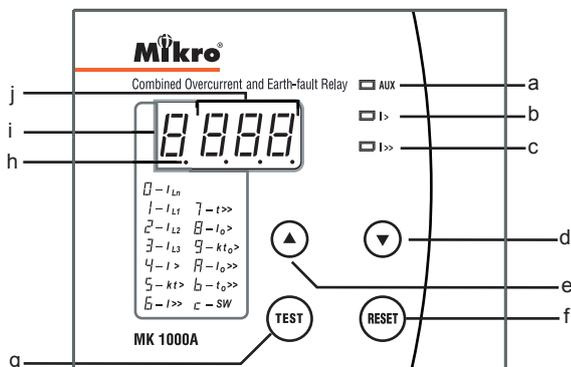


MK1000A Combined Overcurrent & Earth-Fault Relay User's Guide

A BRIEF OVERVIEW



Symbols

- a - Auxiliary power supply indicator
 - b - Low-set start/trip status indicator
 - c - High-set start/trip status indicator
 - d - Down key
 - e - Up key
 - f - Reset key
 - g - Test Key
 - h - DP LED indicator
 - i - FUNCTION LED indicator
 - j - DATA LED indicator
- IL_n - Earth-fault current
 - IL_1 - L1 current
 - IL_2 - L2 current
 - IL_3 - L3 current
 - $I>$ - Overcurrent low-set
 - $kt>$ - Overcurrent time multiplier/ time delay
 - $I>>$ - Overcurrent high-set
 - $t>>$ - Overcurrent high-set delay time
 - $I_{O>}$ - Earth-fault low-set
 - $kt_{O>}$ - Earth-fault time multiplier/ time delay
 - $I_{O>>}$ - Earth-fault high-set
 - $t_{O>>}$ - Earth-fault high-set delay time
 - sw - Soft switches

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:

| LED Indicator | | | | | Status |
|---------------|----|-----|----------|------|---|
| Aux | I> | I>> | FUNCTION | DATA | |
| 0 | 0 | 0 | 0 | 0 | No Auxiliary power supply. |
| 1 | 0 | 0 | X | X | Normal condition, no tripping. |
| 1 | 1 | 0 | X | X | Low-set triggered, time delay countdown started. |
| 1 | 0 | 1 | X | X | High-set triggered, time delay countdown started. |
| 1 | B | 0 | B | B | Low-set tripped, Function LED indicates tripping source, Data LED shows tripped value. |
| 1 | 0 | B | B | B | High-set tripped, Function LED indicates tripping source, Data LED shows tripped value. |
| 1 | X | X | B | 1 | Programming mode. |

Table 1: System Status

1 = ON 0 = OFF X = don't care, not blinking
B = blinking

| Indicator | | |
|-----------|-------|---|
| FUNCTION | DP | DATA |
| 0 | off | Earth-fault current. |
| 1 | off | L1 load current. |
| 2 | off | L2 load current. |
| 3 | off | L3 load current. |
| 0 | blink | Previous earth-fault tripped current. |
| 1 | blink | Previous L1 tripped current. |
| 2 | blink | Previous L2 tripped current. |
| 3 | blink | Previous L3 tripped current. |
| 4 | off | Overcurrent low-set current setting. |
| 5 | off | Overcurrent time multiplier/ delay setting. |
| 6 | off | Overcurrent high-set current setting. |
| 7 | off | Overcurrent high-set delay time setting. |
| 8 | off | Earth-fault low-set current setting. |
| 9 | off | Earth-fault time multiplier/ delay setting. |
| A | off | Earth-fault high-set current setting. |
| b | off | Earth-fault high-set delay time setting. |
| c | off | Soft switch setting. |

Table 2: Function Codes

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:

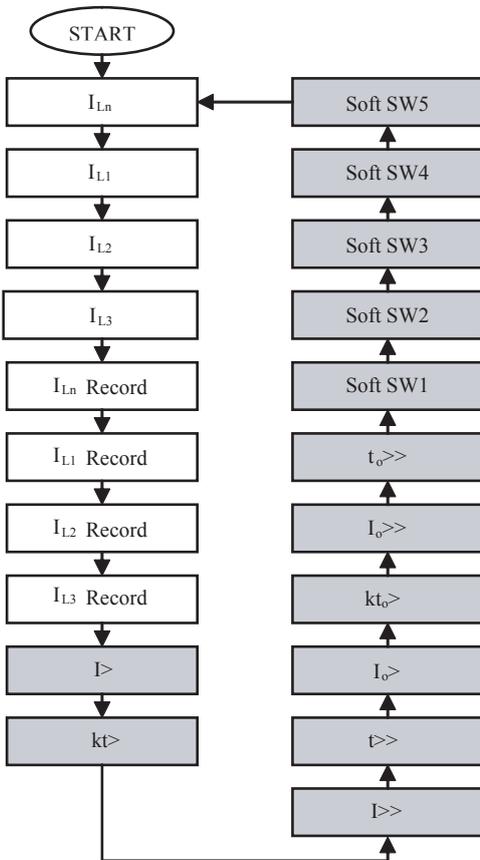


Figure 1: Scroll sequence

 Programmable items

d) Programming Setting

To program the setting for I>, kt>, I>>, t>>, lo>, kto>, lo>>, to>>, soft SW1, soft SW2, soft SW3, soft SW4 and soft SW5.

- Step1: Press "RESET" key until the Function LED shows the required function.
- Step2: Press the "UP" and "DOWN" key simultaneously to enter programming mode. The Function LED blinks to indicates the relay is in programming mode.
- Step3: Use the "UP" or "DOWN" key to select the desired value.
- Step4: To save the selected value, press the "UP" and "DOWN" key simultaneously again. It will exit the programming mode with the Data LED displaying the newly set value.

To exit programming mode without saving the selected setting, press the "RESET" key once.

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

| Procedures | Expected Output | Display |
|---|--|---|
| (i) Press "Reset" key until overcurrent low-set setting function. i.e. Function 4. | Function LED shows "4". Data LED shows default setting is 5.00A | 45.00 |
| (ii) Press "Up" & "Down" keys simultaneously. | Function LED blinks. Relay is in programming mode. |  |
| (iii) Press "Up" key to alter the setting until desired value display. i.e. 6.00 | Data LED shows set value increasing until it shows "6.00" |  |
| (iv) Press "Up" & "Down" keys simultaneously to save new value and exit programming mode. | Function LED stop blinking, DATA LED displays the new setting. i.e. 6.00 | 46.00 |

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.

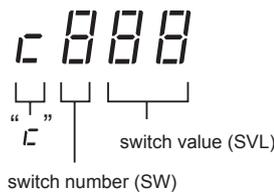


Figure 2: Soft switch indication

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

| Procedures | Expected Output | Display |
|---|--|---|
| (i) Press "Reset" key until soft switch 1 setting function. | Function LED shows "c". Switch number (SW) shows "1" Switch value (SVL) shows "03" | c 103 |
| (ii) Press "Up" & "Down" keys simultaneously. | Function LED blinks. Relay is in programming mode. |  |
| (iii) Press "Up" key to alter the setting until desired value display. | Switch value (SVL) changed to "13". (refer table 3 for soft switch configuration) |  |
| (iv) Press "Up" & "Down" keys simultaneously to save new value and exit programming mode. | Function LED stop blinking, Switch value(SVL) shows the new setting. i.e. "13" | c 113 |

Example 3: To change overcurrent low-set IDMT characteristic from normal inverse 3/10 curve to long time inverse curve.

| Procedures | Expected Output | Display |
|---|--|---------|
| (i) Press "Reset" key until soft switch 4 setting function. | Function LED shows "c". Switch number (SW) shows "4" Switch value (SVL) shows "00" | |
| (ii) Press "Up" & "Down" keys simultaneously. | Function LED blinks. Relay is in programming mode. | |
| (iii) Press "Up" key to alter the setting until desired value display.i | Switch value (SVL) changed to "02", (refer table 3 for soft switch configuration) | |
| (iv) Press "Up" & "Down" keys simultaneously to save new value and exit programming mode. | Function LED stop blinking, Switch value(SVL) shows the new setting. i.e. "02" | |

| SW | SVL | System configuration |
|----|-----|--|
| 1 | 01 | R1 auto reset type, linked to O/C. |
| | 02 | R1 auto reset type, linked to E/F. |
| | 03 | R1 auto reset type, linked to O/C & E/F. |
| | 11 | R1 manual reset type, linked to O/C. |
| | 12 | R1 manual reset type, linked to E/F. |
| | 13 | R1 manual reset type, linked to O/C & E/F. |
| | 2 | 01 |
| 02 | | R2 auto reset type, linked to E/F. |
| 03 | | R2 auto reset type, linked to O/C & E/F. |
| 11 | | R2 manual reset type, linked to O/C. |
| 12 | | R2 manual reset type, linked to E/F. |
| 13 | | R2 manual reset type, linked to O/C & E/F. |
| 3 | | 00 |
| | 01 | E/F high-set disabled; O/C high-set enabled. |
| | 10 | E/F high-set enabled; O/C high-set disabled. |
| | 11 | E/F high-set enabled; O/C high-set enabled. |
| | 4 | 00 |
| 01 | | O/C Normal Inverse curve 1.3/10. |
| 02 | | O/C Long time Inverse curve. |
| 03 | | O/C Very Inverse curve. |
| 04 | | O/C Extremely Inverse curve. |
| 05 | | O/C Definite time. |
| 5 | 00 | E/F Normal Inverse curve 3/10. |
| | 01 | E/F Normal Inverse curve 1.3/10. |
| | 02 | E/F Long time inverse curve. |
| | 03 | E/F Very inverse curve. |
| | 04 | E/F Extremely inverse curve. |
| | 05 | E/F Definite time. |

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

7. Case Dimension

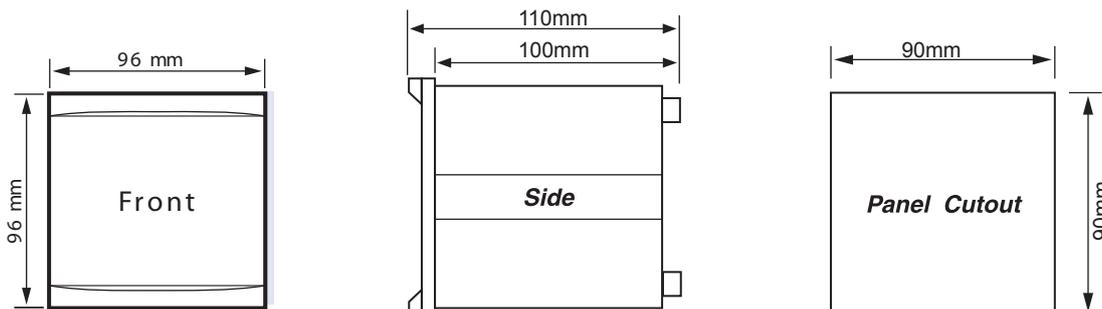


Figure 5: Case dimension

6. Technical Data

Ratings

Rated current /n5 A
Frequency50 or 60 Hz
Burden< 0.3 VA at /n

Auxiliary Supply

Supply voltage
MK1000A-240A(6) 198~265 VAC
MK1000A-240AD(6) 100 ~ 240 VAC
 110 ~ 370 VDC
MK1000A-24D 18 ~ 72 VDC
 Supply frequency50 Hz or 60 Hz
 VA rating3 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 $I_{O>}$ 0.10 - 5.00 A (2% - 100%)
 Low-set time multiplier $kt_{O>}$ 0.05 - 1.00
 Low-set definite time $t_{O>}$ 0.05 - 99 s
 High-set setting $I_{O>>}$ 0.10 -50.0 A (2% - 1000%)
 High-set definite time $t_{O>>}$ 0.05 - 2.5 s

Outputs

Trip Contacts(R1&R2):
 Rated voltage250 VAC
 Continuous carry5A ($\cos \varphi = 1.0$)
 Make and carry for 0.2 s30A
 Expected electrical life 10^5 operations
 Expected mechanical life 5×10^6 operations

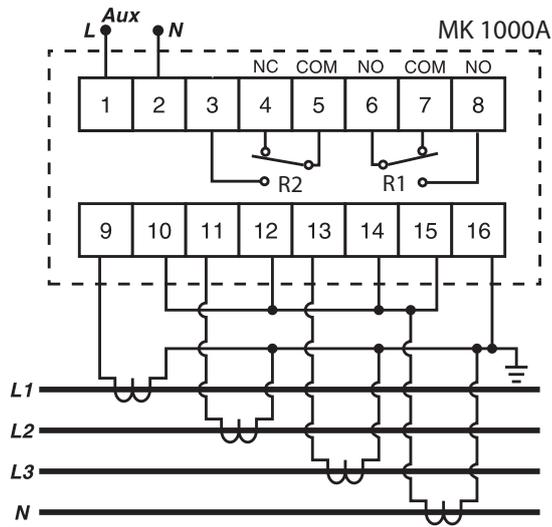
Indicators

Auxiliary supplyGreen LED indicator
 Pick upRed LED indicator
 Trip7-segment LED and red LED indicators

Mechanical

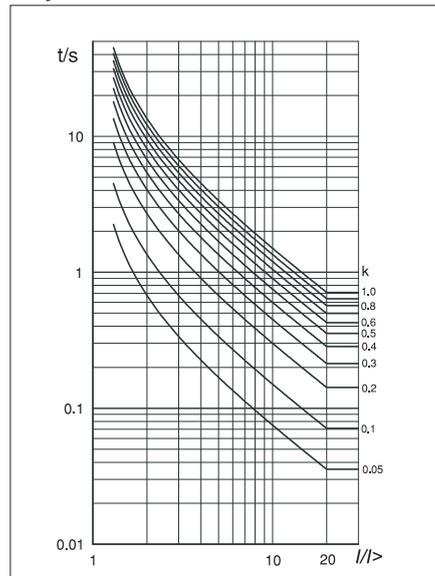
MountingPanel mounting
 Front panel Standard DIN 96x96
 Approximate weight0.75 kg

8. Connection Diagram

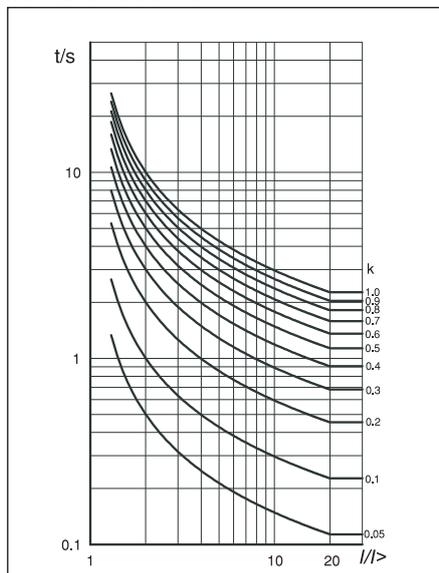


9. Time-current Characteristic

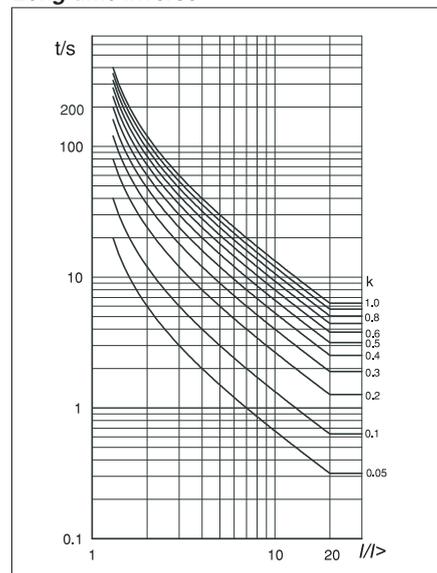
Very Inverse



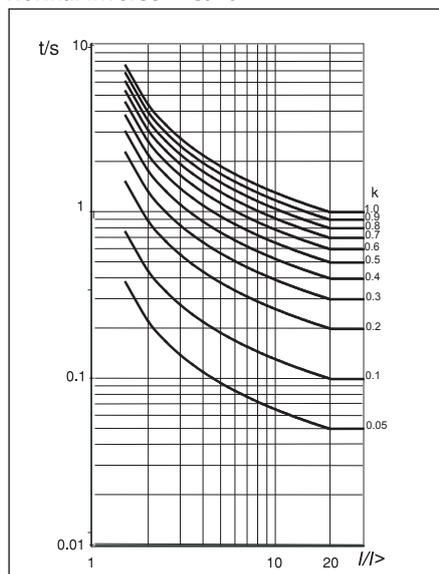
Normal Inverse 3/10



Long-time Inverse



Normal Inverse 1.3/10



Extremely Inverse

