ENGINEERING TOMORROW

Data Sheet

3 phase energy meter
Type **energy meter**

Danfoss EM530: Energy analyser for two and three phase systems

Danfoss EM530 is an energy analyser connected through 5 A current transformers, for two and three phase systems up to 415 V L-L. In addition to a digital input, the unit is equipped with Modbus RTU communication port.

Features

- System and phase variables (V L-L, V L-N, A, W/var, VA, PF, Hz)
- Displaying of 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)
- Streamlined user interface featuring 3 mechanical buttons
- Modbus RTU RS485 (data refresh every 100 ms) allowing integration into AK-SM 800A
- Continuous sampling of each 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 3 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 the 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 EM530 complies with the precision international standard IEC/EN62053-21.
- **Flexible installation:** It can be installed in two-phase, three-phase with neutral, three-phase without neutral, and wild-leg three-phase low-voltage systems.

Functions

- Measure active, reactive and apparent energy
- Measure the main electrical variables
- Measure the load run hours and 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 EM530 can be installed in any low-voltage switchboard, to monitor the energy consumption, the main electrical variables and the harmonic distortion. Compatible with any current transformer with 5 A secondary current, it can be installed in systems with rated current up to 10 kA, even in retrofit applications if used with openable transformers.

If used to monitor a single machine, 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.

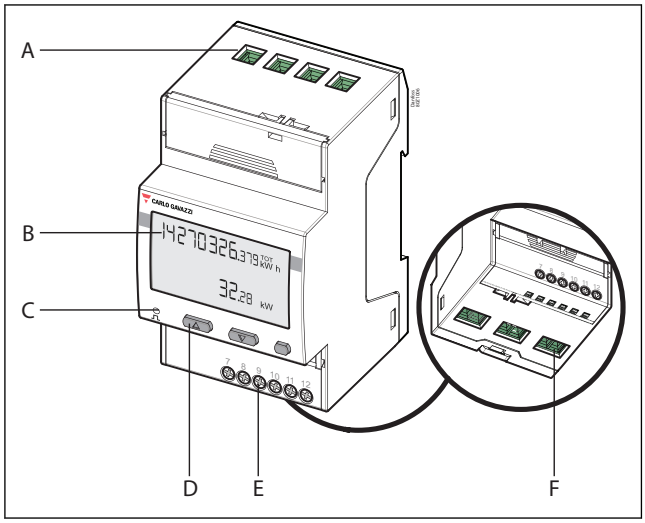
Thanks to the measurement refresh time and to the high resolution of the variables available through a Modbus RTU communication module, it can also be used as data source for control actions, such as avoiding feeding energy into the electricity grid in a photovoltaic joint installation with energy storage.

In combination with energy monitoring it allows you to build a scalable and flexible system to monitor the energy efficiency of buildings and equipment.

Product specification

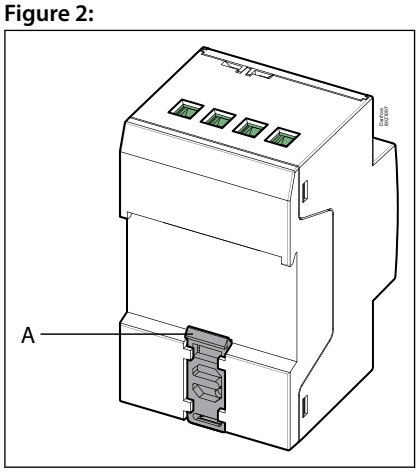
Layout

Figure 1: Front



A	Voltage inputs
B	Display
C	LED
D	Browsing and configuration buttons
E	Digital input and communication connections
F	Current inputs

Figure 2:



A	DIN rail mounting bracket

General specifications

Table 1: General specifications

Features	Description
Material	Housing: PBT Transparent cover: Polycarbonate
Protection degree	Front: IP40 Terminals: IP20
Terminals	Voltage inputs: min. 0.2 mm^2, max. 2.5 mm^2, 0.45 Nm max. Current inputs: min. 0.2 mm^2, max. 2.5 mm^2, 0.45 Nm max. Inputs, outputs and communication: min. 0.2 mm^2, max. 1.5 mm^2, 0.4 Nm max.
Overvoltage category	Cat. III
Pollution degree	2
Mounting	DIN rail
Weight	280 g (packaging included)
Dimensions	3-DIN modules

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	Two-phase (3-wire) Three-phase with neutral (4-wire) Three-phase without neutral (3-wire) Wild leg system (three-phase, four-wire delta)
Voltage inputs	
Voltage connection	Direct
Rated voltage L-N (from Un min to Un max)	120 – 240 V
Rated voltage L-L (from Un min to Un max)	208 – 415 V
Voltage tolerance	0.8 – 1.15 Un
Overload	Continuous: 1.5 Un max
Input impedance	Refer to Table 5: Power supply
Frequency	45 – 65 Hz
Current inputs	
Current connection	Via CT
CT transformation ratio	2000 max
Rated current (In)	5 A
Minimum current (Imin)	0.05 A
Maximum current (Imax)	6 A
Start-up current (Ist)	10 mA
Overload	For 500 ms: 20 Imax (120 A)
Input impedance	< 0.9 VA
Crest factor	3
Measurement type	by means of internal shunts

NOTE:
Danfoss EM530 can also be installed in a wild leg system (three phases, four delta wires), where one of the phase-neutral voltages is higher than the other two.

Figure 3: Wild leg system

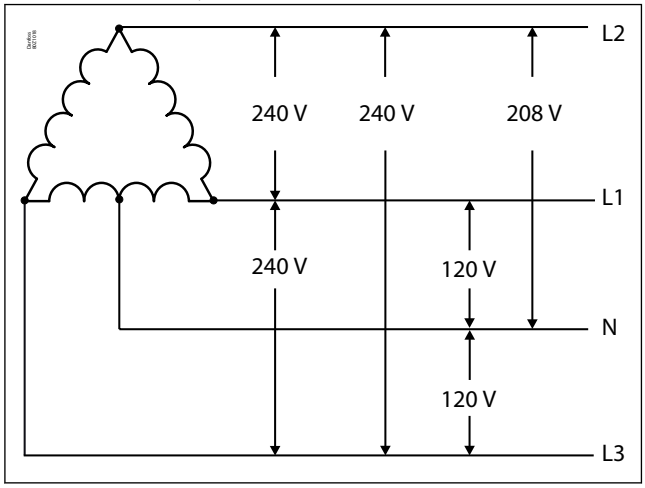


Table 5: Power supply

Features	Description
Type	Self power supply
Consumption	< 1.3 W/2.6 VA
Frequency	50/60 Hz

Table 6: Measurements

Features	Description
Method	TRMS measurements of distorted waveforms

Available measurements

Table 7: Active energy

Active energy	Unit	System	Phase
Imported (+) Total	kWh+	●	●
Imported (+) partial	kWh+	●	-
Exported (-) Total	kWh-	●	-
Exported (-) partial	kWh-	●	-
by tariff	kWh+	●	-

Table 8: Reactive energy

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

Table 9: Apparent energy

Apparent energy	Unit	System	Phase
Total	kVAh	●	-
Partial	kVAh	●	-

Table 10: Run hour meter

Run hour meter	Unit	System	Phase
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	System	Phase
Voltage L-N	V	●	●
Voltage L-L	V	●	●
Current • DMD • DMD Max	A A A	● - -	● ● ●
Neutral current	A	●	-
Active power • DMD • DMD Max	W W W	● ● ●	● - -
Apparent power • DMD • DMD Max	VA VA VA	● ● ●	● - -
Reactive power	Var	●	●
Power factor	PF	●	●
Frequency	Hz	●	-
THD Current[1]	THD A %	-	●
THD Voltage L-N[1]	THD L-N %	-	●
THD Voltage L-L[1]	THD L-L %	-	●

[1] Up to 15th harmonic

NOTE:
The available variables depend on the type of system set. All the variables calculated by the meter are referred to the primary current of the current transformer.

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
For each measuring time interval, the individual phase energies with a plus sign are summed to increase the positive energy meter (kWh+), while the others increase the negative one (kWh-).
Example:
P L1= +2 kW, P L2= +2 kW, P L3= -3 kW
Integration time = 1 hour
kWh+ = (2+2) x1h = 4 kWh
kWh- = 3 x 1h= 3kWh

C measurement
For every measuring interval time, the energies of the single phases are summed; according to the sign of the result, the positive (kWh+) or negative totalizer (kWh-) is increased.
Example:
P L1= +2 kW, P L2= +2 kW, P L3= -3 kW
Integration time = 1 hour
+kWh=(+2+2-3)x1h=(+1)x1h=1 kWh
-kWh=0 kWh

Measurement accuracy

Table 12: Current

From 0.05 In to Imax	± 0.3% rdg
From 0.01 In to 0.05 In	± 0.6% rdg

Table 13: Phase-phase voltage

From Un min -20% to Un max +15%	± 0.2% rdg

Table 14: Phase-neutral voltage

From Un min -20% to Un max +15%	± 0.2% rdg

Table 15: Active and apparent power

From 0.05 In to Imax (PF=1)	± 0.5% rdg
From 0.01 In to 0.05 In (PF=1)	± 1% rdg
From 0.1 In to Imax (PF=0.5L - 0.8C)	± 0.6% rdg
From 0.02 In to 0.1 In (PF=0.5L - 0.8C)	± 1% rdg
Active energy	Class 0.5 S EN 62053-22
Reactive energy	Class 2 (EN62053-23)

Table 16: Reactive power

From 0.1 In to Imax (sinϕ=0.5L - 0.5C) From 0.05 In to Imax (sinϕ=1)	± 2% rdg
From 0.05 In to 0.1 In (sinϕ=0.5L - 0.5C) From 0.02 In to 0.05 In (PF=1)	± 2.5% rdg
Active energy	Class 0.5 S EN 62053-22
Reactive energy	Class 2 (EN62053-23)

Table 17: Frequency

From 45 – 65 Hz	± 0.1% rdg

Measurement resolution

Table 18: Measurement resolution

Variable	Display resolution	Resolution by serial communication
Energy	0.001 kWh/kvarh/kVAh	
Single phase and tariff energy	0.01 kWh	0.001 kWh
Power	0.01 kW/kvar/kVA	0.1 W/var/VA
Current[1]	0.01 A	0.001 A
Voltage	0.1 V	
Frequency	0.01 Hz	0.001 Hz
THD	0.01 %	
Power factor	0.01	0.001

[1] Value referred to CT ratio =1

Display

Table 19: Display

Feature	Description
Type	Segments
Refresh time	500 ms
Description	Backlit LCD
Variable readout	Instantaneous: 5+1 dgt or 5+2 dgt Power factor: 1+2 dgt Energy: 8+3 dgt

Table 20: LED

Feature	Description	
Front	Red. Pulse weight: proportional to energy consumption and depending on the CT ratio (16 Hz maximum frequency):	
	Weight (kWh per pulse)	**CT ratio**
	0.001	≤ 7
	0.01	From 7.1 to 70
	0.1	From 70.1 to 700
	1	From 700.1 to 2000

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

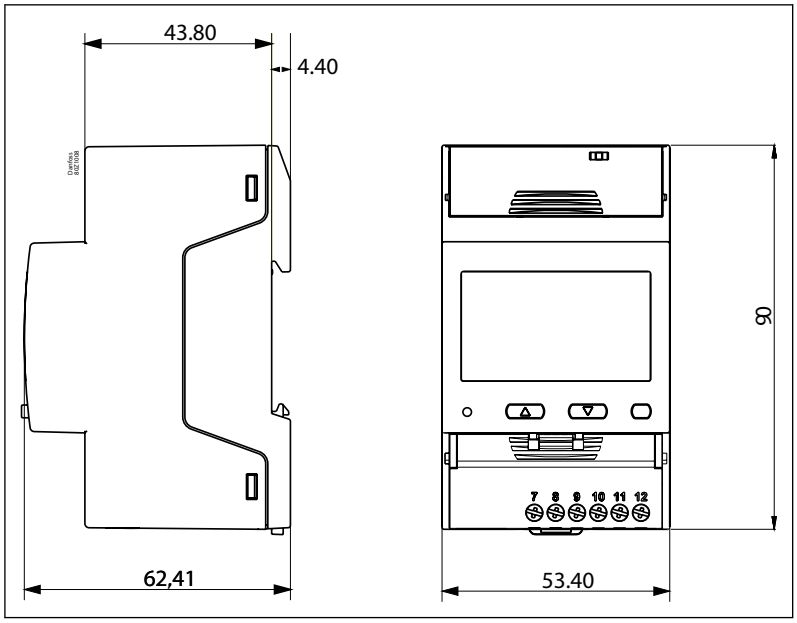
Communication ports

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
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 4: Dimensions



Connection diagrams

Figure 5: Three-phase with neutral (4-wire)

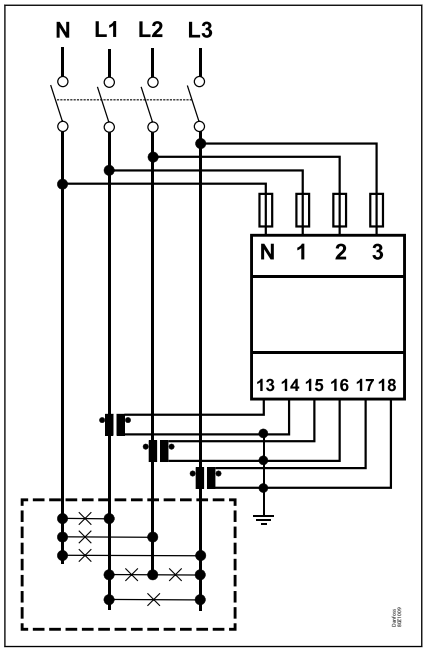


Figure 6: Three-phase without neutral (3-wire)

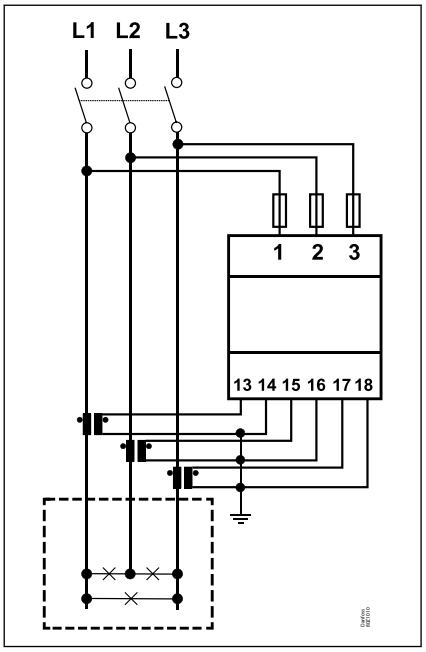


Figure 7: Three-phase without neutral (3-wire)

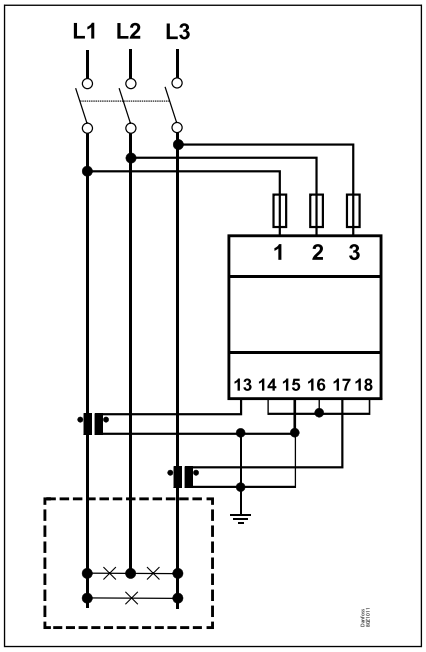
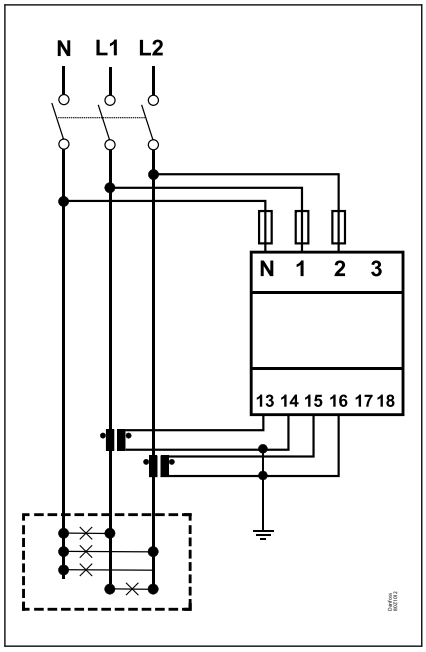
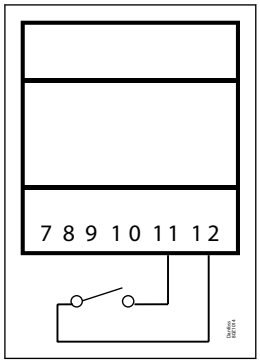


Figure 8: Two-phase system with neutral (3-wire)



Digital inputs

Figure 9: Input



Communication

Figure 10: RS485 port

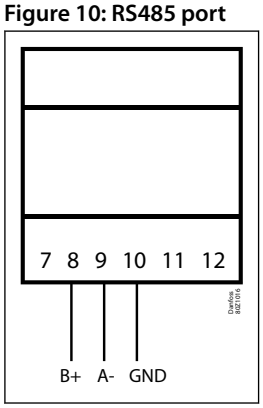
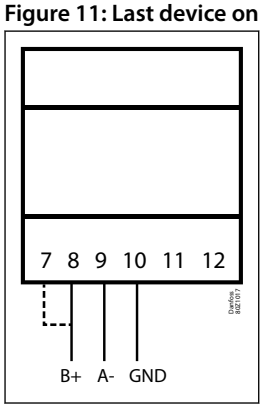


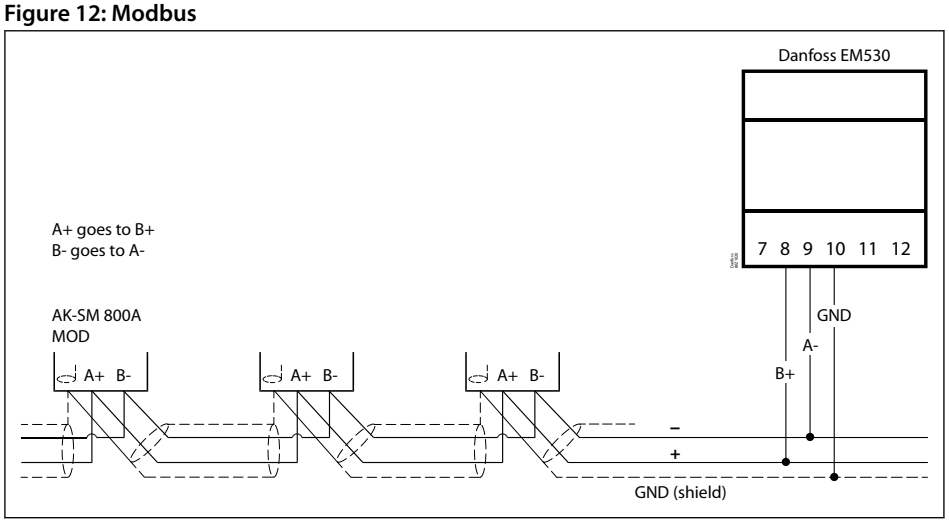
Figure 11: Last device on RS485



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 12: Modbus



Ordering

Table 23: Ordering

Code	Description
080Z2130	3PH energy meter CT 5A RS485
080Z2132	CTD-2X Bus-Bar current transformer 100A
080Z2133	CTD-3X Bus-Bar current transformer 200A
080Z2134	CTD-6X Split core current transformer 400A

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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