Series C MDL-frame
400-800A, 240-600V

Contents

<table>
<thead>
<tr>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog number selection</td>
<td>3</td>
</tr>
<tr>
<td>Digitrip RMS 310+ electronic trip units</td>
<td></td>
</tr>
<tr>
<td>MDL, HMDL, CMDL, CHMDL, MDLB, HMLDB; 800A; 3- and 4-pole; LS and LSG</td>
<td>6</td>
</tr>
<tr>
<td>MDL, HMDL, CMDL, CHMDL, MDLB, HMLDB; 800A; 3- and 4-pole; LSI, LSIG, ALSI, ALSIG</td>
<td>7</td>
</tr>
<tr>
<td>Ground fault protection</td>
<td>8</td>
</tr>
<tr>
<td>Maintenance mode setting; ALSI and ALSIG</td>
<td>9</td>
</tr>
<tr>
<td>Digitrip RMS 310 electronic trip units</td>
<td></td>
</tr>
<tr>
<td>MDL, HMDL, CMDL, CHMD; 800A; 3- and 4-pole; LS and LSG</td>
<td>10</td>
</tr>
<tr>
<td>MDL, HMDL, CMDL, and CHMD; 800A 3- and 4-pole; LSI, LSIG, ALSI, ALSIG</td>
<td>11</td>
</tr>
<tr>
<td>Ground fault protection</td>
<td>12</td>
</tr>
<tr>
<td>MT thermal/magnetic trip unit</td>
<td></td>
</tr>
<tr>
<td>MDL, HMDL, MDLB, and HMDLB, 300-600A</td>
<td>13</td>
</tr>
<tr>
<td>MDL, HMDL, MDLB, and HMDLB, 700-800A</td>
<td>14</td>
</tr>
</tbody>
</table>

Note:
Time/current characteristic curves for series C M-frame circuit breakers—voltages shown in curve headings are maximum at which the breaker may be applied. Interrupting capacity of individual breaker is tabulated on each curve.

Note:
The following curves are UL489 listed for use in North America.
The following circuit breakers are derived from Eaton, Westinghouse, or Cutler-Hammer history.

Time current curves are engineering reference documents for application and coordination purposes only. For field testing molded case circuit breakers, refer to NEMA AB 4 guidelines.
Note: Unless noted below, all curves remain unchanged from their prior revision.

<table>
<thead>
<tr>
<th>Revision</th>
<th>Curve number</th>
<th>Page</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changed trip labels on page 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Updated curves on pages 6 and 7.</td>
<td></td>
<td></td>
<td>2/2020</td>
</tr>
</tbody>
</table>
Catalog number selection

This information is presented only as an aid to understanding catalog numbers. It is not to be used to build catalog numbers for circuit breakers or trip units.

Table 1. Thermal-magnetic trip unit

<table>
<thead>
<tr>
<th>Trip unit type</th>
<th>Number of poles</th>
<th>Trip unit</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT, MES</td>
<td>2 = Two-pole</td>
<td>300</td>
<td>T</td>
</tr>
<tr>
<td></td>
<td>3 = Three-pole</td>
<td>310</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>350</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>400</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>450</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>600</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>700</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>800</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Circuit breaker/frame

<table>
<thead>
<tr>
<th>Circuit breaker/Frame type</th>
<th>Number of poles</th>
<th>Circuit breaker/frame</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDL, MDLB</td>
<td>2 = Two-pole</td>
<td>300</td>
<td>F</td>
</tr>
<tr>
<td>HMDL, HMDLB</td>
<td>3 = Three-pole</td>
<td>310</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>350</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>400</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>450</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>600</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>700</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>800</td>
<td></td>
</tr>
</tbody>
</table>

Note

1. Thermal-magnetic only.
Table 3. MDL breaker assembly

<table>
<thead>
<tr>
<th>MDL</th>
<th>3</th>
<th>800</th>
<th>F</th>
<th>T36</th>
<th>B21</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poles</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amperes</td>
<td>800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame</td>
<td>designation</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trip</td>
<td>unit</td>
<td>type</td>
<td>MES</td>
<td>3</td>
<td>800</td>
<td>ALSIG</td>
</tr>
<tr>
<td>B21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Performance at 480 Vac
- MDL: 50 kAIC
- HMDL: 65 kAIC
- CMDL: 50 kAIC
- CHMDL: 65 kAIC

Features
- Blank = No feature
- B20 = High load alarm
- B21 = Ground fault alarm, with trip
- B22 = Ground fault alarm, no trip
- ZG = Zone selective interlocking

Table 4. MDL electronic trip unit

<table>
<thead>
<tr>
<th>MES</th>
<th>3</th>
<th>800</th>
<th>ALSIG</th>
<th>B21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poles</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amperes</td>
<td>800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame   designation</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Features
- Blank = No feature
- B20 = High load alarm
- B21 = Ground fault alarm, with trip
- B22 = Ground fault alarm, no trip
- ZG = Zone selective interlocking

Table 5. MDL frame only

<table>
<thead>
<tr>
<th>MDL</th>
<th>3</th>
<th>800</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poles</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amperes</td>
<td>800</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Performance at 480 Vac
- MDL: 50 kAIC
- HMDL: 65 kAIC
- CMDL: 50 kAIC
- CHMDL: 65 kAIC

Features
- Blank = No feature
- B20 = High load alarm
- B21 = Ground fault alarm, with trip
- B22 = Ground fault alarm, no trip
- ZG = Zone selective interlocking

Note
1. Maintenance mode and ZSI are only available with LSI and LSIG trip units.
2. B21 and B22 features available only with LSG, LSIG and ALSIG trip units.
3. B2x suffixes cannot be combined with other B2x suffixes.
Figure 1. Digitrip 310+ faceplates
Digitrip 310+ circuit breaker time/current curves (phase current)
Series C M-frame circuit breakers (800A)
Catalog types: MDL, HMDL, CMDL, CHMDL, MDLB, HMLDB
Trip unit types: 33 (LS), 35 (LSG)

Available sensors
Ir/In
A 320A
B 400A
C 450A
D 500A
E 600A
F 600A
G 700A
H 800A

Interrupting rating
UL/CSA rms sym. kA, 50/60 Hz
Breaker type 240V 480V 600V
MDL, MDLB, CMDL 65 50 25
HMDL, HMLDB, CHMDL 100 65 35

Notes:
1. Curve accuracy applies from -20°C to +55°C ambient. For possible continuous ampere derating for ambient above 40°C, refer to Eaton. Temperatures above +88°C cause an over-temperature protection trip.
2. Application frequency is 50/60 Hertz.
3. There is a memory effect that can act to shorten the long delay. The memory effect comes into play if a current above the long delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in shorter time than normal. The amount of time reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately five minutes is required between overloads to completely reset the memory.
4. The right portion of the curve is determined by the interrupting rating of the circuit breaker.
5. The left portion of the curve is shown as a multiple of the long delay setting. (long delay pickup = 115% of Ir). Range is 110%–120%.
6. Total clearing times shown include the response times of the trip unit, the breaker opening, and the interruption of the current.
7. The short delay pick up has 7 settings/positions, 2–8 Ir.
8. Short delay I2T band has a tolerance of ±15%.
9. Breakpoint back to flat response occurs at 8x Ir for upper line of the I2T curve.
10. For high fault current levels, an additional fixed instantaneous hardware override is provided at 8800A (Tolerance ±15%).

Figure 2. Digitrip 310+ trip units (800A), long delay response and short delay with I2T response curve and override (LS, LSG) - TD012051EN, February 2020
Digitrip 310+ circuit breaker time/current curves (phase current)

Series C M-frame circuit breakers (800A)

Catalog types: MDL, HMDL, CMDL, CHMDL, MDLB, HMLDB

Trip unit types: 32 (LSI), 36 (LSIG), 38 (ALSI), and 39 (ALSIG)

Available sensors 

- **A**: 500A
- **B**: 650A
- **C**: 800A
- **D**: 1000A
- **E**: 1250A
- **F**: 1600A
- **G**: 2000A
- **H**: 2500A
- **I**: 3150A

**Maximum Total Clearing Time**

**Available Long Delay Time** (Seconds ±0–30%):
- 2*, 4*, 7*, 10, 12, 15*, 20, 24*
  *Shown below at 6x*

**Minimum Total Clearing Time**

Available Short Delay Pickup Settings 2–8, x Ir ±5%
(See Note 7)

**Interrupting rating**

UL/CSA rms sym. kA, 50/60 Hz

<table>
<thead>
<tr>
<th>Breaker type</th>
<th>240V</th>
<th>480V</th>
<th>600V</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDL, MDLB, CMDL</td>
<td>45</td>
<td>65</td>
<td>95</td>
</tr>
<tr>
<td>HMDL, HMDLB, CHMDL</td>
<td>110</td>
<td>165</td>
<td>250</td>
</tr>
</tbody>
</table>

**Notes:**


2. Application frequency is 50/60 Hertz.

3. There is a memory effect that can act to shorten the long delay. The memory effect comes into play if a current above the long delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in shorter time than normal. The amount of time reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately five minutes is required between overloads to completely reset the memory.

4. The right portion of the curve is determined by the interrupting rating of the circuit breaker.

5. The left portion of the curve is shown as a multiple of the long delay setting (long delay). Range is 110%–120%.

6. Total clearing times shown include the response times of the trip unit, the breaker pickup = 115% of Ir opening, and the interruption of the current.

7. The short delay pickup has 7 settings/positions, 2–8 Ir.

8. For high fault current levels, an additional fixed instantaneous hardware override is provided at 6800A (tolerance ±15%).

---

Figure 3. Digitrip 310+ trip units (800A), long delay response and short delay with flat response curve and override (LSI, LSIG, ALSI, ALSIG) - TD012052EN, February 2020
Digitrip 310+ circuit breaker time/current curves (ground current)
Series C M-frame circuit breakers (800A)
Catalog types: MDL, HMDL, CMDL, CHMDL, MDLB, HMLDB
Trip unit types: LSG, LSIG, ALSIG

Notes:
Curve accuracy applies from -20°C to +55°C ambient. For possible continuous ampere derating for ambient above 40°C, refer to Eaton.
Digitrip RMS 310 trip units are suitable for functional field testing with test kit cat. No. STK2.
For field testing using primary injection methods, follow NEMA publications.
Digitrip 310+ circuit breaker time/current curves

Maintenance mode setting
Trip unit types: 38 (ALSI) and 39 (ALSIG)
Series C M-frame trip unit nameplates

Notes:
1. The maintenance mode feature must be ENABLED via application of 24 Vdc for these curves to apply. The blue LED is lit when in maintenance mode.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. Total clearing times shown include the response times of the trip unit, the breaker opening, and the interruption of the current.
4. Nominal values (pickup) (tolerance is ±15%) 2.5 x In.
5. The total clearing times shown are conservative and consider the maximum response time of the trip unit, the circuit breaker opening, and the interruption of the current in the worst case conditions such as: maximum rated voltages, single-phase interruption, and minimum power factor. Faster clearing times are possible depending on the specific system conditions.

Contact Eaton for additional information.

Figure 5. Maintenance mode setting (ALSI, ALSIG) - curver number - TD012054EN, October 2014
Types MDL, HMDL, CMDL, and CHMDL equipped with type MES digitrip RMS 310 trip units, types MES3800LS and MES3800LSG

![Diagram of circuit breaker time/current curves](image)

**Circuit breaker time/current curves (phase current)**

Series C M-frame circuit breakers

Equipped with type MES digitrip RMS 310 trip units

Catalog types: MES3800LS and MES3800LSG digitrip RMS 310 trip units for use with circuit breaker types MDL, HMDL, CMDL and CHMDL 3 poles.

**Time in seconds**

- 1s
- 5s
- 10s
- 30s
- 2min
- 1min

**Current in multiples of rating plug amperes**

- 0.5
- 1
- 1.5
- 2
- 3
- 4
- 5
- 7
- 10
- 20
- 50
- 100
- 1000

**Notes:**

- Digitrip RMS 310 trip units are suitable for functional field testing with test kit cat. no. STK2.
- For field testing using primary injection methods, follow NEMA AB4 publications.
- Calibration response in short delay pickup range is same for 1, 2 or 3 poles in series.
- There is a memory effect that can act to shorten the long delay. The memory effect comes into play if a current above the long delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload.
- Approximately five minutes is required between overloads to completely reset the memory.

**Figure 6.** MDL, HMDL, CMDL, and CHMDL, types MES3800LS and MES3800LSG - curve number SC-7204-99, June 2020
Types MDL, HMDL, CMDL, and CHMDL equipped with type MES digitrip RMS 310 trip units, types MES3800LSI and MES3800LSIG
Types MDL, HMDL, CMDL, and CHMDL equipped with type MES digitrip RMS 310 trip units, ground fault protection

EATON
Circuit breaker time/current curves (ground current)
Series C M-frame circuit breakers
Equipped with type MES digitrip RMS 310 trip units for Ground Fault Protection
Catalog types: MES3800LSG and MES3800LSIG digitrip RMS 310 trip units for use with circuit breaker types MDL, KMDL, CMDL, CHMDL.

Typical Trip Unit Nameplate

Fixed Short Delay Time

Adjustable Short Delay Time

Notes:
Curve accuracy applies from -20°C to +55°C ambient. For possible continuous ampere derating for ambient above 40°C, refer to Eaton.
Digitrip RMS 310 trip units are suitable for functional field testing with test kit cat. no. STK2. For field testing using primary injection methods, follow NEMA publication (AB4).

Figure 8. MDL, HMDL, CMDL, and CHMDL ground fault protection - curve number SC-6914-98, June 2007
Types MDL, HMDL, MDLB, and HMDLB equipped with type MT thermal-magnetic trip unit, 300 to 600 amperes

---

**Circuit breaker time/ current curves**

Series C M-frame circuit breakers

Equipped with type MT thermal-magnetic trip unit

Catalog types: MDL, HMDL, MDLB, HMDLB circuit breakers, 2 and 3 poles.

For application and coordination purposes only. Thermal calibration based on 40°C ambient, cold start. Connected with four (4) feet of rated wire (75°C) per terminal. Tested in open air with current in all poles. Instantaneous calibration based on single-pole tests.

**Maximum voltage:** 600V, AC (50/60 Hz) 250V, DC

**Breaker rating**

<table>
<thead>
<tr>
<th>Rated amperes (I_n)</th>
<th>Instantaneous trip amperes (See figure below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 - 600</td>
<td>100 to 100% of trip unit rating (DC values are approximately 40% higher)</td>
</tr>
</tbody>
</table>

**Interrupting rating**

<table>
<thead>
<tr>
<th>Breaker type</th>
<th>UL/CSA rms Sym, kA, 50/60 Hz</th>
<th>kA, DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>240V</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>MDL, MDLB</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>480V</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>HMDL, HMDLB</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>600V</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>250V</td>
<td>65</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Breaker type</th>
<th>IEC 60947-2 rms sym, kA, 50/60 Hz</th>
<th>kA, DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>240V</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>MDL, MDLB</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>380V</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>HMDL, HMDLB</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>415V</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>250V</td>
<td>65</td>
<td>50</td>
</tr>
</tbody>
</table>

**Notes:**

For additional information on the trip unit, see IL 29C607.

1. Single pole data at 25°C based on NEMA procedures (AB 4) for verifying performance of molded case circuit breakers.

---

**Figure 9. MDL, HMDL, MDLB, and HMDLB, 300-600A - curve number SC-6911-98, June 2007**
Types MDL, HMDL, MDLB, and HMDLB equipped with type MT thermal-magnetic trip unit, 700 and 800 amperes

Circuit breaker time/current curves
Series C M-frame circuit breakers
Equipped with type MT thermal-magnetic trip unit
Catalog types: MDL, HMDL, MDLB, HMDLB circuit breakers, 2 and 3 poles.

For application and coordination purposes only. Thermal calibration based on 40°C ambient, cold start. Connected with four (4) feet of rated wire (75°C) per terminal. Tested in open air with current in all poles. Instantaneous calibration based on single-pole tests.

Maximum voltage: 600V, AC (50/60 Hz) 250V, DC

Breaker rating

<table>
<thead>
<tr>
<th>Rated amperes (I_{\text{n}})</th>
<th>Instantaneous trip amperes (I_{\text{tr}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>700-800</td>
<td>400 to 800% of trip unit rating (DC values are approximately 40% higher)</td>
</tr>
</tbody>
</table>

Interrupting rating

<table>
<thead>
<tr>
<th>Breaker type</th>
<th>UL/CSA rms sym. kA, 50/60 Hz</th>
<th>kA, DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDL, MDLB</td>
<td>240V 60 50 25 20 10 20 10 20 10</td>
<td></td>
</tr>
<tr>
<td>HMDL, HMDLB</td>
<td>100 50 35 25 20 10 20 10</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Breaker type</th>
<th>IEC 60947-2 rms sym. kA, 50/60 Hz</th>
<th>kA, DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDL, MDLB</td>
<td>240V 60 50 25 20 10 20 10 20 10</td>
<td></td>
</tr>
<tr>
<td>HMDL, HMDLB</td>
<td>100 50 35 25 20 10 20 10</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
For additional information on the trip unit, see IL 29C607.

1 Single pole data at 25°C based on NEMA Procedures (AB 4) for verifying performance of molded case circuit breakers.

Figure 10. MDL, HMDL, MDLB, and HMDLB, 700-800A - curve number SC-6912-98, June 2007