## Characteristic Curves for Series NRX
### Type NF and RF Frame with Digitrip
#### 1150 Trip Unit

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Definitions

$I_n$ is the maximum value of continuous current for which the trip unit can be set.

$I_n$ is the basis (or reference) for both the Instantaneous and the Ground (Earth) protection current settings. The Ampere value of $I_n$ is printed on the Rating Plug.

$I_r$ is the basis for both the Long Delay Time and Short Delay Pick Up protection current settings. The Ampere value of $I_r$ is the Long Delay Pickup Setting $\times I_n$.

Further information may be obtained from:

**Eaton Corporation**
**Electrical Group**
**1000 Cherrington Parkway**
**Moon Township, Pennsylvania 15108-4312**
**United States of America**
**Telephone: 1-800-525-2000 or 1-877-ETN-CARE (877-386-2273)**

Curves can also be found on-line by searching for AD01301005E.
Series NRX Digitrip 1150 / 1150i - Curves

Adjustable LONG PU
0.5 to 1.0x In = Ir
with 0.05 increments
See Note 1

Adjustable LONG TIME
2-24 seconds @ 6x Ir
With 0.5s increments
See Note 6

Adjustable SHORT PU
2.0x to 10x
With 0.5 increments
See Note 4

Adjustable SHORT TIME
0.10s to 0.50s
With 0.05s increments
See Note 4

Minimum persistence
See Notes 4 & 8

Maximum Total clearing time

Circuit Breaker Time/Current Curves (Phase Current)
Series NRX Type NF Frame and Type RF Frame Circuit Breakers
Response: Long Delay (IT) & Short Delay Trip (FLAT & IT)
This curve is for 50Hz or 60Hz applications.

Notes:
1. This curve shown as a multiple of the LONG PU Setting (Ir). The actual pickup point (indicated by rapid flashing of Unit Status LED on the product) occurs at 110% of the Ir current, with a ±10% tolerance.
   LongTIME Curve Equation: Trip = LongTIME * 36/Ir, where Ir is a multiple of Ir (top).
   LongTIME Curve Equation: Trip = LongTIME * 36/Ir * 0.70 (bottom).
   The SHORT TIME Function and the LongTIME Function act independently and the entire set of LongTIME curves continue to be active even after the curves intersect.
2. If Long Delay Memory is enabled, trip times may be shorter than indicated on this chart.
3. The SHORT PU points have 100% ± 10% tolerance.
4. SHORT SLOPE: FLAT
   Tolerance is +0/-0 ms for all settings except
   0.10s setting is 0.05 to 0.13
   0.15s setting is 0.09 to 0.17

5. SHORT SLOPE: IT
   IT slope flattens out at 8x Ir for top of band with FLAT time minimum value prevailing for bottom of band.
   Curve Trip Equation: Trip = SHORT TIME * 64/Ir, where Ir is a multiple of Ir (top)
   Curve Trip Equation: Trip = SHORT TIME * 64/Ir * 0.70 (bottom)
   The above equations indicate tolerance is
   +0/-40% for settings 0.1 to 0.25
   +0/-30% for settings 0.3 to 0.50
   For all curves the lower flat response time value projected to IT line will determine the other Break Point and shape of the curve.
6. The end of the curve is determined by the interrupting rating of the circuit breaker.
7. Curve applies from -20°C to +55°C ambient. Temperatures above +85°C cause automatic trip.
8. Minimum persistence refers to the time at which the breaker will not trip for a given setting.
9. These curves are comprehensive for Series NRX NF and RF frame circuit breakers including all frame sizes, ratings, and constructions. The total clearing times shown include the response time for the trip unit, the breaker opening and the interruption of the current.

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Circuit Breaker Time/Current Curves (Phase Current)

Series NRX Type NF Frame and Type RF Frame Circuit Breakers
Response: Long Delay (I_T) & Short Delay Trip
This curve is for 50Hz or 60Hz applications.

Notes:

1. This curve is shown as a multiple of LONG PU Setting (I_l). The actual Pickup point occurs at 110% of the I_l current, with a ±10% tolerance.

2. If Long Delay Memory is enabled, trip times may be shorter than indicated on this chart

3. In this time region <= 0.5 seconds the I_T Long TIME function will flatten out and be no faster than the Short TIME setting. This is to avoid a notch in graph.

4. The SHORT PU points have conventional 100% ± 10% tolerance.

5. SHORT TIME: FLAT only - setting 0.1s through 0.5s in .05s increments. Tolerance is +0/ -80 ms of setting except 0.10s setting is 0.05 to 0.13 0.15s setting is 0.09 to 0.17

6. The end of the curve is determined by the interrupting rating of the circuit breaker.

7. Curve applies from -20°C to +55°C ambient. Temperatures above +85°C cause automatic trip.

8. Minimum persistence refers to the time at which the breaker will not trip for a given setting

9. These curves are comprehensive for Series NRX NF and RF frame circuit breakers including all frame sizes, ratings, and constructions. The total clearing times shown include the response time for the trip unit, the breaker opening and the interruption of the current.
Circuit Breaker Time/Current Curves (Phase Current)

Series NRX Type NF Frame and Type RF Frame Circuit Breakers
Response: Moderately Inverse & Short Delay Trip
This curve is for 50Hz or 60Hz applications.

Notes:
1. This curve is shown as a multiple of the PICKUP setting ($I_p$). The TimeDial setting combined with SHORT PU and SHORT TIME setting (shown in heavy lines) depict the IEEE Moderately Inverse response. The Instantaneous, shown as a separate response, can be set to OFF.
2. Curve Equation:
   \[ \text{Trip} = \text{TimeDial} \times \left[ \frac{0.0515}{(I - I_p)} + 0.114 \right], \]
   where $I$ is a multiple of $I_p$.
   For current > 1.2x, tolerance is [±15%] or [±15%, ±90 ms], whichever is larger.
   TimeDial curve goes to flat response at 14x$I$ with a shorter time of TimeDial function or SHORT TIME function prevailing if curves overlap. The ShortTime function and the TimeDial function act independently and the entire TimeDial curves continue to be active even after the curves intersect.
3. The actual pickup point (indicated by rapid flashing of Unit Status LED on the product) occurs at 110% of the Ir current, with a ±10% tolerance. The SHORT PU settings have conventional 100% ± 10% as their pickup point.
4. The end of the curve is determined by the interrupting rating of the circuit breaker.
5. SHORT TIME: FLAT only
   Tolerance is ±0/±80 ms of setting except
   0.10s setting is 0.06 to 0.13
   0.15s setting is 0.10 to 0.17
7. Minimum persistence refers to the time at which the breaker will not trip for a given setting.
8. The curves are comprehensive for Series NRX NF and RF frame circuit breakers' including all frame sizes, ratings, and constructions. The total clearing times shown include the response time for the trip unit, the breaker opening and the interruption of the current.
Circuit Breaker Time/Current Curves (Phase Current)

Series NRX Type NF Frame and Type RF Frame Circuit Breakers
Response: Very Inverse & Short Delay Trip
This curve is for 50Hz or 60Hz applications.

Notes:
1. This curve is shown as a multiple of the PICKUP setting \(I_r\). The TimeDial setting combined with SHORT PU and SHORT TIME setting (shown in heavy lines) depict the IEEE Very Inverse response. The Instantaneous, shown as a separate response, can be set to OFF.

2. Curve Equation:
\[
\text{Trip} = \text{TimeDial} \times \left[\frac{19.61}{(I - 1)} + 0.491\right], \text{where } I \text{ is a multiple of } I_r.
\]

For current > 1.2x, tolerance is [±15%] or [-15%, +90 ms], whichever is larger. TimeDial curve goes to flat response at 14x, with a shorter time of TimeDial function or SHORT TIME function prevailing if curves overlap. The ShortTime function and the TimeDial function act independently and the entire TimeDial curves continue to be active even after the curves intersect.

3. The actual pick up point (indicated by rapid flashing of Unit Status LED on the product) occurs at 110% of the Ir, current, with a ±10% tolerance. The SHORT PU settings have conventional 100% ± 10% as their pick up point.

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

5. SHORT TIME: FLAT only
Tolerance is +0/ -80 ms of setting except
- 0.10s setting is 0.06 to 0.13
- 0.15s setting is 0.10 to 0.17


7. Minimum persistence refers to the time at which the breaker will not trip for a given setting.

8. The curves are comprehensive for Series NRX NF and RF frame circuit breakers including all frame sizes, ratings, and constructions. The total clearing times shown include the response time for the trip unit, the breaker opening and the interruption of the current.

Adjustable PICKUP setting 0.5 to 1.0x \(I_r\) with 0.05 increments See Note 3

Adjustable TimeDial Setting 0.20 to 5.00 With 0.10 increments See Note 2

Adjustable SHORT PU 2.0x to 10x \(I_r\) With 0.5 increments See Note 3

Minimum persistence See Notes 5, 7

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Adjustable PICKUP setting 0.5 to 1.0x \( I \) with 0.05 increments
See Note 3

Adjustable TimeDial Setting 0.20 to 5.00
With 0.10 increments
See Note 2

Adjustable SHORT PU
2.0x to 10x \( I \)
With 0.5 increments
See Note 3

Minimum persistence
See Notes 5, 7

Circuit Breaker Time/Current Curves (Phase Current)
Series NRX Type NF Frame and Type RF Frame Circuit Breakers
Response: Extremely Inverse & Short Delay Trip
This curve is for 50Hz or 60Hz applications.

Notes:
1. This curve is shown as a multiple of the PICKUP setting \( I \). The TimeDial setting combined with SHORT PU and SHORT TIME setting (shown in heavy lines) depict the IEEE Extremely Inverse response. The Instantaneous, shown as a separate response, can be set to OFF.

2. Curve Equation:
   \[ \text{Trip} = \text{TimeDial} \times \left( \frac{28.2}{(\text{I} - 1)} + 0.1217 \right) \],
   where \( \text{I} \) is a multiple of \( I \).
   For current > 1.2x, tolerance is ±15% or ±15%, whichever is larger.
   TimeDial curve goes to flat response at 14x, with a shorter time of TimeDial function or SHORT TIME function prevailing if curves overlap. The ShortTime function and the TimeDial function act independently and the entire TimeDial curves continue to be active even after the curves intersect.

3. The actual pick up point (indicated by rapid flashing of Unit Status LED on the product) occurs at 110% of \( I \), current, with a ±10% tolerance. The SHORT PU settings have conventional 100% ± 10% as their pick up point.

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

5. SHORT TIME: FLAT only
   Tolerance is +0/-80 ms of setting except
   0.10s setting is 0.05 to 0.13
   0.15s setting is 0.10 to 0.17


7. Minimum persistence refers to the time at which the breaker will not trip for a given setting.

8. The curves are comprehensive for Series NRX NF and RF frame circuit breakers including all frame sizes, ratings, and constructions. The total clearing times shown include the response time for the trip unit, the breaker opening and the interruption of the current.
Notes:

1. This curve is shown as a multiple of the PICKUP setting (Iᵣ). The TimeDial setting combined with SHORT PU and SHORT TIME setting (shown in heavy lines) depict the IEC-A response. The Instantaneous, shown as a separate response, can be set to OFF.

2. Curve Equation: Trip = TimeDial * [0.14 / (I - 1)]

   For current > 1.2Iᵣ, tolerance is ±15% or [-15%, +90 ms], whichever is larger.

   TimeDial curve goes to flat response at 14xIᵣ with a shorter time of TimeDial function or SHORT TIME function prevailing if curves overlap. The ShortTime function and the TimeDial function act independently and the entire TimeDial curves continue to be active even after the curves intersect.

3. The actual pick up point (indicated by rapid flashing of Unit Status LED on the product) occurs at 110% of the Iᵣ, current, with a ±10% tolerance. The SHORT PU settings have conventional 100% ± 10% as their pick up point.

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

5. SHORT TIME: FLAT only
   Tolerance is +0/ -80 ms of setting except
   0.10s setting is 0.06 to 0.13
   0.15s setting is 0.10 to 0.17


7. Minimum persistence refers to the time at which the breaker will not trip for a given setting.

8. The curves are comprehensive for Series NRX NF and RF frame circuit breakers including all frame sizes, ratings, and constructions. The total clearing times shown include the response time for the trip unit, the breaker opening and the interruption of the current.
Notes:

1. This curve is shown as a multiple of the PICKUP setting ($I_p$). The TimeDial setting combined with SHORT PU and SHORT TIME setting (shown in heavy lines) depict the IEC-B response. The Instantaneous, shown as a separate response, can be set to OFF.

2. Curve Equation: $\text{Trip} = \text{TimeDial} \times \left( \frac{13.5}{I} \right)$, where $I$ is a multiple of $I_p$.
   For current $> 1.2xI$, tolerance is $\pm 15\%$ or $[-15\%, +90\text{ ms}]$, whichever is larger.

3. The actual pick up point (indicated by rapid flashing of Unit Status LED on the product) occurs at $110\%$ of $I_p$, current, with a $\pm 10\%$ tolerance. The SHORT PU settings have conventional $100\% \pm 10\%$ as their pick up point.

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

5. SHORT TIME: FLAT only
   Tolerance is $+0/ -80\text{ ms}$ of setting except
   - $0.10\text{ s}$ setting is $0.06$ to $0.13$,
   - $0.15\text{ s}$ setting is $0.10$ to $0.17$.

6. Curve applies from $-20^\circ\text{C}$ to $+55^\circ\text{C}$ ambient. Temperatures above $+85^\circ\text{C}$ cause automatic trip.

7. Minimum persistence refers to the time at which the breaker will not trip for a given setting.

8. The curves are comprehensive for Series NRX NF and RF frame circuit breakers including all frame sizes, ratings, and constructions. The total clearing times shown include the response time for the trip unit, the breaker opening and the interruption of the current.
Series NRX Digitrip 1150 - IEC Curves - IEC-C (Extremely Inverse)

Circuit Breaker Time/Current Curves (Phase Current)
Series NRX Type NF Frame and Type RF Frame Circuit Breakers
Response: Extremely Inverse & Short Delay Trip
This curve is for 50Hz or 60Hz applications.

Notes:

1. This curve is shown as a multiple of the PICKUP setting ($I_1$). The TimeDial setting combined with SHORT PU and SHORT TIME setting (shown in heavy lines) depict the IEC-C response. The Instantaneous, shown as a separate response, can be set to OFF.

2. Curve Equation:
   \[ \text{Trip} = \text{TimeDial} \times \left( \frac{80.0}{I_1 - 1} \right), \]
   where $I_1$ is a multiple of $I_0$.

3. The actual pick up point (indicated by rapid flashing of Unit Status LED on the product) occurs at 110% of the $I_0$ current, with a ±10% tolerance. The SHORT PU settings have conventional 100% ± 10% as their pick up point.

4. The end of the curve is determined by the interrupting rating of the breaker.

5. SHORT TIME: FLAT only
   Tolerance is ±0.40 ms of setting except
   0.10s setting is 0.06 to 0.13
   0.15s setting is 0.10 to 0.17

6. Curve applies from -20°C to +65°C ambient; temperatures above 85°C cause automatic trip.

7. Minimum persistence refers to the time at which the breaker will not trip for a given setting.

8. The curves are comprehensive for Series NRX NF and RF frame circuit breakers including all frame sizes, ratings, and constructions. The total clearing times shown include the response time for the trip unit, the breaker opening and the interruption of the current.

August 2011
Circuit Breaker Time / Current Curves
(Phase Current)

Series NRX - Type NF Frame Circuit Breakers
Response: Instantaneous Trip
This curve is for 50Hz and 60Hz applications.

Notes:
1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. This curve is shown as a multiple of the Rating Plug (I_n).
3. If Long Delay Memory is enabled, trip times may be shorter than indicated on this chart.
4. The Instantaneous settings have conventional 100% ±10% as the pickup points.
5. Total clearing times shown include the response times of the trip unit, the breaker opening and the interruption of the current.
6. An additional, fixed High Instantaneous Trip function is provided in the circuit breaker set to pickup at 90kA Instantaneous peak current level. This protection is functional even when the Instantaneous is set to the OFF position.
7. These curves are comprehensive for Series NRX - Type NF frame circuit breakers, including all frame sizes, ratings, and constructions. The total Instantaneous clearing times shown are conservative and consider the maximum response times of the trip unit, the circuit breaker opening, and the interruption of the current under factors that contribute to worst case conditions, like: maximum rated voltages, single phase interruption, and minimum power factor. Faster clearing times are possible depending on the specific system conditions, the type of circuit breaker applied, and if any arc reduction settings are employed. Contact Eaton Corporation for additional information.

June 2011
Series NRX - Type RF Frame with Digitrip1150 / 1150 - Instantaneous Curve

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. This curve is shown as a multiple of the Rating Plug (I_r).
3. The Instantaneous settings have conventional 100% ± 10% as the pickup points.
4. On the RF Frames, an additional, fixed High Instantaneous Trip function is provided in the circuit breaker. The circuit breaker’s Short Delay rating is marked according to Test Standards with a preset value. This protection is functional even when the Instantaneous is set to the OFF position.
5. Contact Eaton Corporation for availability of the 85kA and 100kA options.
6. These curves are comprehensive for Series NRX - Type NF frame circuit breakers, including all frame sizes, ratings, and constructions. The total instantaneous clearing times shown are conservative and consider the maximum response times of the trip unit, the circuit breaker opening, and the interruption of the current under factors that contribute to worst case conditions, like: maximum rated voltages, single phase interruption, and minimum power factor. Faster clearing times are possible depending on the specific system conditions, the type of circuit breaker applied, and if any arc reduction settings are employed. Contact Eaton Corporation for additional information.

August 2011
Maintenance Mode Characteristic

Series NRX - Type NF Frame Circuit Breakers
Response: Maintenance Mode Trip
This curve is for 50Hz and 60Hz applications.

Notes:
1. The Maintenance Mode feature must be ENABLED via trip unit keypad, remote switch, or Communications for these curves to apply. Maintenance Mode IN USE message is displayed.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. The Digitrip 1150ARM will light the Instantaneous LED for a Maintenance Mode Trip.
4. Nominal Reduction Values have a tolerance of ±15%.
5. Faster clearing times are possible depending on the specific system conditions, and the type of NRX Circuit Breaker applied.

Contact Eaton Electrical for additional information.
Series NRX Type RF Frame using Digitrip 1150/1150i with Maintenance Mode Trip

Maintenance Mode Characteristic
Series NRX - Type RF Frame Circuit Breakers
Response: Maintenance Mode Trip
This curve is for 50Hz and 60Hz applications.

Notes:
1. The Maintenance Mode feature must be ENABLED via trip unit keypad, remote switch, or Communications for these curves to apply. Maintenance Mode IN USE message is displayed.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
4. The Digitrip 1150ARM will light the Instantaneous LED for a Maintenance Mode Trip.
5. Nominal Reduction Values have a tolerance of ±15%
6. The total clearing times shown are conservative and consider the maximum response times of the trip unit, the circuit breaker opening, and the interruption of the current under factors that contribute to worst case conditions, like: maximum rated voltages, single phase interruption, and minimum power factor. Faster clearing times are possible depending on the specific system conditions, and the type of NRX Circuit Breaker applied.
Contact Eaton Electrical for additional information.
Series NRX - Type NF and RF Frame with Digitrip 1150 / 1150i - Ground (Earth) Curve

Notes:
1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. The curve is shown as a multiple of the Rating Plug (I).
3. The Ground Fault settings have conventional 100% ± 10% as their pick up points.
4. Except as noted, tolerances on current levels are ±10% of values shown in chart.
5. The Ground Fault Pickup is limited to 1200A setting for the Digitrip 1150 unit. The Digitrip 1150 unit only has a minimum Earth Pickup setting at 0.1 x I.
6. Ground Slope: FLAT
   Tolerance is +0 / -80 ms except
   0.10s setting band is 0.05 to 0.13
   0.15s setting band is 0.09 to 0.17
7. Ground Slope: I T
   I T slope flattens out at 0.625x I for top of band with FLAT time minimum value prevailing for bottom of band.
   Curve Trip Equation: Trip = (GROUND TIME) x 0.39 / I (top band)
   Curve Trip Equation: Trip = ((GROUND TIME) x 0.39 / I) * 0.70 (bottom band)
   The above equations indicate tolerance is +0 / -30% for all settings except
   0.10s is +30% -25%
   0.15s is +20% -25%
   0.20s is +10% -25%
8. The curves are comprehensive for Series NRX NF and RF frame circuit breakers including all frame sizes, ratings, and constructions. The total clearing times shown include the response time for the trip unit, the breaker opening and the interruption of the current.
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