kries ON

Information for
Distribution Network Managers

www.kries.com

08
20

Fits the circuit breaker-backup combination still in the digital distribution network?

The protection relay IKI-35_1A increases the availability for the transformer feeder.

Compact voltage transformer replacement requires no measuring field

System accuracy up to 0.5%

IKI-35_1A: protection relay for transformer station
CAPDIS-4o: compact voltage transformer-replacement

Waiblingen, August 2020

With this issue of ON we would like to present two further building blocks for the digitalisation of the distribution network level.

Circuit-breaker-fuse combinations are still widely used, but no longer meet the availability requirements of customers at the transformer outgoing feeder. The CT-powered protection relay IKI-35_1A in combination with a circuit breaker is a highly available, cost-efficient alternative.

Furthermore, voltage measurement in the distribution network was previously reserved exclusively for voltage transformers when acceptable accuracy and 100 V output signals were required. By combining small signal converters with the CAPDIS-4o, classic converters can be replaced.

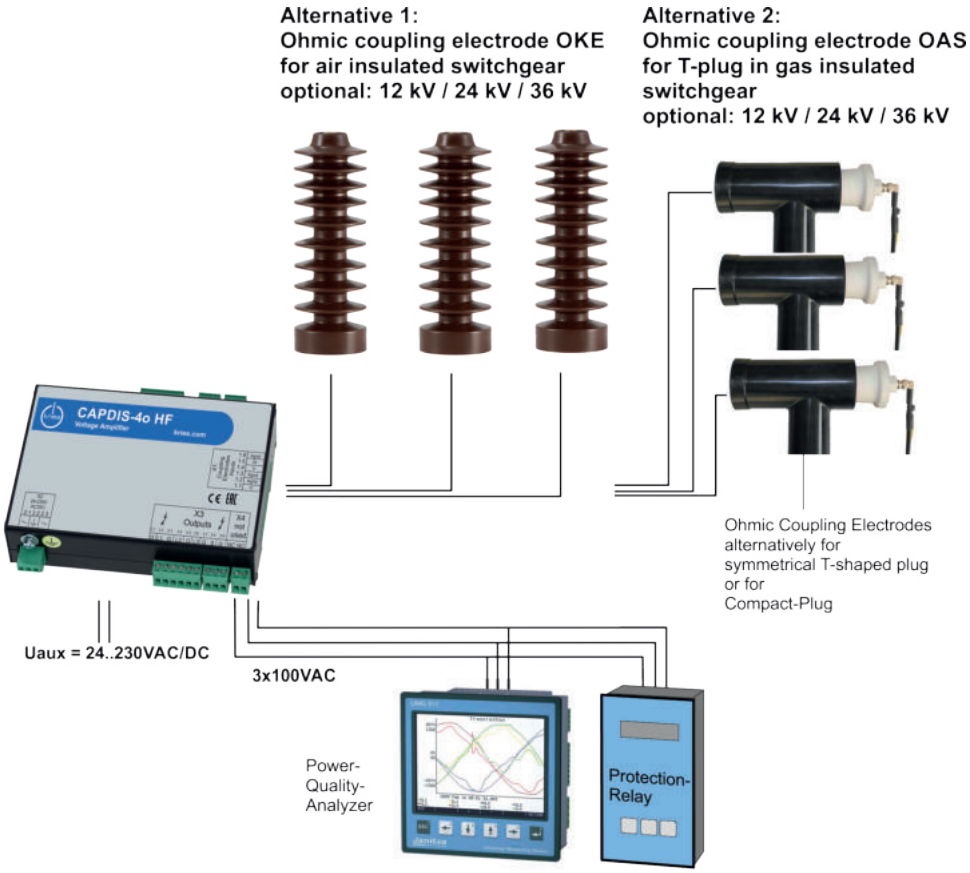
Kind regards from Waiblingen
Tilo Kubach

CAPDIS-4o: Compact Voltage-Transformer Replacement

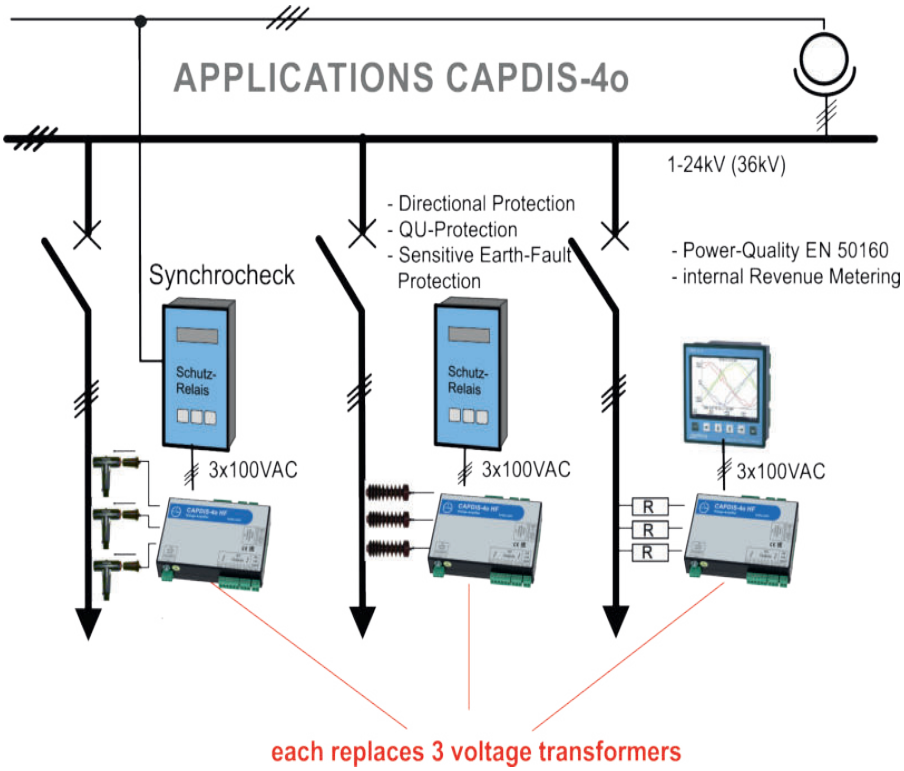
Ohmic dividers are now available for both gas-insulated and air-insulated switchgear for the voltage series 10, 20 and 36 kV and represent a space- and cost-efficient alternative to voltage transformers.
While inductive voltage transformers are still frequently specified exclusively for billing measurements, small-signal transformers are also explicitly described in the nowadays standards about requirements for digital protective devices. For all applications of voltage measurements outside of billing, the advantages of ohmic dividers have long been in the foreground. The use of resistive dividers is particularly attractive wherever separate measuring fields were previously required, which can be eliminated.

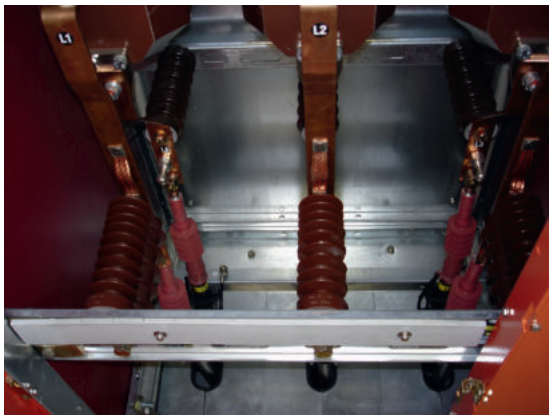
Ohmic dividers, however, only provide high-impedance small signals on the output side and not the typical voltage values of 100 V or 100 V / sqrt(3) with corresponding power required for most measuring and protection devices.

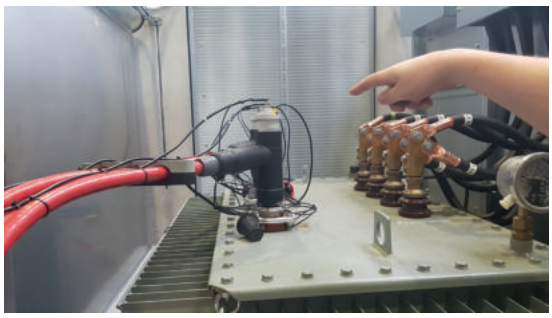
The CAPDIS-4o amplifier was developed to connect such measuring instruments to resistive dividers. Since this amplifier is looped into the measuring chain from the divider to the measuring instrument, its accuracy must be taken into account together with the accuracy of the divider.



CAPDIS-4o: Compact Voltage-Transformer Replacement







Overview of available resistive dividers for air- and gas-insulated switchgear

Type	Nominal voltage [KV]	R1/R2 [Ohm]	Article-No. accuracy: 1%	Article-No. accuracy: 0,5%	Article-No. accuracy: 0,2%	Suitable for:
OAS12	12	100M / 32,5k	2043623	2045222_H001	2045235_H001	for all symmetrical T-plugs with C-cone
OAS 24	24	200M / 32,5k	2043624	2045212_H001	2045236_H001	
OAS12 R2	12	100M / 32,5k	2044695_H001	2045219_H001	2045237_H001	
OAS24 R2	24	200M / 32,5k	2044404_H001	2045201_H001	2045038_H001	
OAS 12	12	100M / 32,5k	2043187	2045221_H001	2045234_H001	for asymmetric T-plugs: NKT CB 24/630; Cellpack CTS 630
OAS 24	24	200M / 32,5k	2502344_H001	2502345_H001	2502346_H001	
OAS 12 R2	12	100M / 32,5k	2044694_H001	2045220_H001	2045239_H001	for asymmetric T-plugs: Nexans Euromold 430 TB; Suedkabel SET24
OAS24 R2	24	200M / 32,5k	2044403_H001	2045200_H001	2045240_H001	
OAS24 R2	24	200M / 32,5k	2045186_H001	2045268_H001	2045269_H001	for asymmetric T-plugs: TE RSTI-5854
OKE 12	12	100M / 32,5k	2043189	2045226	2045241	for all air-insulated switchgears
OKE 24	24	200M / 32,5k	2043190	2045227	2045242	
OKE 36	36	300M / 32,5k	2043544	2045228	2045243	
OKE 12 IEEE	12	100M / 32,5k	2044463			for all air-insulated switchgears according to IEEE standard
OKE 24 IEEE	24	200M / 32,5k	2044464			
OKE 38 IEEE	38	300M / 32,5k	2044794			

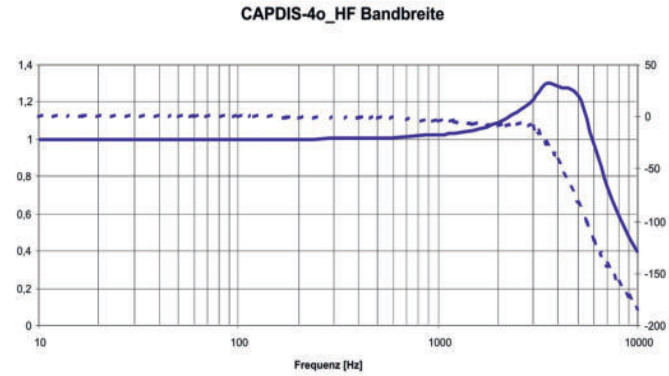
CAPDIS-4o: Compact Voltage-Transformer Replacement

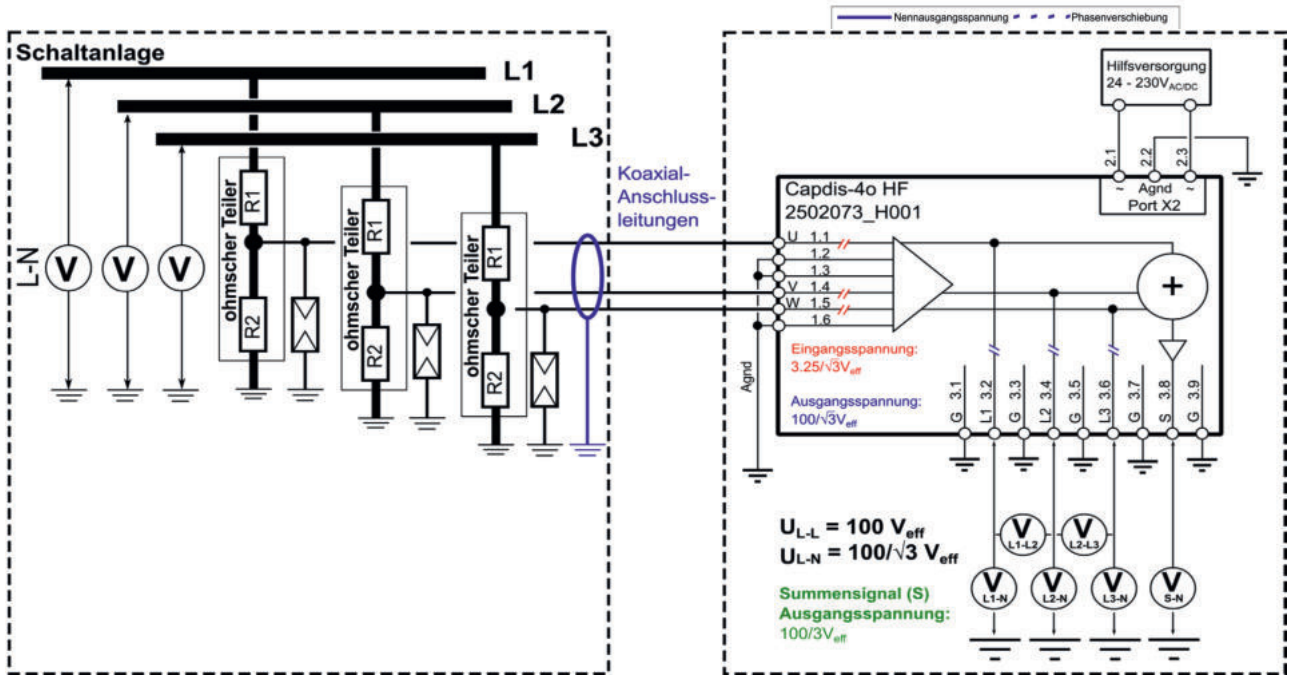
Product name	CAPDIS-4o	CAPDIS-4o HF (H001)	CAPDIS-4o HF (H002)	CAPDIS-4o HF (H003)	CAPDIS-4o HF (H001_S003)	CAPDIS-4o HF (H003_S003)
Article	2502073	2502073_H001	2502073_H002	2502073_H003	2502073_H001_S003	2502073_H003_S003
Max. Output Voltage UL-L [V]	100	100	100	customer specific 100…200	100	customer specific 100…200
Max. Input Voltage U_{L-N} [V]	3,25	3,25	3,25	0,263	3,25	0,263
Cut-off frequency f_g [Hz]	200	2000	2000	2000	2000	2000
Input impedance	47 MΩ	47 MΩ	200 kΩ	47 MΩ	47 MΩ	47 MΩ
Amplification factor	30,8	30,8	30,8	380	30,8	380
Accuracy [%]	0,5	0,5	0,5		0,3	0,5 with R2m-module
Summation signal	no	yes	yes	yes	yes	yes
Accessories	no	no	no	R2m (adapter plug) R2m (RJ-45 jacks)	no	R2m (adapter plug) R2m (RJ-45 jacks)
Dimensions [mm]	175 x 120 x 49	175 x 120 x 49	175 x 120 x 49	175 x 120 x 49	175 x 120 x 49	175 x 120 x 49

Current utility-stanards like VDE or FNN prescribe an accuracy of 0.5% for measuring cores for the connection of EZA controllers for reactive power control / static voltage maintenance in self-generating plants and even class 0.2 for connected loads of Sa > 1 MVA of the customer plant. Class 0.5 can now be achieved by combining resistive dividers with an accuracy of 0.2% and a CAPDIS-4o amplifier with an accuracy of 0.3%.

The CAPDIS-4o_HF also offers a bandwidth of 2 kHz and thus the possibility to analyse harmonics up to the 40th harmonic. Using suitable power quality measuring instruments, the total harmonic content THD can also be determined in accordance with EN 50160.

The output power of the CAPDIS-4o is 0.5 VA per phase and is suitable for connecting 1 - 3 digital protection and / or measuring devices; even power quality measuring devices originally designed for low voltage applications can be connected to the CAPDIS-4o.





Principle Sketch CAPDIS-4o

Dual supplied Protection Relay for Ring Main Units

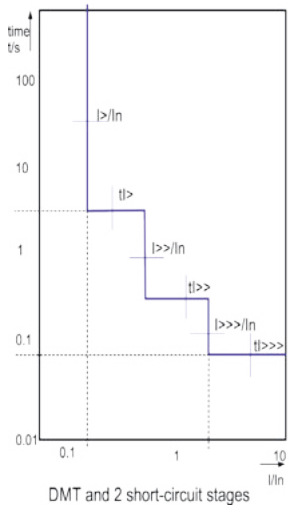
In customer stations, transformers are usually connected via circuit breakers with protective relays for availability reasons. Load-breaker-fuse combinations, on the other hand, are still widely used in distribution network transformer stations and were in the past considered the most cost-efficient connection type for distribution transformers. For transformers up to 1,000 kVA, the fuse was a good choice, at least for short-circuit protection.

IKI-35_1A in front-panel housing for standard-cut 144 x 96 mm

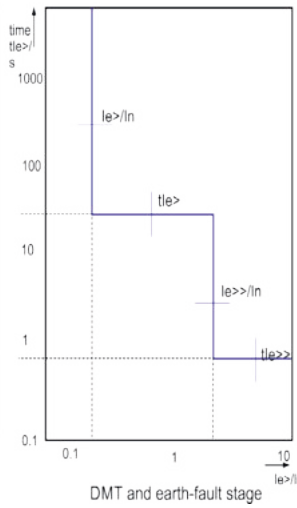
IKI-35_1A wall-mountable housing or C-bar housing

In times of digitalised distribution networks with high availability requirements of all network participants, however, a load breaker-fuse combination often no longer fits into the strategy. Also overcurrent and earth fault protection cannot be solved satisfactorily with fuses. However, the reclosing time is particularly critical for load-breaker switch-fuse combinations after fuse tripping. This has a particularly detrimental effect on the availability of the downstream loads. If the fuse of a load-breaker-fuse combination trips in case of a fault, all three fuses must always be replaced on site. Only type-tested fuses may be used.

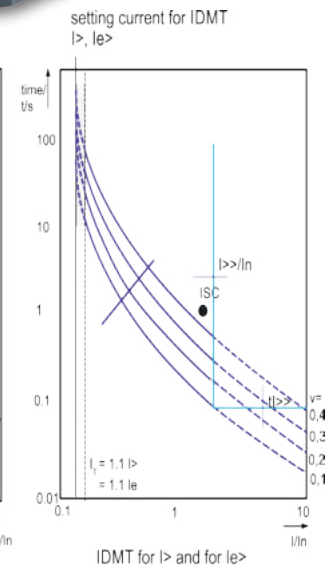
This requires stock, qualified personnel and time. In today's distribution network operation, all of these factors tend to represent a bottleneck. In many other countries, distribution network operators have long since changed over transformer feeders to circuit breakers with transformer protection relays. Circuit-breakers and protection relays were very expensive in the past, but today, thanks to mass production and digital protection technology, they are an efficient alternative to the traditional load-breaker-fuse combination. If an overcurrent event, earth fault, short circuit or thermal transformer fault occurs, these faults can be selectively detected and switched off by the transformer protection relay. After analysis of the fault and its elimination, the transformer feeder can be immediately switched on again.



DMT and 2 short-circuit stages



DMT and earth-fault stage

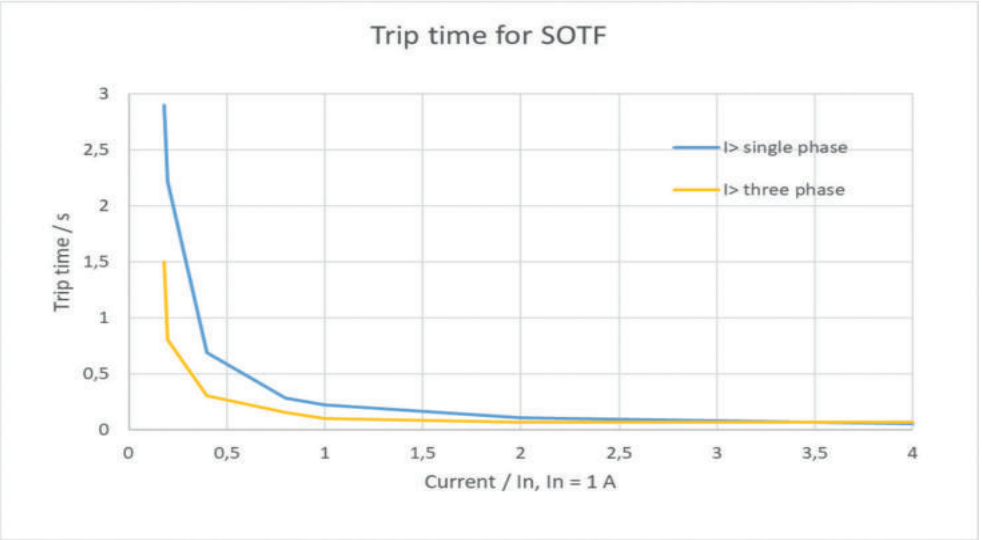


IDMT for I> and for Ie>

IKI-35_1A can be programmed and events can be downloaded by PC-software KriesConfig

Dual supplied Protection Relay for Ring Main Units

This does not even require an uninterruptible power supply, since dual-supplied transformer protection relays can also be supplied from the CTs completely. This is particularly important during commissioning after a power failure or during initial operation, as it is precisely at this point that energy or battery charging is often not yet available from the low voltage. Dual-supplied transformer protection relays play out their strengths here through their SOTF capability. With the SOTF capability (switch-on-to-fault capability), dual-supplied transformer protection relays such as the IKI-35_1A can be operated without auxiliary power, purely from the CT energy and, when switched on to a fault, protect the transformer quickly.

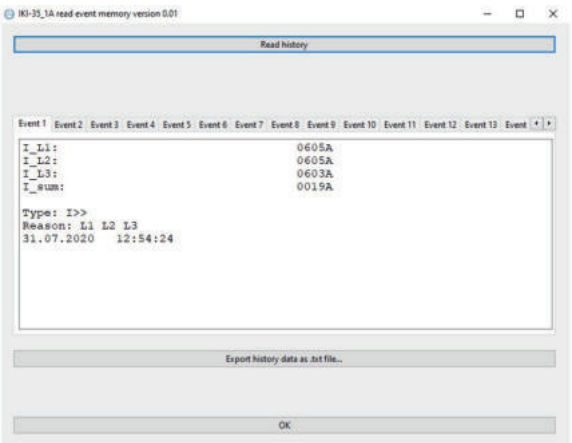


During switch on to fault the IKI-35_1A offers a fast tripping due to supply from CTs

For this protection application we have been offering our transformer protection relays IKI-30 and IKI-35 for many years. Both transformer protection relays operate with wide-range sensor current transformers, i.e. inductive current transformers with low output power, which can, however, supply the IKI-30 / IKI-35.

However, several distribution network operators require protection relays that can be operated on classic ../1A current transformers in order to guarantee the interchangeability of the protection relays. This requirement has been taken into account with the new IKI-35_1A.

- At the same time, the IKI-35_1A has been extended and includes interesting functions compared to the previous protection relays:
- Complete DMT and IDMT functionality acc. to ANSI 51P and ANSI 50P,
- Earth fault protection acc. to ANSI 51N and ANSI 50N
- Communication interface by Modbus RTU
- Fault recorder
- Inrush suppression acc. to the harmonics method ANSI 68
- Complete functionality without battery
- Dual supply either via CTs or via auxiliary power; no UPS required
- Suitable for CTs ../1 A, 2.5 VA, 5 P10
- Thermal overload protection acc. to ANSI 49



Event-recorder for failure-events

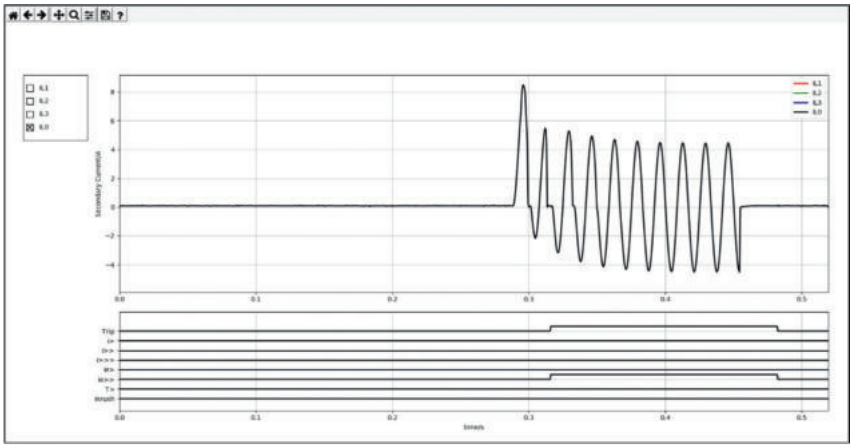


Figure 6: Example of the digital fault recorder ; Second stage earth fault protection Ie>>

Fault recorder in IKI-35_1A can be downloaded by KriesConfig