DUCATI energia

HISTORY DRIVES THE FUTURE

Since 1926

**Low-voltage power factor correction:
capacitors, components, fixed and automatic
equipment and active harmonic filters**

INDEX

DUCATI energia

HISTORY DRIVES THE FUTURE

DUCATI Energia

DESIGNS — PRODUCE — TESTS

CAPACITORS

REACTORS

IN HOUSE

POWER FACTOR CONTROLLERS

PFC EQUIPMENT

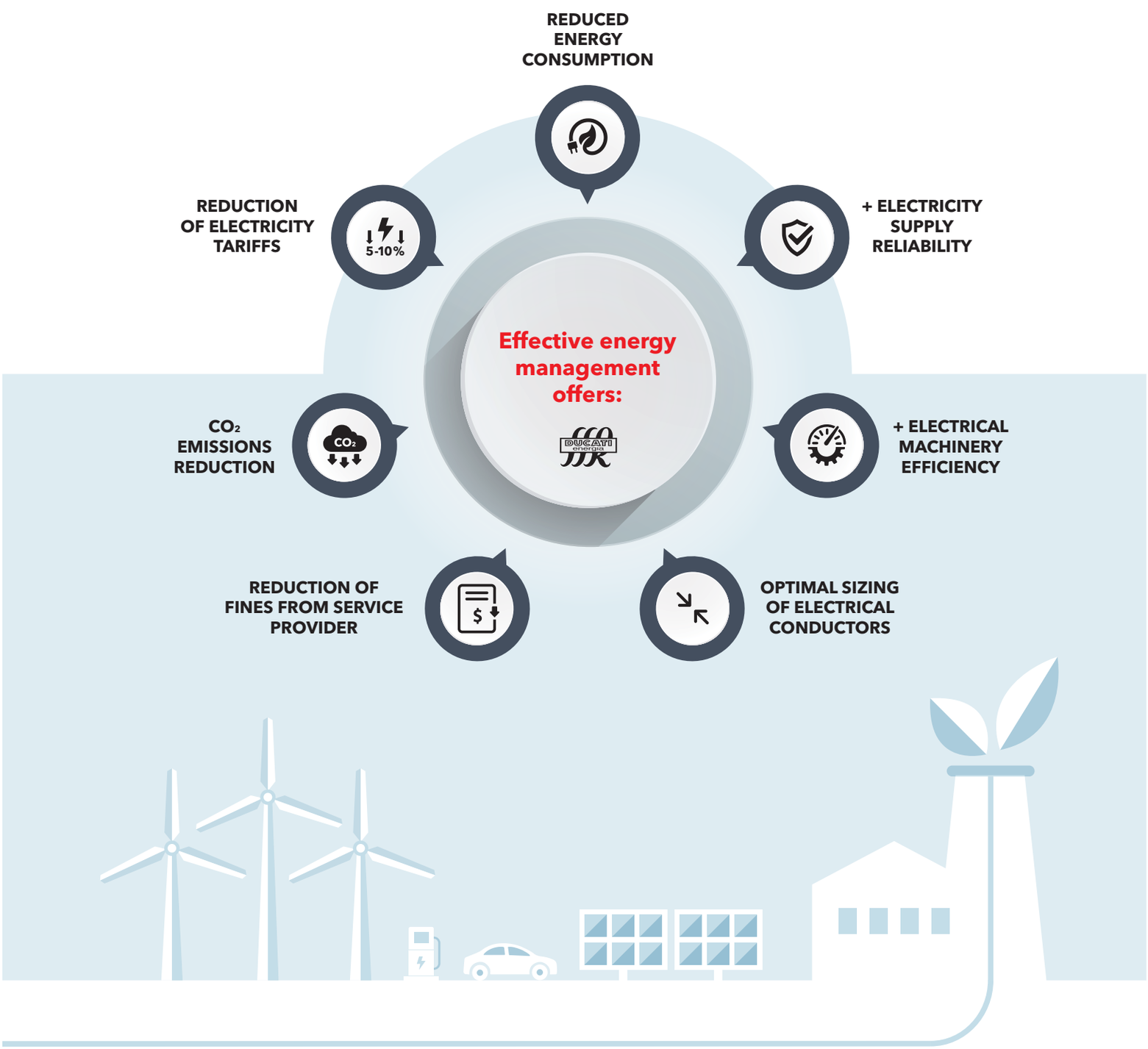
REACTIVE ENERGY MANAGEMENT

DUCATI Energia designs, manufactures and tests **power factor correction** components and equipments used to **optimize the efficiency and quality of electrical power** for several industrial and commercial applications.

Reactive energy can cause inefficiencies in the transmission and distribution of electricity if it is not managed properly.

Power Factor Correction is a process that decreases unnecessary inductive currents in electrical loads, lightening the load on the overall power grid, from generation to distribution.

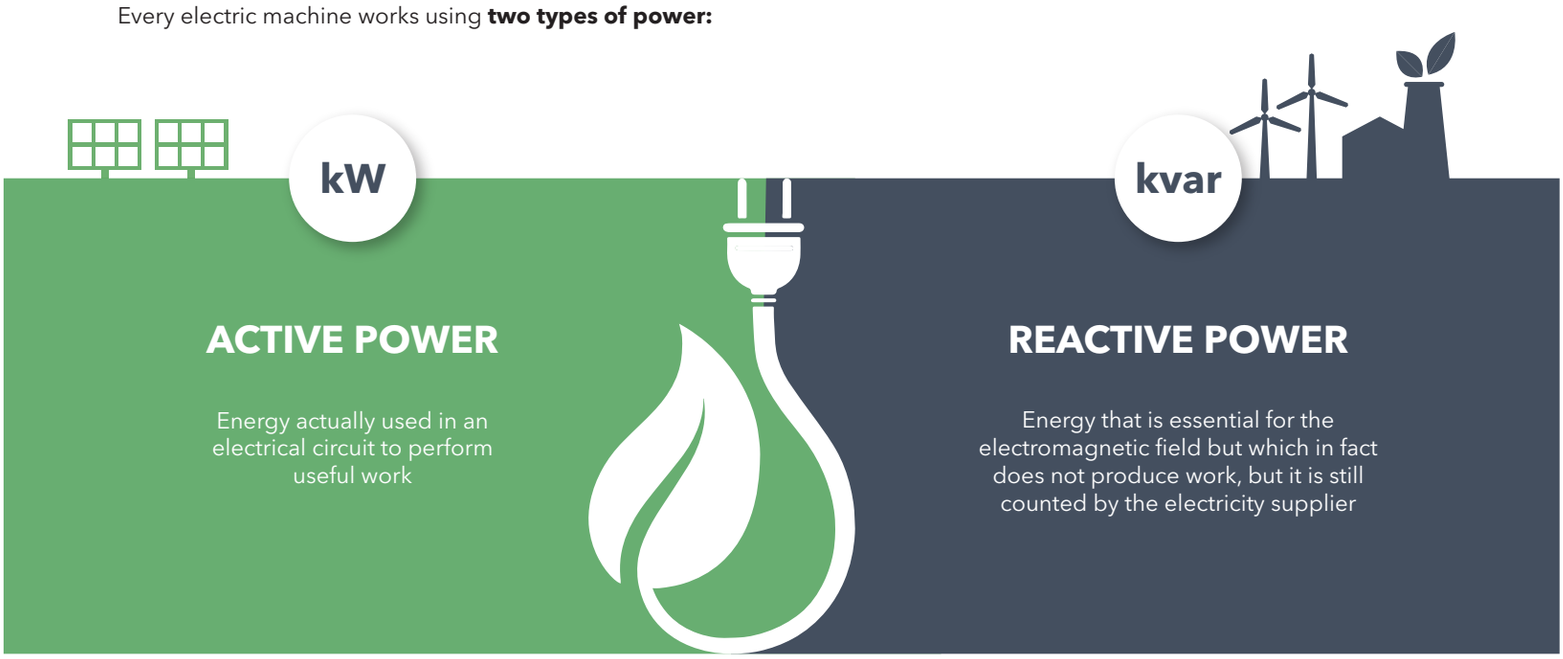
This process is crucial to improve the **energy efficiency** of the user's electrical system and the entire grid.



POWER FACTOR CORRECTION

Reactive energy management is the process of optimizing the efficiency of the electrical system by correcting the power factor.

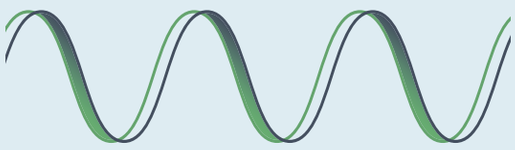
Every electric machine works using **two types of power:**



Before
Power Factor Correction

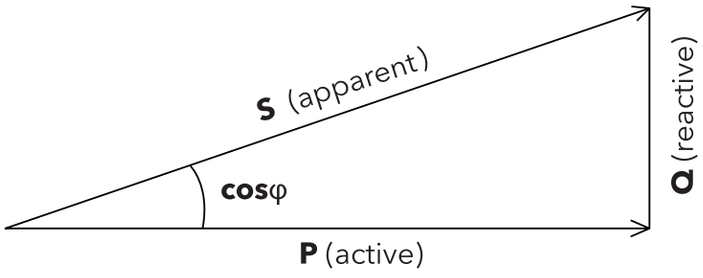
Lag between voltage and current creates waste

With
Power Factor Correction



Wasteful lag is reduced to increase energy

Voltage Current Waste



Without Power Factor Correction system:

- **the management of the electrical system will be more complicated**, forcing the oversize of transformers, cables, and other components due to **increased heating and voltage drops**
- **Installation costs increase**
- **force utilities to increase the capacity of transmission and distribution grids**
- risk increasing of **voltage drops and fluctuations along distribution lines**

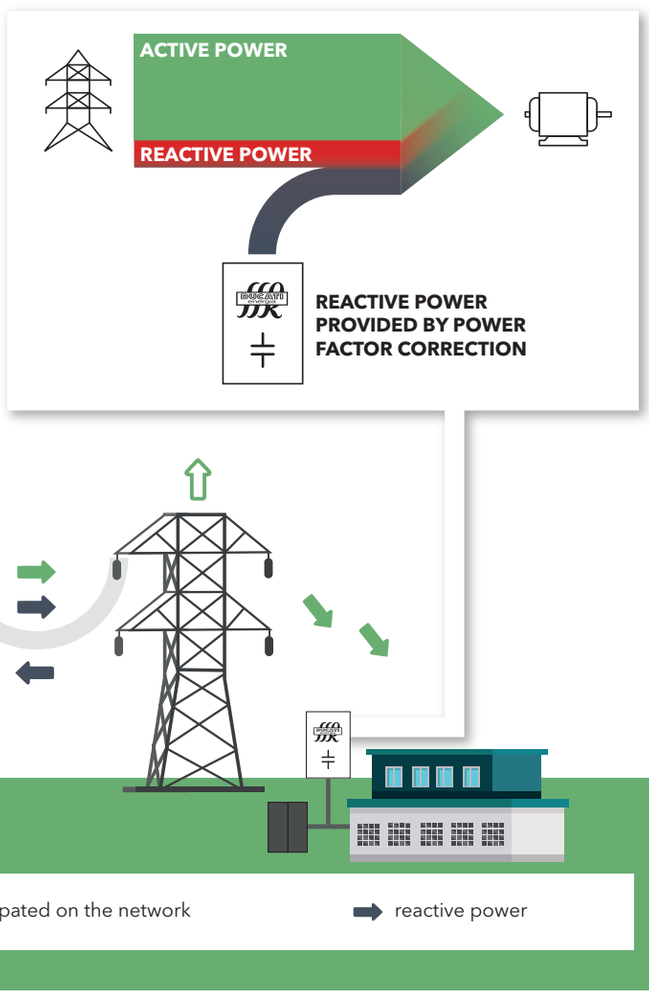
Power Factor Correction emerges as a strategic solution to these problems.

It aims to improve the power factor of a load, effectively reducing the current in the grid by a given amount of active power (kW). The **POWER FACTOR CORRECTION** process decreases the reactive power consumed by the load in a specific grid segment, ideally neutralizing it to reach a power factor (cosφ) of 1.00.

The power factor correction systems proposed by DUCATI energia are an economical and effective solution for energy saving and offer clear advantages to both energy suppliers and companies.

The installation of Power Factor Correction:

- ensures a **more effective use of electricity by reducing** unnecessary **power dissipation**
- **reduces losses caused by the Joule effect** in cables and power transmission system components
- **mitigates undesirable effects associated with load currents** in motors and transformers
- can **reduce the resonance hazard and the resulting current distortions**



DUCATI ENERGIA

About us, quality, services

DUCATI, founded in 1926 by Ducati brothers, has been among the first in the world to start industrial production of capacitors, and has been a market leader ever since.

Since its foundation, DUCATI Energia has always been in the forefront of technical and industrial development, leading the research shaping today's technology and cooperating to the upgrades and improvements leading to the current IEC and EN Standards for Capacitors.

DUCATI Energia firstly introduced the Metallized Polypropylene Film technology and its innovative PPM and PPMh film set the reference for this technology, outclassing the obsolete paper/oil and gas technology in terms of superior performance and reduced dimensions.

DUCATI Energia Group main fields of activities are:

- Motor Lighting Capacitors
- Power Electronics Capacitors
- Capacitors and Industrial Power Factor Correction Systems (LV and MV)
- Alternators and Ignition Systems
- Electrical Vehicles and Charging Stations for Electrical Vehicles
- Energy Analyzers
- Control Systems for energy grids
- Railway Signaling systems
- Ticketing and Transport Automation systems

Quality

Utmost attention to product quality and customer service are constants in DUCATI's history and the main factors contributing to its success worldwide.

DUCATI has always been one of the first companies in its field, in Italy and in Europe, to adopt the most modern standards and procedures in order to assure the highest level of product quality and reliability.

The QUALITY SYSTEM of DUCATI Energia SpA, capacitor division, as described in the Quality Manual, was one of the first in Italy to be approved by the BSI in accordance with ISO 9002 (EN 29002) procedures: Certificate of Registration N. FM22004. DUCATI Energia is fully certified following ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, ISO 27001: 2013, ISO 37001:2016, ISO 50001: 2018 and the SA8000: 2014.

All this has been achieved thanks to fully automated and integrated production processes, completely new and innovative machines, production process control methods based on accurate specifications and the assigning of responsibility to operators at all levels.

Capacitors, systems and relays comply with the requirements set forth in EC Directives 2014/35 ("Low Voltage Directive"), when applicable.

Nearly all models are certified by international institutes and all are manufactured in full compliance with the requirements of said standards.

Services

In the design and choice of industrial PFC equipment, experience and expertise are the main factors that can make a difference. DUCATI Energia guides you all along the process, from the choice of the most suitable PFC system to the commissioning, maintenance and management of the same unit.

A team of experts is dedicated to the design: any prerogative of the equipment is analyzed to obtain the most efficient solution based on the operating condition and the needs of the overall system.

The analysis of the field conditions sometime is essential for the choice of the best equipment to be installed; DUCATI offers the service of analysis measurement by using the most advanced tools on the market.

The after sales service is essential to help the customer in the proper installation of various units. A dedicated number that provides service that will guide the customer in the setting of the various parameters and help you solve small problems that normally can occur when starting the equipment. The best results are obtained by combining the experience gained over the years with deep knowledge of the technologies used. In one word, DUCATI.

Quality Management System
ISO 9001:2015

Environmental Management System
ISO 14001:2018

Energy Management System
ISO 50001:2018

Occupational Health and Safety Management System
ISO 45001:2018

Information Security Management
ISO 27001:2013

Information Security Management
ISO 37001:2016

SA8000:2014

CAPACITORS


DUCATI
energia
PPM 416.53.2360
123.1 µF-5+10%
Qn 6.66 kVar
Un 415Vac 60 Hz
IEC 831 - 1/2 (96)
DUCATI
energia
PPM 416.53.4100
19.3 µF-5+10%
Qn 1.67 kVar
Un 525 Vac 50 Hz
IEC 831 - 1/2 (96)
Made in Europe

TECHNOLOGY

Capacitors' technology

DUCATI was the first company in Italy, and among the first in the world, to introduce capacitors for the radio broadcasting equipment designed by Guglielmo Marconi.

Building upon this tradition, which has always seen DUCATI in the forefront of capacitor technology, the company has developed the innovative PPM and PPMh film with 4In capacitor.

Superior performance and reduced dimensions compared to the by now obsolete paper and oil and gas solutions make PPM/PPMh capacitors the new standard of reference for industrial power factor correction systems.

All the capacitors manufactured by DUCATI Energia feature a protection device conforming to standards EN 60831-1/2. This protection has been achieved by means of a special engineering technology: if a fault occurs the connections will be broken due to overpressure, leaving the insulation of the case intact and preventing the capacitor from exploding or burning.

Technology Long Life 4In

The Continuous research conducted in DUCATI Energia laboratories has led to the development of a polypropylene film with a special metallization, whose purpose is to promote the self-healing process and reduce dielectric losses.

Thanks to this innovative metallization treatment, the polypropylene is subjected to less stress during operation. As a result, it maintains its dielectric properties for a significantly longer period of time, while ensuring a significant improvement in performance in terms of both 4In voltage and current.

The above-described characteristics make these capacitors especially suitable for Continuous duty under highly demanding conditions in harmonic rich environments.

The Long Life 4In series of single-phase industrial power factor correction capacitors, with PPMh film wound elements, are the best in terms of reliability, performance and reduced size.

THREE-PHASE CAPACITORS

Metallized polypropylene technology (PPM / MKP) utilizes a vacuum evaporation technique to deposit an extremely thin layer of metal on one side of the polypropylene film.

The capacitor elements built using this technology are obtained by winding two polypropylene films. The capacitor plates consist in the metallized surface of the two films and the dielectric is the propylene film itself. Three elements are then housed in a plastic container which, together with the impregnating agents, assures dual insulation between the wound cores and metal enclosure. The main advantage of metallized film capacitors is their self-healing capability. This means that they are capable of restoring their electrical properties following the occurrence of a short circuit between the plates. In these capacitors the impregnating agent is a special type of resin. DUCATI Energia has developed an eco-friendly resin composition displaying high dielectric stability, which completely eliminates every possible risk of air and water molecules being present inside the capacitor.

The capacitors which use this kind of technology are:

- Three-phase capacitors STANDARD DUTY **MODULO SD** series
- Three-phase capacitors EXTRA DUTY **MODULO XD** series
- Three-phase capacitors EXTRA DUTY **MODULO XD MINI** series
- Three-phase capacitors F50 **MONO Long Life 4In** series

For further information about the usage of the capacitors, please check the **reference notes** and the installation notes on page **28**.

Single-phase capacitors

	Technology	Reactive Power (kVAr)	Voltage
MONO	4 In	1.67 - 8.33	400 - 525
MONO PLUS	4 In	1.67 - 6.66	400 - 525
FLOPPY CAP	Standard duty	1.67 - 4.17	400 - 550

Three-phase capacitors

	Technology	Reactive Power (kVAr)	Voltage
MODULO SD	Standard Duty	10 - 50	400 - 550
MODULO XD	Extra Duty	1.5 - 50	240 - 800
MODULO XD MINI	Extra Duty	0.5 - 10	400 - 550
F50	4 In	5 - 60	415 - 525

MONO Long Life 4In

Single-phase capacitors

The capacitors making up the series **MONO Long Life 4In** are manufactured using elements wound with the PPMh film and housed in metal cases with metal lids. The parts are assembled by crimping to ensure perfect airtightness of the system and efficient operation of the overpressure safety device.
The use of resin impregnation technology greatly enhances the capacitor's performance in terms of heat dissipation as well as ensuring a long life and excellent ground insulation.

General Characteristics

Power Range	1.67 – 8.33 kVAr
Voltage range	400 - 525 V
Rated frequency	50 Hz/60 Hz
Capacitance tolerance	-5 +10%
Duty	Continuous
Dielectric losses	≤ 0.2 W/kVAr
Expected life	≥ 110000h – 40/D
Max dV/dt	≤ 100 V /µs
Temperature class	-40/D
Maximum overload current	4 x In
Maximum inrush current	200 In
Terminals	Double faston 6.3x0.8/M6 screw for Q=8.33 kVar
Protection rating	IP 00
Discharge resistor	Not included. Available on request only for 400V systems only.
Impregnating material	Eco-friendly resin
Altitude	≤ 2000 m above s.l.
Test voltage (AC) between terminals	2.15 U_n x 2 s
Test voltage (AC) between terminals and case	3kV x 10 s
Standards	IEC 831 - 1/2
Approvals	c UL us * with modified PN 416.84

Un (V)	Qn (kVAr)	In (A)	Cn (µF)	DxH (mm)	Pcs x box	Part number 416.53
	1.67	4.2	33.2	45x115	40	**1100**
	2.5	6.3	49.8	50x115	28	**1150**
	3.33	8.3	66.3	50x150	28	**1200**
400	4.17	10.4	83	55x150	28	**1250**
	5	12.5	99.5	60x150	24	**1300**
	6.66	16.7	132.6	65x160	16	**1355**
	8.33	20.8	165.8	65x165	16	**1400**
	1.67	4	30.9	45x115	40	**2100**
	2.5	6	46.2	50x115	28	**2150**
	3.33	8	61.6	50x150	28	**2200**
415	4.17	10	77.1	55x150	28	**2250**
	5	12	92.5	60x150	24	**2300**
	6.66	16	123.2	65x160	16	**2355**
	8.33	20	154	65x165	16	**2400**
	1.67	3.7	26.3	45x115	40	**3100**
	2.5	5.6	39.3	50x115	28	**3150**
	3.33	7.4	52.4	50x150	28	**3200**
450	4.17	9.3	65.6	55x150	28	**3250**
	5	11.1	78.6	60x150	24	**3300**
	6.66	14.8	104.7	65x160	16	**3355**
	8.33	18.5	131	65x165	16	**3400**
	1.67	3.2	19.3	45x115	40	**4100**
	2.5	4.8	28.9	50x115	28	**4150**
	3.33	6.3	38.5	50x150	28	**4200**
525	4.17	7.9	48.2	55x150	28	**4250**
	5	9.5	57.8	60x150	24	**4300**
	6.66	12.7	77	65x160	16	**4355**
	8.33	15.9	96.2	65x165	16	**4400**

Box dimensions: 195x390x255 mm **Weight:** 9-11 kg

Terminal cover IP54		
Part n. 316.	**Diam. (mm)**	**Packages n. pcs. per box**
23.0860	45	100
23.1070	50	200
52.3350	55	72
52.3355	60	60
52.3360	65	60

To enable the overpressure protection device to operate efficiently, it is necessary to leave a gap of at least 30 mm above the element and to use flexible wires for the connection.

MONO Long Life Plus 4In

Single-phase capacitors

The capacitors making up the new **MONO Long Life Plus 4In** series are made using elements wound with the PPMh film and housed in metal cases with metal lids. The parts are assembled by crimping to ensure perfect airtightness of the system and efficient operation of the overpressure safety device.

The use of resin impregnation technology greatly enhances the capacitor's performance in terms of heat dissipation as well as ensuring a long life and excellent ground insulation.

These characteristics make these capacitors especially suitable for Continuous duty under highly demanding condition in harmonic rich environments.

General Characteristics

Power Range	1.67 – 6.66 kVAr
Voltage range	415 ÷ 525 V
Rated frequency	50 Hz/60 Hz
Capacitance tolerance	-5+10%
Duty	Continuous
Dielectric losses	≤ 0.2 W/kVAr
Expected life	≥ 130000h – 40/D
Max dV/dt	≤ 100 V /µs
Temperature class	-40/D
Maximum overload current	4 x In
Maximum inrush current	200 In
Terminals	Double faston 6.3x0.8
Protection rating	IP 00
Discharge resistor	Not included. Available on request only for 400V systems only.
Impregnating material	Eco-friendly resin
Altitude	≤ 2000 m above s.l.
Test voltage (AC) between terminals	2.15 U_n x 2 s
Test voltage (AC) between terminals and case	3kV x 10 s
Standards	IEC 831 - 1/2
Approvals	cULus * with modified PN 416.84

Un (V)	Qn (kVAr)	In (A)	Cn (µF)	DxH (mm)	Pcs x box	Part number 416.54
415	1.67	4	30.9	50x115	28	**2100**
	2.5	6	46.2	50x150	28	**2150**
	3.33	8	61.6	55x150	28	**2200**
	4.17	10	77.1	60x150	24	**2250**
	5	12	92.5	60x165	18	**2300**
	6.66	16	123.2	65x190	16	**2350**
450	1.67	3.7	26.3	50x115	28	**3100**
	2.5	5.6	39.3	50x150	28	**3150**
	3.33	7.4	52.4	55x150	28	**3200**
	4.17	9.3	65.6	60x150	24	**3250**
	5	11.1	78.6	60x165	18	**3300**
	6.66	18.8	104.7	65x190	16	**3350**
525	1.67	3.2	19.3	45x115	28	**4100**
	2.5	4.8	28.9	50x150	28	**4150**
	3.33	6.3	38.5	55x150	28	**4200**
	4.17	7.9	48.2	55x150	24	**4250**
	5	9.5	57.8	60x165	18	**4300**
	6.66	12.7	77	65x190	16	**4350**

Box dimensions: 195x390x255 mm **Weight:** 9 - 11 kg

Terminal cover IP54		
Part n. 316.	**Diam. (mm)**	**Packages n. pcs. per box**
23.0860	45	100
23.1070	50	200
52.3350	55	72
52.3355	60	60
52.3360	65	60

To enable the overpressure protection device to operate efficiently, it is necessary to leave a gap of at least 30 mm above the element and to use flexible wires for the connection.

FLOPPY CAP

Single-phase capacitors

The capacitors making up the **FLOPPY CAP** series are housed in metal cases. The lids are made of self-extinguishing plastic (Class V2 under the inflammability classification of standard UL 94). The capacitor is sealed closed by reading the case over the lid, a solution that guarantees perfect airtightness, which is necessary to ensure the efficiency of the over-pressure safety device.

The placement of an insulating container between the capacitor element and the metal case, combined with the embedding of the capacitor element in resin, makes the capacitor extremely safe from an electrical point of view (ground insulation) and insensitive to vibrations.

General Characteristics

Power Range	1.67 – 4.17 kVAr
Voltage range	230 ÷ 550 V
Rated frequency	50 Hz/60 Hz
Capacitance tolerance	-5+10%
Duty	Continuous
Dielectric losses	≤ 0.3 W/kVAr
Expected life	≥ 80000h – 40/D
Max dV/dt	≤ 25 V /µs
Temperature class	-40/D
Maximum overload current	4 x In
Maximum inrush current	100 In
Terminals	Double faston 6.3x0.8
Protection rating	IP 00
Discharge resistor	Not included. Available on request only for 400V systems only.
Impregnating material	Eco-friendly resin
Altitude	≤ 2000 m above s.l.
Test voltage (AC) between terminals	2.15 U_n x 2 s
Test voltage (AC) between terminals and case	3kV x 10 s
Standards	IEC 831 - 1/2
Approvals	(excluding 500-550 V models) c UL us (excluding Un >440 V models)

Un (V)	Qn (kVAr)	In (A)	Cn (µF)	DxH (mm)	Pcs x box	Part number 416.30	Dim. Box
230	0.83	3.6	50.2	45x122	25	**0764**	A
	1.67	5.2	100	60x137	25	**0564**	A
400	1.67	4.2	33.2	50x122	25	**3964**	B
	2.5	6.3	50	55x132	25	**4064**	A
	3.33	8.3	66.3	60x137	25	**3764**	A
	4.17	10.4	83	60x137	25	**5064**	A
415	1.67	4	30.9	50x122	25	**3264**	A
	2.5	6	46.2	55x132	25	**3464**	A
	3.33	8	61.6	60x137	25	**3664**	A
	4.17	10	77	60x137	25	**5264**	A
450	1.67	3.7	26.3	50x132	25	**6464**	A
	2.5	5.6	39.3	55x132	25	**6164**	A
	3.33	7.4	52.4	60x137	25	**6264**	A
	4.17	9.3	65.5	60x137	25	**5364**	A
500	1.67	3.3	21.3	50x132	25	**8664**	A
	2.5	5	31.8	55x132	25	**7664**	A
	3.33	6.6	42.4	60x137	25	**7964**	A
	4.17	8.3	53.1	60x137	25	**5664**	A
550	1.67	3	17.6	45x132	25	**8164**	B
	2.5	4.5	26.3	55x132	25	**7464**	A
	3.33	6.1	35.1	60x137	25	**7764**	A
	4.17	7.6	43.4	60x137	25	**8064**	A

Box dimensions: A= 195x390x255 mm. **B=** 195x390x200 mm.
Weight: 9 kg

Terminal cover IP54		
Part n. 316.	**Diam. (mm)**	**Packages n. pcs. per box**
23.0860	45	100
23.1070	50	200
52.3350	55	72
52.3355	60	60

To enable the overpressure protection device to operate efficiently, it is necessary to leave a gap of at least 20 mm above the element and to use flexible wires for the connection.

MODULO XD MINI

Three-phase capacitors

MODULO XD Mini - COMPACT PERFORMANCE capacitors integrate the excellent MODULO XD technology with an innovative mechanical construction, which has been optimized for the 0.5 - 10 kVAr in the 400 - 550 V power/voltage ranges.

Thanks to their mechanical construction and a particularly effective dry-resin impregnation process, **MODULO XD Mini** capacitors deliver excellent performance in a very compact package. The **faston connections**, the integrated discharge resistors and the **IP20 protection cover** simplify their installation and maintenance in every type of application.

General Characteristics

Power Range	0.5 ÷10 kVAr
Voltage range	400 ÷ 550 V
Rated frequency	50 Hz/60 Hz
Capacitance tolerance	-5 +10%
Duty	Continuous
Dielectric losses	≤ 0.2 W/kVAr
Expected life	≥ 150000h - 40/D
Max dV/dt	100 V /µs
Temperature class	-40/D
Maximum overload current	3 x In
Maximum inrush current	200 In
Terminals	Double faston 6.3x0.8
Protection rating	IP20 (with cover supplied)
Internal construction	Delta
Discharge resistor	Internal (50 V after 60'')
Impregnating material	Eco-friendly resin
Altitude	≤ 4000 m above s.l.
Storage Temperature	-40 +80 °C
Test voltage (AC) between terminals	2.15 U_n x 2''
Test voltage (AC) between terminals and case	3kV x 10 s (Un ≤ 660V)
Standards	IEC 831 - 1/2

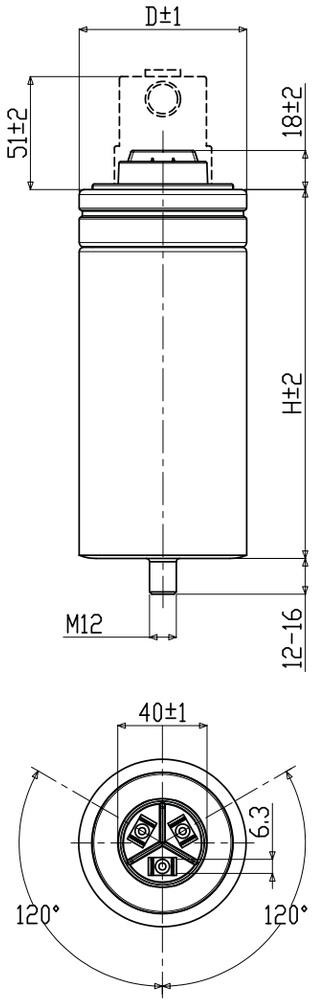
MODULO XD MINI

Un (V)	Qn (kVAr)	In (A)	Cn (µF)	DxH (mm)	Pcs x box	Part number 416.12.	Dim. Box
	0.5	0.7	3x3.3	50x150	21	**1010**	E
	1	1.4	3x6.6	50x150	21	**1020**	E
	1.5	2.2	3x9.9	50x150	21	**1040**	E
400	2.5	3.6	3x16.6	60x150	18	**1060**	E
	5	7.2	3x33.2	75x175	6	**1130**	D
	7.5	10.8	3x49.7	75x265	6	**1150**	D
	10	14.4	3x66.3	75x265	6	**1170**	D
	0.5	0.7	3x3.1	50x150	21	**2010**	E
	1	1.4	3x6.2	50x150	21	**2020**	E
	1.5	2.1	3x9.2	50x150	21	**2040**	E
415	2.5	3.5	3x15.4	60x150	18	**2060**	E
	5	7	3x30.8	75x175	6	**2130**	D
	7.5	10.4	3x46.2	75x265	6	**2150**	D
	10	13.9	3x61.6	75x265	6	**2170**	D
	0.5	0.7	3x2.7	50x150	21	**3010**	E
	1	1.3	3x5.5	50x150	21	**3020**	E
	1.5	2.0	3x8.2	50x150	21	**3040**	E
440	2.5	3.3	3x13.7	60x150	18	**3060**	E
	5	6.6	3x27.4	75x175	6	**3130**	D
	7.5	9.8	3x41.1	75x265	6	**3150**	D
	10	13.1	3x54.8	75x265	6	**3170**	D
	0.5	0.6	3x2.6	50x150	21	**4010**	E
	1	1.3	3x5.2	50x150	21	**4020**	E
	1.5	1.9	3x7.9	50x150	21	**4040**	E
450	2.5	3.2	3x13.1	60x150	18	**4060**	E
	5	6.4	3x26.2	75x175	6	**4130**	D
	7.5	9.6	3x39.3	75x265	6	**4150**	D
	10	12.8	3x52.4	75x265	6	**4170**	D
	0.5	0.6	3x1.9	50x150	21	**5010**	E
	1	1.3	3x3.8	50x150	21	**5020**	E
	1.5	1.9	3x5.8	50x150	21	**5040**	E
525	2.5	3.2	3x9.6	60x150	18	**5060**	E
	5	6.4	3x19.2	75x175	6	**5130**	D
	7.5	9.6	3x28.9	75x265	6	**5150**	D
	10	12.8	3x38.5	75x265	6	**5170**	D
	0.5	0.6	3x1.7	50x150	21	**6010**	E
	1	1.3	3x3.5	50x150	21	**6020**	E
	1.5	1.9	3x5.3	50x150	21	**6040**	E
550	2.5	3.2	3x8.8	60x150	18	**6060**	E
	5	6.4	3x17.5	75x175	6	**6130**	D
	7.5	9.6	3x26.3	75x265	6	**6150**	D
	10	12.8	3x35.1	75x265	6	**6170**	D

Standard box dimensions: E= 195x390x255 mm **D=** 195x290x330 mm

To enable the overpressure protection device to operate efficiently, it is necessary to leave a gap of at least 30 mm above the element and to use flexible wires for the connection.

TECHNICAL DRAWING



Stud	Fixing torque
M12	11 Nm

MODULO SD - Standard Duty

Three-phase capacitors

MODULO SD series capacitors are used for the fixed and automatic power factor correction systems in a wide range of standard industrial applications.

The **three delta-connected elements** are housed in a plastic container which, together with the impregnating agents, assures **dual insulation** between the wound cores and metal enclosure.

In order to guarantee perfect filling during the resin impregnation process, the process itself is carried out before the elements are placed in the enclosure, allowing a complete visual and dimensional control of the distribution and uniformity of the impregnation. The **overpressure protection system** is specially dimensioned so as to constantly ensure **maximum safety** in terms of ground protection and protection against the risk of arcing, even in conditions of **high energy density**.

General Characteristics

Power Range	10 – 50 kVAr
Voltage range	400 ÷ 550 V
Rated frequency	50 Hz/60 Hz
Capacitance tolerance	-5 +10%
Duty	Continuous
Dielectric losses	≤ 0.2 W/kVAr
Expected life	≥ 130000h – 40/D
Max dV/dt	100 V /µs
Temperature class	-40/D
Maximum overload current	4 x In
Maximum inrush current	200 In
Terminals	Screw clamp
Protection rating	IP 20 (IP54 on request)
Internal construction	Delta
Discharge resistor	External (50 V after 60 s)
Impregnating material	Eco-friendly resin
Altitude	≤ 4000 m above s.l.
Storage Temperature	-40 +80 °C
Test voltage (AC) between terminals	2.15 U_n x 2"
Test voltage (AC) between terminals and case	3kV x 10 s (Un ≤ 660V)
Standards	IEC 831 - 1/2
Approvals	c UL us Excluding Ø 125 mm

MODULO SD

Un (V)	Qn (kVAr)	In (A)	C (µF)	DxH (mm)	Type	Pcs x box	Part number 416.46	Dim. Box
400	10	14.4	3x66	75x255	A	6	**9100**	D
	12.5	18.0	3x82	75x255	A	6	**9110**	D
	15	21.7	3x99	85x255	A	6	**9120**	D
	20	28.9	3x132	90x255	A	6	**9130**	D
	25	36.1	3x165	100x255	A	6	**9140**	G
	30	43.3	3x198	116x255	A	4	**9150**	H
	40	57.7	3x265	116x290	A	4	**9160**	H
	50	72.2	3x331	125x290	B	4	**9170**	H
415	10	13.9	3x61	75x255	A	6	**9200**	D
	12.5	17.4	3x77	75x255	A	6	**9210**	D
	15	20.9	3x92	85x255	A	6	**9220**	D
	20	27.8	3x123	90x255	A	6	**9230**	D
	25	34.8	3x154	100x255	A	6	**9240**	G
	30	41.7	3x184	116x255	A	4	**9250**	H
	40	55.6	3x246	116x290	A	4	**9260**	H
	50	69.6	3x308	125x290	B	4	**9270**	H
440	10	13.1	3x54	75x255	A	6	**9300**	D
	12.5	16.4	3x68	75x255	A	6	**9310**	D
	15	19.7	3x82	85x255	A	6	**9320**	D
	20	26.2	3x109	90x255	A	6	**9330**	D
	25	32.8	3x137	100x255	A	6	**9340**	G
	30	39.4	3x164	116x255	A	4	**9350**	H
	40	52.5	3x219	116x290	A	4	**9360**	H
	50	65.6	3x274	116x370	A	4	**9370**	I
450	10	12.8	3x52	75x255	A	6	**9400**	D
	12.5	16.0	3x65	75x255	A	6	**9410**	D
	15	19.2	3x78	85x255	A	6	**9420**	D
	20	25.7	3x104	90x255	A	6	**9430**	D
	25	32.1	3x130	100x255	A	6	**9440**	G
	30	38.5	3x157	116x255	A	4	**9450**	H
	40	51.3	3x209	116x290	A	4	**9460**	H
	50	64.2	3x261	116x370	A	4	**9470**	I

Standard box dimensions: D= 195x290x330 mm **G=** 225x345x330 mm **H=** 275x275x385 mm
I= 275x275x455 **mm**
Weight: 10÷12 kg

60 Hz models available on request

MODULO SD

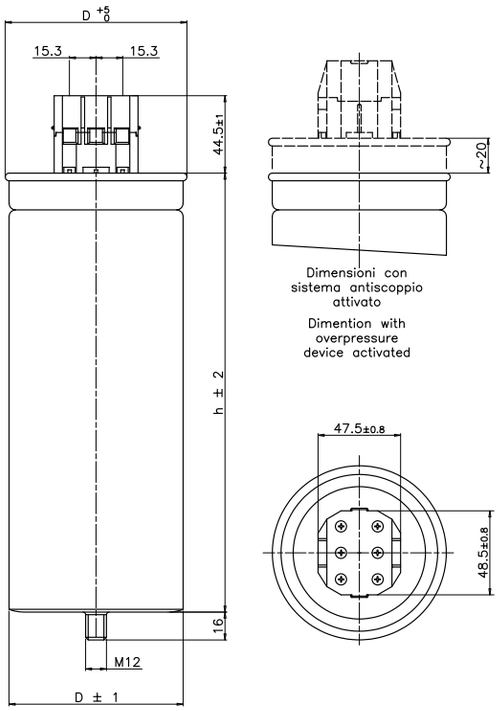
Un (V)	Qn (kVAr)	In (A)	C (µF)	DxH (mm)	Type	Pcs x box	Part number 416.46	Dim. Box
500	10	11.5	3x42	75x255	A	6	**9500**	D
	12.5	14.4	3x53	75x255	A	6	**9510**	D
	15	17.3	3x63	85x255	A	6	**9520**	D
	20	23.1	3x84	90x255	A	6	**9530**	D
	25	28.9	3x106	100x255	A	6	**9540**	G
	30	34.6	3x127	116x255	A	4	**9550**	H
	40	46.2	3x169	116x290	A	4	**9560**	H
	50	57.7	3x212	116x370	A	4	**9570**	I
525	10	11.0	3x38	75x255	A	6	**9600**	D
	12.5	13.7	3x48	75x255	A	6	**9610**	D
	15	16.5	3x57	85x255	A	6	**9620**	D
	20	22.0	3x76	90x255	A	6	**9630**	D
	25	27.5	3x96	100x255	A	6	**9640**	G
	30	33.0	3x115	116x255	A	4	**9650**	H
	40	44.0	3x153	116x290	A	4	**9660**	H
	50	55.0	3x192	116x370	A	4	**9670**	I
550	10	10.5	3x35	75x255	A	6	**9700**	D
	12.5	13.1	3x43	75x255	A	6	**9710**	D
	15	15.7	3x52	85x255	A	6	**9720**	D
	20	21.0	3x70	100x255	A	6	**9730**	D
	25	26.2	3x87	116x255	A	4	**9740**	H
	30	31.5	3x105	116x255	A	4	**9750**	H
	40	42.0	3x140	116x290	A	4	**9760**	H
	50	52.5	3x175	116x370	A	4	**9770**	I

Standard box dimensions: D= 195x290x330 mm **G=** 225x345x330 mm **H=** 275x275x385 mm **I=** 275x275x455 **mm**
Weight: 10÷12 kg

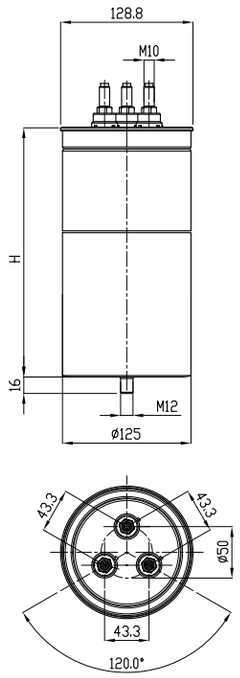
60 Hz models available on request

MODULO SD

TECHNICAL DRAWING TYPE A



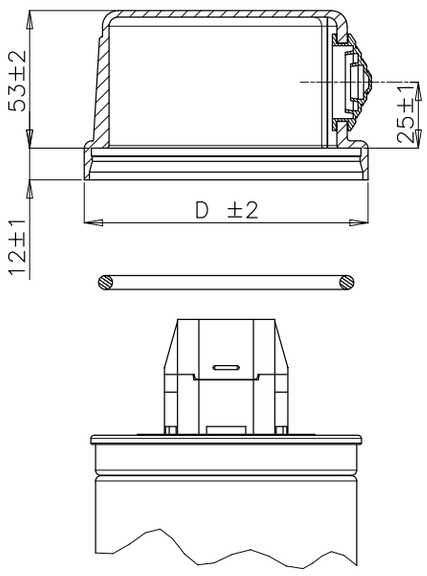
TECHNICAL DRAWING TYPE B



Terminals and stud	Fixing torque
Screw terminals	1.5 Nm
M10**	6 Nm**
M12	10 Nm

(**) Complete the tightening using two wrenches.

TERMINAL COVER IP54



Part n. 316.52	Diam (mm)	Packages n. pcs. per box
.3338	85	30
.3339	90	30
.3340	110	30
.3341	116	20
.3342	125	20

To enable the overpressure protection device to operate efficiently, it is necessary to leave a gap of at least 30 mm above the element and to use flexible wires for the connection.

MODULO XD - Extra Duty

Three-phase capacitors

MODULO XD series capacitors are used for the fixed and automatic power factor correction systems in a wide range of standard industrial applications.

The characteristics of these capacitors are particularly suitable for **continuous operation** under **highly demanding conditions** in environments **with high levels of harmonics**.

The **three delta-connected elements** are housed in a plastic container which, together with the impregnating agents, assures dual insulation between the wound cores and metal enclosure. In order to guarantee perfect filling during the resin impregnation process, the process itself is carried out before the elements are placed in the enclosure, allowing a complete visual and dimensional control of the distribution and uniformity of the impregnation. The **overpressure protection system** is specially dimensioned so as to constantly ensure **maximum safety** in terms of ground protection and protection against the risk of arcing, even in conditions of **high energy density**.

General Characteristics

Power Range	1.5 ÷ 50 kVAr
Voltage range	240 ÷ 800 V
Rated frequency	50 Hz/60 Hz
Capacitance tolerance	-5 +10%
Duty	Continuous
Dielectric losses	≤ 0.2 W/kVAr
Expected life	≥ 180000h – 40/D
Max dV/dt	100 V /µs
Temperature class	-40/D
Maximum overload current	4 x In
Maximum inrush current	200 In
Terminals	Screw clamp
Protection rating	IP20 (IP54 on request)
Internal construction	Delta
Discharge resistor	External (50 V after 60 s)
Impregnating material	Eco-friendly resin
Altitude	≤ 4000 m above s.l.
Storage Temperature	–40 +80 °C
Test voltage (AC) between terminals	2.15 U_n x 2"
Test voltage (AC) between terminals and case	3kV x 10" (UN≤660 V)
Standards	IEC 831 - 1/2
Approvals	cULus Excluding Ø 125 mm

Un (V)	Qn (kVAr)	In (A)	Cn (µF)	DxH (mm)	Type	Pcs. per box	Part number 416.46	Dim. box
240 (60Hz)	1.5	3.6	3x23	65x165	A	14	**0020**	E
	2.5	6	3x28	65x165	A	14	**0030**	E
	5	12	3x77	75x255	A	6	**0050**	E
	7.5	18	3x115	85x255	A	6	**0080**	E
	10	24	3x154	100x255	A	6	**0100**	G
	12.5	30	3x192	100x255	A	6	**0150**	G
	15	36	3x230	116x255	A	4	**0200**	H
400	1.5	2.2	3x9.9	65x165	A	14	**1020**	E
	2.5	3.6	3x17	65x165	A	14	**1030**	E
	5	7.2	3x33	75x165	A	6	**1050**	D
	7.5	10.8	3x50	75x255	A	6	**1080**	D
	10	14.4	3x66	75x255	A	6	**1100**	D
	12.5	18	3x83	85x255	A	6	**1150**	D
	15	21.7	3x99	90x255	A	6	**1200**	D
	20	28.9	3x133	100x255	A	6	**1260**	G
	25	36.1	3x166	116x255	A	4	**1310**	H
	30	43.3	3x199	116x290	A	4	**1360**	H
	40	57.7	3x265	116x370	A	4	**1370**	I
	45	65	3x298	125x370	B	4	**1375**	I
	50	72.7	3x332	125x370	B	4	**1380**	I
415	1.5	2.1	3x9.2	65x165	A	14	**2020**	E
	2.5	3.5	3x154	65x165	A	14	**2030**	E
	5	7	3x31	75x165	A	6	**2050**	D
	7.5	10.4	3x46	75x255	A	6	**2080**	D
	10	13.9	3x62	75x255	A	6	**2100**	D
	12.5	17.4	3x77	85x255	A	6	**2150**	D
	15	20.9	3x92	90x255	A	6	**2200**	D
	20	27.8	3x123	100x255	A	6	**2260**	G
	25	34.8	3x154	116x255	A	4	**2310**	H
	30	41.7	3x185	116x290	A	4	**2360**	H
	40	55.6	3x246	116x370	A	4	**2370**	I
	45	62.6	3x277	116x370	A	4	**2375**	I
	50	39.6	3X308	125x370	B	4	**2380**	I

Standard box dimensions: E= 195x390x255 mm **D=** 195x290x330 mm **G=** 225x345x330 mm **H=** 275x275x385 mm **I=** 275x275x455 mm

Weight: 10÷12 kg

60 Hz models available on request

MODULO XD

Un (V)	Qn (kVAr)	In (A)	C (µF)	DxH (mm)	Type	Pcs x box	Part number 416.46	Dim. Box
	1.5	2	3x8.2	65x165	A	14	**3023**	E
	2.5	3.3	3x14	65x165	A	14	**3033**	E
	5	6.6	3x27	75x165	A	6	**3053**	D
	7.5	9.8	3x41	75x255	A	6	**3083**	D
	10	13.1	3x55	75x255	A	6	**3103**	D
	12.5	16.4	3x69	85x255	A	6	**3153**	D
440	15	19.7	3x82	90x255	A	6	**3203**	D
	20	26.2	3x110	100x255	A	6	**3263**	G
	25	32.8	3x137	116x255	A	4	**3313**	H
	30	39.4	3x164	116x290	A	4	**3363**	H
	40	52.5	3x219	116x370	A	4	**3373**	I
	45	59	3x247	116x370	A	4	**3378**	I
	50	65.6	3x274	125x370	A	4	**3383**	I
	1.5	1.9	3x7.9	65x165	A	14	**3020**	E
	2.5	3.2	3x13	65x165	A	14	**3030**	E
	5	6.4	3x26	75x165	A	6	**3050**	D
	7.5	9.6	3x39	75x255	A	6	**3080**	D
	10	12.8	3x52	75x255	A	6	**3100**	D
	12.5	16.0	3x65	85x255	A	6	**3150**	D
450	15	19.2	3x79	90x255	A	6	**3200**	D
	20	25.7	3x105	100x255	A	6	**3260**	G
	25	32.1	3x131	116x255	A	4	**3310**	H
	30	38.5	3x157	116x290	A	4	**3360**	H
	40	51.3	3x210	116x370	A	4	**3370**	I
	45	57.7	3x236	116x370	A	4	**3375**	I
	50	64.2	3x262	125x370	A	4	**3380**	I
	1.5	1.8	3x6.9	65x165	A	14	**4420**	E
	2.5	3	3x12	65x165	A	14	**4432**	E
	5	6	3X23	75X165	A	6	**4451**	D
	7.5	9	3X34	75X255	A	6	**4454**	D
	10	12	3x46	75x255	A	6	**4456**	D
	12.5	15	3x58	85x255	A	6	**4460**	D
480	15	18	3x69	90x255	A	6	**4465**	D
	20	24	3x92	100x255	A	6	**4467**	G
	25	30	3x115	116x255	A	4	**4468**	H
	30	36.1	3x138	116x290	A	4	**4470**	H
	40	48.1	3x184	116x370	A	4	**4472**	I
	45	54.1	3X207	116X370	A	4	**4475**	I
	50	60.1	3X230	125X370	A	4	**4480**	I
	1.5	1.7	3x6.4	65x165	A	14	**4020**	E
	2.5	2.9	3x11	65x165	A	14	**4030**	E
	5	5.8	3x21	75x165	A	6	**4050**	D
	7.5	8.7	3x32	75x255	A	6	**4080**	D
	10	11.5	3x42	75x255	A	6	**4100**	D
	12.5	14.4	3x53	85x255	A	6	**4150**	D
500	15	17.3	3x64	90x255	A	6	**4200**	D
	20	23.1	3x85	100x255	A	6	**4260**	G
	25	28.9	3x106	116x255	A	4	**4310**	H
	30	34.6	3x127	116x290	A	4	**4360**	H
	40	46.2	3x170	116x370	A	4	**4370**	I
	45	52.0	3x191	116x370	A	4	**4375**	I
	50	57.7	3x212	125x370	A	4	**4380**	I

Standard box dimensions: E= 195x390x255 mm **D=** 195x290x330 mm **G=** 225x345x330 mm
H= 275x275x385 mm **I=** 275x275x455 mm
Weight: 10÷12 kg

MODULO XD

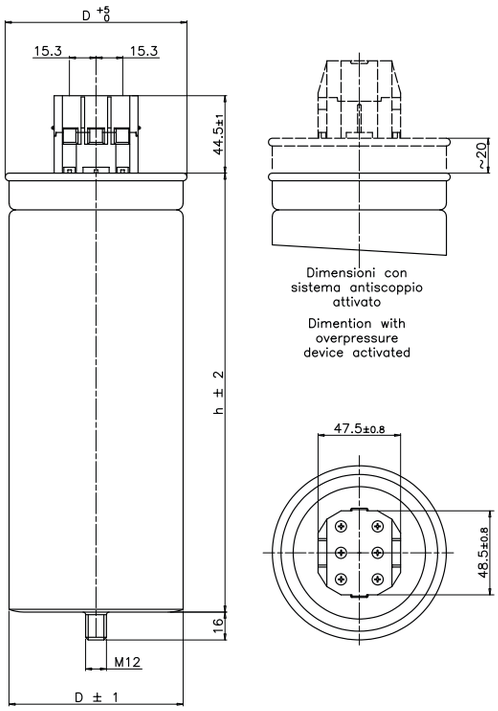
Un (V)	Qn (kVAr)	In (A)	C (µF)	DxH (mm)	Type	Pcs x box	Part number 416.46	Dim. Box
	10	11	3x38	85x255	A	6	**5130**	D
	12.5	13.7	3x48	85x255	A	6	**5170**	D
	15	16.5	3x58	100x255	A	6	**5230**	G
	20	22	3x77	116x255	A	4	**5270**	H
525	25	27.5	3x96	116x255	A	4	**5330**	H
	30	33	3x115	116x290	A	4	**5370**	H
	40	44	3x154	116x370	A	4	**5373**	I
	45	49.5	3x173	116x370	A	4	**5377**	I
	50	55	3x192	125x370	A	4	**5385**	I
	1.5	1.6	3x5.3	65x165	A	14	**5020**	E
	2.5	2.6	3x8.8	65x165	A	14	**5030**	E
	5	5.2	3x18	75x165	A	6	**5050**	D
	7.5	7.9	3x26	75x255	A	6	**5080**	D
	10	10.5	3x35	75x255	A	6	**5100**	D
	12.5	13.1	3x44	85x255	A	6	**5150**	D
550	15	15.7	3x53	90x255	A	6	**5200**	D
	20	21	3x70	100x255	A	6	**5260**	G
	25	26.2	3x88	116x255	A	4	**5310**	H
	30	31.5	3x105	116x290	A	4	**5360**	H
	40	42	3x140	116x370	A	4	**5372**	I
	45	47.2	3x158	116x370	A	4	**5375**	I
	50	52.5	3x175	125x370	A	4	**5380**	I
	10	8.4	3x22	75x255	A	6	**6100**	D
	12.5	10.5	3x28	85x255	A	6	**6150**	D
	15	12.6	3x33	90x255	A	6	**6200**	D
	20	16.7	3x45	100x255	A	6	**6260**	G
690 (*)	25	20.9	3x56	116x255	A	4	**6310**	H
	30	25.1	3x67	116x290	A	4	**6360**	H
	40	33.5	3x89	116x370	A	4	**6370**	I
	45	37.7	3x100	116x370	A	4	**6375**	I
	50	41.8	3x111	125x370	A	4	**6380**	I
	10	7.2	3x17	75x255	A	6	**8100**	D
	12.5	9.0	3x21	85x255	A	6	**8150**	D
	15	10.8	3x25	90x255	A	6	**8200**	D
	20	14.4	3x33	100x255	A	6	**8260**	G
800 (*)	25	18.0	3x41	116x255	A	4	**8310**	H
	30	21.7	3x50	116x290	A	4	**8360**	H
	40	28.9	3x66	116x370	A	4	**8370**	I
	45	32.5	3x75	116x370	A	4	**8375**	I
	50	36.1	3x83	125x370	A	4	**8380**	I

(*) Without discharge resistors.

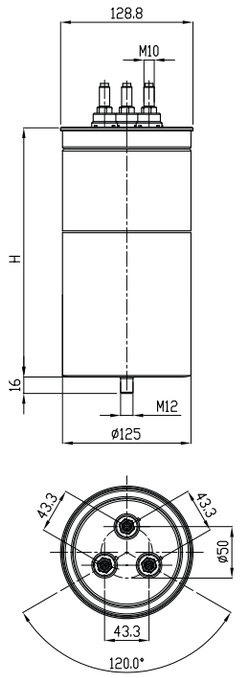
Standard box dimensions: E= 195x390x255 mm **D=** 195x290x330 mm **G=** 225x345x330 mm
H= 275x275x385 mm **I=** 275x275x455 mm
Weight: 10 ÷ 12 kg

MODULO XD

TECHNICAL DRAWING TYPE A



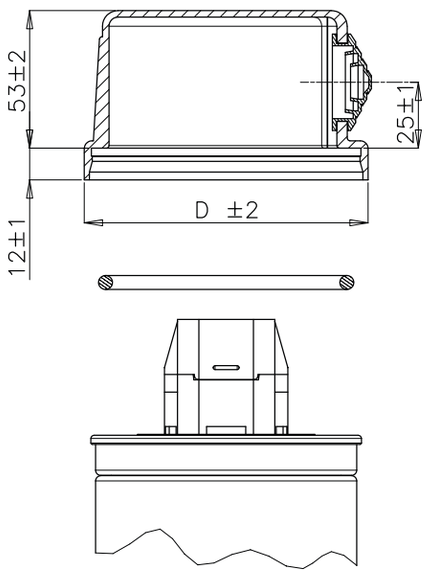
TECHNICAL DRAWING TYPE B



Terminals and stud	Fixing torque
Screw terminals	1.5 Nm
M10**	6 Nm**
M12 stud	10 Nm

(**) Complete the tightening using two wrenches.

TERMINAL COVER IP54



Part n. 316.52	Diam (mm)	Packages n. pcs. per box
.3338	85	30
.3339	90	30
.3340	100	30
.3341	116	20
.3342	125	20

To enable the overpressure protection device to operate efficiently, it is necessary to leave a gap of at least 30 mm above the element and to use flexible wires for the connection.

DUCATI F50 MONO Long Life 4In

Three-phase capacitors

The modular design of the **DUCATI F50** units makes them particularly suitable for fixed transformer power factor correction systems and local power factor correction of motors.
The **DUCATI F50** three-phase capacitor consists of 3 delta-connected single-phase capacitors of the **MONO Long Life 4In** series.

General Characteristics

Power Range	5 – 60 kVAr
Voltage range	415 ÷ 525 V
Rated frequency	50 Hz/60 Hz
Capacitance tolerance	-5 +10%
Duty	Continuous
Dielectric losses	≤ 0.2 W/kVAr
Expected life	≥110000h -25/D
Max dV/dt	≤ 100 V /µs
Temperature class	-40/D
Maximum overload current	4 x In
Maximum inrush current	≤ 200 In
Terminals	Pin 3xM8
Protection rating	IP40
Internal construction	Delta
Discharge resistor	Internal (50 V after 60")
External case material	Insulating V2 class
Altitude	≤ 2000 m above s.l.
Test voltage (AC) between terminals	2.15 Un x 2"
Test voltage (AC) between terminals and case	3 kV x 10"
Standards	EN 60831 – 1/2

DUCATI F50 Un cond = 415 V

$THD_{I\ MAX-C}$ % ≤ 50% THD_I% ≤ 12% Un 400 V - 50 Hz

Un (V)	Qn (kVAr)	Q (400 V) (kVAr)	In (A)	C (µF)	L (mm)	Part number 415.04.
	5	4.7	7.0	3x31	79 (1)	**7010**
	10	9.3	13.9	3x62	79 (1)	**7015**
	12.5	11.6	17.4	3x77	79 (1)	**7018**
	15	13.9	20.9	3x92	79 (1)	**7020**
415	20	18.6	27.9	3x123	79 (1)	**7025**
	25	23.2	34.8	3x154	148 (2)	**7030**
	30	27.9	41.8	3x185	148 (2)	**7035**
	40	37.2	55.7	3x247	148 (2)	**7040**
	50	46.7	69.6	3x308	217 (3)	**7045**

DUCATI F50 Un cond = 450 V

$THD_{I\ MAX-C}$ % ≤ 70% THD_I% ≤ 20% Un 400 V - 50 Hz

Un (V)	Qn (kVAr)	Q (400 V) (kVAr)	In (A)	C (µF)	L (mm)	Part number 415.04.
	5	4.0	6.4	3x26	79 (1)	**7110**
	10	7.9	12.8	3x52	79 (1)	**7115**
	12.5	9.9	16.1	3x66	79 (1)	**7118**
	15	11.9	19.3	3x79	79 (1)	**7120**
450	20	15.8	25.7	3x105	79 (1)	**7125**
	25	19.8	32.1	3x131	148 (2)	**7130**
	30	23.7	38.5	3x157	148 (2)	**7135**
	40	31.6	51.4	3x210	148 (2)	**7140**
	50	39.5	64.2	3x262	217 (3)	**7145**

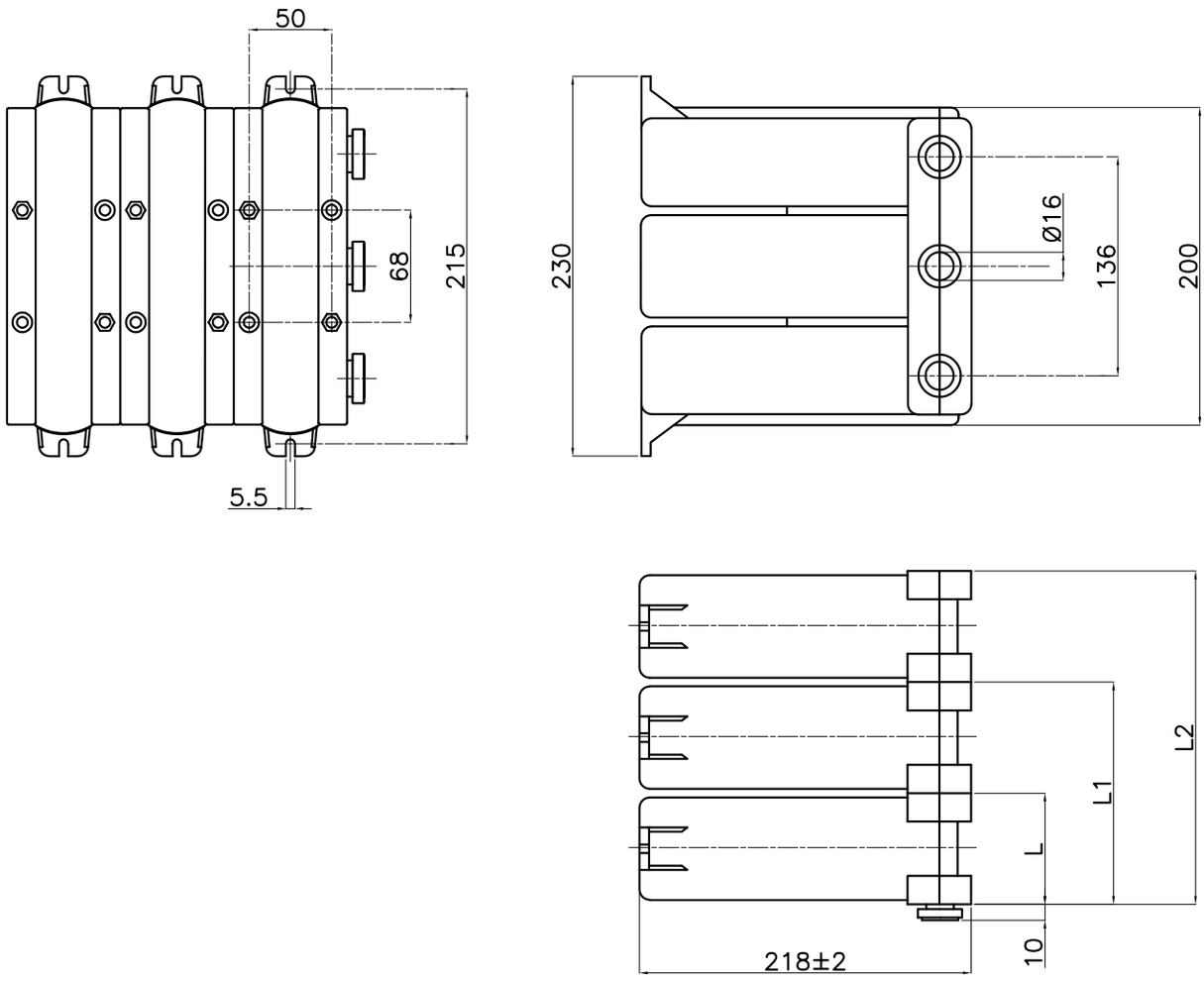
DUCATI F50 Un cond = 525 V

$THD_{I\ MAX-C}$ % ≤ 85% THD_I% ≤ 27% Un 400 V - 50 Hz

Un (V)	Qn (kVAr)	Q (400 V) (kVAr)	In (A)	C (µF)	L (mm)	Part number 415.04.
	5	2.9	5.5	3x19	79 (1)	**7210**
	10	5.8	11.0	3x39	79 (1)	**7215**
	12.5	7.3	13.8	3x48	79 (1)	**7218**
	15	8.7	16.5	3x58	79 (1)	**7220**
	20	11.6	22.0	3x77	79 (1)	**7225**
525	25	14.5	27.5	3x96	148 (2)	**7230**
	30	17.4	33.0	3x116	148 (2)	**7235**
	40	23.2	44.0	3x154	148 (2)	**7240**
	50	29.0	50.1	3x193	217 (3)	**7245**
	60	34.8	66.1	3x231	217 (3)	**7250**

DUCATI F50 MONO Long Life 4In

TECHNICAL DRAWING F50



Kit for unit parallel part. n. 415.69.9910

EQUIPMENT


VIETATO APRIRE
DUCATI energia s.p.a.


DUCATI energia s.p.a.


DUCATI energia s.p.a.
VIETATO APRIRE

SELECTION CRITERIA

Industrial power factor correction: Why?

There are many objectives to be pursued in the planning of an electrical system. Among the measures that enable electricity use to be optimized, improving the power factor of electrical systems is undoubtedly one of the most important. If we quantify this aspect from the utility company's point of view, raising the average operating power factor of the network from 0.7 to 0.95 means:

- Cutting costs due to ohmic losses in the network by 45%
- Increasing the potential of production and distribution plants by 35%

The user which corrects the power factor in his plants gets these advantages:

- To avoid the fees by the supplier
- It reduces the absorbed current and it optimizes the electrical system
- It reduces the voltage drops and the losses due to Joule effect

How to correct

The best technical solution is to install a separate industrial PFC capacitor on each load, which is included in the drive switch (distributed industrial PFC).

However, the most effective industrial power factor correction is the one that involves the installation of an automatic battery on the bars of the distribution panel (Centralized Industrial PFC) and, if necessary, the installation of fixed capacitor banks for the correction of transformers, asynchronous motors and any loads that absorb significant amount of reactive power.

For electrical machines such as induction motors and transformers it is often used a fixed power factor correction, most of the time sized on values obtained from tables.

Power factor correction calculation

The calculation of the capacitor bank to be installed in an installation is simple: given the cosφ of the system without any correction (often available from the electricity bill) and the cosφ to be achieved, the reactive power required to obtain the desired power factor is obtained with a few calculations:

$Qc = P \cdot (\tan\varphi_0 - \tan\varphi_1) = P \cdot K$

P = active power of the system

$\cos\varphi_0$ = cosφ of the system without power factor correction $\cos\varphi_1$ = cosφ target

Qc = Reactive power of the industrial PFC system to be installed

K = given $\cos\varphi_0$ and $\cos\varphi_1$ K is derived from the table below

If the system's cosφ value should be unknown, the calculation of the reactive power necessary for the compensation can be done starting from the data found on the energy utility's bills or read directly from the utility's energy meter.

Knowing the active power [kW] P and the reactive power [kVAr] Q of the system, or the active energy [kWh] and the reactive energy [kVArh], the following formula can be used:

$Q / P = \tan\varphi$

The tanφ value thus calculated can be used with the table to calculate the reactive power of the PFC equipment necessary to correct the power factor to the desired value.

For the monitoring of the system's electrical parameters we suggest the installation of one or more Network Analyzers, providing measurements of all parameters characterizing the system and the loads. DUCATI Energia offers a comprehensive range of Energy Analyzers and Monitoring Systems.

Reference notes

The capacitors and the automatic power factor correction equipment must be installed in well-ventilated areas.

The air should be able to circulate freely through the air vents. The ambient temperature must comply with EN 60831-1/2 standards.

When the system subject to industrial power factor correction includes static AC/DC conversion systems (e.g. for the operation of DC motors, uninterruptible power systems, etc.), harmonic currents are generated and can cause either current or voltage overloads that the capacitors cannot withstand.

DUCATI Energia can provide properly protected equipment suitable for use in such systems as well as filter systems designed to eliminate harmonic components.

When the capacitors are used in automatic equipment, be sure to check that the regulator response time is greater than the capacitor discharge time. If this is not the case, suitable discharge resistors should be installed. The use of rigid connections should be avoided with cylindrical capacitors in order to avoid blocking the intervention of the overpressure device. For this reason at least 3 cm should be left between the terminals and any surface above the upper capacitor.

In the automatic equipment the integrity of the pre-charging resistors should be checked every 10.000 operations or at least once a year. Plan to replace the contactors every 100.000 operations.

The guarantee does not cover problems arising from operation:

- In the presence of excessive harmonic overloads (> 1.3 In, > 1.1 Un.)
- Contactors with worn-out electrical contacts or interrupted precharging resistors

Installation notes

As required by the standards, it is necessary to ensure an appropriate protection against short-circuit and overload (via magnetic/thermal circuit breaker or fuses) for the line supplying the industrial power factor correction units. The protection must be dimensioned for capacitive currents (approx. 1.45 times the equipment's nominal current) and taking into account the short-time short-circuit current values expected in the point of installation and sustainable by the industrial power factor correction equipment.

K FACTOR See the full table at page **91**

Criteria for choosing equipment according to network conditions

Once the maximum necessary power has been determined as directed in the previous sections, the choice of which type of equipment to adopt must be based on the conditions of the electrical network and the types of loads present.

The selection table below, which is based on general system characteristics (and therefore not to be used for design purposes), is intended to give an indication of the industrial power factor correction system generally suitable for the most frequently encountered conditions; electrical systems with a mains voltage of 400 V - 50 Hz, characterized by the presence of distorting loads with a spectrum composed of 5th, 7th, 11th and 13th harmonics.

SERIES THD (*)		THD_I < 12% (THD_{IC} <50%)	THD_I < 20% (THD_{IC} < 70%)	THD_I < 27% (THD_{IC} < 85%)	THD_I < 100% (THD_{IC} <100%)	PV system
Fixed power factor correction equipment						
DUCATI F120 **(5 - 120 kVAr)**		✓ Un = 415 V	✓ Un = 450 V	✓ Un = 525 V	✓ Un = 525 V	
Automatic power factor correction equipment						
DUCATI 50-M **(5 - 50 kVAr)**		✓ Un = 415 V	✓ Un = 450 V	✓ Un = 525 V		✓ Un > 450 V
DUCATI 200-M **(60 - 200 kVAr)**		✓ Un = 415 V	✓ Un = 450 V	✓ Un = 525 V		✓ Un > 450 V
DUCATI 400-M **(220 - 400 kVAr)**		✓ Un = 415 V	✓ Un = 450 V	✓ Un = 525 V		✓ Un > 450 V
DUCATI 1600-R **(240-1600 kVAr)**		✓ Un = 415 V	✓ Un = 450 V			✓ Un > 450 V
DUCATI 2400-R **(240-2400 kVAr)**		✓ Un = 525 V	✓ Un = 525 V	✓ Un = 525 V		✓ Un = 525 V
Automatic power factor correction equipment with filter systems						
DUCATI 170-ML **(25.5 - 170 kVAr)**		✓	✓	✓	✓	✓
DUCATI 1000-RL **(150 - 1000 kVAr)**		✓	✓	✓	✓	✓
DUCATI 1000-RL/HP **(132 - 1056 kVAr)**		✓	✓	✓	✓	✓
Automatic thyristor power factor correction equipment with filter systems						
DUCATI 1000-RL/S **(132 - 1056 kVAr)**		✓	✓	✓	✓	✓

(*) Indicative values valid in the absence of resonance phenomena

DUCATI F120

Fixed power factor correction

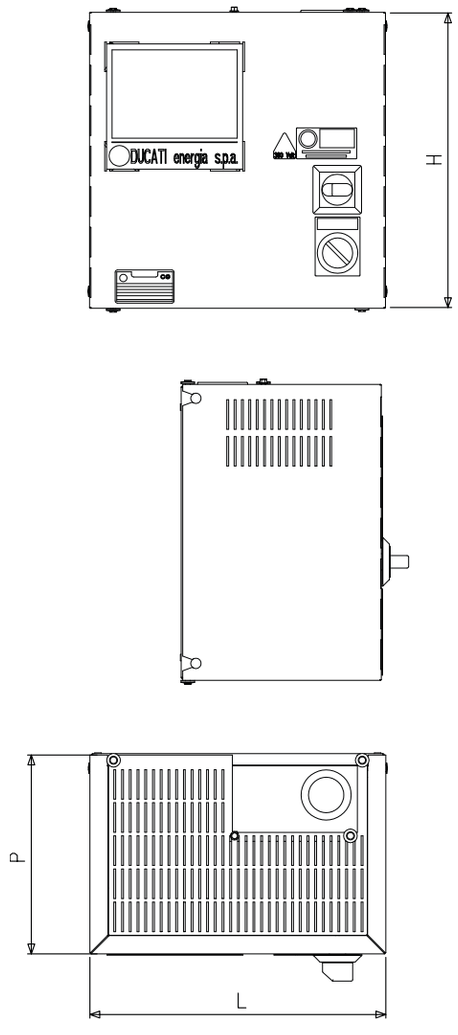
Technical details

- Single-phase **MONO Long Life 4In** series capacitors in PPMh, for a continuous duty under highly demanding conditions in environments with high levels of harmonics.
- Capacitors Rated voltage 415V, 450V, 525V
- External steel structure painted with epoxy powder color RAL 7035
- Omni pole disconnecting switch with door lock and rated current 1.45 In according to the CEI EN standard

General Characteristics

Mains voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Ventilation	Natural
Usage	Indoor
Protection rating	IP 30
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3F + PE
Cable entry	Top
Internal connection	FS17
Discharge devices	On each bank
Fuses	NH-00 GL
Standards	IEC 61439 IEC 61921

TECHNICAL DRAWING DUCATI F120



DUCATI F120 Un cond =415 V

$THD_{I\ MAX-C}$ % ≤ 50% THD_I% ≤ 12% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	In (A)	In sw. (A)	LxWxH (mm)	Weight (kg)
8005	5	4.6	7	40	400x270x400	15
8007	10	9.3	13	40	400x270x400	15
8010	20	18.6	27	63	400x270x400	17
8013	30	27.9	41.8	63	400x270x400	17
8015	40	37.2	54	80	400x270x400	17
8020	60	55.7	80	125	400x270x400	21
8025	80	74.3	107	125	400x270x600	30
8030	100	92.9	134	250	400x270x1000	32
8035	120	111.5	161	250	400x270x1000	33

DUCATI F120 Un cond =450 V

$THD_{I\ MAX-C}$ % ≤ 70% THD_I% ≤ 20% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	In (A)	In sw. (A)	LxWxH (mm)	Weight (kg)
8105	5	4	6	40	400x270x400	15
8107	10	7.9	11	40	400x270x400	15
8110	20	15.8	23	63	400x270x400	17
8113	30	23.7	38.5	63	400x270x400	17
8115	40	31.6	46	80	400x270x400	17
8120	60	47.4	68	125	400x270x400	21
8125	80	63.2	91	125	400x270x600	30
8130	100	79	114	250	400x270x1000	32
8135	120	94.8	137	250	400x270x1000	33

DUCATI F120 Un cond =525 V

$THD_{I\ MAX-C}$ % ≤ 85% THD_I% ≤ 27% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	In (A)	In sw. (A)	LxWxH (mm)	Weight (kg)
8205	5	2.9	4	40	400x270x400	15
8207	10	5.8	8	40	400x270x400	15
8210	20	11.6	17	63	400x270x400	17
8213	30	17.4	33	63	400x270x400	17
8215	40	23.2	34	80	400x270x400	17
8220	60	34.8	50	125	400x270x400	21
8225	80	46.4	67	125	400x270x600	30
8230	100	58	84	250	400x270x1000	32
8235	120	69.7	101	250	400x270x1000	33

DUCATI 50-M

Automatic power factor correction

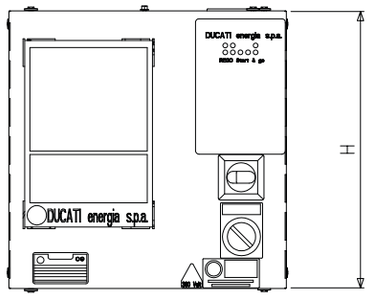
Technical details

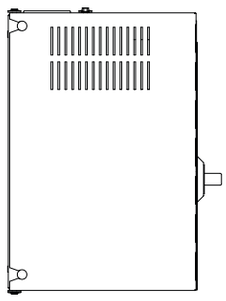
- Single-phase **MONO Long Life 4In** series capacitors in PPMh, for a continuous duty under highly demanding conditions in environments with high levels of harmonics.
- Capacitors Rated voltage 415V, 450V, 525V
- Power Factor controller **START&GO** series. No setup required (TA auto-sensing and automatic start), fast and user friendly. Suitable for cogeneration systems (e.g. PV)
- External steel structure painted with epoxy powder color RAL 7035
- Omni pole disconnecting switch with door lock and rated current 1.45 In according to the CEI EN standard
- Contactors designed to control capacitive loads, equipped with an inrush current limiting device, with 230 V 50-60 Hz power supply

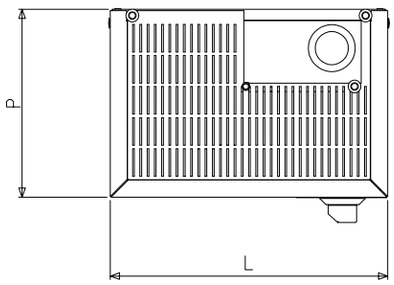
General Characteristics

Mains voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Ventilation	Natural
Usage	Indoor
Protection rating	IP 30
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3F + PE + N
Cable entry	Top
Internal connection	FS17
Discharge devices	On each bank
Fuses	NH-00 GL
Standards	IEC 61439 where applicable IEC 61921
Short circuit current I_{SH}	50 kA (conditioned by the upstream protective device)

TECHNICAL DRAWING DUCATI 50-M







DUCATI 50-M Un - Cond =415 V

$THD_{I\ MAX-C}$ % ≤ 50% THD_I% ≤ 12% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVAr)	Steps	In (A)	In sw. (A)	LxWxH (mm)	Weight (kg)
0010	5	4.7	0.7+1.4+2.9	7	7	40	400x270x400	15
0015	7.5	7	1.1+2.1+4.3	7	10	40	400x270x400	15
0020	10	9.3	1.4+2.9+5.7	7	13	40	400x270x400	16
0025	12.5	11.6	2.5+2x5	5	17	40	400x270x400	16
0030	17.5	16.3	2.5+5+10	7	23	40	400x270x400	16
0035	20	18	2x5+10	4	27	63	400x270x400	17
0040	25	23	5+2x10	5	34	63	400x270x400	17
0045	35	32	5+10+20	7	47	80	400x270x400	18
0050	40	37	2x10+20	4	54	80	400x270x400	18
0055	50	46	10+2x20	5	68	80	400x270x400	19

DUCATI 50-M Un - Cond =450 V

$THD_{I\ MAX-C}$ % ≤ 70% THD_I% ≤ 20% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVAr)	Steps	In (A)	In sw. (A)	LxWxH (mm)	Weight (kg)
0210	20	15	2x5+10	4	23	63	400x270x400	17
0215	25	19	5+2x10	5	29	63	400x270x400	17
0220	35	27	5+10+20	7	40	80	400x270x400	18
0225	40	31	2x10+20	4	46	80	400x270x400	18
0230	50	39	10+2x20	5	57	80	400x270x400	19

DUCATI 50-M Un - Cond =525 V

$THD_{I\ MAX-C}$ % ≤ 85% THD_I% ≤ 27% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVAr)	Steps	In (A)	In sw. (A)	LxWxH (mm)	Weight (kg)
0310	20	11	2x5+10	4	17	63	400x270x400	17
0315	25	14	5+2x10	5	21	63	400x270x400	17
0320	35	20	5+10+20	7	29	80	400x270x400	18
0325	40	23	2x10+20	4	34	80	400x270x400	18
0330	50	29	10+2x20	5	42	80	400x270x400	19

DUCATI 200-M

Automatic power factor correction

Technical details

- Single-phase **MONO Long Life 4In** series capacitors in PPMh, for a continuous duty under highly demanding conditions in environments with high levels of harmonics.
- Capacitors Rated voltage 415V, 450V, 525V
- Power Factor Controller **rEvolution R5** series. NFC connection for configuration exchange with the **"DUCATI Smart Energy"** app. Auto-sensing of the direction and the position of the TA to facilitate the setup operations. Suitable for cogeneration systems (e.g. PV)
- External steel structure painted with epoxy powder color RAL 7035
- Omni pole disconnecting switch with door lock and rated current 1.45 In according to the CEI EN standard
- Contactors designed to control capacitive loads, equipped with an inrush current limiting device, with 230 V 50-60 Hz power supply

General Characteristics

Mains voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Ventilation	Natural
Usage	Indoor
Protection rating	IP 30 - IP54
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3PH + PE + N (Up to 80 kVAr) 3PH + PE (Qn > 80 kVAr)
Cable entry	Top
Internal connection	FS17
Discharge devices	On each bank
Fuses	NH-00 GL
Standards	IEC 61439 where applicable IEC 61921
Short circuit current I_{SH}	50 kA (conditioned by the upstream protective device)

DUCATI 200-M Un - Cond = 415 V IP30

$THD_{I\ MAX-C}$ % ≤ 50% THD_I% ≤ 12% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
0060	60	55	2x10+2x20	6	80	125	400x270x600	30
0065	70	65	10+3x20	7	94	125	400x270x600	35
0070	80	74	2x10+20+40	8	107	125	400x270x600	35
0075	90	83	10+2x20+40	9	121	250	400x270x1000	40
0080	100	92	2x10+2x20+40	10	134	250	400x270x1000	45
0085	120	111	2x10+20+2x40	12	161	250	400x270x1200	50
0090	140	130	20+3x40	7	188	400	400x270x1200	55
0095	160	148	2x20+3x40	8	215	400	400x270x1200	60
0100	180	167	20+4x40	9	241	400	400x270x1400	65
0105	200	185	2x20+2x40+80	10	268	400	400x270x1400	70

DUCATI 200-M Un - Cond = 450 V IP30

$THD_{I\ MAX-C}$ % ≤ 70% THD_I% ≤ 20% Un 400 V - 50 Hz

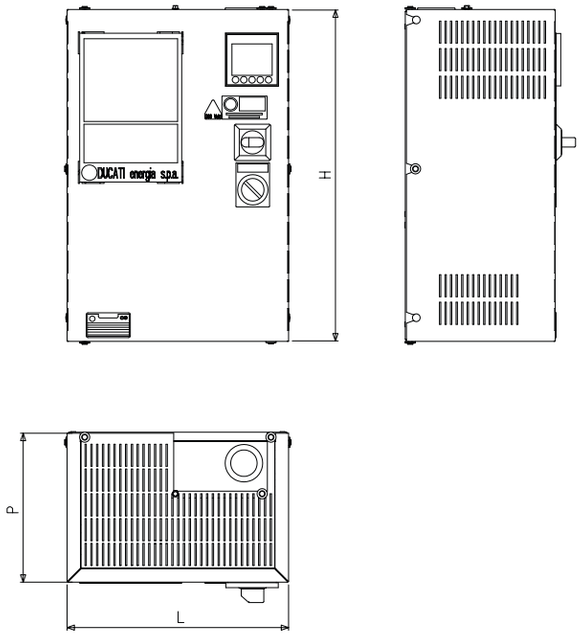
Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
0235	60	47	2x10+2x20	6	68	125	400x270x600	30
0240	70	55	10+3x20	7	80	125	400x270x600	35
0245	80	63	2x10+20+40	8	91	125	400x270x600	35
0250	90	71	10+2x20+40	9	103	250	400x270x1000	40
0255	100	79	2x10+2x20+40	10	114	250	400x270x1000	45
0260	120	94	2x10+20+2x40	12	138	250	400x270x1200	50
0265	140	110	20+3x40	7	160	400	400x270x1200	55
0270	160	126	2x20+3x40	8	182	400	400x270x1200	60
0275	180	142	20+4x40	9	205	400	400x270x1400	65
0280	200	158	2x20+2x40+80	10	228	400	400x270x1400	70

DUCATI 200-M Un - Cond = 525 V IP30

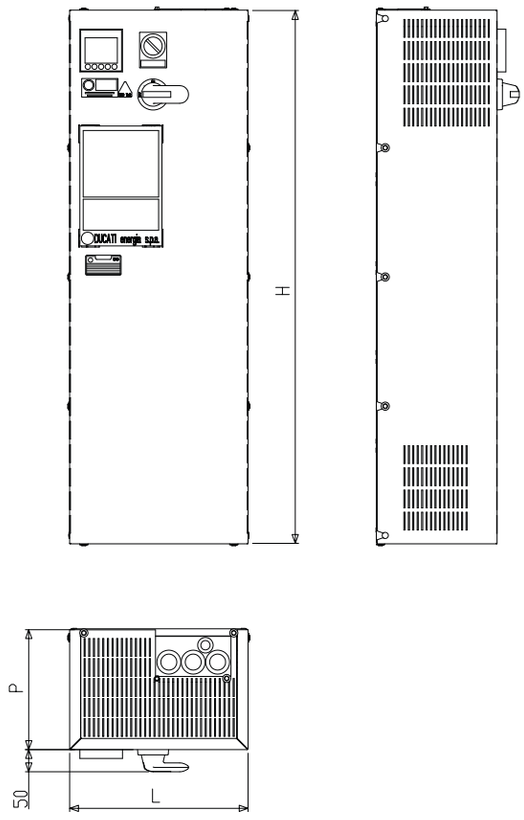
$THD_{I\ MAX-C}$ % ≤ 85% THD_I% ≤ 27% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
0335	60	34	2x10+2x20	6	50	125	400x270x600	30
0340	70	40	10+3x20	7	59	125	400x270x600	35
0345	80	46	2x10+20+40	8	67	125	400x270x600	35
0350	90	52	10+2x20+40	9	75	250	400x270x1000	40
0355	100	58	2x10+2x20+40	10	84	250	400x270x1000	45
0360	120	69	2x10+20+2x40	12	101	250	400x270x1200	50
0365	140	81	20+3x40	7	117	400	400x270x1200	55
0370	160	92	2x20+3x40	8	134	400	400x270x1200	60
0375	180	104	20+4x40	9	151	400	400x270x1400	65
0380	200	116	2x20+2x40+80	10	168	400	400x270x1400	70

TECHNICAL DRAWING DUCATI 200-M IP30
60 ÷ 80 kVAr



TECHNICAL DRAWING DUCATI 200-M IP30
90 ÷ 200 kVAr



DUCATI 200-M Un - Cond = 415 V IP54

$THD_{I\ MAX-C}$ % ≤ 50% THD_I% ≤12% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
0011	5	4.7	0.7+1.4+2.9	7	7	40	500x250x700	39
0016	7.5	7	1.1+2.1+4.3	7	10	40	500x250x700	39
0021	10	9.3	1.4+2.9+5.7	7	13	40	500x250x700	39
0026	12.5	11.6	2.5+2x5	5	17	40	500x250x700	40
0031	17.5	16.3	2.5+5+10	7	23	40	500x250x700	40
0036	20	18	2x5+10	4	27	63	500x250x700	41
0041	25	23	5+2x10	5	34	63	500x250x700	41
0046	35	32	5+10+20	7	47	80	500x250x700	42
0051	40	37	2x10+20	4	54	80	500x250x700	42
0056	50	46	10+2x20	5	67	80	500x250x700	43
0061	60	55	2x10+2	6	80	125	500x250x700	54
0067	70	65	10+3x20	7	94	125	500x250x700	59
0071	80	74	2x10+20+40	8	107	125	500x250x700	59
0076	90	83	10+2x20+40	9	121	250	600x300x1000	77
0081	100	92	2x10+2x20+40	10	134	250	600x300x1000	82
0086	120	111	2x10+20+2x40	12	161	250	600x300x1000	93
0091	140	130	20+3x40	7	188	400	600x300x1000	98
0096	160	148	2x20+3x40	8	215	400	600x300x1200	109
0101	180	167	20+4x40	9	241	400	600x300x1400	114
0106	200	185	2x20+2x40+80	10	268	400	600x300x1400	119

DUCATI 200-M Un - Cond = 450 V IP54

$THD_{I\ MAX-C}$ % ≤ 70% THD_I% ≤ 20% Un 400 V - 50 Hz

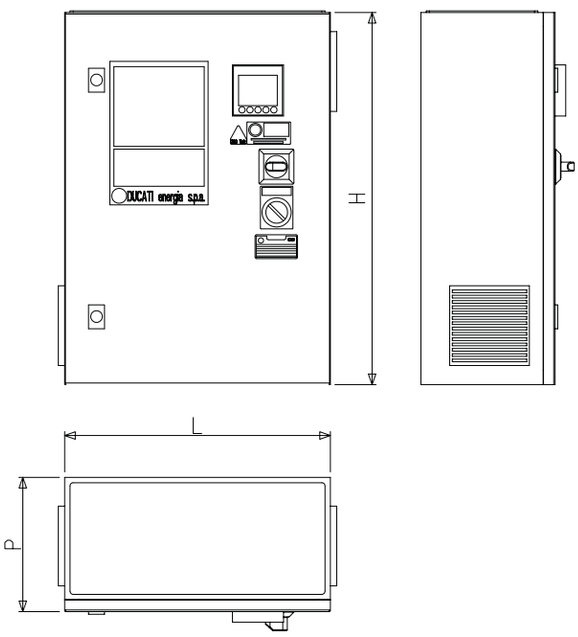
Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
0211	20	15	2x5+10	4	23	63	500x250x700	41
0216	25	19	5+2x10	5	29	63	500x250x700	41
0221	35	27	5+10+20	7	40	80	500x250x700	42
0226	40	31	2x10+20	4	46	80	500x250x700	42
0231	50	39	10+2x20	5	57	80	500x250x700	43
0236	60	47	2x10+2	6	68	125	500x250x700	54
0241	70	55	10+3x20	7	20	125	500x250x700	59
0246	80	63	2x10+20+40	8	91	125	500x250x700	59
0251	90	71	10+2x20+40	9	103	250	600x300x1000	77
0256	100	79	2x10+2x20+40	10	114	250	600x300x1000	82
0261	120	94	2x10+20+2x40	12	137	250	600x300x1000	93
0266	140	110	20+3x40	7	160	400	600x300x1000	98
0271	160	126	2x20+3x40	8	182	400	600x300x1200	109
0276	180	142	20+4x40	9	205	400	600x300x1400	114
0281	200	158	2x20+2x40+80	10	228	400	600x300x1400	119

DUCATI 200-M Un - Cond = 525 V IP54

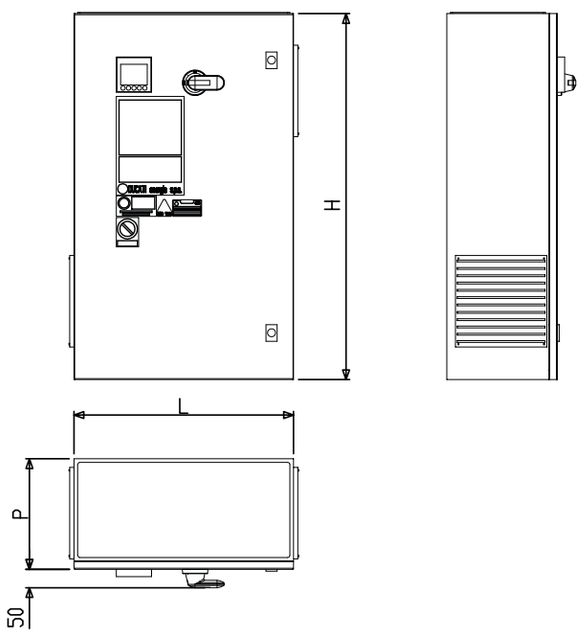
$THD_{I\ MAX\text{-}C}$ % ≤ 85% THD_I% ≤ 27% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
0311	20	11	2x5+10	4	17	63	500x250x700	41
0316	25	14	5+2x10	5	21	63	500x250x700	41
0321	35	20	5+10+20	7	29	80	500x250x700	42
0326	40	23	2x10+20	4	34	80	500x250x700	42
0331	50	29	10+2x20	5	42	80	500x250x700	43
0336	60	34	2x10+2	6	50	125	500x250x700	54
0341	70	40	10+3x20	7	59	125	500x250x700	59
0346	80	46	2x10+20+40	8	67	125	500x250x700	59
0351	90	52	10+2x20+40	9	75	250	600x300x1000	77
0356	100	58	2x10+2x20+40	10	84	250	600x300x1000	82
0361	120	69	2x10+20+2x40	12	101	250	600x300x1000	93
0366	140	81	20+3x40	7	117	400	600x300x1000	98
0371	160	92	2x20+3x40	8	134	400	600x300x1200	109
0376	180	104	20+4x40	9	151	400	600x300x1400	114
0381	200	116	2x20+2x40+80	10	168	400	600x300x1400	119

TECHNICAL DRAWING DUCATI 200-M IP54
5 ÷ 80 kVAr



TECHNICAL DRAWING DUCATI 200-M IP54
90 ÷ 200 kVAr



DUCATI 400-M

Automatic power factor correction

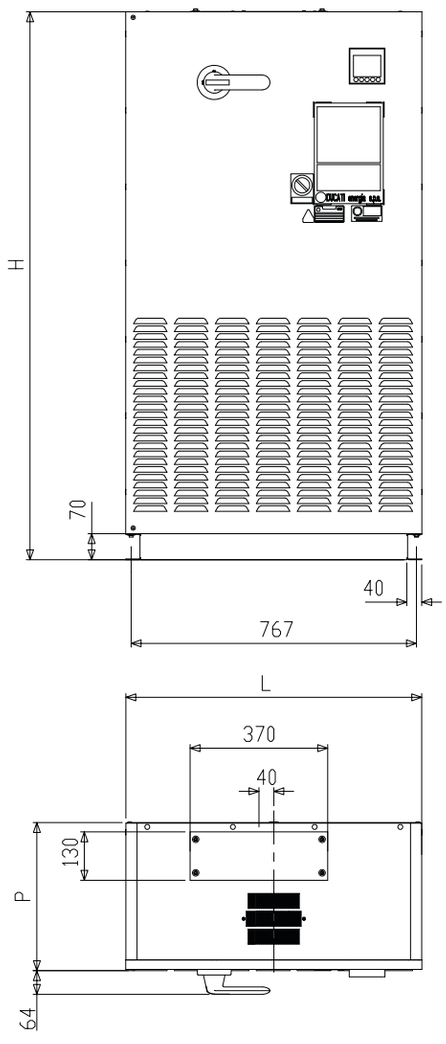
Technical details

- Single-phase **MONO Long Life 4In PLUS** series capacitors in PPMh, for a continuous duty under highly demanding conditions in environments with high levels of harmonics.
- Capacitors Rated voltage 415V, 450V, 525V
- **rEvolution R5** series microprocessor-based digital controller. NFC connection for configuration exchange with the **"DUCATI Smart Energy"** app. Auto-sensing of the direction and the position of the TA to facilitate the setup operations. Suitable for cogeneration systems (e.g. PV). Optional integration with the **DUCNET** cloud data sharing system via RS485 communication port or 868 MHz radio transmission
- External steel structure painted with epoxy powder color RAL 7035
- Omni pole disconnecting switch with door lock and rated current 1.45 In according to the CEI EN standard
- Contactors designed to control capacitive loads, equipped with an inrush current limiting device, with 230 V 50-60 Hz power supply

General Characteristics

Mains voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Ventilation	Natural
Usage	Indoor
Protection rating	IP 30
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3F + PE
Cable entry	Top
Internal connection	FS17
Discharge devices	On each bank
Fuses	NH-00 GL
Standards	IEC 61439 where applicable IEC 61921
Short circuit current I_{SH}	50 kA (conditioned by the upstream protective device)

TECHNICAL DRAWING DUCATI 400-M



DUCATI 400-M Un - Cond = 415 V

$THD_{I\ MAX-C}$ % ≤ 55% THD_I% ≤ 14% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
0510N	220	204	20+3x40+80	11	295	630	800x400x1470	115
0515N	240	223	2x20+40+2x80	12	322	630	800x400x1470	120
0520N	260	241	20+2x40+2x80	13	349	630	800x400x1470	125
0525N	280	260	3x40+2x80	7	375	630	800x400x1470	130
0527N	300	278	20+40+3x80	15	402	630	800x400x1470	135
0530N	320	297	2x40+3x80	8	429	800	800x400x1470	140
0535N	360	334	40+4x80	9	483	800	800x400x1470	145
0540N	400	371	5x80	5	536	800	800x400x1470	150

DUCATI 400-M Un - Cond = 450 V

$THD_{I\ MAX-C}$ % ≤ 75% THD_I% ≤ 22% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
0610N	220	173	20+3x40+80	11	251	630	800x400x1470	115
0615N	240	189	2x20+40+2x80	12	274	630	800x400x1470	120
0620N	260	205	20+2x40+2x80	13	297	630	800x400x1470	125
0625N	280	221	3x40+2x80	7	319	630	800x400x1470	130
0627N	300	237	20+40+3x80	15	342	630	800x400x1470	135
0630N	320	250	2x40+3x80	8	365	800	800x400x1470	140
0635N	360	284	40+4x80	9	411	800	800x400x1470	145
0640N	400	316	5x80	5	456	800	800x400x1470	150

DUCATI 400-M Un - Cond =525 V

$THD_{I\ MAX-C}$ % ≤ 90% THD_I% ≤ 29% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
0710N	220	127	20+3x40+80	11	182	630	800x400x1470	115
0715N	240	139	2x20+40+2x80	12	201	630	800x400x1470	120
0720N	260	150	20+2x40+2x80	13	218	630	800x400x1470	125
0725N	280	162	3x40+2x80	7	235	630	800x400x1470	130
0727N	300	174	20+40+3x80	15	251	630	800x400x1470	135
0730N	320	185	2x40+3x80	8	268	800	800x400x1470	140
0735N	360	209	40+4x80	9	302	800	800x400x1470	145
0740N	400	232	5x80	5	335	800	800x400x1470	150

DUCATI 1600-R

Automatic power factor correction

Technical details

- Single-phase **MONO Long Life 4In PLUS** series capacitors in PPMh, for continuous duty in highly demanding conditions in environments with high levels of harmonics.
- Capacitors Rated voltage 415V, 450V
- **rEvolution R8** series microprocessor-based digital controller with 868 MHz radio module and RS485 and Bluetooth connectivity. In addition of the NFC module, there's a BT connection to exchange configuration files and status information with the **"DUCATI Smart Energy"** App. Auto-sensing of the direction and position of the TA, reducing the number of operator interventions. Suitable for cogeneration systems (e.g. PV). Possibility to integrate with the **DUCNET** cloud data sharing system via RS485 communication port or 868 MHz wireless transmission
- External steel structure painted with epoxy powder color RAL 7035
- Omni pole disconnecting switch with door lock and rated current 1.45 In according to the CEI EN standard
- Contactors designed to control capacitive loads, equipped with an inrush current limiting device with 230 V 50 - 60 Hz power supply

General Characteristics

Mains voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Ventilation	Forced
Usage	Indoor
Protection rating	IP31 - IP54 (on request)
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3F + PE
Cable entry	Top or bottom
Internal connection	FS17
Discharge devices	On each bank
Fuses	NH-00 GL
Standards	IEC 61439 where applicable IEC 61921
Short circuit current I_{SH}	24 kA (0.5s) for In sw = 630A 50 kA for In sw > 630A

DUCATI 1600-R Un - Cond = 415 V

$THD_{I\ MAX\text{-}C}$ % ≤ 55% THD_I% ≤ 14% Un 400 V - 50 Hz

Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVAr)	Steps	In (A)	In sw. (A)	Top Cable entry			Bottom cable entry		
						Part n. 415.04.	LxWxH (mm)	Weight (kg)	Part n. 415.04.	LxWxH (mm)	Weight (kg)
240	223	6x40	6	322	630	**1010**	800x600x2250	265	**1010B**	800x600x2250	265
280	260	7x40	7	375	630	**1012**	800x600x2250	270	**1012B**	800x600x2250	270
320	297	6x40+80	8	429	630	**1015**	800x600x2250	275	**1015B**	800x600x2250	275
360	334	5x40+2x80	9	483	1000	**1017**	800x600x2250	285	**1017B**	800x600x2250	295
400	371	4x40+3x80	10	536	1000	**1020**	800x600x2250	290	**1020B**	800x600x2250	298
440	408	3x40+4x80	11	590	1000	**1022**	800x600x2250	295	**1022B**	800x600x2250	300
480	445	2x40+5x80	12	644	1000	**1025**	800x600x2250	300	**1025B**	800x600x2250	305
520	483	3x40+5x80	13	697	1250	**1027**	800x600x2250	310	**1027B**	800x600x2250	310
560	520	2x40+6x80	14	751	1250	**1030**	800x600x2250	315	**1030B**	800x600x2250	315
600	557	3x40+6x80	15	805	1250	**1032**	800x600x2250	320	**1032B**	800x600x2250	320
640	594	2x40+7x80	16	858	1250	**1035**	800x600x2250	325	**1035B**	800x600x2250	325
680	631	3x40+7x80	17	912	1600	**1037**	800x600x2250	335	**1037B**	1600x600x2250	580
720	668	2x40+8x80	18	965	1600	**1040**	800x600x2250	345	**1040B**	1600x600x2250	582
800	743	2x40+7x80+160	20	1073	1600	**1045**	800x600x2250	350	**1045B**	1600x600x2250	585
880	817	2x40+6x80+2x160	22	1180	1000 + 1000	**1050**	1600x600x2250	580	**1050B**	1600x600x2250	588
960	891	8x80+2x160	12	1287	1000 + 1000	**1055**	1600x600x2250	590	**1055B**	1600x600x2250	590
1040	966	7x80+3x160	13	1395	1000 + 1250	**1060**	1600x600x2250	605	**1060B**	1600x600x2250	605
1120	1040	6x80+4x160	14	1502	1000 + 1250	**1065**	1600x600x2250	615	**1065B**	1600x600x2250	615
1200	1114	5x80+5x160	15	1609	1250 - 1250	**1070**	1600x600x2250	630	**1070B**	1600x600x2250	630
1280	1189	4x80+6x160	16	1716	1250 - 1250	**1075**	1600x600x2250	635	**1075B**	1600x600x2250	635
1360	1263	3x80+7x160	17	1824	1250 - 1600	**1080**	1600x600x2250	650	**1080B**	2400x600x2250	850
1440	1337	2x80+8x160	18	1931	1250 - 1600	**1085**	1600x600x2250	665	**1085B**	2400x600x2250	855
1520	1412	3x80+6x160+320	19	2038	1600 - 1600	**1090**	1600x600x2250	680	**1090B**	2400x600x2250	860
1600	1486	2x80+7x160+320	20	2145	1600 - 1600	**1095**	1600x600x2250	700	**1095B**	2400x600x2250	865

DUCATI 1600-R Un - Cond = 450 V

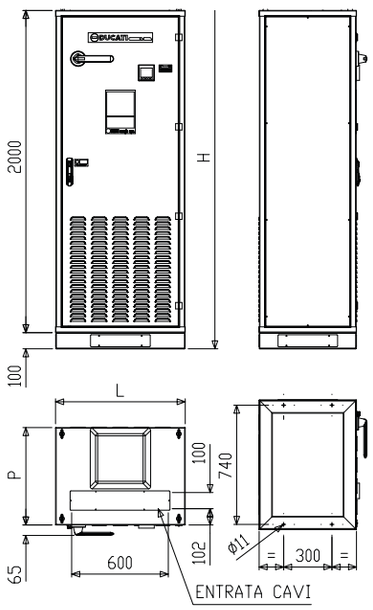
$THD_{I\ MAX-C}$ % ≤ 75% THD_I% ≤ 22% Un 400 V - 50 Hz

Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVAr)	Steps	In (A)	In sw. (A)	Top Cable entry			Bottom cable entry		
						Part n. 415.04.	LxWxH (mm)	Weight (kg)	Part n. 415.04.	LxWxH (mm)	Weight (kg)
240	189	6x40	6	274	630	**1110**	800x600x2250	265	**1110B**	800x600x2250	265
280	221	7x40	7	319	630	**1112**	800x600x2250	270	**1112B**	800x600x2250	270
320	252	6x40+80	8	365	630	**1115**	800x600x2250	275	**1115B**	800x600x2250	275
360	284	5x40+2x80	9	411	1000	**1117**	800x600x2250	285	**1117B**	800x600x2250	295
400	316	4x40+3x80	10	456	1000	**1120**	800x600x2250	290	**1120B**	800x600x2250	298
440	347	3x40+4x80	11	502	1000	**1122**	800x600x2250	295	**1122B**	800x600x2250	300
480	379	2x40+5x80	12	547	1000	**1125**	800x600x2250	300	**1125B**	800x600x2250	305
520	410	3x40+5x80	13	593	1250	**1127**	800x600x2250	310	**1127B**	800x600x2250	310
560	442	2x40+6x80	14	639	1250	**1130**	800x600x2250	315	**1130B**	800x600x2250	315
600	474	3x40+6x80	15	684	1250	**1132**	800x600x2250	320	**1132B**	800x600x2250	320
640	505	2x40+7x80	16	730	1250	**1135**	800x600x2250	325	**1135B**	800x600x2250	325
680	537	3x40+7x80	17	776	1600	**1137**	800x600x2250	335	**1137B**	1600x600x2250	580
720	568	2x40+8x80	18	821	1600	**1140**	800x600x2250	345	**1140B**	1600x600x2250	582
800	630	2x40+7x80+160	20	912	1600	**1145**	800x600x2250	350	**1145B**	1600x600x2250	585
880	695	2x40+6x80+2x160	22	1004	1000 + 1000	**1150**	1600x600x2250	580	**1150B**	1600x600x2250	588
960	758	8x80+2x160	12	1095	1000 + 1000	**1155**	1600x600x2250	590	**1155B**	1600x600x2250	590
1040	821	7x80+3x160	13	1186	1000 + 1250	**1160**	1600x600x2250	605	**1160B**	1600x600x2250	605
1120	884	6x80+4x160	14	1277	1000 + 1250	**1165**	1600x600x2250	615	**1165B**	1600x600x2250	615
1200	948	5x80+5x160	15	1369	1250 - 1250	**1170**	1600x600x2250	630	**1170B**	1600x600x2250	630
1280	1011	4x80+6x160	16	1460	1250 - 1250	**1175**	1600x600x2250	635	**1175B**	1600x600x2250	635
1360	1074	3x80+7x160	17	1551	1250 - 1600	**1180**	1600x600x2250	650	**1180B**	2400x600x2250	850
1440	1137	2x80+8x160	18	1642	1250 - 1600	**1185**	1600x600x2250	665	**1185B**	2400x600x2250	855
1520	1201	3x80+6x160+320	19	1733	1600 - 1600	**1190**	1600x600x2250	680	**1190B**	2400x600x2250	860
1600	1264	2x80+7x160+320	20	1825	1600 - 1600	**1195**	1600x600x2250	700	**1195B**	2400x600x2250	865

IP54 on demand (same sizes as the previous table)

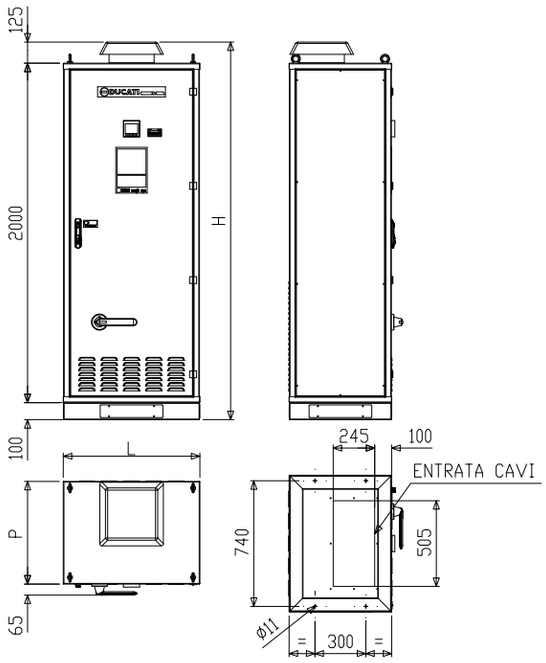
TECHNICAL DRAWING DUCATI 1600-R

1 LEAF TOP CABLE ENTRY

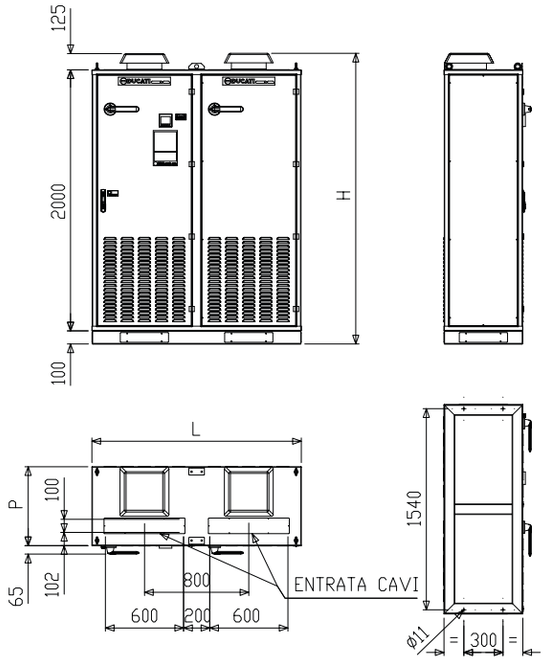


1 ANTA CAVI DALL'ALTO

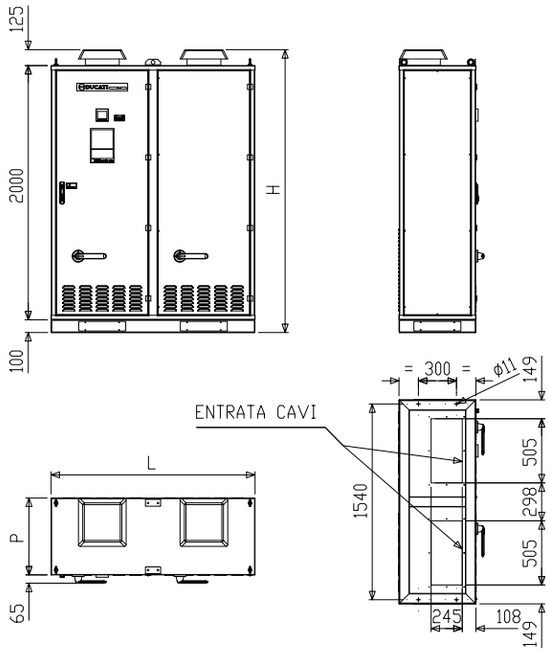
1 LEAF BOTTOM CABLE ENTRY



2 LEAVES TOP CABLE ENTRY

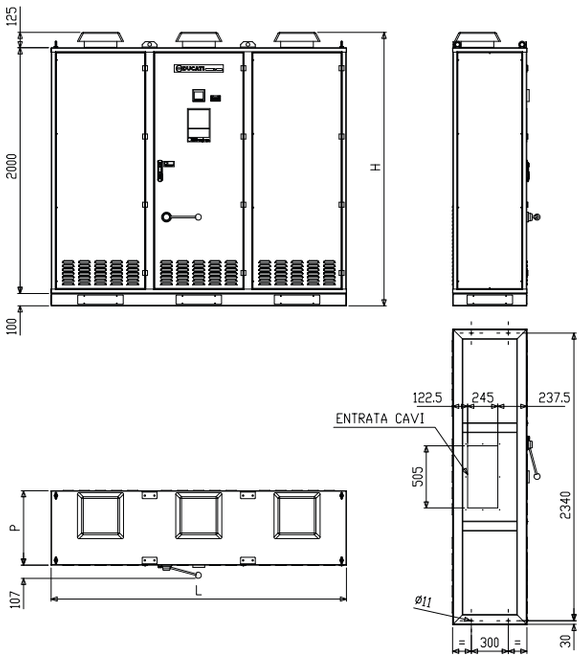


2 LEAVES BOTTOM CABLE ENTRY



TECHNICAL DRAWING DUCATI 1600-R

3 LEAVES BOTTOM CABLE ENTRY



DUCATI 2400-R/FP

Automatic power factor correction

Technical details

- Single-phase **MONO Long Life 4In PLUS** series capacitors in PPMh, for continuous duty in highly demanding conditions in environments with high levels of harmonics.
- Capacitors Rated voltage 525V
- **rEvolution R8** series microprocessor-based digital controller with 868 MHz radio module and RS485 and Bluetooth connectivity. In addition of the NFC module, there's a BT connection to exchange configuration files and status information with the **"DUCATI Smart Energy"** App. Auto-sensing of the direction and position of the TA, reducing the number of operator interventions. Suitable for cogeneration systems (e.g. PV). Possibility to integrate with the **DUCNET** cloud data sharing system via RS485 communication port or 868 MHz wireless transmission
- External steel structure painted with epoxy powder color RAL 7035
- Omni pole disconnecting switch with door lock and rated current 1.45 In according to the CEI EN standard
- Contactors designed to control capacitive loads, equipped with an inrush current limiting device with 230 V 50 - 60 Hz power supply

General Characteristics

Mains voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Ventilation	Forced
Usage	Indoor
Protection rating	IP31 - IP54 (on request)
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3F + PE
Cable entry	Top or bottom
Internal connection	FS17
Discharge devices	On each bank
Fuses	NH-00 GL
Standards	IEC 61439 where applicable IEC 61921
Short circuit current I_{SH}	24 kA (0.5s) for In sw = 630A 50 kA for In sw > 630A

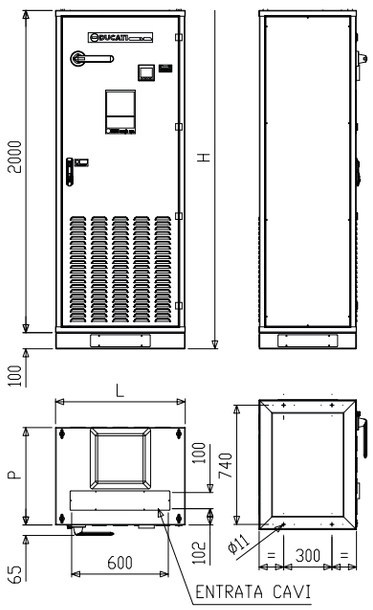
DUCATI 2400-R Un - Cond = 525 V

$THD_{I\ MAX\text{-}C}$ % ≤ 90% THD_I% ≤ 29% Un 400 V - 50 Hz

Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVAr)	Steps	In (A)	In sw. (A)	Top Cable entry			Bottom cable entry		
						Part n. 415.04.	LxWxH (mm)	Weight (kg)	Part n. 415.04.	LxWxH (mm)	Weight (kg)
240	139	4x60	4	201	630	**1610**	800x600x2250	265	**1610B**	800x600x2250	265
300	174	5x60	5	252	630	**1612**	800x600x2250	270	**1612B**	800x600x2250	270
360	209	6x60	6	302	630	**1614**	800x600x2250	275	**1614B**	800x600x2250	275
420	244	7x60	7	353	630	**1616**	800x600x2250	280	**1616B**	800x600x2250	280
480	279	6x60+120	8	403	630	**1618**	800x600x2250	285	**1618B**	800x600x2250	285
540	313	5x60+2x120	9	452	1000	**1620**	800x600x2250	295	**1620B**	800x600x2250	295
600	348	4x60+3x120	10	503	1000	**1622**	800x600x2250	300	**1622B**	800x600x2250	300
660	383	3x60+4x120	11	553	1000	**1624**	800x600x2250	305	**1624B**	800x600x2250	305
720	418	2x60+5x120	12	604	1000	**1626**	800x600x2250	310	**1626B**	800x600x2250	310
780	453	3x60+5x120	13	654	1000	**1628**	800x600x2250	315	**1628B**	800x600x2250	315
840	488	2x60+6x120	14	705	1250	**1630**	800x600x2250	325	**1630B**	800x600x2250	325
900	522	3x60+6 x120	15	754	1250	**1632**	800x600x2250	330	**1632B**	800x600x2250	330
960	557	2x60+7x120	16	804	1250	**1634**	800x600x2250	335	**1634B**	800x600x2250	335
1020	592	3x60+7x120	17	855	1250	**1636**	800x600x2250	340	**1636B**	1600x600x2250	565
1140	662	60+9x120	19	956	1600	**1640**	800x600x2250	355	**1640B**	1600x600x2250	575
1200	697	2x60+7x120+240	20	1007	1600	**1642**	800x600x2250	360	**1642B**	1600x600x2250	580
1260	731	3x60+5x120+2x240	21	1056	1000 + 1000	**1644**	1600x600x2250	590	**1644B**	1600x600x2250	590
1320	766	2x60+6x120+2x240	22	1106	1000 + 1000	**1646**	1600x600x2250	595	**1646B**	1600x600x2250	595
1380	801	60+7x120+2x240	23	1157	1000 + 1000	**1648**	1600x600x2250	600	**1648B**	1600x600x2250	600
1440	836	8x120+2x240	12	1207	1000 + 1000	**1650**	1600x600x2250	605	**1650B**	1600x600x2250	605
1500	871	60+6x120+3x240	25	1258	1000 + 1000	**1652**	1600x600x2250	610	**1652B**	1600x600x2250	610
1560	906	7x120+3x240	13	1308	1250 + 1000	**1654**	1600x600x2250	620	**1654B**	1600x600x2250	620
1620	940	60+5x120+4x240	27	1357	1250 + 1000	**1656**	1600x600x2250	625	**1656B**	1600x600x2250	625
1680	975	6 x 120 + 4 x 240	14	1408	1250 + 1000	**1658**	1600x600x2250	630	**1658B**	1600x600x2250	630
1740	1010	60 + 4 x 120 + 5 x 240	29	1458	1250 + 1000	**1660**	1600x600x2250	635	**1660B**	1600x600x2250	635
1800	1045	5 x 120 + 5 x 240	15	1509	1250 + 1250	**1662**	1600x600x2250	645	**1662B**	1600x600x2250	645
1860	1080	60 + 3 x 120 + 6 x 240	31	1559	1250 + 1250	**1664**	1600x600x2250	650	**1664B**	1600x600x2250	650
1920	1115	4 x 120 + 6 x 240	16	1610	1250 + 1250	**1666**	1600x600x2250	655	**1666B**	1600x600x2250	655
1980	1149	60 + 2 x 120 + 7 x 240	33	1659	1250 + 1250	**1668**	1600x600x2250	660	**1668B**	2400x600x2250	870
2040	1184	3 x 120 + 7 x 240	17	1709	1600 + 1250	**1670**	1600x600x2250	670	**1670B**	2400x600x2250	875
2100	1219	60 + 1 x 120 + 8 x 240	35	1760	1600 + 1250	**1672**	1600x600x2250	675	**1672B**	2400x600x2250	880
2160	1254	2 x 120 + 8 x 240	18	1810	1600 + 1250	**1674**	1600x600x2250	680	**1674B**	2400x600x2250	890
2220	1289	60 + 2 x 120 + 6 x 240 + 480	37	1861	1600 + 1250	**1676**	1600x600x2250	685	**1676B**	2400x600x2250	895
2280	1324	3 x 120 + 6 x 240 + 480	19	1912	1600 + 1600	**1678**	1600x600x2250	695	**1678B**	2400x600x2250	900
2340	1358	60 + 1 x 120 + 7 x 240 + 480	39	1961	1600 + 1600	**1680**	1600x600x2250	700	**1680B**	2400x600x2250	905
2400	1393	2 x 120 + 7 x 240 + 480	20	2011	1600 + 1600	**1682**	1600x600x2250	705	**1682B**	2400x600x2250	910

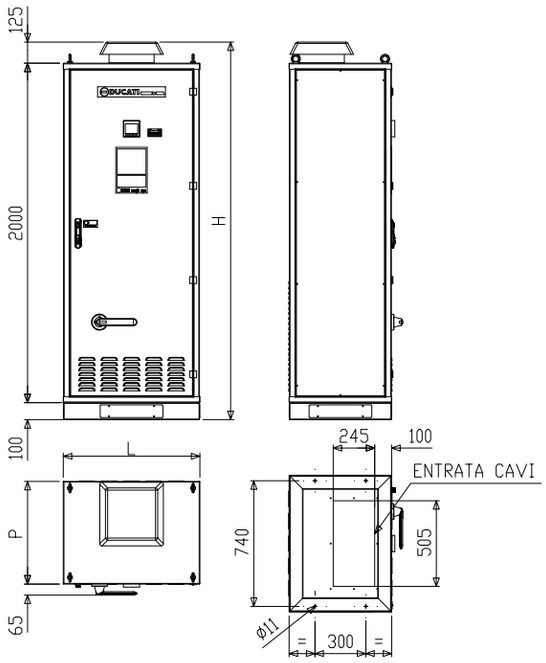
TECHNICAL DRAWING DUCATI 2400-R

1 LEAF TOP CABLE ENTRY

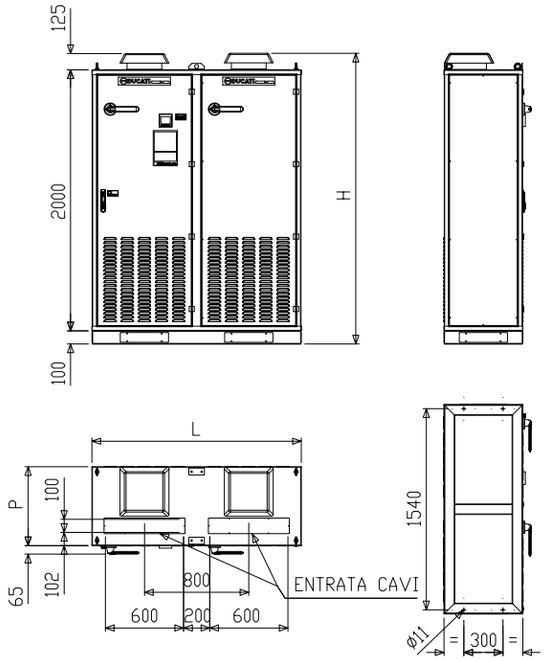


1 ANTA CAVI DALL'ALTO

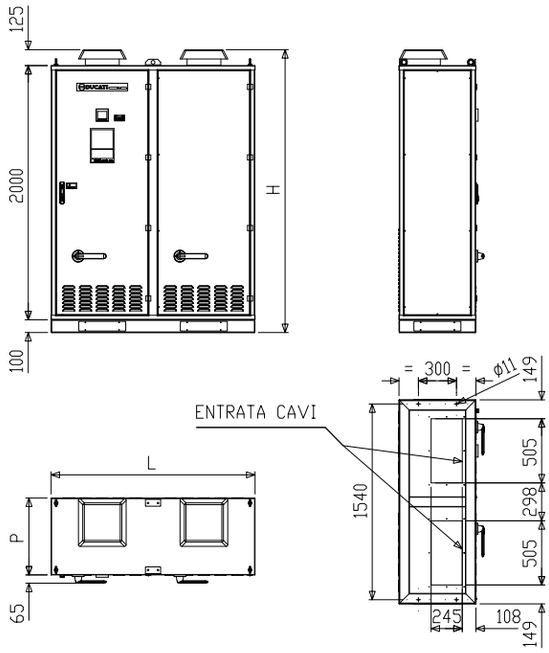
1 LEAF BOTTOM CABLE ENTRY



2 LEAVES TOP CABLE ENTRY

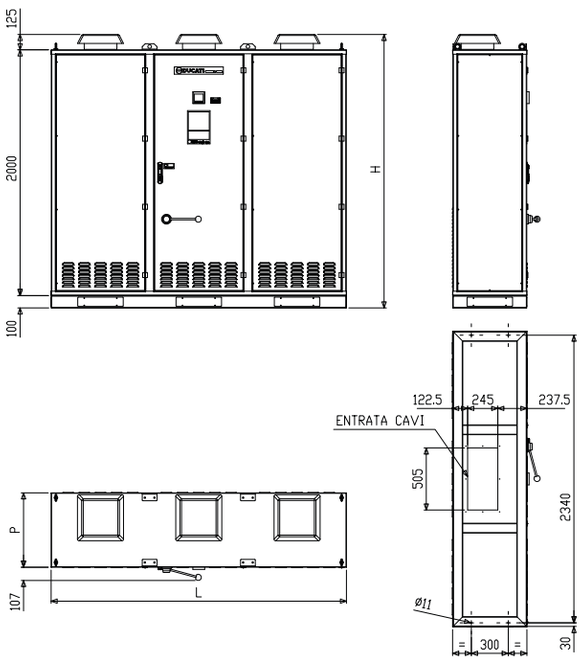


2 LEAVES BOTTOM CABLE ENTRY



TECHNICAL DRAWING DUCATI 2400-R

3 LEAVES BOTTOM CABLE ENTRY



DUCATI 170-ML

Automatic power factor correction with filter systems

Technical details

- Single-phase **MONO Long Life 4In PLUS** series capacitors in PPMh, for a continuous duty under highly demanding conditions in environments with high levels of harmonics.
- Capacitors Rated voltage 480 V
- **rEvolution R5 485 series radio** series microprocessor-based digital controller. NFC connection for exchanging configuration and status information through the dedicated **"DUCATI Smart Energy"** app. Auto-sensing of the direction and position of the TA, reducing the number of operator interventions. Suitable for cogeneration systems (e.g. PV). Possibility to integrate with the **DUCNET** cloud data sharing system via RS485 communication port or 868 MHz wireless transmission
- Harmonic filter reactors tuned to 189 Hz (p= 7%)
- External steel structure painted with epoxy powder color RAL 7035
- Omni pole disconnecting switch with door lock and rated current 1.45 In according to the CEI EN standard
- Contactors designed to control capacitive loads, equipped with an inrush current limiting device, with 230 V 50-60 Hz power supply

General Characteristics

Mains voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Ventilation	Forced
Usage	Indoor
Protection rating	IP 30
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3PH + PE
Cable entry	Top
Internal connection	FS17
Discharge devices	On each bank
Fuses	NH-00 GL
Standards	IEC 61439 where applicable IEC 61921
Short circuit current I_{SH}	50 kA (conditioned by the upstream protective device)

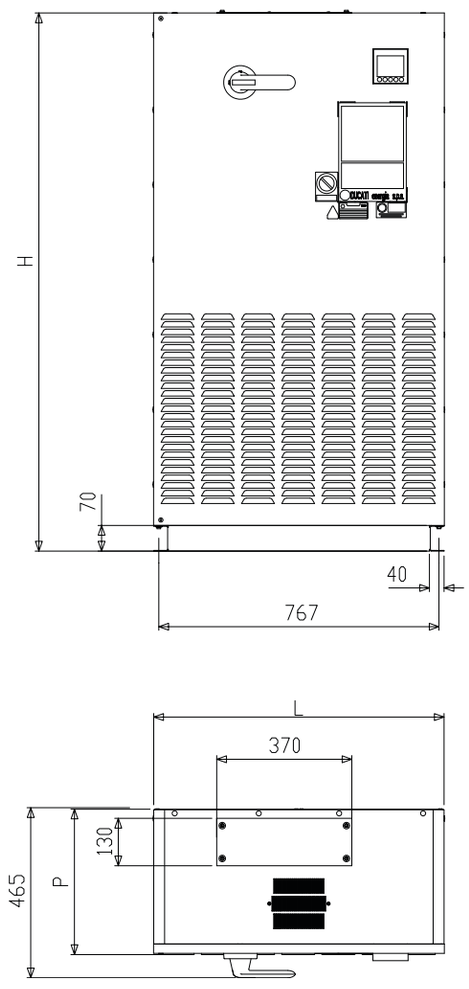
DUCATI 170 ML - Un Cond = 480 V FILTER 189 Hz (*)

THD_i % ≤ 100%(*) THD_V% ≤ 6%(*) Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
2110N	25.5	3x8.5	3	37	160	800x400x1470	170
2115N	34	2x8.5+17	4	49	160	800x400x1470	170
2120N	42.5	8.5+2x17	5	61	160	800x400x1470	175
2125N	59.5	8.5+17+34	7	86	160	800x400x1470	185
2130N	68	2x17+34	4	98	160	800x400x1470	185
2135N	85	17+2x34	5	123	250	800x400x1470	190
2140N	102	2x17+2x34	6	147	250	800x400x1470	220
2145N	119	17+3x34	7	172	250	800x400x1470	220
2150N	136	2x17+3x34	8	196	400	800x400x1470	240
2155N	153	17+4x34	9	221	400	800x400x1470	245
2160N	170	5x34	5	245	400	800x400x1470	250

(*) Other operating voltages and tuning frequencies available upon request.

TECHNICAL DRAWING DUCATI 170-ML



DUCATI 1000-RL

Automatic power factor correction with filter systems

Technical details

- Single-phase **MONO Long Life 4In PLUS** series capacitors in PPMh, for a continuous duty under highly demanding conditions in environments with high levels of harmonics.
- Capacitors Rated voltage 480 V
- **rEvolution R8** series microprocessor-based digital controller with **868 MHz radio module and RS485 and Bluetooth connection.** In addition to the NFC module, there is a BT connection to exchange configuration files and status information with the **"DUCATI Smart Energy"** app. Auto-sensing of the direction and the position of the TC to make configuration easier. Suitable for cogeneration systems such as PV. NFC connection for configuration exchange with the **"DUCATI Smart Energy"** app. Optional integration with **DUCNET** cloud data sharing system via RS485 communication port or 868 MHz radio transmission
- Harmonic filter reactors tuned to 189 Hz (p= 7%)
- External steel structure painted with epoxy powder color RAL 7035
- Omni pole disconnecting switch with door lock and rated current
- 1.45 In according to the CEI EN standard
- Contactors designed to control capacitive loads, equipped with an inrush current limiting device, with 230 V 50-60 Hz power supply

General Characteristics

Mains voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Ventilation	Forced
Usage	Indoor
Protection rating	IP31 - IP54 (on request)
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3F + PE
Cable entry	Top or bottom
Internal connection	FS17
Discharge devices	On each bank
Fuses	NH-00 GL
Standards	IEC 61439 where applicable IEC 61921
Short circuit current I_{SH}	24 kA (0.5s) for In sw = 630A 50 kA for In sw > 630A

DUCATI 1000-RL Un - Cond = 480 V FILTER 189 Hz (*)

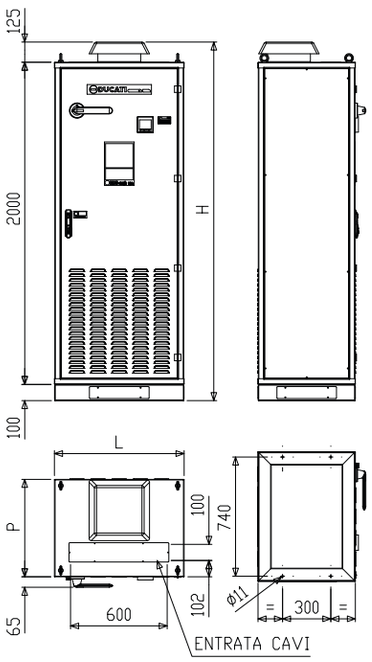
THD_I % ≤ 100%(*), THD_I% @250 Hz <25%, THD_V% ≤ 6%(*) Un 400 V - 50 Hz

Qn (400 V) (kVAr)	Bank Power (kVAr)	Steps	In (A)	In sw. (A)	Top Cable entry			Bottom cable entry		
					Part n. 415.04.	LxWxH (mm)	Weight (kg)	Part n. 415.04.	LxWxH (mm)	Weight (kg)
150	2x25+2x50	6	217	630	**2010**	800x600x2250	360	**2010B**	800x600x2250	360
175	25+3x50	7	253	630	**2015**	800x600x2250	365	**2015B**	800x600x2250	365
200	4x50	4	289	630	**2020**	800x600x2250	370	**2020B**	800x600x2250	370
200	2x25+3x50	8	289	630	**2023**	800x600x2250	400	**2023B**	800x600x2250	460
250	5x50	5	361	630	**2025**	800x600x2250	410	**2025B**	800x600x2250	465
300	6x50	6	433	630	**2030**	800x600x2250	445	**2030B**	800x600x2250	475
350	7x50	7	505	1000	**2035**	800x600x2250	485	**2035B**	800x600x2250	485
400	8x50	8	577	1000	**2040**	800x600x2250	520	**2040B**	800x600x2250	520
500	10x50	10	722	1000	**2045**	800x600x2250	595	**2045B**	1600x600x2250	885
600	6x50+3x100	12	866	630 + 630	**2050**	1600x600x2250	890	**2050B**	1600x600x2250	890
700	6x50+4x100	14	1010	630 + 1000	**2055**	1600x600x2250	965	**2055B**	1600x600x2250	965
800	4x50+6x100	16	1155	1000 + 1000	**2060**	1600x600x2250	1045	**2060B**	1600x600x2250	1045
900	2x50+8x100	18	1299	1000 + 1000	**2065**	1600x600x2250	1110	**2065B**	2400x600x2250	1350
1000	2x50+7x100+200	20	1443	1000 + 1000	**2070**	1600x600x2250	1190	**2070B**	2400x600x2250	1430

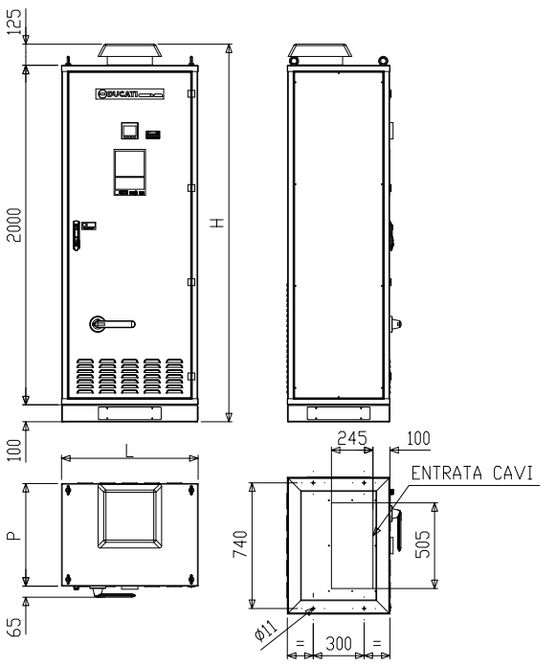
* Other operating voltages and tuning frequencies available upon request.
IP54 on demand (same sizes as the previous table).

TECHNICAL DRAWING DUCATI 1000-RL

1 LEAF TOP CABLE ENTRY

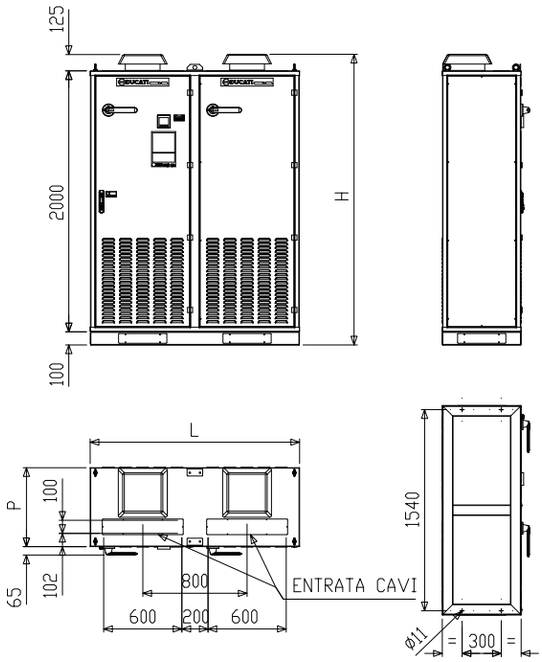


1 LEAF BOTTOM CABLE ENTRY

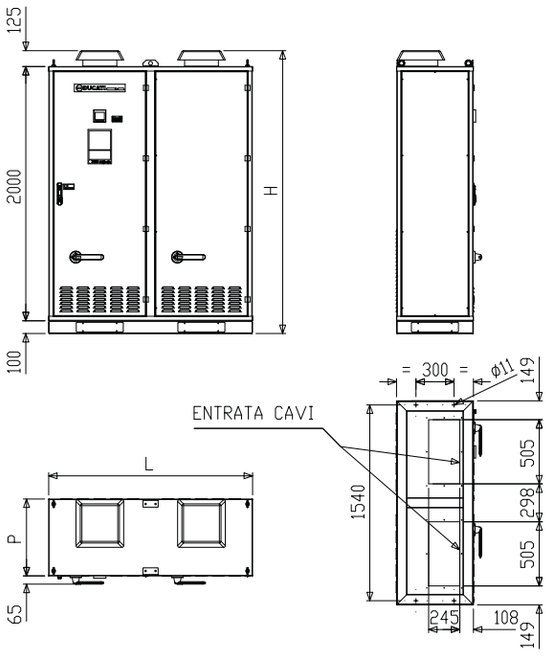


TECHNICAL DRAWING DUCATI 1000-RL

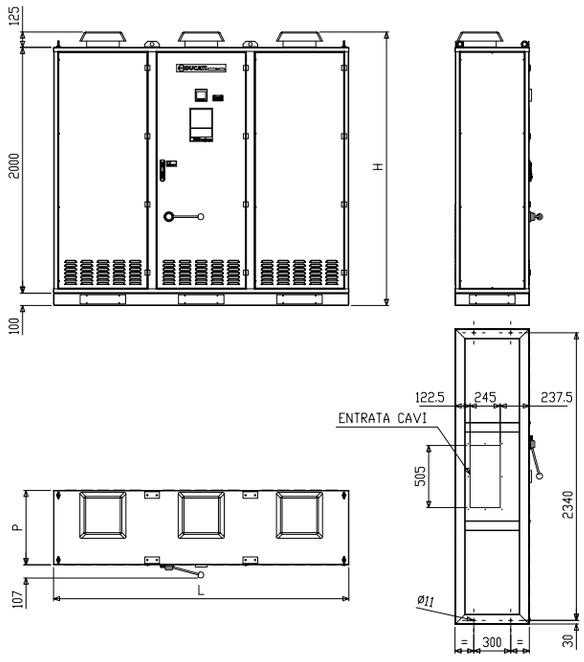
2 LEAVES TOP CABLE ENTRY



2 LEAVES BOTTOM CABLE ENTRY



3 LEAVES BOTTOM CABLE ENTRY



DUCATI 1000-RL/HP

Automatic power factor correction with filter systems

Technical details

- Single-phase **GP84 High Performance** capacitors in PPMh for high power, built exclusively with dual element series to work in systems characterized by high harmonic currents.
- Capacitors Rated voltage 550 V
- **rEvolution R8** series microprocessor-based digital controller with **868 MHz radio module and RS485 and Bluetooth connection**. In addition to the NFC module, there is a BT connection to exchange configuration files and status information with the **"DUCATI Smart Energy"** app. Auto-sensing of the direction and the position of the TC to make configuration easier. Suitable for cogeneration systems such as PV. NFC connection for configuration exchange with the **"DUCATI Smart Energy"** app. Optional integration with **DUCNET** cloud data sharing system via RS485 communication port or 868 MHz radio transmission
- Harmonic filter reactors tuned to 189 Hz (p= 7%)
- External steel structure painted with epoxy powder color RAL 7035
- Omni pole disconnecting switch with door lock and rated current 1.45 In according to the CEI EN standard
- Contactors designed to control capacitive loads, equipped with an inrush current limiting device, with 230 V 50-60 Hz power supply

General Characteristics

Mains voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Ventilation	Forced
Usage	Indoor
Protection rating	IP31 - IP54 (on request)
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3F + PE
Cable entry	Top or bottom
Internal connection	FS17
Discharge devices	On each bank
Fuses	NH-00 GL
Standards	IEC 61439 where applicable IEC 61921
Short circuit current I_{SH}	24 kA (0.5s) for In sw = 630A 50 kA for In sw > 630A

DUCATI 1000-RL/HP Un - Cond = 550 V FILTER 189 Hz (*)

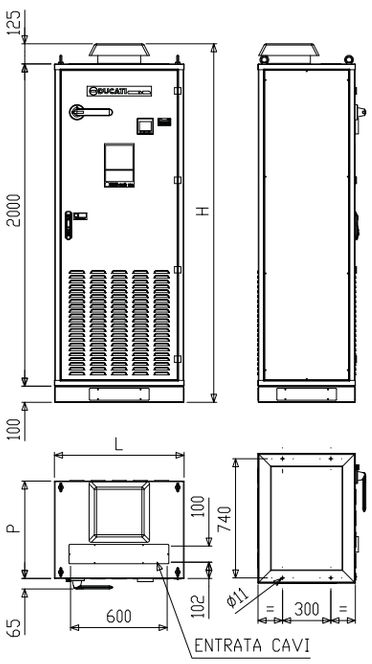
THD_I % ≤ 100%(*), THD_I% @250 Hz <25%(*), THD_V% ≤ 8%(*) Un 400 V - 50 Hz

Qn (kVAr) (400 V)	Bank Power (kVAr)	Steps	In (A)	In sw. (A)	Top Cable entry			Bottom cable entry		
					Part n. 415.04.	LxWxH (mm)	Weight (kg)	Part n. 415.04.	LxWxH (mm)	Weight (kg)
132	2x22+2x44	6	191	630	**2510**	800x600x2250	380	**2510B**	800x600x2250	380
176	4x 44	4	254	630	**2515**	800x600x2250	400	**2515B**	800x600x2250	400
264	6x 44	6	381	630	**2520**	800x600x2250	480	**2520B**	800x600x2250	480
352	8 x 44	8	508	1000	**2525**	800x600x2250	600	**2525B**	800x600x2250	600
440	10x44	10	635	1000	**2530**	1600x600x2250	850	**2530B**	1600x600x2250	850
528	6x44+3x88	12	762	1250	**2535**	1600x600x2250	930	**2535B**	1600x600x2250	930
616	6x44+4x88	14	889	1600	**2540**	1600x600x2250	1000	**2540B**	1600x600x2250	1000
704	4x44+6x88	16	1016	1600	**2545**	1600x600x2250	1080	**2545B**	1600x600x2250	1080
792	2x44+8x88	18	1143	2500	**2550**	2400x600x2250	1400	**2550B**	2400x600x2250	1400
880	2x44+7x88+176	20	1270	2500	**2555**	2400x600x2250	1500	**2555B**	2400x600x2250	1500
968	2x44+6x88+2x176	22	1397	2500	**2560**	2400x600x2250	1600	**2560B**	2400x600x2250	1600
1056	8x88+2x176	12	1524	2500	**2565**	2400x600x2250	1700	**2565B**	2400x600x2250	1700

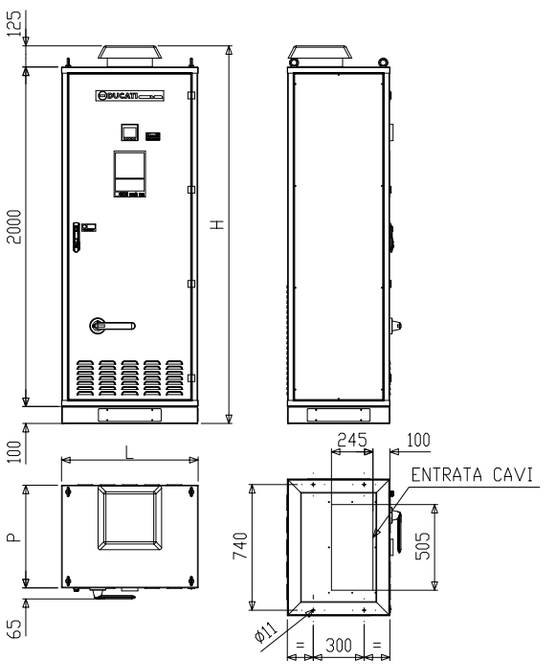
* Other operating voltages and tuning frequencies available upon request.
IP54 on demand (same sizes as the previous table).

TECHNICAL DRAWING DUCATI 1000-RL/HP

1 LEAF TOP CABLE ENTRY

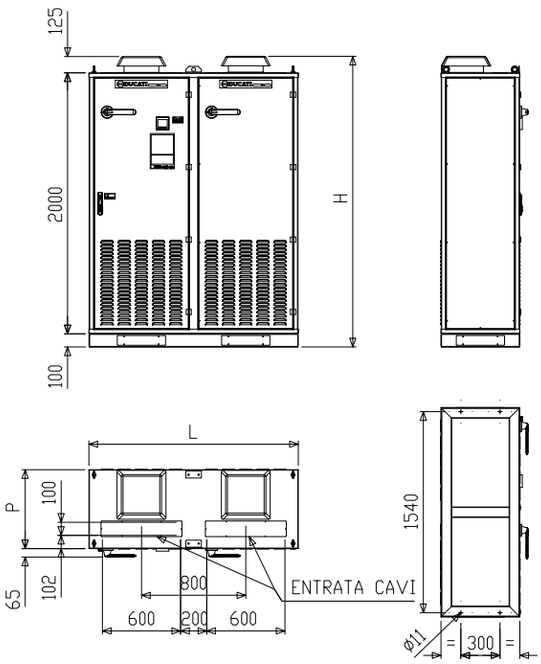


1 LEAF BOTTOM CABLE ENTRY

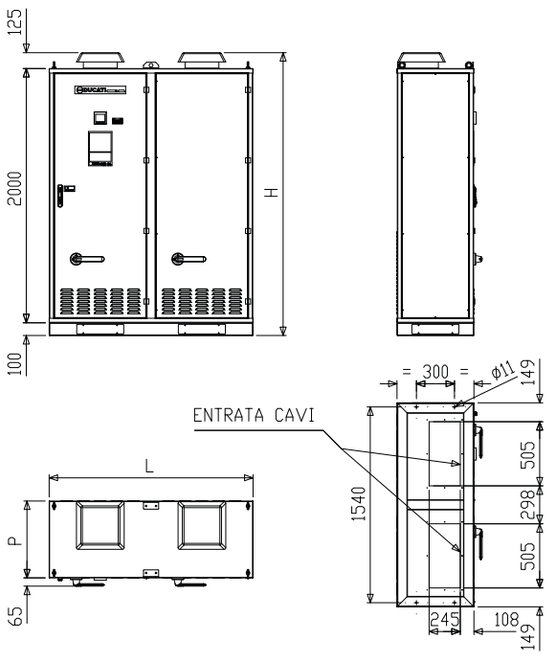


TECHNICAL DRAWING DUCATI 1000-RL/HP

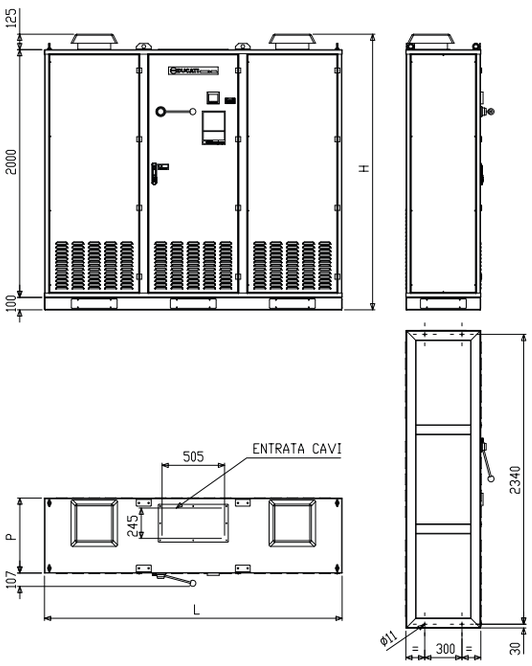
2 LEAVES TOP CABLE ENTRY



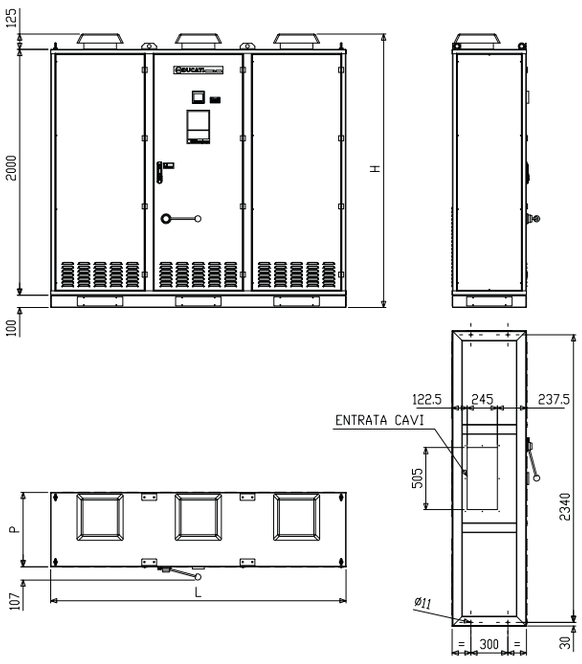
2 LEAVES BOTTOM CABLE ENTRY



3 LEAVES TOP CABLE ENTRY



3 LEAVES BOTTOM CABLE ENTRY



DUCATI 1000-RL/S

Automatic thyristor power factor correction with filter systems

Technical details

- Single-phase **MONO Long Life 4In PLUS** series capacitors in PPMh, for a continuous duty under highly demanding conditions in environments with high levels of harmonics.
- Capacitors Rated voltage 480 V
- **Power factor controller, FCR series** with enhanced VLSI and Digital Signal Processor system for FFT measurement. Real-time analysis with duty cycle around 5 millisecond RS-485.
- Communication serial port RS-485 and built-in customization help software.
- Harmonic filter reactors with tuning frequency 189 Hz (p= 7%).
- External steel structure painted with epoxy powder color RAL 7035, with modular chassis style internal structure.
- Omni pole disconnecting switch with door lock and rated current 1.45 In according to the CEI EN standard
- **Static Switching Module (SCR)** suitable for controlling capacitive loads, inserted outside the delta connection formed by the single-phase capacitive elements.

General Characteristics

Mains voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Ventilation	Forced
Usage	Indoor
Protection rating	IP31 – IP54 (on request)
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3F + PE
Cable entry	Top
Internal connection	FS17
Discharge devices	On each bank according to EN 60831 standard
Fuses	NH-00 GL
Standards	EN 61000-4-2 EN 50081-2 EN 50082-2 IEC 61921 -1/2
Short circuit current I_{SH}	24 kA (0.5s) for In sw = 630A 50 kA for In sw > 630A

DUCATI 1000-RL/S Un - Cond = FILTER 480 V 189 Hz (*)

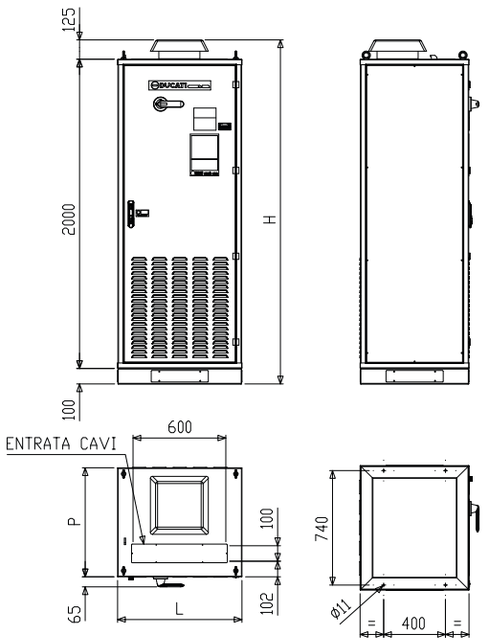
THD_I % ≤ 100%(*), THD_I% @250 Hz <25%(*), THD_V% ≤ 6%(*) Un 400 V - 50 Hz

Part number 415.14	Q (400 V) (kVAr)	Bank Power (kVar)	Steps	In (A)	In sw (A)	LxWxH (mm)	Weight (kg)
1353	150	2x25+2x50	6	217	630	800x700x2150	375
1360	250	2x25+4x50	10	361	630	800x700x2150	465
1365	300	6x50	6	433	630	800x700x2150	505
1370	350	7x50	7	505	1000	1600x700x2150	780
1372	400	8x50	8	577	1000	1600x700x2150	820
1375	450	9x50	9	650	1000	1600x700x2150	860
1380	500	10x50	10	722	1000	1600x700x2150	900
1385	550	11x50	11	794	1250	1600x700x2150	940
1390	600	12x50	12	866	1250	1600x700x2150	980

* Other operating voltages and tuning frequencies available upon request.

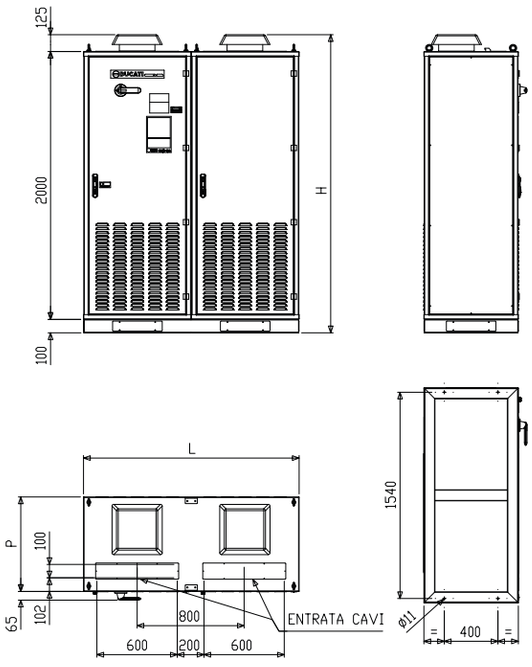
TECHNICAL DRAWING DUCATI 1000-RL/S

1 LEAF TOP CABLE ENTRY

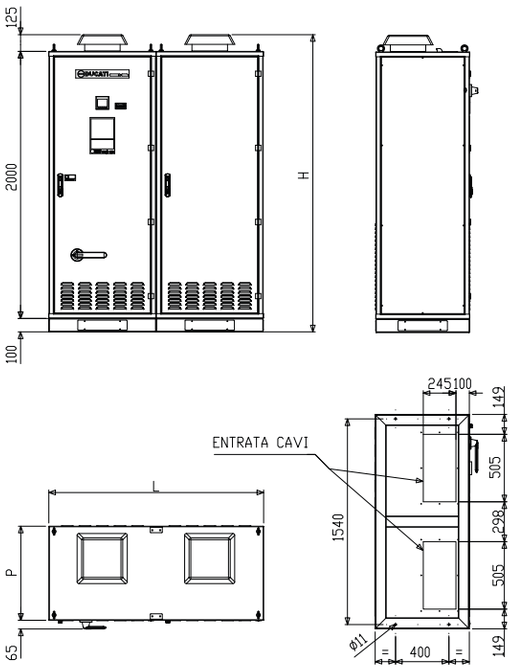


TECHNICAL DRAWING DUCATI 1000-RL/S

2 LEAVES TOP CABLE ENTRY



2 LEAVES BOTTOM CABLE ENTRY



DUCATI ACTISINE PRO

Active harmonic filters

ActiSine detects harmonic currents in real time and eliminates them ACTIVELY by compensating them with equal and opposite currents. Active filters are:

- **EFFECTIVE:** their performance is independent of the characteristics of the network and their sizing is simple and straightforward
- **RELIABLE:** because they adapt automatically and instantly to the operating conditions and cannot be overloaded

Technical details

- **ActiSine** active technology guarantees excellent results (residual THD < 3%) independently from the network's characteristics. The full rated current can be dedicated to harmonic current compensation
- **ActiSine** is equipped with a **DSP (Digital Signal Processor) controller,** which guarantees a real time response (< 20 ms, in one cycle of the mains voltage)
- ActiSine is dimensioned basing on a simple harmonic measurement and is univocal, because it depends exclusively on the harmonic currents
- **ActiSine** cannot be overloaded. If the harmonic currents should exceed the value for which the filter is dimensioned, the system will limit its action to its nominal current, filtering the maximum possible amount of harmonics

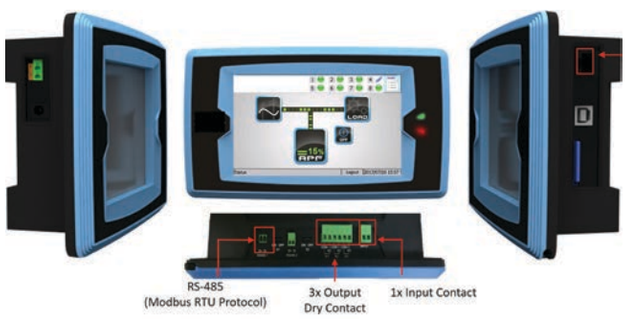
DUCATI ActiSine PRO MODULAR combines a modular structure with the possibility of connecting up to 6 units in parallel, to achieve very high power. These features ensure maximum flexibility during installation and system expandability.

DUCATI ActiSine PRO WALL MOUNT is a complete wall-mounted solution, ready for easy installation in conditions that require space-saving and high power density design.

- Harmonics of 3rd order (and order 9th, 15th, …, 6n+3) generated by single-phase distorting loads (PCs, copying machines, electronic ballasts) add up in the neutral cables, overloading them. ActiSine is available as three-phase + neutral version, capable of effectively canceling these harmonics
- With its default settings ActiSine acts on all harmonics up to the 51st. The user can also set up to 12 harmonics on which to concentrate the filtering action. ActiSine can also be set to use part of its current to correct the load's power factor and can be used together with traditional capacitor-based PFC systems, provided they are equipped with detuning reactors
- Installation is simple and flexible because ActiSine is connected in parallel to the loads to be filtered. The CTs for current measurement can be mounted up or down-stream of the filter (closed or open loop control). The startup is immediate thanks to default and automatic settings. The user interface is simple and straightforward

General Characteristics

Rated voltage	400 V
Voltage tolerance	+15%, -20%
Rated frequency	50 Hz/60 Hz ±3 Hz
Ventilation	Forced
Usage	Indoor
Protection rating	IP21/IP54
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3F , 3F + N
Cable entry	Top
Reference Harmonic Standard	EN61000-3-4, IEEE 519-1992
Reference Design Standard	EN60146
Safety Standard	EN50178
Electromagnetic Compatibility	IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6



DUCATI ACTISINE PRO MODULAR

Power Module specifications

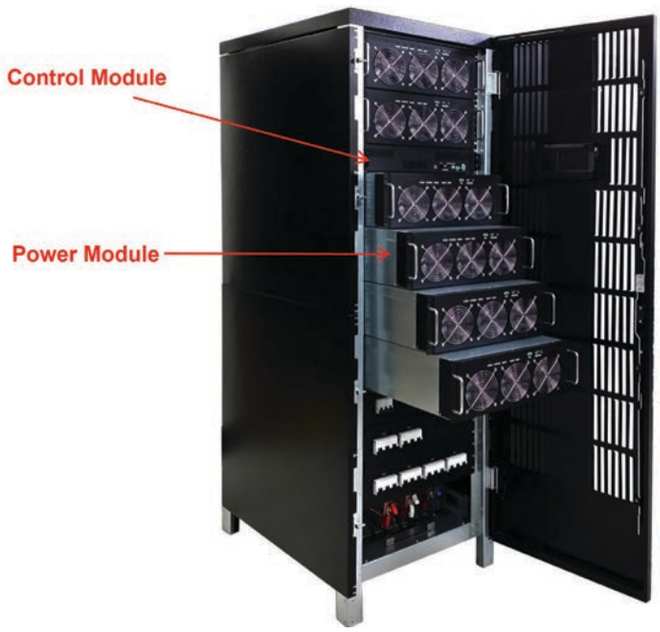
Input Voltage	400V +15%,-20% 3 phase 4 wires/3wires
Frequency	50/60±3 Hz
Rating Current of Each Phase	60 Arms / 80 Arms / 100 Arms
Current Limitation	Yes, at full correcting
Protection Index	IP20
Dimensions (LxWxH)	440 x 630 x 176mm

Control Module specifications

Input Voltage	400V +15%,-20% 3 phase 4 wires/3wires
Frequency	50/60±3 Hz (Auto Sensing)
Compensated Harmonic Orders	From 2nd to 51st order
Power factor correction	Power factor can be programmed from 0.6 lagging to 0.6 leading
Load Balancing	Both phase to phase and phase to neutral
CT Ratio	Primary Current: 100A~10000A Secondary Current: 1A/5A
CT Location	"Source Side: Closed Loop Control Load Side: Open Loop Control"
Response Time	Global<1ms; Selective < 10 ms
Number of controllable Power Module	Up to 6 Power Modules.
Parallel	Up to 4 Control Modules.
Maximum Heat losses	50 Watt
Protection Index	IP20
Dimensions (LxWxH)	440 x 630 x 86mm
Weight	10 kg

PRODUCT TYPE	CURRENT (Arms)	DIMENSIONS (mm)	NOTE
Control Module	-	440x630x86	Control Module
Power Module	60 A	440x630x176	Power Module - 60A
Power Module	80 A	440x630x176	Power Module - 80A
Power Module	100 A	440x630x176	Power Module - 100A
Cabinet LCD IP21	400A (max)	600x900x1500	MAX 4 Power Module
Cabinet LCD IP21	600A (max)	600x900x1950	MAX 6 Power Module
Cabinet LCD - IP54	600A (max)	600x1000x1950	MAX 6 Power Module

* Part n. based on the assembled system

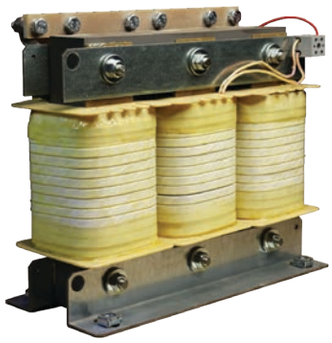


DUCATI ACTISINE PRO WALL MOUNT

Power Module specifications	
Rated voltage	400 V
Voltage tolerance	+15% , -20 %
Rated frequency	50 Hz/60 Hz ± 3 Hz
Phases	3F
Protection class	IP30/IP31

PRODUCT TYPE	CURRENT (Arms)	Part number 415.14	DIMENSIONS (mm)	NOTE
Wall Mount LCD 30 A	30 A	2350	362x175x630	LCD display
Wall Mount LCD 60 A	60 A	2355	500x286x775	LCD display
Wall Mount LCD 80 A	80 A	2360	500x286x775	LCD display
Wall Mount LCD 100 A	100 A	2365	500x286x775	LCD display

ACCESSORIES AND COMPONENTS



rEvolution R5, R8, R14 and R6T

rEvolution SERIES R5, R8, R14 & R6T

Automatic reactive power regulators are systems that automatically manage the banks of capacitors to compensate the reactive power absorbed by the load and to avoid being charged penalties imposed by the Electricity and Gas Authorities.

Thanks to the know-how acquired over years of designing and manufacturing analyzers for electrical measurements, *DUCATI Energia* has developed the innovative **rEvolution series of reactive power regulators**.

The compactness, the latest technology and the complete range of functions make **the rEvolution models** extremely adaptable to any application context in the field of power factor correction systems for low and medium voltage networks, both single-phase and three-phase, in the presence or absence of power generation systems (e.g. photovoltaic).

Depending on the model, the main connectivity options (SRD radio, NFC, Ethernet, RS485, Bluetooth, USB) can be used both for on-site data exchange via the **"DUCATI Smart Energy" Android app**, and for remote monitoring of the performance of the equipment, the status of the capacitor banks and events related to the electrical parameters of the system.

Model	Part number	Connectivity	Relays
R5	**415984050NNNN**	NFC	5
R5 RADIO 485	**415984050QNDN**	NFC, radio, RS-485	5
R8 RADIO	**415986080NNDN**	NFC, radio	8
R8 485 RADIO	**415986080QNDN**	NFC, radio, RS-485	8
R8 485 BT RADIO	**415986080QBDN**	NFC, radio, RS-485, Bluetooth	11
R8 ETH BT RADIO	**415986080EBDN**	NFC, radio, Ethernet, Bluetooth	11
R14	**415988140NNNN**	NFC, radio	15
R14 485	**415988140QNNN**	NFC, radio, RS-485	15
R14 485-BT	**415988140QBNN**	NFC, radio, RS-485, Bluetooth	18
R14 ETH	**415988140ENNN**	NFC, radio, Ethernet	15
R6T USB	**415988160NSNN**	NFC, radio, RS-485, USB	6
R6T BT	**415988160NBNN**	NFC,radio, RS-485, bluetooth	6

App DUCATI Smart Energy

The dedicated **"DUCATI Smart Energy"** app is designed to simplify the setup and control of all the equipment in which the **rEvolution regulators** are installed. Communication with the smartphone can be carried out thanks to the NFC connection, standard on the entire range, or via **Bluetooth** (on models equipped with it). You will be able to manage and **organize an infinite number of DUCATI regulators** with the convenience of the graphic interface.

Main features:

1. Easy and intuitive reading, modification and export of configuration parameters

2. Firmware update

3. Immediate control of the condition of equipment (battery power, contactors operation etc.)

4. Download the configuration file by email

rEvolution R5

Reactive power controller

The new **R5** by DUCATI Energia is a regulator designed for quick and easy installation and correct start-up of power factor correction equipment. The **R5** models are equipped with technology that allows the exchange of performance and system status data both on site via **App Android (NFC)** or **radio SRD**, and remotely (**RS485**) for monitoring purposes, through DUCATI Energia ENERGY BRIDGE datalogger devices. The large display with red LED backlit icons allows the measured values to be read remotely.

The 5-button keypad makes it easy to navigate the menus and intuitive to set the configuration parameters. One of the buttons is dedicated to fast switching from manual to automatic mode and vice versa.

The programming algorithms allow the controller to define in a completely automatic way both the recognition of the direction of the TA and the recognition of the phase on which the TA is installed, thus avoiding possible installation errors. The dual power inputs, one at 230 VAC and one at 400 VAC, allows the regulator to be used in single-phase networks with neutral or in three-phase networks with and without neutral.

Thanks to the advanced features of the microprocessor, the R5 calculates the cosφ from the voltage-current phase shift of the fundamental harmonic at the mains frequency; and measures the total harmonic distortion in voltage (THDV%) and current (THDI%) with a total spectrum up to the 60th component.

Smart Communications

Communication with the standard NFC sensor, or the optional **SRD and RS485 radios** allow the quick exchange of data with the **"DUCATI Smart Energy" Android app** or with the ENERGY BRIDGE **datalogger.**

Technical details

Power supply:
- Rated voltage: 400 or 230 VAC
- Operating limits: 380÷415 VAC ±10% or 220÷240 VAC ±10%
- Frequency: 45 ÷ 66 Hz
- Power consumption: 2.5 W – 3 VA

Current input:
- Rated current: 5 A
- Self-consumption: < 1.8 VA

Relay outputs:
- Number of Relay Outputs: 5 (1 common)
- Contact type: NO (Normally Open)
- Maximum operating voltage: 440 VAC
- Rated capacity: AC1 6 A – 250 VAC, AC15 1.5 A - 440 VAC

Alarms:
- Overvoltage and overcurrent
- Undervoltage and undercurrent
- Maximum Harmonic Distortion in current (THDI) and voltage (THDV)
- Over-temperature
- No power factor correction (low cosφ)
- Other alarms (see manual)

Ambient operating conditions:
- Operating temperature: -20 - 70°C
- Overvoltage category: |||, Measurement category: 3
- Insulation voltage: 600 VAC
- Relative humidity: < 80%

Container:
- Size: 96x96 built-in
- Protection rating: IP51 on the front – IP20 on the terminals
- Weight: 350 g.

RS485 Interface:
- Modbus-RTU
- Ascii-Ducbus

SRD Radio Interface:
- Carrier Frequency: 868 MHz
- Frequency band: 868.0 – 868.6 MHz
- Maximum output power: 12.5 mW
- Protocol: Modbus-RTU

NFC Interface:
- Frequency: 13.56 MHz
- Data exchange with smartphone via antenna behind the display

Standard Compliance:
- Image that contains text, clock Auto-generated description
- EN 61000-6-2
- EN 61000-6-4
- EN 61326-1
- EN 62311
- EN 301-489-1
- EN 301-489-3
- EN 300-220-2
- EN 300-330

rEvolution R8

Reactive power controller

The new **R8** by DUCATI Energia is an innovative regulator characterized by advanced functions suitable for any application context, a wide range of sizes and various communication solutions, all concentrated in the compact 96x96 mm dimensions.

The R8 models are equipped with all the main connectivity options (**Bluetooth, USB, Wireless-radio, NFC, Ethernet, RS485**) both for local data exchange and for remote monitoring of the performance of the equipment. A clear user guide, with texts translated into 9 languages, makes the **R8** models easy to use both during equipment commissioning and during normal operation of the power factor correction system.

The large 128x128 pixel graphic matrix LCD display backlit with white LEDs allows the display of data, waveforms, histograms and icons.

The programming algorithms allow the controller to define in a completely automatic way both the recognition of the direction of the TA and the recognition of the phase on which the TA is installed, thus avoiding possible installation errors.

Thanks to the advanced features of the microprocessor (voltage and current measurements with 1% accuracy), the **R8** calculates the cosφ from the voltage-current phase shift of the fundamental harmonic at the mains frequency and measures the total harmonic distortion in voltage (THDV%) and current (THDI%) with a total spectrum up to the 60th component.

Smart Communications

The following are standard:

- NFC sensor for downloading/uploading configuration parameters via Android App **"DUCATI Smart Energy"**
- Internal memory with data history of up to 1 year and battery-powered RTC sensor
- 868 MHz SRD radio communication interface for connecting to the ENERGY BRIDGE datalogger

The optional "485" models with RS485 interface have a Modbus-RTU communication protocol for interfacing with the DUCATI ENERGIA BRIDGE datalogger or other devices such as PC or SCADA.

Optional "ETH" models with Ethernet network card and isolated RJ45 connector are equipped with integrated Web Server functionality and Modbus-TCP protocol. The optional "USB" models are characterized by a USB host interface for downloading data to memory and/or loading FW updates.

The optional "BT" models are characterized by a Bluetooth interface for the configuration and management of the controller from the "DUCATI Smart Energy" Smartphone App.

Technical details

Power supply:
- Rated voltage: 400 or 230 or 110 VAC
- Operating limits: 110÷415 V AC/DC ±10%
- Frequency range: DC or 45 ÷ 66 Hz
- Power consumption: 2.5 W
- Maximum power consumption: 10 W (for "USB ETH" model)

Voltage input:
- Measuring range: 50 ÷ 525 VAC
- Accuracy: 1% ± 0.5 digits

Current input:
- Rated current: 5 A
- Accuracy: 1% ± 0.5 digits

Relay outputs:
- Total number of outputs: 8 (11 for "USB" and "BT" models)
- Contact type: 6 NO (common C1) + 1 NO (common C2) + 1 NO/NC (common C3)

Contact type for "USB" and "BT" models:
- 6 NO (common C1)
- 1 NO (common C2)
- 1 NO/NC (COMMON C3)
- 2 NO (common C4)
- 1 NO (common C5)

Alarms:
- Overvoltage and overcurrent
- Undervoltage and undercurrent
- Maximum Harmonic Distortion in current (THDI) and voltage (THDV)
- Over-temperature
- No power factor correction (low cosφ)
- Other alarms (see manual)

Ambient operating conditions:
- Operating temperature: -20 - 70°C
- Overvoltage category: |||; Size category: 3
- Relative humidity: < 80%

Container:
- Size: 96x96 built-in
- Protection rating: IP51 on the front – IP20 on the terminals
- Weight: 350 g.

Wireless Interface to SRD Radio:
- Carrier Frequency: 868 MHz
- Frequency band: 868.0 – 868.6 MHz
- Maximum output power: 12.5 mW
- Protocol: Modbus-RTU

NFC Interface:
- Frequency: 13.56 MHz
- Data exchange with smartphone via antenna behind the display

RS485 Interface:
- Protocols: Modbus-RTU, Ascii-Ducbus

Ethernet Interface:
- Galvanically isolated RJ45 connector with auto-crossover MDI/MDX function
- Built-in Web Server
- Modbus-TCP protocol

USB Interface:
- Type: USB-Host 2.0

Bluetooth Interface:
- Bluetooth Low Energy (BLE) type

Standard Compliance:
IEC/EN 61010-1, IEC/EN 61000-6-2, IEC/ EN 61000-6-4, EN 61326-1, EN 62311, EN 301-489-1, EN 301-489-3 EN 300-220-2, EN 300-330, EN 300-328-1

rEvolution R14

Reactive power controller

The new **R14** regulators are dedicated to the to the power factor correction of high-power systems in low and medium voltage networks. The models integrate up to 29 relay outputs, useful for switchboards where many capacitor banks are used to achieve fast and accurate power factor adjustment, or to achieve a high degree of reliability in systems based on multiple bank redundancy. Thanks to the static data, the recorded performance curves and the accessory sensors, you can guarantee a safe management of the banks and a precise diagnosis of the status of all the components of the power factor correction system. These features avoid extraordinary maintenance and allow you to schedule the replacement of the most worn parts well in advance. The display texts are available in 8 languages to help the installer commission the power factor correction system. The **"DUCATI SMART ENERGY"** APP allows you to easily manage both the programming of the regulator and the reading and sharing of diagnostic data using your smartphone. Connectivity options also include a USB port for downloading recorded events, RS485 interface for Modbus-RTU networks and Ethernet-LAN interface for convenient remote management via browser and for Modbus-TCP communication networks. In addition, all **R14** models integrate an SRD 868 MHz radio module as standard, which can be used for IoT wireless networks.

Technical details

Power supply:
- Rated voltage: 400 or 230 or 110 VAC
- Operating limits: 99÷460 V AC/DC
- Frequency range: DC or 45÷66 Hz
- Power consumption: 2.5W (max 10W for models with "USB and ETH")
- Fuses: 1A Quick

Voltage input:
- Measuring range: 50÷525 VAC
- Accuracy: 0.5% ± 0.5 digits
- Frequency range: 45÷400 Hz

Current input:
- Input type: current shunt (use external CTs of appropriate size for the power of the system to be re-phased)
- Rated current: 5 A
- Measuring range: 0.025÷6 A
- Accuracy: 0.5% ± 0.5 digits
- Self-consumption: <1.8VA

Relay outputs:
- Total number of outputs: 15 (expandable up to 29)
- Contact type: up to 28 NO + 1 NO/NC (up to 9 separate commons)
- Maximum operating voltage NO contacts: 440 V~
- Maximum operating voltage NO/NC contact: 400 V~
- Nominal NO contact rating: AC1 6A–250V~, AC15 1.5A-440V~
- Nominal NO/NC contact rating AC1 6A–250V~, AC15 1.5A-440V~
- Mechanical/electrical durability of NO contacts: > 30x106 / > 2x105 manoeuvres
- Mechanical/electrical life of NO/NC contacts: > 1x107 / > 1x104 manoeuvres

User interface:
- 5-button keypad
- Display: 128x128 pixel STN graphic matrix LCD backlit with white LEDs - LCD visual area size: 72.3x57mm
- Languages: Italian, English, French, German, Spanish, Portuguese, Russian, Arabic, Chinese
- Backlight and contrast: adjustable levels from the settings menu

Environmental conditions:
- Operating temperature: -20 - 70°C
- Storage temperature: -30 - 80°C
- Overvoltage category: ||| - Size category: 3
- Insulation voltage: 600VAC

Connection terminals:
- Type: pull-out
- Conductor cross-section: 0.2÷2.5 mm2 (24÷12 AWG)
- Tightening torque: 0.5 Nm - Stripping length: 7 mm

Container:
- Size: 144x144 built-in, material: PBT – Pocan B4225; Weight: 800g
- Protection rating: IP54 on the front (with adhesive gasket for coupling to the panel of the panel) - IP20 on the terminals

Radio SRD (Short Range Device) interface:
- Carrier Frequency: 868MHz - Frequency Band: 868.0 – 868.6 MHz
- Maximum output power: 12.5 mW

13.56 MHz NFC interface:
- Data exchange with smartphone via antenna behind the display; use the DUCATI SMART ENERGY APP for Android devices
- https://play.google.com/store/apps/details?id=it.ducatienergia.smartenergy

Current Inputs for Monitoring Capacitor Banks:
- No. of inputs: 2
- Input Type: Built-in CTs (use 2 external CTs of appropriate size for the power of the capacitor banks)
- Rated current: 5 A
- Measuring range: 0.025÷6 A
- Current measurement accuracy: 0.5% ± 0.5 digits
- Autoconsumption: < 10 mW

Input for external temperature sensors:
- Type of external sensors: Pt100, Pt1000
- Measuring range: -15 - 70°C
- Accuracy: 0.3 °C
- Insulation voltage: 600 V~

4-20mA Input for External Sensors:
- Input span: 0-20mA or 4-20mA configurable from settings menu
- Accuracy: 0.2% FS
- Input Resistance: 50 Ohms

RS485 Interface:
- Protocols: Modbus-RTU, Ascii-Ducbus
- Baud rate: 9600÷115200 bps
- Termination Resistor: 120 Ohm – integrated (jumper on connection terminal)
- Insulation voltage: 600 V~

Ethernet Interface:
- 10/100Base-T network card with galvanically isolated RJ45 connector
- MDI/MDX auto-crossover function for patch or cross cable recognition
- Built-in Web Server
- Modbus-TCP protocol
- Insulation voltage: 600 V~

USB gate:
- USB-Host 2.0 type
- Compatible with pendrives with FAT32 filesystem
- Insulation voltage: 600 V~

Bluetooth Interface:
- Bluetooth Low Energy (BLE) type
- use the DUCATI SMART ENERGY APP for Android devices
- https://play.google.com/store/apps/details?id=it.ducatienergia.smartenergy

Standard Compliance:
IEC/EN61010-1, IEC/EN61000-6-2, IEC/EN61000-6-4, IEC/EN 61326-1; EN301-489-1, EN301-489-3, EN300-220-2, EN300-330, EN300-328-1

rEvolution R6T

Three-Phase Reactive Power Regulators

DUCATI Energia presents the new and innovative **R6T** three-phase regulators. The compactness, the latest generation technology and the complete range of features make the **R6T** models extremely adaptable to any application context in the field of power factor correction systems for three-phase low and medium voltage networks. They allow adjustment according to the cosφ of one of the phases, the equivalent three-phase cosφ or the most inductive or most capacitive cosφ. The type of target cosφ and its value can be selected according to the daily time slots that can be set for each day of the calendar. The R6T models are equipped with all the necessary connectivity options (**Bluetooth, USB, Wireless-radio, NFC, RS485**) both for on-site data exchange and for remote monitoring of equipment performance, capacitor bank status and events related to the electrical parameters of the system. A clear user guide, with texts translated into 9 languages, makes the **R6T** models easy to use both during the commissioning of the equipment and during the normal operation of the power factor correction system with useful tips for troubleshooting the connection of the regulator to the power grid, the setting of configuration parameters and in general the events detected on the quality of voltage and current signals.

Technical details

Power supply:
- Rated voltage: 110÷415V~
- Operating limits: 99÷460 V AC/DC
- Frequency range: DC or 45÷66 Hz
- Power consumption for LV model: < 2.5W
- Power consumption per USB model: < 6W
- Fuses: 1A Quick

Voltage input:
- Rated voltage: 400 or 230 or 110VAC V~
- Measuring range: 50÷525 V~ L-N
- Accuracy: 1% ± 0.5 digits
- Frequency range: 45÷400 Hz
- Type of measurement: true RMS (TRMS)

Current input:
- Input Type: TA
- Rated current: 5 A
- Measuring range: 0.025÷6 A
- Accuracy: 1% ± 0.5 digits
- Type of measurement: true RMS (TRMS)
- Self-consumption: <10mVA

Relay outputs:
- Total number of outputs: 6
- Contact type: 1 NO (common C1) + 2 NO (common C2) + 2 NO (common C3) + 1 NO/NC (common C4)
- Maximum operating voltage NO contacts: 440 V~
- Maximum operating voltage NO/NC contact: 400 V~
- Nominal rating of NO contacts: AC1 6A–250V~, AC15 1.5A-440V~
- NO/NC contact rated rating: AC1 6A–250V~, AC15 1.5A-440V~
- Mechanical/electrical durability of NO contacts: > 30x106/ > 2x105 manoeuvres
- Mechanical/electrical durability of NO/NC contacts: > 1x107/ > 1x104 manoeuvres

User interface:
- 5-button keypad
- Display: 128x128 pixel graphic matrix STN LCD backlit with white LEDs
- LCD view area size: 72.3x57mm
- Backlight and contrast: adjustable levels from the settings menu

Ambient operating conditions:
- Operating temperature: -20 - 70°C
- Storage temperature: -30 - 80°C
- Humid heat sequence: according to IEC60068-2-30 (temperature levels
- 25°C/40°C – humidity levels 93% / >95%)
- Static humid heat: according to IEC60068-2-78 (temperature level 40°C, humidity level 93%)
- Overvoltage category: |||
- Size category: 3
- Insulation voltage: 600 V~

Connection terminals:
- Type: pull-out
- Conductor cross-section: 0.2÷2.5 mm2 (24÷12 AWG)
- Tightening torque: 0.5 Nm
- Stripping length: 7 mm

Container:
- Size: 96x96 built-in
- Material: PBT Thermoplastic Polyester
- Protection rating: IP51 on the front – IP20 on the terminals
- Weight: 350 g.

Radio-frequency wireless interface:
- Carrier Frequency: 868 MHz
- Frequency band: 868.0 – 868.6 MHz
- Maximum output power: 12.5 mW
- Protocol: Modbus
- We suggest the use of the DUCATI ENERGY BRIDGE datalogger-gateway

13.56 MHz NFC interface:
- Data exchange with smartphone via antenna behind the display; use the DUCATI SMART ENERGY APP for Android devices
- https://play.google.com/store/apps/details?id=it.ducatienergia.smartenergy

RS485 Interface:
- Insulation voltage: 4 kV~
- Protocols: Modbus-RTU, Ascii-Ducbus
- Baud rate: 9600÷115200 bps
- We suggest the use of the DUCATI ENERGY GEAR datalogger-gateway

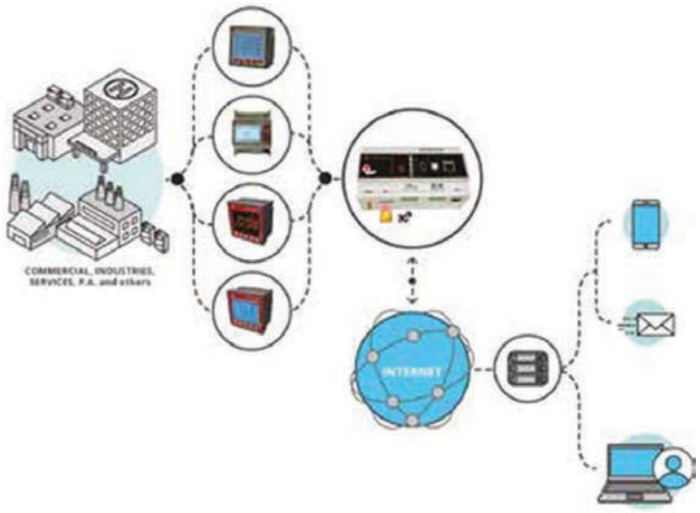
USB Interface:
- USB-Host 2.0 type

Bluetooth Interface:
- Bluetooth Low Energy (BLE), use the DUCATI SMART ENERGY
- https://play.google.com/store/apps/details?id=it.ducatienergia.smartenergy Android device app

Standard Compliance:
IEC/EN 61010-1, IEC/EN 61000-6-2, IEC/ EN 61000-6-4, IEC/EN 61326-1; EN 301-489-1, EN 301-489-3, EN 300-220-2, EN 300-330, EN 300-328-1

DUCNET ENERGY CLOUD

Introduction



Main intended users

INDUSTRY: large plants and high energy demand users, compelled by the law to use power/energy management systems.

PUBLIC BUILDINGS & ADMINISTRATION: hospitals, schools, municipalities, ministries, military facilities, etc.

SERVICE COMPANIES: buildings and structures of post offices, banks, insurance companies, telephone companies, couriers, etc.

RETAIL: department stores, shopping malls, superstores, chain stores.

TOURISM: hotels, airports, ports, camp sites.

RESIDENTIAL: partition of energy costs among multiple users connected to a single utility point.

The **DUCNET Energy** monitoring system is Ducati's cloud solution providing Energy Monitoring and Energy Management solutions compliant with ISO50001, ISO14001, ISO 50001 and Directive 2012/27 / EU. **DUCNET** is the ideal tool for all Energy Managers, who can easily and automatically access, all the energy data of the monitored installations, in order to make effective strategic decisions, immediately reduce energy wastage and check the results in real time.

Main characteristics

The **DUCNET** system provides an accurate overview of energy consumption data and numerous real-time data related to the proper functioning of the electrical network and the loads it supplies. **DUCNET** can also send alarms via email and SMS in order to immediately alert Facility Managers to any anomaly such as electrical faults, interruptions, excessive energy / power consumption, low power factor , excessive harmonic distortion, etc. DUCNET can integrate the new reactive power controllers rEvolution R5 and R8 to share not only network information/data but also the status of the related Industrial Power Factor Correction equipment.

The configuration of the **DUCNET** system, the optional **ENERGY GEAR** dataloggers & gateways and the R5 or R8 reactive power controllers can be done remotely through a web interface (accessed via any browser), without any need of onsite operations.

Diagnostic information is also available for immediate control of the health status of remote monitoring and data collection points.

With DUCNET Cloud system it is possible to check all energy and electrical data client connected to the Internet, such as PCs, smartphones, tablets, SmartTVs, etc., without any need to manage multiple, annoying software installations.

All data will be stored on **DUCATI Energia** servers, without any need to install and maintain local software or provide safe, local data storage space. The service autonomously collects all the data and stores it on the **DUCNET** cloud. No action is required by the customer.

ENERGY GEAR AND ENERGY BRIDGE

Within the **DUCNET** monitoring system DUCATI Energia presents the new **ENERGY GEAR** datalogger-gateway and the **ENERGY BRIDGE** gateway, designed respectively for the energy management and for the monitoring of power factor correction units located in distributed industrial plants, branches of organizations, isolated production facilities or service sites. The main functions of **ENERGY GEAR** are dedicated to reading, storing and communicating data from energy/power analyzers, **rEvolution R5** and **R8** power factor controllers, pulse counters and flow meter and sensors. **ENERGY GEAR** stores the data in its internal memory and shares it with CAN services, servers, or PCs connected to the local LAN.

ENERGY BRIDGE is designed to establish a connection through 868MHz radio interface used by the **rEvolution R5** and **R8** power factor controllers to read and archive data from these. The data is then sent to the DUCATI Servers via LAN / GPRS / UMTS connections.

ENERGY GEAR

ENERGY GEAR means flexibility, ease of use, high reliability and guaranteed availability. **ENERGY GEAR** can read and store data from:

- DUCATI Energia power analyzers and controllers, for electrical energy consumption and system control
- DUCATI Energia indoor or outdoor temperature and / or humidity sensors
- DUCATI Energia modules for the acquisition and storage of digital signals from pulse emitting devices: water meters, gas meters, steam / compressed air / fluids meters, parts counters, etc.
- Any other measurement device with RS485 or Ethernet port and MODBUS-RTU or MODBUS TCP communication protocols ENERGY GEAR as a large internal memory capable of storing up to several years worth of data. The overall storage capacity can be extended by connecting a USB memory stick on the front of the device. Data is stored in .xml or .csv format for easy successive analysis but with Modbus-TCP it's also possible do real-time monitoring. A web server allows quick configuration from any browser.

ENERGY GEAR provides different communication modes:

- Automatic remote transmission to the LAN Server or Internet Cloud through Ethernet port
- Automatic remote transmission or manual download via GPRS modem with a M2M data SIM
- Local Download on a USB memory stick connected to the front port of the device
- Local Download on PC through the USB or Ethernet ports on the front of the device

ENERGY GEAR allows you to program an address book with emails and phone numbers to which communications about alerts or alarms should be sent. Excessive consumption, anomalies or power outages, failures and other similar events can be detected and the relevant alert sent to registered phones or smartphones through the **DUCNET** Cloud Service.

ENERGY BRIDGE

The main features of **ENERGY BRIDGE** are ease of installation, flexibility of use, high reliability.

ENERGY BRIDGE is designed for installers and users who, after the complete activation of Power Factor Correction Units equipped with **rEvolution R5** and **R8** controllers, want to remotely connect the Power Factor Correction controllers/units.

Thanks to the wireless radio communication interface, the main features of **ENERGY BRIDGE** are ease/speed of installation, flexibility and high reliability.

ENERGY BRIDGE connects to one or more **R5** and **R8** controllers via a 868 MHz radio channel (where available).

ENERGY BRIDGE has an internal memory that can store up to 2 years of data. The memory can be further extended by plugging a common USB memory stick into the USB HOST port located on the front of the device. **ENERGY BRIDGE** can share this data to the DUCATI servers in various ways:

- With Ethernet (port located on the front of the device) to the local network, that must allow an internet connection
- Through GPRS / UMTS port with a data SIM card
- Through an external memory via USB HOST port (located on the front of the device) and subsequent upload to the Ducati Server through integrated import process in the **DUCNET** web interface. Once the **R5** and **R8** data are on the Ducati servers, the user can check them by logging on to the **DUCNET** web portal.

ENERGY BRIDGE allows easy configuration via web server using a common browser, locally or remotely connected to the device.

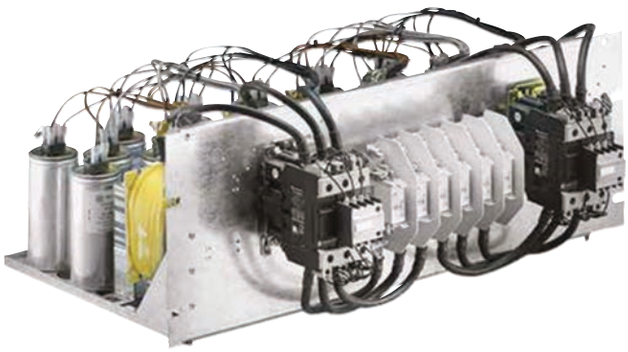
ENERGY GEAR

Part number	Description
468001313GSPL	ENERGY GEAR Europe/Asia inc. Power supply, GPRS modem for Europe/Asia and antenna
468001313ASPL	ENERGY GEAR America inc. Power supply, UMTS Modem America and Antenna

ENERGY BRIDGE 5.0

Part number	Description
468.00.1371	ENERGY BRIDGE 5.0 data logger with Radio 868Mhz, RS-485 and ETHERNET communication

CHASSIS



The current range of DUCATI Energia chassis includes these series:

- **C160** power range 20-160 kVAr
- **C160-MINI** power range 20-160 kVAr
- **C50-L-MINI** power range 25÷50 kVAr equipped with harmonic blocking reactors
- **C100-L** power range 25-100 kVAr equipped with harmonic blocking reactors

These can be used to create automatic power factor correction systems with existing or special structures. Each chassis holds up to 4 capacitor banks.

Technical details

- Single-phase **MONO Long Life 4In PLUS** series capacitors in PPMh, for a continuous duty under highly demanding conditions in environments with high levels of harmonics.
- Rated voltage 415-450-525 V for series **C160** and **C160-MINI**, 480 V for series **C50-L-MINI** and **C100-L**
- Harmonic filter reactors with tuning frequency 189 Hz (only for C50-L-Mini and C100-L)
- Structure made of galvanized sheet steel
- Contactors designed to control capacitive loads, equipped with an inrush current limiting device, with 230 V 50-60 Hz power supply

General Characteristics

Rated voltage	400 V
Rated frequency	50 Hz
Insulation voltage	690 V
Usage	Indoor
Protection rating	IP00
Duty	Continuous
Temperature range	-5 +40 °C
Power supply	3F + PE
Internal connection	FS17
Discharge devices	On each capacitor according EN 60831
Fuses	NH-00 GL
Standards	EN 61921

DUCATI C160 Un - Cond = 415 V

$THD_{I\ MAX-C}$ % ≤ 55% THD_I% ≤ 14% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	In (A)	Dissipated Power (W)	Weight (kg)
9010	20	18	2x10	27	24	20
9015	40	37	4x10	54	47	22
9020	60	55	2x10+2x20	80	72	22
9025	80	74	4x20	107	102	23
9030	100	92	3x20+40	134	127	23
9035	120	111	2x20+2x40	161	157	23
9040	140	130	20+3x40	188	190	24
9045	160	148	4x40	215	226	24

DUCATI C160 Un - Cond = 450 V

$THD_{I\ MAX-C}$ % ≤ 75% THD_I% ≤ 22% Un 400 V - 50 Hz

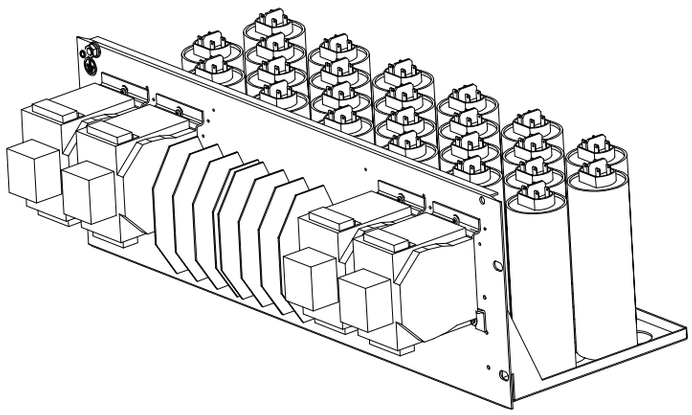
Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	In (A)	Dissipated Power (W)	Weight (kg)
9110	20	15	2x10	23	20	20
9115	40	31	4x10	46	41	22
9120	60	47	2x10+2x20	68	60	22
9125	80	63	4x20	91	84	23
9130	100	79	3x20+40	114	107	23
9135	120	94	2x20+2x40	137	130	23
9140	140	110	20+3x40	160	155	24
9145	160	126	4x40	182	183	24

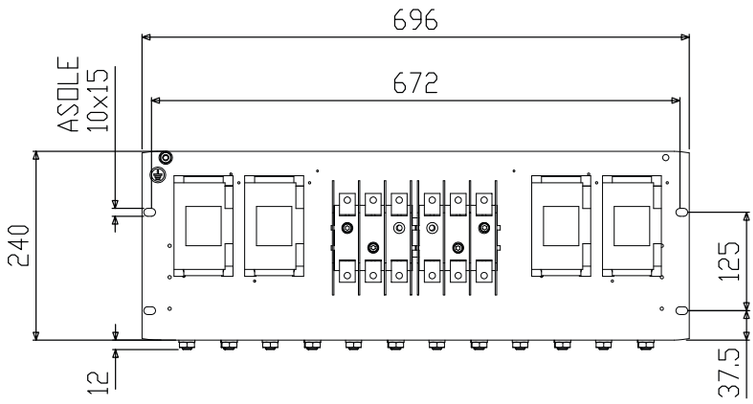
DUCATI C160 Un - Cond =525 V

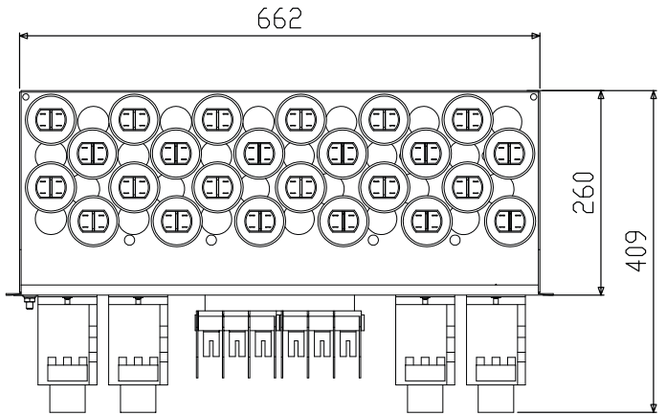
$THD_{I\ MAX-C}$ % ≤ 90% THD_I% ≤ 29% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	In (A)	Dissipated Power (W)	Weight (kg)
9210	20	11	2x10	17	16	20
9215	40	23	4x10	34	32	22
9220	60	34	2x10+2x20	50	44	22
9225	80	46	4x20	67	59	23
9230	100	58	3x20+40	84	79	23
9235	120	69	2x20+2x40	101	94	23
9240	140	81	20+3x40	117	110	24
9245	160	92	4x40	134	127	24

TECHNICAL DRAWING DUCATI C160







DUCATI C160-MINI Un - Cond = 415 V

$THD_{I\ MAX-C}$ % ≤ 55% THD_I% ≤ 14% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	In (A)	Dissipated Power (W)	Weight (kg)
3010	20	18	2x10	27	24	19
3015	40	37	4x10	54	47	21
3020	60	55	2x10+2x20	80	72	21
3025	80	74	4x20	107	102	22
3030	100	92	3x20+40	134	127	22
3035	120	111	2x20+2x40	161	157	22
3040	140	130	20+3x40	188	190	23
3045	160	148	4x40	215	226	23

DUCATI C160-MINI Un - Cond = 450 V

$THD_{I\ MAX-C}$ % ≤ 75% THD_I% ≤ 22% Un 400 V - 50 Hz

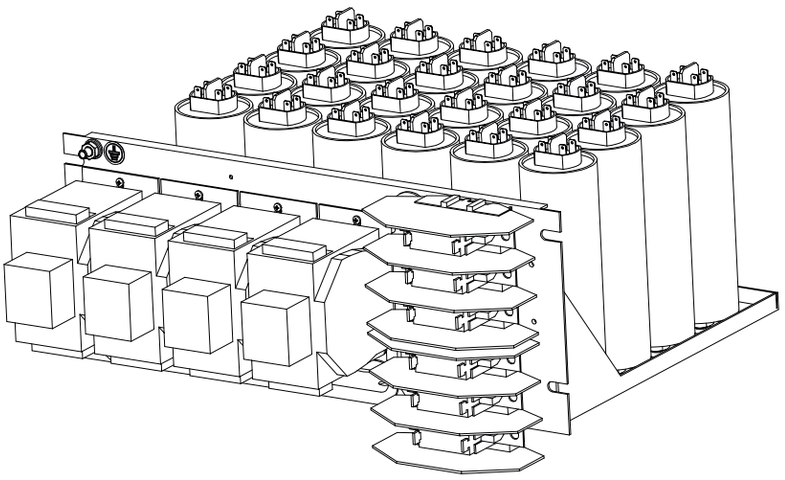
Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	In (A)	Dissipated Power (W)	Weight (kg)
3110	20	15	2x10	23	20	19
3115	40	31	4x10	46	41	21
3120	60	47	2x10+2x20	68	60	21
3125	80	63	4x20	91	84	22
3130	100	79	3x20+40	114	107	22
3135	120	94	2x20+2x40	137	130	22
3140	140	110	20+3x40	160	155	23
3145	160	126	4x40	182	183	23

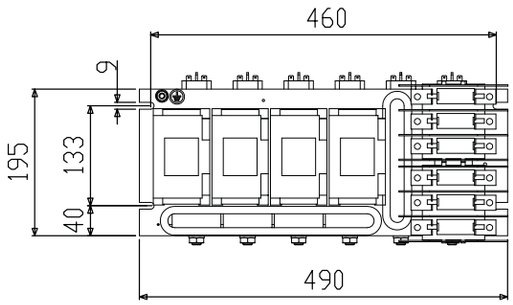
DUCATI C160-MINI Un - Cond =525 V

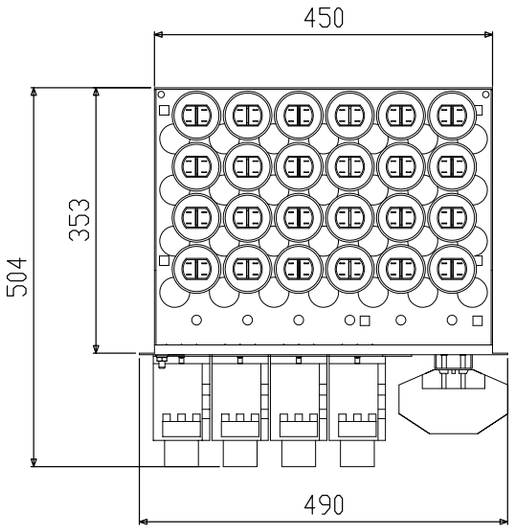
$THD_{I\ MAX-C}$ % ≤ 90% THD_I% ≤ 29% Un 400 V - 50 Hz

Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	In (A)	Dissipated Power (W)	Weight (kg)
3210	20	11	2x10	17	16	19
3215	40	23	4x10	34	32	21
3220	60	34	2x10+2x20	50	44	21
3225	80	46	4x20	67	59	22
3230	100	58	3x20+40	84	79	22
3235	120	69	2x20+2x40	101	94	22
3240	140	81	20+3x40	117	110	23
3245	160	92	4x40	134	127	23

TECHNICAL DRAWING DUCATI C160-MINI







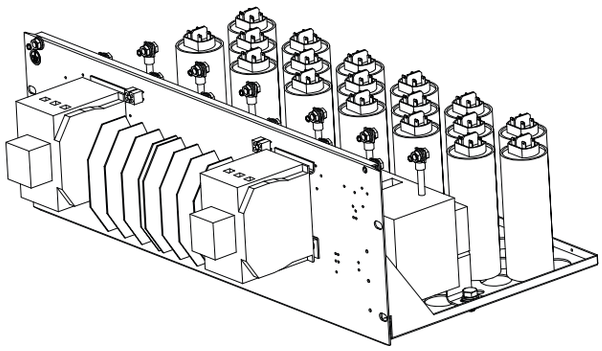
DUCATI C100-L Un - Cond = 480 V FILTER 189 Hz(*)

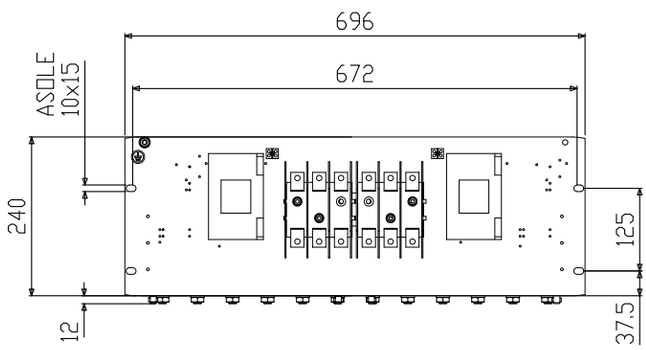
THD_I % ≤ 100%(*), THD_I% @250 Hz <25%(*), THD_V% ≤ 6%(*) Un 400 V - 50 Hz

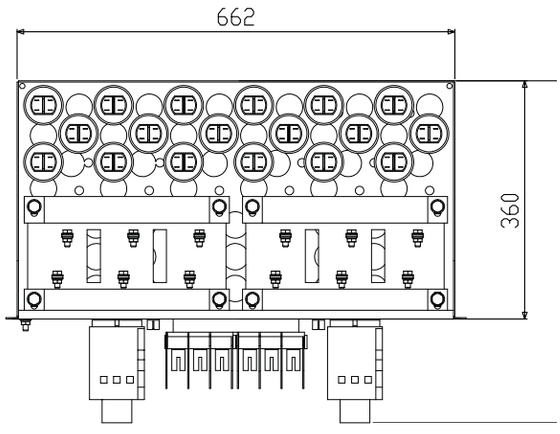
Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	In (A)	Dissipated Power (W)	Weight (kg)
9392	12.5	12.5	1 x 12.5	18	80	17
9393	25	25	1 x 25	36	125	25
9396	25	25	2 x 12.5	36	244	31
9387	37.5	37.5	12.5 + 25	54	293	33
9391	50	50	1 x 50	72	226	42
9388	50	50	2 x 25	72	342	45
9389	75	75	25 + 50	108	412	62
9390	100	100	2 x 50	144	452	76

* Other operating voltages and tuning frequencies available upon request.

TECHNICAL DRAWING DUCATI C100-L







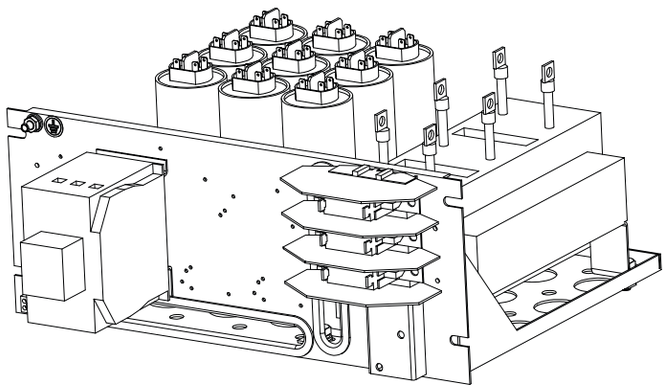
DUCATI C50-L-MINI Un - Cond = 480 V FILTER 189 Hz(*)

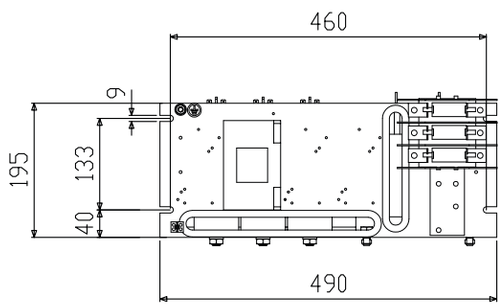
THD_I % ≤ 100%(*), THD_I% @250 Hz <25%(*), THD_V% ≤ 6%(*) Un 400 V - 50 Hz

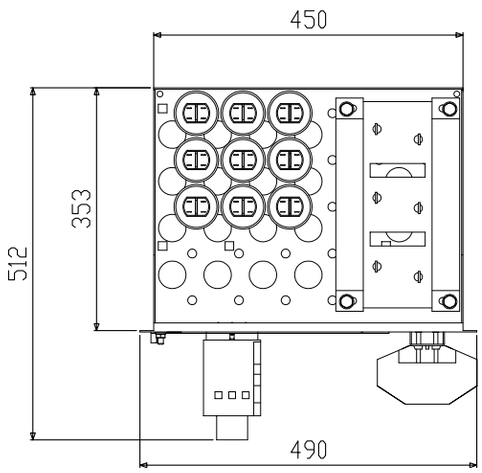
Part number 415.04	Qn (kVAr)	Q (400 V) (kVAr)	Bank Power (kVar)	In (A)	Dissipated Power (W)	Weight (kg)
3310	25	25	2x12.5	36	244	29
3315	37.5	37.5	12.5+25	54	293	31
3320	50	50	2x25	72	342	43
3325	50	50	50	72	337	38

* Other operating voltages and tuning frequencies available upon request.

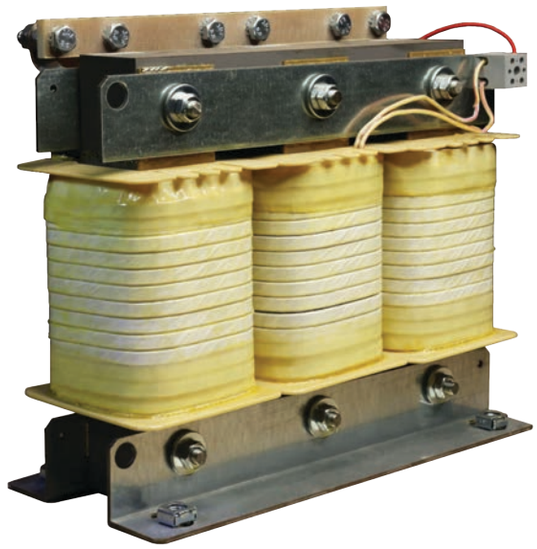
TECHNICAL DRAWING DUCATI C50-L-MINI







BLOCKING REACTORS



When choosing a power factor correction system for industrial networks characterized by the presence of harmonics (typically generated by use of non-linear loads such as rectifiers, welders, etc.), you should pay particular attention to the fact that resonance effects may be produced. To avoid such dangerous phenomena, suitable inductances must be placed in series with the capacitors.

The result is a partial absorption of the critical harmonic component and a blocking effect of the upstream power supply network containing harmonics.

The parameter that defines inductance is the degree of inductance p where:

p= XL/XC

Where XL is the inductive reactance and XC the capacitive inductance.

The presence of the reactor creates other effects, for example the voltage at the capacitor terminals will increase to a value of:

UC=U/(1 - p)

Where:

U_C = Voltage on the capacitor mains

U = mains voltage

P = Degree of inductance

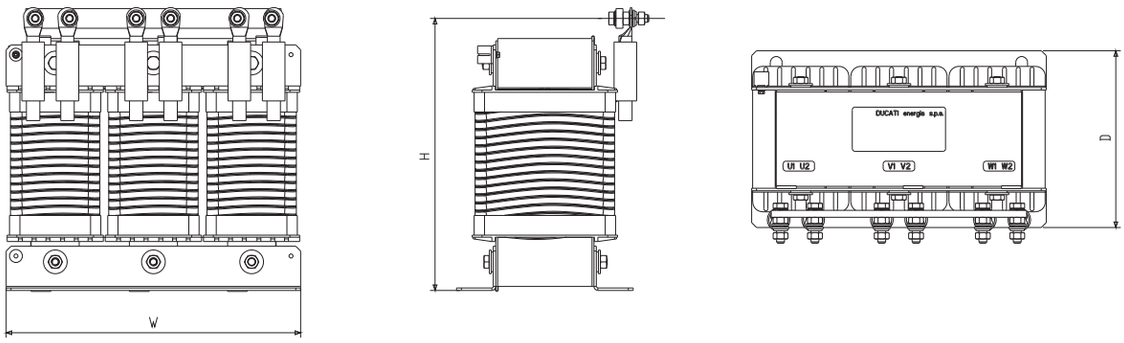
The reactive power delivered by the combination of reactors + capacitors is different from that delivered by capacitors on their own.

When choosing the components to be used in industrial power factor equipment with blocking reactors, you must thus know the characteristics of the power network in which the equipment will be installed and the impact that the reactor used will have on the capacitors.

The capacitors must possess appropriate characteristics in order to operate reliably in the system.

DUCATI Energia can supply reactors and capacitors to suit the most frequent conditions of use.

TECHNICAL DRAWING BLOCKING REACTORS



Three-phase reactors
P = 7% (189 Hz) e P = 5.67% (210 Hz)

General Characteristics

Mains voltage	400V - 415V 50 Hz
Power supply	Three-phase + PE
Continuous current harmonic distortion allowed	5%In 3rd harmonic 25%In 5th harmonic 15%In 7th harmonic
Continuous current harmonic distortion allowed	6%
Insulation	3 kV
Q-factor	> 20
Induction value at In	< 1.4 Tesla
Materials	Class H
Thermal protection	Via thermistor with NC contact, opening at 160°C.

Three-phase reactors
P = 12.5% (141 Hz) e P = 14% (134 Hz)

General Characteristics

Mains voltage	400V - 415V 50 Hz
Power supply	Three-phase + PE
Continuous current harmonic distortion allowed	15%In 3rd harmonic 20%In 5th harmonic 10%In 7th harmonic
Continuous current harmonic distortion allowed	6%
Insulation	3 kV
Q-factor	> 20
Induction value at In	< 1.4 Tesla
Materials	Class H
Thermal protection	Via thermistor with NC contact, opening at 160°C.

THREE-PHASE REACTORS* P= 5.67% (210 HZ) - 400 Vac & 415 Vac - 50 Hz

							Mains voltage 400V	Mains voltage 415V
Part n. 415.99.	**Power output (kVAr)**	**Inductance (mH)**	**I RMS (A)**	**Size (mm)**			**Theoretical Capacity (µF) Vn cond ≥ 440 V**	**Theoretical Capacity (µF) Vn cond ≥ 450 V**
				W	**D**	**H**		
415992405	10	3x3.05	17	240	60	161	3x63	3x62
415992410	12.5	3x2.45	21.5	240	60	161	3x78	3x72
415992415	20	3x1.53	35	240	95	161	3x125	3x116
415992420	25	3x1.23	42	240	95	161	3x157	3x145
415992425	40	3x0.76	69	240	90	224	3x251	3x233
415992430	50	3x0.61	86	240	100	224	3x313	3x291
415992435	100	3x0.31	172	300	120	278	3x626	3x582

THREE-PHASE REACTORS* P= 7% (189 HZ) - 400 Vac & 415 Vac - 50 Hz

							Mains voltage 400V	Mains voltage 415V
Part n. 415.99.	**Power output (kVAr)**	**Inductance (mH)**	**I RMS (A)**	**Size (mm)**			**Theoretical Capacity (µF) Vn cond ≥ 440 V**	**Theoretical Capacity (µF) Vn cond ≥ 450 V**
				W	**D**	**H**		
415992005	10	3x3.84	16.3	185	100	161	3x62	3x58
415992010	12.5	3x3.07	20.4	185	100	161	3x77	3x72
415992015	20	3x1.91	32.7	240	95	161	3x123	3x115
415992020	25	3x1.53	40.8	240	95	161	3x154	3x144
415992025	40	3x0.96	65	240	100	224	3x247	3x230
415992030	50	3x0.77	82	240	100	224	3x308	3x287
415992050	100	3x0.39	164	300	130	274	3x626	3x574

THREE-PHASE REACTORS* P=12.5% (141 HZ) - 400 Vac & 415 Vac - 50 Hz

Mains voltage 400V Mains voltage 415V

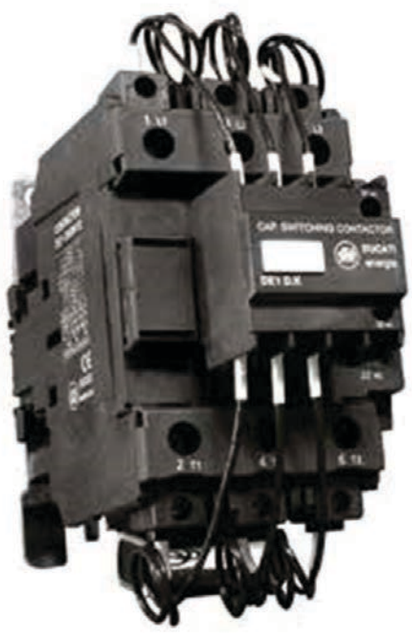
Part n. 415.99.	Power output (kVAr)	Inductance (mH)	I RMS (A)	Size (mm)			Theoretical Capacity (µF) Vn cond ≥ 480 V	Theoretical Capacity (µF) Vn cond ≥ 500 V
				W	D	H		
415992105	10	3x7.28	16.7	240	105	161	3x58	3x54
415992110	12.5	3x5.82	20.9	240	105	161	3x73	3x68
415992115	20	3x3.64	33.4	240	90	224	3x116	3x106
415992120	25	3x2.91	41.8	240	100	224	3x145	3x135
415992125	40	3x1.82	67	300	90	285	3x232	3x216
415992130	50	3x1.46	84	300	90	285	3x290	3x270
415992150	100	3x0.73	168	360	190	380	3x580	3x540

THREE-PHASE REACTORS* P=14.0% (134 HZ) - 400 Vac & 415 Vac - 50 Hz

Mains voltage 400V Mains voltage 415V

Part n. 415.99.	Power output (kVAr)	Inductance (mH)	I RMS (A)	Size (mm)			Theoretical Capacity (µF) Vn cond ≥ 480 V	Theoretical Capacity (µF) Vn cond ≥ 500 V
				W	D	H		
415992505	10	3x8.15	17.5	240	125	161	3x58	3x53
415992510	12.5	3x6.70	20.9	240	125	161	3x73	3x66
415992515	20	3x4.10	35	240	110	224	3x116	3x106
415992520	25	3x3.35	43	240	110	224	3x145	3x133
415992525	40	3x2.05	70	300	100	177	3x232	3x212
415992530	50	3x1.65	87	300	100	177	3x290	3x265
415992550	100	3x0.825	174	360	214	380	3x572	3x530

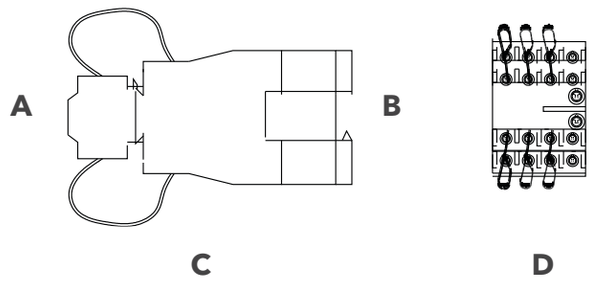
CONTACTORS



When choosing switching contactors for capacitors used to compensate the reactive power present in the network, you should bear several aspects in mind:

- On being energized the capacitor is connected in parallel to the inductive network and the oscillating circuit produced by connecting the capacitor to the network will result in the passage of a high frequency current (from 3 to 15 kHz), which may be 160 times greater than the In current for 1 or 2 ms.
- The presence of harmonic currents and the tolerance with respect to mains voltage determine the continuous passage, within the circuit, of a current whose value is around 1.3 times greater than the rated current In of the capacitor.
- Because of the tolerances allowed by the manufacturer, the exact power of a capacitor may be 1.10 times greater than the rated power.
- The contactor employed must therefore be capable of working with:
- An elevated, albeit transient, peak current during the closing phase
- A closing current that may be 1.43 times greater than the rated current of the capacitor

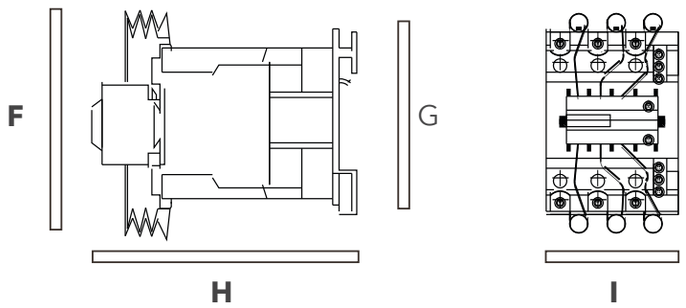
The contactors offered by DUCATI Energia are specifically engineered to work in these conditions.
Select the type of contactor based on the working voltage and effective power (in kVAr) of the capacitor bank to be controlled.



Part number 315.99.	kVAr 50/60 Hz ∂ ≤ 55°C (*)		Auxiliary contacts		Maximum operating frequency	Electric life with rated load
	200 V 240 V	400 V 440 V	NA	NC	Switching per hour	Switching
1143	6.7	12.5	1	1	240	200000
1142	10	20	1	1	240	100000
1141	15	25	1	1	240	100000
1140	20	40	1	2	100	100000
1139	40	60	1	2	100	100000

(*) Average temperature over 24h as per standards IEC 70 and 851.
230 VAC 50/60 Hz coil for all sizes.
WARNING: The capacitors must be completely discharged before being energized by closing contacts (max voltage at terminals < 50 V).

315.99	A (mm)	B (mm)	C (mm)	D (mm)
1143	130	74	117	45
1142	140	84	130	56
1141	140	84	135	56



315.99	F (mm)	G (mm)	H (mm)	I (mm)
1140	180	127	150	75
1139	200	127	157	35

ISOLATING SWITCHES

DUCATI Energia offers a complete series of modular switches for all applications like:

- Main Service Entrance Switch from Transformers & Busbars
- AC or DC Power Distribution System
- Switching & Isolating Motors, capacitors or industrial control equipment Ducati's switches have compact size and their installation is fast and easy.

The handle in the switch disconnectors has a telescopic shaft. It permits installation of the same switch in installations of different depth, without any modification or addition to the enclosures.

Four hole handle fixing on the door permits last minute rotation of the switch inside the panel by 90 degrees on either side as per convenience, again without any modification to the door.

These time saving features increase the ease and flexibility of installation and also reduce installation cost.

Door interlocking prevents opening in the ON position, guarding the operator against an accidental mishap.

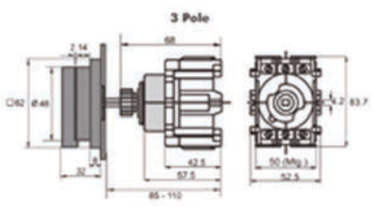
Common Characteristics

Conformity to Standards	-	IEC 60947 Pt.3 e IS 13947 Pt.3
Rated Operational Voltage (Ue)	V	415
Rated Operational Frequency	Hz	50/60
Pollution Degree as per IEC / IC	-	3
Ambient / Cubicle Service Temp.	°C	55
IP Level after mounting	-	IP 54
Number of Poles (4th Pole always 100% rated in 4 Pole switches)	-	3P/4P

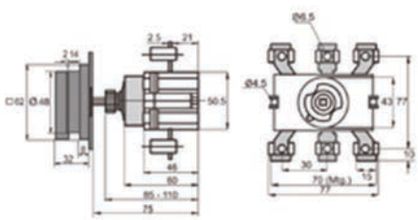
Rated current		**40**	**63**	**80**	**125**	**160**
Number of poles (part. n. 315.99)	**3**	**.0200**	**.0201**	**.0202**	**.0203**	**.0204**
	4	**.0597**	**.0598**	**.0599**	**.0600**	**.0601**
Rated voltage	V	415	415	415	415	415
Max operating voltage	V	690	690	690	690	690
Rated frequency	Hz	50/60	50/60	50/60	50/60	50/60
Insulation voltage	V	750	750	750	750	750
Rated operational current	A	40	63	80	125	160
Rated capacitor power	kVAr	20	35	45	70	80
Rated short time withstand current Icw (1 sec)	kA	1	1	1.5	2.5	5
Mechanical endurance	cycles	25000	25000	25000	25000	25000
Terminals for cable lug size	Sq mm	16	25	25	70	95
Tightening torque	Nm	2	2	4	6	6

TECHNICAL DRAWING ISOLATING SWITCHES

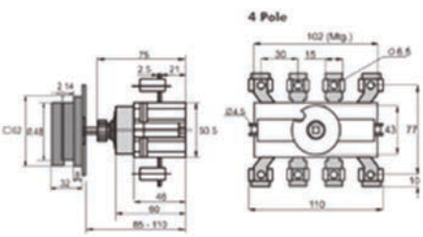
63A Rotatory Type 3 Pole



100A & 125A Rotatory Type 3 Pole



63A - 100A & 125A Rotatory Type 4 Pole



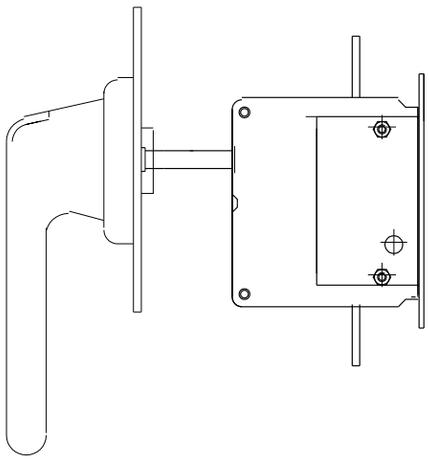
ISOLATING SWITCHES

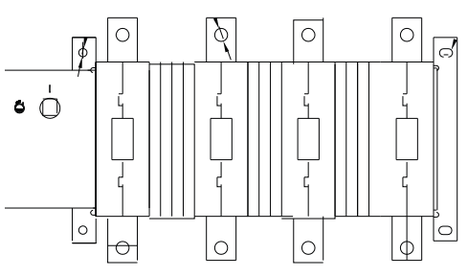
Rated current		250	400	630	800
Number of poles (part. n. 315.99)	**3**	**.0205**	**.0206**	**.0207**	**.0208**
	4	**.0602**	**.0603**	**.0604**	**.0605**
Rated voltage	V	415	415	415	415
Max operating voltage	V	690	690	690	690
Rated frequency	Hz	50/60	50/60	50/60	50/60
Insulation voltage	V	1000	1000	1000	1000
Rated operational current	A	250	400	630	800
Rated capacitor power	kVAr	125	200	315	400
Rated short time withstand current Icw (1 sec)	kA	8	17	17	17
Mechanical endurance	cycles	10000	10000	10000	10000
Terminals for cable lug size	Sq mm	120	300	400	640
Tightening torque	Nm	12	25	45	45

* Other operating voltages and tuning frequencies available upon request.

Rating	A		B	L		P	Q	S	T
	3P	4P		3P	4P				
400 A	211	257	205	151	197	46	25	4	11
603 A	244	306	223	183	245	62	40	4	13.5
800 A	260	330	223	199	269	70	40	5	13.5

TECHNICAL DRAWING ISOLATING SWITCHES 400 A - 800A





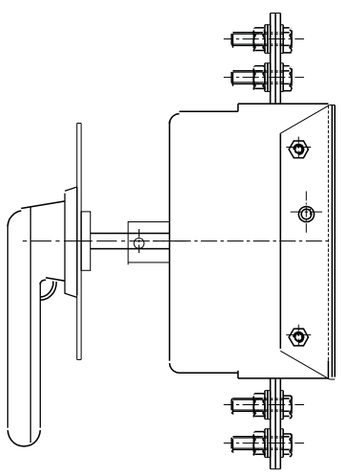
ISOLATING SWITCHES

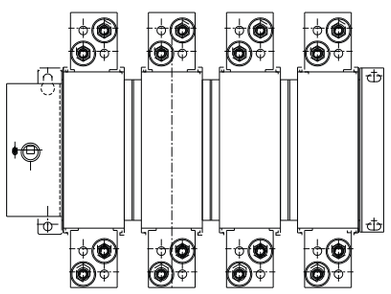
Rated current		1000	1250	1600
Number of poles (part. n. 315.99)	**3**	**.0209**	**.0210**	**.0211**
	4	**.0606**	**.0607**	**.0608**
Rated voltage	V	415	415	415
Max operating voltage	V	690	690	690
Rated frequency	Hz	50/60	50/60	50/60
Insulation voltage	V	1000	1000	1000
Rated operational current	A	1000	1250	1600
Rated capacitor power	kVAr	500	630	800
Rated short time withstand current Icw (1 sec)	kA	50	50	50
Mechanical endurance	cycles	10000	10000	10000
Terminals for cable lug size	Sq mm	-	-	-
Tightening torque	Nm	70	70	70

* Other operating voltages and tuning frequencies available upon request.

Rating	A		B	L		T
	3P	4P		3P	4P	
400 A	211	257	205	151	197	11
603 A	244	306	223	183	245	13.5
800 A	260	330	223	199	269	13.5

TECHNICAL DRAWING ISOLATING SWITCHES 1000 A - 1600A





APPENDIX

Glossary

Cosφ. In an electrical system the phi (φ) is the phase shift between voltage and current at the fundamental frequency of 50 Hz. The cosφ is a dimensionless number between 0 and 1 that represent this shift.

Power Factor. It's a ratio between the active power and the apparent power and as cosφ has value between 0 and 1. Only in a system without harmonics will Cosφ and power factor be equal. In a system with harmonics, the power factor will always be less than cosφ.

Rated voltage of the capacitor (Un) is the rated voltage of the capacitor, at which its rated output power is given. This is the maximum effective value of the alternating sinusoidal voltage for which the capacitor was designed.

Rated power of the capacitor (Qn) is the reactive power supplied by the capacitor at the applied rated voltage and frequency.

Rated capacitance (Cn) is the value of the capacitance that allows the capacitor to deliver the rated power when the rated voltage and frequency are applied to the terminals.

Rated current (In) is the effective value of the alternating current flowing through the capacitor when the rated voltage and frequency are applied to the rated capacitance.

Insulation voltage. For a PFC system that complies with IEC 60429-1/2, the insulation voltage indicates the maximum mains voltage that the entire system can withstand.

Short circuit current I_{SH}. As indicated in the IEC 61429-1 it the prospective short circuit current that the cabinet can endure for a specified time. It's a value stated by the manufacturer based on laboratory tests. It can be increased by installing fuses in this case the data must indicate the presence of the fuses.

Steps of an Automatic PFC unit. They are the physical units of the bank, each of them controlled by a dedicated switching device.

Combinations is the number of different configurations that the PFC unit can make with the combinations of physical steps. For example, a 160 kvar unit with steps 20-20-40-40-40 can use 8 different combinations: 20-40-60-80-100-120-140-160. The more combinations that can be used, the more flexible the use of the PFC unit.

THD (Total Harmonic Distortion). For a non-sinusoidal periodic wave, THD is the ratio between the RMS value of all harmonic components and the RMS value of the fundamental wave at 50 Hz.

THD_{IC} is the maximum THD that a capacitor can bear in terms of current passing through it.

THD_{IR} is the maximum THD present in the system without any PFC unit active. It's useful to define the type of the capacitor to install.

THD_{V} is the voltage THD that a PFC bank with harmonic blocking reactors can withstand.

Operating conditions

Unlike most electrical equipment, industrial power factor correction capacitors operate continuously at full load or at loads that vary from full load only by variations in voltage and frequency each time they are energized. Overstressing and overheating shorten the lifespan of the capacitor. For this reason the operating conditions (temperature, voltage and current) must be carefully controlled in order to obtain optimum results as regards the lifespan of the capacitor.

Voltage

The capacitors are produced in accordance with standards EN 60831-1/2, which regulate their manufacture, testing, installation and application of capacitors, indicating the following maximum overvoltages:

- +10% for 8 hours every 24 hours
- +15% for 30 minutes every 24 hours
- +20% for 5 minutes
- +30% for 1 minute

Overvoltages in excess of 15% should not occur more than 200 times during the life of a capacitor.

When overload conditions may be assumed to occur during service – in the presence of a moderate harmonic load for example – it is common to use capacitors that are oversized in terms of voltage.

In such cases the output power at the operating voltage will be reduced in comparison with the rated load. It is advisable to evaluate the reduction occurring in the output power on the basis of the ratio between the operating voltage and the rated voltage.

$Q_{resa} = Qn \times (Ue/Un)^2$

Where:

Ue= Operating voltage Q_{resa} = Output power at Ue

The table below shows the power output by a 100 kvar capacitor used on a 400 V network having a rated voltage respectively of 415, 450 and 525 V

Un [V]	415	450	525
Qresa [kVar]	93	79	58

Temperature

The temperature of the capacitor during operation is the parameter that, along with the voltage, has the greatest influence on the lifespan of a capacitor.

It is important that the capacitor always be placed in a position where cooling air can freely circulate and away from the radiant heat of hot surfaces of other components.

When capacitors are placed in closed cabinets it is necessary to have air vents which allow for an easy exchange of air between the interior and exterior of the cabinet. Where the protection rating of the cabinet does not permit such an exchange to take place, the positioning of the capacitors must be carefully planned so as to provide the necessary channels for the circulation of cooling air. In this case, suitable fans will have to be installed to force cooling air through the cabinet. As a rule, the temperature of the cooling air inside the cabinet should not differ from the outside air temperature by more than 5 °C.

Cooling air temperature

This is the temperature of the cooling air measured at the hottest point of the capacitor bank, under working conditions, halfway between two capacitors or on the surface of one of them.

Ambient temperature class

This represents the range of cooling air temperatures in which the capacitor is designed to operate. There are 4 standard categories represented by a number and a letter or by two numbers as shown in the table.

Category		Category Ambient air temperature		
		Max	Highest mean over any period of:	
			24 h	1 Year
-25/A	–25 +40 °C	40	30	20
-25/B	–25 +45 °C	45	35	25
-25/C	–25 +50 °C	50	40	30
-25/D	–25 +55 °C	55	45	35

The first number represents the minimum cooling air temperature at which the capacitor can be energized (- 25°C; on request -40°C). The letter or second number represents the upper limit of the temperature range and precisely. the max. value indicated in the table.

Residual voltage

This is the voltage that remains after the capacitor is disconnected from the network. This voltage must be eliminated in order to avoid exposing the operator to dangerous conditions. All three-phase capacitors are equipped with discharge devices that reduce residual voltage to less than 75 V in 3 minutes.

It is important to bear in mind that the capacitors cannot be energized if there is a residual voltage of more than 10% across them. Particular care must thus be taken to harmonize the capacitor discharge times with the response times of the control devices (Power control relays). In cases where the lag time of the controllers is shorter than the capacitor discharge time, additional discharge devices must be provided so that the connection will occur with a residual voltage not exceeding 10%.

Max current

In accordance with standard EN 60831-1/2, the capacitors are designed to function continuously at an effective current that is 1.3 times the current at the rated voltage and frequency. Bearing in mind the capacitance tolerance, the maximum current may reach 1.5 In, value to which it is necessary to refer in the sizing of the lines of control and protection devices. This overcurrent factor can be determined by the combined effect of harmonics, overvoltages and capacitance tolerance.

Max inrush current

Transient overcurrents having elevated amplitudes and high frequencies occur when the capacitors are switched in to the circuit. This is especially true when a capacitor bank is put in a parallel connection with other already energized banks.

It may therefore be necessary to reduce these transient overcurrents to values acceptable for both the capacitor and the contactor used, by connecting the capacitor using suitable devices (resistors or reactors) in the bank's power circuit.

The crest value of overcurrents caused during switching operations must be limited to a maximum of 100 In (crest value of the 1st cycle).

Protection and safety

To ensure protection, the capacitor elements making up the unit are individually fitted with an overpressure safety device.

The function of this device is to interrupt a short circuit when the capacitor reaches the end of its useful life and is no longer able to regenerate itself. This device breaks the connections of the terminal by exploiting the internal pressure that builds during the film's decomposition, which results from the overheating caused by the short circuit.

It should be noted that an external fuse is not as reliable since the short circuit current, being strongly limited by the metallized surface, may vary widely.

All the capacitors are built with environmentally friendly materials conforming to standards EN 60831-1/2.

The effect of harmonics in electrical systems

A harmonic is defined as one of the components obtained from the breakdown of a periodic wave in the Fourier series. The order of a harmonic is further defined as the ratio between the frequency of the harmonic and the fundamental frequency of the periodic wave considered.

In the case of a perfectly sinusoidal waveform (as should characterize the voltage supplied by the utility) only the fundamental harmonic of the first order will be present, which in Europe has a frequency of 50 Hz.

If a sinusoidal voltage is applied to a load, the circulating current will also have a sinusoidal waveform only in the presence of loads with "linear characteristics".

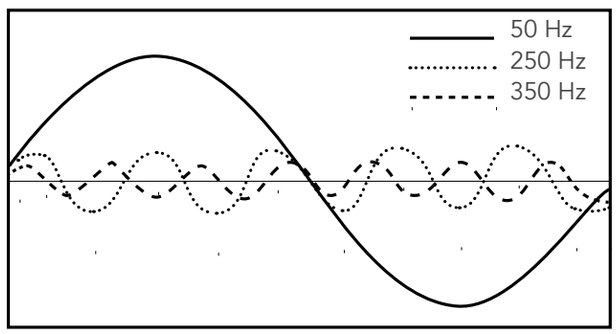
In the presence of a "non-linear" load the current waveform will deviate from the ideal pattern and breaking down the wave according to the Fourier theorem will show evidence of harmonics whose number and amplitude will increase with the degree of distortion in the current waveform.

The increasingly frequent use of non-linear loads in industrial facilities (inverters, fluorescent lamps, welders, etc.) creates elevated distortions in the waveform of circulating current.

This is true in the case of AC/DC converters, for which the input current theoretically displays only harmonics of the order:

$h = mp \pm 1$

where m is an integer other than 0 (thus 1, 2, 3, 4, ...) and p is the number of solid-state switches of the bridge. Therefore, a converter with six-phase reaction (p= 6) generates characteristic harmonics of the 5th and 7th order (m= 1), 11th and 13th order (m= 2), 17th and 19th order (m= 3) etc., whereas a converter with twelve-phase reaction (p= 12) generates characteristic harmonics of the 11th and 13th order (m= 1), 23rd and 25th order (m= 2).



The parameter used to determine the level of harmonic distortion presents in an electrical network is THDI% (Total Harmonic Distortion), defined as:

$$TDH_i\% = \frac{\sqrt{\sum_{k=2}^{\infty} I_k^2}}{I_1}$$

Where I_1 is the effective value of the fundamental and Ik represents the effective values of harmonics of order k.

The presence of current harmonics in the system is therefore an indication of a distortion (deviation from a sinusoidal pattern) in the waveform of the current itself.

This results in increased losses due to the Joule effect and the skin effect in the cables and increased losses due to hysteresis and parasite currents in the iron of transformers and motors. In addition, because of the equivalent cable impedances, the mains voltage may also be distorted.

Installing power factor correction capacitors in the network serves to create a condition of parallel resonance between the equivalent capacitance of the capacitors and the equivalent inductance of the system (which may usually be approximated by calculating the equivalent inductance of the transformer) in correspondence to a frequency fr.

$$\int_r = \int_1 \cdot \sqrt{\frac{Scc}{\Omega}}$$

Where S_{cc} indicates the short circuit power of the system (expressed in MVA) at the point where the capacitors are connected and Q is the installed reactive power (expressed in Mvar), the parallel resonance frequency fr is thus determined:

$$S_{cc} = \frac{A}{V_{cc}\%} \cdot 100$$

Where A is the rated power of the transformer (expressed in kVA) and Vcc% is the percentage short circuit voltage of the transformer.

The voltage harmonics present in the system - having a frequency close to the parallel resonance frequency fr - are amplified. For this reason, an extremely high voltage comes to be created at the capacitor terminals, which causes the dielectric to age rapidly and hence significantly shortens the lifespan of the capacitor.

Risk of Explosion and Fire

All capacitors consists mainly of polypropylene. They can rupture and ignite cause of internal faults (malfunction of safety system, if present) or external overload (Overvoltage, overcurrent, high temperature, etc.).

It must be ensured, by appropriate measures, to avoid any risk of explosion, fire and hazard to their environment in the event of malfunction.

Power factor correction of MV/LV transformers

It is always a good idea to provide the industrial power factor correction for MV/LV transformers because even when operating at no load (e.g. at night), they absorb reactive power that must be compensated.

The exact capacitor power necessary may be calculated using the formula below:

Q = Io% · Pn/100

Io = loadless current (specified by the transformer manufacturer)

PN= rated power of the transformer.

Alternatively, if the required data is not available, you can refer to the table below, which distinguishes between normal-loss and low-loss transformers.

Transformer KVA	Q [Kvar] for Oil Transformer	Q [Kvar] for Resin Transformer	Q [Kvar] for low Losses Resin Transformer
10	1	1.5	
20	2	1.7	
50	4	2	
75	5	2.5	
100	5	2.5	2
160	7	4	3
200	7.5	5	4
250	8	7.5	4
315	10	7.5	5
400	12.5	8	6
500	15	10	6
630	17.5	12.5	7
800	20	15	7
1000	25	17.5	8
1250	30	20	8
1600	35	22	10
2000	40	25	11
2500	50	35	13
3150	60	50	15

Power factor correction of three-phase asynchronous motors

One of the most commonly occurring loads is the three-phase asynchronous motor. The table below shows the power factor correction in the case of squirrel-cage motors. An additional 5% is recommended for motors with wound armatures.
The table shows the approximate powers of the capacitor banks to be installed according to motor power.

Reactive power to be installed - Three-phase motor: 230/400 V					
Rated power		Rotation speed (rpm)			
(kW)	(Cv)	3000	15000	1000	750
22	30	6	8	9	10
30	40	7.5	10	11	12.5
37	50	9	11	12.5	16
45	60	11	13	14	17
55	75	13	17	18	21
75	100	17	22	25	28
90	125	20	25	27	30
110	150	24	29	33	37
132	180	31	36	38	43
160	218	35	41	44	52
200	274	43	47	53	61
250	340	52	57	63	71
280	385	57	63	70	79
355	482	67	76	86	98
400	544	78	82	97	106
450	610	87	93	107	117

Minimum cable cross section for equipment power supply

Main voltage 400 V - 50 Hz - 3F		
Qn kVAr	In A	Minimum cable cross-section suggested for phase 1 (mm2)
5	7	2.5
10	14	4
15	22	6
20	29	10
30	43	16
40	58	16
50	72	35
100	144	70
200	288	185 opp./or 2x70
300	433	2x150
400	576	2x240
500	722	3x185
600	864	3x240
700	1010	4x240
800	1154	4x240
900	1300	6x185
1000	1443	6x240

(1) = Values reported for single-core PVC cables in free air laid not separated on horizontal shelves. For other types of cables and/or installation refer to IEC 60364-5, CEI 64-8 and table UNEL 35024/1.

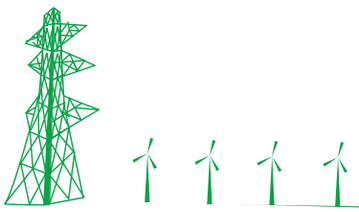
K FACTOR

Existing values		Cosφ target																	
tgφ	cosφ	0.85	0.86	0.87	0.88	0.89	0.90	0.90	0.91	0.92	0.93	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00
3.18	**0.30**	2.560	2.586	2.613	2.640	2.667	2.695	2.695	2.724	2.754	2.785	2.785	2.817	2.851	2.888	2.929	2.977	3.037	3.180
3.07	**0.31**	2.447	2.474	2.500	2.527	2.555	2.583	2.583	2.611	2.641	2.672	2.672	2.704	2.738	2.775	2.816	2.864	2.924	3.067
2.96	**0.32**	2.341	2.367	2.394	2.421	2.448	2.476	2.476	2.505	2.535	2.565	2.565	2.598	2.632	2.669	2.710	2.758	2.818	2.961
2.86	**0.33**	2.241	2.267	2.294	2.321	2.348	2.376	2.376	2.405	2.435	2.465	2.465	2.498	2.532	2.569	2.610	2.657	2.718	2.861
2.77	**0.34**	2.146	2.173	2.199	2.226	2.254	2.282	2.282	2.310	2.340	2.371	2.371	2.403	2.437	2.474	2.515	2.563	2.623	2.766
2.68	**0.35**	2.057	2.083	2.110	2.137	2.164	2.192	2.192	2.221	2.250	2.281	2.281	2.313	2.348	2.385	2.426	2.473	2.534	2.676
2.59	**0.36**	1.972	1.998	2.025	2.052	2.079	2.107	2.107	2.136	2.166	2.196	2.196	2.229	2.263	2.300	2.341	2.388	2.449	2.592
2.51	**0.37**	1.891	1.918	1.944	1.971	1.999	2.027	2.027	2.055	2.085	2.116	2.116	2.148	2.182	2.219	2.260	2.308	2.368	2.511
2.43	**0.38**	1.814	1.841	1.867	1.894	1.922	1.950	1.950	1.979	2.008	2.039	2.039	2.071	2.105	2.143	2.184	2.231	2.292	2.434
2.36	**0.39**	1.741	1.768	1.794	1.821	1.849	1.877	1.877	1.905	1.935	1.966	1.966	1.998	2.032	2.069	2.110	2.158	2.219	2.361
2.29	**0.40**	1.672	1.698	1.725	1.752	1.779	1.807	1.807	1.836	1.865	1.896	1.896	1.928	1.963	2.000	2.041	2.088	2.149	2.291
2.22	**0.41**	1.605	1.631	1.658	1.685	1.712	1.740	1.740	1.769	1.799	1.829	1.829	1.862	1.896	1.933	1.974	2.022	2.082	2.225
2.16	**0.42**	1.541	1.567	1.594	1.621	1.648	1.676	1.676	1.705	1.735	1.766	1.766	1.798	1.832	1.869	1.910	1.958	2.018	2.161
2.10	**0.43**	1.480	1.506	1.533	1.560	1.587	1.615	1.615	1.644	1.674	1.704	1.704	1.737	1.771	1.808	1.849	1.897	1.957	2.100
2.04	**0.44**	1.421	1.448	1.474	1.501	1.529	1.557	1.557	1.585	1.615	1.646	1.646	1.678	1.712	1.749	1.790	1.838	1.898	2.041
1.98	**0.45**	1.365	1.391	1.418	1.445	1.472	1.500	1.500	1.529	1.559	1.589	1.589	1.622	1.656	1.693	1.734	1.781	1.842	1.985
1.93	**0.46**	1.311	1.337	1.364	1.391	1.418	1.446	1.446	1.475	1.504	1.535	1.535	1.567	1.602	1.639	1.680	1.727	1.788	1.930
1.88	**0.47**	1.258	1.285	1.311	1.338	1.366	1.394	1.394	1.422	1.452	1.483	1.483	1.515	1.549	1.586	1.627	1.675	1.736	1.878
1.83	**0.48**	1.208	1.234	1.261	1.288	1.315	1.343	1.343	1.372	1.402	1.432	1.432	1.465	1.499	1.536	1.577	1.625	1.685	1.828
1.78	**0.49**	1.159	1.186	1.212	1.239	1.267	1.295	1.295	1.323	1.353	1.384	1.384	1.416	1.450	1.487	1.528	1.576	1.637	1.779
1.73	**0.50**	1.112	1.139	1.165	1.192	1.220	1.248	1.248	1.276	1.306	1.337	1.337	1.369	1.403	1.440	1.481	1.529	1.590	1.732
1.69	**0.51**	1.067	1.093	1.120	1.147	1.174	1.202	1.202	1.231	1.261	1.291	1.291	1.324	1.358	1.395	1.436	1.484	1.544	1.687
1.64	**0.52**	1.023	1.049	1.076	1.103	1.130	1.158	1.158	1.187	1.217	1.247	1.247	1.280	1.314	1.351	1.392	1.440	1.500	1.643
1.60	**0.53**	0.980	1.007	1.033	1.060	1.088	1.116	1.116	1.144	1.174	1.205	1.205	1.237	1.271	1.308	1.349	1.397	1.458	1.600
1.56	**0.54**	0.939	0.965	0.992	1.019	1.046	1.074	1.074	1.103	1.133	1.163	1.163	1.196	1.230	1.267	1.308	1.356	1.416	1.559
1.52	**0.55**	0.899	0.925	0.952	0.979	1.006	1.034	1.034	1.063	1.092	1.123	1.123	1.156	1.190	1.227	1.268	1.315	1.376	1.518
1.48	**0.56**	0.860	0.886	0.913	0.940	0.967	0.995	0.995	1.024	1.053	1.084	1.084	1.116	1.151	1.188	1.229	1.276	1.337	1.479
1.44	**0.57**	0.822	0.848	0.875	0.902	0.929	0.957	0.957	0.986	1.015	1.046	1.046	1.079	1.113	1.150	1.191	1.238	1.299	1.441
1.40	**0.58**	0.785	0.811	0.838	0.865	0.892	0.920	0.920	0.949	0.979	1.009	1.009	1.042	1.076	1.113	1.154	1.201	1.262	1.405
1.37	**0.59**	0.749	0.775	0.802	0.829	0.856	0.884	0.884	0.913	0.942	0.973	0.973	1.006	1.040	1.077	1.118	1.165	1.226	1.368
1.33	**0.60**	0.714	0.740	0.767	0.794	0.821	0.849	0.849	0.878	0.907	0.938	0.938	0.970	1.005	1.042	1.083	1.130	1.191	1.333
1.30	**0.61**	0.679	0.706	0.732	0.759	0.787	0.815	0.815	0.843	0.873	0.904	0.904	0.936	0.970	1.007	1.048	1.096	1.157	1.299
1.27	**0.62**	0.646	0.672	0.699	0.726	0.753	0.781	0.781	0.810	0.839	0.870	0.870	0.903	0.937	0.974	1.015	1.062	1.123	1.265
1.23	**0.63**	0.613	0.639	0.666	0.693	0.720	0.748	0.748	0.777	0.807	0.837	0.837	0.870	0.904	0.941	0.982	1.030	1.090	1.233
1.20	**0.64**	0.581	0.607	0.634	0.661	0.688	0.716	0.716	0.745	0.775	0.805	0.805	0.838	0.872	0.909	0.950	0.998	1.058	1.201
1.17	**0.65**	0.549	0.576	0.602	0.629	0.657	0.685	0.685	0.714	0.743	0.774	0.774	0.806	0.840	0.877	0.919	0.966	1.027	1.169
1.14	**0.66**	0.519	0.545	0.572	0.599	0.626	0.654	0.654	0.683	0.712	0.743	0.743	0.775	0.810	0.847	0.888	0.935	0.996	1.138
1.11	**0.67**	0.488	0.515	0.541	0.568	0.596	0.624	0.624	0.652	0.682	0.713	0.713	0.745	0.779	0.816	0.857	0.905	0.966	1.108
1.08	**0.68**	0.459	0.485	0.512	0.539	0.566	0.594	0.594	0.623	0.652	0.683	0.683	0.715	0.750	0.787	0.828	0.875	0.936	1.078
1.05	**0.69**	0.429	0.456	0.482	0.509	0.537	0.565	0.565	0.593	0.623	0.654	0.654	0.686	0.720	0.757	0.798	0.846	0.907	1.049
1.02	**0.70**	0.400	0.427	0.453	0.480	0.508	0.536	0.536	0.565	0.594	0.625	0.625	0.657	0.692	0.729	0.770	0.817	0.878	1.020
0.99	**0.71**	0.372	0.398	0.425	0.452	0.480	0.508	0.508	0.536	0.566	0.597	0.597	0.629	0.663	0.700	0.741	0.789	0.849	0.992
0.96	**0.72**	0.344	0.370	0.397	0.424	0.452	0.480	0.480	0.508	0.538	0.569	0.569	0.601	0.635	0.672	0.713	0.761	0.821	0.964
0.94	**0.73**	0.316	0.343	0.370	0.396	0.424	0.452	0.452	0.481	0.510	0.541	0.541	0.573	0.608	0.645	0.686	0.733	0.794	0.936
0.91	**0.74**	0.289	0.316	0.342	0.369	0.397	0.425	0.425	0.453	0.483	0.514	0.514	0.546	0.580	0.617	0.658	0.706	0.766	0.909
0.88	**0.75**	0.262	0.289	0.315	0.342	0.370	0.398	0.398	0.426	0.456	0.487	0.487	0.519	0.553	0.590	0.631	0.679	0.739	0.882
0.86	**0.76**	0.235	0.262	0.288	0.315	0.343	0.371	0.371	0.400	0.429	0.460	0.460	0.492	0.526	0.563	0.605	0.652	0.713	0.855
0.83	**0.77**	0.209	0.235	0.262	0.289	0.316	0.344	0.344	0.373	0.403	0.433	0.433	0.466	0.500	0.537	0.578	0.626	0.686	0.829
0.80	**0.78**	0.183	0.209	0.236	0.263	0.290	0.318	0.318	0.347	0.376	0.407	0.407	0.439	0.474	0.511	0.552	0.599	0.660	0.802
0.78	**0.79**	0.156	0.183	0.209	0.236	0.264	0.292	0.292	0.320	0.350	0.381	0.381	0.413	0.447	0.484	0.525	0.573	0.634	0.776
0.75	**0.80**	0.130	0.157	0.183	0.210	0.238	0.266	0.266	0.294	0.324	0.355	0.355	0.387	0.421	0.458	0.499	0.547	0.608	0.750
0.72	**0.81**	0.104	0.131	0.157	0.184	0.212	0.240	0.240	0.268	0.298	0.329	0.329	0.361	0.395	0.432	0.473	0.521	0.581	0.724
0.70	**0.82**	0.078	0.105	0.131	0.158	0.186	0.214	0.214	0.242	0.272	0.303	0.303	0.335	0.369	0.406	0.447	0.495	0.556	0.698
0.67	**0.83**	0.052	0.079	0.105	0.132	0.160	0.188	0.188	0.216	0.246	0.277	0.277	0.309	0.343	0.380	0.421	0.469	0.530	0.672
0.65	**0.84**	0.026	0.053	0.079	0.106	0.134	0.162	0.162	0.190	0.220	0.251	0.251	0.283	0.317	0.354	0.395	0.443	0.503	0.646
0.62	**0.85**		0.026	0.053	0.080	0.107	0.135	0.135	0.164	0.194	0.225	0.225	0.257	0.291	0.328	0.369	0.417	0.477	0.620
0.59	**0.86**			0.027	0.054	0.081	0.109	0.109	0.138	0.167	0.198	0.198	0.230	0.265	0.302	0.343	0.390	0.451	0.593
0.57	**0.87**				0.027	0.054	0.082	0.082	0.111	0.141	0.172	0.172	0.204	0.238	0.275	0.316	0.364	0.424	0.567
0.54	**0.88**					0.027	0.055	0.055	0.084	0.114	0.145	0.145	0.177	0.211	0.248	0.289	0.337	0.397	0.540
0.51	**0.89**						0.028	0.028	0.057	0.086	0.117	0.117	0.149	0.184	0.221	0.262	0.309	0.370	0.512
0.48	**0.90**								0.029	0.058	0.089	0.089	0.121	0.156	0.193	0.234	0.281	0.342	0.484
0.46	**0.91**									0.030	0.060	0.060	0.093	0.127	0.164	0.205	0.253	0.313	0.456
0.43	**0.92**										0.031	0.031	0.063	0.097	0.134	0.175	0.223	0.284	0.426
0.40	**0.93**												0.032	0.067	0.104	0.145	0.192	0.253	0.395
0.36	**0.94**													0.034	0.071	0.112	0.160	0.220	0.363
0.33	**0.95**														0.037	0.078	0.126	0.186	0.329
0.29	**0.96**															0.041	0.089	0.149	0.292
0.25	**0.97**																0.048	0.108	0.251
0.20	**0.98**																	0.061	0.203
0.14	**0.99**																		0.142

DUCATI energia
HISTORY DRIVES THE FUTURE

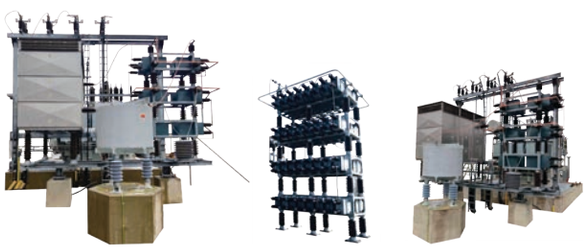
Product range

Motor capacitors



Power electronics capacitors

Power factor correction for low voltage



Power factor correction for medium/high voltage

DUCATI energia

HISTORY DRIVES THE FUTURE

DUCATI Energia s.p.a.
Via M.E.Lepido,182
40132 Bologna, Italy

+39 051-6411511
info@ducatienergia.com

www.ducatienergia.it

**Low-voltage power factor correction:
capacitors, components, fixed and automatic
equipment and active harmonic filters**