

SINEC

FDL Programming Interface

Volume 1 of 1

- 1** Introduction to the FDL Programming Interface
 - 2** The FDL Services
 - 3** Productive Services
 - 4** Management Services
 - 5** Access to Layer 2
 - 6** Function Calls of the IHI Interface
 - 7** Function Calls of the SCP Interface
 - 8** Appendix
 - 9** Index
- Glossary

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SINEC
FDL Programming Interface

Description

C79000-B8976-C072/02

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- Training in or authorization for the maintenance and use of suitable safety equipment in accordance with current standards in safety technology;
- 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 (**Field Data Link** 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 (**Process Field 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 of 127 stations that can be connected opens up a wide spectrum of automation tasks. Different data rates can be selected using the software. □

1	Introduction to the FDL Programming Interface	5
2	The FDL Services	9
2.1	Transfer Mechanisms	12
3	Productive Services	15
3.1	Data Structures of the Productive Services	16
3.2	Request Blocks of the Productive Services	22
3.2.1	SDA (send data with acknowledge)	22
3.2.2	SDN (send data with no acknowledge)	26
3.2.3	SRD (send and request data)	31
3.2.4	REPLY_UPDATE_SINGLE	37
3.2.5	REPLY_UPDATE_MULTIPLE	40
4	Management Services	43
4.1	Data Structures of the Management Services	44
4.2	Request Blocks of the Management Services	51
4.2.1	FDL_READ_VALUE	51
4.2.2	SAP_ACTIVATE	54
4.2.3	RSAP_ACTIVATE	57
4.2.4	SAP_DEACTIVATE	60
4.2.5	LSAP_STATUS	62
4.2.6	FDL_LIFE_LIST_CREATE_REMOTE	66
4.2.7	FDL_LIFE_LIST_CREATE_LOCAL	68
4.2.8	FDL_IDENT	70
4.2.9	FDL_READ_STATISTIC_COUNTER	73
4.2.10	FDL_READ_LAS_STATISTIC_COUNTER	76
4.2.11	AWAIT_INDICATION	78
4.2.12	FDL_EVENT	82
4.2.13	WITHDRAW_INDICATION	83
5	Access to Layer 2	85
5.1	Activating SAPs	87
5.2	Data Transfer	88
5.2.1	Sending Data Frames	89
5.2.2	Receiving Data Frames	91
6	Function Calls of the IHI Interface	95
6.1	ihi_open_dev	97
6.2	ihi_write	98
6.3	ihi_read	99
6.4	ihi_close	100
6.5	Examples	101
7	Function Calls of the SCP Interface	103
7.1	SCP_open	105
7.2	SCP_send	106
7.3	SCP_receive	107
7.4	SCP_close	109
7.5	SCP_get_errno	110
7.6	Examples	111
8	Appendix	113
8.1	Differences in Implementation between the CP 5412 (A1) and CP 5412 (A2)	113
8.2	Compiling and Linking for MS-DOS	116
8.2.1	Working with the MSC 6.0 Compiler	116
8.2.2	Working with the TURBO or Borland C Compiler	117

8.2.3	Program Example for MS-DOS	117
8.3	Compiling and Linking for Windows 3.x	118
8.3.1	Working with the MSC Compiler 6.0 and the SDK from Microsoft	118
8.3.2	Working with the Borland C Compiler	118
8.3.3	Special Features for Windows	119
8.3.4	Restrictions Under Windows	120
8.3.5	Sample Program for WINDOWS 3.x	120
8.4	Compiling and Linking for Windows 95	121
8.4.1	Working with the MSVC Compiler 2.2 and the SDK from Microsoft	121
8.4.2	Special Features for Windows	122
8.4.3	Sample Program for Windows 95	123
8.5	Compiling and Linking for Windows NT	124
8.5.1	Working with the MSVC Compiler 2.2 and the SDK from Microsoft	124
8.5.2	Special Features for Windows	125
8.5.3	Sample Program for Windows NT	126
9	Index	127
	Glossary	129

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.

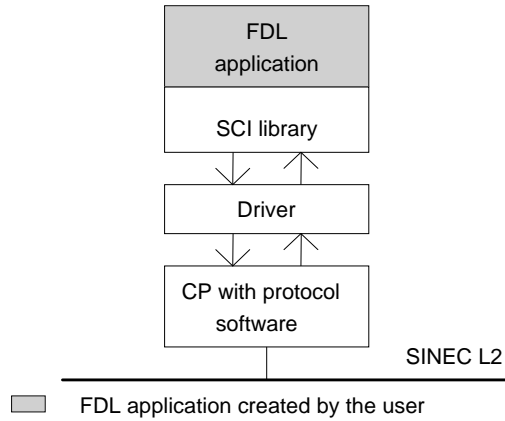


Fig. 1.1: Communications Architecture of the FDL Programming Interface

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).

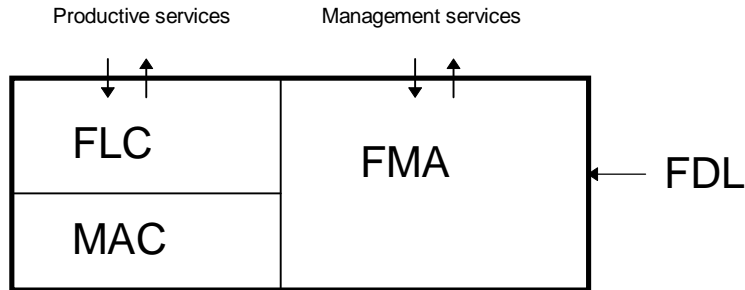


Fig. 1.2: Structure of the Layer 2 Protocol Software (FDL)

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 (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 (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 (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: 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 Difference: 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.

Service	Requester		Responder
	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 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	
subsystem	m	m	m	m	Request block header
opcode	m	m	m	m	
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 block
service.code	m	m	m	m	
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	
subsystem	r	r	r	r	Request block header
opcode	r	r	r	r	
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	Application block
id	x	x	x	x	
service.code	r	r	r	r	
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	
subsystem	r	r	r	r	Request block header
opcode	r	r	r	r	
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	Application block
id	x	x	x	x	
service.code	r	r	r	r	
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".

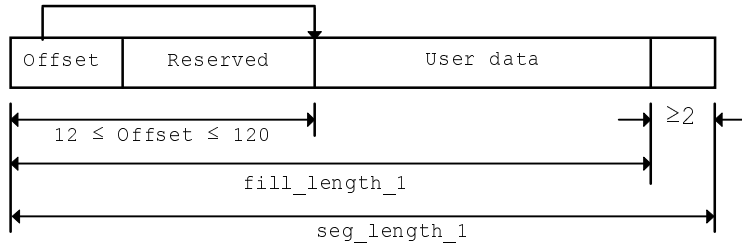
The offset byte and the user data must be entered in the data buffer by the FDL application.

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 I_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_I_sdu.length	May be different from request
send_I_sdu.length	Unchanged from request
I_status	ok, rr, ue, rs, ls, na, ds, iv

I_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

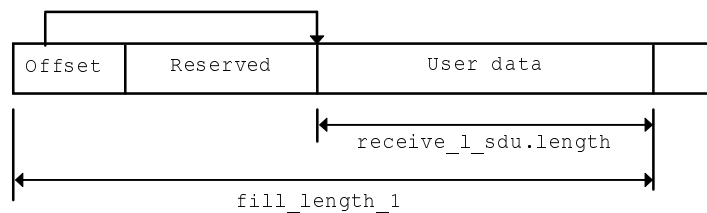
Application Block

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

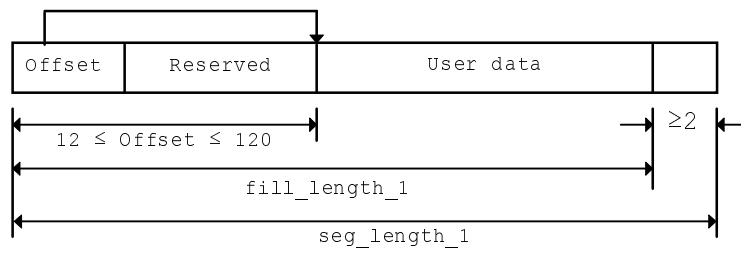
Meaning of the Parameters rem_add.station = BROADCAST: dsap = 63
rem_add.station = MULTICAST: dsap = 0 to 62 or DEFAULT_SAP

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 I_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_I_sdu.length	May be different from request
send_I_sdu.length	Unchanged from request
I_status	ok, ls, ds, iv

I_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

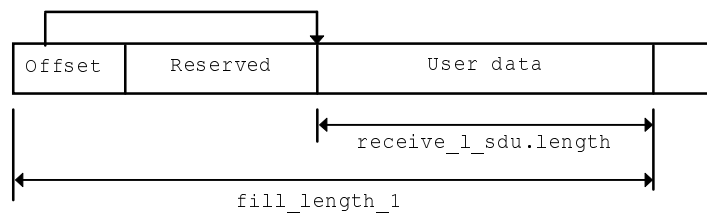
opcode	Indication
subsystem	No significance
id	No significance
service.code	sdn
loc_add.station	Address of the destination station 0 to 126 (local L2 address)
loc_add.segment	NO_SEGMENT
ssap	SAP of the station (local) 0 to 62 or DEFAULT_SAP
dsap	SAP of the station (remote) 0 to 62 or DEFAULT_SAP
rem_add.station	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

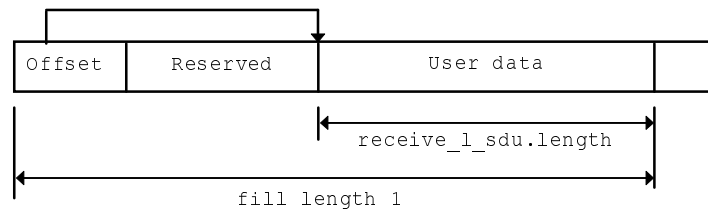
Application Block

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 \geq 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.

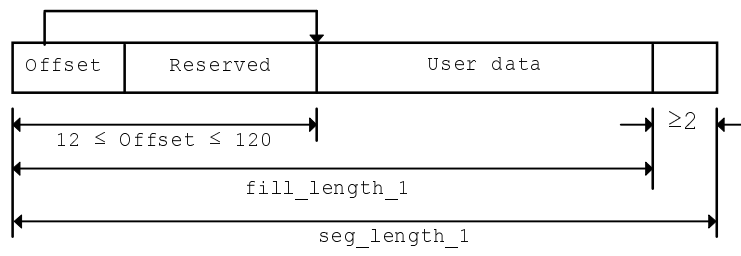
Recommendation

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 I_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

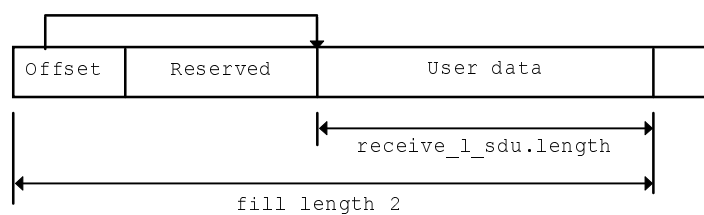
opcode	Confirm
subsystem	No significance
id	No significance
service.code	srd
loc_add.station	Unchanged from request
loc_add.segment	Unchanged from request
ssap	Unchanged from request
dsap	Unchanged from request
rem_add.station	Unchanged from request
rem_add.segment	Unchanged from request
serv_class	Unchanged from request
receive_I_sdu.length	Number of received net bytes 0 to 246, if I_status appropriate
send_I_sdu.length	Unchanged from request
I_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.

I_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 I_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

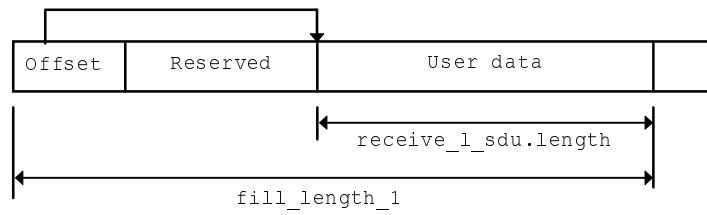
Application Block

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_I_sdu.length	Number of received net bytes 0 to 246, if I_status appropriate
send_I_sdu.length	No significance
I_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
	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".

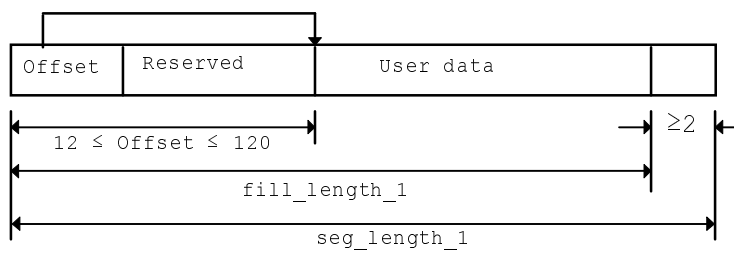
The offset and the user data must be entered in the data buffer by the FDL application.

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 I_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_I_sdu.length	Unchanged from request
send_I_sdu.length	Unchanged from request
I_status	ok, ls, lr, iv

I_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
	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".

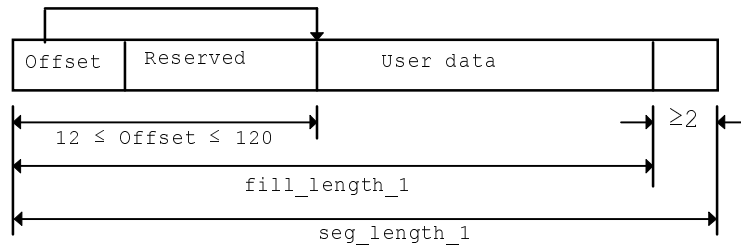
The offset and the user data must be entered in the data buffer by the FDL application.

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 I_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_I_sdu.length	Unchanged from request
send_I_sdu.length	Unchanged from request
I_status	ok, ls, lr, iv

I_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. 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, withdraw_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 (\geq 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 I_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_I_sdu.length	Unchanged from request
send_I_sdu.length	Unchanged from request
I_status	ok, iv

I_status Values

ok = Positive acknowledgment, the bus parameters were read.
 iv = Negative acknowledgment:
 - CP is currently being reset
 - 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_tsd	Minimum station delay time.
max_tsd	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 (\geq 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. Recommendation: 246
access_sap	Optional access right for a particular SAP (remote) on this SAP. Other remote SAPs (\neq access_sap) are not allowed access (0 to 63, ALL). ALL = no access restrictions.
access_station	Optional access right for a particular station (remote) on this SAP. Stations with the L2 address \neq access_station are not allowed access (0 to hsa, ALL). 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 I_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_I_sdu.length	Unchanged from request
send_I_sdu.length	Unchanged from request
I_status	ok, no, iv

I_status Values

- ok = Positive acknowledgment, SAP was activated.
- no = Negative acknowledgment, SAP exists already.
- iv = Negative acknowledgment:
 - CP currently being reset
 - SAP parameter invalid
 - 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 (\geq 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 (\neq access_sap) are not permitted access (0 to 63, ALL).
access_station	ALL = no access restriction. Optional access right for a particular station (remote) on this SAP. Stations with an L2 address \neq access_station are not permitted access (0..hsa, ALL).
access_segment	ALL = no access restrictions
sda	Reserved
sdn	No significance
srd	No significance
csrd	Specifies the role = RESPONDER
*rup_l_sdu_ptr_low	Reserved
*rup_l_sdu_ptr_high	No significance
	No significance

Confirmation The RSAP_ACTIVATE confirmation confirms execution of the RSAP_ACTIVATE request.

The result of the request is entered in the I_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_I_sdu.length	Unchanged from request
send_I_sdu.length	Unchanged from request
I_status	ok, no, iv

I_status Values

- ok = Positive acknowledgment, SAP was activated.
- no = Negative acknowledgment, SAP exists already
- iv = Negative acknowledgment:
 - CP currently being reset
 - SAP parameter invalid
 - 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 \geq 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 I_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_I_sdu.length	Unchanged from request
send_I_sdu.length	Unchanged from request
I_status	ok, no, lr, iv

I_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:
 - CP currently being reset
 - 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
	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

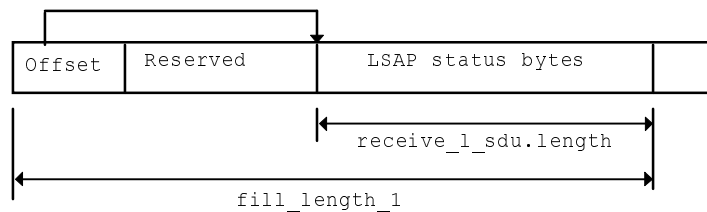
Application Block

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.

I_status Values

- ok = Positive acknowledgment, status was read.
- iv = Negative acknowledgment:
 - CP currently being reset
 - Invalid parameters in the application block
 - 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.
 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 I_status structure element.

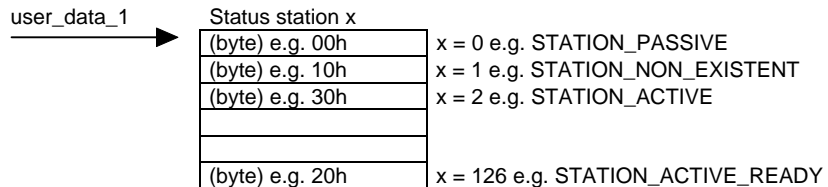
Request Block Header

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 I_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 I_status = ok
send_l_sdu.length	Unchanged from request
I_status	ok, ds, lr, iv

Structure of the Life List



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

I_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:
 - CP currently being reset
 - passive station
 - 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 I_status structure element.

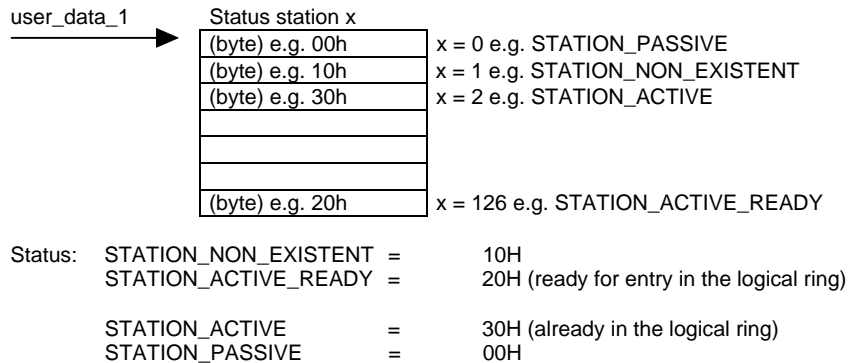
Request Block Header

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 I_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 I_status = ok
send_l_sdu.length	Unchanged from request
I_status	ok, lr, iv

Structure of the Life List



I_status Values

- ok = Positive acknowledgment, life list was created.
- lr = Resources of the CP not available or inadequate.
- iv = Negative acknowledgment:
 - CP currently being reset
 - no life list buffer exists
 - passive station
 - 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 ($\geq \text{LEN_IDENT} \leq 260$)
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
	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 I_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 I_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

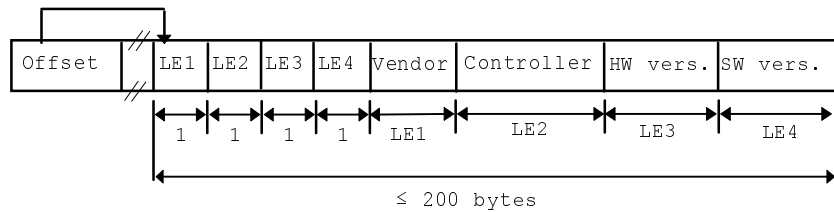
opcode	Confirm
subsystem	No significance
id	No significance
service.code	fdl_ident
loc_add.station	Unchanged from request
loc_add.segment	Unchanged from request
ssap	Unchanged from request
dsap	Unchanged from request
rem_add.station	Unchanged from request
rem_add.segment	Unchanged from request
serv_class	Unchanged from request
receive_I_sdu.length	Length of the Ident 0 to 200, if I_status = ok
send_I_sdu.length	Unchanged from request
I_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.

I_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:
 - CP currently being reset
 - invalid parameters in the application block
 - 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 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 I_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_I_sdu.length	No significance
send_I_sdu.length	Unchanged from request
I_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: - incorrect start delimiter - bus short-circuit or bus collisions - station exists twice - Invalid entry in the frame
send_confirmed_ctr	Number of sent "confirmed requests" (SDA, SRD).
send_sdn_ctr	Number of sent SDN requests.

I_status Values

ok	= Positive acknowledgment, statistics were read.
iv	= Negative acknowledgment: - CP currently being reset - 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 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 I_status structure element.

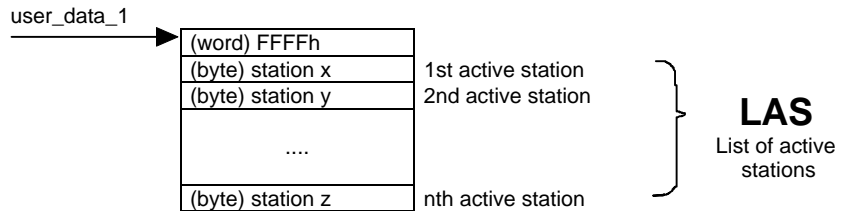
Request Block Header

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_I_sdu.length	Number of active stations (= n)
send_I_sdu.length	Unchanged from request
I_status	ok, iv

Structure of the Statistic Buffer



I_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 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 I_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	Is, Ir, 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_I_sdu.length	Unchanged from request
send_I_sdu.length	Unchanged from request
I_status	Is, Ir, iv

I_status Values

Is = Negative acknowledgment, SAP does not exist.
 Ir = Negative acknowledgment, resource overflow on the CP (more than 255 for one SAP).
 iv = Negative acknowledgment:
 - CP currently being reset
 - 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 I_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_i_sdu.length	Unchanged from request
send_i_sdu.length	Number of returned resources (if I_status = ok)
I_status	ok, ls, iv

I_status Values

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

Fetching the Resources

The WITHDRAW_INDICATION request is followed by the WITHDRAW_INDICATION confirmation. If this service is successful, (I_status = ok), the structure element send_i_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:

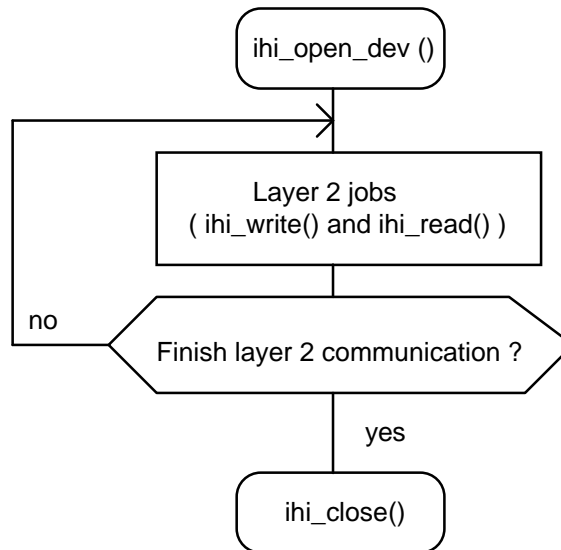


Fig. 5.1: Sequence of an FDL Application

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.

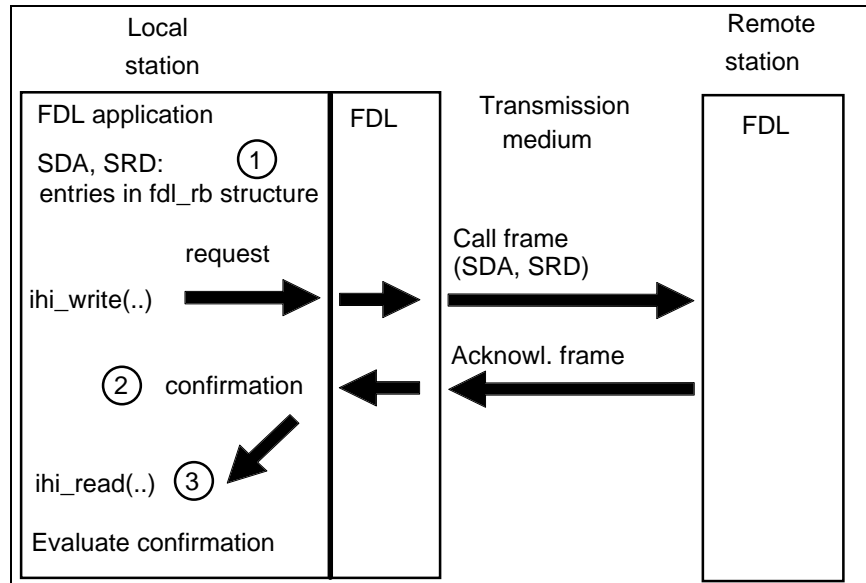


Fig. 5.2: Sending Data Frames SDA, SRD

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.

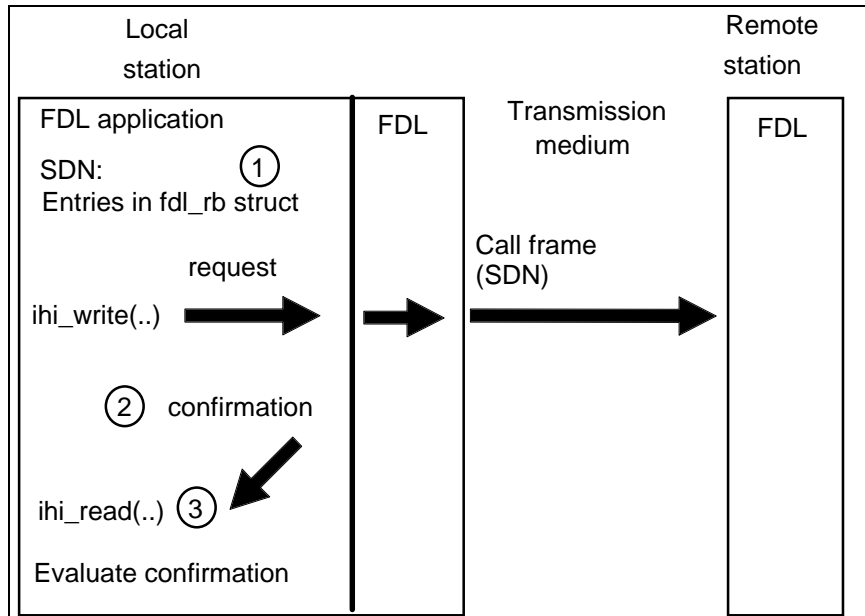


Fig. 5.3: Sending Data Frames SDN

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.

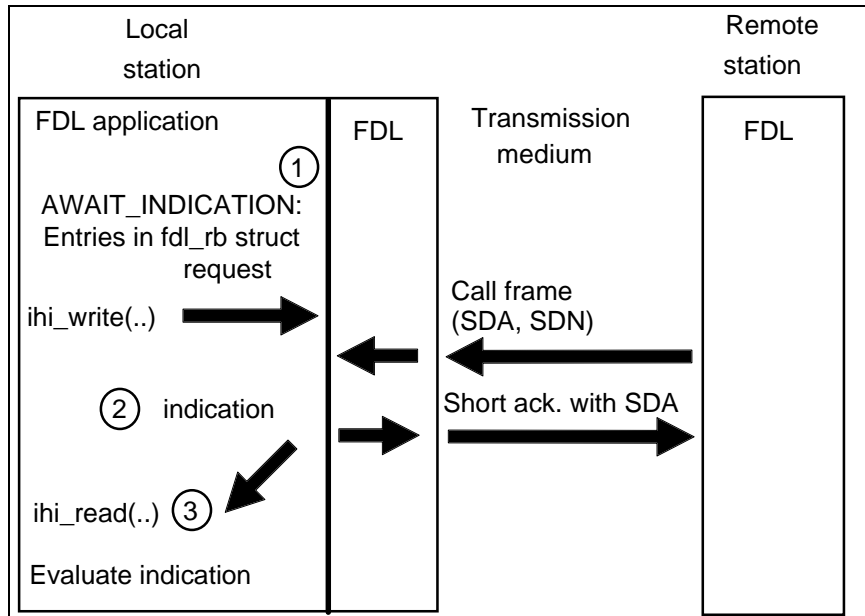


Fig. 5.4: Receiving Data Frames SDA, SDN

Notes

- 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`.
- 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.
- 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.

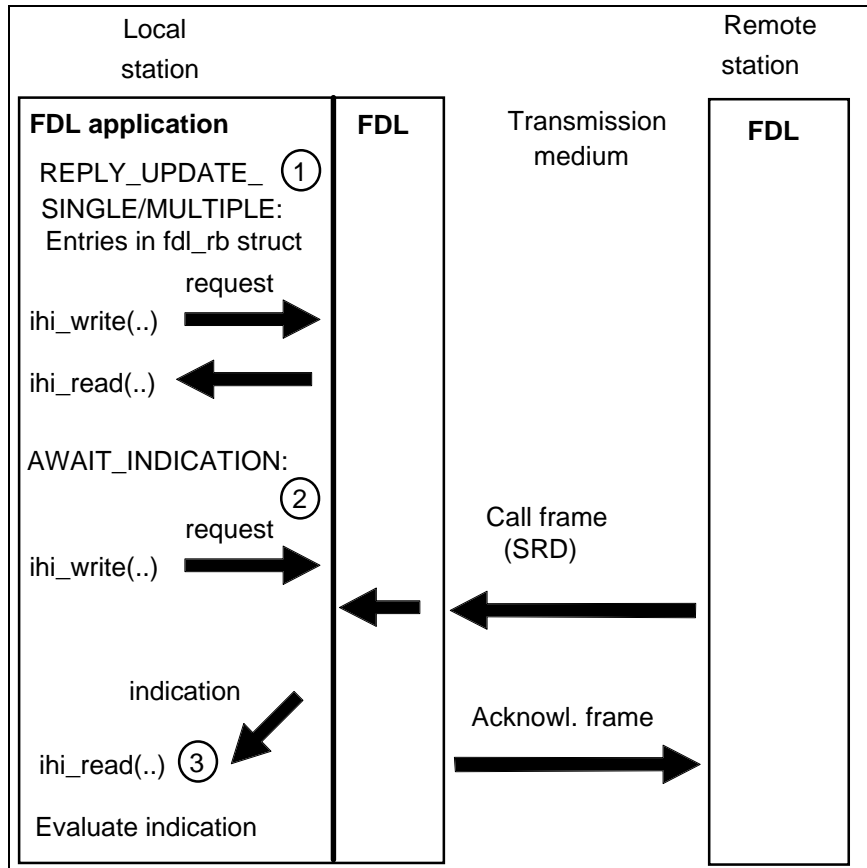


Fig. 5.5: Receiving Data Frames SRD

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	<p>Using the ihi_open_dev function, the FDL application logs on at the driver. The driver transfers the job to the CP.</p> <p>The "dev" parameter selects the CP in the PG/PC. The function returns a handle that must be specified for all further calls.</p>															
Declaration of the Function	<pre>#include "fdl_rb.h" int ihi_open_dev (ord16 mode, char * dev);</pre>															
Description of the Parameters	<p>mode: mode = 0: No device name is specified, instead, communication is via the first CP that supports the ihi function calls.</p> <p>mode = 1: A connection is established between the FDL application and the CP selected with the "dev" parameter.</p> <p>Recommendation: When using the FDL programming interface, select mode = 1.</p> <p>dev: This parameter selects the CP. Syntax: "/name:/FLC"</p> <p>name = identical to the name selected in the configuration program.</p>															
Return Value	<table> <tr> <td style="vertical-align: top;">≥ 0:</td> <td style="vertical-align: top;">Success:</td> <td style="vertical-align: top;">Return value = handle</td> </tr> <tr> <td style="vertical-align: top;">< 0:</td> <td style="vertical-align: top;">Error:</td> <td></td> </tr> <tr> <td></td> <td style="vertical-align: top;">-1:</td> <td style="vertical-align: top;">Bus driver not installed.</td> </tr> <tr> <td></td> <td style="vertical-align: top;">-2:</td> <td style="vertical-align: top;">Error opening driver.</td> </tr> <tr> <td></td> <td style="vertical-align: top;">-3:</td> <td style="vertical-align: top;">Driver already opened.</td> </tr> </table>	≥ 0:	Success:	Return value = handle	< 0:	Error:			-1:	Bus driver not installed.		-2:	Error opening driver.		-3:	Driver already opened.
≥ 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	<pre>#include "fdl_rb.h" int ihi_close (int handle);</pre>												
Description of the Parameters	handle: Reference (see ihi_open).												
Return Value	<table><tr><td>= 0:</td><td>Success:</td><td>Job executed correctly. Under Windows, ihi_close also returns the value 0 if jobs were discarded.</td></tr><tr><td>< 0:</td><td>Error:</td><td></td></tr><tr><td></td><td>-1:</td><td>No ihi_open_dev executed for this handle.</td></tr><tr><td></td><td>-2:</td><td>ihi_close was executed correctly, jobs not yet processed were discarded.</td></tr></table>	= 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.
= 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 */

    /* send 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	<p>Using the SCP_open function, the FDL application logs on at the driver. The driver transfers the job to the CP.</p> <p>The "dev" parameter selects the CP in the PG/PC. The function returns a handle that must be specified for all further calls.</p>						
Declaration of the Function	<pre>#include "fdl_rb.h" int SCP_open (char * dev);</pre>						
Description of the Parameters	<p>dev: This parameter selects the CP. Syntax: "/name/FLC"</p> <p>name = identical to the name selected in the configuration program.</p>						
Return Value	<table><tr><td>≥ 0:</td><td>Success:</td><td>Return value = handle</td></tr><tr><td>= -1:</td><td>Error:</td><td>The exact cause of the error can be obtained with SCP_get_errno().</td></tr></table>	≥ 0:	Success:	Return value = handle	= -1:	Error:	The exact cause of the error can be obtained with SCP_get_errno().
≥ 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"
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.

= 0: **Success** Job executed correctly.
 :

= -1: **Error:** The exact cause of the error can be obtained with SCP_get_errno().

Return Value

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	<pre>#include "fdl_rb.h" int SCP_close (int handle);</pre>									
Description of the Parameters	handle: Reference (see SCP_open).									
Return Value	<table><tr><td>= 0:</td><td>Success</td><td>Job executed correctly.</td></tr><tr><td>:</td><td></td><td>The value 0 is also returned when pending jobs have been discarded.</td></tr><tr><td>= -1:</td><td>Error:</td><td>The exact cause of the error can be obtained with SCP_get_errno().</td></tr></table>	= 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().
= 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_COUNTER 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 active_fast, passive_fast	active, passive 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, select_bus_a select_bus_b 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\libce,,,
```

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 -\sinec\dp5412a2.dw\include -DTURBO_CC -DM_DOS
    exa.c
or
bcc -c -ml -\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\fd\dos` contains the sample program `l2ddemo.c`". This illustrates the use of the SDA service. The directories `\sinec\dp5412a2.dw\sample\fd\dos\msc` and `\sinec\dp5412a2.dw\sample\fd\dos\tc` or `\sinec\dp5412a2.dw\sample\fd\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 /Isinec\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 -Isinec\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\fd\win` contains the sample program `l2wdemo.c`. This illustrates the use of the SDA service. The directories `\sinec\dp5412a2.dw\sample\fd\win\msc` and `\sinec\dp5412a2.dw\sample\fd\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 -I 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 -I 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

AWAIT_INDICATION	78
Bus parameter block	53
Confirmation	12; 20
FDL SAP	58
FDL_EVENT	82
FDL_IDENT	70
FDL_LIFE_LIST_CREATE_LOCAL	68
FDL_LIFE_LIST_CREATE_REMOTE	66
FDL_READ_LAS_STATISTIC_COUNTER	76
FDL_READ_STATISTIC_COUNTER	73
FDL_READ_VALUE	51
Indication	12; 21
LSAP_STATUS	62
PROFIBUS	1
PROFIBUS PA	115
REPLY_UPDATE_MULTIPLE	40
REPLY_UPDATE_SINGLE	37
Request	12; 19
Requester	13
Responder	13
RSAP_ACTIVATE	57
SAP_ACTIVATE	54
SAP_DEACTIVATE	60
SDA	22
SDN	26
SINEC	1
SINEC L2	1; 6
SRD	31
Station	1; 10; 12; 87; 89; 90; 91; 92
WITHDRAW_INDICATION	83

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: Input module Output module 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.

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: gap update factor x target rotation time
Gateway	Intelligent connectivity device that connects different types of local area -> networks at OSI layer 7.

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.

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.

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	<p>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.</p> <p>A -> system consists of several subnets with unique -> subnet numbers. A subnet consists of several ->stations with unique -> L2 addresses.</p>
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

