IEC 61850 communication solutions for SIMATIC
IEC 61850 is a standard protocol. It is designed to ensure easy integration and interoperability between electrical systems.

Customers prefer it over vendor specific communication protocols.

The following slides give an overview of the products and solutions available from Industry solutions.
Motivation
Why IEC 61850 and SIMATIC?

Reduction of Investment Costs
- Only one system for process and electrical equipment saves hardware, engineering cost
- Fewer hardwired signals
- Future proof investment due to international standard

Reduction of Operational Costs
- Fewer operators, closer cooperation between process and electrical
- One maintenance view for all the equipment -> integrated maintenance strategies
- Higher plant availability

Energy savings
- One system provides process and electrical data resulting in transparency. Potential improvements can easily be found and implemented.
- Optimization of energy consumption to reduce energy cost
Overview
Technical concept

IEC 61850 MMS
- client WinCC channel
- server devices

IEC 61850 TCP/IP

S7 communication

SIMATIC OS server
WinCC

OS clients

client WinCC channel

client blocks

IEC 61850 MMS

S7-400
S7-400H
S7-300

OS clients

WinCC

OS server

SIMATIC

S7 communication

IEC 61850 TCP/IP

server devices
Overview
Technical concept

Gateway communication library

Redundant IEC 61850 MMS client gateways

IEC 61850 MMS server devices

OS clients

SIMATIC OS server WinCC

S7-400H

S7-400

S7-300

S7 communication

IEC 61850 MMS

IEC 61850 TCP/IP

OS clients

WinCC

S7 communication

Redundant IEC 61850 MMS client gateways

IEC 61850 MMS server devices

IEC 61850 MMS client gateways

IEC 61850 MMS server devices

IEC 61850 MMS

IEC 61850 TCP/IP
Client blocks
Technical concept

- One protocol block per IEC 61850 device organizes communication
- Subsequent blocks represent data points or specific device
- Device faceplates (SIPROTEC)
- Preconfigured Engineering only in NetPro and CFC

IEC 61850 communicating field devices

IEC 61850 TCP/IP

S7-400H

OS clients

SIMATIC OS server
WinCC

DIGSI 4 Engineering station i.e. DIGSI
Client blocks
Block concept

- **Protocol block**
  handles communication
  included in 9AE4110-2AB00 and 9AE4110-2AA00

- **Tag blocks**
  individual blocks for read/write of tags for various
data types included in 9AE4110-2AB00 and
  9AE4110-2AA00

- **Device blocks**
  Preconfigured blocks representing one IEC 61850
device (i.e. SIPROTEC 7SJ62) including faceplate
  included in 9AE4110-2AA00.
  Device blocks have fixed tag configurations,
  additional tag blocks can be used to adapt to specific
  requirements device blocks are sold per device
  family/series (e.g. SIPROTEC family) For example,
  the SIPROTEC device library contains blocks for
  7SJ61, 6SJ6x, 7UM6x, … If you need a device that’s
  not in the library yet, we add if free of charge. Same
  applies to ABB and Areva device families. You have
  to purchase one license for each device family
  (currently only SIPROTEC family available)

- The order numbers apply for S7-300 and
  S7-400 blocks
Client blocks
Product features

- IEC 61850 MMS clients library
- 8 devices per S7-400H and S7-300, 16 devices per standard S7-400; higher device numbers possible but not recommended
- Less than 1 s update cycle depending on CPU resources
- Reporting of up to 10 tags with original time stamps from IEC device to Operator Station
- Standard blocks including WinCC faceplate for SIPROTEC and other device families available, also in APL Look&Feel
- Easy engineering with standard PCS 7 or STEP 7 tools
- Preconfigured SIPROTEC device blocks
- Easy configuration of project specific variables
- Reading of individual variables with time stamp
- Diagnostic functions
- Redundancy (S7-400H)
Client blocks
Use cases

- Small size systems with few devices per S7-CPU
- Connect SIMATIC automation stations with IEC 61850 devices
- Automation program needs access to device data or needs to control devices
- Mixture of process automation and power control application in one automation system
- Fast integration of a few IEC 61850 devices
Client blocks
System requirements

- 1 TCP/IP connection per device (configured in NetPro)
  2 TCP/IP connections per device for S7-400H (configured in NetPro)

- Memory requirements
  Once: 80 kB work memory for code
  Per device: 50 kb work memory for data

- Cycle time requirements
  between 3 - 10 ms cycle time per device in S7-400 CPUs
  up to 20 ms cycle time per device in S7-400H CPUs
  up to 25 ms cycle time per device in S7-300 CPUs

- For system design please use: IEC_cycletime_calculation.xls
WinCC channel
Technical concept

- WinCC channel for IEC 61850 communication
- IEC 61850 MMS client
- Wizard to import tags from device configuration files (ICD file) to WinCC
- Online import directly from device into WinCC
- 256 communication partners
- MMS Read, MMS Write, Reporting (original device time stamps in WinCC through reporting)
## Reports from IED's

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WinCC channel
Features and use case

- Max. 256 IEC 61850 MMS devices
- Import wizard for data and events
- Configuration import directly from device into WinCC
- Buffered reporting (original device time stamps in WinCC alarm logging)
- Scalable from 20 to 256 devices per server
- Redundancy
- Preconfigured symbols and faceplates (planned)

The WinCC channel is used when only HMI application and no automation is required.
WinCC channel
System requirements

- 1 TCP/IP connection per device
- Windows XP - SP3 (Required .NET Framework 3.5)
  Windows Server 2003 - SP2 (Required .NET Framework 3.5)
- Disk Space: 30MB free disk space.
- Free USB Port
- Standard network card
- WinCC 7.0 or higher
Communication Gateway
System overview

- Full integration into PCS 7
- Redundancy
- PCS 7 CFC library
- Minimum engineering in PCS 7 required
- Almost no engineering in gateway (only network connections)
- Easy adaption to SIPROTEC configuration changes

IEC 61850
IEC 61850 TCP/IP

Redundant
IEC 61850 MMS client gateway

SIMATIC
OS server
WinCC

OS clients

S7-400H

IEC 61850 Communication blocks
Communication Gateway Reporting

- SIPROTEC reports in WINCC with original SIPROTEC time stamp
- Freely configurable engineering with CFC Library
- Easy assignment between alarm and tag

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Engineering station z.B. DIGSI

DIGSI 4

IEC 61850 TCP/IP

Redundant IEC 61850 MMS client gateway

IEC 61850 Communication blocks

SIMATIC OS server WinCC

OS clients

S7-400H
Communication Gateway

Features

- One gateway supports 128 IEC 61850 MMS devices
- 8 S7-400 or S7-400H can communicate with one gateway
- Less than 1 s update cycle depending on CPU resources
- Reporting with original time stamps from IEC device to Operator Station
- Communication blocks including WinCC faceplates for SIPROTEC and other device families available, also in APL Look&Feel
- Easy engineering with standard PCS 7 or STEP 7 tools
- Standard S7 communication between gateway and S7/CPU's (BSEND/BRCV)
- No “gateway engineering” - all engineering is done in CFC
- Easy configuration of project specific variables
- Reading of individual variables with time stamp
- Extensive diagnostic functions
- Redundancy
Communication Gateway

Use case

- Medium to large scale applications with a large number of devices
- High communication requirements (performance)
- Flexibility in device configuration
- Gateway is used when network separation is required between SIMATIC stations and electrical communication network
- Integration of electrical control system and process control system into one system architecture
- Automation program needs access to device data or needs to control devices
Communication Gateway
System requirements

- 1 S7 connections per gateway (configured in NetPro)
  4 S7 connections per redundant gateway for S7-400H (configured in NetPro)

- Memory requirements for communication blocks (per S7 CPU)
  Once: 80 kB work memory for code
  Per device: 50 kb work memory for data

- Cycle time requirements
  between 1 - 2 ms cycle time per device in S7-400 CPUs
  up to 20 ms cycle time per gateway in S7-400H CPUs

- 2-3 Process Objects per device (in PCS 7)
## Selection overview

<table>
<thead>
<tr>
<th>IEC 61850 MMS Client</th>
<th>Blocks</th>
<th>WinCC Channel</th>
<th>Gateway CM104</th>
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<tr>
<td>Monitoring</td>
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<td>Operating</td>
<td>X</td>
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<td>Automation</td>
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<td>X</td>
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<td>Number devices</td>
<td>8 per CPU</td>
<td>256 per server</td>
<td>128 per CM104, 8 S7 CPUs per CM104</td>
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<td>Update speed</td>
<td>1-2 sec*</td>
<td>200 ms</td>
<td>1-2 sec*</td>
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<td>Reporting</td>
<td>10 tags</td>
<td>unlimited</td>
<td>unlimited</td>
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* Update speed depends on various factors: communication resources of CPU, number of devices, number of tags, redundancy
### Pricing structure

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<td><strong>IEC61850 client standard library:</strong></td>
<td>1.850 €</td>
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<tr>
<td>Communication block library for S7-300 / S7-400 / S7 meC reading incl. time stamps and writing of IEC 61850 tags Documentation German/English</td>
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<td>Order No.: 9AE4110-2AB00</td>
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*German/English documentation included.*
### Pricing information

**IEC 61850 WinCC channel**

#### Pricing structure

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<td><strong>IEC61850 WinCC channel MMS Client:</strong> License for one Server WinCC V7.0 and higher up to 20 IEC61850 devices USB Dongle</td>
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<td><strong>IEC61850 WinCC channel MMS Client:</strong> License for one Server WinCC V7.0 and higher up to 256 IEC61850 devices USB Dongle</td>
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The IEC 61850 protocol is still developing. Vendors of relays don’t implement all parts of the protocol or use different mechanisms, data structures. Due to the variety of possible configurations and requirements involved the CM104 for IEC 61850 MMS communication is quoted on a project specific base.
Overview
IEC 61850 Server blocks

IEC 61850 MMS server devices

IEC 61850 MMS server blocks

S7 communication

IEC 61850 TCP/IP

Non SIMATIC system

OS clients

OS clients

SIMATIC OS server WinCC

S7-300

S7-400H

S7-400
Server blocks
Technical concept

- Server block library for data exchange with IEC 61850 MMS clients
- Preconfigured engineering only in NetPro and CFC
Server blocks
Features

- IEC 61850 MMS Server library
- Accepts one IEC 61850 client per function block instance
- Supports following service models:
  Application association: MMS-Initiate, MMS-Conclude, MMS-Reject, MMS-Identify
  Data: MMS-Read, MMS-Write
- Amount of tags: Up to 100 tags can be read/written
- XML-description of device included (for the client to import)
- Easy engineering with standard PCS 7 or STEP 7 tools
- Diagnostic functions
- S7-300 and S7-400
- Redundancy (S7-400H)
Server blocks

Use cases

- Distributed systems automated with SIMATIC CPUs that are required to communicate with a supervisory system (i.e. for power control)
- Applications where IEC 61850 is required and SIMATIC is used for automation
- Data exchange of a few values using IEC 61850 MMS
Pricing information

SIMATIC ↔ IEC 61850 Server block

Pricing structure

- **IEC61850 server library:** 4.250 €
  Communication block library for S7-300 / S7-400 / S7 meC
  reading incl. time stamps and writing of IEC 61850 tags
  Documentation German/English

Order No.: 9AE4110-8AA00
Contact

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Thank you for your attention!