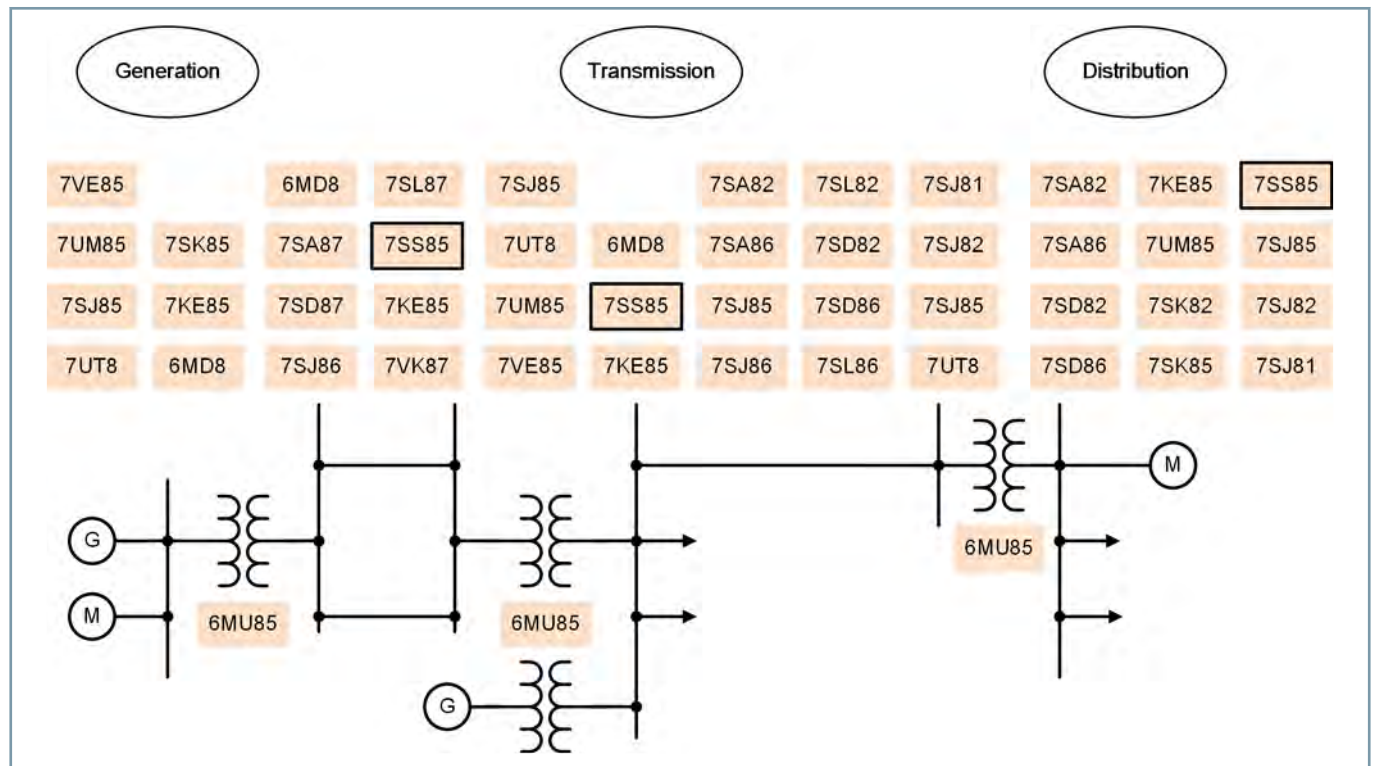


# SIPROTEC 5 Devices and Fields of Application

## Busbar Protection



[dw\_7SS85\_anwendung, 4, en\_US]

Figure 2.15/1 Fields of Application of the SIPROTEC 5 Devices

### SIPROTEC 7SS85

The SIPROTEC 7SS85 busbar protection has been designed with the highest selectivity possible for a large variety of different busbars and all voltage levels. Additional protection and control functions extend the field of application to a complete station protection.

### SIPROTEC 7SS85

The SIPROTEC 7SS85 busbar protection is a selective, safe, and fast protection against busbar short circuits in medium-voltage systems, high-voltage systems, and systems for very high voltage. The proven, fast, and reliable algorithms from the SIPROTEC 7SS52 in conjunction with the flexible, scalable, open, and user-friendly SIPROTEC 5 platform set the new bar for the SIPROTEC 7SS85 busbar protection.

The SIPROTEC 7SS85 is the right solution for interoperable, compatible busbar protection as per IEC 61850, a cost-effective extension of your electrical power system with busbar protection or as the replacement for the SIPROTEC 7SS52.

ONE platform, ONE device, ONE configuration tool for all applications, voltage levels, and busbar-protection systems. The new SIPROTEC 7SS85 offers various options for the busbar-protection architecture: Centralized, distributed or – for the 1st time in the history of busbar protection – a hybrid busbar-protection system where process information can be connected directly as well as measured by distributed bay devices.

The selection of the device base functionalities (significant features) and the modular hardware structure allow optimum adaptation of the SIPROTEC 7SS85 to a large variety of system configurations and functional requirements up to a complete station protection.

### Benefits

The performance and flexibility of the SIPROTEC 7SS85 allow the implementation of the most varied, customer-specific secondary-equipment concepts and solutions, such as:

- IEC 61850 compatible and interoperable distributed busbar protection
- Cost-efficient extension of power-system protection using busbar protection
- Replacement solution for the proven SIPROTEC 7SS52 in the electrical power system

### Functions

Characteristic Key Values of SIPROTEC 7SS85

- Phase-selective measurement and display
- Selective tripping of faulty bus zones
- Disconnecter-independent check zone as additional tripping criterion
- Shortest tripping times to ensure network stability and minimize damage to the system:
  - Centralized busbar protection: 3 ms/7 ms (relay type HS/ type F)
  - Distributed busbar protection: 8 ms/12 ms (relay type HS/ type F)
- Highest stability in case of external faults, even in case of transformer saturation, through stabilization with flowing currents
- Operate curve with freely adjustable characteristic curve sections



[SIP5\_GD\_SS\_LED\_LED\_W3, 2, --, --]

Figure 2.15/2 SIPROTEC 7SS85 – Centralized Busbar Protection

- Additional operate curve with increased sensitivity for low-current errors, for example in resistance-grounded power systems
- Fast recognition of internal or external errors requires only 2 ms of saturation-free time of the current transformers
- Using closed iron core or linearized current transformers in a plant is possible
- Adaptation of different current transformer ratios per parameterization
- Straight-forward dimensioning of current transformers and stabilization factor
- 3 interacting methods of measurement allow minimum tripping times after busbar faults and ensure maximum stability in case of large short-circuit currents
- The integrated circuit-breaker failure protection (CBFP) detects circuit-breaker faults in case of a busbar short circuit and provides a trip signal for the circuit breaker at the line end. The adjacent busbar trips if a circuit breaker in the bus coupler fails.
- Expensive monitoring of current-transformer circuits, measured-value acquisition and processing, and trip circuits to avoid overfunction and underfunction of the protection and effort reduction for routine testing.
- Various control possibilities, such as bay out of order, acquisition blocking from disconnectors and circuit breakers, blocking of protection zones, or circuit-breaker failure protection make the adaptation to operationally-caused special states of your plant easier.
- 1/3-pole or 3-pole circuit-breaker failure protection using the integrated disconnector image for tripping all circuit breakers of the busbar section affected
- End-fault protection for the protection of the section between circuit breaker and current transformer for feeders and bus couplers

# SIPROTEC 5 Devices and Fields of Application

## Busbar Protection – SIPROTEC 7SS85

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- Direct tripping of protection zones through external signals
- Release of the tripping of a protection zone through additional external signals
- Release of tripping through additional, external phase-selective signals
- Cross stabilization as additional tripping release in 3-pole enclosed gas-insulated switchgear
- Bus coupler differential protection for fault clearing in couplers with 2 current transformers
- With distributed busbar protection, any feeder protection function can also be implemented using any modular SIPROTEC 5 device as the bay device.
- Extensive cybersecurity functionality, such as role-based access control (RBAC), logging of security-related events, signed firmware, or authenticated IEEE 802.1X network access

### Applications

The SIPROTEC 7SS85 busbar protection is the solution for the following plant layouts:

- Single busbars up to quintuple busbars with or without a transfer busbar
- Breaker-and-a-half layout
- Dual circuit breaker systems and one or 2 current transformer(s) per feeder
- Truck-type switchgear
- Systems with combined busbars (alternatively main/transfer busbar)
- H-bridge arrangement with bus coupler or disconnection
- Ring busbars

# SIPROTEC 5 Devices and Fields of Application

## Busbar Protection – SIPROTEC 7SS85

	Central Protection	Central Protection with IEC 61850 Compatible Distributed Process Connection	Distributed Protection
Significant features	9, A, B, C, D, E		F, G, H, J, K
Centralized process connection	yes	yes	no
Distributed process connection	no	yes	yes
Hybrid: central and distributed process connection	no	yes	no
Number of bars (max.)	3	3	6
3-phase current measuring points (max.)	20	20 / 24 (with EFP, without further backup protection function in 7SS85)	45
3-phase voltage measuring points	4	4 central and in the Merging Units	In the bay units
Number of busbar sections (max.)	6	6	20
Number couplers (max.)	6	6	20
Number reserve busbar (without measuring function) (max.)	3	3	12
Interoperable measured-value acquisition	yes (1/5A)	yes (IEC 61850-9-2, IEC 61869)	yes (IEC 61850-9-2, IEC 61869, 4000 Hz, 1 ASDU)
Backup protection function	20 x CBFP, 20 x EFP, 20 x definite-time overcurrent protection, 10 x Z<(transformer), 10 x overcurrent protection dir., 10 x V>, 10 x V<	24 x CBFP, 24 x EFP, 24 x definite-time overcurrent protection, 10 x Z<(transformer), 10 x overcurrent protection dir., 10 x V>, 10 x V< plus all protection functions of the individual merging unit	all protection functions of the individual bay unit
<b>Bay Units</b>			
Merging Units SIPROTEC 6MU85	no	yes	yes
SIPROTEC 5 protection device (modular)	no	yes	yes
Interoperable Merging Units according to IEC 61850 Rev. 2.1 (third-party devices)	no	yes	no
<b>Engineering of the protection functionality</b>			
DIGSI 5	yes	yes	yes
IEC 61850 system configurator	-	yes	yes/automated routing according to single-line editor

Table 2.15/1 Selection Table of the Matching Significant Features

2.15

Short description	Significant Features Centralized Protection					
	9	A	B	C	D	E
Main function	Busbar differential protection					Only Circuit-breaker failure protection
Busbar sections	1	2	2	6	6	6
Disconnecter image	No	No	Yes	No	Yes	Yes
Measuring points centralized, 3-phase (maximum)	20	20	20	20	20	20
or...						
Measuring points distributed, 3-phase (maximum)	24	24	24	24	24	24
Bays (maximum)	26	26	26	26	26	26
Bays (included in the basic scope) <sup>3</sup>	3	4	4	6	6	6
Recommended standard hardware variant centralized	V1	V2	V2	V3	V3	V3

<sup>3</sup> For further bays, you need function points.

# SIPROTEC 5 Devices and Fields of Application

## Busbar Protection – SIPROTEC 7SS85

Significant Features Centralized Protection						
Included measuring points 3-phase centralized	3	4	4	6	6	6
Related standard hardware variant distributed	V4	V4	V4	V4	V4	V4

**Table 2.15/2** Significant Features Centralized Protection

Significant Features Distributed Protection					
Short description	F	G	J	K	H
Main function	Busbar differential protection				Only Circuit-breaker failure protection
Busbar sections	6	20	6	20	20
Disconnecter image	No	No	Yes	Yes	Yes
Measuring points distributed, 3-phase (maximum)	45	45	45	45	45
Related standard hardware variant	V4	V4	V4	V4	V4

**Table 2.15/3** Significant Features Distributed Protection

The significant properties E and H *only circuit-breaker failure protection* are a special feature. Here, the main protection function is the Circuit-breaker failure protection. The device permits the implementation of an independent, complete backup protection for a circuit-breaker failure in the station.

### Configuration and Parameterization

The busbar protection is configured and engineered graphically using the primary topology of your plant. That is where you add the SIPROTEC 7SS85 and other devices. Use drag and drop to add the required functions from the DIGSI 5 library to the devices. Then, connect the primary elements of the single-line diagram (busbars, current transformers, disconnectors, circuit breakers) to the function blocks of the devices. The primary topology is now connected to the secondary equipment. This ensures a flexible adaptation to changes and extensions over the entire lifecycle of the plant. You adapt the protection to the various operating states and requirements by means of parameterization.

Online visualization for commissioning, operation, and analysis of important information occurs in the same single-line diagram. The switch positions are shown in addition to the measured values of the feeders and the protection ranges. Additionally, you get information about special operating states, for example in the case of *Bay out of service* or reduced selectivity of protection, for example, with a direct busbar coupler via disconnector switches (busbar shunt by disconnectors).

### Disconnecter Image

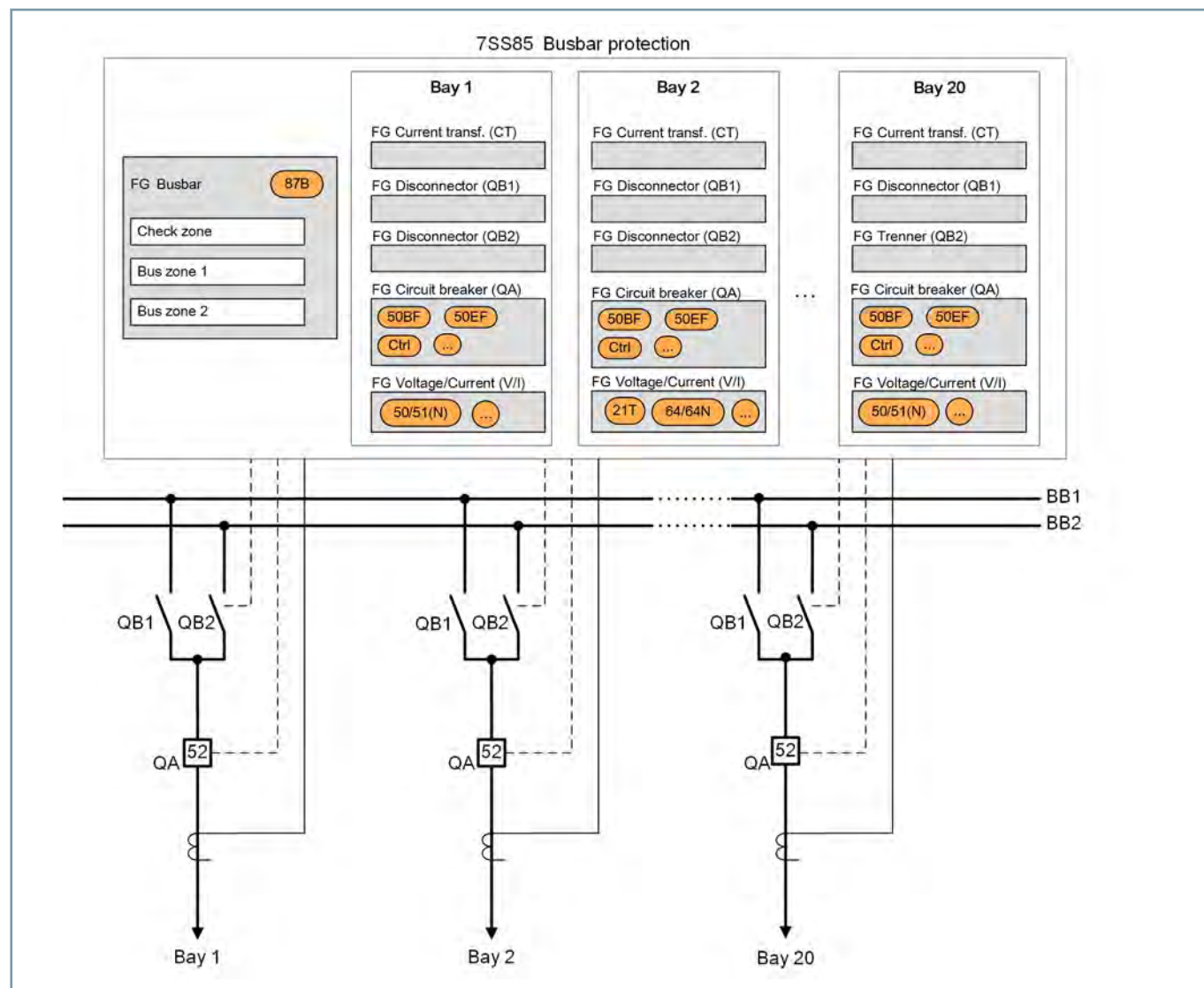
With the integrated SIPROTEC 7SS85 disconnector image, the bay currents are assigned dynamically to the protection zones based on the disconnector-switch position. In case of a failure, selective tripping of the feeders and bus couplers involved takes place by way of the disconnector image. This ensures the availability of the healthy system part for network operation.

SIPROTEC 7SS85 in general has a check zone that is independent of the disconnector. This ensures system stability, even in case of an incorrect assignment of the currents.

This function is characterized by the following product features:

- Processing of up to 20 or 24 current measuring points and 6 busbar sections in the centralized SIPROTEC 7SS85
- Processing of up to 45 current measuring points and 20 busbar sections in the distributed busbar protection
- Disconnector runtime and position monitoring
- Due to the program assignment Disconnector NOT off = Disconnector on, calibrated disconnector auxiliary contacts are not necessary.
- Storage of the disconnector-switch positions in case of an auxiliary-voltage failure
- Convenient graphical project engineering using DIGSI 5
- Dynamic graphical visualization using DIGSI 5 in online mode

### Application Examples



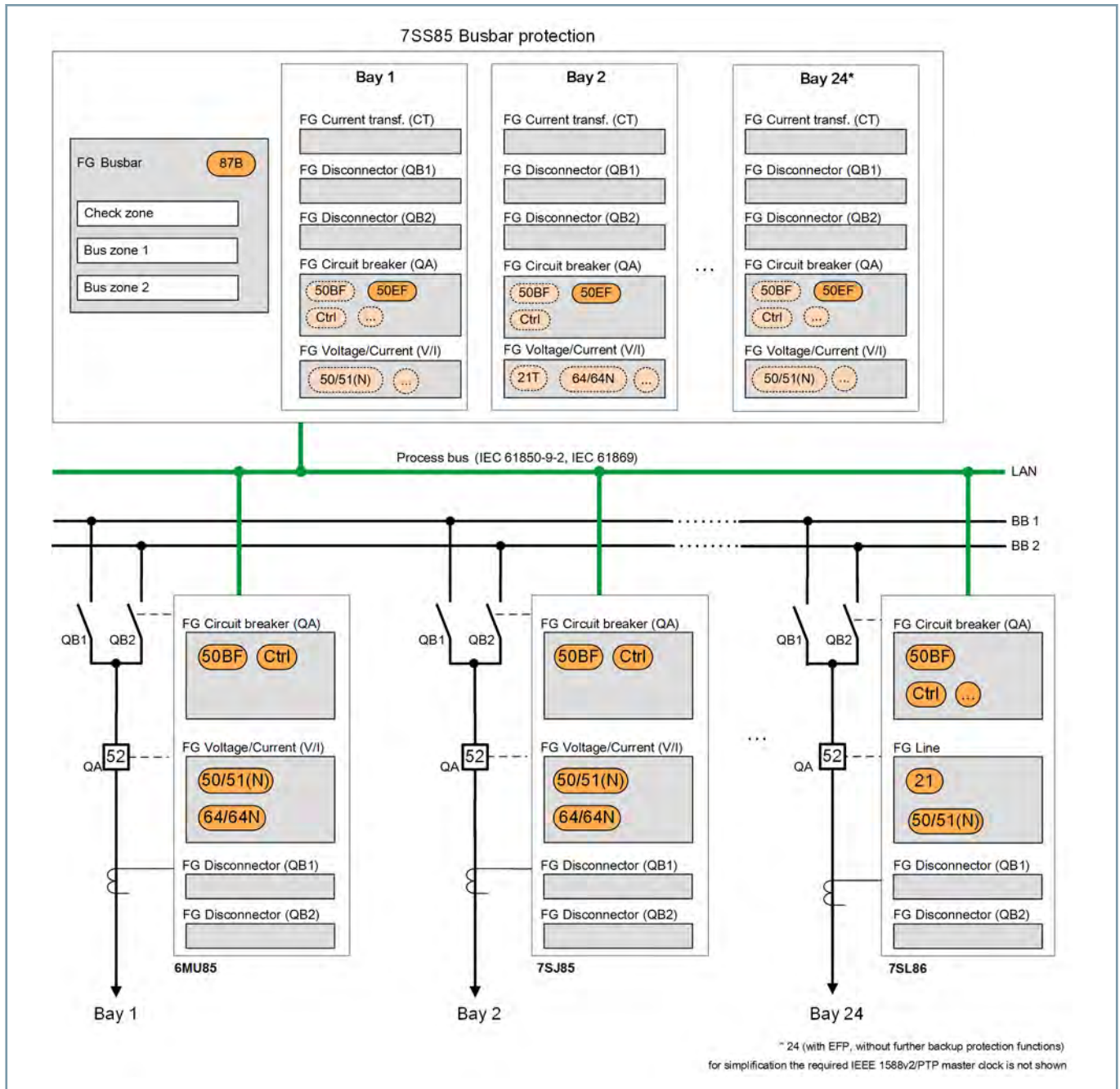
[dw\_01\_config\_cent-busbar, 1, en\_US]

Figure 2.15/3 Centralized Busbar Protection



# SIPROTEC 5 Devices and Fields of Application

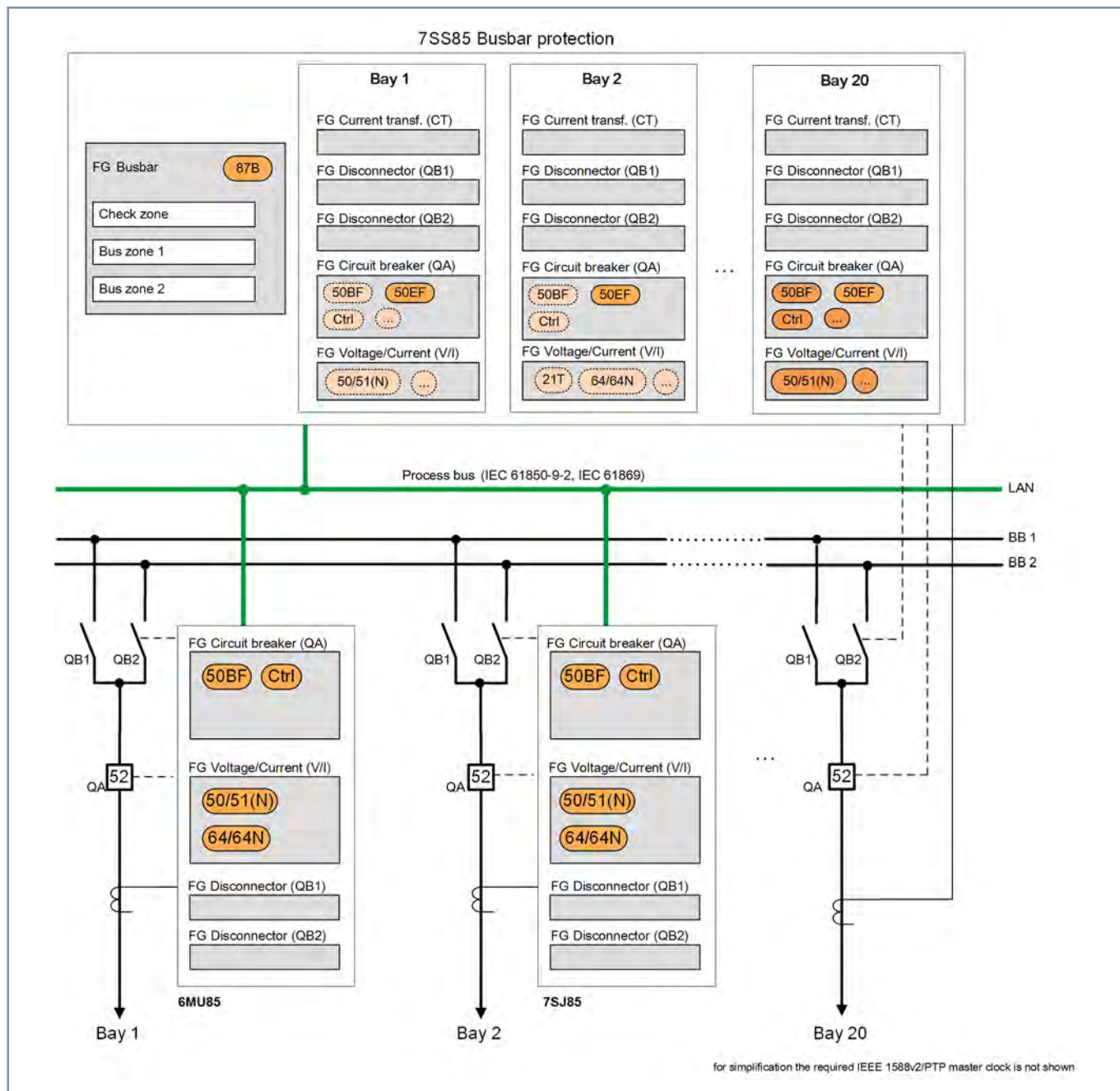
## Busbar Protection – SIPROTEC 7SS85



[dw\_02\_config\_decentr-busbar\_IEC61850\_1\_en\_US]

Figure 2.15/4 Centralized Busbar Protection using IEC 61850 Compatible Distributed Process Connection

2.15



[dw\_03\_config\_decentr-busbar\_hybrid, 1, en\_US]

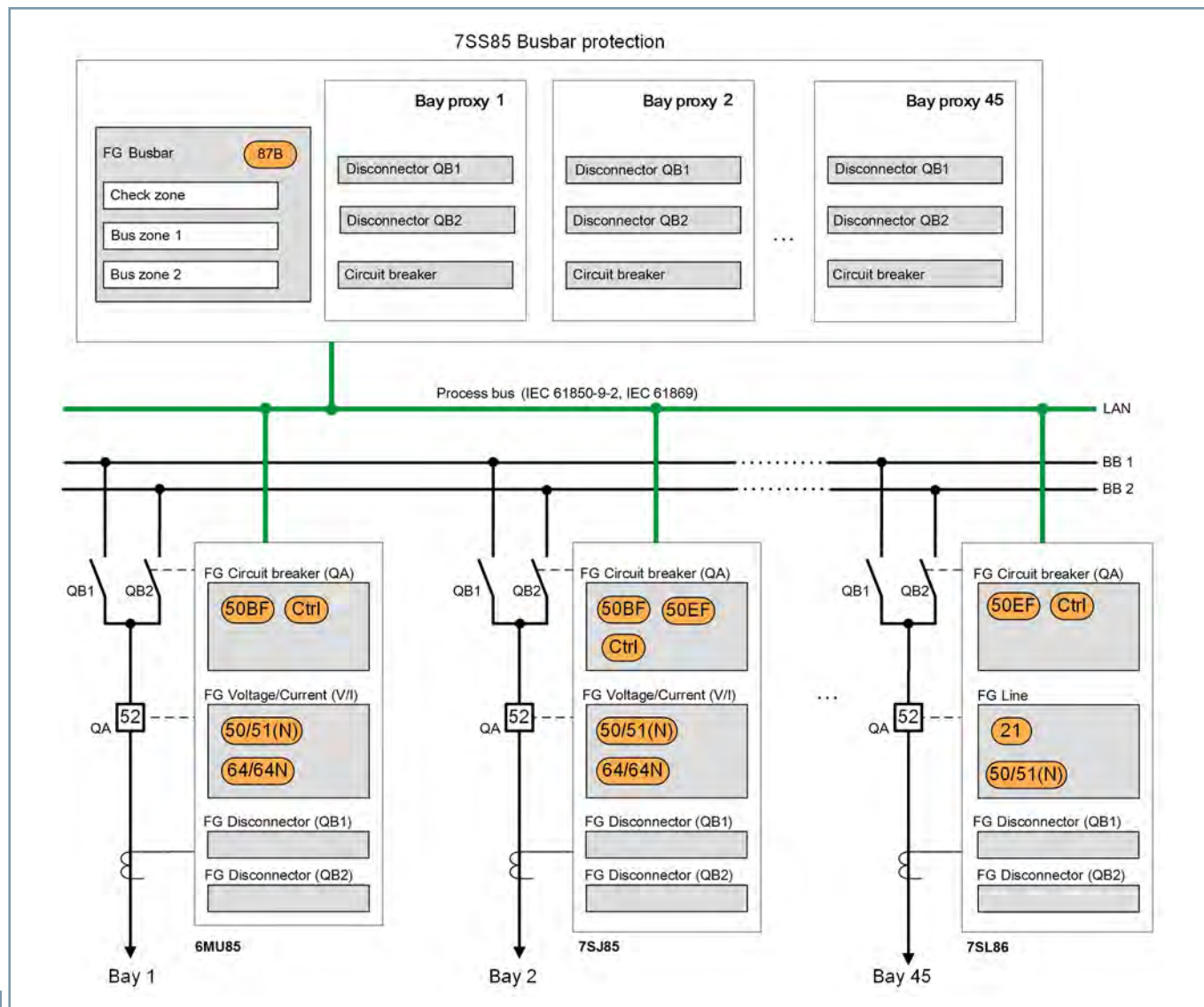
Figure 2.15/5 Centralized Busbar Protection using Hybrid Process Connection

2.15



# SIPROTEC 5 Devices and Fields of Application

## Busbar Protection – SIPROTEC 7SS85



2.15

[dw\_04\_config\_decentr-busbar, 1, en\_US]

Figure 2.15/6 Distributed Busbar Protection

# SIPROTEC 5 Devices and Fields of Application

## Busbar Protection – SIPROTEC 7SS85

ANSI	Function	Abbr.	Available	Application Templates
				1
	Protection functions for 3-pole tripping	3-pole	■	
	Protection functions for 1-pole tripping	1-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	■	
21T	Impedance protection for transformers	Z<	■	
27	Undervoltage protection: "3-phase" or "positive-sequence system V1" or "universal Vx"	V<	■	
38	Temperature supervision	θ>	■	
47	Overvoltage protection, negative-sequence system	V2>	■	
50/51 TD	Overcurrent protection, phases	I>	■	
50N/ 51N TD	Overcurrent protection, ground	IN>	■	
50BF	Circuit-breaker failure protection, 3-pole	CBFP	■	
50BF	Circuit-breaker failure protection 1-pole/3-pole	CBFP	■	
50BF	Inherent circuit-breaker failure protection	CBFP	■	
50EF	End-Fault Protection		■	
59, 59N	Overvoltage protection: "3-phase" or "zero-sequence system V0" or "positive-sequence system V1" or "universal Vx"	V>	■	
67	Directional overcurrent protection, phases	I>, ∠(V, I)	■	
67N	Directional overcurrent protection, ground	IN>, ∠(V, I)	■	
74TC	Trip-circuit supervision		■	
81	Frequency protection: "f>" or "f<" or "df/dt"	f<>; df/dt<>	■	
87B	Busbar differential protection	ΔI	■	
87B	Bus coupler differential protection	ΔI	■	
	Bay		■	
	Cross Stabilization		■	
86	Lockout		■	
	Broken-wire detection for differential protection		■	
87 STUB	Stub fault differential protection (for breaker-and-a-half layouts)		■	
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		■	

# SIPROTEC 5 Devices and Fields of Application

## Busbar Protection – SIPROTEC 7SS85





ANSI	Function	Abbr.	Available	Application Templates
				1
	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		■	
	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
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 2.15/4** SIPROTEC 7SS85 – Functions, Application Templates

(1) Standard busbar

# SIPROTEC 5 Devices and Fields of Application


## Busbar Protection – SIPROTEC 7SS85

Standard Variants for SIPROTEC 7SS85		
V1	1/2, 15 BI, 13 BO, 12 I	
	Housing width 1/2 x 19" 15 binary inputs 13 binary outputs (1 life contact, 2 standard, 10 fast), 12 current transformers Contains the following modules: Base module with PS201 and IO203 Expansion module IO201	
V2	1/2, 11 BI, 11 BO, 16 I	
	Housing width 1/2 x 19" 11 binary inputs 11 binary outputs (1 life contact, 2 standard, 8 fast) 16 current transformers Contains the following modules: base module with PS201 and IO203 Expansion module IO203	
V3	2/3, 15 BI, 15 BO, 24 I	
	Housing width 2/3 x 19" 15 binary inputs 15 binary outputs (1 life contact, 2 standard, 12 fast) 24 current transformers Contains the following modules: base module with PS201 and IO203 2 expansion modules IO203	
V4	1/3, 19 BI, 11 BO	
	Housing width 1/3 x 19" 15 binary inputs 11 binary outputs (1 life contact, 10 standard, 0 fast) 0 current transformers 1 communication module ETH_BD_2FO	

**Table 2.15/5** Standard Variants for SIPROTEC 7SS85

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

2.15

Standard Variant for SIPROTEC 6MU85		
AJ1	1/3, 11 BI, 9 BO, 4 I	
	Housing width 1/3 11 binary inputs 9 binary outputs (1 life contact, 2 standard, 6 fast) 4 current transformers Contains the following modules: base module with PS201 and IO201 1 communication module ETH-BD-2FO	

**Table 2.15/6** Standard Variant for Decentralized Busbar Protection SIPROTEC 6MU85