Cboe Europe

CEDX Multicast PITCH Specification

Version 1.11
27 February 2023

This document has been established for informational purposes only. None of the information concerning the services or products described in this document constitutes advice or a recommendation of any product or service. To the extent that the information provided in this document constitutes a financial promotion as defined in the applicable legislation and regulation, it is only directed at persons who qualify as a "professional client" or "eligible counterparty" as defined in the applicable legislation and regulation. Persons who do not qualify should not act or rely upon it.

Contents

1 Introduction

1.1 Overview

Cboe participants may use Multicast PITCH to receive real-time depth of book quotations, and execution information direct from Cboe.

Multicast PITCH feed descriptions:

- *Gig-Shaped*: Collection of multicast addresses and gap request infrastructure for gigabit connectivity from Cboe. Available in the Production environments only.

- *WAN-Shaped*: Collection of multicast addresses and gap request infrastructure for WAN connectivity from Cboe. Available in the Certification environments only.

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 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 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 receivers 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 and symbols 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, 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 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. 59) shows an example flow of messages between a Participant and a Cboe Multicast PITCH feed and Spin Server.

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).
Signed Binary	Signed and sized to "Length" bytes and ordered using Little Endian convention (least significant byte first).
Binary Short Price	Signed Little Endian encoded two byte binary fields with two implied decimal places (denominator = 100).
Binary Long Price	Signed Little Endian encoded 8 byte binary fields with four implied decimal places (denominator = 10,000).
Binary Date	Unsigned Little Endian encoded 4 byte value where the base-10 representation is the YYYYMMDD representation of that date. For example, October 30 2023 would be represented as 20,231,030 (20231030).
Multiplier	Little Endian encoded 4 byte binary fields with 1 implied decimal place (denominator = 10)
Printable ASCII	Left justified ASCII fields that are space padded on the right that may include ASCII values in the range 0x20 - 0x7e. (denominator = 10)
Bitfield	Fixed width fields with each bit representing a Boolean Flag (the 0 bit is the least significant bit; the 7 bit is the most significant bit).

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   Trade Amendments

Order-book 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.

2.6   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 addition, deletion, modification, or execution of an order in the system.

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

4.1 Time Message

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

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

4.2 Unit Clear Message

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

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

4.3 Add Order Message

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

4.3.1 Long Format

Add Order — Long				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x40	Add Order Message — Long
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Day-specific identifier assigned to this order
Side Indicator	14	1	Alphanumeric	B = Buy Order S = Sell Order
Quantity	15	4	Binary	Number of contracts 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 contracts 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				

4.4 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 Quantity	14	4	Binary	Number of contracts 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 § 4.16, p. 28:

Execution Flags			
Offset	**MMT Level / Fieldname**		**Description**
0	1	Market Mechanism	
1	2	Trading Mode	See § 4.16, p. 28 for possible values
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 Quantity	14	4	Binary	Number of contracts executed
Remaining Quantity	18	4	Binary	Number of contracts 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 § 4.16, p. 28:

Execution Flags			
Offset	**MMT Level / Fieldname**		**Description**
0	1	Market Mechanism	
1	2	Trading Mode	See § 4.16, p. 28 for possible values
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 Contracts	14	4	Binary	Number of contracts 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 Contracts	14	2	Binary	Number of contracts 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
Contracts	14	4	Binary	Number of contracts associated with this order after this modify (may be less than the number of contracts 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
Contracts	14	2	Binary	Number of contracts associated with this order after this modify (may be less than the number of contracts 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.
Contracts	15	4	Binary	Incremental number of contracts 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.
Contracts	15	2	Binary	Incremental number of contracts 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 § 4.16, p. 28:

Trade Flags			
Offset	**MMT Level / Fieldname**		**Description**
0	1	Market Mechanism	
1	2	Trading Mode	
2	3.1	Transaction Category	See § 4.16, p. 28 for possible values
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
Contracts	6	8	Binary	Number of contracts 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	Always CEDX.
Currency	50	3	Alphanumeric	Traded currency.
Cboe Trade Flags	53	1	Alphanumeric	See the EU Column in § 4.9.6, p. 20 for possible values.
Extended Trade Flags	54	14	Alphanumeric	Type flags based on the MMT v3.04 standard.
Total Length = 68 bytes				

4.9.5 Extended Trade Flags

The Cboe Trade - Extended message uses a 14 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 § 4.16, p. 28:

Trade Type Flags			
Offset	**MMT Level / Fieldname**		**Description**
0	1	Market Mechanism	
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	See § 4.16, p. 28 for possible values.
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).

4.9.6 Cboe Trade Flags

The Cboe Trade - Extended message uses a 1 character field to provide detailed information about the trade such as timing and the regulated entity the trade was reported to, as described in the following table:

Regulated Entity		**Description**
UK	**EU**	
'-'	'4'	The trade was reported to Cboe on time and in the Main Session
'1'	'5'	The trade was reported to Cboe 'late'
'2'	'6'	The trade was reported to Cboe out of the Main Session
'3'	'7'	The trade was reported to Cboe late and out of the Main Session

4.10 End of Session Message

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

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

4.11 Transaction Begin Message

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

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

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

4.12 Transaction End Message

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

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

4.13 Trading Status Message

The Trading Status Message is used to indicate the current trading status of a security. A Trading Status Message will be sent whenever a security's trading status changes. In addition, Cboe will send a Trading Status Message for all securities that are "Suspended" before the start of trading hours. If no message has been sent for a given security, it should be treated as Closed.

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	C = Closed Q = Queuing O = Opening/Re-opening Auction T = Trading S = Suspension H = Halted
Reserved1	15	3	Alpha	Reserved
Total Length = 18 bytes				

See the Participant Manual for details on Trading Status phases.

4.14 Fast Status Message

The Fast Status Message is used to indicate that Cboe Europe now consider the given product to be in a Fast Market. LPP obligations will be relaxed from the time a product is marked as Is Fast=1 to the time it is marked Is Fast=0, or the market closes. The Fast Status of a Product will not persist to the next day.

Fast Status				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xE2	Fast Status Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Product Code	6	6	Alphanumeric	Product right padded with spaces
Is Fast	12	1	Binary	0 = Normal 1 = Fast
Total Length = 13 bytes				

4.15 Auction Messages

4.15.1 Auction Summary Message

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	0 = Opening Auction
Price	15	8	Binary Long Price	Auction price
Contracts	23	4	Binary	Cumulative number of contracts executed during the auction
Total Length = 27 bytes				

4.15.2 Opening Auction Update Message

Opening Auction Update messages are used to disseminate price and size information during the Opening and Re-Opening (halt) auctions. Messages are sent every five seconds during an opening period, provided that one of the field values has changed. When no values have changed, a message is sent once every 60 seconds.

Opening Auction Update Message				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xD1	Opening Auction Update Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	8	Printable ASCII	Symbol right padded with spaces
Auction Type	14	1	Alphanumeric	0 = Regular Opening
Reference Price	15	8	Binary Long Price	Collared VMIM price
Buy Contracts	23	4	Binary	Cumulative buy contracts at the Reference Price and above
Sell Contracts	27	4	Binary	Cumulative sell contracts at the Reference Price and below
Indicative Price	31	8	Binary Long Price	Equal to Reference Price
Auction Only Price	39	8	Binary Long Price	Uncollared VMIM price
Opening Condition	47	1	Alphanumeric	0 = Would open Q = Need quote to open B = Need more buyers S = Need more sellers C = Crossed Composite Market
Composite Market Bid Price	48	8	Binary Long Price	Bid Price of the prevailing Composite Market
Composite Market Offer Price	56	8	Binary Long Price	Offer Price of the prevailing Composite Market
Total Length = 64 bytes				

4.15.3 Auction Notification Message

Auction Notification messages are used to disseminate order details of an auction. Auctions will be available for a defined period of time known as the exposure period.

Auction Notification Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xAD	Auction Notification Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	6	Printable ASCII	Symbol right padded with spaces
Auction Id	12	8	Binary	Day specific identifier assigned to this auction
Auction Type	20	1	Alphanumeric	B = AIM C = C-RFQ
Side	21	1	Alphanumeric	"B" or "S"
Price	22	8	Binary Long Price	Limit Price specified on the order
Contracts	30	4	Binary	Number of contracts available in the auction
Customer Indicator	34	1	Alphanumeric	N = Non-Customer C = Customer
Participant Id	35	4	Alphanumeric	Executing Broker (optional) of firm attributed to this quote
Auction End Offset	39	4	Binary	Nanosecond offset from last timestamp
Total Length = 43 bytes				

4.15.4 Auction Cancel Message

Auction Cancel messages are used to disseminate the cancellation of an earlier Auction Notification message as a result of a user cancellation of the original order, a user modification request to change the price or increase the original order quantity, or a fading of the NBBO. Auction Cancel messages will not be issued for order quantity decrements.

Auction Cancel Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xAE	Auction Cancel Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Auction Id	6	8	Binary	Day specific identifier assigned to this auction
Total Length = 14 bytes				

4.15.5 Auction Trade Message

Auction Trade messages are used to disseminate executions resulting from an options auction.

Auction Trade Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xDF	Auction Trade Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Auction Id	6	8	Binary	Day specific identifier assigned to this auction
Execution Id	14	8	Binary	Day specific identifier assigned to this execution
Price	22	8	Binary Long Price	Trade price
Contracts	30	4	Binary	Number of contracts traded
Execution Flags	34	4	Alphanumeric	Type flags based on MMT v3.04 standard
Total Length = 38 bytes				

4.15.6 Execution Flags

The Auction Trade 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 § 4.16, p. 28:

Execution Flags			
Offset	MMT Level / Fieldname		Description
0	1	Market Mechanism	
1	2	Trading Mode	See § 4.16, p. 28 for possible values
2	3.6	Ex/Cum Dividend	
3	3.9	Algorithmic Trade	

Implied MMT flags for the Auction Trade 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

4.15.7 Auction Liquidity Message

An Auction Liquidity Message is sent out for all AIM Auctions to give an indication of the level of response to a given Auction. It is a variable size message, containing one or more Price Level repeating groups. If there are more than 12 Price Levels contributing to a given Auction, additional levels will be sent on subsequent Auction Liquidity messages.

Auction Liquidity Message				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xDE	Auction Liquidity Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Auction Id	6	8	Binary	Day specific identifier assign to this auction
Price Level Count	14	1	Binary	The number of price levels present in this auction. The maximum number is 12.
The following fields repeat `Price Level Count` **times.** i **is zero-based.**				
Price Level	15 + 12 * i	8	Binary Long Price	Price Level
Volume	23 + 12 * i	4	Binary	Total volume of responses at this Price Level
Variable Total Length = 15 + (Price Level Count * 12) bytes				

4.15.8 Width Update Message

The Width Update message is used to communicate the opening quote width multiplier. This message is sent in the event that the exchange decides to change the quote width multiplier on a per underlying basis.

Width Update Message				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xD2	Width Update Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Product Code	6	8	Printable ASCII	Cboe Symbol for underlying Product
Width Type	14	1	Binary	R = Regular
Multiplier	15	4	Multiplier	Width Multiplier
Total Length = 19 bytes				

4.16 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)
'O'	Scheduled Opening Auction
'K'	Scheduled Closing Auction
'I'	Scheduled Intraday Auction
'U'	Unscheduled Auction

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

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

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

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

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

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

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

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

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

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

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

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

4.17 Symbol Definitions

4.17.1 Futures Instrument Definition Message

The Futures Instrument Definition message can be sent as a sequenced message or an unsequenced message. It is sent as a sequenced message when the system starts up at the beginning of a trading session. A new sequenced message may be sent for a Symbol that does not visibly change any attribute. One un-sequenced Futures Instrument Definition message for each Symbol is also sent in a continuous loop.

Futures Instrument Definition Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xDA	Futures Instrument Definition Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	6	Alphanumeric	Symbol right padded with spaces
Product Code	12	8	Alphanumeric	Cboe Symbol for underlying Product
Expiration Date	20	4	Binary Date	Expiration Date of Instrument
Contract Size	24	2	Binary	Contract size of Instrument
Listing State	26	1	Alphanumeric	A = Active I = Inactive T = Test
Price Increment	27	8	Binary Long Price	Minimum Price Increment
Total Length = 35 bytes				

4.17.2 Options Instrument Definition Message

The Options Instrument Definition message can be sent as a sequenced message or an unsequenced message. It is sent as a sequenced message when the system starts up at the beginning of a trading session. A new sequenced message may be sent for a Symbol that does not visibly change any attribute. One un-sequenced Options Instrument Definition message for each Symbol is also sent in a continuous loop.

Options Instrument Definition messages are included in a Spin Response.

Options Instrument Definition Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xDB	Options Instrument Definition Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	6	Alphanumeric	Symbol right padded with spaces
Product Code	12	8	Alphanumeric	Cboe Symbol for underlying Product
Call/Put	20	1	Alphanumeric	P = Put C = Call
Expiration Date	21	4	Binary Date	Expiration Date of Instrument
Strike Price	25	8	Binary Long Price	Strike Price of Instrument
Contract Size	33	2	Binary	Contract size of Instrument
Listing State	35	1	Alphanumeric	A = Active I = Inactive T = Test
Price Increment	36	8	Binary Long Price	Minimum Price Increment
Total Length = 44 bytes				

4.17.3 Complex Instrument Definition Message

A Complex Instrument Definition message represents a complex instrument that is available to place orders. It is sent as a sequenced message the first time a Complex Instrument Definition message is sent for a symbol. These messages will also be sent continuously through the day as an unsequenced message at variable rates as bandwidth allows. The Time offset field should be ignored on an unsequenced message.

The Complex Instrument Definition message will contain two or more repeating groups of leg definitions. There is a limit of 12 leg definitions.

Complex Instrument Definition Message				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xDC	Complex Instrument Definition Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Complex Instrument Id	6	6	Printable ASCII	Complex Instrument Id right padded with spaces
Reference Price	12	8	Binary Long Price	The reference price (optional) of the future leg of a Volatility Strategy
Leg Count	20	1	Binary	The number of legs in the complex instrument. The maximum number is 13.
The following fields repeat `Leg Count` times. i is zero-based.				
Leg Symbol	$21 + 10 * i$	6	Printable ASCII	Option or Future Symbol of leg, right padded with spaces
Leg Ratio	$27 + 10 * i$	4	Signed Binary	Leg Ratio (positive for buy-side, negative for sell-side).
Variable Total Length = 21 + (Leg Count * 10) bytes				

4.18 Trade Break

The Trade Break message is sent whenever an execution is broken. Trade Breaks are rare and only affect applications that rely upon execution-based data. A Trade Break followed immediately by a new Trade with the same Execution Id indicates that a trade correction has occurred. Applications that simply build a book can ignore Trade Break messages.

Trade Break Message				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x2C	Trade Break Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Execution Id	6	8	Binary	Execution Identifier of the execution that was broken
Total Length = 14 bytes				

4.19 Settlement Message

Settlement messages are normally sent once per day per instrument after settlement prices have been calculated for all applicable instruments on a given business date. If there is an error in the settlement it may be re-issued (see the `Issue` field).

Settlement Message				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xB9	Settlement Message

Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	6	Printable ASCII	Six character, base 62 symbol
Trade Date	12	4	Binary Date	Trade Date for the settlement
Settlement Price	16	8	Binary Price	Settlement Price
Issue	24	1	Alphanumeric	S = Initial Settlement
				R = Re-issued Settlement
Total Length = 25 bytes				

4.20 End of Day Summary Message

The End of Day Summary is sent out right after trading ends for a symbol and contains a summary of trading activity for that symbol for the day.

End of Day Message				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xBA	End of Day Summary Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	6	Printable ASCII	Six character, base 62 symbol
Trade Date	12	4	Binary Date	Trade Date for the settlement
Open Interest	16	4	Binary	Unused in CEDX
High Price	20	8	Binary Price	Highest trade price or best bid for the day.
Low Price	28	8	Binary Price	Lowest trade price or best offer for the day.
Open Price	36	8	Binary Price	If Total Volume greater than 0, represents the first trade of the day
Close Price	44	8	Binary Price	For futures represents a calculated price based upon VWAP, last traded or mid-point price. For options represents a price provided by an external vendor
Total Volume	52	4	Binary	Total number of contracts traded
Block Volume	56	4	Binary	Total number of block contracts traded
ECRP Volume	60	4	Binary	Unused in CEDX
Summary Flags	64	1	Bit Field	Bit 0 = Set if High Price is valid
				Bit 1 = Reserved
				Bit 2 = Set if Low Price is valid
				Bit 3 = Reserved
				Bit 4 = Set if both Open and Close Price fields contain valid values
				Bit 5-7 = Reserved
Total Length = 65 bytes				

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. 9) **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. 9).

5.3 Spin Image Available Message

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

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

5.4 Spin Request Message

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

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

5.5 Spin Response Message

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

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

5.6 Spin Finished Message

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

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

5.7 Instrument Definition Request Message

The Instrument Definition Request message is used by a user's process to request transmission of this unit's Instrument Definitions.

Instrument Definition Request Message				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x84	Instrument Definition Request Message
Sequence	2	4	Binary	Must be 0
Total Length = 6 bytes				

5.8 Instrument Definition Response Message

The Instrument Definition Response message is sent in response to a user's Instrument Definition Request message indicating whether a spin will be sent. All non-A status responses should be interpreted as a reject.

Instrument Definition Response Message				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x85	Instrument Definition Response Message
Sequence	2	4	Binary	Will always be 0
Instrument Count	6	4	Binary	Number of Futures Instrument Definition, Options Instrument Definition and Complex Instrument Definition messages which will be contained in this spin.
Status	10	1	Alphanumeric	A = Accepted O = Out of range (Sequence must be 0) S = Spin already in progress (only one spin can be running at a time)
Total Length = 11 bytes				

5.9 Instrument Definition Finished Message

The Instrument Definition Finished message is sent to indicate that all definition messages for this unit have been sent. An Instrument Definition Message is only sent if an Instrument Definition Request was not rejected.

Instrument Definition Finished Message				
Field	**Offset**	**Length**	**Data Type**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x86	Instrument Definition Finished Message
Total Length = 2 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.

6.1 General Bandwidth Recommendations

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.

6.1.1 CEDX Bandwidth Requirements

Unit	Gig-Shaped (A,B)		WAN-Shaped (E)	
	Real-time	Gap Response	Real-time	Gap Response
1	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
2	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
3	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
4	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
5	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
6	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
7	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
8	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
9	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
10	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
11	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
12	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
13	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
14	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
15	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
16	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
17	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
18	71 Mb/s	4.0 Mb/s	7.0 Mb/s	0.5 Mb/s
Total	**450 Mb/s**		**45 Mb/s**	

6.2 Multicast Test Program

The ZIP file located at https://cdn.cboe.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.

7 Multicast Configuration

<mark>Cboe reserves the right to add units and/or change symbol distribution within 48 hours notice and no migration period.</mark> 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. **??**).

<mark>Cboe reserves the right to add multicast addresses with prior notice, but no migration period.</mark> 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	CEDX	A	5.253.108.192/28	224.0.83.192/28	5.253.111.221
LD4	CEDX SSO	A	5.253.108.192/28	224.0.180.64/28	5.253.111.221
LD4	CEDX	B	5.253.108.208/28	224.0.83.208/28	5.253.111.222
LD4	CEDX SSO	B	5.253.108.208/28	224.0.180.80/28	5.253.111.222
LD3	CEDX	E	5.253.109.208/28	224.0.84.64/28	5.253.111.220
LD3	CEDX SSO	E	5.253.109.208/28	224.0.84.80/28	5.253.111.220
LD4	CEDX	UAT	5.253.111.128/27	224.0.85.144/28	5.253.111.223
LD4	CEDX SSO	UAT	5.253.111.128/27	224.0.85.160/28	5.253.111.223
LD3	CEDX	UAT-DR	95.130.111.128/27	224.0.85.128/28	95.130.111.124
LD3	CEDX SSO	UAT-DR	95.130.111.128/27	224.0.84.176/28	95.130.111.124

7.1 Equinix Slough (LD4) CEDX Multicast Configuration

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

7.1.1 CEDX Production Primary Multicast PITCH Feeds (A)

Unit	IP Port	Gig-Shaped (A)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.83.194 (5.253.108.196)	224.0.83.195 (5.253.108.196)
2	31202	224.0.83.196 (5.253.108.196)	224.0.83.197 (5.253.108.196)
3	31203	224.0.83.198 (5.253.108.196)	224.0.83.199 (5.253.108.196)
4	31204	224.0.83.200 (5.253.108.197)	224.0.83.201 (5.253.108.197)
5	31205	224.0.83.202 (5.253.108.197)	224.0.83.203 (5.253.108.197)
6	31206	224.0.83.204 (5.253.108.197)	224.0.83.205 (5.253.108.197)
7	31207	224.0.180.66 (5.253.108.203)	224.0.180.67 (5.253.108.203)
8	31208		
9	31209		
10	31210	224.0.180.68 (5.253.108.198)	224.0.180.69 (5.253.108.198)
11	31211		
12	31212	224.0.180.70 (5.253.108.198)	224.0.180.71 (5.253.108.198)
13	31213	224.0.180.72 (5.253.108.203)	224.0.180.73 (5.253.108.203)
14	31214		
15	31215	224.0.180.74 (5.253.108.198)	224.0.180.75 (5.253.108.198)
16	31216		
17	31217	224.0.180.76 (5.253.108.203)	224.0.180.77 (5.253.108.203)
18	31218	224.0.180.78 (5.253.108.198)	224.0.180.79 (5.253.108.198)

* Units 7-18 will be added at a future date yet to be announced

7.1.2 CEDX Production Secondary Multicast PITCH Feeds (B)

Unit	IP Port	Gig-Shaped (B)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.83.210 (5.253.108.212)	224.0.83.211 (5.253.108.212)
2	31202	224.0.83.212 (5.253.108.212)	224.0.83.213 (5.253.108.212)
3	31203	224.0.83.214 (5.253.108.212)	224.0.83.215 (5.253.108.212)
4	31204	224.0.83.216 (5.253.108.213)	224.0.83.217 (5.253.108.213)
5	31205	224.0.83.218 (5.253.108.213)	224.0.83.219 (5.253.108.213)
6	31206	224.0.83.220 (5.253.108.213)	224.0.83.221 (5.253.108.213)
7	31207	224.0.180.82 (5.253.108.214)	224.0.180.83 (5.253.108.214)
8	31208		
9	31209		
10	31210	224.0.180.84 (5.253.108.215)	224.0.180.85 (5.253.108.215)
11	31211		
12	31212	224.0.180.86 (5.253.108.215)	224.0.180.87 (5.253.108.215)
13	31213	224.0.180.88 (5.253.108.214)	224.0.180.89 (5.253.108.214)
14	31214		
15	31215	224.0.180.90 (5.253.108.215)	224.0.180.91 (5.253.108.215)
16	31216		
17	31217	224.0.180.92 (5.253.108.214)	224.0.180.93 (5.253.108.214)
18	31218	224.0.180.94 (5.253.108.215)	224.0.180.95 (5.253.108.215)

* Units 7-18 will be added at a future date yet to be announced

7.1.3 CEDX UAT Multicast PITCH Feeds

Unit	IP Port	WAN-Shaped	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.85.146 (5.253.111.152)	224.0.85.147 (5.253.111.152)
2	31202	224.0.85.148 (5.253.111.152)	224.0.85.149 (5.253.111.152)
3	31203	224.0.85.150 (5.253.111.152)	224.0.85.151 (5.253.111.152)
4	31204	224.0.85.152 (5.253.111.153)	224.0.85.153 (5.253.111.153)
5	31205	224.0.85.154 (5.253.111.153)	224.0.85.155 (5.253.111.153)
6	31206	224.0.85.156 (5.253.111.153)	224.0.85.157 (5.253.111.153)
7	31207	224.0.85.162 (5.253.111.149)	224.0.85.163 (5.253.111.149)
8	31208		
9	31209		
10	31210	224.0.85.164 (5.253.111.150)	224.0.85.165 (5.253.111.150)
11	31211		
12	31212	224.0.85.166 (5.253.111.150)	224.0.85.167 (5.253.111.150)
13	31213	224.0.85.168 (5.253.111.149)	224.0.85.169 (5.253.111.149)
14	31214		
15	31215	224.0.85.170 (5.253.111.150)	224.0.85.171 (5.253.111.150)
16	31216		
17	31217	224.0.85.172 (5.253.111.149)	224.0.85.173 (5.253.111.149)
18	31218	224.0.85.174 (5.253.111.150)	224.0.85.175 (5.253.111.150)

7.2 Equinix Park Royal (LD3) CEDX Configuration

7.2.1 CEDX Disaster Recovery Multicast PITCH Feed (E)

Unit	IP Port	WAN-Shaped (E)	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.84.66 (5.253.109.212)	224.0.84.67 (5.253.109.212)
2	31202	224.0.84.68 (5.253.109.212)	224.0.84.69 (5.253.109.212)
3	31203	224.0.84.70 (5.253.109.212)	224.0.84.71 (5.253.109.212)
4	31204	224.0.84.72 (5.253.109.213)	224.0.84.73 (5.253.109.213)
5	31205	224.0.84.74 (5.253.109.213)	224.0.84.75 (5.253.109.213)
6	31206	224.0.84.76 (5.253.109.213)	224.0.84.77 (5.253.109.213)
7	31207	224.0.84.82 (5.253.109.214)	224.0.84.83 (5.253.109.214)
8	31208		
9	31209		
10	31210	224.0.84.84 (5.253.109.216)	224.0.84.85 (5.253.109.216)
11	31211		
12	31212	224.0.84.86 (5.253.109.216)	224.0.84.87 (5.253.109.216)
13	31213	224.0.84.88 (5.253.109.214)	224.0.84.89 (5.253.109.214)
14	31214		
15	31215	224.0.84.90 (5.253.109.216)	224.0.84.91 (5.253.109.216)
16	31216		
17	31217	224.0.84.92 (5.253.109.214)	224.0.84.93 (5.253.109.214)
18	31218	224.0.84.94 (5.253.109.216)	224.0.84.95 (5.253.109.216)

* Units 7-18 will be added at a future date yet to be announced

7.2.2 CEDX UAT Disaster Recovery Multicast PITCH Feed (UAT-DR)

Unit	IP Port	WAN-Shaped	
		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31201	224.0.85.130 (95.130.111.152)	224.0.85.131 (95.130.111.152)
2	31202	224.0.85.132 (95.130.111.152)	224.0.85.133 (95.130.111.152)
3	31203	224.0.85.134 (95.130.111.152)	224.0.85.135 (95.130.111.152)
4	31204	224.0.85.136 (95.130.111.153)	224.0.85.137 (95.130.111.153)
5	31205	224.0.85.138 (95.130.111.153)	224.0.85.139 (95.130.111.153)
6	31206	224.0.85.140 (95.130.111.153)	224.0.85.141 (95.130.111.153)
7	31207	224.0.84.178 (95.130.111.154)	224.0.84.179 (95.130.111.154)
8	31208		
9	31209		
10	31210	224.0.84.180 (95.130.111.155)	224.0.84.181 (95.130.111.155)
11	31211		
12	31212	224.0.84.182 (95.130.111.155)	224.0.84.183 (95.130.111.155)
13	31213	224.0.84.184 (95.130.111.154)	224.0.84.185 (95.130.111.154)
14	31214		
15	31215	224.0.84.186 (95.130.111.155)	224.0.84.187 (95.130.111.155)
16	31216		
17	31217	224.0.84.188 (95.130.111.154)	224.0.84.189 (95.130.111.154)
18	31218	224.0.84.190 (95.130.111.155)	224.0.84.191 (95.130.111.155)

8 TCP Configuration

8.1 CEDX Production Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address (LD3)
Gig-Shaped (A) GRP	(all)	18987	5.253.111.162	—
Gig-Shaped (B) GRP	(all)	19985	5.253.111.178	—
WAN-Shaped (E) GRP	(all)	18987	—	5.253.109.222
Spin Server #1	1	18999	5.253.111.162	5.253.109.222
	2	18998		
	3	18997		
	4	18996		
	5	18995		
	6	18994		
	7	19807	5.253.108.199	5.253.109.215
	8	19808		
	9	19809		
	10	19810		
	11	19811		
	12	19812		
	13	19813	5.253.108.201	5.253.109.217
	14	19814		
	15	19815		
	16	19816		
	17	19817		
	18	19818		
Spin Server #2	1	19983	5.253.111.178	N/A
	2	19982		
	3	19981		
	4	19980		
	5	19979		
	6	19978		
	7	19857	5.253.108.217	N/A
	8	19858		
	9	19859		
	10	19860		
	11	19861		
	12	19862		
	13	19863	5.253.108.216	N/A
	14	19864		
	15	19865		
	16	19866		
	17	19867		
	18	19868		

* Units 7-18 will be added at a future date yet to be announced

8.2 CEDX UAT Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Addresses (LD3)
WAN-Shaped UAT GRP	(all)	18987	5.253.111.144	95.130.111.144
UAT Spin Server	1	18999	5.253.111.144	95.130.111.144
	2	18998		
	3	18997		
	4	18996		
	5	18995		
	6	18994		
	7	19807	5.253.111.132	95.130.111.133
	8	19808		
	9	19809		
	10	19810		
	11	19811		
	12	19812		
	13	19813	5.253.111.158	95.130.111.147
	14	19814		
	15	19815		
	16	19816		
	17	19817		
	18	19818		

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
0x84	Instrument Definition Request
0x85	Instrument Definition Response
0x86	Instrument Definition Finished

PITCH 2.X Messages

0x20	Time
0x97	Unit Clear
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
0x32	Trade — Extended
0x2D	End of Session
0xBC	Transaction Begin
0xBD	Transaction End
0x31	Trading Status
0xE2	Fast Status
0x96	Auction Summary
0xD1	Opening Auction Update
0xAD	Auction Notification
0xAE	Auction Cancel
0xDF	Auction Trade
0xDE	Auction Liquidity
0xD2	Width Update
0xDA	Futures Instrument Definition
0xDB	Options Instrument Definition
0xDC	Complex Instrument Definition
0x2C	Trade Break
0xB9	Settlement
0xBA	End of Day 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

Instrument Definition Request Message

Length	06	6 bytes
Type	84	Instrument Definition Request
Sequence	3B 10 00 00	Sequence: 4155

Instrument Definition Response Message

Length	0B	11 bytes
Type	85	Instrument Definition Response
Sequence	3B 10 00 00	Sequence: 4155
Instrument Count	5C 0D 00 00	3420 instruments
Status	41	A = Accepted

Instrument Definition Finished Message

| Length | 02 | 2 bytes |
| Type | 86 | Instrument Definition Finished |

Time Message

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

Unit Clear Message

Length	06	6 bytes
Type	97	Unit Clear
Time Offset	98 85 00 00	34,200 ns since last Time Message

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	41 bytes
Type	24	Order Executed at Price/Size
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
Remaining Shares	BC 4D 00 00	19,900 shares
Execution Id	C8 00 00 00 01 40 57 3A	
Price	E8 A3 0F 00 00 00 00 00	102.50
Execution Flags	31 4B 2D	1 = Central Limit Order Book
		K = Scheduled Closing Auction
		- = Not specified

Reduce Size — Long

Length	12	18 bytes
Type	25	Reduce Size — Long

Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Cancelled Shares	F8 24 01 00	75,000 shares

Reduce Size — Short

Length	10	16 bytes
Type	26	Reduce Size — Short
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Cancelled Shares	64 00	100 shares

Modify Order — Long

Length	1A	26 bytes
Type	27	Modify 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	
Shares	F8 24 01 00	75,000 shares
Price	E8 A3 0F 00 00 00 00 00	102.50

Modify Order — Short

Length	12	18 bytes
Type	28	Modify 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	
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

Transaction Begin

Length	06	6 bytes
Type	BC	Transaction Begin
Time Offset	18 D2 06 00	447,000 ns since last Time Message

Transaction End

Length	06	6 bytes
Type	BD	Transaction End
Time Offset	18 D2 06 00	447,000 ns since last Time Message

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	

Fast Status

Length	0D	13 bytes
Type	E2	Trading Status
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Product Code	45 55 35 30 4F 00	EZ500
Is Fast	01	1 = Fast

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

Opening Auction Update

Length	40	64 bytes
Type	D1	Opening 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	4F	O = Opening Auction
Reference Price	7B 88 01 00 00 00 00 00	10.0475
Buy Contracts	88 13 00 00	5000 shares
Sell Contracts	88 13 00 00	5000 shares
Indicative Price	7B 88 01 00 00 00 00 00	10.0475
Auction Only Price	7B 88 01 00 00 00 00 00	10.0475
Opening Condition	4F	O = Would Open
Composite Market Bid Price	7B 88 01 00 00 00 00 00	10.0475
Composite Market Offer Price	7B 88 01 00 00 00 00 00	10.0475

Auction Notification

Length	2B	43 bytes
Type	AD	Auction Notification
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Symbol	4C 45 4D 44 6C 20	LEMD1
Auction Id	00 F5 01 00 00 00 00 00	Auction Id = 128,256
Auction Type	42	B = AIM
Side	42	B = Buy

Price	7B 88 01 00 00 00 00 00	10.0475
Contracts	32 00 00 00	50
Customer Indicator	43	C = Customer
Participant Id	00 00 00 00	NULL - No attribution in Europe
Auction End Offset	50 C3 00 00	50,000 ns

Auction Cancel

Length	0E	14 bytes
Type	AE	Auction Cancel
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Auction Id	00 F5 01 00 00 00 00 00	Auction Id = 128,256

Auction Liquidity

Length	1B	27 bytes
Type	DE	Auction Liquidity
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Auction Id	00 F5 01 00 00 00 00 00	Auction Id = 128,256
Price Level Count	01	1
Price Level	7B 88 01 00 00 00 00 00	10.0475
Volume	32 00 00 00	50

Auction Trade

Length	26	38 bytes
Type	DF	Auction Trade
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Auction Id	00 F5 01 00 00 00 00 00	Auction Id = 128,256
Execution Id	C8 00 00 00 01 40 57 3A	
Price	7B 88 01 00 00 00 00 00	10.0475
Contracts	32 00 00 00	50
Execution Flags	36 32 2D 2D	6 = Request for Quote
		2 = Continuous Trading
		- = Not specified
		- = Not specified

Width Update

Length	13	19 bytes
Type	D2	Width Update
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Product Code	45 55 35 30 4F 00 00 00	EZ500
Width Type	52	R = Regular
Multiplier	0F 00 00 00	Multiplier of 1.5

Futures Instrument Definition

Length	23	35 bytes
Type	DA	Futures Instrument Definition
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Symbol	4C 45 4D 44 6C 20	LEMD1
Product Code	45 55 35 30 4F 00 00 00	EZ500
Expiration Date	76 B3 34 01	20231030
Contract Size	64 00	50
Listing State	41	A = Active
Price Increment	C4 09 00 00 00 00 00 00	0.25

Options Instrument Definition

Length	23	35 bytes
Type	DA	Futures Instrument Definition
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Symbol	4C 45 4D 44 6C 20	LEMD1
Product Code	45 55 35 30 4F 00 00 00	EZ500
Call/Put	43	C = Call
Expiration Date	76 B3 34 01	20231030
Strike Price	50 C3 00 00 00 00 00 00	5.00
Contract Size	64 00	50
Listing State	41	A = Active
Price Increment	C4 09 00 00 00 00 00 00	0.25

Complex Instrument Definition

Length	29	41 bytes
Type	DC	Complex Instrument Definition
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Complex Instrument Id	4C 45 4D 44 6C 20	LEMD1
Reference Price	00 00 00 00 00 00 00 00	0.00
Leg Count	02	2
Leg Symbol	30 31 32 33 34 35	012345
Leg Ratio	01 00 00 00	1
Leg Symbol	35 36 37 38 39 30	567890
Leg Ratio	02 00 00 00	2

Settlement

Length	19	25 bytes
Type	B9	Settlement
Time Offset	C8 47 17 06	102,189,000 ns since last Time Message
Symbol	4C 45 4D 44 6C 20	LEMD1
Trade Date	76 B3 34 01	20231030
Settlement Price	50 C3 00 00 00 00 00 00	5.00
Issue	53	S = Initial Settlement

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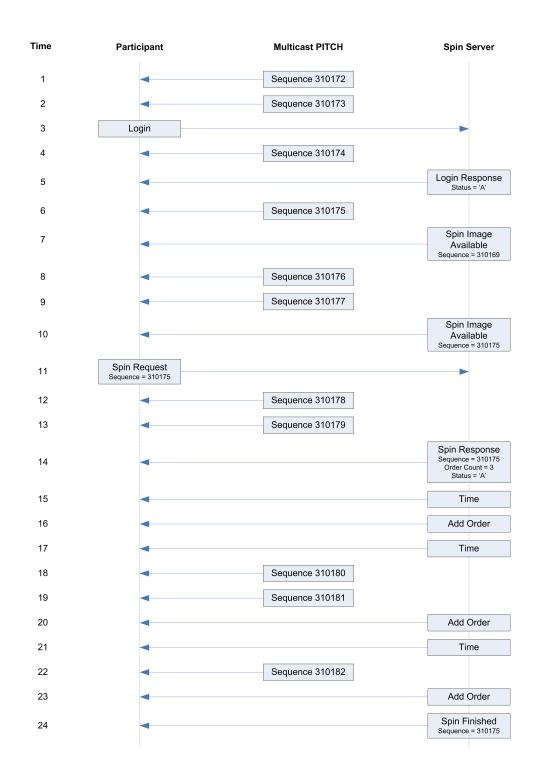
At time 11, the Participant sends a Spin Request for all messages up to and including 310175 and continues to cache Multicast PITCH messages received.

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.

Time	Participant	Multicast PITCH	Spin Server
1		Sequence 310172	
2		Sequence 310173	
3	Login		
4		Sequence 310174	
5			Login Response Status = 'A'
6		Sequence 310175	
7			Spin Image Available Sequence = 310169
8		Sequence 310176	
9		Sequence 310177	
10			Spin Image Available Sequence = 310175
11	Spin Request Sequence = 310175		
12		Sequence 310178	
13		Sequence 310179	
14			Spin Response Sequence = 310175 Order Count = 3 Status = 'A'
15			Time
16			Add Order
17			Time
18		Sequence 310180	
19		Sequence 310181	
20			Add Order
21			Time
22		Sequence 310182	
23			Add Order
24			Spin Finished Sequence = 310175

Appendix D: Specification Differences

This section describes the differences between the Cboe CFE Exchange Futures Multicast PITCH and Cboe US Options Multicast PITCH specifications, and the Cboe Europe CEDX Multicast PITCH Specification.

- The European Derivatives offering will consist of a single unitised Market Data Feed which will serve all trading activity, simple and complex.

- In US Futures, the Time Reference message is used to provide a midnight reference point. The European offering will not cross the data boundary, so this message is unnecessary. Market Data Messages in US Futures also provide a field, "Unit Timestamp", which is not required in Europe.

- In Europe, Symbol Definition Messages will differ from those used in US Futures/Options. Futures Instrument Definition will be used to disseminate data about all Simple Futures. Options Instrument Definition will be used for all Simple Options. Complex Instrument Definition will be used for all Complex Instruments.

- European Futures will not support the Limit Up/Limit Down functionality and so Price Limits messages will not be present.

- Execution and Trade Messages in Europe will have an additional field for Execution and Trade Flags containing MMT Information.

- Auction Updates and Summaries will be disseminated for all Futures and Options in an Auction state. The Options Auction Update Message used in US Options will be used for both the Futures and Options Opening Process, renamed to Opening Auction Update.

- C1 Options has support for SOQ Strike Range Update and Constituent Symbol Mapping messages. This functionality is not available in Europe, and so these messages will not be disseminated.

Revision History

19 February 2020	Version 0.1 Initial draft specification.
04 May 2020	Version 0.2 Updated Underlying Distribution to reflect distribution by Asset Class and Underlier.
10 June 2020	Version 0.3 Updated Underlying Distribution to reflect correct Underlying Product names.
19 June 2020	Version 0.4 Updated § 9, p. 61 with differences between the US and European Derivatives Market Data implementations. Added the Width Update Message.
01 July 2020	Version 0.5 Added Multicast (§ 7, p. 40) and TCP (§ 8, p. 46) sections with UAT Connectivity details.
20 August 2020	Version 0.6 Added message definition for Auction Liquidity.
26 August 2020	Version 0.7 Update possible Status values for the Trading Status message.
17 November 2020	Version 0.8 Update Auction Trade message with new message type and execution flags.
23 November 2020	Version 0.9 Clarify wording for "Underlying Symbol" in Instrument definition messages, to be "Product Code".
04 December 2020	Version 0.10 Updated Underlying Distribution to reflect redistribution of Options Instruments across Units 3-6.
22 January 2021	Version 0.11 Added a Reference Price to the Complex Instrument Definition Message to capture the reference price on the future leg of a Volatility Strategy.
02 February 2021	Version 0.12 Updated set of available feeds. Also added End Of Day Summary message definition.
12 February 2021	Version 0.13 Fixed typo in Options Instrument Definition.
22 February 2021	Version 0.14 Updated Underlying Distribution to reflect DE30 moving from Unit 1 to 2, and UK100 moving from Unit 2 to 1.
24 March 2021	Version 1.00 Removed Draft Watermark.
07 April 2021	Version 1.01 Removed unused Statistics message definition. Added Production Multicast and TCP Connectivity details. Added missing End of Day Summary message to list of Message Types.
06 May 2021	Version 1.02 Added definition for FastStatus [0xE2] message. Updated Message Types and Data Types with missing fields. Updated Multicast Configuration (§ 7, p. 40) with details of Source/Destination Ranges and PIM RP Addresses for Production LD4 Feeds.
26 May 2021	Version 1.03 Updated Multicast Configuration (§ 7, p. 40) with details of WAN E feed in LD3.

15 July 2021	Version 1.04
	Update maximum number of legs in Complex Instrument Definition from 12 to 13.
01 September 2021	Version 1.05
	Updated Underlying Distribution to reflect the change of DE30 to DE40.
08 November 2021	Version 1.06
	Removed Appendix E, as product distribution information is present in the Product Files.
	See https://www.cboe.com/europe/derivatives/support/reference_data/.
01 December 2021	Version 1.07
	Update location of Multicast Test Program.
16 January 2023	Version 1.08
	Added 12 extra units, giving a total of 18.
31 January 2023	Version 1.09
	Modified spin server ports for units 7-18 to avoid clashes with the GRP ports.
22 February 2023	Version 1.10
	Corrected CEDX B Feed Destination Range.
27 February 2023	Version 1.11
	Corrected CEDX E Feed Source IPs, IP Addresses for Unit 7-12 Spin Servers in DR and IP Addresses for Unit 7-12 Secondary Spin Servers.