

Electrical Safety in mines

Ground Fault Protection Equipment for the mining industry

Increased electrical safety thanks to reliable ground fault Monitoring and protection devices in:

- resistance grounded systems
- solidly grounded systems

Power in electrical safety

BENDER – known for its innovative management strategy

The roots of the BENDER Company date back to the year 1936. Walther Bender, the founder of the company, began his work as an inspector for electrical power systems in open pit and underground coal mines in Germany.

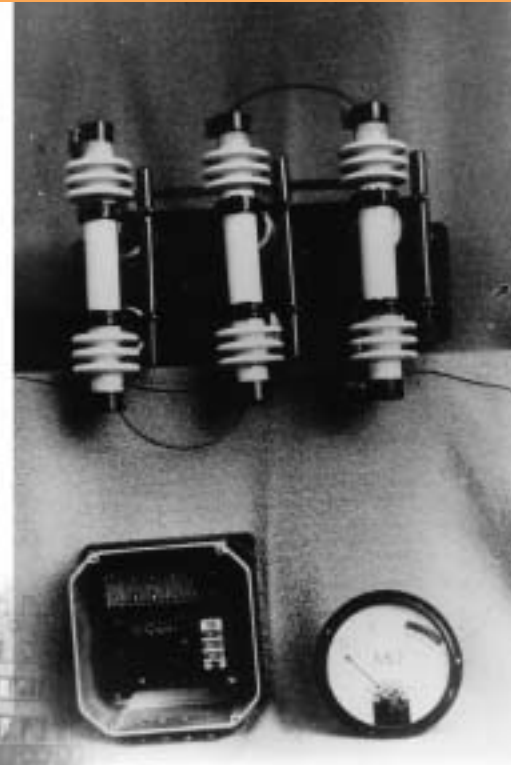
Electrical installations used to be disconnected for high pot testing purposes which inevitably led to production outages. This inspired him to develop an "Insulation Monitoring Device and ground fault indicator for three-phase systems"; the so called "IMD". In 1939 this work originated in the first patent. Since then it was possible to check the electrical installation during online operation and shut downs became obsolete. It is important to note that the German underground mining society employed a majority of ungrounded or floating power systems. The nature of these systems forbid conventional current transformer based ground fault monitoring solutions. The IMD was the first device to close this gap successfully.

In the mining industry ELECTRICAL SAFETY has always been considered a high priority issue, BENDER has advanced to a world leader in Electrical Safety Products.

Today the BENDER Group with its affiliated companies is structured and staffed with talented personnel comprising a work force in excess of 400 employees motivated to reduce cycle time from product inception to commissioning while still surpassing the quality control requirements of ISO 9001.

A considerable percentage of earnings is invested in R & D.

BENDER key personnel actively participates on National and International Standard committees and organizations interested in ELECTRICAL SAFETY issues throughout the Industrial, Mining and Healthcare market.



The new millenium – new ideas based on 60 years of experience

BENDER recently upgraded its existing line of monitoring and protection devices for grounded and resistive grounded systems to fulfil the request for the mining industry in the United States of America and Canada.

In continuous dialogue with the customers, the BENDER product range has been steadily increasing. Practice-oriented solutions are offered for all application fields where electrical safety is paramount.

The main emphasis of BENDER is placed on:

- Ground Fault Current Monitors
- Ground Fault Relays
- Insulation Monitoring Devices



- fixed and portable Ground Fault Location systems
- fixed and portable GFCIs

- system monitoring devices
- monitoring, alarm, control and operator panels
- various power supply units.

Insulation Monitoring Device for ungrounded AC/DC and DC systems A-ISOMETER, IRDH275 / IRDH375



IRDH375

Features:

- ▶ Wide response range 1 kOhm... 10 MOhm
- ▶ Separately adjustable response values for pre-warning/main alarm
- ▶ Comprehensive self-monitoring function

- ▶ Info key for the indication of the selected parameters and current system leakage capacitance.

Examples:

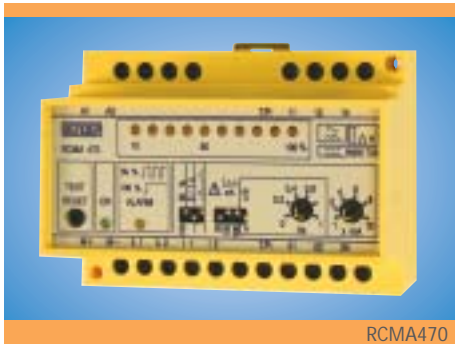
- ▶ Variable-speed drives
- ▶ Ungrounded systems with high leakage capacitances
- ▶ Battery systems

Application fields:

The A-ISOMETER® of the IRDH275/375 series monitor the insulation resistance of ungrounded power supply systems. The devices are suitable for universal use in

3(N)AC, AC/DC 0...793V and DC systems 0...650V. AC systems may include extensive DC supplied loads, such as converters or thyristor-controlled DC drives.

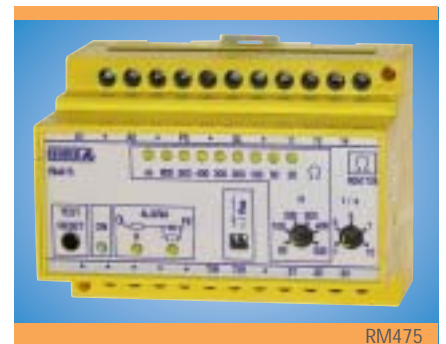
High sensitive Ground Fault Current Monitor for AC/DC and DC grounded and high resistance systems 470/475LY



RCMA470

Features:

- ▶ AC/DC sensitive residual current measurement
- ▶ Pre-warning/main alarm selectable
- ▶ Internal and external indication of the residual current



RM475

Application field:

The AC/DC sensitive residual current monitors of the RCMA470/475 series monitor fault and residual currents in earthed power supply systems utilizing external or internal measuring current transformers. The devices are particularly used in installations where smooth DC currents or residual currents occur the value of which is greater than zero. This is the case with loads having sixpulse bridge rectifiers or oneway rectifiers with smoothing function, such as charging devices, converters, machines with variable-speed electric motors etc.

Examples:

- ▶ Grounded systems with variable-speed drives
- ▶ Battery systems
- ▶ Charging stations
- ▶ Excavator and conveyor systems
- ▶ Mills and vibrators
- ▶ Pumps, fans, compressors

Application:

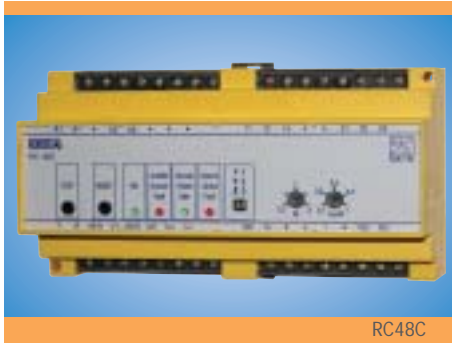
The ground loop monitor RM475LY, in combination with the cable end unit EV22S, monitors a closed and voltage-free loop for interruption (series resistance) and short circuit (cross resistance).

Features:

- ▶ LED bar graph indicator
- ▶ Suitable for installation into standard distribution panels
- ▶ Fault memory

Ground Fault Current and Ground Integrity Monitor for grounded and resistance grounded AC systems RC48C

Application field:



The RC48C monitors the residual current in resistance grounded installations and monitors the grounding conductor for low resistance. The grounding conductor is monitored for low resistance by means of the termination device E6... that is connected between the conductors G (ground) and GC (ground check) at the end of the cables being monitored. By evaluating the voltage drop at this termination device, the RC48C recognizes series resistance faults (cable high resistance or open) or cross resistance faults (short circuit) of the cable.

Features:

- ▶ External alarm indicator and test combination
- ▶ Fault memory
- ▶ Band pass filter

Application:

- ▶ Trailing cables in resistance grounded installations

Ground Fault Current and Neutral Grounding Integrity Monitor for resistance grounded AC systems RC48N



Application field:

The RC48N monitor is used to monitor the zero sequence current, the resistance value of the neutral grounding resistor and the voltage drop on the neutral grounding resistor. For residual current monitoring, the neutral grounding conductor and the connection of the coupling device to the neutral have to be passed through the zero sequence current transformer. Alternatively, all active conductors (phases + N) can be passed through the transformer. When the band pass filter is switched on, only the narrow-band 60 Hz-components of the residual current are detected. In addition, the RC48N monitors the resistance value of the neutral grounding resistor (NGR) and the voltage drop on the neutral grounding resistor via the coupling devices CD1000 and CD5000.

Examples:

- ▶ Trailing cable with supplementary monitoring conductor
- ▶ Ground loops


















Features:

- ▶ For systems up to 5 kV
- ▶ Data memory
- ▶ Test and reset button
- ▶ Adjustable response values
- ▶ External alarm indicator and test combination

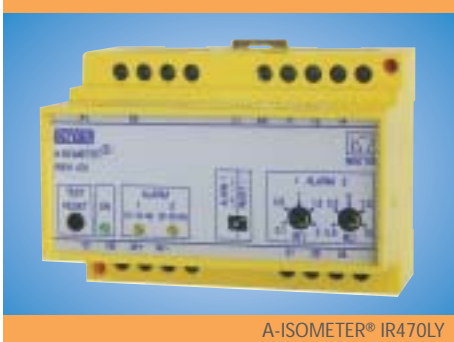
Application

- ▶ Monitoring of trailing cables in resistance grounded installations

Selection Chart Ground Fault Monitors, Insulation Monitoring Devices, Ground Fault Protection Systems and Ground Fault Location Systems

Measuring, monitoring & protection device	Insulation Monitor		Ground fault relay		
Power System	ungrounded		solidly and high resistance grounded		
Voltage	AC	AC/DC & DC	AC	AC/DC & DC	
Applications	Mining Processing, Power generation, Power distribution		Mining Processing, Power generation Mobile Gensets		
images					
Type	IR 470 LY	IR 475 LY	RCM 460 Y	RCMA 470 LY	
Response value	1...200 kOhm	2...500 kOhm	30...300 mA	30 mA...3 A	
Notes	1 Alarm, LED-Bargraph	2 Alarms, LED-Bargraph	external CT	external CT	
images					
Type		IRDH 275	RCM 465 Y	RCMA 475 LY	
Response value		1 k...10 MOhm	30...300 mA	30...500 mA	
Notes		2 Alarms, LC-Display	internal CT 18mm	internal CT	
images					
Type		IRDH 375	RCM 470 LY		
Response value		1 k...10 MOhm	10 mA...10 A		
Notes		2 Alarms, LC-Display	external CT		
images					
Type		IRDH 575	RCM 475 LY		
Response value		1 k...10 MOhm	10 mA...10 A		
Notes		for ground, fault location	internal CT		
images					
Type			W-, WR-, WS- series	W...A series	
Response value					
Notes			standard, split-core, rectangular		
Measuring, monitoring & protection device	Ground fault relay & Ground continuity monitor Canadian Standard CSA M421-00		Ground fault relay & Ground continuity	Ground continuity monitor	Off-line Insulation monitor
Power System	solidly grounded and resistance grounded		solidly grounded and resistance grounded	Ungrounded or grounded	Ungrounded or grounded
Voltage	AC		AC (up to 10KV here)	AC & DC	AC & DC
Application	Trailing cables power distribution		Trailing cables power distribution	Trailing equipment	standby equipment
images					
Type	RC 48 C	RC 48 N	HW 135	RM 475	IREH 470 Y
Response value	(Leave ID off) 0,1...10 A	ID 0,1...10 A	ID 0,1...10 A	50...1000 Ohm	0,1...2 M/0,5...10 M
Notes	Ground continuity and shorted ground monitoring via pilot wire	monitoring of neutral grounded resistor	Grounding continuity and parallel path monitoring via pilot wire	Ground Continuity and parallel path monitoring via pilot wire	2 Alarms

Insulation Monitoring Device for off-line equipment A-ISOMETER IREH470LY



A-ISOMETER® IR470LY

Features:

- ▶ External measured-value display
- ▶ Nominal range can be extended via coupling devices
- ▶ Pre-warning/main alarm

Examples:

- ▶ Fire extinguisher pumps
- ▶ Exhaust air extraction systems
- ▶ Motors
- ▶ Water pumps
- ▶ Slide-valve drives
- ▶ Elevators

Application field:

The IREH... series monitor the insulation resistance of disconnected loads in

grounded and ungrounded power supply systems. The devices are used, for example, for motors, pumps for fire

fighting purposes or dewatering, slide-valve drives.

Ground Fault Current and Ground Integrity Monitor for grounded and resistance grounded high voltage AC systems HW103



HW103

Application field:

The high voltage cable monitor monitors the cable in accordance with the German standard for mine safety DIN VDE 0118 in electrical installations for ground fault, open-circuit of the ground conductor, and for conducting objects penetrating the cable. Earth fault monitoring is based on the residual current monitoring principle. The evaluation of the ground fault current is indirectly carried out via the zero sequence current transformer HWW-11.

The effectiveness of the ÜL/SL (ÜL = monitoring conductor; SL = Ground conductor) is monitored in combination with the termination device EV22S.

Features:

- ▶ For cable lengths up to 2 miles
- ▶ For use in premises demanding a high level of safety, e.g. explosion-proof high voltage switchboards

Examples:

- ▶ Monitoring of supply cables without mechanical protection in underground mines
- ▶ Ground fault clearing in underground mining
- ▶ Monitoring of excavators with trailing cables, e.g. tunnel driving machines

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