

EM24 W1 Kamstrup special version

MID energy analyzer for 3-phase and 1-phase systems, wireless M-Bus communication

Structure

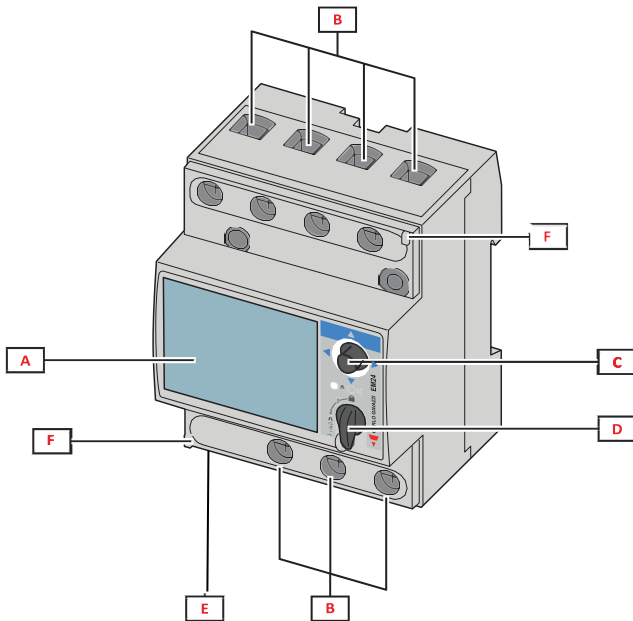


Fig. 1 Direct connection (AV2)

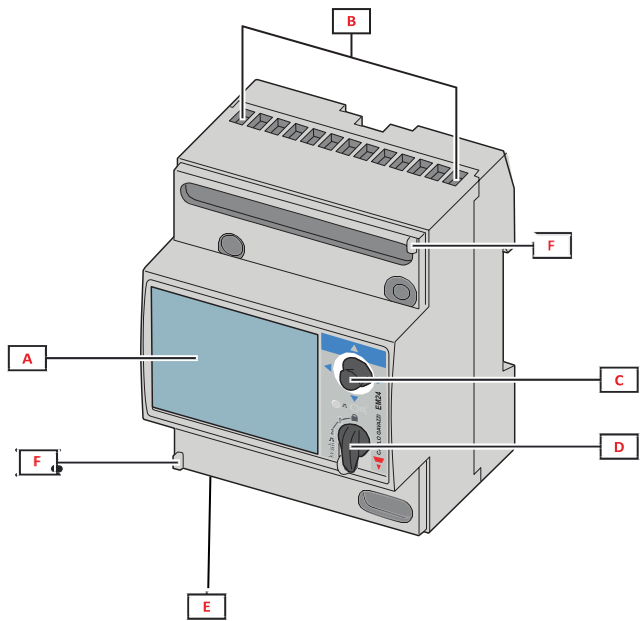


Fig. 2 CT connection (AV5)

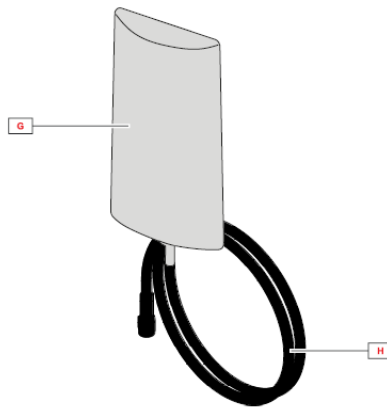


Fig. 3 External antenna

Area	Description
A	LCD display
B	Voltage/current connections
C	Joystick
D	Selector with MID seal (programming block)
E	SMA connector (only in the version with external antenna)
F	Pins for MID seal (protection covers included)
G	External antenna for wireless M-Bus communication
H	SMA connector cable (2 m)

Features

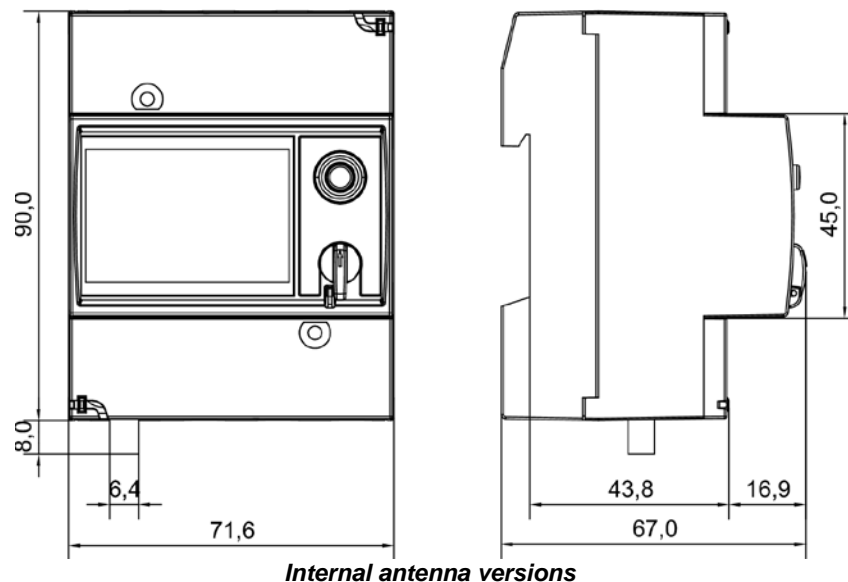
General

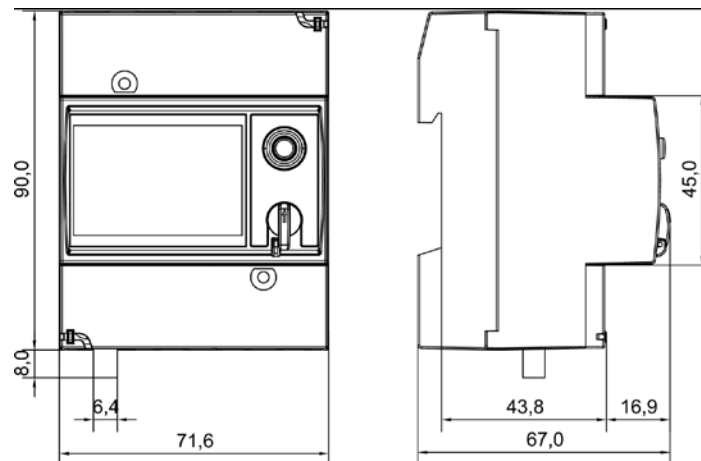
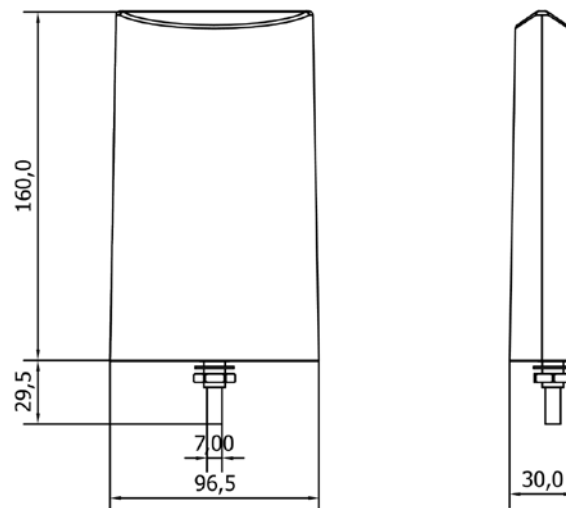
Protection degree	Front: IP50. Terminals: IP20
Terminals	Screw terminals AV2: Max.: 16 mm ² , min.: 2.5 mm ² (by cable lug) AV5: Max.: 1.5 mm ²
Overvoltage category	Cat. III
Pollution degree	2
Mounting	DIN rail
Weight	Internal antenna versions: 400 g (packaging included) External antenna versions: 800 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.



**External antenna versions****Antenna****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 50470-1 (MID) Accuracy: EN 62053-23, EN 50470-3 (MID) ETSI EN 300 220-1 ETSI EN 300 220-2 ETSI EN 301 489 EN 62311
Approvals	CE MID RED



Electrical specifications

Voltage		
Voltage inputs	AV2	AV5
Voltage connection	Direct	
Rated voltage L-N	230 V	230 V
Rated voltage L-L	400 V (3-phase only)	400 V
Voltage tolerance	-20%, +15%	
Overload	Continuous: 1.15 Un max	
Input impedance	Refer to "Power supply"	
Frequency	50/60 Hz	

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
Input impedance	< 1.7 VA	< 0.7 VA
Crest factor	4 (Imax peak 92 A)	3 (Imax peak 15 A)

Power supply

Power supply		
	AV2	AV5
Type	Self power supply	



Measurements

Method	TRMS
Sampling	1600 samples/s @50 Hz 1900 samples/s @60 Hz

Available measurements on display

Active energy	Unit	System	Phase
Imported (+) Total	kWh+	•	-
Exported (-) Total	kWh-	•	-
Imported (+) Partial	kWh+	•	-

Reactive energy	Unit	System	Phase
Imported (+) Total	kvarh+	•	-
Exported (-) Total	kvarh-	•	-
Imported (+) Partial	kvarh+	•	-

Electrical variable	Unit	System	Phase
Voltage L-N	V	•	•
Voltage L-L	V	•	•
Current	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	•	-
Run hour meter	h	•	-

Note: DMD integration interval is equal to the transmission interval.

Available measurements on wireless M-Bus communication

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

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

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 U_n	$\pm(1\% \text{ rdg} + 1\text{dgt})$	

Phase-neutral voltage	AV2	AV5
In the range U_n	$\pm(0.5\% \text{ rdg} + 1\text{dgt})$	

Active and apparent power	AV2	AV5
From 1.0 A to 65.0 A (PF=0.5L, 1, 0.8C)	$\pm(1\% \text{ rdg} + 1\text{dgt})$	-
From 0.5 A to 1.0 A (PF=1)	$\pm(1.5\% \text{ rdg} + 1\text{dgt})$	-
From 0.25 A to 10 A (PF=0.5L, 1, 0.8C)	-	$\pm(1\% \text{ rdg} + 1\text{dgt})$
From 0.05 A to 0.25 A (PF=1)	-	$\pm(1.5\% \text{ rdg} + 1\text{dgt})$

Reactive power	AV2	AV5
From 1.0 A to 2.0 A ($\sin\phi=0.5L$, 0.5C) From 0.5 A to 1.0 A ($\sin\phi=1$)	$\pm(2.5\% \text{ rdg} + 1 \text{ dgt})$	-
From 2.0 A to 65.0 A ($\sin\phi=0.5L$, 0.5C) From 1.0 A to 65.0 A ($\sin\phi=1$)	$\pm(2\% \text{ rdg} + 1 \text{ dgt})$	-
From 0.25 A to 0.5 A ($\sin\phi=0.5L$, 0.5C) From 0.1 A to 0.25 A ($\sin\phi=1$)	-	$\pm(2.5\% \text{ rdg} + 1 \text{ dgt})$
From 0.5 A to 10 A ($\sin\phi=0.5L$, 0.5C) From 0.25 A to 10 A ($\sin\phi=1$)	-	$\pm(2\% \text{ rdg} + 1 \text{ dgt})$

Active energy	Class B (EN50470-3) (MID)
Reactive energy	Class 2 (EN62053-23)

Frequency	
From 45 to 65 Hz	$\pm 0.1 \text{ Hz}$

LED and display

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

Communication

Wireless M-Bus

Protocol	wireless M-Bus according to EN13757-3, EN13757-4, EN13757-7
Frame format	B (not OMS compliant)
Frequency	868,950 MHz (as per C1 requirement)
Mode	C1
Encryption	AES-128 Counter Mode
Transmission interval	96 s
Antenna	Version W1 I: Internal antenna Version W1 E: External antenna for SMA connector (included as accessory, cable length: 2 m)
Transmission power	<25 mW
Configuration parameters	-
Configuration mode	-
Note	<p>After power on, the first frame is sent in a random moment within the first time interval in order to avoid collisions when a great number of meters is powered on at the same time.</p> <p>Both solutions (internal and external antenna) will be tested according to RED requirements and documentation will be available.</p>

Wireless M-Bus frame

Extended Link layer

Reference standard: IS EN13757-4

CI-field	CC-field	ACC-field	SN-field	Payload CRC-field
8D _h	1 byte	1 byte	4 bytes	2 bytes

CI-field: 0x8D: ELL_2

CC-field:

B-field	D-field	S-field	H-field	P-field	A-field	R-field	(RFU)
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Figure 9 — Communication Control Field

B-field: always 0

D-field: always 0

S-field: always 1 (instrument cannot transmit any asynchronous frame)

H-field: always 0

P-field: always 0

A-field: always 0

R-field: always 0

ACC-field is always increased by 1 at every frame transmission (every transmitted frame is synchronous)

SN-field:

ENC-field	Time-field	Session-field
Bit 31 – Bit 29	Bit 28 – Bit 4	Bit 3 – Bit 0

Figure 10 — Session Number Field

ENC-field: always 001b to define AES-128 Counter mode encryption

Note: SN-field is stored at power down of instrument in order to have a session number that is never reused during the lifetime of the meter for optimized encryption purposes

Transport layer

Reference standard: IS EN13757-7

Table 10 — General structure of TPL

CI-Field	TPL Header	APL data	TPL Trailer (optional)
1 byte	None header Short header Long header	Variable number	Variable number

CI-Field: always 0x78 (Application layer without Transport layer, none header)

Application layer

Reference standard: IS EN13757-3

EM24 ELECTRIC MEASUREMENT	DATA FORMAT	ENGINEERING UNIT	DIF [hex]	VIF [hex]	VIFE#1 [hex]	VIFE#2 [hex]	VIFE#3 [hex]
kWh(+) TOT	32 bit integer	Wh*100	04	05			
kvarh(+) TOT	32 bit integer	kVarh*0.1	04	FB	82	75	
kWh(-) TOT	32 bit integer	kWh*0.1	04	85	3C		
kvarh(-) TOT	32 bit integer	kVarh*0.1	04	FB	82	F5	3C
Error flag	8 bit integer		01	FD	17		

Error flag

Note: Error flag is used to manage overflow conditions on electric measurements measured by measuring module. The meaning of the bits are shown in the table below:

Bit								Meaning	
8 [MSb]	7	6	5	4	3	2	1 [LSb]	1P system	3Pn system
0	0	0	0	0	0	0	0	No error	
0	0	0	0	0	0	0	1	V 1-N overflow	
0	0	0	0	0	0	1	0	N.A.	V 2-N overflow
0	0	0	0	0	1	0	0	N.A.	V 3-N overflow
0	0	0	0	1	0	0	0	I1 overflow	
0	0	0	1	0	0	0	0	N.A.	I2 overflow
0	0	1	0	0	0	0	0	N.A.	I3 overflow
0	1	0	0	0	0	0	0	Frequency out of range	

N.A. means that the bit cannot be set because the relevant measurement is not defined. So this bit is always "0".
Frequency out of range is set when occurs an overflow or an underflow of the frequency measured by measuring module.

Connection Diagrams

Three-phase with neutral (4-wire)

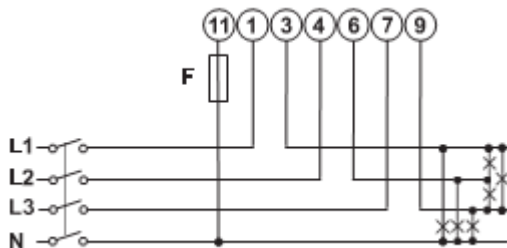


Fig. 3 AV2 3X

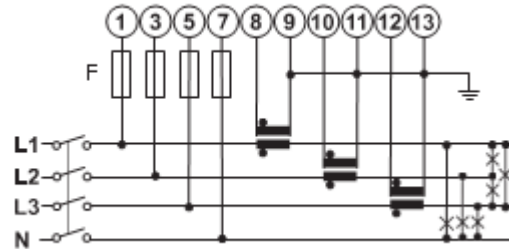


Fig. 4 AV5

Three-phase without neutral (3-wire)

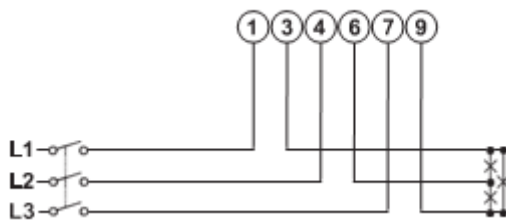


Fig. 5 AV2 3X

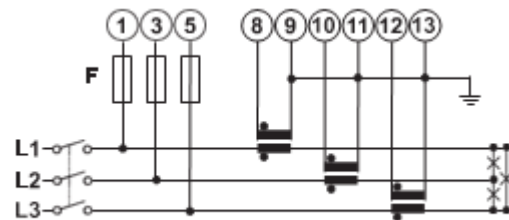


Fig. 6 AV5

Single-phase (2-wire)

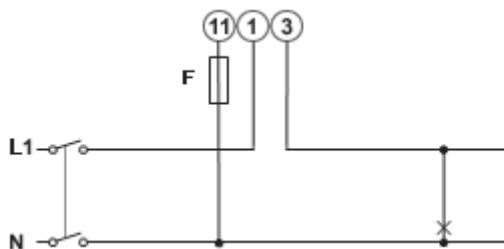


Fig. 7 AV2 1X

Note: Energy meters cannot be reset.

Note: in case of 3-phase meter (AV2 3X or AV5) and 3-phase connection without neutral, L-N voltages are shown on display, referred to a "virtual" neutral.

References

Order code

MID models

Component name/part number	I/O communication	Voltage inputs	Current inputs	Power	System
EM24DIN AV2 1X W1 I PFB 01	wireless M-Bus, INTERNAL antenna	230V L-N 400V L-L	10 (65) A	Self power supply	1-phase
EM24DIN AV2 1X W1 E PFB 01	wireless M-Bus, EXTERNAL antenna	230V L-N 400V L-L	10 (65) A	Self power supply	1-phase
EM24DIN AV2 3X W1 I PFB 01	wireless M-Bus, INTERNAL antenna	230V L-N 400V L-L	10 (65) A	Self power supply	3-phase
EM24DIN AV2 3X W1 E PFB 01	wireless M-Bus, EXTERNAL antenna	230V L-N 400V L-L	10 (65) A	Self power supply	3-phase
EM24DIN AV5 3X W1 I PFB 01	wireless M-Bus, INTERNAL antenna	230V L-N 400V L-L	5(10) A via CT	Self power supply	3-phase
EM24DIN AV5 3X W1 E PFB 01	wireless M-Bus, EXTERNAL antenna	230V L-N 400V L-L	5(10) A via CT	Self power supply	3-phase

Note: Both imported (kWh+) and exported (kWh-) energies are measured, shown on the display and transmitted via wireless M-Bus. Only kWh+ is MID certified.

Additional information by ITEM code

Component name/part number	Item number (TOP number)	Kamstrup name	EAN Code
EM24DIN AV2 1X W1 I PFB 01	6696041	CGEM24 1ph DIN wM-Bus int	8030956087253
EM24DIN AV2 1X W1 E PFB 01	6696042	CGEM24 1ph DIN wM-Bus ext	8030956087260
EM24DIN AV2 3X W1 I PFB 01	6696043	CGEM24 3ph DIN wM-Bus int	8030956087277
EM24DIN AV2 3X W1 E PFB 01	6696044	CGEM24 3ph DIN wM-Bus ext	8030956087284
EM24DIN AV5 3X W1 I PFB 01	6696045	CGEM24 CT DIN wM-Bus int	8030956087291
EM24DIN AV5 3X W1 E PFB 01	6696046	CGEM24 CT DIN wM-Bus ext	8030956087307

Component name/part number	Manufacturer	Version (HEX)	Media (HEX)
EM24DIN AV2 1X W1 I PFB 01	KAM	31	02 (electricity)
EM24DIN AV2 1X W1 E PFB 01	KAM	32	02 (electricity)
EM24DIN AV2 3X W1 I PFB 01	KAM	33	02 (electricity)
EM24DIN AV2 3X W1 E PFB 01	KAM	34	02 (electricity)
EM24DIN AV5 3X W1 I PFB 01	KAM	35	02 (electricity)
EM24DIN AV5 3X W1 E PFB 01	KAM	36	02 (electricity)

Labels and packaging

Box



Standard Carlo Gavazzi box as per the attached picture.

Box label

EM24DIN AV2 1X W1 I PFB 01	<p>EM24-DIN.AV2.1.X.W1.I.P/FB01</p>  <p>8 030956 1087253</p> <p>Supply: self-powered 1,7VA/0,85W Input: 230V 0,5-10(65)A 50Hz Output: wireless M-Bus 1 QTY</p> <p>RoHS MADE IN ITALY CE *X*</p>	<p>6641302</p> <p><input type="checkbox"/> VERIFIED</p>
EM24DIN AV2 1X W1 E PFB 01	<p>EM24-DIN.AV2.1.X.W1.E.P/FB01</p>  <p>8 030956 1087260</p> <p>Supply: self-powered 1,7VA/0,85W Input: 230V 0,5-10(65)A 50Hz Output: wireless M-Bus 1 QTY</p> <p>RoHS MADE IN ITALY CE *X*</p>	<p>6641303</p> <p><input type="checkbox"/> VERIFIED</p>
EM24DIN AV2 3X W1 I PFB 01	<p>EM24-DIN.AV2.3.X.W1.I.P/FB01</p>  <p>8 030956 1087277</p> <p>Supply: self-powered 2,7VA/1,8W Input: 3x230(400)V 0,5-10(65)A 50Hz Output: wireless M-Bus 1 QTY</p> <p>RoHS MADE IN ITALY CE *X*</p>	<p>6641304</p> <p><input type="checkbox"/> VERIFIED</p>
EM24DIN AV2 3X W1 E PFB 01	<p>EM24-DIN.AV2.3.X.W1.E.P/FB01</p>  <p>8 030956 1087284</p> <p>Supply: self-powered 2,7VA/1,8W Input: 3x230(400)V 0,5-10(65)A 50Hz Output: wireless M-Bus 1 QTY</p> <p>RoHS MADE IN ITALY CE *X*</p>	<p>6641305</p> <p><input type="checkbox"/> VERIFIED</p>

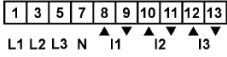







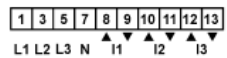









<p>EM24DIN AV5 3X W1 I PFB 01</p>	<p>EM24-DIN.AV5.3.X.W1.I.P/FB01</p>  <p>8 030956 087291</p> <p>Supply: self-powered 2,7VA/1,8W Input: 3x230(400)V 0,05-5(10)A 50Hz Output: wireless M-Bus 1 QTY</p> <p>RoHS MADE IN ITALY CE *X*</p>	<p>6641306</p> <p><input type="checkbox"/> VERIFIED</p>
<p>EM24DIN AV5 3X W1 E PFB 01</p>	<p>EM24-DIN.AV5.3.X.W1.E.P/FB01</p>  <p>8 030956 087307</p> <p>Supply: self-powered 2,7VA/1,8W Input: 3x230(400)V 0,05-5(10)A 50Hz Output: wireless M-Bus 1 QTY</p> <p>RoHS MADE IN ITALY CE *X*</p>	<p>6641307</p> <p><input type="checkbox"/> VERIFIED</p>

X is the revision. For example in case of revision 1 it is *1*.

Connection label and product label






<p>EM24DIN AV2 1X W1 I PFB 01</p>	<p>MADE IN ITALY</p>  <p>S/N: KAM27316138/A4 Supply: self-powered 1,7VA/0,85W Output: wireless M-Bus</p> <p>CARLO GAVAZZI CONTROLS SPA VIA SAFFORZE 8, BELLUNO - 32100 ITALY WWW.GAVAZZI.automation.com</p> 	<p>EM24-DIN.AV2.1.X.W1.I.P/FB01 CGEM24 1ph DIN wM-Bus int</p> <p>YR 2019, QN : xxxxxxxxxxxxxx SW version: r.2.0 230V 0,5-10(65)A 50Hz LED constant: See display Class B kWh EN50470-3 Class 2 kvarh EN62053-23 Operating temperature: -25°C to 55°C</p> <p>RoHS</p> <p>CE M 19 0051 DE-17-MI003-PTB038</p>
<p>EM24DIN AV2 1X W1 E PFB 01</p>	<p>MADE IN ITALY</p>  <p>S/N: KAM27316138/A4 Supply: self-powered 1,7VA/0,85W Output: wireless M-Bus</p> <p>CARLO GAVAZZI CONTROLS SPA VIA SAFFORZE 8, BELLUNO - 32100 ITALY WWW.GAVAZZI.automation.com</p> 	<p>EM24-DIN.AV2.1.X.W1.E.P/FB01 CGEM24 1ph DIN wM-Bus ext</p> <p>YR 2019, QN : xxxxxxxxxxxxxx SW version: r.2.0 230V 0,5-10(65)A 50Hz LED constant: See display Class B kWh EN50470-3 Class 2 kvarh EN62053-23 Operating temperature: -25°C to 55°C</p> <p>RoHS</p> <p>CE M 19 0051 DE-17-MI003-PTB038</p>
<p>EM24DIN AV2 3X W1 I PFB 01</p>	<p>MADE IN ITALY</p>  <p>S/N: KAM27316138/A4 Supply: self-powered 2,7VA/1,8W Output: wireless M-Bus</p> <p>CARLO GAVAZZI CONTROLS SPA VIA SAFFORZE 8, BELLUNO - 32100 ITALY WWW.GAVAZZI.automation.com</p> 	<p>EM24-DIN.AV2.3.X.W1.I.P/FB01 CGEM24 3ph DIN wM-Bus int</p> <p>YR 2019, QN : xxxxxxxxxxxxxx SW version: r.2.0 3x230(400)V 0,5-10(65)A 50Hz LED constant: See display Class B kWh EN50470-3 Class 2 kvarh EN62053-23 Operating temperature: -25°C to 55°C</p> <p>RoHS</p> <p>CE M 19 0051 DE-17-MI003-PTB038</p>
<p>EM24DIN AV2 3X W1 E PFB 01</p>	<p>MADE IN ITALY</p>  <p>S/N: KAM27316138/A4 Supply: self-powered 2,7VA/1,8W Output: wireless M-Bus</p> <p>CARLO GAVAZZI CONTROLS SPA VIA SAFFORZE 8, BELLUNO - 32100 ITALY WWW.GAVAZZI.automation.com</p> 	<p>EM24-DIN.AV2.3.X.W1.E.P/FB01 CGEM24 3ph DIN wM-Bus ext</p> <p>YR 2019, QN : xxxxxxxxxxxxxx SW version: r.2.0 3x230(400)V 0,5-10(65)A 50Hz LED constant: See display Class B kWh EN50470-3 Class 2 kvarh EN62053-23 Operating temperature: -25°C to 55°C</p> <p>RoHS</p> <p>CE M 19 0051 DE-17-MI003-PTB038</p>

EM24DIN AV5 3X W1 I PFB 01	<p>MADE IN ITALY</p>  <p>S/N: KAM27316138/A4 Supply: self-powered 2,7VA/1,8W Output: wireless M-Bus</p>  <p>CARLO GAVAZZI CONTROLS SPA VIA SAFFORZE 8, BELLUNO - IT-32100 ITALY WWW.GAVAZZI.automation.com</p>	<p>EM24-DIN.AV5.3.X.W1.I.P/FB01 CGEM24 CT DIN wM-Bus int</p> <p>YR 2019, QN: xxxxxxxxxxxx </p> <p>SW version: r.2.0</p> <p>3x230(400)V 0,05-5(10)A 50Hz </p> <p>LED constant: See display</p> <p>Class B kWh EN50470-3 </p> <p>Class 2 kvarh EN62053-23</p> <p>Operating temperature: -25°C to 55°C</p>    0051 DE-17-MI003-PTB038
EM24DIN AV5 3X W1 E PFB 01	<p>MADE IN ITALY</p>  <p>S/N: KAM27316138/A4 Supply: self-powered 2,7VA/1,8W Output: wireless M-Bus</p>  <p>CARLO GAVAZZI CONTROLS SPA VIA SAFFORZE 8, BELLUNO - IT-32100 ITALY WWW.GAVAZZI.automation.com</p>	<p>EM24-DIN.AV5.3.X.W1.E.P/FB01 CGEM24 CT DIN wM-Bus ext</p> <p>YR 2019, QN: xxxxxxxxxxxx </p> <p>SW version: r.2.0</p> <p>3x230(400)V 0,05-5(10)A 50Hz </p> <p>LED constant: See display</p> <p>Class B kWh EN50470-3 </p> <p>Class 2 kvarh EN62053-23</p> <p>Operating temperature: -25°C to 55°C</p>    0051 DE-17-MI003-PTB038

Notes:

- KAM27316138/A4 has been used as example
- QN: xxxxxxxxxxxx is the Carlo Gavazzi quality number, identifying production date and lot
- M 19: identifies the production year (MID requirement, in the example 19 means 2019)

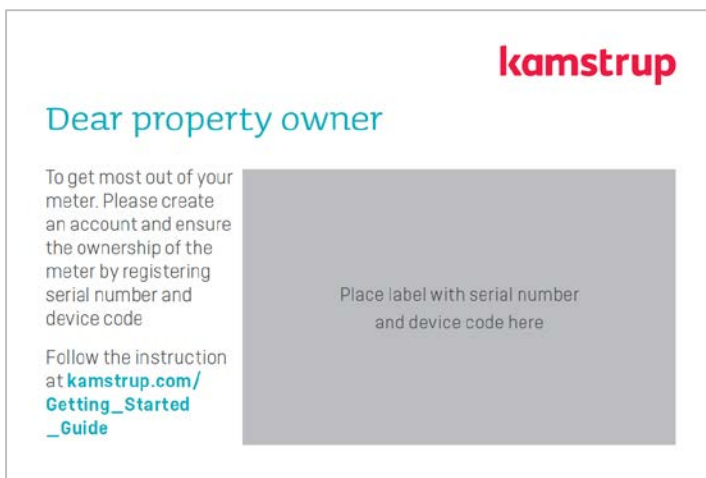
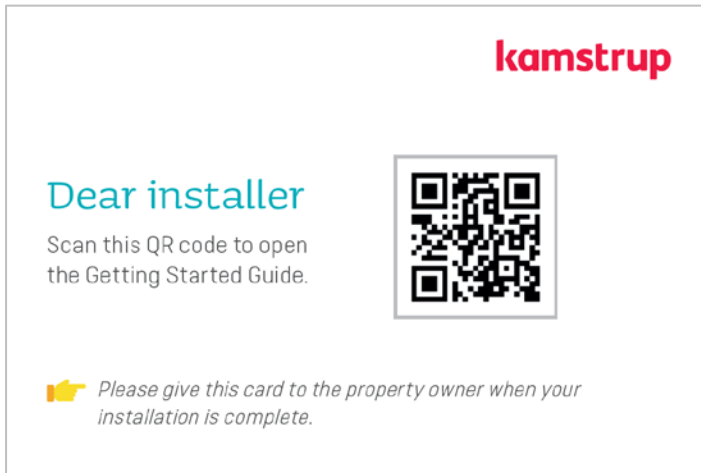
Serial number label

EM24DIN AV2 1X W1 I PFB 01	 27316138
EM24DIN AV2 1X W1 E PFB 01	 27316138
EM24DIN AV2 3X W1 I PFB 01	 27316138
EM24DIN AV2 3X W1 E PFB 01	 27316138
EM24DIN AV5 3X W1 I PFB 01	 27316138
EM24DIN AV5 3X W1 E PFB 01	 27316138

Note: barcode and number depends on serial number. 27316138 has been used as example.

Additional card

An additional card 90x60 mm, including the serial number is included in the packaging. The same information is also written in the instruction manual, without the serial number.





Customer approval

Revision	Date	Signed by	Signature	Note