Description

The SIPROTEC 7SJ81 has been designed for a cost-effective and compact protection of feeders and lines in medium-voltage systems. With its flexibility and the powerful DIGSI 5 engineering tool, the SIPROTEC 5 device offers future-oriented solutions for protection, control, automation, monitoring, and Power Quality – Basic.

Main function	Feeder and overcurrent protection
Inputs and outputs	4 current transformers, 11 binary inputs, 9 binary outputs 4 current transformers, 18 binary inputs, 14 binary outputs 4 current transformers, 4 voltage transformers, 11 binary inputs, 9 binary outputs 4 current transformers, 4 voltage transformers, 16 binary inputs, 11 binary outputs
Hardware flexibility	Different hardware quantity structures for binary inputs and outputs are available in the 1/3 base module. 1 plug-in module position, available with large or small display
Housing width	1/3 × 19 inches

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Figure 2.4/2 SIPROTEC 7SJ81

Benefits

- Compact and low-cost overcurrent protection
- Safety due to powerful 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
- Detection of ground faults of any type in isolated or arc-suppression-coil-ground 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
- Detection of intermittent ground faults with automatic blocking of statically measuring functions to avoid message and fault-record flooding
- Arc protection (note the resulting communication restrictions)
- Overvoltage and undervoltage protection
- Frequency protection and frequency change protection for load shedding applications
- Power protection, configurable as active or reactive power protection
- Directional reactive power undervoltage protection (QU protection)
- Control with switchgear interlocking protection
- Synchrocheck
- Circuit-breaker failure protection
- Detection of current and voltage signals up to the 50th harmonic with high accuracy for selected protection functions and operational measured values
- PQ – Basic: Voltage unbalance; voltage changes: overvoltage, dip, interruption; TDD, THD, and harmonics
- Graphical logic editor to create powerful automation functions in the device
- Single-line representation in small or large display
- Fixed integrated electrical Ethernet RJ45 interface for DIGSI 5 and IEC 61850 (reporting and GOOSE)
- 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
- 1 optional plug-in module for either a) communication protocol or b) for arc protection
- Redundant and simple communication protocols according to IEC 61850, IEC 60870-5-103, IEC 60870-5-104, Modbus TCP, DNP3 serial and TCP, PROFINET IO
- 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

- Time synchronization using IEEE 1588
- Standard fault recording (buffer for a max. record time of approx. 40 sec. 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 two 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 power systems in star, ring, or meshed arrangement
- Backup protection for differential protection devices of all kind for lines, transformers, generators, motors, and busbars
- Universal power protection
- Simple load shedding applications
- Detection and recording of power-quality data in the medium-voltage and subordinate low-voltage power system

Application Templates

Application templates are available in DIGSI 5 for standard applications. They contain basic configurations and default settings.

The following application templates are available:

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

Application Example

Protection and Control on a Single Busbar

The following application example (*Figure 2.4/3*) shows the functional scope and the basic configuration of a SIPROTEC 7SJ81 device for busbar protection and control.

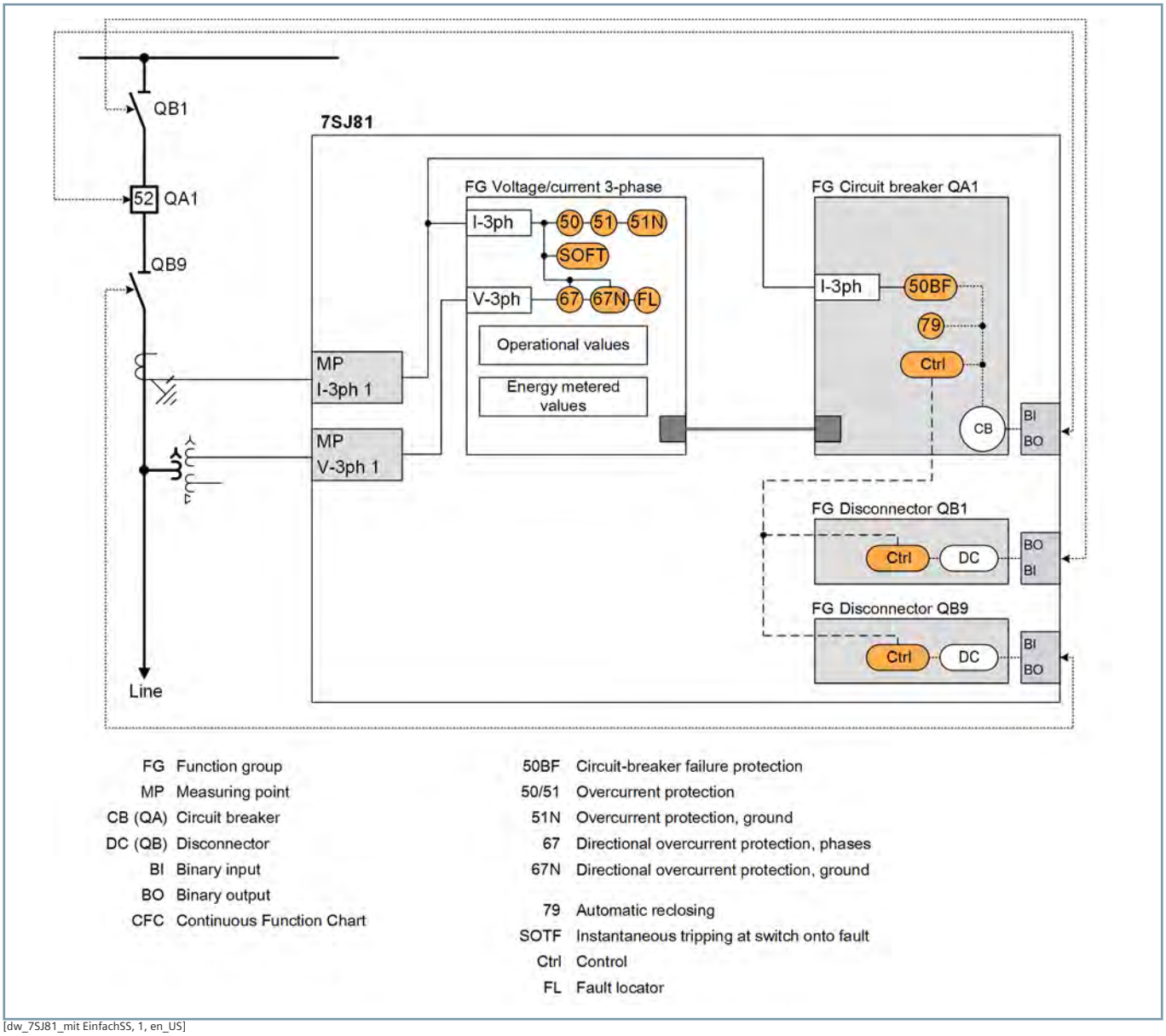

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Figure 2.4/3 Application Example: Overcurrent Protection 7SJ81 on a Busbar

Overcurrent and Feeder Protection – SIPROTEC 7SJ81

ANSI	Function	Abbr.	Available	Application Templates	
				1	2
	Protection functions for 3-pole tripping	3-pole	■	■	■
25	Synchrocheck, synchronization function	Sync	■		
27	Undervoltage protection: "3-phase" or "positive-sequence system V1"	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	θ>	■		
46	Negative-sequence system overcurrent protection	I2>	■		
47	Overvoltage protection, negative-sequence system	V2>	■		
49	Thermal overload protection	θ, I²t	■		
50/51 TD	Overcurrent protection, phases	I>	■	■	■
	Instantaneous tripping at switch onto fault	SOTF	■		
50HS	Instantaneous high-current tripping	I>>>	■		
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>	INs>	■		
	Intermittent ground-fault protection	IIE>	■		
50BF	Circuit-breaker failure protection, 3-pole	CBFP	■		
59, 59N	Overvoltage protection: "3-phase" or "zero-sequence system V0" or "positive-sequence system V1"	V>	■		
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 Intermittent Ground-Fault Protection	IIEdir>	■		
74TC	Trip-circuit supervision		■		
79	Automatic reclosing, 3-pole	AREC	■		
81	Frequency protection: "f>" or "f<" or "df/dt"	f<>; df/dt<>	■		
	Vector-jump protection	Δφ>	■		
86	Lockout		■	■	■
FL	Fault Locator, single-side	FL-one	■		
AFD	Arc protection (only with plug-in module ARC-CD-3FO)		■		
	Measured values, standard		■	■	■
	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)		■		

ANSI	Function	Abbr.	Available	Application Templates	
				1	2
	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		■	■	■
	1 circuit breaker object (number cannot be expanded)		■		
	3 disconnector/grounding conductor objects (number cannot be expanded)		■		
	Fault recording of analog and binary signals		■	■	■
	Monitoring		■	■	■
	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
The configuration and function point class for your application can be determined in the SIPROTEC 5 order configurator at *www.siemens.com/siprotec*.					

Table 2.4/1 SIPROTEC 7SJ81 - 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)

Standard Variants for SIPROTEC 7SJ81		
AI1	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	
AI2	1/3, 18 BI, 14 BO, 4 I	
	Housing width 1/3 x 19" 16 binary inputs 11 binary outputs (1 life contact, 10 standard) 4 current-transformer inputs Contains the following modules: base module with IO101, PS101, IO112	
AI3	1/3, 11 BI, 9 BO, 4 I, 4V	
	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 IO102 and PS101	
AI4	1/3, 16 BI, 11 BO, 4 I, 4 V	
	Housing width 1/3 x 19" 10 binary inputs 14 binary outputs (1 life contact, 13 standard) 4 current-transformer inputs 4 voltage-transformer inputs Contains the following modules: base module with IO102, PS101, and IO113	

Table 2.4/2 Standard Variants for SIPROTEC 7SJ81

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