PM03B

Series 3-Phase IED Power Module
690V AC, 5A with PT100

Data Sheet
Doc: 40427 v1.04

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INTRODUCTION TO LB2 IO SERIES

Before using the LB2 Series I/O Modules, read the LB2 User manual.

The Brodersen LB2 modules can be used with the RTU32N and RTU32M series products. The I/O modules are in two parts, a bottom part containing the backplane bus, and a top part containing the I/O board and logic. All LB2 I/O modules are hot pluggable and equipped with a 200 MHz processor to handle filtering, de-bouncing and logic processing of I/O.

Module firmware updates are managed by the RTU using Brodersen Worksuite. Use only genuine Brodersen bus cables for connection to Brodersen RTUs and extension of I/O module blocks. The LB2 connection cables are made to handle the power and shielding requirements of the LB2 bus communications. The maximum overall length of complete system is 30m. Each I/O module & Power supply module is calculated as 2cm. The cables are as their length indicates, e.g. UCC-610/100 cable is 100 cm.

The maximum number of I/O modules on one LB2 Bus is 60.

INTRODUCTION TO PM03B

The PM03 Phase Power Measurement Module measures electrical data in a three-phase supply network. The voltage is measured via network connection to L1, L2, L3 and N. The current of the three phases is fed to IL1, IL2, IL3 and IN (two clamping points each + & -) via current transformers or via Rogowski coils. The module transmits metrics (e.g., reactive/apparent/effective power, energy consumption, power factor, phase angle, frequency, over-/undervoltage) directly into the process image, without requiring high computing power from the controller, there is an onboard 2 CPUs one for processing data and one for transmitting to backplane bus.
Comprehensive metrics and harmonic analysis up to the 41st harmonic permit extensive network analysis.
Metrics allow the operator to optimize the supply to a drive or machine, protecting the system from damage and failure. Insulation failures can be detected and prevented via current measurement performed in the neutral conductor.

Cable ordering codes:

UCC-610/25	25cm LB2 Cable
UCC-610/50	50cm LB2 Cable
UCC-610/100	100cm LB2 Cable
UCC-610/200	200cm LB2 Cable

POWER SUPPLY MODULE BACKPLANE PART

Description	Part Nr.
BUS module for IOs, Start	BB21A
BUS module for IOs, Middle	BB21B
BUS module for IOs, Extension	BB21C

VERSIONS / ORDERING CODES

Hardware basic version

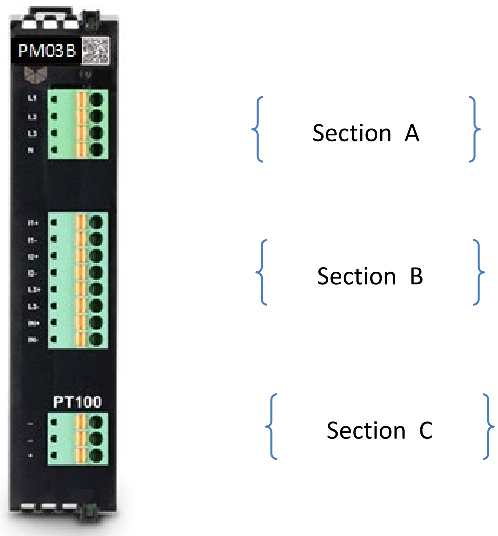
Order code: PM03B

I/O INTERFACE

Connectors V Input:
1x 4 way 7.5mm pluggable spring clamp connector
Conductor Area CSA: 6 mm²

Connector's voltage input:
1x 8 way 2.5mm pluggable spring clamp connector
Conductor Area CSA: 1,5 mm²

Connectors PT100 input:
1x 3 way 2.5mm pluggable spring clamp connector
Conductor Area CSA: 1,5 mm²



TERMINAL LAYOUT

Connector top section A:

Pin 1:	L1 (PHASE 1)
Pin 2:	L2 (PHASE 2)
Pin 3:	L3 (PHASE 3)
Pin 4:	N (Neutral)

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Connector top section B:

Pin 1:	I1+
Pin 2:	I1-
Pin 3:	I2+
Pin 4:	I2-
Pin 5:	I3+
Pin 6:	I3-
Pin 7:	IN+
Pin 8:	IN-

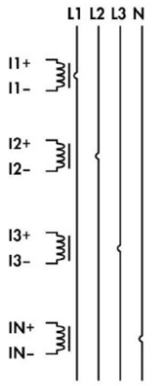
Connector Bottom section c:

Output terminals layout are as follows:

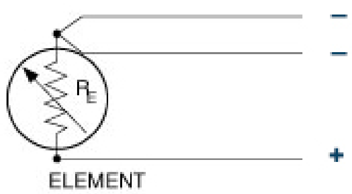
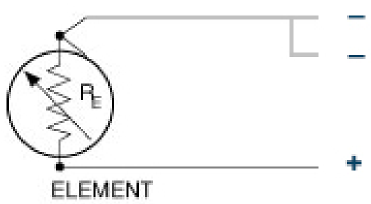
Connector Bottom:

Pin 1	-
Pin 2	-
Pin 3	+

Current transformers connection:



PT100 connection

	3 Wire PT100 sensor with wire resistance compensation
	2 Wire PT100 sensor without wire resistance compensation

ELECTRICAL

Power consumption (from backplane bus):

- Current consumption:	125mA (typ.) @ 12V
- Power consumption:	1.5W (typ.)

POWER MEASUREMENT

3 voltage measurement inputs, 4 differential current measurement inputs

Signal form:	Any periodic signals
Input resistance voltage path	1429 kΩ
Measurement Resolution [bit]	24 Bit
Input resistance current path typ.	22 mΩ
Frequency range, harmonics analysis	0..3300 Hz (+41st harmonic)
Frequency range power supply	45..65 Hz
Max measurement current (RMS)	5 A
Max measurement rated voltage	VLN = 400V AC, VLL = 690V AC

TEMPERATURE MEASUREMENT

1 PT100 measurement inputs.

Input	3 wire PT100
Resolution	16 bit
Update time	4 ms
Input resistance current path typ.	22 mΩ
Accuracy (at 25°C)	±0.1%
Temperature drift: ± 25ppm/°C	± 25ppm/°C
Power-freq. noise rejection	50Hz
Measured temperature range	-50 to 300 °C

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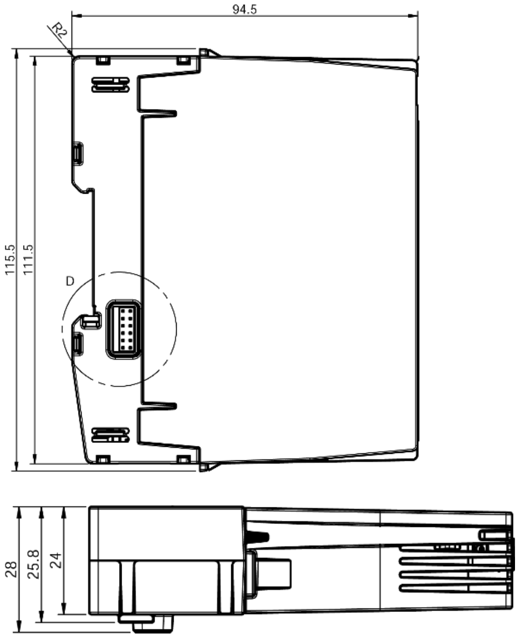
MECHANICAL

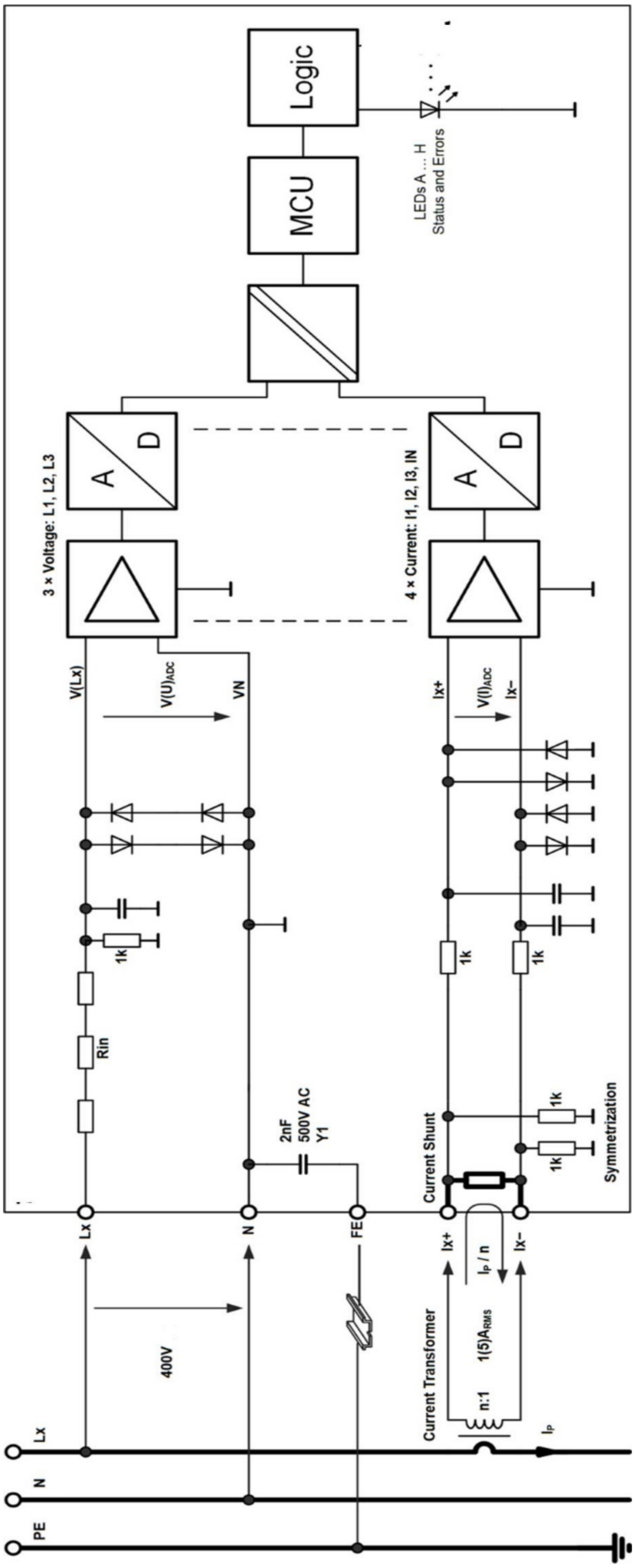


Mounting	DIN 35
Width	24 mm
Height	111.5 mm
Depth	94.5 mm
Weight	102 gram

ENVIRONMENTAL CONDITIONS

Ambient operating temperature range	-40°C to +85°C
Marked degree of protection	IP20
Humidity	0...99.8%
Ventilation Restrictions	No
Pollution degree	2

SCHEMATIC DIAGRAM



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Process data updating:	
Voltage, Lx - N	40 ms
Min./max. voltage, Lx - N	50 ms
Voltage, Lx - Ly	340 ms
Average value, voltage, Lx - N	Adjustable, 5 s ... 900 s
Peak value, voltage, Lx - N	200 ms
Current, Lx	40 ms
Min./max. current, Lx	50 ms
Average value, current, Lx	Adjustable, 5 s ... 900 s
Peak value, current, Lx	200 ms
Current, N	40 ms
Active power, Lx	40 ms
Min./max. active power, Lx	50 ms
Reactive power, Lx	340 ms
Apparent power, Lx	40 ms
Energy meter	400 ms
Line frequency, Lx	280 ms
Min./max. line frequency, Lx	280 ms
Phase angle phi, Lx	340 ms
cos phi	340 ms
PF power factor, Lx	280 ms
LF power factor, Lx	280 ms
Fundamental vibration/upper harmonic	
Current	240 ms
Voltage	240 ms
HD/THD, current	240 ms
HD/THD, voltage	240 ms

Settling times:	
Voltages and currents	620 ms (1300 ms after power-on)
Effective power and apparent power	415 ms at 60 % of $P_{Full-scale}$ 915 ms at 100 % of $P_{Full-scale}$
Reactive power	715 ms at 100 % of $P_{Full-scale}$ 1215 ms at 100 % of $P_{Full-scale}$
Harmonic analysis	790 ms

MEASUREMENT ACCURACY

This information applies to both symmetrical and asymmetrical loads. The values indicated only apply if the conditions described in the section "Measurement Errors" are met.
The reference temperature for the temperature coefficient is +25 °C.

AC voltage		
PM03A	± 0.30 % of URV	50 ppm/K temperature drift
PM03B	± 0.30 % of URV	70 ppm/K temperature drift
PM03C	± 0.30 % of URV	50 ppm/K temperature drift
AC current		
PM03A	± 0.30 % of URV	70 ppm/K temperature drift
PM03B	± 0.30 % of URV	90 ppm/K temperature drift
PM03C	± 0.50 % of URV	50 ppm/K temperature drift
AC effective power		
PM03A	± 0.50 % of UR (phase angle ± 5 °)	100 ppm/K temperature drift
	± 0.65 % of URV (phase angle ± 30 °)	
	± 0.75 % of URV (phase angle 0 to 359 °)	
PM03B	± 0.50 % of URV (phase angle ± 5 °)	120 ppm/K temperature drift
	± 0.65 % of URV (phase angle ± 30 °)	
	± 0.75 % of URV (phase angle 0 ... 359 °)	
PM03C	± 0.50 % of URV (phase angle ± 5 °)	90 ppm/K temperature drift
	± 0.65 % of URV (phase angle ± 30 °)	
	± 0.75 % of URV (phase angle 0 ... 359 °)	
Phase angle		
PM03A	± 0.5 °	
PM03B	± 0.5 °	
PM03C	± 1.0 °	

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Frequency		
PM03A	± 0.1 Hz	
PM03B	± 0.1 Hz	
PM03C	± 0.1 Hz	
Harmonic analysis measurement, voltage		
PM03A	± 1 % of URV	
PM03B	± 1 % of URV	
PM03C	± 1 % of URV	
Harmonic analysis measurement, current		
PM03A	± 1 % of URV	
PM03B	± 1 % of URV	
PM03C	± 1 % of URV	

*) "of URV" = of the upper-range value

STANDARDS

EMC:

- **IEC 61000-6-2**: EMC - Immunity standard for industrial environments
- **IEC 61000-6-4**: EMC - Emission standard for industrial environments
- **IEC 50121-4**: Railway applications - EMC - Emission and immunity of the signalling and telecommunications apparatus

Safety:

- **IEC 60950-1**: Safety requirements for Information technology equipment
- **IEC 61010-1**: Safety requirements for electrical equipment for measurement, control, and laboratory use

Environmental:

- **IEC 60068-2-1**: Environmental testing - Cold
- **IEC 60068-2-2**: Environmental testing - Dry heat
- **IEC 60068-2-30**: Environmental testing - Damp heat, cyclic (12 h + 12 h cycle)
- **IEC 60068-2-78**: Environmental testing - Damp heat, steady state
- **IEC 60068-2-6**: Environmental testing - Vibration (sinusoidal)
- **IEC 60068-2-27**: Environmental testing - Shock

MODULE LED STATUS

A dual color (red/yellow) LED is provided on the module to indicate the module status. Yellow indicates the module mode / state and red indicates module error or warnings (according to the table below):

Status	Yellow	Red
Normal operating	ON	OFF
Communication timeout	Blinking	OFF
Module is not configured / wrong configuration	Single flashing	OFF
Module is configured but is in stopped mode (ready for being started)	Double flashing	OFF
Module is in firmware update mode	Quadruple flashing	OFF
Communication error	N/A	Blinking
Communication warning	N/A	Single flashing
Corrupted module info in EEPROM	N/A	Flickering
Hardware fatal error	OFF	ON
No module power	OFF	OFF

Each pattern / color will operate in 2 sec duty cycles. When the red LED is inactive (off), only the 2 sec yellow duty cycle will operate (yellow is always active). When the red LED is active, a switch between 2 sec yellow, and 2 sec red patterns will occur.

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All about a CT Burden

In Power Automation

Application Note

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What is CT Burden?

CT burden is the total resistance of the secondary load of a current transformer or, in other words, the maximum load that can be applied to a CT's secondary. A CT's maximum burden will vary depending on the CT's turns ratio, the desired CT output, and the sensor's current rating.

CT burden is commonly expressed in one of two ways:

1. The total impedance of the circuit in ohms (Ω)
2. The total VA (volt-amperes) and PF (power factor) at a specified current/voltage and frequency

A CT's total impedance is a combination of three factors:

1. The sum of all resistance present in the CT's secondary winding
2. The resistance in the CT's lead wires
3. The resistance present in the MFM (Multi Function Meter), Protection Relay, or any type of IED modules used in power measurement (PM03, PM04), connected to the CT.

Why is it important to know a CT's burden?

Depending on a facility's layout, it is possible that a power meter may need to be installed some distance away from the load to be measured.

In these instances, it can be helpful to extend the leads of a CT to accommodate longer distances. However, it is also important to note that there is a maximum distance that the leads can be lengthened to beyond which the accuracy will decline. This is because the CT's maximum burden is being exceeded by the added resistance of the CT leads.

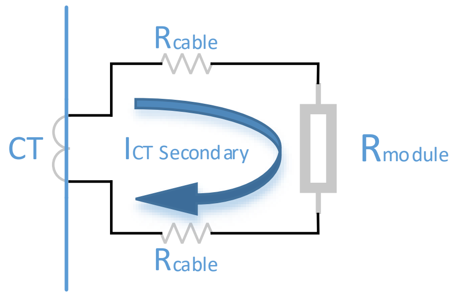
The burden can be calculated by using the following formula:

$$\text{Burden}(\Omega) = (2 \times R_{cable}) + R_{module}$$

or

$$\text{Burden}(VA) = (I_{CT\_Secondary})^2 \times ((2 \times R_{cable}) + R_{module})$$

$$R_{cable}\ (\Omega) = R_{cable}(\Omega/m) \times \text{Length}(m)$$



What is the impedance of the RTU32M Power Meter module?

Module Type	Impedance (Ω)	Max current (A)	VA
PM03A	0.20	1	0.20
PM03B	0.022	5	0.110
PM04A	0.20	1	0.20
PM04B	0.022	5	0.110

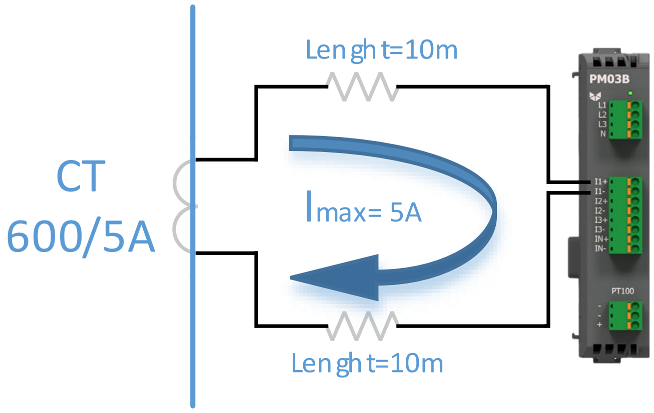
Example :

CT Ratio: 600/5A

CT Burden: 4.1 Ω

Cable Resistance: 11.5 (ohm/km)

Module Impedance: 0.022 Ω



Burden(Ω) = $(2 \times R_{cable}) + R_{module} = 2\times(10\times0.0115) + 0.022 = 0.252$ Ω

Burden < CT burden ==➔ The Accuracy will not affected or decreased