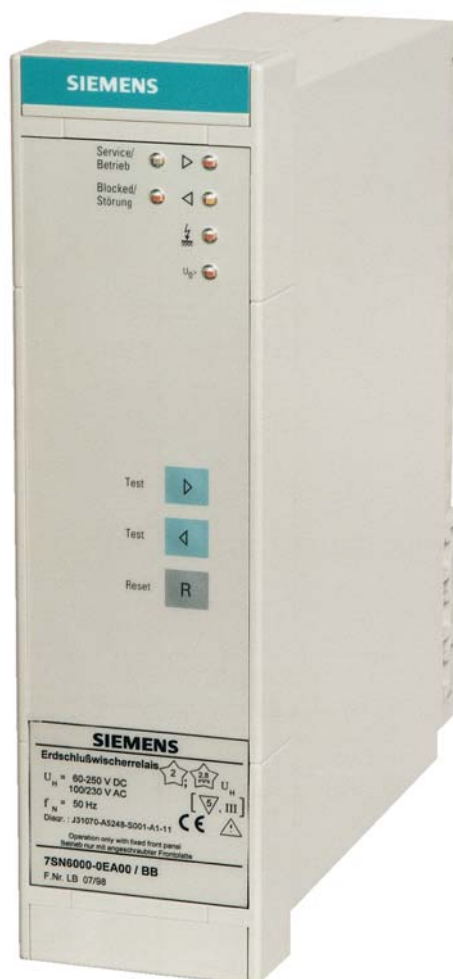


SIEMENS

SIPROTEC 7SN600 Transient earth-fault relay

Instruction Manual



Version Oct. 2011

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The following list of precautions is not intended as a complete description of all safety precautions which apply to the operation of the equipment (device, module) since particular operational conditions call for additional measures.

Warning

Dangerous voltages may occur in certain components of electrical devices during operation. Incorrect use of these devices can therefore result in severe personal injury or substantial damage of property.

- The earthing screw of the device must be connected solidly to the protective earth conductor before any other connection is made.
- Hazardous voltages may be present on all circuits and components connected with the supply voltage.
- Hazardous voltages may be present in the device even after disconnection of the supply voltage (storage capacitors).
- Devices with CT circuits must be terminated.
- The limit values given in the Technical data of the manual must not be exceeded at all, not even during testing and commissioning.
- Only suitably qualified personnel should work on this device. Correct and safe operation of this device is dependent on proper handling, installation, operation and maintenance.

This instruction manual does not purport to cover all details in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

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- is trained and authorized to operate and maintain devices/systems in accordance with established safety practices for devices with electrical circuits.
- is trained in the proper care and use of protective equipment in accordance with established safety practices.
- is trained in first aid.

CE Conformity

This product complies with the directive of the Council of the European Communities on the approximation of the laws of the member states relating to electromagnetic compatibility (EMC Council Directive 89/336/EEG) and concerning electrical equipment for use within certain voltage limits (Low-voltage Directive 73/23/EEG).

This conformity is proved by tests conducted by Siemens AG in accordance with Article 10 of the Council Directive in agreement with the generic standards EN 50081 and EN 50082 for EMC directive, and with the standards EN 60255-6 for the low-voltage directive.

The device is designed and manufactured for application in industrial environments.

The device is designed in accordance with the international standards of IEC 255 and the German standards DIN 57 435 part 303 (corresponding to VDE 0435 part 303).

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1 Application

1.1 Earth fault directional determination

The highly sensitive transient earth-fault relay 7SN60 determines the direction of transient and continuous earth faults in systems with isolated neutral, in systems with high-impedance resistive earthing and in compensated systems.

Continuous earth faults are indicated with a delay, either in conjunction with a transient earth-fault and subsequently persisting displacement voltage, or with just the displacement voltage present.

In the event of an earth fault, the neutral-point voltage to earth can be as high as the full phase voltage.

The phase-to-earth capacitances of the non-earth-faulted phases are charged via the transformer inductance.

This charging process is bound up with a strong current surge (starting oscillation).

The amplitude of this current surge depends on the expansion of the system and on the contact resistance values at the earth-fault location.

This current flows via the phase-to-earth capacitances of the unaffected lines to earth, enters the earth-faulted phase via the earth-fault location and flows back from there to the feeding transformer.

Thus the direction of the earth-fault induced current surge is identical with that of the short-circuited current at the same location (see figure 1.1).

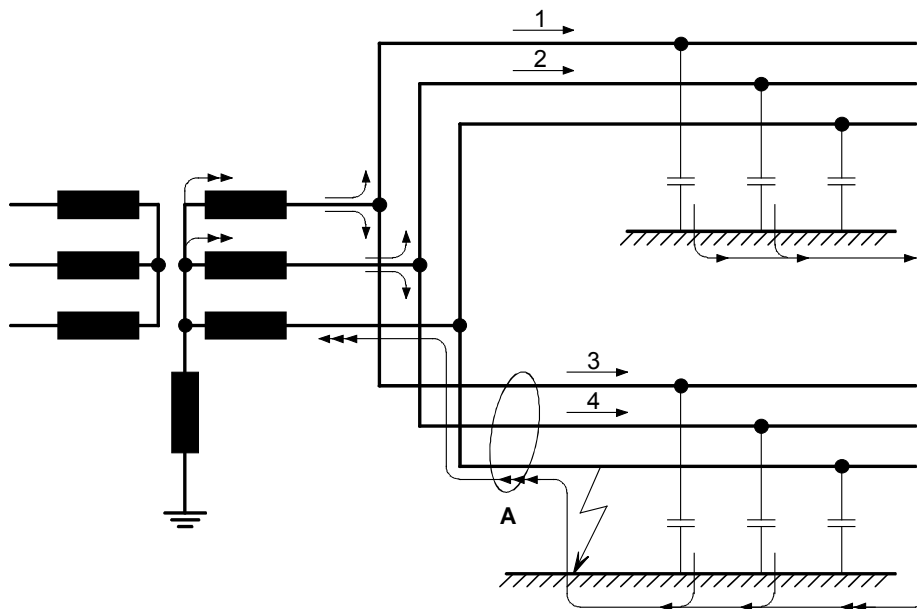


Figure 1.1: Fault currents in the system

1 Application

At measuring point A, as a result of the transformer summation circuit, the earth current of the faulted line is not included in the measurement, as this current portion flows through the summation transformer of the relevant Holmgreen circuit and back, thereby cancelling itself out.

It is the total of the capacitive earth currents from the non-faulted system which has an effect. In the diagram they are summated on the upper line. The capacitive currents of the non-faulted lines 1, 3 and 2, 4 accumulate vectorially, which is why only three arrows instead of four are shown at measuring point A.

With a transient earth fault, the equalizing current forming with a damped oscillation of 100 to more than 1 000 Hz decays after only a few periods.

The displacement voltage U_{EM} thereupon also returns to zero. In earthed systems this takes place after a number of periods (decay of the Petersen coil – earth capacitance oscillation circuit); in non-

earthed systems this occurs after a very short time (figure 1.2).

In the case of a continuous earth fault, the equalizing current in the non-earthed system changes into the mostly capacitive continuous earth current or, in compensated systems, into the relatively low residual active current.

For the directional determination, the direction of the first transient of neutral current and displacement voltage is considered.

The device indicates the direction of the transient earth fault by LEDs (red = forward direction, yellow = reverse direction) and the relevant signalling relay picks up.

Continuous earth faults are indicated after a settable time by an LED on the device and signalled by a signalling relay.

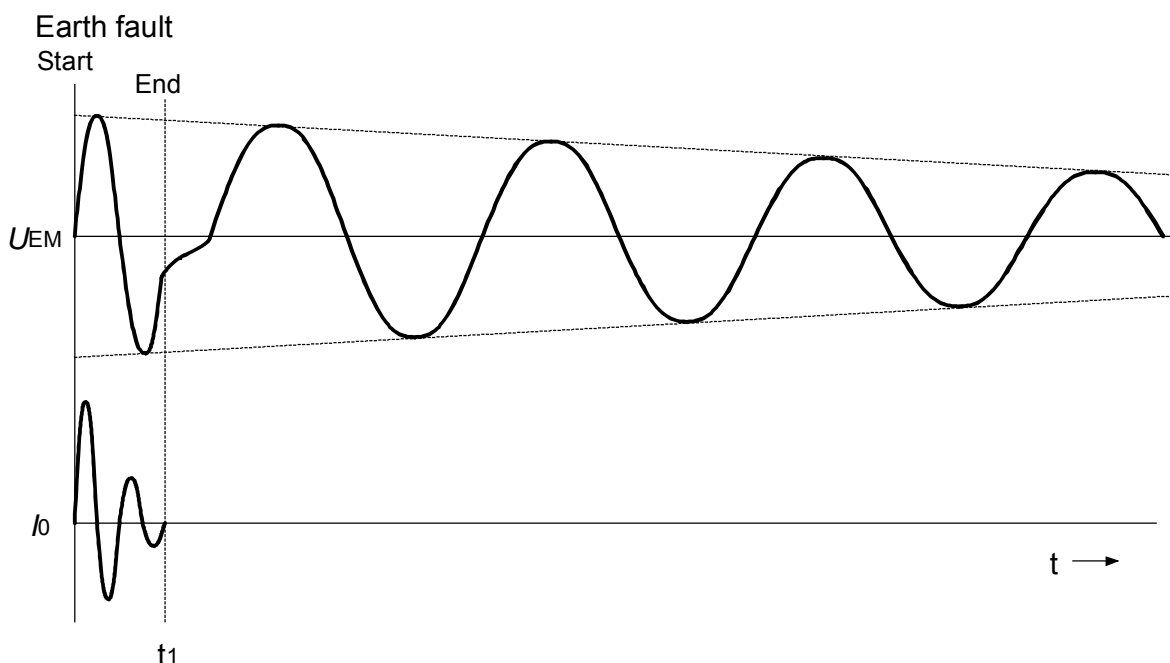


Figure 1.2: Neutral current and displacement voltage

1.2 Detection of the fault location

If the system is of radial configuration (figure 1.3), the red lamp immediately indicates the faulted line.

If one of the lines consists of several sections (figure 1.4), the fault is upstream of the last red lamp.

The transient earth-fault relay can also be used without restrictions in any type of meshed systems (figures 1.5 and 1.6). Transient earth-fault relays distributed at suitable points throughout the system allow detection of the earth-fault location from the directional indications.

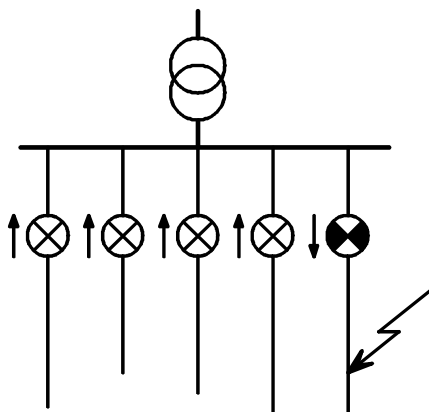


Figure 1.3: Radial system

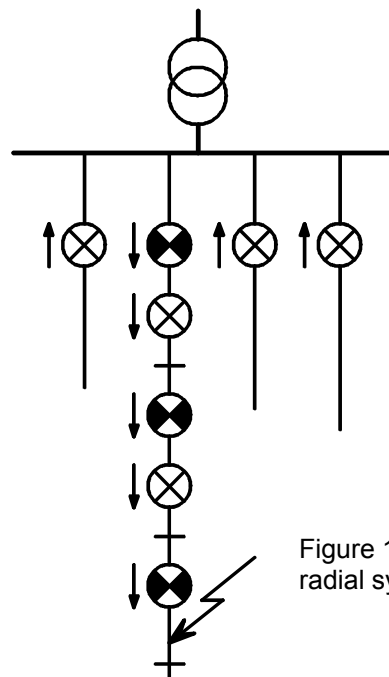
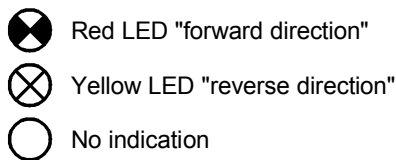


Figure 1.4: Cascaded radial system

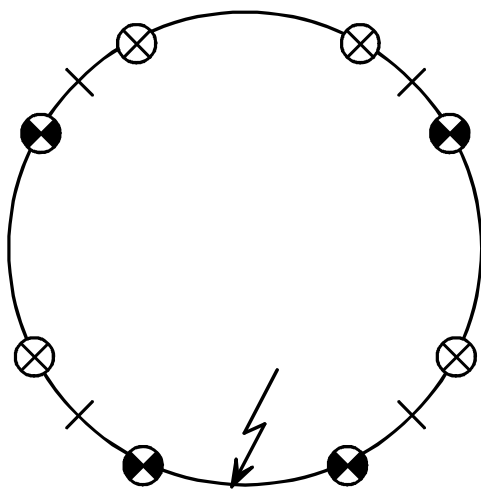


Figure 1.5: Ring system

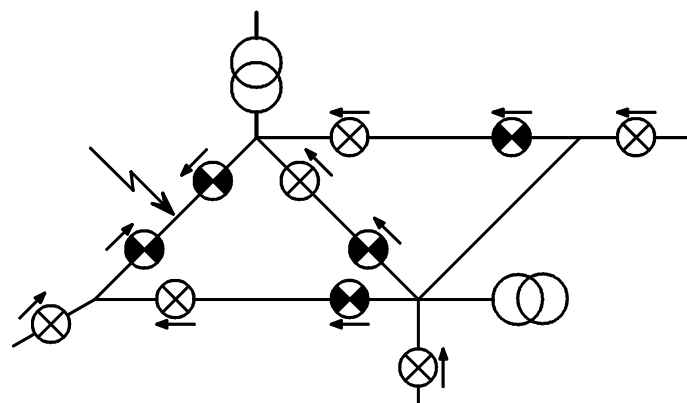


Figure 1.6: Meshed system

1 Application

1.3 Functions and features

- Device versions for panel surface mounting of flush mounting, with terminals on the side, in 7XP20 housing
- Both fault directions indicated by LEDs and signalled by relays
- High pick-up sensitivity due to separate detection and evaluation of total current and displacement voltage
- 1 A and 5 A rated current selectable for current transformer matching
- 16 selectable pickup thresholds for detection of transients in the current path even with higher steady-state total currents of 10 mA to 300 mA
- Fixed pickup threshold of 5 V for detection of transients in the voltage path even in case of higher steady-state displacement voltages
- 4 selectable pickup thresholds for evaluation of the displacement voltage of 10 V to 50 V
- Optional suppression of switching operations by evaluation of the displacement voltage after a switching-induced transient has occurred.
- Wide-range power supply for connection to 110 / 230 V AC systems, 60 – 250 V DC station batteries or 100 V AC voltage transformers without switchover
- Binary inputs for remote reset and blocking with extremely wide input voltage range of 24 to 250 V DC
- Automatic reset of direction indications and signals after 3 s or 10 s (selectable)
- Automatic reset in case of intermittent earth faults only after the last earth fault, i.e. the correct indication and signal of the first earth fault is preserved
- Detection of the displacement voltage and earth fault indication / signal, independent of a transient fault detection
- Signalling and indication of a continuous earth fault possible only in the forward direction
- Command contacts of all signalling relays
- Fault indication if sensitivity is set too high

2 Method of operation

2.1 Detection of transients in the current path

The summation current of the cable-type CT or of the three phase-current CTs in Holmgreen circuit is transformed into a proportional voltage in the input circuit (see figure 2.1).

A surge voltage protector protects the internal electronic system of the device.

To match primary CTs to 1 A or 5 A, the burden is switched over by setting jumper X2.

Switches S3.3-6 are used in conjunction with an amplifier to set the sensitivity of the transient earth fault relay.

Special filters are provided downstream for complete suppression of the fundamental wave content. The relay thus detects only transients of the type observed in a system in the case of earth faults.

The proportional transient voltage is supplied to one positive and one negative comparator and thereby digitized. These digital signals $I_{pos.}$ and $I_{neg.}$ are generated separately in real time; only one signal can be active at any one time.

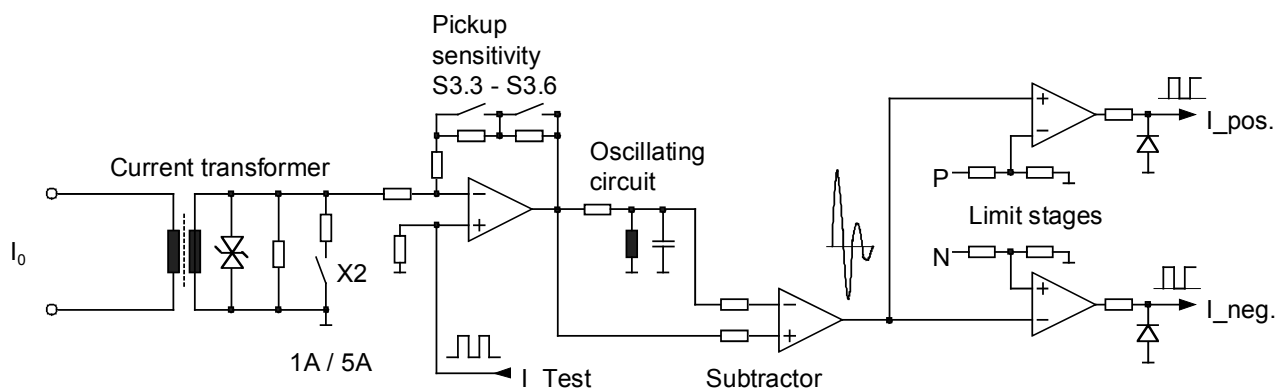


Figure 2.1: Detection of transients in the current path

2 Method of operation

2.2 Detection of transients in the voltage path

The three phase voltages form the virtual starpoint of the voltage transformer delta via the summation resistors in star-delta connection. Hence, the displacement voltage of the system is located between this point and the supplied earth potential of the transformers (see figure 2.2).

Surge voltage protectors protect the voltage transformer against excessive transient voltages.

For the detection of transients, special filters are provided downstream of the voltage transformer

which suppress completely the fundamental wave content. The relay thus detects only transients of the type observed in a system in the case of earth faults.

The proportional transient voltage is supplied to one positive and one negative comparator and thereby digitized. These digital signals $U_{pos.}$ and $U_{neg.}$ are generated separately in real time; only one signal can be active at any one time.

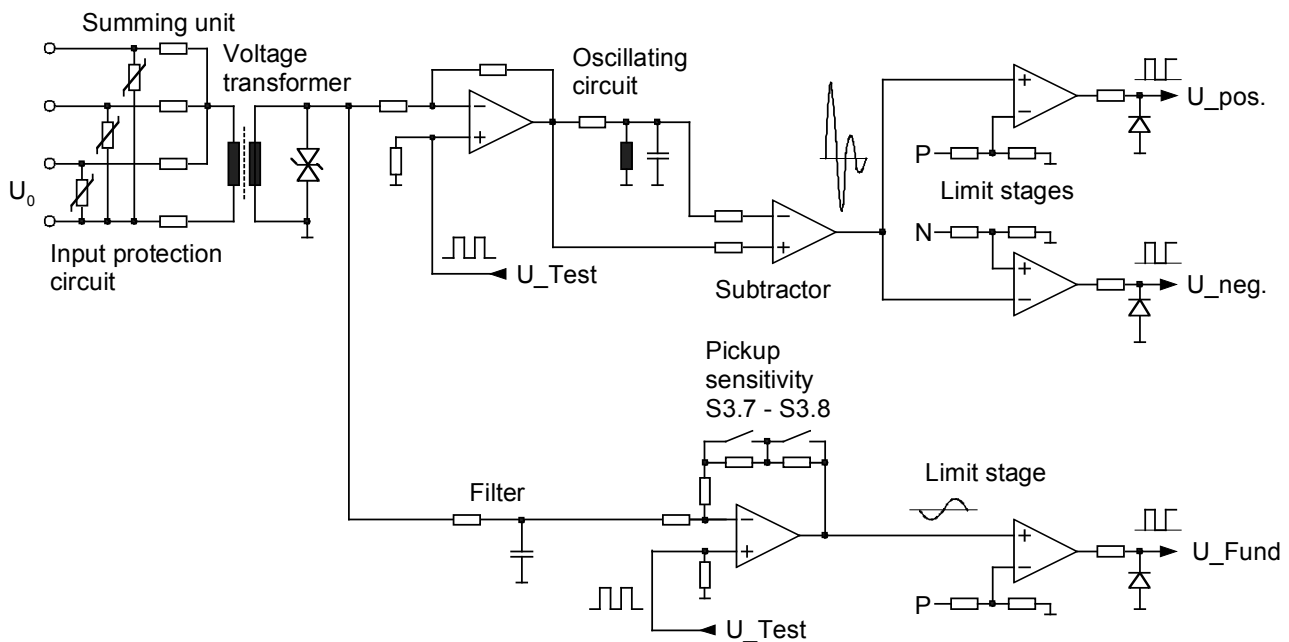


Figure 2.2: Detection of transients and of fundamental wave in the voltage path

2.3 Detection of fundamental wave in the voltage path

For the detection of the fundamental wave, a low-pass filter is provided downstream of the voltage transformer. The relay thus detects the displacement voltage that is observed only in case of a transient or continuous earth fault in the system (see figure 2.2).

Switches S3.7-8 are used in conjunction with an amplifier to the sensitivity for the detection of the displacement voltage.

The proportional voltage is supplied to a comparator that makes digital signals available for the duration of the earth fault if the trigger threshold is exceeded.

2.4 Evaluation logic for directional indication

When the transient earth-fault relay is ready to operate, the evaluation logic is started by the detection of a neutral current I_0 and the first of the two signals "I_pos." or "I_neg." (see figure 2.3).

The digitized measured values are evaluated in a programmable logic device (PLD). The procedure is controlled by a clock-pulse generator.

To ensure that only those transients are detected that occur in connection with transient ground faults, the circuit evaluates only signals that are present for more than 50 μs or 150 μs . The minimum signal duration is set using switch S2.8. The default setting for standard applications is 150 μs , which is equivalent to a frequency

threshold of 3 kHz up to which the transient is reliably detected. The first signal leaving the filter, e.g. "I_pos.", sets the input memory (S Ip) and blocks at the same time via an OR gate the other input memory (R In). The first transient received is stored as I_pos.

Simultaneously, a timer is started that opens a time window of 1 ms or 4 ms for detection of the voltage transient. This interval can be set by switch S3.2. The default setting for standard applications is 4 ms. Any signal U_pos." or "U_neg." arriving during this interval is stored in the same way as for the current path.

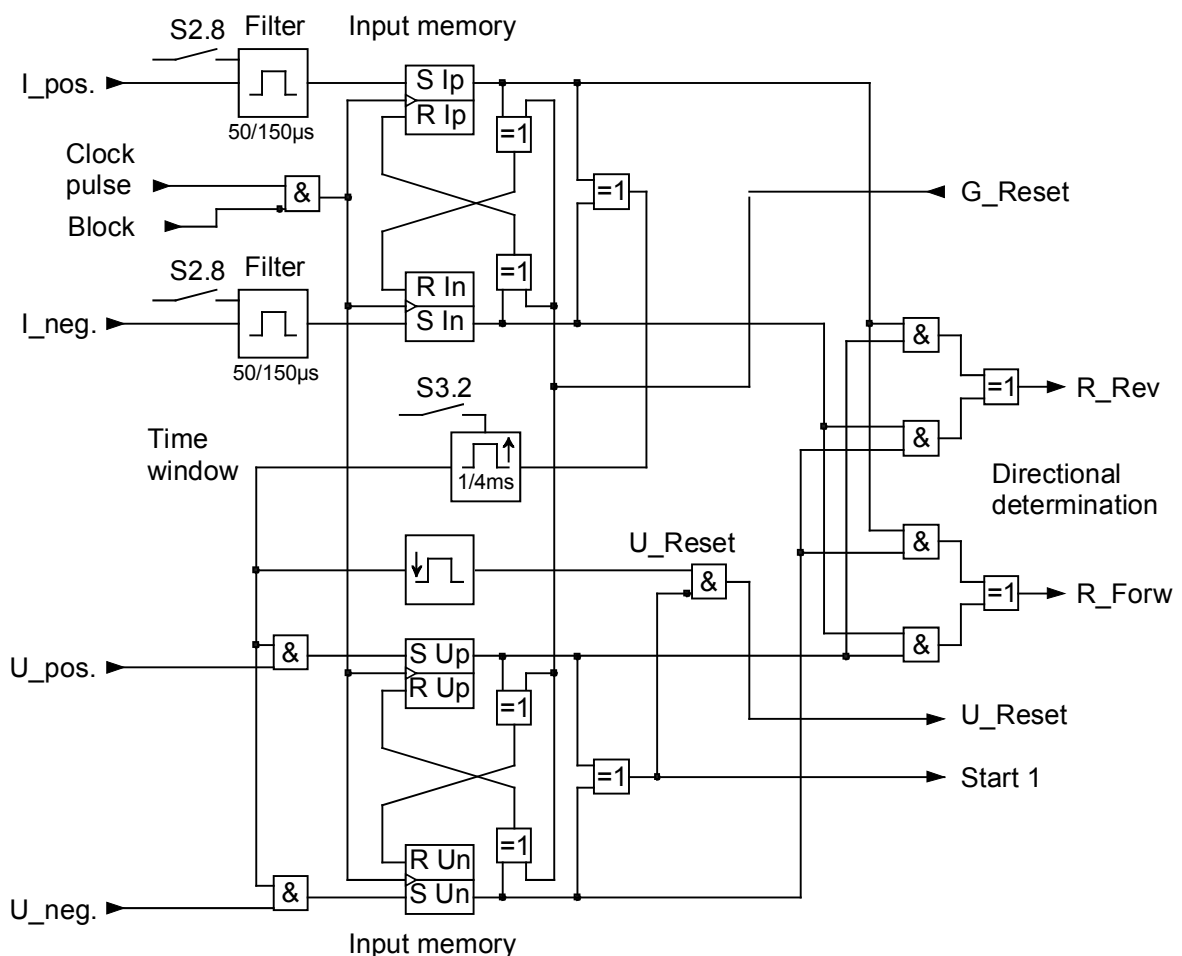


Figure 2.3: Directional indication

2 Method of operation

If no transient voltage is detected within the time window, a reset signal "U_Reset" is generated. A General Reset signal (which is generated if other reset criteria are fulfilled as well) resets all memories and makes the relay ready to operate again. Additionally, the "Blocked" LED is set for 500 ms. This LED allows to recognize during commissioning whether repeated spurious pickups of the transient earth-fault relay are due to interference or to a pickup threshold in the current path that is set too low. The alarm relay is not set.

The information that has been frozen in the input memories is now evaluated. If the first transient current and voltage have the same direction, the fault is in reverse direction ("R_Rev"). If the directions are different, it is in forwards direction ("R_Forw").

"Start 1" starts further plausibility checks. The "Block" signals allows to block the relay by disabling the clock pulse generator.

2.5 Evaluation logic for transient fault indication

On delivery, the device is set so that it does not pick up when switching operations take place in the system. A check is performed whether 90 ms after startup the displacement voltage still exceeds the value set with switch S3.7-8. This value is in the range between 10 V eff and 50 V eff.

To do so, each "U_fundamental" pulse is prolonged by one period, so that a continuous signal is present for the duration of the earth fault. If this signal still subsists after 90 ms, the LEDs and signalling relays for "Transient earth fault forward" or "Transient earth fault reverse" are set.

This indication remains stored until a reset is performed.

If the condition detected is not a transient earth fault, the transient earth-fault relay is reset.

The suppression of switching operations can be deactivated using switch S2.1. Since in isolated systems the displacement voltage U_0 is only briefly present and a transient earth fault would not be indicated in that case, the function can be disabled.

NOTE! The device now detects and indicates switching operations.

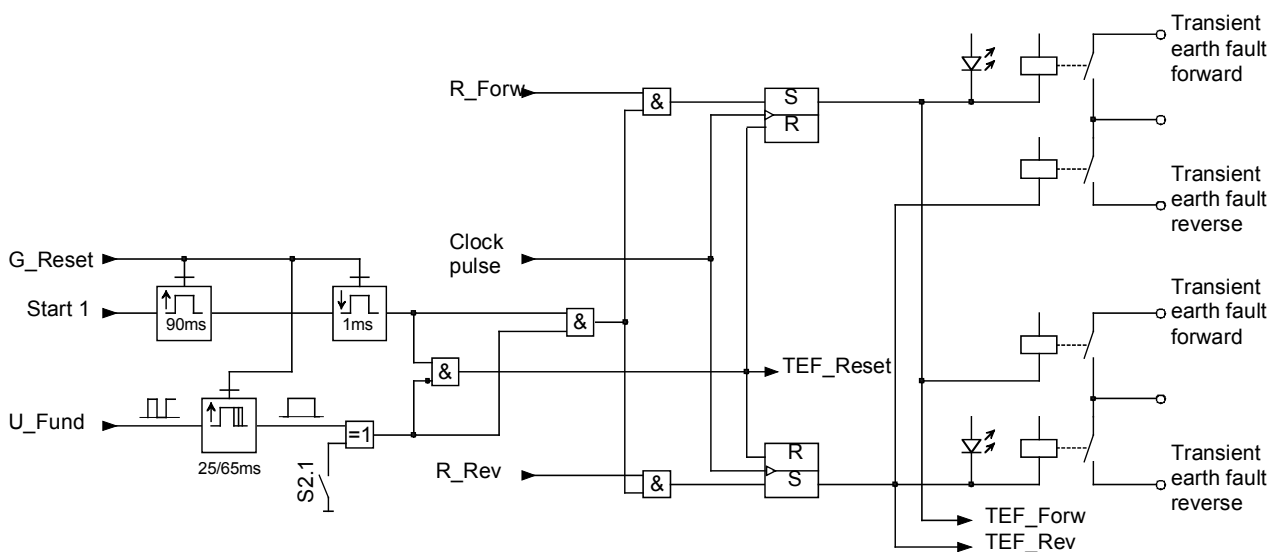


Figure 2.4: Evaluation logic for transient fault indication

2.6 Evaluation logic for continuous earth faults

With S2 in as-delivered position, continuous earth faults are only indicated and output via signalling relay if:

- a transient earth fault of any kind has been detected and the displacement voltage U_0 has been present for at least 2.4 s, or
- only the displacement voltage U_0 has been present for at least 2.4 s.

The monitoring time can be set incrementally between 0 and 2.4 s using switch S2.4-5.

If continuous earth faults are to be indicated only in case of each transient earth fault and the displacement voltage U_0 has been present for at least 2.4 s, switch S2.2 must be set to ON and switch S2.3 must be set to OFF.

fault, i.e. with only the displacement voltage present, switch S2.2 must be set to ON.

If continuous earth faults are to be indicated only in case of a transient earth fault in forwards direction and the displacement voltage U_0 has been present for at least 2.4 s, switches S2.2 and S2.3 must be set to ON.

The enable for the indication and signalling of continuous ground faults is stored but drops off immediately when the displacement voltage disappears. If the stored transient fault indication is not reset, the next “continuous earth fault” is indicated and signalled with delay.

The LED for indicating $U_0 >$ always lights up immediately when the displacement voltage exceeds the preset value.

If continuous earth faults are to be indicated regardless of the detection of a transient earth

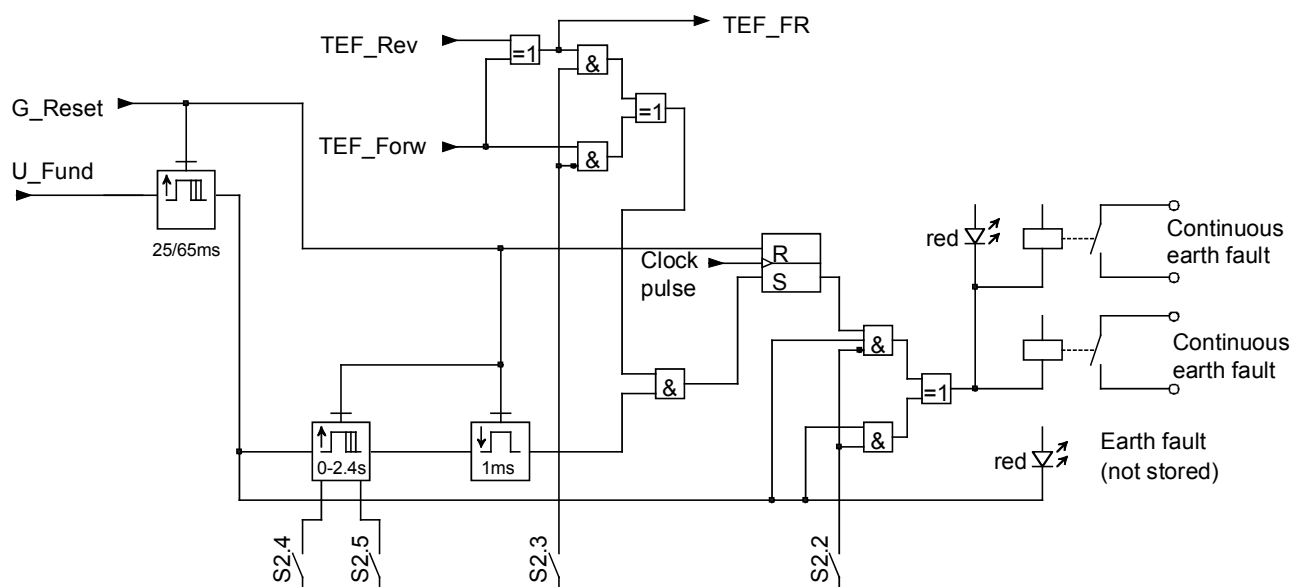


Figure 2.5: Evaluation logic for continuous earth faults

2 Method of operation

2.7 Reset logic

The violation of internal plausibility checks causes a number of different resets. Moreover, the device can be reset locally or by remote control.

Each reset leads to a general reset "G_Reset" which leaves the device ready for operation and set to alert.

Internal reset logic

U_Reset:

Used in cases where a current transient has been detected but no voltage transient has occurred during the monitoring time ("Blocked" LED shines for 500 ms).

TEF_Reset:

Used in cases where no transient fault indication is to be output if the fault direction has been determined but the displacement voltage is absent (suppression of switching operation).

Auto_Reset:

Switches S2.6 and S2.7 can be used to start an automatic reset after a settable delay of 3 or 10 s. The automatic reset is started as soon as the displacement voltage drops off.

In the case of intermittent earth faults, the time is restarted on each voltage dropoff during the runtime, i.e. the first transient fault is indicated.

External reset logic

Local_Reset:

The device can be reset locally by pressing the (R) key on the front panel. On pressing that key, a general reset is performed along with a lamp test (all LEDs light up).

Remote_Reset:

A remote reset is possible via a binary input. On activating the binary input, a general reset is performed along with a lamp test (all LEDs light up).

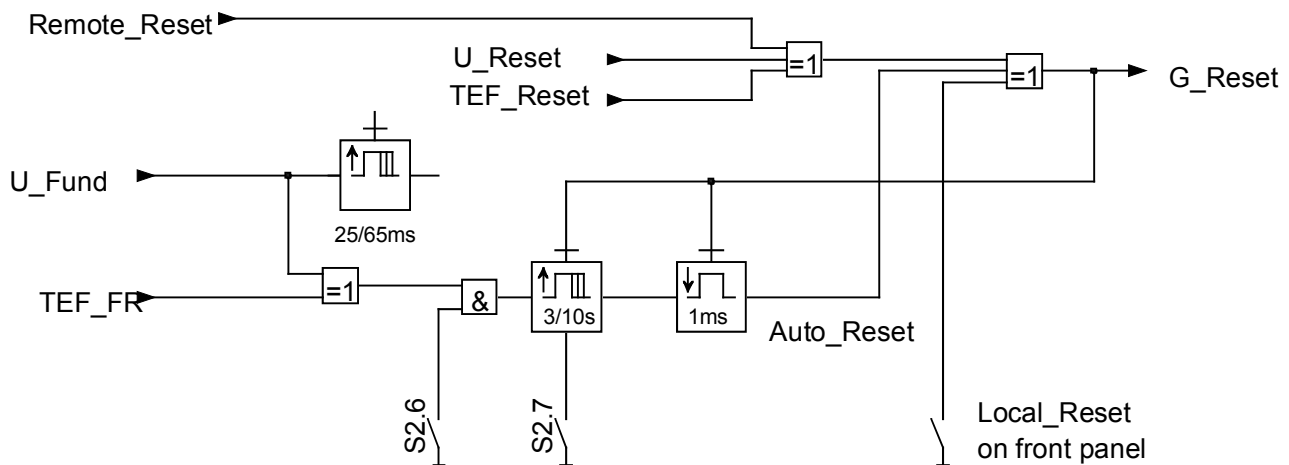


Figure 2.6: Reset logic

2.8 Binary inputs

The transient earth-fault relay has two wide-range binary inputs for the functions “Remote reset” (reset signals) and “Blocking” (freeze signals).

The inputs can be activated with a voltage between 24 V and 250 V DC and are protected against polarity reversal.

Jumpers X30 and X31 can be used to increase the pickup threshold from approx. 19 V DC to approx. 75 V DC.

As the inputs are galvanically separated, they can be fed by different battery circuits.

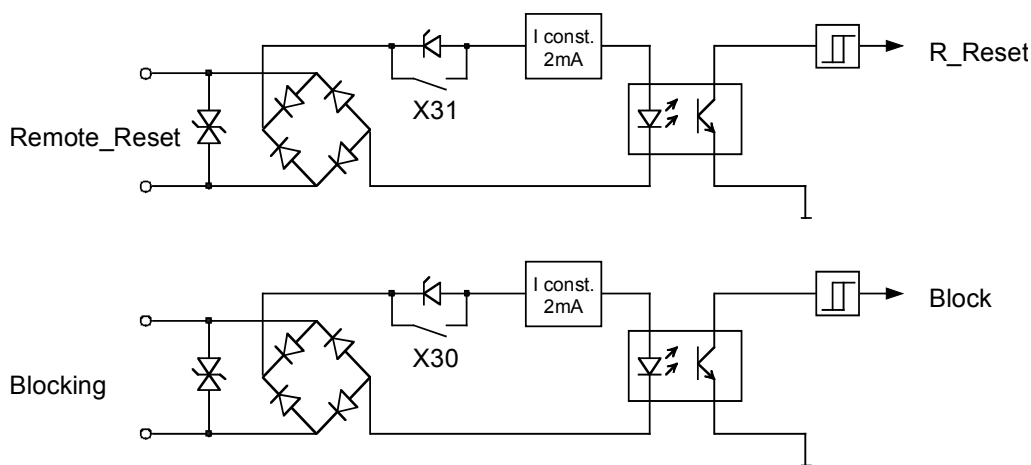


Figure 2.7: Binary inputs

2.9 Operating status LEDs

The device has on its front panel a green LED “Service” and a red LED “Blocked”.

The green “**Service**” LED shines as long as the auxiliary voltage is present and the programmable logic device is working.

The red “**Blocked**” LED shines to indicate the failure of an internal supply voltage or repeated

interference-induced spurious triggering of a too sensitive current input.

In that latter case, the sensitivity of the input should be reduced by means of the switches S3.3-6.

The alarm relay is of the NC type; it signals an internal or external failure of the auxiliary supply voltage.

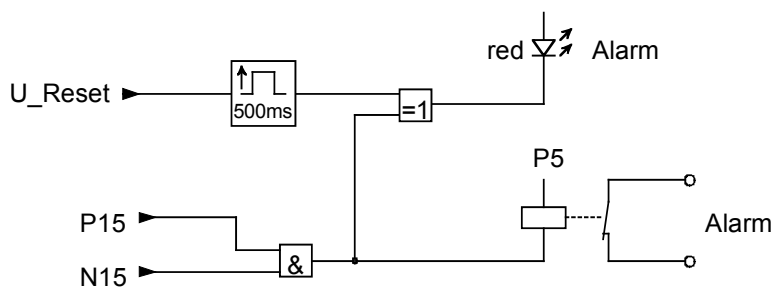


Figure 2.8: “Blocked” signal

2 Method of operation

2.10 Function test using the front keys

By pressing one of the two keys “Test >” or “Test <” in the sealed keypad on the front panel, a transient fault can be simulated. For that purpose, “transients” are fed into the measuring system downstream of the input transformers, and the appropriate directional indication is output on the basis of the polarity relationship between the

current and the voltage transient. The test comprises the filters, the limit stages, the evaluation logic, the indications and the signalling relays. The test signal is maintained for as long as the Test key is pressed, which allows to test the function of the continuous earth fault indication as well.

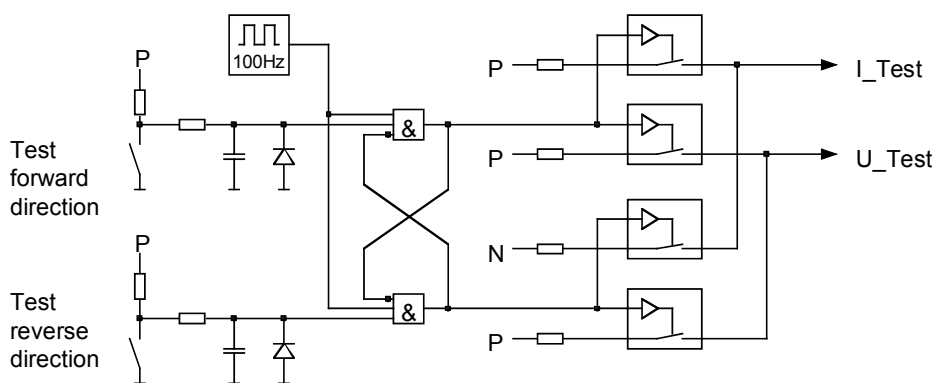


Figure 2.9: Function test

3 Operating instructions

3.1 Safety precautions

All safety precautions which apply for work in electrical installations must be observed during commissioning.

3.2 Connection of the current and voltage transformers

Figure 3.1 shows the connection of the current and voltage transformer set in Holmgreen circuit.

Here, the starpoint at the line-side of the c.t. must be connected to terminal 1 while the starpoint at the bus-bar side of the c.t.s must be connected to terminal 2.

The three phase voltages U_{L1} , U_{L2} and U_{L3} are connected to terminals 7, 8, 9 respectively. The earthed starpoint of the voltage transformer is connected to terminal 10.

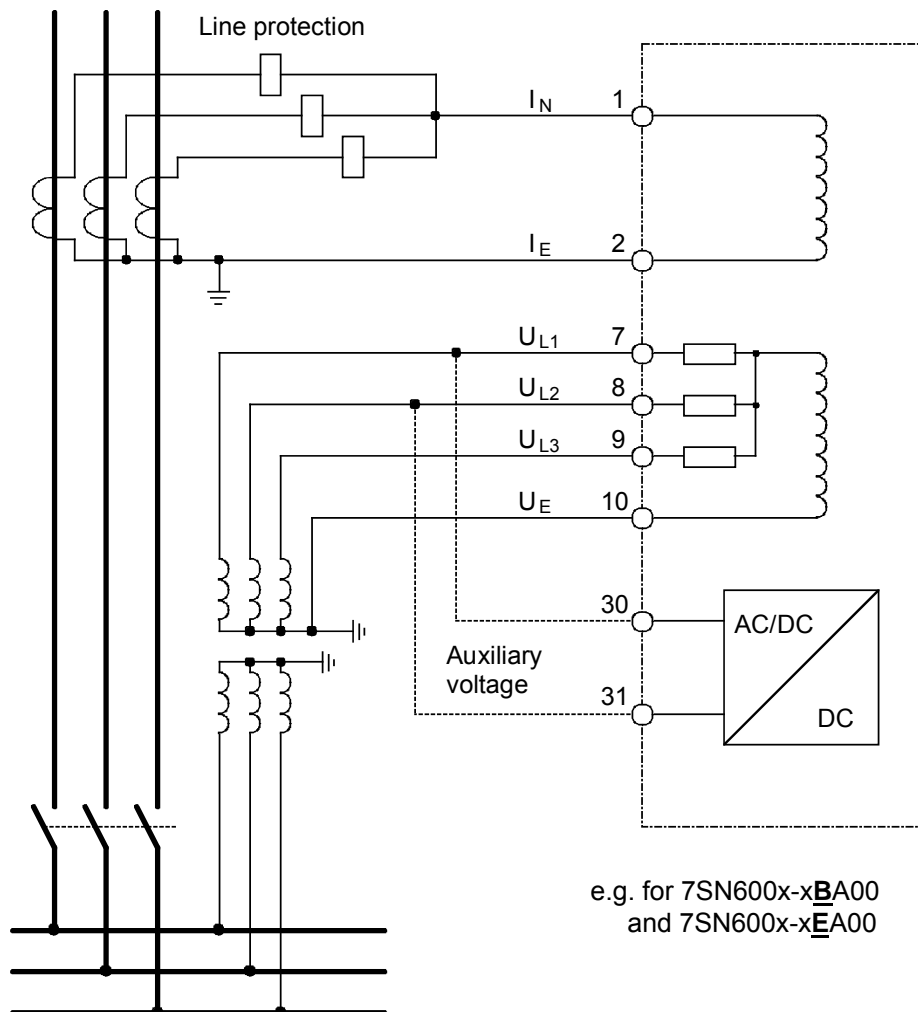


Figure 3.1: Connection of transformers and auxiliary power supply

3 Operating instructions

Figure 3.2 shows the connection of the current and voltage transformer set in Holmgreen circuit.

Here, the star point at the line-side of the c.t. must be connected to terminal 1 while the star point at the bus-bar side of the c.t.s must be connected to terminal 2.

The three phase voltages on the terminals 7, 8 and 9 are to be short-circuited. Together with terminal 10 according to Figure 3.2 it has to be connected to the broken delta winding.

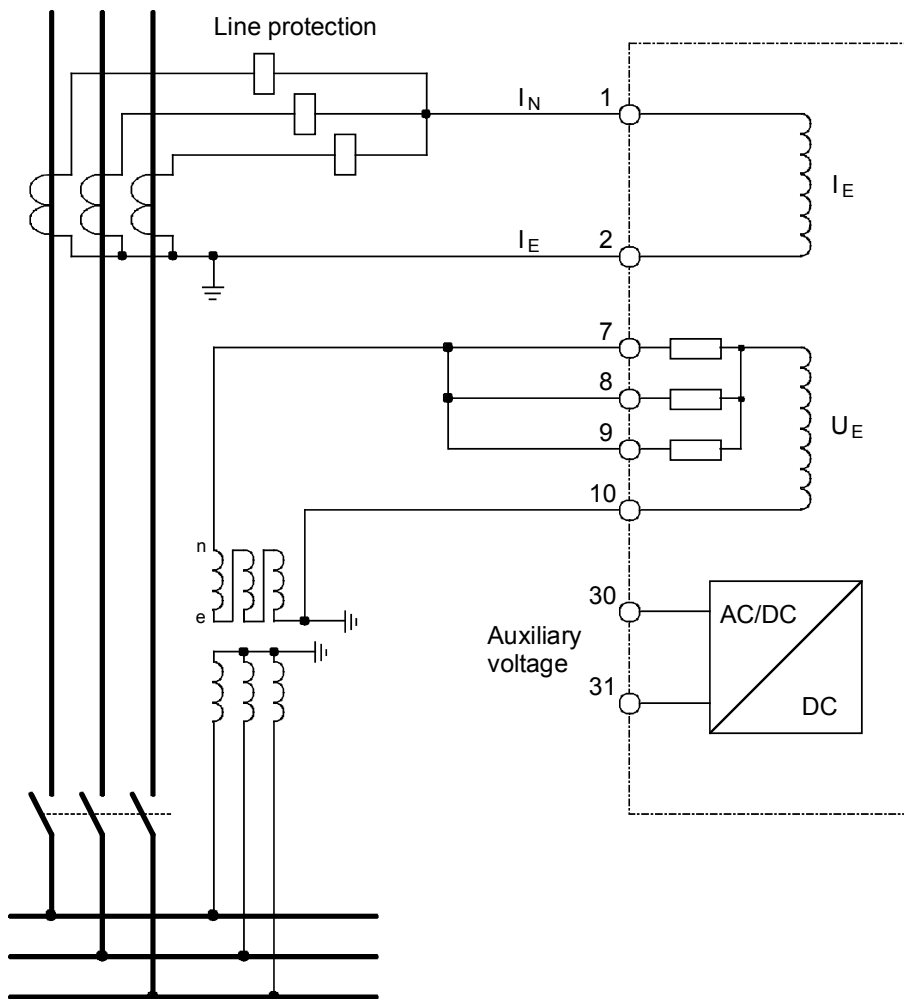


Figure 3.2: Connection of transformers

3.3 Connection to auxiliary power supply

The wide-range power supply of the 7SN600 transient earth-fault relay is suited for rated voltages from 60 V to 250 V DC and from 100 V to 230 V AC.

The device is protected by an internal fuse but should have an external protection as well.

Using terminals 30 / 31 and an external m.c.b. or fuse, the transient earth-fault relay be connected either to a station battery or directly to the voltage transformers (Figure 3.1).

3.4 Settings

3.4.1 Opening the device to make the settings

All settings are made on the p.c.b. inside the device.

Therefore, the device must be opened to make the settings. Proceed as follows:

- Switch off the auxiliary power supply and take the necessary precautions against electrostatic discharges. The c.t. connectors are shorted on withdrawing the p.c.b.
- Slip away the covers at the top and bottom of the front panel to gain access to the fixing screws of the module.

- Unscrew these screws.
- Pull out the front panel with the attached p.c.b.
- Make all necessary settings on jumpers X2, X30, X31 and on switches S2 / S3.
- Proceed in opposite order to reclose the device and switch the auxiliary voltage supply on again.

The device is ready for operation again as soon as the green “Service” LED shines and the red “Blocked” LED has gone out.

3.4.2 Layout of setting elements

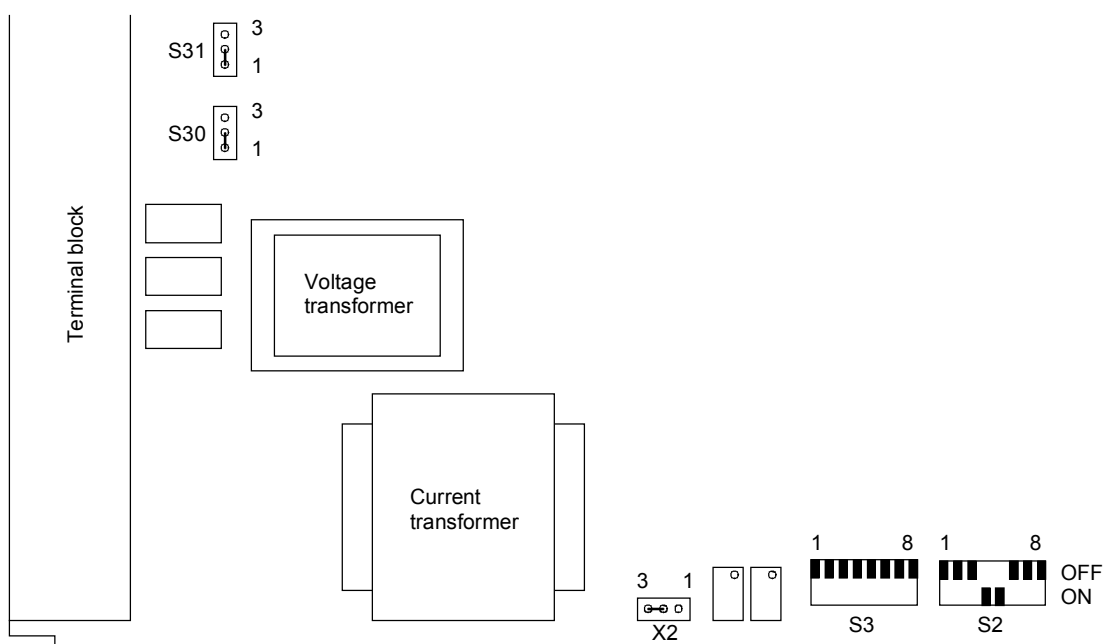


Figure 3.3: Layout of setting elements (position as delivered)

3 Operating instructions

3.4.3 Settings

The matching of the measuring circuits to the 1 A or 5 A primary current transformers is performed by setting jumper X2.

The pickup sensitivity is set by switches S3.3 - S3.6. The setting is determined by the system's earth current I_E in uncompensated state, converted

to the secondary-side value of the current transformers. The sensitivity should be set to about half the value of the calculated current.

All other functions should be set as required according to the following table.

S3.1	S3.2	S3.3	S3.4	S3.5	S3.6	S3.7	S3.8	
								Not used
X								Not used
	X							4 ms time window for voltage transients
								1 ms time window for voltage transients
		X						Pickup value 1A 10 mA 5A 50 mA
			X					in the current path
		X	X					at 1kHz
				X				70 mA
		X		X				90 mA
			X	X				110 mA
		X	X	X				130 mA
					X			150 mA
		X			X			160 mA
			X		X			180 mA
		X	X		X			200 mA
				X	X			220 mA
		X		X	X			240 mA
			X	X	X			260 mA
			X	X	X			280 mA
		X	X	X	X			300 mA
								Pickup value 10 V (see Appendix)
							X	Voltage $U_{o>}$
						X		20 V
							X	40 V
						X	X	50 V

S2.1	S2.2	S2.3	S2.4	S2.5	S2.6	S2.7	S2.8	
								90 ms suppression of switching operations
X								No suppression of switching operations
	X							Continuous earth fault indication upon $U_{o>}$
		X						Continuous earth fault indication upon each transient fault and $U_{o>}$
	X	X						Continuous earth fault indication upon $U_{o>}$
								Continuous earth fault indication upon transient fault forwards and $U_{o>}$
								Continuous earth fault indication immediately
			X					Continuous earth fault indication after 0.8 s
				X				Continuous earth fault indication after 1.6 s
			X	X				Continuous earth fault indication after 2.4 s
								No automatic reset
					X			Automatic reset 10 s after $U_{o>}$ has dropped off
					X	X		Automatic reset 3 s after $U_{o>}$ has dropped off
								150 μs input filter I_o
							X	50 μ s input filter I_o

X = Switch on
 Bold = Position as delivered

X2	X30	X31	
1-2			5 A rated current
2-3			1 A rated current
	1-2		19 V pickup voltage of the blocking input
	2-3		75 V pickup voltage of the blocking input
		1-2	19 V pickup voltage of the remote reset input
		2-3	75 V pickup voltage of the remote reset input

3.5 Internal test using the "Test" keys on the front

The correct evaluation in the 7SN60 transient earth-fault relay can be tested with the keys "Test >" for forward direction and "Test <" for reverse direction. This test comprises all functions

relating to directional indication and continuous earth fault indication, starting directly after the input transformers and as far as the indications and signalling relays.

3.5.1 Testing the directional indication

On pressing the "Test >" key, the red LED ">" must light up on the tested device after approx. 100 ms (with suppression of switching operations), and at the same time the "Transient earth fault forward" signal must be output at the relevant relay.

(with suppression of switching operations), and at the same time the "Transient earth fault reverse" signal must be output at the relevant relay.

On pressing the "Test <" key, the red LED "<" must light up on the tested device after approx. 100 ms

The signals remain stored until an automatic, local or remote reset is performed. These functions can be tested as well after the directional indication test.

3.5.2 Testing the continuous earth fault indication

To test the "Continuous earth fault" signal, the key must be held pressed down for at least the time set for this function. The "Continuous earth fault" signal and the relevant output via the signalling

relay will appear after the set time has elapsed. Upon release of the key, the continuous earth fault indication and signal drop off again.

3.6 External test using test equipment 7VP83

A function test of the transient earth-fault relay, including a test of the connection wiring and input

transformers, can be carried out with test equipment 7VP8300-0.

3.6.1 Test equipment 7VP83 and connection of the test object

The test equipment serves to test the transient earth-fault relays 7TG23, 7SN60, 7SN70 and 7SN71. It operates with the 230 V AC mains voltage. Test current I_0 and test voltage U_0 for the directional detection of the transient earth fault are made available via the terminal sockets. The connection of the test current/voltage and the phase rotation of the current are effected by means of pushbutton S1. Activation of the test current/voltage is indicated by LED H1.

Before testing, the current and voltage inputs of the test object must be isolated, because otherwise the accuracy of the test results can be invalidated.

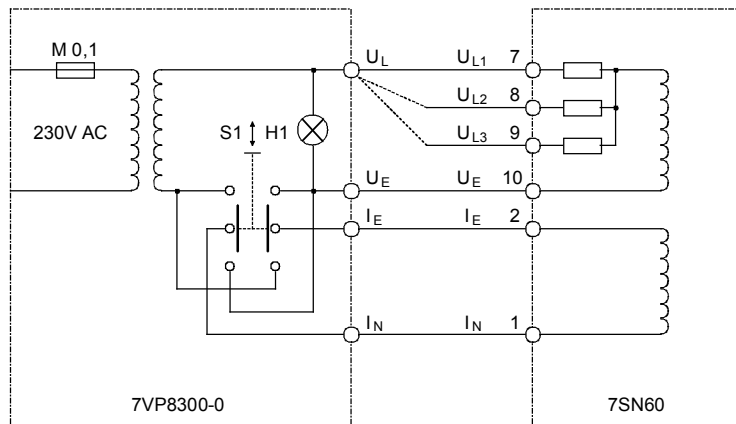
The test object is connected to test equipment 7VP83 as shown in figure 3.3.

IMPORTANT!

Before starting the test, the neutral current pickup sensitivity of the 7SN 60 transient earth-fault relay must be set to maximum. The displacement voltage pickup sensitivity must be set to 20 V or less. These are also the settings as delivered.

All safety precautions which apply for work in electrical installations must be observed during tests.

3 Operating instructions



e.g. for 7SN600x-xBA00
and 7SN600x-xEA00

Figure 3.4: Test setup

3.6.2 Testing the earth-fault direction signal

If the pushbutton of 7VP83 (production stopped in 2004) is pressed to “forward”, the red LED “>” must light up on the test object after approx. 100 ms (with suppression of switching operations), and at the same time the “Transient earth fault forward” signal must be output at the relevant relay.

If the pushbutton of 7VP83 is pressed to “reverse”, the red LED “>” must light up on the test object after approx. 100 ms (with suppression of switching operations), and at the same time the “Transient earth fault reverse” signal must be output at the relevant relay.

The transient fault signals remain stored until an automatic, local or remote reset is performed. These functions can be tested as well after the directional indication test.

Connection of the test current/voltage is independent of the phase relation of the line voltage. If testing is started during zero crossing of the voltage wave, an incorrect directional detection may result. In this case, repeated measurements must be carried out. The test must also take into account the current settings of pickup thresholds and functional scope (see also 3.4.3).

3.6.3 Testing the continuous earth fault signal

To test the “Continuous earth fault” signal, the key must be held pressed down for at least the time set for this function. The “Continuous earth fault” signal and the relevant output via the signalling relay will appear after the set time has elapsed.

Upon release of the key, the continuous earth fault indication and signal drop off again.

The LED “!o>” indicates the presence of the displacement voltage as long as that voltage exceeds the set value. This indication is not output via relay.

4 Technical data

4.1 Tabular overview of technical data

Measuring circuit	<p>Current input Rated current I_o Input impedance Z at 50 Hz and $1 \times I_N$ Thermal rating in current path, continuous 10 s 1 s (at 1 A) 1 s (at 5 A)</p> <p>Voltage Inputs Rated voltage U_N Rated frequency f_N Burden vt circuits at 100 V Thermal rating in voltage path, continuous</p>	<p>1 A or 5 A $< 0.05 \Omega$ $4 \times I_N$ $30 \times I_N$ $100 \times I_N$ 300 A</p> <p>100/110 V AC 50 Hz (16 2/3 Hz) $< 0,12 \text{ VA}$ 140 V AC</p>																												
Auxiliary voltage	<p>Rated auxiliary voltage U_{aux}</p> <p>Power consumption at</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">60 V DC</td> <td style="width: 10%;">3.1 W</td> <td style="width: 40%;">energized</td> <td style="width: 10%;">4.5 W</td> </tr> <tr> <td>110 V DC</td> <td>3.0 W</td> <td></td> <td>4.5 W</td> </tr> <tr> <td>220 V DC</td> <td>3.6 W</td> <td></td> <td>4.6 W</td> </tr> <tr> <td>250 V DC</td> <td>3.7 W</td> <td></td> <td>4.8 W</td> </tr> <tr> <td>100 V AC</td> <td>2.9 VA</td> <td></td> <td>4.2 VA</td> </tr> <tr> <td>110 V AC</td> <td>3.0 VA</td> <td></td> <td>4.2 VA</td> </tr> <tr> <td>230 V AC</td> <td>4.6 VA</td> <td></td> <td>5.8 VA</td> </tr> </table>	60 V DC	3.1 W	energized	4.5 W	110 V DC	3.0 W		4.5 W	220 V DC	3.6 W		4.6 W	250 V DC	3.7 W		4.8 W	100 V AC	2.9 VA		4.2 VA	110 V AC	3.0 VA		4.2 VA	230 V AC	4.6 VA		5.8 VA	<p>24 – 60 V DC or 60 – 250 V DC and 100 – 230 V AC without switchover</p>
60 V DC	3.1 W	energized	4.5 W																											
110 V DC	3.0 W		4.5 W																											
220 V DC	3.6 W		4.6 W																											
250 V DC	3.7 W		4.8 W																											
100 V AC	2.9 VA		4.2 VA																											
110 V AC	3.0 VA		4.2 VA																											
230 V AC	4.6 VA		5.8 VA																											
Binary inputs	<p>Input voltage for blocking and remote reset input Pickup thresholds for Blocking X30 pin 1-2, remote reset X31 pin 1-2 Blocking X30 pin 2-3, remote reset X31 pin 2-3</p>	<p>24 – 250 V DC</p> <p>approx. 19 V approx. 75 V</p>																												
Signalling relays	<p>Number of relays, forward or reverse direction Number of relays, continuous earth fault signal Number of relays, alarm</p> <p>Switching capacity make (all relays) Switching capacity break (all relays) Switching voltage Permissible switching current continuous 0.5 s</p>	<p>2 NO contacts 1 NO contact 1 NC contact</p> <p>1000 W / VA 30 W / VA 250 V AC/DC 5 A 30 A</p>																												
Version	<p>Housing, dimensions</p> <p>For flush mounting, terminals on the back For panel surface mounting, terminals on the side For panel surface mounting, terminals on up/down</p> <p>Weight</p>	<p>SIPROTEC 1/6 wide see dimensional drawings</p> <p>6 current / 25 voltage terminals 6 current / 25 voltage terminals 28 terminals</p> <p>approx. 4 kg</p>																												
Standards	<p>DIN VDE 0435, Part 303 and IEC 255-5</p>	<p>-</p>																												

4 Technical data

4.2 Ordering code / MLFB

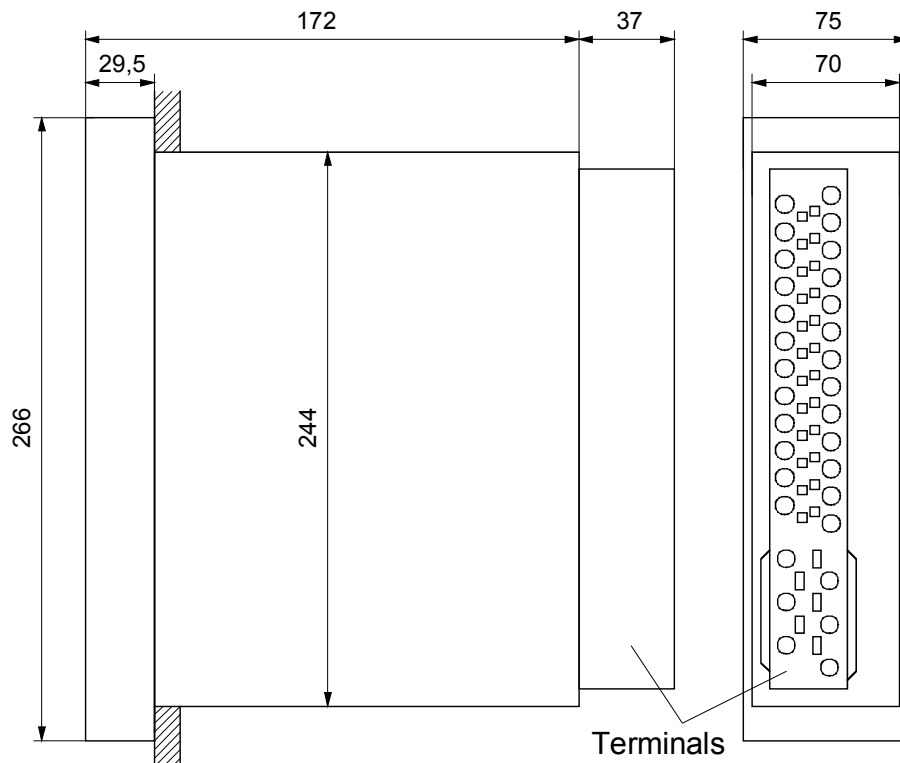
Designation	Order no.:
Transient earth-fault relay	7SN600
In SIPROTEC housing 1/6 wide	
50 Hz rated frequency	0
16 2/3 Hz rated frequency	1
Auxiliary voltage 60-250V DC and 100-220V AC without switchover	0
Auxiliary voltage 24-48V DC	1
Housing for panel surface mounting with terminals on the side	B
Housing for panel surface mounting with terminals on top and bottom	D
Housing for panel flush mounting or cubicle mounting	E

Figure 4.1: Ordering code / MLFB

Housing types and dimensions 5

5 Housing types and dimensions Panel flush mounting

5.1 Dimensions for panel flush mounting



Current connections (terminals 1 - 6)

Insulated ring cable lugs: for screws up to 6 mm
 Maximum outer width 13 mm
 Type e.g. PIDG from AMP Co.
 Conductors with cross-section 2.7 mm² to 6.6 mm²

In parallel double leaf-spring-crimp contact: for diameters of 2.5 to 4.0 mm²

Control connections (terminals 7 - 31)

Insulated ring cable lug: for screws up to 4 mm
 Maximum outer width 9 mm
 Type e.g. PIDG from AMP Co.
 Conductors with cross-section 1.0 mm² to 2.6 mm²

In parallel double leaf-spring-crimp contact: for diameters of 0.5 to 2.5 mm²

Panel cutout
 Dimensions in mm

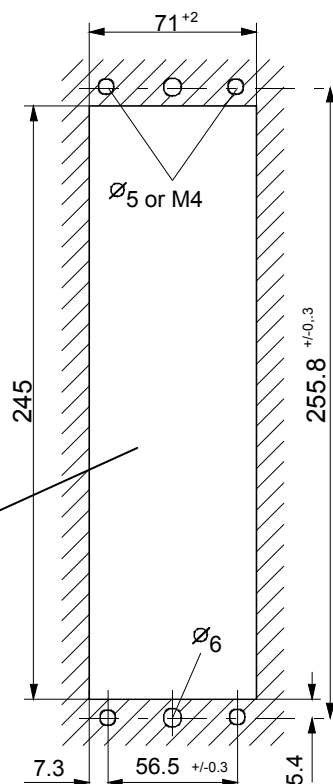
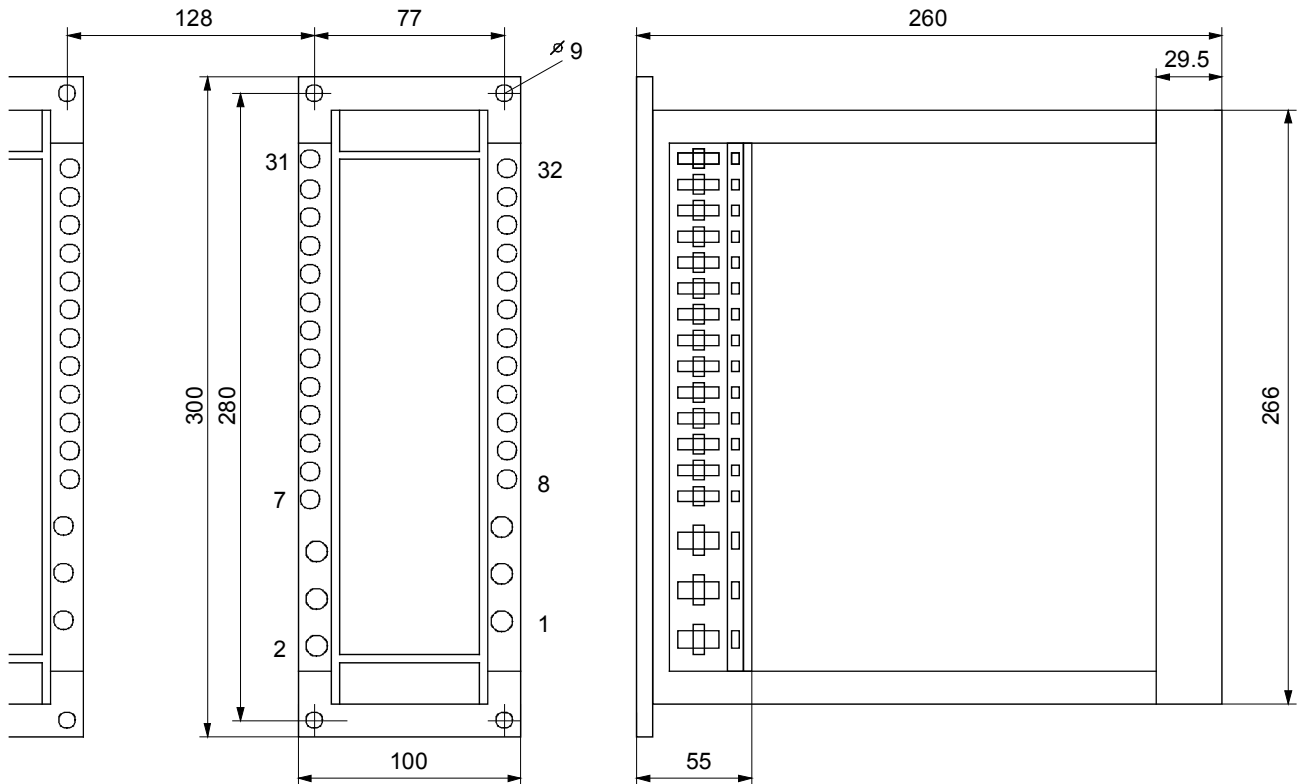


Figure 5.1: Dimensions for panel flush mounting

5 Housing types and dimensions

5.2 Dimensions for panel surface mounting (terminals on the side)



Dimensions in mm

Current connections (terminals 1 - 6)

Insulated ring cable lug: for screws up to 6 mm
 Maximum outer width 13 mm
 Type e.g. PIDG from AMP Co.
 Conductors with cross-section
 2.7 mm² to 6.6 mm²
 Cable end sleeves are required for
 stranded conductors

In parallel double leaf-
 spring-crimp contact: for diameters of 2.5 to 4.0 mm²

Control connections (terminals 7 - 31)

Insulated ring cable lug: for screws up to 4 mm
 Maximum outer width 9 mm
 Type e.g. PIDG from AMP Co.
 Conductors with cross-section
 1.0 mm² to 2.6 mm²

In parallel double leaf-
 spring-crimp contact: for diameters of 0.5 to 2.5 mm²
 Cable end sleeves are required for
 stranded conductors

Figure 5.2: Dimensions for panel surface mounting (terminals on the side)

Housing types and dimensions 5

5.3 Dimensions for panel surface mounting (terminals on top and bottom)

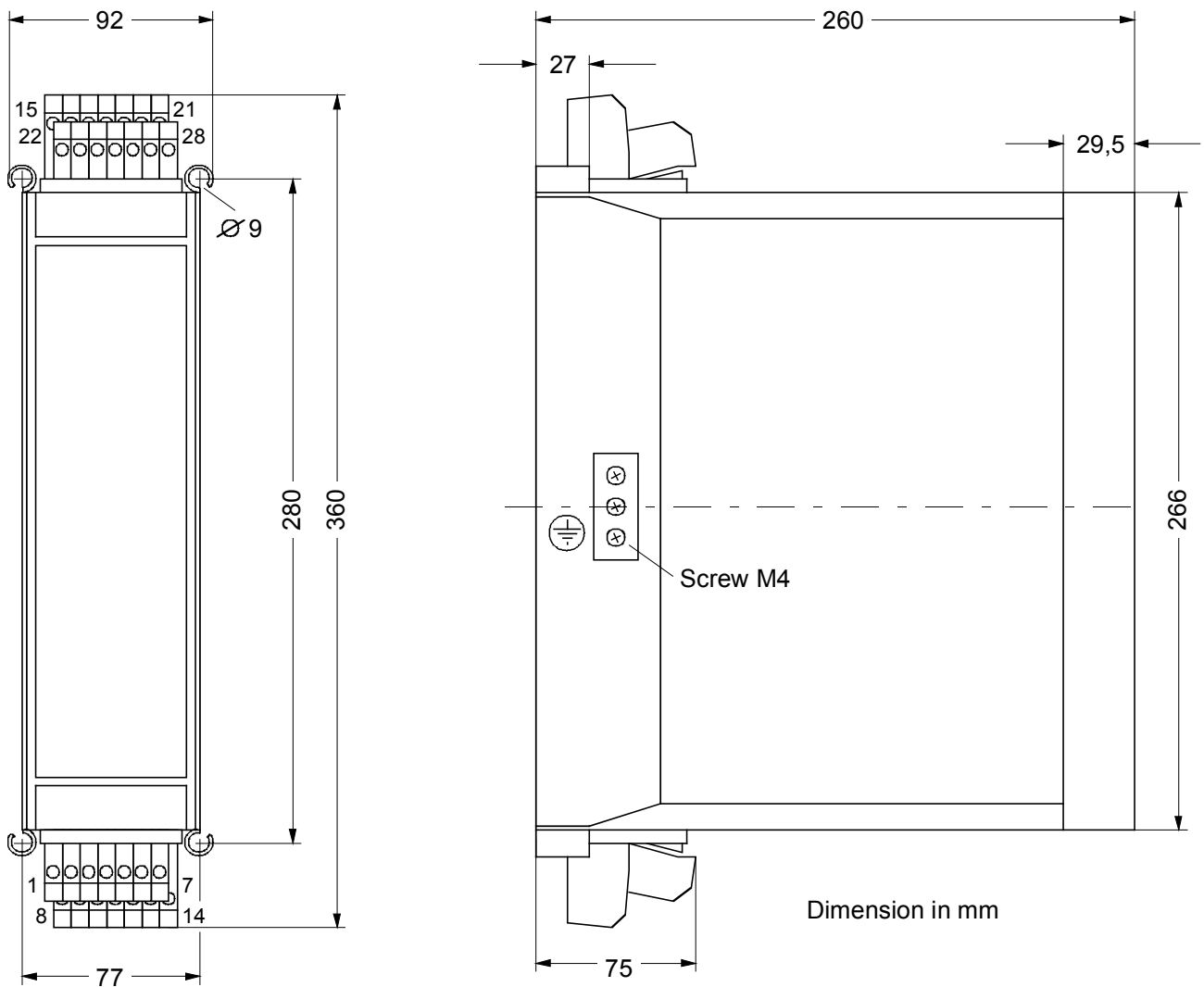


Figure 5.3: Dimensions for panel surface mounting (terminals on top and bottom)

5 Housing types and dimensions

5.4 Front view of relay

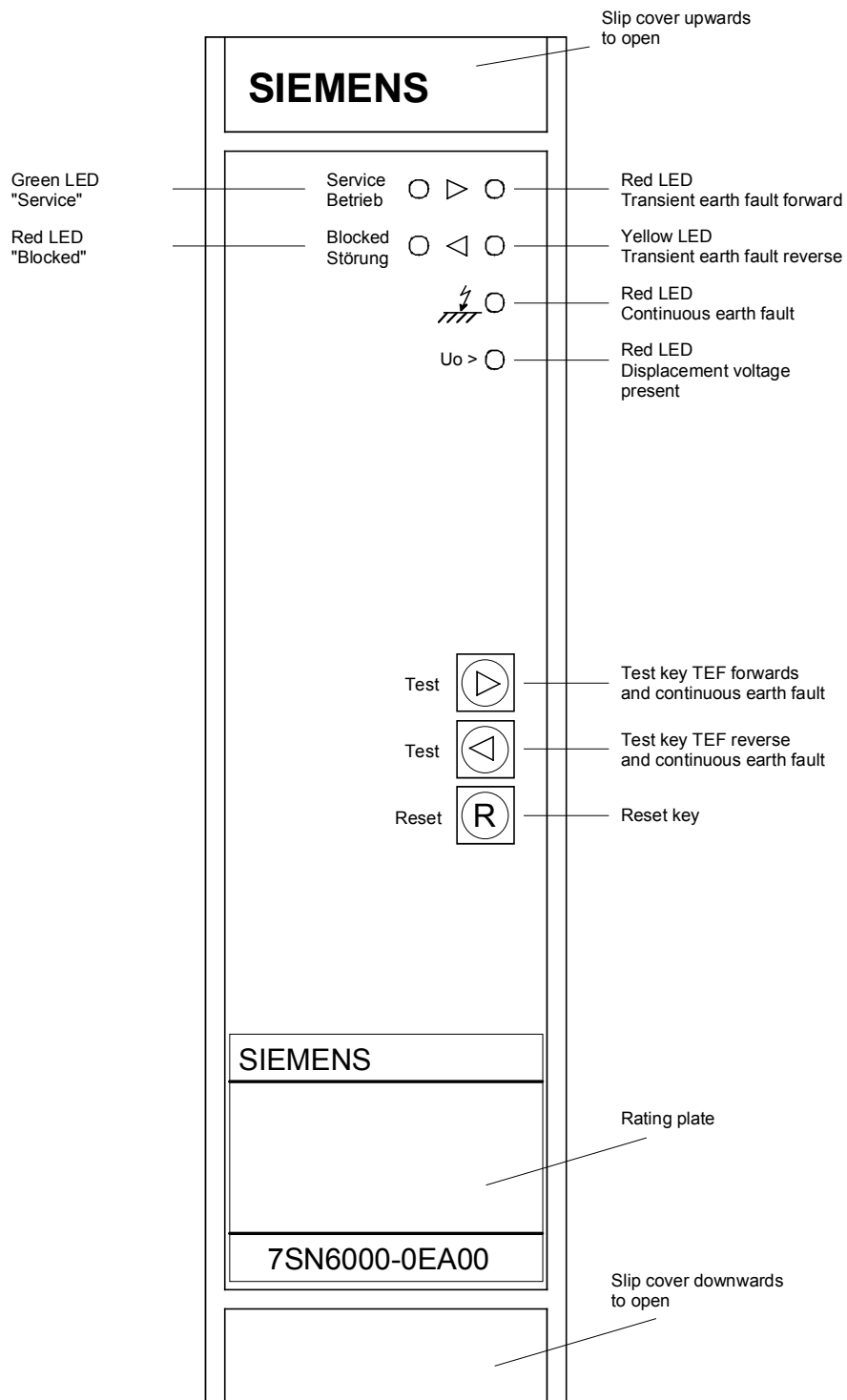
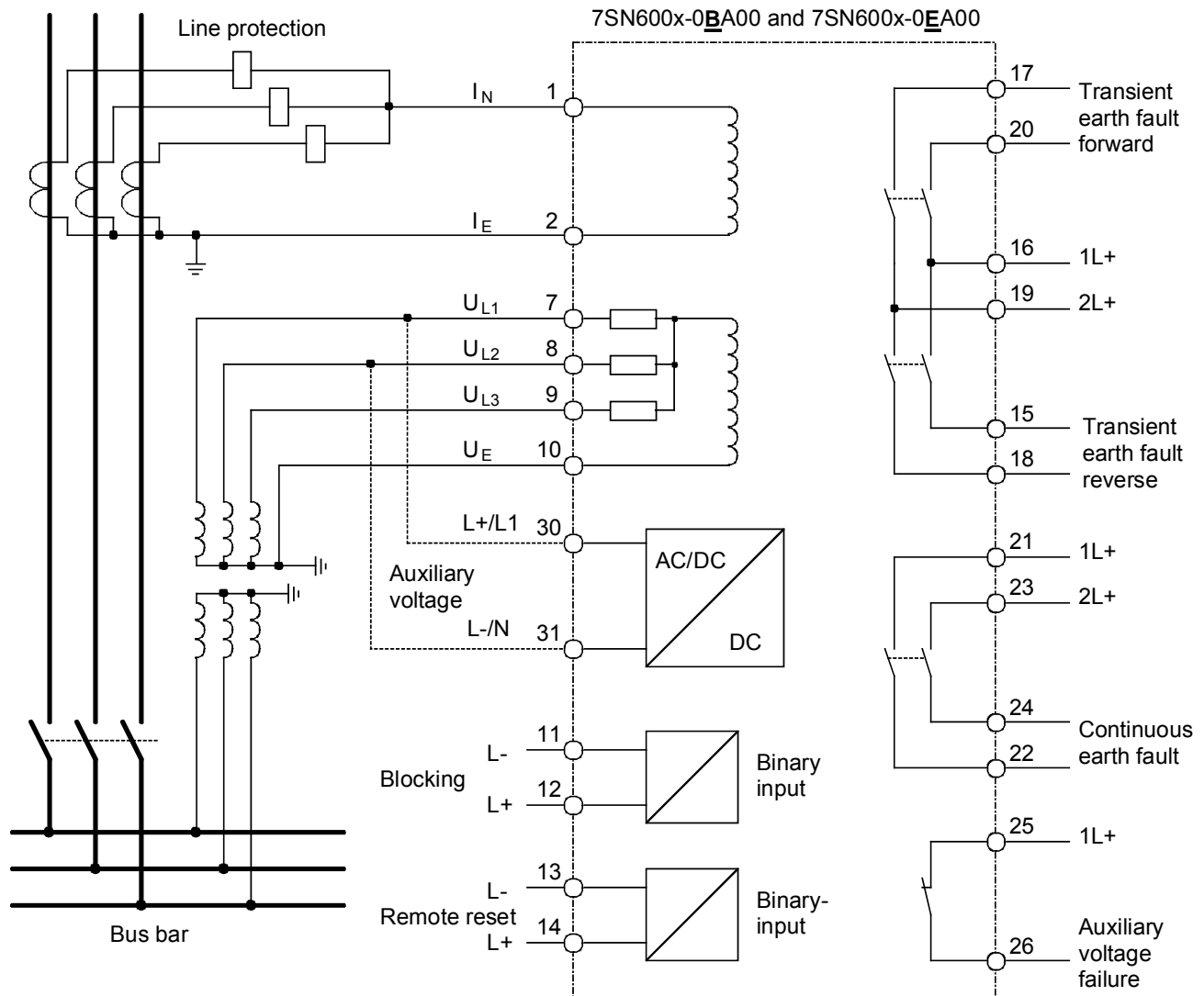


Figure 5.4: Front view of relay

Connection diagram 6

6 Connection diagram

6.1 Panel flush mounting and panel surface mounting (terminals on the side)



6 Connection diagram

Figure 6.1: Connection diagram 7SN600x-0BA00 and 7SN600x-0EA00

6.2 Panel surface mounting (terminals top and bottom)

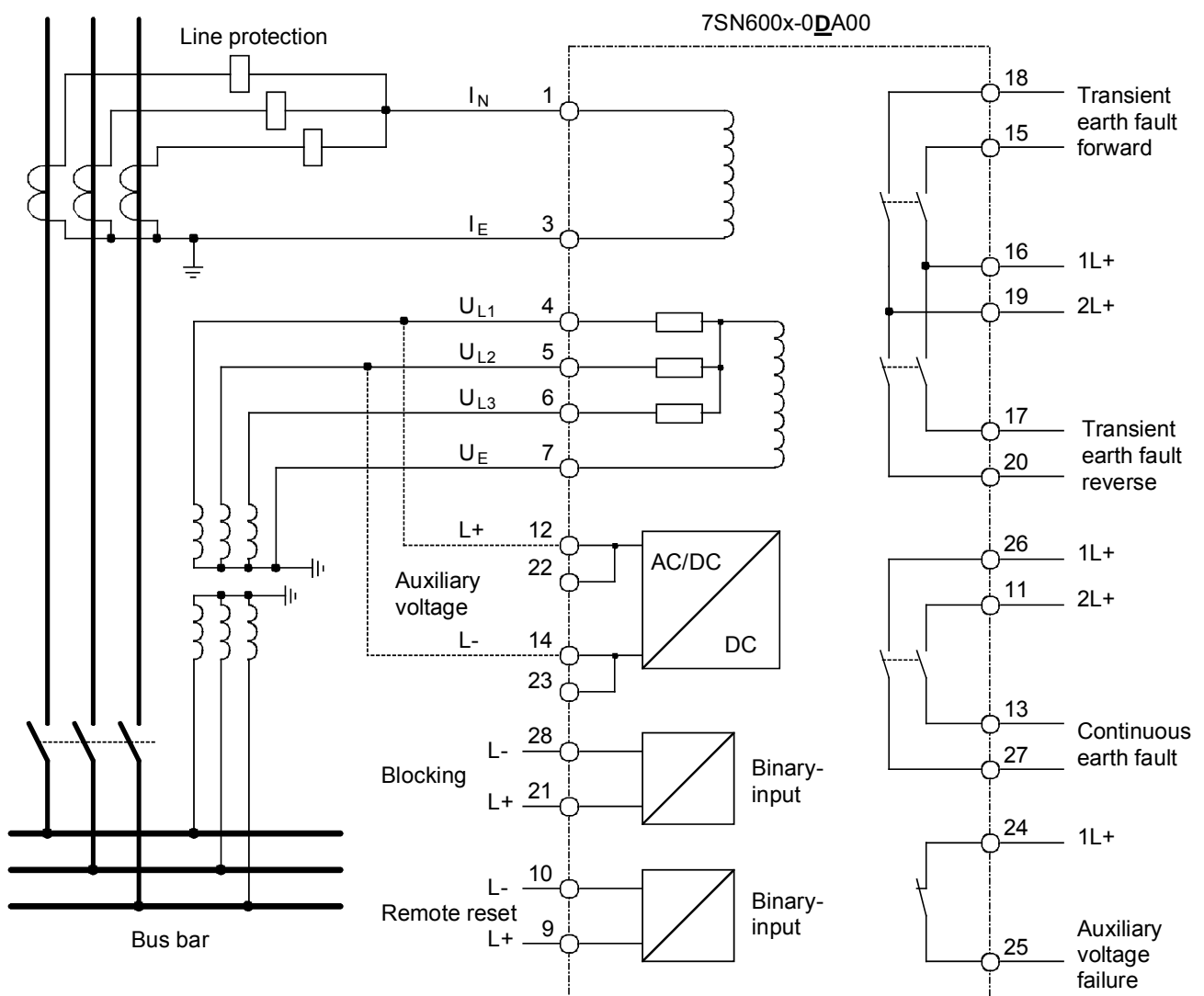


Figure 6.2: Connection diagram 7SN600x-0DA00

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7 Appendix

7.2 Manual versions

Order-No. E50417-G1176-C128-A1:
First Version on 09-02-2000

Order-No. E50417-G1176-C128-A2:
Modified: 20-06-2001

1. Layout of setting elements S3.5, X30 and X31 in Figure 3.2, page 20, was wrong
2. Wrong description of the function for switch 2.2. The document was changed accordingly.

Order-No. E50417-G1176-C128-A3:
Modified: 03-07-2001

1. Device with housing for panel surface mounting with terminals on top and bottom ('D') was added.

Order-No. E50417-G1176-C128-A4:
Modified: 05-02-2002

1. The burden of the VT circuits was added in the Technical Data.
2. The description of the evaluation logic for directional indication was corrected (chapter 2.4).
3. Corrects input impedance Z at 50 Hz and $1 \times I_N < 0,05 \Omega$

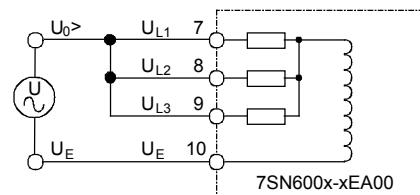
Order-No. E50417-G1176-C128-A5:
Modified: 22-02-2010

1. Corrects pick up value and delivering settings of the neutral displacement voltage $U_{0>}$ on Page 22.

DIP-Switch		Version	/BC /DD	/BD /DE	Version	/FF	from /GG
S3/7	S3/8	Settings	Actual Pick up		Settings	Actual pick up	
off	off	10 V _{eff}	3,4 V _{eff}	4,6 V _{eff}	10 V_{eff}	5,8 V_{eff}	10 V_{eff}
off	on	20 V_{eff}	6,7 V_{eff}	8,7 V_{eff}	20 V _{eff}	11,6 V _{eff}	20 V _{eff}
on	off	30 V _{eff}	13,5 V _{eff}	17,5 V _{eff}	40 V _{eff}	23,2 V _{eff}	40 V _{eff}
on	on	50 V _{eff}	17,0 V _{eff}	21,0 V _{eff}	50 V _{eff}	29,0 V _{eff}	50 V _{eff}

Delivery settings: bold

Test construction: Attaching test voltage between U_{L1} - U_{L2} - U_{L3} and U_E (single-phasesly).



Order-No. E50417-G1176-C128-A6:
Modified: 17-05-2011

1. Connection to broken delta winding (page 18).

Modified: 10-10-2011

2. Layout of setting elements S3/8 in Figure 3.3 does now show the default settings (page 19)

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