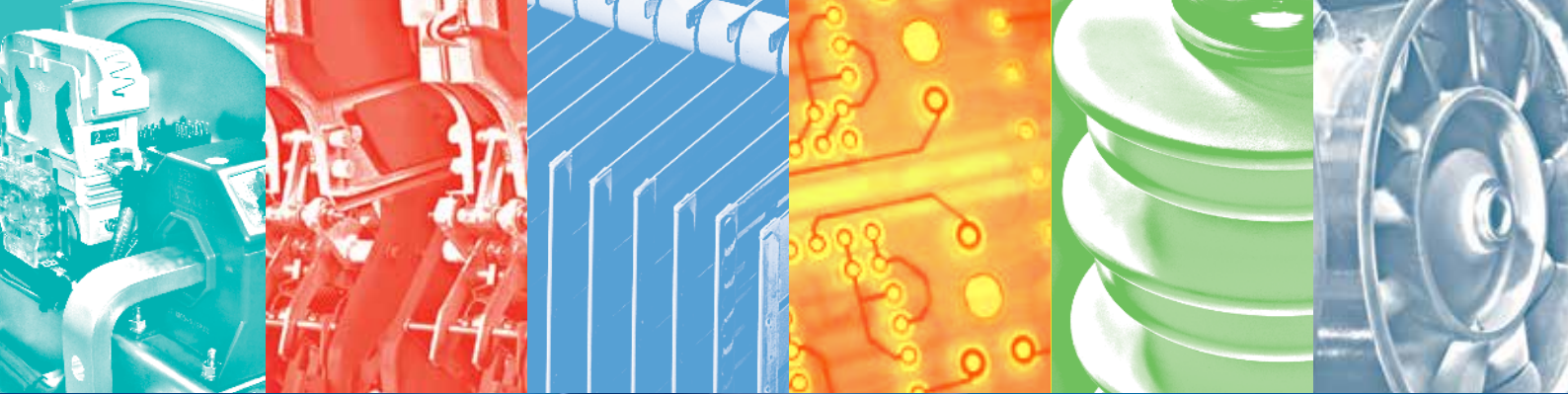


Rail Vehicles

Components for on-board application



Contactors
DC High Speed Circuit Breakers
Disconnectors
Resistors
Metering Systems
Fans



Microelettrica Scientifica



LRV/METRO

A low-medium power range of products covering from 600 to 2.000VDC specifically studied for all applications on board of LRV/ LRT, Monorail, Trolley busses or Metro vehicles.

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

EMU/HST

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

Applications

Switches and Disconnectors for traction and auxiliary converter

System Configuration Switches

High Speed Circuit Breaker (roof or under frame mounted)

Cab Heating Contactors

Brake Resistor

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 4.000VDC or the 15/25kV AC secondary side. Products are integrated in single or multi system locomotives.

Applications

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

Brake Resistor

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 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, Russia 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

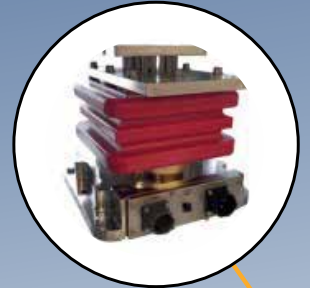
Meetering systems and Energy management

High Voltage Transducers

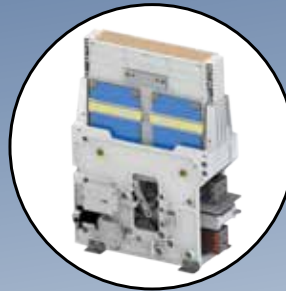
Fans

A tailored solution for every

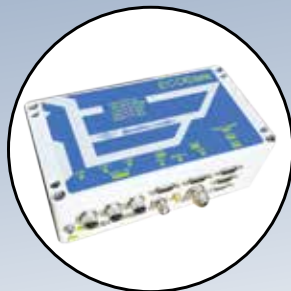
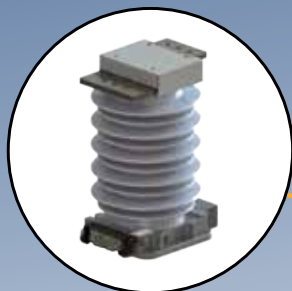
ECOMETER V



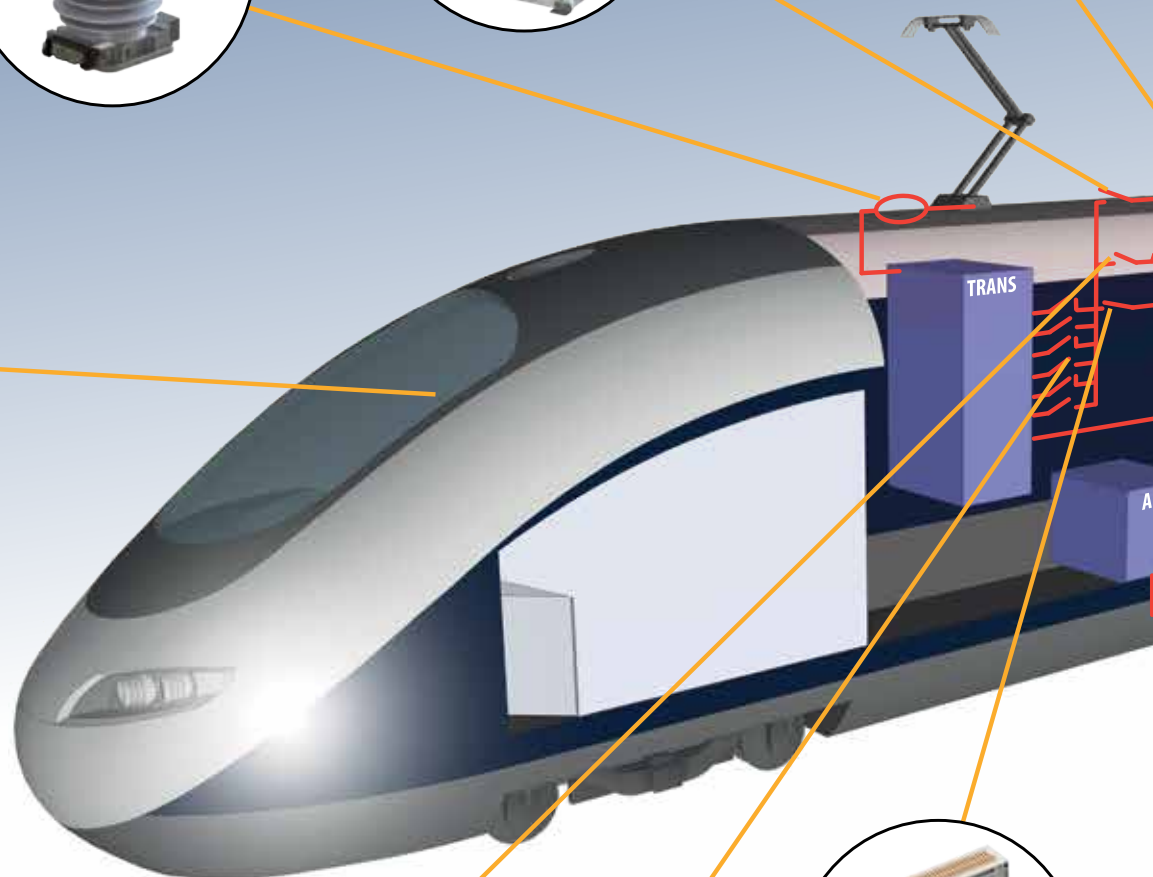
DC HSCB



ECOMETER VI



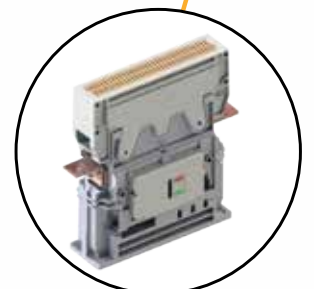
ECOCOM



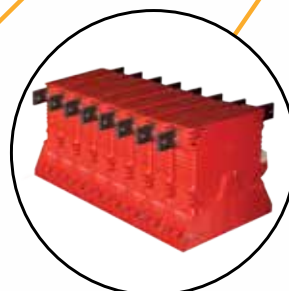
TRANS

A

LINE SWITCH



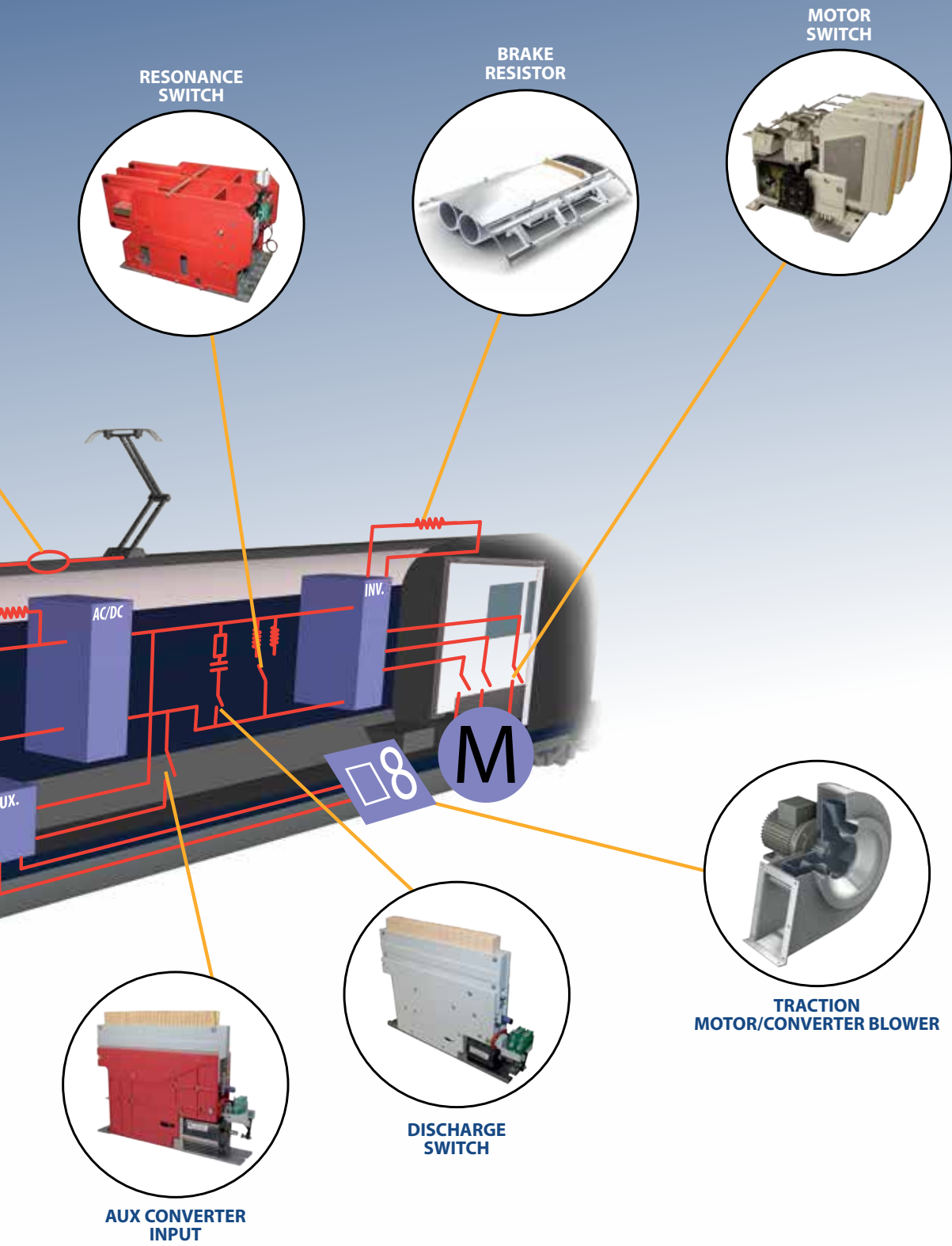
CONFIGURATION SWITCH



PRECHARGE CONTACTOR



traction component need



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

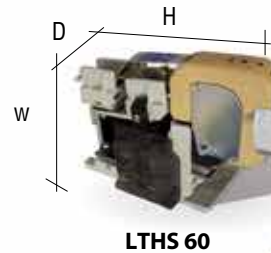
- Normally mounted on LTX Line
- 1 NO + 1 NC block version
- IP67 protection degree
- Double interrupting, self-cleaning, solid silver, snap action contacts

Switches



| Type | U _{max} [Vdc] | I _{th} [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 railway 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.

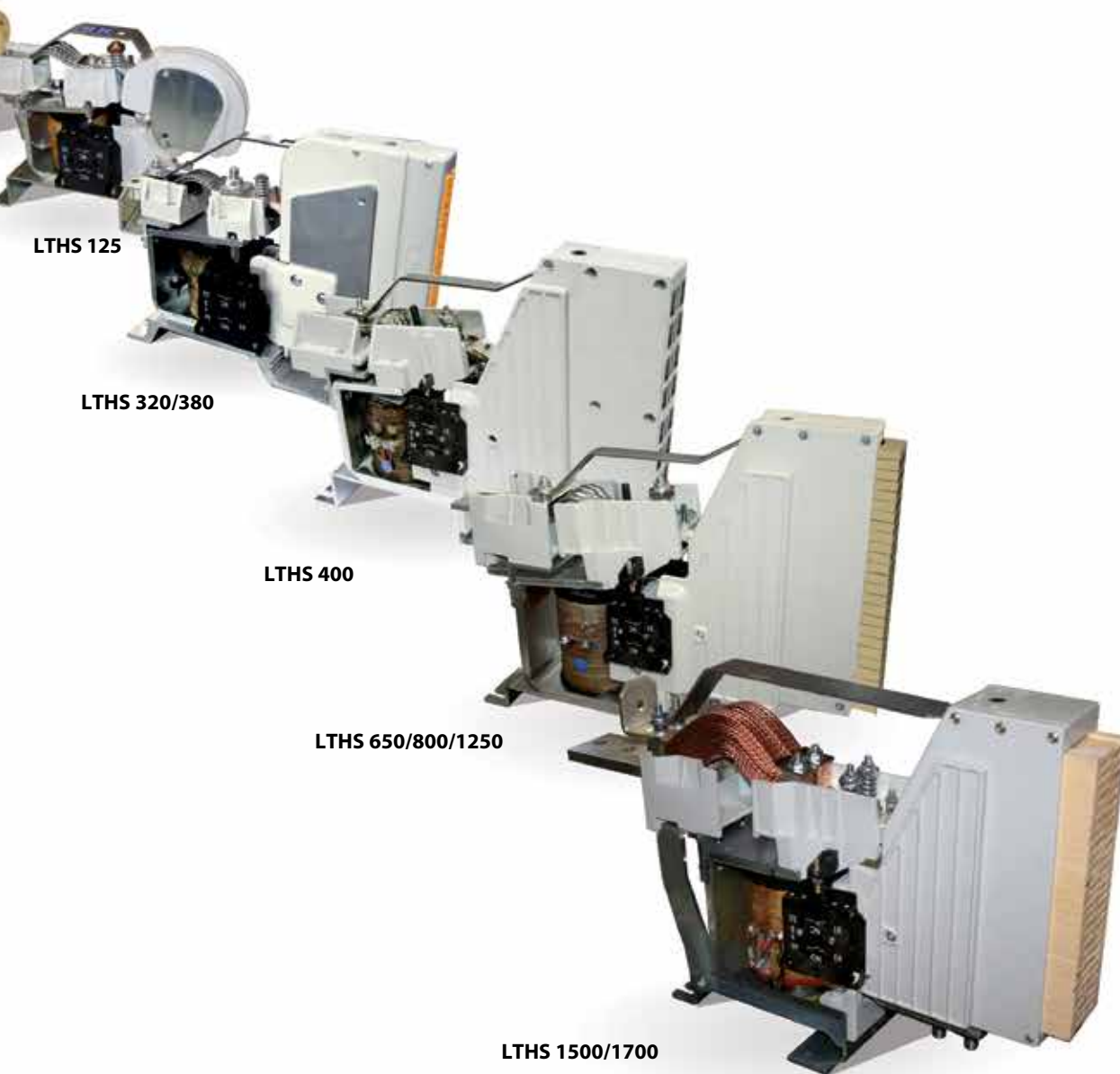
The DC control coil operates without economy resistor within a wide working range. A "varistor" cuts off the peak voltage when the coil is de-energized.

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 60077
- 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 _{max} [V _{AC/DC}] | I _{th} [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.

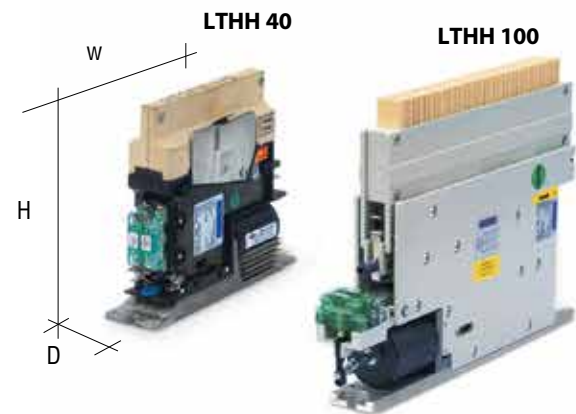
General Characteristics

- The most compact and modern heavy duty line
- Designed for on-board applications according to IEC 60077
- 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 _{AC/DC}] | 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 through 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 60077
- 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



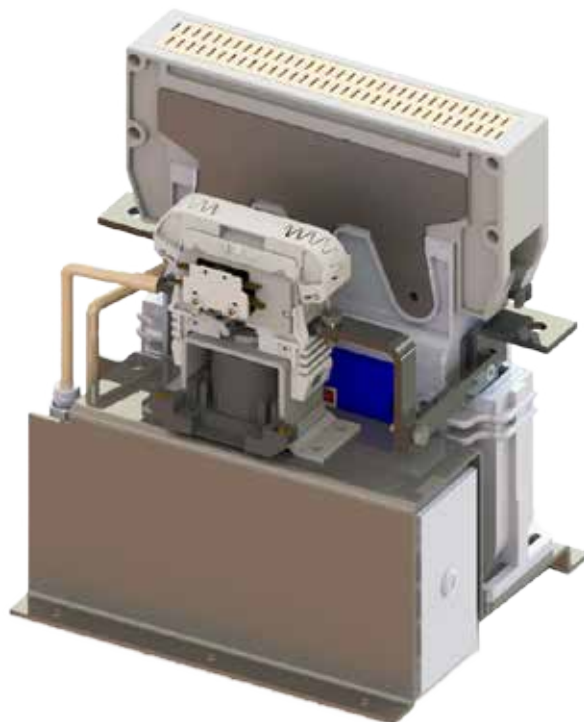
LTP 4-2000



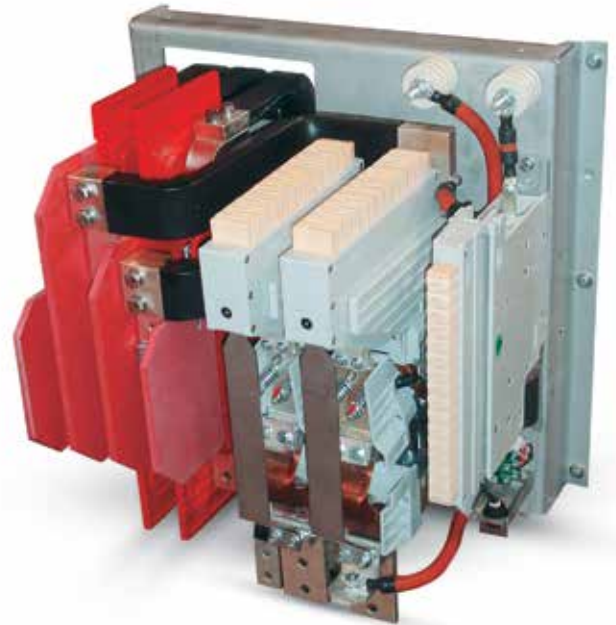
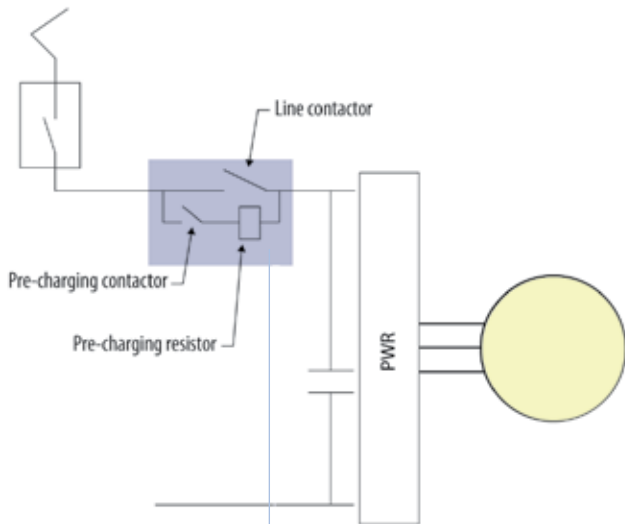
| Type | U _{max} [V _{AC/DC}] | I _{th} [A] | W [mm] | H [mm] | D1/D2 [mm] (1/2 poles) |
|------------|--|---------------------|---------------------|---------------------|---------------------------|
| LTHH 40 | 2000 | 60 | 200(D1)/244(D2) | 162.5(D1)/174.5(D2) | 48/106 |
| LTHH 100 | 4000 | 120 | 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/- |

Integrated Functional Units

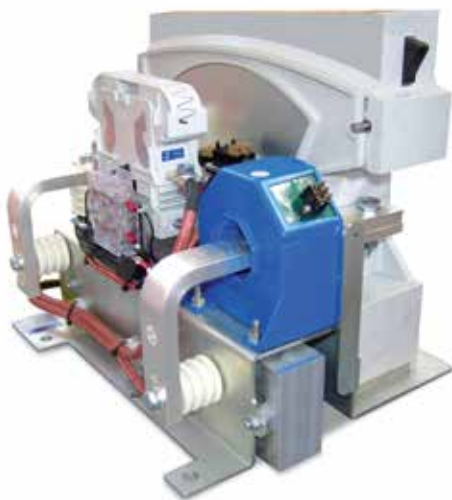
A key of Microelettrica Scientifica success is the ability to provide specific solutions to meet customers' requirements. One of these are IFUs: different Microelettrica Scientifica contactors and disconnectors are supplied already assembled on a structure. A several solutions have been supplied also 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.



Switches

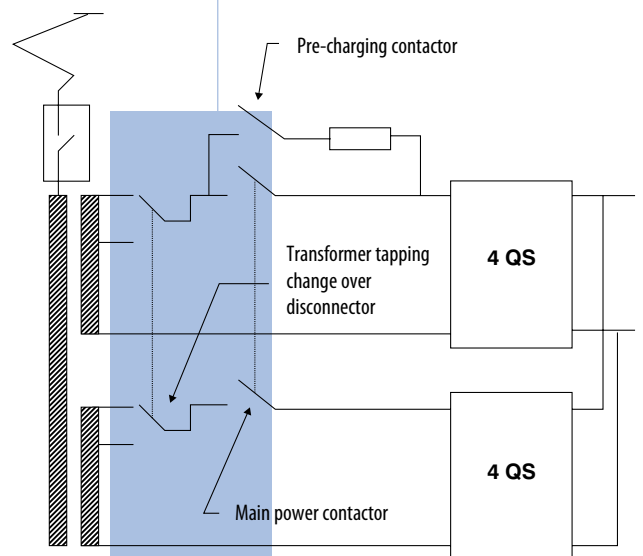


Main power and pre-charging contactors + change over disconnecter



Line and pre-charging contactor + pre-charging resistor

15kV 16.6Hz/25kV 50Hz





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.

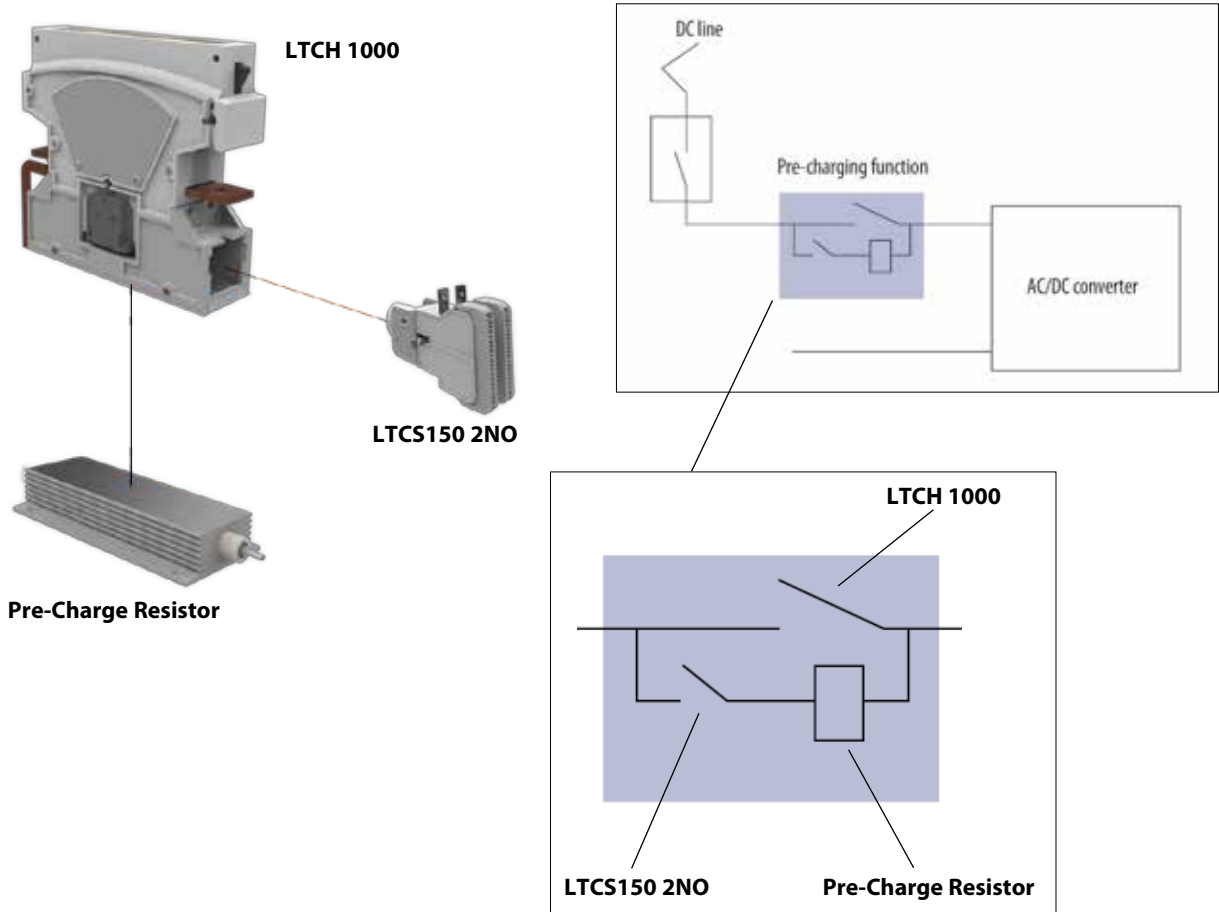
General characteristics

- The LTCH 1000 line contactor has a dedicated base-plate and works up to 2kV – 1000A
- The new LTCS 150 pre-charge contactor is available in 2 poles series connected configuration for applications up to 1kV or up to 2kV. 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

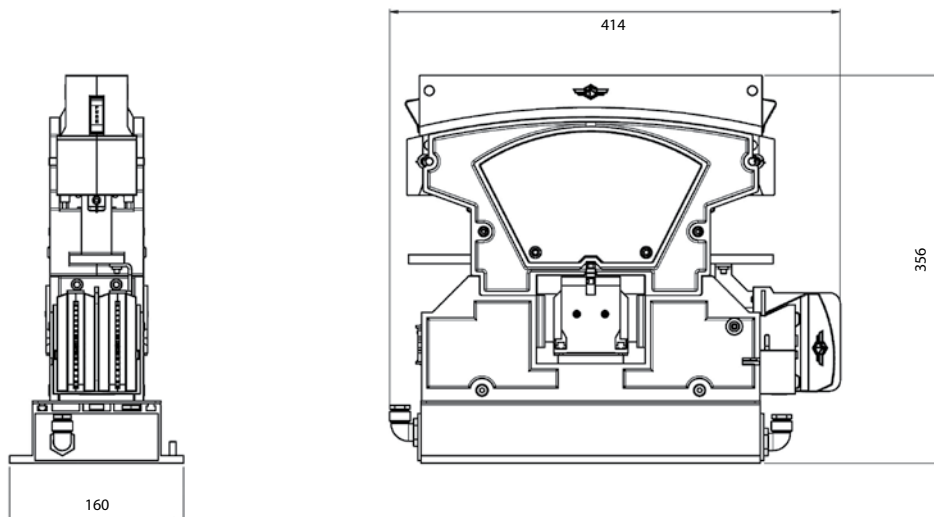
- The electrical connections are integrated so that the terminals are limited to “In” and “Out” only
- Excellent performances with reduced weight and volume
- Quick installation: common interface for HV and for LV
- Quick maintenance: low time to substitute all the system or the single components

Switches



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

Dimensions



IR3000V @ 900 V_{dc}IR3000V @ 1800 V_{dc}

IR3000V line

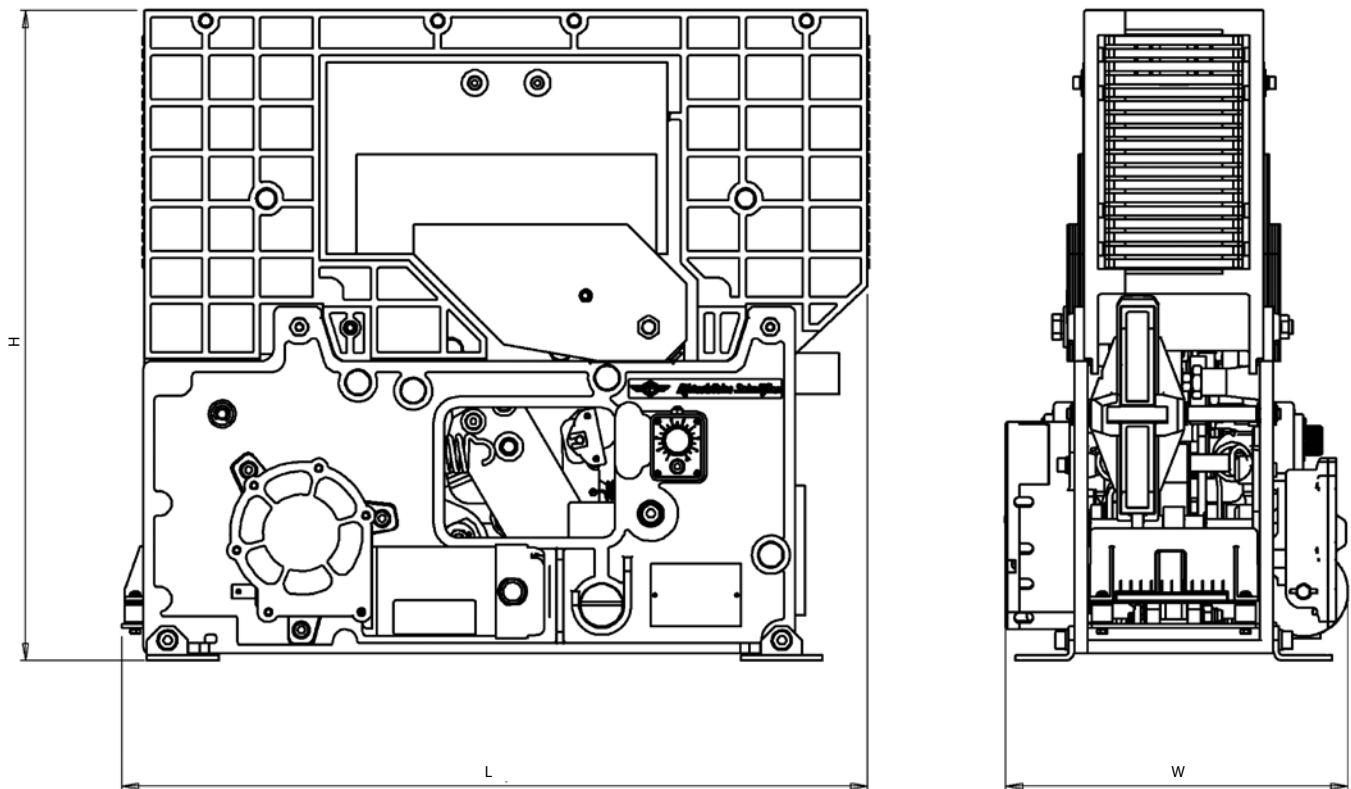
Applications

On the roof under frame

On board

The IR3000V series are single pole, magnetic blow out, trip free, air circuit breakers. The closing mechanism is an independent motor operated type. The IR3000V 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 arching contacts ensure a long duration in electrical life. The IR3000V is available in a IP45 plastic box or IP55 metallic box. The breaker conforms to EN60077.

HSCBs



| Type [V_{dc}] | U_{max} [V] | I [A] | W [mm] | H [mm] | L [mm] |
|-------------------|---------------|-------|--------|--------|--------|
| IR3015V @ 900 | 900 | 1500 | 250,5 | 395 | 546,5 |
| IR3015V @ 1800 | 1800 | 1500 | 250,5 | 478 | 546,5 |
| IR3030V @ 900 | 900 | 3000 | 250,5 | 395 | 546,5 |
| IR3030V @ 1800 | 1800 | 3000 | 250,5 | 478 | 546,5 |

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

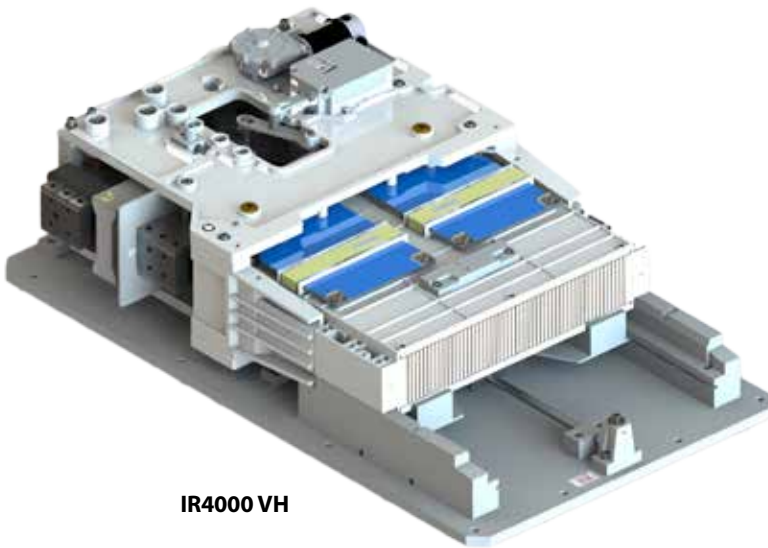
Standard Characteristics

- 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

| On Board application | | | | | Max Breaking current (kA/ms) according to IEC60077 | |
|----------------------|---------------|-----------------|----------------------------|--|--|--|
| | IR4000 V Line | Version | I _{th} (A) @ 75°C | U _e (Vdc) = 1800Vdc | U _e (Vdc) = 3600Vdc | |
| | IR4030VV18M | Very High Power | 3000 | 90 / 0 60 / 15 50 / 40 35 / 100 | - | |
| | IR4045VV18M | Very High Power | 4500 | - | - | |
| | IR4030VV36M | Very High Power | 3000 | - | 55 / 0 50 / 15 50 / 30 50 / 50 | |
| | IR4045VV36M | Very High Power | 4500 | - | - | |
| | IR4030VH18M | Very High Power | 3000 | 90 / 0 60 / 15 50 / 40 35 / 100 | - | |
| | IR4045VH18M | Very High Power | 4500 | - | - | |
| | IR4030VH36M | Very High Power | 3000 | - | 55 / 0 50 / 15 50 / 30 50 / 50 | |
| | IR4045VH36M | Very High Power | 4500 | - | - | |



IR6000V Roof Mounting

IR6000V line

Applications

Vehicles

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 1800/3600V).

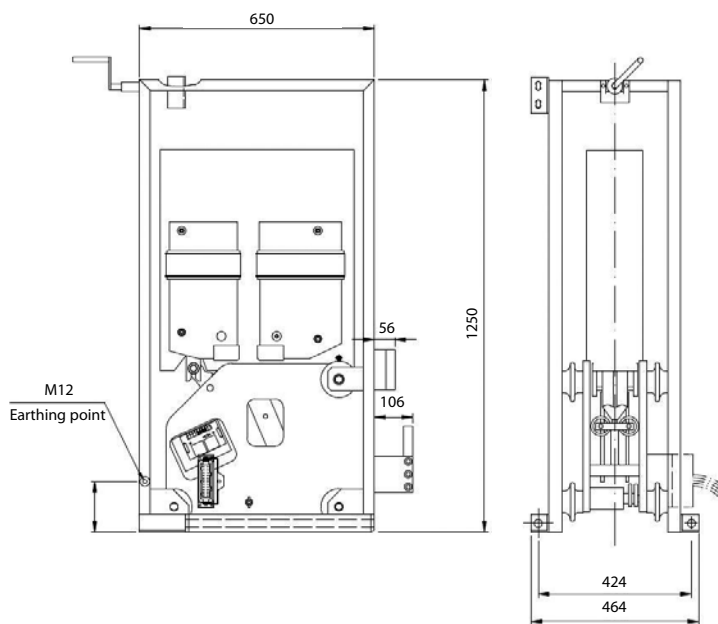
The breaker conforms to EN60077.

HSCBs

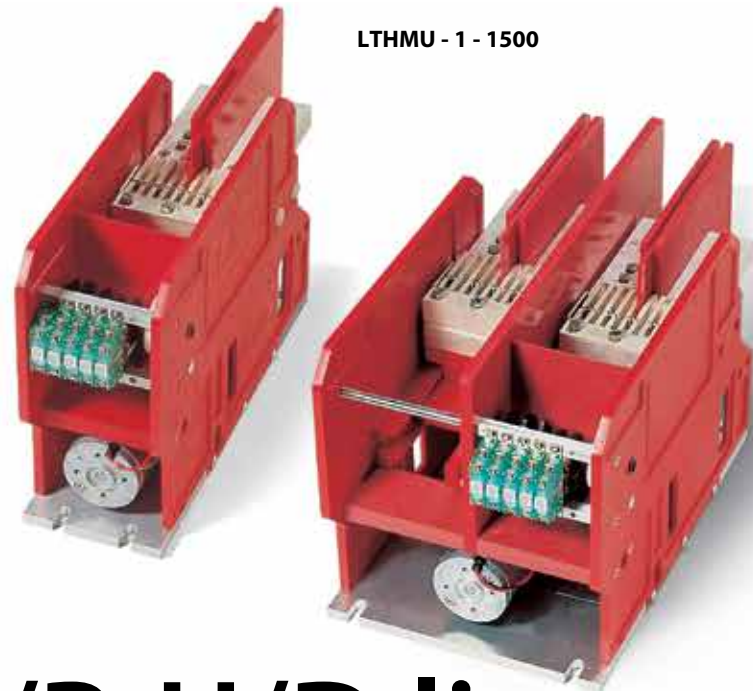


IR6000V Vertical

Overall Dimensions: mm



| Type | U _{max} [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 |



LTHMU - 1 - 1500

LTHM/P-U/D line

Applications

Traction circuit configuration change in multi-system locos

Isolation of power converter

Isolation of traction motors

Microelettrica Scientifica disconnectors, available both in electromotorized and in pneumatic versions, are designed to be employed in circuits up to 4kV. Their current ratings, up to 1500A 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 220kA). Microelettrica Scientifica's effort in designing a product range with reduced space outline, sturdy structure and a long mechanical life (over 100000 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

General Characteristics

- The long experienced heavy duty line for DC and AC applications up to 4000V
- On-board and stationary applications, 2 thermal current ratings per pole: 800 or 1500A
- 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

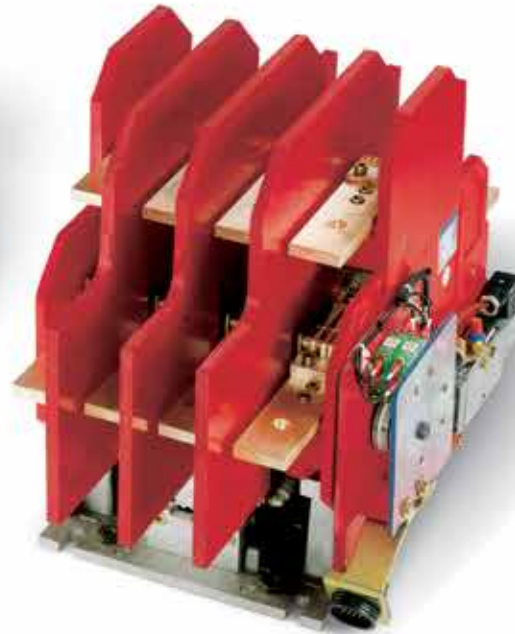
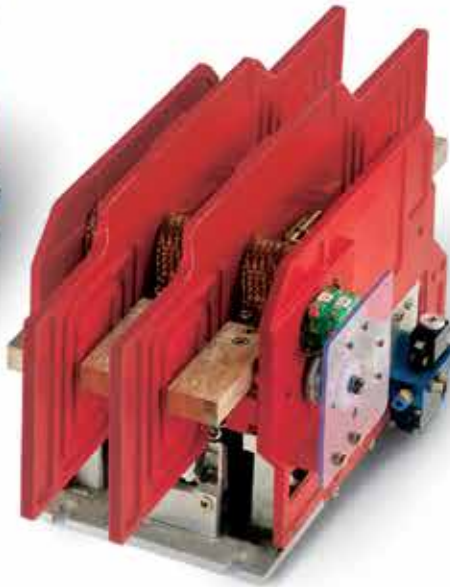
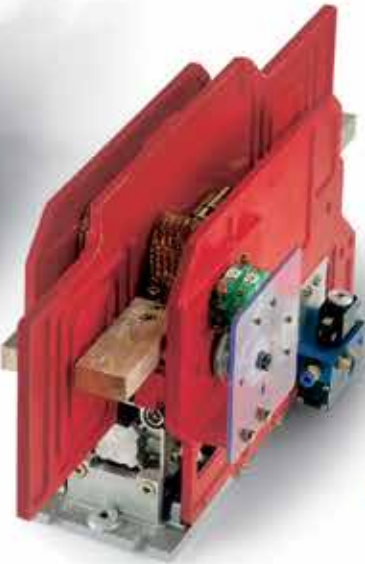
Switches

LTHMU - 2 - 1500

LTHPD - 2 - 1500

LTHPD - 3 - 800

LTHPD - 4 - 800 CO



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

| | | | | |
|-----|---|---|---|------|
| 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: Electromotorized (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)



LTMP line

Applications

Traction circuit configuration change
in multi-system locos

Isolation of power converter

Isolation of traction motors

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.

Switches

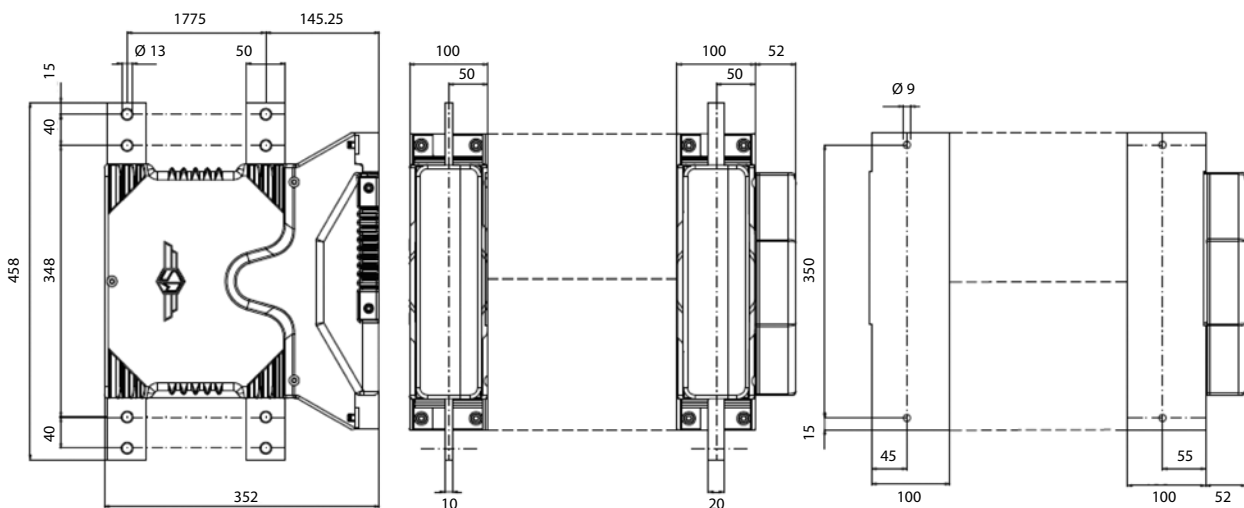
Main Features of each Pole:

- 2 versions: 1000 or 2000A thermal current
- 3 configurations: NO or NO+NC or CO
- Fully modular construction
- Electric motor actuated

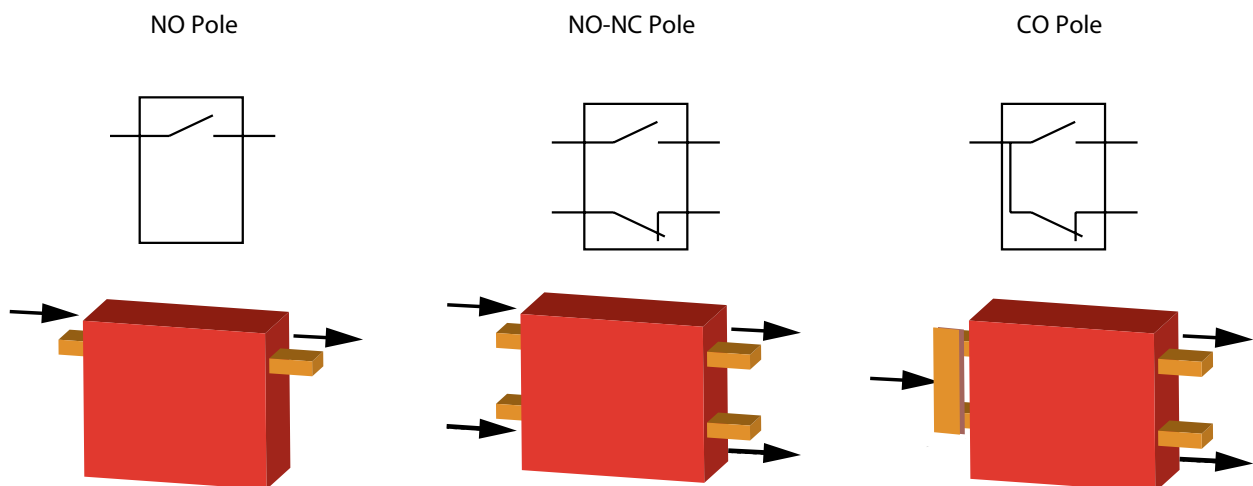
Technical Data

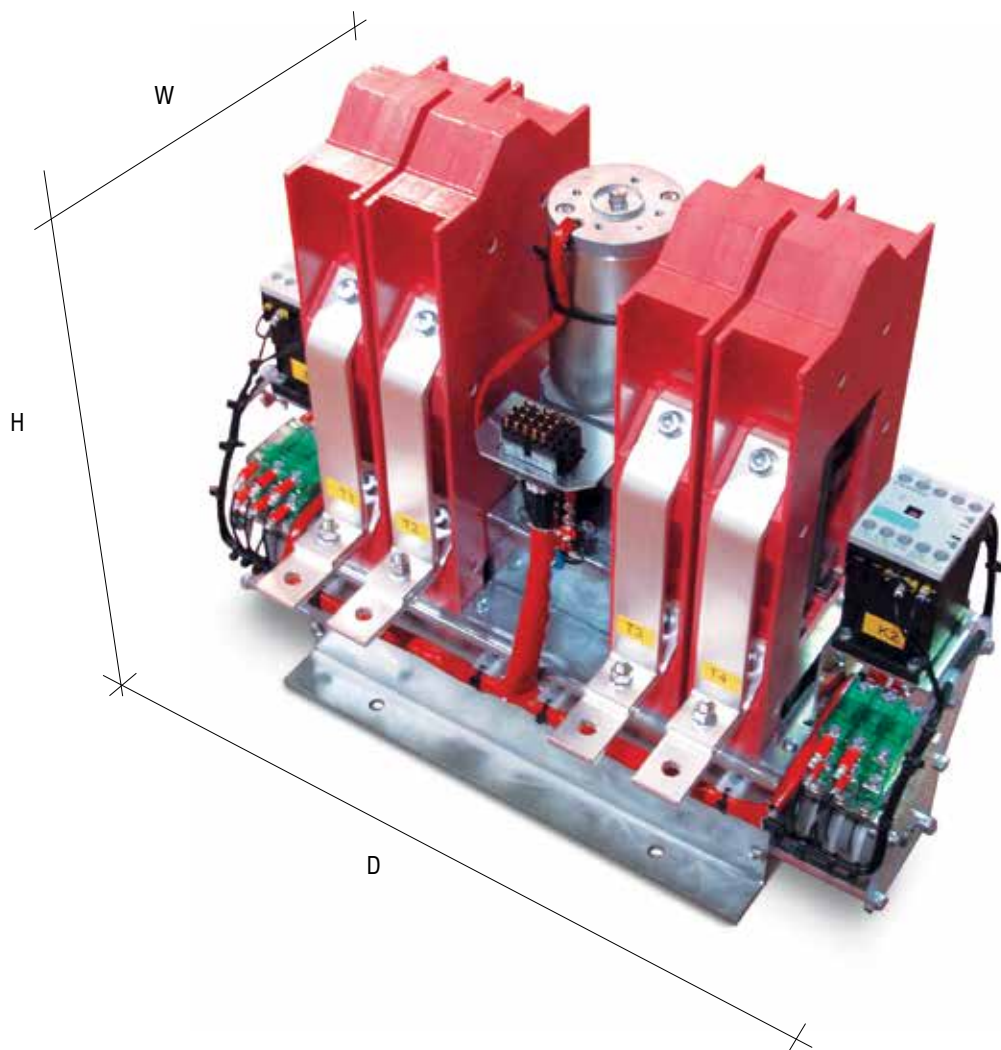
| | |
|--|------------------------|
| Rated Max Voltage (U_{max}) | 4000V _{DC/AC} |
| Rated Operational Current (I_a) at 75°C | Up to 2000A |
| Auxiliary Contacts (type SAIA-BURGESS) | 2 CO per pole |

Overall dimensions (mm)



Pole Configuration





LTRM line

Applications

Traction system configuration

Isolation of power converter

Reverser

Microelettrica Scientifica disconnectors are designed for circuit up to 4kV and available with electric motor control (24, 36, 72 and 110V_{DC}).

Its compact dimensions make it particularly suitable for application up to 300A 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.

Switches

Auxiliary connection

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

- direct control through auxiliary contacts
- control made by mean of one relay
- control made by mean of two relays

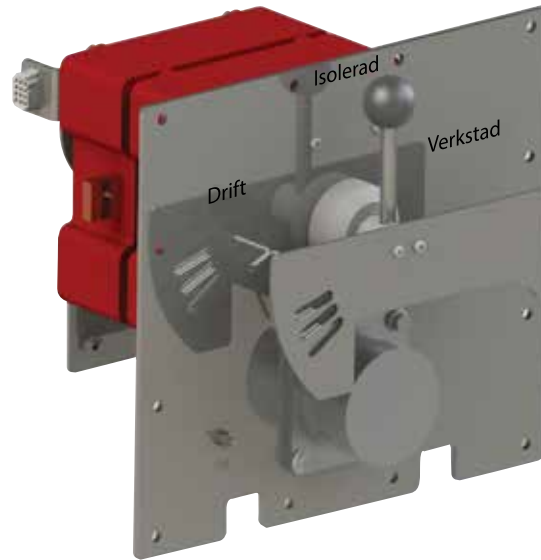
Any kind of connector available in commerce may be used on request.

Reference Standard

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



| Type | U_{max} [V _{DC/AC}] | I_{th} [A] | W [mm] | H [mm] | Dmax [mm] |
|--------------|---------------------------------|--------------|--------|--------|-----------|
| 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 4000V – 350A 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:

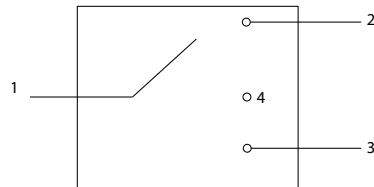
- Contacts suitable for on-load making (Cap. discharge)
- Voltage presence lamp (optional)
- Customized solutions of key and lock pad logic
- Manual switch with 3 positions:
 - Open (4)
 - Load (2)
 - Emergency (3)

Technical data

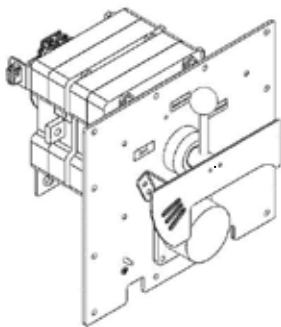
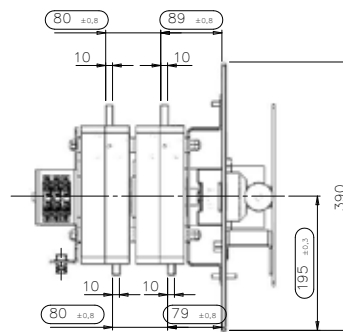
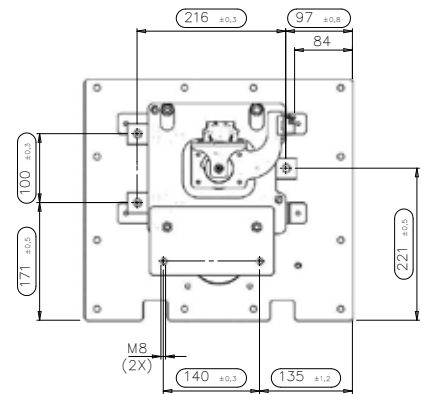
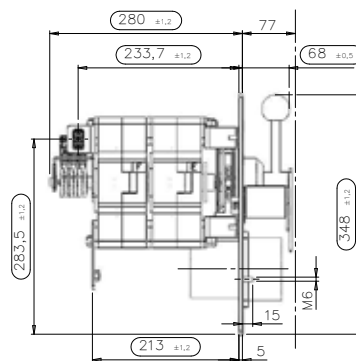
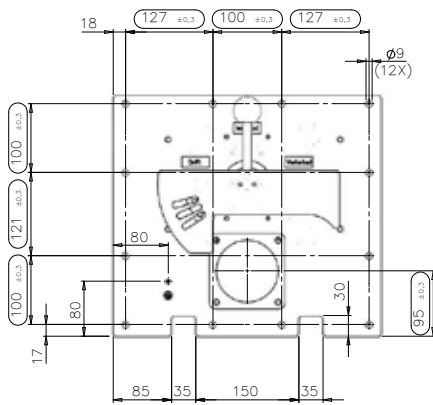
| | |
|---|-----------------|
| Rated operational voltage [Vac/dc] | 4000 |
| Max operational voltage [Vac/dc] | 4800 |
| Rated Insulation Voltage [V] | 5800 |
| Conventional Free Air Thermal Current [A] at 70°C | 350 |
| Control Voltage Rating [Vdc] | 24 ÷ 110 |
| Making Capacity [A] | 2.000 |
| Short circuit withstand capacity [A] | 15.000 (15ms) |
| Dimensions (standard version) WxHxD [mm] | 400 x 420 x 324 |

Switches

Functional diagram



LTWS Line



Compact Aluminium Resistors

Applications

Braking and chopper resistors for variable speed drives

Load and testing resistor

Integration in mounting beneath or beside frequency inverter

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

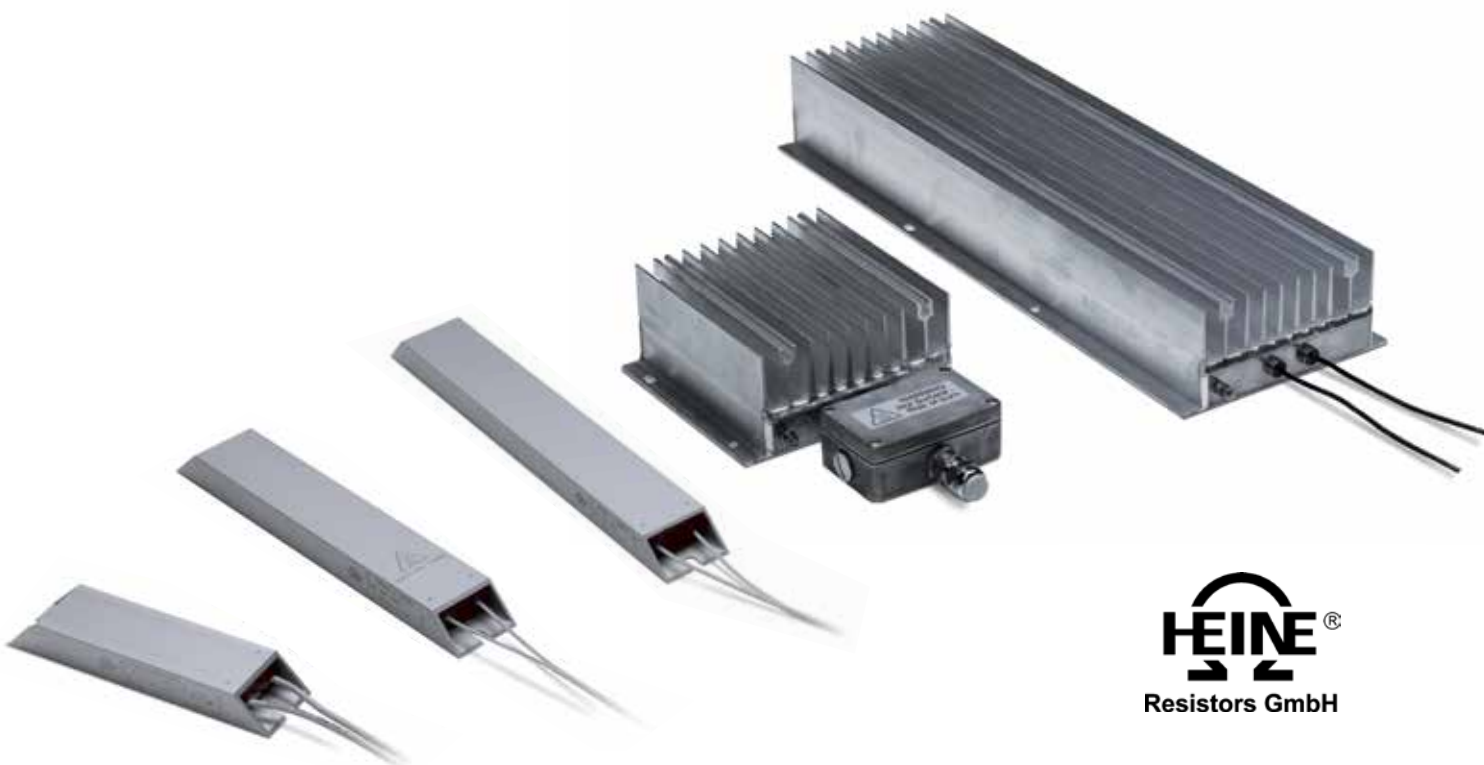
Depending on application, there is the possibility to base either on an aluminium housing or on an aluminium profile housing with integrated cooling fans.

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 IP 66 are guaranteed.

Resistance material support: moulded ceramic base

Resistance wire: NiCr-alloy special heat sink casing

Degree of protection: IP64 up to IP66



Resistors

Wire Wound Resistors

Applications

Braking and chopper resistors in variable-speed drivers

Frequency inverters

Load and testing resistors
Circuit 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.

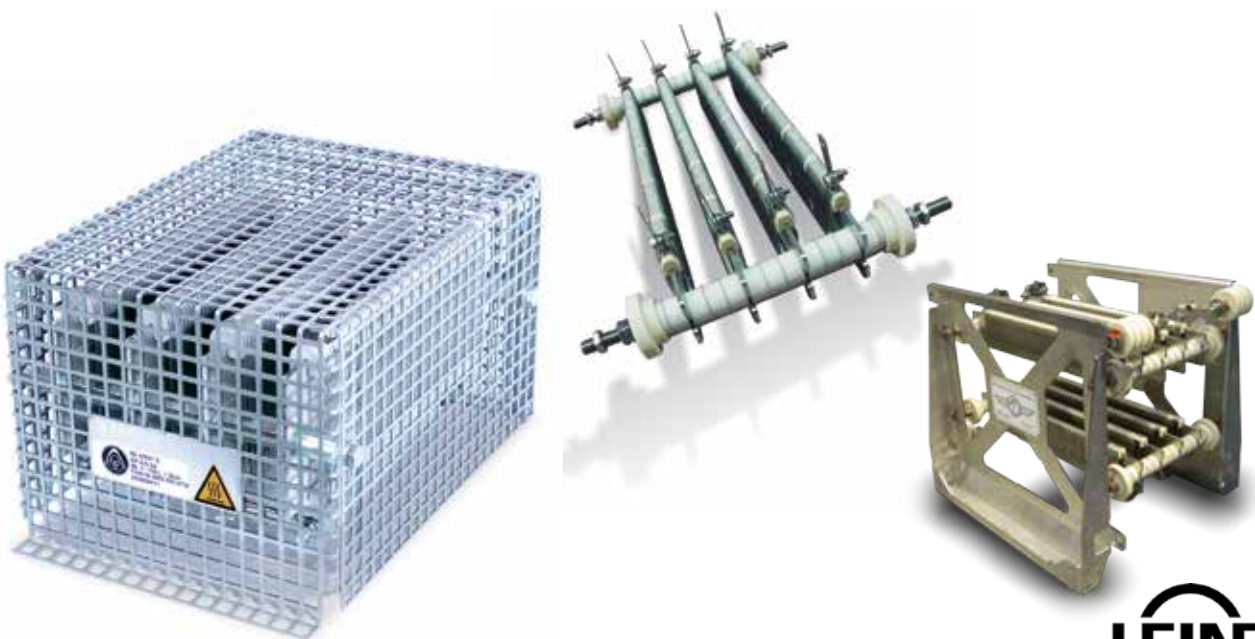
The ability to use them as thermal switches for thermal monitoring and overcurrent relays for controlling overload events opens them to a wide range of applications.

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

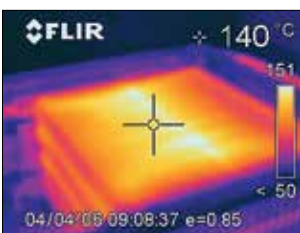
Resistance wire: CuNi 44 or NiCr alloy

Taps (tapping eyes): on request

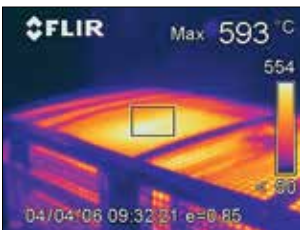
Degree of protection: IP00 - IP23 possible



Stripe Element Resistor



Stripe element technology is spearhead of our products and it is mainly used for braking resistors. These resistors are projected and manufactured directly according with customer requirements and can reach megawatt – range capacities.



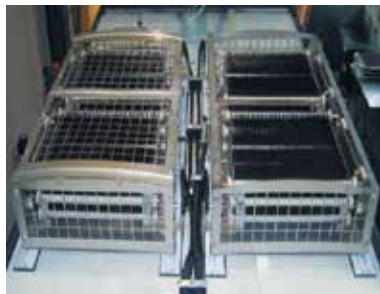
The great capacity of this application is the possibility to define each parameter of stripe element, defining dimension and also stainless steel alloy that better satisfy the customer requirements, ensuring high energy absorbance capacities, rapid heat dissipation and control on ohmic range. For this reason braking resistor are used to transform kinetic energy of the vehicle into heat. Depending on the customer's requirements, cooling can be implemented by convection or forced by specially – sized fan.

Braking Resistors are usually installed:

- On the roof of a vehicle, where hot exhaust air is released upwards
- Under frame, where the hot air released is exhausted sideways when the vehicle is in motion or using a blower
- Inside the vehicle, where the resistors are usually forced air cooled, where fresh air is taken from the bottom of the vehicle and hot air is expelled from the top



Resistors



Resistor elements are assembled in banks by means of strong rods and ceramic spacers. Segments of resistor banks are mounted in a strong support frame of AISI304 stainless steel.

Stainless steel is also used for bolts, nuts and washers. The resistors are designed to avoid disturbing noises caused by pulsating current.

Resistors are designed by our engineers with a sophisticated 3D model in order to find the best solution for our Customers and to withstand shocks and vibrations that normally occur in operation. Design and production, strictly follows our ISO 9001:2008 and IRIS Rev. 2 quality standards as well as the most severe international specifications. Our brake resistors are also compliant with GOST Russian certification.

All our resistors are type tested at our test lab where real service conditions can be reproduced via mock-up and motion air flow simulation. All Microelettrica Scientifica locations are equipped with dedicated testing facilities to guarantee product compliance with specification requirements.

A Railway Resistor is a 100% custom made product, where a few constructive and technological principles are applied in a project-specific mechanical frame layout.

Applications

Rail Vehicles



City Meter

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.

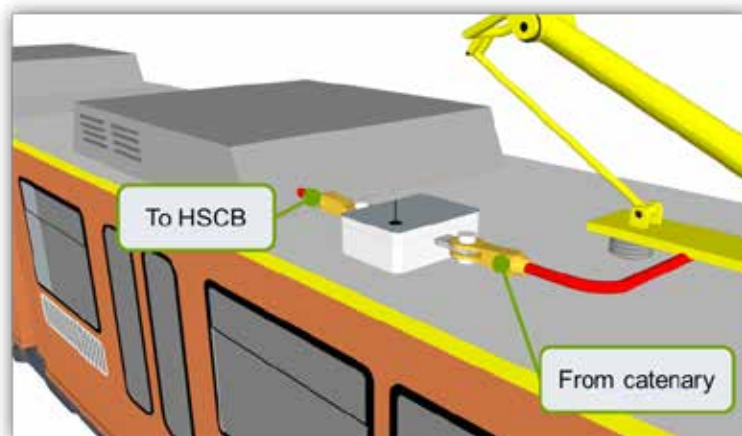
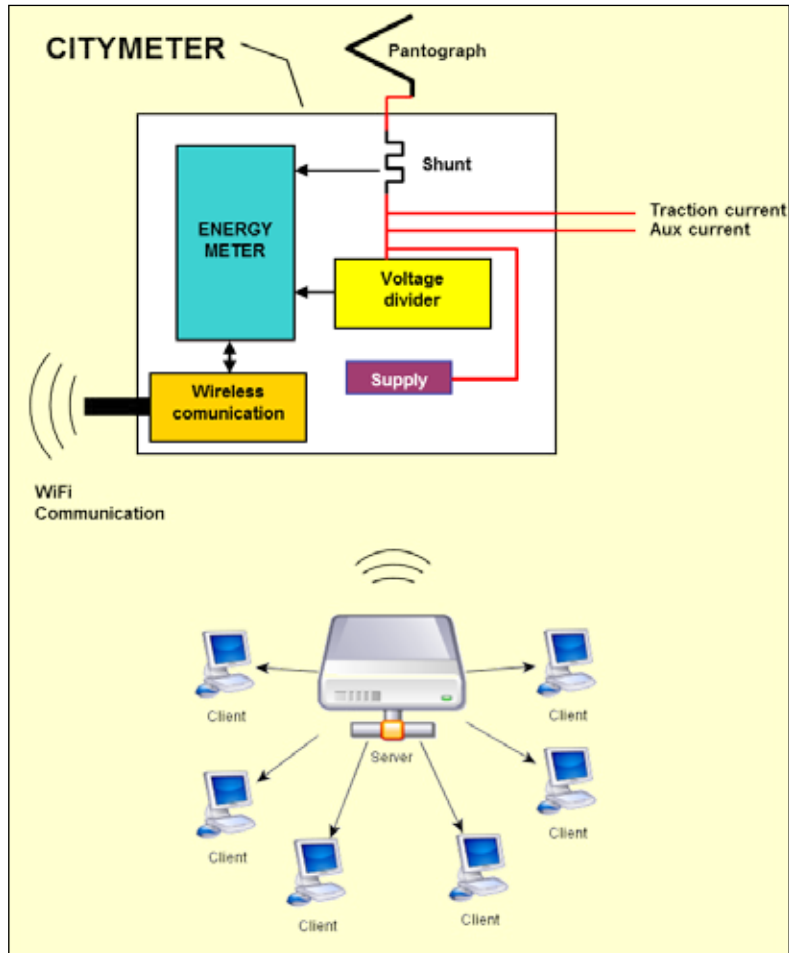
Data are stored on the vehicle and sent to the ground server when the vehicle reach the wireless hot spot

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.

| Parameter | Value | Remarks |
|-------------------------------------|----------------------|------------------------------------|
| Catenary range | 600÷1500 Vdc | |
| Current Measurement | 1500 Adc | |
| 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 |
| Overvoltage category | OV4 | EN 50124-1 |
| Enclosure protection degree | IP67 | defined in EN 60529 |
| Auxiliary power supply | Supply from catenary | |
| Maximum power consumption (average) | 15W | |
| Energy Calculation Accuracy | 1% | |

Metering



Maximum Flexibility in Structuring and Customizing the EMMS System

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

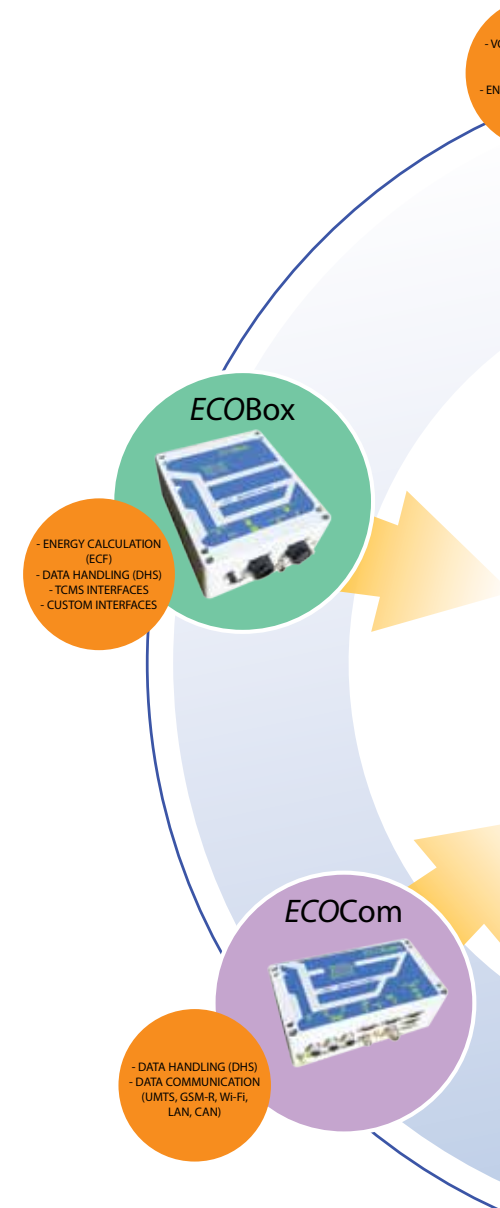
Ecosystem is a comprehensive, flexible and scalable solution that can be used as a simple solution for the implementation of the energy measuring function and its billing as well as being deployed in support of traction control functions.

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 everything with only one supplier interface.

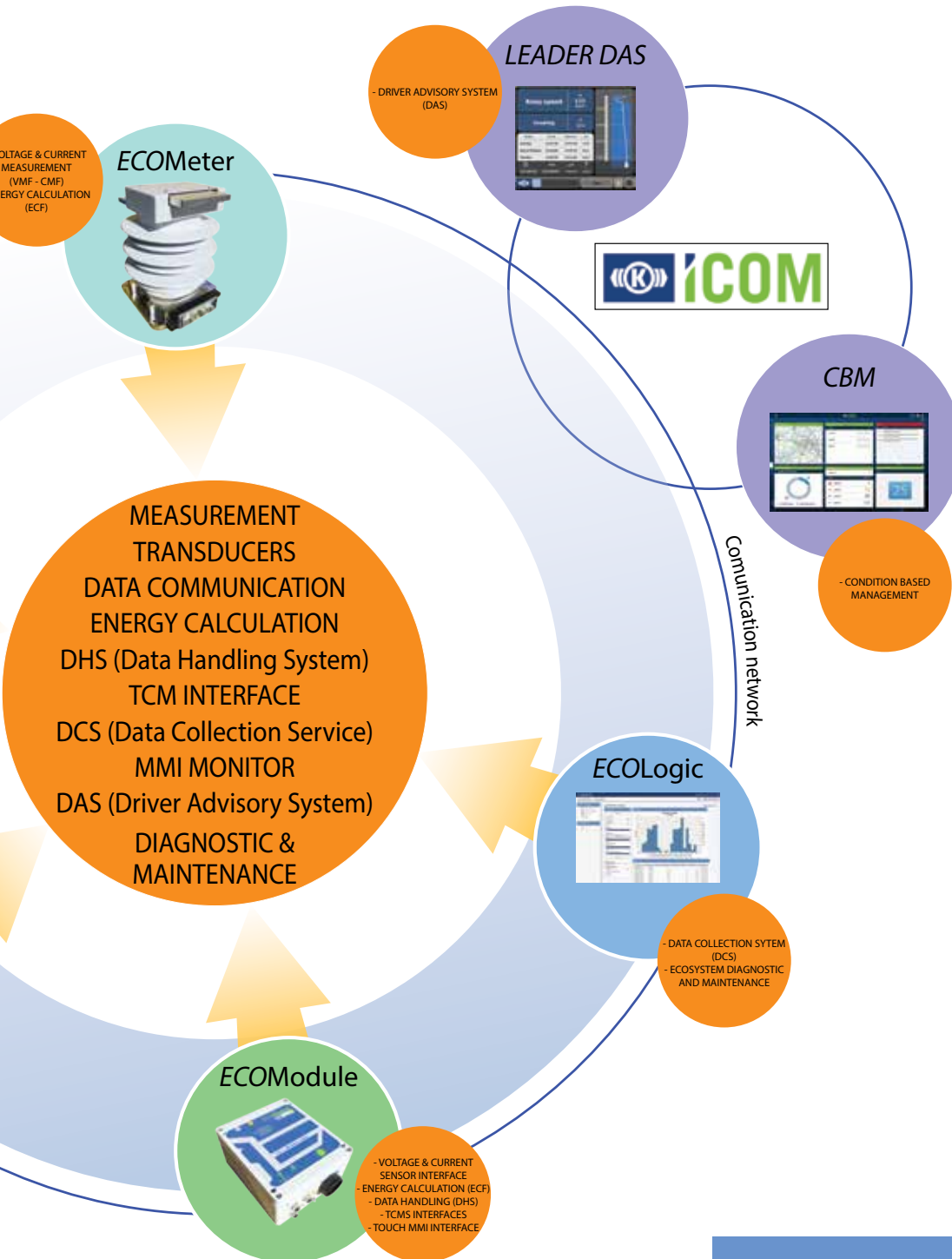
ECOSystem



All Subsystems are Developed and Manufactured in House

Metering

Network



Fully Compliant to EN50463

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 (ECOBX).

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 750V 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.

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.

| 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 VDC | |
| Maximum power consumption (average) | 15W | |

Metering

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

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.

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.

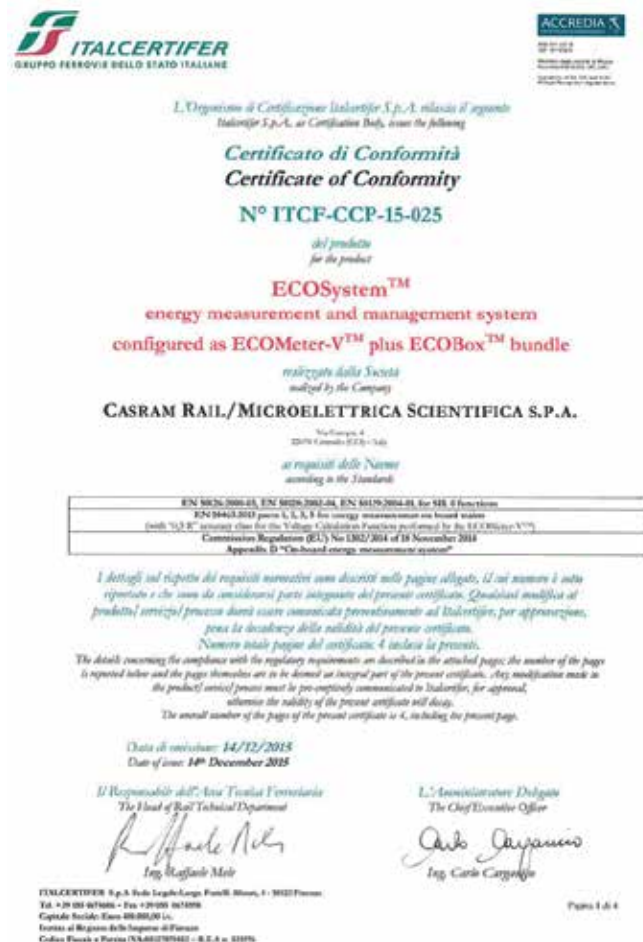
| Function | Options |
|--|--|
| 4 current or voltage Analog output | Up to three additional outputs boards (4 analog outputs + 6 relay outputs each)* |
| 6 relay outputs (nc/no) configurable | General purpose LVDS, I2C and SPI bus for expansion board * |
| Power supply | GMS-R* |
| Digital input/output 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 | |

* Option

Metering

43

| 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 VDC | |
| Maximum power consumption (average) | 30W | |



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.

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.

| Function | Options |
|--|---|
| WiFi network interface external or Internal WiFi antenna | MVB network interface EMD * |
| RS485 for ECOMeter digital sensor | GSM-R* |
| Power supply | Configuration and parameters memory external memory device * |
| Digital input/output at battery level | Temporary Storage or service interface USB keys or maintenance PC * |
| Ethernet network interface | Camera interface * |
| CAN network interface vehicle logic or other devices | Audio interface * |
| RS485/RS232 network interface vehicle logic or other devices | General purpose LVDS, I2C and SPI bus for expansion board * |
| USB | |
| 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 | |

* Option

Metering

| 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 VDC | |
| Maximum power consumption (average) | 15W | |



L'Organismo di Certificazione Italcertifer S.p.A. rilascia il seguente
Italcertifer S.p.A. as Certification Body, issues the following

Certificato di Conformità
Certificate of Conformity

N° ITCF-CCP-16-007

del prodotto
for the product

ECOCom™
Data Handling System

realizzata dalla Società
realized by the Company

CASRAM RAIL/MICROELETTRICA SCIENTIFICA S.P.A.

Via Europa, 4
22090 Comabbio (LC) - Italy

ai requisiti delle Norme
according to the Standards

| |
|---|
| EN 50126:2009-01, EN 50128:2002-04, EN 50155:2014-01, for SIL-0 functions |
| EN 50465:2013 parte 1, 4, 5 for energy measurement on board system |
| for On-board Energy System as described by EN 50465:2013 part 1, 4, 5 |
| Commission Regulation (EU) No. 1067/2014 of 18 November 2014 |
| Appendix D "On-board energy measurement system" |

I dettagli sul rispetto dei requisiti normativi sono descritti nelle pagine allegato, il cui numero è unico
riportato e che sono da considerarsi parte integrante del presente certificato.
Qualsiasi modifica al prodotto/ servizio/ processo dovrà essere comunicata preventivamente ad Italcertifer,
per approvazione, pena la decadenza della validità del presente certificato.
Numero totale pagine del certificato: 4 inclusa la presente.
The details concerning the compliance with the regulatory requirements are described in the attached pages; the number of the pages
is reported below and the pages themselves are to be deemed an integral part of the present certificate.
Any modification made to the product/ service/ process must be pre-emptively communicated to Italcertifer,
for approval, otherwise the validity of the present certificate will decay.
The overall number of the pages of the present certificate is 4, including the present page.

Data di emissione: 11/04/2016
Date of issue: 11th April 2016

Il Responsabile dell'Area Tecnica Ferroviaria
The Head of Rail Technical Department

Raffaello Mole
Ing. Raffaele Mole

L'Amministratore Delegato
The Chief Executive Officer

Carlo Carpani
Ing. Carlo Carpani



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.

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.

| Function | Options |
|--|---|
| 6 Analog input for Current and Voltage sensors | MVB network interface EMD * |
| RS485 for <i>ECOMeter</i> digital sensor | WiFi network interface external or Internal WiFi antenna * |
| Power supply | Configuration and parameters memory external memory device * |
| Digital input/output at battery level | Temporary Storage or service interface USB keys or maintenance PC * |
| Ethernet network interface | LVDS and HDMI interface for TFT display or external monitor * |
| CAN network interface vehicle logic or other devices | Resistive and capacitive touch screen interface * |
| RS485/RS232 network interface vehicle logic or other devices | Camera interface * |
| GPS time and position | Audio interface * |
| GSM/UMTS/up to LTE (internal or external multiband Antenna) | General purpose LVDS, I2C and SPI bus for expansion board * |
| SIM card reader for mobile network double SIM card holder | GMS-R* |
| Diagnostic and signaling external led | |
| Diagnostic and signaling vehicle diagnostic | |

* Option

Metering

| 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 VDC | |
| Maximum power consumption (average) | 15W | |



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, 15kV-50Hz-60s) 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.

Functions

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

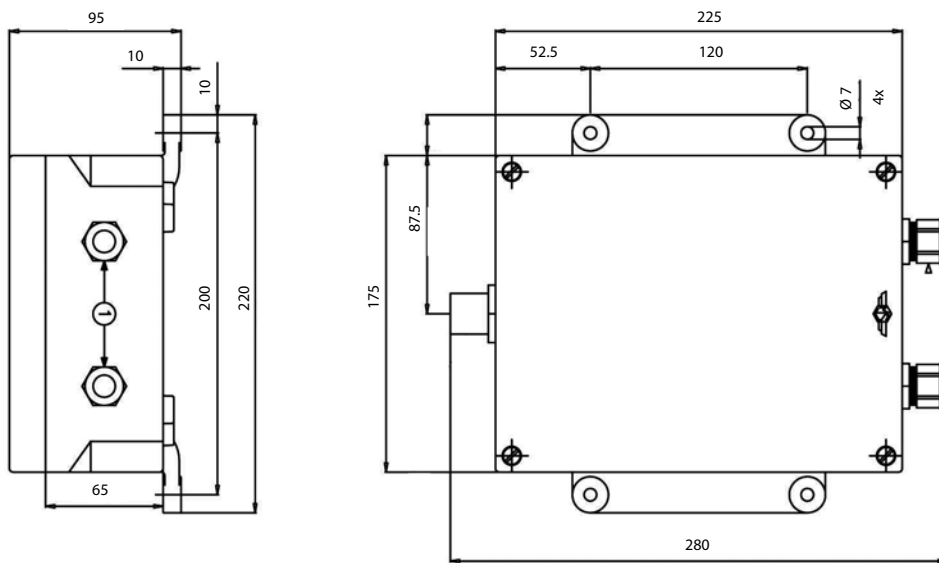
Environmental Performance

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.

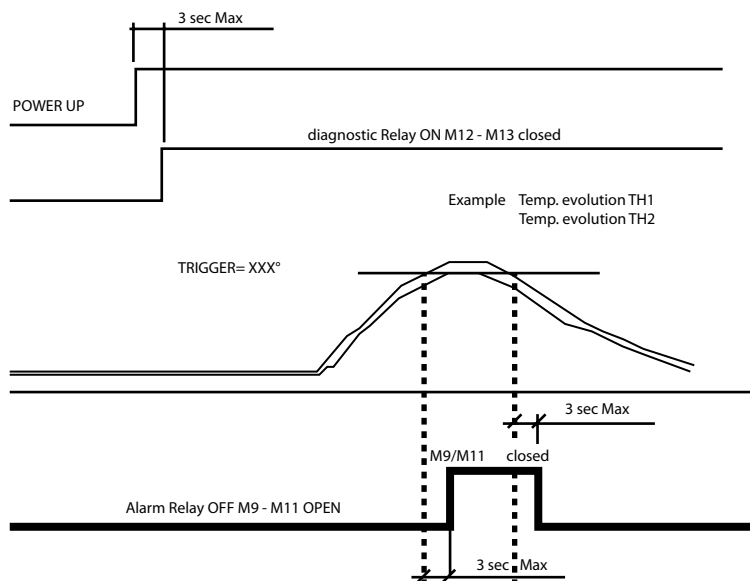
| | |
|---|-------------------------------|
| Storage temperature | from -40°C to +85°C |
| Class of air temperature (EN 50125-1) | TX (from -40°C to +85°C) |
| Class of altitude range (EN 50125-1) | A1 (up to 1400m) |
| Maximum Relative humidity at 40°C | 95% |
| Protection level for terminal box (EN6 0529) | IP 66 |
| Shock and vibrations | EN 61373 Shock and vibrations |
| Consumption | 8W 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 | 24V - 72V - 110V |
| Weight | 3kg |

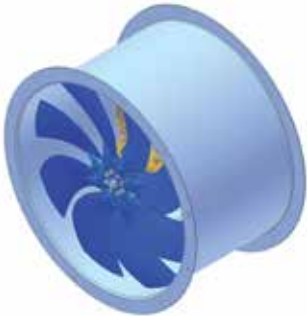
Metering

Overall Dimensions (mm)



Functional Scheme





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 fiberglass or polipropylene, 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

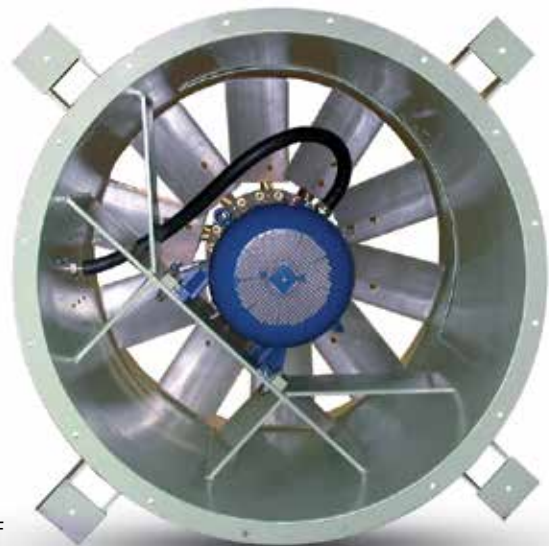
LA

- 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 |



AFH Series

Applications

Brake resistors

Heat exchangers / radiators

Gas turbine enclosures

Forced ventilation

Traction motors

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.

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, 50/60Hz, 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

Fans

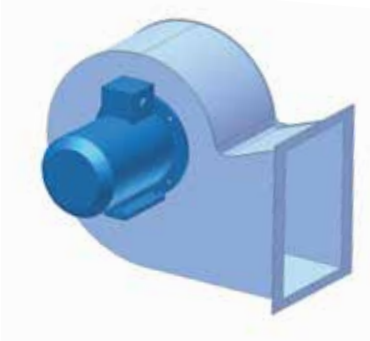


AFH



Technical data

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



Centrifugal fan units

Applications

Heat exchangers / radiators

Traction motors

Transformers

Converters

Ventilation plants

Filtration plants

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.

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, 50/60Hz, 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

Fans

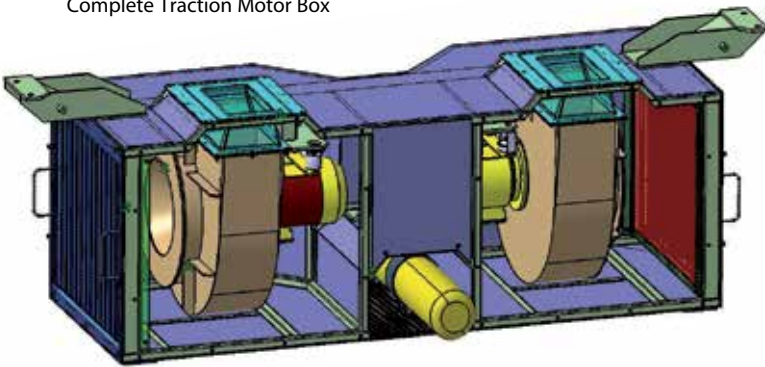


Double-Inlet Centrifugal



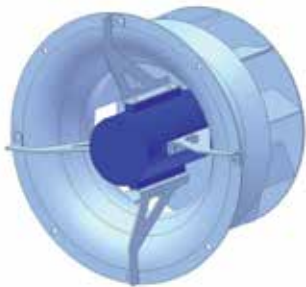
CCF

Complete Traction Motor Box



Technical Data

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



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

Heat exchangers / radiators

Traction motors

Transformers

Converters

Ventilation plants

General Characteristics

- Three-phase motors IP55/IP65, with Class F or H insulation, 50/60Hz, 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.

Fans



COR



OR

Technical Data

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



CNX/MXF Series

Applications

Traction motors

Brake resistors

Forced ventilation systems

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.

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, 50/60Hz, 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.

Fans



CNX



CNX

Technical Data

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



Microelettrica USA

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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MS localization within Knorr-Bremse India

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KNORR-BREMSE

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