London Stock Exchange

London Stock Exchange

MIT 303 Level 2 - MITCH Specification

Issue 11.9

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London Stock Exchange Group

Contents

Disclaimer

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1.0 Introduction

1.1 Purpose

The purpose of this document is to provide full details of the Level 2-MITCH service including message types and fields.

1.2 Readership

This document outlines the detailed message types and fields for the Level 2-MITCH feed as well as details on how to connect to the Replay and Recovery services available on Millennium Exchange.

When read in conjunction with the MIT301 - Guide to Market Data Services it is intended that these documents provide all of the details directly connected London Stock Exchange customers require to develop to the real time market data services.

This document is particularly relevant to technical staff within the Exchange's member firms, information vendors and other market participants interested in receiving London Stock Exchange market data.

1.3 Document Series

This document is part of series of documents providing a holistic view of full trading and information services available from London Stock Exchange post the migration to Millennium Exchange.

The current series of documents are set out below:

- MIT201 - Guide to New Trading System
- MIT202 – Trading Gateway (FIX 5.0) Specification
- MIT203 – Native Interface Message Specification
- MIT204 – Post Trade Gateway (FIX 5.0) Specification
- MIT205 – Drop Copy Gateway (FIX 5.0) Specification

- MIT301 - Guide to Market Data Services
- **MIT303 – Level 2-MITCH Message Specification (this document)**
- MIT304 - Regulatory News Service Specification
- MIT401 - Reference Data Service Specification

- MIT501 – Guide to the Customer Testing Services

- MIT502 – Guide to Application Certification
- MIT503 – Certification Report
- MIT304 - Regulatory News Service Specification
- MIT601 – Guide to Trading Services Disaster Recovery
- MIT701 – Guide to Sponsored Access
- MIT801 – Reject Codes

This series principally covers non-regulatory information. It does not override or supersede the Rules of the London Stock Exchange, the AIM Rules or Admission and Disclosure Standards and is intended to be read in conjunction with these Rules documents and the Millennium Exchange Business Parameters document.

1.4 Document History

This document has been through the following iterations:

Issue	Date	Description
1.0	1 February 2010	First issue of this document published via the Exchange's website and distributed to customers.
2.0	29 March 2010	Updated to include most recent message formats.
3.0	5 May 2010	Third issue of this document published via London Stock Exchange's website and distributed to clients.
4.0	11 June 2010	Fourth issue of this document published via London Stock Exchange's website and distributed to clients.
5.0	19 July 2010	Fifth issue of this document published via London Stock Exchange's website and distributed to clients.
6.0	20 September 2010	Sixth issue of this document published via London Stock Exchange's website and distributed to clients.
7.0	3 December 2010	Seventh issue of this document published via London Stock Exchange's website and distributed to clients.

7.1	19 January 2011	Updated to include minor changes highlighted.
8.0	23 May 2011	Updated to include minor changes highlighted.
9.0	9 December 2011	Updated to support product enhancements being delivered as part of Functional Release Q1 2012.
9.1	29 December 2011	Updated to include an additional new off-book trade type in Appendix B to support enhancements being delivered as part of Functional Release Q1 2012.
9.2	14 March 2012	Minor corrections applied and a further flag added to an existing field in the Add Attributed Order Message.
9.3	1 November 2012	Added Connectivity Policy section 2.4.
10.0	22 March 2013	Amended to reflect the latest Millennium enhancements.
11.0	5 July 2013	Amended to reflect the latest Millennium enhancements.
11.1	26 July 2013	Further amendments to reflect the latest Millennium enhancements.
11.2	18 July 2014	Updated definition of enum “a” in section 4.9.4. Updated definition of price field in Statistics message section 4.9.17.
11.3	31 October 2014	Amended for rebranding ITCH to MITCH. Added Appendix C for Negative value conversion of price field.
11.4	21 December 2014	The following sections have been amended to support the new Cross Order functionality and additional amendments. 2.2 Clarification on the number of connections allowed per compID. 3.1.1 Further clarifications around logon behaviour to

		the Replay service. 3.1.2 Further clarifications around logon behaviour to the Recovery service and response expected from the server before and after 07:00. 4.9.12 Conversion of a current reserved field to the Cross Type field to support the new Cross Order functionality. See MIT902 – Cross Orders Message Change Guidelines for full details on all changes.
11.5	16 Jun 2015	The following sections have been amended for clarification. Note that there are no MITCH interface changes as a result of Release 8.7 : 3.1.1 and 3.1.2 – Added cross reference to *Market Data Parameters* Guide. Clarified description of system behaviour if additional client messages are sent before the exchange of logon messages. 4.8.5 – Clarified the meaning of the sequence number. Correction to Instrument ID description on snapshot complete message. 4.9.14 – Removed Late Trade Bit as not used.
11.6	17 Aug 2015	The following sections have been amended to include the introduction of scheduled level 1 only auctions: 4.5.2 – Added a new 'Top of Book Message' which will disseminate top of book changes when the system is in a scheduled level 1 only auction. 4.9.4 - Added new enum 'G - Scheduled Level 1 Only Auction' for the 'Trading Status' field of the Symbol Status message. 4.9.13 - Added the new enum 'G – Scheduled Level 1 Only Auction' for the 'Auction Type' field of the Auction Trade message. 4.9.16 - Added the new enum 'G – Scheduled Level 1 Only Auction' for the 'Auction Type' field of the Auction Info message. 4.9.18 – Added 'Top of Book' message table.
11.7	16 Aug 2016	The following sections have been amended to aid clarity and also to reflect the changes introduced in Millennium 9.1 upgrade:

		3.1.1, 3.1.2 – Clarified logon behaviour. Added rapid login/logout behaviour. 3.1.2 – Clarified multiple request behaviour and response to a Snapshot Request for an Instrument behaviour. 4.9.2 - 4.9.18 – Clarified Nanosecond field accuracy. 4.9.4 – Removed Closing Price Publication Trading Status. Clarified 'Reason' field behaviour. 4.9.12 – Added new field 'Sub Book'. 4.9.15 – Added new trade type 'RFQ Trades'.
11.8	07 April 2017	The following sections have been amended to aid clarity and also to reflect the changes introduced in the Millennium 9.2 (MiFID II compliant) upgrade: 4.5.2 – Clarified trade cancellations behaviour. 4.5.2, 4.9.1.5 - Removed the 'Trade Break' message 4.9.5 – Extended the Add Order message with a Reserved Field. 4.9.12, 4.9.13, 4.9.14 – Extended the length of the Trade, Auction Trade and Off-Book Trade messages with a new Bit field called 'PTModFlags'.
11.8.1	27 June 2017	The following sections have been amended to aid clarity: 4.9.12, 4.9.13, 4.9.14 – Clarified PTModFlags behaviour 4.9.14 – Clarified Original Price behaviour
11.8.2	11 October	Fixed typo in multiple descriptions of the 'nanosecond' field which is accurate to the *microsecond* not *millisecond*.
11.8.3	7 November 2017	The following sections have been amended to remove references to off-book trade: 4.5.2 – Off-Book Trade message has been removed 4.9.14 - Off-Book Trade message has been removed, the following sections have been re-numbered Appendix B 'Off-book Trade Types' has been removed, Appendix C has been renamed to Appendix B.

11.9	28 August 2018	The following sections have been updated in relation to RFQ functionality: 4.8.5 – '6 – RFQ Quote' flag is added 4.9.4 – 'Private RFQ' book type is added 4.9.5 – '6 - Private RFQ' flag is added 4.9.9 – '6 - Private RFQ' flag is added

Within this document, where amendments have been made to the previous version, these changes will be identified using a series of side bars as illustrated opposite.

Enquiries

Please contact your Technical Account Manager if you have any questions about the Millennium Exchange services outlined in this document. The Technical Account Management team can be contacted at:

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2.0 Connectivity

2.1 Transmission Standards

2.1.1 Multicast Channels

The multicast channel utilises UDP over IP version 4 (IPv4) Ethernet standards. UDP header information is as defined in the IETF RFC 791 (IPv4) and RFC 768 (UDP) transmission standards. Each UDP packet will contain just one Unit Header.

2.1.2 Unicast Channels

The Recovery and Replay channels utilise TCP over IP version 4 (IPv4) Ethernet standards. TCP header information is as defined in the IETF RFC 793 standard and IPv4 is as defined in the RFC 791 standard.

2.2 CompIDs

The CompID of each client wishing to connect to the Recovery and Replay channels must be registered with London Stock Exchange before communications can begin. Each CompID will be assigned a password on registration.

The same CompID could be used to login to Recovery and Replay channels across market data groups. A client could also use the same CompID to login to the Recovery and Replay Channels of both Group Ticker Plant and Level 2-MITCH feeds.

A compID can connect to one Replay and one Recovery service at the same time, either in the same market data gateway or in different market data gateways. However, the same compID cannot connect to more than one Replay service, or more than one Recovery service, at the same time.

Passwords

Each new CompID will be assigned the password **mit_1234** on registration. Unlike other market data services, clients will not be required to change their password on first logon.

2.3 Failover and Recovery

The system has been designed with fault tolerance and disaster recovery technology that ensures that trading should continue in the unlikely event of a process, gateway or site outage.

On unexpected disconnection from the primary gateway, a customer should ensure that their application behaves in accordance with London Stock Exchange's connectivity policy.

2.4 Connectivity Policy

An application should attempt to connect a maximum of 3 times to the primary gateway with a minimum time out value of 3 seconds between attempts before attempting to connect to the secondary gateway – and this should be retried a maximum of a further 3 times. After 6 failed connection attempts (3 on each gateway) the clients should contact London Stock Exchange for further guidance.

Information on London Stock Exchange's Connectivity Policy can be found at the following link:

http://www.londonstockexchange.com/products-and-services/technical-library/technical-guidance-notes/technical-guidance-notes.htm

3.0 Recovery

3.1 Recipient Failures

Recipients have access to two identically sequenced multicast feeds: Feed A and Feed B. Recipients may process both feeds and arbitrate between them to minimise the probability of a data loss.

If a gap in sequence numbers is detected on the multicast channel, the recipient should assume that some or all of the order books maintained on its systems are incorrect and initiate one of the recovery processes outlined below.

3.1.1 Replay Channel

The TCP Replay channel should be used by recipients to recover from a small-scale data loss. It permits clients to request the retransmission of a limited number of messages already

published on the multicast channel. The channel supports the retransmission of the last 65,000 messages published.

Each CompID may login to the Replay channel of a particular market data group up to a limited number times each day. The total number of Replay Requests that a client may send for a particular market data group is also limited. Recipients may request the Exchange to reset its login and request counts. This feature is intended to help manage an emergency situation and should not be relied upon as a normal practice. These limits can be found in the *Market Data Parameters* Guide http://www.londonstockexchange.com/products-and-services/millennium-exchange/millennium-exchange-migration/technicalparasissue2.pdf .

If a client submits multiple requests on the Replay channel, they will be processed serially (i.e. one at a time). Clients are unable to cancel outstanding Replay Requests.

Establishing a Connection

The client should use the relevant IP address and port to establish a TCP/IP session with the Replay channel. The client should initiate a session by sending the Login Request message. The client should identify itself by specifying its CompID in the Username field. The server will validate the CompID, password and IP address.

Once the client is authenticated, the server will respond with a Login Response message with the Status “A”.

The client must wait for the server’s Logon before sending additional messages. The server will ignore messages received prior to sending the Logon message and prior to receiving the Logon response. Subsequently, the Logon sent by the client will be accepted and the user will be logged in successfully.

If a logon attempt fails because of an invalid CompID or IP address, the server will break the TCP/IP connection with the client without sending a Login Response message.

If a logon attempt fails because of an invalid password, a locked CompID or if logins are not currently permitted, the server will send a Login Response and then break the TCP/IP connection with the client.

If a client has exceeded the number permitted of logons for the current day, the server will reject any new logon attempt with a Login Response and then break the TCP/IP connection. The Status of such a Login Response message will be “b”.

If a Login Request is not received within 5 seconds of the establishment of a TCP/IP connection or a Replay Request is not received within 5 seconds of a successful logon, the server will break the TCP/IP connection with the client.

A logon attempt to the Replay channel made by an already logged in client will be disconnected from the server without acknowledgement.

If a client who is already logged in sends another log on attempt via a different TCP/IP connection the system closes the 2nd TCP/IP connection without sending a Login Response message. First connection is not closed in this case.

For each of the below login request rejects, the disconnection will take place within reasonable period time after rejecting the login request. This is to ensure that there is sufficient time for the client to receive the login response prior to breaking the connection.

- Login Response with status 'a'
- Login Response with status 'b'
- Login Response with status 'c'
- Login Response with status 'd'
- Login Response with status 'e’

A protection mechanism is in place in order to protect the gateway from rapid login/logouts. If a user reaches the thresholds for rapid login/logouts, any future logins/logouts will be delayed exponentially.

Heartbeats

The server will not send heartbeats on the Replay channel during periods of inactivity.

Requesting Missed Messages

Once connected to the Replay channel, clients may use the Replay Request message to request the retransmission of missed messages. The request should include the sequence number of the first message in the range to be retransmitted along with the number of messages to be retransmitted.

The retransmission request will be serviced from the server's cache of the last 65,000 messages published on the multicast channel. If the retransmission request includes one or more messages that are not in the server's cache, the entire request will be rejected and no messages will be retransmitted.

Response to a Retransmission Request

The server will respond to the Replay Request with a Replay Response message to indicate whether the retransmission request is successful or not. A Status other than "A" will indicate that the request has been rejected.

In the case of a successful request, the server will retransmit the requested messages immediately after the Replay Response. The sequence numbers of the retransmitted messages will be the same as when they were first disseminated on the multicast channel. The framing of the replayed messages inside of Unit Headers may differ between the original transmission and the retransmission.

Termination of the Connection

If the client does not send a Logout Request and terminate the connection within 5 seconds of the retransmission of the last missed message, the server will break the TCP/IP connection with the client.

3.1.2 Recovery Channel

The TCP Recovery channel should be used by recipients to recover from a large-scale data loss (i.e. late joiner or major outage). It permits clients to request a snapshot of the order book for the active instruments in the market data group.

Each CompID may login to the Recovery channel of a particular market data group a limited number of times each day. The total number of Snapshot Request messages that a client may submit for a particular market data group is also limited. Recipients may request the Exchange to reset its login and request counts. This feature is intended to help manage an emergency situation and should not be relied upon as a normal practice. These limits can be found in the *Market Data Parameters* Guide http://www.londonstockexchange.com/products-and-services/millennium-exchange/millennium-exchange-migration/technicalparasissue2.pdf .

If a client submits multiple requests on the Recovery channel, they will be processed serially (i.e. one at a time), but not sequentially. Active requests of multiple clients will be served on a round robin basis. Clients are unable to cancel outstanding Snapshot Requests.

Establishing a Connection

The client should use the relevant IP address and port to establish a TCP/IP session with the Recovery channel. The client should initiate a connection by sending the Login Request message. The client should identify itself by specifying its CompID in the Username field. The server will validate the CompID, password and IP address of the client.

Once the client is authenticated, the server will respond with a Login Response message with the Status “A”.

The client must wait for the server’s Login Response before sending additional messages. The server will ignore messages received prior to sending the Logon message and prior to receiving the Logon response. Subsequently, the Logon sent by the client will be accepted and the user will be logged in successfully.

If a logon attempt fails because of an invalid CompID or IP address, the server will break the TCP/IP connection with the client without sending a Login Response message.

If a logon attempt fails because of an invalid password, a locked CompID or if logins are not currently permitted, the server will send a Login Response and then break the TCP/IP connection with the client.

If a client has already exceeded the number of permitted log-ins for a particular day, the server will reject any new logon attempt with a Login Response and then break the TCP/IP connection. The Status of such a message will be “b”.

If a Login Request is not received within 5 seconds of the establishment of a TCP/IP connection or a Snapshot Request is not received within 5 seconds of a successful logon, the server will break the TCP/IP connection with the client.

A logon attempt to the Recovery channel made by an already logged in client will be disconnected from the server.

If a client who is already logged in sends another log on attempt via a different TCP/IP connection the system closes the 2nd TCP/IP connection without sending a Login Response message. First connection is not closed in this case.

For each of the below Login Request Rejects, the disconnection will take place within reasonable period time after rejecting the login request. This is to ensure that there is sufficient time for the client to receive the login response prior to breaking the connection.

- Login Response with status 'a'
- Login Response with status 'b'
- Login Response with status 'c'
- Login Response with status 'd'
- Login Response with status 'e’

A protection mechanism is in place in order to protect the gateway from rapid login/logouts. If a user reaches the thresholds for rapid login/logouts, any future logins/logouts will be delayed exponentially.

Heartbeats

The server will not send heartbeats on the Recovery channel during periods of inactivity.

Requesting Order Book Snapshots

Once connected to the Recovery channel, clients may use the Snapshot Request message to request a snapshot of the current order book for all instruments in a specified segment or for a particular instrument. If a client specifies both the Segment and the Instrument ID in the Snapshot Request message, it will be taken as a request for a stated segment.

Although instrument requests can include the sequence number from which the client can build its order books this will not be processed and the service will send a snapshot based on the most recent sequence number on the multicast feed.

A client may submit multiple Snapshot Requests.

Response to a Snapshot Request for an Instrument

The server will transmit a Snapshot Response to indicate whether a Snapshot Request for an Instrument is accepted or rejected. A Status other than “A” will indicate that the request is rejected. The Sequence Number and Order Count fields of the Snapshot Response will always be zero if the response is rejected.

The Snapshot Complete will, if the request is accepted, include the message sequence number of the Real-Time channel with which the instrument’s order book snapshot will be synchronised. The client should buffer all messages on the Real-Time channel for the instrument with sequence numbers greater than that specified in the Snapshot Response.

At the moment, persistent orders from previous trading day are re-injected to the order books just before the beginning of the opening auction at 07:50 UK time. The current logic is as follows.

1. Recovery request sent after 07:00 (UK time)
For each instrument, an Add Order message is sent for each order currently on the book. A Symbol Status and a Snapshot Response messages are also sent.
The Snapshot Response message will include the sequence number with which the order book snapshot was synchronised.

2. Recovery request sent before 07:00 (UK time)
For each instrument, a Symbol Status and a Snapshot Response message will be sent (as there is currently no order on the book).
The Snapshot Response message will also include the sequence number with which the order book snapshot was synchronised.

If the request is successful, the server will disseminate a snapshot of the current book for both the order and quote books (if any) for the requested instrument via a series of Add Order and Add Attributed Order messages. Order book snapshots for the requested instrument(s) will be transmitted serially (i.e. one book at a time). Each such message will represent a single active order and will not include a sequence number. If a particular price point contains multiple orders, they will be disseminated in terms of their time priority (i.e. the oldest order first).

The server will transmit a Symbol Status message once the details for all active orders for the instrument’s order book are disseminated. This message will indicate the current trading status of the requested instrument. This will be followed by the Snapshot Complete message. If an instrument has both order book and quote books, the server will transmit two separate Snapshot Complete messages once the details of all active orders for the particular order book are disseminated. The Snapshot Complete message indicates whether the entry was

made on the order or quote book via the Flags field. The message will include the sequence number with which the order book snapshot was synchronised and the instrument to which it relates. The client may begin processing the buffered messages for the instrument from the multicast channel once the order book snapshot is processed.

Response to a Snapshot Request for a Segment

The server will transmit a Snapshot Response to indicate whether a Snapshot Request for a segment is accepted or rejected. A Status other than “A” will indicate that the request is rejected. The Sequence Number and Order Count fields of the Snapshot Response will be zero whether the request is accepted or rejected.

If the request is successful, the server will disseminate a snapshot of the current book for both the order and quote books (if any) for all instruments in the requested segment via series of Add Order and Add Attributed Order messages. Each such message will represent a single active order and will not include a sequence number. If a particular price point contains multiple orders, they will be disseminated in terms of their time priority (i.e. the oldest order first).

Order book snapshots for the requested instruments will be transmitted serially (i.e. one instrument at a time). The server will transmit a Symbol Status message for each instrument, followed by a Snapshot Complete message once the details of all active orders for a particular instrument’s order book are disseminated. The Snapshot Complete message indicates whether the entry was made on the order or quote book via the Flags field. This message will include the sequence number with which the order book snapshot for the instrument was synchronised. While such a Snapshot Complete will include the instrument to which it relates, it will not include a value in the Segment field. The client may begin processing the buffered messages for the instrument from the multicast channel once its order book snapshot is processed.

The server will also transmit a Snapshot Complete message once the details of all active orders for all instruments in the requested segment are disseminated. The Sequence Number field of the message will be zero. While the final Snapshot Complete will include an indication of the segment to which it relates, it will not include a value in the Symbol field.

3.2 Failures at the Exchange

3.2.1 Snapshots on the multicast channel

In the unlikely event of an outage at the Exchange, recipients may be required to refresh their order book and statistics displays for one or more instruments.

In such a scenario the server will, on the Real-Time channel, broadcast an Order Book Clear message for each affected instrument. In such an event recipients must discard the contents of their order book and statistics displays for these instruments.

The server will then transmit a series of Add Order, Add Attributed Order and Statistics messages, on the Real-Time channel, to disseminate the current order book and statistics for each affected instrument.

3.2.2 Resetting Sequence Numbers

If the market data feed is, in the unlikely event of an outage, failed over to the backup site or is restarted, the message sequence number of the multicast channel will be reset to 1.

4.0 Message Formats

This section provides details on the data types, unit header, nine administrative messages and fifteen application messages utilised by the server. For each message, a description of each field is provided along with the applicable data type, offset and length (in bytes).

4.1 Packet Composition

The Unit Header is used to deliver all administrative and application messages to and from the server on all three channels. A Unit Header may contain zero, one or more payload messages. While a Unit Header may contain multiple application messages, it will never contain more than one administrative message. A Unit Header will not contain both administrative and application messages.

4.2 Sequence Numbers

All application messages transmitted by the server on the multicast and Replay channels are sequenced. The Unit Header only contains the sequence number of the first message. Each subsequent message in the Unit Header will have an implied sequence number one greater than the previous message. The sequence number of first message of the next Unit Header can be determined by adding the value in the Message Count field of the Unit Header to the value in its Sequence Number field.

The application messages sent by the server on the Recovery channel as well as all administrative messages transmitted by both the server and the client are un-sequenced. The Unit Header used to transport all such messages, other than a Heartbeat, will include a Sequence Number of zero.

4.3 Timestamps

The server will, on the multicast channel, transmit a Time message for every second for which at least one application message is generated. The time specified in this message serves as a reference for the times specified in all other application messages. The timestamps in all other messages are specified as a nanosecond offset from the most recent Time message – accurate to the microsecond. This message is not transmitted during periods where no application messages are generated for the multicast channel.

The retransmission of messages on the Replay channel will include the Time messages originally broadcast on the multicast channel (i.e. with the same timestamp).

While Time messages will be included when an order book snapshot is provided on the Recovery channel, the times in these messages will be different from those published when the active orders were originally disseminated on the multicast channel. Clients are unable to determine the time at which an active order was submitted from the messages transmitted on the Recovery channel.

4.4 Data Types

The fields of the various messages utilised by the server will support the data types outlined below.

Data Type	Length	Description
Alpha	Variable	These fields use standard ASCII character bytes. They are left justified and padded on the right with spaces.
Bit Field	1	A single byte used to hold up to eight 1-bit flags. Each bit will represent a Boolean flag. The 0 bit is the lowest significant bit and the 7 bit is the highest significant bit.
Byte	1	A single byte used to hold one ASCII character.
Date	8	Date specified in the YYYYMMDD format using ASCII characters.
Time	8	Time specified in the HH:MM:SS format using ASCII characters.
Price	8	Signed Little-Endian encoded eight byte integer field with eight implied decimal places.
UInt8	1	8 bit unsigned integer.
UInt16	2	Little-Endian encoded 16 bit unsigned integer.
UInt32	4	Little-Endian encoded 32 bit unsigned integer.
UInt64	8	Little-Endian encoded 64 bit unsigned integer.

All Reserved Fields with Alpha Data Type will be populated with Spaces (Hex 0x20). All other Reserved Fields will be populated with Hex 0x00

4.5 Message Overview

4.5.1 Administrative Messages

Name	Message Type		Usage
	ASCII	Hex	
Heartbeat	-	-	Used by the server, on the multicast channel, to exercise the communication line during periods of inactivity.
Login Request	(soh)	0x01	Used by the client to login to the Replay or Recovery channel.
Login Response	(stx)	0x02	Used by the server to accept or reject a login request to the Replay or Recovery channel.
Logout Request	(enq)	0x05	Used by the client to logout of the Replay or Recovery channel.

Replay Request	(etx)	0x03	Used by the client to request a retransmission of messages on the Replay channel.
Replay Response	(eot)	0x04	Used by the server to respond to a retransmission request on the Replay channel.
Snapshot Request	•	0x81	Used by the client to request for a snapshot of the current order book on the Recovery channel.
Snapshot Response	,	0x82	Used by the server to respond to a snapshot request on the Recovery channel.
Snapshot Complete	*f*	0x83	Used by the server to indicate that the transmission of an order book snapshot is complete.

4.5.2 Application Messages

Applications messages may only be sent by the server.

Name	Message Type		Usage
	ASCII	Hex	
Time	T	0x54	Sent by the server for every second for which at least one application message is generated. This message is not transmitted during periods where no other application messages are generated.
System Event	S	0x53	Sent to indicate the start and end of the day.
Symbol Directory	R	0x52	Used to disseminate information (e.g. symbol, segment, ISIN, underlying, etc.) on each instrument.
Symbol Status	H	0x48	Indicates the trading session (e.g. pre-opening, regular trading, etc.) that currently applies to an instrument.
Add Order	A	0x41	Sent to indicate that an anonymous limit or market order is added to the order book.
Add Attributed Order	F	0x46	Indicates that a named order is added to the order book. The identity of the submitting firm is included in the message.
Order Deleted	D	0x44	Sent to indicate that the remainder of a displayed order is cancelled.
Order Modified	U	0x55	Indicates that the displayed quantity or price of a displayed order has been updated. The message will include an indication whether the order has retained or lost its time priority.
Order Book Clear	y	0x79	Sent to instruct recipients to remove all orders from the order book for the specified instrument.
Order Executed	E	0x45	Indicates that the displayed portion of an order is fully or partially filled at its displayed price. The executed quantity is included in the message.

Name	Message Type		Usage
Order Executed With Price/ Size	C	0x43	Sent if a displayed order is fully or partially filled at a price that is different from its displayed price. The executed quantity and price is included in the message along with an indication of whether the trade should update time and sales and statistics displays.
Trade	P	0x50	Sent if a non-display order is fully or partially filled. Also sent to denote trade cancellations.
Auction Trade	Q	0x51	Sent to report details of an auction (e.g. opening, closing, etc.). The message indicates the price and bulk volume associated with the auction. Also sent to denote auction trade cancellations.
Auction Info	I	0x49	Used to disseminate the indicative auction price and the tradable quantity and imbalance at this price.
Statistics	w	0x77	Used to disseminate official Opening and Closing prices
Top of Book Message	q	0x71	Used to disseminate top of book changes when the instrument is in a scheduled level 1 only auction.

4.6 Unit Header

Field	Offset	Length	Type	Description
Length	0	2	UInt16	Length of the message block including the header and all payload messages.
Message Count	2	1	UInt8	Number of payload messages that will follow the header.
Market Data Group	3	1	Byte	Identity of the market data group the payload messages relate to. This field is not validated for client initiated messages.
Sequence Number	4	4	UInt32	Sequence number of the first payload message.
Payload	8	Variable	-	One or more payload messages.

4.7 Administrative Messages (Client)

4.7.1 Login Request

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex Meaning 0x01 Login Request

Username	2	6	Alpha	CompID assigned to the client.
Password	8	10	Alpha	Password assigned to the CompID.

4.7.2 Replay Request

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex Meaning 0x03 Replay Request
Market Data Group	2	1	Byte	Identity of the market data group the replay request relates to.
First Message	3	4	UInt32	Sequence number of the first message in range to be retransmitted.
Count	7	2	UInt16	Number of messages to be resent

4.7.3 Snapshot Request

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex Meaning 0x81 Snapshot Request
Sequence Number	2	4	UInt32	Sequence number from which client can build the order book, only required for instrument level requests.
Segment	6	6	Alpha	Segment the request relates to. The field should contain only spaces if the Instrument ID field is populated
Instrument ID	12	4	UInt32	LSE Instrument Identifier. The instrument the request relates to. The field should contain only zeros if it does not relate to an instrument.

4.7.4 Logout Request

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex Meaning 0x05 Logout Request

4.8 Administrative Messages (Server)

4.8.1 Heartbeat

A Unit Header with a Message Count of zero will be used by the server as a Heartbeat message. Such a message will never increment the sequence number of the multicast channel. However, the next expected sequence number will be included in the Sequence Number to enable recipients to detect gaps on the multicast channel.

4.8.2 Login Response

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x02: Login Response
Status	2	1	Byte	Status of the login request. Value: Meaning A: Login Accepted a: CompID Inactive/Locked b: Login Limit Reached c: Service Unavailable d: Concurrent Limit Reached e: Failed (Other)

4.8.3 Replay Response

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x04: Replay Response
Market Data Group	2	1	Byte	Identity of the market data group the replay request relates to.
First Message	3	4	UInt32	Sequence number of the first message in range to be retransmitted. This will be zero if Status is not “A”.
Count	7	2	UInt16	Number of messages to be resent. This will be zero if Status is not “A”.

Status	9	1	Byte	Status of the replay request. Value – Meaning A – Request Accepted D – Request Limit Reached I – Invalid Market Data Group O – Out of Range U – Replay Unavailable d – Unsupported message type e – Failed (other) c – Concurrent limit reached

4.8.4 Snapshot Response

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex – Meaning 0x82 – Snapshot Response
Sequence Number	2	4	UInt32	This field will always be populated with 0.
Order Count	6	4	UInt32	This field will always be populated with 0.
Status	10	1	Byte	Status of the snapshot request. Value – Meaning A – Request Accepted O – Out of Range U – Snapshot Unavailable a – Valid Segment or Symbol Not Specified b – Request Limit Reached c – Concurrent Limit Reached d – Unsupported message type e – Failed (Other)

4.8.5 Snapshot Complete

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.

Message Type	1	1	Byte	Hex: 0x83 — Meaning: Snapshot Complete
Sequence Number	2	4	UInt32	Sequence number with which the snapshot is synchronised. This signifies the sequence number of the last message that has been recovered.
Segment	6	6	Alpha	Segment the snapshot relates to. The field will contain only spaces if it does not relate to a segment.
Instrument ID	12	4	UInt32	Instrument the snapshot relates to. The field will contain zero if the snapshot does not relate to an instrument.
Flags	16	1	Bit Field	Bit 5 — Name: Firm Quote — Meaning: 0: No, 1: Yes Bit 6 — Name: RFQ Quote — Meaning: 0: No, 1:Yes The field will contain '0' for the order book.

4.9 Application Messages

4.9.1 Time

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: 0x54 — Meaning: Time
Seconds	2	4	UInt32	Number of seconds since midnight. Midnight will be in terms of the local time for the server (i.e. not UTC).

4.9.2 System Event

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: 0x53 — Meaning: System Event
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.

Event Code	6	1	Byte	Value	Meaning
				C	End of Day
				O	Start of Day

4.9.3 Symbol Directory

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x52: Symbol Directory
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Instrument ID	6	4	UInt32	Instrument's symbol.
Reserved	10	1	Byte	Reserved field
Reserved	11	1	Byte	Reserved field
Symbol Status	12	1	Alpha	Value: Meaning S: Suspended a: Inactive H: Halt This field will contain a space if the instrument is active.
ISIN	13	12	Alpha	Instrument identification number
SEDOL	25	12	Alpha	Instrument identification number
Segment	37	6	Alpha	Segment the instrument is assigned to.
Underlying	43	6	Alpha	Reserved for future use
Currency	49	3	Alpha	ISO Currency Code
Reserved	52	1	Byte	Reserved field
Reserved	53	4	Alpha	Reserved field
Previous Close Price	57	8	Price	Previous Close Price of instrument

4.9.4 Symbol Status

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x48: Symbol Status
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Instrument ID	6	4	UInt32	Instrument's symbol.

<table>
<tr><td>Reserved</td><td>10</td><td>1</td><td>Byte</td><td>Reserved field</td></tr>
<tr><td>Reserved</td><td>11</td><td>1</td><td>Byte</td><td>Reserved field</td></tr>
<tr><td>Trading Status</td><td>12</td><td>1</td><td>Byte</td><td><table><tr><th>Value</th><th>Meaning</th></tr><tr><td>H</td><td>Halt</td></tr><tr><td>T</td><td>Regular Trading/Start of Trade Reporting</td></tr><tr><td>a</td><td>Opening/First Auction Call</td></tr><tr><td>b</td><td>Post-Close</td></tr><tr><td>c</td><td>Market Close / System Shutdown</td></tr><tr><td>d</td><td>Closing Auction Call</td></tr><tr><td>e</td><td>AESP Auction Call</td></tr><tr><td>f</td><td>Resume Auction Call</td></tr><tr><td>l</td><td>Pause</td></tr><tr><td>m</td><td>Pre-Mandatory</td></tr><tr><td>n</td><td>Mandatory</td></tr><tr><td>o</td><td>Post-Mandatory</td></tr><tr><td>q</td><td>EDSP Auction Call</td></tr><tr><td>r</td><td>Periodic Auction Call</td></tr><tr><td>t</td><td>End Trade Reporting</td></tr><tr><td>w</td><td>No Active Session</td></tr><tr><td>x</td><td>End of Post Close</td></tr><tr><td>u</td><td>Closing Price Crossing</td></tr><tr><td>G</td><td>Scheduled Level 1 Only Auction</td></tr></table></td></tr>
<tr><td>Flags</td><td>13</td><td>1</td><td>Bit Field</td><td><table><tr><th>Bit</th><th>Name</th><th>Meaning</th></tr><tr><td>5</td><td>Firm Quote</td><td>0: No
1: Yes</td></tr></table></td></tr>
</table>

<table>
<tr><td>Reason</td><td>14</td><td>4</td><td>Alpha</td><td>Reason for the manual session change or the trading halt.
In a manual session change this will be the selected reason from the listed values of the Change Reason Table. If free text is typed, a space will be sent in the Reason field.
If trading is halted this will be stamped with the reason codes listed in Appendix A.

Will also be stamped if the instrument moves to Re-Opening Auction Call or Closing Auction Call due to outer circuit breaker activation .</td></tr>
<tr><td>Session Change Reason</td><td>18</td><td>1</td><td>UInt8</td><td><table><tr><th>Value</th><th>Meaning</th></tr><tr><td>0</td><td>Scheduled Transition</td></tr><tr><td>1</td><td>Extended by Market Ops</td></tr><tr><td>2</td><td>Shortened by Market Ops</td></tr><tr><td>3</td><td>Market Order Imbalance</td></tr><tr><td>4</td><td>Price Outside Range</td></tr><tr><td>9</td><td>Unavailable (recovery service only)</td></tr></table></td></tr>
<tr><td>New End Time</td><td>19</td><td>8</td><td>Time</td><td>New time the session will end. Will only be stamped if the session change was not in the original schedule e.g. AESP auction call or unscheduled session. For all other cases a space will be stamped on this field. New End Time will be in terms of the local market time (i.e. not UTC).</td></tr>
<tr><td>Book type</td><td>27</td><td>1</td><td>UInt8</td><td><table><tr><th>Value</th><th>Meaning</th></tr><tr><td>1</td><td>On-Book</td></tr><tr><td>2</td><td>Off-Book</td></tr><tr><td>3</td><td>Private RFQ</td></tr></table>
Book Type ‘3’ will only be sent along with the Trading Status ‘w’ (No Active Session) via Replay/Recovery channel as Symbol Status for RFQ book is not published via Real-time channel.</td></tr>
</table>

4.9.5 Add Order

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x41: Add Order
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Order ID	6	8	UInt64	Unique identifier of the order.
Side	14	1	Byte	Value: Meaning B: Buy Order S: Sell Order
Quantity	15	4	UInt32	Displayed quantity of the order.
Instrument ID	19	4	UInt32	Instrument identifier
Reserved	23	1	Byte	Reserved field
Reserved	24	1	Byte	Reserved field
Price	25	8	Price	Limit price of the order.
Flags	33	1	Bit Field	Bit: Name: Meaning 4: Market Order: 0: No, 1: Yes 6: Private RFQ: 0: No, 1: Yes
Reserved Field	34	10	Alpha	Reserved field

4.9.6 Add Attributed Order

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x46: Add Attributed Order
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Order ID	6	8	UInt64	Unique identifier of the order.
Side	14	1	Byte	Value: Meaning B: Buy Order S: Sell Order

Quantity	15	4	UInt32	Displayed quantity of the order.
Instrument ID	19	4	Uint32	Instrument identifier
Reserved	23	1	Byte	Reserved field
Reserved	24	1	Byte	Reserved field
Price	25	8	Price	Limit price of the order.
Attribution	33	11	Alpha	Identity of firm that submitted the order.
Flags	44	1	Bit Field	Bit / Name / Meaning 4 / Named Market Order / 0: No, 1: Yes 5 / Firm Quote / 0: No, 1: Yes

4.9.7 Order Deleted

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x44: Order Deleted
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Order ID	6	8	UInt64	Identifier for the order.
Flags	14	1	Bit Field	Bit: Name: Meaning 5: Firm Quote: 0: No, 1: Yes
InstrumentID	15	4	UInt32	Instrument Identifier

4.9.8 Order Modified

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x55: Order Modified
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Order ID	6	8	UInt64	Identifier for the order.
New Quantity	14	4	UInt32	New displayed quantity of the order.
New Price	18	8	Price	New limit price of the order.
Flags	26	1	Bit Field	Bit: Name: Meaning 0: Priority Flag: 0: Priority Lost, 1: Priority Retained 5: Firm Quote: 0: No, 1: Yes

4.9.9 Order Book Clear

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x79: Order Book Clear
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, to the nearest microsecond.
Instrument ID	6	4	UInt32	Instrument identifier
Reserved	10	1	Byte	Reserved field
Reserved	11	1	Byte	Reserved field
Flags	12	1	Bit Field	Bit: Name: Meaning 5: Firm Quote: 0: No, 1: Yes 6: Private RFQ: 0: No, 1: Yes

4.9.10 Order Executed

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x45: Order Executed
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Order ID	6	8	UInt64	Identifier for the order.
Executed Quantity	14	4	UInt32	Quantity executed.
Trade Match ID	18	8	UInt64	Unique identifier of the trade.

4.9.11 Order Executed With Price/Size

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x43: Order Executed With Price/Size

Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Order ID	6	8	UInt64	Identifier for the order.
Executed Quantity	14	4	UInt32	Quantity executed.
Display Quantity	18	4	UInt32	Displayed quantity of the order after the execution.
Trade Match ID	22	8	UInt64	Unique identifier of the trade.
Printable	30	1	Byte	Value Meaning N Non-Printable Y Printable
Price	31	8	Price	Price at which the order was executed.

4.9.12 Trade

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex Meaning 0x50 Trade
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond..
Executed Quantity	6	4	UInt32	Quantity executed.
Instrument ID	10	4	UInt32	Instrument identifier
Reserved	14	1	Byte	Reserved field
Reserved	15	1	Byte	Reserved field
Price	16	8	Price	Executed price.
Trade Match ID	24	8	UInt64	Unique identifier of the trade.

<table>
<tr><td>Cross Type</td><td>32</td><td>1</td><td>UInt8</td><td>The type of the Cross/BTF Order. Will only be populated in case of Cross/BTF order executions. In other scenarios, the field will be populated with a value of ‘0’ (zero).
<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>5</td><td>Internal Cross</td></tr><tr><td>6</td><td>Internal BTF</td></tr><tr><td>7</td><td>Committed Cross</td></tr><tr><td>8</td><td>Committed BTF</td></tr></table></td></tr>
<tr><td>Sub Book</td><td>33</td><td>1</td><td>Uint8</td><td><table><tr><th>Value</th><th>Meaning</th></tr><tr><td>0</td><td>Regular Trades</td></tr><tr><td>11</td><td>RFQ Trades</td></tr></table></td></tr>
<tr><td>PTModFlags</td><td>34</td><td>1</td><td>Bit Field</td><td>Indicates a trade cancellation or amendment.
<table><tr><th>Value</th><th>Meaning</th><th>Meaning</th></tr><tr><td>0</td><td>CANC</td><td>0: No
1: Yes</td></tr><tr><td>1</td><td>AMND</td><td>0: No
1: Yes</td></tr></table></td></tr>
</table>

4.9.13 Auction Trade

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex Meaning 0x51 Auction Trade
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Quantity	6	4	UInt32	Quantity executed in auction.
Instrument ID	10	4	UInt32	Instrument’s symbol.
Reserved	14	1	Byte	Reserved field
Reserved	15	1	Byte	Reserved field
Price	16	8	Price	Price of auction.

Trade Match ID	24	8	UInt64	Unique identifier of the trade.
Auction Type	32	1	Byte	Value: Meaning C: Closing Auction O: Opening Auction A: AESP B: EDSP E: Resume Auction F: Periodic Auction G: Scheduled Level 1 Only Auction
PTModFlags	33	1	Bit Field	Indicates a trade cancellation or amendment. **Value** / **Meaning** / **Meaning** 0 / CANC / 0: No 1: Yes 1 / AMND / 0: No 1: Yes

4.9.14 Auction Info

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x49: Indicative Auction Info
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Paired Quantity	6	4	UInt32	Quantity that will be matched at the indicative price.
Reserved	10	4	UInt32	Reserved field
Reserved	14	1	Byte	Reserved field
Instrument ID	15	4	UInt32	Instrument identifier
Reserved	19	1	Byte	Reserved field
Reserved	20	1	Byte	Reserved field
Price	21	8	Price	Indicative auction price.

Auction Type	29	1	Byte	Value	Meaning
				C	Closing Auction
				O	Opening Auction
				A	AESP
				B	EDSP
				E	Resume auction
				F	Periodic auction
				G	Scheduled Level 1 Only Auction

4.9.15 Statistics

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: 0x77 Meaning: Statistics
Nanosecond	2	4	UInt32	Nanoseconds since last Time message, accurate to the nearest microsecond.
Instrument ID	6	4	UInt32	LSE Instrument Identifier.
Reserved	10	1	Byte	Reserved field
Reserved	11	1	Byte	Reserved field
Statistic Type	12	1	Alpha	Value: O Meaning: Opening Price; Value: C Meaning: Closing Price
Price	13	8	Price	Opening or Closing price. Note that if the Opening and Closing or Previous Close Prices is cleared by the Exchange, a -1 value will be stamped in this field. Refer to **Appendix C** for conversion of negative values

Open/Close Price Indicator	21	1	Alpha	Value: Meaning A: UT B: AT C: Mid of BBO D: Last AT E: Last UT F: Manual I: Derived from previous close
Reserved	22	1	Bit Field	Reserved for future use

4.9.16 Top Of Book

Field	Offset	Length	Type	Description
Length	0	1	UInt8	Length of message including this field.
Message Type	1	1	Byte	Hex: Meaning 0x71: Top of Book
Nanosecond	2	4	UInt32	Nanoseconds offset from the last Time message, accurate to the nearest microsecond.
Instrument ID	6	4	UInt32	LSE Instrument Identifier
Buy Limit Price	10	8	Price	Best bid price. Will contain zero if there are no visible limit orders on the buy side
Buy Limit Size	18	4	UInt32	Cumulative visible size at best bid price. Will contain zero if there are no visible limit orders on the buy side
Sell Limit Price	22	8	Price	Best offer price. Will contain zero if there are no visible limit orders on the sell side
Sell Limit Size	30	4	UInt32	Cumulative visible size at best offer price. Will contain zero if there are no visible limit orders on the sell side

Appendix A – Trading halt reason codes

Code	Reason
9998	Matching partition suspended
9999	System suspended
space	Reason not available
102	Regulatory Halt

Appendix B – Conversion of Negative Values in Price Fields

Encoding Negative Values in Price Fields

Decimal value = -1
Decimal value with eight implied decimal places = -100000000
Remove sign bit = 100000000
Convert to binary = 00000000 00000000 00000000 00000000 00000101 11110101 11100001 00000000
Add sign bit = 10000000 00000000 00000000 00000000 00000101 11110101 11100001 00000000
Hex value = 80 00 00 00 05 f5 e1 00
Hex value converted to Little endian = 00 e1 f5 05 00 00 00 80

Decoding Negative Values in Price Fields

Received bytes in hex = 00 e1 f5 05 00 00 00 80
Change the byte order to big endian = 80 00 00 00 05 f5 e1 00
Convert to binary = 10000000 00000000 00000000 00000000 00000101 11110101 11100001 00000000
Most significant bit is set. Therefore this is a negative value.
Remove the sign bit = 00000000 00000000 00000000 00000000 00000101 11110101 11100001 00000000
Convert to decimal = 100000000
Add sign to decimal = -100000000
Mark eight implied decimal places -1.00000000

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