

T300 Application Note

V2.9.6 release update

1. PURPOSE

This document explains in detail the updates included in PowerLogic T300 v2.9.6 release, with respect to the content available in T300 NT00378-13-EN User Manual.

2. REVISION LIST

Rev.	Modifications	Origin of modification
V0	25/11/2025	Draft version
V1	27/11/2025	Quality approval

Glossary

AD	Active Directory
CAE	Cybersecurity Admin Expert
GPS	Global Positioning System
LDAP	Lightweight Directory Access Protocol
NTP	Network Time Protocol
PTP	Precision Time Protocol
RBAC	Role-Based Access Control
SNTP	Simple Network Time Protocol
TLS	Transport Layer Security

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3. Synchronization (NTP Secure & PTP)

There are several possibilities for synchronizing the RTU:

- Automatically by the communication protocol (via the SCADA).
- Through an SNTP server, if the RTU is connected to an IP network. **NTP secure available since v2.9.6 release.**
- By GPS satellites, if the HU250 module includes a 4G modem with GPS option.
- Automatically by **PTP** server connected to the WAN interface (**available since v2.9.6 release**).

How to configure SNTP & Secure NTP

To configure NTP secure source parameters, need to go to T300 Web server **Settings > Synchronization** page. Secure option status must be the same for all SNTP Clients.

The screenshot shows the 'Synchronization' configuration page for a T300 Web server. The page has a header 'HU01 / Synchronization' and four tabs: 'Synchronization', 'SNTP Keys', 'Local time Zone', and 'Summer Time'. The 'Synchronization' tab is selected. Below the tabs, there are sections for 'SNTP Server', 'Primary Device', and 'Secondary Device'. The 'Device' dropdown is set to 'SNTP' and the 'Timeout (s)' is set to '30'. Below this is a section titled 'SNTP Clients' which contains a form for an 'SNTP Client'. The 'Secure' option is set to 'Yes' (indicated by a toggle switch), 'SNTP Server IP' is '54.5.3.1', 'Mode' is set to 'Active' (indicated by a toggle switch), 'Period (s)' is '254', and 'IPV6' is set to 'No' (indicated by a toggle switch). At the bottom of the 'SNTP Clients' section is a '+ Add' button. At the bottom right of the page is a 'Reset' button.

If Secure option is set as Yes, then it is necessary to configure the SNTP Keys for this protocol to properly work.

Access the tab “NTP Keys” which will only be visible when all SNTP devices have the Secure option set to True. The maximum number of SNTP Keys that can be created is 32. The parameters to be configured in this tab are the following ones:

- **ID**: a numeric identifier for the key. It must be greater than zero. This ID must be unique; no more than one SNTP Key can have the same ID.
- **Type**: it can be either MD5, SHA1, or AES-128 CMAC.
- **Value**: the actual secret key used for authentication. It can contain up to 512 characters.

- **SNTP Server:** this is a dropdown list with all the SNTP Clients IP addresses created, therefore selecting one of them would associate this set of Key ID, Type and Value to the chosen SNTP Client. There can't be several SNTP Keys with the same SNTP Server associated to it.

HU01 / Synchronization

Synchronization
SNTP Keys
Local time Zone
Summer Time

SNTP Server

Key

Id

11223

Type

SHA1

Key

12341c21

SNTP Server

54.5.3.1

+ Add

Reset

The T300 Web server is used to set most of the parameters. However, the settings for SNTP server can only be viewed.

Parameter	Default	Configuration range	Description
Synchronization/Primary or Secondary Device/SNTP Device			
Device	SNTP	- None - SNTP	Enabling the SNTP device as the synchronization source.
Timeout (s)	30	1 – 4294967295	Time delay before the active device is declared to be in DEFECT mode and the switch is made to another device.
SNTP Server IP	–	Valid IP address	SNTP server IP address
Mode	Active	- Active - Passive	In Active mode, the HU250 requests a new synchronization from the SNTP server at the end of the delay set in Period . In Passive mode, the HU250 simply waits to be synchronized by the server.
Period	30	1 – 4294967295	Synchronization period, used in Active mode only. Period should be shorter than Timeout.
IPV6	No	- No - Yes	
Secure	No	- No - Yes	Enhancement of the traditional NTP protocol that adds cryptographic authentication and integrity to time synchronization
NTP Keys			
ID	0	Up to 2147483647	A unique numeric identifier for the key.
Type	MD5	MD5, SHA1 or AES-128 CMAC	Encryption algorithm.
Key	0	Up to 512 characters	The actual secret key used for authentication.

SNTP Server		Dropdown list with all SNTP Clients IP addresses.	SNTP Client associated to the key.
SNTP Server			
Enabled	Yes	• Yes • No	The SNTP server is used by the T300 to set the time on the SC150/ SC160 and LV150 modules. An IED can also be connected as an SNTP client to this server if required for synchronization purposes, by configuring it as follows: Time zone inactive: No summer time management. Passive mode.
Mode	Active	• Active • Passive	The T300 is active for synchronization. It synchronizes clients at the end of the period defined below.
Destination	Eth0		Port on which the SNTP server is active (HU250 LAN)
Period (s)	30		SNTP client synchronization period
IPv6	No	• No • Yes	

NOTE: The grayed-out parameters are fixed, they cannot be modified.

How to configure PTP

To configure PTP source parameters, need to go to T300 Web server **Settings > Synchronization** page:

HU01 / Synchronization

Synchronization
Local time Zone
Summer Time
SNTP Server

Primary Device
Secondary Device

Device
PTP

Timeout (s)
30

PTP Configuration

PTP Synchronization

Clock
Port

Domain number
0

Reset

HU01 / Synchronization

Synchronization

Local time Zone

Summer Time

SNTP Server

Primary Device

Secondary Device

Device

PTP

Timeout (s)

30

PTP Configuration

PTP Synchronization

Clock

Port

Interface name

WAN

Announce message period (2^n s)

3

Maximum announce messages lost

0

Synchronization period (2^n s)

0

E2E Delay req period (2^n s)

0

P2P Delay req period (2^n s)

0

Delay mode

E2E

P2P

Net transport

UDP_IPV4

IEEE_802_3

Reset

PTP Device settings

Parameter	Default	Configuration range	Description
Device	PTP	- None - PTP	Activation of the PTP device as a source of synchronization
Domain	0	0 - 127	The PTP domain is a logical grouping of devices that has its own independent synchronization time. Value of the local clock's "domain" attribute.
Announce message period (2^n s)	0	0 - 127	Average time interval between "Announce messages". Value in seconds, as a base-two logarithm. The default value is 0, i.e., 1 second
Maximum announce messages lost	3	0 - 127	Maximum number of messages lost before considering a loss of communication.
Synchronization period (2^n s)	0	0 - 127	Average time interval between synchronization messages. A shorter interval can improve the accuracy of the local clock. Specified in seconds as a base-two logarithm. The default value is 0, i.e., 1 second.
E2E Delay req period (2^n s)	0	0 - 127	Minimum allowed time interval between "Delay_Req" messages in E2E mode. Specified in seconds as a base-two logarithm. The default value is 0, i.e., 1 second.
P2P Delay req period (2^n s)	0	0 - 127	Minimum allowed time interval between "Delay_Req" messages in P2P mode. Specified in seconds as a base-two logarithm. The default value is 0, i.e., 1 second.
Delay mode	P2P	- E2E - P2P	Delay mechanism mode. Peer-to-peer (P2P) or end-to-end (E2E). P2P calculates the delay for each individual link segment between devices, requiring all devices to be PTP-aware. E2E calculates the total link delay between a client and a server device.
Net transport	IEEE_802_3	- UDP_IPV4 - IEEE_802_3	Network transport mechanism. The options are Transport over UDP/IPv4 and Transport over IEEE 802 3/Ethernet.

4. Cybersecurity Admin Expert (CAE) settings

CAE is the T300 security administration tool for managing the security policy and defining the restrictions for accessing the system or the communication interfaces.

CAE version is changed from 2.4.8 to 4.0.1. The changes on the CAE user interface related with T300 cybersecurity management are the following ones:

Configuration of System Logging Protocol

The screenshot shows the 'CAE - Security settings: Logs and monitoring' window. The interface includes a top navigation bar with 'EcoStruxure Cybersecurity Admin Expert' and 'T300'. Below this is a green header with tabs: 'USER ACCOUNTS', 'ROLES', 'SECURITY SETTINGS', 'SYSTEM EDITOR', and 'MANAGEMENT OF SYSTEM'. The 'SECURITY SETTINGS' tab is active, and within it, the 'Logs and Monitoring' sub-tab is selected. The configuration area is divided into three sections: 'Logging Parameters', 'SYSLOG Parameters', and 'SNMP Parameters'. The 'Logging Parameters' section has a 'Log and monitoring' dropdown menu showing 'BDEW', 'IEEE1686', and 'CS_PH2'. The 'SYSLOG Parameters' section includes 'Server address' and 'Server port *' (set to 6514). The 'SNMP Parameters' section includes 'Manager address 1', 'Manager address 2', 'Security level *' (set to 'No Authentication, No Privacy'), 'Username', 'Authentication password', and 'Privacy password'. A password policy note is visible: 'The password must comply to the following rules: - minimum 8 characters - maximum 50 characters - at least 1 uppercase character, 1 lowercase character, 1 digit and 1 special character - allowed characters are ASCII [33, 122]'. At the bottom, there is a 'Save' button and a 'Cancel' button, along with a legend for required fields.

CAE - Security settings: Logs and monitoring

EcoStruxure Cybersecurity Admin Expert T300

ApplicationAdmin Schneider Electric

USER ACCOUNTS ROLES SECURITY SETTINGS SYSTEM EDITOR MANAGEMENT OF SYSTEM

User Accounts Logs and Monitoring Banners Certificate Store Certificate Policy Authentication Network Services

Logging Parameters

Log and monitoring x BDEW x IEEE1686 x CS_PH2 x

SYSLOG Parameters

Server address

Server port * 6514

SNMP Parameters

Manager address 1

Manager address 2

Security level * No Authentication, No Privacy

Username

Authentication password

Privacy password

The password must comply to the following rules:

- minimum 8 characters
- maximum 50 characters
- at least 1 uppercase character, 1 lowercase character, 1 digit and 1 special character
- allowed characters are ASCII [33, 122]

* Required fields

Save Cancel

Refer to the CAE User Manual for more information on the Security Log configuration.

Common Authentication Configuration on the CAE

CAE - Security settings: Authentication

EcoStruxure Cybersecurity Admin Expert T300 ApplicationAdmin Schneider Electric

USER ACCOUNTS ROLES SECURITY SETTINGS SYSTEM EDITOR MANAGEMENT OF SYSTEM

User Accounts Logs and Monitoring Banners Certificate Store Certificate Policy **Authentication** Network Services

Authentication Policy

Authentication mode * Local, then centralized

Centralized authentication default role VIEWER

Centralized authentication timeout (s) * 5

Centralized authentication protocol * LDAP

LDAP Protocol

Base DN

Server IP address * 127.0.0.1

Server port * 389

Mapping between AD Groups and RBAC Roles

* Required fields

Save Cancel

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Name	Default	Description
Authentication mode	Local	Indicate the type of authentication used: 1. Local 2. Local then centralized 3. Centralized then local
Centralized authentication default role	VIEWER	Role assigned by default when the centralized access is used and that the role is not given by the centralized authentication protocol server. Available roles: - ENGINEER - INSTALLER - None - OPERATOR - RBACMNT - SECADM - SECAUD - VIEWER
Centralized authentication timeout (s)	5	Maximum time for which an authentication response is expected from each centralized authentication protocol server.
Centralized authentication protocol	LDAP	This field is enabled when the Authentication mode is other than Local . Defines the current protocol used to reach a centralized authentication protocol server. 1. Centralized authentication protocol 2. LDAP NOTE: If the centralized authentication protocol RADIUS or LDAP is selected, then the administrator needs to fill up the Protocol Details section.

Example of RADIUS Settings on the CAE

CAE - Security settings: Authentication

Ecostruxure
Cybersecurity Admin Expert

T300

ApplicationAdmin

Schneider Electric

USER ACCOUNTSROLESSECURITY SETTINGSSYSTEM EDITORMANAGEMENT OF SYSTEM

User AccountsLogs and MonitoringBannersCertificate StoreCertificate PolicyAuthenticationNetwork Services

IP Address192.168.1.84

Port *1812

Shared Secret*****

Backup server IP address

Backup server port *0

Backup server shared secret

Role attribute nameIEC62351-8-RoleID

AOR attribute name

Date attribute name

Attribute separator

Dictionary
ATTRIBUTE User-Name 1 string
ATTRIBUTE User-Password 2 string
ATTRIBUTE NAS-IP-Address 4 ipaddr
ATTRIBUTE NAS-Port 5 integer
ATTRIBUTE Service-Type 6 integer
ATTRIBUTE Reply-Message 18 string
ATTRIBUTE State 24 octets
ATTRIBUTE Class 25 octets
ATTRIBUTE Vendor-Specific 26 octets
ATTRIBUTE Session-Timeout 27 integer
ATTRIBUTE NAS-Identifier 32 string
ATTRIBUTE EAP-Message 79 octets
ATTRIBUTE Message-Authenticator 80 octets
VENDOR IEC-62351-8-D 41912
BEGIN-VENDOR IEC-62351-8-D
ATTRIBUTE IEC62351-8-RoleID 1 string
ATTRIBUTE IEC62351-8-roleDefinition 2 string
ATTRIRI ITC 62351-8-ValidFrom 3 string

* Required fields

SaveCancel

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CAE LDAP Authentication Configuration via CAE

CAE - Security settings: Authentication

Ecostruxure
Cybersecurity Admin Expert

T300

ApplicationAdmin

Schneider Electric

USER ACCOUNTSROLESSECURITY SETTINGSSYSTEM EDITORMANAGEMENT OF SYSTEM

User AccountsLogs and MonitoringBannersCertificate StoreCertificate PolicyAuthenticationNetwork Services

Authentication Policy

Authentication mode *Local, then centralized

Centralized authentication default roleVIEWER

Centralized authentication timeout (s) *5

Centralized authentication protocol *LDAP

LDAP Protocol

Base DN

Server IP address *127.0.0.1

Server port *389

Mapping between AD Groups and RBAC Roles

* Required fields

SaveCancel

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General

Name	Default	Description
Base DN		Domain name of the LDAP server. It defines the base distinguished name (DN) used when searching for users, for example: DN=MyDomain, DC=com.
Server IP address		Server IP address of the domain controller expressed in the classic way of IP address: aaa.bbb.ccc.ddd
Server Port	389	Listening port of the domain controller. It is used by the LDAP server to establish the communication with the Security Application: - TCP and UDP port 389 - TCP and UDP port 636 for LDAPS (LDAP over TLS)
Mapping between AD Groups and RBAC Roles		Configurable menu that enables link between LDAP groups and RBAC roles of T300.

The LDAP groups determine which group corresponds to RBAC role. Below is an example of two customized created groups:

Server port* 389

Mapping between AD Groups and RBAC Roles

Group Names

* Substation Engineer

* Multirole

As

☒ ENGINEER

☐ INSTALLER

☐ OPERATOR

☐ RBACMNT

☐ SECADM

Select one or more options ...

Mapping between AD Groups and RBAC Roles

Group Names

* Substation Engineer

* Multirole

As

☒ INSTALLER

☒ OPERATOR

☐ RBACMNT

☐ SECADM

☐ SECAUD

☒ VIEWER

Add a New Group ⓘ

* Required fields

Save Cancel

Mapping between AD Groups and RBAC Roles

Group Names

* Substation Engineer

* Multirole

Associated Roles

x ENGINEER x

x INSTALLER x OPERATOR x VIEWER x

Add a New Group ⓘ

* Required fields

Save Cancel

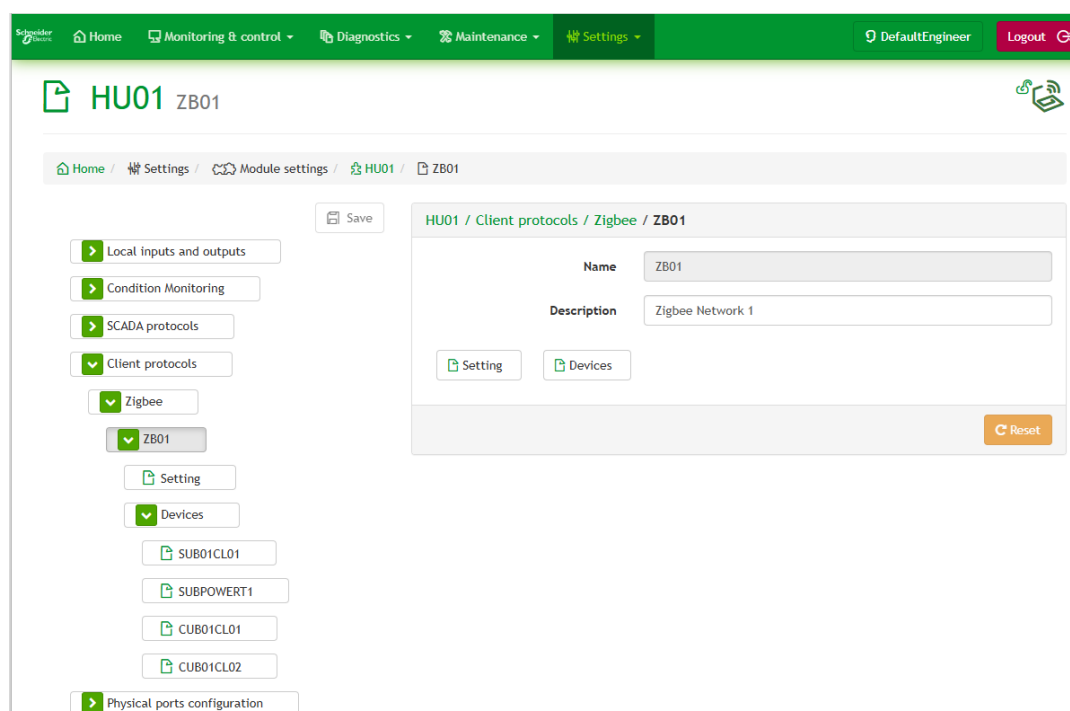
5. PowerTag Rope – R2000

T300 release v2.9.6 includes support of PowerTag Rope R2000, which is a Zigbee energy sensor to measure real-time measurements and energy values.



The sensor is added in a T300 configuration by using Easergy Builder tool (please, check Easergy Builder user manual).

To access to PowerTag Rope definition page, need to go to T300 Web server **Settings > Module settings > HU250 > Client protocols > Zigbee** page:



Setting Zigbee Network Parameters

To configure network parameters, need to go to T300 Web server **Settings > Module settings > HU250 > Client protocols > Zigbee** page, then click **Setting**:

Parameter	Default	Configuration range	Description
Channel	AUTO	- AUTO 11 – 26	Zigbee radio channel configured. AUTO: the channel is selected automatically by K7Z at network creation. NOTE: The change of the radio channel impacts the network creation. To change the channel, you must first unpair all paired devices and create a new network.
Transmission power (db)	7	0 – 7	Transmission power expressed in decibels. Maximum value by default. Can be reduced in some cases, for example to avoid perturbations between different near sites.
Security	YES	- YES - NO	CL110, TH110, R2000 devices are always commissioned with authentication and encryption options.

Setting Zigbee Network Device Parameters

Accessed via **Settings > Module settings > HU250 > Client protocols > Zigbee** page, then click **Devices**.

The **Name**, **Description** and **Type** data for the device is already configured (using Easergy Builder). The sensor ID is also pre-configured, but a Sensor ID can be defined when missing, for example when replacing a sensor.

Parameter	Default	Configuration range	Description
ID	FFFFFFFF	32 bits hexadecimal	Device unique identifier. The value FFFFFFFF is interpreted as "unknown" which means that the device is not configured but it is discovered during the "pairing process".

			NOTE: To pair a PowerTag Rope sensor, it must be powered and showing and orange blinking.
Timeout (seconds)	150 for R2000	120 – 62535	Time in seconds without receiving data to consider that the device is “offline”.

6. Open / Close command for SC150/SC160 modules

From release v2.9.6, open / close pulse commands are implemented in SC150 & SC160 modules.

SC150 affected settings

Parameter	Default	Configuration range	Description
Open command pulse duration (ms)	2,200	50–60,000 (increment = 50)	Definition of the time it takes to send the switch open command polarity (in Fixed width mode).
Close command pulse duration (ms)	2,200	50–60,000 (increment = 50)	Definition of the time it takes to send the switch close command polarity (in Fixed width mode).

SC160 affected settings

Parameter	Default	Configuration range	Description
Open command pulse duration (ms)	2,200	50–60,000 - From 200 in Tripping protection mode (increment = 50)	Definition of the time it takes to send the switch open command polarity (in Fixed width mode).
Close command pulse duration (ms)	2,200	50–60,000 (increment = 50)	Definition of the time it takes to send the switch close command polarity (in Fixed width mode).

The following setting is no longer applicable to SC160.

Name	Description	Type	Unit
MainXSW11_PlsOnTmms_setVal	Main switch control pulse duration	Unsigned int	ms

7. VT Settings for SC160 modules

Voltage sensor parameter settings have been updated from release v2.9.6 for SC160.

To configure VT settings, need to go to T300 Web server **SC0x > Settings > Sensors** page with a CT-LPVT VT board type.

SC01 / Settings / Sensors (SC160)

Current Transformer Voltage Transformer Network characteristics

VT board type: None PowerLogic SC160 CT-LPVT Unknown

VT type: LPVT: Low Power Voltage Transformer (IEC 60044-7)

VT connection mode: 3 phases ABC

L-L nominal voltage: 20000

LPVT or VT Primary rated voltage [3000 V, 36000 V]: 20000

LPVT Secondary rated voltage (V): 3.250

Phase A magnitude correction: 1.00000

Phase B magnitude correction: 1.00000

Phase C magnitude correction: 1.00000

Phase A angle correction: 0.000

Phase B angle correction: 0.000

Phase C angle correction: 0.000

Reset

Parameter	Default	Configuration range	Description
Voltage Transformer			
VT board type	Depends on the model supplied	LPVT	This choice is factory-set as it corresponds to the circuit board specific to each version.
VT- Specific parameter settings			
VT connection mode with PQ	3 phases ABC	3 phases ABC	Choice of the type of connection used for the voltage sensor. The sensor can be wired on a single phase, or between 2 or 3 phases depending on the connection configuration used. The type of voltage measurement performed (with 1, 2 or 3 phases) also depends on the type of connection and mounting of the voltage sensor defined by this parameter.
VT connection mode without PQ	3 phases ABC	3 phases ABC - Single phase A - Single phase B - Single phase C - Line to line AB - Line to line BC - Line to line CA - Vab-Vcb-V0	
VT secondary rated voltage (V)	250.000	50-250 (increment = 0.001)	Definition of the transformer secondary voltage. Must correspond to the characteristics of the transformer used.
VT Adapter magnitude correction phase A	50.600	30-60 (increment = 0.001)	Used to calibrate the phase A measurement taken by the VT adapter to improve accuracy.
VT Adapter magnitude correction phase B	50.600	30-60 (increment = 0.001)	Used to calibrate the phase B measurement taken by the VT adapter to improve accuracy.
VT Adapter magnitude correction phase C	50.600	30-60 (increment = 0.001)	Used to calibrate the phase C measurement taken by the VT adapter to improve accuracy.

NOTICE

RISK OF INCORRECT VOLTAGE MEASUREMENT FOR Vab-Vcb-V0 CONNECTION

When multiple voltage transformers are used, it is important that they have a common earth point, to avoid measurement inaccuracies.

If this is not possible, the Vab-Vcb-V0 connection type must be used, either for Vab-Vcb (metering applications) or for V0 (neutral voltage displacement applications), but not both at the same time.

Failure to follow these instructions can affect measurement accuracy.

8. ANSI 67N update

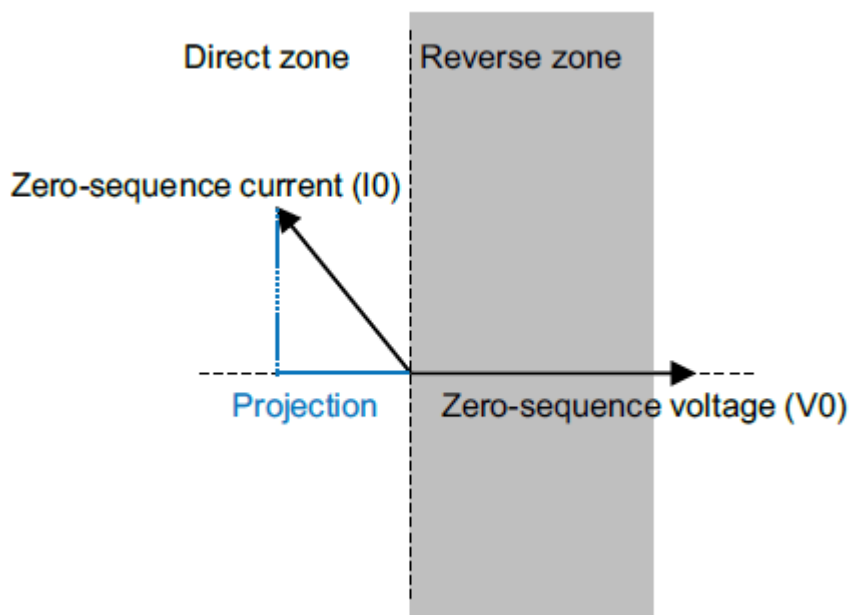
This section includes an update on ANSI 67N implementation specificities, as well as a new available setting for type 2 included in T300 v2.9.6 release.

Detection based on projection of residual current onto residual voltage (Types 1 and 2)

This protection function is suitable for radial feeders in impedant, isolated or compensated neutral systems. The direction of the fault current is determined by projecting the residual current onto the residual voltage during the transient phase. This projection can be detected in 2 distinct zones (see diagram below):

- in the direct zone, if the integral of the projection of I_0 on V_0 is negative
- in the reverse zone, if the integral of the projection of I_0 on V_0 is positive

Principle of projecting the residual current onto the residual voltage to determine the direction of the fault current:



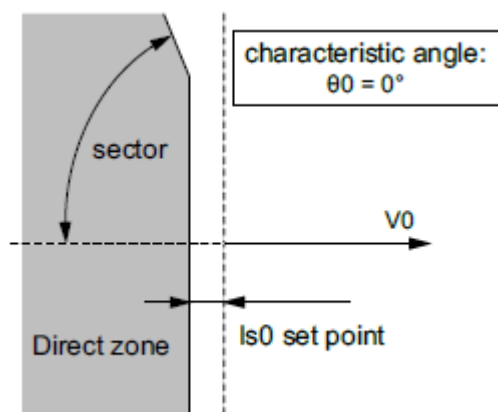
To enable the detection, this projection must reach the threshold defined by configuration, while the residual voltage remains above its threshold for the entire **Operate delay time**. For Type 1, the residual current shall also remain above the configured threshold during this delay, whereas Type 2 relies on the transient current peak. The time delay can be definite time (DT) or inverse time (IDMT), according to the curves indicated in the ANSI 67N characteristics table.

NOTE: For Type 1 algorithm, only Definite Time (DT) operating curve is available.

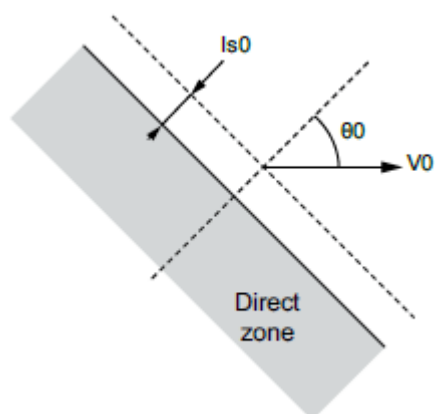
Types 1 and 2 also differ on the available parameters.

- **Type 1:** the function determines the projection of the residual current on the characteristic line, the position of which is determined by the setting of the characteristic angle θ_0 in relation to the residual voltage. When $\theta_0 = 0^\circ$, the **Desensitization area** parameter is used to reduce the detection zone to stabilize it on fault-free feeders

ANSI 67N type 1 operation characteristics for angle $\Theta = 0$:

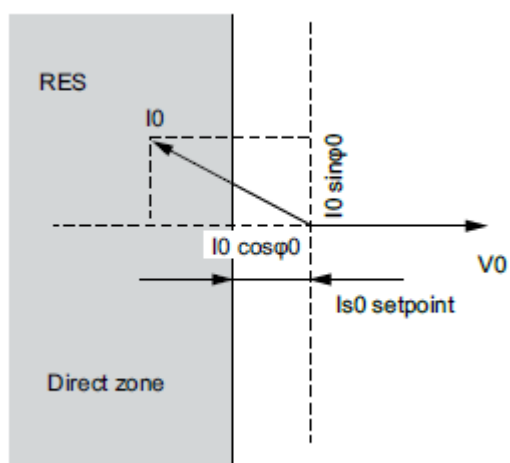


ANSI 67N type 1 operation characteristics for angle $\Theta \neq 0$:

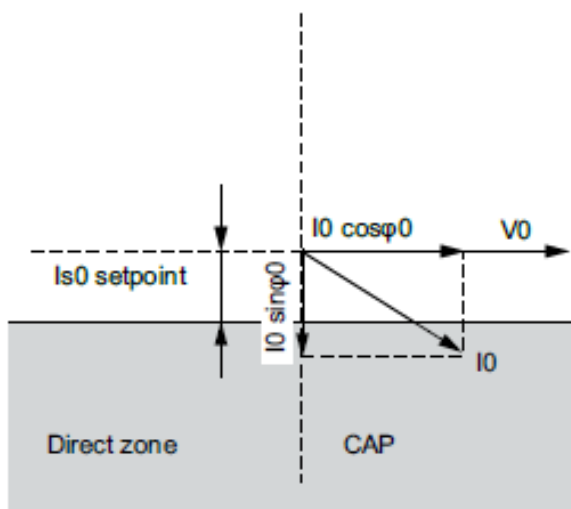


- **Type 2:** the characteristic angle can switch between two values, 0° (Res mode) and 90° (Cap mode), changing the configuration of the **Polarization quantity** parameter.

ANSI 67N Type 2 operation characteristic for Res mode with offset = 0° :



ANSI 67N Type 2 operation characteristic for Cap mode with offset = 0° :



Detection based on the active sector configuration (Type 3)

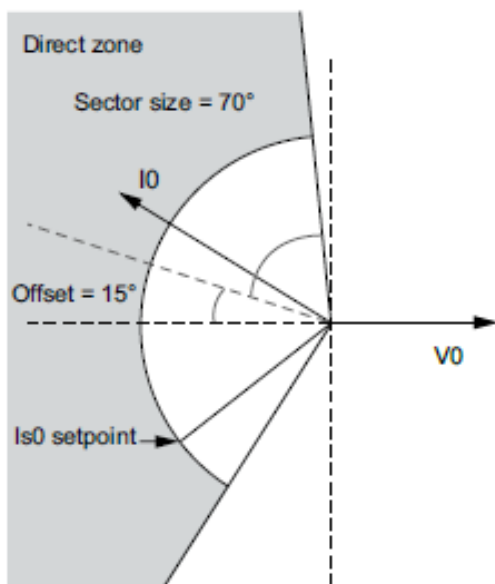
The function operates like an earth fault detection function with an added angular direction criterion: the detection area has the shape of a sector (see diagram below) that can be configured by selecting the angle offset and a sector size with respect to the residual voltage.

The residual current measured or calculated value is compared to the residual current threshold defined in the configuration. The protection function is inhibited for residual voltages below the configured residual voltage and for currents whose phasor lies outside the configured direct zone.

This mode is suitable for closed ring distribution networks with directly earthed/grounded neutral and with a small resistance.

To enable the detection, the residual current must reach the threshold defined by configuration, while the residual voltage remains above its threshold for the entire **Operate delay time** (as for Type 2). This time delay can be definite time (DT) or inverse time (IDMT) according to the curves indicated in the ANSI 67N characteristics table.

ANSI 67N Type 3 operation characteristic:



ANSI 67N Directional Earth (DEfPTOC) Fault Indication Parameter

Note: To ensure consistency with previous firmware versions, the default selection is Type 2 with resistive mode and

an angle offset of 0°. Regarding the new threshold setting (which was not present before), its default value is set to the minimum possible based on the selected CT type.

Parameter	Default	Configuration range	Description
DEfPTOC Common Indication Instance 1 or 2			
I₀ measured	No	- No - Yes	Activation of the I ₀ current measurement by core balance CT for directional ground fault detection. If this option is not enabled, the residual current is calculated by adding the currents from the 3 phase CTs together. NOTE: This parameter is only configurable for a type D connection configuration with core balance CT.
Directional earth fault algorithm	Type 2	- Type 1 - Type 2 - Type 3	Selection of the directional earth fault algorithm.
Threshold value (A)	100	- DT 0.008 I_n – 3.5 I_n for CT = 1 A (*) 0.008 I_n – 1.6 I_n for CT 0 = 5 A (*) - IDMT 0.008 I_n – 1 I_n (**) (increment = 0.1)	Minimum threshold for detecting residual fault currents. The current must be detected above this threshold to validate the presence of a fault current. For Type 1 detection, the current shall remain above this value during the entire Operate delay time .
Operate delay time (ms)	100	50 – 300,000 (increment = 1)	Minimum time for which the detected voltage must be greater than the Threshold value Minimum residual voltage threshold to validate the presence of a fault current.
Reset delay time (ms)	0	50 – 300,000 (increment = 1)	Minimum time for which the voltage must pass and remain below the fault current detection threshold to reset the Operate delay time. For the period when the magnitudes are below the threshold, the Operate delay time maintains its value, as long as there is no reset. This time is incremented again if the voltage exceeds the threshold. This reset time is inactive once the fault current has been validated.
Minimum residual voltage threshold (% nominal line voltage)	Instance 1: 10% Instance 2: 20%	2% – 80% (increment = 1)	Minimum value, as a percentage of the nominal voltage (L-L), above which the residual voltage activates fault current detection. The residual voltage must be detected above this threshold (excluding during the transient phase) for a longer time than the Operate delay time to validate the presence of a zero sequence fault current.
(*) : Setting value of Phase CT secondary rated current or Core Balance CT secondary rated current (if I ₀ measured is selected) in SC0x > Settings > Sensors > Current Transformer parameter. (**) : In corresponds to the nominal current at the CT primary (by default I _n = 500 A) or to the nominal current at the core balance CT primary (by default I _n = 500 A) if I ₀ measured option is selected.			

Parameter	Default	Configuration range	Description
Type 1 DEfPTOC Indication Instance 1 or 2 - Specific parameters			
Operating curve type	IEC definite time	IEC definite time	This type of detection only uses the IEC definite time algorithm.
Characteristic angle (degrees)	0°	-45° 0° 15° 30° 45° 60° 90°	Define the orientation of the operation angle.
Desensitization area (degrees)	86°	76° 83° 86°	Define the desensitization area of the protection. Only if Characteristic angle θ ₀ =0°.

Maximum time for memorization (ms)	0	0 – Instantaneous 50 – 300000 (increment = 1)	Maximum time during which the instantaneous bit is memorized.
Minimum residual voltage threshold for memorization (% nominal line voltage)	0	0% – Disable 2% – 80% (increment = 1)	Minimum value of the residual voltage for which the instantaneous bit is memorized.

Parameter	Default	Configuration range	Description
Type 2 DefPTOC Indication Instance 1 or 2 - Specific parameters			
Operating curve type	IEC definite time	- IEC definite time - IDMT - IEC normal inverse time/A - IEC very inverse time/B - IEC extremely inverse/C - IEEE moderately inverse time - IEEE very inverse time - IEEE extremely inverse time	Choice of the type of standardized IEC or IEEE algorithm to apply to the selected instance for detecting directional earth fault currents.
Enable validation checks	Yes	- No - Yes	Activation of the option to add an extra level of validation to fault current acknowledgment. This filter validates the fault current through the presence of minimum current and voltage peaks during the transient phase of the fault current, according to the values defined by the Minimum (blocking) operating peak voltage (% nominal line voltage) and Minimum (blocking) operating peak current (A) parameters below.
Minimum (blocking) operating peak voltage (% nominal line voltage)	Instance 1: 25% Instance 2: 55%	6% – 60% (increment = 1)	Minimum peak value, as a percentage of the nominal voltage, above which the residual voltage peak (during the transient phase of the fault current) enables the optional fault current detection validation function (if the Enable validation checks option is selected).
Minimum (blocking) operating peak current (A)	Instance 1: 15A Instance 2: 70A	Io calculated: 0.015 In – 2.3 In Io measured: 0.01 In0 – 2.3 In0 (increment = 0.1) Minimum: 0.5 A	Minimum peak value of the residual current peak during the transient phase of the fault current used to enable the optional fault current detection validation function (if the Enable validation checks option is selected).
Angle offset (degrees)	0°	-180° – 179° (increment = 1)	Angular displacement, measured clockwise from the residual voltage phasor, which determines the center of the detection sector.

Parameter	Default	Configuration range	Description
Type 3 DefPTOC Indication Instance 1 or 2 - Specific parameters			
Operating curve type	IEC definite time	- IEC definite time - IDMT - IEC normal inverse time/A - IEC very inverse time/B - IEC extremely inverse/C - IEEE moderately inverse time - IEEE very inverse time - IEEE extremely inverse time	This type of detection only uses the IEC definite time algorithm.
Angle offset (degrees)	0°	-180° – 179° (increment = 1)	Angular displacement, measured clockwise from the residual voltage phasor, which determines the center of the detection sector.
Sector size (degrees)	90°	10° – 170° (increment = 1)	Angular width of the directional detection zone, centered on the offset angle. A directional fault is detected when the residual current phasor lies within this angular sector, relative to the residual voltage.

9. SC160 General Characteristics update

The expected tripping performance of the SC160 has been reviewed and validated in accordance with IEC 60255-151/127 standards. As a result, the General Characteristics table has been extended (see below).

Phase fault protection (ANSI 50/51)	Precision of the threshold	$\pm 5\%$ or $\pm 0.01 I_N$, when influences quantities are at rated values
	Reset ratio	$0.935 \pm 5\%$
	Deviations of the Tripping delay for definite time	$\pm 2\%$ or from -15ms to 30ms (1)
	Deviations of the Tripping delay for depending time (IDMT)	$\pm 5\%$ or from -15ms to 30ms (1)
	Instantaneous operation time (for operate time = 0s)	< 50 ms
	Deviations of the Reset delay time for definite time	$\pm 2\%$ or $\pm 30\text{ms}$
	Return time	< 80 ms
	Overshoot definite time	< 30 ms at 2 Is
	Overshoot depending time (IDMT)	< 30 ms at 5 Is
	Response to time varying for dependent time (IDMT)	In compliance with IEC 60255-151
Earth fault protection (ANSI 50N/51N)	Precision of the threshold for I_0 calculated	$\pm 5\%$ or $\pm 0.01 I_N$, when influences quantities are at rated values
	Precision of the threshold for I_0 measured	$\pm 5\%$ or $\pm 0.01 I_{N0}$, when influences quantities are at rated values
	Reset ratio	$0.935 \pm 5\%$
	Deviations of the Tripping delay for definite time	$\pm 2\%$ or from -15ms to 30ms (1)
	Deviations of the Tripping delay for depending time (IDMT)	$\pm 5\%$ or from -15ms to 30ms (1)
	Instantaneous operation time (for operate time = 0s)	< 50 ms
	Deviations of the Reset delay time for definite time	$\pm 2\%$ or $\pm 30\text{ms}$
	Return time	< 80 ms
	Overshoot definite time	< 30 ms at 2 Is
	Overshoot depending time (IDMT)	< 30 ms at 5 Is
	Response to time varying for dependent time (IDMT)	In compliance with IEC 60255-151
Directional phase fault protection (ANSI 67)	Precision of the threshold	$\pm 5\%$ or $\pm 0.02 I_N$, when influences quantities are at rated values
	Reset ratio	$0.935 \pm 5\%$
	Accuracy of the angle sector	$\pm 2^\circ$
	Deviations of the Tripping delay for definite time	$\pm 2\%$ or from -15ms to 30ms (1)
	Deviations of the Tripping delay for depending time (IDMT)	$\pm 5\%$ or from -15ms to 30ms (1)
	Instantaneous operation time (for operate time = 0s)	< 90 ms (it takes into account the 40 ms confirmation time)
	Deviations of the Reset delay time for definite time	$\pm 2\%$ or $\pm 30\text{ms}$
	Return time	< 80 ms
	Overshoot definite time	< 30 ms at 2 Is
	Overshoot depending time (IDMT)	< 30 ms at 5 Is
	Response to time varying for dependent time (IDMT)	In compliance with IEC 60255-151
Directional earth fault protection (ANSI 67N)	Precision of the threshold for I_0 calculated	$\pm 5\%$ or $\pm 0.02 I_N$, when influences quantities are at rated values
	Precision of the threshold for I_0 measured	$\pm 5\%$ or $\pm 0.01 I_{N0}$, when influences quantities are at rated values
	Reset ratio	$0.935 \pm 5\%$
	Precision of the polarization voltage threshold	$\pm 5\%$ or $\pm 0.01 V_N$, when influences quantities are at rated values
	Accuracy of the angle sector	$\pm 2^\circ$
	Deviations of the Tripping delay for definite time	$\pm 2\%$ or from -15ms to 30ms (1)
	Instantaneous operation time (for operate time = 0s)	< 65 ms
	Deviations of the Reset delay time for definite time	$\pm 2\%$ or $\pm 30\text{ms}$
	Return time	< 80 ms
	Overshoot time definite time	< 30 ms at 2 Is

Neutral overvoltage (ANSI 59N)	Precision of the threshold	$\pm 5\%$ or $\pm 0.01 V_N$ when influences quantities are at rated values
	Reset ratio	$0.93 \pm 5\%$
	Tripping delay definite time	$\pm 2\%$ or from -15ms to 30ms
	Instantaneous operation time (for operate time = 0s)	< 50 ms
	Deviations of the Hold delay time	$\pm 2\%$ or from -15ms to 105ms (it takes into account the Return time)
	Return time	< 60 ms
	Overshoot time definite time	< 30 ms at 2 Is
(1) If H2 restraint is enabled, the tripping time is delayed by 12 ms.		
Power Supply		
Power consumption		< 2 VA