



## ACOS 300

### Reliable protection for network and constructions in medium- and high voltage

#### **VIVAVIS: Your competent partner for protection technology**

Already minor incidents, such as branches dropping on overhead lines or underground cables damaged by construction works, may lead to short circuits or earth faults and, consequently, cause hazard to valuable equipment through dangerous currents and voltages. In the worst of cases, even human life may be put at risk. Power failures resulting from such incidents can lead to incalculable risks. Moreover, power in feeds from renewable energy sources and their volatility put additional strains on power grids.

Therefore, efficient solutions for energy distribution networks and decentralized power generation plants are in ever-increasing demand, to help ensure a secure energy supply and protect persons and valuable equipment against damage. The increasing degree of network automation through safe network protection technology reduces the staff's workload, thereby also leading to a further reduction of costs.

## Products and service by one

With the protection equipment family ACOS 300, VIVAVIS offers innovative grid protection technology. ACOS 300 is designed for the reliable protection of medium-voltage grids and transformers on the high-voltage level, and for their monitoring and control.

The ACOS 300 series features the following highlights:

- Complete portfolio of overcurrent, distance and differential protection functions for medium- and high-voltage systems
- Comprehensive control and monitoring functions (local control in ACOS 35x, optional at ACOS 33x)
- Further functions as reserve protection
- 3.5" color touch display (from ACOS 35x, optional at ACOS 33x), B/W display (ACOS 33x), 5.7" color touch display (optional at ACOS 35x)
- Integrated web server to provide support for operation, tests and configuration
- Configuration via function plan according to IEC 61131-3
- Full communication capability according to IEC 61850, IEC 60870-5-101/-103/-104 or Modbus
- Possibility of a deposited display (from ACOS 35x)
- Integration in door, swing frame, rack or on mounting plate
- Comprehensive logging system
- Complete backup and restore
- Complete back documentation of the protection device

Furthermore, a wide range of additional functions is available as protection reserve.

For the implementation of individual protection concepts in medium-voltage grids, the following protection devices with integrated control function (combined protection) are available:

*Protection devices (optional with 3.5" display also as small combined protection device):*

- ACOS 331 for non-directional overcurrent-time/motor protection
- ACOS 333 for directional overcurrent-time protection
- ACOS 334 for distance protection
- ACOS 335 for line differential protection
- ACOS 338 for frequency and voltage protection



*Combined protection devices:*

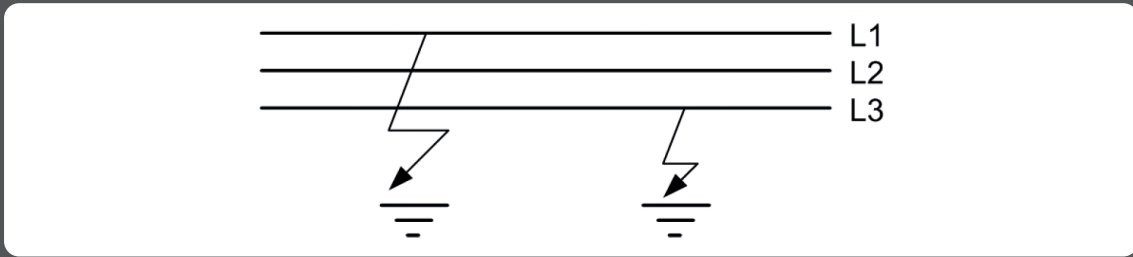
- ACOS 351 for non-directional overcurrent-time protection
- ACOS 353 for directional overcurrent-time protection
- ACOS 354 for distance protection
- ACOS 355 for line differential protection
- ACOS 357 for motor protection
- ACOS 358 for frequency and voltage protection
- ACOS 374 for distance protection
- ACOS 375 for combined line differential and distance protection



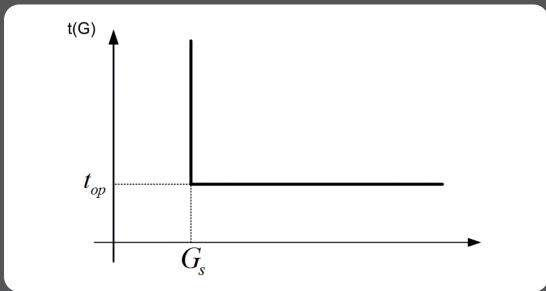
*The following devices (combined protection) have been specially designed for the protection of high-performance two-winding and three-winding transformers:*

- ACOS 392 for transformer differential protection for two-winding transformers
- ACOS 395 for transformer differential protection for three-winding transformers

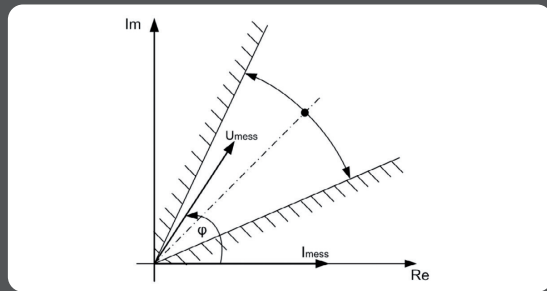
VIVAVIS protection devices are suitable for seamless integration into the digital station automation system VIVAVIS SAS and into third-party systems.



Earth fault protection: Double earth fault



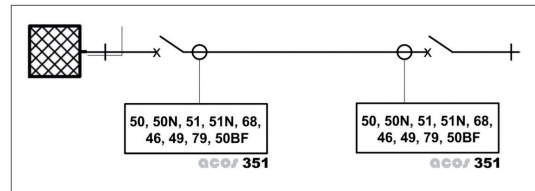
Tripping characteristic – overcurrent protection



Tripping characteristic – earth fault protection

### Overcurrent Protection

All ACOS 300 devices include an overcurrent protection function as a standard. The simplest variant, ACOS 351, is designed for non-directional overcurrent protection. Tripping takes place either independently of the current, or current-dependent, with inverse characteristics according to IEC 60255-151, Edition 1.0, 2009-08 and IEEE.

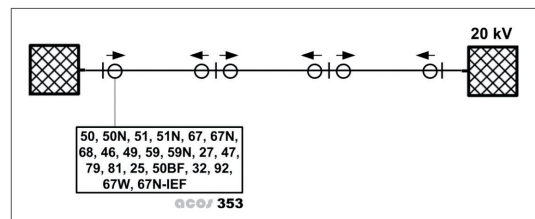


Overcurrent protection: Single-sided feed

In addition to overcurrent protection, ACOS 353 includes several voltage and frequency protection functions. Based on a voltage evaluation, a direction decision is made, thereby ensuring selectivity even in bidirectional power lines. The desired tripping range can be set using different parameters.

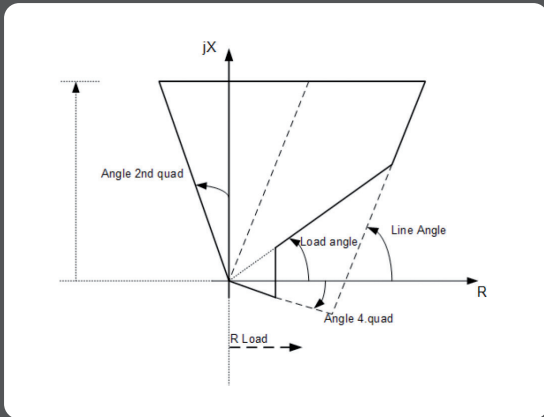
### Earth-Fault Protection

Earth faults or ground faults are frequently occurring faults in grid operation. In grids with effective neutral earthing, dangerous currents may occur at the point of fault, which have to be eliminated as quickly as possible.

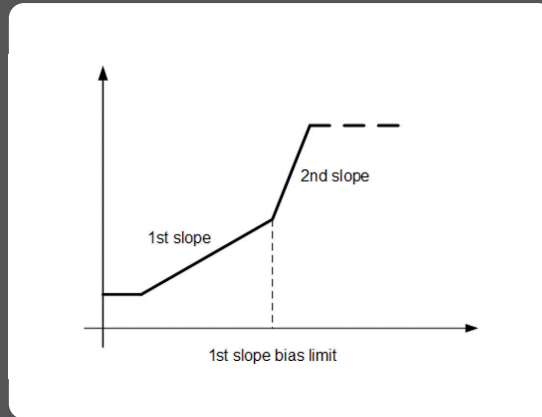


Overcurrent protection: Double-sided feed

The standard configuration scope of each ACOS 300 device also includes earth fault protection functions, which are similar to the overcurrent-time protection function; the total current measured at the neutral point and the calculated zero current, respectively, serve as characteristic quantity.



Tripping characteristic – distance protection



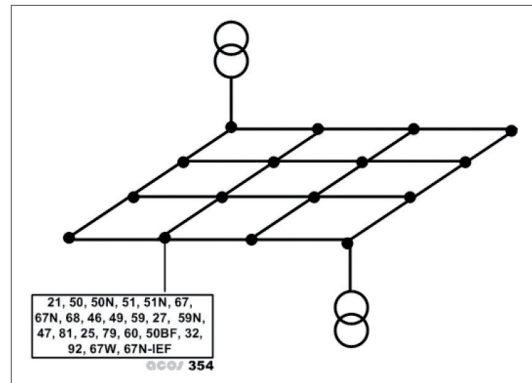
Tripping characteristic – line differential protection

### Distance Protection

An algorithm that is specially adapted to insulated and deleted networks ensures reliable, safe and selective operation. Up to five zones can be parameterized using an individually configurable polygon.

A protection function against inadvertent energizing ensures quick reactions to an existing fault (e.g. after an automatic reclosing) upon connection. If a double earth fault is detected, the distance protection function switches one of the two affected phases off, depending on which phase has been prioritized.

The now single-phase earth fault is finally eliminated through an earth overcurrent protection function.

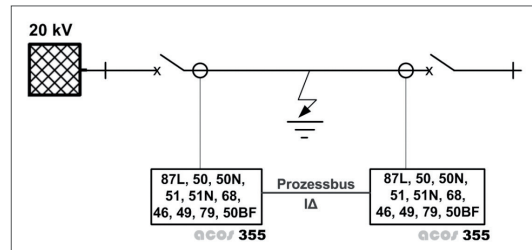


Distance protection: meshed topology

### Line Differential Protection

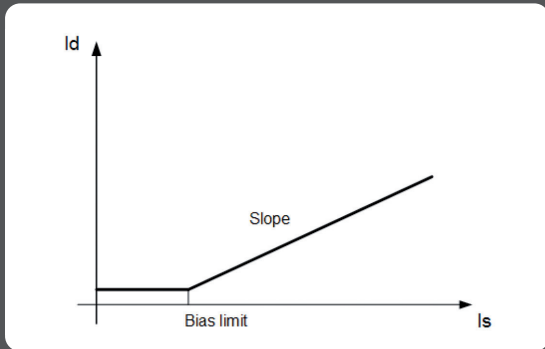
This protection function is based on a comparison of the synchronized scanned currents at both line ends. If the detected differential current is too high, a tripping signal is generated.

Error currents caused by transmission faults of the transformers are taken into account in a tripping characteristic and do not induce tripping.

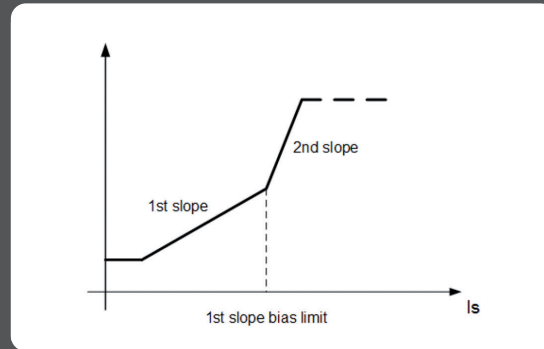


Line differential protection

The benefits of the line differential protection function also include selectivity and quick tripping across the entire protection range.



Tripping characteristic neutral point differential protection

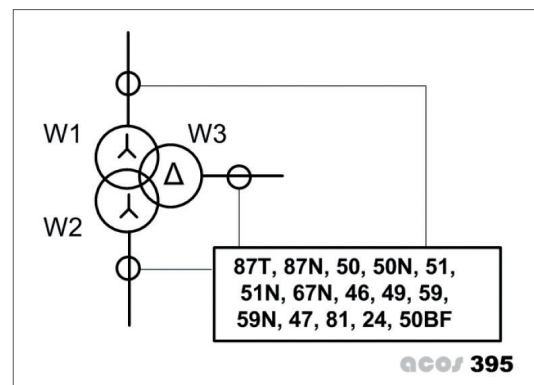


Tripping characteristic transformer differential protection

### Transformer Differential Protection

A comparison of measured currents (primary, secondary and tertiary) takes place after numerical adaptation of switching groups and amplitudes and after an evaluation of the second and fifth harmonic for transformer inrush stabilization. If the detected differential current is too high, a tripping command is generated.

Additionally, the zero-current differential protection function compares the summation current measured at the neutral point with the calculated zero-current component of the three phases. If the parameterized deviation is exceeded, tripping is induced. Other important features of the transformer differential protection function for two- and three-winding transformers are selectivity and instantaneous tripping across the entire protection range.

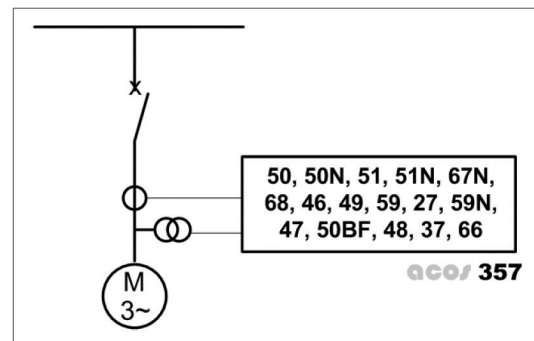


Three-winding transformer

### Motor Protection

Electrical motors are the heart of driving systems in industrial installations. Apart from the standard configuration of the non-directional overcurrent-time protection device ACOS 351, the following additional functions that are specially designed for the protection of motors against thermal and mechanic overload up to the megawatt range are available:

- under voltage protection
- start-up monitoring
- anti-jam protection
- undercurrent monitoring
- prevention of thermal overload caused by an excessive number of start-ups per hour



Motor protection

The protective devices directional overcurrent protection and distance protection are also equipped with **reactive power undervoltage protection (Q-U protection)** and **automatic frequency equalisation (AFE)**.

## Local Control, Parameterization and Diagnostics

ACOS protection devices can be easily operated via the 3.5" color touch display and four capacitive touch keys.

Indications on the color display of the ACOS 300 series are, to a large extent, freely configurable and can be adapted to the user's requirements.

- Plant image with circuit state display
- Indication of
  - Measured values, also as maximum value display
  - Event display
  - Protection and system settings
- Operation and switchgear control
  - Command output with multi-level operational concept
  - Set position display on demand and during a command cycle
  - Further control functions
- Display of different levels

Parameter changes, as well as the display of measured values and logical statuses, can be easily done online. Furthermore, it is possible to carry out system settings with regard to the station bus, Ethernet and serial communication. Any and all event signals can be visualized in an event list.

## Control, Parameterization and Diagnostics via Web Server

A web server that is accessible via ordinary web browsers provides several additional servicing functions. The web server shows an identical image of the local display.

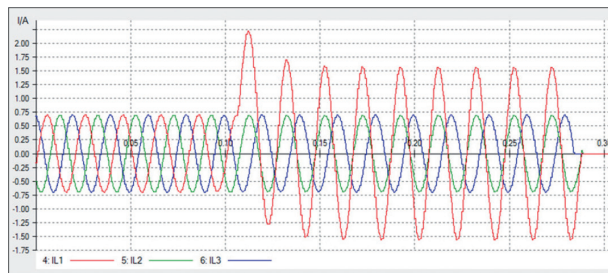
The following functions are available:

- Online parameterization
- Firmware update
- Online visualization of measured values, logical statuses, event lists and system characteristics
- Upload of fault logs in COMTRADE format
- Administration of passwords
- Archiving of documentation (user manuals, configuration descriptions etc.)

Devices are password-protected for safer access.



ACOS 35x with color-touch-display



Fault log – Voltage

5 zone HV Distance			
3Ph Base Sens	20	%	(10 - 30 / 1)
3Res Crosscountry	50	%	(50 - 200 / 1)
Angle 2nd Quad	15	deg	(0 - 30 / 1)
Angle 4th Quad	15	deg	(0 - 30 / 1)
Load Angle	30	deg	(0 - 45 / 1)
Line Angle	75	deg	(45 - 90 / 1)
R Load	10,00	ohm	(0,10 - 200,00 / 0,01)
Line Length	100,0	km	(0,1 - 1000,0 / 0,1)
Line Reactance	10,00	Ohm	(0,10 - 200,00 / 0,01)
Phase Pref	Cyc312		
Operation Zone1	Off		
Zone1 Start Only	<input type="checkbox"/>		
Zone1 R	10,00	ohm	(0,10 - 200,00 / 0,01)
Zone1 X	10,00	ohm	(0,10 - 200,00 / 0,01)
Zone1 (Ro-X1)/X1	1,00	ohm	(0,00 - 5,00 / 0,01)
Zone1 (Ro-R1)/R1	1,00	ohm	(0,00 - 5,00 / 0,01)
Zone1 Time Delay	0	msec	(0 - 60000 / 1)

Parameterization for web server



Online data

## Communication

The following standard protocols can be used for system communication:

- IEC 61850
- IEC 60870-5-101
- IEC 60870-5-103
- IEC 60870-5-104
- Modbus TCP
- SPA-Bus

Communication can be done via one of the following interfaces:

- 1 x 10/100Base-TX Ethernet
- 1 x 10/100Base-FX Ethernet
- 2 x 10/100Base-FX Rail Switch (RSTP)
- 2 x 10/100Base-FX Rail Switch (HSR/PRP, from ACOS 35x)
- 1 x serial RS 485/422
- 1 x serial optical interface

A 10/100Base-TX Ethernet interface serves as service interface. Communication between devices (e.g. differential protection devices) takes place with network-based via FO cables.

Time synchronization is done either serially or via NTP.

## Engineering Tool

The engineering tool included in the ACOS protection equipment is designed for intuitive operation and enables the user to make the following settings:

- off-line parameterization of protection and control functions
- hardware and software configuration
- system settings
- communication settings
- creation of static and dynamic displays, e.g. single-line diagrams, switches, measured values

User-defined interlocks can be implemented quickly and easily via the graphic function chart. The four display levels (Normal, Master, Designer, Administrator) enable a comprehensive overview, thus facilitating work with the engineering tool even more.

### The protection devices of the ACOS 300 series are certified according to the following standards:

Criteria	Norm
Insulation resistance	
- Surge voltage	EN 60255-5, Class III
- AC withstand voltage	EN 60255-5, Class III
Interference immunity (EMC)	
- Electrostatic discharge	EN 61000-4-2, IEC 60255-22-2
- Radiated radio-frequency electromagnetic fields	EN 61000-4-3, IEC 60255-22-3
- Burst	EN 61000-4-4, IEC 60255-22-4
- Surge	EN 61000-4-5, IEC 60255-22-5
- Conducted radio-frequency common mode	EN 61000-4-6, IEC 60255-22-6
- Power frequency magnetic fields	EN 61000-4-8
- Voltage dips and short interruptions	EN 61000-4-11
- Damped oscillatory waves	IEC 60255-22-1, EN 61000-4-18
Emitted interference	
- Radiated disturbances	EN 55011, IEC 60255-25
- Conducted disturbance at main ports	EN 55011, IEC 60255-255
Communication protocol	IEC61850 Edition 2 Certificate Level A IEC61850 Edition 2 Parts 6, 7-1, 7-2, 7-3, 7-4 und 8-1