Motor Protection Relay

REM 610

Buyer's Guide - ANSI version

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Features

- Three-phase thermal overload protection
- Three-phase motor start-up supervision based on thermal stress calculation with speed switch blocking ability
- Three-phase overcurrent protection with definite-time characteristic and speed switch blocking ability
- Three-phase short-circuit protection with instantaneous or definite-time characteristic
- Three-phase undercurrent (loss of load) protection with definite-time characteristic
- Non-directional ground-fault protection with definite-time characteristic
- Three-phase unbalance protection based on the negative-phase-sequence current with inverse definite minimum time characteristic
- Phase reversal protection based on the negative-phase-sequence current
- Cumulative start-up time counter with restart disable function
- Circuit-breaker failure protection
- Temperature protection elements with definite-time characteristic
- Emergency start function
- Optional RTD module
  - with six measuring inputs
  - supports PTC thermistors and various RTD sensors
  - three additional galvanically isolated digital inputs
- Disturbance recorder
  - recording time up to 80 seconds
  - triggering by one or several internal or digital input signals
  - records four analogue channels and up to eight user-selectable digital channels
  - adjustable sampling rate
- Non-volatile memory for
  - up to 100 event codes with time stamp
  - setting values
  - disturbance recorder data
  - recorded data of the five last events with time stamp
  - number of pickups for protection elements
  - operation target messages and LEDs showing the status at the moment of power failure
- Battery back-up for real-time clock
- Battery charge supervision
- Four accurate current inputs
- Two galvanically isolated digital inputs and three additional digital inputs on the optional RTD module
- Time synchronization via a digital input
- All settings can be modified with a PC
- HMI with an alphanumeric LCD and manoeuvring buttons
  - eight programmable LEDs
- Detachable plug-in unit
- Three normally open power output contacts
- Trip-circuit supervision
- Two change-over signal output contacts
- Output contact functions freely configurable for desired operation
- Optical front communication connection: wirelessly or via cable
- Optional rear communication module with plastic fibre-optic, combined fibreoptic (plastic and glass) or RS-485 connection for system communication using the SPA-bus, IEC 60870-5-103 or Modbus (RTU and ASCII) communication protocol
- Continuous self-supervision of electronics and software. At an internal relay fault, all protection elements and outputs will be blocked.
- User-selectable rated frequency 50/60 Hz
- User-selectable password protection for the HMI
- Display of primary current values
- Demand values
- Multi-language support

Application

REM 610 is a versatile multifunction protection relay mainly designed for protection of standard medium and large MV asynchronous motors in a wide range of motor applications. It handles fault conditions during motor start up, normal run, idling, and cooling down at standstill, e.g. in pump, fan, mill or crusher applications.

The large number of integrated protection functions makes REM 610 a complete protection against motor damage.

The relay can be used with both circuit-breaker controlled and contactor controlled drives.

REM 610 can equally well be used to protect, for instance, feeder cables and power transformers which require thermal overload protection and single-, two- or three-phase overcurrent or non-directional ground-fault protection.

Design

REM 610 is based on a microprocessor environment. A self-supervision system continuously monitors the operation of the relay.

The HMI includes a Liquid Crystal Display (LCD) which makes the local use of the relay safe and easy.

Local control of the relay via serial communication can be carried out with a computer connected to the front communication port. Remote control can be carried out via the rear connector connected to the control and monitoring system through the serial communication bus.

REM 610 requires a secured auxiliary voltage supply to operate. The internal power supply of the relay forms the voltages required by the relay electronics. The power supply is a galvanically isolated (flyback-type) DC/DC converter. When the auxiliary voltage is connected, the green indicator LED (ready) on the front panel will be on. For detailed information on power supply, refer to Table 3.

The primary side of the power supply is protected with a fuse located on the PCB of the relay.

Settings

There are two alternative setting groups available, setting groups 1 and 2. Either of these setting groups can be used as the actual settings, one at a time. Both groups have their related registers. By switching between the setting groups, a whole group of settings can be changed at the same time. This can be done in any of the following ways:

Group configuration:
- via the HMI
- entering parameter V150 via serial communication

Group selection:
- switching between group 1 and group 2 is accomplished by means of a digital input

The setting values can be altered via the HMI or with a PC provided with the Relay Setting Tool.

Before the relay is connected to a system it must be assured that the relay has been given the correct settings, refer to the Table 1.

Table 1: Setting values

Setting	Description	Setting range	Default setting
FLA SEC.	FLA secondary scaling factor	0.50...2.50 [1)]	1
t_{6x}	Safe stall time	2...120 s [2)]	2 s
p	Weighting factor	20...100%	50%
K_c	Time constant multiplier	1...64	1
49 ALARM	Prior alarm level	50...100%	95%
49 RESTDIS	Restart disable level	20...80%	40%
T_{amb}	Ambient temperature	0...70°C	40°C
48/14 PICUP/FLA	Start-up current for motor or picup value of element 48/14	1.00…10.0 x FLA	1.00 x FLA
48/14 TDLY	Start-up time for motor or operate time of element 48/14	0.30...80.0 s	0.30 s
50P/FLA	Picup value of element 50P	0.50...20.0 x FLA	1.00 x FLA
50P TDLY	Operate time of element 50P	0.05...30.0 s	0.05 s
51N / I_n CT	Picup value of element 51N	1.0...100% I_n CT	1.0% I_n CT
51N TDLY	Operate time of element 51N	0.05...300 s	0.05 s
37/FLA	Picup value of element 37	30...80% FLA	50% FLA
37 TDLY	Operate time of element 37	2...600 s	2 s
46 PICUP/FLA	Picup value of element 46	0.10…0.50 x FLA	0.20 x FLA
46 TDIAL	Time constant of element 46 at IDMT characteristic	5...100	5
66	Restart disable value	5...500 s	5 s
66 COOL/Δt	Countdown rate of start-up time counter	2...250 s/h	2 s/h
Trip Fail	Operate time of CBFAIL	0.10...60.0 s	0.10 s
RTD1A	Alarm value RTD1A	0...200°C	0°C
RTD1A TDLY	Operate time RTD1A TDLY	1...100 s	1 s
RTD1T	Trip value RTD1T	0...200°C	0°C
RTD1T TDLY	Operate time RTD1T TDLY	1...100 s	1 s
RTD2A	Alarm value RTD2A	0...200°C	0°C
RTD2A TDLY	Operate time RTD2A TDLY	1...100 s	1 s
RTD2T	Trip value RTD2T	0...200°C	0°C
RTD2T TDLY	Operate time RTD2T TDLY	1...100 s	1 s
RTD3A	Alarm value RTD3A	0...200°C	0°C
RTD3A TDLY	Operate time RTD3A TDLY	1...100 s	1 s
RTD3T	Trip value RTD3T	0...200°C	0°C
RTD3T TDLY	Operate time RTD3T TDLY	1...100 s	1 s
RTD4A	Alarm value RTD4A	0...200°C	0°C
RTD4A TDLY	Operate time RTD4A TDLY	1...100 s	1 s
RTD4T	Trip value RTD4T	0...200°C	0°C
RTD4T TDLY	Operate time RTD4T TDLY	1...100 s	1 s
RTD5A	Alarm value RTD5A	0...200°C	0°C
RTD5A TDLY	Operate time RTD5A TDLY	1...100 s	1 s
RTD5T	Trip value RTD5T	0...200°C	0°C
RTD5T TDLY	Operate time RTD5T TDLY	1...100 s	1 s

Table 1: Setting values

Setting	Description	Setting range	Default setting
RTD6A	Alarm value RTD6A	0...200°C	0°C
RTD6A TDLY	Operate time RTD6A TDLY	1...100 s	1 s
RTD6T	Trip value RTD6T	0...200°C	0°C
RTD6T TDLY	Operate time RTD6T TDLY	1...100 s	1 s
PTC1	Trip value PTC1	0.1...15.0 kΩ	0.1 kΩ
PTC2	Trip value PTC2	0.1...15.0 kΩ	0.1 kΩ

1) The FLA secondary scaling factor has only one setting and thus switching between setting groups does not apply.

2) The setting step is 0.5.

Technical data

Table 2: Dimensions

Width	frame 177 mm, case 164 mm
Height	frame 177 mm (4U), case 160 mm
Depth	case 149.3 mm
Weight of the relay	~3.5 kg
Weight of the spare unit	~1.8 kg

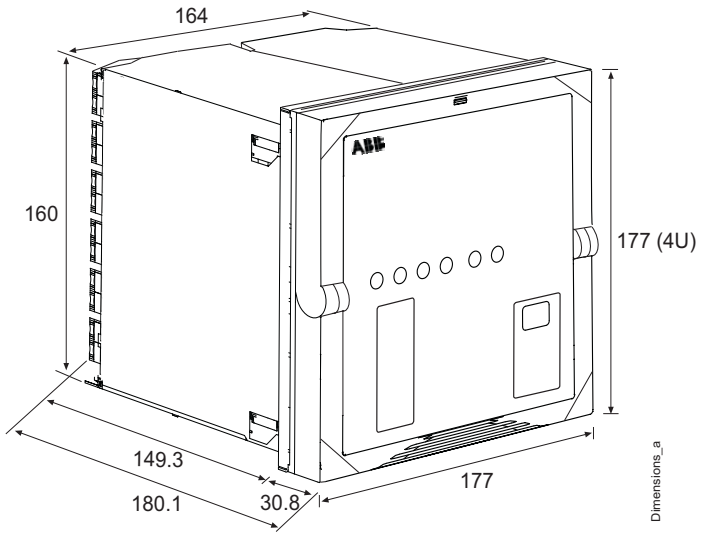

Fig. 1 Dimensions of the relay

Table 3: Power supply

U_{aux} rated	
REM610BxxHxxx	Ur=100/110/120/220/240 V ac Ur=110/125/220/250 V dc
REM610BxxLxxx	Ur=24/48/60 V dc
U_{aux} variation (temporary)	
REM610BxxHxxx	85...110% of U_r (ac) 80...120% of U_r (dc)
REM610BxxLxxx	80...120% of U_r (dc)
Burden of auxiliary voltage supply under quiescent (P_q)/operating condition	<9 W/13 W
Ripple in the dc auxiliary voltage	Max 12% of the dc value
Interruption time in the auxiliary dc voltage without resetting the relay	<50 ms at U_{aux} rated
Time to trip from switching on the auxiliary voltage [1)]	<350 ms
Internal over temperature limit	+100°C
Fuse type	T2A/250 V

1) Time to trip of elements 50P and 51N

Technical data (cont´d)

Table 4: Energizing inputs

Rated frequency	50/60 Hz ± 5 Hz	
Rated current, FLA	1 A	5 A
Thermal withstand capability		
- continuously	4 A	20 A
- for 1 s	100 A	500 A
- for 10 s	25 A	100 A
Dynamic current withstand		
- half-wave value	250 A	1250 A
Input impedance	<100 mΩ	<20 mΩ

Table 5: Measuring range

Measured currents on phases I_a, I_b and I_c as multiples of the rated currents of the energizing inputs	0...50 x I_n CT
Ground-fault current as a multiple of the rated current of the energizing input	0...8 x I_n CT

Table 6: Digital inputs

Operating range	±20% of the rated voltage	
Rated voltage:	DI1...DI2	DI3...DI5 (optional)
• REM610BxxHxxx	110/125/220/250 V dc	
• REM610BxxLxxx	24/48/60/110/125/220/250 V dc	
• REM610BxxxxMx		24/48/60/110/125/220/250 V dc
Current drain	2...18 mA	
Power consumption/input	<0.9 W	

Table 7: Signal outputs SO1

Rated voltage	250 V ac/dc
Continuous carry	5 A
Make and carry for 3.0 s	15 A
Make and carry for 0.5 s	30 A
Breaking capacity when the control-circuit time constant L/R <40 ms, at 48/110/220 V dc	1 A/0.25 A/0.15 A
Minimum contact load	100 mA at 24 V ac/dc

Table 8: Signal outputs SO2 and self-supervision (IRF) output

Rated voltage	250 V ac/dc
Continuous carry	5 A
Make and carry for 3.0 s	10 A
Make and carry for 0.5 s	15 A
Breaking capacity when the control-circuit time constant L/R <40 ms, at 48/110/220 V dc	1 A/0.25 A/0.15 A
Minimum contact load	100 mA at 24 V ac/dc

Table 9: Power outputs (PO1, PO2, PO3)

Rated voltage	250 V ac/dc
Continuous carry	5 A
Make and carry for 3.0 s	15 A
Make and carry for 0.5 s	30 A
Breaking capacity when the control-circuit time constant L/R <40 ms, at 48/110/220 V dc (PO1 with both contacts connected in series)	5 A/3 A/1 A
Minimum contact load	100 mA at 24 V ac/dc
TCS	
- Control voltage range	20...265 V ac/dc
- Current drain through the supervision circuit	~1.5 mA

Technical data (cont´d)

Table 9: Power outputs (PO1, PO2, PO3)

- Minimum voltage over a contact	20 V ac/dc (15...20 V)

Table 10: Enclosure class of the flush-mounted relay

Front side	IP 54
Rear side, top of the relay	IP 40
Rear side, connection terminals	IP 20

Table 11: RTD/analogue inputs

Supported RTD sensors	100 Ω platinum	TCR0.00385 (DIN 43760)
	250 Ω platinum	TCR 0.00385
	1000 Ω platinum	TCR 0.00385
	100 Ω nickel	TCR 0.00618 (DIN 43760)
	120 Ω nickel	TCR 0.00618
	120 Ω nickel (US)	TCR 0.00672
	10 Ω copper	TCR 0.00427
Supported PTC thermistor range	0...20 kΩ	
Maximum lead resistance (three-wire measurement)	200 Ω per lead	
Isolation	2 kV (inputs to protective ground)	
Sampling frequency	5 Hz	
Response time	<8 s	
RTD/Resistance sensing current	Maximum 4.2 mA rms 6.2 mA rms for 10 Ω copper	

Table 12: Environmental tests and conditions

Recommended service temperature range (continuous)	-10...+55°C
Limit temperature range (short-term)	-40...+70°C
Transport and storage temperature range	-40...+85°C according to the IEC 60068-2-48
Dry heat test	According to the IEC 60068-2-2
Dry cold test	According to the IEC 60068-2-1
Damp heat test, cyclic	According to the IEC 60068-2-30

Table 13: Electromagnetic compatibility tests

EMC immunity test level meets the requirements listed below:	
1 MHz burst disturbance test, class III:	According to the IEC 60255-22-1
- Common mode	2.5 kV
- Differential mode	1.0 kV
Electrostatic discharge test, class IV:	According to the IEC 61000-4-2, IEC 60255-22-2 and ANSI C37.90.3-2001
- for contact discharge	8 kV
- for air discharge	15 kV
Radio frequency interference tests:	
- Conducted, common mode	According to the IEC 61000-4-6 and IEC 60255-22-6 (2000) 10 V (rms), f = 150 kHz...80 MHz
- Radiated, amplitude-modulated	According to the IEC 61000-4-3 and IEC 60255-22-3 (2000) 10 V/m (rms), f = 80...1000 MHz
- Radiated, pulse-modulated	According to the ENV 50204 and IEC 60255-22-3 (2000) 10 V/m, f = 900 MHz
Fast transient disturbance tests:	According to the IEC 60255-22-4 and IEC 61000-4-4

Technical data (cont´d)

Table 13: Electromagnetic compatibility tests

• Power outputs, energizing inputs, power supply	4 kV
• I/O ports	2 kV
Surge immunity test:	According to the IEC 61000-4-5
• Power outputs, energizing inputs, power supply	4 kV, line-to-ground 2 kV, line-to-line
• I/O ports	2 kV, line-to-ground 1 kV, line-to-line
Power frequency (50 Hz) magnetic field IEC 61000-4-8	300 A/m continuous
Voltage dips and short interruptions	According to the IEC 61000-4-11 30%/10 ms 60%/100 ms 60%/1000 ms >95%/5000 ms
Electromagnetic emission tests	According to the EN 55011
- Conducted, RF-emission (Mains terminal)	EN 55011, class A, IEC 60255-25
- Radiated RF-emission	EN 55011, class A, IEC 60255-25
CE approval	Complies with the EMC directive 89/336/EEC and the LV directive 73/23/EEC

Table 14: Standard tests

Insulation tests	
Dielectric tests	According to the IEC 60255-5
Test voltage	2 kV, 50 Hz, 1 min
Impulse voltage test	According to the IEC 60255-5
Test voltage	5 kV, unipolar impulses, waveform 1.2/50 μs, source energy 0.5 J
Insulation resistance measurements	According to the IEC 60255-5
Isolation resistance	>100 MΩ, 500 V dc
Mechanical tests	
Vibration tests (sinusoidal)	According to the IEC 60255-21-1, class I
Shock and bump test	According to the IEC 60255-21-2, class I

Table 15: Data communication

Rear interface, connector X5.3 X5.4 or X5.5
- Fibre-optic or RS-485 connection
- SPA bus, IEC 60870-5-103 or Modbus protocol
- 9.6 or 4.8 kbps (additionally 2.4, 1.2 or 0.3 kbps for Modbus)
Front interface
- Optical connection (infrared): wirelessly or via the front communication cable (1MRS050698)
- SPA bus protocol
- 9.6 or 4.8 kbps (9.6 kbps with front communication cable)

Connection diagrams

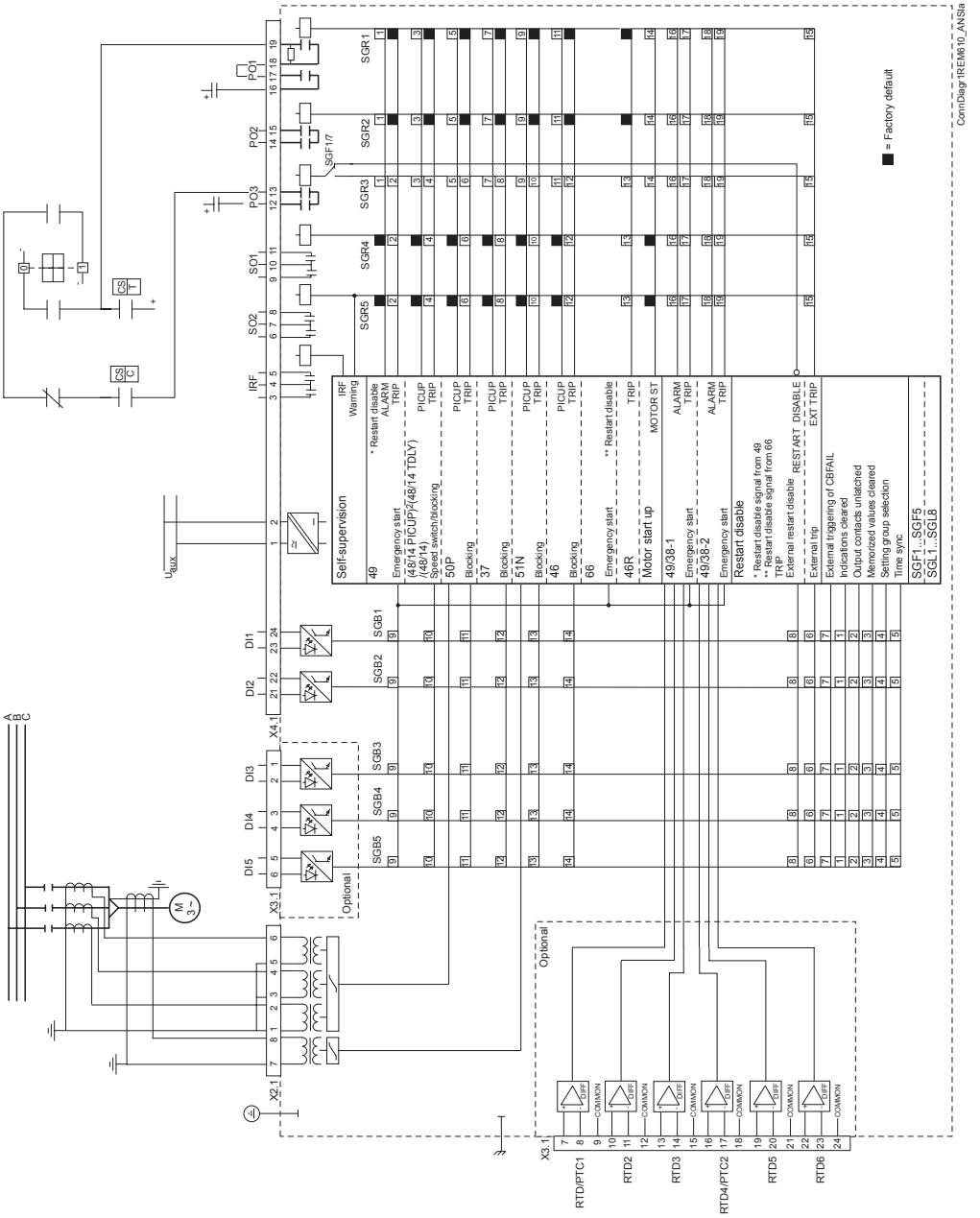

Fig. 2 Residual current is measured via a core-balanced current transformer.

Connection diagrams
(cont´d)

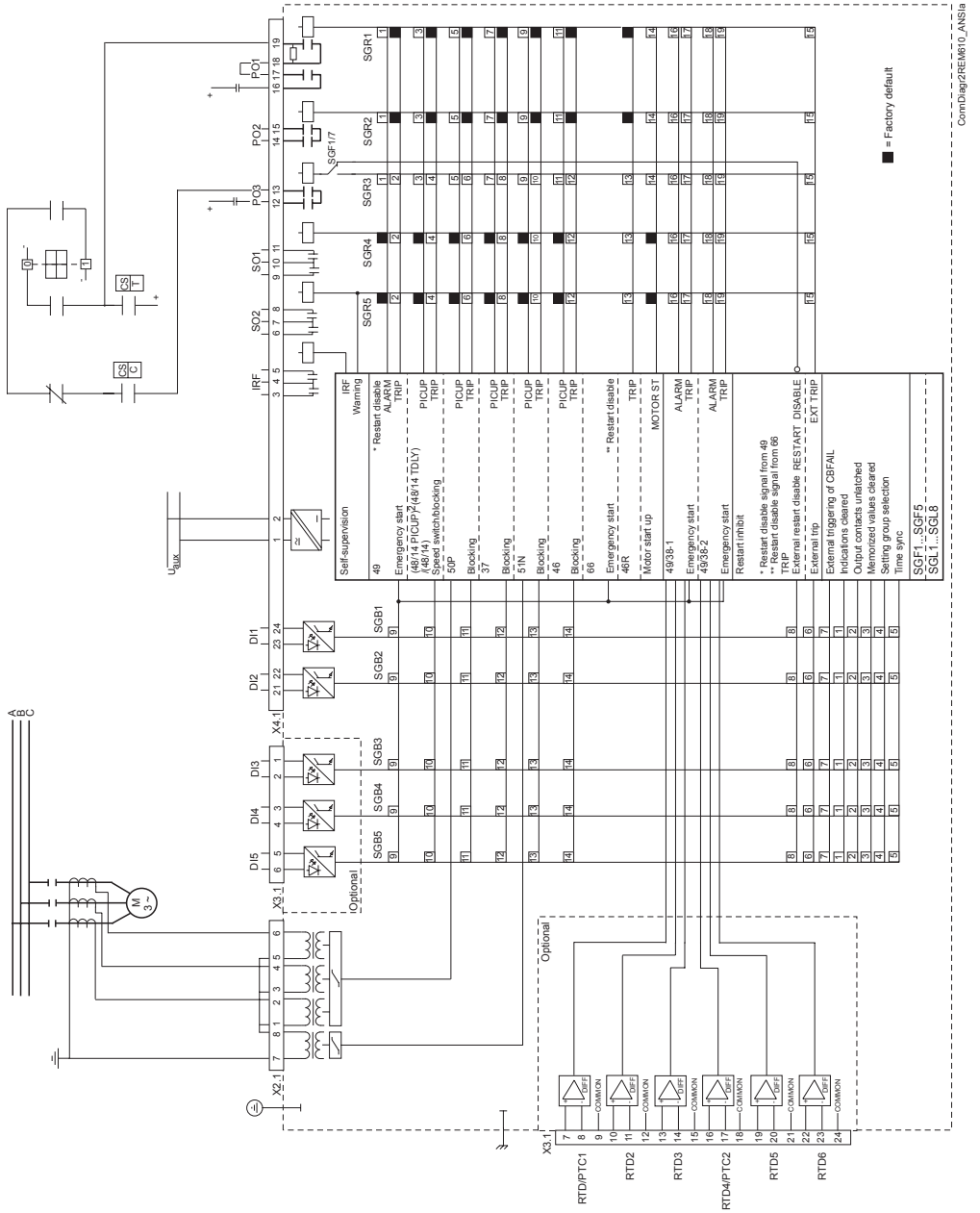

Fig. 3 Residual current is measured via a summation connection of the phase current transformers.

Connection diagrams
(cont´d)

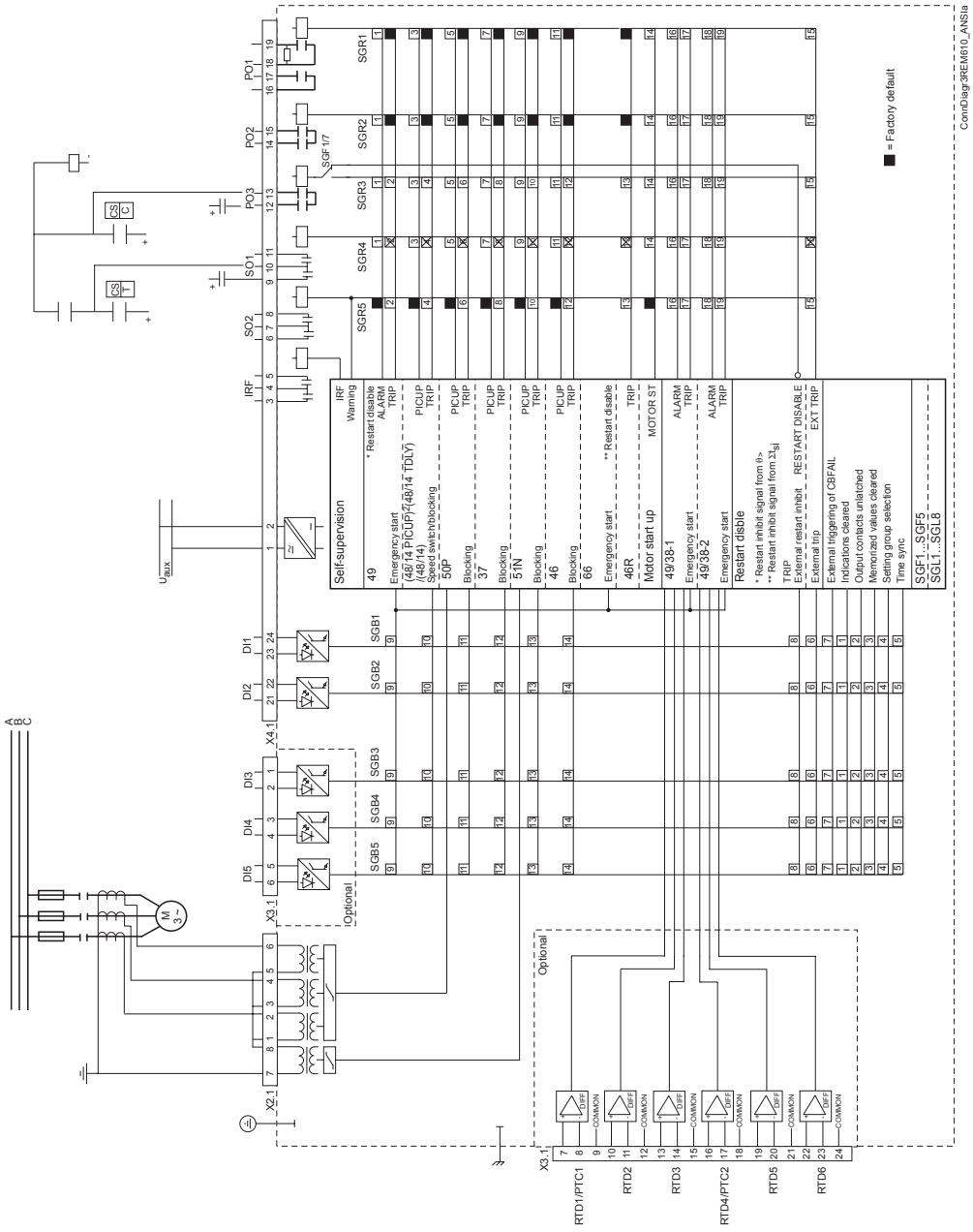

Fig. 4 REM 610 connected to a contactor controlled motor with the trips routed to trip the contactor.

Ordering information

When ordering REM 610 protection relays and/or accessories, please specify the following:

- Order number
- HMI language set number
- Quantity

The order number identifies the protection relay type and hardware as described in figures below and is labelled on the marking strip under the lower handle of the relay. Use the ordering key below to generate the order number when ordering complete protection relays.

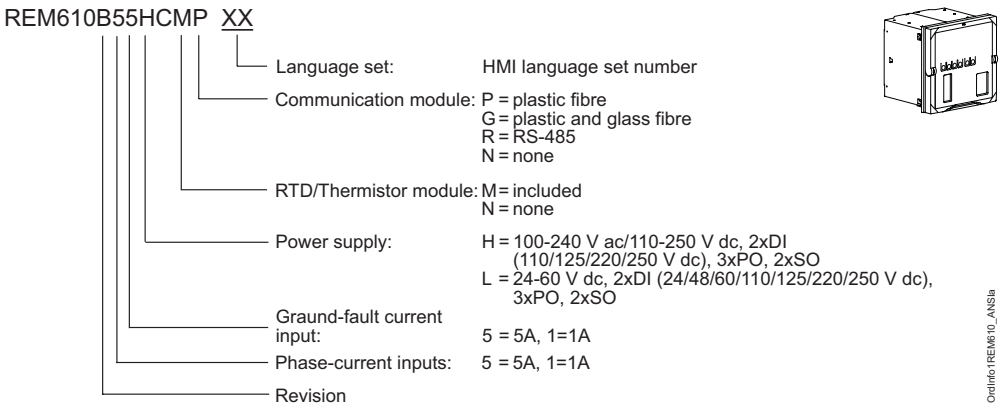

Fig. 5 Ordering key

Use the ordering key in fig. 6 to generate the order number when ordering spare units.

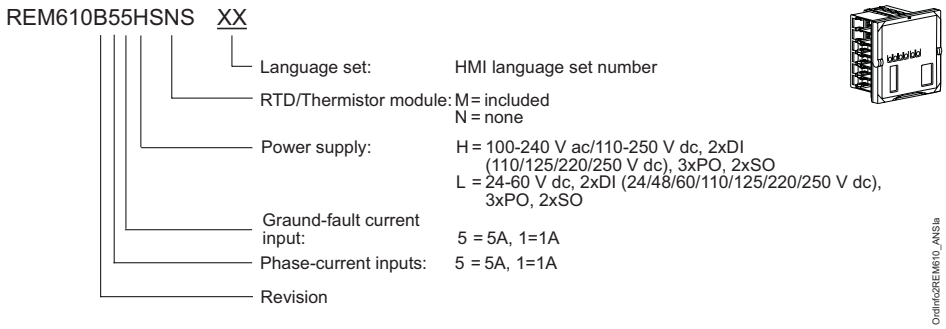

Fig. 6 Ordering key for spare units

HMI language set numbers, corresponding terminology and languages included, are described in table 16 below:

Table 16: HMI language set numbers

Language set number	Terminology	Languages
01	IEC	English, Svenska, Suomi
02	IEC	English, Deutsch, Francais, Italiano, Español
11	ANSI	English (US), Español, Portuguese

Note: The spare unit is a plain plug-in unit without enclosure, terminal connections and the optional communication module.

The following accessories are available:

Item	Order number
Semi-flush mounting kit	1MRS050696
Inclined (∠25°) semi-flush mounting kit	1MRS050831
Wall mounting kit	1MRS050697
19” Rack mounting kit, side-by-side	1MRS050695
19" Rack mounting kit, single relay	1MRS050694
19" Rack mounting kit for single relay and RTXP18	1MRS050783
Front communication cable	1MRS050698

Configuration, setting and SA system tools

The following tool versions are needed to support the new functions and features of REM 610 release B:

CAP 501 Relay Setting Tool	CAP 501 v. 2.3.0-5 or later
CAP 505 Relay Setting Tool	CAP 505 v. 2.3.0-5 or later
SMS 510 Substation Monitoring System	SMS 510 v. 1.1.0 or later
LIB 510 Library for MicroSCADA v. 8.4.4	LIB 510 v. 4.0.5-3 or later

References

Available manuals:

Item	Order number
Technical Reference Manual, ANSI version	1MRS755537
Operator’s Manual, ANSI version	1MRS755538
Installation Manual	1MRS752265-MUM

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