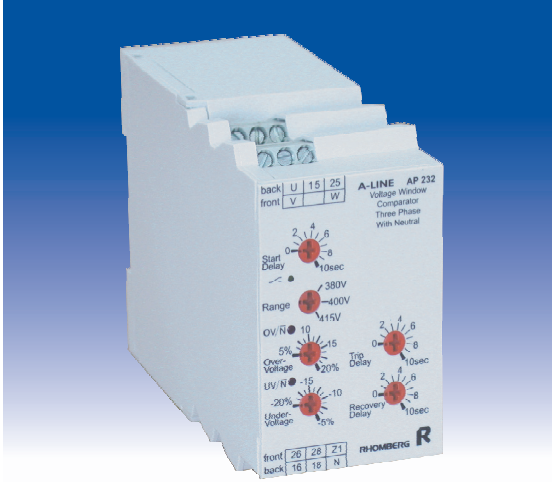


# AP-231/AP-232

## Voltage Window Comparator 3 Phase



### ORDERING CODE

TYPE	MODEL	VOLTAGE	POWER SUPPLY	RELAY CONTACTS
AP	231	230V	A	D

SEE PAGE 32 FOR ORDERING OPTIONS

## Application Examples

- Detection of phase failure.
- Detection of incorrect phase sequence.
- Detection of neutral failure (AP-232).
- Phase monitoring of voltage transformers to ensure the voltage integrity of control circuits in high voltage panels.
- Monitoring of the line supply in rural areas for over-voltage and under-voltage protection.
- Monitoring of supply voltage from standby generator sets to ensure a constant voltage supply.
- Monitoring the voltage output of UPS systems.
- Initiation of generator sets.

## Features

- Fail-to-safe design.
- Combined over-voltage and under-voltage monitoring.
- Monitoring of own supply voltage.
- AP232 available with neutral.
- Selectable power supply voltages.
- High precision and repetitive accuracy.
- Independent adjustment of over-voltage and under-voltage setpoints.
- Separately adjustable response times on trip and recovery (0.1 to 10 seconds.)
- Adjustable start-up delay (0 to 10 seconds) to inhibit latching at start-up.
- Latching on over-voltage or under-voltage (programmable).
- Led indication for type of fault and status of the relay.
- Microprocessor technology incorporated.
- 5A DPDT relay as standard.
- Din rail mounting.

## Description of Operation

The **AP-231** and **AP-232** are precision voltage window comparators for three phase AC applications. Both units also detect and protect against incorrect phase sequence. The **AP-231** monitors phase-to-phase voltages, the **AP-232** monitors phase-to-neutral voltages. They respond to both over-voltage and under-voltage conditions. The voltage to be monitored is tapped off internally from the supply to the comparator.

**Voltage Sensing Inputs:** The relay is energised when the voltage is maintained between the over-voltage and under-voltage setpoints. If the voltage between any two phases rises above the over-voltage setpoint or drops below the under-voltage setpoint, the relay de-energises and the appropriate LED indicates "Over-voltage" or "Under-voltage" respectively. The relay energises again if the voltage recovers to within the set voltage window (i.e. between the two setpoints).

**Incorrect Phase Sequence:** When an incorrect phase sequence is detected the relay de-energises and the Over-voltage and Under-voltage LED's flash alternately.

**Loss of neutral detection:** The AP-232 will detect loss of neutral where the three phase supply is connected to an unbalanced load.

**Hysteresis:** Hysteresis represents the difference between the setpoint and the recovery point of the unit. The hysteresis is fixed at 2% to prevent relay chatter when the voltage fluctuates around either of the setpoints.

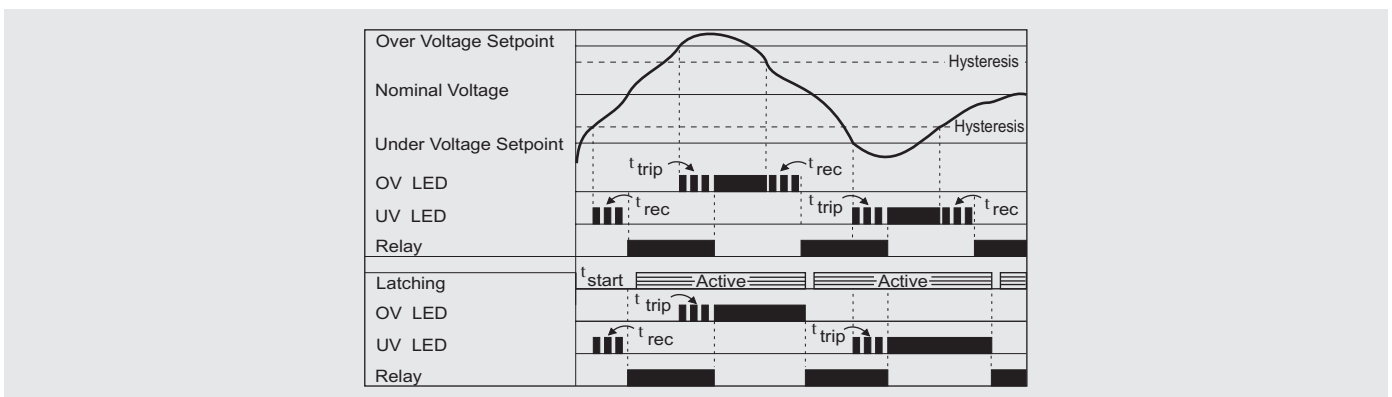
**Latching:** When latching is enabled, the relay will not recover from a tripped condition, but will remain de-energised until reset. The unit can be reset by either interrupting the power supply to the unit or by momentarily disabling the latching circuit (e.g. push-to-open switch).

**Start-up delay:** The latching circuit is inhibited at start-up for a period of time which is adjustable from 0 to 10 seconds.

**Delay on Trip:** Response time on trip for over-voltage and under-voltage is adjustable from 0.1 to 10 seconds. When a trip condition is detected the relay will de-energise after the set trip delay time.

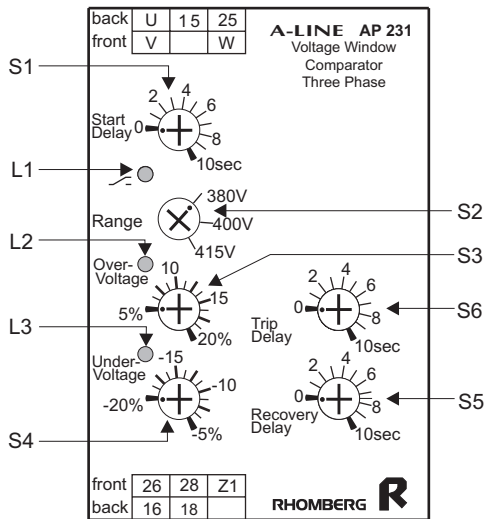
**Delay on Recovery:** Response time on recovery for over-voltage and under-voltage is adjustable from 0.1 to 10 seconds. When a recovery condition is detected the relay will energise after the set recovery delay time.

## Operational Diagram





## Description of Controls



L1: The yellow "Relay ON" marked illuminates when the relay is energised.

L2: The red "Over-voltage" LED illuminates if the supply voltage exceeds the over-voltage setpoint. It flashes during an over-voltage response time for trip and recovery, and flashes alternately with L3 to indicate a phase sequence error.

L3: The red "Under-voltage" LED illuminates if the supply voltage drops below the under-voltage setpoint. It flashes during an under-voltage response time for trip and recovery, and flashes alternately with L2 to indicate a phase sequence error.

S1: **Start-up delay** (for disabling latching) is set on S1. This time is adjustable from 0 to 10 seconds.

S2: **Supply voltage** is set on S2 (e.g. 380, 400 or 415V).

S3: **Over-voltage** setpoint is adjusted on S3 (5 to 20%).

S4: **Under-voltage** setpoint is adjusted on S4 (-5 to -20%).

S5: **Recovery Delay** response time for the over-voltage and under-voltage is set on S5. This time is adjustable from 0.1 to 10 seconds.

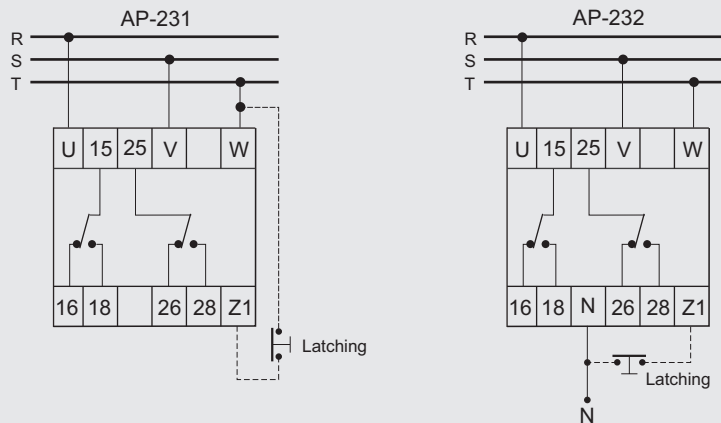
S6: **Trip Delay** response time for the over-voltage and under-voltage is set on S6. This time is adjustable from 0.1 to 10 seconds.

## Wiring and Connection

Power Supply	
R Phase	U
S Phase	V
T Phase	W
N Neutral (AP-232 only)	N

Relay Contacts SPDT	
Normally Open	15 + 18
Normally Closed	15 + 16

Relay Contacts DPDT		
Normally Open	15 + 18	25 + 28
Normally Closed	15 + 16	25 + 26



## Technical Specifications

POWER SUPPLY	
Supply type	AC transformer supply only
Supply voltage	115(110, 115 or 120), 230(220, 230 or 240), 400(380, 400 or 415), 525V
Housing width	45mm
Power consumption	2VA (approx.)
Isolation	Galvanic
Voltage tolerance	±20%

START-UP DELAY	
Start-up delay	0 - 10 seconds (Adjustable)

RESPONSE TIMES	
Response time on trip	0.1 - 10 seconds (Adjustable)
Response time on recovery	0.1 - 10 seconds (Adjustable)

VOLTAGE SENSING	
Setpoints	The unit is calibrated to trip on the RMS value of the supply voltage(assuming no AC waveform distortion).
Repetitive accuracy	1%
Hysteresis	2% (fixed). Hysteresis relates to the supply voltage.

Additional information in Section J, page 131.