



## TSEND\_C: Establishing a connection and sending data

### Validity

The following description of the "TSEND\_C" instruction is valid for:

- Ethernet
  - CPU S7-1200 with firmware version  $\geq$  V4.0 and CPU S7-1500
  - CPU S7-1500 firmware version V2.1 and higher: UDP multicast communication
  - CPU S7-1500 as of firmware version V2.0 and TSEND\_C as of instruction version V3.2: Secure communication

- PROFIBUS

FDL connections of the S7-1500 with CM 1542-5 as of V2.0 with the system data type TCON\_FDL

### Description

The "TSEND\_C" instruction sets up and establishes a communication connection. Once the connection has been set up and established, it is automatically maintained and monitored by the CPU.

The instruction is executed asynchronously and has the following functions:

- Setting up and establishing a communication connection
- Sending data via an existing communication connection
- Terminating or resetting the communication connection

Internally, the instruction "TSEND\_C" uses the communication instructions "TCON", "TSEND", "T\_DIAG", "T\_RESET" and "TDISCON".

#### Note

Support when programming connections

If you select an instruction for communication TCON, TSEND\_C or TRCV\_C in a program block and wish to create and assign parameters to connections of the type TCP, UDP, ISO-on-TCP or FDL, you can use the support of the connection parameter assignment. UDP multicast connections via the integrated PROFINET interfaces are possible for S7-1500-CPU's as of firmware version V2.1 and higher.

You can find the connection parameter assignment in the Inspector window of the program editor.

### Setting up and establishing a communication connection

The communication connection is set up and established with CONT=1. For information on the number of possible communication connections, refer to the technical specifications for your CPU. The connection description specified at the CONNECT parameter is used to set up the communication connection. The following connection types can be used:

- Programmed connections (structure of connection via "TCON"):
  - TCP / UDP: Connection description via the TCON\_IP\_v4 system data type
  - TCP / UDP with secure communication: Connection description via the system data types TCON\_IP\_V4\_SEC or TCON\_QDN\_SEC
  - ISO-on-TCP: Connection description via the TCON\_IP\_RFC system data type
  - ISO: Connection description via the TCON\_ISOnative system data type (for CP1543-1 only)
  - Telecontrol connections to SMS clients: Connection description via the TCON\_PHONE system data type

For this connection type, the station requires access to the mobile network via a mobile network CP.

- FDL connections of the S7-1500 with CM 1542-5 as of V2.0 with the system data type TCON\_FDL
- Configured connections
  - Specify an existing connection in the TCON\_Configured system data type.

An existing connection is terminated and the connection which has been set up is removed when the CPU goes into STOP mode. To set up and establish the connection again, you must execute "TSEND\_C" again.

### Sending data via an existing communication connection

The send job is executed when a rising edge is detected at the REQ parameter. As described above, the communication connection is established first.

You specify the send area with the DATA parameter. This includes the address and the length of the data to be sent. Do not use a data area with the data type BOOL or Array of BOOL at the DATA parameter. With the LEN parameter, you specify the maximum number of bytes sent with a send job. If you use a send area with optimized access at the DATA parameter, the LEN parameter must have the value "0".

The data to be sent must not be edited until the send job is completed.

### Terminating and resetting the communication connection

The communication connection is terminated when the CONT parameter is set to "0" even if an ongoing data transfer is not complete yet. This does not apply if you are using a configured connection for "TSEND\_C".

The connection can be reset at any time by setting the parameter COM\_RST to "1". This terminates the existing communication connection and a new connection is established. If data is being transferred at this time, this can lead to data loss.

### Parameters

The following table shows the parameters of the "TSEND\_C" instruction:

| Parameter | Declaration | Data type | Memory area                     | Description  |
|-----------|-------------|-----------|---------------------------------|--|
| REQ       | Input       | BOOL      | I, Q, M, D, L, T, C or constant | Starts the send job on a rising edge.  |
| CONT      | Input       | BOOL      | I, Q, M, D, L                   | Controls the communication connection: <ul style="list-style-type: none"> <li>• 0: Disconnect the communication connection.</li> <li>• 1: Establish and maintain the communication connection.</li> </ul>  |
| LEN       | Input       | UDINT     | I, Q, M, D, L or constant       | Optional parameter (hidden)<br><br>Maximum number of bytes to be sent with the job. If you use a send area with optimized access at the DATA parameter, the value "0" must be used at the LEN parameter.<br><br>For FDL connections of the CM 1542-5, the maximum length is 240 bytes. In this |

|         |       |         |               |   |
|---------|-------|---------|---------------|---|
|         |       |         |               | regard, note the maximum lengths that can be processed by the connection partner.   |
| CONNECT | InOut | VARIANT | D             | <p>Pointer to the structure of the connection description:</p> <ul style="list-style-type: none"> <li>Programmed connection: <ul style="list-style-type: none"> <li>For TCP or UDP, use the TCON_IP_v4 system data type. For a description, refer to <a href="#">Connection parameters with structure according to TCON_IP_v4</a>.</li> <li>For TCP or UDP with secure communication, use the structure TCON_IP_V4_SEC or TCON_QDN_SEC.</li> </ul> <p>For a description, refer to: <a href="#">Connection parameters in accordance with TCON_IP_V4_SEC</a> or <a href="#">connection parameters in accordance with TCON_QDN_SEC</a></p> <li>For ISO-on-TCP, use the TCON_IP_RFC system data type. For a description, refer to <a href="#">Connection parameters with structure according to TCON_IP_RFC</a>.</li> <li>For ISO, use the TCON_ISOnative system data type (for CP 1543-4 only). For description, refer to instruction "<a href="#">TCON</a>".</li> <li>For connections to SMS clients, use the TCON_PHONE system data type. For a description, refer to <a href="#">Connection parameters to TCON_Phone</a>.</li> <li>For FDL connections of the CM 1542-5, use the system data type TCON_FDL; see <a href="#">Connection parameters to TCON_FDL</a>.</li> </li></ul> <li>Configured connection: <ul style="list-style-type: none"> <li>For existing connections, use the TCON_Configured system data type. For a description, see "System data type for configured connections" below.</li> </ul> </li> |
| DATA    | InOut | VARIANT | I, Q, M, D, L | <p>Pointer to the send area containing the address and the length of the data to be sent.</p> <p>When transferring structures, the structures must be identical at the sending and receiving end.</p>   |
| ADDR    | InOut | VARIANT | D             | Hidden parameter that needs to be used, however, with UDP. In this case it con-   |

|         |        |      |               |  |
|---------|--------|------|---------------|--|
|         |        |      |               | <p>tains a pointer to the system data type TADDR_Param. Store the address information of the recipient (IP address and port number) in a data block with the system data type TADDR_Param.</p> <p>See also: <a href="#">Structure of the address information of the remote partner with UDP</a></p>  |
| COM_RST | InOut  | BOOL | I, Q, M, D, L | <p>Optional parameter (hidden)</p> <p>Resets the connection:</p> <ul style="list-style-type: none"> <li>• 0: Irrelevant</li> <li>• 1: The existing connection is reset.</li> </ul> <p>The COM_RST parameter is reset after evaluation by the "TSEND_C" instruction and should not, therefore, be interconnected statically.</p>  |
| DONE    | Output | BOOL | I, Q, M, D, L | <p>Status parameter with the following values:</p> <ul style="list-style-type: none"> <li>• 0: Send job not yet started or still in progress.</li> <li>• 1: Send job executed without error. This state is only displayed for one cycle.</li> </ul> <p>The output parameter DONE is set if an intermediate step was completed successfully during processing (connection establishment, sending, connection termination) and if the execution of "TSEND_C" was completed successfully.</p> |
| BUSY    | Output | BOOL | I, Q, M, D, L | <p>Status parameter with the following values:</p> <ul style="list-style-type: none"> <li>• 0: Send job not yet started or already completed.</li> <li>• 1: Send job not yet completed. A new send job cannot be started.</li> </ul>   |
| ERROR   | Output | BOOL | I, Q, M, D, L | <p>Status parameter with the following values:</p> <ul style="list-style-type: none"> <li>• 0: No error</li> <li>• 1: Error occurred during connection establishment, data transfer or connection termination.</li> </ul> <p>The output parameter ERROR can be set due to an error in the "TSEND_C" instruction or the communication instructions used internally.</p>   |
| STATUS  | Output | WORD | I, Q, M, D, L | <p>Status of instruction (see the "ERROR and STATUS parameters" description).</p>  |

You can find additional information on valid data types under "[Overview of the valid data types](#)".

## REQ, CONT and COM\_RST parameters

The parameter CONT controls the connection establishment of the "TSEND\_C" instruction regardless of the REQ parameter. The behavior of the CONT parameter partially depends on whether a programmed or a configured connection is used:

- With CONT = "0": No data is sent (regardless of whether a programmed or a configured connection is used).
- When changing CONT = "0" to "1":
  - With a programmed connection, it is established with "TCON".
  - With a configured connection, it is checked with "T\_DIAG".
- With CONT = "1":
  - As long as no data is sent (REQ="0"), the connection is checked with "T\_DIAG".
  - If the internally used communication instructions signal that no connection end point exists, the connection is automatically reestablished with "TCON".
- When changing CONT = "1" to "0":
  - With a programmed connection, it is terminated with "TDISCON".
  - With a configured connection, it is reset with "T\_RESET".

The parameter COM\_RST resets the connection when changing from "0" to "1":

- If a connection is established, it is reset with "T\_RESET" (regardless of whether a programmed or configured connection is used).
- If no connection is established, the setting of the parameter has no effect.

The REQ and COM\_RST parameters only have an effect if CONT has been set to "1". The following table shows the relationship between the REQ, CONT and COM\_RST parameters:

| REQ        | CONT  | COM_RST    | Status of the instruction | Description   |
|------------|-------|------------|---------------------------|---|
| Irrelevant | 0     | Irrelevant | Not yet executed          | No job active (STATUS = 7000).  |
| Irrelevant | 0     | Irrelevant | Initialization            | Connection is being terminated. The instruction is being reset.               |
| Irrelevant | 0 > 1 | Irrelevant | Connection establishment  | Connection is being established. Data is not being transferred yet.           |
| 0          | 1     | 0          | Connection established    | The connection is established and is monitored with the instruction "T_DIAG". |
| Irrelevant | 1     | 0 > 1      | Connection established    | The connection is interrupted by "T_RESET" briefly and reset.                 |
| 0 > 1      | 1     | 0          | Connection established    | Instruction starts sending.   |
| Irrelevant | 1     | 0 > 1      | Data is being sent        | Data transfer is interrupted. The connection is being reset.                  |

## System data type for configured connections

For configured connections at the CONNECT parameter, use the following structure for connection description to TCON\_Configured:

| Byte    | Parameter   | Data type | Start value | Description   |
|---------|-------------|-----------|-------------|---|
| 0 ... 1 | InterfaceID | HW_ANY    | -           | Hardware identifier of the local interface (value range: 0 to 65535). |

|            |                 |              |   |  |
|------------|-----------------|--------------|---|--|
| 2 ...<br>3 | ID              | CONN_O<br>UC | - | Reference to the connection (value range: 1 to 4095).<br><br>Enter the connection ID of the existing connection. |
| 4          | Connection-Type | BYTE         | - | Connection type<br><br>Select 254 (decimal) for a configured connection.   |

**Note**

For reasons of compatibility, the parameters InterfaceID and ConnectionType are part of the structure for the connection description to TCON\_Configured. These parameters do not have an effect on the connection parameter assignment; only the parameter ID for the connection ID is evaluated in the connection parameter assignment.

**BUSY, DONE and ERROR parameters**

You can check the status of the job with the BUSY, DONE, ERROR and STATUS parameters. The BUSY parameter indicates the processing status. With the DONE parameter, you can check whether or not a send job executed successfully. The ERROR parameter is set if errors occur during execution of "TSEND\_C". The error information is output at the STATUS parameter.

The following table shows the relationship between the BUSY, DONE and ERROR parameters:

| DONE | BUSY | ER-<br>ROR | Description  |
|------|------|------------|--|
| 0    | 0    | 0          | The instruction has not been executed yet (no rising edge at REQ parameter).   |
| 0    | 1    | 0          | The instruction is being executed and calls the internally used communication instructions.  |
| 1    | 0    | 0          | The send job was completed successfully. "0000" is output at the STATUS parameter. DONE = "1" is only displayed for one cycle.   |
| 0    | 0    | 1          | The execution of the instruction or an intermediate step during processing was terminated with an error. If there is a subsequent error due to an internally used communication instruction, the error that occurred first during processing is displayed. This state is only displayed for one cycle. |

**ERROR and STATUS parameters**

| ERROR | STA-<br>TUS*<br>(W#16#..<br>.) | Description  |
|-------|--------------------------------|--|
| 0     | 0000                           | Send job was executed without error.                                   |
| 0     | 0001                           | Communication connection established.                                  |
| 0     | 0003                           | Communication connection closed.                                       |
| 0     | 7000                           | No active send job execution; no communication connection established. |
| 0     | 7001                           | Initial call for establishing a connection.                            |

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|---|------|---|
| 0 | 7002 | Second call for establishing a connection   |
| 0 | 7003 | Communication connection is being terminated.   |
| 0 | 7004 | Communication connection has been established and is being monitored. No send job execution active.   |
| 0 | 7005 | Data transfer in progress.  |
| 1 | 80A1 | <ul style="list-style-type: none"> <li>• Connection or port already being used by user.</li> <li>• Communication error: <ul style="list-style-type: none"> <li>◦ The specified connection has not yet been established.</li> <li>◦ The specified connection is being terminated.</li> </ul> </li> </ul> <p>Transfer via this connection is not possible.</p> <ul style="list-style-type: none"> <li>◦ The interface is being re-initialized.</li> </ul> |
| 1 | 80A3 | The nested "T_DIAG" instruction has reported that the connection has closed.  |
| 1 | 80A4 | IP address of the remote endpoint of the connection is invalid or it matches the IP address of the local partner.   |
| 1 | 80A7 | Communication error: You called the instruction with COM_RST = 1 before the send job was complete.  |
| 1 | 80AA | A connection is currently being established with the same connection ID by another block. Repeat the job with a new rising edge at the REQ parameter.   |
| 1 | 80B3 | <ul style="list-style-type: none"> <li>• When using the protocol variant UDP the ADDR parameter does not contain any data.</li> <li>• Error in the connection description</li> <li>• The local port is already being used in a different connection description.</li> </ul>   |
| 1 | 80B4 | <p>You have violated one or both of the following conditions for passive connection establishment (active_est = FALSE) when using the ISO-on-TCP protocol variant (connection_type = B#16#12):</p> <ul style="list-style-type: none"> <li>• local_tsap_id_len &gt;= B#16#02</li> <li>• local_tsap_id[1] = B#16#E0</li> </ul>  |
| 1 | 80B5 | Only passive connection establishment is permitted for connection type 13 = UDP.  |
| 1 | 80B6 | Parameter assignment error in the connection_type parameter of the data block for connection description.   |
| 1 | 80B7 | <ul style="list-style-type: none"> <li>• For system data type TCON_Param:<br/><br/>Error in one of the following parameters of the data block for connection description: block_length, local_tsap_id_len, rem_subnet_id_len, rem_staddr_len, rem_tsap_id_len, next_staddr_len.</li> <li>• For system data types TCON_IP_V4 and TCON_IP_RFC:<br/><br/>IP address of the partner end point was set to 0.0.0.0.</li> </ul>                                |
| 1 | 8085 | The LEN parameter is larger than the highest permitted value.   |
| 1 | 8086 | The ID parameter within the CONNECT parameter is outside the permitted range.   |
| 1 | 8087 | Maximum number of connections reached; no additional connection possible.   |
| 1 | 8088 | The value at the LEN parameter does not correspond to the receive area set at the DATA parameter.   |
| 1 | 8089 | <ul style="list-style-type: none"> <li>• The CONNECT parameter does not point to a data block.</li> <li>• The CONNECT parameter does not point to a connection description.</li> </ul>  |

|   |      |   |
|---|------|---|
|   |      | <ul style="list-style-type: none"> <li>The manually created connection description has an incorrect structure for the selected connection type.</li> </ul>  |
| 1   | 8091 | Maximum nesting depth exceeded.   |
| 1   | 809A | The CONNECT parameter points to a field that does not correspond to the length of the connection description.   |
| 1   | 809B | <p>InterfaceID is invalid:</p> <ul style="list-style-type: none"> <li>It does not point to a local CPU interface or a CP.</li> <li>If you are using the connection parameter assignment, it cannot have the value 0.</li> <li>It must not have the value 0 in the used TCON_xxx structure. See <a href="#">TCON: Establish communication connection</a></li> </ul>  |
| 1   | 80C3 | <ul style="list-style-type: none"> <li>All connection resources are in use.</li> <li>A block with this ID is already being processed in a different priority group.</li> </ul>  |
| 1   | 80C4 | <p>Temporary communication error:</p> <ul style="list-style-type: none"> <li>The connection cannot be established at this time.</li> <li>The connection cannot be established because the firewalls on the connection path are not open for the required ports.</li> <li>The interface is receiving new parameters or the connection is being established.</li> <li>The configured connection is currently being removed by a <a href="#">"TDISCON"</a> instruction.</li> <li>The connection used is being terminated by a call with COM_RST = 1.</li> <li>Temporarily no receive resources available at the connection partner. The connection partner is not ready to receive.</li> </ul> |
| 1   | 80C5 | <ul style="list-style-type: none"> <li>Connection terminated by the communication partner.</li> <li>LSAP of the remote connection partner is not released</li> </ul>  |
| 1   | 80C6 | <p>Network error:</p> <ul style="list-style-type: none"> <li>Remote partner cannot be reached.</li> <li>Physical interruption on PROFIBUS</li> </ul>  |
| 1   | 8722 | Parameter CONNECT: The source area is invalid. The area does not exist in the DB.   |
| 1   | 873A | Parameter CONNECT: Access to the connection description is not possible (for example, because the DB is not available).   |
| 1   | 877F | Parameter CONNECT: Internal error.  |
| 1   | 8822 | Parameter DATA: Invalid source area, the area does not exist in the DB.   |
| 1   | 8824 | Parameter DATA: Area error in the VARIANT pointer.  |
| 1   | 8832 | Parameter DATA: The DB number is too high.  |
| 1   | 883A | Parameter DATA: No access to the data area, for example because the data block does not exist   |
| 1   | 887F | Parameter DATA: Internal error, e.g. invalid VARIANT reference.   |
| 1   | 893A | Parameter ADDR: Access to send area not possible (e.g. because the DB does not exist).  |
| * The error codes can be displayed as integer or hexadecimal values in the program editor. For information on switching the display formats, refer to "See also". |      |   |

**Note**



Error messages of the instructions "TCON", "TSEND", "T\_DIAG", "T\_RESET" and "TDISCON"

Internally, the "TSEND\_C" instruction uses the instructions "[TCON](#)", "[TSEND](#)", "[T\\_DIAG](#)", "[T\\_RESET](#)" and "[TDISCON](#)". The error messages of these instructions can also be output at the STATUS parameter. The meaning of the error codes is described in the corresponding instructions. In the event of identical error codes for internally used instructions with different meanings, the instance data block of "TSEND\_C" can be used to determine which instruction output the error.

## Example

You can find the example here: [Program example for send functions](#).

You can find additional information and the program code for the example here: [Sample Library for Instructions](#).

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## See also

[Basics of Open User Communication \(S7-1200, S7-1500\)](#)

[Difference between synchronous and asynchronous instructions \(S7-1200, S7-1500\)](#)

[Overview of connection configuration \(S7-1200, S7-1500\)](#)

[Starting connection parameter assignment \(S7-1200, S7-1500\)](#)

[Creating and assigning parameters to connections \(S7-1200, S7-1500\)](#)