

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 high-performance DIGSI 5 engineering tool, the SIPROTEC 7SA82 device offers future-oriented solutions for protection, control, automation, monitoring, and Power Quality – Basic.

Main function	Distance protection for medium-voltage and high-voltage applications Interoperability of SIPROTEC 4 and SIPROTEC 5 line protection devices
Tripping	3-pole, minimum tripping time: 19 ms
Inputs and outputs	4 current transformers, 4 voltage transformers, 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 inches

Benefits

- Compact and low-cost distance protection
- Safety due to high-performance protection functions
- Purposeful and easy handling of devices and software thanks to a user-friendly design
- Cybersecurity in accordance with NERC CIP and BDEW White-paper requirements
- Highest availability even under extreme environmental conditions by standard coating of the modules
- Full compatibility between IEC 61850 Editions 1, 2.0, and 2.1
- High investment security and low operating costs due to future-oriented system solutions

Functions

DIGSI 5 permits all functions to be configured and combined as required and as per the functional scope that has been ordered.

- 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 ground faults of any type in compensated or isolated electrical power systems using the following functions: $3I_0>$, $V_0>$, transient ground fault, $\cos \varphi$, $\sin \varphi$, dir. detection of intermittent ground faults, harmonic detection, and admittance measurement
- Ground-fault detection using the pulse-detection method
- Adaptive power-swing blocking



[SIP5_GD_W3, 2, --]

Figure 2.6/1 SIPROTEC 7SA82

- Detection of current-transformer saturation for fast tripping with high accuracy
- Fault locator Plus for accurate fault location with inhomogeneous line sections and targeted automatic overhead line section reclosing (AREC)
- Arc protection
- Automatic frequency relief for underfrequency load shedding, taking changed infeed conditions due to decentralized power generation into consideration
- Power protection, configurable as active or reactive-power protection
- Directional reactive-power undervoltage protection (QU protection)
- Detection of current and voltage signals up to the 50th harmonic with high accuracy for selected protection functions (such as thermal overload protection) and operational measured values
- PQ – Basic: Voltage unbalance; voltage changes: overvoltage, dip, interruption; TDD, THD, and harmonics
- Ground fault detection using the pulse detection method
- Control, synchrocheck, and switchgear interlocking protection
- Graphical logic editor to create high-performance automation functions in the device
- Single-line representation in the small or large display
- Fixed integrated electrical Ethernet RJ45 interface for DIGSI 5 and IEC 61850 (reporting and GOOSE)
- 2 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, PROFINET IO)

SIPROTEC 5 Devices and Fields of Application

Distance Protection – SIPROTEC 7SA82

- Serial protection communication via optical fibers, two-wire connections, and communication networks (IEEE C37.94, and others), including automatic switchover between ring and chain topology
- Reliable data transmission via PRP and HSR redundancy protocols
- Extensive cybersecurity functionality, such as role-based access control (RBAC), logging of security-related events, signed firmware, or authenticated IEEE 802.1X network access.
- Simple, fast, and secure access to the device via a standard Web browser to display all information and diagnostic data, vector diagrams, single-line and device display pages
- Phasor Measurement Unit (PMU) for synchrophasor measured values and IEEE C37.118 protocol
- Time synchronization using IEEE 1588
- High-performance fault recording (buffer for a max. record time of 80 s at 8 kHz or 320 s at 2 kHz)
- Auxiliary functions for simple tests and commissioning

Applications

- Detection and selective 3-pole tripping of short circuits in electrical equipment of star networks, lines with infeed at one or 2 ends, parallel lines, and open-circuited or closed ring systems of all voltage levels
- Detection of ground faults in isolated or arc-suppression-coil-ground systems in star, ring, or meshed arrangement

- Serial protection communication with SIPROTEC 5 and SIPROTEC 4 devices over different distances and physical media, such as optical fiber, two-wire connections, and communication networks
- Backup protection for differential protection devices of all kind for lines, transformers, generators, motors, and busbars
- Phasor Measurement Unit (PMU)
- Detection and recording of power-quality data in the medium-voltage and subordinate low-voltage power system

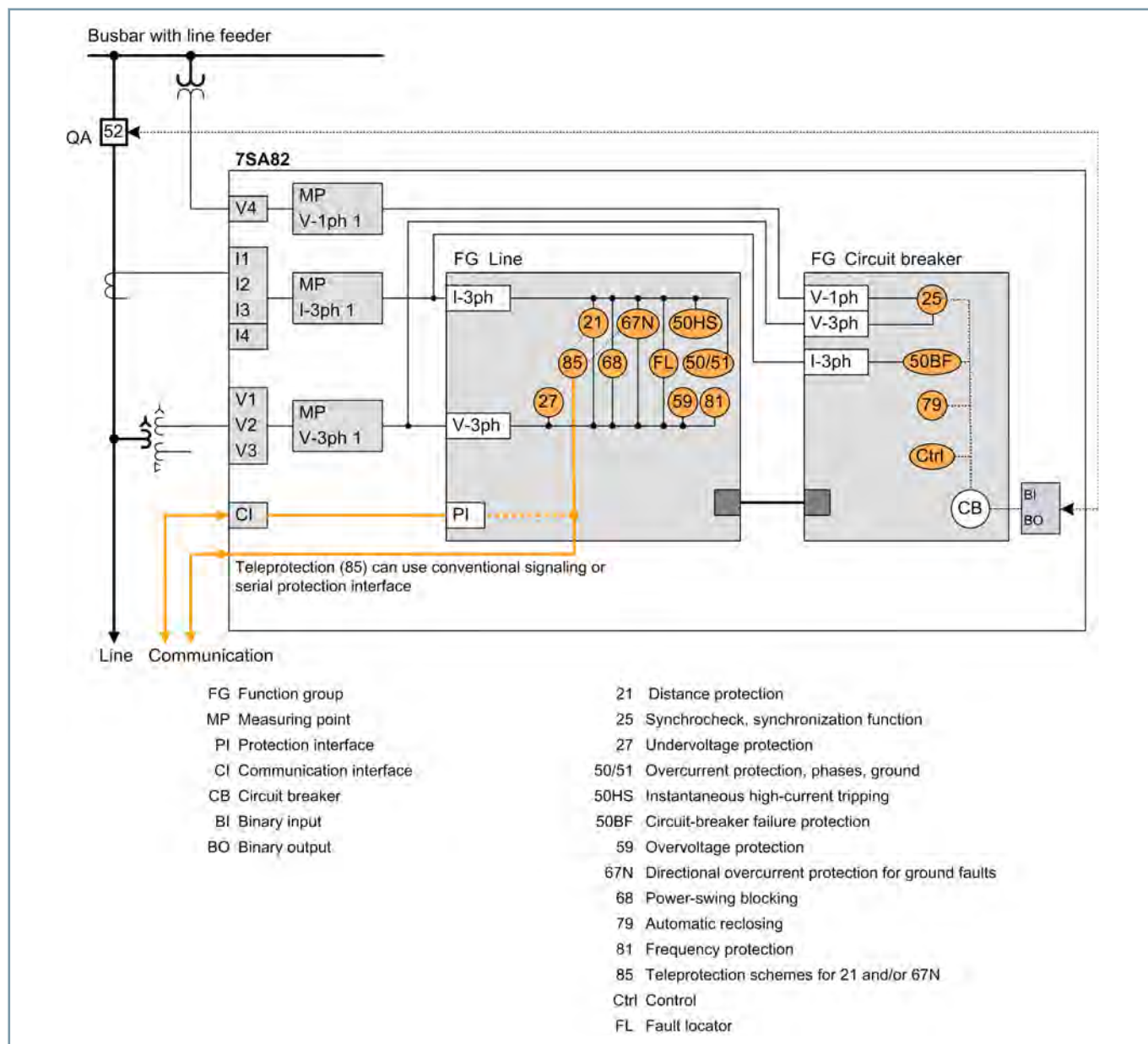
Application Templates

DIGSI 5 provides application templates for standard applications. They include basic configurations and default settings.

The following application templates are available:

- Basic
- Distance protection for resonant/isolated grounded power systems, with automatic reclosing
- Distance protection with reactance method for overhead lines in grounded electrical power systems

Application Example



[dw_7SA82_Ltg, 1, en_US]

Figure 2.6/2 Application Example: Distance Protection for Overhead Line

SIPROTEC 5 Devices and Fields of Application

Distance Protection – SIPROTEC 7SA82

ANSI	Function	Abbr.	Available	Application Templates		
				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, synchronization function	Sync	■			■
27	Undervoltage protection: "3-phase" or "positive-sequence system V1" or "universal Vx"	$V<$	■			
27R, 59R	Voltage change protection (starting with V8.30)	dV/dt	■			
	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 system overcurrent protection	$I2>$	■			
46	Negative-sequence system and overcurrent protection with direction	$I2>, \angle(V2, I2)$	■			
47	Overvoltage protection, negative-sequence system	$V2>$	■			
49	Thermal overload protection	θ, I^2t	■		■	■
50/51 TD	Overcurrent protection, phases	$I>$	■	■	■	■
	Instantaneous tripping at switch onto fault	SOTF	■			
50HS	Instantaneous high-current tripping	$I>>>$	■	■	■	■
50/51 TD	Overcurrent protection with positive-sequence current I1 (from V7.9)	$I1>$	■			
50N/ 51N TD	Overcurrent protection, ground	$IN>$	■	■	■	■
50N/ 51N TD	Overcurrent protection, 1-phase	$IN>$	■			
50 Ns/ 51Ns	Sensitive ground-fault detection for grounded arc suppression coils and isolated power systems including a) $3I0>$ b) admittance $Y0>$, c) $3I0$ -harm $>$ (from V7.8)	$INs>$	■			
	Sensitive ground-fault detection via pulse detection; hint: this stage also requires the function 50Ns/51Ns or 67Ns "sensitive ground-fault detection for grounded arc suppression coils and isolated power systems"	IN pulse	■			
	Intermittent ground-fault protection	$IIE>$	■			
50BF	Circuit-breaker failure protection, 3-pole	CBFP	■		■	■
50RS	Circuit breaker restrike monitoring	CBRM	■			
51V	Voltage-controlled overcurrent protection	$t=f(I, V)$	■			
59, 59N	Overvoltage protection: "3-phase" or "zero-sequence system V0" or "positive-sequence system V1" or "universal Vx"	$V>$	■			
60	Voltage-comparison supervision	$\Delta V>$	■			
67	Directional overcurrent protection, phases	$I>, \angle(V, I)$	■			
67N	Directional ground-fault protection in grounded power systems	$IN>, \angle(V, I)$	■			■
67 Ns	Sensitive ground-fault detection for grounded arc suppression coils and isolated power systems including a) $3I0>$ b) $V0>$, c) $\cos/\sin \Phi$, d) transient ground fault, e) $\Phi(V, I)$, f) admittance		■		■	
	Directional tripping stage with one harmonic; hint: this stage also requires the function "67Ns sensitive ground-fault detection for grounded arc suppression coils and isolated power systems"	$\angle(V0h, I0h)$	■			
	Directional Intermittent Ground-Fault Protection	$IIEdir>$	■			
68	Power-swing blocking	$\Delta Z/\Delta t$	■			■

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ANSI	Function	Abbr.	Available	Application Templates		
				1	2	3
74TC	Trip-circuit supervision		■			
78	Out-of-step protection	$\Delta Z/\Delta t$	■			
74CC	Single circuit monitoring (from V7.9)		■			
79	Automatic reclosing, 3-pole	AREC	■		■	■
81	Frequency protection: "f>" or "f<" or "df/dt"	f<>; df/dt<>	■			
81U	Underfrequency load shedding	f<(ULS)	■			
	Vector-jump protection	$\Delta\varphi$ >	■			
85/21	Teleprotection scheme for distance protection		■	■	■	■
85/27	Weak or no infeed: Echo and tripping		■	■	■	■
85/67N	Teleprotection scheme for directional ground-fault protection		■	■	■	■
86	Lockout		■			
87N T	Restricted ground-fault protection	ΔI_N	■			
90 V	Voltage controller for two-winding transformer		■			
90 V	Voltage controller for two-winding transformer with parallel control		■			
	Number of two-winding transformers with parallel control (hint: only together with the function "voltage controller for two-winding transformer with parallel control")		■			
FL	Fault Locator, single-side	FL-one	■	■	■	■
FL	Fault Locator Plus (from V7.9)	FL plus	■			
PMU	Synchrophasor measurement	PMU	■			
AFD	Arc protection (only with plug-in module ARC-CD-3FO)		■			
	Measured values, standard		■	■	■	■
	Measured values, extended: Min, max, average		■			
	Switching statistics counter		■	■	■	■
	PQ – Basic measured values: THD (Total Harmonic Distortion) and harmonic component (starting with V8.01) and THD voltage average values (starting with V8.40)		■			
	PQ – Basic measured values: Voltage unbalance (starting with V8.40)		■			
	PQ – Basic measured values: Voltage changes – monitoring of voltage dips, overvoltages and voltage interruptions (starting with V8.40)		■			
	PQ – Basic measured values: TDD - Total Demand Distortion (starting with V8.40)		■			
	CFC (standard, control)		■	■	■	■
	CFC arithmetic		■			
	Circuit-breaker wear monitoring	$\Sigma I_x, I^2t, 2P$	■			
	Switching sequence function		■			
	Inrush-current detection		■			
	External trip initiation		■	■	■	■
	Control		■	■	■	■
	Circuit breaker		■	■	■	■
	Disconnectors/grounding conductor		■			
	Fault recording of analog and binary signals		■	■	■	■
	Monitoring		■	■	■	■
	Protection interface, serial		■	■	■	■
	Region, France: Overload protection for 'PSL-PSC' lines		■			
	Region, France: 'MAXI-L' overcurrent protection		■			

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ANSI	Function	Abbr.	Available	Application Templates		
				1	2	3
	Region, France: 'PDA' system decoupling protection		■			
	Region, France: Overload protection for transformers		■			
	Frequency group tracking (from V7.8)		■			
	Cyber security: Role-Based Access Control (from V7.8)		■			
	Temperature recording via communication protocol		■			
	Cyber security: Authenticated network access using IEEE 802.1X (starting from V8.3)		■			
Function point class:				0	100	200
The configuration and function point class for your application can be determined in the SIPROTEC 5 order configurator at www.siemens.com/siprotec .						

Table 2.6/1 SIPROTEC 7SA82 – Functions, Application Templates

- (1) Basic
- (2) DIS Res./Isol. Power systems, with AREC
- (3) DIS RMD Overhead Line, grounded power systems

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