

Troubleshooting the Equipment We Install

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.

Phase 2, Troubleshooting and Service Calls.

Before this module: R2.1 (the service call), R2.2 (meters), R2.4 (breakers that trip). Read the install module for each piece of equipment first: R1.8 (smoke and CO alarms), R1.9 (whole-house surge protection), R1.10 (standby and portable generators), R1.11 (EV chargers). This module assumes you know how each one is installed. It teaches what to do when one stops working.

Code edition. Code references are NEC 2026. Where a section moved, the NEC 2023 number is in parentheses. The local inspector (the AHJ) may enforce an earlier edition, so ask your journeyman which one applies before you quote a section to anyone.

Learning Objectives

When you finish this module you will be able to:

1. Work a standby generator that will not start, will not transfer, or transfers and then drops the house. Check the battery, fuel, control fuse, transfer signal, and load shedding in that order.
2. Work an EV charger that shows a fault light, trips its breaker, or charges slowly. Check supply voltage, the ground, the amperage setting, and the car.
3. Read the status lights on a whole-house surge protective device (SPD) and replace a spent unit.
4. Work a smoke alarm that chirps or goes off for no reason. Check the battery, the age, dust, the location, and the interconnect.
5. Know where our job ends and the manufacturer's service network begins.

Background: The Manufacturer Writes the Diagnosis

Earlier Phase 2 modules dealt with plain wiring: receptacles, switches, breakers, and splices. You found faults with a meter and the rules of how current flows. The four pieces of equipment in this module are different. Each one has its own computer board that watches itself and reports problems with lights, beeps, a screen, or an app. The manufacturer decides what those signals mean and prints the meanings in the owner's manual or the installation guide.

That changes how you work a call:

- Read the unit's signal first. A Generac screen that says "OVERCRANK" or a Kidde alarm that chirps three times a minute already tells you which branch of the tree you are on.
- Look up the signal in that model's manual. Codes are not the same between brands, and they change between models of the same brand. The Arc Workforce field guide lists AFCI blink codes for Square D in two places with two different meanings (Arc Guide, Symptom 4 and Part 8). That is why this module only states a code when it was read from the manufacturer's own document, cited below.
- Check our side of the equipment with a meter. Most "equipment" calls turn out to be the supply: a tripped breaker, a loose terminal, a missing ground, a dead battery. That is electrical work, and it is ours.
- Stop at the manufacturer's line. Generac sends engine and control-board problems to an Independent Authorized Service Dealer (IASD) and says warranty repairs on air-cooled units need an IASD with an active Tech ID who is air-cooled certified (Generac Owner's Manual, p. 33). If YES is not set up as one for that brand, the board, the engine, and the warranty claim are not ours to touch. ChargePoint and United Chargers (Grizzl-E) both send unresolved faults to their own support lines.

Each part of this module follows the order Phase 2 uses for every procedure: the symptom, the questions for the customer, the tests in order (meter setting, where the probes go, what each reading means), and the fix.

Picture coming: One-page "who owns what" diagram for the four devices. Four columns: Generator, EV Charger, Surge Protector, Smoke Alarm. Each column has a green zone labeled "YES checks with a meter" (breaker, wiring, terminals, voltage, ground, battery where applicable) and a gray zone labeled "Manufacturer or dealer" (engine, control board, firmware, warranty claim). A red line between the zones is labeled "Stop here, document, call the office."

Part A: Standby Generator

This part uses the Generac air-cooled home standby generator, 10 kW to 26 kW, 60 Hz, with the Evolution 2.0 / Sync 3.0 controller, because that is the most common air-cooled unit in Alabama houses and its manuals are free. If the unit on your call is a different brand or model, get that model's manual before you start. Read R1.10 for how the system is installed.

A1. How the system works when it works

You cannot find what is broken until you know the normal sequence. From the Generac owner's manual (pp. 16 and 20):

1. The generator's controller watches utility voltage on two sensing wires, N1 and N2, which carry 240 V from the utility side of the transfer switch.

2. In AUTO, if utility voltage drops (below 65 percent of nominal) for 5 seconds, the controller starts the engine. The 5-second delay is dealer programmable.
3. The engine cranks in cycles. On 14–26 kW units: 16 seconds cranking, 7 seconds rest, 16 seconds cranking, 7 seconds rest, then three more cycles of 7 seconds cranking and 7 seconds rest. On 10 kW units the first crank is 15 seconds. If the engine has not started after these five attempts, the controller sets an alarm (OVERCRANK).
4. The engine warms up. With Cold Smart Start on, warm-up depends on outdoor temperature.
5. After warm-up, the controller signals the transfer switch to move the house to generator power.
6. When utility voltage comes back above 80 percent of nominal for 15 seconds, the controller transfers the house back to utility.
7. The engine runs a 1-minute cool-down with no load, then stops.

The generator also runs itself once a week, every two weeks, or once a month for 5 minutes. This is called the exercise. During exercise it does not transfer unless the utility drops (Owner's Manual, pp. 16 and 19).

A2. The control wires between the generator and the transfer switch

Generac lists these control connections (Installation Guidelines, p. 29, Table 6-3):

Terminal	Wire color on decal	What it does	What you should read
N1 and N2	Yellow	240 V AC utility sensing for dropout and pickup	About 240 V AC between N1 and N2 with utility on
T1	Blue	Fused 120 V AC for the battery charger. Generac says it must be connected to keep the battery charged whether the unit is running or not.	About 120 V AC from T1 to neutral with utility on
0	Black	DC common (negative)	Reference for DC readings
194	Red	+12 V DC for the transfer controls	About 12 V DC from 194 to 0
23	White	Transfer control signal	Changes state when the controller calls for transfer (do not guess a value; still being checked against the printed code book)

Generac classes all of these as Class 1 remote-control or signaling circuits, rated 300 V minimum, run in a Chapter 3 wiring method. It prohibits low-voltage cable for them (Installation Guidelines, p. 28). If you find thermostat wire or doorbell wire used for these on a job, that is an installation defect. Note it on the job board.

The controller also checks for a wiring mistake. If utility AC voltage shows up on the DC terminal block, it displays a warning and locks out the generator. Power has to be removed from the controller to clear it (Installation Guidelines, p. 35). On the screen this shows as the WIRING ERROR alarm.

A3. Safety before you touch a standby generator

Safety: it starts by itself. A generator in AUTO will crank and run if it senses the utility is gone, including when you open a breaker upstream of the transfer switch. Generac's warning reads: disconnect utility power and render the unit inoperable before working on it (Installation Guidelines, p. 39). Before you put hands inside the generator or the transfer switch:

1. Press OFF on the generator controller.
2. Set the generator's main line circuit breaker (Generac calls it the MLCB or "generator disconnect") to OFF.
3. Remove the 7.5 A fuse from the generator controller. Generac's shutdown steps list this fuse removal (Installation Guidelines, p. 39).
4. Turn off utility power to the transfer switch, using the breaker or disconnect ahead of it.
5. Prove dead with your meter, live-dead-live, at the point where you will work.

Safety: never move the transfer switch by hand under load. Generac's danger label says to disconnect the transfer switch from all power sources before manual transfer (Owner's Manual, p. 19; Installation Guidelines, p. 38). The handle inside the switch moves heavy contacts. Moving it with power on either side can draw an arc.

Safety: the gas is not ours. Fuel line pressure, regulators, and gas piping belong to the plumber or gas fitter. You can check that the shutoff valve at the generator is open. You do not open gas fittings.

A4. Read the controller first

Walk to the generator, open the lid, and read the screen and the LEDs before anything else. Write down exactly what the screen says. The Generac quick reference (Owner's Manual, pp. 34-35) groups alarms by LED color:

LED	Meaning in the manual	Examples
Red	Shutdown alarm. The unit stopped or will not start.	HIGH TEMPERATURE, OVERLOAD REMOVE LOAD, RPM SENSE LOSS, LOW OIL PRESSURE, OVERCRANK, LOW VOLTS REMOVE LOAD, OVERSPEED, UNDERVOLTAGE, UNDERSPEED, STEPPER OVERCURRENT, WIRING ERROR, OVERVOLTAGE
Flashing red	SHUTDOWN SWITCH. An emergency shutdown switch is open.	Set the switch back to closed (I) and clear the alarm.
Yellow	Warning. The unit can still run.	LOW BATTERY, BATTERY PROBLEM, CHARGER WARNING, CHARGER MISSING AC, SERVICE A, SERVICE B, INSPECT BATTERY
Flashing green	Running in AUTO but no power in the house	Check the generator MLCB
None, screen says not activated	NOT ACTIVATED	The unit was never activated at startup

To clear an active alarm on this controller: press OFF, then ENTER, then AUTO. Generac says to contact an air-cooled certified IASD if the alarm comes back (Owner's Manual, p. 34).

Take a photo of the screen before you clear anything. Once you clear it, the alarm text is gone from the home page, and the office and the dealer need it.

Field photo coming: Close-up of a Generac Evolution controller screen showing an active "OVERCRANK" alarm with the red LED lit. The OFF, AUTO, MANUAL, and ENTER buttons are visible below the screen.

A5. Symptom: the generator did not start when the power went out

Questions for the customer

1. "When did the power go out, and how long was it out?" An outage shorter than the start delay (5 seconds by default) never starts the generator. The controller also cancels a transfer if the utility comes back during warm-up (Owner's Manual, p. 20).
2. "Does it run on its own once a week for a few minutes?" If yes, the engine and battery worked at the last exercise.
3. "Has anyone worked on the gas, the generator, or the panel lately? Has the gas been shut off?"
4. "Did you see any lights on the generator? What color?"
5. "Has it ever worked since it was installed?" A unit that never transferred points to an installation or activation problem.

Tests, in order

#	Test	How	Reading and meaning
1	Controller screen and LED	Look	Red OVERCRANK: engine cranked five cycles and did not start. Red LOW OIL PRESSURE: check oil. Red RPM SENSE LOSS while trying to start: Generac says check the battery. Screen says NOT ACTIVATED: activation was never done. No screen at all: no 12 V DC to the controller (go to Test 3).
2	Mode	Look at which mode is lit	Unit must be in AUTO to start on its own. OFF means it will never start. A customer or another tech may have left it OFF.
3	7.5 A controller fuse	Generator OFF. Pull the fuse. Meter on ohms or continuity. Probes on both ends of the fuse.	Near 0 ohms (beep): fuse good. OL: fuse blown. Generac's table says a blown fuse means a short; replace it and contact an IASD if it blows again (Owner's Manual, p. 32).
4	Battery condition on the controller	MAIN MENU, then the BATTERY menu	"GOOD" or "CHECK BATTERY." Generac says replace the battery if it shows CHECK BATTERY (Owner's Manual, p. 34).
5	Battery terminals	Generator OFF, fuse out. Look and wiggle.	Loose, corroded, or damaged cables are on Generac's list for "engine will not crank" (Owner's Manual, p. 32). Clean and tighten.
6	Battery voltage	Meter on DC volts. Red probe on battery positive post, black on negative post, not on the cable clamps.	Compare to the battery maker's state-of-charge chart. A reading that drops sharply when the engine tries to crank points to a weak battery. Generac's battery spec is 12 V, Group 26R wet cell 540 CCA minimum, or Group 35 AGM 650 CCA minimum (Owner's Manual, p. 10).
7	Charger supply (T1)	Utility on. Meter on AC volts. Probes from T1 to neutral at the generator terminal block.	About 120 V: charger is getting power. 0 V: the T1 fuse or circuit in the transfer switch is open, which leaves the battery to run down. A yellow CHARGER MISSING AC alarm is the same problem shown on the screen (Owner's Manual, p. 35).
8	Fuel valve	Look at the shutoff valve on the gas line at the generator	Valve must be ON. Generac's first action for OVERCRANK is to verify the fuel line shutoff valve is on (Owner's Manual, p. 34).
9	Manual start	Clear the alarm. Press MANUAL.	Starts and runs smooth: the engine is fine, look at sensing and transfer (A6). Cranks and will not start, or runs rough: Generac says contact an IASD (Owner's Manual, p. 34). Does not crank at all: battery, cables, or starter (Owner's Manual, p. 32).

The fix

- Unit left in OFF: put it in AUTO, explain to the customer what the three buttons do, and leave the startup sheet.

- Blown 7.5 A fuse: replace with the same fuse (Generac part number on Owner's Manual, p. 11). If it blows again, stop. That is a short in the controller or its wiring and goes to the IASD.
- Bad battery or cables: replace with the battery type in the manual, clean and tighten the cables, and fix the T1 supply if it was the reason the battery ran down. Generac says not to use an external battery charger (Owner's Manual, p. 11).
- Fuel valve closed: open it and tell the customer and the office who closed it, if known. If the gas was shut off by the utility or a plumber, the gas side has to be restored and checked by them first.
- Not activated: activation is a one-time process in the Generac installation guide. Hand it to your journeyman.
- Cranks but will not start with fuel on and battery good: IASD. Document and stop.

Generac also notes that during the very first startup the unit may set OVERCRANK because air has accumulated in the fuel system (Installation Guidelines, p. 35). That applies only to a new installation.

A6. Symptom: the generator runs, but the house stays dark

Questions for the customer

1. "Did you hear the generator running during the outage?"
2. "Did any lights come on at all? Which ones?"
3. "Has anyone opened the gray box (the transfer switch) or the generator breaker?"

Tests, in order

#	Test	How	Reading and meaning
1	LED	Look	Flashing green with no power in the house: Generac's first check is the generator MLCB (Owner's Manual, p. 34).
2	Generator MLCB	Look at the breaker on the generator	OFF (open): set to ON (closed). This is the most common cause in Generac's table for "no AC output" and "no transfer to standby" (Owner's Manual, pp. 32-33).
3	Warm-up	Read the screen	Engine may still be warming up. Wait for the warm-up timer (Owner's Manual, p. 33).
4	Generator output	Utility off at the transfer switch, transfer switch on UTILITY, generator in MANUAL and warmed up, MLCB ON. Meter on AC volts. Probes on E1 to E2 at the transfer switch. Then E1 to neutral and E2 to neutral.	Generac's no-load target is 238-242 V at 59.5-60.5 Hz (Installation Guidelines, p. 38). About 120 V on each leg to neutral. 0 V: no output reaching the switch. Check the MLCB and the conductors. Correct voltage present but no transfer: transfer switch or transfer signal.
5	Transfer control 12 V	Meter on DC volts. Probes on 194 (red probe) and 0 (black probe) at the transfer switch terminal block.	About 12 V DC: the transfer controls have power. 0 V: open wire or connection between the generator and switch on 194 or 0.
6	Wiring error alarm	Read the screen	WIRING ERROR: Generac says contact an IASD (Owner's Manual, p. 35). Look for AC landed on a DC terminal.

The fix

- MLCB off: turn it on, then run the automatic-operation check from the installation guide with your journeyman: utility on, MLCB on, AUTO, then open the utility supply to the transfer switch and watch it start, warm up, and transfer.
- Loose or broken control wire: repair it in the same wiring method, then run the check.
- Generator output correct, 12 V present, and still no transfer: Generac's list for this is a faulty transfer switch coil, transfer relay, open transfer relay circuit, or control board (Owner's Manual, p. 33). That goes to the IASD.

A7. Symptom: it transfers, then shuts down or drops the house

Questions for the customer

1. "What was running when it shut off? The AC? The range? The dryer? The well pump?"
2. "How long did it run before it shut down?"
3. "Did the lights dim and the AC come back on later by itself?" That is a load-management module doing its job.

Tests, in order

#	Test	How	Reading and meaning
1	Alarm	Read screen and LED	OVERLOAD REMOVE LOAD or LOW VOLTS REMOVE LOAD: too much load on the generator. Generac's action is to clear the alarm, remove household loads, and restart in AUTO (Owner's Manual, p. 34). HIGH TEMPERATURE: check for anything blocking airflow around the intake, exhaust, and rear of the unit (Owner's Manual, p. 34). RPM SENSE LOSS after running: remove loads and restart.
2	Load on the generator	With the house on generator power, clamp meter on E1, then E2, at the transfer switch.	Compare to the generator's rated amperage on its nameplate. Amps near or above rating with the big loads running means an overload.
3	Load management	Find the Smart Management Modules (SMMs) or the transfer switch's load-shed contacts. Note which loads they control.	Generac describes SMMs as modules that manage large loads at startup and shed them to help the generator recover when overloaded (Owner's Manual, p. 12). A large load on the generator that is not on an SMM, such as a range or a second AC, can overload a smaller generator.
4	Airflow	Look	Leaves, mulch, a fence, shrubs, or a stored item against the unit.

The fix

- Overload: clear the alarm, restart, and run the house with fewer big loads at once. Write up which large loads are not under load management. Adding SMMs or changing what the generator covers is a new scope for the office (R3.2).
- High temperature: clear the airflow obstruction, clear the alarm, and test run. If it comes back with clear airflow, IASD.
- Repeated RPM SENSE LOSS, UNDERSPEED, OVERSPEED, UNDERVOLTAGE, OVERVOLTAGE, or STEPPER OVERCURRENT: Generac says contact an IASD (Owner's Manual, pp. 34–35). Document and stop.

A8. Yellow warnings: the customer says "there's a yellow light"

Yellow warnings do not stop the generator, but each one means something needs attention.

Warning	Generac's action (Owner's Manual, p. 35)	What we do
LOW BATTERY	Clear the alarm, check the BATTERY menu. GOOD: contact IASD. CHECK BATTERY: replace battery.	Check terminals, check T1 supply, replace battery if needed
BATTERY PROBLEM	Contact an IASD	Document
CHARGER WARNING	Contact an IASD	Check T1 supply first, then document
CHARGER MISSING AC	Contact an IASD	Check T1 voltage. 0 V means the T1 fuse or circuit is open, which we can trace and fix.
SERVICE A, SERVICE B	Perform the scheduled maintenance and press ENTER to clear	Maintenance belongs to whoever has the maintenance agreement. Tell the office.
INSPECT BATTERY	Inspect the battery and press ENTER	Look at terminals and case, clean, clear

Picture coming: Generator no-start and no-transfer trees on one page. Left tree "Did not start": controller screen → mode (AUTO?) → 7.5 A fuse → battery menu and terminals → T1 120 V → fuel valve → MANUAL start → IASD. Right tree "Runs, house dark": flashing green LED → MLCB ON? → warm-up done? → E1-E2 238-242 V, 59.5-60.5 Hz → 194 to 0 about 12 V DC → IASD. A bottom box "Transfers then drops": alarm text → clamp E1/E2 vs nameplate → SMM coverage → airflow.

Part B: EV Charger

This part uses two common home Level 2 chargers as examples: the ChargePoint Home Flex (CPH50) and the Grizzl-E Classic. Use the manual for the brand on the wall. R1.11 covers sizing and installation.

B1. What the charger does and what the car does

A Level 2 charger is a smart switch with protection built in. It does not charge the battery itself. The car has an on-board charger that does that. The wall unit checks the supply, tells the car how much current it may draw, closes its relay, and watches for ground faults while the car charges. Both manuals say the unit has its own ground-fault protection: ChargePoint calls it charging circuit interrupting device (CCID) protection (Home Flex Installation Guide, p. 10), and the Grizzl-E manual says it has built-in GFCI protection (Grizzl-E Classic User Manual, rev. 3.5, sec. 2.2).

This means a "charger problem" can be in four places: the supply circuit (ours), the charger, the app settings, or the car.

B2. Supply facts you need from the manuals

Item	ChargePoint Home Flex	Grizzl-E Classic
Continuous load	Yes. "The circuit must be rated for 125% of the maximum load" (Installation Guide, p. 9).	Output settings are tied to dedicated circuit ratings (sec. 2.1).
Output vs circuit	16 A on 20 A, 24 A on 30 A, 32 A on 40 A, 40 A on 50 A, 48 A on 60 A, 50 A on 70 A or 80 A (pp. 9–10)	16 A on 20 A, 24 A on 30 A, 32 A on 40 A, 40 A on 50 A (sec. 2.1)
Plug-in allowed	40 A and 50 A circuits (NEMA 14-50 or 6-50). 60 A and up hardwired only (pp. 9–10).	NEMA 6-50 or 14-50, or hardwired (sec. 2.1)
How output is set	In the app at activation. Not activated: limited to 16 A (p. 17).	DIP switches inside the unit. Factory default 40 A (sec. 3).
Supply voltage	240 V dedicated circuit, two-pole breaker (p. 10)	208 V single phase or 240 V split phase, two-pole breaker (sec. 2.1)
GFCI breaker in panel	Not recommended. If code requires GFCI for a plug-in install, ChargePoint recommends hardwiring instead, because a GFCI breaker can cause nuisance tripping (p. 10).	Additional downstream GFCI not needed. Where code requires GFCI at the outlet, the manual says use a 20 mA GFCI breaker and that a 5 mA breaker may disrupt the charger (sec. 2.2). This is still being checked against the printed code book.

B3. Code you need for the GFCI question

NEC 625.54 requires GFCI protection for personnel on all receptacles installed for electric vehicle charging. NEC 210.8(A) also lists garages and outdoors for dwelling receptacles. So a charger plugged into a 14-50 or 6-50 receptacle needs a GFCI ahead of it, and that GFCI plus the charger's own ground-fault protection is the setup both manufacturers warn about. A hardwired charger has no receptacle, so 625.54 does not apply to it. NEC 625.40 requires an individual branch circuit for each outlet supplying EVSE rated more than 16 A or 120 V. NEC 625.41 makes EVSE a continuous load.

B4. Safety before you open a charger

Safety: 240 V and stored energy. Turn off the charger's two-pole breaker. Unplug the car first if it is connected. Prove dead at the charger's field terminals with your meter, L1 to L2, L1 to ground, and L2 to ground, live-dead-live. For a plug-in unit, unplug the charger from the receptacle and test the receptacle.

B5. Symptom: fault light on the charger

Questions for the customer

1. "What color is the light, and is it steady or flashing? How many flashes?" On a Grizzl-E, the number of red flashes is the code.
2. "Does it happen with every car, or one car?"
3. "Does it happen right when you plug in, or partway through charging?"
4. "Has it ever charged correctly? Since when has it acted up?"
5. "Has anyone worked on the panel or the garage wiring? Did the power go out recently?"

Grizzl-E Classic fault codes (User Manual rev. 3.5, sec. 7.2)

Red flashes	Error description in the manual	Where to look first
1	Lost ground – AC Line1	The equipment grounding conductor in the supply circuit (Test 3 below)
2	GFCI High Leakage	Ground fault in the cable, connector, or car; moisture
3	Relay is stuck	Charger internal; manufacturer
4	GFCI Low Leakage	Ground fault, moisture, or a GFCI conflict
5	High temperature of the module	Heat, sun, ventilation; a loose terminal heating up
6	High temperature of the relay	Same as 5
7	Pilot state is Status E	Communication between charger and car (try another car or the car's manual)
8	Pilot state is Status F	Same as 7
9	Diode error	Communication between charger and car
10	Over Current	Car drawing more than the setting
12	Application Error	Charger firmware; manufacturer

The Grizzl-E manual says the unit restarts by itself within 60 seconds when a temporary error clears. If the error happens within 5 seconds of the start of a session, it becomes a permanent fault. The reset for a permanent fault is: count the flashes, unplug the car, turn the breaker off, wait 1–2 minutes, turn it back on, and confirm the fault light is gone. If it stays, contact United Chargers with the number of flashes (sec. 7.3–7.4).

ChargePoint Home Flex. ChargePoint's troubleshooting page says a red round status light means a fault was detected and the car will not charge. Its steps, stopping when the fault clears, are: unplug and replug the connector; in the app, Home Charging, Settings, Restore to Factory Default; turn the charger's breaker off and on; then call ChargePoint (chargepoint.com, Home

Flex Troubleshooting). After a correct install, the front status light glows yellow, then blinks white (Installation Guide, p. 17).

Tests, in order

#	Test	Meter setting and probes	Reading and meaning
1	Breaker	Look	Tripped: go to B6. On: continue.
2	Supply voltage at the charger or receptacle	Breaker ON. Meter on AC volts. For a 14-50: probes in the two straight hot slots (L1-L2), then each hot to the round ground, then neutral to ground. For a hardwired unit: at the field terminals, L1-L2, L1-G, L2-G.	L1-L2 about 240 V on a split-phase house (or about 208 V on a 208 V system). Each hot to ground about 120 V. Neutral to ground near 0 V. A hot to ground of 0 V with L1-L2 normal means the ground is open. One hot reading 0 V to ground and 120 V on the other means one leg is dead: check the two-pole breaker and its terminals.
3	Ground continuity	Breaker OFF, proven dead. Meter on ohms. One probe on the charger's ground terminal (or the receptacle ground), one on the panel's ground bar or the breaker's grounding conductor at the panel. A long test lead may be needed.	Near 0 ohms: ground is continuous. OL or high resistance: open or loose ground. This is the first check for Grizzl-E code 1, "Lost ground."
4	Terminal condition	Breaker OFF. Look at breaker terminals, receptacle terminals, and charger field terminals for discoloration. Torque to the label (110.14(D)).	A discolored terminal on a 40 A or 48 A continuous load is a heat problem waiting to fail. R2.7 covers heat.
5	Current while charging	Car charging. Clamp meter around one hot conductor at the panel.	Compare to the charger's setting. Over the setting: Grizzl-E code 10 or ChargePoint over-current, which both manuals point back to the car.
6	Second car	If the customer or a neighbor has another EV, try it	Fault follows one car: the car. Fault happens with every car: the charger or the supply.

The fix

- Open or loose ground: find and repair it. A charger with no equipment ground is a shock hazard. Both manuals require it to be grounded (ChargePoint Installation Guide, p. 2; Grizzl-E sec. 2.3).
- Loose or heat-damaged terminal: replace the damaged part (receptacle, breaker, or lug), cut back to clean conductor, and torque to the label.
- Dead leg: replace the two-pole breaker if it is not passing voltage on one pole, or fix the terminal.

- Supply is good and the fault stays: run the manufacturer's reset. If it stays, the customer or the office contacts the manufacturer with the code. Do not open the charger's sealed electronics.

B6. Symptom: the charger's breaker trips

Questions: "Does it trip the moment the car plugs in, after a while, or only when it rains?" "Is the breaker a GFCI breaker (has a TEST button)?"

Tests

1. Look at the breaker. If it is a GFCI breaker feeding a 14-50 or 6-50 receptacle, this is the setup both manufacturers warn about (B2). Note the manufacturer's position and the 625.54 requirement.
2. If it is a standard breaker and trips after a while: clamp the current while charging (B5, Test 5). Compare to the breaker and the charger's setting. A charger set to 48 A on a 50 A breaker is set wrong. ChargePoint pairs 48 A with a 60 A circuit (Installation Guide, p. 10).
3. If it trips instantly: breaker OFF, proven dead, charger disconnected. Meter on ohms. Test each conductor to each other and to ground at the panel end. Near 0 ohms between any two: a short in the circuit. Work it like R2.4.
4. If it trips when wet: look for water in the receptacle box, the conduit, or the charger's entry. Outdoor installs need wet-location rated covers (406.9).

Fix: correct the charger's output setting to match the breaker and wire; repair the short; seal the water entry. If the GFCI breaker and the charger keep fighting each other, the change to a hardwired install is a scope for the office (R3.1). Do not remove the GFCI from a receptacle circuit to stop the trips. That breaks 625.54.

B7. Symptom: the car charges slowly

Questions: "How many miles per hour of charge does the car or app show?" "Is this new, or has it always been slow?" "Did the charger lose power or get reset?"

Tests

1. ChargePoint: check the app. A Home Flex that was never activated, or lost its setting, defaults to 16 A (Installation Guide, p. 17; ChargePoint troubleshooting page). The breaker amperage setting lives in Home Charger, Settings, Breaker Amperage.
2. Grizzl-E: breaker OFF, proven dead. Open the unit per the manual and read the DIP switches against the table in sec. 3. Example from the manual: 40 A is switches 1, 2, 3 UP and 4 DOWN.
3. Clamp one hot while charging. The current should be near the setting. Low current with the right setting: the car is limiting itself. Check the car's own charge-current setting in its screen or app.
4. Read L1-L2 under charge. About 208 V instead of 240 V means a 208 V supply, which charges about 13 percent slower at the same current ($208 \div 240 = 0.87$).

5. Check the labels. ChargePoint requires amperage labels on the bottom of the charger and at the breaker (Installation Guide, p. 17). Missing labels are why customers set the wrong amperage.

Fix: set the output to match the breaker and wire (never higher), relabel, and show the customer where the setting lives. If the car is limiting current, the customer works with the car maker.

Picture coming: EV charger fault-light decoder card for the two example brands. Left half: Grizzl-E Classic, a drawing of the unit with a red LED and a table of flash counts 1 through 12 with the manual's descriptions and a "where to look" column. Right half: ChargePoint Home Flex with the round LED ring shown in three states (yellow then blinking white at startup, green ready, red fault) and the three reset steps listed. Footer: "Codes from the manufacturer's own manual. Other brands: look up the manual."

Part C: Whole-House Surge Protective Device (SPD)

R1.9 covers SPD types and installation. NEC 230.67 requires an SPD on every dwelling service, and NEC 242.9 requires an SPD to "provide indication that it is functioning properly." That indication is the light (and on some models, a beeper) you read on a service call.

C1. What the lights mean

Brand and model	Normal	Needs replacement	Other
Eaton CHSPT2MICRO, CHSPT2MAX, CHSPT2ULTRA (Instruction Bulletin IB00414001Y)	LED lit. "With all phase voltages present, the LED indicator reports the status of the protection elements and is active when all of them are intact."	LED off. "Any loss of protection is signaled when the LED extinguishes." "If the unit fails, as evidenced by the LED turning OFF, the unit must be replaced."	If the 2-pole breaker feeding it trips, Eaton says replace the unit. Not repairable.
Siemens FirstSurge FS60, FS100, FS140 (Siemens product flyer RPFL- FSTSU-0515)	Green LEDs lit, no alarm, no red light	Beeper sounds, green LEDs go out, red service light flashes	Ground Reference Monitoring: beeper sounds, green LEDs stay lit, red light flashes. Siemens says this means a compromised neutral-to-ground bond. There is no test or silence switch; de-energizing the SPD silences it.

Eaton specifies a dedicated 2-pole breaker: 15 A for the CHSPT2MICRO and CHSPT2MAX and 50 A for the CHSPT2ULTRA to reach its full published ratings (IB00414001Y, Table 1). Siemens recommends a 20 A breaker for FirstSurge (flyer). Use the size in the instructions for the unit you are working on.

C2. Symptom: SPD light is out, or the SPD is beeping

Questions for the customer

1. "When did you notice it? Was there a storm or a power outage around then?"
2. "Did anything else in the house die at the same time: a TV, a garage door opener, a furnace board?"
3. "Has anyone worked on the panel?"
4. For a beeping Siemens: "Are lights in the house getting brighter and dimmer?"

Tests, in order

#	Test	How	Reading and meaning
1	SPD breaker	Look	Tripped: Eaton says replace the unit. Do not reset it into a failed SPD more than once. Off for another reason: turn on and watch the LED.
2	Voltage at the SPD breaker	Dead front off with your journeyman's OK, PPE per R1.1. Meter on AC volts. Probes on the two SPD breaker terminals (L1-L2), then each terminal to the neutral bar.	About 240 V and about 120 V and 120 V: the SPD is getting power. If the LED is out with normal voltage, the protection elements are spent (Eaton) or the unit has failed.
3	Siemens beeper pattern	Look at green LEDs and red light	Green out + red flashing + beep: replace. Green on + red flashing + beep: Ground Reference Monitoring. Go to Test 4.
4	Neutral-to-ground check	At a receptacle near the panel, meter on AC volts, neutral (tall slot) to ground (round hole). At the panel, read L1-N and L2-N.	In a main panel, neutral and ground are bonded, so N-G at a nearby receptacle should be near 0 V at rest. One leg high and one low is the lost-neutral pattern (R2.5). Look for a missing or loose main bonding jumper, or a subpanel with neutrals and grounds bonded where they should be separate.
5	Lead and terminal condition	Breaker off, proven dead	Burned or melted SPD leads or a scorched breaker terminal.

The fix: replacing a spent SPD

1. Get the office's OK and the replacement unit. Replacing a spent SPD is a repair the office prices. You do not quote it.
2. Turn off the main breaker. Remember the line side of the main stays live (R2.1, Part E). Prove dead at the SPD breaker, live-dead-live.
3. Disconnect the old SPD leads from the breaker, neutral bar, and ground bar. Remove the unit.

4. Mount the new unit in the same spot or closer. Siemens and Eaton both say leads must be as short and straight as possible. Eaton says to twist and bind the leads together (IB00414001Y). Siemens says to use a breaker position close to the SPD and the panel's neutral and ground (flyer).
5. Land the leads: on the Eaton, black and red to the two terminals of the 2-pole breaker (never both on one terminal), white to neutral bar, green to ground bar (IB00414001Y, step 15). Torque to the label (110.14(D)).
6. Before energizing a Siemens, Siemens says confirm the system is bonded per the NEC and clear of faults. It names incorrect neutral-to-ground bonding as the top cause of SPD failures (flyer).
7. Restore power. Turn on the SPD breaker. Confirm the LED or LEDs light. If not: power off, check connections, test again, then call the manufacturer's support line printed in the instructions.
8. Fill in the job board with photos of the lit LEDs.

Also check what else the surge may have taken out. Eaton's and Siemens's literature mention connected-equipment warranties; the customer or the office handles any claim with the manufacturer.

Picture coming: SPD status-light states for the two example brands, drawn as four small panels: Eaton with LED lit ("protected") and LED dark ("replace"); Siemens with green lit and no red ("protected"), green dark plus red flashing plus a speaker icon ("replace"), and green lit plus red flashing plus speaker icon ("check neutral-to-ground bond").

Part D: Smoke and CO Alarms

R1.8 covers placement and installation. This part uses two common 120 V interconnected alarms with battery backup: the Kidde 20SAR (photoelectric, hardwire interconnect, AA backup) and the First Alert/BRK 9120B (ionization, 9 V backup). Chirp patterns differ between brands and models, so always read the back of the alarm for the model number and use that model's guide.

D1. Chirp and light decoder from the manuals

Kidde 20SAR (User Guide P/N G-000009-00 Rev. A, Sections 3 and 4)

Condition	Light	Sound	Kidde's action
Normal on AC power	Green LED steady	None	—
Normal on battery only	Green LED blinks about every 60 s	None	—
False low battery (AC connected before battery tab pulled)	None	Chirp every 60 s	Pull the battery pull tab
Low battery	Amber LED blinks every 60 s	Chirp every 60 s	Replace batteries. Button silences 24 hr. After 7 days it cannot be silenced.
Smoke sensor fault	Amber LED blinks every 60 s	3 chirps every 60 s	Clean the alarm, press button to reset, replace if it continues
Fatal fault	Amber LED blinks 3 times every 60 s	3 chirps every 60 s	Press button to reset, replace if it continues
End of unit life	Amber LED blinks 2 times every 60 s	2 chirps every 60 s	Replace. Button silences 24 hr. After 7 days it cannot be silenced.
Stuck button	Amber LED blinks 4 times every 60 s	3 chirps every 60 s	Push to free it, replace if stuck
MCU failure	None	Constant tone	Replace
Smoke alarm memory	Red LED blinks every 15 s	None	Unit saw smoke in the last 24 hr. Press button to clear.
Initiating alarm	Red LED blinks with the alarm pattern	Alarm	This is the unit that detected smoke

Kidde says the 20SAR alerts 10 years after it was installed, powered, and tested (End of Unit Life).

First Alert/BRK 9120B (User's Manual, "Understanding the Indicator Lights and Alarm Horn Patterns")

Condition	Light	Sound
Normal, AC power	Green LED on; red LED flashes once a minute	None
Normal, DC power only	Green LED off; red LED flashes once a minute	None
Low or missing battery	Red LED flashes once a minute	Chirp once a minute
Testing	Red LED flashes once a second	3 beeps, pause, 3 beeps
Alarm, initiating unit	Red LED flashes rapidly	3 beeps, pause, repeating on all alarms
Alarm, other interconnected units	Red LED off	3 beeps, pause, repeating
Silence mode	Red LED flashes once every 10 s	Silent up to 10 min
Latching indicator (after an alarm)	Green LED on 2 s, off 2 s, on the unit(s) that saw smoke	Silent until reset by pressing Test/Silence

First Alert says to replace the alarm 10 years from the date of manufacture.

Picture coming: Smoke alarm chirp pattern decoder as a phone-size card with two columns, Kidde 20SAR and First Alert 9120B. Each row shows a small alarm drawing with the LED color and blink count, a sound line drawn as tick marks per 60 seconds (1 chirp, 2 chirps, 3 chirps), and the action in five words or fewer. Footer: "Read the model on the back. Other models differ."

D2. Symptom: an alarm chirps

Questions for the customer

1. "Which alarm is chirping?" Most people cannot tell. The chirp comes from one unit, but interconnected units do not chirp together for a battery.
2. "How often? Once a minute? Two or three chirps at a time?"
3. "When did you last change the batteries?"
4. "How old are the alarms? Were they here when you moved in?"
5. "Did the power go out recently, or was work done on the house?" Construction dust is a common cause of sensor faults (Kidde 20SAR guide, Section 8).

Tests, in order

1. Find the chirping unit. Stand under each alarm for a full 60 seconds. On a Kidde 20SAR, look for the amber LED blinking. On a First Alert 9120B, a chirp with the red LED flash points to the battery.
2. Read the back of the unit for the model and the manufacture date. Over 10 years old: replace it. No further testing is needed.
3. Count chirps per minute and look at the LED. Match it to the D1 table for that model.

4. If the decoder points to the battery, replace the battery with the type printed on the unit.
5. If the decoder points to a sensor fault, clean the unit per the manufacturer (both guides cover cleaning), press the button to reset, and wait.
6. Check AC power at the alarm. Turn off the breaker, take the alarm off its bracket, and unplug the harness. Turn the breaker on. Meter on AC volts. Probes on the black (hot) and white (neutral) conductors in the harness plug or the box. About 120 V: AC is good. 0 V: the circuit or a splice is open, and the alarm has been living on its battery, which is why it chirps. Work the dead circuit with R2.3.

The fix

- Battery: replace it, then press and hold the test button to confirm the alarm sounds.
- False low battery on a new Kidde: pull the battery tab (Kidde 20SAR guide).
- End of life or fatal fault: replace the alarm with a compatible model so the interconnect still works (D4).
- Lost AC: repair the circuit, reinstall, and confirm the green AC LED.

Before servicing an AC alarm, First Alert says to turn off AC power at the breaker, remove the backup battery, then press and hold the test button for 5–10 seconds to discharge the circuit (9120B manual, "If You Suspect a Problem").

D3. Symptom: alarms go off with no smoke

Questions for the customer

1. "When does it happen? Cooking? Showers? At random times? At night?"
2. "Which alarm starts it?" Use the initiating-unit indicators (D1) to find out.
3. "Do lights in the house get brighter or dimmer? Have bulbs been burning out fast?"
4. "Was any electrical work done recently, such as a new breaker?"

Tests and causes, in order

#	Check	How	What it means
1	Which unit initiated	Kidde: the initiating unit's red LED blinks with the alarm pattern, and alarm memory blinks red every 15 s for 24 hr afterward. First Alert: initiating unit's red LED flashes rapidly, and afterward its green LED blinks 2 s on, 2 s off (latching).	Work only on the unit that started it
2	Location	Measure from the alarm to the stove, the bathroom door, supply registers, and ceiling fans	Kidde's guide says do not install within 6 ft of cooking appliances (for a kitchen alarm) or heating appliances, or within 3 ft of the door to a bathroom with a tub or shower, forced-air supply ducts, or ceiling or whole-house fans (20SAR guide, Section 8). Steam and cooking smoke set off alarms placed too close.
3	Dust and insects	Look inside the vents with a flashlight	Kidde lists dusty areas and insect-infested areas as places that cause nuisance alarms or failure to alarm.
4	Age	Date on the back	Over 10 years: replace.
5	Voltage	At a receptacle, read hot-to-neutral. Check the other leg (R2.2).	Kuhlman's "Somerville" call started with smoke detectors going off and bulbs burning out. The cause was a bad utility neutral (Kuhlman, pp. 101-102). He also shows a house where a lost neutral set smoke detectors on fire (p. 114). If voltages are high, low, or swinging, stop and go to R2.5.
6	AFCI interaction	Note the breaker type feeding the alarms	Kuhlman describes a call where alarms went off at random until a standard breaker was tried in place of the AFCI. The alarm maker's tech line told him not to use their product with AFCIs, so he switched alarm brands (p. 38). Do not remove AFCI protection to fix this. 210.12 requires it on these circuits. Report the brand combination to your journeyman.
7	Mixed brands on the interconnect	Read the model of every alarm on the system	Each guide lists which models it can be interconnected with. Kidde says all hardwire interconnected units must be powered from a single circuit, interconnect wiring must run in the same cable or raceway as the AC wiring, interconnect wire resistance must be no more than 10 ohms, and the run from first to last unit no more than 1,000 ft (20SAR guide, Section 9). First Alert lists its

#	Check	How	What it means
			compatible models and says to interconnect within a single-family residence only (9120B manual).

The fix

- Too close to a kitchen or bathroom: the move is a scope for the office. In the meantime, a photoelectric alarm or one with a hush feature in that spot may be part of the recommendation; follow R1.8 and the local code.
- Dirty: clean per the manufacturer and retest.
- Old: replace with a compatible model.
- Mixed, incompatible brands: replace the odd unit with one listed as compatible.
- Voltage problem: R2.5.

D4. Symptom: pressing test on one alarm does not set off the others

1. Turn off the alarm circuit. Discharge per the manufacturer (D2). Take down the unit that does not join in.
2. Look at the interconnect wire: red on Kidde harnesses, orange on the First Alert 9120B. Check that it is connected to the interconnect conductor (usually the red conductor of 14/3 or 12/3 cable) and not capped off or broken.
3. Confirm the models are listed as compatible with each other.
4. Confirm every interconnected alarm is on the same circuit (Kidde requirement).
5. Reinstall, restore power, and test each alarm with its own button. First Alert notes that the other alarms sounding only tests the interconnect signal, not each alarm, so every alarm has to be tested individually (9120B manual).

Field photo coming: An interconnected smoke alarm pulled down from its ceiling box, harness unplugged, showing the black, white, and red conductors of 14/3 cable in the box with a wire connector on each, and the alarm's date label visible on the back.

Worked Examples

Example 1: Generator ran during the storm, house stayed dark

Ticket: "Generator ran for six hours during the outage but we had no power."

Intake. The customer heard the generator running the whole time. No lights came on. A lawn crew was at the house the week before. The generator was installed four years ago and has always worked.

Read the controller. Flashing green LED, screen shows the unit running in AUTO earlier and now idle. No red alarms.

Tests. Generac's first check for a flashing green LED with no power in the house is the generator MLCB. It is OFF. The customer thinks the lawn crew bumped the lid open and may have flipped it while using a string trimmer around the unit.

Fix and verify. With your journeyman, set the MLCB to ON, put the unit in AUTO, and run the automatic-operation check: turn off the utility supply to the transfer switch, watch the engine start, warm up, and transfer. Clamp E1 and E2 at the transfer switch: 14 A and 11 A with the house running. Restore utility, watch it transfer back after 15 seconds, run its 1-minute cool-down, and stop.

Document. Photos of the MLCB found OFF and the controller in AUTO. Customer shown the MLCB and told to keep it ON.

Example 2: Grizzl-E flashing red, one flash

Ticket: "EV charger has a red light and won't charge."

Intake. The charger is a Grizzl-E Classic plugged into a 14-50 receptacle in the garage. It worked for a year. Last month a handyman added a receptacle on the garage wall. The light blinks red once, pauses, and repeats.

Decode. One red flash on a Grizzl-E is "Lost ground – AC Line1" (Grizzl-E manual, sec. 7.2).

Tests. At the 14-50: L1–L2 241 V. L1 to ground 0 V. L2 to ground 0 V. Neutral to ground 0 V. Hot to neutral 120 V each. Hots read normal to neutral but zero to ground, so the ground path is open. Breaker off, proven dead. Ohms from receptacle ground terminal to the panel ground bar: OL.

Find it. The handyman tapped the new garage receptacle off the 14-50 box (which should not have been done; 625.40 requires an individual branch circuit for the EV outlet). In the box, the ground pigtail was cut short and not reconnected to the 14-50's ground screw.

Fix and verify. You reconnect the ground, remove the handyman's tap and cap it in a covered box, and write it up for the office. Ohms ground to panel ground bar: 0.3 Ω . Power on, charger runs its startup, car charges at 39.6 A on the clamp. GFCI breaker for the receptacle tests correctly.

Document. Photos of the open ground and the tap. Recommend: "Remove or properly circuit the added garage receptacle." The office prices it.

Example 3: Surge protector beeping, lights going bright and dim

Ticket: "Box on the side of my panel is beeping."

Intake. A Siemens FirstSurge mounted on the side of the panel. The customer says some lights are brighter at night and the microwave clock reset twice.

Read the unit. Beeping, red light flashing, green LEDs still lit. Siemens says that combination is Ground Reference Monitoring: a compromised neutral-to-ground bond.

Tests. At a kitchen receptacle: 131 V hot to neutral. At a hall receptacle on the other leg: 108 V. Total 239 V. That is the lost-neutral pattern.

Stop. This is R2.5. You tell the customer to unplug electronics and you call your journeyman from the driveway. The SPD did its job. Do not replace it until the neutral is fixed, because Siemens names bad neutral-ground bonding as the top cause of SPD failure.

Example 4: Chirping in the middle of the night

Ticket: "Smoke alarm chirps every minute, we changed every battery."

Intake. Five interconnected alarms, all installed when the house was built. The customer changed all five batteries last weekend. The chirp continues. The house was built 12 years ago.

Tests. Standing under each one for a minute, you find the chirp is from the upstairs hall unit, a Kidde. Its amber LED blinks twice every 60 seconds and it chirps twice every 60 seconds. Kidde's guide calls that End of Unit Life. The date on the back is 12 years ago. All five are the same age.

Fix. You explain that alarms have a 10-year life and that all five are past it. Replacing all five with compatible interconnected units is a scope for the office. With the office's OK, you replace them that day, test each one with its own button, and test that one sets off all five.

Common Mistakes

1. **Clearing a generator alarm before photographing it.** The text is gone from the home screen after you clear it. Take the photo first.
2. **Working inside a standby generator in AUTO.** It can start on its own. Press OFF, open the MLCB, pull the 7.5 A fuse, and turn off utility to the transfer switch.
3. **Moving the transfer switch handle with power on.** Disconnect all sources first.
4. **Opening the gas side.** Fuel pressure and piping go to the gas trade.
5. **Repairing an engine or control board as a non-dealer.** Generac ties warranty repairs to certified IASDs.
6. **Guessing a fault code from memory or from another brand.** Look up the model's manual.
7. **Setting a charger above its breaker.** A 48 A setting on a 50 A breaker or 40 A wiring overloads the circuit. The output matches the circuit, never the other way around.
8. **Removing GFCI protection from a charger receptacle to stop trips.** 625.54 requires it on EV receptacles. The fix is a scope change, not removal.
9. **Resetting a tripped SPD breaker over and over.** Eaton says a trip means replace the unit.

10. **Replacing an SPD that is warning about the neutral.** Fix the neutral first, or the new one fails too.
 11. **Replacing every smoke alarm battery without finding the chirping unit.** Find it, read its code, and read its date.
 12. **Mixing alarm brands on one interconnect.** Use models listed as compatible in the manufacturer's guide.
 13. **Removing AFCI protection to stop alarm false trips.** 210.12 still applies.
-

Field Exercise

Setup. Your journeyman runs this on a standby unit (a training unit or a YES customer's unit during a maintenance visit, with the customer's permission and the utility side handled by the journeyman), a training charger, a training panel with an SPD on its own breaker, and a set of three interconnected alarms on the training wall.

Station 1: Generator no-start tree.

1. Make the unit safe: OFF, MLCB open, 7.5 A fuse out, utility to the transfer switch off. Say each step out loud.
2. The journeyman pulls the control fuse and puts the unit in AUTO with the fuse still out. Restore utility. Read the controller (no screen). Walk the no-start tree from A5 until you find the missing fuse. Test the fuse with your meter on ohms.
3. The journeyman reinstalls the fuse and loosens the negative battery lead. Walk the tree again. Read the BATTERY menu, find the loose lead, tighten it, and run the automatic-operation check.
4. Read T1 to neutral (about 120 V AC) and 194 to 0 (about 12 V DC) at the transfer switch terminal block. Write both readings down.

Station 2: Charger supply fault.

1. With the training charger running, the journeyman drops one supply leg (opens one pole feeding the charger through a training disconnect). Read the charger's fault indication and look it up in that model's manual.
2. Take the supply readings from B5, Test 2. Show from the readings which leg is gone.
3. Restore the leg. Open the ground instead (journeyman only). Read the fault, then find the open ground with your meter on ohms.

Station 3: SPD status.

1. Read the SPD's status light with its breaker on. Say what it means using the manufacturer's instructions.
2. Turn off the SPD breaker and show the status light change. Explain to your journeyman what a customer would see if the unit were spent.
3. Read and record L1-L2, L1-N, and L2-N at the SPD breaker.

Station 4: Alarm chirp decoder.

1. The journeyman swaps a dead-battery alarm into the interconnected set while you wait outside.
2. Find the chirping unit by listening and watching LEDs, not by pulling units. Read its chirp count and LED pattern and match it to the model's guide.
3. Replace the battery, test that unit with its own button, then test each of the other two alarms individually, and test that one sets off all three.

Write-up. Fill in a job board card for each station with the complaint, the readings, the cause, the fix, and how you verified it.

Pass standard. You pass when the journeyman signs off that you made the generator safe in the correct order every time, found each planted fault from the readings and the manufacturer's code rather than by swapping parts, never cleared an alarm without a photo, stated codes only from the manual, and wrote four job board cards the office could act on.

NEC 2026 Cross-References

Section	What it says	Why it matters here
Article 702	Optional standby systems (home standby generators)	The installation rules for the generator system you are troubleshooting. 702.4 capacity and rating, 702.5 transfer equipment, 702.7 signs.
702.7(A) (1)	One- and two-family dwellings: labels at each applicable service location for the standby system shutdown or disconnect	Check that the signs are present on every generator call
Article 445	Generators; 445.20 GFCI for receptacles on portable generators	Portable generator calls
250.35	Permanently installed generators	Bonding and grounding questions on a generator call (R1.10)
Article 625	Electric vehicle power transfer system	Charger installation rules
625.40	Individual branch circuit for each outlet supplying EVSE over 16 A or 120 V	A tap off the charger circuit is not allowed (Example 2)
625.41	EVSE is a continuous load	Breaker and wire sized at 125 percent
625.42	Service, feeder, and branch circuit rating; power control systems	Load management on chargers
625.54	GFCI protection for personnel on all receptacles installed for EV charging	The GFCI-breaker trip conflict on plug-in chargers
210.8(A)	Dwelling receptacles in garages, outdoors, and other listed areas need GFCI protection	Same
406.9	Receptacles in damp and wet locations	Outdoor charger receptacles
230.67	SPD required for services supplying dwelling units	Every house we touch has one, or needs one
Article 242	Overvoltage protection; 242.9 says an SPD shall provide indication that it is functioning properly; 242.13 Type 1; 242.14 Type 2	Why every SPD has a status light, and where each type connects
210.12	AFCI protection. Informational Note No. 1 points to NFPA 72, 29.9.6(3), for smoke alarm secondary power.	AFCI applies to the circuits that feed smoke alarms
110.14(D)	Terminal torque	Every terminal on every repair

Smoke and CO alarm placement and replacement are not NEC rules. They are in NFPA 72 Chapter 29 and the International Residential Code (R1.8).

End-of-Chapter Checklist

Every equipment call - [] Read the model number and got that model's manual before diagnosing. - [] Photographed the screen, light, or code before clearing or resetting anything. - [] Stated codes only from the manual. - [] Checked our side (breaker, voltage, ground, terminals, battery) with a meter. - [] Stopped at the manufacturer or dealer line and documented.

Generator - [] Made safe: OFF, MLCB open, 7.5 A fuse out, utility to transfer switch off, proven dead. - [] Read alarm and LED color. - [] Checked mode, fuse, battery menu, battery terminals, T1 120 V, fuel valve, manual start. - [] For no transfer: checked MLCB, warm-up, E1-E2 238-242 V and 59.5-60.5 Hz, 194-0 about 12 V DC. - [] For dropouts: clamped E1/E2 against nameplate, checked load management and airflow. - [] Never transferred by hand under load. Never touched the gas side. - [] Ran the automatic-operation check after any repair.

EV charger - [] Decoded the light with the brand's manual. - [] Read L1-L2, each hot to ground, neutral to ground. - [] Checked ground continuity to the panel on ohms with the circuit dead. - [] Checked terminals for heat and torqued to label. - [] Matched the output setting to the breaker and wire. - [] Left GFCI protection in place on any EV receptacle.

SPD - [] Read the status light against the manufacturer's meaning. - [] Checked the SPD breaker and the voltage at it. - [] Checked for a neutral problem before replacing a Siemens in GRM alarm. - [] Replaced with short, straight, twisted leads, torqued, and confirmed the light.

Smoke and CO alarms - [] Found the chirping or initiating unit before pulling anything. - [] Read the model and date on the back; replaced at 10 years. - [] Decoded the chirp and LED from that model's guide. - [] Checked AC at the harness; discharged per manufacturer before service. - [] Checked location, dust, voltage, brand compatibility, single circuit. - [] Tested each alarm with its own button and tested the interconnect.

Sources

- Generac Power Systems, Owner's Manual, 60 Hz Air-Cooled Generators, 10 kW to 26 kW, Part No. A0001846499 Rev. C, 05/12/2023. <https://www.generac.com/globalassets/products/residential/standby-generators/owners-manual/g-10-26kw-60hz-standby-generator-owners-manual-en.pdf>. Pages cited: 10-12 (battery, charger, parts, SMM), 16 (operating modes), 19-20 (manual transfer, automatic operation, cranking cycles), 32-35 (troubleshooting and quick reference).
- Generac Power Systems, Installation Guidelines, 60 Hz Air-Cooled Generators, 10 kW to 26 kW, Part No. A0001846478 Rev. C, 12/15/2022. Copy retrieved from <https://irp.cdn-website.com/1132da76/files/uploaded/10-26kW%20Installation%20Manual.pdf>. Pages cited: 28-29 (control wiring, Table 6-3), 35 (DC terminal wiring check, first-start OVERCRANK), 38-39 (electrical checks, automatic operation, shutdown during outage).

- ChargePoint, ChargePoint Home Flex 16A–50A Flexible Amperage Charger Installation Guide. https://www.chargepoint.com/files/home/CPH50_InstallGuide.pdf. Pages 2, 9–10, 17 (PDF page numbers).
 - ChargePoint, ChargePoint Home Flex Troubleshooting web page. <https://www.chargepoint.com/drivers/home/troubleshooting/flex>.
 - United Chargers, Grizzl-E Classic EV Charger User Manual & Installation Guide, Manual Revision 3.5. https://ecommerce-space.nyc3.digitaloceanspaces.com/User_Manual_V3_5_aea71e9614.pdf. Sections 2.1–2.3, 3, 7.1–7.4.
 - Eaton, Complete Home Surge Protection, Instruction Bulletin IB00414001Y, effective March 2012. Copy retrieved from <https://images.thdstatic.com/catalog/pdfImages/d9/d9817dee-4558-4b87-877e-946eee1c6f80.pdf>.
 - Siemens Industry, FirstSurge Total Home Protection flyer, Order No. RPFL-FSTSU-0515 (2015), as reproduced at <https://manuals.plus/siemens/siemens-fs140-whole-house-surge-protection-instruction-manual>.
 - Kidde, User Guide, Photoelectric Smoke Alarm with Hardwire Interconnect, Model 20SAR, P/N G-000009-00 Rev. A. https://www.shareddocs.com/hvac/docs/2001/Public/0E/Product_UG_20SAR_0124.pdf. Sections 3, 4, 8, 9.
 - First Alert/BRK, User's Manual, 9120B AC Powered Smoke Alarm with Battery Back-up. <https://www.firstalertstore.com/store/images/pdf/9120-hardwired-smoke-alarm-manual.pdf>.
 - Jesse Kuhlman, Residential Electrical Troubleshooting (2019), pp. 38 (AFCI and smoke alarms), 101–102 ("Somerville"), 114 (lost neutral, smoke detectors burned). Paraphrased.
 - Arc Workforce, Residential Electrical Field Guide, Symptom 4 and Part 8 (cited only to show that its AFCI blink codes disagree with each other).
 - NFPA 70, National Electrical Code, 2026 edition, sections above.
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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
Part A, A4 Read the controller first (clearing an alarm)	Generac Support: Clearing an Alarm Code on a Home Standby Generator Generac • 1:44 Generac's support video: close the external and internal auxiliary shutdown switches, then press OFF and ENTER to clear an alarm, then run in manual to see if it returns. Caution: Photograph the screen before you clear it, as the module says. If the alarm returns, it goes to a Generac dealer.
Part A, A3 Safety and A5 Will not start (hard reset of the controller)	Generac Support: How to Hard Reset a Home Standby Generator Control Panel Generac • 3:07 Generac's support video for a blank, unresponsive, or 'not activated' controller: OFF, pull the 7.5 A fuse, disconnect the battery (negative first), turn off the service disconnect, then restore in order. Caution: The house loses power during this. Follow A3's lockout order before putting hands inside the unit.
Part A, A8 Yellow warnings	GENERATOR MAINTENANCE ALERT YELLOW LIGHT TROUBLESHOOTING BATTERY TESTING & CONTROLLER RESET FixMyGen • 3:52 A Generac-certified tech explains the yellow LED (maintenance due, low battery, charger), pulls the 7.5 A fuse and T1 connector, tests the battery, and checks 13.4 to 14.6 V charging. Caution: Battery-terminal crimp upgrade and a few other steps are dealer work. Re-enter controller settings after a battery disconnect.
Part A, A5 Did not start; A8 Yellow light	Generac Generator Fault Code? Do This Immediately Generac Doctor • 7:29 On a real call, a dealer reads RPM SENSE LOSS with a red light, clears it with OFF, ENTER, AUTO, and tries a manual start, then shows what the yellow-plus-green service light means. Caution: Shows the dealer menu code and a maintenance reset, which are dealer tasks, not helper tasks. Unedited with some rain noise.
Part A, A6 Generator runs but the house stays dark	Generator is running but you have no power. Charleston Electric & Air • 1:43 A contractor shows the first check: open the lid and see if the generator's main line breaker is off. He then shows the manual transfer handle in the ATS. Caution: Before any manual transfer, Generac and the module require the switch to be disconnected from all sources; he shuts off the generator breaker only. At YES a manual transfer is a journeyman task with both sources off.

Part D, D1 Chirp and light decoder; D2 Alarm chirps

[FAQs: Smoke Alarm Sounds & Lights | Kidde Home Safety](#)

Kidde Fire Safety • 3:56

Kidde's own video on beeps versus chirps (one chirp every 30 to 60 seconds means battery, three chirps a minute means cleaning) and green, amber, and red LEDs, plus cleaning and push-testing.

Caution: Kidde-specific codes; other brands such as First Alert/BRK use different patterns, so check the model's manual.