

EIBA Handbook Series

Release 3.0

Volume 3: System Specifications

Part 6: Application Interfaces

Chapter 3: External Message Interface

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1. Overview

The EIB device manufacturer has the choice either to develop a user application to be downloaded to the BAU („internal user application“) or to implement an external user application. In case of an external user application the communication with the local BAU is via external messages. All the external messages together build the "External Message Interface" (EMI) for which certain subsets are defined.

Communication between the periphery module and the BAU is based on message exchange via the serial PEI, see Chapter 3/6/2 "Physical External Interface".

All the following explanations of this document are valid for PEI 10, 12, 16 and 20 only. The subsequent clauses explain

- the general message format at the external message interface (clause 2 "EMI Message Format") without protocol overhead,
- how to let an external user application access to a certain EIB protocol layer (clause 3 "Layer Access Management"),
- and the subsets of the external message interface which are called Bus Monitor EMI, Data Link Layer EMI, Transport Layer EMI and User Layer EMI (clause 4 "Messages at the EIB Protocol Layer EMI"). In the corresponding sub-clauses the message formats available at each EMI subset is summarized.

2. EMI Message Format

Two EMI versions are defined: EMI 1.x and EMI 2.0. In the BAU-descriptions in Part 9/4 "BCU's and BIM's" you will find what EMI is supported for what BAU-type.

The EMI-versions differ in:

- layer access management
- available services
(where part of EMI 1.x is a subset of EMI 2.0)
- service encoding

The message format depends on the serial PEI-protocol (See Chapter 3/6/2 "Physical External Interface" of these Handbook Series).

Message Code Field

The message code field contains the code of the message (also called "service primitive") which depends on the EMI release. Please refer to Part 9/4 "BCU's and BIM's" of this Handbook.

3. Layer Access Management

Layer access management allows to give an application direct access to an EIB communication layer. In principle any EIB protocol layer may be switched on or off, so that each protocol layer may be directly accessed. But only a few switch combinations make really sense. The following sub-clause summarizes the useful ones and the consequences of them.

3.1 Useful Layer Interfaces and their Consequences for the Application Design

The following statements can be made:

- An internal user application can only run if all the EIB communication layers are switched on. This is true for the default "system status".
(Note: The system status was formerly called "config byte").
- Parallel I/O PEI (see Chapter 3/6/2 "Physical External Interface") also requires the default system status.
- The internal user application can only run if the PEI type expected by the internal user application corresponds to the PEI type measured at the A/D converter of the BAU.
- An external user application (i.e. one that is not situated at the BAU processor) needs serial PEI communication (via PEI 10, 12, 16 or 20) for communication with the local BAU. The local BAU may offer to the external user application an access to one of the following EIB communication layers:
 - to the EIB data link layer in bus monitor mode. The corresponding external interface is called bus monitor EMI. The external user application must be a bus monitor application.
 - to the EIB data link layer in normal mode. The corresponding external interface is called data link layer EMI.
 - to the EIB transport layer. The corresponding external interface is called transport layer EMI. The transport layer EMI exists in three versions:
 - full transport layer EMI
 - connection-oriented transport layer EMI
 - connection-less transport layer EMI
 - to the EIB user layer and to the internal user application. The corresponding external interface is called user layer EMI, and is identical to the default system status.

- Selecting access to an EIB Layer:

EMI 1.x (PEI 12, 16 or 20): use the PC_Set_Value.req-message

EMI 2.0 (PEI 10): LM_Switch.req-message

The description and use of these services is BAU implementation dependent, and are therefore not described in § 4. Please refer to the EMI description of the BAU's in Part 9/4 "BCU's and BIM's".

Consequences of the chosen access to an EIB communication layer for the application design:

- With bus monitor EMI, data link layer EMI and full transport layer EMI selected, the internal user application and the object servers will not run. Instead the external user layer must implement all the EIB communication layers above the chosen EMI.
- A broadcast communication relationship to the local device is possible in case it is brought to programming mode, independently of the chosen EMI. The external user application never has to implement the broadcast server functionality for the physical address object.
- With connection-oriented transport layer EMI selected, multicast communication relationships are possible between the internal user application and a remote partner device, i.e. group_object-oriented communication by the internal user application is possible. At the external user application a connection-oriented one-to-one communication relationship to a remote partner device is possible. Except for the group_object and the physical address object no object server will run at the local BAU.
- With connection-less transport layer EMI selected, one-to-one connection-oriented communication relationships are possible between the internal user application and a remote partner device. At the external user application connection-less one-to-one and multicast communication relationships are possible. The internal group_object server will not run.
- With default user layer EMI multicast communication relationships and either one-to-one connection-less or one-to-one connection-oriented communication relationships between the internal user application and a remote partner device are possible. The external user application may only communicate connection-oriented or connection-less with the local BAU respectively the internal user application. Speciality: Even if the internal user application does not run, because the PEI type expected is not identical to the PEI type measured at the A/D converter, the object server functionality is active.

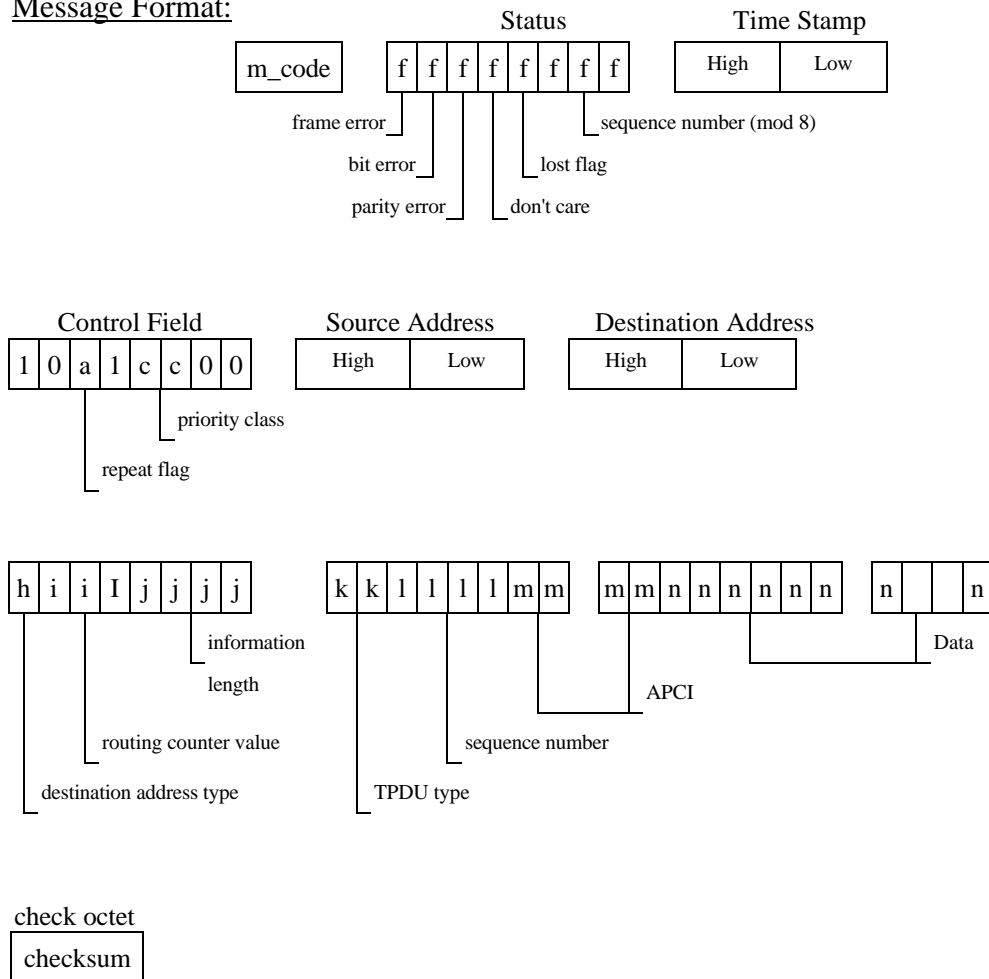
4. Messages at the EIB Protocol Layer EMI

4.1 Bus Monitor EMI

In bus monitor mode exactly the L_Busmon.ind message and the LM_Reset.ind message are available.

4.1.1 L_BUSMON.ind message

Message Format:



Status (octet 2):

- **Sequence number (bit numbers 0...2):** Each received frame lets the data link layer increment the modulo 8 value of the sequence number. The least significant bit of octet 2 is also the least significant bit of the sequence number.
- **Lost flag (bit number 3):** Lost flag set means that at least one frame or frame piece was lost by the bus monitor. Note: The difference between the sequence number of the previous BUSMON.ind without lost flag set and the sequence number of the BUSMON.ind with lost flag set may not reflect exactly the number of lost frames or frame pieces.
- **Overflow flag (bit number 4):** The overflow flag is set.
- **Parity error flag (bit number 5):** An invalid parity bit was detected in one or several of the frame bits.
- **Bit error flag (bit number 6):** An invalid bit was detected in one or several of the frame characters.
- **Frame error flag (bit number 7):** A frame error was detected in one or several of the frame bits.

Time stamp (octets 3 and 4): Time stamp is a 16 bit value and refers to the relative time taken exactly at the time when the frame's control field is completely received at the data link layer. The time is the value of the free-running counter of the BAU. The time unit ("tick") depends on the clock rate of the BAU microcontroller.

Octet 5 (control field) to octet n-1 (= octet before the FCS octet): received Data link layer PDU; n is less than or equal to 27.

FCS octet: The value of the FCS octet is the FCS value received from the EIB bus. It is the task of the external bus monitor application to check its correctness.

4.1.2 LM_Reset.ind message

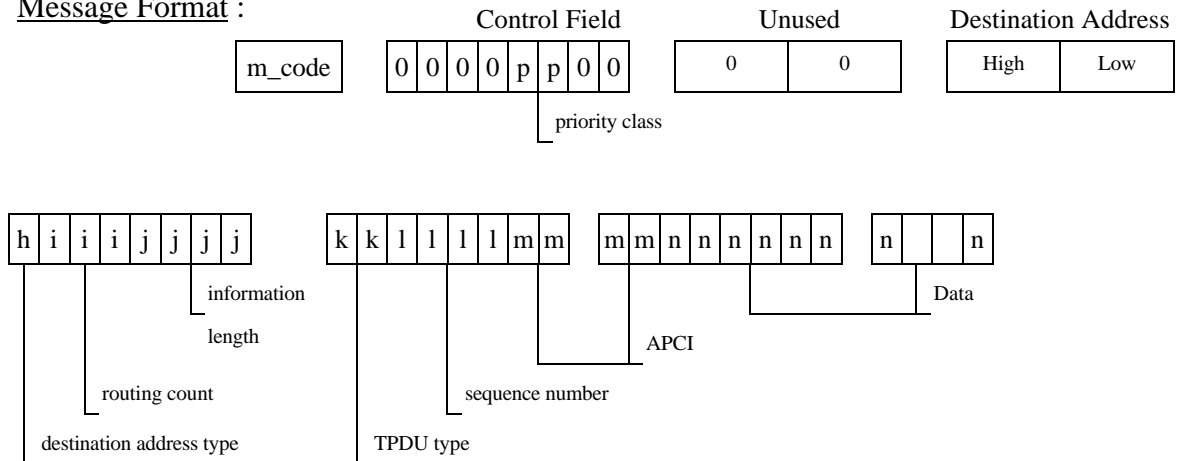
This message is protocol dependent. It is described in Chapter 3/6/2 "Physical External Interface" of this Handbook.

4.2 Data Link Layer EMI

In data link layer normal mode exactly the L_Data.req, L_Data.ind, L_Data.con and the L_Polldata.req / L_Polldata.con messages are available.

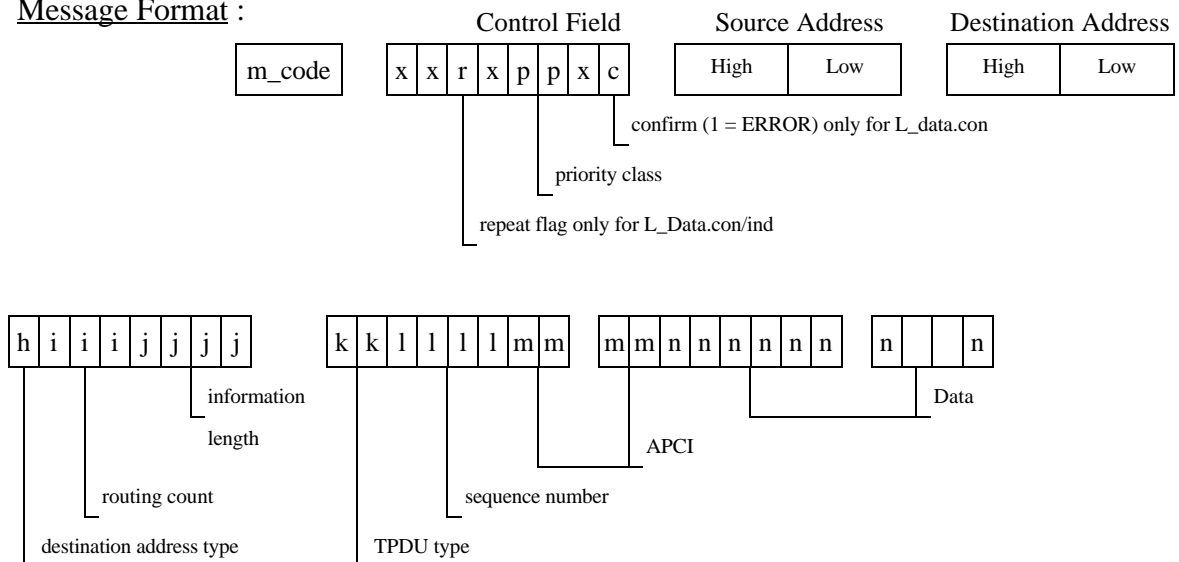
4.2.1 L_Data.req message

Message Format :



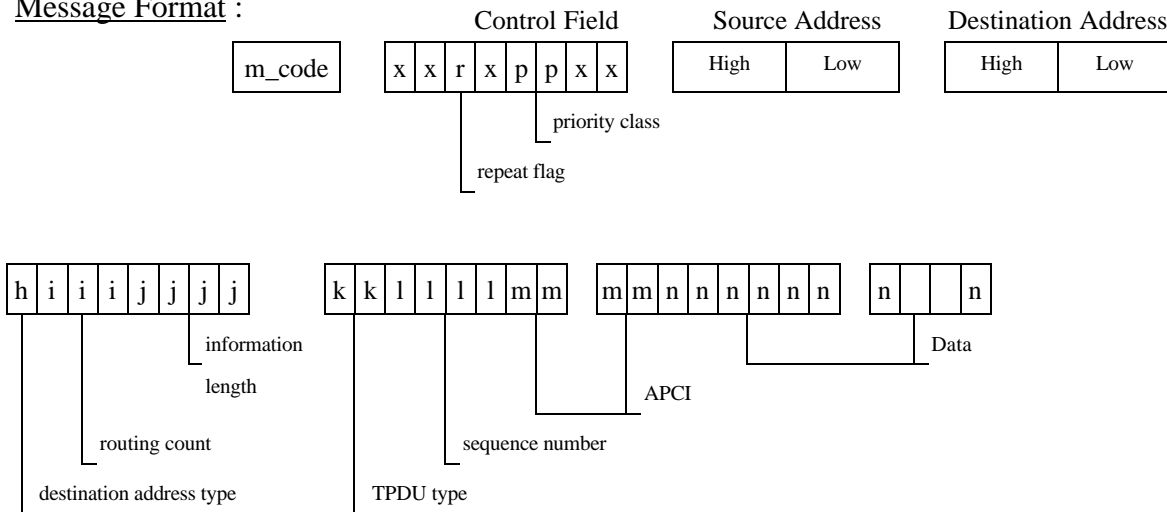
4.2.2 L_Data.con message

Message Format :



4.2.3 L_Data.ind message

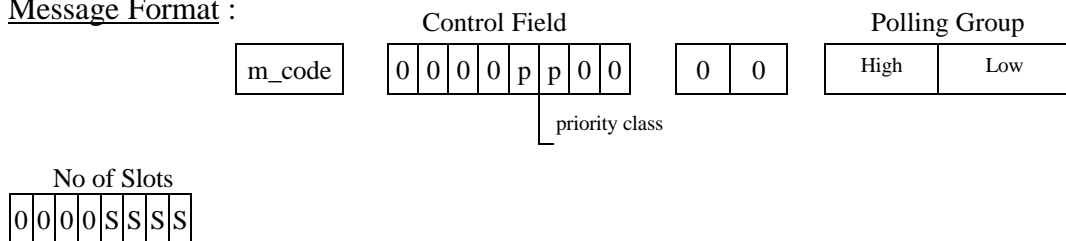
Message Format :



The L_Data.con message exists in a positive and a negative version. Both versions differ in the value of error flag contained in the control field octet: the positive L_Data.con message has the error flag reset, the negative one set.

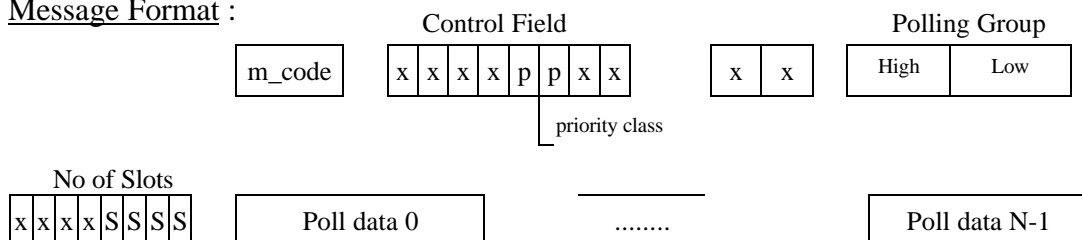
4.2.4 L_Poll_Data.req message

Message Format :



4.2.5 L_Poll_Data.con message

Message Format :



4.2.6 L_Poll_Data_Update.req message

To be defined.

4.2.7 L_Poll_Data_Update.con message

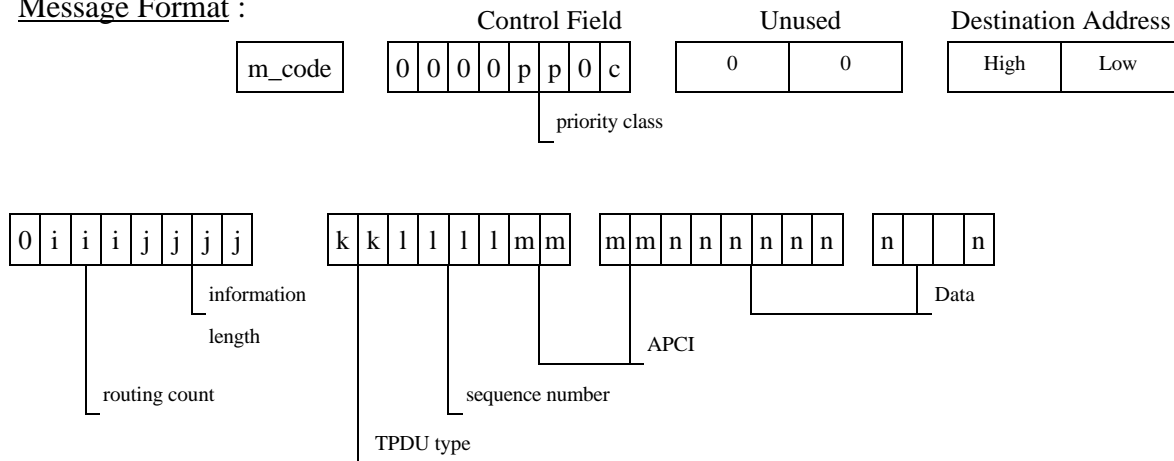
To be defined.

4.3 Network Layer EMI

In Network layer mode exactly the N_Data.req, N_Data.con, N_Data.ind, N_Groupdata.req, N_Groupdata.con, N_Groupdata.ind, N_broadcast.req, N_broadcast.con and N_broadcast.ind messages are available.

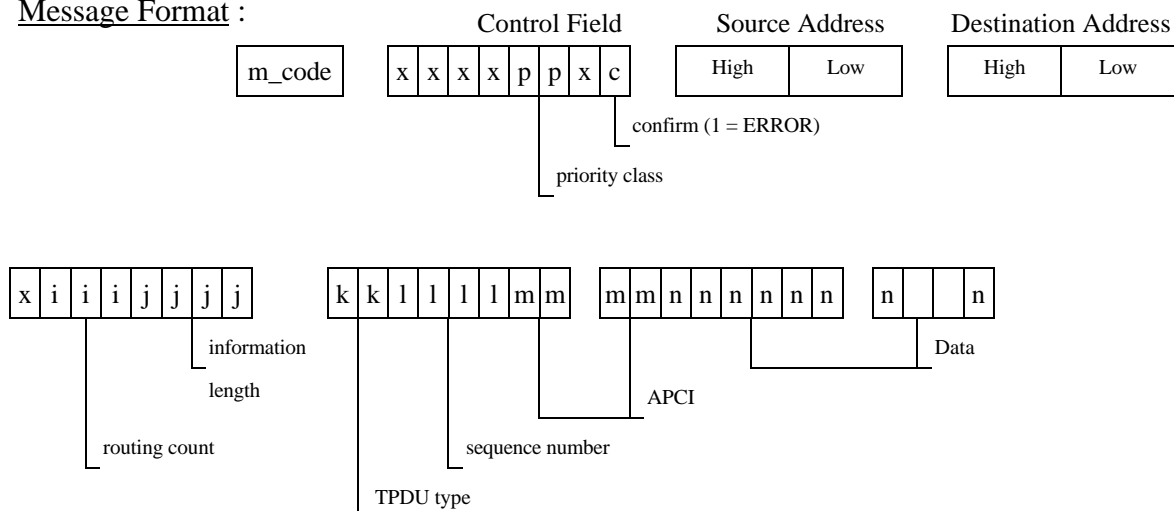
4.3.1 N_Data.req and N_GroupData.req message

Message Format :



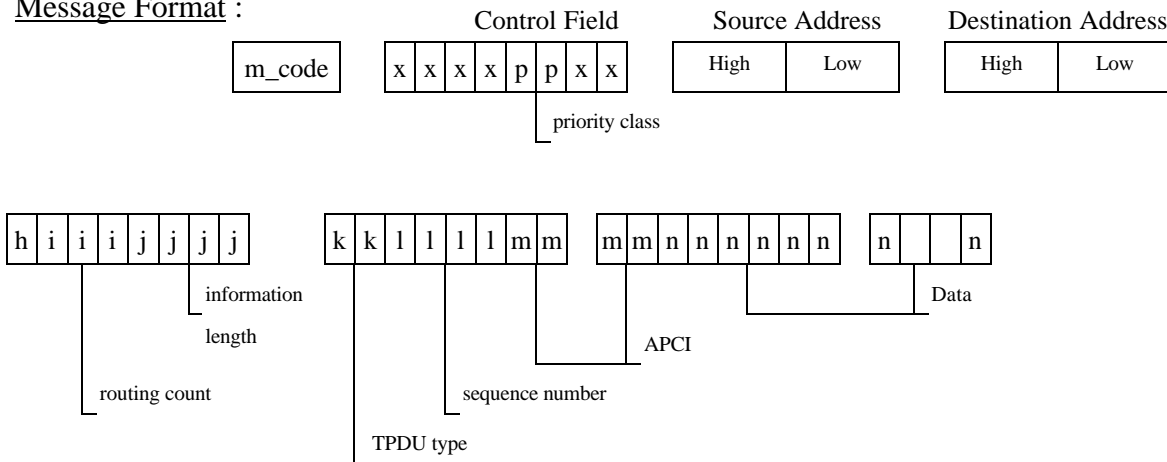
4.3.2 N_Data.con and N_GroupData.con message

Message Format :



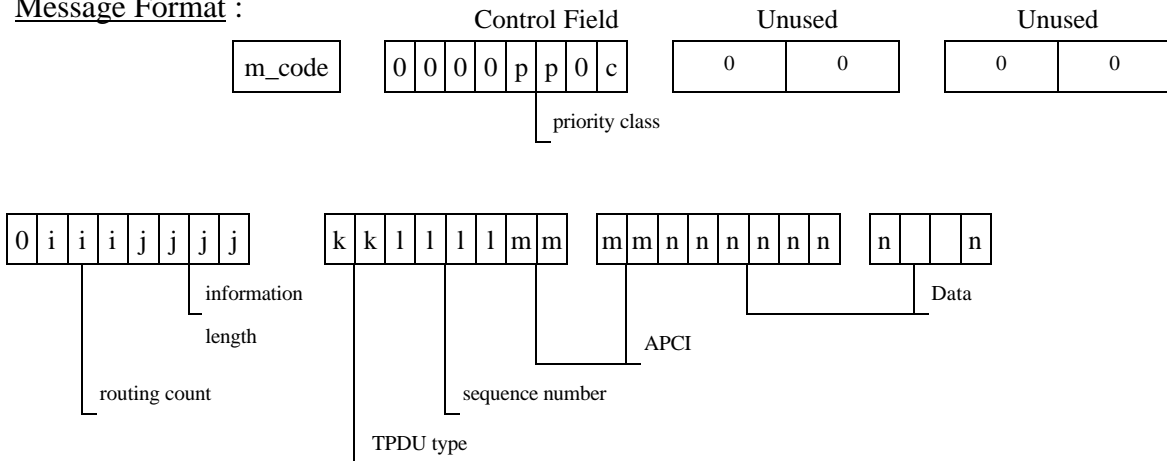
4.3.3 N_Data.ind and N_GroupData.ind message

Message Format :



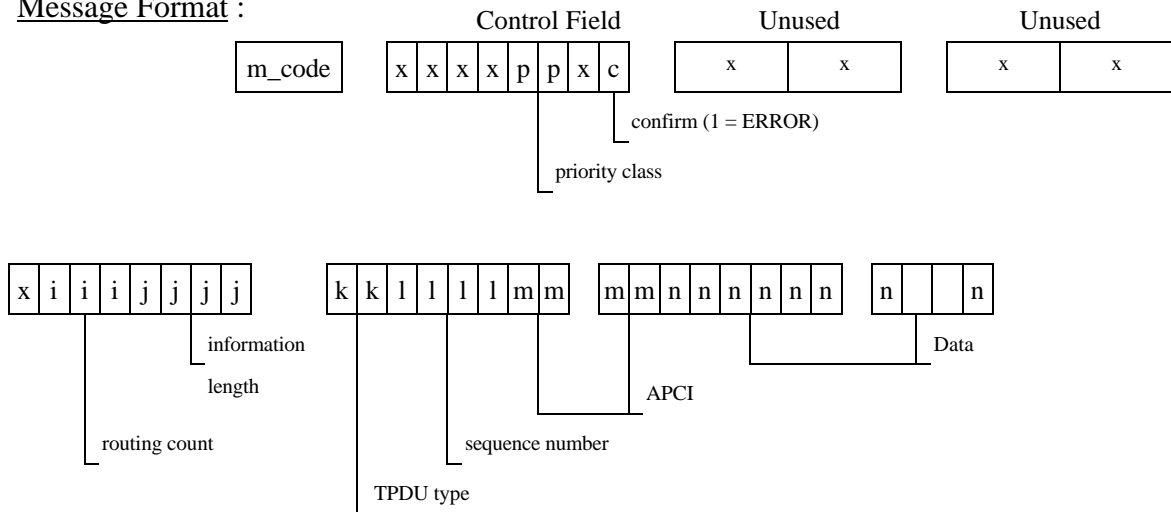
4.3.4 N_Broadcast.req message

Message Format :



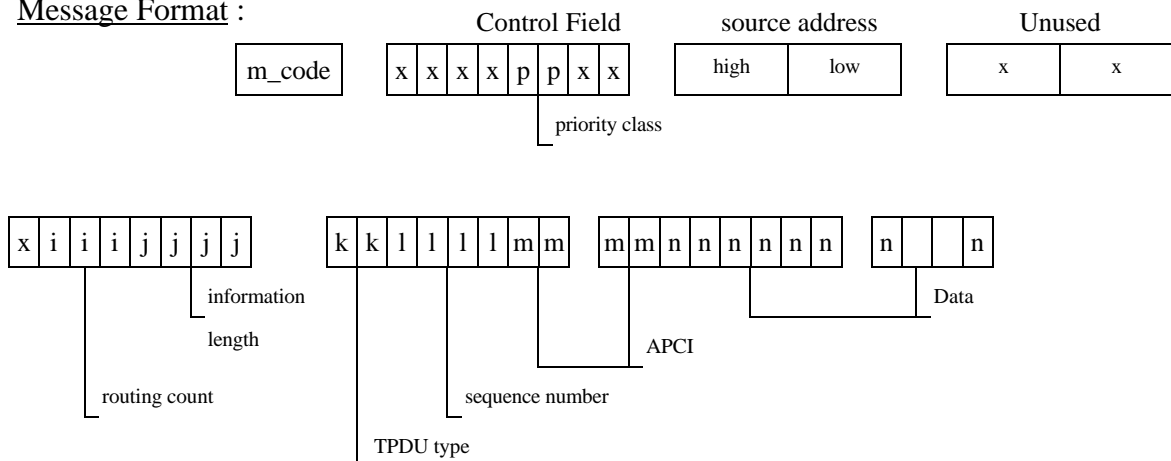
4.3.5 N_Broadcast.con message

Message Format :



4.3.6 N_Broadcast.ind message

Message Format :



4.4 Transport Layer EMI

The full transport layer EMI consists of the connection-oriented transport layer EMI and the connection-less transport layer EMI.

The connection-oriented transport layer EMI consists of exactly the T_Connect.req, T_Connect.ind, T_Connect.con, T_Disconnect.req, T_Disconnect.ind, T_Disconnect.con, T_Data.req, T_Data.ind and T_Data.con.

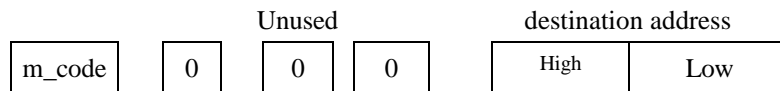
The connection-less transport layer EMI consists of exactly the T_Data_Unack.req, T_Data_Unack.ind, T_Data_Unack.con, T_Broadcast.req, T_Groupdata.req, T_Groupdata.ind and T_Groupdata.con.

The T_Data.con and T_Groupdata.con messages exist in a positive and a negative version. Both versions differ in the value of the error flag contained in the control field octet: the positive message has the error flag reset, the negative one set.

The T_Data.req, T_Data.ind, T_Data.con, T_Data_Unack.req, T_Data_Unack.ind, T_Data_Unack.con, T_Broadcast.req, T_Groupdata.req, T_Groupdata.ind and T_Groupdata.con messages allow to transfer APDU's. See Chapter 3/3/4 "Transport Layer" and Chapter 3/3/7 "Application Layer" for the APDU formats allowed to be transferred with the respective service.

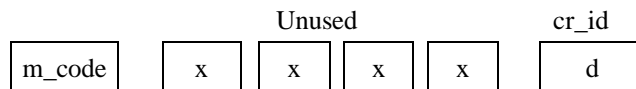
4.4.1 T_Connect.req message

Message Format :



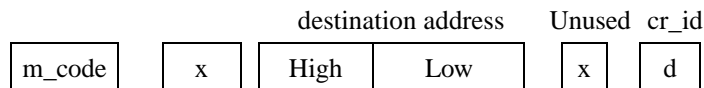
4.4.2 T_Connect.con message

Message Format :



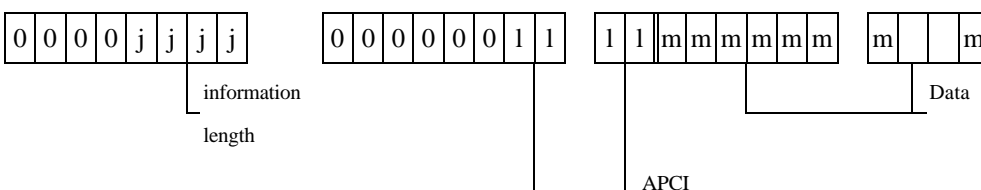
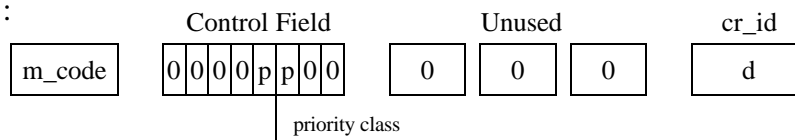
4.4.3 T_Connect.ind message

Message Format :



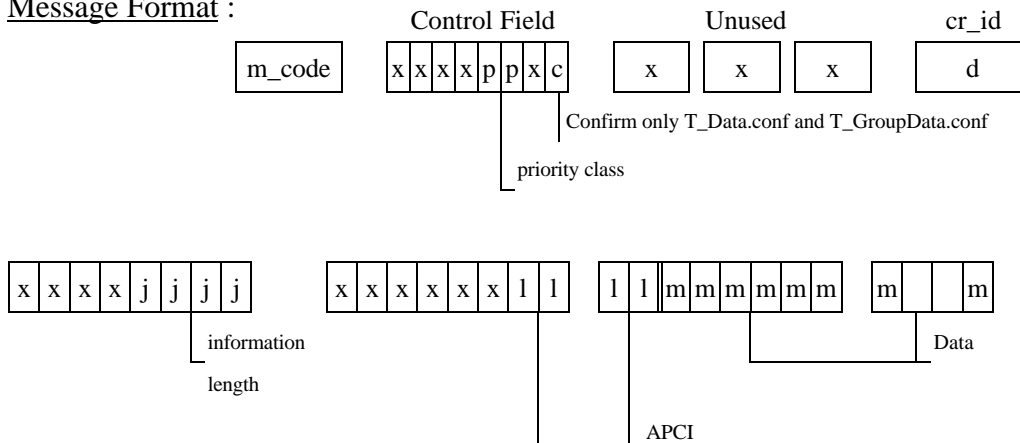
4.4.4 T_Data.req and T_GroupData.req message

Message Format :



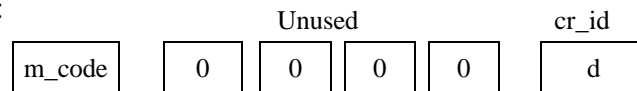
4.4.5 T_Data.con/ind and T_GroupData.con/ind message

Message Format :



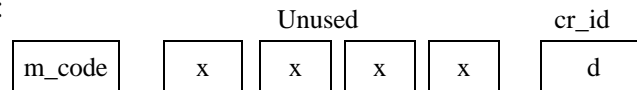
4.4.6 T_Disconnect.req message

Message Format :



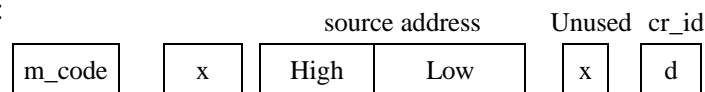
4.4.7 T_Disconnect.con message

Message Format :



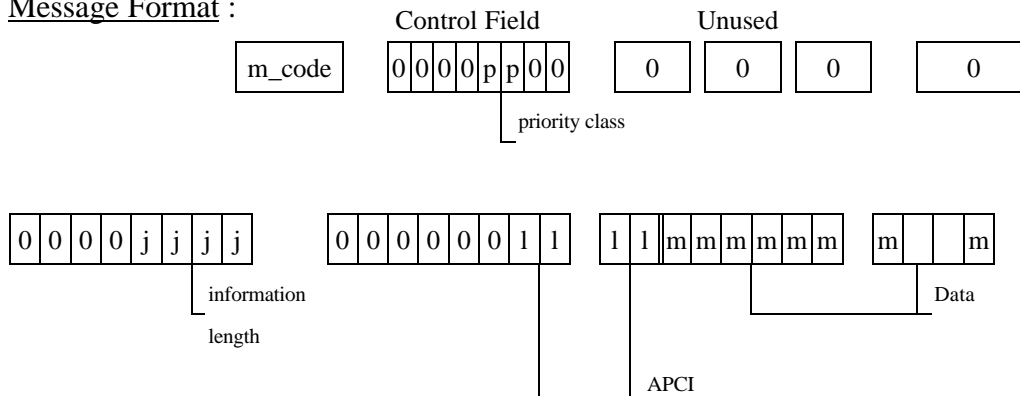
4.4.8 T_Disconnect.ind message

Message Format :



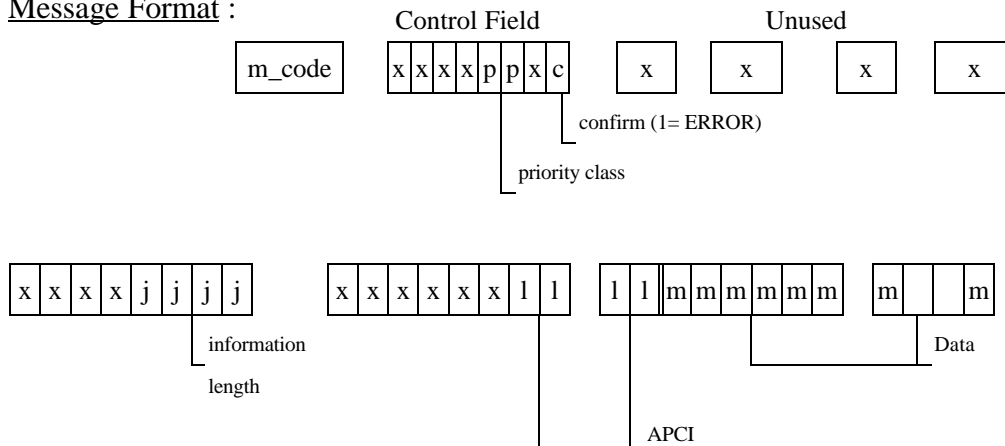
4.4.9 T_Broadcast.req message

Message Format :



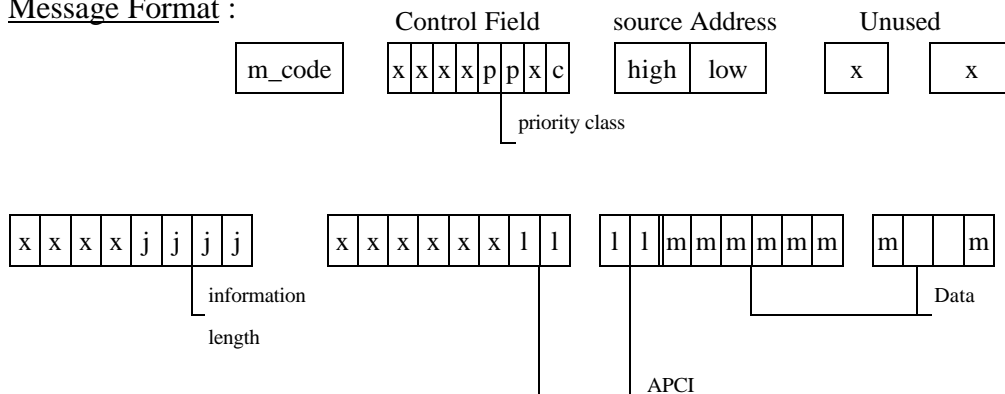
4.4.10 T_Broadcast.con message

Message Format :



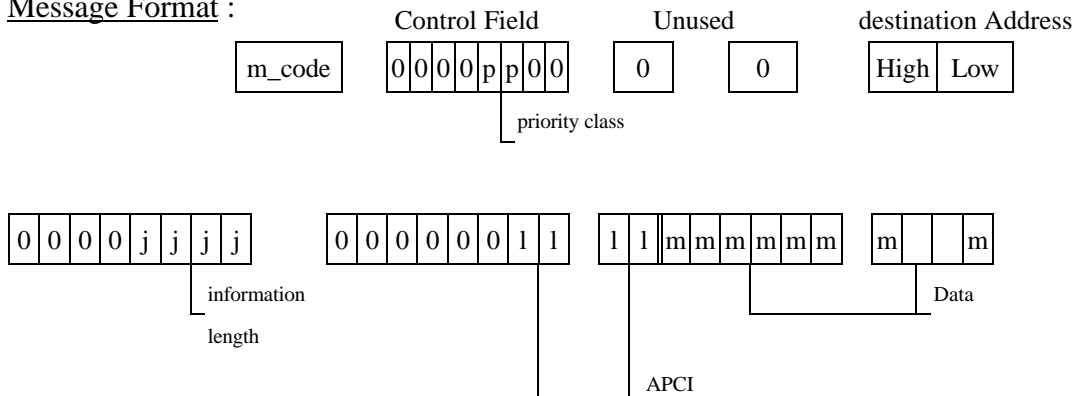
4.4.11 T_Broadcast.ind message

Message Format :



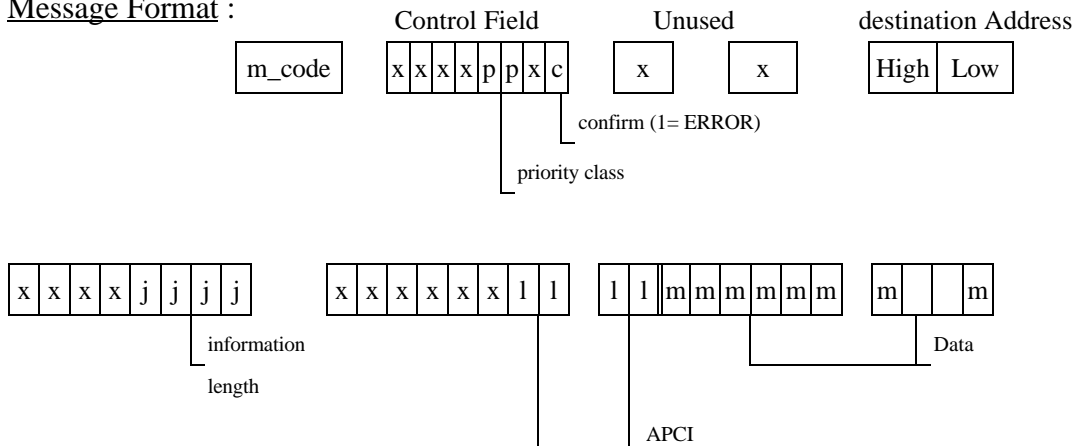
4.4.12 T_Unack.req message

Message Format :



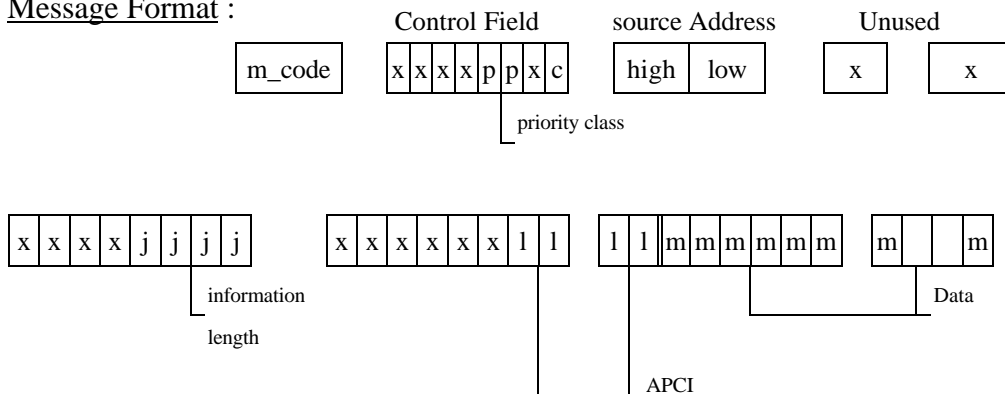
4.4.13 T_Unack.con message

Message Format :



4.4.14 T_Unack.ind message

Message Format :

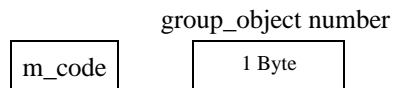


4.5 User Layer (i.e. Default) EMI

The user layer EMI consists of exactly the U_Value_Read.req, U_Value_Read.con, U_Value_Write.req, U_Flags_Read.req, U_Flags_Read.con, U_Event.ind, U_Userdata.req, and U_Userdata.ind message.

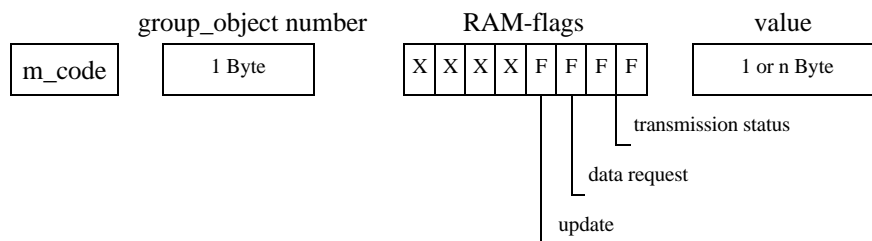
4.5.1 U_Value_Read.req message

Message Format :



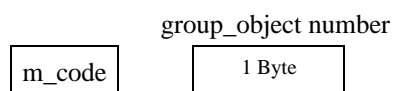
4.5.2 U_Value_Read.con message

Message Format :



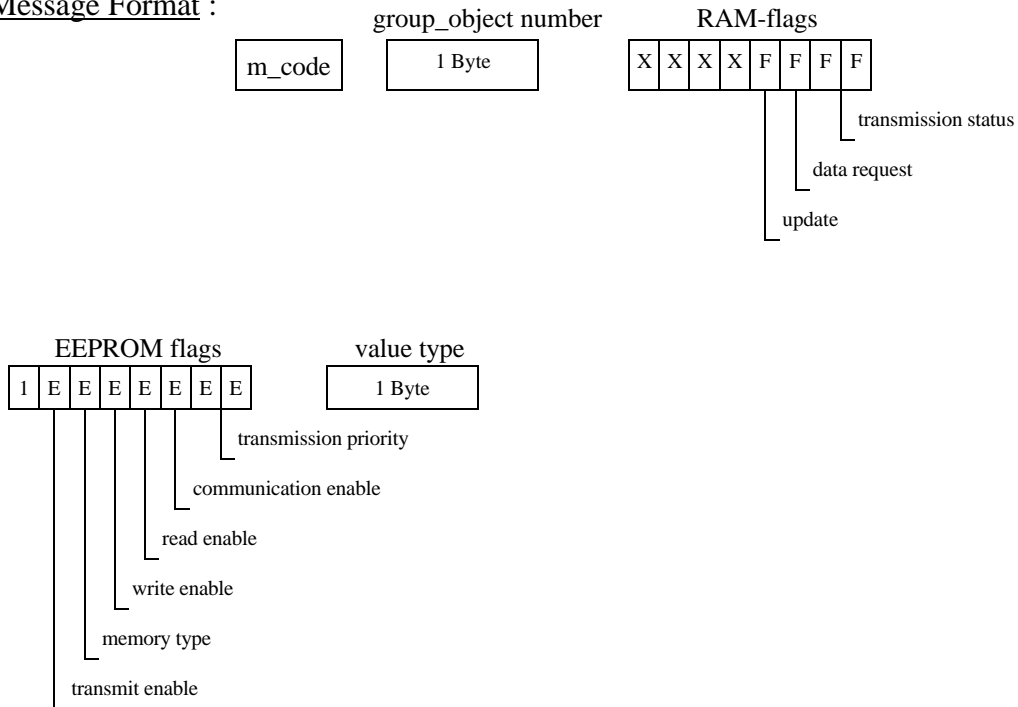
4.5.3 U_Flags_Read.req message

Message Format :



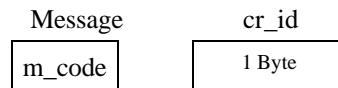
4.5.4 U_Flags_Read.con message

Message Format :



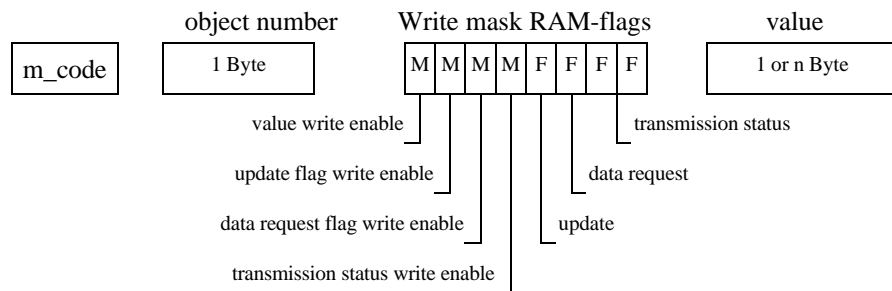
4.5.5 U_Event.ind message

Message Format :

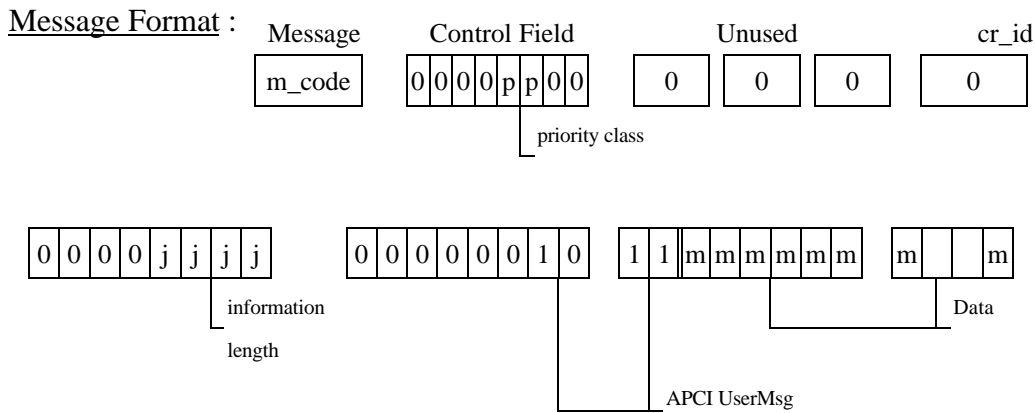


4.5.6 U_Value_Write.req message

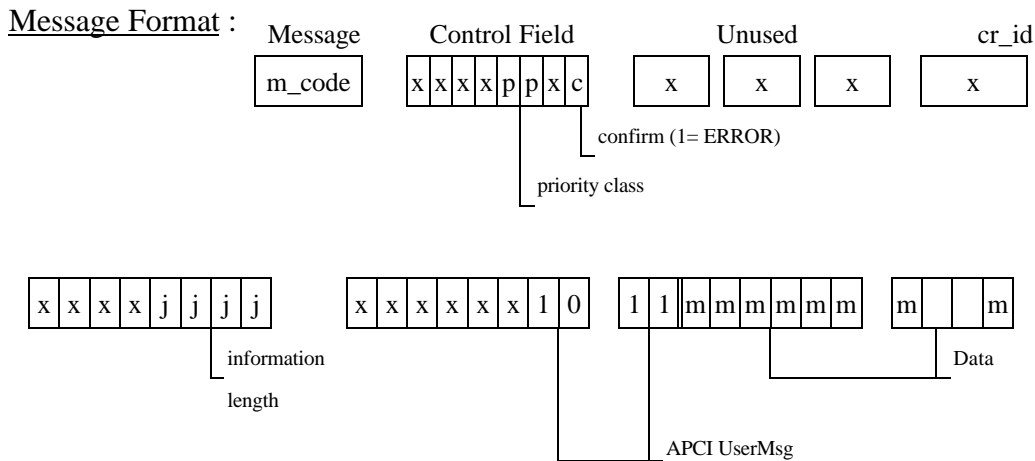
Message Format :



4.5.7 U_Userdata.req message

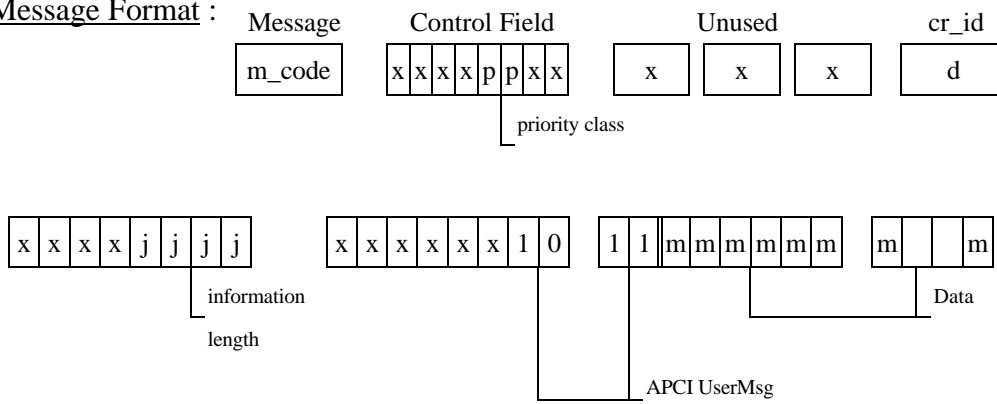


4.5.8 U_Userdata.con message



4.5.9 U_Userdata.ind message

Message Format :



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