Power Xpert Branch Circuit Monitor

Introduction

The Power Xpert® Branch Circuit Monitor (PX BCM) meter module strip provides ANSI C12.20 0.5% revenue class branch circuit metering in panelboard applications for 1-inch pole spacing branch circuit up to 100 A. Factory-installed meter module strips are available with 9, 15 and 21 CT assemblies, enabling ANSI C12.20 0.5% accuracy metering of branch circuits in 18, 30, or 42 circuit panels. Each meter module strip is equipped with four additional auxiliary 333 mV current sensor inputs with ANSI 0.5% metering accuracy for metering of additional circuits such as panelboard mains or other circuits with greater than 100 A or 1-inch pole spacing. Each PX BCM meter module can be used to meter circuits from separately derived voltage sources because each meter module has its own metering voltage inputs. The branch circuit monitor meter base supports up to four Meter Module Strips (PXBCM-MMS), providing metering of 84 branch circuits and 16 auxiliary 333 mV sensors for a total of 100 metered poles.

The Power Xpert Branch Circuit Monitor meter base supports both RS-485 and Ethernet communications. The meter base includes an embedded Web server for user-friendly device configuration and graphical data display. Modbus® RTU and Modbus TCP communications are supported for connection to communications gateways or host software. An optional graphics display can provide easy local access to metered data. When mounted in a panelboard or a switchboard, the Power Xpert Branch Circuit Monitor provides customers with an integrated power distribution and energy metering solution that saves space, reduces installation labor, and lowers total cost.

The Power Xpert BCM Meter Module External (PXBCM-MME) was designed for retrofit applications, or for installation in power distribution assemblies where 1-inch pole spacing 100 A CT strips cannot be applied. The BCM MME supports connection to a total of 25 333 mV sensors for power and energy metering. The meter module external is factory calibrated to meet the ANSI C12.20 0.5% accuracy limits for a transformer rated meter. When used with revenue accuracy 333 mV current sensors, the BCM MME measures energy consumption with ANSI C12 meter accuracy for transformer rated metering applications.
**Product description**

**BCM overall product concept architecture**

**System features**

Each Power Xpert Branch Circuit Monitor meter base, equipped with four meter modules, can measure up to any of the following number of circuits:

- 100, two-wire (single-pole)
- 48, three-wire (two-pole)
- 32, four-wire (three-pole)

The circuits listed above can be mixed provided that multipole circuits are configured to be on the same meter module. The meter provides current; voltage; power factor; demand and active, reactive, and real power (VA, VAR, kW); and active, reactive, and real energy (VA, VAR, kWh) measurements for each load.

**System communications**

With the Power Xpert Branch Circuit Monitor’s built-in communication capabilities, remote meter reading and monitoring functions can be integrated into both new and retrofit applications.

- Standard Modbus RTU and Modbus TCP / HTTP communications

**System software capability**

The Power Xpert Branch Circuit Monitor:

- Can be used as part of an electrical energy monitoring system using Modbus communications
- Can be remotely monitored and configured via onboard Web pages
- Platform independent HTML5 Web page technology allows remote configuration and monitoring on any browser equipped tablet or other mobile device
- Compatible with third-party software platforms and interface devices

**How to configure and commission**

The Power Xpert Branch Circuit Monitor is fully configurable using its own embedded Web server.

- Web server configuration includes combining multiple poles into aggregated virtual meters
- Virtual meters can be assigned user names for easy identification

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**Metered values**

**Table 1. Metered values**

<table>
<thead>
<tr>
<th></th>
<th>Main</th>
<th>Channel</th>
<th>Virtual meter (aggregated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current (I)</td>
<td>IA, IB, IC</td>
<td>Per pole</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>Minimum/maximum</td>
<td>Maximum</td>
<td>Maximum average</td>
</tr>
<tr>
<td>Real power (W)</td>
<td>A, B, C, total</td>
<td>Per pole</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Minimum/maximum</td>
<td>Max</td>
<td>Max total</td>
</tr>
<tr>
<td>Apparent power (VA)</td>
<td>A, B, C, total</td>
<td>Per pole</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Minimum/maximum</td>
<td>Maximum</td>
<td>Maximum total</td>
</tr>
<tr>
<td>Voltage L–N (V)</td>
<td>AN, BN, CN</td>
<td>N/A</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>Min/Max</td>
<td>N/A</td>
<td>Maximum average</td>
</tr>
<tr>
<td>Voltage L–L (V)</td>
<td>AB, BC, CA</td>
<td>N/A</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>Minimum/maximum</td>
<td>N/A</td>
<td>Maximum average</td>
</tr>
<tr>
<td>Frequency</td>
<td>System</td>
<td>N/A</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>Minimum/maximum</td>
<td>N/A</td>
<td>Maximum average</td>
</tr>
<tr>
<td>Power factor</td>
<td>System</td>
<td>Per pole</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Minimum/maximum</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Ampere demand</td>
<td>A, B, C</td>
<td>Per pole</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Peak A, B, C</td>
<td>Peak per pole</td>
<td>N/A</td>
</tr>
<tr>
<td>Forward watt demand</td>
<td>Total</td>
<td>Per pole</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Peak Total</td>
<td>N/A</td>
<td>Peak total</td>
</tr>
<tr>
<td>Reverse watt demand</td>
<td>Total</td>
<td>Per pole</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Peak Total</td>
<td>N/A</td>
<td>Peak total</td>
</tr>
<tr>
<td>Forward energy</td>
<td>System</td>
<td>Per pole</td>
<td>Total</td>
</tr>
<tr>
<td>Reverse energy</td>
<td>System</td>
<td>Per pole</td>
<td>Total</td>
</tr>
</tbody>
</table>

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**Typical submetering applications**

The Power Xpert Branch Circuit Monitor is ideally suited to handle submetering in low voltage power distribution equipment applications such as distribution boards in multi-tenant buildings, PDUs in data center applications, and separately installed enclosures for retrofit metering needs.

The Power Xpert Branch Circuit Monitor provides a cost-effective solution for residential or commercial metering installations. Typical installations include:

- High-rise buildings
- Government institutions
- K–12, universities, and campuses
- Office buildings
- Medical facilities
- Apartment and condominium complexes
- Airports
- Shopping malls
- Industrial sites
- Mixed-use facilities
Features
Each PXBCM meter base monitors power and energy from up to four meter modules, which represents a total of up to 100 current sensors.
- Built-in Modbus RS-485 and Ethernet communication interfaces
- Monitors single-phase and three-phase loads from 120 to 347 Vac L–N
- Monitors current, voltage, power factor, frequency, power, and energy

BCM components—meter base, MMS, MME, display

Figure 1. Meter base

Base mounting screws #8
LED indicators
COM reset button
Configuration switches
Power supply mains terminal PE/N/L
Base mounting screws #8

Figure 2. Meter module external

Base screw mounts #10
LED indicators
MMP: Meter module port
AX: External 33 mV CT inputs
VT: Voltage terminal for mains metering
Base screw mounts #10

Figure 3. MMS left oriented strip

Cover mount screw
AX terminal
MMP LEDs
Rx green
Tx red
VT terminal
PE #10 stud with nut
MMP meter module port case exit

Left meter module strip, PXBCM-MMS-L21-A shown
Right meter module strip, PXBCM-MMS-R21-A shown

Figure 4. Typical OEM arrangement with meter base and meter module strips

Disconnect switch and fuse block
Meter base PXBCM-MB
Approved panel with one or more PXBCM-MMEs mounted. May also be housed with the PXBCM-MB.

PXBCM-CBL nn cable

Disconnect switch and fuse block

Figure 5. Hybrid system—retrofit of external meter module in existing panelboard tied to meter base in OEM panelboard with meter module strips

Dimensions

Figure 6. Meter base mounting dimensions
Figure 7. MMS mounting dimensions in inches (cm)
Wiring diagram examples

**Figure 8. MME mounting dimensions**

**Figure 9. Display mounting dimensions**

**Figure 10. 120/208 V, three-wire apartment service**

**Figure 11. Three-phase, four-wire wye**
### Product specifications

**PXBCM-MB**
- Weight: 1 lb
- W/H/D: 7.0 in (17.6 cm) / 6.3 in (15.8 cm) / 2.6 in (6.6 cm)
- Each meter base can interface to 1–4 meter modules (–MMS and/or –MME)
- Housing: NEMA® 1, IP20
- Pollution degree 2
- Operational temperature range: −20 ºC to +70 ºC
- Storage temperature range: −45 ºC to +85 ºC
- Elevation: 0–3000 m up to 277 V L–N
- Humidity: 5–95% noncondensing
- Elevation: 0–2000 m up to 347 V L–N
- Humidity: 5–95% noncondensing
- Requires control power transformer
- UL® file #E185559, UL standard UL61010-1
- CNL evaluation to CAN/C22.2 No. 1010.1.92
- CE mark
- EMC EN61326–IEC61000-4-X level 3
  - Emissions conducted and radiated as part of PXBCM system, FCC part 15 class B
  - CISPR 11/22 class B

### External circuit connections
- Com1 RS-485 Modbus® Slave RTU:
  - 9600–115.2 K (default) baud
  - –D, +D, Com/Shield
  - Use RS-485 cable—4 K ≤19.2 Kb, 2 K
- LAN ethernet RJ45 CAT5 10/100Base-T
  - Use STP Cat5+ for full EMC compliance
- MMP1-4 meter module ports:
  - 2 pair cable, 1 pair power, 2nd coms
  - Use PXBCM-MMP-CBLnn—CBLEnn cables
  - Each MMP is separately isolated
- Power supply mains 100–277 Vac L:N
  - ±10%, CAT III, 47–63 Hz, 6 W
  - Double insulated
  - 320 Vac surge filter clamp L:N, L:G, N:G—Do not high pot
- Provide external line fuse or breaker sized to protect wiring
- Three-position fixed terminal block 1/2/3 = PE/N/L, supporting 12 AWG (2.5 mm) wire

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**Table 2. Service voltage system**

<table>
<thead>
<tr>
<th>Service voltage system type</th>
<th>Virtual meter load options</th>
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<tbody>
<tr>
<td>Three-phase, four-wire wye</td>
<td>Three-phase, four-wire wye</td>
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<tr>
<td></td>
<td>Three-phase, three-wire delta</td>
</tr>
<tr>
<td></td>
<td>120/208 three-wire apartment</td>
</tr>
<tr>
<td></td>
<td>Single-phase, two-wire</td>
</tr>
<tr>
<td>Three-phase, three-wire delta</td>
<td>Three-phase, three-wire delta</td>
</tr>
<tr>
<td>Three-phase, four-wire delta</td>
<td>Three-phase, three-wire delta</td>
</tr>
<tr>
<td></td>
<td>Single-phase, two-wire</td>
</tr>
<tr>
<td></td>
<td>Single-phase, three-wire</td>
</tr>
<tr>
<td>Single-phase, three-wire</td>
<td>Single-phase, two-wire</td>
</tr>
<tr>
<td>Single-phase, two-wire</td>
<td>Single-phase, two-wire</td>
</tr>
</tbody>
</table>

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**Figure 12. Three-phase, four-wire wye**

**Figure 10, Figure 11, and Figure 12** are representative of wiring configurations that can be used with the BCM. **Table 2** shows the supported service voltage system types and corresponding meter load options.
Technical Data

Effective December 2015

Power Xpert Branch Circuit Monitor

PXBCM-MMS
- Weight 09/15/21: 1.0/1.5/2.0 lb
- Width: 1.4–3.0 in (3.5–7.5 cm)
- Height 2.5 in (6.4 cm)
- Length 09/15/21: 16.9/22.9/28.9 in (43.5/58.2/73.5 cm)
- Housing NEMA 1, IP20, Pollution Degree 2
- Operational/storage temp.: –20 ºC to +70 ºC /–45 ºC to +85 ºC
- Elevation: 0–3000 m up to 277 V L–N
  Humidity: 5–95% noncondensing
- Elevation: 0–2000 m up to 347 V L–N
  Humidity: 5–95% noncondensing
  Requires metering voltage transformers
- CE mark
- Safety: IEC/EN/UL61010-1, UL file # E185559, CNL evaluation to
  CAN/C22.2 No. 1010.1.92
- EMC EN61326—IEC61000-4-X level 3
- Emissions conducted and radiated as part of PXBCM system—
  FCC part 15 and CISPR 11/22 class B
  MMP meter module ports—2x2 connector, 2 pair cable,
  1 pair power, 2nd data coms
  Use PXBCM-MMP-CBLnn—CBLEnn cables
VT—Voltage terminal metering inputs
  - 47–63 Hz, CAT III, 5 Mohm input impedance A/B/C/N
  - Wye 277 Vac L:N(G) 480 V L:L maximum nominal rating
  - Floating delta, corner grounded delta, and high-impedance
    wye not supported without the use of an interposing PT
    potential transformer
  - Four-position fixed terminal block Va, Vb, Vc, Vn,
    - 24–12 AWG—ferrules recommended
  - PE—protective earth grounding stud at base of MMS bracket—
    #8 stud
AX CT current terminal metering inputs
  - 333 mV secondary CT input to MMS at maximum external CT
    primary rating
  - Primary load rating determined by external CT
    - In-line terminal block 24–14 AWG ferrules recommended for
      stranded wire

PXBCM-MME
- Weight: 1 lb
- W/H/D: 7.7 in (19.5 cm) / 8.5 in (21.6 cm) / 1.6 in (4.1 cm)
- Housing NEMA 1, IP20, Pollution Degree 2
- Operational temperature range: –20 ºC to +70 ºC
- Storage temperature range: –45 ºC to +85 ºC
- Elevation: 0–3000 m up to 277 V L–N
  Humidity: 5–95% noncondensing
- Elevation: 0–2000 m up to 347 V L–N
  Humidity: 5–95% noncondensing
  Requires metering voltage transformers
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- CNL evaluation to CAN/C22.2 No. 1010.1.92
- EMC EN61326—IEC61000-4-X level 3
  Emissions conducted and radiated as part of PXBCM system,
  FCC part 15 class B
  CISPR 11/22 class B
MMP meter module ports
  - 2 pair cable, 1 pair power, 2nd data coms
  - Use PXBCM-MMP-CBLnn—CBLEnn cables
VT—voltage terminal metering inputs
  - 47–63 Hz, CAT III, 5 Mohm input impedance
  - Wye 277 Vac L:N(G) 480 V L:L maximum nominal rating
  - Floating delta, corner grounded delta, and high-impedance
    wye not supported without the use of an interposing PT
    potential transformer
  - Five-position fixed terminal block Va, Vb, Vc, Vn, PE
    - 24–12 AWG—ferrules recommended
CT and AX CT current terminal metering inputs
  - 333 mV secondary CT input to MME at maximum external CT
    primary rating
  - Primary load rating determined by external CT
  - CT 21 and AX 4 pair dual tier terminal blocks
    - 24–12 AWG—ferrules recommended
Cables
  - ~1-inch bend radius required
  - 600 V insulation rating
  - 105 ºC temperature rating
  - UL 61010-1
  - UL file #E185559
  - 2 twisted pair, PVC jacket 0.28 inches OD jacket
## Product selection

### Table 3. BCM component catalog numbers

<table>
<thead>
<tr>
<th>Description</th>
<th>Suffix description</th>
<th>Catalog number</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meter base</td>
<td></td>
<td>PXBCM-MB</td>
<td></td>
</tr>
<tr>
<td>Meter module strip Left 9 CT</td>
<td></td>
<td>PXBCM-MMS-L09-A</td>
<td>A = 1-in pitch, 100 A</td>
</tr>
<tr>
<td>Meter module strip Left 15 CT</td>
<td></td>
<td>PXBCM-MMS-L15-A</td>
<td>A = 1-in pitch, 100 A</td>
</tr>
<tr>
<td>Meter module strip Left 21 CT</td>
<td></td>
<td>PXBCM-MMS-L21-A</td>
<td>A = 1-in pitch, 100 A</td>
</tr>
<tr>
<td>Meter module strip Right 9 CT</td>
<td></td>
<td>PXBCM-MMS-R09-A</td>
<td>A = 1-in pitch, 100 A</td>
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<tr>
<td>Meter module strip Right 15 CT</td>
<td></td>
<td>PXBCM-MMS-R15-A</td>
<td>A = 1-in pitch, 100 A</td>
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<tr>
<td>Meter module strip Right 21 CT</td>
<td></td>
<td>PXBCM-MMS-R21-A</td>
<td>A = 1-in pitch, 100 A</td>
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<tr>
<td>Meter module external 21+4 external 333 mV CT</td>
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<td>PXBCM-MME-X25-333MV</td>
<td>X = external CT</td>
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<td>Meter module port cable</td>
<td>Length 6 in</td>
<td>PXBCM-MMP-CBL6I</td>
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<tr>
<td>Meter module port cable</td>
<td>Length 1 ft</td>
<td>PXBCM-MMP-CBL01</td>
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<tr>
<td>Meter module port cable</td>
<td>Length 2 ft</td>
<td>PXBCM-MMP-CBL02</td>
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<tr>
<td>Meter module port cable</td>
<td>Length 3 ft</td>
<td>PXBCM-MMP-CBL03</td>
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<tr>
<td>Meter module port cable</td>
<td>Length 4 ft</td>
<td>PXBCM-MMP-CBL04</td>
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<tr>
<td>Meter module port cable</td>
<td>Length 6 ft</td>
<td>PXBCM-MMP-CBL06</td>
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<tr>
<td>Meter module port cable</td>
<td>Length 8 ft</td>
<td>PXBCM-MMP-CBL08</td>
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<td>Meter module port cable</td>
<td>Length 12 ft</td>
<td>PXBCM-MMP-CBL12</td>
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<td>Meter module port cable</td>
<td>Length 16 ft</td>
<td>PXBCM-MMP-CBL16</td>
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<td>Meter module port cable</td>
<td>Length 20 ft</td>
<td>PXBCM-MMP-CBL20</td>
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<td>Meter module port cable ext.</td>
<td>Length 28 ft</td>
<td>PXBCM-MMP-CBL28</td>
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<tr>
<td>Meter module port cable ext.</td>
<td>Length 8 ft</td>
<td>PXBCM-MMP-CBLEX08</td>
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<tr>
<td>Meter module port cable ext.</td>
<td>Length 16 ft</td>
<td>PXBCM-MMP-CBLEX16</td>
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<tr>
<td>BCM local display</td>
<td>6-in diameter display</td>
<td>PXBCM-DISP-6</td>
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<tr>
<td>BCM local display cable</td>
<td>4-ft display cable</td>
<td>PXBCM-DISP-CBL04</td>
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<tr>
<td>BCM local display cable</td>
<td>12-ft display cable</td>
<td>PXBCM-DISP-CBL12</td>
<td></td>
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</tbody>
</table>

### 333 mV current sensor

![333 mV current sensor](image)

Split-core 333mV sensors can be connected to the four auxiliary current inputs on the BCM-MMS as well as any of the 25 current inputs on the BCM-MME. A variety of window sizes and ratios are available. Refer to TD121001EN for ordering information.