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Dialogic® SS7 Protocols

MTP2 Programmer's Manual

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Revision History

Issue No.	Part No.	Date	Description of Changes
12	05-2331-003	09-Apr-10	Included support for High Speed Signaling Links.
11	05-2331-002	20-Apr-07	Changed to Dialogic format.
10	05-2331-002	29-Apr-04	Improved PDF file browsind and navigation capabilities.
9	Not applicable	19-Apr-04	Manual now references specific SS7 boards. Applicable to MTP2 software core revision V5.xx
8	Not applicable	10-Apr-01	Minor typographical updates.
7	Not applicable	01-Jun-98	Preventive Cyclic Retransmission (PCR) method of error correction added. Ability to generate 2 octet LSSUs added as an option. Ability to operate in receive only mode for monitoring applications added. Applicable to MTP2 software core revision V4.xx.
6	Not Applicable	19-Jan-96	Primitive indications to MTP3 (the upper module) now contain the l3_link_id instead of the l2_llid. CLEAR_GARBAGE action request removed and Congestion statistics added to the READ_STATISTICS message. Multiple congestion thresholds added and SL_FAILURE message changed to L2_Q791_EVENT with additional S7G_ events. No longer uses the Global Configuration Table for data storage area. Document format revised. Applicable to MTP2 software core revision V3.xx.
5	Not Applicable	06-Nov-93	Applies to MTP2 software core revision V2.xx.

Note: The latest released issue of this guide can be found at:
http://www.dialogic.com/support/helpweb/signaling

Chapter 1: Introduction

Signaling System Number 7 (SS7), as defined by the ITU-T and other national standards bodies, defines a Message Transfer Part (MTP) for the reliable transfer of messages between different nodes within a telephony network.

The Signaling Data Link part of the MTP is known as MTP Level 2, as specified in ITU-T recommendation Q.703, ANSI T1.111.3, and as used by many other national and international standards bodies. It provides reliable point-to-point communication over typically 64kbit/s physical signaling links.

This manual relates to the MTP2 software implementation used on Dialogic® DSI SS7 Boards. It is applicable to the following boards: Dialogic® DSI SS7MD Network Interface Boards, Dialogic® DSI SS7HD Network Interface Boards and Dialogic® DSI SPCI Network Interface Boards.

The manual is intended for use by developers who are intending to use the SS7 board level products in conjunction with message-based configuration.

This manual is not applicable to DSI SS7 board users that utilize the s7_mgt protocol configuration utility or for users of the following Dialogic® DSI Components: Dialogic® DSI SS7G3x Signaling Servers, Dialogic® DSI SS7G2x Signaling Servers.

1.1 Applicability

This document details the interface to the MTP2 module, including full details of all run-time configuration options. It applies to revisions of the MTP2 module commencing with a major revision number of 5 (for example, V5.00 and later). The module version can be read back using the GEN_MSG_MOD_IDENT message described later in this manual.

1.2 Related Information

Refer to the following documents for related information:

- *Dialogic® Distributed Signaling Interface Components -Software Environment Programmer's Manual – U10SSS*
- *Dialogic® DSI SS7HD Network Interface Boards Programmer's Manual – 05-2063-xxx*
- *Dialogic® DSI SPCI Network Interface Boards Programmer's – U03HSP*
- ITU-T Recommendation Q.703
- ITU-T Recommendation Q.791
- ANSI T1.111.3

For more information on the SS7 products provided by Dialogic, visit http://www.dialogic.com/support/helpweb/signaling/.

Chapter 2: Functional Overview

2.1 MTP2 Module Overview

The functions within MTP2 can be divided into two categories:

- The high level functions include Link State Control, Initial Alignment Control, Transmission Control and Reception Control.
- The low level functions include signal unit delimitation and alignment, error detection, and signal unit error monitoring.

High Level Functions

The MTP2 module is a full implementation of the high level functions, including:

- Link alignment (normal and emergency)
- Generation of level 2 header information
- Buffering transmission and retransmission of Message Signal Units (MSU)
- Validation and acknowledgement of received signal units
- Generation and transmission of Link Status Signal Units (LSSU)
- Congestion control

The MTP2 module services MTP3 requests and issues indications to MTP3 and to management. The module supports the level 2 monitoring and measurement features defined in ITU-T Recommendation Q.791. The MTP2 module is common to all Dialogic® DSI SS7 boards to which this manual applies.

Low Level Functions

The low level functions are provided by a combination of dedicated hardware and the associated device drivers that are completely embedded within the DSI SS7 board and that vary slightly between the different board types. The features implemented within the driver and dedicated hardware include:

- Signal unit delimitation and alignment
- CRC generation and checking
- Octet counting
- Link Status Signal Unit (LSSU) repetition
- Fill In Signal Unit (FISU) generation
- Length indicator checking
- Signal unit error rate monitoring.

2.2 Feature Overview

Features of the MTP2 implementation include:

- Full implementation of ITU-T Recommendation Q.703 (1988 to 1996).
- Support for ANSI T1.111.3 operation.
- Support for Japan NTT/TTC operation.
- Support for multiple signaling links, each operating independently.
- Support for Signaling Information Field (SIF) lengths up to 272 octets.
- Support for both Basic and PCR methods of error correction.
- Support for single and multiple congestion levels.
- Message oriented interface.
- Flexible per-link run-time configuration capabilities.
- Comprehensive trace options for selectively reporting to system management each primitive issued to or by the MTP2 module on a per link basis.
- Run-time per-link timer value configuration

- Automatic link performance statistics accumulation.
- Management monitoring and measurements in accordance with Q.791.

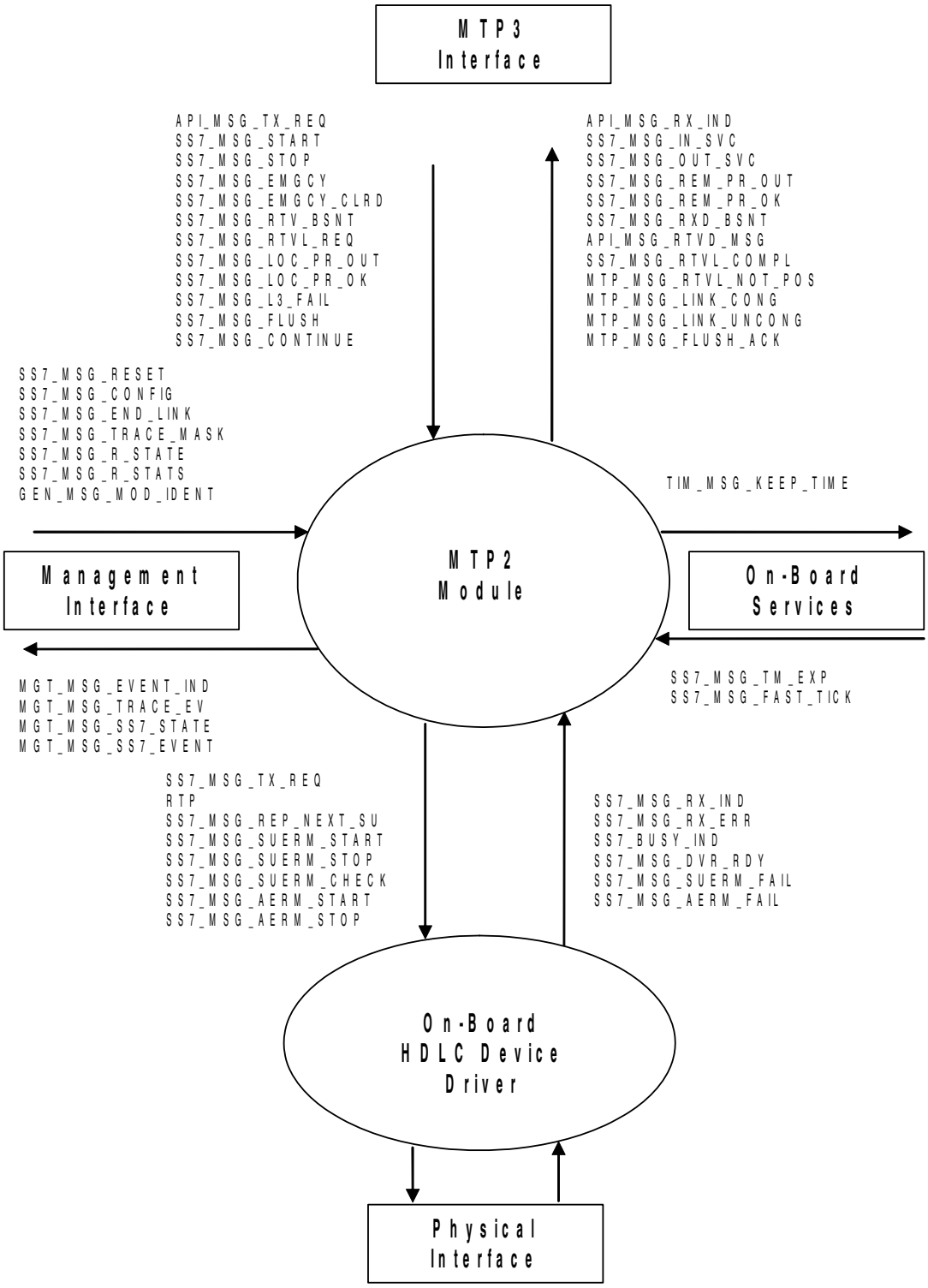
2.3 General Description

The interface to the MTP2 module is entirely message based using the structured messages documented in the Software Environment Programmer's Manual. The module is capable of working in conjunction with an MTP3 module running either on the same DSI SS7 board or running on the host processor. Furthermore, using the interface specified in this manual, MTP2 can be used in conjunction with third party MTP3 implementations if required.

Figure 1 provides an overview of the MTP2 module showing the various interfaces.

The MTP2 module supports multiple physical channels, each supporting one SS7 Signaling Link. Each link is maintained independently of the others. Links are identified by a level 2 logical link identifier (**l2_llid**). The **l2_llid** values run from 0 to one less than the number of links supported and are used to identify the link in all messages sent to the MTP2 module. At configuration time, a level 3 link identifier is associated with each link and this is used in indications issued to the MTP3 module.

Figure 1. MTP2 Context Diagram



2.4 Physical Layer Configuration

Proper operation of the MTP2 module requires correct configuration of the underlying physical layer. This varies depending on the DSI SS7 board type in use. For details, refer to the Programmer's Manual for the specific DSI SS7 board type.

All DSI SS7 boards use the Board Configuration request (MGT_MSG_CONFIG0) to set up basic physical configuration such as clocking and the CT bus. Dialogic® DSI SPCI Network Interface Boards also use this message to configure per-link (up to a maximum of four links) Layer 1 parameters such as, data rate, physical source, timeslot, clocking. Dialogic® DSI SS7HD Network Interface Boards use a separate per-link message (MGT_MSG_L1_CONFIG) for configuration of all Layer 1 parameters. In all cases, Layer 1 configuration should take place prior to configuring a link at MTP2.

Chapter 3: Message Reference

This section describes the individual messages and associated parameters that may be sent to or received from an Dialogic® DSI SS7 board when interfacing to the MTP2 module running on the board. The interface is a message-based interface using messages of type MSG as defined in the Software Environment Programmer's Manual.

These messages are used for the primitive protocol interface with the MTP3 module and for the non-primitive interface to management for the purposes of configuring and managing MTP2 signaling links.

The messages are grouped into the following categories:

- Protocol Requests from MTP3 to MTP2
- Protocol Indications from MTP2 to MTP3
- Management Requests Sent to MTP2
- Management Indications Issued by MTP2

3.1 Protocol Requests from MTP3 to MTP2

Primitive protocol requests are sent from MTP3 to MTP2 in accordance with published MTP2 recommendations. The primitive names used for the MTP2 module are closely aligned with the terminology used in ITU-T Recommendation Q.703.

This section of the manual is applicable only to users intending to write or interface to their own MTP3 implementation. When using MTP3 from the Dialogic® DSI SS7 Product Range, this interface is already implemented within the MTP3 module.

The list of protocol requests sent from MTP3 to MTP2 includes:

- API_MSG_TX_REQ – Message for Transmission Request
- SS7_MSG_START – MTP2 Start Request
- SS7_MSG_STOP – MTP2 STOP Request
- SS7_MSG_EMGCY – MTP2 Set Emergency Request
- SS7_MSG_EMGCY_CLRD – MTP2 Cancel Emergency Request
- SS7_MSG_RTV_BSNT – MTP2 BSNT Retrieval Request
- SS7_MSG_RTVL_REQ – MTP2 Retrieval Request
- SS7_MSG_LOC_PR_OUT – MTP2 LPO Request
- SS7_MSG_LOC_PR_OK – MTP2 LPO Recovered Request
- SS7_MSG_L3_FAIL – MTP2 Level 3 Failure Request
- SS7_MSG_FLUSH – MTP2 Flush Request
- SS7_MSG_CONTINUE – MTP2 Continue Request

When sending messages to MTP2, the user should ensure that the message is sent to the correct **board_id**, the correct **module_id** and the correct Layer 2 Logical Link ID (**l2_llid**).

Prior to sending any message to the board, the application should call the **GCT_set_instance( )** library function to select the board to which the message is to be sent.

The **hdr->dst** field of the message should be initialized to the correct MTP2 **module_id** for the board in use. DSI SS7HD boards have multiple signaling processors, each running its own MTP2 instance that uses a different **module_id**. Other boards have only one MTP2 instance and therefore use a single MTP2 **module_id**.

The **hdr->id** field of the message should be set to the correct **l2_llid**, which is in the range of 0 to one less than the number of signaling links supported by each MTP2 instance.

The **hdr->rsp_req** field may optionally be used to request a confirmation. If requested, the MTP2 module confirms acceptance of the primitive by sending the message back to its originator with bit 14 cleared in the type field of the message. This mechanism is described in detail in the *Software Environment Programmer's Manual*.

Note: Normal MTP3 operation does not require a response from MTP2 for these primitives. However, the mechanism is useful for debugging an application.

3.1.1 API_MSG_TX_REQ – Message for Transmission Request

Synopsis

Message issued to board by MTP3 containing SS7 Message Signal Unit (MSU) for transmission to the network on specified signaling link.

Message Format

Message Header	
Field Name	**Meaning**
type	API_MSG_TX_REQ (0xcf00)
id	l2_llid
src	Originating module_id
dst	MTP2 module ID
rsp_req	0
hclass	0
status	0
err_info	0
len	Number of octets in Message Signal Unit (MSU)

Parameter Area		
OFFSET	**SIZE**	**NAME**
0	len	MSU data in binary format commencing with the Service Information Octet (SIO).

3.1.2 SS7_MSG_START – MTP2 Start Request

Synopsis

Primitive issued by MTP3 to request MTP2 to start the initial alignment procedure for the specified link.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_START (0xc204)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP3 to request that MTP2 commence the initial alignment procedure. If the procedure is successful, an **In Service** indication is issued; if alignment fails, an **Out of Service** indication is issued.

If an EMERGENCY condition exists, then MTP3 should send an SS7_MSG_EMGCY message to MTP2 prior to sending the Start Request.

Changes of EMERGENCY condition can be notified by MTP3 to MTP2 both prior to sending the Start request and during Link Alignment.

Note: Receipt of a confirmation message (if requested) does not imply that the initial alignment procedure has been completed, merely that MTP2 has recognized the request to start the procedure.

3.1.3 SS7_MSG_STOP – MTP2 STOP Request

Synopsis

Primitive issued by MTP3 to request MTP2 to stop a signaling link.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_STOP (0xc205)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP3 to request that MTP2 stops the operation of a signaling link. The link is taken to the out of service state without further indications being issued to MTP3.

Once a link has been stopped, MTP3 may request BSNT and initiate message retrieval if required.

3.1.4 SS7_MSG_EMGCY – MTP2 Set Emergency Request

Synopsis

Primitive issued by MTP3 to request that MTP2 use the emergency proving period on the next attempt at link alignment.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_EMGCY (0xc207)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP3 prior to issuing the Start request or during initial alignment to cause the next attempt at link alignment to use the emergency proving period instead of the normal proving period.

3.1.5 SS7_MSG_EMGCY_CLRD – MTP2 Cancel Emergency Request

Synopsis

Primitive issued by MTP3 to cancel a previous Emergency request.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_EMGCY_CLRD (0xc208)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
len	0

Description

This primitive is issued by MTP3 prior to cancelling any previous Emergency requests and causes the next attempt at link alignment to use the normal proving period.

3.1.6 SS7_MSG_RTV_BSNT – MTP2 BSNT Retrieval Request

Synopsis

Primitive issued by MTP3 to MTP2 requesting the Backward Sequence Number Transmitted (BSNT).

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_RTV_BSNT (0xc209)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP3 to request the sequence number of the last signal unit to be acknowledged, that is, the BSNT. The response is issued by MTP2 as an SS7_MSG_RXD_BSNT indication.

3.1.7 SS7_MSG_RTVL_REQ – MTP2 Retrieval Request

Synopsis

Primitive issued by MTP3 to MTP2 requesting retrieval of unacknowledged messages.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_RTVL_REQ (0xc20a)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
err_info	0
len	1 or 6

Parameter Area		
OFFSET	**SIZE**	**NAME**
0	1	FSNC
1	1	Reserved (set to zero)
2	4	Extended FSNC

Description

This primitive is issued by MTP3 to request retrieval of all unacknowledged messages from the retransmission buffer and the transmission buffer, commencing with the message containing a sequence number immediately following the Forward Sequence Number Confirmed (FSNC) provided in the parameter area of the message. These messages can then be retransmitted by MTP3 over an alternative signaling link.

MTP2 responds with zero, one, or more API_MSG_RTVD_MSG indications, followed by an SS7_MSG_RTVL_COMPL indication. Only messages with an FSN greater than the given FSNC are retrieved.

For high speed links using 12 bit sequence numbers, the extended FSNC field should be set to the required sequence number and FSNC set to 0x80.

3.1.8 SS7_MSG_LOC_PR_OUT – MTP2 LPO Request

Synopsis

Primitive issued by MTP3 (or management) to notify MTP2 of a local processor outage condition.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_LOC_PR_OUT (0xc20b)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued either by MTP3 or by management to notify MTP2 of a local processor outage condition and to request that MTP2 take the appropriate action to deal with such a condition.

3.1.9 SS7_MSG_LOC_PR_OK – MTP2 LPO Recovered Request

Synopsis

Primitive issued by MTP3 (or management) to notify MTP2 that the local processor outage condition has cleared.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_LOC_PR_OK (0xc20c)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued either by MTP3 or by management to notify MTP2 that the local processor outage condition has cleared and to request that MTP2 take the appropriate action to deal with such a condition.

3.1.10 SS7_MSG_L3_FAIL – MTP2 Level 3 Failure Request

Synopsis

Primitive issued by management to notify MTP2 of a failure of the MTP3 process.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_L3_FAIL (0xc20d)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by management to advise MTP2 of a failure condition either within MTP3 or within the communications leading to MTP3 and to request that MTP2 take the appropriate action to deal with such a condition.

Within MTP2, the action taken on receipt of this message is identical to that on receipt of SS7_MSG_LOC_PR_OUT.

3.1.11 SS7_MSG_FLUSH – MTP2 Flush Request

Synopsis

Primitive issued by MTP3 to MTP2 during processor outage to flush out messages from the transmit and retransmit buffers.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_FLUSH (0xc212)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP3 during a period of remote processor outage if MTP3 timer T1 expires. It causes MTP2 to discard any messages currently stored in the transmit and retransmit buffers.

On completion of buffer flushing, MTP2 responds by sending MTP_MSG_FLUSH_ACK to MTP3 and expects MTP3 to issue an SS7_MSG_CONTINUE message to allow normal operation to resume.

3.1.12 SS7_MSG_CONTINUE – MTP2 Continue Request

Synopsis

Primitive issued by MTP3 to MTP2 following a period of processor outage to instruct MTP2 to continue normal operation.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_CONTINUE (0xc211)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required.
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP3 following a period of processor outage to instruct MTP2 to continue normal operation. It may be sent either during the period that MTP3 timer T1 is still running as a result of processor outage clearing or on expiry of T1 after MTP3 has first issued SS7_MSG_FLUSH and received an MTP_MSG_FLUSH_ACK message in response from MTP2.

3.2 Protocol Indications from MTP2 to MTP3

Primitive protocol indications are sent from MTP2 to MTP3 in accordance with published MTP2 recommendations. The primitive names used for the MTP2 module are closely aligned with the terminology used in ITU-T Recommendation Q.703.

This section of the manual is applicable only to users intending to write or interface to their own MTP3 implementation. When using the Dialogic® DSI MTP3 Layer, this interface is already implemented within the MTP3 module.

The list of protocol requests sent from MTP2 to MTP3 includes:

- API_MSG_RX_IND - Received Message Indication
- SS7_MSG_IN_SVC - MTP2 In Service Indication
- SS7_MSG_OUT_SVC - MTP2 Out of Service Indication
- SS7_MSG_REM_PR_OUT - MTP2 RPO Indication
- SS7_MSG_REM_PR_OK - MTP2 RPO Cleared Indication
- SS7_MSG_RXD_BSNT - MTP2 BSNT Indication
- API_MSG_RTVD_MSG - MTP2 Retrieved Message Indication
- SS7_MSG_RTVL_COMPL - MTP2 Retrieval Complete Indication
- SS7_MSG_RTVL_NOT_POS - MTP2 Retrieval Failure Indication
- MTP_MSG_LINK_CONG - MTP2 Link Congested Indication
- MTP_MSG_LINK_UNCONG - MTP2 Congestion Cleared Indication
- MTP_MSG_FLUSH_ACK - MTP2 Flush Acknowledgement Indication

All primitives generated by the MTP2 module are sent to the upper module as defined at configuration time for each link; this should be set to the correct **module_id** for the MTP3 module.

The **hdr->id** field is always set to the **l3_link_id**, as configured for the link at configuration time. Note that this need not be the same as the **l2_llid**. The use of the **l3_link_id** means that it is not necessary for the receiving module (for example, MTP3) to examine the sending **module_id** or the **board_id** from which the message was received.

The MTP3 (or upper) module is responsible for releasing the message using the **relm( )** library function.

3.2.1 API_MSG_RX_IND – Received Message Indication

Synopsis

Message generated by MTP2 containing received Message Signal Unit (MSU) destined to MTP3.

Message Format

Message Header	
Field Name	**Meaning**
type	API_MSG_RX_IND (0x8f01)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	Number of octets in MSU

Parameter Area		
Offset	**Size**	**Name**
0	len	MSU data in binary format commencing with the Service Information Octet (SIO).

3.2.2 SS7_MSG_IN_SVC – MTP2 In Service Indication

Synopsis

Primitive issued by MTP2 to MTP3 to indicate that the signaling link is in service.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_IN_SVC (0x8303)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP2 to the *upper* module to indicate the successful completion of the link alignment procedure.

Note: The **id** field of this message (and all indications to the upper module) contains the **l3_link_id**, which is a configuration parameter for the link and need not be the same as the **l2_llid**, which is used in messages sent to MTP2.

3.2.3 SS7_MSG_OUT_SVC – MTP2 Out of Service Indication

Synopsis

Primitive issued by MTP2 to MTP3 to indicate that the signaling link has failed.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_OUT_SVC (0x8304)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP2 to the *upper* module to indicate that the signaling link is out of service, either due to an excessive error rate or a failure to complete the alignment operation.

3.2.4 SS7_MSG_REM_PR_OUT – MTP2 RPO Indication

Synopsis

Primitive issued by MTP2 to MTP3 to indicate a Remote Processor Outage (RPO) condition.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_REM_PR_OUT (0x8305)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP2 to the *upper* module to indicate that a Remote Processor Outage condition has been detected (that is, SIPO has been received on the signaling link).

3.2.5 SS7_MSG_REM_PR_OK – MTP2 RPO Cleared Indication

Synopsis

Primitive issued by MTP2 to MTP3 to indicate the clearing of a Remote Processor Outage (RPO) condition.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_REM_PR_OK (0x8306)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP2 to the *upper* module to indicate that a signaling link that was previously in the Remote Processor Outage condition has now recovered.

3.2.6 SS7_MSG_RXD_BSNT – MTP2 BSNT Indication

Synopsis

Primitive issued by MTP2 to MTP3 containing the Backware Sequence Number Transmitted (BSNT).

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_RXD_BSNT (0x8307)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	1 or 6

Parameter Area		
Offset	**Size**	**Name**
0	1	BSNT
1	1	Reserved (set to zero)
2	4	Extended BSNT

Description

This primitive is issued by MTP2 in response to a BSNT Retrieval request. It contains the BSNT in the parameter area of the message.

For high speed links using 12 bit sequence numbers, the BSNT field is set to 0x80 and the backwards sequence number is returned in the extended BSNT field.

3.2.7 API_MSG_RTVD_MSG – MTP2 Retrieved Message Indication

Synopsis

Message sent from MTP2 to MTP3 containing the next MSU retrieved from the transmission/retransmission buffer.

Message Format

Message Header	
Field Name	**Meaning**
type	API_MSG_RTVD_MSG (0x8f08)
id	l3_link_id
src	MTP2 module_id
dst	Destination module (MTP2 upper_id)
rsp_req	0
hclass	0
status	0
err_info	0
len	Number of octets in MSU

Parameter Area		
Offset	**Size**	**Name**
0	1	MSU data in binary format commencing with the Service Information Octet (SIO).

3.2.8 SS7_MSG_RTVL_COMPL – MTP2 Retrieval Complete Indication

Synopsis

Primitive issued by MTP2 to MTP3 to indicate the completion of the message retrieval procedure.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_RTVL_COMPL (0x8309)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP2 to the *upper* module to indicate that any messages for retrieval have been conveyed using Retrieved Message Indications so the retrieval procedure is complete.

3.2.9 SS7_MSG_RTVL_NOT_POS – MTP2 Retrieval Failure Indication

Synopsis

Primitive issued by MTP2 to MTP3 to indicate that it is not possible to carry out message retrieval.

Message Format

Message Header	
Field Name	**Meaning**
type	MTP_MSG_RTVL_NOT_POS (0x8315)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP2 to the *upper* module to indicate that for some reason it is not possible to carry out or complete the message retrieval procedure. Any retrieved messages issued to MTP3 should therefore be discarded. The message is issued instead of a Retrieval Complete Indication.

3.2.10 MTP_MSG_LINK_CONG – MTP2 Link Congested Indication

Synopsis

Primitive issued by MTP2 to MTP3 to notify of signaling link congestion.

Message Format

Message Header	
Field Name	**Meaning**
type	MTP_MSG_LINK_CONG (0x8312)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	1

Parameter Area		
Offset	**Size**	**Name**
0	1	Congestion status

Description

This primitive is issued by MTP2 on detection of link congestion or a change in the congestion status of a link. Congestion is detected when the total number of messages stored in the transmit and retransmit buffers exceeds a configurable congestion onset threshold. The module can be configured with either a single congestion threshold or multiple congestion onset thresholds.

The level of congestion is indicated in the parameter field of the message. For single congestion levels, this is either 0 (no congestion) or 1 (congested). For multiple congestion levels, this is 0 (no congestion) or 1, 2 or 3 (indicating increasing levels of congestion).

3.2.11 MTP_MSG_LINK_UNCONG – MTP2 Congestion Cleared Indication

Synopsis

Primitive issued by MTP2 to MTP3 to notify the clearing of link congestion.

Message Format

Message Header	
Field Name	**Meaning**
type	MTP_MSG_LINK_UNCONG (0x8313)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP2 when a link which has been congested returns to the uncongested state.

3.2.12 MTP_MSG_FLUSH_ACK – MTP2 Flush Acknowledgement Indication

Synopsis

Primitive issued by MTP2 to MTP3 to acknowledge completion of buffer flushing.

Message Format

Message Header	
Field Name	**Meaning**
type	MTP_MSG_FLUSH_ACK (0x8316)
id	l3_link_id
src	MTP2 module_id
dst	*upper* module_id (for example, MTP3)
rsp_req	0
hclass	0
status	0
err_info	0
len	0

Description

This primitive is issued by MTP2 in response to an SS7_MSG_FLUSH message after all messages have been flushed by MTP2 from the transmission and retransmission buffers.

3.3 Management Requests Sent to MTP2

In addition to the primitives defined at the MTP2/MTP3 interface, the MTP2 module supports a non-primitive interface for configuration and maintenance.

The non-primitive interface is used to support requests by the user for initialization, configuration and diagnostic purposes and to allow MTP2 to report protocol-based and software error events to the local system management module.

This section describes the formats of all the messages used in the non-primitive interface. The full list of management requests sent to MTP2 includes:

- SS7_MSG_RESET - MTP2 Module Reset Request
- SS7_MSG_CONFIG - MTP2 Link Configuration Request
- SS7_MSG_END_LINK - MTP2 End Link Request
- SS7_MSG_TRACE_MASK - MTP2 Trace Mask Set Request
- SS7_MSG_R_STATE - MTP2 Read Link State Request
- SS7_MSG_R_STATS - MTP2 Read Link Statistics Request
- GEN_MSG_MOD_IDENT - Read Module Version Request

When sending messages to MTP2, the user should ensure that the message is sent to the correct **board_id**, the correct **module_id** and the correct Layer 2 Logical Link ID (**l2_llid**).

Prior to sending any message to the board, the application should call the **GCT_set_instance( )** library function to select the board to which the message is to be sent.

The **hdr->dst** field of the message should be initialized to the correct MTP2 **module_id** for the board in use. Some boards (for example, DSI SS7HD Boards) have multiple signaling processors, each running its own MTP2 instance and using a different **module_id**.

The **hdr->id** field of the message should be set to the correct **l2_llid** (for all link specific messages or zero otherwise); this runs from zero to one less than the number of signaling links supported by each MTP2 instance.

The **hdr->rsp_req** field may optionally be used to request a confirmation. If requested, the MTP2 module confirms acceptance of the primitive by sending the message back to its originator with bit 14 cleared in the type field of the message. This mechanism is described in detail in the *Software Environment Programmer's Manual*.

When the MTP2 module is requested to return a confirmation message, the returned message contains a status value from the following table:

Mnemonic	Value	Description
SUCCESS	0	Success
S7E_BAD_LLID	0x3a	Invalid l2_llid
S7E_BAD_PRIM	0x39	Unrecognized or unexpected primitive

3.3.1 SS7_MSG_RESET – MTP2 Module Reset Request

Synopsis

Message issued by management to MTP2 to initialize the module for operation.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_RESET (0x7200)
id	0
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required
hclass	0
status	0
err_info	0
len	10

Parameter Area		
Offset	**Size**	**Name**
0	4	Reserved, must be set to 0
4	2	num_links - Numberin of links to support
6	2	tx_pool_len - Transmit pool size
8	2	timer_res - Timer resolution

Description

This message is used to initialize the MTP2 module. All messages received by the module before the SS7_MSG_RESET message are discarded. The module can only be reset once.

Note: This message is generated on-board the Dialogic® DSI SS7 board at startup and should not be generated by the user.

Parameters

The SS7_MSG_RESET message includes the following parameters:

- **num_links**
  Maximum number of SS7 signaling links to support. This may range from 1 to one less than the number of links supported, depending on how many signaling links the user wishes to use. It is not necessary to always use this number of links.
- **tx_pool_len**
  Number of frames in the MTP2 transmit pool. It is used for generation of Link Status Signal Units (LSSUs) and Fill In Signal Units (FISUs).
- **timer_res**
  Reserved for future use. This field must always be set to 1

3.3.2 SS7_MSG_CONFIG – MTP2 Link Configuration Request

Synopsis

Message issued by management to MTP2 to configure an individual signaling link for operation.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_CONFIG (0x7203)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required
hclass	0
status	0
err_info	0
len	38, 42 or 60 (see below)

Parameter Area		
Offset	**Size**	**Name**
0	2	options - Run-time options
2	1	upper_id - (for example, MTP3 module_id)
3	1	lower_id - (for example, Driver module_id)
4	1	mgmt_id - Module_id of management module
5	1	monitor_id – Reserved, set to 0.
6	2	max_SIF_len - (for example, 62 or 272)
8	2	cong_onset - Congestion onset threshold
10	2	cong_abate - Congestion abatement threshold
12	2	pcr_n1 - PCR N1 threshold
14	2	pcr_n2 - PCR N2 threshold
16	2	rtv_attempts - Maximum number of retrieval attempts
18	2	t1 - Timer T1 value
20	2	t2 - Timer T2 value
22	2	t3 - Timer T3 value
24	2	t4n - Timer T4 normal value
26	2	t4e - Timer T4 emergency value
28	2	t5 - Timer T5 value
30	2	t6 - Timer T6 value
32	2	t7 - Timer T7 value
34	2	t_suerm - Period between SUERM checks
36	2	t_rtv - Period between retrieval attempts/
38	2	cong_discard - Congestion discard threshold
40	2	l3_link_id - MTP3 link id
42	2	co1 - Congestion onset threshold 1
44	2	co2 - Congestion onset threshold 2
46	2	co3 - Congestion onset threshold 3
48	2	ca1 - Congestion abatement threshold 1
50	2	ca2 - Congestion abatement threshold 2
52	2	ca3 - Congestion abatement threshold 3
54	2	cd1 - Congestion discard threshold 1
56	2	cd2 - Congestion discard threshold 2
58	2	cd3 - Congestion discard threshold 3

Description

This message is used to configure the operational parameters for an individual signaling link and cause the power up action defined in Q.703 to be executed. One such message must be issued to MTP2 (after the SS7_MSG_RESET message has been issued) for each link to be used. Subsequent SS7_MSG_CONFIG messages may be issued to the MTP2 module to modify timer configuration parameters; however, these messages do not affect SS7 operation (that is, the power up sequence is not be re-executed, but the parameters are modified).

For backwards compatibility, the MTP2 module accepts messages with three different parameter area lengths: 38, 42 or 60 bytes. If the length is less than 42 the **cong_discard** parameter is set to 0 so that congestion discard does not take place, and the **l3_link_id** parameter is set to the same value as the **l2_llid**. If the length is less than 60, then the use of single congestion thresholds is assumed.

Note: To use multiple congestion thresholds it is necessary to set the S7C_MCONG bit (bit 3) in the options field in addition to supplying a full length parameter area.

- **options**
  This field is used to convey run-time options to the module as shown in the following table:

Bit	Meaning
0	Set to 1 to enable the Preventive Cyclic Retransmission of error correction or set to 0 to enable the Basic Method of error correction.
3	Set to 1 to enable the Multiple Congestion States and Multiple Message Priority option. This option should always be enabled when running in ANSI mode.
5	Set to 1 to cause generated LSSUs to have a 2 octet status field; otherwise, LSSUs are generated with a single octet status field.
6	Set to 1 if it is required that MTP2 wait for a Continue Request from MTP3 prior to resuming normal operation prior to a period of processor outage.
7	Set to 1 to invoke special MTP2 operation for use in Japanese networks.
8	Only significant when bit 9 is also set to 1; otherwise, it should be set to 0. When bit 9 is also set, setting bit 8 to 1 allows FISU to be reported to the user as part of monitor operation otherwise FISU are not sent to the user. Note: Identical FISU are filtered and not reported to the user.
9	Set to 1 to cause the link to operate in receive only mode for use in monitoring applications.
11	Set to 1 to enable high speed link processing in accordance with Q.703 Annex A.
12	Only significant when bit 11 is also set to 1; otherwise, it should be set to 0. Set to 1 to enable 12 bit sequence numbers or set to 0 to enable 7 bit.
Others	Reserved for future use and must be set to 0.

- **upper_id**
  The module ID of the *upper* layer module. This is the module to which all MTP2/MTP3 indications are to be issued and is typically the module ID of the MTP3 module.
- **lower_id**
  The module ID of the on-board driver module that interfaces with the physical interface. This must always be set to 0.
- **mgmt_id**
  The module ID of the management module to which all trace messages, event indications and state change messages are to be sent.
- **max_SIF_len**
  The maximum length of signaling Information Field (SIF) to support. This should be set to either 62 or 272 in accordance with Q.703.
- **cong_onset**
  The congestion onset threshold for use with the single congestion threshold mode of operation. Congestion is indicated when the total number of messages in the transmit and retransmit buffers equals this value.

- **cong_abate**
  The congestion abatement threshold for use with the single congestion threshold mode of operation. Link uncongested is indicated when the total number of messages in the transmit and retransmit buffers equals this value.
- **pcr_n1**
  The N1 threshold for use with the Preventive Cyclic Retransmission method of error correction. This is typically set to 127 although it may be set to a lower value to limit the maximum number of messages in the retransmission buffer.
- **pcr_n2**
  The N2 threshold for use with the Preventive Cyclic Retransmission method of error correction. This should typically be set to approximately 8 times the loop delay in ms for 64 kbit/s operation or 7 times the loop delay in ms for 56 kbit/s operation. If set to 0, the MTP2 module assumes a value of 400.
- **t1**, **t2**, **t3**, **t4n**, **t4e**, **t5**, **t6**, **t7**
  Values for the protocol timers as defined in Q.703. These should be set to the number of (**tick** * **timer_res**) intervals required for the timer. The timers are checked for expiry every **timer_res** number of ticks. The value given for t1, t2 etc. is the number of times that the timer is checked before indicating expiry.
- **t_suerm**
  The time interval between issuing check SUERM commands to the driver. Specified in the same manner as the protocol timers t1, t2 etc. This should always be set to 10.
- **t_rtv**
  The time interval between retrieval attempts specified in the same manner as the protocol timers t1, t2 etc. Retrieval can only take place once the driver has released all messages queued for transmission. This timer determines the period between successive attempts. This should always be set to 1.
- **cong_discard**
  The congestion discard threshold for use with the single message priority mode of operation. If the number of messages in the transmit and retransmit buffers exceeds this threshold, then further MSU's are discarded.
- **l3_link_id**
  The value to use in the **id** field of all indications issued to the *upper* module (that is, MTP3). For single signaling processor systems, this is typically the same as the **l2_llid**. However, when a system contains more than one MTP2 processor this may not be so.
- **co1**, **co2**, **co3**, **ca1**, **ca2**, **ca3**, **cd1**, **cd2**, **cd3**
  Congestion onset, abatement and discard thresholds for use when the Multiple Congestion Thresholds mode of operation is selected.

3.3.3 SS7_MSG_END_LINK – MTP2 End Link Request

Synopsis

Message issued by management to remove configuration of a link at MTP2.

Note: This operation is currently only supported on DSI SS7HD boards. Other board types do not permit the removal of an MTP2 link.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_END_LINK (0x7212)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required
hclass	0
status	0
err_info	0
len	0

Description

This message is issued to MTP2 to remove configuration of an existing signaling link allowing, for example, the link to be reconfigured with different operating parameters.

To change MTP2 parameters, the following sequence should be used (note that currently this operation is supported only by DSI SS7HD boards):

1. Deactivate the link at MTP3 (causing MTP3 to issue a Stop request to MTP2).
2. Send SS7_MSG_END_LINK to MTP2.
3. Send MGT_MSG_L1_END to the board. See the *Dialogic® DSI SS7HD Network Interface Boards Programmer's Manual* for detailed information about this message.
4. Send MGT_MSG_L1_CONFIG to the board. See the *Dialogic® DSI SS7HD Network Interface Boards Programmer's Manual* for detailed information about this message.
5. Send SS7_MSG_CONFIG to MTP2.
6. Activate the link.

3.3.4 SS7_MSG_TRACE_MASK – MTP2 Trace Mask Set Request

Synopsis

Message issued to MTP2 to cause per-link tracing of protocol primitives.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_TRACE_MASK (0x5213)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required
hclass	0
status	0
err_info	0
len	6

Parameter Area		
Offset	**Size**	**Name**
0	2	op_evt_mask - Output event trace mask.
2	2	ip_evt_mask - Input event trace mask.
4	2	mgmt_evt_mask - Management event mask.

Description

The MTP2 module supports comprehensive tracing options on a per-link and per-primitive basis. The module can be configured to trace any message received or transmitted and a number of management events. This message is used to selectively enable tracing of events. It can be used at any time during operation and continues to be effective until the next Trace Mask Set Request is received for the same link.

Traced events are indicated to the management module using the MGT_MSG_TRACE_EV Event Indication.

Parameters

The SS7_MSG_TRACE_MASK message includes the following parameters:

- **op_evt_mask**
  The output event trace mask. This is a 16-bit value with bits set to 1 to cause a trace message to be sent to the management module whenever a message is issued by MTP2. Care should be taken when tracing messages because the system throughput may be reduced. The fields in the trace mask cause the events indicated in Figure 2 to be traced.

Figure 2. MTP2 Output Event Mask (Per Link)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
RTVL FAIL	REPORT SU	LINK UNCONG	LINK CONG	SUERM CHECK	SUERM STOP	SUERM STOP	XMIT
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
RTVL COMPL	RTVD MSG	RXD BSNT	RPO CLRD	RPO	OUT SVC	IN SVC	RXD MSG

Key:

- RTVL_FAIL - Retrieval not possible indication
- REPORT_SU - Report next SU request
- LINK_UNCONG - Link uncongested indication
- LINK_CONG - Link congested indication
- SUERM_CHECK - SUERM Check request
- SUERM_STOP - SUERM Stop request and Stop AERM request
- SUERM_START - SUERM Start request and Start AERM request
- XMIT - Transmit request
- RTVL_COMPL - Retrieval Complete indication
- RTVD_MSG - Retrieved message indication
- RXD_BSNT - Received BSNT indication
- RPO CLRD - RPO ceases indication and Flush ACK indication
- RPO - RPO indication
- OUT_SVC - Out of service indication
- IN_SVC - In service indication
- RXD_MSG - Received message indication

Note: The shaded boxesrelate to internal events within the board and are of limited use to the user.

- **ip_evt_mask**
  The input event trace mask. This is a 16-bit value with bits set to 1 to cause a trace message to be sent to the management module whenever a message is received by MTP2. Care should be taken when tracing messages as system throughput is reduced. The fields in the trace mask cause the events indicated in Figure 3 to be traced.

Figure 3. MTP2 Input Event Mask (Per Link)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
SUERM FAIL	DVR RDY	FLUSH	LPO CLRD	LPO	RTVL REQ	RTV BSNT	EMGCY CLRD
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
EMGCY	RX ERR	STOP	START	BUSY IND	TM EXP	RX IND	MSG FOR TX

- **Key**:
- SUERM_FAIL - SUERM failure indication and AERM failure indication
- DVR_RDY - Driver ready indication
- FLUSH - Continue request and Flush request
- LPO CLRD - Local processor outage ceases indication
- LPO - Local processor outage indication and MTP failure request
- RTVL_REQ - Retrieval request
- RTV_BSNT - Retrieve BSNT request
- EMGCY_CLRD - Emergency cleared indication
- EMGCY - Emergency indication
- RX_ERR - Receive error indication
- STOP - Stop request
- START - Start request
- BUSY_IND - Busy indication
- TM_EXP - Timer expiry indication
- RX_IND - Receive message indication
- MSG_FOR_TX - Message for transmission request

Note: The shaded boxes relate to internal events within the board and are of limited use to the user.

- **mgmt_evt_mask**
  The management event trace mask. This is a 16-bit value with bits set to 1 to cause an event indication message to be sent to the management module for the events shown. The fields in the trace mask cause the events indicated in Figure 4 to be traced. By default the SL_FAIL, SL_CONG, ERROR and STATE bits are set.

Note: Take care when sending trace mask set requests. Failure to set bits 0, 1 2 and 3 prevents the generation of MGT_MSG_SS7_STATE state change indications and MGT_MSG_SS7_EVENT Q.791 event indications.

Figure 4. MTP2 Management Event Mask (Per link)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
0	0	0	0	0	0	0	0
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	0	SL PROV	SL TEXP	SL CONG	SL FAIL	ERROR	STATE

Key:

- SL_PROV - Report AERM proving failures
- SL_TEXP - Report T1/T2/T3 expiry events
- SL_CONG - Report Q.791 congestion events
- SL_FAIL - Report Q.791 reasons for link failure
- ERROR - Report errors
- STATE - Trace changes of link state

3.3.5 SS7_MSG_R_STATE – MTP2 Read Link State Request

Synopsis

Message issued to MTP2 to read the current internal state of the link.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_R_STATE (0x6215)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit set if response required
hclass	0
status	0
err_info	0
len	6

Parameter Area		
Offset	**Size**	**Name**
0	1	lsc_state - Current Link State control state
1	1	cong_status - Current congestion status.
2	2	num_msgs - Total number of buffered MSU's.
4	2	num_rtx_msgs - Number of MSU's in retransmit buffer.

Description

This message is issued to the MTP2 module to read the current internal state of the link and the number of MSU's currently buffered. The results are written into the parameter area of the message and the message is returned to the sender.

Parameters

- **lsc_state**

Value	State
0	IDLE
1	in service
2	out of service
3	Initial Alignment
4	Aligned / Not ready
5	Aligned ready
6	Processor Outage
7	Not aligned
8	Proving
9	Aligned
10	Monitoring
11	Layer 2 congestion

3.3.6 SS7_MSG_R_STATS – MTP2 Read Link Statistics Request

Synopsis

Message issued to MTP2 to read per-link Q.791 performance statistics.

Message Format

Message Header	
Field Name	**Meaning**
type	SS7_MSG_R_STATS (0x6214)
id	l2_llid
src	Originating module_id
dst	MTP2 module_id
rsp_req	Sending layer's bit must be set.
hclass	0
status	0 = Leave statistics unchanged 1 = Reset statistics after reading
err_info	0
len	58 (or 54 or 38 for backwards compatibility)

Parameter Area		
Offset	**Size**	**Name**
0	4	insvc_duration - Duration of link in service state.
4	2	align_failures - Number of failed alignment attempts.
6	4	SU_err_count - Number of signal units in error.
10	4	NACK_count - Count of negative acknowledgements received.
14	4	busy_duration - Duration of local busy condition.
18	4	txd_octets - Number of SIF and SIO octets transmitted.
22	4	rtx_octets - Number of octets re-transmitted.
26	4	tx_msu_count - Number of MSU's transmitted.
30	4	rxd_octets - Number of SIF and SIO octets received.
34	4	rx_msu_count - Number of MSU's received.
38	4	cong_count - Number of congestion events.
42	4	cong_duration - Duration of link congestion.
46	4	discard_count - Number of MSU's discarded due to congestion.
50	4	discard_events - Number of congestion events leading to MSU discard.
54	4	period – Period during which the measurements have been collected (in multiples of 100ms).

Description

This message is issued to the MTP2 module to read the Q.791 statistics for the link. The statistics are written into the parameter area of the message and the message is returned to the sender. The internal statistics can be reset or left unchanged depending on the setting of the status field.

3.3.7 GEN_MSG_MOD_IDENT – Read Module Version Request

Synopsis

Message issued to any module to read the module type and core revision number.

Message Format

Message Header	
Field Name	**Meaning**
type	GEN_MSG_MODE_IDENT (0x6111)
id	0
src	Originating module_id
dst	Target module_id
rsp_req	Sending layer's bit set must be set
hclass	0
status	0
err_info	0
len	28

Parameter Area		
Offset	**Size**	**Name**
0	2	type – Reserved for future use
2	1	maj_rev – Major revision number.
3	1	min_rev – Minor revision number.
4	24	text – Null terminated test string identifying the module (for example, "SS7 MTP2").

Description

This message can be issued to any module to determine the module type and the core revision number of the internal software.

The confirmation message contains the major and minor revision numbers and a text string identifying the module.

3.4 Management Indications Issued by MTP2

Management indications are sent to the user-nominated management module to advise of events occurring within the MTP2 module such as changes of state, diagnostic traces, error conditions or protocol events.

The full list of management indications available to be sent from MTP2 includes:

- MGT_MSG_EVENT_IND - Error Indication
- MGT_MSG_TRACE_EV - Trace Event Indication
- MGT_MSG_SS7_STATE - MTP2 Link State Indication
- MGT_MSG_SS7_EVENT - MTP2 Q791 Event Indication

Management indications are sent from MTP2 to the per-link management module configured at link configuration time.

The user can select, using trace masks, which events to report and disable the remainder. The **hdr->id** field is always set either to the **l2_llid** or to zero as detailed in this section.

The receiving module is responsible for releasing the message using the **relm( )** library function.

3.4.1 MGT_MSG_EVENT_IND – Error Indication

Synopsis

Message issued by MTP2 to advise management of errors or events occurring within the module.

Message Format

Message Header	
Field Name	**Meaning**
type	MGT_MSG_EVENT_IND (0x0008)
id	See table below
src	MTP2 module id
dst	Management module id
rsp_req	0
hclass	0
status	ERROR CODE (see below)
err_info	Timestamp
len	0

Description

This message is issued by MTP2 the management module (as configured in the configuration message) to advise of errors occurring within MTP2. These indications are only issued if the ERROR bit of the management event mask is set.

The ERROR_CODE and **id** field are coded as shown in the following table:

Value	Mnemonic	id	Description
0x31	S7E_RESET_ERR	0	MTP2 Failed to initialize.
0x33	S7E_POOL_EMPTY	l2_llid	No free buffers in MTP2 transmit pool.
0x34	S7E_TX_FAIL	l2_llid	Failed to send LSSU/FISU to driver.
0x35	S7E_HDR_ERR	l2_llid	No room to add MTP2 header, SU not transmitted.
0x36	S7E_LEN_ERR	l2_llid	Length Error, SU not transmitted.
0x37	S7E_MSU_SEND	l2_llid	Failed to send SU to lower layer, protocol should handle retransmission.
0x38	S7E_GARBAGE		No longer used.
0x39	S7E_BAD_PRIM	l2_llid	MTP2 unable to accept primitive.
0x3a	S7E_BAD_LLID	l2_llid	Invalid l2_llid in HDR structure.
0x3b	S7E_MEM_ERR	l2_llid	MTP2 memory allocation error.
0x3c	S7E_RTVL_ERR	l2_llid	MTP2 failure to perform retrieval.

3.4.2 MGT_MSG_TRACE_EV – Trace Event Indication

Synopsis

Message issued by MTP2 to trace protocol event.

Message Format

Message Header	
Field Name	**Meaning**
type	MGT_MSG_TRACE_EV (0x0003)
id	0
src	MTP2 module_id
dst	Management module_id
rsp_req	0
hclass	0
status	0
err_info	Timestamp
len	18 + length of traced data

Parameter Area		
Offset	**Size**	**Name**
0	1	src - hdr->src from traced message.
1	1	dst - hdr->dst from traced message.
2	2	id - hdr->id from traced message.
4	2	type - hdr->type from traced message.
6	2	status - hdr->status from traced message.
8	4	time - timestamp (in system ticks).
12	4	par - pointer to hdr of message being traced.
16	2	data_length - number of bytes in data field.
18	0 to 280	data - Data taken from parameter area of traced message.

Description

The MTP2 module may be configured to report to management each primitive issued or received. This is useful for trace and debug purposes. The MTP2 event masks are used to enable and disable tracing on a per primitive basis for each link. The parameters from the traced primitive are encoded in the parameter area of the trace message.

3.4.3 MGT_MSG_SS7_STATE – MTP2 Link State Indication

Synopsis

Message issued by MTP2 to advise management of changes of state of the per-link Link State Control state machine.

Message Format

Message Header	
Field Name	**Meaning**
type	MGT_MSG_SS7_STATE (0x0201)
id	l2_llid
src	MTP2 module id
dst	Management module id
rsp_req	0
hclass	0
status	LINK STATE (see below)
err_info	Timestamp
len	0

Description

This primitive is used by MTP2 to advise management of changes of state within the Link State Control function. These indications are only given if the STATE bit of the management event mask is set.

This message is intended for diagnostic and maintenance purposes and does not form part of the protocol specified primitives.

The LINK STATE is coded as shown in the following table:

Value	Mnemonic	Description
1	S7S_IN_SERVICE	Entered IN SERVICE state
2	S7S_OUT_SERVICE	Entered OUT OF SERVICE state
3	S7S_INIT_ALIGN	Entered INITIAL ALIGNMENT state
4	S7S_ALIGN_NOT_RDY	Entered ALIGNED NOT READY state
5	S7S_ALIGN_READY	Entered ALIGNED READY state
6	S7S_PROC_OUTAGE	Entered PROCESSOR OUTAGE state

3.4.4 MGT_MSG_SS7_EVENT – MTP2 Q791 Event Indication

Synopsis

Message issued by MTP2 to advise management of protocol events in accordance with Q.791.

Message Format

Message Header	
Field Name	**Meaning**
type	MGT_MSG_SS7_EVENT (0x0202)
id	l2_llid
src	MTP2 module id
dst	Management module id
rsp_req	0
hclass	0
status	EVENT CODE (see below)
err_info	Timestamp
len	0

Description

This primitive is used by MTP2 to advise management of the occurence of protocol related events in accordance with Q.791. Currently these events either relate to the reason for a signaling link (that was in service) going out of service (events prefixed S7F_) or the occurrence of a congestion related event (prefixed S7G_). These indications are only issued if the appropriate bit (either SL_FAIL or SL_CONG) in the management event mask is set.

The EVENT CODE is coded as shown in the following table:

Value	Mnemonic	Description
0	S7F_STOP	Stop request received
1	S7F_FIBR_BSNR	Abnormal FIBR/BSNR
2	S7F_EDA	Excessive delay of acknowledgement (T7 expiry)
3	S7F_SUERM	Excessive error rate (SUERM)
4	S7F_ECONG	Excessive congestion (T6 expiry)
5	S7F_SIO_RXD	Unexpected SIO received
6	S7F_SIN_RXD	Unexpected SIN received
7	S7F_SIE_RXD	Unexpected SIE received
8	S7F_SIOS_RXD	SIOS received
16	S7G_CONG	Onset of signaling link congestion
17	S7G_CONG_CLR	Abatement of signaling link congestion
18	S7G_CONG_DIS	Congestion event caused MSU discard
32	S7T_T1_EXP	Timer T1 Expiry
33	S7T_T2_EXP	Timer T2 Expiry
34	S7T_T3_EXP	Timer T3 Expiry
48	S7P_AERM	Failed proving attempt

3.5 Message Summary Table

Table 1 lists, by message type, all the messages defined in this manual.

Table 1. Message Summary Table

Message Type	Mnemonic	Description
0x0003	MGT_MSG_TRACE_EV	Trace Event Indication
0x0008	MGT_MSG_EVENT_IND	Error Indication
0x0201	MGT_MSG_SS7_STATE	MTP2 Link State Indication
0x0202	MGT_MSG_SS7_EVENT	MTP2 Q791 Event Indication
0x1213		Confirmation of SS7_MSG_TRACE_MASK
0x2111		Confirmation of GEN_MSG_MOD_IDENT
0x2214		Confirmation of SS7_MSG_R_STATS
0x2215		Confirmation of SS7_MSG_R_STATE
0x3200		Confirmation of SS7_MSG_RESET
0x3203		Confirmation of SS7_MSG_CONFIG
0x3217		Confirmation of SS7_MSG_END_LINK
0x5213	SS7_MSG_TRACE_MASK	MTP2 Trace Mask Set Request
0x6111	GEN_MSG_MOD_IDENT	Read Module Version request
0x6214	SS7_MSG_R_STATS	MTP2 Read Link Statistics Request
0x6215	SS7_MSG_R_STATE	MTP2 Read Link State Request
0x7200	SS7_MSG_RESET	MTP2 Module Reset Request
0x7203	SS7_MSG_CONFIG	MTP2 Link Configuration request
0x7217	SS7_MSG_END_LINK	MTP2 End Link Request
0x8204		Confirmation of SS7_MSG_START
0x8205		Confirmation of SS7_MSG_STOP
0x8207		Confirmation of SS7_MSG_EMGCY
0x8208		Confirmation of SS7_MSG_EMGCY_CLRD
0x8209		Confirmation of SS7_MSG_RTV_BSNT
0x820a		Confirmation of SS7_MSG_RTVL_REQ
0x820b		Confirmation of SS7_MSG_LOC_PR_OUT
0x820c		Confirmation of SS7_MSG_LOC_PR_OK
0x820d		Confirmation of SS7_MSG_L3_FAIL
0x8211		Confirmation of SS7_MSG_CONTINUE
0x8212		Confirmation of SS7_MSG_FLUSH
0x8303	SS7_MSG_IN_SVC	MTP2 In Service Indication
0x8304	SS7_MSG_OUT_SVC	MTP2 Out of Service Indication
0x8305	SS7_MSG_REM_PR_OUT	MTP2 RPO Indication
0x8306	SS7_MSG_REM_PR_OK	MTP2 RPO Cleared Indication
0x8307	SS7_MSG_RXD_BSNT	MTP2 BSNT Indication
0x8309	SS7_MSG_RTVL_COMPL	MTP2 Retrieval Complete Indication
0x8312	MTP_MSG_LINK_CONG	MTP2 Link Congested Indication
0x8313	MTP_MSG_LINK_UNCONG	MTP2 Congestion Cleared Indication
0x8315	SS7_MSG_RTVL_NOT_POS	MTP2 Retrieval Failure Indication
0x8316	MTP_MSG_FLUSH_ACK	MTP2 Flush Acknowledgement Indication
0x8f01	API_MSG_RX_IND	Received Message Indication
0x8f08	API_MSG_RTVD_MSG	MTP2 Retrieved Message Indication
0xc204	SS7_MSG_START	MTP2 Start Request

Table 1. Message Summary Table (Continued)

Message Type	Mnemonic	Description
0xc205	SS7_MSG_STOP	MTP2 Stop Request
0xc207	SS7_MSG_EMGCY	MTP2 Set Emergency Request
0xc208	SS7_MSG_EMGCY_CLRD	MTP2 Cancel Emergency Request
0xc209	SS7_MSG_RTV_BSNT	MTP2 BSNT Retrieval Request
0xc20a	SS7_MSG_RTVL_REQ	MTP2 Retrieval Request
0xc20b	SS7_MSG_LOC_PR_OUT	MTP2 LPO Request
0xc20c	SS7_MSG_LOC_PR_OK	MTP2 LPO Recovered Request
0xc20d	SS7_MSG_L3_FAIL	MTP2 Level 3 Failure Request
0xc211	SS7_MSG_CONTINUE	MTP2 Continue Request
0xc212	SS7_MSG_FLUSH	MTP2 Flush Request
0xcf00	API_MSG_TX_REQ	Message for Transmission Request

Chapter 4: Internal Interfaces

The MTP2 module on the DSI SS7 board interfaces to a driver that manages the interface to the physical layer containing the SS7 HDLC controllers. Detailed operation of this driver is not required to use the DSI SS7 board, however, for completeness the messages and message types used on the internal interface between MTP2 and the driver are detailed in this section.

Primitives issued by the MTP2 module to layer 1 are given in the following table:

Message Mnemonic	Message Type	Brief Description of Internal Use
SS7_MSG_TX_REQ	0xc000	To send a Signal Unit (SU) to the driver for transmission.
RTP	0xc007	To return receive frame buffers to a per-link pool in the driver.
SS7_MSG_SUERM_START	0xc10d	To activate the signal unit error rate monitor (SUERM).
SS7_MSG_SUERM_STOP	0xc10e	To deactivate the SUERM.
SS7_MSG_SUERM_CHECK	0xc10f	Sent periodically to check the SUERM count.
SS7_MSG_AERM_START	0xc111	To activate the alignment error rate monitor (used only on boards were the AERM is implemented in the driver).
SS7_MSG_AERM_STOP	0xc112	To deactivate the AERM.
SS7_MSG_REP_NEXT_SU	0xc110	To reset FISU/LSSU filtering in the driver so that the next SU is reported to MTP2.

Primitives received by the MTP2 module from layer 1 are given in the following table:

Message Mnemonic	Message Type	Brief Description of Internal Use
SS7_MSG_RX_IND	0x8001	Indication of a received SU from driver to MTP2.
SS7_MSG_RX_ERR	0x8006	Indication of SU received in error (used only on boards where the AERM is implemented in MTP2 instead of the driver).
SS7_BUSY_IND	0x8003	Indication of local busy condition clear/occur.
SS7_MSG_DVR_RDY	0x820e	Confirmation from driver to MTP2 that a SU has been passed to the hardware for transmission.
SS7_MSG_SUERM_FAIL	0x820f	Indication of SUERM failure.
SS7_MSG_AERM_FAIL	0x8210	Indication of AERM failure (used only on boards where AERM is implemented in the driver).

Messages exchanged between MTP2 and timer services are given in the following table:

Message Mnemonic	Message Type	Brief Description of Internal Use
SS7_MSG_TM_EXP	0xc002	Periodic 100 ms timer expiry indication sent to MTP3.
SS7_MSG_FAST_TICK	0x0216	Periodic 25 ms timer expiry indication sent to MTP2 (not used on all boards).
TIM_MSG_KEEP_TIME	0x7006	Message sent by MTP2 to initialize timer services.

In addition, three internal messages are used as part of the on-board interface between MTP2 and MTP3 to convey message for transmission to MTP2, to convey received indications to MTP3 and to transfer retrieved messages from MTP2 to MTP3. These messages are not passed off-board so the user does not need to use these messages. These messages are listed here for completeness.

Messages exchanged between MTP2 and the upper on-board layer are given in the following table:

Message Mnemonic	Message Type	Brief Description of Internal Use
SS7_MSG_TX_REQ	0xc000	To send a Message Signal Unit (MSU) to MTP2 for transmission.
SS7_MSG_RX_IND	0x8f01	Indication of a received MSU from MTP2 to *upper* layer.
SS7_MSG_RTVD_MSG	0x8308	Message sent by MTP2 to return retrieved messages to the *upper* layer.

Chapter 5: Typical Configuration Values

This section lists typical values to be used in the configuration messages for correct operation of MTP2 to quickly get the system up and running.

To ensure the appropriate values are being used for a specific installation, refer to the detailed message definitions in this manual.

Table 2. Typical Configuration Values

Parameter	Typical Setting			
	ITU-T	ANSI	HSL 12-bit sequence numbers	
			2048 kbit/s	1544 kbit/s
options	0x0000	0x000a	0x1800	0x180a
upper_id	0x22 (MTP3 module)	0x22 (MTP3 module)	0x22 (MTP3 module)	0x22 (MTP3 module)
lower_id	0x00	0x00	0x00	0x00
mgmt_id	0x8e (Management module)	0x8e (Management module)	0x8e (Management module)	0x8e (Management module)
monitor_id	0	0	0	0
max_SIF_len	272	272	272	272
cong_onset	50	50	320	320
cong_abate	40	40	160	160
pcr_n1	0	0	0	0
pcr_n2	0	0	0	0
rtv_attempts	4	4	4	4
t_suerm	10	10	10	10
t_rtv	1	1	1	1
cong_discard	130	130	4094	4094
l3_link_id	Set to the MTP3 link_id	Set to the MTP3 link_id	Set to the MTP3 link_id	Set to the MTP3 link_id
co1	40	40	240	240
co2	60	60	400	400
co3	80	80	560	560
ca1	30	30	120	120
ca2	50	50	320	320
ca3	70	70	500	500
cd1	45	45	300	300
cd2	65	65	480	480
cd3	85	85	720	720

Table 3. Default Timer Value

Q.703 / T1.111.3 Timer	Default Value ITU-T Mode	Default Value ANSI Mode 56 kbit/s	Default Value ANSI Mode 64 kbit/s	Default Value HSL Mode 2048kbit/s	Default Value HSL Mode 1544 kbit/s
T1	45 sec	13 sec	13 sec	300 sec	300 sec
T2	30 sec	23 sec	23 sec	30 sec	30 sec
T3	1.2 sec	11.5 sec	11.5 sec	1.2 sec	1.2 sec
T4N	8.2 sec	2.3 sec	2.0 sec	30 sec	30 sec
T4E	0.5 sec	0.6 sec	0.5 sec	0.5 sec	0.5 sec
T5	0.1 sec	0.1 sec	0.1 sec	0.1 sec	0.1 sec
T6	5.5 sec	5.5 sec	5.5 sec	5.5 sec	5.5 sec
T7	1.5 sec	1.5 sec	1.5 sec	1.5 sec	1.5 sec

Glossary

BSNT	Backward Sequence Number Transmitted
CRC	Cyclic Redundancy Check
FISU	Fill In Signal Unit. A signaling unit normally transmitted when no MSUs or LLSUs are being transmitted, allowing the SS7 network to receive immediate notification of signaling link failure.
HSL	High speed Signalin Link. A signalin link conforming to ITU-T recommendation Q.703 Annex A.
LISU	Link Status Signal Unit. A signaling unit that provides link status indications to the remote end of the signaling link.
MTP	Message Transfer Part. Layers 1 to 3 of the SS7 protocol stack broadly equivalent to the Physical, Data Link and Network layers in the OSI protocol stack. See also MTP1, MTP2, and MTP3.
MTP1	Message Transfer Part Level 1. An SS7 stack layer that defines the physical and electrical characteristics of the signaling links of the SS7 network. Signaling links use DS0 channels and carry raw signaling data at a rate of 48, 56 or 64 kbit/s.
MTP2	Message Transfer Part Level 2. An SS7 stack layer that provides link-layer functionality. Provides that two end points of a signaling link can reliably exchange signaling messages. It provides error checking, flow control and sequence checking.
MTP3	Message Transfer Part Level 3. An SS7 stack layer that provides network-layer functionality. Provides that messages can be delivered between signaling points across the SS7 network regardless of whether the signaling points are directly connected. It provides node addressing, routing, alternate routing and congestion control.
MSU	Message Signal Unit. A data unit that carries signaling information for call control, transaction processing, network management and maintenance. Typically, the MSU is carried in the Signaling Information Field (SIF) of SS7 messages.
Q.703	ITU-T Recommendation Q.703
Q.791	ITU-T Recommendation Q.791
RPO	Remote Processor Outage
SS7	Signaling System Number 7
SU	Signaling Unit