



(GB)

Code
ECSEM454MID

Model
M3PRO 1-5 MID

Three phase energy meter, measure via CT 1 to 10000 A with MID declaration of conformity and 2 pulse (S0) outputs.

MID certification concerns active energy only.

User instruction.

Safety instructions

Read this manual carefully BEFORE installing the instrument.

This device must be installed indoor only by a professional electrician fitter according to local applicable installation standards.

Do not plug in or unplug this product when the power supplying is ON. Its use is only permitted within the limits shown and stated in the installation instructions. The device and the equipment connected can be destroyed by loads exceeding the values stated.

Any type of intervention on the products, including cases in which they cease to function or present defects, can be dangerous for the operator's safety and relieves the Manufacturer from all civil and criminal liability.

Function

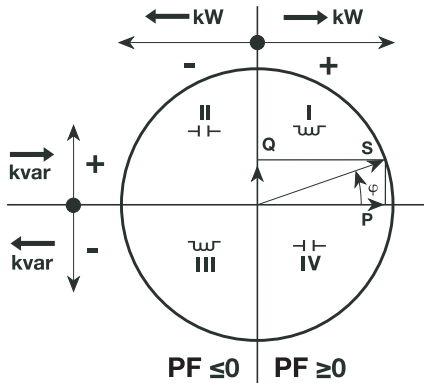
This 4 quadrants meter measures the active and reactive energy used in an electrical installation. This device can manage 2 tariffs by 230 VAC digital input.

Only the total active energy register can be used for billing purposes according to measuring instrument directive (MID).

- Active Energy Class B (according to EN 50470-3:2022)
- Active Power Class 1 (according to IEC 62053-21:2020 and IEC 61557-12:2018)
- Reactive Energy Class 2 (according to IEC 62053-23:2020)
- Reactive Power Class 2 (according to IEC 62053-21:2020).

This device has a backlit LCD and 3 push-button keys to read Energies, V, I, PF, F, P, Q and to configure some parameters. The design and manufacture of this meter comply with Standard EN 50470-3:2022 requirements.

Power factor
Convention according to IEC 62053-23:2020



Layout of device

LCD display

Partial $\sum$ L1-2 $\sum$ L2-3 $\sum$ L3-1
8888 Hz
88888888
L2-3 kWhvarhVA $\sum$ L3-1

Energy for all tariffs
Tariff
Reactive power inductive/capacitive
Phase indicator

00000000 Main Energy Register, not resettable

00000 Partial Energy Register, resettable

Partial
kWhkvarh
kVA ms Hz

Units

Energy import (consumption →)
Energy export (production ←)

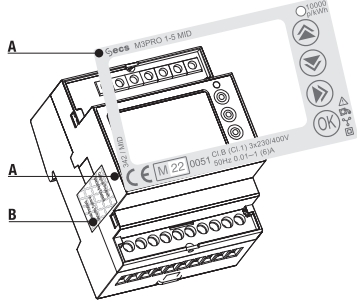
Commands

- **UP button**: to scroll pages and change parameters
- **DOWN button**: to scroll pages and change parameters
- **MENU/ESC button**: to change menu and stop modification procedure of a parameter
- **OK button**: to confirm the modification of a parameter

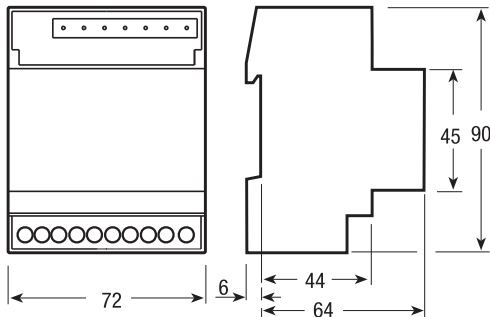
MID certified

A) Device code and certification data indications

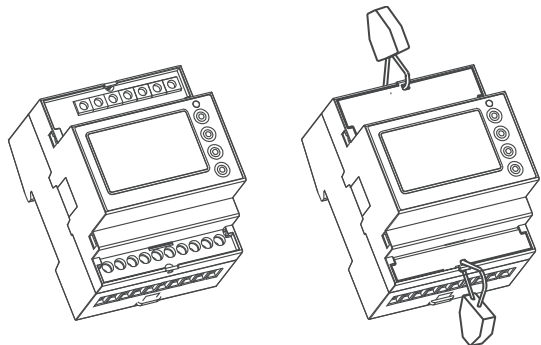
B) Safety-sealing between upper and lower housing part



Dimensions



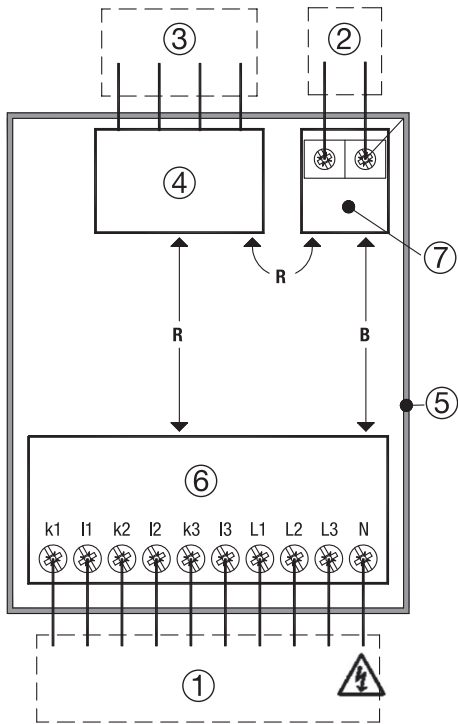
Sealable terminal cover



Wiring

Intended use

The Energy Meter is suitable for use on both impedance grounded networks and not grounded networks.



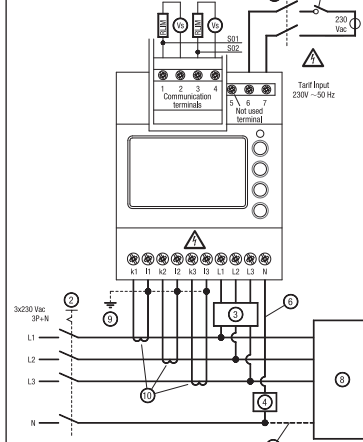
There are no accessible parts

Legend:

B = Basic insulation
D = Double insulation
R = Reinforced insulation
F = Functional insulation

- ① **HLV TERMINAL**, 1 terminal for neutral
- ② **HLV TERMINAL**, 2 terminal for tariff input
- ③ **SELV TERMINALS**, 4 terminals or 2RJ45 connectors
- ④ **SELV CIRCUIT**, (communication) working voltage <25 Vac, <60Vdc
- ⑤ **PLASTIC CASE** (NOT EARTHED)
- ⑥ **HLV CIRCUIT**, (mains) Working Voltage = 300 Vac
- ⑦ **HLV CIRCUIT**, (tariff input) working voltage = 300 Vac

Wiring diagram



- ① Bipolar disconnector 230Vac
- ② Four-pole disconnector 3X230Vac, 3P+N. The disconnectors must be clearly labelled and must be easily accessible by the installer
- ③ 3 fuses or 3 circuit breakers
- ④ Fuse or circuit breaker in series with the neutral conductor, to be adopted in case the source neutral is not earthed. The installer is responsible for coordinating the rating and the characteristics of the supply side overcurrent protection. The devices must be correctly sized with respect to the installation voltage, the maximum overcurrent applicable to the meter and the fault current available. The following parameters are to be taken into consideration:
 - Maximum current = 6A
 - Maximum Overload current = 10A
 - Maximum Voltage = 276 Vac
- ⑤ Control circuit for the tariff: Open contact: Tariff 1, Close contact: Tariff 2
- ⑥ The connection of the Neutral to the Energy Meter is strictly MANDATORY. Failure to connect affects not only the quality of the measurements, but also electrical safety.
- ⑦ The connection of the Neutral to the load is not mandatory. However, consider that in a 3P + N network, if the Neutral is not connected to the load, the measurements referred to L1, L2 and L3 no longer have any meaning. Only the 3-phase ($\sum$ L) measurements remain significant.
- ⑧ 3 wires or 4 wires electrical load.
- ⑨ The earthing of the CTs' secondary winding is regulated by the national standards of the country where the instrument is installed.
- ⑩ 3 CTs with basic insulation.

Installation and uninstallation

The disconnectors (reference ① and ② in the wiring diagram) must be easy to identify and to operate and must be close to the Meter. They both must be in "OFF" position (open circuits) from the beginning to the end of the installation or of the uninstallation. The Energy Meter, the disconnectors and the overload current protection devices must be easily identifiable, must be installed in an adequate cabinet (IP51 and V1) and it must be easy to intervene on them whenever appropriate. Inside the cabinet, do not install any other device with a flammability class worse than V1.

Commissioning



Recommendations

Check the following before putting it into service:

- Make sure that no dangerous voltages are connected to the SELV terminals.
- Make sure that a phase has not been connected to the Neutral terminal (this would cause the internal protections to intervene with permanent damage to the Meter).
- Check that the main page appears on the display (see menu description) and not the Phase Sequence Error page.

Maintenance



- Make sure that no voltage is applied to the instrument.
- Only dry cleaning is allowed with a natural fiber cloth (for example cotton or linen) or synthetic fabric that does not leave residual fibers that can remain on the surface of the Energy Meter or that can penetrate into the Energy Meter.



For this Energy meter, no maintenance, repair or replacement of parts is foreseen. Such interventions are to be considered prohibited. In case of malfunction, it must be replaced.

Help in case of problems

Error condition

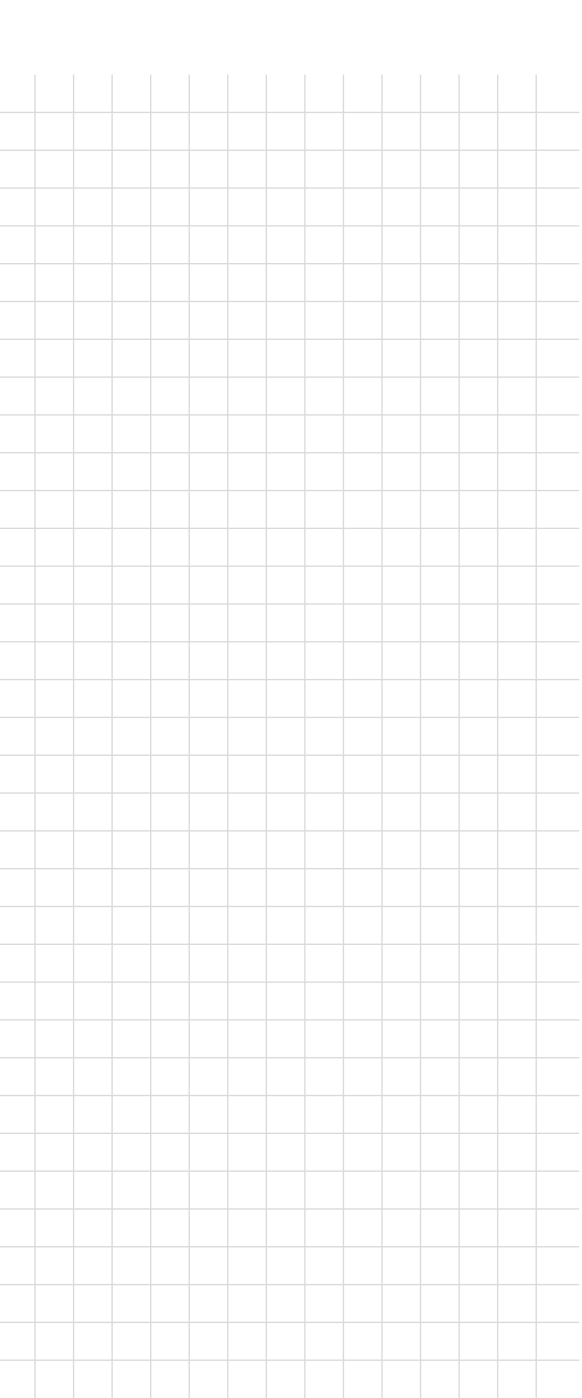
When partial energy blinks, reset partial energy (maximum partial energy register). When the display shows the message ERROR N02 or ERROR N03, the meter has got a malfunction and must be replaced.

Diagnostic message



The cabling sequence (L1-L2-L3) is wrong. L1, L2 and L3 icons blink. Invert the voltage wires of 2 phases (phase 1 <> phase 2 or phase 2 <> phase 3). Otherwise, by pressing the «OK» button for at least 5 seconds, the message disappears until the next restart.

Notes

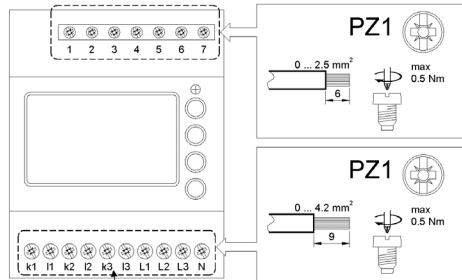


Cable section. Cable stripping length

Screwdriver type. Maximum terminal screw torque

Adopted cables shall retard flame propagation.

Cables must therefore comply with IEC 60332-1-2:2004 or have a flammability rate UL 2556 VW-1



Note on cable sizing. For the current and voltage connection cables, it is recommended to use multi-strand copper cables with AWG 11 (with a 4.2 mm² section), as they are suitable for I_{max} = 6A and I_{ovl} = 10A. The use of cables with a smaller section falls under the responsibility of the installer, who must, in this case, ensure that the maximum permanent current (I_{max}) and the overload current (I_{ovl}) remain proportionally lower for the entire duration of use. For example, with AWG 14 cable (2.1 mm²) the permanently applied current (I_{max}) cannot exceed 3A and the overload current (I_{ovl}) 5A. The overcurrent protective device must therefore be sized accordingly.

Ω	V
A	8



General characteristics		DIN 43880	DIN	4
Housing		DIN 60715	DIN rail	35 mm
Mounting			mm	60
Depth			g	293
Weight				
Operating features				
Connection	to three-phase network - number of wires	-		4
Storage of energy values and configuration	Internal flash non volatile memory	-		☑
Tariff	for active and reactive energy	-		T1 ... T2 230V
Approval (EN 50470-3:2022)				
Connection		-		CT /5A - CT /1A
Reference Voltage (Un)	phase / neutral	VAC		230
	phase / phase	VAC		400
Nominal Current (In)		A		1
Minimum Current (Imin)		A		0.01
Maximum Current (Imax)		A		6
Starting Current (Ist)		A		0.002
External CT	max. CT ratio	-		10000/5 2000/1
Reference Frequency (fn)		Hz		50
Number of phases / number of wires		-		3 / 4
Certified Measures		kWh		→ kWh ← kWh
Accuracy				
- Active Energies (accord. to EN 50470-3:2022)		classe		B / 1
- Active Powers (accord. to IEC 62053-21:2020 and IEC 61557-12:2018)				
- Reactive Energies (accord. to IEC 62053-23:2020)		classe		2
- Reactive Power (accord. to IEC 62053-21:2020)				
Supply Voltage and Power Consumption				
Operating Supply Voltage range		V		92 ... 276 / 160 ... 480
Maximum Power Consumption (Voltage circuit)		VA / W		≤2 / 0.6
Maximum VA burden (Current circuit) @ Imax		VA		≤0.2
Voltage Input Waveform		-		AC
Voltage impedance		MΩ		1
Current impedance		MΩ		≤20
Overload capability				
Voltage	continuous phase / neutral	VAC		276
	temporary (1 s) phase / neutral	VAC		300
	continuous phase / phase	VAC		480
	temporary (1 s) phase / phase	VAC		800
Current	Maximum	A		6
	temporary (0.5 ms)	A		120
Measuring Features				
Voltage range	phase / neutral	VAC		92 ... 276
	phase / phase	VAC		160 ... 480
Current range		A		0.001 ... 6
Frequency range		Hz		45 ... 65
Measured Quantities		-		V, A, kWh, kvarh, PF, Hz, kW, kvar
3 phases Energy calculation		-		WELMEC
Display features				
Display type	LCD with backlight	-		7.2 +3.2
Active Energy	7 digits + 2 decimal digits	kWh		0.01 ... 99999999.9
Reactive Energy	7 digits + 2 decimal digits	kvarh		0.01 ... 99999999.9
Voltage	3 digits + 1 decimal digit	V		92.0 ... 276.0
Current	2 digits + 2 decimal digits / 3+1 / 4+0	A		0.01 ... 6000
Power factor	1 digit + 3 decimal digits with sign + capac./induc. indic.	-		-1.000 ... 1.000
Frequency	2 digits + 2 decimal digits	Hz		45.00 ... 65.00
Active Power	2 digits + 2 decimal digits	kW		0.00 ... 1987
Reactive Power	2 digits + 2 decimal digits	kvar		0.00 ... 1987
Apparent Power	2 digits + 2 decimal digits	kVA		0.00 ... 1987
Display refresh period		s		1
Optical metrological LED				
Front mounted red LED (meter constant)	proportional to active imp/exp Energy	imp/kWh		10000
Safety				
Utilization category		-		UC1
Overvoltage category		-		3
Protective class		classe		II
AC voltage test (EN 50470-3:2022)		kV		4
Degree of pollution		-		2
Operational voltage		V		300
Impulse voltage test (Uimp)		1.2/50		6.4
Housing material flame resistance		UL 94		classe V0
Safety-sealing between upper and lower housing part		-		☑
Printed circuit board flammability class		-		V1
Material Group		-		IIla
IR Connectable Communication Modules				
For communication modules		-		☑
Pulse Outputs (S0 signals)				
Pulse Output 1	acc. to IEC 62053-3 adjustable	-		kWh (T1) →, kWh →, kWh →
Pulse Output 2	adjustable	-		kWh (T2) →, kWh ←, kvarh →
Pulse Rate	adjustable	p/kWh		1 ... N (*)
Pulse ON-time	adjustable	ms		(*) N - dep. on CT-ratio and Pulse on Time
Pulse ON maximum current		mA		30 ... 100
Pulse OFF leakage current		μA		90
Isolation class		-		1
Tariff				SELV circuit
Tariff 1		-		☑
Tariff 2		VAC		230 ±20%
Input impedance		kΩ		224
Environmental conditions				
Storage temperature range		°C		-25 ... +70
Operating temperature range		°C		-25 ... +55
Mechanical environment		-		M1
Electromagnetic environment		-		E2
Installation	indoor only	-		☑
Altitude (max.)		m		≤2000
Humidity	yearly average, without condensation	-		≤75%
	on 30 days per year, without condensation	-		≤95%
IP rating	in built-in condition (front part)	-		IP51
	terminal block	-		IP20
Emission class compatibility CISPR 32		classe		B

Available Energy Groups for a Single phase or a 3-phase meter

Group	Energies	Tariff		OBIS code	Unit
1	ΣL In Wh (T1+T2)	T1+T2	→ Imported	1.8.0	kWh, with 2 decimal digits
	ΣL Out Wh (T1+T2)	T1+T2	← Exported	2.8.0	
2	ΣL In Wh (T1)	T1	→ Imported	1.8.1	kWh, with 2 decimal digits
	ΣL In Wh (T2)	T2	→ Imported	1.8.2	
3	ΣL Out Wh (T1)	T1	← Exported	2.8.1	kWh, with 2 decimal digits
	ΣL Out Wh (T2)	T2	← Exported	2.8.2	
4	ΣL In kVARh (T1+T2)	T1+T2	→ Imported	3.8.0	kvarh, with 2 decimal digits
	ΣL Out kVARh (T1+T2)	T1+T2	← Exported	4.8.0	
5	ΣL In kVARh (T1)	T1	→ Imported	3.8.1	kvarh, with 2 decimal digits
	ΣL In kVARh (T2)	T2	→ Imported	3.8.2	
6	ΣL Out kVARh (T1)	T1	← Exported	4.8.1	kvarh, with 2 decimal digits
	ΣL Out kVARh (T2)	T2	← Exported	4.8.2	

All the 3-Phase Energies are “total”, meaning that they are the sum of the Energies of the 3 phases.

Available measures group for a Single phase or a 3-Phase energy meter

Group	Measures	OBIS code	Notes
7	Phase Voltages L1–L2–L3	(12.7.0)	Instantaneous voltages
8	Phase Currents L1–L2–L3	(11.7.0)	Instantaneous currents
9	Total Active & Reactive Power	(15.7.0)	Resolution 1 W
10	Total Power Factor	(84.7.0)	Resolution 0.001
11	Frequency + Active Tariff	(14.7.0)	Frequency in Hz + tariff code

LoraWAN Network Server

Downlink command in order to updates time ranges

The downlink can be used to send a new timer interval configuration.

The LoRa device sends a data request 3 minutes after startup and then every 1 hour.

The server prepares the downlink message. After the uplink, the device receives a return message from the server.

- The device sends the request for the new interval via uplink.
- The server sends the new timer interval via downlink.
- The device updates the timer interval if the interval differs from the current one.

Even after sending an OBIS message, the server may still deliver a downlink message

The uplink message is

Offset payload	Data code	Ascii	Format Coding	Range	Description
0	0x52	'R'			
1	0x45	'E'			
2	0x51	'Q'			
3	0x30	'0'			

The downlink from server:

Offset payload	Data code	Format Coding	Range	Description
0	0x52	'R'		
1	0x45	'E'		
2	0x51	'Q'		
3	0x30	'O'		
4	0x31-0x37	'1-7'	0x31-0x37	New interval value for energy obis: Tx_5minutes=1 Tx_15minutes=2 Tx_1hour=3 Tx_2hours=4 Tx_4hours=5 Tx_8hours=6 Tx_24hours=7
5	0x31-0x37	'1-7'	0x31-0x37	New interval value for measure: Tx_5minutes=1 Tx_15minutes=2 Tx_1hour=3 Tx_2hours=4 Tx_4hours=5 Tx_8hours=6 Tx_24hours=7

Downlink command to request the transmission of measurements

The downlink can be used to request a specific measurement. There are two ways to request the transmission: either following a REQO command, or after an uplink message containing only the OBIS energy values.

In both cases, the server's downlink message is REQ1

The uplink message is

Offset payload	Data code	Ascii	Format Coding	Range	Description
0	0x52	'R'			
1	0x45	'E'			
2	0x51	'Q'			
3	0x30	'0'			

The downlink from server:

Offset payload	Data code	Format Coding	Range	Description
0	0x52	'R'		
1	0x45	'E'		
2	0x51	'Q'		
3	0x31	'1'		
4	0x31-0x35	'1-5'	0x31-0x35	Request measure: 1 = request OBIS_Voltage "(12.7.0)" 2 = request BIS_Current "(11.7.0)" 3 = request OBIS_Power "(15.7.0)" 4 = request OBIS_PF "(84.7.0)" 5 = request OBIS_Freq_T "(14.7.0)"
5				Not used

Technical Specification (acc. to EN300.220 V3.1.1, EN 301 489, EN 62368-1:2018)

RF features	
Modulation	LoRa® Modulation
MAC protocol	LoRaWAN®
Frequency-Plan	EU863-870
Max RF Output Power	14 dBm
Device Class	Class A
Join procedure type	abp or otaa
Data Rate:	250 – 5470 bit/s
Range	Up to 5 km (urban area) Up to 15 km (rural area)
Frequency band	863.0...870 MHz
DIN-rail mounting (acc. to DIN 43380 and EN60715)	
Housing	1 module (18 mm)
DIN-rail	35 mm
Module depth	70 mm
Power supply	
Operating Voltage	92-276 V~
Power consumption	<=1.5 VA
Operating Frequency	45-65 Hz
Wiring Connection	
Screw head Z +/-	POZIDRIV PZO
Solid wire min (max) section	0.15 (2.5) mm²
Stranded wire min (max) section	0.15 (4) mm²
Wires acc. to IEC 60332-1-2 if section>= 0.5 mm², acc. to IEC 60332-2-2 for smaller sections	

Electric Safety (acc. to EN 62368-1:2019)	
Pollution degree	2
Overvoltage category	III
Working Voltage	300 V
Flammability (acc. to UL 94)	class V0
Insulation (acc. to IEC 61140)	II  (symbol IEC 60417-5172 (2003-02) Insulation between Main supply and accessible parts (antenna and USB connector) = 5kV. Each single equipment is tested in production @4.5kV for 1s (electric strength test)

Environmental conditions	
Operating Temperature	-25°C - +70°C
Storage Temperature	-25°C - +75°C
Relative Humidity not condensing	
Yearly average	<= 75%
On 30 days per year	<= 95%
Installation	Indoor
Altitude	<=2000 m.
Degree of Protection	IP20 (*)

(*) The device must be installed inside a cabinet with IP rating IP30 or better.

Any exposed parts (outside the cabinet) must have a minimum degree of protection IP51.

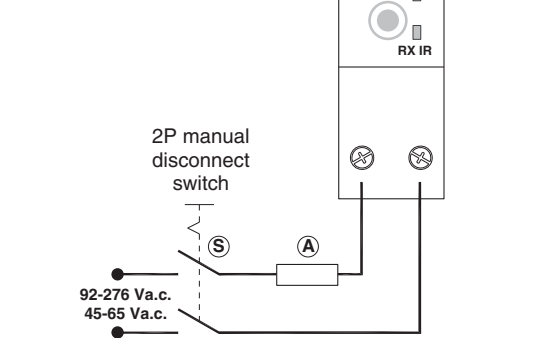
Furthermore, the cabinet must have a Flammability degree V0 (according to UL-94) or better.

USB Interface	
Micro	USB 2.0
Connection micro	USB A o B
Voltage 5Vdc	(min 4.4 Vdc – max 5.25 Vdc)
Current consumption	<= 60 mA
Power consumption	<= 315 mW

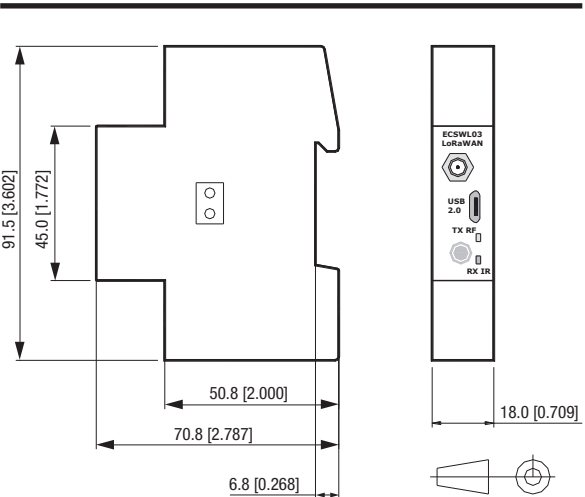
Wiring Diagram

- ⑤ Two poles disconnect device with a contact separation of at least 3 mm.
- ⑥ Cartridge Fuse 5X20mm, Certified according to IEC 60127-2. Medium Acting.
Operating current 125 mA.
Voltage rating 250 Vac.
For example: Littelfuse 0128.125

Both fuse and fuse holder must have a minimum creepage distance of 4mm and minimum clearance distance of 3 mm between poles. The fuse breaks the Phase wire current. The fuse holder is DIN-rail mounting and must be mounted closely to the device.



Dimensions



Notes