



## **Arc-Fault Circuit Interrupters (AFCIs) Frequently Asked Questions**

**Please note, as of January of 2010, the Square D® AFCI breakers used in Lutron’s HomeWorks QS AFCI dimming panel (HWAP-8D) are now able to control a full 2,000 W (16A) of connected dimming load without any false tripping. See information beginning on page 4 for more details.**

**Eaton® also offers AFCI breakers that are rated for use in Eaton load centers, and are capable of controlling a full 2,000W (16A) of connected dimming load without any false tripping. See page 5 for more details.**

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## **AFCI General Overview**

### ***What are AFCIs and what purpose do they serve?***

An AFCI is a special circuit breaker that is designed to help protect against fires resulting from electrical arcing, often caused by damaged or deteriorated wires and cords. Fires result from the heat generated from electrical arcing near combustible materials such as paper, wood, carpet, etc. Some causes of damaged and deteriorated wiring include puncturing of wire insulation from picture hanging, cable staples, drywall screws, poorly installed outlets or switches, cords caught in doors or under furniture, furniture pushed against plugs in an outlet, natural aging, and cord exposure to heat vents and sunlight.

### ***How have AFCIs evolved into the National Electric Code (NEC)?***

The 2002 edition of the *National Electric Code (NEC)*, Section 210.12 requires all branch circuits that supply 120-volt, single-phase, 15- and 20-ampere outlets (“outlets” includes lighting fixtures as defined by code) installed in dwelling unit bedrooms to be protected by an AFCI listed to provide protection of the entire branch circuit. This requirement became effective January 2002 for all new installations.

The 2008 edition of the *NEC*, Section 210.12 Arc-Fault Circuit Interrupter Protection increased these requirements to include dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms for all new installations. The attached Appendix A is a copy of Section 210.12 of the 2008 *NEC*.

For reference, Appendix B shows dwelling unit requirements for tamper resistant receptacles, GFCI protection, and AFCI protection.

### ***How do AFCIs work?***

The internal circuitry of an AFCI continuously monitors current flow in the branch circuit. AFCIs apply intelligent algorithms to the current flow information in an attempt to distinguish between normal arcing (for example the arcing that occurs when a mechanical switch is opened or closed) and unwanted arcing. This allows AFCIs to detect arcing conditions that conventional circuit breakers are unable to detect. Conventional circuit breakers only respond to sustained overloads and short circuits; so they do not protect against arcing that is characterized by erratic current flow. Once an unwanted arcing condition is detected, the control circuitry in the AFCI trips – de-energizing the circuit to avoid a potential fire.

### ***How do AFCIs respond to solid-state dimmed loads?***

Dimmers reduce the amount of power delivered to lighting loads, therefore reducing light output, by electronically switching current flow on and off. This electronic switching results in current flow as seen in Figure 1 below. AFCIs will interpret this current waveform as arcing and may trip if the amplitude of the current exceeds its’ predetermined threshold. The higher the connected load wattage, the higher the current and the closer the current will get to the trip threshold. Additionally, most

lighting loads have a brief warm-up period, during which they will draw significantly more than their rated power (~10 times). The fact that the current flow is temporarily higher in amplitude than normal and changing rapidly during this warm-up period, means that false tripping may occur at turn on.

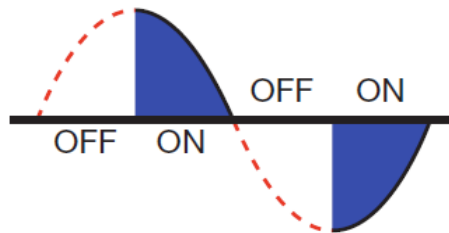


Figure 1 — Typical Dimmer Current Flow

***How do AFCIs respond switched loads?***

A switched output at no point removes power from the load while in the on state, such that the current flow looks like Figure 2 below. The AFCI interprets this as “normal” current flow and will not trip.

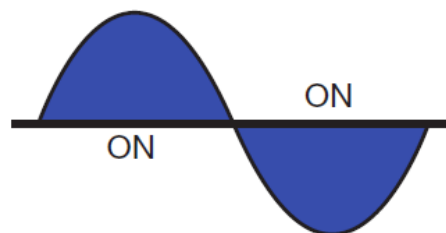


Figure 2 — Switched Output Current Flow

***If I set a dimmer to high-end with a zero second fade time, is that the same as a switch?***

NO. Most dimming products require a portion of the sine wave for charging their internal power supply and performing three-way signaling; shown as the small pieces removed from the sine wave in Figure 3 below. Dimmers will not power the load during this reserved period and thus do not meet the requirements of a switch. Therefore, setting a dimmer to high-end with a zero second fade time may cause an AFCI to trip if the maximum rated amount of connected dimmable load is exceeded.

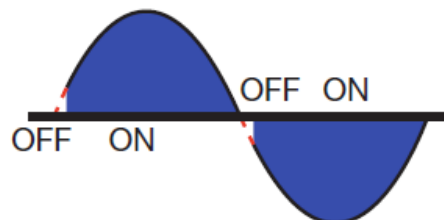


Figure 3 — Dimmer Current Flow at High-End

## **Using AFCI Breakers Rated For 2000 W of Dimming**

### ***Why is having the ability to control 2,000W of connected dimming load per AFCI breaker such a big deal?***

Breakers of all types are Underwriters Laboratories® (UL) Listed before being sold. To become UL Listed, one of the testing criteria states that an AFCI will not trip when less than 1000 W of dimmed tungsten lighting is connected (UL File 1699, Section 41.3.1, Subsection C). According to these testing requirements set by UL, it is permissible for an AFCI to trip with greater than 1000 W of dimmed tungsten lighting load. Remember that the goal of an AFCI is to try to detect arcs and disconnect the circuit.

Because of this, the amount of AFCI circuits required on a project often needs to be doubled for dimmed loads that exceed 1,000W in order to prevent false tripping. This greatly impacts the design, installation, and overall cost of a project.

### ***Does Lutron offer HomeWorks QS panels with AFCI breakers installed, and if so, am I able to load each AFCI circuit with a full 2000 W of dimmable load?***

YES and YES. Lutron does offer panels with AFCI breakers installed (HWAP-8D), and as of January of 2010 (*Square D date code of 1001 or later*), the AFCI breakers installed in Lutron AFCI breaker panels are rated for the full 2000 W of arc-fault dimming per circuit.

### ***Who is the manufacturer and what are the model numbers of the AFCI breakers used in Lutron's AFCI breaker panels in HomeWorks QS?***

Lutron's AFCI breaker panels (HWAP-8D) use Square D QO series AFCI breakers, which are commercial-grade, high-magnetic inrush, combination AFCI breakers. The model numbers of the Square D QO series AFCI breakers that allow for 2000 W of connected dimming load are listed below. See Appendix E for Square D's technical data sheets.

#### **QO Series (Plug-on)**

- QO115CAFIC (1 pole, 15A)
- QO120CAFIC (1 pole, 20A)

### ***Can I retrofit a standard breaker panel (HWBP) with AFCI breakers?***

YES, as long as you use Square D QO series AFCI breakers (called out above). Refer to the attached Appendix C for instructions. This procedure will require re-wiring a portion of the panel due to neutral wire requirements of the AFCI breakers. Modifying the breaker panel may affect the UL Listing of the panel – a qualified UL inspector should inspect the panel after the modifications have been made. Contact Lutron for details.

<p><b>WARNING:</b> Shock hazard. To avoid the risk of electric shock, this installation must be done by a qualified person, and must meet all local and NEC® codes. Failure to comply could result in serious injury or death.</p>
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***Can I replace AFCI breakers in HWAP panels with standard breakers?***

YES, Lutron HWAP panels were designed with additional terminal block connection points to make installation, removal, and replacement of AFCI and standard breakers easy to accomplish. Refer to Appendix D for instructions.

**WARNING:** Shock hazard. To avoid the risk of electric shock, this installation must be done by a qualified person, and must meet all local and NEC® codes. Failure to comply could result in serious injury or death.

***If I am not using Lutron AFCI breaker panels, but using other Lutron products (feed-through panels, local controls, etc.), am I still able to achieve the full 2000W of arc-fault dimming?***

YES. There are 2 options available in order to achieve the full 2000 W of connected dimming load per AFCI circuit:

**OPTION 1:**

You can use Square D QO *series* or *Homeline series* AFCI breakers, with a date code of 1001 or later, mounted in Square D breaker panels (load centers). Square D breakers must be mounted in Square D breaker panels due to their proprietary mounting system. The model numbers of the Square D AFCI breakers are listed below and are available through Square D distributors and local home improvement centers. See Appendix E for Square D's technical data sheets.

**QO Series (Plug-on)**

- QO115CAFIC (1 pole, 15A)
- QO120CAFIC (1 pole, 20A)

**QO Series (Bolt-on)**

- QOB115CAFIC (1 pole, 15A)
- QOB120CAFIC (1 pole, 20A)

**Homeline Series (Plug-on)**

- HOM115CAFIC (1 pole, 15A)
- HOM120CAFIC (1 pole, 20A)

#### OPTION 2:

You can use Eaton's *BR*, *CH*, or *QB series* AFCI breakers mounted in Eaton breaker panels (load centers). Eaton's *BR*, *CH*, and *QB series* AFCI breakers are currently only UL listed, and rated for use in Eaton breaker panels. The model numbers of the Eaton AFCI breakers are listed below and are available through Eaton distributors and local home improvement centers. See Appendix F for Eaton's technical data sheets.

#### **CH Series (3/4" Plug-on)**

- **CHFCAF115 (1 pole, 15A)**
- **CHFCAF120 (1 pole, 20A)**

#### **BR Series (1" Plug-on)**

- **BRCAF115 (1 pole, 15A)**
- **BRCAF120 (1 pole, 20A)**

#### **QB Series (1" Bolt-on)**

- **QB1015CAF (1 pole, 15A)**
- **QB1020CAF (1 pole, 20A)**

## **Using AFCI Breakers ‘NOT’ Rated For 2000 W of Dimming**

### ***Am I able to fully load an AFCI circuit with 2000 W of dimmable load with ‘other’ AFCI breakers?***

NO. Currently Square D’s *QO* and *Homeline* series and Eaton’s *BR*, *CH*, and *QB* series AFCI breakers are the only breakers that have been verified with ALL Lutron products that allow for the full 2000 W of dimming capability. The maximum allowable dimming load with any AFCI breaker other than Square D’s *QO* or *Homeline* series or Eaton’s *BR*, *CH*, or *QB* series AFCI breakers is **1000 W**.

### ***If I am not using Square D’s QO or Homeline series or Eaton’s BR, CH, or QB series AFCI breakers, how does this impact my project design?***

Lutron recommends using Square D’s *QO* or *Homeline* series or Eaton’s *BR*, *CH*, or *QB* series AFCI breaker whenever possible, however, we realize that this may not always be feasible.

To maximize dimming equipment utilization while still meeting the 1000 W maximum dimmed lighting load requirement on AFCIs that are not Square D’s *QO* or *Homeline* series or Eaton’s *BR*, *CH*, or *QB* series, it is recommended that lighting zones which typically do not require dimming be controlled by a switching device and that the load type be designated in the software as non-dimmed (when it is selectable). Mix these switched loads with dimmed loads to maximize equipment utilization. Closets, garages, and some outdoor lighting are often applications where dimming is not required, so switch those zones. By thoughtfully combining dimmed and switched lighting zones and being mindful of the 1000 W dimmed lighting maximum using AFCIs that are not Square D’s *QO* or *Homeline* series or Eaton’s *BR*, *CH*, or *QB* series, you can minimize the need for additional AFCIs and lighting control equipment.

See next 2 pages for project design recommendations when using RPM panels, local Maestro controls, or GRAFIK Eye/WPM units that are controlling AFCI loads. If you exceed 1000 W of dimming in any of the examples below, you will need to use one or more power boosters. Each power booster **must** be on a separate AFCI.

## **RPM Panels**

Dimming modules (4As, 4Js, and 4Us) accept one dedicated feed from the distribution panel. To minimize the required number of AFCI breakers, place all AFCI controlled loads together. Do not place more than 1000 W of dimming load on each Arc-Fault Circuit Interrupter breaker.

- HW-RPM-4A, HW-RPM-4J or HW-RPM-4U.

A single HW-RPM-4A, HW-RPM-4J or HW-RPM-4U can support 4 zones @ 1920 W total. Up to 1000 W on any or all of those 4 zones can be dimmed. Any load beyond the dimmed 1000 W must be switched.

Example:

	<b><u>Dimmed Load</u></b>		<b><u>Switched Load</u></b>	
<b>Zone 1</b>	<b>300 W</b>			
<b>Zone 2</b>			<b>400 W</b>	
<b>Zone 3</b>	<b>500 W</b>			
<b>Zone 4</b>	<b>200 W</b>			
<i>Dimmed total may not exceed 1000 W</i>	<b>1000 W</b>	<b>+</b>	<b>400 W</b>	<b>= 1400 W</b> <i>(RPM total may not exceed 1920 W)</i>

## **Maestro Local Controls**

Do not place more than 1000 W of dimming load on *Maestro* dimmers fed by AFCIs.

- HQRx- or HWx-, -6CL, -6ND, -6NA, -10D, -10ND, G25LW
- RRx-, -6CL, -6NA, -10D, -10ND, G25LW

1920 W can be attached to a single 20 AMP AFCI breaker. Up to, but not exceeding, 1000 W may be dimmed lighting load on a single dimmer or several dimmers combined. The remaining 920 W (available for that AFCI) must be switched.

Example:

	<b><u>Dimmed Load</u></b>		<b><u>Switched Load</u></b>	
<b>Dimmer 1</b>	<b>100 W</b>			
<b>Dimmer 2</b>	<b>300 W</b>			
<b>Switch 1</b>			<b>200 W</b>	
<b>Switch 2</b>			<b>150 W</b>	
<b>Dimmer 3</b>	<b>400 W</b>			
<b>Dimmer 4</b>	<b>200 W</b>			
<i>Dimmed total may not exceed 1000 W</i>	<b>1000 W</b>	<b>+</b>	<b>350 W</b>	<b>= 1350 W</b> <i>(circuit total may not exceed 1920 W)</i>



### **GRAFIK Eye or Wallbox Power Module (WPM)**

Do not place more than 1000 W of dimming load on *GRAFIK Eye* or *WPM* units fed by an AFCI breaker.

- QSGRJ-(3/4/6)P, HQRJ-WPM-6D-120, or LQRJ-WPM-6P (zone count can vary on QSGRJ models)

For example, a QSGRJ-4P can support 4 zones @ 1920 W total. Up to 1000 W total can be dimmed across any of those 4 zones. **Note: you may not exceed more than 800 W on any single zone of a GRAFIK Eye or WPM unless you are using a power booster.** The remaining 920 W (available for that AFCI) must be switched.

Example:

	<u>Dimmed Load</u>		<u>Switched Load</u>	
Zone 1	600 W			
Zone 2			200 W	
Zone 3	400 W			
Zone 4			500 W	
<i>Dimmed total may not exceed 1000 W</i>	1000 W	+	700 W	= 1700 W <i>(total may not exceed 1920 W)</i>

## **Lutron Recommendations for AFCI Nuisance Tripping**

***I have existing AFCIs with dimmable loads over 1000 W that are nuisance tripping, what options do I have?***

1. Install or replace the existing load center with either a Square D load center with Square D QO or Homeline series AFCI breakers installed or an Eaton load center with Eaton's BR, CH, or QB series AFCI breakers installed. This will allow for the full 2000 W of dimming per AFCI circuit.
2. If option 1 is not feasible or possible, you will need to re-lamp the circuit(s) to reduce the total wattage of the connected dimmable load(s).
3. If options 1 and 2 are not possible, convert some of the dimmed loads to switched loads.
4. If options 1, 2 and 3 are not possible, while not guaranteed to resolve nuisance tripping, the following four suggestions are known to affect what the AFCI detection circuitry is measuring and therefore what the internal algorithm decides is happening (arc or no arc). Whether these suggestions resolve the AFCI nuisance tripping will depend on the specific conditions at the installation (see "What other factors affect other AFCIs trip point?"):
  - a. Change bulb wattages. 40 W bulbs at a higher dim percentage may cause less tripping than 60 W bulbs with a lower dim percentage and give the same light output.
  - b. Stagger the turn on of loads – both switched and dimmed loads. Because of the 10 times inrush current when starting up a load, inserting a delay between the start up of large loads on the order of 1 to 2 seconds may avoid tripping.
  - c. Stagger the fade on/off rates of the dimmed loads. Fading on/off several loads at the same rate aligns the dimmers firing edges. Staggering these fading rates from typically 0.5 seconds to 3 seconds (or longer if possible) may avoid tripping.
  - d. Stagger or change the programmed dim percentages. 1000 W of dimming on multiple zones all set to exactly 50.0% may trip an AFCI but those same loads with the dimming staggered from 45 to 55% may not.
5. If all options above are not possible, rewiring to rebalance the loads would be a difficult last resort.

## **Appendices**

# APPENDIX A

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## 210.12 Arc-Fault Circuit-Interrupter Protection.

(A) **Definition: Arc-Fault Circuit Interrupter (AFCI).** A device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected.

(B) **Dwelling Units.** All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit.

FPN No. 1: For information on types of arc-fault circuit interrupters, see UL 1699-1999, *Standard for Arc-Fault Circuit Interrupters*.

FPN No. 2: See 11.6.3(5) of NFPA 72®-2007, *National Fire Alarm Code*®, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.

FPN No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

*Exception No. 1: Where RMC, IMC, EMT or steel armored cable, Type AC, meeting the requirements of 250.118 using metal outlet and junction boxes is installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a combination AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.*

*Exception No. 2: Where a branch circuit to a fire alarm system is installed in accordance with 760.41(B) and 760.121(B) is installed in RMC, IMC, EMT, or steel armored cable, Type AC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.*

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## APPENDIX B

### Dwelling Unit\* requirements - Tamper Resistant Receptacles, GFCI protection, AFCI protection

Tamper-resistant receptacle outlets required in these locations 2008 code articles 210.52, 406.11	GFCI protection required for these receptacle outlet locations <sup>1</sup> 2008 code article 210.8	AFCI protection required on all outlets (not just receptacles) in these locations <sup>2</sup> 2008 code article 210.12
Bathrooms	Bathrooms	
Garages	Garages	
Outdoors	Outdoors	
Laundry	Laundry, Utility, Wet bar sinks	
Basements	Unfinished Basements	
Kitchens	Kitchens - countertop areas	
Living rooms		Living rooms
Dining Rooms		Dining rooms
Libraries		Libraries
Dens		Dens
Sunrooms		Sunrooms
Bedrooms		Bedrooms
Recreation rooms		Recreation rooms
Parlors		Parlors
Family rooms		Family rooms
Hallways		Hallways
Similar rooms or areas		Similar rooms or areas
	Crawl Spaces	
	Boathouses	
		Closets

\* Definition of Dwelling unit – One or more rooms arranged for complete, independent housekeeping purposes, with space for eating, living, and sleeping; facilities for cooking; and provisions for sanitation.

Note 1 - If GFCI receptacles are used, they would be required to be Tamper-resistant at those locations where tamper-resistant receptacle outlets are required.

Note 2 - Bold locations are new AFCI requirements for the 2008 Code.

RSS 20071023

### Installation Instructions Addendum Please Read Before Installing

### Retrofitting AFCI breakers into HWBP-8D and -2S panels



**WARNING:** To avoid the risk of electric shock, this installation must be done by a qualified person, and must meet all local and NEC® codes.

#### Installation

1. Turn panel input power OFF.
2. Locate circuit breaker to be replaced.
3. Remove the black RPM Power Wire from breaker.
4. Remove breaker.
5. Install AFCI breaker.
6. Install the black RPM Power Wire to the Load Terminal on the AFCI breaker (as specified in the instruction sheet included with the AFCI breaker).
7. Remove the white RPM Neutral Wire from the RPM Terminal Block Assembly on the same circuit as the breaker being replaced.
8. Connect the white RPM Neutral Wire (wire just removed) to the AFCI Neutral Wire (pigtail wire permanently connected to AFCI). In most cases, an additional wire length will be necessary to reach the RPM Neutral Wire.
9. Install a jumper wire between the Neutral terminal on the RPM Terminal Block Assembly and the Neutral Load Terminal on the AFCI breaker.
10. Recheck wiring, and restore power to panel.

#### Technical and Sales Assistance

If you need assistance, call the toll-free **Lutron Technical Support Center**. Please provide exact model number when calling.

1.800.523.9466 (U.S.A., Canada and the Caribbean)

Other countries call:

Tel: +1.610.282.3800

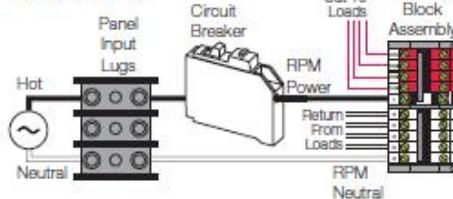
Fax: +1.610.282.3090

Visit our Web site at [www.lutron.com](http://www.lutron.com)

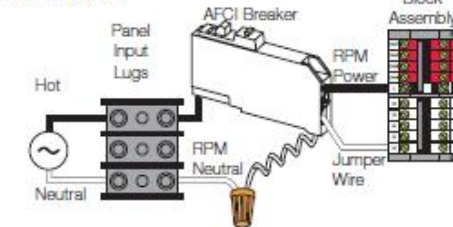
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#### Wiring Diagram

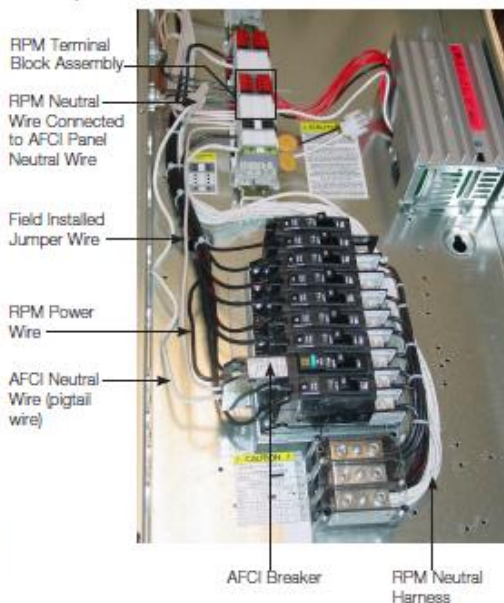
##### Before AFCI



##### After AFCI



#### Component/Wire Location (HWBP-8D shown)





### Installation Instructions Addendum

Please Read Before Installing

**NOTICE:** Installation must be done by a qualified person, and must meet all local and NEC® codes.

#### Installation

1. Turn panel input power OFF.



**WARNING: Shock hazard.** The panel may be fed by multiple circuits. To avoid the risk of electric shock, locate and lock each supply circuit breaker in the off position before proceeding. Wiring with the power on could result in death or serious injury.

2. Locate circuit breaker to be replaced.
3. Remove the black RPM Power Wire and the white RPM Neutral Wire from the AFCI breaker.
4. Remove the white neutral wire permanently attached to the AFCI breaker from the Neutral Wire Terminal Block.
5. Remove AFCI breaker.
6. Install standard breaker.
7. Connect the black RPM Power Wire to the Load Terminal on the standard breaker.
8. Connect the white RPM Neutral Wire from the RPM Terminal Block Assembly to the Neutral Wire Terminal Block.
9. Recheck wiring, and restore power to panel.

#### Technical and Sales Assistance

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1.800.523.9466 (U.S.A., Canada and the Caribbean)

Other countries call:

Tel: +1.610.282.3800

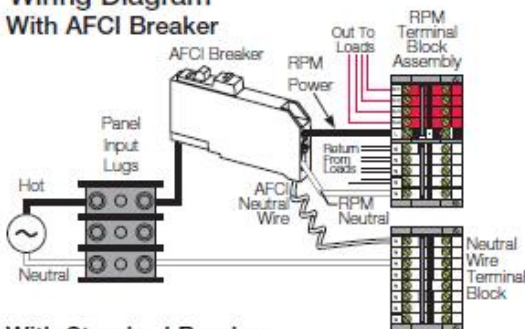
Fax: +1.610.282.3090

Visit our Web site at [www.lutron.com](http://www.lutron.com)

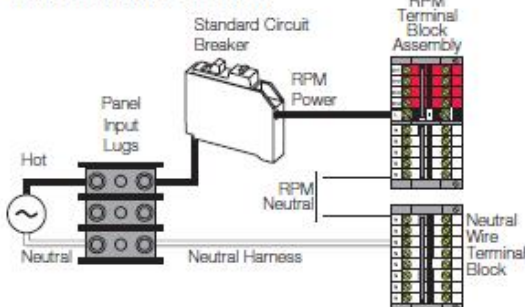
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### Retrofitting standard breakers into HWAP-8D Arc-Fault Panels

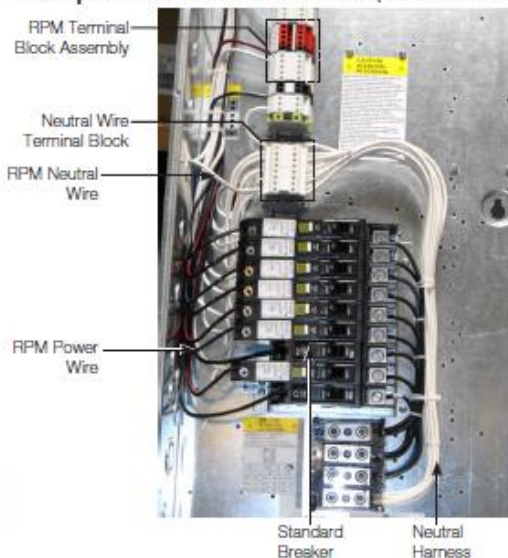
#### Wiring Diagram With AFCI Breaker



#### With Standard Breaker



#### Component/Wire Location (HWAP-8D shown)



# APPENDIX E

## Data Bulletin

0700DB1301  
11/2013

### QO™ and Homeline™ Combination Arc Fault Circuit Interrupter (CAFI)

Miniature Circuit Breaker, 120 V 60 Hz  
Class 0700

Retain for future use.



Commercial status	Commercialized
Product type	Miniature Circuit Breaker
Range of product(s)	QO, Homeline, CHOM, CAFI
I <sub>n</sub> rated current	15 and 20 A
Product certifications	CSA® (CHOM and QO) UL® Listed (HOM and QO)
U <sub>e</sub> rated operational voltage	120 Vac
Mounting mode – line side	Plug-on, Bolt-on (QOB)
Mounting mode – neutral	Pigtail, Plug-on
Pole description	One pole
Short-circuit current	10 kA (QO(B), HOM, CHOM) 22 kA (QO(B)-VH)
Number of spaces required	One
Circuit breaker type	Combination arc fault circuit interrupter
Additional ratings	HACR, SWD, and HID rated
Electrical connection	Pressure plate
AWG gauge	14–8 AWG aluminum/copper
Accessory/separate	None
Part type	None

#### Dimming load

Up to 2000 watts verified compatibility with home lighting automation and dimming components, including Lutron Lighting Controls® listed below:

HomeWorks®

RadioRA®

Grafik Eye®

Wall-mounted dimmer

Schneider Electric USA, Inc.  
1415 S. Roselle Road  
Palatine, IL 60067 USA  
1-888-778-2733  
www.schneider-electric.us

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# APPENDIX F

Technical Data TD003001EN

Effective August 2012

## Type BR (1") Combination Arc Fault Circuit Interrupter



### Description

Beginning in 2008, the National Electrical Code requires all circuits feeding dwelling areas in residential structures to be protected by Combination Type Arc Fault Circuit Interrupters.

Eaton's Type BR (1") Combination AFCI is available in 15 and 20 Amp configurations and includes options for 22kAIC interrupting rating. Eaton has also made a diagnostic version of the BR Arc Fault which includes an LED, indicating the most recent trip code to assist in troubleshooting.

### Design Features

- Compact Footprint as Standard
- Arc Fault Detection Methodology Tolerant of Non-compliant Devices
- Lifetime Trip Code retention
- Overvoltage Protection
- Continuous Self-Test of electronic components
- Available Diagnostic LED to access most recent trip code

Table 1. Type BR (1") CAFCI Selection Chart

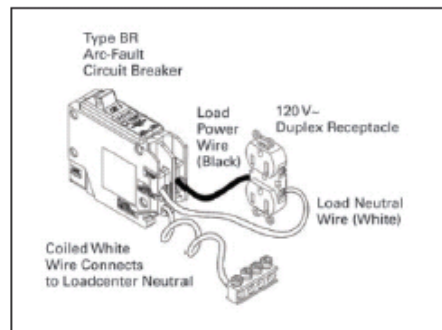
Catalog Number	Amps	Poles	kAIC
<b>Standard - Pigtail</b>			
BRCAF115	15	1	10
BRCAF120	20	1	10
<b>Diagnostic - LED</b>			
BRACAF115	15	1	10
BRACAF120	20	1	10
<b>High - Interrupting - 22 kAIC</b>			
BRHCAF115	15	1	22
BRHCAF120	20	1	22



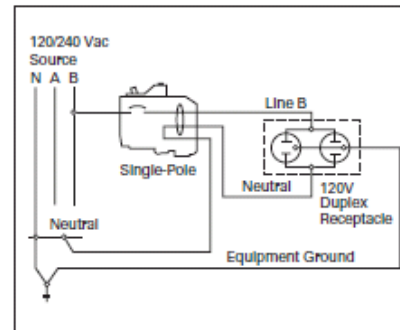
Table 2. Specifications

<b>Catalog Number</b>	BRCAF115, BRCAF120, BRHCAF115, BRHCAF120, BRACAF115, BRACAF120
<b>Voltage Requirement</b>	70 ≤ V- ≤ 160
<b>Frequency Requirement</b>	60 ± 2 Hz
<b>Power Consumption</b>	0.75W
<b>Surge</b>	In accordance with IEC 61000-4-5
<b>Ambient Temperature</b>	-31°C to 66°C (32°F to 151°F)
<b>Humidity</b>	0% to 93% humidity, non-condensing
<b>Warranty</b>	10 Year
<b>Dimming Load</b>	Up to 2,000 Watts verified compatibility with the following systems and controls: <b>Lutron®:</b> • HomeWorks® • RadioRA® • AutoRa® • Grafik Eye® • Wallbox dimmers
<b>UL® Standards</b>	UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures UL 1699 - Arc Fault Circuit Interrupters UL 1998 - Software in Programmable Components
<b>UL File Number</b>	E-7819

## Installation



## Wiring Diagram



**1-Pole 120 Volt Load Application  
Sourced by 120/240 Vac**

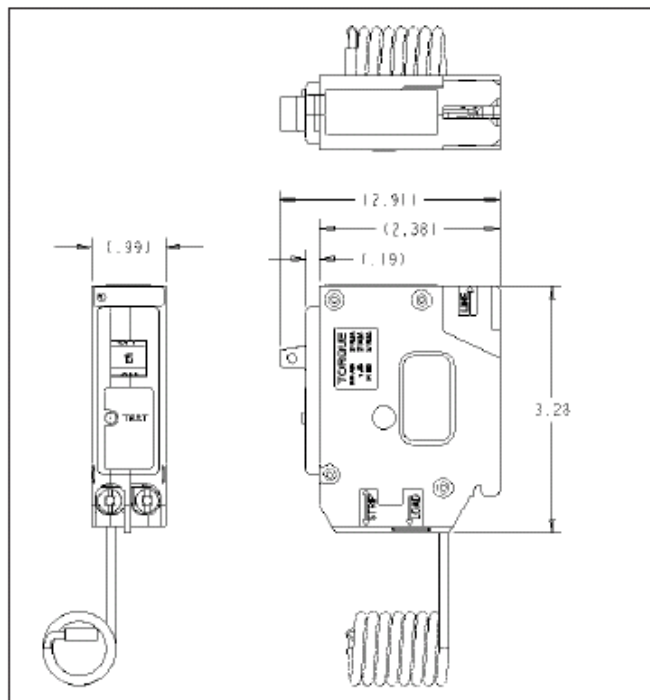
## Type BR (1") Combination Arc Fault Circuit Interrupter

Technical Data TD003001EN  
Effective August 2012

**Table 3. Diagnostic Trip Codes** (The following Trip Codes are displayed through the Diagnostic AFCI (Catalog number: BRACAFX00)

Blink Pattern	Description
0	<b>Mechanical Disconnect</b> The breaker has detected an overload, short circuit or was manually turned off
1	<b>Low Current Arc</b> A low current "series" arc has been detected within one of the current pathways. These arcs are typically found in worn or degraded appliance and extension cords, poor connections in appliances or fixtures, or in contacts within equipment
2	<b>High Current Arc</b> A high current "parallel" arc has been detected between two conductors. These arcs are usually found in installed wiring where the wire has been compromised by a nail or screw, tight staple, damaged insulation.
3	<b>Short Delay</b> Short delay is an electronic backup to the short circuit mechanism
4	<b>Overvoltage</b> The breaker will trip if it experiences voltage of 160V RMS or greater. The breaker can be reset and the "TEST" button can be pushed to verify the breaker is working properly
6	<b>Self Test Failure</b> The breaker continually tests the internal electronics and software to ensure the arc fault detection technology is working properly. If the self diagnostics fail, the breaker will trip

## Dimensions



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**Eaton Corporation**  
Electrical Group  
1000 Cherrington Parkway  
Moon Township, PA 15108  
United States  
877-ETN-CARE (877-386-2273)  
Eaton.com

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# Type CH (3/4") Combination Arc Fault Circuit Interrupter



## Description

Beginning in 2008, the National Electrical Code requires all circuits feeding dwelling areas in residential structures to be protected by Combination Type Arc Fault Circuit Interrupters.

Eaton's Type CH (3/4") Combination AFCI is available in 15 and 20 Amp configurations. Eaton has also included a diagnostic LED as a standard feature in the CH AFCI which indicates the most recent trip code to assist in troubleshooting.

## Design Features

- Arc Fault Detection Methodology Tolerant of Non-compliant Devices
- Lifetime Trip Code retention
- Overvoltage Protection
- Continuous Self-Test of electronic components
- Diagnostic LED to access most recent trip code
- Two position, Trip to "OFF" handle

**Table 1. Type CH (3/4") CAFCI Selection Chart**

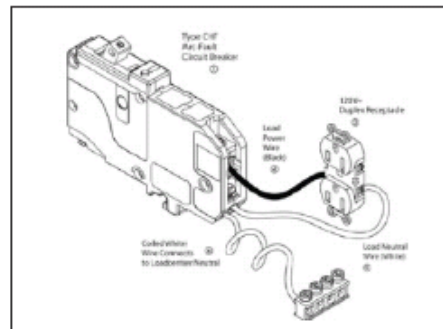
Catalog Number	Amps	Poles	kAIC
<b>Standard - Pigtail</b>			
CHCAF115	15	1	10
CHCAF120	20	1	10
<b>Plug-on Neutral</b>			
CHCAF115PN	15	1	10
CHCAF120PN	20	1	10



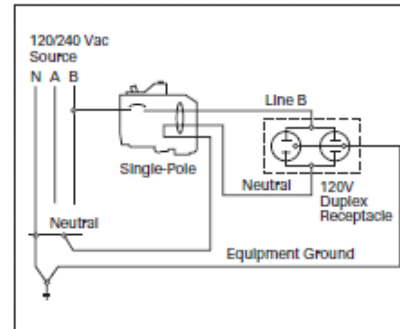
Table 2. Specifications

<b>Catalog Number</b>	CHCAF115, CHCAF120, CHCAF115PN, CHCAF120PN
<b>Voltage Requirement</b>	70 ≤ V- ≤ 160
<b>Frequency Requirement</b>	60 ± 2 Hz
<b>Power Consumption</b>	0.75W
<b>Surge</b>	In accordance with IEC 61000-4-5
<b>Ambient Temperature</b>	-31°C to 66°C (32°F to 151°F)
<b>Humidity</b>	0% to 93% humidity, non-condensing
<b>Warranty</b>	Limited Lifetime
<b>Dimming Load</b>	Up to 2,000 Watts verified compatibility with the following systems and controls: Lutron®: • HomeWorks® • RadioRA® • AutoRa® • Grafik Eye® • Wallbox dimmers
<b>UL® Standards</b>	UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures UL 1699 - Arc Fault Circuit Interrupters UL 1998 - Software in Programmable Components
<b>UL File Number</b>	E-7819
<b>Ground Fault Protection</b>	30mA - Does not meet the requirements of UL 1053 for ground fault sensing & relaying equipment

## Installation



## Wiring Diagram

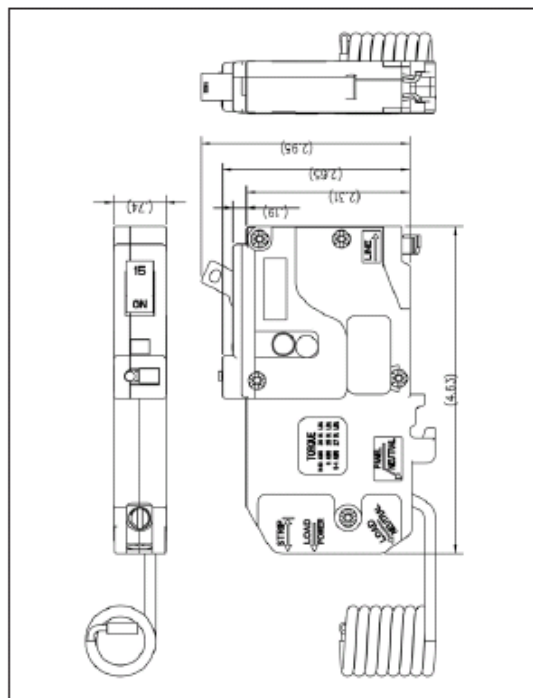


1-Pole 120 Volt Load Application  
Sourced by 120/240 Vac

Technical Data TD003002EN  
Effective August 2012

Blink Pattern	Description
0	<b>Mechanical Disconnect</b> The breaker has detected an overload, short circuit or was manually turned off
1	<b>Low Current Arc</b> A low current "series" arc has been detected within one of the current pathways. These arcs are typically found in worn or degraded appliance and extension cords, poor connections in appliances or fixtures, or in contacts within equipment
2	<b>High Current Arc</b> A high current "parallel" arc has been detected between two conductors. These arcs are usually found in installed wiring where the wire has been compromised by a nail or screw, tight staple, damaged insulation.
3	<b>Short Delay</b> Short delay is an electronic backup to the short circuit mechanism
4	<b>Overvoltage</b> The breaker will trip if it experiences voltage of 160V RMS or greater. The breaker can be reset and the "TEST" button can be pushed to verify the breaker is working properly
5	<b>Ground fault</b> Current has found an alternate path to ground.
6	<b>Self Test Failure</b> The breaker continually tests the internal electronics and software to ensure the arc fault detection technology is working properly. If the self diagnostics fail, the breaker will trip

### Standard Pigtail



Technical drawing of the 1000E power supply unit, showing front, side, and top views with dimensions in inches.

**Front View Dimensions:**

- Overall Width: 4.61
- Overall Height: 2.31
- Mounting Hole Spacing: 2.65
- Top Mounting Hole Offset: .19
- Bottom Mounting Hole Offset: .74

**Front View Labels:**

- STOP LOAD POWER (with arrows pointing to the left)
- 1000E (with a table of specifications below it)
- LINE NEUTRAL (with a switch symbol)
- GROUND (with a ground symbol)
- ON/OFF (with a switch symbol)

**Top View Dimensions:**

- Overall Length: 7.95

**Top View Labels:**

- 15 ON (with a switch symbol)

**Side View Dimensions:**

- Overall Depth: 1.74

**Side View Labels:**

- 15 ON (with a switch symbol)



**Eaton Corporation**  
Electrical Group  
1000 Charrington Parkway  
Moon Township, PA 15108  
United States  
877-ETN-CARE (877-386-2273)  
Eaton.com

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# Type QB (1") Combination Arc Fault Circuit Interrupter



## Description

Beginning in 2008, the National Electrical Code requires all circuits feeding dwelling areas in residential structures to be protected by Combination Type Arc Fault Circuit Interrupters.

Eaton's Type QB (1") Bolt-on Combination AFCI is available in 15 and 20 Amp configurations. Eaton has also included a diagnostic LED as a standard feature in the QB AFCI which indicates the most recent trip code to assist in troubleshooting.

## Design Features

- Arc Fault Detection Methodology Tolerant of Non-compliant Devices
- Lifetime Trip Code retention
- Overvoltage Protection
- Continuous Self-Test of electronic components
- Diagnostic LED to access most recent trip code

**Table 1. Type QB (1") CAFCI Selection Chart**

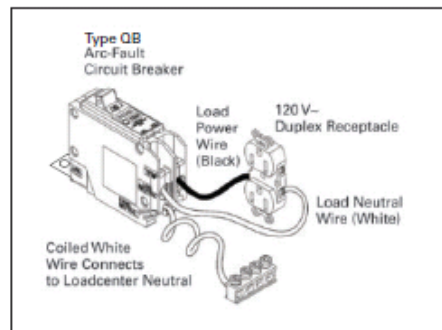
Catalog Number	Amps	Poles	kAIC
<b>Standard - Pigtail</b>			
QB1015CAF	15	1	10
QB1020CAF	20	1	10
<b>High - Interrupting - 22kAIC</b>			
QBH1015CAF	15	1	22
QBH1020CAF	20	1	22



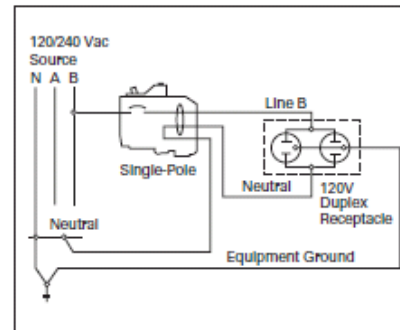
Table 2. Specifications

Catalog Number	QB1015CAF, QB1020CAF, QBH1015CAF, QBH1020CAF
Voltage Requirement	70 ≤ V- ≤ 160
Frequency Requirement	60 ± 2 Hz
Power Consumption	0.75W
Surge	In accordance with IEC 61000-4-5
Ambient Temperature	-31°C to 66°C (32°F to 151°F)
Humidity	0% to 93% humidity, non-condensing
Warranty	1 year - From date of installation
Dimming Load	Up to 2,000 Watts verified compatibility with the following systems and controls: Lutron®: • HomeWorks® • RadioRA® • AutoRa® • Grafik Eye® • Wallbox dimmers
UL® Standards	UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures UL 1699 - Arc Fault Circuit Interrupters UL 1998 - Software in Programmable Components
UL File Number	E-7819

## Installation



## Wiring Diagram



1-Pole 120 Volt Load Application  
Sourced by 120/240 Vac

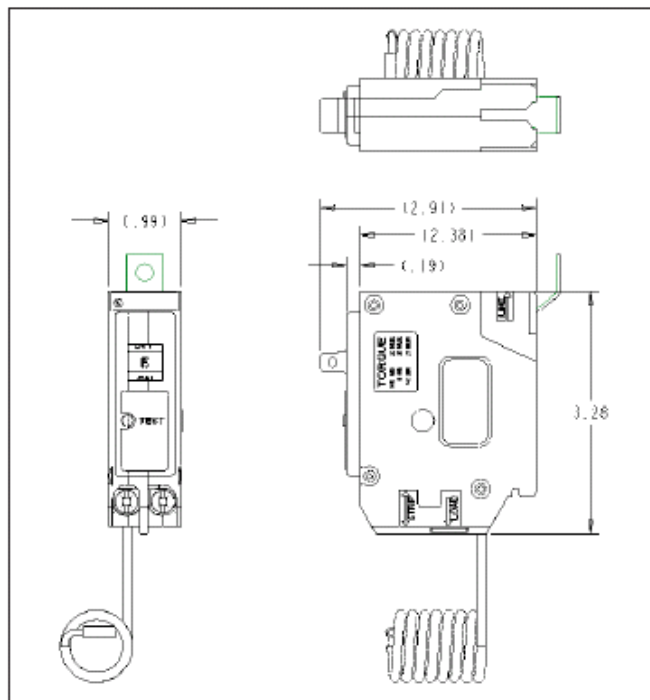
## Type QB (1") Combination Arc Fault Circuit Interrupter

Technical Data TD003003EN  
Effective August 2012

**Table 3. Diagnostic Trip Codes** (The following Trip Codes are displayed through the Diagnostic AFCI (Catalog number: CHACAFX00))

Blink Pattern	Description
0	<b>Mechanical Disconnect</b> The breaker has detected an overload, short circuit or was manually turned off
1	<b>Low Current Arc</b> A low current "series" arc has been detected within one of the current pathways. These arcs are typically found in worn or degraded appliance and extension cords, poor connections in appliances or fixtures, or in contacts within equipment
2	<b>High Current Arc</b> A high current "parallel" arc has been detected between two conductors. These arcs are usually found in installed wiring where the wire has been compromised by a nail or screw, tight staple, damaged insulation.
3	<b>Short Delay</b> Short delay is an electronic backup to the short circuit mechanism
4	<b>Overvoltage</b> The breaker will trip if it experiences voltage of 160V RMS or greater. The breaker can be reset and the "TEST" button can be pushed to verify the breaker is working properly
6	<b>Self Test Failure</b> The breaker continually tests the internal electronics and software to ensure the arc fault detection technology is working properly. If the self diagnostics fail, the breaker will trip

## Dimensions



Technical Data TD003003EN  
Effective August 2012

## Type QB (1") Combination Arc Fault Circuit Interrupter



**Eaton Corporation**  
Electrical Group  
1000 Charrington Parkway  
Moon Township, PA 15108  
United States  
877-ETN-CARE (877-386-2273)  
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