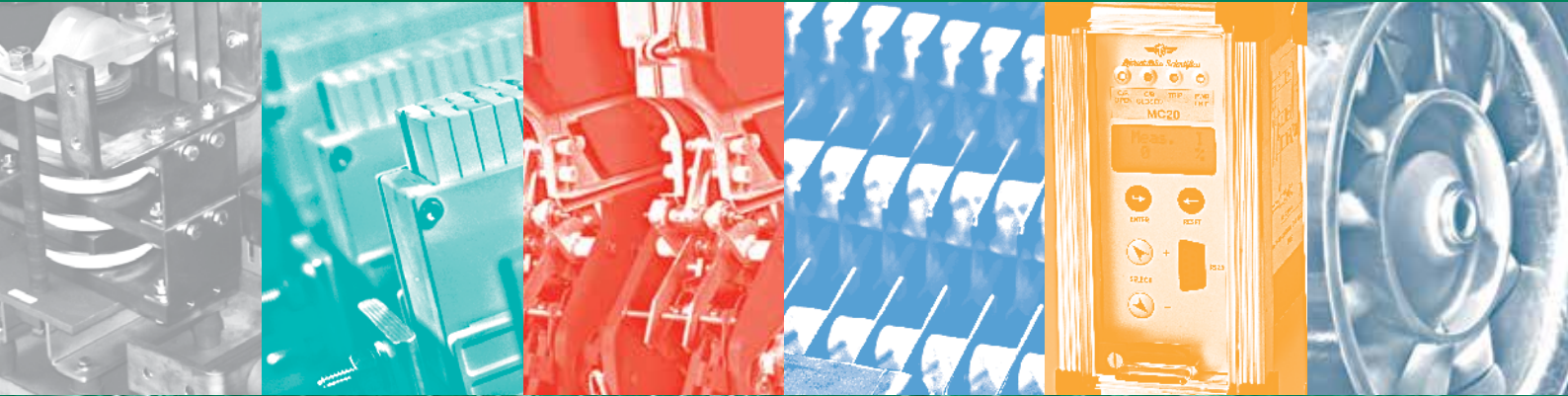


# Infrastructure

Components for Infrastructure



**Rectifiers**  
**DC High Speed Circuit Breakers**  
**Contactors**  
**Resistors**  
**Protection Relays**  
**Transducers**  
**Fans**



*Microelettrica Scientifica*



## Energy

Microelettrica Scientifica's extensive product ranges have become the standard of reference for a growing number of customers worldwide in the challenging Energy Market. Microelettrica Scientifica's been evolving through innovation to support new technology in generation, renewable energy and smart grid.

### Applications

Photovoltaic interface relay

Feeder and bus relay

Generator relay

Resistor for harmonic filters

Neutral grounding resistors

Load banks

DC contactors for inverters and UPSs

Photovoltaic string contactors

Ground fault neutralizer system

### Products

Contactors

Disconnectors

DC High Speed Circuit Breakers

Power Resistor

Protection Relays

Transducers

Fans

Rectifiers

## Industry

During almost 30 years of operation, a close relationship with the Customers has been created. Microelettrica products are present in most of the industries such as Steel making, Cement, Glass, Chemical, Oil&Gas and Utilities.

### Applications

Motor and generator protection

Feeder and bus bar relay

Generator relay

Resistor for harmonic filters

Neutral grounding resistors

Load banks

DC contactors for inverters and UPSs

Photovoltaic string contactors

Ground fault neutralizer system





### Railways

Today, Microelettrica Scientifica is a leading supplier of equipment for dc traction substations. We offer to our Customers a complete portfolio of DC Traction System components.

#### Products

DC Switchgears and Switching Cubicles

DC High Speed Circuit Breakers

Feeder manager and DC Relays for Traction

DC Transducers

Contactors and Disconnectors

Power Resistor for Line Testing

Braking Resistors for Fixed Installation

Fans

Rectifiers

#### Applications

DC Power Substations

Traction lines

DC Switchgears

Depot

Underground ventilation

### Made in Microelettrica Scientifica

Always aiming for the best results, Microelettrica Scientifica develops and manufactures the entire range of products in Buccinasco close to Milan. We also run operations in U.S.A., South Africa, China, India, France, Brasil and Turkey through which our Customers have access to immediate local assistance and the possibility of localization of Microelettrica Scientifica products. Our Customers know they can always count on quality, excellence and accuracy of Microelettrica Scientifica Products and Services.

#### Products

Contactors  
Disconnectors

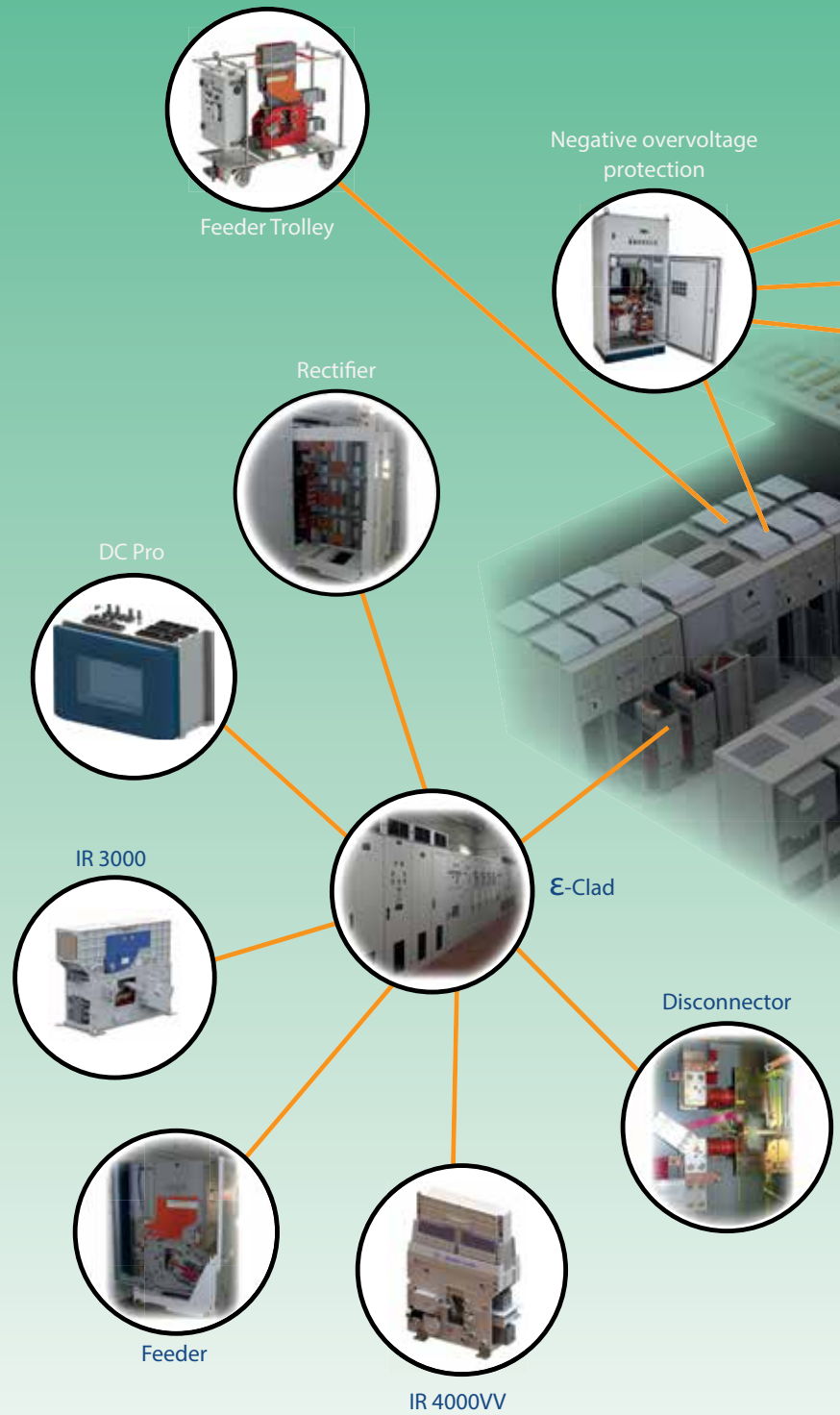
DC High Speed Circuit Breakers

Braking Resistors  
Resistors for Traction Control

High Voltage Transducers

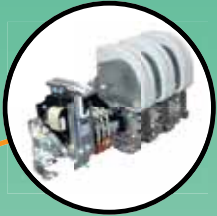
Fans

# A tailored solution for every



# substation component need

Bar DIN Contactor



Hall effect transducer



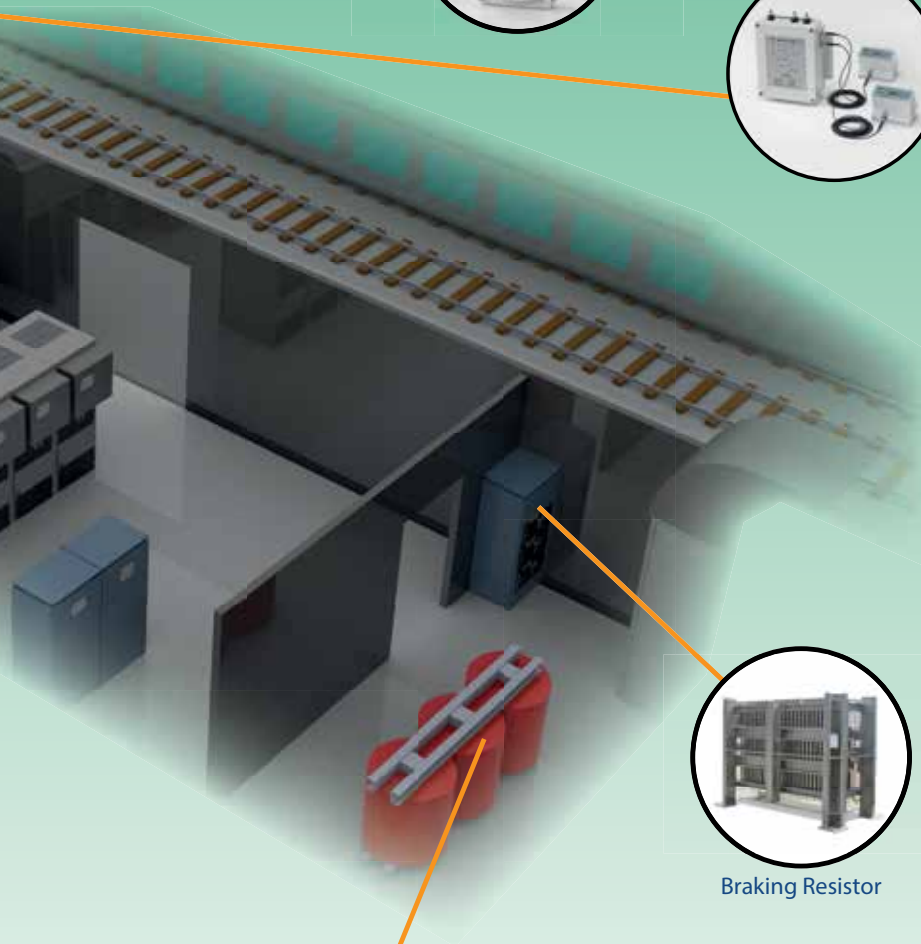
V-I Transducer



Braking Resistor



Transformer



# A tailored solution for every



# industry component need

DC Hall Effect Transducer



Breaker



G Base



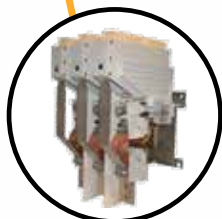
Disconnecter



Interface Protection



Inverter DC Contactor



AC Low Frequency Contactor





# Traction Rectifier



## Functions

Traction Rectifiers are used to convert AC power to DC power for railway traction applications using silicon diodes and aluminium heatsinks.

## General characteristics

Traction Rectifiers could be convection cooled or forced-air cooled (using blowers), and are usually installed:

- In modular, metalclad enclosures
- As a self-contained, open-frame unit in a secured (inter-locked) area

Semiconductor Solutions, an ISO 9001:2008 company based in South Africa, designs and manufactures customised rectifiers in accordance with SANS60146 (IEC 146), EN50328 standards and customer requirements, where constructive and technological principles are applied in a project specific mechanical layout.

Due to high demand for maintainability from our customer, our designs apply specific focus on these elements, for example:

- Easy maintenance, with direct accessibility to the diode modules due to open-frame construction
- Easy component replacement due to modular design and removal of individual power modules in less than 5 minutes

## References

(Only approved supplier in South Africa on all 3.3 kV DC rail systems)

Transnet Freight Rail/PRASA	Rectifier, Diode (4.5MW, Forced-air cooled) – [x120]
Transnet Freight Rail/PRASA	Rectifier, Diode (5MW, Forced-air cooled) – [x159]
Transnet Freight Rail/PRASA	Rectifier, Diode (6MW, Forced-air cooled) – [x10]
Transnet Freight Rail/PRASA	Rectifier, Diode (10MW, Forced-air cooled) – [x10]

## Main Characteristics

Construction	Open-frame / Metal-clad enclosure
Cooling type	Natural convection / forced-air cooled



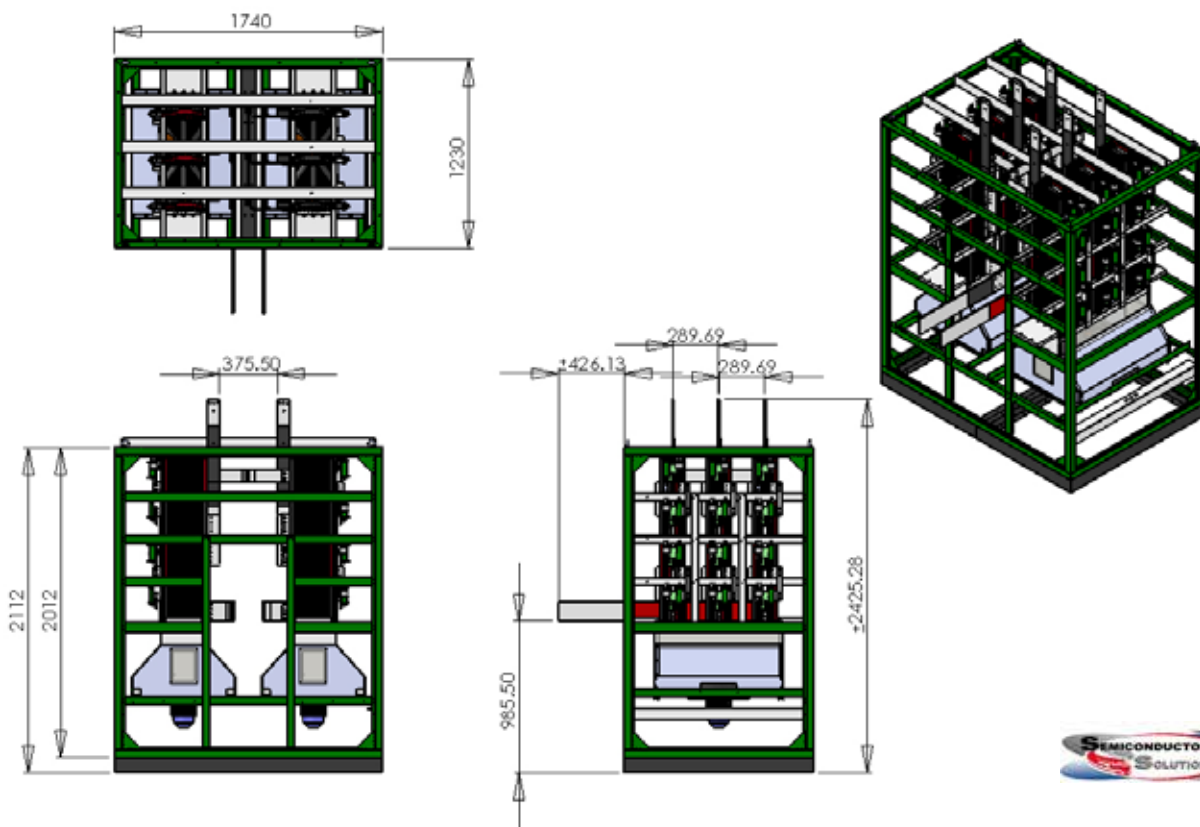
# Power Systems <sup>9</sup>

## Technical Characteristics

Rated power [MW]	1 - 10
Rated DC output voltage [Vdc]	750, 1500, 3000
Rated AC input voltage [Vac]	555 - 2400
Rated frequency [Hz]	50 / 60
Duty class	To customer specification
Rectifier Connections	Series & parallel bridges
No. of pulses	6 & 12-pulse
Semiconductor type	Capsule diode (hockey-puck)
Redundancy	N-1 (Customer to specify)
Protection degree	IPxx (Customer to specify)
Ambient temperature [°C]	-5 / +50
Over-temperature protection	Included (Fibre-optically connected)
Diode fuse protection	Optional
Failed diode monitoring	Optional (Fibre-optically connected)
DC surge protection	Optional (Fuse protected)
Metering	Optional (Voltmeter & Ammeter)

## Features

Diode monitoring	Failed diode LED identification & signal output via potential-free contact
Fan control	Fan controller card can be used to stop/start the fan/s via thermo-switches
Fan protection	Vane switch on each fan signals fan failure/stoppage
Maintenance & repair	Quick & easy diode module change-out
Connection	Many different rectifier connections/configurations possible



# Industrial Rectifier



## Functions

Industrial Rectifiers are used to convert AC power to DC power for many different applications and utilise silicon diodes for uncontrolled applications and thyristors for controlled.

## General characteristics

Industrial Rectifiers could be convection cooled, forced-air cooled (using blowers), or water-cooled in conjunction with a cooling tower and are usually installed

- In modular, metalclad enclosures to customer specified protection rating (IPxx)
- As a self-contained, open-frame unit in a secured (inter-locked) area

## Typical Applications:

Applications involved with to date include but are not limited to:

- electro-winning
- arc-furnace control
- haulage truck assist
- winder/elevator armature & field converters
- electro-plating
- soft starters
- heater control etc.

Semiconductor Solutions, an ISO 9001:2008 company based in South Africa, have built up extensive experience in the design and manufacture of customised rectifiers, in accordance with SANS60146 (IEC146) standards and customer requirements, for industry (e.g. mining operations & plating plants) in the last two decades.

## References

(Extensive experience and know-how in forced-air and water-cooled, controlled, high current rating per mechanical volume systems)

Industrial diamond manufacturing	Rectifier, Thyristor (100V, 40kA, Water-cooled)
Haul-truck propulsion (on-board & fixed)	Rectifier, Diode (2.5MW, 2.6kV, Forced-air cooled)
DC Arc-furnace supply	Rectifier, Thyristor (900V, 76kA, Water-cooled)
Hoist system DC drive	Rectifier, Thyristor (690V, 2kA, Forced-air cooled)
Electro-plating plants	Rectifier, Thyristor (760V, 40kA, Water-cooled)

## Main Characteristics

Construction	Open-frame / Metal-clad enclosure
Cooling type	Natural convection, forced-air & water-cooled

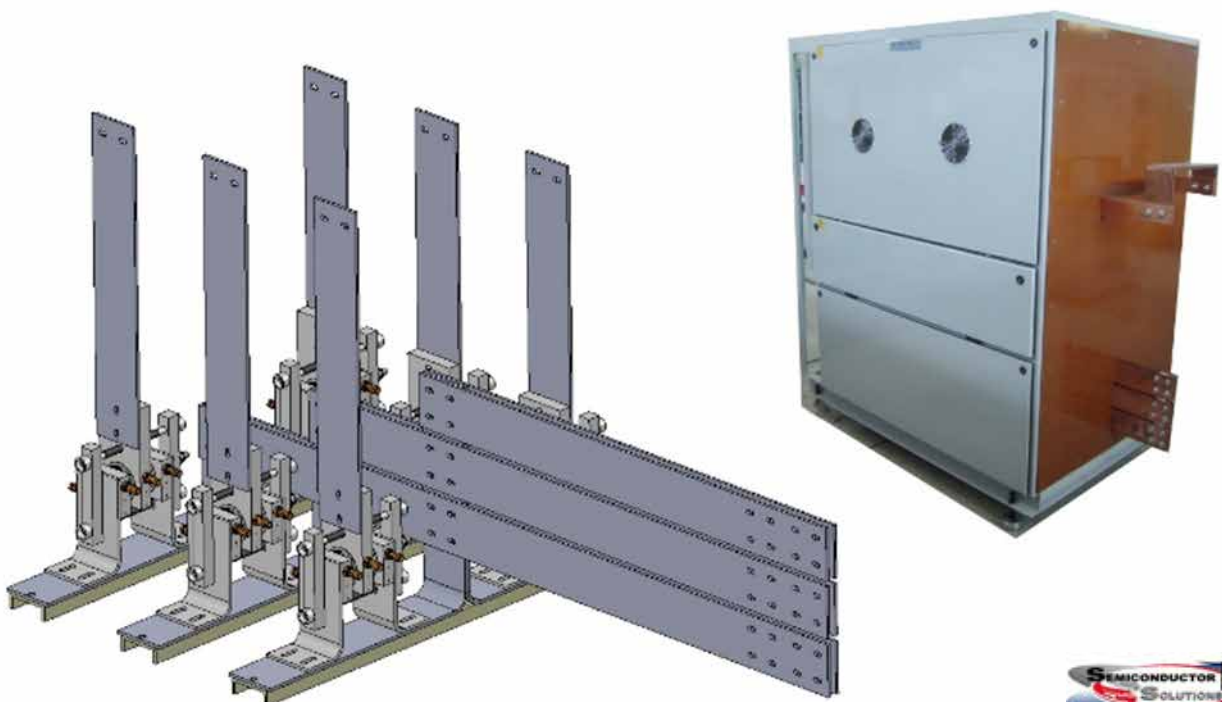
# Power Systems <sup>11</sup>

## Technical Characteristics

Rated current [kA]	Up to 75
Rated DC output voltage [Vdc]	0 - 3000
Rated AC input voltage [Vac]	0 - 2400
Rated frequency [Hz]	50 / 60
Heatsink	Aluminium (air-cooled) / copper (water-cooled)
Duty class	To customer specification
Rectifier Connections	Series & parallel bridges, hexa-phase
No. of pulses	6 & 12-pulse
Semiconductor type	Capsule diode or thyristor (hockey-puck)
Redundancy	N-1 (Customer to specify)
Protection degree	IPxx (Customer to specify)
Ambient temperature [°C]	-5 / +50
RC snubber	Normally included
Over-temperature protection	Included (Fibre-optically connected)
Diode fuse protection	Optional
Failed diode monitoring	Optional (Fibre-optically connected)
DC surge protection	Optional (Fuse protected)
Metering	Optional (Voltmeter & Ammeter)

## Features

Diode monitoring (optional)	Failed diode LED identification & signal output via potential-free contact
Maintenance & repair	Quick & easy diode module change-out
Connection	Many different rectifier connections/configurations possible





IR3000F Vertical

## IR3000F line

### Applications

DC Substation

Industry

The IR3000F series are single pole, magnetic blow out, trip free, air circuit breakers.

The closing mechanism is an independent motor operated type.

The IR3000 Circuit Breaker is held closed by holding coil or by permanent magnet device and is equipped with a direct acting over-current trip device which may be either unidirectional and bidirectional.

The arc chute is made in ceramic material for a longer life and reduced maintenance.

The use of arched contacts ensure a long duration in electrical life.

The breaker conforms to IEC61992; IEEE C37-14; IEEE C37-16.

Different solutions of arc chutes help the cubicle designers for the optimization of the space.



# HSCBs



IR3000F 900



IR3000F 1800

Type	U <sub>max</sub> [V]	I [A]	W [mm]	H [mm]	L [mm]
IR3000F 900	900	3000	220	395	530
IR3000F 1800	1800	3000	220	478	530
IR3000F Vertical	up to 1800	3000	220	720	530

# IR4000 line

## Applications

On the vehicle roof

Under vehicle frame

Inside the loco cubicle

DC Substation

Industry

The IR4000 Line is single pole air High Speed Circuit Breakers for DC applications with rated voltages of 900, 1800 or 3600 Vdc and thermal currents up to 4,5kA.

Based on ceramic fins technology, IR4000 are designed to protect the downstream power circuits from overcurrent and short circuit.

The IR4000 Circuit Breaker is an independent motor operated type and held close by holding coil or permanent magnet. It is the latest generation of the well-known IR6000 line because it integrates all improvements resulting from a long experience in many worldwide rail and industry applications. It replaces easily the first generation IR6000 for both electrical and mechanical aspects.

A compact and robust platform allows to withstand very harsh conditions in order to face all working requirement for onboard applications (IR4000V) as well as fixed installations (IR4000F).

The IR4000 Line is the right solution if high or very high power load protection is required. In order to fit limited space available on vehicles the IR4000 can be mounted:

- Inside the cubicle in vertical mounting position : IR4000VV
- Under the frame as well as on the roof in horizontal mounting position: IR4000VH

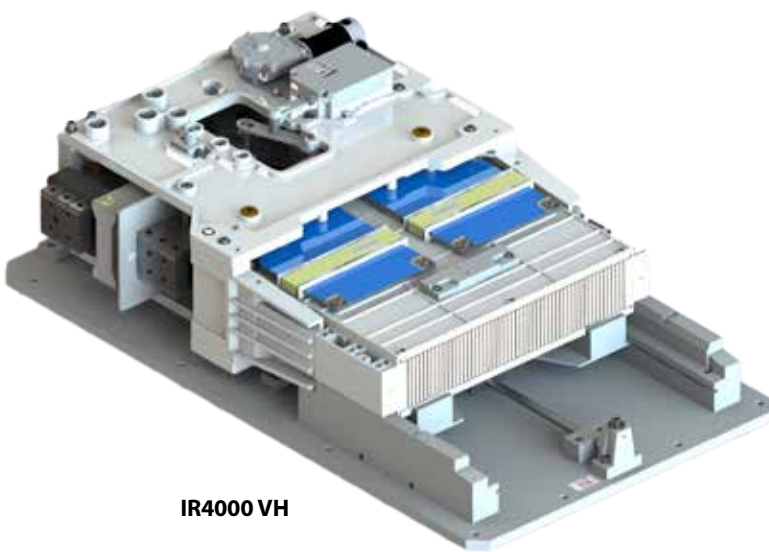
## Standard Characteristics

- Thermal current rating 3000 or 4500A.
- Rated voltages of 900, 1800 or 3600 Vdc
- Single pole, magnetic blow out, trip free, air circuit breakers
- The closing motor is an independent motor operated type.
- Held closed by holding coil or permanent magnet device.
- Bidirectional direct acting over-current trip device.
- Ceramic arc chute guarantees a longer life and reduced maintenance.
- Arcing contacts ensure a long duration in electrical life.
- Reed type auxiliary contacts

## Customization Available

- Monodirectional direct acting over-current trip device.
- Dual voltage arc chute
- IP65 Metal enclosure for roof or under frame application
- Fast opening device for fixed application

# HSCBs

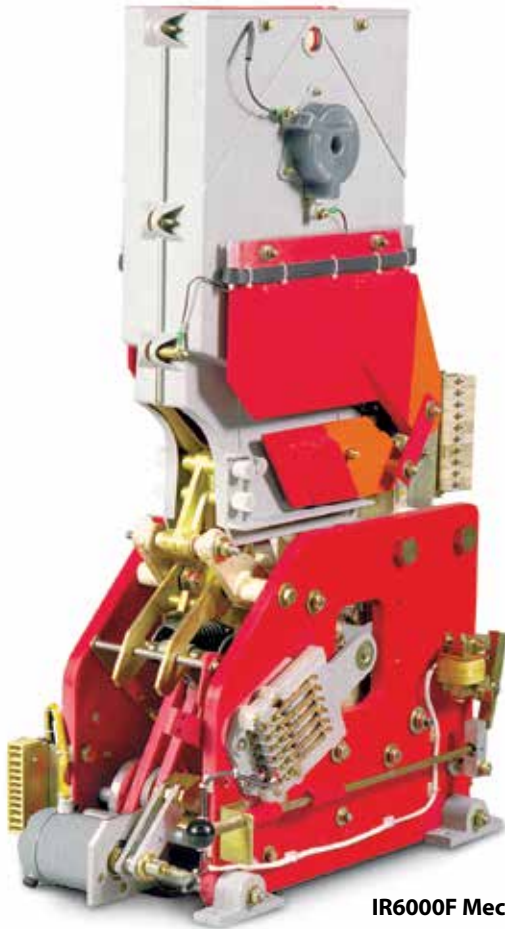


**IR4000 VH**

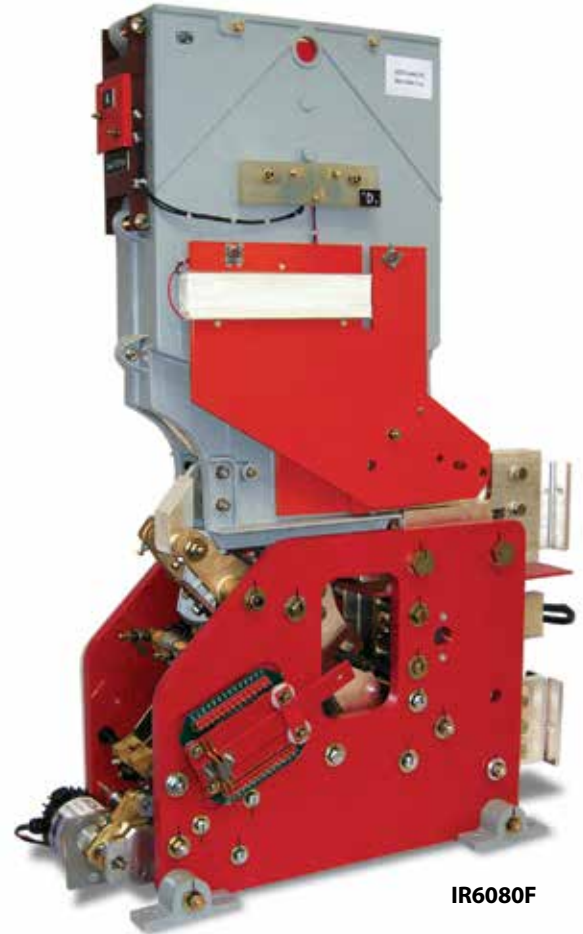


**IR4000 VV and IR4000 F**

				Max Breaking current (kA/ms) according to IEC61992		
Fixed Application	IR4000 F Line	Holding System	I <sub>th</sub> (A) @ 40°C	U <sub>e</sub> (Vdc) = 900Vdc	U <sub>e</sub> (Vdc) = 1800Vdc	U <sub>e</sub> (Vdc) = 3600Vdc
	IR4030FC09M	Holding Coil	3000	125 / 100	-	-
	IR4030FP09M	Permanent Magnet				
	IR4045FC09M	Holding Coil	4500	-	-	
	IR4045FP09M	Permanent Magnet				
	IR4030FC18M	Holding Coil	3000	-	90 / 63	
	IR4030FP18M	Permanent Magnet				
	IR4045FC18M	Holding Coil	4500	-	-	
	IR4045FP18M	Permanent Magnet				
	IR4030FC36M	Holding Coil	3000	-	-	70 / 63
	IR4030FP36M	Permanent Magnet				
	IR4045FC36M	Holding Coil	4500	-	-	-
	IR4045FP36M	Permanent Magnet				



IR6000F Mechanical



IR6080F

# IR6000F line

## Applications

DC Substation

Industry

The IR6000 series are single pole, magnetic blow out, trip free, air circuit breakers.

The closing mechanism is an independent motor operated type.

The IR6000 Circuit Breaker is held closed by holding coil or by permanent magnet device and is equipped with a direct acting over-current trip device which may be either unidirectional and bidirectional.

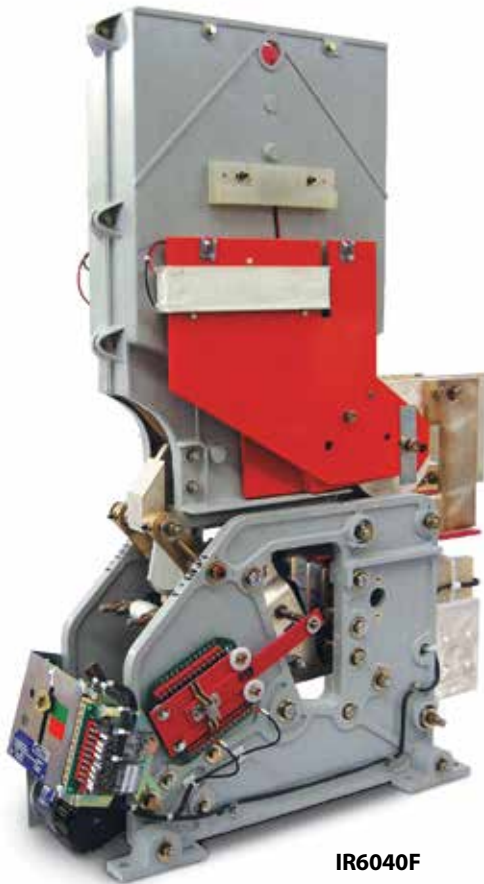
The arc chute is made in ceramic material for a longer life and reduced maintenance.

The use of arcing contacts ensure a long duration in electrical life.

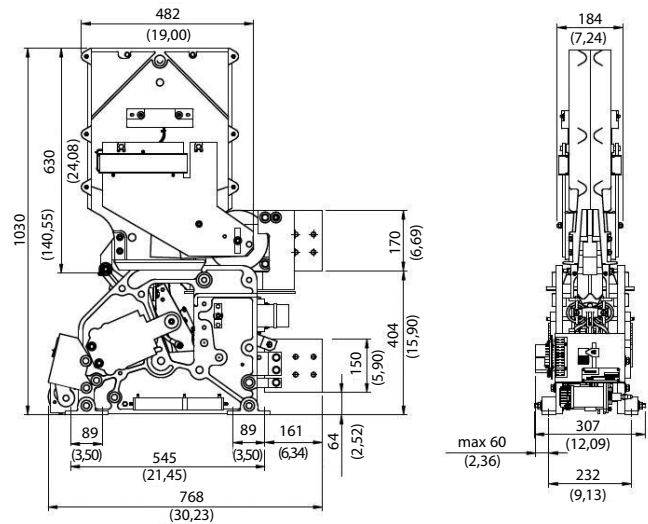
The breakers can be used in single voltage or dual voltage applications, where multisystem solution is required (ex 1800/3600V).



# HSCBs



**IR6040F**



The breaker conforms to IEC61992; IEEE C37-14; IEEE C37-16

A special version of the IR6000F is with mechanical latching. This ensures an high withstand capability to the short circuit currents up to 150kA

Type	U <sub>max</sub> [V]	I [A]	W [mm]	H [mm]	L [mm]
<b>IR6000F Mechanical</b>	up to 1200 (IEEE)	8000	340	1030	650
<b>IR6080F</b>	up to 3600	8000	340	1030	650
<b>IR6040F</b>	up to 3600	4000	300	1030	650

## LTX line

### Applications

Line contactor

Auxiliary converter input

Filter pre-charging

Heating/Air conditioning systems

LTX line contactors are the right solutions where high voltage rating, high thermal current and high breaking capacity (up to 4 kV) are required.

The creepage and clearance distances are widely dimensioned for safe application in polluted environments and the narrow outline is especially conceived for applications where space is a critical issue.

The innovative design of LTX line combines the traditional technology of the arc chute (ceramic fins) with a new blow out system. Ceramic arc chute enables to withstand the highest current ratings and the new blowout system guarantees a high reliability with critical currents.

Contacts open with double speed and the new mechanism guarantees also a higher distance between them.

An electronic control of the main coil allows to combine a high closing power with a reduced power consumption during the holding phase.

The main electric connections can be placed in several positions to cover all the possible market applications.

A contactor status indicator is available and an IP67 Auxiliary contact are provided as a standard.

The LTX is available in 1, 2 or 3 poles configuration and poles can be easily coupled side by side thanks to a modular approach.

### The LTX Line is protected by International PATENT

### General Characteristics

- LTX is the latest generation of the well-known MS contactors. It integrates all improvements resulting from a long experience in many worldwide rail and industry applications.
- The same sturdy working principle is adapted to different applications in order to fulfil all requested field-related standards.
- Ratings up to 400 Vdc/ac and up to 1600 A/pole application
- Multi-pole combination
- Very high level of customization available



### Auxiliary contact blocks type PBX

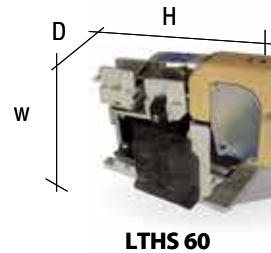
- Normally mounted on LTX Line
- 1 NO + 1 NC block version
- IP67 protection degree
- Double interrupting, self-cleaning, solid silver, snap action contacts

# Switches



Type	U <sub>max</sub> [Vdc]	I <sub>th</sub> [A]	W [mm]	H [mm]	D [mm]
LTX040 1P	900 - 1800 - 3600	450	113	345 - 360 - 440	295 - 320 - 360
LTX060 1P	900 - 1800 - 3600	600	113	345 - 360 - 440	295 - 320 - 360
LTX090 1P	900 - 1800 - 3600	900	113	345 - 360 - 440	295 - 320 - 360
LTX120 1P	900 - 1800 - 3600	1200	143	345 - 360 - 440	295 - 320 - 360
LTX150 1P	900 - 1800 - 3600	1500	143	345 - 360 - 440	295 - 320 - 360
LTX180 1P	900 - 1800 - 3600	1800	143	345 - 360 - 440	295 - 320 - 360

NOTE: Main terminals are fully customizable. These dimensions are considered without terminals.



## LTHS line

### Applications

Line contactor

Power or auxiliary converter input

Filter pre-charging

Traction motors on-load disconnection

Electromagnetic brakes

Heating/Air conditioning systems

Microelettrica Scientifica contactors for industrial applications are designed to be used on electrical equipment in presence of the most severe conditions, such as shocks and vibrations, which occur on on-board traction vehicles.

The LTHS Line displays a traditional design which enables them to withstand the highest current ratings in harsh working conditions.

To accomplish most of the possible applications, all the LTHS contactors can be manufactured in single or multipolar form and, upon request, allow a very high degree of customization. Versions with normally open or normally closed poles are manufactured, and mechanical latching can be supplied. In order to work efficiently both with high and low currents, the contactors are equipped with indirect blow out circuit. This arc-extinguishing technology allows to work indifferently in AC as well as DC.

The DC control coil operates without economy resistor within a wide working range. A "varistor" cuts off the peak voltage when the coil is de-energized.

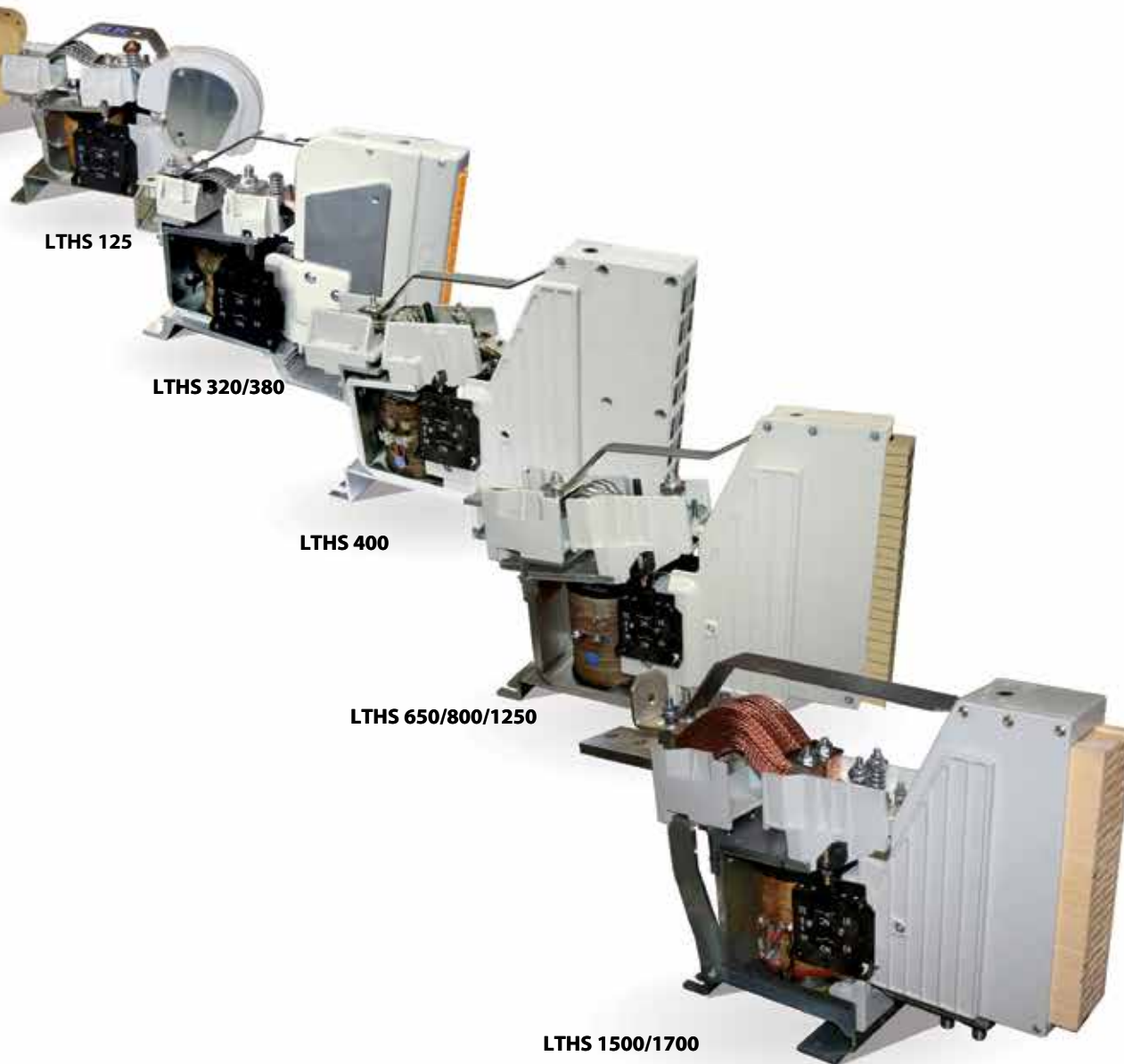
More than 20000 LTHS contactors are delivered every year for the most demanding projects and applications worldwide.

### General Characteristics

- The most experienced extra heavy duty line
- Designed for on-board applications according to IEC 61992-60947
- Ratings up to 2000 VDC/AC and up to 1600 A/pole application
- Direct or indirect arc blow-out systems available according specific application requirements
- Multi-pole combination up to 4 NO or NC poles
- Very high level of customization available



# Switches



Type	U <sub>max</sub> [V <sub>AC/DC</sub> ]	I <sub>th</sub> [A]	W [mm]	H [mm]	D1/D2 [mm] (1/2 poles)
LTHS 60	1000	80	143	197	72/93
LTHS 125	1000	150	185	276	86/114
LTHS 320	2000	350	220.5	300.5	86/114
LTHS 380	2000	380	220.5	300.5	86/114
LTHS 400	2000	500	329	423	115.5/202
LTHS 650/800	2000	700/920	335	438(D1)/441(D2)	119/206.5
LTHS 1250	2000	1300	350	473(D1)/476(D2)	127.2/206.5
LTHS 1500	2000	1350	350	533.5(D1)/536.5(D2)	111/215
LTHS 1700	2000	1600	350	533.5(D1)/536.5(D2)	127/235



## LTC line

### Applications

Auxiliary converter input

Filter pre-charging

Heating/Air conditioning systems

Line contactor

The LTC Series contactors, thanks to their excellent balance between dimensions, performances and robustness, are suitable for all those on-board applications which demand a small, smart device. Their design encourages applications where high operating frequencies and small available spaces are important requirements.

Like all Microelettrica Scientifica contactors, the LTC Series is based on a standard concept, but a very high level of customization can be achieved by replacing a few key components. Normally open and normally closed poles can be fitted, as well as mechanical latching. The breaking circuit is equipped with permanent magnets or indirect arc blow out coil to work efficiently both with high and low currents.

The DC control coil operates without economy resistor within a wide working range. A "varistor" cuts off the peak voltage when the coil is de-energized.

More than 20000 LTC contactors are delivered every year for the most demanding projects and applications worldwide.

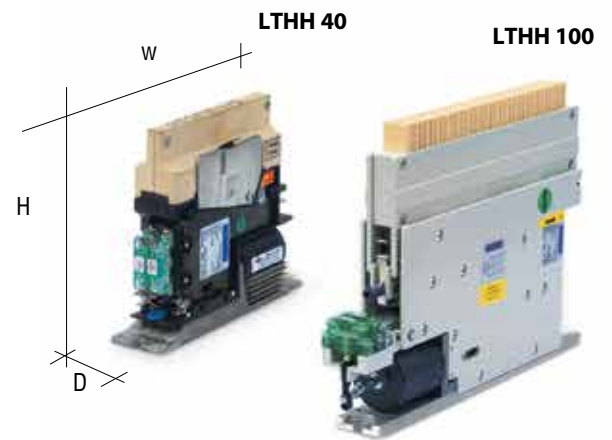
### General Characteristics

- The most compact and modern heavy duty line
- Designed for on-board applications according to IEC 61992-60947
- Ratings up to 4000 VDC/AC and up to 1000 A/pole application
- Permanent magnet or indirect arc blowout systems available according specific application requirements
- Multi-pole combination up to 4 NO or NC poles
- Very high level of customization available

# Switches



Type	$U_{max}$ [V <sub>AC/DC</sub> ]	$I_{th}$ [A]	W [mm]	H [mm]	D [mm]
LTC 100	1000	100	106	127.5	63
LTC 100 2 poles	1000	100/200	120	127	93
LTC 100 NC	1000	100	106	155	60
LTCS 250/300	2000	250	140	156.5	86
LTCS 250/300 2 poles	2000	250/500	140	156.5	109.2
LTCS 250/300 3 poles	2000	250	140	156.5	165.5
LTC 250/300 NC	2000	250	140	196	78
LTCH 250	2000	250	154	176	86
LTCH 60	4000	60	168	221	88
LTCH 60 2 poles	4000	60/120	168	221	125
LTCH 1000	2000	1000	385	300	93



## LTHH/LTE/LTP line

### Applications

Auxiliary converter input

Filter pre-charging

Capacitor discharging

Heating/Air conditioning systems

Line contactor

Train supply line

Resistors based traction systems, for starting and braking of electric motors

The Microelettrica Scientifica LTHH/LTE/LTP Lines for electric traction are supplied to railways and underground systems throughout the world.

Where high voltage ratings are required, the LTHH Series contactors are the right solution.

The creepage and clearance distances are widely dimensioned for safe application in polluted environments. Their narrow outline is especially conceived for applications where space is a critical issue - as more and more often happens on railway vehicles.

To meet all possible applications, they are available both with electric (LTHH/LTE) and pneumatic (LTP) control, and poles can be manufactured in normally open or normally closed configurations.

The direct or indirect blow out circuit makes the LTHH contactors suitable to work both with high and low currents.

The DC control coil operates without economy resistor within a wide working range. More than 10000 LTHH contactors are delivered every year for the most demanding projects and applications worldwide.

### General Characteristics

- The highest voltage single pole heavy duty line
- Designed for on-board applications according to IEC 61992-60947
- Ratings up to 4000 VDC/AC and up to 1350 A/pole application
- Direct or indirect arc blow-out systems available according specific application requirements
- Multi-pole assemblies, NO or NC poles
- Very high level of customization available



# Switches

LTHH 250/400



LTP 2-400/600



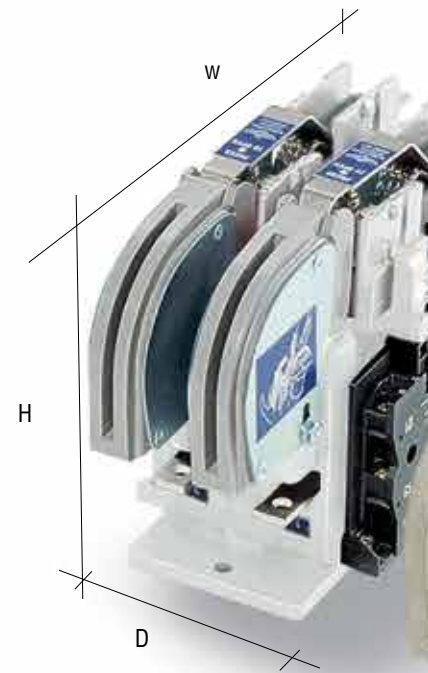
LTP 4-400/600



LTP 4-2000



Type	U <sub>max</sub> [V <sub>AC/DC</sub> ]	I <sub>th</sub> [A]	W [mm]	H [mm]	D1/D2 [mm] (1/2 poles)
LTHH 40	2000	60	200(D1)/244(D2)	162.5(D1)/174.5(D2)	48/106
LTHH 100	4000	120	377(D1)/410(D2)	274(D1)/279(D2)	60/130
LTHH 250	4000	300	380.5(D1)/424(D2)	297(D1)/302(P2)	70/160
LTHH 400	4000	400	380.5(D1)/424(D2)	297(D1)/302(P2)	70/160
LTE 2-400	2000	900	428	367	80/-
LTE 2-600	2000	900	430	370(D1)/365(D2)	80/220
LTP 2-400	2000	900	402	367	80/-
LTP 2-600	2000	900	402	370	80/-
LTE 4-400	4000	900	429.4(D1)/379.3(D2)	394	85/175
LTE 4-600	4000	900	429.4	423	85/-
LTP 4-400	4000	900	402	394	85/-
LTP 4-600	4000	900	402	423	85/-
LTE 4-2000	4000	1350	501	473	119/-
LTP 4-2000	4000	1350	501	473	151.5/-



## LTNS line

### Applications

Transit and railway systems

Control of cranes

Rolling mills

Mining equipment

Renewable energy

Microelettrica Scientifica LTNS series have been developed to answer to the constantly increasing market need of reduced dimensions and weight, taking most of the huge know-how in designing and manufacturing of industrial bar mounted contactors.

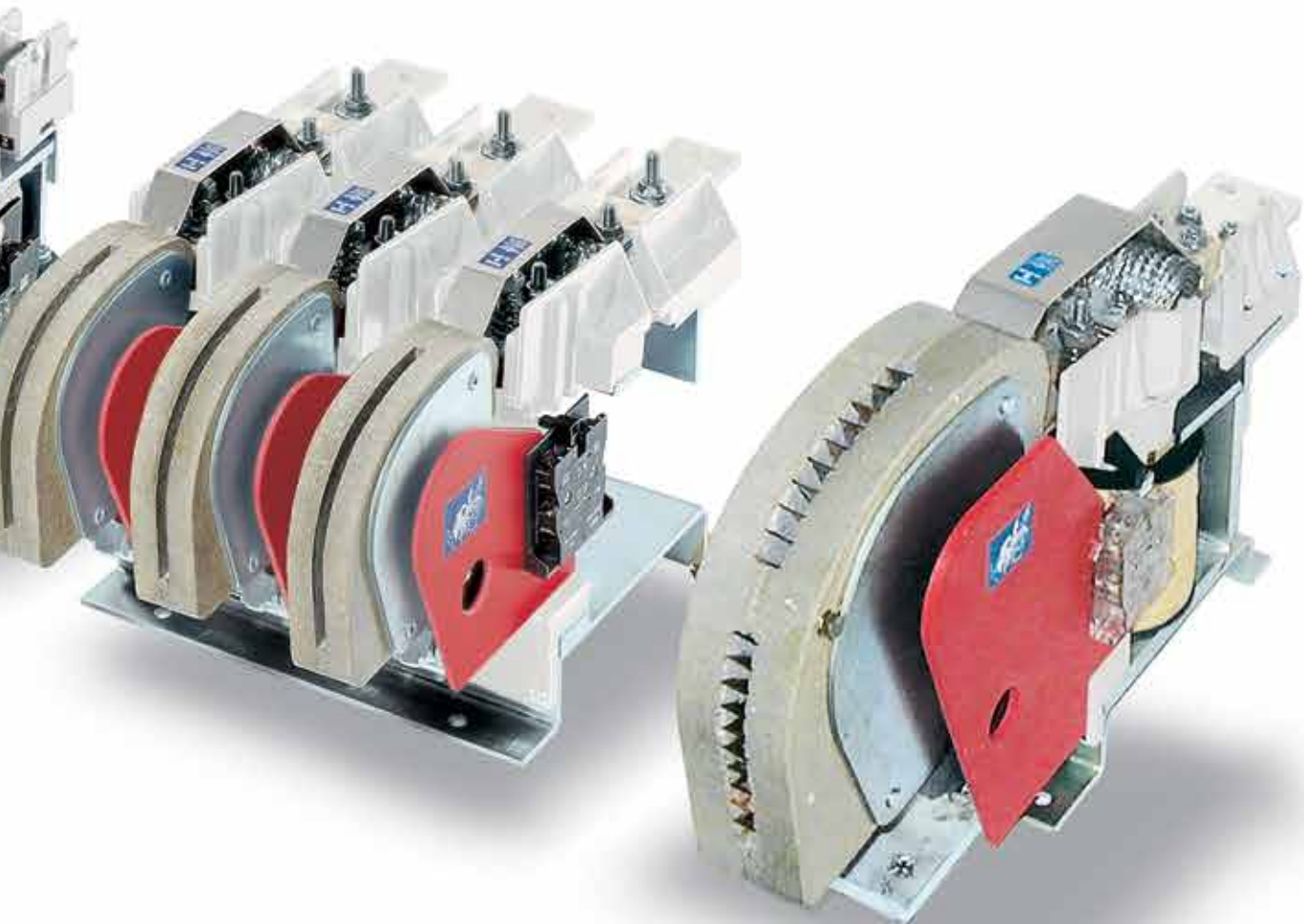
These contactors have been designed starting from the N series electric arc management concept, grafted on the light and compact structure of a rail unit, developed around the control electromagnet.

The LTNS contactors, characterised by a nominal voltage of 750V, are available in a wide range of current ratings, from 80A up to 1300A (up to 3 poles). They can be configured in any combination of Normally Open or Normally Closed poles, with a common rating. They have been designed and tested according to the international standard IEC 60947-4-1 and are suitable for almost any industrial low voltage application, such as: cranes, rolling mills, electric energy production and transformation, photovoltaic panels, induction furnaces, galvanic treatments.

### General Characteristics

- The extra heavy duty flexible line, up to 1000V<sub>DC/AC</sub> application, up to 1500A/pole
- Stationary application only, derived from LTHS line
- 1-2-3 pole configuration, NO and NC poles indirect or direct arc blow out options available
- Flexible control and auxiliary contacts options, high unit customization possible

# Switches



Type	I <sub>th</sub> [A]	Rated Nominal Voltage U <sub>n</sub> [V]	Rated Insulation Voltage U <sub>i</sub> [V]	D1/D3 [mm] Length (1-3 poles)	W [mm]	H [mm]
<b>LTNS 60</b>	80	600	750	72-130	193	138
<b>LTNS 125</b>	150	750	1000	86-169	260	185
<b>LTNS 320</b>	320	750	1000	105-277	350	260
<b>LTNS 450</b>	450	750	1000	105-277	360	260
<b>LTNS 650</b>	700	750	1000	105-277	405	280
<b>LTNS 800</b>	900	750	1000	105-277	405	280
<b>LTNS 1000</b>	1100	750	1000	125-340	459	350
<b>LTNS 1250</b>	1300	750	1000	125-340	459	350

## N line

### Applications

Transit and railway systems

Power generation

Control high power motors

Heavy industries

Crane control

Microelettrica Scientifica N series bar mounted contactors, in spite of their 60 years old technical concept are still state of the art for many industrial, low voltage, heavy duty applications. These contactors are designed and tested according to the standard IEC 60947-4-1. They provide excellent operational performances, making them the best choice for high power load connection, often covering the function of a fault clearing protection device.

The N series contactors are characterised by modular design so that their configuration can be tailored to the specific requirements of each application. In fact, the pole ratings cover a wide range, from 85A up to 6000A, and can be mounted side by side regardless of their size and number on a customisable length shafts set, this way offering custom solutions to a wide range of technical needs.

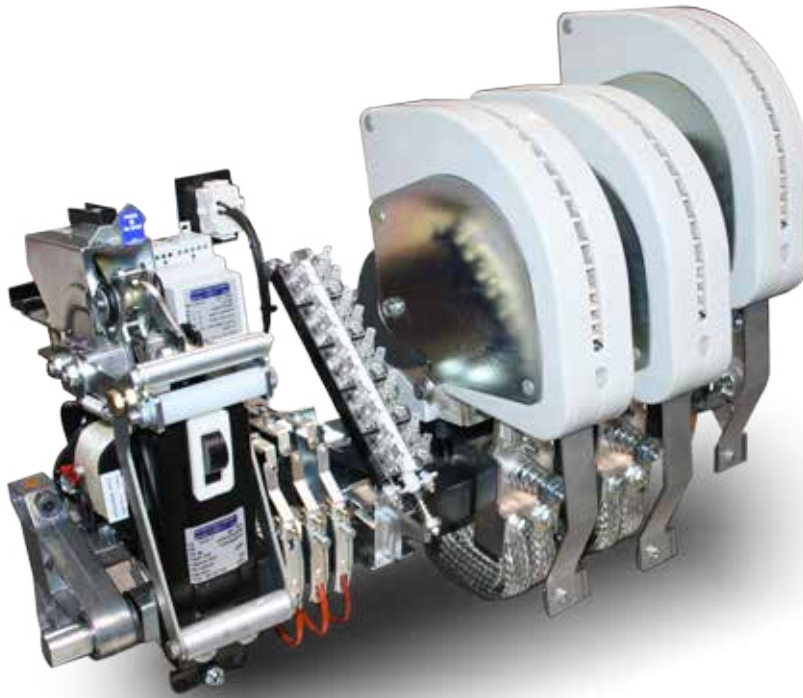
The maintenance is simplified by direct accessibility to all parts due to open construction so that, in most cases, it is not necessary to remove the contactor from the cabinet.

Microelettrica Scientifica has been certified since 1993 according to the International Quality Standard UNI EN ISO 9001:2008. Microelettrica has always paid great attention to the environment and is certified according to the standard UNI EN ISO 14001:2004 and all materials used are RoHS compliant.

Type	Thermal Current I <sub>th</sub> [A]	Rated Nominal Voltage U <sub>n</sub> [V]	Rated Insulation Voltage U <sub>i</sub> [V]	D1/D4 [mm] Length (1-4 poles)	H [mm]	W [mm]
<b>N 85</b>	85	600	1000	250-400	165	155
<b>N 125</b>	125	600	1000	250-400	175	155
<b>N 190</b>	190	600	1000	250-400	205	170
<b>N 270</b>	270	600	1000	250-500	265	215
<b>N 350</b>	350	600	1000	250-500	275	215
<b>N 550</b>	550	600	1000	105-277	300	160
<b>N 650</b>	800	600	1000	300-600	320	160
<b>N 800</b>	650	600	1000	350-650	365	300
<b>N 1000</b>	1000	600	1000	350-650	365	300
<b>N 1250</b>	1250	600	1000	350-700	380	345
<b>N 1600</b>	1600	600	1000	350-800	420	420
<b>N 2000</b>	2000	600	1000	350-800	425	420
<b>N 3000</b>	3000	600	1000	400-1000	475	470
<b>N 4000</b>	4000	600	1000	500-1250	425	420
<b>N 6000</b>	6000	600	1000	600-1500	475	470



# Switches



## General Characteristics

- The bar mounted modular extra heavy duty line, up to 1000V<sub>DC/AC</sub> application, up to 6000A/pole
- Stationary application only
- Up to 6 poles configuration, NO and NC poles direct arc blow out various aux contacts options
- Flexible control and adjustment configurations, total unit customization possible

Contactor	Breaking Capacity						Making capacity I <sub>ch</sub> [A]	Consumption of coils				Operation time (m sec.)		Mech. endurance in million operations)
	A.C. cos $\phi = 0,5$ I <sub>ca</sub> [A] RMS value			D.C. L/R = 15 ms I <sub>cc</sub> [A] (2 poles)				A.C. [VA]		D.C. [W]		Closing	Opening	
	440 V	750 V	1000 V	220 V	440 V	660 V		Pick-up	Holding	Pick-up	Holding			
<b>N 85</b>	1600	700	600	1700	1000	800	2750	350	50	110	15	26	13	15
<b>N 125</b>	2100	1000	900	2500	1500	1000	3500	450	60	130	15	23	13	15
<b>N 190</b>	2500	1600	1300	3000	2000	1400	4200	450	60	130	15	23	12	15
<b>N 270</b>	4300	2500	2000	4500	3000	2500	7000	1300	110	180	12	30	18	15
<b>N 350</b>	4800	3000	2500	5000	3500	3000	8500	1300	110	180	12	30	18	15
<b>N 550</b>	6000	4500	3900	7000	5000	4000	10000	1500	110	300	20	65	15	15
<b>N 650</b>	8000	5500	4500	9000	6000	5000	12000	–	–	300	20	65	15	10
<b>N 800</b>	9500	6500	6000	10000	7000	6000	16000	–	–	650	30	80	16	10
<b>N 1000</b>	12500	8000	7000	13000	9000	7500	21000	–	–	650	30	80	16	10
<b>N 1250</b>	15000	10000	9000	16000	12000	10000	30000	–	–	1000	50	90	10	10
<b>N 1600</b>	20000	15000	10000	25000	16000	12000	35000	–	–	1000	50	95	11	10
<b>N 2000</b>	20000	15000	10000	30000	20000	15000	35000	–	–	1000	50	95	11	10
<b>N 3000</b>	30000	15000	10000	35000	25000	18000	50000	–	–	1500	80	90	10	10
<b>N 4000</b>	35000	20000	10000	40000	30000	20000	50000	–	–	1500	80	90	10	10
<b>N 6000</b>	40000	20000	10000	40000	35000	20000	80000	–	–	2500	100	90	10	10

# Neutral Grounding



Short circuits between phase and ground can result in irreversible damage to networks and equipments; it is therefore of the utmost importance to be able to control and reduce their effects: Grounding Resistors limit the fault current that arises due to phase-neutral short circuits. Grounding through resistor offers several advantages with respect to alternative methods (such as insulated grounding, direct grounding or grounding through a reactance). The main advantages are: easier detection of fault location, limitation of fault current, no transient over voltages.

Relevant parameters in the design of a Neutral Grounding Resistor may vary greatly: Microelettrica has developed a line of standard products (for the most common requirements) along with tailored products, each developed and customised according to the required project characteristics. Our products range from Low Voltage systems (<1kV) to High Voltage (132kV insulation class), and from very low fault current values (tens of Amps) to very high (>10kA).

The essential parameters needed to design a Grounding Resistor are:

- Nominal Voltage
- Fault Current
- Fault Duration (10s is customary)



# Resistors

Other relevant parameters are:

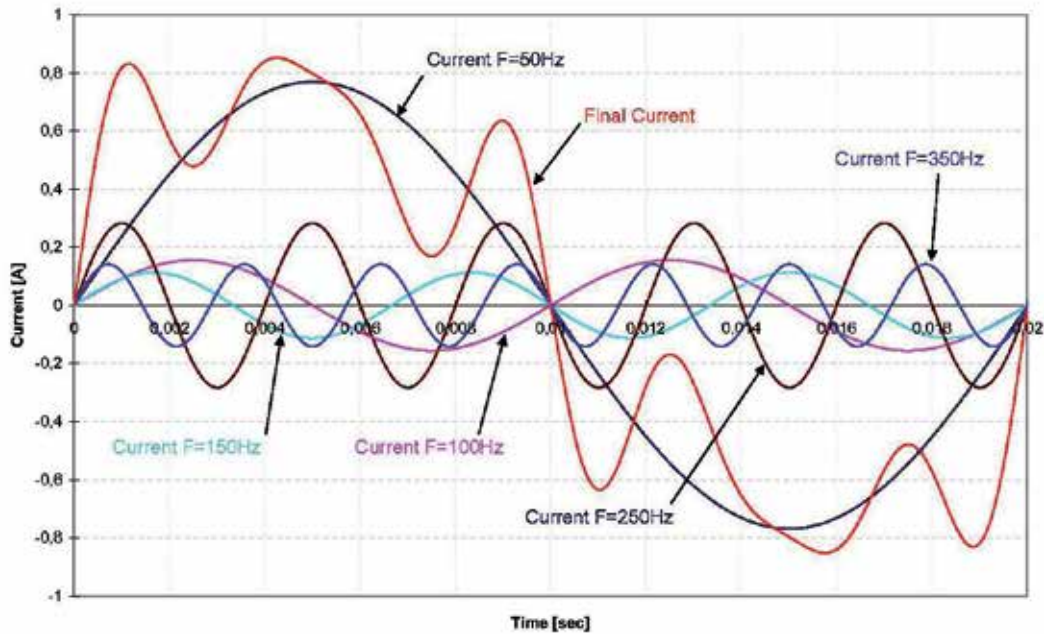
- Protection degree of enclosure: from IP00 - i.e. no enclosure - to IP55, standard solution IP23
- Enclosure finish: our standard is mild galvanised, but different stainless steel grades (such as AISI304 or AISI316) are available. Painting in the desired RAL colour is also an option
- Continuous current rating; it may affect significantly the performance of the resistor, especially when high IP degrees are required
- Environment and Elevation: we design resistors for the harshest industrial or natural settings
- Auxiliary components: during our many years of operation we have selected a number of trusted suppliers for a wide choice of components, such as Current Transformers, Switches, Disconnectors, etc.

## Applications

Energy



# Harmonic Filter



Quality of power is becoming ever more important for both suppliers and end users, as the number of devices that may feed harmonics into power systems is increased, resulting in higher line losses, interferences and resonances.

Harmonic Filters - made up by capacitors, inductors and resistors - help eliminating harmonics which inevitably tends to occur. The LC circuit filters all spurious frequencies and only let the fundamental frequency through, while the Harmonic Filter Resistors (also referred to as Damping Resistors) dissipate harmonic currents into heat.

Typical applications for Harmonic Filter Resistors are HVDC networks and electrical induction furnaces.

Our team of experienced engineers designs the best solution for the different characteristics required and for the most diverse environmental conditions. Microelettrica can custom design Harmonic Filter Resistors from a few kW rating up to tens of MW, as well as B.I.L. up to 600kV. Our Harmonic Filter Resistors employ non-magnetic low temperature-coefficient elements, to minimise Ohmic value drift thus preventing excessive power increase. They also have low parasitic inductance values, which is a key feature for the effective design of damping elements.



# Resistors

The essential parameters needed to design a Harmonic Filter Resistor are:

- Nominal Voltage
- Current or Power
- Ohmic Value (with tolerance in %)

Other relevant parameters are:

- B.I.L.
- Required Insulation Level: HV terminal to hearth, LV terminal to earth, between terminals
- Clearance and Creepage
- Enclosure finish: our standard is mild galvanised, but different stainless steel grades (such as AISI304 or AISI316) are available. Painting in the desired RAL colour is also an option
- Environment: we design resistors for the harshest industrial or natural settings
- Maximum Inductance
- Bushing Layout: top or side mounted
- Mounting: three-phase stacked, side by side, others

## Applications

Energy



# Load Banks



Load Banks allow to effectively check the efficiency of emergency sets (generators, Uninterruptible Power Supplies) and can be employed as dummy loads to prevent wet stacking on diesel engines. They represent a reliable and economic way to extend the lifetime of extremely expensive and important equipment.

Microelettrica custom designs Load Banks to satisfy all requirements, both in terms of power to be dissipated (from tens of kW to tens of MW), insulation level (from hundreds of Volts up to 36kV insulation class) and integration of the most diverse power steps, thanks to the wide variety of grid element types designed and produced by Microelettrica itself. Thanks to its many years of experience in both industrial and railway fields, Microelettrica has also developed reliable ventilation curves, and can therefore offer forced-ventilated Load Banks, which main advantage is that of allowing higher power-per-element and thus smaller size. Microelettrica Load Banks are suitable for indoor and/or outdoor use; they are placed in enclosures with up to IP23 protection degree. Ventilation can be horizontal or vertical.



# Resistors



Microelettrica Load Banks can be controlled either locally or remotely (on request), through switches (also manufactured by Microelettrica Scientifica).

## Applications

Industry

The essential parameters needed to design a Load Bank are:

- Nominal Voltage
- Power
- Number and type of steps, if any
- Type of ventilation (natural or forced)

Other relevant parameters are:

- Maximum Ohmic value drift: in case it is necessary to contain the thermal drift of the resistance value, alloys with extremely low temperature coefficients can be used
- Protection degree of enclosure: up to IP23, standard IP20 (vertical ventilation) or IP21 (horizontal ventilation, only for forced air cooled Load Banks)
- Enclosure finish: our standard is mild galvanised, but different stainless steel grades (such as AISI304 or AISI316) are available. Painting in the desired RAL colour is also an option
- Environment and Elevation: we design resistors for the harshest industrial or natural settings
- Auxiliary components: contactors for step switching, also manufactured by Microelettrica



# Starting Braking Discharge



Starting and Braking Resistors are widely employed for controlling motors during start and/or stop.

**Starting Resistors** may be used for wound rotor induction motor and DC wound motor (this last type of motor is less and less common): adding a series resistor to each rotoric phase reduces the current and improves the starting torque. Starting Resistors may also be employed for squirrel cage induction motors, where series resistors added to the stator, limit initial current to three times its nominal value. Starting Resistors for squirrel cage motors are also known as Ballast Resistors.

The essential parameters needed to design a Starting Resistor are:

- Horsepower
- Rotor/Stator Voltage
- Rotor/Stator Current
- RPM
- Application: different applications require different solutions

Crane control is a quite common application for **Braking Resistors**: during descent the load, especially if heavy, may cause the motor to generate power. Resistors are thus used to avoid unwanted and uncontrolled acceleration.





# Resistors



Braking Resistors for large motors are customised to best comply with any requirement: we have developed special Braking Resistors for important research institutes (among them Max Planck Institute) and for energies in excess of 3400MJ.

De-excitation of large capacitors and inductors must be carried out with care to avoid impulsive currents that could damage them permanently. **Discharge Resistors** limit the peak current and protect the capacitive/inductive device.

The essential parameters needed to design a Discharge Resistor are:

- Nominal Voltage
- Discharge Current
- Discharge Duration

Discharge Resistors are often used by research institutes and they require a very high level of customisation, sometimes also leading to the development of new technologies for resistive elements. Microelettrica has cooperated with Universities all over the world and with the most prestigious research centers (among them, CERN in Geneva).

## Applications

Industry





# Line Test

## Applications

DC Substation

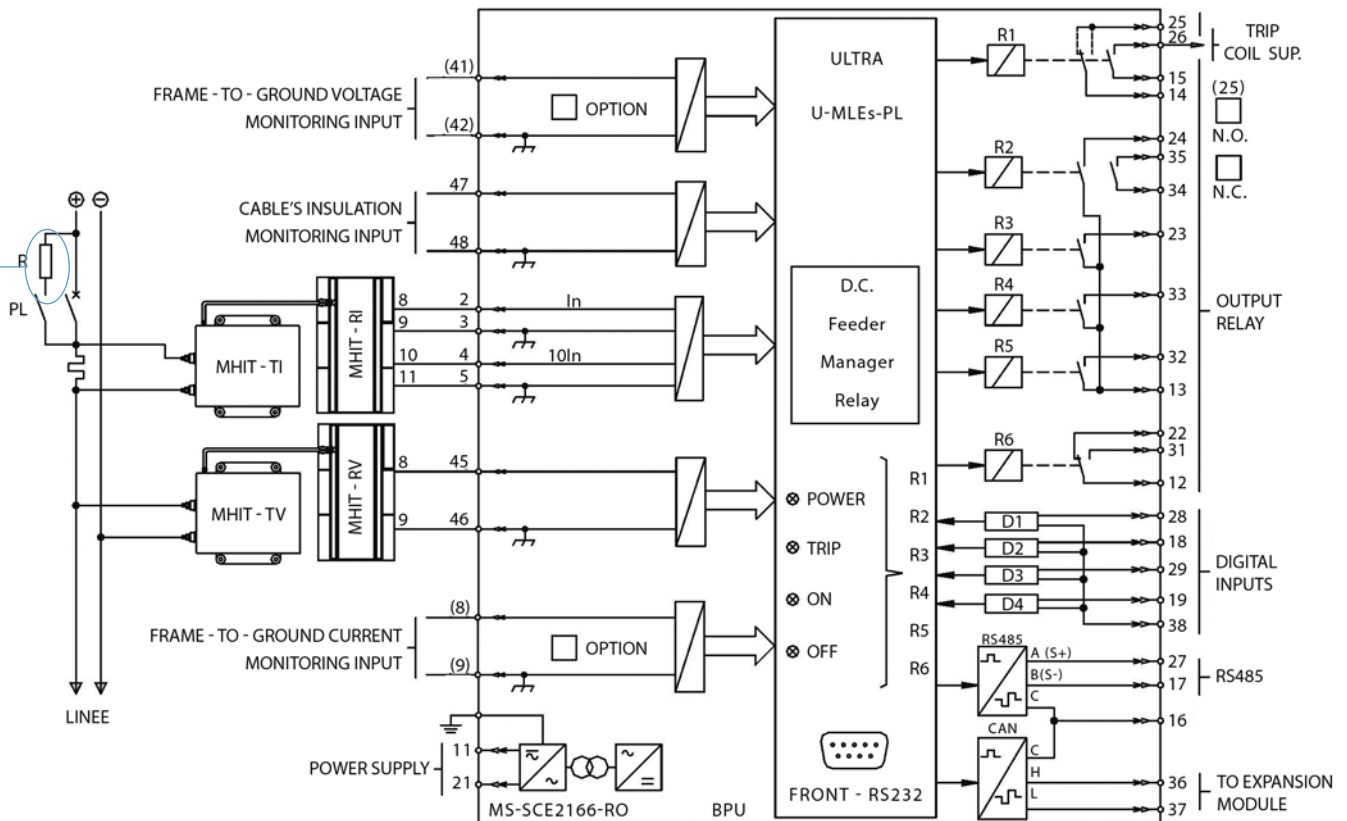
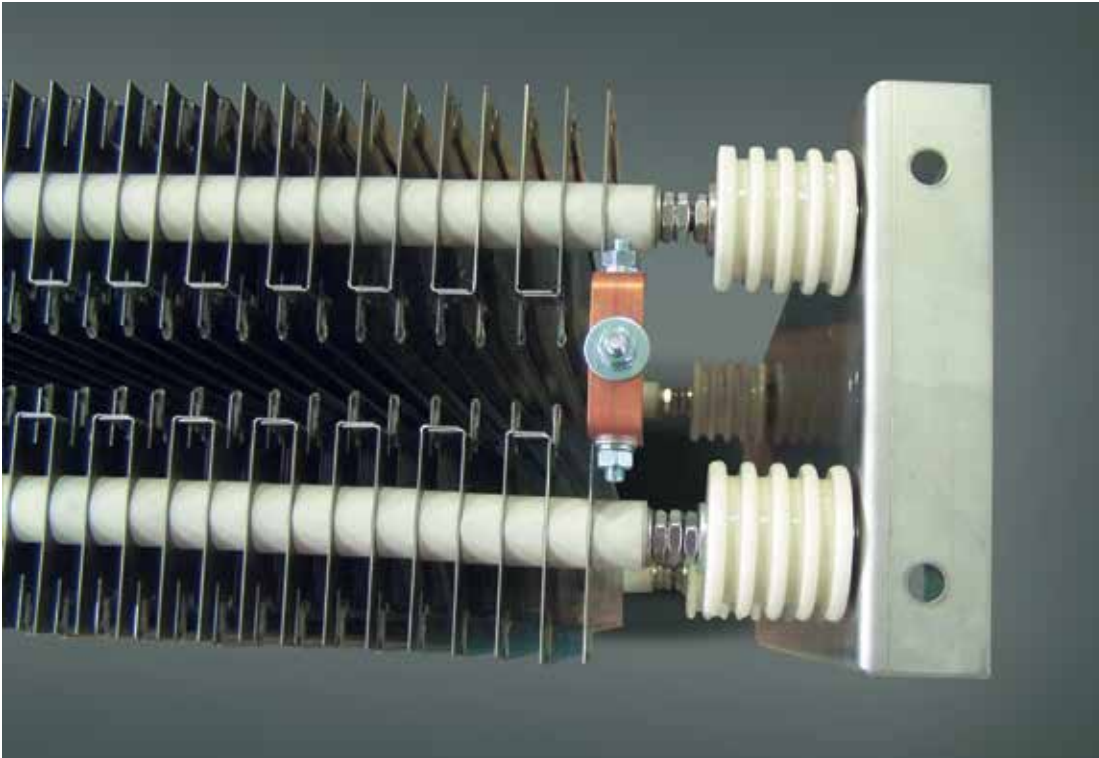
High Speed DC circuit breakers are valuable components which must be protected against wear and tear and excessive current flow. Before closing High Speed Circuit Breaker on a power line, it is therefore advisable to test whether a short circuit is occurring by means of line test resistors. The resistor is electrically connected through a contactor - if no fault current is detected - then it is safe to activate the circuit breaker; otherwise, there is a fault somewhere on the line. It is as well possible that activating the resistor for a few times in a row (On - Off cycles with the desired number of consecutive on steps) may help in getting rid of the physical cause of the short circuit.

The essential pieces of information needed to design a Line Test Resistor are:

- Nominal Voltage
- Test Current
- Duty cycle



# Resistors



# Compact Resistors

## Applications

Braking/chopper resistors for variable speed drives, in particular in the fields of:

Hoisting and conveying equipment

Printing and paper

Packing, plastic, textile

Wire and wood processing

Compact and modern design, low inductance, can be subjected to pulse loads.

**Resistance material support:** moulded ceramic base

**Resistance wire:** NiCr-alloy special heat sink casing

**Degree of protection:** IP64 up to IP66

**Load and testing resistors:**

- In test bays
- In narrow spaces
- In dusty and splash water environments



# Resistors



# Frame Resistors

## Applications

Braking/chopper resistors for frequency converters, load and testing resistors

Flat modular design, high energy absorption capacity, low-inductance versions, can be subjected to pulse loads.

**Resistance material support:** grooved ceramic insulators fixed on both longitudinal sides of a metal or temperature-resistant insulating material frame

**Resistance wire:** CuNi 44 or NiCr alloy

**Taps (tapping eyes):** on request

**Degree of protection:** IP00 - IP23 possible





# Resistors





# G - Base

## THREE PHASE + NEUTRAL CURRENT PROTECTION RELAY

### General Characteristics

G-Base is the new generation of Microelettrica Scientifica's base-performance protection relays.

This range is the ideal solution for protection and automation, thanks to its high configurability.

It is based on the same powerful microprocessor adopted on high-performance G-Pro range. G-Base platform is based on a four-channel configuration, allowing it to be used for current and voltage protection functions.

GB310, part of the G-Base range, is a relay designed for the interface to the power distribution grid.

### Protective Functions

- F49 : Thermal Image (one element)
- F50/51 : Overcurrent, with standard IEC inverse time curves (three elements)
- F50N/51N : Earth Fault, with standard IEC inverse time curves (three elements)
- F46 : Inverse sequence (two elements)
- 74TCS : Trip circuit supervision
- F51BF : Breaker Failure protection
- F79 : Four-shot programmable autoreclosing, with reclosing sequence coordination and reclosing disabling push button
- Two complete setting programs, switchable locally or remotely

### Measurements

- Real Time Measurements (IA - IB - IC - Io)
- Maximum Demand and Inrush Recording (IA - IB - IC - Io)
- Trip Recording

### Hardware

- 8 Output Relays
- 8 Digital Inputs
- Hi-resolution graphic display (240\*128)
- 10 Leds for signalization
- 6 programmable push buttons
- Two-piece plastic enclosure, IP44 protection degree (IP54 available on request)

### Firmware

- Time tagged multiple event recording and journal
- Oscillographic wave form capture up to 40 sec.
- Complete autodiagnostic program
- Blocking Outputs and Blockings Input for pilot wire selectivity coordination

### Power Supply Ratings

- Type 1 : 24V(-20%) / 110V(+15%) a.c. - 24V(-20%) / 125V(+20%) d.c.
- Type 2 : 80V(-20%) / 220V(+15%) a.c. - 90V(-20%) / 250V(+20%) d.c.

### Communications

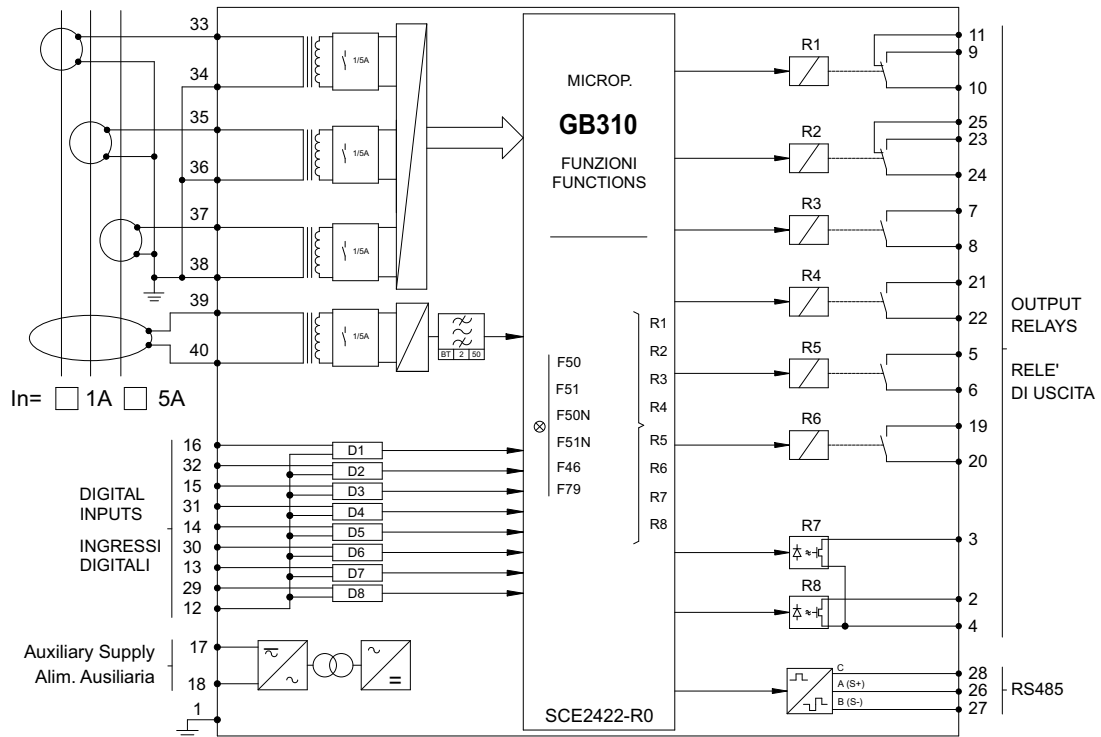
- RS485 Serial communication port on rear side
- USB communication port on front panel
- Modbus RTU / IEC870-5-103 Communication Protocols

### Software

- MCom2 Program interface for device management

# Electronics

Connection Diagram



### Typical Characteristics

Accuracy at reference value of influencing factors	2% In - 0.2% On	for measurements
	2% + (to = 20 ÷ 30ms @ 2xIs)	for times
Rated Current	In = 1A/5A - On = 1A/5A	
Current Overload	500A for 1 sec; 20A continuous	
Burden on current input	0.1VA a In = 1A; 0.3VA a In = 5A	
Average power supply consumption	≤ 7 VA	
Output relays	rating 6 A; Vn = 250 V	
	A.C. resistive switching = 1500W (400V max)	
	make = 30 A (peak) 0.5 sec.;	
	break = 0.3 A, 110 Vcc,	
	L/R = 40 ms (100.000 op.)	

## MC line



### General Characteristics

The MC line has been designed to offer to the market a very competitive protective relay responding to the latest requirements in terms of control and communication capabilities with an extremely high level of modularity. Each relay includes a limited number of protective functions but, thanks to their very compact sizes, different units can be combined in a modular enclosure to satisfy the most demanding needs.

### Measurements

- Real Time Measurements
- Trip Recording  
(last 20 trips with date & time)
- Event recording (last 10 trips)

### Control

- 4 Output Relays (programmable)
- 3 Digital Inputs
- Time tagged multiple event recording
- Oscillographic wave form capture
- Blocking Outputs and Blocking Input for pilot wire selectivity coordination
- Associate C.B. control

### Technical Characteristics

- Complete self diagnosis program
- Display LCD 16 (2x8) characters
- 4 Leds for signalization

### Communications

- 1 RS485 Serial communication port on rear side
- 1 RS232 Serial communication port on front panel
- Modbus RTU/IEC870-5-103/IEC61850 Communication Protocols

### Expansion Modules (optional)

- "UX10-4" 10 Digital Input and 4 Output Relays
- "14DI" 14 Digital Inputs
- "14DO" 14 Output Relays

### Execution

- 1 Module box (2 modules with expansion)
- Totally draw-out execution
- IP44 protection case (on request IP54)

### Software

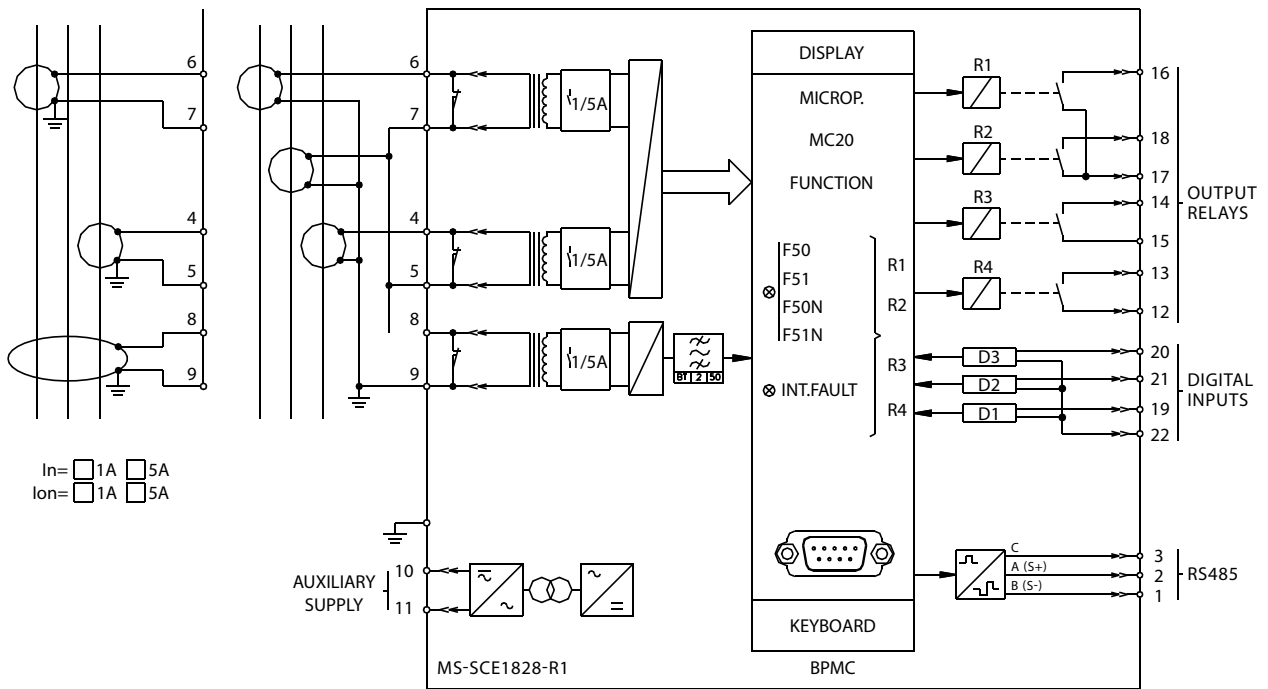
- MCom2 Program interface for device management

### Relays Type

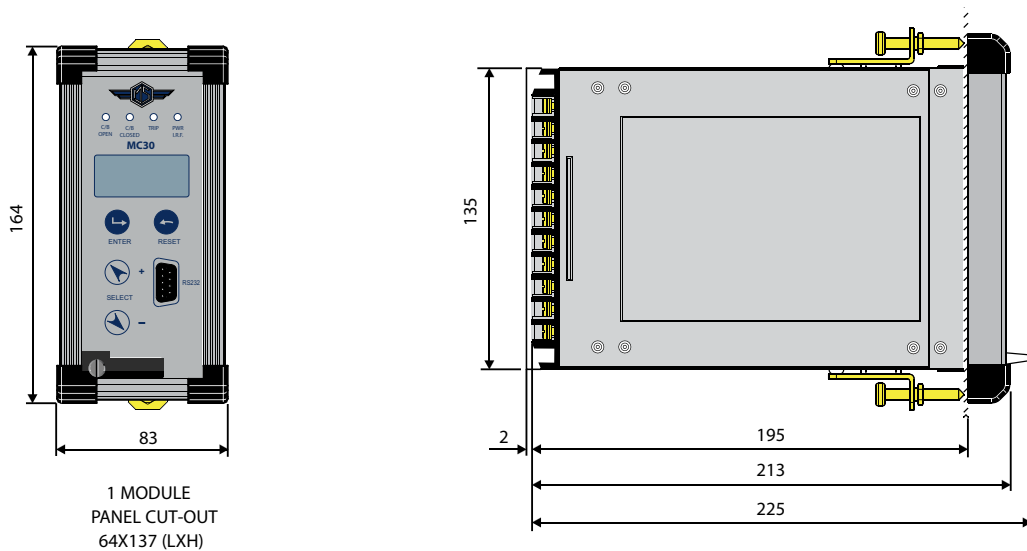
<b>MC1V</b>	Multifunction Single Phase Overvoltage/Undervoltage Relay: 59, 27, 81>, 81<
<b>MC3V</b>	Multifunction Three Phase Overvoltage/Undervoltage Relay: 59, 27, 81>, 81<, 59Vo, 59V2, 27V1
<b>MC20</b>	Overcurrent & Earth Fault Relay: 50/51, 50N/51N, 51BF
<b>MC30</b>	Three Phase Overcurrent & Earth Fault Relay: 49, 50/51, 50N/51N, 51BF
<b>MC40</b>	Three Phase Overcurrent & Earth Fault (connection with 4 CT 's): 49, 50/51, 50N/51N, 51BF
<b>MC20-R</b>	Overcurrent & Earth Fault Relay: 50/51, 50N/51N, 51BF, 79
<b>MC30-R</b>	Three Phase Overcurrent & Earth Fault with reclosing function Relay: 50/51, 50N/51N, 51BF, 79
<b>MC30-BC</b>	Three Phase Overcurrent & Earth Fault + Broken Conductor Relay: 50/51, 50N/51N, 51BF, BC (I2/I2)
<b>MCDC-I</b>	D.C. Current Relay: 76/32, 49, 51BF
<b>MCDC-V</b>	D.C. Voltage Relay: 45, 80
<b>MCM</b>	Motor Protection Relay: 37, 46, 47, 48, 49, 50/51, 51LR, 64S, 66, 68

# Electronics

## Wiring Diagram



## Overall Dimensions: mm





# ULTRA line



## General Characteristics

ULTRA is the top line of Microelettrica Scientifica protective relays; it has been designed to meet the most demanding specifications for any application in Transmission, Distribution and Industrial plants. The ULTRA relays are used in all the applications where, besides the protection, a complete measuring system is needed. Each relay is a multifunctional unit combining protection, measurements and control. Thanks to the CAN BUS communication port and to a complete range of additional modules, the relays of this line can perform a complex input/output logic for interlocking substation system avoiding the use of an additional PLC. The multiprotocol makes the relay very versatile and suitable to be implemented in the most common DCS and SCADA systems.



## Recording

- Event Recording (last 100 events)
- Trip Recording (last 20 trips) complete with cause of tripping and values of the input quantities at the moment of trip
- Oscillographic recording of input quantities (8 channels, 32 sample/cycle, 3 sec each)

## Control

- 6 Output Relays user programmable
- 4 Digital Inputs user programmable
- Blocking input and Blocking output for pilot wire selectivity coordination
- Time tagging resolution 1ms
- Trip circuit supervision
- Associated Circuit Breaker control (OPEN/CLOSE)

## Technical Characteristics

- Graphical Display (128x64 dot)
- 4 Leds for signalization
- Multilanguage Display (English/Italian standard, available - others on request)
- Complete self diagnosis program with dedicated relay

## Communications

- 1 RS485 Serial communication port on rear side
- 1 RS232 Serial communication port on front panel
- Modbus RTU/IEC870-5-103/IEC61850/TCP-IP Modbus Communication Protocols
- Canbus port for external additional modules

## Expansion Modules (optional)

- "UX10-4" 10 Digital Inputs and 4 Output Relays
- "14DI" 14 Digital Inputs
- "14DO" 14 Output Relays

## Execution

- 2 Module box (3 modules with 1 expansion, 4 modules with 2 expansion)
- IP44 protection case (on request IP54)
- Totally draw-out execution

## Software

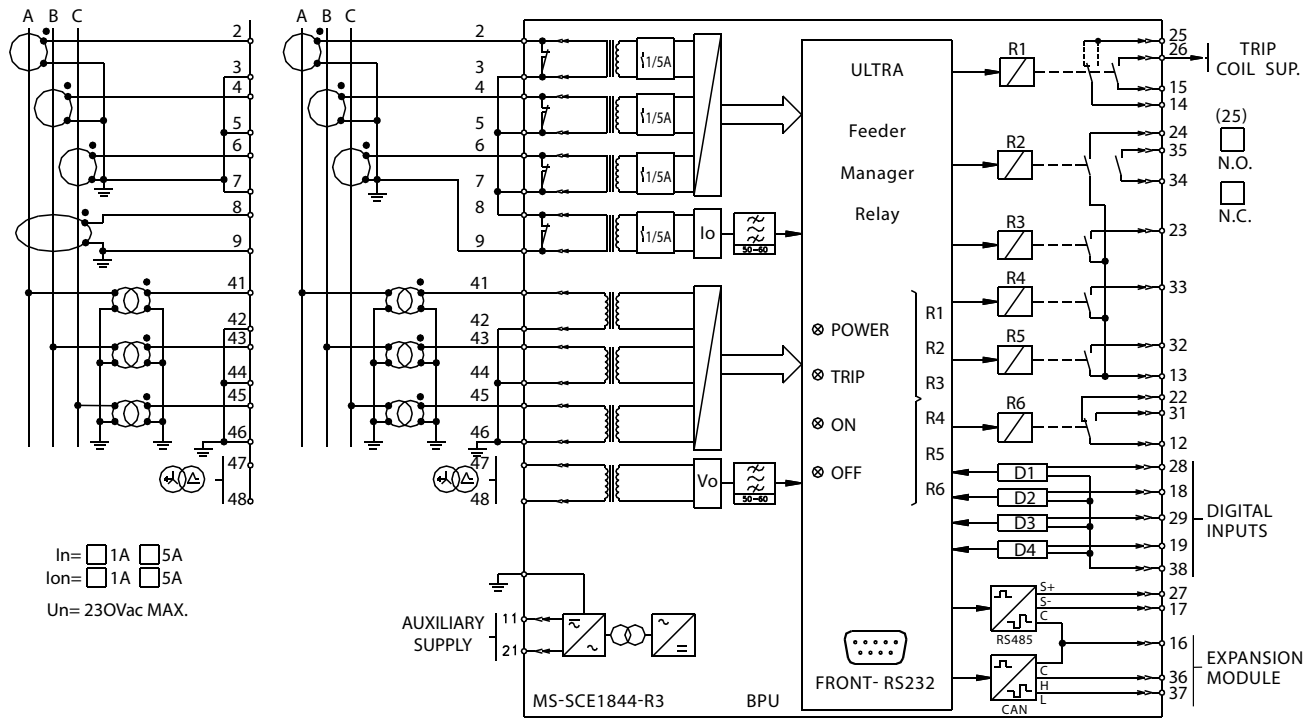
- MCom2 Program interface for device management

## Relays Type

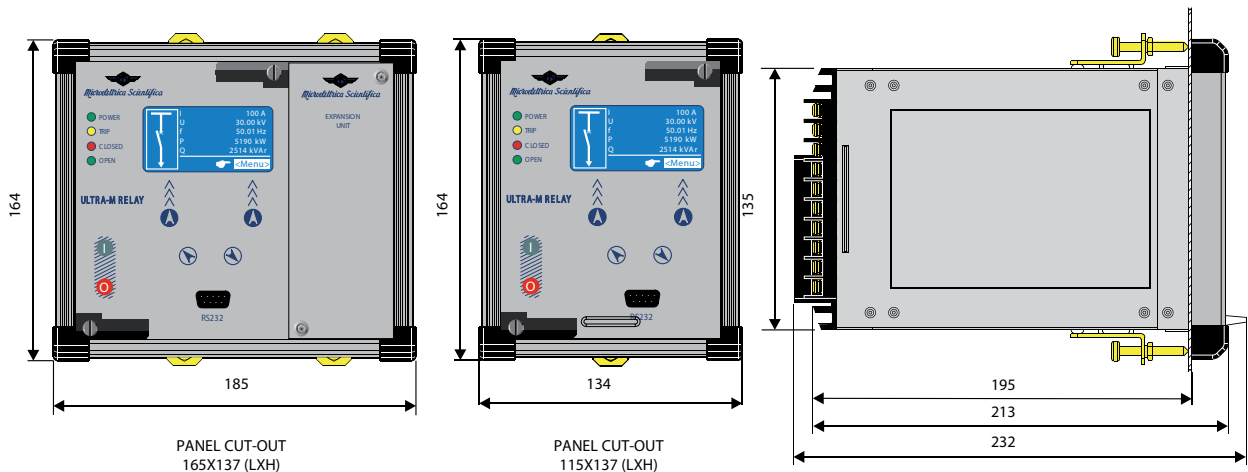
<b>U-MLEs</b>	D.C. Feeder Manager Relay: 49, 32/76, 80, 45, 64, 79, DI, di/dt, Rapp, lapp, CMI, LT, BF
<b>U-MLC</b>	D.C. Feeder Manager Relay (Italian Railway Certification): 27/59, 32, 45, 49, 64, 76, 79, 80
<b>U-MLC- M</b>	D.C. Energy Metering: I, V, W, E
<b>DTMR</b>	Differential Transformer Relay: 50/51, 87T, 87N/51N
<b>FMR</b>	Feeder Manager Relay: 49, 50/51/67, 50N/51N/67N, 27/59, 81, 46, 59Uo, 51BF, F 27U1, 59U2/47, 79
<b>MMR</b>	Motor Manager Relay: 12/14, 37, 27/59, 46, 49, 50/51, 51LR, 51BF, 55, 64, 66, 81
<b>GMR</b>	Generator Protection & Management Relay: 21, 24, 27/59, 32, 37, 40, 46, 49, 50/27, 50V/51V, 51BF, 60FL, 64S, 81

# Electronics

## Wiring Diagram



## Overall Dimensions: mm



## N-DIN line

### General Characteristics

The N-DIN line has been conceived to obtain the most efficient space/performance as well as cost/performance ratio. The execution of the relay is for DIN Rail, but its Front Face Panel (FFP) - including Controls, Signals and Display - is removable and can be flush mounted apart from the Relay Main Body (RMB), on the front panel of the switchboards or the motor control centres. One FFP only can control up to 31 RMB units. The relay main body RMB can also be used as a stand-alone unit, without the front panel FFP.



### Measurements

- Real Time Measurements
- Trip Recording (last 5 trips with date & time)
- Load Profile recording

### Technical Characteristics

The Relay Main Body (RMB) includes:

- 2 Self powered programmable Digital Inputs for remote controls (start, stop, rev., ETC)
- 1 RTD input or User available Digital Input
- 2 Programmable output relays each with one N.O. contact rating 6A
- 1 RS485 port for connection to the communication serial bus (Modbus RTU)
- 1 RS485 port for communication to the Front Face Panel
- 2 Signal Leds, 1 Reset button

The Front Face Panel (FFP) includes:

- 2x16 characters LCD display
- Four Key buttons for local relay management, Four signal leds
- One RS232 port for connection to a local PC (on front side)
- One RS485 port for interconnection with the RMB (on back side)
- Complete self diagnosis program

### Mounting

- DIN46227 (EN50022)

### Relays Type

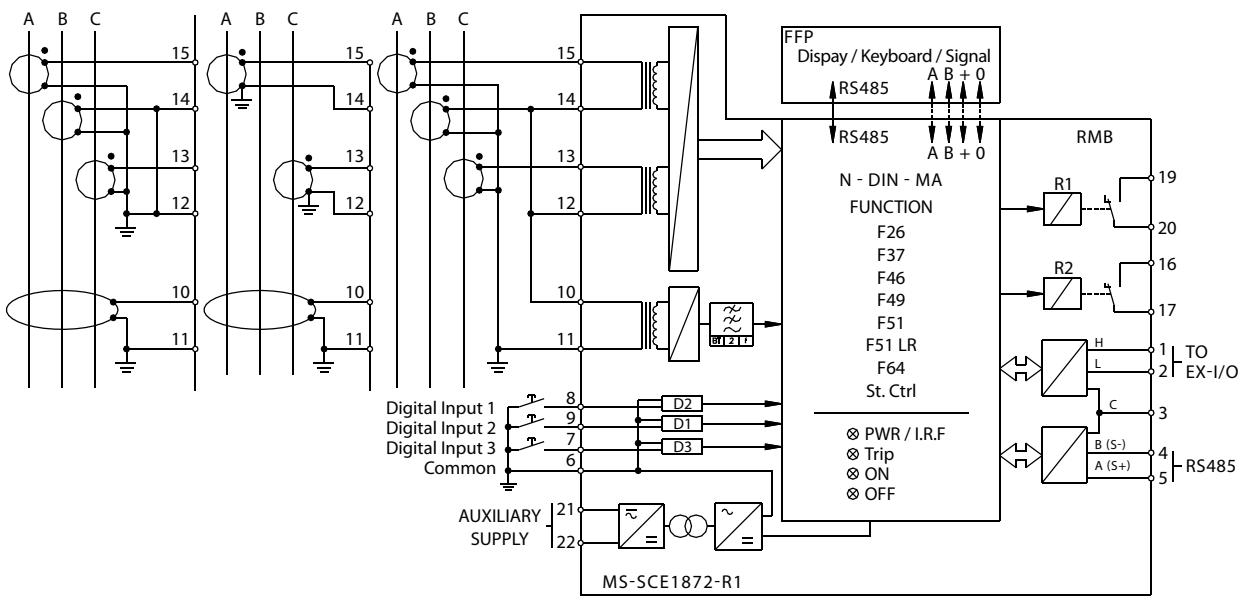
<b>N-DIN-MA</b>	Motor Protection Relay: 37, 46, 49, 51, 51LR, 64/51N, 66
<b>N-DIN-F</b>	Feeder Protection Relay: 46, 49, 51, 50N/51N, 51BF
<b>N-DIN TO64</b>	D.C. Current Relay with High Sensitivity Hall Effect Transducer: 64, 51BF

### Accessories

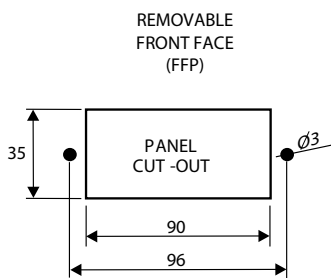
<b>EX-I/O</b>	Input/Output Expansion Module
<b>CPB</b>	Profibus Converter Module
<b>TA-DIN</b>	Current Transformer
<b>TAR-DIN</b>	Current Transformer

# Electronics

## Wiring Diagram



## Overall Dimensions: mm



FFP  
Height = 16



RMB  
Height = 72

DIN 46277  
(EN 50022)

# TRANSDUCER line

## DC measuring converter



### General Characteristics

The DC measuring transducers are designed for high voltage measurement. The Transducers are designed and manufactured to allow safe and full isolated HV measurement of DC currents and voltages. They find their main application in all the DC Traction Substations (Railways, Tramways and Metro) where, directly connected to the high voltage systems (750V, 1,5kV and 3kV) give very accurate and safe analogue outputs for measuring and protective purposes.

The MHCO line includes three models:

#### • TRANSDUCER-TV

For VOLTAGE measurement. Directly connected to the high voltage line up to 6kV through internal voltage divider.

#### • TRANSDUCER-TI

For CURRENT measurement. Connected to the high voltage line through a dedicated shunt (not supplied).

#### • TRANSDUCER-TI

For CURRENT measurement. Connected to the high voltage line through a dedicated shunt (not supplied). For combined CURRENT & VOLTAGE measurement. Connected to the high voltage line up to 6kV through internal voltage divider & through a dedicated shunt (not supplied).

### Highlights

- HV Transducer for Current & Voltage measurement
- Direct Connection up to 6kV
- Fibre Optic connection between HV transmitter and LV receiver
- Measuring channel fully redundant
- Autoranging Multivoltage Power supply (self-powered version available as optional)
- Compatible with traction application standard

### Transmitter Unit

Three different models available, one for each type of transducers (current, voltage and current/voltage). Directly connected to the High Voltage DC system acquires the input signals by a redundant input channel and transmit them, after comparison and confirmation of validity, to the receiver unit through dedicated Fibre Optic connections. It has an autoranging multivoltage Power supply. As option a self powered version is available; in this case the power supply is directly taken from the line voltage through a set of dumping resistors.



# Electronics

## Receiver Unit

Two models available, respectively suitable to be connected to the current and to the voltage transmitter by means of a dedicated Fibre Optic connection. The input signal is converted into 4 linear analogue output signals independently programmable (ie. 0-20/4-20mA etc.). The setting of this unit can be easily done using our MCom2 software tool.

The receiver is equipped with two output relays: one relay is used for self diagnosis (it trips in case of interruption of the Fibre Optic channels or internal failure of the receiver unit, including power supply failure or as alarm for measurement discrepancy between the two transmitter channels); the second relay can be programmed as alarm for under/over voltage and/or current level. Optionally a Front face display and Keyboard panel is available for local measurement and programming.

## Fibre Optic Link

Transmitter and Receiver units are connected by means of a Fibre Optic link which guarantee a very high insulation level.

Two Fibre Optic type are available both provided with standard ST connectors:

PLASTIC FIBRE: 62,5/125 $\mu$

GLASS FIBRE: 200 m HSC

The standard length of the fibre optic connection is 5 meters, other lengths are available on request.

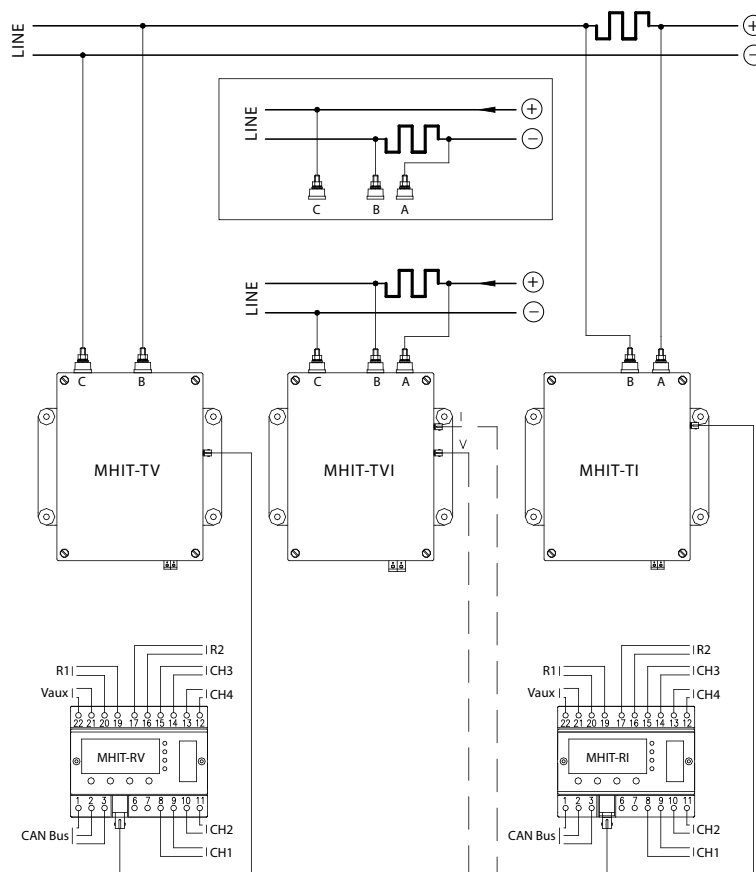
## Characteristics Transmitter/Receiver

Measurement solution: 0.1% of full scale @ (20/+70) $^{\circ}$ C

Response time: 200ms

Connection: Fiber optic type 200.230.500m HCS (plastic) or 62.5/125m (glass) connection type ST  
Fiber optic standard length 5m (max 1 km with glass fiber)

## Wiring Diagram



# DC-Pro

## HIGH PERFORMANCE PROTECTION RELAY



### General Characteristics

DC-Pro protection relay provides top-performance in terms of protection functions, memory and communication characteristic.

Designed for DC railway applications, is the best solution for the most demanding protection and control tasks.

### Communication

- IEC61850 server with GOOSE messages.
- "Internet ready" with multiple connections
  - FTP server (File Transfer) to download/upload files from/to internal memory, or from external USB memory stick.
  - Web server provides information on protection status.  
DHCP/AUTO IP/STATIC IP / Telnet / UDP
- Modbus on TCP, MODBUS RTU on RS485 and USB, IEC103 / NTP (time sync), NMEA (GPS), IRIG-B

### Hardware

- New 32 bit microprocessor, extremely short response time and high memory capacity.
- Analogue inputs fully programmable to accept a wide range of transducers (insulation amplifier, hall effect sensor, etc...)
- Two fiber optic inputs and two fiber optic output for direct connection with Microelettrica transducers.
- Four fully programmable analog outputs for SCADA or analog instrumentation.
- 7" capacitive touch screen with 10 programmable LEDs.
- 24 digital inputs and 14 digital outputs available on the module.

### Firmware

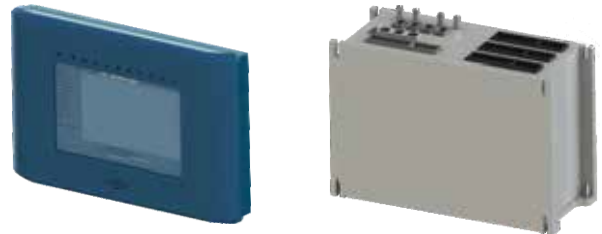
- Four independent setting groups
- PLC functionality: logical operator between inputs and outputs (logical and physical).
- Complete set of protection functions able to cover all requirement in DC traction switchgear.
- Intertripping logic: through digital IO or communication protocol (GOOSE messages).
- Events, trips and oscillographic recorder.

# Electronics

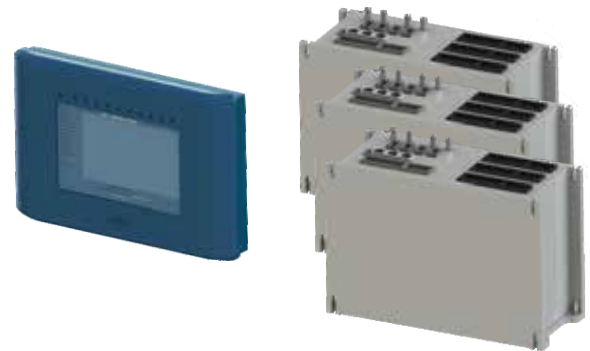
Local Display Version



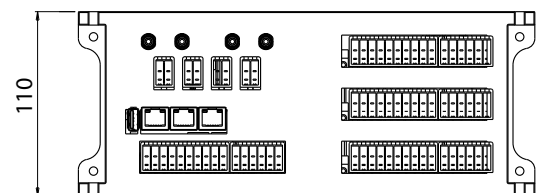
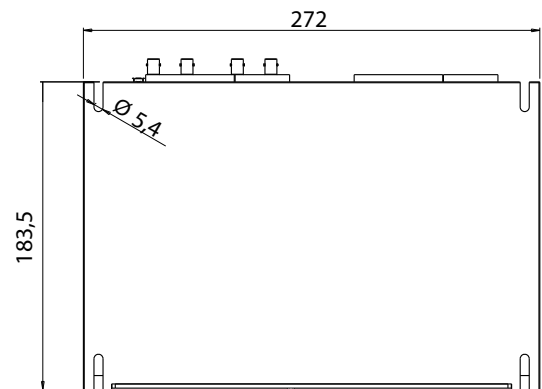
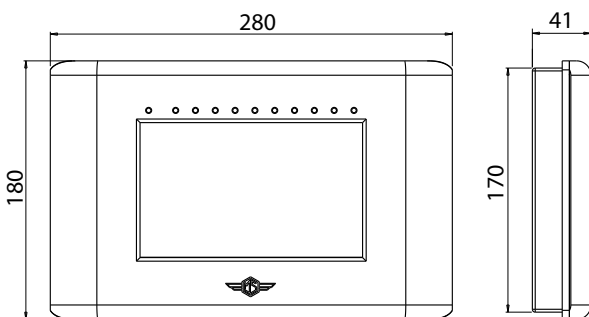
Remote Display One-to-One Version

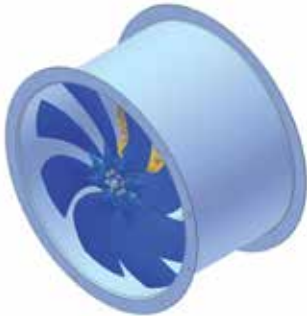


One Display for all Substation Relay



Overall Dimensions (mm)





# AF/LA Series

## Applications

Aircoolers

Heat exchangers / Radiators

Cooling of electrical machines  
(motors, converters, inductors,  
generators, transformers)

Naval

Ventilation and  
Air Conditioning Plants

The medium performance "AF" and "LA" fan Series were designed to meet the majority of cooling and ventilation requirements typical of industrial applications. They were conceived to provide the best mix of reliability, versatility, performance, quality, environmental impact and cost. All of these products have features making them easily compliant with the most widespread technical specifications and allowing significant modification based on specific customer requirements. Direct-coupling solutions with motors from 2 to 16 poles are available, to suit fan performance and noise requirements. Belt-driven solutions with larger diameters and selected speed are also available (see "AFT").

The "AF" and "LA" Series are versatile and reliable, characteristics that make them the COMET's most successful products, suitable for the most frequent ventilation needs. COMET "AF" and "LA" Series of fans have proved their efficiency every day in over 60 countries worldwide, in extreme climates, harsh environments and a wide range of temperatures for the most demanding operations.

These Series of fans are selected using COMET's dedicated software, based upon the results of a huge number of tests performed by COMET on test tunnels and actual installations. The selection is based on five blade profiles in aluminium alloy, and others in fibreglass or polypropylene, with number of blades varying between 3 and 12 blades.

## General Characteristics

### AF

- Impellers with aerofoil profile blades in extruded aluminium alloy low-noise type
- Adjustable blade pitch when standstill
- Three-phase motors IP55 with Class F or H insulation, 50/60Hz, 2-16 pole, from the best European manufacturers
- Casings in carbon steel, electro-welded, with anti-corrosive finishing by hot-dip galvanization

Wide range of ancillary parts and customizations

Special versions with special materials, certified components, motors according to customer's specifications.

Impellers in PPG, FRP or steel are available upon request

### LA

- Impellers with aerofoil profile blades in PPG, low-noise type
- Three-phase motors IP55 with Class F insulation
- Casings in carbon steel, electro-welded
- Finishing by hot-dip galvanization: longer durability in harsh environment

# Fans



LA



AF

## Technical Data

Series	Diameter [mm]	Air Flow	Pressure	Power [kW]
AF	400 ÷ 2400	up to 400000mc/h	up to 1500Pa	0.55 ÷ 90
LA	310 ÷ 800	up to 35000mc/h	up to 800Pa	0.25 ÷ 7.5





# AFT Series

## Applications

Aircoolers

Heat exchangers

Cooling towers

Condensers

Ventilation Plants

The "AFT" Series fans are designed for applications requiring very high air flows and medium-low pressures, when it is impossible or unadvisable to couple the impeller direct to the motor.

They are normally used in the presence of:

- large diameters (air coolers, heat exchangers, cooling towers)
- dusty atmospheres
- high temperatures of the air flow
- low noise installations
- need to set the motor outside the air flow for access

Supports and drives are sized by COMET according to criteria based on 20 years of experience and hundreds of installations. For some models the bearing blocks are designed and built entirely by COMET.

The "AFT" Series fans are selected using the COMET's dedicated software, which provides a clear and concise data sheet with operating curves, including electrical and noise level data, as well as preliminary outline drawing. The selection is based on five blade profiles, with number of blades varying between 3 and 12 blades. This versatility gives unrivalled design options when selecting a fan unit.

## General Characteristics

- Impellers with aerofoil profile blades in extruded alluminium alloy low-noise type
- Adjustable blade pitch when standstill, or autovariable in operation
- Three-phase motors IP55 with Class F or H insulation, 50/60Hz, 2-16 pole, from the best European manufacturers
- Casings in carbon steel, electro-welded, with anti-corrosive finishing by hot-dip galvanization
- V-belt or toothed belt drive, with heavy-duty bearing blocks and external grease lines

Wide range of ancillary parts and customizations

Versions with special materials, special dimension, motors according to customer's specifications.

Impellers in PPG, FRP or fitted with anti-corrosion coatings are available upon request

# Fans



AFTE



AFTN



AFTS

## Technical Data

Series	Diameter [mm]	Characteristics	Power [kW]
<b>AFTE</b>	800 ÷ 2240	Motor mounted outside the fan and the airflow	0.55 ÷ 45
<b>AFTS</b>	2000 ÷ 4800	With vertical axis, motor mounted under the fan ring on a bridge (for aircoolers)	0.55 ÷ 90
<b>AFTN</b>	1600 ÷ 2240	Motor mounted inside the fan casing, fully enclosed	0.55 ÷ 55



# MAP/AVP/MF/XF Series

## Applications

Aircoolers

Heat exchangers / Radiators

Cooling towers

Condensers

Axial Fans

COMET aluminium impellers come in 4 different construction types, aimed at satisfying numerous industrial applications. COMET manufactures 10 different blade profiles and three different impeller designs, giving rise to one of the most extensive and efficient product ranges available on the market.

The larger Series can be selected for large installations with diameters up to 12 metres. The smaller Series are suitable for installation on equipments, machineries or in environments requiring ventilation or cooling, and on small and medium fan units with diameters starting from 350mm.

The "MAP" and "AVP" Series impellers have high-efficiency and low-noise blades made of extruded aluminium alloy. All "MAP" models have variable pitch blades with motor stopped, while "AVP" impellers have variable pitch blades in operation. They were designed to provide precise and continuous adjustment of the air flow as the thermal conditions of the system vary. The blade pitch variation is controlled pneumatically and these impellers are supplied complete with rotating joint for connection to the line and with precision position valve. Special versions of all COMET impeller Series are available for critical operating conditions or special environments.

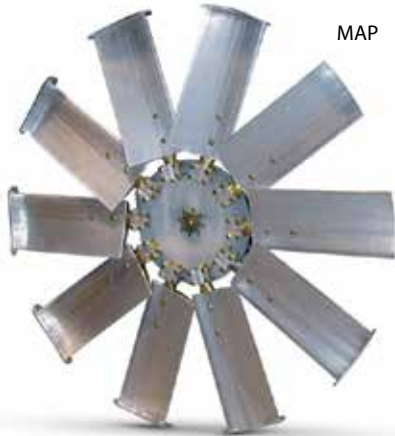
The extensive production in aluminium is supported by "MF" and "XF" Series of impellers, with blades made of fiberglass-reinforced plastic (FRP-GRP-PPG). These Series have Very Low-Noise characteristics and are suitable for corrosive environments.

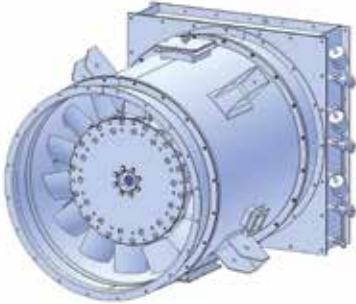
By using COMET selection software, it is possible to select the most advantageous combination of speed, number of blades and blade profile to obtain the best results in terms of noise and power consumption.

## Technical Data

Series	Blade Material	Hub Type	Blade Series	Diameter Range [mm]
MAP	Aluminium	F	12 / 1N	350 ÷ 1000
		P	1N / 2N / 3N / 31	500 ÷ 3100
		D	2N / 3N / 4N / 8N / 31 / 51	1000 ÷ 12000
AVP	Aluminium	P	1N / 2N / 3N / 31	1120 ÷ 3100
		D	2N / 3N / 4N / 8N / 31 / 51	2000 ÷ 8000
MF	FRP – GRP	D	MF	1200 ÷ 10000
XF	FRP – GRP	D	XF	2000 ÷ 12000

# Fans





# ATEX Fans

## Applications

Refineries

Chemical plants

Turbines

Plants and installations with presence of dangerous gas or dust

Most of COMET's fans can be supplied in the ATEX certified version (Directive 94/9/EC).

Series AF/AFT/AFH/AFTH/CNX are always available in ATEX versions.

All these fans are equipped with motors and components of leading brands and are rigorously certified.

Materials and components are checked and recorded for complete traceability.

Design, manufacture and testing are carried out by COMET in accordance with the procedures established by the COMET ATEX Technical File, filed with ICIM (ATEX Notified Body).

COMET products are certified for the following categories:

- Group II, category 3G
- Group II, category 3D
- Group II, category 2G
- Group II, category 2D

The general characteristics and the performances of the products do not vary when they are produced in the ATEX versions. At the same time, it is still available an high grade of customization according to the installation needs and the project specifications.

## General Characteristics

- Impellers in carbon steel, stainless steel, aluminium, FRP or PAGAS
- Three-phase motors IP55/IP65, with Class F or H insulation, T3 / T4, Ex-N / Ex-d, 50/60Hz, suitable for inverter supply
- Casings in carbon steel or stainless steel, electro-welded, with bolted anti-spark track
- Finishing by 3-layers epoxy-pack painting, certified for 500 hours salt mist test resistance, or hot-dip galvanization
- Cables and electrical components made by leading brands and certified
- ATEX certificate and running test report is supplied with each unit

Wide range of ancillary parts and customizations

Versions with special materials, special dimension, motors according to customer's specifications.



# Fans



ATEX



## Technical Data

Series	Diameters [mm]	Characteristics	Power [kW]
<b>AF-Ex</b>	400 ÷ 2400	Medium-performance direct drive Axial	0.55 ÷ 90
<b>AFT-Ex</b>	1000 ÷ 4800	Belt driven Axial	1.5 ÷ 75
<b>AFH-Ex</b>	400 ÷ 1800	High Performance Axial	1.1 ÷ 90
<b>AFTH-Ex</b>	200 ÷ 700	Belt-Driven High Performance Axial	0.55 ÷ 30
<b>CNX-Ex</b>	400 ÷ 1400	Centr axial	1.5 ÷ 55



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Microelettrica do Brasil

MS Resistances France

Heine Resistors Germany

Microelettrica Scientifica Italy

Comet Fans Italy

Casram Rail Italy

MST Elektrotechnik Turkey

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