SIEMENS

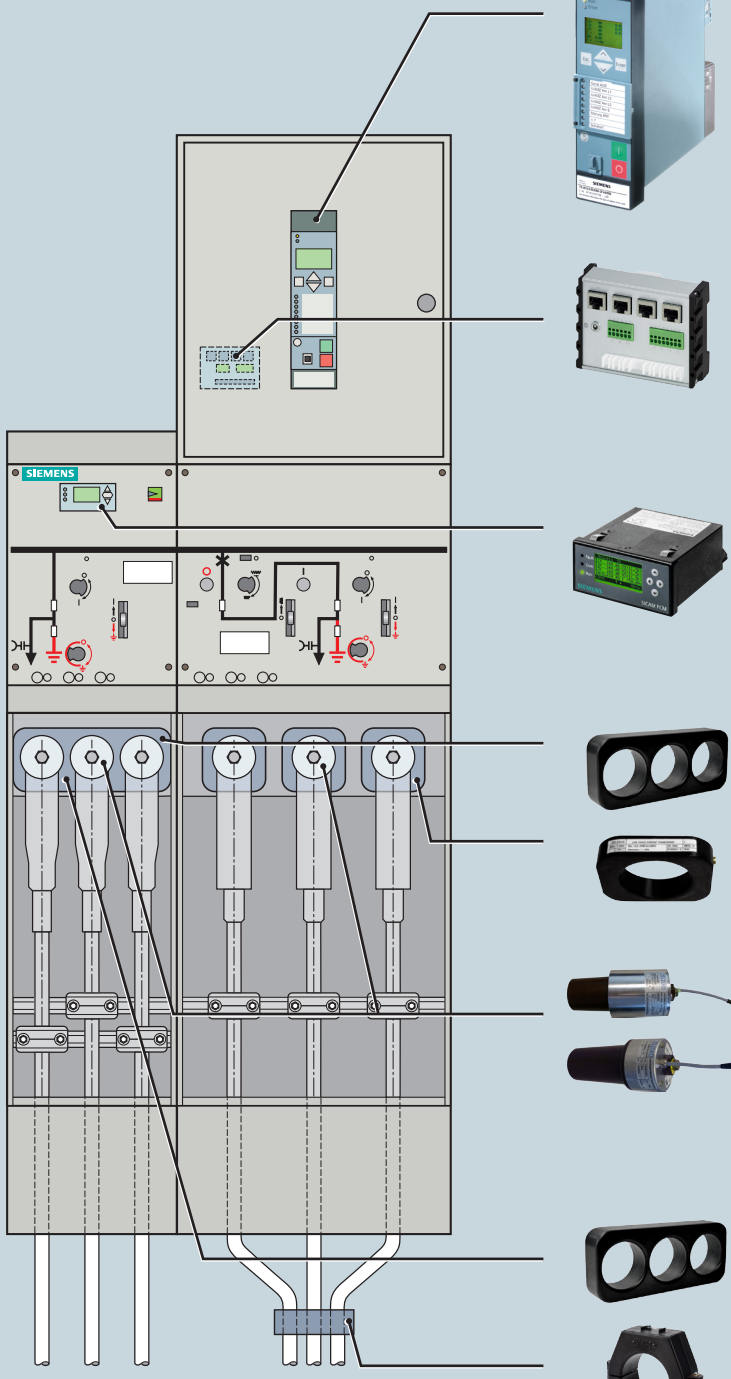
Ingenuity for life

8DJH with Low-Power Current and Voltage Sensors

Innovation Gives Space

siemens.com/8DJH

Full scope of functions with innovative components



1. SIPROTEC 7SJ81

SIPROTEC 7SJ81 is a compact time-overcurrent protection relay with directional fault detection. It was especially developed for use in medium-voltage systems, for the connection of low-power current and voltage sensors.

2. RJ45 merging unit

The compact merging unit enables the connection of 3 low-power voltage sensors and 4 low-power current sensors via spring-loaded terminals, and transfers the signals to RJ45 sockets.

3. SICAM FCM

SICAM FCM (Feeder Condition Monitor) is a short-circuit and earth-fault indicator with direction indication for connection of low-power current and voltage sensors.

4. Low-power current sensors

The low-power current sensors are nearly powerless, inductive current transformers that transform the current into a proportional voltage using a measuring resistor.

5. Low-power voltage sensors

The low-power voltage sensors are based on the functional principle of the resistor divider. It consists of two resistance elements, which divide the input signal so as to reach a standardized output value.

6. Low-power sensor for earth-fault detection

The low-power sensor for earth-fault detection works according to the functional principle of the zero-current transformer. In case of asymmetry between the individual leads routed through the transformer, an earth-fault displacement current develops.

The Centralschweizerische Kraftwerke AG (CKW) build an intelligent transformer substation with innovative Siemens technology

Reference from Switzerland – Interview with Markus Binkert (Head of Pool Network Services)

The Swiss Siemens customer CKW has partially automated a transformer substation for a company in Emmen, near Lucerne, equipping it with cutting-edge intelligence by Siemens.

CKW, Switzerland – Scope of supply:

Gas-insulated medium-voltage switchgear 8DJH with
– Low-power current and voltage sensors
– SIPROTEC 7SJ81
– SICAM CMIC

What challenges did CKW have to master?

The Seetal space in Emmen is one of the largest construction sites in the region. Due to road works for new routes, many new cables have to be newly installed or relocated, which is why road works also take place near medium-voltage cables.

This is not only a challenge for CKW, but also for the construction workers with their machines. Even despite every precaution, the risk of a cable defect cannot be fully eliminated.

The challenge of an increased probability of failure is the reason for our search for a solution.

Which goal did CKW pursue in the end?

Our main target is the security of supply.

For example, we supply power to a company where even short blackouts of a few seconds can lead to production failures. If a power supply interruption lasts longer than 15 minutes, the production facilities will be seriously damaged, and then they have to be expensively repaired for several days. The financial damage is accordingly high, and therefore we must keep it at a minimum.

Which solutions did CKW consider in order to reach the goal?

Together with our customer in the above example, we checked different measures for minimizing the consequences of possible failures in the medium-voltage grid. A cost-benefit analysis of the possible options provided the most efficient and, at the same time, the most economic solution – the partial automation of the transformer substation, which automatically recognizes a failure in the grid.

For this, Siemens offered two approaches to solve the problem:

1) On the one hand, a switchgear type 8DJH with conventional current and voltage transformers as well as the protection relay SIPROTEC 7SJ80, and
2) on the other hand, a switchgear type 8DJH with innovative low-power current and voltage sensors and the low-power transformer protection device SIPROTEC 7SJ81.

Why did you choose the innovative solution by Siemens?

The added value of the innovative solution lies in the optimized space and costs for the same functionality. This means that, thanks to the Siemens low-power voltage sensors, circuit-breaker panels with smaller dimensions (430 mm instead of 500 mm) can be used.

This results in space savings of 210 mm switchgear width, and consequently in a significant cost optimization. Furthermore, the high measuring accuracy of the low-power sensor technology, although requiring less material, convinces as against conventional transformers.

Since when has the transformer substation been in operation right now?

We put the switchgear into operation this year in spring.

Has CKW already been able to report a success of the intelligent transformer substation since commissioning?

Absolutely. It passed the practical test! Today, the power grid is managed in a way that the transformer substation Emmen-Viscosistadt can be supplied by the transformer substation Emmenbrücke as well as by the transformer substation Ruopigen.

Already shortly after installation, the switchgear was disconnected from the transformer substation Emmenbrücke and connected to the grid area of the transformer substation Ruopigen. In this way, major damage could be prevented for the first time. The suitability has thus been proved.

„Thanks to partial automation, today we can minimize the risk and withstand the challenge.“

Proven technology, consequently optimized to save space

Benefits

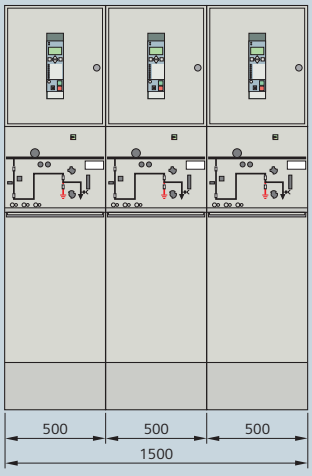
The medium-voltage switchgear 8DJH offers the possibility to install intelligent short-circuit and earth-fault indicators type SICAM FCM or also time-overcurrent protection relays SIPROTEC 7SJ81 for connection to low-power current and voltage sensors. Thanks to the use of low-power voltage sensors instead of conventional voltage transformers, the following benefits can be identified:

Cost savings:
Low-power voltage sensors can be mounted in 310 mm ring-main panels or 430 mm circuit-breaker panels, which in turn are available in block-type construction (multiple panel functions possible in one common gas vessel).

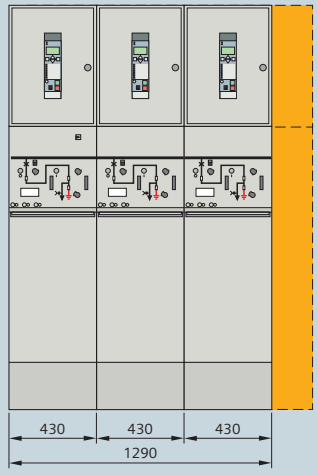
Space savings:
The total switchgear width and therefore the floor area required is reduced.

Accuracy:
Constantly high measuring accuracy despite less use of material.

Switchgear design with conventional transformer technology



Switchgear design with low-power sensor technology



The figure illustrates the space gained for three circuit-breaker panels with low-power current and voltage sensors as against a switchgear with conventional current and voltage transformer technology by the example of the CKW switchgear mentioned as a reference above.

Space savings

Technical details to the switchgear type 8DJH:

8DJH

Technical features		
Rated values up to	**17.5 kV, 25 kA, 1 s**	**24 kV, 20 kA, 3 s**
Rated frequency	50/60 Hz	50/60 Hz
Busbar current up to	630 A	630 A
Feeder current up to	630 A	630 A
Busbars	Single busbar	
Insulation	Gas-insulated	
Switchgear vessel	Hermetically enclosed	
Type of switchgear	Factory-assembled, type-tested, metal-enclosed switchgear according to IEC 62271-200, modular and extendable, panel blocks consisting of 2, 3 and 4 panels	
Internal arc classification (option)	IAC A FL/FLR 21 kA, 1 s	
Dimensions		
Individual panels and panel blocks Width	310 mm to 1720 mm	
Height	Optionally 1200 mm, 1400 mm or 1700 mm (each without low-voltage compartment)	
Height of low-voltage compartment	Optionally 200 mm, 400 mm, 600 mm, 900 mm	
Depth	775 mm, 890 mm (with pressure relief duct at the rear)	

For further information, see catalog HA 40.2 – siemens.com/8DJH-catalogue

All components at a glance

SIPROTEC 7SJ81

- Line protection in high- and medium-voltage systems with earthed, impedance-earthed, isolated, or compensated neutral
- Can be used as Q/U protection for switchgear according to the German Renewable Energies Act (EEG)
- 4 inputs for low-power current sensors according to IEC 60044-8 (225 mV)
- 3 inputs for low-power voltage sensors according to IEC 60044-7 (3.25 V/√3)
- Up to 7 binary inputs and 8 binary outputs
- 9 programmable function keys
- 6-line display
- Buffer battery exchangeable from the front
- USB port at the front
- 2 additional communication ports available
- Pluggable connection terminal blocks

RJ45 merging unit

- Connection of low-power voltage (3 nos.) and current (4 nos.) sensors with spring-loaded terminals
- Enables the connection of low-power current and voltage sensors with open wire ends to SIPROTEC 7SJ81 with patch cables and RJ45 sockets
- Can be mounted on C-rail
- 4 RJ45 ports
- Aluminum housing
- Cable bracket for mechanical relief of the connection points

SICAM FCM

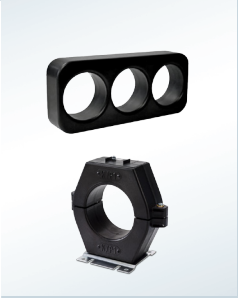
- Directional earth-fault and short-circuit indicator for earthed, isolated and resonant-earthed systems
- RMS measured values for: phase voltage and currents; earth current; system frequency and cos φ; phase angle; active, reactive and apparent power
- 3 inputs for low-power current sensors according to IEC 60044-8 (225 mV)
- Current input L2 as an alternative to earth-fault detection
- 3 inputs for low-power voltage sensors according to IEC 60044-7 (3.25 V/√3)
- 1 binary input and 2 binary outputs
- 4 function keys, 3 LEDs and large display for indication of the latest measured values, or of fault information in case of distribution grid failures
- RS485 interface incl. Modbus RTU communication

Low-power current sensors

- Low-power current sensors according to int. instrument transformer standard IEC 60044-8
- Primary current: 300 A (extension 200%)
- Output signal 225 mV
- Accuracy class 0.5, 1 or 3, and 5P10, 5P20
- Rated burden ≧ 20 kOhms
- Tested for severe ambient conditions (temperature / condensation / EMC)
- Installation with minimum interference with the switchgear
- As a multifunction current sensor, also available with integrated earth-fault detection sensor for 310 mm wide R panels

Low-power voltage sensors

- Low-power voltage sensors according to int. instrument transformer standard IEC 60044-7
- Primary voltage up to 30 kV
- Secondary voltage 3.25 V/√3
- Accuracy class 0.5, 1 or 3 P
- Rated burden 200 kOhms ±1 % accuracy
- No calibration or adjustment to the primary voltage needed
- Tested for severe ambient conditions (temperature / condensation / EMC)
- Installation with minimum interference with the switchgear
- Installation at the rear side of the cable T-plug instead of the sealing stopper
- Available for symmetrical plugs with standard C cone according to EN 50181, or for shortened cone from different manufacturers (exact types on request)



Low-power sensor for earth-fault detection

- Earth-fault detection sensor according to int. instrument transformer standard IEC 60044-8
- Primary current 60 A
- Output signal 225 mV
- Accuracy class 1, phase displacement ±120 Minuten
- Rated burden ≧ 20 kOhms
- Tested for severe ambient conditions (temperature / condensation / EMC)
- Installation with minimum interference with the switchgear

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