EARTH LEAKAGE RELAYS

CATALOG 2011
Aktif trade mark for Medium voltage switchgears, Switching equipment and Kiosks with high quality and environmentally sensitive

Aktif trade mark for Capacitor Banks, Harmonic Filters, Resistors, Medical Insulated Power Panels, Synchronization and Energy automation Panels with high quality and environmentally sensitive


Aktif trade mark for Measuring, Protection, Control and Power Quality products with high quality, long life and environmentally sensitive

Identifies the product as top quality, safe and one step forward of the similar ones.

Symbolizes measurable energy saving products helps to energy continuity.

Identifies smart control logic.

Identifies easy to use products, simplifies the difficult tasks.

Green products, respects to the nature and our future.
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EARTH LEAKAGE RELAYS

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Aktif Raylı Sistemler Ltd.

Aktif Railway Systems (ARS) is established in 2008 for the designing and providing of traction systems’ substations as well as providing on-board equipment used on vehicles.

The main purpose of ARS is providing engineering services and products to public bodies and companies in this sector.

Even though it is a brand new company, ARS managed to complete successfully both Antalya Light Rail System project as well as Istanbul Metro Stinger System projects.

Aktif Mühendislik Ltd.

Aktif Engineering (AMDT) is established in 1996 Measuring, Protecting and Quality of Electricity.

2200m2 headquarter of AMDT is located in Istanbul consisting of 35 employees. Since establishment AMDT provides high quality engineering, supplying and start-up services for the power quality, energy saving, energy metering, protection.

AMDT provides standard and custom designed solutions to domestic and international customers, with over 15 years of experience.

Aksis Enerji Sistemleri Ltd.

Aksis Energy Metering Systems (AKS) is established in 2003 for providing metering solutions like Automatic Meter Reading, Billing Software in every level of energy sector. The company is focused on saving and efficient using of energy by its Meter Management and Loss & Leakage tracing solutions.

AKS answers all expectations in power systems with high quality products and custom design software solutions.

AKS customers create over 100 million Euro energy bills using different Metering, Management and Billing methods of AKS.
Aktif Elektroteknik A.Ş.

The company is established to manufacture Switchgears and Kiosks under the name of “Setas” in 1981. First in 2008, company merged to Aktif Group as Aktif Elektroteknik (AET) and then the company becomes international after significant participation of Italian Friem S.p.A in 2009.

9000m2 factory of AET is located in Ankara consisting of over 100 employees.

AET operates with its 30 years of manufacturing experience, modernized machinery line, ever increasing know-how, experienced Turkish and Italian R&D teams, quality products type tested by the leading accredited European laboratories and the vision of new ideas to meet with future expectations.

Friem S.p.A.

Friem manufactured over 40 million ampere and 1000 power rectifiers for the worldwide since it’s established in Milan at 1950.

Having technical knowledge of energy and electro mechanics along with ability of complete design of conversion systems, FRIEM provides also high voltage DC insulators, DC switches, anodic control and protection products and auxiliary equipments like polarization products to its customers.

Friem is a share holder of Aktif Elektronik in Turkey and also COET S.r.L in Italy.

Coet S.r.L.

Since establishment in 1962 in Milan, COET has been producing AC/DC switching equipments and panels that are used safely by its customers thanks to the COET’s work on industrial and electric equipment and patents obtained in this field.

All manufactured products are the result of long technical research and development work. This way, the company is known for the originality and diversity of its planned solutions.

COET has been working on Industrial and railway systems and has become one of the leading companies in the field of supplying switching equipments for traction substation.
Company Profile

Introduction

Aktif Group is in continuous development with its customer oriented activities, advanced engineering know-how, R&D works, software developing abilities and with the continuous support of loyal customers that are attained and protected by precise work and ethical principles of the company.

The group companies have ISO 9001 since 90s and our factory has ISO 14001 Environment and ISO 18001 Occupational Health and Safety Certificates.

Technology

The most important activities of Aktif is R&D and increase the Employee quality which the investment amount of these activities are more than average.

All mechanical projects are designed by 3D-CAD platforms. Power flow, test and quality works are calculated by Worldwide accepted simulation software and ActWin software as well as developing software for different platforms.

In order to increase the production quality and capacity all machinery within the facility are renewed with latest technology equipment in 2009.

Mission

By the help of our followings mission is continuing to announce product quality and knowledge of our company and country in best possible way by meeting rising customer expectations.

- open minded approach
- high quality policy
- innovative ideas
- constantly improved processes
- polished employees
- knowledge based decisions

Vision

To increase the number of our loyal customers in global market, hence increasing the market share and becoming reputable, reliable and preferred company as worldwide with our:

prominent quality difference, customer oriented approach, innovative activities, open minded approach.
High Performance, Durable and Simple

Endurance of our products, which are produced with high level of awareness and accurateness in addition to follow international standards, ensures an outstanding performance for the users. Therefore our products are considered as top of the line products.

Visual simplicity and being user friendly are the design criteria for the software and hardware of our products. Our products have the most simple and functional features for emergency applications as well as persistence of habits and customer satisfaction are basics in design, production and shipment.

Security

The human safety and security are the main concerns in all of our products.

Design, Interlock logics and documentation of our products are implemented, manufactured and tested in order to reach the highest safety level.

Furthermore, services and site works are done according to human safety rules by taking into account the dangerous of electricity.

Service Continuity

The service continuity means efficiency of power consequently profitability of the business.

Our products are designed and manufactured in order to ensure energy sustainability and provide the best service availability.

This policy is the cornerstone of our orientation and training programs and it is fully applied by our technical and administrative staff.

Local & Remote Monitoring

Energy continuity and efficiency can be ensured only by monitoring of equipments local and remotely.

Our products are designed with remote monitoring and management features by the help of our software development abilities on different platforms and hardware capabilities. This will ensure the saving and profitability, directly.
## Earth Leakage Relays

### A 1. RCR- Td Earth Fault Protection Relay with Internal Toroidal Type Current Transformer

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A 1 RCR- Td Earth Fault Protection Relay with Internal Toroidal Type Current Transformer

Rcr -Td Type earth fault protection relay is manufactured as a compact design of six modules DIN (17.5 mm), consist of all kind of specification of RCR family with wide tripping current range and internal toroidal type current transformer that has 28 mm radius.

By using this relay and this kind of compact design, the cable installation is minimized and in case of occurring electromagnetic area between RCR and toroid coils, the system is protected against hazardous and harmful effects.

The relay has a micro switch which ensures to select the operation method. This switch is performed by without energy stored (cannot open the circuit) or energy stored (in case of fault).

On front panel board, it is possible to control the degree of tripping current (0.025 - 25 A), and monitor the delay time of trip (0 - 5 s) and manual resets.

The relay also has two output contacts and transparent front cover for protection.

A 1.1 Models

RCR-Td : 110-230-400 Vac 50-60 Hz 110 Vdc
RCR-Td : 24-48 Vac 50-60 Hz 24-48 Vdc

A 1.2 Options

F : The internal filters for third harmonics
T : Tropicalization

A 1.3 The Installation Schema
### Electrical Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>External supply voltage</td>
<td>24-48 V ac/dc 110 V ac/dc 230-400 V ac ± %20</td>
</tr>
<tr>
<td>Frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Max. Consumption</td>
<td>3 VA</td>
</tr>
<tr>
<td>Current Adjustments range IN</td>
<td>0.025÷0.25 A K=0,1-0,25÷2.5 A K=1-2.5 A÷25 A K=10</td>
</tr>
<tr>
<td>Time Adjustments range</td>
<td>0.02÷0.5 s K=1-0.2÷5 s K=10</td>
</tr>
<tr>
<td>Transformer internal Radius</td>
<td>28 mm</td>
</tr>
<tr>
<td>Output</td>
<td>2 contacts changeable</td>
</tr>
<tr>
<td>Operation temperature</td>
<td>-10 ÷ 60 °C</td>
</tr>
<tr>
<td>Store Temperature</td>
<td>-20 ÷ 80 °C</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>90%</td>
</tr>
<tr>
<td>Insulation Test</td>
<td>2.5 kV for 60 seconds</td>
</tr>
<tr>
<td>Standards</td>
<td>CEI 41-1 IEC 255 VDE 0664</td>
</tr>
<tr>
<td>Electromagnetic Accommodation</td>
<td>CEI EN 50081-1 CEI EN 50082-2</td>
</tr>
<tr>
<td>Cable installation</td>
<td>T type terminals for up to 2.5 mm² cables</td>
</tr>
<tr>
<td>Installation</td>
<td>DIN ray 35 mm</td>
</tr>
<tr>
<td>Ingress Protection</td>
<td>IP 40, P 20</td>
</tr>
</tbody>
</table>

### A 1.4 Dimensions

![Dimensions Diagram](image-url)
Earth Leakage Relays

A 2 RCR-T Type Earth Fault Protection Relay With Internal Toroidal Current Transformer

The distinction of Rcr Type models is that relays are manufactured with internal toroidal transformer. Specially these relays are designed for the implementations that provides extra area for users, especially motor control center, energy distribution batteries etc.

In spite of the fact that RCR-T type relays have minimal dimensions, these instruments have wider control scala than the other kind of RCR Types. In case of under 50 Volts trip, this specification allows relay to set the degree of existing current due to CEI standards. Furthermore, in case of more than one relay on the same line, trip activity is allowed.

One of the other important specification is that by the filters which conforming to standards of VDE, the RCR-T Relays do not react external effects (even existing ones) and pulse currents which have DC components.

By auxiliary device with reset button, the green led (normal operation) and the red led (trip) can build on the front side of case.

A 2.1 Models

RCR-T/35 - RCR-T/60 - RCR-T/80 - RCR-T/110 : 110 Vac/dc
RCR-T/35 - RCR-T/60 - RCR-T/80 - RCR-T/110 : 24-48 Vac/dc
RCR-T/35 - RCR-T/60 - RCR-T/80 - RCR-T/110 : 230-400 Vac

A 2.2 Options

F : The internal Filters for third harmonics
2 : NO-C-NC couple output contacts
T : Tropicalization

A 2.3 Accessories

AD : Aux device for remote control
Simple installation: DIN 48x48 mm

1- Setting trip time potentiometer,
2- Setting trip current potentiometer,
3- Micro switches for constant selecting:
   a - Trip-Time coefficient
      Coefficient; 1 = K:10
      0 = K:1
    b, c - Trip current coefficient,
      b, c on position 0 = K:0,1
      b on position 1 and c on 0 = K:1
      b, c on 1 position = K:10
    e - On position 1 the outgoing relays hold without energy, and position 0, relays may hold with energy. (fault security)
4- Test button
5- Manuel reset button
6- Green Led for Auxiliary Supply Signal
7- Red Led for Fault Signal
### Electrical Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>External voltage supply</td>
<td>24-48 V ac/dc    110 V ac/dc    230-400 V ac ± %20</td>
</tr>
<tr>
<td>Frequency</td>
<td>50÷60 Hz</td>
</tr>
<tr>
<td>Max. Consumption</td>
<td>3 VA</td>
</tr>
<tr>
<td>Current Adjustments range IN</td>
<td>0,025÷0.25 A K=0,1-0,25÷2.5 A K=1-2.5 A÷25 A K=10</td>
</tr>
<tr>
<td>Time Adjustments range</td>
<td>0.02÷0.5 s K=1-0.2÷5 s K=10</td>
</tr>
<tr>
<td>Output: 2 Contacts changeable</td>
<td>5 A 250 V</td>
</tr>
<tr>
<td>Operation temperature</td>
<td>-10 + 60 °C</td>
</tr>
<tr>
<td>Store Temperature</td>
<td>-20 + 80 °C</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>90%</td>
</tr>
<tr>
<td>Insulation Test</td>
<td>2.5 kV for 60 seconds</td>
</tr>
<tr>
<td>Standards</td>
<td>CEI 41-1 IEC 255 VDE 0664</td>
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<tr>
<td>Electromagnetic Accommodation</td>
<td>CEI EN 50081-1 CEI EN 50082-2</td>
</tr>
<tr>
<td>Cable installation</td>
<td>T type terminals for up to 2.5 mm² cables</td>
</tr>
<tr>
<td>Protection Terminals</td>
<td>IP 20</td>
</tr>
</tbody>
</table>

### A 2.4 Installation Schema

```
Network
N  R  S  T

Load
```

### A 2.5 Dimensions

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCR-T / 35</td>
<td>35</td>
<td>100</td>
<td>60</td>
<td>110</td>
<td>47</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>RCR-T / 60</td>
<td>60</td>
<td>100</td>
<td>60</td>
<td>110</td>
<td>47</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>RCR-T / 80</td>
<td>80</td>
<td>150</td>
<td>110</td>
<td>160</td>
<td>70</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>RCR-T / 110</td>
<td>110</td>
<td>150</td>
<td>110</td>
<td>160</td>
<td>70</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>
Earth Leakage Relays

A 3 RCR 1d Earth Fault Protection Relays

Despite being downsized, RCR 1-d holds all fundamental specifications of DIN 96x96 mm series. Conforming to standard of DIN 43880, the first relay series of three module long modular covered (with 17.5 mm base) types. In case of the holding contact voltage degree below 50 Volts, according to CEI 64 standard, wide control range allows to set the trip current. Also it is the ideal solution if there are more relays which must be protected on the same line.

One of the other superior characteristic of existing relays is that relays constantly can control toroidal RCR circuits. If this protection is interrupted, relay lets the protection to cut the circuit. By using this specification, the operator doesn’t need to wait periodic tests to define the fault.

The device which holds filters on its incoming circuits, protects the system conforming to VDE 0664 and IEC 23 standards, against the external affects and pulse currents which have DC components.

By using micro switches, RCR-1d holds automatic and manual selection by transparent front cover and adjustments are saved.

The remote test option also exists on this relay. And also can connect to any other toroidal current transformer.

A 3.1 Models

RCR-1d : 100 Vac-dc - 230-400 Vac
RCR-1d : 24-48 Vac/dc

A 3.2 Options

T : Tropicalization

A 3.3 Accessories

AD : Auxiliary device for remote control
Simple installation DIN 48 x 48 mm
### Electrical Characteristics

- **External voltage supply:** 24–48 V ac/dc  110 V ac/dc  230–400 V ac ± 2%
- **Frequency:** 50–60 Hz
- **Max. Consumption:** 3 VA
- **Current Adjustments range IN:** 0.025÷0.25 A K=0.1-0.25÷2.5 A K=1-2.5 A K=10
- **Time Adjustments range:** 0.02÷0.5 s K=1- 0.2÷5 s K=10
- **Output: 2 Contacts changeable**
- **Installation:** DIN Ray 35 mm
- **Operation temperature:** -10 + 60 °C
- **Store Temperature:** -20 + 80 °C
- **Relative Humidity:** 90%
- **Insulation Test:** 2.5 kV for 60 seconds
- **Standards:** CEI 41-1 IEC 255 VDE 0664
- **Electromagnetic Accommodation:** CEI EN 50081-1 CEI EN 50082-2
- **Cable installation:** T type terminals for up to 2.5 mm² terminals with screw
- **Protection Terminals conforming to DIN 40050**

### A 3.4 Installation Schema

![Installation Schema Diagram](image)

### A 3.5 Dimensions

![Dimensions Diagram](image)
A 4 RCR-1p Earth Fault Protection Relay

Despite being downsized, RCR 1p relay holds all fundamental specification of DIN 96x96 mm series.

In case of the holding contact voltage degree below 50 Volts, according to CEI 64 standards, wide control range allows to set the trip current. Also it is the ideal solution when using more relays which must be protected on the same line.

One of the other superior characteristic of existing relays is that relays constantly can control toroidal RCR circuits. If this protection is interrupted, relay lets the protection to cut the circuit. By using this attribution, the operator doesn’t have to wait periodic tests to define the fault.

The device which holds filters on its incoming circuit, protects the system conforming to VDE 0664 and IEC 23 standards, against the external affects and pulse currents which have DC components.

By using micro switches, RCR-1d holds automatic and manual selection via transparent front cover and adjustments are saved.

The remote test option also exists on this relay. And also can connect to any other toroidal current transformer.

A 4.1 Options

T : Tropicalization

A 4.2 Installation Schema
**Electrical Characteristics**

- **External supply voltage**: 24-48 V ac/dc, 110 V ac/dc, 230-400 V ac ± 20%
- **Frequency**: 50±60 Hz
- **Max. Consumption**: 3 VA
- **Current Adjustments range IN**: 0.025÷0.25 A K=0.1-0.25; 2.5 A K=1÷2.5 A K=25 A K=10
- **Time Adjustments range**: 0.02÷0.5 s K=1; 0.2÷5 s K=10
- **Output: 2 Contacts changeable**: 5 A 250 V
- **Installation [50022]**: Panel Installation 96 x96 x119
- **Operation temperature**: -10 + 60 °C
- **Store Temperature**: -20 + 80 °C
- **Relative Humidity**: 90%
- **Insulation Test**: 2.5 kV for 60 seconds
- **Standards**: CEI 41-1 IEC 255 VDE 0664
- **Electromagnetic Accommodation**: CEI EN 50081-1 CEI EN 50082-2
- **Cable installation**: T type terminals for up to 2.5 mm² terminals with screw
- **Protection Terminals conforming to DIN 40050**: IP 20

### A.4.3 Dimensions

![Dimensions Diagram](image-url)

- Dimensions: 96 x 96 x 119 mm
- Panel installation
- Protection Terminals conforming to DIN 40050

*Image Credit: AKTIF Group Company*
A 5 CT 1 Type Toroidal Current Transformers

CT type toroids are manufactured with the optimum quality magnetic core which detects the leakage current even leakage is minimal.

The core owns two coils, first one is to detect the leakage (to send to relay) and second one is for testing. Test is performed to ensure optimum conductivity between coupling of relay and toroids. Because relay can perceive the signals which sent to test coils. This signal creates a degree which causes a trip.

Signal is detected by other coil and sent to relay back. This encountered situation (periodic test) is not only confirming type of using of relay, and also to ensure accuracy of connection between relay and toroids.

All phase’s conductors and neutral conductor must pass through inside the toroid. But this situation is not applied to earth conductor.

A 5.1 The special Toroidal Transformers

A 5.1.1 CT1M

CT1M is the amplifier adjusts the RCR’S current up to 250 Ampere’s and includes coefficient. CT1M is implemented between RCR and measurement toroids.(do not pass through inside cables)

A 5.1.2 CT1S

In case of the system’s cable size is larger than toroid’s internal radius, these kind transformers are used. In this situation, current transformers which connected to totaling toroids and RCR, must be used.(for more information please use the implementation notes)

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimension (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>CT -1 / 35</td>
<td>35</td>
</tr>
<tr>
<td>CT -1 / 60</td>
<td>60</td>
</tr>
<tr>
<td>CT -1 / 80</td>
<td>80</td>
</tr>
<tr>
<td>CT -1 / 110</td>
<td>110</td>
</tr>
<tr>
<td>CT -1 / 160</td>
<td>160</td>
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<tr>
<td>CT -1 / 210</td>
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<tr>
<td>CTA-1 / 60</td>
<td>60</td>
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<tr>
<td>CTA-1 / 110</td>
<td>110</td>
</tr>
<tr>
<td>CTA-1 / 160</td>
<td>160</td>
</tr>
<tr>
<td>CTA-1 / 210</td>
<td>210</td>
</tr>
</tbody>
</table>

Notice that when utilizing the RCR’S which includes two outgoing terminals, do not connect CCT1M toroid’s 3 and 4 terminals.
A 5.2 Electrical Characteristics

A 5.2.1 The Implementation of Earth Fault Protection Relays with Current Transformers

A 5.2.1.1 Application

This application is available because of the impossibility of covering all conductors in the system with one transformer. In this situation it is possible to utilize earth fault protection by using current transformers and special toroid transformers (manufactured by us properly current transformers coil rate)

This application needs same current transformer values. 5A seconder current, minimum power consumption 10 VA and class of 0,5. On the other hand, the p1 pole must stay upwardly to protection side and must install appropriate type of seconder implementation.

A 5.2.1.2 Operation

On normal operation the vector totalize of currents by current transformer equals zero. Thus current flow does not occur towards five and six terminals. Thus a potential is not occurred on 1 and 2 terminals to open location of RCR relay.

If a leakage occurs, then, a potential comes to existence between 1 and 2 terminals. So relay’s open function is worked.

It is advisable that the threshold value of RCR is not defeated of 1/100 of current rate of protected system.

A 5.3 Application of RCR with Earth Line Transformers

A 5.3.1 Application

This application is suitable especially if the system is supported by shunt working transformers. Substantially line can be protected by RCRS which are deployed under transformers. Because of the impossibility of understanding where leakage coming from it is understood that the detecting relay’s threshold values is not possible.
**Example**

Ex: We assume that we are protecting a system when leakage current reaches 5 A and thus switches on RCR’s open contacts. If two rcr is set by 5 A, to perform the relay’s open position, the system need more than 5 A.

Otherwise if threshold value is set to 2.5 A, 3/4 of leakage current is carried by one transformer, and 1/4 of it’s carried by other transformer. Because of this before the first transformer’s RCR’s current reaching to 5 A, open position is worked.

It would be a value to specify that in case of low load, transformers throw over the system. In the present case leakage current must fulfil **totally reclosed** and threshold value 5 A via a separated transformer.

Solving of this Problem is shown in diagram.

**A 5.3.2 Operation**

On the diagram, the solution by connecting star point to earth line every transformers which pass through toroidal transformers previously is shown.

Solution base is allowing earth leakage in the event of current way passes by star point of transformers. As it is shown in diagram the amount of current by toroid is measured previously.

As it is said in the forenamed example, need to set the threshold value to 5 A, in case of leakage current is dropped below 5 A.
A 5.4 The Operation of RCR’s with Shunt Connecting Lines

A 5.4.1 Utilizing

This implementation is used if there are various lines which pass through two OMNIBUS systems. In this case the utilizing for every connecting line with RCR’s suitable toroids could cause doubt because of vector totalizing of connecting point currents is not equal to zero. The current is not distributed equally depends on the difference of contact resistance.

In the light of this information a leakage signal can occur between 1 and 2 terminals of toroid and thus in spite of the fact that there is not enough leakage current to perform the RCR, it is sufficient to work the relay.

It is advisable for this kind of distribution is that connecting between 1 and 2 terminals and toroids is performed by looking connecting diagram.

A 5.4.2 Operation

When there is not leakage occurring, as it’s said below, generated signal by first toroidal current transformer is recognized by the generated supply signal second toroidal current transformer, on irregular current distribution. RCR’s open function is not operated because of signals failing to reach the rcr’s terminals.

On the other hand in case of current leakage, apart from distribution, trip occurs because of totalizing signals is measured by different current transformers come together on RCR’S 1 and 2 terminals. This function is applicable for maximum 6 shunt connected current transformers. Please refer to Aktif Mühendislik if more than 6 current transformers is needed.

For this application it advisable that the threshold value must not hold under 1/100 of nominal current amount of protected system.

A 5.5 The Application of RCR’s with Shunt Connecting Lines

In case of utilizing RCR on middle voltage lines. It is appropriate using including internal third harmonic filter type RCR.

Ps: If earth circuit is used, place outside of toroids.

Kablo metalik ekranla montaj yapıldıysa ve toroidden geçiyorsa, topraklama fig2. deki gibi yapılmalıdır.
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