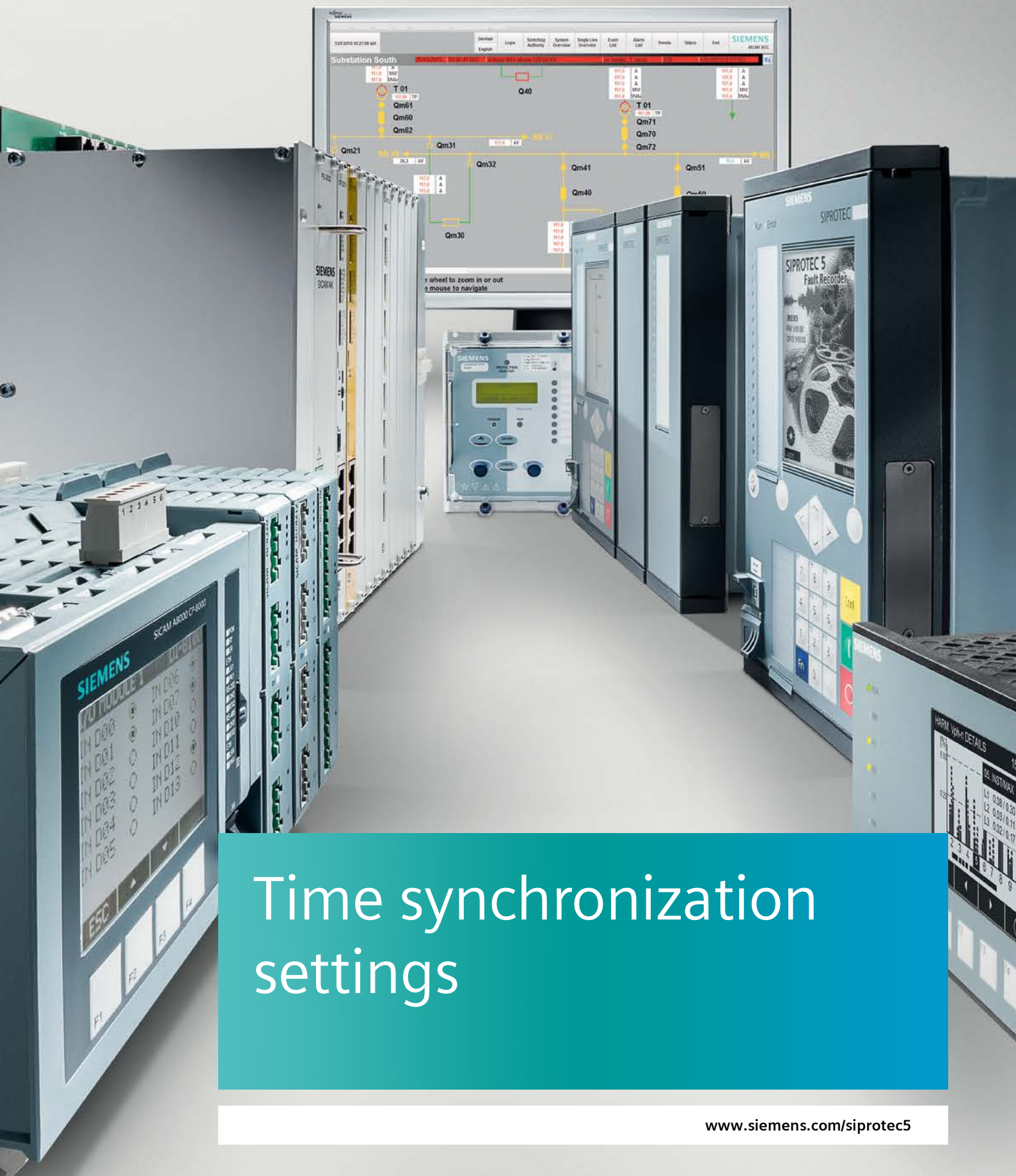


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Time synchronization settings

SIPROTEC 5 Application

Time synchronization settings

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Time synchronization settings

APN-022, Edition 2

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1 Time synchronization settings

1.1 Introduction

SIPROTEC 5 devices can be time synchronized by one or two time sources (TS1 – Time Source 1, TS2 – Time Source 2). TS1 normally will be used, if one time source is available. The TS2 is set to 'None'. If TS1 fails, the internal clock of the device will be used.

If an independent redundant time source TS2 is available and the TS1 is lost, the device switch over to TS2. TS1 will be interrogated and the device switches over to TS1, when it is back again. During failure of TS1, TS2 will be used. If TS2 also fails, the internal time is used.

This application provides a brief summary of the time source settings for SIPROTEC 5 devices and describes special rules for time sync. protocols.

Additional information to set the time settings are described in the chapter 14.4 of the manual „DIGSI 5 Online help“.

1.2 Time source editor

Time source settings can be done only with DIGSI 5. DIGSI 5 provides the TS – editor where TS1 and TS2 can be set depending on the available time sources. Following time sources are possible:

PortG: IRIG-B – This electrical input (port G) on the rear side of the device provides time settings over IRIG-B, telegrams receiving from an external GPS-receiver. High precision time sync. with a pulse per second (PPS) is also supported. Settings for PPS are done in the individual applications using the PPS (e.g. differential protection). Time zone setting is local or UTC (recommended).

PortG: DCF77 – This electrical input (port G) on the rear side of the device provides time setting with DCF77 telegrams (central Europe specific) receiving from a DCF77 receiver. Time zone setting is local. If the time receiver provides summer – winter time switch over, then **Switch daylight sav. time** must be activated in the device.

None - No time sync. for TS1 or TS2. It is normally used for TS2, if only one TS is available.

For test purposes TS1 can be set to None and TS2 is the redundant time source. The time then is used from TS2 for testing the TS2 without influence of TS1. Afterwards the TS1 must be activated again.

Port (E,F,J,N,P):Ch1_or_Ch2:protocol – If the time synchronization is done via protocol (e.g. SNTP for IEC 61850), the port / channel configured with this protocol can be used as time source.

Depending on the protocol UTC or local must be set: SNTP use UTC – time. IEC 60870 protocols use local.

A SNTP – server can also be used for DNP 3 and IEC60870-5-104 instead of synchronization from a protocol master station with the specific protocol.

PI – (PI: Protection Interface) TS is another device (a so called timing master). Local device is connected via a protection interface to this timing master. In such PI – constellation the timing master is set by the lowest device address. The time from the remote device is used (value 1 is the index of the timing master).

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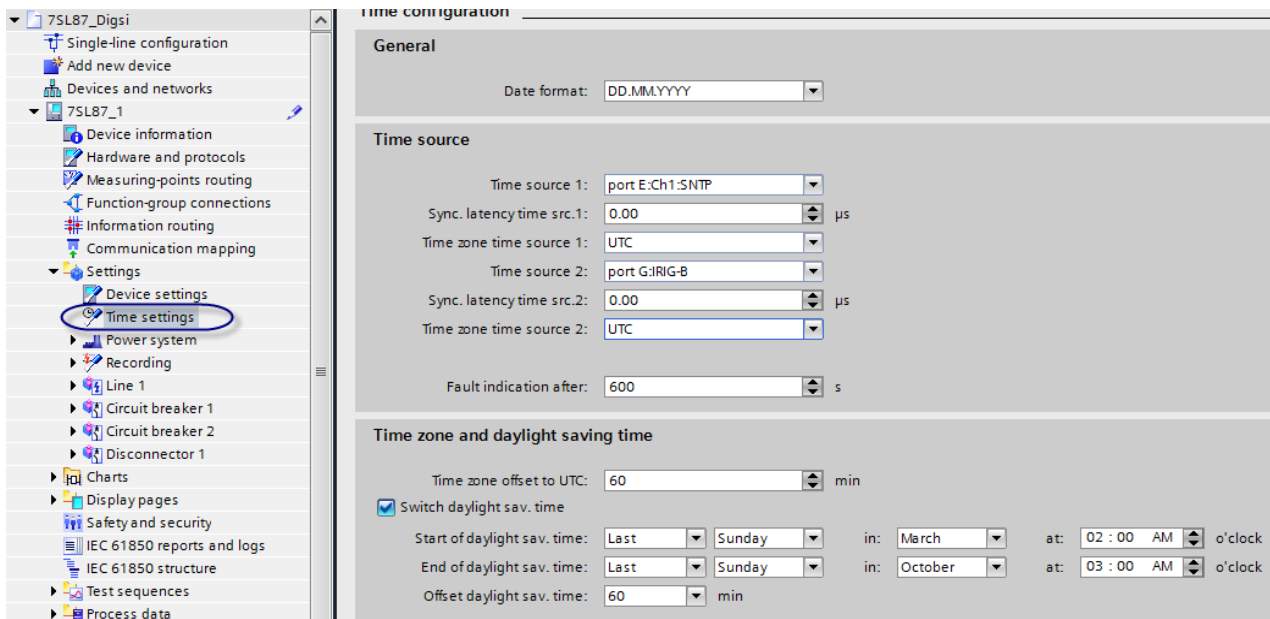


Figure 1: Time source editor in DIGSI 5 for the time settings

1.3 Settings for the protocols

1.3.1 Settings for IEC 60870-5-103

If IEC 60870-5-103 (T103 – protocol) is used for time sync., it must be set as TS1. If another redundant TS will be used, it must be set as TS2 (e.g. portG: DCF77). Time zone must be local. The other way around is not possible.

1.3.2 Settings for SNTP together with Ethernet based protocols

If IEC 61850, DNP 3 TCP, IEEE C37.118PMU or IEC 60870-5-104 is used as main protocol and SNTP is activated for time synchronization, two time servers are allowed in this network. They are not treated as TS1 and TS2. Redundant SNTP for one Ethernet module is treated as TS1 or TS2. The IP – addresses of time server 1 and time server 2 are set in the SNTP – settings for this protocol, see figure 2.

Time zone must be UTC.

Example: If IEC 61850 protocol is configured to port E (an Ethernet module) and SNTP is activated, two IP – addresses can be set for SNTP time servers (see figure 2). If time server IP – address is set to 0.0.0.0 only the time from server 1 will be used (in this case IP-address 192.168.100.200). If IP – address for TS2 is unequal to 0.0.0.0 time from server 2 will be used, if server 1 fails. We can use two SNTP – servers as TS1. Fig. 1 show that in this case **portG: IRIG-B** can be used as TS2 additionally. → 3 time sources are available. (It is not an error if we cannot activate TS2 for the redundant SNTP time server.)

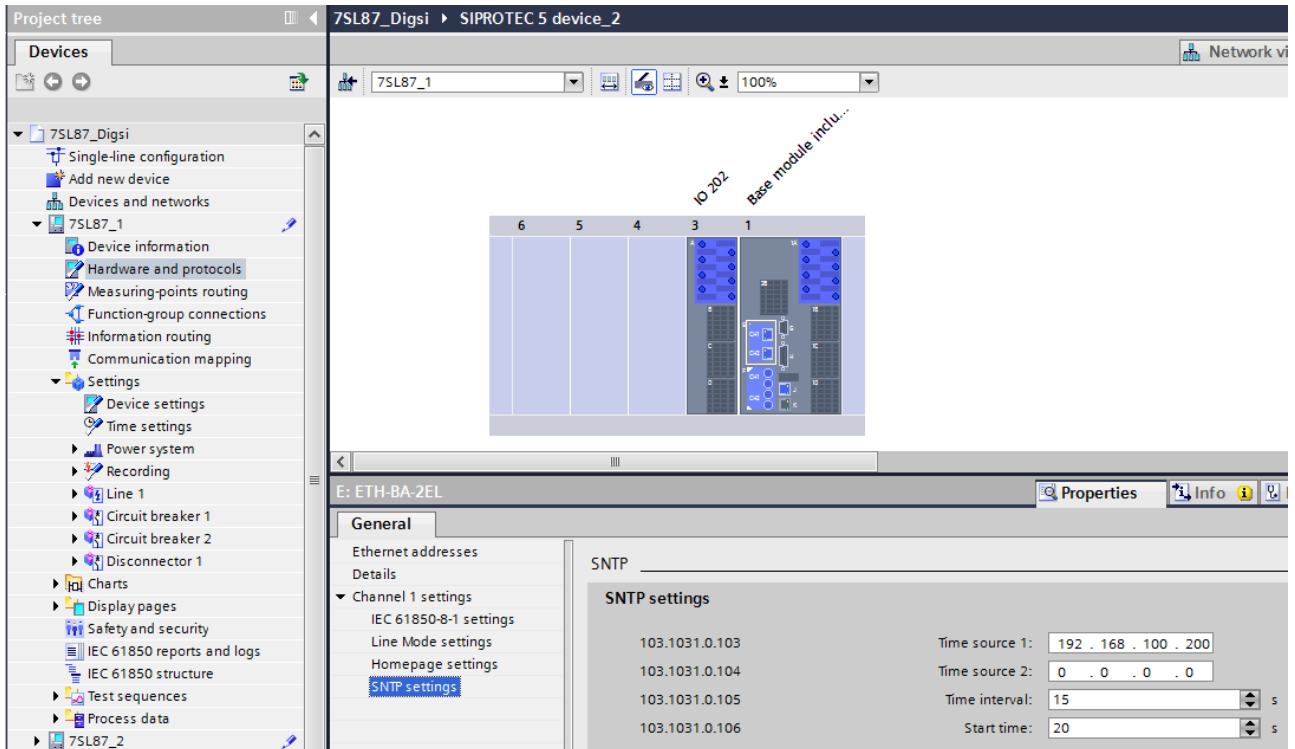


Figure 2: Time server settings for SNTP together with Ethernet based protocols

1.3.3 Settings for DNP 3 (two time source settings!)

If DNP 3 protocol is used as time source, the time zone to be set in the protocol settings. The same time source (local or UTC) to be used in the TS – editor as selected in the protocol settings. This is valid for DNP 3 TCP over Ethernet and the serial DNP 3 protocol over an USART – module.

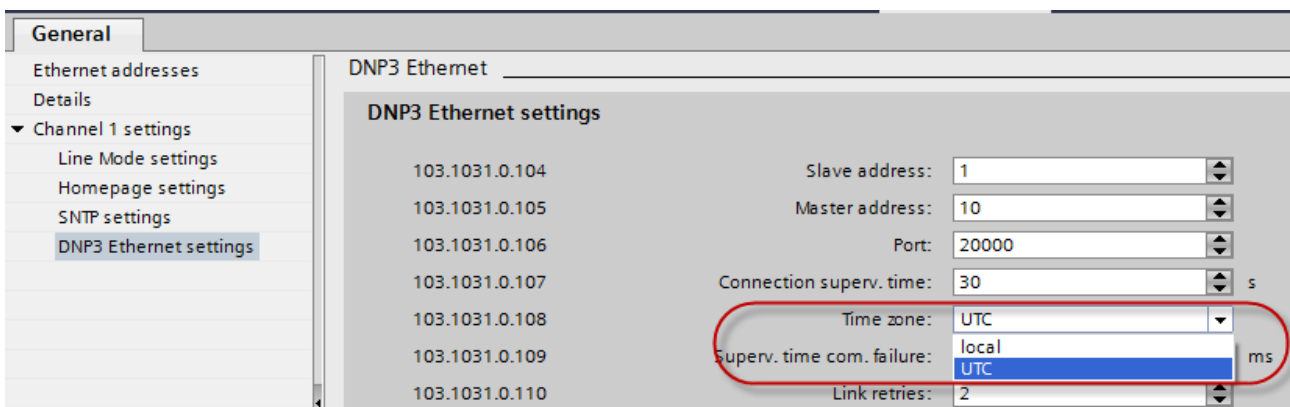


Figure 3: Time zone settings for DNP 3 (here for DNP 3 TCP over Ethernet)

1.3.4 Settings for IEC 60870-5-104 with redundant master stations

If IEC 60870-5-104 protocol is used on an Ethernet module, two master stations are allowed (redundant approach). If this protocol is used for the time sync. (can be selected as TS1 or TS2 in the TS – editor) of the SIPROTEC 5 device, the time from master 1 is used. If master 1 fails or a switching over to master 2 occurs, master 2 provides time sync. telegram over T104. This redundant T104 solution is treated as TS1 or TS2.

If for TS1 IEC 60870-5-104 - protocol is selected, we can use e.g. SNTP as TS 2. SNTP again can be redundant with two time server.

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1.3.5 Settings for IEEE 1588 protocol (accuracy 1µs)

For using the IEEE 1588 protocol, it has to be activated on the Ethernet module (as shown in Figure 4). No further settings are required, but activating the homepage can provide useful information for evaluation. The IEEE 1588 protocol must be selected as time source in order to evaluate the synch telegram from the Grandmaster Clock and for the use for synchronization. The device is configured in the time zone UTC.

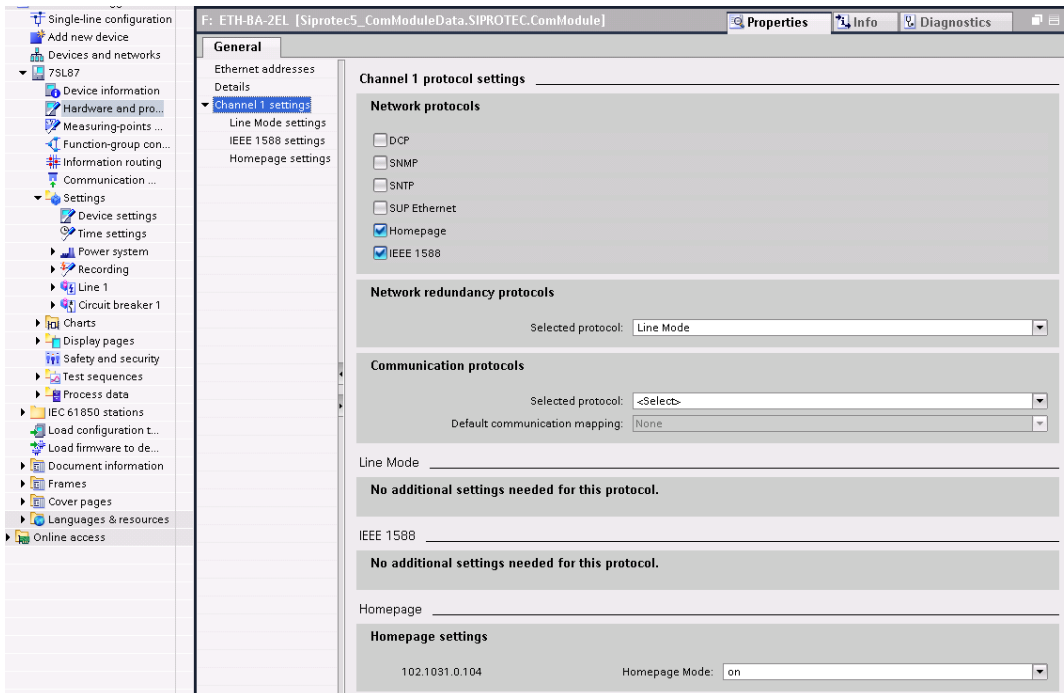


Figure 4: Hardware and protocol

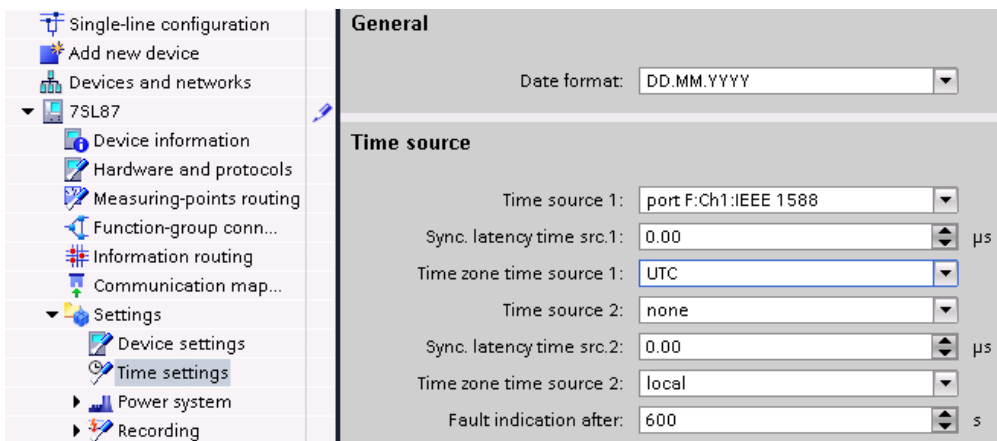


Figure 5: Time settings

The application note APN-028 provides further details of the time synchronization with IEEE 1588, e.g. also the settings of the Grandmaster Clock.

1.4 Summary

Time synchronization is an important property and must be performed with high accuracy. Time synchronization can occur through 1 or 2 timers. Depending on the time source, precision of 1 ms up to 1 µs can be attained.

SIPROTEC 5 devices generally support redundant time synchronization.

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