5. Typical Application Diagram

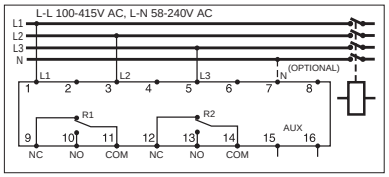

Figure 5

Neutral connection is optional when Phase option is set to L-L. Neutral connection is required when Phase option is set to L-N. (refer to *Setting b - Phase*)

6. Case Dimensions

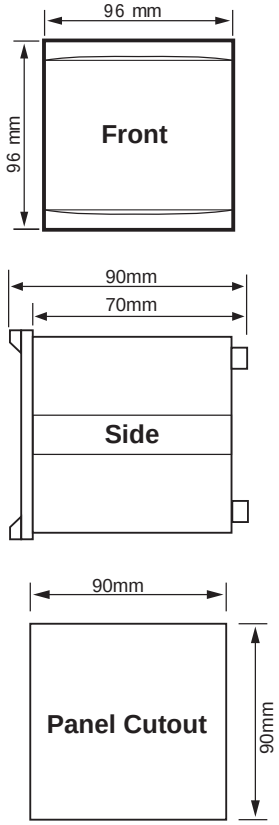

Figure 6: Case Dimensions

7. Technical Data

Setting Ranges

Undervoltage	: Off, 1% – 25%
Time delay for undervoltage	: 0.1s – 30s
Overvoltage	: Off, 1% – 20%
Time delay for overvoltage	: 0.1s – 30s
Unbalance	: Off, 3% – 20%
Time delay for unbalance	: 0.5s – 30s
Phase loss	: off, on, Fixed time <0.5s
Phase sequence	: off, on, Fixed time <0.5s
Start time delay	: 0s – 999s
Auto reset level (undervoltage and overvoltage)	: 1% – 10%

Auxiliary Supply (AUX)

MU350-415V	: 380V(-25%) – 415V(+20%) AC
MU350-220V	: 220V(-25%) – 240V(+20%) AC
MU350-110V	: 100V(-25%) – 120V(+20%) AC
MU350-240AD	: 85V(-25%) – 265V(+20%) AC or : 110V(-25%) – 340V(+20%) DC
Supply frequency	: 45Hz to 65Hz
Maximum power consumption	: 3VA

Measuring Input

Line to line	: 100 – 415(+20%) VAC
Line to Neutral	: 58 – 240(+20%) VAC
Frequency	: 40Hz to 70Hz

Contacts

Contact arrangement	: Change-over
Contact rating	: 5A, 250V AC(cos⊠=1)
Contact material	: Silver alloy
Operating time	: 15 ms max
Expected electrical life	: 100,000 operations at rated current
Expected mechanical life	: 5 x 10^6 operations

Indicators

Auxiliary supply	: Green LED indicator
Pickup indicator	: Red LED indicator
Trip	: 7-segment display and red LED indicators

Mechanical

Mounting	: Din rail mounted
Approximate weight	: 0.31kg

Accuracy

Protection thresholds	: ± 3 %
Time delay	: 0–0.5s, ± 15% with a minimum of 40ms : 0.6s and above, ±3%
Measurements	: ± 3%

MU350 3-Phase Voltage Relay User's Guide V3.2

Brief Overview

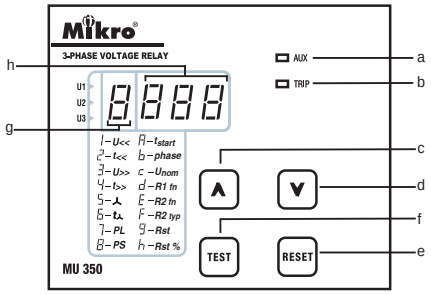

Figure 1: Front panel overview

a – Auxiliary power supply LED

b – Trip/Pickup LED

c – Up key

d – Down key

e – Reset/Mode key

f – Test key

g – Function LED

h – Data LED

Symbols

U<<	- Undervoltage
t<<	- Undervoltage time delay
U>>	- Overvoltage
t>>	- Overvoltage time delay
	- Unbalance/phase
	- Unbalance time delay
PL	- Phase loss
PS	- Phase sequence
t_{start}	- Starting delay
U_{nom}	- Nominal Voltage
fn	- Function
R2 typ	- R2 energized type
Rst	- Reset

1. General Description

MU350 is a voltage relay that combines overvoltage, undervoltage, unbalance, phase loss, phase sequence and delay start functions. It can be connected with or without neutral wire.

MU350 incorporates a 4-digit LED display which allows direct numerical readout of set values, actual measured value and system indication.

MU350 has 2 relay outputs (R1 and R2). R1 is energized under normal operating condition. R2 can be configured as normally energized or de-energized. Both R1 and R2 can be assigned to operate separately by various tripping elements.

2. Voltage and Frequency Display

During power up, when the relay is not under tripping condition, the display will show voltage and frequency reading. The Function LED indicates which line/phase of voltage is being displayed or shows 'F' when frequency is being displayed.

The Data LED showing value. Press “UP” or “DOWN” to scroll through the parameters as shown in Figure 2 and 3 (depends on L-L or L-N setting).

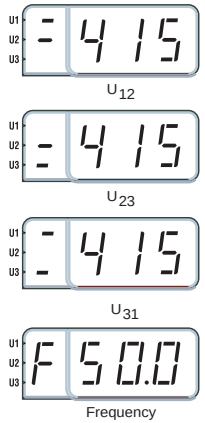

Figure 2: Display for L-L setting. 415V and 50.0Hz shown as example

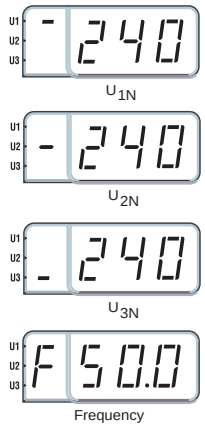

Figure 3: Display for L-N setting. 240V and 50.0Hz shown as example

a) Auto Scroll

Auto scroll let the display to scroll to the next available parameter every 10 seconds. To toggle auto scroll mode, press "UP" and "DOWN" simultaneously.

3. Settings

a) Setting Display

When the relay is not under tripping condition, pressing "RESET/MODE" can scroll through various settings. Function LED shows number or alphabet to indicate which setting is being view as shown in Figure 4. Table 1 gives description of each setting.

Tip: To quickly jump back to voltage display during setting display, press and hold “RESET/MODE” for more than 1.5 seconds.

b) Programming Setting

Step 1: Press “RESET/MODE” until the Function LED shows the required setting.

Step 2: Press “UP” and “DOWN” simultaneously to enter programming mode.
The Function LED blinks to indicate that the relay is in programming mode.

Step 3: Press “UP” or “DOWN” to select the desired value.

Step 4: To save the selected value, press “UP” and “DOWN” 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 “RESET/MODE” once.

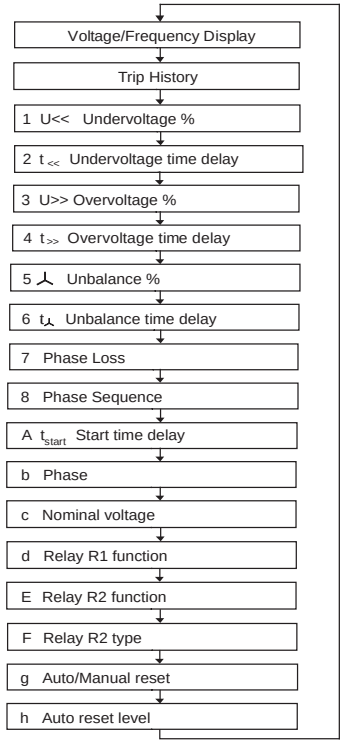

Figure 4: Display mode when pressing Reset/Mode

Setting	Function	Setting Range	Description
1	U<< Undervoltage	off, 1-25 %	Undervoltage % from nominal voltage
2	t<< Undervoltage delay	0.1-30 s	Time delay for undervoltage
3	U>> Overvoltage	off, 1-20 %	Overvoltage % from nominal voltage
4	t>> Overvoltage delay	0.1-30 s	Time delay for overvoltage
5	⅄ Unbalance	off, 3-20%	Unbalance %
6	t⅄ Unbalance delay	0.5-30 s	Unbalance time delay
7	Phase loss	off, on	Phase loss disable/enable
8	Phase sequence	off, on	Phase sequence disable/enable
A	t_{start} Starting delay	0-999 s	On time delay of R1 during power up
b	Phase	L-L, L-N	L-L: Display and uses Line to Line voltage L-N: Display and uses Line to Neutral voltage
c	Nominal Voltage	100 - 415 V or 58 - 240 V	Nominal voltage. Value depends on L-L or L-N setting
d	Relay R1 function	0 - 7	*Refer to Table 2
E	Relay R2 function	0 - 7	*Refer to Table 2
F	Relay R2 type	0 - 1	0: Normally de-energized 1: Normally energized
g	Auto/Manual reset	0=auto, 1=manual	auto: auto reset when trip condition clear manual: press "RESET/MODE" to reset
h	Auto reset level	1-10 %	Auto reset level for U<< and U>>

Table 1: Description of functions

c) Undervoltage

Undervoltage pickup occurs when any line to line or line to neutral voltage is less than [nominal voltage - U<< %], relay trips when delay time is elapsed.

d) Overvoltage

Overvoltage pickup occurs when any line to line or line to neutral voltage is more than [nominal voltage + U>> %], relay trips when delay time is elapsed.

e) Unbalance

Unbalance is calculated as:

(Vmax-Vmin)/Vmin X 100%

Where Vmax is the maximum voltage among the 3 voltages. Vmin is the minimum voltage among the 3 voltages.
Unbalance pickup occurs when unbalance is more than setting %, relay trips when delay time is elapsed.

Phase Sequence trip occurs when the phase sequence in any 2 or all of the lines are reversed.

Phase Loss trip occurs when any voltage is less than 70% of nominal.

f) Starting Delay

Starting delay is the delay time for R1 to energized during power up under normal condition.

g) Relay Function Selection

During tripping, output contact relay R1 or R2 will be de-energized/energized if the related tripping element is activated.
The setting is shown below:

Code	Phase	OV	UV
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

Code : Displays on Data LED
Phase: Unbalance, Phase Loss and Phase Sequence
OV : Overvoltage
UV : Undervoltage

0= De-activated
1= Activated

Table 2: Relay function selection

4. Trip

a) Trip Display

During pickup, Trip/Pickup LED blinks. During tripping condition, Trip/Pickup LED on. Function LED and Data LED blinks with trip source as shown:

Function LED	Data LED	Description
1	trip voltage	Undervoltage trip
3	trip voltage	Overvoltage trip
5	Ub	Unbalance trip
5	PL	Phase loss trip
5	PS	Phase sequence trip
t	EST	Test

Table 3: Trip display

b) Trip Reset

During tripping condition, press "RESET/MODE" to reset the relay, the relay will reset if lower than threshold. Manual reset threshold for U>> / U<< and Unbalance is: Setting % - 1%.

Auto/Manual reset setting applies to U<<, U>>, Unbalance tripping. Phase Sequence and Phase loss is always auto reset.

c) Auto reset level

This sets the U<< and U>> auto reset level. Unbalance auto reset is fix to 2%.

Eg1. if U>> is set to 10% and Auto reset level is set to 2%, U>> trips when voltage >110%, U>> reset when voltage <108%

Eg2. if U<< is set to 20% and Auto reset level is set to 5%, U<< trips when voltage <80%, U<< reset when voltage >85%

If Auto reset % is equal or larger than U<< / U>> %, it will be automatically set to U<< / U>> % - 1%.

d) Trip Test

Trip test is used to simulate a tripping condition. Press "TEST" button and hold for 1.5s, trip LED blinks. After 3.5 seconds, "tESt" will blink, R1 de-energized and R2 will operate dependent on *relay R2 type*. Press "RESET/MODE" to reset.

e) Trip History Display

During Voltage and frequency display, Press “RESET/MODE” button to jump to Trip History Display. Display shows the previous trip status with a 'dot' blinking at Function LED. To clear trip history, press "UP" and "DOWN" simultaneously.

f) Trip Bypass Mode

To disable tripping due to incorrect setting, press “RESET/MODE” and “TEST” simultaneously during power up. The Trip LED slow blink to indicate Trip Bypass Mode. Go into programming mode to correct the setting. Power off and on to reset the relay. The relay will return to normal if no button is pressed for longer than 2 minutes.