



# **Cboe Europe Multicast PITCH Specification**

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# 1 Introduction

## 1.1 Overview

Cboe participants may use Multicast PITCH to receive real-time depth of book quotations, Systematic Internaliser quotes, Indices quotes and execution information direct from Cboe. A WAN-Shaped and Gig-Shaped version of the Multicast PITCH feed is available from Cboe. Participants may choose to utilise either of the Multicast PITCH feeds depending on their location and connectivity to Cboe.

Multicast PITCH feed descriptions:

- *Gig-Shaped*: Collection of multicast addresses and gap request infrastructure for gigabit connectivity from Cboe. Cboe Trade Reporting Facility ("TRF") Trade feed and Cboe Indices (XIC/XID/XIE) feeds are not available as a Gig-Shaped feed.
- *WAN-Shaped*: Collection of multicast addresses and gap request infrastructure for WAN connectivity from Cboe.

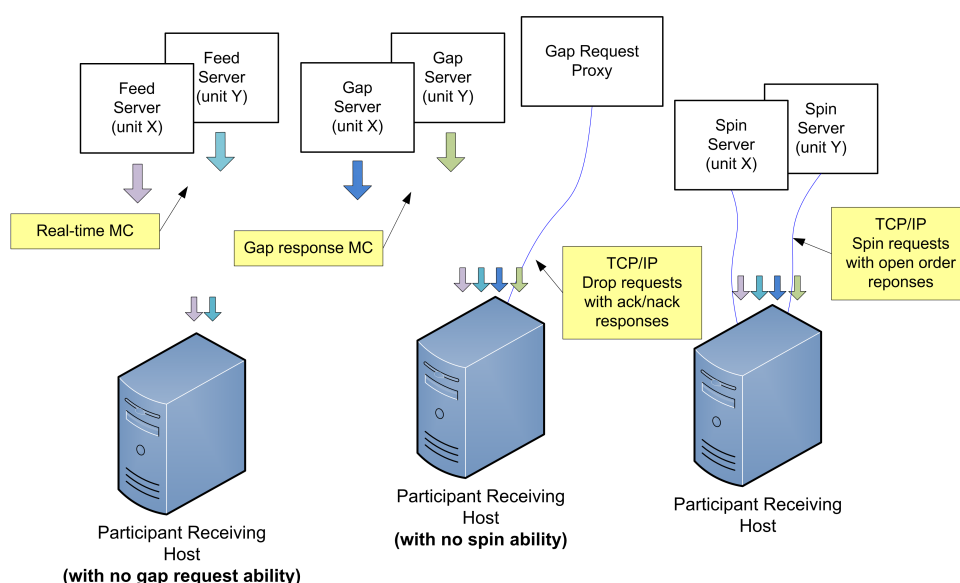
## 1.2 Feed Connectivity Requirements

- Gig-Shaped feeds are available to participants with a minimum of 1 Gb/s of connectivity to Cboe via cross connect or dedicated circuit.
- WAN-Shaped feeds are available to participants who meet the minimum bandwidth requirements to Cboe (see appendix) via cross connect, dedicated circuit, or a supported carrier.

Participants with sufficient connectivity may choose to take both the Gig-Shaped and WAN-Shaped feeds from Cboe and arbitrate the feeds to recover lost data.

Multicast PITCH real-time events are delivered using a published range of multicast addresses divided by market and symbol range. Dropped messages can be requested using a TCP/IP connection to one of the Cboe Gap Request Proxy (GRP) servers with replayed messages being delivered on a separate set of multicast ranges reserved for packet retransmission. Intraday, a spin of all open orders may be requested from a Spin Server. This allows a client to become current without requesting a gap for all messages up to that point in the day.

The following diagram is a logical representation of a Multicast PITCH feed for two units:



### 1.3 Symbol Ranges, Units, and Sequence Numbers

Symbols will be separated into units by a published market and alphabetical distribution. Symbol distribution will not change intraday. Cboe does, however, **reserve the right to add multicast addresses or change the symbol distribution** with prior notice to participants. Care should be taken to ensure that address changes, address additions, and symbol distribution changes can be supported easily.

Message sequence numbers are incremented by one for every sequenced message within a particular unit. It is important to understand that one *or more* units will be delivered on a single multicast address. As with market/symbol ranges, unit distribution across multicast addresses will not change intraday, but may change after notice has been given.

Symbol distribution across units as well as unit distribution across multicast addresses are identical for real-time and gap response multicast addresses.

### 1.4 Gap Request Proxy and Message Retransmission

Requesting delivery of missed data is achieved by connecting to a Gap Request Proxy (GRP). Participants who do not wish to request missed messages do not need to connect to a GRP for any reason or listen to the multicast addresses reserved for message retransmission. Participants choosing to request missed data will need to connect to their assigned GRP, log in, and request gap ranges as necessary. All gap requests will be responded to with a Gap Response Message. A Gap Response Status code of Accepted signals that the replayed messages will be delivered via the appropriate gap response multicast address. Any other Gap Response status code will indicate the reason that the request can not be serviced.

Gap requests are limited in message count, frequency, and age by the GRP. Gap requests will only be serviced if they are within a defined sequence range of the current multicast sequence number for the requested unit. Participants will receive a total daily allowance of gap requested messages. In addition, each participant is given renewable one second and one minute gap request limits.

If overlapping gap requests are received within a short period of time, the gap server will only send the union of the sequence ranges across grouped gap requests. Participants will receive gap responses for their unit/sequence/count, but received should be prepared for the **gap responses to be delivered via multicast in non-contiguous blocks**.

Gap acknowledgements or rejects will be delivered to users for every gap request received by the GRP. Users should be prepared to see replayed multicast data before or after the receipt of the gap response acknowledgement from the GRP.

### 1.5 Spin Servers

A Spin Server is available for each unit. The server allows Participants to connect via TCP and receive a spin of all currently open orders/quotes on that unit. By using the spin, a Participant can get the current book quickly in the middle of the trading session without worry of gap request limits. The spin server for each unit listens on its own address and/or TCP port.

Upon successful login and periodically thereafter, a Spin Image Available message is sent which contains a sequence number indicating the most recent message applied to the book. A Participant may then request the spin for the orders up to the sequence number using a Spin Request message with a sequence number from one of the *last ten* Spin Image Available messages.

The spin consists of Trading Status, Statistics, Add Order (long and/or short) and Time messages. Auction Update messages are also included where relevant. Only open orders will be sent in the spin. Spins will not contain any message for an order which is no longer on the book. While receiving the spin, the Participant must buffer any multicast messages received whose sequence numbers are greater than the sequence number presented in the Spin Request message. When a Spin Finished message is received, the buffered messages must be applied to the spun copy of the book to bring it current.

Trading Status and Statistics messages will be sent for every symbol. These messages are sent before the open orders. The Time Offset is set to zero and no timing should be deduced from these messages.

Appendix C (see p. 83) shows an example flow of messages between a Participant and a Cboe Multicast PITCH feed and Spin Server.

## 1.6 CXE, BXE and DXE Books

The CXE, BXE and DXE integrated and dark pools operate as separate islands of liquidity. The CXE and BXE books represent the UK venue and the DXE books represent the NL venue. Smart order routing capabilities between CXE and BXE are in place.

CXE, BXE and DXE each consist of twelve units. Initially in DXE units 1, 2, 3 and 11 will have no live symbols and will therefore only send heartbeat messages. Participants are advised to configure their Multicast PITCH processing to consume messages from these units in readiness for symbols becoming live on them.

A tradable instrument on each platform is considered distinct. Separate real-time and gap multicast groups, gap request proxies and spin servers will be provided for each market.

- *CXE*:
  - Gig-Shaped Primary (XA)
  - Gig-Shaped Secondary (XB)
  - WAN-Shaped Primary (XC)
  - WAN-Shaped Secondary (XD)
- *BXE*:
  - Gig-Shaped Primary (BA)
  - Gig-Shaped Secondary (BB)
  - WAN-Shaped Primary (BC)
  - WAN-Shaped Secondary (BD)
- *DXE*:
  - Gig-Shaped Primary (DA)
  - Gig-Shaped Secondary (DB)
  - WAN-Shaped Primary (DC)
  - WAN-Shaped Secondary (DD)

In Equinix Park Royal, only a single WAN shaped feed is provided per book:

- *CXE*: WAN-Shaped Disaster Recovery (XE)
- *BXE*: WAN-Shaped Disaster Recovery (BE)
- *DXE*: WAN-Shaped Disaster Recovery (DE)

## 1.7 Trade Reporting Facility and Systematic Internaliser Quote Publication

The Multicast PITCH protocol is also used to disseminate Systematic Internaliser quote data, furthermore it is used by TRF to disseminate details of OTC or SI trades using the Trade - Extended message.

Systematic Internaliser (SI) Quotes will be published on the Systematic Internaliser Multicast PITCH data using a variation of the existing Multicast PITCH Add Order messages. The Expanded Add Order message adds an attribution field allowing the quote to be attributed to a particular systematic internaliser, and a type field, which identifies the order as an SI Quote.

As a Systematic Internaliser modifies or cancels their existing quotes, this activity will be reflected on the Multicast PITCH feed as a series of Delete Order and Expanded Add Order messages as applicable. Hence, participants who already have systems capable of processing Cboe Multicast PITCH messages may be able to re-use much of the same technology to maintain the current SI Quote book with minimal changes.

Order Executed, Trade and Trade Break messages are not applicable to the TRF Multicast PITCH feed.

Separate Quote and Trade Reporting feeds are provided, with WAN shaped feeds of each being available.

In Equinix Slough, separate Quote and Trade Reporting feeds are provided as below:

- *Trade Reporting Facility (TRF):*
  - WAN-Shaped Primary Trades (TC)
  - WAN-Shaped Secondary Trades (TD)
- *SI Quote Publication:*
  - Gig-Shaped Primary Quotes (QA)
  - Gig-Shaped Secondary Quotes (QB)
  - WAN-Shaped Primary Quotes (QC)
  - WAN-Shaped Secondary Quotes (QD)

In Equinix Park Royal, only a single feed of each type is provided:

- *Trade Reporting Facility (TRF):*
  - WAN-Shaped Primary Trades (TE)
- *SI Quote Publication:*
  - WAN-Shaped Primary Quotes (QE)

## 1.8 Indices Quotes

Indices quotes are disseminated only on CXE through the Multicast PITCH protocol, on WAN feeds.

During trading hours quotes are sent once per second. At market close one last quote per index is published, marked with Index Status = 'C'.

On days when the exchange delivery settlement price (EDSP) of an index is calculated, one EDSP quote message is sent per affected index, at market close.

In Equinix Slough feeds are provided as below:

- Wan-Shaped Primary (XIC)
- Wan-Shaped Secondary (XID)

In Equinix Park Royal, only a single WAN shaped feed is provided:

- WAN-Shaped Disaster Recovery (XIE)



## 2 Protocol

Users may use the PITCH 2.X protocol over multicast to receive real-time full depth of book quotations and execution information direct from Cboe.

PITCH 2.X cannot be used to enter orders. For order entry, refer to the Cboe FIX or BOE Specifications.

All visible orders and executions are reflected via the PITCH 2.X feed. All orders and executions are anonymous, and do not contain any Participant identity.

### 2.1 Message Format

The messages that make up the PITCH 2.X protocol are delivered using Cboe Sequenced Unit Header which handles sequencing and delivery integrity. All messages delivered via multicast as well as to/from the Gap Request Proxy (GRP) and Spin Server will use the Sequenced Unit Header for handling message integrity.

All UDP delivered events are self contained. Developers can assume that UDP delivered data will not cross frame boundaries and a single Ethernet frame will contain only one Sequenced Unit Header with associated data.

TCP/IP delivered events from the GRP and Spin Server may cross frames as the data is delivered as a stream of data with the TCP/IP stack controlling Ethernet framing.

The PITCH 2.X data feed is comprised of a series of dynamic length sequenced messages. Each message beings with Length and Message Type fields. Cboe reserves the right to add message types and grow the length of any message without notice. Participants should develop their decoders to ignore unknown message types and messages that grow beyond the expected length. Messages will only be grown to add additional data to the end of the message.

### 2.2 Data Types

The following field types are used within the Sequenced Unit Header, GRP messages, Spin Server messages, and PITCH 2.X.

Data Type	Description
Alphanumeric	Left justified ASCII fields, space padded on the right.
Binary	Unsigned and sized to "Length" bytes and ordered using Little Endian convention (least significant byte first).
Binary Short Price	Unsigned Little Endian encoded two byte binary fields with two implied decimal places (denominator = 100).
Binary Long Price	Unsigned Little Endian encoded 8 byte binary fields with implied decimal places. On The Cboe BXE / CXE systems, four decimal places are implied (denominator = 10,000), while on the Cboe TRF system, six decimal places are implied (denominator = 1,000,000).

### 2.3 Message Framing

Depth of book update messages will be combined into a single UDP frame where possible to decrease message overhead and total bandwidth. The count of messages in a UDP frame will be communicated using the Sequenced Unit Header. Framing will be determined by the server for each unit and site. The content of the multicast across feeds (A/B and Gig-Shaped/WAN-Shaped) will be identical, but framing will not be consistent across feeds. Processes that receive and arbitrate multiple feeds cannot use frame level arbitration to fill gaps.

## 2.4 Cboe Sequenced Unit Header

The Cboe Sequenced Unit Header is used for all Multicast PITCH messages **and messages to/from the Gap Request Proxy (GRP) and Spin Server**.

Sequenced and unsequenced data may be delivered using the Sequenced Unit Header. Unsequenced data will have 0 values for the unit and sequence fields. All messages sent to and from the GRP and Spin Server are unsequenced while multicast may contain sequenced and unsequenced messages.

Sequenced messages have implied sequences with the first message having the sequence number contained in the header. Each subsequent message has an implied sequence one greater than the previous message up to a maximum of count messages. Multiple messages can follow a Sequenced Unit Header, but a combination of sequenced and unsequenced messages cannot be sent with one header.

The sequence numbers for the first message in the next frame can be calculated by adding the Hdr Count field to the Hdr Sequence. This technique will work for sequenced messages and heartbeats.

Sequenced Unit Header				
Field	Offset	Length	Data Type	Description
Hdr Length	0	2	Binary	Length of entire block of messages. Includes this header and "Hdr Count" messages to follow.
Hdr Count	2	1	Binary	Number of messages to follow this header.
Hdr Unit	3	1	Binary	Unit that applies to messages included in this header.
Hdr Sequence	4	4	Binary	Sequence of first message to follow this header.
Total Length = 8 bytes				

## 2.5 Execution Ids

Execution Ids are 12 characters, base 36.

## 2.6 Trade Amendments

Order-book or reported trades that are subsequently amended will result in two Trade - Extended Form messages to be sent. The first trade will be transmitted using all of the details of the original trade, including MMT flags, but with the Cancellation flag set. The second trade will be transmitted using the amended details, including MMT flags, but with the Modification flag set.

## 2.7 Heartbeat Messages

The Sequenced Unit Header with a count field set to "0" is used for heartbeat messages. During trading hours, heartbeat messages will be sent from the GRP and all multicast addresses if no data has been delivered within 1 second. Heartbeat messages never increment the sequence number for a unit, but can be used to detect gaps on the real-time multicast channels during low update rate periods.

Heartbeats on the real-time multicast addresses during trading hours will have a Hdr Sequence value equal to the sequence of the next sequenced message to be sent for the unit. Heartbeats on gap multicast addresses always have the Hdr Sequence field set to 0. All heartbeat messages sent to and from the GRP are considered unsequenced and should have sequence and unit fields set to 0.

Outside of trading hours, Cboe sends heartbeat messages on all real-time and gap channels with a sequence of "0" to help users validate multicast connectivity. Heartbeat messages may not be sent from 12:00am – 1:00am London time or during maintenance windows.

Cboe expects heartbeat messages to be sent to the GRP and Spin Server on live connections no less than every five seconds. Failure to receive two consecutive heartbeat messages will result in the GRP or Spin Server terminating the client connection.

## 3 Gap Request Proxy Messages

The following messages are used for initialising a TCP/IP connection to the Gap Request Proxy (GRP) and to request message retransmissions. Participants only need to implement the following messages if gap requests will be made. The following messages will not be delivered using multicast. **All messages sent to the GRP and Spin Server must be contained in a Sequenced Unit Header.**

Note that message retransmission can't be requested for indices data.

### 3.1 Login Message

The Login Message is the first message sent to the GRP by a user's process after the connection to the GRP is established. Failure to login before sending any other message type will result in the connection being dropped by the GRP.

Login Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x01	Login Message
SessionSubId	2	4	Alphanumeric	SessionSubId supplied by Cboe
Username	6	4	Alphanumeric	Username supplied by Cboe
Filler	10	2	Alphanumeric	(space filled)
Password	12	10	Alphanumeric	Password supplied by Cboe
Total Length = 22 bytes				

### 3.2 Login Response Message

The Login Response Message is sent by the GRP to a user's process in response to a Login Message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the connection will be dropped after the Login Response Message is sent.

Login Response				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x02	Login Response
Status	2	1	Alphanumeric	A = Login accepted N = Not authorised (invalid Username and/or Password) B = Session in use S = Invalid session
Total Length = 3 bytes				

### 3.3 Gap Request Message

The Gap Request Message is used by a user's process to request retransmission of a sequenced message (or messages) by one of the gap servers.

Gap Request				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x03	Gap Request Message
Unit	2	1	Binary	Unit that the gap is requested for
Sequence	3	4	Binary	Sequence of first message (lowest sequence in range)
Count	7	2	Binary	Count of messages requested
Total Length = 9 bytes				

### 3.4 Gap Response Message

The Gap Response Message is sent by the GRP in response to a Gap Request Message. The Unit and Sequence fields will match the values supplied in the Gap Request Message. A Gap Response Message, with a Status of Accepted or reason for failure, will be sent for each Gap Request Message received by the GRP.

Gap Response				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x04	Gap Response Message
Unit	2	1	Binary	Unit the gap was requested for
Sequence	3	4	Binary	Sequence of first message in request
Count	7	2	Binary	Count of messages requested
Status	9	1	Alphanumeric	A = Accepted O = Out of range (ahead of sequence or too far behind) D = Daily gap request allocation exhausted M = Minute gap request allocation exhausted S = Second gap request allocation exhausted C = Count request limit for one gap request exceeded I = Invalid Unit specified in request  All non-A status codes should be interpreted as a reject.  Refer to Section 6 for details on the limits.
Total Length = 10 bytes				

## 4 PITCH 2.X Messages

With the exception of Time Messages, each PITCH message reflects the order addition, order deletion, order modification, or execution of an order in the system.

Order modification messages (Order Executed Message, Reduce Size Message, etc.) refer to an order by its Order Id. Multiple order modification messages may modify a single order and the effects are cumulative. Modify messages may update the size and/or price of an order on the book. When the remaining shares for an order reach zero, the order is dead and should be removed from the book.

### 4.1 Time Message

A Time Message is sent whenever the source time for a unit passes over a second boundary. All subsequent time offset fields for the same unit will use the new Time value as the base until another Time Message is received for the same unit.

Time				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x20	Time Message
Time	2	4	Binary	Number of whole seconds from midnight London time
Total Length = 6 bytes				

### 4.2 Unit Clear Message

The Unit Clear message instructs feed recipients to clear all orders for the Cboe book in the unit specified in the Sequenced Unit Header. This message will be sent in certain recovery events such as a data center fail-over.

Unit Clear				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x97	Unit Clear message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Total Length = 6 bytes				

## 4.3 Add Order Message

An Add Order Message represents a newly accepted visible order on the book. It includes a day-specific Order Id assigned by Cboe to the order.

### 4.3.1 Long Format

Add Order — Long				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x40	Add Order Message — Long
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Day-specific identifier assigned to this order
Side Indicator	14	1	Alphanumeric	B = Buy Order S = Sell Order
Quantity	15	4	Binary	Number of shares being added to the book (may be less than the number entered)
Symbol	19	8	Alphanumeric	Symbol right padded with spaces
Price	27	8	Binary Long Price	The limit order price
Total Length = 35 bytes				

### 4.3.2 Short Format

Add Order — Short				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x22	Add Order Message — Short
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Day-specific identifier assigned to this order
Side Indicator	14	1	Alphanumeric	B = Buy Order S = Sell Order
Quantity	15	2	Binary	Number of shares being added to the book (may be less than the number entered)
Symbol	17	6	Alphanumeric	Symbol right padded with spaces
Price	23	2	Binary Short Price	The limit order price
Total Length = 25 bytes				

### 4.3.3 Expanded Add Order

The Expanded Add Order is used on the Cboe Systematic Internaliser platform to provide visibility of Systematic Internaliser quotes. Such orders are non-executable. This message is not currently used on other Cboe platforms, though is used in a different context on the Cboe US platform.

Add Order — Expanded				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x2f	Add Order Message — Expanded
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Day-specific identifier assigned to this order
Side Indicator	14	1	Alphanumeric	Valid values: B = Buy Order S = Sell Order
Quantity	15	4	Binary	Number of shares applicable to this quote.
Symbol	19	8	Alphanumeric	Symbol, right padded with spaces
Price	27	8	Binary Long Price	The quote price
Add Flags	35	1	Binary	Bit 1 - 'SI Quote' indicator. If set, indicates this Add represents an "SI Quote". Bits 0, 2-7 - Reserved for future use.
ParticipantID	36	4	Alphanumeric	Attributes this quote to a particular participant.
Total Length = 40 bytes				

## 4.4 Order Executed Message

Order Execution Messages are sent when a visible order on the book is executed in whole or in part. The execution price equals the price found in the original Add Order Message or the price on the latest Modify Order Message referencing the Order Id.

Order Executed				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x23	Order Executed Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Order Id of a previously send Add Order Message
Executed Shares	14	4	Binary	Number of shares executed
Execution Id	18	8	Binary	Cboe generated day-unique execution identifier of this execution. Execution Id is also referenced in the Trade Break Message.
Execution Flags	26	4	Alphanumeric	Type flags based on MMT v3.04 standard (Soon to be upgraded to MMT v4.1)
Total Length = 30 bytes				

### 4.4.1 Execution Flags

The Order Executed message uses a 4-character flags field to provide detailed type information regarding the execution.

Each character in the flags field corresponds to MMT Level(s) as described in the following table and § 4.18, p. 34. (MMT v4.1 takes effect from 1 Jan 2024):

Execution Flags			
Offset	MMT Level / Fieldname		Description
0	1	Market Mechanism	See § 4.18, p. 34 for possible values
1	2	Trading Mode	
2	3.6	Ex/Cum Dividend	
3	3.9	Algorithmic Trade	

Implied MMT flags for the Order Executed message are as follows:

- *Level 1* populated per Execution Flags offset 0
- *Level 2* populated per Execution Flags offset 1
- *Levels 3.1 and 3.13* will always be '-' for a standard trade, and not a RFMD Give-up trade
- *Levels 3.2 and 3.10* will always be '-' for not being a Negotiated Trade
- *Level 3.3* will always be '-' for not being a Crossing Trade
- *Level 3.4* will always be '-' for no Modification Indicator
- *Levels 3.5, 3.11, and 3.12* will always be '-' for no special Trade Type
- *Level 3.6* populated per Execution Flags offset 2
- *Level 3.7* will always be '-' for unspecified (as not off book)
- *Level 3.8* will always be 'P' for a Plain-Vanilla Trade
- *Level 3.9* populated per Execution Flags offset 3
- *Levels 4.1, 4.3, and 4.4* will always be '-' for no deferral of publication
- *Level 4.2* will always be '-' for not being applicable
- *Levels 5.1, 5.2, and 5.3* will always be '-' for not being applicable



## 4.5 Order Executed at Price/Size Message

Order Execution at Price/Size Messages are sent when a visible order on the book is executed in whole or in part at a different price than the price on the Add Order Message or the price on the latest Modify Order Message referencing the Order Id. If the Remaining Shares field contains a 0, the order should be completely removed from the book.

Order Executed at Price/Size				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x24	Order Executed at Price/Size Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Order Id of a previously send Add Order Message
Executed Shares	14	4	Binary	Number of shares executed
Remaining Shares	18	4	Binary	Number of shares remaining after the execution
Execution Id	22	8	Binary	Cboe generated day-unique execution identifier of this execution. Execution Id is also referenced in the Trade Break Message.
Price	30	8	Binary Long Price	The execution price of the order
Execution Flags	38	4	Alphanumeric	Type flags based on MMT v3.04 standard (Soon to be upgraded to MMT v4.1)
Total Length = 42 bytes				

### 4.5.1 Execution Flags

The Order Executed at Price/Size message uses a 4-character flags field to provide detailed type information regarding the execution.

Each character in the flags field corresponds to MMT Level(s) as described in the following table and § 4.18, p. 34. (MMT v4.1 takes effect from 1 Jan 2024):

Execution Flags			
Offset	MMT Level / Fieldname		Description
0	1	Market Mechanism	See § 4.18, p. 34 for possible values
1	2	Trading Mode	
2	3.6	Ex/Cum Dividend	
3	3.9	Algorithmic Trade	

Implied MMT flags for the Order Executed at Price/Size message are as follows:

- Level 1 populated per Execution Flags offset 0
- Level 2 populated per Execution Flags offset 1
- Levels 3.1 and 3.13 will always be '-' for a standard trade, and not a RFMD Give-up trade
- Levels 3.2 and 3.10 will always be '-' for not being a Negotiated Trade
- Level 3.3 will always be '-' for not being a Crossing Trade
- Level 3.4 will always be '-' for no Modification Indicator
- Levels 3.5, 3.11, and 3.12 will always be '-' for no special Trade Type
- Level 3.6 populated per Execution Flags offset 2
- Level 3.7 will always be '-' for unspecified (as not off book)
- Level 3.8 will always be 'P' for a Plain-Vanilla Trade
- Level 3.9 populated per Execution Flags offset 3
- Levels 4.1, 4.3, and 4.4 will always be '-' for no deferral of publication
- Level 4.2 will always be '-' for not being applicable
- Levels 5.1, 5.2, and 5.3 will always be '-' for not being applicable

## 4.6 Reduce Size Message

Reduce Size Messages are sent when a visible order on the book is partially reduced.

### 4.6.1 Long Format

Reduce Size — Long				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x25	Reduce Size Message — Long
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Order Id of a previously send Add Order Message
Cancelled Shares	14	4	Binary	Number of shares cancelled
Total Length = 18 bytes				

### 4.6.2 Short Format

Reduce Size — Short				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x26	Reduce Size Message — Short
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Order Id of a previously send Add Order Message
Cancelled Shares	14	2	Binary	Number of shares cancelled
Total Length = 16 bytes				

## 4.7 Modify Order Message

The Modify Order Message is sent whenever an open order is visibly modified. The Order Id refers to the Order Id of the original Add Order Message.

### 4.7.1 Long Format

Modify Order — Long				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x27	Modify Order Message — Long
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Order Id of a previously send Add Order Message
Shares	14	4	Binary	Number of shares associated with this order after this modify (may be less than the number of shares entered)
Price	18	8	Binary Long Price	The limit order price after this modify
Total Length = 26 bytes				

### 4.7.2 Short Format

Modify Order — Short				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x28	Modify Order Message — Short
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Order Id of a previously send Add Order Message
Shares	14	2	Binary	Number of shares associated with this order after this modify (may be less than the number of shares entered)
Price	16	2	Binary Short Price	The limit order price after this modify
Total Length = 18 bytes				

## 4.8 Delete Order Message

The Delete Order Message is sent whenever an open order is completely cancelled. The Order Id refers to the Order Id of the original Add Order Message.

Delete Order				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x29	Delete Order Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Order Id of a previously send Add Order Message
Total Length = 14 bytes				

## 4.9 Trade Message

The Trade Message provides information about executions of hidden orders on the book and routed executions to other trading centres. Trade Messages are necessary to calculate Cboe execution based data. Trade Messages do not alter the book and can be ignored if you are just building a book.

No Add Order Message is sent for hidden orders, and thus, no modify order messages may be sent when hidden orders are executed. Instead, a Trade Message is sent whenever a hidden order is executed in whole or in part. As with visible orders, hidden orders may be executed in parts.

A complete view of all executions can be built by combining all Order Executed Messages and Trade Messages.

The Order ID of a hidden order is obfuscated by default in the Trade Message but may be optionally disseminated for a Participant's own orders upon request. As such, partial executions against the same hidden order will by default have different Order IDs.

### 4.9.1 Long Format

Trade — Long				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x41	Trade — Long
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Obfuscated Order ID or Order ID of the non-displayed executed order
Side Indicator	14	1	Alphanumeric	Always B for hidden trades.
Shares	15	4	Binary	Incremental number of shares executed
Symbol	19	8	Alphanumeric	Symbol right padded with spaces
Price	27	8	Binary Long Price	The execution price
Execution Id	35	8	Binary	Cboe generated day-unique execution identifier of this trade. Execution Id is also references in the Trade Break Message.
Trade Flags	43	5	Alphanumeric	Type flags based on MMT v3.04 standard (Soon to be upgraded to MMT v4.1)
Total Length = 48 bytes				

### 4.9.2 Short Format

Trade — Short				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x2B	Trade — Short
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Obfuscated Order ID or Order ID of the non-displayed executed order
Side Indicator	14	1	Alphanumeric	Always B for hidden trades.
Shares	15	2	Binary	Incremental number of shares executed
Symbol	17	6	Alphanumeric	Symbol right padded with spaces
Price	23	2	Binary Short Price	The execution price
Execution Id	25	8	Binary	Cboe generated day-unique execution identifier of this trade. Execution Id is also references in the Trade Break Message.
Trade Flags	33	5	Alphanumeric	Type flags based on MMT v3.04 standard (Soon to be upgraded to MMT v4.1)

<b>Total Length = 38 bytes</b>
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#### 4.9.3 Trade Flags

The non-Extended Trade messages use a 5-character flags field to provide detailed type information regarding the trade.

Each character in the flags field corresponds to MMT Level(s), as described in the following table and § 4.18, p. 34. (MMT v4.1 takes effect from 1 Jan 2024) :

Trade Flags			
Offset	MMT Level(s) / Fieldname		Description
0	1	Market Mechanism	See § 4.18, p. 34 for possible values
1	2	Trading Mode	
2	3.1 and 3.13	Transaction Category and GiveUp Trade	
3	3.5, 3.11, and 3.12	Trade Types	
4	3.9	Algorithmic Trade	

Implied MMT flags for the non-Extended Trade messages are as follows:

- *Level 1* populated per Trade Flags offset 0
- *Level 2* populated per Trade Flags offset 1
- *Levels 3.1 and 3.13* populated per Trade Flags offset 2
- *Levels 3.2 and 3.10* will always be '-' for not being a Negotiated Trade
- *Level 3.3* will always be '-' for not being a Crossing Trade
- *Level 3.4* will always be '-' for no Modification Indicator
- *Levels 3.5, 3.11, and 3.12* populated per Trade Flags offset 3
- *Level 3.6* will always be '-' for no Special Dividend
- *Level 3.7* will always be '-' for unspecified (as not off book)
- *Level 3.8* will always be 'P' for a Plain-Vanilla Trade
- *Level 3.9* populated per Execution Flags offset 4
- *Levels 4.1, 4.3, and 4.4* will always be '-' for no deferral of publication
- *Level 4.2* will always be '-' for not being applicable
- *Levels 5.1, 5.2, and 5.3* will always be '-' for not being applicable

#### 4.9.4 Extended Format

Only used on the Cboe European platform. This message provides extended details of trades reported to or executed by Cboe. This includes, for example, privately negotiated trades brought 'on-exchange'. Like other Trade messages, these do not alter the book, and can be ignored if you are just building a book.

Trade — Extended				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x32	Trade - Extended
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Shares	6	8	Binary	Number of shares executed
Symbol	14	8	Alphanumeric	Symbol right padded with spaces
Price	22	8	Binary Long Price	The execution price. This may be zero if the price is pending, as denoted by Level 3.8 of the Extended Trade Flags.
Trade ID	30	8	Binary	Cboe generated identifier of this trade. This identifier is guaranteed to be unique for at least 7 calendar days.
Trade timestamp	38	8	Binary	Date/Time on which the trade occurred, encoded as the number of nanoseconds since the January 1st 1970 UTC (also known as the Unix epoch).
Execution Venue	46	4	Alphanumeric	The venue on which the trade executed, when applicable. This will contain the MIC representing the venue on which the trade occurred, where applicable. Cboe UK LIS (CXE) trades have the value LISX and Cboe BIDS Europe (DXE) trades have the value LISZ. Cboe UK LIS (CXE) VWAP trades have the value XWAP and Cboe BIDS Europe (DXE) VWAP trades have the value VWAP. This will contain SINT if the trade occurred on a Systematic Internaliser or XOFF if OTC. Cboe will include third-country venue publication here when MMT v4.1 is introduced. See below for details.
Currency	50	3	Alphanumeric	Traded currency.
Cboe Trade Flags	53	1	Alphanumeric	See § 4.9.7, p. 24 for possible values.
Extended Trade Flags	54	14	Alphanumeric	Type flags based on the MMT v3.04 standard. (Soon to be upgraded to MMT v4.1)
<b>Total Length = 68 bytes</b>				

From 1 Jan 2024, Cboe plans to include third-country venue publication in the Execution Venue field, together with the introduction of MMT v4.1.

Where a firm has executed a trade which is reportable via the EU APA and which has been executed on an organised trading platform outside of the EU which is not included in the Annex to the ESMA Transparency Opinion, this field will contain the 4-character MIC. Additionally, the Cboe Trade Flags field is extended with values indicating the non-recognised third-country status.

#### 4.9.5 Trade Message — Unknown Symbol

Only used on the Cboe European Trade Reporting Facility. This message provides details of trades reported to Cboe, but traded on a symbol not currently known to Cboe. These trades are identified by the ISIN and the reported currency. Like other Trade messages, these do not alter the book, and can be ignored if you are just building a book.

Trade — Unknown Symbol				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x35	Trade - Unknown Symbol
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Shares	6	8	Binary	Number of shares traded
Symbol	14	12	Alphanumeric	Symbol in ISIN
Price	26	8	Binary Long Price	The reported price. This may be zero if the price is pending, as denoted by Level 3.8 of the Extended Trade Flags.
Trade ID	34	8	Binary	Cboe generated identifier of this trade. This identifier is guaranteed to be unique for at least 7 calendar days.
Trade timestamp	42	8	Binary	Date/Time on which the trade occurred, encoded as the number of nanoseconds since the January 1st 1970 UTC (also known as the Unix epoch).
Execution Venue	50	4	Alphanumeric	The venue on which the trade executed, when applicable. This will contain the MIC representing the venue on which the trade occurred, where applicable. This field will contain SINT if the trade occurred on a Systematic Internaliser or XOFF if OTC. Cboe will include third-country venue publication here when MMT v4.1 is introduced. See below for details.
Currency	54	3	Alphanumeric	Reported currency.
Cboe Trade Flags	57	1	Alphanumeric	See § 4.9.7, p. 24 for possible values.
Extended Trade Flags	58	14	Alphanumeric	Type flags based on the MMT v3.04 standard. (Soon to be upgraded to MMT v4.1)
<b>Total Length = 72 bytes</b>				

From 1 Jan 2024, Cboe plans to include third-country venue publication in the Execution Venue field, together with the introduction of MMT v4.1.

Where a firm has executed a trade which is reportable via the EU APA and which has been executed on an organised trading platform outside of the EU which is not included in the Annex to the ESMA Transparency Opinion, this field will contain the 4-character MIC. Additionally, the Cboe Trade Flags field is extended with values indicating the non-recognised third-country status.

#### 4.9.6 Extended Trade Flags

The Cboe Trade - Extended message uses a 14 character flags field to provide detailed type information regarding the trade.

The meaning of the flags field is different between different versions of MMT.

For MMT v3.04, the version currently supported, please consult § 4.17, p. 31.

For MMT v4.1, please consult § 4.18, p. 34.

#### 4.9.7 Cboe Trade Flags

The Cboe Trade - Extended message uses a 1 character field to provide detailed information about the trade such as timing, the regulated entity the trade was reported to, as well as whether the trade was reported to have been executed under an ESMA non-recognised third-country venue, as described in the following table:

Regulated Entity		Description
UK	EU	
'-'	'4'	The trade was reported to Cboe on time and in the Main Session
'1'	'5'	The trade was reported to Cboe 'late'
'2'	'6'	The trade was reported to Cboe out of the Main Session
'3'	'7'	The trade was reported to Cboe late and out of the Main Session
N/A	'C'	Same as 4, and trade venue is an ESMA non-recognised 3rd Country venue
N/A	'D'	Same as 5, and trade venue is an ESMA non-recognised 3rd Country venue
N/A	'E'	Same as 6, and trade venue is an ESMA non-recognised 3rd Country venue
N/A	'F'	Same as 7, and trade venue is an ESMA non-recognised 3rd Country venue

Please note that values 'C' through 'F' (see bit 3 below), which highlight the trade was executed under an ESMA non-recognised third-country venue, will be introduced alongside the MMT v4.1 enhancements. Such trades should be considered 'XOFF', but will contain the MIC of the ESMA non-recognised third-country trading venue in the Execution Venue field.

Participants may choose to convert this field to a bitfield (mapping '-' to 0) and apply the following bitfield interpretations:

Bit 0: Set when the trade was reported to Cboe 'late'

Bit 1: Set when the trade was reported out of the Main Session

Bit 2: Set when the trade was reported to the ESMA (EU jurisdiction)

Bit 3: Set when the trade was reported to have been executed on an ESMA non-recognised third-country trading venue (XOFF)



## 4.10 End of Session Message

The End of Session Message is sent for each unit when the unit shuts down. No more sequenced messages will be delivered for this unit, but heartbeats from the unit may be received.

End of Session				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x2D	End of Session Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Total Length = 6 bytes				

## 4.11 Transaction Begin Message

The Transaction Begin message indicates any subsequent messages, up to the accompanying Transaction End message, are all part of the same transaction block. One example of where this might be used is when a single aggressive order executes against several resting orders. All PITCH messages corresponding to such an event would be included between a Transaction Begin and Transaction End. It is important to note that any PITCH Message Type may be included in a transaction block and there is no guarantee that the messages apply to the same price level. Transaction Begin messages do not alter the book and can be ignored if messages are being used solely to build a book.

Feed processors can use a transaction block as a trigger to postpone publishing a quote update until the end of the transaction block. In the prior example of a single aggressive order executing against multiple resting orders, a top of book feed would be able to publish a single trade message and quote update resulting from multiple Order Executed messages once it finished processing all of the messages within the transaction block.

Transaction Begin				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xBC	Transaction Begin Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Total Length = 6 bytes				

## 4.12 Transaction End Message

The Transaction End message indicates that a transaction indicated by a previous Transaction Begin message has completed. Transaction End messages do not alter the book and can be ignored if messages are being used solely to build a book.

Transaction End				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xBD	Transaction End Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Total Length = 6 bytes				

### 4.13 Trading Status Message

The Trading Status Message is used to indicate the current trading status of a security. A Trading Status Message will be sent whenever a security's trading status changes. In addition, Cboe will send a Trading Status Message for all securities that are "Suspended" before the start of trading hours.

Trading Status				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x31	Trading Status Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	8	Alphanumeric	Symbol right padded with spaces
Status	14	1	Alpha	T = Trading R = Off-Book Reporting C = Closed S = Suspension N = No Reference Price V = Volatility Interruption O = Opening Auction E = Closing Auction H = Halt <sup>1</sup> M = Market Order Imbalance Extension P = Price Monitoring Extension U = Cboe Closing Cross Y = Halt Auction
Reserved1	15	3	Alpha	Reserved
Total Length = 18 bytes				

See the Participant Manual for details on Trading Status phases.

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<sup>1</sup>Reserved for future use

## 4.14 Statistics Message

Only used on the Cboe European platform. The Statistics Message is used to disseminate the statistics prices: opening, closing, high, low. When a value changes a new message will be sent. At the start of each trading day a "Previous Closing Price" will be sent with the closing price of the previous trading day.

If a trade that generated the price is subsequently busted another Statistics Message will be sent.

The "Price Determination" will by default be "Normal". The value of "Manual" arises from prices being adjusted by market supervision. A lower "High Price" or higher "Low Price" could result from breaking a trade, these will be flagged with "Manual".

Cboe reserves the right to add additional values to the "Statistics Type" and "Price Determination" fields without notice. Participants should develop their decoders to ignore unknown values.

Statistics Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x34	Statistics Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	8	Alphanumeric	Symbol right padded with spaces
Price	14	8	Binary Long Price	Price
Statistic Type	22	1	Alphanumeric	C = Closing Price H = High Price L = Low Price O = Opening Price P = Previous Closing Price
Price Determination	23	1	Alphanumeric	0 = Normal 1 = Manual (Price override by Market Supervision)
Total Length = 24 bytes				

## 4.15 Auction Messages

### 4.15.1 Auction Update Message

Auction Update messages are used to disseminate indicative price and size information during auctions for Cboe auction eligible securities. The Auction Update messages are published periodically during the call and extension phases of the auction process.

Auction Update Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xAC	Auction Update Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	8	Alphanumeric	Symbol right padded with spaces
Auction Type	14	1	Alphanumeric	O = Opening Auction C = Closing Auction H = Halt Auction V = Volatility Auction P = Periodic Auction U = Cboe Closing Cross
Reference Price	15	8	Binary Long Price	Reference price used in tie-breaker situations
Indicative Price	23	8	Binary Long Price	Price at which the auction would match if executed at the time of the message
Indicative Shares	31	4	Binary	Number of shares at the Indicative Price
Outside Tolerance	35	1	Alphanumeric	Indicates whether the price on this update is outside the Cboe EBBO collar: O = Outside tolerance I = Inside tolerance - = Not specified
Includes Primary	36	1	Alphanumeric	Indicates whether the Cboe EBBO used to collar this update includes the Primary Market quotes: P = Includes Primary N = Excludes Primary - = Not specified
Total Length = 37 bytes				

#### 4.15.2 Auction Summary

Auction Summary messages are used to disseminate the results of an auction in a Cboe auction eligible security.

Auction Summary Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x96	Auction Summary Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	8	Alphanumeric	Symbol right padded with spaces
Auction Type	14	1	Alphanumeric	O = Opening Auction C = Closing Auction H = Halt Auction V = Volatility Auction P = Periodic Auction U = Cboe Closing Cross
Price	15	8	Binary Long Price	Auction price
Shares	23	4	Binary	Cumulative number of shares executed during the auction
Total Length = 27 bytes				

## 4.16 Indices Messages

These messages are only available on a dedicated PITCH feed (XIC/XID/XIE)

### 4.16.1 Index Quote

Index Quote Messages are sent every second.

Index Quote				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xD8	Index Quote Message
Timestamp	2	8	Binary	Nanoseconds since midnight
Index Ticker	10	10	String	Index ticker code eg BUK100P, see reference file for the mapping to other identifiers
Price	20	8	Binary Long Price	Price of the index
Index Status	28	1	Alphanumeric	N = Normal I = Indicative (this occurs if certain validation checks are breached, indicating a potential issue with the values) C = Closing
Total Length = 29 bytes				

### 4.16.2 Index Quote EDSP

Index Quote EDSP Messages are sent at end of day.

The end of day EDSP indices values will also be available to download after market hours.

Index Quote EDSP				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xD9	Index Quote EDSP Message
Timestamp	2	8	Binary	Nanoseconds since midnight
Index Ticker	10	10	String	Index ticker code eg BUK100P, see reference file for the mapping to other identifiers
Price	20	8	Binary Long Price	Price of the index
Total Length = 28 bytes				

## 4.17 MMT v3.04 Value Mappings

The following tables define type information as detailed by version 3.04 of the Market Model Typology standard ("MMT"). See <http://www.fixtradingcommunity.org/pg/group-types/mmt> for more details.

Each character in the flags field corresponds to a distinct MMT field, as described in the following table:

Trade Type Flags			
Offset	MMT Level / Fieldname		Description
0	1	Market Mechanism	See § 4.17, p. 31 for possible values.
1	2	Trading Mode	
2	3.1	Transaction Category	
3	3.2	Negotiated Trade	
4	3.3	Crossing Trade	
5	3.4	Modification Indicator	
6	3.5	Benchmark/Reference Price Indicator	
7	3.6	Special Dividend	
8	3.7	Off Book Automated Indicator	
9	3.8	Price Formation/Discovery Process	
10	3.9	Algorithmic Indicator	
11	4.1	Publication Mode/Deferral Reason	
12	4.2	Deferral or Enrichment Type	
13	5	Duplicative Indicator	

### Special notes regarding Deferral or Enrichment Type

This is for RTS 2 only and currently unsupported in Cboe. A value of "-" should hence be expected for offset 12 (level 4.2).

Not all values are currently applicable to Cboe services. However, participants are advised to design their systems to cope with any of the listed MMT values.

1. Market Mechanism	
Value	Meaning
'1'	Central Limit Order Book
'2'	Quote Driven Market
'3'	Dark Order Book
'4'	Off Book
'5'	Periodic Auction
'6'	Request For Quotes
'7'	Any Other, Including Hybrid

2. Trading Mode	
Value	Meaning
'1'	Undefined Auction
'2'	Continuous Trading
'3'	At Market Close Trading
'4'	Out Of Main Session
'5'	Trade Reporting (On Exchange)
'6'	Trade Reporting (Off Exchange)
'7'	Trade Reporting (Systematic Internaliser)
'0'	Scheduled Opening Auction
'K'	Scheduled Closing Auction
'I'	Scheduled Intraday Auction
'U'	Unscheduled Auction

3.1 Transaction Category	
Value	Meaning
'D'	Dark Trade
'R'	Trade that has Received Price Improvement
'Z'	Packaged trade
'Y'	Exchange for Physicals Trade
'–'	None of the above apply

3.2 Negotiated Trade or Pre-Trade Transparency Waiver	
Value	Meaning
'1'	Negotiated Trade in Liquid Financial Instruments
'2'	Negotiated Trade in Illiquid Financial Instruments
'3'	Negotiated Trade Subject to Conditions Other than the Current Market Price
'N'	Negotiated Trade Where None of the Above Apply
'4'	Pre-Trade Transparency Waiver for Illiquid Instrument on an SI
'5'	Pre-Trade Transparency Waiver for Above Standard Market Size on an SI
'6'	Pre-Trade Transparency Waivers for Illiquid Instrument on an SI and Above Standard Market Size on an SI
'–'	Not specified

3.3 Crossing Trade	
Value	Meaning
'X'	Crossing Trade
'–'	Not specified

3.4 Modification Indicator	
Value	Meaning
'A'	Indicates a modification of a previously reported trade
'C'	Indicates a cancellation of a previously reported trade
'–'	Not specified

3.5 Benchmark or Reference Price Indicator	
Value	Meaning
'B'	Benchmark trade if (optionally) set by reporting party
'S'	Reference Price Trade
'–'	Not specified

3.6 Ex/Cum Dividend	
Value	Meaning
'E'	Ex/Cum/Special dividend if (optionally) set by reporting party
'–'	Not specified

3.7 Off Book Automated Indicator	
Value	Meaning
'Q'	Automated
'M'	Manual
'–'	Not specified



3.8 Contribution to Price Formation or the Price Discovery Process	
Value	Meaning
'P'	Standard trade for the specified Market Mechanism or Trading Mode
'T'	Non-Price Forming Trade (formerly known as Technical Trade)
'J'	Trade not Contributing to Price Discovery Process (formerly Technical Trade)
'N'	Price is currently not available but pending

3.9 Algorithmic Trade	
Value	Meaning
'H'	Algorithmic Trade
'-'	Non-algorithmic Trade

4.1 Publication Mode / Post-Trade Deferral Reason	
Value	Meaning
'1'	Trade report reported late without permitted deferral
'2'	Deferral Trade for "Large In Scale"
'3'	Deferral Trade for "Illiquid Instrument"
'4'	Deferral Trade for "Size Specific"
'5'	Deferral Trade for "Illiquid Instrument" and "Size Specific"
'6'	Deferral Trade for "Illiquid Instrument" and "Large In Scale"
'-'	Not specified (Immediate Publication)

4.2 Post-Trade Deferral or Enrichment Type	
Value	Meaning
'1'	Limited Details Trade
'2'	Daily Aggregated Trade
'3'	Volume Omission Trade
'4'	Four Weeks Aggregation Trade
'5'	Indefinite Aggregation Trade
'6'	Volume Omission Trade, Eligible For Subsequent Enrichment in Aggregated Form
'7'	Full Details of Earlier Limited Details Trade
'8'	Full Details of Earlier Daily Aggregated Trade
'9'	Full Details of Earlier Volume Omission Trade
'V'	Full Details of Four Weeks Aggregation Trade
'W'	Full Details of Earlier Volume Omission Trade, Eligible For Subsequent Enrichment in Aggregated Form
'-'	Not Applicable

5. Duplicative Indicator	
Value	Meaning
'1'	Duplicative Trade Report
'-'	Unique Trade Report

## 4.18 MMT v4.1 Value Mappings

From 1 Jan 2024, Cboe's market data will support the Market Model Typology (MMT) v4.1 standard.

The number of characters used to represent a trade remains unchanged in v4.1 - it will remain at 14 characters, just like v3.04.

However, effective from MMT v4.1 onwards, an "efficient encoding string" for MMT is used, which has been decoupled from the MMT v4.1 level structure. It will no longer be the case that each character of the MMT string represents a single level in the MMT, but instead there is an encoding algorithm which decides for each position, which one or more MMT levels are represented, and encoded accordingly.

However, it's important to note that MMT v4.1 is backwards compatible with the encoding for the preceding version v3.04. All values that are present in version 3.04 are still represented in version 4.1, but some encoding values are not applicable to earlier versions of MMT.

### Special notes regarding Deferral or Enrichment Type

This is for RTS 2 only and currently unsupported in Cboe. A value of "-" should hence be expected for offset 12 (level 4.2).

Not all values are currently applicable to Cboe services. However, participants are advised to design their systems to cope with any of the listed MMT values.

Offset 0 Represents MMT Level 1 Market Mechanism	
Value	Meaning
'1'	Central Limit Order Book
'2'	Quote Driven Market
'3'	Dark Order Book
'4'	Off Book
'5'	Periodic Auction
'6'	Request For Quotes
'7'	Any Other, Including Hybrid (Original ESMA definition)
'8'	Hybrid System (Revised ESMA definition)
'9'	Any Other, Excluding Hybrid (Revised ESMA definition)

Offset 1 Represents MMT Level 2 Trading Mode	
Value	Meaning
'1'	Undefined Auction
'2'	Continuous Trading
'3'	At Market Close Trading
'4'	Out Of Main Session
'5'	Trade Reporting (On Exchange)
'6'	Trade Reporting (Off Exchange)
'7'	Trade Reporting (Systematic Internaliser)
'0'	Scheduled Opening Auction
'K'	Scheduled Closing Auction
'I'	Scheduled Intraday Auction
'U'	Unscheduled Auction
'P'	On-Demand Auction

Note: As Cboe transitions to MMT v4.1, executions from Cboe's Periodic Auction books will be flagged as 'On-Demand Auction' ('P'), rather than ('I').

Offset 2 Encodes MMT Level 3.1 and Level 3.13		
Value	Level 3.1 Transaction Category	Level 3.13 RFMD Give-up Trade
'D'	Dark Trade	-
'R'	Trade that has Received Price Improvement	-
'Z'	Packaged Trade	-
'Y'	Exchange for Physicals Trade	-
'H'	Exchange for Physicals Trade	GIVE
'G'	None of the above apply	GIVE
'-'	None of the above apply	-

Offset 3 Encodes MMT Level 3.2 and Level 3.10		
Value	Level 3.2 Negotiation Indicator or Pre-Trade Transparency Waiver	Level 3.10 Pre-Trade Transparency Waiver Related To Size/Scale
'1'	NLIQ(Negotiated Trade in Liquid Financial Instruments)	-
'2'	OILQ(Negotiated Trade in Illiquid Financial Instruments)	-
'3'	PRIC(Negotiated Trade Subject to Conditions Other than the Current Market Price)	-
'4'	ILQD(Pre-Trade Transparency Waiver for Illiquid Instrument on an SI)	-
'5'	-	SIZE(Pre-Trade Transparency Waiver for Above Standard Market Size on an SI)
'6'	ILQD(Pre-Trade Transparency Waiver for Illiquid Instrument on an SI)	SIZE(Pre-Trade Transparency Waiver for Above Standard Market Size on an SI)
'7'	-	NTLS(Negotiated Trade Larger Than LIS Brought Onto A Venue)
'8'	NETW(Negotiated Trade With Pre-Trade Transparency Waiver)	
'9'	NLIQ(Negotiated Trade in Liquid Financial Instruments)	NTLS(Negotiated Trade Larger Than LIS Brought Onto A Venue)
'a'	OILQ(Negotiated Trade in Illiquid Financial Instruments)	NTLS(Negotiated Trade Larger Than LIS Brought Onto A Venue)
'b'	PRIC(Negotiated Trade Subject to Conditions Other than the Current Market Price)	NTLS(Negotiated Trade Larger Than LIS Brought Onto A Venue)
'c'	NETW(Negotiated Trade With Pre-Trade Transparency Waiver)	NTLS(Negotiated Trade Larger Than LIS Brought Onto A Venue)
'N'	N(Negotiated Trade Where None of the Above Apply)	-
'-'	Not a Negotiated Trade	

Note that, in MMT v3, the values of 5 and 6 were already representing

- 5: SIZE (Pre-Trade Transparency Waiver For Above Standard Market Size on an SI)
- 6: ILQD+SIZE (Pre-Trade Transparency Waivers for Illiquid Instrument on an SI and Above Standard Market Size on an SI)

While SIZE has now been separated out into its own Level 3.10, the possible values remain the same.

Offset 4 Represents MMT Level 3.3 Crossing Trade	
Value	Meaning
'X'	Crossing Trade
'-'	Not specified

Offset 5 Represents MMT Level 3.4 Modification Indicator	
Value	Meaning
'A'	Indicates a modification of a previously reported trade
'C'	Indicates a cancellation of a previously reported trade
'-'	Not specified

Offset 6 Encodes three MMT Level 3 Transaction Types - Levels 3.5, 3.11 and 3.12			
Value	Level 3.5 Benchmark (BENC), Benchmark Transactions Executed at Market Closing Price (CLSE), or Reference Price Indicator (RFPT)	Level 3.11 Portfolio Trade (PORT)	Level 3.12 Contingent Trade (CONT)
'B'	BENC	-	-
'C'	-	-	CONT
'M'	BENC	-	CONT
'N'	-	PORT	CONT
'O'	BENC	PORT	CONT
'P'	-	PORT	-
'S'	RFPT	-	-
'Y'	BENC	PORT	-
'1'	CLSE	-	-
'2'	CLSE	PORT	-
'3'	CLSE	-	CONT
'4'	CLSE	PORT	CONT
'-'	-	-	-

Offset 7 Represents MMT Level 3.6 Special Dividend Indicator	
Value	Meaning
'E'	Special dividend if (optionally) set by reporting party
'-'	Not specified

Offset 8 Represents MMT Level 3.7 Off Book Automated Indicator	
Value	Meaning
'Q'	Automated
'M'	Manual
'-'	Not specified

Offset 9 Represents MMT Level 3.8 Contribution to Price Formation or the Price Discovery Process	
Value	Meaning
'P'	Standard trade for the specified Market Mechanism or Trading Mode
'T'	(NPFT) Non-Price Forming Trade (formerly known as Technical Trade)
'J'	(TNCP) Trade not Contributing to Price Discovery Process (formerly Technical Trade)
'N'	(PNDG) Price is currently not available but pending
'Z'	(NOAP) Price is Not Applicable

Note: TNCP is due to be deprecated by ESMA on new trades from 2024.

Offset 10 Represents MMT Level 3.9 Algorithmic Trade	
Value	Meaning
'H'	Algorithmic Trade
'-'	Non-algorithmic Trade

Offset 11 Encodes three MMT Levels 4.1, 4.3, and 4.4			
Value	Level 4.1 - Publication Mode / Post-Trade Deferral Reason	Level 4.3 - Post-Trade Deferral Reason: Illiquid Instrument (ILQD)	Level 4.4 - Post-Trade Deferral Reason: Size Specific. (SIZE)
'1'	Trade report reported late without permitted deferral		
'2'	LRGS	-	-
'3'	-	ILQD	-
'4'	-	-	SIZE
'5'	-	ILQD	SIZE
'6'	LRGS	ILQD	-
'-'	Not specified (Immediate publication)		

Key:

- **LRGS**: Deferral Trade for Large In Scale
- **ILQD**: Deferral Trade for Illiquid Instrument
- **SIZE**: Deferral Trade for Size Specific

Since ILQD and SIZE were originally in Level 4.1 in MMT v3, the relocation of ILQD and SIZE to their own levels does not change the values possible in offset 12, and hence the encoding algorithm essentially keeps the same values.

Offset 12 Represents MMT Level 4.2 Post-Trade Deferral or Enrichment Type	
Value	Meaning
'1'	Limited Details Trade
'2'	Daily Aggregated Trade
'3'	Volume Omission Trade
'4'	Four Weeks Aggregation Trade
'5'	Indefinite Aggregation Trade
'6'	Volume Omission Trade, Eligible For Subsequent Enrichment in Aggregated Form
'7'	Full Details of Earlier Limited Details Trade
'8'	Full Details of Earlier Daily Aggregated Trade
'9'	Full Details of Earlier Volume Omission Trade
'V'	Full Details of Four Weeks Aggregation Trade
'W'	Full Details of Earlier Volume Omission Trade, Eligible For Subsequent Enrichment in Aggregated Form
'-'	Not Applicable

Offset 13 Encodes the three MMT Level 5 Reporting Circumstance flags - Levels 5.1, 5.2 and 5.3			
Value	Level 5.1 Duplicative Within Jurisdiction (Duplicative Trade Report)	Level 5.2 Duplicative Across Jurisdictions (Cross Border Duplicative Trade Report)	Level 5.3 Intra-Group Trade
'1'	DUPL	-	-
'2'	-	-	IGRP
'3'	DUPL	-	IGRP
'4'	-	XBDT	-
'5'	DUPL	XBDT	-
'6'	DUPL	XBDT	IGRP
'7'	-	XBDT	IGRP
'-'	-		

## 5 Spin Messages

### 5.1 Login Message

The Login Message is the first message sent to the Spin Server by a user's process after the connection to the Spin Server is established. Failure to login before sending any other message type will result in the connection being dropped by the Spin Server.

The format of the Login Message for the Spin Server is identical to that of the GRP (see § 3.1, p. 11) **and must be sent inside of a Sequenced Unit Header**.

Note that message retransmission can't be requested for indices data.

### 5.2 Login Response Message

The Login Response Message is sent by the Spin Server to a user's process in response to a Login Message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the connection will be dropped after the Login Response Message is sent.

The format of the Login Response Message for the Spin Server is identical to that of the GRP (see § 3.2, p. 11).

### 5.3 Spin Image Available Message

The Spin Image Available Message is sent once per second and indicates through what sequence number a spin is available.

Spin Image Available				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x80	Spin Image Available Message
Sequence	2	4	Binary	Spin is available which is current through this sequence number
Total Length = 6 bytes				

### 5.4 Spin Request Message

The Spin Request message is used by a user's process to request transmission of a spin of the unit's order book. The sequence number presented in the Spin Request message must match the sequence sent in one of the last ten Spin Image Available messages. The Participant must buffer all multicast messages for the unit with a sequence number greater than the sequence number requested so that when the spin is finished, the buffered messages can be applied to bring the book current. A Spin Request Message **must be sent inside of a Sequenced Unit Header**.

Spin Request Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x81	Spin Request Message
Sequence	2	4	Binary	Sequence number from a Spin Image Available Message received by the Participant
Total Length = 6 bytes				

## 5.5 Spin Response Message

The Spin Response Message is sent in response to a user's Spin Request message, indicating whether a spin will be sent.

Spin Response Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x82	Spin Response Message
Sequence	2	4	Binary	Sequence number from a Spin Image Available Message received by the Participant
Order Count	6	4	Binary	Number of Add Order messages which will be contained in this spin; 0 if spin cannot be satisfied
Status	10	1	Alphanumeric	A = Accepted O = Out of range (spin no longer available) S = Spin already in progress (only one spin can be running at a time)  All non-A status codes should be interpreted as a reject.
Total Length = 11 bytes				

## 5.6 Spin Finished Message

The Spin Finished Message is sent to indicate that all Add Order messages for the spin requested have been sent. A Spin Finished Message is only sent if a Spin Request was not rejected. Upon receipt of a Spin Finished Message, any buffered multicast messages should be applied to the Participant's copy of the book to make it current.

Spin Finished Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x83	Spin Finished Message
Sequence	2	4	Binary	Sequence number from the Spin Request Message
Total Length = 6 bytes				



## 6 Limitations/Configurations

The following table defines the Cboe current configuration for network and gap request limitations. Cboe reserves the right to adjust the gap request limitations to improve the effectiveness of the gap request infrastructure.

Gap request limits are per Multicast PITCH feed, not per GRP session. For example, the request limit is 50 requests/second. If a Participant has two GIG A GRP sessions, the limit is 50 requests/second *combined* across both GRP sessions, and *not* 50 requests/second for each session.

Period/Type	Limit/Setting	Notes
MTU	1,500 bytes	Cboe will send UDP messages up to 1,500 bytes. Participants should ensure that their infrastructure is configured accordingly.
Throttle	1 Gb/s (Gig-Shaped), 50 Mb/s (WAN-Shaped)	The real-time and gap multicast head ends are configured to shape their output to this level to minimize packet loss.
Gap Response Delay	2 ms	The Gap Server will delay resending sequenced messages via multicast for the specified limit in order to satisfy multiple GRP gap requests with one multicast response.
Count	100	Any single gap request may not be for more than this number of dropped messages.
1 Second	50 Requests	Users' retransmission requests are limited to this many requests per second. This is renewed every clock second.
1 Minute	500 Requests	Users' retransmission requests are limited to this many requests per minute. This is renewed every clock minute.
Day	100,000 Requests	Users' retransmission requests are limited to this many requests per day.
Within Range	1,000,000 Messages	Users' retransmission requests must be within this many messages of the most recent sequence sent by the real-time feed.

## 7 Multicast Configuration

Cboe reserves the right to add units and/or change symbol distribution within 48 hours notice and no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to, at minimum, support mappings in these tables via software configuration. Symbol ranges are chosen to try to distribute updates evenly. The distribution is reviewed periodically and may be adjusted. Refer to Appendix E (p. 86).

Cboe reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.

Data Centre	Market	Feed	Source Range	Destination Range	PIM RP Address
LD4	BXE	BA	95.130.109.128/28	224.0.83.16/28	95.130.109.244
LD4	BXE	BA	95.130.109.144/28	224.0.83.128/28	95.130.109.245
LD4	BXE	BC	95.130.109.128/28	224.0.83.48/28	95.130.109.244
LD4	BXE	BC	95.130.109.144/28	224.0.83.144/28	95.130.109.245
LD4	BXE	BB	95.130.109.160/28	224.0.83.80/28	95.130.109.246
LD4	BXE	BB	95.130.109.176/28	224.0.83.160/28	95.130.109.247
LD4	BXE	BD	95.130.109.160/28	224.0.83.112/28	95.130.109.246
LD4	BXE	BD	95.130.109.176/28	224.0.83.176/28	95.130.109.247
LD3	BXE	BE	95.130.107.80/29	224.0.84.16/28	95.130.107.252
LD3	BXE	BE	95.130.107.88/29	224.0.84.32/28	95.130.107.253
LD4	BXE	UAT	95.130.110.224/27	224.0.85.16/28	95.130.109.255
LD4	CXE	XA	95.130.108.128/28	224.0.82.16/28	95.130.108.244
LD4	CXE	XA	95.130.108.144/28	224.0.82.192/28	95.130.108.245
LD4	CXE	XC	95.130.108.128/28	224.0.82.48/28	95.130.108.244
LD4	CXE	XC	95.130.108.144/28	224.0.82.208/28	95.130.108.245
LD4	CXE	XB	95.130.108.160/28	224.0.82.80/28	95.130.108.246
LD4	CXE	XB	95.130.108.176/28	224.0.82.224/28	95.130.108.247
LD4	CXE	XD	95.130.108.160/28	224.0.82.112/28	95.130.108.246
LD4	CXE	XD	95.130.108.176/28	224.0.82.240/28	95.130.108.247
LD3	CXE	XE	95.130.106.80/29	224.0.84.208/28	95.130.106.252
LD3	CXE	XE	95.130.106.88/29	224.0.84.224/28	95.130.106.253
LD4	CXE	UAT	95.130.110.192/27	224.0.85.0/28	95.130.108.255
LD3	CXE	UAT-DR	95.130.111.192/28	224.0.85.48/28	95.130.106.255
LD4	DXE	DA	5.253.108.80/28	224.0.180.0/28	5.253.108.112
LD4	DXE	DC	5.253.108.80/28	224.0.180.16/28	5.253.108.112
LD4	DXE	DB	5.253.108.96/28	224.0.180.32/28	5.253.108.113
LD4	DXE	DD	5.253.108.96/28	224.0.180.48/28	5.253.108.113
LD3	DXE	DE	5.253.109.80/28	224.0.84.240/28	5.253.109.127
LD4	DXE	UAT	95.130.110.64/27	224.0.85.80/28	95.130.110.126
LD3	DXE	UAT-DR	95.130.111.96/28	224.0.85.96/28	95.130.111.126
LD4	TRF	TC	95.130.104.176/29	224.0.83.248/29	95.130.104.249
LD4	TRF	TD	95.130.104.184/29	224.0.83.232/29	95.130.104.253
LD3	TRF	TE	95.130.106.176/29	224.0.84.160/29	95.130.106.254
LD4	TRF	UATT	95.130.110.0/28	224.0.85.32/29	95.130.104.255
LD4	SI	QA	95.130.104.80/28	224.0.82.160/28	95.130.104.124
LD4	SI	QB	95.130.104.96/28	224.0.82.176/28	95.130.104.125
LD4	SI	QC	95.130.104.80/28	224.0.82.128/28	95.130.104.126
LD4	SI	QD	95.130.104.96/28	224.0.82.144/28	95.130.104.127
LD3	SI	QE	95.130.105.192/28	224.0.84.192/28	95.130.105.255
LD4	SI	UATQ	95.130.110.32/27	224.0.85.64/28	95.130.110.127

LD4	CXE	XIC	95.130.105.208/29	224.0.83.224/29	95.130.105.252
LD4	CXE	XID	95.130.105.216/29	224.0.83.240/29	95.130.105.253
LD3	CXE	XIE	95.130.105.224/29	224.0.84.48/29	95.130.105.254
LD4	CXE	UAT	95.130.110.192/27	224.0.85.112/29	95.130.110.125
LD3	CXE	UAT-DR	95.130.111.192/27	224.0.85.120/29	95.130.111.125

## 7.1 Equinix Slough (LD4) BXE Multicast Configuration

The following describe the setup which will be used in the Equinix Slough (LD4) facility for the BXE book.

### 7.1.1 BXE Production Primary Multicast PITCH Feed (BA, BC)

Unit	IP Port	Gig-Shaped (BA)		WAN-Shaped (BC)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.83.18 (95.130.109.132)	224.0.83.19 (95.130.109.132)	224.0.83.50 (95.130.109.133)	224.0.83.51 (95.130.109.133)
2	31202				
3	31203				
4	31204	224.0.83.130 (95.130.109.149)	224.0.83.131 (95.130.109.149)	224.0.83.146 (95.130.109.150)	224.0.83.147 (95.130.109.150)
5	31205				
6	31206	224.0.83.132 (95.130.109.149)	224.0.83.133 (95.130.109.149)	224.0.83.148 (95.130.109.150)	224.0.83.149 (95.130.109.150)
7	31207	224.0.83.134 (95.130.109.148)	224.0.83.135 (95.130.109.148)	224.0.83.150 (95.130.109.150)	224.0.83.151 (95.130.109.150)
8	31208	224.0.83.134 (95.130.109.149)	224.0.83.135 (95.130.109.149)		
9	31209	224.0.83.136 (95.130.109.148)	224.0.83.137 (95.130.109.148)	224.0.83.152 (95.130.109.150)	224.0.83.153 (95.130.109.150)
10	31210				
11	31211	224.0.83.20 (95.130.109.132)	224.0.83.21 (95.130.109.132)	224.0.83.52 (95.130.109.133)	224.0.83.53 (95.130.109.133)
12	31212	224.0.83.138 (95.130.109.148)	224.0.83.139 (95.130.109.148)	224.0.83.154 (95.130.109.150)	224.0.83.155 (95.130.109.150)

### 7.1.2 BXE Production Secondary Multicast PITCH Feeds (BB, BD)

Unit	IP Port	Gig-Shaped (BB)		WAN-Shaped (BD)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.83.82 (95.130.109.164)	224.0.83.83 (95.130.109.164)	224.0.83.114 (95.130.109.165)	224.0.83.115 (95.130.109.165)
2	31202				
3	31203				
4	31204	224.0.83.162 (95.130.109.180)	224.0.83.163 (95.130.109.180)	224.0.83.178 (95.130.109.182)	224.0.83.179 (95.130.109.182)
5	31205				
6	31206	224.0.83.164 (95.130.109.180)	224.0.83.165 (95.130.109.180)	224.0.83.180 (95.130.109.182)	224.0.83.181 (95.130.109.182)
7	31207	224.0.83.166 (95.130.109.180)	224.0.83.167 (95.130.109.180)	224.0.83.182 (95.130.109.182)	224.0.83.183 (95.130.109.182)
8	31208	224.0.83.166 (95.130.109.181)	224.0.83.167 (95.130.109.181)		
9	31209	224.0.83.168 (95.130.109.181)	224.0.83.169 (95.130.109.181)	224.0.83.184 (95.130.109.182)	224.0.83.185 (95.130.109.182)
10	31210				
11	31211	224.0.83.84 (95.130.109.164)	224.0.83.85 (95.130.109.164)	224.0.83.116 (95.130.109.165)	224.0.83.117 (95.130.109.165)
12	31212	224.0.83.170 (95.130.109.181)	224.0.83.171 (95.130.109.181)	224.0.83.186 (95.130.109.182)	224.0.83.187 (95.130.109.182)

### 7.1.3 BXE UAT Multicast PITCH Feeds

Unit	IP Port	WAN-Shaped	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31501	224.0.85.18 (95.130.110.228)	224.0.85.19 (95.130.110.228)
2	31502		
3	31503		
4	31504	224.0.85.20 (95.130.110.228)	224.0.85.21 (95.130.110.228)
5	31505		
6	31506	224.0.85.22 (95.130.110.228)	224.0.85.23 (95.130.110.228)
7	31507		
8	31508	224.0.85.24 (95.130.110.228)	224.0.85.25 (95.130.110.228)
9	31509		
10	31510	224.0.85.26 (95.130.110.228)	224.0.85.27 (95.130.110.228)
11	31511		
12	31512	224.0.85.28 (95.130.110.228)	224.0.85.29 (95.130.110.228)

## 7.2 Equinix Slough (LD4) CXE Multicast Configuration

The following describe the setup which will be used in the Equinix Slough (LD4) facility for the CXE book.

### 7.2.1 CXE Production Primary Multicast PITCH Feeds (XA, XC)

Unit	IP Port	Gig-Shaped (XA)		WAN-Shaped (XC)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.82.18 (95.130.108.132)	224.0.82.19 (95.130.108.132)	224.0.82.50 (95.130.108.133)	224.0.82.51 (95.130.108.133)
2	31202				
3	31203				
4	31204	224.0.82.194 (95.130.108.148)	224.0.82.195 (95.130.108.148)	224.0.82.210 (95.130.108.150)	224.0.82.211 (95.130.108.150)
5	31205				
6	31206	224.0.82.196 (95.130.108.148)	224.0.82.197 (95.130.108.148)	224.0.82.212 (95.130.108.150)	224.0.82.213 (95.130.108.150)
7	31207	224.0.82.198 (95.130.108.148)	224.0.82.199 (95.130.108.148)	224.0.82.214 (95.130.108.150)	224.0.82.215 (95.130.108.150)
8	31208	224.0.82.198 (95.130.108.149)	224.0.82.199 (95.130.108.149)		
9	31209	224.0.82.200 (95.130.108.149)	224.0.82.201 (95.130.108.149)	224.0.82.216 (95.130.108.150)	224.0.82.217 (95.130.108.150)
10	31210				
11	31211	224.0.82.20 (95.130.108.132)	224.0.82.21 (95.130.108.132)	224.0.82.52 (95.130.108.133)	224.0.82.53 (95.130.108.133)
12	31212	224.0.82.202 (95.130.108.149)	224.0.82.203 (95.130.108.149)	224.0.82.218 (95.130.108.150)	224.0.82.219 (95.130.108.150)

### 7.2.2 CXE Production Secondary Multicast PITCH Feeds (XB, XD)

Unit	IP Port	Gig-Shaped (XB)		WAN-Shaped (XD)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.82.82 (95.130.108.164)	224.0.82.83 (95.130.108.164)	224.0.82.114 (95.130.108.165)	224.0.82.115 (95.130.108.165)
2	31202				
3	31203				
4	31204	224.0.82.226 (95.130.108.180)	224.0.82.227 (95.130.108.180)	224.0.82.242 (95.130.108.182)	224.0.82.243 (95.130.108.182)
5	31205				
6	31206	224.0.82.228 (95.130.108.180)	224.0.82.229 (95.130.108.180)	224.0.82.244 (95.130.108.182)	224.0.82.245 (95.130.108.182)
7	31207	224.0.82.230 (95.130.108.180)	224.0.82.231 (95.130.108.180)	224.0.82.246 (95.130.108.182)	224.0.82.247 (95.130.108.182)
8	31208	224.0.82.230 (95.130.108.181)	224.0.82.231 (95.130.108.181)		
9	31209	224.0.82.232 (95.130.108.181)	224.0.82.233 (95.130.108.181)	224.0.82.248 (95.130.108.182)	224.0.82.249 (95.130.108.182)
10	31210				
11	31211	224.0.82.84 (95.130.108.164)	224.0.82.85 (95.130.108.164)	224.0.82.116 (95.130.108.165)	224.0.82.117 (95.130.108.165)
12	31212	224.0.82.234 (95.130.108.181)	224.0.82.235 (95.130.108.181)	224.0.82.250 (95.130.108.182)	224.0.82.251 (95.130.108.182)

### 7.2.3 CXE UAT Multicast PITCH Feeds

Unit	IP Port	WAN-Shaped	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31501	224.0.85.2 (95.130.110.196)	224.0.85.3 (95.130.110.196)
2	31502		
3	31503		
4	31504	224.0.85.4 (95.130.110.196)	224.0.85.5 (95.130.110.196)
5	31505		
6	31506	224.0.85.6 (95.130.110.196)	224.0.85.7 (95.130.110.196)
7	31507		
8	31508	224.0.85.8 (95.130.110.196)	224.0.85.9 (95.130.110.196)
9	31509		
10	31510	224.0.85.10 (95.130.110.196)	224.0.85.11 (95.130.110.196)
11	31511		
12	31512	224.0.85.12 (95.130.110.196)	224.0.85.13 (95.130.110.196)

#### 7.2.4 CXE Production Primary Indices Multicast PITCH Feeds (XIC)

WAN-Shaped (XIC)		
Unit	IP Port	Real-time MC and (Src) IP Addr
1	33201	224.0.83.224 (95.130.105.212)

#### 7.2.5 CXE Production Secondary Indices Multicast PITCH Feeds (XID)

WAN-Shaped (XID)		
Unit	IP Port	Real-time MC and (Src) IP Addr
1	33201	224.0.83.240 (95.130.105.220)

#### 7.2.6 CXE UAT Indices Multicast PITCH Feeds

WAN-Shaped		
Unit	IP Port	Real-time MC and (Src) IP Addr
1	33001	224.0.85.114 (95.130.110.218)



### 7.3 Equinix Slough (LD4) DXE Multicast Configuration

The following describe the setup which will be used in the Equinix Slough (LD4) facility for the DXE book.

#### 7.3.1 DXE Production Primary Multicast PITCH Feeds (DA, DC)

Unit	IP Port	Gig-Shaped (DA)		WAN-Shaped (DC)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.180.2 (5.253.108.81)	224.0.180.3 (5.253.108.81)	224.0.180.18 (5.253.108.84)	224.0.180.19 (5.253.108.84)
2	31202				
3	31203				
4	31204	224.0.180.4 (5.253.108.82)	224.0.180.5 (5.253.108.82)	224.0.180.20 (5.253.108.84)	224.0.180.21 (5.253.108.84)
5	31205				
6	31206	224.0.180.6 (5.253.108.82)	224.0.180.7 (5.253.108.82)	224.0.180.22 (5.253.108.84)	224.0.180.23 (5.253.108.84)
7	31207	224.0.180.8 (5.253.108.82)	224.0.180.9 (5.253.108.82)	224.0.180.24 (5.253.108.84)	224.0.180.25 (5.253.108.84)
8	31208	224.0.180.8 (5.253.108.83)	224.0.180.9 (5.253.108.83)		
9	31209	224.0.180.10 (5.253.108.83)	224.0.180.11 (5.253.108.83)	224.0.180.26 (5.253.108.84)	224.0.180.27 (5.253.108.84)
10	31210				
11	31211	224.0.180.12 (5.253.108.81)	224.0.180.13 (5.253.108.81)	224.0.180.28 (5.253.108.84)	224.0.180.29 (5.253.108.84)
12	31212	224.0.180.14 (5.253.108.83)	224.0.180.15 (5.253.108.83)	224.0.180.30 (5.253.108.84)	224.0.180.31 (5.253.108.84)

#### 7.3.2 DXE Production Secondary Multicast PITCH Feeds (DB, DD)

Unit	IP Port	Gig-Shaped (DB)		WAN-Shaped (DD)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.180.34 (5.253.108.97)	224.0.180.35 (5.253.108.97)	224.0.180.50 (5.253.108.100)	224.0.180.51 (5.253.108.100)
2	31202				
3	31203				
4	31204	224.0.180.36 (5.253.108.98)	224.0.180.37 (5.253.108.98)	224.0.180.52 (5.253.108.100)	224.0.180.53 (5.253.108.100)
5	31205				
6	31206	224.0.180.38 (5.253.108.98)	224.0.180.39 (5.253.108.98)	224.0.180.54 (5.253.108.100)	224.0.180.55 (5.253.108.100)
7	31207	224.0.180.40 (5.253.108.98)	224.0.180.41 (5.253.108.98)	224.0.180.56 (5.253.108.100)	224.0.180.57 (5.253.108.100)
8	31208	224.0.180.40 (5.253.108.99)	224.0.180.41 (5.253.108.99)		
9	31209	224.0.180.42 (5.253.108.99)	224.0.180.43 (5.253.108.99)	224.0.180.58 (5.253.108.100)	224.0.180.59 (5.253.108.100)
10	31210				
11	31211	224.0.180.44 (5.253.108.97)	224.0.180.45 (5.253.108.97)	224.0.180.60 (5.253.108.100)	224.0.180.61 (5.253.108.100)
12	31212	224.0.180.46 (5.253.108.99)	224.0.180.47 (5.253.108.99)	224.0.180.62 (5.253.108.100)	224.0.180.63 (5.253.108.100)

### 7.3.3 DXE UAT Multicast PITCH Feeds

Unit	IP Port	WAN-Shaped	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.85.82 (95.130.110.68)	224.0.85.83 (95.130.110.68)
2	31202		
3	31203		
4	31204	224.0.85.84 (95.130.110.68)	224.0.85.85 (95.130.110.68)
5	31205		
6	31206	224.0.85.86 (95.130.110.68)	224.0.85.87 (95.130.110.68)
7	31207		
8	31208	224.0.85.88 (95.130.110.68)	224.0.85.89 (95.130.110.68)
9	31209		
10	31210	224.0.85.90 (95.130.110.68)	224.0.85.91 (95.130.110.68)
11	31211		
12	31212	224.0.85.92 (95.130.110.68)	224.0.85.93 (95.130.110.68)
		224.0.85.94 (95.130.110.68)	224.0.85.95 (95.130.110.68)

## 7.4 Equinix Slough (LD4) Trade Reporting Facility (TRF) Multicast Configuration

The following describe the setup which will be used in the Equinix Slough (LD4) facility for the Trade Reporting Facility.

### 7.4.1 TRF Production Multicast PITCH Trade Feeds (TC, TD)

Unit	IP Port	WAN-Shaped Primary (TC)		WAN-Shaped Secondary (TD)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31104	224.0.83.250 (95.130.104.180)	224.0.83.251 (95.130.104.180)	224.0.83.234 (95.130.104.188)	224.0.83.235 (95.130.104.188)
2	31105				
3	31106				

### 7.4.2 TRF UAT Multicast PITCH Trade Feeds

Unit	IP Port	WAN-Shaped	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31504	224.0.85.34 (95.130.110.13)	224.0.85.35 (95.130.110.13)
2	31505		
3	31506		

### 7.4.3 Systematic Internaliser Production Multicast PITCH Quote Feeds

Unit	IP Port	Gig-Shaped (QA)		WAN-Shaped (QC)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	30001	224.0.82.162	224.0.82.163	224.0.82.130 (95.130.104.87)	224.0.82.131 (95.130.104.87)
2	30002	(95.130.104.84)	(95.130.104.84)		
3	30003	224.0.82.162 (95.130.104.85)	224.0.82.163 (95.130.104.85)		
4	30004	224.0.82.164 (95.130.104.85)	224.0.82.165 (95.130.104.85)	224.0.82.132 (95.130.104.87)	224.0.82.133 (95.130.104.87)
5	30005	224.0.82.164 (95.130.104.86)	224.0.82.165 (95.130.104.86)		
6	30006	224.0.82.166 (95.130.104.86)	224.0.82.167 (95.130.104.86)	224.0.82.134 (95.130.104.87)	224.0.82.135 (95.130.104.87)
7	30007	224.0.82.168	224.0.82.169	224.0.82.136 (95.130.104.88)	224.0.82.137 (95.130.104.88)
8	30008	(95.130.104.84)	(95.130.104.84)		
9	30009	224.0.82.170	224.0.82.171	224.0.82.138 (95.130.104.88)	224.0.82.139 (95.130.104.88)
10	30010	(95.130.104.85)	(95.130.104.85)		
11	30011	224.0.82.172	224.0.82.173	224.0.82.140 (95.130.104.88)	224.0.82.141 (95.130.104.88)
12	30012	(95.130.104.86)	(95.130.104.86)		

Unit	IP Port	Gig-Shaped (QB)		WAN-Shaped (QD)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	30001	224.0.82.178	224.0.82.179	224.0.82.146 (95.130.104.102)	224.0.82.147 (95.130.104.102)
2	30002	(95.130.104.100)	(95.130.104.100)		
3	30003	224.0.82.178 (95.130.104.100)	224.0.82.179 (95.130.104.100)		
4	30004	224.0.82.180 (95.130.104.100)	224.0.82.181 (95.130.104.100)	224.0.82.148 (95.130.104.102)	224.0.82.149 (95.130.104.102)
5	30005	224.0.82.180 (95.130.104.100)	224.0.82.181 (95.130.104.100)		
6	30006	224.0.82.182 (95.130.104.100)	224.0.82.183 (95.130.104.100)	224.0.82.150 (95.130.104.102)	224.0.82.151 (95.130.104.102)
7	30007	224.0.82.184	224.0.82.185	224.0.82.152 (95.130.104.103)	224.0.82.153 (95.130.104.103)
8	30008	(95.130.104.101)	(95.130.104.101)		
9	30009	224.0.82.186	224.0.82.187	224.0.82.154 (95.130.104.103)	224.0.82.155 (95.130.104.103)
10	30010	(95.130.104.101)	(95.130.104.101)		
11	30011	224.0.82.188	224.0.82.189	224.0.82.156 (95.130.104.103)	224.0.82.157 (95.130.104.103)
12	30012	(95.130.104.101)	(95.130.104.101)		

#### 7.4.4 Systematic Internaliser UAT Multicast PITCH Quote Feeds

Unit	IP Port	WAN-Shaped	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	32001	224.0.85.66 (95.130.110.40)	224.0.85.67 (95.130.110.40)
2	32002		
3	32003		
4	32004	224.0.85.68 (95.130.110.40)	224.0.85.69 (95.130.110.40)
5	32005		
6	32006	224.0.85.70 (95.130.110.40)	224.0.85.71 (95.130.110.40)
7	32007	224.0.85.72 (95.130.110.40)	224.0.85.73 (95.130.110.40)
8	32008		
9	32009	224.0.85.74 (95.130.110.40)	224.0.85.75 (95.130.110.40)
10	32010		
11	32011	224.0.85.76 (95.130.110.40)	224.0.85.77 (95.130.110.40)
12	32012		

## 7.5 Equinix Park Royal (LD3) BXE Multicast Configuration

### 7.5.1 BXE Disaster Recovery Multicast PITCH Feed (BE)

Unit	IP Port	WAN-Shaped (BE)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.84.18 (95.130.107.84)	224.0.84.19 (95.130.107.84)
2	31202		
3	31203		
4	31204	224.0.84.34 (95.130.107.92)	224.0.84.35 (95.130.107.92)
5	31205		
6	31206	224.0.84.36 (95.130.107.92)	224.0.84.37 (95.130.107.92)
7	31207	224.0.84.38 (95.130.107.92)	224.0.84.39 (95.130.107.92)
8	31208		
9	31209	224.0.84.40 (95.130.107.92)	224.0.84.41 (95.130.107.92)
10	31210		
11	31211	224.0.84.20 (95.130.107.84)	224.0.84.21 (95.130.107.84)
12	31212	224.0.84.42 (95.130.107.92)	224.0.84.43 (95.130.107.92)

## 7.6 Equinix Park Royal (LD3) CXE Configuration

### 7.6.1 CXE Disaster Recovery Multicast PITCH Feed (XE)

Unit	IP Port	WAN-Shaped (XE)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.84.210 (95.130.106.84)	224.0.84.211 (95.130.106.84)
2	31202		
3	31203		
4	31204	224.0.84.226 (95.130.106.92)	224.0.84.227 (95.130.106.92)
5	31205		
6	31206	224.0.84.228 (95.130.106.92)	224.0.84.229 (95.130.106.92)
7	31207	224.0.84.230 (95.130.106.92)	224.0.84.231 (95.130.106.92)
8	31208		
9	31209	224.0.84.232 (95.130.106.92)	224.0.84.233 (95.130.106.92)
10	31210		
11	31211	224.0.84.212 (95.130.106.84)	224.0.84.213 (95.130.106.84)
12	31212	224.0.84.234 (95.130.106.92)	224.0.84.235 (95.130.106.92)

## 7.6.2 CXE UAT Disaster Recovery Multicast PITCH Feed (UAT-DR)

Unit	IP Port	WAN-Shaped	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31801	224.0.85.50 (95.130.111.196)	224.0.85.51 (95.130.111.196)
2	31802		
3	31803		
4	31804	224.0.85.52 (95.130.111.196)	224.0.85.53 (95.130.111.196)
5	31805		
6	31806	224.0.85.54 (95.130.111.196)	224.0.85.55 (95.130.111.196)
7	31807	224.0.85.56 (95.130.111.196)	224.0.85.57 (95.130.111.196)
8	31808		
9	31809	224.0.85.58 (95.130.111.196)	224.0.85.59 (95.130.111.196)
10	31810		
11	31811	224.0.85.60 (95.130.111.196)	224.0.85.61 (95.130.111.196)
12	31812		



### 7.6.3 CXE Disaster Recovery Indices Multicast PITCH Feed (XIE)

WAN-Shaped (XIE)		
Unit	IP Port	Real-time MC and (Src) IP Addr
1	33201	224.0.84.48 (95.130.105.228)

### 7.6.4 CXE UAT Disaster Recovery Indices Multicast PITCH Feed (UAT-DR)

WAN-Shaped		
Unit	IP Port	Real-time MC and (Src) IP Addr
1	33101	224.0.85.122 (95.130.111.218)

## 7.7 Equinix Park Royal (LD3) DXE Configuration

### 7.7.1 DXE Disaster Recovery Multicast PITCH Feed (DE)

Unit	IP Port	WAN-Shaped (DE)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.84.242 (5.253.109.81)	224.0.84.243 (5.253.109.81)
2	31202		
3	31203		
4	31204	224.0.84.244 (5.253.109.81)	224.0.84.245 (5.253.109.81)
5	31205		
6	31206	224.0.84.246 (5.253.109.81)	224.0.84.247 (5.253.109.81)
7	31207	224.0.84.248 (5.253.109.81)	224.0.84.249 (5.253.109.81)
8	31208		
9	31209	224.0.84.250 (5.253.109.81)	224.0.84.251 (5.253.109.81)
10	31210		
11	31211	224.0.84.252 (5.253.109.81)	224.0.84.253 (5.253.109.81)
12	31212	224.0.84.254 (5.253.109.81)	224.0.84.255 (5.253.109.81)

### 7.7.2 DXE UAT Disaster Recovery Multicast PITCH Feed (UAT-DR)

Unit	IP Port	WAN-Shaped	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.85.98 (95.130.111.100)	224.0.85.99 (95.130.111.100)
2	31202		
3	31203		
4	31204	224.0.85.100 (95.130.111.100)	224.0.85.101 (95.130.111.100)
5	31205		
6	31206	224.0.85.102 (95.130.111.100)	224.0.85.103 (95.130.111.100)
7	31207	224.0.85.104 (95.130.111.100)	224.0.85.105 (95.130.111.100)
8	31208		
9	31209	224.0.85.106 (95.130.111.100)	224.0.85.107 (95.130.111.100)
10	31210		
11	31211	224.0.85.108 (95.130.111.100)	224.0.85.109 (95.130.111.100)
12	31212	224.0.85.110 (95.130.111.100)	224.0.85.111 (95.130.111.100)

## 7.8 Equinix Park Royal (LD3) Trade Reporting Facility (TRF) Configuration

### 7.8.1 TRF Disaster Recovery Multicast PITCH Trade Feed (TE)

WAN-Shaped (TE)			
Unit	IP Port	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31304	224.0.84.162 (95.130.106.180)	224.0.84.163 (95.130.106.180)
2	31305		
3	31306		

### 7.8.2 Systematic Internaliser Quotes Disaster Recovery Multicast PITCH Feed (QE)

WAN-Shaped (QE)			
Unit	IP Port	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31001	224.0.84.194 (95.130.105.196)	224.0.84.195 (95.130.105.196)
2	31002		
3	31003		
4	31004	224.0.84.196 (95.130.105.196)	224.0.84.197 (95.130.105.196)
5	31005		
6	31006	224.0.84.198 (95.130.105.196)	224.0.84.199 (95.130.105.196)
7	31007	224.0.84.200 (95.130.105.197)	224.0.84.201 (95.130.105.197)
8	31008		
9	31009	224.0.84.202 (95.130.105.197)	224.0.84.203 (95.130.105.197)
10	31010		
11	31011	224.0.84.204 (95.130.105.197)	224.0.84.205 (95.130.105.197)
12	31012		

## 7.9 General Bandwidth Recommendations

The order book UAT feeds require 0.5 Mb/s (0.4 Mb/s real-time + 0.1 Mb/s gap) per unit per market making a total of 6 Mb/s of bandwidth for the full feed for each market (or 18 Mb/s for BXE, CXE and DXE books). The UAT feed for the new MiFID II focused SI Quote publication requires the same allocation, also totalling 6Mb/s. The minimum requirement is 1 Mb/s if a single multicast address comprising two units is consumed for a single market.

The TRF UAT feeds requires a total of 1.0 Mb/s (0.95 Mb/s real-time + 0.05 Mb/s gap) per unit making a total of 3 Mb/s of bandwidth for the full feed.

The table below shows the bandwidth split per unit.

Cboe operations staff monitors bandwidth usage across units and reserves the right to adjust bandwidth allocations per unit at any time without prior notice provided that the total allocation across all units would not exceed the previously published limit.

Cboe operations staff may increase the total bandwidth allocation across all units, but only with appropriate prior notice to all Participants.

In the event that market data rates exceed the allocated bandwidth for a unit, messages will be queued by Cboe and delivered as quickly as possible.

## 7.10 BXE Bandwidth Requirements

Unit	Gig-Shaped (BA,BB)		WAN-Shaped (BC,BD,BE)	
	Real-time	Gap Response	Real-time	Gap Response
1	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.2 Mb/s
2	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.2 Mb/s
3	27 Mb/s	2.0 Mb/s	2.4 Mb/s	0.2 Mb/s
4	35 Mb/s	2.0 Mb/s	3.0 Mb/s	0.2 Mb/s
5	35 Mb/s	2.0 Mb/s	3.0 Mb/s	0.2 Mb/s
6	35 Mb/s	2.0 Mb/s	3.0 Mb/s	0.2 Mb/s
7	35 Mb/s	2.0 Mb/s	3.2 Mb/s	0.2 Mb/s
8	35 Mb/s	2.0 Mb/s	3.2 Mb/s	0.2 Mb/s
9	32 Mb/s	2.0 Mb/s	3.2 Mb/s	0.2 Mb/s
10	1 Mb/s	1.0 Mb/s	0.1 Mb/s	0.1 Mb/s
11	27 Mb/s	2.0 Mb/s	1.4 Mb/s	0.2 Mb/s
12	35 Mb/s	2.0 Mb/s	2.2 Mb/s	0.2 Mb/s
<b>Total</b>	<b>400 Mb/s</b>		<b>35 Mb/s</b>	

## 7.11 CXE Bandwidth Requirements

Unit	Gig-Shaped (XA,XB)		WAN-Shaped (XC,XD,XE)	
	Real-time	Gap Response	Real-time	Gap Response
1	45 Mb/s	2.0 Mb/s	4.9 Mb/s	0.3 Mb/s
2	45 Mb/s	2.0 Mb/s	4.9 Mb/s	0.3 Mb/s
3	30 Mb/s	2.0 Mb/s	3.2 Mb/s	0.3 Mb/s
4	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
5	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
6	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
7	40 Mb/s	2.0 Mb/s	4.2 Mb/s	0.3 Mb/s
8	40 Mb/s	2.0 Mb/s	4.2 Mb/s	0.3 Mb/s
9	34 Mb/s	2.0 Mb/s	3.0 Mb/s	0.3 Mb/s
10	3 Mb/s	1.0 Mb/s	0.5 Mb/s	0.3 Mb/s
11	30 Mb/s	2.0 Mb/s	2.4 Mb/s	0.3 Mb/s
12	40 Mb/s	2.0 Mb/s	3.1 Mb/s	0.3 Mb/s
<b>Total</b>	<b>450 Mb/s</b>		<b>46 Mb/s</b>	

Dedicated feeds for index data:

Unit	WAN-Shaped (XIC,XID,XIE)
	Real-time
1	0.1 Mb/s
<b>Total</b>	<b>0.1 Mb/s</b>

## 7.12 DXE Bandwidth Requirements

Unit	Gig-Shaped (DA,DB)		WAN-Shaped (DC,DD,DE)	
	Real-time	Gap Response	Real-time	Gap Response
1	45 Mb/s	2.0 Mb/s	4.9 Mb/s	0.3 Mb/s
2	45 Mb/s	2.0 Mb/s	4.9 Mb/s	0.3 Mb/s
3	30 Mb/s	2.0 Mb/s	3.2 Mb/s	0.3 Mb/s
4	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
5	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
6	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
7	40 Mb/s	2.0 Mb/s	4.2 Mb/s	0.3 Mb/s
8	40 Mb/s	2.0 Mb/s	4.2 Mb/s	0.3 Mb/s
9	34 Mb/s	2.0 Mb/s	3.0 Mb/s	0.3 Mb/s
10	3 Mb/s	1.0 Mb/s	0.5 Mb/s	0.3 Mb/s
11	30 Mb/s	2.0 Mb/s	2.4 Mb/s	0.3 Mb/s
12	40 Mb/s	2.0 Mb/s	3.1 Mb/s	0.3 Mb/s
<b>Total</b>	<b>450 Mb/s</b>		<b>46 Mb/s</b>	



### 7.13 Trade Reporting Facility (TRF) Bandwidth Requirements

WAN-Shaped Trade (TC,TD,TE)		
Unit	Real-time	Gap Response
1	3.8 Mb/s	0.4 Mb/s
2	3.8 Mb/s	0.4 Mb/s
3	3.4 Mb/s	0.3 Mb/s
<b>Total</b>	<b>12 Mb/s</b>	

### 7.14 SI Quote bandwidth requirements

Unit	Gig-Shaped (QA,QB)		WAN-Shaped (QC,QD,QE)	
	Real-time	Gap Response	Real-time	Gap Response
1	45 Mb/s	2.0 Mb/s	9 Mb/s	0.4 Mb/s
2	45 Mb/s	2.0 Mb/s	9 Mb/s	0.4 Mb/s
3	30 Mb/s	2.0 Mb/s	6 Mb/s	0.4 Mb/s
4	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
5	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
6	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
7	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
8	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
9	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
10	45 Mb/s	2.0 Mb/s	9 Mb/s	0.4 Mb/s
11	30 Mb/s	2.0 Mb/s	6 Mb/s	0.4 Mb/s
12	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
<b>Total</b>	<b>499 Mb/s</b>		<b>99.8 Mb/s</b>	

### 7.15 Multicast Test Program

The ZIP file located at [https://cdn.cboe.com/resources/membership/mcast\\_pitch.zip](https://cdn.cboe.com/resources/membership/mcast_pitch.zip) contains a sample program that may be used to test Multicast PITCH feed connections and to troubleshoot multicast issues. Refer to the included README file for build and usage information.

## 8 TCP Configuration

### 8.1 BXE Production Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address (LD3)
Gig-Shaped (BA) GRP	(all)	18987	95.130.109.89	—
Gig-Shaped (BB) GRP	(all)	18985	95.130.109.93	—
WAN-Shaped (BC) GRP	(all)	18986	95.130.109.89	—
WAN-Shaped (BD) GRP	(all)	18984	95.130.109.93	—
WAN-Shaped (BE) GRP	(all)	18971	—	95.130.107.241
Spin Server #1	1	18999	95.130.109.90	95.130.107.242
	2	18998		
	3	18997		
	4	18996	95.130.109.82	95.130.107.186
	5	18995		
	6	18994		
	7	18993		
	8	18992		
	9	18991		
	10	18990		
	11	18989	95.130.109.90	95.130.107.242
	12	18988	95.130.109.82	95.130.107.186
Spin Server #2	1	18983	95.130.109.94	—
	2	18982		
	3	18981		
	4	18980	95.130.109.86	—
	5	18979		
	6	18978		
	7	18977		
	8	18976		
	9	18975		
	10	18974		
	11	18973	95.130.109.94	—
	12	18972	95.130.109.86	—

## 8.2 CXE Production Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address (LD3)
Gig-Shaped (XA) GRP	(all)	19987	95.130.108.89	—
Gig-Shaped (XB) GRP	(all)	19985	95.130.108.93	—
WAN-Shaped (XC) GRP	(all)	19986	95.130.108.89	—
WAN-Shaped (XD) GRP	(all)	19984	95.130.108.93	—
WAN-Shaped (XE) GRP	(all)	19971	—	95.130.106.241
Spin Server #1	1	19999	95.130.108.90	95.130.106.242
	2	19998		
	3	19997		
	4	19996	95.130.108.82	95.130.106.186
	5	19995		
	6	19994		
	7	19993		
	8	19992		
	9	19991		
	10	19990		
	11	19989	95.130.108.90	95.130.106.242
	12	19988	95.130.108.82	95.130.106.186
Spin Server #2	1	19983	95.130.108.94	—
	2	19982		
	3	19981		
	4	19980	95.130.108.86	—
	5	19979		
	6	19978		
	7	19977		
	8	19976		
	9	19975		
	10	19974		
	11	19973	95.130.108.94	—
	12	19972	95.130.108.86	—

### 8.3 DXE Production Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address (LD3)
Gig-Shaped (DA) GRP	(all)	19987	5.253.108.69 5.253.108.70	—
Gig-Shaped (DB) GRP	(all)	19985	5.253.108.73 5.253.108.74	—
WAN-Shaped (DC) GRP	(all)	19986	5.253.108.69 5.253.108.70	—
WAN-Shaped (DD) GRP	(all)	19984	5.253.108.73 5.253.108.74	—
WAN-Shaped (DE) GRP	(all)	19971	—	5.253.109.65 5.253.109.66
Spin Server #1	1	19999	5.253.108.65 5.253.108.66	5.253.109.65 5.253.109.66
	2	19998		
	3	19997		
	4	19996		
	5	19995		
	6	19994		
	7	19993	5.253.108.67 5.253.108.68	5.253.109.67 5.253.109.68
	8	19992		
	9	19991		
	10	19990		
	11	19989		
	12	19988		
Spin Server #2	1	19983	5.253.108.75 5.253.108.76	N/A
	2	19982		
	3	19981		
	4	19980		
	5	19979		
	6	19978		
	7	19977		
	8	19976		
	9	19975		
	10	19974		
	11	19973		
	12	19972		

## 8.4 Trade Reporting Facility (TRF) Production Gap Request Proxies (GRPs)

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address (LD3)
WAN-Shaped (TC) GRP	(all)	20985	95.130.104.155 95.130.104.156	—
WAN-Shaped (TD) GRP	(all)	20983	95.130.104.157 95.130.104.158	—
WAN-Shaped (TE) GRP	(all)	20981	—	95.130.106.155 95.130.106.156

## 8.5 Systematic Internaliser Quotes Production Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address (LD3)
Gig-Shaped (QA) GRP	(all)	18987	95.130.104.49	—
Gig-Shaped (QB) GRP	(all)	18985	95.130.104.73	—
WAN-Shaped (QC) GRP	(all)	18986	95.130.104.49	—
WAN-Shaped (QD) GRP	(all)	18984	95.130.104.73	—
WAN-Shaped (QE) GRP	(all)	18971	—	95.130.105.169
Spin Server #1	1	18999	95.130.104.49	95.130.105.169
	2	18998		
	3	18997		
	4	18996		
	5	18995		
	6	18994		
	7	18993		
	8	18992		
	9	18991		
	10	18990		
	11	18989		
	12	18988		
Spin Server #2	1	18983	95.130.104.73	—
	2	18982		
	3	18981		
	4	18980		
	5	18979		
	6	18978		
	7	18977		
	8	18976		
	9	18975		
	10	18974		
	11	18973		
	12	18972		

## 8.6 BXE UAT Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)
WAN-Shaped UAT GRP	(all)	18986	95.130.110.226
UAT Spin Server	1	18999	95.130.110.226
	2	18998	
	3	18997	
	4	18996	
	5	18995	
	6	18994	
	7	18993	
	8	18992	
	9	18991	
	10	18990	
	11	18989	
	12	18988	

## 8.7 CXE UAT Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Addresses (LD3)
WAN-Shaped UAT GRP	(all)	18986	95.130.110.194	95.130.111.197
UAT Spin Server	1	18999	95.130.110.194	95.130.111.197
	2	18998		
	3	18997		
	4	18996		
	5	18995		
	6	18994		
	7	18993		
	8	18992		
	9	18991		
	10	18990		
	11	18989		
	12	18988		

## 8.8 DXE UAT Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Addresses (LD3)
WAN-Shaped UAT GRP	(all)	18987	95.130.110.69	95.130.111.101
UAT Spin Server	1	18999	95.130.110.69	95.130.111.101
	2	18998		
	3	18997		
	4	18996		
	5	18995		
	6	18994		
	7	18993		
	8	18992		
	9	18991		
	10	18990		
	11	18989		
	12	18988		

## 8.9 Trade Reporting Facility (TRF) UAT Gap Request Proxies (GRPs)

Service	Unit	TCP Port	IP Addresses (LD4)
WAN-Shaped UAT Trade GRP	(all)	18987	95.130.110.12



## 8.10 Systematic Internaliser Quotes UAT Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)
WAN-Shaped UAT Quote GRP	(all)	18986	95.130.110.40
Spin Server #1	1	18999	95.130.110.40
	2	18998	
	3	18997	
	4	18996	
	5	18995	
	6	18994	
	7	18993	
	8	18992	
	9	18991	
	10	18990	
	11	18989	
	12	18988	

## 9 Support

Please email support questions or comments regarding this specification to:

[tradedeskeurope@cboe.com](mailto:tradedeskeurope@cboe.com)

## Appendix A: Message Types

### Gap Request Proxy Messages

0x01	Login
0x02	Login Response
0x03	Gap Request
0x04	Gap Response

### Spin Server Messages

0x01	Login
0x02	Login Response
0x80	Spin Image Available
0x81	Spin Request
0x82	Spin Response
0x83	Spin Finished

### PITCH 2.X Messages

0x20	Time
0x40	Add Order — Long
0x22	Add Order — Short
0x23	Order Executed
0x24	Order Executed at Price/Size
0x25	Reduce Size — Long
0x26	Reduce Size — Short
0x27	Modify Order — Long
0x28	Modify Order — Short
0x29	Delete Order
0x41	Trade — Long
0x2B	Trade — Short
0x2C	Trade Break
0x2D	End of Session
0x2F	Expanded Add Order
0x31	Trading Status
0x32	Trade - Extended Message
0x34	Statistics
0xAC	Auction Update
0x96	Auction Summary

## Appendix B: Example Messages

### Login Message

Length	16	22 bytes
Type	01	Login
SessionSubId	30 30 30 31	0001
Username	46 49 52 4D	FIRM
Filler	20 20	
Password	41 42 43 44 30 30 20 20 20 20	ABCD00

### Login Response Message

Length	03	3 bytes
Type	02	Login Response
Status	41	Login accepted

### Gap Request Message

Length	09	9 bytes
Type	03	Gap Request
Unit	01	Unit 1
Sequence	3B 10 00 00	First message: 4155
Count	32 00	50 messages

### Gap Response Message

Length	0A	10 bytes
Type	04	Gap Response
Unit	01	Unit 1
Sequence	3B 10 00 00	First message: 4155
Status	41	Accepted

### Spin Image Available Message

Length	06	6 bytes
Type	80	Spin Image Available
Sequence	3B 10 00 00	Sequence: 4155

### Spin Request Message

Length	06	6 bytes
Type	81	Spin Request
Sequence	3B 10 00 00	Sequence: 4155

### Spin Response Message

Length	0B	11 bytes
Type	82	Spin Response
Sequence	3B 10 00 00	Sequence: 4155
Order Count	42 00 00 00	66 orders
Status	41	Accepted

### Spin Finished Message

Length	06	6 bytes
Type	83	Spin Finished
Sequence	3B 10 00 00	Sequence: 4155
Status	41	Accepted

### Time Message

Length	06	6 bytes
Type	20	Time
Sequence	98 85 00 00	34,200 seconds = 09:30 AM UK time

### Add Order — Long

Length	23	35 bytes
Type	40	Add Order — Long
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Side Indicator	42	Buy
Shares	20 4E 00 00	20,000 shares
Symbol	5A 56 5A 5A 54 6C 20 20	ZVZZTI
Price	5A 23 00 00 00 00 00 00	0.9050

### Add Order — Short

Length	19	25 bytes
Type	22	Add Order — Short
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Side Indicator	42	Buy
Shares	20 4E	20,000 shares
Symbol	46 50 70 20 20 20	FPp
Price	0A 28	102.50

### Order Executed

Length	1D	29 bytes
Type	23	Order Executed
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Executed Shares	64 00 00 00	100 shares
Execution Id	C8 00 00 00 01 40 57 3A	

Execution Flags      31 32 2D

1 = Central Limit Order Book  
2 = Continuous Trading  
- = Not specified

#### Order Executed at Price/Size

Length                29  
Type                  24  
Time Offset        18 D2 06 00  
Order Id            05 40 5B 77 8F 56 1D 0B  
Executed Shares    64 00 00 00  
Remaining Shares   BC 4D 00 00  
Execution Id        C8 00 00 00 01 40 57 3A  
Price                E8 A3 0F 00 00 00 00 00  
Execution Flags    31 4B 2D

41 bytes  
Order Executed at Price/Size  
447,000 ns since last Time Message  
  
100 shares  
19,900 shares  
  
102.50  
1 = Central Limit Order Book  
K = Scheduled Closing Auction  
- = Not specified

#### Reduce Size — Long

Length                12  
Type                  25  
Time Offset        18 D2 06 00  
Order Id            05 40 5B 77 8F 56 1D 0B  
Cancelled Shares    F8 24 01 00

18 bytes  
Reduce Size — Long  
447,000 ns since last Time Message  
  
75,000 shares

#### Reduce Size — Short

Length                10  
Type                  26  
Time Offset        18 D2 06 00  
Order Id            05 40 5B 77 8F 56 1D 0B  
Cancelled Shares    64 00

16 bytes  
Reduce Size — Short  
447,000 ns since last Time Message  
  
100 shares

#### Modify Order — Long

Length                1A  
Type                  27  
Time Offset        18 D2 06 00  
Order Id            05 40 5B 77 8F 56 1D 0B  
Shares              F8 24 01 00  
Price                E8 A3 0F 00 00 00 00 00

26 bytes  
Modify Order — Long  
447,000 ns since last Time Message  
  
75,000 shares  
102.50

#### Modify Order — Short

Length                12  
Type                  28  
Time Offset        18 D2 06 00  
Order Id            05 40 5B 77 8F 56 1D 0B

18 bytes  
Modify Order — Short  
447,000 ns since last Time Message

Shares	64 00	100 shares
Price	0A 28	102.50

### Delete Order

Length	0E	14 bytes
Type	29	Delete Order
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	

### Trade — Long

Length	2F	47 bytes
Type	41	Trade — Long
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	For dark book trade, all zeroes
Side Indicator	42	Buy
Shares	F8 24 01 00	75,000 shares
Symbol	56 4F 44 6C 20 20 20 20	VOD1
Price	E8 A3 0F 00 00 00 00 00	102.50
Execution Id	C8 00 00 00 01 40 57 3A	
Trade Flags	33 32 44 45	3 = Dark Book 2 = Continuous Trading D = Dark Trade E = Ex/Cum Dividend

### Trade — Short

Length	25	37 bytes
Type	2B	Trade — Short
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	For dark book trade, all zeroes
Side Indicator	42	Buy
Shares	64 00	100 shares
Symbol	56 4F 44 6C 20 20	VOD1
Price	0A 28	102.50
Execution Id	C8 00 00 00 01 40 57 3A	
Trade Flags	31 4F 50 2D	1 = Central Limit Order Book O = Scheduled Opening Auction P = Plain-Vanilla Trade - = Not specified

### Trade Break

Length	0E	14 bytes
Type	2C	Trade Break
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Execution Id	C8 00 00 00 01 40 57 3A	

### End of Session

Length	06	6 bytes
Type	2D	End of Session
Time Offset	18 D2 06 00	447,000 ns since last Time Message

### Expanded Add Order

Length	28	40 bytes
Type	2F	End of Session
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	For dark book trade, all zeroes
Side Indicator	42	Buy
Shares	64 00 00 00	100 shares
Symbol	56 4F 44 6C 20 20 20 20	VOD1
Price	A0 06 1C 06 00 00 00 00	102.50, with implied 6 d.p (assumes TRF system)
Add Flags	02	SI Quote bit set
Participant ID	41 42 43 44	Attributed to participant ABCD

### Trading Status

Length	12	18 bytes
Type	31	Trading Status
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	56 4F 44 6C 20 20 20 20	VOD1
Status	54	T = Trading
Reserved	00 00 00	

### Statistics

Length	18	24 bytes
Type	34	Statistics
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	56 4F 44 6C 20 20 20 20	VOD1
Price	5A 23 00 00 00 00 00 00	0.9050
Statistic Type	4F	O = Opening Price
Price Determination	30	0 = Normal

### Auction Update

Length	25	37 bytes
Type	AC	Auction Update
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Symbol	4C 45 4D 44 6C 20 20 20	LEMD1
Auction Type	50	P = Periodic Auction
Reference Price	7B 88 01 00 00 00 00 00	10.0475
Indicative Price	7B 88 01 00 00 00 00 00	10.0475
Indicative Shares	88 13 00 00	5000 shares
Outside Tolerance	49	I = Inside Tolerance
Includes Primary	50	P = Includes Primary



## Auction Summary

Length	1B	27 bytes
Type	96	Auction Summary
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Symbol	4C 45 4D 44 6C 20 20 20	LEMD1
Auction Type	4F	O = Opening Auction
Price	7B 88 01 00 00 00 00 00	10.0475
Shares	88 13 00 00	5000 shares

## Sequenced Unit Header with 2 Messages

Sequenced Unit Header:

Hdr Length	31 00	49 bytes, including header
Hdr Count	02	2 messages to follow
Hdr Unit	01	Unit 1
Hdr Sequence	01 00 00 00	First message has sequence number 1

Message 1: (Add Order — Short)

Length	19	25 bytes
Type	22	Add Order — Short
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	631WC4000005
Side Indicator	42	Buy
Shares	E1 02	737 shares
Symbol	56 4F 44 6C 20 20	VOD1
Price	01 00	0.01

Message 2: (Reduce Size — Short)

Length	10	16 bytes
Type	26	Reduce Size — Short
Time Offset	18 D9 06 00	449,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	631WC4000005
Cancelled Shares	64 00	100 shares

### Index Quote

Length	19	25 bytes
Type	D8	Index Quote
Timestamp	00 68 64 73 8F 21	10:15:00+000
Index Ticker	42 41 54 32 30 4E 00 00 00 00	BAT20N
Price	E8 A3 0F 00 00 00 00 00	102.5
Index Status	49	Indicative

### Index Quote EDSP

Length	18	24 bytes
Type	D9	Index Quote EDSP
Timestamp	00 68 64 73 8F 21	10:15:00+000
Index Ticker	42 41 54 32 30 4E 00 00 00 00	BAT20N
Price	E8 A3 0F 00 00 00 00 00	102.5

## Appendix C: Spin Server Usage Example

The following diagram (see next page) shows the exchange of messages over time between a Participant and a Cboe Multicast PITCH feed and Spin Server.

At time 1, the Participant has no state of the book and desires to become current. The Participant caches the received Multicast PITCH messages (sequences 310172 and 310173) for later use. Since the Participant has no book, they cannot yet be applied.

At time 5, the Participant has successfully logged into the Spin Server and has cached another message, sequence 310174.

At time 7, the Participant receives a Spin Image Available message which indicates that the Spin Server is capable of giving them a spin of all open orders as of sequence 310169. The Participant does not have all messages cached after 310169 (they are missing 310170 and 310171), so this spin is not useful to the Participant.

At time 10, the Participant receives a Spin Image Available message which is useful since it would be a spin of all orders up to and including sequence 310175, and the Participant has all messages after 310175 cached.

At time 11, the Participant sends a Spin Request for all messages up to and including 310175 and continues to cache Multicast PITCH messages received.

At time 14, the Spin Server acknowledges the Spin Request and indicates that three open orders will be sent.

At time 24, the Spin Server indicates that it has finished sending all open orders. The Participant must then apply the cached messages from sequence number 310176 through current.

### Notes:

- A Spin Request may only be sent for a sequence number which was present in a Spin Image Available message. Arbitrary sequence numbers cannot be sent.
- Spin Servers are available for each unit. Participants may need to employ multiple Spin Servers depending upon their architecture.



## Appendix D: Specification Differences

This section describes the differences between the Cboe BZX Exchange Equities Multicast PITCH specification and the Cboe Europe Multicast PITCH Specification.

- Some Cboe BZX Multicast PITCH messages have an additional field called “Add Flags” on the end which are not present on the corresponding Cboe Europe messages. (Add Order Short (0x22))
- Some Cboe BZX Multicast PITCH messages have an additional field called “Modify Flags” on the end which are not present on the corresponding Cboe Europe messages. (Modify Order Long (0x27), Modify Order Short (0x28))
- Cboe BZX Multicast PITCH sends a number of messages which are not present on Cboe Europe Multicast PITCH. (Trade Expanded (0x30))
- Cboe Europe Multicast PITCH sends a number of messages which are not present on Cboe BZX Multicast PITCH. (Trade Report (0x32))
- Cboe Europe Multicast PITCH sends a number of messages which serve the same function in Cboe BZX Multicast PITCH but are binary incompatible. (Add Order - Long (0x40), Trade - Long (0x41))
- Some Cboe Europe Multicast PITCH messages have an additional field called “Execution Flags” on the end which are not present on the corresponding Cboe BZX messages. (Order Executed (0x23) and Order Executed at Price/Size (0x24))
- Some Cboe Europe Multicast PITCH messages have an additional field called “Trade Flags” on the end which are not present on the corresponding Cboe BZX messages. (Trade - Short (0x2B))

## Appendix E: Symbol distribution across units

The following table illustrates how symbology is distributed across the 12 matching units for BXE, CXE, DXE and SI Quote feeds. The Cboe TRF system is distributed across 3 matching units. The downloadable reference data file <sup>2</sup> may be used by participants that require knowledge of the symbol-to-unit mappings.

BXE, CXE, DXE and Systematic Internaliser Quotes:

Unit	Markets
1	London, Great Britain (O-H) (BXE and CXE only) <sup>3</sup>
2	London, Great Britain (I-R) (BXE and CXE only) <sup>3</sup>
3	London, Great Britain (S-Z); Cboe UK (BXE and CXE only) <sup>3</sup>
4	Euronext Paris, France (O-F)
5	Euronext Paris, France (G-Z)
6	Euronext (Lisbon, Portugal; Brussels, Belgium; Amsterdam, Netherlands); Dublin, Ireland
7	XETRA, Germany (O-E); XFRA, Germany (O-E)
8	XETRA, Germany (F-Z); XFRA, Germany (F-Z); Vienna, Austria
9	Milan, Italy; SIBE, Spain
10	Cboe EU Warsaw, Poland; Prague, Czech Republic; Budapest, Hungary Athens, Greece; Bucharest, Romania; Bratislava, Slovakia Nicosia, Cyprus; Zagreb, Croatia; Ljubljana, Slovenia; Luxembourg Valletta, Malta; Riga, Latvia; Sofia, Bulgaria; Tallinn, Estonia Vilnius, Lithuania; Johannesburg; Ex-Europe, Ex-US
11	SIX Swiss Exchange (BXE and CXE only) <sup>3</sup>
12	Helsinki, Finland; Copenhagen, Denmark; Oslo, Norway; Stockholm, Sweden; Reykjavik, Iceland; US Securities Traded in Europe

<sup>2</sup>[https://www.bats.com/europe/equities/support/reference\\_data/](https://www.bats.com/europe/equities/support/reference_data/)

<sup>3</sup>In DXE this unit will have no live symbols at launch. Heartbeat messages will be emitted from this unit.

Trade Reporting Facility (TRF):

TRF Unit	Markets
1	Cboe UK London, Great Britain Euronext (Lisbon, Portugal; Brussels, Belgium; Amsterdam, Netherlands) Dublin, Ireland
2	Euronext Paris, France XETRA, Germany XFRA, Germany Vienna, Austria
3	Cboe EU Athens, Greece; Bratislava, Slovakia; Bucharest, Romania Budapest, Hungary; Copenhagen, Denmark; Ex-Europe, Ex-US Helsinki, Finland; Johannesburg Ljubljana, Slovenia; Luxembourg; Milan, Italy Nicosia, Cyprus; Oslo, Norway; Prague, Czech Republic Reykjavik, Iceland; Riga, Latvia; SIBE, Spain SIX Swiss Exchange; Sofia, Bulgaria; Stockholm, Sweden; Tallinn, Estonia; US Securities Traded in Europe; Valletta, Malta Vilnius, Lithuania; Warsaw, Poland; Zagreb, Croatia

## Revision History

6 March 2009	Initial draft version
19 March 2009	Version 1.2 Final Cboe Europe version. Finalized multicast addresses and bandwidth requirements.
23 March 2009	Version 1.3 Multicast address changed for unit 3. Symbol and market distribution rebalanced.
14 April 2009	Version 1.4 Corrected multicast rendezvous address. Corrected source address for Gig-Shaped Unit 3 real-time and gap feeds.
22 June 2009	Version 1.5 Unit 6 will contain data for Euronext Lisbon (XLIS) securities.
30 June 2009	Version 1.6 Additional clarification that all messages sent to the GRP and Spin Server must be contained in a Cboe Sequenced Unit Header.
23 July 2009	Version 1.7 Published multicast addresses and ports for UAT/Certification environment.
31 July 2009	Version 1.8 Trades for hidden orders will now always show the side of the trade as B (buy).
6 August 2009	Version 1.9 Corrected multicast ports for UAT/Certification environment.
16 October 2009	Version 1.10 Added XSWX on unit 11.
11 December 2009	Version 1.11 Added XMCE. Corrected UAT/Certification multicast ports.
16 December 2009	Version 2.0 Added XDUB on unit 12. Added section on interpreting Execution Ids (see § 2.5, p. 10). Corrected currency in some example messages (showed US dollars).
19 January 2010	Version 2.1 Added secondary production Gig- and WAN-shaped feeds.
4 February 2010	Version 2.2 Corrections for new secondary production Gig- and WAN-shaped feeds.
5 February 2010	Version 2.3 UAT multicast groups published.
23 February 2010	Version 2.4 WAN-Shaped (D) feed multicast group addresses corrected.
10 March 2010	Version 2.5 Moved XDUB symbols from unit 12 to unit 3.
15 April 2010	Version 2.6 Added a table in Bandwidth Recommendations (§ 7.9, p. 61) which lists the current bandwidth allocations for Gig- and WAN-shaped Multicast PITCH feeds for each unit.
19 April 2010	Version 2.7 Updated UAT symbol distribution table to have 12 units with distribution matching the production feeds.
20 May 2010	Version 2.8 Trades for dark book orders will now always have an Order Id of all zeroes.
18 June 2010	Version 2.9 Order IDs in Trade Messages are now obfuscated by default. This obsoletes the change made to Order IDs on 20 May 2010.



8 October 2010	Version 2.10 Modified UAT multicast groups and ports to reflect new setup. Added a UAT bandwidth recommendation.
3 December 2010	Version 2.11 Modified WAN-Shaped (C) and WAN-Shaped (D) source IP addresses, effective from 15 December 2010 onwards.
18 January 2011	Version 2.12 WBAH was missing from unit 12 on some tables.
1 April 2011	Version 2.13 Updated URL to sample program.
11 May 2011	Version 2.14 Minor changes to WAN feed bandwidth allocations.
17 June 2011	Version 2.15 Corrected Execution Id offset in Order Executed at Price/Size.
23 June 2011	Version 2.5 Included information on setup in Equinix Slough LD4 data centre. Updated bandwidth recommendations. Added spin server and GRP information.
12 October 2011	Version 3.0 Removed multicast information from LHC data centre now that the move to LD4 is complete.
13 October 2011	Version 3.1 Clarification on GRP limits being per Multicast PITCH feed, not per GRP session.
9 November 2011	Version 3.2 Added Appendix D.
21 November 2011	Version 3.3 Corrected LD4 Production Spin Server addresses.
13 December 2011	Version 3.4 Remove reference to MOC/TAL.
18 January 2012	Version 4.0 Added information around Chi-X Europe migration.
23 January 2012	Version 4.1 Noted future move of Austrian feed (WBAH) to unit 8.
25 January 2012	Version 4.2 Added UAT port and address details for GRP and Spin Servers.
6 February 2012	Version 4.3 Corrected some TCP addresses and ports for Park Royal (LD3) GRP and Spin Servers for both BATS Europe and Chi-X Europe.
6 February 2012	Version 4.4 Corrected TCP addresses for Chi-X Europe GRPs.
8 February 2012	Version 4.5 Updated source IP addresses for upcoming Park Royal (LD3) Multicast PITCH feeds (BE, XE).
22 February 2012	Version 4.6 Added Spin Server #2 to Park Royal (LD3) environments to match Spin Server #2 in Slough (LD4) environments.
27 February 2012	Version 4.7 Added XFRA and EFTP MICs for completeness.
2 March 2012	Version 4.8 Formatting changes only.
17 April 2012	Version 4.9 Remove extraneous 'execution'.

22 April 2012	Version 4.10 Updated § 7, p. 42 to include source and destination ranges per multicast feed.
17 May 2012	Version 4.11 Fixed the link to the Multicast test program.
8 June 2012	Version 4.12 Removed Chi-X migration notes. Updated branding.
7 February 2013	Version 5.0 New Off-Book Trade, Off-Book Trade Break and Unit Clear messages.
28 March 2013	Version 5.1 Support for indicating an off-book trade was reported out of the Main Session.
9 April 2013	Version 5.2 Updated link to FESE website
20 June 2013	Version 5.3 Section 1.7 added, introducing use of PITCH by the Trade Reporting Facility. Re-worded 'Binary Long Price' definition to specify 6 implied decimal places for TRF. Addition of Expanded Add Order message to support SI Quote publication. Added multicast and TCP configuration information for the TRF. Adjusted bandwidth recommendations. Addition of Trading Status message. Addition of Statistics message to disseminate Open/High/Low/Close.
5 August 2013	Version 5.4 Updated symbol distribution. Spanish and Italian symbols are affected and CXE listed symbols are allocated space.
15 August 2013	Version 5.5 Additional information given on the new Trading Status and Statistics messages.
19 September 2013	Version 5.6 MIC update: WBAH to XWBO
27 September 2013	Version 5.7 Updated wording on Spin message types.
3 October 2013	Version 5.8 Support for new markets
20 November 2013	Version 5.9 Layout improvements

6 December 2013	<p>Version 6.0</p> <p>Renamed Off-Book Trade Message to Trade Report Message.</p> <p>Removed the Off-Book Trade Break Message. Use a Modification Indicator of 'C' in the Trade Type Flags field to delete a Trade Report.</p> <p>Widened the Shares field from 4 to 8 bytes in the Trade Report (previously Off-Book Trade) message.</p> <p>Added a special value of 'BCS' to the Execution Venue field in the Trade Report (previously Off-Book Trade) message to indicate a 'Broker Crossing System' trade.</p> <p>Added a new Cboe specific Transaction Sub-Category flag to the end of the Trade Report Flags field in the Trade Report (previously Off-Book Trade) message.</p> <p>Widened the Symbol field from 6 to 8 bytes in the Add Order - Long and Trade - Long messages.</p> <p>The Add Order - Long message type has been changed from 0x21 to 0x40 to indicate binary incompatibility with the US version of this message.</p> <p>The Trade - Long message type has been changed from 0x2A to 0x41 to indicate binary incompatibility with the US version of this message.</p> <p>Expanded the Status flag in the Trading Status message to include values for Regulatory Halts ('H'), Market Order Imbalance ('M') and Price Monitoring ('P') extensions. Additionally the Auction ('A') status has been removed and sub-divided into Opening Auction ('O') and Closing Auction ('E').</p> <p>Added an Execution Flags field to the Order Executed and Order Executed at Price/Size messages.</p> <p>Added a Trade Flags field to the Trade message.</p> <p>Section 4.15 added, introducing the Auction Update and Auction Summary messages.</p>
24 December 2013	<p>Version 6.1</p> <p>Made Trade Report Message's Transaction Sub-Category field reserved for future use.</p>
21 January 2014	<p>Version 6.2</p> <p>Renamed 'Regulatory Halt' trading status to 'Halt'.</p> <p>Clarified the trading statuses that are reserved for future use.</p> <p>Corrected the implied value for the level 3.1 MMT flag in the Execution Flags section.</p> <p>VenueField indicator for BCS becomes AUT.</p>
10 June 2014	<p>Version 6.3</p> <p>Add XZAG to TRF Unit Three markets</p>
12 June 2014	<p>Version 6.4</p> <p>Deprecate usage of the fourth character of the Execution ID to help differentiate the nature of the trade in favour of MMT flags directly. Rename the Cboe Transaction Sub-Category Trade Report flag for the new MMT 3.7 trade flag. Added support for the new MMT 2 flag for an undefined auction.</p>
23 September 2014	<p>Version 6.5</p> <p>Added XIST (Turkey) to unit 11 in BCE and unit 3 in BXTR.</p>
7 October 2014	<p>Version 6.6</p> <p>Removed 'effective from' labels.</p>
29 March 2015	<p>Version 6.6</p> <p>Clarify trade timing indicator.</p>
2 June 2015	<p>Version 6.7</p> <p>Remove deprecated AUT flag. Rename Trade Report to Trade - Extended. New Auction Update message type. Extended the Auction Type flag in the Auction Update and Auction Summary messages to include Periodic Auctions ('P').</p>

14 December 2015	Version 6.8 Added XQMH to unit 11 in BCE and unit 3 in BXTR.
8 January 2016	Version 6.9 SINT and XOFF as possible values for the Execution Venue field of the Trade - Extended Form message. Details on semantic change for Trade Amendments. Removal of Trade Break messages.
19 February 2016	Version 6.10 Updated with new branding.
29 April 2016	Version 6.11 Removed 'Effective' content related to Q2 2016 Release.
17 June 2016	Version 6.12 Renamed a few dangling 'Trade Reporting message' to 'Trade - Extended message'.
8 July 2016	Version 6.13 Added MTAH market
31 August 2016	Version 6.14 Updated with multi-cast details for the new certification CXE book in LD3.
14 September 2016	Version 6.15 Correction to the multicast source range netmask for CXE UAT-DR.
1 February 2017	Version 6.16 MMT v3 support
23 May 2017	Version 6.17 New IP addresses for BXE/CXE GRP B and D. Removed the Modify Order message from the list of possible message types in the SI Quote introduction text. For technical reasons SI Quote modifies are modeled as Cancel/New on the MC PITCH feed. Clarified valid values for the Cboe Trade Timing Indicator and Execution Venue fields.
19 July 2017	Version 6.18 MMT v3.04 support for Q4 2017 release.
2 August 2017	Version 6.19 Removed XIST (Turkey) as a supported market.
14 August 2017	Version 6.20 Added details for new 12-unit SI Quote publication. Various multi-cast tables reformatted for clarity.
24 November 2017	Version 6.21 Branding updates. Removal of highlighting relevant to the October release.
26 January 2018	Version 6.22 Updated MIC used in Execution Venue for Cboe NT trades in BXE and CXE.
19 July 2018	Version 6.23 Added begin and end transaction messages.
31 August 2018	Version 6.24 Added XWAR, XBUD, XPRA as supported markets.
25 October 2018	Version 6.25 Renamed Cboe Trade Timing Indicator Field to Cboe Trade Flags and added new possible values. Removed references to old multi-cast groups and services, no longer applicable since the Q4 2017 release. Added new multi-cast groups and services applicable post-Brexit.

6 February 2019	Version 6.26 Corrections to LD3 IP GRP and Spin addresses: From 95.130.106.233 to 95.130.106.241 From 95.130.106.234 to 95.130.106.242 From 95.130.106.235 to 95.130.106.243 From 95.130.107.233 to 95.130.107.241 From 95.130.107.234 to 95.130.107.242 From 95.130.107.235 to 95.130.107.243
6 March 2019	Version 6.27 Removed IP addresses for LD3 for Spin Server. #2.
31 May 2019	Version 6.28 Add DXE environment. Add Cboe Closing Cross.
26 July 2019	Version 6.29 Updated IP addresses for DXE GRP GIG A and C (Highlighted in yellow).
21 August 2019	Version 6.30 Updated DXE Production GRP and Spin TCP ports.
10 September 2019	Version 6.31 Decommission of legacy MC PITCH feed infrastructure postponed. GIG B (BB and XB), WAN D (BD and XD) and WAN E (BE and XE) infrastructure will be decommissioned effective Friday 29th November 2019. GIG A (BA and XA), and WAN C (BC and XC) infrastructure will be decommissioned effective Monday 27th January 2020.
7 November 2019	Version 6.32 Clarified when Unit Clear messages are sent.
6 February 2020	Version 6.33 Updated Execution Ids
28 February 2020	Version 6.34 Add indices feeds and messages.
26 March 2020	Version 6.35 Update Indices MC addresses
9 April 2020	Version 6.36 Correct multicast configuration for indices feeds
30 April 2020	Version 6.37 Removed legacy MC PITCH feed infrastructure details. Removed the 'n' post-suffix from what was previously described as the 'new' feed infrastructure, as that is the only feed infrastructure that exists, now the legacy feed infrastructure has been removed.
26 May 2020	Version 6.38 Updated CXE UAT Indices Multicast section (§ 7.2.6, p. 48), to remove UAT-DR designation.
28 August 2020	Version 6.39 Add a more detailed description for the indices messages.
14 October 2020	Version 6.40 Update location of multicast test program zip file.
27 October 2020	Version 6.41 Added LISZ as Execution Venue for Cboe BIDS Europe (DXE) ETRs.
8 February 2023	Version 6.42 Update BXE Production Primary Multicast PITCH Feed (BA, BC) section (§ 7.1.1, p. 44) for units 4, 5, 6, 9, 10 and 12.
6 April 2023	Version 6.43 Added the XFRA (Boerse, Germany) market to the symbol ranges tables for on-exchange and TRF

9 May 2023	Version 6.44 Clarify the usage of systematic internaliser quotes.
6 July 2023	Version 6.45 Added MMT v4 support and new values in Execution Venue field.
17 July 2023	Version 6.46 Removed NTLS from MMT v4 Level 3.2.
1 September 2023	Version 6.47 Added new values supported in Cboe Trade Flags.
16 October 2023	Version 6.48 Added MMT v4.1 support.
16 November 2023	Version 6.49 Updated description for Execution Flags, and Trade Flags.
21 May 2024	Version 6.50 Added halt and volatility auction support for corporate listings.
15 Jul 2024	Version 6.51 Added BIDS VWAP and XWAP execution venue fields, for VWAP-X trades in their respective jurisdictions.