Micrologic

Control units
5.0 P, 6.0 P and 7.0 P
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Discovering Micrologic P

All Masterpact NT and NW circuit breakers are equipped with a Micrologic control unit that can be changed on site. Control units are designed to protect power circuits and connected loads. They offer current, voltage, frequency, power and energy measurements. The functions provided by Micrologic 5.0 P, 6.0 P and 7.0 P control units optimise continuity of service and power management in your installation.

Identification

X: type of protection
- 2 for basic protection
- 5 for selective protection
- 6 for selective + ground-fault protection
- 7 for selective + earth-leakage protection

Y: version number
Identification of the control-unit generation: "0" signifies the first generation.

Z: type of measurement
- A for "ammeter"
- E for "energy meter"
- P for "power meter"
- H for "harmonic meter"
- no indication = no measurements

Micrologic 5.0 P
Selective protection + Idmtl, power measurements and additional protection

Micrologic 6.0 P
Selective protection + Idmtl + ground-fault protection, power measurements and additional protection

Micrologic 7.0 P
Selective protection + Idmtl + earth-leakage protection, power measurements and additional protection
Discovering Micrologic P

1  top fastener
2  terminal block for external connections
3  housing for battery
4  screw for long-time rating plug
5  long-time rating plug
6  cover opening point
7  protective cover
8  lead-seal fixture for protective cover
9  infrared link with communications interfaces
10  connection with circuit breaker
11  bottom fastener

**Indications**

12  LED indicating long-time tripping
13  LED indicating short-time or instantaneous tripping
14  LED indicating ground-fault or earth-leakage tripping
15  LED indicating additional-protection or auto-protection tripping
16  graphics display
17  button for reset of fault-trip LED reset and battery test

**Navigation**

18  access button to the "Metering" menu (1)
19  access button to the "History, maintenance and setup" menu (1)
20  access button to the "Protection" menu (1)
21  button used to scroll down or reduce the displayed value
22  button used to scroll up or increase the displayed value
23  button used to select or confirm a choice

**Adjustment dials**

24  long-time current setting Ir
25  long-time tripping delay tr
26  short-time pickup Isd
27  short-time tripping delay tsd
28  instantaneous pickup Ii
29  ground-fault pickup Ig
30  ground-fault tripping delay tg
31  earth-leakage pickup I.ln
32  earth-leakage tripping delay \(\Delta t\)
33  LED indicating an overload
34  test button for ground-fault and earth-leakage protection
35  test connector

(1) These buttons include a LED indicating the active menu.
Dials
- Dials are used to set Micrologic P protection thresholds and tripping delays for overloads, short-circuits, ground faults and earth leakage.
- If the set thresholds are overrun, these protection functions systematically trip the circuit breaker.

Buttons
- Buttons on the keypad are used for fine adjustments of the protection thresholds and tripping delays for overloads, short-circuits, ground faults and earth leakage. The value previously set using a dial automatically becomes the maximum value for the keypad settings.
- They may also be used to activate other factory-disabled protection functions available on Micrologic P. These other protection functions are not accessible via the dials.

With the protective cover open, make all the necessary settings for your control unit.

All fine adjustments are permanently stored in memory, unless the setting is modified using the adjustment dial.

For remote settings using the communications option, see the "Remote settings" section in the "Com setup" menu under "History, maintenance and setup".

Important
A new overload (long-time) or short-circuit (short-time and instantaneous) protection setting made using one of the dials:
- deletes all the fine adjustments previously made using the keypad for the overload (long-time) and short-circuit (short-time and instantaneous) protection
- does not affect the fine adjustments made using the keypad for ground-fault and earth-leakage protection
- does not affect any other settings made using the keypad.

Similarly, a new ground-fault or earth-leakage protection setting made using one of the dials:
- deletes all the fine adjustments previously made using the keypad for the ground-fault and earth-leakage protection
- does not affect the fine adjustments made using the keypad for the overload (long-time) and short-circuit (short-time and instantaneous) protection
- does not affect any other settings made using the keypad.
With the protective cover closed, it is not possible to set the protection functions. However, it is possible to set metering functions and alarms, as well as view all measurements, settings and histories.

**View the settings and measurements**

- Close the protective cover for the dials
- Access to the dials is blocked and it is no longer possible to make fine adjustments using the keypad
- If necessary, install a lead seal to protect the settings
- Settings may be viewed at any time using the keypad.

**Important**

If you notice that the tab on the back of the protective cover has been broken off, contact the Schneider Electric after-sales support department to replace the cover.
Consider a 2000 A circuit breaker.

Set the thresholds

\[ I_n = 2000 \text{ A} \]
\[ I_r = 0.5 \times 2000 = 1000 \text{ A} \]
\[ I_{sd} = 2 \times 1000 = 2000 \text{ A} \]
\[ I_i = 2 \times 2000 = 4000 \text{ A} \]

Set the time delays

\[ t_r = 1 \text{ s} \]
\[ t_{sd} = 0.2 \text{ s} \]

Thresholds

- \( I_r \): LT threshold
- \( I_{sd} \): ST pickup
- \( I_i \): Instantaneous pickup

Time delays

- \( t_r \): LT tripping delay
- \( t_{sd} \): ST tripping delay
Discovering Micrologic P

Consider a 2000 A circuit breaker.

**Setting Micrologic 6.0 P using the dials**

Set the thresholds

- $I_n = 2000\, \text{A}$
- $I_r = 0.5 \times 2000 = 1000\, \text{A}$
- $I_sd = 2 \times 1000 = 2000\, \text{A}$
- $I_i = 2 \times 2000 = 4000\, \text{A}$
- $B \rightarrow I_g = 640\, \text{A}$

Set the time delays

- $t_r = 1\, \text{s}$
- $t_{sd} = 0.2\, \text{s}$
- $t_g = 0.2\, \text{s}$

See pages 22 to 26 for selection of the setting ranges.

**Thresholds**
- $I^2t$ ON curve
- $I^2t$ OFF curve

**Time delays**
- $I^2t$ ON curve
- $I^2t$ OFF curve

- $I_r$: LT threshold
- $I_{sd}$: ST pickup
- $I_i$: Instantaneous pickup

- $t_r$: LT tripping delay
- $t_{sd}$: ST tripping delay

- $I_g$: ground-fault pickup

- $t_g$: ground-fault tripping delay
Consider a 2000 A circuit breaker.

Set the thresholds

- \( I_r = 0.5 \times 2000 = 1000 \, A \)
- \( I_{sd} = 2 \times 1000 = 2000 \, A \)
- \( I_{i} = 2 \times 2000 = 4000 \, A \)
- \( I_{\Delta n} = 1 \, A \)

Set the time delays

- \( t_r = 1 \, s \)
- \( t_{sd} = 0.2 \, s \)
- \( \Delta t = 140 \, ms \)

See pages 22 to 26 for selection of the setting ranges.

Thresholds

- \( I_{r} \): LT threshold
- \( I_{sd} \): ST pickup
- \( I_{i} \): Instantaneous pickup

Time delays

- \( t_{r} \): LT tripping delay
- \( t_{sd} \): ST tripping delay
- \( \Delta t \): Earth-leakage tripping delay
Selection dial on four-pole circuit breakers

On four-pole circuit breakers, it is possible to select the type of neutral protection for the fourth pole using the three-position dial on the circuit breaker:

- no neutral protection 4P 3D
- half neutral protection 3D + N/2
- full neutral protection 4P 4D

The factory default setting is 3D + N/2.

Important
With the 4P 3D setting, the current in the neutral must not exceed the rated current of the circuit breaker.
Main menus

The Micrologic P control unit offers access to the main screen and three menus:

- the main screen displaying the continuous measurement of the phase currents (I1, I2, I3) and the neutral current (IN), if it exists
- the "Metering" menu
- the "History, maintenance and setup" menu
- the "Protection" menu.

Main screen

As long as no functions are activated, Micrologic P control units display in real time the current on the most heavily loaded phase. The number for that phase is presented in a square.

The current in the neutral is displayed if the neutral CT is set as internal or external (see "Ineutral (A)" settings in the "Current protection" menu).

"Metering", "History, maintenance and setup" and "Protection" menus

- "Metering" menu

When a menu button is pressed, a presentation screen is displayed and the green LED on the button goes ON.

- press the or button to return to the main screen
- press the button to return to the previous screen
- whatever the screen displayed, if no further action is taken, the system returns to the main screen after a few minutes
- the LED goes OFF on exiting the menu.
Main menus

■ "History, maintenance and setup" menu

□ press the or button to return to the main screen
□ press the button to return to the previous screen
□ whatever the screen displayed, if no further action is taken, the system returns to the main screen after a few minutes
□ the LED goes OFF on exiting the menu.

■ "Protection" menu

□ press the or button to return to the main screen
□ press the button to return to the previous screen
□ whatever the screen displayed, if no further action is taken, the system returns to the main screen after a few minutes
□ the LED goes OFF on exiting the menu.

■ Saving settings

When a setting is made in any of the three menus, the screen used to save the modification(s) may be accessed by pressing one of the three buttons , or .
□ select yes to save the modifications
□ select no to cancel and maintain the previous settings
□ this screen remains displayed until yes or no are selected.

Do you want to save new settings?

no
yes
Press the button to select the "Metering" menu.

- move the cursor down the screen or decrement a value.
- move the cursor up the screen or increment a value.
- select an option in a list, confirm a selection or the value of a setting.
- indicates that the operator is in the "Metering" menu and returns to the previous screen.
- return to the main screen.

### Current measurements

<table>
<thead>
<tr>
<th>Access to the following sections:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (A)</td>
</tr>
<tr>
<td>U (V)</td>
</tr>
<tr>
<td>P (kW)</td>
</tr>
<tr>
<td>E (kWh)</td>
</tr>
<tr>
<td>F (Hz)</td>
</tr>
</tbody>
</table>

- Instant.
- I1, I2, I3, IN currents (depending on the type of system)
- Max
- Demand
- Demand current on the phases I1, I2, I3 and on IN (depending on the type of system)
- Max

### Voltage measurements

<table>
<thead>
<tr>
<th>Access to the following sections:</th>
</tr>
</thead>
<tbody>
<tr>
<td>U (V)</td>
</tr>
<tr>
<td>P (kW)</td>
</tr>
<tr>
<td>E (kWh)</td>
</tr>
<tr>
<td>F (Hz)</td>
</tr>
</tbody>
</table>

- Instantaneous phase-to-phase U12, U23, U31 and phase-to-neutral V1N, V2N, V3N voltages (depending on the type of system)
- Average voltage U average of the phase-to-phase voltages.
- Unbalance voltage U unbal. of the phase-to-phase voltages.
- Phase sequence.
### Power measurements

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>(A)</td>
</tr>
<tr>
<td>U</td>
<td>(V)</td>
</tr>
<tr>
<td>P</td>
<td>(kW)</td>
</tr>
<tr>
<td>E</td>
<td>(kWh)</td>
</tr>
<tr>
<td>F</td>
<td>(Hz)</td>
</tr>
</tbody>
</table>

**P** (kW) access to the following sections:

- **Instant.**
- **Total active power** P
- **Total reactive power** Q
- **Total apparent power** S
- **Power factor** PF

**Demand**

- **Demand values for the:**
  - total active power P
  - total reactive power Q
  - total apparent power S
- **Max**

### Energy measurements

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>(A)</td>
</tr>
<tr>
<td>U</td>
<td>(V)</td>
</tr>
<tr>
<td>P</td>
<td>(kW)</td>
</tr>
<tr>
<td>E</td>
<td>(kWh)</td>
</tr>
<tr>
<td>F</td>
<td>(Hz)</td>
</tr>
</tbody>
</table>

**E** (kWh) access to the following sections:

- **E total**
- **E in**
- **E out**

**Positive component of:**

- the total active energy E.P
- the total reactive energy E.Q

**Negative component of:**

- the total active energy E.P
- the total reactive energy E.Q

**Reset Energy**

Reset all the energy values to zero

### Frequency measurement

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>(A)</td>
</tr>
<tr>
<td>U</td>
<td>(V)</td>
</tr>
<tr>
<td>P</td>
<td>(kW)</td>
</tr>
<tr>
<td>E</td>
<td>(kWh)</td>
</tr>
<tr>
<td>F</td>
<td>(Hz)</td>
</tr>
</tbody>
</table>

**F** (Hz) access to the frequency measurement
Press the button to select the "History, maintenance and setup" menu.

- move the cursor down the screen or decrement a value.
- move the cursor up the screen or increment a value.
- select an option in a list, confirm a selection or the value of a setting.
- indicates that the operator is in the "History, maintenance and setup" menu and returns to the previous screen.
- return to the main screen.

**Event history**

access to the following sections:

- **Trip history**
  - The last ten faults recorded

- **Alarm history**
  - The last ten alarms recorded

- **Operation counter**
  - Number of operations (opening or closing)

- **Contact wear**
  - Wear of the circuit-breaker main contacts

**M2C / M6C Contacts**

access to the following sections:

- **Alarm type**
  - Assignment of a protection alarm to an M2C or an M6C contact

- **Setup**
  - Latching mode for each M2C or M6C contact

- **Reset**
  - Reset of the M2C or M6C contacts
Discovering Micrologic P

**Micrologic setup**

- Access to the following sections:
  - **Language**
  - **Date / time**
  - **Breaker selection**
  - **Power sign**
  - **VT ratio**
  - **System frequency**

**Metering setup**

- Access to the following sections:
  - **System type**
    - 3 phases, 3 wires, 3 CTs: method using two wattmeters
    - 3 phases, 4 wires, 3 CTs: method using three wattmeters
    - 3 phases, 4 wires, 4 CTs: method using three wattmeters with measurement of the neutral current.
  - **Current demand**
  - **Power demand**
  - **Sign convention**
    - Setting of the sign convention for the power factor and reactive power, i.e. IEEE, IEEE alternate or IEC (see page 87 to determine the sign convention)

**COM communications-option setup**

- Access to the following sections:
  - **Com. parameter**
  - **Remote settings**
  - **Remote control**
  - **IP Data**
    - Setting of parameters for the COM communications option.
    - Authorisation of access to settings via the COM communications option.
    - Authorisation of access to the circuit-breaker ON and OFF commands via the COM communications option.
    - Displays the IP address of the IFE.
Press the button to select the "Protection" menu.
- move the cursor down the screen or decrement a value
- move the cursor up the screen or increment a value
- select an option in a list, confirm a selection or the value of a setting
- indicates that the operator is in the "Protection" menu and returns to the previous screen
- return to the main screen

**Current protection**

Access to the following sections:

- **I** (A) - Fine settings of the long-time \( I_t \), short-time and instantaneous protection functions
- **Idmtl** (A) - Fine settings of the long-time \( Idmtl \), short-time and instantaneous protection functions
- **I \( \neq \)** (A) - Fine settings of the:
  - ground-fault (Micrologic 6.0 P)
  - earth-leakage (Micrologic 7.0 P) protection functions
- **I neutral** (A) - Selection of the type of neutral sensor and type of neutral protection
- **I \( \neq \) Alarm** - Setting of the \( I \neq \) alarm
- **I unbal** (%) - Setting of the current-unbalance protection \( I \text{ unbal} \)
- **I1 max** (A) - Setting of the maximum-current protection \( I1 \text{ max} \)
- **I2 max** (A) - Setting of the maximum-current protection \( I2 \text{ max} \)
- **I3 max** (A) - Setting of the maximum-current protection \( I3 \text{ max} \)
- **IN max** (A) - Setting of the maximum-current protection \( IN \text{ max} \)
Voltage protection

- Setting of the minimum-voltage protection $U_{\text{min}}$ (V)
- Setting of the maximum-voltage protection $U_{\text{max}}$ (V)
- Setting of the voltage-unbalance protection $U_{\text{unbal}}$ (%)

Other protection

- Setting of the reverse-power protection $rP_{\text{max}}$ (W)
- Setting of the minimum-frequency protection $F_{\text{min}}$ (Hz)
- Setting of the maximum-frequency protection $F_{\text{max}}$ (Hz)
- Setting of the phase-rotation protection

Load shedding depending on current

Access to load shedding and reconnection depending on current

Load shedding depending on power

Access to load shedding and reconnection depending on power
Overview of functions

For the default values, the setting ranges, increment steps and setting accuracies, see the technical appendix.

Current protection

**I^2t long-time protection**

The long-time protection function protects cables against overloads. This function is based on true rms measurements. It is possible to select either I^2t long-time protection or Idmtl long-time protection.

### I^2t long-time protection

**Long-time current setting I_r and standard tripping delay t_r**

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>Accuracy</th>
<th>5.0 P, 6.0 P and 7.0 P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tripping between 1.05 and 1.20 I_r</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I_r = In (*) x …</td>
<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>0.95</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Other ranges or disable by changing rating plug

<table>
<thead>
<tr>
<th>Time setting</th>
<th>0.5</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time delay (s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tr at 1.5 x I_r</td>
<td>0 to -30%</td>
<td>12.5</td>
<td>25</td>
<td>50</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>tr at 6 x I_r</td>
<td>0 to -20%</td>
<td>0.7</td>
<td>(1)</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>tr at 7.2 x I_r</td>
<td>0 to -20%</td>
<td>0.7</td>
<td>(2)</td>
<td>0.69</td>
<td>1.38</td>
<td>2.7</td>
<td>5.5</td>
<td>8.3</td>
<td>11</td>
</tr>
</tbody>
</table>

* In: circuit breaker rating

(1) 0 to -40%

(2) 0 to -60%

- It is possible to enhance the I_r setting accuracy (reduced range) or disable the long-time protection function by using a different long-time rating plug. See the technical appendix “Changing the long-time rating plug”.

**Thermal memory**

- The thermal memory continuously accounts for the amount of heat in the cables, both before and after tripping, whatever the value of the current (presence of an overload or not). The thermal memory optimises the long-time protection function of the circuit breaker by taking into account the temperature rise in the cables.

- The thermal memory assumes a cable cooling time of approximately 15 minutes.
### Idmtl Protection

**Long-time current setting** Ir and Idmtl tripping delay tr

<table>
<thead>
<tr>
<th>Idmtl Protection</th>
<th>Current setting</th>
<th>Idmtl long-time protection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ir = ln ((\text{Ir})) (\times) ...</td>
<td>other ranges or disable by changing rating plug</td>
</tr>
<tr>
<td></td>
<td>tripping between 1.05 and 1.20 Ir</td>
<td></td>
</tr>
<tr>
<td><strong>Time setting</strong></td>
<td>(\text{tr})</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### DT

**Time delay (s)**

- \(\text{tr}\) at 1.5 x Ir
  - 0 to -20%: 0.53
- \(\text{tr}\) at 6 x Ir
  - 0 to -20%: 0.53
- \(\text{tr}\) at 7.2 x Ir
  - 0 to -20%: 0.53
- \(\text{tr}\) at 10 x Ir
  - 0 to -20%: 0.53

### SIT

**Time delay (s)**

- \(\text{tr}\) at 1.5 x Ir
  - 0 to -30%: 1.9
- \(\text{tr}\) at 6 x Ir
  - 0 to -20%: 0.5
- \(\text{tr}\) at 7.2 x Ir
  - 0 to -20%: 0.7
- \(\text{tr}\) at 10 x Ir
  - 0 to -20%: 0.7

### VIT

**Time delay (s)**

- \(\text{tr}\) at 1.5 x Ir
  - 0 to -30%: 3.6
- \(\text{tr}\) at 6 x Ir
  - 0 to -20%: 0.5
- \(\text{tr}\) at 7.2 x Ir
  - 0 to -20%: 0.7
- \(\text{tr}\) at 10 x Ir
  - 0 to -20%: 0.7

### EIT

**Time delay (s)**

- \(\text{tr}\) at 1.5 x Ir
  - 0 to -30%: 12.5
- \(\text{tr}\) at 6 x Ir
  - 0 to -20%: 0.7
- \(\text{tr}\) at 7.2 x Ir
  - 0 to -20%: 0.7
- \(\text{tr}\) at 10 x Ir
  - 0 to -20%: 0.7

### HVF

**Time delay (s)**

- \(\text{tr}\) at 1.5 x Ir
  - 0 to -30%: 164.5
- \(\text{tr}\) at 6 x Ir
  - 0 to -20%: 0.7
- \(\text{tr}\) at 7.2 x Ir
  - 0 to -20%: 0.7
- \(\text{tr}\) at 10 x Ir
  - 0 to -20%: 0.7

---

* In: circuit breaker rating

\( (f) \) 0 to -40%

\( (2) \) 0 to -60%

- These curves with different slopes are used to improve:
  - discrimination with fuses positioned upstream (HV) and/or downstream
  - protection for certain types of loads
- Five types of curves are available:
  - DT: definite time curve
  - SIT: standard inverse time curve \( (f^0.5t) \)
  - VIT: very inverse time curve \( (ft) \)
  - EIT: extremely inverse time curve \( (f^2t) \)
  - HVF: compatible with high-voltage fuses \( (f^4t) \).

### Neutral protection

Overload protection (long time) for the neutral is disabled if the Idmtl protection function is selected. However, the short-circuit protection (short time and instantaneous) remains operational.

### Intermittent overloads

As long as the Micrologic P control unit remains supplied with power, the effects of intermittent overloads on cables are calculated. If power is cut, temperature rise in cables is not calculated.

### Circuit-breaker thermal limit

For certain settings, the Idmtl curves may be limited by the \( I^2 t \) curve when the tripping delay tr is set to 24 seconds or by its thermal memory. The maximum \( I^2 t \) curve remains active for the phases and the neutral even when the Idmtl curves are activated.
Overview of functions

For the default values, the setting ranges, increment steps and setting accuracies, see the technical appendix.

Current protection
Short-time and instantaneous protection

Short-time protection
- The short-time protection function protects the distribution system against impedant short-circuits
- The short-time tripping delay and the $I^2t$ ON and $I^2t$ OFF options can be used to ensure discrimination with a downstream circuit breaker
- This function carries out true rms measurements.
- Use of $I^2t$ curves with short-time protection:
  - $I^2t$ OFF selected: the protection function implements a constant time curve
  - $I^2t$ ON selected: the protection function implements an $I^2t$ inverse-time curve up to 10 Ir. Above 10 Ir, the time curve is constant.
- Zone selective interlocking (ZSI)
  The short-time and ground-fault protection functions enable time discrimination by delaying the upstream devices to provide the downstream devices the time required to clear the fault. Zone selective interlocking can be used to obtain total discrimination between circuit breakers using external wiring.
- Intermittent faults are taken into account by Micrologic P and may lead to shorter tripping times than those set.

Micrologic control unit 5.0 P, 6.0 P and 7.0 P

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>Short-time pickup Isd and tripping delay tsd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup</td>
<td>5.0 P, 6.0 P and 7.0 P</td>
</tr>
<tr>
<td>Isd = Ir x ... accuracy ± 10 %</td>
<td>1.5</td>
</tr>
<tr>
<td>Time delay (s)</td>
<td>at 10Ir</td>
</tr>
<tr>
<td>setting</td>
<td>0.1</td>
</tr>
<tr>
<td>$I^2t$ Off</td>
<td>0.1</td>
</tr>
<tr>
<td>$I^2t$ On or</td>
<td>tsd (max resettable time) (ms)</td>
</tr>
<tr>
<td>tsd (max break time)</td>
<td>80</td>
</tr>
</tbody>
</table>

If the "without long-time protection" plug is used and the long-time protection function is disabled, the short-time pickup Isd is automatically multiplied by In instead of Ir as is the standard case.

Instantaneous protection
- The instantaneous-protection function protects the distribution system against solid short-circuits. Contrary to the short-time protection function, the tripping delay for instantaneous protection is not adjustable. The tripping order is sent to the circuit breaker as soon as current exceeds the set value, with a fixed time delay of 20 milliseconds.
- This function carries out true rms measurements.
- The energy reduction maintenance setting (ERMS) function is added to the instantaneous protection function by addition of an optional IO module to the IMU configured to perform the pre-defined application 3 or the ERMS user-defined application.
- For more information, refer to IO Input/Output Interface for LV circuit breaker user guide.

Micrologic control unit 5.0 P, 6.0 P and 7.0 P

<table>
<thead>
<tr>
<th>Instantaneous pickup $I_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup</td>
</tr>
<tr>
<td>$I_i = In (*) x ... accuracy ± 10 %</td>
</tr>
</tbody>
</table>

- Circuit breakers have two types of instantaneous protection:
  - adjustable instantaneous protection $I_i$
  - self-protection.
- Depending on the circuit breaker, the OFF position corresponds to the self-protection pickup.
Overview of functions

Current protection

Instantaneous protection

Energy reduction maintenance settings (ERMS) function

The energy reduction maintenance setting (ERMS) function is available on circuit breaker fitted with:
- a BCM ULP with firmware version 4.1.0 and above.
- a Micrologic P control unit:
  - with firmware version Plogic-2014AN and above.
  - with hardware compatible with the ERMS function. Use the customer engineering tool to check the Micrologic hardware version, or the COM option to check that the hardware version coded in register 8709 is equal to 0x1000.

The ERMS function allows the selection of the Micrologic control unit settings:
- Normal and ERMS mode.

The ERMS function is used to reduce the Ii protection settings in order to trip as fast as possible when a fault occurs. The factory setting for Ii protection in ERMS mode is 2xIn. This protection parameter can be modified using the customer engineering tool.

If any of the basic protection settings using the rotary dial is modified on the Micrologic control unit while in ERMS mode, the Micrologic control unit switches immediately to the normal mode. The Micrologic control unit returns automatically to the ERMS mode after 5 seconds.

The selection of the normal or ERMS mode is made by a selector switch connected to two inputs of the IO module.

When the ERMS mode is engaged, ERMS is shown on the display of the Micrologic control unit and a pilot light connected to the output O3 of the IO module will be in ON state.

The locking pad of the communication interface module (IFM or IFE) must be in UNLOCK position (padlock open) while performing the energy reduction maintenance setting (ERMS).

The parameter ACCESS PERMIT in the COM setup/Remote setting menu on the display of the Micrologic control unit must be set to YES for IMU without IFM/IFE.

This is based on the following behavior:

- IMU with IFM/IFE
  - Setting access permit parameter: The access permit parameter can be changed only from IFE/IFM using the LOCK/UNLOCK dial.
  - Behavior: ERMS ON and OFF orders are executed even if access permit parameter is set as NO.
- IMU without IFM/IFE
  - Setting access permit parameter: The access permit parameter can be changed only from the display of the Micrologic control unit.
  - Behavior: ERMS ON and OFF orders are not executed if access permit parameter is set as NO.

Note:
The ERMS ON and OFF orders are executed only when the access parameter is set to YES and the passcode in the Micrologic control unit must be set to 0000.

If the ERMS function or COM option is used, it is advised to use a second dedicated power supply to supply the Micrologic P control unit (terminals F1-, F2+).

The AD power supply is recommended due to its low stray primary secondary capacitance. Good operation of the Micrologic control unit in noisy environment is not guaranteed with other power supplies.

DANGER

HAZARD OF ARC FLASH
- Do not change the Micrologic P or H control unit's setting while in ERMS mode.
- Seal the transparent cover of the Micrologic P and H control unit when using the ERMS mode.

Failure to follow these instructions will result in death or serious injury.

Micrologic display with ERMS mode engaged.
For the default values, the setting ranges, increment steps and setting accuracies, see the technical appendix.

### Current protection

#### Neutral protection

**Three-pole circuit breakers**

Protection of the neutral is possible on a three-pole circuit breaker by connecting an external sensor. Settings are made using the 

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>Setting</th>
<th>Type of neutral</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0 P, 6.0 P and 7.0 P</td>
<td>OFF</td>
<td>No neutral protection</td>
<td>The distribution system does not require protection of the neutral conductor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Half neutral protection</td>
<td>The cross-sectional area of the neutral conductor is half that of the phase conductors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full neutral protection</td>
<td>The cross-sectional area of the neutral conductor is equal to that of the phase conductors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oversized neutral protection</td>
<td>In installations with a high level of third-order harmonic currents (or multiples thereof), the current in the neutral conductor may exceed that of the phase currents under steady-state conditions</td>
</tr>
</tbody>
</table>

**Four-pole circuit breakers**

The initial protection setting is made using the dial on the neutral pole of the circuit breaker.

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>Setting</th>
<th>Type of neutral</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0 P, 6.0 P and 7.0 P</td>
<td>OFF</td>
<td>No neutral protection</td>
<td>The distribution system does not require protection of the neutral conductor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Half neutral protection</td>
<td>The cross-sectional area of the neutral conductor is half that of the phase conductors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full neutral protection</td>
<td>The cross-sectional area of the neutral conductor is equal to that of the phase conductors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oversized neutral protection</td>
<td>The cross-sectional area of the neutral conductor is greater than that of the phase conductors.</td>
</tr>
</tbody>
</table>
Current protection
Ground-fault and earth-leakage protection

Overview of functions

For the default values, the setting ranges, increment steps and setting accuracies, see the technical appendix.

Ground-fault protection on Micrologic 6.0 P

- An ground fault in the protection conductors can provoke local temperature rise at the site of the fault or in the conductors. The purpose of the ground-fault protection function is to eliminate this type of fault.
- There are two types of ground-fault protection.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual</td>
<td>The function determines the zero-phase sequence current, i.e. the vector sum of the phase and neutral currents (depending on the type of installation)</td>
</tr>
<tr>
<td>Source Ground Return</td>
<td>Using a special external sensor, this function directly measures the fault current returning to the transformer via the earth cable. It detects faults both upstream and downstream of the circuit breaker. The maximum distance between the sensor and the circuit breaker is ten metres.</td>
</tr>
</tbody>
</table>

- Ground-fault and neutral protection are independent and can therefore be combined.

Ground-fault pickup Ig and tripping delay tg

The pickup and tripping-delay values can be set independently and are identical for both the residual and "source ground return" ground-fault protection functions.

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>6.0 P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pickup</strong></td>
<td></td>
</tr>
<tr>
<td>Ig = In (*) x ... accuracy ± 10 %</td>
<td>A</td>
</tr>
<tr>
<td>In &lt; 400 A</td>
<td>0.3</td>
</tr>
<tr>
<td>400 A &lt; In &lt; 1200 A</td>
<td>0.2</td>
</tr>
<tr>
<td>In &gt; 1200 A</td>
<td>500 A</td>
</tr>
<tr>
<td><strong>Time delay (s)</strong> at In or 1200 A</td>
<td>settings</td>
</tr>
<tr>
<td>Ig (max. break time) (ms)</td>
<td>20</td>
</tr>
<tr>
<td>Ig (max. break time) (ms)</td>
<td>80</td>
</tr>
</tbody>
</table>

(*) In: circuit-breaker rating

Earth-leakage protection on sur Micrologic 7.0 P

- The earth-leakage protection function primarily protects people against indirect contact because an earth-leakage current can provoke an increase in the potential of the exposed conductive parts. The earth-leakage pickup value I∆n is displayed directly in amperes and the tripping delay follows a constant-time curve.
- An external rectangular sensor is required for this function.
- This function is inoperative if the long-time rating plug is not installed.
- Protected against nuisance tripping.
- DC-component withstand class A up to 10 A.
- If the optional external voltage-measurement input is used, a 24 V DC external power supply must be connected to Micrologic P (terminals F1-, F2+).

Pickup value I∆n and tripping delay Δt

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>7.0 P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pickup (A)</strong></td>
<td>I∆n accuracy 0 to - 20 %</td>
</tr>
<tr>
<td><strong>Time delay (ms)</strong></td>
<td>settings</td>
</tr>
<tr>
<td></td>
<td>Δt (max. break time)</td>
</tr>
</tbody>
</table>
Current protection
I ↓ Alarm, current unbalance, maximum current

Operating principle
Protection tripped by a maximum value

1: pickup threshold
2: pickup time delay
3: dropout threshold
4: dropout time delay

For protection tripped by a maximum value, it is possible to set:
- a pickup threshold (1) that activates an alarm, a contact and/or tripping
- a pickup time delay (2) that steps in when the pickup threshold (1) is reached
- a dropout threshold (3) corresponding to deactivation of the alarm and/or contact
- a dropout time delay (4) that steps in when the dropout threshold (3) is reached
- The dropout threshold is always less than or equal to the pickup threshold.

I ↓ Alarm
- The alarm function is tripped by the rms value of an earth-leakage current
- This alarm signals an earth-leakage current under the pickup value and does not produce circuit-breaker tripping.

Current-unbalance protection I unbal
- This protection is activated by an adjustable level of unbalance between the RMS values of the three phase currents.

Maximum-current protection per phase Imax
- Protection values may be set for each of the following currents:
  - I1 max: maximum current on phase 1
  - I2 max: maximum current on phase 2
  - I3 max: maximum current on phase 3
  - IN max: maximum current in the neutral
- This function calculates the rms demand value of the current for the given phase (I1, I2, I3) or the neutral (IN), over a sliding time interval.
  The time interval is the same as that for the calculation of the demand currents in the “Metering” menu.
  Settings are made in the “Metering setup” menu.

Note:
IIN max protection does not take into account the neutral-protection setting (N, N/2, 1.6xN, OFF).
Overview of functions

Voltage protection
Minimum voltage, maximum voltage, voltage unbalance

For the pickup and dropout thresholds and time delays, see the technical appendix.

Operating principle

- Protection tripped by a minimum value
- Protection tripped by a maximum value

1: pickup threshold
2: pickup time delay
3: dropout threshold
4: dropout time delay

- For protection tripped by a minimum or maximum value, it is possible to set:
  - a pickup threshold (1) that activates an alarm, a contact and/or tripping
  - a pickup time delay (2) that steps in when the pickup threshold (1) is reached
  - a dropout threshold (3) corresponding to deactivation of the alarm and/or contact
  - a dropout time delay (4) that steps in when the dropout threshold (3) is reached
- For protection tripped by a minimum value, the dropout threshold is always greater than or equal to the pickup threshold
- For protection tripped by a maximum value, the dropout threshold is always less than or equal to the pickup threshold
- If both the minimum and maximum protection functions are activated at the same time, the minimum threshold is automatically limited to the value of the maximum and vice versa.

Minimum-voltage protection \( U_{\text{min}} \)

- This function calculates the minimum rms value of the three phase-to-phase voltages
- Protection is activated when at least one of the three phase-to-phase voltages (\( U_{12}, U_{23}, U_{31} \)) is below the threshold set by the user
- This protection function does not detect phase failure.

Maximum-voltage protection \( U_{\text{max}} \)

- This function calculates the maximum rms value of the three phase-to-phase voltages
- Protection is activated when the three phase-to-phase voltages (\( U_{12}, U_{23}, U_{31} \)) are simultaneously above the threshold set by the user.

Voltage-unbalance protection \( U_{\text{unbal}} \)

This protection is activated by an adjustable level of unbalance between the rms values of the three phase-to-phase voltages.

This function calculates the rms value of the unbalance between the three phase-to-phase voltages.

- From:
  - \( U_{\text{avg}} \) is the average value of the rms voltages of the three phases
    \[
    U_{\text{avg}} = \frac{U_{12} + U_{23} + U_{31}}{3}
    \]
  - \( E_{\text{max}} \): is the maximum difference between the voltage of each phase and \( U_{\text{avg}} \)
  - Micrologic P uses the two values above to calculate the voltage unbalance:
    \[
    U_{\text{unbal}} = \frac{E_{\text{max}}}{U_{\text{avg}}}
    \]
Overview of functions

Other protection
Reverse power, min. frequency, max. frequency, phase rotation

For the pickup and dropout thresholds and time delays, see the technical appendix.

Operating principle

For protection tripped by a minimum value
- protection tripped by a minimum value
- For protection tripped by a minimum or maximum value, it is possible to set:
  - a pickup threshold (1) that activates an alarm, a contact and/or tripping
  - a pickup time delay (2) that steps in when the pickup threshold (1) is reached
  - a dropout threshold (3) corresponding to deactivation of the alarm and/or contact
  - a dropout time delay (4) that steps in when the dropout threshold (3) is reached
- For protection tripped by a minimum value, the dropout threshold is always greater than or equal to the pickup threshold
- For protection tripped by a maximum value, the dropout threshold is always less than or equal to the pickup threshold
- If both the minimum and maximum protection functions are activated at the same time, the minimum threshold is automatically limited to the value of the maximum and vice versa.

Reverse-power protection rP max
- This function calculates the value of the total active power on the three phases
- The function is activated when the total active power of the three phases flows in the direction opposite that set by the user is greater than the pickup threshold (1) for a time greater than the time delay (2).

Note:
The direction of flow is set by the user in the “Power sign” section of the “Micrologic setup” menu under “History, maintenance and settings”.
- + corresponds to the normal direction of flow, i.e. from the top terminals on the circuit breaker to the bottom terminals
- - is the opposite.

Minimum and maximum-frequency protection F min. and F max
These functions monitor the value of the frequency on the distribution system.

Phase-rotation alarm
This alarm is activated if two of the three phases are inverted.

Note:
The alarm is activated following a fixed 300-millisecond time delay. If one of the phases is absent, the alarm will not operate. If the 400 Hz frequency is set, the alarm cannot be activated.

If the voltage protection functions are activated and the voltage measurement inputs are still energised, it is impossible to reset and close the circuit breaker.
Overview of functions

Load shedding and reconnection

For the pickup and dropout thresholds and time delays, see the technical appendix.

Load shedding and reconnection depending on current

The pickup curve for load shedding and reconnection depending on current is parallel to the LT $I_{t}$ and $I_{dmt}$ curves. If a “without long-time protection” rating plug is installed, the load shedding/reconnection function based on current cannot be activated.

- $I_{t}$ protection: the neutral is taken into account
- $I_{dmt}$: the neutral is not taken into account.

This function does not trip the circuit breaker, but can be used to set off an alarm linked to an M2C or M6C contact (disconnection and reconnection of non-priority loads).

The load-shedding and reconnection function is determined by thresholds and time delays.

![Diagram](https://via.placeholder.com/150)

1: pickup threshold  
2: pickup time delay  
3: dropout threshold  
4: dropout time delay

The pickup threshold is always greater than or equal to the dropout threshold.

Load shedding and reconnection depending on power

Load shedding and reconnection depending on power calculates the total active power on the three phases. This function does not trip the circuit breaker, but can be used to set off an alarm linked to an M2C or M6C contact (disconnection and reconnection of non-priority loads).

The load-shedding and reconnection function is determined by thresholds and time delays.

![Diagram](https://via.placeholder.com/150)

1: pickup threshold  
2: pickup time delay  
3: dropout threshold  
4: dropout time delay

The pickup threshold is always greater than or equal to the dropout threshold.
Measurements
Current and voltage

Overview of functions

For the setting ranges and measurement accuracies, see the technical appendix.

Instantaneous current
Micrologic P control units offer two, non-exclusive measurement possibilities.
■ On the bargraph display on the main screen
The instantaneous current of the most heavily loaded phase is automatically displayed in amperes for phases 1, 2, 3 and the neutral (depending on the neutral protection settings). The bargraph indicates the percent load of the three phases.
■ In the I inst. section of the instantaneous currents
□ display in amperes of the instantaneous currents I (rms) on phases I1, I2 and I3 and the neutral current IN, the ground-fault current Ig (Micrologic 6.0 P), the earth-leakage current I∆n (Micrologic 7.0 P)
□ the maximum instantaneous currents are displayed and stored in memory
□ the stored maximums can be reset at any time.

Demand current
■ Display of the demand current on phases I1, I2, I3 and the neutral IN (depending on the type of distribution system)
■ Selection of the demand calculation method
■ Display of the interval over which the value is calculated
■ The maximum demand values are displayed and stored in memory
■ The stored maximums can be reset at any time.

Note:
The calculation method, the type of calculation window (fixed or sliding) and its duration may be set in the “Metering setup” menu under “History, maintenance and setup.”

Phase-to-neutral and phase-to-phase voltages
Micrologic P offers different voltage measurements:
■ Phase-to-phase voltages (rms) between phases U12, U23 and U31, displayed in volts
■ Phase-to-neutral voltages (rms) between the phases and the neutral V1N, V2N and V3N, displayed in volts.

Average voltage
Average Uavg of the instantaneous voltages between phases U12, U23 and U31.

Phase rotation
Displays the phase sequence.

Voltage unbalance
Display of the unbalance Uunbal between the three phase-to-phase voltages, displayed as a percentage.

From:
□ Uavg is the average value of the rms voltages of the three phases
Uavg = \frac{U_{12} + U_{23} + U_{31}}{3}
□ Emax is the maximum difference between the voltage of each phase and Uavg
□ Micrologic P uses the two values above to calculate the voltage unbalance
Uunbal = \frac{E_{\text{max}}}{U_{\text{avg}}}

To display the phase-to-neutral voltages, select the "3ф 4ф CT" option in "System type" in the "Metering setup" menu under "History, maintenance and setup."
Overview of functions

Measurements
Power, energy and frequency

For the setting ranges and measurement accuracies, see the technical appendix.

Instantaneous power and power factor
Micrologic P offers a number of different measurements.
- Total power measurements:
  - instantaneous active power $P$ in kW
  - instantaneous reactive power $Q$ in kvar
  - instantaneous apparent power $S$ in kVA
- Measurement of the power factor $PF$.

Demand power
- Display of the demand values for the active power $P$, reactive power $Q$ and apparent power $S$.
- Selection of the demand calculation method
- Display of the interval over which the value is calculated
- The maximum demand values are displayed and stored in memory
- The stored maximums can be reset at any time.

Note:
- the calculation method, the type of calculation window (fixed or sliding) and its duration may be set in the "Metering setup" menu under "History, maintenance and setup".
- the synchronisation function (Synchro.Com) is available only with the COM communication option; with this function, the demand power is determined on the basis of a signal synchronised by the communication module.
- these settings apply to all demand powers (active power $P$, reactive power $Q$ and apparent power $S$). If the settings are modified, the demand values are systematically recalculated.

Energy
Micrologic P offers a number of different measurements:
- Total energy:
  - total active energy $E.P$ in kWh
  - total reactive energy $E.Q$ in kvarh
  - total apparent energy $E.S$ in kVAh
- Energy consumed (Energy in), positively incremented:
  - active energy $E.P$ in kWh
  - reactive energy $E.Q$ in kvarh
- Energy supplied (Energy out), negatively incremented:
  - active energy $E.P$ in kWh
  - reactive energy $E.Q$ in kvarh
- Energy values can be reset.

Note:
- the Energy in and Energy out values are incremented according to the power sign set in the "Metering setup" menu under "History, maintenance and setup".
- as standard, the total calculated energy values are "absolute total values". They represent the sum of the energy in and out values:
  - $EP = \sum EP_{in} + \sum EP_{out}$
  - $EQ = \sum EQ_{in} + \sum EQ_{out}$
- as an option (access exclusively via the COM communications option), energy can be calculated algebraically:
  - $EP = \sum EP_{in} - \sum EP_{out}$
  - $EQ = \sum EQ_{in} - \sum EQ_{out}$
- These values are called "signed" energies.

Frequency
The frequency of the distribution system is displayed in Hz.
Alarms

For information on the communications option and the portable test kit, see the respective user guides.

- An alarm may be viewed using:
  - the "Alarm history" menu
  - the COM communications option
  - the portable test kit.
- The commands in the "Protection" menu are used to attribute a specific operating mode to each of the protection functions:
  - OFF: protection disabled
  - Alarm: the function issues an alarm, but does not trip the circuit breaker
  - Trip + Alarm: the function issues an alarm and trips the circuit breaker.
- The protection functions against overloads (long time), short circuits (short time and instantaneous) and ground faults (ground-fault and earth-leakage currents) automatically result in tripping and cannot be deactivated (Trip mode only).
- The "I \( \downarrow \) Alarm" and phase rotation alarms can be set exclusively to OFF or Alarm mode.
- The other protection functions for current, voltage, power and frequency may be set to any of the three modes, OFF, Alarm or Trip + Alarm.
- The load shedding and reconnection function may be set to ON or OFF.
- The resettable alarms linked to device tripping are activated when the Ir, Isd/Ii or I \( \downarrow \) thresholds are overrun. The Ir alarm is reset one second after tripping. The Isd/Ii and \( \downarrow \) alarms are reset by pressing the button.

### Current protection

<table>
<thead>
<tr>
<th>Off</th>
<th>Alarm</th>
<th>Trip + Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ir</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isd / Ii</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I ( \downarrow )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Delayed alarms are activated when the pickup and dropout thresholds are overrun and the corresponding time delays have expired.

<table>
<thead>
<tr>
<th>Off</th>
<th>Alarm</th>
<th>Trip + Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>I ( \uparrow ) Alarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I unbal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2 max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T3 max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T4 max</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Voltage protection

<table>
<thead>
<tr>
<th>Off</th>
<th>Alarm</th>
<th>Trip + Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>U min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U unbal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Other protection

<table>
<thead>
<tr>
<th>Off</th>
<th>Alarm</th>
<th>Trip + Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>( rP ) max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F max</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Phase rotation

- \( T1 \)
- \( T2 \)

### Sheding/reconnection

<table>
<thead>
<tr>
<th>Off</th>
<th>On</th>
</tr>
</thead>
<tbody>
<tr>
<td>current I</td>
<td></td>
</tr>
<tr>
<td>power P</td>
<td></td>
</tr>
</tbody>
</table>
The interrupted currents are indicated in terms of their peak values.

**Trip history**
- The trip history is the means to display at any time the parameters measured during the last ten trips.
- For each trip, the following parameters are recorded:
  - tripping cause
  - trip threshold
  - interrupted currents in amperes (only if an external power supply is present) for Ir, Isd/Ii, Ig or In trips
  - date
  - time (hours, minutes and seconds).

**Alarm history**
- The alarm history is the means to display at any time the parameters measured during the last ten alarms.
- For each alarm, the following parameters are recorded:
  - alarm cause
  - alarm threshold
  - date
  - time (hours, minutes and seconds).

**Operation counter**
This function is available only via the COM communications option.
- Micrologic P:
  - stores and displays the total number of operations (incremented each time the circuit breaker opens) since the initial installation of the circuit breaker
  - stores and displays the total number of operations since the last reset.

**Contact wear indication**
This function can be used to:
- Determine the condition of the most worn contact in the circuit breaker. A counter is displayed on the screen. The contacts must be inspected each time the counter reaches a hundred mark. The message "Not available or circuit breaker type not defined" is displayed if the type of circuit breaker has not been defined. In this case, see "Breaker selection" in the "Micrologic setup" menu under "History, maintenance and setup".
- Reset the indicator after changing the main contacts. Reset is also carried out via "Breaker selection" in the "Micrologic setup" menu.

*Note:*
If the control unit is changed, the circuit breaker must be defined again. In this case, see "Breaker selection" in the "Micrologic setup" menu under "History, maintenance and setup".
The procedure required to reclose the circuit-breaker following a fault trip is presented in the circuit-breaker user guide.

Concerning the presence or absence of an external power supply, see the “Power supply” section in the technical appendix.

**Important**
The battery maintains the trip indications. If no indications are displayed, check the battery.

**Fault-trip indications**

- **Control-unit status**
The circuit breaker has tripped. The control unit may or may not have an external power supply. The voltage measurement inputs may be connected upstream or downstream.

- **Control unit without an external power supply and with voltage measurement input connected downstream**
- **Control unit with an external power supply and with voltage measurement input connected upstream**

A LED signals the type of fault (Ir, Isd, li, Ig, IΔn or Ap).

The type of fault is signalled by a LED and on the graphic display.
The self-protection function (excessive temperature, fault detected in ASIC power supply or instantaneous self-protection built into the device) trips the circuit breaker and turns the Ap LED on.

A number of simultaneous causes may result in tripping. For example, a short-circuit and a distribution-system voltage under a set value. The LED signalling the last fault chronologically is the only one to remain ON. E.g., the Ap LED may signal a voltage drop under a set value where the voltage drop was caused by a short-circuit.

The activated LED indicates the menu for which the screen is displayed:
- "Metering"
- "History, maintenance and setup"
- "Protection".
Communication
COM option

Communication options
For fixed and drawout devices, the common communication option is made up of:
- a BCM ULP module, which is installed behind the Micrologic control unit, is supplied with its set of sensors (OF, SDE, PF and CH micro switches), kit for connection to XF and MX1 communicating voltage releases and COM terminal block (inputs E1 to E6). This module is independent of the control unit. It receives and transmits information on the communication network. An infra-red link transmits data between the control unit and the communication module.
  Consumption: 30 mA, 24 V.
- IFM, the Modbus-SL interface for LV circuit breaker, is required for the network connection, contains the Modbus address (1 to 99) declared by the user via the two dials in front. It automatically adapts (baud rate, parity) to the Modbus network in which it is installed.
  or
- IFE, the Ethernet interface for LV breaker, enables an intelligent modular unit (IMU). For example, a Masterpact NT/NW or Compact NSX circuit breaker to be connected to an Ethernet network. Each circuit breaker has its own IFE and a corresponding IP address.

For drawout device, the Cradle Management option must be added:
IO input/output interface module for LV circuit breaker is delivered with withdrawable devices ordered with the COM option for cradle management. It must be installed on a DIN rail near the device. It must be connected to the ULP system and to the position contacts (CD, CT, CE) that transmit the position of the device in the cradle.

For communicating remote control, option with XF and MX1 communicating voltage releases must be added:
The XF and MX1 communicating voltage releases are equipped for connection to the "device" communication module. The remote-tripping function (MX2 or MN) are independent of the communication option. They are not equipped for connection to the "device" communication module.

For more information on the communication option, refer to the:
- ULP system user guide
- IO module user guide
- IFE user guide

Overview of functions
All the Masterpact devices can be fitted with the communication function. Masterpact uses the Ethernet or Modbus communication protocols for full compatibility with the supervision management systems.
Eco COM is limited to the transmission of metering data and status. It is not used to communicate controls.
Overview of functions

Communication
Communication architecture

Fixed electrically-operated devices

Drawout electrically-operated devices

1 BCM ULP
2 OF, SDE ... microswitches
3 COM terminal block (E1 to E6)
4 MX1 and XF communicating voltage releases
5 CE, CD and CT contacts
6 Breaker ULP cord
7 IO module
8 ULP cord
9 IFE module
10 IFM module

Ethernet
Modbus

ULP system

or

Modbus
Ethernet

Module Status
Network Status

IFE
IFE_XX.YY
.ZZ (factory set)

ETH1
ETH2

Module Status
Network Status

IFE
IFE_XX.YY
.ZZ (factory set)
Overview of functions

Optional M2C and M6C contacts

An alarm is issued if the Alarm or the Trip + Alarm mode was set for the given protection function.

Important

The M2C and M6C contacts require an auxiliary power supply. See the "Power supply" section in the technical appendix.

- Available types of contacts:
  - M2C: up to two contacts maximum, S1 and S2
  - M6C: up to six contacts maximum, S1 to S6.

- Current protection:
  - Ir
  - Isd
  - li
  - I unbal.

- Voltage protection:
  - U min
  - U max
  - U unbal.

- Other protection:
  - F min
  - F max
  - rP max
  - phase rotation.

- Load shedding and reconnection:
  - current I
  - power P

- Latching settings:
  - non-latching contact: the contact remains activated as long as the fault that caused the alarm has not been cleared
  - latching contact: the contact remains activated until it is reset ("Reset menu")
  - time-delay contact: the contact remains activated for the duration of an adjustable time delay or until it is reset ("Reset menu")
  - locked to 1: the contact is forced to 1 for an automation test
  - locked to 0: the contact is forced to 0 for an automation test.

- Contact operating diagram for long-time protection

- Contact operating diagram for short-time, instantaneous and ground-fault protection

- Contact operating diagram for the other protection functions
Setup

Setting up the optional M2C / M6C contacts

Select an alarm

Note:
An alarm may be selected if the "Alarm" or "Trip + Alarm" mode was selected during setup of the given protection function, in the "Protection" menu.

Select the command

Select the command

Select the latching mode:
- non-latching
- latching
- time-delay
- locked to 1
- locked to 0.

Confirm.

Select a contact.

Select an alarm.

Confirm.

Select a latching mode:
- non-latching
- latching
- time-delay
- locked to 1
- locked to 0.

Confirm.

Select a contact.
Setting up the optional M2C / M6C contacts

- Set the time delay for time-delay latching

![Diagram showing time delays and settings]

- Select the command

  - M2C / M6C Contacts
  - Reset

- Reset the contacts to 0

  - M2C / M6C
    - S1 0
    - S2 0
  - M2C / M6C
    - S1 1
    - S2 1

- Reset (- / +)

  - Reset the contacts to 0… or cancel the reset, then confirm.

- Select the time delay.
  - Adjust.
  - Confirm.
Setting up the Micrologic control unit

Prior to setting up the protection functions or carrying out measurements, the following operations are required:
- selection of the display language
- entry of the date and time
- entry of the circuit-breaker type
- entry of the power sign
- selection of the transformation ratio between the primary and secondary windings
  if an auxiliary voltage transformer is installed
- entry of the rated frequency.

Select the display language

Select the command

Micrologic
setup
Language

Select the command

Micrologic
setup
Date / time

If the time is set via a communications module, any previous manual setting is automatically erased.

To return to English
1. Return to the main screen by pressing any of the three buttons
2. Select the "History, maintenance and setup" menu by pressing
3. Select the “Micrologic setup” menu by moving the cursor up on the first menu. Move the cursor down on the third menu and confirm by pressing
4. Select the "Language" menu by moving the cursor up on the first menu. Confirm by pressing

Set the date and time

■ Enter the date and time for time-stamping purposes in the trip and alarm histories.

The resolution of the time setting is 20 ms.
Setup

Date and time are backed up by battery.

If time is not synchronised by the supervisor via the communication module, a drift of up to one hour per year may be observed.

Select the command

- **Micrologic setup**
- **Breaker selection**

The circuit-breaker code is required to identify the device and activate the contact-wear counter.

Note this code if the control unit must be changed (example 03E7).

Enter this code when setting up a new control unit on the circuit breaker. For a new device, the code is set to zero.

When the main circuit-breaker contacts are replaced, this code must be reset to zero.

Circuit-breaker selection

- **Breaker selection**
- **Standard**
  - **UL**
    - Circuit breaker Masterpact type NT08N 03E7 P Logicxxxxxx
  - **IEC**
    - Circuit breaker Masterpact type NT H1 03E7 P Logicxxxxxx

- **Compact NS**
  - Circuit breaker type 630b 03E7 P Logicxxxxxx

- **800**
  - Circuit breaker Compact NS type 800 03E7 P Logicxxxxxx

Date and time are backed up by battery.

If time is not synchronised by the supervisor via the communication module, a drift of up to one hour per year may be observed.
Setting up the Micrologic control unit

Select the command

![Micrologic setup](image)

Power sign

By default, Micrologic P uses P+ for the power flowing from top to bottom terminals. The selected direction of flow is valid for:
- measurement of power and the power factor
- measurement of energy
- load shedding and reconnection depending on power.

Select the command

![Micrologic setup](image)

VT ratio

If the supply voltage for the control unit exceeds 690 V, an external voltage transformer must be installed.

To display the true voltage values, enter the transformation ratio between the primary and secondary voltages of the transformer.

Note that if Digipact display modules are used, the rated distribution-system voltage must be entered.

Select the command

![Micrologic setup](image)

System frequency

If the phase-rotation protection function is activated, the 400 Hz frequency may not be selected. If the 400 Hz frequency is selected, the phase-rotation protection function is disabled.

Select the sign of the power

![Power sign](image)

Select either the:
- primary voltage
- secondary voltage.

Enter the voltage-transformation ratio

![VT ratio](image)

Enter the voltage.

Go on to the next setting.

Enter the rated frequency

![System frequency](image)

400Hz

Select.

Choose.

Confirm.
Important
The neutral current IN cannot be measured with the “3-phase, 3-wire, 3-CT” and “3-phase, 4-wire, 3-CT” types.

For a 3-pole device, the neutral, if distributed, must be connected to terminal VN of the Micrologic P control unit.

See the “Overview of functions” section for information on the available types of measurements.

Setting up the metering functions

Prior to setting up the protection functions or carrying out measurements, the following operations are required:
- entry of the system type
- selection of the calculation mode for the demand current
- selection of the calculation mode for the demand power
- select the power sign
- select the sign convention for the power factor measurement.

Select the system type
The Micrologic P control unit offers three measurement options:
- 3 phases, 3 wires, 3 CTs (method using two wattmeters)
  The currents on phases I1, I2 and I3 are displayed.
  The current on the neutral I_N is not displayed.
  The phase-to-phase voltages U12, U23 and U31 are displayed.
  The phase-to-neutral voltages V1N, V2N and V3N are not displayed.
- 3 phases, 4 wires, 3 CTs (method using three wattmeters)
  The currents on phases I1, I2 and I3 are displayed.
  The current on the neutral I_N is not displayed.
  The phase-to-phase voltages U12, U23 and U31 are displayed.
  The phase-to-neutral voltages V1N, V2N and V3N are displayed.
- 3 phases, 4 wires, 4 CTs (method using three wattmeters)
  The currents on phases I1, I2 and I3 are displayed.
  The current on the neutral I_N is displayed.
  The phase-to-phase voltages U12, U23 and U31 are displayed.
  The phase-to-neutral voltages V1N, V2N and V3N are displayed.

Note:
It is advised not to use the “3-phase, 4-wire, 4-CT” type of measurement unless the neutral is effectively connected to the control unit (four-pole circuit breaker with an external voltage-measurement input).

Select the command
Metering setup
System type

Select the calculation method for demand current

Thermal method based in I^2t calculation.
Setting up the metering functions

Select the command

Metering setup

Power demand

The synchronisation function “Synchro.Com” is available only with the COM communication option.

With this function, the demand power is determined on the basis of a signal synchronised by the communication module.

Thermal method based on $I_2t$ calculation.

Sliding window: power demand is refreshed every 15 seconds.

Fixed window: power demand is refreshed at the end of the time interval.

Select the calculation method for demand power

Power demand

Calculation method

thermal

Window type

sliding

Interval

15 min

Select.

Choose between:

- thermal
- block interval
- sync. to comms

Confirm.

Power demand

Calculation method

block interval

Window type

sliding

Interval

15 min

Select.

Choose between fixed or sliding.

Confirm.

Power demand

Calculation method

block interval

Window type

fixed

Interval

15 min

Select.

Confirm.
## Setting up the metering functions

### Power demand
- Calculation method: 
- Block interval: 
- Window type: fixed
- Interval: 15 min

### Power demand
- Calculation method: 
- Block interval: 
- Window type: fixed
- Interval: 20 min

### Power demand
- Calculation method: 
- Block interval: 
- Window type: fixed
- Interval: 20 min

### Set up the power-factor calculation

<table>
<thead>
<tr>
<th>Sign convention</th>
<th>IEEE</th>
<th>IEEE alt.</th>
<th>IEEE alt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Select the command**

- Metering setup
- Sign convention

See page 87 for the description of power factor sign conventions.
As soon as the communications option is connected, the control unit recognises it and displays the type of module on the graphic screen. Automatic time updates are possible only with the Modbus system.

**Setting up the COM communications option**

When a COM communications option is used, it is necessary to:
- set up the COM communications option
- authorise remote setting of the Micrologic control unit
- authorise remote control of the circuit breaker.

**Set up the Modbus address**

The setting of the Modbus address depends on the COM option.

<table>
<thead>
<tr>
<th>COM option</th>
<th>Modbus address</th>
<th>Modbus address range</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCM or BCM ULP not connected to IFM or IFE</td>
<td>The Modbus address is set up on the Modbus Com setting screen, with the parameters of the communication option (see below).</td>
<td></td>
</tr>
<tr>
<td>BCM ULP connected to IFM</td>
<td>The Modbus address is set up on the 2 address rotary switches on the front panel of the IFM.</td>
<td></td>
</tr>
<tr>
<td>BCM ULP connected to IFM with legacy firmware</td>
<td>The Modbus address is set up on the 2 address rotary switches on the front panel of the IFM.</td>
<td></td>
</tr>
<tr>
<td>BCM ULP connected to IFE</td>
<td>The Modbus address is fixed and cannot be changed.</td>
<td></td>
</tr>
</tbody>
</table>

**Baud-rate**

- **2Wires+ULP**
  - 9600

**Parity**

- None

**Connection**

- 2Wires+ULP
- 4Wires

**View and set up the communications option**

- Select an existing parameter.
- Adjust.
- Confirm.

- Select an existing setting.
- Choose.
- Confirm.
Setting up the COM communications option

Authorise remote setup of Micrologic

To authorise the remote setup of the Micrologic control unit equipped with a BCM or BCM ULP, access permit must be set to YES on the Remote settings screen.

If the BCM or BCM ULP is connected to an IFM or IFE communication interface, the IFM or IFE locking pad must be set to UNLOCK (padlock open).

The access code is a password that must be provided by the supervisor prior to accessing the Micrologic settings.

If the operator does not enter a specific access code, the default access code is 0000 and is requested by the supervisor.
It is possible to set circuit-breaker control to local only ("Manual") or to local and remote ("Auto").

**Select the command**

- **Com. setup**
- **Remote control**

**Authorise remote control of the circuit breaker**

To authorise the remote control of the circuit breaker, Auto must be set on the Remote control screen.

![Remote control screen](image)


If the circuit breaker is connected to other ULP modules, each ULP module must be set to authorise the remote control of the circuit breaker:

- On FDM121 display unit, set the circuit breaker in remote control mode on the FDM121 Control menu
- On IO module with predefined application 2 (breaker application), set the selector switches connected to the IO module inputs to:
  - Remote control mode (I1 = 1)
  - Enable close order (I4 = 1)
- On IFM or IFE communication interface, the IFM or IFE locking pad must be set on UNLOCK (padlock open).

For more information on the communication option, refer to the:

- ULP system user guide
- IO module user guide
- IFE user guide
- FDM121 user guide
Protection settings

Fine adjustment of the long-time $I^2t$, short-time and Instantaneous settings using the keypad

Select the command.

Current protection

Select a setting. Adjust the value. Confirm.

Adjust the other settings and confirm.

When all the settings have been adjusted, quit the screen by pressing one of the menu-access buttons. This saves the new values.

Do you want to save new settings?

- no
- yes

Select the command.

Current protection

Select a setting. Adjust the value. Confirm.

Adjust the other settings and confirm.

When all the settings have been adjusted, quit the screen by pressing one of the menu-access buttons. This saves the new values.
Fine adjustment of the long-time Idmtl, short-time and instantaneous settings using the keypad

Select the command

Current protection
Idmtl (A)

Idmtl (A)

Trip
1000 A
1.0 s
EIT
2000 A
0.2 s
4000 A

long-time current setting Ir
long-time tripping delay tr
Idmtl protection: DT, SIT, VIT, EIT, HVF
short-time pickup Isd
short-time tripping delay tsd
instantaneous pickup Ii

Idmtl (A)
Change I(A) settings with Idmtl(A)?

No
Yes

Select yes.
Select a setting.
Change the setting.

Idmtl (A)
Trip
1000 A
1.0 s
EIT
2000 A
0.2 s
4000 A

VIT

Do you want to save new settings?
no
yes

Idmtl (A)
Trip
1000 A
1.0 s
VIT
2000 A
0.2 s
4000 A

Idmtl (A)
Trip
1000 A
1.0 s
VIT
2000 A
0.2 s
4000 A

Select the command

Current protection
Idmtl (A)

Idmtl (A)

Trip
1000 A
1.0 s
EIT
2000 A
0.2 s
4000 A

long-time current setting Ir
long-time tripping delay tr
Idmtl protection: DT, SIT, VIT, EIT, HVF
short-time pickup Isd
short-time tripping delay tsd
instantaneous pickup Ii

Idmtl (A)
Change I(A) settings with Idmtl(A)?

No
Yes

Select yes.
Select a setting.
Change the setting.

Idmtl (A)
Trip
1000 A
1.0 s
VIT
2000 A
0.2 s
4000 A

Do you want to save new settings?
no
yes

Protection settings

Select the command

Current protection
Idmtl (A)

Idmtl (A)

Trip
1000 A
1.0 s
EIT
2000 A
0.2 s
4000 A

long-time current setting Ir
long-time tripping delay tr
Idmtl protection: DT, SIT, VIT, EIT, HVF
short-time pickup Isd
short-time tripping delay tsd
instantaneous pickup Ii

Idmtl (A)
Change I(A) settings with Idmtl(A)?

No
Yes

Select yes.
Select a setting.
Change the setting.

Idmtl (A)
Trip
1000 A
1.0 s
VIT
2000 A
0.2 s
4000 A

Do you want to save new settings?
no
yes

Protection settings
Protection settings

Fine adjustment of the ground-fault and earth-leakage protection setting using the keypad

Select the command

Current protection

Select a setting.

Adjust the value.

When all the settings have been adjusted, quit the screen by pressing one of the menu-access buttons. This saves the new values.
Protection settings

**Setting the neutral protection**

Select the command

![Current protection](image1)

**Neutral** (A)

**Important**
Selection of the CT type determines the "Neutral" protection in the "Protection" menu.
- "none" disables the neutral protection.
- "Internal" for a four-pole circuit breaker provides access to the N/2, N and OFF protection functions.
- "External" for a three-pole circuit breaker provides access to the N/2, N, 1.6xN and OFF protection functions.

<table>
<thead>
<tr>
<th>Type of circuit breaker</th>
<th>Possibles choices</th>
</tr>
</thead>
</table>
| Four-pole               | OFF: no neutral protection  
|                         | N / 2: half neutral protection  
|                         | N: full neutral protection  |
| Three-pole              | OFF: no neutral protection  
|                         | N / 2: half neutral protection  
|                         | N: full neutral protection  
|                         | 1.6 x N: oversized neutral protection  |

**Using the keypad on the control unit**

![Neutral (A) Neutral CT](image2)

**Neutral CT**

**Internal**

**Protection**

**OFF**

Select. then

Choose between:
- internal  
- external  
- none.

Confirm.

![Neutral (A) Neutral CT](image3)

**Neutral CT**

**External**

**Protection**

**OFF**

Select. then

Choose.

Confirm.

![Neutral (A) Neutral CT](image4)

**Neutral CT**

**External**

**Protection**

**N/2**

Select. then

Do you want to save new settings?

- no
- yes

Quit the setting screen.

Note:
On four-pole circuit breakers, setting of the neutral using the keypad is limited by the dial setting.
Protection settings

Select the corresponding menu

Current protection

| I ⚠ Alarm | I unbal (%) | I₁ max (A) | I₂ max (A) | I₃ max (A) | IN max (A) |

Voltage protection

| U min (V) | U max (V) | U unbal (%) |

Other protection

| rP max (W) | F min (Hz) | F max (Hz) |

Phase rotation

In trip mode, the dropout threshold is equal to the pickup threshold. The dropout time delay is fixed and equal to 1 second.

Setting the I ⚠, I unbal, I₃ max, U min, U max, U unbal, rP max, F min, F max, and phase-rotation protection functions using the keypad

Example: Maximum voltage setting (U max)

Select Alarm mode

| U max (V) | U max (V) | U max (V) |

Select the first setting. Choose Off or Alarm.

In trip mode, the dropout threshold is equal to the pickup threshold. The dropout time delay is fixed and equal to 1 second.
Protection settings

Setting the \( I_\text{max}, I_\text{unbal}, T_\text{max}, U_\text{min}, U_\text{max}, U_\text{unbal}, rP_\text{max}, F_\text{min}, F_\text{max}, \) and phase-rotation protection functions using the keypad

For protection tripped by a maximum value, the dropout threshold is always less than or equal to the pickup threshold.

For protection tripped by a minimum value, the dropout threshold is always greater than or equal to the pickup threshold.

If both the minimum and maximum protection values are activated, the minimum threshold is automatically limited to the value of the maximum and vice versa.

When all the settings have been made, quit the screen by pressing one of the menu-access buttons. This saves the new values.
Protection settings

Setting load shedding / reconnection

Select the command

- Load shedding I
- Load shedding P

- Load shedding
  - type of shedding (I or P)
  - operating mode (On, Off)

- Pick up
  - pickup threshold
  - pickup time delay

- Drop out
  - dropout threshold
  - dropout time delay
**Protection settings**

**Setting load shedding / reconnection**

Example: Take load shedding / reconnection depending on power.

Select the first setting.

- **Off:** load shedding disabled
- **On:** load shedding enabled.

Select: then Confirm.

Select the existing dropout threshold.

Adjust.

Select then Confirm.

Set the other parameters.

Quit the setting screen.

Do you want to save new settings?

**no**

**yes**

When all the settings have been made, quit the screen by pressing one of the menu-access buttons. This saves the new values.
Continuous current measurement
The bargraph displays the value in amperes of the most heavily loaded phase.

Measure an instantaneous-current value
■ Measure the instantaneous currents

Check the instantaneous-current maximeter

Select the command

Select. then View.
Current measurements

- Reset the maximeter

**Imax instant.**

\[
\begin{align*}
I_1 &= 0 \text{ A} \\
I_2 &= 0 \text{ A} \\
I_3 &= 0 \text{ A} \\
I_N &= 0 \text{ A} \\
I_{\text{max}} &= 0 \text{ A}
\end{align*}
\]

Reset ( - / +)

Reset the maximeter or...

cancel the reset.

Select the command

\[ I \quad (A) \]

Demand.

- Measure a demand-current value

**Demand**

\[
\begin{align*}
I_{1,2,3,IN}
\end{align*}
\]

Max

Select then

**Demand**

\[
\begin{align*}
\bar{I}_1 &= 3950 \text{ A} \\
\bar{I}_2 &= 4270 \text{ A} \\
\bar{I}_3 &= 3890 \text{ A} \\
\bar{I}_N &= 340 \text{ A}
\end{align*}
\]

View.
Current measurements

- Check the demand-current maximeter

**Demand**

\[
\begin{align*}
n_1, n_2, n_3, n_N \\
\text{Max}
\end{align*}
\]

Select. then View.

- Reset the maximeter

**Imax**

<table>
<thead>
<tr>
<th>Demand</th>
<th>15min</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I_1)</td>
<td>4020 A</td>
</tr>
<tr>
<td>(I_2)</td>
<td>4450 A</td>
</tr>
<tr>
<td>(I_3)</td>
<td>4300 A</td>
</tr>
<tr>
<td>(I_N)</td>
<td>600 A</td>
</tr>
</tbody>
</table>

Reset (-/+) 15min

**Imax**

<table>
<thead>
<tr>
<th>Demand</th>
<th>15min</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I_1)</td>
<td>0 A</td>
</tr>
<tr>
<td>(I_2)</td>
<td>0 A</td>
</tr>
<tr>
<td>(I_3)</td>
<td>0 A</td>
</tr>
<tr>
<td>(I_N)</td>
<td>0 A</td>
</tr>
</tbody>
</table>

Reset (-/+) 15min

**Imax**

<table>
<thead>
<tr>
<th>Demand</th>
<th>15min</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I_1)</td>
<td>4020 A</td>
</tr>
<tr>
<td>(I_2)</td>
<td>4450 A</td>
</tr>
<tr>
<td>(I_3)</td>
<td>4300 A</td>
</tr>
<tr>
<td>(I_N)</td>
<td>600 A</td>
</tr>
</tbody>
</table>

Reset (-/+) 15min

Reset the maximeter or...
Select the command

**Voltage measurements**

**Measure an instantaneous-voltage value (U or V)**

```
U (V)

Instant.
Average 3Φ
Unbal 3Φ
Phase rotation
```

```
U_{inst.}

U_{12} = 400 V
U_{23} = 404 V
U_{31} = 401 V
U_{1N} = 230 V
U_{2N} = 229 V
U_{3N} = 233 V
```

Select. then View.

**Measure the average voltage U avg**

```
U (V)

Instant.
Average 3Φ
Unbal 3Φ
Phase rotation
```

```
U_{avg.}

3Φ

402 V
```

Select. then View.

**Measure the voltage unbalance U unbal**

```
U (V)

Instant.
Average 3Φ
Unbal 3Φ
Phase rotation
```

```
U_{unbal}

3Φ

1 %
```

Select. then View.

The phase-to-neutral voltages are displayed if the selected system type is 3-phase, 4-wire (see page 43).
Determine the phase sequence

\[ U(V) \]
- Instant.
- Average 3Φ
- Unbal 3Φ

Phase rotation
\[ \Delta \Phi: 1, 2, 3 \]
To ensure reliable power and power-factor measurements, the "Power sign" and "Sign convention" parameters must be set.

**Measure an instantaneous-power value**

<table>
<thead>
<tr>
<th>Pinst.</th>
<th>Pinst.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P, Q, S</td>
<td>P, Q, S</td>
</tr>
<tr>
<td>Power factor</td>
<td>Power factor</td>
</tr>
<tr>
<td>P (kW)</td>
<td>2180</td>
</tr>
<tr>
<td>Q (kvar)</td>
<td>-650</td>
</tr>
<tr>
<td>S (kVA)</td>
<td>2280</td>
</tr>
</tbody>
</table>

**Measure the power factor**

<table>
<thead>
<tr>
<th>Pinst.</th>
<th>Pinst.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P, Q, S</td>
<td>P, Q, S</td>
</tr>
<tr>
<td>Power factor</td>
<td>Power factor</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Measure a demand-power value**

Display the demand power

<table>
<thead>
<tr>
<th>Demand</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>P, Q, S</td>
<td>P, Q, S</td>
</tr>
<tr>
<td>Max</td>
<td>Max</td>
</tr>
<tr>
<td>P (kW)</td>
<td>2350</td>
</tr>
<tr>
<td>Q (kvar)</td>
<td>-820</td>
</tr>
<tr>
<td>S (kVA)</td>
<td>2640</td>
</tr>
</tbody>
</table>
Power measurements

- Check the demand-power maximeter

**Demand**

<table>
<thead>
<tr>
<th>P, Q, S</th>
<th>Max</th>
</tr>
</thead>
</table>

**Pmax Demand**

<table>
<thead>
<tr>
<th>P (kW)</th>
<th>2450</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q (kvar)</td>
<td>-800</td>
</tr>
<tr>
<td>S (kVA)</td>
<td>2700</td>
</tr>
</tbody>
</table>

Reset (- / +)

Select. then View.

- Reset the maximeter

**Pmax Demand**

<table>
<thead>
<tr>
<th>P (kW)</th>
<th>2450</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q (kvar)</td>
<td>-800</td>
</tr>
<tr>
<td>S (kVA)</td>
<td>2700</td>
</tr>
</tbody>
</table>

Reset (- / +)

Reset the maximeter or... cancel the reset.
Select the command

To ensure reliable energy measurements, the "Power sign" and "Sign convention" parameters must be set.

Energy measurements

Measure the energy values

Select the energy value to be measured:
- total energy
- energy in (positive component in the total energy)
- energy out (negative component in the total energy).

E (kWh)

E total
E in
E out
Reset energy

Select the command

E total
E in
E out

E (kWh)

E total
E in
E out

E (kWh)

View the total energy values.
View the energy in values.
View the energy out values.

Reset the energy values

Reset Energy

Are you sure?
No
Yes

To reset energy press enter

Select the command

Select yes or no.

If yes, confirm.
Select the command

Select the command

View.
Important
If the circuit breaker remains closed and the Ap LED remains ON after the reset, open the circuit breaker and contact the after-sales support department.

The fault indication is maintained until it is reset on the control panel. Press the reset button.
Viewing the event histories

Select the command

Event history
Trip history

Trip history

Trip
22/11/1999
02:04:04
U min 160V

U min
27/01/1999
Ir
27/06/1998
Ir
18/02/1998

Select a fault.

Alarm history

Alarm
27/01/1999
13:06:09
I2 max 3400A

I2 max
27/01/1999
In max
23/03/1998
U max
12/02/1998

Select an alarm.

View.
Operation counter and contact-wear indicator

Select the command

- Event history
- Operation counter

View and/or reset the operation counter

Select the command

- Event history
- Contact wear

Check the wear of the contacts

Contact wear is indicated from 0 to 900. The contacts should be inspected every time the counter reaches a multiple of 100.
If the battery needs to be changed, order a new battery with the Schneider Electric catalogue number 33593.
- Lithium battery
- 1.2 AA, 3.6 V, 800 mA/h
- Ambient temperature: 130°C.

Press and hold down the test button on the control unit to check the LEDs and the battery. The battery information is displayed if the control unit is equipped with an external power supply or if the circuit breaker is ON.

**Check the control-unit battery**

1. remove the battery cover
2. remove the battery
3. insert a new battery. Check the polarity.
4. put the cover back in place. Press the battery-test button to check the new battery.

**Replacing the control-unit battery**
Test the ground-fault (Micrologic 6.0 P) and earth-leakage (Micrologic 7.0 P) protection functions

The circuit breaker must be supplied with power and closed for the test.

Press the TEST button. The circuit breaker should trip.

If the circuit breaker does not trip, contact the after-sales support department.

Refer to the manual that comes with the test kits.

Mini test kit and portable test kit

The test connector is used to connect the mini or the portable test kit to check that the control unit is operating correctly.
Tripping curves

Long-time $I^2t$, short-time and instantaneous protection Micrologic 5.0 P, 6.0 P, 7.0 P

Long-time $Idt$, short-time and instantaneous protection Micrologic 5.0 P, 6.0 P, 7.0 P
Ground-fault protection - Micrologic 6.0 P

Tripping curves

I (A) / in

lg = A / t x ln (I)

1200 A max.
Micrologic P is equipped with a three-phase voltage power supply that, with respect to the distribution system, may be considered a delta load. The three-phase power supply reinjects voltage on an open phase. The voltage-protection functions react as indicated below.

**Minimum-voltage protection**
This function is based on the measurement of the phase-to-phase voltages.

In diagrams 1, 3 and 4 on the next page, a fuse has blown. The control unit reinjects voltage on the failed phase and measures a phase-to-phase voltage higher than the actual voltage. The phase-to-neutral voltage should be zero, but the value measured is not zero.

In diagram 2, the phase-to-neutral voltage is effectively zero and the measurement indicates zero as well.

By limiting the pickup threshold of the minimum-voltage protection to the 80% - 100% range of the rated distribution-system voltage, the differences between the real voltages and the measured values are not significant and Micrologic will operate under all circumstances in the expected manner.

**Voltage-unbalance protection**
This function is based on the measurement of the phase-to-phase voltages.

In diagrams 1, 3 and 4 on the next page, a fuse has blown. The control unit reinjects voltage on the failed phase and measures a phase-to-phase voltage higher than the actual voltage. The phase-to-neutral voltage should be zero, but the value measured is not zero.

In diagram 2, the phase-to-neutral voltage is effectively zero and the measurement indicates zero as well.

By limiting the pickup threshold of the voltage-unbalance protection to the 0% - 20% range, the differences between the real voltages and the measured values are not significant and Micrologic will operate under all circumstances in the expected manner.

**Phase failure**
Detection of phase failure is not possible on the basis of the minimum-voltage and voltage-unbalance protection functions. The Micrologic power supply requires at least two phases (between 100 and 690 V).

In diagrams 1, 3 and 4, if two phases have failed, Micrologic H measures for the three phases the value of the single voltage present (e.g. \( U_{12} = U_{23} = U_{31} = 410 \text{ V} \)).
Voltage measurements

Diagram 1

Diagram 2

Diagram 3

Diagram 4

Other measurement and protection systems
Zone selective interlocking (ZSI)

Operating principle
- A fault occurs at point A
  Downstream device no. 2 clears the fault and sends a signal to upstream device no. 1, which maintains the short-time tripping delay tsd or the ground-fault tripping delay tg to which it is set.
- A fault occurs at point B
  Upstream device no. 1 detects the fault. In the absence of a signal from a downstream device, the set time delay is not taken into account and the device trips according to the zero setting. If it is connected to a device further upstream, it sends a signal to that device, which delays tripping according to its tsd or tg setting.

Note:
On device no. 1, the tsd and tg tripping delays must not be set to zero because this would make discrimination impossible.

Connections between control units
A logic signal (0 or 5 volts) can be used for zone selective interlocking between the upstream and downstream circuit breakers.
- Micrologic 5.0 A, 6.0 A, 7.0 A
- Micrologic 5.0 E, 6.0 E
- Micrologic 5.0 P, 6.0 P, 7.0 P
- Micrologic 5.0 H, 6.0 H, 7.0 H.
An interface is available for connection to previous generations of trip units.

Wiring
- Maximum impedance: 2.7 Ω / 300 metres
- Capacity of connectors: 0.4 to 2.5 mm²
- Wires: single or multicore
- Maximum length: 3000 metres
- Limits to device interconnection:
  - the common ZSI - OUT (Z1) and the output ZSI - OUT (Z2) can be connected to a maximum of ten inputs
  - a maximum of 100 devices may be connected to the common ZSI - IN (Z3) and to an input ZSI - IN CR (Z4) or GF (Z5).

Test
The portable test kit may be used to check the wiring and operation of the zone selective interlocking between a number of circuit breakers.
**Important**
It is advised to use the AD power-supply module rather than an off-the-shelf 24 V power supply to ensure Class II insulation on the front panel of the Micrologic P control unit.

The power supply must have the following characteristics:
- Output voltage 24 V DC
- DC ripple less than 5%
- Power rating 5 W / 5 VA
- Dielectric withstand (input/output): 3 kV rms

### AD power-supply module
The AD power-supply module provides auxiliary 24 V DC power for the control-unit functions listed below:
- Graphic display:
  - Device OFF or not supplied
  - The long-time, short-time, instantaneous and ground-fault protection functions operate under all circumstances on their own power
- Activation of an M2C programmable contact

The AD power-supply module is required to assign an M2C programmable contact to an alarm.

The AD power-supply module can supply the following voltages:
- 110 V AC
- 220 V AC
- 380 V AC
- 24 / 30 V DC
- 48 / 60 V DC
- 125 V DC.

### Battery module
Use of a BAT battery module, mounted in series with the AD power-supply module, ensures a continuous supply of 24 V DC power for 12 hours if the AD module fails.

### Wiring diagrams
- Reliable or backed-up auxiliary system
- Auxiliary system without back-up
- Supply with the MC6 module
Using the AD power-supply module

The 24 V DC external power-supply (AD module) is required for certain operating configurations as indicated in the table below:

- yes means the power supply is required
- no means it is not required.

<table>
<thead>
<tr>
<th>Circuit breaker</th>
<th>Closed</th>
<th>Open</th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC power present for Micrologic P</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>M2C, M6C programmable-contacts option</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Display function</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Time-stamping function</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Circuit-breaker status indications and control via</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>communications bus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identification, settings, operation and maintenance aids</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

- If the 24 V DC external power supply (AD module) is used, the maximum cable length between 24 V DC (G1, G2) and the control unit (F1-, F2+) must not exceed 10 metres.
- The communications bus requires its own 24 V DC power source (E1, E2). This source is not the same as the 24 V DC external power-supply module (F1-, F2+).

Selection of the voltage-measurement inputs

The voltage-measurement inputs are standard equipment on the downstream connectors of the circuit breaker.

It is possible to measure distribution-system voltage externally using the PTE external voltage-measurement input option.

With this option, the internal voltage-measurement inputs are disconnected. The PTE option is required for voltages greater than 690 V (in which case a voltage transformer is required).

When the PTE option is implemented, the supply circuit of the voltage-measurement input must be protected against short-circuits. Installed as close as possible to the busbars, this protection function is ensured by a P25M circuit breaker (1 A rating) with an auxiliary contact (cat. no. 21104 and 21117).

The supply circuit of the voltage-measurement input is reserved exclusively for the control unit and must never be used to supply other circuits.
Important
Following any modifications to the long-time rating plug, all control-unit protection parameters must be checked.

Select the long-time rating plug
A number of long-time rating plugs are available for Micrologic P control units.

<table>
<thead>
<tr>
<th>Part number</th>
<th>Setting range for the Ir value</th>
</tr>
</thead>
<tbody>
<tr>
<td>33542</td>
<td>standard 0.4 to 1 x Ir</td>
</tr>
<tr>
<td>33543</td>
<td>low setting 0.4 to 0.8 x Ir</td>
</tr>
<tr>
<td>33544</td>
<td>high setting 0.8 to 1 x Ir</td>
</tr>
<tr>
<td>33545</td>
<td>without long-time protection</td>
</tr>
</tbody>
</table>

| b | Ir = In for the short-time protection setting |
| b | Frequency protection not available |
| b | Load shedding / reconnection based on current not available |

Change the long-time rating plug
Proceed in the following manner.

1. open the circuit breaker
2. open the protective cover of the control unit
3. completely remove the long-time rating plug screw
4. snap out the rating plug
5. clip in the new rating plug
6. refit the screw for the long-time rating plug
7. check and/or modify the control-unit settings

Important
If no long-time rating plug is installed, the control unit continues to operate under the following downgraded conditions:
- the long-time current setting Ir is 0.4
- the long-time tripping delay tr corresponds to the value indicated by the adjustment dial
- the earth-leakage protection function is disabled
- the voltage-measurement inputs are disconnected.
Thermal memory

The thermal memory is the means to take into account temperature rise and cooling caused by changes in the flow of current in the conductors.

These changes may be caused by:
- repetitive motor starting
- loads fluctuating near the long-time protection settings
- repeated circuit-breaker closing on a fault.

Control units with a thermal memory record the temperature rise caused by each overload, even very short ones. This information stored in the thermal memory reduces the tripping time.

Micrologic control units and thermal memory

All Micrologic control units are equipped as standard with a thermal memory.

- For all protection functions, prior to tripping, the temperature-rise and cooling time constants are equal and depend on the tripping delay:
  - if the tripping delay is short, the time constant is low
  - if the tripping delay is long, the time constant is high.

- For long-time protection, following tripping, the cooling curve is simulated by the control unit. Closing of the circuit breaker prior to the end of the time constant (approximately 15 minutes) reduces the tripping time indicated in the tripping curves.

Short-time protection and intermittent faults

For the short-time protection function, intermittent currents that do not provoke tripping are stored in the Micrologic P memory. This information is equivalent to the long-time thermal memory and reduces the tripping delay for the short-time protection.

Following a trip, the short-time tsd tripping delay is reduced to the value of the minimum setting for 20 seconds.

Ground-fault protection and intermittent faults

The ground-fault protection implements the same function as the short-time protection (see above).
The COM communications option can be used to remotely access the Micrologic P measurement, setting, maintenance and protection values.

### Measurements
- **Currents:**
  - instantaneous currents
  - maximum and minimum instantaneous currents
  - average instantaneous currents
  - instantaneous-current unbalance per phase
  - maximum and minimum instantaneous-current unbalance per phase
- **Demand current:**
  - demand current per phase
  - maximum and minimum demand current per phase since last reset
  - prediction of demand current per phase
  - time-stamping of demand-current maximums and minimums
- **Voltages:**
  - phase-to-neutral and phase-to-phase voltages
  - average phase-to-neutral and phase-to-phase voltages
  - phase-to-neutral and phase-to-phase voltage unbalance
  - maximum and minimum phase-to-neutral and phase-to-phase voltage unbalance
- **Active, reactive and apparent power per phase**
- **Demand power:**
  - demand power per phase
  - maximum and minimum demand power per phase since last reset
  - maximum and minimum recommended demand power per phase
  - time-stamping of demand-power maximums and minimums
- **Energy:**
  - total active and reactive energy
  - positively incremented energy
  - negatively incremented energy
- **System frequency**
- **Power factor**
- **Reset date of demand currents, demand power and energy.**

### Setup / Maintenance
- **Setting of the control-unit date and time**
- **Password for the measurement module**
- **Control-unit ID code**
- **Control-unit ID name**
- **Selection of the measurement calculation algorithm**
- **Sign convention for the active power**
- **Total-energy measurement mode**
- **Interval for the demand-current calculation window**
- **Power quality indication**
- **Demand-power calculation mode**
- **Interval for the demand-power calculation window**
- **Battery-charge indication**
- **Trip and alarm histories**
- **Operation counter and contact-wear indicator**
- **Assignment and setup of programmable contacts**
- **Event log and maintenance register.**

### Protection
- **Circuit-breaker rated current**
- **Type of neutral protection**
- **Long-time I^2t protection settings**
- **Long-time Idmtl protection settings**
- **Short-time protection settings**
- **Instantaneous-protection settings**
- **Ground-fault protection settings**
- **Earth-leakage protection settings**
- **Current-unbalance, I^2t alarm and maximum-current protection settings**
- **Voltage-protection settings**
- **Setting for other protection functions.**
## Technical appendix

### Threshold and time-delay settings

#### Long-time \( I^t \) and \( \Delta I \)mtl protection

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I^t ) current setting</td>
<td>0.4 to ( I_n )</td>
<td>maximum</td>
<td>1 A</td>
<td>1.05 to 1.20 ( I_n )</td>
</tr>
<tr>
<td>( I^t ) tripping delay</td>
<td>0.5 to 24 s</td>
<td>maximum</td>
<td>0.5 s</td>
<td>-20%, +0%</td>
</tr>
</tbody>
</table>

#### Short-time protection

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isd pickup</td>
<td>1.5 to 10 ( I_r )</td>
<td>maximum</td>
<td>10 A</td>
<td>±10%</td>
</tr>
<tr>
<td>Isd tripping delay</td>
<td>0 - 0.1 - 0.2 - 0.3 - 0.4 s</td>
<td>maximum</td>
<td>0.1 s</td>
<td></td>
</tr>
</tbody>
</table>

#### Instantaneous protection

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I_l ) pickup</td>
<td>2 to 15 ( I_n ) or OFF in Normal mode</td>
<td>maximum</td>
<td>10 A</td>
<td>±10%</td>
</tr>
<tr>
<td>( I_l ) pickup</td>
<td>2 to 15 ( I_{ERMS} ) mode</td>
<td>maximum</td>
<td>10 A</td>
<td>±10%</td>
</tr>
<tr>
<td>( I_g ) pickup</td>
<td>depends on rating</td>
<td>maximum</td>
<td>1 A</td>
<td>±10%</td>
</tr>
<tr>
<td>( I_g ) tripping delay</td>
<td>0 - 0.1 - 0.2 - 0.3 - 0.4 s</td>
<td>maximum</td>
<td>0.1 s</td>
<td></td>
</tr>
</tbody>
</table>

#### Ground-fault protection on Micrologic 6.0 P

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I_g ) pickup</td>
<td>depends on rating</td>
<td>maximum</td>
<td>1 A</td>
<td>±10%</td>
</tr>
<tr>
<td>( I_g ) tripping delay</td>
<td>0 - 0.1 - 0.2 - 0.3 - 0.4 s</td>
<td>maximum</td>
<td>0.1 s</td>
<td></td>
</tr>
</tbody>
</table>

#### Earth-leakage protection on Micrologic 7.0 P

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I_{ln} ) pickup</td>
<td>maximum</td>
<td>maximum</td>
<td>0.1 A</td>
<td>-20%, +0%</td>
</tr>
<tr>
<td>( \Delta t ) tripping delay</td>
<td>60 -140 - 230 - 350 - 800 ms</td>
<td>maximum</td>
<td>1 setting</td>
<td></td>
</tr>
</tbody>
</table>

#### Neutral protection

<table>
<thead>
<tr>
<th>Type</th>
<th>Factory setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-pole device</td>
<td>Off, N/2, N, 1.6xN</td>
</tr>
<tr>
<td>Four-pole device</td>
<td>Off, N/2, N</td>
</tr>
</tbody>
</table>
## Threshold and time-delay settings

### Current protection

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current unbalance I unbal</td>
<td>5 % to 60 %</td>
<td>60 %</td>
<td>1 %</td>
<td>-10 %, +0 %</td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>5 % of pickup threshold</td>
<td>pickup threshold</td>
<td>1 %</td>
<td>-10 %, +0 %</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>1 s to 40 s</td>
<td>40 s</td>
<td>1 s</td>
<td>-20 %, +0 %</td>
</tr>
<tr>
<td>Pickup time delay</td>
<td>10 s to 360 s</td>
<td>10 s</td>
<td>1 s</td>
<td>-20 %, +0 %</td>
</tr>
</tbody>
</table>

### Ground-fault I alarm

| Pickup threshold          | 20 A to 1200 A         | 120 A           | 1 A  | +/- 15 %              |
| Dropout threshold         | 20 A to pickup threshold| pickup threshold| 1 A  | +/- 15 %              |
| Pickup time delay         | 1 s to 10 s            | 10 s            | 0.1 s| -20 %, +0 %           |
| Dropout time delay        | 1 s to 10 s            | 1 s             | 0.1 s| -20 %, +0 %           |

### Earth-leakage I alarm

| Pickup threshold          | 0.5 A to 30 A          | 30 A            | 0.1 A| -20 %, +0 %           |
| Dropout threshold         | 0.5 A to pickup threshold| pickup threshold| 0.1 A| -20 %, +0 %           |
| Pickup time delay         | 1 s to 10 s            | 10 s            | 0.1 s| -20 %, +0 %           |
| Dropout time delay        | 1 s to 10 s            | 1 s             | 0.1 s| -20 %, +0 %           |

### Maximum current I¹ max, I₂ max, I₃ max, IN max

| Pickup threshold          | 0.2 In to In            | In              | 1 A  | +/- 6.6%              |
| Dropout threshold         | 0.2 In to pickup threshold| pickup threshold| 1 A  | +/- 6.6%              |
| Pickup time delay         | 15 s to 1500 s          | 1500 s          | 1 s  | -20 %, +0 %           |
| Dropout time delay        | 15 s to 3000 s          | 15 s            | 1 s  | -20 %, +0 %           |

### Voltage protection

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum voltage U min</td>
<td>100 V to U max pickup threshold</td>
<td>100 V</td>
<td>5 V</td>
<td>-5 %, +0 %</td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>pickup threshold</td>
<td>pickup threshold</td>
<td>5 V</td>
<td>-5 %, +0 %</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup time delay</td>
<td>1.2 s to 5 s</td>
<td>5 s</td>
<td>0.1 s</td>
<td>-0 %, +20 %</td>
</tr>
<tr>
<td>Dropout time delay</td>
<td>1.2 s to 36 s</td>
<td>1.2 s</td>
<td>0.1 s</td>
<td>-0 %, +20 %</td>
</tr>
</tbody>
</table>

### Maximum voltage U max

| Pickup threshold          | U min pickup threshold to 1200 V | 725 V        | 5 V  | -0 %, +5 %            |
| Dropout threshold         | 100 V to pickup threshold      | pickup threshold| 5 V  | -0 %, +5 %            |
| Pickup time delay         | 1.2 s to 5 s                 | 5 s           | 0.1 s| -0 %, +20 %           |
| Dropout time delay        | 1.2 s to 36 s                | 1.2 s         | 0.1 s| -0 %, +20 %           |

### Voltage unbalance U unbal

| Pickup threshold          | 2 % to 30 %               | 30 %           | 1 %  | -20 %, +0 %           |
| Dropout threshold         | 2 % to pickup threshold    | pickup threshold| 1 %  | -20 %, +0 %           |
| Pickup time delay         | 1 s to 40 s               | 40 s           | 1 s  | -20 %, +0 %           |
| Dropout time delay        | 10 s to 360 s              | 10 s           | 1 s  | -20 %, +0 %           |
## Technical appendix

### Threshold and time-delay settings

#### Other protection

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse power $r P_{\text{max}}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>5 to 500 kW</td>
<td>500 kW</td>
<td>5 kW</td>
<td>± 2.5%</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>5 kW to pickup threshold</td>
<td>pickup threshold</td>
<td>5 kW</td>
<td>± 2.5%</td>
</tr>
<tr>
<td>Pickup time delay</td>
<td>0.2 s to 20 s</td>
<td>20 s</td>
<td>0.1 s</td>
<td>-0 %, +20 %</td>
</tr>
<tr>
<td>Dropout time delay</td>
<td>1 s to 360 s</td>
<td>1 s</td>
<td>0.1 s</td>
<td>-0 %, +20 %</td>
</tr>
<tr>
<td><strong>Maximum frequency $F_{\text{max}}$</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>$F_{\text{min}}$ pickup threshold to 440 Hz</td>
<td>65 Hz</td>
<td>0.5 Hz</td>
<td>± 0.5 Hz</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>45 Hz to pickup threshold</td>
<td>pickup threshold</td>
<td>0.5 Hz</td>
<td>± 0.5 Hz</td>
</tr>
<tr>
<td>Pickup time delay</td>
<td>1.2 s to 5 s</td>
<td>5 s</td>
<td>0.1 s</td>
<td>-0 %, +20 %</td>
</tr>
<tr>
<td>Dropout time delay</td>
<td>1.2 s to 36 s</td>
<td>1.2 s</td>
<td>0.1 s</td>
<td>-0 %, +20 %</td>
</tr>
<tr>
<td><strong>Minimum frequency $F_{\text{min}}$</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>45 Hz to $F_{\text{max}}$ pickup threshold</td>
<td>45 Hz</td>
<td>0.5 Hz</td>
<td>± 0.5 Hz</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>pickup threshold to $F_{\text{max}}$ pickup threshold</td>
<td>pickup threshold</td>
<td>0.5 Hz</td>
<td>± 0.5 Hz</td>
</tr>
<tr>
<td>Pickup time delay</td>
<td>1.2 s to 5 s</td>
<td>5 s</td>
<td>0.1 s</td>
<td>-0 %, +20 %</td>
</tr>
<tr>
<td>Dropout time delay</td>
<td>1.2 s to 36 s</td>
<td>1.2 s</td>
<td>0.1 s</td>
<td>-0 %, +20 %</td>
</tr>
<tr>
<td><strong>Phase rotation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>Ph1, Ph2, Ph3 or Ph1, Ph3, Ph2</td>
<td>none</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>pickup threshold</td>
<td>pickup threshold</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Pickup time delay</td>
<td>0.3 s</td>
<td>0.3 s</td>
<td>none</td>
<td>-0 %, +50 %</td>
</tr>
<tr>
<td>Dropout time delay</td>
<td>0.3 s</td>
<td>0.3 s</td>
<td>none</td>
<td>-0 %, +50 %</td>
</tr>
</tbody>
</table>

(1) + 30 % on dial 0.2 s  
(2) + 30 % up to 1.5 s

#### Load shedding and reconnection

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>50 % to 100 % Ir</td>
<td>100 % Ir</td>
<td>1 %</td>
<td>± 6 %</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>30 % Ir to shedding threshold</td>
<td>shedding threshold</td>
<td>1 %</td>
<td>± 6 %</td>
</tr>
<tr>
<td>Pickup time delay</td>
<td>20 % to 80 % Ir</td>
<td>80 % Ir</td>
<td>1 %</td>
<td>-20 %, +0 %</td>
</tr>
<tr>
<td>Dropout time delay</td>
<td>10 s to 600 s</td>
<td>10 s</td>
<td>1 s</td>
<td>-20 %, +0 %</td>
</tr>
<tr>
<td>Power P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>200 kW to 10 000 kW</td>
<td>10 000 kW</td>
<td>50 kW</td>
<td>± 2.5 %</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>100 kW to shedding threshold</td>
<td>shedding threshold</td>
<td>50 kW</td>
<td>± 2.5 %</td>
</tr>
<tr>
<td>Pickup time delay</td>
<td>10 s to 3600 s</td>
<td>3600 s</td>
<td>10 s</td>
<td>-20 %, +0 %</td>
</tr>
<tr>
<td>Dropout time delay</td>
<td>10 s to 3600 s</td>
<td>10 s</td>
<td>10 s</td>
<td>-20 %, +0 %</td>
</tr>
</tbody>
</table>
### M2C / M6C contacts

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time-delay latching</td>
<td>1 - 360 s</td>
<td>360 s</td>
<td>1 s</td>
</tr>
<tr>
<td>Time delay</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Micrologic setup

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td></td>
<td>English UK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>German</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>English US</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>English UK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Italian</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>French</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spanish</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chinese</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date / time</td>
<td></td>
<td>1 s</td>
<td></td>
</tr>
<tr>
<td>Circuit-breaker selection</td>
<td></td>
<td>&quot;no def&quot;</td>
<td></td>
</tr>
<tr>
<td>Neutral TC</td>
<td></td>
<td>no TC</td>
<td></td>
</tr>
<tr>
<td>VF ratio primary voltage</td>
<td>min. 100 V, max. 1150 V</td>
<td>690 V</td>
<td>1 V</td>
</tr>
<tr>
<td>secondary voltage</td>
<td>min. 100 V, max. 690 V</td>
<td>690 V</td>
<td>1 V</td>
</tr>
<tr>
<td>System frequency</td>
<td>50/60 Hz</td>
<td>50/60 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or 400 Hz</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Measurement setup

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand-current calculation method</td>
<td>thermal or block interval</td>
<td>block interval</td>
<td></td>
</tr>
<tr>
<td>type of window</td>
<td>fixed or sliding</td>
<td>sliding</td>
<td></td>
</tr>
<tr>
<td>calculation interval</td>
<td>5 to 60 minutes</td>
<td>15 minutes</td>
<td>1 minute</td>
</tr>
<tr>
<td>Demand-power calculation method</td>
<td>thermal or block interval or sync. to comms</td>
<td>block interval</td>
<td></td>
</tr>
<tr>
<td>type of window</td>
<td>fixed or sliding</td>
<td>sliding</td>
<td></td>
</tr>
<tr>
<td>calculation interval</td>
<td>5 to 60 minutes</td>
<td>15 minutes</td>
<td>1 minute</td>
</tr>
<tr>
<td>Power sign</td>
<td>P+</td>
<td>P-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(flow from top to bottom)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign convention</td>
<td>IEEE</td>
<td>IEEE alternate</td>
<td>IEC</td>
</tr>
</tbody>
</table>

### Communication setup

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Com parameter</td>
<td>Modbus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>address</td>
<td>1-47</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>baud rate</td>
<td>9600 to 19200 bauds</td>
<td>19200 bauds</td>
<td></td>
</tr>
<tr>
<td>parity</td>
<td>even</td>
<td>even</td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>2Wires+ULP or 4Wires</td>
<td>2Wires+ULP</td>
<td></td>
</tr>
<tr>
<td>Remote settings</td>
<td>yes / no</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>access code</td>
<td>0000 to 9999</td>
<td>0000</td>
<td></td>
</tr>
<tr>
<td>Remote control</td>
<td>manual</td>
<td>automatic</td>
<td></td>
</tr>
</tbody>
</table>

### Protection setup

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current protection</td>
<td>alarm / trip / OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>voltage protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>other protection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Measurement setting ranges and accuracy

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Accuracy at 25 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instantaneous current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_1, I_2, I_3$</td>
<td>$0.05 	imes I_n$ to $20 	imes I_n$</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>$I_N$</td>
<td>$0.05 	imes I_n$ to $20 	imes I_n$</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>$I_{\text{ground}}$</td>
<td>$0.05 	imes I_n$ to $I_n$</td>
<td>±10 %</td>
</tr>
<tr>
<td>$I_{\text{earth leakage}}$</td>
<td>$0$ to $30$ A</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>$I_{\text{max ground}}$</td>
<td>$0.05 	imes I_n$ to $I_n$</td>
<td>±10 %</td>
</tr>
<tr>
<td>$I_{\text{max earth leakage}}$</td>
<td>$0$ to $30$ A</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>Demand current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_1, I_2, I_3$</td>
<td>$0.05 	imes I_n$ to $20 	imes I_n$</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>$I_N$</td>
<td>$0.05 	imes I_n$ to $20 	imes I_n$</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>$I_{\text{max}}$</td>
<td>$0.05 	imes I_n$ to $20 	imes I_n$</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>Phase-to-phase voltages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$U_{12}$</td>
<td>170 to 1150 V</td>
<td>±0.5 %</td>
</tr>
<tr>
<td>$U_{23}$</td>
<td>170 to 1150 V</td>
<td>±0.5 %</td>
</tr>
<tr>
<td>$U_{31}$</td>
<td>170 to 1150 V</td>
<td>±0.5 %</td>
</tr>
<tr>
<td>Phase-to-neutral voltages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{1N}$</td>
<td>100 to 1150 V</td>
<td>±0.5 %</td>
</tr>
<tr>
<td>$V_{2N}$</td>
<td>100 to 1150 V</td>
<td>±0.5 %</td>
</tr>
<tr>
<td>$V_{3N}$</td>
<td>100 to 1150 V</td>
<td>±0.5 %</td>
</tr>
<tr>
<td>Average voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$U_{\text{avg}}$</td>
<td>170 to 1150 V</td>
<td>±0.5 %</td>
</tr>
<tr>
<td>Voltage unbalance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$U_{\text{unbal}}$</td>
<td>0 to 100 %</td>
<td>±0.5 %</td>
</tr>
<tr>
<td>Instantaneous power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P$</td>
<td>0.015 to 184 MW</td>
<td>±2 %</td>
</tr>
<tr>
<td>$Q$</td>
<td>0.015 to 184 Mvar</td>
<td>±2 %</td>
</tr>
<tr>
<td>$S$</td>
<td>0.015 to 184 MVA</td>
<td>±2 %</td>
</tr>
<tr>
<td>Power factor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$PF$</td>
<td>-1 to +1</td>
<td>±2 %</td>
</tr>
<tr>
<td>Demand power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P$</td>
<td>0.015 to 184 MW</td>
<td>±2 %</td>
</tr>
<tr>
<td>$Q$</td>
<td>0.015 to 184 Mvar</td>
<td>±2 %</td>
</tr>
<tr>
<td>$S$</td>
<td>0.015 to 184 MVA</td>
<td>±2 %</td>
</tr>
<tr>
<td>$P_{\text{max}}$</td>
<td>0.015 to 184 MW</td>
<td>±2 %</td>
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<tr>
<td>$Q_{\text{max}}$</td>
<td>0.015 to 184 Mvar</td>
<td>±2 %</td>
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<tr>
<td>$S_{\text{max}}$</td>
<td>0.015 to 184 MVA</td>
<td>±2 %</td>
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<tr>
<td>Total energy</td>
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<tr>
<td>$E_P$</td>
<td>-10^{10} GWh to +10^{10} GWh</td>
<td>±2 %</td>
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<tr>
<td>$E_Q$</td>
<td>-10^{10} Gvarh to +10^{10} Gvarh</td>
<td>±2 %</td>
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<tr>
<td>$E_S$</td>
<td>-10^{10} GVAh to +10^{10} GVAh</td>
<td>±2 %</td>
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<td>Total energy in</td>
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<tr>
<td>$E_P$</td>
<td>-10^{10} GWh to +10^{10} GWh</td>
<td>±2 %</td>
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<tr>
<td>$E_Q$</td>
<td>-10^{10} Gvarh to +10^{10} Gvarh</td>
<td>±2 %</td>
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<td>Total energy out</td>
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<tr>
<td>$E_P$</td>
<td>-10^{10} GWh to +10^{10} GWh</td>
<td>±2 %</td>
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<tr>
<td>$E_Q$</td>
<td>-10^{10} Gvarh to +10^{10} Gvarh</td>
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<td>Frequency</td>
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<tr>
<td>$F$</td>
<td>45 Hz to 440 Hz</td>
<td>±0.1 %</td>
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**Example:**

For a circuit breaker with a 4000 A rating and a current displayed on Micrologic of 49 A, the accuracy is:

$$0.5 \% \times 4000 + 1.5 \% \times 49 = \pm 21 \text{ A}$$

---

**Note:** The accuracy of the current measurements depends on both the value displayed (or transmitted) and the circuit-breaker rating, where:

$$\text{Accuracy} = 0.5 \% \times I_n + 1.5 \% \times \text{reading}$$

---

**Technical appendix**
Power factor sign conventions

Flow of active and reactive power

- P from load
- Q to load
- P to load
- Q to load

IEC

P = -
Q = +
pf = -

P = -
Q = -
pf = -

P = +
Q = +
pf = +

P = +
Q = -
pf = +

IEEE

P = -
Q = +
pf = + (leading)

P = -
Q = -
pf = - (lagging)

P = +
Q = +
pf = + (leading)

P = +
Q = -
pf = - (lagging)

IEEE Alt

P = -
Q = -
pf = + (leading)

P = -
Q = +
pf = - (lagging)

P = +
Q = -
pf = + (leading)

P = +
Q = +
pf = - (lagging)
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