MiCOM P211

Motor Protection Relay

P211/EN M/A31

Software version 7C

Technical Manual

Schneider Electric

CONTENTS

FIGURES

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1. STANDARD SAFETY STATEMENTS AND EXTERNAL LABEL INFORMATION FOR SCHNEIDER ELECTRIC EQUIPMENT

1.1 Introduction

This Safety Section and the relevant equipment documentation provide full information on safe handling, commissioning and testing of this equipment. This Safety Section also includes reference to typical equipment label markings.

The technical data in this Safety Section is typical only; see the technical data section of the relevant equipment documentation for data specific to a particular product.

Before carrying out any work on the equipment the user should be familiar with the contents of this Safety Section and the ratings on the equipment's rating label.

Reference should be made to the external connection diagram before the equipment is installed, commissioned or serviced.

Language specific, self-adhesive User Interface labels are provided in a bag for some equipment.

1.2 Health and safety

The information in the Safety Section of the equipment documentation is intended to ensure that equipment is properly installed and handled in order to maintain it in a safe condition.

It is assumed that everyone who will be associated with the equipment will be familiar with the contents of this Safety Section, or the Safety Guide (SFTY/4L M).

When electrical equipment is in operation, dangerous voltages will be present in certain parts of the equipment. Failure to observe warning notices, incorrect use, or improper use may endanger personnel and equipment and also cause personal injury or physical damage.

Before working in the terminal strip area, the equipment must be isolated.

Proper and safe operation of the equipment depends on appropriate shipping and handling, proper storage, installation and commissioning, and on careful operation, maintenance and servicing. For this reason only qualified personnel may work on or operate the equipment.

Qualified personnel are individuals who:

- Are familiar with the installation, commissioning, and operation of the equipment and of the system to which it is being connected;
- Are able to safely perform switching operations in accordance with accepted safety engineering practices and are authorized to energize and de-energize equipment and to isolate, ground, and label it;
- Are trained in the care and use of safety apparatus in accordance with safety engineering practices;
- Are trained in emergency procedures (first aid).

The equipment documentation gives instructions for its installation, commissioning, and operation. However, the manuals cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate Schneider Electric technical sales office and request the necessary information.

1.3 Symbols and labels on the equipment

For safety reasons the following symbols which may be used on the equipment or referred to in the equipment documentation, should be understood before it is installed or commissioned.

Symbols

	
Caution: refer to equipment documentation	Caution: risk of electric shock
	
Protective Conductor (*Earth) terminal	Functional/Protective Conductor (*Earth) terminal Note: This symbol may also be used for a Protective Conductor (Earth) terminal if that terminal is part of a terminal block or sub-assembly e.g. power supply.

*NOTE: THE TERM EARTH USED THROUGHOUT THIS TECHNICAL MANUAL IS THE DIRECT EQUIVALENT OF THE NORTH AMERICAN TERM GROUND.

Labels

See Safety Guide (SFTY/4L M) for typical equipment labeling information.

1.4 Installing, commissioning and servicing

Equipment connections

Personnel undertaking installation, commissioning or servicing work for this equipment should be aware of the correct working procedures to ensure safety.

The equipment documentation should be consulted before installing, commissioning, or servicing the equipment.

Terminals exposed during installation, commissioning and maintenance may present a hazardous voltage unless the equipment is electrically isolated.

Any disassembly of the equipment may expose parts at hazardous voltage; also electronic parts may be damaged if suitable electrostatic voltage discharge (ESD) precautions are not taken.

If there is unlocked access to the rear of the equipment, care should be taken by all personnel to avoid electric shock or energy hazards.

Voltage and current connections should be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety.

Watchdog (self-monitoring) contacts are provided in numerical relays to indicate the health of the relay. Schneider Electric strongly recommends that these contacts are hardwired into the substation's automation system, for alarm purposes.

To ensure that wires are correctly terminated the correct crimp terminal and tool for the wire size should be used.

The equipment must be connected in accordance with the appropriate connection diagram.

Protection Class I Equipment

- Before energizing the equipment it must be earthed using the protective conductor terminal, if provided, or the appropriate termination of the supply plug in the case of plug connected equipment.
- The protective conductor (earth) connection must not be removed since the protection against electric shock provided by the equipment would be lost.
- When the protective (earth) conductor terminal (PCT) is also used to terminate cable screens, etc., it is essential that the integrity of the protective (earth) conductor is checked after the addition or removal of such functional earth connections. For M4 stud PCTs the integrity of the protective (earth) connections should be ensured by use of a locknut or similar.

The recommended minimum protective conductor (earth) wire size is 2.5 mm² (3.3 mm² for North America) unless otherwise stated in the technical data section of the equipment documentation, or otherwise required by local or country wiring regulations.

The protective conductor (earth) connection must be low-inductance and as short as possible.

All connections to the equipment must have a defined potential. Connections that are pre-wired, but not used, should preferably be grounded when binary inputs and output relays are isolated. When binary inputs and output relays are connected to common potential, the pre-wired but unused connections should be connected to the common potential of the grouped connections.

Before energizing the equipment, the following should be checked:

- Voltage rating/polarity (rating label/equipment documentation);
- CT circuit rating (rating label) and integrity of connections;
- Protective fuse rating;
- Integrity of the protective conductor (earth) connection (where applicable);
- Voltage and current rating of external wiring, applicable to the application.

Accidental touching of exposed terminals

If working in an area of restricted space, such as a cubicle, where there is a risk of electric shock due to accidental touching of terminals which do not comply with IP20 rating, then a suitable protective barrier should be provided.

Equipment use

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Removal of the equipment front panel/cover

Removal of the equipment front panel/cover may expose hazardous live parts, which must not be touched until the electrical power is removed.

UL and CSA listed or recognized equipment

To maintain UL and CSA approvals the equipment should be installed using UL and/or CSA listed or recognized parts of the following type: connection cables, protective fuses/fuse holders or circuit breakers, insulation crimp terminals, and replacement internal battery, as specified in the equipment documentation.

Equipment operating conditions

The equipment should be operated within the specified electrical and environmental limits.

Current transformer circuits

Do not open the secondary circuit of a live CT since the high voltage produced may be lethal to personnel and could damage insulation. Generally, for safety, the secondary of the line CT must be shorted before opening any connections to it.

For most equipment with ring-terminal connections, the threaded terminal block for current transformer termination has automatic CT shorting on removal of the module. Therefore external shorting of the CTs may not be required; the equipment documentation should be checked to see if this applies.

For equipment with pin-terminal connections, the threaded terminal block for current transformer termination does NOT have automatic CT shorting on removal of the module.

External resistors, including voltage dependent resistors (VDRs)

Where external resistors, including voltage dependent resistors (VDRs), are fitted to the equipment, these may present a risk of electric shock or burns, if touched.

Battery replacement

Where internal batteries are fitted they should be replaced with the recommended type and be installed with the correct polarity to avoid possible damage to the equipment, buildings and persons.

Insulation and dielectric strength testing

Insulation testing may leave capacitors charged up to a hazardous voltage. At the end of each part of the test, the voltage should be gradually reduced to zero, to discharge capacitors, before the test leads are disconnected.

Insertion of modules and pcb cards

Modules and PCB cards must not be inserted into or withdrawn from the equipment whilst it is energized, since this may result in damage.

Insertion and withdrawal of extender cards

Extender cards are available for some equipment. If an extender card is used, this should not be inserted or withdrawn from the equipment whilst it is energized. This is to avoid possible shock or damage hazards. Hazardous live voltages may be accessible on the extender card.

External test blocks and test plugs

Great care should be taken when using external test blocks and test plugs such as the MMLG, MMLB and MiCOM P990 types, hazardous voltages may be accessible when using these. *CT shorting links must be in place before the insertion or removal of MMLB test plugs, to avoid potentially lethal voltages.

*Note: When a MiCOM P992 Test Plug is inserted into the MiCOM P991 Test Block, the secondaries of the line CTs are automatically shorted, making them safe.

Fiber optic communication

Where fiber optic communication devices are fitted, these should not be viewed directly. Optical power meters should be used to determine the operation or signal level of the relay.

Cleaning

The equipment may be cleaned using a lint free cloth dampened with clean water, when no connections are energized. Contact fingers of test plugs are normally protected by petroleum jelly, which should not be removed.

1.5 De-commissioning and disposal

De-commissioning

The supply input (auxiliary) for the equipment may include capacitors across the supply or to earth. To avoid electric shock or energy hazards, after completely isolating the supplies to the equipment (both poles of any dc supply), the capacitors should be safely discharged via the external terminals prior to de-commissioning.

Disposal

It is recommended that incineration and disposal to water courses is avoided. The equipment should be disposed of in a safe manner. Any equipment containing batteries should have them removed before disposal, taking precautions to avoid short circuits. Particular regulations within the country of operation, may apply to the disposal of the equipment.

1.6 Technical specifications for safety

Unless otherwise stated in the equipment technical manual, the following data is applicable.

1.6.1 Protective fuse rating

The recommended maximum rating of the external protective fuse for equipments is 16A, high rupture capacity (HRC) Red Spot type NIT, or TIA, or equivalent. The protective fuse should be located as close to the unit as possible.

CAUTION - CTs must NOT be fused since open circuiting them may produce lethal hazardous voltages.

1.6.2 Protective class

IEC 60255-27: 2005 EN 60255-27: 2005	Class I (unless otherwise specified in the EN 6025 equipment documentation). This equipment requires a protective conductor (earth) connection to ensure user safety.

1.6.3 Installation category

IEC 60255-27: 2005	Installation category II (Overvoltage Category II):
EN 60255-27: 2006	Distribution level, fixed installation. Equipment in this category is qualification tested at 2.5 kV peak, 1.2/50 µs, 500 Ω, 0.5 J, between all supply circuits and earth and also between independent circuits.

1.6.4 Environment

The equipment is intended for indoor installation and use only. If it is required for use in an outdoor environment then it must be mounted in a specific cabinet of housing which will enable it to meet the requirements of IEC 60529 with the classification of degree of protection IP54 (dust and splashing water protected).

Pollution Degree - Pollution Degree 2 Altitude - Operation up to 2000 m IEC 60255-27: 2005 EN 60255-27: 2005	Compliance is demonstrated by reference to safety standards.

2. TECHNICAL DATA

2.1 Mechanical Specifications

Design
Mounting is front of panel flush mounting, or rail mounted (ordering options).

Enclosure Protection
Per EN 60529: 1991
IP54 Protection (front panel) against dust and dripping water for the flush mounted model.
IP40 Protection for the front panel on the DIN rail mounted model.
IP40 Protection for sides of the case.
IP20 Protection for terminals.

Weight
approx. 0.5 kg

2.2 Terminals

AC Current Inputs (flush case only)

Flush mounted case:
Threaded M3 terminals, with wire protection for conductor cross-section
(i) 0.2 to 6 mm^2 single-core
(ii) 0.2 to 4 mm^2 finely stranded

DIN Rail case:
Phase current inputs
The current carrying conductors which pass through the phase CTs must be insulated.

Earth fault input:
Threaded M3 terminals, with wire protection for conductor cross-section
(i) 0.2 to 4 mm^2 single-core
(ii) 0.2 to 2.5 mm^2 finely stranded

Global Input/Output Terminals
For power supply, opto and contact inputs, output contacts and COM for rear communications.

Threaded M3 terminals, with wire protection for conductor cross-section
(i) 0.2 to 4 mm^2 single-core
(ii) 0.2 to 2.5 mm^2 finely stranded

For "PTC" (T1-T2 terminals) and "SIn" (S1-S2 terminals) inputs connection the screened cable should be used.

Rear Communications Port
EIA(RS)485 signal levels, two wire
Connections located on general purpose block, M3 screw.
For screened twisted pair cable, multi-drop, 1000 m max.
For Modbus RTU protocol.
Isolation to SELV level.

2.3 Ratings

AC Measuring Inputs
Phase current
Nominal frequency: 50 to 60 Hz
Operating range: 10 to 250 Hz

Earth fault current (model B, C only)
Nominal frequency: 50 to 60 Hz
Operating range: 40 to 70 Hz

Voltage input (model U only)
Nominal frequency: 50 to 60 Hz
Operating range: 40 to 70 Hz

AC Current
Nominal current (In): Maximum value of base current (IB) but not lower than 5 A
Note:
(i) All analogue input ordering options can function with a 5 A or 1 A nominal secondary CT current
(ii) For the rail mounting case, the In nominal current is defined as the maximum value of the IB base current (ordering option).
There are no terminals for phase current inputs and no primary wires of internal transformer I/V which may influence the nominal current value and thermal withstand.
It is strongly recommended to use an appropriate type of insulation and cross section of current wires should have a thermal withstand as indicated below.

Base current IB range (IBmin to IBmax):
(i) Rail mounting case: 0.37 to 1.5 A, 1.5 to 6 A, 5 to 20 A, 20 to 80 A
(ii) Flush mounting case: 0.37 to 1.5 A, 1.5 to 6 A, 5 to 20 A

Nominal burden per phase:
< 0.3 VA at 5 A (In = 5 A)
Thermal withstand:

Flush mounting case:
(i) continuous 20 A (4 x In for In = 5 A)
(ii) for 10 s: 150 A (30 x In for In = 5 A)
(iii) for 1 s; 500 A (100 x In for In = 5 A)

Rail mounting case:
(i) continuous: 4 x IBmax but not lower than 20 A
(ii) for 10 s: 30 x IBmax but not lower than 150 A
(iii) for 1 s: 100 x IBmax but not lower than 500 A

Note: For rail mounting cases, the current wire insulation's withstand is added.

AC Voltage (Model U only)
Nominal voltage (Vn): 230 Vac
Nominal burden per phase: <0.02 VA at Vn
Thermal withstand:
Continuous: 2 Vn
For 10 s: 2.6 Vn

2.4 Power Supply

Auxiliary Voltage (Vx)
Two ordering options:
(i) Vx: 24 to 48 Vdc
(ii) Vx: 60 to 240 Vdc, and
60 to 240 Vac (rms)

Operating Range
(i) 19 to 75 Vdc, 19 to 53 Vac
(ii) 48 to 300 Vdc, 48 to 265 Vac
With a tolerable ac ripple of up to 12% for a dc supply, per IEC 60255-11: 1979.

Nominal Burden

Power Supply:
Without energized outputs:
(i) 1.7 W (60 to 240 Vac/dc)
(ii) 2.5 W (24 to 48 Vac/dc).
Additions for energized binary inputs/outputs:
Per opto input: 0.03 W
Per energized output relay: 0.3 W

For 4 energized output relays and 4 energized inputs: 3W (60-240 Vac/dc)

Binary inputs:
Nominal burden for V1-C and V2-C inputs:
(i) for 240 Vdc: 0.6 W

Power-up Time
Time to power up < 1 s.

Power Supply Interruption
Per IEC 60255-11: 1979
The relay will withstand a 20 ms interruption in the DC auxiliary supply, without de-energizing.
Per EN 61000-4-11: 1997
The relay will withstand a 20 ms interruption in an AC auxiliary supply, without de-energizing.

Digital ("Opto") Inputs

Universal opto inputs: V1-C and V2-C.
May be energized from the external battery supply.
Rated nominal voltage: same as Vx
Operating range: same as Vx
Withstand: 300 Vdc.

Nominal pick-up and reset thresholds:
(i) for DC:
Pick-up: approx. 50% of minimum value of Auxiliary Voltage Operating Range,
Reset: approx. 45% of minimum value of Auxiliary Voltage Operating Range.

(ii) for AC:
Pick-up: approx. 90% of minimum value of Auxiliary Voltage Operating Range,
Reset: approx. 45% of minimum value of Auxiliary Voltage Operating Range.

Recognition time: <20 ms.
Universal opto-inputs: S1-S2 and T1-T2, energized by shorting terminals
Note: Do not any voltage to the S1-S2 and T1-T2 terminals. That could damage the P211.

2.5 Output Contacts

Standard Contacts
General purpose relay outputs for signaling, tripping and alarming:
Rated voltage: 250 V
Continuous current: 5 A
Short-duration current: 25 A for 3 s
Making capacity: 150 A for 30 ms
Breaking capacity:
(i) DC: 50 W resistive
(ii) DC: 25 W inductive (L/R = 40 ms)
(iii) AC: 1250 VA resistive (cos ϕ = unity)
(iiii) AC: 1250 VA inductive (cos ϕ = 0.7)
Response to command: < 10 ms
Durability:
(i) Loaded contact: 10,000 operations minimum,
(ii) Unloaded contact: 100,000 operations minimum.

2.6 Environmental Conditions

Ambient Temperature Range
Per EN 60255-6: 1994
Operating temperature range:
-20°C to +60°C (or -4°F to +140°F).
Storage and transit:
-25°C to +70°C (or -13°F to +158°F).

Ambient Humidity Range
Per IEC 60068-2-3: 1969:
56 days at 93% relative humidity and +40°C
Per EN 60068-2-30: 2005:
Damp heat cyclic, six (12 + 12) hour cycles, 93% RH, +25 to +55°C

2.7 Type Tests

Insulation
Per IEC 60255-5: 2000
Insulation resistance > 100 MΩ at 500 Vdc (Using only electronic/brushless insulation tester).

Creepage Distances and Clearances
Per
IEC 60255-27: 2005
Pollution degree 2,
Overvoltage category II,
Impulse test voltage 2.5 kVp.

High Voltage (Dielectric) Withstand
Per IEC 60255-27: 2005, 1.35 kV rms AC, 1 minute:
Between all case terminals connected together, and the case earth simulated by a layer of metal foil surrounding the case.
Also, between all terminals of independent circuits.
1 kV rms AC for 1 minute, across open watchdog contacts.
1 kV rms AC for 1 minute, across open contacts of changeover output relays.

Impulse Voltage Withstand Test
Per IEC 60255-27: 2005,
Front time: 1.2 µs,
Time to half-value: 50 µs,
Peak value: 2.5 kV, 0.5 J
Between all terminals, and all terminals and simulated case earth.

2.8 Electromagnetic Compatibility (EMC)

1 MHz Burst High Frequency Disturbance Test
Per IEC 60255-22-1: 1988, Class III,
Common-mode test voltage: 2.5 kV,
Differential test voltage: 1.0 kV,
Test duration: 2 s, Source impedance: 200 Ω

Immunity to Electrostatic Discharge
Per IEC 60255-22-2: 1996, Class 3,
8 kV discharge in air to all communication ports.
6 kV point contact discharge to any part of the front of the product.

Electrical Fast Transient or Burst Requirements
Per EN 60255-22-4: 2002. Test severity Class III and IV:
Amplitude: 2 kV, burst frequency 5 kHz (Class III),

Surge Immunity Test
Per EN60255-22-5: 2002; EN 61000-4-5: 1995 Level 3,
Time to half-value: 1.2/50 µs,
Amplitude: 2 kV between all groups and case earth,
Amplitude: 1 kV between the terminals of each group.

Immunity to Radiated Electromagnetic Energy
Per EN 60255-22-3: 2000, Class III:
Test field strength, frequency band 80 to 1000 MHz:
10 V/m,
Test using AM: 1 kHz / 80%,

Radiated Immunity from Digital Radio Telephones
Per Per EN 60255-22-3: 2000
10 V/m, 900 MHz.

Immunity to Conducted Disturbances Induced by Radio Frequency Fields
Per EN 61000-4-6: 1996, Level 3,
Disturbing test voltage: 10 V

Power Frequency Magnetic Field Immunity
Per IEC 61000-4-8: 1994, Level 4,
30 A/m applied continuously,
300 A/m applied for 3 s.

Conducted Emissions
Per EN60255-25: 2000:
0.15 - 0.5 MHz, 79 dBµV (quasi peak)
66 dBµV (average)
0.5 - 30 MHz, 73 dBµV (quasi peak)
60 dBµV (average).

Radiated Emissions
Per EN60255-25: 2000
30 - 230 MHz, 40 dBµV/m at a 10 m measurement distance
230 - 1 GHz, 47 dBµV/m at a 10 m measurement distance.

2.9 EU Directives

EMC Compliance
Per 89/336/EEC:
Compliance with the European Commission Directive on EMC is claimed via the Technical Construction File route. Product Specific Standards were used to establish conformity:
EN 50263: 2000

Product Safety
Per 73/23/EEC:
Compliance with European Commission Low Voltage Directive.
Compliance is demonstrated by reference to generic safety standards:
EN 60255-27: 2005

2.10 Mechanical Robustness

Vibration Test
Per IEC 60255-21-1: 1995
Response Class 1
Endurance Class 1

Shock and Bump
Per EN 60255-21-2: 1995
Shock response Class 1
Shock withstand Class 1
Bump Class 1

2.11 Protection Data

2.11.1 Three Phase Overcurrent Protection

Accuracy

I> (Thermal replica):
Thermal replica class: 10 (in accordance with EN 60255-8). Refer to Table 1.
Thermal replica operating time: 120 ms

I>> (short-circuit):
Pick-up: ±10%
Drop-off: 0.95 x setting ±5%
DT operation: ±3% or 100 ms, whichever is greater
DT reset: ±10%
Instantaneous operating time is not less than twice the set value: <100 ms

I< (underload):
Pick-up: ±2% from set value but not lower than ±0.05 x IB
Drop-off: 0.9 x setting ±2% from set value
DT operation: ±3% or 200 ms, whichever is greater
DT reset: ±10%
Instantaneous operating time is not less than twice the set value: <200 ms

Unbalance ΔIph (asymmetry) and Phase Loss:

Pick-up: ±2% from set value but not lower than ±0.05 x IB
Drop-off: 0.9 x setting ±2% from set value
DT operation: ±3% or 200 ms, whichever is greater
DT reset: ±10%
Instantaneous operating time is not less than twice the set value: <200 ms

Prolonged start or stall:

Pick-up: ±10%
Drop-off: 0.95 x setting ±5%
DT operation: ±3% or 100 ms, whichever is greater
DT reset: ±10%
Instantaneous operating time is not less than twice the set value: <100 ms

2.11.2 Earth Fault Protection (models B, C)

Earth Fault Io> and Io>>
Pick-up: Setting ±10%
Drop-off: 0.9 x setting ±5%
DT operation:
±2% or 100 ms whichever is greater (for currents greater than 2 x setting)
DT reset: ±10%
Repeatability: 2.5%
Instantaneous operating time: <100 ms

Vref Undervoltage threshold (Model U only)

Pick-up: Setting ±5%
Drop-off: 0.9 x setting ±5%

2.12 Measurements and Recording Facilities

Measurements
Phase current
Current: 0.1 x IBmin to 2 x IBmax
Accuracy: ±5.0% of reading or 0.05 x IBmax, whichever is greater
Earth fault current
Current: 0.2 to 1 In
Accuracy: ±10.0% of reading

Performance
Year 2000: Compliant
Real time clock accuracy: <±2% seconds/day (Model E only)

Timer Accuracy
Timers: ±3% or 40 ms whichever is greater
Reset time: <40 ms

2.13 Settings, Measurements and Records List

2.13.1 Settings List

Global Settings (System Data)
Overcurrent: Disabled/Enabled
Earth Fault: Disabled/Enabled

CT Ratios
Phase CT ratio: 1 to 9998; step 1
E/F CT ratio: 1 to 9998; step 1

Communications
Protocol: MODBUS RTU
Physical Link: Copper; RS485 half-duplex
Comms. Mode:
Data Bit: 8
Stop bit: 1
Parity: none
Address: 0 to 255
Baud Rate:
(i) 1200 bits/s
(ii) 2400 bits/s
(iii) 4800 bits/s
(iv) 9600 bits/s
(v) 19200 bits/s
Type of single 2-byte register:
- the most significant byte (MSB) is followed by the least significant byte (LSB)
- the least significant byte (LSB) is followed by the most significant byte (MSB)

2.14 Protection Functions

2.14.1 IB settings

Note: IB is the nominal current used for the motor setting
(hardware option):
(i) 0.37 to 1.50 A; step 0.01 A
(ii) 1.5 to 6.0 A; step 0.1 A
(iii) 5.0 to 20.0 A; step 0.1 A
(iv) 10.0 to 40.0 A; step 0.1 A (rail mounting case only)
(v) 20.0 to 80.0 A; step 0.1 A (rail mounting case only)

2.14.2 I> (Overload – Thermal replica)

Alarm thermal stage:
50 to 120%, step 1%, factory setting: 80%
Threshold for thermal start inhibit
(reset ratio of thermal trip):
30 to 99%, step 1%, factory setting: 70%
Tripping time for I = 6 x IB:
0.1 to 50 s, step 0.1 s, factory setting: 1 s
Latching of thermal trip:
(i) Disabled (P1 set to 0)
(ii) Enabled (P1 set to 1) (default)
Protection status:
(i) Disabled (set to 0)
(iii) Enabled on trip (set to 1)
(iv) Enabled on alarm (set to 2)

2.14.3 Io> (Earth Fault - measured value)

Current Set:
(hardware option):
(i) 0.01 to 0.50 A (Ion = 1/5 A, typical applic. 1 A)
(ii) 0.05 to 2.5 A (Ion = 1 A/5 A, typical applic.: 5 A)
Time Delay: 0.02 to 99.90 s
Protection status:
(i) Disabled (set to 0)
(ii) Enabled on trip (set to 1)
(iii) Enabled on alarm (set to 2)

2.14.4 I>> (Short Circuit)

Current Set: 1 to 12 x IB, step 1 x IB
Time Delay: 0.02 to 99.90 s
Protection status:
(i) Disabled (set to 0)
(ii) Enabled on trip (set to 1)
(iii) Enabled on alarm (set to 2)

2.14.5 I< (Loss of Load)

Current Set: 20% to 90% x IB, step 1%
Time Delay: 0.02 - 99.90 s
Protection status:
(i) Disabled (set to 0)
(ii) Enabled on trip (set to 1)
(iii) Enabled on alarm (set to 2)

2.14.6 Ph:Lo (Phase Loss)

Time Delay: 0.02 to 99.90 s
Protection status:
(i) Disabled (set to 0)
(ii) Enabled on trip (set to 1)
(iii) Enabled on alarm (set to 2)

2.14.7 Ph:AS (Load Assymetry)

Current Set: 15% to 50% x IB, step 1%
Time Delay: 0.02 - 99.90 s
Protection status:
(i) Disabled (set to 0)
(ii) Enabled on trip (set to 1)
(iii) Enabled on alarm (set to 2)

2.14.8 Prolonged start or stall

Current Set: 1 to 12 x IB, step 1 x IB
Time Delay for prolonged start:
0.02 to 99.90 s
Time Delay for stall or locked rotor:
0.02 to 99.90 s
Protection status:
(i) Disabled (set to 0)
(ii) Enabled on trip (set to 1)
(iii) Enabled on alarm (set to 2)

2.14.9 Number of permitted starts

Number setting range: 1 to 5, step 1
Treference (time window in which number of starting is calculated):
10 to 7200 s, step 1 s
Lock-out time (cooling time of the motor after reaching 0 permitted start.
During this time, any new start is blocked):
10 to 7200 s, step 1 s
Protection status:
(i) Disabled (set to 0)
(ii) Enabled (set to 1)

2.14.10 Input for PTC sensors

Max. resistance in cold state: 1.5 kΩ
Tripping resistance stage:
3.85 kΩ ±0.15 kΩ
Resetting resistance stage:
2.0 kΩ ±0.1 kΩ
Number of PTC sensors connected in series:
up to 6
Status:
(i) Disabled (set to 0)
(ii) Enabled on trip (set to 1)
(iii) Enabled on alarm (set to 2)

Table 1. Tripping time of overload protection.

Timing accuracy	Current I_B multiple	Motor thermal state [%]	Time setting for $I = 6 \times I_B$															
			1	2	3	4	5	6	7	8	9	10	15	20	25	30	35	40
10%	6	0	1	2	3	4	5	6	7	8	9	10	15	20	25	30	35	40
		50	0,54	1,09	1,50	2,10	2,58	3,12	3,54	4,14	4,74	5,06	7,90	10,3	12,9	14,8	17,2	20,6
20%	5	0	1,44	2,98	4,44	5,96	7,40	9,00	10,3	11,9	13,5	14,8	22,7	29,6	37,2	42,4	49,5	59,7
		50	0,72	1,96	2,28	3,06	3,4	4,56	5,22	6,06	6,84	7,48	11,5	15,0	18,8	21,5	25,0	30,2
	4	0	2,34	4,7	7,02	9,42	11,7	14,3	16,6	18,8	21,4	23,5	36,2	47,8	58,8	67,0	78,9	94,5
		50	1,2	2,49	3,60	4,80	5,94	7,32	8,28	9,66	10,9	11,9	18,4	24,0	30,0	34,2	40,2	48,2
	3	0	4,32	8,80	12,9	17,3	21,5	26,3	29,8	34,6	39,2	43,1	66,3	87,0	107	124	143	174
		50	2,28	4,73	6,72	8,94	11,1	13,6	15,5	17,9	20,3	22,3	34,3	45,0	55,5	64,2	74,0	90,4
	2	0	10,7	22,0	32,3	43,3	54,0	65,5	74,4	86,0	97,7	108	166	216	276	311	357	418
		50	5,88	12,4	17,6	23,6	29,4	35,7	40,5	46,9	53,2	58,8	90,5	118	150	170	194	228
40%	1,5	0	23,1	47,0	68,7	92,5	116	141	159	188	210	233	360	449	572	664	791	978
		50	13,7	28,9	40,8	55,0	69,3	84,2	94,7	112	125	139	214	265	340	396	472	540

TABLE 1: TRIPPING TIME OF OVERLOAD PROTECTION

3. SETTINGS

3.1 Document convention

There are five hardware versions of the MiCOM P211. Model “A” is the standard version. Inputs in this model are not optional. Model “B” has an additional earth-fault current input Io and an RS485 communication port. Model “C”, in addition to Model “B” 's features, has binary inputs (V1 and V2), and output relays (P3 and P4). Model "U" has a voltage input instead of an e/f input. Depending on the model selected, there are different options for the relay's configuration.

Therefore, the following convention has been adopted throughout this manual: if no reference is made to a model in the description of a feature, it means that this feature is available for all the models; if the (BC)* or (CU)* references are used, then the described feature is only available for models: B and C or C and U, respectively.

Please refer to the sales publication for further information on the product features and application arrangements.

FIGURE 1: CONNECTION OF PHASE WIRES TO THE P211, IF IBMAX > IN > IBMIN
(IN = NOMINAL CURRENT OF THE MOTOR, IBMAX = MAXIMUM VALUE OF IB, IBMIN = MINIMUM VALUE OF IB)

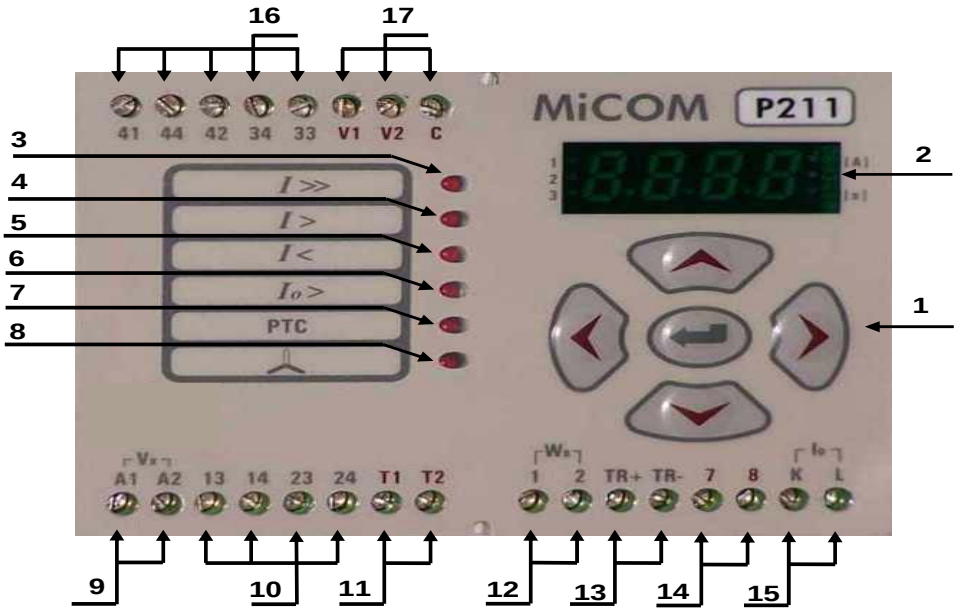
3.2 Product Description

The scope of the P211's applications includes:

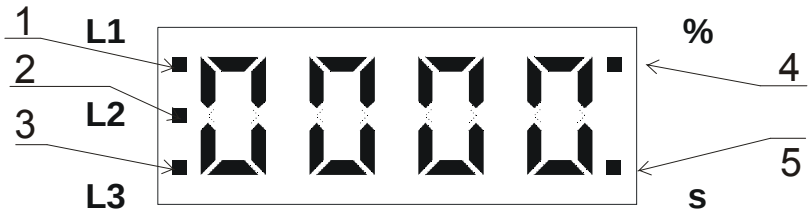
1. LV motors
2. Replacement of electromechanical relays for the protection of small MV motors

The relay can be used in one-, two- or three-phase applications to protect against earth faults and phase-to-phase short-circuit faults. It can control a circuit-breaker or a contactor. Thanks to its integrated communications port, it is able to exchange information with a supervision system in terms of measurements, relay states, switch controls, etc.

FIGURE 2: CONNECTION OF PHASE WIRES TO THE P211, IF IN < IBMIN
(IN = NOMINAL CURRENT OF THE MOTOR, IBMIN = MINIMUM VALUE OF IB)



1- Keypad, 2- LCD display, 3- LED indicator: I>> trigger and trip, 4- LED indicator: I> trigger and trip, 5- LED indicator: I< trigger and trip, 6- LED indicator: Io> trigger and trip, 7- LED indicator: Excessive temperature of PTC sensors,	8- LED indicator: Unbalance or loss-of-phase conditions, 9- Auxiliary voltage supply terminals, 10- Output relay terminals: 13 - 14 - relay P1, 23 - 24 - relay P2, 11- PTC sensor terminals, 12- Control input terminals: S1-S2,	13- RS485 terminals (BCU)* 14- Vref voltage input (U)* 15- Io input terminals (BC)* 16- Output relays' terminals (CU)*: 41 - 42 - 44 - relay P4, 33 - 34 - relay P3, 17- Control input terminals (CU)*: V1-C and V2-C



1 - This LED lights up when the L1 phase current is displayed 2 - This LED lights up when the L2 phase current is displayed 3 - This LED lights up when the L3 phase current is displayed 4 - LED indicates, that a value is displayed in [%] units 5 - LED indicates, that a value is displayed in [s] units	1,2,3 - When all LEDs light up simultaneously, the maximum current of the most recent start is displayed NOTE: If no LED lights on, then Io current is readout

FIGURE 3: P211 FRONT PANEL VIEW

3.3 Mounting Procedure

There are two types of cases available: 35 mm DIN rail or flush mounted.

Rail mounted version:

Clip the relay onto a rail (no tool needed). To detach it from the rail use a narrow, flat screwdriver, insert its tip the dedicated aperture at the base of the relay and push the screwdriver handle upwards to release the spring bolt.

Flush mounted version:

Cut-out the mounting plate according to Fig. 7, then insert the relay into the aperture. Insert the fastening elements (see Fig. 7) into the slots on the sides of the case, and fasten the screws until the relay is securely fixed to the plate. To remove the relay, losen the screws until the fastening element can be extracted, and the relay can be withdrawn from the cut-out in the mounting plate.

3.4 Connection of feeder wires

NOTE: Terminals “K” - “L” (optional earth fault input), and “TR+” - “TR-” (optional communication port) are only available if the corresponding relay version is ordered. The optional nature of the terminals is indicated by the fact that their label on the relay's front panel is red. Before wiring these terminals, make sure that you have the correct relay version (Io input and RS485 options are only available in B and C models).

35 mm DIN rail mounted case:

All screw terminals allow the connection of conductor cross-section of up to 2.5 mm^2 for threaded wires or 4 mm^2 for solid wires. If the required current setting is within the relay's setting range, then the motor phase conductors should be fed through the guiding channels in the relay's case (Fig. 1). If the required current setting is greater than 80 A, then external protection CTs’ should be used together with the relay 's (3-6) A base current range. The CTs' secondary circuit wires should be fed through the guiding channels in the relay's case (Fig. 1). If the required current setting is below the minimum value of the relay setting range, then the motor's phase conductors should be coiled several times through the guiding channels in the relay's case (Fig. 2), if only one channel cross section permits it. The number of turns (n) must be identical for all the phases.

Example:

The relay has a setting range of (1.5-6) A;

the required current setting range is (0.5-2) A.

The motor feeders should be coiled three-fold through the relevant channels in the relay's case (increasing the number of coils in a CT results in the corresponding reduction of the transformer ratio: 3 A/3 = 1 A).

Flush mounted case:

Screw terminals are located on the rear panel of the case, and are used to connect inputs, outputs, and current circuits. Threaded or solid wires with 4 mm² conductor cross-sections may be connected to current terminals. The remaining terminals allow connection of conductor cross-sections of up to 2.5 mm² for threaded wires or 4 mm² of conductor cross section for solid wires. Due to the implementation of screw terminals for current circuits, continuous and dynamic load rating is limited, as compared to the rail mounted version (see Technical Data). It is therefore recommended that the flush mounted version of the relay be used with external CTs.

NOTE: Due to the required accuracy limit factors it is recommended to use CTs dedicated to protection relays.

Inputs and outputs

Terminal connections for DIN rail and flush mounted versions have identical descriptions. This does not apply to the current circuits of the rail mounted version, which phase wires are fed through guiding channels in the relay's case. On the flush mounted version phase wires are connected to screw terminals: phase A (L1): 1-2; phase B (L2): 3-4; phase C (L3): 5-6.

Auxiliary voltage supply Vx is connected to A1-A2 terminals. The polarity of the connection is not fixed. However, for the sake of clarity it is recommended to apply “+” (L) to A1, and “-” (N) to A2.

Output contacts are assigned to the following terminal connections of the relay: 13-14 (relay P1); 23-24 (relay P2); 33-34 (relay P3) (CU)*; 41-42-44 (relay P4) (CU)*.

Technical data of the output contacts are quoted in the Technical data section.

The S1-S2 and T1-T2 terminals may be connected to an external NO contact or a switch, which purpose is to trigger a relay function assigned to these terminals (previously configured using the relay's menu).

T1-T2 can also be configured as a PTC sensor input. It can then be used to connect up to 6 PTC sensors connected in series. The PTC input is standardized, and can co-operate with sensors of any type and origin.

T1-T2, if configured as a PTC input, can also be used as an input for an external protection device within the motor application. If that is the case, a normally closed contact should be connected to the T1-T2 terminals. If the external protection device does not trip, then T1-T2 is closed by the NC contact; if the external protection device is trips, then its output circuit connected to T1-T2 opens, and thus trips the relay.

NOTE: Since an internal current source is connected to the S1-S2, T1-T2 input, no voltage should be applied to the terminals. If the S1-S2, T1-T2 input is not used, the terminals must remain open.

The V1-C (CU)* and V2-C (CU)* terminals are assigned to binary inputs. If auxiliary supply Vx is applied to the inputs, two assigned functions of the MiCOM P211 can be triggered.

The K-L (BC)* terminals are used to connect an external earth fault current filter, ie. a core-balanced CT (Ferranti) or a Holmgreen arrangement. Although e/f protection Io> is non-directional and the polarity of its connection to the relay is not fixed, for the sake of clarity it is recommended to connect “K” and “L” on the relay to the respective “k” and “l” terminals on the e/f CT. A standard core-balanced CT has a rated current of 1 A, therefore a relay's model with a rated e/f current of Ion = 1 A should be ordered. In case a higher setting range is required for the relay, then a model with Ion = 5 A must be ordered. For a Holmgreen arrangement, which CTs' secondary rated current is 5 A, a MiCOM P211 with Ion = 5 A must be ordered.

Model U has a Vref voltage input (7,8 terminals)

“TR+” and “TR-” (BCU)* are used to connect a standard RS485 two-wire communication link.

NOTE: Unlike the other terminals pairs, it is crucial that the “TR+” and “TR-” terminals keep the required polarity of the connection.

3.5 Setting and commissioning

NOTES: - All settings may be input to the relay before it is actually connected in an application

- The relay's settings should be changed while the motor's main switch is open

Setting and configuration of the relay is done by means of the front panel keypad (Fig. 3, item 1), while the corresponding information is displayed on the front panel LCD (Fig. 3, item 2).

Figure 5 shows the relay menu and how to navigate through it. The information given in this figure refers to the relay's factory settings. The black squares indicate that a specified setting may be modified.

3.5.1 Navigating keys

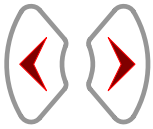
	to move the cursor to a next menu cell (upwards) or increase a setting value;
	to move the cursor to a next menu cell (downwards) or decrease a setting value;
	to move the cursor to a next menu cell (left or right) or to a next password digit (left or right);
	to enters edit mode / accept a modified setting value;

FIGURE 4: NAVIGATION KEYS

NOTE: The “Right” and “down” keys, when pressed simultaneously, perform a display and LEDs” test, during which all LEDs and segments of the display illuminate for 3 s.

3.5.2 Starting the relay; setting procedures

3.5.2.1 Connecting aux. voltage supply Vx to terminals A1-A2.

Then:

(i) LEDs: I>>, I>, I<, Io>, PTC, and ⅄ flash briefly,

(ii) LED L1 lights up and the actual current value for phase L1 is shown on the display.

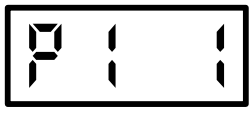
e.g. 

If the relay is disconnected from voltage supply Vx or if a voltage supply interruption occurs after one of the relay's protection functions has tripped, then the relay's state is recorded. When the voltage supply is restored, the LED corresponding to the protection function which has tripped lights up, and output relays switch over to the states preceeding the voltage interruption (depending on the selected configuration set for the relay).

Re-starting the motor is only possible after the tripping state has been reset.

If the relay is disconnected from voltage supply Vx or if a voltage supply interruption occurs in while the relay is in stand-by (no protection function has tripped), the states of the output relays are as follows:

After the auxiliary voltage supply has been applied, the state of the output relay P1 (terminals: 13-14) depends on the selected mode of switch control:

(i) “circuit breaker” mode (P1 set to 0 in the menu 

): P1 is open

(ii) “contactor” mode (P1 set to 1 in the menu): P1 is closed

(iii) “contactor with RS485” mode (P1 set to 2 in the menu): P1 is open (CU)*

The state of output relays P2 and P3 (CU)* does not change after the voltage supply has been applied (the output contacts remain open).

The state of output relay P4 (CU)* (change-over contacts 41-42-44) after the voltage supply has been applied depends on its configuration in the menu, (

menu cell), which is:

(i) “protection trigger” mode (P4 set to 0 in the menu): P4 is de-energized (41-42 closed, 41-44 open);

(ii) “protection trip” mode (P4 set to 1 in the menu): P4 is de-energized (41-42 closed, 41-44 open);

(iii) “no protection alarm” (warning signal) mode (P4 set to 3 in the menu) P4 is energized (41-44 closed, 41-42 open)

(iv) “no protection trip” (without TSTP) mode (P4 set to 4 in the menu) P4 is energized (41-44 closed, 41-42 open)

(iv) “delta arrangement” mode (P4 set to 5 in the menu): P4 is de-energized (41-42 closed, 41-44 open),

NOTE: **“**Output relays” states on applying auxiliary voltage supply Vx may be different if any of the protection functions tripped before the voltage interruption (see section 10 for details).

3.5.2.2 Switching the P211 to OFF-LINE mode

It is possible to change the relay settings only in if it is in OFF-LINE mode. When switching the relay's operation mode to OFF-LINE, the protection tripping states are reset, and all protection fonctions are latched. The relay status is kept thus until it is switched again to ON-LINE mode.

To switch the relay mode to OFF-LINE, select menu cell 

, then press 
. Then the letter "L" starts flashing. Press 
. Now, the menu displays 

. Press 
. All the LEDs start flashing, which indicates an OFF-LINE operation mode. If a password was previously entered, then the relay will not switch to OFF-LINE mode, but the menu will display the password edition mode (see section 7.7: “Entering and changing the password”).

3.5.2.3 Selecting the appropriate menu cell

Select a menu cell to be modified using the keypad on the relay's front panel, as shown in Figure 5 (Menu navigation).

3.5.2.4 Setting

Press  . The digit at the right hand side of the display starts flashing. The setting can be modified by means of the  and  keys. Once the required value has been entered, press  . Repeat the procedure for the remaining settings to be modified.

3.5.2.5 Switching to ON-LINE mode

Once all the necessary changes have been made, select menu cell  , press  , then  and, again,  , in order to switch back to the ON-LINE mode - the LEDs stop flashing and the relay is activated with the new settings.

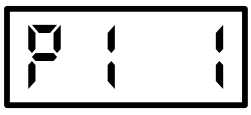
NOTE! Entering the edit mode of the setting module will block all the protection functions, and reset their trip states.

3.6 Configuring the relay

3.6.1 Selecting a control switch - control procedures

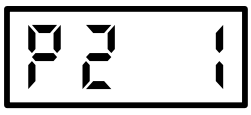
There are three operation modes to which the relay may be configured in terms of cooperation with a control switch. An operation mode is selected by configuring output relay P1 (terminals 13-14), output relay P2 (terminals 23-24), input V1 (terminals V1-C) (CU)* and input V2 (terminals V2-C) (CU)*. The available options are: "circuit-breaker" mode, "contactor" mode and “contactor with RS485" mode (contactor controlled via input V1 or RS485") (CU)*.

3.6.1.1 "circuit-breaker" mode

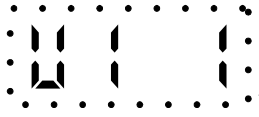
(P1 set to 0 in the menu ):

If P1 is set to operate in "circuit-breaker" mode, then any protection trip set to trip the relay or a trip command sent via the RS485 link will make the P1 output relay switch over for a period of time ł 0.5 s (BCU)*.

Closing of the circuit-breaker is initiated via the P2 output relay, therefore, when closing is controlled by the MiCOM P211 output relay P2 should be set to "close circuit-breaker" mode.

(P2 set to 2 in the menu ).

Closing of the circuit breaker is triggered via:

(i) input V1-C, if it is set to “remote or local CB close” mode) (V1 set to 0 in the menu ) **(CU)***,

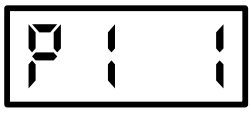
(ii) close command sent from a system via the RS485 communication link **(BCU)***

When initiating the closure of the circuit-breaker, output relay P2 (terminals 23-24) is closed for a period of 0.5s.
It is only possible to close the circuit-breaker if the trip-signalling LED has previously been reset, which prevents multiple attempts to close the circuit-breaker when a fault is present.

NOTE: In "circuit breaker" mode, the P2 latching option should be switched off (P2c set to 0 in the menu ).

Otherwise it will remain closed until it is reset.

3.6.1.2 “Protection-contactor” mode

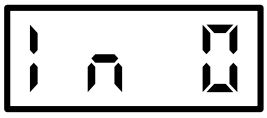
(P1 set to 1 in the menu 

This control mode is meant for applications where a contactor is the control switch and is not intended to be triggered via the RS485 port.

In this mode it is recommended to use the standard contactor control arrangement. Upon applying auxiliary voltage supply Vx the contacts of output relay P1 are closed. This allows closing the contactor. The operation of any protection configured to trip makes the contacts of output relay P1 open, and so does it for the contactor. P1 is kept open until output relays’ tripping states and indicating LEDs are reset.

This can be done by means of:

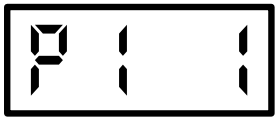
(i) the front panel keypad

(ii) binary input S1-S2 (if configured to “reset of LEDs and latching” mode: the relevant value is set to 0 in the menu )

(iii) the RS485 communication link **(BCU)*.**

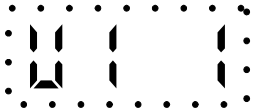
After the relay has been reset, the output contacts of relay P1 close again, thus allowing the contactor to be closed again.

3.6.1.3 “Bay terminal-contactor” mode (CU)*

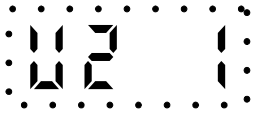
(P1 set to "2" ).

This mode is meant for applications where control operations are to be performed through the RS485 communication link or/and by means of an external switching contact.

Thus input V1-C must be set to:“local CB close” mode



(V1 set to 0 in the menu), and input V2-C must be set to: "CB/contactor state" mode



(V2 set to 0 in the menu).

After auxiliary voltage supply Vx has been applied the state of output relay P1 (13-14) does not change (the contacts remain open), as when the "contactor" mode is selected.

Closing of the contactor (P1) is initiated by:

(i) applying auxiliary supply voltage to binary input V1-C;

(ii) sending close command from the system, through communication link RS485.

It is only possible to close the contactor if the trip-signalling LED has previously been reset, which prevents unwanted closing after a protection trip. Once the closing operation is initiated, the contacts (13-14) of output relay P1 close for 150 ms. Afterwards the status of the contactor, which auxiliary contacts control the relay's V2-C input is checked. If the contactor is closed (high state at V2-C input), then output relay P1 remains closed.

NOTE: Tripping by any protection function will instantaneously de-energize output relay P1, regardless of the operating state of the relay (tripping has a higher priority than closing).

Contactor tripping can be performed through:

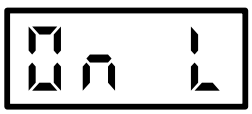
(i) opening of the contactor control circuit (external OFF switch). If the circuit is open, the contactor is de-energized. This process is monitored by the relay's V2-C input, which is configured to represent the switching state. If the input's state changes from high to low, then output relay P1 will instantaneously de-energize;

(ii) trip command sent via the RS485 communication link, which makes the contacts of output relay P1 (13-14) open;

(iii) trip of any protection set to “trip” mode.

3.6.2 Configuration procedure for the P211's global settings

The relay's global settings are configured in the menu column: 



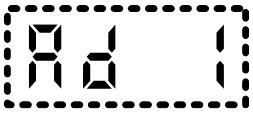
- the current operation mode of the relay is set in this cell. ON-LINE - all protection functions are active. OFF-LINE - all protection functions are blocked and it is possible to modify the relay's settings.

- where the relay is connected via external CTs, this cell is used to set the transformer ratio for phase currents. The ratio can be selected within a range from 1 to 9998, in steps of 1. E.g., for an external CT ratio of 200 A/5 A, the value to be entered will be 40. It is critical for the correct measurement and display of phase currents in primary values that the ratio is correctly calculated and entered.

NOTE: Changing the CT ratio does not affect the protection settings, which always use secondary values.

- where the relay is connected to an external neutral transformer (core balanced CT or Holmgreen arrangement), this cell is used to set the transformer ratio for earth faults **(BC)***. The ratio can be selected within a range from 1 to 9998, in steps of 1. E.g., for an external CT ratio: 75 A/1 A, the value to be entered will be 75. It is critical for the correct measurement and display of the earth current in primary values that the ratio is correctly calculated and entered.

NOTE: Changing the CT ratio does not affect the protection settings, which always use secondary values.



- this cell is used to assign a network address to the relay **(BCU)*.** Up to 32 P211 relays can be connected to one RS485 link. To ensure that the communication link between the network and the relays is secure and reliable, and that each relay is clearly identified within the network, a unique address must be assigned to each relay. The address can be selected from 1 to 255.

- the transmission rate is set in this cell **(BCU)*.** It is important to select this value correctly to allow communication with the relay via the RS485 port. The transmission rates to choose from are (1.2 - 19.2) kbps.

- this cell is used to choose the data bytes order.

“0” is the order pertaining to the S&R Modbus and P20 series

“1” is the order used in firmware versions below 6.A

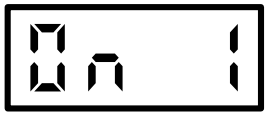
See “P211 Modbus Database”

- a password can be activated and modified in this cell.

3.6.3 Star/delta control logic

Switching between star and delta connections is done via output relay P2. To enable this function, option 4 should be selected in column “Set 3”:

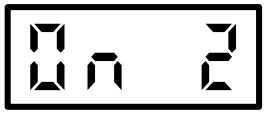
The configuration of the star / delta control logic is done in the menu column:

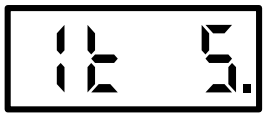

- this cell is used to globally set the function:

0 - disabled

1 - enabled during motor start-up and during normal motor operation (economizer)

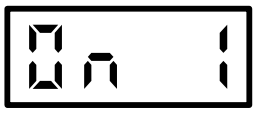
2 - enabled only during motor start-up


- if this option is selected (control logic enabled only during motor start-up), the parameters in the next cells of the 
column must be set:

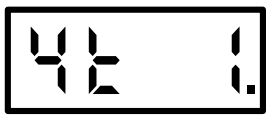

- time period, when the motor operates in a star arrangement, during start-up

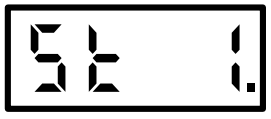

- time period, between star and delta arrangement during switching

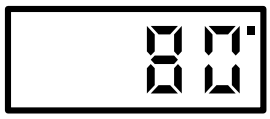

- time criteria for the detection of the motor's standstill state. This indicates a time period during which the motor's phase current is less than 10% of its nominal value, in order to initiate the star / delta start-up procedure again


- it is possible to allow star / delta switching not only during the motor's start-up but also during its normal operation (economizer option). This means that if a phase current value drops below a set threshold, switching over from a delta to a star arrangement will occur, after a user-defined time-delay. On the other hand, if the current exceeds the set threshold, switching over from a star to a delta arrangement will occur, after a user-defined time-delay.

The economizer's parameters are set in the following cells:


- time-delay of delta to star switchover after the phase current value has dropped below the set threshold


- time-delay for star to delta switchover, after the phase current value has exceeded the set threshold.

 - current threshold (in % of Ib) for star to delta and delta to star switchover

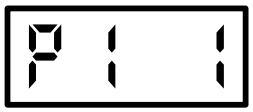
 - current threshold for the detection of the motor's standstill state.

3.6.3.1 Inputs and outputs configuration

Inputs and outputs are configured in the menu columns:  and

 **(CU)***

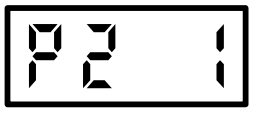
Inputs and outputs are configured in the cells below:

 - output relay P1 configuration. A control switch and the means of control can be selected here.

0 – “circuit breaker” mode. Trip control is done by closing the P1 contacts, for a period of time when protection functions operate. The minimum duration of the trip signal is 0.5s. The energized relay is not latched.

1 – “protection-contactor” mode in the standard control arrangement. This option does not allow tripping of a contactor through the RS485 communication link. Once auxiliary voltage supply Vx is applied, the contacts of output relay P1 close. Tripping by any protection function will make P1 contacts open and remain in that state until it is reset from the front panel keypad or through the adequately configured input S1-S2. Reset of the energized output relay P1 can also be done through the RS485 link **(BCU)*.**

2 – ”bay terminal-contactor” mode **(CU)*.**
Applying auxiliary voltage supply Vx to the relay does not change the state of output relay P1. If voltage is applied to an input assigned to a close function or if a close command is sent via RS485, then P1 contacts close, and are kept in that state until a trip command is sent via RS485 or until the contactor opens (if the contactor's coil circuit is opened).

 - output relay P2 configuration.

0 – “trigger of any protection on trip”. P2 contacts are energized if current protection functions (PTC excluded) set to trip are triggered. (trigger of: I>>, I>, I<, Io>, ⅄, if set to trip);

1 – “trip of any protection (without TSTP)”. P2 contacts are energized if any protection function (PTC included) set to trip P1 issues a trip signal, without external TSTP protection (via configured input V2-C: 6);

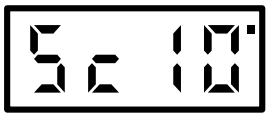
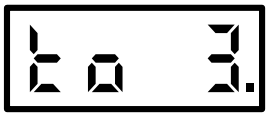
2 – “alarm (warning signal) of any protection set to alarm”. P2 contacts are energized if any protection function set to send a warning signal issues a trip signal;

3 – “thermal overload trigger, trip or alarm”. P2 contacts are energized if the overload protection function I> is triggered;

4 – “delta arrangement”. This option is used if a motor starts up in a star/delta arrangement of motor circuits. P2 is energized when the motor is running in a delta arrangement;

5 - **(BCU)*** - “remote or local CB close” - P2 contacts are used as an output relay in the “circuit breaker” operation mode to issue a “close circuit breaker” control signal. When the CB is closed through the RS485 communication link or an adequately configured input of the relay, P2 contacts are closed for 0.5 s.

NOTE: If P2 is set to option “5”, and a close command is initiated, then output relay P2 is also energized when a contactor is selected as a switch. Thus, when “protection-contactor” mode is selected, P2 can be configured to any option except “5”.

6 - delayed opening based on current criteria. Delayed drop-off timer function (option 5 for “A” version). If the current exceeds threshold set in cell  the contact is closed. The contact will be open if the current is lower than the threshold for the time-delay set in cell 

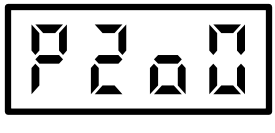
NOTE: If P2 is set to option "5", and a close command is initiated, then output relay P2 is also energized when a contactor is selected as a switch. Therefore, when the "contactor" mode is selected, P2 can be configured to any option except “5”.

7 - close CB by reacceleration or close command. The action is similar to item 6 but the contact will also be energized by the reacceleration function (closing the contactor if the busbar is re-energized. Closing occurs after the time-delay set in cell 

 - configuration of the operation mode of output relay P2

0 - without. No latching after energizing (the relay is automatically reset, if the cause of its energizing ceases);

1 - latching. Latching of the energized relay, until it is reset from the relay's keypad or the adequately configured input S1-S2, T1-T2 or via the RS485 communication link (BCU)*.

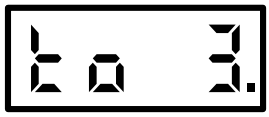
 - P2 operation mode

0 - normally open. Energize-on-signal arrangement (NO)

1 - normally closed. Normally energized arrangement (NC)

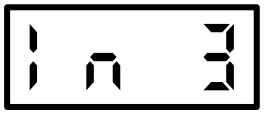
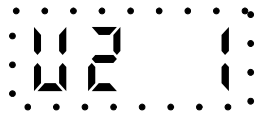
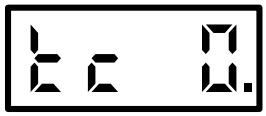
NOTE: This does not apply to P2 if it is set to 5 (BCU)* (”close circuit-breaker” control).


- Undervoltage stage for the reacceleration (restart of motors) function. Settings: 44 – 99% of Vn (230 VAC); step 1%


- reacceleration authorization time. Time settings for drop-off timer function

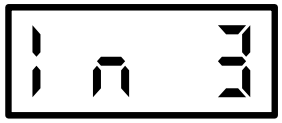
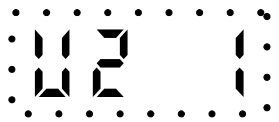
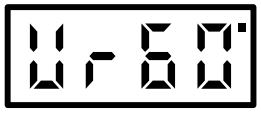
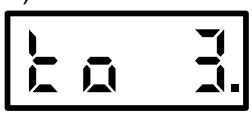
In some particuliar applications, it is necessary to detect interruptions in the motor's power supply and measure their duration. If a supply interruption is not longer than a set drop-off time period, then self-starting of the motor is permitted (emergency restart). This function is based on the phase current measurement and is executed by output relays P2 or P3, if they are assigned to the drop-off function. If the current's value exceeds the current threshold (set in the cell


, for example 10% of Ib), output relay P2 (or P3) is energized immediately. If the current drops below the threshold, for example 10% of Ib, then relay P2 (or P3) will be de-energized after a set drop-off time period.

(i) If output relay P1 is set as a “bay terminal-contactor", then the relay will be de-energized immediately upon dropping below a current value, for example 10% of Ib. However, if information is received that the busbar has re-energized (control via configured input:  or  , or if Vref is lower than the set value) and the duration of the voltage interruption is not longer than a set drop-off time delay  , then relay P1 will be energized after a closing time delay 

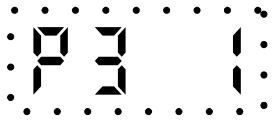
(ii) If output relay P1 is set as a “protection-contactor" mode, then the contactor supplied from AC network will be de-energized immediately on dropping down of voltage on the busbar.

(iii) However, if there will be information that voltage on the busbar return (control via configured input:


or  or the threshold of Vref is lower than ) and the duration of the voltage interruption is not longer than a set drop-off time-delay  , then, if the voltage picks up again (control via

binary inputs), after set time-delay for closing  , relay P2 (if set to ) will be energized for 0.5 s.

Thanks to MiCOM P211's immunity to voltage interruptions, (e.g. minimum hold time period of 5.2 s at 230 VAC), the function can be used even if the relay and the motor are powered from the same source (AC power network).

 - configuring output relay P3 **(CU)***.

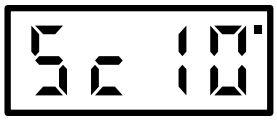
0 – “trigger of any protection on trip”. The relay is energized if any current protection (I>>, I>, I<, Io>, ASYM) set to “trip” the relay is triggered;

1 – “trip of any protection (without TSTP)”. P3 contacts are energized if any protection set to “trip” output relay P1 issues a trip signal (without external TSTP protection (via configured input V2-C: 6);

2 – “alarm (warning signal) of any protection”. The relay is energized if any protection set to “warning signal” issues a trip signal;

3 – “delayed open based on current criteria”. Delayed drop-off timer function if the current drops below the set value 

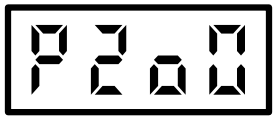
4 - star arrangement. This option is used if motor starting is performed in a star-delta arrangement of motor circuits. If P3 is energized the motor is running in a star arrangement;

5 - motor run. Motor running indication (the phase current is greater than the set value )

 - configuration of the operation mode of output relay P3 **(CU)*.**

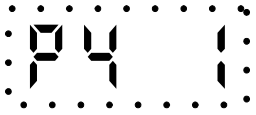
0 – “without”. No latching after energizing (the relay is self-reset if the cause for its energizing ceases);

1 – “latching”. Latching of the energized relay until it is reset from the relay's keypad or the adequately configured input S1-S2, T1-T2, or via the RS485 communication link.

 - P3 operation mode

0 - "normally open". Energize-on-signal arrangement (NO)

1 - "normally closed". Normally energized arrangement (NC)



- configuration of output relay P4 **(CEF)***.

0 – “trigger of any protection on trip”. The relay is energized if any current protection (PTC and ZZ excluded) set to “trip” the relay is triggered;

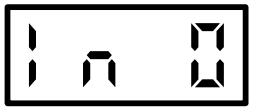
1 - "trip of any protection (without TSTP)". P4 contacts are energized if any protection (without external protection TSTP - via configured input V2-C: 6) set to trip output relay P1 issues a trip signal;

2 - "no protection alarm" (warning signal). When this option is selected the voltage supply's presence is monitored. P4 contacts are energized after auxiliary voltage supply Vx is applied to terminals A1 and A2 (41-44 closed, 41-12 open).

If the auxiliary supply is interrupted or if the relay fails or if any protection set to issue a warning signal issues a trip signal, the contacts of output relay P4 switch back to their original position (41-44 open, 41-12 closed);

3 - "no protection trip" (without TSTP). Same as option 2, except that it is activated if any protection (without external protection TSTP - via configured input V2-C: 6) set to trip output relay P1 issues a trip signal.

4 - "delta arrangement". This option is used if a motor start-up is performed in a star-delta arrangement of motor circuits. If P4 is energized the motor is running in a delta arrangement.



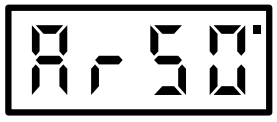
- configuration of binary input S1-S2.

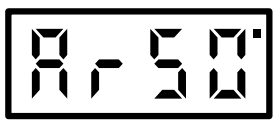
The input is controlled by means of a contact, which means that it is enabled if terminals S1-S2 are closed. The following events can occur upon closing S1-S2:

0 - "blocking of RL1 (P1)". Block the energization of output relay P1;

1 - "reset of LEDs and latchings". Reset the trip state;

2 - "trigger of RL2 (P2)". Energize output relay P2 contacts;

3 - " reacceleration trigger". Initiate a cycle of motor self-starting scheme. If the “close S1-S2” signal is sent from an external undervoltage relay, which monitors the voltage values of the motor's phase feeders (self-start initiated), and the actual thermal replica of motor is greater than 

, then, in order to enable the motor's self-start, the replica will be reduced down to the level of 

. Once this is done, input S1-S2 is blocked for a period of 60 s. Afterwards, the thermal replica's value may be further reduced to permit another self-start of the motor. If the thermal replica's value is below 

, it will remain unchanged if a self-start signal is received;

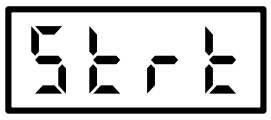
4 - "blocking of any remote controls (RS485)". Blocking of remote controls such as: remote control test, reset of LEDs and latchings, clearing of fault records, clearing of the thermal replica, breaker / contactor TRIP, breaker / contactor CLOSE, set ON-Line (working mode), set OFF-Line (maintenance mode) or changes in any settings;

5 - "clear thermal replica". Reset (to 0) of the thermal replica's value

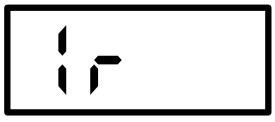
6 - "emergency shutdown (ESTP)". This option is used for external trip protection commands. Protection is activated if S1-S2 is not short. A short state of S1-S2 will deactivate the trip signal. The trip signal is not latched. The function can be assigned to an Emergency Push Button with a normally closed contact.

The high state of the input lights up the PTC LED and gives the reason of the trip on the display 

If this function is used it is necessary to change the description of the PTC LED using a sticker.

7 - "speed switch for high-inertia motors". This function is used for high-inertia motors and is activated only during the motor's starting state (

) . This function supervises the speed switch during the motor's start-up (detection of rotating motor), if it is not short (no rotation) it means that the motor has stalled during start-up and the tIstall time delay (

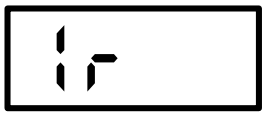
in the 

column) is initiated.

If a trip occurs, the I> LED is lit and the reason for the trip is shown on the display

If while the motor is starting (starting state:

) the speed is short of S1-S2 it will switch to the tIstart (

in the 

column) time-delay.

If a trip occurs, the I> LED is lit and the reason for the trip is shown on the display.

- configuration of binary input T1-T2.

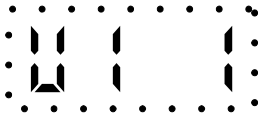
The input is controlled by means of a contact, which means it is enabled if terminals T1-T2 are closed.

The following events can occur upon closing S1-S2:

0 - "over temperature protection PTC". This configuration activates the PTC protection function

1 - "Resetting of LEDs and latchings". Resetting of the trip state;

2 - "blocking of CB close". Shorting of T1-T2 blocks any CB close command (remote or local) which issued by the P211).



- configuration of binary input V1-C (CU)*.

The input is enabled upon applying a voltage to terminals V1-C. Then, the following events can take place:

0 - "local CB close". If V1 is set to "0", then the close command is enabled (local closing operation);

1 - "external trip ZZ". Trip issued by an external protection device ZZ;

2 - "outputs in maintenance state". The output relays P1, P2, P3 and P4 are set to their rest position - blocking of energizing by function or protection configured for this input..

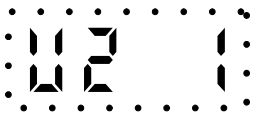
NOTE: If the output relay is set to normally closed (for example: 

), a high state of the input switches the contact to its closed position (like without action of any configured function);

3 - "no action". It can be used for sending information via RS485.

4 - "FUSE trip". This function is used as external protection. It can be used for the Fuse Trip protection command, if fuses have auxiliary contacts to detect the fuse trip. The high state of the input lights up the PTC LED and gives the reason for the trip on the display 

. If this function is used it is necessary to change the description of the PTC LED using a sticker. This protection function is not latched.



- configuration of binary input V2-C (CU)*.

The input is enabled upon applying a voltage to terminals V2-C. The following events can then take place:

0 - "CB / contactor state". The closed state of the circuit-breaker or contactor is represented by the high state of the input. Enabling this option is essential if the contactor is intended to be controlled via the RS485 communication link;

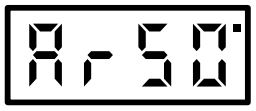
1 - "external trip ZZ". Trip by an external protection device ZZ;

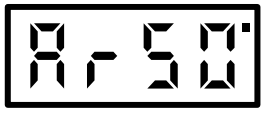
2 - "resetting of LEDs and latchings". Resetting of the latched output relays' trip states and warning signals (KAS);

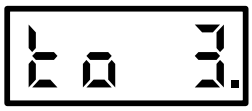
3 - "blocking of any remote controls (RS485)". Blocking of remote controls such as: remote control test, resetting of LEDs and latchings, clearing fault records, clearing the thermal replica, breaker / contactor TRIP, breaker / contactor CLOSE, set ON-Line (working mode), set OFF-Line (maintenance mode) or changing of any settings. The high level of the input activates the function.

4 - "blocking of CB close". The low state of the input blocks any CB close command (remote or local) issued by the P211).

5 - "trigger of reacceleration". Monitoring of the auxiliary voltage supply to allow performing the self-start scheme. The low state of the input activates the self-starting logic. If:

(i) P1 is set to 2 (bay terminal-contactor). The low state opens the P1 contact and the thermal state is reduced to its set value ()

(ii) P1 is set to 1 (protection-contactor) the thermal state is reduced to its set value ()

The next reacceleration authorization time  is calculated. If the high state is back before this time has elapsed the reacceleration close time  starts. After this time-delay a close command (0.5 s pulse) is issued:

(i) P1 is set to 2 (bay terminal-contactor): closing of P1

(ii) P1 is set to 1 (protection-contactor): closing of P2 (if set to 7).

6 - technological shutdown (TSTP). External protection which can be used for emergency technological shutdown of the motor.

The high state of the input lights up the PTC LED and gives the reason for the trip on the display:

 .

If this function is used it is necessary to change the description of the PTC LED using a sticker.

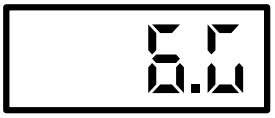
This protection function is not latched.

3.6.4 Relay identification

Hardware and software relay versions can be read in the menu column  . The version of the relay (e.g. A, B, C) and firmware version is indicated here.

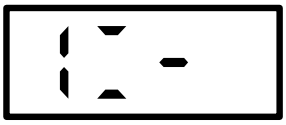
 - the relay type is indicated here.

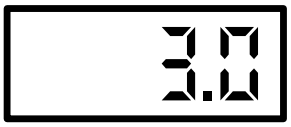
 - the relay model (e.g. A, B, C) and hardware version is indicated here.

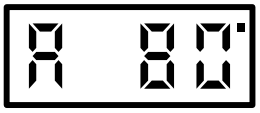

- the firmware version is indicated here.

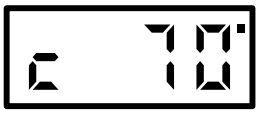
3.6.5 Protection setting and configuration

3.6.5.1 Overload I>




- "base current". IB (motor's nominal current)


- "alarm threshold". Alarm thermal threshold [% of trip]


- "theta forbid start". Reset the thermal threshold (percentage of the Ib current)

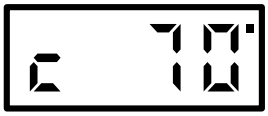

- "time contact (t6 x Ib)". Time-delay setting at I = 6 Ib, selected within the range of 0.1 to 50 s, in steps of 0.1 s.

t6xIb - time to trip (100% thermal state) if the 3 phase currents are equal: 6xIb and if the calculated start from the thermal state equals 0%.

For time ranges at other multiple values of the base current Ib, and various motor thermal replica states, see table 1.

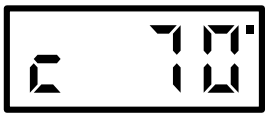

- reset options for LED indication, energization state of P1 output relay and trip signal.

0 - "without". Self-reset of trip if the thermal state is below the thermal value set in cell

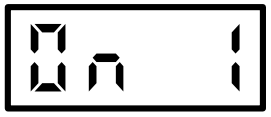


1 - "latching". Manual reset of trip state

NOTE: manual reset is possible if the thermal state is below value set in cell:



For a real manual reset please set the value in cell



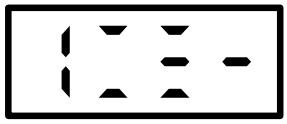
- configuration of Overload protection I>:

0 - "disable". Disable I>;

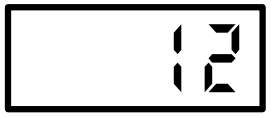
1 - "trip". Enable tripping for the 100% threshold of the thermal state;

2 - "alarm (warning signal)". Enable issuing of a warning signal for the 100% threshold of the thermal state.

3.6.5.2 Overcurrent I>>

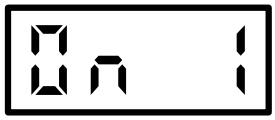


This is a three-phase protection function. The setting of this element is compared with the maximum phase current on phases L1, L2, L3.



- current setting of I>>, selected within the range of (1 to12) IB, and in steps of 1 IB.

- time delay setting of I>>, selected from 0.02s to 99.90 s, in steps of 0.01 s.



- configuration of Overcurrent protection I>>:

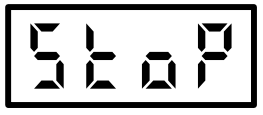
0 - "disable". Disable I>>;

1 - "trip". Enable tripping;

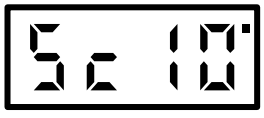
2 - "alarm (warning signal)". Enable issuing of a warning signal.

3.6.5.3 Prolonged Start or Stalled rotor

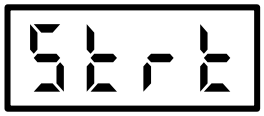
Prolonged start is activated if the motor was previously at standstill

(

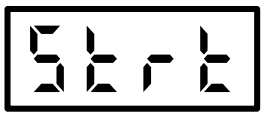
) and the 3-phase current is above the current threshold set in cell:

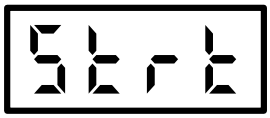


(current criteria for motor start-up).This motor state is shown in cell



. The calculation of the tIstart time-delay is started.

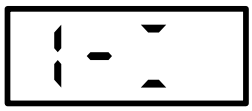
After this time-delay if the motor is in the  state, a trip signal is issued (if configured to trip), the I> LED is lit and the reason for the trip  is displayed.

Switching from the  state to the  state is done if the 3-phase current drops below the threshold: 1.1xIB.

If during the  state of the motor, the 3-phase current is above the Istart / Istall (Ir) threshold (). The tIstall time-delay is initiated ()

After this time-delay has elapsed, if the current is above the Istart/Istall threshold, a trip signal is issued (if configured to trip), the I> LED is lit and the reason for the trip  is displayed.

3.6.5.4 Undercurrent Protection I<



 - current value setting represented as a percentage of Ib, selected within the range of (20 to 90)%, in steps of 1%.

 - time delay setting of I<, selected within the range of (0.02 to 99.90) s, in steps of 0.01 s.

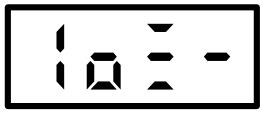
 - configuration of undercurrent protection I<:

0 - "disable". Disable I<;

1 - "trip". Enable tripping;

2 - "alarm (warning signal)". Enable issuing of a warning signal.

3.6.5.5 Earthfault Protection Io>



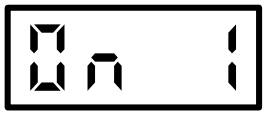
(B, C only)

- current value of Io setting; the setting range depends on the selected version:

(i) 0.01 to 0.50 A , step of 0.01 A.

(ii) 0.05 to 2.50 A, step of 0.01 A.

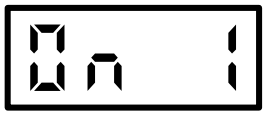
- time-delay setting of Io>, selected within the range of (0.02 to 99.90) s, in steps of 0.01 s.



- configuration of earth fault protection Io>: same as for 7.6.3

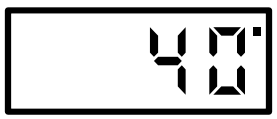
3.6.5.6 Loss of Phase

- time delay setting for the protection to trip the relay, selected within the range of (0.00 s to 99.90) s, in steps of 0.01 s.



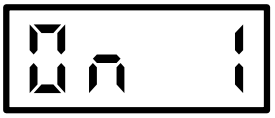
- configuration of earth fault protection Io>: same as for 7.6.3

3.6.5.7 PhAs Unbalance (Assymetry)



- unbalance ratio in %, selected within the range of (15 to 50)%, in steps of 1%.

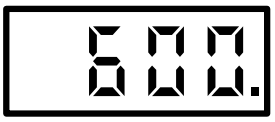
- time delay for the protection to trip the relay, selected within the range of (0.02 to 99.90) s, in steps of 0.01 s.



- configuration of earth fault protection Io>: same as for 7.6.3

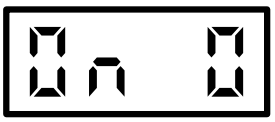
3.6.5.8 Number of permitted starts

- number of permitted starts



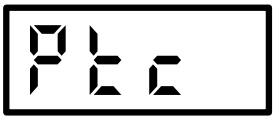
- Treference. Time window in which starts are calculated

- Lockout time. The time after a number of starts during which the last trip is latched (time for cooling of motor).



- configuration of the number of starts: same as for 7.6.3

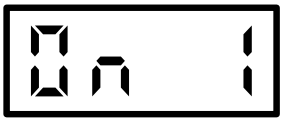
3.6.5.9 PTC Overtemperature Protection



- latching trip. Reset options for LED indications and energization state of output relay P1

0 - "without". Self-reset

1 - "latching". Manual reset



- configuration of over-temperature protection:

0 - "disable". Disable PTC protection;

1 - "trip". Enable tripping;

2 - "alarm (warning signal)". Enable issuing of a warning signal.

3.6.6 Factory settings

Factory settings are shown in Fig. 5, which describes how to navigate through the relay's menu. The settings for the I> and Io> protection functions are not included in this figure because they vary depending on the relay version. The factory settings for I> and Io>, and for different relay versions, are described in the Technical Data section: the relevant setting values are underlined.

3.6.7 Entering and changing password

If access and changes to the settings must be restricted, a three-digit password should be set in the relay. Then, without the password it will be possible to view the settings, but not to modify them.

If the password is lost or forgotten, it is necessary to contact the manufacturer in order to obtain the factory password. In such case, please contact Schneider Electric Contact Centre

If "000" is chosen as a password, the protection of the settings is removed.

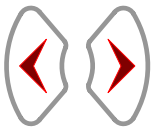
The factory setting for the password is “000”

3.6.7.1 Entering a password for the first time

(the factory setting is “000”)

Change the operation mode to OFF-LINE (see item 6.2b)

Select the menu cell  and press  .

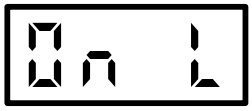
Using the  and  keys, change the flashing digit to the required value. Then, using the  keys, move to the next digit, and modify it to the required value.

Repeat the procedure for the remaining digits.

Press  Change mode of operation to ON-LINE (see item 6.2 e).

After completion of the above procedure, the password will need to be entered in order to modify the settings or configuration of the relay.

3.6.7.2 Changing the password

Select the menu cell  and press  : this will make the relay switch to menu cell  .

Enter a valid password, starting from the flashing digit. After entering the three digits of the password, press  and change the operation mode to OFFLINE (see item 6.2 b)

Select the menu cell  and enter the new password.

Change the operation mode to ON-LINE (see item 6.2 c).

3.6.7.3 Changing the settings or configuration of the password protected relay

Every attempt to change the operation mode to OFFLINE in the password-protected relay, will automatically switch the menu to the password window  , with one flashing digit. Enter a valid password and press  . If the password entered is not correct, any further attempt to change the operation mode will cause the display to switch back to the password cell.

3.7 LED indicators

There are several LED indicators on the front panel of the MiCOM P211: I>>, I>, I<, Io>, PTC, ⅄, L1, L2, L3, [%], [s] and a 4-digit display. If a protection function is set to trip and it issues a trip signal, then the respective LED (I>>, I>, I<, Io>, PTC, or ⅄) lights up, and remains lit until the trip signal is reset.

If a protection function is set to send a warning signal, then the respective LED is extinguished when the fault which triggered the protection has been cleared.

I>, I>>, I<, Io LEDs**:**

(i) a flashing LED indicates that the respective protection has been triggered,

(ii) a constant illumination of a LED indicates that the respective protection has tripped (triggering period exceeded a set time-delay)

NOTE: I< is blocked while the motor is starting. This state is indicated by the LED flashing in a particular way: the LED remains extinguished for a longer time, then emits a couple of short flashes and cycle is repeated.

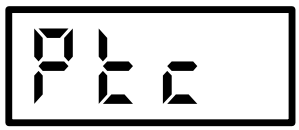
⅄ LED:

(i) the flashing LED indicates that the current unbalance of the motor's feeders has exceeded the set threshold, therefore it also applies to unbalance conditions due to the loss of a phase.

(ii) a constant illumination of the LED indicates that the protection against unbalance / loss of phase has tripped.

PTC LED:

the constant illumination of the LED indicates that:

(i) he temperature has exceeded the PTC trip threshold or the T1 - T2 terminals have been opened. The reason for the trip  is shown on the display;

(ii) the FUSE external protection device (via configured input) has tripped and the reason for the trip  is shown on the display;

(iii) the EStP (Emergency Shutdown) external protection (via a configured input) has tripped and the reason for the trip  is shown on the display;

(iv) the tStP (Emergency Technological Shutdown) external protection (via a configured input) has tripped and the reason for the trip  is shown on the display.

A (L1), B (L2), C (L3) LEDs:

(i) they are lit individually to indicate that their respective phase current is being displayed.

[kA] LED:

(ii) this LED lights up when the current value is displayed in [kA]. If the LED is off, the current value is displayed in [A].

[s] LED:

(iii) this LED lights up settings of the I>, I>>, Ip>, Io>.trip time values are being entered.

The simultaneous flashing of all the LEDs: I>, I>>, Ip>, Io>, PTC, ZZ indicates that the relay is currently in the OFF-LINE operation mode.

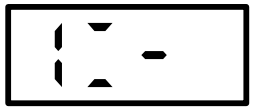
If none of the LEDs nor the display is on, it indicates that the auxiliary voltage supply is not applied or that the relay has failed.

3.8 Fault and start recording

Fault and Start Recording is presented in column: 

The records of the most recent trips may be stored. They contain the reasons for the trips, the phase & earth fault current values during the trips and the last starting values: current and time.

 - remaining number of permitted starts

 - the reason for the last trip

 - the value of the current in phase L1 at the beginning of the last trip command.

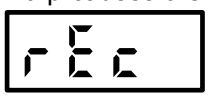
 - the value of the current in phase L2 at the beginning of the last trip command.

 - the value of the current in phase L3 at the beginning of the last trip command.

 - the value of the earth fault current at the beginning of the last trip command **(BC)***.

 - the value of the highest phase current (L1, L2 or L3) during the last start-up of the motor

 - the time-stamp for the last start-up of the motor

NOTE: Each trip causes the LDC to display the reason for the last trip cell in the  column.

3.9 Resetting of protection trip states

NOTE:

If the the relay is disconnected from voltage supply Vx or if voltage supply interruption occurs after one of the relay's protection functions has tripped, then the relay's state is recorded. When the voltage supply is restored, the LED corresponding to the protection function which has tripped lights up, and the output relays switch over to the states preceeding the voltage interruption (depending on the selected configuration set for the relay), that is:

(i) P1 state is restored, if it is set to the “protection-contactor” mode;

(ii) P2 or/and P3 or/and P4 states are restored if they are set to latch upon energizing

Resetting LEDs: I>>, I>, I<, Io>, PTC, ⅄, and output relays set to latch upon energizing is only possible if the cause of their energizing ceases.

NOTE: If a protection function set to signal an alarm is triggered, the respective LED lights up. If the cause of the alarm ceases, then the LED lights off automatically.

There are several ways of resetting the LEDs which indicate protection states set to trip and relays’ states, which energized states are latched:

(i) close terminals S1-S2 for a short instant of time if the input is assigned to a reset function (S1-S2 input set to option “0”);

(ii) manual reset from the relay's keypad.

(iii) press the  key repeatedly until the  cell is displayed. Then press the  key.

(iv) remote reset via the RS485 communication link **(BCU)*,** if the reset command is sent via the MODBUS RTU protocol.

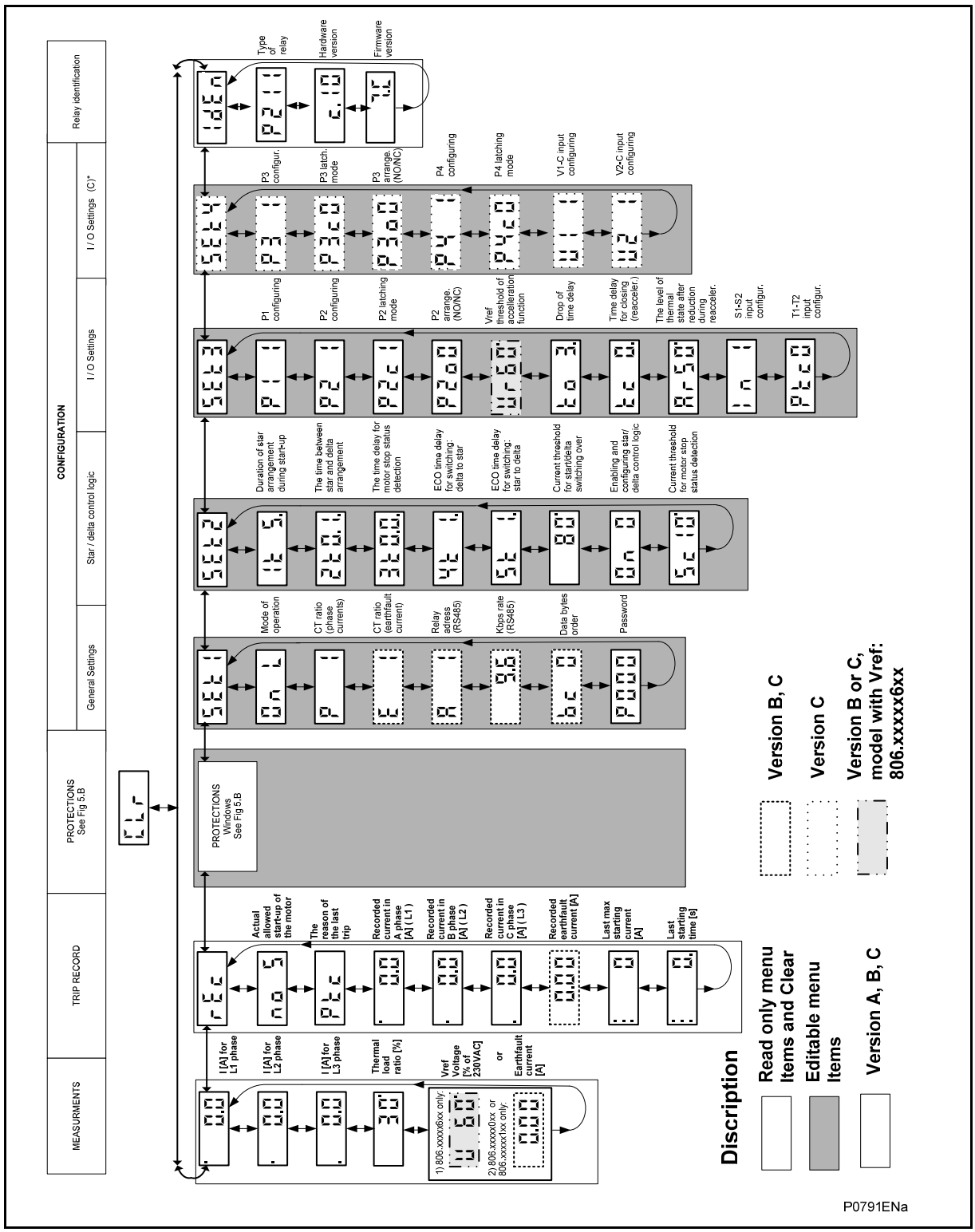


FIGURE 5: NAVIGATING THE MENU (PART 1)

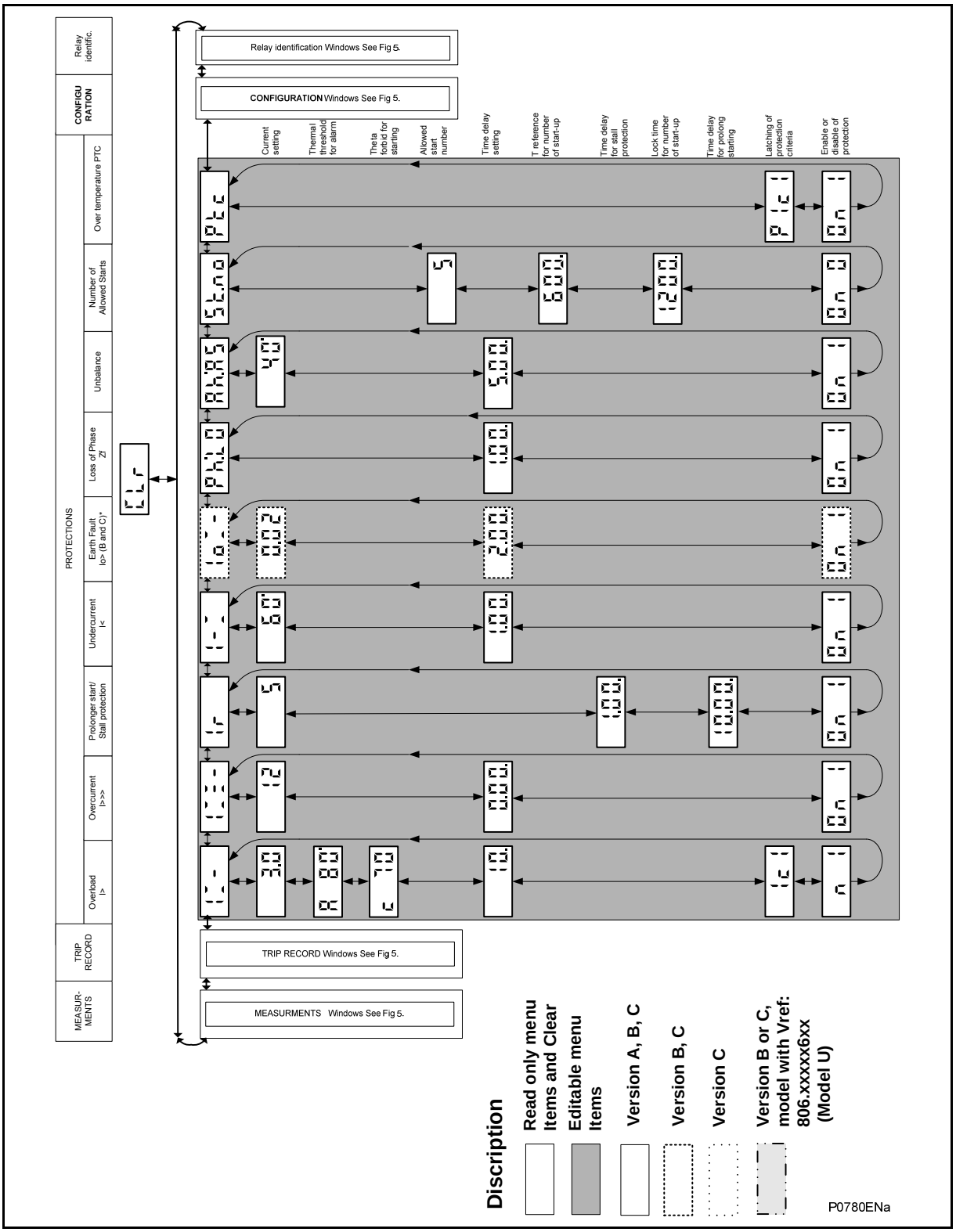


FIGURE 6: NAVIGATING THE MENU (PART 2)

4. RECEIPT OF RELAYS

Upon receipt, relays should be examined immediately to ensure no external damage has been sustained in transit. If damage has been sustained, a claim should be made to the transport contractor and Schneider Electric should be promptly notified.

Relays that are supplied unmounted and not intended for immediate installation should be returned to their protective polythene bags and delivery carton. Section 6 of P211/EN IN gives more information about the storage of relays.

5. HANDLING OF ELECTRONIC EQUIPMENT

A person's normal movements can easily generate electrostatic potentials of several thousand volts. Discharge of these voltages into semiconductor devices when handling electronic circuits can cause serious damage that, although not always immediately apparent, will reduce the reliability of the circuit. The relay's electronic circuits are protected from electrostatic discharge when housed in the case. Do not expose them to risk by removing the front panel or printed circuit boards unnecessarily.

Each printed circuit board incorporates the highest practicable protection for its semiconductor devices. However, if it becomes necessary to remove a printed circuit board, the following precautions should be taken to preserve the high reliability and long life for which the relay has been designed and manufactured.

Before removing a printed circuit board, ensure that you are at the same electrostatic potential as the equipment by touching the case.

Handle analog input modules by the front panel, frame or edges of the circuit boards. Printed circuit boards should only be handled by their edges. Avoid touching the electronic components, printed circuit tracks or connectors.

Do not pass the module to another person without first ensuring you are both at the same electrostatic potential. Shaking hands achieves equipotential.

Place the module on an anti-static surface, or on a conducting surface that is at the same potential as you.

If it is necessary to store or transport printed circuit boards removed from the case, place them individually in electrically conducting anti-static bags.

In the unlikely event that you are making measurements on the internal electronic circuitry of a relay in service, it is preferable that you are earthed to the case with a conductive wrist strap. Wrist straps should have a resistance to ground between 500 kΩ to 10 MΩ. If a wrist strap is not available you should maintain regular contact with the case to prevent a build-up of electrostatic potential. Instrumentation which may be used for making measurements should also be earthed to the case whenever possible.

More information on safe working procedures for all electronic equipment can be found in BS EN 100015: Part 1: 1992. It is strongly recommended that detailed investigations on electronic circuitry or modification work should be carried out in a special handling area such as described in the British Standard document.

6. STORAGE

If relays are not to be installed immediately upon receipt, they should be stored in a place free from dust and moisture in their original cartons. Where de-humidifier bags have been included in the packing they should be retained.

Care should be taken on subsequent unpacking that any dust, which has collected on the carton, does not fall inside. In locations of high humidity the carton and packing may become impregnated with moisture and the de-humidifier crystals will lose their efficiency.

Prior to installation, relays should be stored at a temperature of between –25˚C to +70˚C (-13˚F to +158˚F).

7. UNPACKING

Care must be taken when unpacking and installing the relays so that none of the parts are damaged and additional components are not accidentally left in the packing or lost. Ensure that any User's CDROM or technical documentation is NOT discarded – this should accompany the relay to its destination substation.

Relays must only be handled by skilled persons.

The site should be well lit to facilitate inspection, clean, dry and reasonably free from dust and excessive vibration.

8. RELAY MOUNTING

MiCOM relays are dispatched either individually or as part of a panel/rack assembly.

Individual relays are normally supplied with an outline diagram showing the dimensions for panel cutouts and hole centers. This information can also be found in the product publication.

Secondary front covers can also be supplied as an option item to prevent unauthorized changing of settings and alarm status on DIN rail models.

The design of the relay is such that the fixing holes in the mounting flanges are only accessible when the access covers are open and hidden from sight when the covers are closed.

If a P991 or MMLG test block is to be included, it is recommended that, when viewed from the front, it be positioned on the right-hand side of the relay (or relays) with which it is associated. This minimizes the wiring between the relay and test block, and allows the correct test block to be easily identified during commissioning and maintenance tests.

There are two types of case available: 35 mm DIN rail or flush mounted.

Rail mounted version:
Clip the relay onto a rail (no tool needed). In order to detach it from the rail use a narrow, flat screwdriver, insert its tip into the dedicated aperture at the base of the relay and push the screwdriver handle upwards to release the spring bolt.

Flush mounted version:
Make a cut-out in mounting plate according to Fig. 7. Then insert the relay into it. Fit the fastening elements (see Fig. 1) into the slots in the sides of the case, and keep fastening the screws until the relay is securely fixed to the plate. To withdraw the relay, losen the screws until the fastening element can be removed. The relay can then be withdrawn from the cut-out in the mounting plate.

9. RELAY WIRING

This section serves as a guide to selecting the appropriate cable and connector type for each terminal on the MiCOM relay.

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4L M/G11 OR LATER ISSUE, OR THE SAFETY AND TECHNICAL DATA SECTION OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.

9.1 Medium and heavy duty terminal block connections

Key:

Heavy duty terminal block:	CT circuits, terminals 1-6
Medium duty:	All other terminal blocks

The following minimum wire sizes are recommended:

Current Transformers	2.5 mm^2
Auxiliary Supply, Vx	1.5 mm^2
EIA(RS)485 Port	See separate section
S1-S2, T1-T2 terminals	Screened wires 1.0 mm^2
Other Circuits	1.0 mm^2

Heavy duty terminals in Flush case (1-6 terminals):

Threaded M3 terminals, with wire protection for conductor cross-section:

- 0.2 to 6 mm^2 single-core
- 0.2 to 4 mm^2 finely stranded

Phase current inputs in rail mounting case:

The cables, which pass through the phase CTs built into the P211 must be insulated

Earth fault input (K-L terminals):

Threaded M3 terminals, with wire protection for conductor cross-section:

- 0.2 to 4 mm^2 single-core
- 0.2 to 2.5 mm^2 finely stranded

Global Input/Output Terminals

For power supply, opto and contact inputs, output contacts and COM rear communications.

Threaded M3 terminals, with wire protection for conductor cross-section:

- 0.2 to 4 mm^2 single-core
- 0.2 to 2.5 mm^2 finely stranded

Connections to the equipment must only be made using single strand wire or stranded wire with the use of insulated crimp terminals.

For “PTC” (T1-T2 terminals) and “SIn” (S1-S2 terminals) inputs screened cable must be used to connect these ports to other equipment.

The screen of each cable must be earthed at one end only and must be continuous. Multiple earthing of the screen can cause circulating currents to flow along the screen, which would induce the noise and also could be unsafe. To minimize noise pick-up it is recommended that low voltage cables are kept close to earthed metal casing and avoid areas of high electromagnetic and radio interference. The low voltage cables should not be routed adjacent to or in the same conduit as high voltage or current cables.

The wire used for all connections to the terminal blocks, except the EIA(RS)485 port, should have a minimum voltage rating of 300 Vrms.

It is recommended that the auxiliary supply wiring be protected by a 16A maximum rated high rupture capacity (HRC) fuse of type NIT or TIA. For safety reasons, current transformer circuits must never be fused. Other circuits should be appropriately fused to protect the wire used.

EIA(RS)485 port

Connections to the EIA(RS)485 port are made using ring terminals. It is recommended that a 2-core screened cable is used with a maximum total length of 1000 m or 200nF total cable capacitance. A typical cable specification would be:

Each core:	16/0.2 mm copper conductors
	PVC insulated
Nominal conductor area:	0.5 mm^2 per core
Screen:	Overall braid, PVC sheathed

See SCADA Communications (P211/EN CT) for detailed discussion on setting up an EIA(RS)485 bus.

The RS485 communications port must used screened cable to connect this port to other equipment to maintain insulation requirements.

9.2 Watchdog contacts

Watchdog (self-monitoring) contacts are provided in numerical relays to indicate the health of the relay. Schneider Electric strongly recommend that these contacts are hardwired into the substation's automation system, for alarm purposes.

10. P211 CASE DIMENSIONS

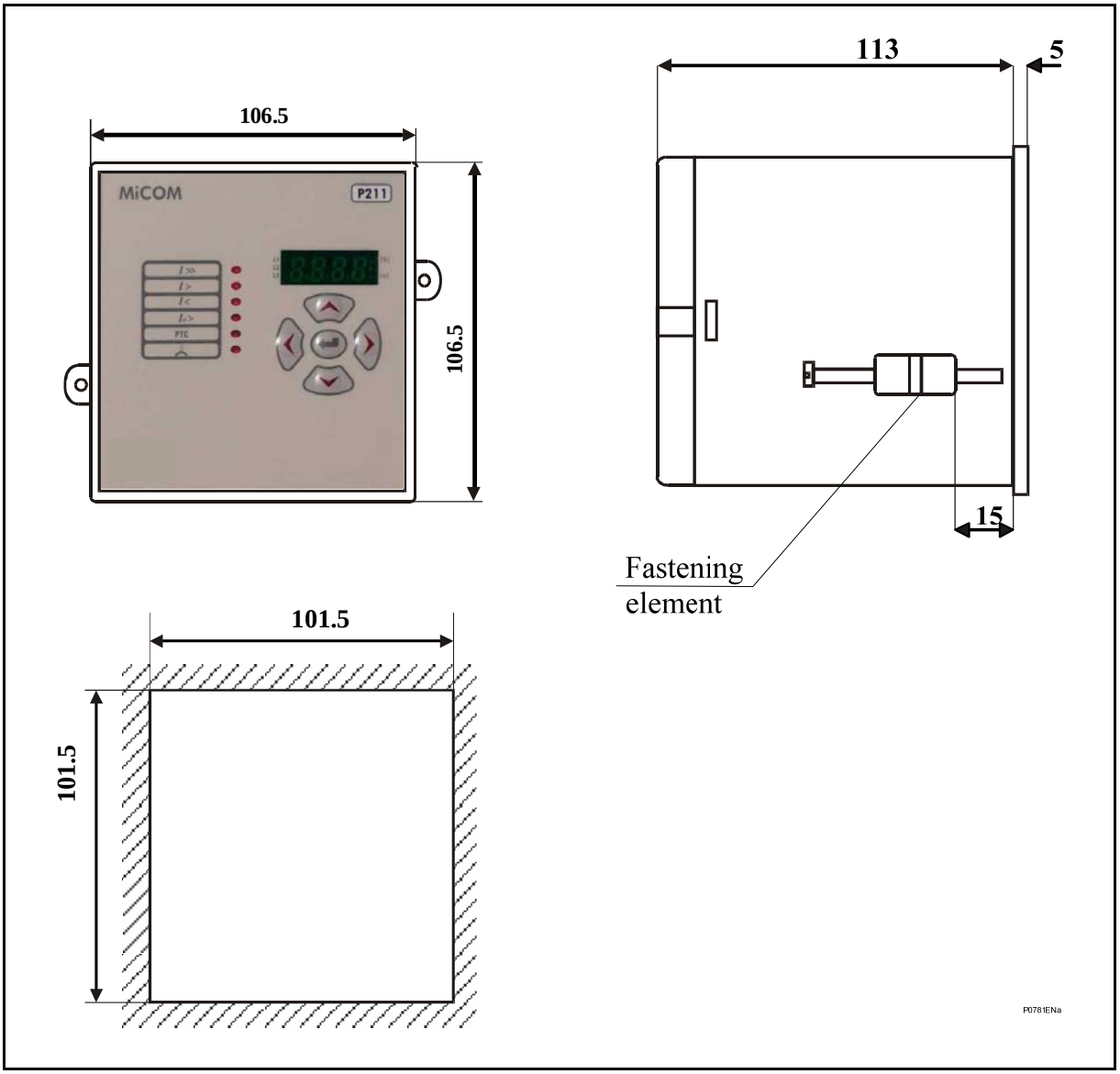


FIGURE 7: CASE DIMENSIONS FOR THE FLUSH MOUNTING CASE

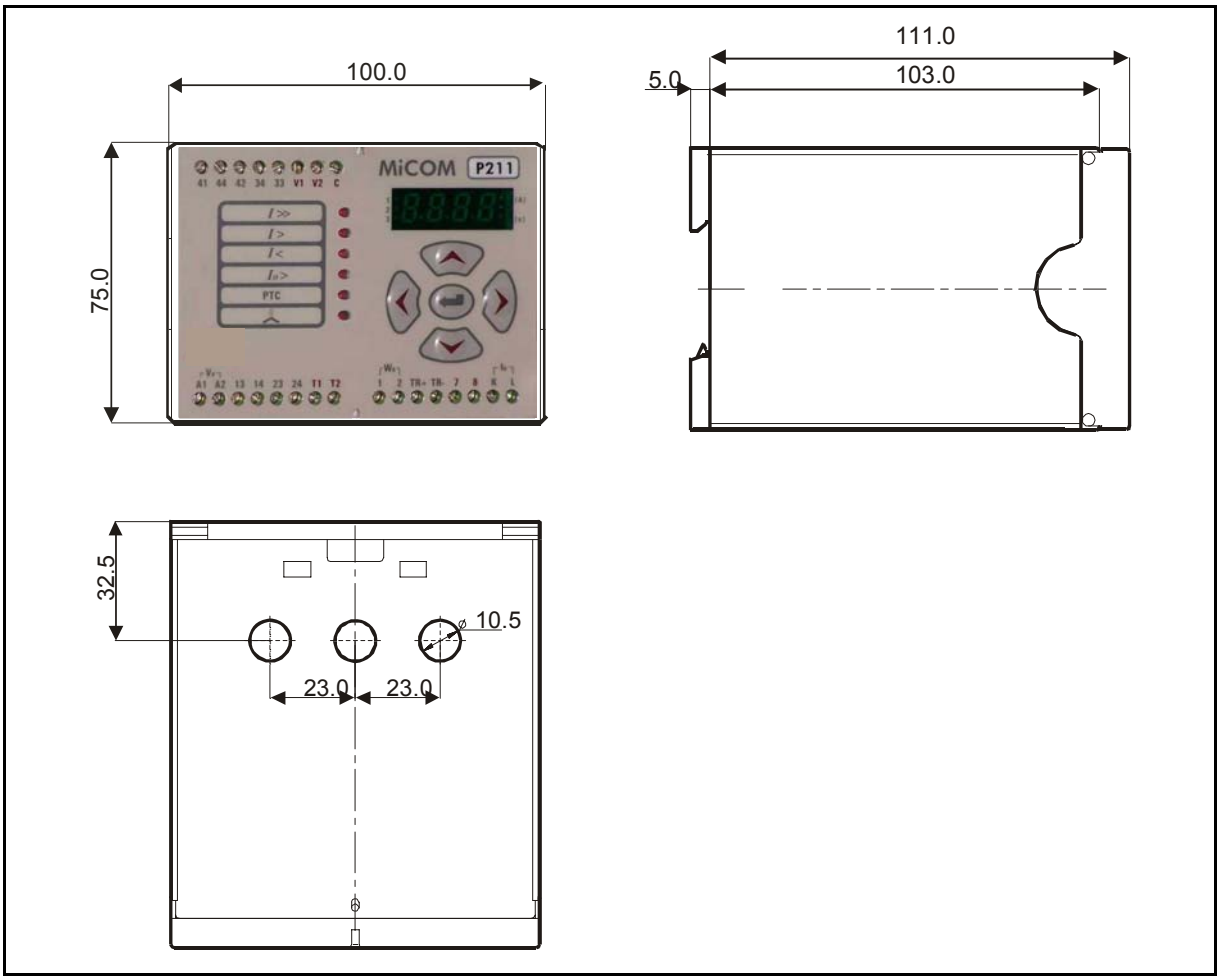


FIGURE 8: CASE DIMENSIONS FOR THE RAIL MOUNTING CASE

11. P211 EXTERNAL CONNECTION DIAGRAMS

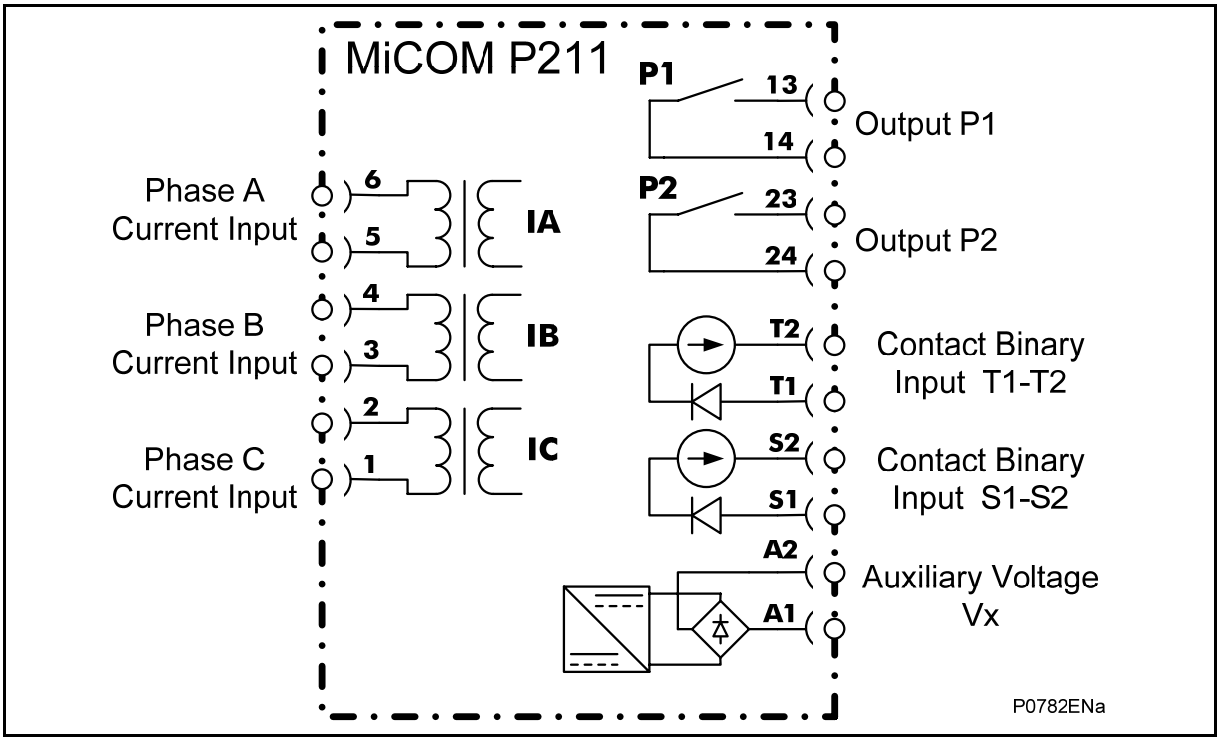


FIGURE 9: EXTERNAL CONNECTION DIAGRAM FOR MODEL A, FLUSH MOUNTING CASE

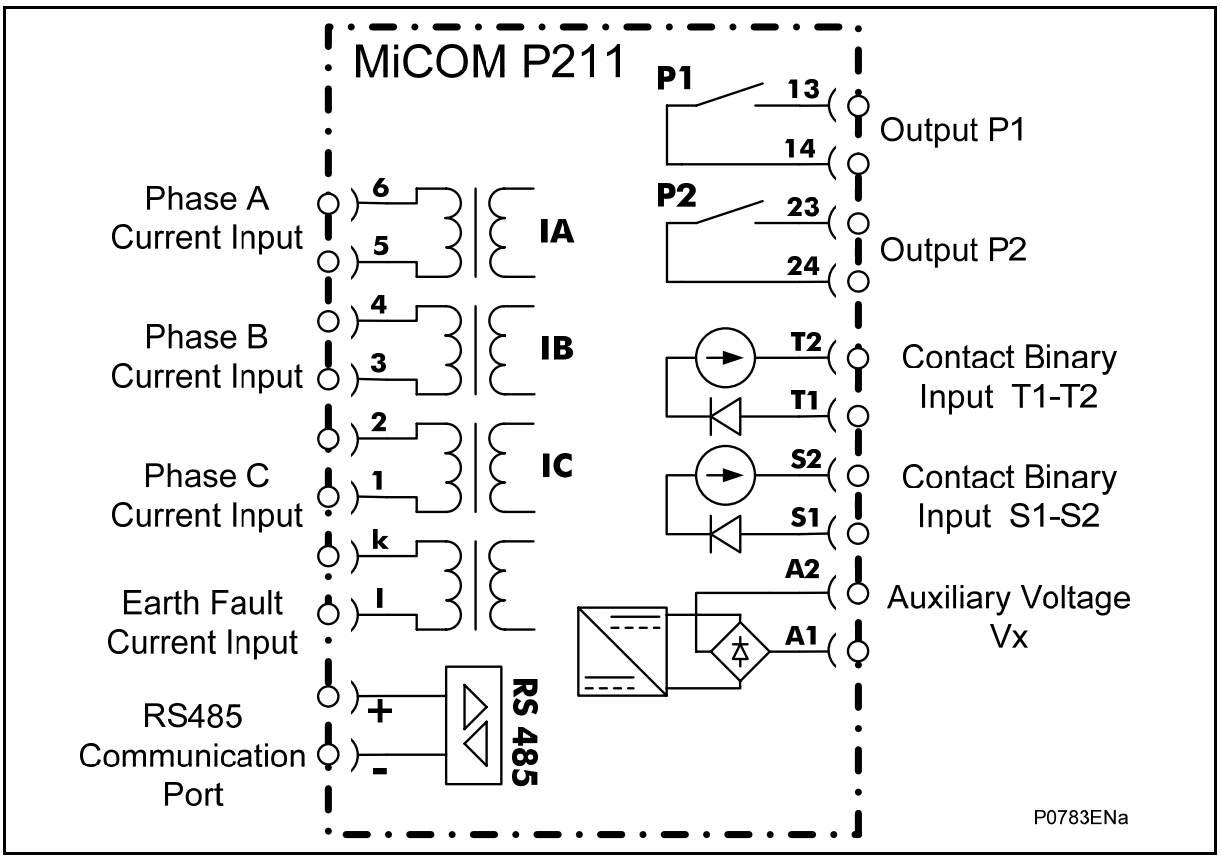


FIGURE 10: EXTERNAL CONNECTION DIAGRAM FOR MODEL B, FLUSH MOUNTING CASE

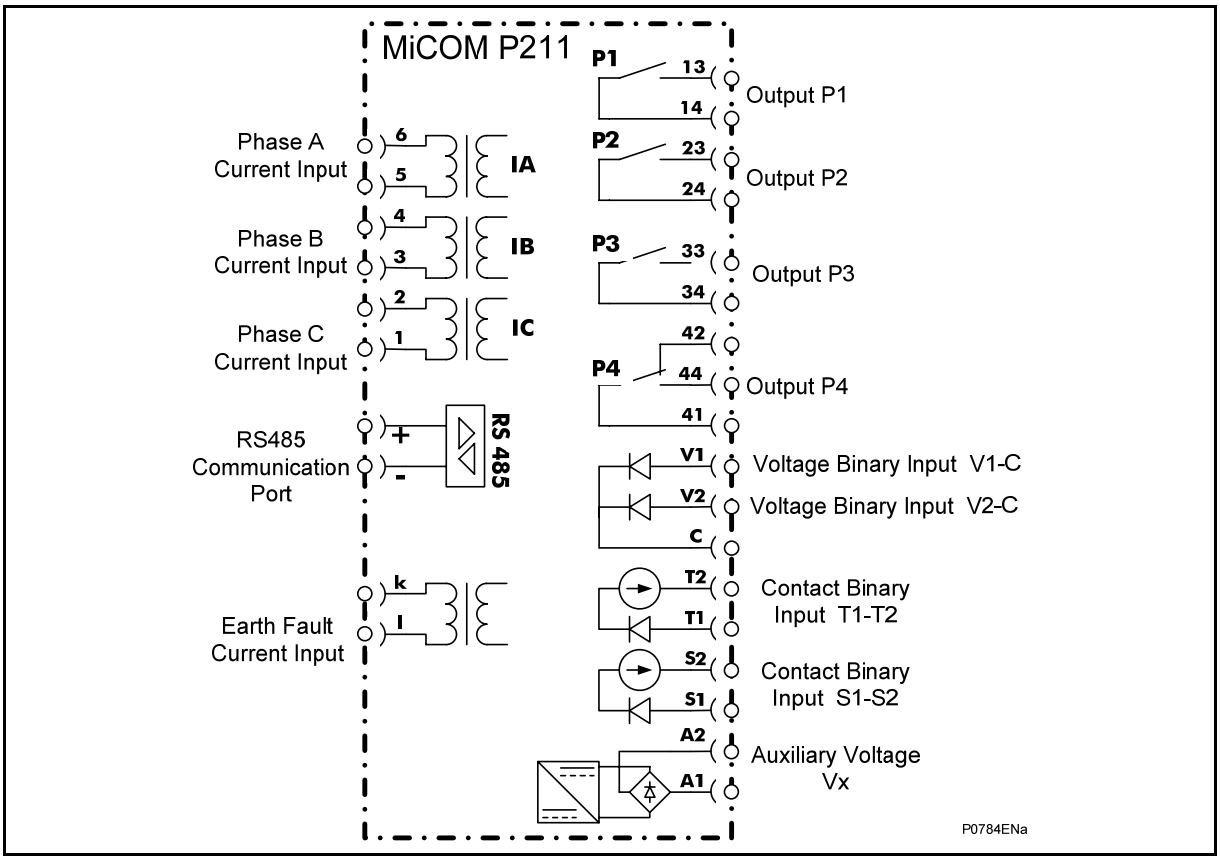


FIGURE 11: EXTERNAL CONNECTION DIAGRAM FOR MODEL C, FLUSH MOUNTING CASE

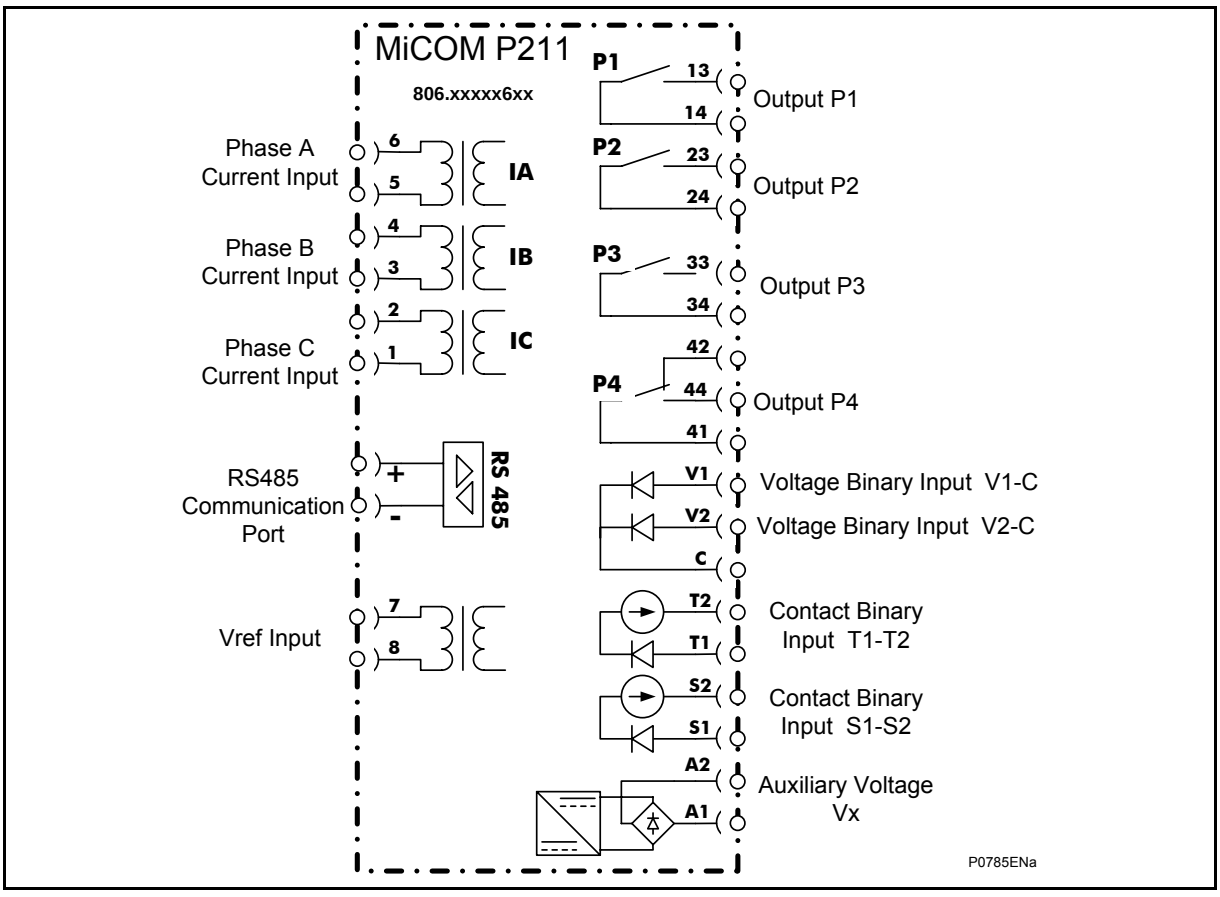


FIGURE 12: EXTERNAL CONNECTION DIAGRAM FOR MODEL U (806.XXXXX6XX), FLUSH MOUNTING CASE

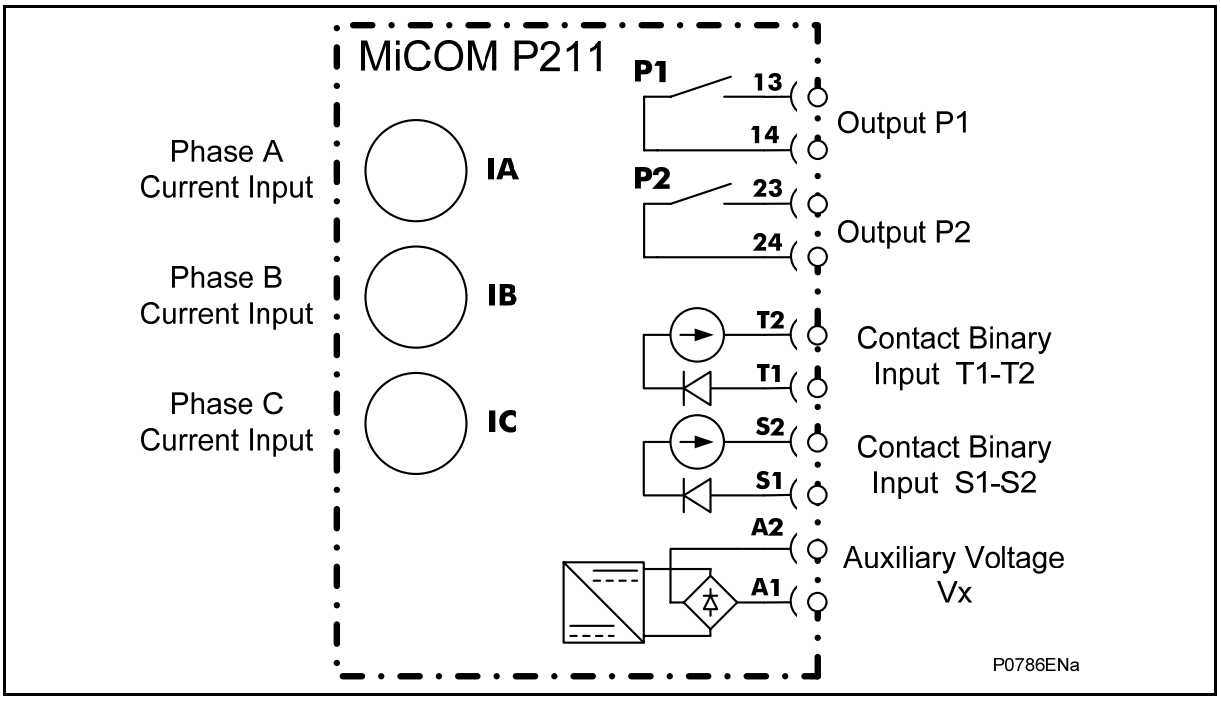


FIGURE 13: EXTERNAL CONNECTION DIAGRAM FOR MODEL A, RAIL MOUNTING CASE

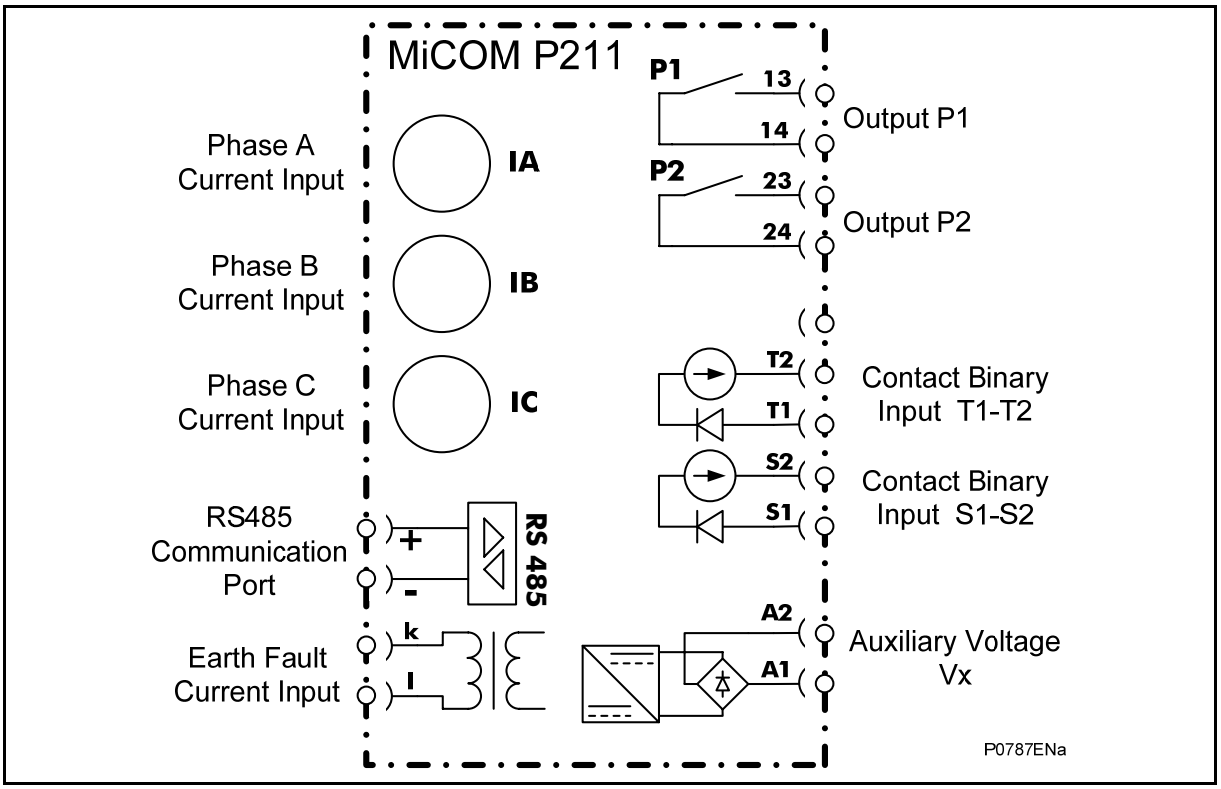


FIGURE 14: EXTERNAL CONNECTION DIAGRAM FOR MODEL B, RAIL MOUNTING CASE

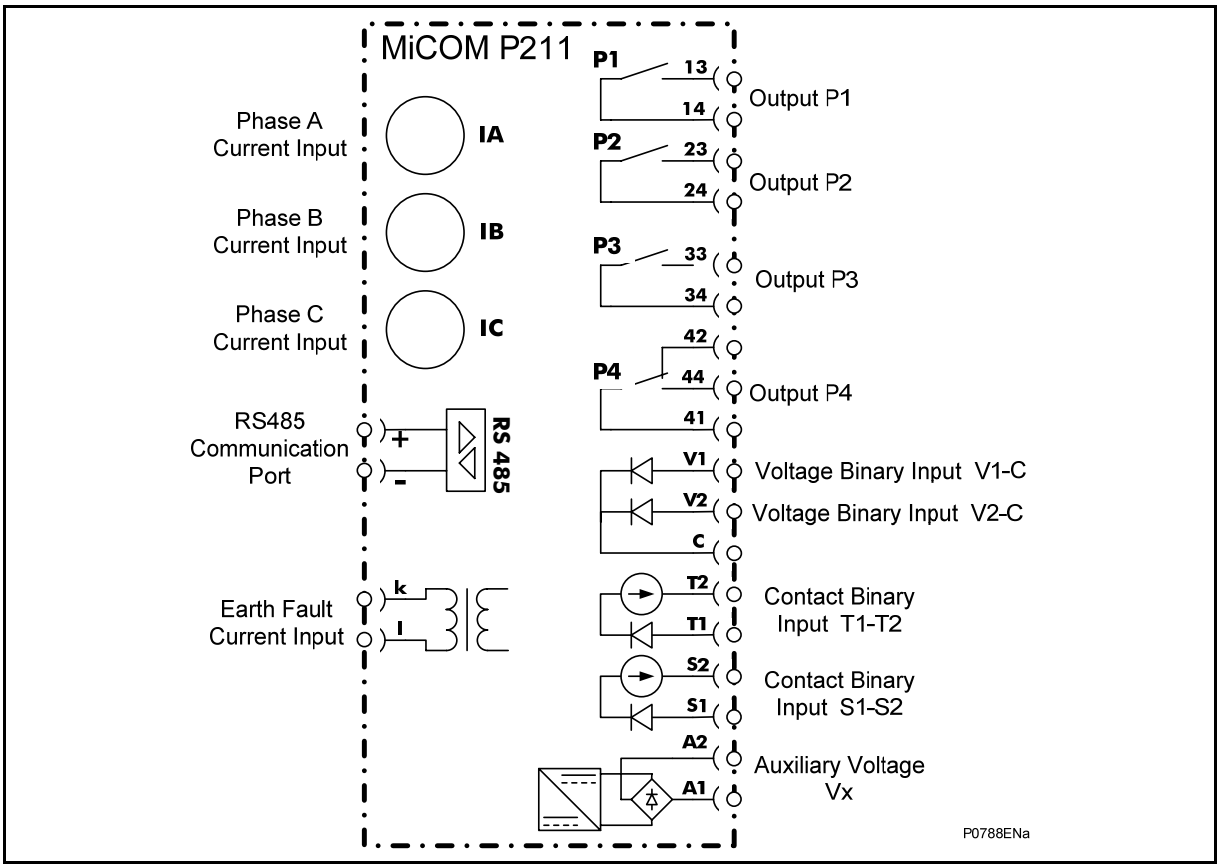


FIGURE 15: EXTERNAL CONNECTION DIAGRAM FOR MODEL C, RAIL MOUNTING CASE

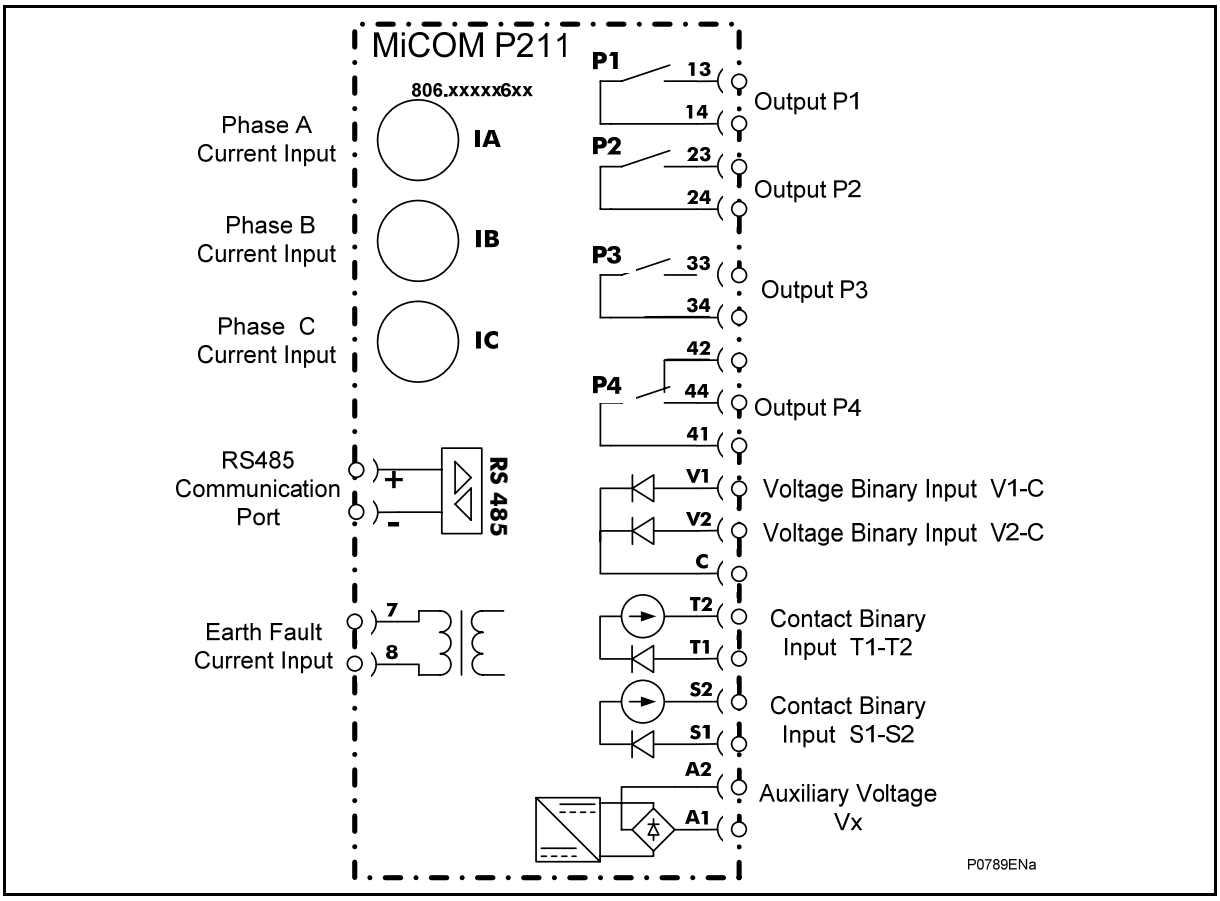


FIGURE 16: EXTERNAL CONNECTION DIAGRAM FOR MODEL U (806.XXXXX6XX), RAIL MOUNTING CASE

Customer Care Centre

http://www.schneider-electric.com/CCC

Schneider Electric

35 rue Joseph Monier
92506 Rueil-Malmaison
FRANCE

Phone: +33 (0) 1 41 29 70 00
Fax: +33 (0) 1 41 29 71 00

www.schneider-electric.com

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