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DEP Documentation

DEP Host Interface Protocol

Version Management Report

Version	Name(s)	Date	Comments
01.00	F. Demaertelaere	10/02/2000	Initial version
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TABLE OF CONTENTS

1. SCOPE OF THE DOCUMENT

This *DEP Host Interface Protocol* document defines the interface between the DEP Platform and the host.

It describes in detail the structures of the messages that have to be sent at application level by the host to the DEP Platform. Moreover, this document gives also a description of the messages at communication level.

The document is required when implementing the host driver that communicates with the DEP Platform.

1.1. REFERENCES

This document contains references to other documents about the DEP. This paragraph gives a list of all the documents referred to.

- *DEP/Linux User Manual*
- *DEP DS3 and DS4 Principles*
- *DEP/NMS User Manual*
- *DEP/T6 Owner's Manual*

There are no references made to the following documents, but they could be useful to understand this document.

- *DEP Introduction to DEP*
- *DEP General Architecture*
- *DEP Glossary*

1.2. CONTACTING ATOS WORLDLINE

You can visit *Atos Worldline* on the World Wide Web to find out about new products and about various other fields of interest.
URL: www.atosworldline.com.

For the documentation visit http://www.banksys.com web page.

For support on issues related to DEP, customers, partners, resellers, and distributors can send an email to the DEP Hotline:
mailto:dephotline-atosworldline@atosorigin.com.

2. COMMUNICATION ARCHITECTURE

The communication between the host and the DEP Platform is based on a *client-server* architecture where

- the host is the *client* part of the architecture it sends commands to the Application Software of the DEP and waits for responses
- the DEP Platform is the *server* part of the architecture: it waits for commands, executes them (by means of its Application Software) and sends the responses back to the client part.

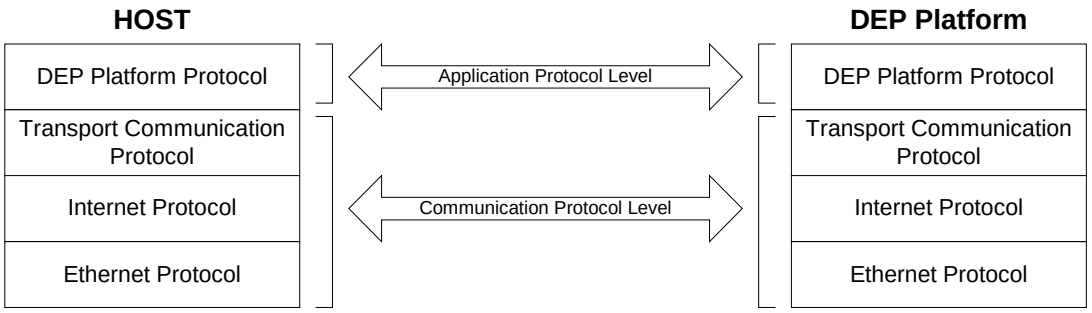
The communication between the two parts has to pass through a single bi-directional communication channel. Depending on the underlying communication protocols, the channel is a point-to-point communication line or a network.

In some circumstances (see paragraph 3.3.1 on page 11), there may be more than one host communicating with a DEP Platform at the time.

The communication between the client and the server is organized in several communication protocol levels. Considering the stack of protocol layers, we can divide it in two levels:

- The bottom level consists of standard communication protocols. This level allows messages to be transported from the host to the DEP Platform and conversely. This level, called the *Communication Protocol Level*, handles the communication channel connecting the host and the DEP Platform.
- The top level is a single layer level, consisting of a *Atos Worldline*-defined application protocol. This level, called the *Application Protocol Level*, allows messages to be sent from a host application to a particular Application Software of the DEP Platform and conversely.

The figure presented below illustrates the two levels for a particular case: the DEP Platform protocol over TCP/IP on Ethernet.



3. COMMUNICATION PROTOCOLS

As described previously, this level ensures the communication between the host and the DEP Platform, regardless of the final application destination. This level is implemented by different protocols. They can be classified in two different groups:

- Point-to-Point Protocols
- Network Protocols

For the supported network protocols, initially, there was only one virtual circuit connecting the host to the DEP Platform. This implied that there was no possibility to connect two host applications to a DEP Platform at the same time. Recently, an *Atos Worldline* added a multi-connection property so that multiple hosts can be connected to one DEP Platform.

3.1. POINT-TO-POINT PROTOCOLS

3.1.1. PDP Asynchronous on RS232

Asynchronous RS232 communication is available on DEP/XP and DEP/T6.

3.1.1.1. Overall RS232 Characteristics

The overall RS232 communication characteristics of the PDP Asynchronous protocol are defined here.

- baudrate: 4800, 9600, 19200, 38400, 56000, 57600 or 115200,
- stop bits: 1 stop bit,
- characters: 8 bits, no parity.

These properties should be specified in the DEP/NMS application. For more information refer to the *DEP/NMS User Manual.*

There are two possible checksums in the PDP Asynchronous protocol:

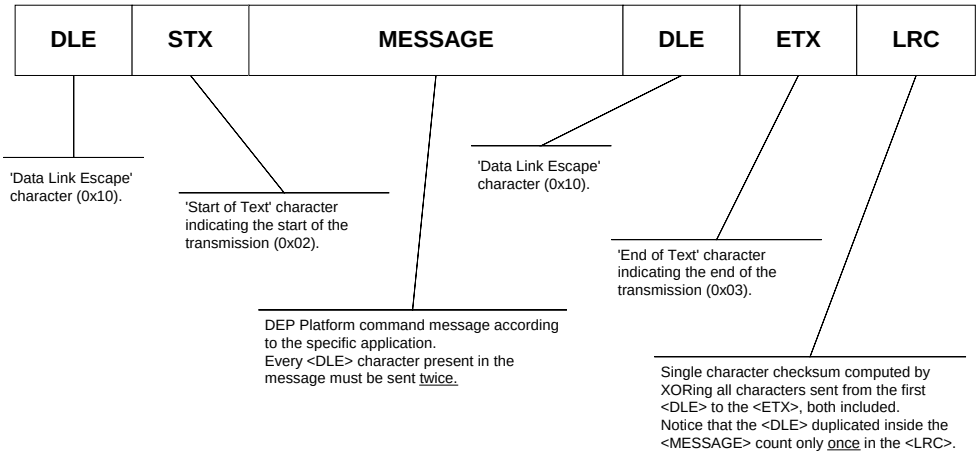
- LRC
- CRC

The PDP Asynchronous protocol parameters need to be specified in the *DEP/NMS* application (refer to *DEP/NMS User Manual for more information*).

Because the CRC checksum is stronger than the LRC, it is recommended to use the CRC checksum.

3.1.1.2. Asynchronous PDP Protocol with LRC

The byte stream that has to be transferred from the host to the DEP Platform is defined in the following way:



The **<LRC>** should be calculated from the first **<DLE>** to the last <**ETX**>, both included. <**LRC**> calculation is done before duplicating the <**DLE**> characters in the <**MESSAGE**>.

For example, if the following command (**I_STD_ECHO**) shall be sent to the DEP Platform:

```
FF 01000100 0005010A102530 02000900 01000200,
```

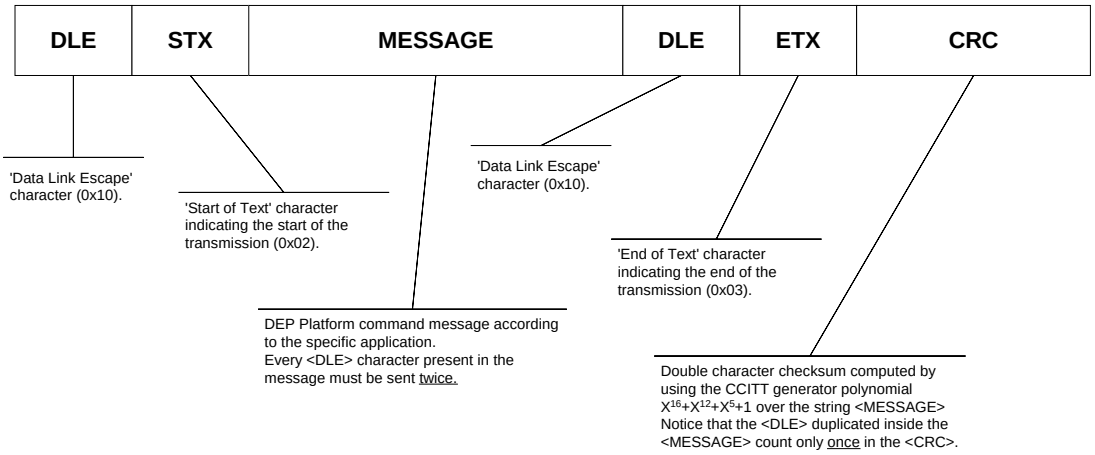
the following byte streams will be exchanged between the host and the DEP Platform. All the added protocol characters are underlined and the characters included in the <**LRC**> are indicated in bold.

Host to DEP Platform:
10 02 FF 01000100 0005010A10102530 02000900 01000200 10 03 FD

DEP Platform to Host:
10 02 00 01000200 0005010A10102530 10 03 09

3.1.1.3. Asynchronous PDP Protocol with CRC

The byte stream that has to be transferred from the host to the DEP Platform is defined in the following way:



The <**CRC**> should be calculated only over the <**MESSAGE**>. <**CRC**> calculation is done before duplicating the <**DLE**> characters in the <**MESSAGE**>.

For example, if the following command (***I_STD_ECHO***) shall be sent to the DEP Platform:

```
FF 01000100 0005010A102530 02000900 01000200,
```

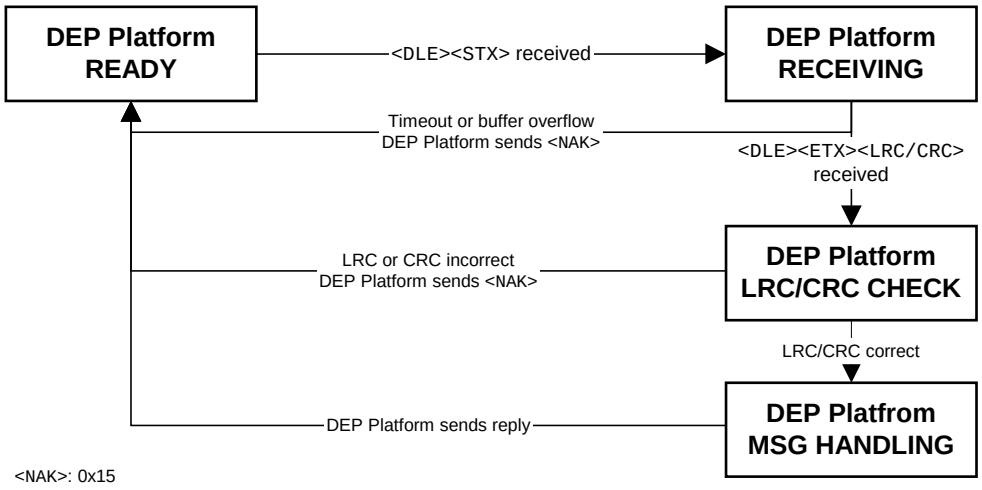
the following byte streams will be exchanged between the host and the DEP Platform. All the added protocol characters are underlined and the characters included in the CRC are indicated in bold.

Host to DEP Platform:
10 02 **FF 01000100 0005010A10102530 02000900 01000200** 10 03 34 B3

DEP Platform to Host:
10 02 **00 01000200 0005010A10102530** 10 03 97 0F

3.1.1.4. Protocol Flowchart

When communicating with the DEP Platform by using the PDP Asynchronous protocol, the following flow has to be taken into account.



3.1.1.5. CRC Sample Code

This paragraph gives a sample C-code for the calculation of the CRC.

```
#include <stdio.h>

#define word unsigned short
#define byte unsigned char
#define dword unsigned long

void CRCUpdate ( byte in_data, dword *accum )
{
    word    i;
    word    c1, c2, c3, c4;

    c1 = 65535;
    c2 = 32768;

    for (i=0; i<=7; i++) {

        c3 = (in_data*256) & c1;
        c4 = (*accum ^ c3) & c2;

        if ( c4 != 0 ) {
            *accum ^= 0x0810;
            *accum *= 2;
            *accum |= 1;
            *accum &= c1;
        }
        else {
            *accum *= 2;
            *accum &= c1;
        }

        in_data = (in_data*2) & 0xFF;

    }

}

int CRCCalc ( byte *mes, word len, word *CRC )
{

    word    i;
    dword   DCRC;

    DCRC = 65535;

    for (i=0; i<len; i++)
        CRCUpdate (mes[i], &DCRC);
    *CRC = DCRC & 0xFFFF;

    return(0);
}


void main ( void )
{
    byte    mes1[20];
    byte    mes2[20];
    word    CRCFinal;

    mes1[0] = 0x02;

    mes2[0] = 0x00;
    mes2[1] = 0x00;

    CRCCalc (&mes1[0], 1, &CRCFinal);
    printf ("CRC1= %02X %02X\n\n", CRCFinal>>8, CRCFinal&0xFF);

    CRCCalc (&mes2[0], 2, &CRCFinal);
    printf ("CRC2= %02X %02X\n\n", CRCFinal>>8, CRCFinal&0xFF);
}
```

3.1.2. Other Protocols

Other protocols could possibly be available in the future (on request).

3.2. NETWORK PROTOCOLS

3.2.1. TCP/IP on Ethernet

3.2.1.1. Overall TCP/IP Characteristics

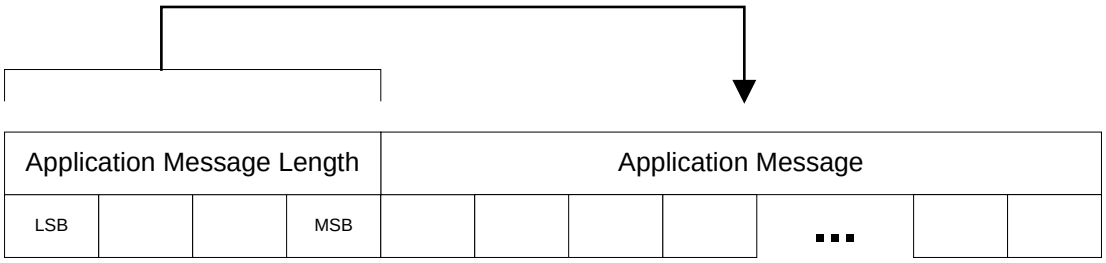
The standard TCP/IP protocol could be used for establishing communication with the DEP Platform. This assumes that a standard TCP/IP stack has been installed. Connecting to a DEP Platform should be done by the standard TCP/IP connection procedure.

The TCP/IP address and port number can be defined on the DEP/XP, DEP/Linux or DEP/T6. Refer to the *DEP/Linux User Manual* or *the DEP/T6 Owner's Manual* to know how these setting have to be defined.

In case of a multiple connection, every host should connect to the DEP Platform by using the same TCP/IP address and port number. Remark that there are some restrictions when using a multiple connection (e.g. the number of connections in parallel).

3.2.1.2. Additional Message Information

Because TCP is a *byte-stream* protocol that provides no message boundaries, all application messages transmitted through the TCP connection are preceded by a length field of four bytes, the *Application Message Length* field.



The *Application Message Length* field is a hexadecimal field with the least significant byte (**LSB**) as the first byte and the most significant byte (**MSB**) as the last byte.

For example, if the following command (***I_STD_ECHO***) shall be sent to the DEP Platform:

```
FF 01000100 0005010A102530 02000900 01000200,
```

the following byte streams will be exchanged between host and DEP Platform. The added *Application Message Length* field bytes are underlined.

Host to DEP Platform:
14000000 FF 01000100 0005010A102530 02000900 01000200

DEP Platform to Host:
0C000000 00 01000200 0005010A102530

3.2.2. Other Protocols

Other protocols could possibly be available in the future (on request).

4. APPLICATION PROTOCOLS

4.1. DEP COMMAND STRUCTURES

4.1.1. DS2 Command Structure

Every DS2 command and reply is composed of a fixed sequence of fields that compose a DEP command.

Such DEP command always starts with a one-byte command code, ranging from 0x00 to 0xFD. Depending on the value of the command code, several pre-defined data objects need to follow the command code.

Each data object has a fixed length value and a dedicated place in the command. In case of variable length fields, the length of the data value is always available in the data object.

The DEP has all the information about the structure of the data objects.

Com. Code (1 byte)	Command Data Structure (variable length)				
0x00-0xFD	FIELD1	FIELD2	FIELD3	...	FIELD n

The reply of the DEP contains a one-byte response code, followed by several pre-defined data objects.

Reply Code (1 byte)	Command Data Structure (variable length)				
reply dependent	FIELD1	FIELD2	FIELD3	...	FIELD n

4.1.2. DS3 Command Structure

A DEP DS3 command always starts with a one-byte DS3 identifier, i.e. 0xFF. This identifier is followed by a list of input data tags immediately followed by their corresponding actual data, a list of functions to execute and a list of output data tags.

DS3 Identifier	Command Data Structure (variable length)									
0xFF	DATA TAG 1	VALUE1	...	DATA TAG *n*	VALUE n	FUNC TAG 1	...	FUNC TAG *m*	DATA TAG 1	...	DATA TAG *l*

The reply of the DEP contains a one-byte response code, followed by several tags and their corresponding data.

Reply Code (1 byte)	Command Data Structure (variable length)				
reply dependent	TAG 1	VALUE1	...	TAG n	VALUE n

Refer to the document *DEP DS3 and DS4 Principles* for more information.

4.1.3. DS4 Command Structure

A DEP DS4 command always starts with a one-byte identifier, i.e. 0xFF. This identifier is followed by one function tag and a structure of data objects.

Each data object has a fixed length value and a dedicated place in the command. In case of variable length fields, the length of the data value is always available in the data object.

The DEP has all the information about the structure of the data objects.

DS4 Identifier	Command Data Structure (variable length)					
0xFF	FUNCTION TAG	FIELD1	FIELD2	FIELD3	...	FIELD*n*

The reply of the DEP contains a one-byte response code, followed by several tags and their corresponding data. In case of a correct answer (Reply Code is 0x00), the DEP will return a DS2-like answer.

Reply Code (1 byte)	Command Data Structure (variable length)				
0x00	FIELD1	FIELD2	FIELD3	...	FIELD n

Error cases are replied by a DS3-like answer.

Reply Code (1 byte)	Command Data Structure (variable length)				
reply dependent	TAG 1	VALUE1	...	TAG n	VALUE n

Refer to the document *DEP DS3 and DS4 Principles* for more information.

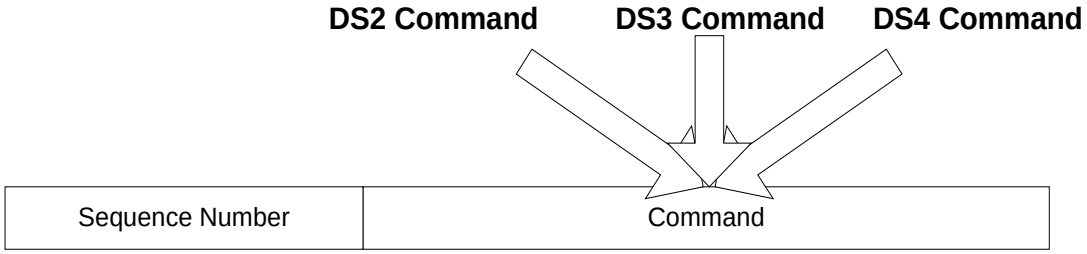
4.2. DEP PROTOCOL (DP)

The DEP Platform offers the possibility that a sequence number precedes the DS2/DS3/DS4 command. The reply will be preceded with the same *sequence number*.

The *sequence number* field needs to be managed by the host and offers the possibility for the host to identify command and reply messages. Although this field is called a *sequence number* field, the use of a sequence number is just one of the possible implementations for the message and reply identification. The feature offers a general possibility…

The *sequence number* field could be useful for hosts accessing different DEP Platforms to make the link between the command sent and the reply received.

The *sequence number* is optional and its length may vary from 0 to 15 bytes. The length of this field must be defined in the *DEP/NMS* application and in the *DEPD Daemon Configuration File* for the DEP/Linux.



The command field contains the instructions to be processed by the DEP Crypto Module and can either have a DS2 command structure, a DS3 command structure or a DS4 command structure.

When the DP is used for sending messages to a DEP Platform containing different DEP Crypto Modules, these messages are always forwarded internally to the *DEP POOL* (see paragraph 4.3.3 on page 15).

For example, if the following command (***I_STD_ECHO***) will be sent to the DEP Platform in DP with a *sequence number* of 4 bytes

```
FF 01000100 0005010A102530 02000900 01000200,
```

the following byte streams (without communication protocol) will be exchanged between the host and the DEP Platform. The added *sequence number* field bytes are underlined.

Host to DEP Platform:
12345678 FF 01000100 0005010A102530 02000900 01000200

DEP Platform to Host:
12345678 00 01000200 0005010A102530

4.3. ENHANCED DEP PROTOCOL (EDP)

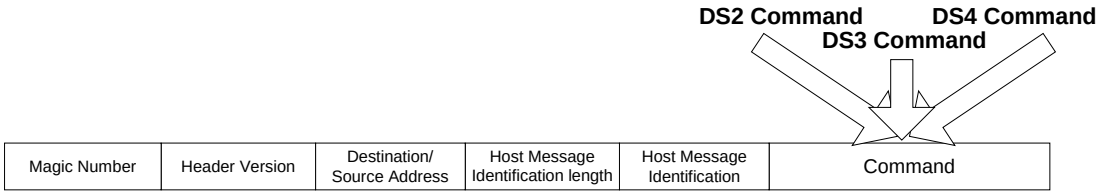
The DEP Protocol described in paragraph 4.2 on page 13 offers only a basic principle for communicating with a DEP Platform.

The Enhanced DEP Protocol is extended with some new concepts:

- allowing the host to specify some more information concerning the destination of the message

- allowing additional security applications and security hardware modules to be integrated in the system.

This protocol consists of command messages sent by the host applications to the DEP Platform and the reply messages returned by the DEP Platform to the host applications. To each command corresponds one and only one reply.



4.3.1. Magic Number

The *Magic Number* can be configured in the *DEP/NMS* application and the *DEP Daemon Configuration File* of the DEP/Linux. It allows making a difference between the DEP Protocol and the Enhanced DEP Protocol.

The *Magic Number* received from the host application should match the *Magic Number* that is configured on the DEP Platform. The same value of the *Magic Number* is returned in the reply message.

The length of the Magic Number can range from 0 to 16 bytes.

Refer to the *DEP/NMS User Manual* to know how to set the *Magic Number* for the DEP/T6 and to the *DEP/Linux User Manual* for the DEP/Linux.

4.3.2. Header Version

The *Header Version* field is created to allow handling different versions of the protocol. It has a fixed length of one byte.

The most significant nibble (4 bits) indicates the release number and the least significant nibble is the version number. The *Header Version* is also returned in the reply message.

Actually, the value of the *Header Version* should be 0x30.

4.3.3. Destination/Source Address

The *Destination/Source Address* consists of two bytes. The *Destination Address* is used in command messages to the DEP Platform; the *Source Address* is used in the reply messages from the DEP Platform.

The first byte of the *Destination/Source Address* is the *Application Address* and identifies the application that must receive the message or that replies the command message.

For applications controlling several hardware modules, the second byte of the *Destination/Source Address* (*Device Address*) identifies the hardware module for which the message was sent or that replied the response message. The interpretation of the second byte is application dependent.
The following table gives an overview of the supported *Destination Addresses* and their meaning.

APPLICATION ADDRESS	DEVICE ADDRESS	MEANING
0x01 - DEP Handler or DEP Daemon	0x00	(DEP POOL) DEP Handler makes a load balancing between the available pool of DEP Crypto Modules
	0x01	(FIRST) Command must be treated by the first DEP Crypto Module
	0x02	(SECOND) Command must be treated by the second DEP Crypto Module
	0x03	(THIRD) Command must be treated by the third DEP Crypto Module
	0x04	(FOURTH) Command must be treated by the fourth DEP Crypto Module

The *Destination Address* in the command is duplicated in the response message, but should then be interpreted by the host as a *Source Address* instead of a *Destination Address*. The *Application Address* in the reply message will be the same as the *Application Address* in the command message, except if a protocol error has been detected.

The following table gives an overview of the possible returned *Source Addresses* and their meaning.

APPLICATION ADDRESS	DEVICE ADDRESS	MEANING
0x01 - DEP Handler or DEP Daemon	0x01-0x04	(OK) The Device Address indicates the DEP Crypto Module that treated the command message (0x01=FIRST, 0x02=SECOND, 0x03=THIRD, 0x04=FOURTH)
	0x80	(ERROR) A command message was sent to the DEP POOL, but there is no DEP Crypto Module in the pool
	0x82	(ERROR) An invalid Device Address was specified
	0xA0-0xA3	(ERROR) The accessed DEP Crypto Module was in the FATAL mode (0xA0=FIRST, 0xA1=SECOND, 0xA2=THIRD, 0xA3=FOURTH)
	0xA4-0xA7	(ERROR) The accessed DEP Crypto Module was in the OFF-LINE mode (0xA4=FIRST, 0xA5=SECOND, 0xA6=THIRD, 0xA7=FOURTH)
	0xA8-0xAB	(ERROR) The accessed DEP Crypto Module did not return a response within the maximum response time specified (0xA8=FIRST, 0xA9=SECOND, 0xAA=THIRD, 0xAB=FOURTH)
	0xAC-0xAF	(ERROR) The accessed DEP Crypto Module returned an invalid response to the DEP Handler or DEP Daemon (0xAC=FIRST, 0xAD=SECOND, 0xAE=THIRD, 0xAF=FOURTH)
	0xB0-0xB3	(ERROR) The Host Messages attribute was not set for the DEP Crypto Module (0xB0=FIRST, 0xB1=SECOND, 0xB2=THIRD, 0xB3=FOURTH)

	0xB8-0xBB	(ERROR) There was an error sending the command to the DEP Crypto Module (0xB8=FIRST, 0xB9=SECOND, 0xBA=THIRD, 0xBB=FOURTH)
	others	(ERROR) An undefined error was returned by the DEP Handler or the DEP Daemon
0xFF - Protocol Error	0x01	(ERROR) An invalid Header Version was sent to the DEP Platform
	0x02	(ERROR) An invalid Application Address was sent to the DEP Platform
	0x03	(ERROR) The addressed application was not available (either not installed or not started)
	0x05	(ERROR) An incorrect Magic Number was sent to the DEP Platform
	0x06	(ERROR) An invalid Host Message Identification Length was sent to the DEP Platform
	0x07	(ERROR) The length of the sent message was not correct
	others	(ERROR) An undefined protocol error was returned by the DEP Platform

4.3.4. Host Message Identification Length

This one-byte field identifies the length of the *Host Message Identification* field. The value ranges from 0 to 15.

When no *Host Message Identification* is used, the *Host Message Identification Length* field should be set at 0. When another value is specified, this field should be followed with a *Host Message Identification* field of the specified length (see paragraph 6.3.5 on page 17).

4.3.5. Host Message Identification

The *Host Message Identification* field needs to be managed by the host and offers the possibility for the host to identify command and reply messages. The *Host Message Identification* field could be useful for hosts accessing different DEP Platforms to make the link between the command sent and the reply received.

The DEP Platform will duplicate the received *Host Message Identification* information in its reply message.

The length of this field is identified in the *Host Message Identification Length* field that is preceded (see paragraph 4.3.4 on page 17).

4.3.6. Command

The command field contains the instructions to be processed by the DEP Crypto Module can be formatted either in DS2, DS3 or DS4.

4.3.7. Summary Table

This table gives an overview of all the parameters used in the Enhanced DEP Protocol.

FIELD	LENGTH	VALUE
MAGIC NUMBER	Specified in the *DEP/NMS* application or *DEPD Daemon Configuration File* - (0-16)	Specified in the *DEP/NMS* application or *DEPD Daemon Configuration File*
HEADER VERSION	1 byte	0x30
DESTINATION ADDRESS	2 bytes	Application Address: 0x00-0x06 Device Address: application dependent
HOST MESSAGE IDENTIFICATION LENGTH	1 byte	0x00-0x0F
HOST MESSAGE IDENTIFICATION	Specified in *Host Message Identification Length*	Managed by the host

4.3.8. Example

For example, if the following command (***I_STD_ECHO***) will be sent to the DEP Platform in DP with a *Host Message Identification Length* of 4 bytes

```
FF 01000100 0005010A102530 02000900 01000200,
```

the following byte streams (without communication protocol) will be exchanged between host and DEP Platform. The added protocol field bytes are underlined.

- using the *POOL* of DEP Crypto Modules

Host to the POOL DEP Platform:
FE 30 0100 04 12345678 FF 01000100 0005010A102530 02000900
01000200

DEP Platform (DEP Crypto Module 2) to Host:
FE 30 0102 04 12345678 00 01000200 0005010A102530

- addressing directly the DEP Crypto Module 3

Host to the DEP Crypto Module 3 DEP Platform:
FE 30 0103 04 12345678 FF 01000100 0005010A102530 02000900
01000200

DEP Platform (DEP Crypto Module 3) to Host:
FE 30 0103 04 12345678 00 01000200 0005010A102530

4.4. MIX OF PROTOCOL

4.4.1. Rules

When using the DEP Protocol and the Enhanced DEP Protocol simultaneously, some rules have to be respected to allow the DEP to unambiguously recognize the protocol used for each message.

The following rules should be taken into account. Not respecting these rules may cause a wrong interpretation of some message headers.

- The *Sequence Number* field of the DEP Protocol should not start with the *Magic Number* defined in the Enhanced DEP Protocol. This can be achieved by setting the length of the *Magic Number* field (Enhanced DEP Protocol) equal to the length of the *Sequence Number* field (DEP Protocol) plus one.

- The last byte of the *Magic Number* field should be 0xFE.

When the length of the *Magic Number* field is set to zero, no mix of protocols is allowed and all messages are assumed to respect the Enhanced DEP Protocol.

4.4.2. Treatment of Messages

Each command message received from the host is analyzed using the following rules:

1. When the length of the *Magic Number* field is set to zero or when the first byte(s) of the message match the *Magic Number*, the format of the message is assumed to correspond to the Enhanced DEP Protocol. The other fields are analyzed:

    1.1. If the *Header Version* is invalid, the protocol error **Invalid Header Version in Host Command** is returned

    1.2. If the *Host Message Identification Length* is invalid (longer than 15 bytes), the protocol error **Invalid Length Host Message ID Field in Host Command** is returned.

    1.3. The *Application Address* is checked.

        1.3.1. If the address corresponds to a configured and started application of the DEP Platform, the message is passed to it.

The command is processed by the application and the reply is sent back to the host.

1.3.2. If the address corresponds to a non-installed, a non-configured or a not started application, the protocol error **Destination in Host Command not Available** is returned.

1.3.3. Otherwise, the address is considered as an invalid address and the protocol error **Invalid Destination in Host Command** is returned.

2. Otherwise, it is assumed not to be an Enhanced DEP Protocol command message. The *Device Address* is assumed to be POOL, allowing the message command to be treated by any DEP Crypto Module of the DEP Platform.

4.4.3. Recommendation

To take the advantage of some specific functionality, it is recommended that the Enhanced DEP Protocol be used for new developments.

E.g. the Enhanced DEP Protocol allows the host to access a dedicated DEP Crypto Module of one DEP Platform. This could be interesting when the DEP Crypto Modules are loaded with different Application Software and/or keys.

Although retro-compatibility is guaranteed in the future, it is not excluded that the Enhanced DEP Protocol is extended with additional functionality, or that the DEP Platform functionality is extended with new features by using the Enhanced DEP Protocol.

5. BUFFERING COMMAND MESSAGES

Several command messages may be sent by the host to the DEP Platform before receiving the first response from the DEP Platform. The DEP Platform will memorize each command message until the resource needed to execute the command message becomes free. If several command messages need the same resource, they will be scheduled. The response message corresponding to the command message is sent as soon as it is available.

At the host side, the relationship between the command messages and response messages can be ensured by the *Sequence Number* field (DEP Protocol) or the *Host Message Identification* (Enhanced DEP Protocol).

The goal of this mechanism is to maximize the throughput between the host and the DEP Platform. The improvement will particularly be significant on low speed communication lines. The number of command messages simultaneously accepted by the DEP Platform is limited to a maximal value, to be defined in the *DEP/NMS*

application (see the document *DEP/NMS User Manual*).and the *DEPD Daemon Configuration File* (see the document *DEP/Linux User Manual*).