General differential protection RED 521*1.0

1MRK 505 031-BUS

Page 1
Revision: B
Issued: November 2003
Data subject to change without notice

Three-Phase Terminal

Three One-Phase Terminals

Features

- High speed general differential protection. Minimal operating time around 10 ms
- No interposing CTs are required, easy installation in existing stations for improved power network stability
- Numerical design with advanced features
- Three-phase version of the terminal with one measuring zone for up to six three-phase CT inputs
- One-phase version of the terminal with two measuring zones for up to eighteen CT inputs. Three terminals per protection scheme are usually required, one for each phase.
- Cost effective summation differential principle is available with one-phase version of the terminal
- General differential protection can be used for protection of:
  - meshed corners
  - T-connections
  - reactors
  - autotransformers
  - generators
  - motors
  - HV capacitor banks
  - Buses with up to six bays per protection zone (three-phase version)
  - Buses with up to eighteen bays per protection zone (one-phase version)
- Low CT requirement, only 2 milliseconds to saturation needed for correct operation
- Stability is ensured for through faults, even with heavy CT saturation, and a maximum remanence in the CT core during high-speed auto-reclosing
- Different CT ratios can be used in all bays. Although any CT ratio difference can be accommodated a difference larger than 10:1 is not practically viable.
- One hardware version for 1A and 5A CTs
- No switching in CT circuits
- No separate check zone or extra measuring criteria are necessary. The algorithm provides full stability for open CT circuit condition
- Software functionality ensures simple adaptation to buses with the CT on only one side of the bus-section or bus-coupler circuit breaker
- Fixed, factory pre-configured input/output configuration
- Display of analog service values for each phase and zone of protection
- Event list with the last sixteen events
- Continuous self monitoring and diagnostics
- Front mounted menu driven display with a key pad for simple setting of the terminal
- Remote data communication via LON bus
- Available for 19 inch rack mounting, surface mounting or flush mounting
- Hardware characteristics:
  - Pre-configured binary input and output modules
  - Optional separate COMBITEST® test switch for reliable and safe testing

Application Three-Phase Terminal

The numerical, three-phase, general differential terminal RED 521 is designed for fast and selective protection of meshed corners, T-connections, generators, motors, reactors, autotransformers, HV capacitor banks, smaller buses etc. Up to six three-phase current inputs can be included in the measuring zone. Service values for differential and incoming currents are displayed on the front HMI for each phase.

General differential protection function in three-phase terminal.

This protection function is intended for fast and selective tripping of faults in different objects within the power system. Typical applications with principal CT locations are shown in the following figures:

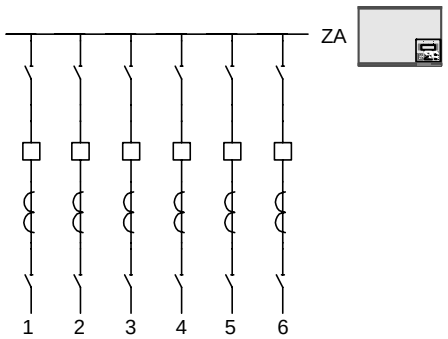


Fig. 1 Single Bus with up to 6 bays

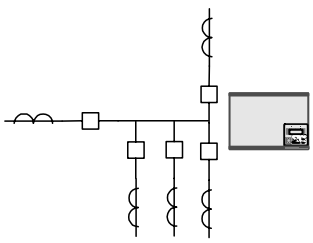


Fig. 2 Meshed Corners

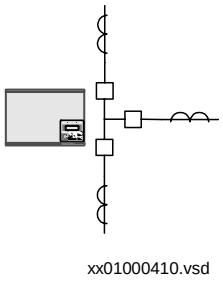


Fig. 3 T-connections

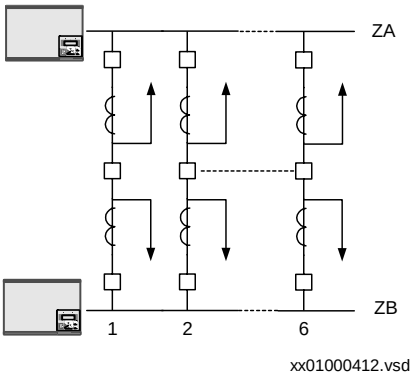


Fig. 4 1½ Breaker Station with up to 6 diameters

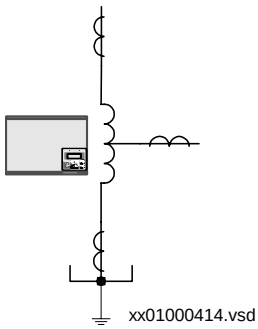


Fig. 5 Single or Double Tank Autotransformers

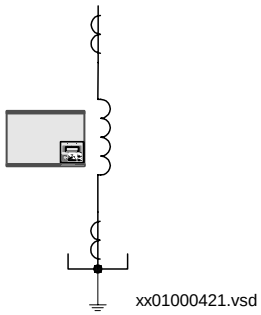


Fig. 6 Generators, Motors or Reactors

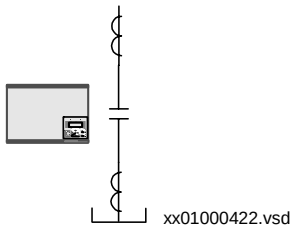


Fig. 7 HV Capacitor Banks

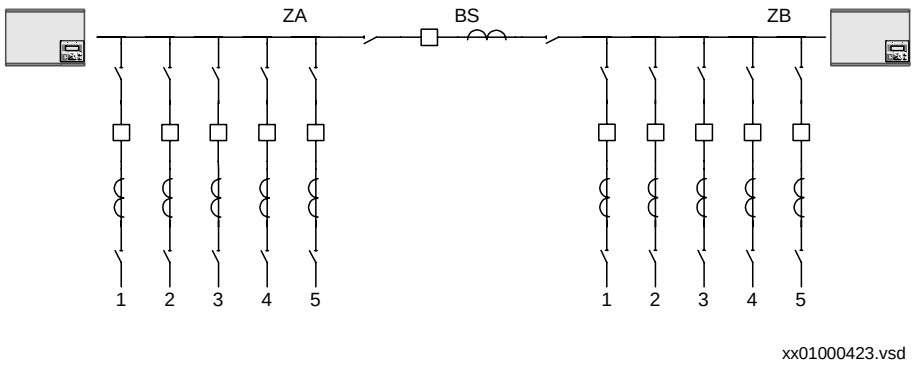


Fig. 8 Two Single Buses with Bus-Section Breaker and up to five feeder bays on each side

For each of the six three-phase current inputs, the rated CT primary current can be set. In this way adaptation to different CT ratios is provided in the simplest way. The minimum pick-up value for the differential current is then set to give a suitable sensitivity for all internal faults. Multiphase as well as single phase faults are detected and tripped at high speed in solidly or low resistance grounded systems. For bus protection applications typical setting value for the minimum differential operating current is from 50% to 100% of the biggest CT. However for other types of applications, for example generator differential, this value can be set more sensitive, down to 5% of the biggest CT.

All current inputs are indirectly provided with a restraint feature. The operation is based on the well proven RADSS percentage restraint stabilization principle, with an extra stabilization feature to stabilize for very heavy CT saturation. Stability for external faults is guaranteed if a CT is not saturated for at least two milliseconds during each power system cycle. It is also possible to block the differential function with an external binary signal.

The innovative measuring algorithm provides stability also for the open CT circuit condition, which means that no separate check zone is necessary. Pick-up current level for open CT detection can usually be set to detect the open circuit condition for the smallest CT. This built-in feature allows the protection terminal to be set very sensitive, lower than maximum through-load current. Upon detection of open circuits, the differential protection will be instantly blocked and an alarm is given. When the fault has been corrected, a manual reset must be given. This can be done locally from the front HMI, via the LON communication or via a binary input.

Each CT input can be included or excluded from the differential function in software. This can be done by setting or activated externally via a binary input. This feature gives a simple control over the connected current inputs for multizone applications. At the same time it gives the possibility for disconnection of the CT cores for bus-section or bus-coupler bays with CT only on one side of the circuit breaker. This ensures correct and

fast fault clearance of faults between the CT and the circuit breaker within these bays.

A load transfer functionality is included into the design which allows simple applications for double bus sections. Load transfer is activated externally via a binary input. When this input is activated CT inputs 2 to 6 are included in the zone, but CT input 1 is disconnected. Therefore CT input 1 shall be dedicated as the bus-coupler CT input.

Parameter settings

The RED 521 terminal has wide setting facilities to ensure application flexibility. The settings are organized as the configuration settings and the differential protection function settings. One setting group is available.

Under configuration settings data, the CT primary rated currents and the way how each CT input is connected to the protection zone are entered.

Under settings for the differential function the minimum operate current and sensitivity for open CT detection are entered. These settings are made directly in primary amperes. The operating slope for the differential function is fixed to 53% in the algorithm.

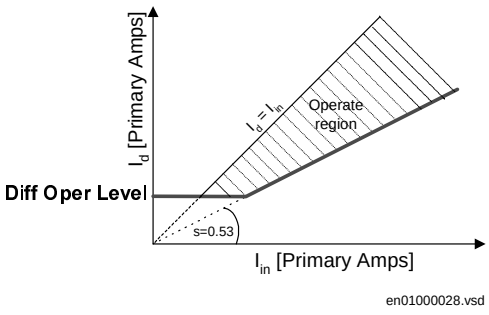


Fig. 9 Diff. Function Operating Characteristic

The settings can be changed only from the front HMI. It is possible to block any setting changes via an external binary signal.

Scheme engineering

The three-phase RED 521 terminal allows an effective scheme solution for applications on smaller buses, due to the software feature, which allows simple control over the connected CT inputs.

Overall scheme engineering is quite simple and very much standardised. Principle drawings, for typical protection schemes, are available from ABB.

The simple engineering and factory made configuration combined with the high speed tripping has made RED 521 a natural choice as additional protection for substations for improved power system stability.

Future switchgear extensions can be either pre-engineered in the original scheme design or the auxiliary equipment can be easily added at a later stage. If the overall required number of CT inputs are included in RED 521 hardware at the ordering stage, no software changes are required within the RED 521 terminals to facilitate these extensions.

Indications, events and service values

Internal relay supervision, open CT detection and trip indications are available on the front HMI LEDs (green, yellow & red LED respectively). The time-tagged event list, with resolution of 1 ms is available on the front HMI or from another location over the LON data communication system. The event list operates on first-in-first-out principle. The last sixteen events are available. The terminal internal real time clock can be synchronized with minute pulse synchronization.

Service values for the differential and the incoming current per phase are available on the front HMI.

Data communication

One remote communication port for LON bus can be included. It enables communication with a station control system (SCS), where events can be logged and open CT alarms and trip indications can be reset.

Application One-Phase Terminal

The numerical, one-phase, general differential protection terminal RED 521 is designed for fast and selective protection of elements of the power system with up to eighteen CT inputs per zone of protection and phase. Usually three terminals per protection scheme are required, one for each phase. However, cost effective summation principle is available as well.

General differential protection function in one-phase terminal.

Two one-phase differential functions are available in each terminal. These two protection functions are intended for fast and selective tripping of faults on larger buses. Typical applications with principal CT locations are shown in the following figures:

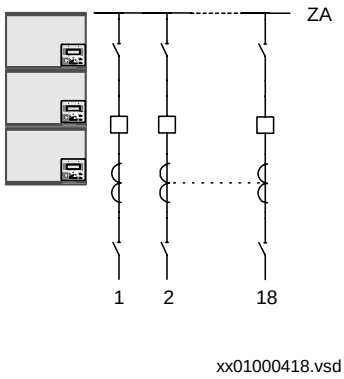


Fig. 10 Single Bus with up to nine or eighteen bays (one or two AIM modules)

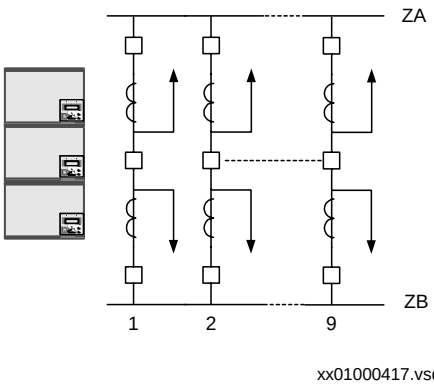


Fig. 11 1½ Breaker Station with up to 9 diameters

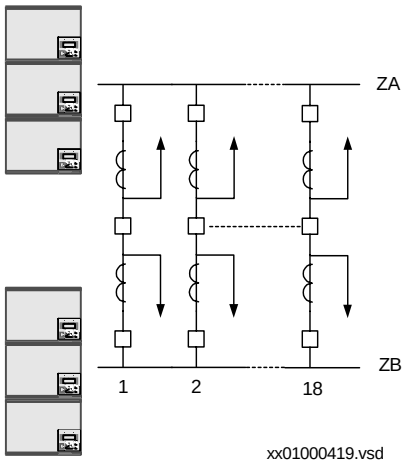


Fig. 12 1½ Breaker Station with up to 18 diameters

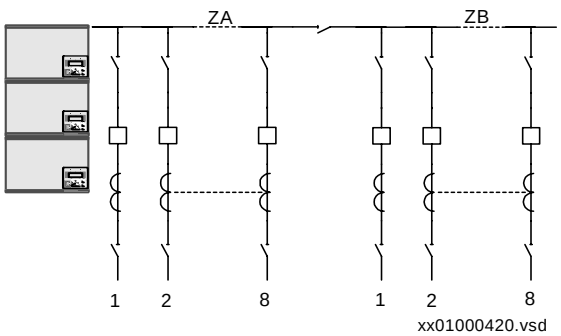


Fig. 13 Two Single Buses with Bus-Sectionalising Disconnector and up to eight feeder bays on each side of the switchgear

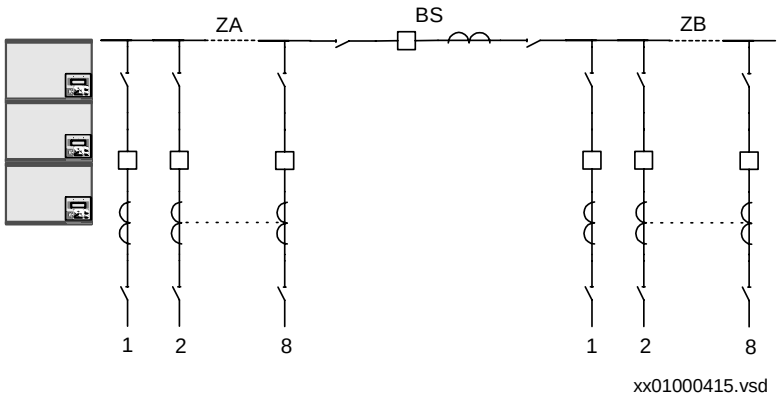


Fig. 14 Two Single Buses with Bus-Section Breaker and up to eight feeder bays on each side of the switchgear

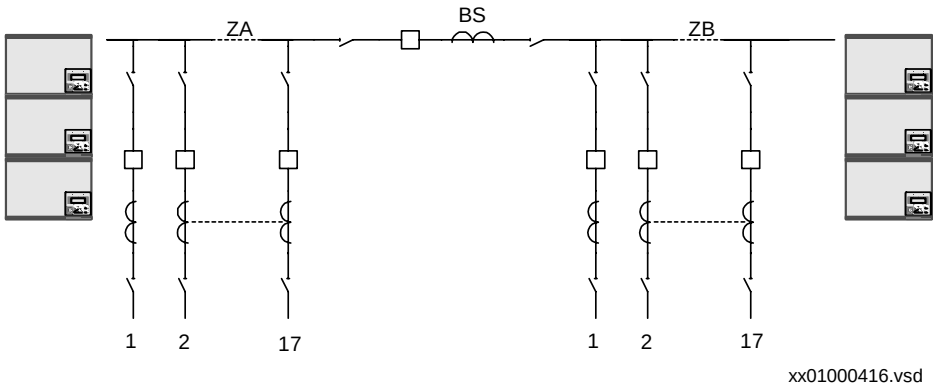


Fig. 15 Two Single Buses with Bus-Section Breaker and up to seventeen feeder bays on each side of the switchgear

For each of the eighteen current inputs, the CT rated primary current can be set. In this way adaptation to different CT ratios is provided in the simplest way. The minimum pick-up value for the differential current is then set to give a suitable sensitivity for all internal faults. Multi-phase as well as single phase faults are detected and tripped at high speed in solidly or low resistance grounded systems. For bus protection applications typical setting value for the minimum differential operating current is from 50% to 100% of the biggest CT.

All current inputs are indirectly provided with a restraint feature. The operation is based on the well proven RADSS percentage restraint stabilization principle with an extra stabilization feature to stabilize for heavy CT saturation. Stability for external faults is guaranteed if a CT is not saturated for at least two milliseconds during each power system cycle. Both protection zones can be individually blocked with external binary signals.

The innovative measuring algorithm provides stability also for open CT circuit condition, which means that no separate check zone is necessary. Pick-up current level for open CT detection can usually be set to detect the open circuit condition for the smallest CT. This built-in feature allows the protection terminal to be set very sensitive, lower than maximum through-load current. At detection of open circuits, the differential protection will be instantly blocked and an alarm is given. This feature can however not be fully utilised when the summation principle is used.

When the open CT circuit has been found and corrected a manual reset must be given. This can be done locally from the front HMI, via the LON communication or via a binary input.

Each CT input can be included or excluded from two differential functions in software. This can be done by setting or activated externally via binary input. This feature gives a simple control over the connected current inputs for multizone applications. At the same time it gives the possibility for disconnection of the CT cores for bus-section or bus-coupler bays with a CT only on one side of the circuit breaker. This ensures correct and fast fault clearance of faults between the CT and the circuit breaker within these bays.

A load transfer functionality is included into the design, which allows very simple applications for double bus sections. Load transfer is automatically started when any of the CT inputs 3 to 18 is connected at the same time to both differential zones. It is also possible to start load transfer externally via a binary input. When load transfer is started, CT inputs 3 to 18 are all included simultaneously into both zones. However CT inputs 1 and 2 are at the same time disconnected from both zones. Therefore the CT inputs 1 and 2 shall be dedicated as the bus-coupler CT inputs for these applications.

Parameter settings

RED 521 terminal has wide setting facilities to ensure application flexibility. The settings are organized as the configuration settings and the differential protection function settings. One setting group is available.

Under configuration settings data, the CT primary rated currents and the way how each CT input is connected to the protection zones are entered.

Under settings for the differential function, the minimum operate current and sensitivity for open CT detection are entered. Both settings are made directly in primary amperes. These two settings are common for both differential functions within the terminal. The operating slope for the differential function is fixed to 53% in the algorithm.

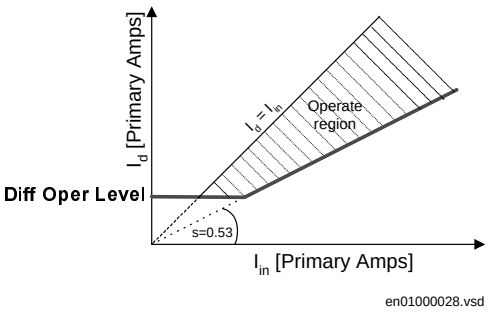


Fig. 16 Diff. Function Operating Characteristic

The settings can be changed only from the front human-machine-interface (HMI). It is possible to block any setting changes via an external binary signal.

Scheme engineering

The one-phase RED 521 terminal allows an effective scheme solution for applications on larger buses, due to the software feature, which allows simple control over the connected CT inputs.

Overall scheme engineering is quite simple and very much standardised. Principle drawings, for typical protection schemes, are available from ABB.

The simple engineering and factory made configuration combined with the high speed tripping has made RED 521 a natural choice as additional protection for substations for improved power system stability.

Future switchgear extensions can be either pre-engineered in the original scheme design or the auxiliary equipment can be easily added at a later stage. If the overall required number of CT inputs are included in RED 521 hardware at the ordering stage, no software changes are required within the RED 521 terminals to facilitate these extensions.

Indications, events and service values

Internal relay supervision, open CT detection and trip indications are available on the front HMI LEDs (green, yellow & red LED respectively). The time-tagged event list with resolution of 1 ms is available on the front HMI or from another location

over the LON data communication system. The event list operates on first-in-first-out principle. The last sixteen events are available. The terminal internal real time clock can be synchronized with minute pulse synchronization.

Service values for the differential and the incoming current per protection zone are available on the front HMI.

Data communication

One remote communication port for LON can be included in each terminal. It enables communication with a station control system (SCS), where events can be logged and open CT alarms and trip indications can be reset.

Design

The physical design of the RED 521 terminal is in line with the other products in the REx 5xx series. It is housed in painted sheet steel enclosure, suitable for different mounting by use of particular mounting accessories. Wire connections are made at the rear side of the terminal. All wires are connected by compression type of terminal tightened by a screw. Optical fibres for data communication are also connected at the rear side. On the front there is an HMI-panel with the common look and feel with the other 500 series terminals.

Behind the front cover, there is an interconnection board (motherboard) to which printed circuit boards (PCBs) are plugged in from the rear side. The input module for analog AC quantities is fixed mounted and the connection terminal for these circuits are also fixed mounted. The connection terminals for the DC contact circuits are of the multi-pole detachable type, to facilitate easy disconnection for exchange of PCBs.

It is possible to synchronize the real time clock within RED 521 terminal by using the minute pulse from the station clock.

The following hardware modules can be included in the RED 521 terminals:

Analog input module (AIM) provides galvanic separation and adaptation of the AC signals to the levels accepted by the terminal hardware. The analog input module facilitates both 1A and 5A CT connections on the same hardware. Choice is made by connection of the CT secondary wire to the appropriate tap. To accommodate different applications, there are two variants of each version of the terminal with one or two analog input modules. Each analog input module has nine current inputs. The analog input module contains analog to digital converters (AD-converters). Some digital low-pass filtering of AC input signals is performed on the AIM module as well.

Main processor module does the analog and digital data processing for the protection functions. A communication interface for connection to a station control system (SCS) via LON bus can be included as well.

Power supply module with DC/DC converter supplies all power required by the internal electronic circuits and provides the required barrier against electromagnetic disturbances.

Binary input/output modules can be of two different types. Binary input module, BIM, with 16 optocoupler inputs and a binary output module, BOM, with 24 output relay contacts.

On the front HMI panel, there are three light-emitting diodes (LEDs), one LCD display with 4 lines with 16 characters per line and a six-button key pad.

Communication interface module (CIM) is available as an option. It is used for connection of the RED 521 terminal to the ABB intelligent air insulated switchgear (I-AIS) power process highway (PPH) bus. Connection to the PPH bus allows free use and any combination of ABB optical instrument current transformers and traditional magnetic current transformers within the same protection zone.

Technical data

Table 1: Energizing quantities, rated values and limits

Quantity	Rated value	Nominal range	Operative range
Rated Current Burden	I_r = 1 A or 5 A < 0.25 VA at I_r	(0.2-30) x I_r (0.2-4) x I_r continuously	(0.03-100) x I_r 100 x I_r for 1 s*
Frequency	f_r = 50/60 Hz	±2.5 Hz	±5 Hz
Auxiliary DC voltage EL Power consumption basic terminal	EL = (24-60) V EL = (90-250) V ≤ 33 W	±20% ±20%	±20% ±20%
Binary input (16) module DC voltage RL power consumption each I/O board RL24 = 24/30 V RL48 = 48/60 V RL110 = 110/125 V RL220 = 220/250 V	 RL24 = 24/30 V RL48 = 48/60 V RL110 = 110/125 V RL220 = 220/250 V ≤0.5 W max. 0.05 W/input max. 0.1 W/input max. 0.2 W/input max. 0.4 W/input	 ±20% ±20% ±20% ±20%	 ±20% ±20% ±20% ±20%
Binary output (24/12) module power consumption each output board each output relay	 ≤ 1 W ≤ 0.25 W		
Ambient temperature	20°C	-5°C to +55°C	-20°C to +70°C
Ripple in dc auxiliary voltage	max. 2%	max. 12%	Full wave rectified
Relative humidity	10-90%	10-90%	0-95%

* Max 350 A for 1 s when COMBIFLEX test switch is used

Table 2: Influencing factors, Permissible influence

Dependence on	Within nominal range	Within operative range
Ambient temperature	0.01%/1°C	Correct function
Ripple in auxiliary DC voltage	negligible	Correct function
Interruption in auxiliary DC voltage without resetting no unwanted function	 ≤ 50 ms 0 - ∞	 ≤ 50 ms 0 - ∞

Table 3: Electromagnetic compatibility (EMC), immunity tests

Test	Type test values	Reference standards
1 MHz burst disturbance	2.5 kV	IEC 60255-22-1, Class III
Electrostatic discharge	8 kV	IEC 60255-22-2, Class III
Fast transient disturbance	4 kV	IEC 60255-22-4, Class IV
Surge immunity test	2-4 kV, 1.2/50 μs, high energy	IEC 61000-4-5, Class IV
Radiated electromagnetic field disturbance	10 V/m, 26-1000 MHz	EN 61000-4-3, level 3
Conducted electromagnetic field disturbance	10 V/m, 0.15-80 MHz	EN 61000-4-6, level 3

Table 4: Electromagnetic compatibility (EMC), emission tests

Test	Type test values	Reference standards
Electromagnetic emission radiated	30-1000 MHz, class A	EN 55011
Electromagnetic emission conducted	0.15 - 30 MHz, class A	EN 55081-2

Table 5: Insulation tests

Test	Type test values	Reference standards
Dielectric test	2.0 kV AC 1 min	IEC 60255-5
Impulse voltage test	5 kV, 1.2/50 µs, 0.5 J	IEC 60255-5
Insulation resistance	> 100 MOhm at 500 V DC	IEC 60255-5

Table 6: Mechanical tests

Test	Type test values	Reference standards
Vibration	Class I	IEC 60255-21-1
Shock and bump	Class I	IEC 60255-21-2
Seismic	Class I	IEC 60255-21-3

Table 7: Contact data (reference standard: IEC 60255)

Function or quantity	Trip- and signal relays	
Max. system voltage	250 V AC, DC	
Test voltage across open contact, 1 min	1.0 kV RMS	
Current carrying capacity continuous 1 s	 8 A 10 A	
Making capacity at inductive load with L/R > 10 ms 0.2 s 1.0 s	 30 A 10 A	
Breaking capacity for AC, cosφ > 0.4	250 V/8.0 A	
Breaking capacity for DC with L/R < 40 ms	48 V/1 A 110 V/0.4 A 220 V/0.2 A 250 V/0.15 A	

Table 8: Connection system

Connector type	Rated voltage	Maximum square area	Maximum load continuous	Maximum load 1 s
Binary input/output module voltage compression	250 V AC	2,5 mm^2 2 x 1 mm^2	10 A	30 A
Analog input module voltage/current compression	250 V AC	4 mm^2	20 A	500 A
Voltage Ring Lugs	250 V AC	5.3 mm^2	10 A	30 A
Current Ring Lugs	250 V AC	5.3 mm^2	20 A	500 A
Fiber connectors	Glass: Bayonet ST Plastic: Snap in Simplex Latching			

Table 9: Additional general data

Dimensions Width Height Depth	 483 mm (1/1 of 19” rack) 6U = 266 mm 245 mm
Storage temperature	-40°C to +70°C

Table 10: Event List

Functionality	Binary Value Recorded on Change
Time tagging resolution	1 ms (relative time)
Number of Event List entries	16

Table 11: Rated power system frequency

Quantity	Parameter	Value or Range
Rated frequency	fr	50 or 60 Hz

Table 12: General dIfferential protection

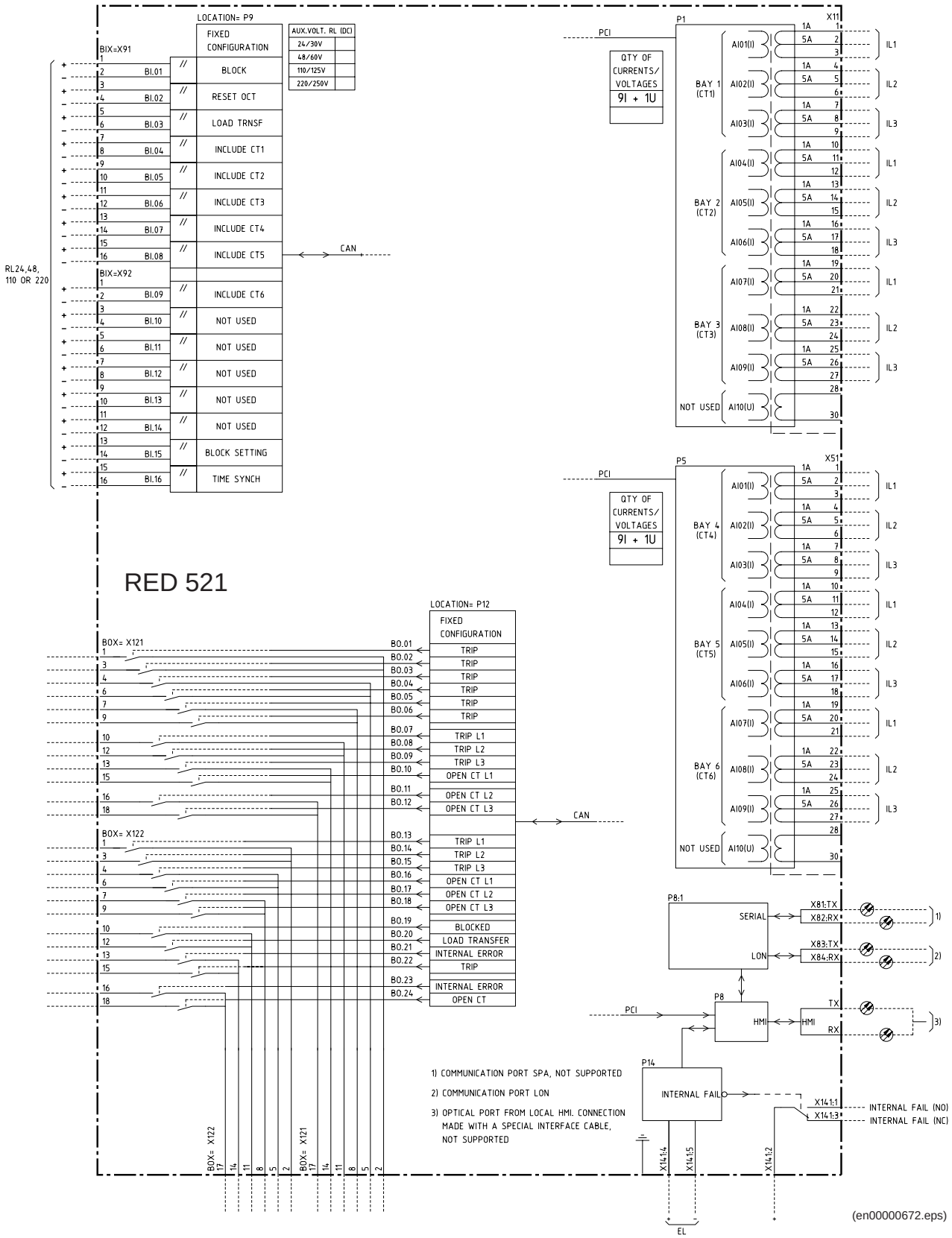
Function	Parameter	Value or Range and step
Differential current operating level	Diff Oper Level	1 - 10000 A; in step of 1A
Stabilizing slope	s	53% fixed
Open CT sensitivity	Open CT Level	1 - 5000 A; in step of 1A
Operate time		12 ms, typically
Trip Reset Time		10 cycles, typically

Table 13: CT input configuration parameters

Function	Parameter	Value or Range and step
Set CT rated primary current	CT Prim Inp x	-10000 - +10000 A; in step of 1A
Determine the way how CT input is connected to the protection zone	ZoneSelection / CTx	Contact Ctrl / Fixed to ZA / (Fixed to ZB) ( ) only available in one-phase version of the terminal

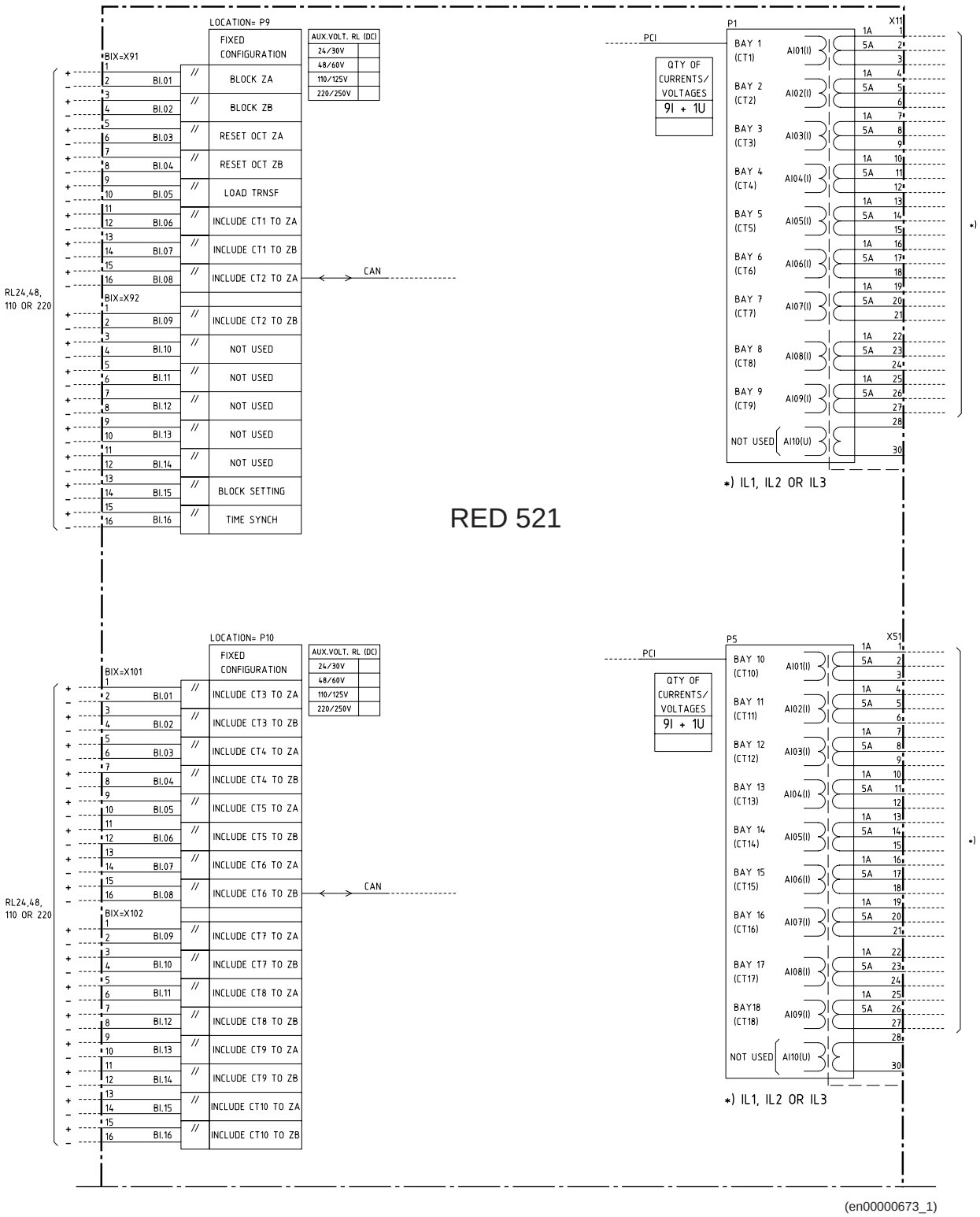
Terminal diagrams

Three-phase terminal

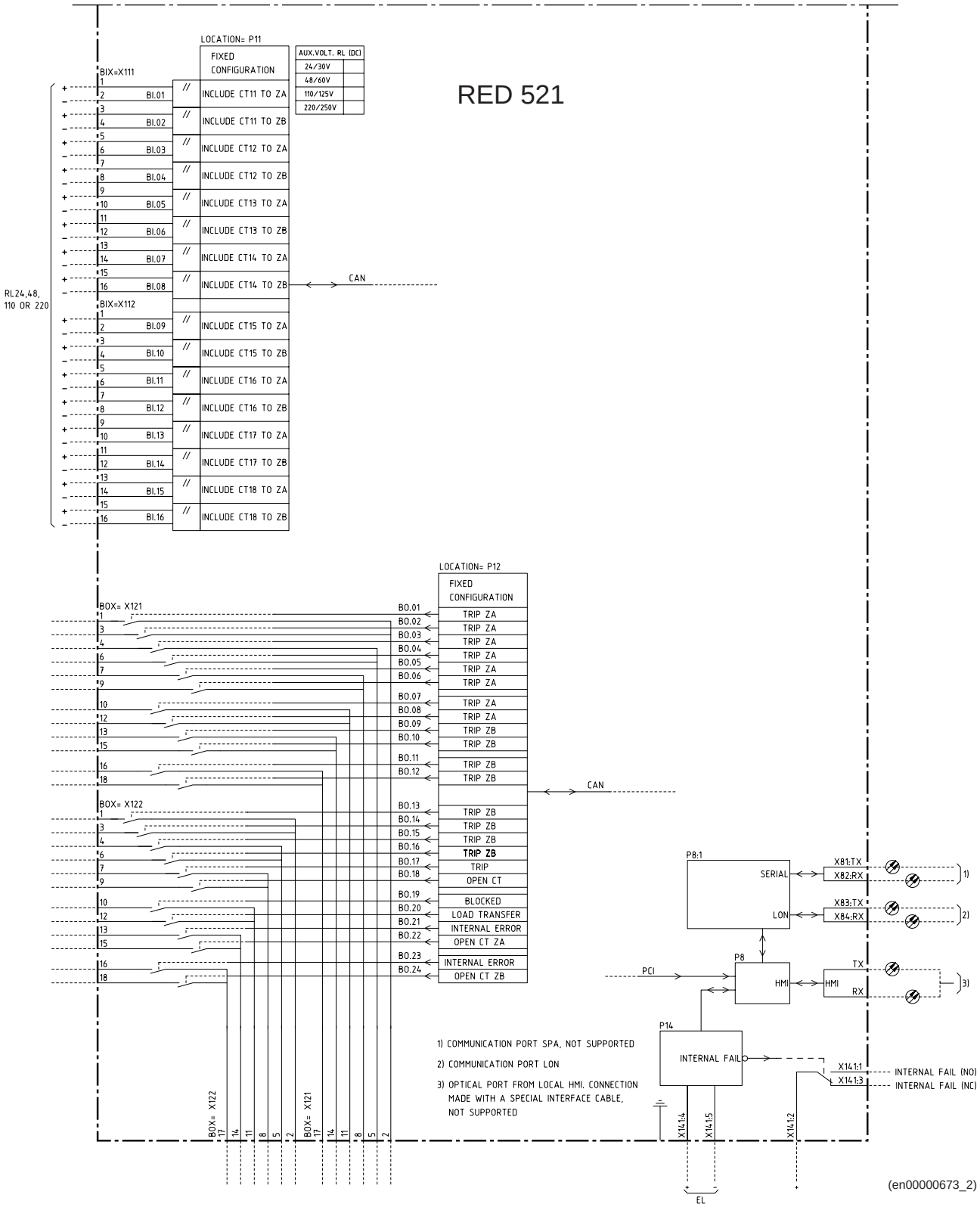


Terminal diagrams

One-phase terminal



(en00000673_1)


RED 521
LOCATION= P11
FIXED CONFIGURATION
AUX.VOLT. RL (DC)
24/30V
48/60V
110/125V
220/250V
BIX=X111
BI.01
BI.02
BI.03
BI.04
BI.05
BI.06
BI.07
BI.08
BIX=X112
BI.09
BI.10
BI.11
BI.12
BI.13
BI.14
BI.15
BI.16
INCLUDE CT11 TO ZA
INCLUDE CT11 TO ZB
INCLUDE CT12 TO ZA
INCLUDE CT12 TO ZB
INCLUDE CT13 TO ZA
INCLUDE CT13 TO ZB
INCLUDE CT14 TO ZA
INCLUDE CT14 TO ZB
CAN
RL24,48, 110 OR 220
LOCATION= P12
FIXED CONFIGURATION
BOX= X121
BOX= X122
BO.01 TRIP ZA
BO.02 TRIP ZA
BO.03 TRIP ZA
BO.04 TRIP ZA
BO.05 TRIP ZA
BO.06 TRIP ZA
BO.07 TRIP ZA
BO.08 TRIP ZA
BO.09 TRIP ZB
BO.10 TRIP ZB
BO.11 TRIP ZB
BO.12 TRIP ZB
BO.13 TRIP ZB
BO.14 TRIP ZB
BO.15 TRIP ZB
BO.16 TRIP ZB
BO.17 TRIP
BO.18 OPEN CT
BO.19 BLOCKED
BO.20 LOAD TRANSFER
BO.21 INTERNAL ERROR
BO.22 OPEN CT ZA
BO.23 INTERNAL ERROR
BO.24 OPEN CT ZB
CAN
P8:1
SERIAL
LON
X81:TX
X82:RX
X83:TX
X84:RX
1)
2)
P8
PCI
HMI
TX
RX
3)
P14
INTERNAL FAIL
X141:1
X141:3
INTERNAL FAIL (NO)
INTERNAL FAIL (NC)
1) COMMUNICATION PORT SPA, NOT SUPPORTED
2) COMMUNICATION PORT LON
3) OPTICAL PORT FROM LOCAL HMI. CONNECTION MADE WITH A SPECIAL INTERFACE CABLE, NOT SUPPORTED
X141:4
X141:5
X141:2
EL
(en00000673_2)

Ordering Sheet for Three-Phase Terminal

The numerical, three-phase, general differential terminal RED 521 is designed for fast and selective protection of meshed corners, T-connections, generators, motors, reactors, HV capacitor banks, smaller buses etc. Up to six three-phase bays can be included in the measuring zone. One 16 channel input board and one 24 channel output board with fixed configured inputs respectively outputs are provided. One or two AIM boards, each equipped with three, three-phase analog inputs, can be selected. A CIM board for PPH communication can be additionally provided. No CAP or SMS modules are available for this version.

Hardware base modules

Casing with connection board and front HMI panel, 6U 19 inch

Main processor module

One BIM module

One BOM module

Auxiliary power supply module 110-250 V

Software base functions

Service value reading for differential current and incoming (i.e. bias) current

Event List with 16 entries

Event Reporting via LON bus

One three-phase differential function, open CT detection, load transfer

Configuration of the three-phase RED 521 terminal is fixed with inputs and outputs according to the terminal diagram 1MRK 002 002-AA

Ordering Number:			**Quantity:**
3	bays	1MRK 002 001-AA	☐
6	bays	1MRK 002 001-BA	☐

Basic data:

Nominal frequency:	50/60 Hz (selectable by setting)			
Rated CT input current	1/5 A (selectable by tap)			
CT connection terminal type	☐ compression	☐ ring lugs		
Rated auxiliary dc voltage EL for Power Supply Module	☐ 24-60 V	☐ 90-250 V		
Select rated dc voltage RL for optocoupler binary inputs	☐ 24/30 V	☐ 48/60 V	☐ 110/125 V	☐ 220/250 V

Communication module
Serial LON channel module for remote communication

Plastic	☐ 1MRK 001 608-AA
Glass	☐ 1MRK 001 608-CA

Mechanical options:

First test switch

COMBITEST test switch module RTXP 24 No 1 for the first AIM. ☐ 1MRK 000 371-EA

On/Off switch for the terminal dc-supply ☐ RK 795 017-AA

Second test switch

COMBITEST test switch module RTXP 24 No 2 for the second AIM. ☐ 1MRK 000 371-EB

NOTE!
The test switches have external star point connection of three-phase CT groups.
Each RTXP 24 test switch module will be mounted in a separate RHGS 6 case with window door.
One test switch per analog input module (AIM) is required so two test switches are needed if two analog input modules are used. Connections between the AIMs and test switches are not made in the factory. These connections have to be done by the user.

Optional mounting details

Mounting details with IP40 degree of protection from the front for protection terminal case and if needed for extra test switch case(s):

	Protection terminal	One Test switch case	Two Test switch cases
19” rack	☐ 1MRK 000 020-CA	☐ 1MRK 000 020-BE	☐ 1MRK 000 020-BB
Wall mounting	☐ 1MRK 000 020-DA	☐ 1MRK 000 020-DA	☐ 1MRK 000 020-DA
Flush mounting	☐ 1MRK 000 020-Y	☐ 1MRK 000 020-Y	☐ 1MRK 000 020-Y
Additional sealing for IP54 (Only available for flush mounted terminal)	☐ 1MKC 980 001-2		
No mounting details	☐	☐	☐

Accessories:	**Quantity:**	
User’s Guide for RED 521	☐	1MRK 505 031-UEN

For our reference and statistics we would be pleased if we are provided with the following application data:

Country: End user:

Station name: Voltage level: kV

Ordering Sheet for One-Phase Terminal

The one-phase RED 521 general differential protection terminal can be used for protection of larger buses with up to 18 bays. Two measuring zones (one phase) are available in each terminal. Usually three terminals per protection scheme are required, one for each phase. One or two AIM modules, each equipped with nine current analog inputs, can be included. The one-phase RED 521 terminal is also equipped with two or three 16 channel input boards (depending on number of ordered AIM modules) and one 24 channel output board. All these boards are with fixed configuration. In addition, a CIM board for PPH communication can be provided. No CAP or SMS modules are available for this version.

Hardware base modules

Casing with connection board and front HMI panel, 6U 19 inch

Main processor module

Two or three BIM modules

One BOM module

Auxiliary power supply module 110-250 V

Software base functions

Service value reading for the differential current and the incoming (i.e. bias) current.

Event List with 16 entries

Event Reporting via LON bus.

Two one-phase differential functions, open CT detection, load transfer

Configuration of the one-phase RED 521 terminal is fixed with inputs and outputs according to the terminal diagram 1MRK 002 004-AA.

Ordering Number:			**Quantity: Note: Normally multiple of 3 (i.e. 3, 6, 9,... etc.)**
9	bays	1MRK 002 003-AA	
18	bays	1MRK 002 003-BA	

Basic data:

Nominal frequency:	50/60 Hz (selectable by setting)			
Rated CT input current	1/5 A (selectable by tap)			
CT connection terminal type	☐ compression		☐ ring lugs	
Rated auxiliary dc voltage EL for Power Supply Module	☐ 24-60 V	☐ 90-250 V		
Select rated dc voltage RL for optocoupler binary inputs	☐ 24/30 V	☐ 48/60 V	☐ 110/125 V	☐ 220/250 V

Communication module
Serial LON channel module for remote communication

Plastic	☐ 1MRK 001 608-AA
Glass	☐ 1MRK 001 608-CA

Auxiliary summation CT: **Quantity:**

3 pcs SLCE 8-1 summation transformers on apparatus plate (2U high)	1/1 A	☐	1MRK 000 643-EA
3 pcs SLCE 8-1 summation transformers on apparatus plate (2U high)	5/1 A	☐	1MRK 000 643-FA

Mechanical options:

First test switch
COMBITEST test switch module RTXP 24 No 1 for the first AIM. ☐ 1MRK 000 371-EA

On/Off switch for the terminal dc-supply ☐ RK 795 017-AA

Second test switch
COMBITEST test switch module RTXP 24 No 2 for the second AIM. ☐ 1MRK 000 371-EB

NOTE!
The test switches have external star point connection of three-phase CT groups.
Each RTXP 24 test switch module will be mounted in a separate RHGS 6 case with window door.
One test switch per analog input module (AIM) is required so two test switches per each terminal are needed, if 18 bays version is used. Therefore if three terminals are ordered six test switches will be delivered. Connections between the AIMs and the test switches are not made in the factory. These connections have to be done by the user.

Optional mounting details
Mounting details with IP40 degree of protection from the front for protection terminal case and if needed for extra test switch case(s):

	Protection terminal	One Test switch case	Two Test switch cases
19” rack	☐ 1MRK 000 020-CA	☐ 1MRK 000 020-BE	☐ 1MRK 000 020-BB
Wall mounting	☐ 1MRK 000 020-DA	☐ 1MRK 000 020-DA	☐ 1MRK 000 020-DA
Flush mounting	☐ 1MRK 000 020-Y	☐ 1MRK 000 020-Y	☐ 1MRK 000 020-Y
Additional sealing for IP54 (Only available for flush mounted terminal)	☐ 1MKC 980 001-2		
No mounting details	☐	☐	☐

Accessories: **Quantity:**

User’s Guide for RED 521	☐	1MRK 505 031-UEN

For our reference and statistics we would be pleased if we are provided with the following application data:

Country: End user:

Station name: Voltage level: kV

Sample specification

Numerical differential protection terminal is intended for the selective, reliable and fast protection of buses, T-connections, meshed corners, generators, autotransformers, etc. The terminal shall be applicable for the protection of medium voltage (MV), high voltage (HV) and extra high voltage (EHV) installations at a power system frequency of 50Hz or 60Hz. The terminal shall be able to detect all types of internal phase-to-phase and phase-to-ground faults in solidly grounded or low impedance grounded power systems, as well as all internal phase-to-phase faults in isolated or high-impedance grounded power systems.

For all applications, it shall be possible to include 1A and 5A primary CTs, with up to 10:1 ratio difference within the same differential protection zone. There shall be no requirements for any auxiliary CTs. Compensation of different main CT ratios shall be achieved numerically by a parameter setting.

The differential protection function shall have completely phase-segregated measurements. The minimal operating time in case of internal fault shall be around 10 milliseconds, with guaranteed stability of the differential function for external faults even with very high short-circuit currents and heavy CT saturation. The facility to selectively block differential functions with an external binary signal shall be provided.

The terminal shall include the ability to detect CT open circuit condition. No incorrect operation of the protection terminal shall occur for CT open circuit condition and an alarm shall be issued to the supervisory system. Stability of the differential function must be guaranteed even for the case when only two feeders are connected to the zone of protection and then one of the two CTs is accidentally open circuited under full through-load condition. It shall be possible to reset the CT open circuit condition locally or remotely via the communication. Reset of the CT open circuit condition shall only be possible if there is no differential current detected in the protected zone.

Future station extensions must not require any software or hardware modifications within the protection terminal if the finally required number of CT inputs are allowed for in the terminal at the ordering stage. It must be possible to add future bays on a one-by-one basis.

Comprehensive and continuous self-monitoring of the protection terminal shall ensure no incorrect operations of the differential function in case of internal relay failure. The terminal shall be provided with a front mounted menu driven human-machine-interface. Display of the service values for differential current and total through-load current for each phase and zone of protection shall be provided. An event list with the last 16 events shall be available. Communication to the station control system shall be included.

The summation bus differential principle shall be available as a cost effective solution for less demanding applications.

References

Series RE 500 mechanical packaging and connection	1MRK 510 010-BEN
COMBITEST® Test system	1MRK 512 001-BEN
Auxiliary relays RXMS 1	1MRK 508 015-BEN
Bistable relays RXMD 1	1MRK 508 017-BEN
Compact current relay RXHL 411 (3Ph BF initiation)	1MRK 509 049-BEN
Breaker failure relay RAHB 411 (1Ph/3Ph initiation)	1MRK 509 070-BEN

Customer support in USA

ABB Inc
Substation Automation and Protection
4300, Coral Ridge Drive
Coral Springs, FL 33065
USA
Tel: (954) 752-6700 Toll Free: 800-523-2620
Fax: (954) 345-5329

ABB Inc
Substation Automation and Protection
7036, Snowdrift Road
Allentown, PA 18106
USA
Tel: (610) 395-7333 Toll Free: 800-634-6005
Fax: (610) 395-1055

Customer support in Canada

ABB Inc
Utility Automation
3450 Harvester Rd, Burlington,
Ontario L7N 3W5
Tel: (905) 639-8840
Fax: (905) 639-8639

Manufacturer

ABB Automation Technology Products AB
Substation Automation
SE-721 59 Västerås
Sweden
Telephone: +46 (0) 21 34 20 00
Facsimile: +46 (0) 21 14 69 18
Internet: www.abb.com/substationautomation