Relion® 605 series

Motor protection and control REM601 ANSI Product guide

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1. Description

The REM601 is a dedicated motor protection relay with an optional control feature. The relay is intended for the protection of medium voltage and low voltage asynchronous motors in manufacturing and process industries. The REM601 is a member of ABB's Relion® product family and part of its 605 series.

The relay provides an optimized composition of protection, monitoring and control functionality in one unit, with the best performance usability in its class. The relay is based on ABB's in-depth knowledge of protection and numerical technology.

2. Relay functions

The REM601 can be preconfigured which facilitates easy and fast commissioning of switchgear.

To emphasize the simplicity of using this relay, only application specific parameters need to be set within the relay's intended area of application. The standard signal configuration can be altered by LHMI (local human-machine interface).

The relay is available in two alternative application configurations, as indicated in Table 2.

Table 1. Standard configurations

Description	Relay type
Motor protection	REM601 with application configuration B
Motor protection and control	REM601 with application configuration C

Table 2. Application configurations and supported functions

Functionality	ANSI	IEC	B	C
Protection				
Non-directional overcurrent protection, low-set stage	51P	3I>	●	●
Non-directional overcurrent protection, high-set stage	50P-1	3I>>	●	●
Ground fault protection, low-set stage	51N	Io>	●	●
Ground fault protection, high-set stage	50N	Io>>	●	●
Three-phase thermal protection for motor	49M	3Ith>	●	●
Phase discontinuity/single phasing protection	46PD	I2/I1>	●	●
Negative sequence overcurrent protection	46	I2>	●	●
Phase reversal protection	46R	I2R>	●	●
Motor startup supervision, stalling protection with provision of speed switch input, repetitive startup protection, and restart inhibit	51LRS/ 14/48/66	Is2t n<	●	●
Locked rotor protection	50P-2	3I>>>	●	●
Under current protection	37	3I<	●	●
Circuit breaker failure protection	50BF/50NBF	3I>BF/ Io>BF	●	●
Master trip	94/86	Master Trip	●	●
Two setting groups	-	-	●	●
Control				
Breaker control functionality	52 CB	I <-> O CB	-	●
Emergency restart	ESTART	ESTART	●	●
Condition monitoring				
Trip circuit supervision	TCM	TCS	●	●
Measurement				
Three-phase current measurement	3I	3I	●	●
Residual current measurement	IN	Io	●	●
Negative phase sequence current	I2	I2	●	●
Thermal level	θ	ϑ	●	●
Operation counter	-	-	●	●
Motor run time	-	-	●	●
Latest motor startup max. current	-	-	●	●
Latest motor startup time	-	-	●	●
Time to next possible motor startup	-	-	●	●

● = Included

3. Protection functions

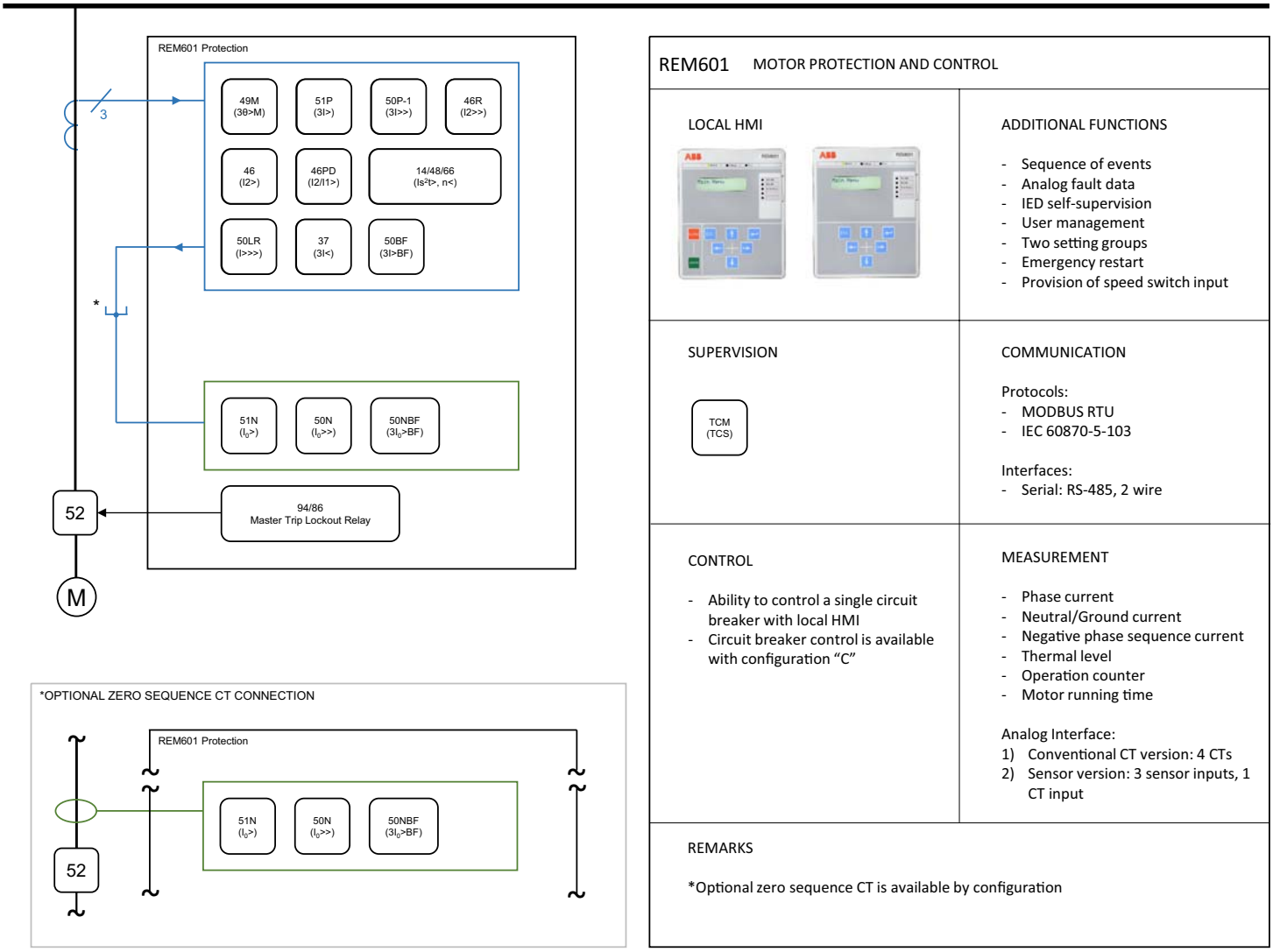
The REM601 offers a full range of protection functionality necessary for adequate protection of motors. The relay has thermal overload, short circuit, startup supervision, negative phase sequence, loss-of phase and locked rotor protections. The relay also incorporates sensitive ground fault, under current and circuit breaker failure protection functions.

The thermal protection supervises the thermal stress of the protected object during various load conditions. The protection provides a thermal pre-condition alarm to warn the operators to take action before motor trip. When the thermal level exceeds a set trip level it activates trip. It also prevents the motor from being re-energized if the motor is too hot.

The start-up supervision function protects the motor during starting. The protection also prevents the motor from overheating during stall condition. There is a provision of accepting speed switch input for making protection suitable motors having permissible stalled time shorter than the motor starting time. The repetitive startup function protects the motor from too many start-up attempts in a short period of time, otherwise causing overheating of the motor.

The negative sequence function protects the motor from stress caused due to an unbalanced network. The phase discontinuity protection detects broken conductor single phasing condition. Additionally, phase reversal protection function protects the motor from incorrectly connected phases, which would cause the motor to rotate in the reverse detection.

Figure 1. Function overview of REM601 Application Configurations



REM601 MOTOR PROTECTION AND CONTROL

LOCAL HMI

ADDITIONAL FUNCTIONS

- Sequence of events
- Analog fault data
- IED self-supervision
- User management
- Two setting groups
- Emergency restart
- Provision of speed switch input

SUPERVISION

TCM (TCS)

COMMUNICATION

Protocols:
- MODBUS RTU
- IEC 60870-5-103

Interfaces:
- Serial: RS-485, 2 wire

CONTROL

- Ability to control a single circuit breaker with local HMI
- Circuit breaker control is available with configuration "C"

MEASUREMENT

- Phase current
- Neutral/Ground current
- Negative phase sequence current
- Thermal level
- Operation counter
- Motor running time

Analog Interface:
1) Conventional CT version: 4 CTs
2) Sensor version: 3 sensor inputs, 1 CT input

REMARKS

*Optional zero sequence CT is available by configuration

4. Application

The REM601 is a protection relay aimed at protection and control of medium voltage and low voltage asynchronous motors. The relay can be used for three phase motors in all conventional contactor or circuit breaker controlled motor drives.

The relay with application configuration B offers thermal overload, short circuit, startup supervision, negative phase sequence, loss of phase and locked rotor protections. Configuration B also incorporates sensitive ground fault, under current and circuit breaker failure protection functions.

The residual current for the ground fault protection is derived from the phase currents. When applicable, a core-balance current transformer can be used for measuring the residual current, especially when sensitive ground fault protection is required. The application configuration C offers the added feature of built in breaker or contactor control functionality on top of all the functions of application configuration B.

5. Optimized for limited space

With its compact size and unique technical features, the REM601 is an ideal relay for retrofits, compact switchgear and switchgear with limited space. The relay has a small mounting depth and does not have any loose mounting accessories. Uniquely, the REM601 uses a press-fit mounting arrangement, which makes it suitable for quick and easy installation on switchgear.

6. Control

The REM601 application configuration C features control of one circuit breaker with dedicated push-buttons and guidance on local HMI for opening and closing. It includes two dedicated outputs for breaker control. The breaker control is also possible through optional MODBUS / IEC 60870-5-103 communication.

7. Measurement

The relay continuously measures phase currents and ground current. Ground current can be measured using an external zero sequence current transformer or can be calculated internally. During service, the default view of the display shows the most loaded phase current in primary terms (Amps), and the ground current. The values measured can be accessed locally via the user interface on the relay or remotely via the communication interface of the relay.

The relay continuously measures negative sequence current, thermal level, motor run time and counter values if these functions are supported as per application configurations.
The REM601 displays the most recent motor startup current value, motor startup time and time to next possible motor startup in case the restart inhibit function is active.

8. Event log

To collect sequence of events (SoE) information, the relay incorporates non-volatile memory with a storage capacity of 100 events with associated time stamps and a resolution of 1 ms. The event log includes trip circuit monitoring status, protection operation status, binary I/O status and relay fault code. The event logs are stored sequentially, the most recent being first and so on. The non-volatile memory retains its data in the event of temporary auxiliary supply loss.

The event log facilitates detailed post-fault analysis of feeder faults and disturbances. The SoE information can be accessed locally via the user interface on the relay front panel or remotely via the communication interface of the relay.

9. Recorded data

The relay stores fault records of analog values for the last five trip events in non-volatile memory. The fault recording is triggered by the trip signal of protection function. Each fault record includes the current values for three phases and ground current along with a time stamp. These records enable the user to analyze the five most recent power system events. The relay records the number of phase and ground fault trip events into dedicated trip counters. These trip counters cannot be reset by the user and are stored in non-volatile memory. The recorded information can be accessed locally via user interface on the relay front panel and can be uploaded for subsequent fault analysis.

10. Self-supervision and test function

The relay's built-in self-supervision system continuously monitors the state of the relay hardware and the operation of the relay software. Any fault or malfunction detected will be used for alerting the operator. A permanent relay fault will block the protection functions of the relay to prevent incorrect relay operation. The relay supports a built-in test mode which enables user to test the relay HMI and binary outputs.

11. Trip-circuit monitoring

The trip-circuit monitoring continuously monitors the availability and operability of the trip circuit. It provides open-circuit monitoring both when the circuit breaker is in its closed and in its open position. It also detects loss of circuit-breaker control voltage.

12. Access control

To protect from unauthorized access and to maintain the integrity of information, the relay is armed with a three level, role-based user authentication system with individual passwords for operator, engineer and administrator levels. There are two alternative password protection options. The default is a combination of different navigation keys. The alternative is an alpha-numeric password. The user can select the password option based on their requirement.

13. Local HMI

The local HMI features an alpha-numeric LCD display, LED indicators and navigation keys. Measurements, recorded data, events and settings can be viewed on the display. The relays have six LED indicators on the LHMI which are pre-configured for normal/IRF condition, pickup, trip, phase fault trip, ground fault trip and trip circuit fault indications. Support for multiple languages is built-in to the REM601.

14. Inputs and outputs

All configurations are offered with conventional CTs and are equipped with four 1A or 5A analog current inputs. Three are for phase current and one for ground current measurement.

The relay has four standard binary inputs. The binary inputs can be configured for various functions like emergency start, speed switch input, blocking, protection reset, breaker position, breaker control and trip circuit monitoring. These signals can be mapped to binary outputs and LEDs for indications. Individual inputs can be configured either as “Inverted or “Non Inverted”.

The REM601 has six output contacts. Of these, two are power outputs and four are signaling outputs. The output contacts can be configured for different functions like routing of protection start/trip signals, external trip/open, external close command, and trip circuit monitoring status, etc. One dedicated output contact is available for normal condition/IRF status indication.

All binary input and output contacts are pre-con-figured accor-ding to the default configuration. However, they can be easily reconfigured by using the LHMI menu.

15. Communication

The relay is available with an optional communication feature with Modbus RTU protocol or IEC 60870-5-103 on RS-485 bus with two wire connection. This allows the relay to connect to a control and monitoring system through serial communication for remote monitoring. The communication card may be added at any time.

16. Application warning

In case the REM601 is supplied with UPS step-wave or square-wave, an interposing transformer is needed to keep the supply voltage (peak voltage) below the upper limit of the relay.
These are the recommended transformer characteristics:

- Nominal Power: 20 VA
- Secondary voltage: in the range 30...150 V AC

Table 3. Input/output overview

Relay type	Analog input	Binary inputs	Binary outputs
	CT	BI	BO
REM601	4	4	6

17. Technical data

Table 4. Dimensions

Relay type description	Value	
Width	Frame	5.12 inches (130.0 mm)
	Case	4.78 inches (121.5 mm)
Height	Frame	6.39 inches (160.0 mm)
	Case	5.96 inches (151.5 mm)
Depth		5.96 inches (151.5 mm)
Weight		3.2 lbs (1.43 kg)

Table 5. Power supply

Description	Value
V nominal (V_n)	24…240 V AC, 50 and 60 Hz
	24…240 V DC
V_n variation	85…110% of V_n (20.4…264 V AC)
	70…120% of V_n (16.8…288 V DC)
Burden of auxiliary voltage supply under quiescent (Pq)/operating condition	< 5.0 VA
Ripple in the DC auxiliary voltage	Max 12% of the DC value (at frequency of 100 Hz)
Maximum interruption time in the auxiliary DC voltage without resetting the relay	50 ms at nominal voltage

Table 6. Energizing inputs (conventional CT)

Description		Value	
Rated frequency		50/60 Hz	
Current inputs	Rated current, I_n	1 A [1)]	5 A [1)]
	Thermal withstand capability:		
	· Continuously	4 A	20 A
	· For 1 s	100 A	500 A
	Dynamic current withstand		
	· Half-wave value	250A	1250A
	Input impedance	< 100 mΩ	< 20 mΩ

[1)] Ordering option for current input

Table 7. Binary input

Description	Value
Rated voltage	24…240 V AC/DC
Operating range	85…110% of V_n for AC and
	70…120% of V_n for DC
Current drain	2…20 mA
Power consumption/input	< 500 mW
Input sensing time	25 ms
Trip-circuit monitoring (TCM): (BI2)	
Control voltage range	48…250 V AC/DC
Current drain through the supervision circuit	~ 1.5 mA
Minimum voltage over the TCS contact	20 V AC/DC (15…20 V)

Table 8. Double-pole power output (XK2 : BO2)

Description	Value
Rated voltage	240 V AC/DC
Continuous contact carry	8 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 (two contacts connected in series)	5 A/3 A/1 A
Minimum contact load	100 mA at 24 V AC/DC

Table 9. Single-pole power output relay (XK10 : BO1)

Description	Value
Rated voltage	240 V AC/DC
Continuous contact carry	8 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 35 / 220 V DC	5 A/0.2 A
Minimum contact load	100 mA at 24 V AC/DC

Table 10. Signal output and IRF output (XK2 : BO3, BO4, BO5, BO6)

Description	Value
Rated voltage	240 V AC/DC
Continuous contact carry	6 A
Make and carry for 3.0 s	8 A
Make and carry for 0.5 s	10 A
Breaking capacity when the control-circuit time constant L/R<40 ms, at 35 / 220 V DC	4 A/0.15 A
Minimum contact load	100 mA at 24 V AC/DC

Table 11. Degree of protection of relay

Description	Value
Front side	IP 54
Rear side, connection terminals	IP 20

Table 12. Environmental conditions

Description	Value
Operating temperature range	-25…+55 °C
Service temperature range	-25…+70 °C (<16 h)
Relative humidity	< 93%, non-condensing
Atmospheric pressure	86…106 kPa
Altitude	Up to 6561 ft (2000 m)
Transport and storage temperature range	-40…+85 °C

Table 13. Environmental tests

Description	Type test value	Reference
Dry heat test (humidity < 50%) · Working · Storing	· 96 h at +70 °C · 96 h at +85 °C	IEC 60068-2-2 IEC 60068-2-48
Dry cold test · Working · Storing	· 96 h at -25 °C · 96 h at -40 °C	IEC 60068-2-1 IEC 60068-2-48
Damp heat test, cyclic	· 2 cycles (12 h + 12 h) at +25°C...+55 °C, Rh > 93%	IEC 60068-2-30
Damp heat test, steady state	· 96 h at +40 °C, humidity, Rh > 93%	IEC 60068-2-78

Table 14. Electromagnetic compatibility tests

Description	Type test value	Reference
1 MHz/100 kHz burst disturbance test: - Common mode - Differential mode	 2.5 kV, 1MHz, 400 pulses/s 1.0 kV, 1MHz, 400 pulses/s	IEC 61000-4-12, class III IEC 60255-22-1
Electrostatic discharge test: - Contact discharge - Air discharge	 6 kV, 150 pF/330 Ω 8 kV, 150 pF/330 Ω	IEC 60255-22-2, class III IEC 61000-4-2
Radiated, electromagnetic field immunity test	10 V/m f=80-1000 MHz, 1.4-2.7 GHz 10 V/m f=80, 160, 450, 900 MHz, 900 PM, 1850 PM, 2150 PM	IEC 60255-22-3, class III IEC 61000-4-3
Fast transient disturbance tests: - All ports	 4 kV, 5.0 kHz, 4 kV, 5.0 kHz	IEC 60255-22-4, class A IEC 61000-4-4
Surge immunity test: - Common mode - Differential mode	4.0 kV, 1.2/50 µs 2.0 kV, 1.2/50 µs	IEC 60255-22-5 IEC 61000-4-5
Power frequency magnetic field immunity test: - Continuous - Short duration (1 s)	 100 A/m 1000 A/m	IEC 61000-4-8
Conducted radio frequency interference tests:	10 V f=150 KHz...80 Mhz	IEC 60255-22-6, class III IEC 61000-4-6
AC Voltage dips and short interruptions:	30% / 25 period 60% / 10 periods 100% / 2.5 periods 100% / 250 periods	IEC 61000-4-11
DC Voltage dips and short interruptions	30% / 500 ms 60% / 200 ms 100% / 50 ms 100% / 5000 ms	IEC 61000-4-29
Power frequency immunity test: · Common mode · Differential mode	 300 V rms 150 V rms	IEC 60255-22-7, Class A
Pulse magnetic field immunity tests:	1000 A/m, 6.4/16 µs	IEC 61000-4-9

Table 14. Electromagnetic compatibility tests (continued)

Description	Type test value	Reference
Emission tests:		IEC 60255-25 EN 55011-CISPR II
Conducted		
150 kHz-0.5 MHz	< 66 dB (µV/m)	
0.5 MHz-30 MHz	< 60 dB (µV/m)	
Radiated		
30-230 MHz	< 40 dB (µV/m)	
230-1000 MHz	< 47 dB (µV/m)	

Table 15. Insulation tests

Description	Type test value	Reference
Dielectric test		IEC 60255-5
- Test voltage	2 kV, 50 Hz, 1 min	IEC 60255-27
Impulse voltage test		IEC 60255-5
- Test voltage	5 kV, 1.2/50 µs, 0.5 J	IEC 60255-27
Insulation resistance test		IEC 60255-5
- Isolation resistance	> 100 MΩ at 500 V DC	IEC 60255-27

Table 16. Mechanical tests

Description	Type test value	Reference
Vibration tests		IEC 60255-21-1, class I
- Response	10...150 Hz, 0.035 mm / 1.0g, 1 sweep / axis	
- Endurance / Withstand	10...150 Hz, 2.0 g, 20 sweeps / axis	
Shock tests		IEC 60255-21-2, class II
- Response	10 g, 3 pulses in each direction	
- Endurance / Withstand	30 g, 3 pulses in each direction	
Bump tests	10 g, 1000 bumps in each direction	IEC 60255-21-2, class I

Table 17. Product safety

Description	Type test value
LV directive	2006/95/EC
Standards	EN 60255-27 (2005) EN 60255-1 (2009)

Table 18. EMC compliance

Description	Type test value
EMC directive	2004/108/EC
Standards	EN 50263 (2000) EN 60255-26 (2007)

Table 19. RoHS compliance

Description
Complies with the RoHS directive 2002/95/EC

Table 20. Data communication (optional)

Description	Type test value
Protocol	MODBUS RTU or IEC 60870-5-103
Communication port	RS485, 2 wire

Protection functions

Table 21. Low-set three-phase overcurrent protection, stage I> / 51P

Parameter	Value (Range)
Setting range of pick-up current 'I>/51P'	0.1...2.5 x In in steps 0.001, infinite
Operation accuracy	± 5.0% of set value, ± 10.0% of set value for set value < 0.2
Operate time delay (DMT) 't >'	0.04...64 s in steps of 0.01
Operation time accuracy	± 5.0% of set value or ± 30 ms
Operating curve type	IEC 60255-3: Normal Inverse, Very Inverse, Extremely Inverse, Long-time Inverse ANSI C37.112: Moderate Inverse, Normal Inverse, Very Inverse, Extremely Inverse Special curves: RI Inverse
Time multiplier setting 'k'	0.02...1.6, in steps of 0.01
Operation time accuracy	
- IEC and ANSI characteristics	class E(5) or ± 30 ms, class E(7.5) or ± 30 ms for set value < 0.2
- RI characteristics	± 5.0% of set value or ± 30 ms
Reset ratio	IDMT : 0.96 and DT : 0.98

Table 22. High-set three-phase overcurrent protection, stage I>> / 50P-1

Parameter	Value (Range)
Setting range of pick-up current 'I>>/50P-1'	0.2...25.0 x In in steps 0.001, infinite for CT variant
Operation accuracy	± 5.0% of set
Operation mode	Definite time, Instantaneous
Operate time delay (DMT) 't >>'	0.04...64 s in steps of 0.01
Operation time accuracy	± 5.0% of set value or ± 30 ms
Reset ratio	0.98

Table 23. Low-set ground fault protection, stage Io> / 51N

Parameter	Value (Range)
Setting range of pick-up current 'Io>/51N'	External ground measurement : 0.01...2.0 x In in steps 0.001, infinite Internal ground measurement : 0.1...2.0 x In in steps 0.001, infinite
Operation accuracy	External ground measurement : ± 5.0% of set value External ground measurement : ± 10.0% of set value, for set value < 0.05 Internal ground measurement : ± 15.0% of set value
Operate time delay (DMT) 't >'	0.04...64 s in steps of 0.01
Operation time accuracy	External ground measurement : ± 5.0% of set value or ± 30 ms Internal ground measurement : ± 10.0% of set value or ± 30 ms
Operating curve type	IEC 60255-3: Normal inverse, Very Inverse, Extremely Inverse, Long-time Inverse ANSI C37.112: Moderate inverse, Normal Inverse, Very Inverse, Extremely Inverse Special curves: RI inverse
Time multiplier setting 'k'	0.02...1.6, in steps of 0.01
Operation time accuracy	
- IEC and ANSI characteristics	External ground measurement : class E(5) or ± 30 ms
- RI characteristics	External ground measurement : class E(7.5) or ± 30 ms
- IEC and ANSI characteristics	Internal ground measurement : ± 5.0% of set value or ± 30 ms
- RI characteristics	Internal ground measurement : ± 10.0% of set value or ± 30 ms
Reset ratio	IDMT : 0.96 and DT : 0.98

Table 24. High-set ground fault protection, stage Io>> / 50N

Parameter	Value (Range)
Setting range of pick-up current 'Io>>/50N'	External ground measurement : 0.05...12.5 x In in steps 0.001, infinite Internal ground measurement : 0.5...12.5 x In in steps 0.001, infinite
Operation accuracy	External ground measurement : ± 5.0% of set value Internal ground measurement : ± 15.0% of set value
Operation mode	Definite time, Instantaneous
Operate time delay (DMT) 'to >>'	0.04...64 s in steps of 0.01
Operation time accuracy	External ground measurement : ± 5.0% of set value or ± 30 ms Internal ground measurement : ± 10.0% of set value or ± 30 ms
Reset ratio	0.98

Table 25. Thermal overload protection, 3Ith> / 49

Parameter	Value (Range)
Initial thermal level of apparatus ϑ0	0.0…100%, in steps of 1%
Reference current leading to thermal calculation "Ib"	0.1 … 1.5 x In, in steps of 0.1
Heating time constant of object 't'	1.0…300 min, in steps of 1.0
Cooling time constant of object 'τ↓,'	1.0…300 min, in steps of 1.0
Alarm value, ϑalm/49_A	50…200%, in steps of 1%
Operate value, ϑtrip/49T	50…200%, in steps of 1%
Start inhibit value, ϑstartinhibit/49 Block	50…200%, in steps of 1%
Options for calculating thermal value during power interruption, ϑpowerOFF	1…4[1])
Operation time accuracy	3% of 5 time constant or ± 30s
Reset ratio	0.98

[1]) Options for calculating thermal image during power interruption shall be as below:
1 = On restoration of power, new value of current after power on will be considered to calculate new value of thermal image for interruption period Δt.
2 = On restoration of power, new value of thermal image is calculated for interruption period Δt considering that current has remained constant value during power interruption.
3 = Power interruption of the relay assumes no change of thermal image during interruption period.
4 = Power interruption of the relay resets the thermal image to the set value defined by setting ϑ0.

Table 26. Motor start-up supervision protection, I2t n< / 51LRS, 14,48,66

Parameter	Value (Range)
Current value for detection of motor start, 'Istart >'	1…10 x Ib [1]), in steps of 0.1
Restraint 68M	Yes, No
Motor startup current, 'I startup'	1…10 x Ib, in steps of 0.1
Motor startup time, 't startup'	5… 120 s, in steps of 1.0
Permitted stalling time, 't lockrotor'	2… 200 s, in steps of 1.0
Maximum start allowed per defined supervised time, 'Max Str'	1… 10
Supervised time allowed for maximum starts, 'tn'	1… 180 minute, in steps of 1.0
Operation accuracy	± 5.0% of set value
Operation time accuracy	3% of set or ± 30 ms

[1]) Ib: Rated current of motor defined by base current setting

Table 27. Negative sequence overcurrent protection, I2> / 46

Parameter	Value (Range)
Start value, 'I2>/46"	0.1…1.5 x In, in steps of 0.01
Operate delay time, 'tI2>/Time'	0.1 … 300 s, in steps of 0.1
Block the negative phase sequence protection	0 = No, 1 = Yes
Operation accuracy	± 5.0% of set value
Operation time accuracy	3% of set value or ± 30ms
Reset ratio	0.98

Table 28. Phase discontinuity protection, I2/I1> / 46PD

Parameter	Value (Range)
Pickup value, 'I2/I1>/46PD"	10…100%, in steps of 1%
Operate delay time, 'tI2/I1>/Time'	0.1 … 64 s, in steps of 0.1
Block the phase discontinuity protection	0 = No, 1 = Yes
Operation accuracy	± 5.0% of set value
Operation time accuracy	3% of set or ± 30 ms
Reset ratio	0.98

Table 29. Phase reversal protection, I2R> / 46R

Parameter	Value (Range)
Start value, 'I2R/46R>"	0.1…1.5 x Ib, in steps of 0.01
Operate delay time, 'tI2R/46Rtd >'	0.1 … 300 s, in steps of 0.1
Block the protection	0 = No, 1 = Yes
Operation accuracy	± 5.0% of set value
Operation time accuracy	3% of set or ± 30 ms
Reset ratio	0.98

Table 30. Undercurrent protection, 3I < / 37

Parameter	Value (Range)
Start value, '3I</37"	0.12…0.80 x Ib, in steps of 0.01
Operate delay time, 't3I</37td'	0. … 30 s, in steps of 0.1
Block the phase reversal protection	0 = No, 1 = Yes
Operation accuracy	± 5.0% of set value
Operation time accuracy	3% of set or ± 30 ms
Reset ratio	1.02

Table 31. Circuit breaker failure protection, 3I/IoBF / 50BF/50NBF

Parameter	Value (Range)
Operating phase current, 'ICBFP/Iph_pu'	0.2…2.0 x In, in steps of 0.1
Operating neutral current, 'IoCBFP/In_pu'	0.1…2.0 x In, in steps of 0.1
Time delay for retrip, 'tretrip'	0.06…0.5 s, in steps of 0.01
Time delay for backup protection, 'tbackup'	0.06…0.5 s, in steps of 0.01
Block the circuit breaker failure protection	0 = No, 1 = Yes
Operation accuracy	± 5.0% of set value
Operation time accuracy	3% of set value or ± 30ms

Table 32. Counter

Parameter	Value (Range)
Initial value of the counter at the start of IED, 'Value'	0…65535, in steps of 1
Binary input configured at PULSE_INPUT, 'BIconf'	1…4 (1=BI1, 2=BI2, 3=BI3, 4=BI4) '-' no selection if counter selection not needed

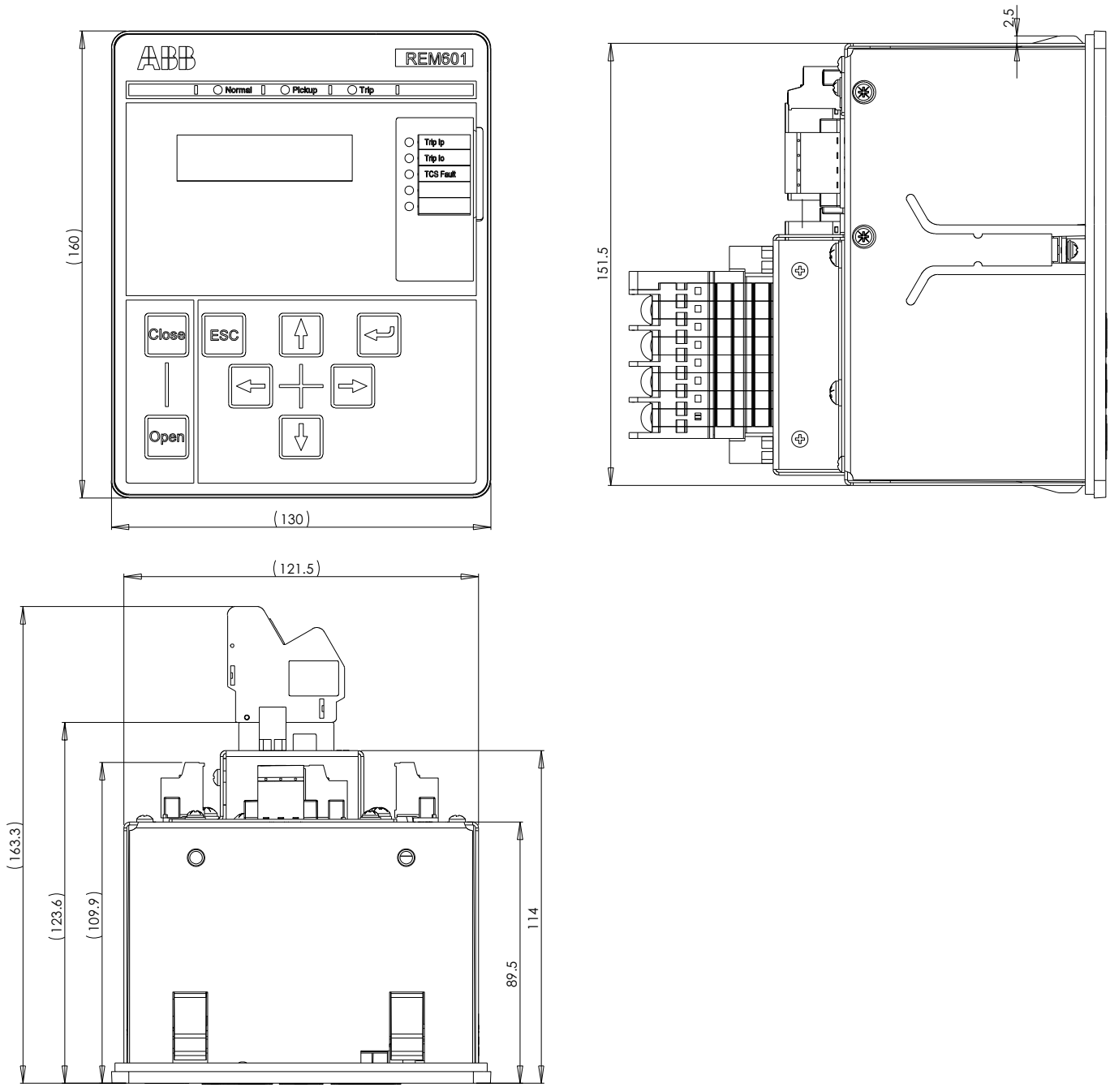
18. Dimensions and mounting

The REF601 has been equipped with a press-fit panel mounting mechanism. Without using any additional mounting accessories, the relay can be easily flush mounted on the panel.

With appropriate mounting accessories the REM601 can be mounted on circuit breakers of types VD4 or HD4. The dimensions are listed below for the panel cut-out for flush mounting:

- Height : 5.96” ± 0.02” (151.5 ± 0.5 mm)
- Width : 4.78” ± 0.02” (121.5 ± 0.5 mm)
- Thickness of panel : 0.0787” – 0.1181” (2.0 – 3.0 mm)

Figure 2. Dimension of REM601 – Flush mounting CT variant



19. Selection and ordering data

The relay type and serial number label identifies the protection relay. An order number label is placed on the side of the relay. The order number consists of a string of codes generated from hardware and software modules of relay.

Use the ordering key information below to generate the order number when ordering the protection relay.

Example code			REF601	A	E4	46	B	C	1	B	H
#	**Description**										
1	**Relay type**										
	Motor protection with control	REM601									
	Motor protection	REM601									
2	**Standard**										
	ANSI	A									
	IEC	B									
3,4	**Analog input / output**										
	Phase and Ground current input – 1A	D4									
	Phase and Ground current input – 5A	E4									
5,6	**Binary input / output**										
	4 BI + 6 BO	46									
7	**Serial communication**										
	MODBUS RTU with RS485 two wire	B									
	IEC60870-5-103 with RS485 two wire	C									
	None	N									
8	**Application configuration**										
	Motor protection	B									
	Motor protection with control	C									
9	**Power supply**										
	24...240V AC / DC	1									
10	**Configuration**										
	Ring lug terminals	B									
11	**Version**										
	Product version 2.2 FP1	H									

Example order code: REM601 A E4 46 B C 1 B H

Your ordering code:

Digit (#)	1	2	3 4	5 6	7	8	9	10	11
Code									

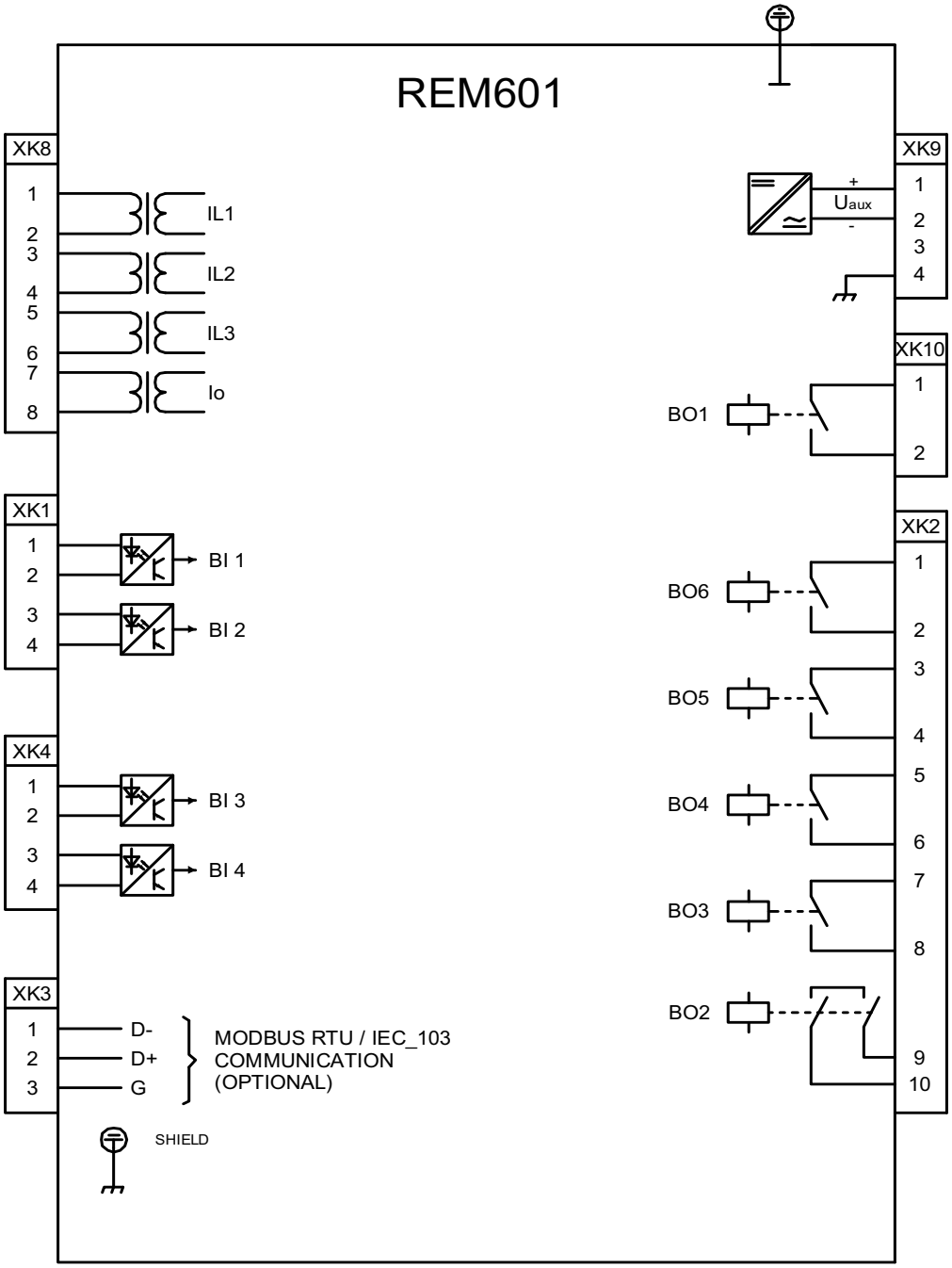
20. Accessories and ordering data

Table 33. Accessories

Item	Order number
RE_601 communication card	CIM601BNNNNBANXG

21. Terminal diagram

Figure 3. Terminal diagram of REM601 for CT variant



22. References

The www.abb.com/substationautomation portal offers you information about the distribution automation product and service range.

You will find the latest relevant information on the REM601 protection relays on the product page.

The download area contains the latest product documentation, such as technical reference manuals, technical presentations and so on. The selection tool on the webpage helps you find the documents by the document category and language.

23. Document revision history

Document revision/date	Product version	History
A / June 2015	V1.0	REM601 product release

24. Notes

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