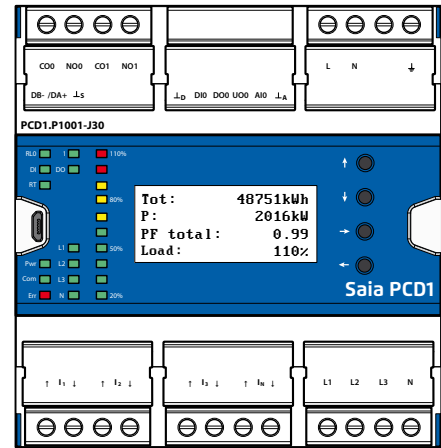sbc✚

**SAIA BURGESS CONTROLS**

# PCD1.P1001-J30

## E-Line PQA 110-230 VAC
## RS-485

The Power Quality Analyser (PQA) is a device for measuring and checking the quality of the electricity system, produced as a DIN rail device in industrial quality. The compact construction of the E-Line design helps save space when installed in electrical junction boxes. With a wide range of measurement options, it enables analysis of all kinds of parameters with cyclical or event-oriented data recording and automatic alerting should a measured value be outside the tolerance limit. The integrated RS-485 interface is available in S-Bus/Modbus and enables communication with a Saia PCD® controller or other master devices. A comprehensive FBox library with web templates makes the engineering quick and highly efficient.

## Features

▶ Power quality analyser with 0.5 % measurement accuracy
▶ Measures the 3 phases and the neutral line
▶ Current measurement inputs for transformer connection
▶ Measured data (event/cyclical) saved on internal memory
▶ 1.9 inch LCD display
▶ Galvanically isolated measurement inputs
▶ Temperature measurement input
▶ Galvanically isolated RS-485 interface for S-Bus/Modbus (switchable)
▶ 105 mm wide DIN rail devices (6 units)

## General technical data

### Power supply

| | |
|---|---|
| Supply voltage (separate supply) | 110–230 VAC, +15 % –20 %, 50/60 Hz |
| Galvanic isolation | 4,000 VAC between power supply, RS-485, digital part and the measuring inputs |
| Power consumption | Typical: 1.5 W<br>Max.: 6 W |

### Interfaces

| | |
|---|---|
| Communications interface | RS-485 with galvanic isolation<br>Baud rate: 4,800, 9,600, 19,200, 38,400, 57,600,115,200 bps |
| Bus protocol | S-Bus or Modbus interface: Selectable via LCD |
| Configuration | Modbus parity: Selectable via LCD |
| Address | Address range:<br>S-Bus: 1…247<br>Modbus: 1…247<br>Selectable via LCD<br>Factory setting: 1 |
| Terminator box | Integrated, can be activated via the display and interface |

### General data

| | |
|---|---|
| Ambient temperature | Operation: –25 °C - +55 °C<br>Storage: –30 °C - +70 °C |

## Dimensions and assembly
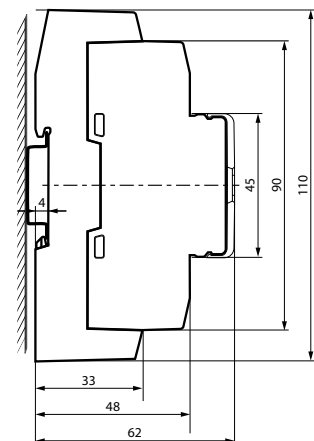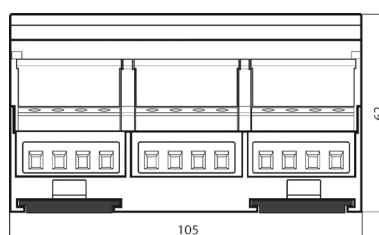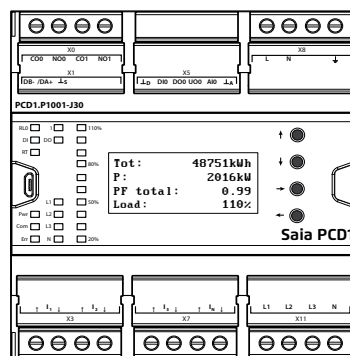
On top-hat rails 35 mm
(as per DIN EN 60715 TH 35)

Housing width 6 TE (105 mm)
Compatible with electrical switching cabinets
(as per DIN 43880, size 2 × 55 mm)

## Measurements

### Measurement data

| | |
|---|---|
| Voltage | RMS value (L1, L2, L3) |
| Current | RMS value (L1, L2, L3, N) |
| Power | Active power, reactive power and apparent power (L1, L2, L3, ΣL1–L3)<br>Maximum and average value per time interval |
| Energy | Active energy, reactive energy and apparent energy (L1, L2, L3, ΣL1–L3) |
| Mains power quality | Current and voltage harmonics of the 1st - 40th order<br>Distortion factor THD for voltage and current in % (L1, L2, L3)<br>Distortion factor TDD for current in % (L1, L2, L3)<br>Over-, under- and peak-detection for voltage and current (threshold value adjustable)<br>Power factor [L1, L2, L3, ΣL1–L3] |
| Mains symmetry | Phase sequence detection<br>Phase angle (UL1-UL2, UL2-UL3, UL1-UL3) |
| Frequency | Mains frequency |

### Voltage input

| | |
|---|---|
| Number | 4 (L1, L2, L3, N) |
| Nominal voltage | 110 or 230 VAC between L1, L2, L3 and N |
| Input voltage | L-N:  2 … 700 VAC<br>L-L:  4 … 1,200 VAC |
| Voltage resolution | 0.1 V |
| Measurement frequency | 45 … 65 Hz |
| Sampling frequency, measuring chip | 8 kHz |
| Peak detection | >125 µs |
| Input impedance | 2 MΩ per input |
| Isolation | 4,000 VAC |

### Current input

| | |
|---|---|
| Number | 8 (2 per phase and neutral wire) |
| Input current | 1 A / 5 A (switchable) |
| Current range | Max. 6 A |
| Conversion ratios | Adjustable in stages of 1 for each phase,<br>5 A:  5:5 – 1500:5<br>1 A:  1:1 – 1500:1 |
| Sampling frequency, measuring chip | 8 kHz |
| Peak detection | >125 µs |
| Input impedance | 15 mΩ |
| Isolation | 4,000 VAC |

## Measurement accuracy

### Active energy and power as per IEC61557-12

| Current value | Power factor | Tolerance, class 0.5 |
|---|---|---|
| 1 % In ≤ I < 5 % In | 1 | ± 1 % |
| 5 % In ≤ I < Imax | 1 | ± 0.5 % |
| 2 % In ≤ I < 10 % In | 0.5 inductive<br>0.8 capacitive | ± 1 % |
| 10 % In ≤ I < Imax | 0.5 inductive<br>0.8 capacitive | ± 0.6 % |

### Reactive energy and power as per IEC61557-12

| Current value | sin phi (inductive/capacitive) | Tolerance, class 1 |
|---|---|---|
| 2 % In ≤ I < 5 % In | 1 | ± 1.25 % |
| 5 % In ≤ I < Imax | 1 | ± 1 % |
| 5 % In ≤ I < 10 % In | 0.5 | ± 1.25 % |
| 10 % In ≤ I < Imax | 0.5 | ± 1 % |
| 10 % In ≤ I < Imax | 0.25 | ± 1.25 % |

**Apparent energy and power as per IEC61557-12**

| Current value | Tolerance, class 0.5 |
|---|---|
| 2 % In ≤ I < 5 % In | ± 1 % |
| 5 % In ≤ I < Imax | ± 0.5 % |

**Voltage and current as per IEC61557-12**

| Value | Tolerance, class 0.5 |
|---|---|
| 20 % Vn ≤ V < Vmax | ± 0.5 % |
| 10 % In ≤ I < Imax | ± 0.5 % |

**Harmonics and THD**

| Value | Tolerance, class 0.5 |
|---|---|
| Voltage harmonics | ± 5 % |
| Current harmonics | ± 5 % |
| THD (0 % - 20 %) | ± 0,6 |
| TDD (0 % - 100 %) | ± 0,6 |

## Input/output configuration

**Digital inputs**

| | |
|---|---|
| **Number** | 1 |
| **Input voltage** | 5 - 30 VDC, source operation (pos. switching) |
| **Switching level** | Low: 0 - 1.3 VDC,     High: 1.4 - 30 VDC |
| **Input current** | Typically 2 mA |

**Digital outputs**

| | |
|---|---|
| **Number** | 1 |
| **Reference source voltage U_DO** | 5 - 30 VDC |
| **Output voltage** | U_DO VDC, source operation (pos. switching) |
| **Output current** | Max. 500 mA |
| **Protection** | No |

**Relay outputs**

| | |
|---|---|
| **Number** | 2 closing contacts |
| **Switching voltage** | 250 VAC/24 VDC |
| **Switching current** | 5 A/1.5 A, 250 VAC (AC15)/1 A, 24 VDC (DC13) as per IEC60947-5-1 |
| **Contact protection** | None |
| **Isolation (coil contact)** | 4,000 VAC |

**Analogue inputs/temperature measurement**

| | | |
|---|---|---|
| **Number of external connections** | 1 | |
| **Number of internal sensors** | 1 | |
| **Electrical isolation** | Yes | |
| **Signal range and measured values** <br> **Selectable by means of display** | Internal: <br> External Pt1000: <br> External Ni1000: | −40 °C  -  +85  °C <br> −50 °C  -  +400 °C <br> −30 °C  -  +210 °C |
| **Temperature coefficient** | External Pt1000: <br> External Ni1000: | 3850 ppm/K <br> 6180 ppm/K (Standard type) |
| **Measurement accuracy** | Internal: <br> External: | ± 5 °C <br> −25 °C ≤ - ≤ +300 °C   ± 1 °C <br> −50 °C ≤ - ≤ +400 °C   ± 2 °C |

## Standards/Normative

| | | |
|---|---|---|
| **Product standard for PQA** | Power quality measurement in power supply systems | As per IEC 61557-1, IEC 61557-12 |
| **Voltage burst** | Main power circuit:    2 kV; direct <br> Interfaces:    1 kV; capacitively coupled | As per IEC 61000-4-4 |
| **Voltage surge** | Supply:    2 kV; 1.2/50 us <br> Voltage measurement inputs: 2 kV; 1.2/50 us <br> Current measurement inputs: 2 kV; 1.2/50 us <br> Interfaces:    1 kV; 1.2/50 us | As per IEC 61000-4-5 |
| **ESD** | Contact:    4 kV <br> Air:    8 kV | As per IEC 61000-4-2 |

## Terminal technology

**Push-in spring-loaded terminals**

are fitted in the upper row of terminals. These terminals allow wiring with rigid or flexibly cores of up to 1.5 mm² cross section. Including ferrules, the max. permitted cross section is 1 mm².
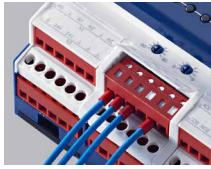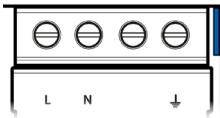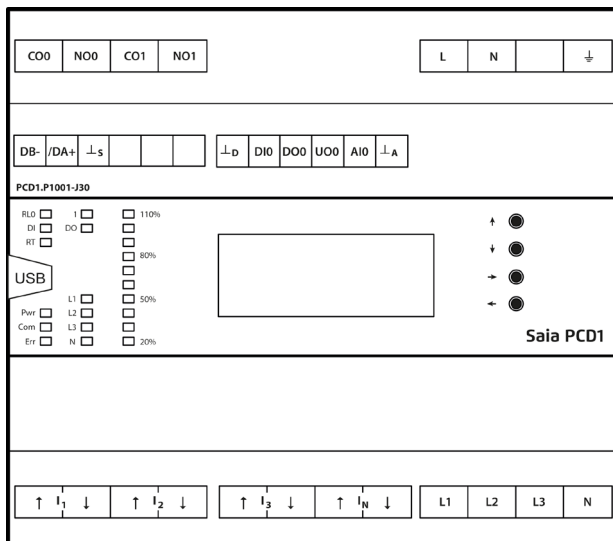
## Screwed terminals

are fitted on the lower row of terminals for the screw-in measurement inputs. Cable cross sections of up to 2.5 mm² can be connected.

## Power supply

The device has a separate supply for connecting the 110-230 VAC 50 / 60 Hz mains voltage.

## Bus wiring

The terminals DB- and /DA+ should be used for data exchange. The bus is wired into a terminal to make sure that modules can be replaced without interrupting the bus.
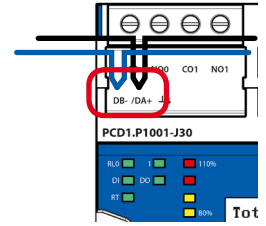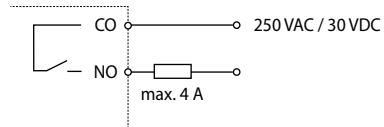
The communication bus can be terminated via the internal terminator boxes, which can be activated via the display, FBoxes and interface.
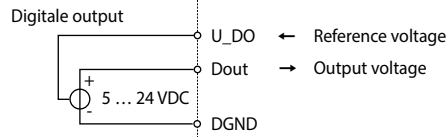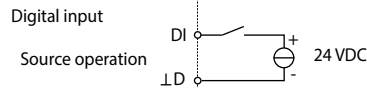
> ! Flexible RS-485 cables with a maximum cross section of 0.75 mm² are allowed for the bus wiring. The total permitted cable cross section per terminal is 1.5 mm².
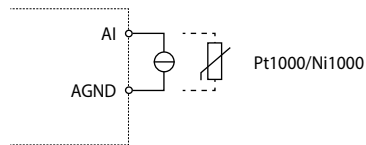
## Assignment overview

| CO0 | NO0 | CO1 | NO1 | | | L | N | ⏚ |

| DB- | /DA+ | ⊥S | | | ⊥D | DI0 | DO0 | UO0 | AI0 | ⊥A |

**PCD1.P1001-J30**

RL0  I  110%
DI  DO  80%
RT
USB
Pwr  L1  50%
Com  L2  L3
Err  N  20%

↑ ↓ → ←

**Saia PCD1**

| ↑ I₁ ↓ | ↑ I₂ ↓ | ↑ I₃ ↓ | ↑ Iₙ ↓ | L1 | L2 | L3 | N |

PCD1.P1001-J30

## Connection schematic

### Relays (contact open as standard)

CO ○——○ 250 VAC / 30 VDC
NO ○——○ max. 4 A

### Digital inputs/outputs

Digital input
Source operation
DI ○—— + 24 VDC
⊥D ○—— -

Digitale output
U_DO ← Reference voltage
Dout → Output voltage
5 … 24 VDC
DGND

### Analogue input / Pt1000/Ni1000

AI ○
AGND ○    Pt1000/Ni1000

| GND | ⊥ | Ground |
| DGND | ⊥D | Digital galvanically isolated ground |
| AGND | ⊥A | Analogue galvanically isolated ground |
| SGND | ⊥S | Signal ground |
| | a, b, .. | alphanumeric index by different grounds |

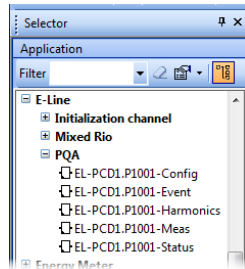## Programming/parametrisation

**5** The modules are addressed and programmed with Saia PG5® Fupla FBoxes. There are different FBoxes for configuration and communication. The FBoxes enable direct creation of the symbols, as well as connection to web macros.
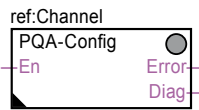
## FBoxes

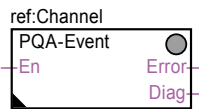### Fupla library

▶ Saia PG5® E-Line library

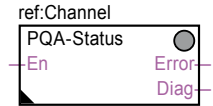### Basic values

▶ Active/reactive energy
▶ Voltage, current
▶ Apparent energy
▶ Power factor, THD
▶ …
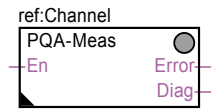
### Additional values

▶ States of the inputs / outputs
▶ Error messages
▶ …

### Configuration

▶ FBoxes for device configuration and bus communication

### Event values

▶ Peak detection
▶ Limit monitoring

### Harmonics measurements

▶ Harmonics per phase
▶ Current and voltage
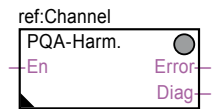
The PQA can be addressed via S-Bus standard. The FBox from the E-Line library, however, is used for configuring these modules. We therefore recommend using the optimised S-Bus protocol and the corresponding FBoxes from the E-Line library. A mixed operation slows down the exchange of data.

## Web macros/templates

A range of Saia PG5® web editor templates are available for visualisation, such as displaying energy values or basic information from the device.

| Basic Values | Temperature internal 38.9 °C | | Temperature extern 400.0 °C | |
|---|---|---|---|---|
| Phase | Phase 1 | Phase 2 | Phase 3 | N |
| Voltage (U) | 217.2 V | 215.4 V | 216.4 V | |
| Current (I) | 0.98 A | 0.98 A | 0.99 A | 2.11 A |
| Active Power (P) | 0.11 KW | 0.11 KW | 0.11 KW | |
| Activ Energy | 0.03 KWh | 0.03 KWh | 0.03 KWh | |
| Power Factor | -0.537 | -0.536 | -0.531 | |

▲ Example 1: Display of the basic values like voltage, current

| Advanced Values | Temperature internal 38.8 °C | | Temperature extern 400.0 °C | |
|---|---|---|---|---|
| Phase | Phase 1 | Phase 2 | Phase 3 | N |
| Reactive Power (Q) | -0.05 kvar | -0.05 kvar | -0.05 kvar | |
| Apparent Power (S) | 0.21 kVA | 0.21 kVA | 0.21 kVA | |
| Reactive Energy | 0.01 kvarh | 0.01 kvarh | 0.01 kvarh | |
| Apparent Energy | 0.08 KVAh | 0.08 kVAh | 0.08 kVAh | |

▲ Example 2: Display of the advanced values like reactive power, apparent power
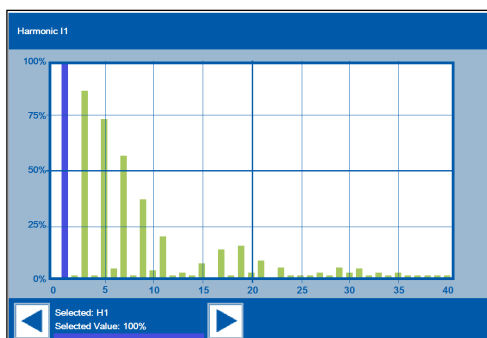


▲ Example 3: Display the harmonic I or U from phase 1 to 3

| Events 1 | | | | | | |
|---|---|---|---|---|---|---|
| Phase | Phase 1 | | Phase 2 | | Phase 3 | |
| SAGU | 0 V | 0 ms | 0 V | 0 ms | 0 V | 0 ms |
| PEAKU_1 | 0 V | 00:00:00 | 0 V | 00:00:00 | 0 V | 00:00:00 |
| PEAKI_1 | 0.0 A | 00:00:00 | 0.0 A | 00:00:00 | 0.0 A | 00:00:00 |
| THD_U | 0 V | 0 ms | 0 V | 0 ms | 0 V | 0 ms |
| THD_I | 0.0 A | 0 ms | 0.0 A | 0 ms | 0.0 A | 0 ms |

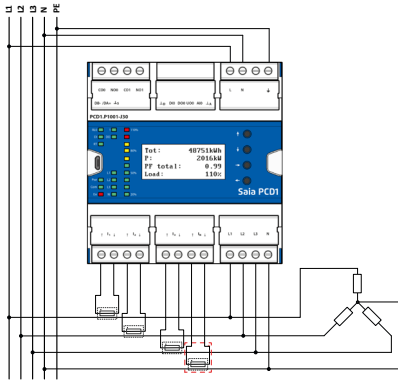▲ Example 4: Display the events like TDD, SAG

Further information, such as "Getting started", "Which FBoxes are supported", etc. is available on our support site www.saia-support.com.
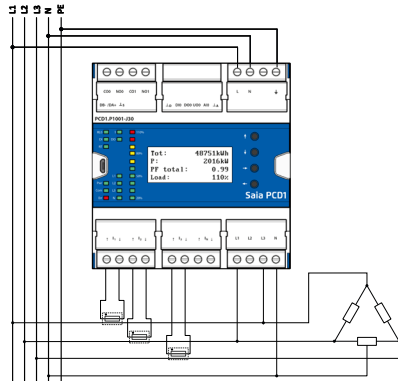
## Possible connection types

### Star connection in 4 wire system

3-phase system with neutral wire as star connection 230/400 VAC. Measurement of the neutral wire current is optional.
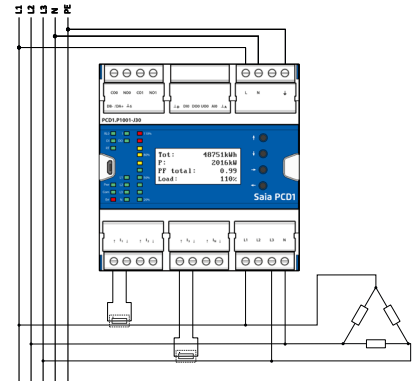


### Delta connection in 4 wire system

3-phase, 4-wire system as delta connection. Neutral wire is connected as reference voltage to the measurement input for neutral wire.



### Delta connection in 3 wire system

3-phase, 3-wire system as delta connection. Phase 2 is connected as reference voltage to the voltage measurement input for neutral wire.



## Order information

| Type | Outline | Description | Weight |
|------|---------|-------------|--------|
| PCD1.P1001-J30 | E-Line PQA 110-230VAC RS-485 | E-Line Power Quality Analyzer<br>LCD 128×64 monochrome 1.9 inch.<br>LED for ON/OFF and status.<br>Supply 110-230 VAC; 50/60 Hz.<br>Measurement inputs 3 PH+N up to 700 VAC.<br>1 digital input 30 VDC, high active.<br>1 digital output 5 - 30 VDC.<br>1 analogue input PT1000 or NI1000 sensor.<br>2 relays NO 230 VAC, 5 A (ohmic load).<br>1 RS-485 interface (S-Bus/Modbus) with switchable terminator box | 380 g |