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# **KNORR-BREMSE**



Microelettrica Scientifica



# Applications DC Substation DC Switchgear Depots

## **Traction innovation**

For over 50 years, Microelettrica Scientifica products have accompanied and often anticipated the evolution of rail transport all over the world. Today, Microelettrica Scientifica contactors, disconnectors, line test resistors, protection relays and high voltage transducers, together with EMC Traction DC high speed circuit breakers and complete DC switchgears represent a very complete and qualitatively outstanding offer for a growing number of DC substations customers, at different level and all over the world.

### Know how in continuous evolution

The frontiers of rail and urban transport systems are changing continuously and 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, personnell and main line, as well as full customers satisfaction, but more than that 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.

To achieve the best results, the EMC Traction facility in also get supported locally.

## Made in Microelettrica Scientifica

Microelettrica Scientifica develops and produces the entire range of products in its own facilities in Rozzano and Lacchiarella, as well as Vimodrone, all very near to Milano. But we also run operations in USA, South Africa, France, 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

## Products

Contactors

DC High Speed Circuit Breakers DC Switchgear





# **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 2000VDC/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

Туре	Umax [V <sub>AC/DC</sub> ]	lth [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





LTCS 250 3 poles

LTC 250 NC

# 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 dimensions, performances and strength, are suitable for all those applications on board which demand a small, smart device. Their design encourages applications where high operating frequencies and small available spaces are important requirements.

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LTC 100

LTC 100 NC

LTCS 250

LTCS 250 2 poles

Like all Microelettrica Scientifica contactors, the LTC series are based on a standard concept, but a very high level of customisation can be achieved by replacing 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 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 deenergized. More than 20.000 LTC contactors are delivered worldwide for every year the most important projects.

### **General Characteristics**

The modern and compact heavy duty line, up to 4000V<sub>DC/AC</sub> application, up to 1000A/pole
On board and stationary application

- 1-2-3 pole configuration mostly available, NO and NC poles, permanent magnets or indirect 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

Туре	Umax [V <sub>AC/DC</sub> ]	lth [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	1000	250	140	156,5	86
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

## Components for DC Substation Application



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### LTCH 250









# LTHH/LTE/LTP line

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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(P) series contactors for electric traction are supplied to railways and underground systems throughout the world.

Where high voltage ratings are required, the LTHH series contactors are the right solution. The creepage and clearance distances are widely dimensioned for safe application in polluted ambient. 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 the possible applications, they are available both with electric and pneumatic control, and poles can be manufactured in normally open or normally closed configurations. The indirect blow out circuit makes the LTHH contactors suitable to work both with high and low currents and with relatively high frequency (1500 Hz).

The DC control coil operates without economy resistor within a wide working range. More than 10.000 LTHH contactors are delivered worldwide every year for the most important projects.

### **General Characteristics**

- The higher voltage single pole heavy duty line, up to  $4000V_{\text{DC/AC}}$  application, up to 1300A/pole
- On board and stationary application
- Multipole assembles, NO and NC poles, indirect arc blow out
- Flexible control and auxiliary contacts options, high unit customization possible



#### Auxiliary Contact Blocks Type SJ11

Normally mounted on LTHH contactors and on disconnectors/changeovers
Execution in Makrolon, self extinguishing and transparent polycarbonate
Double interrupting, self cleaning, solid silver, snap action contacts
On request, special execution with gold plated contacts

Туре	Umax [V <sub>AC/DC</sub> ]	lth [A]	W [mm]	H [mm]	D1/D2 [mm]
LTHH 40	2000	60	200	162	48/106
LTHH 100	4000	120	377	274	60/130
LTHH 250	4000	300	377	295	70/160
LTE/P 2-400/600	2000	900	404	370	80/220
LTE/P 4-400/600	4000	900	403	394	85/220
LTE/P 4-2000	4000	1350	500	473	119/-

## Components for DC Substation Application



LTE/P 2-400/600

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LTE/P 4-400/600



# Switch

# **LTNS** line

#### Applications

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

# Microelettrica Scientifica LTNS series have been developed to answer to the constantly increasing market need of reduced dimensions and weight, taking most of the huge know-how in designing and manufacturing of industrial bar mounted contactors. These contactors have been designed starting from the N series electric arc management concept, grafted on the light and compact structure of a rail unit, developed around the control electromagnet.

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

### **General Characteristics**

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

Туре	lth [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
LTNS 1250	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.

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



### General Characteristics

- The bar mounted modular extra heavy duty line, up to 1000V<sub>DC/AC</sub> application, up to 6000A/pole Stationary application only
- Flexible control and adjustment configurations, total unit customization possible

		В	reaking	capaci	ty		Making	Со	nsumpti	ion of c	of coils Operation		Mech.	
Contactor	A.C. I'ca [/	cosφ= A] RMS γ	0,5 value	D.C. I' cc	L/R = 1 [A] (2 p	5 ms oles)	<b>capacity</b> lch	A.C.	[VA]	D.C.	[W]	tir (m	ne sec.)	endurance in million
	440 V	750 V	1000 V	220 V	440 V	660 V	[A]	Pick-up	Holding	Pick-up	Holding	Closing	Opening	operations
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



• Up to 6 pole configuration, NO and NC poles direct arc blow out various aux contacts options

# Disconnectors

LTHMU - 1 - 1500

LTHMU - 2 - 1500

LTHPD - 2 - 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, 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	Μ	U	1	800	LTH	Ρ	U	1	800
LTH	М	U	1	1500	LTH	Ρ	U	1	1500
LTH	М	U	2	800	LTH	Ρ	U	2	800
LTH	М	U	2	1500	LTH	Ρ	U	2	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)

## Components for DC Substation Application



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LTH	Μ	D	1	800	LTH	Ρ	D	1	800
LTH	М	D	1	1500	LTH	Ρ	D	1	1500
LTH	Μ	D	2	800	LTH	Ρ	D	2	800
LTH	М	D	2	1500	LTH	Ρ	D	2	1500
LTH	Μ	D	3	800	LTH	Ρ	D	3	800
LTH	М	D	3	1500	LTH	Ρ	D	3	1500
LTH	Μ	D	4	800	LTH	Ρ	D	4	800
LTH	Μ	D	4	1500	LTH	Ρ	D	4	1500



# **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**

Туре		IRA Magnetic
Rated Voltage [V]	Un	1500
Rated Current [A]	In	Up to 3000
Short Circuit Breaking Capacity (EN 50123) (IEC77)	Ue	1800 [V]
	cc	100 [kA]-Peak
	l cc	60 [kA]-Steady State
Rated Voltage Auxiliary Circuit [Vpc]	Un	24 ÷250



IRA Magnetic/Pneumatic
3000
Up to 3000
3600 [V]
60 [kA]-Peak
40 [kA]-Steady State
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]	Un	750	1500
Rated Current [A]	<b>I</b> n	Up to 3000	Up to 3000
Short Circuit Breaking Capacity (ANSI C 37-14)	Ue	800 [V]	
	CC	89 [kA]-Peak	
	l cc	82 [kA]-Steady State	
Short Circuit Breaking Capacity (EN 50123)	Ue	900 [V]	1800 [V]
	l cc	50 [kA]-Peak	45 [kA]-Peak
	lcc	30 [kA]-Steady State	25 [kA]-Steady State
Rated Voltage Auxiliary Circuit $[V_{DC}]$	Un	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]	Un	750	1200	1500
Rated Current [A]	In	Up to 8000	Up to 8000	Up to 8000
Short Circuit Breaking Capacity (ANSI C 37-14) (IR6000 4kA)	Ue	800 [V]	1200 [V]	
	l <sub>cc</sub>	200 [kA]-Peak	135 [kA]-Peak	
	cc	120 [kA]-Steady State	80 [kA]-Steady State	
Short Circuit Breaking Capacity (EN 50123)	Ue	800 [V]		1800[V]
	lcc	120 [kA] - Peak		100 [kA] - Peak
	cc	90 [kA]-Steady State		70 [kA] - Steady State
Rated Voltage Auxiliary Circuit [VDc]	Un	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]	Un	750	1200	1500	3000
Rated Current [A]	n	Up to 8000	Up to 8000	Up to 8000	Up to 4000
Short Circuit Breaking Capacity (ANSI C 37-14) (IR6000 4kA)	Ue	800 [V]	1200 [V]		
	cc	200 [kA]-Peak	132 [kA]-Peak		
	cc	120 [kA]-Steady State	80 [kA]-Steady State		
Short Circuit Breaking Capacity (EN 50123)	$U_{\rm e}$	800 [V]		1800[V]	3600[V]
	lcc	120 [kA] - Peak		100 [kA] - Peak	61<[kA] - Peak
	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 [VDc]	Un	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** 

Туре		Rectifier	Rectifier	Feeder	Feeder
Rated Voltage [V]	Un	750	1200	750	1200
Rated Current [A]	In	Up to 10000	Up to 10000	Up to 10000	Up to 10000
Short Circuit Breaking Capacity (ANSI C 37-14)	Ue	800 [V]	1200 [V]	800 [V]	1200 [V]
	cc	149 [kA]-Peak	100 [kA]-Peak	200 [kA] - Peak	132 [kA] - Peak
	lcc	90 [kA]-Steady State	60 [kA]-Steady State	120 [kA]-Steady State	80 [kA]-Steady State
Rated Voltage Auxiliary Circuit [VDC]	Un	48 ÷ 225	48 ÷ 225	48 ÷ 225	48 ÷ 225







# **DC Switchgears**



**Diaclad Switchgears** 

# DC Switchgears Type DIACLAD

For substations (750V DC - 1.5KV DC - 3KV DC)

Applications DC Substation The DC Switchgears type "DIACLAD" are designed and manufactured for 750, 1500 and 3000 V according to EN 50123. The Diaclad Switchgears are capable to withstand internal arc at 50 kA – 300 ms. The cubicle, metalclad type, are pre-fabricated with IP 30 degree of protection, suitable for indoor installation. The minimum thickness of the frame is 3 mm. The doors, panels and diaphragms are made with 2 mm minimum thickness plates. When the doors are open an IP20 degree of protection is guaranteed. Any device location of each cubicle is aimed to ease maintenance and replacement operations. The quality and technology of Diaclad components enable to limit the dimensions and ease the maintenance: live components are completely separate allowing access to high and low voltage devices even when adjacent cell's are in operation.



**Rectifier Cubicle** 







**Disconnector Cubicle** 



Feeder Cubicle



**Protection Relay** 

# tationary

# **Line Test**

# Applications

DC Substation

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

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

- Nominal Voltage
- Test Current
- Duty cicle







# Relays



0 30 0

# **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.

Communications

port on rear side

4 Output Relays

• "14DI" 14 Digital Inputs

• "14DO" 14 Output Relays

Totally draw-out execution

port on front panel

• 1 RS485 Serial communication

1 RS232 Serial communication

Communication Protocols

Expansion Modules (optional)

• "UX10-4" 10 Digital Input and

• Modbus RTU/IEC870-5-103/IEC61850

### 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**

• 4 Leds for signalization

- Complete autodiagnostic program
- Display LCD 16 (2x8) characters

# • IP44 protection case (on request IP54)

Software

Execution

 MSCom2 Program interface for device management

• 1 Module box. (2 modules with expansion)

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
МСМ	Motor Protection Relay: 37, 46, 47, 48, 49, 50/51, 51LR, 64S, 66, 68



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# Relays **Ultra line**



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# **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

with dedicated relay

- Multilanguage Display (English/Italian
- standard, available other on request)
- Complete autodiagnostic program

#### **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

#### 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





### **Overall Dimensions (mm)**





115X137 (LXH)







# **N-DIN line**

### **General Characteristics**

Relays

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



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## **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
СРВ	Profibus Converter Module
TA-DIN	Current Transformer
TAR-DIN	Current Transformer











FFP Height= 16

## **Components for DC Substation Application**





RMB Height= 72

# **MHCO** line

DC measuring converter

Relays



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#### **General Characteristics**

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

#### The MHCO line includes three models:

#### ΜΗCΟ-ΤV

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

#### МНСО-ТІ

For CURRENT measurement.

Connected to the high

voltage line through

a dedicated shunt

(not supplied).

# ΜΗCO-ΤVI

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

#### Highlights

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

#### **Transmitter Unit**

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

#### **Receiver Unit**

Two models available, respectively suitable to be connected to the current and to the voltage transmitter by means of a dedicated Fibre Optic connection. The input signal is converted into 4 linear analogue output signals independently programmable (ie. 0-20/4-20mA etc..). The setting of this unit can be easily done using our MSCom2 software tool.

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

#### **Fibre Optic Link**

Transmitter and Receiver units are connected by means of a Fibre Optic link which guarantee a very hight insulation level. Two Fibre Optic type are available both provided with standard ST connectors: PLASTIC FIBRE: 62,5/125µ GLASS FIBRE: 200 m HSC The standard length of the fibre opti connection is 5 meters, other lengths are available on request.

#### **Characteristics Transmitter/Receiver**

Measurement solution: 0.1% of full scale @ (20/+70)°C Responce time: 200ms Connection: Fiber optic standard length 5m (max 1 km with glass fiber)

#### Wiring Diagram



(\*) Version with optional display shown in the figure

## **Components for DC Substation Application**

Fiber optic type 200.230.500m HCS (plastic) or 62.5/125m (glass) connection type ST

# Transducers

# **MHIT** line

DC measuring converter



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#### **General Characteristics**

The DC measuring transducers MHIT are the latest generation of transducers for high voltage measurement designed by Microelettrica Scientifica. They are the result of the long experience of Microelettrica in this field with the addition compared to the previous line (MHCO) of the full redundancy of the measuring channel which gives a further level of reliability to the product. The MHIT are designed and manufactured to allow safe and full isolated HV measurement of DC currents and Voltages. They find their main application in all the DC Traction Substations (Railways, Tramways and Metro) where, directly connected to the high voltage systems (750V, 1,5kV and 3kV) gives very accurate and safe analogue outputs for measuring and protective purposes.

The MHIT line includes three models:

#### MHIT-V

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

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

#### MHIT-VI

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

#### Highlights

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

#### **Transmitter Unit**

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

#### **Receiver Unit**

Two models available, respectively suitable to be connected to the current and to the voltage transmitter by means of a dedicated Fibre Optic connection. The input signal is converted into 4 linear analogue output signals independently programmable (ie. 0-20/4-20mA etc..). The setting of this unit can be easily done using our MSCom2 software tool.

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

#### Fibre Optic Link

Transmitter and Receiver units are connected by means of a Fibre Optic link which guarantee a very hight insulation level. Two Fibre Optic type are available both provided with standard ST connectors: PLASTIC FIBRE: 62,5/125µ GLASS FIBRE: 200 m HSC The standard length of the fibre optic connection is 5 meters, other lengths are available on request.

### **Characteristics Transmitter/Receiver**

Measurement solution: 0.1% Vn/0.05% Full Scale (2Vn)

	channel (0,1)In-0.05% In/0.05% Full Scale
	channel (0,10)In-0.5% In/0.05% Full Scale
Accuracy class:	0.2
Responce time:	200ms
Connection:	Fiber optic type 200.230.500m HCS (plast
	Fiber optic standard length 5m (max 1 km

### Wiring Diagram



## **Components for DC Substation Application**

tic) or 62.5/125m (glass) connection type ST m with glass fiber)