

# SIPROTEC 5 Devices and Fields of Application

## Distance Protection – SIPROTEC 7SA82

### Description

The SIPROTEC 7SA82 distance protection has been designed particularly for the cost-optimized and compact protection of lines in medium-voltage and high-voltage systems. With its flexibility and the powerful DIGSI 5 engineering tool, SIPROTEC 7SA82 offers future-oriented system solutions with high investment security and low operating costs.

Main function	Distance protection for medium-voltage and high voltage applications
Tripping	3-pole, minimum tripping time: 19 ms
Inputs and outputs	4 current transformers, 4 voltage transformers (optional), 11 or 23 binary inputs, 9 or 16 binary outputs
Hardware flexibility	Different hardware quantity structures for binary inputs and outputs are available in the 1/3 base module. Adding 1/6 expansion modules is not possible; available with large or small display.
Housing width	1/3 x 19"

### Benefits

- Compact and low-cost distance protection
- Safety due to powerful protection functions
- Data security and transparency over the entire lifecycle of the plant save time and money
- Purposeful and easy handling of devices and software thanks to a user-friendly design
- Increased reliability and quality of the engineering process
- Consistent implementation of high safety and security mechanisms
- Powerful communication components ensure safe and effective solutions
- Full compatibility between IEC 61850 Editions 1 and 2
- High investment security and low operating costs due to future-oriented system solution

### Functions

DIGSI 5 permits all functions to be configured and combined as required.

- Minimum tripping time: 19 ms
- 6 independent measuring loops (6-system distance protection)
- Several distance-protection functions can be selected: Classic, reactance method (RMD), impedance protection for transformers
- Directional backup protection and various additional functions
- Detection of static, intermittent and transient ground faults (fleeting contact function) in arc-suppression-coil-ground and isolated power systems
- Adaptive power-swing blocking
- Detection of current-transformer saturation for fast tripping at high accuracy
- Arc protection



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Figure 2.6/1 SIPROTEC 7SA82

- Power protection, configurable as active or reactive power protection
- Reactive power-undervoltage protection (QU protection)
- Recognition of current and voltage signals up to the 50th harmonic with a high accuracy for selected protection functions (such as thermal overload protection) and operational measured values
- Control, synchrocheck and switchgear interlocking protection
- Graphical logic editor to create powerful automation functions in the device
- Single line representation in small or large display
- Integrated electrical Ethernet RJ45 for DIGSI and IEC 61850 (reporting and GOOSE)
- Two optional pluggable communication modules, usable for different and redundant protocols (IEC 61850, IEC 60870-5-103, IEC 60870-5-104, Modbus TCP, DNP3 (serial and TCP))
- Serial protection data communication via optical fibers, two-wire connections and communication networks (IEEE C37.94, and others), including automatic switchover between ring and chain topology.
- Redundancy protocols PRP and HSR
- Cyber security in accordance with NERC CIP and BDWE White-paper requirements
- Phasor measurement unit (PMU) for synchrophasor measured values and IEEE C37.118 protocol
- Time synchronization with IEEE 1588
- Powerful fault recording (buffer for a max. record time of 80 s at 8 kHz or 320 s at 2 kHz)
- Auxiliary functions for easy tests and commissioning.

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### Applications

- Detection and selective 3-pole tripping of short circuits in electrical equipment of star networks, lines with infeed at one or two ends, parallel lines and open or closed ring systems of all voltage levels
- Detection of ground faults in isolated or arc-suppression-coil-ground power systems in star, ring, or meshed arrangement
- Backup protection for differential protection devices of all kind for lines, transformers, generators, motors, and busbars
- Phasor measurement unit (PMU).

### Application templates

Application templates are available in DIGSI for standard applications. They comprise all basic configurations and default settings.

The following application templates are available:

- Basic
- Distance protections for compensated/isolated systems with AR
- Distance protection with reactance method for overhead line for grounded systems, with AR.

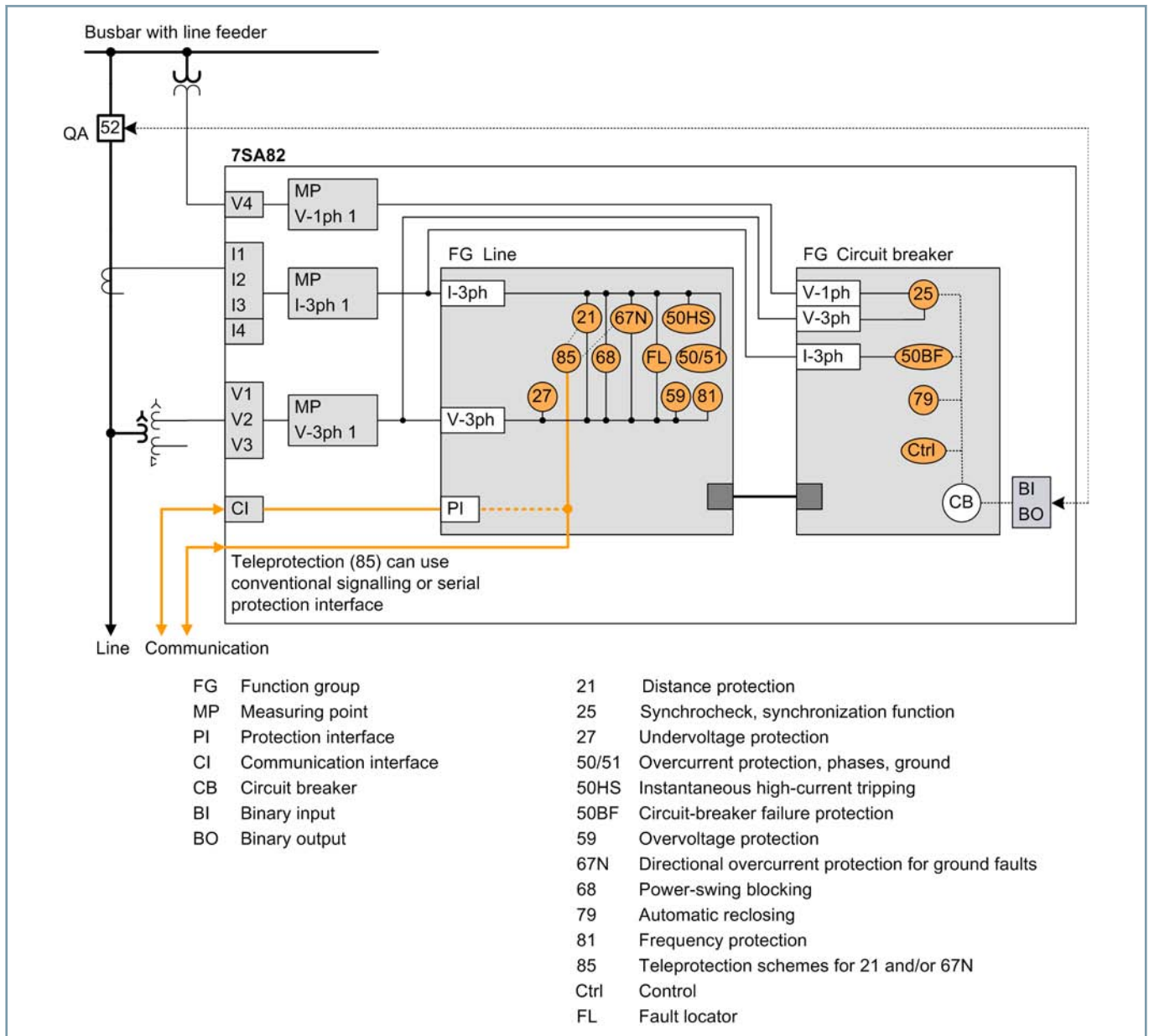


Figure 2.6/2 Application example: Distance protection for overhead line

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## Functions and application templates

ANSI	Functions	Abbr.	Available	Template		
				1	2	3
	Protection functions for 3-pole tripping	3-pole	■	■	■	■
21/21N	Distance protection	$Z<, V< /I> / \angle (V,I)$	■	■	■	■
21T	Impedance protection for transformers	$Z<$	■			
25	Synchrocheck, synchronizing function	Sync	■			■
27	Undervoltage protection: "3-phase" or "pos.seq. V1" or "universal Vx"	$V<$	■			
	Undervoltage-controlled reactive power protection	$Q> / V<$	■			
32, 37	Power protection active/reactive power	$P<>, Q<>$	■			
37	Undercurrent	$I<$	■			
38	Temperature Supervision	$\theta>$	■			
46	Negative sequence overcurrent protection with direction	$I2>, \angle(V2,I2)$	■			
47	Overvoltage protection, negative-sequence system	$V2>$	■			
49	Thermal overload protection	$\theta, I^2t$	■		■	■
50/51 TD	Overcurrent protection, phases	$I>$	■	■	■	■
50N/ 51N TD	Overcurrent protection, ground	$IN>$	■	■	■	■
50HS	High speed instantaneous overcurrent protection	$I>>>$	■	■	■	■
	Instantaneous tripping at switch onto fault	SOTF	■			
50N/ 51N TD	Overcurrent protection, 1-phase	$IN>$	■			
50Ns/ 51Ns	Sensitive ground-current protection for systems with resonant or isolated neutral	$INs>$	■			
	Intermittent ground fault protection	$lie>$	■			
50BF	Circuit-breaker failure protection, 3-pole	CBFP	■		■	■
50RS	Circuit-breaker restrike protection	CBRS	■			
51V	Voltage dependent overcurrent protection	$t=f(I,V)$	■			
59, 59N	Overvoltage protection: "3-phase" or "zero seq. V0" or "pos.seq. V1" or "universal Vx"	$V>$	■			
67	Directional overcurrent protection, phases	$I>, \angle(V,I)$	■			
67N	Directional overcurrent protection for ground faults in grounded systems	$IN>, \angle(V,I)$	■			■
67Ns	Dir. sensitive ground-fault detection for systems with resonant or isolated neutral incl. a) $3I0>$ , b) $V0>$ , c) $\text{Cos}/\text{SinPhi}$ , d) Transient fct., e) $\text{Phi}(V,I)$ , f) admittance		■		■	
	Directional intermittent ground fault protection	$lie\ dir>$	■			
68	Power-swing blocking	$\Delta Z/\Delta t$	■			■
74TC	Trip circuit supervision	TCS	■			
78	Out-of-step protection	$\Delta Z/\Delta t$	■			
79	Automatic reclosing, 3-pole	AR	■		■	■
81	Frequency protection: "f>" or "f<" or "df/dt"	$f>, <; df/dt>, <$	■			
85/21	Teleprotection for distance protection		■	■	■	■
85/27	Weak or no infeed: Echo and Tripping	WI	■	■	■	■
85/67N	Teleprotection for directional ground fault protection		■	■	■	■
86	Lockout		■			
87N T	Restricted ground-fault protection	$\Delta IN$	■			
90V	Automatic voltage control for 2 winding transformer		■			
90V	Automatic voltage control for 3 winding transformer		■			

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ANSI	Functions	Abbr.	Available	Template		
				1	2	3
90V	Automatic voltage control for grid coupling transformer		■			
FL	Fault locator, single-ended measurement	FL-one	■	■	■	■
PMU	Synchrophasor measurement (1 PMU can be used for max. 8 voltages and 8 currents)	PMU	■			
AFD	Arc-protection (only with plug-in module ARC-CD-3FO)		■			
	Measured values, standard		■	■	■	■
	Measured values, extended: Min, Max, Avg		■			
	Switching statistic counters		■	■	■	■
	Circuit breaker wear monitoring	$\Sigma I_x, I^2t, 2P$	■			
	CFC (Standard, Control)		■	■	■	■
	CFC arithmetic		■			
	Switching sequences function		■			
	Inrush current detection		■			
	External trip initiation		■	■	■	■
	Control		■	■	■	■
	Fault recording of analog and binary signals		■	■	■	■
	Monitoring and supervision		■	■	■	■
	Protection interface, serial		■	■	■	■
	Circuit Breaker		■	■	■	■
	Disconnecter		■			
	Region France: Overload protection for lines and cables 'PSL-PSC'		■			
	Region France: Overcurrent protection 'MAXI-L'		■			
	Region France: Net decoupling protection 'PDA'		■			
	Region France: Overload protection for transformers		■			
Function-points class:				0	100	200
The configuration and function points for your application can be ascertained in the SIPROTEC 5 order configurator under: <a href="http://www.siemens.com/siprotec">www.siemens.com/siprotec</a>						

**Table 2.6/1** SIPROTEC 7SA82 - Functions and application templates

- 1 DIS Basic
- 2 DIS, comp./isol. neutral point, with AR
- 3 DIS RMD overhead line, solid grounded neutral point