Digital Directional Overcurrent - Time Protection with Earth-Fault Direction DSRZE 2

1 Application

This multifunction protection device is used mainly for directional overcurrent-time protection of single and double fed lines in radial and ring systems. The system neutral may be insulated, compensated or earthed.
The direction of short-circuits and earth-faults can be determined.
Additionally, it features the detection of zero-power directions in earthed-neutral systems having a possible high zero phase-sequence impedance (e.g., resistive-earthing systems, earthed overhead lines without earth wire.
It can protect ties and is used as a back-up protection for transformers and generators. An integrated overload protection module can be used for cables and transformers etc.. An inrush restraint function allows tight overcurrent settings in feeders with a transformer or similar equipment.

Selectivity will be better and tripping times can be reduced by utilising the signal transmission (teleprotection) between protectors. So it is possible using H2-Logic (reverse interlocking) to trip in shortest times for all faults without applying a distance protection. Signal transmission also allows protection of short lines (instead of using a differential protection device).

The output of a relatively accurate fault location is very helpful for the service.
The optional IEC 60870-5-103 - interface of the DSRZE 2 permits the connection to a substation control system.

2 Functions

The protector integrates the protective and additional functions indicated below. Most of them may be switched on or off:

- Definite-time phase-selective overcurrent protection (OTP) $I_L>$, $t_{IL}>$ and $I_L>>$, $t_{IL}>>$
- Definite-time earth-fault current protection $I_E>$, $t_{IE}>$ and $I_E>>$, $t_{IE}>>$
- Earth-fault current stabilisation
- Separate time stages for forward and reverse direction
- Detection of short-circuit direction
- Voltage memory for direction decision of three pole short-line faults
- Detection of zero-power direction
- Detection of earth-fault direction
- Switch-on-to-fault protection
- Emergency overcurrent-time protection in case of a voltage path fault
- Overload protection (thermal replica)
- Teleprotection:
  - two-wire connection to remote station
  - reverse interlock
  - H2-Logic
  - permissive overreach protection
  - blocking overreach protection
  - unidirectional operation
  - intertripping in weak infeeds
- Fault localisation
- Circuit-breaker failure protection
- Logical combination of input signals
- External requests for a TRIP command,
- Pulse shaper stage
- Three characteristic sets, switchable
- Operate value display
- Event logging
- Disturbance data logging
- Time synchronisation
- Short restart time after interruption of auxiliary voltage.
- Test auto-reclosing / trip test
- Optocoupler check
- Optical fibre interface test
- self-test
- Serial interface RS 232
- Readout and setting is menu driven so the use of the PC operator software is not forced.

Options:

- Inrush stabilising
- auto-reclosing
- IEC 60870-5-103 interface
- Level shifter for H2-Logic
- PC operator routine COMM-3
- Program for graphical representation of disturbance data SDA 2

3 Construction

The DSRZE 2 is housed in a sheet-steel enclosure in the following designs:

- panel surface-mounting
- panel flush mounting.

Additionally three different installation positions exist – current terminals

- at the bottom
- right or
- left hand side

For all versions, the low depth of 140 mm allows the installation into medium-voltage switchgear cells. Therefore, behind the relay other devices like terminals may be located.
For panel surface mounting, the terminals can be accessed from the front panel, whereas for panel flush-mounted units they can be accessed from the rear side.
The front operator panels of all versions are equal. They include the membrane keyboard, a four-line LCD display of 20 characters per line, 12 LED's and a 9-pin Sub-D connector for plugging in a PC.

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The optional IEC 60870-5-103 interface is available in two physical designs: optical fibre connection or RS485 twisted-pair wire. The optical fibre interface has two connectors for the transmission and reception direction. It is located in the upper level of the terminals. The alternative RS485 wire interface uses terminals.

4 Method of operation

For connecting the DSRZE 2, the phase currents I_1, I_2, I_3 as well as I_E derived from a cable-type CT and the voltages U_{1E}, U_{2E}, and U_{3E} of the system to be monitored are required.
A microcontroller with a built-in A/D converter processes all information.
The setting sets are stored in an EEPROM to be preserved if the supply voltage and the back-up battery fail. Due to the back-up battery, recorded events and disturbance data are maintained in case of a voltage failure. The restart time of the protection device is dramatically reduced also.
A real-time clock is provided for time stamping of events.

5 Protective functions

5.1 Overcurrent-time protector

The overcurrent-time protector may be adjusted separately for the overcurrent (I_L>) and high-current (I_L>>) time stages. Current measurement is phase-selective in each phase.
There are different time stages for forward (fw) and reverse (rv) direction, so one can use the DSRZE 2 for both directions at the same time.

5.2 Inrush stabilising (Option)

Spurious trippings by magnetising inrush are avoided by valuating the adjustable ratio from the 2nd to the 1st harmonic in the measured currents.
The startings and tripping at ratio over range in a phase, independent from the result of the other phases, will be blocked (cross block). The cross block function may be switched off.
With greater currents no blocking is issued (limit adjustable).

5.3 Earth-fault current-time protection (short-circuit protection)

Earth-fault current-time protection uses the calculated quantity i_E. There are two stages I_E> and I_E>>.
To avoid spurious starts of the earth-fault current-time protector I_E>, for example due to transformer errors, the operate value is stabilised. Stabilising the earth-fault current serves to rise the operate value of the earth-fault current-time protector depending on the amount of the phase currents. It is effective only after a phase starting. In case of a three phase short-circuit stabilisation is a maximum.
There are different time stages for forward (fw) and reverse (rv) direction too.

5.4 Short-circuit direction

A single-element measuring method is used to determine the direction of a short circuit ("forward" corresponds to the energy flow away from the busbar). The measured values applied are selected depending on the fault - the voltage perpendicular to the fault current: 90° circuitry. Thus, except for the three-phase short-line fault, a sound measuring voltage is available for determining the direction.
In the event of a three-phase short-line fault, a voltage memory is used.

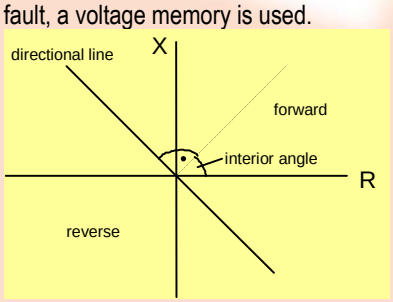

Fig. 1: Characteristic for determining the short-circuit directions

The location of the directional line may be changed by turning the interior angle (see Fig. 1). When doing so, the interior angle is perpendicular to the directional line.
The trip command may be issued either only in forward direction or, alternatively, in both directions but with times adjustable to different values.

5.5 Zero-power direction

In earthed-neutral systems having a possible high zero phase-sequence impedance the zero-power direction can be determined as a back-up protection - presupposition: the earth-fault current stage starts alone and displacement voltage U_{NE} is greater than its setting value.
As measured values, the values i_E and u_{NE} are used. Both values are calculated and the power is determined. Characteristic is shown in Fig. 1.

5.6 Earth-fault detection

In insulated and compensated systems an earth-fault may be detected. The operate value of the displacement voltage is setable.
It can be set also, that the protection should give a TRIP command when the earth-current exceeds I_E>.

5.7 Earth-fault direction

The DSRZE 2 detects the active and the reactive power and therefrom, depending on the type of system (insulated or compensated), the earth-fault direction. It is a new feature that it can adapt its sensitivity to an optimum value depending on the earth-fault location and the earth-fault resistance. To do so, the power operate value is increased or decreased by a variable factor. A direction decision is taken, if the given power P is higher than the setting P> divided by the factor. This results in a high reliability of the direction decision also. This measures aim is to let only relays respond, which have a high factor. This happens in the feeder with the earth-fault.
In insulated systems a directional TRIP-command can be configured.

5.8 Switch-on-to-fault protection

When switching on to an existing short circuit, this function can produce an undelayed TRIP command. The input-signal “CB manual close“ starts a timer. Short circuits detected during this time are switched off immediately if selected. A possibly switched on auto-reclosing function will be blocked.

5.9 Emergency overcurrent time protection

If the voltage for the determination of direction fails, e.g., if the voltage transformer circuit breaker operates, the DSRZE 2 functions automatically as a non-directional overcurrent-time protector. The protector operates with the current stages and their times for the forward direction as definite-time overcurrent protector.
Also, in case of switching off or blocking direction decision the overcurrent time protection still works.

5.10 Auto-reclosing (AR) (Option)

The DSRZE 2 is equipped with a three-phase auto-recloser. Up to five reclosures are possible with the first interruption being adjustable as a short-time interruption. As any other function, the auto-recloser may be switched off if unused (also through the substation control interface). It may also be blocked temporarily by an input signal. Other in-

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put signals required for the auto-recloser are the ready signal from the circuit breaker and the manual close signal.
Various starting conditions for the auto-recloser may be set in the protector.
The auto-recloser may also be started by an external signal through an input.
When looped through a break contact of the DSRZE 2, the "breaker tripped" signal may be interrupted in case the trip command is not final.
Another relay contact closes for short periods, if the intended "CLOSE command" is not issued, for example, due to auto-reclosure blocking in the meantime. As a result, the previously suppressed breaker tripping impulse can be simulated afterwards.

5.11 Teleprotection method

Configuration enables the methods indicated below:

- Two-wire connection to remote station (another DSRZE 2 protector): a signal comparison with the remote station through a two-wire-signal loop which is supplied by a battery voltage of a station where the contacts of the transmitting relays and the optocoupler inputs of both relays are arranged in series.
- Reverse interlock, i.e., shortened TRIP command time, if the response of protective devices on the relative outgoing feeders is missing.
- In ring systems H2-Logic is a good solution for shortest tripping times.
- When applying teleprotection devices, there are different options:
  - unidirectional operation,
  - permissive overreach protection
  - and blocking overreach protection.
- Intertripping in weak infeeds.

With the optional coupling to the substation control system, the "teleprotection" protective function may be switched on or off by use of a telegram.

5.12 Circuit-breaker failure protection

Two effects are available:

1. detection of failure of the own associated circuit breaker
2. trip request by an input signal resulting from an external circuit breaker failure

In the former case, the time stage t_{CBF} is started together with the trip command, and during its operating time the current in all phases must have fallen below the minimum value. Otherwise an output relay to be configured will be started.
In the latter case, additional conditions for outputting the trip command may be set. For example, a phase start or another input signal may be required.

5.13 Thermal overload protection

The integrated overload protection works with a thermal model.
The calculated thermal level will be compared with the set tripping value respectively warning level value. If occasion arises, a response or an alarm is issued.
The influence of the previous load will be regarded. The characteristic meets IEC 60255-8.

$$t_a = \tau \cdot \ln \left[\frac{\left(\frac{I}{I_B}\right)^2 - \left(\frac{I_p}{I_B}\right)^2}{\left(\frac{I}{I_B}\right)^2 - k^2} \right]$$

wherein are:

- t_a tripping time after overload has been started
- τ heating time constant of the equipment
- I actually flowing current
- I_B basic current
- I_P preloading current
- k factor for multiplying the basic current to reach the operating limit.

A reclosing lockout prevents the switching on of the protective object as long as the thermal level is higher than a set value.

5.14 External TRIP commands

Over the binary optocoupler inputs a TRIP command may be demanded. Up to two TRIP commands inputs can be used.
Grouping all TRIPs in the protection relay gives the advantage of logging them in the event memory and also in substation control equipment.

5.15 Input signal processing

The input signals wanted for the different protective and additional functions are freely programmable; several inputs for one function may be used.
Processing the optocoupler input signals, the logic functions negation (NOT), AND, OR are available. As a result, there are logical input signals for internal processing in the protector.

5.16 Pulse shaper stage

The pulse shaper stages offer the possibility of changing up to two input signals in their time characteristic. So, delays, extensions, shortenings, displacements and storage may be realised.

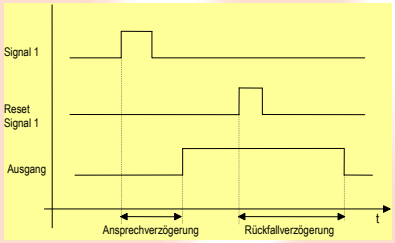

Fig. 2: Example for one effect of the pulse shaper stage – here Flip-Flop

These result signals may be either

- routed to an output signal (input / output coupling) or
- may be used as a blocking signal for protective functions.

The pulse shaper stage has two ports functioning independently of each other.

5.17 Change of characteristic sets

Three characteristic sets may be entered. The respectively active set can be selected by an operator action or by command from the substation control system. Changing the configuration allows to switch between the characteristic sets using the optocouplers.

6 Additional functions

6.1 Display of operating values

Three programs to display the operating values can be selected:

1. The three phase currents and the three phase-to-phase voltages.
2. The three phase currents and the three earth-to-phase voltages.
3. The three-phase active, reactive and apparent power.

Alternating both average r.m.s. and their peak values (dragging indicator) are shown.
The selection of the operating value range comprises:

- as primary quantities in kA, kV, MW or MVAr,
- as secondary quantities referred to the secondary nominal value.

When overload protection is enabled, its actual thermal level and the maximum are shown.
During an earth-fault and power display selected earth fault values are given.

6.2 Visual display of system faults

For first short information concerning a system fault, 12 light emitting diodes (LED's) and a four-line display with 20 characters each per line are available.

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The LED display may be shown either in steady light or flashing light, while the flashing light dominates.
The LED display as delivered in the standard configuration is shown in Table 1. As an output command can be derived practically from each sub-function of the DSRZE 2, the LED assignment can be changed within wide limits by changing the configuration.

LED	steady light		flashing light	
green G	Protection available	u	–	
red R	Alarm	l t	Malfunction	l t
yellow 0	TRIP	l t	–	
yellow 1	I1>(>)	l	–	
yellow 2	I2>(>)	l	–	
yellow 3	I3>(>)	l	–	
yellow 4	IE>	l	IE>>	l
yellow 5	IL>>	s	–	
yellow 6	AR Cycle runs	u	TRIP by SOTF	l
yellow 7	Earth-Fault forward	l	Short Circuit forward	l
yellow 8	Earth-Fault reverse	l	Short Circuit reverse	l
yellow 9	Earth-Fault	u	–	

Table 1: LED assignment on delivery for DSRZE 2 (abbreviations are as follows: u: updating l: latching
t: additional indication on LCD)

The four-line LCD text display shown after a "final TRIP" command includes the following information:

- tripping reason, expressed by short symbols,
- period of fault (relative time until TRIP command),
- r.m.s. value of current in the individual phases at the time of the TRIP command output,
- fault location in km

It should be considered that this LCD report is only used as first information after a "final TRIP". Information that is more detailed can be found in the event and disturbance data memories of all relays started.

6.3 Event logging

Event logging is used to make a follow-up analysis of what happened in the protective object and in the protective relays.

To achieve a better survey, the events are divided into the following groups:

- system faults,
- indications,
- operator actions and
- internal malfunctions and alarms.

Moreover, it can be seen whether the events occurred during

- normal, or
- test operation.

The division into

- main and
- subevents

supports the temporal classification.
Main events are numbered and time-stamped. Subevents contain the time in ms relative to the assigned main event.
The r.m.s. values of U_{LE}, U_{LL}, I_L und I_E together with all binary input states are logged in the event memory in case of a general starting.

The content of the event memory can be selected and displayed on the front panel without using a PC.
The installed back-up battery preserves the event memory content even if the supply voltage fails.

6.4 Disturbance data logging

Disturbance data logging means the storage of the digitised instantaneous values of measured input quantities together with the time marks of some important events (like start, trip and opto-coupler inputs). Logging clock is 1 ms.
Disturbance data logging is done as follows:

- for systems faults by starting of the protector,
- for non-started protectors via a binary input signal that can be configured (not configured in the delivery state),
- for non-started protectors via a function key on the front panel if selected.

The maximum logging time for a fault or an externally generated logging is 3.6 s. Four faults of maximum length can be stored.
In case of a system fault a continuous logging from starting "coming" to "going" including a 50 ms set-up time (pre-travel) and a 150 ms overshoot time is performed.
The disturbance data logging invoked by the input signal is a record that includes the period of the input signal.
Key-initiated disturbance data logging is always a continuous record of maximum length.

The stored disturbance data can only be visualised on a PC screen using PC operating programs.

The disturbance data memory is also designed as a shift memory overwriting the data of the oldest main event.
The installed back-up battery preserves the content of the disturbance data memory if the supply voltage fails.

6.5 Fault localisation

Faults are localised after every "final TRIP" of the protection relay by processing the resulted values from the fault loop. Fault localisation determines:

1. the primary fault reactance X_p in Ω,
2. the distance of fault location l_F in km,
3. the fault distance in percent $l_p = l_F \cdot 100 / l_{100\%}$.

The result output of the fault localisation includes:

- Entry of the result values into the event memory.
- Additional LCD text display after a "final TRIP" by indicating the distance of the fault location in km.
- Summary of the real-time information with X_p for the control system.

6.6 Measured-value checking

Measured current and voltage values arriving through the protector transformers are monitored for plausibility. This includes, among others, phase sequence and balancing checks during the non-started state of the DSRZE 2.
If a voltage path disturbance appears, the non-directional overcurrent-time protection is used.

6.7 Time synchronisation

Beside the default time synchronisation by substation control, it is possible to set the time 12:00:00 by an optocoupler input signal.

7 Tests

7.1 Self-test

Comprehensive monitoring routines of the hardware and for the software are provided to detect and signal malfunctions of the protector. There are cyclic tests and tests during start-up.
Depending on the detected abnormal condition, the protector is taken out of operation or an alarm is issued. Using the green LED to indicate the ready state and the red LED for malfunction and alarm signal is advisable. The pre-configured signal relay “Protection available“ signals any malfunction and

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lack of auxiliary voltage. Alarms may be configured to another signal relay.

7.2 C.B.-Test, Test auto-reclosing

To test the break and make circuits of the circuit breaker, an auto-reclosing test operation may be performed. This function is available after pressing the "Tests" key on the DSRZE 2. If an auto-reclosure is impossible, this function may work as trip test.

7.3 Checking Optocoupler Inputs

Optocoupler-inputs may be monitored by the test-function “Optocoupler test“.

7.4 Test of fibre optic interface

An easy to use check for transmitter, receiver and fibre optic cable is integrated.

7.5 Application of test plug devices

Checking the mounted protection relays periodically many power supply companies apply test plug devices or test selector switches that cause a safe switch over from the measured quantities of the system to the test devices. The TRIP command to the circuit breaker is also involved into the switch over.
Building the "check/test mode“, the test plug device respectively the test selector switch has to make a binary signal for one optocoupler input of the protector available. This marks all logged events as “test“. Information blocking is available to substation control equipment by an optocoupler input too.

8 Serial interfaces

The front 9-pole Sub-D connector constitutes the interface S0 for the operator PC.
The IEC 60870-5-103 interface S1 for connection to the substation control system is available as an option. The optical fibre variant is a point-to-point connection while the RS485 is a twisted-pair half-duplex connection (several devices may be connected).

9 Operation

9.1 Front panel

The following operations can be executed on the front panel:

- Reading and resetting of LED’s and display provided automatically by the relay including the following:
  - operating value display during normal operation,
  - LCD report after a TRIP command of the protector,
  - LCD report after switching off the protector and because of an internal malfunction.
  - In case of an alarm, the operating values and the alarms are displayed.
- Setting of the protector
  Pressing the password-protected "Setting" key displays an easily comprehensible plain-text menu comprising the following main items:
  - *Equipment adaptation* - data concerning the installation and the system,
  - *Protective functions* -- switching the protective and additional functions on or off,
  - *Input configuration* - free assignment and logic combination of optocoupler input signals to device software functions.
  - *Output configuration of relays and LED's* - free assignment of the possible output commands to trip relays, signal relays and LED's, this can generate group signals,
  - *Characteristic sets* - setting values for the selected protective functions are separately adjustable for three characteristic sets,
  - *Device address*,
  - *Operator control* - common settings, e.g. protector On/Off, password, date and time, operating mode, etc.
- Display of stored information
  After pressing the "Readout" key the stored information may be indicated on the display:
  - logged events (with elapse time),
  - all settings,
  - information on the protector type, e.g. versions.

  As the key is not password-protected and the information selection is shown in a plain-text menu, it is easy to get a local readout.
- Calling of tests
  Pressing the "Tests“ key accesses a menu used for the above-mentioned tests and the manufacturer's service. The menu is password-protected.

9.2 PC operator routine COMM-3

Although no PC software is necessary for setting and readout of the protection device a PC operator routine COMM-3 and graphic software SDA 2 is available. It is used for preparing and performing the setting of the digital protection relay at the engineer's place of work. In addition to setting the protectors, the routine may also be used for reading out and displaying events and with the additionally graphics software SDA 2 disturbance data can be displayed. Archiving of settings and events is easy to do.
COMM-3 consists of a management program and several device programs (characterised by the “structure” number).
Graphic display and evaluation of disturbance data are by the graphics software featuring the COMTRADE file format (IEEE standard C37.1991). Using this file format data exchange may be performed between compatible devices such as state of the art test devices.

9.3 Control by substation

The IEC 60870-5-103 interface of digital protectors to the substation control equipment is optionally available. Regardless of the manufacturer, this interface supports the connection of protectors to correspondingly compatible equipment.
The scope of signals and commands agreed upon by the compatibility class 2 of a directional overcurrent-time protection is available. Additional private signals give a complete outline of what happens in the protection device.

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10 Specifications

The protection relay satisfies the requirements of the product standards EN 60255-6 (IEC 60255-6); DIN 57 435, part 303.

Mechanical construction

- sheet-steel housing for panel surface mounting
  or panel flush mounting
- dimensions see dimensioned drawings
- weight (panel/flush) ca. 5,8 / 6,4 kg
- degree of protection: housing IP 51
  terminals IP 20
- terminals
  transformers solid wire 0.5 ... 16 mm²
  stranded wire 0.5 ... 10 mm²
  others: solid wire 0.2 ... 4 mm²
  stranded wire 0.2 ... 2.5 mm²

Permissible ambient conditions

- operating temperature -10°C...+55°C
- storage temperature -25°C...+55°C
- transport temperature -25°C...+70°C
- rel. humidity annual mean <75%
  for 30 days 95% at <40°C
  moisture condensation not permitted

Mechanical strength

- resistance to earthquakes (IEC 255-21-3)
  nominal frequency range 1...35 Hz
  cut-off frequency 8...9 Hz
  horizontal 3.5 mm; 10 m/s²
  vertical 1.5 mm; 5 m/s²
- vibration strain (IEC 255-21-1, IEC 68-2-6)
  Fc: 10...150 Hz; 0.075 mm; 1g
- repeated impact strain
  (IEC 255-21-2, 68-2-27+29)
  Ea: 11 ms, 15 g; Eb: 16 ms, 10 g

Auxiliary power supply

- U_H depending on design 24-65.5 V DC
  or 60-137 V DC, 60-100 V AC
  or 110-320 V DC, 100-240 V AC
- operating range $0.8\text{-}1.1 \cdot U_H$
  for 24-65.5 V - version: $0.84\text{-}1.1 \cdot U_H$
- power consumption <15 W
- stored energy time in case of auxiliary power failure, based on nominal voltage ≥ 50 ms
- backup battery for event-data
  3 V CR ½ AA lithium

Measuring input circuits

- nominal frequency 50 Hz
- current paths (different terminals)
  rated current (In) 1 A / 5 A
  load capability
  permanent 4·In
  1 sec 100·In
  limiting dynamic value (10 ms) 250·In
  power consumption at In < 0.25 VA
  power consumption IN at In < 0.4 VA
- voltage paths
  rated voltage (Vn) 100 V
  load capability 1.5·Vn
  power consumption at Vn < 0.3 VA

Binary signal inputs (optocoupler) [1]

- nominal input voltage (Vi) 24...220 V DC
- power consumption $< 4 \cdot 10^{-4}\ (Vi)^2$ W
- logic low level <10 V

Output relays

- trip relays (marked: S1, S2)
  switching voltage 300 V DC, 250 V AC
  limiting making capacity 2000 W (VA)
  limiting breaking capacity
  90...250 W (voltage- and load dependent)
  0.25 A at 220 V DC, L/R = 0 ms
  0.15 A at 220 V DC, L/R = 40 ms
  both contacts in series:
  0.25 A at 220 V DC, L/R = 40 ms
  limiting continuous current 8 A
  limiting short-time current for 0.5 s 30 A
- pilot relays (marked M1... M6)
  switching voltage 300 V DC, 250 V AC
  switching current 8 A
  switching capacity <2000 VA,
  50...220 W (voltage- and load dependent)
  limiting continuous current 6 A

Serial interfaces

- PC interface RS 232; 9-pin Sub-D
  electrical isolation (depending on design)
  0 kV / 1.5 kV
- IEC 60870-5-103 interface optional
  optical fibre connector F-SMA
  optical wavelength 850 nm
  distance < 1 km
  permissible path attenuation < 8 dB
  glass fibre 62.5/125 µm
  idle position light on
  or RS 485 half-duplex
  unit load 1
  potential separation 1.6 kV, 1 s
  connection terminal

Displays

- LED's green: 1; red: 1; yellow: 10
- LCD four-line of 20 characters each illuminated

Setting values and ranges (selection)

- number of switchable characteristic sets 3
- overcurrent stage IL > 0.20...25.00·In
- high current stage I_L>> 2.0...40.0·In
- earth-fault current stage I_E> 0.1....12.0·In
- high current stage I_E>> 1.0...20.0·In
- resetting ratio I_L> 0.95 (fixed)
  I_L>>, I_E>, I_E>> 0.20...0.95
- definite-time time stages 0.01....9.99 s
  (independent for forward and reverse direction)
- inrush stabilising I100/I50> 0.10...0.40
- auto-recloser
  number of reclosures 1...5
  short dead time 0.05...9.99 s
  long dead time 1...300 s
  action time window 0.05...9.99 s
  reclaim and blocking time 1...300 s
- short-circuit direction decision
  internal angle φi 10...80 °
  voltage memory use 0.5...6 V
- zero power direction detection
  internal angle φi 10...80 °
- earth-fault direction detection
  operate value P> (Q>) 0.002...0.5 Vn·In
- thermal replica (overload protection)
  basic current I_B 0.2...2.0·In
  operate factor k 1.00...1.20
  thermal time constant 60...7200 s
  warning levels 40...98%

Routine testing

- dielectric test 2.5 kV, 50 Hz, 1 s
  exception: power supply 2.83 kV DC
  RS485 1.6 kV, 1 s
- Each protection relay will be subjected to a 72-hour alternate temperature test while in function.

Type testing

- impulse voltage test
  5 kV; 1.2/50 µs; 500 Ω
- dielectric test 2.5 kV, 50 Hz, 60 s
  exception: power supply 2.83 kV DC
  RS485 1.5 kV, 60 s
  Isolated PC interface 1.5 kV, 60 s
- EMC noise immunity EN 50082-2, severity class 3
  electromagnetic RF field
  magnetic field of power engineering frequency
  discharge of static electricity (ESD)
  fast transients (bursts)
  transients (surges)
  RF interference test (IEC 255-22-1)
  transformer cross voltage 2.5 kV
- EMC emitted interference EN 50081-2

[1] On special-wish, differently from the default long-range input voltage optocoupler inputs can be dimensioned for a Low/High switching voltage of about 60 V.

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Order data DSRZE 2

Pl.-No.: 1743 8-- ---

H2-level shifter: 6th digit
- No level shifter 0
- 1 input 6
- 2 inputs 7

auxiliary voltage: 7th digit [2]
- 110 - 240 V DC/AC 0
- 60 - 137 V DC 1
- 24 - 65 V DC 2

type of housing: 8th digit

panel surface-mounted
- CT terminals down 0
- CT terminals right 2
- CT terminals left 4

panel flush-mounted
- CT terminals down 1
- CT terminals right 3
- CT terminals left 5

IEC interface / language: 9th digit
- Fibre optical / German 0
- Fibre optical / English 1
- RS485 / German 5
- RS485 / English 6

design: 10th digit
- 0
- 1

Design includes:	0	1
binary inputs	2	5
trip relays	2	2
pilot relays (1 changeover contact)	2	2
pilot relays (1 make contact)	0	3
pilot relays (1 break contact)	0	1
PC interface electrically isolated	X	X
IEC 60870-5-103 I&C interface	-	X
auto reclosing	-	X
inrush restraint	-	X

Optocoupler inputs:

On special-wish, differently from the default long-range input voltage optocoupler inputs can be delivered with a Low/High switching voltage of about 60 V.
This wish is separated with order to declare.

Heed please that when using two-wire signal loop two optocoupler-inputs are connected in series. Therefore only the half of the auxiliary voltage is available at an input.

[2] complete voltage ranges see Specifications

Accessories

PC-protector interconnecting cable

Pl. No.: 1743 900 010

COMM-3 PC operator software

- Management program

Pl.-No.: 1744 990 00-

Variant: 10th digit
- Full-version 0
- Upgrade from COMM-2 to 3 1
- Update of COMM-3 2
- Demo version 9

On supplied CDROM the user manual exists as a PDF-file.

- Device programs

Pl.-No.: 1744 991 ---

Type of device: 8th and 9th digit
- all devices [structure versions] 0 0
- DM 2 [1004] 1 0
- DSRZ(W) 2 [2001] 2 0
- DSZ(W) 2 [3007] 3 0
- DSZW 4 [3105] 3 1
- DSZ 4 [3205] 3 2
- DQ2S 2, DQ3S 2 [4008] 4 0
- DD 2 [5033] 5 0
- P9x-DD.. 6 [5601] 5 6
- DDS(E) 2 [6002] 6 0
- DSRZE 2 [7000] 7 0
- DSRZE 3 [7100] 7 1
- P9x-DS.. 6 [7604] 7 6

Variant: 10th digit
- current structure version 0
- old structure version 1

When reordering a device program the structure version number of the device is necessary additionally (see label on device). Example for DSZ 2, old structure version 3001:
Pl.-No. 1744 991 **301- 3001**

SDA 2 graphics software

Pl.-No.: 1744 992 000

On supplied CDROM the user manual exists as a PDF-file.

User manuals COMM-3, SDA 2 printed version

Pl.-No.: 1744 993 0--

Language: 9th digit
- German 0
- English 1

Manual: 10th digit
- COMM-3 0
- SDA 2 1

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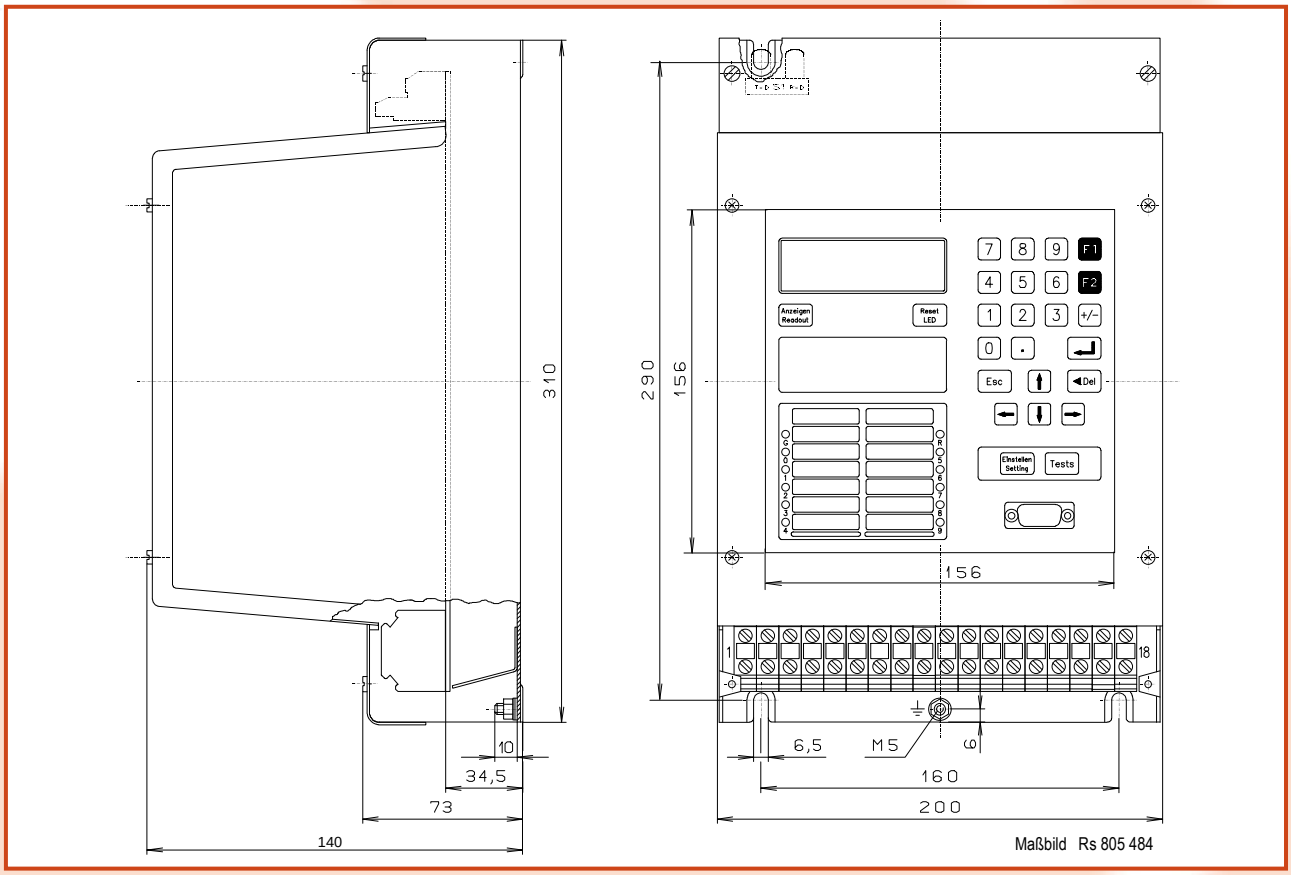

Fig. 3: DSRZE 2 housing for panel surface mounting, lower terminal cover not shown in top view. With the horizontal models the keypad is turned + or -90°.

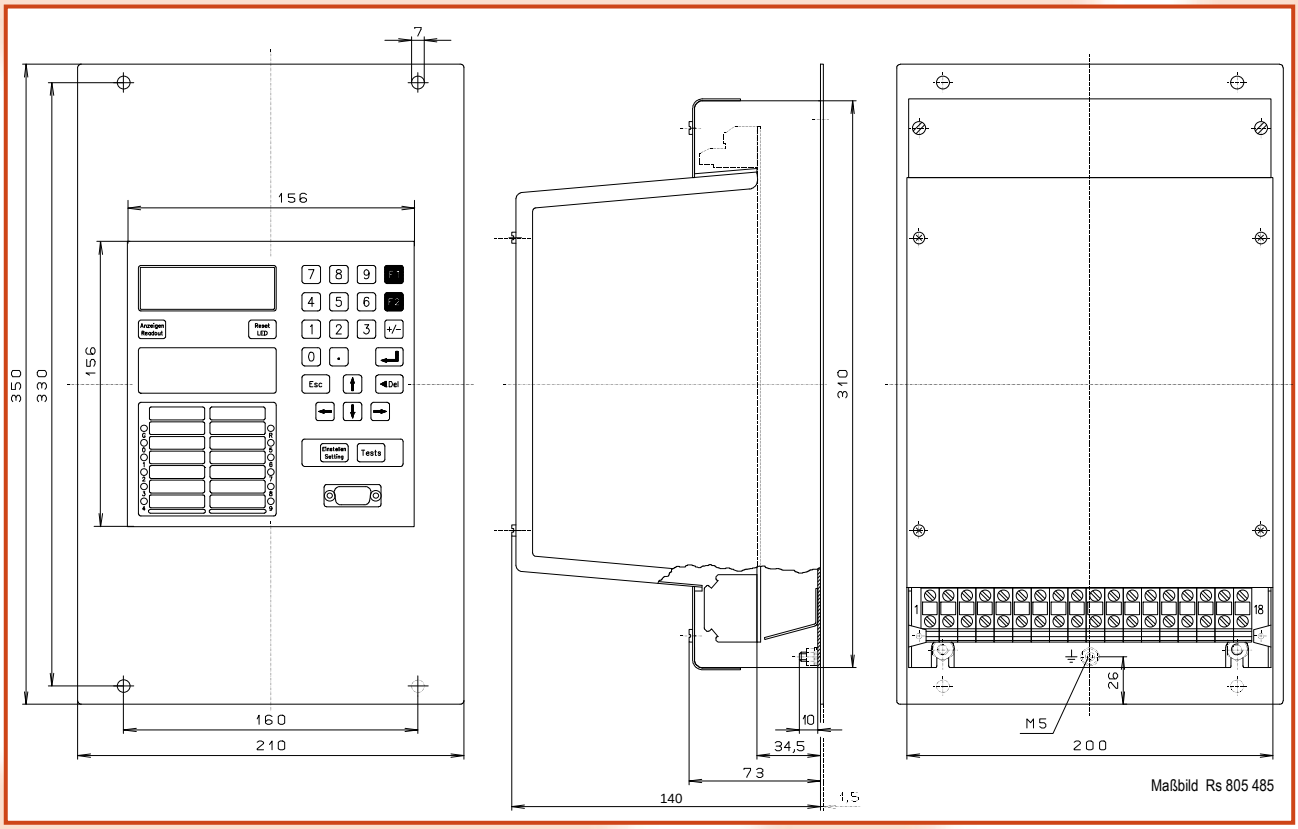

Fig. 4: DSRZE 2 housing for panel flush mounting, lower terminal cover not shown in rear view (right-hand side). The panel cutout should be 202 mm * 312 mm when device will be put through from front side.
With the horizontal models the keypad is turned + or -90°.

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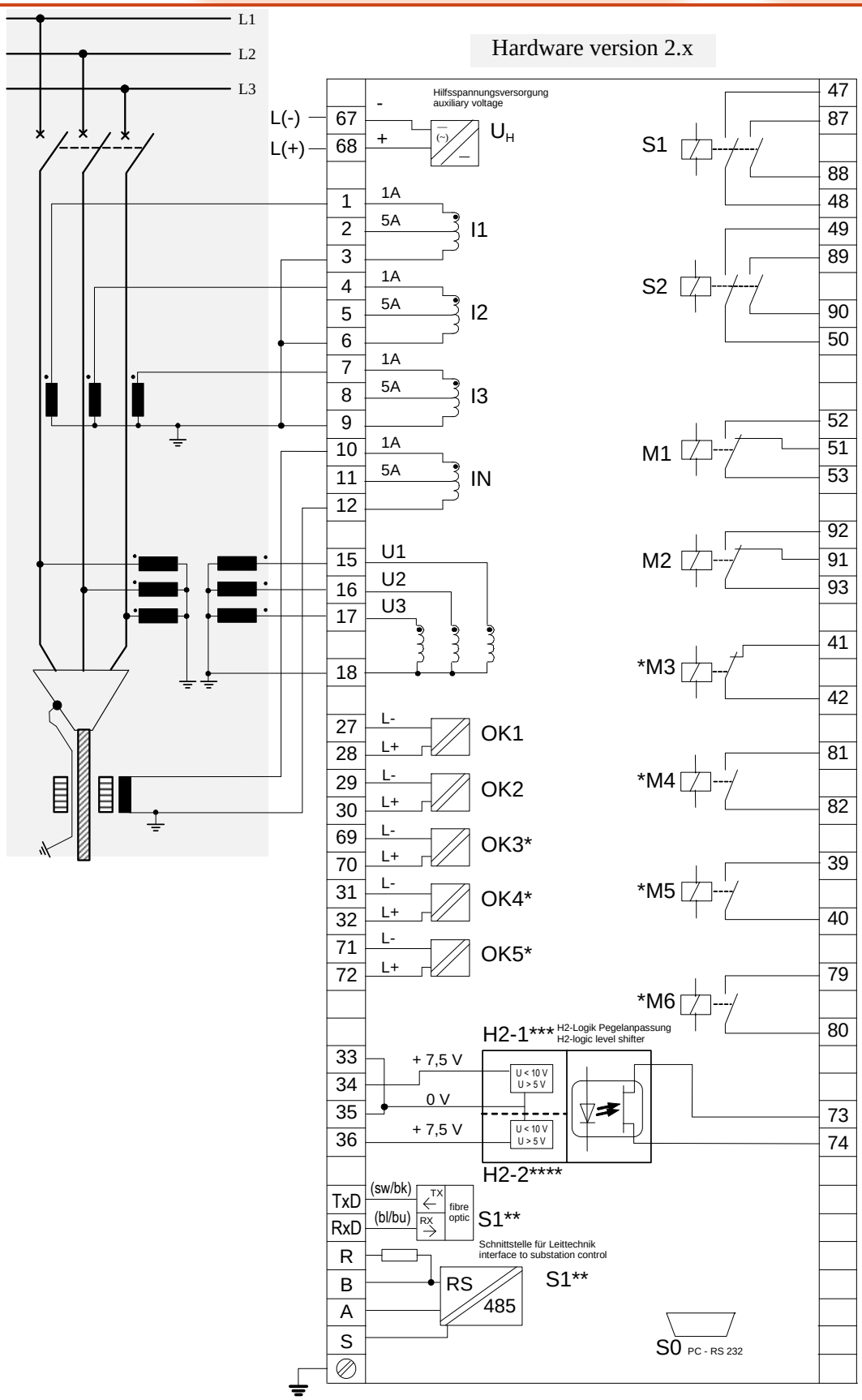

*) only in PI-No. 1743 80x xx1 **) only in PI-No. 1743 80x xx1, alternatively as fibre optical or RS485 interface
) not in PI-No. 1743 80x xxx *) only in PI-No. 1743 87x xxx

Fig. 5: Terminal assignment of DSRZE 2 with connection example

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