Enclosed circuit breaker (ECB) with Arcflash Reduction Maintenance System

Overview

The enclosed circuit breaker (ECB) with Arcflash Reduction Maintenance System™ is an extension of the arc flash risk reducing solutions currently offered by Eaton. The assembly provides an enclosed circuit breaker with functionality that allows the operator to place the breaker into a maintenance mode, thus reducing the amount of available arc flash incident energy downstream. This is the market's first UL® listed, enclosed circuit breaker design with arc flash mitigation technology. It's a fully industrialized, packaged solution that uses Eaton's Digitrip™ 310+ technology with Arcflash Reduction Maintenance System. The new ECB with Arcflash Reduction Maintenance System is a welcome addition to the product line not only for applications affected by 2014 updates to NEC® Article 240.87, but for any application where a reduction of the amount of available arc flash incident energy is desired.

The information below is taken directly from the National Electrical Code® (NEC) 2014. Changes to Code text made in the 2014 edition are highlighted by gray shading.

240.87 Arc Energy Reduction

Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200 A or higher, 240.87(A) and (B) shall apply.

(A) Documentation. Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).

(B) Method to Reduce Clearing Time. One of the following or approved equivalent means shall be provided:

1. Zone selective interlocking
2. Differential relaying
3. Energy-reducing maintenance switching with local status indicator
4. Energy-reducing active arc flash mitigation system
5. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to "no intentional delay" to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2012, Standard for Electrical Safety in the Workplace, and then to set the trip unit back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps to reduce arcing duration in the electrical distribution system. No change in the circuit breaker or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2012, Standard for Electrical Safety in the Workplace.

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Product description

Selected models of Eaton's molded case circuit breakers are available with an Arcflash Reduction Maintenance System to provide reduced levels of incident arc flash energy when put in the maintenance mode. The Arcflash Reduction Maintenance System is available within an enclosed circuit breaker assembly, including KD, HKD, LGE, LGH, NGS, and NGH frame circuit breakers using the Digitrip 310+ electronic trip unit. These trip units have maintenance mode settings of 2.5 and 4.0 times the current rating. This dedicated Arcflash Reduction Maintenance System analog sensing circuit delivers breaker clearing times that are faster than the standard instantaneous function by eliminating microprocessor processing latencies. This faster clearing time provides superior arc flash energy reduction as compared to competitors' systems that simply lower the pickup set point of the standard instantaneous function. When the Eaton Arcflash Reduction Maintenance System is enabled, the resulting reduced arc flash energy allows for reduced PPE, which improves worker dexterity and mobility. The pickup setting of each Arcflash Reduction Maintenance System trip unit is determined by completing a power system analysis to assess the arcing fault current levels at the circuit breaker. Based on that analysis of the arcing fault current, the Arcflash Reduction Maintenance System maintenance mode pickup settings are defined, achieving a reduced level of arc flash energy. The maintenance mode is activated by switching the lockable selector switch on the front of the enclosure, allowing this to be integrated into standard lock-out/tag-out procedures. Positive indication that the Arcflash Reduction Maintenance System maintenance mode is active is shown with a blue LED indicating light on the front of the enclosure. An additional control relay is also included to allow users to enable the Arcflash Reduction Maintenance System via a remote input signal.

Standard features

- Digitrip 310+ trip unit with ALSI protection
- Full range, 55 A to 1200 A
- NEMA® Type 1, 3R, 12, 4X
- 600 Vac maximum
- 65 kAIC maximum at 480 Vac
- Additional control relay included to allow users to enable the Arcflash Reduction Maintenance System maintenance mode via a remote input signal
- 48 W power supply
- 100 VA CPT
- Cover controls, including padlockable selector switch for Arcflash Reduction Maintenance System maintenance mode activation and blue LED indication light
- Padlockable in the OFF position ①
- Padlockable enclosure
- Three-position handle (ON/Tripped/OFF)
- Assembly is fully factory wired and ready to go out of the box
- Can be applied on three-phase and single-phase systems ②

① From the factory, the handle can only be locked in the OFF position and can accommodate a maximum of three padlocks. Field modification to drill the shroud can allow locking in the ON position. Check with your local AHJ for requirements. The breaker will trip as usual, even with the handle locked ON.

② For single-phase applications, the customer must wire using the breaker's two outside poles.

Optional features

- Standard molded case breaker accessories available
- For ground fault applications, ALSIG protection is available
- Modifications available such as custom paint, 316-stainless enclosures, lock-on provisions, and more. Call the Flex Center at 888-329-9272 for more information.

Standards

- UL 489 (File Number E309241)
- cUL® 489 (File Number E309241)
- NEC 240.87 Compliant

Product selection

Table 1. Short-circuit ratings

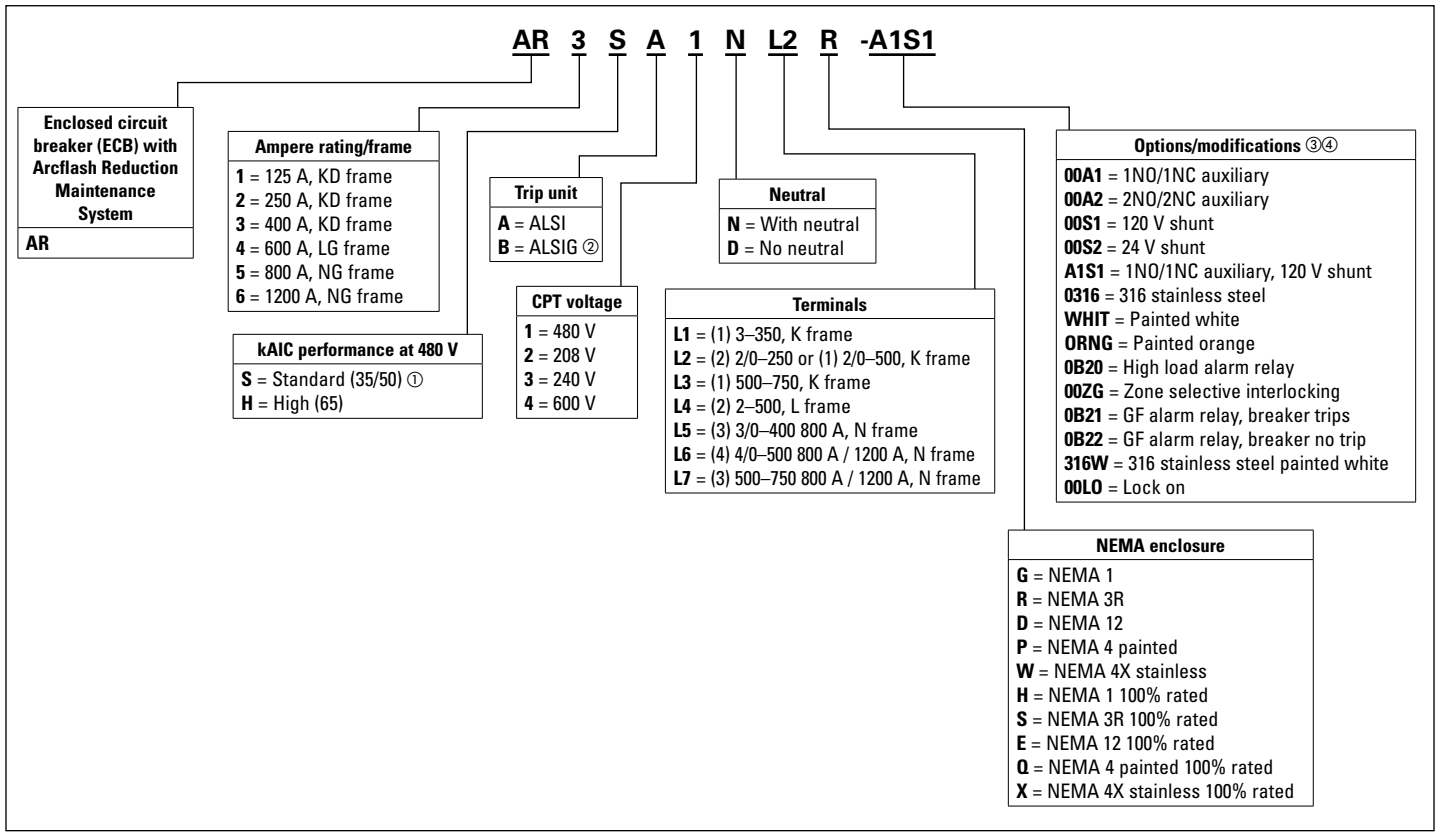
Breaker frame	kAIC ratings 240 V	480 V	600 V	Catalog numbers
KD	65	35	25	**AR1S, AR2S, AR3S**
HKD	100	65	35	**AR1H, AR2H, AR3H**
LGE	65	35	18	**AR4S**
LGH	100	65	35	**AR4H**
NGS	85	50	25	**AR5S, AR6S**
NGH	100	65	35	**AR5H, AR6H**

Table 2. Neutral field kits

Ampere rating/ breaker frame	Catalog number prefix	Trip unit	Neutral assembly	Neutral wire range
125 A KD-frame	AR1	ALSI	**DS400NK**	2 lugs with range (1) 750 kcmil–1/0 or (2) 300 kcmil–1/0
		ALSIG	**AR1NGFCT** ①	3 lugs with range (1) 250 kcmil–#6
250 A KD-frame	AR2	ALSI	**DS400NK**	2 lugs with range (1) 750 kcmil–1/0 or (2) 300 kcmil—1/0
		ALSIG	**AR2NGFCT** ①	3 lugs with range (1) 250 kcmil–#6
400 A KD-frame	AR3	ALSI	**DS400NK**	2 lugs with range (1) 750 kcmil–1/0 or (2) 300 kcmil–1/0
		ALSIG	**AR3NGFCT** ①	3 lugs with range (1) 250 kcmil–#6
600 A LG-frame	AR4	ALSI	**DS600NK**	2 lugs with range (1) 750 kcmil–1/0 and (1) 600 kcmil–#2
		ALSIG	**AR4NGFCT** ①	3 lugs with range (1) 250 kcmil–#6
800 A NG-frame	AR5	ALSI	**DS800NK**	2 lugs with range (4) 750 kcmil–1/0
		ALSIG	**AR56NGFCT** ①	3 lugs with range (1) 250 kcmil–#6
1200 A NG-frame	AR6	ALSI	**DS800NK**	2 lugs with range (4) 750 kcmil–1/0
		ALSIG	**AR56NGFCT** ①	3 lugs with range (1) 250 kcmil–#6

① Includes neutral and ground fault neutral sensor.

Table 3. Catalog numbering system



① Standard = 35 kAIC for KD and LG, 50 kAIC for NG.

② Neutral CTs are included for ground fault protected breakers (ALSIG option).

③ More combinations and options are available.

④ Breaker accessories (shunt, UVR, etc.) can be field installed. See molded case breaker catalog section for information regarding accessories and proper installation.

Technical data and specifications

Table 4. 310+ configuration notes

Notes
B21 and B22 features available only with ALSIG trip unit
B2x suffixes cannot be combined with other B2x suffixes; however, they may be combined with suffix ZG
ALSIG trip unit is not available in four-pole breakers with neutral protection
Four-pole trip units include fully protected neutral pole; contact Eaton for other four-pole requirements

Table 5. Adjustability specifications

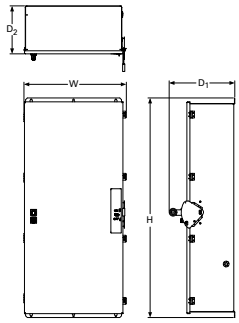
310+settings	Breaker frame	KD-frame	KD-frame	KD-frame	LG-frame	NG-frame	NG-frame
I_r = continuous current or long delay pickup (A) (All 310+)	$I_r \setminus I_n$	**125 A**	**250 A**	**400 A**	**600 A**	**800 A**	**1200 A**
	A (=I_r)	55 A	100 A	160 A	250 A	320 A	500 A
	B (=I_r)	60 A	125 A	200 A	300 A	400 A	600 A
	C (=I_r)	70 A	150 A	225 A	315 A	450 A	630 A
	D (=I_r)	80 A	160 A	250 A	350 A	500 A	700 A
	E (=I_r)	90 A	175 A	300 A	400 A	600 A	800 A
	F (=I_r)	100 A	200 A	315 A	450 A	630 A	900 A
	G (=I_r)	110 A	225 A	350 A	500 A	700 A	1000 A
	H (=I_r=I_n)	125 A	250 A	400 A	600 A	800 A	1200 A
t_r = long delay time (s) (All 310+)	2	2 s	2 s	2 s	2 s	2 s	2 s
	4	4 s	4 s	4 s	4 s	4 s	4 s
	7	7 s	7 s	7 s	7 s	6 s	7 s
	10	10 s	10 s	10 s	10 s	8 s	10 s
	12	12 s	12 s	12 s	12 s	10 s	12 s
	15	15 s	15 s	15 s	15 s	12 s	15 s
	20	20 s	20 s	20 s	20 s	14 s	20 s
	24	24 s	24 s	24 s	24 s	14 s	24 s
I_{sd} x I_r = short delay pickup (All 310+)	Position 1	2 x I_r	2 x I_r	2 x I_r	2 x I_r	2 x I_r	2 x I_r
	Position 2	3 x I_r	3 x I_r	3 x I_r	3 x I_r	3 x I_r	3 x I_r
	Position 3	4 x I_r	4 x I_r	4 x I_r	4 x I_r	4 x I_r	4 x I_r
	Position 4	5 x I_r	5 x I_r	5 x I_r	5 x I_r	5 x I_r	5 x I_r
	Position 5	6 x I_r	6 x I_r	6 x I_r	6 x I_r	6 x I_r	6 x I_r
	Position 6	7 x I_r	7 x I_r	7 x I_r	7 x I_r	7 x I_r	7 x I_r
	Position 7	8 x I_r	8 x I_r	8 x I_r	8 x I_r	8 x I_r	8 x I_r
	Position 8	10 x I_r	10 x I_r	10 x I_r	10 x I_r	9 x I_r	9 x I_r
	Position 9	12 x I_r	12 x I_r	12 x I_r	12 x I_r	9 x I_r	9 x I_r
I_g x I_n = ground fault pickup (310+ with ground fault)	Position 1	25 A	50 A	80 A	120 A	160 A	240 A
	Position 2	37.5 A	75 A	120 A	180 A	240 A	360 A
	Position 3	50 A	100 A	160 A	240 A	320 A	480 A
	Position 4	75 A	150 A	240 A	360 A	480 A	720 A
	Position 5	100 A	200 A	320 A	480 A	640 A	960 A
	Position 6	125 A	250 A	400 A	600 A	800 A	1200 A
I_i x I_n = Instantaneous / maintenance mode onboard switch settings (some 310+ equipped with maintenance mode)	Position 1 (2.5x)	—	—	—	1500 A	2000 A	3000 A
	Position 2 (4x)	—	—	—	2400 A	3200 A	4800 A
	Position 3 (6x)	—	—	—	3600 A	4800 A	7200 A
	Position 4 ①	—	—	—	4200 A	5600 A	8400 A
	Position 5 ①	—	—	—	4800 A	6400 A	9600 A
	Position 6 ①	—	—	—	6000 A	8000 A	12,000 A
	Position 7 ①	—	—	—	7200 A	14,400 A	14,400 A
Remote maintenance mode input (24 V) (all 310+ equipped with maintenance mode)	Fixed setting (2.5x)	312 A	625 A	1000 A	1500 A	2000 A	3000 A

① Varies by frame I_n.

Table 6. Short delay and ground fault delay times for ALSI and ALSIG trip units

t_{sd}/t_g = Short delay time and ground fault time (ms/ms) (310+ with fixed instantaneous and ground fault)	t_{sd}/t_g = Short delay time and ground fault time (ms/ms) (310+ with adjustable instantaneous and ground fault)	t_{sd} = Short delay time (ms) (310+ with adjustable instantaneous, without ground fault)
LSIG, ALSIG (KD)	ALSIG (LG, NG)	ALSI (All frames)
J = Inst / Inst	J = 50 ms / 50 ms	Position 1 = 50 ms
K = Inst / 120 ms	K = 50 ms / 120 ms	Position 2 = 50 ms
L = Inst / 300 ms	L = 50 ms / 300 ms	Position 3 = 50 ms
M = 120 ms / Inst	M = 120 ms / 50 ms	Position 4 = 120 ms
N = 120 ms / 120 ms	N = 120 ms / 120 ms	Position 5 = 120 ms
O = 120 ms / 300 ms	O = 120 ms / 300 ms	Position 6 = 120 ms
P = 300 ms / Inst	P = 300 ms / 50 ms	Position 7 = 300 ms
Q = 300 ms / 120 ms	Q = 300 ms / 120 ms	Position 8 = 300 ms
R = 300 ms / 300 ms	R = 300 ms / 300 ms	Position 9 = 300 ms

Table 7. Dimensions



Breaker frame	Maximum amperage	Height (H)	Width (W)	Depth (D1)	Depth (D2)
K	400	53.63 (1362.2)	26.48 (672.6)	12.69 (322.3)	7.54 (191.5)
LG	600	53.63 (1362.2)	26.48 (672.6)	12.69 (322.3)	7.54 (191.5)
NG	1200	63.54 (1614.0)	29.63 (752.6)	18.99 (482.3)	13.87 (352.3)
K 100% rated	400	53.63 (1362.2)	26.48 (672.6)	12.69 (322.3)	7.54 (191.5)
LG 100% rated	600	53.63 (1362.2)	26.48 (672.6)	12.69 (322.3)	7.54 (191.5)
NG 100% rated	1200	①	①	①	①

① Contact the Switching Device Flex Center at 1-888-329-9272 or FlexSwitches@eaton.com for availability of this product.

Wiring diagram

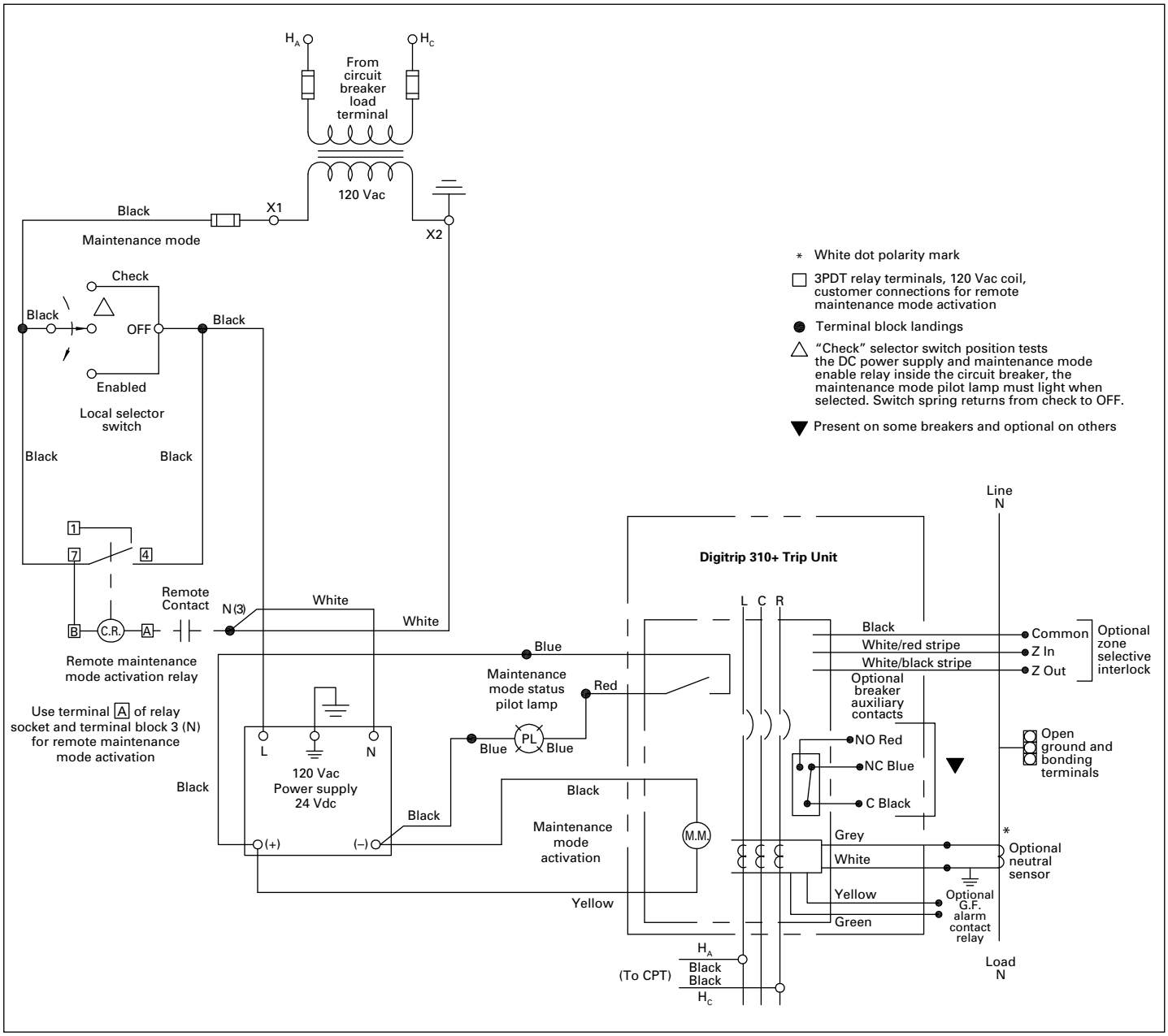


Figure 1. ECB with Arcflash Reduction Maintenance System wiring

Enclosed circuit breaker (ECB) with Arcflash Reduction Maintenance System

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

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