FR circuit breaker - hydraulic magnetic, railway, very high current

Datasheet

Description

Hydraulic magnetic circuit breaker for very high current railway applications to protect electronic equipment and components against unintended high currents. Optional with integrated auxiliary contacts to monitor the circuit.

The trip point is always at maximum allowable current, independent of ambient temperature. Mid-trip handle to indicate clearly a breaker operation caused by electrical fault. With unique arc chute design which results in high interrupting capacities. Up to 3 poles which all break its electronic circuits when 1 breaker trips, for optimal protection of the system. Wide range of currents from 100 A to 700 A and many options available.

Application

To be used in every high current application where electrical systems, circuits or components must be protected against too high currents. This situation can occur, when under strained or heavy use a motor or other load-generating component within the equipment will draw additional current from the power source. High currents cause the wires or components to overheat and ultimately burn up.

A circuit protection device should be employed at any point where a conductor size changes. Many electronic circuits and components like transformers have a lower overload withstand threshold level than conductors such as wires and cables. These components require circuit protection devices featuring very fast overload sensing and opening capabilities.
The FR circuit breaker can be used in all Railway applications where protection against overload and short circuit is necessary, for example HVAC systems, (door) control systems, braking systems, passenger information systems, etc.

Features

- Ideal for very high current applications
- Precise, temperature independent operation
- Panel mount
- Integrated auxiliary contacts (optional)
- Up to 3 poles configuration
- High interrupting capacities due to unique arc chute method
- Mid-trip handle for electrical trip indication (optional)
- Immediate resetting possible
- Wide current range: 100 - 700 A
- Wide choice of time delays
- Maximum voltage 137.5 VDC / 277 VAC
- High contact pressure & longer contact life due to wiping self-cleaning contacts
- Flexibility by many options

Benefits

- Proven reliable
- Long term availability
- Low lifecycle cost
- No maintenance

Railway compliancy

All our circuit breakers are designed according:

- IEC 60077 - 1/2/3/4
- NF F62-001 - 1/2/3
- NF F16-101/102
- EN 45545-2
- EN 50155
- EN 61373
- EN 50124-1
- IEC 60068-2-30
- IEC 60068-2-52
- NF F61-010
- MIL Method 107D, condition A
- MIL-STD-202G, Method 204C

FR circuit breakers
Technical specifications




Electrical characteristics

Application voltage	**DC for 1-3 poles**	**AC for 1-3 poles**
Rated voltage	12 - 110 VDC	12 - 251 VAC
Min. operating voltage	8.4 VDC	10.8 VAC
Max. operating voltage	137.5 VDC	277 VAC
	Remark: DC applications: max. 250 A for 1 pole 300 A - 450 A for 2 poles (parallel pole construction) 500 A - 700 A for 3 poles (parallel pole construction) AC applications: max. 250 A for 1-3 poles	
Current ratings	100 - 700 A. Other ratings on request.	
Dielectric strength	1960 VAC, 50/60 Hz for 1 minute between all electrically isolated terminals.	
Creepage and clearance	EN 50124-1 8 mm spacing requirements from hazardous voltage to operator accessible surfaces, between adjacent poles and from main circuits to auxiliary circuits.	
Insulation resistance	Minimum of 100 MΩ @ 500 VDC	
Operating frequency	50/60 Hz, DC	
Max. interrupting capacity	IEC 60947-2	25.000 A @ 125 VDC, 50 - 250 A
	UL 489	50.000 A @ 125 VDC, 50 - 250 A
	UL 489A	50.000 A @ 125 VDC, 251 - 700 A
	UL 489	10.000 A @ 277 VDC, 100 - 250 A
Auxiliary switch	Integrated, load side. SPST. Auxiliary switch senses the on-off position of circuit breaker handle, as well as the open-closed position of breaker contact.	
		Silver auxiliary contacts / Gold auxiliary contacts
	AC min. switching capacity	5 - 20 VAC: 100 mA ≥ 20 VAC: 10 mA / 5 mA / 5 VAC
	AC max. switching capacity	5 A / 125 VAC / 100 mA / 125 VAC
	DC min switching capacity	≤ 20 VDC: 100 mA ≥ 20 VDC: 10 mA / 5 mA / 5 VDC
	DC max. switching capacity	3 A / 32 VDC / 100 mA / 125 VDC (max. 2000 cycles) / 100 mA / 32 VDC / 2 mA / 110 VDC (max. 2000 cycles)
	All loads mentioned are resistive loads.	

FR circuit breakers
Technical specifications

General characteristics

Number of poles	1, 2 or 3 poles
Terminals	Stud / screw / box wire connector, see circuit & terminal diagrams
Auxiliary contacts	Faston or solder type, see circuit & terminal diagrams
Mounting	The hydraulic-magnetic circuit breakers of Mors Smitt can be mounted in any position. A hydraulic-magnetic breaker is designed to "must hold" at 100% of the breaker's current rating and is calibrated to "must trip" at 125% of the breaker's current rating. If the mounting position is +90 degrees from a vertical panel mount (handle facing down, ceiling mount position) the trip and must hold rating is reduced by 10%.
Body	Blue colour
Actuator handle	Black or white with "I O" and "On-off" legends
Int. circuit configuration	Series trip
Weight	950 gram per pole (average, depending on configuration)
Width per pole	38.1 mm
Material	Half shell - BMC 605 Handle - Valox 420SEO UL94V0 Terminals - Brass with acid tin plate

Mechanical characteristics

Endurance	Single or multipole: 8.000 operations @ 5 per minute (4.000 "ON-OFF" operations with rated current and voltage + 4.000 operations with no load). Parallel pole construction: 1.000 operations with rated current and voltage @ 5 per minute.
Trip indication:	
Standard (no mid-trip)	When manually moving the operating handle from OFF to ON position, an auxiliary switch is actuated. When an overload or a short circuit causes the circuit breaker to trip, the operating handle moves positively to the OFF position and the auxiliary switch is actuated.
Mid-trip	When manually moving the operating handle from OFF to ON position, an auxiliary switch is actuated. When an overload or a short circuit causes the circuit breaker to trip, the operating handle moves positively to the mid position and the auxiliary switch is actuated.
Mid-trip with alarm switch	When manually moving the operating handle from OFF to ON position, an auxiliary switch is not actuated. When an overload or a short circuit causes the circuit breaker to trip, the operating handle moves positively to the mid position and the auxiliary switch is actuated. In this case the auxiliary switch is only actuated by an electrical trip, not by manually operating the handle. Remark: It is possible to manually switch the circuit breaker to the mid-trip position when the handle is switched from OFF to ON position quickly and with strong upwards force. Normally this won't occur in standard use. This is a normal phenomenon related to the design of the product.

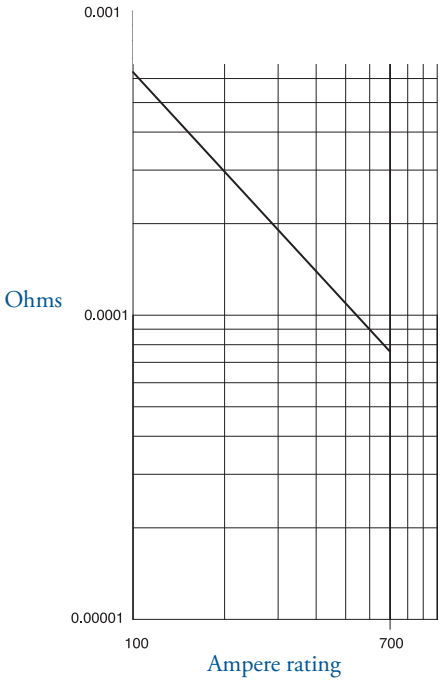
FR circuit breakers
Technical specifications

Environmental characteristics

Environmental	Complies to EN 50125-1 and IEC 60077-1
Operating temperature	-50 °C...+85 °C
Vibration	IEC 61373, Category 1, class B body mounted
Shock	IEC 61373, Category 1, class A & B body mounted
Thermal shock	Complies to MIL-PRF-55629 & MIL-STD-202
Salt spray	Complies to MIL-PRF-55629 & MIL-STD-202
Fire & smoke	Complies to NFF 16101, NFF 16102
Protection	IEC 60529, IP40 when a panel is mounted over the circuit breaker
Moisture resistance / humidity	Complies to MIL-PRF-55629 & MIL-STD-202

Resistance, impedance

Resistance, impedance values from Line to Load terminals
(Values based on series trip circuit breaker)



Current (amps)	Tolerance (%)
100 - 700	± 50%

FR circuit breakers
Technical specifications

Table of time delay values

	PERCENT OF RATED CURRENT								
	Delay	100%	125%	150%	200%	400%	600%	800%	1000%
TRIP TIME (SECONDS)	11	No Trip	.013 - .125	.010 - .070	.008 - .032	.006 - .020	.005 - .020	.004 - .020	.004 - .020
	12	No Trip	.475 - 10.0	.275 - 2.80	.140 - .850	.030 - .190	.015 - .125	.010 - .050	.008 - .038
	14	No Trip	10.0 - 110	6.00 - 40.0	2.50 - 15.0	.500 - 3.00	.180 - 1.00	.010 - .280	.008 - .080
	16	No Trip	110 - 1000	60.0 - 40 0	22.0 - 15 0	4.00 - 25.0	1.00 - 5.50	.010 - 1.80	.008 - .390
	22	No Trip	.700 - 12.0	.350 - 4.00	.130 - 1.30	.027 - .220	.008 - .130	.004 - .090	.004 - .045
	24	No Trip	10.0 - 16 0	6.00 - 60.0	.220 - 20.0	.300 - 3.00	.050 - 1.30	.007 - .500	.005 - .060
	26	No Trip	50.0 - 70 0	32.0 - 35 0	10.0 - 90.0	1.50 - 15.0	.500 - 7.00	.020 - 3.00	.006 - 2.00

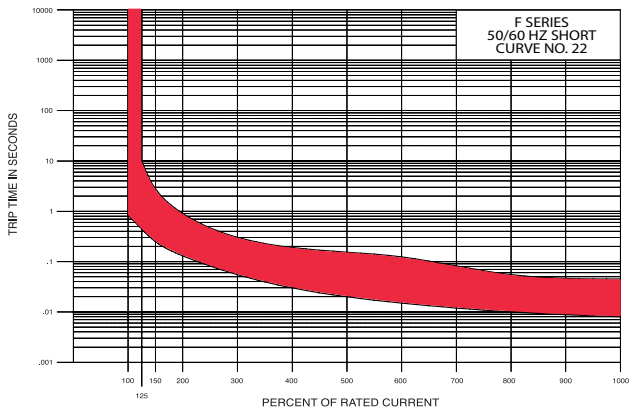
Notes:

- Delay curves 11, 12, 14, 16, 21, 22, 24, 26: Breakers to hold 100% and must trip at 125% of rated current and greater within the time limit shown in this curve
- All curves: Curve data shown represents breaker response at ambient temperature of 25 °C (77 °F) with no preloading. Breakers are mounted in standard wall-mount position. Delay times may vary at different temperature, the trip current rating remains unchanged
- The minimum inrush pulse tolerance handling capabilities is 10 times rated current based on a 60 Hz 1/2 cycle, 8.33 ms pulse

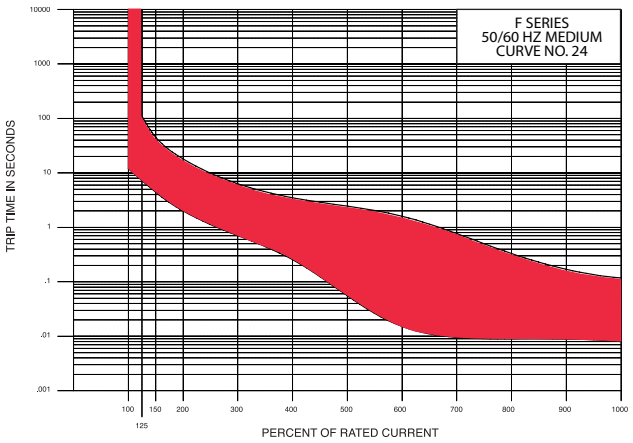
FR circuit breakers
Time delay values

AC

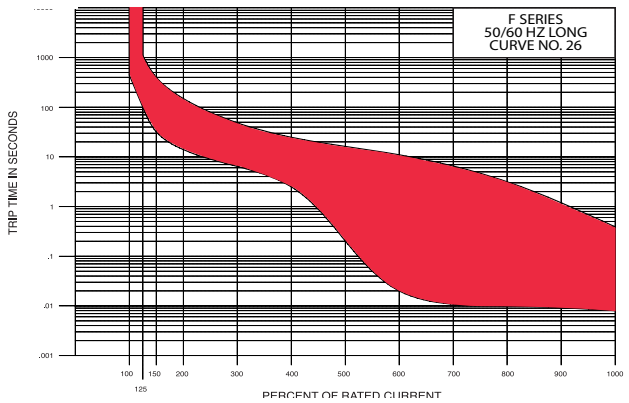
Short



Medium



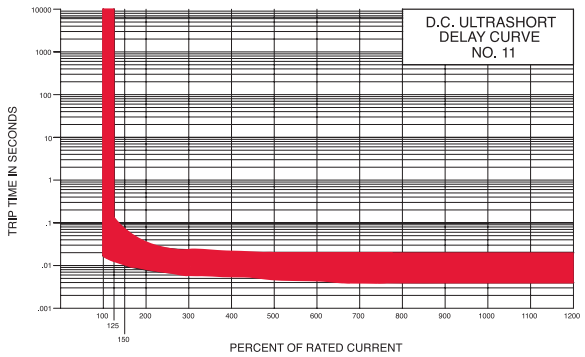
Long



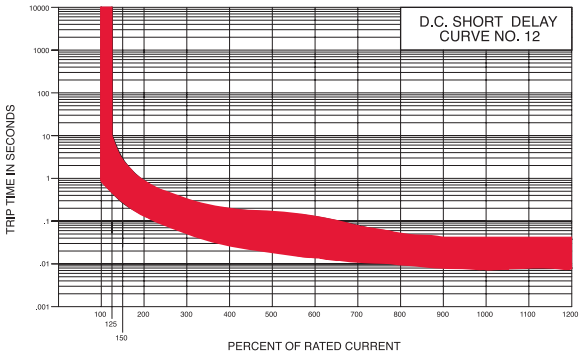
FR circuit breakers
Time delay values

DC

Ultrashort



Short



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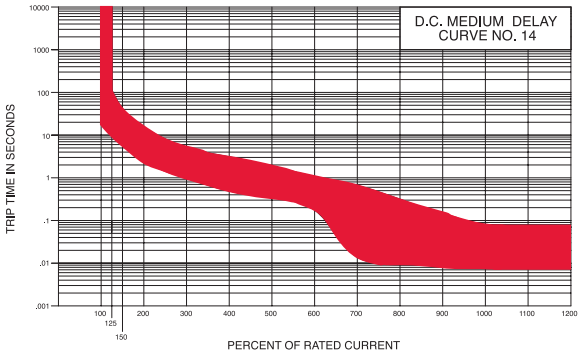

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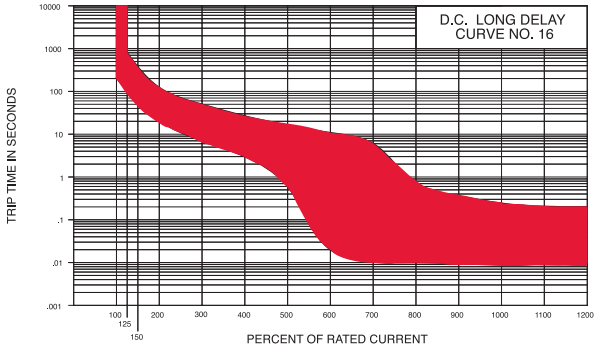
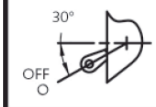
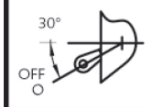
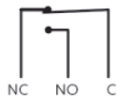
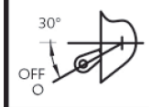
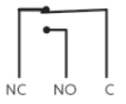
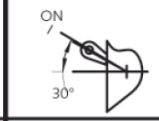
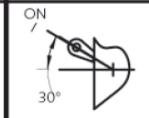
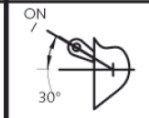
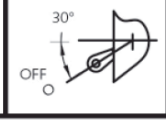
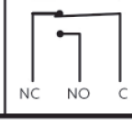
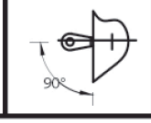
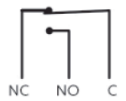
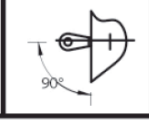
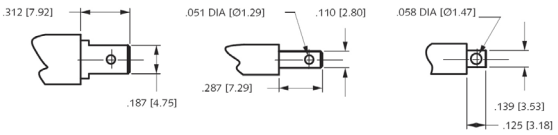


FR circuit breakers
Circuit & terminal diagrams

HANDLE POSITION VS. AUX/ALARM SWITCH MODE						
	STANDARD C/B		MID TRIP C/B		MID TRIP C/B + ALARM SWITCH MODE	
CIRCUIT BREAKER MODE	HANDLE POSITION	AUX. SWITCH MODE	HANDLE POSITION	AUX. SWITCH MODE	HANDLE POSITION	AUX. SWITCH MODE
OFF						
ON						
ELECTRICAL TRIP						

AUXILIARY / ALARM SWITCH TERMINAL DETAIL

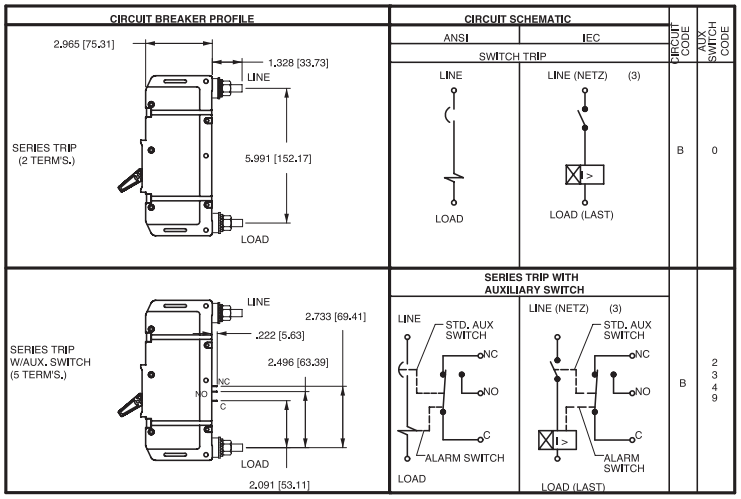


TAB (Q.C.) .187 | TAB (Q.C.) .110 | SOLDER TYPE

Notes 1 All dimensions are in inches [millimeters]
2 Tolerance ±0.020 [0.51] unless otherwise specified

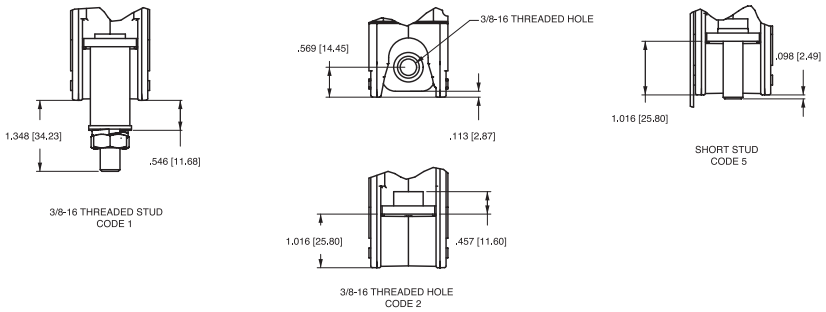
FR circuit breakers
Circuit & terminal diagrams

Non-parallel pole construction (1-3 pole)

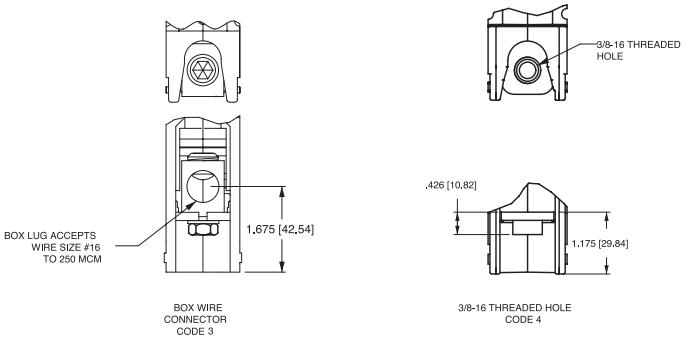


TERMINAL DETAILS

BACK CONNECT



FRONT CONNECT



Notes
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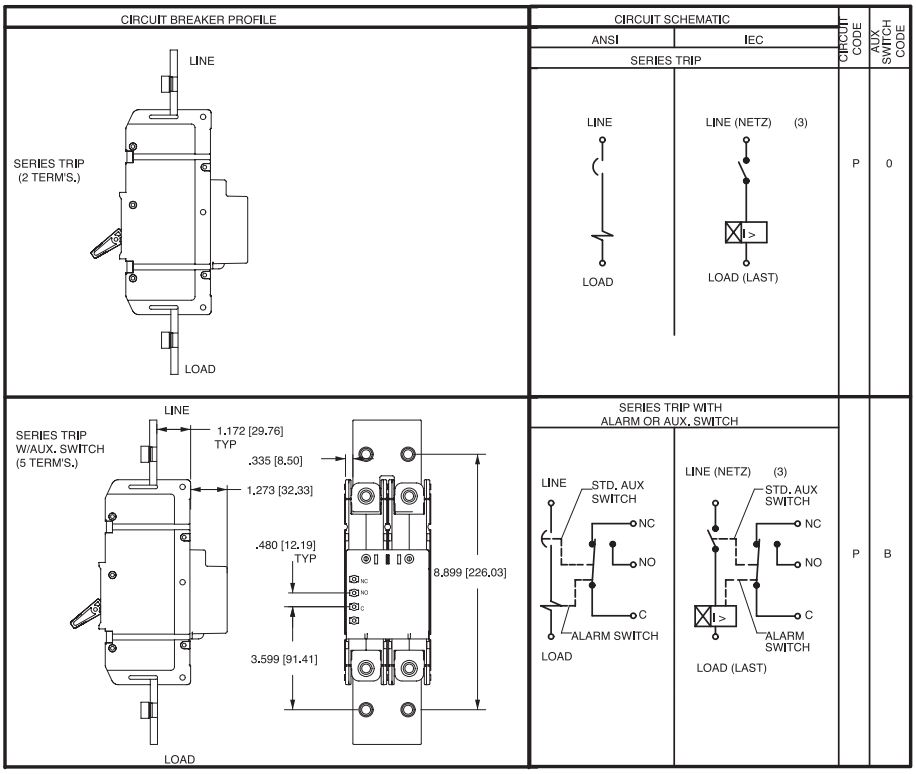
FR circuit breakers
Circuit & terminal diagrams

Parallel pole construction (2-3 pole)



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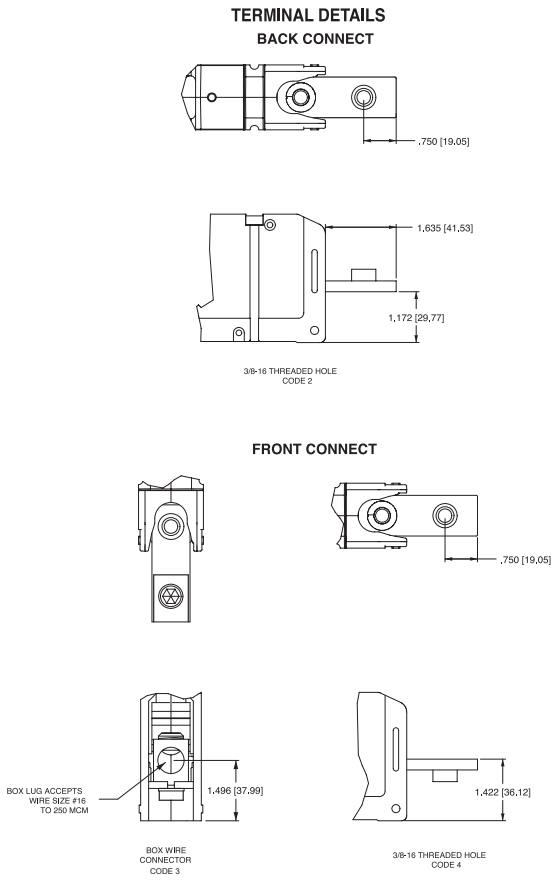
FR circuit breakers
Circuit & terminal diagrams



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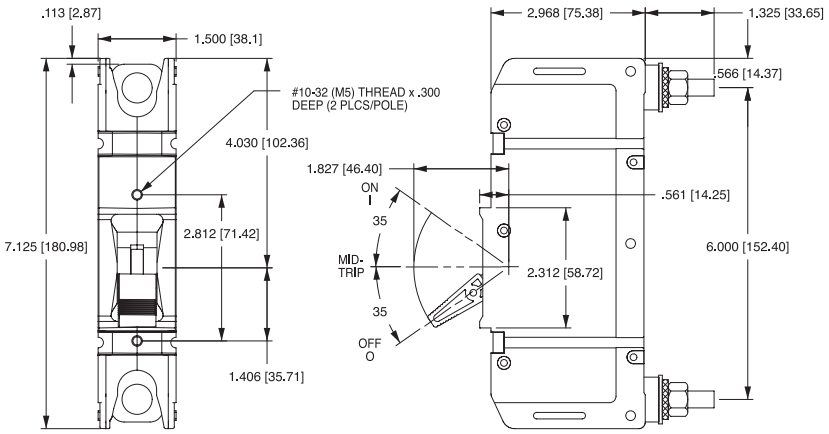
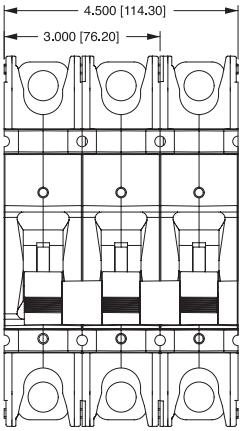
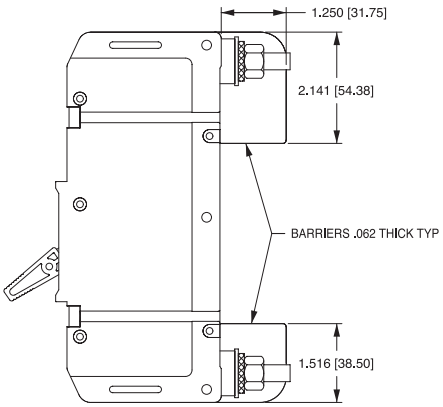
FR circuit breakers
Circuit & terminal diagrams

SERIES TRIP BACK CONNECT (STUD TERMINALS SHOWN)





MULTIPOLE SERIES TRIP, SHOWING TERMINAL BARRIER



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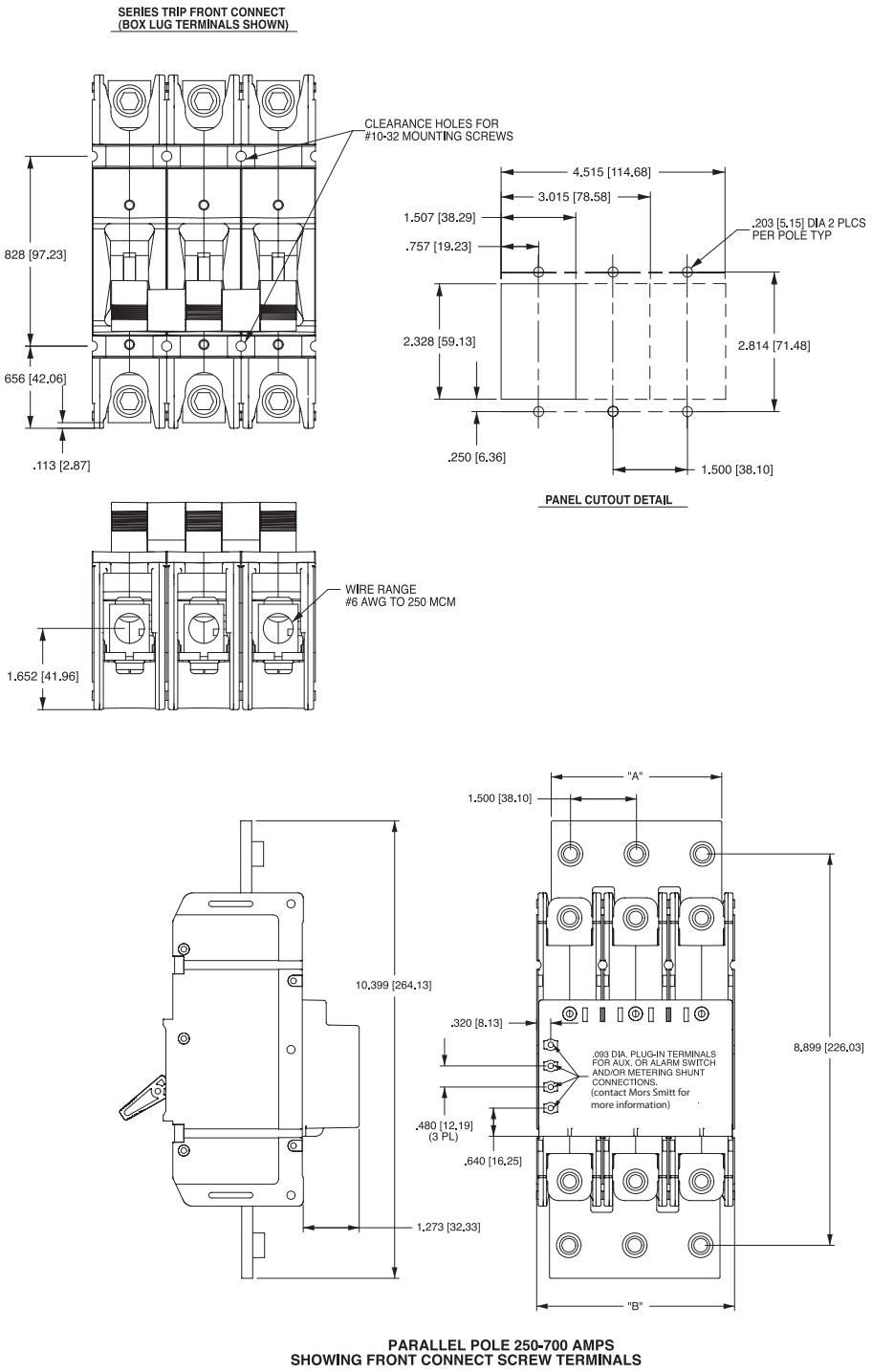
FR circuit breakers
Circuit & terminal diagrams



Notes 1 All dimensions are in inches [millimeters]
2 Tolerance ±0.020 [0.51] unless otherwise specified

FR circuit breakers
Ordering scheme

FR	2	-	820	-	14	-	B	-	A	-	2	-	0	-	1	-	A	-	B	-	A
1. Series	2. Poles		3. Current rating		4. Frequency & delay		5. Circuit		6. Actuator		7. Actuator colour & legend		8. Auxiliary switch		9. Terminal		10. Mounting		11. Max. application rating		12. Agency approval

1 Series

FR

2 Poles

1 One
2 Two
3 Three

3 Current rating (amperes)

810	100.0	820	200.0	840[8]	400.0
812	120.0	922	225.0	845[8]	450.0
912	125.0	825	250.0	850[8]	500.0
815	150.0	830[8]	300.0	860[8]	600.0
917	175.0	835[8]	350.0	870[8]	700.0

4 Frequency & delay

11 DC ultra short
12 DC short
14 DC medium
16 DC long
22 50/60 Hz short
24 50/60 Hz medium
26 50/60 Hz long

5 Circuit

Single pole or multi-pole (max. 250 A)
B Series trip (current)

Parallel pole construction (300 A - 700 A)
P[1] Series trip (current)

6 Actuator[2]

A Handle, one per pole
S Mid-trip handle, one per pole
T Mid-trip handle, one per pole & alarm switch

7 Actuator colour & legend

Actuator colour	I-O	ON-OFF	Dual	Legend colour
White	A	B	1	Black
Black	C	D	2	White

FR circuit breakers
Ordering scheme

8 Auxiliary switch[3]

0	Without auxiliary switch
2	SPDT, 0.110 QC terminals
3	SPDT, 0.139 solder lug
4	SPDT, 0.110 QC terminals (gold contacts)
9	SPDT, 0.187 QC terminals
B[4]	SPDT, 0.093 round QC terminals

9 Terminal

Back connected (front mounted only)		Max. rating
1[5]	Stud 3/8-16	250 A
2[6]	Screw, line & load 3/8-16	700 A
5[6]	Short stud 3/8-16	250 A
Front connected (back mounted only)[7]		**Max. rating**
3	Box wire connector, line & load	700 A
4[6]	Screw, line & load 3/8-16	700 A

10 Mounting

	Front mounting inserts	Back mounting inserts
A	10-32	10-32 screw clearance holes
B	ISO M5	10-32 screw clearance holes

11 Maximum application rating

	Voltage	Current
B	125 VDC	700 A
C[8]	120/240 VAC	250 A
F	277 VAC	250 A
7[9]	120/208 VAC	250 A

12 Agency approval

A	No approval[10]

Notes:

1. Parallel pole constructions are supplied with factory installed busbar on line and load
2. Actuator code:
   S: Handle moves to mid-position only upon electrical trip of the breaker
   T: Handle moves to mid-position and alarm switch activates only upon electrical trip of the breaker
3. On multi-pole breakers, one auxiliary switch is supplied, mounted in the extreme right pole (rear view)
   On parallel pole constuction breakers, one auxiliary switch is supplied, mounted in the extreme left pole (rear view)
   Back mounted breakers require special mounting provisions when an auxiliary switch is specified
4. Only available for and must be used with parallel pole construction
5. An 'anti-flash over barrier' is supplied between poles on multipole breakers with 3/8 - 16 stud terminals
6. Terminals 2, 4 & 5 are shipped without terminals hardware
7. Box wire connector will accept #6 through 250 MCM copper wire
8. 2- or 3-pole circuit breaker required for 120/240 VAC rating
9. 3-pole circuit breaker required for 120/208 VAC rating
10. TUV certified: possible on request

Mors Smitt
A Wabtec Company

SERVING SAFETY

DS-FR circuit breakers-V1.3 February 2017

Mors Smitt France SAS
Tour Rosny 2, Avenue du Général de Gaulle,
F - 93118 Rosny-sous-Bois Cedex, FRANCE
T +33 (0)1 4812 1440, F +33 (0)1 4855 9001
E sales.msf@wabtec.com

Mors Smitt Asia Ltd.
29/F., Fun Towers, 35 Hung To Road
Kwun Tong, Kowloon, HONG KONG SAR
T +852 2343 5555, F +852 2343 6555
E sales.msa@wabtec.com

Mors Smitt B.V.
Vrieslantlaan 6, 3526 AA Utrecht,
NETHERLANDS
T +31 (0)30 288 1311
E sales.msbv@wabtec.com

Mors Smitt Technologies Inc.
1010 Johnson Drive,
Buffalo Grove, IL 60089-6918, USA
T +1 847 777 6497, F +1 847 520 2222
E salesmst@wabtec.com

Mors Smitt UK Ltd.
Graycar Business Park, Barton under Needwood,
Burton on Trent, Staffordshire, DE13 8EN, UK
T +44 (0)1283 722650 F +44 (0)1283 722651
E sales.msuk@wabtec.com

RMS Mors Smitt
6 Anzed Court, Mulgrave,
VIC 3170, AUSTRALIA
T +61 (0)3 8544 1200 F +61 (0)3 8544 1201
E sales.rms@wabtec.com

www.morssmitt.com