

Whole-House Surge Protection

YES Electric • NEC 2026 with NEC 2023 numbers in parentheses

Draft 1 (October 2026). This chapter is under review. Code numbers are NEC 2026. Your local inspector may use an earlier edition, so ask your journeyman which one applies. Boxes marked "Picture coming" will get drawings and photos in a later version.

YES Electric Residential Course • Phase 1, Install • Read after R1.5

Code edition. This module cites NEC 2026. Where a section moved, the NEC 2023 number is in parentheses. The local inspector (the AHJ) may still enforce an earlier edition, so ask your journeyman which one applies.

What this module covers. R1.5 tells you an SPD is required on every service change and lists it in the material. This module is the SPD job itself: what the device does, which type goes where, how to pick one, how to mount and wire it so it works, how to check it, and what to tell the customer. The commercial course covers short-circuit current ratings in more depth in Module 2.4.

Learning Objectives

When you finish this module you will be able to:

1. Explain in plain words what a surge protective device (SPD) does, and why the NEC requires one on every dwelling service, including replaced service equipment.
2. Tell Type 1, Type 2, and Type 3 SPDs apart and say where each one is allowed to connect.
3. Read an SPD label and data sheet: type, voltage, MCOV, VPR, nominal discharge current (I_n), surge current, and short-circuit current rating (SCCR).
4. Check the SPD's SCCR against the available fault current at the panel.
5. Install a panel-mount SPD with the shortest leads you can make, on the breaker the manufacturer calls for, and check its status lights.
6. Explain to a customer, in two sentences, that an SPD wears out and how they can tell.

Plain-Language Background

What a surge is

A surge (also called a transient) is a voltage spike that lasts a few millionths of a second. It can be thousands of volts on a 120 V circuit. Lightning that hits near the lines causes the biggest ones. Utility switching causes smaller ones more often, and so do motors and other loads

switching inside the house (Domitrovich, "Silencing Surge," IAEI Magazine, January–February 2015, <https://iaeimagazine.org/electrical-fundamentals/silencing-surge/>). Domitrovich describes impulse transients lasting 0.5 to 200 microseconds and oscillatory transients lasting up to one cycle.

A spike that short does not trip a breaker. A breaker reacts to current over time. A surge is over before the breaker's trip mechanism moves. What a surge does is punch through the insulation and the tiny parts on circuit boards. Ranges, refrigerators, washers, HVAC boards, smoke alarms, GFCIs, and garage door openers all have circuit boards now.

What an SPD does

An SPD sits connected between the wires (hot to neutral, hot to ground, neutral to ground, hot to hot). At normal voltage it does nothing and draws almost no current. When the voltage jumps past its clamping level, it turns into a near short for that instant and dumps the surge current into the neutral and ground, which holds the voltage down for everything else on the panel. When the surge passes, it goes back to doing nothing.

The NEC definition says the same thing: an SPD limits transient voltages by diverting or limiting surge current, and it stops the follow current afterward while staying able to do it again (NEC 2026 Art. 100, "Surge-Protective Device").

Most residential SPDs use metal oxide varistors (MOVs). Each surge wears an MOV a little. After enough surges, or one very big one, the MOV is used up. Good SPDs disconnect the worn part internally and turn off a light or sound an alarm so someone knows. That is why the code requires the SPD to show whether it is working (242.9).

Why the code requires one

Since NEC 2020, every service that supplies a dwelling unit must have an SPD (230.67(A)). The rule also covers dormitories, hotel and motel guest rooms, patient sleeping rooms in nursing homes, and sleeping quarters in fire and police stations. When service equipment is replaced, the whole rule applies (230.67(D)), so a YES panel change always includes an SPD.

NEC 2026 has the same requirement for feeders (215.18). If a feeder supplies a dwelling unit, an SPD goes in or next to the panel on that feeder that holds the branch breakers. This matters now that most YES services have an outdoor disconnect and an inside subpanel (R-SERVICE, Procedure 6).

The three types you will see

Type	Where it connects	Typical product	Rule
Type 1	Between the utility transformer secondary and the line side of the service disconnect overcurrent device. Also allowed on the load side.	Meter-base SPD, or a hard-wired SPD on the service lugs	Art. 100 definition; 242.13; 230.82(10)
Type 2	On the load side of the service disconnect overcurrent device, including branch panels	Panel-mount SPD on a two-pole breaker, or a breaker-style SPD	Art. 100 definition; 242.14
Type 3	Point of use, on the load side of a branch-circuit breaker	Plug-in strip, SPD receptacle	Art. 100 definition; 242.16
Type 4	Component inside other equipment	Installed only by the equipment maker	242.18

The service requirement in 230.67(C) and the feeder requirement in 215.18(C) both accept Type 1 or Type 2. A plug strip (Type 3) does not count.

Twitty describes the same three types for inspectors, and notes that Type 3 point-of-use protectors still make sense behind a whole-house SPD (Twitty, "Surge Protection for Smart Homes (and Smart Homeowners)," IAEI Magazine, July–August 2020, <https://iaeimagazine.org/issue/july-august-2020/surge-protection-for-smart-homes-and-smart-homeowners/>).

The words on the label

Term	Meaning	What you want
System voltage	The system it is built for, e.g., 120/240 V single phase	Must match the panel. Siemens warns that a 120 V SPD "will fail instantly" on 240 V (Siemens FirstSurge guide, p. 2).
MCOV (maximum continuous operating voltage)	The highest voltage it can sit on all the time without conducting	At or above the system voltage in every mode. An SPD rated below the phase-to-ground voltage is not allowed (242.12(3)).
VPR (voltage protection rating)	The voltage that gets through during the UL test surge, measured with 6 in. leads	Lower is better. 600 V L-N is common on residential units.
In (nominal discharge current)	A test current the SPD survives 15 times	10 kA or more is required at a dwelling service (230.67(E)) and on a dwelling feeder (215.18(E)).
Maximum surge current (kA)	The biggest single surge the maker says it can take	Marketing number. 50 kA, 80 kA, 140 kA are common.
SCCR (short-circuit current rating)	The most fault current the SPD can safely be exposed to if it fails shorted	At or above the available fault current where it is installed (242.8; 110.10).
Type	1, 2, or 3	1 or 2 at the service
Modes	Which wire pairs it protects	L-N, L-G, N-G, L-L

The 6 in. lead length used in the UL VPR test comes from Mersen's technical note on lead length (Lieland, Surge Protection Note 8: Effects of Wire Lead Length on Voltage Protection Rating, Mersen, https://us.mersen.com/sites/default/files/files_imported_ep/TT-SPN8-Effects-of-Wire-Lead-Length-on-Voltage-Protection-Rating.pdf).

Why lead length matters so much

A surge rises in a few millionths of a second. To a signal that fast, a wire acts like a coil, and every foot of wire adds voltage on top of what the SPD clamps to. Siemens puts a number on it for its FirstSurge units: 1 ft of wire adds 175 V to the clamp voltage during the UL test surge (Siemens FirstSurge data sheet, "Wire Length vs. Response Time and Let-Through Voltage," <https://assets.new.siemens.com/siemens/assets/api/uuid:c739e929-d2e7-44ff-8258-fc55e06b54dc/firstsurge-installation-guide-lp-1414.pdf>). The equipment in the house sees the SPD's clamp voltage plus the voltage across the leads.

Mersen tested this. With straight leads separated by about 1 in., one sample rated 600 V L-N measured 600 V at 6 in. of lead and 1,200 V at 36 in. With the same 36 in. leads twisted together, it measured 700 V (Mersen Note 8, Tables 1 and 3). Twisting the leads lets their magnetic fields cancel, which lowers the inductance.

The NEC turns this into a plain rule: the conductors to the SPD "shall not be any longer than necessary and shall avoid unnecessary bends" (242.24).

Picture coming: Two panels side by side. Left panel, labeled "GOOD": SPD mounted on the panel side right next to a two-pole breaker at the top of the bus, leads about 6 in. long, twisted together, gentle bends, VPR callout "about 600 V." Right panel, labeled "BAD": SPD mounted on the wall 3 ft away, leads coiled up inside the gutter with a loop and two sharp 90° bends, landed on a breaker at the bottom of the panel, VPR callout "about 1,200 V." Small note at the bottom: "Data: Mersen Surge Protection Note 8, Table 1 and Table 3; Siemens: 175 V per foot."

Numbered Step-by-Step Procedures

Procedure 1. Pick the SPD

1. **Decide where it connects.** On a YES service change with an outdoor service disconnect and an inside subpanel, put the SPD at the inside panel where the branch breakers are. That meets the feeder rule (215.18(B)) and, through the 230.67(B) exception for services that supply only feeders, the service rule too. If the panel inside is still the service panel, put it at that panel (230.67(B)).
2. **Pick the type.** For a panel-mount SPD on a breaker, use a Type 2 or a device listed as Type 1 that the maker allows on a breaker. For a connection on the line side of the main, only a Type 1 is allowed (230.82(10); 242.13). A Type 2 may be on the line side only as part of listed equipment with its own overcurrent protection and disconnect (230.82(11)), which you will rarely see on a house.
3. **Match the voltage.** 120/240 V single phase for nearly every house we serve. Read it on the label, not the box.
4. **Check In.** 10 kA or more (230.67(E)).
5. **Check SCCR against the available fault current** (Procedure 2).
6. **Check it is listed.** SPDs must be listed (242.2). Reconditioned SPDs may not be installed (242.3(B)).
7. **Check the indicator.** It must show whether it is working (242.9). Pick a model with lights you can see with the panel cover on.
8. **Read the install sheet before you go to the job.** It tells you the breaker size, wire size, lead treatment, and mounting. Listed equipment has to be installed by its instructions (110.3(B)).

Three models YES may stock, from their manufacturer documents

Item	Siemens FS140 (FirstSurge Pro)	Eaton CHSPT2ULTRA	Square D HEPD80
Type	Type 2	Type 2 (model name; not stated in the bulletin text read)	Not stated in the bulletin text read; read the label
System voltage	120/240 V split phase	120/240 V	120/240 V
Maximum surge current	140,000 A	Not in the bulletin	80 kA
In	Not in the documents read	Not in the bulletin	10 kA
MCOV	150 V L-N, L-G, N-G; 300 V L-L	Not in the bulletin	150 V L-N/L-G; 300 V N-G/L-L
VPR	600 V L-N, L-G, N-G; 900 V L-L	Not in the bulletin	600 V L-N/L-G; 900 V N-G; 1,000 V L-L
SCCR	100 kA	Not in the bulletin	25 kA
Breaker	20 A recommended	2-pole 50 A for full published rating (2-pole 15 A recommended for the MICRO and MAX models)	Two-pole, or two adjacent single-pole, 15, 20, or 30 A maximum; the bulletin also shows a direct-to-bus connection
Leads	#10 AWG, torque 18 in-lb	Cut to 12 in. or less; twist one turn per inch	12 AWG solid, supplied 34 ±1 in.; twist, trim, no loops or coils
Mounting	Chase nipple into a panel knockout preferred	½ in. knockout closest to the breaker; or surface mount with EMT	Knockout closest to the breaker; flush-mount kit HEPD58MKF for flush panels
Indicator	Green phase LEDs, red alarm light, audible alarm	LED; out = replace	Green status LED
Source	Siemens data sheet LP-1408-2 and FirstSurge guide	Eaton IB00414001Y, March 2012	Schneider Electric NVE82551 Rev. 04, 05/2019

Sources: Siemens, <https://assets.new.siemens.com/siemens/assets/api/uuid:3eb4a3de-a6e1-4664-b525-d690178d6e20/firstsurge-datasheet-lp-1408-2.pdf> and <https://assets.new.siemens.com/siemens/assets/api/uuid:c739e929-d2e7-44ff-8258-fc55e06b54dc/firstsurge-installation-guide-lp-1414.pdf>. Eaton, <https://images.thdstatic.com/catalog/pdfImages/d9/d9817dee-4558-4b87-877e-946eee1c6f80.pdf>. Square D, <https://images.thdstatic.com/catalog/pdfImages/a0/a0a5413f-738f-4292-9ae2-a0af36bed5bd.pdf>.

The Siemens guide YES found is the Canadian edition and still refers to "NEC Article 285." NEC 2020 moved the SPD rules from Art. 285 into Art. 242. Use Art. 242.

The three makers recommend breakers from 15 A to 50 A for the same job. Twitty reports that some inspectors refuse a 50 A breaker feeding the #12 leads on some SPDs, even when the maker's sheet calls for it (IAEI Magazine, July–August 2020). The Eaton bulletin explains that the leads carry no load current, only the short surge currents. Before you install a 50 A SPD breaker, ask your journeyman how the local inspector treats it, and have the install sheet on the job.

Procedure 2. Check the SCCR against available fault current

An SPD that fails usually fails shorted. If it is on a point in the system where more fault current is available than its SCCR, it can blow apart before the breaker clears it. The code says an SPD "shall not be installed at a point on the system where the available fault current is in excess of that rating" (242.8).

1. **Look for a field label.** Service equipment at other than dwelling units must be field-marked with the available fault current (110.24(A)). Houses are exempt, so most houses have no label.
2. **Ask the utility.** Call Alabama Power (or the serving utility) through the office and ask for the available fault current at the meter, or for the transformer kVA and impedance (%Z). Utilities publish or provide these values (110.24 Informational Note No. 2).
3. **If you only have the transformer nameplate,** estimate the worst case at the transformer secondary terminals with the point-to-point method (Eaton Bussmann Selecting Protective Devices handbook, Section 4.1.5, p. 4-4,). See Worked Example 2. The real number at the panel will be lower because the service conductors add impedance, so the estimate is on the safe side.
4. **Compare.** SPD SCCR must be equal to or higher than that number. If not, pick a different SPD.
5. **Write the number and its source** in the job notes.

Procedure 3. Install a panel-mount Type 2 SPD on a breaker

This is the job you will do most. The steps follow the three install sheets above and Art. 242. Where your SPD's sheet says something different, follow the sheet (110.3(B)).

Tools and material: the SPD and its install sheet, a two-pole breaker of the size and brand listed for the panel, the knockout punch or screwdriver and hammer, a multimeter rated for the panel, insulated screwdrivers, torque screwdriver, wire strippers, cutters, and a weatherproof fitting if the panel is outdoors.

1. **Read the SPD label and confirm the voltage matches** the panel. Measure L1-N, L2-N, L1-L2 before you shut off. Expect about 120 V, 120 V, 240 V. If anything is off, stop: an SPD on a panel with a bad neutral or a wrong voltage will fail.
2. **Pick the breaker space.** Use the open two-pole space closest to where the SPD will mount and closest to the neutral and ground bars. Twitty notes that some makers want the

SPD on the first space at the top of the bus, nearest the main, and others do not specify (IAEI, July–August 2020). If the sheet does not say, the top space next to the main is a good default because it gives the shortest path.

3. **Pick the knockout** closest to that breaker. Most SPDs mount on the side or the bottom of the can through a ½ in. knockout (Eaton IB00414001Y, Step 6).
4. **Shut off power.** For a panel with a main breaker, turn the main off.

SAFETY: Turning the main off does not de-energize the line side of the main or the service lugs. Those stay live until the utility pulls the meter. Keep your hands and tools away from the main lugs. Verify dead at the branch bus with a meter you tested on a live source first, then test the meter again after. Wear the PPE your journeyman calls for on panel work (commercial Module 2.1 covers PPE and LOTO).

1. **Remove the dead front.** Verify dead at the bus stabs where the breaker will go: each stab to neutral and to ground, and stab to stab.
2. **Mount the SPD.** Remove the locknut from the SPD's nipple, feed the leads through the knockout, put the locknut back on from inside, and tighten. Turn the SPD so the lights face out where they can be seen (Siemens FirstSurge guide, Figure 1).
3. **Plan the lead route.** Lay the leads along the shortest path to the breaker, neutral bar, and ground bar. No loops, no coils, no extra bends (242.24; all three install sheets).
4. **Cut the leads to length.** Cut off every inch you do not need. Eaton recommends 12 in. or less (IB00414001Y). Do not splice leads to make them longer (Twitty, IAEI, July–August 2020).
5. **Twist the leads together**, about one twist per inch (Eaton IB00414001Y), or twist and bundle them as the sheet says (Square D NVE82551).
6. **Strip about ½ in.** of each lead (Eaton IB00414001Y, Step 12). Do not nick the conductor.
7. **Land the leads.**
 - White to the neutral bar.
 - Green to the ground bar.
 - Black and red (or the two blacks) to the two terminals of the two-pole breaker, one wire per terminal. Do not put both on one terminal (Eaton IB00414001Y, Step 15).
 - In a subpanel, the neutral and ground bars are separate. Land each wire on its own bar. In the service panel they are bonded, and both still land as marked.
8. **Torque** the breaker terminals and bar screws to the values on the breaker and panel labels, or the SPD sheet (Siemens lists 18 in-lb for its #10 leads). Use a torque screwdriver (110.14(D)).
9. **Snap the breaker in**, handle off.
10. **Check the panel bonding** before you power up. Siemens says neutral-to-ground bonding that is not per the NEC is the number one cause of SPD failures (Siemens FirstSurge guide, Step 8). In a subpanel, the bonding screw must be out. In a service panel, it must be in.
11. **Put the dead front back**, turn the main on, then turn on the SPD breaker.

12. **Check the lights.** All phase lights should be on. If any is off, shut it off, check every connection, and try again. If it is still off, the unit or the supply has a problem (Siemens guide Step 9; Eaton "Power Up and System Checkout"). If the SPD breaker trips when you turn it on, Eaton says replace the unit (IB00414001Y, Step 19 note).
13. **Label the breaker** "SURGE PROTECTOR" in the directory (408.4).
14. **Photograph the install** with the lights on and the cover on.

SAFETY: Never megger (insulation-resistance or hi-pot test) a panel with an SPD connected. The test voltage destroys it. All three makers say this. Disconnect the SPD leads first, then test, then reconnect.

Picture coming: Inside a 200 A residential load center with the dead front removed: a panel-mount SPD on the left side wall of the can at the top, its nipple through a ½ in. knockout, four leads about 8 in. long twisted together, black and red landed on a two-pole breaker in the top-left space next to the main, white on the neutral bar, green on the ground bar. Callouts: "top space, nearest the main," "leads cut short and twisted," "no loops," "one wire per terminal."

Procedure 4. Install a breaker-style SPD

Some panels take an SPD built into a breaker-sized body, or a two-pole breaker with SPD built in. Twitty describes the version that takes the place of two single-pole breakers and protects two branch circuits plus the panel (IAEI, July–August 2020).

1. Confirm the device is listed for that exact panel brand and series. A Square D QO SPD goes in a QO panel, a Homeline SPD in a Homeline panel, and so on. Mixing brands violates the listing (110.3(B)).
2. Shut off the main, verify dead at the stabs, and snap it in like a breaker in the space the panel label allows.
3. Land the pigtail neutral on the neutral bar and any ground lead on the ground bar, as short as they go.
4. Turn the main on and check the light.
5. Label it.

Procedure 5. Install a Type 1 SPD at the meter base or service lugs

YES does this only when the job calls for it, for example a meter-main combo with an SPD made for that enclosure, or when the customer wants protection ahead of the main.

1. Confirm the device is listed as Type 1. Only a Type 1 may connect on the supply side of the service disconnect (230.82(10); 242.13).
2. Confirm with Alabama Power before you add anything inside a meter socket. The meter socket is sealed and only the company opens it (APC Residential Electric Service and Meter Installation Handbook, §II.F.1 and §II.G.3; see R-SERVICE).

3. At the service, the Type 1 SPD's ground connects to one of these: the grounded service conductor, the grounding electrode conductor, the grounding electrode, or the equipment grounding terminal in the service equipment (242.13(B)).
4. All line-side work is done with the utility's power cut, the same as a service change (R-SERVICE, Procedure 7).

Procedure 6. Check an existing SPD on a service call

1. Look at the lights before you open anything. Write down what each light shows.
2. Compare to the maker's chart. For the Siemens FirstSurge (guide p. 2):

Light 1	Light 2	Red alarm	Audible	Siemens says
Out	Out	Out	Off	Reset breaker; if it opens again, replace unit
Green	Green	Off	Off	No action
Out	Green	Blinks	Sounds	Replace unit
Green	Out	Blinks	Sounds	Replace unit
Green	Green	Blinks	Sounds	Check neutral-to-ground connection before replacing unit

1. For Eaton CHSP: LED on means protection intact. LED out means loss of protection, and the unit must be replaced (Eaton IB00414001Y, "Routine Operation").
2. If the lights are out, check the SPD breaker first. If it is off or tripped, reset it once and watch.
3. If the alarm points at neutral-to-ground, check the bonding in the panel and the service neutral. A loose service neutral can put more than 120 V on one leg and kill an SPD. Kuhlman describes a house that went to 240 V when the neutral was lost: several cheap plug strips melted, and the surge-protector strips did not (Kuhlman, Residential Electrical Troubleshooting, p. 92). R2.5 covers lost-neutral troubleshooting.
4. Write up what you found, with a photo of the lights.

Picture coming: Four small drawings of a panel-mount SPD face showing status-light states, each with a one-line caption: (1) all green, "Working. No action." (2) one green out, red blinking, "One phase lost protection. Replace." (3) all out, "No power to SPD or failed. Check breaker; if it trips again, replace." (4) all green, red blinking, "Check neutral-to-ground bonding first." Caption under the set: "Always check the maker's chart. These are the Siemens FirstSurge states."

Worked Examples

Worked Example 1. How much does lead length cost?

Given. A Siemens FS140 has a VPR of 600 V L-N. Siemens says each foot of lead adds 175 V during the 6 kV/3 kA test surge.

Lead length (total path)	Added voltage	What the house sees, approx.
6 in. (0.5 ft)	$0.5 \times 175 = 88 \text{ V}$	$600 + 88 = 688 \text{ V}$
1 ft	175 V	775 V
2 ft	350 V	950 V
3 ft	525 V	1,125 V

This is a rough rule from one maker. The VPR test itself is run with 6 in. leads, so the first row is close to the label value already. The point holds: 3 ft of loose lead nearly doubles what the house sees. Mersen's measured numbers agree: 600 V at 6 in., 1,200 V at 36 in. for straight separated leads, and 700 V at 36 in. when twisted (Mersen Note 8).

What to do with it: mount the SPD on the panel next to the breaker, cut the leads short, and twist them.

Worked Example 2. Is the SPD's SCCR high enough?

Given. A house on an overhead service from a 50 kVA single-phase pole transformer, 120/240 V. The nameplate is not readable from the ground. The office asked Alabama Power and was told 2.0%Z. The customer wants a Square D HEPD80 (SCCR 25 kA).

Step 1. Transformer full-load amps (Bussmann handbook, Section 4.1.5.1, Step 1, single phase): $\text{FLA} = \text{kVA} \times 1000 \div \text{E(L-L)} = 50 \times 1000 \div 240 = 208 \text{ A}$.

Step 2. Multiplier (Step 2): $100 \div \%Z$. For the worst case, Bussmann says to multiply %Z by 0.9 for the $\pm 10\%$ tolerance on listed transformers (Note 2): $2.0 \times 0.9 = 1.8$. Multiplier = $100 \div 1.8 = 55.6$.

Step 3. Fault current at the transformer terminals (Step 3): $208 \times 55.6 = 11,565 \text{ A}$, about 11.6 kA.

Step 4. Compare. 11.6 kA is less than 25 kA. The HEPD80 is acceptable. The real number at the panel is lower still because of the drop and the service conductors.

Now change the transformer. A new subdivision has a 167 kVA pad-mount transformer, 1.5%Z, and the house is the first one on it.

1. $\text{FLA} = 167,000 \div 240 = 696 \text{ A}$.
2. $\%Z$ worst case = $1.5 \times 0.9 = 1.35$. Multiplier = $100 \div 1.35 = 74.1$.
3. Fault current at the terminals = $696 \times 74.1 = 51,574 \text{ A}$, about 51.6 kA.
4. Compare: 51.6 kA is more than the HEPD80's 25 kA. Unless a full point-to-point calculation down the service conductors shows the panel is under 25 kA, use an SPD with a higher SCCR, such as the Siemens FS140 at 100 kA.

The transformer sizes and impedances in this example are made up for practice. Get the real values from the utility for each job.

Worked Example 3. Where does the SPD go on this job?

Given. A service change. YES installs a meter-main combo outside and converts the old inside panel to a subpanel fed by a four-wire feeder. All branch breakers are inside.

1. The service supplies only one feeder (to the inside panel). The 230.67(B) exception lets the SPD be on the load side of each feeder instead of at the service.
2. The feeder supplies a dwelling unit, so 215.18(A) requires an SPD at the distribution equipment on that feeder that holds the branch breakers (215.18(B)).
3. One Type 2 SPD at the inside panel meets both rules.
4. If the meter-main also feeds a second feeder to a detached shop with its own panel, the 230.67(B) exception needs an SPD at the load side of that feeder too. The shop is not a dwelling unit, so 215.18 does not require one there, but 230.67(B) does if you are using the exception instead of putting the SPD at the service. In that case, the simpler answer is one Type 1 or Type 2 SPD at the meter-main itself, if the maker has one listed for that enclosure.

Worked Example 4. Breaker size

Given. You are installing an Eaton CHSPT2ULTRA. The panel has an open two-pole space at the top.

1. Eaton's Table 1 calls for a 2-pole 50 A breaker for the CHSPT2ULTRA to get its full published ratings.
2. Use a 2-pole 50 A breaker of the panel's brand and type.
3. Keep the install sheet with the permit papers, because some inspectors question a 50 A breaker on small leads (Twitty, IAEI, July–August 2020). The listing instructions are part of the code requirement (110.3(B)).
4. If you were installing a Square D HEPD80 instead, its bulletin caps the breaker at 30 A. Each SPD has its own number. Read the sheet.

The Customer Explanation

The outline asks you to write a two-sentence explanation. Here is a model. Say it in your own words.

"This surge protector sits in your panel and takes the hit when a voltage spike comes in from lightning or the power company, so your appliances and electronics don't. It wears out a little with every spike, so if this green light ever goes out, call us and we'll replace it."

Things not to say:

- Do not promise it stops all damage. A direct lightning strike can beat any SPD.

- Do not say it replaces plug-in surge strips. Point-of-use strips still help for computers and TVs (Twitty, IAEI, July–August 2020).
- Do not quote a warranty from memory. Read the maker's warranty card and leave it with the customer.

Common Mistakes

Mistake	What goes wrong	Rule or source
Long leads coiled in the gutter	Let-through voltage roughly doubles	242.24; Mersen Note 8; Siemens data sheet
SPD on a breaker at the bottom of the panel when the top space is open	Longer path, worse protection	Twitty, IAEI 2020; maker sheets
Splicing leads to reach a far breaker	Adds length and a connection that can fail	Twitty, IAEI 2020
Both hot leads on one breaker terminal	One phase unprotected; double-lugged terminal	Eaton IB00414001Y Step 15; 110.14
Wrong voltage SPD	Fails instantly	Siemens guide; 242.12(3)
SPD SCCR lower than available fault current	Can blow apart on failure	242.8; 110.10
Type 2 on the line side of the main	Not allowed except in listed equipment with OCPD	230.82(11); 242.14(A)
Neutral-ground bond left in a subpanel	SPD failure; shock hazard	Siemens guide Step 8; 250.24(B)
Megger test with the SPD connected	Destroys the SPD	Siemens, Eaton, Square D sheets
No SPD on a panel replacement	Fails inspection	230.67(D)
No SPD at the subpanel after moving the disconnect outside	Fails 215.18	215.18(A), (B)
Lights facing the wall	Nobody ever sees it has failed	Siemens guide Figure 1
Reconditioned SPD	Not allowed	242.3(B)
Plug strip offered as the "whole-house" SPD	Type 3 does not meet the service rule	230.67(C)

Field Exercise (from the outline, written out in full)

You need the training panel from R1.5 (200 A load center on the training wall), one panel-mount Type 2 SPD and its install sheet, a two-pole breaker of the size on that sheet and the panel's brand, the tools from Procedure 3, and a phone camera. A journeyman watches and signs off.

1. Read the SPD's install sheet aloud to the journeyman. Point out the breaker size, the wire size, what it says about lead length, and the light chart.
2. Read the SPD's label. Write down: type, voltage, MCOV, VPR, In, maximum surge current, SCCR.
3. Find the panel's ratings label. Write down its short-circuit rating (often "10,000 A" or "22,000 A RMS symmetrical," shown on the panel label or the main breaker).
4. Find the available fault current. The training panel will not have a field label because dwelling panels are not required to have one (110.24(A)). Use the transformer the journeyman gives you (kVA and %Z) and do Worked Example 2. Write the number.
5. Compare: is the SPD's SCCR equal to or more than the available fault current? Is the panel's rating? Write yes or no for each.
6. With the main off and the bus verified dead, mount the SPD on the side of the can next to the main, through the knockout closest to the top two-pole space.
7. Install the two-pole breaker in the top space next to the main.
8. Route the leads, cut them as short as they can go, and twist them together.
9. Land white on the neutral bar, green on the ground bar, and the two hot leads on the two breaker terminals. Torque to the label.
10. Measure the finished lead length from the SPD body to each termination with a tape. Write the longest one.
11. Have the journeyman energize. Check the lights. Photograph the status lights with the cover on.
12. Turn off the SPD breaker and photograph the lights again. Write what each state means from the maker's chart.
13. Write the two-sentence customer explanation in your own words on the back of the job sheet.
14. Convert: tell the journeyman where the SPD would go if this panel became a subpanel fed from an outdoor meter-main, and name the code section.

Pass: leads are as short as the layout allows and twisted, every terminal is torqued and has one wire, the SCCR check is written and correct, the lights work, and the customer explanation is two clear sentences.

Field photo coming: The trainee's finished training-panel SPD with the dead front on and the green lights lit, a tape measure held along the leads before the cover went on (second photo), and the label ratings readable in a close-up (third photo).

NEC 2026 Cross-References

Section	Topic
Art. 100, "Surge-Protective Device"	Definition and Types 1-4
110.3(B)	Install listed equipment per its instructions
110.10	Equipment ratings coordinated with available fault current
110.14(D)	Terminal torque
110.24(A)	Available fault current field marking; not required for dwelling units
215.18	SPD required on feeders supplying dwelling units; Type 1 or 2; $I_n \geq 10$ kA; applies on replacement
230.67	SPD required at dwelling services; location; Type 1 or 2; replacement; $I_n \geq 10$ kA
230.82(10), (11)	Type 1 allowed on the supply side; Type 2 only as part of listed equipment with OCPD and disconnect
230.94 Exception No. 2	Type 1 SPDs permitted ahead of the service OCPD
242.2	SPDs must be listed
242.3(B)	Reconditioned SPDs not permitted
242.8	SCCR marking; not installed where available fault current exceeds it
242.9	Must indicate it is working
242.12	Uses not permitted, including rating below phase-to-ground voltage
242.13	Type 1 installation and grounding connection at the service
242.14	Type 2 location
242.16	Type 3 location
242.20	Connect to each ungrounded conductor
242.22	Indoors or outdoors; not accessible to unqualified persons unless listed for it
242.24	Leads no longer than necessary; avoid unnecessary bends
242.28	Leads not smaller than 14 AWG copper or 12 AWG aluminum
242.30	Connection between any two conductors; N and G interconnected only during a surge
250.24(B)	No neutral-to-ground connection on the load side of the service
408.4	Circuit directory

End-of-Chapter Checklist

- [] Install sheet read and on the job.
 - [] SPD listed, Type 1 or Type 2, not reconditioned.
 - [] Voltage matches the panel (120/240 V single phase).
 - [] In is 10 kA or more.
 - [] SCCR equal to or above the available fault current; number and source written in the job notes.
 - [] Location correct: at the service panel, or at the panel on the feeder that holds the branch breakers when the disconnect is outside.
 - [] Mounted on the panel next to its breaker; lights facing out.
 - [] Breaker size per the maker's sheet; correct panel brand and type.
 - [] Breaker in the space closest to the SPD and the bars, top of the bus if open.
 - [] Leads cut short, twisted, no loops, no splices, no sharp bends.
 - [] One wire per terminal; white to neutral bar, green to ground bar.
 - [] Every connection torqued to label.
 - [] Panel bonding correct for service panel or subpanel.
 - [] Lights checked and photographed.
 - [] Directory labeled "SURGE PROTECTOR."
 - [] Customer told what the lights mean; warranty card left.
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Sources

- NEC 2026 text: Art. 100 (SPD definition), 110.3, 110.10, 110.24, 215.18, 230.67, 230.82, 230.94, 242.1-242.32, 250.24.
- Siemens, FirstSurge data sheet LP-1408-2 (FS060, FS100, FS140). <https://assets.new.siemens.com/siemens/assets/api/uuid:3eb4a3de-a6e1-4664-b525-d690178d6e20/firstsurge-datasheet-lp-1408-2.pdf>
- Siemens, FirstSurge User Manual, Canada (English), LP-1414. <https://assets.new.siemens.com/siemens/assets/api/uuid:c739e929-d2e7-44ff-8258-fc55e06b54dc/firstsurge-installation-guide-lp-1414.pdf>
- Eaton, Complete Home Surge Protection instruction bulletin IB00414001Y, effective March 2012. <https://images.thdstatic.com/catalog/pdfImages/d9/d9817dee-4558-4b87-877e-946eee1c6f80.pdf>
- Schneider Electric (Square D), SurgeArrest Whole Home Surge Protective Device HEPD50/HEPD80 instruction bulletin NVE82551 Rev. 04, 05/2019. <https://images.thdstatic.com/catalog/pdfImages/a0/a0a5413f-738f-4292-9ae2-a0af36bed5bd.pdf>
- Mike Twitty, "Surge Protection for Smart Homes (and Smart Homeowners)," IAEI Magazine, July-August 2020. <https://iaeimagazine.org/issue/july-august-2020/surge-protection-for-smart-homes-and-smart-homeowners/>

- Thomas A. Domitrovich, "Silencing Surge," IAEI Magazine, January–February 2015. <https://iaeimagazine.org/electrical-fundamentals/silencing-surge/>
 - Jeremy Lieland, Surge Protection Note 8: Effects of Wire Lead Length on Voltage Protection Rating, Mersen. https://us.mersen.com/sites/default/files/files_imported_ep/TT-SPN8-Effects-of-Wire-Lead-Length-on-Voltage-Protection-Rating.pdf
 - Eaton Bussmann, Selecting Protective Devices handbook, Section 4.1.5, point-to-point method, p. 4-4.
 - Kuhlman, Residential Electrical Troubleshooting (2019), p. 92 (melted plug strips after a lost neutral).
 - Commercial Module 2.4 for short-circuit current ratings and fault current in depth.
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Videos to watch

These videos are made by other electricians and companies, not YES Electric. Watch each one after you read the section it goes with. Where a video does something differently from this module, the caution line says so. Follow this module and your journeyman, not the video. Click a title to open it on YouTube.

Section	Video
Background: What an SPD does, the three types, why lead length matters	What Surge Protectors Actually Do (and What They Don't) Electrician U • 19:29 Dustin Stelzer explains that an SPD is not lightning protection, shows panel-mount and breaker-style units, explains Types 1 through 4, and why the leads should never be lengthened. Caution: All the hardware shown is ABB. He says a Type 1 unit can land on line-side lugs; the module allows that only for a listed Type 1 and only with the utility's power cut (Procedure 5).
Procedure 3. Install a panel-mount Type 2 SPD on a breaker	Watch Me Work: Whole-Home Surge Protector Installation Palmer Electrical • 13:15 A licensed electrician installs an Eaton CHSPT2ULTRA on a 150 A panel: moves a breaker to free the top space, turns the main off and meters dead while minding the live main lugs, mounts the SPD in a 1/2 in knockout, twists the hot leads one twist per inch, lands them on a 2-pole 50 A breaker, torques to the labels, and checks both status lights. Caution: He uses almost the full factory lead length because the knockout forced it; the module wants every unneeded inch cut off. He describes dark LEDs as 'discharged'; the module says a dark LED with the breaker on means lost protection and the unit is replaced. The 50 A breaker is Eaton's sheet for that model; other SPDs call for other sizes.
Procedure 4. Install a breaker-style SPD	Installing QO2175SB Surge Protective Device into QO™ Load Center Schneider Electric Schneider Electric • 2:03 Schneider shows the QO2175SB going into a QO panel as close to the main as possible: neutral pigtail landed first, clip on the rail, rock it onto the bus, then check the green light. Caution: The video says to work de-energized but does not show the shutoff or verify-dead steps; follow the module's Procedure 3 steps 4 and 5. Use only in a QO panel; Homeline takes its own SPD.
Procedure 5. Install a Type 1 SPD at the meter base	Meter Base Surge Protection Installation Kenick Inc • 2:28 The maker shows a collar-type Type 1 SPD that plugs into the meter socket between the jaws and the meter: meter pulled, white lead to the neutral, collar in, meter back in, light check, reseal. Caution: Manufacturer product video. YES does not pull Alabama Power meters or open a sealed socket; this is only done with Alabama Power's approval and the utility handling the meter (module Procedure 5 step 2). Watch it to recognize the device on a service call.