**MK1000A Combined Overcurrent & Earth-Fault Relay User’s Guide**

**A BRIEF OVERVIEW**

![MK1000A Combined Overcurrent & Earth-Fault Relay](image)

**1. General Description**

The MK1000A combined overcurrent and earth-fault relay is a microprocessor-based numerical relay. It uses fundamental frequency current measurement for excellent harmonic current rejection. The relay provides three independent phase overcurrent elements and one non-directional earth-fault element. All these elements are connected to the current transformers of the feeder to be protected.

The overcurrent and the earth-fault elements consist of independent low-set units and high-set units. The time current characteristic of the low-set units are selectable between inverse definite minimum time (IDMT) normal inverse curve 3/10, normal inverse curve 1.3/10, long time inverse curve, very inverse curve, extremely inverse curve and definite time. The high-set units are the definite time type, instantaneous tripping is made possible by setting the time to minimum.

The MK1000A incorporates a 4-digit LED indicator which allows direct numerical readout of set values, actual measured value, recorded value and system indication. All current measurements and current settings are based on 5A current transformer (CT).

**2. Light indication**

The indicators display the status of the system as follow:

<table>
<thead>
<tr>
<th>LED Indicator</th>
<th>FUNCTION</th>
<th>DATA</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aux</td>
<td>&gt;</td>
<td>&gt;&gt;</td>
<td>OFF</td>
</tr>
<tr>
<td>L1</td>
<td>OFF</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>L2</td>
<td>OFF</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>L3</td>
<td>OFF</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>IL &gt;</td>
<td>blink</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>IL &gt;&gt;</td>
<td>blink</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>IL t&gt;</td>
<td>blink</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>IL t&gt;&gt;</td>
<td>blink</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>IL t &lt;&gt;</td>
<td>OFF</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>IL t &lt;&gt;</td>
<td>OFF</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>IL &gt;</td>
<td>OFF</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>IL t &gt;</td>
<td>OFF</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>IL t t &gt;</td>
<td>OFF</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>IL t t t &gt;</td>
<td>OFF</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>IL t t t t &gt;</td>
<td>OFF</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>IL t t t t t &gt;</td>
<td>OFF</td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

**Note:** Under normal operating condition, The 4-digit display is off. When the RESET key is pressed, the 4-digit display will light up. The display will switch off automatically after 6 minutes if no further key is pressed.

**3. Push-buttons Operation**

a) Trip Test

Press the “TEST” button to simulate a trip condition.

b) Trip Reset

Press the “RESET” button to reset the relay when tripped.
c) View Setting
When the relay is not under tripped condition, pressing the “RESET” button will scroll through the various functions. The sequence of selection is as follow:

```
START
Ia
I2
I3
I4
I5
I6
I7
I8
I9
I10
I11
I12
I13
I14
I15
I16
I17
I18
I19
I20
```

Figure 1: Scroll sequence

Programable items

Example 1: To set overcurrent low-set setting from 5A(100%) to 6A(120%)

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Expected Output</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Press &quot;Reset&quot; key until overcurrent low-set setting function. i.e. Function 4.</td>
<td>Function LED shows &quot;4&quot;. Data LED shows default setting is 5.00A</td>
<td>4500</td>
</tr>
<tr>
<td>2. Press &quot;Up&quot; &amp; &quot;Down&quot; keys simultaneously.</td>
<td>Function LED blinks. Relay is in programming mode.</td>
<td>4500</td>
</tr>
<tr>
<td>3. Press &quot;Up&quot; key to alter the setting until desired value display i.e. 6.00</td>
<td>Data LED shows set value increasing until it shows &quot;6.00&quot;</td>
<td>4600</td>
</tr>
<tr>
<td>4. Press &quot;Up&quot; &amp; &quot;Down&quot; keys simultaneously to save new value and exit programming mode.</td>
<td>Function LED stop blinking. Data LED displays the new setting i.e. 6.00</td>
<td>4600</td>
</tr>
</tbody>
</table>

4. Output Contacts

The MK1000A has two relay outputs (R1 and R2). The output contacts can be programmed as follow:

- linked to overcurrent trip signal.
- linked to earth-fault trip signal.
- manual reset or auto reset type.

For auto reset type, the contact remains activated until the fault current is removed.

For manual reset type, the contact remains activated even with the removal of fault current. This contact can only be reset by pressing the "RESET" key.

5. Soft Switches

The MK1000A incorporates 5 soft switches for system configuration. When the Function LED shows "c", the relay is in “soft switch setting” mode.

Example 2: To change contact R1(linked to overcurrent & earth-fault) from auto reset to manual reset.

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Expected Output</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Press &quot;Reset&quot; key until soft switch 1 setting function.</td>
<td>Function LED shows &quot;c&quot;. Switch number (SW) shows &quot;13&quot;.</td>
<td>103</td>
</tr>
<tr>
<td>2. Press &quot;Up&quot; &amp; &quot;Down&quot; keys simultaneously.</td>
<td>Function LED blinks. Relay is in programming mode.</td>
<td>103</td>
</tr>
<tr>
<td>3. Press &quot;Up&quot; key to alter the setting until desired value display i.e. 13. (refer table 3 for soft switch configuration)</td>
<td>Switch value (SVL) changed to &quot;13&quot;.</td>
<td>113</td>
</tr>
<tr>
<td>4. Press &quot;Up&quot; &amp; &quot;Down&quot; keys simultaneously to save new value and exit programming mode.</td>
<td>Function LED stop blinking. Switch value(SVL) shows the new setting i.e. &quot;13&quot;.</td>
<td>113</td>
</tr>
</tbody>
</table>

Example 2: To change contact R1(linked to overcurrent & earth-fault) from auto reset to manual reset.
Example 3: To change overcurrent low-set IDMT characteristic from normal inverse 3/10 curve to long time inverse curve.

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Expected Output</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Press “Reset” key until soft switch 4 setting function.</td>
<td>Function LED shows “c”. Switch number (SW) shows “4”. Switch value (SVL) shows “00”</td>
<td>400</td>
</tr>
<tr>
<td>(ii) Press “Up” &amp; “Down” keys simultaneously.</td>
<td>Function LED blinks. Relay is in programming mode.</td>
<td>400</td>
</tr>
<tr>
<td>(iii) Press “Up” key to alter the setting until desired value display.</td>
<td>Switch value (SVL) changed to “02”. (refer table 3 for soft switch configuration)</td>
<td>402</td>
</tr>
<tr>
<td>(iv) Press “Up” &amp; “Down” keys simultaneously to save new value and exit</td>
<td>Function LED stop blinking, Switch value(SVL) shows the new setting, i.e. ’02’</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Soft switches setting
E/F = Earth-fault O/C = Overcurrent

6. Technical Data

<table>
<thead>
<tr>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current In ..........................5 A</td>
</tr>
<tr>
<td>Frequency ..................................50 or 60 Hz</td>
</tr>
<tr>
<td>Burden ..................................&lt; 0.3 VA at In</td>
</tr>
</tbody>
</table>

Auxiliary Supply

Supply voltage
MK1000A-240A(6) ...........198–265 VAC
MK1000A-240AD(6) .........100 – 240 VAC
MK1000A-150D .............24 – 150 VDC

Supply frequency .................50 Hz or 60 Hz
VA rating ..........................3 VA typical

Setting Ranges

(i) Overcurrent elements
Low-set setting I> ..................0.50 - 10.00 A (10%-200%)
Low-set time multiplier kt> .......0.05 - 1.00
Low-set definite time t> ..........0.05 - 99 s
High-set setting I>> ...............0.50 - 99.9 A (10% - 1998%)
High-set definite time t>> .......0.05 - 2.5 s

(ii) Earth-fault elements
Low-set setting Io >..................0.10 - 5.00 A (2% - 100%)
Low-set time multiplier kto> .......0.05 - 1.00
Low-set definite time tO> ..........0.05 - 99 s
High-set setting Io>> ...............0.10 -50.0 A (2% - 1000%)
High-set definite time t>> .......0.05 - 2.5 s

Outputs

Trip Contacts(R1&R2):
Rated voltage ..........................250 VAC
Continuous carry ..................5A (cos Ψ = 1.0)
Make and carry for 0.2 s ..........30A
Expected electrical life ..............5 x 10^6 operations
Expected mechanical life ..........5 x 10^6 operations

Indicators

Auxiliary supply .........................Green LED indicator
Pick up ..................................Red LED indicator
Trip .....................................7-segment LED and red LED indicators

Mechanical

Mounting ...............................Panel mounting
Front panel .......................... Standard DIN 96x96
Approximate weight .................0.75 kg

7. Case Dimension

![Case Dimension Diagram](image-url)
8. Connection Diagram

9. Time-current Characteristic

**Normal Inverse 3/10**

**Very Inverse**

**Normal Inverse 1.3/10**

**Long-time Inverse**

**Extremely Inverse**