

Smart transformers – keep an eye on everything with residual current monitoring

RCM



We make it possible to use
electricity with confidence.

— the essence of our brand

Agenda

- 1 _____ 5 questions
- 2 _____ What is an RCM?
- 3 _____ Regulations & Standards
- 4 _____ Protection objectives and protection class
- 5 _____ Introduction to Doepke RCM
- 6 _____ Quick commissioning of the DCTR sensor
with the DCTR manager



Is there current in the
protective conductor?

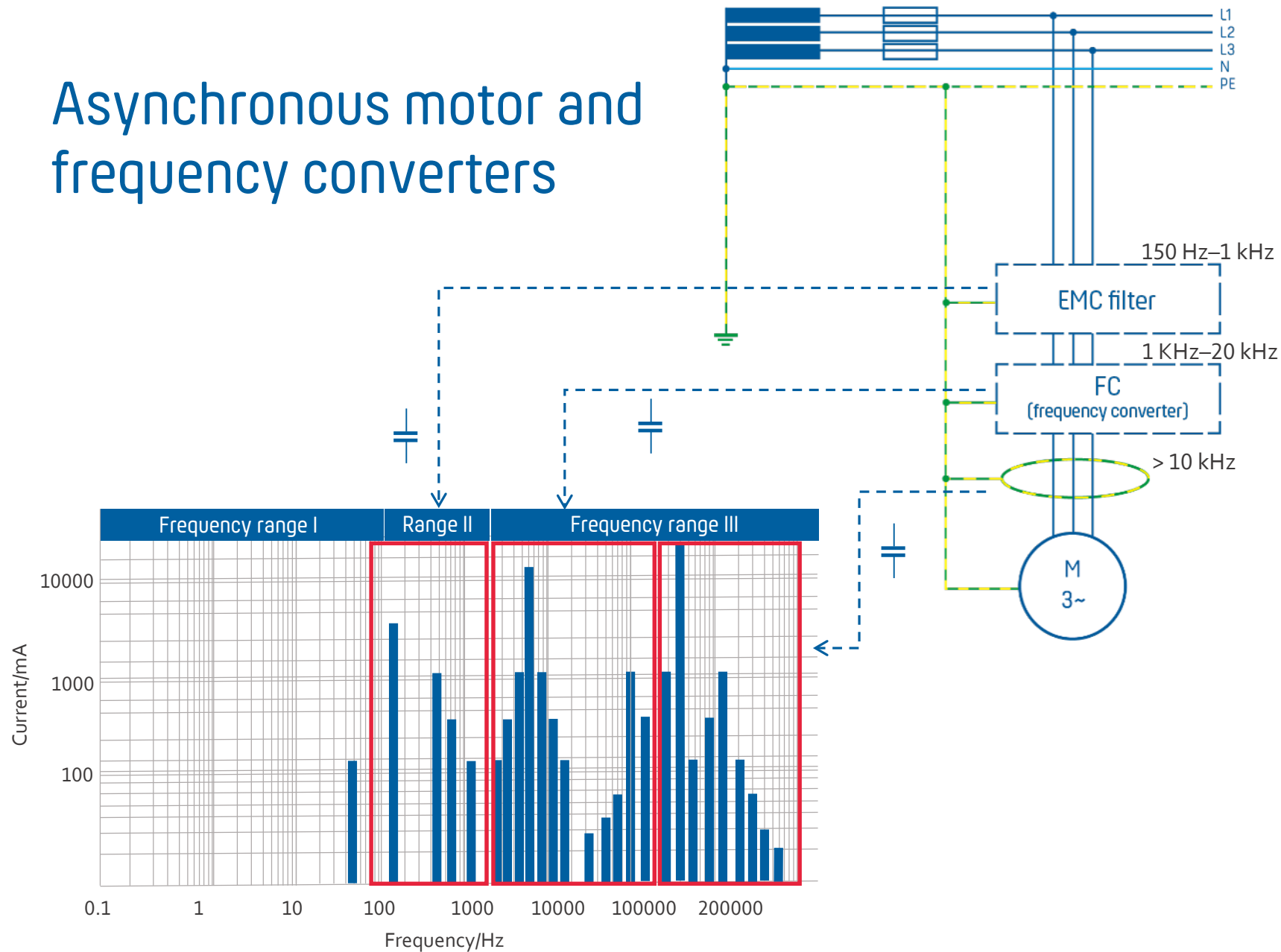
- Yes
- No
- Don't know



Where is the current in the protective conductor coming from?

- Electronic consumers
- Insulation fault
- EMC
- Filter
- Leakage currents
- ...

Asynchronous motor and frequency converters



What is the value of the PE conductor current?

- Don't know
- 300 mA
- > 500 mA
- Even more? ☹️



Practical examples

4.31 A



6.36 A



Practical examples

3.08 A



20.04 A



17.55 A



Practical examples

0.50 A



1.73 A



2.29 A

Is it useful to know how much current is in the protective conductor? Why?

- Yes
- Fire protection
- Preventative maintenance
- Testing
- Equipment protection—

Safety



DCTR

Smart transformers –
keep an eye on everything
with residual current monitoring

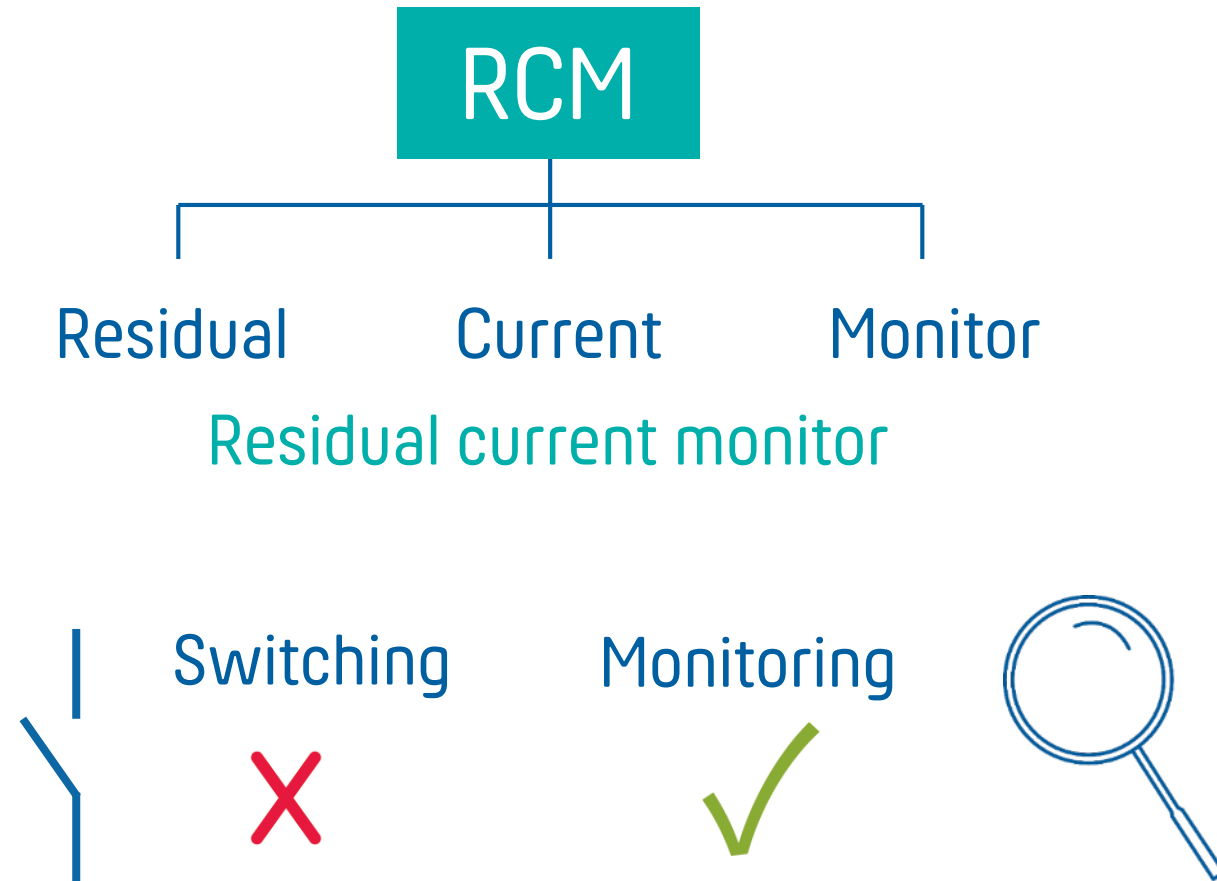


What is an RCM?

- It's not an RCD
- Explanation of terms
- Applications and areas of use

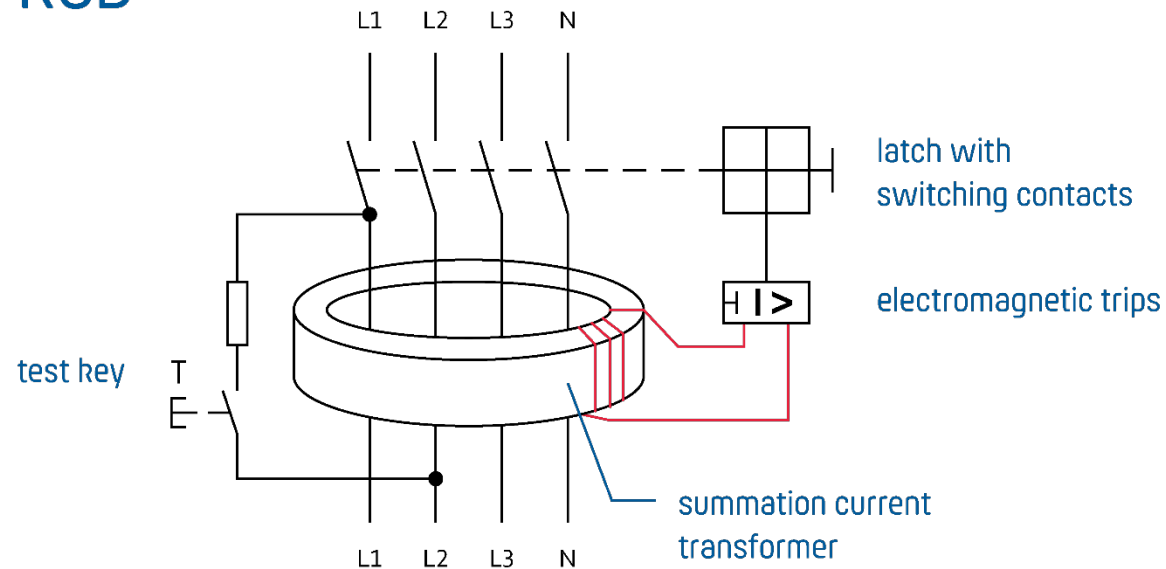


What is an RCM?



Difference between RCD and RCM

RCD

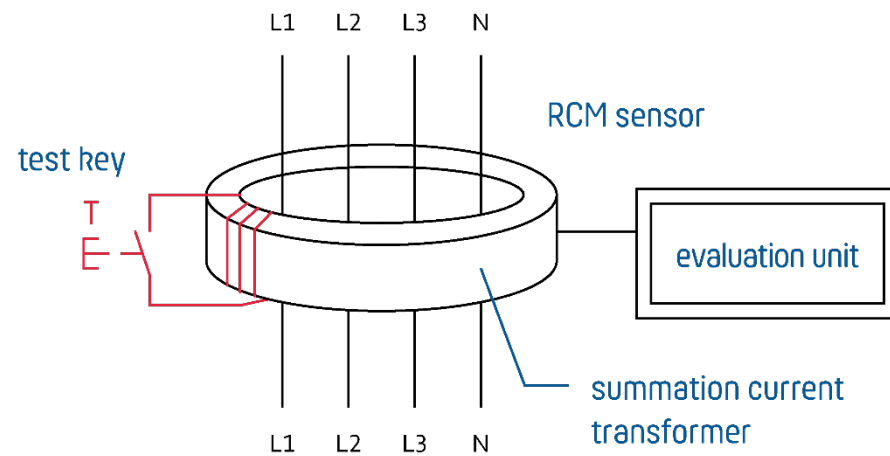


Function:

If the residual current exceeds the trip threshold disconnect all live conductors.

Difference between RCD and RCM

RCM



Function:

Detecting and monitoring residual currents.

Applications and areas of use for RCMs

Agriculture



Applications and areas of use for RCMs

Fire protection



Applications and areas of use for RCMs

Wind energy



Applications and areas of use for RCMs

Photovoltaics



Applications and areas of use for RCMs

Industry



Regulations & Standards

- DIN VDE 0105-100:A1 06/2019
- DGUV Regulation 3:01/05

VDE / DGUV details specific requirements to what how and when installations and machines should be tested.



*DGUV
Linked directly to
Statutory Accident Insurance
German Insurance Industry*

No direct UK equivalent

*UK Law is less prescriptive:
What do you have to do?
How much do you have to do?
When do you have to do it?
Do you have to keep records?*

*Defense in legal proceedings (HSE)?
Company insurance requirements?*

UK Regulations & Standards

UK Regulations - relating to electrical systems, equipment and machines

— The Health and Safety at Work Act 1974

- 2(2)(a) *"the provision and maintenance of plant and systems of work that are, so far as is reasonably practicable, safe and without risks to health"*

— The Electricity at Work Regulations 1989 "EAWR" ?

- Work on or near an electrical supply

— The Provision & Use of Work Equipment Regulations 1998 "PUWER"

- Covers all equipment and machines
- Specific requirements for dangerous machines
e.g. Loler for lifting equipment, Power presses, Woodworking machines...

UK Regulations & Standards

UK Standards and Approved Codes of Practice (ACOPs)

- Standards such as BS7671 offer best advice (see page 2)
- ACOPs have special legal status in the UK e.g. PUWER

HSE: *"If you are prosecuted for breach of health and safety law, and it is proved that you did not follow the relevant provisions of the Code, you will need to show that you have complied with the law in some other way or a Court will find you at fault"*

Permanent monitoring of electrical systems – Technical regulations, standards

EAWR

The law does not specify what needs to be done, by whom or how frequently (for example, it does not make it a legal requirement to test all electrical equipment every year). This allows the dutyholder to select precautions appropriate to the risk, rather than having precautions imposed that may not be relevant to a particular work activity. See IET Guidance Note 3

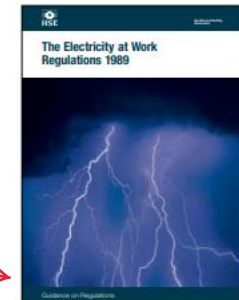
UK
Law!



- EAWR do not require records to be kept, although it is recommended in the HSE Guidance for EAWR (see defense under Reg 29)

PUWER

- 6 (2) Every employer shall ensure that work equipment exposed to conditions causing deterioration which is liable to result in dangerous situations is inspected
- 6 (3) Every employer shall ensure that the result of an inspection made under this regulation is recorded and kept until the next inspection under this regulation is recorded.



HSR25 (Third edition)
Published 2015



Safe use of work equipment

Provision and Use of Work Equipment Regulations 1998

Approved Code of Practice and guidance

This Approved Code of Practice and guidance is aimed at employers, dutyholders and anyone who has responsibility for the safe use of work equipment, such as maintenance and supervisors. It sets out what is needed to comply with the Regulations.

Defense Regulation 29? "Keep records"

Permanent monitoring of electrical systems

– Technical regulations, standards

UK BS 7671

UK
Guidance

651.2

- *"Where a circuit is permanently monitored by an RCM or an IMD it is not necessary to measure the insulation resistance if the functioning of the RCM or IMD is correct"*
- *"The functioning of the RCM or IMD shall be verified"*

538.4.1

- *"RCMs shall comply with BS EN 62020"*

Permanent monitoring of electrical systems

– Technical regulations, standards



UK
Law

UK EAWR 1989 Regulation 4

- "(2) *As may be necessary to prevent danger, all systems shall be maintained so as to prevent, so far as is reasonably practicable, such danger*"
- "(70) *Advice on inspection and testing of some fixed installations is given in BS 7671*"
- Note: BS7671 Inspection recommendations only apply for circuits < 100 A. see Apx. 6

UK PUWER 1998 Regulation 6 (Employers)

- (1)where the safety of work equipment depends on the installation conditions, it is inspected... before operation.. to ensuresafe to operate.
- (2) ...work equipment...conditions...deterioration.. Liable to result in dangerous situations is inspected
 - (a) at suitable intervals; and
 - (b) each time that exceptional circumstances which are liable to jeopardise the safety of the work equipment have occurred, to ensure that health and safety conditions are maintained and that any deterioration can be detected and remedied in good time.

Table 1A: Recurrent testing of permanently installed electrical systems and equipment

System/equipment	Test period	Type of test	Tester
Electrical systems and permanently installed equipment	4 years	for proper condition	Electrically skilled person
Electrical systems and permanently installed electrical equipment in 'work premises, rooms and special types of installations' (DIN VDE 0100 Group 700)	1 year		
Protective measures with residual current devices in non-stationary systems	1 month	for efficacy	Electrical specialist or person trained in electrical engineering for the use of suitable measuring and test equipment
Residual current, differential current and fault voltage circuit-breakers – in stationary systems – in non-stationary systems	6 months Every working day	For proper functioning by operating the test device	User

UK Law does not specify specific time scales between tests



Exception: changes relating to Private Rented Sector / devolved laws require tests every 5 years or on change of occupancy by electrical skilled person.

The requirements are also met for permanently installed electrical systems and equipment, e.g. if these are permanently monitored by an electrical specialist.
Permanently installed electrical systems and equipment are considered to be permanently monitored if they are

- maintained by electrical specialists and
- **checked using metrological measures during operation (e.g. monitoring of the insulating resistance) on an ongoing basis.**

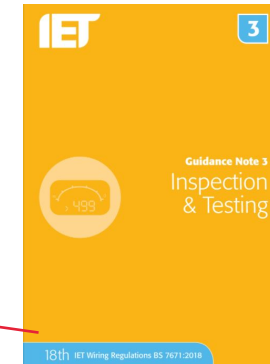
Source: Accident prevention regulation Electrical systems and equipment – DGUV Regulation 03:01/05

Recommended initial frequencies of inspection of electrical installations

IET guidance not 3 (Inspection & Testing) gives some recommendations for different types of installation – Table 3.2

Type of installation	Routine check see section 3.5	Maximum period between inspections and testing (note 8)	Notes
Domestic accommodation – general	–	Change of occupancy/ 10 years	
Domestic accommodation – rented houses and flats	1 year	Change of occupancy/ 5 years	1, 2, 10
Residential accommodation (Houses of Multiple Occupation) – halls of residence, nurses accommodation etc.	1 year	Change of occupancy/ 5 years	1, 2, 10, 11
Commercial	1 year	Change of occupancy/ 5 years	1, 2, 3, 4
Educational establishments	6 months	5 years	1, 2, 6

UK
Guidance



Ministry of Housing,
Communities &
Local Government



UK
Law

Defense Regulation 29 ? " Keep records "

Protection objectives and protection class

- Protection via automatic switch-off DIN VDE 0100-410
- Additional protection
- Fire protection



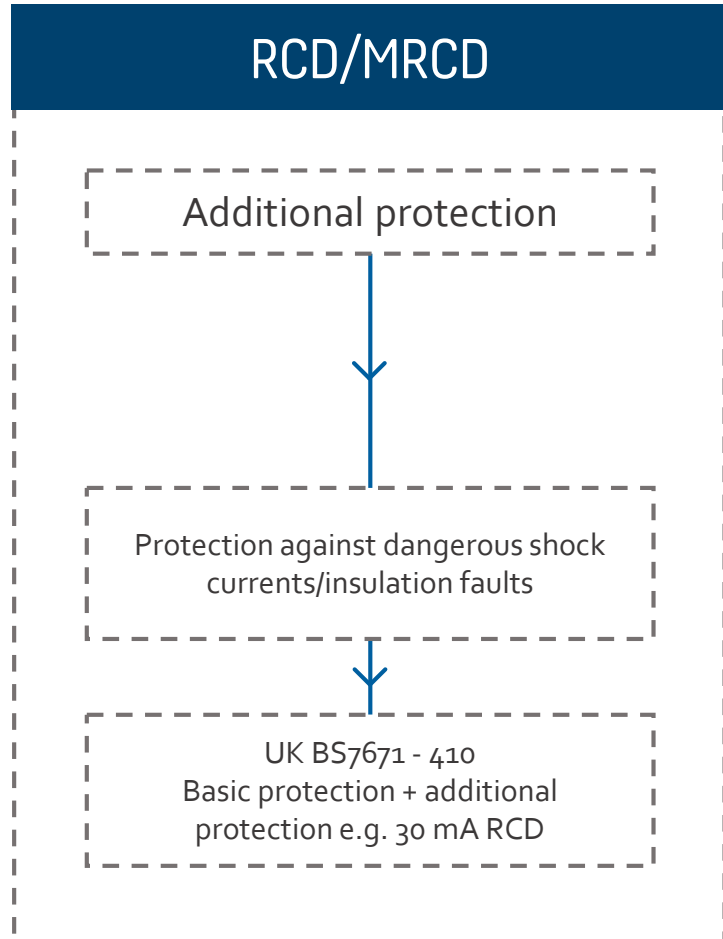
Protection objectives and protection class

UK

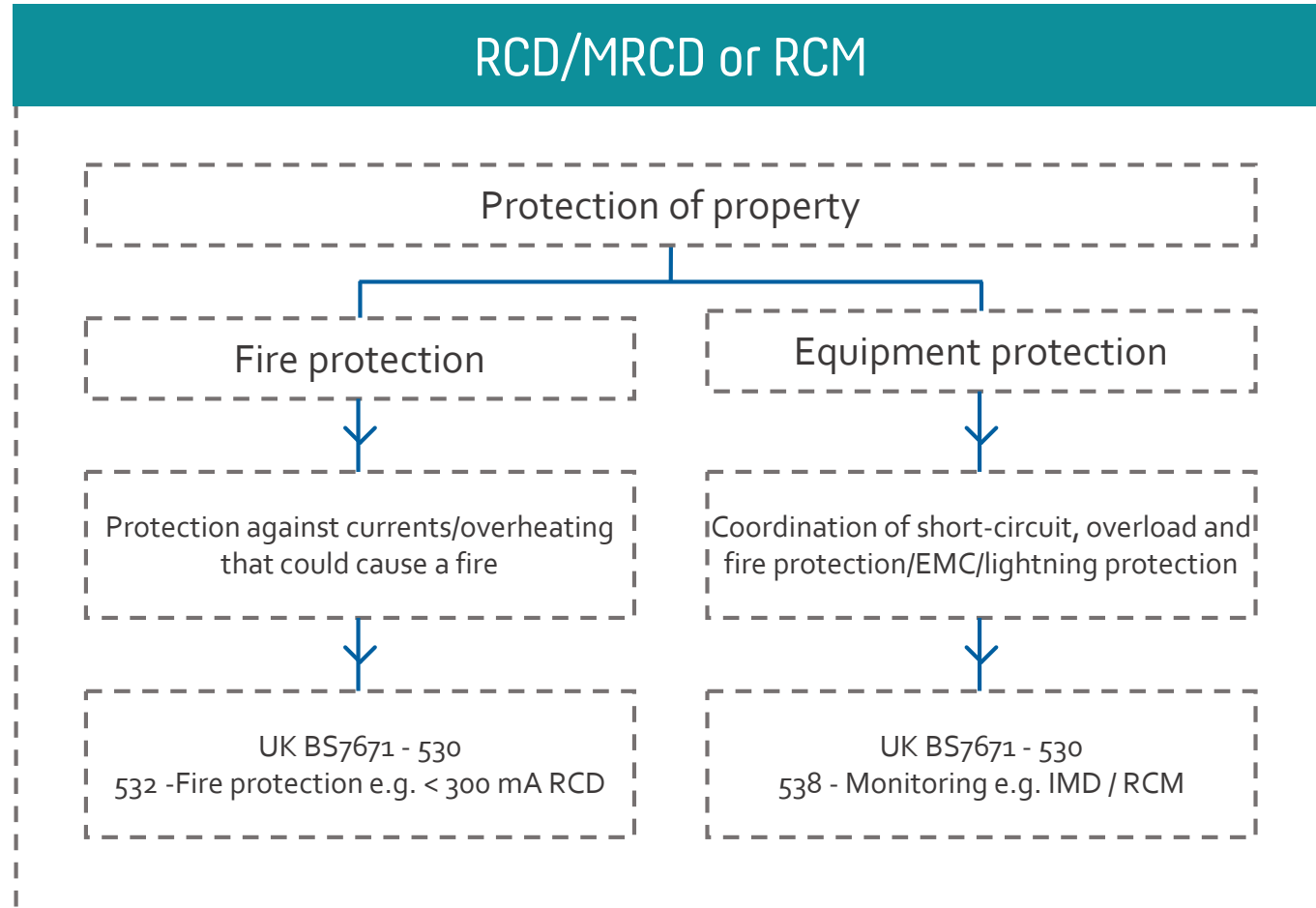
- Protection via automatic disconnection of supply BS 7671 - 411
- Additional protection BS 7671 - 415
- Fire protection BS 7671 - 532



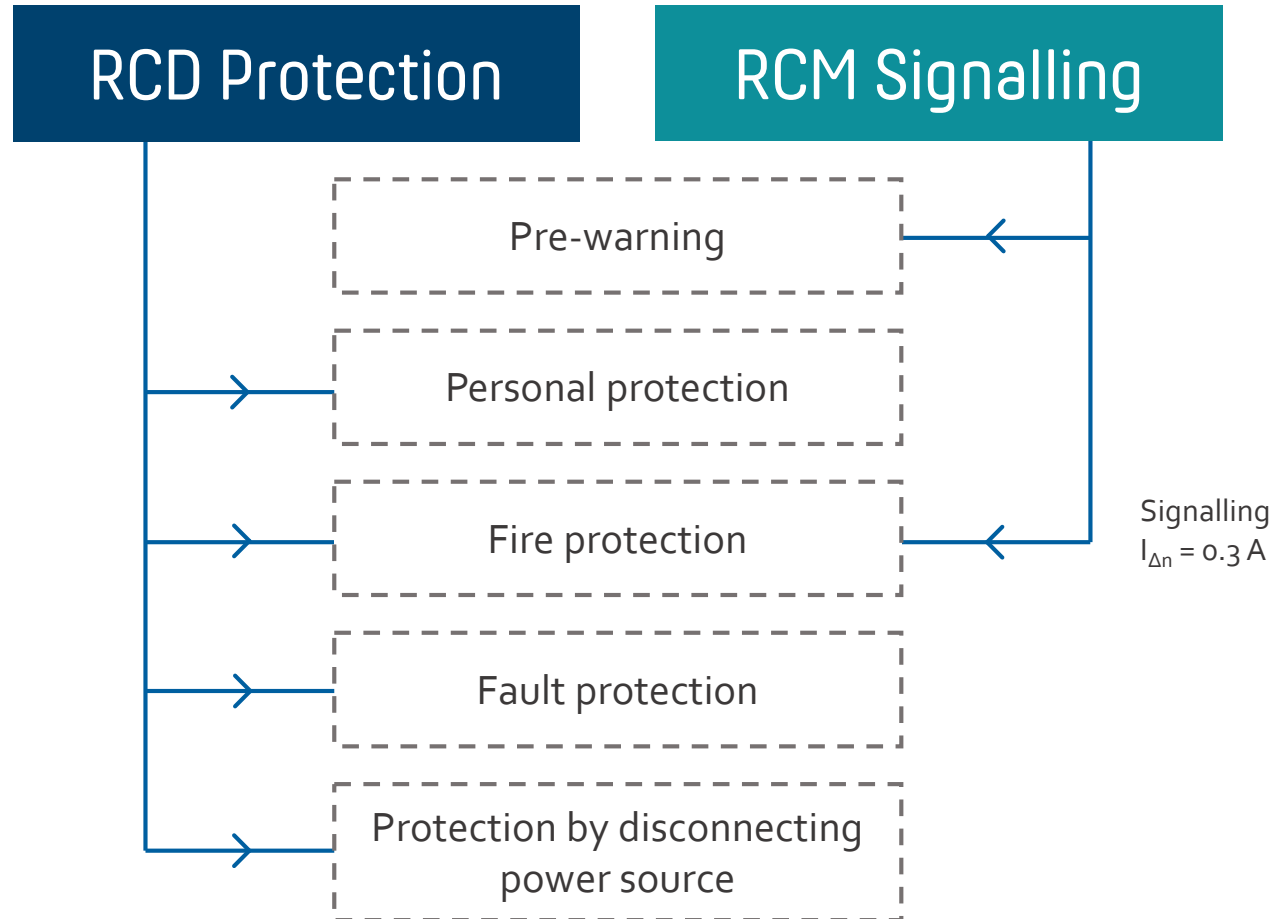
Effective and economical protection – protection objectives



Effective and economical protection – protection objectives



Level of protection provided by RCD and RCM signalling



Introduction to Doepke RCM residual current monitors

- Product specifications
- DCTR Manager



Residual current monitors RCM

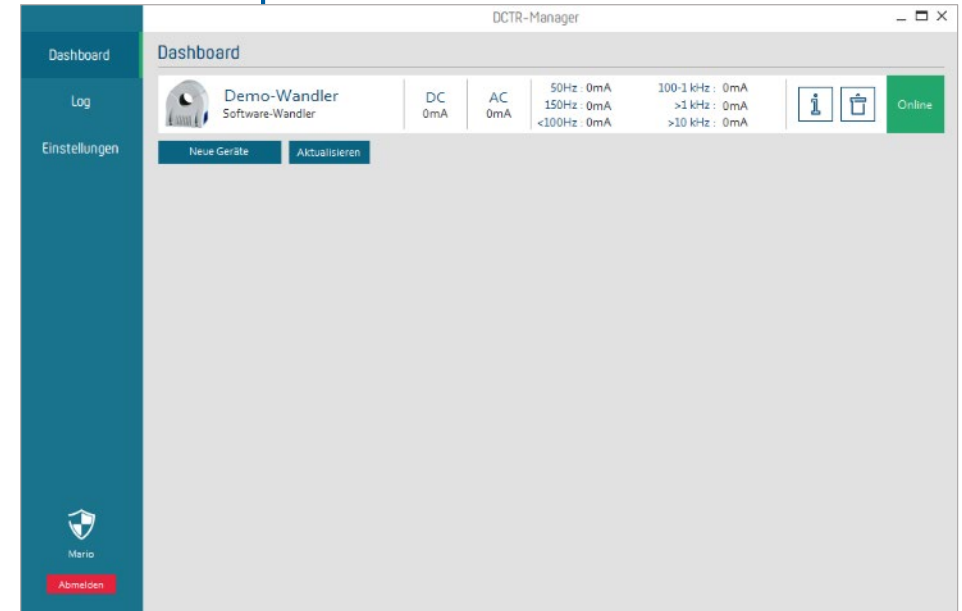
DCTR B-X Hz-PoE

- evaluation unit integrated into the transformer
- eight evaluable frequency ranges
- different transformer diameters
35 mm and 70 mm
- easy commissioning
via PoE or Ethernet cabling
- potential-free contacts
for alarm thresholds 1 and 2
- frequency range 0 Hz–100 kHz



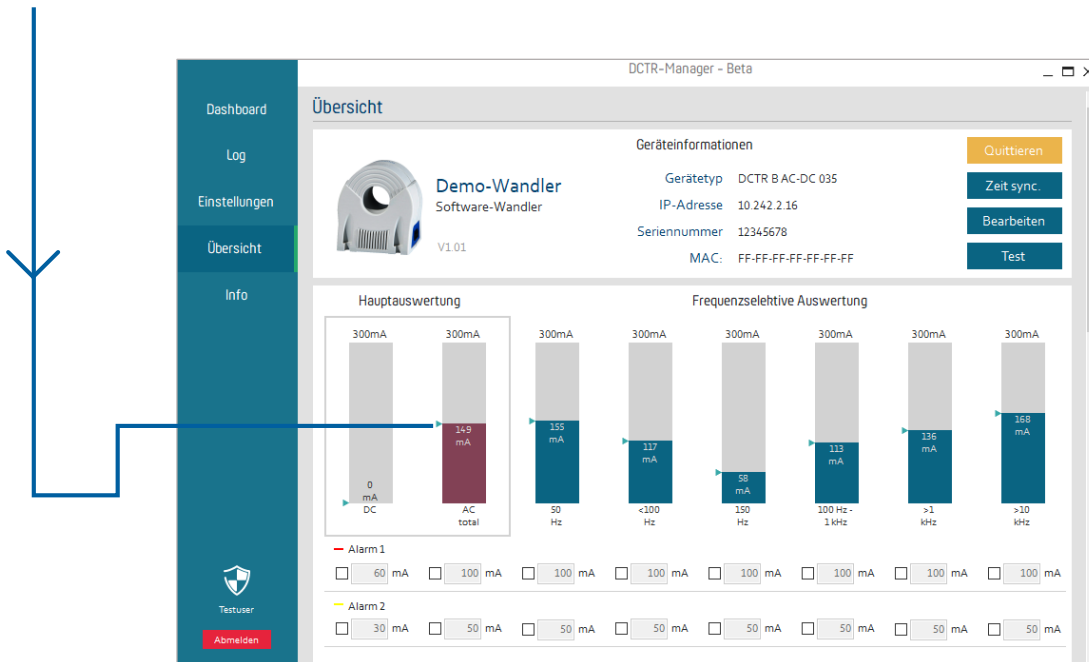
DCTR Manager software

- software for **managing, programming and visualising** series DCTR B-X Hz PoE residual current monitors
- transformers that are connected to the network can be added easily via IP address assignment
- clear **dashboard overview** of all transformers available in the network
- **user data and access management**
- transformer names can be changed for clear and easy assignment



DCTR Manager software

- current display of residual currents with **'drag indicators'** for display of the maximum values



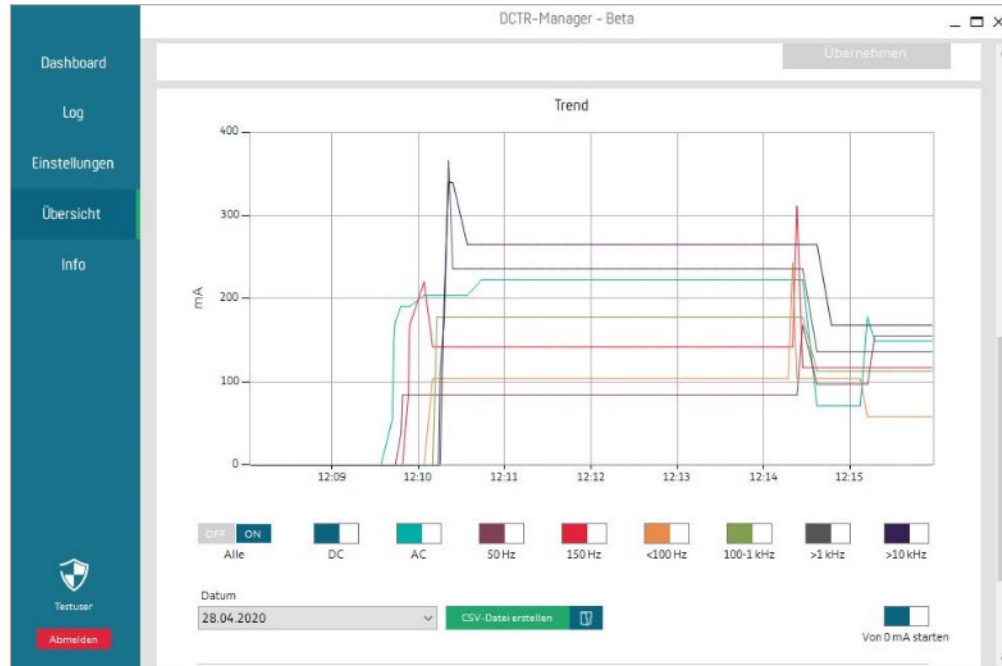
DCTR Manager software

- parametrisation of the **alarm thresholds**
(Alarm 1, Alarm 2) by activating the alarm thresholds
on the **individual channels**



DCTR Manager software

CSV
report



- Long-term evaluation and csv. export with evaluation in MS Excel possible for transformer data

DCTR Manager software

— Integrated logbook records changes to all settings



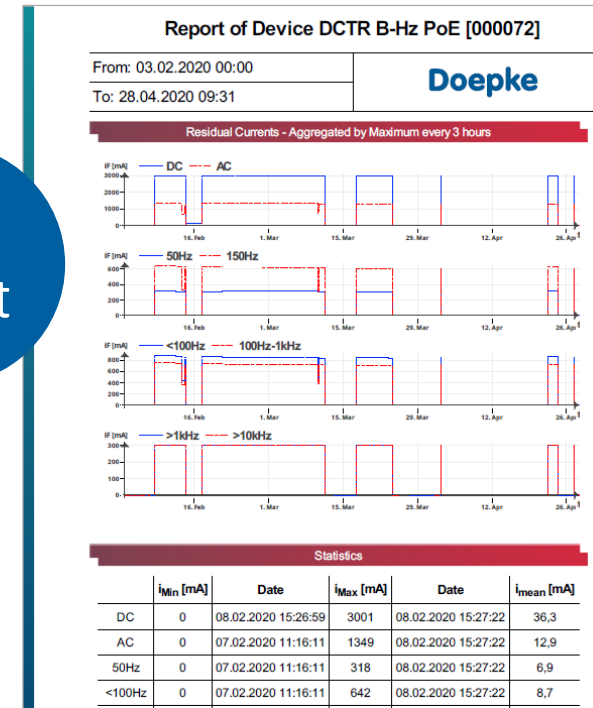
DCTR-Manager - Beta			
Log			
28.04.2020	12:24:34	-> Schwellenwert überschritten! (Demo-Wandler, 12345678, Alarm2, 50 Hz, 155mA)	!
28.04.2020	12:24:33	-> Testuser hat 'Demo-Wandler (12345678)' quittiert	u
28.04.2020	12:24:13	-> Schwellenwert überschritten! (Demo-Wandler, 12345678, Alarm2, 50 Hz, 155mA)	!
28.04.2020	12:24:13	-> Testuser hat 'Demo-Wandler (12345678)' quittiert	u
28.04.2020	12:14:20	-> Schwellenwert überschritten! (Demo-Wandler, 12345678, Alarm2, <100 Hz, 243m...	!
28.04.2020	12:13:18	-> Testuser hat 'Demo-Wandler (12345678)' quittiert	u
28.04.2020	12:13:06	-> Testuser hat den Schwellenwert von 'Demo-Wandler (12345678)' geändert	u
28.04.2020	12:12:22	-> Testuser hat den Schwellenwert von 'Demo-Wandler (12345678)' geändert	u
28.04.2020	12:12:14	-> Schwellenwert überschritten! (Demo-Wandler, 12345678, Alarm1, AC, 223mA)	!
28.04.2020	12:12:14	-> Testuser hat den Schwellenwert von 'Demo-Wandler (12345678)' geändert	u
28.04.2020	12:12:01	-> Testuser hat den Schwellenwert von 'Demo-Wandler (12345678)' geändert	u

DCTR Manager software

Reports and documentation

- automatic **monthly report** on each transformer with automatic storage of the report in file structure
- **manual report** on individual transformers or all transformers at variable intervals
- clear **monthly monitoring report** via email which contains the most important information and specifies which transformers have exceeded the alarm thresholds
- automatic documentation of the transformer's technical inspection in the **logbook** when **test button** is pressed

PDF
report

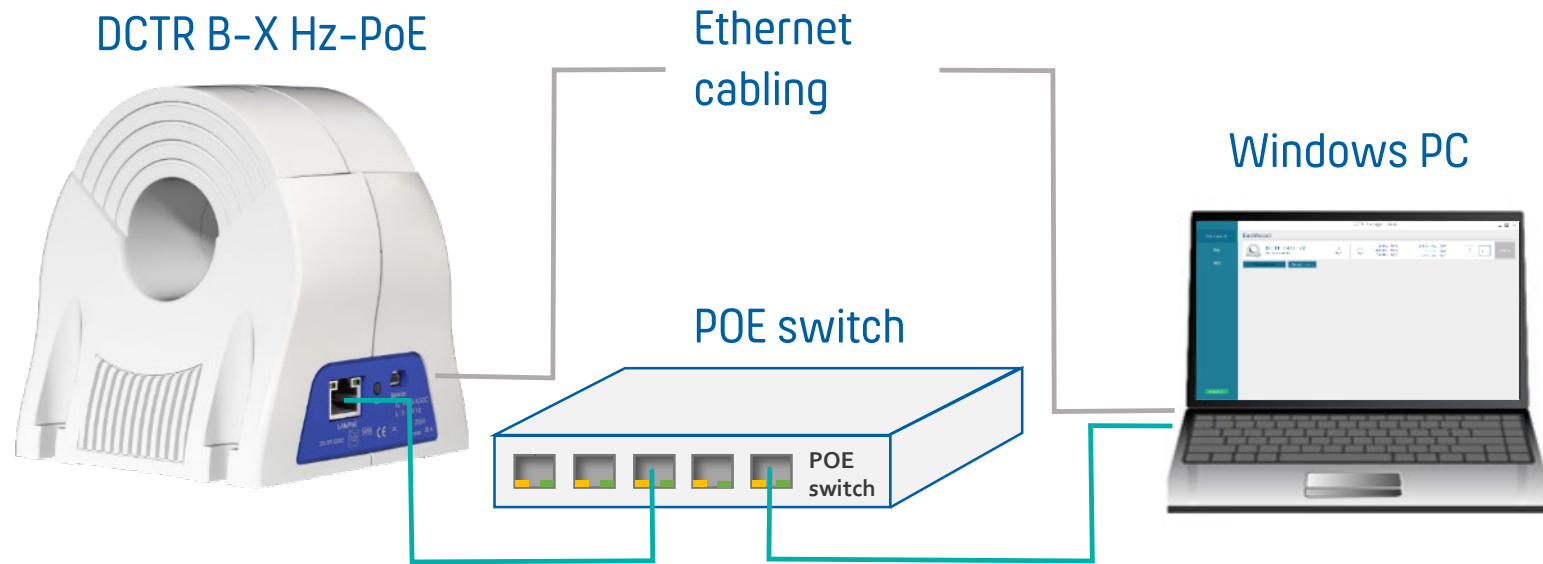


Quick commissioning of the DCTR B-X Hz-PoE with the DCTR manager

- What is required?
- Initial steps



What is required?



Information/queries

We are happy to answer any questions right now
or even at a later date:

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F _____ +49 49 31 18 06 - 1 55

e _____ info@doepke.de

www _____ doepke.de

A photograph of a lighthouse with a white body and a red band, situated on a sandy dune. The dune is covered with green beach grass. The sky is blue with some white clouds. A teal-colored rectangular box is overlaid on the left side of the image, containing the text 'Many thanks for your attention' and 'Your Doepke team'.

Many thanks for your attention

Your Doepke team