 Electrical connections

WARNING: The PQstorI range of products can tolerate network voltages of up to 415 V for a 3-wire configuration. Never connect these products to a network that will sustain extended periods of over-voltage (+10%).

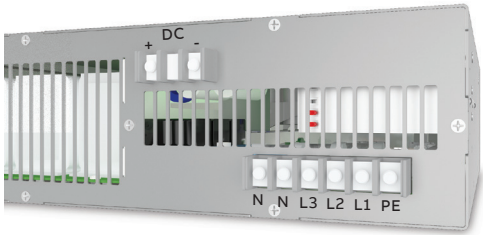
Only copper cables rated for 75°C or above are allowed to be used for the power cabling of the inverter. The maximum cable size that can fit into these terminals is 25 mm².

The wiring methods for electrical installation of the inverter shall be in accordance with the National Electrical Code and with ANSI/NFPA70.

4.5.1 Earth connection

Ground the PQstorI connecting an earth cable with an appropriate cross-section (minimum 10 mm²) to the ground terminal (PE) on the back of the module (Figure 15). Tighten its screw to a torque of 3 - 5 N.m.

—
Figure 15: Earth, AC and DC power connection to the PQstorI



4.5.2 Power supply (AC)

Connect the module to an AC power supply by screwing power cables of an appropriate cross-section to each phase-line terminal on its back panel (Figure 15). Tighten each screw to a torque of 3 - 5 N·m.

Make sure that the voltage phase rotation at the power supply remains clockwise (L1 (R, U) -> L2 (Y, V) -> L3 (B, W) -> L1 (R, U)).

WARNING: For safety reasons, when using a phase rotation meter, the phase rotation must be measured at the upstream protection level and not in the module itself. The internal power connections of the PQstorI inverter are isolated from the earthing. Thus, it is installer's responsibility to ensure that the AC supply system is earthed and an earth cable must be connected in the inverter's earth terminal

When powered, the module will automatically check the phase rotation. If the power cables are connected incorrectly, the module will not start, the status button of the Wi-Fi user interface will turn yellow (Section 4.1.3) and a message indicating wrong phase rotation will appear in Event Logging (Section 4.1.7.3). Correct the phase rotation before supplying power to the module to avoid a potential malfunction or damage to the equipment.

4.5.3 Battery

Connect the battery to the DC terminals on the back of the PQstorI. Make sure that the positive (+) terminal of the inverter is connected to the positive (+) terminal of the battery (Figure 16). Inverting the polarities will result in the error message Global Battery Voltage Error (Section 4.1.7.4).

The PQstorI requires no external DC protection. However, follow instructions provided by the battery supplier for any protection needed by the energy storage system and make sure that the installation meets local regulations for cable protection.

Do not ground the battery terminals.

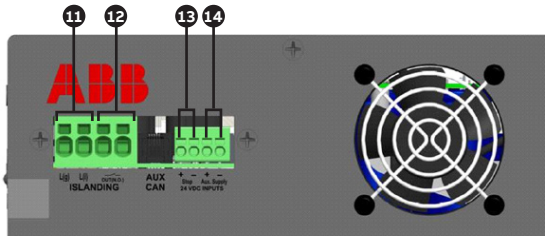
4.5.4 Black start board

The inverter has a board (10 in Figure 2) with terminals that interface with customer's system in the matter of grid code compliance in some countries. This board is called as "blackstart board" as it is intended to be used in the future for black start/ islanding functions (not available yet).

The black start board includes supercaps to enable the inverter to ride through low voltage interruptions while still providing energy for the control circuit without the use of an external 24Vdc supply (minimum 15sec holdup with fault repetition less than 5 sec depending on the voltage depth). This function is comply with grid code requirements (LVRT).

The black start board enables parallel connection of a 24Vdc emergency stop signal (terminals 13 in Figure 16 – MUST CONNECT) which interconnects via the NS protection relay to comply with some grid code requirements. Under normal operation the inverter must receive a 24Vdc signal between the terminals and, in case of an emergency stop, the 24Vdc shall go to 0Vdc and the inverter has its E-Stop function activated.

Figure 16: Black start board



WARNING: Even if the e-stop function is not required by local grid code, this e-stop connector **must be wired with 24 Vdc.**

The blackstart board enables connection of an external 24Vdc supply for extended low voltage interruption beyond 15 seconds where it may be required by local grid code requirements. Note that with the external 24Vdc supply connected, the supercaps of the black start PCBA are not charged.

It also includes an islanding dry contact (terminals 12 in Figure 16) for the main BESS breaker to trip in an event of an active islanding detection by the inverter. This function is also part of some grid code requirements and might be connected when applicable. The terminals 11 are not functional and will be used for future functionalities of the PQstorI inverter.

NOTE: The terminals 12 are suitable for cables with cross-section from 0.5 mm² (20AWG) to 10mm² (8AWG). Only copper cables rated for 75°C or above are allowed to be used. The terminals 13 and 14 are suitable for cables with cross-section from 0.5 mm² (20AWG) to 2.5mm² (14AWG). Only copper cables rated for 75°C or above are allowed to be used.

Table 14: Connection terminals on the black start board

	Components of the black start board
11	Measurement of the AC voltage across 1 pole of the islanding contactor/breaker (not functional at present)
12	Islanding dry contact to control the main breaker
13	Input for the 24Vdc emergency stop signal (mandatory)
14	Input for 24 Vdc power supply for extended low voltage interruption (optional)

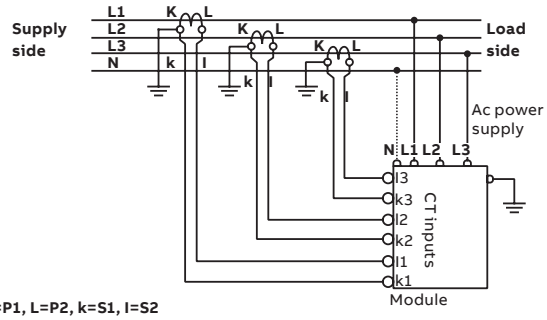
4.5.5 Current transformers (optional)

The purpose of the connection with current transformers is to allow the use of power quality functionalities that will be available in the future. Due to that, the connection with CTs is not mandatory yet.

WARNING: Only a qualified electrician should perform the operations described in this section.

Connect a current transformer (CT) to each phase line of the network as described in Figure 17.

Figure 17: Basic CT connection diagram

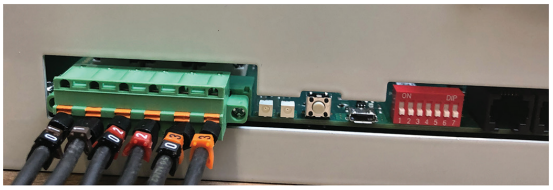


K=P1, L=P2, k=S1, I=S2

The operating conditions of the PQstorI require class 1.0 X/ 5A CT that can withstand 15 VA over 20 meters of 2.5 mm2 (14AWG) cables. Insert each CT wire into the appropriate pole of the spring-contact female plug on the front panel of the module (Figure 18).

NOTE: The CTs terminals in the inverters are suitable for 0,5mm² (20AWG) to 4mm² (12AWG), 75°C, copper conductors only.

Figure 18: CT connections to the module



4.6 Addressing the module

The inverter has a DIP switch that allows to define a unique binary address to the unit. The DIP switch is located on the front panel of the inverter (❼ in Figure 2).

The first four switches on the left of the DIP switch module can be moved to ↑ or ↓ positions to assign this binary address (see Table 15).

Switch 7 determines the CAN termination of the module. Set it to ↑ for the last module in the system and to ↓ for all others.

Table 15: Possible DIP switch settings

Address	DIP switch position				
	1	2	3	4	7
1	↓	↓	↓	↓	↓
2	↑	↓	↓	↓	↓*
3	↓	↑	↓	↓	↓*
4	↑	↑	↓	↓	↓*
5	↓	↓	↑	↓	↓*
6	↑	↓	↑	↓	↓*
7	↓	↑	↑	↓	↓*
8	↑	↑	↑	↓	↓*
9	↓	↓	↓	↑	↓*
10	↑	↓	↓	↑	↓*
11	↓	↑	↓	↑	↓*
12	↑	↑	↓	↑	↓*
13	↓	↓	↑	↑	↓*
14	↑	↓	↑	↑	↓*
15	↓	↑	↑	↑	↓*
16	↑	↑	↑	↑	↑

* Set the switch 7 to ↑ for the last module in your system and to ↓ for all others.

The Wi-Fi user interface communicates with the module that has the lowest address in the

WARNING: Failing to set switch 7 properly will lead to malfunction and damage the equipment.

4.7 Modbus

An external controller (e.g. an Energy Management System) can be used to operate the PQstorI remotely, provided that it can communicate with the PQstorI over Modbus. To establish this connection, plug an Ethernet cable with an RJ45 connector (not provided, use Cat5e or more advanced) to the PQconnecT as illustrated in X of Figure 19. For a list of key Modbus commands used to operate the PQstorI, refer to Section 3.2.

Figure 19: PQconnecT and Modbus connection

05 Commissioning

Perform the following commissioning procedure after the first installation of your product.

5.1 Installation check

WARNING: Before checking the installation, make sure that the module is isolated from the electrical network. In systems of multiple modules connected in parallel, ensure that each module is disconnected from the power supply.

- Make sure that the module is installed in a location where no conductive dust is present and that it conforms to tolerable altitude, temperature and environmental conditions (Table 13). If these limits are exceeded, see Section 5.5 on derating the system
- Ensure that adequate upstream electrical protection is provided
- Check the product for visible damage (e.g. from transport)
- Check that the installation fulfills requirements set out in Section 4, notably:
  - Check the tightness of connections, including power cables, grounding, battery connections, optional CT connections and RJ12 CAN bus communication connectors, as well as connection terminals of the blackstart board, if used (see Section 4.5)
  - Check the cross-section of cables (Section 4.5).

WARNING: Before powering the PQstorI make sure that it is not mechanically or electrically damaged and that it can tolerate the voltage on the electrical network.

Close the upstream protection for powering the module. If the cabling is correct, the red status LED on the front panel of the module (❺ in Figure 2) will turn on.

Log onto the Wi-Fi user interface (Section 3.1.1).

5.2 Network characteristics

Navigate to the **Network Characteristics** page of the Wi-Fi user interface (Section 3.6.1) and set the **nominal network voltage** and **network frequency** of the electrical network (Figure 20).

Figure 20: Configuring PQstorI network characteristics

InstallationSettings / NetworkCharacteristics

Name	Value	Unit
V nominal	400	V
Frequency	50	Hz

The inverter is suitable to operate with a voltage +/-10% of nominal voltage, +/-7% of nominal frequency, without grid code compliance.

In case of requirement to comply with any local grid code, please contact ABB.

5.3 AIP characteristics

Navigate to the **AIP Characteristics** page (Section 3.6.2) of the Wi-Fi user interface and enter the connection mode of the system as either 3-wire (only phase lines are connected) or 4-wire (neutral is also connected). The 4w operation is a feature that still is not available for normal use in the inverter. Modules are rated in terms of their current at 400 V (i.e. a 30 kW rated module corresponds to 40 A, 80 kW to 120 A and the 100 kW to 150 A respectively).

Figure 21: Configuring PQstorI characteristics

InstallationSettings / AIPCharacteristics

Name	Value	Unit
I Nominal	40	A
Connection type	3W	
Edit		

5.4.1 Automatic detection

Navigate to the **Auto CT Detection** page (Section 3.6.4) of the Wi-Fi user interface and set **bStartAutoCT** to 1 to determine the ratio and position of your current transformers automatically.

—

Figure 22: Configuring PQstorI characteristics

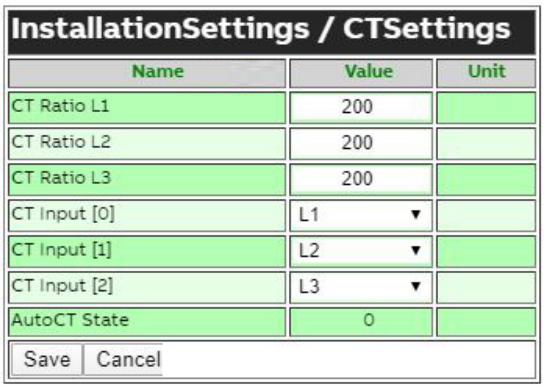
If **Auto CT Detection** fails to identify the appropriate CT ratio and position (as can occur for instance in weak networks with high impedance), amend the CT ratio in **CT settings** manually (Section 5.4.2).

5.4.2 Manual input

If **Auto CT Detection** fails, navigate to the **CT settings** page (Section 3.6.3) of the Wi-Fi user interface and set the CT ratio and position for each phase line.

—

Figure 23: Entering the CT ratio manually



5.5 User settings

Navigate to the **Start/ Stop** page and set the conditions under which your PQstorI will automatically enter and come out of standby mode (Section 3.5.1).

Navigate to the **Start/ Stop** page and set the Clock to accurately record the time-signature of error messages and events (Section 3.5.4).

Navigate to the **PQstorI** page and set the real and reactive power set points that you want the module to follow.

5.6 Derating

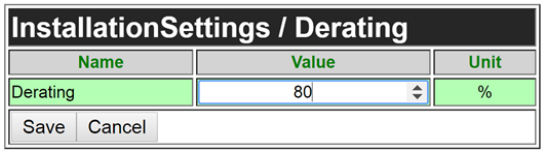
If the PQstorI is operating under environmental conditions outside the range described in Table 13, derate the system accordingly:

- At altitudes higher than 1000 meters (3300 ft) above sea level, derate the maximum output current of the module by 1% for every additional 100 meters (330 ft)
- Above 40°C (104°F), auto-derating reduces the maximum output current by 2% for every additional 1°C (1.8°F). Maximum allowed ambient temperature is 50°C (122°F)

Failing to derate the system risks leading to malfunction and could damage the equipment.

—

Figure 24: Derating the PQstorI



Navigate to the **Derating** page (Section 3.6.5) of the Wi-Fi user interface and set the Derating factor to the percentage calculated above.

5.7 Ethernet configuration

It is possible to operate PQstorI inverter through Modbus TCP/IP protocol over Ethernet interface. This can be done through the PQconnecT Modbus/CAN converter. For more information about the use of this component, please refer to the product's manual.

5.8 Open ports

WiFi's web server uses:
- Port 80 when SSL/TLS is not required
- Port 443 when SSL/TLS is used

HMI uses:
- Port 502 on the Ethernet connection (Modbus protocol)

5.9 Cyber security disclaimer note

This product is designed to be connected to and to communicate information and data via a network interface. It is user's sole responsibility to provide and continuously ensure a secure connection between the product and user network or any other network (as the case may be). User shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB Ltd and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

5.10 Commissioning report

Consult the annex of this manual for an overview of commissioning steps for the PQstorI.

06 Operation

6.1 Starting and stopping

To start the PQstorI, either press the manual button on its front panel (❺ in Figure 2) or log on to its Wi-Fi user interface (Section 6) and activate the green status button at the top left of the screen (Section 8). To stop the system, press the manual button again or activate the red **status button** in the Wi-Fi user interface.

6.2 Current and voltage measurements

To track the current and voltage on each line on the electrical network, navigate to the **Voltages** and **Line Current** pages of the Wi-Fi user interface as described in Sections 3.4.2 and 3.4.3 respectively.

6.3 Checking system faults

To consult system errors and important events encountered in the operation of the PQstorI, navigate to the Event Logging page of the Wi-Fi user interface and browse through its records as described in Section 3.7.3.

6.4 Retrieving manufacturer data

To consult the manufacturer details of your product, navigate to the About PQstorI page of the Wi-Fi user interface and choose among the options described in Section 3.8.2.

07 Maintenance

Regular maintenance will extend the lifespan of your equipment.

WARNING: All maintenance operations inside the PQstorI range of products should be undertaken by a qualified electrician and performed only when the equipment is off and de-energized. Before touching the exterior of the module, check for voltage between its terminals and the ground. Internal components are isolated but damage to the equipment could charge external surfaces and cause serious harm when touched.

Before opening the module, always wait 20 minutes after disconnecting its power supply for capacitors to discharge.

7.1 Maintenance intervals

Table 16 describes the frequency with which maintenance operations should be performed.

Table 16: Recommended maintenance intervals

Maintenance	Interval	Instructions
Check system faults	Constantly	3.7.3
Cleaning	12-24 months (depending on nearby dust and dirt)	7.3
Tightening screws	12-24 months	7.3
Change cooling fan	40,000 hours of operation	7.4

7.2 Check system faults and operating hours

Navigate to the page on Event Logging of the Wi-Fi user interface to check for recent errors (Section 3.7.3).

Navigate to the **PQstorI Operation** page of the Wi-Fi user interface and check the hours of operation of the cooling fan (Section 3.7.5). If the cooling fan has operated over 40,000 hours, refer to Section 7.4.

Navigate to the **Filter Load** page of the Wi-Fi user interface and check the **Temperature** of the system for overheating (Section 3.7.2).

If your PQstorI operates in a multi-module system, navigate to the **Status** page on the Wi-Fi user interface and check the operating status of each module (Section 3.7.1).

7.3 Cleaning and tightening screws

WARNING: Before touching the exterior of the module, make sure that the equipment is turned off and check the voltage between its terminals and the ground. Internal components are insulated but damage to the equipment could charge external surfaces and cause serious harm when touched.

Clean dust and residues near the module and close to the fan outlet. Check wires and connection terminals for corrosion. Tighten screws connecting power cables and the module to a torque of 2 N·m.

7.4 Replacing the fan

WARNING: Only a qualified electrician should replace the fan inside the module. Only replace the fan when the equipment is turned off and fully de-energized. Wait 20 minutes after disconnecting the equipment for capacitors to discharge.

Replace the fan on your module if it has been damaged, if the system is overheating or after 40 000 hours of operation. You can order fan replacement kits from your ABB supplier.

To replace the fan:

- Unscrew the three screws on the front cover of the module as displayed in Figure 25
- Take out the old fan, disconnect its power socket
- Screw the new fan in, orienting it to evacuate hot air out of the module
- Plug the new fan into the power socket
- Replace the front cover of the module as displayed in Figure 25
- Reset the fan operating hours on the Wi-Fi user interface (Section 3.7.5)

7.5 Troubleshooting

To solve technical issues,
contact your ABB service provider at
be-bess.services@hitachi-powergrids.com

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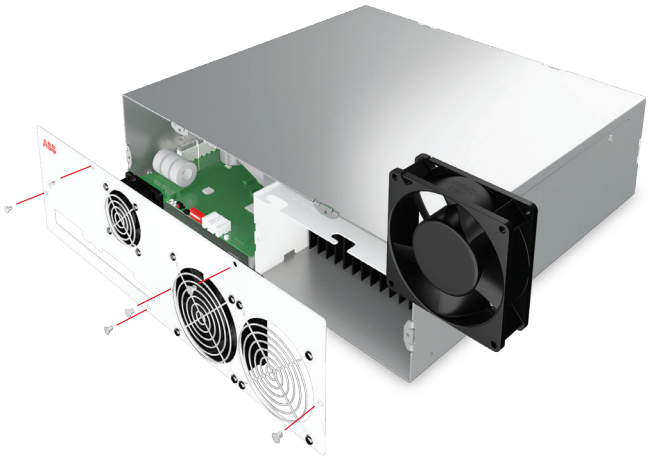
Figure 25: Replacing the fan



08 Technical specifications

Specifications	PQstorI - M	PQstorI - WM
	Module	Wall-mounted
Electrical characteristics		
AC grid tied connection side		
Connection method	3P3W+PE	
Network voltage (+/ - 10%)	208 - 415 V	
Network frequency (+/ - 5%)	50/ 60Hz	
Rated power (at 400 V)	30 kW	
Line current rating per base unit (A)	43 A	
DC Energy souce connection side		
DC voltage (min)	620 V for 3 W application[1]	
DC voltage (max)	830 V (890 V with reduced power)	
DC current	52A	
Environmental specifications		
Ambient temperature	-10°C to 40°C (up to 50°C with auto-derating)	
Storage temperature	-25°C to 70°C during storage	
Cooling	Forced air ventilation (replaceable fans)	
Humidity	Max. 95% non-condensing during operation	
	Max. 85% non-condensing during storage	
Pollution Degree	PD2	
Overvoltage Category	OVC III (AC)	
	OVC II (DC)	
Altitude	Indoor installation in clean environment at 1000m (upto 5000m with derating)	
IP protection	IP20 from front access	IP30
Noise	< 61dB @ 1m	
Performance specifications		
Efficiency	typically 98%	
Equipment losses	<2% of the equipment power typically	
Voltage accuracy	< ± 1%	
Output THDi	≤ 3%	
Power factor	1 to -1, capacitive to inductive, continuously adjustable	
Frequency accuracy	< ± 0.01Hz	
Power accuracy	< ± 2% kW/ kVar	
Overload capability	None	
Inverter technology	Three level inverter	
Switching frequency of semiconductors	18 kHz	
Parallel operation	Up to 16 modules can be combined Different module ratings are allowed	
Redundancy	Any unit can become a master (defined as the lowest ID that is operational)	
	In case of failure, other unit takes the lead as master	

Specifications		PQstorI - M	PQstorI - WM
		Module	Wall-mounted
Interface/ communication			
Wi-Fi communication		Webserver on smartphone or computer for simple diagnostics and parameters setup	
USB		With dedicated optional software (servicing/ programming)	
RJ12		For CAN bus communication between PQconnecT and other modules	
CT inputs		3 ph CT measurements (class 1.0 or better, 15 VA)	
2x 24Vdc inputs		1 for emergency stop	
		1 for external supply	
230Vac Relay output		For control of external grid contactor/ breaker	
PQconnecT	Dimensions (W x D x H)	78 x 25 x 94 mm	
	IP protection	IP 20	
	Communications	CAN: RJ12 - 500 kbit/s or 1 Mbit/s	
		Ethernet: 10/100 Mbit, full or half-duplex, HP Auto-MDIX support	
	I/O	1 relay output, normally open, 5 A / 30 VDC	
Mechanical aspects			
Mounting	Modules, suitable to integrate into a cabinet on draws or as part of a rack system with push connectors		Wall-mounted
Dimensions (W x D x H)	435 x 459 x 130 mm		438 x 199 x 517 mm
Color	-		Surface treated metal frames
Fixation	Special kit allows module to be integrated into cabinet		via wall-mounting kit
Cable entry	Rear for power cables		Top for power cables
	Front for control cables		Bottom for control cables
Compliance with standards			
General construction and safety aspects for PQstorI - M		EN 62477-1 (2012) "Safety requirements for power electronic converter systems and equipment"	
EMC immunity (CE version only)		EN/IEC 61000-6-2, Industrial level	
EMC emissions (CE version only)		EN/ IEC 61000-6-4, Class A	
Certification		CE	
		VDE-AR-N 4105:2018-11	
		VDE-AR-N 4110:2018-11	
		ENA-EREC G99 (2019)	
		TF 3.3.1	
		EN50549-1: 2019	
		EN50549-2: 2019	

[1] Limited high voltage ride through support at lower DC voltages

09 Annex - Commissioning report

		Project:		
PQstorI		Issued by:		
Commissioning report		Date:		Page 1 of 6

9.1 Module identification

Product type[a]				
Global ratings[a]	Maximum voltage (V)			
	Total current (A)			
System serial number[a]				
Module connection mode (3-W)				
Module ratings/serial number[a]		Rating (A)	Serial number	Article code[a]
	Module 1 (M)			
Software version[b]				
	Wi-Fi user interface			
	µcontroller software			
	DSP software			
Installation location				

Remarks:

[a]Read from main identification tag located on the master enclosure (see Section 4.3).

[b]Navigate to the About AIP page of the Wi-Fi user interface (see Section 3.8.2).

[c]Select whether this module is a master (M) or a slave (S).

	Project:	
PQstorI	Issued by:	
Commissioning report	Date:	Page 2 of 6

9.2 Inspection on site – verification after installation

Ambient conditions	**OK/ NOK**
Check the ambient temperature (< 40°C/ 104°F) (if > 40°C/ 104°F, derating is required)	
Check the installation altitude (< 1000m/ 3300 ft) (if > 1000m/ 3300 ft, derating is required)	
Check the ventilation (room and enclosure)	
Ensure that no sources of conductive dust are present	
Upstream cabling and protection	
Upstream protection installed	
Check cross-section of power supply cables (L1 - L2 - L3)	
Check cross-section of protective conductors (PE) connected to each enclosure.	
Earth interconnection between the different modules installed	
Check the setting and operation of the protective apparatus	
Check tightness of conductor fixations	
The material of terminals and conductors must be compatible (corrosion)	
Installation[(a)]	
Check the voltage in accordance with specifications	
Check that the phase rotation order is clockwise (with filter auxiliaries off)[(b)]	
Check visually the current transformers	
- Ratio	
- Installed at correctly (for open or closed loop)	
Remove all jumpers of all current transformers (CTs and SCTs)	

Remarks:

[(a)]Refer to Section 4.6 of the manual for further information on this topic.

[(b)]Refer to Section 4.5.3 of the manual for further information on this topic.

	Project:	
PQstorI	Issued by:	
Commissioning report	Date:	Page 3 of 6

9.3 Programming

Apply voltage to the module[a]	
Apply voltage to the module (restore upstream protection)	
Connect to Wi-Fi user interface, start the module, status button turns red	
Fans start running	
Program equipment[b]	
Network characteristics	
- Supply voltage (V)	
- Supply frequency (Hz)	
- Synchro mode (should normally not be changed, default value is Single ph.)	
Ratings	
- Connection mode (3-wire)	
CT position and ratio	
- Automatic detection feature used	YES/ NO
- Module terminal 'Input 1' is connected to the CT (including sign)[a]	Line 1, 2, 3, -1, -2, -3
- Module terminal 'Input 2' is connected to the CT (including sign)[a]	Line 1, 2, 3, -1, -2, -3
- Module terminal 'Input 3' is connected to the CT (including sign)[a]	Line 1, 2, 3, -1, -2, -3
- Ratio of CT installed in line L1 (R, U)	
- Ratio of CT installed in line L2 (Y, V)	
- Ratio of CT installed in line L3 (B, W)	
Derating factor (temp > 40°C/ 104°F or altitude > 1000m/ 3300ft or…)	
- Derating (%)	

Remarks:

[a]Refer to Section 4.5.3 of the manual for more information on this topic.

[b]Consult the manual provided with the HMI installation kit (sold separately).

		Project:		
PQstorI		Issued by:		
Commissioning report		Date:		Page 4 of 6

9.4 Testing (with battery)

Before starting the system	**OK/ NOK**
Execute the commissioning procedures specified by the batteries manufacturer	
Start the system[(a)]	
While the system is running[(b)]	
Set the '**P setpoint**' to -5 kW. It will charge the batteries at -5kW	
Check the current of the inverter	
Check the power absorbed by the inverter	
Check the batteries voltage through the BMS	
Check the batteries current through the BMS	
Set the '**P setpoint**' to 0	
Check the current of the inverter. Shall be 0	
Set the '**P setpoint**' to 5kW.It will discharge the batteries at -5kW	
Check the current of the inverter	
Check the power absorbed by the inverter	
Check the batteries voltage through the BMS	
Check the batteries current through the BMS	
Set the '**P setpoint**' to 0	
Set up the user requirements for harmonics and reactive power/ balancing	
Check the line currents (Irms, THDI and waveforms)	
Check the line voltage (Vrms, THDV and waveforms)	

Remarks:
[(a)]Refer to Section 3.3 of the manual for more information on this topic.
[(b)]Refer to Section 6 of the manual for more information on this topic.

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NOTE: During the load test with the batteries keep the monitoring of the batteries parameters to avoid any value be out of proper range of operation.

PQstorI

Project:

Issued by:

Commissioning report

Date:

9.5 Programmed parameters

Alarms
Prog. alarms
Prog. alarm 1
Prog. alarm 2
Prog. alarm 3
Alarm delay
Alarm rst. del.

Warnings
Warning levels
T. IGTB warn.
T. crtl. warn.
V. min. warn.
V. max. warn.
Imbalance
Ground fault

Start - Stop Settings
Stdby status
Standby level
Stdby del. off
Standby hyst
stdby del con
Auto start
Auto st. del.

Prog. Warnings
Prog. warn. 1
Prog. warn. 2
Prog. warn. 3
Warning delay
Warn. rst. del.

9.6 Comments

	Commissioning Engineer	**Customer's representative**
Name		
Signature		
Date		

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9AKK107046A8909 - REV C 09.10.2020