Numerical Protective Relays Training System
8108680 (8010-L0)

FESTO

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General Description

Protective relaying provides detection of abnormal operating conditions in electrical systems and is needed in order to act quickly to protect circuits, equipment, and the general public. The theoretical background, as well as practical application, of these protective devices and their protection functions are an important part of the education of power systems for electrical engineers.

Power-utility-grade equipment, Siemens' newest generation the SIPROTEC 5 series, is used in this innovative teaching approach. Example scenarios are created in the accompanying professional programming tool, DIGSI 5, which allows users to create different setups and simulate possible faults using the built-in relay testing unit. The response of the relay is then analyzed with the relay display and the fault record. This customizable solution allows perfect alignment for individual teaching needs.

The available range of relays and manuals provide coverage of these general topics:

- Overcurrent/Overload Protection
- Directional Protection
- Differential Protection
- Distance Protection

Features & Benefits

- Self-contained devices with internal testing capabilities not requiring external devices to create faults
- Power-utility grade equipment with Siemens' newest generation of the SIPROTEC 5 Series
- Professionnal programming tool DIGSI 5 to create and test different scenarios
- Complete curriculum with all the necessary theory and manipulations to cover these comprehensive topics
- Possibility to cover all dedicated workbooks on numerical relay protection with only two units

List of Equipment

Qty	Description	Model number
1	_____	589887 (52173-00)
1	_____	589888 (52173-10)
1	_____	589889 (52174-00)
1	_____	589890 (52174-10)
1	_____	590085 (52175-00)
1	_____	590086 (52175-10)
1	_____	593880 (52176-00)
1	_____	593881 (52176-10)
1	Numerical Distance Relay _____	589062 (3813-00)
1	Numerical Differential Protective Relay _____	589891 (3819-00)

List of Manuals

Description	Manual number
Overcurrent and Overload Protection Using Protective Relays (Workbook) _____	589887 (52173-00)
Overcurrent and Overload Protection Using Protective Relays (Workbook (Instructor)) _____	589888 (52173-10)
Directional Protection (Workbook) _____	589889 (52174-00)
Directional Protection (Workbook (Instructor)) _____	589890 (52174-10)
Differential Protection (Workbook) _____	590085 (52175-00)

Description	Manual number
Differential Protection (Workbook (Instructor))	590086 (52175-10)
Numerical Protective Relays (User Guide)	590108 (52766-E0)
Distance Protection (Workbook)	593880 (52176-00)
Distance Protection (Workbook (Instructor))	593881 (52176-10)
Numerische Schutzrelais (User Guide)	593908 (52766-EG)
Relais de protection numériques (User Guide)	593909 (52766-E1)
Relés numéricos de protección (User Guide)	593910 (52766-E2)

Table of Contents of the Manual(s)

Overcurrent and Overload Protection Using Protective Relays (Workbook) (589887 (52173-00))
- 1 Overcurrent Protection
- 2 Overcurrent and Overload Protection of AC Machines and Power Transformers
- 3 Overcurrent Protection of Radial Feeders

Directional Protection (Workbook) (589889 (52174-00))
- 1 Directional Overcurrent Protection
- 2 Directional Comparison Protection
- 3 Directional Power Protection

Differential Protection (Workbook) (590085 (52175-00))
- 1 Fundamentals of Differential Protection
- 2 Percentage Restrained Differential Protection

Distance Protection (Workbook) (593880 (52176-00))
- 1 Distance Relay Impedance Characteristic
- 2 Conventional Time-Stepped Distance Protection
- 3 Distance Protection Using Communication-Assisted Tripping Schemes

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	License for DIGSI 5 Premium Software	779959 (52286-00) [1]

System Specifications

Parameter	Value
Physical Characteristics	
Intended Location	On a table able to support the weight of the workstation and installed equipment
Dimensions (H x W x D)	890 x 935 x 465 mm (35.0 x 36.8 x 18.3 in)
Net Weight	X kg (X lb)

[1] Required for non-educational customers only. For educational customer, the software is provided for free with a 10 users license.

Equipment Description

Numerical Distance Relay
589062 (3813-00)

The Numerical Distance Relay is a power-utility grade, numerical protective relay (Siemens SIPROTEC 5 series) mounted in a table-top enclosure. The relay can perform the protection functions listed below.

Phase distance (21) protection
Ground distance (21N) protection
Directional phase overcurrent (67) protection
Directional ground overcurrent (67N) protection
Directional power (32) protection
Instantaneous phase overcurrent (50) protection
Instantaneous ground overcurrent (50N) protection
Phase overcurrent (51) protection
Ground overcurrent (51N) protection
Machine or transformer thermal (49) protection

The Numerical Distance Relay can also perform several other standard protection functions (ANSI 27, 37, 38, 46, 59, 68, 74, 81, 86, and 87N).

The front panel of the relay features a display that can provide information about the relay protection functions, indicate numerous currently measured values such as the line voltages, line currents, phase power, three-phase power, and power factor, and show information about trip events that have been recorded. A keypad, also on the front panel of the relay, allows users to select the information displayed. The front panel of the relay also features a set of 16 LEDs that allows quick monitoring of the status of various relay functions.

Relay programming (e.g., protection function selection, function settings) is achieved via the Siemens DIGSI 5 software. This software is designed to be run from a personal computer with a Microsoft® Windows™ operating system. Communication between the computer and the relay is through a USB port or an Ethernet port. Relay function settings can also be performed using the keypad and display located on the front panel of the relay. Once programmed, the Numerical Distance Relay can be tested using a built-in relay testing unit to ensure it is programmed to operate as expected. This eliminates the need for users to purchase a costly external relay tester to perform relay testing. The built-in relay testing unit is operated using the DIGSI 5 software.

Access to the voltage and current inputs of the Numerical Distance Relay is through a removable panel located at the back of the relay enclosure. Access to the relay Ethernet port, binary inputs, and binary outputs (e.g., trip contacts) is also through this removable panel. The Numerical Distance Relay is powered via an ac power inlet mounted on the front of the relay enclosure. A variant of the Numerical Distance Relay with safety jacks and connectors mounted on the front panel to provide access to all relay inputs, outputs, and ports is also available. See the Numerical Distance Relay, Model 3813-A.

Courseware

Different courses are available to perform exercises using the Numerical Distance Relay. Each course consists of a student manual providing comprehensive theory presentations, guided, easy-to-understand lab procedures, and review questions. Each course also comprises an instructor guide that includes both the content of the student manuals as well as the results and answers to questions.

The following table indicates which courses are available for each numerical protective relay.

Numerical protection relay	Available courses (each including a student manual and an instructor guide)			
	Overcurrent and Overload Protection Using Protective Relays Manual 52173	Directional Protection Manual 52174	Differential Protection Manual 52175	Distance Protection Manual 52176
3812	X	X		
3813	X	X		X
3819	X		X	

List of Manuals

Description	Manual number
Numerical Protective Relays (User Guide)	590108 (52766-E0)
Numerische Schutzrelais (User Guide)	593908 (52766-EG)
Relais de protection numériques (User Guide)	593909 (52766-E1)
Relés numéricos de protección (User Guide)	593910 (52766-E2)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	License for DIGSI 5 Premium Software	779959 (52286-00) [2]

Optional Manual(s)

Qty	Description	Model number
1	Overcurrent and Overload Protection Using Protective Relays (Workbook)	589887 (52173-00)
1	Overcurrent and Overload Protection Using Protective Relays (Workbook (Instructor))	589888 (52173-10)
1	Directional Protection (Workbook)	589889 (52174-00)
1	Directional Protection (Workbook (Instructor))	589890 (52174-10)
1	Distance Protection (Workbook)	593880 (52176-00)
1	Distance Protection (Workbook (Instructor))	593881 (52176-10)

Specifications

Parameter	Value
Relay Type	Siemens 7SA82
Power Requirements	
Voltage	100-240 V
Apparent Power	35 VA
Frequency	50/60 Hz
Input	IEC C14 input on the front panel
Protection	6 A circuit breaker
Computer Interface	
Connection	RJ45 EtherNet port on the front panel
Software	DIGSI 5 Software included, free license for educational institutions obtainable from Siemens via application
Physical Characteristics	
Intended Location	On a work surface able to support the weight of the equipment, or on a Festo-approved A4 workstation or equivalent
Dimensions (H x W x D)	295 x 260 x 240 mm (11.61 x 10.24 x 9.45 in)

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[2] This license is intended only for the non-educational customers. For educational customer, the software is provided for free with a 10 users license. No need to add this additional part number in the order.

Parameter	Value
Net Weight	7.08 kg (15.6 lb)

Numerical Differential Protective Relay
589891 (3819-00)

The Numerical Differential Protective Relay is a power-utility grade, numerical protective relay (Siemens SIPROTEC 5 series) mounted in a table-top enclosure. The relay can perform the protection functions listed below.

Transformer differential (87T) protection
Instantaneous phase overcurrent (50) protection
Instantaneous ground overcurrent (50N) protection
Phase overcurrent (51) protection
Ground overcurrent (51N) protection
Machine or transformer thermal (49) protection

The Numerical Differential Protective Relay can also perform several other standard protection functions (ANSI 37, 38, 46, 74, 86, 87N, and 87M).

The front panel of the relay features a display that can provide information about the relay protection functions, indicate currently measured values of the transformer winding currents, and show information about trip events that have been recorded. A keypad, also on the front panel of the relay, allows users to select the information displayed. The front panel of the relay also features a set of 16 LEDs that allows quick monitoring of the status of various relay functions.

Relay programming (e.g., protection function selection, function settings) is achieved via the Siemens DIGSI 5 software. This software is designed to be run from a personal computer with a Microsoft® Windows™ operating system. Communication between the computer and the relay is through a USB port or an Ethernet port. Relay function settings can also be performed using the keypad and display located on the front panel of the relay. Once programmed, the Numerical Differential Protective Relay can be tested using a built-in relay testing unit to ensure it is programmed to operate as expected. This eliminates the need for users to purchase a costly external relay tester to perform relay testing. The built-in relay testing unit is operated using the DIGSI 5 software.

Access to the current inputs of the Numerical Differential Protective Relay is through a removable panel located at the back of the relay enclosure. Access to the relay Ethernet port, binary inputs, and binary outputs (e.g., trip contacts) is also through this removable panel. The Numerical Differential Protective Relay is powered via an ac power inlet mounted on the front of the relay enclosure. A variant of the Numerical Differential Protective Relay with safety jacks and connectors mounted on the front panel to provide access to all relay inputs, outputs, and ports is also available. See the Numerical Differential Protective Relay, Model 3819-A.

Courseware

Different courses are available to perform exercises using the Numerical Differential Protective Relay. Each course consists of a student manual providing comprehensive theory presentations, guided, easy-to-understand lab procedures, and review questions. Each course also comprises an instructor guide that includes both the content of the student manuals as well as the results and answers to questions.

The following table indicates which courses are available for each numerical protective relay.

Numerical protection relay	Available courses (each including a student manual and an instructor guide)			
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3812	X	X		
3813	X	X		X
3819	X		X	

List of Manuals

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Optional Manual(s)

Qty	Description	Model number
1	Overcurrent and Overload Protection Using Protective Relays (Workbook)	589887 (52173-00)
1	Overcurrent and Overload Protection Using Protective Relays (Workbook (Instructor))	589888 (52173-10)
1	Differential Protection (Workbook)	590085 (52175-00)
1	Differential Protection (Workbook (Instructor))	590086 (52175-10)

Specifications

Parameter	Value
Relay Type	Siemens 7UT82
Power Requirements	
Voltage	100-240 V
Apparent Power	35 VA
Frequency	50/60 Hz
Input	IEC C14 input on the front panel
Protection	6 A circuit breaker
Computer Interface	
Connection	RJ45 EtherNet port on the front panel
Software	DIGSI 5 Software included, free license for educational institutions obtainable from Siemens via application
Physical Characteristics	
Intended Location	On a work surface able to support the weight of the equipment, or on a Festo-approved A4 workstation or equivalent
Dimensions (H x W x D)	295 x 260 x 240 mm (11.61 x 10.24 x 9.45 in)
Net Weight	7.08 kg (15.6 lb)

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