

SIP Parameter Access for ctrlX DRIVES

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Platform	TIA Portal V14
Controller	S7-300, S7-1200 & S7-1500
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1. Introduction

Sercos over Internet Protocol (SIP) allows accessing certain services of Bosch Rexroth Drives over TCP and UDP frames. The function blocks explained in this document use these services to read and write drive parameters over SIP using TCP. The read/write operations are carried out asynchronously and are non-real time.

Note: The function blocks/ Application described here serve merely as examples, i.e., Bosch Rexroth does not assume any warranty for any possible compatibility problems arising in connection with future control units. Moreover, the user does not have any claim to servicing and/or extension of the published function blocks/ applications.

2. General Information

2.1 Supported Drives

The following Bosch Rexroth drives are supported.

- ctrlX DRIVES – firmware versions AXS03xx and above
- IndraDrive C/M/Cs with SIP interfaces – firmware versions MPx7 and above; MPx17 and above

2.2 System Overview

A possible connection between the Siemens PLC and drives can be seen in the image below.

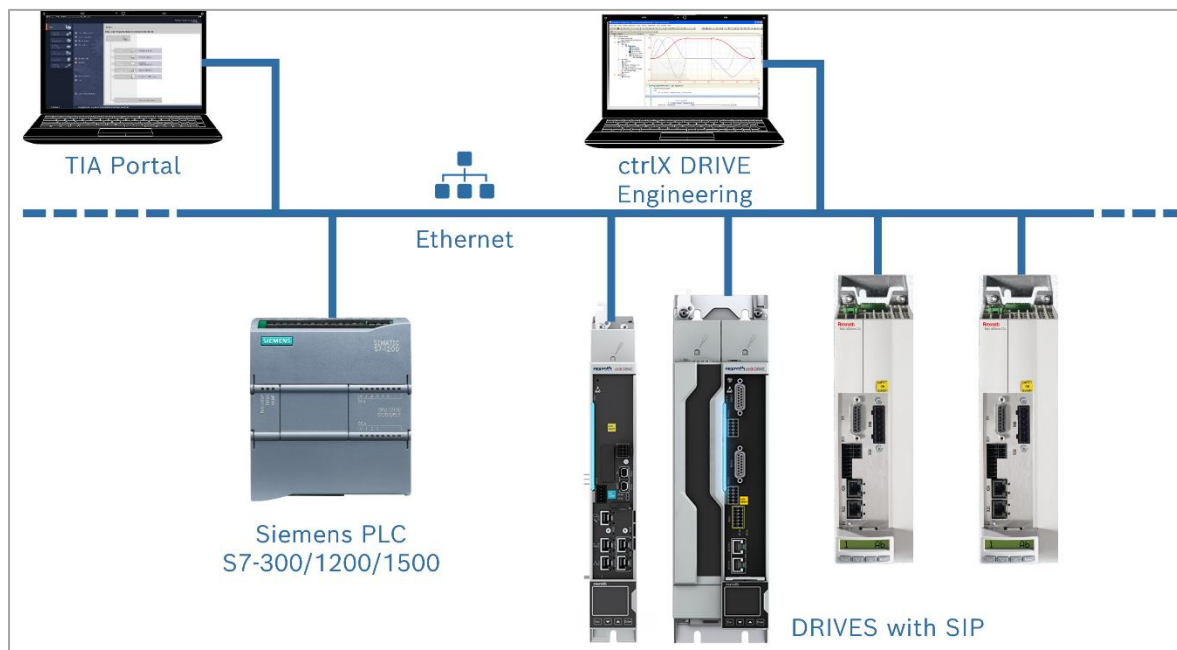


Fig-1: System overview

3. Hardware Configuration in Siemens PLC

There is no special configuration needed in the Siemens PLC. The PLC must have an Ethernet interface (built-in port or add-on Eth module) which supports TCP/IP communication. The corresponding device ID of the interface must be provided to the *LocalDeviceID* input of the *SIP_Connect* function block.

Multiple drives can be connected over SIP, if they are accessible by the PLC over their IP addresses. When the PLC and drives are part of different networks (different subnets), proper routing must be setup for the PLC to access the drives.

The following image shows a configuration, where the built-in PN port is used for TCP communication.

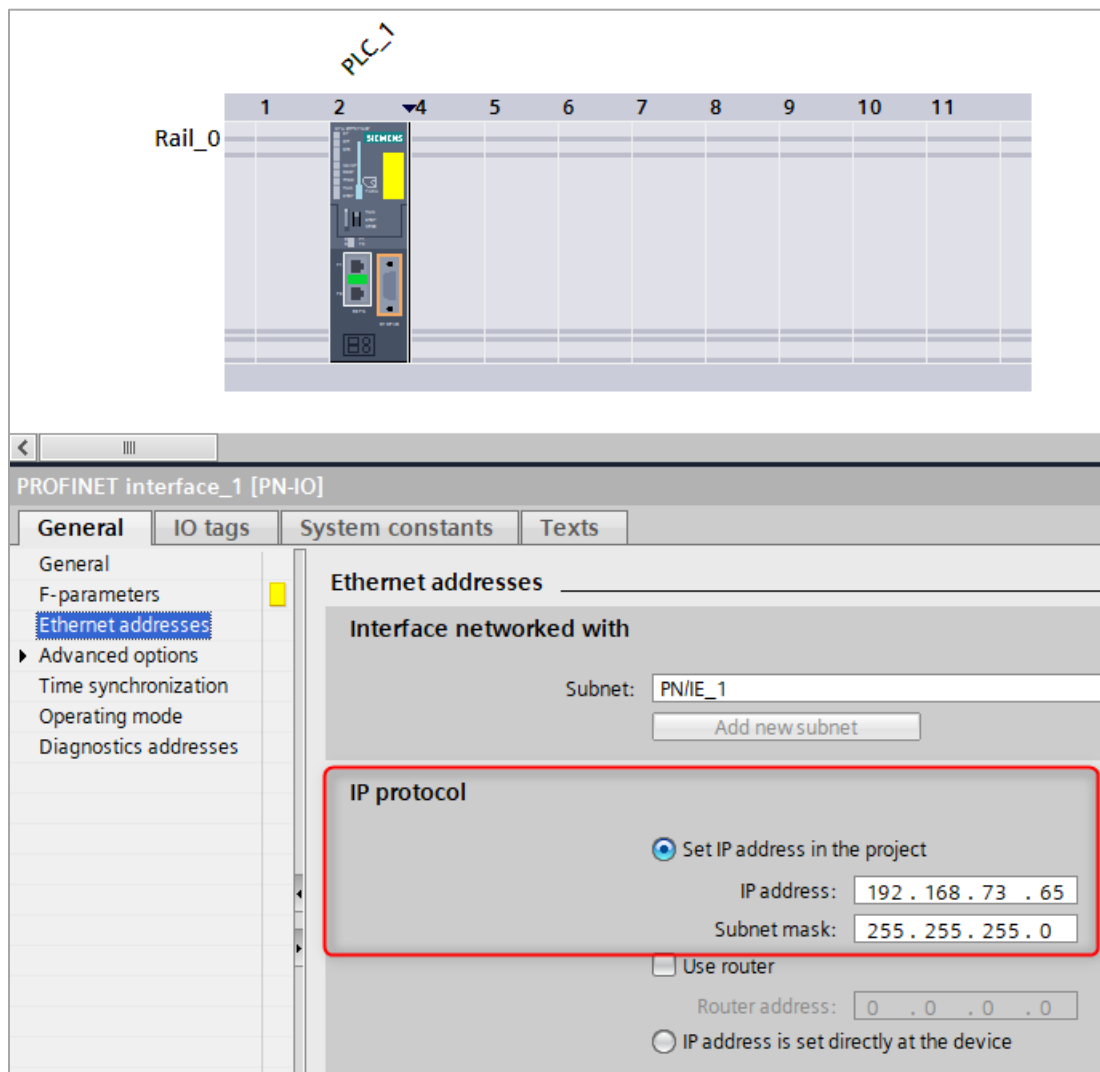


Fig-2: Hardware configuration in TIA Portal

4. Hardware Configuration in Drives

The drives can be configured with any Ethernet based master communication, as SIP can be used in all *Multi-Ethernet* configurations including *Master Communication Not Active*.

In case of EtherCAT, respective mailboxes must be enabled in the drives, so they are accessible through their virtual IP addresses.

The following image shows a sample configuration of a drive with respect to PLC configuration shown in Fig-2.

Engineering Port (X26) Allgemein																	
MAC Adresse	00-60-34-A7-A6-97																
IP Adresse	192.168.73.5																
Netzwerkmaske	255.255.255.0																
Standard Gateway	192.168.73.2																
<div>IP Einstellungen aktivieren</div> <div>Status IP Kommunikation <<</div>																	
Status IP Kommunikation (Steuerteil) <table border="1"> <tbody> <tr> <td>IP Adresse</td> <td>Gelesene IP Adresse aktiv</td> </tr> <tr> <td>Device IP Adresse</td> <td>Aktive IP Adresse manuell eingestellt</td> </tr> <tr> <td>Device Netzwerk Maske</td> <td>Gelesene Netzwerk Maske aktiv</td> </tr> <tr> <td>Einstellung Device Gateway</td> <td>Aktive Gateway Information manuell eingestellt</td> </tr> <tr> <td>Status Device Gateway</td> <td>Gelesene Gateway Adresse aktiv</td> </tr> <tr> <td>Standard Gateway Information</td> <td>Aus Engineering Port (P-0-1533)</td> </tr> <tr> <td>Plausibilität</td> <td>IP Einstellungen plausibel</td> </tr> <tr> <td>Aktive Max. Transmission Unit (MTU)</td> <td>1500 Byte</td> </tr> </tbody> </table>		IP Adresse	Gelesene IP Adresse aktiv	Device IP Adresse	Aktive IP Adresse manuell eingestellt	Device Netzwerk Maske	Gelesene Netzwerk Maske aktiv	Einstellung Device Gateway	Aktive Gateway Information manuell eingestellt	Status Device Gateway	Gelesene Gateway Adresse aktiv	Standard Gateway Information	Aus Engineering Port (P-0-1533)	Plausibilität	IP Einstellungen plausibel	Aktive Max. Transmission Unit (MTU)	1500 Byte
IP Adresse	Gelesene IP Adresse aktiv																
Device IP Adresse	Aktive IP Adresse manuell eingestellt																
Device Netzwerk Maske	Gelesene Netzwerk Maske aktiv																
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Status Device Gateway	Gelesene Gateway Adresse aktiv																
Standard Gateway Information	Aus Engineering Port (P-0-1533)																
Plausibilität	IP Einstellungen plausibel																
Aktive Max. Transmission Unit (MTU)	1500 Byte																

Fig-3: Hardware configuration in IndraWorks

5. Function Blocks

5.1 Warning Information

It is necessary that the user of the function blocks described in this document, should understand the following warnings before using them, to ensure safe operation.

5.1.1 Caution: PLC Task Class!

It is recommended to call all the FB instances that use a single connection in similar *Task Classes* with the same scan interval (e.g., 2ms) in the PLC. Else this could lead to undesirable behavior and connection loss.

5.1.2 Warning 1: Possible PLC Crash!

Every function block has an InOut parameter called *ConnectionInfo*, which is of the data type *SIP_CONNECTION_INFO*. This is a mandatory parameter and must be passed to every function block instance that is called in the user program. This parameters reference must not be modified during an online change. This might lead to a PLC crash, if the newly passed reference is invalid. In case the *ConnectionInfo* parameter needs to be changed, it is advised that the entire program be downloaded to the PLC, to ensure safe operation.

5.1.3 Warning 2: Certain Data Loss!

For each connection to a drive from the Siemens PLC, there should be only one *ConnectionInfo* variable. The same variable should be used for the *ConnectionInfo* parameter, across all the FB instances which use that connection to communicate to the drive. Using different *ConnectionInfo* variables for FB instances communicating on the same connection might lead to circumstances including but not limited to data loss, data corruption and communication loss. The following image illustrates an example of a valid and an invalid configuration.

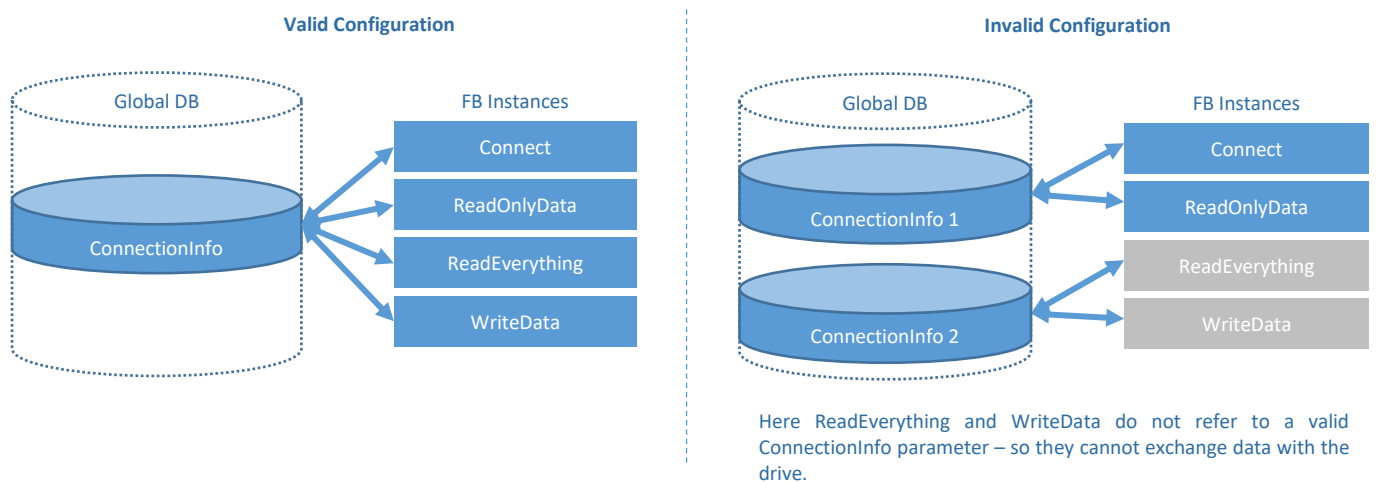


Fig-4: ConnectionInfo configuration

5.1.4 Warning 3: Maximum Read/Write Length in S7-1200 PLCs!

S7-1200 PLCs can handle up to 8192 bytes per TCP telegram. This becomes the maximum allowed read and write lengths for list parameters for these PLCs. Attempting to read/write larger list parameters will result in called function block error and connection loss.

5.1.5 Warning 4: Data Swap for Parameter Data in S7-1200 PLCs!

There is a difference in endianness between S7 PLCs and Bosch Rexroth Drives. So, the received parameter data need to be swapped in the PLC side (data swap needed for parameter write as well). This is handled inside the function blocks in S7-300 and S7-1500 PLCs. But due to limitations of the S7-1200 PLC this needs to be manually handled by the user in their application program.

5.2 FB_SIP_Connect

5.2.1 Functional Description

This function block can connect to the drive and keep the connection alive when the socket is idle. On rising edge of the *Enable* input, the function block connects the PLC socket to the drive and reads the list of available services on the drive using the *Connect* service. The connection information and available services information are made available at the *ConnectionInfo* InOut parameter once the connection is complete. If the socket has been idle for a time almost equal to the lease timeout, then the function block performs a *SIP Ping* to keep the connection alive. When the *Enable* input goes low the function block disconnects PLC from the drive.

5.2.2 Interface Overview

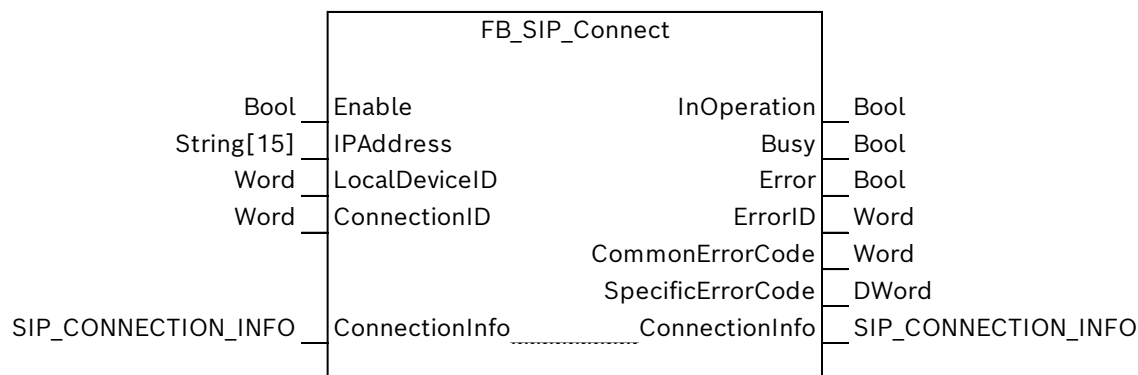


Fig-5: Interface diagram

5.2.3 Interface Description

Group	Name	Type	Description
Var_Input	Enable	Bool	Enable the function block
	IPAddress	String[15]	IP address of the drive
	LocalDeviceID	Word (UInt for S7-1200 and S7-1500 PLCs)	<p>Local device to be used (built-in Eth port / Eth module / etc.)</p> <p>The following values apply for S7-300 PLC:</p> <ul style="list-style-type: none"> ▪ B#16#00: Communication via CP 443-1EX (only with S7-400 and connection_type = B#16#12) Permitted CPs: CP443-1EX4x, CP443-1EX20, CP443-1GX20, CP443-1EX30, CP443-1GX30 ▪ B#16#01: Communication via IE interface on interface slot 1 (IF1) for WinAC RTX (only TCP) ▪ B#16#02: Communication over the integrated IE interface with CPUs 315-2 PN/DP and 317-2 PN/DP ▪ B#16#03: Communication via the integrated IE interface for CPU 319-3 PN/DP ▪ B#16#05: Communication via the integrated IE interface with CPUs 414-3 PN/DP, 416-3 PN/DP, 416-3F PN/DP and 41x-5H PN/DP (Rack 0) ▪ B#16#06: Communication via IE interface on interface slot 2 (IF2) for WinAC RTX (only TCP) ▪ B#16#0B: Communication via IE interface on interface slot 3 (IF3) for WinAC RTX (only TCP)

			<ul style="list-style-type: none"> ▪ B#16#0F: Communication via IE interface on interface slot 4 (IF4) for WinAC RTX (only TCP) ▪ B#16#15: Communication via the integrated IE interface for CPUs 41x-5H PN/DP (Rack 1) <p>The following values apply for S7-1200 PLC:</p> <ul style="list-style-type: none"> ▪ 64: Default, 1: ID for the local PN/IE interface. ▪ For other add on modules, check the module user document <p>The following values apply for S7-1500 PLC:</p> <ul style="list-style-type: none"> ▪ 64: Default ▪ For other on modules, check the module user document
	ConnectionID	Word	Unique Id for this connection
Var_Output	InOperation	Bool	SIP connection established
	Busy	Bool	Function block is busy connecting / disconnecting
	Error	Bool	Function block error
	ErrorID	Word	Error Id for current error
	CommonErrorCode	Word	Common error code returned by drive during a SIP exception
	SpecificErrorCode	DWord	Service specific error code returned by drive during a SIP exception
Var_InOut	ConnectionInfo	SIP_CONNECTION_INFO	Connection information for the current connection

5.2.4 Datatypes Description

This section details the structures and enumerations used by the function block.

Name	Element	Type	Description
SIP_CONNE CTION_ INFO	Connected	Bool	A connection to drive is available
	Busy	Bool	The connected socket is busy
	TransactionID	DInt	Transaction Id of the current request/response
	ConnectionID	Word	Unique Id for the current connection
	SupportedServices	Array[1..50] of DWord	List of SIP services supported by the connected drive

5.3 FB_SIP_ReadDataStatus

5.3.1 Functional Description

This function block can read the data status of the operating data of a parameter over SIP communication. The data status is directly available at the function block output once the operation is complete. The *SIP_CONNECTION_INFO* variable linked to the *FB_SIP_Connect* for the current drive should be made available to this function block through the *ConnectionInfo* InOut parameter.

5.3.2 Interface Overview

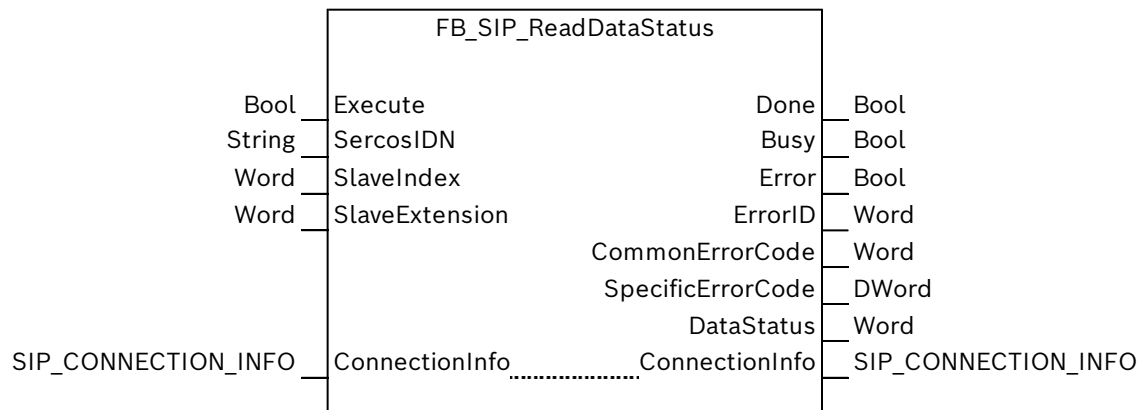


Fig-6: Interface diagram

5.3.3 Interface Description

Group	Name	Type	Description
Var_Input	Execute	Bool	Rising edge executes the function block
	SercosIDN	String	Parameter EIDN string Some valid formats are given below: <ul style="list-style-type: none"> ▪ '57' (S-0-0057.0.0) - only parameter number ▪ '123.5.1' (S-0-0123.5.1) - parameter number + SI + SE ▪ 'S17' (S-0-0017.0.0) - parameter type + parameter number ▪ 'P34.2.9' (P-0-34.2.9) - parameter type + parameter number + SI + SE ▪ 'S-0-0024' (S-0-0024.0.0) - parameter type + parameter number ▪ 'S-1-0043.34.12' - parameter type + parameter set + parameter number + SI + SE

			<i>Note: When a particular element of the parameter IDN is not provided in the string its value is assumed to be zero as shown in the above formats</i>
	SlaveIndex	Word	SlaveIndex for the operation
	SlaveExtension	Word	SlaveExtension for the operation
Var_Output	Done	Bool	Function block operation successful
	Busy	Bool	Function block is busy
	Error	Bool	Function block error
	ErrorID	Word	Error Id for current error
	CommonErrorCode	Word	Common error code returned by drive during a SIP exception
	SpecificErrorCode	DWord	Service specific error code returned by drive during a SIP exception
	DataStatus	Word	Data status of the parameter
Var_InOut	ConnectionInfo	SIP_CONNECTION_INFO	Connection information for the current connection

5.4 FB_SIP_ReadDescription

5.4.1 Functional Description

This function block can read the description of a parameter over SIP communication. The description values (valid elements, name, unit, min/max values, etc.) are directly available at the various outputs of the function block output once the operation is complete. The *SIP_CONNECTION_INFO* variable linked to the *FB_SIP_Connect* for the current drive should be made available to this function block through the *ConnectionInfo* InOut parameter.

5.4.2 Interface Overview

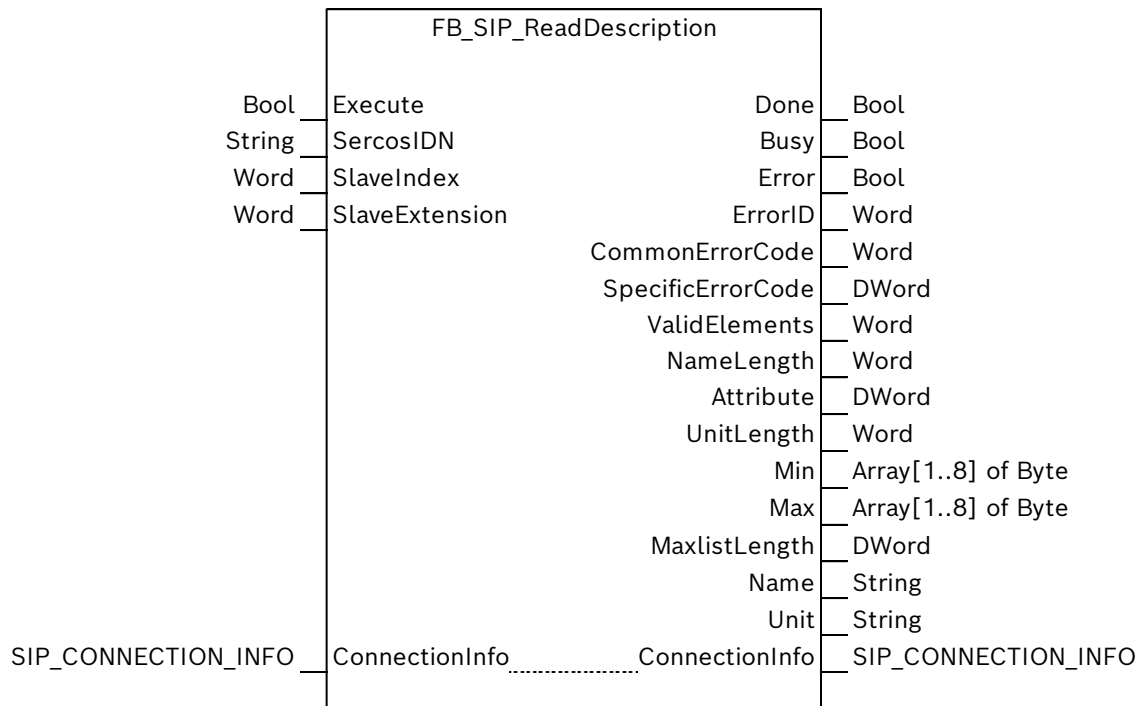


Fig-7: Interface diagram

5.4.3 Interface Description

Group	Name	Type	Description
Var_Input	Execute	Bool	Rising edge executes the function block
	SercosIDN	String	Parameter EIDN string
			Some valid formats are given below: <ul style="list-style-type: none"> ▪ '57' (S-0-0057.0.0) - only parameter number ▪ '123.5.1' (S-0-0123.5.1) - parameter number + SI + SE

			<ul style="list-style-type: none"> ▪ 'S17' (S-0-0017.0.0) - parameter type + parameter number ▪ 'P34.2.9' (P-0-34.2.9) - parameter type + parameter number + SI + SE ▪ 'S-0-0024' (S-0-0024.0.0) - parameter type + parameter number ▪ 'S-1-0043.34.12' - parameter type + parameter set + parameter number + SI + SE <p><i>Note: When a particular element of the parameter IDN is not provided in the string its value is assumed to be zero as shown in the above formats</i></p>
	SlaveIndex	Word	SlaveIndex for the operation
	SlaveExtension	Word	SlaveExtension for the operation
Var_Output	Done	Bool	Function block operation successful
	Busy	Bool	Function block is busy
	Error	Bool	Function block error
	ErrorID	Word	Error Id for current error
	CommonErrorCode	Word	Common error code returned by drive during a SIP exception
	SpecificErrorCode	DWord	Service specific error code returned by drive during a SIP exception
	ValidElements	Word	Valid elements of the parameter
	NameLength	Word	Length of name of the parameter in bytes
	Attribute	DWord	Attribute of the parameter
	UnitLength	Word	Length of unit of the parameter in bytes
	Min	Array[1..8] of Byte	Minimum value allowed for the operating data of the parameter
	Max	Array[1..8] of Byte	Maximum value allowed for the operating data of the parameter
	MaxlistLength	DWord	Maximum list length of the parameter
	Name	String	Name of the parameter
	Unit	String	Unit of the parameter
Var_InOut	ConnectionInfo	SIP_CONNECTION_INFO	Connection information for the current connection

5.5 FB_SIP_ReadEverything

5.5.1 Functional Description

This function block is used to read the description and the operating data of a parameter over SIP communication. The values (valid elements, name, unit, min/max values, etc.) are directly available at the various outputs of the function block output once the operation is complete. The operating data of the parameter is copied at the *Data (Any)* input provided by the user. The SIP_CONNECTION_INFO variable linked to the FB_SIP_Connect for the current drive should be made available to this function block through the ConnectionInfo InOut parameter.

5.5.2 Interface Overview

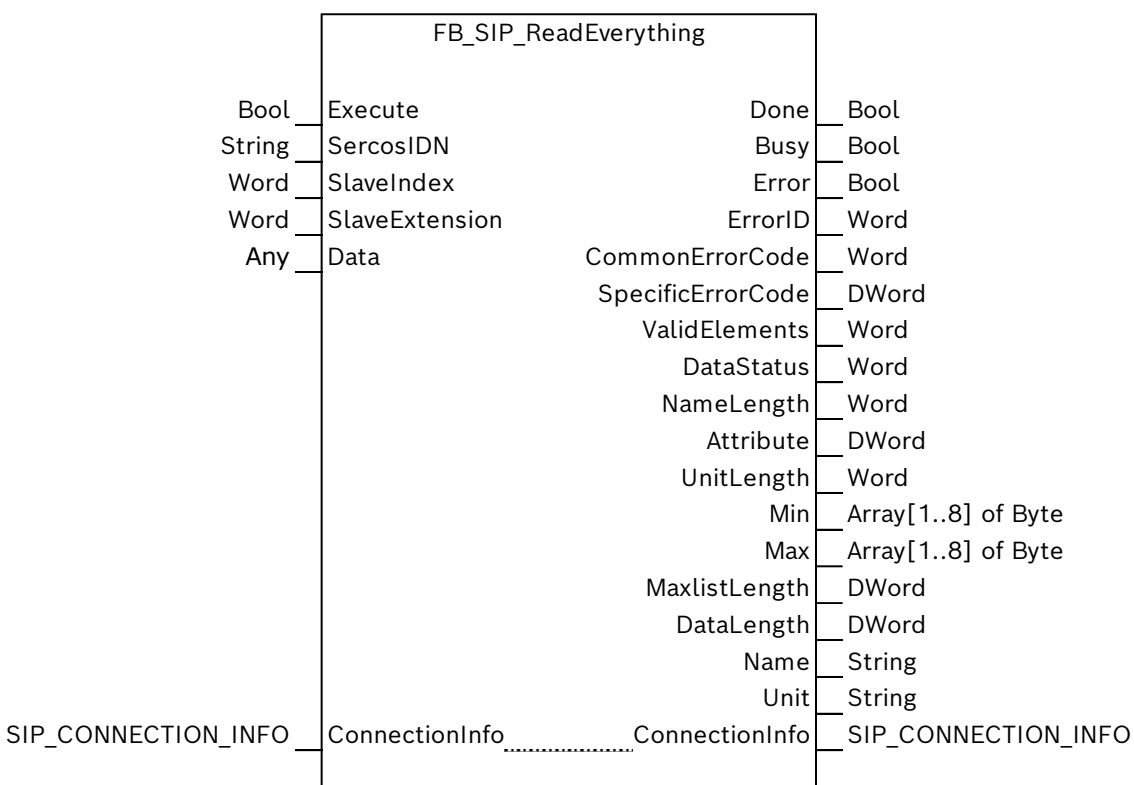


Fig-8: Interface diagram

5.5.3 Interface Description

Group	Name	Type	Description
Var_Input	Execute	Bool	Rising edge executes the function block
	SercosIDN	String	Parameter EIDN string Some valid formats are given below: <ul style="list-style-type: none"> '57' (S-0-0057.0.0) - only parameter number

			<ul style="list-style-type: none"> ▪ '123.5.1' (S-0-0123.5.1) - parameter number + SI + SE ▪ 'S17' (S-0-0017.0.0) - parameter type + parameter number ▪ 'P34.2.9' (P-0-34.2.9) - parameter type + parameter number + SI + SE ▪ 'S-0-0024' (S-0-0024.0.0) - parameter type + parameter number ▪ 'S-1-0043.34.12' - parameter type + parameter set + parameter number + SI + SE <p><i>Note: When a particular element of the parameter IDN is not provided in the string its value is assumed to be zero as shown in the above formats</i></p>
	SlaveIndex	Word	SlaveIndex for the operation
	SlaveExtension	Word	SlaveExtension for the operation
	Data	Any (Variant for S7-1200 PLC)	Reference to the memory area where the operating data of the parameter needs to be copied. User must take care to ensure that this area is large enough for the operating data of the parameter. Otherwise, the integrity of data received from the drive is lost, the function block will throw an error and the connection has to be reset at the <i>FB_SIP_Connect</i> function block.
Var_Output	Done	Bool	Function block operation successful
	Busy	Bool	Function block is busy
	Error	Bool	Function block error
	ErrorID	Word	Error Id for current error
	CommonErrorCode	Word	Common error code returned by drive during a SIP exception
	SpecificErrorCode	DWord	Service specific error code returned by drive during a SIP exception
	ValidElements	Word	Valid elements of the parameter
	DataStatus	Word	Data status of the parameter
	NameLength	Word	Length of name of the parameter in bytes
	Attribute	DWord	Attribute of the parameter
	UnitLength	Word	Length of unit of the parameter in bytes

	Min	Array[1..8] of Byte	Minimum value allowed for the operating data of the parameter
	Max	Array[1..8] of Byte	Maximum value allowed for the operating data of the parameter
	MaxlistLength	DWord	Maximum list length of the parameter
	DataLength	DWord	Length of the operating data of the parameter in bytes
	Name	String	Name of the parameter
	Unit	String	Unit of the parameter
Var_InOut	ConnectionInfo	SIP_CONNECTION_INFO	Connection information for the current connection

5.6 FB_SIP_ReadOnlyData

5.6.1 Functional Description

This function block is used to read the operating data of a parameter over SIP communication. The operating data of the parameter is copied at the *Data (Any)* input provided by the user once the function block operation is complete. The *SIP_CONNECTION_INFO* variable linked to the *FB_SIP_Connect* for the current drive should be made available to this function block through the *ConnectionInfo* InOut parameter.

5.6.2 Interface Overview

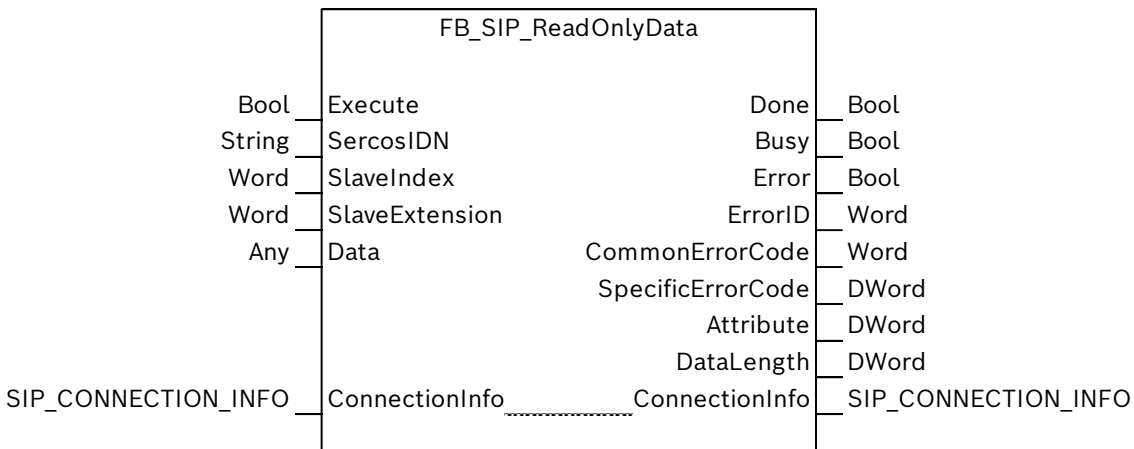


Fig-9: Interface diagram

5.6.3 Interface Description

Group	Name	Type	Description
Var_Input	Execute	Bool	Rising edge executes the function block
	SercosIDN	String	Parameter EIDN string Some valid formats are given below: <ul style="list-style-type: none"> ▪ '57' (S-0-0057.0.0) - only parameter number ▪ '123.5.1' (S-0-0123.5.1) - parameter number + SI + SE ▪ 'S17' (S-0-0017.0.0) - parameter type + parameter number ▪ 'P34.2.9' (P-0-34.2.9) - parameter type + parameter number + SI + SE ▪ 'S-0-0024' (S-0-0024.0.0) - parameter type + parameter number

			<ul style="list-style-type: none"> ▪ 'S-1-0043.34.12' - parameter type + parameter set + parameter number + SI + SE <p><i>Note: When a particular element of the parameter IDN is not provided in the string its value is assumed to be zero as shown in the above formats</i></p>
	SlaveIndex	Word	SlaveIndex for the operation
	SlaveExtension	Word	SlaveExtension for the operation
	Data	Any (Variant for S7-1200 PLC)	Reference to the memory area where the operating data of the parameter needs to be copied. User must take care to ensure that this area is large enough for the operating data of the parameter. Otherwise the integrity of data received from the drive is lost, the function block will throw an error and the connection has to be reset at the <i>FB_SIP_Connect</i> function block.
Var_Output	Done	Bool	Function block operation successful
	Busy	Bool	Function block is busy
	Error	Bool	Function block error
	ErrorID	Word	Error Id for current error
	CommonErrorCode	Word	Common error code returned by drive during a SIP exception
	SpecificErrorCode	DWord	Service specific error code returned by drive during a SIP exception
	Attribute	DWord	Attribute of the parameter
	DataLength	DWord	Length of the operating data of the parameter in bytes
Var_InOut	ConnectionInfo	SIP_CONNECTION_INFO	Connection information for the current connection

5.7 FB_SIP_ReadSegment

5.7.1 Functional Description

This function block is used to read a portion of the operating data of a list parameter over SIP communication. The operating data of the parameter is copied at the *Data (Any)* input provided by the user once the function block operation is complete. The *SIP_CONNECTION_INFO* variable linked to the *FB_SIP_Connect* for the current drive should be made available to this function block through the *ConnectionInfo* InOut parameter.

5.7.2 Interface Overview

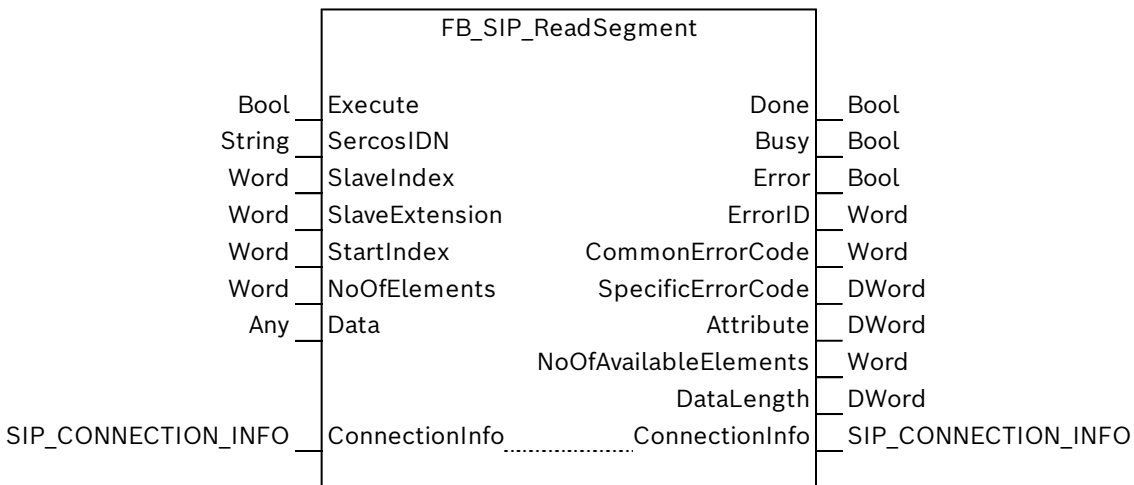


Fig-10: Interface diagram

5.7.3 Interface Description

Group	Name	Type	Description
Var_Input	Execute	Bool	Rising edge executes the function block
	SercosIDN	String	Parameter EIDN string Some valid formats are given below: <ul style="list-style-type: none"> ▪ '57' (S-0-0057.0.0) - only parameter number ▪ '123.5.1' (S-0-0123.5.1) - parameter number + SI + SE ▪ 'S17' (S-0-0017.0.0) - parameter type + parameter number ▪ 'P34.2.9' (P-0-34.2.9) - parameter type + parameter number + SI + SE ▪ 'S-0-0024' (S-0-0024.0.0) - parameter type + parameter number

			<ul style="list-style-type: none"> ▪ 'S-1-0043.34.12' - parameter type + parameter set + parameter number + SI + SE <p><i>Note: When a particular element of the parameter IDN is not provided in the string its value is assumed to be zero as shown in the above formats</i></p>
	SlaveIndex	Word	SlaveIndex for the operation
	SlaveExtension	Word	SlaveExtension for the operation
	StartIndex	Word	Index starting from which data must be read
	NoOfElements	Word	Number of elements to read
	Data	Any (Variant for S7-1200 PLC)	Reference to the memory area where the operating data of the parameter needs to be copied. User must take care to ensure that this area is large enough for the operating data of the parameter. Otherwise the integrity of data received from the drive is lost, the function block will throw an error and the connection has to be reset at the <i>FB_SIP_Connect</i> function block.
Var_Output	Done	Bool	Function block operation successful
	Busy	Bool	Function block is busy
	Error	Bool	Function block error
	ErrorID	Word	Error Id for current error
	CommonErrorCode	Word	Common error code returned by drive during a SIP exception
	SpecificErrorCode	DWord	Service specific error code returned by drive during a SIP exception
	Attribute	DWord	Attribute of the parameter
	NoOfAvailableElements	Word	Total number of data elements available
	DataLength	DWord	Length of the operating data of the parameter in bytes
Var_InOut	ConnectionInfo	SIP_CONNECTION_INFO	Connection information for the current connection

5.8 FB_SIP_WriteData

5.8.1 Functional Description

This function block is used to write the operating data of a parameter over SIP communication. The data of which needs to be written to the parameter must be available the *Data (Any)* input provided by the user. The *SIP_CONNECTION_INFO* variable linked to the *FB_SIP_Connect* for the current drive should be made available to this function block through the *ConnectionInfo* InOut parameter.

5.8.2 Interface Overview

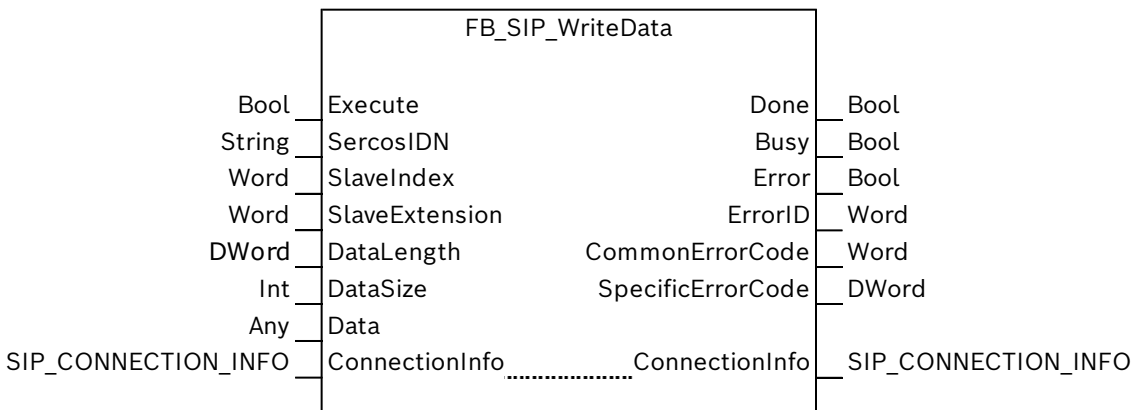


Fig-11: Interface diagram

5.8.3 Interface Description

Group	Name	Type	Description
Var_Input	Execute	Bool	Rising edge executes the function block
	SercosIDN	String	Parameter EIDN string Some valid formats are given below: <ul style="list-style-type: none"> ▪ '57' (S-0-0057.0.0) - only parameter number ▪ '123.5.1' (S-0-0123.5.1) - parameter number + SI + SE ▪ 'S17' (S-0-0017.0.0) - parameter type + parameter number ▪ 'P34.2.9' (P-0-34.2.9) - parameter type + parameter number + SI + SE ▪ 'S-0-0024' (S-0-0024.0.0) - parameter type + parameter number ▪ 'S-1-0043.34.12' - parameter type + parameter set + parameter number + SI + SE

			<i>Note: When a particular element of the parameter IDN is not provided in the string its value is assumed to be zero as shown in the above formats</i>
	SlaveIndex	Word	SlaveIndex for the operation
	SlaveExtension	Word	SlaveExtension for the operation
	DataLength	DWord	Length of data counted in octets / bytes to be written
	DataSize	Int (DWord for S7-1200 PLC)	For single parameter - same as DataLength input; For list parameter - size of each data element of parameter - 1/2/4/8 bytes
	Data	Any (Variant for S7-1200 PLC)	Reference to the memory area where the data to be written to the parameter needs to be available. User must take care to ensure that this area is large enough as the <i>DataLength</i> input. Otherwise the function block will throw an error.
Var_Output	Done	Bool	Function block operation successful
	Busy	Bool	Function block is busy
	Error	Bool	Function block error
	ErrorID	Word	Error Id for current error
	CommonErrorCode	Word	Common error code returned by drive during a SIP exception
	SpecificErrorCode	DWord	Service specific error code returned by drive during a SIP exception
Var_InOut	ConnectionInfo	SIP_CONNECTION_INFO	Connection information for the current connection

5.9 FB_SIP_WriteDataBits

5.9.1 Functional Description

This function block is used to write specific bits of the operating data of a parameter over SIP communication. This works only for single parameters and is not supported for list parameters. The data of which needs to be written to the parameter and its data mask must be available the *Data (Any)* and *DataMask (Any)* inputs respectively. The *SIP_CONNECTION_INFO* variable linked to the *FB_SIP_Connect* for the current drive should be made available to this function block through the *ConnectionInfo* InOut parameter.

5.9.2 Interface Overview

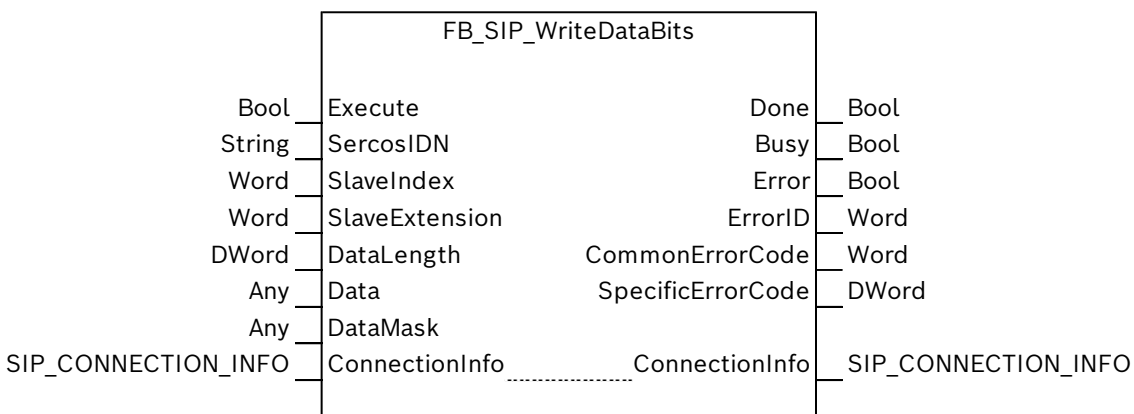


Fig-12: Interface diagram

5.9.3 Interface Description

Group	Name	Type	Description
Var_Input	Execute	Bool	Rising edge executes the function block
	SercosIDN	String	Parameter EIDN string Some valid formats are given below: <ul style="list-style-type: none"> '57' (S-0-0057.0.0) - only parameter number '123.5.1' (S-0-0123.5.1) - parameter number + SI + SE 'S17' (S-0-0017.0.0) - parameter type + parameter number 'P34.2.9' (P-0-34.2.9) - parameter type + parameter number + SI + SE 'S-0-0024' (S-0-0024.0.0) - parameter type + parameter number

			<ul style="list-style-type: none"> ▪ 'S-1-0043.34.12' - parameter type + parameter set + parameter number + SI + SE <p><i>Note: When a particular element of the parameter IDN is not provided in the string its value is assumed to be zero as shown in the above formats</i></p>
	SlaveIndex	Word	SlaveIndex for the operation
	SlaveExtension	Word	SlaveExtension for the operation
	DataLength	DWord	Length of data counted in octets / bytes to be written
	Data	Any (Variant for S7-1200 PLC)	Reference to the memory area where the data to be written to the parameter needs to be available. User must take care to ensure that this area is large enough as the <i>DataLength</i> input. Otherwise the function block will throw an error.
	DataMask	Any (Variant for S7-1200 PLC)	Reference to the memory area where the data mask for the operating data to be written to the parameter needs to be available. User must take care to ensure that this area is large enough as the <i>DataLength</i> input. Otherwise the function block will throw an error.
Var_Output	Done	Bool	Function block operation successful
	Busy	Bool	Function block is busy
	Error	Bool	Function block error
	ErrorID	Word	Error Id for current error
	CommonErrorCode	Word	Common error code returned by drive during a SIP exception
	SpecificErrorCode	DWord	Service specific error code returned by drive during a SIP exception
Var_InOut	ConnectionInfo	SIP_CONNECTION_INFO	Connection information for the current connection

6. Error Description

The function blocks described in this document can provide a range of error information to the user through the various error outputs. Whenever there is an error, the *Error* output of the function block is set to *TRUE*. The reason for the error can be identified from the following sections that explain each error output separately.

6.1 Output – ErrorID

This output provides the error code for the current function block error. This could be from the function block itself or an error code thrown by one of the instructions used internally. The SIP function blocks use the following Siemens instructions internally; *TCON*, *TDISCON*, *TSEND* and *TRCV*. If a returned error code does not match with the values from the following table, then the user must refer the TIA portal help for error codes of the internal instructions.

Value Hex	Name	Description
16#1001	ERR_INVALID_INPUT	One or more inputs are invalid or function block is called without passing the <i>ConnectionInfo</i> InOut parameter
16#1002	ERR_CONNECT_TIMEOUT	Timeout occurred when connecting to the drive
16#1003	ERR_TCPSEND_TIMEOUT	Timeout occurred when trying to send data to drive
16#1004	ERR_TCPRECEIVE_TIMEOUT	Timeout occurred when trying to receive data from drive
16#1005	ERR_RECEIVE_LENGTH_INVALID	Length of data received from drive is invalid, execute function block again or disconnect and connect to drive again
16#1006	ERR_INVALID_RESPONSE	Response received from drive is invalid, execute function block again or disconnect and connect to drive again
16#1007	ERR_TOO_MANY_MESSAGE_TYPES	Number of message types received from drive exceeds the maximum possible types, enable function block again
16#1008	ERR_EXCEPTION_RESPONSE	Exception returned by drive - See <i>CommonErrorCode</i> and <i>SpecificErrorCode</i> sections for more information
16#1009	ERR_DRIVE_NOT_CONNECTED	There is no active connection to the drive
16#100A	ERR_CONNECTION_BUSY	Socket is busy, try again later or disconnect and connect to drive again
16#100B	ERR_PING_TIMEOUT	Timeout occurred when trying to do an SIP ping
16#100C	ERR_SERVICE_NOT_SUPPORTED	Current function block service is not supported by the drive

16#100D	ERR_INSUFFICIENT_DATA_SIZE	Size of <i>Data</i> variable is insufficient to copy the parameter data of drive, increase the memory area of the variable
16#100E	ERR_INVALID_DATA_AREA	Memory area identified by the <i>Data</i> variable is invalid, try again with different memory area

6.2 Output – CommonErrorCode

This output provides the common error code returned by the drive during an exception response.

Value Dec	Name	Description
1	CONNECTION_ERROR	If the server is not able to serve a TCP based S/IP connection
2	TIMEOUT	If a timeout exceeds or a TCP connection gets lost. Network activities are controlled by local timeout handling. If the server doesn't respond in time, this error code is used to indicate the error to the user on client-side.
3	UNKNOWN_MESSAGE_TYPE	If the server receives an unknown message type, it shall send an exception with this error code to the client. In case of a TCP based S/IP request the server returns the exception to the client and shall close the TCP stream socket connection.
4	SERVICE_SPECIFIC	Services are able to have their own error code. Further information is available in the <i>SpecificErrorCode</i> section.
5	PDU_TOO_LARGE	This is an UDP specific error. See Limitations of PDU size for further details.
6	PDU_PROTOCOL_MISMATCH	This is an UDP specific error. E. g. the length of the received datagram is not conform to the expected PDU size of the service. This error indicates an incompatible implementation.

6.3 Output – SpecificErrorCode

This output provides the service specific error codes returned by the drive during an exception response.

Value Hex	Description	Comment
0x0nnn	General error	
0x0000	No error in the service channel	
0x0001	Service channel not open	
0x0009	Invalid access to closing the service channel	

0x1nnn	Element 1	Identification number
0x1001	IDN not supported	
0x1009	Invalid access to element 1	
0x2nnn	Element 2	Name
0x2001	Name not supported	
0x2002	Name transmission too short	Master set "last transmission" too early
0x2003	Name transmission too long	Master does not set "last transmission"
0x2004	Name cannot be changed	Name is read only
0x2005	Name is write-protected at this time	
0x3nnn	Element 3	Attribute
0x3002	Attribute transmission too short	Master set "last transmission" too early
0x3003	Attribute transmission too long	Master does not set "last transmission"
0x3004	Attribute cannot be changed	Attribute is read only
0x3005	Attribute is write-protected at this time	
0x4nnn	Element 4	Unit
0x4001	Unit not supported	
0x4002	Unit transmission too short	Master set "last transmission" too early
0x4003	Unit transmission too long	Master does not set "last transmission"
0x4004	Unit cannot be changed	Unit is read only
0x4005	Unit is write-protected at this time	
0x5nnn	Element 5	Minimum input value
0x5001	Minimum input value not supported	
0x5002	Minimum input value transmission too short	Master set "last transmission" too early
0x5003	Minimum input value transmission too long	Master does not set "last transmission"
0x5004	Minimum input value cannot be changed	Minimum input value is read only
0x5005	Minimum input value is write-protected at this time	
0x6nnn	Element 6	Maximum input value
0x6001	Maximum input value not supported	
0x6002	Maximum input value transmission too short	Master set "last transmission" too early
0x6003	Maximum input value transmission too long	Master does not set "last transmission"
0x6004	Maximum input value cannot be changed	Maximum input value is read only
0x6005	Maximum input value is write-protected at this time	
0x7nnn	Element 7	Operation data
0x7002	Operation data transmission too short	Master set "last transmission" too early
0x7003	Operation data transmission too long	Master does not set "last transmission"
0x7004	Operation data cannot be changed	Operation data is read only
0x7005	Operation data is write-protected at this communication phase	

0x7006	Operation data is smaller than the minimum input value	
0x7007	Operation data is greater than the maximum input value	
0x7008	Invalid operation data	which may be an unsupported x bit number or bit combination, x value, code or x configured IDN
0x7009	Operation data write protected by a password	
0x700A	Operation data is write protected, it is configured cyclically	IDN is configured in the MDT or AT. Therefore writing via the service channel is not allowed.
0x700B	Invalid indirect addressing	e.g., data container, list handling etc.
0x700C	Operation data is write protected, due to other settings	e.g., operation mode, sub-device is enabled, setting of communication version etc.
0x700D	Invalid floating point number	
0x700E	Operation data is write protected at parameterization level	
0x700F	Operation data is write protected at operating level	
0x7010	Procedure command already active	
0x7011	Procedure command not interruptible	
0x7012	Procedure command at this time not executable	e.g., in this phase the procedure command cannot be activated.
0x7013	Procedure command not executable	the corresponding parameters are invalid or false
0x7014	The received current length of list parameter does not match to expectation	
0x7015	Operation data is not yet created completely	it takes more time to create the operation data, try it again later
0x71nn	Segment wise transmission of list parameters via SVC	
0x7101	IDN in S-0-0394 not valid	
0x7102	Empty list in S-0-0397 not allowed for write access	
0x7103	Maximum length of the list in S -0-0394 is exceeded by take-over of the list segment.	
0x7104	Read access only: The length of the list segment as of the list index exceeds the current length of the list in S-0-0394.	

0x7105	IDN in S-0-0394 is write protected	
0x7106	Operation data in list segment is smaller than the minimum input value	
0x7107	Operation data in list segment is greater than the maximum input value	
0x7108	Invalid list index in S-0-0395	
0x7109	Parameter in IDN S-0-0394 does not have variable length	
0x710A	IDN S-0-0397 not permitted as operation data in S-0-0394	
0x8nnn	Reserved for master internal error codes	Error codes may be defined by the manufacturer of control units (e.g. NC, PLC etc.)
0xAxxx	Reserved	
0xBxxx	Reserved	
0xCxxx	Reserved for slave specific error codes	used for fault analysis and trace functionality (troubleshooting)
0xDxxx	Error codes are not generated and transmitted via SVC	Error codes shall be defined by a TWG of sercos
0xD000	no error	
0xD001	service channel (temporarily) not available	
0xD002	service channel engaged by an application	
0xD003	service channel busy, slave is processing previous request	
0xD004	Sercos Slave not reachable	
0xD005	service channel transaction aborted	
0xD006	writing this element is not supported by the service channel	
0xExxx	Reserved for master internal error codes	Error codes may be defined by the manufacturer of control units (e.g. NC, PLC etc.)
0xFxxx	Reserved for master internal error codes	Error codes may be defined by the manufacturer of control units (e.g. NC, PLC etc.)
All other error codes shall be reserved		

7. Sample Project

The sample project in the deliverable package contains examples for S7-300, S7-1200 and S7-1500 PLCs, with instances of all the function blocks.

8. Document History

Version	Date (dd.mm.yyyy)	Author	Comment
1.0	29.11.2022	PRD6KOR	Initial version