



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 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 is not available as a Gig-Shaped feed.
- *WAN-Shaped*: Collection of multicast addresses and gap request infrastructure for WAN connectivity from Cboe.

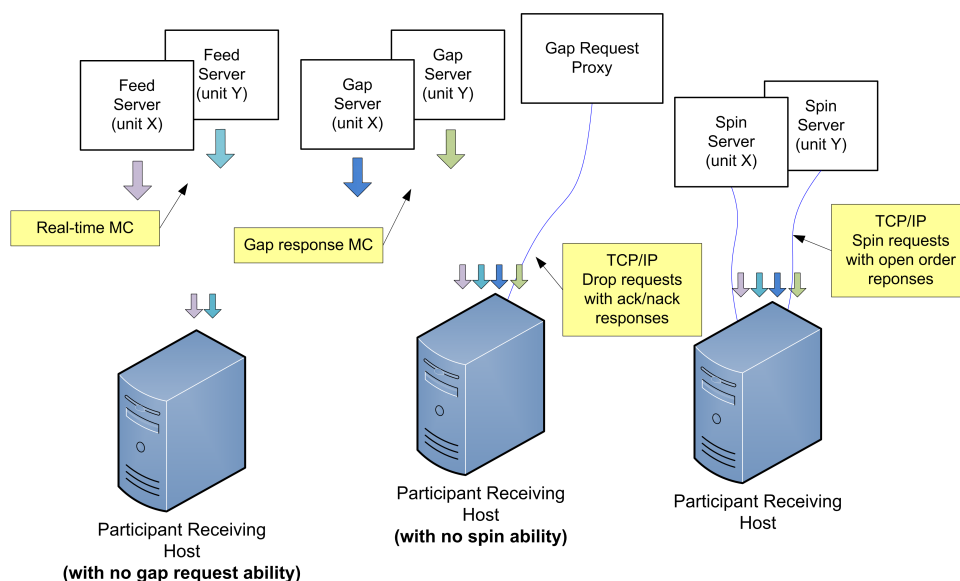
1.2 Feed Connectivity Requirements

- 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. 64) shows an example flow of messages between a Participant and a Cboe Multicast PITCH feed and Spin Server.

Please note that while Spin Server facilities is provided for the Trade-only feed for the TRF for consistency reasons, it will not provide any useful information due to the fact that there are no open orders/quotes relevant for that feed.

1.6 CXE and BXE Books

The CXE and BXE integrated and dark pools operate as separate islands of liquidity, with smart order routing capabilities between the two. 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.

In Equinix Slough, four feeds are provided per book:

- 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)

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)

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.

System Internaliser (SI) Quotes will be modelled in the TRF 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 Internalizer 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) — new in November 2017
 - Gig-Shaped Secondary Quotes (QB) — new in November 2017
 - 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)

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

The fourth character of an Execution Id (after converting to 12 character, base 36, left zero-padded) may be used to differentiate the type of execution:

| Character | Meaning |
|-----------|---------------------------|
| 0 (zero) | BXE Integrated Order Book |
| 1 | CXE Integrated Order Book |
| D | BXE Dark Order Book |
| E | CXE Dark Order Book |

For example, after conversion, the execution ID 000D3980018L is a BXE Dark Order Book trade.

Please note, use of the fourth character of an Execution ID to differentiate type of execution is now deprecated. Please utilise the Execution/Trade flags stamped on the message to achieve this differentiation.

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.**

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 at startup each day. It would also be distributed 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 TRF platform to provide visibility of Systematic Internalizer 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 |
| 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 a distinct MMT field, as described in the following table and § 4.14, p. 30:

| Execution Flags | | | |
|-----------------|-----------------------|-------------------|---------------------------------------|
| Offset | MMT Level / Fieldname | | Description |
| 0 | 1 | Market Mechanism | See § 4.14, p. 30 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
- *Level 3.1* will always be '-' for a standard trade
- *Level 3.2* 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
- *Level 3.5* will always be '-' for no Benchmark or Reference Price Indicator
- *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
- *Level 4.1* will always be '-' for no deferral of publication
- *Level 4.2* will always be '-' for not being applicable
- *Level 5* 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 |
| 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 a distinct MMT field, as described in the following table and § 4.14, p. 30:

| Execution Flags | | | |
|-----------------|-----------------------|-------------------|---------------------------------------|
| Offset | MMT Level / Fieldname | | Description |
| 0 | 1 | Market Mechanism | See § 4.14, p. 30 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
- Level 3.1 will always be '-' for a standard trade
- Level 3.2 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
- Level 3.5 will always be '-' for no Benchmark or Reference Price Indicator
- 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
- Level 4.1 will always be '-' for no deferral of publication
- Level 4.2 will always be '-' for not being applicable
- Level 5 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 |
| 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 |
| Total Length = 38 bytes | | | | |

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 a distinct MMT field, as described in the following table and § 4.14, p. 30:

| Trade Flags | | | |
|-------------|-----------------------|-------------------------------------|---------------------------------------|
| Offset | MMT Level / Fieldname | | Description |
| 0 | 1 | Market Mechanism | See § 4.14, p. 30 for possible values |
| 1 | 2 | Trading Mode | |
| 2 | 3.1 | Transaction Category | |
| 3 | 3.5 | Benchmark/Reference Price Indicator | |
| 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
- *Level 3.1* populated per Trade Flags offset 2
- *Level 3.2* 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
- *Level 3.5* 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
- *Level 4.1* will always be '-' for no deferral of publication
- *Level 4.2* will always be '-' for not being applicable
- *Level 5* 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. e.g. for Cboe NT trades, this shall be the segment MIC BATF for BXE off-book trades, CHIO for CXE off-book trades and BARO for REGM off-book trades. This will contain SINT if the trade occurred on a Systematic Internaliser or XOFF if OTC. Cboe LIS trades have the value LISX. |
| Currency | 50 | 3 | Alphanumeric | Traded currency. |
| Cboe Trade Timing Indicator | 53 | 1 | Alphanumeric | '1' The trade was reported to Cboe 'late', '2' The trade was reported to Cboe out of the Main Session, '3' The trade was reported to Cboe late and out of the Main Session '-' otherwise. NOTE: 2 and 3 are not valid values on the Trade Reporting Facility. |
| Extended Trade Flags | 54 | 14 | Alphanumeric | Type flags based on the MMT v3.04 standard. |
| Total Length = 68 bytes | | | | |

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. |
| Currency | 54 | 3 | Alphanumeric | Reported currency. |
| Cboe Trade Timing Indicator | 57 | 1 | Alphanumeric | '1' The trade was reported to Cboe 'late', '-' otherwise. |
| Extended Trade Flags | 58 | 14 | Alphanumeric | Type flags based on the MMT v3.04 standard. |
| Total Length = 72 bytes | | | | |

4.9.6 Extended Trade Flags

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

Each character in the flags field corresponds to a distinct MMT field, as described in the following table and § 4.14, p. 30:

| Trade Type Flags | | | |
|------------------|-----------------------|-------------------------------------|--|
| Offset | MMT Level / Fieldname | | Description |
| 0 | 1 | Market Mechanism | See § 4.14, p. 30 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).

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 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 ¹ M = Market Order Imbalance Extension P = Price Monitoring Extension |
| Reserved1 | 15 | 3 | Alpha | Reserved |
| Total Length = 18 bytes | | | | |

See the Participant Manual for details on Trading Status phases.

¹Reserved for future use

4.12 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 | | | | |

4.13 Auction Messages

4.13.1 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 |
| 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 | | | | |

4.13.2 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 |
| Price | 15 | 8 | Binary Long Price | Auction price |

| | | | | |
|--------------------------------|----|---|--------|---|
| Shares | 23 | 4 | Binary | Cumulative number of shares executed during the auction |
| Total Length = 27 bytes | | | | |

4.14 MMT 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.

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 Internalizer) |
| '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 |

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. 12) **and must be sent inside of a Sequenced Unit Header**.

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. 12).

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 0 = 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. 67).

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 | 95.130.109.128/27 | 224.0.83.0/28 | 95.130.109.248 |
| LD4 | BXE | BC | 95.130.109.128/27 | 224.0.83.32/28 | 95.130.109.249 |
| LD4 | BXE | BB | 95.130.109.160/27 | 224.0.83.64/28 | 95.130.109.252 |
| LD4 | BXE | BD | 95.130.109.160/27 | 224.0.83.96/28 | 95.130.109.253 |
| LD3 | BXE | BE | 95.130.107.64/27 | 224.0.84.128/28 | 95.130.107.249 |
| LD4 | BXE | UAT | 95.130.110.224/27 | 224.0.85.16/28 | 95.130.109.255 |
| LD4 | CXE | XA | 95.130.108.128/27 | 224.0.82.0/28 | 95.130.108.248 |
| LD4 | CXE | XC | 95.130.108.128/27 | 224.0.82.32/28 | 95.130.108.249 |
| LD4 | CXE | XB | 95.130.108.160/27 | 224.0.82.64/28 | 95.130.108.252 |
| LD4 | CXE | XD | 95.130.108.160/27 | 224.0.82.96/28 | 95.130.108.253 |
| LD3 | CXE | XE | 95.130.106.64/27 | 224.0.84.0/28 | 95.130.106.249 |
| 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 | TRF | QC | 95.130.104.176/29 | 224.0.83.240/29 | 95.130.104.249 |
| LD4 | TRF | TC | 95.130.104.176/29 | 224.0.83.248/29 | 95.130.104.249 |
| LD4 | TRF | QD | 95.130.104.184/29 | 224.0.83.224/29 | 95.130.104.253 |
| LD4 | TRF | TD | 95.130.104.184/29 | 224.0.83.232/29 | 95.130.104.253 |
| LD3 | TRF | QE | 95.130.106.176/29 | 224.0.84.168/29 | 95.130.106.254 |
| LD3 | TRF | TE | 95.130.106.176/29 | 224.0.84.160/29 | 95.130.106.254 |
| LD4 | TRF | UATQ | 95.130.110.0/28 | 224.0.85.40/29 | 95.130.104.255 |
| 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 |

Note: The TRF publication of QC, QD, QE and UATQ will be decommissioned in favour of the corresponding SI multicast publications. The schedule for this transition is published separately.

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 | 224.0.83.2 | 224.0.83.3 | 224.0.83.34 (95.130.109.145) | 224.0.83.35 (95.130.109.145) |
| 2 | 31202 | (95.130.109.129) | (95.130.109.129) | | |
| 3 | 31203 | 224.0.83.2 (95.130.109.130) | 224.0.83.3 (95.130.109.130) | | |
| 4 | 31204 | 224.0.83.4 (95.130.109.130) | 224.0.83.5 (95.130.109.130) | 224.0.83.36 (95.130.109.145) | 224.0.83.37 (95.130.109.145) |
| 5 | 31205 | 224.0.83.4 (95.130.109.131) | 224.0.83.5 (95.130.109.131) | | |
| 6 | 31206 | 224.0.83.6 (95.130.109.131) | 224.0.83.7 (95.130.109.131) | 224.0.83.38 (95.130.109.145) | 224.0.83.39 (95.130.109.145) |
| 7 | 31207 | 224.0.83.8 | 224.0.83.9 | 224.0.83.40 (95.130.109.145) | 224.0.83.41 (95.130.109.145) |
| 8 | 31208 | (95.130.109.129) | (95.130.109.129) | | |
| 9 | 31209 | 224.0.83.10 | 224.0.83.11 | 224.0.83.42 (95.130.109.145) | 224.0.83.43 (95.130.109.145) |
| 10 | 31210 | (95.130.109.130) | (95.130.109.130) | | |
| 11 | 31211 | 224.0.83.12 | 224.0.83.13 | 224.0.83.44 (95.130.109.145) | 224.0.83.45 (95.130.109.145) |
| 12 | 31212 | (95.130.109.131) | (95.130.109.131) | | |

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 | 224.0.83.66 | 224.0.83.67 | 224.0.83.98 (95.130.109.177) | 224.0.83.99 (95.130.109.177) |
| 2 | 31202 | (95.130.109.161) | (95.130.109.161) | | |
| 3 | 31203 | 224.0.83.66 (95.130.109.161) | 224.0.83.67 (95.130.109.161) | | |
| 4 | 31204 | 224.0.83.68 (95.130.109.161) | 224.0.83.69 (95.130.109.161) | 224.0.83.100 (95.130.109.177) | 224.0.83.101 (95.130.109.177) |
| 5 | 31205 | 224.0.83.68 (95.130.109.161) | 224.0.83.69 (95.130.109.161) | | |
| 6 | 31206 | 224.0.83.70 (95.130.109.161) | 224.0.83.71 (95.130.109.161) | 224.0.83.102 (95.130.109.177) | 224.0.83.103 (95.130.109.177) |
| 7 | 31207 | 224.0.83.72 | 224.0.83.73 | 224.0.83.104 (95.130.109.177) | 224.0.83.105 (95.130.109.177) |
| 8 | 31208 | (95.130.109.162) | (95.130.109.162) | | |
| 9 | 31209 | 224.0.83.74 | 224.0.83.75 | 224.0.83.106 (95.130.109.177) | 224.0.83.107 (95.130.109.177) |
| 10 | 31210 | (95.130.109.162) | (95.130.109.162) | | |
| 11 | 31211 | 224.0.83.76 | 224.0.83.77 | 224.0.83.108 (95.130.109.177) | 224.0.83.109 (95.130.109.177) |
| 12 | 31212 | (95.130.109.162) | (95.130.109.162) | | |

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 | 224.0.85.24 (95.130.110.228) | 224.0.85.25 (95.130.110.228) |
| 8 | 31508 | | |
| 9 | 31509 | 224.0.85.26 (95.130.110.228) | 224.0.85.27 (95.130.110.228) |
| 10 | 31510 | | |
| 11 | 31511 | 224.0.85.28 (95.130.110.228) | 224.0.85.29 (95.130.110.228) |
| 12 | 31512 | | |

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 | 31101 | 224.0.82.2 | 224.0.82.3 | 224.0.82.34 (95.130.108.145) | 224.0.82.35 (95.130.108.145) |
| 2 | 31102 | (95.130.108.129) | (95.130.108.129) | | |
| 3 | 31103 | 224.0.82.2 (95.130.108.130) | 224.0.82.3 (95.130.108.130) | | |
| 4 | 31104 | 224.0.82.4 (95.130.108.130) | 224.0.82.5 (95.130.108.130) | 224.0.82.36 (95.130.108.145) | 224.0.82.37 (95.130.108.145) |
| 5 | 31105 | 224.0.82.4 (95.130.108.131) | 224.0.82.5 (95.130.108.131) | | |
| 6 | 31106 | 224.0.82.6 (95.130.108.131) | 224.0.82.7 (95.130.108.131) | 224.0.82.38 (95.130.108.145) | 224.0.82.39 (95.130.108.145) |
| 7 | 31107 | 224.0.82.8 | 224.0.82.9 | 224.0.82.40 (95.130.108.145) | 224.0.82.41 (95.130.108.145) |
| 8 | 31108 | (95.130.108.129) | (95.130.108.129) | | |
| 9 | 31109 | 224.0.82.10 | 224.0.82.11 | 224.0.82.42 (95.130.108.145) | 224.0.82.43 (95.130.108.145) |
| 10 | 31110 | (95.130.108.130) | (95.130.108.130) | | |
| 11 | 31111 | 224.0.82.12 | 224.0.82.13 | 224.0.82.44 (95.130.108.145) | 224.0.82.45 (95.130.108.145) |
| 12 | 31112 | (95.130.108.131) | (95.130.108.131) | | |

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 | 31101 | 224.0.82.66 | 224.0.82.67 | 224.0.82.98 (95.130.108.177) | 224.0.82.99 (95.130.108.177) |
| 2 | 31102 | (95.130.108.161) | (95.130.108.161) | | |
| 3 | 31103 | 224.0.82.66 (95.130.108.161) | 224.0.82.67 (95.130.108.161) | | |
| 4 | 31104 | 224.0.82.68 (95.130.108.161) | 224.0.82.69 (95.130.108.161) | 224.0.82.100 (95.130.108.177) | 224.0.82.101 (95.130.108.177) |
| 5 | 31105 | 224.0.82.68 (95.130.108.161) | 224.0.82.69 (95.130.108.161) | | |
| 6 | 31106 | 224.0.82.70 (95.130.108.161) | 224.0.82.71 (95.130.108.161) | 224.0.82.102 (95.130.108.177) | 224.0.82.103 (95.130.108.177) |
| 7 | 31107 | 224.0.82.72 | 224.0.82.73 | 224.0.82.104 (95.130.108.177) | 224.0.82.105 (95.130.108.177) |
| 8 | 31108 | (95.130.108.162) | (95.130.108.162) | | |
| 9 | 31109 | 224.0.82.74 | 224.0.82.75 | 224.0.82.106 (95.130.108.177) | 224.0.82.107 (95.130.108.177) |
| 10 | 31110 | (95.130.108.162) | (95.130.108.162) | | |
| 11 | 31111 | 224.0.82.76 | 224.0.82.77 | 224.0.82.108 (95.130.108.177) | 224.0.82.109 (95.130.108.177) |
| 12 | 31112 | (95.130.108.162) | (95.130.108.162) | | |

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) |

7.3 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.

7.3.1 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 | | | | |

7.3.2 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 | | |

7.3.3 Systematic Internaliser Production Multicast PITCH Quote Feeds (QC, QD)

From 24th November, 2017 these feeds will cease:

| Unit | IP Port | WAN-Shaped Primary (QC) | | WAN-Shaped Secondary (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 | 31101 | 224.0.83.242 (95.130.104.180) | 224.0.83.243 (95.130.104.180) | 224.0.83.226 (95.130.104.188) | 224.0.83.227 (95.130.104.188) |
| 2 | 31102 | | | | |
| 3 | 31103 | | | | |

From 24th November, 2017 :

| 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 | 224.0.82.137 |
| 8 | 30008 | (95.130.104.84) | (95.130.104.84) | (95.130.104.88) | (95.130.104.88) |
| 9 | 30009 | 224.0.82.170 | 224.0.82.171 | 224.0.82.138 | 224.0.82.139 |
| 10 | 30010 | (95.130.104.85) | (95.130.104.85) | (95.130.104.88) | (95.130.104.88) |
| 11 | 30011 | 224.0.82.172 | 224.0.82.173 | 224.0.82.140 | 224.0.82.141 |
| 12 | 30012 | (95.130.104.86) | (95.130.104.86) | (95.130.104.88) | (95.130.104.88) |

| 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 | 224.0.82.153 |
| 8 | 30008 | (95.130.104.101) | (95.130.104.101) | (95.130.104.103) | (95.130.104.103) |
| 9 | 30009 | 224.0.82.186 | 224.0.82.187 | 224.0.82.154 | 224.0.82.155 |
| 10 | 30010 | (95.130.104.101) | (95.130.104.101) | (95.130.104.103) | (95.130.104.103) |
| 11 | 30011 | 224.0.82.188 | 224.0.82.189 | 224.0.82.156 | 224.0.82.157 |
| 12 | 30012 | (95.130.104.101) | (95.130.104.101) | (95.130.104.103) | (95.130.104.103) |

7.3.4 Systematic Internaliser UAT Multicast PITCH Quote Feeds

From 24th November, 2017 these feeds will cease:

| Unit | IP Port | WAN-Shaped | |
|------|---------|--------------------------------------|---|
| | | Real-time MC and (Src) IP Addr | Gap Response MC and (Src) IP Addr |
| 1 | 31501 | 224.0.85.42 (95.130.110.13) | 224.0.85.43 (95.130.110.13) |
| 2 | 31502 | | |
| 3 | 31503 | | |

From 1st September, 2017 :

| 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 | | |

7.4 Equinix Park Royal (LD3) BXE Multicast Configuration

7.4.1 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 | 31401 | 224.0.84.130 (95.130.107.93) | 224.0.84.131 (95.130.107.93) |
| 2 | 31402 | | |
| 3 | 31403 | | |
| 4 | 31404 | 224.0.84.132 (95.130.107.93) | 224.0.84.133 (95.130.107.93) |
| 5 | 31405 | | |
| 6 | 31406 | 224.0.84.134 (95.130.107.93) | 224.0.84.135 (95.130.107.93) |
| 7 | 31407 | 224.0.84.136 (95.130.107.94) | 224.0.84.137 (95.130.107.94) |
| 8 | 31408 | | |
| 9 | 31409 | 224.0.84.138 (95.130.107.94) | 224.0.84.139 (95.130.107.94) |
| 10 | 31410 | | |
| 11 | 31411 | 224.0.84.140 (95.130.107.94) | 224.0.84.141 (95.130.107.94) |
| 12 | 31412 | | |

7.5 Equinix Park Royal (LD3) CXE Configuration

7.5.1 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 | 31301 | 224.0.84.2 (95.130.106.93) | 224.0.84.3 (95.130.106.93) |
| 2 | 31302 | | |
| 3 | 31303 | | |
| 4 | 31304 | 224.0.84.4 (95.130.106.93) | 224.0.84.5 (95.130.106.93) |
| 5 | 31305 | | |
| 6 | 31306 | 224.0.84.6 (95.130.106.93) | 224.0.84.7 (95.130.106.93) |
| 7 | 31307 | 224.0.84.8 (95.130.106.94) | 224.0.84.9 (95.130.106.94) |
| 8 | 31308 | | |
| 9 | 31309 | 224.0.84.10 (95.130.106.94) | 224.0.84.11 (95.130.106.94) |
| 10 | 31310 | | |
| 11 | 31311 | 224.0.84.12 (95.130.106.94) | 224.0.84.13 (95.130.106.94) |
| 12 | 31312 | | |

7.5.2 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 Equinix Park Royal (LD3) Trade Reporting Facility (TRF) Configuration

7.6.1 TRF Disaster Recovery Multicast PITCH Trade Feed (TE)

| Unit | IP Port | WAN-Shaped (TE) | |
|------|---------|----------------------------------|-----------------------------------|
| | | 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 | | |

7.6.2 Systematic Internaliser Quotes Disaster Recovery Multicast PITCH Feed (QE)

From 24th November, 2017 these feeds will cease:

| Unit | IP Port | WAN-Shaped (QE) | |
|------|---------|----------------------------------|-----------------------------------|
| | | Real-time MC and (Src) IP Addr | Gap Response MC and (Src) IP Addr |
| 1 | 31301 | 224.0.84.170 (95.130.106.180) | 224.0.84.171 (95.130.106.180) |
| 2 | 31302 | | |
| 3 | 31303 | | |

From 24th November, 2017 :

| Unit | IP Port | WAN-Shaped (QE) | |
|------|---------|----------------------------------|-----------------------------------|
| | | 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 | | |

7.7 Supported Carriers for Multicast

The WAN-Shaped feed will be made available to Participants through extranet carriers that have completed their multicast implementation with Cboe. Please contact your respective carrier for more information on using their services to connect to Cboe Multicast PITCH.

7.8 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 12 Mb/s for both BXE and CXE 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.

7.9 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 |
| Total | 400 Mb/s | | 35 Mb/s | |

7.10 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 |
| Total | 450 Mb/s | | 46 Mb/s | |

7.11 Trade Reporting Facility (TRF) Bandwidth Requirements

From 24th November, 2017 the QC,QD and QE feeds in the following table will cease:

| Unit | WAN-Shaped Quote (QC,QD,QE) | | WAN-Shaped Trade (TC,TD,TE) | |
|--------------|-----------------------------|----------------|-----------------------------|----------------|
| | Real-time | Gap Response | Real-time | Gap Response |
| 1 | 13 Mb/s | 0.7 Mb/s | 3.8 Mb/s | 0.4 Mb/s |
| 2 | 13 Mb/s | 0.7 Mb/s | 3.8 Mb/s | 0.4 Mb/s |
| 3 | 10 Mb/s | 0.5 Mb/s | 3.4 Mb/s | 0.3 Mb/s |
| Total | | 38 Mb/s | | 12 Mb/s |

7.12 SI Quote bandwidth requirements

From 24th November, 2017 :

| 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 |
| Total | 499 Mb/s | | 99.8 Mb/s | |

7.13 Multicast Test Program

The ZIP file located at http://www.batstrading.com/resources/membership/mcast_pitch.zip on the Cboe US Exchange website 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 | 95.130.109.64 95.130.109.65 | — |
| Gig-Shaped (BB) GRP | (all) | 18985 | 95.130.109.73 95.130.109.74 | — |
| WAN-Shaped (BC) GRP | (all) | 18986 | 95.130.109.64 95.130.109.65 | — |
| WAN-Shaped (BD) GRP | (all) | 18984 | 95.130.109.73 95.130.109.74 | — |
| WAN-Shaped (BE) GRP | (all) | 18971 | — | 95.130.107.64 95.130.107.65 95.130.107.66 95.130.107.67 |
| Spin Server #1 | 1 | 18999 | 95.130.109.64 95.130.109.65 | 95.130.107.64 95.130.107.65 95.130.107.66 95.130.107.67 |
| | 2 | 18998 | | |
| | 3 | 18997 | | |
| | 4 | 18996 | | |
| | 5 | 18995 | | |
| | 6 | 18994 | | |
| | 7 | 18993 | 95.130.109.66 95.130.109.67 | 95.130.107.68 95.130.107.69 95.130.107.70 95.130.107.71 |
| | 8 | 18992 | | |
| | 9 | 18991 | | |
| | 10 | 18990 | | |
| | 11 | 18989 | | |
| | 12 | 18988 | | |
| Spin Server #2 | 1 | 18983 | 95.130.109.68 95.130.109.69 95.130.109.70 | 95.130.107.72 95.130.107.73 95.130.107.74 95.103.107.75 |
| | 2 | 18982 | | |
| | 3 | 18981 | | |
| | 4 | 18980 | | |
| | 5 | 18979 | | |
| | 6 | 18978 | | |
| | 7 | 18977 | | |
| | 8 | 18976 | | |
| | 9 | 18975 | | |
| | 10 | 18974 | | |
| | 11 | 18973 | | |
| | 12 | 18972 | | |

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 | 95.130.108.64 95.130.108.65 | — |
| Gig-Shaped (XB) GRP | (all) | 19985 | 95.130.108.73 95.130.108.74 | — |
| WAN-Shaped (XC) GRP | (all) | 19986 | 95.130.108.64 95.130.108.65 | — |
| WAN-Shaped (XD) GRP | (all) | 19984 | 95.130.108.73 95.130.108.74 | — |
| WAN-Shaped (XE) GRP | (all) | 19971 | — | 95.130.106.64 95.130.106.65 95.130.106.66 95.130.106.67 |
| Spin Server #1 | 1 | 19999 | 95.130.108.64 95.130.108.65 | 95.130.106.64 95.130.106.65 95.130.106.66 95.130.106.67 |
| | 2 | 19998 | | |
| | 3 | 19997 | | |
| | 4 | 19996 | | |
| | 5 | 19995 | | |
| | 6 | 19994 | | |
| | 7 | 19993 | 95.130.108.66 95.130.108.67 | 95.130.106.68 95.130.106.69 95.130.106.70 95.130.106.71 |
| | 8 | 19992 | | |
| | 9 | 19991 | | |
| | 10 | 19990 | | |
| | 11 | 19989 | | |
| | 12 | 19988 | | |
| Spin Server #2 | 1 | 19983 | 95.130.108.68 95.130.108.69 95.130.108.70 | 95.130.106.72 95.130.106.73 95.130.106.74 95.130.106.75 |
| | 2 | 19982 | | |
| | 3 | 19981 | | |
| | 4 | 19980 | | |
| | 5 | 19979 | | |
| | 6 | 19978 | | |
| | 7 | 19977 | | |
| | 8 | 19976 | | |
| | 9 | 19975 | | |
| | 10 | 19974 | | |
| | 11 | 19973 | | |
| | 12 | 19972 | | |

8.3 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 |

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

From 24th November, 2017 these services will cease:

| Service | Unit | TCP Port | IP Addresses (LD4) | IP Address (LD3) |
|---------------------|-------|----------|----------------------------------|----------------------------------|
| WAN-Shaped (QC) GRP | (all) | 20986 | 95.130.104.155 95.130.104.156 | — |
| WAN-Shaped (QD) GRP | (all) | 20984 | 95.130.104.157 95.130.104.158 | — |
| WAN-Shaped (QE) GRP | (all) | 20982 | — | 95.130.106.155 95.130.106.156 |
| Spin Server #1 | 1 | 20989 | 95.130.104.155 95.130.104.156 | 95.130.106.155 95.130.106.156 |
| | 2 | 20988 | | |
| | 3 | 20987 | | |
| Spin Server #2 | 1 | 20992 | 95.130.104.157 95.130.104.158 | 95.130.106.157 95.130.106.158 |
| | 2 | 20991 | | |
| | 3 | 20990 | | |

From 24th November, 2017 :

| 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 | | |

8.5 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 | |

8.6 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 | | |

8.7 Trade Reporting Facility (TRF) UAT Gap Request Proxies (GRPs) and Spin Servers

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

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

From 24th November, 2017 these services will cease:

| Service | Unit | TCP Port | IP Addresses (LD4) |
|--------------------------|-------|----------|--------------------|
| WAN-Shaped UAT Quote GRP | (all) | 18986 | 95.130.110.12 |
| UAT Spin Server | 1 | 18990 | 95.130.110.12 |
| | 2 | 18989 | |
| | 3 | 18988 | |

From 1st September, 2017 :

| 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

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 |

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 Cboe 12 units. This includes BXE, CXE and the new 12-unit SI Quote feed. The Cboe TRF system is distributed across 3 units, as indicated by the appropriate column. The downloadable reference data file ² may be used by participants that require knowledge of the symbol-to-unit mappings.

| Unit | TRF Unit | Markets |
|------|----------|--|
| 1 | 1 | London, Great Britain (0-H) |
| 2 | 1 | London, Great Britain (I-R) |
| 3 | 1 | London, Great Britain (S-Z); Dublin, Ireland |
| 4 | 2 | Euronext Paris, France (0-F) |
| 5 | 2 | Euronext Paris, France (G-Z) |
| 6 | 1 | Euronext (Lisbon, Portugal; Brussels, Belgium; Amsterdam, Netherlands) |
| 7 | 2 | XETRA, Germany (0-E) |
| 8 | 2 | XETRA, Germany (F-Z); Vienna, Austria |
| 9 | 3 | Milan, Italy; SIBE, Spain |
| 10 | 3 | Cboe (self-listed) Warsaw, Poland; Athens, Greece; Bucharest, Romania; Bratislava, Slovakia Budapest, Hungary; Nicosia, Cyprus; Zagreb, Croatia; Ljubljana, Slovenia; Luxembourg Valletta, Malta; Prague, Czech Republic; Riga, Latvia; Sofia, Bulgaria; Tallinn, Estonia Vilnius, Lithuania; Johannesburg; Ex-Europe, Ex-US |
| 11 | 3 | SIX Swiss Exchange; Istanbul, Turkey |
| 12 | 3 | Helsinki, Finland; Copenhagen, Denmark; Oslo, Norway; Stockholm, Sweden; Reykjavik, Iceland; US Securities Traded in Europe |

² <https://www.bats.com/europe/equities/support/reference.data/>

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 (§ 7.8, p. 47) 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. 36 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 4.13 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. |