6 Link SINEC H1

This Chapter is identical in both the P16 and P32 communication. Specific information differences are designated.

The configuration of the module CP1470 requires the configuring tool NML!

Order number (see SINEC Catalog IK 10):

- SINEC NML CP141x, CP1470 6GK1740-0AB00-0BA0
- SINEC NML CP141x, CP1470 with CP141 6GK1740-1AB00-0BA0

6.1 General Description

Three versions exist for the communication via SINEC H1:

**Layer 2:** The data is transmitted directly via Ethernet, defined in the SINEC H1 protocol stack. The transmission is made without a connect and without acknowledge. The communication partners are designated as transmitter and receiver. The data is packed in telegrams and transmitted or received. Therefore all SIMADYN communication utilities can communicate via SINEC H1 in this manner.

**Layer 4:** The data is transmitted via the ISO transport layer defined in the SINEC H1 protocol stack. The transmission is connect oriented and occurs with acknowledge. The communications partner is designated as transmitter and receiver. The data is packed in telegrams and transmitted or received. Therefore all SIMADYN communication utilities can communicate via SINEC H1 in this manner.

**Layer 7 (STF):** The data to be transmitted is defined as variable (object) and processed with the STF utilities “Read Variable”, “Write Variable”. The STF utilities always include a Client and a Server. The server defines the variables and reacts to utility requests; the client makes utility requests. Therefore the SIMADYN utilities “Process Data” and “Message System” can communicate via SINEC H1 in this manner.

STF is under development. Please contact SIEMENS AG when required!

Each bus user requires the following for a functional operation on the bus:

- **Ethernet Address:** Defined by the STRUC configuring.
- **Application Relations** (only for layer 7, STF) and **transport connections** define paths for the data transfer between the bus users. They are configured with NML.
- **Variable** (only layer 7, STF) or **telegrams** (only layer 4) are defined for SIMADYN by the STRUC configuring.

Terms:

**STF:** SINEC technological functions (STF) is the definition of the SINEC H1 layer 7, defined by “SINEC AP 1.0 Specification” by SIEMENS. A component of STF is the MMS conform variable utility utilized in SIMADYN.

**Client:** The client is the creator of the job for a STF utility, and the initiator of the communication.

**Server:** The server is the job recipient for a STF utility, and the reactor for the communication. The server defines objects, to which the client can access via the STF utilities.
**Variable**: A variable is a simple or compound object, localized at the server, which a client can access with STF variable utilities.

**Read Variable**: A client reads the value, with this STF utility of a variable at a server. The client transmits the request “Read Variable X”; the server transmits the value of the variable as a reply.

**Write Variable**: A client changes the value of a variable, with this STF utility, at a server. The client transmits the request “Write Variable X”, together with the new values to the server; the server transmits an acknowledge as a reply.

**Transport Connection**: The transport connection is a defined communication path between two bus users on the OSI layer 4. A transport connection is configured with NML, the configuring must correspond in both bus users. The transport connections are initially created after the bus users have started up; the data transfer is subsequently possible.

**Application Relation**: the application relation is a defined communication path between two bus users on the OSI layer 7 (STF). An application relation is configured with NML, the configuring must correspond in both bus users. One or several application relations can be based on a transport connection.

### 6.2 Hardware and Central Block

A CSH11 board must be installed and configured in the STRUC master program.

**Necessary hardware:**
- Wide rack,
- Processor module P32 or P16,
- CSH11.

The data exchange area (dual port RAM) between the processor module and the CSH11 usually has a size of 16 k byte. Utilization in a pure P32 environment with coupling memory MM4 increases the data exchange area to a size of 64 K byte.

#### 6.2.1 Light Emitting Diodes

The red and green light emitting diodes on the CSH11 front panel indicate roughly the status of the board:

<table>
<thead>
<tr>
<th>Green</th>
<th>Red</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Off</td>
<td>Temporary intermediate status (CSH11 waits approximately 3 minutes, until SIMADYN has started up) or board without power.</td>
</tr>
<tr>
<td>On</td>
<td>Off</td>
<td>Data base and synchronization with SIMADYN O.K.</td>
</tr>
<tr>
<td>Flashing</td>
<td>Off</td>
<td>Data base inconsistent; correct the NML configuring !</td>
</tr>
<tr>
<td>Off</td>
<td>On</td>
<td>No synchronization with SIMADYN; (possible cause: no @CSH11 has been configured or false slot or firmware incompatible).</td>
</tr>
<tr>
<td>Off</td>
<td>Flashing</td>
<td>Hardware Fault.</td>
</tr>
<tr>
<td>Flashing</td>
<td>On</td>
<td>Switch in position STOP or ADMIN.</td>
</tr>
</tbody>
</table>

#### 6.2.2 Switch

The ADMIN switch on the CSH11 has three positions:
~ **RUN**
All transport connections are created, data transfer takes place.

~ **STOP**
Transport connections are created, no data transfer takes place. The SIMADYN block indicates a temporary interruption of the data transfer (i.e. at the YTS connector). The green light emitting diode flashes, the red is on.

~ **ADM**
Same state as with STOP, a reset of the CSH11 with the RESET switch is additionally possible.

The data base, loaded with NML and inserted into non-volatile memory, can be deactivated with the aid of the ADMIN and RESET switch: (1) ADMIN switch in the ADM position; (2) activate RESET; (3) wait 30 seconds; (4) ADMIN switch in the RUN position. The board then starts up with a minimum configuration; productive operation is not possible. The board starts up again with the data base stored in the non-volatile memory after a further reset.

### 6.2.3 Central Block @CSH11

Configure the function block @CSH11 to initialize the CSH11.

#### 6.2.3.1 SINEC H1 – Specific Connectors

**MAA:** Ethernet address, the Ethernet address must be defined as a string, consisting of 12 hexa decimal digits; i.e. '080006010001'.

#### 6.2.3.2 Error Class and Error Code

Principle warnings and grave errors are indicated at the connectors ECL (error class) and ECO (error code) of the central block.

<table>
<thead>
<tr>
<th>Error Class</th>
<th>Error Code</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (Warning)</td>
<td>0</td>
<td>O.K.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Station address faulty.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Station address is not compatible with data base.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Link type incorrect.</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>No data base or data base incomplete (see remarks).</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>CSH11 in the STOP state.</td>
</tr>
</tbody>
</table>
| > 0 (Error) | Irrelevant| Unrepairable error; red LED flashing. Note error class and error code and report to SIEMENS AG.

Remark to error code 6 (for pure layer 4 operation): when error code 6 is indicated (data base incomplete), and the green LED on the CSH11 is on (data base consistent), then the NML configuring must be corrected in the following manner:

~ Select “CSH1 SINEC TF00” in the menu panel “Import FVT” (“System FVT00” is not necessary).

~ The available “Application Relations” of the FVT “CSH1 SINEC TF00” in the menu panel “Application Relations” – “FVT Allocation”.
6.3 Layer 2

All SIMADYN communication utilities can communicate via SINEC H1 layer 2. The definition is implemented by configuring the address connectors (AT, AR).

**Address Connectors:**

The channel name and the address stage 1 must always be defined at the address connector for layer 2 communication. Address stage 2 is mandatory for transmitters and optional for receivers.

The general layout of an address connector for the utilization of SINEC H1 layer 2 is:

AR – ‘kkkkkkkk.#2--ll.eeeeeeeeeee--rr.@bbbbbb.gggggC’

The dot is a mandatory separator!

- **kkkkkkkk:** Channel name, selectable without restriction, maximum 8 characters long, must always be present. The channel name has no specific significance for SINEC H1 layer 2.

- **#2--ll:** Address stage 1, must always be present. The address stage 1 consists of:
  - **#2-:** Reserved identifier for utilization of SINEC H1 layer 2.
  - **ll:** Local Link Service Access Point (LLSAP). The LLSAP consists of two hexa decimal digits and must always be dividable by four: 04, 0C, 10, 14, 18, 1C, ... (exception: 00 and 08 are not permitted).

- **eeeeeeeeee--rr:** Address stage 2 must always be present for transmitters and bi-directional channels (US connector). The definition is optional for receivers. Address stage 2 consists of:
  - **eeeeeeeeee:** The Ethernet address of the communication partner consisting of twelve hexa decimal digits.
  - **-**: The hyphen is mandatory and is utilized for separating the Ethernet address and RLSAP.
  - **rr:** Remote Link Service Access Point (RLSAP). The RLSAP consists of two hexa decimal digits and must be dividable by four: 04, 0C, 10, 14, 18, 1C, ... (exception: 00 and 08 are not permitted).

- **@bbbbbb.gggggC:** Network definition (see “P 32 Communication”, chapter “Point to Point Network”), can be present or not, independent of the other specifications. Therefore it is possible to link a SIMADYN utility, configured in a rack without CSH11 board, to a CSH11 board configured in another rack. A prerequisite is a connection of both racks via a rack link and a minimum of SIMADYN network configuring.

- **bbbbbb:** Name of the rack containing the CSH11 board, maximum 6 characters.

- **ggggggC:** Name of the CSH11 board, exactly 6 characters, last character must be a “C”.

If the address stage 2 is configured at the receiver, then only telegrams from that particular specified communication will be received and accepted. If the receiver does not contain an address stage 2, then all telegrams will be received and accepted from the specified address stage 1 LLSAP (“Open” LLSAP).
Each LLSAP can be bi-directional, (i.e. simultaneously utilized by both transmitters and receivers). Either an AT (transmit channel) and an AR connector (receive channel) or exactly one US connector (transmit and receive channel) can utilize the same LLSAP.

**Address Examples:**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT</td>
<td>‘Trans.#2-44.0800060100AA-12’</td>
<td>“Transmits via LLSAP 44 to partner with ethernet address 0800060100AA to its LLSAP 12”</td>
</tr>
<tr>
<td>AR</td>
<td>‘Recv.#2-44.0800060100AA-12′</td>
<td>“Receives via the same path as above”</td>
</tr>
<tr>
<td>AR</td>
<td>‘Recv2.#2-48’</td>
<td>“Receives via an open LLSAP 48”</td>
</tr>
<tr>
<td>US</td>
<td>‘Service.#2-20.080006010002-20’</td>
<td>“Receives and transmits via LLSAP 20”</td>
</tr>
</tbody>
</table>

The example shows that the LLSAP 44 is simultaneously utilized by a transmitter and a receiver, i.e. bi-directional.

The P32 service can be accessed from the communication partner with the Ethernet address 0800060100AA and the RLSAP 20 via the LLSAP 20. The LLSAP 20 is utilized bi-directionally for service requests (receive) and replies (transmissions).

The transmission of data only, requires care to be taken that the length for the transmitters and receivers are conform. Otherwise the transmission is “Transparent”, i.e. the CSH11 passes everything unchecked.

Word (2 byte) and double word (4 byte) variables are transmitted Little Endian, i.e. the lower significant byte first and the upper significant byte last. Communications with machines, that save their data Big Endian, must be adapted by the user (i.e. in SIMADYN with the conversion block CBRx).

### 6.4 Layer 4

All SIMADYN communication utilities can communicate via SINEC H1 layer 4. The definition is implemented by configuring the address connectors (AT, AR, US).

**Address Connectors:**

The channel name and address stage 1 must always be defined at the address connector for layer 4 communication. Address stage 2 is not utilized.

General layout of the address connector for utilization of SINEC H1 layer 4:

AR – ‘kkkkkkkkk.#4ttttttttttt.@bbbbbb.gggggC’

The dot is a mandatory separator!

- **kkkkkkkk:** Channel name, no selection restrictions, maximum 8 characters long, must always be entered. The channel name has no specific significance for the SINEC H1 layer 4.
- **#4ttttttttttt:** Address stage 1, must always be entered. Address stage 1 consists of:
  - **#4:** Reserved designation for utilization of SINEC H1 layer 4.
  - ttttttttttt: Transport connection name, maximum 12 characters. The symbolic name refers to a transport connection configured with NML. The transport connection name is the only
allocation between SIMADYN configuring and NML configuring.

~ @bbbbbb.ggggC: Network definition (see “P32 Communication”, chapter “Transit Network”) can exist or not, independent of the other definitions. Therefore it is possible to link a SIMADYN utility, configured in a rack without CSH11 board, to a CSH11 board, configured in another rack. The prerequisite is a connection of the two racks via a rack link and a minimum of SIMADYN network configuring.

~ bbbbb: Name of the rack with the CSH11 board maximum 6 characters.

~ ggggC: Name of the CSH11 board, exactly 6 characters, last character must be a “C”.

Each transport connection can be bidirectional, i.e. simultaneously utilized for both transmitting and receiving. Either an AT connector (transmit channel) and an AR connector (receive channel) each or exactly one US connector (transmit and receive channel) can refer to a transport connection.

<table>
<thead>
<tr>
<th>Address Examples:</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT - ‘Trans.#4TRAVERB1’ “Transmit via Transport Connection TRAVERB1”</td>
</tr>
<tr>
<td>AR - ‘Recv.#4TRAVERB1’ “Receive via the same Transport Connection”</td>
</tr>
<tr>
<td>US - ‘Service.#4TRAVERB2’ “Receive and Transmit via TRAVERB2”</td>
</tr>
</tbody>
</table>

In the example, the transport connection “TRAVERB1” is simultaneously utilized from both a transmitter and a receiver, i.e. bidirectional.

The P32 service can be invoked via the transport connection “TRABERB2”. “TRABERB2” is bidirectionally utilized for service requests (receive) and service replies (transmit).

Care should be taken during the transmission of data, that the lengths of the transmitters and receivers, communicating with one another, are conform. Otherwise the transmission is “Transparent”, i.e. the CSH11 passes everything without checking.

6.5 Layer 7 (STF)

STF is under development. Contact SIEMENS AG when required!

6.6 System Time

The CSH11 can be utilized as a time source for the SIMADYN system time. A prerequisite is a SINEC time of day transmitter (see SINEC catalog IK 10). The function block RTCM is to be configured for the distribution of the time of day (for further explanations see this description).
6.7 Data Volume, Cycle Times

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number SIMADYN channels (low net data) approx.</td>
<td>100</td>
</tr>
<tr>
<td>Maximum number SIMADYN channels (2048 byte net data).</td>
<td>7</td>
</tr>
<tr>
<td>Max. number SIMADYN channels (low net data) with MM4 coupling memory approx.</td>
<td>400</td>
</tr>
<tr>
<td>Max. number SIMADYN channels (2048 byte net data) with MM4 coupling memory.</td>
<td>29</td>
</tr>
<tr>
<td>Maximum channel length (net data).</td>
<td>2048 Byte</td>
</tr>
<tr>
<td>Maximum number transport connections.</td>
<td>46</td>
</tr>
<tr>
<td>Fastest layer 4 cycle.</td>
<td>10 ms</td>
</tr>
</tbody>
</table>

The maximum number of transport connections is **46** (basic CP1470 feature). This signifies that a maximum of both 46 SIMADYN transmitters and receivers can utilize the layer 4 of the CSH11.

The fastest cycle time on the layer 4 lies around 10 milli-seconds (up to a maximum of 512 bytes, no exact experience is available for larger data volumes). If 15 transmitters have been configured, then they should be configured with a sampling time larger than $15 \times 10 \text{ ms} = 150 \text{ ms}$. The sampling time of the receiver can (and should possibly) be shorter, since the initiative always lies with the transmitter for the layer 4 communication.

Receivers should be configured with a shorter sampling time as the corresponding transmitters (for mode “Handshake”). If transmitters and receivers are configured in the same sampling time and also with the mode “Handshake”, then the connection will regularly detach.

Explanation: since the transmitters and receivers are not synchronized via SINEC H1, it will sometimes occur that the CP1470 receives data at the receiver end but the corresponding SIMADYN receive channel has not completed reading. In cases such as these, the CP1470 disconnects (with the intention of indicating to the transmitter that the data could not be delivered; there is no other acknowledge mechanism available in layer 4!). The worst alternative would be simply to discard the received data.

6.8 NML – Network Management

Configuring the transport connections and application relations requires the configuring tool NML. This tool must be additionally ordered (see above). Dialog operations with NML require reviewal of the corresponding documentation. Certain remarks are made here:

Since the Ethernet address is defined per SIMADYN configuring, no “Christening” of the CSH11 is necessary. All NML configuring can therefore be implemented by the H1 bus.

A minimum of NML configuring is also necessary for pure layer 2 operation.

Utilize the profile “CSH11_E4_2000” for the configuring of layer 2 or layer 4. If this is not available in the supplied NML version, then it can be ordered from Siemens AG ASI 1 D V122.

Profile to be imported: “Mgt-Tbez.”, “e4_handshake”.
Function distribution table to be imported: “CSH1 SINECTF00”.

The transport connections must be configured for layer 4 operation. “e4_handshake” is recommended as the profile.

The (standard) application relationships, available in the menu item “Application Relationships” – “FVT Allocation”, must be allocated to FVT “CSH1 SINEC TF00” for both the layer 2 and the layer 4 operation.