The numerical overhead contact line protection relay Siprotec® 7ST61 / 7ST63 is a selective and quick responding protection device for overhead contact lines fed from one or multiple points in AC traction power supplies.

The relay possesses all functions required to protect a section of the overhead contact line and can therefore be deployed universally.

**Features:**
- Integration of protection and measurement functions into a single unit (7ST61)
- Integration of protection, control, measurement and automation functions into a single unit (7ST63)
- Shortest tripping times due to adaptive protection algorithms
- Efficient operation due to a universal tool for all tasks
- Flexible use thanks to standard communication protocols

**Technical data (depending on product version)**

<table>
<thead>
<tr>
<th>Specification</th>
<th>7ST61</th>
<th>7ST63</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal frequency</td>
<td>16.7</td>
<td>25; 50 or 60</td>
</tr>
<tr>
<td>Current / voltage inputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– number of current inputs</td>
<td>1 or 3</td>
<td>1 or 5</td>
</tr>
<tr>
<td>– nominal current of current inputs</td>
<td>[A]</td>
<td>[VA]</td>
</tr>
<tr>
<td>– number of voltage inputs</td>
<td>1 or 3</td>
<td>80…125</td>
</tr>
<tr>
<td>– nominal voltage of voltage inputs (adjustable)</td>
<td>[V]</td>
<td></td>
</tr>
<tr>
<td>Power consumption per phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– at (I_n = 1) A</td>
<td>[VA]</td>
<td>approx. 0.05</td>
</tr>
<tr>
<td>– at (I_n = 5) A</td>
<td>[VA]</td>
<td>approx. 0.3</td>
</tr>
<tr>
<td>Binary inputs / outputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– number of inputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– 7ST61</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>– 7ST63</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>– number of outputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– 7ST61</td>
<td>22 or 27</td>
<td></td>
</tr>
<tr>
<td>– 7ST63</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Fast tripping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– shortest tripping time</td>
<td>[ms]</td>
<td>&lt; 2</td>
</tr>
</tbody>
</table>

**Standards**
- IEC 60255 (product standards)
- ANSI / IEEE C37.90.0/1.2
- UL 508
- DIN 57435 T.303

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**Siprotec 7ST61 / 7ST63**

**Numerical overhead contact line protection for AC traction power supply**

**Product Information / Version 1.1.0**

Transportation Systems
Overview

The Siprotec 7ST61 / 7ST63 numerical overhead contact line protection relay is a member of the Siprotec 4 product family, which stands for excellent quality and powerful protection relays and is characterized by the following features:

- Powerful 32-bit microprocessor system
- Completely numerical data processing and control, from the measurement of voltages and currents to the switching decision logic of the circuit-breaker
- Complete galvanic and interference-immune isolation of the internal processing circuitry from the measurement, control and power supply circuits of the switchgear via measured value transformers, binary input and output modules, and DC and AC voltage converters
- Simple operation via integrated operator panel or connected personal computer with operating software Digsil®

In addition to these, the following functions are available as options:

- High-speed overcurrent protection
- Voltage protection
- Circuit-breaker failure protection
- Inrush restraint
- Automatic reclosure function
- Synchronism and voltage check
- Fault locator (even for fast tripping)
- Calculation of the circuit-breaker load
- CFC (Continuous Function Chart) for implementation of user defined functions

The Siprotec 7ST61 / 7ST63 protection relays offer the following basic functions as standard:

- Distance protection
- Time overcurrent protection
- Emergency time overcurrent protection
- Thermal overload protection
- Defrosting protection (depending on product version)
- Trip circuit supervision
- Command processing (depending on product version)
- Monitoring functions

Combined Siprotec 7ST63 protection / control unit

1. Individual parameterizable LEDs for display of any process or device information
2. RS232 operator interface
3. Keyswitch for switching between „local and remote control“ and between „interlocked and non-interlocked operation“
4. Illuminated LC display
5. Navigation keys
6. Keys for control of the switching devices
7. Numerical operating keys
8. Four individual programmable function keys
Basic functions

Distance protection (21)
- Distance protection function with three zones (Z1, Z2 and Z3), high measuring accuracy, and flexible options for adaptation to power system conditions
- Impedance characteristic with „combined“ or „polygon“ tripping characteristic
- The direction characteristics „forward“, „forward extended“, „non-directional“ and „reverse“ can be set for each distance zone
- Tripping characteristics with separate setting of reach (impedance Z or reactance X), angle and load delimitation (resistance R)
- Instantaneous tripping when switching onto a fault

Time overcurrent protection (50/51)
- Full-value, non-directional overcurrent-time protection (definite/inverse-time) in three stages (very high current I>>, high current I>>, overcurrent I>)
- Fast tripping when switching onto a fault

Emergency time overcurrent protection (51)
- Back-up protection upon measuring voltage failure
- Single-stage back-up overcurrent-time protection (I> DMT)
- Instantaneous tripping when switching onto a fault

Thermal overload protection (49)
- Overhead line temperature calculated by means of a thermal model of the object being protected
- Catenary switchover
- Adjustable thermal warning stage
- Ambient temperature measurement possible

Defrosting protection (87) (depending on product version)
- Differential protection for de-icing current with parameterizable characteristic
- Back-up protection with two-level definite-time characteristic

Trip circuit supervision (74TC)
- Integrated trip circuit supervision

Command processing (depending on product version)
- Closing and opening of switching devices manually via local control keys (7ST63), programmable function keys, via the system interface (e. g. station control system Sitrans® SCS) or via the operator interface (by means of personal computer and Digsi operator program)
- Feedback of the switching states via the CB auxiliary contacts (for commands with feedback)
- Plausibility monitoring of circuit-breaker positions and interlocking conditions for switching

Monitoring functions
- Monitoring of internal measuring circuits, the auxiliary power supply and the hardware and software, thus increasing reliability
- Monitoring of the signal of the overhead line voltage (fuse failure monitoring)
- Monitoring of ambient temperature sensing
- Monitoring of the tripping circuit possible
- Display of the operational impedances and direction

Further functions
- Battery-backed clock that can be synchronized via the synchronization signal (DCF 77, IRIG B by means of satellite receiver), binary input or system interface
- Constant calculation and indication of the operating measurements on the front display
- Writing of all parameters into a non-volatile memory so the setting values are retained even in the event of auxiliary power failure
- Fault value storage for the last eight power system faults (fault in the network), with real-time assignment
- Event store for storing the last 200 operational and 80 fault indications
- Communication with the control system possible via serial interfaces (depending on order variant), or optionally via data line, modem, or fiber-optic cable
- Commissioning aids such as connection and direction check and circuit-breaker check
Optional functions

High-speed overcurrent protection (50HS)
- Shortest tripping times (<2 ms) on exceeding tripping threshold
- Fault current tripping possible already in the first zero crossing of the current (in 16.7 Hz power systems)

Voltage protection (27/59)
- Two overvoltage stages for the overhead contact line, (U>>, U>)
- Two undervoltage stages for the overhead contact line, (U<<, U<)

Circuit-breaker failure protection (50BF)
- With independent current levels for monitoring the current flow
- Tripping by two independent, settable monitoring time levels
- Starting by tripping command of each integrated protection function
- External starting possible

Inrush restraint
- Distinction between operation and fault by means of harmonic analysis
- With blocking option for certain protection functions
  - Distance protection (from zone Z2)
  - Overcurrent-time protection and emergency definite-time tripping

Automatic reclosure function (79)
- Single or multiple reclosing (up to eight shots)
- With separate dead and operative times for the first two shots
- Testing of synchronism before reclosing (in combination with synchronism and voltage check function)

Fault location
- Calculation of fault location upon tripping, release of starting or high-speed tripping
- Output of the fault location as linear data (kilometers, miles, % of line length) or impedance data (Ω)

Synchronism and voltage check (25)
- Check of synchronous conditions before connection
- Alternatively check of absence of voltage before connection
- Fast measurement of voltage U_{diff} and frequency difference f_{diff}
- Switching on asynchronous power system conditions with advance calculation of synchronization instant possible
- Settable minimum and maximum voltage
- Check of synchronous conditions or absence of voltage even before planned closure of the circuit-breaker possible

Communication

Four serial interfaces are available for communication with external operating and control systems.
- Operator interface (front side)
- Service interface
- System interface
- Interface for time synchronization

Communication interface (replaceable)

<table>
<thead>
<tr>
<th>Connection</th>
<th>RS232; RS485; fibre optic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocols</td>
<td>IEC 60870-5-103, Profibus FMS/DP, Modbus, DNP 3.0, IEC 61850 (in preparation*)</td>
</tr>
</tbody>
</table>

* Due to the modular interface concept the relays have already been prepared for the application of the IEC 61850 protocols
**Operation**

Siprotec 7ST6 can be operated via
- the operator panel on the front of the unit or
- the Digsi 4 user interface of your PC connected locally to the operator interface or via modem to the service interface of the relay.

**Siprotec 7ST6 operator panel**

Routine operator actions can be performed while using the on ergonomic principles designed operator panel as well as settings of individual parameters and display information required for network management and general diagnostics can be made.

Depending on the version, the operator panel of the relay can be arranged as a 4-line display or a graphic display.

**Digsi 4 operating and diagnostics software on PC**

Digsi 4 can be used for easy parameterization and operation of the Siprotec devices on a PC.

Digsi 4 uses Windows techniques familiar from other applications for operator guidance. So the operator is working in a familiar system environment.

On the user interface only device-specific relevant parameters are offered during configuration and routine operation.

Numerous tools, such as context menus, dropdown lists for selection, permissible parameters, limit setting for digital values, and tooltips make an easy parameterization of the Siprotec devices possible.
## Technical data

### Dimensions of Siprotec 7ST61 / 7ST63 (dimensions in mm)

<table>
<thead>
<tr>
<th>Side view</th>
<th>Rear view</th>
<th>Rear view</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siprotec 7ST61 / 7ST63</td>
<td>Siprotec 7ST61</td>
<td>Siprotec 7ST63</td>
</tr>
</tbody>
</table>

### Ambient conditions

<table>
<thead>
<tr>
<th>Climatic stress according to</th>
<th>IEC 60255-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended temperature during operation*</td>
<td>[°C]</td>
</tr>
<tr>
<td>Permissible humidity stress on 56 days a year (relative humidity)*</td>
<td>≤ 93 %</td>
</tr>
<tr>
<td>Permissible humidity stress (relative humidity) *</td>
<td></td>
</tr>
<tr>
<td>– annual average</td>
<td>≤ 75 %</td>
</tr>
<tr>
<td>– on 56 days a year</td>
<td>≤ 93 %</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>[m]</td>
</tr>
</tbody>
</table>

* other values on request

### Mechanical design

<table>
<thead>
<tr>
<th>Weight 7ST61</th>
<th>[kg]</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight 7ST63</td>
<td>[kg]</td>
<td>10</td>
</tr>
<tr>
<td>Degree of protection according to IEC 60529</td>
<td>IP51</td>
<td></td>
</tr>
</tbody>
</table>
# Electrical data

## Auxiliary voltage (depending on product version)

<table>
<thead>
<tr>
<th>Nominal auxiliary direct voltage $U_{H}$</th>
<th>[V DC]</th>
</tr>
</thead>
<tbody>
<tr>
<td>24/48</td>
<td></td>
</tr>
<tr>
<td>60/110/125</td>
<td></td>
</tr>
<tr>
<td>110/125/220/250</td>
<td></td>
</tr>
</tbody>
</table>

## Binary inputs

<table>
<thead>
<tr>
<th>Quantity</th>
<th>12 (configurable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>– 7ST61</td>
<td></td>
</tr>
<tr>
<td>– 7ST63</td>
<td>38 (configurable)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nominal voltage range</th>
<th>[V DC]</th>
</tr>
</thead>
<tbody>
<tr>
<td>24...250</td>
<td></td>
</tr>
</tbody>
</table>

## Output relays

<table>
<thead>
<tr>
<th>Number</th>
<th>NO contact (normal)</th>
<th>NO contact / NC contact (switchable)</th>
<th>NO contact (fast)</th>
</tr>
</thead>
<tbody>
<tr>
<td>– 7ST61 (version with one transformer)</td>
<td>21</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>– 7ST61 (version with three transformers)</td>
<td>16</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>– 7ST63</td>
<td>30</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Making power</th>
<th>[W or VA]</th>
<th>1000</th>
<th>1000</th>
<th>1000</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Breaking power</th>
<th>[W]</th>
<th>30 VA</th>
<th>30 VA</th>
<th>1000 W or VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>– ohmic</td>
<td>40</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– at L/R ≤ 50 ms</td>
<td>25</td>
<td>25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Switching voltage AC     | [V] | 250 | 250 | 200 |
| Switching voltage DC     | [V] | 250 | 250 | 300 |
| Continuous current per contact | [A] | 5   | 5   | 5   |
| Total continuous current for grouped contacts | [A] | 5   | 5   | –   |
| Max. making current DC for an on duration of 0.5 s for the NO contacts | [A] | 30  | 30  | 30  |
Application area

Typical configuration of an AC contact line feeder with a numerical overhead contact line protection relay (contains optional functions)

AC 25 kV; 50 Hz

-T1

-Q0

-Q1

Siprotec 7ST61

Typical configuration of an AC contact line feeder in the autotransformer system with a numerical overhead contact line control and protection relay (contains optional functions)

AC 2x 25 kV; 50 Hz

-T1

-Q0

-Q1

Siprotec 7ST63

Siemens AG
Transportation Systems
Electrification
P.O. Box 32 40
91050 Erlangen
Germany

electrification.ts@siemens.com
www.siemens.com/transportation/
electrification

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The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases. If not stated otherwise, we reserve the right to include modifications, especially regarding the stated values and dimensions.