US Options Complex Multicast PITCH Specification

Version 2.1.18

January 31, 2020

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1 Introduction

1.1 Overview

Note that this specification will be the standard specification to be used for complex options on the Cboe Options ("C1"), C2 Options and EDGX Options Exchange platforms.

Cboe customers may use Complex Multicast PITCH to receive real-time depth of book quotations and execution information direct from Cboe. This feed will only include quotations and executions related to complex orders.

Complex Multicast PITCH cannot be used to enter orders. For order entry, refer to the appropriate US Options FIX or BOE Specifications.

A Gig-Shaped version of the Complex Multicast PITCH feed is available from both of Cboe's datacenters. Customers may choose to take one or more of the following Complex Multicast PITCH feed options depending on their location and connectivity to Cboe.

1.2 Complex Multicast PITCH Feed Descriptions

Exchange	Shaping (Gig)	Served From Data Center (Primary/Secondary)	Multicast Feed ID
C1 Options	Gig	Primary	CAC
C1 Options	Gig	Primary	CBC
C1 Options	Gig	Secondary	CEC
C2 Options	Gig	Primary	WAC
C2 Options	Gig	Primary	WBC
C2 Options	Gig	Secondary	WEC
EDGX Options	Gig	Primary	EAC
EDGX Options	Gig	Primary	EBC
EDGX Options	Gig	Secondary	EEC

1.3 Feed Connectivity Requirements

Gig Shaped feeds are available to customers with a minimum of 1 Gb/s of connectivity to Cboe via cross connect or dedicated circuit.

Customers with sufficient connectivity may choose to take more than one Gig-Shaped feed from the Cboe datacenters and arbitrate the feeds to recover lost data. It should be noted that feeds from the secondary datacenter will have additional latency for those co-located with Cboe in the primary datacenter due to proximity.

Cboe Complex Multicast PITCH real-time events are delivered using a published range of multicast addresses divided by symbol range units. Dropped messages can be requested using a TCP/IP connection to one of Cboe's 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

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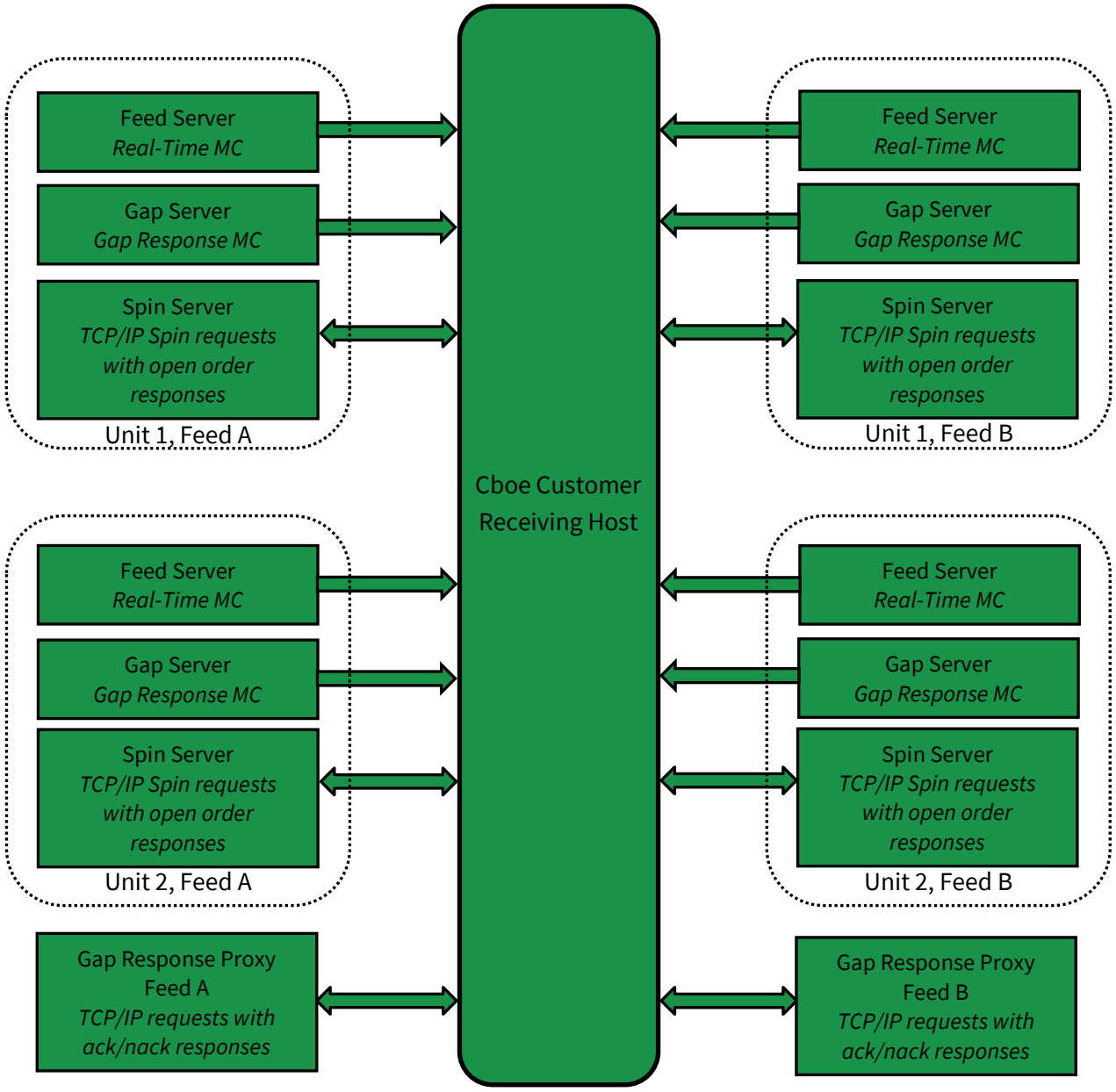
orders may be requested from a Spin Server. This allows a client to become current without requesting a gap for all messages up to that point in the day. The following diagram is a logical representation Complex Multicast PITCH feed message flow between Cboe and a customer feed handler that is listening to the "A" and "B" instances of two units:



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1.4 Symbol Ranges, Units, and Sequence Numbers

Symbols will be separated by underlyer into units by a published distribution. Symbol distribution will not change intra-day. Cboe does, however, reserve the right to add multicast addresses or change the symbol distribution with prior notice to customers. 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 symbol 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 intra-day, 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.

1.5 Complex Options Specific Symbol Processing

Cboe has implemented a Complex Instrument Creation ("CIC") process due to the seemingly infinite number of combinations that can make up a complex instrument. This allows the Complex Multicast PITCH specification to be consistent with the equities, standard and auction options Multicast PITCH specifications. This CIC process significantly reduces the size of the Complex Multicast PITCH feed and allows customers to use the same feed handler for Cboe equity, options, and futures exchanges.

Real-time CIC messages are available on each unit's multicast feed. `Complex Instrument Definition Expanded` messages are used to map the 6 character feed Complex Instrument ID ("CID") to the complex instrument definition. A complex instrument definition consists of two or more option legs. The complex instrument is valid only for the current trading date on which it was created. `Complex Instrument Definition` Expanded messages are sequenced messages and can be sent from pre-market through the end of trading. Once a complex instrument is created, it cannot be deleted or modified for the remainder of the trading day.

1.6 Gap Request Proxy and Message Retransmission

Requesting delivery of missed data is achieved by connecting to the Cboe Gap Request Proxy ("GRP") for the complex options data feed. Customers 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. Customers 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 cannot 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

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requested unit. Customers will receive a total daily allowance of gap requested messages. In addition, each customer is given renewable one second and one minute gap request limits.

If more than one gap request is received for a particular unit/sequence/count combination within a short timeframe, all requests will receive a successful `Gap Response` message from the GRP, but only a single replayed message will be sent on the gap response multicast address.

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. Customers will receive gap responses for their requested 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.

1.7 Spin Servers

A Spin Server is available for each unit. The server allows customers to connect via TCP and receive a spin of all complex instrument definitions and currently open orders with limited trading conditions on that unit. By using the spin, a customer can get the current complex 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 complex book. Using a `Spin Request` message, a customer may request a spin for the orders up to a sequence number noted within one of the last ten `Spin Image Available` messages distributed. If the `Spin Request` submitted does not present a sequence number that matches one of the last ten `Spin Image Available` messages distributed, the spin will return orders up to the next closest sequence number reported through a `Spin Image Available` message that is greater than the sequence number requested.

In the case a customer sends a sequence number in a `Spin Request` that is higher than the sequence number reported by the most recent `Spin Image Available` message, the next spin image to be generated will be returned when it is available. If the requested sequence number is still higher at that time, an “O” (Out of Range) error will be generated.

A spin consists only of `Complex Instrument Definition Expanded`, `Add Order` (long and/or short), `Trading Status` and `Time` messages. `Trading Status` messages will be sent in spins for all complex instruments that are not “S”uspended, which results in at least two messages for every complex instrument that has not been “S”uspended since system startup. Spins will not contain any message for an order which is no longer on the book. While receiving the spin, the customer must

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buffer multicast messages received. If the `Spin Image Available` message sequence number is the customer's reference point, multicast messages with larger sequence numbers should be buffered. If a non-`Spin Image Available` sequence number is the customer's reference point from which they send in their `Spin Request`, they should buffer from that point on, but note that the spin they will receive will contain sequence numbers beyond that point which may be disregarded. When a `Spin Finished` message is received, the buffered messages must be applied to spun copy of the book to bring it current.

Customers can also use the Spin Server to request a spin of all `Symbol Mapping` and `Complex Instrument Definition Expanded` messages by sending an `Instrument Definition Request`. The Spin Server can only process one spin at a time. Customers will need to wait for a `Spin Finished` or `Instrument Definition Finished` message before submitting another request.

Section 5 shows an example flow of messages between a customer and Cboe's Multicast PITCH feed and Spin Server.

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2 Protocol

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

2.1 Message Format

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

All UDP delivered events will be 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 may cross frames as the data will be delivered as a stream of data with the TCP/IP stack controlling Ethernet framing.

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

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2.2 Data Types

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

- **Alphanumeric** fields are left justified ASCII fields and space padded on the right.
- **Binary** fields are unsigned and sized to "Length" bytes and ordered using Little Endian convention (least significant byte first).
- **Signed Binary** fields are signed and sized to "Length" bytes and ordered using Little Endian convention (least significant byte first).
- **Binary Signed Short Price** fields are signed Little Endian encoded 2 byte binary fields with 2 implied decimal places (denominator = 100). The short price range is -327.68 to +327.67. Prices outside of this range will use the long price.
- **Binary Signed Long Price** fields are signed Little Endian encoded 8 byte binary fields with 4 implied decimal places (denominator = 10,000).
- **Bit Field** fields are fixed width fields with each bit representing a Boolean flag (the 0 bit is the lowest significant bit; the 7 bit is the highest significant bit).
- **Printable ASCII** fields are left justified ASCII fields that are space padded on the right that may include ASCII values in the range of 0x20 – 0x7e.

2.3 Message Framing

Depth of book update messages will be combined into 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 (e.g. A/B & Gig-Shaped) will be identical, but framing will not be consistent across feeds. Receiving processes that receive and arbitrate multiple feeds cannot use frame level arbitration to fill gaps.

2.4 Sequenced Unit Header

The `Sequenced Unit Header` is used for all Cboe Complex Multicast PITCH messages as well as messages to and from the Gap Request Proxy ("GRP") and Spin Servers.

Sequenced and un-sequenced data may be delivered using the `Sequenced Unit Header`. Un-sequenced headers will have a 0 value for the sequence field and potentially for the unit field. All messages sent to and from the GRP and Spin Server are un-sequenced while multicast may contain sequenced and un-sequenced messages.

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Sequenced messages have implied sequences with the first message having the sequence number contained in the header. Each subsequent message will have an implied sequence one greater than the prev4ious message up to a maximum of count messages. Multiple messages can follow a `Sequenced Unit Header`, but a combination of sequenced and un-sequenced messages cannot be sent with one header.

The sequence number 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**	**Value/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 Heartbeat Messages

The `Sequenced Unit Header` with a count field set to "0" will be 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 will always have the *Hdr Sequence* field set to 0. All `Heartbeat` messages sent to and from the GRP are considered un-sequenced 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 12:00 am – 1:00 am ET or during maintenance windows.

Cboe expects `Heartbeat` messages to be sent to the GRP on live connections no less than every 5 seconds. Failure to receive 2 consecutive `Heartbeat` messages will result in the GRP terminating the client connection.

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3 PITCH 2.X Messages

3.1 Time

A `Time` message is immediately generated and sent when there is a PITCH event for a given clock second. If there is no PITCH event for a given clock second, then no Time message is sent for that second. 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 Name	**Offset**	**Length**	**Type/(Value)**	**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 Eastern Time
Total Length = 6 bytes				

3.2 Unit Clear

The `Unit Clear` message instructs feed recipients to clear all orders for the Cboe complex book in the unit specified in the `Sequenced Unit Header`. For Equities only, this message will be sent at startup each day. It would also be distributed in certain recovery events such as a data center fail-over.

Unit Clear				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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				

3.3 Transaction Begin

The `Transaction Begin` message indicates any subsequent messages, up to the accompanying `Transaction End` message, are all part of the same transaction block. 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 or even the same Symbol. `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.

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Transaction Begin				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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				

3.4 Transaction End

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 Name	**Offset**	**Length**	**Type/(Value)**	**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				

3.5 Complex Instrument Definition Expanded

A `Complex Instrument Definition Expanded` 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 Expanded` message is sent for a symbol. These messages will also be sent continuously through the day as an unsequenced message (sequence = 0) at variable rates as bandwidth allows. The *Time offset* field should be ingored on an unsequenced `Complex Instrument Definition Expanded` message.

The `Complex Instrument Definition Expanded` message will contain two or more repeating groups of leg definitions. There is a limit of 11 leg definitions plus one equity leg.

Complex Instrument Definition Expanded				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x9A	`Complex Instrument Definition Expanded` 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.
Complex Instrument Underlying	12	8	Printable ASCII	Complex Instrument Underlying right padded with spaces.

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Complex Instrument Type	20	4	Alphanumeric	4 character field; each field describes a characteristic. **Character 1: Complex Option Type** O = All legs are options E = One leg is an equity leg **Characters 2-4: Reserved**
Leg Count	24	1	Binary	The number of legs in the complex instrument. The maximum number of legs is 12.
The following fields repeat *Leg Count* times for multi-leg strategies. *Leg Index i*s zero-based.				
Leg Symbol	25 + Leg Index * 13	8	Printable ASCII	Option or Equity Symbol of leg, right padded with spaces.
Leg Ratio	33 + Leg Index * 13	4	Signed Binary	Leg ratio (positive for buy-side, negative for sell-side). For options this is the number of contracts, for equities this is the number of shares.
Leg Security Type	37 + Leg Index * 13	1	Alphanumeric	O = Leg is an Option instrument E = Leg is an Equity instrument
Total Length = *25* + (*Leg Count* * *13*) bytes				

3.6 Symbol Mapping

A `Symbol Mapping` message is used to map the 6 character multicast feed symbol field to an OSI symbol and Underlying. These messages are not sequenced (sequence = 0) and are sent continuously through the day at variable rates as bandwidth allows.

Symbol Mapping				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x2E	`Symbol Mapping` Message
Feed Symbol	2	6	Printable ASCII	*Symbol* right padded with spaces.
OSI Symbol	8	21	Printable ASCII	OSI Symbol
Symbol Condition	29	1	Alphanumeric	N = Normal C = Closing Only
Underlying	30	8	Alphanumeric	Symbol of underlying equity right padded with spaces. All spaces if not available or not applicable.
Total Length = 38 bytes				

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3.7 Add Order

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

Add Order (long)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x21	`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	Instrument quantity added to the complex book (may be less than the number entered).
Complex Instrument Id	19	6	Printable ASCII	*Complex Instrument Id* right padded with spaces.
Price	25	8	Binary Signed Long Price	The limit order price
Reserved	33	1	Reserved	Reserved
Total Length = 34 bytes				

Add Order (short)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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	Instrument quantity being added to the complex book (may be less than the number entered).
Complex Instrument Id	17	6	Printable ASCII	Complex Instrument Id right padded with spaces.
Price	23	2	Binary Signed Short Price	The limit order price
Reserved	25	1	Reserved	Reserved
Total Length = 26 bytes				

Add Order (expanded)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x2F	`Add Order` Message (expanded)
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Day-specific identifier assigned to this order

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Side Indicator	14	1	Alphanumeric	"B" = Buy Order "S" = Sell Order
Quantity	15	4	Binary	Instrument quantity being added to the complex book (may be less than the number entered).
Complex Instrument Id	19	8	Printable ASCII	Complex Instrument Id right padded with spaces.
Price	27	8	Binary Signed Long Price	The limit order price
Reserved	35	1	Reserved	Reserved
Participant ID	36	4	Alphanumeric	*Optionally specified.* If specified the Executing Broker of firm attributed to this quote. Space filled otherwise.
Customer Indicator	40	1	Alphanumeric	"N" = Non-Customer "C" = Customer
Client ID	41	4	Alphanumeric	Optional user specified value attributed to this quote. Space filled otherwise.
Total Length = 45 bytes				

3.8 Order Modification Messages

Order Modification messages refer to an Order ID previously sent with an `Add Order` message. Multiple Order Modification messages may modify a single complex order and the effects are cumulative. Modify messages may update the size and/or the price of a complex order on the book. When the remaining size of a complex order reaches zero, the complex order is dead and should be removed from the book.

3.8.1 Order Executed

`Order Executed` messages are sent when a visible complex order on the Cboe complex book is executed in whole or in part. The execution price equals the limit order price found in the original `Add Order` message or the limit order price in the latest `Modify Order` message referencing the *Order Id*.

Note even if there are single leg to complex order executions, this feed will only contain the order execution for the complex order. Any single leg execution information is available on the standard PITCH feed.

Order Executed				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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 sent `Add Order` message that was executed

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Executed Quantity	14	4	Binary	Instrument quantity executed
Execution Id	18	8	Binary	Cboe generated day-unique execution identifier of this execution.
Trade Condition	26	1	Alphanumeric	**See Options Trade Condition Codes section for details about new codes.**
Total Length = 27 bytes				

3.8.2 Order Executed at Price/Size

`Order Execution at Price/Size` messages are sent when a complex order on the Cboe complex book is executed in whole or in part at a different price than the limit price on the original `Add Order` message or the limit order price in the latest `Modify Order` message referencing the *Order Id*. If the *Remaining Quantity* field contains a 0 the complex order should be completely removed from the complex book.

`Order Execution at Price/Size` messages may also be sent in the event the existing size for Order Id is not equal to *Executed Quantity* + *Remaining Quantity*. In this case the complex order should be prioritized the same as a new complex order.

Order Executed at Price/Size				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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 sent `Add Order` message that was executed
Executed Quantity	14	4	Binary	Instrument quantity 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.
Price	30	8	Binary Signed Long Price	The execution price of the order
Trade Condition	38	1	Alphanumeric	**See Options Trade Condition Codes section for details about new codes.**
Total Length = 39 bytes				

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3.8.3 Reduce Size

`Reduce Size` messages are sent when a complex order on the Cboe complex book is partially reduced.

Reduce Size (long)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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 sent `Add Order` message that has been reduced
Canceled Quantity	14	4	Binary	Instrument quantity canceled
Total Length = 18 bytes				

Reduce Size (short)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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 sent `Add Order` message that has been reduced
Canceled Quantity	14	2	Binary	Instrument quantity canceled
Total Length = 16 bytes				

3.8.4 Modify Order

The `Modify Order` message is sent whenever an open complex order is visibly modified. The *Order Id* refers to the *Order Id* of the original `Add Order` message.

Note that `Modify Order` messages that appear to be "no ops" (i.e. they do not appear to modify any relevant fields) will still lose priority.

Modify (long)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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 sent `Add Order` message that has been modified
Quantity	14	4	Binary	Instrument quantity associated with this complex order after this modify (may be less than the number entered)
Price	18	8	Binary Signed Long Price	The limit order price after this modify

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Reserved	26	1	Bit Field	Reserved
Total Length = 27 bytes				

Modify (short)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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 sent `Add Order` message that has been modified
Quantity	14	2	Binary	Instrument quantity associated with this complex order after this modify (may be less than the number entered)
Price	16	2	Binary Signed Short Price	The limit order price after this modify
Reserved	18	1	Bit Field	Reserved
Total Length = 19 bytes				

3.8.5 Delete Order

The `Delete Order` message is sent whenever an open complex order is completely canceled. The *Order Id* refers to the Order Id of the original `Add Order` message.

Delete				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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 sent `Add Order` message that has completely cancelled
Total Length = 14 bytes				

3.9 Trade

The `Trade` message provides information about executions of complex order auctions on the Cboe complex book. A `Trade` message can also be sent when an auction executes against a non-displayed order, such as a contra response . `Trade` messages are necessary to calculate Cboe execution-based data. `Trade` messages do not alter the complex book and can be ignored if messages are being used solely to build a complex book.

No `Add Order` message is sent for complex auction orders, and thus, no order modification messages may be sent when complex auctions are executed. Instead, a `Trade` message is sent whenever a complex auction is executed in whole or in part. A complete view of all Cboe complex executions can be built by combining all `Order Executed` messages and `Trade` messages.

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Trade (long)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x2A	`Trade` Message (long)
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	*Order Id* of the executed order.
Side Indicator	14	1	Alphanumeric	Always "B" = Buy Order regardless of resting side
Quantity	15	4	Binary	Instrument quantity traded
Complex Instrument Id	19	6	Printable ASCII	*Complex Instrument Id* right padded with spaces.
Price	25	8	Binary Signed Long Price	The execution price of the order
Execution Id	33	8	Binary	Cboe generated day-unique execution identifier of this trade.
Trade Condition	41	1	Alphanumeric	**See Options Trade Condition Codes section for details about new codes.**
Total Length = 42 bytes				

Trade (short)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x2B	`Trade` Message (short)
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	*Order Id* of the executed order.
Side Indicator	14	1	Alphanumeric	Always "B" = Buy Order regardless of resting side
Quantity	15	2	Binary	Instrument quantity traded
Complex Instrument Id	17	6	Printable ASCII	*Complex Instrument Id* right padded with spaces.
Price	23	2	Binary Signed Short Price	The execution price of the order
Execution Id	25	8	Binary	Cboe generated day-unique execution identifier of this trade.
Trade Condition	33	1	Alphanumeric	**See Options Trade Condition Codes section for details about new codes.**
Total Length = 34 bytes				

3.10 Auction Notification

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

Auction Notification				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xAD	`Auction Notification` Message

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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.
Auction ID	12	8	Binary	Day specific identifier assigned to this auction.
Auction Type	20	1	Alphanumeric	C = Complex Auction (COA) S = Complex Solicitation Auction Mechanism B = Complex AIM O = COA All or None
Side	21	1	Alphanumeric	B = Buy S = Sell
Price	22	8	Binary Signed Long Price	Auction price. The price field will be populated for all Auctions on EDGX Options, and for SAM Auctions on C1. This field will be set to zero for AIM on C1 and COA on C1 and C2 Options.
Quantity	30	4	Binary	Instrument quantity.
Customer Indicator	34	1	Alphanumeric	N = Non-Customer C = Customer
ParticipantID	35	4	Alphanumeric	Executing Broker (optional) of firm attributed to this quote.
Auction End Offset	39	4	Binary	Nanosecond offset from last timestamp.
Client ID	43	4	Alphanumeric	Optional user specified value attributed to this quote. Space filled otherwise.
Total Length = 47 bytes				

3.11 Auction Cancel

`Auction Cancel` messages are used to disseminate the cancelation of an earlier `Auction Notification` message as a result of a user cancelation of the original complex auction, a user modification request to change the complex auction price or increase the original complex auction quantity, a fading of the NBBO or to cancel any remaining complex auction quantity from the original `Auction Notification` following the complex auction termination.

A user request to modify the complex auction price or to increase the original complex auction quantity will result in a cancelation of the complex auction followed by a new `Auction Notification` message. `Auction Cancel` messages will not be issued for complex auction quantity decrements.

Auction Cancel				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field

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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				

3.12 Auction Trade

`Auction Trade` messages are used to disseminate executions resulting from a complex auction.

Auction Trade				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xAF	`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 Signed Long Price	Trade price
Quantity	30	4	Binary	Instrument quantity traded
Total Length = 34 bytes				

3.13 Trading Status

The `Trading Status` message is used to indicate the current trading status of a complex instrument. A `Trading Status` message will be sent whenever a complex instrument trading status changes.

A `Trading Status` message will be sent for all complex instruments where the underlying security is Halted, Trading or Quoting.

Starting at 7:30AM ET, Cboe will send a *Trading Status* of "Q" once orders can be accepted for queuing in preparation for the market open. Sometime after 9:30AM ET, Cboe will send a *Trading Status* of "T" as series are open for trading on the Cboe platform. Note *Trading Status* of "Q" can also be explicitly disseminated during a Regulatory Halt Quoting Period.

A `Trading Status` message will also be sent:

- for a Regulatory Halt "Q"uoting Period in any series where the underlying has experienced a Regulatory Halt as well as the "T"rading resumption for the same series.
- for instruments that are in a "Q"uoting period for auctions.

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The *Trading Status* field will be used to represent the status of the RTH Session (9:30am ET – 4:15pm ET) and the *GTH Trading Status* field will be used to represent the status of the GTH Session **(C1 Only)**.

Trading Status				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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
Complex Symbol ID	6	6	Printable ASCII	*Complex Symbol* right padded with spaces.
Reserved	12	2	Reserved	*Reserved*
Trading Status	14	1	Alpha	H = Halted Q = Quote-Only T = Trading
Reserved	15	1	Reserved	Reserved
GTH Trading Status **(C1 Only)**	16	1	Alpha	H = Halted Q = Quote-Only T = Trading
Reserved2	17	1	Alpha	Reserved
Total Length = 18 bytes				

3.14 Options Auction Update

`Options Auction Update` messages are used to disseminate price and size information during the Opening and Re-Opening (halt) process for complex instruments. The `Options Auction Update` messages are sent every five seconds during an opening period. Refer to the Cboe Options Complex Book Process specification for more information.

Options Auction Update				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0xD1	`Options Auction Update` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Complex Instrument ID	6	8	Printable ASCII	*Complex Instrument* right padded with spaces.
Auction Type	14	1	Alphanumeric	G = GTH Opening **(C1 Only)** O = RTH Opening H = Halt Re-Opening
Reference Price	15	8	Binary Long Price	*Not used for complex series. Will contain zero value.*
Buy Contracts	23	4	Binary	Cumulative Buy interest at the Indicative Price.
Sell Contracts	27	4	Binary	Cumulative Sell interest at the Indicative Price.

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Indicative Price	31	8	Binary Signed Long Price	SNBBO Collared Volume Maximizing Imbalance Minimizing Price computed on combined Auction-Only and Continuous Book (if any).
Auction Only Price	39	8	Binary Signed Long Price	*Not used for complex series. Will contain zero value.*
Opening Condition	47	1	Alphanumeric	*Not used for Complex series. Will contain zero value.*
Composite Market Bid Price	48	8	Binary Signed Long Price	*Not used for Complex series. Will contain zero value.*
Composite Market Offer Price	56	8	Binary Signed Long Price	*Not used for complex series. Will contain zero value.*
Total Length = 64 bytes				

3.15 Auction Summary

`Auction Summary` messages are used to disseminate the results of an auction of a complex instrument. An Opening or Re-Opening `Auction Summary` message for each complex instrument is sent at the conclusion of its Opening or Re-Opening auction and represents Cboe opening price. Refer to the Cboe Options Complex Book Process specification for more information.

The `Auction Summary` message has the following format:

Auction Summary				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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.
Complex Instrument Id	6	8	Printable ASCII	*Complex Instrument Id* right padded with spaces.
Auction Type	14	1	Alphanumeric	G = GTH Opening **(C1 Only)** O = RTH Opening H = Halt Re-Opening
Price	15	8	Binary Signed Long Price	Auction price
Quantity	23	4	Binary	Cumulative instrument quantity executed during the auction
Total Length = 27 bytes				

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3.16 End of Session

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 Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x2D	`End of Session` Message
Timestamp	2	4	Binary	Nanosecond offset from last unit timestamp
Total Length = 6 bytes				

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4 Gap Request Proxy Messages

The following messages are used for initializing a TCP/IP connection to the Gap Request Proxy ("GRP") and to request message retransmissions. Customers only need to implement the following messages if gap requests will be made. The following messages will not be delivered using multicast.

4.1 Login

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				
Field	**Offset**	**Length**	**Value/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				

4.2 Login Response

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**	**Value/Type**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x02	`Login Response` Message
Status	2	1	Alphanumeric	Accepted or reason for reject
Total Length = 3 bytes				

Login Response – Status Codes	
'A'	Login Accepted
'N'	Not authorized (Invalid Username/Password)
'B'	Session in use
'S'	Invalid Session

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4.3 Gap Request

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

Gap Request				
Field	**Offset**	**Length**	**Value/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				

4.4 Gap Response

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**	**Value/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	Accepted or reason for reject
Total Length = 10 bytes				

Gap Response – Status Codes	
'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
'U'	Unit is currently unavailable

* - All non-'A' status codes should be interpreted as a reject.

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5 Spin Messages

5.1 Login

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 described previously in Section 4.1.

5.2 Login Response

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 described previously in Section 4.2.

5.3 Spin Image Available

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

Spin Image Available				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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

The `Spin Request` message is used by a user's process to request transmission of a spin of the unit's order book. Refer to Section 1.6 for more complete details regarding *Sequence* specification as well as buffering requirements.

Spin Request				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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 customer
Total Length = 6 bytes				

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5.5 Spin Response

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

Spin Response				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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 customer
Order Count	6	4	Binary	Number of `Add Order` messages which will be contained in this spin
Status	10	1	Alphanumeric	Accepted or reason for reject
Total Length = 11 bytes				

Spin Response – Status Codes	
'A'	Accepted
'O'	Out of Range (*Sequence* requested is greater than *Sequence* available by the next spin)
'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.

5.6 Spin Finished

The `Spin Finished` message is sent to indicate that all 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 customer's copy of the book to make it current.

Spin Finished				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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

The `Instrument Definition Request` message is used by a user's process to request transmission of this unit's Symbol Mappings and Complex Instrument Definitions. All `Symbol Mapping` Messages will be sent before `Complex Instrument Definition Expanded` messages. Refer to Section 1.6 for more complete details regarding *Sequence* specification as well as buffering requirements.

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Instrument Definition Request				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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. Only the current Symbol Mappings and Complex Instrument Definitions are available.
Total Length = 6 bytes				

5.8 Instrument Definition Response

The `Instrument Definition Response` message is sent in response to a user's `Instrument Definition Request` message indicating whether a spin will be sent.

Instrument Definition Response				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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 `Symbol Mapping` and `Complex Instrument Definition` (if applicable) messages which will be contained in this spin
Status	10	1	Alphanumeric	Accepted or reason for reject
Total Length = 11 bytes				

Instrument Definition Response – Status Codes	
'A'	Accepted
'O'	Out of Range (*Sequence* must be 0)
'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.

5.9 Instrument Definition Finished

The `Instrument Definition Finished` message is sent to indicate that all `Symbol Mapping` and `Complex Instrument Definition Expanded` messages for this unit have been sent. An `Instrument Definition Finished` message is only sent if an `Instrument Definition Request` was not rejected.

Instrument Definition Finished				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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				

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5.10 Spin Server Usage Example

The following diagram (see next page) shows the exchange of messages over time between a customer and Cboe's Multicast PITCH feed and spin server. Note that while the example may seem to imply only `Complex Instrument Definition Expanded`, `Time` and `Add Order` messages would be sent on a spin, this is not the case. `Trading Status and Auction Update` messages may also be sent.

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

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

At time 7, the customer 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 customer does not have all messages cached after 310169 (they are missing 310170 and 310171), so this spin is not useful to the customer.

At time 10, the customer 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 customer has all messages after 310175 cached.

At time 11, the customer 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 five messages will be sent (complex instrument definition and open orders).

At time 24, the spin server indicates that it has finished sending all messages. The customer must then apply the cached messages from sequence number 310176 through current.

Notes:

- Spin Servers are available for each unit. Customers may need to employ multiple Spin Servers depending upon their architecture.
- As a rule of thumb, in its options markets Cboe typically has ~300,000 complex instruments defined and ~3.2 million open orders across all units, or an average of about 9,375 complex instruments and 100,000 open orders per unit. The actual number per unit varies depending upon activity in individual symbols. Expect this number to increase and plan accordingly.

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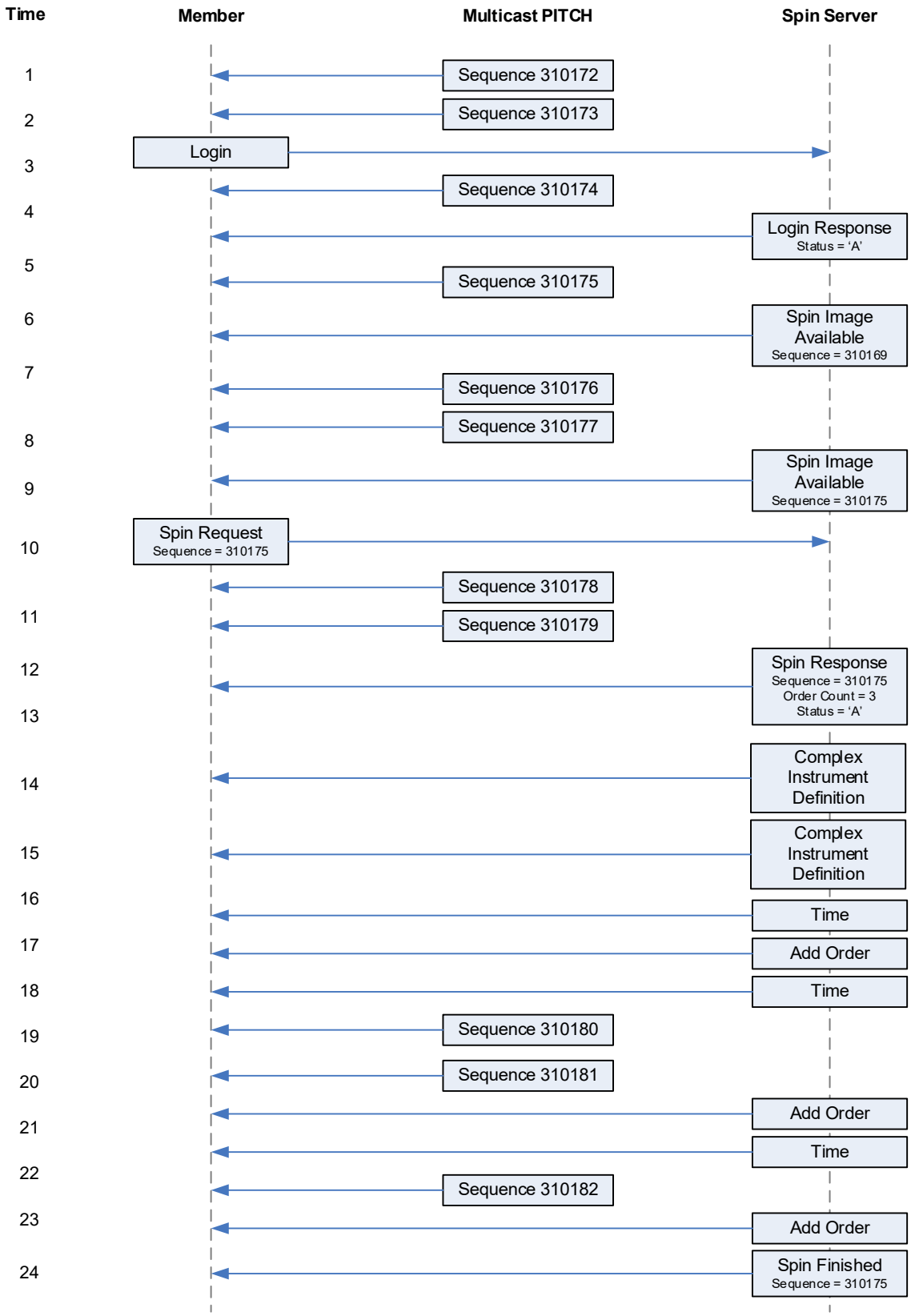

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6 Message Types

6.1 Gap Request Proxy Messages

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

6.2 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

6.3 PITCH 2.X Messages

0x20	Time
0x21	Add Order – Long
0x22	Add Order – Short
0x2F	Add Order – Expanded
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
0x2A	Trade – Long
0x2B	Trade – Short
0xAD	Auction Notification
0xAE	Auction Cancel
0xAF	Auction Trade
0x2D	End of Session
0x31	Trading Status
0x95	Auction Update
0xD1	Options Auction Update

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0x96	Auction Summary
0x97	Unit Clear
0x9A	Complex Instrument Definition Expanded
0x2F	Symbol Mapping

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7 Example Messages

Each of the following message types must be wrapped by a sequenced or unsequenced unit header as described in Section 2.4. Note that in the following examples, each byte is represented by two hexadecimal digits.

7.1 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     "
```

7.2 Login Response Message

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

7.3 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
```

7.4 Gap Response Message

```
Length       08                                8 bytes
 Type              04                                Gap Response
 Unit              01                                Unit 1
 Sequence          3B 10 00 00                       First message: 4155
 Status            41                                Accepted
```

7.5 Spin Image Available Message

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

7.6 Spin Request Message

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

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7.7 Spin Response Message

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

7.8 Spin Finished Message

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

7.9 Instrument Definition Request

Length	06	6 bytes
Type	84	Instrument Definition Request
Sequence	00 00 00 00	Sequence: 0

7.10 Instrument Definition Response

Length	0B	11 bytes
Type	85	Instrument Definition Response
Sequence	00 00 00 00	Sequence: 0
Instrument Count	B8 0B 00 00	3000 Instruments
Status	41	Accepted

7.11 Instrument Definition Finished

Length	02	2 bytes
Type	86	Instrument Definition Finished

7.12 Time Message

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

7.13 Unit Clear

Length	06	6 bytes
Type	97	Unit Clear
Time offset	18 D2 06 00	447,000 ns since last Time Message

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7.14 Add Order – Long

Length	22								34 bytes
Type	21								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	631WC4000005
Side Indicator	42								Buy
Quantity	32	00	00	00					50
CID	43	30	30	30	31	32			C00012
Price	28	23	00	00	00	00	00	00	$0.9000
Reserved	00								Reserved

7.15 Add Order – Short

Length	1A								26 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
Quantity	32	00							50
CID	43	30	30	30	31	32			C00012
Price	0A	28							$102.50
Reserved	00								Reserved

7.16 Add Order – Expanded

Length	2D								45 bytes
Type	2F								Add Order – Expanded
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
Quantity	32	00							50
CID	43	30	30	30	31	32	20	20	C00012
Price	28	23	00	00	00	00	00	00	$0.9000
Reserved	00								Reserved
Participant ID	41	42	43	44					ABCD
Customer Indicator	4E								Non-Customer
Client ID	43	4C	49	44					CLID

7.17 Order Executed

Length	1A								26 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	631WC4000005
Executed	64	00	00	00					100

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Quantity			
Execution Id	34 2B 46 E0 BB 00 00 00		0AAP09VEC

7.18 Order Executed at Price/Size

Length	26		38 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		631WC4000005
Executed Quantity	64 00 00 00		100
Remaining	32 00 00 00		50
Execution Id	34 2B 46 E0 BB 00 00 00		0AAP09VEC
Price	E8 A3 0F 00 00 00 00 00		$102.50

7.19 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		631WC4000005
Canceled Quantity	64 00 00 00		100

7.20 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		631WC4000005
Canceled Quantity	64 00		100

7.21 Modify Order – Long

Length	1B		27 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		631WC4000005
Quantity	4B 00 00 00		75
Price	E8 A3 0F 00 00 00 00 00		$102.50
Reserved	00		Reserved

7.22 Modify Order – Short

Length	13		19 bytes
Type	28		Modify Order – Short

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Time offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	631WC4000005
Quantity	4B 00	75
Price	0A 28	$102.50
Reserved	00	Reserved

7.23 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	

7.24 Trade – Long

Length	29	41 bytes
Type	2A	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	631WC4000005
Side	42	Buy
Quantity	4B 00 00 00	75
CID	43 30 30 30 31 32	C00012
Price	E8 A3 0F 00 00 00 00 00	$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC

7.25 Trade – Short

Length	21	33 bytes
Type	2B	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	631WC4000005
Side	42	Buy
Quantity	64 00	100
CID	43 30 30 30 31 32	C00012
Price	0A 28	$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC

7.26 Auction Notification Message

Length	2F	47 bytes
Type	AD	Auction Notification
Time offset	18 D2 06 00	447,000 ns since last Time Message
CID	43 30 30 30 31 32	C00012
Auction ID	05 40 5B 77 8F 56 1D 0B	631WC4000005
Auction Type	4F	O = COA AON
Side	42	B = Buy Side

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Price	00 00 00 00 00 00 00 00	Price not displayed
Quantity	64 00 00 00	100
Customer Indicator	43	C = Customer
ParticipantID	45 46 49 44	EFID
Auct. End Offset	38 73 0E 00	947,000 ns since last Time Message
Client ID	43 4C 49 44	CLID

7.27 Auction Cancel Message

Length	E	14 bytes
Type	AE	Auction Cancel
Time offset	18 D2 06 00	447,000 ns since last Time Message
Auction ID	05 40 5B 77 8F 56 1D 0B	631WC4000005

7.28 Auction Trade Message

Length	22	34 bytes
Type	AF	Auction Trade
Time offset	18 D2 06 00	447,000 ns since last Time Message
Auction ID	05 40 5B 77 8F 56 1D 0B	631WC4000005
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Price	E8 A3 0F 00 00 00 00 00	$102.50
Quantity	64 00 00 00	100

7.29 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

7.30 Trading Status Message

Length	12	18 bytes
Type	31	Trading Status
Time Offset	18 D2 06 00	447,000 ns since last Time Message
CID	39 39 38 38 37 37	998877
Reserved	20 20	Reserved
Trading Status	54	T = Trading
Reserved	20	Reserved
Global Trading Hours Status	48	H = Halted
Reserved	20	Reserved

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7.31 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	1A	26 bytes
Message format	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
Quantity	E1 02	737
CID	43 30 30 30 31 32	C00012
Price	01 00	0.01
Reserved	00	Reserved

Message 2: Reduce Size (Short)

Length	10	16 bytes
Message format	26	Reduce Size – Short
Time offset	E8 D9 06 00	449,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	631WC4000005
Canceled Quantity	E1 02	737

7.32 Options Auction Update Message

Length	40	64 bytes
Type	D1	Options Auction Update
Time offset	18 D2 06 00	447,000 ns since last Time Message
CID	43 30 30 30 31 32 20 20	C00012
Auction Type	4F	RTH Opening
Reference Price	00 00 00 00 00 00 00 00	always zero
Buy Contracts	64 00 00 00	100 Contracts
Sell Contracts	C8 00 00 00	200 Contracts
Indicative Price	E8 A3 0F 00 00 00 00 00	$102.50
Auction Only Price	00 00 00 00 00 00 00 00	always zero
Opening Condition	00	always zero
Composite Market Bid Price	00 00 00 00 00 00 00 00	always zero
Composite Market Offer Price	00 00 00 00 00 00 00 00	always zero

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7.33 Auction Summary Message

Length	1B								27 bytes
Type	96								Auction Summary
Time offset	18	D2	06	00					447,000 ns since last Time Message
CID	43	30	30	30	31	32	20	20	C00012
Auction Type	4F								RTH Opening
Price	E8	A3	0F	00	00	00	00	00	$102.50
Quantity	4B	00	00	00					75

7.34 Complex Instrument Definition Expanded Message

Length	33								51 bytes
Type	9A								Complex Instrument Definition Expanded
Time offset	18	D2	06	00					447,000 ns since last Time Message
CID	43	30	30	30	31	32			C00012
Complex Instrument	5A	56	5A	5A	54	20	20	20	ZVZZT
Underlying Complex Instrument Type	4F	00	00	00					O = All Legs are Options
Leg Count	02								2 Legs
Leg Symbol	30	30	30	30	30	31	20	20	000001
Leg Ratio	FF	FF	FF	FF					-1 = Sell 1
Leg Security Type	4F								Option Leg
Leg Symbol	30	30	30	30	30	32	20	20	000002
Leg Ratio	01	00	00	00					1 = Buy 1
Leg Security Type	4F								Option Leg

7.35 Symbol Mapping Message

Length	26								38 bytes
Type	2E								Symbol Mapping Message
Feed Symbol	30	30	6D	45	56	4F			00mEVO
OSI Symbol	4D	53	46	54	20	20	31	39	MSFT 190920C00150000
	30	39	32	30	43	30	30	31	
	35	30	30	30	30				
Symbol Condition	43								‘C’ – Closing Only
Underlying	4D	53	46	54	20	20	20	20	MSFT

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8 Multicast Configuration

8.1 Production Environment Configuration

8.1.1 Limitations/Configurations

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

Period/Type	Limit/Setting	Notes
MTU	1500	Cboe will send UDP messages up to 1500 bytes. Customers should ensure that their infrastructure is configured accordingly.
Gig-Shaped Throttle	1 Gb/s	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	320 Requests	This is the maximum number of retransmission requests allowed per second for each session. This is renewed every clock second.
1 Minute	1500 Requests	This is the maximum number of retransmission requests allowed per minute for each session. This is renewed every clock minute.
Day	100,000 Requests	This is the maximum number of retransmission requests allowed per day for each session.
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.

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8.1.2 Unit/Product Distribution

Unit	BZX/C2/EDGX Symbol Range	BZX/C2/EDGX Exceptions	C1 Symbol Range	C1 Exceptions
1	A – ADOZZ		A – ACNAZ	
2	ADP – ANETZ	Excludes AMZN	ACNB – AMGNZ	
3	ANEU – BAAAZ		AMGO – BAAZ	Excludes AMZN
4	BAAB – BKNFZ		BAB – BKNFZ	
5	BKNG – BZZZZ		BKNG – CASZZ	
6	C – CLGXZ		CAT – COOZZ	
7	CLGY – CSXAZ		COP – DEAAZ	
8	CSXB – DISAZ		DEAB – EEMAZ	Excludes DJX
9	DISB – ETFBZ	Excludes DJX	EEMB – FBAAZ	
10	ETFC – FIVDZ		FBAB – GOOFZ	
11	FIVE – GLDAZ		GOOG – GOOGZ	
12	GLDB – GOOGZ		GOOH – IFFAZ	
13	GOOH – HSXZZ		IFFB – IWLZZ	
14	HSY – IWLZZ		IWM – IWMAZ	
15	IWM – JNJAZ		IWMB – LOVZZ	
16	JNJB – LMTAZ		LOW – MPCAZ	
17	LMTB – MLNXZ		MPCB – NFLWZ	Excludes MXEA, MXEF
18	MLNY – MUAAZ		NFLX – NUEAZ	
19	MUAB – NTESZ		NUEB – PEPAZ	Excludes OEX
20	NTET – OXYAZ		PEPB – ROKUZ	Excludes QQQ, RLG, RLV
21	OXYB – QGENZ		ROKV – SPZZZ	Excludes RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPX, SPXW, SPY
22	QGEO – RHAAZ		SQ – TLRYZ	
23	RHAB – SMGZZ	Excludes RUT, RUTW	TLRZ – TSLAZ	
24	SMH – SYEZZ	Excludes SPY	TSLB – UVXXZ	Excludes UKXM
25	SYF – TSKZZ		UVXY – VZZZZ	Excludes VIX, VIXW
26	TSL – UALAZ		W – XLEAZ	Excludes XEO
27	UALB – VLOAZ		XLEB – ZZZZZ	Excludes XSP
28	VLOB – WDCAZ		QQQ	
29	WDCB – XLDZZ		AMZN	
30	XLE – ZZZZZ	Excludes XSP	SPY	
31	AMZN		DJX, MXEA, MXEF, OEX, RLG, RLV, RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, XEO, UKXM, XSP	
32	SPY		VIX, VIXW	
33	RUT (BZX only) DJX, RUT, RUTW (C2 only) XSP (EDGX only)		SPX	
34	N/A		SPXW	
35	N/A		SPX/SPXW, Cross Product Spreads	

Note – Cboe reserves the right to add units and/or change symbol distribution with 48 hours of notice and no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.

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8.1.3 C1 Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.183
Primary Data Center B feed	74.115.128.184
Secondary Data Center E feed	174.136.181.249

8.1.4 C2 Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.176
Primary Data Center B feed	74.115.128.177
Secondary Data Center E feed	170.137.16.134

8.1.5 EDGX Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.162
Primary Data Center B feed	74.115.128.163
Secondary Data Center E feed	174.136.181.240

For additional information about physical connectivity, refer to the US Equities/Options Connectivity Manual.

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8.1.6 C1 Options Address/Unit Distribution

The following tables describe the unit distribution across the C1 Complex Multicast PITCH feeds.

Primary Datacenter		Gig-Shaped [CAC] 170.137.114.80/28		Gig-Shaped [CBC] 170.137.115.80/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30351	224.0.74.80	224.0.74.82	233.182.199.208	233.182.199.210
2	30352				
3	30353				
4	30354				
5	30355				
6	30356				
7	30357				
8	30358				
9	30359				
10	30360				
11	30361				
12	30362				
13	30363				
14	30364				
15	30365				
16	30366				
17	30367	224.0.74.81	224.0.74.83	233.182.199.209	233.182.199.211
18	30368				
19	30369				
20	30370				
21	30371				
22	30372				
23	30373				
24	30374				
25	30375				
26	30376				
27	30377				
28	30378				
29	30379				
30	30380				
31	30381				
32	30382				
33	30383				
34	30384				
35	30385				

Note – Cboe reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration. Addresses in the gray area are pre-assigned but not available. Customers should not configure their networks or systems for these addresses.

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Secondary Datacenter		Gig-Shaped [CEC] 170.137.124.224/28	
Unit	**IP Port**	**Real-time MC**	**Gap Response MC**
1	31351	233.19.3.240	233.19.3.242
2	31352		
3	31353		
4	31354		
5	31355		
6	31356		
7	31357		
8	31358		
9	31359		
10	31360		
11	31361		
12	31362		
13	31363		
14	31364		
15	31365		
16	31366		
17	31367	233.19.3.241	233.19.3.243
18	31368		
19	31369		
20	31370		
21	31371		
22	31372		
23	31373		
24	31374		
25	31375		
26	31376		
27	31377		
28	31378		
29	31379		
30	31380		
31	31381		
32	31382		
33	31383		
34	31384		
35	31385		

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

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8.1.7 C2 Options Address/Unit Distribution

The following tables describe the unit distribution across the C2 Complex Multicast PITCH feeds.

Primary Datacenter		Gig-Shaped [WAC] 174.136.164.64/28		Gig-Shaped [WBC] 174.136.164.80/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30301	224.0.131.248	224.0.131.250	233.130.124.248	233.130.124.250
2	30302				
3	30303				
4	30304				
5	30305				
6	30306				
7	30307				
8	30308				
9	30309				
10	30310				
11	30311				
12	30312				
13	30313				
14	30314				
15	30315				
16	30316				
17	30317	224.0.131.249	224.0.131.251	233.130.124.249	233.130.124.251
18	30318				
19	30319				
20	30320				
21	30321				
22	30322				
23	30323				
24	30324				
25	30325				
26	30326				
27	30327				
28	30328				
29	30329				
30	30330				
31	30331				
32	30332				
33	30333				

Note – Cboe reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration. Addresses in the gray area are pre-assigned but not available. Customers should not configure their networks or systems for these addresses.

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Secondary Datacenter		Gig-Shaped [WEC] 170.137.17.96/29	
Unit	**IP Port**	**Real-time MC**	**Gap Response MC**
1	31301	233.182.199.104	233.182.199.106
2	31302		
3	31303		
4	31304		
5	31305		
6	31306		
7	31307		
8	31308		
9	31309		
10	31310		
11	31311		
12	31312		
13	31313		
14	31314		
15	31315		
16	31316		
17	31317	233.182.199.105	233.182.199.107
18	31318		
19	31319		
20	31320		
21	31321		
22	31322		
23	31323		
24	31324		
25	31325		
26	31326		
27	31327		
28	31328		
29	31329		
30	31330		
31	31331		
32	31332		
33	31333		

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

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8.1.8 EDGX Options Address/Unit Distribution

The following tables describe the unit distribution across the EDGX Complex Multicast PITCH feeds.

Primary Datacenter		Gig-Shaped [EAC] 174.136.164.32/28		Gig-Shaped [EBC] 174.136.164.48/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30551	224.0.131.152	224.0.131.154	233.130.124.152	233.130.124.154
2	30552				
3	30553				
4	30554				
5	30555				
6	30556				
7	30557				
8	30558				
9	30559				
10	30560				
11	30561				
12	30562				
13	30563				
14	30564				
15	30565				
16	30566				
17	30567	224.0.131.153	224.0.131.155	233.130.124.153	233.130.124.155
18	30568				
19	30569				
20	30570				
21	30571				
22	30572				
23	30573				
24	30574				
25	30575				
26	30576				
27	30577				
28	30578				
29	30579				
30	30580				
31	30581				
32	30582				
33	30583				

Note – Cboe reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration. Addresses in the gray area are pre-assigned but not available. Customers should not configure their networks or systems for these addresses.

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Secondary Datacenter		Gig-Shaped [EEC] 174.136.174.144/28	
Unit	IP Port	Real-time MC	Gap Response MC
1	31951	233.19.3.136	233.19.3.138
2	31952		
3	31953		
4	31954		
5	31955		
6	31956		
7	31957		
8	31958		
9	31959		
10	31960		
11	31961		
12	31962		
13	31963		
14	31964		
15	31965		
16	31966		
17	31967	233.19.3.137	233.19.3.139
18	31968		
19	31969		
20	31970		
21	31971		
22	31972		
23	31973		
24	31974		
25	31975		
26	31976		
27	31977		
28	31978		
29	31979		
30	31980		
31	31981		
32	31982		
33	31983		

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

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8.2 Certification Environment Configuration

8.2.1 Unit/Product Distribution

Unit	BZX/C2/EDGX Symbol Range	BZX/C2/EDGX Exceptions	C1 Symbol Range	C1 Exceptions
1	A – ADOZZ		A – ACNAZ	
2	ADP – ANETZ	Excludes AMZN	ACNB – AMGNZ	
3	ANEU – BAAAZ		AMGO – BAAZ	Excludes AMZN
4	BAAB – BKNFZ		BAB – BKNFZ	
5	BKNG – BZZZZ		BKNG – CASZZ	
6	C – CLGXZ		CAT – COOZZ	
7	CLGY – CSXAZ		COP – DEAAZ	
8	CSXB – DISAZ		DEAB – EEMAZ	Excludes DJX
9	DISB – ETFBZ	Excludes DJX	EEMB – FBAAZ	
10	ETFC – FIVDZ		FBAB – GOOFZ	
11	FIVE – GLDAZ		GOOG – GOOGZ	
12	GLDB – GOOGZ		GOOH – IFFAZ	
13	GOOH – HSXZZ		IFFB – IWLZZ	
14	HSY – IWLZZ		IWM – IWMAZ	
15	IWM – JNJAZ		IWMB – LOVZZ	
16	JNJB – LMTAZ		LOW – MPCAZ	
17	LMTB – MLNXZ		MPCB – NFLWZ	Excludes MXEA, MXEF
18	MLNY – MUAAZ		NFLX – NUEAZ	
19	MUAB – NTESZ		NUEB – PEPAZ	Excludes OEX
20	NTET – OXYAZ		PEPB – ROKUZ	Excludes QQQ, RLG, RLV
21	OXYB – QGENZ		ROKV – SPZZZ	Excludes RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPX, SPXW, SPY
22	QGEO – RHAAZ		SQ – TLRYZ	
23	RHAB – SMGZZ	Excludes RUT, RUTW	TLRZ – TSLAZ	
24	SMH – SYEZZ	Excludes SPY	TSLB – UVXXZ	Excludes UKXM
25	SYF – TSKZZ		UVXY – VZZZZ	Excludes VIX, VIXW
26	TSL – UALAZ		W – XLEAZ	Excludes XEO
27	UALB – VLOAZ		XLEB – ZZZZZ	Excludes XSP
28	VLOB – WDCAZ		QQQ	
29	WDCB – XLDZZ		AMZN	
30	XLE – ZZZZZ	Excludes XSP	SPY	
31	AMZN		DJX, MXEA, MXEF, OEX, RLG, RLV, RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, XEO, UKXM, XSP	
32	SPY		VIX, VIXW	
33	RUT (BZX only) DJX, RUT, RUTW (C2 only) XSP (EDGX only)		SPX	
34	N/A		SPXW	
35	N/A		SPX/SPXW, Cross Product Spreads	

Note – Cboe reserves the right to add units and/or change symbol distribution with 48 hours of notice and no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.

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8.2.2 Options Multicast Routing Parameters

Primary Certification Data Center	Rendezvous Point
C2 and EDGX	74.115.128.129
C1	74.115.128.131

8.2.3 C1 Options Address/Unit Distribution

The following table describes the unit distribution across certification C1 Complex Multicast PITCH feeds out of the Primary datacenter.

Primary Datacenter		Certification 170.137.126.16/28	
Unit	IP Port	Real-time MC	Gap Resp. MC
1	32351	233.103.126.8	233.103.126.10
2	32352		
3	32353		
4	32354		
5	32355		
6	32356		
7	32357		
8	32358		
9	32359		
10	32360		
11	32361		
12	32362		
13	32363		
14	32364		
15	32365		
16	32366		
17	32367	233.103.126.9	233.103.126.11
18	32368		
19	32369		
20	32370		
21	32371		
22	32372		
23	32373		
24	32374		
25	32375		
26	32376		
27	32377		
28	32378		
29	32379		
30	32380		
31	32381		
32	32382		
33	32383		
34	32384		
35	32385		

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

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8.2.4 C2 Options Address/Unit Distribution

The following table describes the unit distribution across certification C2 Complex Multicast PITCH feeds out of the Primary datacenter.

Primary Datacenter		Certification 174.136.160.80/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32251	224.0.74.160	224.0.74.162
2	32252		
3	32253		
4	32254		
5	32255		
6	32256		
7	32257		
8	32258		
9	32259		
10	32260		
11	32261		
12	32262		
13	32263		
14	32264		
15	32265		
16	32266		
17	32267	224.0.74.161	224.0.74.163
18	32268		
19	32269		
20	32270		
21	32271		
22	32272		
23	32273		
24	32274		
25	32275		
26	32276		
27	32277		
28	32278		
29	32279		
30	32280		
31	32281		
32	32282		
33	32283		

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

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8.2.5 EDGX Options Address/Unit Distribution

The following table describes the unit distribution across certification EDGX Complex Multicast PITCH feeds out of the Primary datacenter.

Primary Datacenter		Certification 174.136.174.176/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32551	224.0.74.184	224.0.74.186
2	32552		
3	32553		
4	32554		
5	32555		
6	32556		
7	32557		
8	32558		
9	32559		
10	32560		
11	32561		
12	32562		
13	32563		
14	32564		
15	32565		
16	32566		
17	32567	224.0.74.185	224.0.74.187
18	32568		
19	32569		
20	32570		
21	32571		
22	32572		
23	32573		
24	32574		
25	32575		
26	32576		
27	32577		
28	32578		
29	32579		
30	32580		
31	32581		
32	32582		
33	32583		

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

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9 Options Trade Condition Codes

The following table defines valid values for the *Trade Condition* field.

Type	Field Value
f	Complex to Complex Electronic Trade Cboe auction type is COA
g	Complex Auction Trade Cboe order types include C-AIM, C-SAM
h	Complex Cross Cboe auction types include Cust to Cust C-AIM, C-QCC
j	Complex Electronic Trade Against Single Leg(s)
k	Complex with Stock Options Auction Trade Cboe auction types include C-AIM w/ Stock, C-SAM w/ Stock
n	Complex with Stock Electronic Trade Includes COA auctions done electronically
o	Complex with Stock Cross Cboe auction types include C-QCC w/ Stock
I	Electronic Trade
O*	Opening Trade

*****The *Trade Condition* value of "O=Opening Trade" will continue to be disseminated on the options PITCH and TOP feeds but will not be sent to OPRA.

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10 Connectivity

10.1 Supported Extranet Carriers

Cboe has certified a number of carriers defined in the Cboe US Equity/Options Connectivity Manual with respect to redistribution of Cboe Multicast data feeds. For more information on receiving Multicast PITCH through any of these providers, reach out to the vendor contact noted in the Extranet Providers section of the Connectivity Manual.

10.2 Bandwidth Recommendation

The Gig-shaped feeds require 1Gbps of bandwidth. Cboe will use 90% of these respective bandwidths for Multicast PITCH to allow customers to use the same physical connection for FIX order entry if desired.

10.3 Multicast Test Program

The ZIP file located at http://www.batstrading.com/resources/membership/mcast_pitch.zip contains a sample program that may be used to test Multicast PITCH feed connections and to troubleshoot Multicast issues. Refer to the included README file for build and usage information.

11 References

For more information on Cboe Symbology, please refer to the Cboe Symbology Reference document.

12 Support

Please e-mail questions or comments regarding this specification to tradedesk@cboe.com.

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Revision History

Document Version	Date	Description
2.0.0	05/11/17	Initial version of US Options Complex Multicast PITCH Specification based on Multicast PITCH 2.X.
2.0.1	05/18/17	Various minor updates and clarification added.
2.0.2	07/28/17	Added Multicast Ips/Ports for Certification environment. Added `Auction Update` and `Auction Summary` messages.
2.0.3	08/08/17	Added Multicast Ips/Ports for Production environment.
2.0.4	09/01/17	Added C2 Options references.
2.0.5	10/17/17	Cboe branding/logo changes.
2.0.6	11/24/17	Added C2 Options Certification IP and Port information. Added RUT, RUTW options (C2 Options Only) to distinct unit (unit 33).
2.0.7	02/05/18	Removed the "A" *Trading Status* field value as this is used for equities only. Added C2 Options Production IP and Port information.
2.0.8	03/08/18	Updated Unit Distribution ranges.
2.0.9	03/23/18	Unit Distribution ranges Effective Date updated to 4/14/18.
2.1.0	11/16/18	Added support for Cboe Options Exchange.
2.1.1	12/06/18	Added notes identifying Feature Pack 4 updates.
2.1.2	12/21/19	Removed Floor Trade value from *Trade Condition* field, as this was added in error. Added a note of clarification, indicating that a `Trade` message can also be sent when an auction executes against a non-displayed order, such as a contra response.
2.1.3	02/14/19	Corrected value of Complex AIM value to "B"for *Auction Type* field in `Auction Notification` message. Added certification IP port information.
2.1.4	03/04/19	Added matching engine unit 33 information in support of XSP trading on EDGX Options effective 04/08/19. Added C1 primary data center rendezvous point IP address and C1 Certification symbol ranges.
2.1.5	04/15/19	Added C1 production IP port and unit distribution. `Transaction Begin` and `Transaction End` messages are currently restricted to C1 only. Added DJX to C2 ME 33 in Unit/Product Distribution tables (effective 05/08/19).

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2.1.6	05/01/19	Added note indicating `Transaction Begin` and `Transaction End` messages will be disseminated for C2 and EDGX options (effective with C1 Feature Pack 7).
2.1.7	05/08/19	Removed *Trading Status* value 'S' = Exchange Specific Suspension. Corrected C1 Production Gig-Shaped [CAC] and [CBC] source network IP addresses.
2.1.8	05/14/19	Added *Composite Market Bid Price* and *Composite Market Offer Price* fields to the `Options Auction Update` message and updated associated example message. Added additional proprietary products to matching unit 31 in C1.
2.1.9	06/12/19	Corrected certification and production C1 symbol range for units 9 and 20.
2.1.10	08/02/19	Added note indicating `Options Auction Update` message *Opening Condition* field value will always be zero. Updated example message. Removed Complex Instrument Definition from list of PITCH 2.X messages. Corrected Leg Count field description in `Complex Instrument Definition Expanded` message to indicate a total of 12 legs are allowed.
2.1.11	09/18/19	Corrected OSI Symbol example values in `Symbol Mapping` message type example.
2.1.12	10/03/19	Corrected UKXM symbol exclusion entry in Unit Distribution table. Changed instances of `Complex Instrument Definition` to `Complex Instrument Definition Expanded`, as the former was deprecated 02/28/19.
2.1.13	10/31/19	Clarified description of `Time` message. Added Options Trade Condition section (effective 01/13/20).
2.1.14	11/12/19	Added note indicating Unit Clear message is sent at the beginning of the day for Equities only. Added note indicating GTH will be applicable for C1 only as GTH is being sunset for C2 and EDGX (effective 11/22/19).
2.1.15	12/19/19	Updated Options Trade Condition Codes by adding 'O' =Opening Trade and correcting field value description for 'p'by removing "Includes Complex Auctions on the Floor". (Effective 01/13/20).
2.1.16	01/03/20	Updated description of Options Trade Condition Code 't' to read, Complex Floor Trade of Proprietary Products Marked as "Combo Order" .

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2.1.17	01/08/20	Removed “l = Complex Auction Against Single Legs(s)” from Options Trade Condition Codes table.
2.1.18	01/31/20	Corrected Unit Symbol Distribution tables to indicate QQQ is an exception for C1 Unit 20 as it has a dedicated location on Unit 28. Updated Complex Trade Condition Values.

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