

Data Sheet

1 phase energy meter

Type **energy meter**

Danfoss EM511: energy analyzer for 1-phase systems



Danfoss EM511 is an energy analyser 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

- 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

Features

- **AK-SM 800A** integrated.
- **Enhanced readability:** The backlit display ensures perfect visibility even in low light. The different size of the digits preceding and following the dot makes the displayed values easier to read, while the essential style of the units of measure allows you to readily understand the available variables.
- **Easy browsing:** Page configuration and browsing are very intuitive, thanks to the user interface with 2 mechanical keys. The slideshow function automatically displays the desired measurements in sequence, without having to use the keyboard; the page filter allows you to hide unnecessary information.
- **Quick configuration:** The configuration wizard which runs when the system is started up for the first time allows you to commission the unit without errors in a matter of seconds.
- **Accurate measuring:** Danfoss EM511 complies with the accuracy international standard IEC/EN62053- 21, EN50470- 3.

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

Applications

Danfoss EM511 can be installed in any low-voltage switchboard with rated current up to 45 A, thanks to the 10 mm² / 8 AWG screw terminals, to monitor the energy consumption, the main electrical variables and the harmonic distortion.

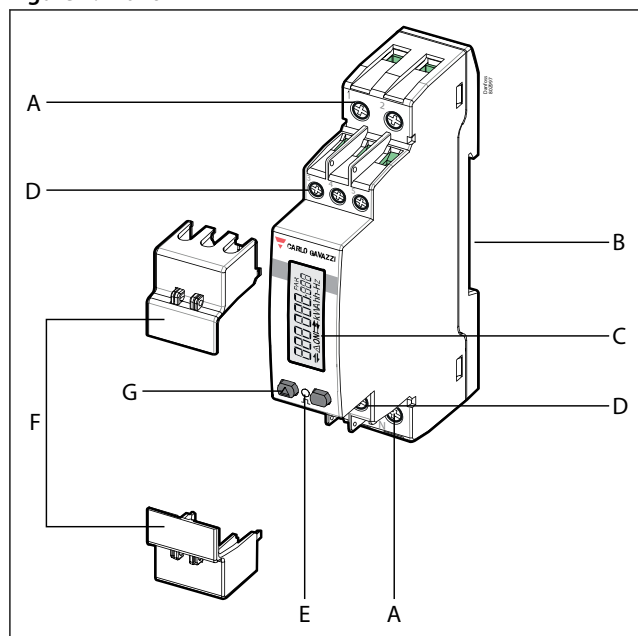
If used to monitor a single machine or a specific load, it provides all the main electrical variables to identify any possible malfunction in its early stage and can correlate the energy consumption with the hours of operation, to plan maintenance and prevent failures. The partial meter reset function,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

Product specification

Layout

Figure 1: 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 1: 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)

Environmental specifications

Table 2: Environmental specifications

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

NOTE:

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

Input and output insulation

Table 3: 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.

Electrical specifications

Table 4: 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 5: Power supply

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

Table 6: Measurements

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

Available measurements

Table 7: Active energy

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

Table 8: Reactive energy

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

1 phase energy meter, type energy meter

Table 9: Apparent energy

Apparent energy	Unit
Total	kVAh
Partial	kVAh

Table 10: 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 11: Electrical variable

Electrical variable	Unit
Voltage L-N	V
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
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 12: Current

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

Table 13: Voltage

From 0.8 Un min to 1.15 Un max	± 0.5% rdg
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Table 14: Active and apparent power

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

Table 15: Reactive power

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

1 phase energy meter, type energy meter

Table 16: Energy

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

Table 17: Frequency

From 45 – 65 Hz	± 0.1% rdg
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Measurement resolution

Table 18: 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 19: 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 20: LED

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

Digital inputs

Table 21: 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

Communication ports

Table 22: Modbus RTU

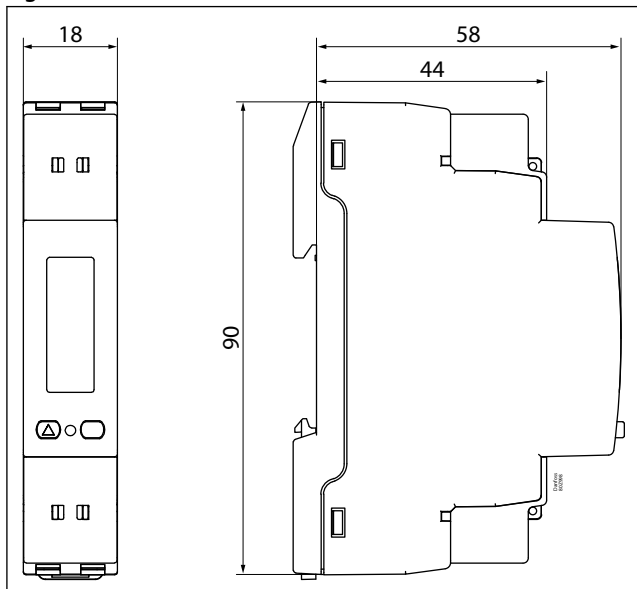
Feature	Description
Protocol	Modbus RTU
Devices on the same bus	Max. 247 (1/8 unit load)
Communication type	Multidrop, bidirectional
Connection type	2 wires

1 phase energy meter, type energy meter

Feature	Description
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

Dimensions

Figure 2: Dimensions



Connection diagrams

Figure 3: Single-phase system (solution A)

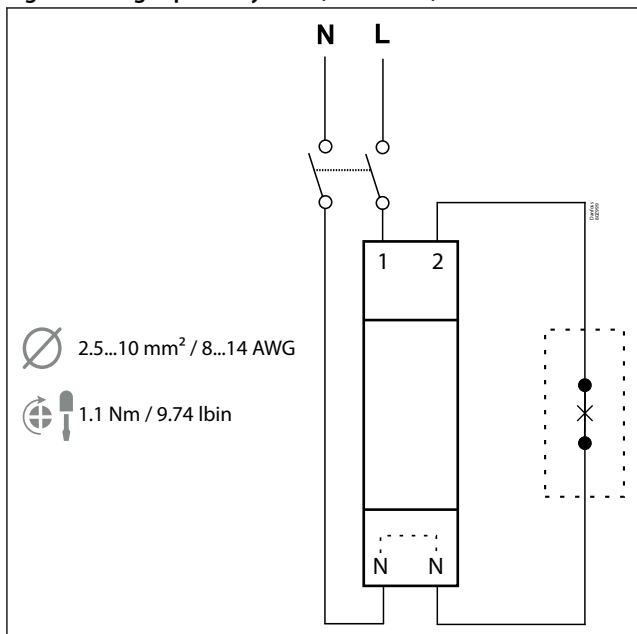
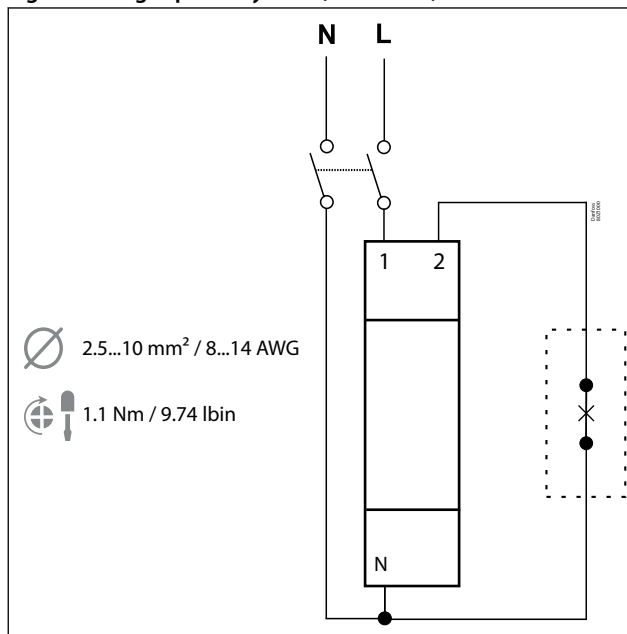
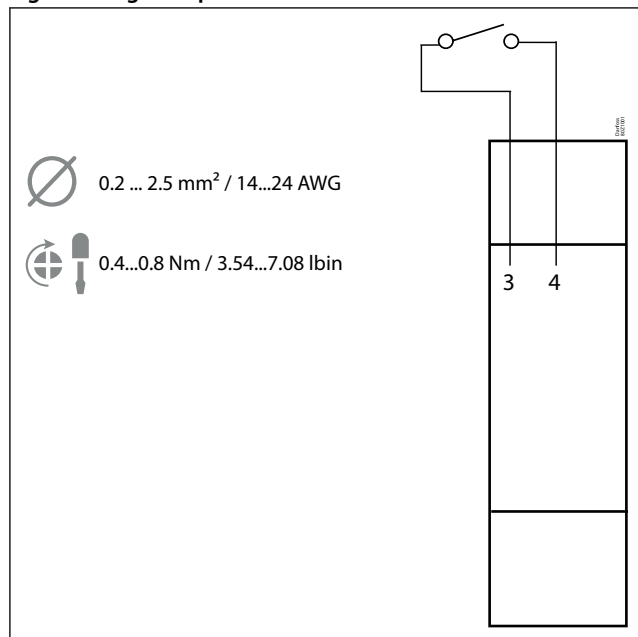


Figure 4: Single-phase system (solution B)



Digital input

Figure 5: Digital input



Communication

Figure 6: RS485 port

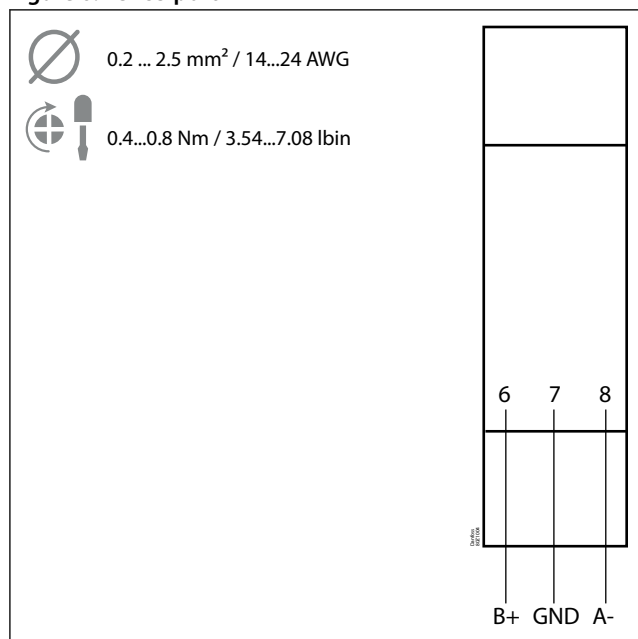
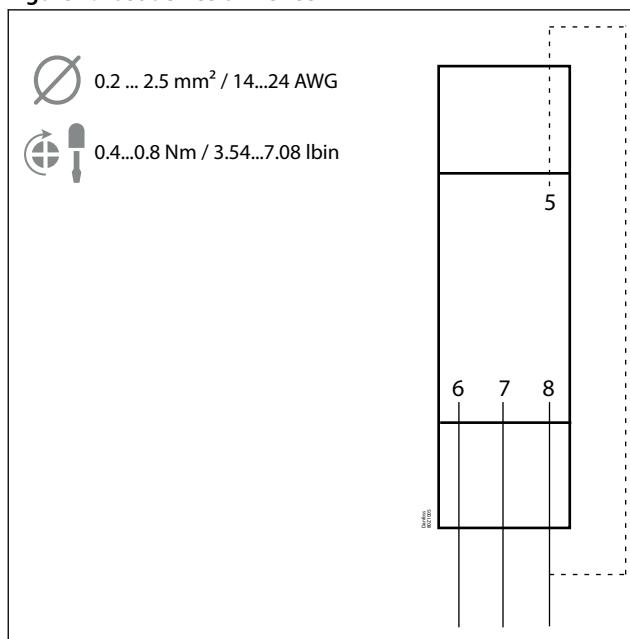


Figure 7: Last device on RS485

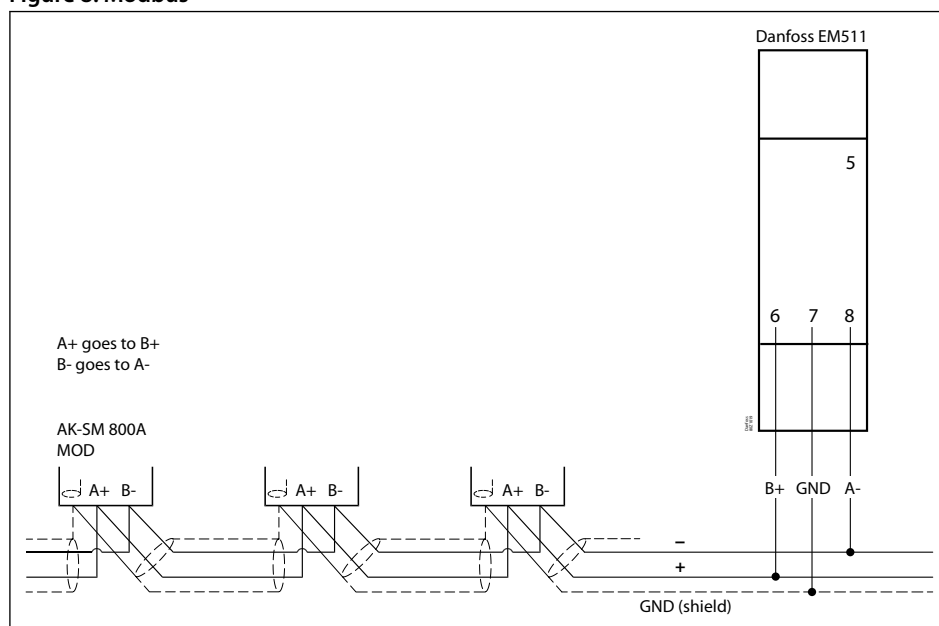


NOTE:

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 8: Modbus



Ordering

Table 23: Ordering

Code	Description
080Z2131	1PH energy meter 45A direct connection RS485

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.

Some approvals may change over time. You can check the most current status at danfoss.com or contact your local Danfoss representative if you have any questions.

Certificates, declarations, and approvals

Table 24: 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)

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