Data sheet

Energy meter

EM511 (1-phase energy meter)

Danfoss EM511: energy analyzer for 1-phase systems

Description

Danfoss EM511 is an energy analyzer for 1-phase systems up to 240 V L-N and current up to 45 A. In addition to a digital input, the unit is equipped with a Modbus RTU communication port.

Features & benefits

- Real time variables (V L-N, A, W/var, VA, PF, Hz)
- Displaying the consumed active energy with a resolution of 0.001 kWh
- The frequency value is available via Modbus, with a resolution of 0.001 Hz
- Average value calculation (dmd) for current and power (kW/kVA)
- Modbus RTU RS485 (data refresh every 100 ms) allowing integration into AK-SM 800A
- Continuous sampling of voltage and current
- Backlit LCD display

Applications

Danfoss EM511 can be installed in any low-voltage switchboard with rated current up to 45 A, thanks to the 10 mm^2 / 8 AWG screw terminals, to monitor the energy consumption, the main electrical variables and the harmonic distortion.

If used to monitor a single machine or a specific load, it provides all the main electrical variables to identify any possible malfunction in its early stage and can correlate the energy consumption with the hours of operation, to plan maintenance and prevent failures. The partial meter reset function, easily implementable by means of a digital input, allows you to monitor each individual machine cycle.

Thanks to the fast communication refresh time and the high resolution of the variables, Danfoss EM511 can also be used as a data source for control actions, such as avoiding feeding energy into the electricity grid in a photovoltaic joint installation with energy storage.

Ordering

Product code numbers

Product name	Type	Supply voltage [V] AC	Code number
Energy meter	Accessory	240	080Z2131

Functions

- Measure active, reactive and apparent energy
- Measure the main electrical variables
- Measure the load run hours of the analyser
- Measure the total harmonic distortion (THD) of current and voltages
- Transmit data to other systems through Modbus RTU
- Visualize the measured variables on the display

Data communication

Communication ports

Table: Modbus RTU

Feature	Description
Protocol	Modbus RTU
Devices on the same bus	Max. 247 (1/8 unit load)
Communication type	Multidrop, bidirectional
Connection type	2 wires
Configuration parameters	Modbus address (from 1 – 247) Baud rate (9.6/19.2/38.4/115.2 kbps) Parity (None/Even)
Refresh time	≤ 100 ms
Configuration mode	Via keypad

Communication

Figure: RS485 port

0.2 – 2.5 mm² / 14 – 24 AWG

0.4. – 0.8 Nm / 3.54 – 7.08 lbin

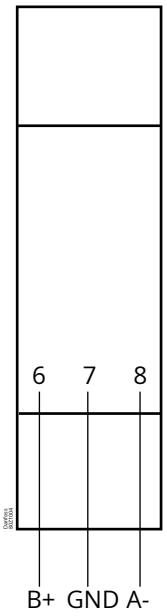
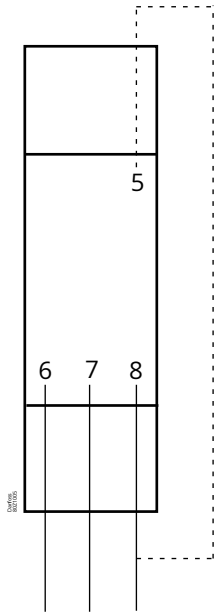


Figure: Last device on RS485

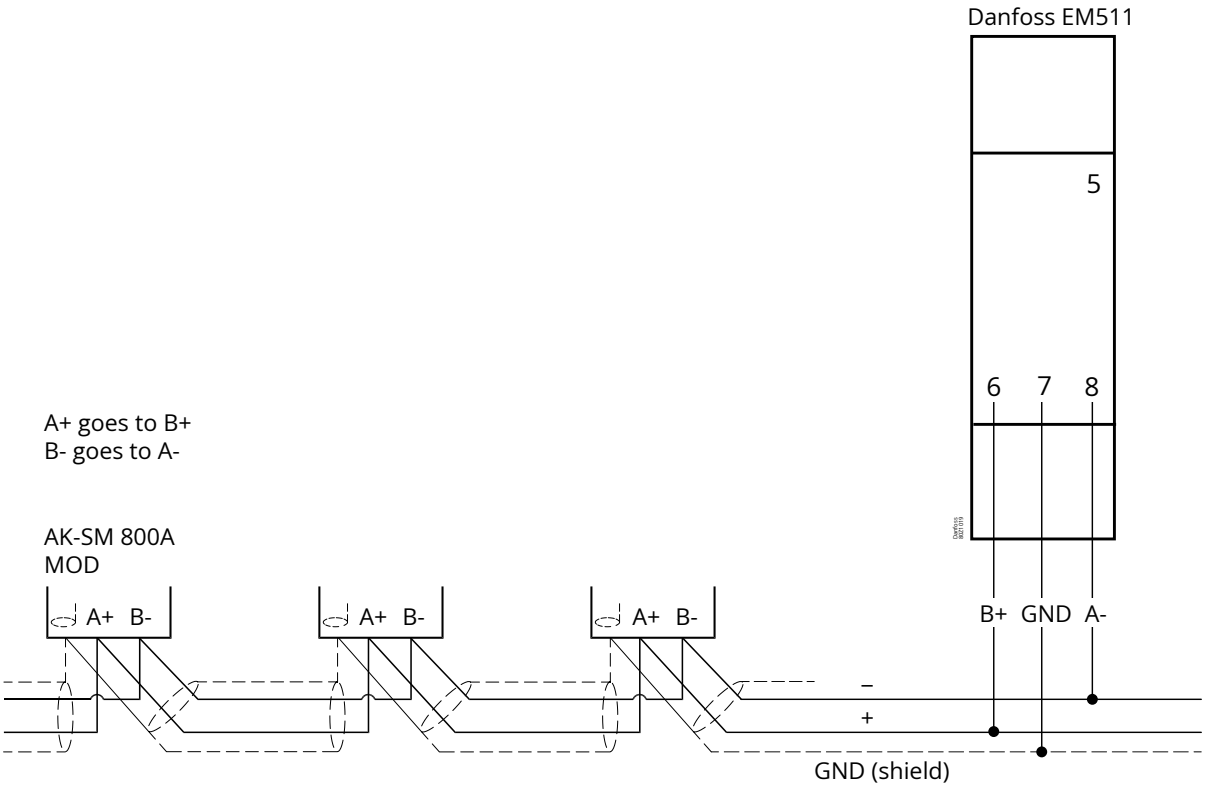
0.2 – 2.5 mm² / 14 – 24 AWG

0.4 – 0.8 Nm / 3.54 – 7.08 lbin



Note: In AK-SM 800A communication the Modbus levels are A+ and B-
The plus and minus symbols should be considered, not the letters A and B, that means within in the ADAP-KOOL® Refrigeration control systems, Modbus A+ of the AK-SM 800A must be connected to B+ of the energy meter and Modbus B- of the AK-SM 800A must be connected to A- of the energy meter (please refer to Communication Design Guide AJ430138910308en-000101).

Figure: Modbus

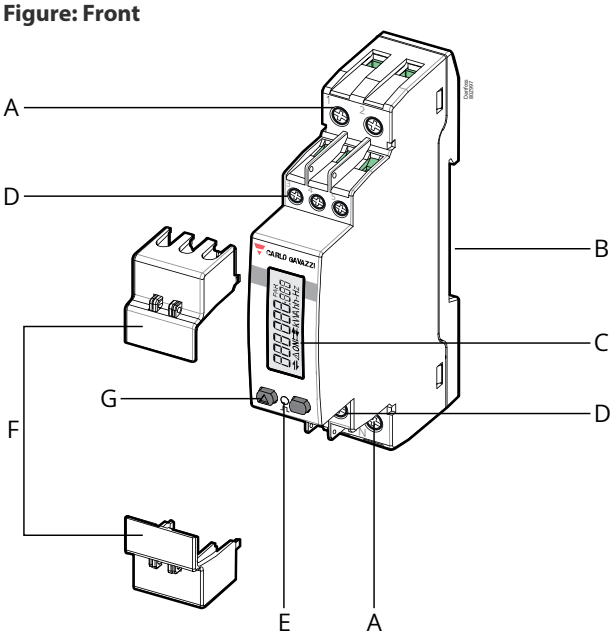


Product details

General data

Layout

Figure: Front



A	Voltage inputs / Current inputs
B	DIN - rail mounting bracket
C	Display
D	Digital input and communication connections
E	LED
F	Sealable covers
G	Browsing and configuration buttons

General specifications

Table: General specifications

Features	Description
Material	Housing: PBT Transparent cover: Polycarbonate
UL flammability class	Housing: V-0 Transparent cover: V-2
Protection degree	Front: IP40 Terminals: IP20
Terminals	Measurement inputs: 2.5 – 10 mm^2 / 8 – 14 AWG, 1.1 Nm / 9.74 lbin Inputs, outputs and communication: 0.2 – 2.5 mm^2 / 14 – 24 AWG, 0.4 – 0.8 Nm / 3.54 – 7.08 lbin
Overvoltage category	Cat. III
Pollution degree	2
Mounting	DIN rail
Weight	155 g / 0.34 lb (packaging included)

Table: Input and output insulation

Type	Measurement inputs	Digital input	RS485 serial port
Measurement inputs	-	Double/Reinforced	Double/Reinforced
Digital input	Double/Reinforced	-	none
RS485 serial port	Double/Reinforced	none	-

According to: EN 61010-1. Overvoltage category III. Pollution degree 2.

Table: Electrical specifications

Features	Description
Electrical system	
Managed electrical system	Single-phase
Voltage inputs	
Voltage connection	Direct
Rated voltage L-N (from Un min. to Un max.)	120 – 240 V
Voltage tolerance	From 0.8 – 1.15 Un
Input impedance	Refer to “Power supply”
Frequency	50/60 Hz
Current inputs	
Current connection	Direct
Base current (Ib)	5 A
Minimum current (Imin.)	0.25 A
Maximum current (Imax.)	45 A
Start-up current (Ist)	0.02 A
Overload	For 10 ms: 30 Imax (1350 A)
Input impedance	<1.4 VA
Crest factor	2.5

Table: Power supply

Features	Description
Type	Self power supply
Consumption	< 0.6 W / 1.8 VA

Table: Measurements

Features	Description
Method	TRMS measurements of distorted waveforms
Sampling	1600 samples/s @ 50 Hz 1920 samples/s @ 60 Hz

Available measurements

Table: Active energy

Active energy	Unit
Imported (+) partial	kWh+
Exported (-) partial	kWh-
Imported (+) tariff 1	kWh+
Imported (+) tariff 2	kWh+

Table: Reactive energy

Reactive energy	Unit
Imported (+) Total	kvarh+
Imported (+) partial	kvarh+
Exported (-) Total	kvarh-
Exported (-) partial	kvarh-

Table: Apparent energy

Apparent energy	Unit
Total	kVAh
Partial	kVAh

Table: Run hour meter

Run hour meter	Unit
Total (kWh+)	hh:mm
Partial (kWh+)	hh:mm
Total (kWh-)	hh:mm-
Partial (kWh-)	hh:mm-
Total ON time	hh:mm

Table: Electrical variable

Electrical variable	Unit
Voltage L-N	V
Current • DMD • DMD Max	A A A

Active power • DMD • DMD Max	kW kW kW
Apparent power • DMD • DMD Max	kVA kVA kVA
Reactive power	kvar
Power factor	PF
Frequency	Hz
THD Current[1]	%
THD Voltage[1]	%

[1] Up to 15th harmonic

Energy metering

Energy metering depends on the measurement type you choose.

A measurement
Easy connection function: irrespective of the current direction, the power always has a plus sign and contributes to increase the positive energy meter. The negative energy meter is not available.

B measurement
Bidirectional: according to the power sign, the positive or the negative energy meter increases.

Measurement accuracy

Table: Current

0.5 – 45 A	±0.5% rdg
0.25 – 0.5 A	±1% rdg

Table: Voltage

From 0.8 Un min to 1.15 Un max	±0.5% rdg

Table: Active and apparent power

0.5 – 45 A (PF = 0.5L, 1, 0.8C)	±1% rdg
0.25 – 0.5 A (PF = 1)	±1.5% rdg

Table: Reactive power

1 – 45.0 A (sinϕ = 0.5L, 0.5C) 0.5 – 45 A (sinϕ = 1)	±2% rdg
0.5 – 1.0 A (sinϕ = 0.5L, 0.5C) 0.25 – 0.5 A (PF = 1)	±2.5% rdg

Table: Energy

Active energy	Class 1 (EN62053-21)
Reactive energy	Class 2 (EN62053-23)

Table: Frequency

45 – 65 Hz	±0.1% rdg

Measurement resolution

Table: Measurement resolution

Variable	Display resolution	Resolution by serial communication
Energy	0.001 kWh/kvarh/kVAh	
Power	0.001 kW/kvar/kVA	0.1 W/var/VA
Current	0.001 A	
Voltage	0.1 V	
Frequency	0.001 Hz	
THD	0.01 %	
Power factor	0.01	0.001
Hour meter	1 min	

Display

Table: Display

Feature	Description
Type	Segments
Refresh time	500 ms
Description	Backlit LCD
Variable readout	Instantaneous: 5+1 dgt, 5+2 dgt or 5+3 dgt Power factor: 1+3 dgt Energy: 6+3 dgt

Table: LED

Feature	Description
Front	Red. pulse weight: proportional to energy consumption: 0.001 kWh per pulse

Table: Digital inputs

Feature	Description
Connection type	Screw terminals
Number of inputs	1
Type	Free contact
Function	Remote status Tariff management Partial meter start/pause Partial meter reset
Features	Open contact voltage: 5 V DC +/- 5% Closed contact current: 5 mA max. Input impedance: 11.6 kΩ Open contact resistance: ≥ 25 kΩ Closed contact resistance: ≤ 840 Ω Maximum voltage applicable with no damages: 30 V AC
Configuration parameters	Input function
Configuration mode	Via keypad

Performance and environmental conditions

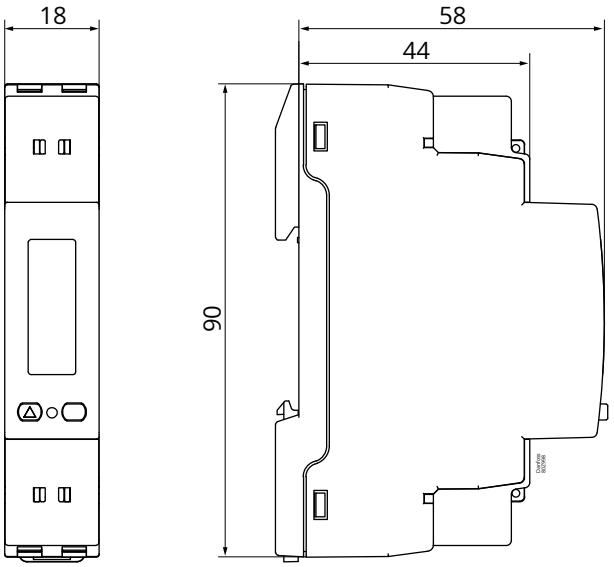
Table: Environmental specifications

Features	Description
Operating temperature	-25 – +55 °C / -13 – +131 °F
Storage temperature	-25 – +70 °C / -13 – +158 °F
Electromechanical environmental condition	E2
Mechanical environmental condition	M2

Note: R.H. < 90% non-condensing @ 40 °C / 104 °F

Dimensions

Figure: Dimensions



Connections

Connection diagrams

Figure: Single-phase system (solution A)

2.5 – 10 mm² / 8 – 14 AWG

1.1 Nm / 9.74 lbin

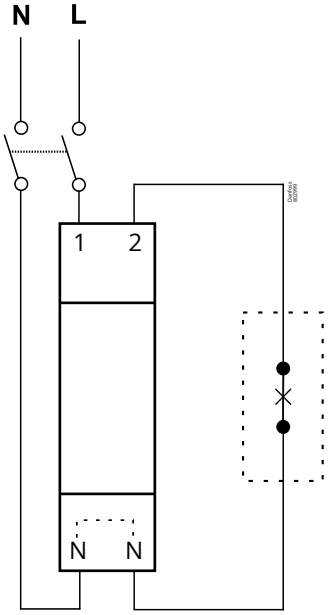


Figure: Single-phase system (solution B)

2.5 – 10 mm² / 8 – 14 AWG

1.1 Nm / 9.74 lbin

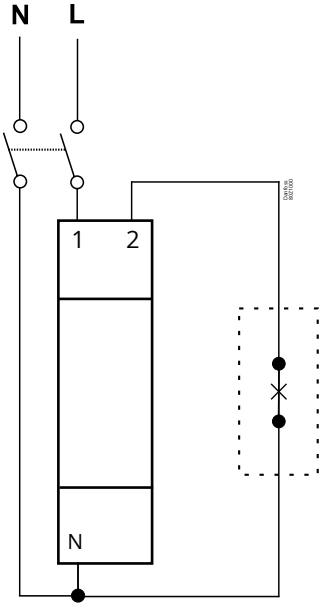
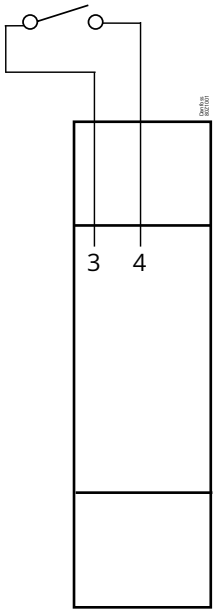


Figure: Digital input

0.2 – 2.5 mm² / 14 – 24 AWG

0.4 – 0.8 Nm / 3.54 – 7.08 lbin



Certificates, declarations and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

When you click on the link you will be directed to the latest version of the 'Declaration of Conformity'. Products developed and sold before this date of issue conform to the directives/standards in force at the time of their sale.

Table: Certificates, declarations, and approvals

Directives	Standards	Mark	Country
• 2014/35/EU (LVT - Low Voltage) • 2014/30/EU (EMC - Electro Magnetic Compatibility) • 2011/65/EU (Electric-electronic equipment hazardous substances • IEC/EN61557-12 PMD performance measuring and monitoring device compliant	• EN 62052-11: Electromagnetic Compatibility (EMC) - emissions and immunity • Electrical safety: EN 61010-1 • Metrology: EN62053-21, EN62053-23	CE UKCA	EU UK
• cULus UL 61010		UL listing	NAM (US and Canada)

Contact details

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