



RelAir R2M PRO / PROX / HOME

Wireless M-Bus to Wired M-Bus
Gateways



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**This documentation is valid from M-Bus Generation: \$60
and firmware version V1.5.0**

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1 Functional description

The RelAir R2M allows you to integrate up to 63 Wireless M-Bus meters into your existing M-Bus installation. For this purpose the OMS-compliant gateway stores the meter data and answers a request by the M-Bus Master with the last answer telegram.

The Gateway receives devices with wireless M-Bus interfaces (OMS) compliant with EN137574 at 868 MHz in S1, T1 or C1 mode and M-Bus application layer according to EN13757-3. The protocols DLMS and SML are not supported. The RelAir R2M decodes unencrypted or AES encrypted telegrams according to Mode 5 or 7.

For the different fields of application there are two different housing variants with an internal antenna and a model with external antenna connection. An elegant white wall cabinet (RelAir R2M Home) is particularly well suited for residential installation, while the industrial version (RelAir R2M Pro or ProX for external antennas) is presented in a rugged and better protected junction box.

M-Bus Communication



Picture: Wireless M-Bus system with PadPuls M2W, RelAir R2M Gateway and PW250

Due to the integrated mini USB interface the RelAir R2M can also be used as a full operational Wireless M-Bus Master, which e.g. in combination with MBSheet enables a read out. Our new gateway works without an external power supply and is either supplied from the M-Bus (6 unit loads) or via the USB interface. One of both interfaces must be connected for operation.

Attention: Never connect an M-Bus Master and a USB cable at the same time!

A configuration of the whitelist is absolutely necessary.

With the free PC software RelAirConf the setting of the parameters, the keys and the whitelists is very comfortable.

2 Installation and commissioning

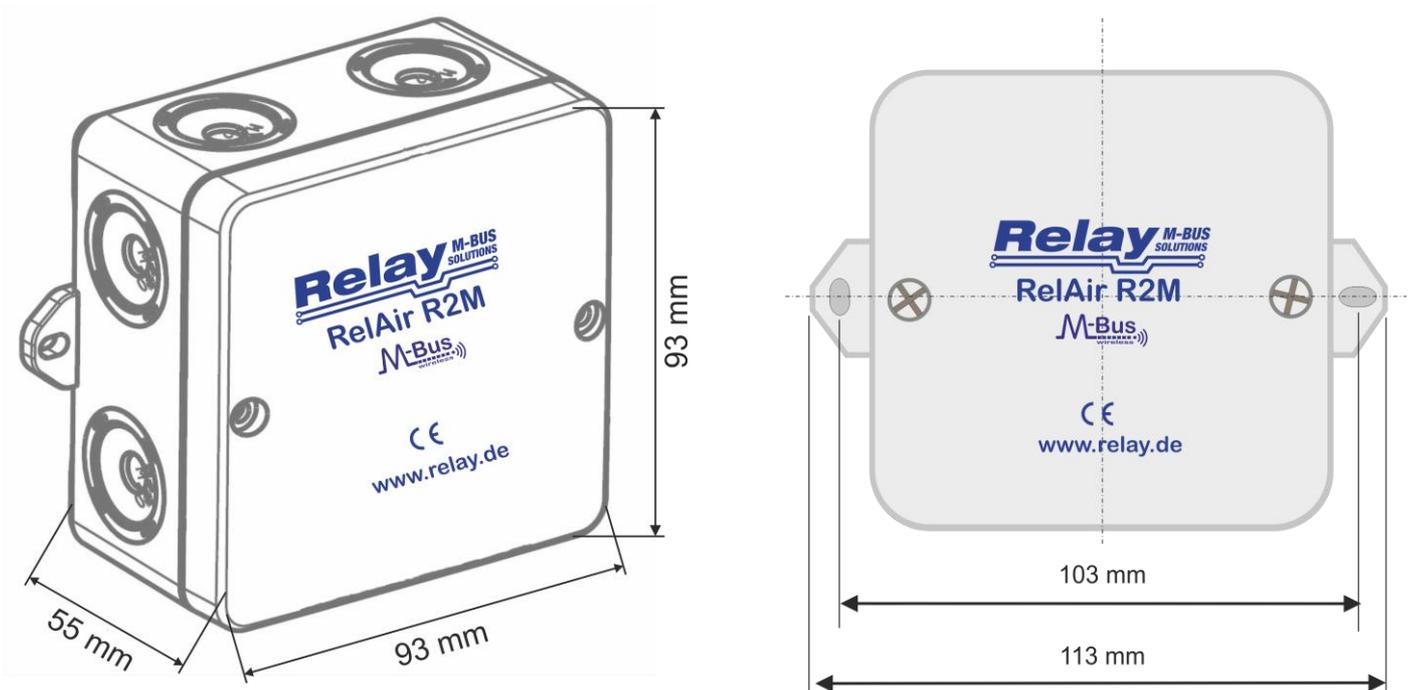
2.1 Mounting and cabling RelAir Pro / ProX

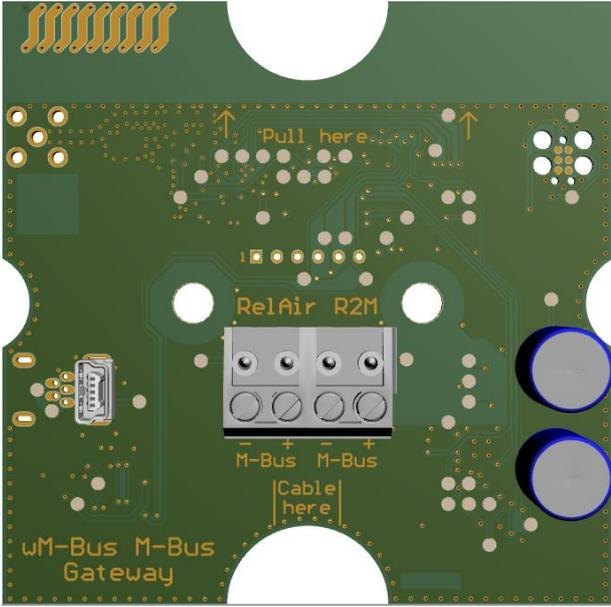
The bottom part of case is first attached to the wall with the terminals arranged downward. Please use 2 screws mounted through the outside drillings at the case.

The cable for the M-Bus interface are led through the self-sealing cable glands in the housing. You should break the cable glands with a small screw driver if you use flexible cables. To ensure a high protective class of up to IP65 the hole must be much smaller than the outer diameter of the cable. If you lift the terminal connectors and feed the cables far enough through the glands, you can connect the wires comfortably outside of the housing. Afterwards please withdraw the cables again and put the terminals on the appropriate pin rows on the circuit board. Please make sure that the cables are not routed at the top left near of the antenna as this could have a negative effect on the radio signals. The strain relief is given by looping the enclosed cable straps around the cable. If you have completed all assembly and configuration work, you should protect the device against manipulation with one labels on each screw on the cover of the case.

If you have the ProX variant, connect a suitable 868 MHz antenna to the external SMA socket. Please note that external antennas, especially round antennas, do not automatically improve the reception!

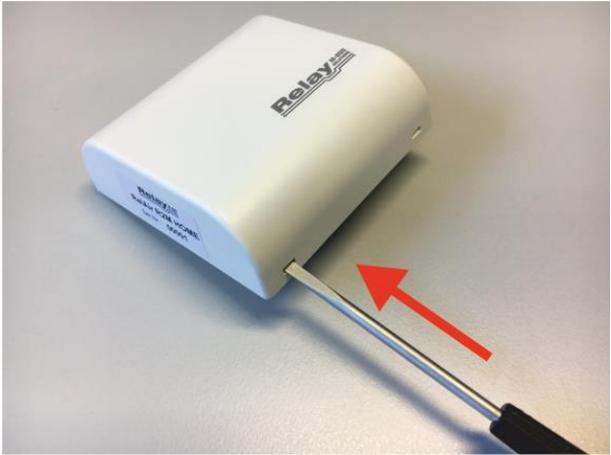
The accompanying drawing shows the dimensions for wall mounting:





This figure shows the assembled printed circuit board including the connection terminals for the M-Bus line (s) and the mini USB socket.

2.2 Mounting and cabling RelAir Home

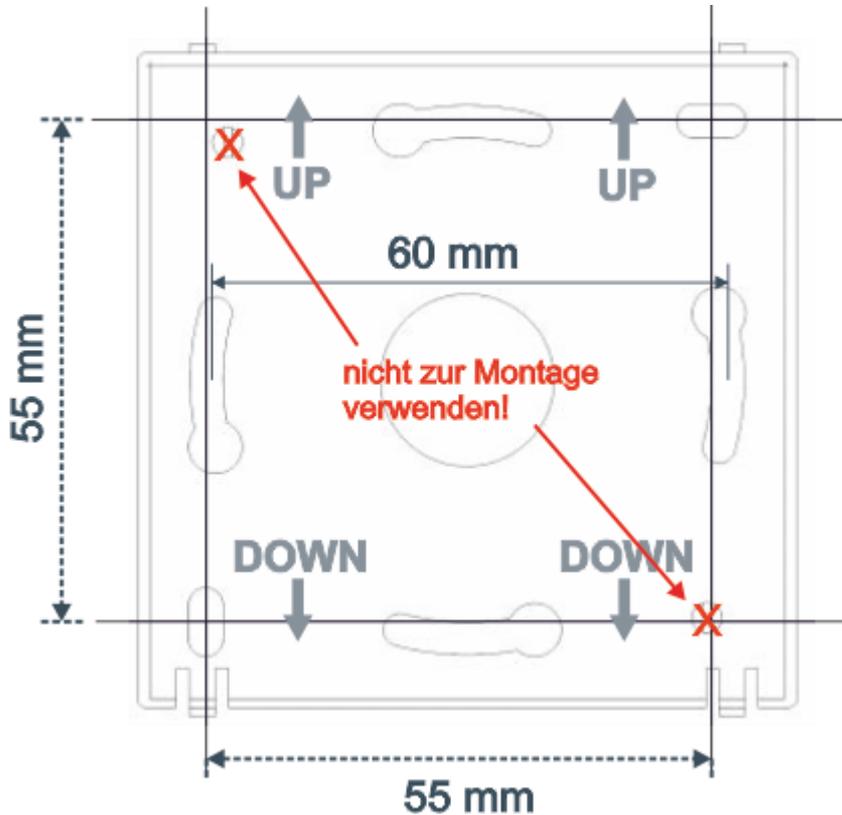


The housing must first be opened for assembly. To do this, push the tip of a slotted screwdriver one after the other into the two openings on the lower side so that the locking mechanism of the cover is released from the mounting plate.



Subsequently, the upper shell can be lifted off the mounting plate.

The lower shell of the housing is screwed with the clamps down to the wall or to the in-wall box. Please pay attention to the correct orientation of the mounting plate according to the following drawing. The holes in the top left and bottom right must not be used for assembly.

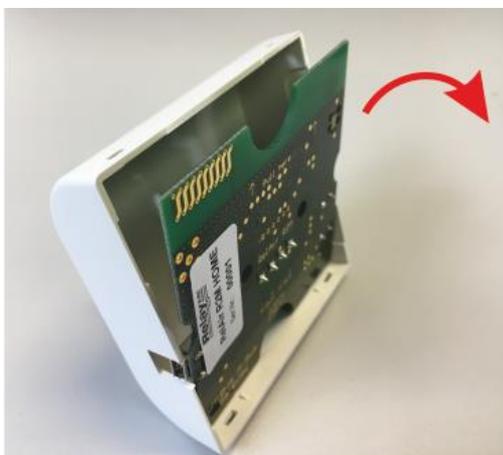


The housing of the RelAir R2M Home offers two different options for mounting:

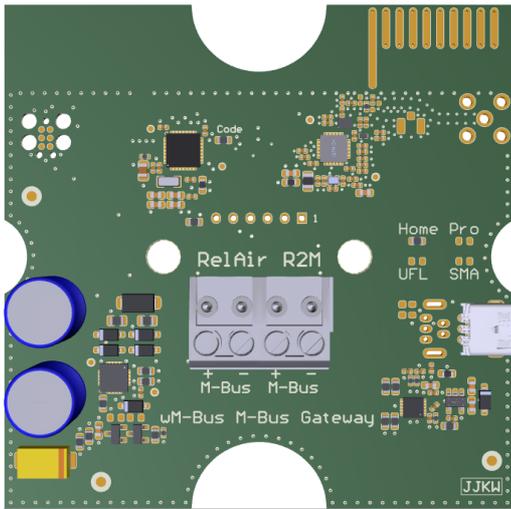
A) Mounting on a wall using two holes (diagonal in the horizontal and vertical distance of 55 mm).

B) Mounting on a commercially available in-wall or cavity wall socket (60 mm)

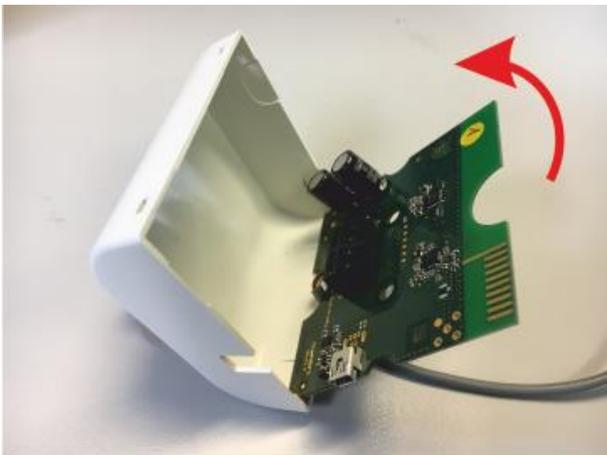
The RelAir R2M Home can either be operated via the USB interface on the outside of the housing or in an M-Bus system via the internal M-Bus interface (slave). In this case, the housing must be opened to connect the cable. The flush-mounted cable from the M-Bus Master is routed through the large break-out opening in the mounting plate.



To connect the cable, first tilt the circuit board out of the top shell by pulling on top of the edge of the semicircular notch on the circuit board.



Now connect the M-Bus cable to one of the two removable terminals. The printed circuit board with the terminals can be seen in the picture opposite.



The cable is then led back through the lower semicircular notch of the circuit board. Then insert the PCB at the bottom and tilt it up until it clicks into place.

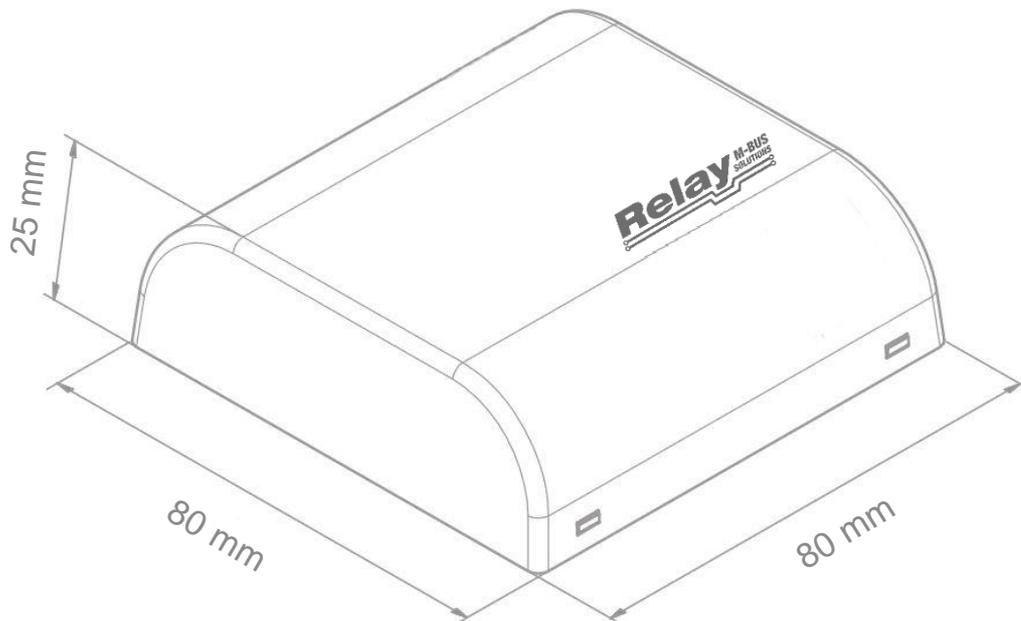


The housing cover with the latched circuit board and connected cable looks like this:



Finally, the housing cover incl. printed circuit board is clipped onto the already mounted mounting plate. To do this, attach the lid to the top edge of the mounting plate and press the lid firmly onto the plate until it snaps into place.

The following drawing shows the dimensions of the housing:



2.2 Parameterization and commissioning

The parameterization of the RelAir R2M is done with the help of the free software RelAirConf, which you will find on our CD "Tools & Docs" or on our homepage www.relay.de. You can either use the USB interface with a mini-USB cable or directly the M-Bus interface. Please note that the RelAir R2M gateways cannot be used without parameterization.

The configuration procedure can be found in the separate user manual for the RelAirConf software.

3 M-Bus Telegrams of registered meters

The RelAir R2M simulates all counters registered in the whitelist. They can either be selected and read out via their primary address (if configured with the parameterization software RelAirConf) or secondary address. The gateway always keeps the last received wMBus telegram from the registered meters ready. If necessary, the telegram is decrypted and packaged in an M-Bus compliant telegram.

Example (Read direct by primary address 0x05):

REQ_UD2: 10 7B 05 80 16

Note: If you want to use primary addressing, you must program a unique address for each transmitter using the RelAirConf tool.

Example (Read by secondary address **00h 11h 22h 33h ACh 48h B8h 07h**):

Selection: 68 0B 0B 68 53 FD 52 **00 11 22 33 AC 48 B8 07** BB 16

REQ_UD2: 10 7B FD 78 16

Note: The secondary address is automatically taken from the received Wireless M-Bus telegram.

There are four possible response telegrams, which are described on the following pages:

a) Empty telegram

The gateway returns a telegram without data records if, after registering in the whitelist, no telegram has been received from the registered meter. The data records with RSSI (DR1) and age (DR2) are optional and will only be transmitted if these options are activated in the RelAir R2M (possible from firmware V1.5.0).

		RSP_UD: M-Bus empty telegram			
Byte	Name	Content	Bytes [hex]	Layer	
1	Start	Start-Byte	68h	Data Link Layer (DLL)	
2	L-Field	Telegram length	17h		
3	L-Field	Telegram length	17h		
4	Start	Start-Byte	68h		
5	C-Field	SND_UD	08h		
6	A-Field	Primary address (meter)	00h		
7	CI-Field	72h (long Header)	72h	Transport Layer (TPL)	
8	ID-Field	Identification number LSB	00h		
9	ID-Field	Identification number	11h		
10	ID-Field	Identification number (meter ID)	22h		
11	ID-Field	Identification number MSB	33h		
12	Manufacturer	Manufacturer code LSB (Code = REL)	ACh		
13	Manufacturer	Manufacturer code MSB	48h		
14	Version	Version	B8h		
15	Type	Device type	07h		
16	Acc.	Access number	01h		
17	State	M-Bus State (e.g. error, alarm)	00h		
18	Config.	Configuration field (e.g. encryption)	00h		
19	Config.	Configuration field (e.g. encryption)	00h		
20	DR1	DIF (integer 8 Bit)	01h	Application Layer (APL)	
21	DR1	VIF (linear extension)	FDh		
22	DR1	VIFE (RSSI / RF level units in dBm)	71h		
23	DR1	Value	00h		
24	DR2	DIF (integer 16 Bit)	02h		
25	DR2	VIF (age / actuality duration)	74h		
26	DR2	Value LSB (900s)	84h		
27	DR2	Value MSB	03h		
	Checksum		??h	DLL	
	Stop	Stop-Byte	16h		

Telegram – M-Bus empty telegram

b) Telegram with wM-Bus container

If the telegram cannot be decrypted despite a registered or because of a missing AES key, the telegram is packed into a wM-Bus container data record and made available. The data records with RSSI (DR1) and age (DR2) are optional and will only be transmitted if these options are activated in the RelAir R2M (possible from firmware V1.5.0).

		RSP_UD:	Example	Layer
Byte	Name	Content	Bytes [hex]	
1	Start	Start-Byte	68h	Data Link Layer (DLL)
2	L-Field	Telegram length	??h	
3	L-Field	Telegram length	??h	
4	Start	Start-Byte	68h	
5	C-Field	SND_UD	08h	
6	A-Field	Primary address (meter)	00h	
7	CI-Field	72h (long Header)	72h	Transport Layer (TPL)
8	ID-Field	Identification number LSB	00h	
9	ID-Field	Identification number	11h	
10	ID-Field	Identification number (meter ID)	22h	
11	ID-Field	Identification number MSB	33h	
12	Manufacturer	Manufacturer code LSB (Code = REL)	ACh	
13	Manufacturer	Manufacturer code MSB	48h	
14	Version	Version	B8h	
15	Type	Device type	07h	
16	Acc.	Access number	01h	
17	State	M-Bus State (e.g. error, alarm)	00h	
18	Config.	Configuration field (e.g. encryption)	00h	
19	Config.	Configuration field (e.g. encryption)	00h	
20	DR1	DIF (variable length)	0Dh	
21	DR1	VIF (linear extension)	FDh	
22	DR1	VIFE (data container for the Wireless-M-Bus protocol)	3Bh	
23	DR1	LVAR	32h	
24	DR1	Telegram content starting from L-field	8Ch	
	
	DR1	Last byte of the telegram	06	
	DR2	DIF (integer 8 Bit)	01h	
	DR2	VIF (linear extension)	FDh	
	DR2	VIFE (RSSI / RF level units in dBm)	71h	
	DR2	Value	A0h	
	DR3	DIF (integer 16 Bit)	02h	
	DR3	VIF (age / actuality duration)	74h	
	DR3	Value LSB (900s)	84h	
	DR3	Value MSB	03h	
	Checksum		??h	DLL
	Stop	Stop-Byte	16h	

Telegram – wM-Bus container data record

c) Decrypted Telegram

In the case that a registered meter sends an unencrypted telegram or the correct AES128 key is stored, the data records contained in the wireless telegram are simply copied to the wired M-Bus telegram. However, all uniquely identifiable idle fillers (2Fh) are removed. The data records with RSSI (DR1) and age (DR2) are optional and will only be transmitted if these options are activated in the RelAir R2M (possible from firmware V1.5.0).

Byte	Name	RSP_UD:	Example	Layer
		Content	Bytes [hex]	
1	Start	Start-Byte	68h	Data Link Layer (DLL)
2	L-Field	Telegram length	1Dh	
3	L-Field	Telegram length	1Dh	
4	Start	Start-Byte	68h	
5	C-Field	SND_UD	08h	Transport Layer (TPL)
6	A-Field	Primary address (meter)	00h	
7	CI-Field	72h (long Header)	72h	
8	ID-Field	Identification number LSB	00h	
9	ID-Field	Identification number	11h	
10	ID-Field	Identification number (meter ID)	22h	
11	ID-Field	Identification number MSB	33h	
12	Manufacturer	Manufacturer code LSB (Code = REL)	ACh	
13	Manufacturer	Manufacturer code MSB	48h	
14	Version	Version	B8h	
15	Type	Device type	07h	
16	Acc.	Access number	01h	
17	State	M-Bus State (e.g. error, alarm)	00h	
18	Config.	Configuration field (e.g. encryption)	00h	
19	Config.	Configuration field (e.g. encryption)	00h	Application Layer (APL)
20	DR1	DIF (BCD 8 digits)	0Ch	
21	DR1	VIF (Volume [I])	13h	
22	DR1	Value LSB	15h	
23	DR1	Value	08h	
24	DR1	Value (00000815 [I])	00h	
25	DR1	Value MSB	00h	
26	DR2	DIF (integer 8 Bit)	01h	
27	DR2	VIF (linear extension)	FDh	
28	DR2	VIFE (RSSI / RF level units in dBm)	71h	
29	DR2	Value	A0h	
30	DR3	DIF (integer 16 Bit)	02h	
31	DR3	VIF (age / actuality duration)	74h	
32	DR3	Value LSB (900s)	84h	
33	DR3	Value MSB	03h	
	Checksum		??h	DLL
	Stop	Stop-Byte	16h	

Telegram – RSP_UD of a registered meter

d) Application Error Telegram

If the gateway cannot decrypt a received wM bus telegram, then the entire telegram is packed into a wM-Bus container. The wM-Bus Container can have a maximum length of 191 bytes according to the standard "EN13757-3-2018". For longer wM-Bus telegrams that do not fit into the container, the RelAir R2M sends a so-called application error:

Byte	Name	RSP_UD:	Example	Layer
		Content	Bytes [hex]	
1	Start	Start-Byte	68h	Data Link Layer (DLL)
2	L-Field	Telegram length	10h	
3	L-Field	Telegram length	10h	
4	Start	Start-Byte	68h	
5	C-Field	SND_UD	08h	
6	A-Field	Primary address (meter)	00h	
7	CI-Field	Application error from device (long)	6Fh	Transport Layer (TPL)
8	ID-Field	Identification number LSB	00h	
9	ID-Field	Identification number	11h	
10	ID-Field	Identification number (meter ID)	22h	
11	ID-Field	Identification number MSB	33h	
12	Manufacturer	Manufacturer code LSB (Code = REL)	ACh	
13	Manufacturer	Manufacturer code MSB	48h	
14	Version	Version	B8h	
15	Type	Device type	07h	
16	Acc.	Access number	01h	
17	State	M-Bus State (e.g. error, alarm)	00h	
18	Config.	Configuration field (e.g. encryption)	00h	
19	Config.	Configuration field (e.g. encryption)	00h	
20	Error	Buffer overflow	02h	APL
21	Checksum		??h	DLL
22	Stop	Stop-Byte	16h	

Telegram - Application Error

4 Technical Data

4.1 General Data

Operating temperature	0 to 40 °C
Storage temperature	-20 to 55°C
Humidity	10% to 70% (not condensing)
Terminals cable Ø	Fixed wire: 0,14 to 1,5 mm ² / Flexible wire: 0,14 to 1,0 mm ²

4.2 Housing RelAir R2M PRO / PROX

Mounting	Wall mounting
Material	Polystyrene, light-grey
W x L x H	(93 x 93 x 55) mm
Protective class	IP54, IP65 is possible if the cable entry is done carefully
Antenna (ProX)	SMA socket on the outside of the housing

4.3 Housing RelAir R2M HOME

Mounting	Wall mounting or mounting on an in-wall box (60 mm)
Material	ABS, white
B x L x H	(80 x 80 x 25) mm
Protective class	IP40

4.4 Power Supply

M-Bus connection	Power from M-Bus at max. 6 Unit Loads (current <= 9,0 mA)
USB connection	Power from USB (current <= 90 mA)

4.5 Wireless M-Bus Interface

Standard	EN13757-4 (link layer) and EN13757-3 (application layer), compatible to OMS
Receive modes	S1, T1, C1, T1+C1 (unidirectional) / Frame Format A and B
Encryption	Mode 0 (not encrypted), Mode 5 or Mode 7
Radio Scan List	Up to 488 devices
Whitelist	Up to 63 devices can be configured

4.6 Wired M-Bus Interface

Standard	EN13757-2 and EN13757-3
Current consumption	6 Unit Loads á 1.5 mA Allows e.g. max. 3 gateways at a PW20 (MR006) and 10 gateways at a PW60 (MR004C) Operation at a PW3 (MR005) is not possible!
Addressing	- Primary address (factory default = 0, configurable with RelAirConf software) - Secondary address RelAir R2M HOME: ID = 1xxxxxxx, with xxxxxxx = serial number RelAir R2M PRO: ID = 2xxxxxxx, with xxxxxxx = serial number RelAir R2M PROX: ID = 3xxxxxxx, with xxxxxxx = serial number

4.7 Ordering Information

Ordering number	Description
RelAir R2M Home	Wireless M-Bus to M-Bus Gateway, housing for living rooms, internal antenna
RelAir R2M PRO	Wireless M-Bus to M-Bus Gateway, industrial housing, internal antenna
RelAir R2M PROX	Wireless M-Bus to M-Bus Gateway, industrial housing, for external SMA antenna (antenna not included)
ANT WMB001	Magnetic mount antenna 868 MHz with 1,5m detachable cable for Wireless M-Bus, SMA male connector
KA004	USB cable A to mini B 5-pin, length = 1,8 m

4.8 CE Declaration



www.relay.de

EU DECLARATION OF CONFORMITY for RelAir R2M

We the company **Relay GmbH**
Stettiner Str. 38
D-33106 Paderborn

declare that the products **RelAir R2M Home**
RelAir R2M Pro
RelAir R2M ProX

Wireless M-Bus to Wired M-Bus Gateways

are compliant with the requirements of the following directives:

EMC Directive (2014/30/EU)
Low Voltage Directive (2014/35/EU)
RoHS Directive (2011/65/EU)

The products have been tested in accordance with the following standards:

EN 300220-2 V3.1.1	Radio equipment (SRD) in the frequency range 25 MHz to 1 GHz (receiver Class 2/3)
EN 301489-1 V2.2.20 draft	EMC for radio equipment and services, Part 1: technical requirements
EN 301489-3 V2.1.1 final draft	EMC and ERM for radio equipment and services, Part 2: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz
EN 62368-1 2014 + AC 215	Audio/video, information and communication technology equipment Part 1: Safety requirements
EN 62479: 2011-09	Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz - 300 GHz)

Paderborn, 02.07.2018


Matthias Rütger (Development Manager)

EU Declaration of Conformity - RelAir R2M	02.07.18	Page 1 of 1
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