SIEMENS

# SINEC

## FDL Programming Interface

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# SINEC
## FDL Programming Interface

**Description** C79000-B8976-C072/02

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**WARNING !**

**!**

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– First Aid qualification.

# FDL Programming Interface

This manual describes the FDL programming interface and the services available on the PROFIBUS Layer 2.

The FDL protocol (**F**ield **D**ata **L**ink protocol) is suitable for SINEC L2 in the open, heterogeneous SINEC communication system for the cell and field area and is specially intended for an industrial environment.

Known under the name PROFIBUS (**Pro**cess **Fi**eld **Bus**), SINEC L2 is based on the PROFIBUS DIN 19245 Part 1 standard and is oriented on the ISO/OSI reference model.

By complying with the requirements of DIN 19 245 Part 1, SINEC L2 guarantees an open system for the attachment of components of other vendors that comply with the standard.

SINEC L2 is the network for the middle range of performance. The maximum off 127 stations that can be connected opens up a wide spectrum of automation tasks. Different data rates can be selected using the software. ❑

## Notes

# 1 Introduction to the FDL Programming Interface

This chapter introduces the concept of the FDL programming interface. It explains the basic mechanisms you require to be able to program an application.

You require the information in this chapter as a basis for the chapters that follow.

**Introduction**

The program that uses the layer 2 services is known as an FDL application.

An FDL application can be created in the programming language C or C++. To allow access to the CP, include files and libraries are supplied on the diskette.

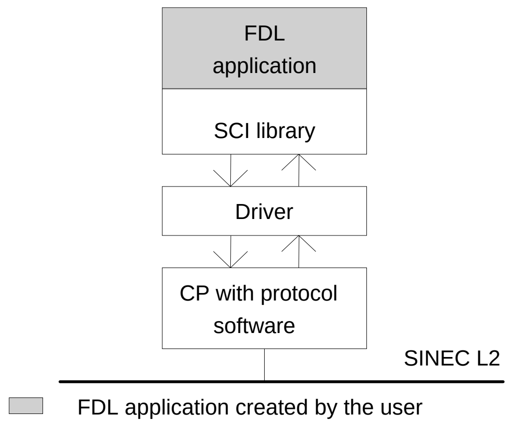

FDL application
SCI library
Driver
CP with protocol software
SINEC L2
FDL application created by the user

Fig. 1.1: Communications Architecture of the FDL Programming Interface

**Structure of Layer 2**

The layer 2 protocol software of SINEC L2 can be divided into three entities, FLC (Fieldbus Link Control), FMA (Fieldbus Management), MAC (Media Access Control).

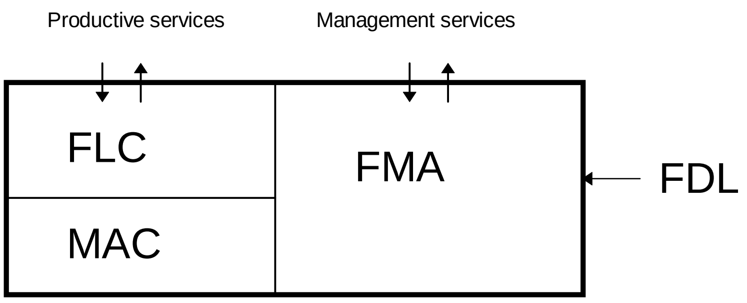


Fig. 1.2: Structure of the Layer 2 Protocol Software (FDL)

Using the FLC and FMA entities, the FDL application can transfer jobs to layer 2 that, if applicable, are passed on to the physical medium by the MAC entity. In the opposite direction, the MAC entity receives frames on the bus that can then be transferred to the FLC or FMA entities of the FDL application.

| | |
|---|---|
| FLC | The FLC entity is responsible for receiving the services on the FDL programming interface as described in PROFIBUS (data transfer services, send and receive frames). The jobs of the FDL application are received, processed (frame processing etc.) and if applicable, passed on to the MAC entity via an internal interface. |
| FMA | The FMA entity is responsible for receiving the management services described in PROFIBUS (administrative services, parameter assignment, modifications to operating parameters etc.). |
| MAC | The MAC entity implements the complete bus access management according to DIN 19245 Part 1. |

**Mechanism of the Interface**

The FDL programming interface uses request blocks (job blocks, RB) for processing jobs with the CP. A request block completely describes a job for the FDL programming interface. The request block is transferred to the CP with one of the functions of the SCI library and is then fetched later by a different function.

**Request Block ID**

In general, the FDL application transfers a request block to layer 2 with the **request** ID and, depending on the service, receives a request block back with the **confirm** ID or with the **indication** ID.

| Request Block ID | Task of the Request Block |
|---|---|
| request | Jobs from the FDL application for the CP. |
| confirm | Acknowledgment of a request from the CP to the FDL application. |
| indication | Indication of an event from the CP to the FDL application. ❑ |

## Notes

# 2 The FDL Services

This chapter explains which services the FDL protocol provides for communication with other stations on the bus.

## Description of the FDL Services

The services of layer 2 can be divided into productive services and management services. Productive services are used in the productive phase to send data frames. Management services are used to activate/deactivate local SAPs (Service Access Point), to provide resources for receiving data frames from other stations and other administrative services. The following tables contain an overview of the available FDL services.

## Productive Services

| | |
|---|---|
| SDA<br>(send and request data with acknowledge) | The CP sends a data frame to a remote station. If this is successful, the addressed remote station returns an acknowledgment. If an error occurs, layer 2 generates a local error message. |
| SDN<br>(send data with no acknowledge) | The CP sends a data frame to one or more remote stations. In contrast to the SDA service, the addressed remote stations do not return an acknowledgment. After the frame is sent, layer 2 generates a local acknowledgment. |
| SRD<br>(send and request data) | The CP sends a data frame to a remote station. If this is successful, the addressed remote station returns an acknowledgment. In contrast to the SDA service, the remote station can also send user data in the reply frame. If an error occurs, layer 2 generates a local error message. |
| REPLY_UPDATE_SINGLE | With this call, data is transferred to layer 2 that can be read out by a remote station. The data is sent back to a remote station in the acknowledgment of an SRD frame. The data can only be read by the remote station **once**. |
| REPLY_UPDATE_MULTIPLE | Sequence as for REPLY_UPDATE_SINGLE. Difference:<br>The data transferred to layer 2 can be read **more than once** by remote stations. |

## Management Services

| | |
|---|---|
| SAP_ACTIVATE | With this service, an SAP (Service Access Point) can be activated at layer 2. This must be activated before data frames can be sent or received. |
| RSAP_ACTIVATE | Corresponds to the SAP_ACTIVATE call<br>Difference:<br>With this RSAP_ACTIVATE service, an SAP cannot be initialized for active sending of data frames. |
| SAP_DEACTIVATE | With this service, an SAP activated with (R)SAP_ACTIVATE can be deactivated again. Following this, no further data transfer is possible with this SAP. |
| AWAIT_INDICATION | With this service, a receive buffer can be transferred to an SAP. Only then is it possible for a call frame (SDA, SDN, SRD) to be received from a remote station. After receiving a remote call frame, a new receive buffer must be transferred to the SAP. |
| WITHDRAW_INDICATION | With this service, receive buffers transferred to an SAP with AWAIT_INDICATION, can be fetched back. |
| LSAP_STATUS | This service checks the configuration of an SAP of the local station. |
| FDL_IDENT | This service checks the identification of the local or a remote station. |
| FDL_LIFE_LIST_CREATE_LOCAL | This service provides a list of **active** and some of the **passive** stations on the bus. The list is generated using only local information within layer 2. No additional frames are sent on the bus. |
| FDL_LIFE_LIST_CREATE_REMOTE | This service provides a list of the active and passive stations on the bus. In contrast to FDL_LIFE_LIST_CREATE_LOCAL a status frame is requested from all possible stations (extra load on the bus). |
| FDL_READ_STATISTIC_ CTR | This service is used to read out bus-specific statistical values (invalid frames etc.). |
| FDL_READ_LAS_STATISTIC_CTR | This service is used to read bus-specific statistical values (number of token frames etc.). |
| FDL_EVENT | With this service, the FDL application is informed of layer 2 events. |
| FDL_READ_VALUE | With this service, the current parameter assignment data of layer 2 can be read out. |

## 2.1 Transfer Mechanisms

**Transfer to the FDL Application**

An FDL application communicates with layer 2 using three different transfer mechanisms:

1) FDL application request to layer 2
2) Layer 2 confirmation to the FDL application
3) Layer 2 indication to the FDL application

**Request**

A request involves the FDL application requesting a service at layer 2. The request is transferred to the CP with an SCP_send call (see Section 7.2) or ihi_write call (see Section 6.2).

The call parameters of the function are a ‘handle’ and the address of the pointer that points to a request block structure *). The entries must be made in the request block before the call in keeping with the service description.

The return value of the SCP_send or ihi_write call relates only to the correct transfer of the request to layer 2 by the driver.

Only the corresponding layer 2 confirmation shows whether a request was processed without errors by layer 2.

**Confirmation**

In a confirmation, layer 2 informs the FDL application of the result of a processed request. The confirmation must be read out using an SCP_receive call (see Section 7.3) or an ihi_read call (see Section 6.3) to the CP.

The return value of the SCP_receive or ihi_read call relates only to the correct transfer of the data to the driver. The result of the request processing is contained in the request block returned with ihi_read.

**Indication**

Using an indication, layer 2 informs the FDL application that a call frame (SDA, SRD or SDN) has been received from a remote station. The indication must be read out with an SCP_receive call or an ihi_read call to the CP *).

The return value of the SCP_receive call or ihi_read call relates only to the correct transfer of the data to the driver. The type and content of the indication is contained in the request block that is returned with SCP_receive or ihi_read.

*) see 3.1 Data Structures of the Productive Services

**Requester and Responder**

| | |
|---|---|
| Requester | The station that triggers job processing and waits to receive the confirmation. |
| Responder | The station that receives a data frame from a remote station and returns an acknowledgment frame. |

The following table shows the possible transfer mechanisms for the available productive and management services for requesters and responders.

| | Requester | | Responder |
|---|---|---|---|
| Service | Request | Confirmation | Indication |
| SDA (Send data with acknowledge) | yes | yes | yes |
| SDN (Send data with no acknowledge) | yes | yes | yes |
| SRD (Send and request data) | yes | yes | yes |
| REPLY UPDATE SINGLE | yes | yes | no |
| REPLY UPDATE MULTIPLE | yes | yes | no |
| SAP ACTIVATE | yes | yes | no |
| RSAP ACTIVATE | yes | yes | no |
| SAP DEACTIVATE | yes | yes | no |
| AWAIT_INDICATION | yes | Success: no<br>Error: yes | no |
| WITHDRAW_INDICATION | yes | yes | no |
| LSAP_STATUS | yes | yes | no |
| FDL_IDENT | yes | yes | no |
| FDL_LIFE_LIST_CREATE_ REMOTE | yes | yes | no |
| FDL_LIFE_LIST_CREATE_LOCAL | yes | yes | no |
| FDL_READ_STATISTIC_ COUNTER | yes | yes | no |
| FDL_EVENT | no | no | yes |
| FDL_READ_VALUE | yes | yes | no ❑ |

## Notes

# 3 Productive Services

This chapter explains the principles of productive services.

The chapter covers the following topics:

- ➢ The data structures of the productive services
- ➢ The request blocks of the productive service

The following productive services are dealt with in detail:

- ➢ SDA (send and request data with acknowledge)
- ➢ SDN (send and request data with no acknowledge)
- ➢ SRD (send and request data)
- ➢ REPLY_UPDATE_SINGLE
- ➢ REPLY_UPDATE_MULTIPLE

## 3.1 Data Structures of the Productive Services

**Request Block Structure**

The data structures are defined in the **"fdl_rb.h" include file**.

The "fdl_rb" structure described below is the request block assigned to the ihi functions as a parameter.

```
typedef struct
{
  rb2_header_type          rb2_header;
  struct application_block application_block;
  UBYTE  reserved  [12];
  UBYTE  reference [2];
  UBYTE  user_data_1 [260];
  UBYTE  user_data_2 [260];
} fdl_rb;
```

**Description of the Parameters**

| | |
|---|---|
| rb2_header | Request block header. General, non-service-specific parameters |
| application_block | Argument area. FDL parameters. |
| reference | ID of the FDL application. |
| user_data_1 | User data, dependent on particular job. |
| user_data_2 | User data, dependent on particular job. |

**Substructure Request Block Header**

```
typedef  struct
{
  UWORD     reserved [2];
  UBYTE     length;
  UWORD     user;
  UBYTE     rb_type;
  UBYTE     priority;
  UBYTE     reserved_1;
  UWORD     reserved_2;
  UBYTE     subsystem;
  UBYTE     opcode;
  UWORD     response;
  UWORD     fill_length_1;
  UBYTE     reserved_3;
  UWORD     seg_length_1;
  UWORD     offset_1;
  UWORD     reserved_4;
  UWORD     fill_length_2;
  UBYTE     reserved_5;
  UWORD     seg_length_2;
  UWORD     offset_2;
  UWORD     reserved_6;
} rb2_header_type;
```

**Description of the Parameters**

| | |
|---|---|
| length | Length of the request block without "user_data_1" and "user_data_2" (= 80 bytes). |

| | |
|---|---|
| user | Available for the FDL application |
| rb_type | Type of request block used (= 2). |
| priority | Priority of the job (identical to the "serv_class" parameter in the application block). |
| subsystem | Selects the communications layer. (FDL = 22h). |
| opcode | Request, confirm, indication (same as the “opcode” parameter in the application block). |
| response | Return parameter (same as the "l_status" parameter in the application block). |
| fill_length_1 | Number of relevant bytes in data buffer 1. |
| seg_length_1 | Actual length of data buffer 1. |
| offset_1 | Offset of data buffer 1 relative to the start of the request block. |
| fill_length_2 | Number of relevant bytes in data buffer 2. |
| seg_length_2 | Actual length of data buffer 2. |
| offset_2 | Offset of data buffer 2 relative to the start of the request block. |

**Substructure Argument Area**

```
struct application_block
{
  UBYTE                                 opcode;
  UBYTE                                 subsystem;
  UWORD                                 id;
  struct    service                     service;
  struct    remote_address              loc_add;
  UBYTE                                 ssap;
  UBYTE                                 dsap;
  struct    remote_address              rem_add;
  enum      service_class               serv_class;
  struct    link_service_data_unit      receive_l_sdu;
  UBYTE                                 reserved_1;
  UBYTE                                 reserved;
  struct    link_service_data_unit      send_l_sdu;
  enum      link_status                 l_status;
  UWORD                                 reserved_2 [2];
};
```

```
struct service
{
  enum      service_code           code;
};
struct remote_address
{
  UBYTE                            station;
  UBYTE                            segment;
};
struct link_service_data_unit
{
  void      far *                   buffer_ptr;
  UBYTE                             length;
};
```

**Description of the Parameters**

| | |
|---|---|
| opcode | Request, confirm, indication |
| subsystem | Reserved for the CP. |
| id | Reserved for the CP. |
| service.code | sda, sdn, sdn_broadcast , srd, reply_update_single, reply_update_multiple |
| loc_add.station | Local address 0 to 126; for SDN: 127 = MULTICAST/ BROADCAST |
| loc_add.segment | Reserved |
| ssap | Source service access point, 0 to 62 |
| dsap | Destination service access point, 0 to 63 |
| rem_add.station | Remote address, 0 to 126; for SDN : 127 = MULTICAST/BROADCAST |
| rem_add.segment | Reserved |
| serv_class | Priority of the service ( low or high ) |
| receive_l_sdu.buffer_ptr | Reserved for the CP. |
| receive_l_sdu.length | Buffer length, 32 to 255 ( for request ); user data length for confirm, indication |
| send_l_sdu.buffer_ptr | Reserved for the CP. |
| send_l_sdu.length | User data length of the send frame. |
| l_status | Return parameter, link_status |

**Constants for the Application Block**

The constants used in this chapter that are available to the FDL application are as follows:

| | | |
|---|---|---|
| DEFAULT_SAP | FFH | Default SAP ID |
| NO_SEGMENT | FFH | Segment invalid |
| BROADCAST | 127 | Global address |
| MULTICAST | 127 | Global address |
| LEN_MAX_RECEIVE_BUFFER | 255 | Max. receive buffer |
| LEN_MIN_RECEIVE_BUFFER | 32 | Min. receive buffer |
| LEN_DATA_OVERHEAD | 14 | Length of maximum frame header + trailer |

**Declaration**

The following tables indicate which parameters are mandatory (m), optional (o), don't care (x), returned (r) for the request blocks of the productive services:

**Request**

| **request** | sda | sdn | srd | reply_update | |
|---|---|---|---|---|---|
| length | m | m | m | m | |
| user | x | x | x | x | |
| rb_type | m | m | m | m | |
| priority | m | m | m | m | Request |
| subsystem | m | m | m | m | block |
| opcode | m | m | m | m | header |
| response | x | x | x | x | |
| fill_length_1 | m | m | m | m | |
| seg_length_1 | m | m | m | m | |
| offset_1 | m | m | m | m | |
| fill_length_2 | m | m | m | m | |
| seg_length_2 | m | m | m | m | |
| offset_2 | x | x | m | x | |
| opcode | m | m | m | m | |
| subsystem | x | x | x | x | |
| id | x | x | x | x | Application |
| service.code | m | m | m | m | block |
| loc_add.station | x | o | x | x | |
| loc_add.segment | x | x | x | x | |
| ssap | m | m | m | m | |
| dsap | m | m | m | m | |
| rem_add.station | m | m | m | m | |
| rem_add.segment | x | x | x | x | |
| serv_class | m | m | m | m | |
| receive_l_sdu.length | x | x | m | x | |
| send_l_sdu.length | m | m | m | m | |
| l_status | x | x | x | x | |
| user_data_1 | m | m | m | m | User data 1 |
| user_data_2 | x | x | m | x | User data 2 |

## Confirmation

| confirm | sda | sdn | srd | reply_update | |
|---|---|---|---|---|---|
| length | r | r | r | r | |
| user | x | x | x | x | |
| rb_type | r | r | r | r | |
| priority | r | r | r | r | Request |
| subsystem | r | r | r | r | block |
| opcode | r | r | r | r | header |
| response | r | r | r | r | |
| fill_length_1 | r | r | r | r | |
| seg_length_1 | x | x | x | x | |
| offset_1 | r | r | r | r | |
| fill_length_2 | x | x | r | x | |
| seg_length_2 | x | x | r | x | |
| offset_2 | x | x | r | r | |
| opcode | r | r | r | r | |
| subsystem | x | x | x | x | |
| id | x | x | x | x | Application |
| service.code | r | r | r | r | block |
| loc_add.station | x | o | x | x | |
| loc_add.segment | x | x | x | x | |
| ssap | r | r | r | r | |
| dsap | r | r | r | r | |
| rem_add.station | r | r | r | r | |
| rem_add.segment | x | x | x | x | |
| serv_class | r | r | r | x | |
| receive_l_sdu.length | x | x | r | x | |
| send_l_sdu.length | r | r | r | r | |
| l_status | r | r | r | r | |
| user_data_1 | x | x | x | x | User data 1 |
| user_data_2 | x | x | r | x | User data 2 |

## Indication

| indication | sda | sdn | srd | sdn_broadcast | |
|---|---|---|---|---|---|
| length | r | r | r | r | |
| user | x | x | x | x | |
| rb_type | r | r | r | r | |
| priority | r | r | r | r | Request |
| subsystem | r | r | r | r | block |
| opcode | r | r | r | r | header |
| response | r | r | r | r | |
| fill_length_1 | r | r | r | r | |
| seg_length_1 | x | x | x | x | |
| offset_1 | r | r | r | r | |
| fill_length_2 | x | x | x | x | |
| seg_length_2 | x | x | x | x | |
| offset_2 | x | x | x | x | |
| opcode | r | r | r | r | |
| subsystem | x | x | x | x | |
| id | x | x | x | x | Application |
| service.code | r | r | r | r | block |
| loc_add.station | x | o | x | x | |
| loc_add.segment | x | x | x | x | |
| ssap | r | r | r | r | |
| dsap | r | r | r | r | |
| rem_add.station | r | r | r | r | |
| rem_add.segment | x | x | x | x | |
| serv_class | r | r | r | r | |
| receive_l_sdu.length | r | r | r | r | |
| send_l_sdu.length | x | x | x | x | |
| l_status | x | x | r | x | |
| user_data_1 | r | r | r | r | User data 1 |
| user_data_2 | x | x | x | x | User data 2 |

## 3.2 Request Blocks of the Productive Services

### 3.2.1 SDA (send data with acknowledge)

**Request**

The local station sends data to a remote station and receives a confirmation of the correct or incorrect data transfer.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the send frame low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | Length of the data 13 to 258 |
| seg_length_1 | Length of the buffer used 15..260 |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | sda |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | 0 to 62 or DEFAULT_SAP |
| dsap | 0 to 63 or DEFAULT_SAP |
| rem_add.station | 0 to 126 |
| rem_add.segment | No significance |
| serv_class | Priority of the send frame low/high |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | Number of net bytes to be transferred 1 to 246 |
| l_status | No significance |

The following diagram shows the structure of the data of the SDA frame. This data is contained in the user_data_1 structure element of the request block.

The total length of the structure element is fixed at 260 bytes in the header file "fdl_rb.h".

The offset byte and the user data must be entered in the data buffer by the FDL application.

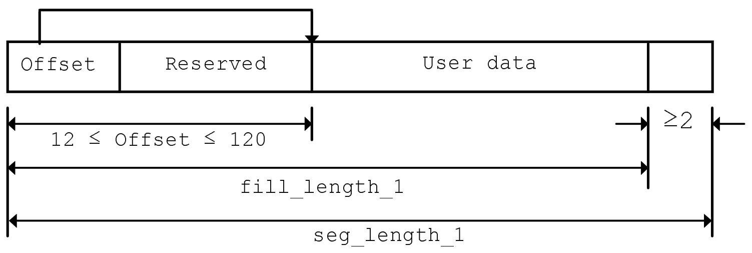
**Recommendation**

Select 12 for the offset byte.

Select 260 as the value for seg_length_1.

Select 12 + the length of the user data as the value for fill_length_1.

**Structure of the Send Buffer**



**Address Extension**

The use of address extensions reduces the maximum number of net bytes that can be transmitted by up to 2 bytes.

Address extensions occur when an SAP other than the default SAP is used for dsap and/or ssap.

**Confirm**

The SDA confirmation confirms execution of the SDA request.

The result of the service is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, rr, ue, rs, ls, na, ds, iv |
| fill_length_1 | No significance |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | Unchanged from request |
| service.code | sda |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | May be different from request |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, rr, ue, rs, ls, na, ds, iv |

**l_status Values**

| | | |
|---|---|---|
| ok | = | Positive acknowledgment, service executed. |
| rr | = | Negative acknowledgment, resources of the CP (remote) not available. |
| ue | = | Negative acknowledgment, FDL application/FDL interface error (remote) |
| rs | = | Service or rem_add not activated on SAP (remote) |
| ls | = | Service not activated on SAP (local) |
| na | = | No or no plausible reaction from station (remote) |
| ds | = | CP (local) not in logical token ring or disconnected from the bus. |
| iv | = | Invalid parameters in the request. |

**Indication**

The SDA indication shows that an SDA request has been received from a remote station.

The receive data are entered in the receive buffer.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Unchanged from "await_indication" |
| rb_type | 2 |
| priority | Priority of the receive frame low/high |
| subsystem | 22H |
| opcode | Indication |
| response | No significance |
| fill_length_1 | Length of the data (≤ 258) |
| seg_length_1 | No significance |
| offset_1 | 80 |
| fill_length_2 | No significance |
| seg_length_2 | No significance |
| offset_2 | No significance |

**Application Block**

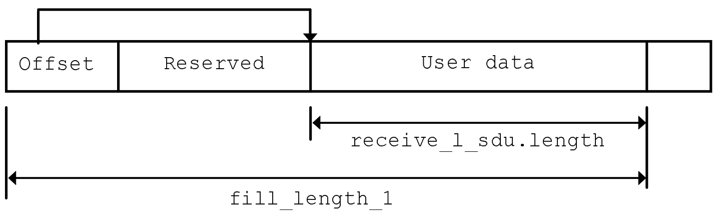
| | |
|---|---|
| opcode | Indication |
| subsystem | No significance |
| id | No significance |
| service.code | sda |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | SAP of the station (local) 0 to 63 or DEFAULT_SAP |
| dsap | SAP of the station (remote) 0 to 62 or DEFAULT_SAP |
| rem_add.station | address of the source station 0 to 126 |
| rem_add.segment | No significance |
| serv_class | Priority of the receive frame low/high |
| receive_l_sdu.length | Length of the received user data 1 to 246 |
| send_l_sdu.length | No significance |
| l_status | No significance |

The following diagram shows the structure of the data received with the SDA indication.

This data is contained in the user_data_1 structure element of the request block.

The offset and the user data are entered in the receive buffer by the CP.

**Structure of the Receive Buffers**



The offset (first byte in the receive buffer) indicates the number of bytes from the start of the receive buffer to the first byte of the user data.

### 3.2.2 SDN (send data with no acknowledge)

**Request**

The station (local) sends data to a station, a group of stations (MULTICAST) or all stations (BROADCAST). The FDL application only receives a local confirmation, but no confirmation of reception from the remote station(s).

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the send frame low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | Length of the data 13 to 258 |
| seg_length_1 | Length of the buffer used 15..260 |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | sdn |
| loc_add.station | No significance |
| loc_add.segment | NO_SEGMENT |
| ssap | 0 to 62 or DEFAULT_SAP |
| dsap | 0 to 63 or DEFAULT_SAP |
| rem_add.station | 0 to 126 or MULTICAST (= 127) or BROADCAST (= 127) |
| rem_add.segment | NO_SEGMENT |
| serv_class | Priority of the send frame low/high |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | Number of net bytes to be transferred 1 to 246 |
| l_status | No significance |

**Meaning of the Parameters**

rem_add.station = BROADCAST: dsap = 63
rem_add.station = MULTICAST: dsap = 0 to 62 or DEFAULT_SAP

The following diagram shows the structure of the data of the SDN frame. This data is contained in the user_data_1 structure element of the request block.

The total length of the structure element is fixed at 260 bytes in the header file "fdl_rb.h".

The offset byte and the user data must be entered in the data buffer by the FDL application.

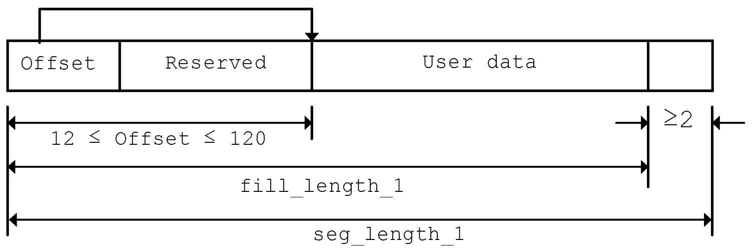
**Recommendation**

Select 12 for the offset byte.

Select 260 as the value for seg_length_1.

Select 12 + the length of the user data as the value for fill_length_1.

**Structure of the Send Buffer**



**Note**

The use of address extensions reduces the maximum number of net bytes that can be transmitted by up to 2 bytes.

Address extensions occur when an SAP other than the default SAP is used for dsap and/or ssap.

**Confirmation**

The SDN confirmation confirms execution of the SDN request.

The result of the service is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, ls, ds, iv |
| fill_length_1 | No significance |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | sdn |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | May be different from request |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, ls, ds, iv |

**l_status Values**

| | | |
|---|---|---|
| ok | = | Transfer of the data from the CP completed |
| ls | = | Service not activated on the SAP (local) |
| ds | = | CP not in the logical token ring or disconnected from the bus |
| iv | = | Invalid parameters in the request |

**Indication**

The SDN indication shows that an SDN request has been received from a remote station.

The received data entered in the receive buffer.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Unchanged from "await_indication" |
| rb_type | 2 |
| priority | Priority of the receive frame low/high |
| subsystem | 22H |
| opcode | Indication |
| response | No significance |
| fill_length_1 | Length of the data (≤ 258) |
| seg_length_1 | No significance |
| offset_1 | 80 |
| fill_length_2 | No significance |
| seg_length_2 | No significance |
| offset_2 | No significance |

**Application Block**

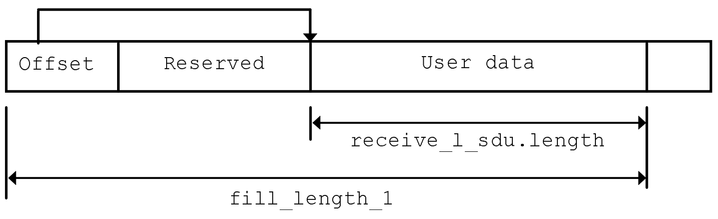
| | |
|---|---|
| opcode | Indication |
| subsystem | No significance |
| id | No significance |
| service.code | sdn |
| loc_add.station | Address of the destination station 0 to 126 (local L2 address) |
| loc_add.segment | NO_SEGMENT |
| ssap | SAP of the station (local) 0 to 62 or DEFAULT_SAP |
| dsap | SAP of the station (remote) 0 to 62 or DEFAULT_SAP |
| rem_add.station | Address of the source station 0 to 126 |
| rem_add.segment | NO_SEGMENT |
| serv_class | Priority of the receive frame low/high |
| receive_l_sdu.length | Length of the received user data 1 to 246 |
| send_l_sdu.length | No significance |
| l_status | No significance |

The following diagram shows the structure of the data received with the SDN indication.

This data is contained in the user_data_1 structure element of the request block.

The offset and the user data are entered in the receive buffer by the CP.

**Structure of the Receive Buffer**



The offset (first byte in the receive buffer) indicates the number of bytes from the start of the receive buffer to the first byte of the user data.

**Indication (Broadcast, Multicast)**

The SDN_BROADCAST indication shows that an SDN request has been received from a remote station that was sent to more than one or to all stations.

The received data are entered in the receive buffer.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Unchanged from "await_indication" |
| rb_type | 2 |
| priority | Priority of the receive frame low/high |
| subsystem | 22H |
| opcode | Indication |
| response | No significance |
| fill_length_1 | Length of the data (≤ 258) |
| seg_length_1 | No significance |
| offset_1 | 0 |
| fill_length_2 | No significance |
| seg_length_2 | No significance |
| offset_2 | No significance |

**Application Block**

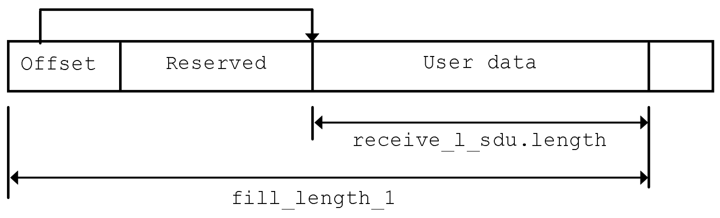
| | |
|---|---|
| opcode | Indication |
| subsystem | No significance |
| id | No significance |
| service.code | sdn_broadcast |
| loc_add.station | Address of the destination station BROADCAST |
| loc_add.segment | NO_SEGMENT |
| ssap | SAP of the station (local) 0 to 62: MULTICAST or 63: BROADCAST |
| dsap | SAP of the station (remote) 0 to 62, DEFAULT_SAP |
| rem_add.station | Address of the source station 0 to 126 |
| rem_add.segment | NO_SEGMENT |
| serv_class | Priority of the receive frame low/high |
| receive_l_sdu.length | Length of the received user data 1 to 246 |
| send_l_sdu.length | No significance |
| l_status | No significance |

The following diagram shows the structure of the data received with the SDN indication.

This data is contained in the user_data_1 structure element of the request block.

The offset and the user data are entered in the receive buffer by the CP.

**Structure of the Receive Buffer**



The offset (first byte in the receive buffer) indicates the number of bytes from the start of the receive buffer to the first byte of the user data.

### 3.2.3 SRD (send and request data)

**Request**

The station (local) sends data to a remote station and at the same time requests data back from this station. As a confirmation of the reception of the data by the remote station, the local station receives the response data.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the send frame low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | Length of the data 12 to 258 |
| seg_length_1 | Length of the send buffer used 14..260 |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | Length of the receive buffer 260 |
| offset_2 | Offset from the start of the request block to the data buffer user_data_2 |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | srd |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | 0 to 62 or DEFAULT_SAP |
| dsap | 0 to 62 or DEFAULT_SAP |
| rem_add.station | 0 to 126 |
| rem_add.segment | No significance |
| serv_class | Priority of the send frame low/high |
| receive_l_sdu.length | Receive buffer length ≥ max. (LEN_MIN_RECEIVE_BUFFER, expected frame length) Recommendation: 255 |
| send_l_sdu.length | Number of net bytes to be transferred 0 to 246 |
| l_status | No significance |

The following diagram shows the structure of the data of the SRD frame. This data is contained in the user_data_1 structure element of the request block.

The total length of the structure element is fixed at 260 bytes in the header file "fdl_rb.h".

The offset and the user data must be entered in the data buffer by the FDL application.

**Recommendation**

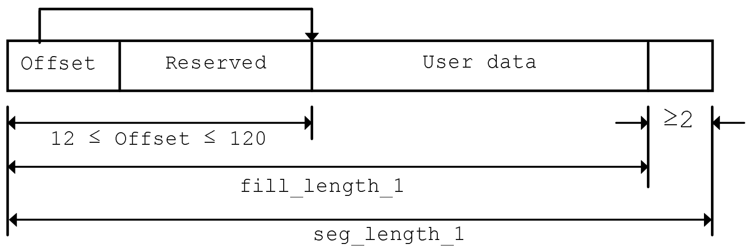
Select 12 for the offset byte in the send buffer.

Select 260 as the value for seg_length_1.

Select 12 + the length of the user data as the value for fill_length_1.

Select 340 as the value for offset_2 (offset_1 + seg_length_1). This makes sure that the received data are entered in the user_data_2 structure element.

**Structure of the Send Buffer**



**Structure of the Receive Buffer**

See SRD confirmation.

The use of address extensions reduces the maximum number of net bytes that can be transferred by up to 2 bytes.

**Confirmation**

The SRD confirmation confirms execution of the SRD request.

The result of the service is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ue, rr, rs, dl, nr, dh, rdl, rdh, ls, na, ds, iv |
| fill_length_1 | No significance |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Number of received data (≤ 258) |
| seg_length_2 | Unchanged from request |
| offset_2 | Offset from the start of the request block to data buffer user_data_2 |

**Application Block**

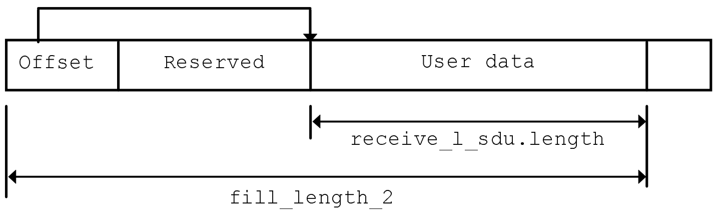
| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | srd |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Number of received net bytes 0 to 246, if l_status appropriate |
| send_l_sdu.length | Unchanged from request |
| l_status | ue, rr, rs, dl, nr, dh, rdl, rdh, ls, na, ds, iv |

The following diagram shows the structure of the data received with the SRD confirmation.

This data is in the user_data_2 structure element of the request block.

The offset and the user data are entered in the receive buffer by the CP.

**Structure of the Receive Buffer**



The offset (first byte in the receive buffer) indicates the number of bytes from the start of the receive buffer to the first byte of the user data.

☞ **Note that here fill_length_2 is used since fill_length_1 is already being used for sending the data.**

**l_status Values**

| | | |
|---|---|---|
| ue | = | Negative acknowledgment, FDL application/FDL interface error (remote). |
| rs | = | Service or rem_add not activated on SAP (remote) . |
| ls | = | Service not activated on SAP (local). |
| na | = | No or no plausible reaction from station (remote). |
| ds | = | CP not in logical token ring or disconnected from the bus. |
| iv | = | Invalid parameters in the request. |
| dl | = | Response data low exist. Positive acknowledgment for transmitted data. |
| dh | = | Response data high exist. Positive acknowledgment for transmitted data. |
| nr | = | Negative acknowledgment. Response data not available on CP (remote). Positive acknowledgment for transmitted data. |
| rdl | = | Response data low exist. Negative acknowledgment for transmitted data since CP resources (remote) are not available. |
| rdh | = | Response data high exist. Negative acknowledgment for transmitted data since CP resources (remote) are not available. |
| rr | = | Negative acknowledgment. CP resources (remote) and response data (remote) are not available. |

**Indication**

The SRD indication confirms the reception of an SRD request from a remote station.

The received data are entered in the receive buffer.

The update status of the service is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Unchanged from "await_indication" |
| rb_type | 2 |
| priority | Priority of the receive frame low/high |
| subsystem | 22H |
| opcode | Indication |
| response | Update_status |
| fill_length_1 | Length of the data |
| seg_length_1 | No significance |
| offset_1 | 80 |
| fill_length_2 | No significance |
| seg_length_2 | No significance |
| offset_2 | No significance |

**Application Block**

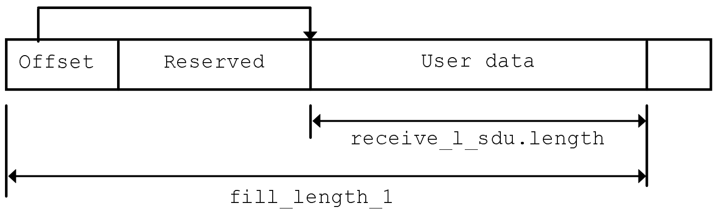
| | |
|---|---|
| opcode | Indication |
| subsystem | No significance |
| id | No significance |
| service.code | srd |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | SAP of the station (local) 0 to 62 of the DEFAULT_SAP |
| dsap | SAP of the station (remote) 0 to 62 of the DEFAULT_SAP |
| rem_add.station | Address of the source station 0 to 126 |
| rem_add.segment | No significance |
| serv_class | Priority of the receive frame low/high |
| receive_l_sdu.length | Number of received net bytes 0 to 246, if l_status appropriate |
| send_l_sdu.length | No significance |
| l_status | update_status |

The following diagram shows the structure of the data received with the SRD indication.

This data is contained in the user_data_1 structure element of the request block.

The offset and the user data are entered in the receive buffer by the CP.

**Structure of the Receive Buffer**



The offset (first byte in the receive buffer) indicates the number of bytes from the start of the receive buffer to the first byte of the user data.

**update_status Values**

| | | |
|---|---|---|
| lo | = | The response to this SRD was low priority data. |
| hi | = | The response to this SRD was high priority data. |
| no_data | = | No data were transmitted in response to this SRD. |

### 3.2.4 REPLY_UPDATE_SINGLE

**Request**

With this service, the FDL application prepares data for a particular service access point (ssap). This data can be fetched by a different station that has access to this SAP using an SRD. The data is only transferred **once**.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the send frame |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | Length of the data 12 to 258 |
| seg_length_1 | Length of the buffer used 14..260 |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | Reply_update_single |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | 0 to 62 or DEFAULT_SAP<br>Data is made ready for this SAP |
| dsap | No significance |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | Priority of the send frame low/high |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | Number of net bytes to be transferred 0 to 246 |
| l_status | No significance |

The following diagram shows the structure of the data of the REPLY_UPDATE_SINGLE. This data is contained in the user_data_1 structure element of the request block.

The total length of the structure element is fixed at 260 bytes in the header file "fdl_rb.h".

The offset and the user data must be entered in the data buffer by the FDL application.

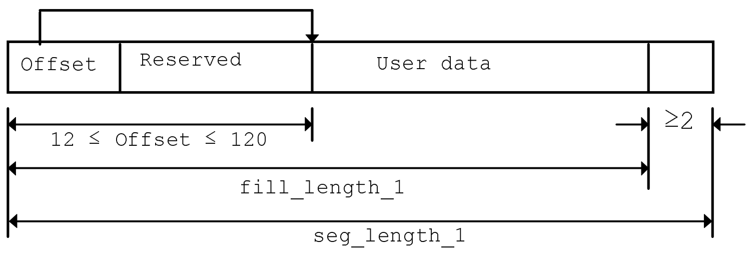
**Recommendation**

Select 12 for the offset byte in the send buffer.

Select 260 as the value for seg_length_1.

Select 12 + the length of the user data as the value for fill_length_1.

**Structure of the Send Buffer**



The FDL can only provide a low **or** high priority data buffer per SAP.

**Confirmation**

The REPLY_UPDATE_SINGLE confirmation confirms execution of the REPLY_UPDATE_SINGLE request.

The result of the service is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, ls, lr, iv |
| fill_length_1 | No significance |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | reply_update_single |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Unchanged from request |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, ls, lr, iv |

**l_status Values**

| | | |
|---|---|---|
| ok | = | data area loaded. |
| ls | = | service not activated on the SAP (local) |
| lr | = | response resource currently being used by the CP (temporary error). |
| iv | = | invalid parameters in the request. |

To transfer new data to an SAP, the FDL application can use the REPLY_UPDATE_SINGLE service at any time.

Please note that the job is acknowledged negatively if such a buffer has already been transferred to this SAP with REPLY_UPDATE_SINGLE or REPLY_UPDATE_MULTIPLE **and** this buffer is currently being sent. The REPLY_UPDATE_SINGLE must then be started again.

### 3.2.5 REPLY_UPDATE_MULTIPLE

**Request**

With this service, the FDL application prepares data for a certain service access point (ssap). This data can be fetched by any other station with access to this SAP using an SRD.

In contrast to the REPLY_UPDATE_SINGLE request, the data can be transferred **more than once**.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the send frame low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | Length of the data 12 to 258 |
| seg_length_1 | Length of the buffer used 14..260 |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | Reply_update_multiple |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | 0 to 62 or DEFAULT_SAP<br>Data are prepared for this SAP |
| dsap | No significance |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | Priority of the send frame low/high |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | Number of net bytes to be transferred 0 to 246 |
| l_status | No significance |

The following diagram shows the structure of the data of the REPLY_UPDATE_MULTIPLE. This data is contained in the user_data_1 structure element of the request block.

The total length of the structure element is fixed at 260 bytes in the header file "fdl_rb.h".

The offset and the user data must be entered in the data buffer by the FDL application.

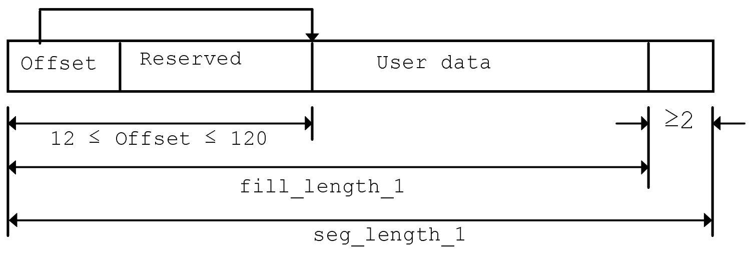
**Recommendation**

Select 12 for the offset byte in the send buffer.

Select 260 as the value for seg_length_1.

Select 12 + the length of the user data as the value for fill_length_1

**Structure of the Send Buffer**



The FDL can only prepare either a low **or** high priority data buffer per SAP.

**Confirmation**

The REPLY_UPDATE_MULTIPLE confirmation confirms execution of the REPLY_UPDATE_MULTIPLE request.

The result of the service is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, ls, lr, iv |
| fill_length_1 | No significance |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | Reply_update_multiple |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Unchanged from request |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, ls, lr, iv |

**l_status Values**

| | | |
|---|---|---|
| ok | = | data area loaded. |
| ls | = | service not activated on the SAP (local). |
| lr | = | response source currently being used by the CP (temporary error). |
| iv | = | invalid parameters in the request. |

To transfer new data to an SAP, the FDL application can use the REPLY_UPDATE_MULTIPLE service at any time.

Please note that the job is acknowledged negatively if such a buffer has already been transferred to this SAP with REPLY_UPDATE_SINGLE or REPLY_UPDATE_MULTIPLE **and** this buffer is currently being sent. The REPLY_UPDATE_MULTIPLE must then be started again. ❑

# 4 Management Services

This chapter explains the basic principles of the management services.

The chapter explains the following:

- ➢ The data structures of the management services
- ➢ The request blocks of the management services

The following management services are described in detail:

- ➢ SAP_ACTIVATE
- ➢ RSAP_ACTIVATE
- ➢ SAP_DEACTIVATE
- ➢ AWAIT_INDICATION
- ➢ WITHDRAW_INDICATION
- ➢ LSAP_STATUS
- ➢ FDL_LIFE_LIST_CREATE_LOCAL
- ➢ FDL_LIFE_LIST_CREATE_REMOTE
- ➢ FDL_READ_STATISTIC_COUNTER
- ➢ FDL_READ_LAS_STATISTIC_COUNTER
- ➢ FDL_EVENT
- ➢ FDL_READ_VALUE

## 4.1 Data Structures of the Management Services

**Request Block Structure**

The same request block structure is used for the management services as for the productive services. Owing to the different functions, there are new service codes and the contents of the send and receive buffers are different. Up to now, the FDL application has structured the user data of the frames when it saved them, the data required by the management service are, however, now saved in the appropriate structure.

```
typedef struct
{
  rb2_header_type rb2_header;
  struct application_block    application_block;
  UBYTE     reserved  [12];
  UBYTE     reference [2];
  UBYTE     user_data_1 [260];
  UBYTE     user_data_2 [260];
} fdl_rb;
```

**Description of the Parameters**

| | |
|---|---|
| rb2_header | Request block header.<br>General, non service-dependent parameters |
| application_block | Argument area. FDL parameters. |
| reference | ID of the FDL application. |
| user_data_1 | User data depending on the particular job. |
| user_data_2 | User data depending on the particular job. |

**Substructure of the Request Block Header**

```
typedef  struct
{
  UWORD     reserved [2];
  UBYTE     length;
  UWORD     user;
  UBYTE     rb_type;
  UBYTE     priority;
  UBYTE     reserved_1;
  UWORD     reserved_2;
  UBYTE     subsystem;
  UBYTE     opcode;
  UWORD     response;
  UWORD     fill_length_1;
  UBYTE     reserved_3;
  UWORD     seg_length_1;
  UWORD     offset_1;
  UWORD     reserved_4;
  UWORD     fill_length_2;
  UBYTE     reserved_5;
  UWORD     seg_length_2;
  UWORD     offset_2;
  UWORD     reserved_6;
} rb2_header_type;
```

**Description of the Parameters**

| | |
|---|---|
| length | Length of the request block without "user_data_1" and "user_data_2" (= 80 bytes). |
| user | User ID, available for the FDL application. |
| rb_type | Type of request block used (= 2). |
| priority | Priority of the job. |
| subsystem | Communication layer selection (FDL = 22h). |
| opcode | Request, confirm, indication (same as the parameter "opcode" in the application block). |
| response | Return parameter (same as the parameter "l_status" in the application block). |
| fill_length_1 | Number of relevant bytes in data buffer 1. |
| seg_length_1 | Actual length of data buffer 1. |
| offset_1 | Offset of data buffer 1 relative to the start of the request block. |
| fill_length_2 | Number of relevant bytes in data buffer 2. |
| seg_length_2 | Actual length of data buffer 2. |
| offset_2 | Offset of data buffer 2 relative to the start of the request block. |

**Substructure Argument Area**

```
struct application_block
{
  UBYTE                              opcode;
  UBYTE                              subsystem;
  UWORD                              id;
  struct    service                  service;
  struct    remote_address           loc_add;
  UBYTE                              ssap;
  UBYTE                              dsap;
  struct    remote_address           rem_add;
  enum      service_class            serv_class;
  struct    link_service_data_unit   receive_l_sdu;
  UBYTE                              reserved_1;
  UBYTE                              reserved;
  struct    link_service_data_unit   send_l_sdu;
  enum      link_status              l_status;
  UWORD                              reserved_2 [2];
};
struct service
{
  enum      service_code             code;
};
struct remote_address
{
  UBYTE                              station;
  UBYTE                              segment;
};
struct link_service_data_unit
{
  void      far *                    buffer_ptr;
  UBYTE                              length;
};
```

**Description of the Parameters**

| | |
|---|---|
| opcode | Request, confirm, indication |
| subsystem | Reserved for the CP. |
| id | Reserved for the CP. |
| service.code | fdl_read_value, sap_activate, rsap_activate, sap_deactivate, fdl_life_list_create_local, fdl_ident, fdl_event, await_indication, with-draw_indication, fdl_read_las_statistic_ctr, lsap_status, fdl_life_list_create_remote |
| loc_add.station | Irrelevant for management services |
| loc_add.segment | Irrelevant for management services |
| ssap | Source service access point, 0 to 62 |
| dsap | Destination service access point for LSAP_STATUS; Number of the SAP for (R)SAP_ACTIVATE, SAP_DEACTIVATE (0 to 63) |
| rem_add.station | Remote address, 0 to 126, for FDL_IDENT |
| rem_add.segment | Reserved |
| serv_class | Priority of the service ( low or high ) |
| receive_l_sdu.length | Service dependent |
| send_l_sdu.length | No significance |
| l_status | Return parameter, link_status |

**Send Buffers**

The send buffers have the following significance for the various jobs:

| Service | Structure used |
|---|---|
| sap_activate | fdl_sap |
| rsap_activate | fdl_sap |
| Others | No significance |

**Return Values**

The FDL application receives the following completed structures:

| Service | Structure used |
|---|---|
| fdl_read_value | Bus_parameter_block |
| fdl_event | Event_indication |
| lsap_status | Byte buffer |
| fdl_life_list_create_local | Byte buffer |
| fdl_life_list_create_remote | Byte buffer |
| fdl_ident | Byte buffer |
| fdl_read_statistic_ctr | Statistic_ctr_list |
| fdl_read_las_statistic_ctr | Byte buffer |
| await_indication | Byte buffer |
| others | No significance |

**Substructure Bus Parameter Block**

```
struct      bus_parameter_block
{
  UBYTE                       hsa;
  UBYTE                       ts;
  enum      station_type      station_type;
  enum      baud_rate         baud_rate;
  enum      redundancy        medium_red;
  UWORD                       retry_ctr;
  UBYTE                       default_sap;
  UBYTE                       network_connection_sap;
  UWORD                       tsl;
  UWORD                       tqui;
  UWORD                       tset;
  UWORD                       min_tsdr;
  UWORD                       max_tsdr;
  d_word                      ttr;
  UBYTE                       g;
  boolean                     in_ring_desired;
  enum      physical_layer    physical_layer;
  struct    ident             ident;
};
```

```
struct ident
{
  UBYTE                 reserved_header[8];
  UBYTE                 ident[202];
  UBYTE                 response_frame_length;
};
```

**Meaning of the Parameters**

| | |
|---|---|
| hsa | Highest L2 address of an active station on the bus |
| ts | L2 address of the station (local) |
| station_type | Type of the station (local) (active, passive); |
| baud_rate | Kbps_9_6 , Kbps_19_2, Kbps_93_75, Kbps_187_5, Kbps_500, Mbps_1_5, Mbps_3, Mbps_6, Mbps_12 |
| medium_red | Redundancy |
| retry_ctr | Number of repeated calls to a responder that is not answering, 0 to 7 |
| network_connection_sap | No significance |
| default_sap | Number of the default SAP (local) |
| tsl | SLOT time |
| tqui | Transmitter fall time/repeater changeover time |
| tset | Setup time |
| min_tsdr | Minimum station delay time |
| max_tsdr | Maximum station delay time |
| ttr | Target rotation time |
| g | GAP update factor |
| in_ring_desired | Request to enter ring |
| physical_layer | Selectable physical bus characteristics |
| ident | Vendor name, controller type, hardware and software versions |

**Structure fdl_sap**

```
struct      fdl_sap
{
  UWORD     user_id;
  UBYTE     max_l_sdu_length;
  UBYTE     access_sap;
  UBYTE     access_station;
  UBYTE     access_segment;
  UBYTE     max_l_sdu_length;
  UBYTE     sda;
  UBYTE     sdn;
  UBYTE     srd;
  UBYTE     csrd;
  void      far   *rup_l_sdu_ptr_low;
  void      far   *rup_l_sdu_ptr_high;
};
```

**Meaning of the Parameters**

see Section 4.2.2

**Structure event_indication**

```
struct      event_indication
{
  struct    event_ctr   time_out;
  struct    event_ctr   not_syn;
  struct    event_ctr   uart-error;
  struct    event_ctr   out_of_ring;
  struct    event_ctr   sdn_not_indicated;
  struct    event_ctr   duplicate_address;
  struct    event_ctr   hardware_error;
  struct    event_ctr   mac_error;
};
```

**Meaning of the Parameters**

see Section 4.2.12

**Structure event_ctr**

```
struct      event_ctr
{
  UWORD     threshold
  UWORD     counter
};
```

**Meaning of the Parameters**

see Section 4.2.12

**Structure statistic_ctr_list**

```
struct      statistic_ctr_list
{
  UWORD     invalid_start_delimiter_ctr;
  UWORD     invalid_fcb_fcv_ctr;
  UWORD     invalid_token_ctr;
  UWORD     collision_ctr;
  UWORD     wrong_fcs_or_ed_ctr;
  UWORD     frame_error_ctr;
  UWORD     char_error_ctr;
  UWORD     retry_ctr;
  d_word    start_delimiter_ctr;
  d_word    stop_receive_ctr;
  d_word    send_confirmed_ctr;
  d_word    send_sdn_ctr;
};
```

**Meaning of the Parameters**

see Section 4.2.10

**Constants**

Constants used in this chapter and available to the FDL application are as follows:

**Values for the Application Block:**

| | | |
|---|---|---|
| DEFAULT_SAP | FFH | Default SAP identifier |
| NO_SEGMENT | FFH | Segment invalid |
| BROADCAST | 127 | Global address |
| MULTICAST | 127 | Global address |
| EVENT_SAP | 64 | SAP number for events |
| LEN_MAX_RECEIVE_BUFFER | 255 | Max. receive buffer |
| LEN_MIN_RECEIVE_BUFFER | 32 | Min. receive buffer |
| LEN_DATA_OVERHEAD | 14 | Length of the maximum frame header plus trailer |

**Structure Values for Management Services:**

| | |
|---|---|
| LEN_BUS_PARAMETER | Length of structure "bus_parameter_block" |
| LEN_SAP_ACTIVATE | Length of structure "fdl_sap" |
| LEN_POLL_ELEMENT | Length of structure "user_poll_element" |
| LEN_APPLICATION_BLOCK | Length of structure "application_block" |
| LEN_IDENT | Length of structure "ident" |
| LEN_EVENT_INDICATION | Length of structure "event_indication" |
| LEN_STATISTIC_CTR_LIST | Length of structure "statistic_ctr_list" |

**Constants for SAP Configurations:**

| | |
|---|---|
| ALL | 7FH |
| SEGMENT_VALID | 80H |
| SEGMENT_INVALID | 00H |
| SEGMENT_TYP | 40H |
| INITIATOR | 00H |
| RESPONDER | 10H |
| BOTH_ROLES | 20H |
| SERVICE_NOT_ACTIVATED | 30H |

**Constants for Life List:**

| | |
|---|---|
| STATION_PASSIVE | 00H |
| STATION_NOT_EXISTENT | 10H |
| STATION_ACTIVE_READY | 20H |
| STATION_ACTIVE | 30H |

## 4.2 Request Blocks of the Management Services

### 4.2.1 FDL_READ_VALUE

**Request**

The current bus parameters of the CP can be read with this service.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | 0 |
| seg_length_1 | Length of the buffer used (≥ LEN_BUS_PARAMETER) |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | fdl_read_value |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | No significance |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | No significance |
| l_status | No significance |

**Confirmation**

The FDL_READ_VALUE confirmation confirms execution of the FDL_READ_VALUE request.

The result of the request is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, iv |
| fill_length_1 | LEN_BUS_PARAMETER |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | fdl_read_value |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Unchanged from request |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, iv |

**l_status Values**

| | | |
|---|---|---|
| ok | = | Positive acknowledgment, the bus parameters were read. |
| iv | = | Negative acknowledgment:<br>- CP is currently being reset<br>- No receive buffer |

**Meaning of the Parameters**

The parameters described in the following structure are entered in the user_data_1 structure element by the CP.

**struct bus_parameter_block**

| | |
|---|---|
| hsa | Highest L2 address on the bus, 2 to 126. |
| ts | L2 address local station, 0 to hsa or 126. |
| station_type | Type of station (local) |
| baud_rate | Data rate: Kbps_9_6, Kbps_19_2, Kbps_93_75, Kbps_187_5, Kbps_500, Mbps_1_5, Mbps_3, Mbps_6, Mbps_12. |
| medium_red | Redundancy |
| retry_ctr | Number of repeated calls to a non-responding station (remote), 0 to 7. |
| default_sap | Number of the default SAP of the station (local), 0 to 63. |
| network_connection_sap | Reserved |
| tsl | SLOT time |
| tqui | Transmitter fall time/repeater changeover time |
| tset | Setup time |
| min_tsdr | Minimum station delay time. |
| max_tsdr | Maximum station delay time. |
| ttr | Target rotation time |
| g | GAP update factor |
| in_ring_desired | Request to enter the ring |
| physical_layer | Selectable physical bus characteristics |
| ident | Vendor name, controller type, hardware and software versions |

### 4.2.2 SAP_ACTIVATE

**Request**

With this service you can assign parameters to service access points (SAPs) in the FDL and activate them.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | LEN_SAP_ACTIVATE |
| seg_length_1 | Length of the buffer used (≥ LEN_SAP_ACTIVATE) |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | Sap_activate |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | Number of the SAP to be activated, 0 to 63 |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | No significance |
| l_status | No significance |

**Structure Element user_data_1**

The parameters described in the following structure are entered in the user_data_1 structure element by the FDL application.

**struct fdl_sap**

| | |
|---|---|
| user_id | Identification for the FDL application; no significance for the CP. |
| max_l_sdu_length | Maximum user data length processed on this SAP.<br>Recommendation: 246 |
| access_sap | Optional access right for a particular SAP (remote) on this SAP.<br>Other remote SAPs (≠ access_sap) are not allowed access (0 to 63, ALL).<br>ALL = no access restrictions. |
| access_station | Optional access right for a particular station (remote) on this SAP. Stations with the L2 address ≠ access_station are not allowed access (0 to hsa, ALL).<br>ALL = no access restrictions. |
| access_segment | Reserved |
| sda | Specifies the role |
| sdn | Specifies the role |
| srd | Specifies the role |
| csrd | Reserved |
| *rup_l_sdu_ptr_low | No significance |
| *rup_l_sdu_ptr_high | No significance |

**Role:**

| | |
|---|---|
| INITIATOR | Station (local) can only be initiator of the service. |
| RESPONDER | Station (local) can only be responder in the service. |
| BOTH_ROLES | Station (local) can be both initiator and responder in the service. |
| SERVICE_NOT_ACTIVATED | Service is not activated. |

**Note:**

An SAP can be activated for several services. If, however BOTH_ROLES and/or RESPONDER are entered more than once, all entries (SDA, SDN and SRD) become BOTH_ROLES.

CSRD is no longer supported.

**Note on LSAP_STATUS**

The service LSAP_STATUS allows the roles set with SAP_ACTIVATE to be read.

**Confirmation**

The SAP_ACTIVATE confirmation confirms execution of the SAP_ACTIVATE request.

The result of the request is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, no, iv |
| fill_length_1 | No significance |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | Sap_activate |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Unchanged from request |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, no, iv |

**l_status Values**

| | | |
|---|---|---|
| ok | = | Positive acknowledgment, SAP was activated. |
| no | = | Negative acknowledgment, SAP exists already. |
| iv | = | Negative acknowledgment:<br>- CP currently being reset<br>- SAP parameter invalid<br>- SAP number invalid |

### 4.2.3 RSAP_ACTIVATE

**Request**

With this service, service access points (SAPs) with a pure responder role can be assigned parameters and activated for SRD in the FDL.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | LEN_SAP_ACTIVATE |
| seg_length_1 | Length of the buffer used (≥ LEN_SAP_ACTIVATE) |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | Rsap_activate |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | Number of the SAP to be activated, 0 to 63 |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | No significance |
| l_status | No significance |

**Structure Element user_data_1**

The parameters described in the following structure are entered in the user_data_1 structure element by the FDL application.

**struct fdl_sap**

| | |
|---|---|
| user_id | Identification for the FDL application, no significance for the CP. |
| max_l_sdu_length | Maximum user data length processed on this SAP (recommendation 246). |
| access_sap | Optional access rights for a particular SAP (remote) on this SAP. Other remote SAPs (≠ access_sap) are not permitted access (0 to 63, ALL).<br>ALL = no access restriction. |
| access_station | Optional access right for a particular station (remote) on this SAP. Stations with an L2 address ≠ access_station are not permitted access (0..hsa, ALL).<br>ALL = no access restrictions |
| access_segment | Reserved |
| sda | No significance |
| sdn | No significance |
| srd | Specifies the role = RESPONDER |
| csrd | Reserved |
| *rup_l_sdu_ptr_low | No significance |
| *rup_l_sdu_ptr_high | No significance |

**Confirmation**

The RSAP_ACTIVATE confirmation confirms execution of the RSAP_ACTIVATE request.

The result of the request is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, no, iv |
| fill_length_1 | No significance |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | rsap_activate |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Unchanged from request |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, no, iv |

**l_status Values**

| | | |
|---|---|---|
| ok | = | Positive acknowledgment, SAP was activated. |
| no | = | Negative acknowledgment, SAP exists already |
| iv | = | Negative acknowledgment:<br>- CP currently being reset<br>- SAP parameter invalid<br>- SAP number invalid |

### 4.2.4 SAP_DEACTIVATE

**Request**

With this service, service access points (SAPs) can be deactivated.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | 0 |
| seg_length_1 | Length of the buffer used ≥ LEN_SAP_ACTIVATE |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | sap_deactivate |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | Number of the SAP to be deactivated, 0 to 63 |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | No significance |
| l_status | No significance |

An SAP can only be deactivated when there are no more resources attached to the SAP. Buffers transferred with previous AWAIT_INDICATION requests that still exist in layer 2 must first be fetched back with WITHDRAW_INDICATION before an SAP_DEACTIVATE can be performed.

**Confirmation**

The SAP_DEACTIVATE confirmation confirms execution of the SAP_DEACTIVATE request.

The result of the request is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, no, lr, iv |
| fill_length_1 | LEN_SAP_ACTIVATE |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | sap_deactivate |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Unchanged from request |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, no, lr, iv |

**l_status Values**

| | | |
|---|---|---|
| ok | = | Positive acknowledgment, SAP was deactivated |
| no | = | Negative acknowledgment, SAP does not exist |
| lr | = | Negative acknowledgment: CP access to SAP (temporary), there are still indication resources on the SAP. |
| iv | = | Negative acknowledgment:<br>- CP currently being reset<br>- SAP number invalid |

Data, transferred to the CP for this SAP using "REPLY_UPDATE_..." are discarded.

### 4.2.5 LSAP_STATUS

**Request**

This service allows configuration parameters for a particular SAP to be read. Only the SAPs of the local station (local) can be read.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | 0 |
| seg_length_1 | Length of the receive buffer |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | lsap_status |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | Number of the SAP (local) 0 to 63 or DEFAULT_SAP |
| rem_add.station | ts (local L2 address) |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | Receive buffer length<br>Recommendation: 255 |
| send_l_sdu.length | No significance |
| l_status | No significance |

**Confirmation**

The LSAP_STATUS confirmation confirms execution of the LSAP_STATUS request.

The result of the request is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, iv |
| fill_length_1 | Length of the returned data + offset (see "Structure of the receive buffer") |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

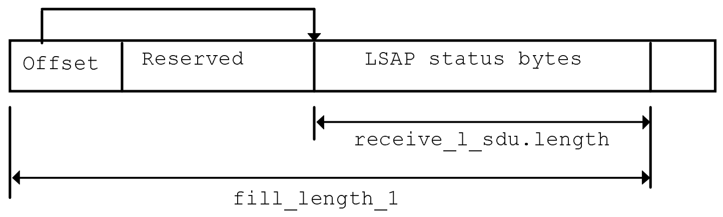
| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | lsap_status |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Number of returned net bytes 0 to 6, with appropriate l_status |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, iv |

The following diagram shows the structure of the data received with the LSAP_STATUS confirmation.

This data is contained in the user_data_1 structure element of the request block.

The offset and the user data are entered in the receive buffer by the CP.

**Structure of the Receive Buffer**



The offset (first byte of the receive buffer) indicates the number of bytes from the start of the receive buffer to the first byte of the user data.

| | | | |
|---|---|---|---|
| **l_status Values** | ok | = | Positive acknowledgment, status was read. |
| | iv | = | Negative acknowledgment:<br>- CP currently being reset<br>- Invalid parameters in the application block<br>- Other management service currently active |

**Meaning of the Parameters:**

If l_status = ok, 6 status bytes are read. The bytes have the following meaning:

| | |
|---|---|
| BYTE 1: | Station access restriction (access_station) |
| BYTE 2: | Reserved |
| BYTE 3 to 6: | Status of the individual services (SDA, SDN, SRD) |

Structure of BYTE 1:

| | |
|---|---|
| b8: | Bit 8 is always 1. |
| b7 to b1: | Only the station with the L2 address b7 to b1 can access this SAP.<br>b7 to b1 = 7FH means there is no access restriction (ALL). |

Structure of BYTE 2:

| | |
|---|---|
| b8 .. b1: | Reserved |

Structure of BYTE 3 to 5:

b8 to b5: Specifies the role in the service:

| | |
|---|---|
| 0000 | INITIATOR |
| 0001 | RESPONDER |
| 0010 | BOTH_ROLES |
| 0011 | SERVICE_NOT_ACTIVATED |

b4 to b1: Specifies the service ID:

| | |
|---|---|
| 0000 | SDA_RESERVED |
| 0001 | SDN_RESERVED |
| 0011 | SRD_RESERVED |
| 0101 | Reserved |

Structure of BYTE 6:
Reserved

**Note**

The CSRD is no longer supported.

## 4.2.6 FDL_LIFE_LIST_CREATE_REMOTE

**Request**

This service supplies the FDL application with a current list of functional stations on the bus. A status frame is sent to all possible active or passive stations on the bus (bus load).

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | 0 |
| seg_length_1 | Length of the buffer used 127..260 |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | fdl_life_liste_create_remote |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | No significance |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | No significance |
| l_status | No significance |

In contrast to FDL_LIFE_LIST_CREATE_LOCAL, the function also provides the L2 addresses of passive stations (slaves) with which the local CP does **not** exchange data.

## Confirmation

The FDL_LIFE_LIST_CREATE_REMOTE confirmation shows the execution of the FDL_LIFE_LIST_CREATE_REMOTE request.

The result of the request is entered in the l_status structure element.

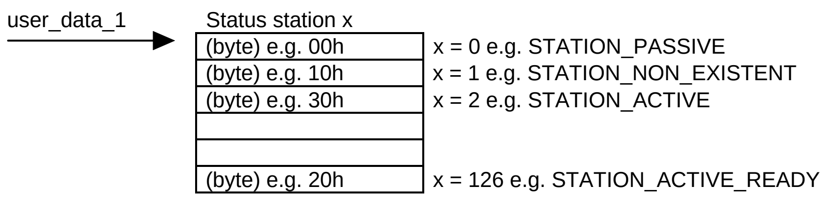
**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, ds, lr, iv |
| fill_length_1 | 127 if l_status = ok |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | fdl_life_list_create_remote |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | 127 if l_status = ok |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, ds, lr, iv |

## Structure of the Life List


user_data_1
Status station x
(byte) e.g. 00h
(byte) e.g. 10h
(byte) e.g. 30h
(byte) e.g. 20h
x = 0 e.g. STATION_PASSIVE
x = 1 e.g. STATION_NON_EXISTENT
x = 2 e.g. STATION_ACTIVE
x = 126 e.g. STATION_ACTIVE_READY

## Values for Status

| | | | |
|---|---|---|---|
| Status: | STATION_NON_EXISTENT | = | 10H |
| | STATION_ACTIVE_READY | = | 20H (ready for entry in the logical ring) |
| | STATION_ACTIVE | = | 30H (already in the logical ring) |
| | STATION_PASSIVE | = | 00H |

## l_status Values

| | | |
|---|---|---|
| ok | = | Positive acknowledgment, life list was created. |
| ds | = | CP not in logical token ring or disconnected from the bus. |
| lr | = | Resources of the CP not available or inadequate. |
| iv | = | Negative acknowledgment:<br>- CP currently being reset<br>- passive station<br>- other management service currently active |

## 4.2.7 FDL_LIFE_LIST_CREATE_LOCAL

**Request**

The service provides the FDL application with a current list of functional stations on the bus. The list is generated from the information on the local station (no bus load).

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | 0 |
| seg_length_1 | Length of the buffer used 127..260 |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | fdl_life_list_create_local |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | No significance |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | No significance |
| l_status | No significance |

In contrast to FDL_LIFE_LIST_CREATE_REMOTE, the function only provides the L2 addresses of passive stations (slaves) with which the local CP exchanges data.

If the FDL_LIFE_LIST_CREATE_REMOTE service has already been executed, an image of all stations is provided, this means that passive stations that have already been entered are not removed.

## Confirmation

The FDL_LIFE_LIST_CREATE_LOCAL confirmation shows the execution of the FDL_LIFE_LIST_CREATE_LOCAL request.

The result of the request is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, lr, iv |
| fill_length_1 | 127 if l_status = ok |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | fdl_life_list_create_local |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | 127 if l_status = ok |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, lr, iv |

## Structure of the Life List

user_data_1 $\longrightarrow$

| Status station x | |
|---|---|
| (byte) e.g. 00h | x = 0 e.g. STATION_PASSIVE |
| (byte) e.g. 10h | x = 1 e.g. STATION_NON_EXISTENT |
| (byte) e.g. 30h | x = 2 e.g. STATION_ACTIVE |
| | |
| | |
| | |
| (byte) e.g. 20h | x = 126 e.g. STATION_ACTIVE_READY |

| | | | |
|---|---|---|---|
| Status: | STATION_NON_EXISTENT | = | 10H |
| | STATION_ACTIVE_READY | = | 20H (ready for entry in the logical ring) |
| | STATION_ACTIVE | = | 30H (already in the logical ring) |
| | STATION_PASSIVE | = | 00H |

## l_status Values

| | | |
|---|---|---|
| ok | = | Positive acknowledgment, life list was created. |
| lr | = | Resources of the CP not available or inadequate. |
| iv | = | Negative acknowledgment:<br>- CP currently being reset<br>- no life list buffer exists<br>- passive station<br>- other management service currently active |

### 4.2.8 FDL_IDENT

**Request**

With this service, a station (local or remote) can be identified. The identification includes the vendor name, the module type and the hardware and software versions.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | 0 |
| seg_length_1 | Length of the receive buffer used (≥ LEN_IDENT ≤ 260 ) |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | fdl_ident |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | No significance |
| rem_add.station | 0 to 126; if local L2 address, then check local ident |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | receive buffer length<br>Recommendation: 255 |
| send_l_sdu.length | No significance |
| l_status | No significance |

**Confirmation**

The FDL_IDENT confirmation confirms execution of the FDL_IDENT request.

The result of the request is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, na, ds, nr, lr, iv |
| fill_length_1 | Length of the Ident (0..200) + offset (if l_status = ok) |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

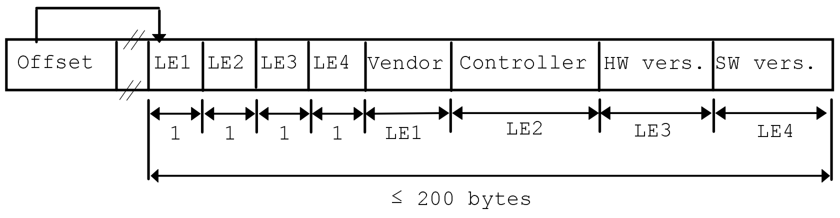
| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | fdl_ident |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Length of the Ident 0 to 200, if l_status = ok |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, na, ds, nr, lr, iv |

The following diagram shows the structure of the data received with the FDL_IDENT confirmation.

This data is contained in the user_data_1 structure element of the request block.

The offset and die Ident-data are entered in the receive buffer by the CP.

**Structure of the Receive Buffer**



The offset (first byte of the receive buffer) indicates the number of bytes from the start of the receive buffer to the first byte of the user data.
The last four elements contain character strings.

**l_status Values**

| | | |
|---|---|---|
| ok | = | Positive acknowledgment, Ident was read. |
| na | = | No or no plausible reaction from the addressed station (remote). |
| ds | = | CP not in the logical token ring or disconnected from the bus. |
| nr | = | Negative acknowledgment for Ident-data, since these are not available on the addressed station (remote). |
| lr | = | Resources of the CP not available or inadequate. |
| iv | = | Negative acknowledgment:<br>- CP currently being reset<br>- invalid parameters in the application block<br>- other management service currently active. |

### 4.2.9 FDL_READ_STATISTIC_COUNTER

**Request**

This service is used to read the statistical data of the local station. Each time the data is read, the counters are reset.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | 0 |
| seg_length_1 | Length of the buffer used<br>Recommendation: 260 |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | fdl_read_statistic_ctr |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | No significance |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | No significance |
| l_status | No significance |

**Confirmation**

The FDL_READ_STATISTIC_COUNTER confirmation shows the execution of the FDL_READ_STATISTIC_COUNTER request.

The result of the request is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, iv |
| fill_length_1 | LEN_STATISTIC_CTR_LIST |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | fdl_read_statistic_ctr |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, iv |

**Structure Element user_data_1**

The parameters described in the following structure are entered in the user_data_1 structure element by the CP.

**struct statistic_ctr_list:**

| | |
|---|---|
| invalid_start_delimiter_ctr | Receive frame with invalid start delimiter |
| invalid_fcb_fcv_ctr | Reserved |
| invalid_token_ctr | Invalid token received |
| collision_ctr | Unexpected response frame, possibly bus collisions or bus short-circuit. |
| wrong_fcs_or_ed_ctr | Reserved |
| frame_error_ctr | Gap in the received frame. |
| char_error_ctr | Reserved |
| retry_ctr | Frame repetitions |
| start_delimiter_ctr | Receive frame with valid start delimiter. |
| stop_receive_ctr | Reception aborted, because:<br>- incorrect start delimiter<br>- bus short-circuit or bus collisions<br>- station exists twice<br>- Invalid entry in the frame |
| send_confirmed_ctr | Number of sent "confirmed requests" (SDA, SRD). |
| send_sdn_ctr | Number of sent SDN requests. |

**l_status Values**

| | | |
|---|---|---|
| ok | = | Positive acknowledgment, statistics were read. |
| iv | = | Negative acknowledgment:<br>- CP currently being reset<br>- no statistic buffer exists |

## 4.2.10 FDL_READ_LAS_STATISTIC_COUNTER

**Request**

This service is used to read bus-related statistics. Each time the statistical data is read, the counters are reset.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | 0 |
| seg_length_1 | Length of the buffer used<br>Recommendation: 260 |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | fdl_read_las_statistic_ctr |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | No significance |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | No significance |
| l_status | No significance |

**Confirmation**

The FDL_READ_LAS_STATISTIC_COUNTER confirmation confirms execution of the FDL_READ_LAS_STATISTIC_COUNTER request.

The result of the request is entered in the l_status structure element.

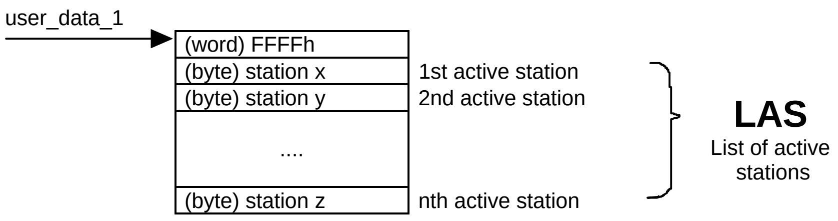
**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, iv |
| fill_length_1 | number of active stations + 2 |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | fdl_read_las_statistic_ctr |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Number of active stations (= n) |
| send_l_sdu.length | Unchanged from request |
| l_status | ok, iv |

**Structure of the Statistic Buffer**



**l_status Values**

ok = Positive acknowledgment, statistics were read
iv = Negative acknowledgment:
- CP currently being reset
- no statistic buffer exists

### 4.2.11 AWAIT_INDICATION

**Request**

With this service, a resource for an indication is made available to the CP. The management of individual resources is SAP-related.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | If dsap = EVENT_SAP: LEN_EVENT_INDICATION otherwise: 0 |
| seg_length_1 | Recommendation: 260 |
| offset_1 | 80 |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | await_indication |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | 0 to 63 or EVENT_SAP; SAP for which resources are made available |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | receive buffer length<br>Recommendation: 255 |
| send_l_sdu.buffer_ptr | 0 |
| send_l_sdu.length | 1 |
| l_status | No significance |

☞ **If the DSAP structure element has the value EVENT_SAP, an FDL_EVENT indication is received with the resource. In all other cases, the resource is made available for receiving an SDA, SDN or SRD indication.**

☞ **In contrast to all other SAPs, the EVENT-SAP does not need to be created with the SAP_ACTIVATE service.**

**Lengths Dependent on the SAP Used**

| | SAP 0..63 | EVENT_SAP |
|---|---|---|
| fill_length_1 | Recommendation: 0 | Recommendation: 258 |
| seg_length_1 | Recommendation: 260 | Recommendation: 260 |
| receive_l_sdu.length | Recommendation: 255 | No significance |

☞ **Please remember that there is only a direct confirmation with the “l_status = ls”, "lr" or "iv" for the AWAIT_INDICATION service if the service was unsuccessful. If the request was correct, the request block remains on the CP.**

☞ **If you fetch back the resources using the WITHDRAW_INDICATION service, the opcode structure element is unchanged, in other words the entry continues to be "request".**

## Meaning of the Parameters

| | |
|---|---|
| dsap = EVENT_SAP: | A resource is made available for the FDL_EVENT indication. A resource consists of an application block and a receive buffer (=LEN_EVENT_INDICATION, struct event_indication). |
| dsap = 0 to 63: | A resource is made available for an SDA, SDN or SRD indication. A resource consists of an application block and a receive buffer. |

## Structure of the Receive Buffer with FDL_EVENT

The parameters described in the following structure are entered in the user_data_1 structure element by the FDL application. /1/

**struct event_indication**

| | |
|---|---|
| time_out.counter | Initialize with 0. |
| time_out.threshold | 1 to 65535; threshold, can be set individually for every event. As soon as the "time_out.counter" reaches the "time_out.threshold" an FDL_EVENT indication with the complete receive buffer is triggered. |
| not_syn.counter | Initialize with 0. |
| not_syn.threshold | 1 to 65535; threshold, can be set individually for every event. As soon as the "not_syn.counter" reaches the "not_syn.threshold" an FDL_EVENT indication with the complete receive buffer is triggered. |
| uart_error.counter | Initialize with 0. |
| uart_error.threshold | Not supported. |
| out_of_ring.counter | Initialize with 0. |
| out_of_ring. threshold | 1 to 65535; threshold, can be set individually for every event. As soon as the "out_of_ring.counter" reaches the "out_of_ring.threshold" an FDL_EVENT indication with the complete receive buffer is triggered. |
| sdn_not_indicated.counter | Initialize with 0. |
| sdn_not_indicated.threshold | Not supported. |
| duplicate_address.counter | Initialize with 0. |
| duplicate_address.threshold | 1 to 65535; threshold, can be set individually for every event. As soon as the “duplicate_address.counter" reaches the "duplicate_address.threshold" an FDL_EVENT indication with the complete receive buffer is triggered. |
| hardware_error.counter | Initialize with 0. |
| hardware_error.threshold | 1 to 65535; threshold, can be set individually for every event. As soon as the "hardware_error.counter" reaches the "hardware_error.threshold" an FDL_EVENT indication with the complete receive buffer is triggered. |
| mac_error.counter | Initialize with 0. |
| mac_error.threshold | 1 to 65535; threshold, can be set individually for every event. As soon as the "mac_error.counter" reaches the "mac_error.threshold" an FDL_EVENT indication with the complete receive buffer is triggered. |

**Confirmation**

The AWAIT_INDICATION confirmation is only returned if an error occurs.

If the service is successful, there is no confirmation.

The result of the request is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ls, lr, iv |
| fill_length_1 | No significance |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | await_indication |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Unchanged from request |
| send_l_sdu.length | Unchanged from request |
| l_status | ls, lr, iv |

**l_status Values**

| | | |
|---|---|---|
| ls | = | Negative acknowledgment, SAP does not exist. |
| lr | = | Negative acknowledgment, resource overflow on the CP (more than 255 for one SAP). |
| iv | = | Negative acknowledgment:<br>- CP currently being reset<br>- invalid parameters in the request |

**Note**

The request block remains on the CP until an indication is received. It is then returned to the FDL application as an SDA, SDN or SRD indication.

### 4.2.12 FDL_EVENT

**Indication**

With this service, the FDL application is informed of events on the CP. An application block and an event buffer (more than one also possible) must be made available to the CP using the AWAIT_INDICATION service. The CP returns the counter readings providing information about how often the corresponding events occur. The indication is triggered when one of the counters reaches the sensitivity threshold that can be set individually by the FDL application. The FDL application receives the application block and the complete event buffer.

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Unchanged from "await_indication" |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Indication |
| response | No significance |
| fill_length_1 | LEN_EVENT_INDICATION |
| seg_length_1 | No significance |
| offset_1 | 80 |
| fill_length_2 | No significance |
| seg_length_2 | No significance |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Indication |
| subsystem | No significance |
| id | No significance |
| service.code | fdl_event |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | EVENT_SAP |
| dsap | No significance |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | No significance |
| l_status | No significance |

The Structure of the event buffer is described along with the AWAIT_INDICATION service. The buffer is in the user_data_1 structure component.

### 4.2.13 WITHDRAW_INDICATION

**Request**

With this service, receive resources transferred previously to the CP by the FDL application with the AWAIT_INDICATION service can be fetched back. These resources normally remain on the CP until data are received from a station (remote). With the WITHDRAW_INDICATION service, the resources can be fetched back prematurely (for example to deactivate the SAP).

**Request Block Header**

| | |
|---|---|
| length | 80 |
| user | Free for use by FDL application |
| rb_type | 2 |
| priority | Priority of the job low/high |
| subsystem | 22H |
| opcode | Request |
| response | No significance |
| fill_length_1 | 0 |
| seg_length_1 | 0 |
| offset_1 | No significance |
| fill_length_2 | 0 |
| seg_length_2 | 0 |
| offset_2 | No significance |

**Application Block**

| | |
|---|---|
| opcode | Request |
| subsystem | Reserved for the CP |
| id | Reserved for the CP |
| service.code | withdraw_indication |
| loc_add.station | No significance |
| loc_add.segment | No significance |
| ssap | No significance |
| dsap | 0 to 63 or EVENT_SAP; SAP from which the resources are fetched back |
| rem_add.station | No significance |
| rem_add.segment | No significance |
| serv_class | No significance |
| receive_l_sdu.length | No significance |
| send_l_sdu.length | No significance |
| l_status | No significance |

Before deactivating an SAP, the resources must be fetched back. The number of returned resources is transferred in the confirmation in the send_l_sdu.length structure element. The resources must then be fetched with individual "ihi_read" or “SCP_receive” calls.

**Confirmation**

The WITHDRAW_INDICATION confirmation shows the execution of the WITHDRAW_INDICATION request.

The result of the request is entered in the l_status structure element.

**Request Block Header**

| | |
|---|---|
| length | Unchanged from request |
| user | Unchanged from request |
| rb_type | Unchanged from request |
| priority | Unchanged from request |
| subsystem | 22H |
| opcode | Confirm |
| response | ok, ls, iv |
| fill_length_1 | Unchanged from request |
| seg_length_1 | Unchanged from request |
| offset_1 | Unchanged from request |
| fill_length_2 | Unchanged from request |
| seg_length_2 | Unchanged from request |
| offset_2 | Unchanged from request |

**Application Block**

| | |
|---|---|
| opcode | Confirm |
| subsystem | No significance |
| id | No significance |
| service.code | withdraw_indication |
| loc_add.station | Unchanged from request |
| loc_add.segment | Unchanged from request |
| ssap | Unchanged from request |
| dsap | Unchanged from request |
| rem_add.station | Unchanged from request |
| rem_add.segment | Unchanged from request |
| serv_class | Unchanged from request |
| receive_l_sdu.length | Unchanged from request |
| send_l_sdu.length | Number of returned resources (if l_status = ok) |
| l_status | ok, ls, iv |

**l_status Values**

| | | |
|---|---|---|
| ok | = | Positive acknowledgment, service was executed. |
| ls | = | Negative acknowledgment, SAP does not exist |
| iv | = | Negative acknowledgment:<br>- CP currently being reset<br>- invalid parameters in the request |

**Fetching the Resources**

The WITHDRAW_INDICATION request is followed by the WITHDRAW_INDICATION confirmation. If this service is successful, (l_status = ok), the structure element send_l_sdu.length contains the number of returned resources. After the confirmation, these must be fetched individually by the FDL application using ihi_read or SCP_receive calls. The request or application block of the returned resource is **unchanged** from the AWAIT_INDICATION request. ❑

# 5 Access to Layer 2

This chapter illustrates the relationship between interface functions and the FDL services. The chapter also explains how communication is implemented between the local and remote station using productive services.

**Basic Structure of the FDL Application**

An FDL application has the following basic structure:

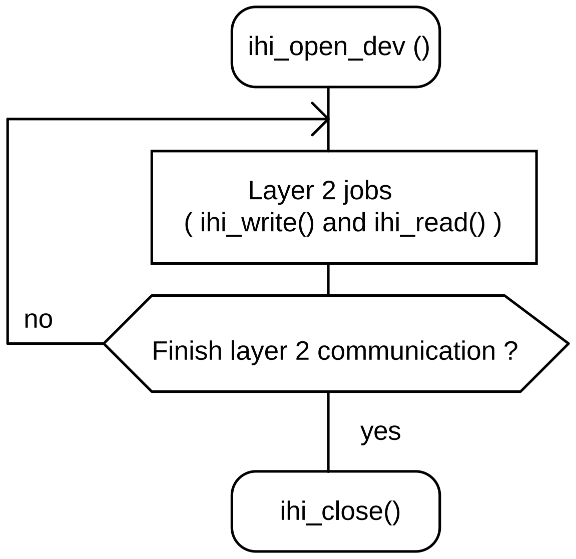

ihi_open_dev ()
Layer 2 jobs
( ihi_write() and ihi_read() )
no
Finish layer 2 communication ?
yes
ihi_close()

Fig. 5.1: Sequence of an FDL Application

**Sequence of Communication**

The communication between the FDL application and the CP consists of three essential steps:

1) The FDL application logs on at the CP with the SCP_open or ihi_open_dev() call.

2) Layer 2 jobs executed with SCP_send and SCP_receive or ihi_write() and ihi_read().

3) The FDL application logs off after terminating layer 2 communication with SCP_close or ihi_close().

The interface functions SCP_open(), SCP_send(), SCP_receive(), and SCP_close() are described in Chapter 7 Function Calls of the SCP Interface

The interface functions ihi_open_dev(), ihi_write(), ihi_read() and ihi_close() are described in Chapter 6 Function Calls of the IHI Interface.

## 5.1 Activating SAPs

**Conditions for Data Transfer**

Before data can be transmitted or received via the layer 2 interface, one or more SAPs must be activated by one of the management services SAP_ACTIVATE or RSAP_ACTIVATE. SAPs are data interfaces within a PROFIBUS station. The source and destination of a data frame are specified by the L2 address and the SAP number.

☞ **No data exchange with other PROFIBUS stations is possible without activating SAPs.**

**Parameters**

To activate an SAP, several parameters must be specified, such as the maximum data length, access rights (remote access, remote SAP), permitted productive services and permitted access type (as initiator or responder).

See also Section 4.2.2 SAP_ACTIVATE.

**Default SAP**

The default SAP is a special case. If the source and/or destination of a data frame is only specified using the L2 address, the PROFIBUS station automatically uses the default SAP as the local data interface. As with all other SAPs used for sending or receiving, the default SAP must be activated by the FDL application using the (R)SAP_ACTIVATE service. The number of the default SAP can be read using the FDL_READ_VALUE service. With management services affecting the default SAP, the SAP number must always be specified. On the other hand, with productive services, the constant DEFAULT_SAP as defined in the "fdl_rb.h" include file can be used.

## 5.2 Data Transfer

**Sequence of the Data Transfer**

The FDL application, the FDL protocol software and the remote PROFIBUS stations are involved in data transfer.

To make the situation clearer in the examples, following each request, the application waits for the corresponding result (confirmation/indication). As explained in Chapter 2 and 7, several requests can be sent to layer 2 one after the other and the application only waits for the result after the requests have been sent.

### 5.2.1 Sending Data Frames

**SDA and SRD to a Remote Partner**

The CP sends an **acknowledged** data frame to **one** other station.

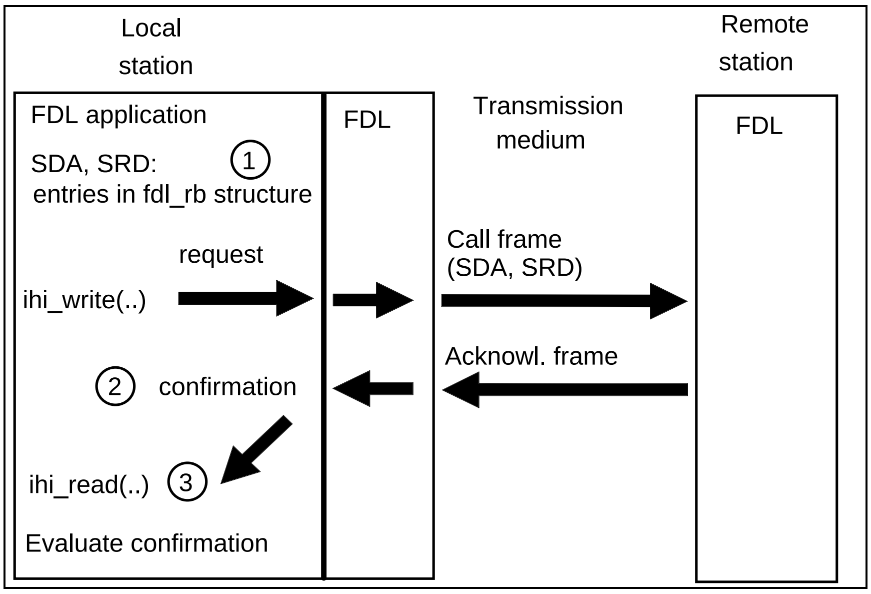


Fig. 5.2: Sending Data Frames SDA, SRD

**Notes**

① Entries made in the structure according to the service description (Chapter 3 Productive Services).

☞ **Make sure that an offset of at least 12 bytes to the user data is maintained in the send buffer. The size of the offset must be entered in the first byte of the send buffer.**

② After receiving the acknowledgment frame, layer 2 returns the confirmation. If an error occurs (syntax error, remote station does not respond, ...), layer 2 generates a local confirmation.

③ The confirmation must be read out with ihi_read() or SCP_receive(). In the polling mode, ihi_read() or SCP_receive() may need to be called several times.

☞ **If several jobs are processed simultaneously by layer 2, the FDL application should specify the type of structure returned (confirmation/indication) based on the ‘opcode’ structure element of the ‘rb2_header_type’ structure. With a confirmation, the assignment to the corresponding request should also be checked.**

**SDN to Remote Partner(s)**

The CP sends an **unacknowledged** data frame to **one or more** other stations.

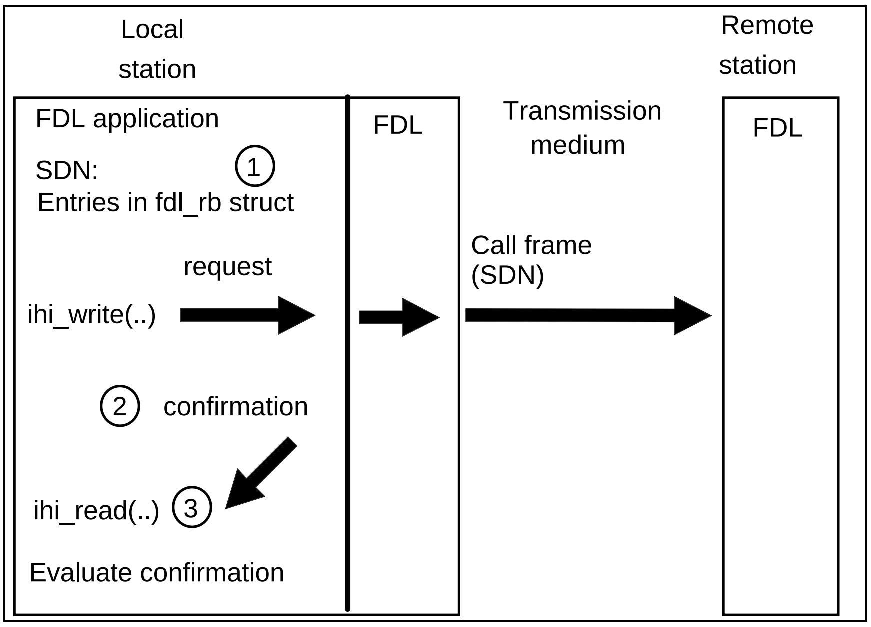


Fig. 5.3: Sending Data Frames SDN

**Notes**

① Make entries in the structure according to the service description (Chapter 3 Productive Services).

☞ **Make sure that an offset of at least 12 bytes to the user data is maintained in the send buffer. The size of the offset must be entered in the first byte of the send buffer.**

② With unacknowledged services (SDN, SDN_BROADCAST), layer 2 generates a local confirmation after sending the call frame.

③ The confirmation must be read out with ihi_read() or SCP_receive(). In the polling mode, ihi_read() or SCP_receive() may need to be called several times.

☞ **If several jobs are processed simultaneously by layer 2, the FDL application should specify the type of structure returned (confirmation/indication) based on the ‘opcode’ structure element of the ‘rb2_header_type’ structure. With a confirmation, the assignment to the corresponding request should also be checked.**

## 5.2.2 Receiving Data Frames

**SDA, SDN from Remote Partner**

The CP receives call frames from a remote station.

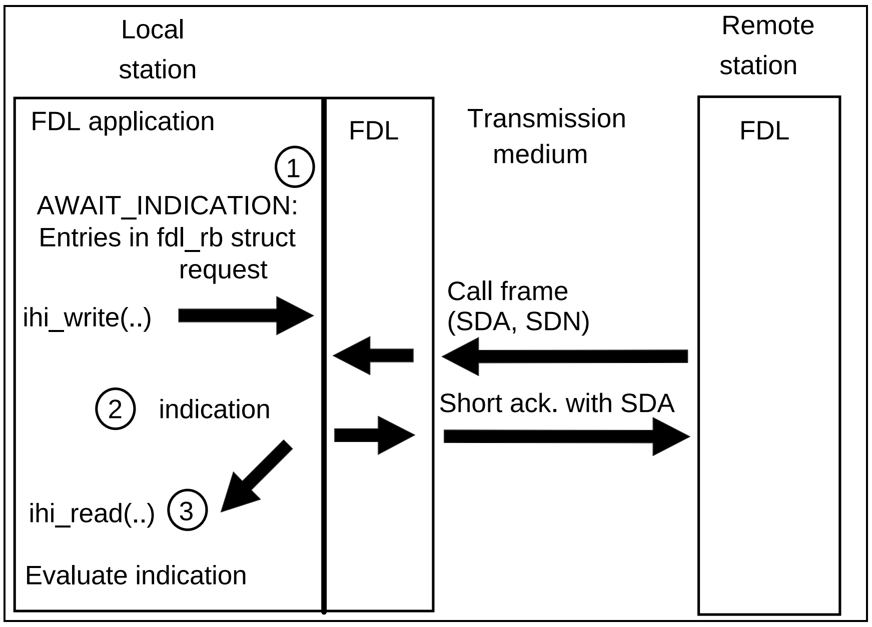


Fig. 5.4: Receiving Data Frames SDA, SDN

**Notes**

① Entries in the structure according to the service description (Chapter 3 Productive Services). To be able to receive a data frame from a remote station, one or more receive resources must be transferred to the SAP using AWAIT_INDICATION. Several receive resources can be transferred to the SAP by repeatedly calling AWAIT_INDICATION. After a call frame has been received, the resource is used up and must be replaced by a new AWAIT_INDICATION.

② After receiving a call frame, layer 2 generates an indication containing the received data and sends it to the FDL application. The first byte of the receive buffer contains the offset to the received data.

③ The indication must be read out using ihi_read() or SCP_receive(). In the polling mode, ihi_read() or SCP_receive() may need to be called several times.

☞ **If several jobs are processed simultaneously by layer 2, the FDL application should specify the type of structure returned (confirmation/indication) based on the 'opcode' structure element of the 'rb2_header_type' structure.**

☞ **With a confirmation, the assignment to the corresponding request should also be checked. The FDL application must transfer the AWAIT_INDICATION to the CP to continue receiving.**

**SRD from Remote Partner**

The CP receives a call frame and sends an acknowledgment frame with data back to the remote station.

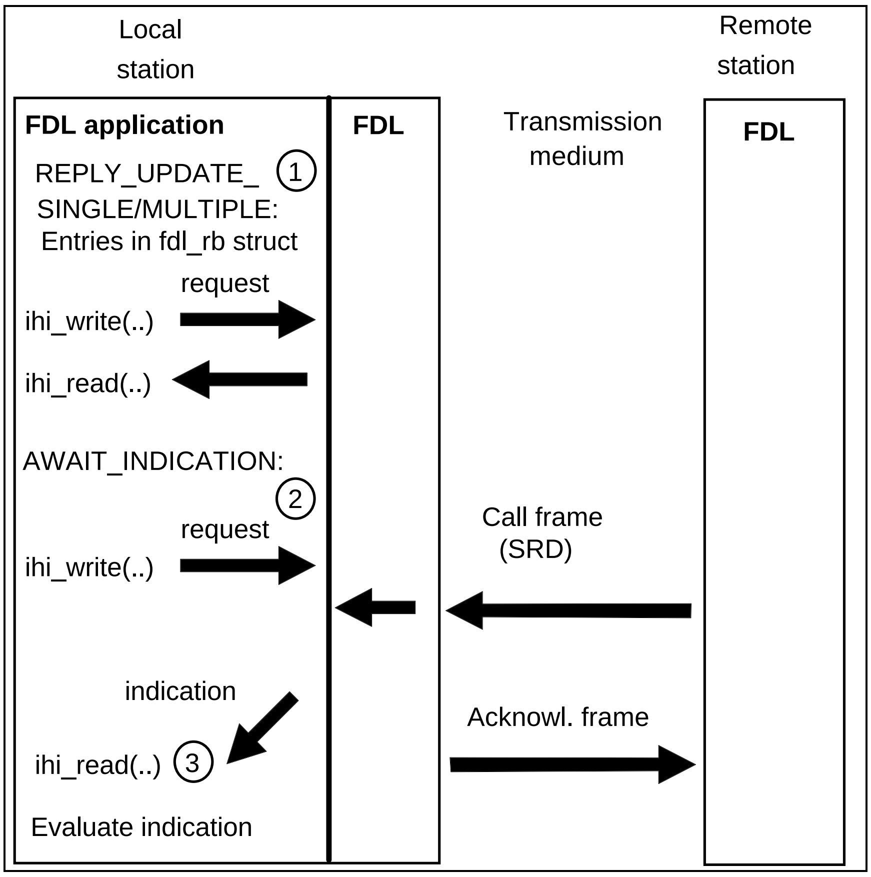


Fig. 5.5: Receiving Data Frames SRD

**Notes**

① With the REPLY_UPDATE_SINGLE or REPLY_UPDATE_ MULTIPLE service, data is transferred to layer 2 and can be fetched by a remote station using an SRD service. The data is sent to the remote station in the acknowledgment frame. With the REPLY_UPDATE_SINGLE service, the data can only be read out once whereas with the REPLY_UPDATE_ MULTIPLE service it can be read out several times.

☞ **Make sure that an offset of at least 12 bytes to the user data is maintained in the send buffer. The size of the offset must be entered in the first byte of the send buffer.**

**If the acknowledgment frame to the remote station does not contain data, ① can be omitted.**

② To be able to receive a data frame from a remote station, one or more receive resources must be transferred to the SAP with AWAIT_INDICATION. Several receive resources can be transferred to the SAP by repeatedly calling AWAIT_INDICATION. After receiving a call frame, the resource is used up and must be replaced by a new AWAIT_INDICATION.

③ After receiving a call frame, layer 2 generates an indication containing the received data for the FDL application. The first byte of the receive buffer contains the offset to the received data. The indication can be read out with an ihi_read () or SCP_receive() call.❑

## Notes

# 6 Function Calls of the IHI Interface

This chapter describes the IHI interface functions with which you transfer FDL jobs and fetch the results.

Under MS-DOS and Windows 3.x, you should only use these calls of the IHI interface.

Under Windows 95 and Windows NT, the IHI calls are only intended for porting old applications.

## FDL Programming Interface

The FDL programming interface is made available to the FDL application in the form of a library. The library functions of the FDL programming interface handle the transfer of FDL jobs to the CP for the FDL application.

The FDL programming interface involves the following functions:

| | |
|---|---|
| Logon function for the FDL application | ihi_open_dev |
| Sending jobs, data | ihi_write |
| Receiving data (jobs, acknowledgments) | ihi_read |
| Logoff function for the FDL application | ihi_close |

## How the Interface Works

The calls for the FDL programming interface must be made by the FDL application. The following order must be maintained: The first interface call is **ihi_open_dev**. Using **ihi_write**, the FDL application can then send jobs to the CP. Each job must then be fetched again with **ihi_read**. Until a request block has been fetched, neither it nor the data buffer appended to it can be used. Finally, the connection to the CP is terminated with **ihi_close**.

## 6.1 ihi_open_dev

**Description of the Function**

Using the ihi_open_dev function, the FDL application logs on at the driver. The driver transfers the job to the CP.

The “dev” parameter selects the CP in the PG/PC. The function returns a handle that must be specified for all further calls.

**Declaration of the Function**

```
#include "fdl_rb.h"
int        ihi_open _dev  (ord16 mode, char * dev);
```

**Description of the Parameters**

| | | |
|---|---|---|
| mode: | mode = 0: | No device name is specified, instead, communication is via the first CP that supports the ihi function calls. |
| | mode = 1: | A connection is established between the FDL application and the CP selected with the “dev” parameter. |
| | | Recommendation: When using the FDL programming interface, select mode = 1. |
| dev: | | This parameter selects the CP. Syntax: "/name:/FLC" |
| | | name = identical to the name selected in the configuration program. |

**Return Value**

| | | |
|---|---|---|
| ≥ 0: | **Success:** | Return value = handle |
| < 0: | **Error:** | |
| | -1: | Bus driver not installed. |
| | -2: | Error opening driver. |
| | -3: | Driver already opened. |

## 6.2 ihi_write

**Description of the Function**

Using the ihi_write function, request blocks are transferred to the CP for processing.

**Declaration of the Function**

```
#include "fdl_rb.h"
int      ihi_write (int handle, RB * rb);
```

**Description of the Parameters**

| | |
|---|---|
| handle: | Reference (see ihi_open) |
| rb: | Address for the request block to be transferred. |

**Return Value**

| | | |
|---|---|---|
| = 0: | **Success:** | Job transferred correctly to the CP. |
| < 0: | **Error:** | |
| | -1: | No ihi_open_dev executed for this handle. |
| | -2: | Job can no longer be transferred. Maximum number of simultaneous jobs exceeded. |
| | -3: | No longer occurs. |
| | -4: | Meaning as for return value -2. |
| | -5: | Incorrect job, the job was not passed on to the CP. |

## 6.3 ihi_read

**Description of the Function**

With this call, the FDL application receives back the request blocks processed by the CP. They are returned using a pointer to the request block.

The FDL application has the choice between a synchronous mode in which the call is only completed when a request block is received, and an asynchronous mode, that allows the results to be polled.

**Declaration of the Function**

```
#include "fdl_rb.h"
int      ihi_read (int handle, ord16 mode,RB ** rb);
```

**Description of the Parameters**

| | | |
|---|---|---|
| handle: | | Reference (see ihi_open) |
| mode: | mode=0 | Asynchronous mode, polling. The function enters the address of an RB in the rb parameter if the return value is 1. Otherwise, the function is terminated with *rb = 0. |
| | mode=1 | Synchronous mode, wait for result. The call is only completed when a request block is returned by the CP. |
| rb: | | Address of a request block pointer returned by the CP. |

**Return Value**

| | | |
|---|---|---|
| = 0: | **Success:** | Job executed correctly. |
| = 1: | **Success:** | Job executed correctly. RB transferred. |
| < 0: | **Error:** | |
| | -1: | No ihi_open_dev executed for this handle. |
| | -2: | No jobs exist. |
| | -3: | Illegal receive mode. |
| | -4: | No longer occurs. |
| | -5: | No longer occurs. |

☞ **The synchronous mode and asynchronous mode must not be used simultaneously in a program.**

☞ **Under Windows, only the asynchronous mode can be used.**

## 6.4 ihi_close

**Description of the Function**

Using the ihi_close function, an FDL application logs off at the driver. Following this call, productive communication is no longer possible with this handle.

**Declaration of the Function**

```
#include "fdl_rb.h"
int       ihi_close (int handle);
```

**Description of the Parameters**

| | |
|---|---|
| handle: | Reference (see ihi_open). |

**Return Value**

| | | |
|---|---|---|
| = 0: | **Success:** | Job executed correctly. |
| | | Under Windows, ihi_close also returns the value 0 if jobs were discarded. |
| < 0: | **Error:** | |
| | -1: | No ihi_open_dev executed for this handle. |
| | -2: | ihi_close was executed correctly, jobs not yet processed were discarded. |

## 6.5 Examples

**Example 1:** Jobs are sent to the CP one after the other.

```
#include "fdl_rb.h"

ex_1 ()
{     int handle;
      RB   rb;    /* request block/
      int ret;
      RB * rb_ptr;

      handle = ihi_open_dev(1,"/CP_L2_1:/FLC");

      if (handle < 0)
      {
          /* error opening the connection to
             the CP 5412 */
      }
      /* make entries in rb */
      ret = ihi_write (handle, &rb);

      if (ret >= 0 )
      {
           /* fetch the request block */
           ret = ihi_read (handle,1,&rb_ptr);
       }

      /* make entries in rb */
      /*(see examples on the diskette) */
      ret = ihi_write (handle, &rb);

      if (ret >= 0 )
      {
           /* fetch the request block */
           ret = ihi_read (handle,1,&rb_ptr);
       }

       /* finish working with L2 */
       ret = ihi_close (handle);
}
```

**Example 2:** Several jobs are processed simultaneously on the CP.

```
#include "fdl_rb.h"
ex_2 ()
{     int handle;
      RB   rb1;    /* request block*/
      RB   rb2;    /* request block*/
      RB   rb3;    /* request block*/
      int ret;
      RB * rb_ptr;
      int i;

      handle = ihi_open_dev(1,"/CP_L2_1:/FLC");

      if (handle < 0)
      {
          /* error opening the connection to
             the CP5412 */
      }

      /* make entries in rb1 */

      /* senfd rb1 to the CP */
      ret = ihi_write (handle, &rb1);

      /* make entries in rb2 */

      /* send rb2 to the CP */
      ret = ihi_write (handle, &rb2);

      /* make entries in rb3 */

      /* send rb3 to the CP */
      ret = ihi_write (handle, &rb3);
     /* fetch the request blocks */
     for (i = 0; i < 2; i++)
     {
         ret = ihi_read (handle,1,&rb_ptr);
     }

     /* make entries in rb */

     ret = ihi_write (handle, &rb1);

     if (ret >= 0 )
     {
         /* fetch the request block */
         ret = ihi_read (handle,1,&rb_ptr);
     }

     /* finish communication */
     ret = ihi_close (handle);
}
```

❑

# 7 Function Calls of the SCP Interface

This chapter describes the SCP interface functions with which you transfer FDL jobs and fetch the results.

Under MS-DOS and Windows 3.x, these calls are not available for FDL jobs.

Under Windows 95 and Windows NT, the SCP calls are intended for new FDL applications.

## FDL Programming Interface

The FDL programming interface is made available to the FDL application in the form of a library. The library functions of the FDL programming interface handle the transfer of FDL jobs to the CP for the FDL application.

The FDL programming interface involves the following functions:

| | |
|---|---|
| Logon function for the FDL application | SCP_open |
| Sending jobs, data | SCP_send |
| Receiving data (jobs, acknowledgments) | SCP_receive |
| Logoff function for the FDL application | SCP_close |
| Fetching error IDs | SCP_get_errno |

## How the Interface Works

The calls for the FDL programming interface must be made by the FDL application. The following order must be maintained: The first interface call is **SCP_open**. Using **SCP_send**, the FDL application can then send jobs to the CP. Each job must then be fetched again with **SCP_receive**. Until a request block has been fetched, neither it nor the data buffer appended to it can be used. Finally, the connection to the CP is terminated with **SCP_close**.

After every function that returns the value -1, **SCP_get_errno** can be called to obtain an error ID that identifies the cause of the error in more detail.

☞ **Please note the points made about the specific operating systems in the Appendix.**

## 7.1 SCP_open

**Description of the Function**

Using the SCP_open function, the FDL application logs on at the driver. The driver transfers the job to the CP.

The “dev” parameter selects the CP in the PG/PC. The function returns a handle that must be specified for all further calls.

**Declaration of the Function**

```
#include "fdl_rb.h"
int        SCP_open (char * dev);
```

**Description of the Parameters**

| | |
|---|---|
| dev: | This parameter selects the CP. Syntax: "/name/FLC"<br>name = identical to the name selected in the configuration program. |

**Return Value**

| | | |
|---|---|---|
| $\geq$ 0: | **Success:** | Return value = handle |
| = -1: | **Error:** | The exact cause of the error can be obtained with SCP_get_errno(). |

## 7.2 SCP_send

|  |  |
|---|---|
| **Description of the Function** | Using the SCP_send function, request blocks are transferred to the CP for processing. |
| **Declaration of the Function** | #include "fdl_rb.h"<br>int SCP_send (int handle, UWORD length, char * rb); |

**Description of the Parameters**

|  |  |
|---|---|
| handle: | Reference (see SCP_open) |
| length: | Length of the request block to be transferred in bytes. |
| rb: | Address of the request block to be transferred. |

**Return Value**

|  |  |  |
|---|---|---|
| = 0: | **Success:** | Job transferred correctly to the CP. |
| = -1: | **Error:** | The exact cause of the error can be obtained with SCP_get_errno(). |

## 7.3 SCP_receive

**Description of the Function**

With this call, the FDL application receives back job acknowledgments and data from the CP. They are returned in a buffer provided by the application.

The FDL application has the choice between a synchronous mode in which the call is only completed when a request block is received, and an asynchronous mode, that allows the results to be polled.

**Declaration of the Function**

```
#include "fdl_rb.h"

int     SCP_receive (int handle, UWORD timeout,
                     UWORD *data_len,
                     UWORD length, char *buffer);
```

**Description of the Parameters**

| | | |
|---|---|---|
| handle: | | Reference (see SCP_open) |
| timeout: | | Waiting time for the receive job. The following values are possible. |
| | 0 | Asynchronous mode (SCP_NOWAIT): The function is completed immediately. If no data are available for the caller, then *data_len = 0. |
| | FFFFh | Synchronous mode (SCP_FOREVER): The call is only completed when data have arrived for the caller. |
| | 0 < timeout < FFFFh | The function is completed when data arrive for the caller or at the latest when a timeout specified in seconds expires. |
| data_len: | | Pointer to the number of bytes received (return parameter) |
| length: | | Length of the receive buffer in bytes. |
| buffer: | | Address of the receive buffer. |

**Return Value**

| | | |
|---|---|---|
| = 0: | **Success:** | Job executed correctly. |
| = -1: | **Error:** | The exact cause of the error can be obtained with SCP_get_errno(). |

☞ **The synchronous and asynchronous modes must not be used at the same time in a program.**

☞ **In Windows applications, you can only work in the asynchronous mode.**

## 7.4 SCP_close

**Description of the Function**

Using the SCP_close function, an FDL application logs off at the driver. Following this call, productive communication is no longer possible with this handle.

**Declaration of the Function**

```
#include "fdl_rb.h"
int        SCP_close (int handle);
```

**Description of the Parameters**

| | |
|---|---|
| handle: | Reference (see SCP_open). |

**Return Value**

| | | |
|---|---|---|
| = 0: | **Success:** | Job executed correctly. The value 0 is also returned when pending jobs have been discarded. |
| = -1: | **Error:** | The exact cause of the error can be obtained with SCP_get_errno(). |

## 7.5 SCP_get_errno

**Description of the Function**

Using the SCP_get_errno function, an application can query the cause of an error that occurred in an SCP function.

**Declaration of the Function**

```
#include "fdl_rb.h"
int        WINAPI SCP_get_errno (void);
```

**Description of the Parameters**

none

**Return Value**

| | |
|---|---|
| = 0: | Last job executed correctly |
| = 202: | Lack of resources in driver or in the library |
| = 203: | Configuration error |
| = 205: | Job not currently permitted |
| = 206: | Parameter error |
| = 207: | Device already/not yet open. |
| = 208: | CP not reacting |
| = 209: | Error in firmware |
| = 210: | Lack of memory for driver |
| = 215: | No message |
| = 216: | Error accessing application buffer |
| = 219: | Timeout expired |
| = 225: | Maximum number of logons exceeded |
| = 226: | Job aborted |
| = 233: | An auxiliary program could not be started |
| = 234: | No authorization exists for this function |
| = 304: | Initialization not yet completed |
| = 305: | Function not implemented |
| = 4865: | CP name does not exist |
| = 4866: | CP name not configured |
| = 4867: | Channel name does not exist |
| = 4868: | Channel name not configured |

## 7.6 Examples

**Example 1:** Jobs are sent to the CP one after the other.

```
#include "fdl_rb.h"

exa_1 ()
{     int    handle;
      fdl_rb rb;    /* request block, job block */
      int    ret;
      UWORD  data_len;

      handle = SCP_open ("/CP_L2_1:/FLC");

      if (handle == -1)
      {
           /* error opening the connection to
             the CP */
      }
      /* make entries in rb */
      ret = SCP_send (handle, sizeof(fdl_rb), &rb);

      if (ret == 0)
      {
           /* fetch the acknowledgment/data */
           ret = SCP_receive (handle, 0xffff,
                              &data_len,
                              sizeof(fdl_rb), &rb);
      }

      /* make entries in rb */
      /*(see examples on the diskette) */
      ret = SCP_send (handle, sizeof(fdl_rb), &rb);

      if (ret == 0)
      {
           /* fetch the acknowledgment/data */
           ret = SCP_receive (handle, 0xffff,
                              &data_len,
                              sizeof(fdl_rb), &rb);
      }

      /* finish working with FDL */
      ret = SCP_close (handle);
}
```

**Example 2:** Several jobs are processed simultaneously on the CP.

```
#include "fdl_rb.h"
exa_2 ()
{     int    handle;
      fdl_rb rb;   /* request block, job block */
      int    ret;
      UWORD  data_len;
      int    i;

      handle = SCP_open ("/CP_L2_1:/FLC");

      if (handle == -1)
      {
          /* error opening connection to CP */
      }

      /* enter first job in rb */

      /* send rb to the CP */
      ret = SCP_send (handle, sizeof(fdl_rb), &rb);

      /* enter second job in rb */

      /* send rb to the CP */
      ret = SCP_send (handle, sizeof(fdl_rb), &rb);

      /* enter third job in rb */

      /* send rb to the CP */
      ret = SCP_send (handle, sizeof(fdl_rb), &rb);

      /* fetch the request blocks */
      for (i = 0; i < 2; i++)
      {
         ret = SCP_receive (handle, 0xffff,
                            &data_len,
                            sizeof(fdl_rb), &rb);
      }

      /* enter fourth job in rb */

      /* send rb to the CP */
      ret = SCP_send (handle, sizeof(fdl_rb), &rb);

      /* fetch the request blocks */
      if (ret != -1)
      {
         ret = SCP_receive (handle, 0xffff,
                            &data_len,
                            sizeof(fdl_rb), &rb);
      }

      /* finish communication */
      ret = SCP_close (handle);
}
```
❑

# 8 Appendix

## 8.1 Differences in Implementation between the CP 5412 (A1) and CP 5412 (A2)

The CP 5412 (A2) is the compatible successor to the CP 5412 (A1).

By using an optimized bus controller ASIC, for example to achieve a higher transmission rate, it was necessary to modify some of the characteristics of the CP 5412 (A1).

These modifications affect the following services:

- SAP_ACTIVATE
- FDL_READ_(LAS)_STATISTIC_COUNTER
- REPLY_UPDATE
- AWAIT_INDICATION
- WITHDRAW_INDICATION
- FDL_EVENT
- FDL_READ_VALUE
- CSRD
- FDL_SET_VALUE
- FDL_RESET
- MAC_RESET

Due to the multi-application capability for Windows users and to achieve higher performance, CP 5412 (A1) users may need to make certain adaptations.

|  |  |
|---|---|
| **SAP_ACTIVATE** | The network connection SAP is not supported by the CP 5412 (A2). |
| **LSAP_STATUS** | The LSAP_STATUS service is only possible locally. This is no longer available as a remote service. |
| **FDL_READ_STATISTIC_ COUNTER** | Only some of the statistic cells of FDL_READ_STATISTIC_CTR are available. Statistic cells that are not supported always have the value 0. |

| statistic_ctr_list | CP 5412 (A1) | CP 5412 (A2) |
|---|---|---|
| invalid_start_delimiter | supported | not supported |
| invalid_fcb_fcv_ctr | supported | not supported |
| invalid_token_ctr | supported | supported |
| collision_ctr | supported | supported |
| wrong_fcs_or_ed_ctr | supported | supported |
| frame_error_ctr | supported | supported |
| char_error_ctr | supported | supported |
| start_delimiter_ctr | supported | supported |
| retry_ctr | supported | supported |
| stop_receive_ctr | supported | supported |
| send_confirmed_ctr | supported | supported |
| send_sdn_ctr | supported | supported |

|  |  |
|---|---|
| **FDL_READ_LAS_ STATISTIC_ COUNTER** | The FDL_READ_LAS_STATISTIC_COUNTER service no longer supports the LAS_cycle_ctr. The value FFFFh is entered. |
| **REPLY_UPDATE** | The REPLY_UPDATE service does not support priority-related buffers per SAP. Either a high priority or a low priority buffer can be transferred. With the REPLY_UPDATE service, the dsap parameter has no significance. The actions previously associated with this parameter are no longer supported. |

**AWAIT_ INDICATION, WITHDRAW_ INDICATION**

The AWAIT_INDICATION and WITHDRAW_INDICATION services do not distinguish between high and low priority buffers. The buffer management of layer 2 uses only one indication queue per SAP which means that no reserve buffer can be included for high priority jobs in the SAP.

**FDL_EVENT**

Only some of the events are supported.

| Event | CP 5412 (A1) | CP 5412 (A2) |
|---|---|---|
| time_out | supported | supported |
| not_syn | supported | supported |
| uart_error | supported | not supported |
| out_of_ring | supported | supported |
| sdn_not_indicated | supported | not supported |
| duplicated_address | supported | supported |
| hardware_error | supported | supported |
| mac_error | supported | supported |

**FDL_READ_VALUE**

The range of values for the bus parameters are different.

| Parameter | CP 5412 (A1) | CP 5412 (A2) |
|---|---|---|
| hsa | 2 .. 126 | 1 .. 126 |
| ts | 0 .. 126 | 0 .. 126 |
| station_type | active, passive<br>active_fast, passive_fast | active, passive<br><br>sm_active, sm_passive *) |
| baudrate | 9.6; 19.2; 93.75; 187.5; 500; 1.5M | 9.6; 19.2; 93.75; 187.5; 500; 1.5M, 3M; 6M; 12M |
| redundancy | no_redundancy,<br>select_bus_a<br>select_bus_b<br>redundancy_on | not supported |
| retry_ctr | 1 to 8 | 0 to 7 |
| default_sap | 2 to 62 | 2 to 62 |
| network-connection-sap | 2 to 62 | not supported |
| tsl | 1 to 65535 | 37 to 16383 |
| tqui | 0 to 255 | 0 to 127 |
| tset | 0 to 255 | 1 to 479 (494) |
| min_tsdr | 1 to 65535 | 11 to 1023 |
| max_tsdr | 1 to 65535 | 35 to 1023 |
| ttr | 1 to (2^24)-1 | 256 to (2^24)-1 |
| g | 1 to 100 | 1 to 255 |

*) Parallel operation with PROFIBUS-PA is not possible as long as the station is in the S mode state (special mode of PROFIBUS PA). With the FDL_READ_VALUE service, it is possible to read out whether the station was set as sm_active or sm_passive.

**Services No Longer Supported**

The following services are no longer supported:

- ➢ CSRD
- ➢ FDL_SET_VALUE
- ➢ FDL_RESET
- ➢ MAC_RESET

## 8.2 Compiling and Linking for MS-DOS

**Note**

The libraries for MS-DOS are in the directory \sinec\dp5412a2.dw\lib.

The include files are in \sinec\dp5412a2.dw\include.

The names are made up as follows:

<Memory model><operating system>sci<compiler>,
for example ldscimsc.lib means memory model large for MS-DOS with the Microsoft C compiler.

| | | |
|---|---|---|
| <Memory model> : | l | Large model |
| | b | Big or huge model |
| <Operating system> : | d | MS-DOS |
| | w | Windows |
| <Compiler> : | msc | Microsoft C compiler 6.X or higher |
| | tc | Turbo C 2.0 or Turbo C++ 1.0 or higher or Borland C/C++ |

### 8.2.1 Working with the MSC 6.0 Compiler

**Note**

The library for the MSC Compiler 6.0 is
\sinec\dp5412a2.dw\lib\ldscimsc.lib.

The include files are in \sinec\dp5412a2.dw\include.

An example program exa.c is compiled and linked as follows:

```
cl  /c /AL /Os /I\sinec\dp5412a2.dw\include  /DM_DOS   exa.c
link exa.obj,exa.exe,,\sinec\dp5412a2.dw\lib\ldscimsc+
        c:\c600\lib\llibce,,,
```

## 8.2.2 Working with the TURBO or Borland C Compiler

**Note**

The library for the Turbo C compiler 2.0, Turbo C++ 1.0, Borland C or Borland C++ is \sinec\dp5412a2.dw\lib\ldscitc.lib.

An example program exa.c is compiled and linked as follows:

```
tcc -c -ml -I\sinec\dp5412a2.dw\include -DTURBO_CC -DM_DOS
          exa.c
or
bcc -c -ml -I\sinec\dp5412a2.dw\include -DTURBO_CC -DM_DOS
          exa.c
tlink @exa.lnk
```

The exa.lnk file contains the instructions for the linker (4 lines):

```
\tc\lib\c0l.obj  exa.obj
exa.exe
exa.map
\tc\lib\emu.lib \tc\lib\mathl \tc\lib\cl.lib
          \sinec\dp5412a2.dw\lib\ldscitc.lib
```

## 8.2.3 Program Example for MS-DOS

**Note**

The directory \sinec\dp5412a2.dw\sample\fdl\dos contains the sample program l2ddemo.c". This illustrates the use of the SDA service. The directories \sinec\dp5412a2.dw\sample\fdl\dos\msc and \sinec\dp5412a2.dw\sample\fdl\dos\tc or \sinec\dp5412a2.dw\sample\fdl\dos\bc contain the make files for the Microsoft and Turbo C compilers.

## 8.3 Compiling and Linking for Windows 3.x

### 8.3.1 Working with the MSC Compiler 6.0 and the SDK from Microsoft

**Note** The library for the MSC Compiler 6.0 for Windows 3.x is \sinec\dp5412a2.dw\lib\lwscimsc.lib.

An sample program exa.c is compiled and linked as follows:

```
cl /c /Zi -Gw -Zp /AL /Os /I\sinec\dp5412a2.dw\include -DM_WINDOWS  /DM_DOS  exa.c
rc -r exa.rc
link /NOD exa.obj,exa.exe,exa.map,\sinec\sci\dp5412a2.dw\lwscimsc.lib+
             LLIBCEW+LIBW,exa.def
rc -K exa.res
```

**Note** rc is the resource compiler of Windows SDK.

### 8.3.2 Working with the Borland C Compiler

**Note** The library for the Borland C or C++-Compiler is \sinec\dp5412a2.dw\lib\lwscibc.lib.

An example program exa.c is compiled and linked as follows:

```
bcc -c -ml -I\sinec\dp5412a2.dw\include -DTURBO_CC -DM_DOS   exa.c

rc -r exa.rc

tlink exa.obj,exa.exe,exa.map,\sinec\dp5412a2.dw\lib\lwscibc.lib mathwl
      import cwl , exa.def

rc -r exa.res
```

**Note** rc is the resource compiler of Windows SDK.

## 8.3.3 Special Features for Windows

**Note**

The library supports the enhanced mode under Windows 3.0/3.1.

The library must be linked to the FDL application. A DLL library is not yet supported.

Windows programs differ from DOS programs in that they branch to a WndProc. At a central point, Windows programs wait for Windows messages that are then processed in a WndProc procedure. It is possible that during the processing of the WndProc, control is transferred to Windows and the WndProc is called again.

After ihi_open_dev() in a Windows program, you must call the routine SetSinecHWnd with a Windows handle so that the driver knows where to send its messages. If an asynchronous command is issued, a WM_SINEC message is sent to Windows when a message is received. It can then be processed in the corresponding WndProc if you execute an ihi_read with mode 0.

Example of a typical Windows application:

```
WndProc (hWnd, )
{
int handle;
int ret;
RB * rb_ptr;

   switch (msg)
   {
      case ....  /* init code */ :
            handle = ihi_open_dev ("/CP_L2_1:/FLC");
            SetSinecHWnd (handle,hWnd);
            break;

      case  .... /* trigger the function */:
            ret = ihi_write (handle,....  );
            break;

      case WM_SINEC:
            ret = ihi_read (handle, 0, &rb_ptr  );
            if (ret == 1 )
            {
               /* a request block was returned==>*/
               /* analyze it                     */
            }
            break;
   }
}
```

Call format for SetSinecHWnd:

**SetSinecHWnd** (int handle, HWND hWnd)

The function used as an alternative to SetSinecHWnd

**SetSinecHWndMsg** (int handle,HWND hWnd,
unsigned int msg_id)

allows the FDL application to be informed by the driver when data arrive using a self-defined message (msg_id).

### 8.3.4 Restrictions Under Windows

**Note**

Compared to MS-DOS, the layer 2 interface under Windows has the following restrictions:

- ➢ You can only establish one link to the driver with ihi_open_dev in one task. Once you have called ihi_close, however, you can send a further ihi_open_dev.
- ➢ The event SAP can only be used in one task, otherwise no assignment of events is possible.
- ➢ In the same way, only one task can be responsible for the statistic cells.

### 8.3.5 Sample Program for WINDOWS 3.x

**Note**

The directory \sinec\dp5412a2.dw\sample\fdl\win contains the sample program l2wdemo.c. This illustrates the use of the SDA service. The directories \sinec\dp5412a2.dw\sample\fdl\win\msc and \sinec\dp5412a2.dw\sample\fdl\win\bc contain the make files for the Microsoft and Borland C compilers. ❑

## 8.4 Compiling and Linking for Windows 95

### 8.4.1 Working with the MSVC Compiler 2.2 and the SDK from Microsoft

**Note**

Under Windows 95, the SCP interface is made available by a DLL. The import library for the MSVC Compiler 2.2 for Windows 95 is s7onlinx.lib. This is in the folder (directory) \sinec\dp5412a2.w95\lib or at the location specified in the installation instructions.

A sample program exa.c is compiled and linked as follows:

```
cl /c /GX /YX /O2 /I\sinec\dp5412a2.w95\include /D "WIN32" /D "NDEBUG" /D
"_WINDOWS" exa.c
rc -l 0x407 exa.rc
link @exa.dat

with exa.dat:
kernel32.lib user32.lib gdi32.lib winspool.lib comdlg32.lib advapi32.lib shell32.lib ole32.lib\
 oleaut32.lib uuid.lib odbc32.lib odbccp32.lib /NOLOGO /SUBSYSTEM:windows \
 /INCREMENTAL:no /MACHINE:I386 /DEF:".\exa.def" /OUT:".\exa.exe"
exa.res exa.obj \sinec\dp5412a2.w95\lib\s7onlinx.lib
```

### 8.4.2 Special Features for Windows

**Note**

One of the differences between Windows programs and console programs is that they branch to a WndProc. At a central point, Windows programs wait for Windows messages that are then processed in a WndProc procedure. It is possible that during the processing of the WndProc, control is transferred to Windows and the WndProc is called again.

After SCP_open() in a Windows program, you must call the routine SetSinecHWnd with a Windows handle so that the driver knows where to send its messages. If an asynchronous command is issued, a WM_SINEC message is sent to Windows when a message is received. It can then be processed in the corresponding WndProc if you execute an SCP_receive with timeout 0.

Example of a typical Windows application:

```
WndProc (hWnd,... )
{
int handle;
int ret;
RB * rb_ptr;

   switch (msg)
   {
      case ....  /* init -code */ :
            handle = SCP_open ("/CP_L2_1:/FLC");
            SetSinecHWnd (handle,hWnd);
            break;

      case  .... /* trigger the function */:
            ret = SCP_send (handle,....);
            break;

      case WM_SINEC:
            ret = SCP_receive (handle, 0, &rb_ptr);
            if (ret != -1)
            {
               /* a request block was returned==> */
               /* analyze it                      */
            }
            break;
   }
}
```

Call format for SetSinecHWnd:

**SetSinecHWnd** (int handle, HWND hWnd)

The function used as an alternative to SetSinecHWnd

**SetSinecHWndMsg** (int handle,HWND hWnd,
unsigned int msg_id)

allows the FDL application to be informed by the driver when data arrive using a self-defined message (msg_id).

### 8.4.3 Sample Program for Windows 95

**Note**

The folder (directory) \sinec\dp5412a2.w95\sample\fdl contains the sample program l295demo.c. This illustrates the use of the SDA service. The corresponding make file for Microsoft Visual C++ is also in this folder.

## 8.5 Compiling and Linking for Windows NT

### 8.5.1 Working with the MSVC Compiler 2.2 and the SDK from Microsoft

**Note**

Under Windows NT, the SCP interface is made available by a DLL. The import library for the MSVC Compiler 2.2 for Windows NT is scilib.lib. This is in the directory \sinec\dp5412a2.nt\lib or at the location specified in the installation instructions.

A sample program exa.c is compiled and linked as follows:

```
cl /c /GX /YX /O2 /I\sinec\dp5412a2.nt\include /D "WIN32" /D "NDEBUG"
/D "_WINDOWS" exa.c
rc -l 0x407 exa.rc
link @exa.dat

with exa.dat:
kernel32.lib user32.lib gdi32.lib winspool.lib comdlg32.lib advapi32.lib shell32.lib \
ole32.lib oleaut32.lib uuid.lib odbc32.lib odbccp32.lib /NOLOGO
/SUBSYSTEM:windows \
/INCREMENTAL:no /MACHINE:I386 /DEF:".\exa.def" /OUT:".\exa.exe"
exa.res exa.obj \sinec\dp5412a2.nt\lib\scilib.lib
```

### 8.5.2 Special Features for Windows

One of the differences between Windows programs and console programs is that they branch to a WndProc. At a central point, Windows programs wait for Windows messages that are then processed in a WndProc procedure. It is possible that during the processing of the WndProc, control is transferred to Windows and the WndProc is called again.

After SCP_open() in a Windows program, you must call the routine SetSinecHWnd with a Windows handle so that the driver knows where to send its messages. If an asynchronous command is issued, a WM_SINEC message is sent to Windows when a message is received. It can then be processed in the corresponding WndProc if you execute an SCP_receive with timeout 0.

Example of a typical Windows application:

```
WndProc (hWnd,... )
{
int handle;
int ret;
RB * rb_ptr;

   switch (msg)
   {
      case ....  /* init -code */ :
            handle = SCP_open ("/CP_L2_1:/FLC");
            SetSinecHWnd (handle,hWnd);
            break;

      case  .... /* trigger the function */:
            ret = SCP_send (handle,....);
            break;

      case WM_SINEC:
            ret = SCP_receive (handle, 0, &rb_ptr);
            if (ret != -1)
            {
               /* a request block was returned==> */
               /* analyze it                      */
            }
            break;
   }
}
```

**Note**

Call format for SetSinecHWnd:

**SetSinecHWnd** (int handle, HWND hWnd)

The function used as an alternative to SetSinecHWnd

**SetSinecHWndMsg** (int handle,HWND hWnd,
unsigned int msg_id)

allows the FDL application to be informed by the driver when data arrive using a self-defined message (msg_id).

### 8.5.3 Sample Program for Windows NT

**Note**

The directory \sinec\dp5412a2.nt\sample\fdl contains the sample program l2ntdemo.c. This illustrates the use of the SDA service. The corresponding make file for Microsoft Visual C++ is also in this directory.

# 9 Index

## Notes

# Glossary

| | |
|---|---|
| **Base address** | Logical address of a module in S7 systems. |
| **Bus parameters** | Bus parameters control the data transmission on the bus. Each -> station on the -> SINEC L2 network must use bus parameters that match those of other stations. |
| **Bus segment** | Part of a -> subnet. Subnets can consist of bus segments and connectivity devices such as repeaters and bridges. |
| **CFB** | Communication Function Block: A communication technique for program-controlled transmission of data from or to a CPU in an S7-300/400 using special function blocks. These function blocks were defined based on the IEC 1131-5 draft. The communication partners can be other modules with communication capabilities in an S7-300/400, operator stations, PCs or other controllers and computers. |
| **COML DP** | Configuration tool for configuring -> DP masters in -> SINEC L2. |
| **CP** | Communications Processor. Module for communication tasks. |
| **Device master data** | Device master data (DMD) contain DP slave descriptions complying with DIN E 19245 Part 3. Using DMD makes configuration of the -> DP master and -> DP slaves easier. |
| **Distributed I/Os** | Input and output modules used at a distance (distributed) from the CPU (central processing unit of the controller). The connection between the programmable controller and the distributed I/Os is established on -> SINEC L2. The programmable logic controllers do not recognize any difference between these I/Os and local process inputs and outputs. |
| **DP I/O module** | DP slaves have a modular design. A -> DP slave has at least one DP I/O module. |
| **DP I/O type** | The DP I/O type identifies a -> DP I/O module. The following types exist:<br>Input module<br>Output module<br>Input/output module |
| **DP master** | A -> station with master functions in -> SINEC L2 DP. The DP master controls the exchange of user data with the -> DP slaves assigned to it. |
| **DP module list** | The DP module list contains the modules belonging to a -> DP slave. You make entries in the DP module list when configuring a -> DP master with -> COML DP. |
| **DP module name** | Name of a -> DP I/O module entered in the ->DP module list. |

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| **DP module type** | Type identifier of a -> DP I/O module in the -> device master data of a -> DP slave complying with DIN E 19245 Part 3. |
| **DP slave** | A -> station with slave functions in -> SINEC L2 DP. |
| **DP slave catalog** | The DP slave catalog contains the device descriptions of -> DP slaves required for configuring -> DP masters according to the -> DP standard. The DP slave catalog is available when configuring with -> COML DP. |
| **DP slave name** | A DP slave name is entered in the DP slave list to identify a -> DP slave in the DP configuration. |
| **DP subnet** | SINEC L2 subnet in which only -> distributed I/Os are operated. |
| **DP subsystem** | A -> DP master and all -> DP slaves with which this DP master exchanges data. |
| **Driver** | Software required for the data transfer between applications and the -> CP. |
| **Enhanced mode** | Enhanced mode under 3.x for personal computers with an Intel 386 or compatible processor. |
| **FDL** | Fieldbus Data Link. Layer 2 in -> PROFIBUS. |
| **Frame** | A message from one PROFIBUS station to another. |
| **Frame header** | A frame header consists of an identifier for the -> frame and the source and destination address. |
| **Frame trailer** | A frame trailer consists of a checksum and the end identifier of the -> frame. |
| **FREEZE mode** | The FREEZE mode is a DP mode in which process data are acquired at the same time and fetched from all (or a group of) DP slaves. The time at which the data are acquired is indicated in the FREEZE command (a synchronization control frame). |
| **Gap update factor** | A free address area (gap) between two active -> stations is checked cyclically by the station with the lower -> L2 address to find out whether or not another station is requesting to enter the logical ring. The cycle time for this check is as follows:<br>gap update factor x target rotation time |
| **Gateway** | Intelligent connectivity device that connects different types of local area -> networks at OSI layer 7. |

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| **GD circle** | A GD circle is a group of -> stations that exchange global data with each other. A -> GD packet is sent to the stations belonging to the GD circle. |
| **GD packet** | Collection of data that may be distributed within the programmable logic controller (for example flags/memory bits or data blocks) to be transferred using the -> global data technique. |
| **Global data** | Global data (GD) is the name of a communication technique for the cyclic exchange of limited amounts of data from STEP 7 data areas between CPUs of the S7-300/400. Transmitted data can be received by several CPUs at the same time. |
| **Global I/Os** | Part of the I/O area of SIMATIC S5 PLCs can be used for global data exchange between SIMATIC S5 PLCs on -> SINEC L2. The main characteristic of this technique is the cyclic transmission of data that have changed since the last cycle. |
| **Group identifier** | DP slaves can be assigned to one or more groups using a group identifier. The -> control frames can be addressed to specific groups of DP slaves using the group identifier. |
| **Highest L2 address** | A -> bus parameter for -> SINEC L2. This specifies the highest -> L2 address (HSA) of an active -> station on the SINEC L2 bus. L2 addresses higher than the highest station address are possible for passive stations (possible values: HSA 1 to 126). |
| **L2 address** | The L2 address is a unique identifier for a -> station connected to -> SINEC L2 (PROFIBUS). The L2 address is transferred in the -> frame to address a -> station. |
| **Master** | An active station in -> SINEC L2 that can send -> frames on its own initiative when it is in possession of the token. |
| **Maximum station delay** | A -> bus parameter for -> SINEC L2. The maximum station delay (max. TSDR) specifies the longest interval required by a -> station in the -> subnet between receiving the last bit of an unacknowledged -> frame and sending the first bit of the next frame. After sending an unacknowledged frame, a sender must wait for the max. TSDR to elapse before sending a further frame. |
| **Minimum station delay** | A -> bus parameter for -> SINEC L2. The minimum station delay (min. TSDR) specifies the minimum time that the receiver of a -> frame must wait before sending the acknowledgment or sending a new frame. The min. TSDR takes into account the longest interval required by a station in the subnet for receiving an acknowledgment after sending a frame. |
| **Network** | A network consists of one or more interconnected -> subnets with any number of -> stations. Several networks can exist side by side. There is a common -> node table for every -> subnet. |

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| **Node table** | The node table applies to all -> networks within a -> system. Each entry in the node table describes the interface between a programmable logic controller (or any other station) and a -> subnet. The entries in the subnet are used by the system to locate and establish connections between stations. |
| **Offset** | The length of the reserved area at the beginning of a data buffer of the FDL programming interface. |
| **Process image** | The process image is a special memory area in the programmable logic controller. At the start of the cyclic program, the signal states of the input modules are transferred to the process image of the inputs. At the end of the cyclic program, the process image of the outputs is transferred to the output modules |
| **PROFIBUS** | A fieldbus complying with DIN 19245. |
| **PROFIBUS DP** | DP mode complying with DIN E 19245 Part 3. |
| **PROFIBUS PA** | PROFIBUS PA is a recommendation of the PROFIBUS users' organization extending PROFIBUS DIN 19245 to include aspects of intrinsic safety. |
| **Protocol** | A set of rules governing data transmission. Using these rules, both the formats of the messages and the data flow during transmission can be specified. |
| **Reorganization token ring** | All the -> masters on -> SINEC L2 (PROFIBUS) form a logical token ring. Within this token ring, the token is passed on from station to station. If the transmission of the token is incorrect or if a master is removed from the ring, this leads to an error when the token is passed on (the token is not accepted by this station) and the station is excluded from the ring. The number of exclusions is counted in the internal token_error_counter. If this counter reaches an upper limit value, the logical token ring is then reorganized. |
| **SCOPE L2** | Diagnostic software for -> SINEC L2 with which the traffic on the -> network can be recorded and analyzed. |
| **Segment** | Synonym for -> bus segment. |
| **Services** | Services provided by a communication protocol. |
| **Setup time** | A -> bus parameter for -> SINEC L2. The setup time specifies the minimum interval on the sender between receiving an acknowledgment and sending a new call frame. |
| **SINEC** | Siemens Network and Communication. Product name for -> Siemens networks and network components. |
| **SINEC L2** | SINEC bus system for industrial applications based on PROFIBUS. |
| **SINEC L2 DP** | SINEC L2 distributed I/Os. Transmission services complying with PROFIBUS DIN E 19245 Part 3. |

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| **SINEC L2 DP master** | A -> station with master functions in -> SINEC L2 DP. |
| **SINEC L2 FMS** | SINEC L2 Fieldbus Message Specification. Upper sublayer of layer 7 of the ISO/OSI reference model for PROFIBUS. |
| **Slot time** | A bus parameter for -> SINEC L2. The slot time (TSL) is the time during which the sender of a -> frame waits for the acknowledgment from the receiver before detecting a timeout. |
| **Station** | A station is identified by an -> L2 address in the -> SINEC L2 network. |
| **Subnet** | A subnet is part of a -> network whose -> bus parameters (for example -> L2 addresses) must be matched. It includes the bus components and all attached stations. Subnets can, for example, be connected together by -> gateways to form a network.<br>A -> system consists of several subnets with unique -> subnet numbers. A subnet consists of several ->stations with unique -> L2 addresses. |
| **Subnet number** | A -> system consists of several -> subnets with unique subnet numbers. |
| **SYNC mode** | The SYNC mode is a DP mode in which several or all -> DP slaves transfer data to their process outputs at a certain time. The time at which the data is transferred is indicated in the SYNC command (a control command for synchronization). |
| **System** | All the electrical equipment within a system. A system includes, among other things, programmable logic controllers, devices for operation and monitoring, bus systems, field devices, actuators, supply lines. |
| **Target rotation time** | A -> bus parameter for -> SINEC L2. The token represents the right to transmit for a -> station on SINEC L2. A station compares the actual token rotation time it has measured with the target rotation time and depending on the result can then send high or low priority frames. |
| **Transmission rate** | Transmission rate on the bus (unit in bits per second). A -> bus parameter for -> SINEC L2. The set or selected transmission rate depends on various conditions, for example distance across the network. |
| **Watchdog** | A monitoring time that can be set for a -> DP slave so that it detects the failure of the -> DP master to which it is assigned. |

## Notes

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