

# SPD, Power Conditioning, PF Capacitors and Harmonic Filters

## Industrial Surge Protection Products



## 2.1 Surge Protection and Power Conditioning

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## Industrial and Commercial Surge Protection



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## Introduction

## Industrial and Commercial Surge Protection

- SPD Series for Integration into Electrical Distribution Equipment
- SPD Series for Mounting External to Electrical Distribution Equipment

**SPD Series Sidemount Units**

Specification grade surge protective devices for installation external to electrical distribution equipment.

**SPD Series Integrated Units**

Specification grade surge protective devices installed within Eaton's electrical assemblies.



SPD Series Integrated Unit



SPD Series Sidemount Unit

## Critical Load Protection

Series filtering and surge protection for critical single-phase loads.

- Current ratings up to 60 A
- 120 and 240 Vac units
- 24 and 48 Vdc units
- DIN mounting available on some models
- Up to 80 kA of peak surge protection
- AC units are UL® 1449 4th Edition and UL 1283 7th Edition listed



AEGIS Products

## Commercial and Light Industrial Surge Protection

The SPC Series offers robust protection in a compact, flexible design and is configurable for a wide range of commercial and light industrial applications. The SPC combines surge suppression components and the options of EMI/RFI filtering, Form C contacts and an audible alarm.

Surges (also known as transients), due to lightning, utility grid switching, switching of external/internal inductive or capacitive loads, and other sources, travel on power line conductors throughout the electrical distribution system, causing system operating problems and equipment downtime.



SPC Series

**Surge Protection for Sub-Panel and OEM Applications**

In today's business environment that calls for 24 hours a day, 7 days a week uptime and reliability, Eaton's CVX050 and CVX100 surge protective devices (SPDs) ensure that a customer's investment in equipment and processes is protected from the damaging effects of voltage transients. Designed for installation on service entrance, branch panels or individual equipment disconnects, the CVX050/100 provides enhanced surge protection for mission-critical applications.

**Panelboards with Integrated Surge Protective Devices**

- Available in standard and custom configurations
- Ratings:
  - 120/240 Vac, single-phase, three-wire
  - 208Y/120 Vac, three-phase, four-wire
  - 480Y/277 Vac, three-phase, four-wire
  - 600Y/347 Vac, three-phase, four-wire (other voltage configurations are available)
- Copper bus
- 12, 18, 24, 30, 36 and 42 circuits
- Bolt-on branch breakers
- A full range of factory installed modifications and accessories
- Fully rated or series rated



**Surge Protective Devices can be Integrated within a variety of Eaton Electrical Assemblies**

**Power Conditioning****Sag Ride-Through (SRT2)**

The sag ride-through (SRT2) is a power conditioner that corrects voltage sags to maintain uptime and productivity.



**Sag Ride-Through (SRT2)**

**Power-Sure 700 (T700)**

The Power-Sure 700 (T700) is designed to meet the needs of customers who experience voltage regulation problems due to brownout conditions from their electric utilities.



**Power-Sure 700 (T700)**

**Facility-Wide Power Protection Solutions**

A facility-wide protection approach should be employed to address power quality issues. This approach minimizes overall lifecycle costs and optimizes facility uptime. The following is a recommended design approach for implementing facility-wide Eaton power protection solutions.

The most accepted design methodology is based on two concepts:

1. Ensure proper grounding conditions exist. All forms of power protection/conditioning rely on good grounding, bonding and earthing practices.
2. Surge protection should be installed at key distribution panels and critical loads.

## Application Description

## 2

## Application Recommendations for Surge Products

| Application Type            | Eaton's Surge Product                                                                                              | Features and Competitive Advantages                                         |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Light Commercial            |                                                                                                                    |                                                                             |
| Design build                | SPD Series integrated units                                                                                        | Ideal package for any commercial facility                                   |
| Chain stores                | SPD Series sidemount units                                                                                         | Cost-effective, reliable protection using the SPD Series or SPC units       |
| Small facilities            | SPC units                                                                                                          |                                                                             |
|                             | CVX units                                                                                                          |                                                                             |
|                             | SP1 units                                                                                                          |                                                                             |
| Large Projects              |                                                                                                                    |                                                                             |
| Including:                  | SPD Series integrated units in panelboards, switchboards, MCCs, switchgear, busway and automatic transfer switches | Able to meet competitors' surge protection specifications                   |
| Commercial                  |                                                                                                                    | Increased surge protection performance by using integrated SPD Series units |
| Government                  | SPD Series sidemount units                                                                                         | Wall space savings by using integrated SPD Series units                     |
| Schools                     | SPD MAX units                                                                                                      | Quick-ship capabilities from Eaton assembly satellites and service centers  |
| Institution                 | AEGIS units for critical load applications                                                                         | Power conditioning capability for a wide variety of applications            |
| Military                    | Power conditioners (T700, T800 and T100 and SRT2 units)                                                            |                                                                             |
| Industrial                  |                                                                                                                    |                                                                             |
| Including:                  | SPD Series integrated units in panelboards, switchboards, MCCs, switchgear, busway and automatic transfer switches | Increased surge protection performance by using integrated SPD Series units |
| Small and large facilities  |                                                                                                                    | Wall space savings by using integrated SPD Series units                     |
| WWTP                        | SPD Series sidemount units                                                                                         | MCCs with SPD Series units installed protect drives from damage             |
|                             | SPD MAX units                                                                                                      | AEGIS products protect expensive critical loads from harmful damage         |
|                             | AEGIS units for critical load applications such as PLCs, robotics applications, etc.                               | T700 and T800 units correct voltage regulation problems                     |
|                             | Power conditioners (T700, T800 and T100 and SRT2 units)                                                            | SRT2 units correct voltage sag problems                                     |
| OEM                         |                                                                                                                    |                                                                             |
| Any OEM customer including: | SPD Series integrated units                                                                                        | Years of experience in a variety of OEM applications                        |
| Integrators                 | SPD Series sidemount units                                                                                         | Application assistance and recommendations                                  |
| Medical equipment           | CVX units                                                                                                          | Small footprint enables integration in a variety of applications            |
|                             | SPC units                                                                                                          | Ability to meet customized requirements                                     |
| Automation and control      | SP1 units                                                                                                          |                                                                             |
|                             | AEGIS units for critical load applications                                                                         |                                                                             |
| Telecommunications          |                                                                                                                    |                                                                             |
| Including:                  | Panelboards and automatic transfer switches with integrated SPD Series units                                       | Ability to meet customized requirements                                     |
| Cellular sites              | SPD Series sidemount units                                                                                         | Application assistance and recommendations                                  |
| Microwave                   | CVX units                                                                                                          |                                                                             |
|                             | SPC units                                                                                                          |                                                                             |
| PCS                         | SP1 units                                                                                                          |                                                                             |

**SPD Series Sidemount Units****Contents****Description**

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**Product Overview****Product Description**

Eaton's SPD series surge protective devices are the latest and most advanced UL 1449 4th Edition certified surge protectors. Units are available integrated within Eaton electrical assemblies, including panelboards, switchboards, motor control centers, switchgear, automatic transfer switches and bus plugs.

A complete offering of sidemount units designed for mounting external to electrical distribution equipment is also available. Application of SPD Series units throughout a facility will ensure that equipment is protected with the safest and most reliable surge protective devices available. SPD Series units are available in all common voltages and configurations and also in a variety of surge current capacity ratings from 50 through 400 kA. Three feature package options are also available to choose from, ensuring the proper unit is available for a variety of applications.

**SPD Series Integrated Units****Features, Benefits and Functions**

- Uses thermally protected metal oxide varistor (MOV) technology
- Three feature package options
- True protection status indicators report the status of the protection elements, not the status of the applied power
- Available integrated within the following Eaton electrical assemblies: panelboards, switchboards, motor control centers, switchgear, automatic transfer switches and bus plugs
- 10-year warranty (15-year warranty with online registration)

**Safety Features**

- All units use thermally protected metal oxide varistor technology (MOV) as their core surge suppression component. Usage of this technology ensures safe operation when the unit is subjected to abnormal conditions such as temporary overvoltage or high fault current conditions. Under such conditions, the self-protected MOVs are removed from the circuit quickly and safely before a potentially unsafe condition can occur
- SPD Series units contain no replaceable parts such as surge modules, fuses, or surge counter memory backup batteries. This prevents potential arc flash and shock hazards, as the units require no periodic service or user intervention after installation
- Integrated versions of the unit are factory installed and sidemount versions are factory sealed. These important safety measures further enhance user safety

**Three Feature Package Options Available**

The SPD Series provides users with the option of selecting between three feature packages. These feature packages are the basic, standard and standard with surge counter. The proper feature package can be selected based on the requirements of the application or specification. A side by side comparison of the individual features found in each package is below.

**Basic Feature Package**

The basic feature package is perfect for applications where basic, cost-effective, safe and reliable surge protection is required, but budgets don't allow for extra, additional features. Rather than sacrifice performance or safety due to cost, SPD Series units with the basic feature package provide you with high-performing surge protection without sacrificing safety or reliability. The basic feature package provides the same level of surge protection and safety provided by the standard and standard with surge counter feature packages minus some of the features found in them. The package contains dual-colored protection status LEDs that report the true status of the protection in each phase/mode. All four-wire plus ground units also contain an additional set of dual-colored protection status LEDs that report the status of the protection in the neutral/ground mode.

**Standard Feature Package**

The standard feature package includes all of the features found in the basic feature package, plus an audible alarm with silence button, EMI/RFI filtering, and a form 'C' relay contact that can be used for remote annunciation of the SPD's status. The audible alarm activates and the form 'C' relay contact changes state when any loss of protection is detected or a fault condition exists with the unit. Should such a condition occur, the audible alarm can be silenced by pressing the silence button. The EMI/RFI filter provides up to 50 dB of noise attenuation over the range of 10 kHz through 100 MHz.

**Standard with Surge Counter Feature Package**

The standard with surge counter feature package includes all of the features found in the standard feature package plus a six-digit surge counter with a reset button. The surge counter indicates the ongoing count of the number of surges the unit has been exposed to and stores them in nonvolatile memory. Should power to the SPD Series unit be completely interrupted, the surge counter will recall and display the surge count prior to the interruption when power is restored. Unlike many surge protectors, the SPD Series' surge counter memory feature does not require a backup battery that would require periodic replacement in order to achieve its memory functionality.

**Side-By-Side Comparison of the SPD Series' Available Feature Packages**

| Feature Package Comparison                                                           | Basic | Standard | Standard with Surge Counter |
|--------------------------------------------------------------------------------------|-------|----------|-----------------------------|
| Surge protection using self-protected MOV technology                                 | ■     | ■        | ■                           |
| Dual-colored protection status indicators for each phase                             | ■     | ■        | ■                           |
| Dual-colored protection status indicators for the N-G protection mode                | ■     | ■        | ■                           |
| Audible alarm with silence button                                                    |       | ■        | ■                           |
| Form 'C' relay contact                                                               |       | ■        | ■                           |
| EMI/RFI filtering, providing up to 50 dB of noise attenuation from 10 kHz to 100 MHz |       | ■        | ■                           |
| Surge counter with reset button                                                      |       |          | ■                           |

**Standards and Certifications**

- Integrated versions of the unit are UL 1449 4th Edition recognized components for the United States and Canada, covered by Underwriters Laboratories certification and follow-up service
- Sidemount versions are UL 1449 4th Edition listed devices and are also CSA® approved

**Technical Data and Specifications**

- 20 kA nominal discharge current ( $I_n$ ) rating (maximum rating assigned by UL)
- 50 through 400 kA surge current capacity ratings
- 200 kA short-circuit current rating (SCCR)



## SPD Series Unit Integrated within an Eaton Panelboard



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## SPD Series for Integration into Electrical Distribution Equipment

## Product Description

Eaton's SPD Series surge protective devices are the latest and most advanced UL 1449 4th Edition certified surge protectors. SPD Series units are available in all common voltages and configurations, and also in a variety of surge current capacity ratings from 50 to 400 kA.

## Application Description

The SPD Series is available as an integrated device within the following Eaton electrical assemblies:

- Panelboards
- Switchboards
- Motor control centers
- Switchgear
- Automatic transfer switches
- Bus plugs

## Features, Benefits and Functions

- Uses thermally protected metal oxide varistor (MOV) technology
- Three feature package options
- 10-year warranty (15-year with online registration)

**The Integrated SPD Performance Advantage**

Installation conductor length is the single most important factor related to an SPD's performance. Performance decreases as the connected conductor length increases. Integrating the SPD within the electrical assembly provides the best possible surge protection by keeping installation conductor lead lengths as short as possible. Integrating the SPD within an electrical assembly can decrease let-through voltages by hundreds of volts, providing you with the best possible surge protection for sensitive electronic loads.

**Remote Display Mounting Option Available**

The SPD Series offers the option of mounting its display remotely from the device. This is useful for applications where OEMs or other integrators would like to embed the unit within a piece of equipment and still be able to view its display.



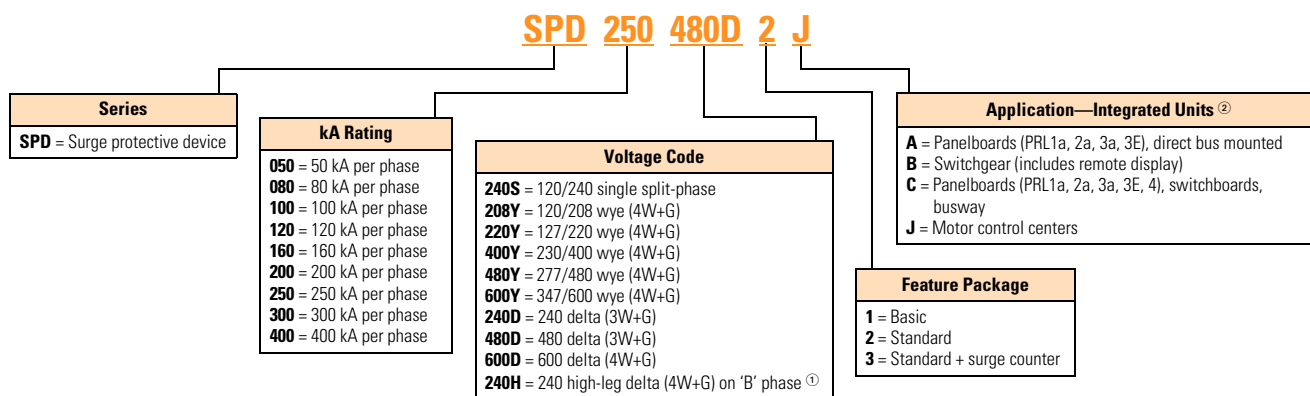
*In this installation, the SPD Series is mounted directly to the panelboard's bus bars. This type of installation will provide the best possible surge protection by minimizing the connected lead length.*



*The SPD Series is also available as an integrated unit interfaced via a circuit breaker resident in the electrical assembly. This installation keeps connected lead lengths short while providing a means of disconnecting power to the unit quickly and easily.*

**Standards and Certifications**

- UL 1449 4th Edition recognized component for the United States and Canada, covered by Underwriters Laboratories certification and follow-up service
- UL 1283 7th Edition (Type 2 SPDs only)

**Catalog Number Selection****SPD Series Units Mounted Internal to Electrical Distribution Equipment****Notes**

<sup>①</sup> Please consult the factory for 240 high-leg delta (4W+G) applications with high leg on 'C' phase.

<sup>②</sup> Units used in PRL1a, 2a, 3a and 3E panelboard applications are available in 50–200 kA ratings only. Use the 'C' option for PRL1a, 2a, 3a and 3E panelboard applications when unit is connected through a circuit breaker.

Example: SPD250480D2J = SPD Series, 250 kA per phase, 480D voltage, standard feature package, motor control center application.



## Technical Data and Specifications

## SPD Series Specifications

2

| Description                                                         | Specification                                                                                                                                  |                    |
|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Surge capacity ratings available                                    | 50, 80, 100, 120, 160, 200, 250, 300, 400 kA per phase                                                                                         |                    |
| Nominal discharge current ( $I_n$ )                                 | 20 kA (maximum rating assigned by UL)                                                                                                          |                    |
| Short-circuit current rating (SCCR)                                 | 200 kA                                                                                                                                         |                    |
| SPD type                                                            | Basic feature package = Type 1 (can also be used in Type 2 applications)<br>Standard and standard with surge counter feature packages = Type 2 |                    |
| Single split-phase voltages available                               | 120/240                                                                                                                                        |                    |
| Three-phase wye system voltages available                           | 120/208, 127/220, 230/400, 277/480, 347/600                                                                                                    |                    |
| Three-phase delta system voltages available                         | 240, 480, 600                                                                                                                                  |                    |
| Input power frequency                                               | 50/60 Hz                                                                                                                                       |                    |
| Power consumption (basic units):                                    |                                                                                                                                                |                    |
| 208Y, 220Y, 240S, 240D and 240H voltage codes                       | 0.5 W                                                                                                                                          |                    |
| 400Y, 480Y and 480D voltage codes                                   | 1.1 W                                                                                                                                          |                    |
| 600Y and 600D voltage codes                                         | 1.3 W                                                                                                                                          |                    |
| Power consumption (standard and standard with surge counter units): |                                                                                                                                                |                    |
| 208Y, 220Y, 240S, 240D and 240H voltage codes                       | 0.6 W                                                                                                                                          |                    |
| 400Y, 480Y and 480D basic voltage codes                             | 1.7 W                                                                                                                                          |                    |
| 600Y and 600D voltage codes                                         | 2.1 W                                                                                                                                          |                    |
| Protection modes                                                    | Single split-phase                                                                                                                             | L-N, L-G, N-G, L-L |
|                                                                     | Three-phase wye                                                                                                                                | L-N, L-G, N-G, L-L |
|                                                                     | Three-phase delta                                                                                                                              | L-G, L-L           |
|                                                                     | Three-phase high-leg delta                                                                                                                     | L-N, L-G, N-G, L-L |
| Maximum continuous operating voltage (MCOV):                        |                                                                                                                                                |                    |
| 240S, 208Y, 220Y and 240H MCOV                                      | 150 L-N, 150 L-G, 150 N-G, 300 L-L                                                                                                             |                    |
| 400Y and 480Y MCOV                                                  | 320 L-N, 320 L-G, 320 N-G, 640 L-L                                                                                                             |                    |
| 600Y MCOV                                                           | 420 L-N, 420 L-G, 420 N-G, 840 L-L                                                                                                             |                    |
| 240D MCOV                                                           | 320 L-G, 320 L-L                                                                                                                               |                    |
| 480D MCOV                                                           | 640 L-G, 640 L-L                                                                                                                               |                    |
| 600D MCOV                                                           | 840 L-G, 840 L-L                                                                                                                               |                    |
| Ports                                                               | 1                                                                                                                                              |                    |
| Operating temperature                                               | -40 °F through 122 °F (-40 °C through 50 °C)                                                                                                   |                    |
| Operating humidity                                                  | 5% through 95%, noncondensing                                                                                                                  |                    |
| Operating altitude                                                  | Up to 16,000 ft (5000 m)                                                                                                                       |                    |
| Seismic withstand capability                                        | Meets or exceeds the requirements specified in IBC 2006, CBC 2007 and UBC Zone 4                                                               |                    |
| Form C relay contact ratings                                        | 150 Vdc or 125 Vac, 1 A maximum                                                                                                                |                    |
| Form C relay contact logic                                          | Power ON, normal state—NO contact = open, NC contact = closed<br>Power OFF or fault state—NO contact = closed, NC contact = open               |                    |
| EMI/RFI filtering attenuation                                       | Up to 50 dB from 10 kHz to 100 MHz                                                                                                             |                    |

# 2.1

## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

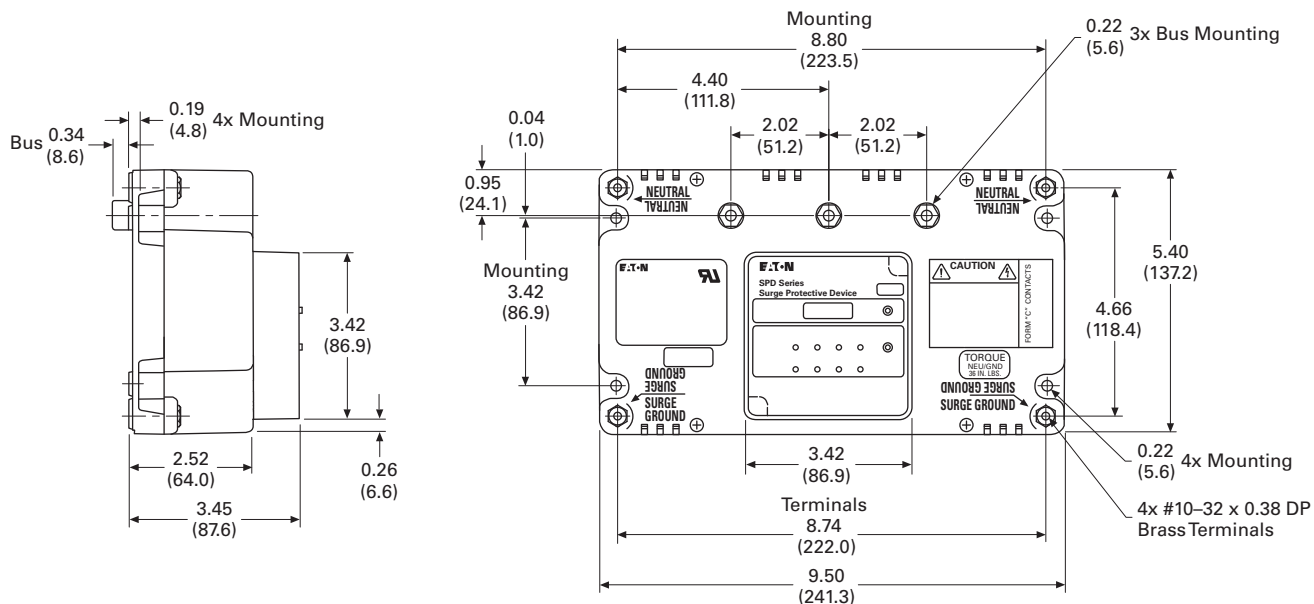
### Surge Protection and Power Conditioning

#### Dimensions

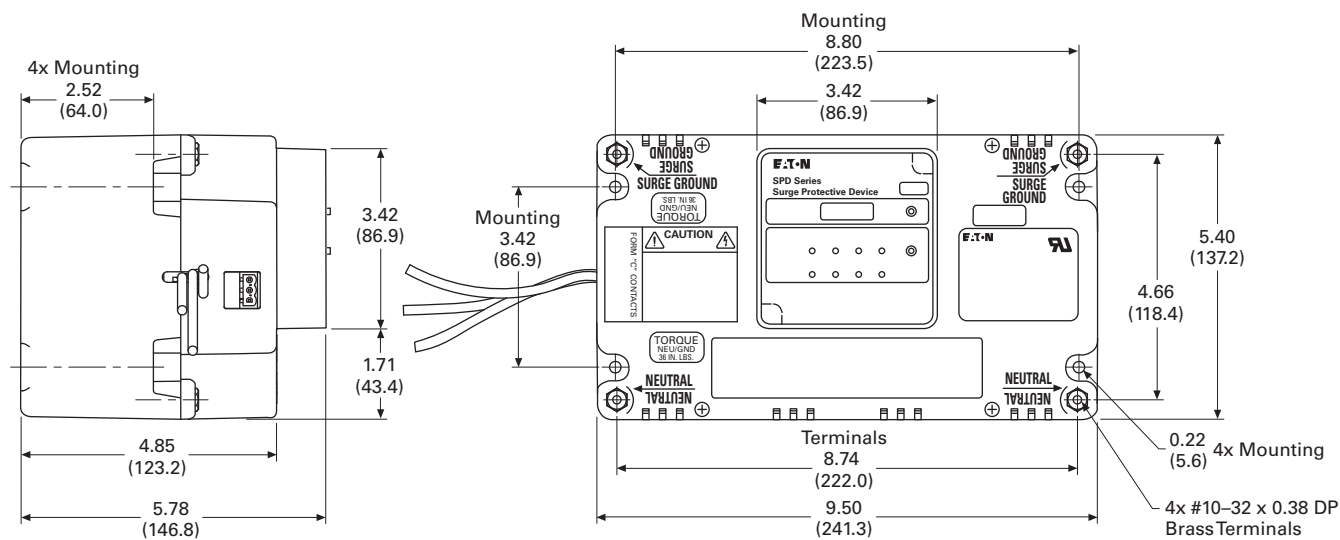
Approximate Dimensions in Inches (mm)

2

#### 50–200 kA Integrated Units



#### 250–400 kA Integrated Units



#### Weights

- 50–200 kA units approximately 3.5 lb (1.6 kg)
- 250–400 kA units approximately 7.0 lb (3.2 kg)

Eaton SPD Series Sidemount Unit Mounted Externally to an Eaton Panelboard



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## SPD Series for Mounting External to Electrical Distribution Equipment

### Product Description

Eaton's sidemount versions of the SPD Series surge protective devices are the latest and most advanced UL 1449 4th Edition listed surge protectors. Application of SPD Series units throughout a facility will ensure that equipment is protected with the safest and most reliable surge protective devices available. Units are available in all common voltages and configurations, and also in a variety of surge current capacity ratings from 50 through 400 kA. Three feature package options are also available to choose from.

### Features, Benefits and Functions

- Uses self-protected metal oxide varistor (MOV) technology
- Three feature package options
- 10-year warranty (15-year with registration)

### Standards and Certifications

- UL 1449 4th Edition listed device
- Canadian Standards Association (CSA)
- UL 1283 7th Edition (Type 2 SPDs only)



*All SPD Series sidemount units come prewired and include a factory-installed conduit interface, making installation very easy.*



*All SPD Series units are factory sealed, ensuring that the user/installer has no potential of coming into contact with harmful voltages present inside the unit.*

# 2.1

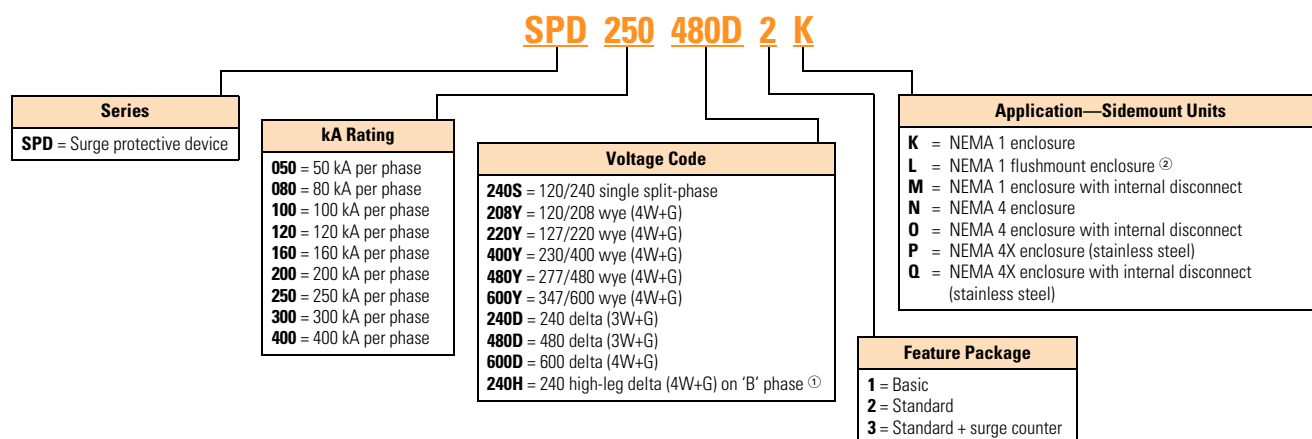
## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

### Surge Protection and Power Conditioning

#### Catalog Number Selection

## 2

#### SPD Series Units for Mounting External to Electrical Distribution Equipment



#### Notes

<sup>①</sup> Please consult the factory for 240 high-leg delta (4W+G) applications with high leg on 'C' phase.

<sup>②</sup> NEMA 1 flushmount units are available in 50–200 kA ratings only.

Example: SPD250480D2K = SPD Series, 250 kA per phase, 480D voltage, standard feature package, housed in NEMA 1 enclosure.

## Technical Data and Specifications

## SPD Series Specifications

2

| Description                                                         | Specification                                                                                                                                              |
|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surge capacity ratings available                                    | 50, 80, 100, 120, 160, 200, 250, 300, 400 kA per phase                                                                                                     |
| Nominal discharge current ( $I_n$ )                                 | 20 kA (maximum rating assigned by UL)                                                                                                                      |
| Short-circuit current rating (SCCR)                                 | 200 kA                                                                                                                                                     |
| SPD type                                                            | Basic feature package = Type 1 (can also be used in Type 2 applications)<br>Standard and standard with surge counter feature packages = Type 2             |
| Single split-phase voltages available                               | 120/240                                                                                                                                                    |
| Three-phase wye system voltages available                           | 120/208, 127/220, 230/400, 277/480, 347/600                                                                                                                |
| Three-phase delta system voltages available                         | 240, 480, 600                                                                                                                                              |
| Input power frequency                                               | 50/60 Hz                                                                                                                                                   |
| Power consumption (basic units):                                    |                                                                                                                                                            |
| 208Y, 220Y, 240S, 240D and 240H voltage codes                       | 0.5 W                                                                                                                                                      |
| 400Y, 480Y and 480D voltage codes                                   | 1.1 W                                                                                                                                                      |
| 600Y and 600D voltage codes                                         | 1.3 W                                                                                                                                                      |
| Power consumption (standard and standard with surge counter units): |                                                                                                                                                            |
| 208Y, 220Y, 240S, 240D and 240H voltage codes                       | 0.6 W                                                                                                                                                      |
| 400Y, 480Y and 480D basic voltage codes                             | 1.7 W                                                                                                                                                      |
| 600Y and 600D voltage codes                                         | 2.1 W                                                                                                                                                      |
| Protection modes                                                    | Single split-phase L-N, L-G, N-G, L-L<br>Three-phase wye L-N, L-G, N-G, L-L<br>Three-phase delta L-G, L-L<br>Three-phase high-leg delta L-N, L-G, N-G, L-L |
| Maximum continuous operating voltage (MCOV):                        |                                                                                                                                                            |
| 240S, 208Y, 220Y and 240H MCOV                                      | 150 L-N, 150 L-G, 150 N-G, 300 L-L                                                                                                                         |
| 400Y and 480Y MCOV                                                  | 320 L-N, 320 L-G, 320 N-G, 640 L-L                                                                                                                         |
| 600Y MCOV                                                           | 420 L-N, 420 L-G, 420 N-G, 840 L-L                                                                                                                         |
| 240D MCOV                                                           | 320 L-G, 320 L-L                                                                                                                                           |
| 480D MCOV                                                           | 640 L-G, 640 L-L                                                                                                                                           |
| 600D MCOV                                                           | 840 L-G, 840 L-L                                                                                                                                           |
| Ports                                                               | 1                                                                                                                                                          |
| Operating temperature                                               | –40 °F to 122 °F (–40 °C to 50 °C)                                                                                                                         |
| Operating humidity                                                  | 5% through 95%, noncondensing                                                                                                                              |
| Operating altitude                                                  | Up to 16,000 ft (5000 m)                                                                                                                                   |
| Seismic withstand capability                                        | Meets or exceeds the requirements specified in IBC 2006, CBC 2007 and UBC Zone 4                                                                           |
| Enclosure dimensions and weights                                    | Refer to figures on <b>Pages V3-T2-14–V3-T2-15</b> for enclosure dimensions and weights                                                                    |
| Form C relay contact ratings                                        | 150 Vdc or 125 Vac, 1 A maximum                                                                                                                            |
| Form C relay contact logic                                          | Power ON, normal state—NO contact = open, NC contact = closed<br>Power OFF or fault state—NO contact = closed, NC contact = open                           |
| EMI/RFI filtering attenuation                                       | Up to 50 dB from 10 kHz to 100 MHz                                                                                                                         |

# 2.1

## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

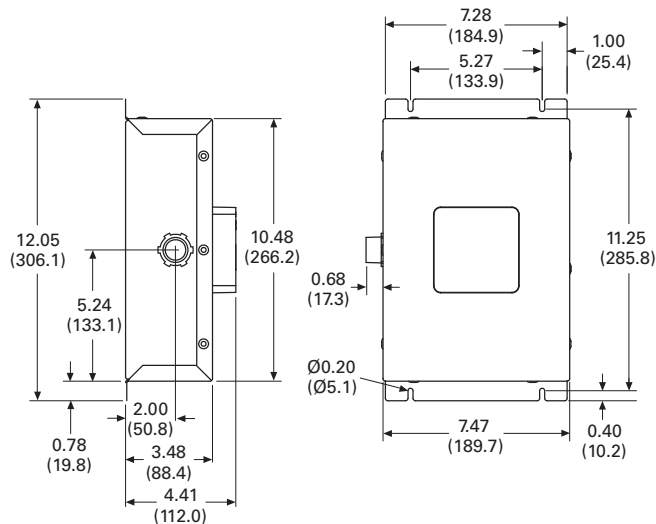
### Surge Protection and Power Conditioning

#### Dimensions

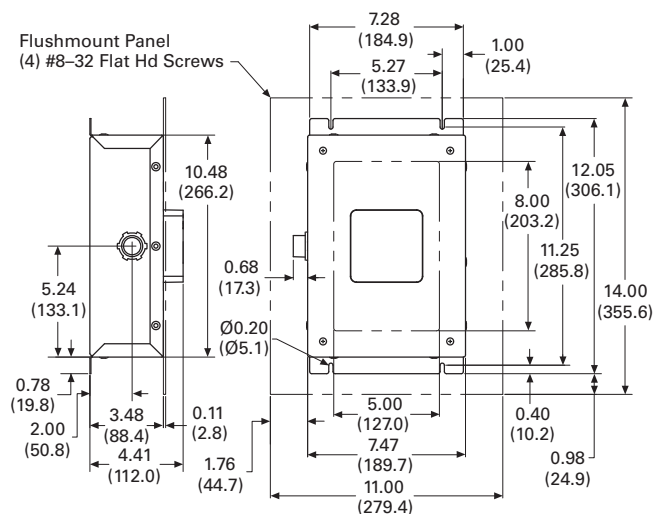
Approximate Dimensions in Inches (mm)

2

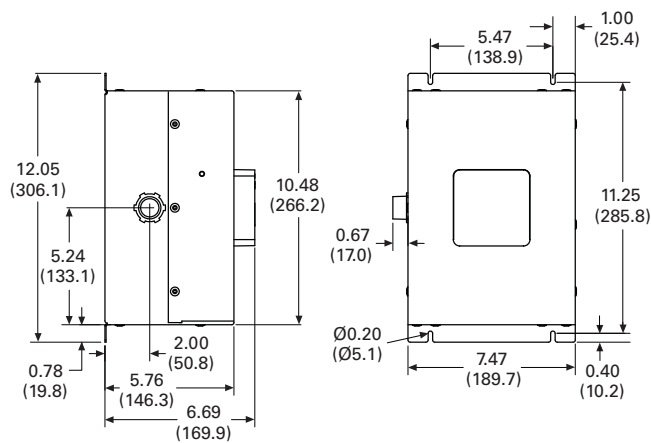
**50–200 kA Units in a NEMA 1 Rated Enclosure, Weight = 6.8 Lb**



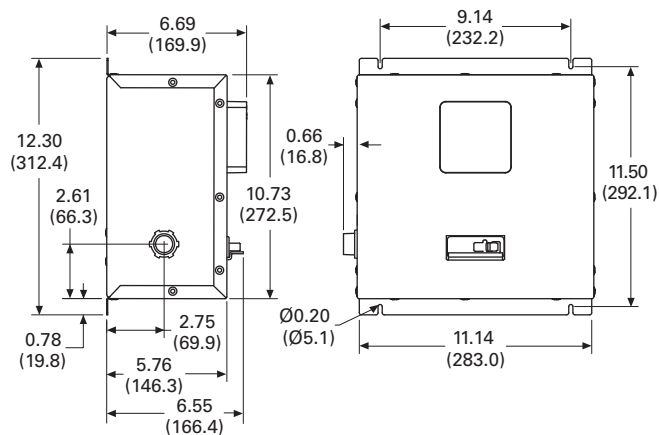
**50–200 kA Units in a NEMA 1 Rated Flushmount Enclosure, Weight = 6.8 Lb**



**250–400 kA Units in a NEMA 1 Rated Enclosure, Weight = 13.5 Lb**



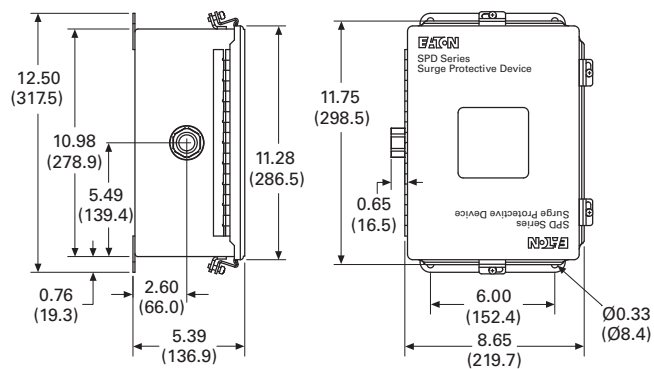
**50–400 kA Units in a NEMA 1 Rated Enclosure with Internal Disconnect, Weight = 14.7 Lb**



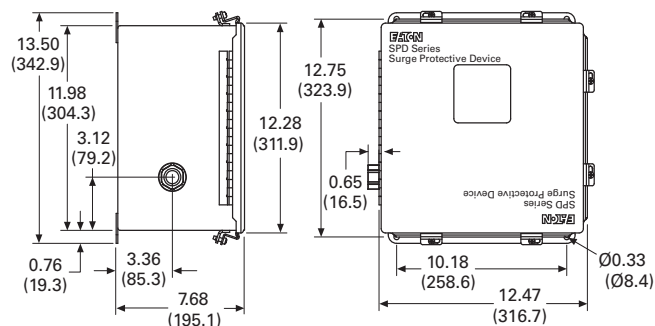


Approximate Dimensions in Inches (mm)

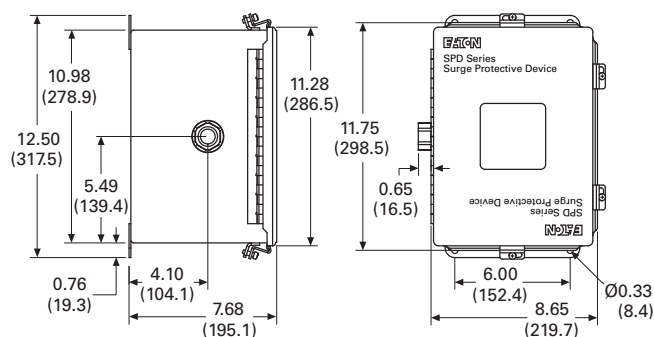
**50–200 kA Units in a NEMA 4 or 4X Rated Enclosure,  
Weight = 14.6 Lb**



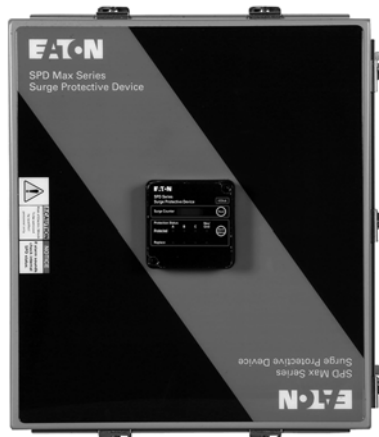
**50–400 kA Units in a NEMA 4 or 4X Rated Enclosure with  
Internal Disconnect, Weight = 27.5 Lb**



**250–400 kA Units in a NEMA 4 or 4X Rated Enclosure,  
Weight = 14.6 Lb**



## SPD MAX



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## SPD MAX Series Surge Protection

## Product Description

Eaton's SPD MAX Series side-mounted surge protective devices are the latest and most advanced UL 1449 4th Edition certified surge protectors. Applying SPD MAX Series units at main service entrances and critical loads will ensure that equipment is protected with the safest and most reliable surge protective devices (SPDs) available. Units are available in all common voltages and configurations, and also in a variety of surge current capacity ratings from 100 kA through 800 kA. Additionally, you may choose from two feature package options.

## Application Description

The breadth of the SPD MAX Series' features, options and configurations ensures that the correct unit is available for all electrical applications, including service entrances, main switchgear, motor control centers, distribution switchboards, panelboards and point-of-use applications.

## Features

- Uses thermally protected metal oxide varistor (MOV) technology
- Lockout and tagout provisions
- Safety barriers
- 20 kA nominal discharge current ( $I_n$ ) rating (maximum rating assigned by UL)
- 100 kA through 800 kA surge current capacity ratings
- Installation flexibility, #10 to 1/0 wire may be used
- Two feature package options
- 200 kA short-circuit current rating (SCCR) (maximum rating assigned by UL)
- Field serviceable
- 15-year warranty standard, additional 5 years with product registration

## Standards and Certifications

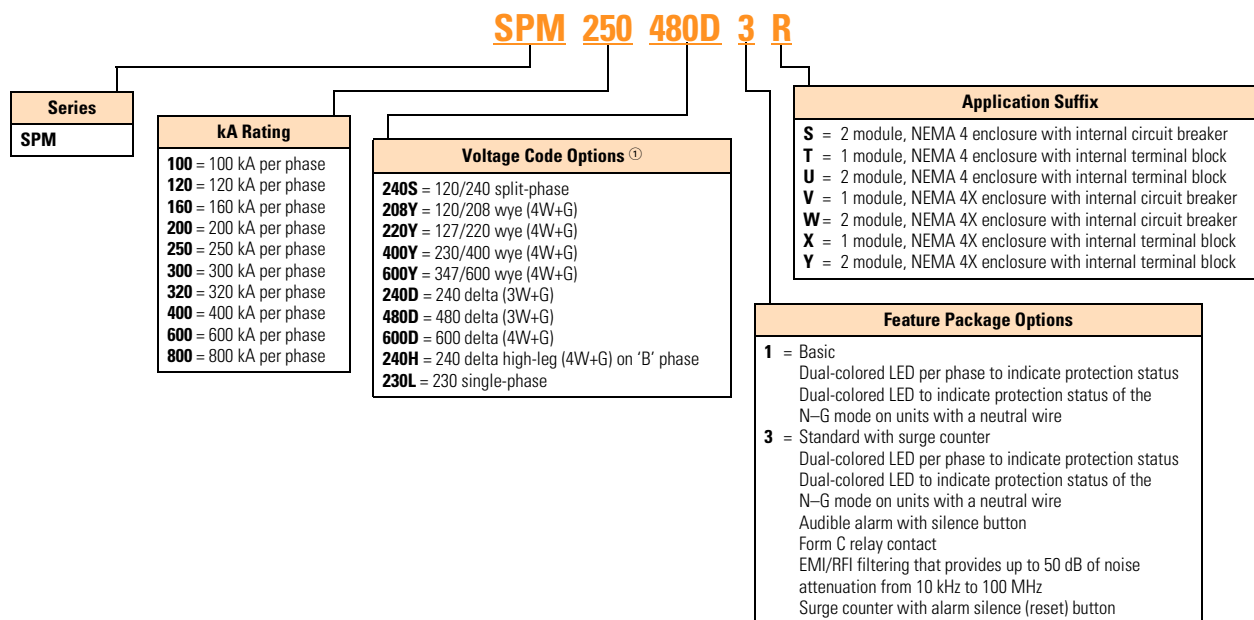
- UL 1449 4th Edition
- UL 1283 7th Edition
- Canadian Standards Association (CSA)
- Built in an ISO 9001 facility
- Designed and tested in accordance with:
  - IEEE® C62.41.1
  - IEEE C62.41.2
  - IEEE C62.43-2005
  - IEEE C62.45-2002
  - IEEE C62.48-2005
  - IEEE C62.62-2010



## Catalog Number Selection

## SPD MAX Series Surge Protection

2

**Notes**

<sup>①</sup> Please consult the factory for 240 high-leg delta (4W+G) applications with high leg on 'C' phase.

SPD250480D3R = SPD MAX Series, 250 kA per phase, 480D voltage, standard with counter features package, NEMA 4 enclosure with internal circuit breaker.

## Technical Data and Specifications

## 2

## SPD MAX Series Surge Protection

| Description                                                  | Specification                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surge current capacity per phase                             | 100 kA, 120 kA, 160 kA, 200 kA, 250 kA, 300 kA, 320 kA, 400 kA, 600 kA, 800 kA ratings available                                                                                                                                                                                   |
| Nominal discharge current ( $I_n$ )                          | 20 kA                                                                                                                                                                                                                                                                              |
| Short-circuit current rating (SCCR)                          | 200 kA                                                                                                                                                                                                                                                                             |
| SPD type                                                     | Basic feature package = Type 1 (can also be used in Type 2 applications)<br>Standard with surge counter feature package = Type 2                                                                                                                                                   |
| Enclosure types                                              | NEMA 4, NEMA 4X enclosure                                                                                                                                                                                                                                                          |
| Circuit breaker—30 A                                         | Eaton catalog number: FDC3030L                                                                                                                                                                                                                                                     |
| <b>Circuit Breaker Load and Line</b>                         |                                                                                                                                                                                                                                                                                    |
| Terminal torque specifications                               | #10 AWG 35 lb-in; #8 AWG 40 lb-in; #6–#4 AWG 45 lb-in; #3–1/0 AWG 50 lb-in<br>(SPD maximum wire range #10–1/0 AWG)                                                                                                                                                                 |
| Standard split-phase voltages available                      | 120/240                                                                                                                                                                                                                                                                            |
| Single-phase                                                 | 230                                                                                                                                                                                                                                                                                |
| Three-phase wye system voltages available                    | 120/208, 127/220, 230/400, 277/480, 347/600                                                                                                                                                                                                                                        |
| Three-phase delta system voltages                            | 240, 480, 600                                                                                                                                                                                                                                                                      |
| Three-phase high leg delta system voltages                   | 120/240 high leg phase wire will be identified with a tag from the factory                                                                                                                                                                                                         |
| Input power frequency                                        | 50/60 Hz                                                                                                                                                                                                                                                                           |
| <b>Power Consumption (Standard with Surge Counter Units)</b> |                                                                                                                                                                                                                                                                                    |
| 208Y, 220Y, 230L, 240S, 240D and 240H voltage codes          | 0.6 W                                                                                                                                                                                                                                                                              |
| 400Y, 480Y and 480D basic voltage codes                      | 1.7 W                                                                                                                                                                                                                                                                              |
| 600Y and 600D voltage codes                                  | 2.1 W                                                                                                                                                                                                                                                                              |
| Protection modes                                             | Single split-phase L–N, L–G, N–G, L–L, single-phase L–N, L–G, N–G, three-phase delta L–G, L–L, three-phase wye L–N, L–G, N–G, L–L, three-phase high leg delta L–N, L–G, N–G, L–L                                                                                                   |
| <b>Maximum Continuous Operating Voltage (MCOV)</b>           |                                                                                                                                                                                                                                                                                    |
| 230 V single-phase                                           | 320 V L–N, 320 V L–G, 320 V N–G                                                                                                                                                                                                                                                    |
| 127 V/220 V wye, 120 V/240 V single split phase              | 150 V L–N, 150 V L–G, 150 V N–G, 300 V L–L                                                                                                                                                                                                                                         |
| 120 V/240 V hi leg                                           | 150 V L–N, 150 V L–G, 150 V N–G, 300 V L–L, 320 V H–N, 320 V H–G, 470 V H–L                                                                                                                                                                                                        |
| 230 V/400 V wye, 277 V/480 V wye                             | 320 V L–N, 320 V L–G, 320 V N–G, 640 V L–L                                                                                                                                                                                                                                         |
| 347 V/600 V wye                                              | 420 V L–N, 420 V L–G, 420 V N–G, 840 V L–L                                                                                                                                                                                                                                         |
| 240 V delta                                                  | 300 V L–G, 300 V L–L                                                                                                                                                                                                                                                               |
| 480 V delta                                                  | 640 V L–G, 640 V L–L                                                                                                                                                                                                                                                               |
| 600 V delta                                                  | 840 V L–G, 840 V L–L                                                                                                                                                                                                                                                               |
| Ports                                                        | 1 or 2                                                                                                                                                                                                                                                                             |
| Operating temperature and humidity                           | –20 °C through +50 °C (–4 °F through +122 °F), 5% through 95%, noncondensing                                                                                                                                                                                                       |
| Storage temperature                                          | –20 °C through +50 °C (–4 °F through +122 °F)                                                                                                                                                                                                                                      |
| Operating altitude                                           | Up to 16,000 ft (5000 m)                                                                                                                                                                                                                                                           |
| Weight                                                       | Not to exceed 52 lb                                                                                                                                                                                                                                                                |
| Form C relay contact ratings                                 | Maximum 0.46 A, 150 Vac, 1 A, 30 Vdc                                                                                                                                                                                                                                               |
| Form C terminal block ratings                                | Rated 300 V, 16 A, 30–12 AWG solid or stranded wire. Torque range 5–7 lb-in                                                                                                                                                                                                        |
| Form C relay contact logic                                   | Power on, normal state—NO contact = OPEN, NC contact = CLOSED<br>Power off, fault state—NO contact = CLOSED, NC contact = OPEN                                                                                                                                                     |
| EMI/RFI filtering attenuation (standard with surge counter)  | Up to 50 dB from 10 kHz to 100 MHz                                                                                                                                                                                                                                                 |
| Standards / agency certifications                            | UL 1449 Edition 4—standard for surge protective devices<br>UL 1283 Edition 7—standard for EMI filters (Type 2 SPDs only)<br>CSA Electrical Notice No. 516 Edition 1—surge/transient voltage suppressor (excludes 230 L voltage code)<br>CSA 22.2 NO. 8-M1986 Edition 4—EMI filters |
| Warranty                                                     | 15 years from the date of delivery to the purchaser, 20 years if the product is properly registered at <a href="http://www.eaton.com">www.eaton.com</a>                                                                                                                            |
| RoHS compliant                                               | Yes                                                                                                                                                                                                                                                                                |

## SPD MAX Series Surge Protection



## SPC



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| AEGIS Powerline Filters . . . . .                                               | <b>V3-T2-29</b> |
| AEGIS DN Series . . . . .                                                       | <b>V3-T2-34</b> |
| Sag Ride-Through (SRT2) . . . . .                                               | <b>V3-T2-37</b> |
| Power-Sure 700 (T700) . . . . .                                                 | <b>V3-T2-41</b> |
| Power-Sure 800 (T800) . . . . .                                                 | <b>V3-T2-44</b> |
| Power-Suppress 100 (T100) . . . . .                                             | <b>V3-T2-48</b> |

## SPC Surge Protective Device

## Product Description

Eaton's SPC Series surge protective devices are UL, 1449 4th Edition, certified surge protectors. Application of SPC Series units throughout a facility will ensure that equipment is protected with the safest and most reliable surge protective devices available. The compact design and NEMA 4X enclosure of the SPC Series allows for installation external to an electrical assembly in a variety of environments.

SPC Series units are available in all common voltages and configurations, and in a variety of peak surge current capacity ratings from 50 through 200 kA per phase. Several feature package options, including filtering, audible alarm and Form C contacts, are available to choose from. A range of configurable options is available to customize the SPC Series features for most electrical applications, including service entrances, distribution panelboards and point-of-use applications. The SPC Series belongs to Eaton's complete family of surge protection solutions, providing coverage for any application.

## Application Description

Surge events—short-term transients in voltage threatening critical downstream equipment—happen for many reasons. The most common source, though, is internal devices powering on and off: motors, transformers, photocopiers, fluorescent lighting ballasts, light dimmers, fax machines and more. They can also be generated externally by events like lightning, grid switching or electrical equipment in adjacent buildings.

While seemingly innocent, surge events can wreak serious havoc on unprotected and inadequately protected facilities. They can disrupt, damage or destroy sensitive microprocessor-based devices (computers, programmable logic controls, etc.), resulting in premature aging of equipment, process interruptions and catastrophic failures.

The best way to prevent downtime from an electrical surge is through facility-wide cascaded surge protection at all stages of the electrical distribution system. When properly installed, surge protective devices can mitigate problems with susceptible equipment, keeping it and its related processes running reliably without surge-related disruptions.

Eaton's SPC Series surge protective device (SPD) is a key component to your cascaded protection strategy. It's compact, flexible and configurable to protect most electrical applications, including service entrances, distribution panelboards and point-of-use applications.

## Features

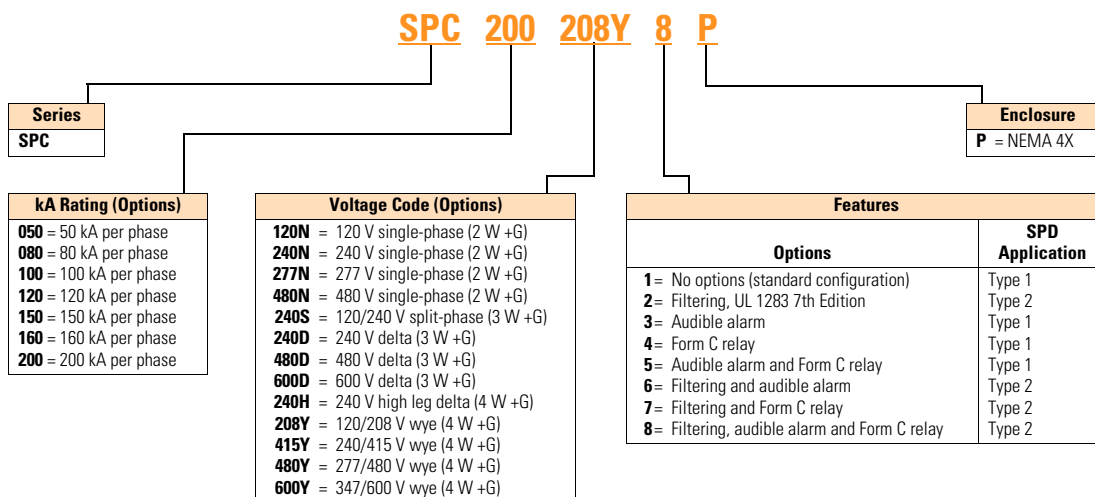
- Thermally protected metal oxide varistor (MOV) technology
- Tri-colored LED protection status indicators
- 20 kA nominal discharge current ( $I_n$ ) rating (maximum rating in the UL 1449 4th Edition standard)
- 50 through 200 kA per phase peak surge current capacity ratings
- Configure-to-order with eight custom feature combinations
- Corrosion-resistant NEMA 4X enclosure with mounting feet
- 200 kA short-circuit current rating (SCCR)
- Factory prewired with 36 inches of 10 AWG wire
- No user-serviceable parts or items requiring periodic maintenance
- 5-year warranty that can be extended to 10 years with product registration at [Eaton.com/spc](http://Eaton.com/spc)

**Standards and Certifications**

- UL 1449 4th Edition Type 1 and Type 2
- UL 1283 7th Edition (Feature packages: 2, 6, 7 and 8)
- Canadian Standards Association (CSA) Type 1 and Type 2



2

**Catalog Number Selection****SPC**

## Technical Data and Specifications

## SPC

2

| Description                                                   | Specification                                                                                                                                             |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peak surge current capacity ratings available                 | 50, 80, 100, 120, 150, 160, 200 kA per phase                                                                                                              |
| Nominal discharge current ( $I_n$ )                           | 20 kA                                                                                                                                                     |
| Short-circuit current rating (SCCR)                           | 200 kA                                                                                                                                                    |
| Single-phase voltages available (2 W + G)                     | 120, 240, 277, 480                                                                                                                                        |
| Split-phase voltages available (3 W + G)                      | 120/240                                                                                                                                                   |
| Three-phase wye system voltages available (4 W + G)           | 120/208, 240/415, 277/480, 347/600                                                                                                                        |
| Three-phase delta system voltages available (3 W + G)         | 240, 480, 600                                                                                                                                             |
| Three-phase high leg delta system voltage available (4 W + G) | 240                                                                                                                                                       |
| Input power frequency                                         | 50/60 Hz                                                                                                                                                  |
| Protection modes                                              | Single-phase: L-N, N-G, L-G<br>Split-phase: L-N, N-G, L-G, L-L<br>Wye: L-N, N-G, L-G, L-L<br>Delta: L-G, L-L                                              |
| Maximum continuous operating voltage (MCOV):                  |                                                                                                                                                           |
| 120N                                                          | 150 L-N, 150 L-G, 150 N-G                                                                                                                                 |
| 240N, 277N                                                    | 320 L-N, 320 L-G, 320 N-G                                                                                                                                 |
| 480N                                                          | 550 L-N, 550 L-G, 550 N-G                                                                                                                                 |
| 240S, 208Y                                                    | 150 L-N, 150 L-G, 150 N-G, 300 L-L                                                                                                                        |
| 240H                                                          | 150 L-N, 150 L-G, 150 N-G, 300 L-L, 470 H-L, 320 H-N, 320 H-G                                                                                             |
| 415Y and 480Y                                                 | 320 L-N, 320 L-G, 320 N-G, 640 L-L                                                                                                                        |
| 600Y                                                          | 320 L-N, 320 L-G, 320 N-G, 840 L-L                                                                                                                        |
| 240D                                                          | 320 L-G, 300 L-L                                                                                                                                          |
| 480D                                                          | 550 L-G, 640 L-L                                                                                                                                          |
| 600D                                                          | 840 L-G, 840 L-L                                                                                                                                          |
| Ports                                                         | 1                                                                                                                                                         |
| Operating temperature                                         | −40 °F to 140 °F (−40 °C to 60 °C)                                                                                                                        |
| Storage temperature                                           | −40 °F to 140 °F (−40 °C to 60 °C)                                                                                                                        |
| Operating humidity                                            | 5% through 95%, noncondensing                                                                                                                             |
| Operating altitude                                            | Up to 2000 m (6561 ft)                                                                                                                                    |
| Agency certification/listing                                  | UL 1449 4th edition, UL 1283 7th edition, CSA C22.2 No. 269.1-14 for Type 1 SPD, CSA C22.2 No. 269.2-13 for Type 2 SPD, CSA C22.2 no. 8-13 for EMI Filter |
| Durability Repetitive Strike Test                             | Passed 15,000 strikes to ANSI/IEEE C62.41 (20 kV, 10 kA) Category C Waveform                                                                              |
| SPD type                                                      | UL 1449 4th edition and CSA Type 1 and Type 2 SPD (dependent on feature options)                                                                          |
| Enclosure dimensions and weights                              | Refer to <b>Page V3-T2-23</b> for enclosure dimensions and weights                                                                                        |
| Enclosure rating                                              | NEMA 4X enclosure <sup>①</sup>                                                                                                                            |
| Form C relay contact ratings                                  | 2A at 30 Vdc or 250 Vac                                                                                                                                   |
| Form C relay contact logic                                    | Power ON, normal state; NO contact = open, NC contact = closed<br>Power OFF or fault state; NO contact = closed, NC contact = open                        |
| EMI/RFI filtering attenuation                                 | Up to 40 dB from 10 kHz to 100 MHz                                                                                                                        |
| RoHS compliant                                                | Yes                                                                                                                                                       |
| Warranty                                                      | 5 years standard, 10 years with product registration on <a href="http://www.eaton.com/spc">www.eaton.com/spc</a>                                          |

## SPC voltage configurations per enclosure size

| P1 Enclosure                    | P2 Enclosure                     |
|---------------------------------|----------------------------------|
| 120N/240N/277N/480N = 50–200 kA | 240S = 120–200 kA                |
| 240S = 50–100 kA                | 208Y/415Y/480Y/600Y = 120–200 kA |
| 208Y/415Y/480Y/600Y = 50–100 kA | 240D/480D = 120–200 kA           |
| 240D/480D = 50–100 kA           | 600D = 50–200 kA                 |
| 240H = 50–100 kA                | 240H = 120–200 kA                |

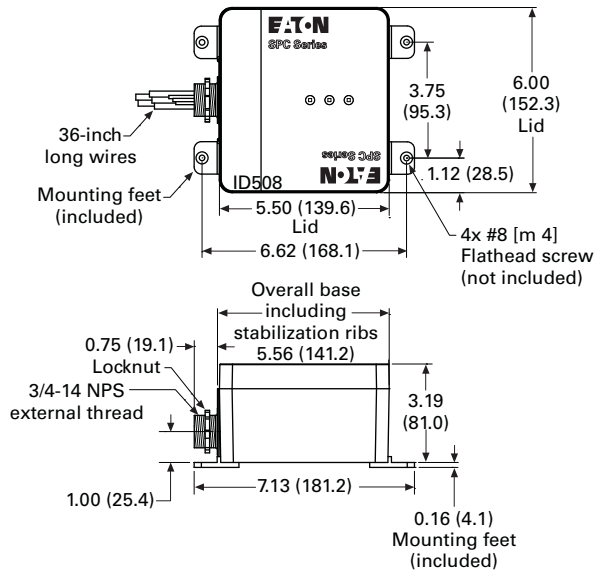
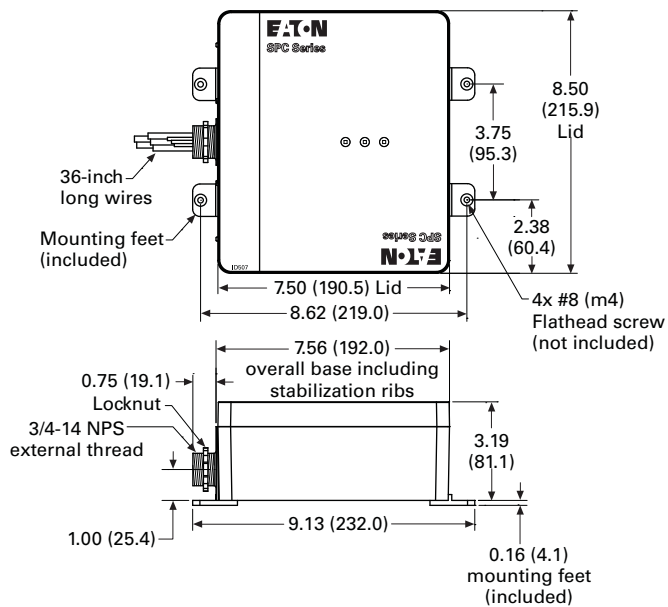
## Note

① Mounting feet required to achieve NEMA 4X rating.



**Dimensions**

Approximate Dimensions in Inches (mm)

**P1****P2**

CVX050/100



## CVX050/100

### Product Description

With over two decades of experience in the surge suppression industry and extensive R&D initiatives, Eaton is considered a world leader in surge protective device (SPD) manufacturing. All of Eaton's products are manufactured in an ISO® 9001:2000 and ISO 14001 certified facility.

Eaton's CVX050/100 models are rugged, cost-effective, high-quality SPDs that feature self-protected MOVs that eliminate the failure characteristics of standard metal oxide varistors. This technology results in a fail-safe device that monitors the status of the metal oxide disk and disconnects itself from the power system when the disk is approaching breakdown.

The CVX050/100 is easy to install adjacent or even internal to electrical equipment. When installing an SPD in a retrofit environment, it is important to mount the device as close to the electrical equipment as possible. Keep the wiring (lead length) between the electrical equipment and SPD as short as possible, and twist or wire tie the conductors together to reduce the wire's impedance factor.

### Application Description

Eaton's CVX050 and CVX100 SPDs protect electronic equipment from damaging transients. These units are suitable for medium and low exposure level applications that require cost-effective, high quality system protection including:

- Residential/small business
- Light industrial
- Light commercial
- Branch panel protection
- OEM applications

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### Description

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### Features, Benefits and Functions

- Advanced surge path technology for high fault current capacity, low impedance, high frequency design
- Rugged NEMA® 4X (IP65) enclosure
- Large diameter, self-protected metal oxide varistors provide long life and fail-safe operation
- LED monitoring of each phase
- Wide range of voltage applications from 100 to 600 Vac and 48 and 125 Vdc
- 5-year free replacement warranty

### Optional Features

- External mounting feet (catalog number MNTGFTX)
- Flush mounting plate (catalog number FLUSHMNTPLATE12)

### Standards and Certifications

- UL 1449 4th Edition for surge protective devices
- CE marked
- Vibration tested IEC 60255-21-1 and -2



**Note:** CE, CSA and UL on AC unit only.

## Catalog Number Selection

CVX050/100

2

## CVX 050 - 240S

| Per Phase Peak Surge Current | Configuration and Voltage Ranges                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 050 = 50 kA<br>100 = 100 kA  | <b>230L</b> = Single-phase—200, 208, 220, 230, 240, 277 Vac<br><b>480L</b> = Single-phase—480 Vac<br><b>240S</b> = Split-phase—100/200, 110/220, 120/240 Vac<br><b>240H</b> = Three-phase high leg delta—120/240 Vac<br><b>208Y</b> = Three-phase wye (star)—100/174, 110/190, 120/208, 127/220 Vac<br><b>480Y</b> = Three-phase wye (star)—220/380, 230/400, 240/415, 277/480 Vac<br><b>600Y</b> = Three-phase wye (star)—305/525, 347/600 Vac<br><b>240D</b> = Three-phase delta—200, 208, 220, 230, 240 Vac<br><b>480D</b> = Three-phase delta—380, 400, 415, 440, 480 Vac<br><b>600D</b> = Three-phase delta—525, 600 Vac (600D available in 50 kA only)<br><b>048DC</b> = Direct current—48 Vdc ①<br><b>125DC</b> = Direct current—125 Vdc ① |

## Technical Data and Specifications

## CVX050/100 Model Specifications

| Description                  | Specification                                                                                                                                                                                        |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peak kA per phase            | 50, 100                                                                                                                                                                                              |
| Peak kA per mode             | 50                                                                                                                                                                                                   |
| Nominal discharge current    | 20 kA ①                                                                                                                                                                                              |
| Short-circuit current rating | 100 kA                                                                                                                                                                                               |
| Single-phase voltages        | 200, 208, 220, 230, 240, 277, 380, 400, 440, 460, 480 Vac                                                                                                                                            |
| Split-phase voltages         | 100/200, 110/220/ 120/240 Vac                                                                                                                                                                        |
| High leg delta voltages      | 240 Vac                                                                                                                                                                                              |
| Wye system voltages          | 100/175, 110/190, 120/208, 127/220, 220/380, 230/400, 240/415, 277/480, 305/525, 347/600 Vac                                                                                                         |
| Delta system voltages        | 200, 208, 220, 230, 240, 380, 400, 415, 440, 480, 525, 600 Vac                                                                                                                                       |
| Direct current Voltage ②     | 48 Vdc, 125 Vdc                                                                                                                                                                                      |
| Input power frequency        | 47–420 Hz (50/60 Hz typical)                                                                                                                                                                         |
| Protection modes             | Single-phase: L-N, N-G, L-G<br>Split-phase: L-N, N-G, L-G, L-L<br>High leg delta: L-N, N-G, L-G, L-L, H-N, H-G, H-L<br>Wye: L-N, N-G, L-G, L-L<br>Delta: L-G, L-L<br>Direct current ① (DC): L-L, L-G |
| Number of ports              | 1                                                                                                                                                                                                    |
| Specific energy              | 100 kJ/Ohm                                                                                                                                                                                           |
| Weight                       | ≈2.0 lb (1.0 kg)                                                                                                                                                                                     |
| Operating temperature        | –13 °F (–25 °C) to +140 °F (+60 °C)                                                                                                                                                                  |
| Vibration tested             | IEC 60255-21-1 and IEC 60255-21-2                                                                                                                                                                    |

## Notes

① 480L, 600D and 600Y units rated 10 kA  $I_n$ .

② DC models only available in 50 kA.

# 2.1

## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

### Surge Protection and Power Conditioning

#### CVX050/100 Voltage Ratings

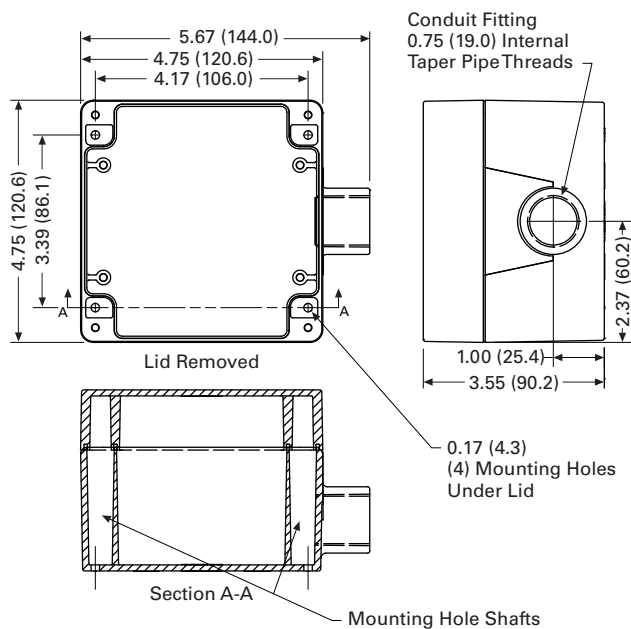
2

| Model  | System Configuration                      | Nominal System Voltage             | MCOV |     |      |     | UL 1449-4 VPR <sup>①</sup> |      |      |      |
|--------|-------------------------------------------|------------------------------------|------|-----|------|-----|----------------------------|------|------|------|
|        |                                           |                                    | L-L  | L-N | L-G  | N-G | L-L                        | L-N  | L-G  | N-G  |
| CVX050 |                                           |                                    |      |     |      |     |                            |      |      |      |
| 230L   | Single-phase two-wire + ground            | 200, 208, 220, 230, 240, 277       | —    | 320 | 640  | 320 | —                          | 1200 | 1200 | 1200 |
| 480L   | Single-phase two-wire + ground            | 380, 400, 440, 460, 480            | —    | 550 | 1100 | 550 | —                          | 1800 | 4000 | 1800 |
| 240S   | Split-phase three-wire + ground           | 100/200, 110/220, 120/240          | 300  | 150 | 300  | 150 | 1200                       | 700  | 1200 | 800  |
| 208Y   | Three-phase wye (star) four-wire + ground | 100/175, 110/190, 120/208, 127/220 | 300  | 150 | 300  | 150 | 1200                       | 700  | 1200 | 800  |
| 480Y   | Three-phase wye (star) four-wire + ground | 220/380, 230/400, 240/415, 277/480 | 640  | 320 | 640  | 320 | 2500                       | 1200 | 2000 | 1200 |
| 600Y   | Three-phase wye (star) four-wire + ground | 305/525, 347/600                   | 840  | 420 | 840  | 420 | 2500                       | 1500 | 2500 | 1500 |
| 240D   | Three-phase delta three-wire + ground     | 200, 208, 220, 230, 240            | 640  | —   | 320  | —   | 2000                       | —    | 1200 | —    |
| 240H   | Three-phase high leg delta                | 240                                | 300  | 150 | 150  | 640 | 1500                       | 700  | 1200 | 700  |
| 480D   | Three-phase delta three-wire + ground     | 380, 400, 415, 440, 480            | 1100 | —   | 550  | —   | 3000                       | —    | 1800 | —    |
| 600D   | Three-phase delta three-wire + ground     | 525, 600                           | 1100 | —   | 700  | —   | 3000                       | —    | 2500 | —    |
| 048DC  | Direct current                            | 48 Vdc <sup>②</sup>                | 130  | —   | 65   | —   | —                          | —    | —    | —    |
| 125DC  | Direct current                            | 125 Vdc <sup>②</sup>               | 288  | —   | 144  | —   | —                          | —    | —    | —    |
| CVX100 |                                           |                                    |      |     |      |     |                            |      |      |      |
| 230L   | Single-phase two-wire + ground            | 200, 208, 220, 230, 240, 277       | —    | 320 | 320  | 320 | —                          | 1200 | 1200 | 1200 |
| 480L   | Single-phase two-wire + ground            | 380, 400, 440, 460, 480            | —    | 550 | 550  | 550 | —                          | 1800 | 1800 | 1800 |
| 240S   | Split-phase three-wire + ground           | 100/200, 110/220, 120/240          | 300  | 150 | 150  | 150 | 1200                       | 700  | 800  | 700  |
| 208Y   | Three-phase wye (star) four-wire + ground | 100/175, 110/190, 120/208, 127/220 | 300  | 150 | 150  | 150 | 1000                       | 600  | 700  | 700  |
| 480Y   | Three-phase wye (star) four-wire + ground | 220/380, 230/400, 240/415, 277/480 | 640  | 320 | 320  | 320 | 1800                       | 1200 | 1200 | 1200 |
| 600Y   | Three-phase wye (star) four-wire + ground | 305/525, 347/600                   | 840  | 420 | 420  | 420 | 2500                       | 1500 | 1500 | 1500 |
| 240D   | Three-phase delta three-wire + ground     | 200, 208, 220, 230, 240            | 640  | —   | 320  | —   | 1800                       | —    | 1200 | —    |
| 240H   | Three-phase high leg delta                | 240                                | 300  | 150 | 150  | 150 | 1200                       | 700  | 700  | 700  |
| 480D   | Three-phase delta three-wire + ground     | 380, 400, 415, 440, 480            | 1100 | —   | 550  | —   | 3000                       | —    | 1800 | —    |

#### Dimensions

Approximate Dimensions in Inches (mm)

#### CVX050/100 Standard Dimensions



Dimensions are in Inches (mm)

#### Notes

- <sup>①</sup> UL 1449 4th Edition VPR (voltage protection rating) test environment: All tests performed with 6-inch lead length, positive polarity.
- <sup>②</sup> DC units available in 50 kA only. Voltages shown are the maximum suggested operating voltages and are not UL certified.

**SP1 Surge Protective Device****SP1 Surge Protective Device****Product Description**

Eaton's SP1 is a UL 1449 4th Edition-listed surge protective device that provides reliable, cost-effective surge protection. This Type 1 SPD is capable of being installed on either the line or the load side of the service entrance disconnect, and can be used as a replacement for devices formerly known as secondary surge arresters or lightning arresters, which could not be manufactured after UL 1449 4th Edition went into effect on September 29, 2009. The unit is available in many common voltages and configurations. Multiple mounting options coupled with a compact footprint enables installation of the SP1 in a wide range of applications, including panelboards, loadcenters, pump panels, control cabinets, and other electrical assemblies and applications.

Installation and operation of the SP1 is simple. The unit comes pre-wired with 24.00 inches of 10-gauge wire and is mounted via the half-inch nipple that is molded into its enclosure. Wall or DIN rail mounting can also be accomplished with the addition of an optional kit. When powered, the unit's light-emitting diode (LED) indicator reports the status of the protection elements and is active when all of them are intact and providing protection. Any loss of protection is signaled when the LED extinguishes.

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| Power-Sure 800 (T800) . . . . .                                                 | <b>V3-T2-44</b> |
| Power-Suppress 100 (T100) . . . . .                                             | <b>V3-T2-48</b> |

**Features**

- Type 1 SPD capable of installation on either the line or the load side of the service entrance disconnect
- 20 kA nominal discharge current rating ( $I_n$ ) on most models
- 50 kA per phase surge current capacity
- Compact footprint—4.80-inch L x 2.90-inch W x 2.50-inch D
- Pre-wired with 24.00 inches of 10-gauge wire
- Half-inch nipple molded into enclosure enables quick and easy mounting
- Optional kit enables wall or DIN rail mounting
- Two-year warranty

**Standards and Certifications**

- UL 1449 4th Edition-listed device



# 2.1

## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

### Surge Protection and Power Conditioning

#### Catalog Number Selection

##### SP1

#### SP1 - XXXX

| Series | Voltage Code                                                                                                                                                                                                        |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SP1    | <b>240S</b> = 120/240 V single split-phase<br><b>208Y</b> = 120/208 wye<br><b>480Y</b> = 277/480 wye<br><b>600Y</b> = 347/600Y wye<br><b>240D</b> = 240 delta<br><b>480D</b> = 480 delta<br><b>600D</b> = 600 delta |

SP1MNTGKIT = optional wall or DIN rail mounting kit  
(order separately—not included with SP1 unit)

#### Technical Data and Specifications

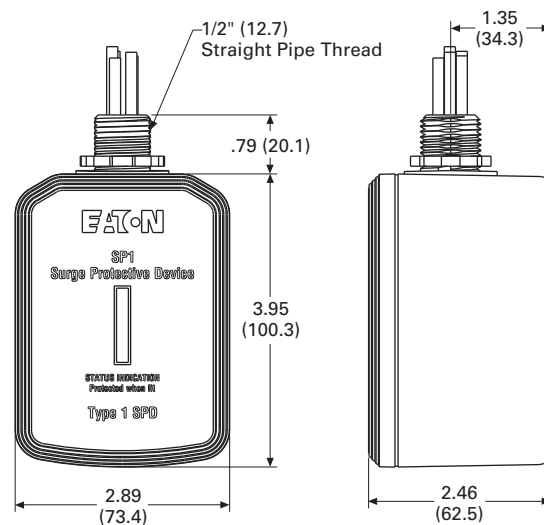
##### SP1

| Description                                 | Ratings                                                                      |
|---------------------------------------------|------------------------------------------------------------------------------|
| Surge current capacity per phase            | 50 kA                                                                        |
| Nominal discharge current ( $I_n$ )         | 20 kA for SP1-240S, 208Y, 480Y, 240D and 480D<br>10 kA for SP1-600Y and 600D |
| Short-circuit current rating (SCCR)         | 200 kA                                                                       |
| SPD type                                    | Type 1 (can also be used in Type 2 applications)                             |
| System voltages available (Vac)             |                                                                              |
| Single split-phase                          | 120/240                                                                      |
| Three-phase wye                             | 120/208, 277/480, 347/600                                                    |
| Three-phase delta                           | 240, 480, 600                                                                |
| Protection modes                            |                                                                              |
| Single split-phase and three-phase wye      | L-N, L-L                                                                     |
| Three-phase delta                           | L-G, L-L                                                                     |
| Maximum continuous operating voltage (MCOV) |                                                                              |
| SP1-240S and SP1-208Y                       | 150 L-N, 300 L-L                                                             |
| SP1-480Y                                    | 320 L-N, 640 L-G                                                             |
| SP1-600Y                                    | 420 L-N, 840 L-G                                                             |
| SP1-240D                                    | 300 L-G, 300 L-L                                                             |
| SP1-480D                                    | 640 L-G, 640 L-L                                                             |
| SP1-600D                                    | 840 L-G, 840 L-L                                                             |
| Input power frequency                       | 50/60 Hz                                                                     |
| Enclosure rating                            | NEMA 4                                                                       |
| Operating temperature                       | -20 °C to 50 °C (-4 °F to 122 °F)                                            |
| Operating humidity                          | 5–95%, noncondensing                                                         |
| Operating altitude                          | Up to 16,000 ft (5000 m)                                                     |
| Agency certification and approvals          | UL 1449 4th Edition Listed device                                            |
| Warranty                                    | 2 years                                                                      |

#### Dimensions

Approximate Dimensions in Inches (mm)

##### SP1



#### ANSI/UL 1449 4th Edition Voltage Protection Ratings

| Catalog Number | Protection Mode |      |      |
|----------------|-----------------|------|------|
|                | L-N             | L-G  | L-L  |
| SP1-240S       | 600             | N/A  | 1000 |
| SP1-208Y       | 600             | N/A  | 1000 |
| SP1-480Y       | 1200            | N/A  | 2000 |
| SP1-600Y       | 1500            | N/A  | 2500 |
| SP1-240D       | N/A             | 1000 | 1000 |
| SP1-480D       | N/A             | 2000 | 2000 |
| SP1-600D       | N/A             | 2500 | 2500 |

## AEGIS Solutions



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## Description

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## AEGIS Powerline Filters

## Product Description

Eaton AEGIS™ Series line filters and surge protectors are specifically designed to protect sensitive electronics from hazards that exist within a facility. The AEGIS Series hybrid filter reacts instantly to changes in voltage regardless of phase angle or polarity. In comparison to other line filters, this technology provides a higher level of suppression, reliability and life expectancy.

## Application Description

By providing surge protection and line filtering, AEGIS devices can suppress the noise and transients prevalent throughout the power distribution system to support reliable operations in applications including:

- Instrumentation
- Water treatment facilities
- Pulp and paper operations
- Refrigeration and heating plants
- Petrochemical and refinery
- Food processing
- Textiles
- Automotive assembly
- Manufacturing operations

No matter where transients originate, the application of AEGIS Series devices will help protect sensitive electronic equipment including:

- Programmable logic controllers (PLCs)
- Scanning devices
- Automatic teller machines (ATMs)
- Cash registers
- Alarm systems
- Microprocessor-controlled
- OEM products
- Robotics
- CAD/CAM systems
- Control equipment
- Medical electronics and devices

AEGIS Series devices are available in a variety of common voltages and configurations.

**Why Should Sensitive Electronic Loads be Protected?**

PLC manufacturers and service technicians recommend the use of power line filters and surge suppressors to prevent downtime and equipment damage due to surges and electrical line noise. Studies have shown that failure to protect sensitive electronic loads costs American manufacturing and commercial and service industries over \$39 billion per year in lost time and revenue. Preventing these losses is a major cost-saving opportunity.

**Features, Benefits and Functions**

- Compact design with multiple mounting options
- Meets new UL safety standards for surge and filtering protection
- AC models available with up to 80 kA surge current capacity ratings
- DIN rail mounting available on most models
- Contains no replaceable parts or items that require periodic maintenance
- Alarm contact available
- Five- to ten-year warranty standard dependent on model; warranty extended an additional five years if registered

The breadth of the AEGIS Series' features, options and configurations ensures that the correct unit is available for all critical electrical applications, including control panels, security systems, measurement systems, lab equipment and other point-of-use applications.



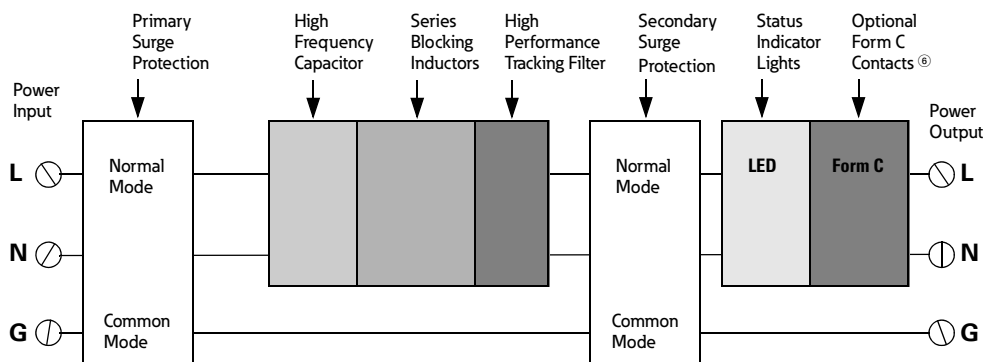
**The AEGIS PH Series Protects Critical Loads up to 20 A**



**The AEGIS PV Series Protects Critical Loads up to 5 A**

**AEGIS Summary**

| Specifications                                            | PH          | PV          | CF                                    | CN                                    |
|-----------------------------------------------------------|-------------|-------------|---------------------------------------|---------------------------------------|
| Voltage                                                   | 120/240 Vac | 120/240 Vac | 120/240 Vac <sup>①</sup><br>24/48 Vdc | 120/230 Vac <sup>①</sup><br>24/48 Vdc |
| Current range                                             | 3–20 A      | 1–5 A       | 10–60 A                               | 30 A                                  |
| DIN mounting                                              | Yes         | Yes         | Yes <sup>②</sup>                      | No                                    |
| UL 1283 7th Edition & UL 1449 4th Edition                 | Yes         | Yes         | Yes <sup>③</sup>                      | Yes <sup>③</sup>                      |
| Filtering                                                 | Yes         | Yes         | Yes                                   | No                                    |
| EMI/RFI filtering attenuation at 100 kHz                  | 75 dB       | 50 dB       | 40 dB                                 | N/A                                   |
| L to G, L to N & N to G protection modes                  | Yes         | Yes         | Yes                                   | Yes                                   |
| Peak kA per phase / mode                                  | 60/30       | 40/20       | 80/40                                 | 80/40                                 |
| UL nominal discharge current (I <sub>n</sub> )            | 5 kA        | 5 kA        | 5 kA                                  | 5 kA                                  |
| UL voltage protection rating (VPR) L–G / L–N <sup>④</sup> | 330/400     | 330/400     | 500/500                               | 500/500                               |
| Short-circuit current rating (SCCR)                       | 5 kA        | 5 kA        | 10 kA                                 | 10 kA                                 |
| Alarm contacts                                            | Yes         | No          | Yes <sup>⑤</sup>                      | No                                    |
| Standard warranty / registered warranty (years)           | 10/15       | 10/15       | 5/10                                  | 5/10                                  |
| Communication line protection (UL 497A)                   | No          | No          | Yes <sup>⑤</sup>                      | No                                    |

**AEGIS PH and PV Series Hybrid Powerline Filters****Three-Wire Design has Normal and Common Mode Protection (L-N, L-G, N-G)****Notes**

- ① Voltage rating of 240 Vac applies to CF24010-DIN2 unit only. Voltage rating of 230 Vac applies to 15 and 30 A units.
- ② Standard on 10 A; optional on 15 A, 30 A and 60 A with DIN mounting kit.
- ③ Vac models only.
- ④ Ratings shown for 120 Vac models, other voltages listed in Technical Data.
- ⑤ Optional on 30 A and 60 A models only.
- ⑥ Available on the PH Series only.





AEGIS Products

**Standards and Certifications**

- UL 1449 4th Edition
- UL 1283 7th Edition
- Built in an ISO® 9001 facility
- Designed and tested in accordance with:
  - IEEE C62.41.1
  - IEEE C62.41.2
  - IEEE C62.43-2005
  - IEEE C62.45-2002
  - IEEE C62.48-2005
  - IEEE C62.62-2010
  - RoHS compliant

**Catalog Number Selection****AEGIS**

| AG             |                                               |                                                                |                                                             |
|----------------|-----------------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------|
| Product Family | Protection/Filtering                          | Voltage                                                        | Amperage                                                    |
| AG             | PH = Premium protection with hybrid filtering | 120 = 120 Vac<br>240 = 240 Vac                                 | 03 = 3 A<br>05 = 5 A<br>10 = 10 A<br>15 = 15 A<br>20 = 20 A |
|                | PV = Premium protection with filtering        | 120 = 120 Vac<br>240 = 240 Vac                                 | 01 = 1 A<br>03 = 3 A<br>05 = 5 A                            |
|                | CF = Critical protection with filtering       | 120 = 120 Vac                                                  | 10 = 10 A                                                   |
|                |                                               | 240 = 240 Vac                                                  | 10 = 10 A                                                   |
|                |                                               | 024 = 24 Vdc<br>048 = 48 Vdc                                   | 10 = 10 A                                                   |
|                |                                               | 230 = 230 Vac                                                  | 15 = 15 A                                                   |
|                |                                               | 120 = 120 Vac<br>230 = 230 Vac                                 | 30 = 30 A                                                   |
|                |                                               |                                                                | 60 = 60 A <sup>②</sup>                                      |
|                | CN = Critical protection without filtering    | 120 = 120 Vac<br>230 = 230 Vac<br>024 = 24 Vdc<br>048 = 48 Vdc | 30 = 30 A                                                   |

**Notes**

- ① Only available in the 10 A, 120 Vac CF version.  
 ② Only available in the 120 Vac version.

## Technical Data and Specifications

## 2

## AEGIS PH and PV

| Specifications                                     | PH 120 Vac<br>3, 5, 10, 15, 20 A | PH 240 Vac<br>3, 5, 10, 15, 20 A | PV 120 Vac<br>1, 3, 5 A | PV 240 Vac<br>1, 3, 5 A |
|----------------------------------------------------|----------------------------------|----------------------------------|-------------------------|-------------------------|
| DIN mounting                                       | Yes                              | Yes                              | Yes                     | Yes                     |
| UL 1283 7th Edition and UL 1449 4th Edition        | Yes                              | Yes                              | Yes                     | Yes                     |
| RoHS compliant                                     | Yes                              | Yes                              | Yes                     | Yes                     |
| Filtering                                          | Yes                              | Yes                              | Yes                     | Yes                     |
| EMI/RFI filtering attenuation at 100 kHz           | 75 dB                            | 75 dB                            | 50 dB                   | 50 dB                   |
| L–G, L–N and N–G protection modes                  | Yes                              | Yes                              | Yes                     | Yes                     |
| Peak kA per phase/mode                             | 60/30                            | 60/30                            | 40/20                   | 40/20                   |
| UL nominal discharge current ( $I_n$ )             | 5 kA                             | 5 kA                             | 5 kA                    | 5 kA                    |
| UL voltage protection rating (VPR) L–G / L–N / N–G | 330/400/330                      | 600/700/600                      | 330/400/330             | 600/700/600             |
| MCOV                                               | 150                              | 275                              | 150                     | 275                     |
| Short-circuit current rating (SCCR)                | 5 kA                             | 5 kA                             | 5 kA                    | 5 kA                    |
| Alarm contacts                                     | Yes                              | Yes                              | No                      | No                      |
| Standard warranty / registered warranty (years)    | 10/15                            | 10/15                            | 10/15                   | 10/15                   |
| Communication line protection (UL 497A)            | No                               | No                               | No                      | No                      |

## AEGIS CF

| Specifications                                     | CF 24 Vdc |       | CF 48 Vdc |       | CF 120 Vac  |             |             |             | CF 230 Vac |       | CF 240 Vac  |
|----------------------------------------------------|-----------|-------|-----------|-------|-------------|-------------|-------------|-------------|------------|-------|-------------|
|                                                    | 10 A      | 10 A  | 10 A      | 10 A  | 10 A        | 10 A        | 30 A        | 60 A        | 15 A       | 30 A  | 10 A        |
| DIN mounting                                       | Yes       | No    | Yes       | No    | Yes         | No          | Yes ①       | Yes ①       | No         | No    | Yes         |
| UL 1283 7th Edition and UL 1449 4th Edition        | —         | —     | —         | —     | Yes         | Yes         | Yes         | Yes         | Yes        | Yes   | Yes         |
| RoHS compliant                                     | —         | —     | —         | —     | Yes         | Yes         | Yes         | Yes         | Yes        | Yes   | Yes         |
| Filtering                                          | Yes       | Yes   | Yes       | Yes   | Yes         | Yes         | Yes         | Yes         | Yes        | Yes   | Yes         |
| EMI/RFI filtering attenuation at 100 kHz           | 40 dB     | 40 dB | 40 dB     | 40 dB | 40 dB       | 40 dB       | 40 dB       | 40 dB       | 40 dB      | 40 dB | 40 dB       |
| L–G, L–N and N–G protection modes                  | Yes       | Yes   | Yes       | Yes   | Yes         | Yes         | Yes         | Yes         | Yes        | Yes   | Yes         |
| Peak kA per phase/mode                             | 6/2       | 6/2   | 20/6      | 20/6  | 30/10       | 40/20       | 80/40       | 80/40       | 24/8       | 56/24 | 30/10       |
| UL nominal discharge current ( $I_n$ )             | N/A       | N/A   | N/A       | N/A   | 3 kA        | 5 kA        | 5 kA        | 5 kA        | N/A        | N/A   | 3 kA        |
| UL voltage protection rating (VPR) L–G / L–N / N–G | N/A       | N/A   | N/A       | N/A   | 500/500/500 | 500/500/500 | 500/500/500 | 500/500/500 | N/A        | N/A   | 900/800/900 |
| MCOV                                               | 30        | 30    | 50        | 50    | 150         | 150         | 150         | 150         | 275        | 275   | 275         |
| Short-circuit current rating (SCCR)                | 10 kA     | 10 kA | 10 kA     | 10 kA | 10 kA       | 10 kA       | 10 kA       | 10 kA       | 10 kA      | 10 kA | 10 kA       |
| Alarm contacts                                     | No        | No    | No        | No    | No          | No          | No          | No          | No         | No    | No          |
| Standard warranty / registered warranty (years)    | 5/10      | 5/10  | 5/10      | 5/10  | 5/10        | 5/10        | 5/10        | 5/10        | 5/10       | 5/10  | 5/10        |
| Communication line protection (UL 497A)            | No        | No    | No        | No    | No          | No          | Yes ①       | Yes ①       | No         | Yes ① | No          |

**Note**

① Optional.

## AEGIS CN

| Specifications                                     | 24 Vdc<br>30 A | 48 Vdc<br>30 A | 120 Vac<br>30 A | 230 Vac<br>30 A |
|----------------------------------------------------|----------------|----------------|-----------------|-----------------|
| DIN mounting                                       | No             | No             | No              | No              |
| UL 1283 7th Edition and UL 1449 4th Edition        | —              | —              | Yes             | Yes             |
| RoHS compliant                                     | Yes            | Yes            | Yes             | Yes             |
| Filtering                                          | No             | No             | No              | No              |
| EMI/RFI filtering attenuation at 100 kHz           | N/A            | N/A            | N/A             | N/A             |
| L–G, L–N and N–G protection modes                  | Yes            | Yes            | Yes             | Yes             |
| Peak kA per phase/mode                             | 20/6           | 46/20          | 80/40           | 56/24           |
| UL nominal discharge current ( $I_n$ )             | N/A            | N/A            | 5 kA            | N/A             |
| UL voltage protection rating (VPR) L–G / L–N / N–G | N/A            | N/A            | 500/500/500     | N/A             |
| MCOV                                               | 30             | 50             | 150             | 275             |
| Short-circuit current rating (SCCR)                | 10 kA          | 10 kA          | 10 kA           | 10 kA           |
| Alarm contacts                                     | No             | No             | No              | No              |
| Standard warranty / registered warranty (years)    | 5/10           | 5/10           | 5/10            | 5/10            |
| Communication line protection (UL 497A)            | No             | No             | No              | No              |

2

## Maximum EMI/RFI Attenuation—MIL-STD-220

| Model         | 10 kHz | 100 kHz | 1 MHz | 10 MHz | 100 MHz | Maximum<br>Attenuation<br>Frequency |
|---------------|--------|---------|-------|--------|---------|-------------------------------------|
| AGPH120AG     | 30 dB  | 74 dB   | 76 dB | 37 dB  | 36 dB   | 101 dB at 0.5 MHz                   |
| AGPV120AG     | 27 dB  | 56 dB   | 55 dB | 36 dB  | 28 dB   | 66 dB at 0.085 MHz                  |
| AGCF12010-CP  | 16 dB  | 35 dB   | 62 dB | 40 dB  | 50 dB   | 68 dB at 1.25 MHz                   |
| AGCF12010-DIN | 16 dB  | 35 dB   | 56 dB | 29 dB  | 51 dB   | 66 dB at 0.7 MHz                    |
| AGCF12010     | 17 dB  | 35 dB   | 64 dB | 33 dB  | 51 dB   | 64 dB at 1.0 MHz                    |
| AGCF12030     | 24 dB  | 44 dB   | 58 dB | 42 dB  | 53 dB   | 67 dB at 0.6 MHz                    |
| AGCF12060     | 20 dB  | 48 dB   | 53 dB | 29 dB  | 46 dB   | 69 dB at 0.4 MHz                    |

Let-Through Voltages Based on IEEE Std. C62.62-2010 Testing Waveforms <sup>①</sup>

| Test Impulse                                                             | AEGIS Series |           |           |               |              |              |              |           |
|--------------------------------------------------------------------------|--------------|-----------|-----------|---------------|--------------|--------------|--------------|-----------|
|                                                                          | AGPH120AG    | AGPV120AG | AGCF12010 | AGCF12010-DIN | AGCF12010-CP | AGCF12030AGx | AGCF12060AGx | AGCN12030 |
| IEEE Category A<br>100 kHz ring wave<br>6000 V, 200 A                    | 25 V         | 30 V      | 150 V     | 300 V         | 300 V        | 150 V        | 90 V         | 400 V     |
| IEEE Category B<br>100 kHz ring wave<br>6000 V, 500 A                    | 35 V         | 40 V      | 330 V     | 400 V         | 400 V        | 330 V        | 230 V        | 500 V     |
| IEEE Category B<br>combination wave<br>6000 V, 3000 A<br>(UL 1449-3 VPR) | 360 V        | 370 V     | 470 V     | 480 V         | 460 V        | 460 V        | 450 V        | 460 V     |

**Note**<sup>①</sup> All tests conducted on 120 Vac units.

## AEGIS DN Series



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## AEGIS DN Series

## Product Description

With a broad range of devices, the Eaton AEGIS series is helping original equipment manufacturers (OEMs) adopt best-in-class surge and line protection solutions. These solutions meet specific requirements in global commercial and industrial applications to support reliable operation and reduce maintenance costs due to damaged electrical equipment.

Eaton's DIN rail surge protective device (SPD) is Open Type 1 SPD listed for DIN rail mounting applications and is available in both AC and DC voltages. The pluggable multi-pole SPD comes equipped with an optional remote contact (RC) connector for remote monitoring. The metal oxide varistor (MOV)-based protection modules feature up to 50 kA per phase of surge protection with a 20 kA nominal discharge current rating.

There is an increasing need and/or requirement of surge protection in today's distribution systems. Studies have shown that the failure to protect sensitive electronic loads cost the American manufacturing, commercial and services industries more than \$39 billion per year in lost time and revenue. This underscores the need for facility-wide surge protection applied at all stages of the electrical distribution system, from the electrical service entrance down to critical single-phase loads.

## Application Description

The AEGIS DN series provides DIN rail surge protection in a compact package. The AEGIS DN can be used where:

- Only surge and transient voltage protection is needed
- 120–600 Vac, 12/24/48 Vdc or 1000/1500 Vdc circuits are to be protected
- Replacement modules are specified

## Features, Benefits and Functions

- Up to 50 kA per phase of surge protection
- 20 kA nominal discharge current rating
- Up to four protection modes (L1–N, L2–N, L3–N and N–G)
- Nominal voltages:
  - 120 Vac, 240 Vac, 277 Vac, 400 Vac, 480 Vac and 600 Vac
  - 12 Vdc, 24 Vdc and 48 Vdc
  - 1000 Vdc and 1500 Vdc photovoltaic units
- Red–green status indication flag
- Optional RC signaling
- Vibration and shock resistance withstand capabilities
- Thermal disconnecter
- Replaceable modules

**Standards and Certifications**

- ANSI/UL 1449 5th Edition voltage protection ratings
- RoHS, REACH and Prop 65 compliant

**Catalog Number Selection****AEGIS**

| AG DN 120 10R  |                                                  |                   |                                                    |
|----------------|--------------------------------------------------|-------------------|----------------------------------------------------|
| Product Family | Protection/Filtering                             | Voltage           | Number of Protection Modes                         |
| AG             | DN = DIN rail surge protection without filtering | 120 = 120 Vac     | 10R = 1 mode (single-phase)                        |
|                |                                                  | 240 = 240 Vac     | 20R = 2 modes (two-phase) <sup>①</sup>             |
|                |                                                  | 277 = 277 Vac     | 30R = 3 modes (three-phase) <sup>②</sup>           |
|                |                                                  | 400 = 400 Vac     | 40R = 4 modes (three-phase + neutral) <sup>③</sup> |
|                |                                                  | 480 = 480 Vac     |                                                    |
|                |                                                  | 600 = 600 Vac     |                                                    |
|                |                                                  | 012 = 12 Vac      |                                                    |
|                |                                                  | 024 = 24 Vac      |                                                    |
|                |                                                  | 048 = 48 Vac      |                                                    |
|                |                                                  | 1000PV = 1000 Vac | 30LR = Solar                                       |
|                |                                                  | 1500PV = 1500 Vac |                                                    |
|                |                                                  |                   |                                                    |

**Product Selection****Replacement modules for DN series**

| Voltage | Unit Application for Module                    | Catalog Number |
|---------|------------------------------------------------|----------------|
| 120 V   | AGDN12010R, AGDN12020R, AGDN12030R, AGDN12040R | AGDN120P       |
| 240 V   | AGDN24010R, AGDN24020R, AGDN24030R, AGDN24040R | AGDN240P       |
| 277 V   | AGDN27710R, AGDN27720R, AGDN27730R, AGDN27740R | AGDN277P       |
| 400 V   | AGDN40010R, AGDN40020R, AGDN40030R, AGDN40040R | AGDN400P       |
| 480 V   | AGDN48010R, AGDN48020R, AGDN48030R, AGDN48040R | AGDN480P       |
| 600 V   | AGDN60010R, AGDN60020R, AGDN60030R             | AGDN600P       |
| 500 V   | AGDN1000PV30LR                                 | AGDN500PVP     |
| 750 V   | AGDN1500PV30LR                                 | AGDN750PVP     |

**Notes**

- ① 20R typically used for split-phase.  
 ② 30R used for split-phase plus neutral to ground protection.  
 ③ 40R not available in 600 Vac versions.

## Technical Data and Specifications

## Ratings

2

| Description                             | Rating                                         |
|-----------------------------------------|------------------------------------------------|
| Application                             | Single-, split- or three-phase systems         |
| Input voltage range—AC                  | 120–600 Vac                                    |
| Input voltage range—DC                  | 12–48 Vdc, 1000–1500 Vdc                       |
| Amperage                                | N/A                                            |
| Frequency                               | 50/60 Hz                                       |
| Protection modes                        | L–N, L–G and N–G                               |
| MCOV                                    | Up to 1500 V                                   |
| Peak surge current per phase / per mode | Up to 50 kA / 25 kA                            |
| Operating temperature                   | –40 °F to +185 °F (–40 °C to +85 °C)           |
| Response time                           | <25 nanoseconds                                |
| Agency approvals                        | UL 1449 5th Edition, IEC 61643-11, EN 61643-11 |
| UL 1449 Type                            | Type 1CA                                       |
| Warranty <sup>①</sup>                   | 1 year                                         |
| Status indicator                        | Indication flag                                |

## AEGIS DN Specifications

| Specifications                          | 12 Vdc | 24 Vdc | 48 Vdc | 120 Vac | 240 Vac | 277 Vac | 400 Vac | 480 Vac | 600 Vac | 1000 Vdc | 1500 Vdc |
|-----------------------------------------|--------|--------|--------|---------|---------|---------|---------|---------|---------|----------|----------|
| DIN mounting                            | Yes    | Yes    | Yes    | Yes     | Yes     | Yes     | Yes     | Yes     | Yes     | Yes      | Yes      |
| UL 1449 5th Edition                     | Yes    | Yes    | Yes    | Yes     | Yes     | Yes     | Yes     | Yes     | Yes     | Yes      | Yes      |
| Filtering                               | No     | No     | No     | No      | No      | No      | No      | No      | No      | No       | No       |
| L–G, L–N and N–G protection modes       | Yes    | Yes    | Yes    | Yes     | Yes     | Yes     | Yes     | Yes     | Yes     | N/A      | N/A      |
| Peak kA per phase                       | 20 kA  | 20 kA  | 20 kA  | 50 kA   | 50 kA   | 50 kA   | 50 kA   | 50 kA   | 35 kA   | 40 kA    | 40 kA    |
| UL nominal discharge current ( $I_n$ )  | 10 kA  | 10 kA  | 10 kA  | 20 kA   | 20 kA   | 20 kA   | 20 kA   | 20 kA   | 20 kA   | 20 kA    | 10 kA    |
| UL voltage protection rating (VPR)      | N/A    | N/A    | N/A    | 600 V   | 900 V   | 1000 V  | 1500 V  | 2000 V  | 2500 V  | 2500 V   | 4000 V   |
| MCOV                                    | 15     | 28     | 52     | 150     | 300     | 350     | 480     | 550     | 750     | 1000     | 1500     |
| Short-circuit current rating (SCCR)     | N/A    | N/A    | N/A    | 200 kA  | 150 kA  | 200 kA  | 200 kA  | 200 kA  | 200 kA  | 50 kA    | 65 kA    |
| Alarm contacts                          | No     | No     | No     | Yes     | Yes     | Yes     | Yes     | Yes     | Yes     | Yes      | Yes      |
| Warranty (years)                        | 1      | 1      | 1      | 1       | 1       | 1       | 1       | 1       | 1       | 1        | 1        |
| Communication line protection (UL 497A) | No     | No     | No     | No      | No      | No      | No      | No      | No      | No       | No       |

## Note

<sup>①</sup> With product registration.

**Sag Ride-Through (SRT2)****Contents****Description**

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| Power-Sure 800 (T800) . . . . .                                                 | <b>V3-T2-44</b> |
| Power-Suppress 100 (T100) . . . . .                                             | <b>V3-T2-48</b> |

**Sag Ride-Through (SRT2)****Product Description**

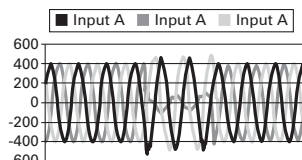
Eaton's sag ride-through is the first of its kind.

The SRT2 power conditioner prevents expensive electrical downtime. The SRT2 represents Eaton's state-of-the-art solution to today's power conditioning challenges.

**The Problem—Voltage Sags and Brownouts**

The ability of a plant to ride-through voltage sags can have a significant impact on operations and competitiveness. In the United States, voltage sags cost billions of dollars in lost production, interruption, damaged materials, retooling and scrap. In addition, sags can cause: increased operating costs, the need for product reworks, safety hazards, equipment damage and/or failure, reduced product quality, increased clean-up, additional labor costs, increased scrap material and costs associated with investigations into the problem.

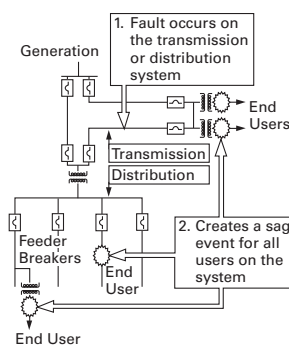
Today's industrial and large commercial electricity customers are becoming more sensitive to power disturbances and are demanding better electric quality. However, the quality of power grids is not significantly improving. Customers still experience power quality problems that affect plant operations and profitability.

**Deep, Single-Phase Sag****Definition of Voltage Sag**

A voltage sag is a sudden, momentary decrease in supply voltage. It can last from a cycle to several seconds. Voltage sags are most often caused by faults on the electrical transmission or distribution system. They can be caused by lightning strikes, animal contact, starting of large motors or an internal fault within a customer's facility.

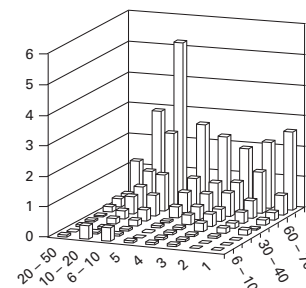
Depending on the proximity to the fault, which can be hundreds of miles away, the voltage during the sag is typically 40%–90% of nominal utility voltage. The operation of circuit breakers, fuses and reclosers limits most sags to less than 15 cycles.

Voltage sags are experienced 10 to 20 times more frequently than complete outages. However, voltage sags are equally disruptive to sensitive equipment.

**Voltage Sags****Regularity of Voltage Sags**

EPRI conducted a two-year study of power quality levels on distribution systems in the United States. A variation event was recorded every time the voltage dropped below 90% of the nominal. The results are shown below.

A typical distribution system customer experiences about 50 events per year when the voltage drops below 90%, and only about two events per year when the voltage drops below 30% of nominal. The utility study concluded that sags represented almost all of the events experienced at a typical facility.

**Events per Year**

## Application Description

### Industries and Applications Affected by Sags

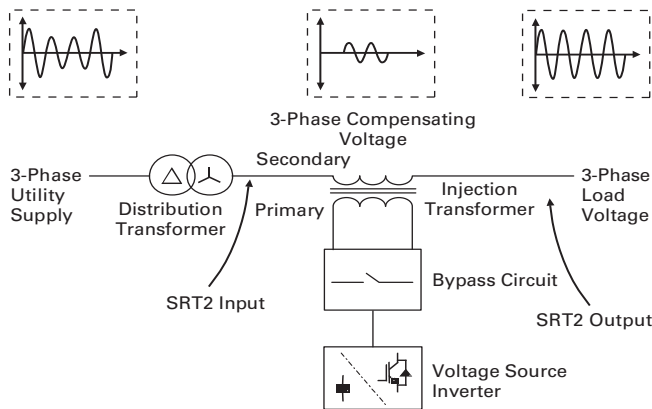
Key industries:

- Semi-conductor manufacturers
- Communications
- Steel mills
- Petroleum and chemical processing
- Health care
- Paper mills
- Automotives
- Textile
- Printing
- Plastics
- Other manufacturing

Equipment or processes:

- Manufacturing process controllers
- Variable speed drives
- Robotics
- Motor conductor
- Telephone systems
- HID lighting
- HVAC controls
- Medical equipment
- Computers

### Block Diagram of the SRT2 Active Voltage Conditioner



## Features, Benefits and Functions

### Sag Correction Using the SRT2

The SRT2 is a high performance, inverter-based voltage conditioning device developed to provide protection to sensitive loads against commonly occurring voltage sags.

The SRT2 monitors the incoming supply voltage and when it deviates from the nominal voltage level, the SRT2 achieves voltage conditioning by injecting the appropriate correction voltage in series with the power supply. The SRT2 provides an extremely fast reaction time and subcycle response to sag events that would otherwise cause loads to drop out.

The SRT2 is designed for low voltage systems and is also offered in medium voltage applications from up to 50 MVA. Installation is simple and the SRT2 provides customers with a new solution to improve productivity and reduce downtime for sag related problems.

The SRT2 meets the stringent requirements of the Semi-F47 standard; a key requirement for SAG correction in the semi-conductor industry.

- Complete correction of single-phase voltage sags down to 63% for 30 seconds
- Partial correction of three-phase sags down to 50% for 30 seconds
- Correction of utility voltage unbalance (from network side of transformer)
- Attenuation of voltage flicker

### Continuous Regulation

The Sag Ride-Through is an active voltage conditioner. This means it will constantly respond to voltage sags and swells in the  $\pm 10\%$  range with a regulated output in the  $\pm 1\%$  range. The SRT2 can be applied to the main service entrance, at branch locations or in front critical loads. The SRT2 provides an outstanding return on investment. It delivers operation productivity that is just not possible with traditional tap switching or ferroresonant technologies. The SRT2 consists of a voltage source inverter, bypass circuit and an injection transformer connected in series between the incoming utility supply and the load, as shown in the figure below. For the standard sag correcting model, the injection transformer consists of a boost component. The SRT2 monitors the incoming supply voltage and when it deviates from the nominal voltage level the SRT2 inserts an appropriate compensating voltage using the IGBT inverter and series injection transformer. Energy is sourced from the supply during this time. This regulates the load voltage to its nominal value, thus eliminating voltage disturbances from the utility supply affecting the load.

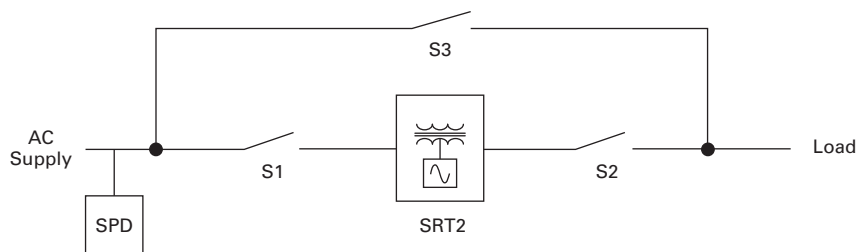


## Product Selection

SRT2 <sup>①</sup>

| Load Capacity at Nominal Voltage 480 V (kVA) <sup>②</sup> | Terminal Cabinet <sup>③</sup> | Fault Capacity (kVA) | System Efficiency (%) | System Dissipation (Worst Case) (kW) | Airflow (m3/min) | Cabinet Dimensions H x W x D in Inches (mm)       | Catalog Number <sup>④</sup> |
|-----------------------------------------------------------|-------------------------------|----------------------|-----------------------|--------------------------------------|------------------|---------------------------------------------------|-----------------------------|
| 150                                                       | No                            | 40                   | 97.5                  | 3.8                                  | 18               | 85.00 x 32.00 x 32.00 (2159.0 x 812.8 x 812.8)    | SRT20150480AA               |
| 150                                                       | Yes                           | 40                   | 97.5                  | 3.8                                  | 18               | 85.00 x 32.00 x 32.00 (2159.0 x 812.8 x 812.8)    | SRT20150480AA-TC            |
| 225                                                       | No                            | 40                   | 97.7                  | 5.2                                  | 18               | 85.00 x 32.00 x 32.00 (2159.0 x 812.8 x 812.8)    | SRT20225480AA               |
| 225                                                       | Yes                           | 40                   | 97.7                  | 5.2                                  | 18               | 85.00 x 32.00 x 32.00 (2159.0 x 812.8 x 812.8)    | SRT20225480AA-TC            |
| 300                                                       | No                            | 40                   | 98.0                  | 6.1                                  | 18               | 85.00 x 40.00 x 32.00 (2159.0 x 1016 x 812.8)     | SRT20300480AA               |
| 300                                                       | Yes                           | 40                   | 98.0                  | 6.1                                  | 18               | 85.00 x 40.00 x 32.00 (2159.0 x 1016 x 812.8)     | SRT20300480AA-TC            |
| 450                                                       | No                            | 40                   | 98.2                  | 8.0                                  | 36               | 85.00 x 40.00 x 32.00 (2159.0 x 1016 x 812.8)     | SRT20450480AA               |
| 450                                                       | Yes                           | 40                   | 98.2                  | 8.0                                  | 36               | 85.00 x 40.00 x 32.00 (2159.0 x 1016 x 812.8)     | SRT20450480AA-TC            |
| 600                                                       | No                            | 40                   | 98.4                  | 9.8                                  | 36               | 85.00 x 40.00 x 32.00 (2159.0 x 1016 x 812.8)     | SRT20600480AA               |
| 600                                                       | Yes                           | 40                   | 98.4                  | 9.8                                  | 36               | 85.00 x 40.00 x 32.00 (2159.0 x 1016 x 812.8)     | SRT20600480AA-TC            |
| 750                                                       | No                            | 40                   | 98.4                  | 12.2                                 | 54               | 85.00 x 96.00 x 48.00 (2159.0 x 2438.4 x 1219.2)  | SRT20750480AA               |
| 750                                                       | Yes                           | 40                   | 98.4                  | 12.2                                 | 54               | 85.00 x 96.00 x 48.00 (2159.0 x 2438.4 x 1219.2)  | SRT20750480AA-TC            |
| 900                                                       | No                            | 40                   | 98.5                  | 13.2                                 | 54               | 85.00 x 96.00 x 48.00 (2159.0 x 2438.4 x 1219.2)  | SRT20900480AA               |
| 1200                                                      | No                            | 40                   | 98.5                  | 18.1                                 | 72               | 85.00 x 126.00 x 96.00 (2159.0 x 3200.4 x 2438.4) | SRT21200480AA               |
| 1500                                                      | No                            | 50                   | 98.7                  | 20.2                                 | 90               | 85.00 x 126.00 x 96.00 (2159.0 x 3200.4 x 2438.4) | SRT21500480AA               |
| 1800                                                      | No                            | 50                   | 98.8                  | 22.1                                 | 108              | 85.00 x 126.00 x 96.00 (2159.0 x 3200.4 x 2438.4) | SRT21800480AA               |

## SRT2 with External Maintenance Bypass Block Diagram



**Note:** A terminal cabinet may be needed if a bypass cabinet is not used. SRT2 units 900 kVA and larger do not require a terminal cabinet; however, an external three-breaker mechanical bypass with integrated surge protection is recommended.

## Notes

- ① For 50 Hz international applications, consult factory.
- ② 480 V is standard. If additional voltage is needed, consult factory.
- ③ Eaton external three-breaker maintenance bypass cabinet is recommended. If a bypass is not used, a terminal cabinet may be required. Contact factory.
- ④ TC in the model number denotes terminal cabinet, which is not required for units of 900 kVA and larger.

## Technical Data and Specifications

## 2

## SRT2 Specifications

| Features                                                                           | Specifications                                                           |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| <b>Load Capacity</b>                                                               |                                                                          |
| Capacity                                                                           | 150–1800 kVA (consult factory for custom design; up to 36 kVA available) |
| Displacement power factor of connected load                                        | 0 lagging to 0.9 leading                                                 |
| Crest factor for rated kVA                                                         | 3 at 100% of rated load                                                  |
| Overload capacity (>90% supply voltage)                                            | 150%, 30 seconds, once per 500 s                                         |
| <b>Input Supply</b>                                                                |                                                                          |
| Nominal supply voltage (according to model)                                        | 480 V<br>Voltages up to 36 kV available as custom applications ①         |
| Power system type                                                                  | Three-phase, center ground referenced                                    |
| Supply voltage category                                                            | Level III transient voltage capability                                   |
| Fault capacity                                                                     | Refer to model tables                                                    |
| <b>Operating Voltage Range for Regulation</b>                                      |                                                                          |
| Supply voltage for regulation                                                      | 90–110% of nominal input voltage unit rating                             |
| <b>Output Supply</b>                                                               |                                                                          |
| Nominal voltage (V)                                                                | Set to match nominal supply voltage                                      |
| Three-phase V regulation range                                                     | ±10% continuous                                                          |
| Three-phase V regulation accuracy                                                  | ±1%                                                                      |
| Three-phase balanced sag/swell correction ability:<br>40% model                    | +40% / –10% at least 30 s at full load                                   |
| Sag correction accuracy (within specified range)                                   | ±2.5%                                                                    |
| Sag correction response:                                                           |                                                                          |
| Initial                                                                            | <250 µs                                                                  |
| Complete                                                                           | <0.25 cycle                                                              |
| Single-phase sag correction ability:<br>40% model (15% retained voltage / 85% sag) | 90% nominal                                                              |
| Equivalent series impedance (operating)                                            | <4% typical                                                              |
| Efficiency of system                                                               | 0.98 to 0.99 (refer to model tables)                                     |
| <b>Bypass</b>                                                                      |                                                                          |
| Capacity                                                                           | 100% model rating (kVA)                                                  |
| Maximum overload capacity (in bypass):                                             |                                                                          |
| For 10 minutes                                                                     | 125%                                                                     |
| For 1 minute                                                                       | 150%                                                                     |
| For 1 second                                                                       | 500%                                                                     |
| For 200 milliseconds                                                               | 2000%                                                                    |
| Transfer time:                                                                     |                                                                          |
| Inverter to bypass                                                                 | <0.5 ms                                                                  |
| Equivalent series impedance (in bypass)                                            | <2.5% typical                                                            |
| <b>Interface</b>                                                                   |                                                                          |
| Access protocol                                                                    | Ethernet connectivity; Modbus® TCP, dry contacts                         |
| <b>Environmental</b>                                                               |                                                                          |
| Enclosure rating                                                                   | NEMA® 1, IP20                                                            |
| Pollution degree rating                                                            | 2                                                                        |
| Minimum operating temperature                                                      | 0 °C                                                                     |
| Maximum operating temperature                                                      | 40 °C                                                                    |
| Temperature derating                                                               | Above 40 °C derate at 2% per °C to a maximum of 50 °C                    |
| Capacity elevation derating                                                        | –2% every 100 m above 1000 m                                             |
| Cooling:                                                                           |                                                                          |
| Inverter                                                                           | Forced ventilation                                                       |
| Transformer                                                                        | Fan assisted ventilation                                                 |
| Humidity                                                                           | <95%, noncondensing                                                      |
| EMC emissions                                                                      | CISPR 22 level G                                                         |
| Noise                                                                              | 65 dBA                                                                   |
| Warranty                                                                           | 1 year                                                                   |

**Note**

① 480 V is standard. If additional voltage is needed, consult factory.

Power-Sure 700 (T700)



## Power-Sure 700 (T700)

### Product Description

Eaton's Power-Sure 700 (T700) is the ideal solution for keeping your facility and equipment up and running during brownouts, undervoltage conditions and other power problems. The Power-Sure 700 (T700) can significantly reduce the costs of equipment damage and downtime when these situations occur. The state-of-the-art design provides rapid response time, high efficiency, high inrush current capability, and operating advantages exclusive to Eaton.

The Power-Sure 700 (T700) maintains a tightly regulated output voltage by automatically activating the appropriate transformer tap through a silicone controlled rectifier (SCR). Tap changer response time is initiated at one cycle, ensuring rapid and precise regulation. Switching at zero current enables noise reduction during tap transitions.

### Brownouts

In the United States, most facilities have sufficient voltage regulation. However, in some U.S. locations and many developing countries, regulation problems occur because of overstressed utility distribution systems.

In some cases, due to the excessive demand on the utility system, voltage may be below 10% of nominal (~10%) during the day. This condition is called a **voltage dip or brownout**. Customers may notice dim lights and reduced power. During the evening, voltage may rise above 10% of nominal (+10%) because large facilities and loads are shut down. This shutdown reduces the power demand on the grid and results in a voltage increase.

The IEEE defines voltage regulation as overvoltage or undervoltage. Voltage regulation events last from **a few minutes to many hours** with voltage varying by  $\pm 20\%$ . Long-term regulation problems differ from short duration sags and dips, which are much deeper voltage drops.

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### Features and Benefits

- Coordinated with standard thermal-magnetic breakers to allow motor starts
- Optional 50 kA or 100 kA per phase surge protection
- Input frequency range operation from 57–63 Hz
- Integral manual rotary maintenance bypass switch standard on 50 to 500 kVA units and optional on smaller units
- Not affected by load power factor. Can operate effectively in low-load applications due to "unique leakage reactance" technology
- Fail-safe bypass circuit, isolation transformer and overtemperature protection
- Less than 1% THD
- Optional Standard and Premium metering to monitor voltage, current, frequency, power, energy, PF with minimum and maximum, and communication capabilities

### The Solution

Prior to installing an expensive solution, Eaton encourages customers to monitor incoming voltage to determine if voltage regulation is a problem. The local utility may also be able to provide information on voltage expected at the facility.

Using a meter, it can quickly be determined if a voltage regulation problem or brownout condition exists. The appropriate solution would be a Power-Sure 700 (T700). The Power-Sure 700 (T700) can be installed at the service entrance, branch panel or at critical loads.

Eaton's Power-Sure 700 (T700) is a solid-state tap changing power conditioner designed to protect against brownouts and long duration voltage regulation problems.

# 2.1

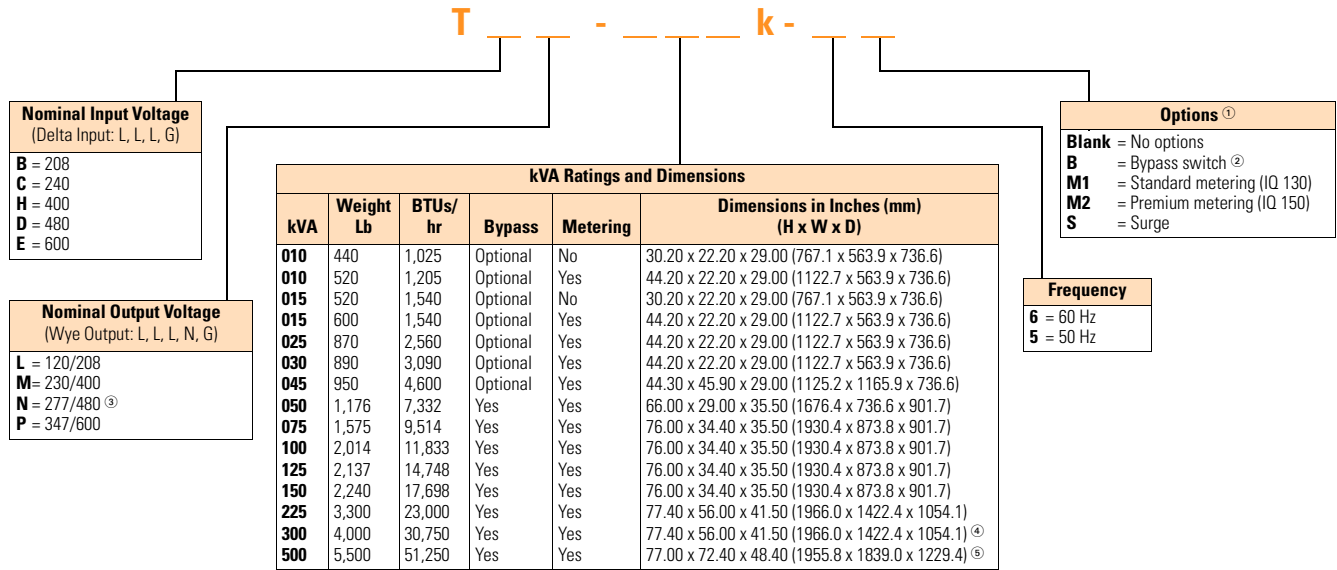
## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

### Surge Protection and Power Conditioning

#### Catalog Number Selection

##### Power-Sure 700 (T700)

2



#### Notes

- ① Units with no surge protection option, bypass option or metering will have blanks in the last three spaces in the catalog number.
- ② Bypass is standard on 50 kVA and larger units and an option on 45 kVA and smaller units.
- ③ 10 kVA and 15 kVA units will have a height of 44 inches (1117.6 mm).
- ④ Only UL listed units with an input voltage of 480 V and an output voltage of 120/208 V or 277/480 V will consist of the following dimension. Use table below for the dimensions of an input voltage 208 V and output voltage of 120/208 V.
- ⑤ Only UL listed for an input voltage of 480 V and an output voltage of 277/480 V.

All weights are approximate. Monitor option includes main input circuit breaker. Refer to PAD for pricing and availability.

Listings—UL Listed, CSA Certified, except for 600 V; no UL, CSA on 600 V units.

For output distribution, call factory.

K factor—rated units available on request.

#### Dimensions for UL listed T700

| Catalog number | kVA | Input Voltage | Output Voltage | Dimensions in Inches        | Weight in Lb |
|----------------|-----|---------------|----------------|-----------------------------|--------------|
| TBL-300K-6     | 300 | 208           | 208/120        | 88.00 W x 50.75 D x 85.00 H | 6,700        |

#### Dimensions for cUL listed T700, EP Configured

| kVA | Dimensions in Inches        | Weight in Lb |
|-----|-----------------------------|--------------|
| 10  | 29.00 W x 24.00 D x 59.00 H | 610          |
| 15  | 29.00 W x 24.00 D x 59.00 H | 690          |
| 25  | 29.00 W x 24.00 D x 59.00 H | 870          |
| 30  | 29.00 W x 24.00 D x 59.00 H | 890          |
| 50  | 29.00 W x 36.00 D x 66.00 H | 1,176        |
| 75  | 34.50 W x 36.00 D x 76.00 H | 1,575        |
| 100 | 34.50 W x 36.00 D x 76.00 H | 2,014        |
| 125 | 34.50 W x 36.00 D x 76.00 H | 2,137        |
| 150 | 34.50 W x 36.00 D x 76.00 H | 2,240        |

**Technical Data and Specifications****Power-Sure 700 (T700) Specification (10 to 500 kVA)**

| Feature                     | Description                                                                                                                                                                                                |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Technology                  | Electronic tap changer                                                                                                                                                                                     |
| Input voltages              | 208–600 V, three-phase (three-wire)                                                                                                                                                                        |
| Input voltage range         | +10% to –23% of nominal rated input                                                                                                                                                                        |
| Output voltage              | ±3% of nominal                                                                                                                                                                                             |
| Response time               | 1/2 cycle                                                                                                                                                                                                  |
| Frequency                   | 60 Hz, ±3%                                                                                                                                                                                                 |
| Efficiency                  | 97% typical                                                                                                                                                                                                |
| Line regulation             | Output is ±3% of nominal for input variations of +10% to –23% of nominal                                                                                                                                   |
| Load regulation             | Output is maintained within 3% of nominal from no load to full load                                                                                                                                        |
| Correction time             | Output will be corrected to within ±3% of nominal in 1.5 cycles or less                                                                                                                                    |
| Harmonic distortion         | Less than 1.0% added to the output waveform under any dynamic linear loading conditions presented to the line regulator                                                                                    |
| Noise attenuation           |                                                                                                                                                                                                            |
| Common mode                 | 146 dB                                                                                                                                                                                                     |
| Normal mode                 | 3 dB down at 1000 Hz, 40 dB/decade to below 50 dB with resistive load                                                                                                                                      |
| Turn-on characteristics     | When energized, voltage overshoot will be less than 5% of nominal for 1 cycle or less                                                                                                                      |
| Overload rating             | 1000% for 1 cycle and 200% for 10 seconds                                                                                                                                                                  |
| Ambient rating              | –10 ° to 40 °C                                                                                                                                                                                             |
| Monitoring                  | Three green LEDs (phase power on indication), one red LED (alert indication)                                                                                                                               |
| Surge protection (optional) | CVX 50 kA SPD device 50 kVA and below, CVX 100 kA SPD device 75 kVA and above                                                                                                                              |
| Input breaker               | MCCB rated 125% of full rated current                                                                                                                                                                      |
| Bypass switch               | Normal and bypass selector                                                                                                                                                                                 |
| Metering (optional)         | Standard metering (IQ 130)—voltage and current with minimum and maximum<br>Premium metering (IQ 150)—voltage, current, frequency, power, energy, PF, with minimum and maximum, communications capabilities |
| Warranty                    | 1-year parts                                                                                                                                                                                               |

## Power-Sure 800

2



Superior Power Conditioning for Industrial and Commercial

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## Power-Sure 800 (T800)

## Product Description

Eaton's Power-Sure 800 (T800)<sup>TM</sup> cleans up and purifies fluctuating and erratic power that exists in commercial and industrial facilities so that sensitive electronic equipment is not affected.

The Power-Sure 800 (T800) is a self-regulating isolation transformer. It was developed to protect against fluctuating voltages, brownouts, line noise, short-duration power outages, sags, surges, spikes and transients. The Power-Sure 800 also has one of the highest K-factors—K-30—and eliminates harmonic current in the power line, which helps prevent damage to building wiring.

## Application Description

The Power-Sure 800 (T800) is ideal for use in industrial applications, such as computer programmable controllers and robotics. Use the Power-Sure 800 (T800) whenever continuous, well-regulated, transient-free power is required.

## Features

- Superior isolation
- Tight voltage regulation
- High immunity to distortion
- Lightning and surge protection
- Protection against power interruptions
- Power factor correction
- Bi-directional harmonic filtering
- K-30 rated design
- Warranty: two years

Eaton's Power-Sure 800 (T800) power conditioners provide high-quality power with inherent surge protection, noise and bi-directional harmonic filtering, as well as superior isolation. These units range from office models to floor- or wall-/panel-mounted industrial models and provide an excellent solution for any application with noisy or poor power quality.

## Standards and Certifications

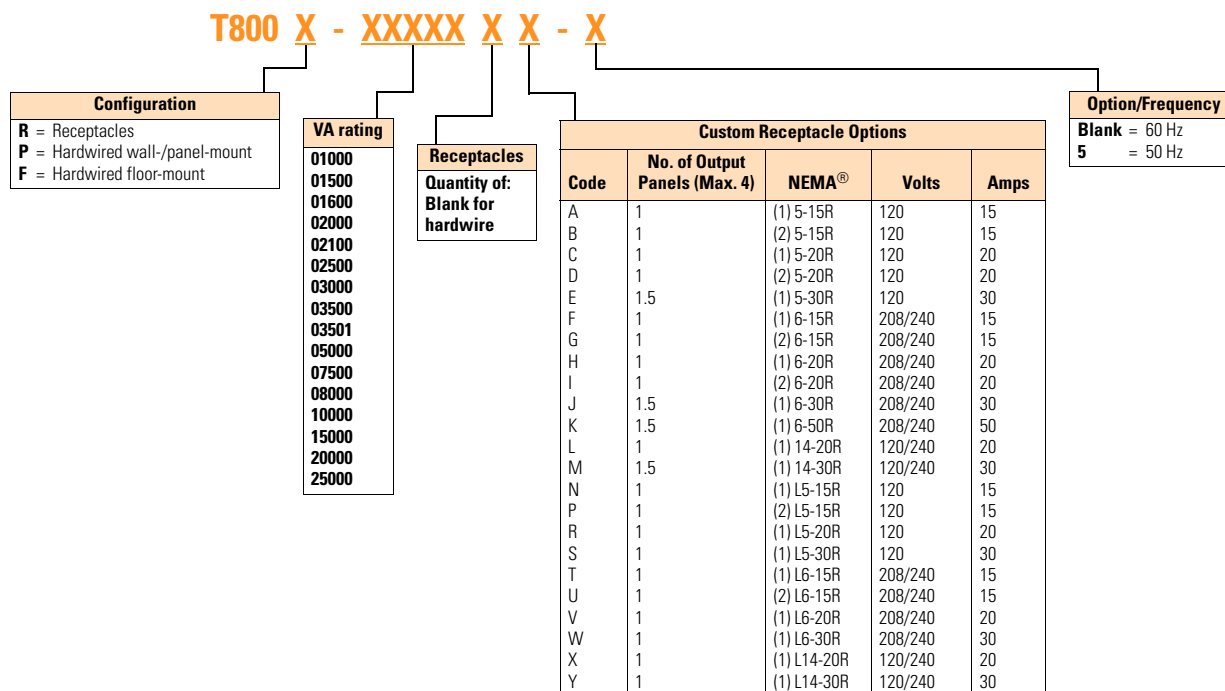
- UL 1012, UL 544 and cUL listed
- Meets ANSI standards for computers with inputs as low as 50% of nominal



## Catalog Number Selection

## Power-Sure 800

2



# 2.1

## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

### Surge Protection and Power Conditioning

#### Product Selection

#### 2

#### Power-Sure 800 Models

| Rating (VA/Watts)                                      | Input Voltage         | Output Voltage       | Input Interface | Output Interface    | Part Number        |
|--------------------------------------------------------|-----------------------|----------------------|-----------------|---------------------|--------------------|
| <b>Office Models (with Receptacles)</b>                |                       |                      |                 |                     |                    |
| 1000/700                                               | 120                   | 120                  | 5-15P           | (4) 5-20R           | <b>T800R-01000</b> |
| 1600/1200                                              | 120                   | 120                  | 5-15P           | (4) 5-20R           | <b>T800R-01600</b> |
| 2100/1500                                              | 120                   | 120                  | 5-20P           | (4) 5-20R           | <b>T800R-02100</b> |
| 2500/1750                                              | 120                   | 120                  | 5-30P           | (4) 5-20R           | <b>T800R-02500</b> |
| 3500/2450                                              | 120                   | 120/240              | 5-50P           | (4) 5-20R           | <b>T800R-03500</b> |
| 3500/2450                                              | 208/240               | 120/240              | 6-20P           | (4) 5-20R           | <b>T800R-03501</b> |
| 5000/3500                                              | 208/240               | 120/240              | Hardwired       | Custom <sup>①</sup> | <b>T800R-05000</b> |
| 7500/5250                                              | 208/240               | 120/240              | Hardwired       | Custom <sup>①</sup> | <b>T800R-07500</b> |
| 10,000/7000                                            | 208/240               | 120/240              | Hardwired       | Custom <sup>①</sup> | <b>T800R-10000</b> |
| 15,000/10,500                                          | 208/240               | 120/240              | Hardwired       | Custom <sup>①</sup> | <b>T800R-15000</b> |
| <b>Industrial Models (Hardwired Wall-/Panel-Mount)</b> |                       |                      |                 |                     |                    |
| 500/500                                                | Range 1 <sup>②④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800P-00500</b> |
| 750/750                                                | Range 1 <sup>②④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800P-00750</b> |
| 1000/1000                                              | Range 1 <sup>②④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800P-01000</b> |
| 1500/1500                                              | Range 1 <sup>②④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800P-01500</b> |
| 2000/2000                                              | Range 1 <sup>②④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800P-02000</b> |
| 3000/3000                                              | Range 1 <sup>②④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800P-03000</b> |
| 5000/5000                                              | Range 1 <sup>②④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800P-05000</b> |
| 8000/8000                                              | Range 2 <sup>③④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800P-08000</b> |
| 10,000/10,000                                          | Range 2 <sup>③④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800P-10000</b> |
| <b>Industrial Models (Hardwired Floor-Mount)</b>       |                       |                      |                 |                     |                    |
| 5000/5000                                              | Range 1 <sup>②④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800F-05000</b> |
| 8000/8000                                              | Range 2 <sup>③④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800F-08000</b> |
| 10,000/10,000                                          | Range 2 <sup>③④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800F-10000</b> |
| 15,000/15,000                                          | Range 2 <sup>③④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800F-15000</b> |
| 20,000/20,000                                          | Range 2 <sup>③④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800F-20000</b> |
| 25,000/25,000                                          | Range 2 <sup>③④</sup> | Range 3 <sup>⑤</sup> | Hardwired       | Hardwired           | <b>T800F-25000</b> |

#### Notes

<sup>①</sup> See Catalog Numbering Selection on **Page V3-T2-45**; 5 panels available for distribution; HW output utilizes 1 panel, other 4 panels can be used for receptacle interface or cabling.

<sup>②</sup> Range 1: 120/208/240/480.

<sup>③</sup> Range 2: 208/240/480.

<sup>④</sup> Input and output voltage is field configurable; units will ship from the factory configured as follows: Range 1—120 V (input/output); Range 2—240 V (input/output).

<sup>⑤</sup> Range 3: 120/208/240.



**Technical Data and Specifications**

- Line regulation:  $\pm 3\%$  V-out for +10% to -20% V-in at 100% load
- Load regulation:  $\pm 3\%$  for 0–75% load  $\pm 2\%$  for 100% load
- Immunity to distortion: at 40% THD V-in, 5% max. THD V-out at 50% load or higher
- Ride-through capability: 1 cycle
- Voltage recovery: 2 cycles to 95%, 3 cycles to 100%
- K-factor: K-30 rated
- Power factor correction: input of 0.95 typical
- Harmonic attenuation: -23 dB for load-reflected harmonics
- Galvanic isolation: NEC 250.5d, 0.001 PF
- Surge protection: 330 V let-through voltage when tested to ANSI/IEEE® 62.41-Cat B3
- Common mode noise attenuation: 140 dB
- Transverse mode noise attenuation: 120 dB
- Reliability: 200,000 hours (MTBF)
- Audible noise: 52–56 dB measured at 1 meter, A scale
- Efficiency: approximately 92% at full load
- Operating temperature: -20 °C to +40 °C

**Dimensions**

Approximate Dimensions in Inches (mm)

**Power-Sure 800 Models**

| Dimensions, W x D x H                                  | Weight, Lb (kg) | Part Number        |
|--------------------------------------------------------|-----------------|--------------------|
| <b>Office Models (with Receptacles)</b>                |                 |                    |
| 8.50 x 12.75 x 17.50 (215.9 x 323.9 x 444.5)           | 46 (21)         | <b>T800R-01000</b> |
| 8.50 x 12.75 x 17.50 (215.9 x 323.9 x 444.5)           | 62 (28)         | <b>T800R-01600</b> |
| 8.50 x 12.75 x 17.50 (215.9 x 323.9 x 444.5)           | 65 (29)         | <b>T800R-02100</b> |
| 8.50 x 12.75 x 17.50 (215.9 x 323.9 x 444.5)           | 68 (31)         | <b>T800R-02500</b> |
| 8.50 x 12.75 x 17.50 (215.9 x 323.9 x 444.5)           | 72 (33)         | <b>T800R-03500</b> |
| 8.50 x 12.75 x 17.50 (215.9 x 323.9 x 444.5)           | 73 (33)         | <b>T800R-03501</b> |
| 15.00 x 23.75 x 22.50 (381.0 x 603.3 x 571.5)          | 176 (80)        | <b>T800R-05000</b> |
| 15.00 x 23.75 x 22.50 (381.0 x 603.3 x 571.5)          | 210 (95)        | <b>T800R-07500</b> |
| 15.00 x 23.75 x 22.50 (381.0 x 603.3 x 571.5)          | 256 (116)       | <b>T800R-10000</b> |
| 15.00 x 23.75 x 22.50 (381.0 x 603.3 x 571.5)          | 314 (142)       | <b>T800R-15000</b> |
| <b>Industrial Models (Hardwired Wall-/Panel-Mount)</b> |                 |                    |
| 9.00 x 14.00 x 10.00 (228.6 x 355.6 x 254.0)           | 52 (24)         | <b>T800P-00500</b> |
| 9.00 x 14.00 x 10.00 (228.6 x 355.6 x 254.0)           | 60 (27)         | <b>T800P-00750</b> |
| 9.00 x 14.00 x 10.00 (228.6 x 355.6 x 254.0)           | 82 (37)         | <b>T800P-01000</b> |
| 13.00 x 16.50 x 14.75 (330.2 x 419.1 x 374.7)          | 106 (48)        | <b>T800P-01500</b> |
| 13.00 x 16.50 x 14.75 (330.2 x 419.1 x 374.7)          | 125 (57)        | <b>T800P-02000</b> |
| 13.00 x 16.50 x 14.75 (330.2 x 419.1 x 374.7)          | 157 (71)        | <b>T800P-03000</b> |
| 27.00 x 22.50 x 28.50 (685.8 x 571.5 x 723.9)          | 437 (198)       | <b>T800P-05000</b> |
| 27.00 x 22.50 x 28.50 (685.8 x 571.5 x 723.9)          | 495 (225)       | <b>T800P-08000</b> |
| 27.00 x 22.50 x 28.50 (685.8 x 571.5 x 723.9)          | 537 (244)       | <b>T800P-10000</b> |
| <b>Industrial Models (Hardwired Floor-Mount)</b>       |                 |                    |
| 23.00 x 20.00 x 28.50 (584.2 x 508.0 x 723.9)          | 407 (185)       | <b>T800F-05000</b> |
| 23.00 x 20.00 x 28.50 (584.2 x 508.0 x 723.9)          | 465 (211)       | <b>T800F-08000</b> |
| 23.00 x 20.00 x 28.50 (584.2 x 508.0 x 723.9)          | 507 (230)       | <b>T800F-10000</b> |
| 35.00 x 25.00 x 39.50 (889.0 x 635.0 x 1003.3)         | 830 (376)       | <b>T800F-15000</b> |
| 35.00 x 25.00 x 39.50 (889.0 x 635.0 x 1003.3)         | 950 (431)       | <b>T800F-20000</b> |
| 35.00 x 25.00 x 39.50 (889.0 x 635.0 x 1003.3)         | 1070 (485)      | <b>T800F-25000</b> |

## Eaton Power-Suppress 100



Ultra-Isolator Noise Suppressor and Isolation Provider

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| Technical Data and Specifications                                     | V3-T2-50 |

## Power-Suppress 100 (T100)

## Product Description

Eaton's Power-Suppress™ 100 ultra-isolator noise suppressors protect sensitive equipment from electrical noise disturbances. Using exclusive double shielding techniques, the Power-Suppress 100 blocks all forms of electrical noise including radio frequency interference (RFI)/ electromagnetic interference (EMI), over a broad range of frequencies. Furthermore, the noise suppression is achieved without impeding normal power flow.

Power-Suppress 100 ultra-isolator noise suppressors can reduce a 6000-volt spike to an insignificant 0.0030 volt. These high-voltage transients contain enough energy to completely destroy the electrical circuit components that are vital to daily operation.

## Application Description

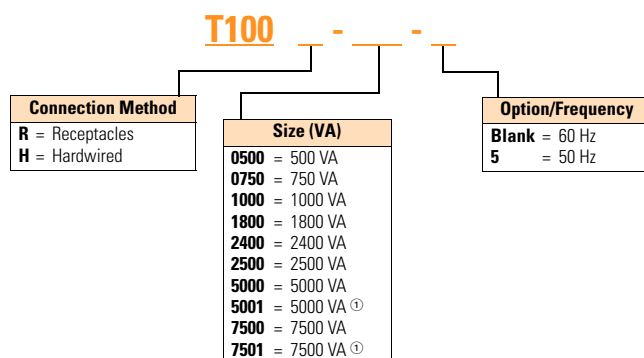
Applications for the Power-Suppress 100 include audio and video equipment, computer and process equipment, telecommunications systems, and virtually any sensitive electronic instruments.

## Features

- Traps unwanted harmonics
- Removes surge voltages and minimizes reflected THD
- Cleans and conditions the sine wave
- Eliminates load-generated feedback
- Available in both hardwired or line cord/receptacle models
- Fast and easy installation
- Long-life operation
- Small footprint—saves valuable space
- Two-year warranty complete unit, five-year warranty core and coil

**Standards and Certifications**

- UL 1012, UL 1449, cUL listed, ANSI/IEEE C57.12.91
- Meets FCC Category A, IEEE C62.41 Category A3

**Catalog Number Selection****Power-Suppress 100****Product Selection****Power-Suppress 100 Models**

| Input Voltages <sup>②</sup>        | Output Voltages <sup>②</sup> | Output VA <sup>③</sup> | I/O Interfaces (NEMA) | Catalog Number                 |
|------------------------------------|------------------------------|------------------------|-----------------------|--------------------------------|
| <b>Line-Cord/Receptacle Models</b> |                              |                        |                       |                                |
| 120                                | 120                          | 500                    | 5-15P/(1) 5-20R2      | <b>T100R-0500</b>              |
| 120                                | 120                          | 750                    | 5-15P/(1) 5-20R2      | <b>T100R-0750</b>              |
| 120                                | 120                          | 1000                   | 5-15P/(1) 5-20R2      | <b>T100R-1000</b>              |
| 120                                | 120                          | 1800                   | L5-20P/(2) 5-20R2     | <b>T100R-1800</b>              |
| 120                                | 120                          | 2400                   | L5-30P/(2) 5-20R2     | <b>T100R-2400</b>              |
| <b>Terminal Style Models</b>       |                              |                        |                       |                                |
| 120/240                            | 120/240                      | 500                    | Hardwired             | <b>T100H-0500</b>              |
| 120/240                            | 120/240                      | 750                    | Hardwired             | <b>T100H-0750</b>              |
| 120/240                            | 120/240                      | 1000                   | Hardwired             | <b>T100H-1000</b>              |
| 120/240                            | 120/240                      | 1800                   | Hardwired             | <b>T100H-1800</b>              |
| 120/240                            | 120/240                      | 2500                   | Hardwired             | <b>T100H-2500</b>              |
| 120/240                            | 120/240                      | 5000                   | Hardwired             | <b>T100H-5000</b>              |
| 240/480                            | 120/240                      | 5000                   | Hardwired             | <b>T100H-5001</b> <sup>①</sup> |
| 120/240                            | 120/240                      | 7500                   | Hardwired             | <b>T100H-7500</b>              |
| 240/480                            | 120/240                      | 7500                   | Hardwired             | <b>T100H-7501</b> <sup>①</sup> |

**Notes**

- <sup>①</sup> Models T100H-5001 and T100H-7501 will ship configured to 240 V input and output voltage.
- <sup>②</sup> Input and output voltages can be field configured for either 120 Vac or 240 Vac, 240 Vac or 480 Vac, as indicated above.
- <sup>③</sup> 500 VA to 7500 VA hardwired models will ship configured to 120 V input and output voltage.

## Technical Data and Specifications

## 2

## Technical Specifications

| Description                  | Specifications                                            |
|------------------------------|-----------------------------------------------------------|
| Input voltage/frequency      | 120, 240, 480 V $\phi$ /60 Hz                             |
| Common-mode noise            | 140 dB at 100 kHz                                         |
| Normal-mode noise            | 65 dB at 100 kHz                                          |
| Overload capacity            | 600% for 1 cycle, 300% for 30 seconds                     |
| Dielectric strength          | 2,500 Vac minimum                                         |
| Frequency                    | 60 Hz $\pm$ 5%                                            |
| Impedance                    | 3–6% typical                                              |
| Efficiency                   | 93–97% typical                                            |
| Input voltage range          | $\pm$ 10% of nominal rated voltage                        |
| Harmonic distortion          | Adds less than 1% THD, under linear loading               |
| Coil insulation              | 200 °C                                                    |
| Temperature rise             | 115 °C max rise above a 40 °C ambient, depending on model |
| Electromagnetic interference | <0.2 gauss at 36 inches                                   |

## Environments

| Description           | Specifications                                              |
|-----------------------|-------------------------------------------------------------|
| Audible noise         | Less than 50 dBA measured at 3 ft from the noise suppressor |
| Operating temperature | 0 to 40 °C                                                  |
| Storage temperature   | –20 to 50 °C                                                |
| Operating altitude    | Up to 12,000 ft (3657.6 m) (without derating)               |
| Operating humidity    | 95% relative (noncondensing)                                |

## Plug and Receptacle Configuration Models

| Rating      | Input Plug | Output Receptacle |
|-------------|------------|-------------------|
| 500–1000 VA | 5-15P      | 5-20R duplex      |
| 1.8 kVA     | L5-20P     | 2 x 5-20R duplex  |
| 2.4 kVA     | L5-30P     | 2 x 5-20R duplex  |

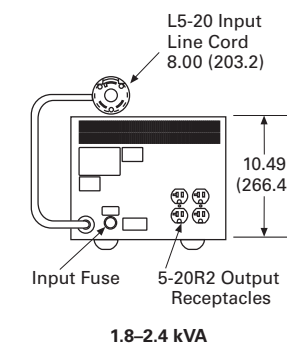
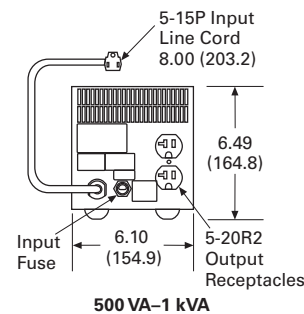
## Dimensions

Approximate Dimensions in Inches (mm)

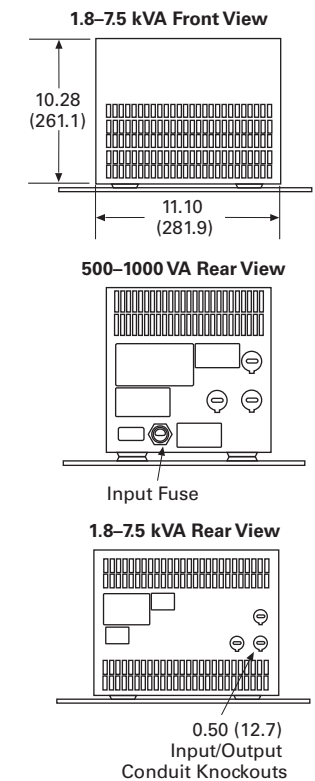
## Power-Suppress 100 Models

| Dimensions, W x D x H                         | Weight, Lb (kg) | Catalog Number    |
|-----------------------------------------------|-----------------|-------------------|
| <b>Line-Cord/Receptacle Models</b>            |                 |                   |
| 6.49 x 6.10 x 12.00 (164.8 x 154.9 x 304.8)   | 22 (10)         | <b>T100R-0500</b> |
| 6.49 x 6.10 x 12.00 (164.8 x 154.9 x 304.8)   | 28 (13)         | <b>T100R-0750</b> |
| 6.49 x 6.10 x 12.00 (164.8 x 154.9 x 304.8)   | 31 (14)         | <b>T100R-1000</b> |
| 10.49 x 11.10 x 17.00 (266.4 x 281.9 x 431.8) | 54 (24)         | <b>T100R-1800</b> |
| 10.49 x 11.10 x 17.00 (266.4 x 281.9 x 431.8) | 58 (26)         | <b>T100R-2400</b> |
| <b>Terminal Style Models</b>                  |                 |                   |
| 6.42 x 6.10 x 12.00 (163.1 x 154.9 x 304.8)   | 22 (10)         | <b>T100H-0500</b> |
| 6.42 x 6.10 x 12.00 (163.1 x 154.9 x 304.8)   | 28 (13)         | <b>T100H-0750</b> |
| 6.42 x 6.10 x 12.00 (163.1 x 154.9 x 304.8)   | 31 (14)         | <b>T100H-1000</b> |
| 10.28 x 11.10 x 17.00 (261.1 x 281.9 x 431.8) | 54 (24)         | <b>T100H-1800</b> |
| 10.28 x 11.10 x 17.00 (261.1 x 281.9 x 431.8) | 58 (26)         | <b>T100H-2500</b> |
| 10.28 x 11.10 x 17.00 (261.1 x 281.9 x 431.8) | 86 (39)         | <b>T100H-5000</b> |
| 10.49 x 11.10 x 17.00 (266.4 x 281.9 x 431.8) | 92 (42)         | <b>T100H-5001</b> |
| 10.28 x 11.10 x 17.00 (261.1 x 281.9 x 431.8) | 116 (53)        | <b>T100H-7500</b> |
| 10.28 x 11.10 x 17.00 (261.1 x 281.9 x 431.8) | 111 (50)        | <b>T100H-7501</b> |

## Line-Cord Style



## Terminal Style



## Note

① 480 V available for 5 and 7.5 kVA models only.

## Capacitor Cell with Cage Clamp Terminals



## Product Overview

## Product Description

Eaton's power factor correction capacitors and harmonic filters are an essential part of modern electric power systems. Power factor correction capacitors are the simplest and most economical means of increasing the capacity of any power system, minimizing energy losses and correcting load power factor. In addition, power factor penalties can be reduced and power quality can be greatly enhanced.

There are several reasons to correct poor power factor. The first is to reduce or eliminate a power factor penalty charged by the utility. Another reason is that your existing transformer is, or shortly will be, at full capacity and installing power factor correction capacitors can be a very cost-effective solution to installing a brand new service. Depending on the amount of power factor correction (kvar that needs to be injected into the electrical system to improve the power factor) and the dynamic nature of the load, a fixed or switched capacitor bank may be the best solution.

## Contents

## Description

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| Transient-Free Static Switching Power Factor Correction Units . . . . .   | V3-T2-83 |
| HCU2 Harmonic Correction Unit . . . . .                                   | V3-T2-85 |
| HCUH Harmonic Correction Unit . . . . .                                   | V3-T2-89 |

When capacity becomes a problem, the choice of a solution will be dependent upon the size of the increase needed. Like all power quality solutions, there are many factors that need to be considered when determining which solution will be best to solve your power factor problem.

## Harmonic Filtering

As the world becomes more dependent on electric and electronic equipment, the likelihood that the negative impact of harmonic distortion increases dramatically. The efficiency and productivity gains from these increasingly sophisticated pieces of equipment have a negative side effect...increased harmonic distortion in the power lines. The difficult thing about harmonic distortion is determining the cause. Once this has been determined, the solution can be easy. Active harmonic filtering equipment will mitigate specific harmonic issues, and correct poor power factor as well.

## Product Selection

## 2

## Capacitor Cell Chart

Dimensions in Inches (mm)

| Voltage | kvar <sup>①</sup> | D          | H            | Weight in Lb (kg) | Catalog Number |
|---------|-------------------|------------|--------------|-------------------|----------------|
| 240     | 1.5               | 3.1 (79.5) | 7.9 (200.0)  | 1.1 (0.5)         | 643PCRMB       |
| 240     | 2                 | 3.1 (79.5) | 9.4 (238.0)  | 1.3 (0.6)         | 8B43PCRMB      |
| 240     | 2.5               | 3.1 (79.5) | 9.4 (238.0)  | 1.3 (0.6)         | 1043PCRMB      |
| 240     | 3                 | 3.5 (89.5) | 9.4 (238.0)  | 1.8 (0.8)         | 12X43PCRMB     |
| 240     | 4                 | 3.1 (79.5) | 7.9 (200.0)  | 1.1 (0.5)         | 423PCRMB       |
| 240     | 5                 | 3.5 (89.5) | 12.3 (313.0) | 2.6 (1.2)         | 2043PCRMB      |
| 240     | 6.3               | 3.1 (79.5) | 9.4 (238.0)  | 1.3 (0.6)         | 6B23PCRMB      |
| 240     | 7.5               | 3.1 (79.5) | 9.4 (238.0)  | 1.3 (0.6)         | 7X23PCRMB      |
| 240     | 8.3               | 3.5 (89.5) | 9.4 (238.0)  | 3.3 (1.5)         | 8B23PCRMB      |
| 240     | 10                | 3.5 (89.5) | 9.4 (238.0)  | 2.0 (0.9)         | 1023PCRMB      |
| 240     | 12.5              | 3.5 (89.5) | 12.3 (313.0) | 2.6 (1.2)         | 12X23PCRMB     |
| 240     | 15                | 3.5 (89.5) | 12.3 (313.0) | 2.6 (1.2)         | 1523PCRMB      |
| 480     | 1.5               | 2.1 (53.0) | 5.0 (125.8)  | 0.7 (0.3)         | 1X43PCRMA      |
| 480     | 2                 | 2.5 (63.5) | 5.5 (140.8)  | 0.9 (0.4)         | 243PCRMA       |
| 480     | 2.5               | 2.5 (63.5) | 5.5 (140.8)  | 0.9 (0.4)         | 2X43PCRMA      |
| 480     | 3                 | 2.5 (63.5) | 5.5 (140.8)  | 0.9 (0.4)         | 343PCRMA       |
| 480     | 4                 | 2.5 (63.5) | 6.5 (165.8)  | 0.9 (0.4)         | 443PCRMA       |
| 480     | 5                 | 2.5 (63.5) | 6.5 (165.8)  | 0.9 (0.4)         | 543PCRMA       |
| 480     | 6                 | 3.1 (79.5) | 7.9 (200.0)  | 1.1 (0.5)         | 643PCRMB       |
| 480     | 7.5               | 3.1 (79.5) | 7.9 (200.0)  | 1.1 (0.5)         | 7X43PCRMB      |
| 480     | 8.3               | 3.1 (79.5) | 9.4 (238.0)  | 1.3 (0.6)         | 8B43PCRMB      |
| 480     | 9                 | 3.1 (79.5) | 9.4 (238.0)  | 1.3 (0.6)         | 943PCRMB       |
| 480     | 10                | 3.1 (79.5) | 9.4 (238.0)  | 1.3 (0.6)         | 1043PCRMB      |
| 480     | 12.5              | 3.5 (89.5) | 9.4 (238.0)  | 1.8 (0.8)         | 12X43PCRMB     |
| 480     | 15                | 3.5 (89.5) | 9.4 (238.0)  | 1.8 (0.8)         | 1543PCRMB      |
| 480     | 18                | 3.5 (89.5) | 12.3 (313.0) | 2.6 (1.2)         | 1843PCRMB      |
| 480     | 20                | 3.5 (89.5) | 12.3 (313.0) | 2.6 (1.2)         | 2043PCRMB      |
| 480     | 25                | 3.5 (89.5) | 12.3 (313.0) | 2.6 (1.2)         | 2543PCRMB      |
| 600     | 5                 | 3.1 (79.5) | 9.4 (238.0)  | 1.3 (0.6)         | 563PCRMB       |
| 600     | 7.5               | 3.1 (79.5) | 9.4 (238.0)  | 1.3 (0.6)         | 7X63PCRMB      |
| 600     | 10                | 3.1 (79.5) | 9.4 (238.0)  | 1.3 (0.6)         | 1063PCRMB      |
| 600     | 12.5              | 3.5 (89.5) | 9.4 (238.0)  | 1.8 (0.8)         | 12X63PCRMB     |
| 600     | 15                | 3.5 (89.5) | 12.3 (313.0) | 2.6 (1.2)         | 1563PCRMB      |
| 600     | 17.5              | 3.5 (89.5) | 12.3 (313.0) | 2.6 (1.2)         | 17X63PCRMB     |
| 600     | 20                | 3.5 (89.5) | 12.3 (313.0) | 3.3 (1.5)         | 2063PCRMB      |
| 600     | 25                | 3.5 (89.5) | 15.3 (388.0) | 3.3 (1.5)         | 2563PCRMB      |

## Heavy-Duty Capacitor Cell Chart

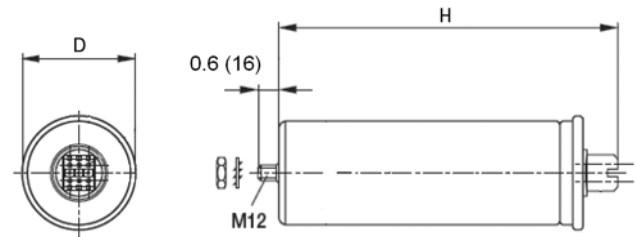
Dimensions in Inches (mm)

| Name-plate Voltage | kvar | D          | H            | Internal Voltage Rating | Weight in Lb (kg) | Catalog Number |
|--------------------|------|------------|--------------|-------------------------|-------------------|----------------|
| 240                | 12.5 | 3.5 (89.5) | 15.3 (388.0) | 360                     | 3.3 (1.5)         | 12X23PHRMB     |
| 480                | 15.0 | 3.5 (89.5) | 12.3 (313.0) | 525                     | 2.6 (1.2)         | 1543PHRMB      |
| 480                | 16.7 | 3.5 (89.5) | 15.3 (388.0) | 600                     | 3.3 (1.5)         | 16S43PHRMB     |
| 480                | 20.0 | 3.5 (89.5) | 15.3 (388.0) | 525                     | 3.3 (1.5)         | 2043PHRMB      |
| 480                | 25.0 | 3.5 (89.5) | 15.3 (388.0) | 525                     | 3.3 (1.5)         | 2543PHRMB      |
| 600                | 12.3 | 3.5 (89.5) | 12.3 (313.0) | 660                     | 2.6 (1.2)         | 12A63PHRMB     |
| 600                | 14.7 | 3.5 (89.5) | 15.3 (388.0) | 660                     | 3.3 (1.5)         | 14S63PHRMB     |
| 600                | 16.7 | 3.5 (89.5) | 15.3 (388.0) | 660                     | 3.3 (1.5)         | 16S63PHRMB     |

## Dimensions

Approximate Dimensions in Inches (mm)

## Capacitor Cell



## Note

- ① kvar rating standard. Standard kvar tolerance is 0% to +5%.  
Part number shown is for three-phase units. Up to 5 kvar at 480 V—quick disconnect terminals are standard. Above 5 kvar at 480 V (and on all other voltages)—cage clamp terminals are standard.

## UNIPUMP



## Contents

## Description

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| AUTOVAR Filter—LV Automatic Detuned Filter . . . . .                      | V3-T2-76 |
| Transient-Free Static Switching Power Factor Correction Units . . . . .   | V3-T2-83 |
| HCU2 Harmonic Correction Unit . . . . .                                   | V3-T2-85 |
| HCU1 Harmonic Correction Unit . . . . .                                   | V3-T2-89 |

## UNIPUMP

## Product Description

Non-fused capacitors for outdoor irrigation and oil field installations.

- Designed expressly for outdoor pumping applications
- Pole or wall mounting
- Small, light-weight enclosure for easy installation
- SO-WA type flexible cable facilitates installation (4-conductor)
- Gland-type weatherproof bushings
- Strong outer case

## Application Description

Outdoor irrigation and oil and gas field pumping.

## Features, Benefits and Functions

## Configuration

- **Outer case:** Heavy, No. 14 gauge steel finished with durable powder coat finish. Integral strap mounting bracket with keyhole at top for pole or wall installation. No knockouts

## Capacitor Cells

- **Terminals:** Insulated finger-safe terminals rated for 3 kVAC withstand
- **Dielectric fill:** Dry-type cells use soft organic polymer resin—Resinol
- Eliminates potential for corona/partial discharge/electrochemical oxidation
- Excellent heat dissipation
- Flash point: +444 °F (+229 °C)
- Fire point: +840 °F (+449 °C)

- **Design:** Self-healing metallized high crystalline polypropylene with ramp metallization film. Total losses less than 0.45 watt per kvar. (Dielectric losses less than 0.2 watt per kvar)
- **Ramp metallization:** Provides thicker film at higher current density areas, allowing for reduced internal losses, lower operating temperatures and longer life expectancy. Also prevents chain reaction breakdown by limiting propagation of film vaporization
- **Pressure sensitive interrupter:** Built-in, three-phase pop-up interrupter design. UL recognized. Removes capacitor from line before internal pressure can cause case rupture. Bulged capacitor cell top provides easy visual indication of interrupter operation
- **Ceramic discharge resistors:** Reduce residual voltage to less than 50 volts within one minute of de-energization. Selected for 20-year nominal life. Exceeds NEC requirements
- **Capacitor operating temperature:** -40 °F (-40 °C) to +115 °F (+46 °C)
- **Case:** Weatherproof aluminum housing
- **Warranty:** The longest in the industry—two full years of warranty on capacitor cells

## Standards and Certifications

- UL 810 and C22.2 No. 190 listed



# 2.2

## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

### Power Factor Correction and Harmonic Filtering

#### Product Selection

2

UNIPUMP

UNIPUMP



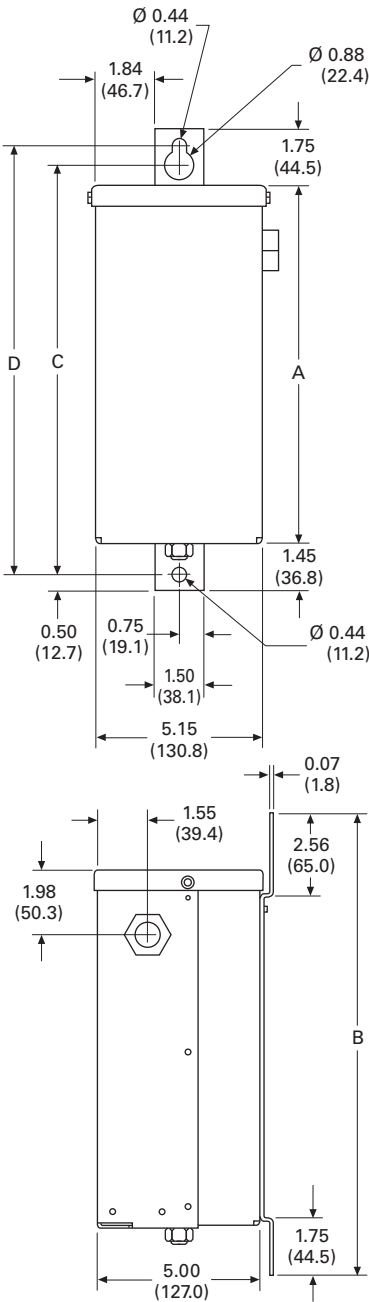
| kvar           | Rated Current | Case Size | Cable Size | Shipping Weight in Lb (kg) | Catalog Number |
|----------------|---------------|-----------|------------|----------------------------|----------------|
| <b>240 Vac</b> |               |           |            |                            |                |
| 2              | 4.8           | AA        | 14         | 10.0 (4.5)                 | 223JMR         |
| 2.5            | 6.0           | AA        | 14         | 10.0 (4.5)                 | 2X23JMR        |
| 3              | 7.2           | AA        | 14         | 10.0 (4.5)                 | 323JMR         |
| 4              | 9.6           | AA        | 14         | 11.0 (5.0)                 | 423JMR         |
| 5              | 12.0          | BB        | 12         | 11.0 (5.0)                 | 523JMR         |
| 6              | 14.4          | BB        | 12         | 15.0 (6.8)                 | 623JMR         |
| 7.5            | 18.0          | BB        | 12         | 15.0 (6.8)                 | 7X23JMR        |
| <b>480 Vac</b> |               |           |            |                            |                |
| 2              | 2.4           | AA        | 14         | 10.4 (4.7)                 | 243JMR         |
| 2.5            | 3.0           | AA        | 14         | 10.4 (4.7)                 | 2X43JMR        |
| 3              | 3.6           | AA        | 14         | 10.4 (4.7)                 | 343JMR         |
| 4              | 4.8           | AA        | 14         | 10.4 (4.7)                 | 443JMR         |
| 5              | 6.0           | AA        | 14         | 10.4 (4.7)                 | 543JMR         |
| 6              | 7.2           | AA        | 14         | 10.6 (4.8)                 | 643JMR         |
| 7.5            | 9.0           | AA        | 14         | 10.6 (4.8)                 | 7X43JMR        |
| 10             | 12.0          | AA        | 14         | 10.8 (4.9)                 | 1043JMR        |
| 12.5           | 15.0          | BB        | 12         | 15.0 (6.8)                 | 12X43JMR       |
| 15             | 18.0          | BB        | 12         | 15.0 (6.8)                 | 1543JMR        |
| 17.5           | 21.0          | BB        | 8          | 15.8 (7.2)                 | 17X43JMR       |
| 20             | 24.0          | BB        | 8          | 16.8 (7.6)                 | 2043JMR        |
| 25             | 30.0          | BB        | 8          | 16.8 (7.6)                 | 2543JMR        |
| <b>600 Vac</b> |               |           |            |                            |                |
| 5              | 4.9           | AA        | 14         | 10.8 (4.9)                 | 563JMR         |
| 7.5            | 7.4           | AA        | 14         | 10.8 (4.9)                 | 7X63JMR        |
| 10             | 9.8           | AA        | 14         | 10.8 (4.9)                 | 1063JMR        |
| 12.5           | 12.3          | BB        | 12         | 15.0 (6.8)                 | 12X63JMR       |
| 15             | 14.7          | BB        | 12         | 15.8 (7.2)                 | 1563JMR        |
| 17.5           | 17.2          | BB        | 8          | 16.8 (7.6)                 | 17X63JMR       |
| 20             | 19.6          | BB        | 8          | 16.8 (7.6)                 | 2063JMR        |



Dimensions

Approximate Dimensions in Inches (mm)

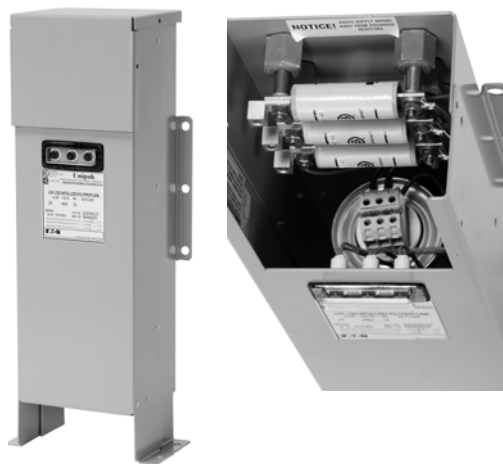
UNIPUMP



UNIPUMP Dimension Chart

| Size Code | A             | B             | C             | D             |
|-----------|---------------|---------------|---------------|---------------|
| AA        | 11.00 (279.4) | 14.20 (360.7) | 12.60 (320.0) | 13.20 (335.3) |
| BB        | 14.00 (355.6) | 17.10 (434.3) | 15.50 (393.7) | 16.10 (408.9) |

## UNIPAK



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## UNIPAK

## Product Description

**UNIPAK Low Voltage Fixed Capacitor Banks**

- Two-year warranty on capacitor cells (units with standard-duty cells)
- Five-year warranty on capacitor cells (units with heavy-duty cells)
- Indoor/outdoor service
- Wall-mount (up to C2) and floor-mounted units available
- Short lead-times
- Slim profile allows reduced footprint, conserving valuable floor space

**UNIPAK with Heavy-Duty Capacitor Cells**

- Standard fixed capacitor systems using heavy-duty capacitor cells
- For use in moderate harmonic environments where engineering evaluation allows in place of detuned filter designs
- Provides future conversion capability into a detuned filter system when required by facility growth or increased nonlinear load levels

**UNIPAK Low Voltage Fixed Detuned Filters**

- Detuned filter systems for low voltage, heavy-duty applications
- Correct power factor in high harmonic environments
- Two-enclosure design isolates capacitors from high-temperature operating reactors and allows for flexible installation
- Five-year cell warranty/one-year reactor warranty
- Three-phase cell capacitor construction

## Application Description

Designed for power factor correction in plants experiencing harmonics problems due to high amounts of nonlinear loads.

**Features, Benefits and Functions****UNIPAK Low Voltage Fixed Capacitor Banks**

- **Outer enclosure:** Heavy, No. 14 gauge steel finished with durable baked powder coat finish. Wall-mounting flanges and floor-mounting feet. Elimination of knockouts permits indoor/outdoor use. Manufactured to NEMA 1 and 3R requirements
- Elevated floor-mounting feet allow access for easy maintenance
- **Cover:** "L" shaped gasketed cover with multiple fasteners provides front opening for ease of installation and service
- **UNIPAK operating temperature:** -40 °F to +115 °F (-40 °C to +46 °C)
- **UNIPAK storage temperature:** -40 °F to +131 °F (-40 °C to +55 °C)
- **Power and ground terminal lugs:** Furnished inside enclosure
- **Pressure-sensitive interrupter:** All units have built-in UL recognized pressure-sensitive interrupter, and thermally or mechanically activated disconnecting link removes capacitor from the supply before dangerous pressure buildup or excessive fault current occurs. Bulged capacitor cell top provides easy visual indication of interrupter operation

- **Standard fusing:**

- **Size Code A1:** Three midjet-type fuses with 100,000 A interrupting capacity
- **Size Code A2 and larger:** Slotted-blade type fuses with 200,000 A interrupting capacity; fuses mounted on stand-off bushings; solderless connectors for easy hookup of incoming line conductors
- **Fuse indicating lights:** Red, neon cleared-fuse indicating lights are protected by transparent weatherproof guard

- **Options:**

- Non-fused units available, selected sizes
- Heavy-duty capacitor cells, selected sizes

**UNIPAK Low Voltage Fixed Detuned Filters**

- **Enclosures:** Standard NEMA 1 enclosures have durable baked powder coat finish
- **UNIPAK detuned filter operating temperature:** -40 °F to +115 °F (-40 °C to +46 °C)
- **UNIPAK detuned filter storage temperature:** -40 °F to +131 °F (-40 °C to +55 °C)
- **Power and ground terminal lugs:** Furnished inside enclosures

**Standards and Certifications****UNIPAK Low Voltage Fixed Capacitor Banks**

- UL 810 and CSA C.22.2 No.190 Listed

**UNIPAK Low Voltage Fixed Detuned Filters**

- UL 508A and CSA C22.2 No. 190 Listed



## Product Selection

## UNIPAK Low Voltage Fixed Capacitor Banks

2

## UNIPAK

## 240 Vac UNIPAK Selection Chart



| kvar | Rated Current (Amperes) | Enclosure | Shipping Weight in Lb (kg) | Catalog Number |
|------|-------------------------|-----------|----------------------------|----------------|
| 1    | 2.4                     | A1        | 18 (8)                     | 123PMURF       |
| 1.5  | 3.6                     | A1        | 18 (8)                     | 1X23PMURF      |
| 2    | 4.8                     | A1        | 19 (9)                     | 223PMURF       |
| 2.5  | 6                       | A1        | 19 (9)                     | 2X23PMURF      |
| 3    | 7.2                     | A1        | 19 (9)                     | 323PMURF       |
| 4    | 9.6                     | A1        | 20 (9)                     | 423PMURF       |
| 5    | 12                      | A2        | 29 (13)                    | 523PMURF       |
| 6    | 14.4                    | A2        | 29 (13)                    | 623PMURF       |
| 7.5  | 18                      | A2        | 30 (14)                    | 7X23PMURF      |
| 8    | 19.2                    | A2        | 31 (14)                    | 823PMURF       |
| 10   | 24                      | A2        | 31 (14)                    | 1023PMURF      |
| 12.5 | 30                      | A2        | 32 (14)                    | 12X23PMURF     |
| 15   | 36                      | A2        | 33 (15)                    | 1523PMURF      |
| 17.5 | 42                      | B1        | 44 (20)                    | 17X23PMURF     |
| 20   | 48                      | B1        | 45 (20)                    | 2023PMURF      |
| 22.5 | 54                      | B1        | 46 (21)                    | 22X23PMURF     |
| 25   | 60                      | B1        | 46 (21)                    | 2523PMURF      |
| 30   | 72                      | B1        | 47 (21)                    | 3023PMURF      |
| 32.5 | 78                      | C1        | 47 (22)                    | 32X23PMURF     |
| 35   | 84                      | C1        | 48 (22)                    | 3523PMURF      |
| 37.5 | 90                      | C1        | 60 (27)                    | 37X23PMURF     |
| 40   | 96                      | C1        | 64 (29)                    | 4023PMURF      |
| 42.5 | 102                     | C1        | 65 (30)                    | 42X23PMURF     |
| 45   | 108                     | C1        | 66 (30)                    | 4523PMURF      |
| 50   | 120                     | C1        | 68 (31)                    | 5023PMURF      |
| 60   | 144                     | C1        | 69 (31)                    | 6023PMURF      |
| 70   | 168                     | C2        | 99 (45)                    | 7023PMURF      |
| 75   | 180                     | C2        | 100 (46)                   | 7523PMURF      |
| 80   | 192                     | C2        | 101 (46)                   | 8023PMURF      |
| 90   | 216                     | C2        | 103 (47)                   | 9023PMURF      |
| 100  | 240                     | D1        | 104 (47)                   | 10023PMURF     |
| 120  | 288                     | D1        | 133 (60)                   | 12023PMURF     |
| 140  | 336                     | E1        | 137 (62)                   | 14023PMURF     |
| 150  | 360                     | E1        | 140 (64)                   | 15023PMURF     |
| 160  | 384                     | E1        | 175 (80)                   | 16023PMURF     |
| 180  | 432                     | E1        | 182 (83)                   | 18023PMURF     |
| 200  | 480                     | E1        | 189 (86)                   | 20023PMURF     |

**Notes**

Multiply the 240 Vac kvar rating by 0.75 to calculate the kvar value at 208 Vac.

Fused with blown-fuse indication available standard. Non-fused and no lights also available—please consult the factory.

Other ratings available, consult factory.

For dimensional information, refer to **Page V3-T2-63**.

**Part Numbers:**

PMURF—three fuses + three lights

PMURN—non-fused

480 Vac UNIPAK Selection Chart

| kvar | Rated Current (Amperes) | Enclosure | Shipping Weight in Lb (kg) | Catalog Number |
|------|-------------------------|-----------|----------------------------|----------------|
| 1.5  | 1.8                     | A1        | 17 (8)                     | 1X43PMURF      |
| 2    | 2.4                     | A1        | 18 (8)                     | 243PMURF       |
| 2.5  | 3                       | A1        | 18 (8)                     | 2X43PMURF      |
| 3    | 3.6                     | A1        | 19 (9)                     | 343PMURF       |
| 4    | 4.8                     | A1        | 19 (9)                     | 443PMURF       |
| 5    | 6                       | A1        | 19 (9)                     | 543PMURF       |
| 6    | 7.2                     | A1        | 19 (9)                     | 643PMURF       |
| 7.5  | 9                       | A1        | 20 (9)                     | 7X43PMURF      |
| 8    | 9.6                     | A1        | 20 (9)                     | 843PMURF       |
| 9    | 10.8                    | A1        | 20 (9)                     | 943PMURF       |
| 10   | 12                      | A1        | 20 (9)                     | 1043PMURF      |
| 12.5 | 15                      | A2        | 29 (13)                    | 12X43PMURF     |
| 15   | 18                      | A2        | 29 (13)                    | 1543PMURF      |
| 17.5 | 21                      | A2        | 30 (14)                    | 17X43PMURF     |
| 20   | 24                      | A2        | 31 (14)                    | 2043PMURF      |
| 22.5 | 27                      | B1        | 44 (20)                    | 22X43PMURF     |
| 25   | 30                      | A2        | 32 (15)                    | 2543PMURF      |
| 27.5 | 33                      | B1        | 44 (20)                    | 27X43PMURF     |
| 30   | 36                      | B1        | 44 (20)                    | 3043PMURF      |
| 32.5 | 39                      | B1        | 45 (20)                    | 32X43PMURF     |
| 35   | 42                      | B1        | 45 (20)                    | 3543PMURF      |
| 37.5 | 45                      | B1        | 46 (21)                    | 37X43PMURF     |
| 40   | 48                      | B1        | 46 (21)                    | 4043PMURF      |
| 42.5 | 51                      | B1        | 47 (21)                    | 42X43PMURF     |
| 45   | 54                      | B1        | 47 (22)                    | 4543PMURF      |
| 50   | 60                      | B1        | 48 (22)                    | 5043PMURF      |
| 55   | 66                      | C1        | 48 (22)                    | 5543PMURF      |
| 60   | 72                      | C1        | 48 (22)                    | 6043PMURF      |
| 65   | 78                      | C1        | 64 (29)                    | 6543PMURF      |
| 70   | 84                      | C1        | 65 (30)                    | 7043PMURF      |
| 75   | 90                      | C1        | 65 (30)                    | 7543PMURF      |
| 80   | 96                      | C1        | 66 (30)                    | 8043PMURF      |
| 85   | 102                     | C1        | 68 (31)                    | 8543PMURF      |
| 90   | 108                     | C1        | 68 (31)                    | 9043PMURF      |
| 100  | 120                     | C1        | 69 (31)                    | 10043PMURF     |
| 120  | 144                     | C2        | 69 (31)                    | 12043PMURF     |
| 125  | 150                     | C2        | 99 (45)                    | 12543PMURF     |
| 140  | 168                     | C2        | 100 (46)                   | 14043PMURF     |
| 150  | 180                     | C2        | 101 (46)                   | 15043PMURF     |
| 160  | 192                     | D1        | 103 (47)                   | 16043PMURF     |
| 180  | 216                     | D1        | 104 (47)                   | 18043PMURF     |
| 200  | 240                     | D1        | 137 (62)                   | 20043PMURF     |
| 225  | 270                     | D1        | 140 (64)                   | 22543PMURF     |
| 250  | 300                     | E1        | 170 (77)                   | 25043PMURF     |
| 300  | 360                     | E1        | 175 (80)                   | 30043PMURF     |
| 350  | 420                     | E1        | 182 (83)                   | 35043PMURF     |
| 400  | 480                     | E1        | 189 (86)                   | 40043PMURF     |

600 Vac UNIPAK Selection Chart

| kvar | Rated Current (Amperes) | Enclosure | Shipping Weight in Lb (kg) | Catalog Number |
|------|-------------------------|-----------|----------------------------|----------------|
| 5    | 4.9                     | A1        | 19 (9)                     | 563PMURF       |
| 7.5  | 7.4                     | A1        | 19 (9)                     | 7X63PMURF      |
| 10   | 9.8                     | A1        | 20 (9)                     | 1063PMURF      |
| 12.5 | 12.3                    | A1        | 20 (9)                     | 12X63PMURF     |
| 15   | 14.7                    | A2        | 29 (13)                    | 1563PMURF      |
| 17.5 | 17.2                    | A2        | 29 (13)                    | 17X63PMURF     |
| 20   | 19.6                    | A2        | 30 (14)                    | 2063PMURF      |
| 22.5 | 22.1                    | B1        | 44 (20)                    | 22X63PMURF     |
| 25   | 24.5                    | B1        | 31 (14)                    | 2563PMURF      |
| 27.5 | 27.0                    | B1        | 44 (20)                    | 27X63PMURF     |
| 30   | 29.4                    | B1        | 45 (20)                    | 3063PMURF      |
| 32.5 | 31.9                    | B1        | 45 (20)                    | 32X63PMURF     |
| 35   | 34.3                    | B1        | 46 (21)                    | 3563PMURF      |
| 37.5 | 36.8                    | B1        | 46 (21)                    | 37X63PMURF     |
| 40   | 39.2                    | B1        | 47 (21)                    | 4063PMURF      |
| 42.5 | 41.7                    | B1        | 47 (22)                    | 42X63PMURF     |
| 45   | 44.1                    | B1        | 48 (22)                    | 4563PMURF      |
| 50   | 49.0                    | B1        | 48 (22)                    | 5063PMURF      |
| 55   | 53.9                    | C1        | 64 (29)                    | 5563PMURF      |
| 60   | 58.8                    | C1        | 64 (29)                    | 6063PMURF      |
| 65   | 63.7                    | C1        | 65 (30)                    | 6563PMURF      |
| 70   | 68.6                    | C1        | 65 (30)                    | 7063PMURF      |
| 75   | 73.5                    | C1        | 66 (30)                    | 7563PMURF      |
| 80   | 78.4                    | C1        | 68 (31)                    | 8063PMURF      |
| 85   | 83.3                    | C1        | 68 (31)                    | 8563PMURF      |
| 90   | 88.2                    | C1        | 69 (31)                    | 9063PMURF      |
| 100  | 98.0                    | C1        | 69 (31)                    | 10063PMURF     |
| 120  | 117.6                   | C2        | 99 (45)                    | 12063PMURF     |
| 125  | 122.5                   | C2        | 100 (46)                   | 12563PMURF     |
| 140  | 137.2                   | C2        | 101 (46)                   | 14063PMURF     |
| 150  | 147.0                   | C2        | 103 (47)                   | 15063PMURF     |
| 160  | 156.8                   | D1        | 135 (61)                   | 16063PMURF     |
| 180  | 176.4                   | D1        | 137 (62)                   | 18063PMURF     |
| 200  | 196.0                   | D1        | 140 (64)                   | 20063PMURF     |
| 225  | 220.5                   | D1        | 143 (65)                   | 22563PMURF     |
| 250  | 245.0                   | E1        | 170 (77)                   | 25063PMURF     |
| 300  | 294.0                   | E1        | 175 (80)                   | 30063PMURF     |
| 350  | 343.0                   | E1        | 182 (83)                   | 35063PMURF     |
| 400  | 392.0                   | E1        | 189 (86)                   | 40063PMURF     |

**Notes**

Fused with blown-fuse indication available standard.

Non-fused and no lights also available—please consult the factory.

Other ratings available, consult factory.

For dimensional information, refer to **Page V3-T2-63**.

Part Number

PMURF—three fuses + three lights

PMURN—non-fused

**UNIPAK—with Harmonic Cells****2****Harmonic Cells****Low Voltage Fixed Capacitor Systems with Heavy-Duty Cells**

| kvar         | Rated Current (Amperes) | Case Size | Shipping Weight in Lb (kg) | Catalog Number   |
|--------------|-------------------------|-----------|----------------------------|------------------|
| <b>240 V</b> |                         |           |                            |                  |
| 15           | 36                      | B1        | 38.4 (17)                  | <b>1523HURF</b>  |
| 25           | 60                      | B1        | 38.4 (17)                  | <b>2523HURF</b>  |
| 30           | 72                      | C1        | 55.2 (25)                  | <b>3023HURF</b>  |
| 50           | 120                     | C1        | 57.6 (26)                  | <b>5023HURF</b>  |
| 60           | 144                     | C2        | 100.8 (46)                 | <b>6023HURF</b>  |
| 75           | 180                     | C2        | 104.4 (47)                 | <b>7523HURF</b>  |
| 100          | 240                     | D1        | 136.8 (62)                 | <b>10023HURF</b> |
| 125          | 300                     | E1        | 189.6 (86)                 | <b>12523HURF</b> |
| <b>480 V</b> |                         |           |                            |                  |
| 15           | 18                      | B1        | 25.2 (11)                  | <b>1543HURF</b>  |
| 25           | 30                      | B1        | 37.2 (17)                  | <b>2543HURF</b>  |
| 30           | 36                      | B1        | 38.4 (17)                  | <b>3043HURF</b>  |
| 50           | 60                      | C1        | 39.6 (18)                  | <b>5043HURF</b>  |
| 60           | 72                      | C1        | 52.8 (24)                  | <b>6043HURF</b>  |
| 75           | 90                      | C2        | 55.2 (25)                  | <b>7543HURF</b>  |
| 100          | 120                     | C2        | 57.6 (26)                  | <b>10043HURF</b> |
| 125          | 150                     | D1        | 100.8 (46)                 | <b>12543HURF</b> |
| 150          | 180                     | D1        | 104.4 (47)                 | <b>15043HURF</b> |
| 200          | 240                     | E1        | 136.8 (62)                 | <b>20043HURF</b> |
| 250          | 300                     | E1        | 186.0 (84)                 | <b>25043HURF</b> |
| <b>600 V</b> |                         |           |                            |                  |
| 15           | 14.7                    | B1        | 37.2 (17)                  | <b>1563HURF</b>  |
| 25           | 24.5                    | B1        | 38.4 (17)                  | <b>2563HURF</b>  |
| 30           | 29.4                    | B1        | 39.6 (18)                  | <b>3063HURF</b>  |
| 50           | 49                      | C1        | 55.2 (25)                  | <b>5063HURF</b>  |
| 60           | 58.8                    | C1        | 57.6 (26)                  | <b>6063HURF</b>  |
| 75           | 73.5                    | C2        | 100.8 (46)                 | <b>7563HURF</b>  |
| 100          | 98                      | C2        | 104.4 (47)                 | <b>10063HURF</b> |
| 125          | 122.5                   | D1        | 136.8 (62)                 | <b>12563HURF</b> |
| 150          | 147                     | D1        | 136.8 (62)                 | <b>15063HURF</b> |
| 200          | 196                     | E1        | 186.0 (84)                 | <b>20063HURF</b> |
| 250          | 245                     | E1        | 189.6 (86)                 | <b>25063HURF</b> |

**Notes**

Fused with blown-fuse indication standard.

Other ratings available, consult factory.

**UNIPAK Low Voltage Fixed Detuned Filters****Fixed UNIPAK Detuned Filters**

2

| kvar         | Rated Current (Amperes) | Capacitor Enclosure Size | Shipping Weight in Lb (kg) | Reactor Enclosure Case Size | Reactor Shipping Weight in Lb (kg) | Combined Shipping Weight in Lb (kg) | Catalog Number |
|--------------|-------------------------|--------------------------|----------------------------|-----------------------------|------------------------------------|-------------------------------------|----------------|
| <b>240 V</b> |                         |                          |                            |                             |                                    |                                     |                |
| 15           | 36                      | B1                       | 48.4 (22.0)                | R                           | 90.0 (40.9)                        | 138.4 (62.8)                        | 15232HMURFY    |
| 25           | 60                      | B1                       | 48.4 (22.0)                | R                           | 105.0 (47.7)                       | 153.4 (69.6)                        | 25232HMURFY    |
| 30           | 72                      | C1                       | 65.2 (29.6)                | R                           | 110.0 (49.9)                       | 175.2 (79.5)                        | 30232HMURFY    |
| 50           | 120                     | C1                       | 67.6 (30.7)                | R                           | 130.0 (59.0)                       | 197.6 (89.7)                        | 50232HMURFY    |
| 60           | 144                     | C2                       | 110.8 (50.3)               | R                           | 160.0 (72.6)                       | 270.8 (122.9)                       | 60232HMURFY    |
| 75           | 180                     | C2                       | 114.4 (51.9)               | R                           | 185.0 (84.0)                       | 299.4 (135.9)                       | 75232HMURFY    |
| 100          | 240                     | D1                       | 146.8 (66.6)               | R                           | 240.0 (109.0)                      | 386.8 (175.6)                       | 100232HMURFY   |
| 125          | 300                     | E1                       | 199.6 (90.6)               | S                           | 280.0 (127.1)                      | 479.6 (217.7)                       | 125232HMURFY   |
| 150          | 360                     | E1                       | 220.0 (99.9)               | S                           | 280.0 (127.1)                      | 500.0 (227.0)                       | 150232HMURFY   |
| <b>480 V</b> |                         |                          |                            |                             |                                    |                                     |                |
| 15           | 18                      | B1                       | 35.2 (16.0)                | R                           | 90.0 (40.9)                        | 125.2 (56.8)                        | 15432HMURFY    |
| 25           | 30                      | B1                       | 47.2 (21.4)                | R                           | 105.0 (47.7)                       | 152.2 (69.1)                        | 25432HMURFY    |
| 30           | 36                      | B1                       | 48.4 (22.0)                | R                           | 110.0 (49.9)                       | 158.4 (71.9)                        | 30432HMURFY    |
| 50           | 60                      | C1                       | 49.6 (22.5)                | R                           | 130.0 (59.0)                       | 179.6 (81.5)                        | 50432HMURFY    |
| 60           | 72                      | C1                       | 62.8 (28.5)                | R                           | 160.0 (72.6)                       | 222.8 (101.2)                       | 60432HMURFY    |
| 75           | 90                      | C2                       | 65.2 (29.6)                | R                           | 185.0 (84.0)                       | 250.2 (113.6)                       | 75432HMURFY    |
| 100          | 120                     | C2                       | 67.6 (30.7)                | R                           | 240.0 (109.0)                      | 307.6 (139.7)                       | 100432HMURFY   |
| 125          | 150                     | D1                       | 110.8 (50.3)               | R                           | 280.0 (127.1)                      | 390.8 (177.4)                       | 125432HMURFY   |
| 150          | 180                     | D1                       | 114.4 (51.9)               | S                           | 280.0 (127.1)                      | 394.4 (179.1)                       | 150432HMURFY   |
| 200          | 240                     | E1                       | 146.8 (66.6)               | S                           | 330.0 (149.8)                      | 476.8 (216.5)                       | 200432HMURFY   |
| 250          | 300                     | E1                       | 196.0 (89.0)               | T                           | 570.0 (258.8)                      | 766.0 (347.8)                       | 250432HMURFY   |
| <b>600 V</b> |                         |                          |                            |                             |                                    |                                     |                |
| 15           | 14.7                    | B1                       | 47.2 (21.4)                | R                           | 90.0 (40.9)                        | 137.2 (62.3)                        | 15632HMURFY    |
| 25           | 24.5                    | B1                       | 48.4 (22.0)                | R                           | 90.0 (47.7)                        | 153.4 (69.6)                        | 25632HMURFY    |
| 30           | 29.4                    | B1                       | 49.6 (22.5)                | R                           | 105.0 (49.9)                       | 159.6 (72.5)                        | 30632HMURFY    |
| 50           | 49                      | C1                       | 65.2 (29.6)                | R                           | 110.0 (59.0)                       | 195.2 (88.6)                        | 50632HMURFY    |
| 60           | 58.8                    | C1                       | 67.6 (30.7)                | R                           | 130.0 (72.6)                       | 227.6 (103.3)                       | 60632HMURFY    |
| 75           | 73.5                    | C2                       | 110.8 (50.3)               | R                           | 160.0 (84.0)                       | 295.8 (134.3)                       | 75632HMURFY    |
| 100          | 98                      | C2                       | 114.4 (51.9)               | R                           | 185.0 (109.0)                      | 354.4 (160.9)                       | 100632HMURFY   |
| 150          | 147                     | D1                       | 146.8 (66.6)               | S                           | 280.0 (127.1)                      | 426.8 (193.8)                       | 150632HMURFY   |
| 200          | 196                     | E1                       | 196.0 (89.0)               | T                           | 330.0 (149.8)                      | 526.0 (238.8)                       | 200632HMURFY   |
| 250          | 245                     | E1                       | 199.6 (90.6)               | T                           | 570.0 (258.8)                      | 769.6 (349.4)                       | 250632HMURFY   |

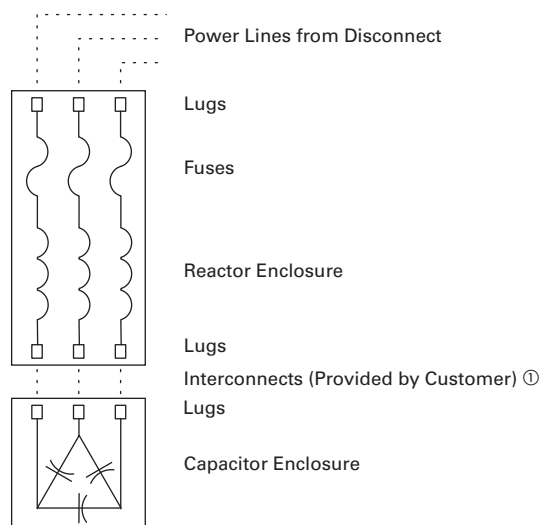
**Notes**

Other ratings available, consult factory.

Fused with blown-fuse indication standard.

**Wiring Diagram****Filter Schematic with Wiring Interconnects**

2

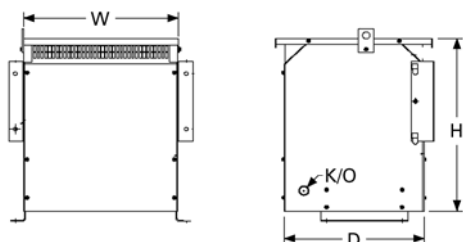
**Note**

① Refer to NEC.



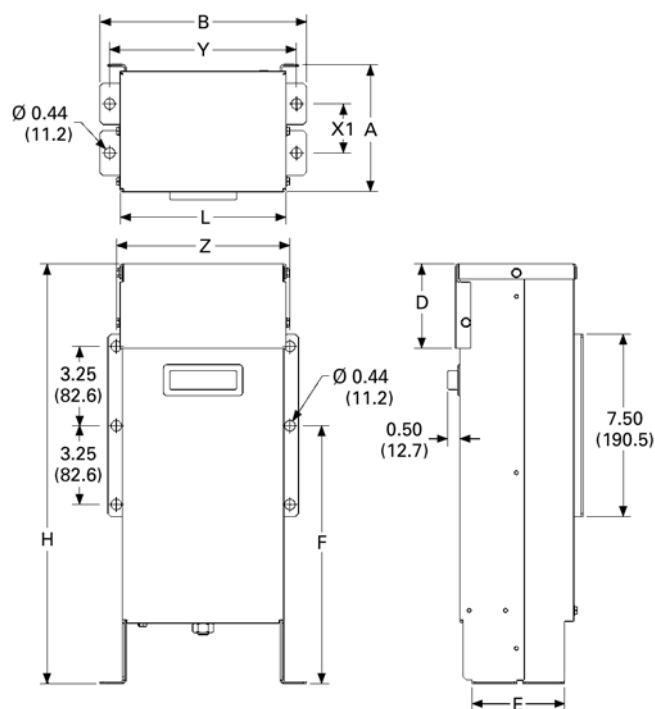
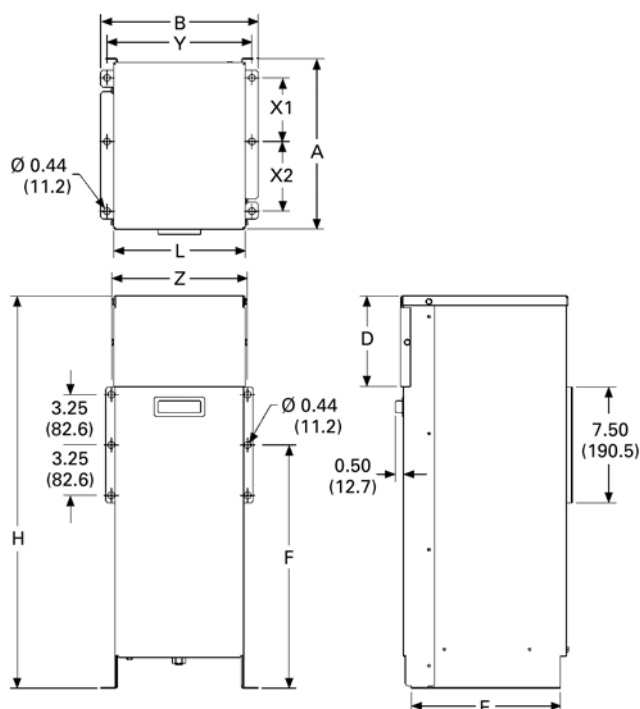
**Dimensions**

Approximate Dimensions in Inches (mm)

**Reactor Cabinet****Reactor Cabinet**

| Case Size | Height        | Width         | Depth         |
|-----------|---------------|---------------|---------------|
| R         | 24.75 (628.7) | 20.00 (508.0) | 18.13 (460.5) |
| S         | 25.00 (635.0) | 24.25 (616.0) | 20.25 (514.4) |
| T         | 31.00 (787.4) | 25.00 (635.0) | 32.75 (831.9) |

2

**Low Voltage Fixed Capacitor Banks and Fixed Harmonic Filters****Case A1, A2****Case B1****UNIPAK Enclosures**

| Case Size | A             | B             | D            | E            | F             | H             | L            | X1           | X2           | X3  | Y            | Z            |
|-----------|---------------|---------------|--------------|--------------|---------------|---------------|--------------|--------------|--------------|-----|--------------|--------------|
| A1        | 5.30 (134.6)  | 8.50 (215.9)  | 3.50 (88.9)  | 3.80 (96.5)  | 10.60 (269.2) | 17.30 (439.4) | 6.80 (172.7) | 2.00 (50.8)  | N/A          | N/A | 7.70 (195.6) | 7.20 (182.9) |
| A2        | 6.00 (152.4)  | 8.50 (215.9)  | 5.60 (142.2) | 4.50 (114.3) | 13.30 (337.8) | 22.30 (566.4) | 6.80 (172.7) | 2.30 (58.4)  | N/A          | N/A | 7.70 (195.6) | 7.20 (182.9) |
| B1        | 11.10 (281.9) | 10.10 (256.5) | 5.80 (147.3) | 9.60 (243.8) | 15.70 (398.8) | 25.30 (642.6) | 8.50 (215.9) | 4.10 (104.1) | 4.50 (114.3) | N/A | 9.30 (236.2) | 8.80 (223.5) |

**Legend:**

A = Total depth

B = Total width

D = Height of removable front cover

E = Depth of feet

F = Height of middle mounting hole in wall bracket

H = Total height

L = Width without feet and brackets

X = Depth between front and rear mounting holes in inches

Y = Width between floor mounting holes

Z = Width between wall bracket mounting holes

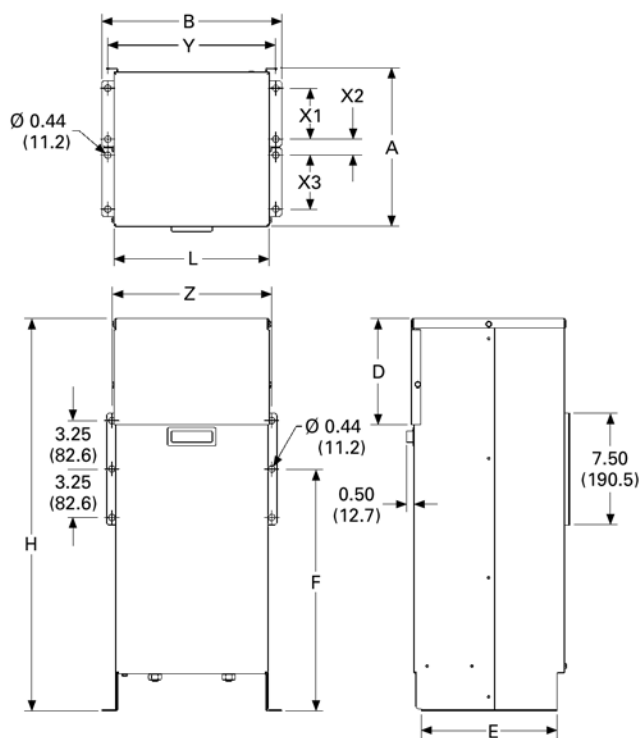
## 2.2

## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

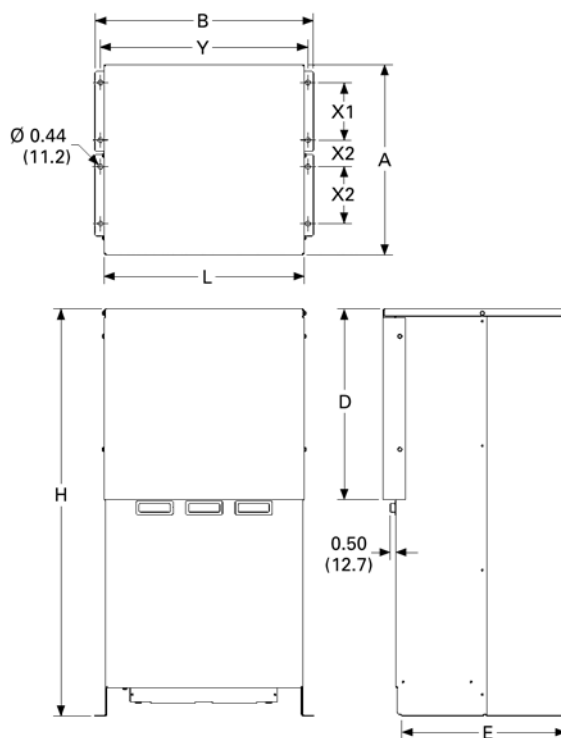
### Power Factor Correction and Harmonic Filtering

Approximate Dimensions in Inches (mm)

#### Case C1, C2



#### Case D1, E1



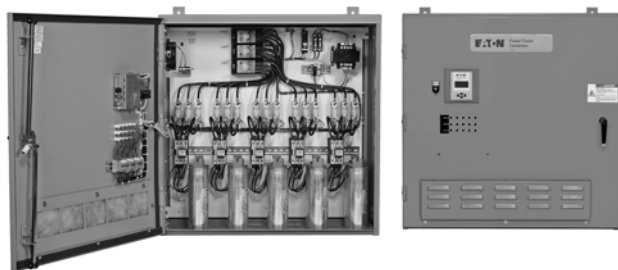
#### UNIPAK Enclosures

| Case Size | A             | B             | D             | E             | F             | H             | L             | X1           | X2           | X3           | Y             | Z             |
|-----------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|--------------|--------------|---------------|---------------|
| C1        | 10.60 (269.2) | 12.10 (307.3) | 7.10 (180.3)  | 9.10 (231.1)  | 16.20 (411.5) | 26.30 (668.0) | 10.40 (264.2) | 3.40 (86.4)  | 1.10 (27.9)  | 3.60 (91.4)  | 11.30 (287.0) | 10.70 (271.8) |
| C2        | 12.00 (304.8) | 19.30 (490.2) | 16.90 (429.3) | 9.50 (241.3)  | 16.30 (414.0) | 36.00 (914.4) | 17.70 (449.6) | 3.00 (76.2)  | 1.50 (38.1)  | 3.80 (96.5)  | 18.30 (464.8) | 18.00 (457.2) |
| D1        | 16.80 (426.7) | 19.30 (490.2) | 16.90 (429.3) | 14.60 (370.8) | N/A           | 36.00 (914.4) | 17.70 (449.6) | 5.10 (129.5) | 2.40 (61.0)  | 5.00 (127.0) | 18.30 (464.8) | N/A           |
| E1        | 22.30 (566.4) | 24.40 (619.8) | 16.80 (426.7) | 19.50 (495.3) | N/A           | 36.00 (914.4) | 22.70 (576.6) | 6.50 (165.1) | 4.40 (111.8) | 5.00 (127.0) | 22.40 (569.0) | N/A           |

#### Legend:

- A = Total depth
- B = Total width
- D = Height of removable front cover
- E = Depth of feet
- F = Height of middle mounting hole in wall bracket
- H = Total height
- L = Width without feet and brackets
- X = Depth between front and rear mounting holes in inches
- Y = Width between floor mounting holes
- Z = Width between wall bracket mounting holes

## AUTOVAR 300



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## AUTOVAR 300 Automatic Power Factor Correction Capacitor Systems

## Product Description

Automatically switched power factor correction systems for low voltage applications.

- Wallmount design is ideal for minimum space requirements
- Programmable to automatically add/subtract capacitor stages to maintain preset target power factor
- Heavy-duty, three-phase capacitor construction
- Two-year warranty of cells against manufacturing defects

## Application Description

AUTOVAR 300 is an ideal capacitor bank to automatically regulate power factor where floor space is limited and expansion of the facility's electrical load is not expected.

## Features

## Configuration

- **Cabinet:** Wallmounting 12 gauge steel with ANSI 61 gray, NEMA 1 (gasketed)
- **Power line interconnect:** Rugged, power distribution block connection. Typical power distribution block can accommodate phase wire sizes from 4 AWG to 500 kcmil; typical ground lug can accommodate wire sizes from 14 AWG to 2/0 AWG. Consult equipment approval drawings for actual lug size
- **Control wiring:** UL type MTW/AWM, CSA TEW 105 °C copper wire is standard
- **Fusing:** 200,000 A interrupting capacity provided on all three phases of each stage. Blade-type fuses mounted on insulator stand-offs with cleared-fuse indicating lights
- **Cleared-fuse lights:** Cleared-fuse neon indicating lights for each phase and stage located on the door
- **Door interlock:** Door interlock automatically disengages capacitors. Power continues to be provided to the unit until the disconnect is open
- **Exhaust fan:** Provides ventilation; dust filtering included
- **Safety:** Ground fault interruption provides protection in case of accidental contact with control power and ground
- **Conduit/cable entry:** Available in top/side cable entry
- **Thermal sensing:** Built-in thermal sensing, alarming, and protection feature allows the unit to operate in optimal temperature while alerting the user of ambient temperature exceeding the nominal operating range. Stages will be automatically switched off if temperature exceeds the maximum specified temperature
- **Temperature range:** The operating temperature range is –20 °C to +46 °C, and the storage temperature range is –40 °C to +55 °C. For optimal equipment life, the temperature should not exceed 35 °C annual average, and the environment should not exceed Pollution Degree 2 as defined in UL 61010-1

**Controller**

- Visual indication of incorrect CT polarity
- Digital display of power factor and number of energized stages
- Automatic setting of c/k value (sensitivity based on CT ratio and kvar available)
- Visual indication of insufficient kvar to reach target power factor
- Automatic sensing of kvar values per step
- Optional communications capable controller (RS-485/Modbus)
- Standard metering capability:
  - Voltage
  - Current (sensed phase only)
  - Frequency
  - Active power (kW)
  - Reactive power (kvar)
  - Apparent power (kVA)
  - Total voltage harmonic distortion (VTHD)
  - Individual harmonic voltage distortion (odd orders up to the 19th harmonic)
- Built-in manual mode allows for testing and manual operation of stages
- Multiple user-friendly alarm displays. Controller provides easy-to-understand alarms for various conditions, such as:
  - Undervoltage or overvoltage
  - Undercurrent or overcurrent
  - Target power factor not met
  - Harmonic overload
  - Faulty step/stages
  - Overtemperature alarm

**Contactor**

- Fully rated for capacitor switching
- Integral pre-charge/pre-insertion module standard. The contactor reduces damaging switching transients, providing safety and durability for the system
  - Lessens the chance of disrupting sensitive electronic equipment
  - Reduced inrush current extends the life of the capacitor cells

**Options**

- Optional main molded-case circuit breaker
- NEMA 3R weather-resistant enclosure
- Hand-Off-Auto switches
- Remote alarm relay terminal block
- Communications capable controller

**Support and Service**

- Renewal parts are available through local Eaton distributors
- Factory trained service personnel are available through Eaton's Electrical Services & Systems

**Standards and Certifications**

- UL/CSA listed and recognized
- Entire cabinet assembly is UL 508A and CSA C22.2 No. 190 Listed
- Capacitors are UL 810 recognized
- Contactor is UL/CSA recognized and IEC 6b rated



## Product Selection

Wallmounted AUTOVAR 300 Switched Capacitor Banks—  
Low Voltage Applications

| kvar         | Step x kvar | Rated Current Amperes | Base Shipping Weight in Lb (kg) <sup>①</sup> | Catalog Number     |
|--------------|-------------|-----------------------|----------------------------------------------|--------------------|
| <b>240 V</b> |             |                       |                                              |                    |
| 25           | 5 x 5       | 60                    | 217 (98.5)                                   | <b>25MCSR2313</b>  |
| 50           | 5 x 10      | 120                   | 255 (115.8)                                  | <b>50MCSR2313</b>  |
| 75           | 5 x 15      | 180                   | 260 (118.0)                                  | <b>75MCSR2313</b>  |
| 100          | 5 x 20      | 240                   | 270 (122.6)                                  | <b>100MCSR231</b>  |
| 125          | 5 x 25      | 300                   | 292 (132.6)                                  | <b>125MCSR231</b>  |
| <b>480 V</b> |             |                       |                                              |                    |
| 50           | 5 x 10      | 60                    | 200 (90.8)                                   | <b>50MCSR4313</b>  |
| 75           | 5 x 15      | 90                    | 210 (95.3)                                   | <b>75MCSR4313</b>  |
| 100          | 5 x 20      | 120                   | 210 (95.3)                                   | <b>100MCSR4313</b> |
| 125          | 5 x 25      | 150                   | 240 (109.0)                                  | <b>125MCSR4313</b> |
| 150          | 5 x 30      | 180                   | 240 (109.0)                                  | <b>150MCSR4313</b> |
| 175          | 5 x 35      | 210                   | 260 (118.0)                                  | <b>175MCSR431</b>  |
| 200          | 5 x 40      | 241                   | 270 (122.6)                                  | <b>200MCSR431</b>  |
| 225          | 5 x 45      | 270                   | 290 (131.7)                                  | <b>225MCSR431</b>  |
| 250          | 5 x 50      | 300                   | 292 (132.6)                                  | <b>250MCSR431</b>  |
| <b>600 V</b> |             |                       |                                              |                    |
| 50           | 5 x 10      | 48                    | 200 (90.8)                                   | <b>50MCSR6313</b>  |
| 75           | 5 x 15      | 72                    | 210 (95.3)                                   | <b>75MCSR6313</b>  |
| 100          | 5 x 20      | 96                    | 210 (95.3)                                   | <b>100MCSR6313</b> |
| 125          | 5 x 25      | 120                   | 240 (109.0)                                  | <b>125MCSR6313</b> |
| 150          | 5 x 30      | 144                   | 240 (109.0)                                  | <b>150MCSR6313</b> |
| 175          | 5 x 35      | 168                   | 260 (118.0)                                  | <b>175MCSR631</b>  |
| 200          | 5 x 40      | 192                   | 270 (122.6)                                  | <b>200MCSR631</b>  |
| 225          | 5 x 45      | 216                   | 290 (131.7)                                  | <b>225MCSR631</b>  |
| 250          | 5 x 50      | 240                   | 292 (132.6)                                  | <b>250MCSR631</b>  |

## Spare Fuses

## kvar Rating/Bank

| 240 V | 480 V | 600 V | Amperes | Eaton Fuse Part Number |
|-------|-------|-------|---------|------------------------|
| 5     | 10    | 10    | 30      | <b>SP030217-0029J</b>  |
| —     | 15    | 20    | 50      | <b>SP030217-0037D</b>  |
| 10    | 20    | —     | 60      | <b>SP030217-0037E</b>  |
| —     | 25    | 25–30 | 80      | <b>SP030217-0037G</b>  |
| 15    | 30    | 40    | 100     | <b>SP030217-0037J</b>  |
| 20    | 40    | 50    | 125     | <b>SP030217-0037K</b>  |
| 25    | 50    | —     | 150     | <b>SP030217-0037L</b>  |

## Renewal Parts

| Description                         | Catalog Number        |
|-------------------------------------|-----------------------|
| Replacement PF controller, ACX type | <b>SP039010-0035U</b> |
| Replacement contactor, 72 A         | <b>SP039010-0014B</b> |
| Replacement contactor, 32 A         | <b>SP039010-0014C</b> |

## Options

| Description                                                                                                                         | Option Code |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Remote alarm relay terminal block—relay terminal block for a remote alarm to indicate controller alarm status                       | <b>A</b>    |
| Communicating controller (Modbus RS-485)                                                                                            | <b>C</b>    |
| Hand-Off-Auto switch—provides manual control to connect or disconnect capacitor stages regardless of controller output <sup>②</sup> | <b>H</b>    |
| Molded-case circuit breaker (see circuit breaker section)                                                                           | <b>M</b>    |
| Weather-resistant enclosure (NEMA 3R gasketed)                                                                                      | <b>W</b>    |

## Integrated Main Breakers—AUTOVAR 300

| kvar         | AUTOVAR Rated Current Amperes | Breaker Size (Amperes) <sup>③</sup> | Breaker Interrupting Rating (kA) | Breaker Weight in Lb (kg) | Standard Wire Lug Size <sup>④</sup> |
|--------------|-------------------------------|-------------------------------------|----------------------------------|---------------------------|-------------------------------------|
| <b>240 V</b> |                               |                                     |                                  |                           |                                     |
| 25           | 60                            | 125                                 | 100                              | 10 (4.5)                  | (1) #3–350                          |
| 50           | 120                           | 250                                 | 100                              | 10 (4.5)                  | (1) #3–350                          |
| 75           | 180                           | 250                                 | 100                              | 10 (4.5)                  | (1) #3–350                          |
| 100          | 240                           | 400                                 | 100                              | 10 (4.5)                  | (2) #3/0–250                        |
| 125          | 300                           | 600                                 | 100                              | 25 (11.4)                 | (2) #3/0–350                        |
| <b>480 V</b> |                               |                                     |                                  |                           |                                     |
| 50           | 60                            | 125                                 | 65                               | 10 (4.5)                  | (1) #3–350                          |
| 75           | 90                            | 125                                 | 65                               | 10 (4.5)                  | (1) #3–350                          |
| 100          | 120                           | 250                                 | 65                               | 10 (4.5)                  | (1) #3–350                          |
| 125          | 150                           | 250                                 | 65                               | 10 (4.5)                  | (1) #3–350                          |
| 150          | 180                           | 250                                 | 65                               | 10 (4.5)                  | (1) #3–350                          |
| 175          | 210                           | 400                                 | 65                               | 10 (4.5)                  | (2) #3/0–250                        |
| 200          | 240                           | 400                                 | 65                               | 10 (4.5)                  | (2) #3/0–250                        |
| 225          | 270                           | 400                                 | 65                               | 10 (4.5)                  | (2) #3/0–250                        |
| 250          | 300                           | 600                                 | 65                               | 25 (11.4)                 | (2) #3/0–350                        |
| <b>600 V</b> |                               |                                     |                                  |                           |                                     |
| 50           | 48                            | 125                                 | 35                               | 10 (4.5)                  | (1) #3–350                          |
| 75           | 72                            | 125                                 | 35                               | 10 (4.5)                  | (1) #3–350                          |
| 100          | 96                            | 250                                 | 35                               | 10 (4.5)                  | (1) #3–350                          |
| 125          | 120                           | 250                                 | 35                               | 10 (4.5)                  | (1) #3–350                          |
| 150          | 144                           | 250                                 | 35                               | 10 (4.5)                  | (1) #3–350                          |
| 175          | 168                           | 250                                 | 35                               | 10 (4.5)                  | (1) #3–350                          |
| 200          | 192                           | 400                                 | 35                               | 10 (4.5)                  | (2) #3/0–350                        |
| 225          | 216                           | 400                                 | 35                               | 10 (4.5)                  | (2) #3/0–350                        |
| 250          | 240                           | 400                                 | 35                               | 10 (4.5)                  | (2) #3/0–350                        |

## Notes

<sup>①</sup> To calculate AUTOVAR 300 weight:

1. Obtain base unit weight from table above.

2. Add option weights as necessary:

A = 1 lb

C = 1 lb

H = 5 lb

W = 10 lb

M = 50 lb enclosure weight adder plus circuit breaker weight (see circuit breaker table)

S = Consult Eaton's Technical Resource Center (TRC) at 1-800-809-2772, choose option #4, then option #2

Heavy-duty cells, 50 Hz units, and other ratings available, please consult factory. A minimum of one CT is required per AUTOVAR unit. kvar output is voltage and frequency dependent. 60 Hz units are shown. For other voltages and frequencies, consult Eaton Technical Resource Center (TRC) at 1-800-809-2772, choose option #4, then option #2.

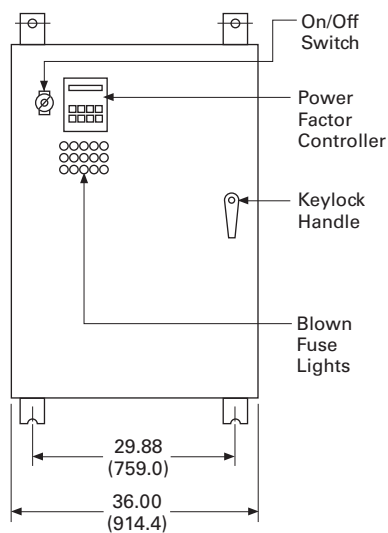
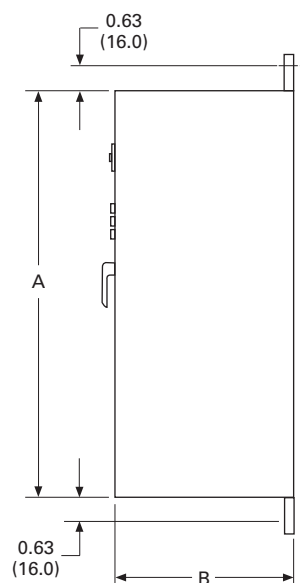
<sup>②</sup> Manual control is always available through controller menu system, even if the H option is not selected.

<sup>③</sup> Breakers are sized at a minimum of 135% of the unit rated Amperes per the NEC<sup>®</sup>.

<sup>④</sup> See equipment drawings for actual lug sizes.

**Dimensions**

Approximate Dimensions in Inches (mm)

**2****Enclosure J****Front View****Side View**

| Description | Height A       | Depth B       |
|-------------|----------------|---------------|
| J1          | 36.00 (914.4)  | 14.00 (355.6) |
| J2          | 60.00 (1524.0) | 14.00 (355.6) |

## AUTOVAR 600



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## AUTOVAR 600 Automatic Power Factor Correction Capacitor Systems

## Product Description

- Programmable to automatically add/subtract capacitor stages to maintain preset target power factor
- Three-phase capacitor cell construction
- Two-year warranty of cells against manufacturing defects
- Cool operating, 100% copper wound, thermal-protected reactors are sized up to 150% of rated capacitor current (AUTOVAR detuned filter only)

## Application Description

- Service entrance or substation power factor correction installations requiring precise maintenance of target power factor (AUTOVAR 600)
- Service entrance or substation power factor correction installations requiring precise maintenance of target power factor in three-phase, nonlinear, high harmonic environments (AUTOVAR detuned filter)
- Typically connected at main low voltage switchgear

## Features

## Configuration

- **Cabinet:** 12 gauge steel with ANSI 61 gray, baked finish. Removable lift bolts standard, NEMA 1 (gasketed)
- **Power line interconnect:** Rugged, copper busbar connection with access provided for top entry. Contact factory for availability of bottom entry. Busbars are braced for 65 kA (optional 100 kA rating available). All internal power wiring connections from bus are laid out on a most direct basis with minimum bends for ease of troubleshooting. Clear barrier limiting access to live parts included standard
- **Modular tray design:** Capacitor stages arranged in modular trays with capacitors, fuses, cleared-fuse indicating lights, and contactors grouped in a logical, easily understood layout. This permits easy access, quick identification of operating problems, and ease of expandability
- **Fusing:** UL recognized, 200,000 A interrupting capacity provided on all three phases of each stage. Blade-type fuses mounted on insulator stand-offs

- **Cleared-fuse indicating lights:** LEDs located door-mounted and neon at individual fuses to facilitate tracing of cleared fuses
- **Push-to-test:** Allows testing of door-mounted LED cleared fuse indicating lights
- **AutoLocate:** When door is open and bus is energized, fuse circuit automatically checks for cleared fuses. If a fuse has cleared, the light at the fuse turns on for easy troubleshooting
- **Door interlock:** Door interlock automatically turns off control circuit when engaged. Power continues to be provided to the unit until disconnect is open
- **Exhaust fans:** Two side louver fans per cabinet provide cooling and reduce operator exposure to discharge. Replaceable dust filtering provided. Dust filters can be replaced without opening cabinet
- **Ease of expansion:** Capacitor stage nests are self-contained and can be added in the field. Two bolts mount the nest in the field. Control wire plugs connect to factory standard wire harness on the left side of the cabinet
- **Ease of replacement:** Cells can be easily replaced individually by removing the mounting bolt and lifting out of the nest without removal of any other components
- **Thermal sensing:** Built-in thermal sensing, alarming, and protection feature allows the unit to operate in optimal temperature while alerting the user of ambient temperature exceeding the nominal operating range. Stages will be automatically switched off if temperature exceeds the maximum specified temperature
- **Temperature range:** The operating temperature range is  $-20^{\circ}\text{C}$  to  $+46^{\circ}\text{C}$ , and the storage temperature range is  $-40^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ . For optimal equipment life, the temperature should not exceed  $35^{\circ}\text{C}$  annual average, and the environment should not exceed Pollution Degree 2 as defined in UL 61010-1



**Controller**

- Visual indication of incorrect CT polarity
- Digital display of power factor and number of energized stages
- Automatic setting of c/k value (sensitivity based on CT ratio and kvar available)
- Visual indication of insufficient kvar to reach target power factor
- Automatic sensing of kvar values per step
- Optional communications capable controller (RS-485/Modbus)
- Standard metering capability:
  - Voltage
  - Current (sensed phase only)
  - Frequency
  - Active power (kW)
  - Reactive power (kvar)
  - Apparent power (kVA)
  - Total voltage harmonic distortion (VTHD)
  - Individual harmonic voltage distortion (odd orders up to the 19th harmonic)
- Built-in manual mode allows for testing and manual operation of stages
- Multiple user-friendly alarm displays. Controller provides easy-to-understand alarms for various conditions, such as:
  - Undervoltage or overvoltage
  - Undercurrent or overcurrent
  - Target power factor not met
  - Harmonic overload
  - Faulty step/stages
  - Overtemperature alarm

**Contactors**

- Fully rated for capacitor switching
- Integral pre-charge/pre-insertion module standard. The contactor reduces damaging switching transients, providing safety and durability for the system
  - Lessens the chance of disrupting sensitive electronic equipment
  - Reduced inrush current extends the life of the capacitor cells

**Reactors**

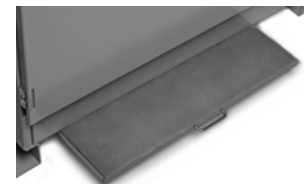
- **Detuning:** Standard reactor designs are detuned to the 4.2nd harmonic and recommended to protect capacitors against harmonic resonance. Detuning to the 4.7th harmonic is available as an option. The harmonic spectrum should be evaluated for applications involving reactors detuned to the 4.7th harmonic to ensure optimal equipment life, specifically when used in conjunction with six-pulse motor drives
- **Windings:** 80 °C temperature rise design 100% copper windings for minimal losses
- **Thermal overload protection:** Each reactor includes three normally closed, auto reset thermostats that open at 180 °C. When thermostats engage, the contactor opens
- **Insulation:** 220 °C insulation system
- **Warranty:** One-year replacement of reactors

**Additional Features**

- Optional molded-case main circuit breaker
- Ground fault interruption provides protection in case of accidental contact with control power and ground
- Control wiring—standard NEC color-coded modular bundles with quick disconnect feature for ease of troubleshooting or ease of expendability. UL type MTW/AWM, CSA TEW 105 °C copper wire is standard.
- Optional digital metering—IQ 250
- Mechanical wire lugs are included as standard equipment. Typical phase lugs range from (2) 6 AWG–350 kcmil to (4) 3 AWG–750 MCM. Typical ground lug can accept wire from 6 AWG to 350 kcmil. Lugs are compatible with copper wire 90 °C
- Heavy-duty capacitor cells are standard on AUTOVAR detuned filter and optional on AUTOVAR 600. For 480 V units, standard-duty cells are 525 V rated, and heavy-duty cells are 600 V rated

**Support and service**

- Renewal parts are available through local Eaton distributors
- Factory trained service personnel are available through Eaton's Electrical Services & Systems

**AUTOVAR 600—Interior View****Modular Step Nest Assembly****Dust Filter Tray****Standards and Certifications**

- Entire cabinet assembly is UL 508A and CSA C22.2 No. 190 Listed
- Capacitors are UL 810 recognized
- Contactor is UL/CSA recognized and IEC 6b rated



Listed



**Product Selection****Options—AUTOVAR 600 and AUTOVAR Detuned Filter**

| Description                                                                                                                         | Option Code |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Remote alarm relay terminal block—relay terminal block for a remote alarm to indicate controller alarm status                       | <b>A</b>    |
| Fully insulated main bus                                                                                                            | <b>B</b>    |
| Communicating PF controller (Modbus RS-485)                                                                                         | <b>C</b>    |
| Hand-off-auto switch provides manual control to connect or disconnect capacitor stages regardless of controller output <sup>①</sup> | <b>H</b>    |
| Integrated main breaker                                                                                                             | <b>M</b>    |
| Integrated main breaker with high interrupting rating (see breaker table for more information), includes 100 kA busbar bracing      | <b>M1</b>   |
| 100 kA busbar bracing                                                                                                               | <b>N1</b>   |
| Integrated CVX series surge protection, without sine wave tracking                                                                  | <b>T1</b>   |
| Integrated SPD series surge protection, 160 kA per phase, with sine wave tracking                                                   | <b>T2</b>   |
| IQ 250 electronic meter <sup>②</sup>                                                                                                | <b>Q</b>    |
| Weather resistant enclosure (NEMA 3R gasketed) <sup>③</sup>                                                                         | <b>W</b>    |
| Standard filter detuned to the 4.2nd harmonic <sup>④</sup>                                                                          | <b>Y</b>    |

**Notes**

- ① Manual control is always available through menu controller on system, even if the H option is not selected.
- ② Not available on NEMA 3R units (W option).
- ③ Only available on AUTOVAR 600 with heavy-duty cells and AUTOVAR detuned filters using 'L + L', 'L + KK', and 'KK + KK' enclosures.
- ④ Tuning to the 4.2nd harmonic is the preferred option. Other tunings available. Contact Eaton's Technical Resource Center (TRC) power factor application engineers at 1-800-809-2772, choose option #4, then option #2.

To calculate AUTOVAR 600 or AUTOVAR detuned filter weight:

Obtain base unit weight from tables on **Pages V3-T2-72–V3-T2-74** (as appropriate).

Add option weights as necessary:

- A = 1 lb (0.5 kg)  
 B = 10 lb (4.5 kg)  
 C = 1 lb (0.5 kg)  
 H = 10 lb (4.5 kg)  
 M = Circuit breaker weight (see circuit breaker table)  
 M1 = 10 lb (4.5 kg) hardware weight adder plus circuit breaker weight (see circuit breaker table)  
 N1 = 10 lb (4.5 kg)  
 T1 = 5 lb (2.3 kg)  
 T2 = 10 lb (4.5 kg)  
 Q = 5 lb (2.3 kg)  
 W = 10 lb (4.5 kg) per door  
 Y = 0 lb (0 kg)

# 2.2

## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

### Power Factor Correction and Harmonic Filtering

2

#### AUTOVAR 600 Floor-Mounted Switched Capacitor Banks Units with Standard-Duty Cells—Low Voltage Applications

| kvar <sup>①</sup> | Step x<br>kvar | Rated<br>Current<br>Amperes | Base<br>Shipping<br>Weight<br>in Lb (kg) | Base<br>Catalog<br>Number |
|-------------------|----------------|-----------------------------|------------------------------------------|---------------------------|
| <b>240 Vac</b>    |                |                             |                                          |                           |
| 75                | 3 x 25         | 180                         | 644 (292.4)                              | <b>75TPCSR231</b>         |
| 100               | 4 x 25         | 240                         | 692 (314.2)                              | <b>100TPCSR231</b>        |
| 125               | 5 x 25         | 300                         | 740 (336.0)                              | <b>125TPCSR231</b>        |
| 150               | 6 x 25         | 361                         | 788 (357.8)                              | <b>150TPCSR231</b>        |
| 200               | 8 x 25         | 481                         | 884 (401.3)                              | <b>200TPCSR231</b>        |
| 250               | 10 x 25        | 600                         | 944 (428.6)                              | <b>250TPCSR231</b>        |
| 300               | 12 x 25        | 720                         | 1022 (464.0)                             | <b>300TPCSR231</b>        |
| 350               | 7 x 50         | 844                         | 1616 (734.0)                             | <b>350TPCSR231</b>        |
| 400               | 8 x 50         | 965                         | 1704 (774.0)                             | <b>400TPCSR231</b>        |
| <b>480 Vac</b>    |                |                             |                                          |                           |
| 100               | 2 x 50         | 120                         | 588 (266.7)                              | <b>100TPCSR431</b>        |
| 150               | 3 x 50         | 180                         | 632 (287.0)                              | <b>150TPCSR431</b>        |
| 200               | 4 x 50         | 240                         | 676 (306.9)                              | <b>200TPCSR431</b>        |
| 250               | 5 x 50         | 300                         | 720 (326.9)                              | <b>250TPCSR431</b>        |
| 300               | 6 x 50         | 360                         | 764 (346.9)                              | <b>300TPCSR431</b>        |
| 350               | 7 x 50         | 420                         | 808 (366.8)                              | <b>350TPCSR431</b>        |
| 400               | 8 x 50         | 480                         | 852 (386.8)                              | <b>400TPCSR431</b>        |
| 450               | 9 x 50         | 540                         | 896 (406.8)                              | <b>450TPCSR431</b>        |
| 500               | 10 x 50        | 600                         | 944 (428.6)                              | <b>500TPCSR431</b>        |
| 550               | 11 x 50        | 660                         | 984 (446.7)                              | <b>550TPCSR431</b>        |
| 600               | 12 x 50        | 720                         | 1022 (464.0)                             | <b>600TPCSR431</b>        |
| 660               | 11 x 60        | 792                         | 1010 (458.5)                             | <b>660TPCSR431</b>        |
| 700               | 7 x 100        | 840                         | 1616 (734.0)                             | <b>700TPCSR431</b>        |
| 720               | 12 x 60        | 864                         | 1050 (476.7)                             | <b>720TPCSR431</b>        |
| 800               | 8 x 100        | 960                         | 1704 (774.0)                             | <b>800TPCSR431</b>        |
| 900               | 9 x 100        | 1080                        | 1792 (814.0)                             | <b>900TPCSR431</b>        |
| 1000              | 10 x 100       | 1200                        | 1888 (857.0)                             | <b>1000TPCSR431</b>       |
| 1100              | 11 x 100       | 1320                        | 1966 (893.0)                             | <b>1100TPCSR431</b>       |
| 1200              | 12 x 100       | 1440                        | 2044 (928.0)                             | <b>1200TPCSR431</b>       |
| <b>600 Vac</b>    |                |                             |                                          |                           |
| 100               | 2 x 50         | 46                          | 588 (266.7)                              | <b>100TPCSR631</b>        |
| 150               | 3 x 50         | 144                         | 632 (287.0)                              | <b>150TPCSR631</b>        |
| 200               | 4 x 50         | 192                         | 676 (306.9)                              | <b>200TPCSR631</b>        |
| 250               | 5 x 50         | 240                         | 720 (326.9)                              | <b>250TPCSR631</b>        |
| 300               | 6 x 50         | 288                         | 764 (346.9)                              | <b>300TPCSR631</b>        |
| 350               | 7 x 50         | 336                         | 808 (366.8)                              | <b>350TPCSR631</b>        |
| 400               | 8 x 50         | 384                         | 852 (386.8)                              | <b>400TPCSR631</b>        |
| 450               | 9 x 50         | 432                         | 896 (406.8)                              | <b>450TPCSR631</b>        |
| 500               | 10 x 50        | 480                         | 944 (428.6)                              | <b>500TPCSR631</b>        |
| 550               | 11 x 60        | 528                         | 984 (446.7)                              | <b>550TPCSR631</b>        |
| 600               | 12 x 50        | 576                         | 1022 (464.0)                             | <b>600TPCSR631</b>        |
| 660               | 11 x 60        | 634                         | 1010 (458.5)                             | <b>660TPCSR631</b>        |
| 700               | 7 x 100        | 672                         | 1616 (734.0)                             | <b>700TPCSR631</b>        |
| 720               | 12 x 60        | 692                         | 1050 (476.7)                             | <b>720TPCSR631</b>        |
| 800               | 8 x 100        | 768                         | 1704 (774.0)                             | <b>800TPCSR631</b>        |
| 900               | 9 x 100        | 864                         | 1792 (814.0)                             | <b>900TPCSR631</b>        |
| 1000              | 10 x 100       | 960                         | 1888 (857.0)                             | <b>1000TPCSR631</b>       |
| 1100              | 11 x 100       | 1056                        | 1966 (893.0)                             | <b>1100TPCSR631</b>       |
| 1200              | 12 x 100       | 1152                        | 2044 (928.0)                             | <b>1200TPCSR631</b>       |

#### AUTOVAR 600 Sizing Chart for Units with Standard-Duty Cells

| kvar  | Step x<br>kvar | Enclosure Size ②                           |                                        |
|-------|----------------|--------------------------------------------|----------------------------------------|
|       |                | NEMA 1, without Main<br>Breaker, No Suffix | NEMA 1, with Main<br>Breaker, M Suffix |
| 240 V |                |                                            |                                        |
| 75    | 3 x 25         | L                                          | L                                      |
| 100   | 4 x 25         | L                                          | L                                      |
| 125   | 5 x 25         | L                                          | L                                      |
| 150   | 6 x 25         | L                                          | L                                      |
| 200   | 8 x 25         | L                                          | L                                      |
| 250   | 10 x 25        | L                                          | L                                      |
| 300   | 12 x 25        | L                                          | L                                      |
| 350   | 7 x 50         | KK                                         | KK                                     |
| 400   | 8 x 50         | KK                                         | C/F                                    |
| 480 V |                |                                            |                                        |
| 100   | 2 x 50         | L                                          | L                                      |
| 150   | 3 x 50         | L                                          | L                                      |
| 200   | 4 x 50         | L                                          | L                                      |
| 250   | 5 x 50         | L                                          | L                                      |
| 300   | 6 x 50         | L                                          | L                                      |
| 350   | 7 x 50         | L                                          | L                                      |
| 400   | 8 x 50         | L                                          | L                                      |
| 450   | 9 x 50         | L                                          | L                                      |
| 500   | 10 x 50        | L                                          | L                                      |
| 550   | 11 x 50        | L                                          | L                                      |
| 600   | 12 x 50        | L                                          | L                                      |
| 660   | 11 x 60        | L                                          | L                                      |
| 700   | 14 x 50        | KK                                         | KK                                     |
| 720   | 12 x 60        | L                                          | L                                      |
| 800   | 8 x 100        | KK                                         | C/F                                    |
| 900   | 9 x 100        | KK                                         | C/F                                    |
| 1000  | 10 x 100       | KK                                         | C/F                                    |
| 1100  | 11 x 100       | KK                                         | C/F                                    |
| 1200  | 12 x 100       | KK                                         | C/F                                    |
| 600 V |                |                                            |                                        |
| 100   | 2 x 50         | L                                          | L                                      |
| 150   | 3 x 50         | L                                          | L                                      |
| 200   | 4 x 50         | L                                          | L                                      |
| 250   | 5 x 50         | L                                          | L                                      |
| 300   | 6 x 50         | L                                          | L                                      |
| 350   | 7 x 50         | L                                          | L                                      |
| 400   | 8 x 50         | L                                          | L                                      |
| 450   | 9 x 50         | L                                          | L                                      |
| 500   | 10 x 50        | L                                          | L                                      |
| 550   | 11 x 50        | L                                          | L                                      |
| 600   | 12 x 50        | L                                          | L                                      |
| 660   | 11 x 60        | L                                          | L                                      |
| 700   | 14 x 50        | KK                                         | KK                                     |
| 720   | 12 x 60        | L                                          | L                                      |
| 800   | 8 x 100        | KK                                         | KK                                     |
| 900   | 9 x 100        | KK                                         | KK                                     |
| 1000  | 10 x 100       | KK                                         | C/F                                    |
| 1100  | 11 x 100       | KK                                         | C/F                                    |
| 1200  | 12 x 100       | KK                                         | C/F                                    |

#### Notes

- ① Other ratings available. Please consult factory. kvar output is voltage and frequency dependent. 60 Hz units are shown. For other voltages and frequencies, consult Eaton Technical Resource Center (TRC) at 1-800-809-2772, choose option #4, then option #2.
- ② Enclosure sizing for units with integrated surge protection or bottom entry can vary and may not be available on all kvar sizes. Contact Eaton's Technical Resource Center at 1-800-809-2772, choose option #4, then option #2.

C/F = Consult factory

**AUTOVAR 600 Floor-Mounted Switched Capacitor Banks  
Units with Heavy-Duty Cells—Low Voltage Applications**

| kvar <sup>①</sup> | Step x<br>kvar | Rated<br>Current<br>Amperes | Base<br>Shipping<br>Weight in<br>Lb (kg) | Base<br>Catalog<br>Number |
|-------------------|----------------|-----------------------------|------------------------------------------|---------------------------|
| <b>240 Vac</b>    |                |                             |                                          |                           |
| 75                | 3 x 25         | 180                         | 659 (298.9)                              | <b>75TPHSR231</b>         |
| 100               | 4 x 25         | 240                         | 712 (323.0)                              | <b>100TPHSR231</b>        |
| 125               | 5 x 25         | 300                         | 765 (347.0)                              | <b>125TPHSR231</b>        |
| 150               | 6 x 25         | 361                         | 818 (371.0)                              | <b>150TPHSR231</b>        |
| 200               | 8 x 25         | 481                         | 924 (419.1)                              | <b>200TPHSR231</b>        |
| 250               | 10 x 25        | 601                         | 994 (450.9)                              | <b>250TPHSR231</b>        |
| 300               | 12 x 25        | 720                         | 1082 (490.8)                             | <b>300TPHSR231</b>        |
| 350               | 7 x 50         | 844                         | 1686 (764.8)                             | <b>350TPHSR231</b>        |
| 400               | 8 x 50         | 965                         | 1784 (809.2)                             | <b>400TPHSR231</b>        |
| <b>480 Vac</b>    |                |                             |                                          |                           |
| 100               | 2 x 50         | 120                         | 617 (279.9)                              | <b>100TPHSR431</b>        |
| 150               | 3 x 50         | 180                         | 677 (307.1)                              | <b>150TPHSR431</b>        |
| 200               | 4 x 50         | 240                         | 736 (333.8)                              | <b>200TPHSR431</b>        |
| 250               | 5 x 50         | 300                         | 795 (360.6)                              | <b>250TPHSR431</b>        |
| 300               | 6 x 50         | 360                         | 854 (387.4)                              | <b>300TPHSR431</b>        |
| 350               | 7 x 50         | 420                         | 913 (414.1)                              | <b>350TPHSR431</b>        |
| 400               | 8 x 50         | 480                         | 972 (440.9)                              | <b>400TPHSR431</b>        |
| 450               | 9 x 50         | 540                         | 1031 (467.7)                             | <b>450TPHSR431</b>        |
| 500               | 10 x 50        | 600                         | 1094 (496.2)                             | <b>500TPHSR431</b>        |
| 550               | 11 x 50        | 660                         | 1149 (521.2)                             | <b>550TPHSR431</b>        |
| 600               | 12 x 50        | 720                         | 1202 (545.2)                             | <b>600TPHSR431</b>        |
| 700               | 14 x 50        | 792                         | 1826 (828.3)                             | <b>700TPHSR431</b>        |
| 800               | 8 x 100        | 462                         | 1944 (881.8)                             | <b>800TPHSR431</b>        |
| 900               | 9 x 100        | 1083                        | 2062 (935.3)                             | <b>900TPHSR431</b>        |
| 1000              | 10 x 100       | 1203                        | 2198 (997.0)                             | <b>1000TPHSR431</b>       |
| 1100              | 11 x 100       | 1323                        | 2296 (1041.4)                            | <b>1100TPHSR431</b>       |
| 1200              | 12 x 100       | 1443                        | 2404 (1090.4)                            | <b>1200TPHSR431</b>       |
| <b>600 Vac</b>    |                |                             |                                          |                           |
| 100               | 2 x 50         | 96                          | 617 (279.9)                              | <b>100TPHSR631</b>        |
| 150               | 3 x 50         | 144                         | 677 (307.1)                              | <b>150TPHSR631</b>        |
| 200               | 4 x 50         | 192                         | 736 (333.8)                              | <b>200TPHSR631</b>        |
| 250               | 5 x 50         | 240                         | 795 (360.6)                              | <b>250TPHSR631</b>        |
| 300               | 6 x 50         | 288                         | 854 (387.4)                              | <b>300TPHSR631</b>        |
| 350               | 7 x 50         | 336                         | 913 (414.1)                              | <b>350TPHSR631</b>        |
| 400               | 8 x 50         | 384                         | 972 (440.9)                              | <b>400TPHSR631</b>        |
| 450               | 9 x 50         | 432                         | 1031 (467.7)                             | <b>450TPHSR631</b>        |
| 500               | 10 x 50        | 480                         | 1094 (496.2)                             | <b>500TPHSR631</b>        |
| 550               | 11 x 60        | 529                         | 1149 (521.2)                             | <b>550TPHSR631</b>        |
| 600               | 12 x 50        | 576                         | 1202 (545.2)                             | <b>600TPHSR631</b>        |
| 700               | 7 x 100        | 672                         | 1826 (828.3)                             | <b>700TPHSR631</b>        |
| 800               | 8 x 100        | 768                         | 1944 (881.8)                             | <b>800TPHSR631</b>        |
| 900               | 9 x 100        | 864                         | 2062 (935.3)                             | <b>900TPHSR631</b>        |
| 1000              | 10 x 100       | 962                         | 2198 (997.0)                             | <b>1000TPHSR631</b>       |
| 1100              | 11 x 100       | 1058                        | 2296 (1041.4)                            | <b>1100TPHSR631</b>       |
| 1200              | 12 x 100       | 1155                        | 2404 (1090.4)                            | <b>1200TPHSR631</b>       |

**AUTOVAR 600 Sizing Chart for Units with Heavy-Duty Cells**

| kvar  | Step x<br>kvar | Enclosure Size ②                                 |                                              |                                                  |                                                |
|-------|----------------|--------------------------------------------------|----------------------------------------------|--------------------------------------------------|------------------------------------------------|
|       |                | NEMA 1,<br>without Main<br>Breaker,<br>No Suffix | NEMA 1,<br>with Main<br>Breaker,<br>M Suffix | NEMA 3R,<br>without Main<br>Breaker,<br>W Suffix | NEMA 3R,<br>with Main<br>Breaker,<br>MW Suffix |
| 240 V |                |                                                  |                                              |                                                  |                                                |
| 75    | 3 x 25         | L                                                | L                                            | L                                                | L                                              |
| 100   | 4 x 25         | L                                                | L                                            | L                                                | L                                              |
| 125   | 5 x 25         | L                                                | L                                            | L                                                | L                                              |
| 150   | 6 x 25         | L                                                | L                                            | L                                                | L                                              |
| 200   | 8 x 25         | L                                                | L                                            | L                                                | L                                              |
| 250   | 10 x 25        | L                                                | L                                            | L                                                | L                                              |
| 300   | 12 x 25        | L                                                | L                                            | L                                                | L                                              |
| 350   | 7 x 50         | L                                                | KK                                           | KK                                               | KK                                             |
| 400   | 8 x 50         | KK                                               | C/F                                          | KK                                               | C/F                                            |
| 480 V |                |                                                  |                                              |                                                  |                                                |
| 100   | 2 x 50         | L                                                | L                                            | L                                                | L                                              |
| 150   | 3 x 50         | L                                                | L                                            | L                                                | L                                              |
| 200   | 4 x 50         | L                                                | L                                            | L                                                | L                                              |
| 250   | 5 x 50         | L                                                | L                                            | L                                                | L                                              |
| 300   | 6 x 50         | L                                                | L                                            | L                                                | L                                              |
| 350   | 7 x 50         | L                                                | L                                            | L                                                | L                                              |
| 400   | 8 x 50         | L                                                | L                                            | L                                                | L                                              |
| 450   | 9 x 50         | L                                                | L                                            | L                                                | L                                              |
| 500   | 10 x 50        | L                                                | L                                            | L                                                | L                                              |
| 550   | 11 x 50        | L                                                | L                                            | L                                                | L                                              |
| 600   | 12 x 50        | L                                                | L                                            | L                                                | L                                              |
| 700   | 14 x 50        | KK                                               | KK                                           | KK                                               | KK                                             |
| 800   | 8 x 100        | KK                                               | C/F                                          | KK                                               | C/F                                            |
| 900   | 9 x 100        | KK                                               | C/F                                          | KK                                               | C/F                                            |
| 1000  | 10 x 100       | KK                                               | C/F                                          | KK                                               | C/F                                            |
| 1100  | 11 x 100       | KK                                               | C/F                                          | KK                                               | C/F                                            |
| 1200  | 12 x 100       | KK                                               | C/F                                          | KK                                               | C/F                                            |
| 600 V |                |                                                  |                                              |                                                  |                                                |
| 100   | 2 x 50         | L                                                | L                                            | L                                                | L                                              |
| 150   | 3 x 50         | L                                                | L                                            | L                                                | L                                              |
| 200   | 4 x 50         | L                                                | L                                            | L                                                | L                                              |
| 250   | 5 x 50         | L                                                | L                                            | L                                                | L                                              |
| 300   | 6 x 50         | L                                                | L                                            | L                                                | L                                              |
| 350   | 7 x 50         | L                                                | L                                            | L                                                | L                                              |
| 400   | 8 x 50         | L                                                | L                                            | L                                                | L                                              |
| 450   | 9 x 50         | L                                                | L                                            | L                                                | L                                              |
| 500   | 10 x 50        | L                                                | L                                            | L                                                | L                                              |
| 550   | 11 x 50        | L                                                | L                                            | L                                                | L                                              |
| 600   | 12 x 50        | L                                                | L                                            | L                                                | L                                              |
| 700   | 14 x 50        | KK                                               | KK                                           | KK                                               | KK                                             |
| 800   | 8 x 100        | KK                                               | KK                                           | KK                                               | KK                                             |
| 900   | 9 x 100        | KK                                               | KK                                           | KK                                               | KK                                             |
| 1000  | 10 x 100       | KK                                               | C/F                                          | KK                                               | C/F                                            |
| 1100  | 11 x 100       | KK                                               | C/F                                          | KK                                               | C/F                                            |
| 1200  | 12 x 100       | KK                                               | C/F                                          | KK                                               | C/F                                            |

**Notes**

- ① Other ratings available. Please consult factory. kvar output is voltage and frequency dependent. 60 Hz units are shown. For other voltages and frequencies, consult Eaton Technical Resource Center (TRC) at 1-800-809-2772, choose option #4, then option #2.
- ② Enclosure sizing for units with integrated surge protection or bottom entry can vary and may not be available on all kvar sizes. Contact Eaton's Technical Resource Center at 1-800-809-2772, choose option #4, then option #2.

C/F = Consult factory

# 2.2

## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

### Power Factor Correction and Harmonic Filtering

2

#### Floor-Mounted Switched Detuned Filters—Low Voltage

| kvar <sup>①</sup> | Step x kvar | Rated Current Amperes | Base Shipping Weight in Lb (kg) | Base Catalog Number  |
|-------------------|-------------|-----------------------|---------------------------------|----------------------|
| <b>240 Vac</b>    |             |                       |                                 |                      |
| 150               | 6 x 25      | 361                   | 1830 (830.8)                    | <b>150THFSR232Y</b>  |
| 200               | 8 x 25      | 481                   | 2222 (1008.8)                   | <b>200THFSR232Y</b>  |
| 250               | 10 x 25     | 601                   | 2525 (1146.4)                   | <b>250THFSR232Y</b>  |
| 300               | 12 x 25     | 720                   | 2830 (1284.8)                   | <b>300THFSR232Y</b>  |
| 350               | 7 x 50      | 844                   | 3090 (1401.6)                   | <b>350THFSR231Y</b>  |
| 400               | 8 x 50      | 965                   | 3560 (1614.8)                   | <b>400THFSR232Y</b>  |
| <b>480 Vac</b>    |             |                       |                                 |                      |
| 100               | 2 x 50      | 120                   | 1105 (501.2)                    | <b>100THFSR431Y</b>  |
| 150               | 3 x 50      | 180                   | 1242 (564.6)                    | <b>150THFSR431Y</b>  |
| 200               | 4 x 50      | 240                   | 1438 (652.9)                    | <b>200THFSR431Y</b>  |
| 250               | 5 x 50      | 300                   | 1634 (741.8)                    | <b>250THFSR431Y</b>  |
| 300               | 6 x 50      | 360                   | 1830 (830.8)                    | <b>300THFSR432Y</b>  |
| 350               | 7 x 50      | 420                   | 2026 (919.8)                    | <b>350THFSR432Y</b>  |
| 400               | 8 x 50      | 480                   | 2222 (1008.8)                   | <b>400THFSR432Y</b>  |
| 450               | 9 x 50      | 540                   | 2371 (1076.4)                   | <b>450THFSR432Y</b>  |
| 500               | 10 x 50     | 600                   | 2525 (1146.4)                   | <b>500THFSR432Y</b>  |
| 550               | 11 x 50     | 660                   | 2750 (1248.5)                   | <b>550THFSR432Y</b>  |
| 600               | 12 x 50     | 720                   | 2830 (1284.8)                   | <b>600THFSR432Y</b>  |
| 700               | 7 x 100     | 792                   | 3090 (1401.6)                   | <b>700THFSR431Y</b>  |
| 800               | 8 x 100     | 962                   | 3560 (1614.8)                   | <b>800THFSR432Y</b>  |
| 900               | 9 x 100     | 1083                  | 3900 (1769.0)                   | <b>900THFSR432Y</b>  |
| 1000              | 10 x 100    | 1203                  | 4240 (1923.2)                   | <b>1000THFSR432Y</b> |
| 1100              | 11 x 100    | 1323                  | 4500 (2041.2)                   | <b>1100THFSR432Y</b> |
| <b>600 Vac</b>    |             |                       |                                 |                      |
| 100               | 2 x 50      | 96                    | 1105 (501.2)                    | <b>100THFSR631Y</b>  |
| 150               | 3 x 50      | 144                   | 1242 (564.6)                    | <b>150THFSR631Y</b>  |
| 200               | 4 x 50      | 192                   | 1438 (652.9)                    | <b>200THFSR631Y</b>  |
| 250               | 5 x 50      | 240                   | 1634 (741.8)                    | <b>250THFSR631Y</b>  |
| 300               | 6 x 50      | 288                   | 1830 (830.8)                    | <b>300THFSR632Y</b>  |
| 350               | 7 x 50      | 336                   | 2026 (919.8)                    | <b>350THFSR632Y</b>  |
| 400               | 8 x 50      | 384                   | 2222 (1008.8)                   | <b>400THFSR632Y</b>  |
| 450               | 9 x 50      | 432                   | 2371 (1076.4)                   | <b>450THFSR632Y</b>  |
| 500               | 10 x 50     | 480                   | 2525 (1146.4)                   | <b>500THFSR632Y</b>  |
| 550               | 11 x 50     | 529                   | 2750 (1248.5)                   | <b>550THFSR632Y</b>  |
| 600               | 12 x 50     | 576                   | 2830 (1284.8)                   | <b>600THFSR632Y</b>  |
| 700               | 7 x 100     | 672                   | 3090 (1401.6)                   | <b>700THFSR631Y</b>  |
| 800               | 8 x 100     | 768                   | 3560 (1614.8)                   | <b>800THFSR632Y</b>  |
| 900               | 9 x 100     | 864                   | 3900 (1769.0)                   | <b>900THFSR632Y</b>  |
| 1000              | 10 x 100    | 962                   | 4240 (1923.2)                   | <b>1000THFSR632Y</b> |
| 1100              | 11 x 100    | 1058                  | 4500 (2041.2)                   | <b>1100THFSR632Y</b> |

#### AUTOVAR Detuned Filter Sizing Chart

| kvar  | Step x<br>kvar | Enclosure Size ②                                |                                             |                                                 |                                               |
|-------|----------------|-------------------------------------------------|---------------------------------------------|-------------------------------------------------|-----------------------------------------------|
|       |                | NEMA 1<br>without Main<br>Breaker,<br>No Suffix | NEMA 1<br>with Main<br>Breaker,<br>M Suffix | NEMA 3R<br>without Main<br>Breaker,<br>W Suffix | NEMA 3R<br>with Main<br>Breaker,<br>MW Suffix |
| 240 V |                |                                                 |                                             |                                                 |                                               |
| 150   | 6 x 25         | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 200   | 8 x 25         | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 250   | 10 x 25        | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 300   | 12 x 25        | L + L ③                                         | KK                                          | L + L ③                                         | KK                                            |
| 350   | 7 x 50         | KK                                              | L + KK ③                                    | L + KK ③                                        | KK                                            |
| 400   | 8 x 50         | L + KK ③                                        | C/F                                         | L + KK ③                                        | C/F                                           |
| 480 V |                |                                                 |                                             |                                                 |                                               |
| 100   | 2 x 50         | L                                               | L                                           | L + L ③                                         | L + L ③                                       |
| 150   | 3 x 50         | L                                               | L                                           | L + L ③                                         | L + L ③                                       |
| 200   | 4 x 50         | L                                               | L                                           | L + L ③                                         | L + L ③                                       |
| 250   | 5 x 50         | L                                               | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 300   | 6 x 50         | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 350   | 7 x 50         | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 400   | 8 x 50         | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 450   | 9 x 50         | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 500   | 10 x 50        | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 550   | 11 x 50        | L + L ③                                         | KK                                          | L + L ③                                         | L + KK ③                                      |
| 600   | 12 x 50        | L + L ③                                         | KK                                          | L + L ③                                         | L + KK ③                                      |
| 700   | 7 x 100        | KK                                              | KK                                          | L + KK ③                                        | L + KK ③                                      |
| 800   | 8 x 100        | L + KK ③                                        | C/F                                         | L + KK ③                                        | C/F                                           |
| 900   | 9 x 100        | KK + KK ③                                       | C/F                                         | KK + KK ③                                       | C/F                                           |
| 1000  | 10 x 100       | KK + KK ③                                       | C/F                                         | KK + KK ③                                       | C/F                                           |
| 1100  | 11 x 100       | KK + KK ③                                       | C/F                                         | KK + KK ③                                       | C/F                                           |
| 600 V |                |                                                 |                                             |                                                 |                                               |
| 100   | 2 x 50         | L                                               | L                                           | L + L ③                                         | L + L ③                                       |
| 150   | 3 x 50         | L                                               | L                                           | L + L ③                                         | L + L ③                                       |
| 200   | 4 x 50         | L                                               | L                                           | L + L ③                                         | L + L ③                                       |
| 250   | 5 x 50         | L                                               | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 300   | 6 x 50         | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 350   | 7 x 50         | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 400   | 8 x 50         | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 450   | 9 x 50         | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 500   | 10 x 50        | L + L ③                                         | L + L ③                                     | L + L ③                                         | L + L ③                                       |
| 550   | 11 x 50        | L + L ③                                         | KK                                          | L + L ③                                         | L + KK ③                                      |
| 600   | 12 x 50        | L + L ③                                         | KK                                          | L + L ③                                         | L + KK ③                                      |
| 700   | 7 x 100        | KK                                              | KK                                          | L + KK ③                                        | L + KK ③                                      |
| 800   | 8 x 100        | L + KK ③                                        | L + KK ③                                    | L + KK ③                                        | L + KK ③                                      |
| 900   | 9 x 100        | KK + KK ③                                       | KK + KK ③                                   | KK + KK ③                                       | KK + KK ③                                     |
| 1000  | 10 x 100       | KK + KK ③                                       | C/F                                         | KK + KK ③                                       | C/F                                           |
| 1100  | 11 x 100       | KK + KK ③                                       | C/F                                         | KK + KK ③                                       | C/F                                           |

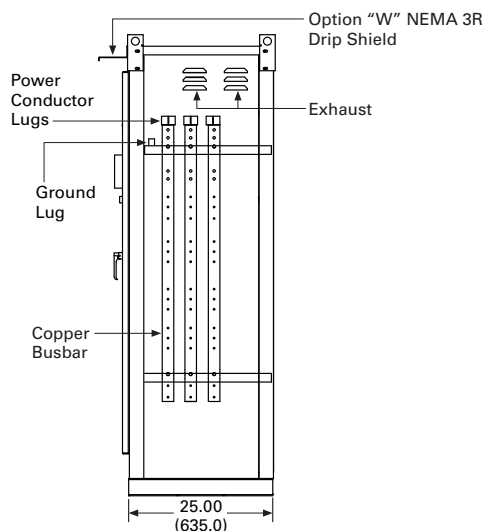
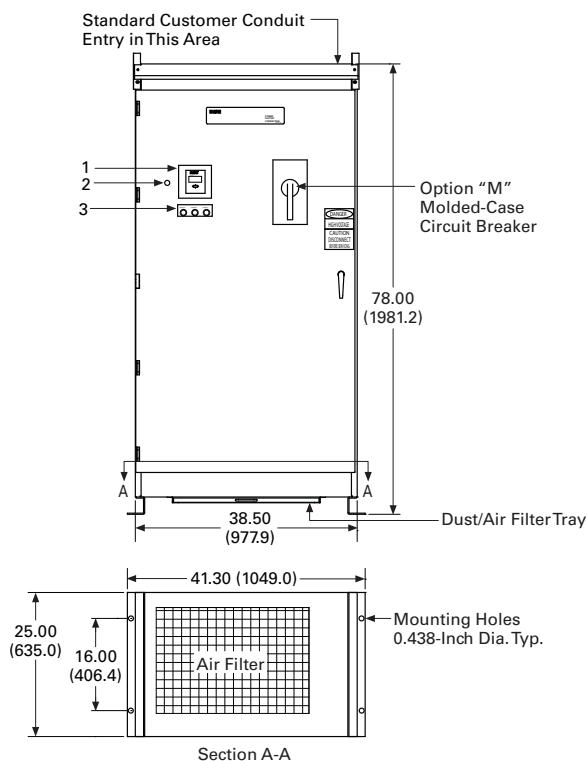
#### Notes

- <sup>①</sup> kvar output is voltage and frequency dependent. 60 Hz units are shown. For other voltages and frequencies, consult Eaton Technical Resource Center (TRC) at 1-800-809-2772, choose option #4, then option #2.
- <sup>②</sup> Enclosure sizing for units with integrated surge protection or bottom entry can vary and may not be available on all kvar sizes. Contact Eaton's Technical Resource Center at 1-800-809-2772, choose option #4, then option #2.
- <sup>③</sup> Dual enclosure design requires customer installation of factory supplied interconnecting wires.

C/F = Consult factory

**Dimensions**

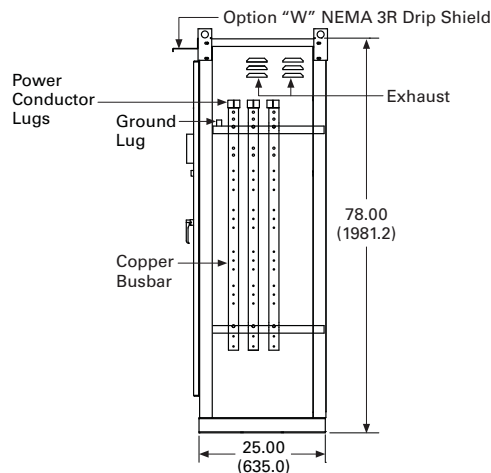
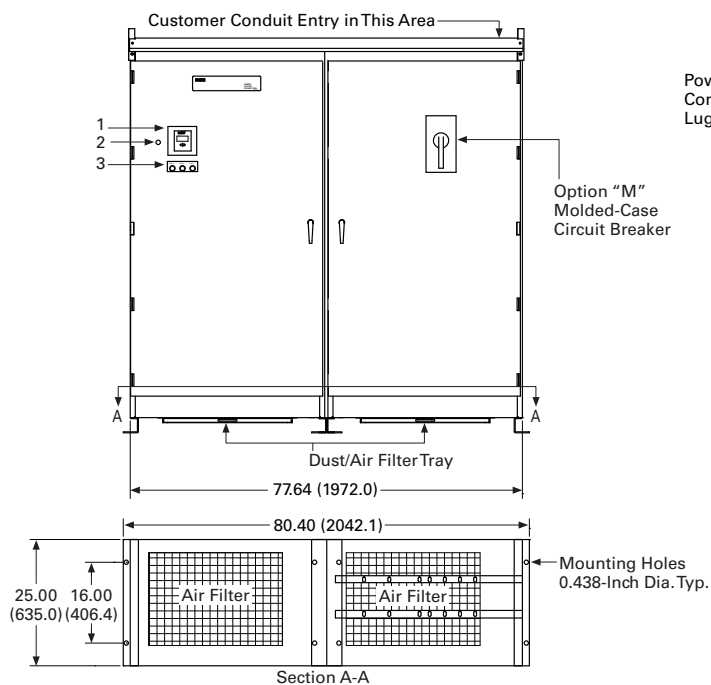
Approximate Dimensions in Inches (mm)

**Enclosure L Front View****Legend**

1. Controller
2. On/Off Switch
3. Cleared Fuse Indicating Lights

**Notes:**

1. 6-Inch Minimum Clearance Each Side
2. 45-Inch Front Clearance or per Local Code

**Enclosure KK Front and Side Views****Legend**

1. Controller
2. On/Off Switch
3. Cleared Fuse Indicating Lights

**Notes:**

1. 6-Inch Minimum Clearance Each Side
2. 45-Inch Front Clearance or per Local Code

## AUTOVAR Filter



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## AUTOVAR Filter—LV Automatic Detuned Filter

## Product Description

- Programmable to automatically add/subtract capacitor stages to maintain preset target power factor
- Three-phase capacitor cell construction
- Five-year warranty of cells against manufacturing defects
- Cool operating, 100% copper wound, thermal-protected reactors are sized up to 150% of rated capacitor current (AUTOVAR detuned filter only)

## Application Description

- Service entrance or substation power factor correction installations requiring precise maintenance of target power factor (AUTOVAR 600)
- Service entrance or substation power factor correction installations requiring precise maintenance of target power factor in three-phase, nonlinear, high harmonic environments (AUTOVAR detuned filter)
- Typically connected at main low voltage switchgear

## Features

## Configuration

- **Cabinet:** 12 gauge steel with ANSI 61 gray, baked finish. Removable lift bolts standard, NEMA 1 (gasketed)
- **Power line interconnect:** Rugged, copper busbar connection with access provided for top entry. Contact factory for availability of bottom entry. Busbars are braced for 65 kA (optional 100 kA rating available). All internal power wiring connections from bus are laid out on a most direct basis with minimum bends for ease of troubleshooting. Clear barrier limiting access to live parts included standard
- **Modular tray design:** Capacitor stages arranged in modular trays with capacitors, fuses, cleared-fuse indicating lights, and contactors grouped in a logical, easily understood layout. This permits easy access, quick identification of operating problems, and ease of expandability
- **Fusing:** UL recognized, 200,000 A interrupting capacity provided on all three phases of each stage. Blade-type fuses mounted on insulator stand-offs

- **Cleared-fuse indicating lights:** LEDs located door-mounted and neon at individual fuses to facilitate tracing of cleared fuses
- **Push-to-test:** Allows testing of door-mounted LED cleared fuse indicating lights
- **AutoLocate:** When door is open and bus is energized, fuse circuit automatically checks for cleared fuses. If a fuse has cleared, the light at the fuse turns on for easy troubleshooting
- **Door interlock:** Door interlock automatically turns off control circuit when engaged. Power continues to be provided to the unit until disconnect is open
- **Exhaust fans:** Two side louver fans per cabinet provide cooling and reduce operator exposure to discharge. Replaceable dust filtering provided. Dust filters can be replaced without opening cabinet
- **Ease of expansion:** Capacitor stage nests are self-contained and can be added in the field. Two bolts mount the nest in the field. Control wire plugs connect to factory standard wire harness on the left side of the cabinet
- **Ease of replacement:** Cells can be easily replaced individually by removing the mounting bolt and lifting out of the nest without removal of any other components
- **Thermal sensing:** Built-in thermal sensing, alarming, and protection feature allows the unit to operate in optimal temperature while alerting the user of ambient temperature exceeding the nominal operating range. Stages will be automatically switched off if temperature exceeds the maximum specified temperature
- **Temperature range:** The operating temperature range is  $-20^{\circ}\text{C}$  to  $+46^{\circ}\text{C}$ , and the storage temperature range is  $-40^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ . For optimal equipment life, the temperature should not exceed  $35^{\circ}\text{C}$  annual average, and the environment should not exceed Pollution Degree 2 as defined in UL 61010-1

**Controller**

- Visual indication of incorrect CT polarity
- Digital display of power factor and number of energized stages
- Automatic setting of c/k value (sensitivity based on CT ratio and kvar available)
- Visual indication of insufficient kvar to reach target power factor
- Automatic sensing of kvar values per step
- Optional communications capable controller (RS-485/Modbus)
- Standard metering capability:
  - Voltage
  - Current (sensed phase only)
  - Frequency
  - Active power (kW)
  - Reactive power (kvar)
  - Apparent power (kVA)
  - Total voltage harmonic distortion (VTHD)
  - Individual harmonic voltage distortion (odd orders up to the 19th harmonic)
- Built-in manual mode allows for testing and manual operation of stages
- Multiple user-friendly alarm displays. Controller provides easy-to-understand alarms for various conditions, such as:
  - Undervoltage or overvoltage
  - Undercurrent or overcurrent
  - Target power factor not met
  - Harmonic overload
  - Faulty step/stages
  - Overtemperature alarm

**Contactors**

- Fully rated for capacitor switching
- Integral pre-charge/pre-insertion module standard. The contactor reduces damaging switching transients, providing safety and durability for the system
  - Lessens the chance of disrupting sensitive electronic equipment
  - Reduced inrush current extends the life of the capacitor cells

**Reactors**

- **Detuning:** Standard reactor designs are detuned to the 4.2nd harmonic and recommended to protect capacitors against harmonic resonance. Detuning to the 4.7th harmonic is available as an option. The harmonic spectrum should be evaluated for applications involving reactors detuned to the 4.7th harmonic to ensure optimal equipment life, specifically when used in conjunction with six-pulse motor drives
- **Windings:** 80 °C temperature rise design 100% copper windings for minimal losses
- **Thermal overload protection:** Each reactor includes three normally closed, auto reset thermostats that open at 180 °C. When thermostats engage, the contactor opens
- **Insulation:** 220 °C insulation system
- **Warranty:** One-year replacement of reactors

**Additional Features**

- Optional molded-case main circuit breaker
- Ground fault interruption provides protection in case of accidental contact with control power and ground
- Control wiring—standard NEC color-coded modular bundles with quick disconnect feature for ease of troubleshooting or ease of expendability. UL type MTW/AWM, CSA TEW 105 °C copper wire is standard.
- Optional digital metering—IQ 250
- Mechanical wire lugs are included as standard equipment. Typical phase lugs range from (2) 6 AWG–350 kcmil to (4) 3 AWG–750 MCM. Typical ground lug can accept wire from 6 AWG to 350 kcmil. Lugs are compatible with copper wire 90 °C
- Heavy-duty capacitor cells are standard on AUTOVAR detuned filter and optional on AUTOVAR 600. For 480 V units, standard-duty cells are 525 V rated, and heavy-duty cells are 600 V rated

**Support and service**

- Renewal parts are available through local Eaton distributors
- Factory trained service personnel are available through Eaton's Electrical Services & Systems

**AUTOVAR Filter—Reactor Cabinet****Standards and Certifications**

- Entire cabinet assembly is UL 508A and CSA C22.2 No. 190 Listed
- Capacitors are UL 810 recognized
- Contactor is UL/CSA recognized and IEC 6b rated





## Product Selection

## 2

## Options—AUTOVAR 600 and AUTOVAR Detuned Filter

| Description                                                                                                                         | Option Code |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Remote alarm relay terminal block—relay terminal block for a remote alarm to indicate controller alarm status                       | <b>A</b>    |
| Fully insulated main bus                                                                                                            | <b>B</b>    |
| Communicating PF controller (Modbus RS-485)                                                                                         | <b>C</b>    |
| Hand-off-auto switch provides manual control to connect or disconnect capacitor stages regardless of controller output <sup>①</sup> | <b>H</b>    |
| Integrated main breaker                                                                                                             | <b>M</b>    |
| Integrated main breaker with high interrupting rating (see breaker table for more information), includes 100 kA busbar bracing      | <b>M1</b>   |
| 100 kA busbar bracing                                                                                                               | <b>N1</b>   |
| Integrated CVX series surge protection, without sine wave tracking                                                                  | <b>T1</b>   |
| Integrated SPD series surge protection, 160 kA per phase, with sine wave tracking                                                   | <b>T2</b>   |
| IQ 250 electronic meter <sup>②</sup>                                                                                                | <b>Q</b>    |
| Weather resistant enclosure (NEMA 3R gasketed) <sup>③</sup>                                                                         | <b>W</b>    |
| Standard filter detuned to the 4.2nd harmonic <sup>④</sup>                                                                          | <b>Y</b>    |

**Notes**

- ① Manual control is always available through menu controller on system, even if the H option is not selected.
- ② Not available on NEMA 3R units (W option).
- ③ Only available on AUTOVAR 600 with heavy-duty cells and AUTOVAR detuned filters using 'L + L', 'L + KK', and 'KK + KK' enclosures.
- ④ Tuning to the 4.2nd harmonic is the preferred option. Other tunings available. Contact Eaton's Technical Resource Center (TRC) power factor application engineers at 1-800-809-2772, choose option #4, then option #2.

To calculate AUTOVAR 600 or AUTOVAR detuned filter weight:

Obtain base unit weight from table on **Page V3-T2-79** (as appropriate).

Add option weights as necessary:

A = 1 lb (0.5 kg)

B = 10 lb (4.5 kg)

C = 1 lb (0.5 kg)

H = 10 lb (4.5 kg)

M = Circuit breaker weight (see circuit breaker table)

M1 = 10 lb (4.5 kg) hardware weight adder plus circuit breaker weight (see circuit breaker table)

N1 = 10 lb (4.5 kg)

T1 = 5 lb (2.3 kg)

T2 = 10 lb (4.5 kg)

Q = 5 lb (2.3 kg)

W = 10 lb (4.5 kg) per door

Y = 0 lb (0 kg)



## Floor-Mounted Switched Detuned Filters—Low Voltage

| kvar <sup>①</sup> | Step x kvar | Rated Current Amperes | Base Shipping Weight in Lb (kg) | Base Catalog Number  |
|-------------------|-------------|-----------------------|---------------------------------|----------------------|
| <b>240 Vac</b>    |             |                       |                                 |                      |
| 150               | 6 x 25      | 361                   | 1830 (830.8)                    | <b>150THFSR232Y</b>  |
| 200               | 8 x 25      | 481                   | 2222 (1008.8)                   | <b>200THFSR232Y</b>  |
| 250               | 10 x 25     | 601                   | 2525 (1146.4)                   | <b>250THFSR232Y</b>  |
| 300               | 12 x 25     | 720                   | 2830 (1284.8)                   | <b>300THFSR232Y</b>  |
| 350               | 7 x 50      | 844                   | 3090 (1401.6)                   | <b>350THFSR231Y</b>  |
| 400               | 8 x 50      | 965                   | 3560 (1614.8)                   | <b>400THFSR232Y</b>  |
| <b>480 Vac</b>    |             |                       |                                 |                      |
| 100               | 2 x 50      | 120                   | 1105 (501.2)                    | <b>100THFSR431Y</b>  |
| 150               | 3 x 50      | 180                   | 1242 (564.6)                    | <b>150THFSR431Y</b>  |
| 200               | 4 x 50      | 240                   | 1438 (652.9)                    | <b>200THFSR431Y</b>  |
| 250               | 5 x 50      | 300                   | 1634 (741.8)                    | <b>250THFSR431Y</b>  |
| 300               | 6 x 50      | 360                   | 1830 (830.8)                    | <b>300THFSR432Y</b>  |
| 350               | 7 x 50      | 420                   | 2026 (919.8)                    | <b>350THFSR432Y</b>  |
| 400               | 8 x 50      | 480                   | 2222 (1008.8)                   | <b>400THFSR432Y</b>  |
| 450               | 9 x 50      | 540                   | 2371 (1076.4)                   | <b>450THFSR432Y</b>  |
| 500               | 10 x 50     | 600                   | 2525 (1146.4)                   | <b>500THFSR432Y</b>  |
| 550               | 11 x 50     | 660                   | 2750 (1248.5)                   | <b>550THFSR432Y</b>  |
| 600               | 12 x 50     | 720                   | 2830 (1284.8)                   | <b>600THFSR432Y</b>  |
| 700               | 7 x 100     | 792                   | 3090 (1401.6)                   | <b>700THFSR431Y</b>  |
| 800               | 8 x 100     | 962                   | 3560 (1614.8)                   | <b>800THFSR432Y</b>  |
| 900               | 9 x 100     | 1083                  | 3900 (1769.0)                   | <b>900THFSR432Y</b>  |
| 1000              | 10 x 100    | 1203                  | 4240 (1923.2)                   | <b>1000THFSR432Y</b> |
| 1100              | 11 x 100    | 1323                  | 4500 (2041.2)                   | <b>1100THFSR432Y</b> |
| <b>600 Vac</b>    |             |                       |                                 |                      |
| 100               | 2 x 50      | 96                    | 1105 (501.2)                    | <b>100THFSR631Y</b>  |
| 150               | 3 x 50      | 144                   | 1242 (564.6)                    | <b>150THFSR631Y</b>  |
| 200               | 4 x 50      | 192                   | 1438 (652.9)                    | <b>200THFSR631Y</b>  |
| 250               | 5 x 50      | 240                   | 1634 (741.8)                    | <b>250THFSR631Y</b>  |
| 300               | 6 x 50      | 288                   | 1830 (830.8)                    | <b>300THFSR632Y</b>  |
| 350               | 7 x 50      | 336                   | 2026 (919.8)                    | <b>350THFSR632Y</b>  |
| 400               | 8 x 50      | 384                   | 2222 (1008.8)                   | <b>400THFSR632Y</b>  |
| 450               | 9 x 50      | 432                   | 2371 (1076.4)                   | <b>450THFSR632Y</b>  |
| 500               | 10 x 50     | 480                   | 2525 (1146.4)                   | <b>500THFSR632Y</b>  |
| 550               | 11 x 50     | 529                   | 2750 (1248.5)                   | <b>550THFSR632Y</b>  |
| 600               | 12 x 50     | 576                   | 2830 (1284.8)                   | <b>600THFSR632Y</b>  |
| 700               | 7 x 100     | 672                   | 3090 (1401.6)                   | <b>700THFSR631Y</b>  |
| 800               | 8 x 100     | 768                   | 3560 (1614.8)                   | <b>800THFSR632Y</b>  |
| 900               | 9 x 100     | 864                   | 3900 (1769.0)                   | <b>900THFSR632Y</b>  |
| 1000              | 10 x 100    | 962                   | 4240 (1923.2)                   | <b>1000THFSR632Y</b> |
| 1100              | 11 x 100    | 1058                  | 4500 (2041.2)                   | <b>1100THFSR632Y</b> |

## AUTOVAR Detuned Filter Sizing Chart

|              |             | Enclosure Size <sup>②</sup>            |                                    |                                        |                                      |
|--------------|-------------|----------------------------------------|------------------------------------|----------------------------------------|--------------------------------------|
| kvar         | Step x kvar | NEMA 1 without Main Breaker, No Suffix | NEMA 1 with Main Breaker, M Suffix | NEMA 3R without Main Breaker, W Suffix | NEMA 3R with Main Breaker, MW Suffix |
| <b>240 V</b> |             |                                        |                                    |                                        |                                      |
| 150          | 6 x 25      | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 200          | 8 x 25      | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 250          | 10 x 25     | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 300          | 12 x 25     | L + L <sup>③</sup>                     | KK                                 | L + L <sup>③</sup>                     | KK                                   |
| 350          | 7 x 50      | KK                                     | L + KK <sup>③</sup>                | L + KK <sup>③</sup>                    | KK                                   |
| 400          | 8 x 50      | L + KK <sup>③</sup>                    | C/F                                | L + KK <sup>③</sup>                    | C/F                                  |
| <b>480 V</b> |             |                                        |                                    |                                        |                                      |
| 100          | 2 x 50      | L                                      | L                                  | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 150          | 3 x 50      | L                                      | L                                  | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 200          | 4 x 50      | L                                      | L                                  | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 250          | 5 x 50      | L                                      | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 300          | 6 x 50      | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 350          | 7 x 50      | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 400          | 8 x 50      | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 450          | 9 x 50      | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 500          | 10 x 50     | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 550          | 11 x 50     | L + L <sup>③</sup>                     | KK                                 | L + L <sup>③</sup>                     | L + KK <sup>③</sup>                  |
| 600          | 12 x 50     | L + L <sup>③</sup>                     | KK                                 | L + L <sup>③</sup>                     | L + KK <sup>③</sup>                  |
| 700          | 7 x 100     | KK                                     | KK                                 | L + KK <sup>③</sup>                    | L + KK <sup>③</sup>                  |
| 800          | 8 x 100     | L + KK <sup>③</sup>                    | C/F                                | L + KK <sup>③</sup>                    | C/F                                  |
| 900          | 9 x 100     | KK + KK <sup>③</sup>                   | C/F                                | KK + KK <sup>③</sup>                   | C/F                                  |
| 1000         | 10 x 100    | KK + KK <sup>③</sup>                   | C/F                                | KK + KK <sup>③</sup>                   | C/F                                  |
| 1100         | 11 x 100    | KK + KK <sup>③</sup>                   | C/F                                | KK + KK <sup>③</sup>                   | C/F                                  |
| <b>600 V</b> |             |                                        |                                    |                                        |                                      |
| 100          | 2 x 50      | L                                      | L                                  | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 150          | 3 x 50      | L                                      | L                                  | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 200          | 4 x 50      | L                                      | L                                  | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 250          | 5 x 50      | L                                      | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 300          | 6 x 50      | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 350          | 7 x 50      | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 400          | 8 x 50      | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 450          | 9 x 50      | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 500          | 10 x 50     | L + L <sup>③</sup>                     | L + L <sup>③</sup>                 | L + L <sup>③</sup>                     | L + L <sup>③</sup>                   |
| 550          | 11 x 50     | L + L <sup>③</sup>                     | KK                                 | L + L <sup>③</sup>                     | L + KK <sup>③</sup>                  |
| 600          | 12 x 50     | L + L <sup>③</sup>                     | KK                                 | L + L <sup>③</sup>                     | L + KK <sup>③</sup>                  |
| 700          | 7 x 100     | KK                                     | KK                                 | L + KK <sup>③</sup>                    | L + KK <sup>③</sup>                  |
| 800          | 8 x 100     | L + KK <sup>③</sup>                    | L + KK <sup>③</sup>                | L + KK <sup>③</sup>                    | L + KK <sup>③</sup>                  |
| 900          | 9 x 100     | KK + KK <sup>③</sup>                   | KK + KK <sup>③</sup>               | KK + KK <sup>③</sup>                   | KK + KK <sup>③</sup>                 |
| 1000         | 10 x 100    | KK + KK <sup>③</sup>                   | C/F                                | KK + KK <sup>③</sup>                   | C/F                                  |
| 1100         | 11 x 100    | KK + KK <sup>③</sup>                   | C/F                                | KK + KK <sup>③</sup>                   | C/F                                  |

## Notes

<sup>①</sup> kvar output is voltage and frequency dependent. 60 Hz units are shown. For other voltages and frequencies, consult Eaton Technical Resource Center (TRC) at 1-800-809-2772, choose option #4, then option #2.

<sup>②</sup> Enclosure sizing for units with integrated surge protection or bottom entry can vary and may not be available on all kvar sizes. Contact Eaton's Technical Resource Center at 1-800-809-2772, choose option #4, then option #2.

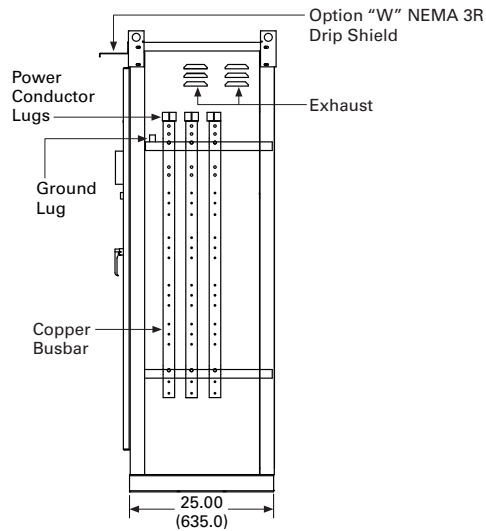
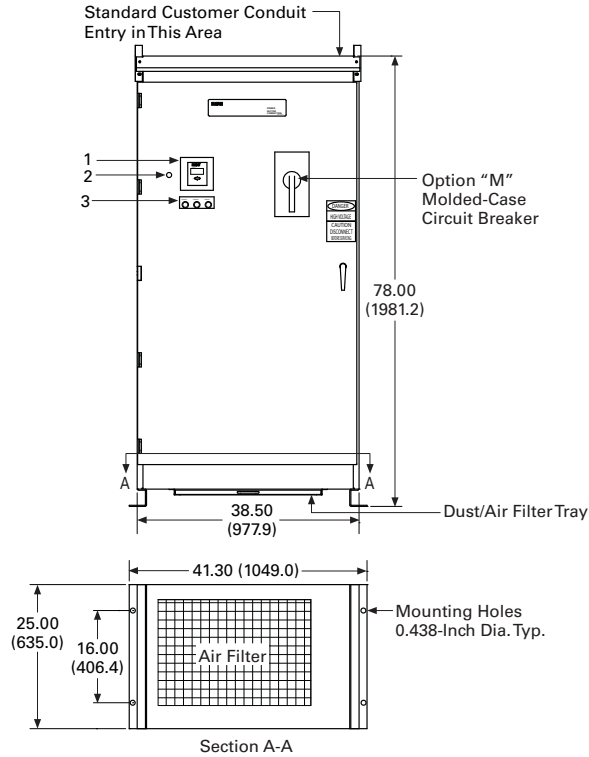
<sup>③</sup> Dual enclosure design requires customer installation of factory supplied interconnecting wires.

C/F = Consult factory

**Dimensions**

Approximate Dimensions in Inches (mm)

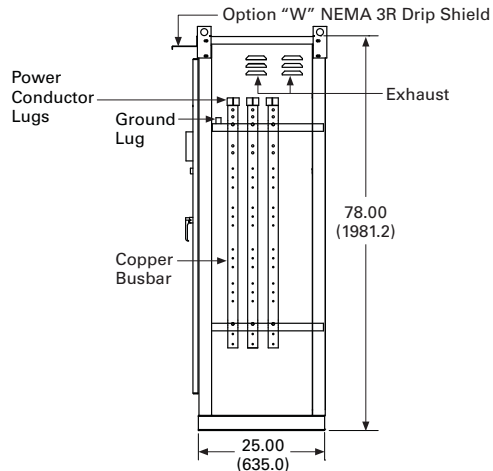
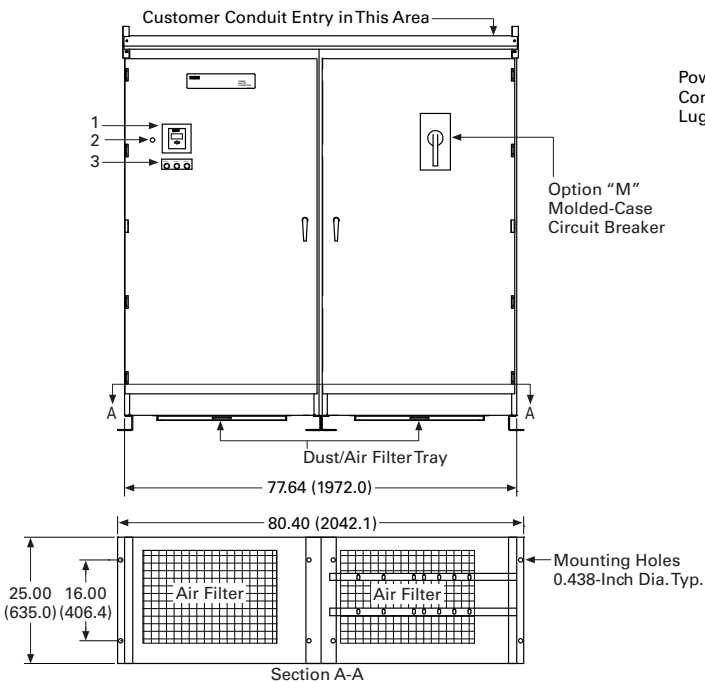
2

**AUTOVAR "L" (Single Door) Enclosure****Legend**

1. Controller
2. On/Off Switch
3. Cleared Fuse Indicating Lights

**Notes:**

1. 6-Inch Minimum Clearance Each Side
2. 45-Inch Front Clearance or per Local Code

**AUTOVAR "KK" (Double Door) Enclosure****Legend**

1. Controller
2. On/Off Switch
3. Cleared Fuse Indicating Lights

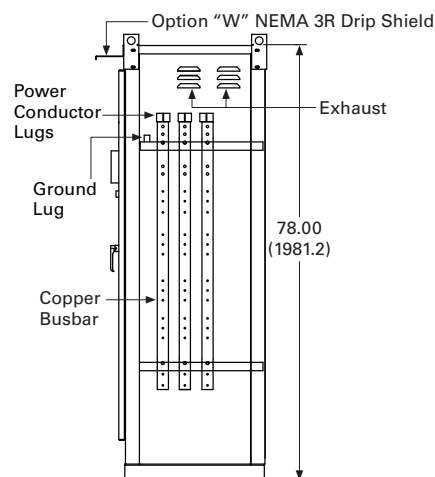
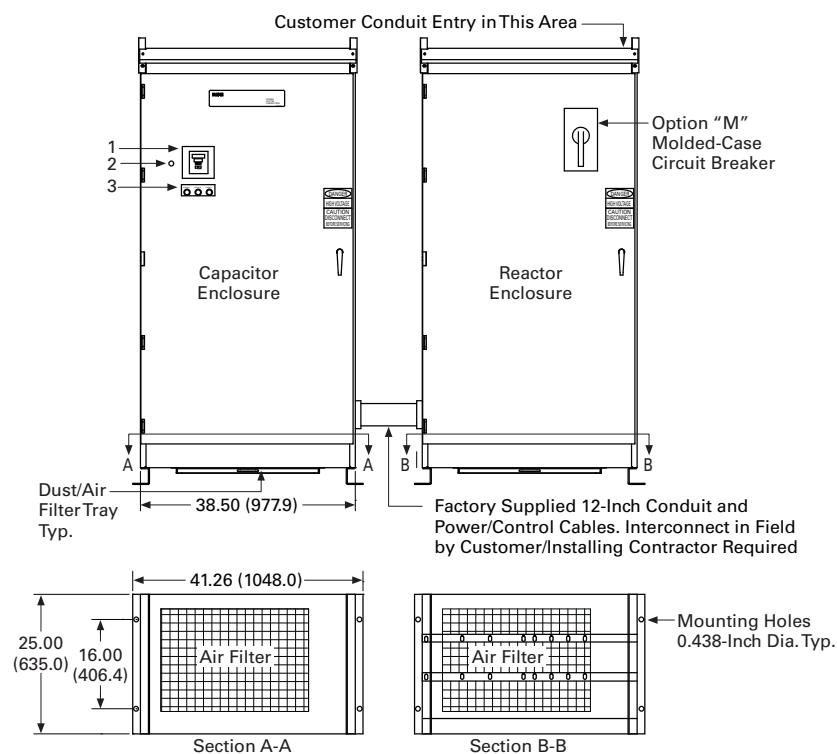
**Notes:**

1. 6-Inch Minimum Clearance Each Side
2. 45-Inch Front Clearance or per Local Code

Approximate Dimensions in Inches (mm)

## AUTOVAR "L + L" (2 Single Door) Enclosures

2

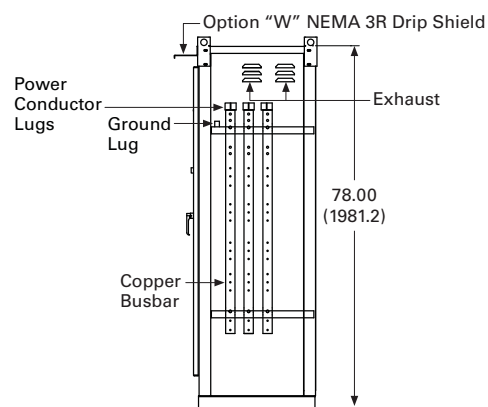
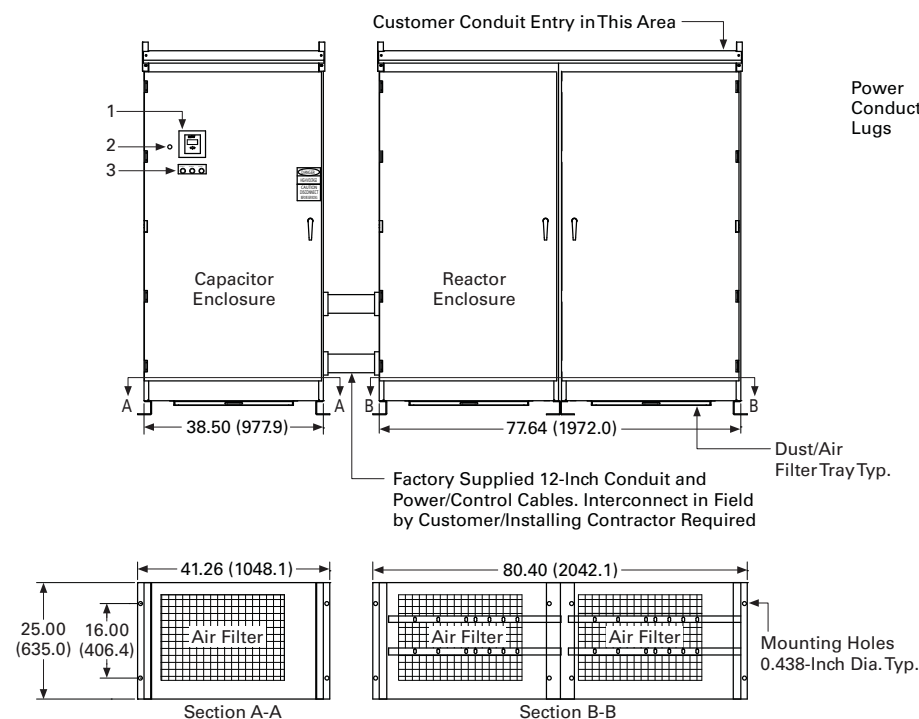
**Legend**

1. Controller
2. On/Off Switch
3. Cleared Fuse Indicating Lights

**Notes:**

1. 6-Inch Minimum Clearance Each Side
2. 45-Inch Front Clearance or per Local Code
3. 12-Inch Minimum Separation Between Enclosures

## L + KK Enclosure (AUTOVAR Detuned Filter Only)

**Legend**

1. Controller
2. On/Off Switch
3. Cleared Fuse Indicating Lights

**Notes:**

1. 6-Inch Minimum Clearance Each Side
2. 45-Inch Front Clearance or per Local Code
3. 12-Inch Minimum Separation Between Enclosures

## 2.2

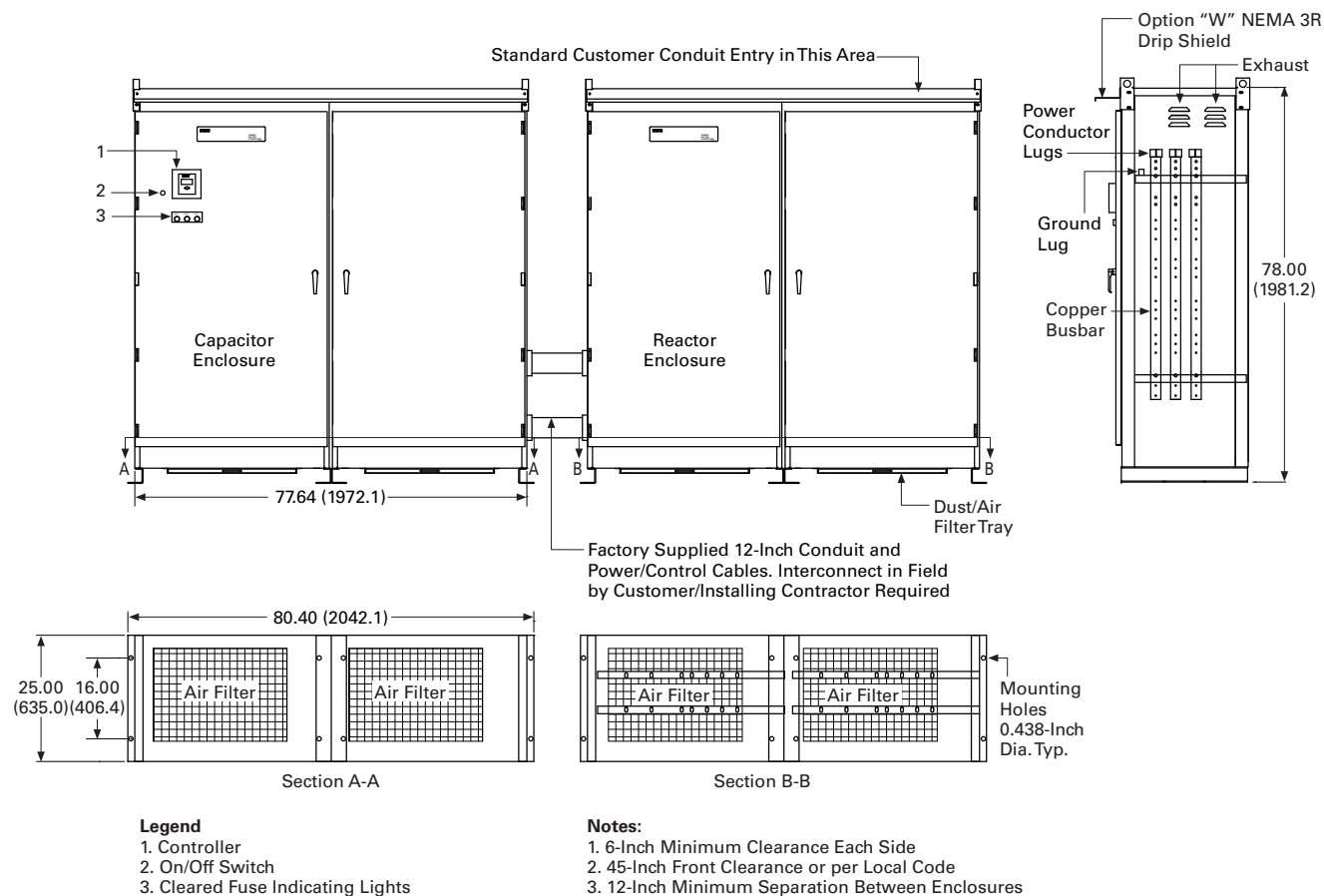
## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

### Power Factor Correction and Harmonic Filtering

Approximate Dimensions in Inches (mm)

## 2

### AUTOVAR "KK + KK" Enclosures



**Transient-Free Power Factor Correction System****Contents**

| <b>Description</b>                                                           | <b>Page</b>     |
|------------------------------------------------------------------------------|-----------------|
| Product Overview . . . . .                                                   | <b>V3-T2-51</b> |
| UNIPUMP . . . . .                                                            | <b>V3-T2-53</b> |
| UNIPAK . . . . .                                                             | <b>V3-T2-56</b> |
| AUTOVAR 300 Automatic Power Factor Correction<br>Capacitor Systems . . . . . | <b>V3-T2-65</b> |
| AUTOVAR 600 Automatic Power Factor<br>Correction Capacitor Systems . . . . . | <b>V3-T2-69</b> |
| AUTOVAR Filter—LV Automatic Detuned Filter . . . . .                         | <b>V3-T2-76</b> |
| Transient-Free Static Switching Power Factor<br>Correction Units . . . . .   | <b>V3-T2-84</b> |
| Product Selection . . . . .                                                  | <b>V3-T2-85</b> |
| HCU2 Harmonic Correction Unit . . . . .                                      | <b>V3-T2-85</b> |
| HCU1 Harmonic Correction Unit . . . . .                                      | <b>V3-T2-89</b> |

**Transient-Free Static Switching Power Factor Correction Units****Product Description**

Transient-free statically switch capacitor units are available in two models.

The FTE model is a real-time transient-free system, used to compensate extremely rapid loads within one cycle of operation (typically 5–20 msec).

The FTA model is a fast transient-free system, used to compensate any loads within 3–4 seconds.

The FTA and FTE units employ a fast or real-time response, and include the ability to switch larger steps without creating significant line noise. These relatively maintenance-free units reside in a smaller footprint and are ideal for use in applications such as flicker control, large motor starting, bus voltage stabilization, fault ride-through solutions, power factor correction and many more.

**Application Description**

- Motor starting
- On-site generation support
- Spot welding
- Wind turbines
- Other dynamic loads

Three current transformers with a 5 ampere secondary are required to operate this capacitor bank.

Rating based on Service Entrance Ampacity. For other ratios, please consult factory.

- Startup and Commissioning by factory trained personnel is required for proper operation and warranty of this system

**Standards and Certifications****Enclosure**

- EMC—EN50081-2, EN50082-2, EN55011, EN61000-4-2/3/4/5, ENV50204, ENV50141
- CE Mark—73/23/EEC am. 93/68, 98/37/EC art. 4(2)
- Safety—EN61010-1, EN60439-1, EN60204
- UL 508
- CSA



**Product Selection****2*****Transient-free reactive power compensation systems***

The transient-free systems are custom engineered to order.

The Eaton transient-free statically switched capacitor systems represent the “next level” of power system enhancements by using semi-conductor devices to switch capacitors at the same potential or zero potential difference, thereby eliminating the possible problem of transients caused by capacitor switching and increasing the speed of capacitive var compensation.

This level of performance is needed when high-current loads rapidly switch on and off and require power factor, voltage flicker, sag, or harmonic improvement. These disturbances can be found in many industries, including rockcrushing, arc-welding, plastic injection molding, and crane applications.

Please call Eaton’s Technical Resource Center at 1-800-809-2772, option #4, suboption #2 to discuss your application. See TD02607012E for additional technical information on Eaton’s transient-free reactive power compensation systems. Pricing and availability is available through Eaton’s Technical Resource Center. Please fill out the following questionnaire before requesting a quotation.

**Transient-Free Reactive Power Compensation Systems Questionnaire**

|                                           |       |                                                                                                                            |
|-------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------|
| Type of industry                          | _____ | (Automotive, alternative energy, lumber, etc.)                                                                             |
| Type of application                       | _____ | (Welding, wind turbine, sawmill, etc.)                                                                                     |
| Project objectives                        | _____ | (PF correction, voltage control, reactive power control, damping of power oscillations, unbalance control, motor starting) |
| Amount of kvar required (if known)        | _____ | kvar (300 to 3000 kvar)                                                                                                    |
| Nominal system voltage                    | _____ | V                                                                                                                          |
| Nominal system frequency                  | _____ | Hz                                                                                                                         |
| Integral main breaker needed              | _____ | (Yes/No)                                                                                                                   |
| Harmonic tuning order required (if known) | _____ | (2.67, 3.8, 4.5, or other)                                                                                                 |
| Compensation time required (if known)     | _____ | (3–4 seconds or 5–20 milliseconds)                                                                                         |

## HCU2 Active Harmonic Filters



## Contents

## Description

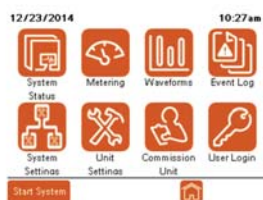
| Description                                                               | Page     |
|---------------------------------------------------------------------------|----------|
| Product Overview . . . . .                                                | V3-T2-51 |
| UNIPUMP . . . . .                                                         | V3-T2-53 |
| UNIPAK . . . . .                                                          | V3-T2-56 |
| AUTOVAR 300 Automatic Power Factor Correction Capacitor Systems . . . . . | V3-T2-65 |
| AUTOVAR 600 Automatic Power Factor Correction Capacitor Systems . . . . . | V3-T2-69 |
| AUTOVAR Filter—LV Automatic Detuned Filter . . . . .                      | V3-T2-76 |
| Transient-Free Static Switching Power Factor Correction Units . . . . .   | V3-T2-83 |
| HCU2 Harmonic Correction Unit                                             |          |
| Catalog Number Selection . . . . .                                        | V3-T2-86 |
| Technical Data and Specifications . . . . .                               | V3-T2-86 |

## HCU2 Harmonic Correction Unit

## Product Description

Eaton's HCU2 active harmonic filters are engineered to provide dynamic harmonic correction by actively injecting the required currents into an electrical distribution system to cancel the entire spectrum of harmonic currents at the point of connection.

## HMI Home Screen Shot



## Application Description

Typical applications include locations with large amounts of nonlinear loads including 6- and 12-pulse PWM alternating current (AC) variable frequency drives, direct current (DC) drives, as well as other switch-mode power supply equipment. This equipment can be found in water and wastewater treatment facilities, industrial manufacturing and warehousing plants, military bases and commercial locations.

Unlike passive filters, Eaton's HCU2 can provide effective harmonic correction for varying load conditions and harmonic spectrums by providing dynamic correction up to their rated capacity. The HCU2 also has the secondary benefit of providing power factor correction with any excess capacity after correcting all harmonic conditions.

## Features, Benefits and Functions

- Fast-acting harmonic correction
- NEMA 1, NEMA 2, NEMA 12, IP31, IP54 enclosures, and chassis mount versions available
- 60, 120, 200 and 300 A units available (ampere rating given at 380–480 V)
- Touchscreen human machine interface (HMI)
- Communications connectivity
- Designed for use in environmentally controlled conditions
- Can be sized to meet specific levels of harmonic correction, providing compliance with IEEE® 519 recommended levels
- Engineered to prevent overloading
- Scalable design can be expanded without impacting performance
- Broad spectrum of cancellation for robust protection (2nd to 51st harmonic)
- Helps improve power factor to maximize efficiency

- Easier and less expensive installation than passive filters, as active filter design reduces the need for detailed engineering studies
- HMI provides comprehensive control through icon-driven interface

## Improvements from HCUE to HCU2

- Closed loop control: A higher degree of harmonic correction is available with closed loop control than open loop control
- Reduced kW losses: Lower kW losses result in lower operating expenses and reduced requirements for equipment room HVAC systems. The maximum heat loss for a 300 A, 480 V unit is 7.1 kW
- Reduced footprint: Wall-mounted 480 V NEMA® 1 units are available in 60, 120, 200 and 300 A ratings
- Ease of maintenance and service: A standard USB service port is provided for firmware updates

## Standards and Certifications

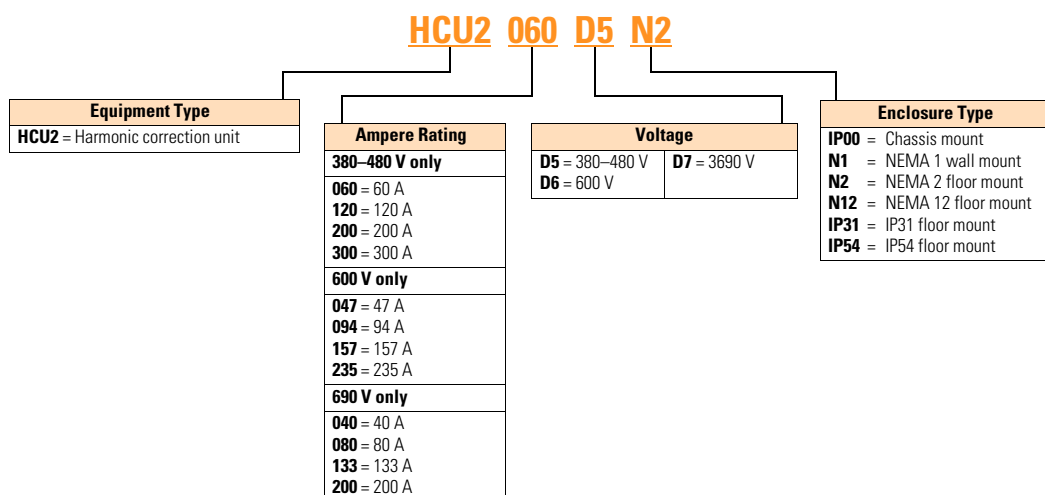
- UL/CSA approved



## Catalog Number Selection

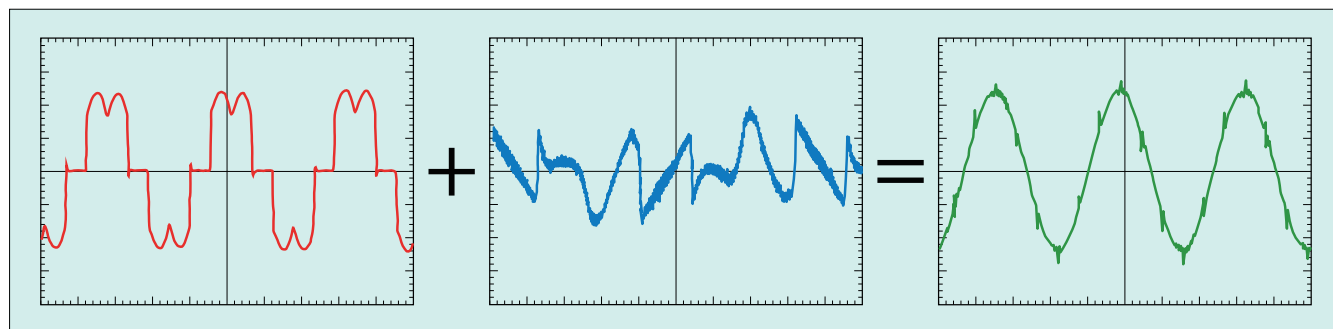
2

## HCU2 Harmonic Correction Unit

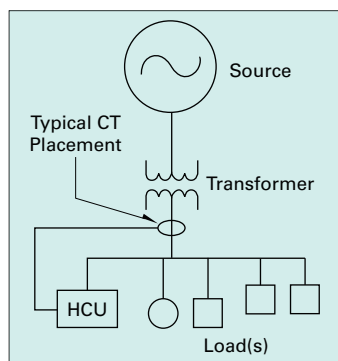


## Technical Data and Specifications

Typical Uncorrected 6-Pulse Rectifier (Before) Current + HCU2 Injection Current = Corrected (After) Current



## Recommended Placement





## Eaton HCU2 Specifications

| Specification                       | Description                                                                                                                                                                                                                                                                                   |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Technical Specifications</b>     |                                                                                                                                                                                                                                                                                               |
| Standard rms output current ratings | 60 A, 120 A, 200 A, 300 A at 380 Vac to 480 Vac<br>47 A, 94 A, 157 A, 235 A at 600 Vac<br>40 A, 80 A, 133 A, 200 A at 690 Vac                                                                                                                                                                 |
| Nominal frequency                   | 50/60 Hz, $\pm 3$ Hz auto sensing                                                                                                                                                                                                                                                             |
| Number of phases                    | 3-phase                                                                                                                                                                                                                                                                                       |
| Topology                            | Digital harmonic FFT Digital reactive power                                                                                                                                                                                                                                                   |
| Losses                              | To 480 Vac <3%; to 690 Vac <5%                                                                                                                                                                                                                                                                |
| CT VA loading                       | 1.0 VA (5 A CT secondary)                                                                                                                                                                                                                                                                     |
| Spectrum cancellation               | 2nd to 51st, discrete; fully selectable per harmonic order (amplitude and on/off)                                                                                                                                                                                                             |
| Control basis                       | Closed loop (for new installations)<br>Open loop compatible for retrofit applications                                                                                                                                                                                                         |
| Harmonic attenuation                | Closed loop: <3% THD(i); max. 20:1 THD(i) reduction with load harmonic current above 50% of HCU2 rating<br>Open loop: <5% TDD<br>Requires 3% or higher inductive impedance per nonlinear load                                                                                                 |
| Harmonic operational features       | % THDi set point<br>% THDv set point                                                                                                                                                                                                                                                          |
| Harmonic avoidance                  | Output at specific harmonic order turned off if resonance or lack-of impedance detected; or manually turned off                                                                                                                                                                               |
| Parallel operation                  | Up to 10 units per set of CT (to 51st order), any size combination<br>Backward compatibility with Eaton HCUE operated in parallel<br>Contact Eaton for applications of more than 10 units                                                                                                     |
| Parallel operation options          | Master/master Master/slave<br>Multi-master/multi-slave<br>Same as Eaton HCUE for retrofits                                                                                                                                                                                                    |
| Parallel sequence options           | Lead/lag with unit rotation: one unit operates to full capacity before next unit turns on; timed rotation Load share: All operating units function at the same output percentage                                                                                                              |
| Parallel HMI control                | Any unit permits viewing and changing parameter settings of complete system or any other unit in parallel system                                                                                                                                                                              |
| Parallel communications             | Proprietary COM bus between operating units                                                                                                                                                                                                                                                   |
| Power factor correction             | Optimized unity PF, leading (capacitive) or lagging (inductive) power factor (Cos $\phi$ ) to target                                                                                                                                                                                          |
| Control response time               | 25 $\mu$ s                                                                                                                                                                                                                                                                                    |
| Harmonic correction time            | 2 cycles                                                                                                                                                                                                                                                                                      |
| Reactive correction time            | 1/4 cycle                                                                                                                                                                                                                                                                                     |
| Display                             | 144 mm QVGA TFT 64k-color touchscreen                                                                                                                                                                                                                                                         |
| Display parameters                  | Hundreds of parameters are available. Examples include THDi, THDv, oscilloscope for viewing many selected parameters, phasor diagrams, load power, measured currents for $I_h$ , $I_s$ , $I_f$ , $I$ neg seq, PF (Cos $\phi$ ), injected currents for $I_h$ , $I$ reactive, $I$ neg seq, etc. |

| Specification                               | Description                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Technical Specifications (Continued)</b> |                                                                                                                                                                                                                                                                                                                                  |
| Communications capability                   | Modbus RTU, Modbus TCP/IP                                                                                                                                                                                                                                                                                                        |
| Discrete input/outputs                      | 4 input and 4 output dry contacts; assignable                                                                                                                                                                                                                                                                                    |
| Noise level (ISO3746)                       | <70 dB at 1 meter from unit surface                                                                                                                                                                                                                                                                                              |
| Earthing (grounding) systems                | EMC filter ground switch for Isolated Terra, high resistance                                                                                                                                                                                                                                                                     |
| <b>Environmental Condition</b>              |                                                                                                                                                                                                                                                                                                                                  |
| Operating temperature                       | 0 °C to 40 °C                                                                                                                                                                                                                                                                                                                    |
| Relative humidity                           | 0–95%, noncondensing                                                                                                                                                                                                                                                                                                             |
| Seismic rating                              | Complies with IBC and ASCE7                                                                                                                                                                                                                                                                                                      |
| Operating altitude                          | 1000 m, (derate 1%/100 m above), maximum 4800 m                                                                                                                                                                                                                                                                                  |
| Automatic rollback of output                | Occurs whenever heatsink temperature sensor exceeds temperature limit                                                                                                                                                                                                                                                            |
| Ambient temperature protection              | Absolute shutdown if air inlet temperature reaches 51 °C                                                                                                                                                                                                                                                                         |
| Preset output limits (rms)                  | Programmable set limit due to altitude or ambient temperature—becomes fixed output limit                                                                                                                                                                                                                                         |
| <b>Reference Standards</b>                  |                                                                                                                                                                                                                                                                                                                                  |
| Design                                      | CE EMC Certification IEC/EN 60439-1, EN 61000-6-4 Class A, EN 61000-6-2                                                                                                                                                                                                                                                          |
| Protection (enclosure)                      | IP00, IP20, IP31, IP54, NEMA 1, NEMA 2, NEMA 12, UL Type Open (chassis mount)                                                                                                                                                                                                                                                    |
| Standards compliance/certification          | cULus (UL 508, CSA 22.2 No. 14)<br>CE Certified, ABS, Lloyds, other local standards                                                                                                                                                                                                                                              |
| <b>Installation</b>                         |                                                                                                                                                                                                                                                                                                                                  |
| Wall mount                                  | Chassis mount (UL Type open) and NEMA 1 configurations                                                                                                                                                                                                                                                                           |
| Free-standing                               | IP31, IP54, NEMA 2 and NEMA 12                                                                                                                                                                                                                                                                                                   |
| Circuit protection                          | NEMA 1 and chassis mount—external means required<br>Free-standing enclosures—incoming circuit breaker with mechanical door interlock                                                                                                                                                                                             |
| AIC rating (input circuit breaker)          | To 415 Vac—200 kA cULus; 125 kA IEC To 480 Vac—200 kA cULus; 75 kA IEC To 600 Vac—100 kA cULus; 100 kA IEC To 690 Vac—No cULus; 100 kA IEC                                                                                                                                                                                       |
| Cable entry                                 | Wall mount and chassis mount—bottom only<br>Free-standing—top and bottom entry through gland plates                                                                                                                                                                                                                              |
| PCBA protection                             | Conformal coating on all PCBs Pollution Degree 2                                                                                                                                                                                                                                                                                 |
| Cooling configuration                       | Separate air plenums for heatsink section and PCBA section: Heatsink (high heat plenum) input from bottom and exhaust out top.<br>All components in high heat plenum rated IP54 or better $\geq$ no filtering required<br>PCBA air supply must be clean and dry (filtering may be required)<br>No conductive particles permitted |

# 2.2

## SPD, Power Conditioning, PF Capacitors and Harmonic Filters

### Power Factor Correction and Harmonic Filtering

#### Harmonic Correction Unit Ratings

2

| Model         | Voltage (V) | Frequency (Hz) | Total Current Amperes (rms) | Watt Losses (kW) | HCU2 Enclosure Type | Version | Integral Disconnect |
|---------------|-------------|----------------|-----------------------------|------------------|---------------------|---------|---------------------|
| HCU2060D5N1   | 380–480     | 50/60          | 60                          | 1.3              | Wall mount NEMA 1   | UL/CSA  | No                  |
| HCU2120D5N1   | 380–480     | 50/60          | 120                         | 2.8              | Wall mount NEMA 1   | UL/CSA  | No                  |
| HCU2200D5N1   | 380–480     | 50/60          | 200                         | 5.4              | Wall mount NEMA 1   | UL/CSA  | No                  |
| HCU2300D5N1   | 380–480     | 50/60          | 300                         | 7.1              | Wall mount NEMA 1   | UL/CSA  | No                  |
| HCU2060D5IP00 | 380–480     | 50/60          | 60                          | 1.3              | Chassis mount       | UL/CSA  | No                  |
| HCU2120D5IP00 | 380–480     | 50/60          | 120                         | 2.8              | Chassis mount       | UL/CSA  | No                  |
| HCU2200D5IP00 | 380–480     | 50/60          | 200                         | 5.4              | Chassis mount       | UL/CSA  | No                  |
| HCU2300D5IP00 | 380–480     | 50/60          | 300                         | 7.1              | Chassis mount       | UL/CSA  | No                  |
| HCU2060D5IP31 | 380–480     | 50/60          | 60                          | 1.3              | Floor mount IP31    | CE      | Yes                 |
| HCU2120D5IP31 | 380–480     | 50/60          | 120                         | 2.8              | Floor mount IP31    | CE      | Yes                 |
| HCU2200D5IP31 | 380–480     | 50/60          | 200                         | 5.4              | Floor mount IP31    | CE      | Yes                 |
| HCU2300D5IP31 | 380–480     | 50/60          | 300                         | 7.1              | Floor mount IP31    | CE      | Yes                 |
| HCU2060D5N2   | 380–480     | 50/60          | 60                          | 1.3              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2120D5N2   | 380–480     | 50/60          | 120                         | 2.8              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2200D5N2   | 380–480     | 50/60          | 200                         | 5.4              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2300D5N2   | 380–480     | 50/60          | 300                         | 7.1              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2060D5N12  | 380–480     | 50/60          | 60                          | 1.3              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2120D5N12  | 380–480     | 50/60          | 120                         | 2.8              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2200D5N12  | 380–480     | 50/60          | 200                         | 5.4              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2300D5N12  | 380–480     | 50/60          | 300                         | 7.1              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2060D5IP54 | 380–480     | 50/60          | 60                          | 1.3              | Floor mount IP54    | CE      | Yes                 |
| HCU2120D5IP54 | 380–480     | 50/60          | 120                         | 2.8              | Floor mount IP54    | CE      | Yes                 |
| HCU2200D5IP54 | 380–480     | 50/60          | 200                         | 5.4              | Floor mount IP54    | CE      | Yes                 |
| HCU2300D5IP54 | 380–480     | 50/60          | 300                         | 7.1              | Floor mount IP54    | CE      | Yes                 |
| HCU2047D6IP31 | 600         | 50/60          | 47                          | 1.8              | Floor mount IP31    | CE      | Yes                 |
| HCU2094D6IP31 | 600         | 50/60          | 94                          | 3.9              | Floor mount IP31    | CE      | Yes                 |
| HCU2157D6IP31 | 600         | 50/60          | 157                         | 7.2              | Floor mount IP31    | CE      | Yes                 |
| HCU2235D6IP31 | 600         | 50/60          | 235                         | 9.9              | Floor mount IP31    | CE      | Yes                 |
| HCU2047D6N2   | 600         | 50/60          | 47                          | 1.8              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2094D6N2   | 600         | 50/60          | 94                          | 3.9              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2157D6N2   | 600         | 50/60          | 157                         | 7.2              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2235D6N2   | 600         | 50/60          | 235                         | 9.9              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2047D6IP54 | 600         | 50/60          | 47                          | 1.8              | Floor mount IP54    | CE      | Yes                 |
| HCU2094D6IP54 | 600         | 50/60          | 94                          | 3.9              | Floor mount IP54    | CE      | Yes                 |
| HCU2157D6IP54 | 600         | 50/60          | 157                         | 7.2              | Floor mount IP54    | CE      | Yes                 |
| HCU2235D6IP54 | 600         | 50/60          | 235                         | 9.9              | Floor mount IP54    | CE      | Yes                 |
| HCU2047D6N12  | 600         | 50/60          | 47                          | 1.8              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2094D6N12  | 600         | 50/60          | 94                          | 3.9              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2157D6N12  | 600         | 50/60          | 157                         | 7.2              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2235D6N12  | 600         | 50/60          | 235                         | 9.9              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2040D7IP31 | 690         | 50/60          | 40                          | 2.1              | Floor mount IP31    | CE      | Yes                 |
| HCU2080D7IP31 | 690         | 50/60          | 80                          | 4.5              | Floor mount IP31    | CE      | Yes                 |
| HCU2133D7IP31 | 690         | 50/60          | 133                         | 8.2              | Floor mount IP31    | CE      | Yes                 |
| HCU2200D7IP31 | 690         | 50/60          | 200                         | 11.4             | Floor mount IP31    | CE      | Yes                 |
| HCU2040D7N2   | 690         | 50/60          | 40                          | 2.1              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2080D7N2   | 690         | 50/60          | 80                          | 4.5              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2133D7N2   | 690         | 50/60          | 133                         | 8.2              | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2200D7N2   | 690         | 50/60          | 200                         | 11.4             | Floor mount NEMA 2  | UL/CSA  | Yes                 |
| HCU2040D7IP54 | 690         | 50/60          | 40                          | 2.1              | Floor mount IP54    | CE      | Yes                 |
| HCU2080D7IP54 | 690         | 50/60          | 80                          | 4.5              | Floor mount IP54    | CE      | Yes                 |
| HCU2133D7IP54 | 690         | 50/60          | 133                         | 8.2              | Floor mount IP54    | CE      | Yes                 |
| HCU2200D7IP54 | 690         | 50/60          | 200                         | 11.4             | Floor mount IP54    | CE      | Yes                 |
| HCU2040D7N12  | 690         | 50/60          | 40                          | 2.1              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2080D7N12  | 690         | 50/60          | 80                          | 4.5              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2133D7N12  | 690         | 50/60          | 133                         | 8.2              | Floor mount NEMA 12 | UL/CSA  | Yes                 |
| HCU2200D7N12  | 690         | 50/60          | 200                         | 11.4             | Floor mount NEMA 12 | UL/CSA  | Yes                 |

HCU<sub>n</sub> Active Harmonic Filters

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HCU<sub>n</sub> Harmonic Correction Unit

## Product Description

Eaton's HCU<sub>n</sub> is a high-performance active harmonic filtering solution for building and commercial applications. The HCU<sub>n</sub> provides reliability and efficiency for your electrical system as well as prolonged equipment life and increased uptime.

## Application Description

- Airport terminals
- Railway terminals
- Universities
- Hospitals
- Casinos
- Data center SMPS loads
- Commercial space SMPS loads
- LED and CFL loads

## Features, Benefits and Functions

- Employ digital logic and IGBT semiconductors to synthesize a current waveform that is injected into the electrical network to cancel harmonic currents caused by nonlinear loads
- Utilize current transformers to measure the load current to determine the content of harmonic current present
- Mitigate network harmonic currents, thus reducing the heating effects of harmonic current and reducing voltage distortion
- Have the ability to correct for poor displacement power factor (DPF) and for mains current balancing
- NEMA 1 and IP00 enclosure styles are available; chassis mount open chassis designs can be installed in other types of enclosures such as motor control centers
- Can be powered by three-phase conductors to provide corrective current for Line-to-Line connected loads or by three-phase conductors and neutral to provide correction for Line-to-Line and Line-to-Neutral connected loads

## Standards and Certifications

## Design reference

- IEC 62477-1, IEC 61439-1
- EN 61000-6-2, EN 61000-6-4 Class A
- ISO 9001
- IEEE Std 519-2014

## EMC compliance

- EN 61000-6-4 Class A (Emissions)
- EN 61000-6-2 (Immunity)

## Seismic compliance

- IBC 2015
- ICC-ES AC156 (SDS = 2.47 g)

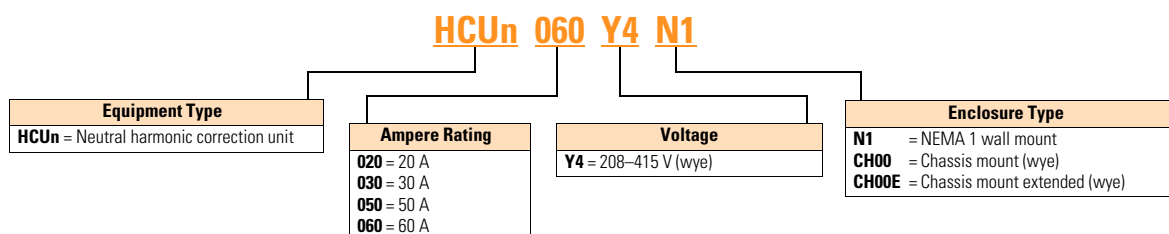
## Product certification

- CE certified
- RCM
- EAC
- RoHS
- IBC
- UL/CSA approved



## Catalog Number Selection

2

HCU<sub>n</sub> Harmonic Correction Unit

## Product Selection

HCU<sub>n</sub> 208–415 V, 50/60 Hz

| Rated Current (A) | Neutral Rated Current (A) | Rated kvar at 415 V | Enclosure Rating | Mounting Type | Unit Type | Cable Entry | Frame | Mass lb (kg) | Catalog Number |
|-------------------|---------------------------|---------------------|------------------|---------------|-----------|-------------|-------|--------------|----------------|
| 20                | 60                        | 14                  | IP00/type OPEN ① | Chassis       | Main      | Bottom      | 12    | 134.48 (61)  | HCUN020Y4CH00  |
| 30                | 90                        | 22                  | IP00/type OPEN ① | Chassis       | Main      | Bottom      | 12    | 134.48 (61)  | HCUN030Y4CH00  |
| 50                | 150                       | 36                  | IP00/type OPEN ① | Chassis       | Main      | Bottom      | 12    | 165.35 (75)  | HCUN050Y4CH00  |
| 60                | 180                       | 43                  | IP00/type OPEN ① | Chassis       | Main      | Bottom      | 12    | 165.35 (75)  | HCUN060Y4CH00  |
| 60                | 180                       | 43                  | IP00/type OPEN ① | Chassis       | Expansion | Bottom      | 12    | 165.35 (75)  | HCUN060Y4CH00E |
| 20                | 60                        | 14                  | UL type 1        | Wallmount     | Main      | Bottom      | 13    | 163.14 (74)  | HCUN020Y4N1    |
| 30                | 90                        | 22                  | UL type 1        | Wallmount     | Main      | Bottom      | 13    | 163.14 (74)  | HCUN030Y4N1    |
| 50                | 150                       | 36                  | UL type 1        | Wallmount     | Main      | Bottom      | 13    | 196.21 (89)  | HCUN050Y4N1    |
| 60                | 180                       | 43                  | UL type 1        | Wallmount     | Main      | Bottom      | 13    | 196.21 (89)  | HCUN060Y4N1    |

**Note**

① UL type OPEN models shall be installed with fuse kit (HCUNFUSKIT230 or HCUNFUSKIT560) on line side to maintain cUL<sub>US</sub> compliance.

**Technical Data**

| Description                                    | Specification                                                                                                                                                                                                                                            |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Electrical Characteristics</b>              |                                                                                                                                                                                                                                                          |
| Standard rms output current ratings            | Chassis: 20 A, 30 A, 50 A, 60 A<br>Wall: 20 A, 30 A, 50 A, 60 A                                                                                                                                                                                          |
| Nominal voltage                                | 208–415 Vac, –15%/+10%                                                                                                                                                                                                                                   |
| Nominal frequency                              | 50/60 Hz, $\pm 3$ Hz auto sensing                                                                                                                                                                                                                        |
| Connection type                                | 3-phase/3-wire or 3-phase/4-wire                                                                                                                                                                                                                         |
| Compensation type                              | 3-phase only or 3-phase + neutral                                                                                                                                                                                                                        |
| Earthing systems                               | TT, TN-C, TN-S, TN-C-S, IT, corner ground, center-tapped delta and HRG                                                                                                                                                                                   |
| Network voltage distortion                     | Maximum 20% phase to phase (up to 30th order)                                                                                                                                                                                                            |
| Voltage notch limits                           | Notch depth: 10%, Notch area (AN): 13,667 V <sub>ps</sub> at 400 V as per IEEE 519-2014, Annex C                                                                                                                                                         |
| <b>Technical Product Characteristics</b>       |                                                                                                                                                                                                                                                          |
| Power electronics                              | 3-level IGBT                                                                                                                                                                                                                                             |
| Topology                                       | Digital harmonic FFT<br>Digital instantaneous reactive power                                                                                                                                                                                             |
| Efficiency and losses                          | 400–415 Vac $\geq 97\%$<br>3-phase compensation: $\leq 20.4$ W/A<br>3-phase + neutral compensation: $\leq 22.6$ W/A                                                                                                                                      |
| Current transformer (CT)                       | Any ratio with 1 A or 5 A secondary; Class 1.0 accuracy;<br>50/60 Hz or 400 Hz rated (instrument rated or better);<br>Grounded; can be shared with other devices                                                                                         |
| CT VA loading                                  | 1 A: 0.04 VA<br>5 A: 1 VA                                                                                                                                                                                                                                |
| Quantity of CT                                 | 2 or 3 CTs for 3-phase loads<br>3 CTs are required for 4-wire with neutral connected loads                                                                                                                                                               |
| CT position                                    | Grid or load sense                                                                                                                                                                                                                                       |
| Control basis                                  | Closed or open loop                                                                                                                                                                                                                                      |
| Spectrum cancellation and selection            | 2nd to 51st harmonic order; discrete, fully selectable adjustable per harmonic order (amplitude % and ON/OFF)                                                                                                                                            |
| Modes of operation                             | Multi-modes simultaneously or discrete<br>- phase harmonic correction<br>- neutral harmonic correction with user-adjustable current limit up to 3 times unit rating<br>- power factor correction (cos w)<br>- mains load balancing                       |
| Operational features                           | % THDi setpoint<br>% THDv setpoint<br>Target PF setpoint                                                                                                                                                                                                 |
| Harmonic attenuation and filtering performance | THDi < 3% in closed loop control; maximum 20:1 THDi typical (reduction with load harmonic above 50% unit rating) requires 3% or higher inductive impedance per nonlinear load                                                                            |
| Power factor correction                        | Optimize PF and target PF (cos w) programmable leading (capacitive) or lagging (inductive)                                                                                                                                                               |
| Load balancing                                 | Negative and zero sequence; selectable individually or simultaneously                                                                                                                                                                                    |
| Resonance avoidance                            | Output at specific harmonic order turned off if resonance or lack of impedance detected or manually turned off                                                                                                                                           |
| <b>Paralleling Characteristics</b>             |                                                                                                                                                                                                                                                          |
| Scalability and expandability                  | Up to 12 units in parallel per set of CT; any size unit combination possible (maximum nth order subject to network characteristics)                                                                                                                      |
| Parallel operation options                     | Primary/secondary, multi-primary, multi-primary/multi-secondary (primaries receive CT connection)<br>Main units (primary capable): 20 A, 30 A, 50 A, 60 A<br>Expansion units (secondary only—no CT connection): 60 A                                     |
| Paralleling architecture                       | Distributed redundancy with no independent controller required                                                                                                                                                                                           |
| Parallel sequence options                      | Load share: all operating units function at the same output percentage<br>Cascade: lead/lag with unit rotation; one unit operates to full capacity before next unit turns on; timed rotation                                                             |
| Unit ID assignment                             | Automatic parallel ID assignment capability or can be set manually                                                                                                                                                                                       |
| Parallel redundancy                            | As long as there is a main (primary capable) unit online, any unit with CT connections will automatically become primary if the controlling primary is taken offline; Automatic increase in output of all units to make up capacity of any offline unit. |
| Parallel HMI control                           | The main unit permits viewing and changing parameter settings of the complete system or any other unit in the parallel system                                                                                                                            |

| Description                                              | Specification                                                                                                                                                                                                                                                                |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Control and Communications</b>                        |                                                                                                                                                                                                                                                                              |
| Parallel communications                                  | Proprietary communication bus between operating units (shielded CAT5e or higher required with RJ-45 connectors)                                                                                                                                                              |
| Control response time                                    | 40–60 ms typical                                                                                                                                                                                                                                                             |
| Harmonic correction time                                 | ≤ 2 cycles                                                                                                                                                                                                                                                                   |
| Reactive correction time                                 | ≤ 1/2 cycle                                                                                                                                                                                                                                                                  |
| Communications protocol                                  | Main units: Modbus RTU and Modbus TCP/IP<br>Expansion units: Modbus RTU                                                                                                                                                                                                      |
| Discrete I/O                                             | 4 inputs, 4 outputs assignable                                                                                                                                                                                                                                               |
| <b>Environmental Conditions</b>                          |                                                                                                                                                                                                                                                                              |
| Operating temperature                                    | 0 °C to +45 °C (full performance, continuous operation without derating)<br>Derate 2% per °C up to +50 °C                                                                                                                                                                    |
| Relative humidity                                        | 0–95%, noncondensing                                                                                                                                                                                                                                                         |
| Operating altitude                                       | 1000 m (full performance, continuous operation)<br>Derate 1% per 100 m above<br>Above 3000 m requires solid ground<br>Absolute maximum altitude: 4800 m                                                                                                                      |
| Ambient temperature safety                               | Automatic temperature roll back based upon IGBT overtemperature<br>Absolute shutdown if air inlet temperature reaches +51 °C                                                                                                                                                 |
| Preset output limits (rms)                               | Programmable set limit due to altitude or ambient temperature—becomes fixed output limit                                                                                                                                                                                     |
| Storage (in original shipping packaging)                 | Temperature: –20 °C to +60 °C, relative humidity: up to 95%, noncondensing, clean, dry and protected<br>No conductive particles permitted                                                                                                                                    |
| Contaminant Levels—operating (IEC 60721-3-3)             | Chemical Class 3C2, Mechanical Class 3S2<br>No conductive particles permitted                                                                                                                                                                                                |
| Contaminant levels—transport and storage (IEC 60721-3-3) | Chemical Class 3C3, Mechanical Class 3S3 (stored in original shipping packaging)<br>No conductive particles permitted                                                                                                                                                        |
| <b>Mechanical and Installation Characteristics</b>       |                                                                                                                                                                                                                                                                              |
| Mounting configuration                                   | Indoor<br>Vertical: chassis and wall mount<br>Floor standing possible using chassis unit                                                                                                                                                                                     |
| Ingress protection                                       | Chassis mount: IP00 / Wall mount: IP20                                                                                                                                                                                                                                       |
| PCBA protection                                          | Conformal coating on all PCBAs / Pollution degree 2                                                                                                                                                                                                                          |
| Incoming circuit protection                              | None—supplied by others external to Eaton HCU unit<br>Recommended earth leakage protection: 500 mA                                                                                                                                                                           |
| Cable entry                                              | Chassis and wall mount: bottom entry                                                                                                                                                                                                                                         |
| Cooling configuration                                    | Variable speed controlled forced ventilation; high heat plenum; air flow: 560 m³/hr<br>Chassis and wall mount: bottom to top<br>No conductive particles permitted, no corrosive gases                                                                                        |
| Noise level                                              | 63 dB(A) typical                                                                                                                                                                                                                                                             |
| Dimensions (H x W x D) mm                                | Chassis and wall mount: 960 x 440 x 265                                                                                                                                                                                                                                      |
| Color and material                                       | Galvanized steel enclosure<br>Powder-coated light grey RAL7035 wall mount door                                                                                                                                                                                               |
| <b>HMI and Service Provisions</b>                        |                                                                                                                                                                                                                                                                              |
| Display                                                  | Magelis STU HMI, high-definition color touchscreen TFT QVGA 64 k                                                                                                                                                                                                             |
| Operator interface                                       | Chassis mount: 144 mm (5.70 in) supplied for remote mounting<br>Expansion units: no HMI required                                                                                                                                                                             |
| User interface options                                   | Plain language, no cryptic code<br>Multiple languages: English, French, Spanish, Portuguese, Chinese and Korean                                                                                                                                                              |
| Service port                                             | 2xUSB port or firmware update, diagnostics file and event log download, connection to PC                                                                                                                                                                                     |
| Commissioning features                                   | On-board step-by-step commissioning protocol via HMI<br>On-board commissioning report for download—no additional software required<br>Automatic CT calibration, polarity detection and correction<br>Phase sequence insusceptible<br>Automatic unit neutral connection check |
| <b>Interoperability and Integration</b>                  |                                                                                                                                                                                                                                                                              |
| Floor-standing enclosures                                | Using chassis module, ensuring air flow requirement is met                                                                                                                                                                                                                   |
| System integration                                       | Suitable for integration in 3rd party EPMS/SCADA through Modbus mapping                                                                                                                                                                                                      |

Dimensions

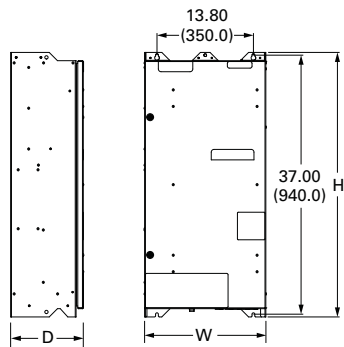
Approximate Dimensions in Inches (mm)

Eaton HCU<sub>n</sub> Unit Dimensions and Installation Guidelines

| Frame Size<br>Figure | Description                                      | Exterior Dimensions in Inches (mm) |               |               |
|----------------------|--------------------------------------------------|------------------------------------|---------------|---------------|
|                      |                                                  | Height                             | Width         | Depth         |
| 12                   | Eaton HCU <sub>n</sub> chassis IP00/UL type OPEN | 37.80 (960.0)                      | 17.32 (440.0) | 10.43 (265.0) |
| 13                   | Eaton HCU <sub>n</sub> wallmount UL type 1       | 56.69 (1440.0)                     | 17.52 (445.0) | 10.43 (265.0) |

**Note:** UL type OPEN dimensions exclude fuse kit.

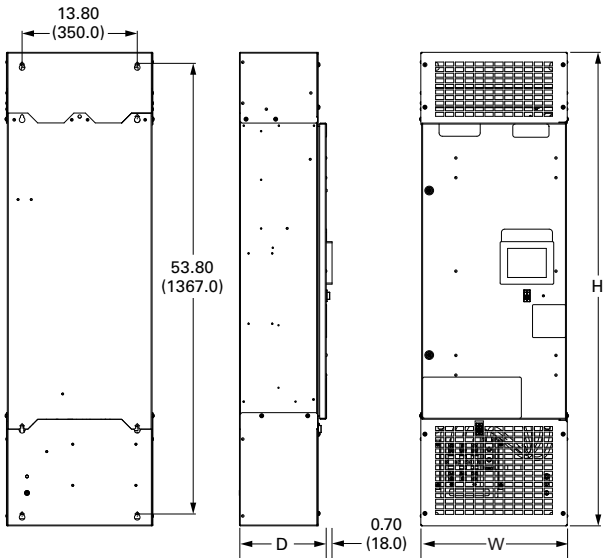
Frame Size 12—Chassis Mount IP00/UL Type OPEN



- HMI only on main unit—supplied loose in the box for mounting remotely
- Expansion unit has the same dimensions as the main unit, except no HMI provided

**Note:** Fuse kit shall be installed on line side to maintain cUL<sub>US</sub> compliance.

Frame Size 13—Wall Mount UL Type 1

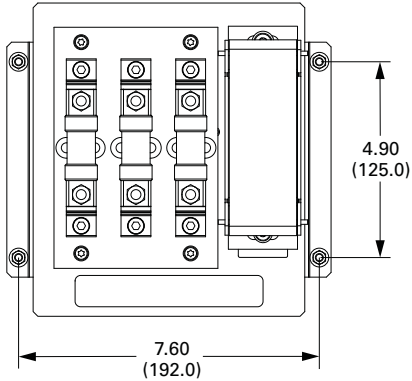


- HMI only on main unit
- Expansion unit has the same dimensions as the main unit, except no HMI provided

**Note:** All dimensions are indicative. Please refer to the dimensions in the Installation manual and engineering drawings for design purposes.

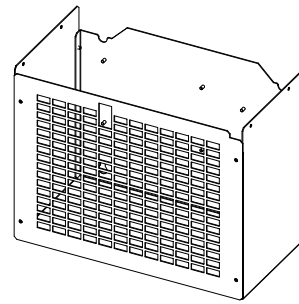
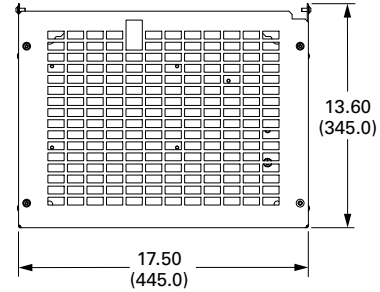
**Accessories**

Approximate Dimensions in Inches (mm)

**2****Fuse Kit**

HCUNFUSKIT230—for 20 A and 30 A chassis models  
 HCUNFUSKIT560—for 50 A and 60 A chassis models

Note: Fuse kit required on line side of chassis  
 IP00 model to maintain  $cUL_{us}$  compliance.

**Terminal Kit**

HCUNBTMKIT01—optional cable termination  
 box for chassis IP00 models

**Note:** All dimensions are indicative. Please refer to the dimensions in the installation manual and engineering drawings for design purposes.