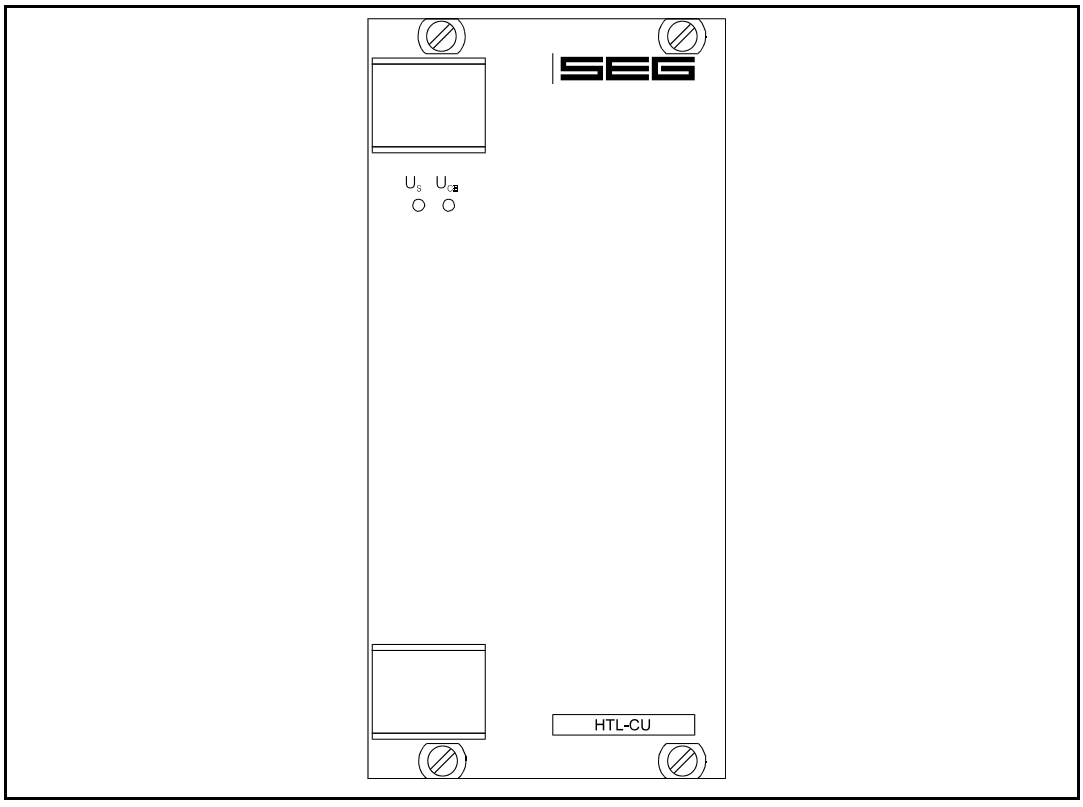
HTL-CU-230 - Capacitor storage



Contents

1 Application

The auxiliary voltage can be considered as a very essential pillar of the protection technology. When the aux. voltage failes, the operating reliabilty of essential protection devices are at risk and so is the safety of the object to be protected. Although in such cases a tripping command is given via a closed-circuit contact in the protection device, a circuit breaker could not electrically be switched-off due to the missing voltage at the tripping coil.

Very often a secure auxiliary voltage supply (rectifier, battery) is not economical for a smaller sized switchboard and for such applications the *HTL-CU* is a very effective alternative. As an additional device it provides the necessary energy reserve to buffer the aux. voltage. By this capacitor storage up to three *HIGH TECH LINE* relays can be supplied and dependent on the power demand, it ensures that a circuit breaker can be switched-off up to three times when the normal aux. voltage has failed. The *HTL-CU* is provided with two separate capacitor storages, equipped with high duty cycle long-life capacitors.

2 Features and characteristics

- Can be used as additional device with *HIGH TECH LINE* relays
- Is looped into the aux. voltage supply of protection devices
- Buffer time between 2s and 9s (depending on type and number of protection devices used)
- Separate energy storage for protection devices and tripping coil of the C.B.
- Enables up to three times a C.B. to be switched off
- Up to three protection relays can be supplied
  Can be connected to 230 V AC or 230 V DC

3 Design

3.1 Connections

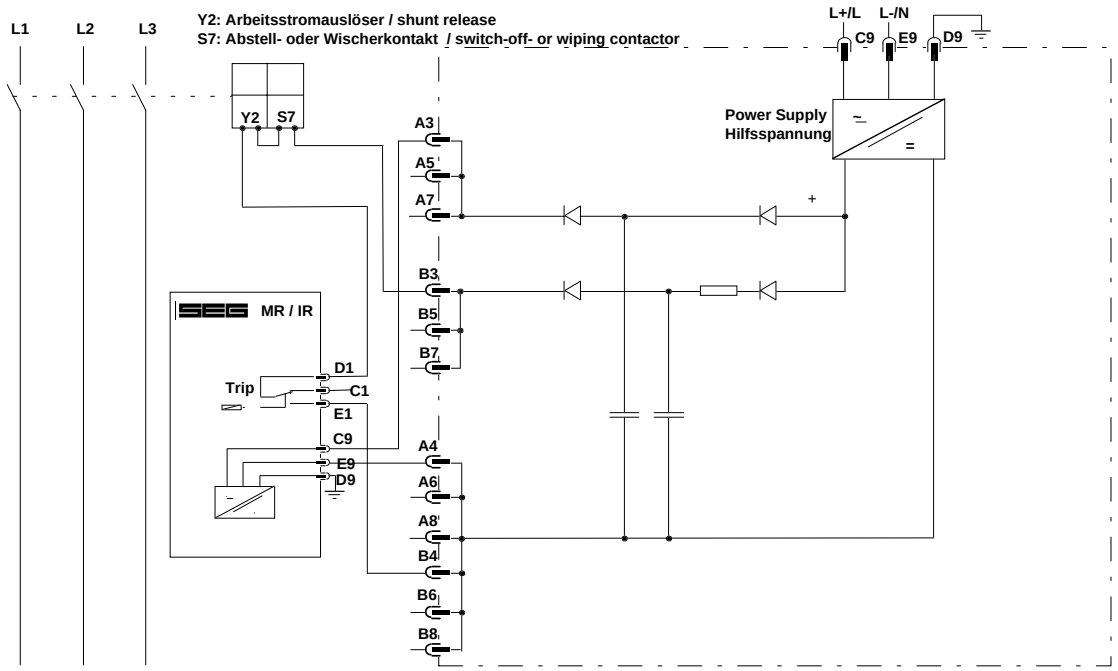


Fig. 3.1: Connections

3.1.1 Input terminals

The supply voltage which is considered not to have fail-safe properties is connected to terminals C9 and E9.

3.1.2 Output terminals

The aux. voltage for the C.B. tripping coil be taken from terminals B3, B5 and B7 (+), the aux. voltage for the protection devices from the terminals A3, A5 and A7 (+). The common return wires (-) of both voltages are connected to terminals A4, A6, A8, B4, B6 or B8.

3.2 Front plate

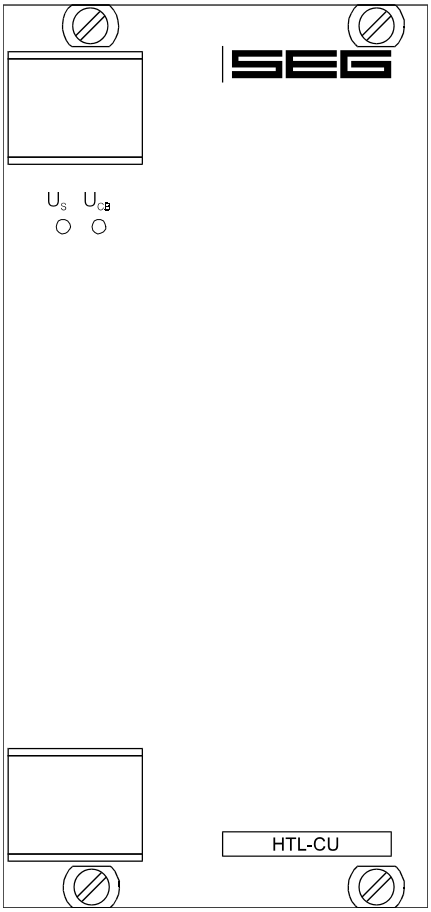


Fig. 3.2: Front plate

3.2.1 LEDs

The status of the the two energy storages is indicated by two LEDs.
LED U_s flashes, if the voltage of the capacitor storage for supply of protection devices exceeds 270 V DC.
The LED U_{CB} flashes if the voltage of the capacitor storage for C.B. tripping exceeds 270 V DC.
Should the voltage of the respective storage be below 270 V DC, the LED does not light up.

4 Working principle

The unsecured aux. voltage for the protection devices and C.B. tripping is connected to the *HTL-CU*, then rectified and used for charging the two energy stores. Due to the rectifier it does not make any difference whether AC or DC voltage is applied. The storage for the C.B. control is additionally charged via a series resistor and by this the max. charging current is limited.

Backward charching of the capacitors via output terminals is prevented by special diodes in the *HTL-CU*. This is very important for applications where several *HTL-CUs* are connected in parallel in order to have more storage capacity available.
There are two other diodes which separate the capacitors and by this an energy interchange between the capacitors is prevented.

The two rectified and buffered aux. voltages are always applied at the output terminals of the *HTL-CU.* A DC voltage can be used for direct supply of the *HIGH TECH LINE* relays, the other one for control of the circuit breaker.

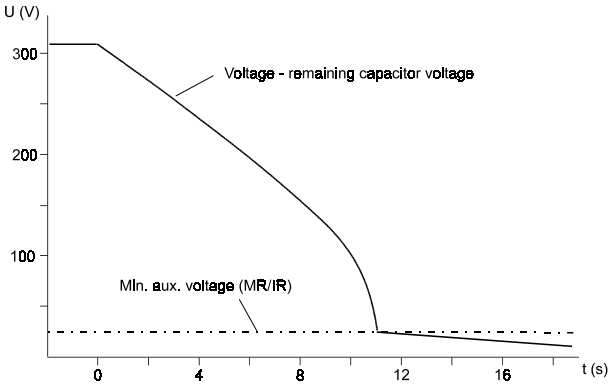


Fig. 4.1: Storage discharge at aux. voltage failure (relay connected is IRI1-I)

4.1 Protection devices

The maximal buffer time is conditional on the load connected. The following table informs about the times for power buffering of protection devices connected to a voltage of 230 V AC or 325 V DC:

Relay type	Quantity	Min. buffer time in s
MR	1	6
	2	4
	3	2
IR	1	9
	2	6
	3	3

Table. 4.1: Buffer time for protection devices

4.2 Circuit breaker

For the C.B. control the following should be taken into account:

The tripping coil of the C.B. should be rated for 230 V AC/DC and in operating current principle. When the tripping coil is connected, the C.B. opens. The switching-off/momentary contact of the C.B. should be connected in series to the contact of the protection device which controls the tripping coil. The tripping coil current is disconnected by the momentary contact as soon as the C.B. has opened. By this it is guaranteed that the DC power is disconnected by the momentary contact and not by the output relay of the protection device.

Another advantage of this connection is the lower power consumption. Energy for a tripping process is only needed until the C.B. has opened and so the residual energy can be used for other switching actions.

The voltage characteristic in the energy store is explained by the following formula:

$$u(t) = U_0 \cdot e^{-t/\tau} \text{ with } \tau = R \cdot C$$

The time available for control of the circuit breaker by the ***HTL-CU*** can be gathered from the result, i.e.:

$$\Rightarrow \quad t = -\tau \cdot \ln\left(\frac{U_{min}}{U_0}\right)$$

where:

t:	Begin of the switching
u(t):	Voltage at time t
U_0:	Charging voltage before switching action
U_{min}:	Min. voltage to ensure reliable function
τ:	Discharge of time constant
R:	Ohmic resistance of the tripping coil
C:=1540µF	Storage capacity

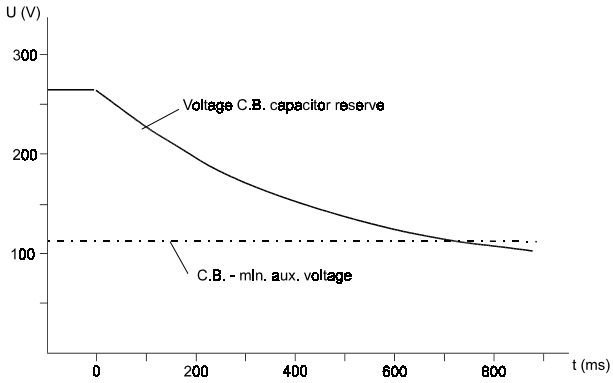


Fig. 4.2: Voltage characteristics in the energy store at continuous control of the tripping coil

4.3 Charging time

Charging of the storages begins immediately after the aux. voltage has been applied at the *HTL-CU*. In the following figures the charging process at 230 V is graphically be illustrated.

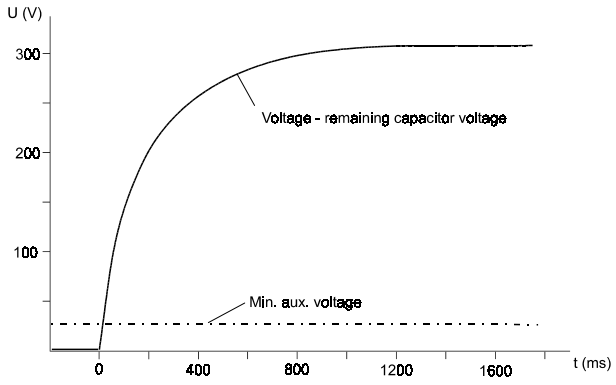


Fig. 4.3: Charging process of the protection device storage

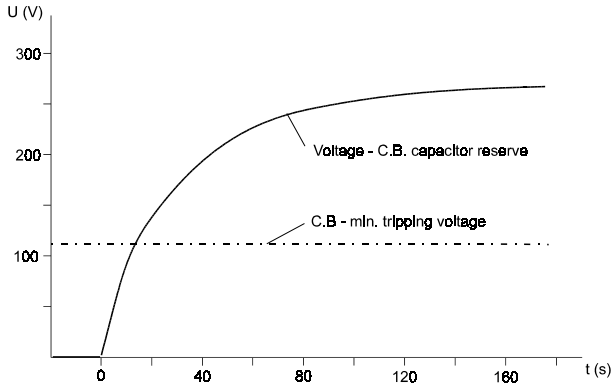


Fig. 4.4: Charging process of the C.B. storage

5 Operation and settings

There are no adjustments needed at the *HTL-CU.*

6 Maintenance and commisioning

Important note!
The capacitors of the *HTL-CU* have their own discharge resistors. The discharge time constant for the protection device storage is 90 s and for the C.B. storage 300 s. After a time equal to three times the time constant, the voltage is still about 5% of the initial charging voltage.

When removing a *HTL-CU* and the capacitors are not completely discharged, there is a risk of electric shock. Therefore it must be ensured that prior to repair work or test assemblies the capacitors must be discharged. For speeding up this procedure a separate discharge resistor of at least 300 Ω can be used. Then the discharge time per store is about 3 s. Each of the stores must be discharged individually.

7 Technical data

Supply

Rated voltage U_N:	230V AC / 325V DC
Rated frequency f_N:	50/60 Hz
Carrying capacity:	250 V AC / 360 V DC
Power consumption:	1 W internal consumption + consumption of components connected
Max. inrush current:	2.0 A
Thermal withstand capacity:	250 V AC / 360 V DC continuous

Energy storage for protection devices

Compatible with IR/MR relays:	H-type (aux. voltage 50-270 V_{AC}, 70-360 V_{DC})
Rated output voltage U_N:	325 V DC (no-load operation)
Output voltage on-load:	312 V DC (1 MR relay) 305 V DC (3 MR relays)
Max. buffer time for	
MR relays:	2 s (3 relays), 6 s (1 relay)
IR relays:	3 s (3 relays), 9 s (1 relay)
Max. number of relays:	3
Max. power consumption:	3 x 5 W
Stored energy:	23.3 Ws at U_N, 20 Ws with 3 MR relays connected
Storage capacity:	440 µF
Charging time constant:	200 ms
Discharging time constant:	90 s (by internal discharge resistors)

Energy store for C.B.

Max. Output voltage:	265 V DC
Number of switching actions possible:	about 3, dependent on the operating current release used
Max. number of operating current tripping devices:	3
Storage capacitor:	1570 µF (7x220 µF)
Stored energy:	54 Ws at rated voltage
Charging time constant:	28 s
Discharging time constant:	300 s (by internal discharge resistors)

Indication

LED 1:	flashing if protection device aux. voltage is >270 V
LED 2:	flashing if C.B operating current release aux. voltage is >270 V

Climatic conditions

Temperature range:	operation	-20°C - 75 °C
	storage, operation	-40°C - 85 °C
Service life of capacitors:	at least 15 years at 25 °C	

Mechanical stress

Shock, Vibration:	nach DIN IEC 255 T 21-2, T 21-1
Enclosure:	IP 54 when front cover is closed, IP 00 at the rear
Weight:	approx. 765 g

7.1 Dimensional drawings

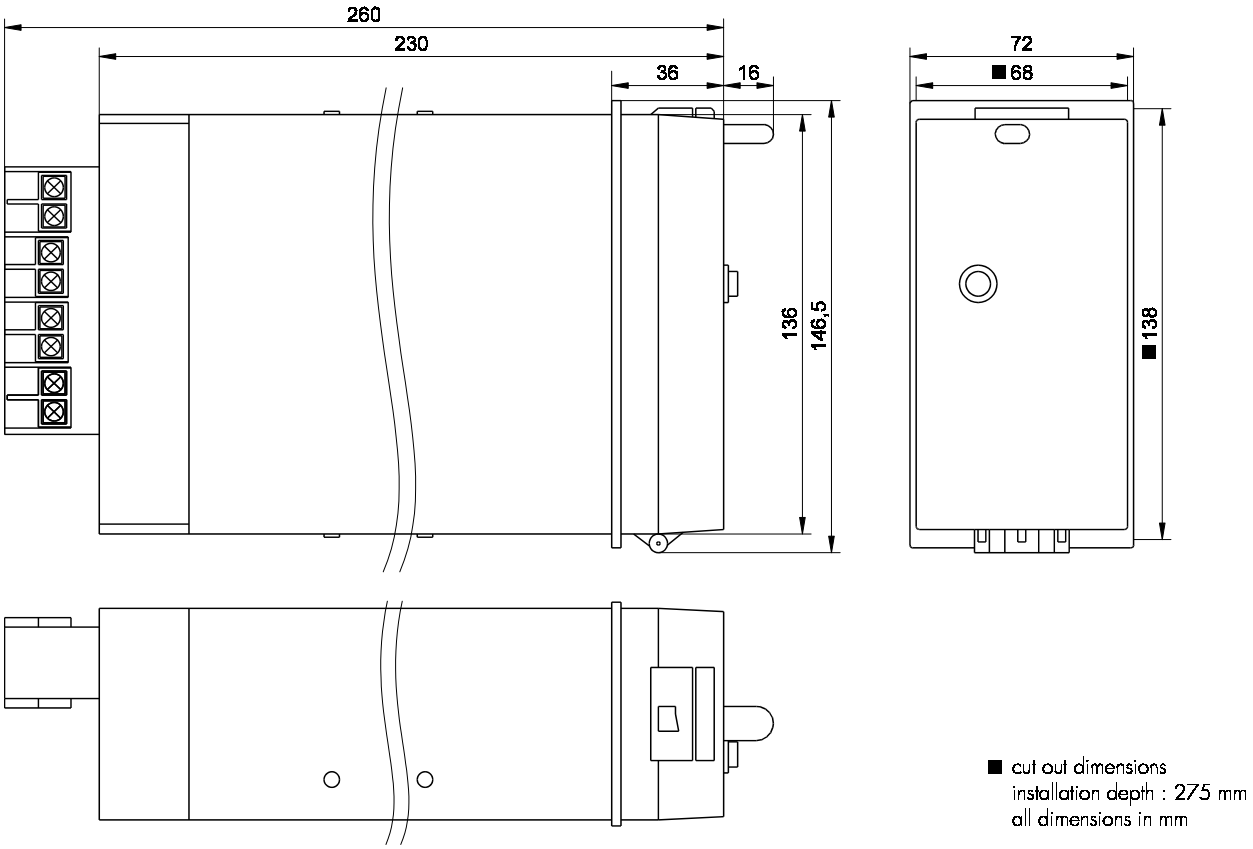


Fig. 7.1: Dimensional drawings

Please observe!

A distance of 50 mm is necessary when the units are mounted one below the other for the front cover to be easily opened. The front cover can be opened downwards

8 Order form

Capacitor storage		***HTL-CU-230-***	
Enclosure	19" rack		**A**
	Flush mounting		**D**

Technical data subject to change without notice!

Caution:

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