Description

The SIPROTEC 7SJ82 overcurrent protection has been designed specifically for a cost-effective and compact protection of feeders and lines in medium-voltage and high-voltage systems. With its flexibility and the high-performance DIGSI 5 engineering tool, the SIPROTEC 7SJ82 device offers future-oriented solutions for protection, control, automation, monitoring, and Power Quality – Basic.

Main function	Feeder and overcurrent protection for all voltage levels
Inputs and outputs	4 current transformers, 4 voltage transformers (optional), 11 or 23 binary inputs, 9 or 16 binary outputs, or 8 current transformers, 7 binary inputs, 7 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 × 19 inches

Benefits

- Compact and low-cost overcurrent protection
- Safety due to high-performance protection functions
- Purposeful and easy handling of devices and software thanks to a user-friendly design
- Cybersecurity according to NERC CIP and BDEW Whitepaper requirements (for example, logging security-related events and alarms)
- 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

Functions

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

- Directional and non-directional overcurrent protection with additional functions
- Optimized tripping times due to directional comparison and protection communication
- Detection of ground faults of any type in compensated or isolated electrical power systems using the following functions: 3I0>, V0>, transient ground-fault function, cos φ, sin φ, dir. detection of intermittent ground faults, harmonic detection, and admittance measurement
- Ground-fault detection using the pulse-detection method
- Detection of intermittent ground faults with automatic blocking of statically measuring functions to avoid message and fault-record flooding
- Fault locator plus for accurate fault location with inhomogenous line sections and targeted automatic overhead-line section reclosing (AREC)
- Arc protection

[SIP5_7xx82_GD_W3, 2, --_--]

Figure 2.4/4 SIPROTEC 7SJ82

- Overvoltage and undervoltage protection
- Frequency protection and frequency-change protection for load-shedding applications
- 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
- Protection functions for capacitor banks, such as overcurrent, overload, current-unbalance, peak overvoltage, or differential protection
- Directional reactive-power undervoltage protection (QU protection)
- Control, synchrocheck, and switchgear interlocking protection, circuit-breaker failure protection
- Circuit-breaker failure protection
- Circuit-breaker reignition monitoring
- Graphical logic editor to create high-performance automation functions in the device
- Detection of current and voltage signals up to the 50th harmonic with high accuracy for selected protection functions (such as peak overvoltage protection for capacitors) and operational measured values
- PQ – Basic: Voltage unbalance; voltage changes: overvoltage, dip, interruption; TDD, THD, and harmonics
- 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)

- 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
- Whitepaper Phasor Measurement Unit (PMU) for synchrophasor measured values and IEEE C37.118 protocol
- Time synchronization using IEEE 1588
- Control of power transformers
- 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 1 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
- Backup protection for differential protection devices of all kind for lines, transformers, generators, motors, and busbars
- Protection and monitoring of simple capacitor banks
- Phasor Measurement Unit (PMU)
- Reverse-power protection
- Load shedding applications
- Automatic switchover
- Regulation or control of power transformers (two-winding transformers)
- 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:

Non-directional definite-time overcurrent protection/inverse-time overcurrent protection

- Overcurrent protection (non-directional) for phases and ground
- Transformer inrush-current detection

Directional definite-time overcurrent protection/inverse-time overcurrent protection – grounded power system

- Overcurrent protection (directional and non-directional) for phases and ground
- Transformer inrush-current detection
- Measuring-voltage failure detection

Directional definite-time overcurrent protection/inverse-time overcurrent protection – arc-suppression-coil-ground systems/ isolated systems

- Overcurrent protection (directional and non-directional) for phases
- Directional sensitive ground-fault detection for static ground faults
- Directional sensitive ground-fault detection for transient and static ground faults
- Transformer inrush-current detection
- Measuring-voltage failure detection

Capacitor bank. H-bridge

- Overcurrent protection for phases and ground
- Capacitor-bank phase unbalance protection
- Peak overvoltage protection
- Overload protection
- Undercurrent protection

Application Example

Directional Comparison Protection via Protection Interfaces for Power Line with an Infeed at Both Ends

With the direction determination of the directional overcurrent protection, you can implement directional comparison protection for power line with an infeed at both ends (*Figure 2.4/5*). Directional comparison protection is used for the selective isolation of a faulty line section (for example, subsections of closed rings). Sections are isolated quickly, that is, they do not suffer the disadvantage of long grading times. This technique requires that directional information can be exchanged between the individual protection stations. This information exchange can, for example, be implemented via a protection interface. Alternatives for the protection interface are IEC 61850 GOOSE or exchange via pilot wires for signal transmission, with an auxiliary-voltage loop.

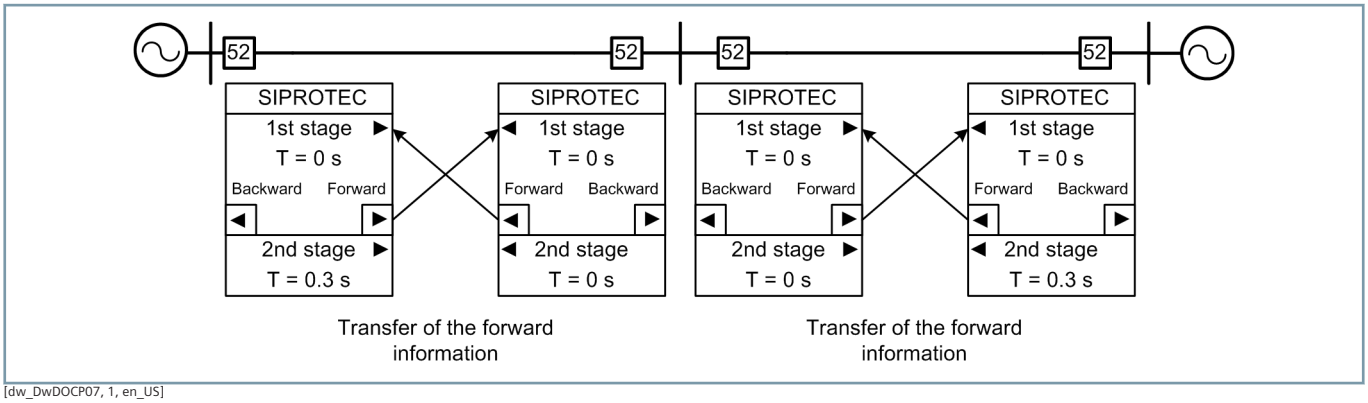

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Figure 2.4/5 Principle of Directional Comparison Protection for Power Line with Infeed at 2 Ends

The following application example (*Figure 2.4/6*) shows the functional scope and the basic configuration of a SIPROTEC 7SJ82 device for this application. The **Directional definite-time overcurrent protection/inverse-time overcurrent protection – grounded power system** application template is used as the basis. In addition, the device must be equipped with a communication module for protection communication. The protection communication function group is created automatically when the module is configured. The **Communication mapping** DIGSI editor is used to determine the information that must be transmitted to the opposite end and received from the opposite end. The received information can directly be combined with the binary input signals of the directional overcurrent protection. No additional logic with a CFC chart is necessary.

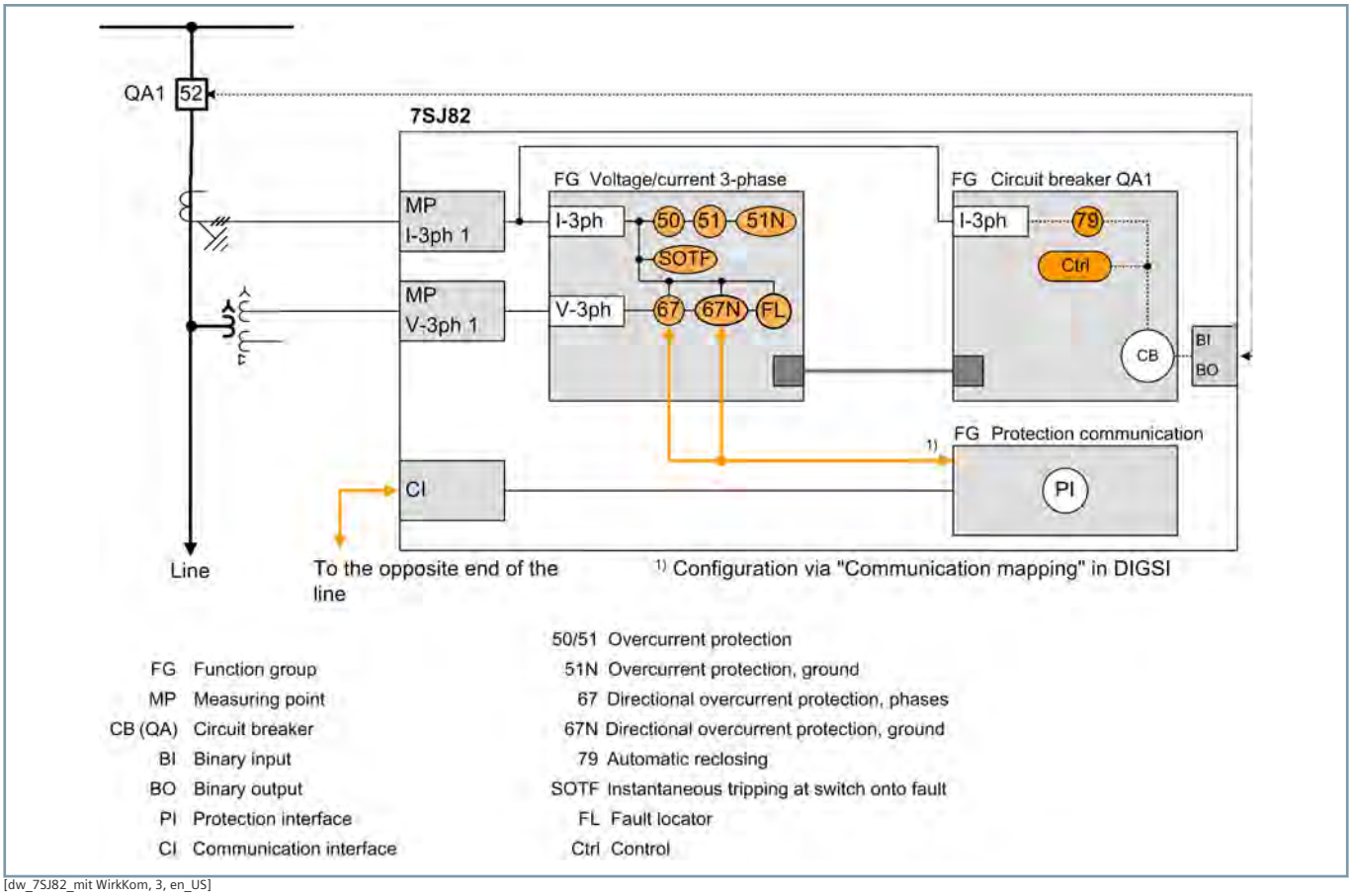

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Figure 2.4/6 Application Example: Directional Comparison Protection for Power Line with Infeed at 2 Ends and Protection Communication

ANSI	Function	Abbr.	Available	Application Templates				
				1	2	3	4	5
	Protection functions for 3-pole tripping	3-pole	■	■	■	■	■	■
24	Overexcitation protection	V/f	■					
25	Synchrocheck, synchronization function	Sync	■					
25	Synchrocheck, synchronization function with adjusting commands (from V7.82)	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<>	■					
32R	Reverse-power protection	- P<	■					
37	Undercurrent	I<	■					■
38	Temperature supervision	θ>	■					
46	Negative-sequence system overcurrent protection	I2>	■					■
46	Unbalanced-load protection (thermal)	$I2^2$ t>	■					
46	Negative-sequence system and overcurrent protection with direction	I2>, ∠(V2, I2)	■					
47	Overvoltage protection: "Negative-sequence system V2" or "negative-sequence system V1/positive-sequence system V1"	V2>; V2/V1>	■					
49	Thermal overload protection	θ, I^2t	■					■
49	Thermal overload protection, user-defined characteristic curve	θ, I^2t	■					
49	Overload protection for RLC filter circuit elements of a capacitor bank	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>	■					
50/51 TD	Overcurrent protection for RLC filter circuit elements of a capacitor bank	I>	■					
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>	■					
59C	Peak overvoltage protection, 3-phase, for capacitors	V> cap.	■					■
60C	Current-unbalance protection for capacitor banks	Iunbal>	■					■
60	Voltage-comparison supervision	ΔV>	■					

Overcurrent and Feeder Protection – SIPROTEC 7SJ82

ANSI	Function	Abbr.	Available	Application Templates				
				1	2	3	4	5
67	Directional overcurrent protection, phases	I>, ∠(V, I)	■			■	■	
67N	Directional overcurrent protection, ground	IN>, ∠(V, I)	■			■		
67 Ns	Sensitive ground-fault detection for grounded arc suppression coils and isolated power systems including a) 3I0> b) V0>, c) cos/sine 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"	∠(V0h,I0h)	■					
	Directional Intermittent Ground-Fault Protection	IIEdir>	■					
74TC	Trip-circuit supervision		■					
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	Δφ>	■					
86	Lockout		■	■	■	■	■	■
87N T	Restricted ground-fault protection	ΔIN	■					
87C	Differential protection for capacitor banks	ΔI	■					
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	ΣIx, I²t, 2P	■					
	Switching sequence function		■					
	Inrush-current detection		■	■	■	■	■	
	External trip initiation		■					
	Control		■	■	■	■	■	■
	Circuit breaker		■	■	■	■	■	■

ANSI	Function	Abbr.	Available	Application Templates				
				1	2	3	4	5
	Disconnector/grounding conductor		■	■	■	■	■	
	Fault recording of analog and binary signals		■	■	■	■	■	■
	Monitoring		■	■	■	■	■	■
	Protection interface, serial		■					
	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	0	30	50	100
The configuration and function point class for your application can be determined in the SIPROTEC 5 order configurator at *www.siemens.com/siprotec*.								

Table 2.4/3 SIPROTEC 7SJ82 – Functions, Application Templates

(1) Non-directional definite-time overcurrent protection/inverse-time overcurrent protection (4*I)

(2) Non-directional definite-time overcurrent protection/inverse-time overcurrent protection (4*I, 4*V)

(3) Directional definite-time overcurrent protection/inverse-time overcurrent protection – grounded power system

(4) Directional definite-time overcurrent protection/inverse-time overcurrent protection - grounded arc suppression coils/isolated power systems

(5) Capacitor bank: H-bridge

Standard Variants for SIPROTEC 7SJ82		
V1	1/3, 11 BI, 9 BO, 4 I	
	Housing width 1/3 x 19"	
	11 binary inputs	
	9 binary outputs (1 life contact, 8 standard)	
	4 current-transformer inputs	
	Contains the following modules: base module with PS101 and IO101	
V2	1/3, 23 BI, 16 BO, 4 I	
	Housing width 1/3 x 19"	
	23 binary inputs	
	16 binary outputs (1 life contact, 15 standard)	
	4 current-transformer inputs	
	Contains the following modules: base module with PS101, IO101, and IO110	
V3	1/3, 11 BI, 9 BO, 4 I, 4 V	
	Housing width 1/3 x 19"	
	11 binary inputs	
	9 binary outputs (1 life contact, 8 standard)	
	4 current-transformer inputs	
	4 voltage-transformer inputs	
	Contains the following modules: base module with PS101 and IO102	
V4	1/3, 23 BI, 16 BO, 4 I, 4 V	
	Housing width 1/3 x 19"	
	23 binary inputs	
	16 binary outputs (1 life contact, 15 standard)	
	4 current-transformer inputs	
	4 voltage-transformer inputs	
	Contains the following modules: base module with PS101, IO102, and IO110.	
V5	1/3, 7 BI, 7 BO, 8 I	
	Housing width 1/3 x 19"	
	7 binary inputs	
	7 binary outputs (1 life contact, 6 standard)	
	8 current-transformer inputs	
	Contains the following modules: base module with PS101 and IO103	

Table 2.4/4 Standard Variants for SIPROTEC 7SJ82

You can find the technical data of the devices in the manual
www.siemens.com/siprotec.