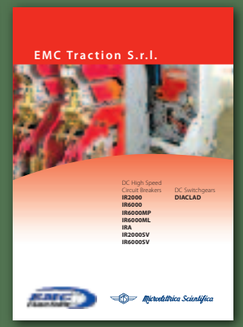

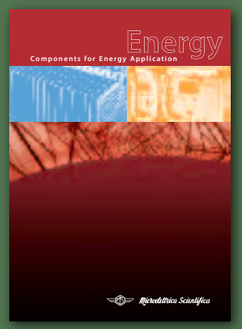

KNORR-BREMSE

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Industry

Components for Industry Application

KNORR-BREMSE
WESTINGHOUSE platform screen doors
IFE Automatic Door Systems
merak
Microelettrica Scientifica
transportdata
ZELISKO
railservice

- Contactors
- Disconnectors
- DC High Speed Circuit Breakers
- Power Resistors
- Protection Relays

Microelettrica Scientifica

Applications

- Generator control
- Crane and motor control
- Heavy industry
- Light industry

Industrial Evolution

Microelettrica Scientifica boasts decades of experience in designing and manufacturing products for Industrial Application of high quality and performances. Today, Microelettrica Scientifica wide ranges of contactors, disconnectors, power resistors and protection relays, together with EMC Traction DC high speed circuit breakers, have become the standard of reference for a growing number of highly qualified customers in several industries all over the world.

Know how in continuous evolution

The frontiers of industrial and utilities market, from crane operation to motor control, from LV utilities components to the automation industry, are constantly changing. Microelettrica Scientifica is evolving with them through continuous innovation of products and technologies. All the steps of our processes, from product conception to product validation, from choice of materials to final routine tests, are accurately controlled to guarantee total safety of equipment, persons and plants, as well as full customers satisfaction, but more importantly to constantly find innovative solutions that improve the cost/performance/features balance of our products.

We work together with our customers

Our industrial philosophy is to manage the evolution of our products in full coordination and collaboration with our customers. Since the first contacts, we are pleased to foster relations with them. In this way we can help in selecting the product from our wide range which better fits the requirements. And, in case of special requirements, we are always eager to develop custom-designed products: our company is well prepared to manage the most challenging projects and our factories will easily realize them.

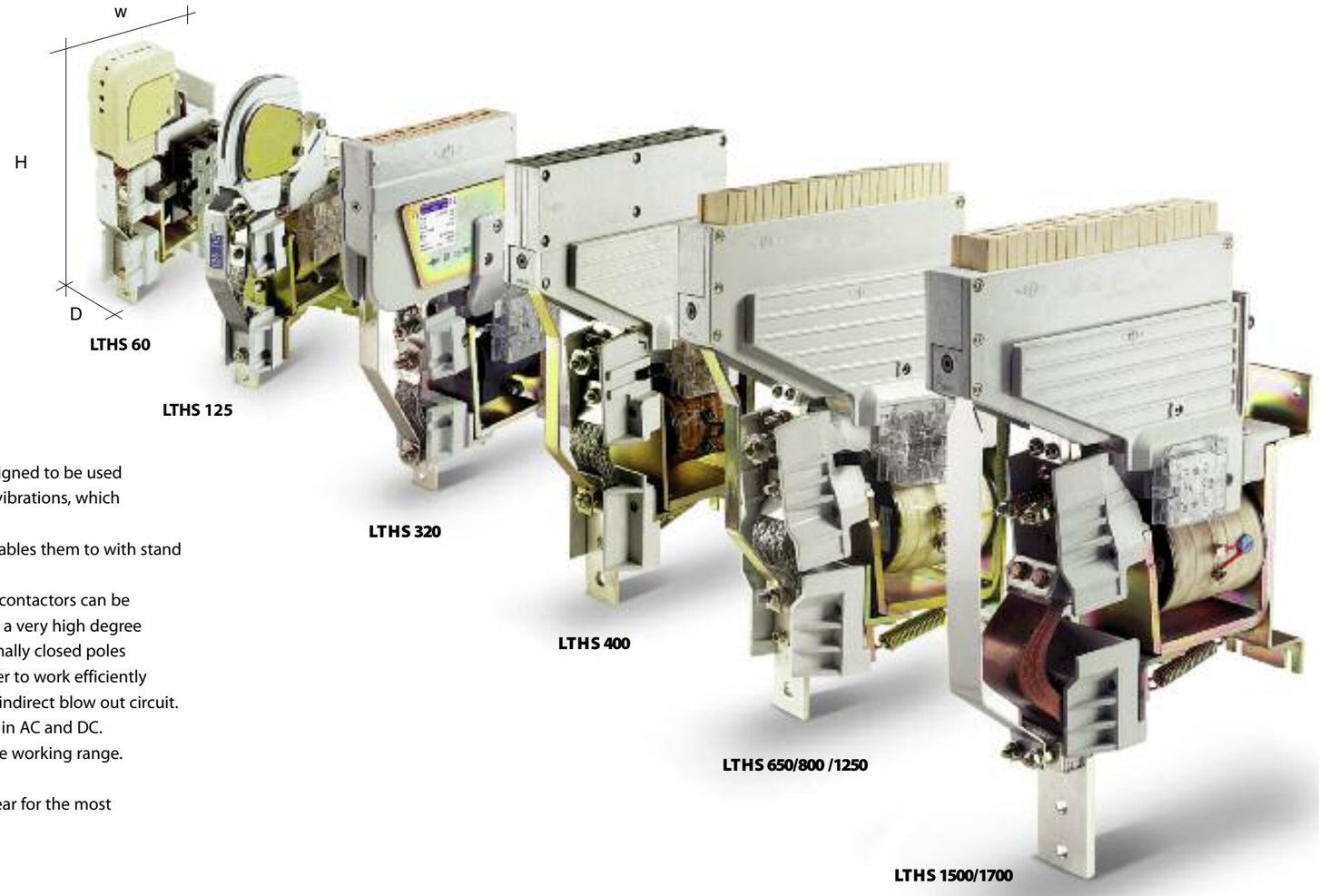
Made in Microelettrica Scientifica

To achieve the best results, Microelettrica Scientifica develops and produces the entire range of products in its own facilities in Rozzano and Lacchiarella, as well as the EMC Traction facility in Vimodrone, all very near to Milano. But we also run operations in USA, South Africa, India and China. Wherever in the world customers know they can always count on quality, excellence and accuracy in the realization of each single product and component, but also get supported locally.

Products

- Contactors
  Disconnectors
- DC High Speed Circuit Breakers
- Power Resistors
- Protection Relays

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 onelectrical equipment in presence of the most severe shocks and vibrations, which occur on board of traction vehicles.
The LTHS series of contactors displays a traditional design which enables them to with stand the highest current ratings in harsh working conditions.
To accomplish most of the possible applications, all the LTHS series contactors can be manufactured in single or multipolar form and, upon request, allow a very high degree of customisation. For example, 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 both in AC and 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 deenergized.
More than 20.000 LTHS contactors are delivered worldwide every year for the most important projects.

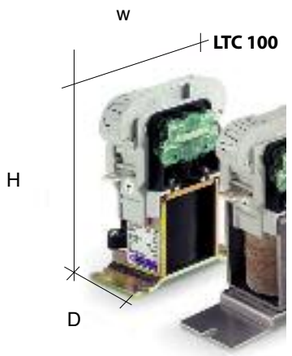
General Characteristics

- The long experienced extra heavy duty flexible line, up to 2000$V_{DC/AC}$ application, up to 1500A/pole
- On board and stationary application
- Combination of up to 3 NO or NC poles and auxiliary contact options
- High unit customization possible

Auxiliary Contact Blocks Type sk11

- Normally mounted on LTHS and LTC contactors
- Execution Makrolon, self extinguishing and transparent polycarbonate to allow contactors inspection
- Double interrupting, self cleaning, solid silver
- On request special execution with gold plated contacts

Type	Umax [$V_{AC/DC}$]	Ith [A]	W (mm)	H [mm]	D1/D2 [mm]
LTHS 60	1000	80	143	197	72/93
LTHS 125	1000	150	185	278	88/115
LTHS 320	1000	350	220	298	86/114
LTHS 400	2000	500	329	423	116/202
LTHS 650/800	2000	700/920	335	440	116/202
LTHS 1250	2000	1300	350	472	127/202
LTHS 1500	2000	1350	350	534	111/202
LTHS 1700	2000	1600	350	534	116/235



LTC line

Applications
Auxiliary converter input
Filter pre-charging
Electromagnetic brakes
Heating/Air conditioning systems
Line contactor

The LTC series contactors, thanks to their excellent balance between dime
performances and strength, are suitable for all those applications on boar
a small, smart device. Their design encourages applications where high op
and small available spaces are important requirements.
Like all Microelettrica Scientifica contactors, the LTC series are based on a
but a very high level of customisation can be achieved by replacing few ke
Normally open and normally closed poles can be fitted, as well as mechan
The breaking circuit is equipped with permanent magnets to work efficier
high and low currents.
The DC control coil operates without economy resistor within a wide work
A "varistor" cuts off the peak voltage when the coil is deenergized.
More than 20.000 LTC contactors are delivered worldwide for every year th
important projects.

General Characteristics

- The modern and compact heavy duty line, up to 4000$V_{DC/AC}$ application, u
- On board and stationary application
- 1-2-3 pole configuration mostly available, NO and NC poles, permanent
  arc blowouts
- Flexible control and auxiliary contacts options, customization possible

Auxiliary Contact Blocks Type rk11

- Contacts based on Reed relay technology
- Sealed tips, not affected by harsh environmental conditions
- Shielding case from external magnetic fields
- Same mechanical interface of standard SK11auxiliary blocks
- Power rating 10 VA

LTCS 250 2 poles	**2000**	**250/500**	**140**	**156,5**	**109**
LTCS 250 3 poles	**2000**	**250**	**140**	**156,5**	**154**
LTC 250 NC	**2000**	**250**	**140**	**196**	**78**
LTCH 250	**1000**	**250**	**154**	**176**	**86**
LTCH 60	**4000**	**60**	**168**	**220**	**88**
LTCH 60 2 poles	**4000**	**60/120**	**220**	**168**	**125**
LTCH 1000	**2000**	**1000**	**385**	**300**	**93**

LTNS line

Applications

- Transit and railway systems
- Control of cranes
- Rolling mills
- Mining equipment
- Renewable energy

Microelettrica Scientifica LTNS series have been developed to answer to the constantly increasing market need of reduced dimensions and weight, taking most of the huge know-how in designing and manufacturing of industrial bar mounted contactors.
These contactors have been designed starting from the N series electric arc management concept, grafted on the light and compact structure of a rail unit, developed around the control electromagnet.
The LTNS contactors, characterised by a nominal voltage of 750V, are available in a wide range of current ratings, from 80A up to 1300A (up to 3 poles). They can be configured in any combination of Normally Open or Normally Closed poles, with a common rating.
They have been designed and tested according to the international standard IEC 60947-4-1 and are suitable for almost any industrial low voltage application, such as: cranes, rolling mills, electric energy production and transformation, photovoltaic panels, induction furnaces, galvanic treatments.

General Characteristics

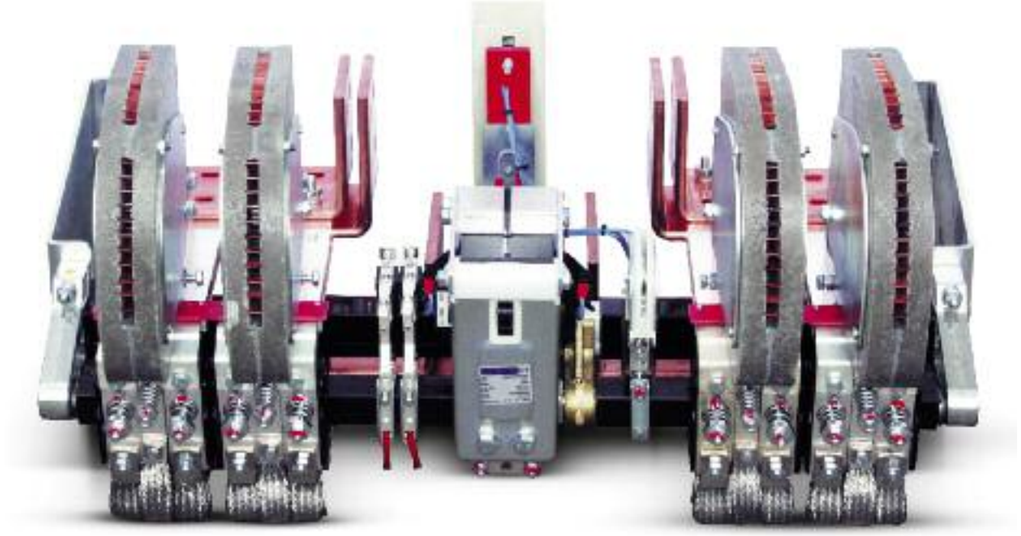
- The extra heavy duty flexible line, up to 1000$V_{DC/AC}$ application, up to 1500A/pole
- Stationary application only, derived from LTHS line
- 1-2-3 pole configuration, NO and NC poles indirect or direct arc blow out options available
- Flexible control and auxiliary contacts options, high unit customization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

Type	Ith [A]	Rated Nominal Voltage Ue [V]	Rated Insulation Voltage Ui [V]	D1/D3 [mm] Length (1-3 poles)	W [mm]	H [mm]
LTNS 60	80	600	750	72-130	193	138
LTNS 125	150	750	1000	86-169	260	185
LTNS 320	320	750	1000	105-277	350	260
LTNS 450	450	750	1000	105-277	360	260
LTNS 650	700	750	1000	105-277	405	280
LTNS 800	900	750	1000	105-277	405	280
LTNS 1000	1100	750	1000	125-340	459	350
LTNS1250	1300	750	1000	125-340	459	350

N line

Applications
Transit and railway systems
Power generation
Control high power motors
Heavy industries
Crane control

Microelettrica Scientifica N series bar mounted contactors, in spite of their 50 years old technical concept are still state of the art for many industrial, low voltage, heavy duty applications. These contactors are designed and tested according to the standard IEC 60947-4-1. They provide excellent operational performances, making them the best choice for high power load connection, often covering the function of a fault clearing protection device.
The N series contactors are characterised by modular design so that their configuration can be tailored to the specific requirements of each application. In fact, the pole ratings cover a wide range, from 85A up to 6000A, and can be mounted side by side regardless of their size and number on a customisable length shafts set, this way offering custom solutions to a wide range of technical needs.
The maintenance is simplified by direct accessibility to all parts due to open construction so that, in most cases, it is not necessary to remove the contactor from the cabinet.
Microelettrica Scientifica has been certified since 1993 according to the International Quality Standard UNI EN ISO 9001:2008. Microelettrica has always paid great attention to the environment and is certified according to the standard UNI EN ISO 14001:2004 and all materials used are RoHS compliant.



Type	Thermal Current Ith [A]	Rated Nominal Voltage Ue [V]	Rated Insulation Voltage Ui [V]	D1/D4 [mm] Length (1-4 poles)	H [mm]	W [mm]
N85	85	600	1000	250-400	165	155
N125	125	600	1000	250-400	175	155
N190	190	600	1000	250-400	205	170
N270	270	600	1000	250-500	265	215
N350	350	600	1000	250-500	275	215
N550	550	600	1000	105-277	300	160
N650	650	600	1000	300-600	320	160
N800	800	600	1000	350-650	365	300
N1000	1000	600	1000	350-650	365	300
N1250	1250	600	1000	350-700	380	345
N1600	1600	600	1000	350-800	420	420
N2000	2000	600	1000	350-800	425	420
N3000	3000	600	1000	400-1000	475	470
N4000	4000	600	1000	500-1250	425	420
N6000	6000	600	1000	600-1500	475	470

General Characteristics

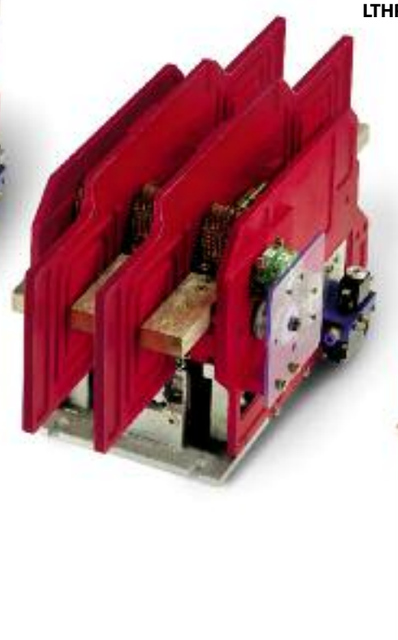
- The bar mounted modular extra heavy duty line, up to 1000$V_{DC/AC}$ application, up to 6000A/pole
- Stationary application only
- Up to 6 pole configuration, NO and NC poles direct arc blow out various aux contacts options
- Flexible control and adjustment configurations, total unit customization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

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

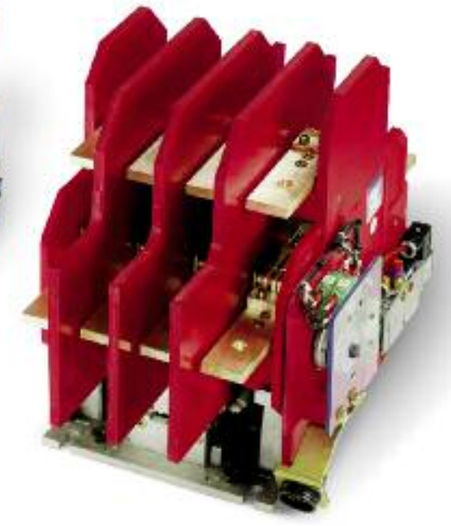
LTHMU - 1 - 1500

LTHMU - 2 - 1500

LTHPD - 2 - 1500



LTHPD - 3 - 800



LTHPD - 4 - 800 CO

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, supplied both in the electromotorized and in the pneumatic versions, 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 the applications. Their contact technology, based on multi-finger jaws, enables the LTHM and LTHP contactors 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 6,000 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 application up to 4000V
- On board and stationary application, 2 thermal current rating 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 possible and mostly used
- 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

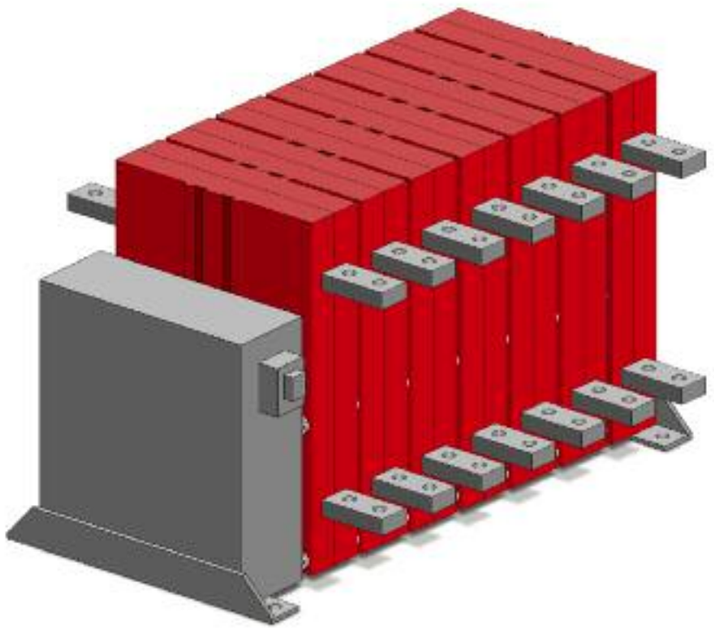
LTH	M	U	1	800
LTH	M	U	1	1500
LTH	M	U	2	800
LTH	M	U	2	1500

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 or Pneumatic bistable control
- U/D: Power terminals on same side or on opposite side
- 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 Disconnector with Binary Control Option

Main Features of each Pole:
- 2 versions: 1000 or 2000 A thermal current
- 3 configurations: NO or NO+NC or CO
- Integrated control device for command logic
- Fully modular construction, up to 12 poles
- Visual indication of pole status
- Maintenance-free

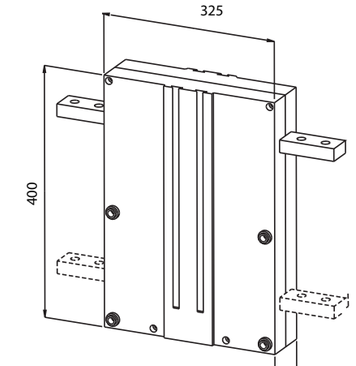
Main Features Control:
- Electric motor actuated
- Electronic control of poles positions
- Virtually infinite combinations of poles positions
- Predetermined positions accessed sequentially or by dedicated control signal

Options:
- Binary control code module (No. of digits = No. of poles)

Technical Data

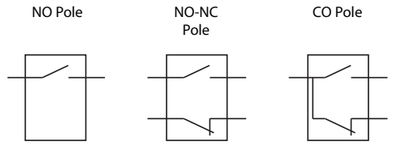
Rated Voltage (Un)	3000 V	
Rated Max Voltage (Umax)	4000 V	
Insulation Reference Voltage (Ui)	4000 V	
Rated Operational Current (Ie)	1000 A	2000 A
Rated Short Circuit Withstand for 15ms (Icc)	160 kA	220 kA
Rated Breaking Current at 4000V$_{DC}$	400mA	
Position Change Time at Uc	Max 5 sec	
Mechanical Endurance	> 500'000 operations	
Contact Opening Distance	> 40mm	
Dielectric Test Voltage	HV to ground 12000V Aux to ground 2000V Bwn open contacts 9500V	
Auxiliary Contacts (type SJ 11)	1NO+1NC per pole	
Control Module Weight	5 kg	
NO Pole Weight (per pole)	6.2 kg	7 kg
CO Pole Weight	7.5 kg	8.5 kg
NO-NC Pole Weight	8.2 kg	9 kg
Operating Temperature Range	-50°C ÷ +85°C	
Control Voltage (Uc)	24 / 72 / 110 V$_{DC}$	
Control Voltage Working Range at +85°c	± 30%	
Absorbed Power at 20°c and Uc	Max 150W	

Dimensions



Version	Pole Width
1000 A	90 mm
2000 A	110 mm

Pole Configuration



IRA series

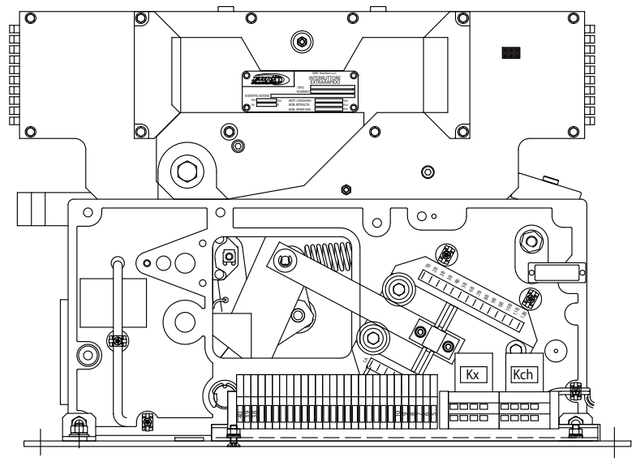
High Speed Circuit Breaker Type IRA With Holding Coil for Substations and Industrial Applications or Closing Pneumatic Mechanism for Locomotives

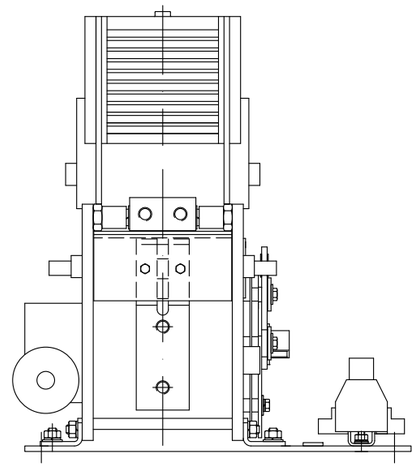
Applications
DC Substation
Industry
Locomotives
EMU

The IRA series are single pole, magnetic blow out, trip free, air circuit breakers.
The breaker closing device is electromagnetic (for Substation and Industry applications) or electropneumatic (for Locomotives) type.
The breaker is held closed by an holding coil and is equipped with a direct acting unidirectional over-current trip device.

Technical Data

Type		IRA Magnetic	IRA Magnetic/Pneumatic
Rated Voltage [V]	U_n	1500	3000
Rated Current [A]	I_n	Up to 3000	Up to 3000
Short Circuit Breaking Capacity (EN 50123) (IEC77)	U_e	1800 [V]	3600 [V]
	I_{cc}	100 [kA]-Peak	60 [kA]-Peak
	I_{cc}	60 [kA]-Steady State	40 [kA]-Steady State
Rated Voltage Auxiliary Circuit [V_{DC}]	U_n	24 ÷250	24 ÷250





IR2000 series

High Speed Circuit Breaker Type IR2000 for Substation and Industry Applications

Applications

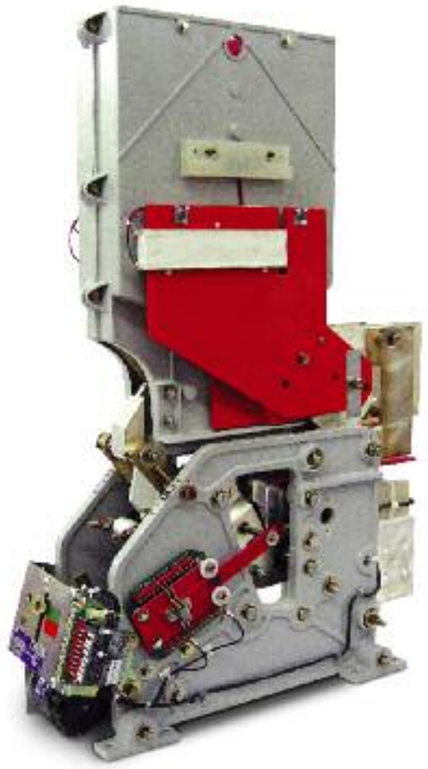
DC Substation

Industry

The IR2000 series are single pole, magnetic blow out, trip free, air circuit breakers.
The breakers closing mechanism is the indipendent type motor operated.
The IR2000 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 breaker conforms to ANSI C 37-14, ANSI C 37-16 and EN 50123 Standard.

Technical Data

Rated Voltage [V]	U_n	750	1500
Rated Current [A]	I_n	Up to 3000	Up to 3000
Short Circuit Breaking Capacity (ANSI C 37-14)	U_e	800 [V]	
	I_{cc}	89 [kA]-Peak	
	I_{cc}	82 [kA]-Steady State	
Short Circuit Breaking Capacity (EN 50123)	U_e	900 [V]	1800 [V]
	I_{cc}	50 [kA]-Peak	45 [kA]-Peak
	I_{cc}	30 [kA]-Steady State	25 [kA]-Steady State
Rated Voltage Auxiliary Circuit [V_{DC}]	U_n	24 ÷220	24 ÷220



IR6000 MP series

High Speed Circuit Breaker Type IR6000 with Permanent Magnet Latch for DC Substation and Industry Applications

Applications

DC Substation

Industry

The IR6000 Permanent magnet latch series are fixed or withdrawable, single pole, magnetic blow out, trip free, air circuit breakers.
The closing mechamism is an independent motor operated type.
The breaker is held closed by a permanent magnet device and is equipped with a direct acting over-current trip device which may be either unidirectional or bidirectional.
The breaker conforms to ANSI C 37-14, ANSI C 37-16 and EN50123 Standard.

Technical Data

Rated Voltage [V]	U_n	750	1200	1500
Rated Current [A]	I_n	Up to 8000	Up to 8000	Up to 8000
Short Circuit Breaking Capacity (ANSI C 37-14) (IR6000 4kA)	U_e	800 [V]	1200 [V]	
	I_{cc}	200 [kA]-Peak	135 [kA]-Peak	
	I_{cc}	120 [kA]-Steady State	80 [kA]-Steady State	
Short Circuit Breaking Capacity (EN 50123)	U_e	800 [V]		1800[V]
	I_{cc}	120 [kA] - Peak		100 [kA] - Peak
	I_{cc}	90 [kA]-Steady State		70 [kA] - Steady State
Rated Voltage Auxiliary Circuit [V_{DC}]	U_n	24 ÷220	24 ÷220	24 ÷220

IR6000 series

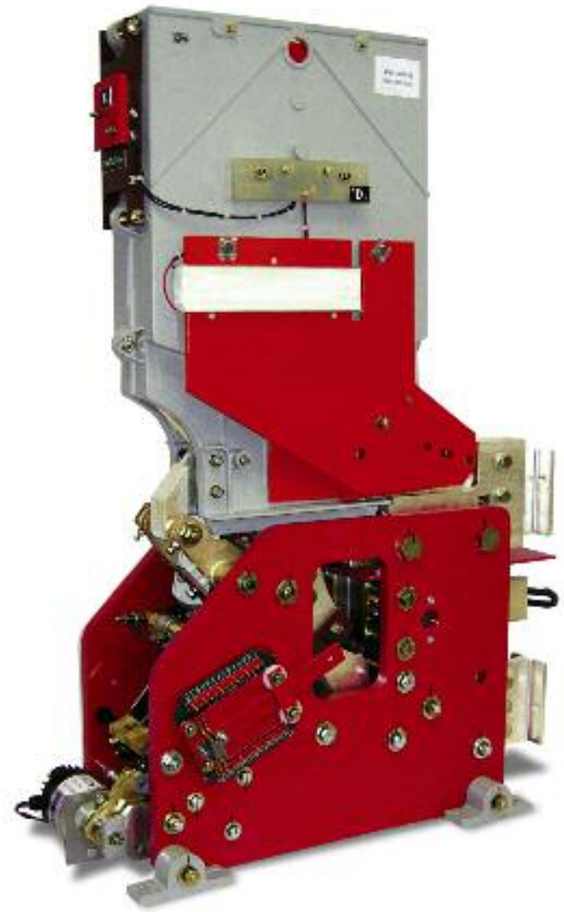
High Speed Circuit Breaker Type IR6000 with Electromagnetic Latch for Substations and Industry Applications

Applications

DC Substation

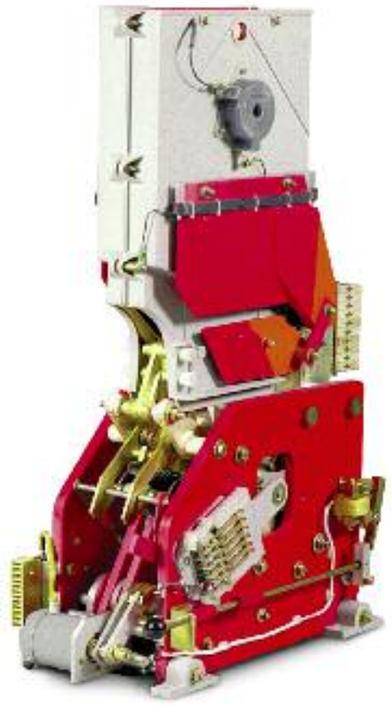
Industry

The IR6000 Electromagnetic latch series are fixed or withdrawable, single pole magnetic blow out, trip free, air circuit breakers.
The closing mechanism is an independent motor operated type.
The breaker is held closed by holding coil and is equipped with a direct acting over-current trip device which may be either unidirectional or bidirectional.
The breaker conforms to ANSI C 37-14, ANSI C 37-16 and EN 50123 Standard.



Technical Data

Rated Voltage [V]	U_n	750	1200	1500	3000
Rated Current [A]	I_n	Up to 8000	Up to 8000	Up to 8000	Up to 4000
Short Circuit Breaking Capacity (ANSI C 37-14) (IR6000 4kA)	U_e	800 [V]	1200 [V]		
	I_{cc}	200 [kA]-Peak	132 [kA]-Peak		
	I_{cc}	120 [kA]-Steady State	80 [kA]-Steady State		
Short Circuit Breaking Capacity (EN 50123)	U_e	800 [V]		1800[V]	3600[V]
	I_{cc}	120 [kA] - Peak		100 [kA] - Peak	61<[kA] - Peak
	I_{cc}	90 [kA]-Steady State		70 [kA] - Steady State	40 [kA] - Steady State
					100 [kA] - Steady State
					70 [kA] - Steady State
Rated Voltage Auxiliary Circuit [V_{DC}]	U_n	24 ÷220	24 ÷220	24 ÷220	24 ÷220



IR6000 ML series

High Speed Circuit Breaker Type IR6000 ML Mechanical Latch for Substation and Industry Applications

Applications

DC Substation

Industry

The IR6000 ML series are single pole, magnetic blow out, trip free, mechanical latch, air circuit breakers.
The closing mechanism is an independent motor operated type.
The breaker is held closed by a mechanical latched and is equipped with a direct acting over-current trip device which may be either unidirectional or bidirectional, instantaneous or delayed.
The breakers is designed to be installed in fixed plants or withdrawable type.
The breaker conforms to ANSI C 37-14, ANSI C 37-16 Standard.

Technical Data

Type		Rectifier	Rectifier	Feeder	Feeder
Rated Voltage [V]	U_n	750	1200	750	1200
Rated Current [A]	I_n	Up to 10000	Up to 10000	Up to 10000	Up to 10000
Short Circuit Breaking Capacity (ANSI C 37-14)	U_e	800 [V]	1200 [V]	800 [V]	1200 [V]
	I_{cc}	149 [kA]-Peak	100 [kA]-Peak	200 [kA] - Peak	132 [kA] - Peak
	I_{cc}	90 [kA]-Steady State	60 [kA]-Steady State	120 [kA]-Steady State	80 [kA]-Steady State
Rated Voltage Auxiliary Circuit [V_{DC}]	U_n	48 ÷ 225	48 ÷ 225	48 ÷ 225	48 ÷ 225

Neutral Grounding

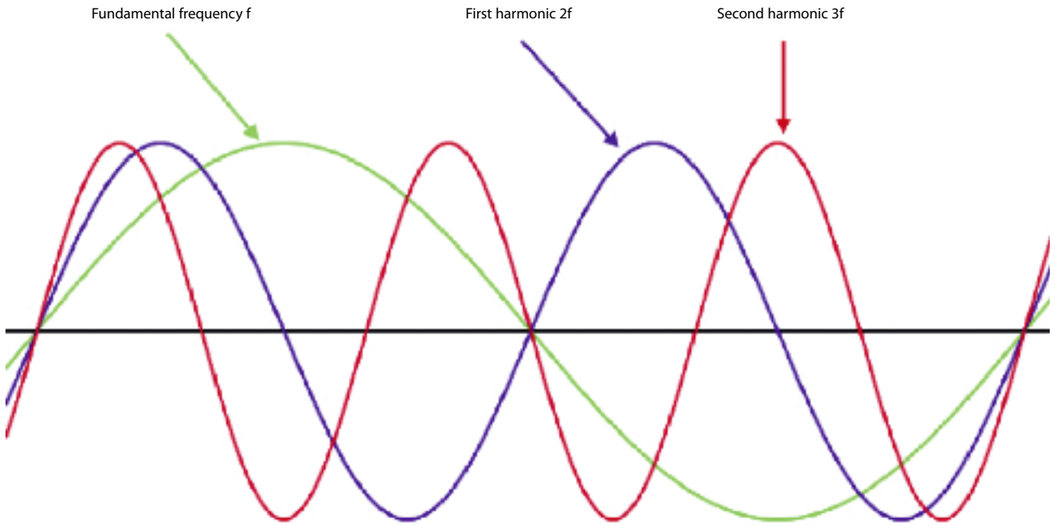
Short circuits between phase and ground can result in irreversible damage to networks and equipments; it is therefore of the utmost importance to be able to control and reduce their effects: Grounding Resistors limit the fault current that arises due to phase-neutral short circuits. Grounding through resistor offers several advantages with respect to alternative methods (such as insulated grounding, direct grounding or grounding through a reactance). The main advantages are: easier detection of fault location, limitation of fault current, no transient over voltages.
Relevant parameters in the design of a Neutral Grounding Resistors may vary greatly: Microelettrica has developed a line of standard products (for the most common requirements) along with tailored projects, each developed and customised according to the required characteristics. Our products range from Low Voltage systems (<1kV) to High Voltage (132kV insulation class), as well as from very low fault current values (tens of Amps) to very high (>10kA).

The essential pieces of information needed to design a Grounding Resistors are:
- Nominal Voltage
- Fault Current
- Fault Duration (10s is customary)

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

Applications
Energy
Industry

Harmonic Filter



Quality of power is becoming ever more important for both suppliers and end users, as the number of devices that may feed harmonics in power systems is increased, resulting in higher line losses, interferences and resonances.
Harmonic Filters - made up by capacitors, inductors and resistors - help clearing harmonics which inevitably tend to occur. The LC circuit filters all spurious frequencies and only lets fundamental frequency through, while the Harmonic Filter Resistors (Harmonic Filters Resistors, also referred to as Damping Resistors) dissipate harmonic currents into heat.

Typical fields of applications for Harmonic Filters Resistors are HVDC networks and electrical induction furnaces.

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

The essential pieces of information needed to design an Harmonic Filters Resistors are:
- Nominal Voltage
- Current or Power
- Ohmic Value (with tolerance in %)

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

Applications
Energy
Industry

Load Banks

Load Banks allow to effectively check the efficiency of emergency sets (generators, Uninterrutible Power Supplies…) and can be employed as dummy loads to prevent wet stacking on diesel engines. They represent a reliable and economic way to prolong the lifetime of extremely expensive and important equipments.
Microelettrica custom designs Load Banks to satisfy all requirements, both in terms of power to be dissipated (from tens of kW to tens of MW), of insulation level (from hundreds of Volts up to 36kV insulation class) and of integration of the most diverse power steps, thanks to the wide variety of grid types designed and produced by Microelettrica itself.
Thanks to its many years of experience in both industrial and railway field, Microelettrica has also developed reliable ventilation curves, and can therefore offer forced-ventilated Load Banks, whose main advantage is that of allowing higher power-per-element and thus smaller size. Microelettrica Load Banks are suitable for indoor and/or outdoor use; they are placed in enclosures with up to IP23 protection degree. Ventilation can be without distinction horizontal or vertical.

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

The essential pieces of information needed to design a Load Banks are:
- Nominal Voltage
- Power
- Number and type of steps, if any
- Type of ventilation (natural or forced)

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

Applications
- Energy
- Industry

Starting Braking Discharge

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

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

The essential pieces of information needed to design a Starting Resistor are:
- Horsepower
- Rotor/Stator Voltage
- Rotor/Stator Current
- RPM
- Application; different applications require different solutions

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

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

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

The essential pieces of information needed to design a Discharge Resistors are:
- Nominal Voltage
- Discharge Current
- Discharge Duration

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

Applications
Industry

A line

General Characteristics

The series of electronic analogic protective relays herebelow presented has been designed according to the most advanced technologies in order to obtain the highest reliability, accuracy and immunity to interference and is made with first choice components safely dimensioned and protected.
The application of severe testing and quality control procedures guarantees the reliability of the product.

Relays Type

PB../..	Dual level current relay: 50/51
UB0-A	Earth fault current relay desensitised to the third harmonic: 51N
BI20/..	Two phase + earth fault overcurrent relay: 49, 51, 51N
BI2C	Dual level D.C. current relay: 49, 76
BF3	Three phase breaker failure relay: 50BF
UB./.	Under/Over-voltage relay: 27, 59, 45, 80
UB./.	Dual level voltage relay: 27, 59, 45, 80
UB0	Zero sequence voltage relay desensitised to the third harmonic: 64
UB./60	Voltage balance relay: 60
UB0/100	Relay for 100% generator stator earth fault protection: 64s
UB1/2/C	Battery positive/negative leakage to earth fault protection
UB3/59-S	Overvoltage relay for supervision of CTs ' circuits
RBW	Directional overcurrent relay: 32, 67, 67N
RRS	Automatic load sharing control relay for generators: 95
UB0/CR	Rotor earth fault relay: 64R
RB4	Lock-out relay: 86
RHS	Rotating diode failure detection relay: 58
RCA	Trip circuit supervision relay: 74
UB0/ATR	High impedence differential relay: 87N(87G)

The main features are the following:

- Measuring inputs supplied through internal adaptor transformers
- Multivoltage a.c. and d.c. autoranging power supply unit
- Draw-out modular execution on standard european size P.C. boards
- Fibreglass reinforced epoxy resin P.C. boards with tinplated copper tracks, solder mask special silicon humidity protection and screen printed component designators
- P.C. board connectors with golden plated pins rated 10A continuous and 200A 1sec

Execution

"E" For flush mounting with back connection terminals, draw-out relay boards with automatic short circuiting of the current inputs. Transparent front cover. Protection degree IP54; accessories for surface mounting (E/I) are also available.
"E/R" Standard 19"3U (8 modules) or 6U (16 modules) rack with back connection terminals, draw-out relay boards with short circuiting of the current.

Output Relays

Two versions are provided:

- Standard version: the output relays are deenergized on normal operating conditions and are energized on relay's tripping
- Positive protected version (on request): the output relays are energized on normal operating conditions, (i.e. with auxiliary supply on and input values at normal levels) and are deenergized on relay 's tripping, failure of power supply, internal relay fault

Signalization

- Green led: auxiliary power supply presence
- Red led: trip indication
- Yellow led: trip memorisation

Control

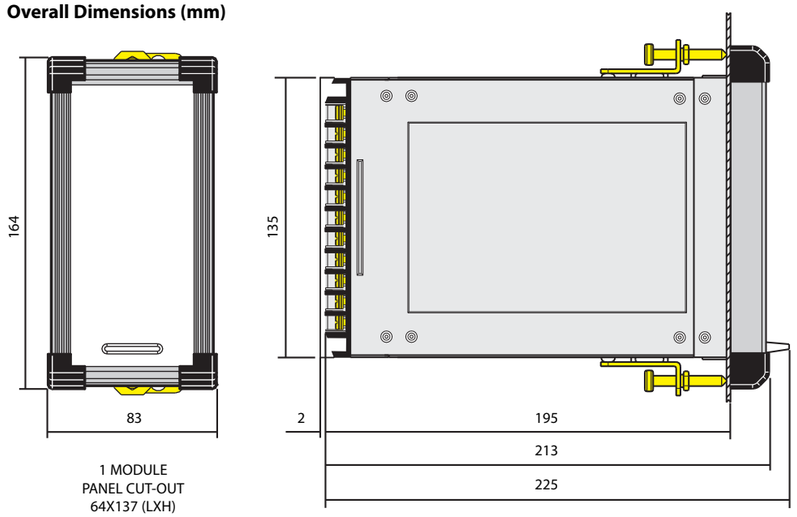
- Relay test with or without tripping of output contacts
- Automatic and/or local/remote reset of the output relays
- Local manual reset only for signal leds

Blocking and Intertripping Circuits

On request are available:

- Blocking input (BI)
- Blocking output (BO)
- Time start output (TO)

Overall Dimensions (mm)



M line

General Characteristics

M line is a complete series of microprocessor based relays suitable for protection of high and medium voltage systems; it offers a unique combination of performances, functionalities, innovation and reliability. The line is completed by a number of communication and control modules giving a good level of modularity.

Measurements

- Real Time Measurements
- Maximum Demand and Inrush Recording
- Trip Recording (last 5 trips with date & time)

Control

- 5 Output Relays (programmable)
- 3 Digital Inputs
- Time tagged event recording
- Blocking Outputs and Blocking Input for pilot wire selectivity coordination

Communications

- 1 RS485 Serial communication port on rear side
- Modbus RTU Communication Protocols

Technical Characteristics

- Complete autodiagnostic program
- 8 Digit alphanumerical Display
- 8 Leds for signalization

Mounting

- 2 Module boxes
- IP44 protection case (on request IP54)
- Totally draw-out execution

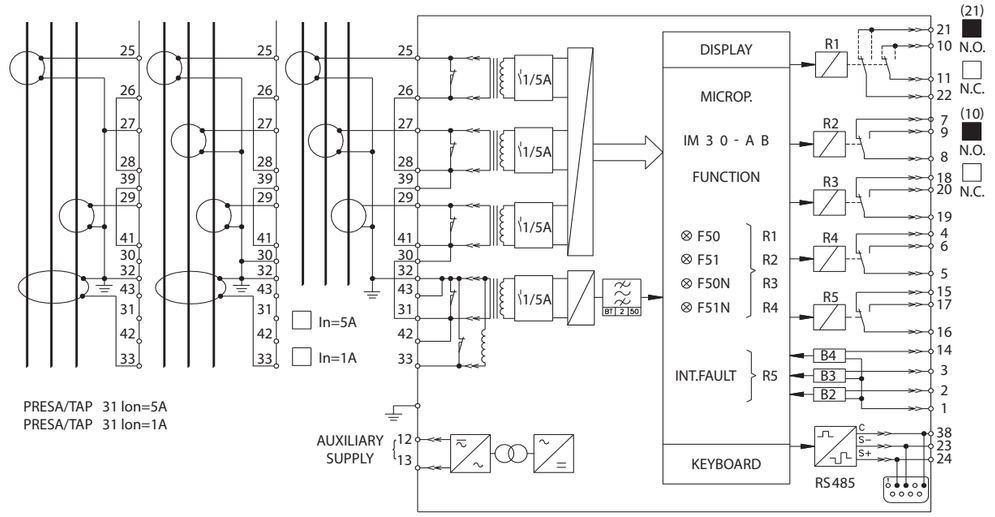
Software

- MSCom Program interface for device management

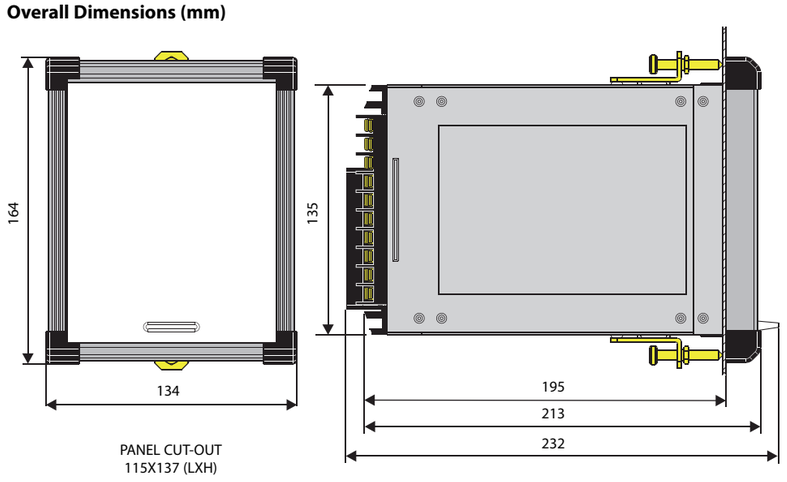
Relays Type

IM30-AB	Three-phase Overcurrent and Earth Fault - Dual Setting : 50/51, 50N/51N, 51BF
IM30-AP	Three-phase Overcurrent and Earth Fault: 50/51, 50N/51N, 51BF
IM30-C	Capacitor Overload, Earth Fault And Unbalance Protection: 50/51, 50N/51N, 46N, 37, 51BF
IM30-D	Three-phase Overcurrent + Directional Earth Fault: 50/51, 50N/51N/67N, 59Uo, I^2t, 51BF
M-ARM513	Multishot Programmable Single/Three Phase Autoreclose: 79
SCM21	Three Inputs Synchrocheck: 25, 27/59, 81.
MM30	Motor Protection: 12/14, 37, 46, 47, 48, 49, 50/51, 51LR, 64, 66
MM30-D	Motor Protection With Directional Earth Fault: 12/14, 37, 46, 47, 48, 49, 50/51, 51LR, 64N, 66
MM30-W	Motor Protection Relay With Voltage & Power Control: 12/14, 27/59, 37, 46, 47, 48, 49, 50/51, 51LR, 55, 64, 66, 81
IM30-T	Three-phase Thermal + Overcurrent + Earth Fault: 46, 49, 50/51, 50N/51N, 51BF, I^2t
MD32-T	Percentage Biased Transformer Differential: 87, 87N
MD33-T	Percentage Biased Differential Relay For 3-winding Transformers: 87, 50/51
MTR33	Transformer On-load Tap-Changer Control: 27, 59, 37, 50/51, 90
IM30-G	Multifunction Generator Protection: 32, 40, 46, 50/51, 51BF, 64S
IM30-B00	Earth Fault Relay - Dual Setting: 50N/51N, 51BF
IM30-DR	Three-phase Overcurrent with Directional Earth Fault + Autoreclosing: 50/51, 50N/51N/67N, 46, 79, 51BF
MG30	Generator Protection & Management: 21, 24, 27/59, 32, 37, 40, 46, 49, 50/27, 50V/51V, 51BF, 60FL, 64S, 81
MD32-G	Percentage Biased Generator Differential Relay: 50/51, 87N or 64S, F87, 51BF
SPM21	Generator Synchronizing Relay: 25, 27/59/81, 90
M-LIB3	Modular Low-Impedance Bus-bar Protection: 87B
M-HIB3	High Impedance Biased Differential Relay: 87, 51BF
M-HIV3	Three Phase High Impedance Busbar Differential Relay With Supervision of CT Secondary Circuits: 87B, 59S
MFP	Pilot Wire Differential Protection Relay for Cables & Lines: 87/85, 50/51, 51BF
UM30-A	Three-phase Voltage, Frequency & Zero Sequence Voltage with Vector Shift Detection: 24, 27d/59d, 47, 59, 59Uo, 81
UFD34	Three-phase Digital 4-stage Frequency Relay With Df/dt & Dv/dt Control: 27/59, 81, df/dt, dv/dt
MU30	Multifunction Three-phase Measuring Unit
MW33	Power Management Relay: 27/59, 81, 32
MX7-5	Programmable Interface & Control Module: 7 Digital Inputs & 5 Output Relays
MX14-5	Programmable Interface & Control Module: 14 Digital Inputs & 5 Output Relays

Wiring Diagram



Overall Dimensions (mm)



MC line

General Characteristics

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

Measurements

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

Control

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

Technical Characteristics

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

Communications

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

Expansion Modules (optional)

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

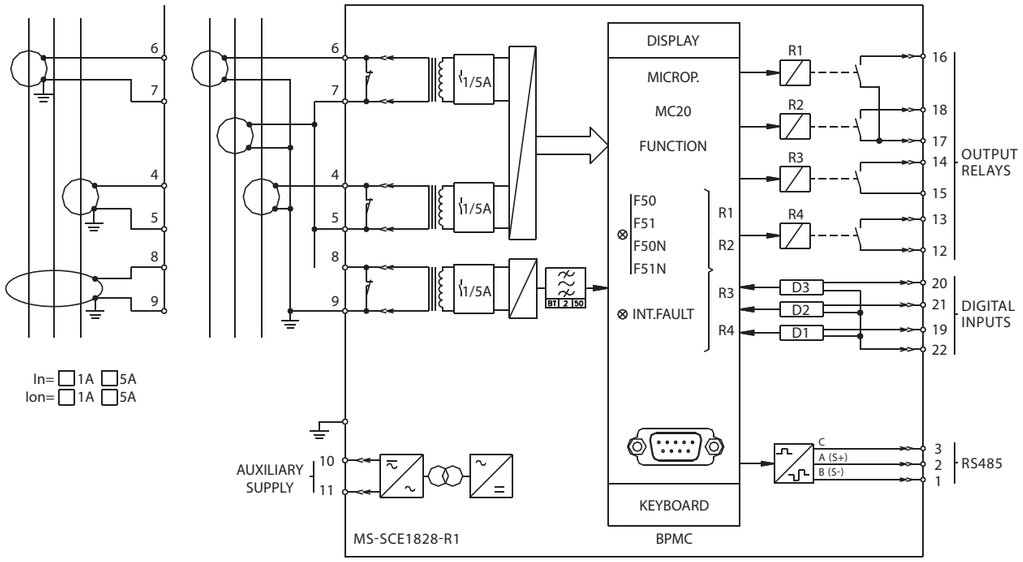
Execution

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

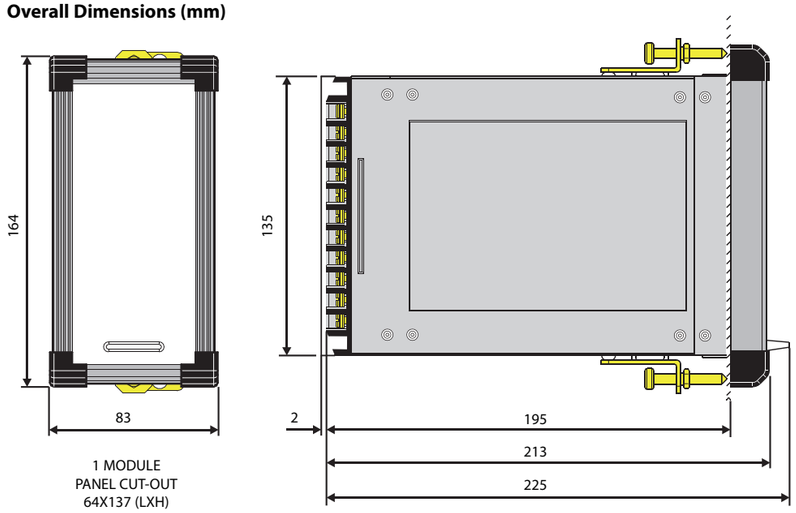
Software

- MSCom2 Program interface for device management

Wiring Diagram



Overall Dimensions (mm)



Relays Type

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

Ultra line

General Characteristics

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

Recording

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

Control

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

Technical Characteristics

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

Communications

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

Expansion Modules (optional)

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

Execution

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

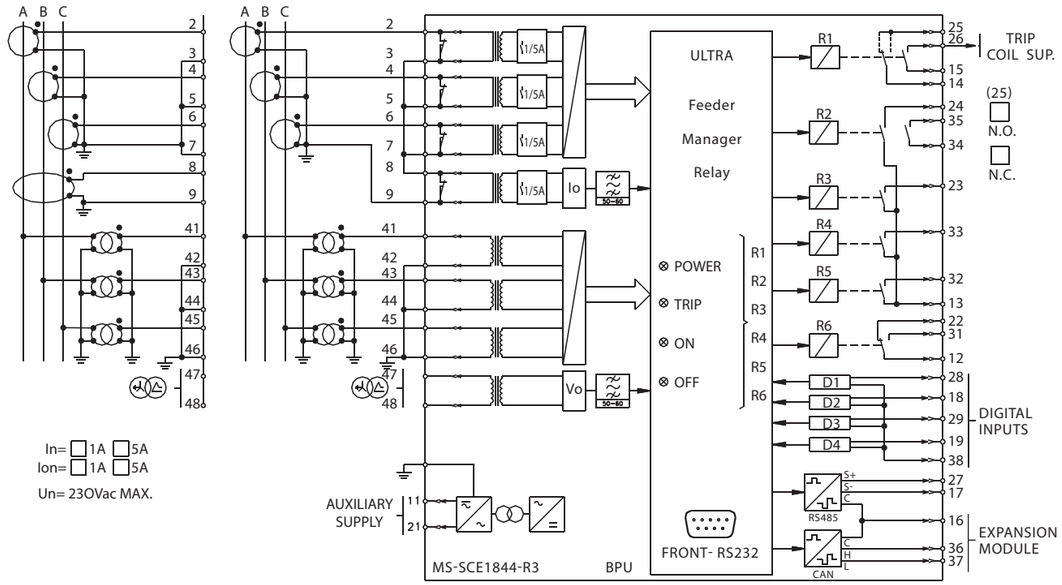
Software

- MSCom2 Program interface for device management

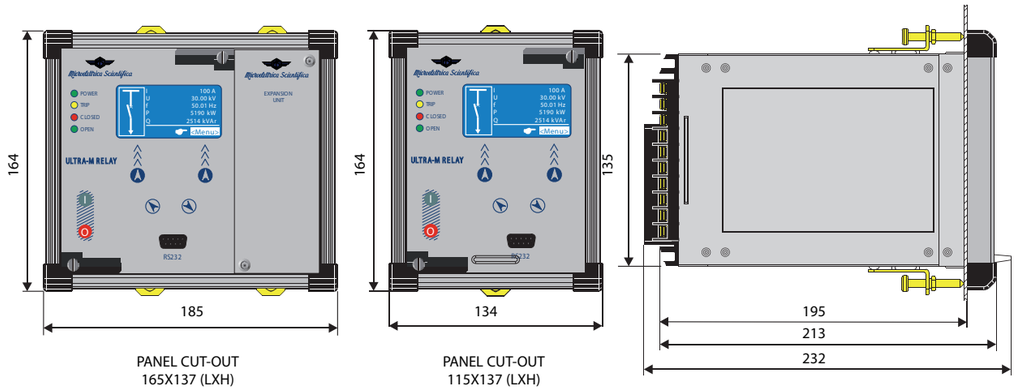
Relays Type

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

Wiring Diagram



Overall Dimensions (mm)



N-DIN line

General Characteristics

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

Measurements

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

Technical Characteristics

The Relay Main Body (RMB) includes:

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

The Front Face Panel (FFP) includes:

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

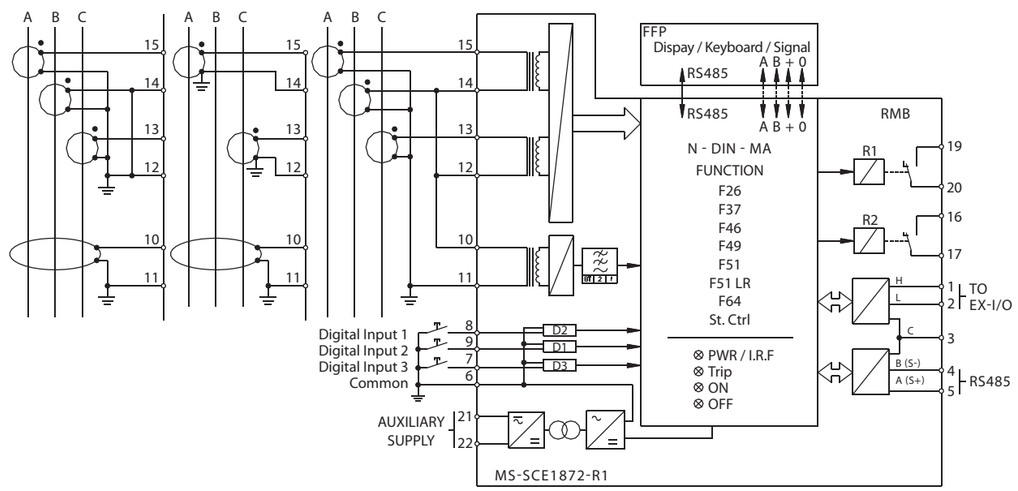
Mounting

- DIN46227 (EN50022)

Relays Type

N-DIN-MA	Motor Protection Relay: 37, 46, 49, 51, 51LR, 64/51N, 66
N-DIN-F	Feeder Protection Relay: 46, 49, 51, 50N/51N, 51BF
N-DIN TO64	D.C. Current Relay with High Sensitivity Hall Effect Transducer: 64, 51BF
Accessories	
EX-I/O	Input/Output Expansion Module
CPB	Profibus Converter Module
TA-DIN	Current Transformer
TAR-DIN	Current Transformer

Wiring Diagram



Overall Dimensions (mm)