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Siemens S7 Interface Reference

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EPDOC-X130-en-431A	431	0	February 2015

Disclaimer

Contents

Planning considerations for installing and configuring Siemens S7 controllers

This reference describes how to set up, configure, and test Siemens S7 controllers.

Revision history

Revision	Date	Description
A	February 2015	Initial release of document.

How to use this guide

Complete each step before commencing the next step.

Steps	Go to
Set up the controller and network	Communication settings for Siemens S7
Set up the server	Setting up the server
Use Quick Builder to define channels	• Siemens S7 channel and controller reference • "Build channels" topic in the *Quick Builder User's Guide*
Use Quick Builder to define controllers	• Siemens S7 channel and controller reference • "Build controllers" topic in the *Quick Builder User's Guide*
Download channel and controller definitions to the server	"Downloading items" topic in the *Quick Builder User's Guide*
Test communications	Testing Siemens S7 communications with the server
Use Quick Builder to define points	Siemens S7 points reference

Related topics

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"Architectures for Siemens" on page 9
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"Siemens S7 points reference" on page 21

Devices supported by the Siemens S7 interface

The server supports Siemens S7 series controllers, as listed in the following table.

Controller Model	Communications Processor Card
TI-505 series	CP 1434 TF
S7-300	CP 343-1
S7-400	CP 443-1

The server requires a CP 1613 card.

The server supports the following versions of Siemens CP 1613 drivers:

- Please consult the Software Change Notice.

Attention

Not all memory addresses exist on all controller types. Refer to the Siemens documentation for detail on what addresses are available for each type.

Other documentation for Siemens

For details on configuring Siemens controllers, refer to the Siemens SIMATIC NET Electronics Manuals CD-ROM.

Siemens-specific terms

Application association	A logical link between the communications processor (CP) card in the server and the CP card in a controller.
CP card	Communications processor card. Each Siemens controller, as well as the server, requires a CP card.
VFD	Virtual Field Device. A VFD is a logical link between the CP card in the server and the CP card in the controller. The server uses the VFD to address the controller, and to acquire and control its data.

Architectures for Siemens

The following figure shows the basic architecture.

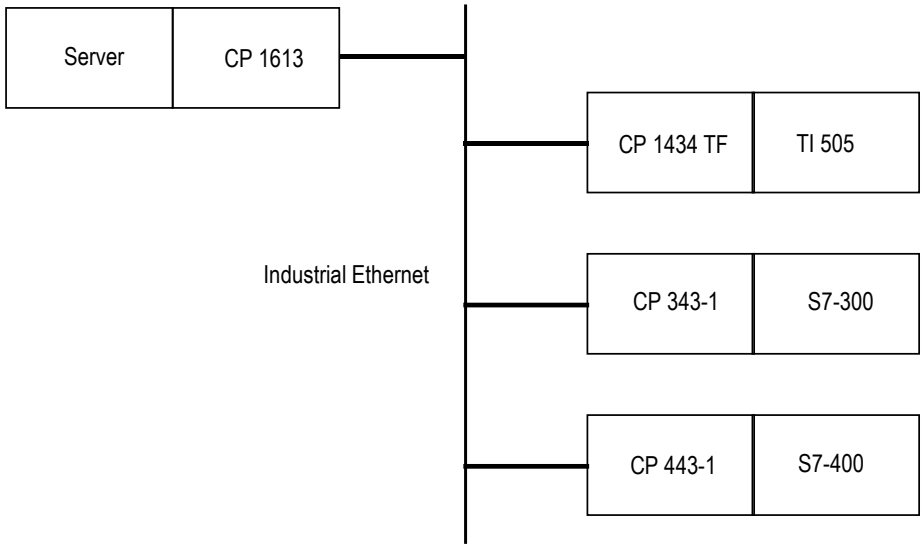

Figure 1: Siemens S7 architecture

Attention

The Siemens S7 interface does not support multiple CP1613 communication processor cards in the server.

The CP1613 communication processor card in the server can only be used for S5 or S7 communication, not both. If you have both S5 and S7 series controllers, you should use the OPC interface instead of the Siemens S7 interface.

You can build multiple controllers on a single controller, each using their own connection in the Siemens software. However, you cannot configure redundant links to Siemens controllers.

Communication settings for Siemens S7

You must install the appropriate communications module in each Siemens controller and assign a MAC (hardware) address for each card. The controllers communicate with the server via an Ethernet LAN compliant with IEEE 802.3.

When working with an S7 controller, use the Siemens Step7 software with the NCM S7 optional package installed to assign the Ethernet address.

Refer to the Siemens documentation for details.

Setting up the server

You need to install and configure the CP 1613 card in the server. Refer to the appropriate Siemens documentation for details.

Multiple CP 1613 cards in the server

The server can use only one CP 1613 card. This card can support S7 communications. The Siemens S7 interface can have multiple channels using one card.

Reserving memory for dual-port RAM

The Siemens manual refers to using a free memory area as dual-port RAM to avoid memory conflicts. However, this is not possible on DELL computers.

When adding any plug-in cards, check that there are no memory conflicts.

Memory hole

The Siemens manual refers to enabling a memory hole—do not do this.

Configuring the communications processor database

Generate the communications processor database with the COML S7 program.

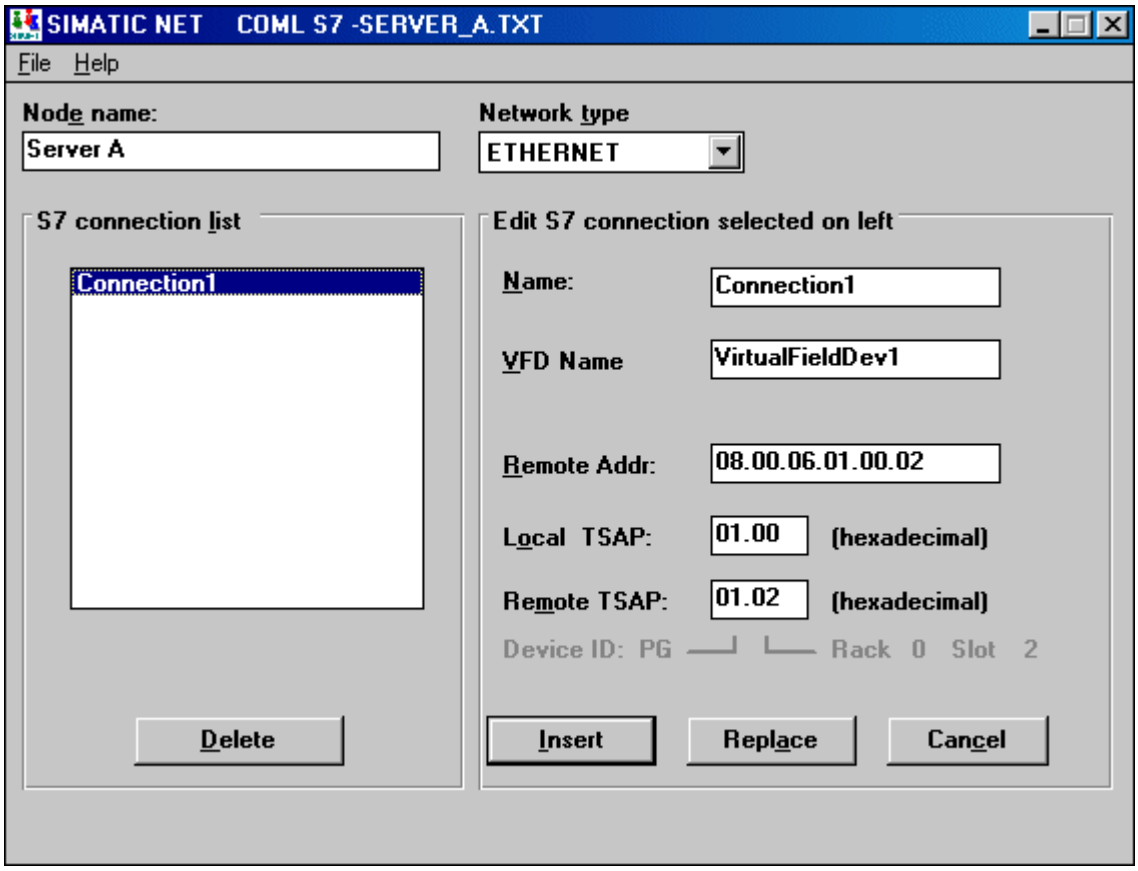

Figure 2: Typical database settings for an S7 controller

Property	Description
S7 connection list	A Connection is a representation of a single link to a configured VFD. The server architecture supports only one connection per VFD.
VFD Name	A Virtual Field Device (VFD) is a logical link between the CP card in the server and the CP card in the controller. The server uses the VFD to address the controller, and to acquire and control its data. 18 characters maximum. Typically, you configure one VFD for each controller on the network. However, you can define multiple VFDs for a controller to segregate the points built on a single controller into logical groups. This does not affect the bandwidth requirements of point scanning. You can configure a maximum of 3 VFDs per physical controller.
Remote Addr	The Remote Address is the address of the CP card in the controller, as configured in the Siemens software.
Local TSAP	Always configure the Local TSAP as *01.00*.
Remote TSAP	Configure the Remote TSAP for the rack and slot number of the CPU module in the physical device. The server communicates with this CPU using the configured VFD and Connection names.

Symbolic addresses

The server communicates with the controller using Siemens symbolic addresses. These addresses specify the location and type of data to be acquired or controlled in the controller.

Finalizing the database

Once you have generated the database, save it in both text and binary forms. The text form gives you a base for future modifications, while the binary format is loaded by the CP card on system startup.

Siemens S7 channel and controller reference

This section describes the configuration and addressing information specific to Siemens S7 channels and controllers.

In addition to the information contained in this reference, and for help to build channels and controllers, see the section titled "Building controllers or channels" in the *Quick Builder User's Guide*.

Related topics

“Main properties for a Siemens S7 channel” on page 16
“Main properties for a Siemens S7 controller” on page 18
“Optimizing Siemens S7 scanning performance” on page 19
“Planning considerations for installing and configuring Siemens S7 controllers” on page 5

Main properties for a Siemens S7 channel

The Main tab defines the basic properties for a Siemens S7 channel.

For information about how to create a channel, see the topic titled "Building controllers and channels" in the *Quick Builder User's Guide*.

Property	Description
Name	The unique name of the channel. A maximum of *10* alphanumeric characters (no spaces or double quotes). Note: In Station displays, underscore characters (_) appear as spaces.
Description	(Optional) A description of the channel. A maximum of *132* alphanumeric characters, including spaces.
Marginal Alarm Limit	The communications alarm marginal limit at which the channel is declared to be marginal. When this limit is reached, a high priority alarm is generated. To change the priority of the alarm system wide, see the topic titled "Configuring system alarm priorities" in the *Server and Client Configuration Guide*. To change the priority of the alarm for one channel, see the topic titled "About configuring custom system alarm priorities for an individual channel or controller" in the *Server and Client Configuration Guide*. A channel barometer monitors the total number of requests and the number of times the controller did not respond or response was incorrect. The barometer increments by two or more, depending on the error, and decrements for each good call. To calculate an acceptable marginal alarm limit, use the formula: Square root of the number of controllers on the channel × Marginal Alarm Limit defined on those controllers (Normally, you specify the same value for all controllers on a channel). For example, if there are 9 controllers on the channel and their Marginal Alarm Limit is set to *25*, the value would be *3* (which is the square root of 9) *x 25 = 75*.
Fail Alarm Limit	The communications alarm fail limit at which the channel is declared to have failed. When this barometer limit is reached, an urgent alarm is generated. To change the priority of the alarm system wide, see the topic titled "Configuring system alarm priorities" in the *Server and Client Configuration Guide*. To change the priority of the alarm for one channel, see the topic titled "About configuring custom system alarm priorities for an individual channel or controller" in the *Server and Client Configuration Guide*. Set this to double the value specified for the channel Marginal Alarm Limit.
Diagnostic Scan Period	The period, in seconds, between diagnostic scans that verify communications integrity with the controller. The default value is *60* seconds. The diagnostic scans continue even if a controller is marked as failed, thus enabling the system to detect return-to-normal communications. If there are multiple controllers configured on a channel, the diagnostic scan rate should be set to *60* seconds multiplied by the number of controllers on that channel. For example, if there are five controllers configured on the channel, the diagnostic scan rate should be set to *300* seconds. Diagnostic scans occur at the set scan rate per controller. Therefore, with five controllers and a default value of *60* seconds, the diagnostic scans will occur every *12* seconds.
Device Name	The device name of the Siemens CP 1613 card. Normally, *CP_H1_1:*.
Item Type	The type of channel specified when this item was created.
Last Modified	The date and time the channel properties were modified.
Last Downloaded	The date and time the channel was last downloaded to the server.

Property	Description
Item Number	The unique item number currently assigned to this channel, in the format *CHNcc*, where *cc* is the channel number. You can change the item number if you need to match your current server database configuration. The number must be between *01* and the maximum number of channels allowed for your system. For more information about setting the maximum value, see the topic titled "Adjusting sizing of non-licensed items" in the *Supplementary Installation Tasks Guide*.

Main properties for a Siemens S7 controller

The **Main** tab defines the basic properties for a Siemens S7 controller.

For information about how to create a controller, see the topic titled "Building controllers and channels" in the *Quick Builder User's Guide*.

Property	Description
Name	The unique name of the controller. A maximum of *10* alphanumeric characters (no spaces or double quotes). Note: In Station displays, underscore characters (_) appear as spaces. For LAN–connected controllers, the name is used to look up the IP address in the TCP/IP database if you do not specify an **IP Address** property.
Description	(Optional) A description of the controller. A maximum of *132* alphanumeric characters, including spaces.
Associated Asset	The Tag Name of the Asset to be associated with the alarm group.
Channel Name	The name of the channel on which the controller communicates with the server. (You must have already defined a channel for it to appear in this list.)
Marginal Alarm Limit	The communications alarm marginal limit at which the controller is declared to be marginal. When this limit is reached, a high priority alarm is generated. To change the priority of the alarm system wide, see the topic titled "Configuring system alarm priorities" in the *Server and Client Configuration Guide*. To change the priority of the alarm for one controller, see the topic titled "About configuring custom system alarm priorities for an individual channel or controller" in the *Server and Client Configuration Guide*. A controller barometer monitors the total number of requests and the number of times the controller did not respond or response was incorrect. The barometer increments by two or more, depending on the error, and decrements for each good call. The default value is *25*.
Fail Alarm Limit	The communications alarm fail limit at which the controller is declared to have failed. When this barometer limit is reached, an urgent alarm is generated. To change the priority of the alarm system wide, see the topic titled "Configuring system alarm priorities" in the *Server and Client Configuration Guide*. To change the priority of the alarm for one controller, see the topic titled "About configuring custom system alarm priorities for an individual channel or controller" in the *Server and Client Configuration Guide*. Set this to double the value specified for the controller Marginal Alarm Limit. The default is *50*.
Connection	The name of the connection that the server uses to communicate with the controller.
VFD Name	The name of the Virtual Field Device that the server uses to communicate with the controller.
Item Type	The type of controller specified when this item was created.
Last Modified	The date and time the controller properties were modified.
Last Downloaded	The date and time the controller was last downloaded to the server.
Item Number	The unique item number currently assigned to this controller, in the format *RTUnnnnn*. You can change the item number if you need to match your current server database configuration. The number must be between *01* and the maximum number of controllers allowed for your system. For more information about setting the maximum value, see the topic titled "Adjusting sizing of non-licensed items" in the *Supplementary Installation Tasks Guide*.

Optimizing Siemens S7 scanning performance

Siemens S7 scan packets contain up to 19 addresses, due to limitations in packet size that can be sent to the S7 controller.

Since the fastest scan rate specified within a variable is always used for all points referencing the variable, it is important to match scan rates of the elements within a variable.

Try to make each packet as close to the maximum size as possible. Ensure there are no small packets being scanned at fast rates.

If more than one parameter references the same address in a controller, only one scan packet entry is created. If the parameters do not have the same scan rate, the scan entry will be created for the faster of the scan rates for those parameters.

If two points reference the same address but have different scan rates, the server only scans the address at the fastest scan rate.

You verify your scanning strategy by using the List Scan utility, **lisscn**, to list the scan packets you have built. See the *Server and Client Configuration Guide* for usage of **lisscn**.

Siemens S7 points reference

This section describes how to configure points for a Siemens S7 controller using Quick Builder.

In addition to the information contained in this reference, and for help to build points, see the section titled "Building and configuring points" in the *Quick Builder User's Guide*.

Related topics

“Defining a Siemens S7 address for a point parameter” on page 22
“Address syntax for Siemens S7 controllers” on page 23
“Planning considerations for installing and configuring Siemens S7 controllers” on page 5

Defining a Siemens S7 address for a point parameter

For **PV Source Address**, **Source Address**, and **Destination Address,** the format for a Siemens controller address is:

ControllerName Address

Part	Description
ControllerName	The name of the Siemens controller.
Address	The address within the controller where the value is stored.

For help when defining an address, click ... next to **Address** to display Address Builder.

Address syntax for Siemens S7 controllers

The format for the address is:

Variable [B:*BitNumber*|*DataFormat*]

Part	Description
Variable	The name of the variable configured in the controller's CP card.
BitNumber	(Only applicable to status points.) The valid range is 0 (default) to 15, where 0 is the right most bit in the register. The number of bits used for the point parameter is implicit and is determined by the width of the parameter.
DataFormat	(Only applicable to Analog point parameters.) Explicit data formatting is not required when defining S7 variable names because the name implicitly contains the data format. You can override automatic data formatting by explicitly specifying the format, but this practice is not recommended. Only override a data format as a last resort and check that the server retrieves the desired format before forcing the data format for any other point parameters.

Supported symbolic addresses

The server uses the Siemens SAPI-S7 interface for device communications. Consequently, the server accesses S7 addresses in accordance with valid S7 symbolic addresses. Refer to the Siemens document, *S7 Programming Interface*, for details.

The following table lists example symbolic address names supported by the server, and indicates whether you can override the default data format. The examples are only valid if the S7 controller has been configured with appropriate data areas and/or peripherals.

Address Examples	Default Data Format	Point Type(s)	Data Format Override Possible
DB2,INT4 DI2,INT4	S16B	Analog	Yes
DB1,DINT8 DI1,DINT8	S32B	Analog	Yes
DB1,B1 DB2,BYTE2 DI1,B1 DI2,BYTE2	U8B	Analog	Yes
DB1,W10 DB1, WORD1 DI1,W10 DI1, WORD1	U16B or bit position	Status/Analog	Yes (Analog)
DB1,D4 DB1,DWORD4 DI1,D4 DI1,DWORD4	U32B	Analog	Yes

Address Examples	Default Data Format	Point Type(s)	Data Format Override Possible
DB2,REAL12 DI2,REAL12	IEEEFP	Analog	Yes
DB1,X14.2 DI1,X14.2	Bit position	Status	No
Z1	U32B	Accumulator	No
C1	U32B	Accumulator	No
T5	U32B	Accumulator	No
A5	U32B or bit position	Status (Source Only)/Analog	No
E5	U32B or bit position	Status (Source Only)/Analog	No
MB1,1	U8B	Analog	Yes
MB1,2	U16B	Analog	Yes
MW2,2	U32B	Analog	Yes
MD4,1	U32B	Analog	Yes

Attention

The number specifying the location in the data block (for example, *DB1,B***1**, *DB2,REAL***5**, *MW2,***1**) is always the byte offset into the data block. In the case of *DB1,DINT4*, the number *4* is the byte offset into data block *1* and not a double word offset.

Address declarations can overlap. For example, *DB1,W0* and *DB1,B1* share the same lower byte and *DB1,DWORD0* contains both *DB1,W0* and *DB1,B1*.

When using the address format *DB1,X14.2*, no bit position can be specified since the last digit (*2* in this example) is the bit position. All other status points must specify the starting bit position by using the syntax *B:x*, where *x* is the bit position. The following example shows how to specify reading from bit 1 of the S7 symbolic address *DB1, WORD3*.

Example

This example shows a PV source address for the controller SMNSTA1

```
SMNSTA1 DB1,WORD3 B:1
```

Data formats

User-defined data formats are not supported for the Siemens S7 interface.

Data Format	Description	Scaled by Server Range
S8B	–128–127	Yes
S16B	–32768–32767	Yes
S32B	–2147483648–2147483647	No
U8B	0–255	Yes
U16B	0–65535	Yes
U32B	0–4294967296	No
IEEEFP	Single-precision floating point	No

Troubleshooting Siemens S7 controllers

This section describes troubleshooting tasks for Siemens S7 that you can perform either on the server or from any Station.

Related topics

“Testing Siemens S7 communications with the server” on page 26
“Troubleshooting Siemens S7 point configuration errors” on page 27
“Diagnostic failures on Siemens S7 controllers” on page 28

Testing Siemens S7 communications with the server

You use the diagnostic utility, **sms7tstd**, to test communications between the Siemens S7 controller and the server, and to verify the Siemens variable addressing syntax. Note that the utility uses Siemens rather than server point names.

The utility does not make any assumptions regarding the format of points read from the controller. All values are shown in hexadecimal, decimal, and floating point representation. Depending on the point address, one or more of these may not be relevant. The length and error variables are values returned from the Siemens S7 API.

Attention

Do not run **sms7tstd** while the server is running because it will interfere with the operation of the server. (The system services must be stopped, but the server database and daemon services must be running.)

To run the sms7tstd utility

1. Open a Command Prompt window.
2. Type `sms7tstd` and press ENTER.
3. Follow the directions as prompted. Note that you should access menu items sequentially. (Warning messages are generated if a selected menu item is not currently available.)

Related topics

“Planning considerations for installing and configuring Siemens S7 controllers” on page 5

Troubleshooting Siemens S7 point configuration errors

Incorrectly configured points may reveal themselves in one of two ways.

- Errors while downloading Quick Builder point definitions to the server.

  If points are configured with illegal configuration details this may cause problems when they are downloaded to the server. If this occurs read the *xxxx.out* file created and correct the errors.

- Errors when scanning

  If points are built with variables that are not configured in the controller, they will not be reported as errors until the server attempts to acquire data from those points. They will be evident by the point detail showing a bad value (indicated by inverse video). Error messages about these points are printed in the error log. If this occurs, the points should be checked for references to variables that are not configured within the controller.

  If all the points built against a particular controller are bad and this controller fails, the configuration of this controller might be incorrect. Verify that the VFD and Connection are defined in the controller.

Diagnostic failures on Siemens S7 controllers

The server performs a diagnostic scan once a minute to confirm communications with the S7 controller. This diagnostic relies on the existence of the timer point "T1" in the controller. If this point is not configured, the diagnostic will fail and the associated channel will get errors and possibly fail. To prevent this, ensure that the S7 variable "T1" can be read from the controller using the Siemens Monitor-Modify Variables program included with the Step7 software.

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- Send an email to security@honeywell.com.

  or

- Contact your local Honeywell Process Solutions Customer Contact Center (CCC) or Honeywell Technical Assistance Center (TAC) listed in the “Support and other contacts” section of this document.

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