

Processing IEC 60870-5-104 Commands

Description

IEC 60870-5-104 protocol allows commands to be sent in one of two formats: with time and without time. This includes single, double, regulating step, set point, and bit string commands. The type identifications for commands without time are from 45 to 51. The type identifications for commands with time are from 58 to 64.

In order for commands with time to be useful, the controlled and controlling stations must have synchronized clocks, although the synchronization accuracy is not critical. A rough synchronization on the order of several seconds is usually adequate.

The purpose of commands with time is to protect against messages that might be significantly delayed in network communication equipment such as store-and-forward devices. Each controlled station has a configured time-stamp accuracy it applies when receiving a command. Time in the command message is compared against the device's time source. The command is ignored if the difference is greater than the configured maximum accuracy. The assumption is that the command has been delayed in network equipment and is no longer valid. When a command is rejected because of a time error, no response is sent.

IEC 60870-5-104 controlled stations are allowed to accept either commands without time (45 to 51) or commands with time (58 to 64), but must not accept both.

IEC 60870-5-101 protocol provides the same functionality as IEC 60870-5-104, except 60870-5-101 operates over serial lines. Since there are no store-and-forward delays in serial networks, the set of "with time" commands are not needed and are therefore not part of the IEC60870-5-101 protocol. That protocol uses only the "without time" command set.

SPT Properties

Properties defining the acceptable set of command type identifications are contained within two properties at the IEC 60870-5-101/104 protocol node. Properties for the SPT operating as a controlled station (From Master) and as a controlling station (To RTU) are independent and set at the corresponding IEC 60870-5-101/104 nodes.

The properties are *ControlMode* and *ControlDiscard*.

CU1BalanceClass2	Background Scan
COTClass1	Spontaneous
COTClass2	Spontaneous
COTExecuteInhibit	0
COTSelectInhibit	0
CauseSize	1
CommonAddressSize	1
ControlDiscard	600000
ControlMode	Default 101, No-Time 104, With-Time
DataLinkSize	Default 101, No-Time 104, With-Time
Direction	No-Time
ExecuteTimeout	With-Time

ControlMode has three settings:

- **Default** uses “Without Time” commands with IEC 60870-5-101 and “With Time” commands for IEC 60870-5-104
- **No-Time** uses the “Without Time” commands for both protocols
- **With Time** uses the “With Time” commands for both protocols

ControlDiscard is used when processing commands with time. It defines the difference, in milliseconds, between the time in the command message and time in the SPT. If the difference is greater than or equal to the configured value, then the control is discarded. If the difference is less, the control is processed.

This property is used only in the “FromMaster” direction for commands received with time. It is not used in the “ToRTU” direction and it is not used for command types without time.

Time Synchronization

In order to correctly process commands with time, the SPT4-NET must have the correct time.

Commands with time will be rejected if received before the SPT has determined the correct time.

The SPT can obtain the time from one of three sources.

Protocol Time Synchronization

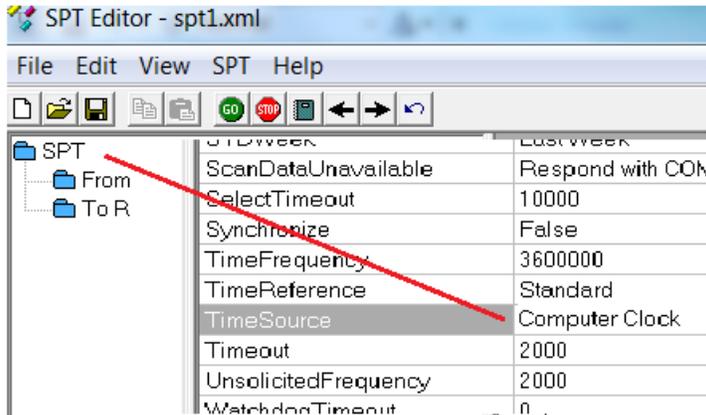
The first way is to receive a time synchronization message via the protocol. An IEC 60870-5-104 controlling station may or may not support transmission of time synchronization messages. A time synchronization message sent over a network is not as accurate as one sent with IEC 60870-5-101 protocol over a serial line. The IEC specification states:

The clock synchronization procedure defined in IEC 60870-5-5 cannot be used in this standard because the link layer according to IEC 60870-5-2, which provides the exact time of sending the clock command, is no longer available. However, clock synchronization may be used in configurations where the maximum network delay is less than the required accuracy of the clock in the receiving station.

Since a highly accurate time is not required for command time verification, protocol time synchronization could be used for this purpose. Protocol time synchronization is a preferred method, but it is necessary to verify that this is supported by the controlling station.

Computer Clock

SPT software comes in two forms. SPT4-NET software operates in a SPT4-NET box. This hardware has no computer clock, so the **Computer Clock** option cannot be used with an SPT4-NET. SPT-PC software operates in a Windows PC. In this case, time can be obtained from the PC’s computer clock by setting the **TimeSource** property in the SPT editor at the SPT node.



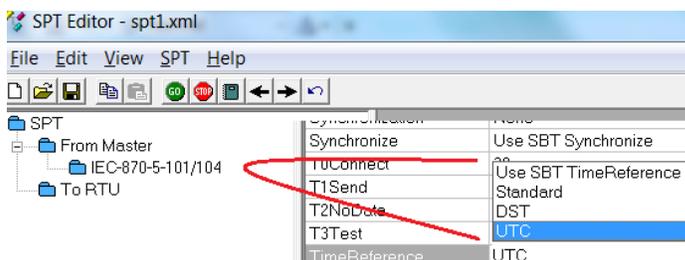
NTP

The SPT can also obtain time from an NTP server by setting the *TimeSource* property described above to NTP. In this case, the IP address of one or more NTP servers must be entered into the *NTPServers* property. Multiple server addresses are separated by commas.

UTC Time

The SPT must also be told if times in commands received from the controlling station are in *Standard* local time or *UTC*. This is configured into two properties: *TimeReference* and *LocalTimeBias*.

The *TimeReference* property is located at both the SPT node and the IEC 60870-5-101/104 node in the FromMaster direction. It must be set to *Standard* or *UTC*.



The *LocalTimeBias* property is at the SPT node and is set to the difference between the local time zone and UTC. The offset is in minutes from UTC time. UTC time equals the local time plus the *LocalTimeBias*. For example, the *LocalTimeBias* for New York would be 300 (5 hours * 60 minutes). The *LocalTimeBias* for Paris would be -60 (- 1 hour * 60 minutes).

Errors

When there is a mismatch between the configured command property and a command received from the controlling station, the SPT logs the error:

Request Function Invalid

This means one of the following conditions occurred:

- A command was received without time when time was required, or
- A command was received with time when time is not required.