

EMI/EMC Topics on Smart Grid Applications: Electricity Smart Meters

SMART METER (ELECTRICITY) & OTHER APPLICATIONS WHICH WORKS
<150/500KHz



de Nederlandse EMC-ESD Vereniging
EMC-ESD Event 2019

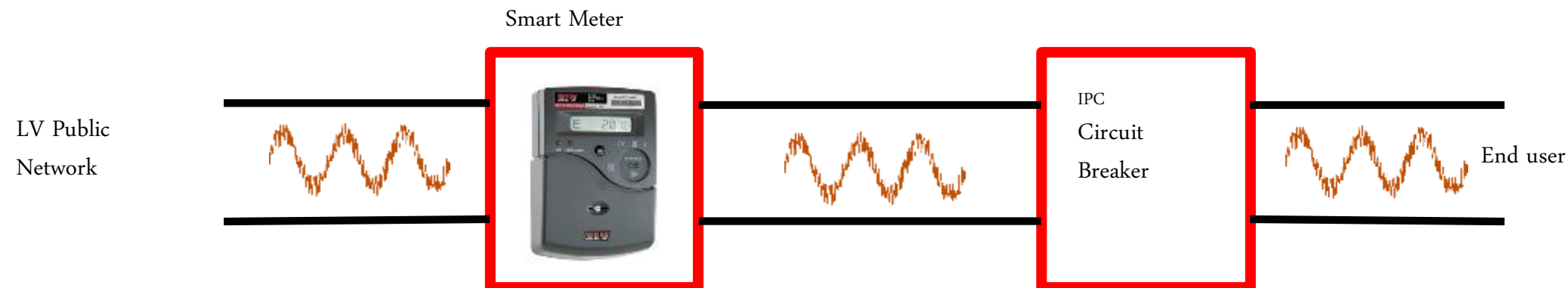
**NH Conference Centre Koningshof
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woensdag 20 november



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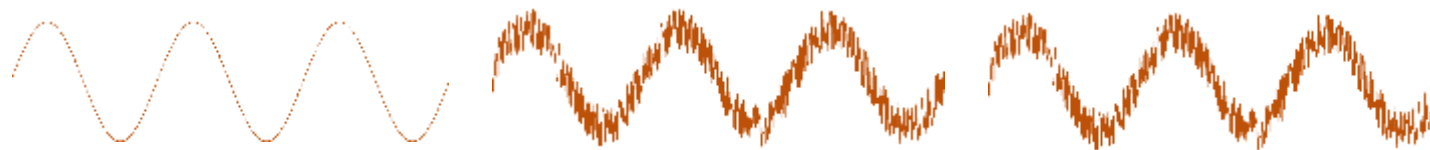
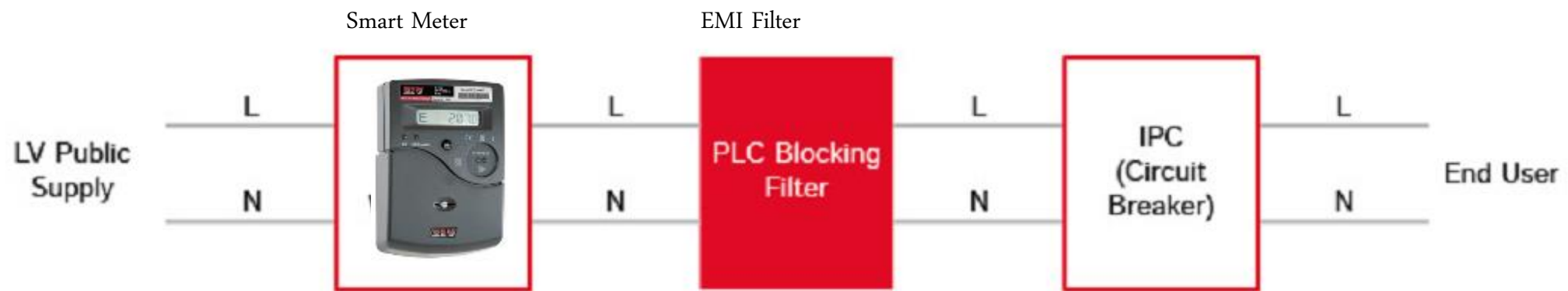
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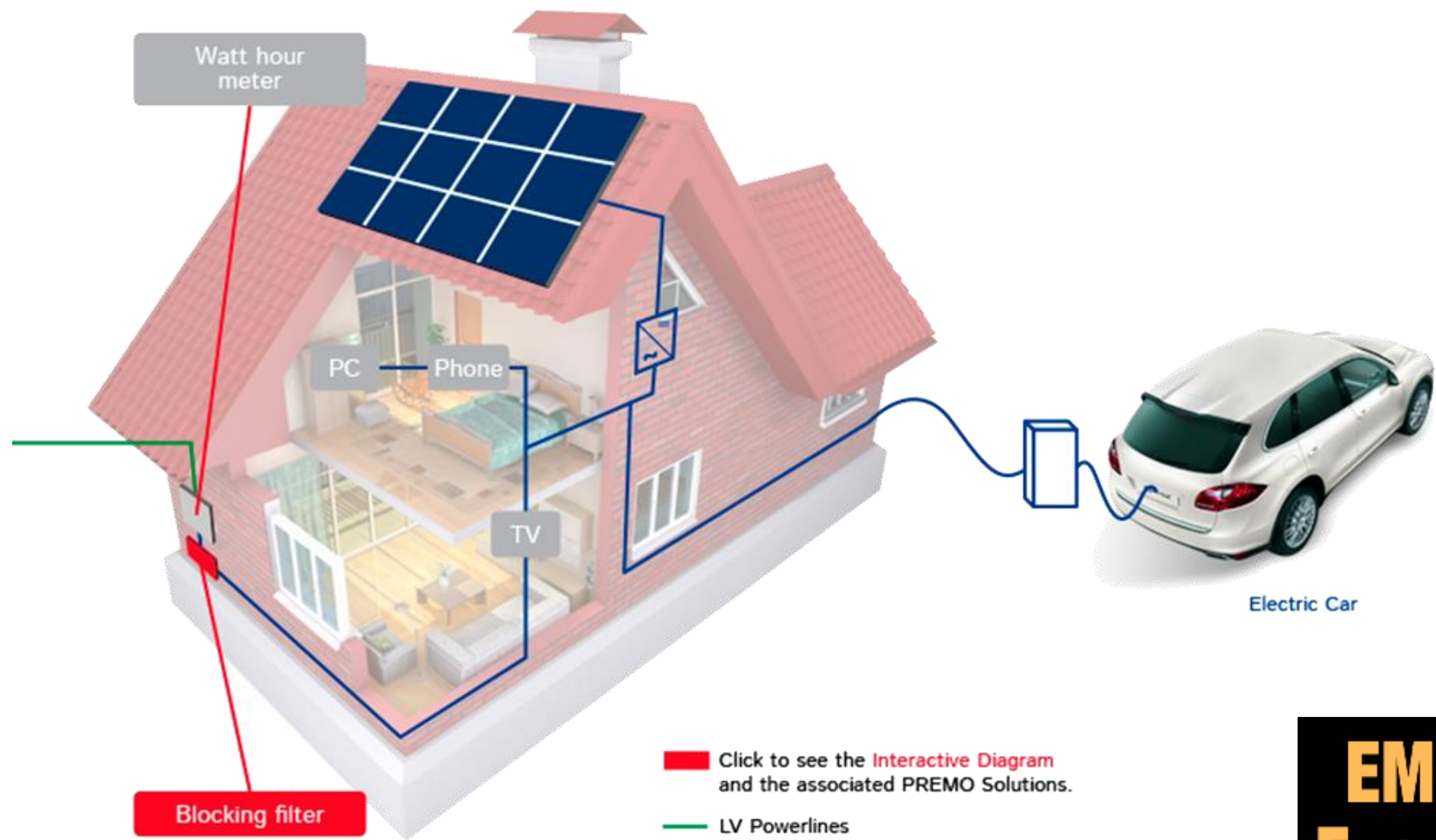


THE PROBLEMATIC

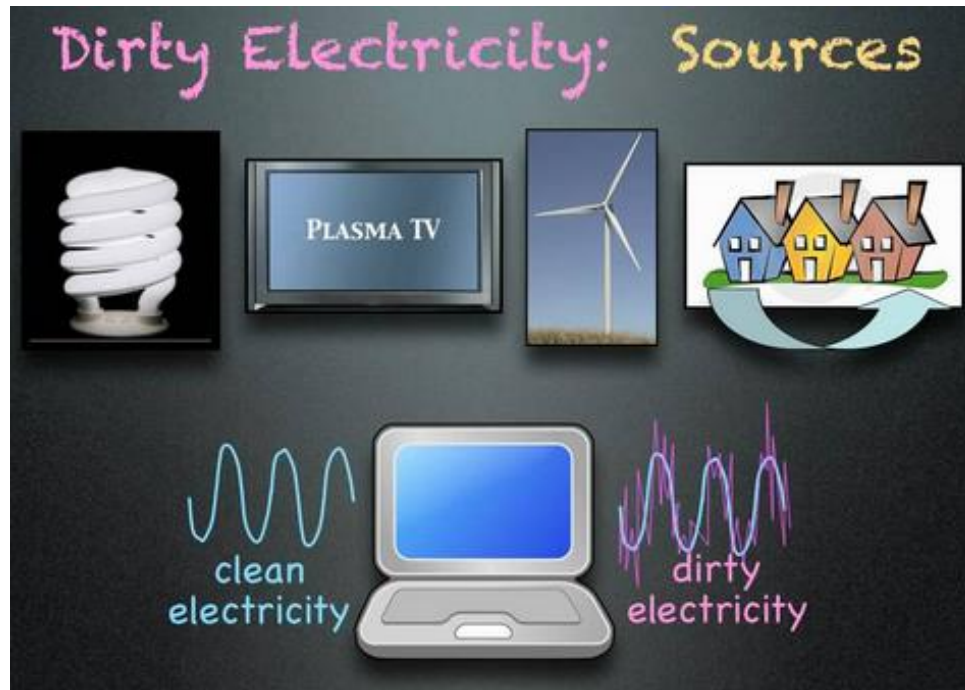
All the European utility companies are **changing Old Electricity meter to Smart meters** which works by PLC systems using low frequency signals, such as PRIME (42-89KHz), G3-PLC (35-91KHz) & CENELEC Band A (9-95KHz).

And the noise is coming from the end-user equipments via household wiring which is too close to PLC frequency ranges and is blocking communication between Smart meters and Concentrators. This problem arise in the 2-5% of installations.





INTRODUCTION



Common Dirty Electricity Sources

Dirty electricity (EMI) is all around us - in domestic and Industrial. It is produced when electronics, appliances, energy-efficient lights, and other electrical devices must convert one form of electricity to another in order to operate.

It is also generated when these devices draw electrical current intermittently rather than continuously.

These processes create micro surges or spikes of powerful, high frequency energy that travel along a building's wiring and radiate into rooms as potentially harmful electromagnetic fields (EMFs).



INTERNAL DIRTY ELECTRICITY SOURCES

Created by devices operating inside the building:

Compact fluorescent light bulbs (CFLs) ,Fluorescent tubes

Light dimmer switches, Computers, laptops , Printers, TV set, Video games,

Chargers, Solar power systems, Kitchen appliances

Washers and dryers,

Heating systems (A/c, hair dryers, Heaters) WiFi routers



EXTERNAL DIRTY ELECTRICITY SOURCES

Travel to a building's wiring from outside sources via power lines)

Dirty electricity from other buildings, SMART meters, Solar power systems , Ground loop currents

ABOUT SMART METERS & CENELEC BANDS

Smart Meter for electricity, gas, and water is intended to create the precondition for transparency of used electricity, gas and water without additional personal (meter reading at site).

CENELEC Band frequency range User

- - 3 - 9 kHz Energy supplier
- **A: 9 - 95 kHz Energy supplier**
- B: 95 - 125 kHz Customer devices
- C: 125 - 140 kHz Customer devices
- D: 140 - 148,5 kHz Customer devices

Example of some devices work in the frequency range from 3 – 150 KHz: Typical clocking frequencies:

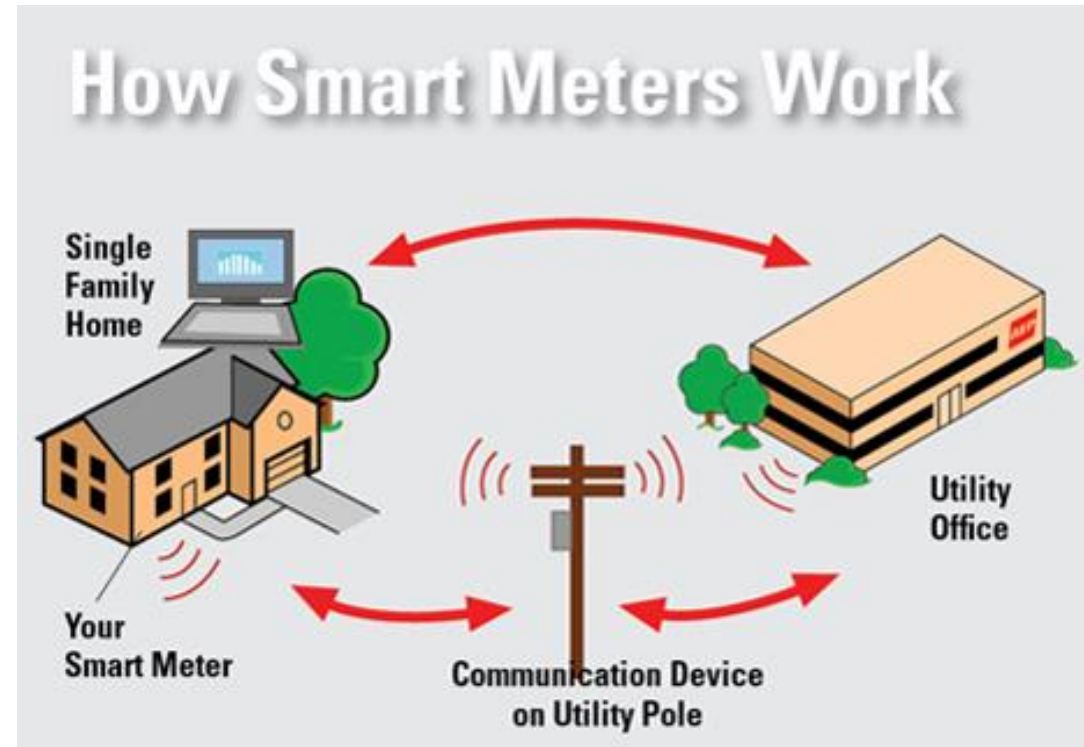
LED 3-10KHz

Frequency converter 5 – 20kHz

Switch power supply 20 – 300kHz

Lightning EVG's 20 – 200kHz

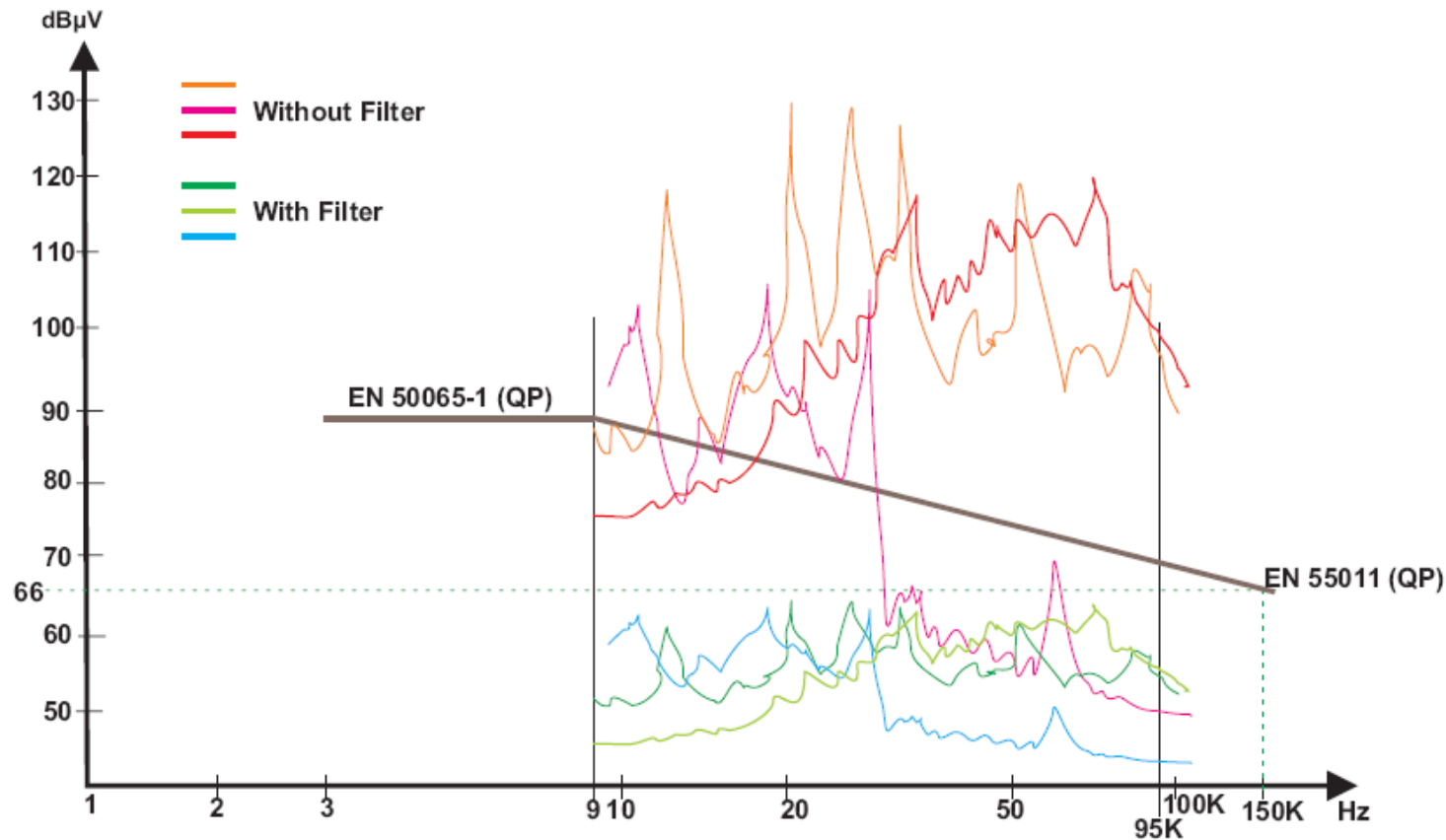
Induction plants 100-150KHz



EMI filters are available to prevent power line communication (PLC) signals in the Kilohertz range from entering the household wiring. Some types of PLC systems use low frequency signals, which are too close to the power frequency to filter out.

REGULATION EN 50065 CENELEC BAND A & 10KHz-150KHz

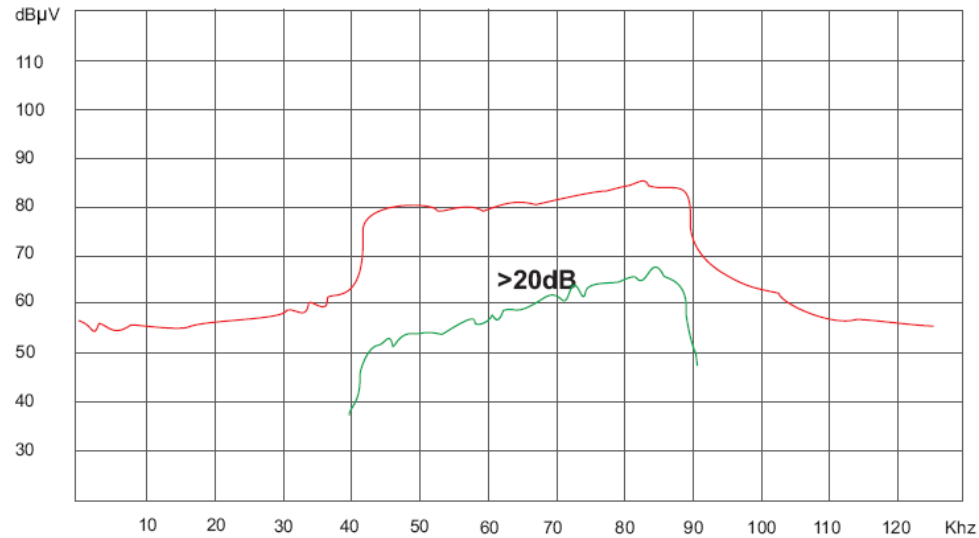
Basically the supply grids are only constructed for energy supply.
According to the telecommunication law the usable bandwidth is limited to the range from 3 to 148,5kHz (CENELEC –band).



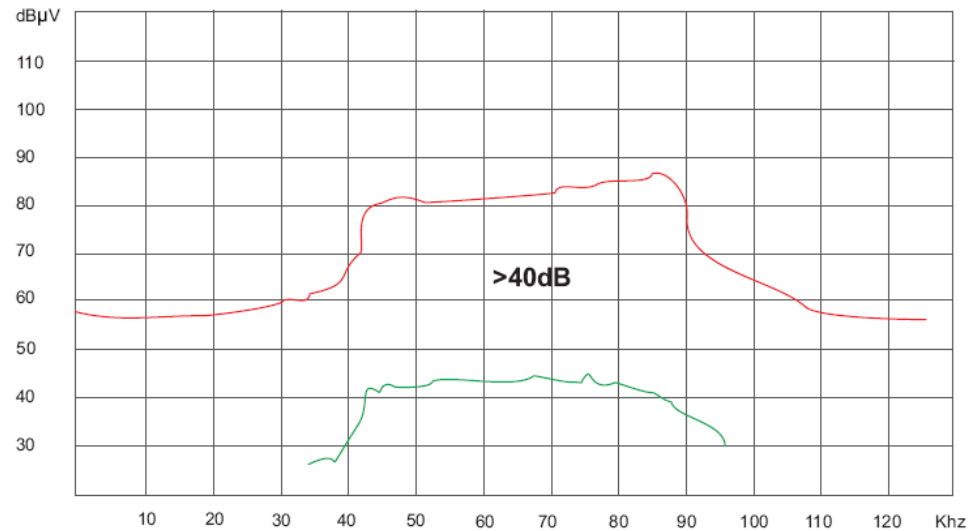
■ Noise level is below 60 dBμV
between 35KHz to 95KHz

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PERFORMANCE OF 30A FILTER



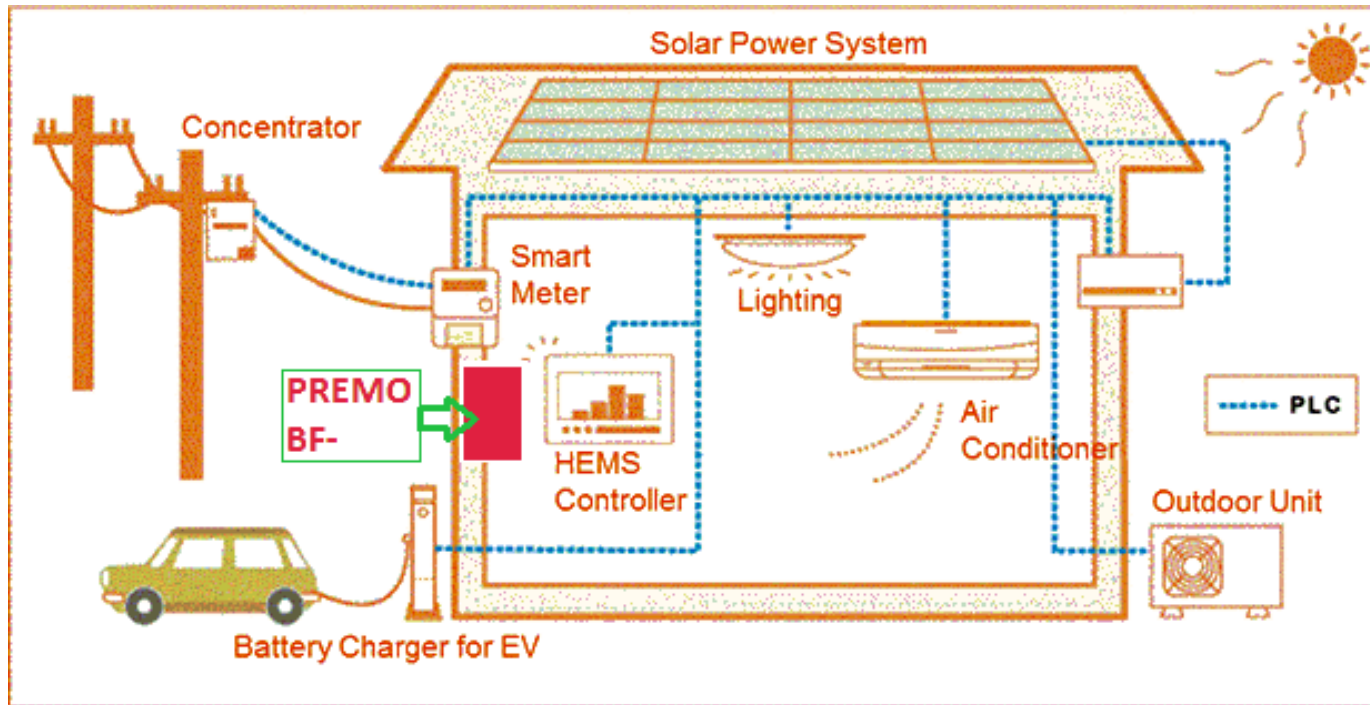
■ Attenuation level of BF-30-MM is
>20 dBμV between 35KHz to 95KHz



■ Attenuation level of BF-30 is
>40 dBμV between 35KHz to 95kHz

Without filter – Red Curve
With filter – Green curve

SMART METER WORKS WITH SOLAR SYSTEM



Suitable filters:

16A, 40A,
60A and 80A



Blocking filters-Standard version

Should be used in all smart meters designs to protect the environment

from electromagnetic pollution comes from the Solar inverter

■ Reduction of conducted EMI towards the Smart meters

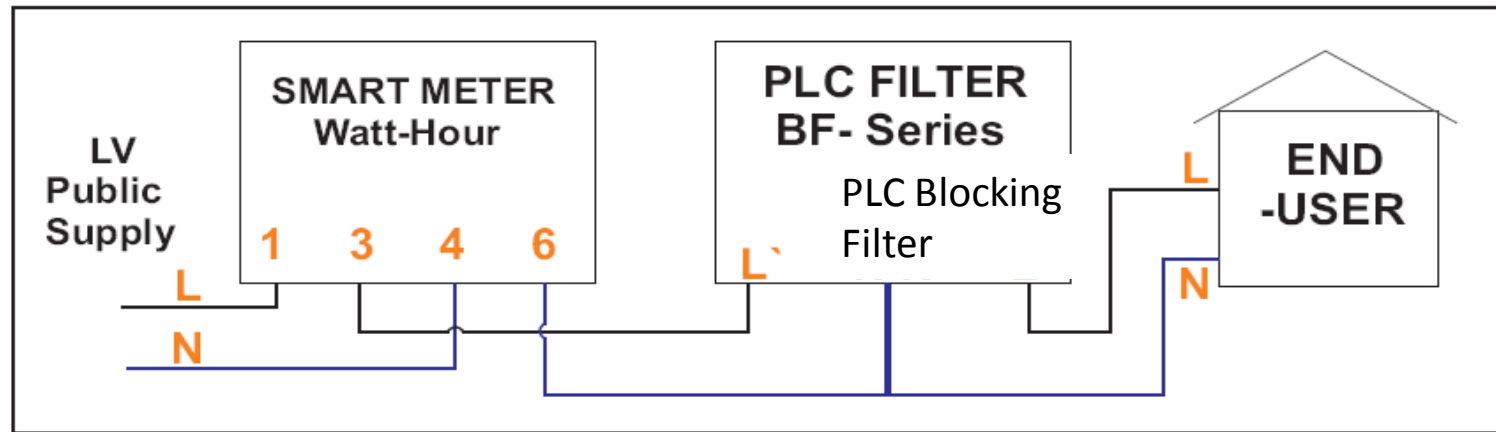
■ Support with CENELEC Band A according to EN 50065 regulations

■ Improvement of the reliability of nearby equipment

■ High attenuation below 150kHz

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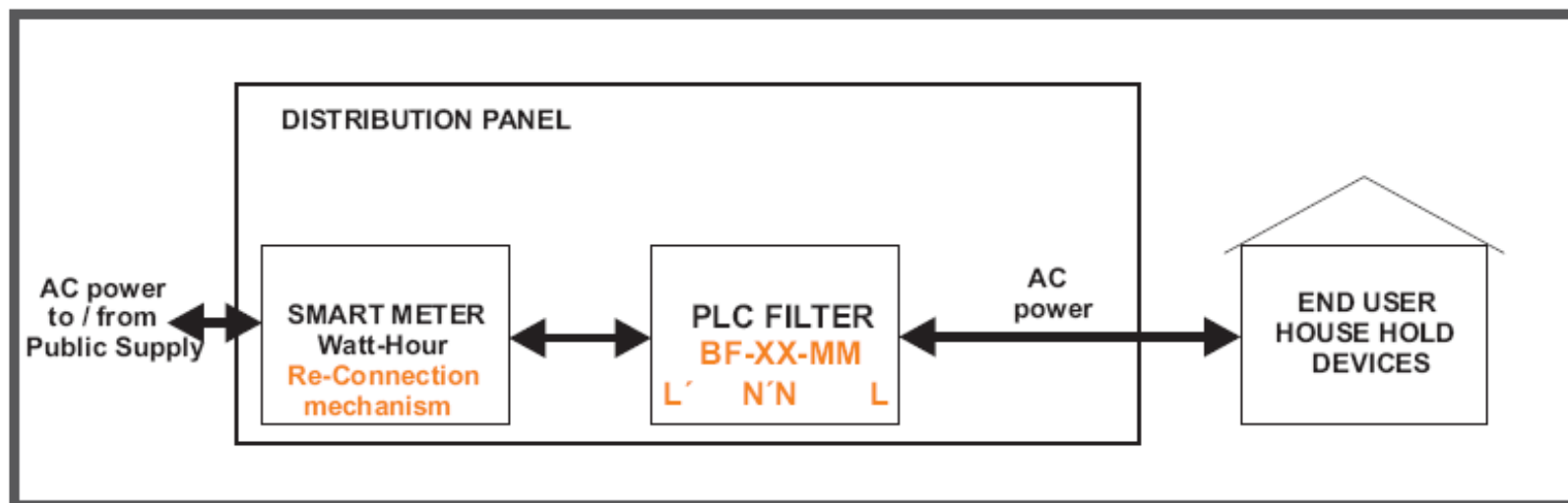
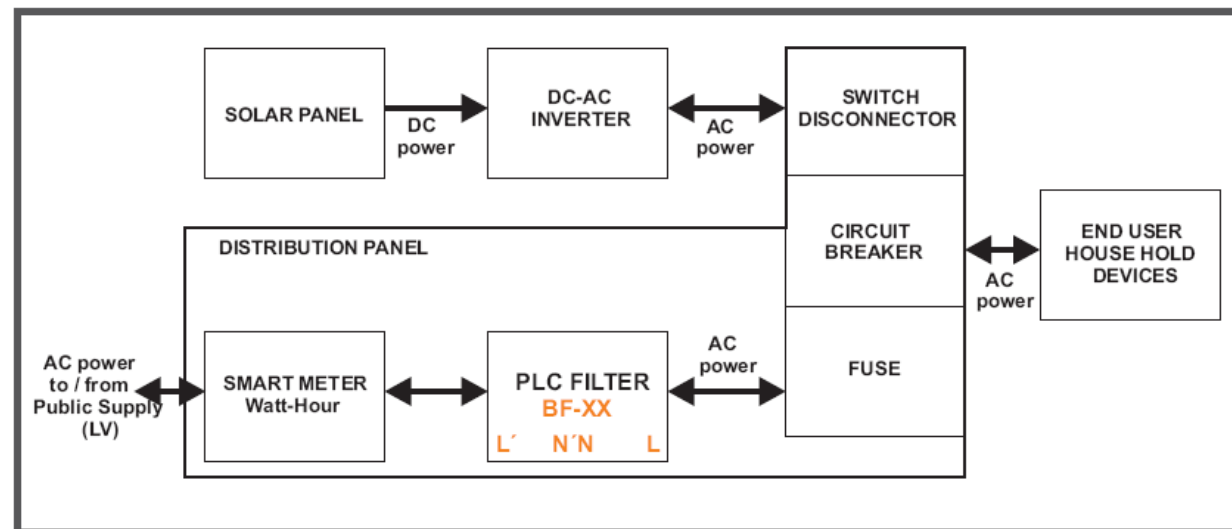
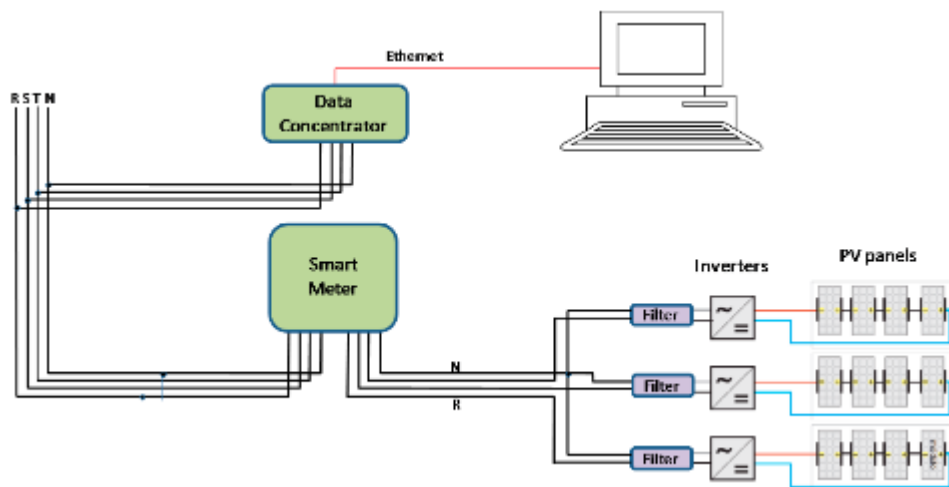
SMART METERS IN HOME APPLICATION



Blocking filters-Mechanism version should be used in all smart meter designs to protect the environment from electromagnetic pollution.

- It suppress interference coming from House-hold devices and as well as from Smart meters.
- Support with CENELEC Band A according to EN 50065 regulations
- Improvement of the reliability of nearby equipment
- It Supports on smart meter with re-Connection mechanism.
- Good attenuation from 35KHz to 90KHz with Smart meters which comply with PLC G3 & PRIME technology

DETAILED BLOCK DIAGRAM OF SMART METERS WITH PV INVERTER AND RECONNECTION MECHNISM AT BUILDING/HOME



LOW & HIGH CURRENT MODELS



Filters with Neutral :

07A

16A



Filter with Neutral : -65A

Filter without Neutral : 60A-
SP



Filter with Neutral : 80A

Filter without Neutral : 80A-
SP

MID & HIGH CURRENT MODELS



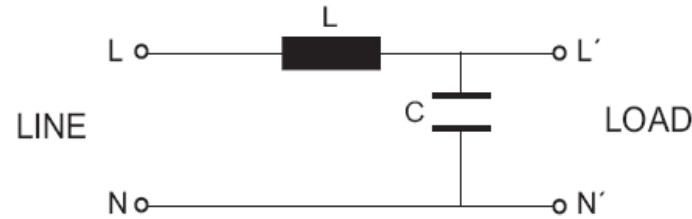
Filters with Neutral :

40A

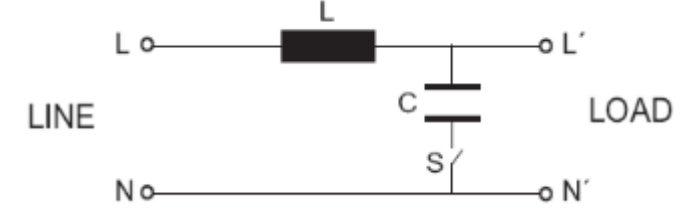


Filter three-phase & neutral: 40A-3PHN

250VAC, 20, 30, 40 & 60A , @50/60Hz



BF: Support without re-Connection mechanism Smart Meters



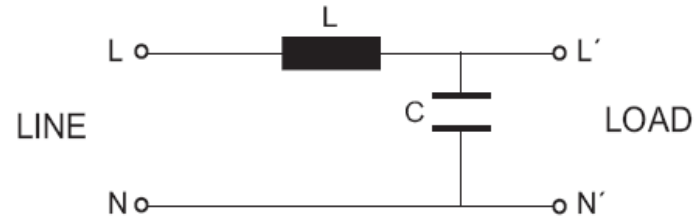
BF: Support Re-Connection mechanism Smart Meters

Rated Current (A) @ 40°C	Terminal L & L'	Terminal N + N'	Effective dimensions		
			Length	Width	Height
20	25 mm ²	35 mm ²	180	75	80,5
30	25 mm ²	35 mm ²	180	75	80,5
40	25 mm ²	35 mm ²	180	75	80,5

- Compact size
- Less price
- Safe terminal with double -screws connection
- DIN-Rail or Panel -mounting option

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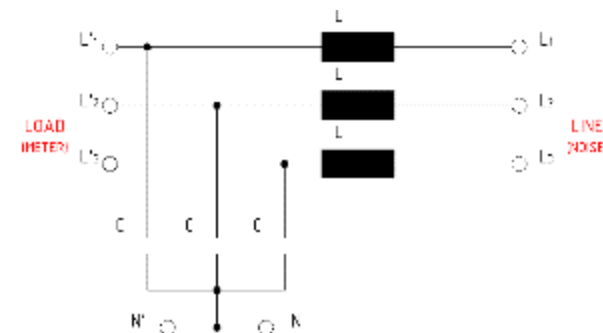
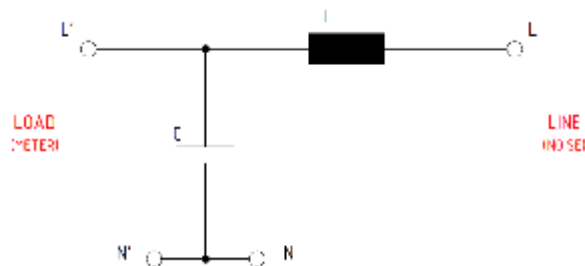
250VAC, 40, 65 & 80A , @50/60Hz



Rated Current (A)	Terminal L & L'	Terminal N & N'	Effective dimensions		
			Length	Width	Height
40	25 mm ²	25 mm ²	180	90	70
65	35 mm ²	35 mm ²	180	90	70
65	35 mm ²	35 mm ²	160	90	78,5
80	25 mm ²	25 mm ²	180	75	80,5

- Compact size
- Less price
- Safe terminal with double-screws connection
- DIN-Rail or Panel-mounting option

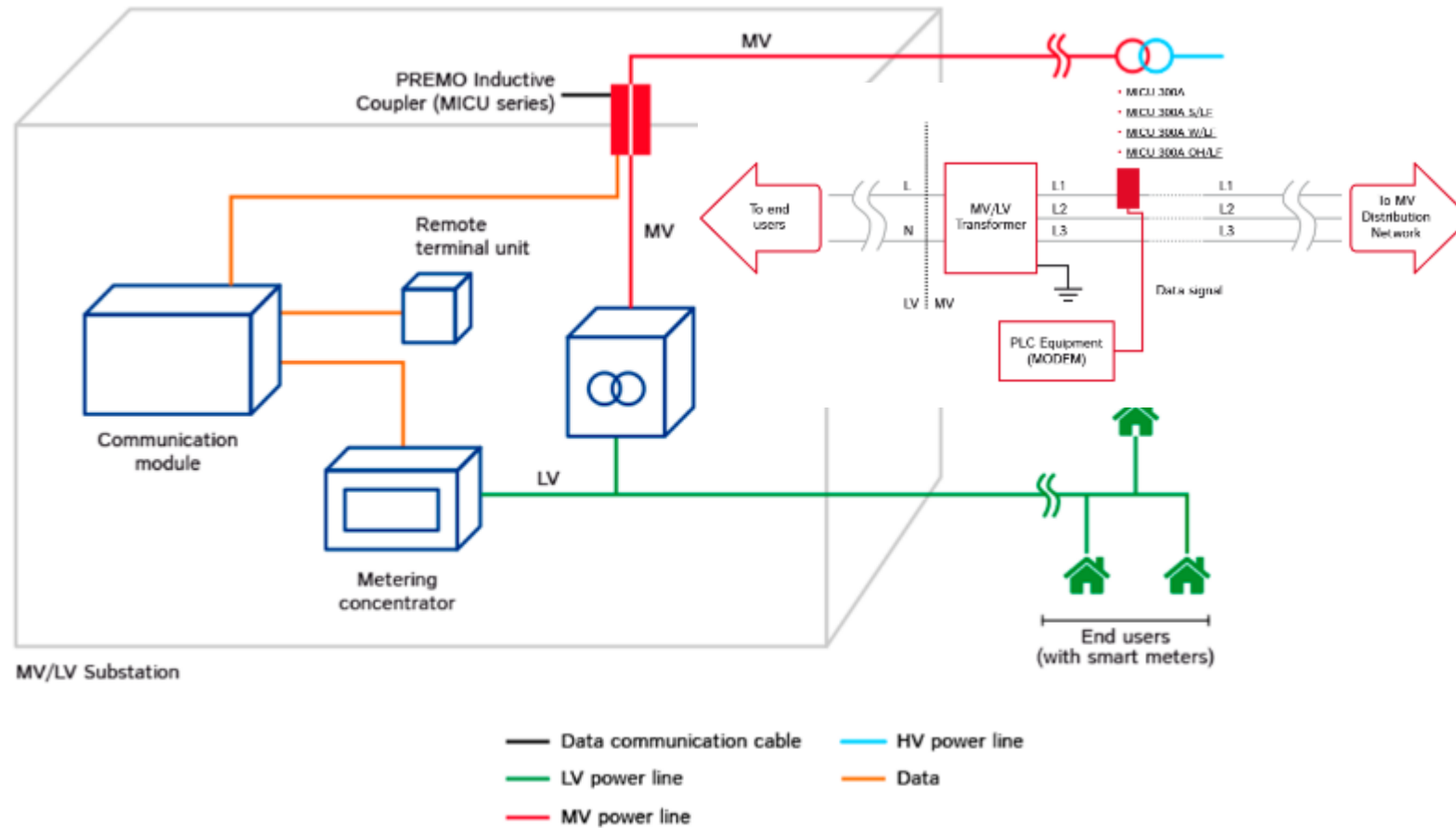
250/380VAC, 40/80A , @50/60Hz



Rated Current (A)	Terminal L & L'	Terminal N & N'	Effective dimensions		
			Length	Width	Height
40	25 mm ²	25 mm ²	100	100	75,5
65	70 mm ²	70 mm ²	250	150	93,5

- Compact size
- Less price
- Safe terminal with double -screws connection
- DIN-Rail or Panel -mounting option

Inductive coupler in MV Network



Inductive Couplers for Smart Meters and other applications



Rated Current	Frequency Range	Inner Diameter (mm)	Height (mm)	Width (mm)	Water Resistance	Insulation Level
300A	2/40MHz	44	90	97	-	5kV
300A	30/500kHz	50	117.4	106	IP65	4.7kV
300A	30/500kHz	50	117.4	106	IP67	4.7kV
300A	30/500kHz	40	180	106	IP65	24kV

Thanks for your attention

Please visit our stand and our demo

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