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Basic Examples for Open User Communication: ISO-on-TCP

Programmed ISO-on-TCP Connection

<https://support.industry.siemens.com/cs/ww/en/view/109747710>

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1 Introduction

1.1 Overview

Content of the application example

The TCP/IP based **Open User Communication** (OUC) is now the standard in the communication with SIMATIC S7 CPUs.

In the S7 CPU, the OUC is implemented on the basis of instructions (for example, TCON, TSEND, TRCV and TDISCON). The user has to configure the instructions in their user program and in a fail-tolerant way. This task has to be rethought by each user again and again. In order to facilitate this, we offer a function block (FB) in SCL. The FB calls the OUC instructions in the order and in the way that is recommended in the manuals. The FB also includes the following mechanisms:

- Connection management with the instructions "TCON" and "TDISCON"
- Sending data to a partner CPU
- Receiving data from a partner CPU

You can use the FB as template for your own communication projects.

The application example provides the following information:

- Library for STEP 7 (TIA Portal) that contains the FB
- Description of the FB to communicate via **programmed connection** with **ISO-on-TCP**

The application example shows in which places you can integrate your individual expansions in the code.

Overview of all OUC variants in this row

This application example is part of a larger series of basic examples for PLC communication.

[Table 1-1](#) shows the variants of the OUC that are provided to the user in a series of basic examples. The variant described in this application example is highlighted in color.

Table 1-1

Protocol	Frame length	Programmed connection
ISO-on-TCP	Variable	✓
TCP	Fixed	✓
	Variable	✓
UDP	–	✓

Note

The variants with the compact instructions for OUC (TSEND_C and TRECVC) are not dealt with in this series.

For more information, please refer to the following FAQ:

<https://support.industry.siemens.com/cs/ww/en/view/67196808>

For each variant the OUC has its own FB that is used as communication template. All communication templates are summarized in the "LOpenUserComm" library. This application example only relates to the variant "programmed connection with ISO-on-TCP".

1.2 Mode of Operation

Realization as state machine

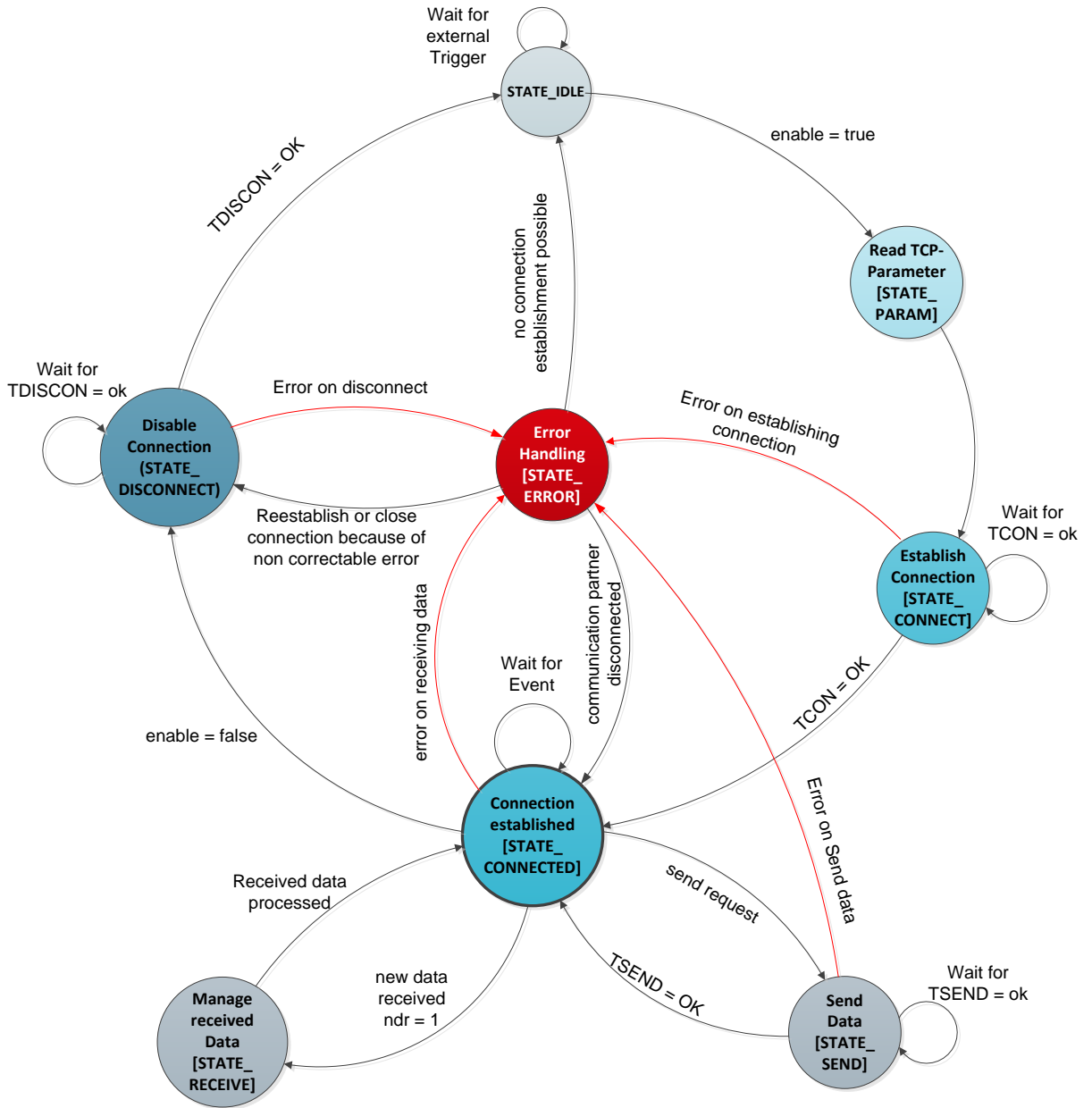
The FB for controlling the OUC instructions (TCON, TSEND, TRCV and TDISCON) is realized as state machine. The design model of a state machine is particularly suitable for the modeling of complex asynchronous processes, for example, the communication between partners that stretch over several cycles.

A certain state is cyclically run until a transition condition is fulfilled and the machine switches to the next subsequent state. This does not only improve the clarity in comparison to a conventional logic controller but also facilitates finding possible errors in the program logic quicker.

Status display in FB "LOpenUserComm_IsoOnTcp"

The figure below shows the states that are implemented in this FB.

Figure 1-1: State machine of FB



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Description of the states

The following table describes the realized states and the possible transitions. More information can be found in the documented code.

Table 1-2

State	Description	Transition condition
STATE_IDLE (1)	In the "STATE_IDLE" idle state the FB has the following characteristics: <ul style="list-style-type: none"> • No connection is active. • Status tags are reset. 	The "STATE_IDLE" idle state is now left, if a connection is triggered via a parameter (enable).
STATE_PARAM (2)	The ISO-on-TCP connection parameters are read and the TCON instruction is assigned.	The FB goes straight to the "STATE_CONNECT" state without transition condition.
STATE_CONNECT (3)	The ISO-On-TCP connection to the partner is established.	The "STATE_CONNECT" state is left when one of the following conditions is fulfilled: <ul style="list-style-type: none"> • If the connection is still not established after the lapse of the watchdog timer (180s), the FB goes to "STATE_ERROR" state. • If the connection is established, the FB goes to "STATE_CONNECTED" state.
STATE_CONNECTED (7)	In the "STATE_CONNECTED" state the FB performs the following actions: <ul style="list-style-type: none"> • It waits for the trigger of the send job to send the data via the connection. • It monitors whether the data has been received by the partner. • It monitors the connection to the partner. 	The "STATE_CONNECTED" state is left when one of the following conditions is fulfilled: <ul style="list-style-type: none"> • If an error occurs when receiving the data, the FB goes to "STATE_ERROR" state. • When the connection is to be actively disconnected, the FB goes to "STATE_DISCONNECT" state. • When data is to be sent, the FB goes to "STATE_SEND" state. • When new data is to be received, the FB goes to "STATE_RECEIVE" state.

State	Description	Transition condition
STATE_SEND (5)	<p>In the "STATE_SEND" state, the FB performs the following actions:</p> <ul style="list-style-type: none"> • It enables the parameters of the "TSEND" OUC instruction. • It waits until the "TSEND" OUC instruction is completed successfully (DONE=1) or with error (ERROR=1). • It disables the "TRCV" OUC instruction during the running send process. 	<p>The "STATE_SEND" state is left, if one of the following conditions is fulfilled:</p> <ul style="list-style-type: none"> • When the send process is completed successfully, the FB goes back to the "STATE_CONNECTED" state. • If an error occurs during sending, the FB goes to "STATE_ERROR" state.
STATE_RECEIVE (6)	<p>The "RECEIVE" state is used for an individual processing of the received data.</p> <p>In this application example the state is empty.</p>	<p>The FB goes straight back to the "STATE_CONNECTED" state without transition condition.</p>
STATE_DISCONNECT (4)	<p>In the following cases, the FB disconnects the connection to the partner in the "STATE_DISCONNECT" state.</p> <ul style="list-style-type: none"> • The disconnection is triggered by the user (enable). • The disconnection is triggered by the FB, if the connection has to be re-established or if an error that cannot be removed occurred. 	<p>The "STATE_DISCONNECT" state is left, if one of the following conditions is fulfilled:</p> <ul style="list-style-type: none"> • When the connection was disconnected without error, the FB goes to "STATE_IDLE" state. • If an error occurs when disconnecting the connection, the FB goes to the "STATE_ERROR" state.
ERROR (8)	<p>In the "STATE_ERROR" state, the FB performs the following actions:</p> <ul style="list-style-type: none"> • It decides whether it autonomously attempted to remove an error within the FB by calling other states. • It supplies the output parameters with error information 	<p>The "STATE_ERROR" state is left, if one of the following conditions is fulfilled</p> <ul style="list-style-type: none"> • The FB goes to the "DISCONNECT" state if the connection has to be re-established or if an error that cannot be removed occurred. • If the connection is not established, the FB goes to "STATE_IDLE" idle state. • If the partner discontinues the connection, the FB goes to the "STATE_CONNECTED" state.

1.3 Components used

This application example was created with the following hardware and software components:

Table 1-3

Component	Number	Article number	Note
CPU 1513-1 PN	1	6ES7513-1AL01-0AB0	<p>Alternatively, you can use any other S7-1500 CPU, ET 200SP CPU, ET 200pro CPU or the following CPs and CMs:</p> <ul style="list-style-type: none"> • CP 1543-1 (article number: 6GK7543-1AX00-0XE0) • CM 1542-1 (article number: 6GK7542-1AX00-0XE0) • CP 1542SP-1 (article number: 6GK7542-6UX00-0XE0) • CP 1542SP-1 IRC (article number: 6GK7542-6VX00-0XE0) • CP 1543SP-1 (Article number: 6GK7543-6WX00-0XE0)
CPU 1214C DC/DC/DC	1	6ES7214-1AG40-0AB0	<p>Alternatively, you can use any S7-1200 CPU as of firmware V4.0 or following CPs as of firmware: V2.1:</p> <ul style="list-style-type: none"> • CP 1243-1 (article number: 6GK7243-1BX30-0XE0) • CP 1242-7 GPRS (article number: 6GK7242-7KX31-0XE0) • CP 1243-7 LTE (article number: 6GK7243-7KX30-0XE0) • CP 1243-8 IRC (article number: 6GK7243-8RX30-0XE06GK7243-8RX30-0XE0)

1 Introduction

Component	Number	Article number	Note
CPU 315-2 PN/DP	1	6ES7315-2EH14-0AB0	<p>Alternatively, you can use any S7-300 CPU with integrated IE interface as of firmware V2.5.</p> <p>Alternatively, you can use the IM 151-8(F) PN/DP and IM 154-8 (F/FX) PN/DP.</p> <p>Alternatively, you can use any S7-400 CPU with integrated IE interface and the following CPs.</p> <ul style="list-style-type: none"> • 6GK7443-1EX20-0XE0 • 6GK7443-1EX30-0XE0 • 6GK7443-1EX40-0XE0 • 6GK7443-1EX41-0XE0 • 6GK7443-1GX20-0XE0 • 6GK7443-1GX30-0XE0 • 6GK7443-1UX00-0XE0
STEP 7 V14 Update 2	1	Package: 6ES7822-0AA04-0YA5 Download: 6ES7822-0AE04-0YA5	

2 Engineering

2.1 Interface description for S7-1200 and S7-1500

Function description

The FB "LOpenUserComm_IsoOnTcp" implements a complete ISO-on-TCP communication relationship to a partner. It encapsulates all OUC instructions in a user-friendly shell to perform the following functions:

- Management of establishing connection and disconnection using the "enable" input
- Sending user data of the length "sendLen" via the "sendData" input to the partner as soon as the "sendRequest" input detects a positive edge.
- Receiving data from a partner and saving it in a storage area that is created on the "rcvData" parameter.

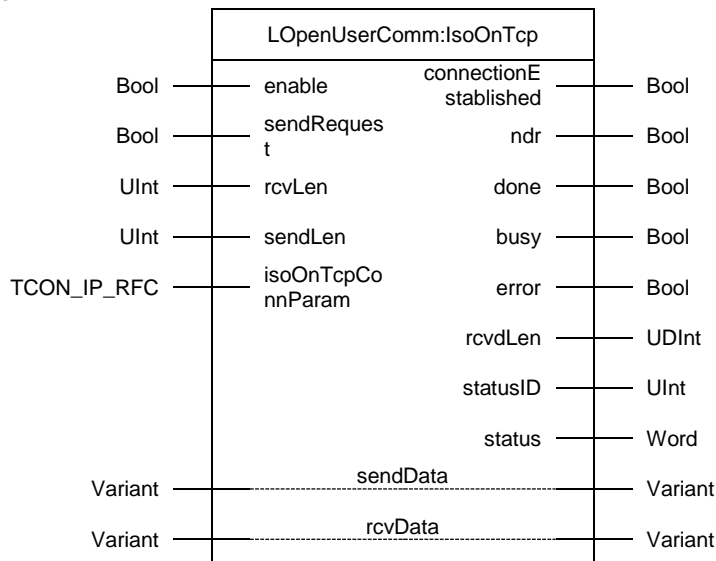
Note:

If the received data is saved in an optimized data block, the "rcvLen" input parameter has to include the value 0. For a standard data block this input parameter has to contain the number of bytes that is to be received.

- Outputting state of the transmission and connection on the "status" output parameter.

Block interface

Figure 2-1



The following table shows the inputs and outputs of the "LOpenUserComm_IsoOnTcp" function block for S7-1200 and S7-1500.

Table 2-1

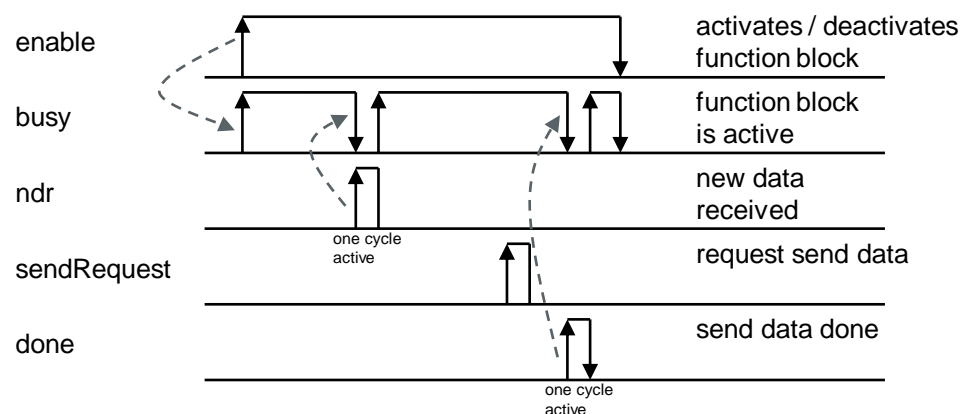
Name	P type	Data type	Comment
enable	IN	Bool	Release signal for the establishing the connection and the data exchange
sendRequest	IN	Bool	Trigger of a send job
rcvLen	IN	UInt	Length of the receive data If the receive data is saved in an optimized DB, rcvLen = 0.
sendLen	IN	UInt	Maximum number of bytes that are sent with the job
isoOnTcpConnParam	IN	TCON_IP_RFC	Connection parameters
connectionEstablished	OUT	Bool	Status display: Connection has been established
ndr	OUT	Bool	Status display: New data received
done	OUT	Bool	Status display: Send job successfully completed
busy	OUT	Bool	FB in process
error	OUT	Bool	Error display
rcvdLen	OUT	UDInt	Length of received data (in byte)
statusID	OUT	UInt	Parameter shows which OUC instruction supplies the error
status	OUT	Word	Status display of the OUC instructions
sendData	IN_OUT	Variant	Send data area
rcvData	IN_OUT	Variant	Receive data area

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Function charts

The following function chart shows how the most important output parameters are set, depending on the input parameters.

Figure 2-2



2.2 Interface description for S7-300 and S7-400

Function description

The FB "LOpenUserComm_IsoOnTcp" implements a complete ISO-on-TCP communication relationship to a partner. It encapsulates all OUC instructions in a user-friendly shell to perform the following functions:

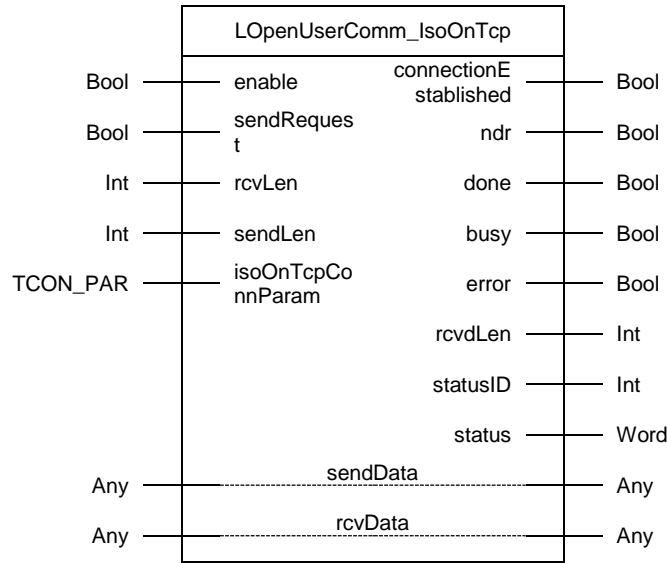
- Management of establishing connection and disconnection using the "enable" input.
- Sending user data of the length "sendLen" via the "sendData" input to the partner as soon as the "sendRequest" input detects a positive edge.
- Receiving data from a partner and saving it in a defined receive area. The receive area is defined by the following two dimensions:
 - Pointer at the beginning of the area
 - Length of the area
- Outputting state of the transmission and connection on the "status" output parameter.

Note

For ISO-on-TCP the length of the area is either specified by the rcvLen parameter (if rcvLen \neq 0) or the length specification of the parameter "rcvData" (rcvLen = 0).

Block interface

Figure 2-3



The following table shows the inputs and outputs of the "LOpenUserComm_IsoOnTcp" function block for S7-300 and S7-400.

Table 2-2

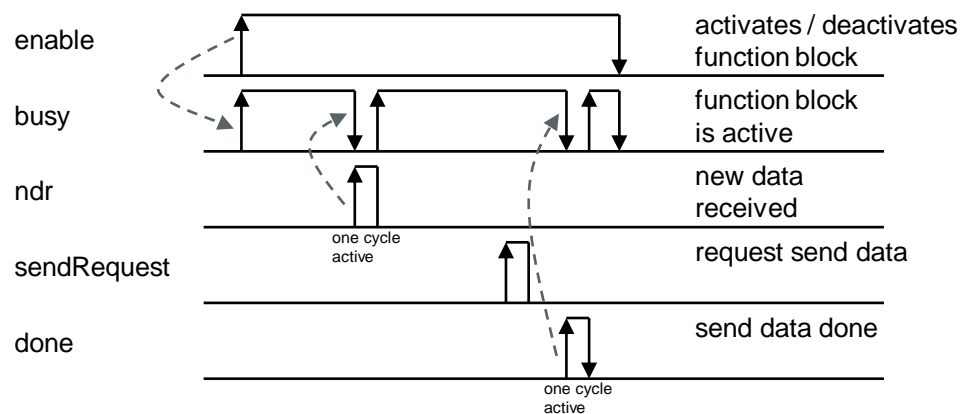
Name	P type	Data type	Comment
enable	IN	Bool	Release signal for the establishing the connection and the data exchange
sendRequest	IN	Bool	Trigger of a send job
rcvLen	IN	Int	Length of the receive data <ul style="list-style-type: none"> rcvLen = 0 (recommended): The length of the receive area is specified by the length details of the "rcvData" parameter. rcvLen <> 0: The length of the receive area is specified by the "rcvData" parameter.
sendLen	IN	Int	Maximum number of bytes that are sent with the job
isoOnTcpConnParam	IN	TCON_PAR	Connection parameters
connectionEstablished	OUT	Bool	Status display: Connection has been established
nbr	OUT	Bool	Status display: New data received
done	OUT	Bool	Status display: Send job successfully completed
busy	OUT	Bool	FB in process
error	OUT	Bool	Error display

Name	P type	Data type	Comment
rcvdLen	OUT	Int	Length of received data (in byte)
statusID	OUT	Int	Parameter shows which OUC instruction supplies the error
status	OUT	Word	Status display of the OUC instructions
sendData	IN_OUT	Any	Send data area
rcvData	IN_OUT	Any	Receive data area

Function charts

The following function chart shows how the most important output parameters are set, depending on the input parameters.

Figure 2-4



2.3 Integration into the user project

2.3.1 Opening library in STEP 7 (TIA Portal)

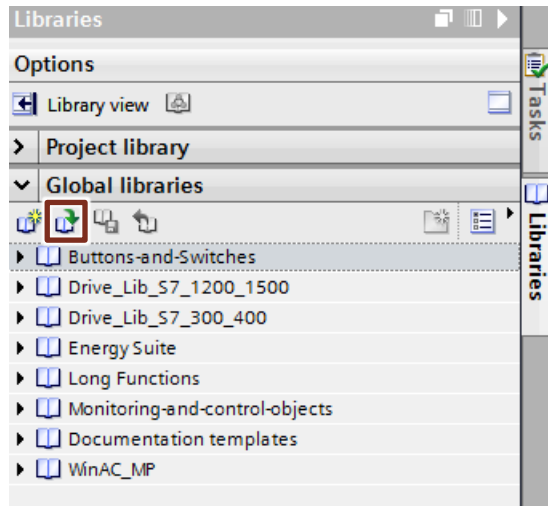
Proceed according to the following instruction in order to open the "LOpenUseComm" library in STEP 7 (TIA Portal).

Prerequisite

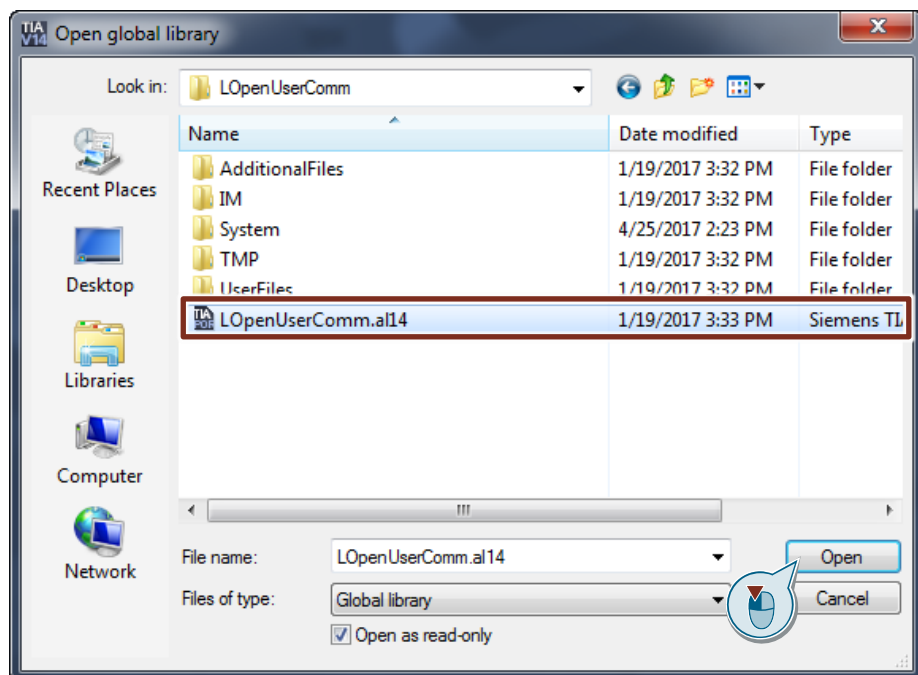
- STEP 7 (TIA Portal) is open.
- You have created a new project in STEP 7 (TIA Portal) or opened an already existing project.

Instruction

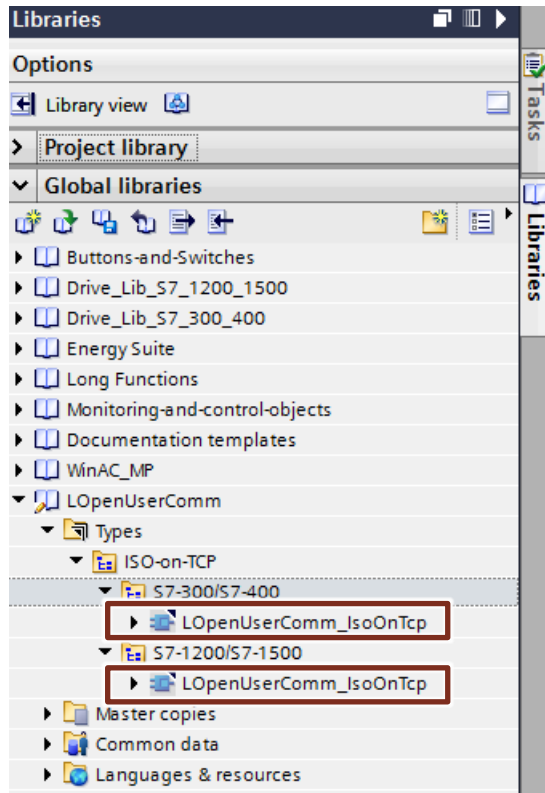
1. Open the "Libraries" task card.
2. Click the "Open global library" button in the "Global libraries" palette. The "Open global library" dialog box opens.



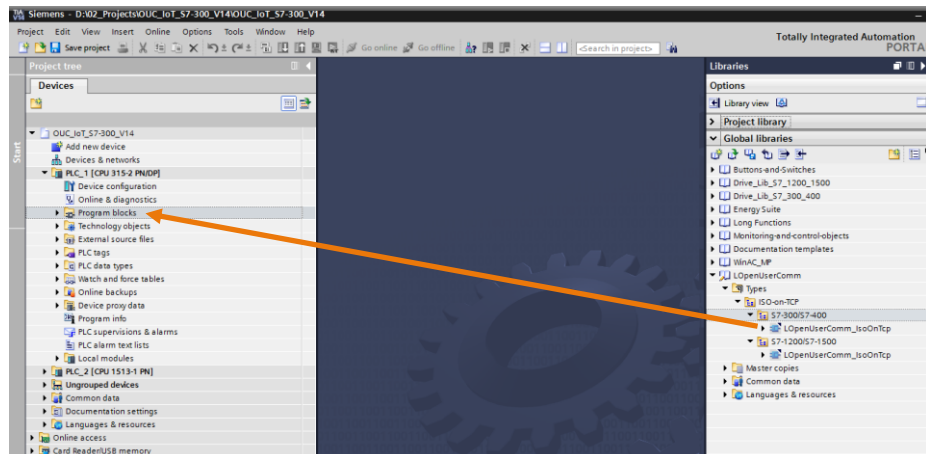
3. Select the "LOpenUserComm.al14" library and click the "Open" button. The "LOpenUserComm" library in "Global libraries" palette is opened.



- The "LOpenUserComm_IsoOnTcp" function blocks can be found in the "LOpenUserComm" library in "Types > ISO-on-TCP" > S7-300/S7-400 and in "Types > ISO-on-TCP" > S7-1200/S7-1500.



- Add the "LOpenUserComm_IsoOnTcp" function block from the library to the "Program blocks" folder of your CPU, using drag-and-drop.



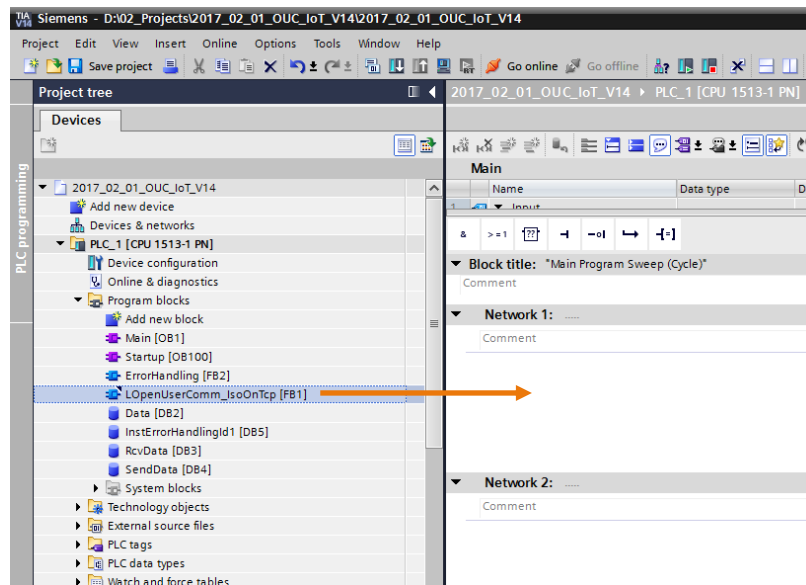
- Integrate the "LOpenUserComm_IsoOnTcp" function block into the user program of your CPU.

2.3.2 Integrating "LOpenUserComm_IsoOnTcp" function block into the user program

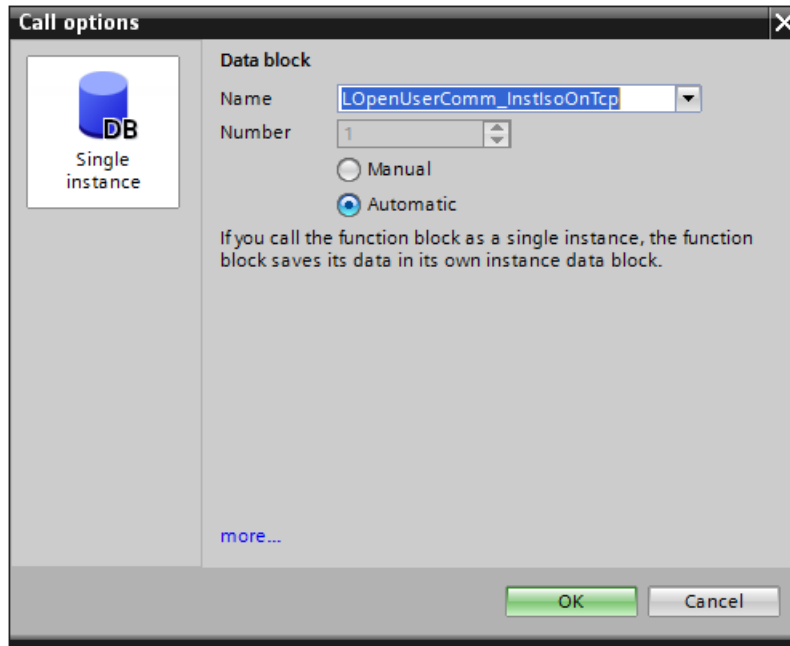
Proceed in accordance with the following instruction in order to integrate the "LOpenUserComm_IsoOnTcp" function block into the user program of your CPU.

Cyclically call the "LOpenUserComm_IsoOnTcp" function block in OB 1.

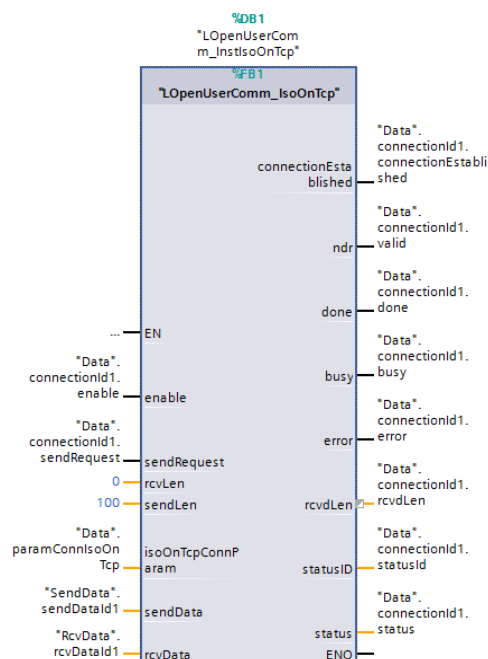
1. Double-click the "Main [OB1]" block in the project tree in the "Program blocks" folder of the CPU. The OB 1 is opened in the workspace.
2. Select the "LOpenUserComm_IsoOnTcp" function block in the project tree in the "Program blocks" folder of your CPU and add it into a network of the OB 1, using drag-and-drop. The "Call options" dialog is opened automatically in order to create the instance data block of the "LOpenUserComm_IsoOnTcp" function block.



- Enter the name of the instance DB, for example, "LOpenUserComm_InstIsoOnTcp". Select the "Automatic" option so that the number of the instance DB is automatically assigned by STEP 7 (TIA Portal).



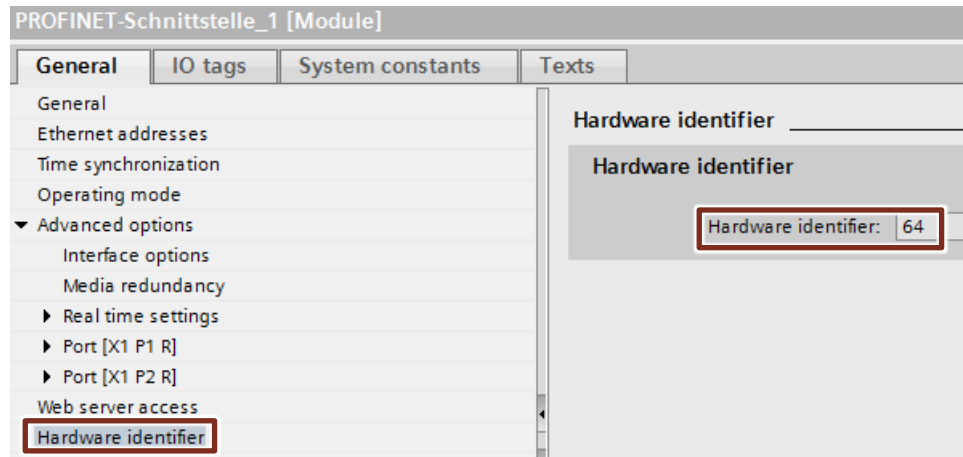
- Assign the inputs and outputs of the "LOpenUserComm_IsoOnTcp" function block with the appropriate variables.



2.4 Determining hardware identifier of the CPU or CP/CM interface

1. In the network view or device view select the CPU or CP/CM interface whose hardware identifier you would like to determine.
2. The properties of the CPU or CP/CM interface are displayed in the inspector window.
3. Click the "Hardware identifier" entry in the "General" tab in order to display the hardware identifier of the interface.

Figure 2-5



2.5 Error handling S7-1200 and S7-1500

In FB "LOpenUser Comm_IsoOnTcp" some error states are caught as an example and responses are programmed. However, you can also catch all error states that are supplied by the OUC instructions and implement your own responses according to this pattern depending on your requirements.

2.5.1 Error while establishing the connection

Connection partner cannot be reached (network error)

The connection partner can, for example, not be reached, when the network cable to the connection partner is not plugged in or broken.

When actively establishing a connection, the "TCON" instruction recognizes this error and outputs status 80C6 (hex). In this case the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-3

Output parameter	Value	Description	Remedy
status	16#80C6	Status display of the TCON instruction: The connection partner cannot be reached (network error).	Check the network cable between the communication partners: Plug in the network cable or replace it, if required. Retrigger the connection establishment via the enable=1 parameter.
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	

Note Because the values are output on the output parameters only for one cycle, the values of "status" and "statusId" have to be saved if error=1.

When passively establishing a connection, the "TCON" instruction does not recognize this error. In this case the watchdog timer is started. When the watchdog timer has lapsed after 3 min, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-4

Output parameter	Value	Description	Remedy
status	16#8102	Connection could not be established (watchdog timer lapsed (3 min)).	Check the network cable between the communication partners: Plug in the network cable or replace it, if required. Retrigger the connection establishment via the enable=1 parameter.
statusId	1	internal error in function block	
error	1	Error display: 1: Error detected	

IP address of the remote end point of the connection invalid

If the IP address of the remote end point of the connection is invalid or it corresponds to the IP address of the local end point of the connection, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-5

Output parameter	Value	Description	Remedy
status	16#80A4	Status display of the TCON instruction	Check the remote IP address in the TCON_IP_RFC parameter data record. No broadcast and network addresses must be used. Retrigger the connection establishment via the enable=1 parameter.
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	

Among others, invalid remote IP addresses are:

- Broadcast addresses, for example, 192.168.0.255
- Network addresses, for example, 192.168.0.0

Temporary communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-6](#), if one of the following temporary communication errors occurs:

- The connection can currently not be established if, for example, the IP address of the partner endpoint is not correctly entered in the "TCON_IP_RFC" parameter data record in "RemoteAddress".
- The connection cannot be established because the firewalls on the connection path are not released for the required ports.
- The interface is currently receiving new parameters.
- The configured connection is currently removed from a TDISCON instruction.

Table 2-6

Output parameter	Value	Description	Remedy
status	16#80C4	Status display of the TCON instruction	Check the IP address of the partner endpoint in the "TCON_IP_RFC" parameter data record. Enter the IP address of the partner endpoint at RemoteAddress in the "TCON_IP_RFC" parameter data record. Retrigger the connection establishment via the enable=1 parameter.
statusId	2	Error while establishing the connection with TCON	
Error	1	Error display: 1: Error detected	

Connection partner denies connection establishment

Connection partner denies connection establishment if the following conditions apply:

- Connection partner is passively involved in the connection establishment and does not initiate the connection establishment.
- Configuration of TSelectors is not correct. The local TSelector in communication partner A has to match the remote TSelector in communication partner B and the remote TSelector in communication partner A has to match the local TSelector in communication partner B.

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle.

Table 2-7

Output parameter	Value	Description	Remedy
status	16#80C5	Status display of the TCON instruction	Check if the passive communication partner initiates the connection establishment. Check the remote and local TSelector as well as the connection number in the "TCON_IP_RFC" parameter data record. Use the same local and remote TSelector. The FB starts the connection establishment again.
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	

Length of the remote or local TSelector larger 32 bytes

The length of the local and remote TSelector must be a maximum of 32 bytes.

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as in [Table 2-8](#), if the following conditions apply:

- The local or remote TSelector that is specified at "Tsel" has a length larger 32 bytes.
- A length larger 32 byte is specified at "TselLength" of the local or remote TSelector.
- In the "TCON_IP_RFC" parameter data record the IP address of the partner endpoint is set to "0.0.0.0".

Table 2-8

Output parameter	Value	Description	Remedy
status	16#80B7	Status display of the TCON instruction	Check the length of the remote and local TSelector in the "TCON_IP_RFC" parameter data record. Enter a length up to 32 bytes at "TselLength" of the local or remote TSelector. Use a local and remote TSelector that has a length of up to 32 bytes at "Tsel".
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	
statusId	2	Error while establishing the connection with TCON	Enter the IP address of the partner endpoint at "RemoteAddress" in the "TCON_IP_RFC" parameter data record. Retrigger the connection establishment via the enable=1 parameter.
error	1	Error display: 1: Error detected	

Hardware identifier in the connection parameters not correct

If the "Interfaceld" parameter of the "TCON_IP_RFC" parameter data record does not reference a hardware identifier of a CPU or CM/CP interface or if it has the value "0", the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-9

Output parameters	Value	Description	Remedy
status	16#809B	Status display of the TCON instruction	Enter the hardware identifier of the local interface (value range: 0 to 65535) in the "TCON_IP_RFC" parameter data record at "Interfaceld". Detailed information on the determination of the hardware identifier can be found in chapter 2.4. Retrigger the connection establishment via the enable=1 parameter.
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	

Connection number is outside the permitted range

If the "ID" parameter of the "TCON_IP_RFC" parameter data record is outside the permitted range, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-10

Output parameters	Value	Description	Remedy
status	16#8086	Status display of the TCON instruction	Enter a value in the "TCON_IP_RFC" parameter data record at "ID" that is in the value range from 1 to 4095. Retrigger the connection establishment via the enable=1 parameter.

Configuration error in "Connectiontype" parameter

If there is a configuration error in the "ConnectionType" parameter of the "TCON_IP_RFC" parameter data record, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-11

Output parameters	Value	Description	Remedy
status	16#80B6	Status display of the TCON instruction	Enter the value 0x0C (hex) or 0x12 (hex) in the "TCON_IP_RFC" parameter data record at "ConnectionType". Retrigger the connection establishment via the enable=1 parameter.

Communication error: "TDISCON" was executed before "TCON" was ended

If the "TCON" instruction finished the connection establishment with DONE=1 or ERROR=1, a job for connection termination may be triggered.

If the connection establishment is cancelled prematurely by calling a "TDISCON", the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle.

Table 2-12

Output parameters	Value	Description	Remedy
status	16#80A7	Status display of the TCON instruction	The connection is disconnected by the FB, since the connection establishment was prematurely cancelled by calling a "TDISCON". Retrigger the connection establishment via the enable=1 parameter.
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	

Job for establishing a connection is triggered during connection termination

If a job to establish a connection is triggered, whilst the disconnection of a connection is running, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle.

Table 2-13

Output parameters	Value	Description	Remedy
status	16#80A3	Status display of the TCON instruction	The connection is disconnected by the FB, since the job for establishing a connection was triggered during a running connection termination. Retrigger the connection establishment via the enable=1 parameter.
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	

2.5.2 Error when receiving data

Configured length of the receive data invalid

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as in [Table 2-14](#), if the following conditions apply:

- The configured length of the receive data is larger than the largest permitted value.
- The parameters "rcvLen" and "rcvData" of FB "LOpenUserComm_IsoOnTcp" have the value "0".

Table 2-14

Output parameters	Value	Description	Remedy
status	16#8085	Status display of the TRCV instruction	Specify the length of the data to be received on the "rcvLen" parameter. Specify the receive area on the "rcvData" parameter. Detailed information regarding the maximum number of user data that is to be transferred using ISO-on-TCP can be found in the following FAQ 18909487 . Note If you use a receive area with optimized access on the "rcvData" parameter, the "rcvLen" parameter has to have the value 0.
statusId	3	Error when receiving data using TRCV	
error	1	Error display: 1: Error detected	

Receive area incorrectly configured

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as in [Table 2-15](#), if the following conditions apply:

- Receive area too small
- Value on "rcvLen" parameter larger than the receive area that is specified on the "rcvData" parameter

Table 2-15

Output parameters	Value	Description	Remedy
status	16#8088	Status display of the TRCV instruction	Value on "rcvLen" parameter must not be larger than the receive area that is specified on the "rcvData" parameter. If you use a receive area with optimized access on the "rcvData" parameter, the "rcvLen" parameter has to have the value 0.
statusId	3	Error when receiving data using TRCV	
error	1	Error display: 1: Error detected	

Length of the receive area smaller than the length of the sent data

If the length of the receive area is smaller than the length of the data that the communication partner sends, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-16

Output parameters	Value	Description	Remedy
status	16#80C9	Status display of the TRCV instruction	<p>The receive area that you specify on the "rcvData" parameter has to have at least the size of the length of the data that is sent by the communication partner.</p> <p>The length that is specified on the "rcvLen" parameter has to have at least the size of the length of the data that the communication partner sends.</p> <p>If you use a receive area with optimized access on the "rcvData" parameter, the "rcvLen" parameter has to have the value 0.</p>
statusId	3	Error when receiving data using TRCV	
Error	1	Error display: 1: Error detected	

Communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-17](#), if one of the following communication errors occurs:

- The specified connection has not been established yet.
- The specified connection is currently disconnected. Receive job not possible via this connection
- The connection is currently reinitiated.

Table 2-17

Output parameters	Value	Description	Remedy
status	16#80A1	Status display of the TRCV instruction	<p>Check the network cable between the communication partners: Plug in the network cable or replace it, if required.</p> <p>Check if the communication partner has disconnected the connection.</p> <p>If enable = 1, the connection is automatically re-established by the FB as soon as the communication error is removed.</p>
statusId	3	Error when receiving data using TRCV	
error	1	Error display: 1: Error detected	

Temporary communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-18](#), if one of the following temporary communication errors occurs:

- Connection to the partner can currently not be established.
- The interface receives new parameter settings or the connection is established.

Table 2-18

Output parameters	Value	Description	Remedy
status	16#80C4	Status display of the TRCV instruction	Check the network cable between the communication partners: Plug in the network cable or replace it, if required. Check if the communication partner has disconnected the connection. If enable = 1, the connection is automatically re-established by the FB as soon as the communication error is removed.
statusId	3	Error when receiving data using TRCV	
error	1	Error display: 1: Error detected	

2.5.3 Error when sending data

Configured length of the send data invalid

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as in [Table 2-19](#), if the following conditions apply:

- The configured length of the send data is larger than the largest permitted value.
- The parameters "sendLen" and "sendData" of FB "LOpenUseComm_IsoOnTcp" have the value "0".

Table 2-19

Output parameters	Value	Description	Remedy
status	16#8085	Status display of the TSEND instruction	Specify the length of the data to be sent on the "sendLen" parameter. Specify the send area on the "sendData" parameter. Detailed information regarding the maximum number of user data that is to be transferred using ISO-on-TCP can be found in the following FAQ 18909487 .
statusId	4	Error when receiving data using TSEND	
error	1	Error display: 1: Error detected	

Send area incorrectly configured

The output parameters of "LOpenUserComm_IsoOnTcp" function block are set for one cycle as in [Table 2-20](#), if the following conditions apply:

- Send area too small.
- Value on "sendLen" parameter larger than the send area that is specified on the "sendData" parameter.

Table 2-20

Output parameters	Value	Description	Remedy
status	16#8088	Status display of the TSEND instruction	Value on "sendLen" parameter must not be larger than the send area that is specified on the "sendData" parameter.
statusId	4	Error when receiving data using TSEND	
error	1	Error display: 1: Error detected	

Communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-21](#), if one of the following communication errors applies:

- The specified connection has not been established yet.
- The specified connection is currently disconnected. Send job not possible via this connection
- The connection is currently reinitiated.

Table 2-21

Output parameters	Value	Description	Remedy
status	16#80A1	Status display of the TSEND instruction	Check the network cable between the communication partners: Plug in the network cable or replace it, if required. Check if the communication partner has disconnected the connection. If enable = 1, the connection is automatically re-established by FB "LOpenUserComm_IsoOnTcp" as soon as the communication error is removed.
statusId	4	Error when receiving data using SEND	
error	1	Error display: 1: Error detected	

Temporary communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-22](#), if one of the following temporary communication errors applies:

- Connection to the partner can currently not be established.
- The interface receives new parameter settings or the connection is established.

Table 2-22

Output parameters	Value	Description	Remedy
status	16#80C4	Status display of the TSEND instruction	Check the network cable between the communication partners: Plug in the network cable or replace it, if required. Check if the communication partner has disconnected the connection. If enable = 1, the connection is automatically re-established by the FB as soon as the communication error is removed.
statusId	4	Error when receiving data using TSEND	
error	1	Error display: 1: Error detected	

2.5.4 Error while connection termination

Connection does not exist or is already disconnected

If the connection that is referenced via the "ID" parameter of the "TCON_IP_RFC" parameter data record does not exist or is already disconnected, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-23

Output parameters	Value	Description	Remedy
status	16#80A3	Status display of the TDISCON instruction	Retrigger the connection establishment via the enable=1 parameter.
statusId	5	Error while the connection termination using TDISCON	
error	1	Error display: 1: Error detected	

Connection number is outside the permitted range

If the "ID" parameter of the "TCON_IP_RFC" parameter data record is outside the permitted range, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-24

Output parameters	Value	Description	Remedy
status	16#8086	Status display of the TDISCON instruction	Enter a value in the "TCON_IP_RFC" parameter data record at "ID" that is in the value range from 1 to 4095.
statusId	5	Error while the connection termination using TDISCON	
Error	1	Error display 1: Error detected	

Temporary communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-25](#), if one of the following temporary communication errors occurs:

- Interface is reconfigured
- Connection currently being set up

Table 2-25

Output parameter	Value	Description	Remedy
status	16#80C4	Status display of the TDISCON instruction	The FB tries to disconnect the connection again.
statusId	5	Error while the connection termination using TDISCON	
Error	1	Error display: 1: Error detected	

2.6 Error handling S7-300 and S7-400

2.6.1 Error while establishing the connection

Connection partner cannot be reached

The connection partner cannot be reached if, for example, the following conditions apply:

- Network cable to connection partner not plugged in or broken
- The correct IP address of the partner endpoint was not entered in the "TCON_PAR" parameter data record at "rem_staddr".
- Configuration of the local and remote TSAP-ID is not correct. The local TSAP-ID in communication partner A has to match the remote TSAP-ID in communication partner B and the remote TSAP-ID in communication partner A has to match the local TSAP-ID in communication partner B.

- Connection partner is passively involved in the connection establishment and does not initiate the connection establishment.

In this case the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-26

Output parameter	Value	Description	Remedy
status	16#8102	Connection could not be established (watchdog timer lapsed (3 min)).	<ul style="list-style-type: none"> • Check the network cable between the communication partners: Plug in the network cable or replace it, if required. • Check the IP address of the partner endpoint in the "TCON_PAR" parameter data record: Enter the IP address of the partner endpoint at rem_staddr in the "TCON_PAR" parameter data record. • Check the remote and local TSAP-ID in the "TCON_PAR" parameter data record: Use the same local and remote TSAP-ID. • Check if the passive communication partner initiates the connection establishment. Retrigger the connection establishment via the enable=1 parameter.
statusId	1	internal error in function block	
error	1	Error display: 1: Error detected	

Temporary communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in , if one of the following temporary communication errors occurs:

- The connection cannot be established because the firewalls on the connection path are not released for the required ports.
- The interface is currently receiving new parameters.
- The configured connection is currently removed from a TDISCON instruction.

Table 2-27

Output parameter	Value	Description	Remedy
status	16#80C4	Status display of the TCON instruction	Retrigger the connection establishment via the enable=1 parameter.
statusId	2	Error while establishing the connection with TCON	
Error	1	Error display: 1: Error detected	

Length parameter in parameter data record "TCON_PAR" incorrectly configured

If the following length parameters are configured incorrectly, the local and remote TSelector must be a max. of 32 bytes.

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle, if the following length parameters are incorrectly configured in the "TCON_PAR" parameter data record:

- block_length: Length of the parameter data record "TCON_PAR": 64 bytes (fixed)
- local_tsap_id_len: Length of the local TSAP-ID
- rem_subnet_id_len: Parameter is currently not used: B#16#00
- rem_staddr_len: Length of the address of the remote connection endpoint
 - 0: unspecified, i.e. rem_staddr parameter is irrelevant
 - 4: valid IP address in rem_staddr parameter
- rem_tsap_id_len: Length of the remote TSAP-ID
- next_staddr_len: used length of the next_staddr parameter

Table 2-28

Output parameter	Value	Description	Remedy
status	16#80B7	Status display of the TCON instruction	Check the length parameters in the "TCON_PAR" parameter data record. Retrigger the connection establishment via the enable=1 parameter.
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	

"local_device_id" does not match CPU

If the "local_device_id" that is specified in parameter data record "TCON_PAR" does not match the CPU, the output parameters of the FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle.

Table 2-29

Output parameters	Value	Description	Remedy
status	16#809B	Status display of the TCON instruction	Check whether the "local_device_id" specified in the "TCON_PAR" parameter data record, matches the CPU. Detailed information on the "local_device_id" parameter is available in the following entry FAQ 51339682 . Retrigger the connection establishment via the enable=1
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	

Output parameters	Value	Description	Remedy
			parameter.

Connection number is outside the permitted range

If the "id" parameter of the "TCON_PAR" parameter data record is outside the permitted range, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-30

Output parameters	Value	Description	Remedy
status	16#8086	Status display of the TCON instruction	Enter a value in the "TCON_PAR" parameter data record at "id" that is in the value range from W#16#0001 to W#16#0FFF. Retrigger the connection establishment via the enable=1 parameter.

Configuration error in "connection_type" parameter

If there is a configuration error in the "connection_type" parameter of the "TCON_PAR" parameter data record, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-31

Output parameters	Value	Description	Remedy
status	16#80B6	Status display of the TCON instruction	Enter the value B#16#12 in the "TCON_PAR" parameter data record at "connection_type". Retrigger the connection establishment via the enable=1 parameter.

Communication error: "TDISCON" was executed before "TCON" was ended

If the "TCON" instruction ended the connection establishment with DONE=1 or ERROR=1, a job for establishing a job may be triggered.

If the connection establishment is cancelled prematurely by calling a "TDISCON", the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle.

Table 2-32

Output parameters	Value	Description	Remedy
status	16#80A7	Status display of the TCON instruction	The connection is disconnected by the FB, since the connection establishment was prematurely cancelled by calling a "TDISCON". Retrigger the connection establishment via the enable=1 parameter.
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	

Attempt to establish a connection of an existing connection

If you are trying to re-establish an existing connection, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle.

Table 2-33

Output parameters	Value	Description	Remedy
status	16#80A3	Status display of the TCON instruction	Since you are trying to re-establish an existing connection, the connection is disconnected by the FB. Retrigger the connection establishment via the enable=1 parameter.
statusId	2	Error while establishing the connection with TCON	
error	1	Error display: 1: Error detected	

2.6.2 Error when receiving data

Configured length of the receive data invalid

If the configured length of the receive data is larger than the largest permitted value, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle.

Table 2-34

Output parameters	Value	Description	Remedy
status	16#8085	Status display of the TRCV instruction	Specify the length of the data to be received on the "rcvLen" parameter. Detailed information regarding the max. number of user data that is to be transferred using ISO-on-TCP can be found in the following FAQ 18909487 .
statusId	3	Error when receiving data using TRCV	
error	1	Error display: 1: Error detected	

Receive area incorrectly configured

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as in [Table 2-15](#), if the following conditions apply:

- Receive area too small
- Value on "rcvLen" parameter larger than the receive area that is specified on the "rcvData" parameter

Table 2-35

Output parameters	Value	Description	Remedy
status	16#8088	Status display of the TRCV instruction	Value on "rcvLen" parameter must not be larger than the receive area that is specified on the "rcvData" parameter.
statusId	3	Error when receiving data using TRCV	
error	1	Error display: 1: Error detected	

Communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-36](#), if one of the following communication errors occur:

- The specified connection has not been established yet.
- The specified connection is currently disconnected. Receive job not possible via this connection
- The connection is currently reinitiated.

Table 2-36

Output parameters	Value	Description	Remedy
status	16#80A1	Status display of the TRCV instruction	<p>Check the network cable between the communication partners: Plug in the network cable or replace it, if required.</p> <p>Check if the communication partner has disconnected the establishment.</p> <p>If enable = 1, the connection is automatically re-established by the FB as soon as the communication error is removed.</p>

Temporary communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-37](#), if one of the following temporary communication errors occurs:

- Connection to the partner can currently not be established.
- The interface receives new parameter settings or the connection is established.
- Length of the receive area is smaller than the length of the data that the communication partner sends

Table 2-37

Output parameters	Value	Description	Remedy
status	16#80C4	Status display of the TRCV instruction	<p>Check the network cable between the communication partners: Plug in the network cable or replace it, if required. Check if the communication partner has disconnected the establishment.</p> <p>The length of the receive area that you specify on the "rcvData" parameter has to have at least the size of the length of the data that is sent by the communication partner.</p> <p>The length that is specified on the "rcvData" parameter has to have at least the size of the length of the data that the communication partner sends.</p> <p>If enable = 1, the connection is automatically re-established by the FB as soon as the communication error is removed.</p>

2.6.3 Error when sending data

Configured length of the send data invalid

If the configured length of the send data is larger than the largest permitted value, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle.

Table 2-38

Output parameters	Value	Description	Remedy
status	16#8085	Status display of the TSEND instruction	<p>Specify the length of the data to be sent on the "sendLen" parameter.</p> <p>Detailed information regarding the max. number of user data that is to be transferred using ISO-on-TCP can be found in the following FAQ: 18909487.</p>

Send area incorrectly configured

The output parameters of "LOpenUserComm_IsoOnTcp" function block are set for one cycle as in [Table 2-39](#), if the following conditions apply:

- Send area too small
- Value on "sendLen" parameter larger than the send area that is specified on the "sendData" parameter

Table 2-39

Output parameters	Value	Description	Remedy
status	16#8088	Status display of the TSEND instruction	Value on "sendLen" parameter must not be larger than the send area that is specified on the "sendData" parameter
statusId	4	Error when receiving data using TSEND	
error	1	Error display: 1: Error detected	

Communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-40](#), if one of the following communication errors are the case:

- The specified connection has not been established yet.
- The specified connection is currently disconnected. Receive job not possible via this connection
- The connection is currently reinitiated.

Table 2-40

Output parameters	Value	Description	Remedy
status	16#80A1	Status display of the TSEND instruction	Check the network cable between the communication partners: Plug in the network cable or replace it, if required. Check if the communication partner has disconnected the establishment. If enable = 1, the connection is automatically re-established by FB "LOpenUserComm_IsoOnTcp" as soon as the communication error is removed.

Temporary communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-41](#), if one of the following temporary communication errors is the case:

- Connection to the partner can currently not be established.
- The interface receives new parameter settings or the connection is established.

Table 2-41

Output parameters	Value	Description	Remedy
status	16#80C4	Status display of the TSEND instruction	Check the network cable between the communication partners: Plug in the network cable or replace it, if required. Check if the communication partner has disconnected the establishment. If enable = 1, the connection is automatically re-established by the FB as soon as the communication error is removed.

2.6.4 Error while connection termination

Connection does not exist or is already disconnected

If the connection that is referenced via the "ID" parameter of the "TCON_IP_RFC" parameter data record does not exist or is already disconnected, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-42

Output parameters	Value	Description	Remedy
status	16#80A3	Status display of the TDISCON instruction	Retrigger the connection establishment via the enable=1 parameter.
statusId	5	Error while the connection termination using TDISCON	
error	1	Error display: 1: Error detected	

Connection number is outside the permitted range

If the "id" parameter of the "TCON_PAR" parameter data record is outside the permitted range, the output parameters of FB "LOpenUserComm_IsoOnTcp" are set as follows for one cycle:

Table 2-43

Output parameters	Value	Description	Remedy
status	16#8086	Status display of the TDISCON instruction	Enter a value in the "TCON_PAR" parameter data record at "id" that is in the value range from W#16#0001 to W#16#0FFF.
statusId	5	Error while the connection termination using TDISCON	
Error	1	Error display 1: Error detected	

Temporary communication error

The output parameters of FB "LOpenUserComm_IsoOnTcp" are set for one cycle as shown in [Table 2-44](#), if one of the following temporary communication errors occurs:

- Interface is reconfigured
- Connection currently being set up

Table 2-44

Output parameter	Value	Description	Remedy
status	16#80C4	Status display of the TDISCON instruction	The FB tries to disconnect the connection again.
statusId	5	Error while the connection termination using TDISCON	
Error	1	Error display: 1: Error detected	

2.6.5 Explanation regarding the "stateMachine" region

The state machine includes the following states:

- STATE_IDLE
- STATE_PARAM
- STATE_CONNECT
- STATE_CONNECTED
- STATE_RECEIVE
- STATE_SEND

STATE_IDLE

In the "STATE_IDLE" idle state all parameters (static tags and outputs of the FB "LOpenUserComm_IsoOnTcp") are reset.

The FB "LOpenUserComm_IsoOnTcp" waits in the "STATE_IDLE" state until it detects a positive edge on the "enable" input parameter.

STATE_PARAM

The connection parameters are read.

The FB "LOpenUserComm_IsoOnTcp" changes to the "STATE_CONNECT" state without transition conditions.

STATE_CONNECT

The job for establishing a connection is triggered if the connection is not established.

If the connection is successfully established with "TCON", the FB "LOpenUserComm_IsoOnTcp" goes to the "STATE_CONNECTED" state. The connection remains established until "TDISCON" is disconnected the connection.

If an error occurs while establishing the connection, the following actions are performed in FB "LOpenUserComm_IsoOnTcp":

- The error information is saved in the static "statStatus" tag of the "Word" data type.
- The state in which the error occurred is saved in the static "statStatusId" tag of the "UInt" data type.
- The FB changes into the "STATE_ERROR" state.

The values of the tags "statStatus" and "statStatusId" are transferred to the "status" and "statusId" output parameters of the FB "LOpenUserComm_IsoOnTcp" in the "STATE_ERROR" state.

Table 2-45 shows the values and meaning of the output parameters "status" and "statusId".

STATE_CONNECTED

The receipt of data using "TRCV" is released.

If new data is received using "TRCV", the following actions are performed in FB "LOpenUserComm_IsoOnTcp":

- The output parameters "ndr" and "busy" are set to the following values for one cycle:
 - ndr = 1
 - busy = 0
- The FB changes into the "STATE_RECEIVE" state.

If an error occurs while receiving data using "TRCV", the following actions are performed in FB "LOpenUserComm_IsoOnTcp":

- The error information is saved in the static "statStatus" tag of the "Word" data type.
- The state in which the error occurred is saved in the static "statStatusId" tag of the "UInt" data type.
- The FB changes into the "STATE_ERROR" state.

The values of the tags "statStatus" and "statStatusId" are transferred to the "status" and "statusId" output parameters of the FB "LOpenUserComm_IsoOnTcp" in the "STATE_ERROR" state.

Table 2-45 shows the values and meaning of the output parameters "status" and "statusId".

STATE_RECEIVE

The received data can be processed individually.

The FB "LOpenUserComm_IsoOnTcp" changes back to the "STATE_CONNECTED" state without transition conditions.

STATE_SEND

A new send job is triggered, if the following conditions apply:

- positive edge on "sendRequest" input parameter
- no send job active

If a send job is active, the following actions are performed in FB "LOpenUserComm_IsoOnTcp":

- The receipt of data using "TRCV" is disabled.
- The new send job cannot be triggered.

If a send job was successfully completed using "TSEND", the following actions are performed in FB "LOpenUserComm_IsoOnTcp":

- The output parameters "done" and "busy" are set to the following values for one cycle:
 - done = 1
 - busy = 0
- The FB changes back into the "STATE_CONNECTED" state.

If an error occurs while sending data using "TSEND", the following actions are performed in FB "LOpenUserComm_IsoOnTcp":

- The error information is saved in the static "statStatus" tag of the "Word" data type.
- The state in which the error occurred is saved in the static "statStatusId" tag of the "UInt" data type.
- The FB changes into the "STATE_ERROR" state.

The values of the tags "statStatus" and "statStatusId" are transferred to the "status" and "statusId" output parameters of the FB "LOpenUserComm_IsoOnTcp" in the "STATE_ERROR" state.

Table 2-45 shows the values and meaning of the output parameters "status" and "statusId".

STATE_DISCONNECT

The job for connection termination is triggered, if the connection is established or if another attempt to establish the connection is to be initiated.

If the connection is successfully disconnected, the FB "LOpenUserComm_IsoOnTcp" goes to the "STATE_IDLE" idle state.

If an error occurs while disconnecting the connection, the following actions are performed in FB "LOpenUserComm_IsoOnTcp":

- The error information is saved in the static "statStatus" tag of the "Word" data type.
- The state in which the error occurred is saved in the static "statStatusId" tag of the "UInt" data type.
- The FB changes into the "STATE_ERROR" state.

The values of the tags "statStatus" and "statStatusId" are transferred to the "status" and "statusId" output parameters of the FB "LOpenUserComm_IsoOnTcp" in the "STATE_ERROR" state.

[Table 2-45](#) shows the values and meaning of the output parameters "status" and "statusId".

STATE_ERROR

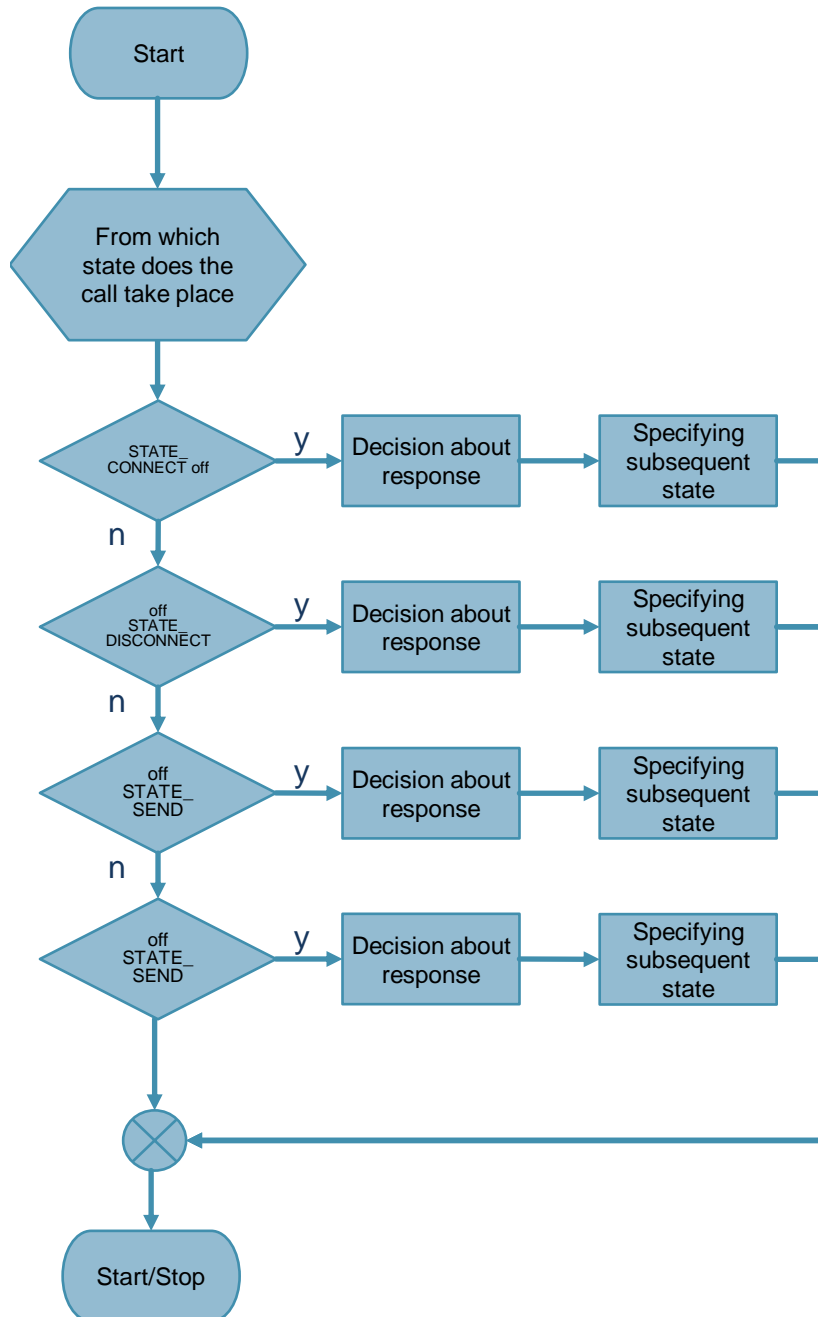
The "ERROR" state evaluates the most important error information of the OUC instructions ("TCON", "TDISCON", "TSEND" and "TRCV") and shows the user how the can respond to this error information.

The user has the option to expand the "STATE_ERROR" state according to this pattern:

- Analyze other OUC error messages and realize individual responses.
- Create your own user-specific error analyzes, for example, if the received data does not correspond to what the program expects.

The following figure shows the general pattern according to which this state is realized.

Figure 2-6



In the "Decision about response" program block it is defined how the FB "LOpenUserComm_IsoOnTcp" will respond in the event of an error. The response depends on the state in which the error occurred. In this example, the following responses present themselves, depending on the cause of the error:

- If an error occurs while establishing the connection, the following responses are realized in FB "LOpenUserComm_IsoOnTcp":
 - In order to remove the error autonomously, the FB changes to the "STATE_DISCONNECT" or "STATE_CONNECT" state.
If an established connection has to be disconnected first before the establishment of a connection can be started again internally, the FB changes to the "STATE_DISCONNECT" state.
If the connection partner refuses the establishment of a connection or has actively disconnected the connection, the FB changes to the "STATE_CONNECT" state, in order to internally restart the connection establishment.
 - If an error occurs that has to be removed by the user, the FB changes to the "STATE_IDLE" idle state. This error occurs, for example, if the connection configuration is incorrect or there is a network error so that the connection partner cannot be reached. The user has to remove the error and then retrigger establishing a connection via the "enable" parameter.
- If an error occurs while sending or receiving data, the following responses are realized in FB "LOpenUserComm_IsoOnTcp":
 - If the connection partner cannot be reached or there is a temporary communication error, the FB changes to the "STATE_CONENCTED" state. A temporary communication error occurs, for example, if the network cable to the connection partner is not plugged in or broken.
 - If an error occurs that has to be removed by the user, the FB changes to the "STATE_DISCONNECT" state. This error occurs if the length is not correctly specified on the input parameters "rcvLen" or "sendLen" or the send or receive buffer on the input parameters "rcvData" or "sendData" are not correctly specified. The connection is disconnected. The user has to remove the error and then retrigger establishing a connection via the "enable" parameter.
 - If the connection was disconnected via the "enable" parameter, the FB goes to the "STATE_IDLE" idle state.
- If an error occurs while disconnecting the connection, the following responses are realized in FB "LOpenUserComm_IsoOnTcp":
 - In order to start another attempt to disconnect the connection, the FB changes to the "STATE_DISCONNECT" state. Once the connection has been successfully disconnected, it is waited in the "STATE_IDLE" state until a positive edge is detected on the "enable" input parameter.

Note

If an error occurs, the "error" output parameter is set to the value "1" for one cycle and the respective error information is output on the "status" output parameter. Via the "statusId" output parameter you will receive information on the state in which the error occurred.

The following table shows the values and meaning of the output parameters "status" and "statusId" of the "LOpenUserComm_IsoOnTcp" function block.

Table 2-45

statusId Value (dec)	Meaning	status Value (hex)	Comment
1	internal error in function block	16#8101	Function block could not be activated.
1	internal error in function block	16#8102	Connection could not be established (watchdog timer lapsed (3 min)).
2	Error on TCON	-	The "status" of TCON is output on the "status" output parameter of the "LOpenUserComm_IsoOnTcp" function block.
3	Error on TREC V	-	The "status" of TRCV is output on the "status" output parameter of the "LOpenUserComm_IsoOnTcp" function block.
4	Error on TSEND	-	The "status" of TSEND is output on the "status" output parameter of the "LOpenUserComm_IsoOnTcp" function block.
5	Error on TDISCON	-	The "status" of TDISCON is output on the "status" output parameter of the "LOpenUserComm_IsoOnTcp" function block.

3 Valuable Information

3.1 Basics

3.1.1 Basics on ISO-on-TCP Protocol

For more information on the ISO-on-TCP protocol, please refer to the following FAQ:

<https://support.industry.siemens.com/cs/ww/en/view/26484227>

3.1.2 Configuration of the "TCON_IP_RFC" parameter data record

In order to configure the communication connections at ISO-on-TCP, a connection description DB with a structure according to "TCON_IP_RFC" is used for the CPUs of S7-1200 as of V4.0 and S7-1500. The fixed data structure of the "TCON_IP_RFC" contains the parameters required to establish the connection.

The "isoOnTcpConnParam" connection parameter of the FB "LOpenUserComm_IsoOnTcp" contains a reference to the data block used.

Table 3-1

Byte	Parameter	Data type	Start value	Description
0 to 1	Interfaceld	HM_ANY	64	Hardware identifier of the local interface (value range: 0 to 65535) Detailed information on the determination of the hardware identifier can be found in chapter 2.4.
2 to 3	ID	CONN_OUC	1	Connection number (values range: 1 to 4095)
4	ConnectionType	BYTE	12	Connection type 12: ISO-on-TCP (12 dec = 0x0C hex)
5	ActiveEstablished	BOOL	False	Identifier for the type of connection establishment: <ul style="list-style-type: none"> False: passive connection establishment True: active connection establishment
8 to 11	RemoteAddress	ARRAY [1..4] of BYTE	-	IP address of the partner endpoint, for example, for 192.168.0.2
12 to 45	RemoteTselector	TSelector	-	TSelector of the remote connection partner: <ul style="list-style-type: none"> TSelLength = value range 0 to 32 as UINT TSel[1-32] = value range each 0 to 255 in byte

Byte	Parameter	Data type	Start value	Description
46 to 79	LocalTselector	TSelector	-	TSelector of the local connection partner: <ul style="list-style-type: none"> TSelLength = value range 0 to 32 as UINT TSel[1-32] = value range each 0 to 255 in byte

Note

We recommend using the same TSelector for the local and remote connection partner.

3.1.3 Configuration of the "TCON_PAR" parameter data record

In order to configure the communication connections at ISO-on-TCP, create a DB for the CPUs of S7-300 and S7-400 that contains the data structure from UDT 65 "TCON_PAR". This data structure contains the parameters you need to establish the connection.

The "isoOnTcpConnParam" connection parameter of the FB "LOpenUserComm_IsoOnTcp" contains a reference to the data block used.

Table 3-2

Byte	Parameter	Data type	Start value	Description
0 to 1	block_length	WORD	W#16#40	Length of UDT 65: 64 bytes (fixed)
2 to 3	id	WORD	W#16#0001	Connection number (value range: W#16#0001 to W#16#0FFF)
4	connection_type	BYTE	B#16#12	Protocol variant B#16#12: ISO-on-TCP
5	active_est	BOOL	False	Identifier for the type of connection establishment: <ul style="list-style-type: none"> False: passive connection establishment True: active connection establishment
6	local_device_id	BYTE	B#16#02	Detailed information on the "local_device_id" parameter is available in entry 51339682 .
7	local_tsap_id_len	BYTE	B#16#02	Used length of the "local_tsap_id" parameter The following values are possible at "connection_type" = B#16#12: <ul style="list-style-type: none"> 2 to 16
8	rem_subnet_id_len	BYTE	B#16#00	This parameter is currently not used. You have to assign it using B#16#00.

3 Valuable Information

Byte	Parameter	Data type	Start value	Description
9	rem_staddr_len	BYTE	B#16#00	Length of the address of the remote connection endpoint: <ul style="list-style-type: none"> 0: unspecified, i.e., "rem_staddr" parameter is irrelevant 4: valid IP address in "rem_staddr" parameter
10	rem_tsap_id_len	BYTE	B#16#00	Used length of the "rem_tsap_id" parameter The following values are possible at "connection_type" = B#16#12: <ul style="list-style-type: none"> Active page: 2 to 16 Passive page: 0 (unspecified) or 2 to 16
11	next_staddr_len	BYTE	B#16#00	Used length of the parameter (only relevant for ISO-on-TCP)
12 to 27	local_tsap_id	ARRAY [1..16] of BYTE	-	Local TSAP-ID Detailed information on TSAP-ID can be found in chapter " Length and configuration of the local and remote TSAP-ID "
28 to 33	rem_subnet_id	ARRAY [1..16] of BYTE	B#16#00	This parameter is currently not used. You have to assign it using B#16#00.
34 to 39	rem_staddr	ARRAY [1..6] of BYTE	-	IP address of the remote connection endpoint, for example, 192.168.0.1: rem_staddr[1] = B#16#C0 rem_staddr[2] = B#16#A8 rem_staddr[3] = B#16#0 rem_staddr[4] = B#16#1 rem_staddr[5] = B#16#00 rem_staddr[6] = B#16#00
40 to 55	rem_tsap_id	ARRAY [1..16] of BYTE	-	Remote TSAP-ID Detailed information on TSAP-ID can be found in chapter " Length and configuration of the local and remote TSAP-ID "

Byte	Parameter	Data type	Start value	Description
56 to 61	next_staddr	ARRAY [1..6] of BYTE	-	Depending on "local_device_id" parameter "local_device_id" = B#16#00: <ul style="list-style-type: none"> next_staddr[1]: Rack and slot of the appropriate (local) CP (bits 0 to 4: slot, bits 5 to 7: rack) next_staddr[2-6]: B#16#00 "local_device_id" <> B#16#00: <ul style="list-style-type: none"> next_staddr[1-6] = B#16#00
62 to 63	spare	WORD	W#16#0000	Reserve Assign this parameter using W#16#0000.

Length and configuration of the local and remote TSAP-ID

- Active connection establishment:
 - Remote TSAP-ID:
Each string with a length of between 1 and 16 byte is permitted. Each string can have a value between B#16#00 to B#16#FF.
 - Local TSAP-ID:
For an integrated IE interface, each string with a length of between 1 and 16 byte is permitted. Each string can have a value between B#16#00 to B#16#FF.
- Passive connection establishment:
 - Remote TSAP-ID:
Each string with a length of between 1 and 16 byte is permitted. Each string can have a value between B#16#00 to B#16#FF.
 - Local TSAP ID: see [Table 3-3](#)

Table 3-3

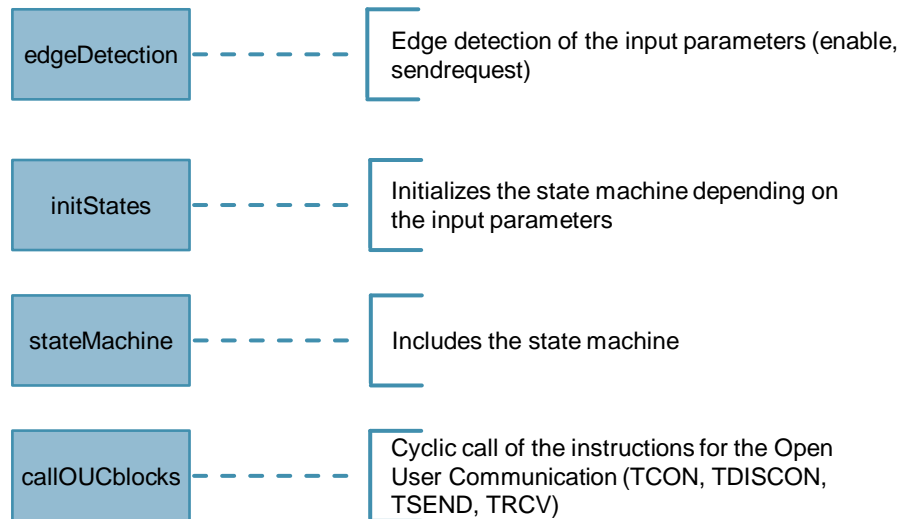
loc_tsap_id_len	local_tsap_id[1]	local_tsap_id[2]	local_tsap_id[3 to 16]
2	B#16#E0 (connection type T connection)	0 (only for integrated IE interface) or rack and slot of the dedicated CPU (bits 0 to 4 slot, bits 5 to 7 rack number)	Does not exist
3 to 16	B#16#E0 (connection type T connection)	0 (only for integrated IE interface) or rack and slot of the dedicated CPU (bits 0 to 4 slot, bits 5 to 7 rack number)	TSAP expansion
	only for integrated IE interface: a ASCII string (B#16#20 to B#16#7E)	irrelevant	TSAP expansion

3.2 Details on the mode of operation

3.2.1 Structure of the program

The following figure shows the structure of FB "LOpenUserComm_IsoOnTcp". The program consists of four regions.

Figure 3-1



3.2.2 Explanation regarding the "edgeDetection" region

The "edgeDetection" region includes the edge evaluation of the following input parameters:

- "enable": positive and negative edge is evaluated
- "sendRequest": positive edge is evaluated

3.2.3 Explanation regarding the "initStates" region

If a positive edge is detected on the "enable" input parameter, the following actions are performed in FB "LOpenUserComm_IsoOnTcp":

- "busy" output parameter is set to value "1".
- State machine is initiated using the "STATE_PARAM" state, in order to read the connection parameters and to trigger a job to establish a connection.

- State machine is initialized using the "STATE_DISCONNECT" state in order to establish a connection if it could not be successfully established within 3 min.

If a negative edge is detected on the "enable" input parameter, the state machine is initialized using the "STATE_DISCONNECT" state in order to trigger a job to establish a connection.

If a positive edge is detected on the "sendRequest" input parameter and the connection is established, the state machine is initialized using the "STATE_SEND" state in order to trigger a send job.

4 Annex

4.1 Service and support

Industry Online Support

Do you have any questions or need support?

Siemens Industry Online Support offers access to our entire service and support know-how as well as to our services.

Siemens Industry Online Support is the central address for information on our products, solutions and services.

Product information, manuals, downloads, FAQs and application examples – all information is accessible with just a few mouse clicks at

<https://support.industry.siemens.com/>.

Technical Support

Siemens Industry's Technical Support offers quick and competent support regarding all technical queries with numerous tailor-made offers – from basic support to individual support contracts.

Please address your requests to the Technical Support via the web form:

www.siemens.en/industry/supportrequest.

Service offer

Our service offer comprises, among other things, the following services:

- Product Training
- Plant Data Services
- Spare Parts Services
- Repair Services
- On Site and Maintenance Services
- Retrofit and Modernization Services
- Service Programs and Agreements

Detailed information on our service offer is available in the Service Catalog:

<https://support.industry.siemens.com/cs/sc>

Industry Online Support app

Thanks to the "Siemens Industry Online Support" app, you will get optimum support even when you are on the move. The app is available for Apple iOS, Android and Windows Phone.

<https://support.industry.siemens.com/cs/ww/en/sc/2067>

4.2 Links and literature

Table 4-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the entry page of the application example https://support.industry.siemens.com/cs/ww/en/view/109747710
\3\	STEP 7 Professional V14 SP1 https://support.industry.siemens.com/cs/ww/en/view/109747136

4.3 Change documentation

Table 4-2

Version	Date	Modifications
V1.0	06/2017	First version
V1.1	08/2017	Entry for S7-300, S7-400 and CPs/CMs expanded <ul style="list-style-type: none"> Chapter 2.6 and chapter 3.1.3 added