Description

The SIPROTEC 7UT85 transformer differential protection has been designed specifically for the protection of two-winding transformers (2 sides). It is the main protection for the transformer and contains many other protection and monitoring functions. The additional protection functions can also be used as backup protection for protected downstream objects (such as cables, line). In this process, you are also supported by the modular expandability of the hardware. With its modular structure, flexibility and the powerful DIGSI 5 engineering tool, SIPROTEC 7UT85 offers future-oriented system solutions with high investment security and low operating costs.

Main function	1 differential protection function (standard or auto transformer) with additional stabilization; up to 2 ground fault differential protection functions
Usable measuring points	5 x 3-phase current measuring points, 3 x 1-phase current measuring points, 3 x 3-phase voltage measuring points; expandable to 3 sides
Inputs and outputs	2 predefined standard variants with 8 current transformers 7 to 19 binary inputs, 7 to 23 binary outputs
Hardware flexibility	Flexibly adjustable and expandable I/O quantity structure within the scope of the SIPROTEC 5 modular system
Housing width	1/3 × 19" to 2/1 × 19"

Benefits

- Safety due to powerful protection functions
- Data security and transparency over the entire lifecycle of the plant save time and money
- Purposeful and simple operation of the devices and software thanks to user-friendly design
- Increased reliability and quality of the engineering process
- Consistent implementation of high safety and security mechanisms
- Powerful communication components ensure safe and effective solutions
- Full compatibility between IEC 61850 Editions 1 and 2
- Highly available Ethernet communication due to integrated Ethernet redundancy protocols PRP and HSR.

Functions

DIGSI 5 permits all functions to be configured and combined as required.

- Transformer differential protection for two-winding transformers with versatile, additional protection functions; expandable to 3 windings
- Transformer differential protection for phase-angle regulating transformers of the single core type and special transformers
- Universal usability of the permissible measuring points
- Applicable from average up to extra-high voltage
- Protection of standard power transformers, auto transformers and motors

[SIP5_GD_W3, 1, --_--]

Figure 2.11/5 SIPROTEC 7UT85 transformer differential protection (1/3 device = standard variant O1)

- Typical properties of a transformer differential protection such as flexible adaptation to the transformer vector group, control of inrush and overexcitation processes, safe behavior in the case of current-transformer saturation with different degrees of saturation
- Adaptive adaptation of the operate curve to the transformer tap position
- Increased sensitivity with near-neutral-point ground faults through a separate ground fault differential protection
- Additional current and voltage inputs can be supplements for standard protection functions, such as overcurrent, voltage frequency, etc.
- Arc protection
- Voltage controller function ANSI 90V for two-winding transformers, three-winding transformers and grid coupling transformers
- Graphical logic editor to create powerful automation functions in the device
- Up to 4 pluggable communication modules, usable for different and redundant protocols (IEC 61850, IEC 60870-5-103, IEC 60870-5-104, DNP3 (serial and TCP), Modbus TCP)
- Redundancy protocols PRP and HSR
- Cyber security in accordance with NERC CIP and BDWE Whitepaper requirements
- Secure serial protection data communication, also over great distances and all available physical media (fiber-optic cable, 2-wire connections and communication networks)
- Capturing operational measured variables and protection function measured values to evaluate the plant state, to support commissioning, and to analyze faults
- Phasor measurement unit (PMU) for synchrophasor measured values and IEEE C37.118 protocol
- Powerful 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
- Flexibly adjustable I/O quantity structure within the scope of the SIPROTEC 5 modular system

Applications

Application templates are available in DIGSI for standard applications. They contain basic configurations and default settings. These can be used directly or as a template for application-related adaptation. The available measuring points make varied applications possible. Prior to ordering a device, please configure the application with DIGSI. Table "Functions and application templates" shows the functional scope of the device. Use the configurator to determine the necessary function points.

Application examples

Two-winding transformer basis (***Figure 2.11***/6)

- Differential protection
- Overload protection, backup protection for the downstream electrical power system

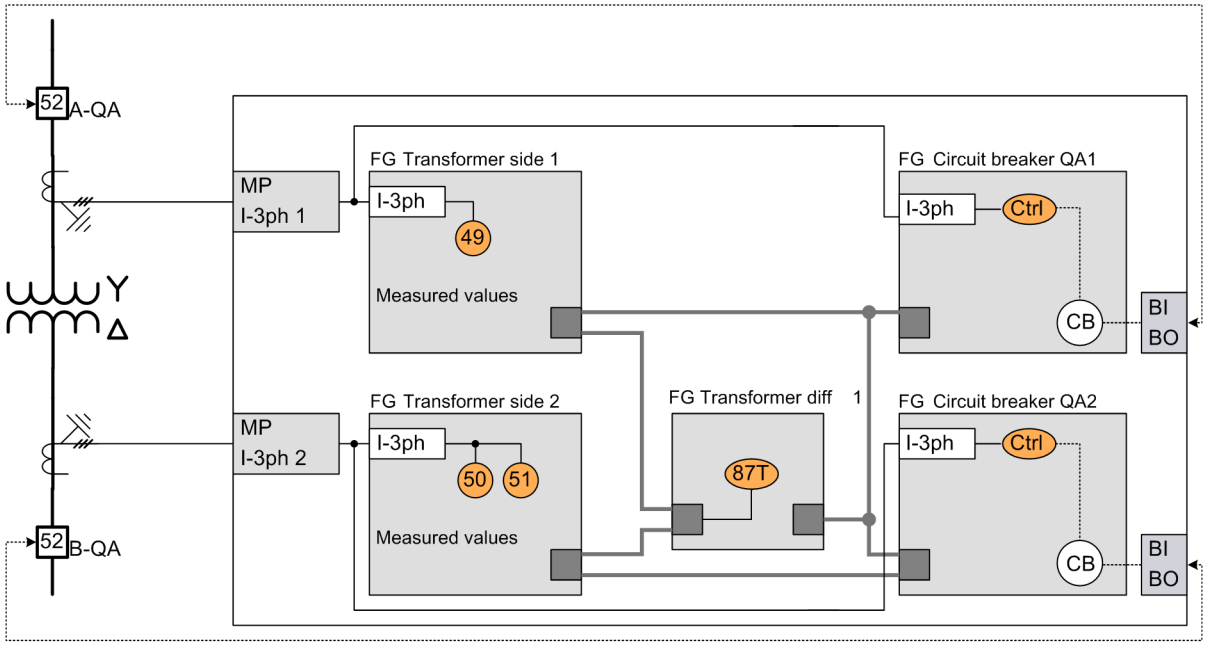
Two-winding transformer with restricted ground-fault differential protection (REF) (***Figure 2.11***/7)

- Differential protection
- Ground fault differential protection on the star side
- Overload protection, backup protection for the downstream electrical power system
- Circuit-breaker failure protection

Two-winding transformer in breaker-and-a-half application (***Figure 2.11***/8)

- Differential protection
- Ground fault differential protection on the star side
- Overload protection, backup protection for the downstream electrical power system
- Circuit-breaker failure protection.

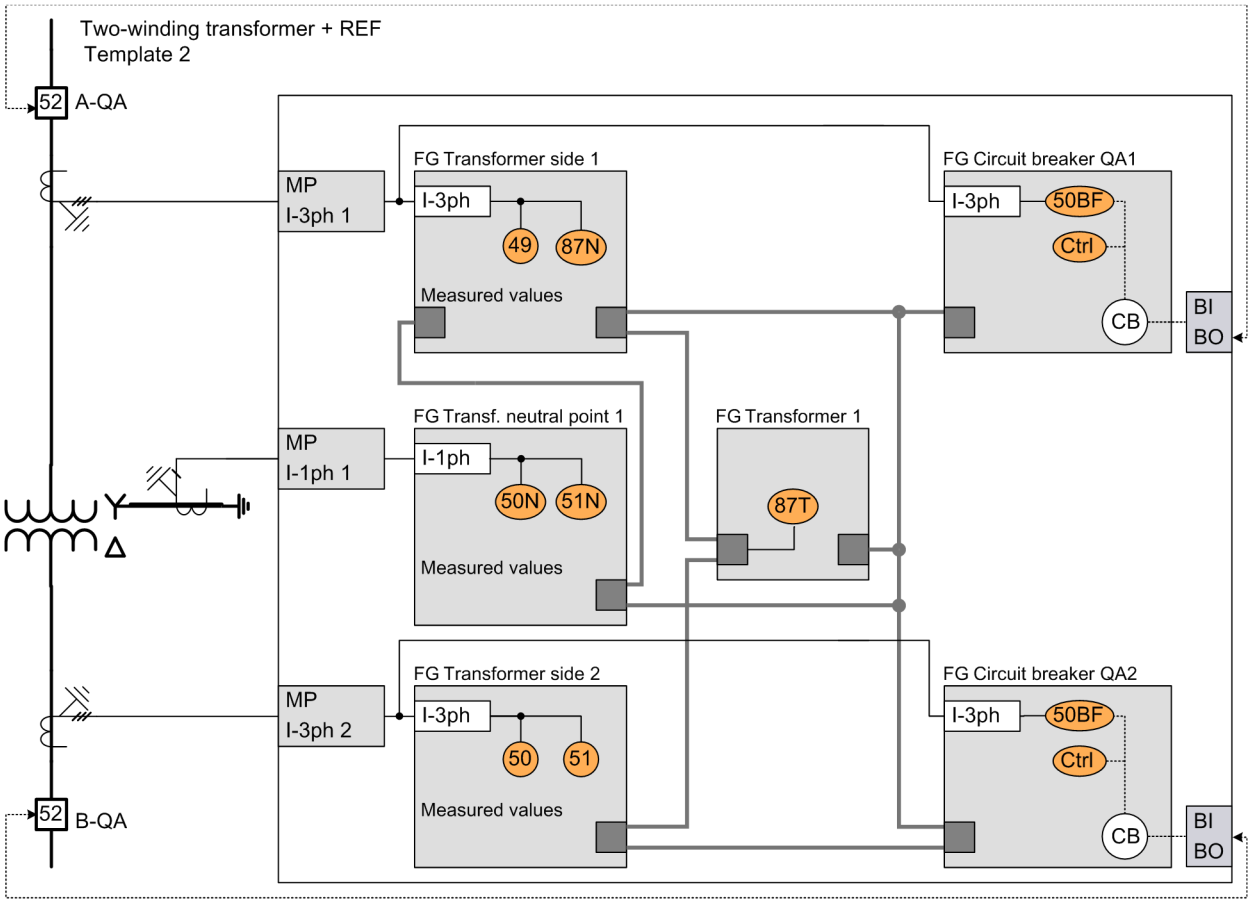
The ***Figure 2.11***/6 shows the typical structure of an application template, the measuring points used, the function groups used, their internal interconnection, and the predefined functions. The example shows the two-winding transformer with ground fault differential protection.



FG	Function group	49	Overload protection
MP	Measuring point	50/51	Overcurrent protection
BI	Binary input	87T	Transformer differential protection
BO	Binary output		
QA/CB	Circuit breaker		
Ctrl	Control		

[dw_two-winding-temp_01, 2, en_US]

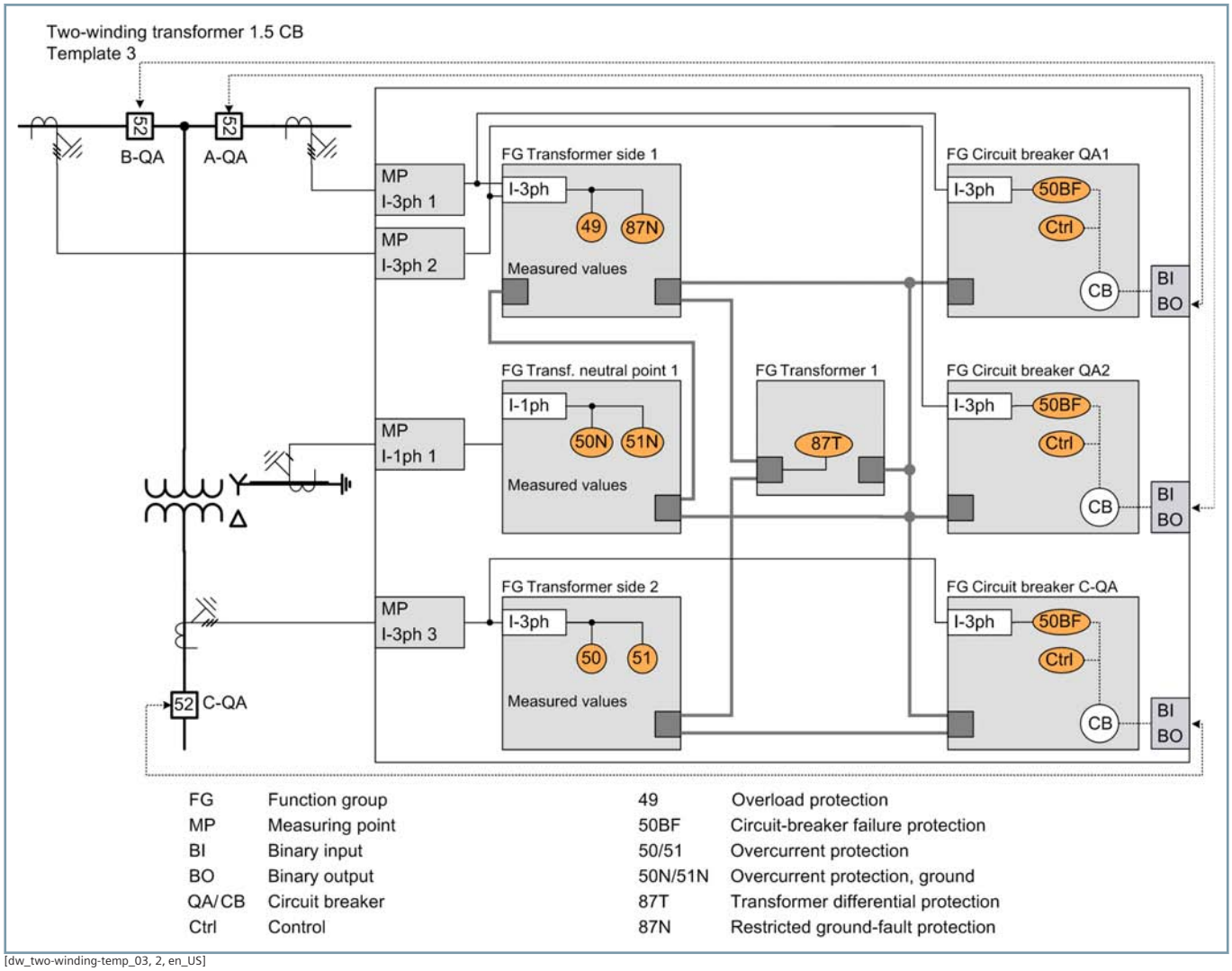
Figure 2.11/6 Application example: Protection of a Two-Winding Transformer



FG	Function group	49	Overload protection
MP	Measuring point	50BF	Circuit-breaker failure protection
BI	Binary input	50/51	Overcurrent protection
BO	Binary output	50N/51N	Overcurrent protection, ground
QA/CB	Circuit breaker	87T	Differential protection
Ctrl	Control	87N	Restricted ground-fault protection

[dw_two-winding-temp_02, 2, en_US]

Figure 2.11/7 Application example: Protection of a two-winding transformer with ground fault differential protection



[dw_two-winding-temp_03, 2, en_US]

Figure 2.11/8 Application example: Protection of a two-winding transformer in breaker-and-a-half layout

Functions and application templates

ANSI	Functions	Abbr.	Available	Template				
				1	2	3	4	5
	Hardware quantity structure expandable	I/O	■					
21/21N	Distance protection	Z<, V< /I>/∠ (V,I)	■					
21T	Impedance protection for transformers	Z<	■					
87L	Line differential protection for 2 line ends	ΔI	■					
24	Overexcitation protection	V/f	■					
25	Synchrocheck, synchronizing function	Sync	■					
27	Undervoltage protection: "3-phase" or "pos.seq. V1" or "universal Vx"	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 overcurrent protection	I2>	■					■
46	Unbalanced-load protection (thermal)	$I2^2$ t>	■					
47	Overvoltage protection, negative-sequence system	V2>	■					
47	Overvoltage protection, negative-sequence- / positive-sequence system	V2/V1>	■					
49	Thermal overload protection	θ, I^2t	■	■	■	■	■	■
49H	Hot spot calculation	θh, I^2t	■					
50/51 TD	Overcurrent protection, phases	I>	■	■	■	■	■	■
50N/ 51N TD	Overcurrent protection, ground	IN>	■		■			
50HS	High speed instantaneous overcurrent protection	I>>>	■					
	Instantaneous tripping at switch onto fault	SOTF	■					
50N/ 51N TD	Overcurrent protection, 1-phase	IN>	■			■		
50Ns/ 51Ns	Sensitive ground-current protection for systems with resonant or isolated neutral	INs>	■					
	Intermittent ground fault protection	Iie>	■					
50BF	Circuit-breaker failure protection, 3-pole	CBFP	■		■	■	■	■
50RS	Circuit-breaker restrike protection	CBRS	■					
51V	Voltage dependent overcurrent protection	t=f(I,V)	■					
59, 59N	Overvoltage protection: "3-phase" or "zero seq. V0" or "pos.seq. V1" or "universal Vx"	V>	■				■	■
59	Overvoltage protection: "3-phase" or "pos.seq. V1" or "universal Vx"	V>	■					
67	Directional overcurrent protection, phases	I>, ∠(V,I)	■					
67N	Directional overcurrent protection for ground faults in grounded systems	IN>, ∠(V,I)	■					
67N	Directional overcurrent protection, ground	IN>, ∠(V,I)	■					■
67Ns	Dir. sensitive ground-fault detection for systems with resonant or isolated neutral incl. a) 3I0>, b) V0>, c) Cos-/SinPhi, d) Transient fct., e) Phi(V,I), f) admittance		■					
	Directional intermittent ground fault protection	Iie dir>	■					
68	Power-swing blocking	ΔZ/Δt	■					
74TC	Trip circuit supervision	TCS	■	■	■	■	■	
79	Automatic reclosing, 3-pole	AR	■					
81	Frequency protection: "f>" or "f<" or "df/dt"	f>,<; df/dt>,<	■					■
85/21	Teleprotection for distance protection		■					
85/27	Weak or no infeed: Echo and Tripping	WI	■					

ANSI	Functions	Abbr.	Available	Template				
				1	2	3	4	5
85/67N	Teleprotection for directional ground fault protection		■					
86	Lockout		■	■	■	■	■	
87T	Transformer differential protection	ΔI	■	■	■	■	■	
87T	Transformer differential protection for phase angle regulating transformer (single core)	ΔI	■					
87T	Transformer differential protection for special transformers	ΔI	■					
87T Node	Differential protection (Node protection for Auto-transformer)	ΔI Node	■					
87N T	Restricted ground-fault protection	ΔIN	■		■	■		
87M	Motor differential protection	ΔI	■					■
87G	Generator differential protection	ΔI	■					
	Option for line differential protection:charging-current compensation	ΔI	■					
87 STUB	STUB Differential protection (for one-and-half circuit-breaker applications)		■					
90V	Automatic voltage control for 2 winding transformer		■				■	
90V	Automatic voltage control for 3 winding transformer		■					
90V	Automatic voltage control for grid coupling transformer		■					
FL	Fault locator, single-ended measurement	FL-one	■					
PMU	Synchrophasor measurement (1 PMU can be used for max. 8 voltages and 8 currents)	PMU	■					
AFD	Arc-protection (only with plug-in module ARC-CD-3FO)		■					
	Measured values, standard		■	■	■	■	■	■
	Measured values, extended: Min, Max, Avg		■					
	Switching statistic counters		■	■	■		■	
	Circuit breaker wear monitoring	ΣIx, I²t, 2P	■					
	CFC (Standard, Control)		■	■	■	■	■	■
	CFC arithmetic		■					
	Switching sequences function		■					
	Inrush current detection		■	■	■	■	■	
	External trip initiation		■			■		
	Control		■	■	■	■	■	■
	Fault recording of analog and binary signals		■	■	■	■	■	■
	Monitoring and supervision		■	■	■	■	■	■
	Protection interface, serial		■					
	Circuit Breaker		■	■	■	■	■	■
	Disconnector		■					
	Transformer Side 7UT85		■					
Function-points class:				0	30	30	175	50
The configuration and function points for your application can be ascertained in the SIPROTEC 5 order configurator under: *www.siemens.com/siprotec*								

Table 2.11/2 SIPROTEC 7UT85 - Functions and application templates

1 Two winding transformer basic (87T)

2 Two winding transformer (87T, 50BF, 87N)

3 Two winding transformer 1,5CB (87T, 50BF, 87N)

4 Two winding transformer (87T, 50BF, 87N, 90V)

5 Motor DIFF (87M, 50BF, 27, 81, 46, 49)