



# Power electrics for Rail Application

## COMPONENTS FOR ON-BOARD APPLICATION

- CONTACTORS
- DC HIGH SPEED CIRCUIT BREAKERS
- DISCONNECTORS
- RESISTORS
- ELECTRONIC TRANSDUCERS
- FANS
- SWITCHGEARS ON BOARD



*Microelettrica Scientifica*



## LRV/METRO

A low-medium power range of products covering from 600 to 2.000 V<sub>DC</sub> specifically studied for all applications on board of LRV/LRT, Monorail, Trolley buses or Metro vehicles.

## EMU/HST

A medium-high power range of products covering up to 4.000 V<sub>DC</sub> or the 15/25 kV<sub>AC</sub> secondary side. Products developed for on board applications on trains with distributed traction system.

### Applications

Switches and Disconnectors for traction and auxiliary converter  
Cab Heating Contactors  
Roof or under frame mounted High Speed Circuit Breaker  
Brake Resistor  
Traction Motor Blowers  
Converter Cooling Blowers  
Integrated Functional Units  
Metering Transducers  
Transformer Cooling Systems  
Converter Cooling Systems

Switches and Disconnectors for traction and auxiliary converter  
System Configuration Switches  
High Speed Circuit Breaker (roof or under frame mounted)  
Cab Heating Contactors  
Transformer Cooling Systems  
Converter Cooling Systems  
Filtering Systems  
Control Resistors  
Metering Transducers  
Traction Motor Blowers  
Brake Resistor Blower  
Converter Cooling Blower  
Integrated Functional Units



## LOCO

A high power range of products covering up to 4.000 V<sub>DC</sub> or the 15/25 kV<sub>AC</sub> secondary side. Products are integrated in single-voltage or multi-system locomotives.

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Switches and Disconnectors for traction and auxiliary converter  
 System Configuration Switches  
 Train Power Supply Line  
 High Speed Circuit Breaker integrated in HV box  
 Cab Heating Contactors  
 Machine Room Blowers  
 Converter Cooling Systems  
 Filtering Systems  
 Control Resistors  
 Metering Systems  
 Traction Motor Blowers  
 Brake Resistor Blower  
 Converter Cooling Blower  
 Cab Ventilation Blower  
 Integrated Functional Units

## MADE IN MICROELETTRICA SCIENTIFICA

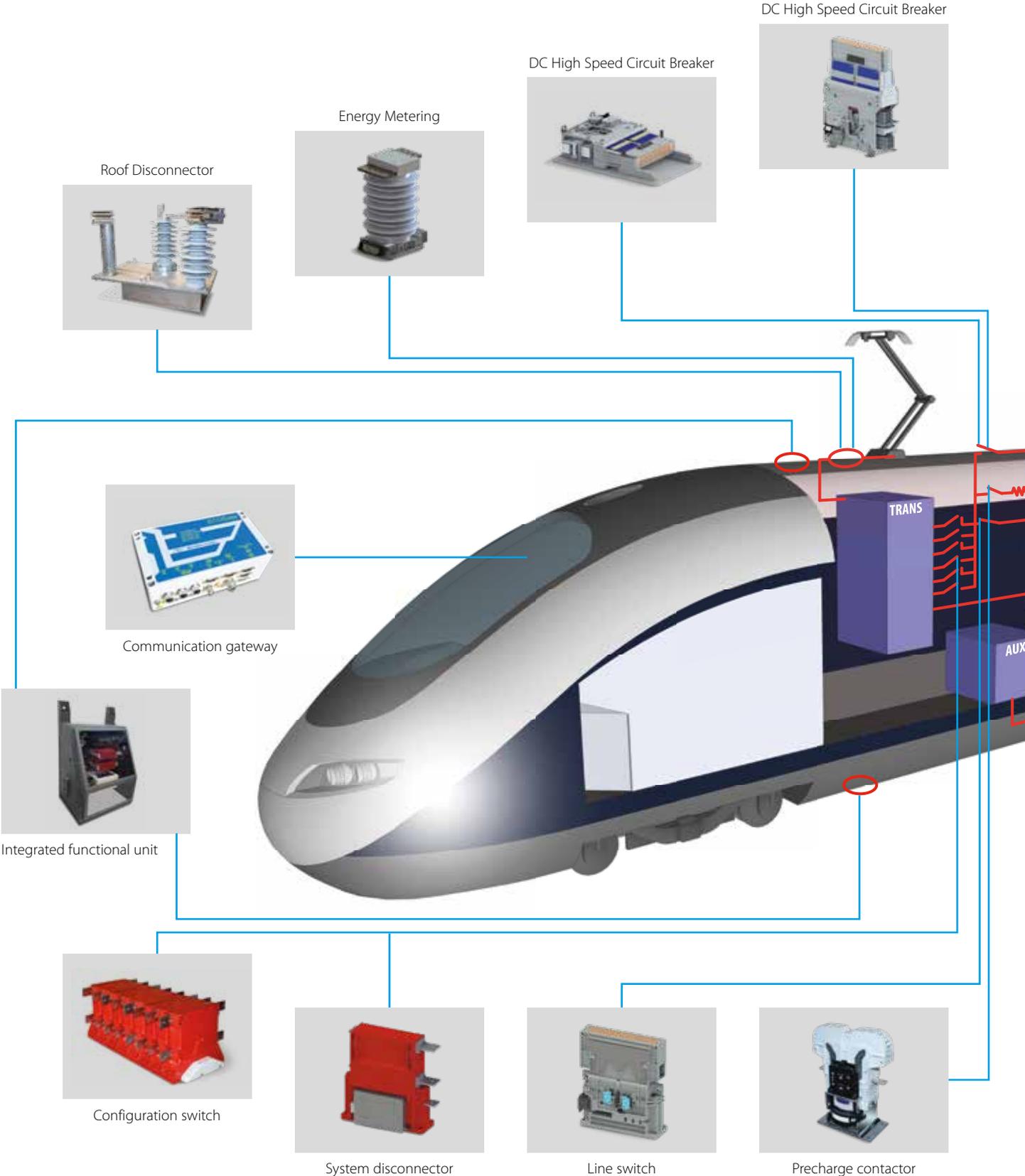
Always aiming to the best results, Microelettrica Scientifica develops and manufactures the entire range of products in Buccinasco close to Milan. We also run operations in U.S.A., South Africa, China, India, France, Brasil and Russia through which our Customers have access to immediate local assistance 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.

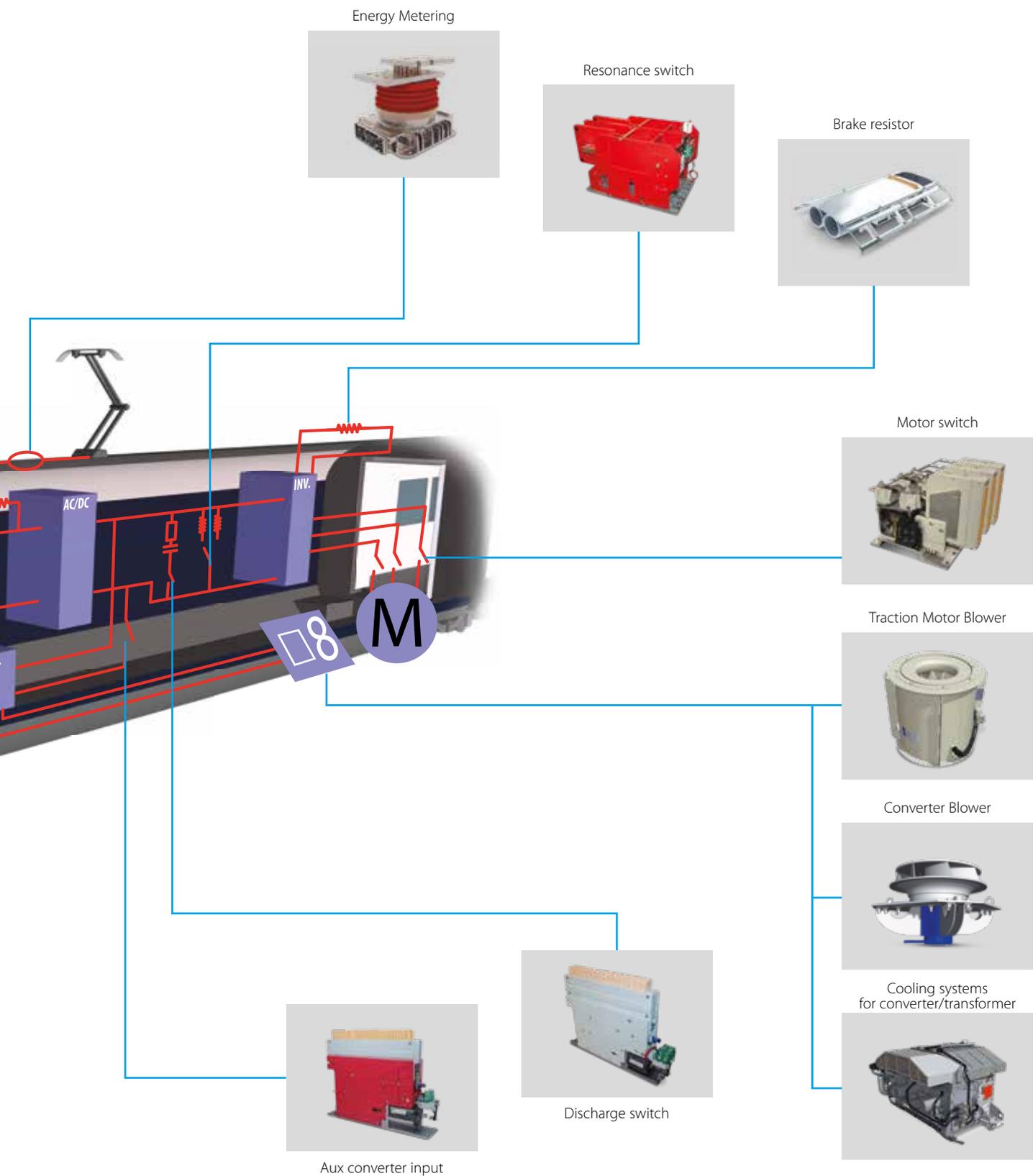
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### Products

-  Contactors - Disconnectors
-  DC High Speed Circuit Breakers
-  Braking Resistors - Resistors for Traction Control
-  Meetering systems and Energy management
-  High Voltage Transducers
-  Fans
-  Switchgears on Board

# A tailored solution for every traction component need





# LTX line

LTX contactors combine the typical robustness of Microelettrica Scientifica products with new and advanced concepts in electric arc breaking. They represent the right solution where high voltage rating, high thermal current and high breaking capacity are required. Specifically, they incorporate the traditional arc-chute design based on ceramic fins with an innovative blow-out system that enhances the contactor's breaking capacity and guarantees the maximum breaking reliability over the entire range of currents. The opening mechanism enhances the LTX's breaking and insulating performances, thanks to a fast opening speed and the highest distance between open contacts available on the market.

This allows to achieve the highest performances and reliability demanded by the railway and industrial markets.

Creepage and clearance distances designed to withstand voltages over 4 kV allow a safe use in polluted environments.

The main power terminals are conceived to match all busbar and cable interfaces. This, combined with an extremely compact outline, reduces all efforts of integration and installation.

The control circuit called "ECOBoost" has an energy saving function during the holding phase, to minimize energy consumption.

It extends the control range to cover a wide variety of railway LV control ratings, without need of coil customization or external DC/DC converters, and is not sensitive to any voltage or temperature oscillation. Its LV interface has two separate channels, for power and control.

The contactor's feedback circuit is based on up to four IP67 auxiliary contact blocks, that are very resistant to pollution, dust and oxidation, and maximize the reliability of the feedback also under the lowest voltage and current conditions.

LTX is available in 1-pole and 2-pole configurations, and is based on a modular concept that allow to combine several types of main body and arc-chute, to adapt it to the current and voltage performances required by the application.

**The LTX line is protected by International PATENT.**

## Applications

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Line contactor

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Power or auxiliary converter input

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Filter pre-charging

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Heating/Air conditioning system

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## GENERAL CHARACTERISTICS

LTX is the latest development resulting from Microelettrica Scientifica's long experience in railway and industrial applications

Its working principles are declined in a wide range of products that fulfill all application-related standards

Ratings up to 4000 V<sub>DC/AC</sub> and 900 A per pole

1-pole and 2-pole configurations

Highly customizable design

LTX	U <sub>emax</sub> [V <sub>DC</sub> ]	I <sub>th</sub> [A]	W [mm]	H [mm]	D [mm]
LTX S 900 1P	1000	900	113	345	300
	2000		113	360	320
	3600		113	440	360
LTX E 900 1P	1000	900	113	345	300
	2000		113	360	320
	3600		113	440	360
LTX B 900 1P	1000	900	113	345	300
	2000		113	360	320
LTX S 900 2P	1000	900	197	345	300
	2000		197	360	320
	3600		197	440	360
LTX E 900 2P	1000	900	197	345	300
	2000		197	360	320
	3600		197	440	360
LTX B 900 2P	1000	900	197	345	300
	2000		197	360	320

LTX S 900 1P 3600 V



### STANDARD VERSION

Standard configuration 1 (a0 b0) auxiliary contact

+ 1 (a1 b1) auxiliary contact

LV connector type AMP 16 poles

### OPTIONALS AVAILABLE

Different combination 2 (a0 b0) auxiliary contact and 2

(a1 b1) auxiliary contact up to a total of four auxiliary contact

LV connector from any brand

# LTHS line

Microelettrica Scientifica's LTHS contactors range is designed for demanding applications in railway and industry, where high performances in terms of electrical endurance and current rating are requested, also in presence of 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.

Available with normally open or normally closed configuration, LTHS line contactors are manufactured also in the mechanical latch version. 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.

## Applications

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Line contactor

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Power or auxiliary converter input

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Filter pre-charging

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Traction motors on-load disconnection

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Electromagnetic brakes

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Heating/Air conditioning systems

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LTHS 320



## GENERAL CHARACTERISTICS

The most used extra heavy duty line

Designed for railway application according to EN 60077 and for industrial applications according to IEC 61992-60947

Ratings up to 2000  $V_{DC/AC}$  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

Suitable for OV3, PD3 systems

LTHS 60



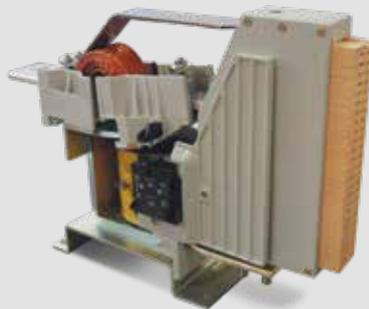
LTHS 125



LTHS 400



LTHS 650/800/1250



LTHS 1500/1700



Type	U <sub>max</sub> [V <sub>AC/DC</sub> ]	I <sub>th</sub> [A]	W [mm]	H [mm]	D1/D2 [mm]
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

The LTC Series contactors, thanks to their excellent balance between dimensions, performances and robustness, are suitable for all those switchgear 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.

## Applications

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Auxiliary converter input

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Filter pre-charging

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Heating/Air conditioning systems

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Line contactor

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## GENERAL CHARACTERISTICS

The most compact and modern heavy duty line

Designed for railway application according to EN 60077 and switchgear application according to IEC 61992-60947

Ratings up to 4000 V<sub>DC/AC</sub> 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

Suitable for OV3, PD3 systems

LTC 100



LTC 100 NC



LTCS 250



LTC 250 NC



LTCH 250



LTCH 60



LTCH 1000



Type	U <sub>max</sub> [V <sub>AC/DC</sub> ]	I <sub>th</sub> [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

Microelettrica Scientifica LTHH/LTE/LTP range is supplied to railway 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.

## 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

LTHH 250/400



## GENERAL CHARACTERISTICS

High-voltage heavy-duty range

Designed for railway applications according to EN 60077 and for switchgear applications according to IEC 61992-60947

Ratings up to 4000 V<sub>DC/AC</sub> 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

Suitable for OV3, PD3 systems

LTHH 40



LTHH 100



LTE 2-400/600



LTE 4-400/600



LTE 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
LTE 4-600	4000	900	429.4	423	85/- LTP 4-400
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/-

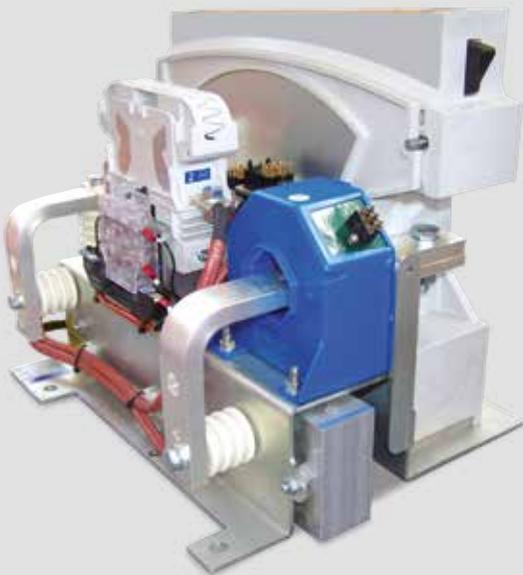
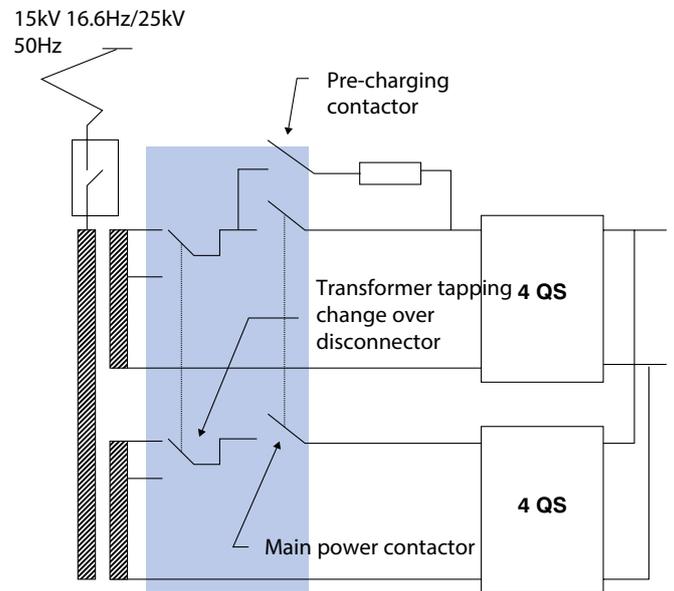
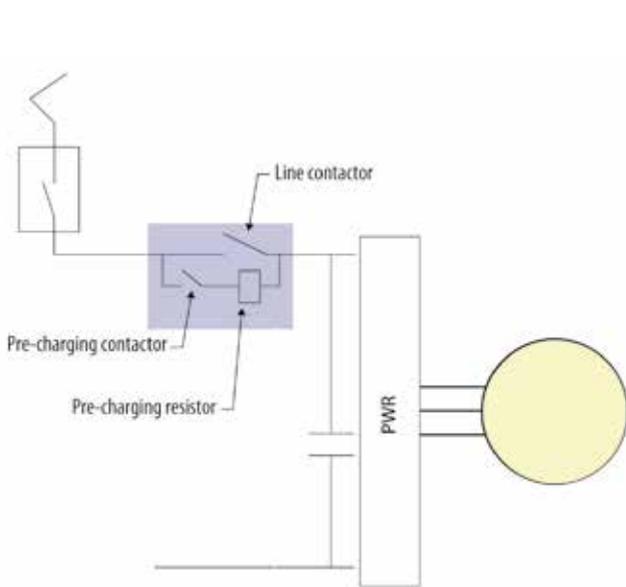
# Integrated Functional Units

A key of Microelettrica Scientifica success is the ability to provide specific solutions to meet customers' requirements. One of these are IFUs: different Microelettrica Scientifica contactors and disconnectors are supplied already assembled on a structure. Several solutions have been supplied also including charging and discharging resistors on the same frame. In this way customers do not have to worry about installing several components on a vehicle: it's just a matter of inserting the whole assembly in its own cubicle and tightening some screws.

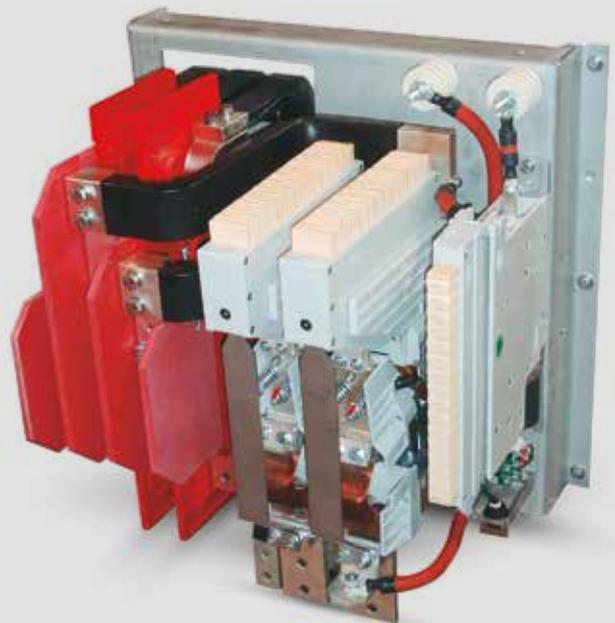
For example, all the traction circuit switchgears can be part of just one IFU. Such a solution helps also in case of maintenance: a IFU is removed from the train in a short time and is replaced with another assembly, to speed up processes. Then, the removed IFU can be checked and revamped in the workshop, with no concerns of time and space.



Line and pre-charging contactor + pre-charging resistor



Line and pre-charging contactor + pre-charging resistor



Main power and pre-charging contactors  
+ change over disconnecter

# LPRC line

New modular integrated system LPRC 1000 is composed by LTCH 1000 line contactor associated with LTCS 150 pre-charge contactor and pre-charge resistor. LPRC consist of compact solution from overall dimensions solutions point of view.

## GENERAL CHARACTERISTICS

The LTCH 1000 line contactor has a dedicated base-plate and works up to 2 kV – 1000 A

The new LTCS 150 pre-charge contactor is available in 2 poles series connected configuration for applications up to 1 kV or up to 2 kV. Its overall dimensions are limited as it is enclosed in the volume of the LTCH 1000 for the most part

The pre-charge resistor, integrated in the base, has different resistance values depending on the application

## TECHNICAL ADVANTAGES

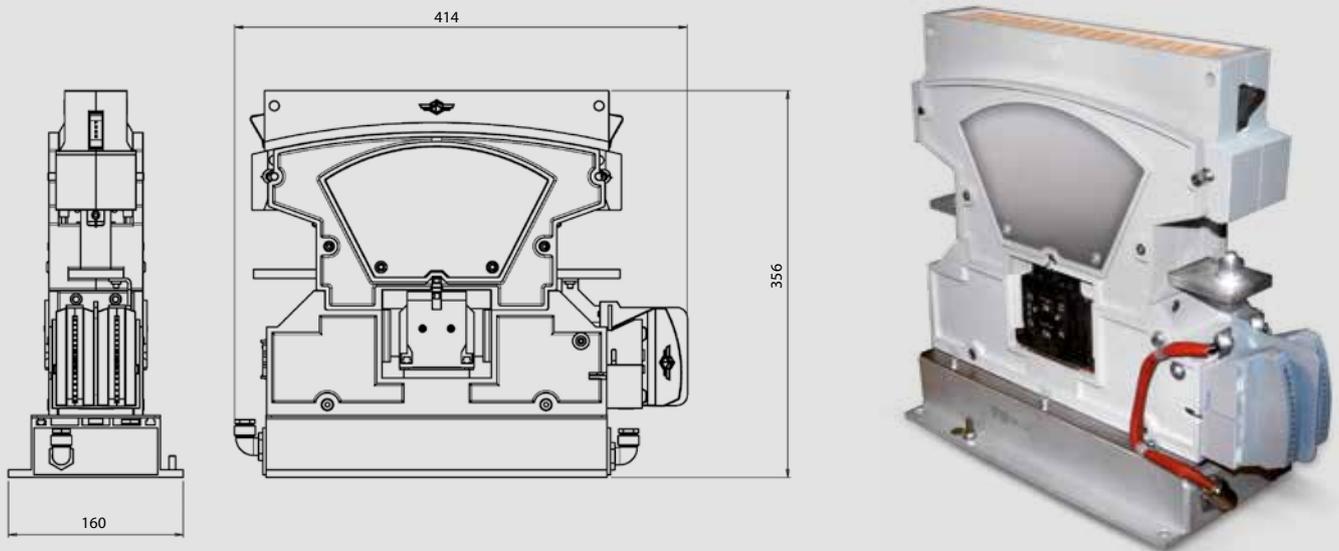
The electrical connections are integrated so that the terminals are limited to "In" and "Out" only

Excellent performances with reduced weight and volume

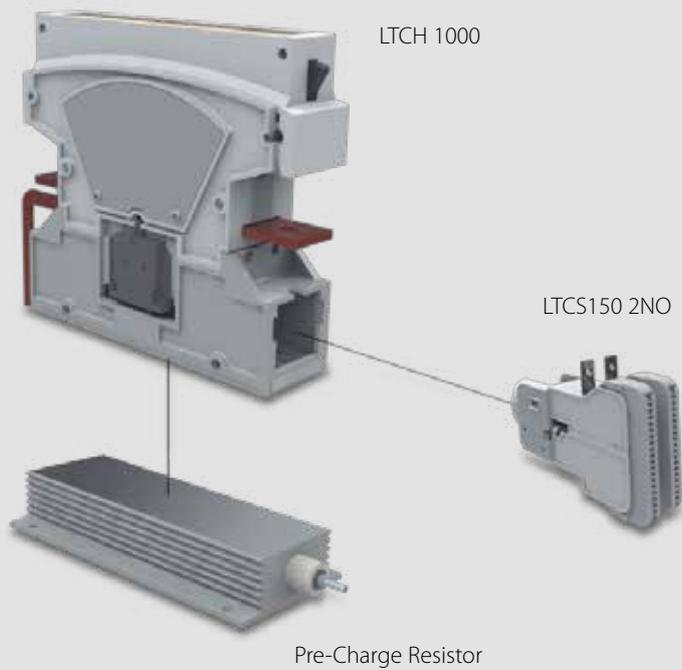
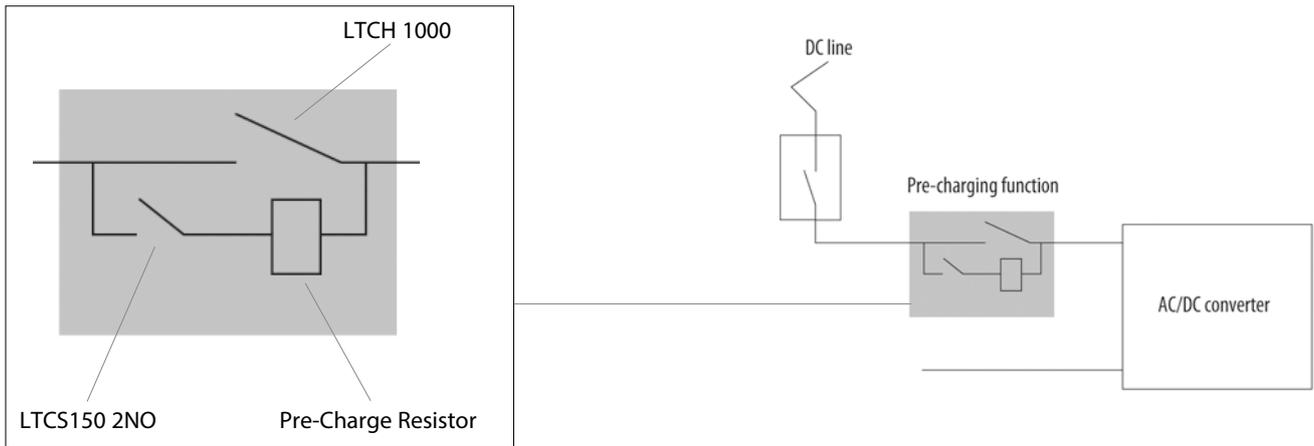
Quick installation: common interface for HV and for LV

Quick maintenance: low time to substitute all the system or the single components

Overall Dimensions: mm



Type	U <sub>max</sub> [V <sub>AC/DC</sub> ]	I <sub>th</sub> [A]	Resistance [Ω]
LTCH 1000	2000	1000	-
LTCS 150 2NO	2000	150	-
Pre-Charge Resistor	-	-	10 ÷ 100



# IR3000V line

The IR3000V is a range of DC Circuit Breakers conceived for Metro, Light train and EMU rolling stock where the highest breaking capacity is required. It is specifically designed to protect the downstream power circuits against fault conditions that lead to over-currents and short circuits.

It includes single pole, breakers for DC applications with breaking in air, available in two voltage ratings of 900 V<sub>DC</sub> and 1800 V<sub>DC</sub> and with thermal current up to 3 kA.

The main contacts of IR3000V are held closed by a holding coil. The Circuit Breaker is equipped with a direct acting over-current trip device which may be either unidirectional or bidirectional. The closing mechanism is an independent motor-operated type.

Several solutions implemented in the IR3000V are intended to ensure a longer life and reduced maintenance costs.

For example, the arc chute is made of ceramic fins, capable of withstanding better than any other materials the high temperatures typical of breaking operations, even if repeated in short sequence.

The adoption of arching contacts is intended to preserve the main contacts from wear and extends the electrical life of the Breaker.

Its modular design allows to configure the IR3000V in different version by changing only the arc chute:

- Low Power version (09L)

- Medium Power version (09M and 18M)

This allows to minimize the space occupied within electric cubicle or HV Box in relation to the requested breaking capacity.

The breaker is compliant to all the relevant standard for railway applications: the most relevant IEC60077, the newest fire and smoke EN45545, the S&V withstand capability IEC61373 and the EMC compatibility IEC 62236-3-2.

## Applications

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On the vehicle roof

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Under vehicle frame

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Inside the vehicle HV cubicle

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IR 3000 Low Power



**ONBOARD APPLICATION**

	IR3000F line	Holding System	I <sub>th</sub> (A)= @ 40°C	Rated Short Circuit Making and Breaking Capacity/Time constant [kA/ms] according to IEC60077	
				U <sub>e</sub> (V <sub>dc</sub> )=900	U <sub>e</sub> (V <sub>dc</sub> )=1800
Low Power	IR3015VV09L	Holding coil	1500	T1: 30/0 kA/ms T2: 30/15 kA/ms T3: 30/50 kA/ms T4: 30/150 kA/ms	-
	IR3030VV09L	Holding coil	3000		
Medium Power	IR3015VV09M	Holding coil	1500	T1: 50/0 kA/ms T2: 32,5/15 kA/ms T3: 30/50 kA/ms T4: 30/150 kA/ms	-
	IR3030VV09M	Holding coil	3000		
	IR3015VV18M	Holding coil	1500	-	T1: 30/0 kA/ms T2: 30/15 kA/ms T3: 30/40 kA/ms T4: 30/100 kA/ms
	IR3030VV18M	Holding coil	3000		

IR 3000 Medium Power



**STANDARD CHARACTERISTICS**

- Thermal current rating 1500 or 3000 A
- Rated voltages of 900 or 1800 V<sub>dc</sub>
- Contacts holding system based on holding coil
- Bidirectional direct acting over-current trip device
- Reed-type auxiliary contacts (protected against dust, pollution and oxidation)

**OPTIONAL CHARACTERISTICS**

- Unidirectional direct acting over-current trip device
- Dual voltage arc chute
- Reed-type auxiliary contacts (protected against dust, pollution and oxidation)
- IP45 plastic box for roof application
- IP55 stainless steel box for roof or underframe application

# IR4000V line

The IR4000V is a new range of DC High Speed Circuit Breakers for Metro, Light train, EMU, High Speed Train and Locomotive applications. Their extremely high breaking performances obtained with a compact design makes them a unique solution in the railway scenario. The IR4000V line is a range of single pole, high speed circuit breakers for DC applications with breaking in air, available in two voltage ratings of 1800 and 3600 V<sub>DC</sub> and two thermal currents of 3 and 4.5 kA.

The main contacts of IR4000V are held closed by a holding coil. The Circuit Breaker is equipped with a direct acting over-current trip device which may be either unidirectional or bidirectional. The closing mechanism is an independent motor-operated type. Several solutions implemented in the IR4000V are intended to ensure a longer life and reduced maintenance costs.

The arc chute is made of ceramic fins, capable of withstanding better than any other materials the high temperatures typical of breaking operations, even if repeated in short sequence. The adoption of arcing contacts is intended to preserve the main contacts from wear and extends the electrical life of the Breaker.

The control circuit minimizes the power consumption during the whole mission profile, by means on an energy saving system that limits the current draw from the auxiliary circuit during the holding phase. It covers all LV ratings adopted in railway technology without need for components customization.

Thanks to the current driving, the mechanical performances during closing operation are independent from power supply voltage and ambient temperature fluctuations.

Its modular design allows to configure the IR4000V in different version by changing only the arc chute:

1800 V<sub>DC</sub> version (18M)

3600 V<sub>DC</sub> version (36M)

## Applications

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On the vehicle roof

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Under vehicle frame

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Inside the vehicle HV cubicle

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It can be mounted in two different position according to the available space:

Vertical (VV)

Horizontal (VH)

This allows to minimize the space occupied within the electric cubicle or HV Box in relation to the requested breaking capacity.

The breaker is compliant to all the relevant standard for railway applications: the most relevant IEC60077, the newest fire and smoke EN45545, the S&V withstand capability IEC61373 and the EMC compatibility IEC 62236-3-2.

### ONBOARD APPLICATION: VERTICAL MOUNTING

IR4000VV line	Holding System	I <sub>th</sub> (A)= @ 40°C	Rated Short Circuit Making and Breaking Capacity/Time constant [kA/ms] according to IEC60077	
			U <sub>e</sub> (V <sub>dc</sub> )=1800	U <sub>e</sub> (V <sub>dc</sub> )=3600
IR4030VV18M	Holding coil	3000	T1: 100/0 kA/ms T2: 60/15 kA/ms T3: 50/40 kA/ms T4: 35/100 kA/ms	-
IR4045VV18M	Holding coil	4500		
IR4030VV36M	Holding coil	3000	-	T1: 55/0 kA/ms T2: 50/15 kA/ms T3: 50/50 kA/ms T4: 50/150 kA/ms
IR4045VV36M	Holding coil	4500		

### ONBOARD APPLICATION: HORIZONTAL MOUNTING

IR4000VH line	Holding System	I <sub>th</sub> (A)= @ 40°C	Rated Short Circuit Making and Breaking Capacity/Time constant [kA/ms] according to IEC60077	
			U <sub>e</sub> (V <sub>dc</sub> )=1800	U <sub>e</sub> (V <sub>dc</sub> )=3600
IR4030VH18M	Holding coil	3000	T1: 90/0 kA/ms T2: 60/15 kA/ms T3: 50/40 kA/ms T4: 35/100 kA/ms	-
IR4045VH18M	Holding coil	4500		
IR4030VH36M	Holding coil	3000	-	T1: 55/0 kA/ms T2: 50/15 kA/ms T3: 50/50 kA/ms T4: 50/150 kA/ms
IR4045VH36M	Holding coil	4500		

### STANDARD CHARACTERISTICS

- Thermal current rating 3000 or 4500 A
- Rated voltages of 1800 or 3600 V<sub>dc</sub>
- Contacts holding system based on holding coil
- Bidirectional direct acting over-current trip device
- Reed-type auxiliary contacts (protected against dust, pollution and oxidation)

### OPTIONAL CHARACTERISTICS

- Unidirectional direct acting over-current trip device
- Dual voltage arc chute
- IP56 stainless steel or painted steel box for roof or underframe application

# IR6000V line

The IR6000V 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 1800/3600 V).

The breaker conforms to EN60077.

## Applications

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On the vehicle roof

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Under vehicle frame

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Inside the vehicle HV cubicle

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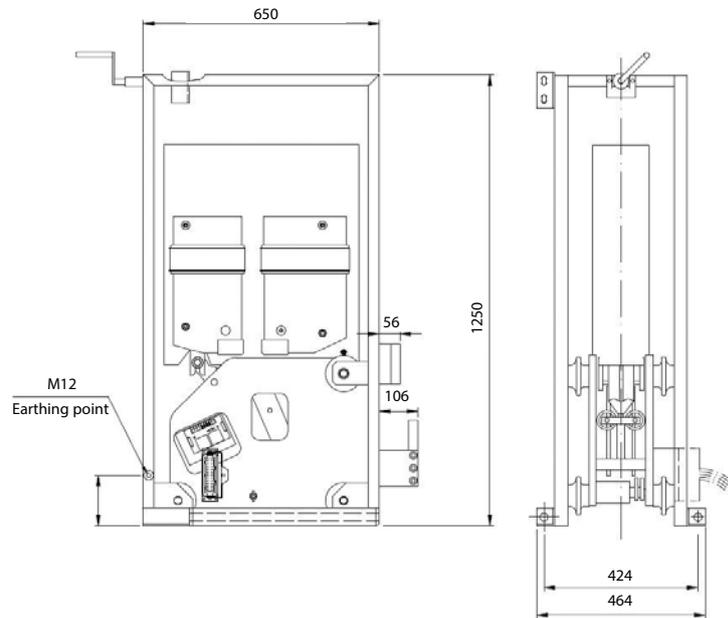
IR6000V Vertical



SWITCHES  
DC HIGH SPEED CIRCUIT BREAKERS

COMPONENTS FOR  
ON-BOARD APPLICATION

Overall Dimensions: mm



IR6000V Roof Mounting



Type	U <sub>max</sub> [V]	I [A]	W [mm]	H [mm]	L [mm]
IR6000 Vertical	up to 3600	4000	464	1250	650
IR6000 Horizontal	up to 3600	2500	470	680	1200
IR6000 Roof	up to 3600	2500	560	525	1600

# LTK line

LTK disconnectors combine the heavy duty and well known technology of Microelettrica Scientifica on the high power circuit together with the most advanced technology on the control circuit. This results in a compact and versatile solution for applications where high voltages (up to 4 kV) and thermal currents are required.

A unique design allows to minimize the overall dimensions while keeping long creepage and clearance distances that guarantee safety in polluted environments.

## Applications

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Traction circuit configuration change in multi-system vehicles

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Insulation of power converter

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Insulation of traction motors

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The concept of extreme integration, on which LTK disconnectors are based, resulted in a design without any LV cabling (except for the LV connector).

The control system allows to operate the disconnectors with virtually all LV ratings used in railway applications.

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

**The LTK line is protected by International PATENT.**

### GENERAL CHARACTERISTIC

Heavy-duty disconnectors for DC and AC applications up to 4000 V

Innovative design, compact and versatile

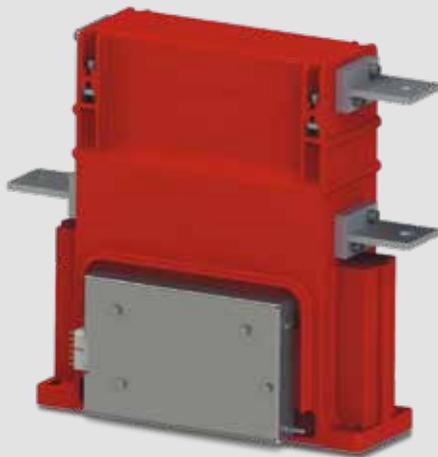
For on-board and stationary applications, with thermal current rating of up to 900 A per pole

Normally open, normally closed, change over poles

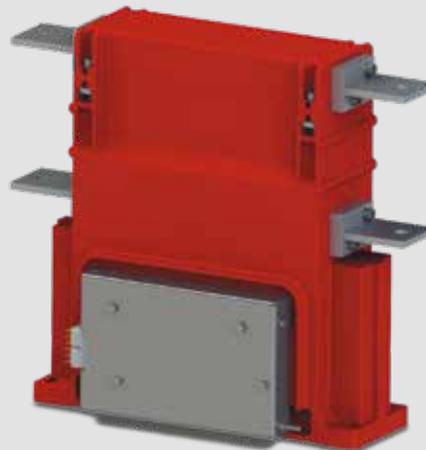
1-pole and 2-pole disconnectors with single actuation system

Highly customizable

LTK S 900 1P CO



LTK S 900 1P NO+NC



LTK	I <sub>th</sub> [A]	U <sub>e</sub> max [V <sub>oc</sub> ]	Pole configuration	W [mm]	H [mm]	D [mm]
LTK S 900 1P	900	4400	NO Pole/M Version	121	285	360
			CO Pole/Y Version	121	310	360
			NO+NC Pole/H Version	121	310	350
LTK E 900 1P	900	4400	NO Pole/M Version	121	285	320
			CO Pole/Y Version	121	310	320
LTK S 900 2P	900	4400	NO Pole/M Version	215	330	370
			CO Pole/Y Version	215	330	370
			NO+NC Pole/H Version	215	330	370
LTK E 900 2P	900	4400	NO Pole/M Version	215	330	370
			CO Pole/Y Version	215	330	370

# Roof Disconnectors

Roof Disconnectors are off-load switches, Motor Operated, and designed to be installed outdoors on the roof of electric traction vehicles. On the basis of customer application, they can be chosen as LTPD only for disconnection or LTSD also for earthing connection. Both products are suitable for single-voltage as well as for multi-voltage vehicles, covering all the usual line voltages (1,5 kV<sub>DC</sub>; 3 kV<sub>DC</sub>; 15 kV<sub>AC</sub> and 25 kV<sub>AC</sub>) as well as the different vehicle's currents rated up to 2000 A.

## MAIN FEATURES

- High rated short time withstand current
- Motor Operated
- Suitable for high speed train, EMUs and locomotives
- Suitable for outdoor applications



Technical data	
Type	LTPD-LTSD
Number of Poles	1 NO
Rated free air thermal current [kA]	2
Auxiliary Contact Blocks	4 NO + 4 NC
Reference standard	IEC60077
Short circuit withstand capacity (DC)	
I <sub>cw</sub> [kA]	40
t [ms]	60
Short circuit withstand capacity (AC)	
I <sub>cw</sub> [kA]	30
t [ms]	100

Dielectric features	
Rated Insulation Voltage [kV <sub>AC</sub> ]	27.5
Maximum Voltage (semi-permanent) [kV <sub>AC</sub> ]	32
Pollution degree	PD4
Over voltage category	OV4
Minimum Clearance [mm]	320
Minimum Creepage [mm]	690
Rated power frequency withstand voltage [kV]	75
Rated Impulse voltage [kV]	170



# LTMP line

Modular multipole-multiposition off-load disconnectors.

The disconnectors are configurable assembling side by side poles, every one completely independent and controlled by a motor.

The modular structure allows easy maintenance through independent replaceability of every single pole.

Feedbacks may be managed, on demand, through a low voltage connector installed on every pole. Reference standard IEC 60077-2.

## MAIN FEATURES OF EACH POLE

2 versions: 1000 or 2000 A thermal current

3 configurations: NO or NO+NC or CO

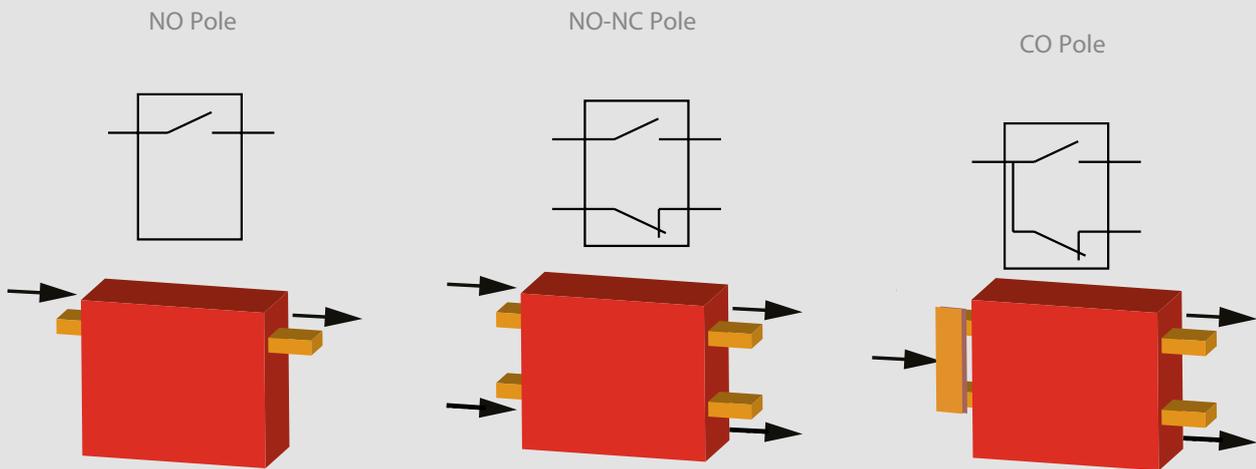
Fully modular construction

Electric motor actuated



Technical data	
Rated Max Voltage (U <sub>max</sub> )	4000 V <sub>DC/AC</sub>
Rated Operational Current (I <sub>e</sub> ) at 75°C	Up to 2000 A
Auxiliary Contacts (type SAIA-BURGESS)	2 CO per pole

Pole Configuration



# LTHM/P-U/D line

Microelettrica Scientifica disconnectors, available both with electric motor control and with pneumatic control, are designed to be employed in circuits up to 4 kV. Their current ratings, up to 1500 A per pole, allow them to fit almost all applications. Their contact technology, based on multi-finger jaws, enables the LTHM and LTHP disconnectors to withstand consistent dynamic currents (up to 220 kA). Microelettrica Scientifica's effort in designing a product range with reduced space outline, sturdy structure and a long mechanical life (over 100,000 operations), has led to a worldwide success in railway applications.

Poles can be connected in parallel to obtain higher thermal currents on single contact (up to 6000 Amps)

On D versions, poles can be reversed forming NC poles, or single-double pole changeover without additional structure

On D versions, additional upper structure is available to create 1 to 4 changeover poles

24 combinations are available with more than 130 pole configurations

Several options available for control circuits and for auxiliary contacts connection

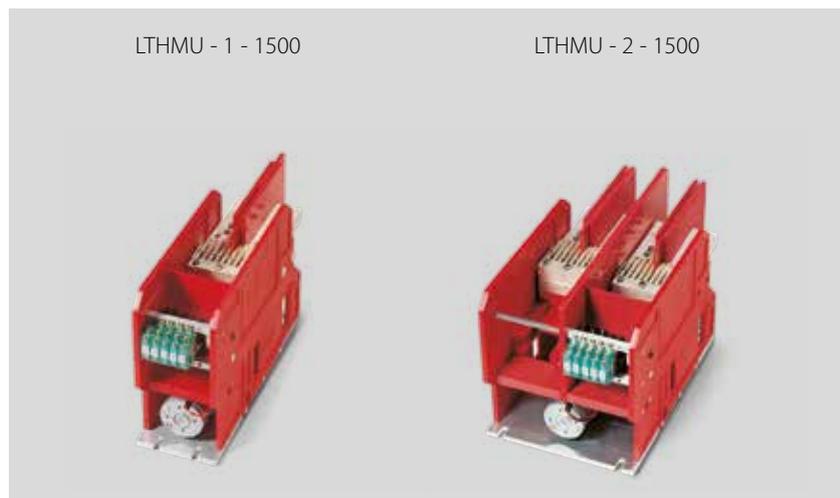
Integrated solutions: multiple switches are assembled on frame with customised busbar system and integrated control circuits

## Applications

Traction circuit configuration change in multi-system locos

Isolation of power converter

Isolation of traction motors



## GENERAL CHARACTERISTICS

Heavy duty line for DC and AC applications up to 4000 V

On-board and stationary applications, 2 thermal current ratings per pole: 800 or 1500 A

Normally open, normally closed, changeover poles from 1 to 4 poles units with single control

Electric DC motor or pneumatic cylinder control, with customized auxiliary contacts execution

High customization level is available and mostly applied

Integrated multifunctional units designed and customized on request

### AUXILIARY CONNECTIONS

To meet all customer requirements, special connections and cabling can be supplied both on the high voltage and on the low voltage circuits.

On the HV side, poles can be connected in series or parallel. Terminals can be shaped according to customers' requirements

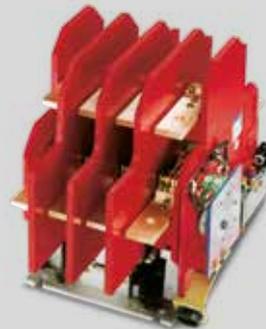
LV circuits can be cabled to perform different logical functions. Any kind of connector available in commerce can be fitted to these circuits



LTHPD - 2 - 1500

LTHPD - 3 - 800

LTHPD - 4 - 800 CO



LTH	M	U	1	800
LTH	M	U	1	1500
LTH	M	U	2	800
LTH	M	U	2	1500

LTH	P	U	1	800
LTH	P	U	1	1500
LTH	P	U	2	800
LTH	P	U	2	1500

LTH	M	D	1	800
LTH	M	D	1	1500
LTH	M	D	2	800
LTH	M	D	2	1500
LTH	M	D	3	800
LTH	M	D	3	1500
LTH	M	D	4	800
LTH	M	D	4	1500

LTH	P	D	1	800
LTH	P	D	1	1500
LTH	P	D	2	800
LTH	P	D	2	1500
LTH	P	D	3	800
LTH	P	D	3	1500
LTH	P	D	4	800
LTH	P	D	4	1500

M/P: Electric motor (M) or pneumatic (P) bistable control

U/D: Power terminals on same side (U) or on opposite side (D)

1/2/3/4: Number of poles

800/1500: Thermal current of each pole (in Amps)

# LTRM line

Microelettrica Scientifica's LTRM disconnectors are designed for applications up to 4 kV and are available with electric motor control (23, 36, 72, 110 V<sub>bc</sub>).

Its compact dimensions make it particularly suitable for application up to 300 A where 3 or 4 poles (1NO+1NC or CO) are required to be fitted in little space.

As for the largest part of Microelettrica switches LTRM line may be easily personalized in order to match with customers specifications. This, combined with easy on-board maintenance, high performances and reliability are the most relevant characteristics of this device.

## Applications

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Traction system configuration

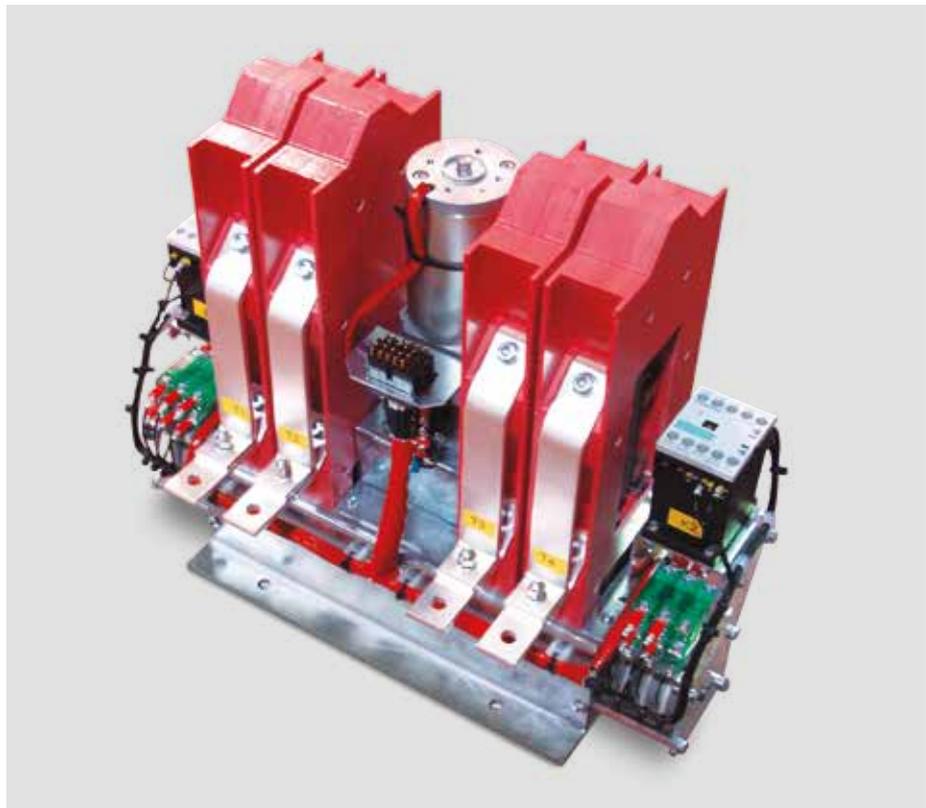
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Isolation of power converter

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Reverser

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### AUXILIARY CONNECTIONS

LV circuit can be cabled according to customer requirements to perform different logic functions:

- Direct control through auxiliary contacts
- Control made by means of one relay
- Control made by means of two relays
- Any kind of connector may be used upon request

### REFERENCE STANDARD

- EN60077-1
- EN60077-2
- EN61373
- EN50124-1
- TS45545-2



<b>U<sub>max</sub> [V<sub>DC/AC</sub>]</b>	<b>I<sub>th</sub> [A]</b>	<b>W [mm]</b>	<b>H [mm]</b>	<b>D<sub>max</sub> [mm]</b>	<b>W [mm]</b>
LTRM 3 poles	2000	300	193	341	331
LTRM 3 poles	4000	300	300	341	331
LTRM 4 poles	2000	300	252	341	388
LTRM 4 poles	4000	300	300	341	388

# LTWS line

## Modular Grounding Switch 4000 V – 350 A up to 24 contacts

Manual simultaneous switch for HV circuits in traction converters and cabinets, with associated key pad with customizable interlocking logic.

### MAIN CHARACTERISTICS:

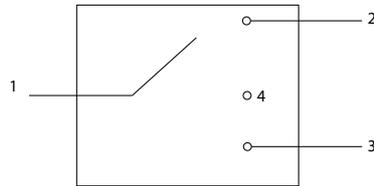
- Contacts suitable for on-load making (capacitor discharge)
- Voltage presence lamp (optional)
- Customized solutions of key and lock pad logic
- Manual switch with 3 positions:
  - Open (4)
  - Load (2)
  - Emergency (3)



### Technical data

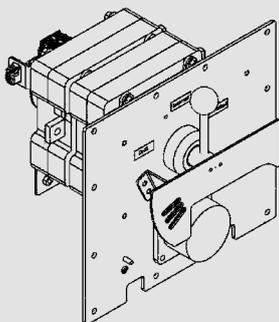
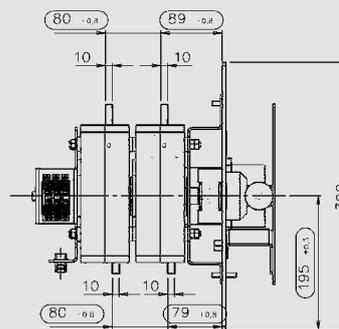
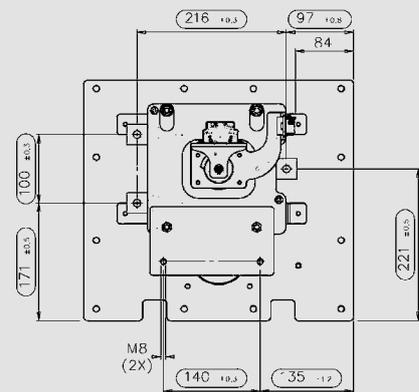
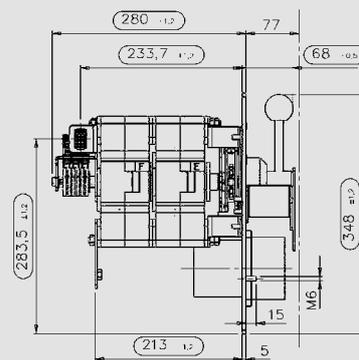
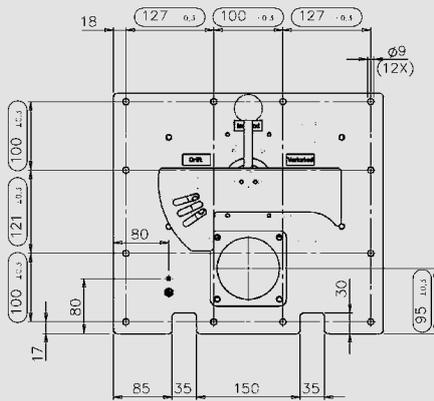
Rated operational voltage [ $V_{AC/DC}$ ]	4000
Max operational voltage [ $V_{AC/DC}$ ]	4800
Rated Insulation Voltage [V]	5800
Conventional Free Air Thermal Current [A] at 70°C	350
Control Voltage Rating [ $V_{DC}$ ]	24 ÷ 110
Making Capacity [A]	2000
Short circuit withstand capacity [A]	15,000 (15 ms)
Dimensions (standard version) WxHxD [mm]	400 x 420 x 3240

FUNCTIONAL DIAGRAM



LTWS LINE

Overall Dimensions: mm



# Compact Aluminium Resistors

These products are characterized by compact and modern design that ensures combination of lightness, low inductance and great energy absorption capacity.

Depending on application, there is the possibility to base either on an aluminium housing or on an aluminium profile housing with integrated cooling fans.

## Applications

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Braking and chopper resistors  
for variable speed drives

---

Load and testing resistor

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Integration in mounting beneath  
or beside frequency inverter

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By connecting multiple compact resistors in series, resistor units with capacities of between 50 W and 10 kW can be reached. Accordingly, protection classes up to IP66 are guaranteed.

**Resistance material support:** moulded ceramic base

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

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



# Wire Wound Resistors

The best feature of Wire Wound Resistors is its compact and modular design, joined to high energy absorption capacity.

Optimization on frame combined with electrical insulation guarantees low inductivity and high insulation voltage. All coupled with great ability of the wire wound resistor to maintain high absorption even if resistor wire heats up. These products are available in protection classes from IP00 to IP 23.

## Applications

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Braking and chopper resistors  
in variable-speed drivers

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Frequency inverters

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Load and testing resistors  
Circuit resistors

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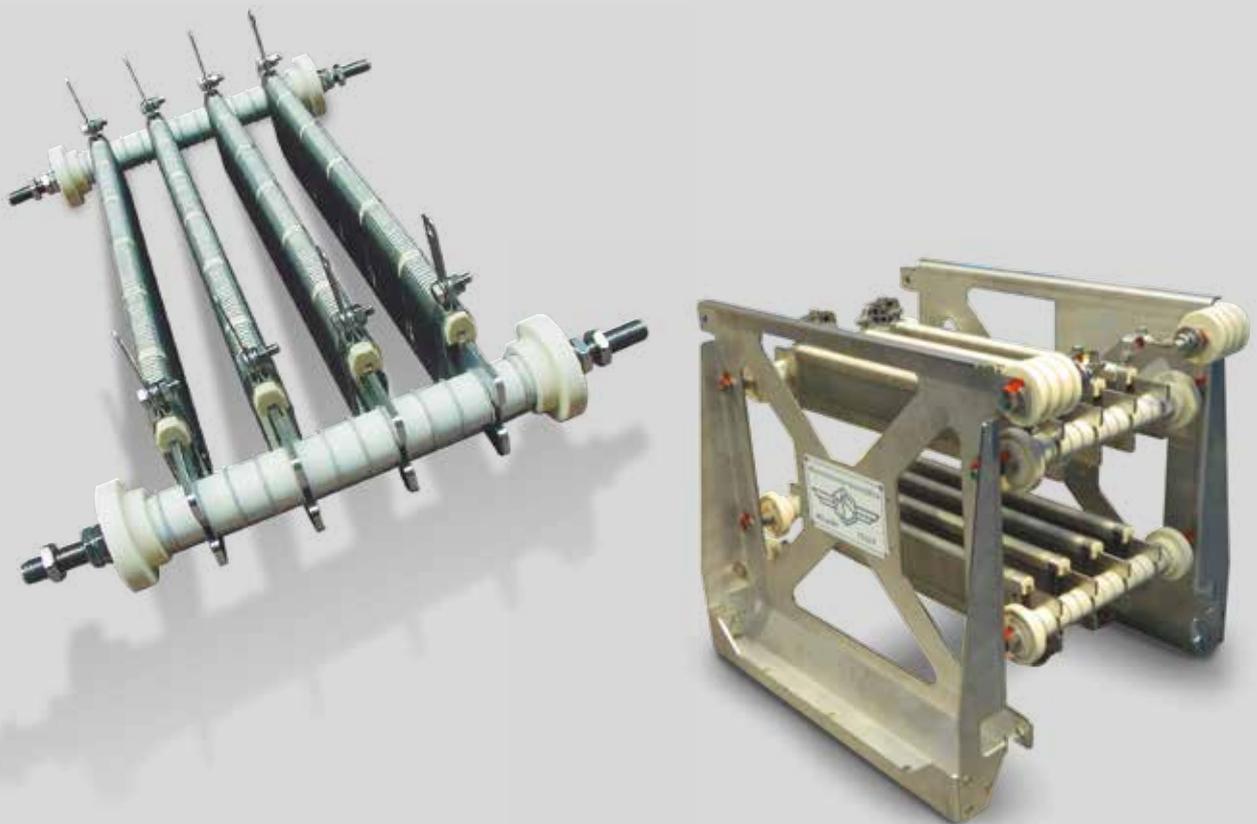
The ability to use them as thermal switches for thermal monitoring and overcurrent relays for controlling overload events opens them to a wide range of applications.

**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



# Stripe Element Resistor

Stripe element technology is spearhead of our products and it is mainly used for braking and over-voltage protection for on-board applications. This flexible technology allows a complete customization of the resistor, allowing for optimum heat exchange over a wide range of resistance values. From the simplest natural cooling solutions up to the multi-megawatt forced cooling resistors, each product is carefully designed to meet and exceed Customer's expectations. Indeed, thanks to our strong partnership with Comet Fans, our forced cooled solutions can be considered a landmark in the worldwide market.

From snowy mountains to dusty deserts, our rugged products can endure the harshest environmental conditions.

As a part of the KB group, we are able to support our Customers meeting the project local content by producing in different locations around the world. Several non-magnetic austenitic alloys can be used for manufacturing our resistor elements, which are supported by durable spacers made of advanced ceramics and stainless steel tie rods. Stainless steel is also used for the enclosure and the hardware, allowing for unrivalled resistance to environmental stress. Electric insulation is granted by ceramic spacers and high performance secondary insulators.

## Applications

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Dynamic braking

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Overvoltage protection

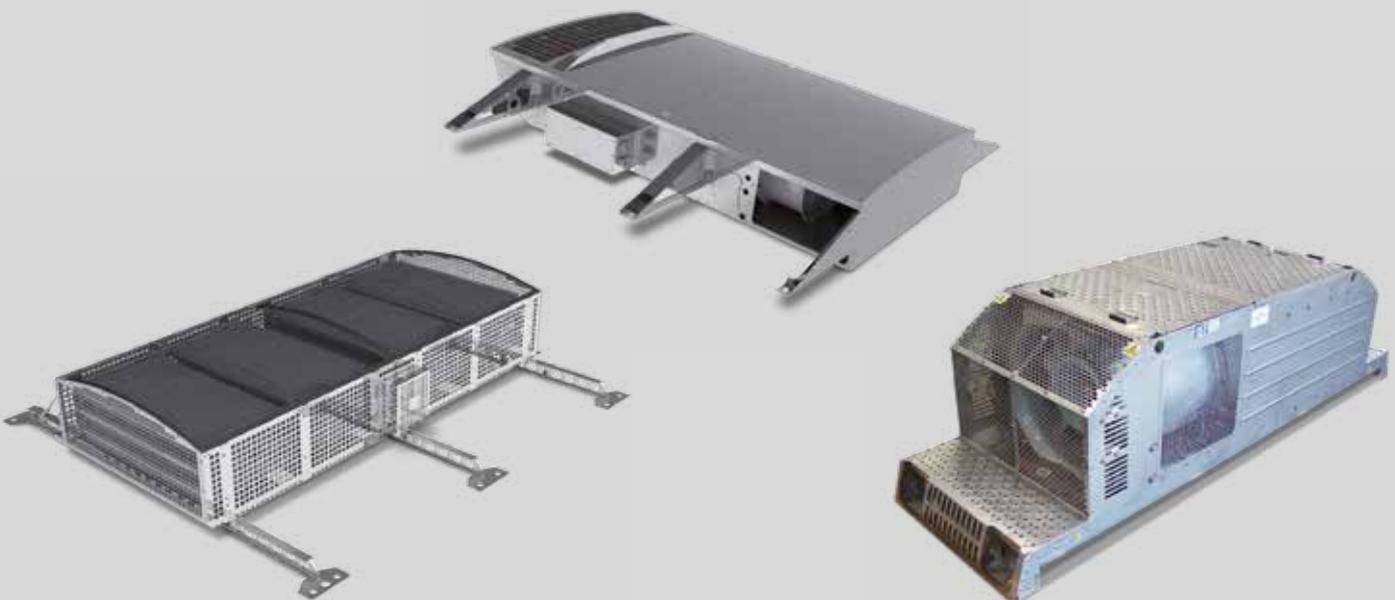
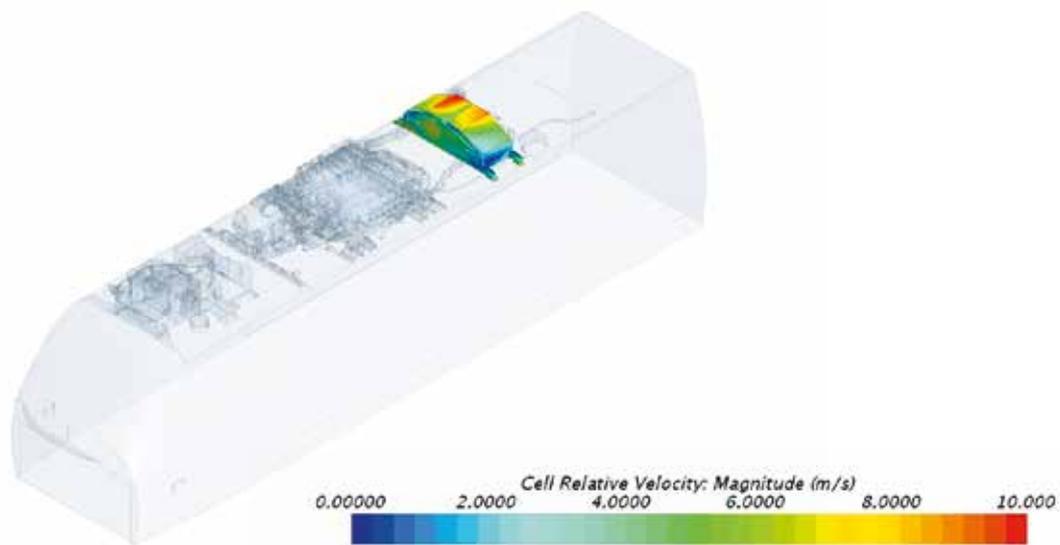
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Filter

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Our engineers design the resistor with sophisticated 3D model and with the most innovative CFD tools. Finite elements analysis can be performed and all the structural joints can be verified according to VDI 2230. Both design and production phases, abide by the strictest quality standards such as ISO/TS 22163 (IRIS Rev 3), ISO 9001, and UNI EN ISO 3834 Part 2 and UNI EN 15085-2 CL1 for welding. Performance, environment, safety, reliability and maintainability are all main drivers in our design. Type tests are performed according to EN 60322 in our facility. Our test rooms allow us to precisely reproduce the working conditions of the resistors reproducing virtually any duty cycle and performing vibration and shock tests according to IEC 61373. Every single unit built is routine tested to guarantee the highest level of quality.



# CITYMeter

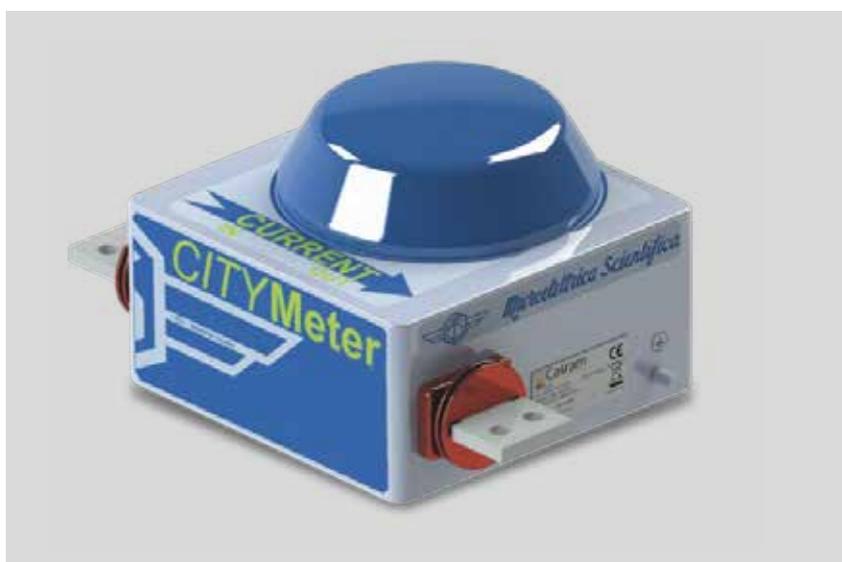
## GENERAL CHARACTERISTICS

CITYMeter is an Energy Metering System developed for light rail vehicles and trolley buses. The system is composed by an on board module and a WEB Service application software.

The system is applicable for DC vehicle systems. The measurement is accurate and reliable but not for billing purpose.

The Energy measurement done at vehicle level provides consumed and regenerated Energy with minimum interval of one minute.

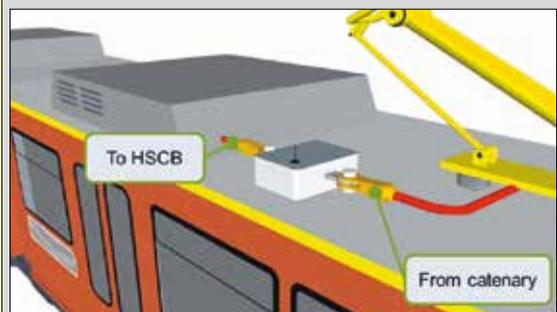
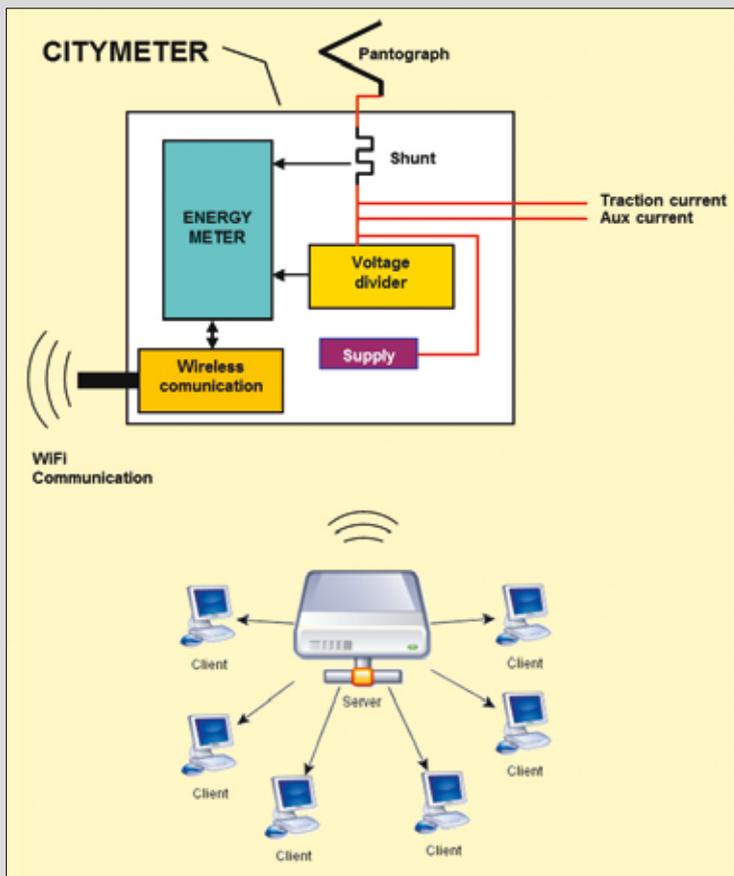
Data are stored on the vehicle and sent to the ground server when the vehicle reach the wireless hot spot.



Parameter	Value	Remarks
Catenary range	600÷1500 V <sub>dc</sub>	-
Current Measurement	1500 A <sub>dc</sub>	-
Altitude class	AX	EN 50125-1
Air temperature class	TX	EN 50155, for electronic equipment
EN 50125-1, for other equipment	≤ 75%	EN 50125-1
Humidity yearly average	≤ 75%	EN 50125-1
Pollution degree	UP to PD4	EN 50124-1
Vibration and shock Category/Class	1/A	EN 61373
Overtoltage category	OV4	EN 50124-1
Enclosure protection degree	IP67	defined in EN 60529
Auxiliary power supply	Supply from catenary	-
Maximum power consumption (average)	15 W	-
Energy Calculation Accuracy	1%	-

The centralised Energy data collection allows to perform off line analysis, which could be used to establish fleet strategy usage. Data collection and visualisation are realized by a WEB Service Application CITYLogic.

Thanks to the reduced dimensions CITYMeter can easily be installed on the roof, close to the pantograph. In case of rolling stock fed by third rail, the CITYMeter enclosure protection degree and the mechanical design allow the underframe installation.



# ECOSystem Network

## THE NEED TO MEASURE

Three simple questions:

How to achieve the best improvement of rolling stock energy consumption?

How is it possible to develop an approach to eco-driving without a system of measurement and control?

How it is possible to integrate energy measurement with train control functions?

**EcoSystem** is a comprehensive, flexible and scalable solution that can be used as a simple solution for the implementation of the energy measuring function and its billing as well as being deployed in support of traction control functions.

**EcoSystem** allows the realization of integrated solutions that simplify the design and the installation on both new trains and existing fleets with the result of saving space and weight.

Conclusions: Yes, we can! All is possible with only one supplier interface.

**ICOM ASSIST**



DRIVER - ADVISORY - SYSTEM (DAS)



**ICOM MONITOR**



CONDITION BASED - MAINTENANCE

- MEASUREMENT
- TRANSDUCERS
- DATA COMMUNICATION
- ENERGY CALCULATION
- DHS (Data Handling System)
- TCM INTERFACE
- DCS (Data Collection Service)
- MMI MONITOR
- DIAGNOSTIC & MAINTENANCE

**Maximum Flexibility in Structuring and Customizing the EMMS System**

**All Subsystems are Developed and Manufactured in House**

**Fully Compliant to EN50463**

### ECOMeter



- VOLTAGE & CURRENT MEASUREMENT (VMF - CMF)
- ENERGY CALCULATION (ECF)

### ECOBox



- ANALOGUE OUTPUTS EN50463
- TCMS INTERFACES
- CUSTOM INTERFACES

### ECOCom



- DATA HANDLING (DHS)
- DATA COMMUNICATION (UMTS, GSM-R, Wi-Fi, LAN, CAN)

### ECOLogic



- DATA COLLECTION SYSTEM (DCS)
- ECOSYSTEM DIAGNOSTIC AND MAINTENANCE

### ECOModule



- VOLTAGE & CURRENT SENSOR INTERFACE
- ENERGY CALCULATION (ECF)
- DATA HANDLING (DHS)
- TCMS INTERFACES
- TOUCH MMI INTERFACE

# ECOMeter

## GENERAL CHARACTERISTICS

The **ECOMeter** is a meter device which measures the consumed and regenerated active or reactive energy of a traction unit on one hand and allows transferring information about the line voltage and the line current to the traction control unit (TCU) on the other hand through an expansion box (**ECOB**ox).

The device provides the detection of the type of catenary voltage system. It can be used on railway vehicles which operate in AC 25 kV 50 Hz, AC 15 kV 16.7 Hz, DC 3 kV, DC 1.5 kV and DC 750 V voltage systems.

The line voltage and the line current are measured and the energy value are calculated in compliance with EN 50463-2. According to EN 50463 these functionalities are called voltage measurement function (VMF), current measurement function (CMF) and energy calculation function (ECF). The combination of these three functions is called energy measurement function (EMF). All these functions are integrated in the device.



Parameter	Value	Remarks
Altitude class	AX	EN 50125-1
Air temperature class	TX	EN 50155, for electronic equipment
EN 50125-1, for other equipment	CAN: Standard compliant ISO 11898	EN 50125-1, for other equipment
Other data sources	CAN: Standard compliant ISO 11898	CAN: Standard compliant ISO 11898
Humidity yearly average	≤ 75%	EN 50125-1
Pollution degree	UP to PD4	EN 50124-1
Vibration and shock Category/Class	1/A	EN 61373
Overvoltage category	UP to OV4	EN 50124-1
Enclosure protection degree	IP67	defined in EN 60529
Auxiliary power supply	16,8 ÷ 137,5 V <sub>DC</sub>	-
Maximum power consumption (average)	15W	-

The energy data is transferred via a digital interface to a data handling system (DHS) to create and storage the Compiled Energy Billing Data (CEBD).

The device provides a digital fiber optic communication to the expansion box in order to elaborate and convert the measured data according to the requested traction control unit interface with a negligible delay time.

The main feature of the device is the high accuracy in measurement and the high insulation degree between Low Voltage and High Voltage side. The device is characterized by very low energy consumption.

The device is suitable for railway rolling stock application, designed to be installed on the roof close to the pantograph.

Configuration Description	Catenary Range	Output ports	Output Data
 <p><b>ECOMeter VI-170:</b> - Function: VMF, CMF and ECF - Max Peak voltage: 170 kV - Weight: 40 kg</p>	<p>25 kV<sub>AC</sub> (OV4; PD4) 15 kV<sub>AC</sub> 3 kV<sub>DC</sub> 1500 kV<sub>DC</sub> 750 V<sub>DC</sub></p>	<p>O.F. Communication</p> <p>1 RS485</p> <p>1 RS485 for TCU</p> <p>Ethernet communication</p> <p>Digital outputs</p>	<p>Catenary detection</p> <p>Catenary codification</p> <p>Voltage: instantaneous</p> <p>Current: instantaneous</p> <p>Energy calculation (ECF)</p> <p>Energy data accumulation (max. 1 minute)</p>
 <p><b>ECOMeter VI-125:</b> - Function: VMF, CMF and ECF - Max Peak voltage: 125 kV - Weight: 35 kg</p>	<p>25 kV<sub>AC</sub> (OV3; PD3A) 15 kV<sub>AC</sub> 3 kV<sub>DC</sub> 1500 kV<sub>DC</sub> 750 V<sub>DC</sub></p>		
 <p><b>ECOMeter DC-F:</b> - Function: VMF, CMF and ECF - Max Peak voltage: 30 kV - Weight: 20 kg</p>	<p>3 kV<sub>DC</sub> 1500 kV<sub>DC</sub> 750 V<sub>DC</sub></p>		<p>Overcurrent detection</p> <p>Harmonic alarm detection</p>
 <p><b>ECOMeter-V 170:</b> - Function: VMF, CMF and ECF - Max Peak voltage: 170 kV - Weight: 30 kg</p>	<p>25 kV<sub>AC</sub> (OV4; PD4) 15 kV<sub>AC</sub> 3 kV<sub>DC</sub> 1500 kV<sub>DC</sub> 750 V<sub>DC</sub></p>		<p>Catenary detection</p> <p>Catenary codification</p>
 <p><b>ECOMeter-V 125:</b> - Function: VMF, CMF and ECF - Max Peak voltage: 125 kV - Weight: 25 kg</p>	<p>25 kV<sub>AC</sub> (OV3; PD3A) 15 kV<sub>AC</sub> 3 kV<sub>DC</sub> 1500 kV<sub>DC</sub> 750 V<sub>DC</sub></p>		<p>Voltage: instantaneous</p>

# ECOBox

## GENERAL CHARACTERISTICS

The **ECOBox** is a device interfaced to the **ECOMeter** that collects in real time the catenary voltage and current and provides an interface to different vehicle functional systems.

The **ECOBox** provides signals for the traction control module, the energy measurement function, vehicle communication system and any vehicle function that use the information coming from the catenary.

The **ECOBox** is an high level customizable component. It can be configured according to the specific Customer requirement and provides several different interfaces.

Different types of outputs are available: analog outputs configurable as number of ports available and type of analog signals, clean contacts digital outputs, serial communication, Ethernet communication, any other output input type under specific request.



## FUNCTION

- 4 current or voltage Analog output
- 6 relay outputs (nc/no) configurable
- Power supply
- Digital input/output at battery level
- Ethernet network interface
- RS485/RS232 network interface vehicle logic or other devices
- Diagnostic and signaling external led
- Diagnostic and signaling vehicle diagnostic
- Enclosure protection degree
- Auxiliary power supply
- Maximum power consumption (average)

## OPTIONS

- Up to three additional outputs boards (4 analog outputs + 6 relay outputs each)\*
- General purpose LVDS, I2C and SPI bus for expansion board\*
- GMS-R\*

\* Option

Diagnostic led are present in the front panel to show information about the component operative status and the devices connect to it (example the **ECOMeter**).

Advanced functionalities like harmonics calculation and over voltage or overcurrent can be implemented by an additional SW application. The SW can be upload or updated just connecting the unit to a PC or from remote if available the communication unit **ECOCom**.

The compact design and easy installation simplify the integration in the vehicle.



Parameter	Value	Remarks
Altitude class	AX	EN 50125-1
Air temperature class	TX	EN 50155, for electronic equipment
EN 50125-1, for other equipment	CAN: Standard compliant ISO 11898	EN 50125-1, for other equipment
Humidity yearly average	≤ 75%	EN 50125-1
Pollution degree	PD1	EN 50124-1
Vibration and shock Category/Class	1/A	EN 61373
Overvoltage category	OV1	EN 50124-1
Enclosure protection degree	IP50	defined in EN 60529
Maximum weight	3,5 kg	-
Auxiliary power supply	16.8 ÷ 137.5 V <sub>DC</sub>	-
Maximum power consumption (average)	30 W	-

# ECOCom

## GENERAL CHARACTERISTICS

The **ECOCom** is a Data Handling System (DHS) that integrates the capacity to handle not only the energy consumption data for the billing purpose but can be also use a gateway to support other systems like DAS, CBM and data transfer in general.

A digital communication port, Ethernet or Serial, is used to connect the Energy Measurement Unit (ECF) that provides the energy data.

The energy data transferred to the DHS is used to create and storage Compiled Energy Billing Data (CEBD).

The Compiled Energy Billing Data is prepared and submitted to the ground systems that deal with the management of energy consumption.

The integrated wireless connectivity offered by the DHS, provides the time information and geographic location.



## FUNCTION

- 4 current or voltage Analog output
- 6 relay outputs (nc/no) configurable
- Power supply
- Digital input/output at battery level
- Ethernet network interface
- RS485/RS232 network interface vehicle logic or other devices
- Diagnostic and signaling external led
- Diagnostic and signaling vehicle diagnostic
- Enclosure protection degree
- Auxiliary power supply
- Maximum power consumption (average)

## OPTIONS

- Up to three additional outputs boards  
(4 analog outputs + 6 relay outputs each)\*
- General purpose LVDS, I2C and SPI bus for expansion board\*
- GMS-R\*

\* Option

The storage capacity allows to have additional space that can be used by other equipment on board which require data storage and data transmission.

The DHS implements mechanisms of protection and security able to ensure both the integrity of the transmitted data to ground systems and the management of data loss due to lack of connectivity.

The configuration software allows easily to configure the communication parameters and vehicle data.

The compact design and easy installation simplify the integration in the vehicle.



Parameter	Value	Remarks
Altitude class	AX	EN 50125-1
Air temperature class	TX	EN 50155, for electronic equipment
EN 50125-1, for other equipment	CAN: Standard compliant ISO 11898	EN 50125-1, for other equipment
Other data sources	CAN: Standard compliant ISO 11898	CAN: Standard compliant ISO 11898
Humidity yearly average	≤ 75%	EN 50125-1
Pollution degree	PD2	EN 50124-1
Vibration and shock Category/Class	1/A	EN 61373
Overvoltage category	OV2	EN 50124-1
Enclosure protection degree	IP54	defined in EN 60529
Maximum weight	5 kg	-
ECF Active energy/Reactive energy	0.5R/1.0R	-
Auxiliary power supply	16.8 ÷ 137.5 V <sub>DC</sub>	-
Maximum power consumption (average)	15 W	-

# ECOModule

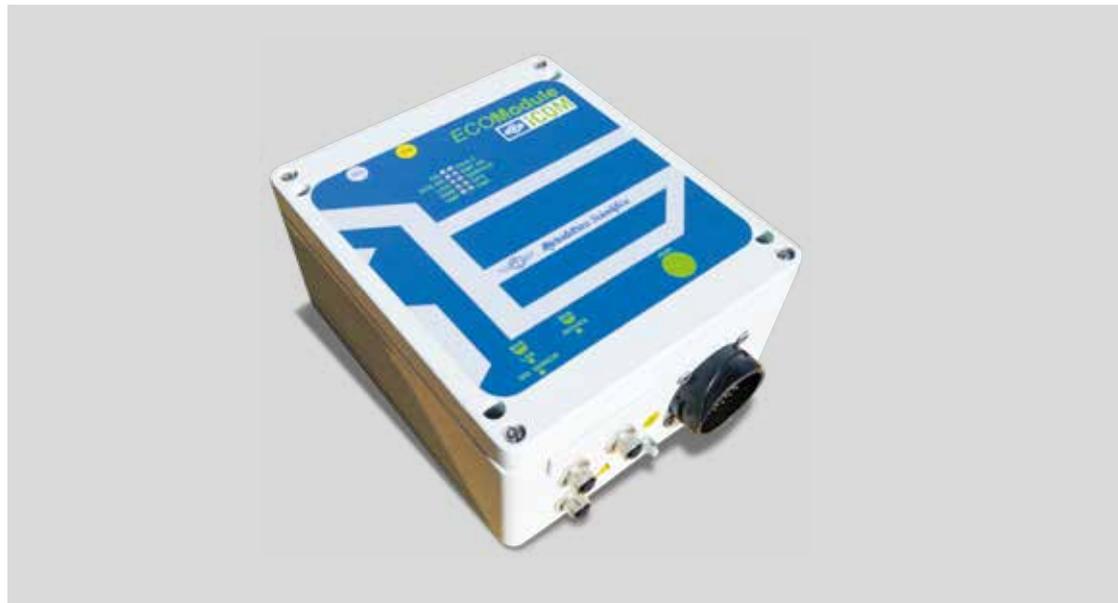
## GENERAL CHARACTERISTICS

The **ECOModule** is a device that integrates the analog signal metering, the Energy Calculation Function (ECF) and the Data Handling System (DHS) in the same compact unit.

The energy value are calculated on the base of the line voltage and the line current measured by dedicated external sensors. The energy data is transferred to the DHS to create and storage Compiled Energy Billing Data (CEBD).

The Compiled Energy Billing Data is prepared and submitted to the ground systems that deal with the management of energy consumption.

The integrated wireless connectivity offered by the DHS, provides the time information and geographic location.



## FUNCTION

- 6 Analog input for Current and Voltage sensors
- RS485 for **ECOMeter** digital sensor
- Power supply
- Digital input/output at battery level
- Ethernet network interface
- CAN network interface vehicle logic or other devices
- RS485/RS232 network interface vehicle logic or other devices
- GPS time and position
- GSM/UMTS/up to LTE (internal or external multiband Antenna)
- SIM card reader for mobile network double SIM card holder
- Diagnostic and signaling external led
- Diagnostic and signaling vehicle diagnostic

## OPTIONS

- MVB network interface EMD\*
- WiFi network interface external or Internal WiFi antenna\*
- Configuration and parameters memory external memory device\*
- Temporary Storage or service interface USB keys or maintenance PC\*
- LVDS and HDMI interface for TFT display or external monitor\*
- Resistive and capacitive touch screen interface\*
- Camera interface\*
- Audio interface\*
- General purpose LVDS, I2C and SPI bus for expansion board\*
- GMS-R\*

\* Option

The storage capacity allows to have additional space that can be used by other equipment on board which require data storage and data transmission.

The DHS implements mechanisms of protection and security able to ensure both the integrity of the transmitted data to ground systems and the management of data loss due to lack of connectivity.

The configuration software allows easily to configure the analog inputs allowing the usage of the same PN to several different vehicle configurations.



Parameter	Value	Remarks
Altitude class	AX	EN 50125-1
Air temperature class	TX	EN 50155, for electronic equipment
EN 50125-1, for other equipment	CAN: Standard compliant ISO 11898	EN 50125-1, for other equipment
Other data sources	CAN: Standard compliant ISO 11898	CAN: Standard compliant ISO 11898
Humidity yearly average	≤ 75%	EN 50125-1
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Enclosure protection degree	IP54	defined in EN 60529
Maximum weight	5 kg	-
ECF Active energy/Reactive energy	0.5R/1.0R	-
Auxiliary power supply	16.8 ±137.5 V <sub>DC</sub>	-
Maximum power consumption (average)	15 W	-

# Thepsys

## GENERAL CHARACTERISTICS

Thepsys is a device that has a diagnostics function able to detect power supply failure or thermocouple break. The main feature of the device is the galvanic insulation between HV and LV sections, made by means of a transformer (insulation level, 15 kV-50 Hz-60 s) which feeds the HV section and transmits the signal (proportional to the temperature) to the low voltage section via an optical channel; the signal is then elaborated in order to drive the various outputs foreseen.



## FUNCTION

Thepsys functions are highly customizable according to our customer needs as well as suggestions derived from our experience.

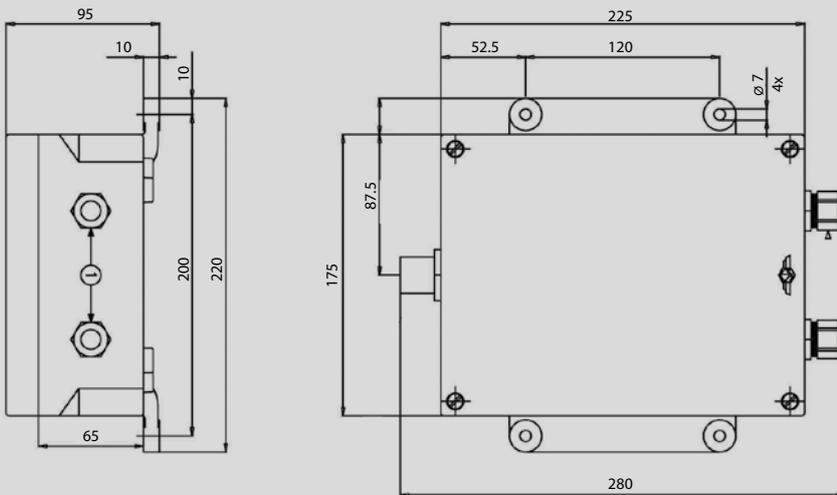
- Measured temperature
- Diagnostic relay contact
- Alarm relay contact
- Analog output

## ENVIRONMENTAL PERFORMANCE

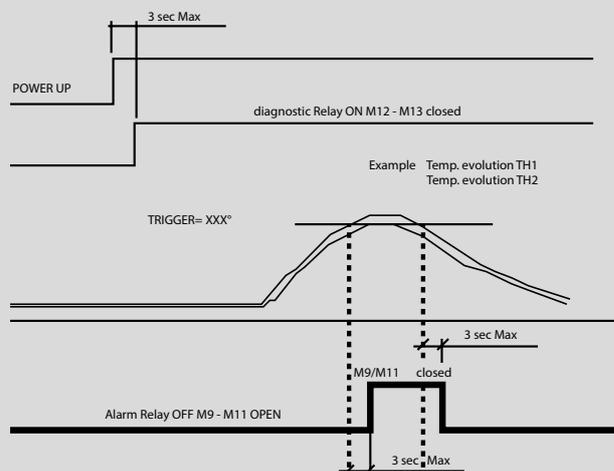
The device is compliant with all regulations of the rail market. All the components are homologated for the industrial temperature range (from -40°C to +85°C - Class TX - EN 50125-1) and ensure a proper working in the worst environmental conditions. The precision is 1% on the whole TX range; 0.5% at 23°C.

Storage temperature	from -40°C to +85°C
Class of air temperature (EN 50125-1)	TX (from -40°C to +85°C)
Class of altitude range (EN 50125-1)	A1 (up to 1400 m)
Maximum Relative humidity at 40°C	95%
Protection level for terminal box (EN6 0529)	IP 66
Shock and vibrations	EN 61373 Shock and vibrations
Consumption	8 W typically
Measurements range	0°C to 1000°C
Thermocouple accuracy	± 1% over max scale 1000°C
Measurements accuracy	30°C
Analogic output accuracy	Class 1
Battery supply	24 V - 72 V - 110 V
Weight	3 kg

Overall Dimensions (mm)



Functional Scheme



# AF/LA Series

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.

## Applications

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Aircoolers

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Heat exchangers/Radiators

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

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Naval

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Ventilation and Air Conditioning Plants

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LA



**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, 50/60 Hz, 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



Series	Diameter [mm]	Air Flow	Pressure	Power [kW]
AF	400 ÷ 2400	up to 400,000 mc/h	up to 1500 Pa	0.55 ÷ 90
LA	310 ÷ 800	up to 35,000 mc/h	up to 800 Pa	0.25 ÷ 7.5

# AFH Series

High quality, no-compromise products for applications requiring a guaranteed and reliable component providing high pressures and precise air flows. They are most suitable for applications which require the fan to be a critical part of the system both in terms of performance and reliability. They are used in different applications such as power generation, railway, naval, cement and are always characterized by the demanding and critical nature of the service. Direct coupling solutions with motors from 2 to 8 poles are available, as well as belt-driven solutions for all cases in which it is convenient to decouple the motor from the impeller for service or maintenance. Only top quality components, sized by COMET according to criteria based on 15 years of experience and many industrial applications, are used for the manufacturing of these units. Detailed aerodynamic studies are the basis of the design of the "AFH".

Series fans, which feature key characteristics for use in critical applications:

- Above average pressures and air flows
- Reduced dimensions
- Moderate noise
- High reliability
- Cost effective solution

The "AFH" Series is the ideal choice when looking for a high performance product of superior quality.

## Applications

- Brake resistors
- Heat exchangers/radiators
- Gas turbine enclosures
- Forced ventilation
- Traction motors



**GENERAL CHARACTERISTICS**

- Impellers with high-efficiency, low-noise aerofoil type blades, in aluminium alloy
- Three-phase motors IP55/IP65, with Class F or H insulation, 50/60 Hz, suitable for inverter supply
- Casings in carbon steel, electro-welded, with anti-corrosive finishing by hot-dip galvanization
- Single or double array of fixed vanes for performance increase, optimized for the application

Wide range of ancillary parts and customizations.

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

Double-stage or double-impeller solutions for higher performances are available upon request.

Series	Diameter [mm]	Characteristics	Pressure	Power [kW]
AFH	360 ÷ 1800	Direct drive	up to 2800 Pa (single stage)	0.55 ÷ 90
			up to 4000 Pa (double stage)	
AFTH	630 ÷ 1800	Belt drive	up to 2500 Pa (single stage)	1.5 ÷ 55



# Centrifugal fan units

COMET's centrifugal fan Series are mainly intended for use in critical applications where guaranteed performance and high reliability are required.

The production range includes several types of fans and Series of impellers, based upon our wide know-how in the design and manufacturing of dedicated and engineered fan solutions. All COMET's centrifugal units have been designed to reach high levels of reliability and versatility, and they are characterized by a compact design and wide possibilities of customization.

Impellers with straight, curved and profiled blades are available on all types of centrifugal fans. Furthermore, carbon steel, stainless steel or aluminium, can be used for the manufacturing, in order to always offer the most suitable solution to the vast majority of environmental, mechanical and noise requirements.

COMET can also provide a wide range of ancillary parts and complete systems, which include filters, dampers, supporting frames, noise insulating systems, and more.

## Applications

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Heat exchangers/radiators

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Traction motors

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Transformers

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Converters

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Ventilation plants

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Filtration plants

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Double-Inlet Centrifugal



### GENERAL CHARACTERISTICS

- Impellers in carbon steel, stainless steel or alluminium, with straight, curved or profiled blades
- Three-phase motors IP55/IP65, with Class F or H insulation, 50/60 Hz, suitable for inverter supply
- Fan cowls in carbon steel or stainless steel, electro-welded
- Finishing by 3-layers epoxy-pack painting, certified for 500 hours salt mist test resistance

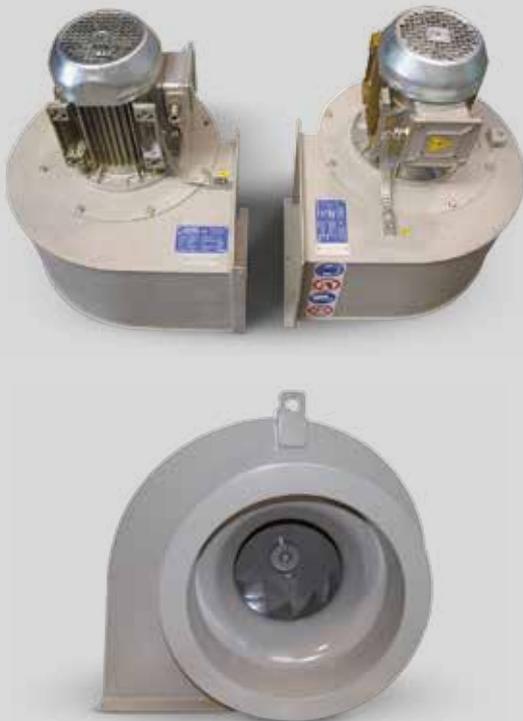
Wide range of ancillary parts and customizations.

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

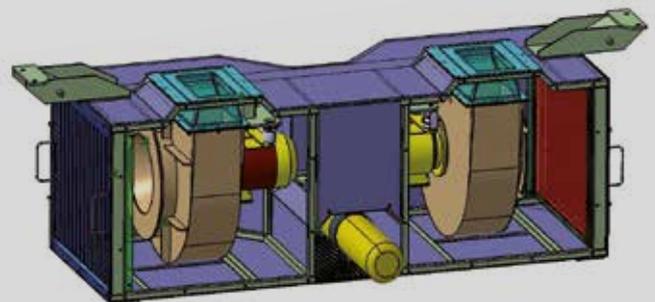
Double-inlet or double-impeller solutions are available upon request.

Series	Diameter [mm]	Characteristics	Pressure	Power [kW]
CCF	150 ÷ 700	Centrifugal with straight/ curved/profiled blades	up to 5000 Pa	0.18÷ 30

CCF



Complete Traction Motor Box



# OR/COR/ORV Series

Ideal products for applications requiring a very compact and high-performance solution, the open-running centrifugals (OR Series) eliminate some typical limits of the traditional centrifugal fans. The compact dimension and the absence of a preferential direction of the airflow make these fans very useful wherever high pressures must be generated in a small space and a 90° change of direction of the airflow is not recommended.

They are the optimal solution for the forced ventilation of limited environments (like boxes containing electrical or electronic equipments). ORV Series fans are fitted with a simplified housing to separate the motor from the flow generated by the fan (e.g. applications with air temperature higher than 60°C). Ready-to install and innovative, the COR Series features an extremely compact design, due to an exclusive fixation system of the electric motor. Derived from the technology of COMET's centrifugal fan units, the impellers used on OR/COR/ORV Series can be made of carbon steel, aluminum or stainless steel, with straight, curved or profiled blades.

## Applications

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Heat exchangers/radiators

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Traction motors

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Transformers

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Converters

---

Ventilation plants

---

CCF



**GENERAL CHARACTERISTICS**

- Three-phase motors IP55/IP65, with Class F or H insulation, 50/60 Hz, suitable for inverter supply
- Impellers in carbon steel, stainless steel or aluminium, with straight, curved or profiled blades
- Finishing by 3-layers epoxy-pack painting, certified for 500 hours salt mist test resistance
- Special motors and special fixation system for COR Series

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

Complete Traction Motor Box



Series	Diameter [mm]	Characteristics	Pressure	Power [kW]
OR	150 ÷ 500	Open-Running Centrifugal (Plug-Fan)	up to 3000 Pa	0.18 ÷ 22
COR	200 ÷ 500	Compact Open-Running Centrifugal, with fixing plate	up to 2500 Pa	0.37 ÷ 15
ORV	200 ÷ 500	Open-Running Centrifugal with simplified housing	up to 3000 Pa	0.55 ÷ 22

# CNX/MXF Series

Designed to combine the high pressure levels obtained by the centrifugal fans with the advantages of size and ease of installation given by the axials, the CNX and MXF Series are based on COMET's decades of experience in the design and production of high-performance axial fan units.

The CNX and MXF Series provide maximum pressures which are 50% higher than those of the correspondent axial, in their typical range of airflows. This is achieved with dimensions comparable to those of a conventional axial fan.

Besides the advantage in terms of performances, these products also offer distinct low-noise characteristics. Sound emissions are comparable to centrifugal units, allowing in many cases to avoid the use of silencers or reducing the impact of noise insulation systems.

This is offered together with the usual flexibility of design and construction which characterizes COMET's products, making them suitable for the most demanding applications and critical duties.

## Applications

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Traction motors

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Brake resistors

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Forced ventilation systems

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CNX



### GENERAL CHARACTERISTICS

Impellers in carbon steel, stainless steel or aluminium, with straight, curved or profiled blades

Three-phase motors IP55/IP65, with Class F or H insulation, 50/60 Hz, suitable for inverter supply

Casings in carbon steel or stainless steel, electro-welded

Finishing by 3-layers epoxy-pack painting, certified for 500 hours salt mist test resistance, or hot-dip galvanization

Single or double array of fixed vanes for performance increase, optimized for the application

Wide range of ancillary parts and customizations

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

CNX



Series	Diameter [mm]	Characteristics	Pressure	Power [kW]
CNX	400 ÷ 1400	Centr axial	up to 4500 Pa	1.5 ÷ 55
MXF	300 ÷ 800	Mixed-Flow	up to 4000 Pa	1.5 ÷ 45

# MicroBox

Roof or under-frame mounted boxes have been in use for years in rolling stock, each application however requires so far its specific design effort to fit the specific application.

The exhibit shown is a typical real example of the current generation of roof-mounted boxes. In particular the real specific application is used for 2 AC system with 2 traction windings each, while the exhibit shown is only half the real envelope for space limitations and contains therefore the components for 1 AC system.

The box contains change over switches, line contactors, pre-charge contactors, pre-charge resistors and a protection wire for fire detection and is designed for installation outside the train (roof mounted) and connects the traction transformer to the traction converter.

All current generation boxes suffer from some inevitable drawbacks as a direct consequence of the design activity required for each application to fulfil the requirements of the customer's specification. Non-recurring costs for the system integration activity, for the necessary prototypes, for validation tests are inevitable as well as a long time-to market.



**MicroBox EVO** is the new generation of roof or under-frame mounted boxes that, thanks to its innovative design allows to minimize the design time and achieve the following advantages:

- Reduced non-recurring costs and time-to-market, thanks to its physical and functional modularity

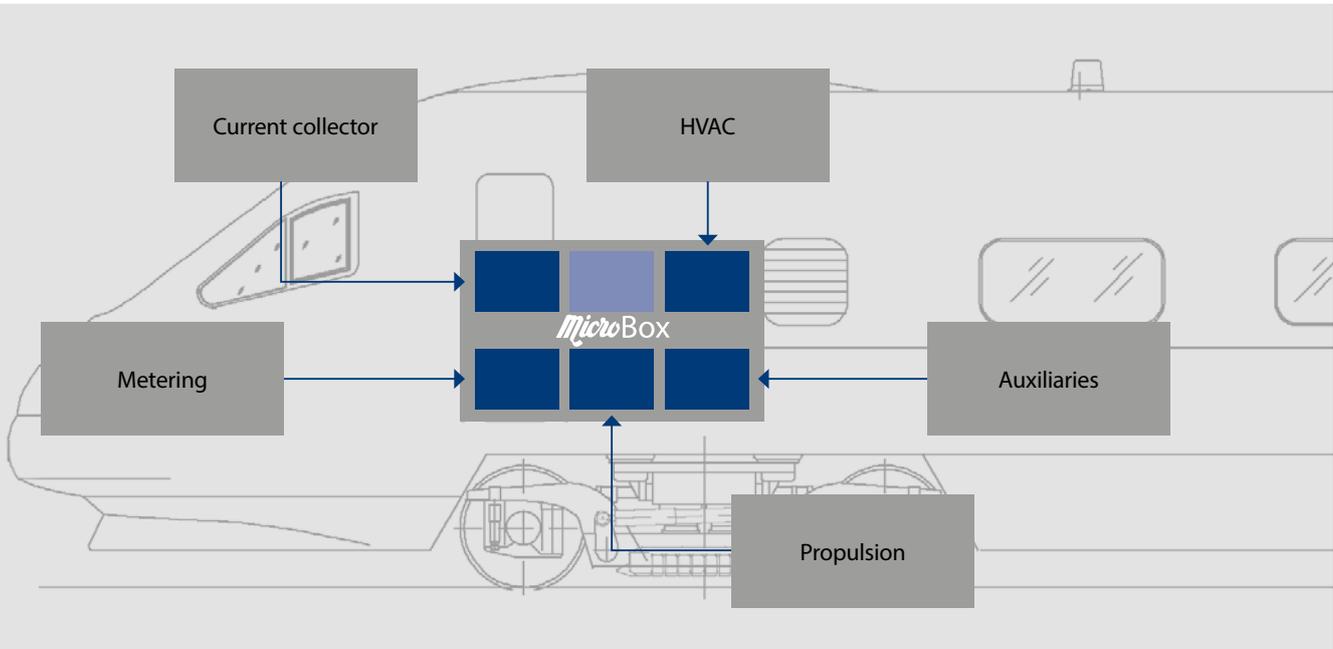
- Optimized product cost, thanks to an innovative solution for the metal sheet envelope

- Optimized components integration, thanks to Microelettrica Scientifica expertise matured on more than sixty years in the design and manufacturing of DC switches

**MicroBox EVO** innovative design concept, based on modular blocks and plug-in interfaces, allows easy customization to fit different rolling stock platform architectures.

**MicroBox EVO** is ready for the KB CONNECTED SYSTEMS, thanks to the optional remote control unit.

**MicroBox EVO** concept allows the Car Builder to concentrate its efforts on the preparation of the system functional specification and leave to Microelettrica the design and the supply of the complete system, fully tested and ready to be installed on board, both for AC and DC propulsion applications.



### MAIN FEATURES

- Use of new generation HV/MV Microelettrica components
- Deep expertise of HV/MV components at the service of a proven system engineering capability for a reliable integration
- Advanced diagnostics and connectivity for a powerful Condition Based Maintenance
- Standard functions and modular blocks to greatly reduce the time-to-market
- Compact size
- Easy maintenance with use of the plug-in blocks
- New MS welding-free structure technology
- High recyclability rate
- Electronic LV energy saving on all internal components

### SAFETY

- High protection level in harsh environmental conditions adopting solid metal enclosure to withstand worst climatic events, shock and vibrations and ensure a high insulation degree

### SYSTEM CONNECTION

- Integrated intelligent controller unit designed for the KNORR-BREMSE CONNECTED SYSTEMS
- Communication interfaces are Ethernet, CAN and MVB (option)
- Easy configuration thanks to specific device libraries for subsystems
- Support of the consist networks according to IEC 61375
- Integrated service tool accessible with conventional web browsers

### CATALOGUE OF MAIN FUNCTIONS

- Many applications can be covered by use of modular functions:
- Current collector, HVAC, Propulsion, Metering, Auxiliaries.

Microelettrica Scientifica S.p.A.  
20090 Buccinasco (MI) - Via Lucania 2 - Italy  
Tel. +39 02 575731 - Fax +39 02 57510940 - E-mail: [info@microelettrica.com](mailto:info@microelettrica.com)  
[www.microelettrica.com](http://www.microelettrica.com)



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