

EM24 SFA/SFB



Energy analyzer for three-phase systems



Benefits

- **Time saving set-up**, by frontal joystick and selector.
- **Error-proof installation**, by self-power supply.
- **Easy variable scrolling**, by means of the front joystick.
- **Wide interfacing capability**, choosing among 2 pulse outputs, the RS485, the M-Bus or the Ethernet communication port.
- **Flexible installation**, by means of the direct connection up to 65 A or the connection of 5 A current transformers.
- **Legal metrology**, guaranteed by the MID approval

Description

Three-phase energy analyzer for DIN-rail mounting with configuration joystick, frontal selector and LCD display. Direct connection up to 65A or via current transformers. It can be equipped with 2 digital outputs (pulse transmission or alarm function). In alternative the Modbus RTU communication port, the M-Bus communication, or the Modbus TCP/IP Ethernet ports are available.

Applications

EM24 is the perfect solution in any application, specially in building and industrial automation where energy and main electrical variables monitoring is required.

EM24 is particularly suited for:

- energy efficiency monitoring
- cost allocation
- fiscal/legal sub-billing.

Main functions

- Measurement of energy consumption and main electrical variables of three-phase loads.
- Transmission of data via serial communication (Modbus RTU or M-Bus) or Ethernet (Modbus TCP/IP).
- Transmission of energy consumption via pulse output (optional).
- Easy connection function (SFA).

Main features

- Energy measurements: total kWh
- TRMS measurements of distorted sine waves (voltages/currents)

Structure

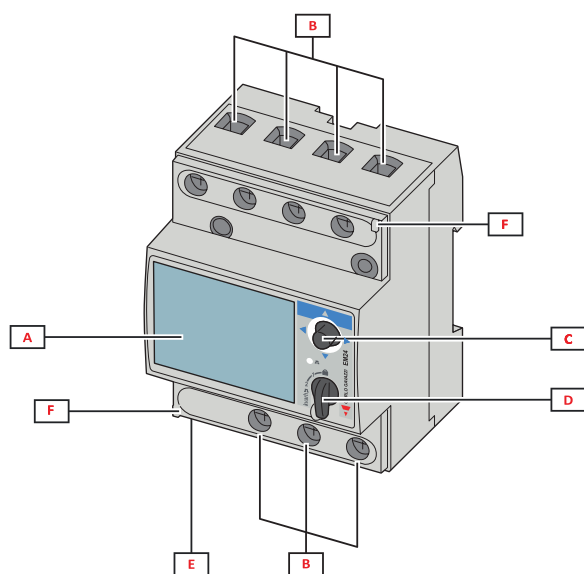


Fig. 1 Direct connection

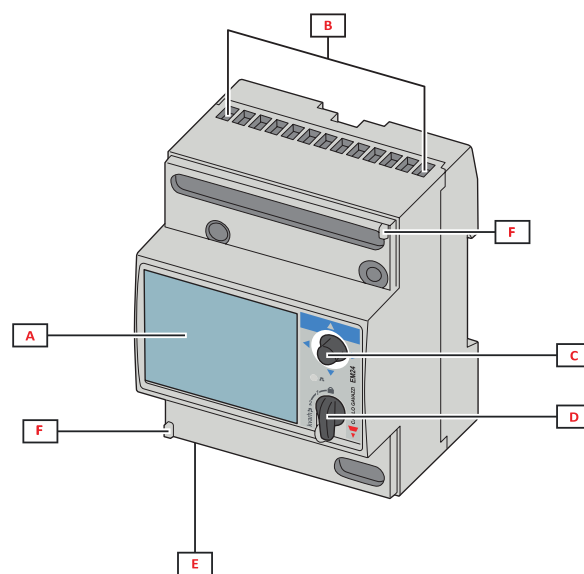


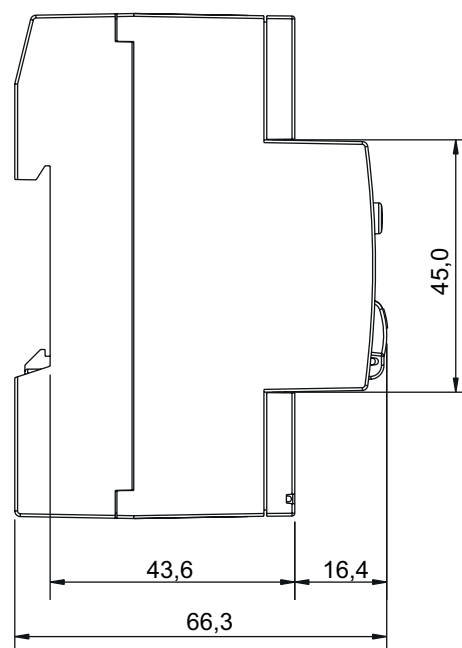
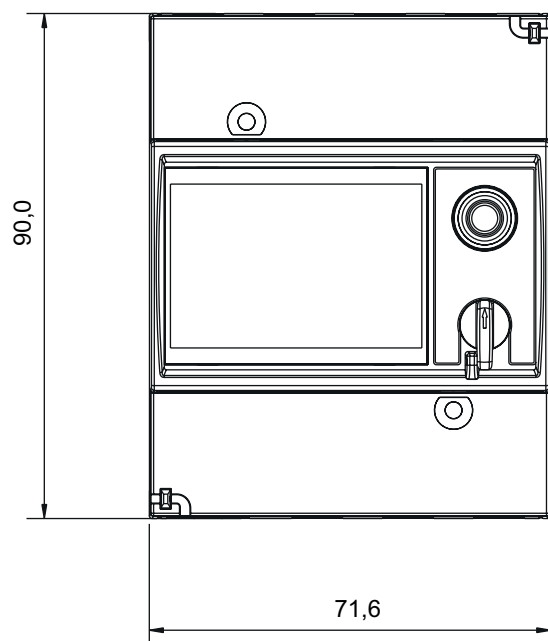
Fig. 2 CT connection

Area	Description
A	LCD display
B	Voltage/current connections
C	Joystick
D	Selector with pin for MID seal (programming block)
E	Inputs/outputs or communication port
F	Pins for MID seal (protection covers included)

Features

General

Protection degree	Front: IP50. Terminals: IP20
Terminals	Screw terminals AV2: Max.: 16 mm ² , min.: 2.5 mm ² (by cable lug) AV5: Max.: 1.5 mm ²
Overvoltage category	Cat. III
Utilisation category	UC2
Pollution degree	2
Noise rejection (CMRR)	100 dB, from 42 to 62 Hz
Mounting	DIN rail
Weight	400 g (packaging included)



Environmental specifications

Operating temperature	From -25 to +55 °C/from -13 to +131 °F
Storage temperature	From -30 to +70 °C/from -22 to +158 °F

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

Input and output insulation

Type	Measuring inputs	Open collector outputs	Communication port	Ethernet port	Self power supply
Measuring inputs	-	4 kV	4 kV	4 kV	0 kV
Open collector outputs	4 kV	-	-	-	4 kV
Communication port	4 kV	-	-	-	4 kV
Ethernet port	4 kV	-	-	-	4 kV
Self power supply	0 kV	4 kV	4 kV	4 kV	-

Compatibility and conformity

Directives	2011/65/EU (RoHs), 2014/53/EU (RED)
Standards	Electromagnetic compatibility (EMC) - emissions and immunity: EN 62052-11 Electrical safety: EN 61010-1, EN 50470-1 (MID), UL 61010-1 Accuracy: EN 50470-3 (MID) Pulse outputs: IEC 62053-31, DIN 43864
Approvals	 MID

Electrical specifications

Voltage		
Voltage inputs	AV2	AV5
Voltage connection	Direct	
Rated voltage L-N (from Un min to Un max)	133 to 230 V	230 V
Rated voltage L-L (from Un min to Un max)	230 to 400 V	400 V
Voltage tolerance (*)	-20%, +15%	
Overload (**)	Continuous: 1.15 Un max	
Input impedance	Refer to "Power supply"	
Frequency	50 Hz	

(*) reference range for stated accuracy

(**) max reference for no instrument damage



Current		
Current inputs	AV2	AV5
Current connection	Direct	Via CT
Rated current (In)	-	5 A
Base current (Ib)	10 A	-
Minimum current (Imin)	0.5 A	0.05 A
Maximum current (Imax)	65 A	10 A
Start-up current (Ist)	0.04 A	0.01 A
Overload	Continuous: 65 A @50 Hz For 10 ms: 1950 A @50 Hz	Continuous: 10 A @50 Hz For 500 ms: 200 A @ 50 Hz
Short circuit withstand	For 10 ms: 4500 A according to IEC 62052-31:2015	-
Input impedance	< 1.1 VA	< 0.6 VA
Crest factor	4 (Imax peak 92 A)	3 (Imax peak 15 A)

Maximum CTxVT ratio		
Current inputs	AV2	AV5
Non-MID models except E1	-	4629
Non-MID models: E1, W1	-	6975
MID models except E1	-	3150
MID models: E1, W1	-	2615

Power supply

Model	AV2	AV5
Type	Self power supply	
Consumption	IS: < 12VA/2W E1: < 4.7VA/2.9 W Others: < 20VA/1W	<4.5VA/2.9W E1: < 4.7VA/2.9 W

Measurements

Method	TRMS measurements of distorted waveforms
Sampling	1600 samples/s @50 Hz 1900 samples/s @60 Hz

Available measurements

Active energy	Unit	System	Phase	Note
Imported (+) Total	kWh+	•	•	

Electrical variable	Unit	System	Phase
Voltage L-N	V	•	•
Voltage L-L	V	•	•
Current	A	-	•
Power factor	PF	•	•

Energy metering



Energy metering depends on the model:

A measurement (MID SFA models)

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 (MID SFB models)

For every measuring interval time, the energies of the single phases are summed; the positive totalizer (kWh+) is increased only if the sign is positive. The negative energy meter is not available.

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.

Measurement accuracy

Current	AV2	AV5
From 0.5 A to 2 A	$\pm(0.5\% \text{ rdg} + 3\text{dgt})$	
	-	
From 2 A to 65 A	$\pm(0.5\% \text{ rdg} + 1\text{dgt})$	
	-	
From 0.05 A to 1 A	-	$\pm(0.5\% \text{ rdg} + 3\text{dgt})$
From 1 A to 10 A	-	$\pm(0.5\% \text{ rdg} + 1\text{dgt})$
Phase-phase voltage	AV2	AV5
In the range Un	$\pm(1\% \text{ rdg} + 1\text{dgt})$	
Phase-neutral voltage	AV2	AV5
In the range Un	$\pm(0.5\% \text{ rdg} + 1\text{dgt})$	
Active energy	Class B (EN50470-3) (MID)	

Display

Type	LCD
Refresh time	< 750 ms
Description	3 rows: 1 st : 8 digits (7 mm) 2 nd : 4 digits (7 mm) 3 rd : 4 digits (7 mm)
Variable readout	Instantaneous: 4 digits, min: 0.000, max: 9999 Energy: 8 digits (imported), 7 digits (exported), min: 0.00, max: 99 999 999

LED

Model	CT*VT	Weight (kWh per pulse)
AV5/AV6	≤ 7	0.001
	$> 7 \leq 70.0$	0.01
	$> 70 \leq 700.0$	0.1
	> 700	1
AV2/AV9	N/A	0.001

Digital outputs

Digital outputs: static output (O2)

Connection type	Screw terminals
Maximum number of outputs	2
Type	Open collector
Function	Pulse output or alarm output
Features	V_{ON} 1.2 V dc, max. 100 mA V_{OFF} 30 V dc max
Configuration parameters	Output function (pulse/alarm) Output normal status Pulse weight (0.001 to 10 kWh/pulse or kvarh/pulse) Pulse duration (30 or 100 ms) Linked variable Alarm delay
Configuration mode	Via joystick

Communication ports

RS485 port (IS)

Protocol	Modbus RTU
Devices on the same bus	Max 160 (1/5 unit load)
Communication type	Multidrop, bidirectional
Connection type	2 wires
Configuration parameters	Modbus address (from 1 to 247) Baud rate (4.6/9.6 kbps) 1 stop bit, no parity
Refresh time	< 750 ms
Configuration mode	Via joystick or UCS software

M-Bus (M1)

Protocol	M1: M-Bus according to EN13757-3:2005
Driver input capability	1 unit load
Communication type	One-drop, directional
Connection type	2 wires
Configuration parameters	Primary address (1 to 247) Baud rate (0.3/ 2.4 / 9.6 kbps)
Configuration mode	Via joystick

Ethernet port (E1)

Protocols	Modbus TCP/IP
Client connections	Maximum 5 simultaneously
Connection type	RJ45 connector (10 Base-T, 100 Base-TX), maximum distance 100 m
Configuration parameters	IP address Subnet mask Gateway TCP/IP port DHCP enabling
Configuration mode	Via joystick or UCS software

Connection Diagrams

Static outputs

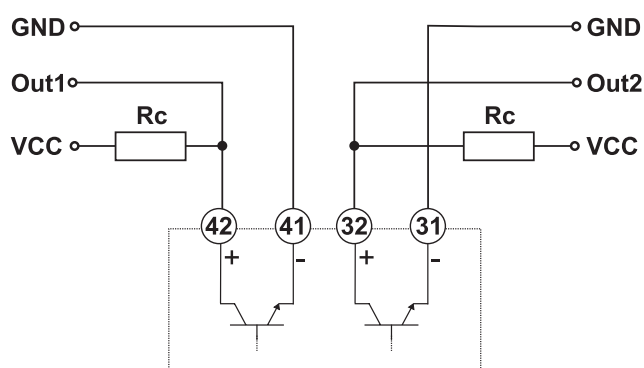


Fig. 3 Static outputs, GND reference

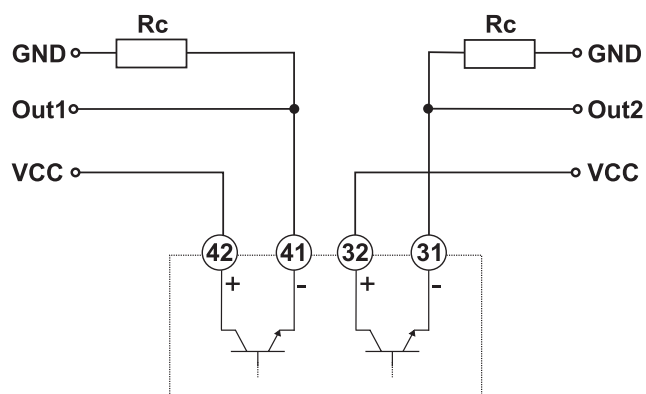


Fig. 4 Static outputs, VDC reference

RS485 port

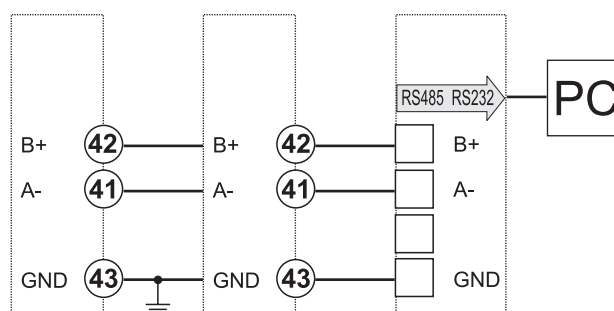
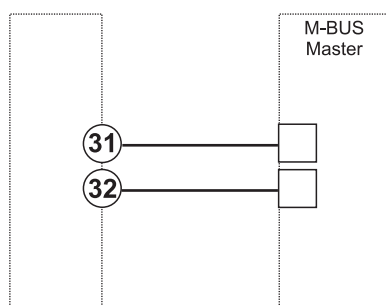


Fig. 5 RS485 port

M-Bus



Note: $F=315\text{ mA}$

MID connection diagrams

Three-phase with neutral (4-wire)

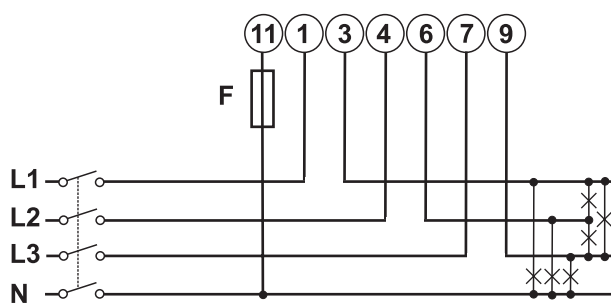


Fig. 6 AV2, AV9

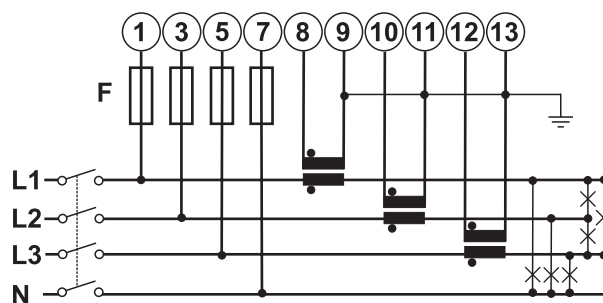


Fig. 7 AV5

Note: F=315 mA

References

Order code

Component name/part number	I/O communication	Voltage inputs	Current inputs	Power supply
EM24DIN AV5 3X O2 SFA EM24DIN AV5 3X O2 SFB	2 static outputs	230V L-N 400V L-L	5 (10) A via CT	Self power supply
EM24DIN AV2 3X O2 SFA EM24DIN AV2 3X O2 SFB	2 static outputs	230V L-N 400V L-L	10 (65) A	Self power supply

Component name/part number	I/O communication	Voltage inputs	Current inputs	Power supply
EM24DIN AV5 3X IS SFA EM24DIN AV5 3X IS SFB	3 digital inputs + RS485 Modbus RTU	230V L-N 400V L-L	5 (10) A via CT	Self power supply
EM24DIN AV2 3X IS SFA EM24DIN AV2 3X IS SFB	3 digital inputs + RS485 Modbus RTU	230V L-N 400V L-L	10 (65) A	Self power supply

Component name/part number	I/O communication	Voltage inputs	Current inputs	Power supply
EM24DIN AV5 3X E1 SFA EM24DIN AV5 3X E1 SFB	Ethernet Modbus TCP/IP	230V L-N 400V L-L	5 (10) A via CT	Self power supply
EM24DIN AV2 3X E1 SFA EM24DIN AV2 3X E1 SFB	Ethernet Modbus TCP/IP	230V L-N 400V L-L	10(65) A	Self power supply

Component name/part number	I/O communication	Voltage inputs	Current inputs	Power supply
EM24DIN AV5 3X M1 SFA EM24DIN AV5 3X M1 SFB	M-Bus according to EN 13757-3 (2005)	230V L-N 400V L-L	5 (10) A via CT	Self power supply
EM24DIN AV2 3X M1 SFA EM24DIN AV2 3X M1 SFB	M-Bus according to EN 13757-3 (2005)	230V L-N 400V L-L	10(65) A	Self power supply

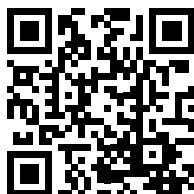
- SFA: Easy connection, the total energy totalizer (kWh+) is certified according to MID.
 - SFB: only the positive totalizer (kWh+) is MID-certified. The negative energy totalizer is not available.
- Note: for each measuring time interval, the energies of the individual phases are summed up; if the sign of the result is positive, the system increases the positive totalizer (kWh+).

Further reading

Information	Where to find it
User manual - E1	www.productselection.net/MANUALS/UK/em24_E1_im_use.pdf
Installation instruction - E1	www.productselection.net/MANUALS/UK/em24_E1_im_inst.pdf
User manual - IS	www.productselection.net/MANUALS/UK/em24_IS_im_use.pdf
Installation instruction - IS	www.productselection.net/MANUALS/UK/em24_IS_im_inst.pdf
User manual - M1/M2	www.productselection.net/MANUALS/UK/em24_M1/M2_im_use.pdf
Installation instruction - M1/M2	www.productselection.net/MANUALS/UK/em24_M1/M2_im_inst.pdf
Instruction manual - other versions	www.productselection.net/MANUALS/UK/em24_im.pdf
Instruction manual - other versions MID	www.productselection.net/MANUALS/UK/em24_mid_im.pdf

CARLO GAVAZZI compatible components

Purpose	Component name/part number	NOTES
Monitor data from several analyzers	UWP 3.0	See relevant datasheet



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