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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.

**Micrologic 5.0 P**

Selective protection + Idmtl, power measurements and additional protection

- 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"
  - P for "power meter"
  - H for "harmonic meter"
  - no indication = no measurements

**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
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 ts
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 tgd
31. earth-leakage pickup IIn
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.
Discovering Micrologic P

Setting procedure

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".

Settings using the dials

- Open the protective cover.
- Make the necessary settings using the dials.
- The screen automatically displays the relevant curve.
- Check the set value on the screen, in absolute value in amperes (A) and in seconds (s).

Settings using the keypad

- The and buttons under the screen may be used for fine adjustments of the settings made using the dials.
- All the settings not available via the dials are made in the same manner, using the keypad.

Caution!

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.

**Caution!**
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.

**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.

**Caution!**
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.

**In 2000 A**

See pages 22 and 24 for selection of the setting ranges.

### Set the thresholds

- **In** = 2000 A
- **Ir** = 0.5 x 2000 = 1000 A
- **Isd** = 2 x 1000 = 2000 A
- **Ii** = 2 x 2000 = 4000 A

### Set the time delays

- **tr** = 1 s
- **tsd** = 0.2 s
Consider a 2000 A circuit breaker.

**Setting thresholds**

- \( I_L = 0.5 \times 2000 = 1000 \text{ A} \)
- \( I_S = 2 \times 2000 = 2000 \text{ A} \)
- \( I_I = 2 \times 2000 = 4000 \text{ A} \)
- \( B \rightarrow I_g = 640 \text{ A} \)

**Setting time delays**

- \( \tau_R = 1 \text{ s} \)
- \( \tau_S = 0.2 \text{ s} \)
- \( \tau_G = 0.2 \text{ s} \)

---

**Thresholds**

- \( I_L \) on curve
- \( I_L \) off curve
- \( I_S \)
- \( I_I \)

- \( I_g \): ground-fault pickup

**Time delays**

- \( \tau_R \) on curve
- \( \tau_S \) off curve

- \( \tau_G \): ground-fault tripping delay

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

Setting Micrologic 7.0 P using the dials

Consider a 2000 A circuit breaker.

Set the thresholds

- **In** = 2000 A
- **Ir** = 0.5 \times 2000 = 1000 A
- **Isd** = 2 \times 1000 = 2000 A
- **Ii** = 2 \times 2000 = 4000 A
- **IΔn** = 1 A

Set the time delays

- **tr** = 1 s
- **tsd** = 0.2 s
- **Δt** = 140 ms

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

<table>
<thead>
<tr>
<th>Thresholds</th>
<th>Time delays</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I_r)</td>
<td>(t_r)</td>
</tr>
<tr>
<td>(I_{sd})</td>
<td>(t_{sd})</td>
</tr>
<tr>
<td>(I_i)</td>
<td>(t_{i})</td>
</tr>
<tr>
<td>(I_{\Delta n})</td>
<td>(\Delta t)</td>
</tr>
</tbody>
</table>

\(I_r\): LT threshold  
\(I_{sd}\): ST pickup  
\(I_i\): Instantaneous pickup  
\(I_{\Delta n}\): earth-leakage pickup  
\(t_r\): 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.

Caution!
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).

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

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

- "Metering" 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.
- **“History, maintenance and setup” menu**

  - Event history
  - Contacts
  - M2C / M6C
  - Micrologic setup
  - Metering setup
  - Com. setup

  - 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**

  - Current protection
  - Voltage protection
  - Other protection
  - Load shedding []
  - Load shedding [P]

  - 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**

Access to the following sections:

- **Instant.**
  - I1, I2, I3, IN currents (depending on the type of system)
- **Max**
  - Storing and reset of the maximum instantaneous currents.

- **Demand**
  - Demand current on the phases I1, I2, I3 and on IN (depending on the type of system)
  - Max
  - Storing and reset of the maximum demand currents.

**Voltage measurements**

Access to the following sections:

- **Instant.**
  - Instantaneous phase-to-phase U12, U23, U31 and phase-to-neutral V1N, V2N, V3N voltages (depending on the type of system)
- **Average 3 Φ**
  - Average voltage U average of the phase-to-phase voltages.
- **Unbal 3 Φ**
  - Unbalance voltage U unbal. of the phase-to-phase voltages.
- **Phase rotation**
  - Phase sequence.
Discovering Micrologic P

Power measurements

access to the following sections:

- \( P \) (kW) 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 \( S \)

Energy measurements

access to the following sections:

- \( E \) (kWh) Total active energy \( E.P \)
- Total reactive energy \( E.Q \)
- Total apparent energy \( E.S \)
- 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 all the energy values to zero

Frequency measurement

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
### Micrologic setup

<table>
<thead>
<tr>
<th>Access to the following sections:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Language</strong></td>
</tr>
<tr>
<td><strong>Date / time</strong></td>
</tr>
<tr>
<td><strong>Breaker selection</strong></td>
</tr>
<tr>
<td><strong>Power sign</strong></td>
</tr>
<tr>
<td><strong>VT ratio</strong></td>
</tr>
<tr>
<td><strong>System frequency</strong></td>
</tr>
</tbody>
</table>

### Metering setup

<table>
<thead>
<tr>
<th>Access to the following sections:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System type</strong></td>
</tr>
<tr>
<td><strong>Current demand</strong></td>
</tr>
<tr>
<td><strong>Power demand</strong></td>
</tr>
<tr>
<td><strong>Sign convention</strong></td>
</tr>
</tbody>
</table>

### COM communications-option setup

<table>
<thead>
<tr>
<th>Access to the following sections:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Com. parameter</strong></td>
</tr>
<tr>
<td><strong>Remote settings</strong></td>
</tr>
<tr>
<td><strong>Remote control</strong></td>
</tr>
</tbody>
</table>
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:

  - Fine settings of the long-time I\textsubscript{t}, short-time and instantaneous protection functions
  - Fine settings of the long-time Idmtl, short-time and instantaneous protection functions
  - Fine settings of the:
    - ground-fault (Micrologic 6.0 P)
    - earth-leakage (Micrologic 7.0 P) protection functions
  - Selection of the type of neutral sensor and type of neutral protection
  - Setting of the I\textsubscript{1} alarm
  - Setting of the current-unbalance protection I\textsubscript{unbal}
  - Setting of the maximum-current protection I\textsubscript{1 max}
  - Setting of the maximum-current protection I\textsubscript{2 max}
  - Setting of the maximum-current protection I\textsubscript{3 max}
  - Setting of the maximum-current protection I\textsubscript{N max}
**Voltage protection**

- **Voltage protection**
- **Other protection**
- **Load shedding**
- **Load shedding**

**Other protection**

- **Other protection**
- **Load shedding**
- **Load shedding**

**Load shedding depending on current**

- **Load shedding**
- **Load shedding**

**Load shedding depending on power**

- **Load shedding**
- **Load shedding**
Overview of functions

Current protection

\( I^2t \) long-time protection

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

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>( I_r = I_n (*) \times \ldots )</td>
<td>( 0.4 ) ( 0.5 ) ( 0.6 ) ( 0.7 ) ( 0.8 ) ( 0.9 ) ( 0.95 ) ( 0.98 ) ( 1 )</td>
</tr>
<tr>
<td>tripping between 1.05 and 1.20 ( I_r )</td>
<td>other ranges or disable by changing rating plug</td>
<td></td>
</tr>
</tbody>
</table>

<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>( t_r \text{ at } 1.5 \times 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>
</tr>
<tr>
<td>( t_r \text{ at } 6 \times I_r )</td>
<td>0 to -20%</td>
<td>0.7 ( (1) )</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>( t_r \text{ at } 7.2 \times I_r )</td>
<td>0 to -20%</td>
<td>0.7 ( (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>
<td>13.8</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>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>tr = In (*) x ...</td>
<td>0.4 0.5 0.6 0.7 0.8 0.9 0.95 0.98 1</td>
</tr>
<tr>
<td>trip between 1.05 and 1.20 Ir</td>
<td>other ranges or disable by changing rating plug</td>
<td></td>
</tr>
<tr>
<td>Time setting</td>
<td>0.5 1 2 4 8 12 16 20 24</td>
<td></td>
</tr>
<tr>
<td>DT</td>
<td>0 to -20%</td>
<td>0.53 1 2 4 8 12 16 20 24</td>
</tr>
<tr>
<td>SIT</td>
<td>0 to -30%</td>
<td>1.9 3.8 7.6 15.2 30.4 45.5 60.7 75.8 91</td>
</tr>
<tr>
<td>VIT</td>
<td>0 to -20%</td>
<td>0.7 0.88 1.77 3.54 7.08 10.6 14.16 17.7 21.2</td>
</tr>
<tr>
<td>EIT</td>
<td>0 to -20%</td>
<td>0.7 0.8 1.43 2.86 5.73 8.59 11.46 14.33 17.19</td>
</tr>
<tr>
<td>HVF</td>
<td>0 to -30%</td>
<td>3.6 7.2 14.4 28.8 57.7 86.5 115.4 144.2 173.1</td>
</tr>
</tbody>
</table>

* In: circuit breaker rating

(1) 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 ($I^{0.5}t$)
  - VIT: very inverse time curve ($It$)
  - EIT: extremely inverse time curve ($I^2t$)
  - HVF: compatible with high-voltage fuses ($I^4t$).

**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 $I^2t$ curve when the tripping delay tr is set to 24 seconds or by its thermal memory. The maximum $I^2t$ curve remains active for the phases and the neutral even when the Idmtl curves are activated.
Overview of functions

Current protection
Short-time and instantaneous protection

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

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.

Short-time pickup $I_{sd}$ and tripping delay $t_{sd}$

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>5.0 P, 6.0 P and 7.0 P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup</td>
<td>$I_{sd} = I_{r} \times \ldots \text{accuracy} \pm 10%$</td>
</tr>
<tr>
<td>Time delay (ms)</td>
<td></td>
</tr>
<tr>
<td>at 10 Ir</td>
<td>$I^2t$ Off 0 0.1 0.2 0.3 0.4</td>
</tr>
<tr>
<td>$I^2t$ On</td>
<td>0.1 0.2 0.3 0.4</td>
</tr>
<tr>
<td>$I^2t$ On or</td>
<td>$I_{sd}$ (max resettable time) 20 80 140 230 350</td>
</tr>
<tr>
<td>$I^2t$ Off</td>
<td>$I_{sd}$ (max break time) 80 140 200 320 500</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 $I_{sd}$ is automatically multiplied by $I_{n}$ instead of $I_{r}$ 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.

Instantaneous pickup $I_{i}$

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>5.0 P, 6.0 P and 7.0 P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup</td>
<td>$I_{i} = I_{n} (*) \times \ldots \text{accuracy} \pm 10%$</td>
</tr>
</tbody>
</table>

* $I_{n}$: circuit-breaker rating
- 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
Neutral protection

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

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 \[ \text{\textbullet\textbullet\textbullet} \] and \[ \text{\textbullet\textbullet\textbullet} \] buttons on the control unit.

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>5.0 P, 6.0 P and 7.0 P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>OFF        N/2    N  1.6xN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of neutral</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No neutral protection</td>
<td>The distribution system does not require protection of the neutral conductor.</td>
</tr>
</tbody>
</table>
| Half neutral protection | The cross-sectional area of the neutral conductor is half that of the phase conductors.  
  - The long-time current setting \( I_r \) for the neutral is equal to half the setting value  
  - The short-time pickup \( I_{sd} \) for the neutral is equal to half the setting value  
  - The instantaneous pickup \( I_i \) for the neutral is equal to the setting value  
  - For ground-fault protection (Micrologic 6.0 P), pickup \( I_g \) for the neutral is equal to the setting value. |
| Full neutral protection | The cross-sectional area of the neutral conductor is equal to that of the phase conductors.  
  - The long-time current setting \( I_r \) for the neutral is equal to the setting value  
  - The short-time pickup \( I_{sd} \) for the neutral is equal to the setting value  
  - The instantaneous pickup \( I_i \) for the neutral is equal to the setting value  
  - For ground-fault protection (Micrologic 6.0 P), pickup \( I_g \) for the neutral is equal to the setting value. |
| Oversized neutral protection | 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  
  - The long-time current setting \( I_r \) for the neutral is 1.6 times that of the setting value  
  - The short-time pickup \( I_{sd} \) for the neutral is 1.6 times that of the setting value, but may not exceed 10 \( I_n \) to limit transients and self-protect the installation  
  - The instantaneous pickup \( I_i \) for the neutral is equal to the setting value  
  - For ground-fault protection (Micrologic 6.0 P), pickup \( I_g \) for the neutral is equal to the setting value. |

Four-pole circuit breakers
The initial protection setting is made using the dial on the neutral pole of the circuit breaker.
The \[ \text{\textbullet\textbullet\textbullet} \] and \[ \text{\textbullet\textbullet\textbullet} \] buttons on the control unit may then be used for a more precise setting. The dial setting constitutes the upper limit for adjustments using the keypad.

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>5.0 P, 6.0 P and 7.0 P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>OFF        N/2    N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of neutral</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No neutral protection</td>
<td>The distribution system does not require protection of the neutral conductor.</td>
</tr>
</tbody>
</table>
| Half neutral protection | The cross-sectional area of the neutral conductor is half that of the phase conductors.  
  - The long-time current setting \( I_r \) for the neutral is equal to half the setting value  
  - The short-time pickup \( I_{sd} \) for the neutral is equal to half the setting value  
  - The instantaneous pickup \( I_i \) for the neutral is equal to the setting value |
| Full neutral protection | The cross-sectional area of the neutral conductor is equal to that of the phase conductors.  
  - The long-time current setting \( I_r \) for the neutral is equal to the setting value  
  - The short-time pickup \( I_{sd} \) for the neutral is equal to the setting value  
  - The instantaneous pickup \( I_i \) for the neutral is equal to the setting value. |
Overview of functions

Current protection
Ground-fault and earth-leakage protection

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 \(I_g\) 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.

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 \(I_{\Delta n}\) 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.
■ \(I_{\Delta n}\) 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 \(I_{\Delta n}\) and tripping delay \(\Delta t\)

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>6.0 P</th>
<th>7.0 P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup</td>
<td>(I_g = In (*) \times ...) accuracy (\pm 10%)</td>
<td>(I_{\Delta n}) accuracy (0% - 20%)</td>
</tr>
<tr>
<td>(In \leq 400 \text{ A})</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>(400 \text{ A} &lt; In \leq 1200 \text{ A})</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>(In &gt; 1200 \text{ A})</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Time delay (ms)</td>
<td>(\Delta t) Off</td>
<td>(\Delta t) Off</td>
</tr>
<tr>
<td>(I_g (\text{max. resett. time}))</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>(tg (\text{max. break time}))</td>
<td>80</td>
<td>140</td>
</tr>
</tbody>
</table>

(*) \(In\): circuit-breaker rating

<table>
<thead>
<tr>
<th>Micrologic control unit</th>
<th>6.0 P</th>
<th>7.0 P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup (A)</td>
<td>(I_{\Delta n})</td>
<td>(I_{\Delta n})</td>
</tr>
<tr>
<td>(\Delta t) (max resett. time)</td>
<td>60</td>
<td>140</td>
</tr>
<tr>
<td>(\Delta t) (max. break time)</td>
<td>140</td>
<td>200</td>
</tr>
</tbody>
</table>
Current protection
I ⇔ Alarm, current unbalance, maximum current

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

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 I max
- Protection values may be set for each of the following currents:
  - I max: maximum current on phase 1
  - I max: maximum current on phase 2
  - I 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 "Meter setup" menu.

Note:
IN 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 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 (U12, U23, U31) is below the threshold set by the user
- This protection function does not detect phase failure.

Maximum-voltage protection U 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 (U12, U23, U31) are simultaneously above the threshold set by the user.

Voltage-unbalance protection U 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 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 max: is the maximum difference between the voltage of each phase and U 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

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.

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 Idmt 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
- Idmt: 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.

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.

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.
Overview of functions

Measurements
Current and voltage

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.

![Diagram]

- From:
  - U avg is the average value of the rms voltages of the three phases
  - U avg = \( \frac{U_{12} + U_{23} + U_{31}}{3} \)
  - E max is the maximum difference between the voltage of each phase and U avg
  - Micrologic P uses the two values above to calculate the voltage unbalance
  - U unbal = \( \frac{E\ max}{U\ avg} \)
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:
  - \( EP = \Sigma EP_{in} + \Sigma EP_{out} \)
  - \( EQ = \Sigma EQ_{in} + \Sigma EQ_{out} \)
- as an option (access exclusively via the COM communications option), energy can be calculated algebraically:
  - \( EP = \Sigma EP_{in} - \Sigma EP_{out} \)
  - \( EQ = \Sigma EQ_{in} - \Sigma EQ_{out} \)
These values are called "signed" energies.

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

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 "Ir ↓ 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↓ thresholds are overrun. The Ir alarm is reset one second after tripping. The Isd/Ii and ↓ alarms are reset by pressing the \button.

**Current protection**

- Off
- Alarm
- Trip + Alarm

**Voltage protection**

- U min
- U max

**Other protection**

- rP max
- F min
- F max

**Phase rotation**

**Shedding/reconnection**

- Off
- On

**History logging**

- Alarm mode: as soon as a given protection threshold is overrun, an alarm is recorded in the "Alarm history".
- Trip mode: as soon as a given protection threshold is overrun, the circuit breaker trips and the fault is recorded in the "Trip history".

The "Protection setup" menu under "History, maintenance and setup" is used to enable or disable the Trip mode that is displayed in the protection-setting screens. On leaving the factory, the protection functions are set to Alarm mode.

The "M2C / M6C contacts" menu under "History, maintenance and setup" is used to link an M2C or M6C contact to an alarm. M2C and M6C contacts may not be used together. They require a 24 V external power supply.

The COM communications module can be used to transmit alarms to a supervisor.
An alarm is issued if the Alarm or the Trip + Alarm mode was set for the given protection function.

Caution!
The M2C and M6C contacts require an auxiliary power supply. See the “Power supply” section in the technical appendix.

Optional M2C and M6C contacts

Current protection:
- Ir
- Isd
- Ii
- I t
- I unbal
- I1
- I2 max
- I3 max
- IN max.

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
Overview of functions

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 \( I_r, I_{sd/l}, I_g, I_\Delta \) 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.

Caution! 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, I∆n 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.

### Fault-trip LEDs
- The LEDs indicate the type of fault that tripped the circuit breaker
- The LEDs are located in the upper part of the front panel (red Ir, Isd, Ii, Ig, In and Ap LEDs)
- When activated, a LED remains ON until it is locally reset.

#### Ir LED
Signals tripping following overrun of the long-time current setting Ir.

#### Isd, Ii LED
Signals tripping following overrun of the short-time pickup Isd or the instantaneous pickup Ii.

#### Ig, In LED
Signals tripping following overrun of the ground-fault pickup Ig or the earth-leakage pickup In.

#### Ap LED
Signals tripping due to:
- Self-protection function:
  - temperature
  - ASIC power supply
  - instantaneous pickup for circuit-breaker self protection
- Protection functions:
  - current unbalance I unbal
  - maximum current I max, I1 max, I2 max, I3 max, IN max;
  - voltage unbalance U unbal
  - maximum voltage U max
  - minimum voltage U min
  - reverse power rP max
  - maximum frequency F max
  - minimum frequency F min.

#### LEDs on buttons to access the menus
The activated LED indicates the menu for which the screen is displayed:
- "Metering"
- "History, maintenance and setup"
- "Protection".
Communication options

Digipact and ModBus are the indispensable elements when integrating Micrologic P in the Digivision and SMS Powerlogic installation-management systems which communicate via the BatiBus and ModBus protocols. External gateways are available for communication over other networks, including ProfiBus, Ethernet, etc.

The communications option makes possible the following remote functions:

- **Device identification:**
  - address
  - device type
  - control-unit type
  - type of long-time rating plug

- **Settings:**
  - reading of the dial settings
  - fine adjustments within the range determined by the dial
  - protection and alarm settings
  - setup of the M2C / M6C contacts.

**Operating and maintenance aids**

- **Protection and alarm values:**
  - standard
  - set.

- **Measurement values:**
  - currents
  - voltages, frequencies, power, etc.

- **Fault values:**
  - fault type
  - interrupted current.

- **Histories and logs:**
  - trip history
  - alarm history
  - event history.

- **Indicators:**
  - contact wear, counters, etc.
  - maintenance register.
Setup

Setting up the optional M2C / M6C contacts

Select the command

Contacts M2C / M6C

Alarm type

Select the command

Contacts M2C / M6C

Setup

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 an alarm

Select a contact.

Confirm.

Select the latching mode

Select a contact.

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

Confirm.
Set the time delay for time-delay latching

Select the time delay.

Adjust.

Confirm.

Reset the contacts to 0

or cancel the reset,

then confirm.

Select the command

M2C / M6C Contacts

Reset
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 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

To return to English
1. Return to the main screen by pressing any of the three buttons
   or press the button followed by 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.

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

Setting up the Micrologic control unit

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

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

NT08N
0 3 E 7
P Logicxxxxxx

Select the standard.

Choose and confirm.

Compact NS

630b
0 3 E 7
P Logicxxxxxx

Select the type.

Choose and confirm.

IEC
Circuit breaker
Masterpact

NT H1
0 3 E 7
P Logicxxxxxx

Select the circuit breaker.
Setting up the Micrologic control unit

Select the command

Micrologic
setup
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
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
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.
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 I₉ is not displayed.
  - The phase-to-phase voltages U₁₂, U₂₃ and U₃₁ are displayed.
  - The phase-to-neutral voltages V₁₉, V₂₉ and V₃₉ 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 I₉ is not displayed.
  - The phase-to-phase voltages U₁₂, U₂₃ and U₃₁ are displayed.
  - The phase-to-neutral voltages V₁₉, V₂₉ and V₃₉ 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 I₉ is displayed.
  - The phase-to-phase voltages U₁₂, U₂₃ and U₃₁ are displayed.
  - The phase-to-neutral voltages V₁₉, V₂₉ and V₃₉ 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

Select the system type

Select: System type

3 Φ 4w 3CT

Select: Choose.

Select: Confirm.

Select the command

Select the command

Select the calculation method for demand current

Select: System type

Select: System type

Select: System type

Select: Select.

Select: Adjust.

Select: Confirm.

Thermal method based in I²t calculation.
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 I²t 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
block interval
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

Power
demand
Calculation method
block interval
Window type
fixed
Interval
15 min

Select.

Choose between fixed or sliding.

Confirm.
Select the command

- **Metering setup**
- **Sign convention**

See page 87 for the description of power factor sign conventions.
Setting up the COM communications option

As soon as the Digipact or ModBus 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.

<table>
<thead>
<tr>
<th>Modbus Com</th>
<th>Modbus Com</th>
<th>Modbus Com</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>Address</td>
<td>Address</td>
</tr>
<tr>
<td>47</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Baud-rate</td>
<td>Baud-rate</td>
<td>Baud-rate</td>
</tr>
<tr>
<td>9600</td>
<td>9600</td>
<td>9600</td>
</tr>
<tr>
<td>Parity</td>
<td>Parity</td>
<td>Parity</td>
</tr>
<tr>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

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.

View and set up the communications option

Adjust all the other parameters for the communications option in the same manner.

<table>
<thead>
<tr>
<th>DIGIPACT (read only)</th>
<th>MODBUS (read and set up)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>1 - 255</td>
</tr>
<tr>
<td>Baud rate</td>
<td>9 600 bauds</td>
</tr>
<tr>
<td>Parity</td>
<td>Even</td>
</tr>
</tbody>
</table>

Select the command

Select the command

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

Authorise remote setup of Micrologic

Access code

Remote settings

Access permit

No

Yes

Remote settings

Access code

0 0 0 0

0 0 0 0

0 0 0 0
It is possible to set circuit-breaker control to local only ("Manual") or to local and remote ("Auto").
Fine adjustment of the long-time I^2t, short-time and Instantaneous settings using the keypad

Select the command.

![Diagram]

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

I (A)

Trip

- 1000 A
- 1.0 s
- 2000 A
- 0.2 s
- 4000 A

long-time current setting Ir
long-time tripping delay tr
short-time pickup Isd
short-time tripping delay tsd
instantaneous pickup li

Quit the setting screen.

Confirm.

Protection settings
Protection settings

Fine adjustment of the long-time Idmtl, short-time and instantaneous settings using the keypad

Select the command

[ ] Current protection

**Idmtl** (A)

- **Trip**
  - 1000 A
  - 1.0 s
  - VIT
  - 2000 A
  - 0.2 s
  - 4000 A

Idmtl protection:
- DT, SIT, VIT, EIT, HVF
- short-time pickup Isd
- short-time tripping delay tsd
- instantaneous pickup Ii

Change I(A) settings with Idmtl(A)?
- No
- Yes

Select yes.

Select a setting.

Change the setting.

Do you want to save new settings?
- No
- Yes
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.

Confirm.

Go to the next setting.

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

Select a setting.

Adjust the value.

Confirm.

Quit the setting screen.

Protection settings

Select the command

Current protection

Select a setting.

Adjust the value.

Confirm.

Go to the next setting.

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

Select the command

Caution!
Selection of the CT type determines the “Ineutral” 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.

Using the keypad on the control unit

Type of circuit breaker | Possibles choices
--- | ---
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

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 (%)**
  - **I 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**

**Example: Maximum voltage setting (U max)**

- **Select Alarm mode**

<table>
<thead>
<tr>
<th>Off</th>
<th>Alarm</th>
<th>Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>U max (V)</td>
<td>690V</td>
<td>690V</td>
</tr>
<tr>
<td>Pick up</td>
<td>5.00s</td>
<td>5.00s</td>
</tr>
<tr>
<td>Drop out</td>
<td>690V</td>
<td>690V</td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>5.00s</td>
<td>5.00s</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>690V</td>
<td>690V</td>
</tr>
<tr>
<td>Pickup time delay</td>
<td>0.50s</td>
<td>0.50s</td>
</tr>
<tr>
<td>Dropout time delay</td>
<td>690V</td>
<td>690V</td>
</tr>
</tbody>
</table>

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

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, T max, U min, U max, U unbal, rP max, F min, F 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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>load shedding disabled</td>
</tr>
<tr>
<td>On</td>
<td>load shedding enabled</td>
</tr>
</tbody>
</table>

Select the first setting.

Select:
- Off: load shedding disabled
- On: load shedding enabled

Adjust.

Set the other parameters.

Quit the setting screen.

Do you want to save new settings?
- no
- yes
Metering

Current measurements

Only the measurements for the phase (1, 2, 3) and neutral currents are displayed on the main screen.

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

Continuous current measurement
The bargraph displays the value in amperes of the most heavily loaded phase.

![Bargraph displays current measurements for phases (1, 2, 3) and neutral.]

Select the command

<table>
<thead>
<tr>
<th></th>
<th>(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instant.</td>
</tr>
</tbody>
</table>

Select the command

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instant.</td>
</tr>
</tbody>
</table>

Measure an instantaneous-current value

- Measure the instantaneous currents

![Instantaneous current values displayed on the bargraph.]

Max

Select. then View.

Check the instantaneous-current maximeter

![Maximeter values displayed on the bargraph.]

Max

Reset ( - / + )

Select. then View.
**Current measurements**

- **Reset the maximeter**
  
<table>
<thead>
<tr>
<th>Demand</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I_1 )</td>
<td>( I_1 )</td>
</tr>
<tr>
<td>( I_2 )</td>
<td>( I_2 )</td>
</tr>
<tr>
<td>( I_3 )</td>
<td>( I_3 )</td>
</tr>
<tr>
<td>( I_N )</td>
<td>( I_N )</td>
</tr>
<tr>
<td>( I_{\text{Max}} )</td>
<td>( I_{\text{Max}} )</td>
</tr>
</tbody>
</table>

- **Measure a demand-current value**

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

Select the command

- **I Metering**

  - **Current measurements**
**Current measurements**

- Check the demand-current maximeter

**Demand**

\[ I_1, I_2, I_3, I_N \]

Max

Select. then View.

- Reset the maximeter

**Imax**

Demand

15min

\[ \bar{I}_1 = 4020 \text{ A} \]
\[ \bar{I}_2 = 4450 \text{ A} \]
\[ \bar{I}_3 = 4300 \text{ A} \]
\[ \bar{I}_N = 600 \text{ A} \]

Reset \((-/+)\)

Reset the maximeter or...

- cancel the reset.

15min

\[ I_1 = 0 \text{ A} \]
\[ I_2 = 0 \text{ A} \]
\[ I_3 = 0 \text{ A} \]
\[ I_N = 0 \text{ A} \]

Reset \((-/+)\)

Imax

Demand

15min

\[ \bar{I}_1 = 4020 \text{ A} \]
\[ \bar{I}_2 = 4450 \text{ A} \]
\[ \bar{I}_3 = 4300 \text{ A} \]
\[ \bar{I}_N = 600 \text{ A} \]

Reset \((-/+)\)
Select the command

**Voltage measurements**

Measure an instantaneous-voltage value (U or V)

![Voltage measurement diagram]

Select. View.

**Measure the average voltage U avg**

![Average voltage measurement diagram]

Select. View.

**Measure the voltage unbalance U unbal**

![Voltage unbalance measurement diagram]

Select. 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

<table>
<thead>
<tr>
<th>U (V)</th>
<th>Phase rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instant.</td>
<td>$\Delta \Phi : 1, 2, 3$</td>
</tr>
<tr>
<td>Average 3Φ</td>
<td></td>
</tr>
<tr>
<td>Unbal 3Φ</td>
<td></td>
</tr>
<tr>
<td>Phase rotation</td>
<td></td>
</tr>
</tbody>
</table>

Select. then View.
To ensure reliable power and power-factor measurements, the "Power sign" and "Sign convention" parameters must be set.

Select the command

**P** (kW)

**Demand**

**Instant.**

Measure an instantaneous-power value

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

**Pinst.**

<table>
<thead>
<tr>
<th>P (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2180</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q (kvar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-650</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S (kVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2280</td>
</tr>
</tbody>
</table>

Select the command

**P** (kW)

**Power factor**

1.00

Select the command

**Demand**

**Max**

**Demand**

<table>
<thead>
<tr>
<th>P (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2350</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q (kvar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-820</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S (kVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2640</td>
</tr>
</tbody>
</table>
Check the demand-power maximeter

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

Select then View.

Reset the maximeter

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

Reset (- / +)

Reset the maximeter or... cancel the reset.
Energy measurements

Select the command

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

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).

 Reset the energy values

Are you sure?

No

Yes

To reset energy press enter

If yes, confirm.
Frequency measurements

Select the command

F (Hz)

View.

60.0
Caution!
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

Trip history

Trip history

Trip
22/11/1999
02:04:04
Umin 160V

Select a fault. View.

Alarm history

Alarm history

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

Select an alarm. View.

Trip history

Trip history

U min
27/01/1999

Ir
27/06/1998

Ir
18/02/1998

Select the command

Event history

Trip history

Select the command

Event history

Alarm history

Select the command

Event history

Alarm history

Trip
27/01/1999

I2 max
27/01/1999

In max
23/03/1998

U max
12/02/1998

Select the command

Event history

Trip history

Select the command

Event history

Alarm history

Select the command

Event history

Alarm history

Trip
27/01/1999

I2 max
27/01/1999

In max
23/03/1998

U max
12/02/1998

Select the command

Event history

Trip history

Select the command

Event history

Alarm history

Select the command

Event history

Alarm history

Operation counter and contact-wear indicator

Select the command

- **Event history**
- **Operation counter**

View and/or reset the operation counter

```
<table>
<thead>
<tr>
<th></th>
<th>Number of operations</th>
<th>Number of operations</th>
<th>Number of operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total 17824</td>
<td>Total 17824</td>
<td>Total 17824</td>
</tr>
<tr>
<td>Operations since last reset 6923</td>
<td>Operations since last reset 0</td>
<td>Operations since last reset 6923</td>
<td></td>
</tr>
<tr>
<td>Reset ( - / + )</td>
<td>Reset ( - / + )</td>
<td>Reset ( - / + )</td>
<td></td>
</tr>
</tbody>
</table>

Reset… … or cancel the reset, then confirm.
```

Check the wear of the contacts

```
<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact wear</td>
</tr>
<tr>
<td>59</td>
</tr>
</tbody>
</table>
```

Select the command

- **Event history**
- **Contact wear**

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.

Checking/replacing the battery

Check the control-unit battery

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.

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

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

Tripping curves
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. U12 = U23 = U31 = 410 V).
Voltage measurements

Diagram 1

Diagram 2

Diagram 3

Diagram 4

Technical appendix
Caution!
If the protection function is not used on circuit breakers equipped for ZSI protection, a jumper must be installed to short terminals Z3, Z4 and Z5. If the jumper is not installed, the short-time and ground-fault tripping delays are set to zero, whatever the position of the adjustment dial.

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 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.

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.

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.
Caution!
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 communications bus</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Identification, settings, operation and maintenance aids via communications bus</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.
Caution!
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>

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

Caution!
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 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).
Data available via the COM communications option

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 Iₜ and I_dmtl 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>Ir current setting</td>
<td>0.4 to ln</td>
<td>maximum</td>
<td>1 A</td>
<td>± 1.05 to 1.20 Ir</td>
</tr>
<tr>
<td>Ir 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 Ir</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>It pickup</td>
<td>2 to 15 ln or off</td>
<td>maximum</td>
<td>10 A</td>
<td>± 10 %</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>Ig pickup</td>
<td>depends on rating</td>
<td>maximum</td>
<td>1 A</td>
<td>± 10 %</td>
</tr>
<tr>
<td>Ig 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>In pickup</td>
<td>maximum</td>
<td>0.1 A</td>
<td></td>
<td>± 20 %, ± 0 %</td>
</tr>
<tr>
<td>In 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>Range</th>
<th>Factory setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three-pole device</td>
<td>Off, N/2, N, 1.6xN</td>
<td>off</td>
</tr>
<tr>
<td>Four-pole device</td>
<td>Off, N/2, N</td>
<td>N/2</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>Pickup time delay</td>
<td>1 s to 40 s</td>
<td>40 s</td>
<td>1 s</td>
<td>-20 %, +0 %</td>
</tr>
<tr>
<td>Dropout 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 %         |
| Pickup time delay           | 1 s to 10 s            | 10 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 %      |
| Pickup time delay           | 1 s to 10 s            | 10 s                  | 0.1 s  | -20 %, +0 %      |

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

| Pickup threshold            | 0.2 In to ln           | ln                    | 1 A    | ± 6.6 %          |
| Pickup time delay           | 1 s to 10 s            | 10 s                  | 0.1 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>Dropout threshold</td>
<td>pickup threshold to U max pickup threshold</td>
<td>pickup threshold</td>
<td>5 V</td>
<td>-5 %, +0 %</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 to pickup threshold to 1200 V | 725 V              | 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 %      |
| 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 rP 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>Maximum frequency F max</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>F min to pickup threshold</td>
<td>440 Hz</td>
<td>65 Hz</td>
<td>± 0.5 Hz</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>pickup threshold</td>
<td>45 Hz</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 s</td>
<td>0.1 s</td>
<td>-0 %, +20 %</td>
</tr>
<tr>
<td>Minimum frequency F min</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>45 Hz to F max pickup threshold</td>
<td>65 Hz</td>
<td>65 Hz</td>
<td>± 0.5 Hz</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>pickup threshold</td>
<td>45 Hz</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 s</td>
<td>0.1 s</td>
<td>-0 %, +20 %</td>
</tr>
<tr>
<td>Phase rotation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup threshold</td>
<td>Ph1, Ph2, Ph3 or Ph1, Ph2, Ph3</td>
<td></td>
<td>Ph1, Ph2, Ph3</td>
<td>none</td>
</tr>
<tr>
<td>Dropout threshold</td>
<td>pickup threshold</td>
<td>Ph1, Ph2, Ph3</td>
<td>pickup threshold</td>
<td>none</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>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>
### Technical appendix

#### Other settings

### 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>
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### Micrologic setup

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<th>Step</th>
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<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>
<td></td>
<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><em>no def</em></td>
<td></td>
</tr>
<tr>
<td>Neutral TC</td>
<td></td>
<td>no TC</td>
<td></td>
</tr>
<tr>
<td>Vf ratio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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>
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### Measurement setup

<table>
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<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>System type</td>
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<td>3 Φ, 4 w, 4 CT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 Φ, 3 w, 3 CT</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 Φ, 4 w, 3 CT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand-current</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P+</td>
<td>P+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(flow from top to bottom)</td>
<td>P+</td>
<td></td>
</tr>
<tr>
<td>Sign convention</td>
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<td>IEEE</td>
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<td></td>
<td>IEEE alternate</td>
<td>IEC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEEE</td>
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### Communication setup

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Factory setting</th>
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</thead>
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<tr>
<td>Com parameter</td>
<td>MODBUS</td>
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</tr>
<tr>
<td>address</td>
<td>1 - 47</td>
<td>47</td>
</tr>
<tr>
<td>baud rate</td>
<td>9600 to 19200 bauds</td>
<td>19200 bauds</td>
</tr>
<tr>
<td>parity</td>
<td>even</td>
<td>even</td>
</tr>
<tr>
<td>Remote settings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>access authorisation</td>
<td>yes / no</td>
<td>yes</td>
</tr>
<tr>
<td>access code</td>
<td>0000 to 9999</td>
<td>0000</td>
</tr>
<tr>
<td>Remote control</td>
<td>manual</td>
<td>automatic</td>
</tr>
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</table>

### Protection setup

<table>
<thead>
<tr>
<th>Type</th>
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<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

The accuracy of the current measurements depends on both the value displayed (or transmitted) and the circuit-breaker rating, where: 
Accuracy = 0.5 % In + 1.5 % reading

Example:
For a circuit breaker with a 4000 A rating and a current displayed on Micrologic of 49 A, the accuracy is: 
0.5 % x 4000 + 1.5 % x 49 = ±21 A

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Accuracy at 25 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instantaneous current</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_1, I_2, I_3 )</td>
<td>0.05 x In to 20 x In</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>( I_N )</td>
<td>0.05 x In to 20 x In</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>( I_{\text{ground}} )</td>
<td>0.05 x In to In</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}} ), ( I_{\text{max}} ), ( I_{\text{max}} )</td>
<td>0.05 x In to 20 x In</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>( I_{\text{max} \text{ground}} )</td>
<td>0.05 x In to In</td>
<td>±10 %</td>
</tr>
<tr>
<td>( I_{\text{max} \text{earth leakage}} )</td>
<td>0 to 30 A</td>
<td>±1.5 %</td>
</tr>
<tr>
<td><strong>Demand current</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_1, I_2, I_3 )</td>
<td>0.05 x In to 20 x In</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>( I_N )</td>
<td>0.05 x In to 20 x In</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>( I_{\text{max}} ), ( I_{\text{max}} ), ( I_{\text{max}} )</td>
<td>0.05 x In to 20 x In</td>
<td>±1.5 %</td>
</tr>
<tr>
<td>( I_{\text{max} \text{ground}} )</td>
<td>0.05 x In to In</td>
<td>±10 %</td>
</tr>
<tr>
<td><strong>Phase-to-phase voltages</strong></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><strong>Phase-to-neutral voltages</strong></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><strong>Average voltage</strong></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><strong>Voltage unbalance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( U_{\text{unbal}} )</td>
<td>0 to 100 %</td>
<td>±0.5 %</td>
</tr>
<tr>
<td><strong>Instantaneous power</strong></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><strong>Power factor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( PF )</td>
<td>-1 to +1</td>
<td>±2 %</td>
</tr>
<tr>
<td><strong>Demand power</strong></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>
</tr>
<tr>
<td>( Q_{\text{max}} )</td>
<td>0.015 to 184 Mvar</td>
<td>±2 %</td>
</tr>
<tr>
<td>( S_{\text{max}} )</td>
<td>0.015 to 184 MVA</td>
<td>±2 %</td>
</tr>
<tr>
<td><strong>Total energy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( E_P )</td>
<td>-10^{10} GWh to +10^{10} GWh</td>
<td>±2 %</td>
</tr>
<tr>
<td>( E_Q )</td>
<td>-10^{10} Gvarh to +10^{10} Gvarh</td>
<td>±2 %</td>
</tr>
<tr>
<td>( E_S )</td>
<td>-10^{10} GVAh to +10^{10} GVAh</td>
<td>±2 %</td>
</tr>
<tr>
<td><strong>Total energy in</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( E_P )</td>
<td>-10^{10} GWh to +10^{10} GWh</td>
<td>±2 %</td>
</tr>
<tr>
<td>( E_Q )</td>
<td>-10^{10} Gvarh to +10^{10} Gvarh</td>
<td>±2 %</td>
</tr>
<tr>
<td><strong>Total energy out</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( E_P )</td>
<td>-10^{10} GWh to +10^{10} GWh</td>
<td>±2 %</td>
</tr>
<tr>
<td>( E_Q )</td>
<td>-10^{10} Gvarh to +10^{10} Gvarh</td>
<td>±2 %</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( F )</td>
<td>45 Hz to 440 Hz</td>
<td>±0.1 %</td>
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Power factor sign conventions

Flow of active and reactive power

<table>
<thead>
<tr>
<th>P from load</th>
<th>Q to load</th>
</tr>
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<tr>
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<td>Q to load</td>
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</tbody>
</table>

**IEC**

<table>
<thead>
<tr>
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<th>Q = +</th>
</tr>
</thead>
<tbody>
<tr>
<td>P = +</td>
<td>Q = -</td>
</tr>
<tr>
<td>pf = -</td>
<td>pf = +</td>
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</tbody>
</table>

**IEEE**

<table>
<thead>
<tr>
<th>P = -</th>
<th>Q = +</th>
</tr>
</thead>
<tbody>
<tr>
<td>P = +</td>
<td>Q = -</td>
</tr>
<tr>
<td>pf = + (leading)</td>
<td>pf = - (lagging)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P = -</th>
<th>Q = +</th>
</tr>
</thead>
<tbody>
<tr>
<td>P = +</td>
<td>Q = -</td>
</tr>
<tr>
<td>pf = - (lagging)</td>
<td>pf = + (leading)</td>
</tr>
</tbody>
</table>

**IEEE Alt**

<table>
<thead>
<tr>
<th>P = -</th>
<th>Q = +</th>
</tr>
</thead>
<tbody>
<tr>
<td>P = +</td>
<td>Q = -</td>
</tr>
<tr>
<td>pf = + (leading)</td>
<td>pf = - (lagging)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P = -</th>
<th>Q = +</th>
</tr>
</thead>
<tbody>
<tr>
<td>P = +</td>
<td>Q = -</td>
</tr>
<tr>
<td>pf = - (lagging)</td>
<td>pf = + (leading)</td>
</tr>
<tr>
<td>A</td>
<td>25, 26, 27, 28, 31</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Activation</td>
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</tr>
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<td>30, 63</td>
</tr>
<tr>
<td>Active, reactive, apparent power</td>
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<td>AD power-supply module</td>
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<td>B</td>
<td>46</td>
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<td>Baud rate</td>
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<tr>
<td>Buttons</td>
<td>5, 6</td>
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<tr>
<td>C</td>
<td>41</td>
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<td>Circuit-breaker selection</td>
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<tr>
<td>COM communication option</td>
<td>36, 46, 81</td>
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<tr>
<td>Contact</td>
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<tr>
<td>Contact wear</td>
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<td>Control unit identification</td>
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<tr>
<td>Control-unit battery</td>
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</tr>
<tr>
<td>Current demand calculation</td>
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<tr>
<td>D</td>
<td>40</td>
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<tr>
<td>Date and time</td>
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<tr>
<td>Demand power</td>
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<td>Digipact</td>
<td>46</td>
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<td>Dropout</td>
<td>25, 26, 27, 28, 31</td>
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<tr>
<td>DT</td>
<td>21, 49</td>
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<tr>
<td>E</td>
<td>24</td>
</tr>
<tr>
<td>Earth-leakage protection</td>
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<tr>
<td>Earth-leakage protection tripping delay Δ</td>
<td>24</td>
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<tr>
<td>EIT</td>
<td>21, 49</td>
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<tr>
<td>F</td>
<td>30, 52</td>
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<td>F min</td>
<td>30, 52</td>
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<td>Fault</td>
<td>66</td>
</tr>
<tr>
<td>Frequency</td>
<td>30, 64</td>
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<tr>
<td>Full neutral protection</td>
<td>23, 51</td>
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<tr>
<td>Graphic display</td>
<td>5</td>
</tr>
<tr>
<td>Ground-fault / Earth-leakage fault protection test</td>
<td>70</td>
</tr>
<tr>
<td>Ground-fault protection</td>
<td>24</td>
</tr>
<tr>
<td>H</td>
<td>23, 51</td>
</tr>
<tr>
<td>Half neutral protection</td>
<td></td>
</tr>
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