

# SIPROTEC 5 Devices and Fields of Application

## Overcurrent and Feeder Protection – SIPROTEC 7SJ85

ANSI	Function	Abbr.	Available	Application Templates				
				1	2	3	4	5
	Protection functions for 3-pole tripping	3-pole	■	■	■	■	■	■
	Expandable hardware quantity structure	I/O	■	■	■	■	■	■
	Process bus client protocol (hint: PB client requires a separate ETH-BD-2FO plug-in module, from V8.0)	PB client	■					
	IEC61850-9-2 Merging Unit Stream (hint: Each stream requires a separate ETH-BD-2FO plug-in module, from V8.0)	MU	■					
	IEC61850-9-2 Merging Unit Stream 7SS85 CU (hint: Only for communication with a 7SS85 CU. A separate ETH-BD-2FO plug-in module is required starting with V8.40)	MU	■					
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)	I2² t>	■					
46	Negative-sequence system and overcurrent protection with direction	I2>, ∠(V2, I2)	■					
47	Overvoltage protection, negative-sequence system	V2>	■					
49	Thermal overload protection	θ, I²t	■				■	■
49	Thermal overload protection, user-defined characteristic curve	θ, I²t	■					
49	Overload protection for RLC filter circuit elements of a capacitor bank	θ, I²t	■				■	
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>	■					

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				1	2	3	4	5
50BF	Circuit-breaker failure protection, 3-pole	CBFP	■					■
50EF	End-fault protection (hint: For use only in decentralized busbar protection with a 7SS85 CU starting with V8.40)		■					
50RS	Circuit breaker restrrike 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>	■					
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	■					■
87V	Voltage differential protection for capacitor banks	ΔV	■					
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")		■					
90 V	Voltage controller for three-winding transformer		■					
90 V	Voltage controller for grid coupling transformer		■					
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)		■					

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ANSI	Function	Abbr.	Available	Application Templates				
				1	2	3	4	5
	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		■	■	■	■	■	■
PoW	Point-on-wave switching (starting with V7.90)	PoW	■					
	Circuit breaker		■	■	■	■	■	■
	Disconnectors/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	30	50	100	300
The configuration and function point class for your application can be determined in the SIPROTEC 5 order configurator at <a href="http://www.siemens.com/siprotec">www.siemens.com/siprotec</a> .								

**Table 2.4/5** SIPROTEC 7SJ85 – Functions, Application Templates

- (1) Non-directional definite-time overcurrent protection/inverse-time overcurrent protection (4\*1, 4\*V)
- (2) Directional definite-time overcurrent protection/inverse-time overcurrent protection – grounded power system
- (3) Directional definite-time overcurrent protection/inverse-time overcurrent protection - grounded arc suppression coils/isolated power systems
- (4) Capacitor bank: H-bridge + 1\*RLC
- (5) Capacitor bank: MSCDN

# SIPROTEC 5 Devices and Fields of Application

## Overcurrent and Feeder Protection – SIPROTEC 7SJ85

Standard Variants for SIPROTEC 7SJ85		
S1	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, 2 standard, 6 fast) 4 current-transformer inputs 4 voltage-transformer inputs Contains the following modules: base module with PS201 and IO202	
S2	1/2, 17 BI, 16 BO, 4 I, 4 V Housing width 1/2 x 19" 17 binary inputs 16 binary outputs (1 life contact, 9 standard, 6 fast) 4 current-transformer inputs 4 voltage-transformer inputs Contains the following modules: base module with PS201 and IO202 Expansion modules IO206	
S3	1/2, 27 BI, 17 BO, 4 I, 4 V Housing width 1/2 x 19" 27 binary inputs 17 binary outputs (1 life contact, 10 standard, 6 fast) 4 current-transformer inputs 4 voltage-transformer inputs Contains the following modules: base module with PS201 and IO202 Expansion modules IO207	
S4	2/3, 43 BI, 25 BO, 4 I, 4 V Housing width 2/3 x 19" 43 binary inputs 25 binary outputs (1 life contact, 18 standard, 6 fast) 4 current-transformer inputs 4 voltage-transformer inputs Contains the following modules: base module with PS201 and IO202 Expansion modules 2x IO207	
S5	5/6, 59 BI, 33 BO, 4 I, 4 V Housing width 5/6 x 19" 59 binary inputs 33 binary outputs (1 life contact, 26 standard, 6 fast) 4 current-transformer inputs 4 voltage-transformer inputs Contains the following modules: base module with PS201 and IO202 Expansion modules 3x IO207	

**Table 2.4/6** Standard Variants for SIPROTEC 7SJ85

You can find the technical data of the devices in the manual  
[www.siemens.com/siprotec](http://www.siemens.com/siprotec).

**7SJ85 Overcurrent-Time Protection - Overview Function points calculation**

(P1J195681)

*Functions Free of Charge*

ANSI	Function	Abbr.	Included
	Protection functions for 3-pole tripping	3-pole	✓
	Hardware quantity structure expandable	I/O	✓
37	Undercurrent	I<	✓
38	Temperature supervision	θ>	✓
46	Negative-sequence overcurrent protection	I2>	✓
46	Unbalanced-load protection (thermal)	I2 <sup>2</sup> t>	✓
49	Thermal overload protection	θ, I <sup>2</sup> t	✓
49	Thermal overload protection, user-defined characteristic	θ, I <sup>2</sup> t	✓
	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>	20 X ✓
50N/ 51N TD	Overcurrent protection, ground	IN>	✓
50N/ 51N TD	Overcurrent protection, 1-phase	IN>	✓
50Ns/ 51Ns	Sensitive ground-current detection for systems with resonant or isolated neutral systems incl. a) 3I0>, b) admittance Y0>, c) 3I0-harm> (from V7.8)	INs>	✓
74TC	Trip-circuit supervision	TCS	✓
74CC	Closed-circuit supervision (from V7.9)	CCS	✓
86	Lockout		✓
AFD	Arc-protection (only with plug-in module ARC-CD-3FO)		5 X ✓
	Measured values - standard		✓
	Switching statistic counters		✓

	PQ-Basic measured values: THD (Total Harmonic Distortion) and harmonics (from V8.01) THD voltage aggregation values (from V8.40)		✓
	CFC (Standard, control)		✓
	Inrush current detection		✓
	External trip initiation		✓
	Control		✓
	Protection interface, serial		✓
	Monitoring and supervision		✓
	Fault recording of analog and binary signals		✓
	Frequency-tracking groups (from V7.8)		6 X ✓
	Temperature acquisition via communication protocol		✓

*Functions with Costs*

ANSI	Function	Abbr.	Included	Quantity	Value	Points
	IEC 61850-9-2 Merging Unit function (Note: Max. 2 streams per MU function, each MU function requires a ETH-BD-2FO plug-in module)	MU		0	200	0
	Process Bus Client function (Note: This function requires a ETH-BD-2FO plug-in module)	PB client		0	100	0
	IEC 61850-9-2 Merging Unit function for 7SS85 CU (Note: Only for communication with a 7SS85 with Significant properties: "CU: ...". This function requires a ETH-BD-2FO plug-in module)	MU (7SS85 CU)		0	295	0
	IEEE 1588v2/PTP Grandmaster Clock (Note: This function requires a ETH-BD-2FO, with V9.20)	GMC		0	200	0
24	Overexcitation protection	V/f		0	25	0
25	Synchrocheck, synchronization function	Sync		0	50	0
25	Synchronization function with balancing commands, 1 channel for each sync. location	Sync		0	80	0

27	Undervoltage protection: "3-phase" or "positive-sequence system V1" or "universal Vx"	V<		0	5	0
27R, 59R	Rate-of-voltage-change protection (from V8.30)	dV/dt		0	5	0
	Undervoltage-controlled reactive power protection	Q>/V<		0	15	0
32, 37	Power protection active/reactive power	P<>, Q<>		0	10	0
32R	Reverse-power protection	- P<		0	5	0
46	Negative-sequence overcurrent protection with direction			0	10	0
47	Overvoltage protection, negative-sequence system	V2>		0	5	0
49	Thermal overload protection for RLC filter elements of a capacitor bank	$\theta, I^2t$		0	10	0
50/51 TD	Overcurrent protection, phases	I>	2 X ✓	0	30	0
50/51 TD	Overcurrent protection for RLC filter elements of a capacitor bank	I>		0	10	0
	Ground-fault detection via pulse pattern detection; Note: this stage additionally requires the function 50Ns/51Ns or 67Ns "Sensitive ground-fault detection for systems with resonant or isolated neutral"	IN-pulse		0	15	0
	Intermittent ground-fault protection	lie>		0	20	0
50BF	Circuit-breaker failure protection, 3-pole	CBFP		0	5	0
50RS	Circuit-breaker restrike protection	CBRS		0	20	0
50EF	End-fault protection (Note: Only useable for distributed busbar protection with 7SS85 CU with V8.40)			0	5	0
51V	Overcurrent protection, voltage dependent	t=f(I,V)		0	10	0
59, 59N	Overvoltage protection: "3-phase" or "zero-sequence system V0" or "universal Vx"	V>		0	5	0

59C	Peak overvoltage protection, 3-phase, for capacitors	V> cap.		0	30	0
59NU	Neutral-point Voltage-Unbalance Protection (from V8.6)	UNU>		0	30	0
60	Voltage-comparison supervision	$\Delta U >$		0	5	0
60C	Current-unbalance protection for capacitor banks	Iunbal>		0	50	0
67	Directional overcurrent protection, phases			0	15	0
67N	Directional overcurrent protection, ground			0	15	0
67Ns	Dir. sensitive ground-fault detection for systems with resonant or isolated neutral incl. a) $3I_0 >$ , b) $V_0 >$ , c) $\text{Cos-/SinPhi}$ , d) Transient ground-fault fct., e) $\text{Phi}(V,I)$ , f) admittance			0	30	0
	Directional stage with a harmonic; Note: this stage additionally requires the function "67Ns Dir. sensitive ground-fault detection for systems with resonant or isolated neutral"			0	10	0
	Directional intermittent ground-fault protection	lie dir>		0	20	0
79	Automatic reclosing, 3-pole	AR		0	35	0
81	Frequency protection: "f>" or "f<" or "df/dt"	f<>; df/dt<>		0	5	0
81U	Underfrequency load-shedding	f<(UFLS)		0	15	0
	Vector-jump protection	$\Delta \varphi >$		0	20	0
87N	Restricted ground-fault protection	$\Delta I_N$		0	15	0
87C	Differential protection, capacitor bank	$\Delta I$		0	95	0
87V	Voltage differential protection, capacitor bank	$\Delta V$		0	50	0
90V	Automatic voltage controller for two-winding transformer			0	150	0
90V	Automatic voltage controller for two-winding transformer with parallel operation			0	180	0



	Number of two-winding transformers with parallel operation (Note: only together with the function "Automatic voltage controller for two-winding transformer with parallel operation")		2 X ✓	0	5	0
90V	Automatic voltage controller for three-winding transformer			0	200	0
90V	Automatic voltage controller for grid coupling transformer			0	175	0
FL	Fault locator, single-sided	FL-one		0	25	0
FL	Fault locator plus (from V7.9)	FL plus		0	45	0
PMU	Synchrophasor measurement	PMU		0	40	0
	Measured values - extended: Min, Max, Avg			0	3	0
	PQ-Basic measured values: Voltage unbalance (from V8.40)			0	20	0
	PQ-Basic measured values: Voltage variations - voltage dips, swells and interruptions (from V8.40)			0	30	0
	PQ-Basic measured values: TDD - Total Demand Distortion (from V8.40)			0	10	0
	CFC arithmetic			0	40	0
	Circuit-breaker monitoring (from V9.20)	$\Sigma I_x$ , $I^2t$ , 2P, tO, tC, pole scatter, discrepancy		0	10	0
	Disconnecter monitoring (from V9.50)	tO, tC		0	5	0
	Switching sequences function			0	5	0
PoW	Point-on-wave switching (from V7.90)	PoW		0	425	0
	Point-on-wave with residual flux estimation (from V9.80)	PoW		0	465	0
	Circuit-breaker		4 X ✓	0	3	0
	Disconnecter/Grounding switch		4 X ✓	0	3	0
	Multiplexing of protection interface			0	50	0

SSR	Slow-scan recorder (Mod.: from V8.80, Non-Mod.: from V9.40)	SSR	1 X ✓	0	40	0
CR	Continuous recorder (Mod.: from V9.20, Non-Mod.: from V9.40)	CR	1 X ✓	0	25	0
	PQ-10/12 cycle values for continuous recorder (from V9.20)	CR		0	25	0
TR	Trend recorder (Mod.: from V9.30, Non-Mod.: from V9.40)	TR	1 X ✓	0	25	0
	PQ-Trend value for Trend Recorder (from V9.30)	TR		0	25	0
	PQ-Flicker values for Trend Recorder (from V9.30)	TR		0	25	0
	Cyber Security: Role-Based Access Control (from V7.8)			0	25	0
	Cyber Security: IEEE 802.1x based network authentication (from V8.3)			0	10	0
27-CEI	Region Italy: undervoltage protection according to the CEI 0-16 standard (from V9.50)	V<		0	5	0
59-CEI	Region Italy: overvoltage protection according to the CEI 0-16 standard (from V9.50)	V>		0	5	0
81-CEI	Region Italy: frequency protection according to the CEI 0-16 standard (from V9.50)	f<>		0	10	0
Total:						0