California Title 24 and other Load Disaggregation Solutions

Title 24 Compliant
P2 Panelboards

Panelboard customization to meet various load disaggregation requirements.
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Load disaggregation is the grouping of all loads of the same type, with the ability to independently measure and monitor energy usage by each separate load type. Thus, electrical power systems must be designed to group load types together (Ex: Elevator loads must be grouped and measured separately from receptacle loads). It is important to note that Title 24 specifications require load disaggregation capability to be in place, but most leave meter provisions as optional for future installation. Title 24 applies to the majority of projects with a scope of 50KVA or greater in the California market, with the exception of multi-family residential buildings and hotel guest rooms. 2013 Building Energy Efficiency Standards – California Code of Regulations Title 24, Part 6 should be reviewed to determine exact compliance requirements.

The purpose of this brochure is to highlight the capabilities of Siemens existing panels, and how SEM3™ technology integrates with these panels to provide a unique solution that can assist contractors in meeting requirements such as Title 24 and ASHRAE 90.1, or any company or consumer interested in increasing energy efficiency by monitoring load groups.

California Title 24 requires the disaggregation of the following load types:

Table 130.5B Required Disaggregation of Electrical Loads

<table>
<thead>
<tr>
<th>Load Type</th>
<th>Services rated 50kVA or less</th>
<th>Services rated between 50 and 250 kVA</th>
<th>Services rated between 250 and 1000 kVA</th>
<th>Services rated greater than 1000 kVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting type loads</td>
<td>Not required</td>
<td>All lighting in aggregate</td>
<td>All lighting disaggregated by floor, type or area</td>
<td>All lighting disaggregated by floor, type, or area</td>
</tr>
<tr>
<td>HVAC systems and components loads</td>
<td>Not required</td>
<td>All HVAC in aggregate</td>
<td>All HVAC in aggregate and each HVAC load rated at least 50 kVA</td>
<td>All HVAC in aggregate and each HVAC load rated at least 50 kVA</td>
</tr>
<tr>
<td>Domestic and service Water system loads</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Plus Type (Receptacle) loads including appliances rated less than 25 kVA</td>
<td>Not required</td>
<td>• All plug loads in aggregate&lt;br&gt;• Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sq. ft.</td>
<td>• All plug load separated by floor, type or area&lt;br&gt;• Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sq. ft.</td>
<td>• All plug load separated by floor, type or area&lt;br&gt;• All groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sq. ft.</td>
</tr>
<tr>
<td>Elevator type loads</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Other individual non-HVAC loads or appliances rated 25 kVA or greater</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Industrial or commercial Load Centers rated 25 kVA or greater</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Renewable power source</td>
<td>Each group</td>
<td>Each group</td>
<td>Each group</td>
<td>Each group</td>
</tr>
<tr>
<td>Loads associated with renewable power source</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Charging Stations for electric vehicles</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
</tbody>
</table>

1 Not considered part of typical P2 application.
Other applications

In addition to Title 24, there are other codes requiring load segregation for various equipment. For example, ASHRAE 90.1, which focuses on commercial and high-rise residential buildings, sets mandatory energy efficiency requirements for certain load types. Its scope has widened in recent years to include the majority of loads detailed in Title 24. Load disaggregation and monitoring provides an avenue to compliance for these other types of requirements as well.

ASHRAE 90.1-2016 Requirements

As the national reference standard, ASHRAE 90.1 sets the minimum acceptable level for all nonresidential nationwide. New construction requires:

- Total electrical energy
- HVAC system
- Interior lighting
- Exterior lighting
- Receptacle circuits

For multi-tenant buildings, these loads must be separately monitored both for the total building and for each tenant (excluding shared systems). In addition, the code requires specific recording and reporting of energy data:

- Automatically record energy use at least every 15 minutes
- Report use at least hourly, daily, monthly, and annually
- Provide subtenant energy data to each individual tenant
- Retain energy data at least 36 months
**Features**

**Siemens P2 with Load disaggregation Features**

Title 24 interiors are familiar P2 series Panelboards with up to 400A AL or CU bus material. Features include:
- Main Lug Only or Main Breaker Panels
- Multiple CT (current transformer) provisions available
- Grouping Breakers for load monitoring is easy to configure in COMPAS
- Feed-thru and Sub-feed capability for multiple panels if more circuits are needed
- CT Provisions can be placed as needed within the unit space available including just after the Main

Title 24 Panels use existing series of enclosures
- 7.75" deep box minimum required
- 20" or 24" Wide available
- Height of Enclosures available: 26", 32", 38", 44", 50", 56", 62", 68" & 74"

**References**


P2 Cut Sheet: PDFL-TI241-xxxx

To access SEM3 Solutions Guide and Data Sheets, visit: www.usa.siemens.com/sem3

SEM3 Solutions Guide: PDBR-SEM3S-xxxx

SEM3 Data Sheet: RPFL-SEMDS-xxxx

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Siemens has designed an easy to install compact solution with CT Provisions for metering segregated loads within P2 Panels with up to 400A bus in a 20” wide x 7.75” deep Type 1 or NEMA 3R enclosure.

Many advantages can be seen below:
- **Easy** to group loads as needed
  - Nearly unlimited configuration design possibilities within P2 size constraints up to 74” high Enclosure

- **Easy** to configure and order in COMPAS
  - Support for multiple CT provisions within one enclosure, plus feed-thru or sub-feed capability to monitor more Load groups in a second or third enclosure when needed

- **Easy** to install split CTs on bus up to 400A.
  - Same 400A CTs can be used for bus and line side monitoring, as well as for feed-thru and sub-feed monitoring (other SEM3 CTs available for cable mounting as needed)

- **Easy** to select and install fronts for Type 1 panels – uses same fronts as standard P2 panels

Note that SEM3 is also available in P4 and P5 Panelboards, as well as Switchboards. In these scenarios, all breakers must be monitored independently unless the entire panel is one load type.
Ease of Installation

Split-core CTs must be used in Siemens Title 24 Capable Lighting Panels. **Note that the CT on the central bus bar must be installed first for 3-phase applications; there is not room to install the middle CT if the CTs on each end are installed first.**

Note that the images here are intended to portray the ease of use of the split-core CTs. For actual installation instructions, please see the instruction label on the back of the P2 panelboard.

1. First, wrap split-core CT around middle bus. *(Use CT #4LSF0400R only for bus mounting)*

2. Snap CT connection plate into place to create the connection. Attach CT on front side to red glastic insulator with nylon wire tie *(shown below).*

3. Repeat steps 1 and 2 for each additional phase required. Note that the same type of CT can be used for sub-feed breakers, lugs, or any load carry cables that need to be monitored. *(See complete list of split-core CTs later in this document)*

4. CT attached to red glastic insulator

Nylon tie to be installed
The Title 24 compliant P2 Panel offers the same versatility and features of existing Siemens panels, but leverages the customizable nature of SEM3 to offer a configuration that satisfies any branch circuit monitoring requirement. Below is an example of the standard SEM3 parts needed to turn the existing Siemens P2 panel into one capable of satisfying load disaggregation requirements, along with further detail on SEM3’s capabilities.

Multi Family
The SEM3 was designed with branch circuit monitoring applications in mind. The SEM3 can precisely measure the energy consumption of up to 45 poles per controller\(^1\) in a space-savings Siemens panelboard solution. SEM3 can master a Siemens S7 1200 PLC configured to accept up to 44 digital inputs that may be configured in the controller as water or gas meter inputs and logged into the controller memory for extraction and transmit all of this critical billing information to third-party billing software as well as provide remote access via onboard webpages for quick system diagnostics and management.

The SEM3’s unique design allows you to expand by adding additional metered circuits in the future without expensive system modifications or retrofits. Its compact, integrated and cost effective design eliminates unsightly meter socket centers making your property more attractive to tenants and customers alike. SEM3 is now approved by the state and city of New York as a sub billing meter system.

SEM3 is approved by the state of California as a sub billing metering system.

SEM3 is CTEP Certified (California Type Evaluation Program) by CDFA (California Department of Food and Agriculture), a division of Measurement Standards, CA for sub billing applications.

Currently, SEM3 controller has the capability to sum individual CT loadings in order to group various load types. Subtraction calculation capabilities will be available in future updates. At this point in time, for applications requiring subtraction calculations, data can be exported to external software WinPM.Net or Powermanager. Additionally, data can be exported as text to Excel and any calculations can be manually performed from there.

WinPM.Net

Powermanager

This is a typical BOM for a simple SEM3 addition to a P2 Title 24 Panel. Exact components will need to be selected based on the application, number of CTs required, etc.

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>Catalog Numbers</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEM3 42M ENCL Type 1 20T X 16W X 6.62D</td>
<td>SEM342ENCL1</td>
<td>1</td>
<td>Enclosure includes controller, disconnect, and 2 Meter Racks 21 Position. Note that standard enclosure with HMI display is larger than enclosure without it.</td>
</tr>
<tr>
<td>SEM3 42M ENCL Type 1 w/display/switch 20 X 20 X 8D</td>
<td>SEM342ENCL1DS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meter Modules</td>
<td>Catalog Numbers</td>
<td>Quantity</td>
<td>Notes</td>
</tr>
<tr>
<td>Meter - standard accuracy 1% with pulse output</td>
<td>SEM3PLAMETER</td>
<td>1 per CT</td>
<td></td>
</tr>
<tr>
<td>Meter Racks</td>
<td>Catalog Numbers</td>
<td>Quantity</td>
<td>Notes</td>
</tr>
<tr>
<td>Meter Rack 21 Position</td>
<td>SEM3RACK21</td>
<td>2</td>
<td>Recommend minimum size to include space for 2 meter racks of 21 positions</td>
</tr>
<tr>
<td>Cables</td>
<td>Catalog Numbers</td>
<td>Quantity</td>
<td>Notes</td>
</tr>
<tr>
<td>Controller to Rack Cable - 12 Inch</td>
<td>SEM3CAB12INCH</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Split-Core CTs</td>
<td>Catalog Numbers</td>
<td>Quantity</td>
<td>Notes</td>
</tr>
<tr>
<td>Split Core CT 400:01 (1.565&quot; X 1.770&quot; Window) - 100 mA Output</td>
<td>4LSFO400R</td>
<td>1 CT per phase bus location</td>
<td>3 CTs needed for 3-phase grouping, 2 CTs needed for 1-phase grouping. For any additional cable or wire monitoring, choose appropriate CTs for size and type as needed for installation.</td>
</tr>
</tbody>
</table>

\(^1\) With two controllers, a single Panelboard can be configured with more than 45 poles monitored in one enclosure. Two controllers can monitor up to 90 poles.
1. Typical One Panel Installation Example

The following is an example configuration where P2 and SEM3 may meet Title 24 requirements, while minimizing costs for various applications. Any configuration requiring Title 24 compliance should be verified at installation by a local inspection or engineer of record.

**Example SEM3 load calculations**
Group 1 Load = CT [1] – CT [2]
Group 4 Load = CT [4]

**Note:** Currently, SEM3 controller can sum individual CT loadings in order to group load types. For subtraction calculations, data can be exported to external software. See page 7 for further information.

Blue lines indicate CT connections
Gold lines indicate load current connections
Ovals in diagrams represent CTs
Must use part number 4LSF0400R for any CT location designated in the example by an oval.
Recommend split-core CTs sized to match service for any CT location designated in the example by a square.

1 Will need separate SEM3 external retrofit panel for controller and meters

Examples of Groups
- Lighting type loads
- HVAC load
- Water system loads
- Receptacle type loads
- Elevator type load

For other load groupings, refer to Title 24 Table 130.5B
2. Typical Two Panel Installation Example

The following is an example configuration where P2 and SEM3 may meet Title 24 requirements, while minimizing costs for various applications. Any configuration requiring Title 24 compliance should be verified at installation by a local inspection or engineer of record.

External Retrofit SEM3 Panel
Optional Install when needed
(CT Wires can be extended up to 500 feet)

Blue lines indicate CT connections
Gold lines indicate load current connections
Ovals in diagrams represent CTs
Must use part number 4LSF0400R for any CT location designated in the example by an oval.
Recommend split-core CTs sized to match service for any CT location designated in the example by a square.

1 Will need separate SEM3 external retrofit panel for controller and meters
3. Typical Multi-Room Example – Electrical Room #1

The following is an example configuration where P2 and SEM3 may meet Title 24 requirements, while minimizing costs for various applications. Any configuration requiring Title 24 compliance should be verified at installation by a local inspection or engineer of record.

External Retrofit SEM3 Panel
Optional Install when needed (CT Wires can be extended up to 100 feet)

CT Wires can be extended up to 500 feet)

Example SEM3 load calculations
Group 1 Load = CT [1] – CT [2]
Group 4 Load = CT [4]

Note: Currently, SEM3 controller can sum individual CT loadings in order to group load types. For subtraction calculations, data can be exported to external software. See page 7 for further information.

Blue lines indicate CT connections
Gold lines indicate load current connections
Ovals in diagrams represent CTs
Must use part number 4LSF0400R for any CT location designated in the example by an oval.
Recommend split-core CTs sized to match service for any CT location designated in the example by a square.

1 Will need separate SEM3 external retrofit panel for controller and meters
Electrical Room #2 (Remote)

Typical Receptacle Loads (Add additional panels as needed). Can use a P1 Panel.

Typical Lighting Loads (Add additional panels as needed). Can use a P1 Panel.

Option for additional panels as needed
4. Multiple Panel System Example

The following is an example configuration where P2 and SEM3 may meet Title 24 requirements, while minimizing costs for various applications. Any configuration requiring Title 24 compliance should be verified at installation by a local inspection or engineer of record.

External Retrofit SEM3 Panel
Optional Install when needed
(CT Wires can be extended up to 500 feet)

Blue lines indicate CT connections
Gold lines indicate load current connections
Ovals in diagrams represent CTs
Must use part number 4LSF0400R for any CT location designated in the example by an oval.
Recommend split-core CTs sized to match service for any CT location designated in the example by a square.

1 Will need separate SEM3 external retrofit panel for controller and meters
**Note:** Currently, SEM3 controller can sum individual CT loadings in order to group load types. For subtraction calculations, data can be exported to external software. See page 7 for further information.

Example SEM3 load calculations

- Group 1 Load = CT [1] – CT [2]
- Group 6 Load = CT [6]

**Receptacle Panel 2**
(Can be a P1 Panel)

**Lighting Panel 1**
(Can be a P1 Panel)

**Transformer**
(optional as needed)

**Option for additional panels as needed**
5. SEM3 Main Panel Feeding Additional Panels Example

The following is an example configuration where P2 and SEM3 may meet Title 24 requirements, while minimizing costs for various applications. Any configuration requiring Title 24 compliance should be verified at installation by a local inspection or engineer of record.

![Diagram of panel configuration]

Group Load
125A MLO
1 P2 Panel, 30 circuits,
60A 2 pole breakers X 6

SEM3 Panel
400A Main Breaker
Main Monitor
125A 2 pole breakers X 4
250A 3 pole breakers X 2
Feed Thru Lugs

125A MLO
1 P1 Panel, 66 circuits

Lighting Load
125A MLO
1 P1 Panel, 66 circuits

Blue lines indicate CT connections
Gold lines indicate load current connections
Ovals in diagrams represent CTs
Must use part number 4LSF0400R for any CT location designated in the example by an oval.
Recommend split-core CTs sized to match service for any CT location designated in the example by a square.

1 Will need separate SEM3 external retrofit panel for controller and meters
Note that CT provisions can be used in the future and wired back to main SEM3 panel.
The modular design of the SEM3 Series allows for customization to suit large or small metering needs. The simple, snap in standard or high accuracy meter modules facilitate easy maintenance and are adaptable to Siemens panelboards and all front connected switchboards, eliminating the need for large metering stations. The SEM3 system has a wide range of applications and is commonly used in:

- Sub Billing and Cost Allocation
- System Diagnostics and Trending
- LEED Certification
- Load Management/Disaggregation
- Commercial, Residential, and Industrial Metering
- Meter System Retrofits

Communications
- Modbus RTU
- Modbus TCP
- 2 Pulse Inputs
- One Total Energy Pulse Output
- SMTP, SNMP, and NTP
- 2 pulse inputs native to the controller up to 44 inputs using S7 1200 mastered by the SEM3 controller

Meter module
- Up to ANSI C12.20/0.2
- (C12.20 Class 0.2) Third party tested and verified to ANSI C12.20 class 0.5
- Standalone Design, Single Phase Meter
- Modbus RTU communication to the Controller
- Scalable, customizable, and configurable
- 2 levels of metering accuracy (0.2% and 1%)
- Modular design simplifies installation and use
- Over, under, and delay alarms
- Low cost and low maintenance
- Ethernet communications
- Digital I/O
- Readily ties into existing lighting panels, distribution panels, and switchboards

Controller
- Converts single meter modules into 1, 2 and 3 phase meters
- Provides a single Modbus slave address for entire panel
- Supplies Class 2 signals to Meter Modules representing A, B, C and N voltage levels

Independent placement of CTs on mounting adapter

SEM3 Series is a family of devices designed to measure the current, voltage, energy usage, and many additional parameters for anywhere from 1 to 45 branch circuits in an integrated panelboard or switchboard. (More than 45 branch circuits with two controllers in one enclosure.)

The SEM3 series delivers accurate power information within a power distribution system with minimal space requirements. The fully programmable system also contains configurable alarms allowing you to better monitor loads and energy usage. This revolutionary design results in:

- Reduced total cost of ownership
- Reduced footprint
- Real-time metering data

1 Field-installed Class 2, Class 3, and other low voltage conductors shall be separated by a minimum 1/4 inch (6.4mm) from factory or field-installed electric light, power, Class 1, non-power-limited fire alarm circuit conductors, and medium power network-powered broadband communications cables. Separation of conductors may be obtained by clamping, routing, or an equivalent means.
## Embedded Micro Metering Module
### Functional Features

<table>
<thead>
<tr>
<th>Instantaneous values</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>Phase-Phase (2,3 Phase) &lt;br&gt;Phase-Neutral (1 phase)</td>
</tr>
<tr>
<td>Currents</td>
<td>Per Phase</td>
</tr>
<tr>
<td>Active, Reactive, and Apparent power (kW, kVAR, kVA)</td>
<td>Per Phase and Total</td>
</tr>
<tr>
<td>Power Factor</td>
<td>Per Phase and Total</td>
</tr>
<tr>
<td>Frequency</td>
<td>45...64 Hz</td>
</tr>
<tr>
<td>Phase Angle</td>
<td></td>
</tr>
<tr>
<td>Current Demand - kW demand</td>
<td>Per Phase and Total</td>
</tr>
<tr>
<td>Max Values</td>
<td>Current Demand</td>
</tr>
<tr>
<td></td>
<td>Current</td>
</tr>
<tr>
<td></td>
<td>kW Demand</td>
</tr>
<tr>
<td></td>
<td>kW</td>
</tr>
<tr>
<td>Average Values</td>
<td>Voltage</td>
</tr>
<tr>
<td></td>
<td>Current</td>
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</table>

### Energy Measurement

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Active Energy (kWh)</td>
<td></td>
</tr>
<tr>
<td>Reactive Energy (kVARh)</td>
<td></td>
</tr>
<tr>
<td>Apparent Energy (kVAh)</td>
<td></td>
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</tbody>
</table>

### Alarming / Monitoring Functions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Phase Loss</td>
<td></td>
</tr>
<tr>
<td>Over Current Warning</td>
<td></td>
</tr>
<tr>
<td>Over Current Alarm</td>
<td></td>
</tr>
<tr>
<td>Over kW Demand Alarm</td>
<td></td>
</tr>
<tr>
<td>Under/Over Voltage Alarm</td>
<td></td>
</tr>
</tbody>
</table>

### Communications

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet/Modbus TCP/IP, BACnet IP, SNMP, NTP and SMTP</td>
<td>Integrated RJ45 port as standard (can support three masters and one integrated web access simultaneously)</td>
</tr>
<tr>
<td>Modbus RTU</td>
<td>Integrated RS485 port</td>
</tr>
<tr>
<td>kWhr Pulse Input1/2</td>
<td>Monitors Meters (Water, Gas, etc.)</td>
</tr>
<tr>
<td>kWhr Pulse Output1</td>
<td>Form A / C 28 VDC (± 4)</td>
</tr>
<tr>
<td></td>
<td>Form A / C max 30 VDC</td>
</tr>
</tbody>
</table>

### General

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Password Protection</td>
<td></td>
</tr>
</tbody>
</table>

### Technical Data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement Types</td>
<td>1, 2, or 3 phase</td>
</tr>
<tr>
<td>Measurement Accuracy - Standard</td>
<td>ANSI C12.16/1</td>
</tr>
<tr>
<td>Measurement Accuracy - High</td>
<td>ANSI C12.20/0.2</td>
</tr>
<tr>
<td>Measured Voltage without Transformer</td>
<td>Delta/Wye 480V max</td>
</tr>
<tr>
<td>Current Inputs</td>
<td>100 mA output CTs 50-1200A CTs</td>
</tr>
<tr>
<td>Power Supply</td>
<td>AC 120-480 VAC (±10%)</td>
</tr>
<tr>
<td>Degree of Protection</td>
<td>Front / Rear</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>°C / °F</td>
</tr>
</tbody>
</table>

### Safety Standards and Compliance

- CSA C22.2 No. 1010-1 Safety Requirements for Electrical Equipment for Measurement
- UL916 Energy Management Equipment
- IEC 62052-11; IEC 62053 Class 0.5S; UL61010-1 (IEC 61010-1) Test and Measurement Equipment
- Current transformer listed to UL 2808 Energy Monitoring Current Transformers
- Approved by New York City PSC (Public Service Commission) for sub billing application
- CTEP Certified (California Type Evaluation Program) by CDFA (California Department of Food and Agriculture), a division of Measurement Standards, CA for sub billing applications
- Approved by third party NRTL (Nationally Recognized Test Lab) for ANSI C12.20 standards
Embedded Micro Metering Module
SEM3 System configured in Panelboards

The Siemens SEM3 system can be configured for factory installation in branch circuit monitoring applications using the Siemens COMPAS configuration tool. This option can lower the installation time of the system for the installer while providing a factory warranted solution.

SEM3 use in Siemens Panelboards

Type P2: Enclosure
- Available in a NEMA 1, 3R, or 12 rated enclosure.
- Minimum width and depth: 24" width x 5.75" depth
- Height: Up to 74" depending on branch breaker selection
  - Addition of monitoring on some mains (primary and subfeed) may require additional box length. In these cases the box will be increased to the next size available as a standard design.
  - In cases where enclosure size is increased all multi-section panels will be increased to match the largest section.

Controller
SEM3 controller is mounted in unit space opposite of the feed location specified in COMPAS (i.e., bottom mount for top feed) and will require 3" of unit space. Each controller will be powered by direct tap connection to the panel section bus. Each controller can monitor up to 45 circuits. Applications that require monitoring more than 45 circuits will require additional controllers.

Current Transformers (CTs)
Five sizes of CTs are available for use in the P2 panel: 50, 125, 250, 400 and 600 amp. All CTs are pre-mounted to a support bracket that attaches to the base rail of the interior of the panel board. Each bracket supports a maximum of 3 CTs and is designed for the breaker selected (brackets are not interchangeable between breaker frames). Each CT will be attached to a data module that is placed in the meter racks. Refer to page 22 for detailed list of parts.

Meter Racks
Each meter rack requires 3" of unit space. All meter racks will be installed next to the SEM3 controller in unit space. The COMPAS configuration tool will select the appropriate meter rack configuration according to the user’s application and will use the 21 space meter rack as a default option where possible. Only one meter rack (regardless of number of positions) can be installed in 3" of unit space.

NOTE: Monitoring of 45 circuits will require 9" of unit space: two 21 position racks and one 3 position rack.
**P2 Devices**

**Enclosure sizes**

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**Example P2 Panel with SEM3 Type 1 Enclosure (24” Wide x 5.75” Deep)**

Enclosure heights are in 6" increments from 26" thru 74".


The COMPAS configuration tool can provide actual dimensions based on the configuration. Example below is largest standard P2 enclosure for factory assembled panel with all small (1") branch breakers installed.

---

**Main Breaker / Main Lug space varies based on selected options**

**Unit space varies based on selected options**

**Note:** All circuits do not have to be monitored by SEM3 – user can select any circuits in this space to be monitored.

In this situation, there is a maximum of 63 circuits that can be monitored with the configuration shown (including all of the branch breakers and the 3-phase main breaker).

Some selections of main breakers and other subfeed options could further limit this.

In this situation there is 30” of unit space available – so 60 branch circuits could be monitored.

If monitoring the main, three additional circuits could be monitored with a total of 63 circuits.

This requires two controllers and three 21 position racks using 15” of unit space.

---

**SEM3 space varies by number of circuits monitored – this uses unit space.**

- $> 6”$ of space for up to 21 circuits monitored one controller and one 21-pos rack
- $> 9”$ of space for up to 42 circuits monitored one controller and two 21-pos racks
- $> 12”$ of space for up to 45 circuits monitored one controller and two 21-pos racks plus one 3-pos rack
- $> 15”$ of space for up to 63 circuits monitored two controllers and three 21-pos racks

**Note:** If subfeed space is needed – it will take away from available unit space.

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**Example not designed for Title 24 compliance**
Embedded Micro Metering Module
SEM3 System Configured in Distribution Panels and Switchboards

The information below pertains to panelboard types P4, P5 and switchboard types SB2, and SB3. Please note SEM3 is not available for P3 panelboards or SB1 switchboards. SEM3 is available in NEMA type 1, 3R, and 12 enclosures. SEM3 specifics to P4, P4, SB2, and SB3 are:

SEM3 for use in Siemens Switchboards

**Controller**
SEM3 controller is mounted in unit space. For P4 and P5 panels it will be mounted opposite of the feed location specified in COMPAS (i.e., bottom mount for top feed). The controller will require 3.75” of unit space in P4/5 and SB2/3. Each controller will be powered by direct tap connection to the section bus and can monitor up to 45 circuits. Applications that require monitoring more than 45 circuits will require additional controllers. For multi-section applications each controller will only be connected to meter racks in the same section as the controller.

**Current Transformers (CTs)**
Seven sizes of CTs are available for use in P4/5 & SB2/3 applications: 50, 125, 250, 400, 600, 800 and 1200 amp. All CTs are pre-mounted to a support bracket that attaches to the interior. Each bracket supports a maximum of 3 CTs and is designed for the breaker selected (brackets are not interchangeable between breaker frames). Each CT will be attached to a data module that is placed in the meter racks. Refer to page 22 for detailed list of parts.

**Meter Racks**
Each meter rack requires 3.75” of unit space. All meter racks will be installed next to the SEM3 controller in unit space. The COMPAS configuration tool will select the appropriate meter rack configuration according to the user’s application and will use the 21 space meter rack as a default option where possible. Only one meter rack (regardless of number of positions) can be installed in 3.75” of unit space. For multi-section applications, each rack will only be connected to data modules from CTs in that section. Racks will not be setup to monitor CTs from adjacent sections.

**NOTE:** Monitoring of 45 circuits will require 9” of unit space: two 21 position racks and one 3 position rack.

**Other Considerations**
**Configuration:** Data modules from CTs monitoring a circuit breaker must be mounted adjacent to one another in the meter rack. Any field changes to the factory configuration must take this into account.

**Start-up & Commissioning:** Siemens can provide these services. Contact your local Siemens PDS Power Solutions Business Developer for more details.

**Billing Services for sub billing applications:** Billing services are available. Contact your local Siemens PDS Power Solutions Business Developer for more details.
P4 and P5 devices

Enclosure sizes

Example P4 and P5 Panel with SEM3 Type 1 Enclosure

P4 = (32" Wide x 10" Deep)  
P5 = (38" or 46" Wide x 10" Deep)

Enclosure heights are in 15" increments from 60" thru 90". Enclosure heights: 60", 75", 90" (there are also optional depths).

The COMPAS configuration tool can provide actual dimensions based on the configuration. Example below is largest standard P4 enclosure for factory assembled panel – unit space is in 3.75" increments – up to 6 circuits can occupy each 3.75" of unit space.

P4 and P5 devices

Enclosure sizes

Note: All circuits do not have to be monitored by SEM3 – user can select any circuits in this space to be monitored.

In this situation, there is a maximum of 63 circuits that can be monitored with the configuration shown (including all of the branch breakers and the 3-phase main breaker). Some selections of main breakers and other subfeed options could further limit this.

In this situation there are 37.5" of unit space available, so 60 branch circuits can be monitored. If monitoring the main, three additional circuits could be monitored with a total of 63 circuits.

This requires two controllers and three 21 position racks using 18.75" of unit space.

If subfeed space is needed – it will take away from available unit space.

Example not designed for Title 24 compliance
## Ordering Information

<table>
<thead>
<tr>
<th>Controller</th>
<th>Catalog number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Controller</td>
<td>SEM3CONTROLLER</td>
</tr>
</tbody>
</table>

### Meter Modules

Must use this meter with pulse output capability to meet California Title 24 requirements.

- **Meter – Standard Accuracy 1% with Pulse Output** SEM3PLAMETER
- **Meter – High Accuracy 0.2% with Pulse Output** SEM3PHAMETER

### Meter Racks

- **Meter Rack 3 Position** SEM3RACK3
- **Meter Rack 6 Position** SEM3RACK6
- **Meter Rack 9 Position** SEM3RACK9
- **Meter Rack 15 Position** SEM3RACK15
- **Meter Rack 21 Position** SEM3RACK21

### Cables

- **Controller to Rack Cable - 6 Inch** SEM3CAB6INCH
- **Controller to Rack Cable - 12 Inch** SEM3CAB12INCH
- **Controller to Rack Cable - 24 Inch** SEM3CAB24INCH
- **Controller to Rack Cable - 36 Inch** SEM3CAB36INCH

### Solid Core CTs

- **Solid Core CT 50:0.1** SEM3SCCT50
- **Solid Core CT 125:0.1** SEM3SCCT125
- **Solid Core CT 250:0.1** SEM3SCCT250
- **Solid Core CT 400:0.1** SEM3SCCT400
- **Solid Core CT 600:0.1** SEM3SCCT600
- **Solid Core CT 800:0.1** SEM3SCCT800
- **Solid Core CT 1200:0.1** SEM3SCCT1200
- **Solid Core CT 1600:0.1** SEM3SCCT1600
- **Solid Core CT 2000:0.1** SEM3SCCT2000

### Split Core CTs

- **Split Core CT 50:01** 4LSF0050
- **Split Core CT 125:01** 4LSF0125
- **Split Core CT 250:01** 4LSF0250
- **Split Core CT 400:01** 4LSF0400
- **Split Core CT 600:01** 4LSF0600
- **Split Core CT 800:01** 4LSF0800
- **Split Core CT 1200:01** 4LSF1200
- **Split Core CT 1600:0.1** 4LSF1600
- **Split Core CT 2000:0.1** 4LSF2000

For P2 CT compartment, must use this part number to fit the CT around the bus.

- **Split Core CT 400:0.1** 4LSF0400R

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1 For Pulse output meter modules, please contact Sales for availability.
2 Custom cable lengths may be available contact Siemens Sales or PDS Business Developers for details.
Standard Enclosures for External Applications

The SEM3 standalone enclosure is ideal for retrofit/external wall mount applications, as it requires minimal modification of existing systems while gaining full functionality of the SEM3 branch circuit monitoring solution. Installation of the required milliamp current transformers (CT) is minimized by utilizing the Siemens Split Core CTs ranging from 50 to 1200 amps. See “Split Core CT” section.

SEM3 standard enclosures are available with NEMA 1, 4 and 12 ratings. The SEM3 meter enclosure is shipped with all the required components installed. The control voltage is wired to a fusible disconnect switch to protect the system and to provide a disconnect from outside power to the meter. SEM3 CTs are self-shorting, not requiring a shorting block in the enclosure/panel. The enclosure has a ground lug for equipment grounding. When the control voltage is greater than 480 volts, a CPT is provided between the disconnect switch and SEM3 controller. The enclosure is pre-drilled to make mounting quick and easy.

The standard enclosure comes with the controller, power supply, disconnect, meter racks, communication cables, and shorting blocks. Meter modules and CTs are added separately. As mentioned previously, the display is available as an option.

Typical SEM3™ with display example
# Standard Enclosures for External Applications

## No Display Standard Enclosure for External Application – HMI, SEM3 Meter Modules, and CTs are not included

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEM3 3M ENCL Type 1 16T x 12W X 6D</td>
<td>SEM303ENCL1</td>
</tr>
<tr>
<td>SEM3 3M ENCL Type 12 16T x 12W X 6D</td>
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<tr>
<td>SEM3 3M ENCL Type 4 16T x 12W X 6D</td>
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<td>SEM3 15M ENCL Type 1 16DT x 12W X 6D</td>
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<tr>
<td>SEM3 15M ENCL Type 12W 16DT x 12W X 6D</td>
<td>SEM315ENCL12</td>
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<tr>
<td>SEM3 18M ENCL Type 1 20T x 12W x 6D</td>
<td>SEM318ENCL1</td>
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<tr>
<td>SEM3 18M ENCL Type 12W 20T x 12W x 6D</td>
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<td>SEM3 18M ENCL Type 4 20T x 12W x 6D</td>
<td>SEM318ENCL4</td>
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<tr>
<td>SEM3 21M ENCL Type 1 20T x 12W x 6D</td>
<td>SEM321ENCL1</td>
</tr>
<tr>
<td>SEM3 21M ENCL Type 12W 20T x 12W x 6D</td>
<td>SEM321ENCL12</td>
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<td>SEM3 21M ENCL Type 4 20T x 12W x 6D</td>
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<td>SEM3 42M ENCL Type 1 20T x 16W x 6.62D</td>
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</tr>
<tr>
<td>SEM3 45M ENCL Type 4 20T x 16W x 6.62D</td>
<td>SEM345ENCL4</td>
</tr>
</tbody>
</table>

## Standard Enclosure with HMI Display and Switch for External Application – SEM3 Meter Modules, and CTs are not included

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEM3 3M w/display/switch 16 x 16 x 6.5</td>
<td>SEM303ENCL1DS</td>
</tr>
<tr>
<td>SEM3 3M w/display 16 x 16 x 6.5</td>
<td>SEM303ENCL1D</td>
</tr>
<tr>
<td>SEM3 9M w/display/switch 16 x 16 x 6.5</td>
<td>SEM309ENCL1DS</td>
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<tr>
<td>SEM3 9M w/display 16 x 16 x 6.5</td>
<td>SEM309ENCL1D</td>
</tr>
<tr>
<td>SEM3 15M w/display/switch 20 x 16 x 8</td>
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<td>SEM3 18M w/display/switch 20 x 16 x 8</td>
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<tr>
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<td>US2:SEM345ENCL1D</td>
</tr>
</tbody>
</table>
SEM3 Network Topology Solutions

Rack Configurations
A common SEM3 meter rack combination is shown below. The combination illustrated shows the maximum number of single phase circuits one SEM3 controller may monitor, 45. This configuration is common in applications where the meter points are located relatively close together, such as a panelboard.

Note: 600V Isolated Ethernet cables between controller and racks are available in 6”, 12”, 24” and 36” lengths.