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# Protection Devices in facilities without reliable auxiliary power supply

APN-001, Edition 1

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Reyrolle Application Note

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## Reyrolle – Application Note

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## 1 Protection Devices in facilities without reliable auxiliary power supply

### 1.1 Introduction

The effective protection of an electrical system depends not only on the protection device itself but also on the appropriated power supply, in terms of availability and reliability. Nevertheless, some simple applications in industrial and commercial facilities as well as in rural areas, cannot bear the associated cost to a continuous voltage DC system, such rectifier and battery bank for the protection device and circuit breaker. Moreover in some specific applications, as those in the renewable distributed generation field, there is neither AC power supply nor DC power supply at the facility.

This application note describes the possibilities to overcome the limitations on power supply granting higher reliability with either no additional investment or at a marginal cost.

### 1.2 Installations without auxiliary power supply

Normally the protection devices require an external power supply to power up. What should be done then, if there is no auxiliary power supply available in the facility, as it is the case of a wide range of applications among which wind mills and switchgears for secondary distribution, also known as Ring Main Units – RMU outstand? The so called “self powered” protection devices were designed for such a specific technical situation, since they have the capability of deriving its power supply from the current transformers.

In Siemens the Reyrolle 7SR45 Self Powered Overcurrent and Earth Fault Relay was developed using the latest generation of hardware technology and it is a member of the Siemens Reyrolle® protection devices Argus product family. This device grants a sensitivity of  $0,2xI_n$  in single phase and  $0,13xI_n$  in three phase connections. The sensitivity describes the minimum phase current required by the relay to be energized, detect a fault and issue a proper trip.

As in the case of the protection relay, the circuit breaker also needs to have special features which allow it operating. In Siemens medium voltage switchgears the circuit breaker can be offered with two different c.t.-operated releases:

- The c.t.-operated release 3AX1102 which consists of an energy store, an unlatching mechanism and an electromagnetic system. Rated tripping current: 0.5 A / 1 A
- The c.t.-operated release 3AX1104 (low-energy release) which is adequate for a tripping pulse of  $\leq 0.1$  Ws in connection with adequate protection systems. That is, tripping via protection relay.

Similar c.t.-operated releases are offered by other MV switchgears manufacturers. Therefore you can also consider the examples below matching the circuit breaker features with the corresponding scheme.

#### 1.2.1 Circuit breaker with low-energy release (as Siemens 3AX1104)

In case of stations using circuit breakers with low-energy trip release (as Siemens 3AX1104) you can take advantage of the built-in capacitor discharge pulse output for low-energy trip coil of the circuit breaker (24V, 0,1Ws) in the Reyrolle 7SR45 device, marked as PO in the figures. This is a very cost-effective solution since the requirements on the primary CT are very low. 2,5 VA or even 1,5 VA are sufficient.

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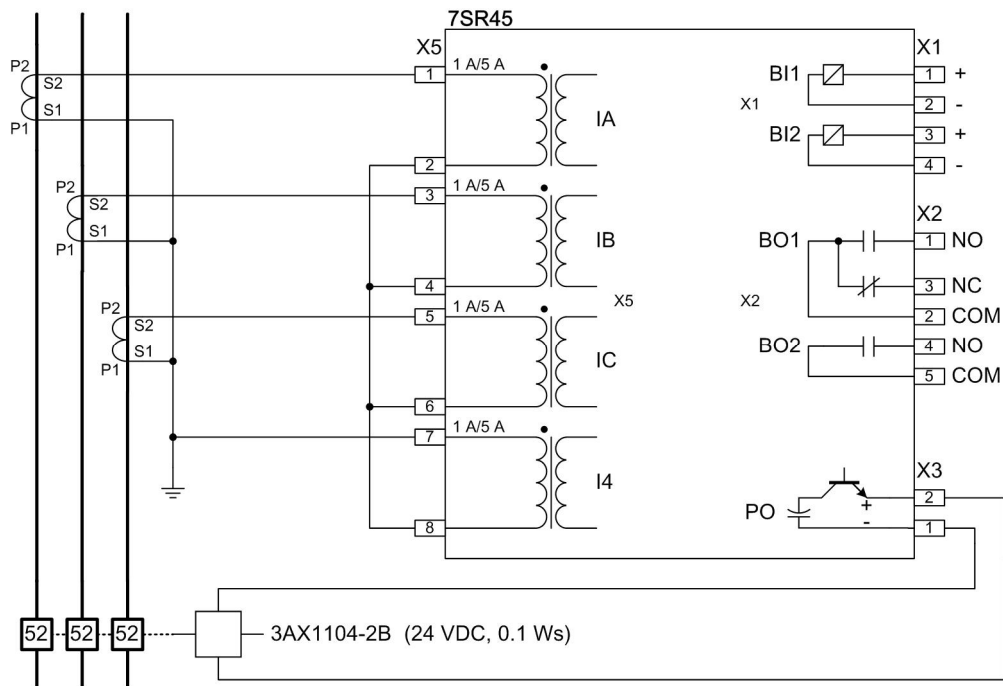


Fig 1. Trip with Pulse Output

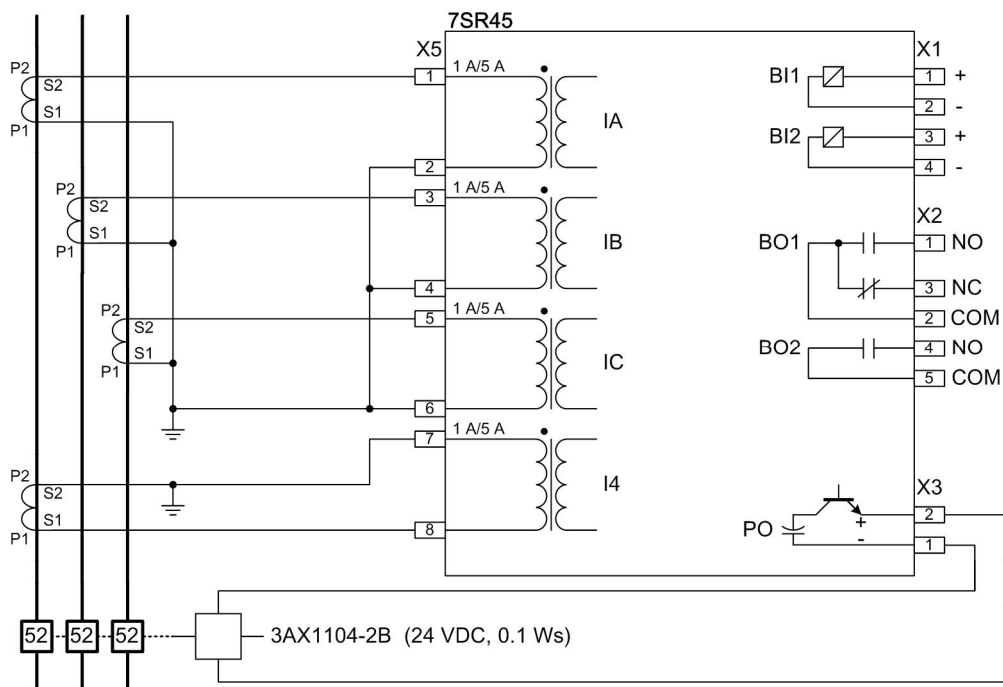


Fig 2. Trip with Pulse Output. 3-phase core-balanced measurement

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## 1.2.2 Circuit breaker with energy store, unlatching mechanism and electromagnetic system (as Siemens 3AX1102)

For existing switchgears with already installed auxiliary trip transformers and current-transformer-operated releases, are the NO/NC contacts to be used. In case of a new or existing installation without the above mentioned accessories, it is recommended to use the auxiliary trip transformer 4AM5065-2CB (1A) or 4AM5070-8AB (5A) along with the current transformer-operated trip releases 3AX1102-2A (rated normal current 0,5A) or 3AX1102-2B (rated normal current 1A). For this application more powerful primary CTs, e.g. 20VA or 30VA are recommended

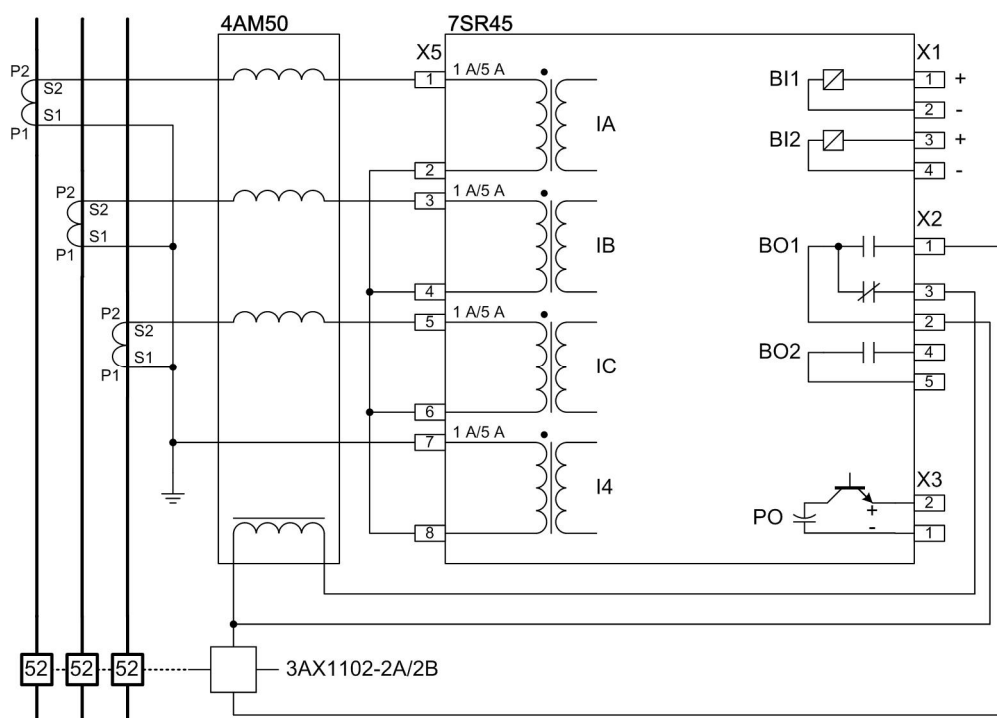


Fig 3. Trip with NO/NC Contacts

## 1.3 Safety disconnection in facilities without reliable auxiliary power supply

Some installations are equipped with an AC voltage power supply in such a way that standard protection devices can be used. Here it is also possible to build up a solution which guarantees the maximum reliability while ensures the safety for both personal and assets. By using a small external uninterruptible power supply UPS as source for the relay and trip circuit, it is possible to add some seconds of autonomy to the system after the loss of the AC power supply, with the aim of safely open the corresponding circuit breaker before the protection device powers off.

This alternative can be used with conjunction with Reyrolle protection relays 7SR10 / 7SR11 suitable to be powered on and also to activate its binary inputs with 115VAC.

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## 1.4 Summary

The use of suited protection devices together with a conformed electrical design is the key to optimize the reliability of electrical installations while granting a highest safety level for personal and assets.

In special facilities without the availability of power supply and in installations where the power supply depends on a non-reliable source, the appropriate protection device selection is the key to overpass the limitation and achieve a reliable system. For that the Reyrolle 7SR45, 7SR10 and 7SR11 protection devices are a secure investment.

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