

# EM50



## Energy analyzer for 3-phase, 2-phase and 1-phase systems



### Benefits

- **Flexible installation.** EM50 is suitable for single-phase, two-phase, three-phase and wild-leg systems with different voltage levels used in USA and Canada.
- **Selectable communication protocol.** Modbus RTU and BACnet MS/TP in the same unit.
- **Extended energy measurements.** 4-quadrants reactive power and multi-tariff metering.
- **Easy navigation.** The slideshow function automatically displays the desired measurements in sequence without having to use the keypad.
- **Legal metrology.** The Measurement Canada version can be used for legal metrology in Canada.
- **Quick configuration.** The proprietary UCS configuration software is free and permits quick system configuration.

### Description

EM50 is a three-phase energy analyzer for DIN-rail mounting with LCD display.

It is equipped with a static output (pulse transmission), a relay output (alarm or remote control function) and Modbus RTU or BACnet MS/TP port.

EM50 manages direct voltage connection up to 600 V L-L or by means of voltage transformers. The current measurement is carried out via 5 A current transformer, 333 mV or 80 mA (Measurement Canada only) current sensor or Rogowski coil.

### Applications

EM50 is the perfect solution especially in building and industrial automation where energy and main electrical variables monitoring is required.

It is particularly suited for energy efficiency monitoring, cost allocation, and fiscal/legal sub-billing, where the Measurement Canada approval is required.

### Main functions

- Measure energy consumption and main electrical variables of single-phase, two-phase or three-phase loads
- Display single phase and total variables
- Transmit data via serial communication (Modbus RTU or BACnet MS/TP)
- Transmit energy consumption via pulse output
- Transmit alarm and manage remote control via relay output
- Manage monthly energy log (current month and the previous two months)
- Manage event log database (resets, terminal cover openings, configurations, alarms, etc.)

 **Main features**

- Energy measurements: imported and exported kWh, 4-quadrants kvarh and 4 tariffs energy meters; single phase measurements
- Selectable DMD calculation method (fixed, sliding, sliding with selectable refresh time or thermal)
- Real time clock and tariff management

# Structure

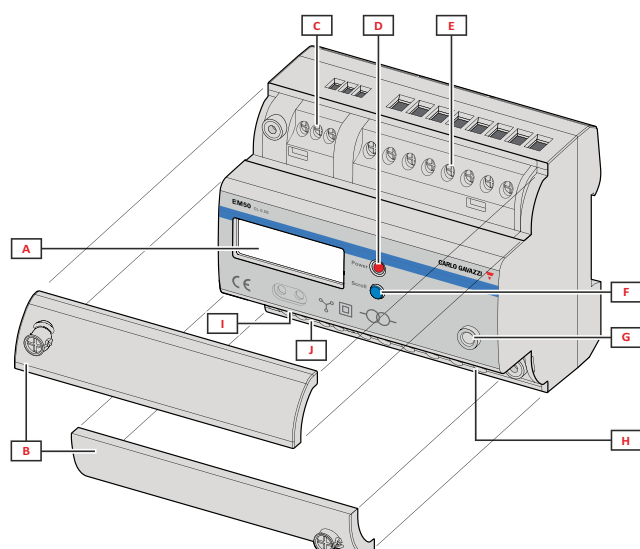


Fig. 1 Front

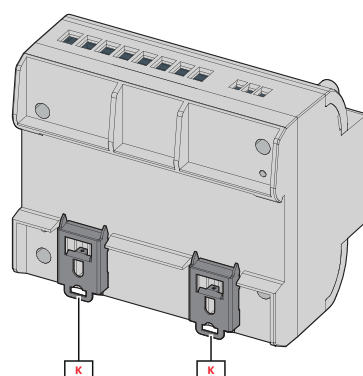


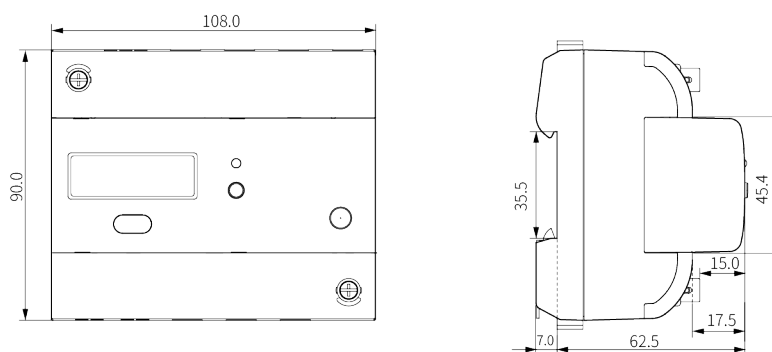
Fig. 2 Back

| Area | Description                          |
|------|--------------------------------------|
| A    | Backlit LCD display                  |
| B    | Terminal protection covers           |
| C    | RS485 connections                    |
| D    | Power supply LED                     |
| E    | Current connections                  |
| F    | Push button for page scrolling       |
| G    | Sealable locking cap                 |
| H    | Power supply and voltage connections |
| I    | Static output and relay connections  |
| J    | Push button for programming          |
| K    | DIN rail mounting springs            |

# Features

## General

|                                    |                                                                                                                                                  |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Protection degree</b>           | Front: IP40<br>Terminals: IP20                                                                                                                   |
| <b>Terminals</b>                   | Screw terminals<br>Voltage and current: max: 4 mm <sup>2</sup> ; min: 0.2 mm <sup>2</sup><br>Outputs and communication: max: 2.5 mm <sup>2</sup> |
| <b>Overvoltage category</b>        | Cat. III                                                                                                                                         |
| <b>Pollution degree</b>            | 2                                                                                                                                                |
| <b>Noise rejection (CMRR)</b>      | 100 db, 45-65 Hz                                                                                                                                 |
| <b>Mounting</b>                    | DIN rail                                                                                                                                         |
| <b>Weight (packaging included)</b> | 340 g                                                                                                                                            |



## Environmental specifications

|                              |                                         |
|------------------------------|-----------------------------------------|
| <b>Operating temperature</b> | From -25 to +75 °C/from -13 to +167 °F  |
| <b>Storage temperature</b>   | From -40 to + 85 °C/from -40 to +185 °F |

## Input and output insulation

| Type                                           | Measuring in-puts up to 600V to ground | Relay output | Static output | Communication port | Auxiliary power supply |
|------------------------------------------------|----------------------------------------|--------------|---------------|--------------------|------------------------|
| <b>Measuring in-puts up to 600 V to ground</b> | -                                      | 2 kV         | 2.5 kV*       | 3 kV**             | 2 kV                   |
| <b>Relay output</b>                            | 2 kV                                   | -            | 1.5 kV*       | 3 kV**             | 2 kV                   |
| <b>Static output</b>                           | 2.5 kV*                                | 1.5 kV*      | -             | 2 kV               | 2.5 kV*                |
| <b>Communication port</b>                      | 3 kV**                                 | 3 kV**       | 2 kV          | -                  | 3 kV**                 |
| <b>Auxiliary power supply</b>                  | 2 kV                                   | 2 kV         | 2.5 kV*       | 3 kV**             | -                      |

\*Note: an isolated S0 reader shall be used when connecting the static output. Not suitable for Class II supply circuit.

\*\*Note: an isolated repeater or converter shall be used when connecting a bus to the serial port.

## Compatibility and conformity

|                   |                                                                                                                                                                                                                                                                                                                   |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Directives</b> | 2011/65/EU (RoHs2)<br>2015/863/EU (Rohs3)<br>2014/30/EU (EMC)<br>2014/35/EU (LVD)                                                                                                                                                                                                                                 |
| <b>Standards</b>  | Electromagnetic compatibility (EMC) - emissions and immunity: EN61000-6-3/ EN61000-6-2<br>Electrical safety: EN 61010-1<br>Accuracy: EN 62053-22 (Active energy, Class 0.5 s)<br>IEC 62053-23 (Reactive energy, Class 2 and 3)                                                                                    |
| <b>Approvals</b>  | <br><br>Measurement Canada: LMB-EG-07. Specifications for Approval of Type of Electricity Meters, Instrument Transformers and Auxiliary Devices |

## Electrical specifications

| Voltage inputs                                   | AV5                    | MV5 | RG5 | MA5 |
|--------------------------------------------------|------------------------|-----|-----|-----|
| <b>Voltage connection</b>                        | Direct or via VT       |     |     |     |
| <b>Max VT ratio</b>                              | 200000                 |     |     |     |
| <b>Rated voltage L-N (from Un min to Un max)</b> | 100 to 347 V           |     |     |     |
| <b>Rated voltage L-L (from Un min to Un max)</b> | 100 to 600 V           |     |     |     |
| <b>Voltage tolerance</b>                         | -20%, +15%             |     |     |     |
| <b>Overload</b>                                  | Continuous: 1.5 Un max |     |     |     |
| <b>Input impedance</b>                           | 2 MΩ                   |     |     |     |
| <b>Frequency</b>                                 | 50/60 Hz               |     |     |     |

| Current inputs                      | AV5                                                  | MV5                                       | RG5                                     | MA5                                 |
|-------------------------------------|------------------------------------------------------|-------------------------------------------|-----------------------------------------|-------------------------------------|
| Current connection                  | Via CT                                               | Via 333 mV current sensor                 | Via Rogowski coil (100 mV/kA @50 Hz)    | Via 80 mA current sensor            |
| Max CT ratio                        | 50000                                                | -                                         | -                                       | -                                   |
| Rated current (I <sub>n</sub> )     | 5 A                                                  | 333 mV                                    | 100 mV                                  | 80 mA                               |
| Minimum current (I <sub>min</sub> ) | 0.05 A                                               | 0.01 I <sub>n</sub>                       | 0.01 I <sub>n</sub>                     | 0.8 mA                              |
| Maximum current (I <sub>max</sub> ) | 10 A                                                 | 1.5 I <sub>n</sub>                        | 2 I <sub>n</sub>                        | 160 mA                              |
| Start-up current (I <sub>st</sub> ) | 5 mA                                                 | 0.001 I <sub>n</sub>                      | 0.005 I <sub>n</sub>                    | 0.08 mA                             |
| Overload                            | Continuous: 10 A @ 50/60 Hz<br>1 s: 100 A @ 50/60 Hz | Continuous: 1.5 I <sub>n</sub> @ 50/60 Hz | Continuous: 2 I <sub>n</sub> @ 50/60 Hz | Continuous: 160 mA @ 50/60 Hz       |
| Input impedance                     | ≤ 0.6 VA                                             | -                                         | -                                       | -                                   |
| Crest factor                        | 5<br>(I <sub>max</sub> peak 25 A)                    | 1.5                                       | 5                                       | 4<br>(I <sub>max</sub> peak 320 mA) |

## Power supply

| Version       | Standard (suffix X)                     | Measurement Canada (suffix MC) |
|---------------|-----------------------------------------|--------------------------------|
| Type          | Auxiliary power supply                  |                                |
| Voltage range | 100-415 V ac, 50/60 Hz;<br>100-300 V dc | 120 V ac, 60 Hz                |
| Consumption   | < 2W or < 10 VA                         |                                |

## Measurements

|          |                                                |
|----------|------------------------------------------------|
| Method   | TRMS measurements of distorted waveforms       |
| Sampling | 3200 samples/s @50 Hz<br>3840 samples/s @60 Hz |

## Available measurements on display

| Active energy      | Unit | System | Phase |
|--------------------|------|--------|-------|
| Imported (+) Total | kWh+ | ●      | ●     |

| Electrical variable  | Unit | System | Phase |
|----------------------|------|--------|-------|
| Voltage L-N          | V    | -      | ●     |
| Current              | A    | -      | ●     |
| Neutral current      | A    | ●      | -     |
| Active power         | kW   | ●      | ●     |
| Frequency            | Hz   | ●      | -     |
| Run hour meter       | h    | ●      | -     |
| Device operating     | h    | ●      | -     |
| Internal temperature | °C   | ●      | -     |

### Available measurements via communication

| Active energy      | Unit | System              | Phase |
|--------------------|------|---------------------|-------|
| Imported (+) Total | kWh+ | Total and by tariff | •     |
| Exported (-) Total | kWh- | Total and by tariff | •     |

| Reactive energy    | Unit  | System              | Phase |
|--------------------|-------|---------------------|-------|
| Imported (+) Total | kvarh | Total and by tariff | -     |
| Exported (-) Total | kvarh | Total and by tariff | -     |
| Imported (+): Q1   | kvarh | Total and by tariff | -     |
| Imported (+): Q2   | kvarh | Total and by tariff | -     |
| Exported (-): Q3   | kvarh | Total and by tariff | -     |
| Exported (-): Q4   | kvarh | Total and by tariff | -     |

| Apparent energy     | Unit  | System | Phase |
|---------------------|-------|--------|-------|
| Imported (+) Total  | kVAh+ | •      | •     |
| Exported (-) Total* | kVAh- | •      | •     |

Note\*: not available in Measurement Canada models.

| Electrical variable  | Unit | System | Phase |
|----------------------|------|--------|-------|
| Voltage L-N          | V    | •      | •     |
| Voltage L-L          | V    | •      | •     |
| Current              | A    | •      | •     |
| Neutral current      | A    | •      | -     |
| DMD                  | A    | -      | •     |
| DMD max              | A    | -      | •     |
| Active power         | kW   | •      | •     |
| DMD                  | kW   | •      | -     |
| DMD max              | kW   | •      | -     |
| Apparent power       | kVA  | •      | •     |
| DMD                  | kVA  | •      | -     |
| DMD max              | kVA  | •      | -     |
| Reactive power       | kvar | •      | •     |
| DMD                  | kW   | •      | -     |
| DMD max              | kW   | •      | -     |
| Power factor         | PF   | •      | •     |
| Frequency            | Hz   | •      | -     |
| Run hour meter       | h    | •      | -     |
| Device operating     | h    | •      | -     |
| Internal temperature | °C   | •      | -     |

### Measurement accuracy

| Current                                   |            |
|-------------------------------------------|------------|
| From I <sub>min</sub> to I <sub>max</sub> | ± 0.5% rdg |

| Phase-phase voltage         |            |
|-----------------------------|------------|
| In the range U <sub>n</sub> | ± 0.5% rdg |

| Phase-neutral voltage       |            |
|-----------------------------|------------|
| In the range U <sub>n</sub> | ± 0.5% rdg |

|                        |                                                      |
|------------------------|------------------------------------------------------|
| <b>Reactive power</b>  |                                                      |
| <b>Active power</b>    | $\pm 0.5\%$ rdg                                      |
| <b>Apparent power</b>  | $\pm 0.5\%$ rdg                                      |
| <b>Reactive power</b>  | $\pm 0.5\%$ rdg                                      |
| <b>Active energy</b>   | Class 0.5S (IEC 62053-22)<br>Class 0.5 (ANSI C12.20) |
| <b>Reactive energy</b> | Class 2.0 S (IEC 62053-23)                           |

|                         |                 |
|-------------------------|-----------------|
| <b>Frequency</b>        |                 |
| <b>From 45 to 65 Hz</b> | $\pm 0.2\%$ rdg |

## Display

|                         |                                                                                       |
|-------------------------|---------------------------------------------------------------------------------------|
| <b>Type</b>             | Backlit LCD                                                                           |
| <b>Refresh time</b>     | < 1000 ms                                                                             |
| <b>Description</b>      | 7 digits (8 mm)                                                                       |
| <b>Variable readout</b> | Instantaneous: min: 0.000; max: 9999.999<br>Energy: 7 digits; min: 0.0; max: 999999.9 |

## Digital outputs

### Static output

|                                  |                                                                                                                                |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Connection type</b>           | Screw terminals                                                                                                                |
| <b>Maximum number of outputs</b> | 1                                                                                                                              |
| <b>Type</b>                      | Mosfet                                                                                                                         |
| <b>Function</b>                  | Pulse output                                                                                                                   |
| <b>Features</b>                  | V <sub>ON</sub> 0.35 V dc, max. 100 mA<br>V <sub>OFF</sub> 250 V max                                                           |
| <b>Configuration parameters</b>  | Linked variable (Active power/Reactive power)<br>Pulse duration (20-100 ms)<br>Pulse weight (1-60000 pulse/kWh or pulse/kvarh) |
| <b>Configuration mode</b>        | Via keypad or UCS software                                                                                                     |

Note: an isolated S0 reader shall be used when connecting the static output. Not suitable for Class II supply circuit.

### Relay output

|                                  |                                                                                                      |
|----------------------------------|------------------------------------------------------------------------------------------------------|
| <b>Connection type</b>           | Screw terminals                                                                                      |
| <b>Maximum number of outputs</b> | 1                                                                                                    |
| <b>Type</b>                      | Relay (SPST)                                                                                         |
| <b>Function</b>                  | Remote control or alarm                                                                              |
| <b>Features</b>                  | 5A@250 V ac<br>5A@30 V dc                                                                            |
| <b>Configuration parameters</b>  | Function<br>Alarm Output Mode (level/ pulse)<br>Pulse Output Time (50-3000 ms)<br>Delay (0-30000 ms) |
| <b>Configuration mode</b>        | Via UCS software                                                                                     |

Note: an isolated S0 reader shall be used when connecting the static output. Not suitable for Class II supply circuit.

## Communication ports

### RS485 port

|                                 |                                                                                                                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Protocol</b>                 | Modbus RTU                                                                                                                                                                                  |
| <b>Devices on the same bus</b>  | Max 247                                                                                                                                                                                     |
| <b>Communication type</b>       | Multidrop, bidirectional                                                                                                                                                                    |
| <b>Connection type</b>          | 2 wires                                                                                                                                                                                     |
| <b>Configuration parameters</b> | Modbus address (from 1 to 247)<br>Baud rate (1200/2400/4800/9600/19200/38400/115200 bps)<br>1 stop bit, no parity / 2 stop bit no parity / 1 stop bit, even parity / 1 stop bit, odd parity |
| <b>Refresh time</b>             | < 200 ms                                                                                                                                                                                    |
| <b>Configuration mode</b>       | Via keypad or UCS software                                                                                                                                                                  |

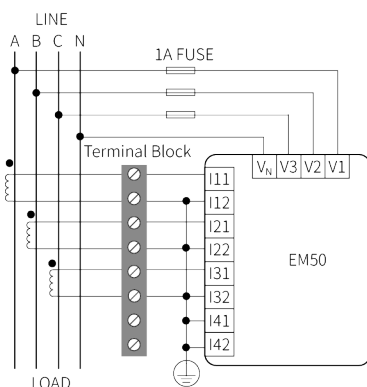
Note: an isolated repeater or converter shall be used when connecting a bus to the serial port

### BACnet MS/TP

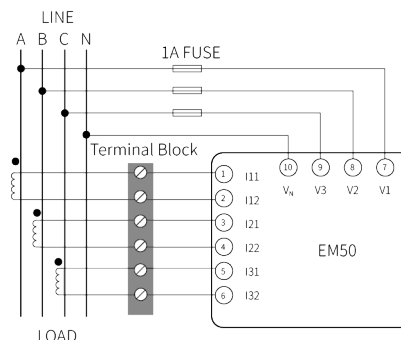
|                                 |                                                                                                                                                                |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Protocol</b>                 | BACnet MS/TP                                                                                                                                                   |
| <b>Communication type</b>       | Multidrop, monodirectional                                                                                                                                     |
| <b>Connection type</b>          | 2-wires, maximum distance 1000 m                                                                                                                               |
| <b>Supported services</b>       | I-have, I-am, Who-has, Who-is, Read-property (multiple)                                                                                                        |
| <b>Supported objects</b>        | Type 2 (analogue value)<br>Type 8 (device)                                                                                                                     |
| <b>Configuration parameters</b> | Maximum information frame number (from 10 to 255)<br>Instance number (from 1 to 4194302)<br>Baud rate (9.6/19.2/38.4/76.8 kbps)<br>MAC address (from 0 to 127) |
| <b>Configuration mode</b>       | Via keypad                                                                                                                                                     |

## Connection Diagrams

Three-phase with neutral (4-wire)

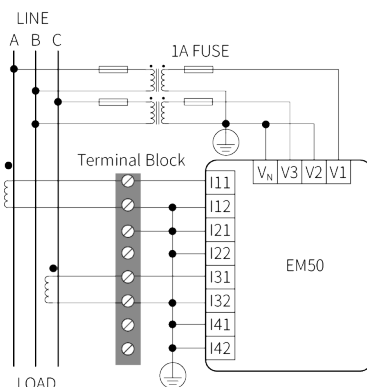


**Fig. 3 AV5**

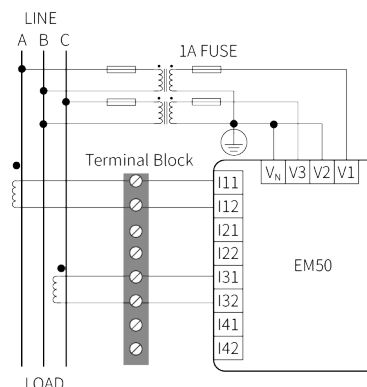


**Fig. 4 MV5, RG5, MA5**

Three-phase without neutral (3-wire). Voltage connection via VT

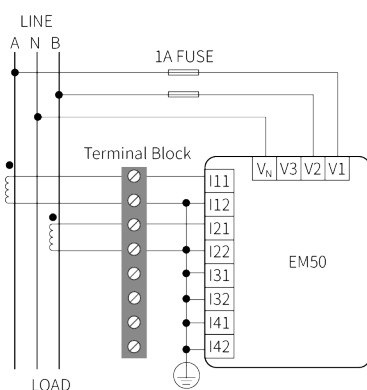


**Fig. 5 AV5**

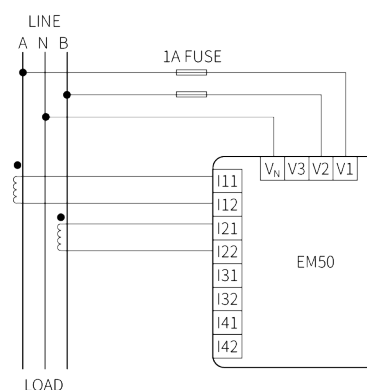


**Fig. 6 MV5, RG5, MA5**

Two-phase (3-wire)

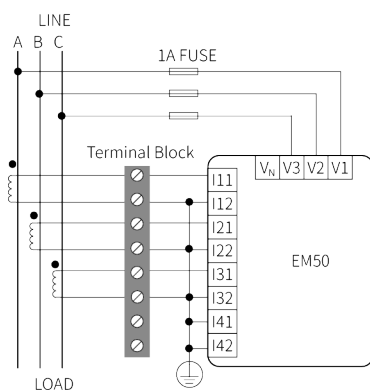


**Fig. 7 AV5**

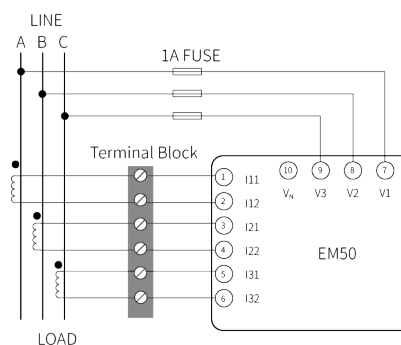


**Fig. 8 MV5, RG5, MA5**

### Three-phase without neutral (3-wire). Direct connection

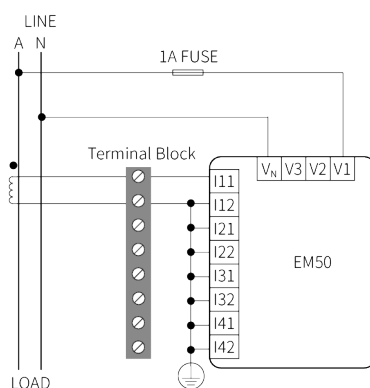


**Fig. 9 AV5**

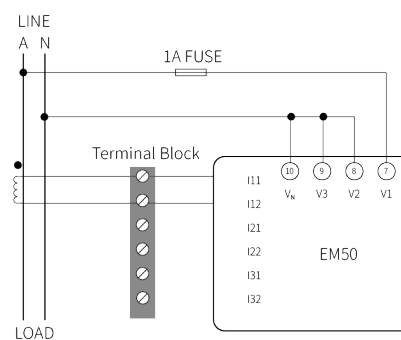


**Fig. 10 MV5, RG5, MA5**

### Single-phase (2-wire)



**Fig. 11 AV5**



**Fig. 12 MV5, RG5, MA5**

## References

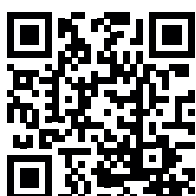
### Order code

### Measurement Canada

| Component name/part number | I/O communication                       | Voltage inputs         | Current inputs | Power supply           | System  |
|----------------------------|-----------------------------------------|------------------------|----------------|------------------------|---------|
| EM50DIN MA5 3H RS MC       | Static output, relay output, Modbus RTU | 347 V L-N<br>600 V L-L | 80 mA          | Auxiliary power supply | 3-phase |
| EM50DIN AV5 3H RS MC       | Static output, relay output, Modbus RTU | 347 V L-N<br>600 V L-L | 5 (10) A       | Auxiliary power supply | 3-phase |

### Standard

| Component name/part number | I/O communication                       | Voltage inputs         | Current inputs | Power supply           | System                        |
|----------------------------|-----------------------------------------|------------------------|----------------|------------------------|-------------------------------|
| EM50DIN AV5 3H RS X        | Static output, relay output, Modbus RTU | 347 V L-N<br>600 V L-L | 5 (10) A       | Auxiliary power supply | 3-phase<br>2-phase<br>1-phase |
| EM50DIN MV5 3H RS X        | Static output, relay output, Modbus RTU | 347 V L-N<br>600 V L-L | 333 mV         | Auxiliary power supply | 3-phase<br>2-phase<br>1-phase |
| EM50DIN RG5 3H RS X        | Static output, relay output, Modbus RTU | 347 V L-N<br>600 V L-L | Rogowski       | Auxiliary power supply | 3-phase<br>2-phase<br>1-phase |



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