US Equities/Options Multicast Depth of Book (PITCH) Specification

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1 Introduction

1.1 Overview

Note that this specification will be the standard Multicast PITCH specification to be used for Cboe BYX Exchange, BZX Exchange, EDGA Exchange, EDGX Exchange, BZX Options Exchange, Cboe Options Exchange ("C1"), C2 Options Exchange, and EDGX Options Exchange platforms.

Cboe members may use Multicast PITCH to receive real-time depth of book quotations, execution information and auction update information during auctions for Cboe listed securities. Cboe Auction Update and Auction Summary messages support the Cboe Opening, Closing, Halt and IPO Auctions on the BZX Exchange. Refer to the Cboe US Equities Auction Process specification for more information on Cboe Auctions.

One or more of WAN-Shaped, Gig-Shaped, 5-Gig Shaped, or 8-Gig Shaped versions of the Multicast PITCH feed may be available from one or both of Cboe's datacenters. Members may choose to take one or more of the following Multicast PITCH feed options depending on their location and connectivity to Cboe.

1.2 Multicast PITCH Feed Descriptions

Exchange	Shaping (Gig/WAN)	Served From Data Center (Primary/Secondary)	Multicast Feed ID
BYX Exchange	Gig	Primary	YA
BYX Exchange	Gig	Primary	YB
BYX Exchange	WAN	Primary	YC
BYX Exchange	WAN	Primary	YD
BYX Exchange	WAN	Secondary	YE
BZX Exchange	Gig	Primary	ZA
BZX Exchange	Gig	Primary	ZB
BZX Exchange	WAN	Primary	ZC
BZX Exchange	WAN	Primary	ZD
BZX Exchange	WAN	Secondary	ZE
EDGA Exchange	Gig	Primary	AA
EDGA Exchange	Gig	Primary	AB
EDGA Exchange	WAN	Primary	AC
EDGA Exchange	WAN	Primary	AD
EDGA Exchange	WAN	Secondary	AE
EDGX Exchange	Gig	Primary	XA
EDGX Exchange	Gig	Primary	XB
EDGX Exchange	WAN	Primary	XC
EDGX Exchange	WAN	Primary	XD
EDGX Exchange	WAN	Secondary	XE
BZX Options	Gig	Primary	OA
BZX Options	Gig	Primary	OB
BZX Options	5-Gig	Primary	OC

BZX Options	5-Gig	Primary	OD
BZX Options	Gig	Secondary	OE
Cboe Options	5-Gig	Primary	CA
Cboe Options	5-Gig	Primary	CB
Cboe Options	8-Gig	Primary	CC
Cboe Options	8-Gig	Primary	CD
Cboe Options	5-Gig	Secondary	CE
C2 Options	Gig	Primary	WA
C2 Options	Gig	Primary	WB
C2 Options	5-Gig	Primary	WC
C2 Options	5-Gig	Primary	WD
C2 Options	Gig	Secondary	WE
EDGX Options	Gig	Primary	EA
EDGX Options	Gig	Primary	EB
EDGX Options	5-Gig	Primary	EC
EDGX Options	5-Gig	Primary	ED
EDGX Options	Gig	Secondary	EE

1.3 24x5 Feed Hours and System Restart (C1 Options Only)

For C1 Options operating in 24x5 mode, the PITCH feed starts on Sunday at approximately 1:00 p.m. ET and shuts down on Friday at approximately 5:30 p.m. ET. A daily restart occurs between 5:30 and 7:00 p.m. ET each day at which time sequences will be reset. The daily restart is typically observed between 5:30 p.m. and 6:00 p.m. ET, but could occur later (between 6:00 p.m. and 7:00 p.m ET) if needed for operational reasons. Feed startup and shutdown times may be adjusted without notice.

Under normal operations, it is expected that the order books are cleared (Delete Order messages sent for any open orders, including GTC and GTD orders), prior to the daily restart and reset of sequences. Persisted GTC and GTD orders will be added back onto the order books immediately after restart.

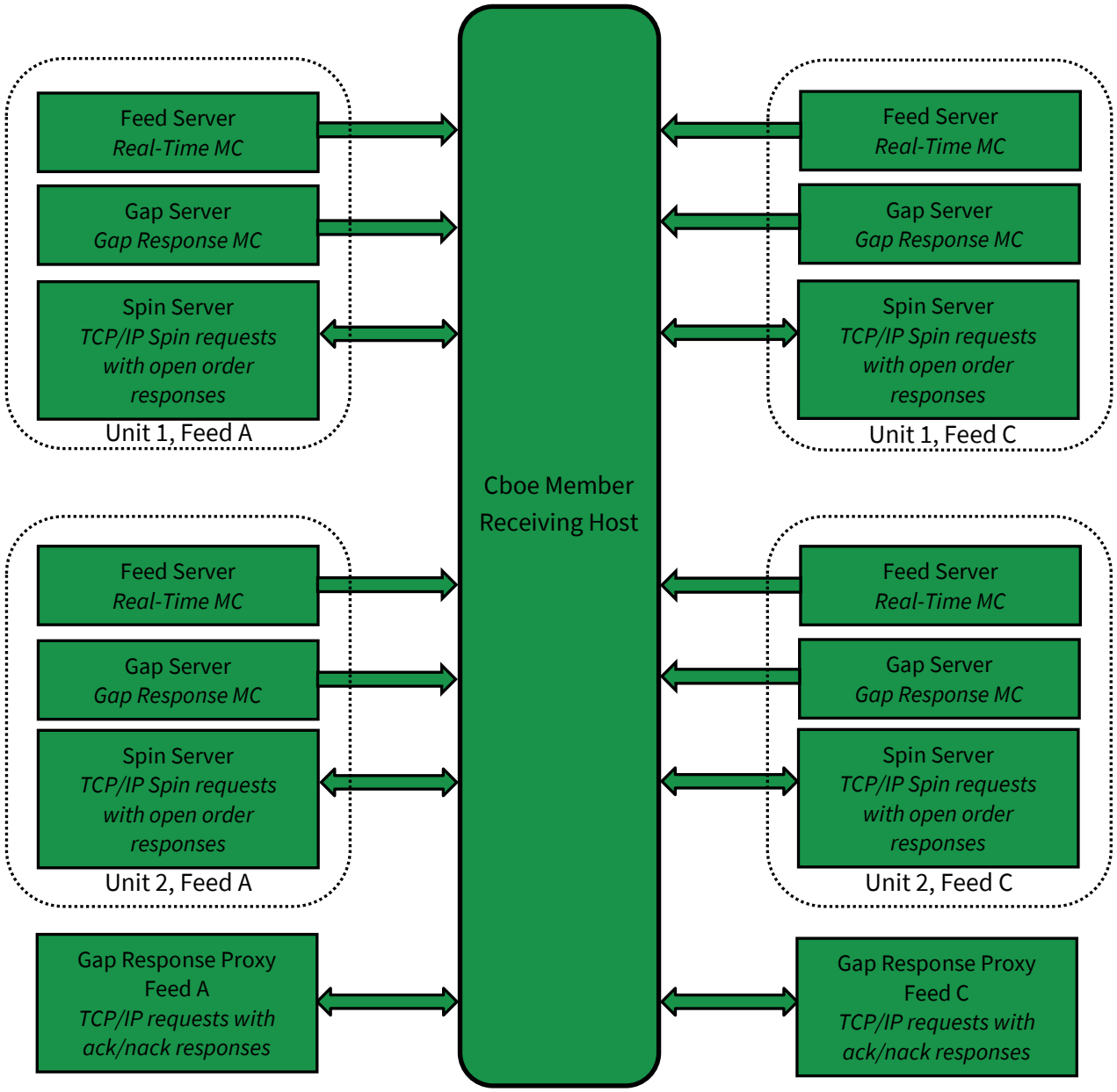
1.4 Feed Connectivity Requirements

- Gig Shaped feeds are available to members with a minimum of 1 Gb/s of connectivity to Cboe via cross connect or dedicated circuit.
- 5-Gig and 8-Gig Shaped Options feeds are available to members with a minimum of 10 Gb/s of connectivity to Cboe via cross connect or dedicated circuit.
- WAN-Shaped feeds are available to members who meet the minimum bandwidth requirements to Cboe via cross-connect, dedicated circuit, or a supported carrier.

Members with sufficient connectivity may choose to take both the A/B (Gig) and C/D (5-Gig, 8 Gig, or WAN) feeds from one of Cboe datacenters and arbitrate the feeds to recover lost data. Alternatively, members may choose to arbitrate feeds from both datacenters. 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 and business continuity processing.

Cboe 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 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 Multicast PITCH feed message flow between Cboe and a member feed handler that is listening to the “A” and “C” instances of two units:



1.5 Symbol Ranges, Units, and Sequence Numbers

Symbols will be separated into units by a published alphabetical 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 members. Care should be taken to ensure that address changes, address additions, and symbol distribution changes can be supported easily.

Message sequence numbers start at one at the beginning of the day and are incremented by one for every sequenced message within a particular symbol unit. When the message sequence number reaches the maximum value of an unsigned 32-bit integer (2^32 – 1, or 4,294,967,295), the message sequence number will rollover to one (not zero which implies un-sequenced). The rollover handling must also be applied to the Gap and Spin servers.

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

1.6 Options Specific Symbol Processing

Cboe has implemented a symbol mapping mechanism for the options Multicast PITCH feeds due to the large size of options symbols and to keep the options Multicast PITCH specification consistent with the equities Multicast PITCH specification. This symbol mapping mechanism significantly reduces the size of the Multicast PITCH feed for options and allows members to use the same feed handler for Cboe equity and options exchanges.

Real-time symbol mapping messages are available on each unit's multicast feed. `Symbol Mapping` messages are used to map the 6 character feed symbol (used in all other Pitch 2.X messages) to an OSI symbol and Underlying. `Symbol Mapping` messages are un-sequenced messages and are sent continuously from pre-market through the end of trading. The rate is variable and will be adjusted as bandwidth allows.

In addition to the symbol mapping events available on the Multicast PITCH feed, a downloadable file with current mappings is available via the Listed Series (csv) link on the Market Data page of the Cboe Options web site.

1.7 Gap Request Proxy and Message Retransmission

Requesting delivery of missed data is achieved by connecting to a Cboe Gap Request Proxy (GRP). Members 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. Members 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 requested unit. Members will receive a total daily allowance of gap requested messages. In addition, each member 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. Members 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.

1.8 Spin Servers

A Spin Server is available for each unit. The server allows members to connect via TCP and receive a spin of all currently open orders and symbols with limited trading conditions on that unit. By using the spin, a member can get the current Cboe 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. Using a `Spin Request` message, a member 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 Member 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 the message types listed below:

US Equities

- Time
- Add Order (long, short, expanded)
- Trading Status
- Auction Update (BZX only)
- Retail Price Improvement (BYX only)

US Options

- Time
- Add Order (long, short, expanded)
- Trading Status

Trading Status messages will be sent in spins for all symbols that are not "S"uspended, which results in at least one message for every symbol 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 member must buffer multicast messages received. If the Spin Image Available message sequence number is the Member's reference point, multicast messages with larger sequence numbers should be buffered. If a non-Spin Image Available sequence number is the Member's reference point which they send in their Spin Request, they should buffer from that point on, but note that the spin they will receive sequence numbers beyond that point which they may disregard. 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 options Symbol Mapping 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 6 shows an example flow of messages between a member and Cboe's Multicast PITCH feed and Spin Server.

2 Protocol

Cboe 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 Specification.

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

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. Members 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.

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).
- **Binary Short Price** fields are unsigned Little Endian encoded 2 byte binary fields with 2 implied decimal places (denominator = 100).
- **Binary Long Price** fields are unsigned 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.
- **Binary Date** fields are 4 byte unsigned Little Endian values 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** fields are unsigned Little Endian encoded 4 byte binary fields with 1 implied decimal place (demoninator = 10).

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 versus B and A versus C) 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 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.

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 previous 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 logic must account for sequence number rollover 4,294,967,295 to 1. 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 Execution IDs

The 1st character of an Execution ID (after converting to a 9 character base 36 number zero-padded on the left) may be used to differentiate between internal matched trades, internal auction fills, and routed trades as follows:

- 0 (zero) = Cboe Internal Match
- 1 = Cboe Internal Match (C1 Options Only)
- 2 = Cboe Internal Match (C1 Options Only)
- C = Auction Fill
- M = Cboe Market Close Trade
- P = Periodic Auction Trade (BYX Only)
- R = Routed Trade

2.6 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 a.m. – 1:00 a.m. ET or during maintenance windows.

Cboe expects heartbeat messages to be sent to the GRP and Spin Servers on live connections no less than every 5 seconds. Failure to receive two consecutive heartbeat messages will result in the GRP or Spin Servers terminating the client connection.

3 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. Members only need to implement the following messages if gap requests will be made. Each of the following message types must be wrapped by an unsequenced unit header as described in Section 2.4. The following messages will not be delivered using multicast.

3.1 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				

3.2 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

3.3 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				

3.4 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.

3.5 Gap Server Rollover Usage Example

The following describes the exchange of messages between a member and Cboe's Multicast PITCH feed and Gap Server during rollover.

The member detects a gap, having received sequence 4,294,967,293 and then sequence 3. The member recognizes this as a roll-over and sends a Gap Request to the GRP with Sequence 4,294,967,294 (first sequence in the range) and a Count of 4 (since zero is not included in a roll-over).

The GRP sends a Gap Response with a Sequence of 4,294,967,294 and Count of 4 (to match the request), with a Status of Accepted.

The Gap Server sends the requested gap messages which are sequences: 4,294,967,294 ; 4,294,967,295 ; 1 ; and 2. The member uses these messages to fill the gap.

4 PITCH 2.X Messages

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

4.1 Time Reference (C1 Options Only)

The `Time Reference` message is used to provide a midnight reference point for recipients of the feed. It is sent whenever the system starts up and when the system crosses a midnight boundary. All subsequent `Time` messages for the same unit will the use the last *Midnight Reference* until another `Time Reference` message is received for that unit. The `Time Reference` message includes the *Trade Date*, so most other sequenced messages will not include that information.

`Time Reference` messages will be included in a spin response.

Time Reference				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0xB1	`Time Reference` Message
Midnight Reference	2	4	Binary	Midnight Eastern Time reference time for subsequent `Time` messages, expressed as number of whole seconds since the Epoch (Midnight January 1, 1970 UTC).
Time	6	4	Binary	Number of whole seconds from midnight Eastern time.
Time Offset	10	4	Binary	Nanosecond offset from last unit timestamp.
Trade Date	14	4	Binary Date	Current Trade Date
Total Length = 18 bytes				

4.2 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. The *Time* field is the number of seconds relative to midnight Eastern Time. 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. On C1 Options only, the `Time` message includes the *Epoch Time* field, which is the current time represented as the number of whole seconds since the Epoch (midnight January 1, 1970).

For C1 Options only, a given trading day may span multiple calendar days. C1 options market data recipients must prepare for a crossing of the midnight ET boundary. At such time, a new `Time Reference` message will be sent and the *Time* field in subsequent `Time` messages will reset to reflect the number of seconds from the most recent midnight ET time.

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
Epoch Time	6	4	Binary	*C1 Options Only* Number of whole seconds since the Epoch (midnight January 1, 1970 UTC).
Total Length = 6 bytes, 10 bytes for *C1 Options Only*				

4.3 Unit Clear

The `Unit Clear` message instructs feed recipients to clear all orders for the Cboe 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				

4.4 Transaction Begin (Options Only)

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.

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				

4.5 Transaction End (Options Only)

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				

4.6 Add Order

An `Add Order` message represents a newly accepted visible order on the Cboe book. It includes a day-specific Order Id assigned by Cboe to the 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	Number of shares/contracts being added to the book (may be less than the number entered).
Symbol	19	6	Printable ASCII	*Symbol* right padded with spaces.
Price	25	8	Binary Long Price	The limit order price
Add Flags	33	1	Bit Field	**Bit 0 – Display** `0` = Order is not displayed in the Cboe SIP quote `1` = Order is displayed in the Cboe SIP quote **Bits 1– 2 – Reserved** **Bit 3 – AON (Options only)** `0` = Order is a firm quote `1` = Order is AON (All or None) **Bits 4-7 – 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	Number of shares/contracts being added to the book (may be less than the number entered).
Symbol	17	6	Printable ASCII	*Symbol* right padded with spaces.
Price	23	2	Binary Short Price	The limit order price
Add Flags	25	1	Bit Field	**Bit 0 – Display** `0` = Order is not displayed in the Cboe SIP quote `1` = Order is displayed in the Cboe SIP quote **Bits 1– 2 – Reserved** **Bit 3 – AON (Options only)** `0` = Order is a firm quote `1` = Order is AON (All or None) **Bits 4-7 – Reserved**
Total Length = 26 bytes				

The following **expanded** version of the `Add Order` message has been made available to accommodate larger symbol sizes possible through the ISRA plan.

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
Side Indicator	14	1	Alphanumeric	`B` = Buy Order `S` = Sell Order
Quantity	15	4	Binary	Number of shares/contracts being added to the book (may be less than the number entered).
Symbol	19	8	Printable ASCII	*Symbol* right padded with spaces.
Price	27	8	Binary Long Price	The limit order price

Add Flags	35	1	Bit Field	**Bit 0 – Display** `0` = Order is not displayed in the Cboe SIP quote `1` = Order is displayed in the Cboe SIP quote **Bits 1– 2 – Reserved** **Bit 3 – AON (Options only)** `0` = Order is a firm quote `1` = Order is AON (All or None) **Bits 4-7 – Reserved**
ParticipantID	36	4	Alphanumeric	*Optionally specified.* If specified, MPID (equities) or Executing Firm ID (options) of firm attributed to this quote. Alternatively "RTAL" for retail specified orders (equities). Space filled otherwise.
Customer Indicator	40	1	Alphanumeric	*BZX/C1/EDGX Options Only (space filled on C2 Options and all equities markets).* N = Non-Customer C = Customer R = Retail Priority order (EDGX Equities only)
Client ID	41	4	Alphanumeric	*Options Only* Optional user specified value attributed to this quote. Space filled otherwise.
Total Length = 45 bytes for options, 41 bytes for equities				

4.7 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 order and the effects are cumulative. Modify messages may update the size and/or the price of an order on the book. When the remaining size of an order reach zero, the order is dead and should be removed from the book.

4.7.1 Order Executed

`Order Executed` messages are sent when a visible order on the Cboe 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*.

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
Executed Quantity	14	4	Binary	Number of shares/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
Trade Condition	26	1	Alphanumeric	***Options Only (byte not sent in Equities)*.** **See Options Trade Condition Codes section for details about new codes.**
Total Length = 27 bytes (*Options*), 26 bytes (*Equities*)				

4.7.2 Order Executed at Price/Size

`Order Executed at Price/Size` messages are sent when a visible order on the Cboe 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 order should be completely removed from the book.

`Order Executed 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 order should be prioritized the same as a new order. For example,

- A buy order on the book has 100 shares/contracts of existing size at $1.00.
- An `Order Executed at Price/Size` is sent for this order with *Executed Quantity* = 100 and *Remaining Quantity* = 100 with a price of $1.01.
- The trade of 100 shares/contracts at $1.01 should be recorded and the order placed back on the book at $1.00 for 100 shares/contracts (*Remaining Quantity*) with a new timestamp.

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	Number of shares/contracts executed
Remaining Quantity	18	4	Binary	Number of shares/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
Trade Condition	38	1	Alphanumeric	***Options Only (byte not sent in Equities)*** **See Options Trade Condition Codes section for details about new codes.**
Total Length = 39 bytes (*Options*), 38 bytes (*Equities*)				

4.7.3 Reduce Size

`Reduce Size` messages are sent when a visible order on the Cboe 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	Number of shares/contracts 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	Number of shares/contracts canceled
Total Length = 16 bytes				

4.7.4 Modify Order

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.

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	Number of shares/contracts associated with this order after this modify (may be less than the number entered)
Price	18	8	Binary Long Price	The limit order price after this modify
Modify Flags	26	1	Bit Field	**Bit 0 – Display** `0` = Order is not aggregated in the Cboe SIP quote `1` = Order is aggregated in the Cboe SIP quote **Bit 1 – Maintain Priority** `0` = Reset Priority `1` = Maintain Priority **Bits 2-7 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	Number of shares/contracts associated with this order after this modify (may be less than the number entered)
Price	16	2	Binary Short Price	The limit order price after this modify
Modify Flags	18	1	Bit Field	**Bit 0 – Display** `0` = Order is not aggregated in the Cboe SIP quote `1` = Order is aggregated in the Cboe SIP quote **Bit 1 – Maintain Priority** `0` = Reset Priority `1` = Maintain Priority **Bits 2-7 Reserved**
Total Length = 19 bytes				

4.7.5 Delete Order

The `Delete Order` message is sent whenever a booked order is cancelled or leaves the order book. The *Order Id* refers to the *Order Id* of the original `Add Order` message. An order that is deleted from the book may return to the book later under certain circumstances. Therefore, a `Delete Order` message does not indicate that a given *Order Id* will not be sent again on a subsequent `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 been removed from order book.
Total Length = 14 bytes				

4.8 Trade

The `Trade` message provides information about executions of non-displayed orders on the Cboe book and routed executions to other trading centers. In options 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 book and can be ignored if messages are being used solely to build 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 or routed order is executed in whole or in part. A `Trade` message is also sent when there is an execution against any non-displayed portion of a reserve order. As with visible orders, hidden, routed and reserve orders may be executed in parts. A complete view of all Cboe 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 member's own orders upon request. As such, partial executions against the same hidden order will by default have different *Order IDs*.

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	Obfuscated *Order ID* or *Order Id* of the executed order.

Side Indicator	14	1	Alphanumeric	Always "B" = Buy Order regardless of resting side
Quantity	15	4	Binary	Incremental number of shares/contracts executed
Symbol	19	6	Printable ASCII	*Symbol* right padded with spaces.
Price	25	8	Binary Long Price	The execution price of the order
Execution Id	33	8	Binary	Cboe generated day-unique execution identifier of this trade. *Execution Id* is also referenced in the `Trade Break` message.
Trade Condition	41	1	Alphanumeric	***Options Only (byte not sent in Equities)*** **See Options Trade Condition Codes section for details about new codes.**
Total Length = 42 bytes (*Options*), 41 bytes (*Equities*)				

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	Obfuscated *Order ID* or *Order Id* of the executed order.
Side Indicator	14	1	Alphanumeric	Always "B" = Buy Order regardless of resting side
Quantity	15	2	Binary	Incremental Number of shares/contracts executed
Symbol	17	6	Printable ASCII	*Symbol* right padded with spaces.
Price	23	2	Binary Short Price	The execution price of the order
Execution Id	25	8	Binary	Cboe generated day-unique execution identifier of this trade. *Execution Id* is also referenced in the `Trade Break` message.
Trade Condition	33	1	Alphanumeric	***Options Only (byte not sent in Equities)*** **See Options Trade Condition Codes section for details about new codes.**
Total Length = 34 bytes (*Options*), 33 bytes (*Equities*)				

The following **expanded** version of the Trade message has been made available to accommodate larger symbol sizes possible through the ISRA plan.

Trade (expanded)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x30	`Trade` Message (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 executed order.
Side Indicator	14	1	Alphanumeric	Always "B" = Buy Order regardless of resting side
Quantity	15	4	Binary	Incremental number of shares/contracts executed
Symbol	19	8	Printable ASCII	*Symbol* right padded with spaces.
Price	27	8	Binary Long Price	The execution price of the order
Execution Id	35	8	Binary	Cboe generated day-unique execution identifier of this trade. *Execution Id* is also referenced in the `Trade Break` message.
Trade Condition	41	1	Alphanumeric	***Options Only (byte not sent in Equities)*** **See Options Trade Condition Codes section for details about new codes.**
Total Length = 44 bytes (*Options*), 43 bytes (*Equities*)				

4.9 Trade Break

The `Trade Break` message is sent whenever an execution on Cboe is broken. Trade breaks are rare and only affect applications that rely upon Cboe execution-based data. Applications that simply build a Cboe book can ignore `Trade Break` messages.

Trade Break				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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	Cboe execution identifier of the execution that was broken. *Execution Id* refers to previously sent `Order Executed` or `Trade` message.
Total Length = 14 bytes				

4.10 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				

4.11 Symbol Mapping (Options Only)

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.

Members who consume the 5 Gig or 8 Gig-Shaped Multicast PITCH feeds will be able to receive the full list of symbols in approximately 5 minutes, and will allow for optimal distribution in situations where market data is susceptible to throttling as a result of high message burst rates. All 1 Gigabit-Shaped ("1G-Shaped") feeds will continue to complete the full loop of *Symbol Mapping* messages in approximately 30 minutes.

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.
Total Length = 38 bytes				

4.12 Trading Status

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.

Equities

Trading Status of "S" is to be implied at system startup for all symbols. Starting at 6:00 a.m. ET, Cboe will send a *Trading Status* of "A" once orders can be accepted for queuing in preparation for the market open. At 7:00 a.m. ET, Cboe will send a *Trading Status* of "T" as symbols are open for trading on the Cboe platform. On EDGX only, Cboe will send a *Trading Status* of "A" starting at 2:30 a.m. ET and a *Trading Status* of "T" at 4:00 a.m. ET.

A `Trading Status` message will also be sent:

- for Regulatory "H"alts in any security as well as the "T"rading resumption for the same security.
- in the event of an Exchange specific "S"uspension.
- for Cboe Listed securities that are in a "Q"uoting period for auctions.
- to indicate a Reg SHO price test is in effect.

Trading Status (Equities)				
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
Symbol	6	8	Printable ASCII	*Symbol* right padded with spaces.
Trading Status	14	1	Alpha	`A` = Accepting Orders for Queuing (equities only) `H` = Halted `Q` = Quote-Only `S` = Exchange Specific Suspension `T` = Trading
Reg SHO Action	15	1	Alphanumeric	`0` = No price test in effect `1` = Reg SHO price test restriction in effect
Reserved1	16	1	Alpha	Reserved
Reserved2	17	1	Alpha	Reserved
Total Length = 18 bytes				

Options

A `Trading Status` message will be sent for all securities as they transition through various trading states.

Starting at 7:30 a.m. ET, Cboe will send a *Trading Status* of "Q" once orders can be accepted for queuing in preparation for the RTH open. At or after 9:30 a.m. ET, Cboe will send a *Trading Status* of "R" (Opening Rotation) followed by a *Trading Status* of "T" as series are opened for trading. Cboe will send a *Trading Status* of "L" as SPX or VIX series transition from RTH trading to Curb trading.

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.

The *Trading Status* field will be used to represent the status of the RTH (9:30 a.m. ET – 4:15 p.m. ET) and Curb sessions. The *GTH Trading Status* field will be used to represent the status of series that trade during the GTH session. The GTH session will run from 8:15 p.m. to 9:15 a.m. ET for SPX and VIX series (C1 Options Only).

Trading Status (Options)				
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
Symbol	6	6	Printable ASCII	*Symbol* right padded with spaces.
Reserved	12	2	Reverved	*Reserved*
Trading Status	14	1	Alpha	H = Halted L = Curb Trading (C1 Only) Q = Quote-Only R = Opening Rotation T = RTH Trading
Reserved	15	1	Reserved	Reserved
GTH Trading Status (C1 Only)	16	1	Alpha	H = Halted Q = Quote-Only R = Opening Rotation T = Trading
Reserved2	17	1	Alpha	Reserved
Total Length = 18 bytes				

4.13 Width Update (Options Only)

The `Width Update` message is used to communicate opening quote width multiplier. This message will be sent in the event that the exchange decides to change the quote width multiplier on a per underying basis. For complete details on the opening collars see the Cboe Opening Process Specification.

Width Update				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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.
Underlying	6	8	Printable ASCII	Underlying right padded with spaces.
Width Type	14	1	Alphanumeric	R = Regular V = Volatility
Multiplier	15	4	Multiplier	Width multiplier
Total Length = 19 bytes				

4.14 Auction Update (BYX and BZX Equities Only)

`Auction Update` messages are used to disseminate Cboe price and size information during auctions for Cboe listed securities and for Cboe Market Close (CMC) crosses on BZX, and for Periodic Auctions on BYX. Refer to the Cboe US Equities Auction Process specification for more information on Cboe Auctions.

Cboe `Auction Update` messages support the Cboe Opening, Closing, Halt and IPO Auctions on the BZX Exchange. `Auction Update` messages are sent every five seconds during a Halt/IPO Quote-Only period. Opening `Auction Update` messages are disseminated every five seconds between 8:00 and 9:30 a.m. ET Closing `Auction Update` messages are distributed every five seconds between 3:00 and 4:00 p.m ET.

At approximately 3:35 p.m. ET an `Auction Update` will be disseminated for any symbol with crossed Cboe Market Close shares. The *Buy Shares* and *Sell Shares* fields will each indicate matched shares.

The BZX `Auction Update` message has the following format:

Auction Update (BZX Equities)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x95	`Auction Update` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Stock Symbol	6	8	Printable ASCII	*Stock Symbol* right padded with spaces.
Auction Type	14	1	Alphanumeric	`O` = Opening Auction `C` = Closing Auction `H` = Halt Auction `I` = IPO Auction `M` = Cboe Market Close
Reference Price	15	8	Binary	BBO Collared auction price (see Auction Process Spec).
Buy Shares	23	4	Binary	Number of shares on buy side at the *Reference Price*. Shares matched for Cboe Market Close.
Sell Shares	27	4	Binary	Number of shares on sell side at the *Reference Price*. Shares matched for Cboe Market Close.
Indicative Price	31	8	Binary	Price at which the auction book and the continuous book would match.
Auction Only Price	39	8	Binary	Price at which the auction book would match using only *Eligible Auction Orders* (see Auction Process Spec).
Total Length = 47 bytes				

On the BYX Exchange, `Auction Update` messages will be sent out at a randomized time between the start of an auction period and the end of the auction period minus 1 millisecond to inform participants that a Periodic Auction is taking place. `Auction Update` messages will not include order imbalance information or information for continuous book orders.

Auction Update (BYX Equities)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x95	`Auction Update` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Stock Symbol	6	8	Printable ASCII	*Stock Symbol* right padded with spaces.
Auction Type	14	1	Alphanumeric	`P = Periodic Auction`
Reference Price	15	8	Binary	Collared price at which the periodic auction would trade. Calculated using orders eligible for periodic auction.
Buy Shares	23	4	Binary	Paired size of eligible periodic auction orders at the *Reference Price*.
Sell Shares	27	4	Binary	Paired size of eligible periodic auction orders at the *Reference Price*.
Indicative Price	31	8	Binary	N/A. Populated with zero.
Auction Only Price	39	8	Binary	N/A. Populated with zero.
Total Length = 47 bytes				

4.15 Options Auction Update (Options Only)

`Options Auction Update` messages are used to disseminate price and size information and Composite Market bid and offer prices during Opening and Re-Opening (halt) auctions on the Cboe Options Exchange. `Options Auction Update` 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. Refer to the Cboe Options Opening Process specification for more information.

The `Options Auction Update` message has the following format:

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.
Symbol	6	8	Printable ASCII	*Symbol* right padded with spaces.

Auction Type	14	1	Alphanumeric	`G = GTH Opening` (C1 Only)
				`O = RTH Opening` (C1 Only)
				`H = Halt Re-Opening`
				`V = Volatility Opening`

Reference Price	15	8	Binary Long Price	Collared VMIM price computed on the queuing book only.
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	Collared VMIM price computed on the combined queueing book and the continuous book. Equal to *Reference Price* for options that do not have a GTH trading session.
Auction Only Price	39	8	Binary Long Price	Uncollared VMIM price computed on the queuing book only.
Opening Condition	47	1	Alphanumeric	O = Would open Q = Need quote to open B = Need more buyers (C1 Only) S = Need more sellers (C1 Only) 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				

4.16 Auction Summary (BYX Equities, BZX Equities, and Options Only)

`Auction Summary` messages are used to disseminate the results of an auction of a Cboe listed security on BZX, the results of an Opening or Re-Opening of any options series on C1, and for Periodic Auctions on BYX.

Cboe `Auction Summary` messages support the Cboe Opening, Closing, Halt and IPO Auctions on the BZX Exchange. An `Auction Summary` message for each Cboe listed security is sent at the conclusion of its Opening Auction at 9:30 a.m. and represents the Cboe official opening price. A Closing `Auction Summary` message for each Cboe listed security is sent at the conclusion of its closing auction at 4:00 p.m. and represents the Cboe official closing price. An IPO `Auction Summary` message for each Cboe listed security is sent at the conclusion of the IPO Auction and represents the official Cboe IPO opening price.

`Auction Summary` messages are also used in support of Opening and Re-Openings on the Cboe Options Exchange, including those for both GTH and RTH sessions. These messages indicate the price and size executed in such an Opening or Re-Opening. Refer to the Cboe Options Opening Process specification for more information.

An `Auction Summary` message will be sent for Cboe Market Close (CMC) once the official closing price for each security is available. The *Price* and *Shares* field will indicate the price of the CMC match and the number of shares that were executed. If the official closing price is updated after its initial publication, then another Auction Summary message will be disseminated to reflect the updated price of the CMC match.

On the BYX Exchange, `Auction Summary` messages will be sent out upon conclusion of a Periodic Auction. `Auction Summary` messages will provide the results of the Periodic Auction, including the price and shares executed.

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.
Stock Symbol	6	8	Printable ASCII	*Stock Symbol* right padded with spaces.
Auction Type	14	1	Alphanumeric	`O` = Opening Auction (C1 Only) `C` = Closing Auction `G` = GTH Opening (C1 Only) `H` = Halt Auction `I` = IPO Auction `M` = Cboe Market Close `V` = Volitility Auction `P` = Periodic Auction (BYX Only)
Price	15	8	Binary Long Price	Auction price or CMC match price.
Shares/Contracts	23	4	Binary	Cumulative number of shares/contracts executed during the auction or CMC match.
Total Length = 27 bytes				

4.17 Auction Notification (C1 and EDGX Options Only)

`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				
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
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` = Bats Auction Mechanism (BAM) (EDGX Only) or AIM (C1 Only) `S` = Solicitation Auction Mechanism (C1 Only) `T` = Step Up Mechanism (SUM)

				A = SUM All or None
Side	21	1	Alphanumeric	"B" or "S"
Price	22	8	Binary Long Price	For SUM this will reflect the NBBO price of the opposite side of the auction at the time of entry. For BAM and SAM this will reflect the limit price specified on the order. For SPX and SPXW AIM, this field will reflect the auction start price (C1 Only). For all other AIM this field will be zero.
Contracts	30	4	Binary	Number of contracts available in the auction.
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.
Total Length = 47 bytes				

4.18 Auction Cancel (C1 and EDGX Options Only)

`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 order, a user modification request to change the price or increase the original order quantity, a fading of the NBBO or to cancel any remaining order quantity from the original `Auction Notification` following the auction termination.

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

Auction Cancel				
Field Name	**Offset**	**Length**	**Type/(Value)**	**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				

4.19 Auction Trade (C1 and EDGX Options Only)

`Auction Trade` messages are used to disseminate executions resulting from an options 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 Long Price	Trade price
Contracts	30	4	Binary	Number of contracts traded
Total Length = 34 bytes				

4.20 Retail Price Improvement (BYX Exchange Only)

The `Retail Price Improvement` message is only available on the BYX Exchange. This message is a Retail Liquidity Indicator (RLI) that includes symbol and side, but not price and size. An RLI will be disseminated when there is a Retail Price Improving (RPI) order present for a symbol on the BYX Exchange order book OR to indicate a RPI order is no longer available. RPI orders offer price improvement in increments of $.001 to Retail Member Organizations.

The `Retail Price Improvement` message has the following format:

Retail Price Improvement				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x98	`Retail Price Improvement` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	8	Printable ASCII	*Symbol* right padded with spaces.
Retail Price Improvement	14	1	Alpha	B = Buy Side RPI S = Sell Side RPI A = Buy & Sell RPI N = No RPI
Total Length = 15 bytes				

4.21 SOQ Strike Range Update (C1 Only)

The `SOQ Strike Range Update` message is only available on the C1 Exchange. This message disseminates the minimum and maximum strike prices of the strike price range used to calculate the Special Opening Quote ("SOQ") on a Volatility Settlement date. In the event that multiple distinct SOQ calculations occur on the same day, the applicable SOQ is differentiated by the *SOQ Identifier* field, which is set to the CSMi symbol on which the final settlement SOQ value is disseminated.

The `SOQ Strike Range Update` message has the following format:

SOQ Strike Range Update				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x9D	`SOQ Strike Range Update` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
SOQ Identifier	6	20	Printable ASCII	Dissemination symbol of the final SOQ right padded with spaces.
Lower Strike Price	26	8	Binary Long Price	SOQ lower strike price
Upper Strike Price	34	8	Binary Long Price	SOQ upper strike price
Total Length = 42 bytes				

4.22 Constituent Symbol Mapping (C1 Only)

The `Constituent Symbol Mapping` message is only available on the C1 Exchange. This message is used to communicate which options series (if any) are Constituent Series in a Volatility Settlement Special Opening Quote ("SOQ"). The message is identical to the `Symbol Mapping` message with the addition of the *SOQ Identifier* field, which is set to the CSMi symbol on which the final settlement SOQ value is disseminated. The `Constituent Symbol Mapping` message is sent as an unsequenced message with one message sent for each Constituent Series in a continuous loop as bandwidth allows.

The `Constituent Symbol Mapping` message has the following format:

Constituent Symbol Mapping				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x9E	`Constituent 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
SOQ Identifier	38	20	Printable ASCII	Dissemination symbol of the final SOQ right padded with spaces.
Total Length = 58 bytes				

5 Order Representation

5.1 Hidden Orders

Cboe obfuscates the *OrderID* for all trade messages generated from non-displayed liquidity on the Cboe book, including executions from hidden orders. By default, *OrderID*s on trade messages are obfuscated in the data feed.

5.2 Reserve Orders

To better protect reserve orders, Cboe handles executions against reserve orders as follows:

1. The displayed and non-displayed portions of an execution against a reserve order are separated into two (2) executions on the PITCH feed.

2. One execution represents the displayed size and carries the displayed *OrderID*. This is reported as an Execution (0x23) of the displayed portion of the order.

3. The second execution represents the hidden size executed and has an obfuscated *OrderID* so that the displayed and hidden executions cannot be linked. This is reported by a Trade (0x2A, 0x2B, or 0x30) with the obfuscated *OrderID*.

4. The execution against the hidden portion of the order is reported after displayed, non-displayed, and peg executions at the same price matching the Cboe Exchange Priority Rule 11.12.

5. When the displayed portion of the reserve order is refreshed, the order is assigned a new *OrderID* on the PITCH feed. This is reported by an Add Order (0x21, 0x22, or 0x2F) when the remainder is nonzero.

5.3 OrderID Obfuscation Opt-out

Members who do not wish for their orders to be subject to the *OrderID* obfuscation defined in Sections 5.1 and 5.2 may opt-out at the port level, via request to the Cboe Trade Desk. An opt-out will impact all `Trade` messages (0x2A, 0x2B, or 0x30) generated from non-displayed liquidity on a given order.

6 Spin Messages

Each of the following message types must be wrapped by an unsequenced unit header as described in Section 2.4.

6.1 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 3.1.

6.2 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` message for the Spin Server is identical to that of the GRP described previously in Section 3.2.

6.3 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				

6.4 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 member
Total Length = 6 bytes				

6.5 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 member
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.

6.6 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 member'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				

6.7 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. Refer to Section 1.6 for more complete details regarding *Sequence* specification as well as buffering requirements.

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				

6.8 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.

6.9 Instrument Definition Finished

The `Instrument Definition Finished` message is sent to indicate that all `Symbol Mapping` and `Complex Instrument Definition` 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				

6.10 Spin Server Usage Example

The following diagram (see next page) shows the exchange of messages over time between a member and Cboe's Multicast PITCH feed and spin server. Note that while the example alone may seem to imply `Add Order` messages only would be sent on a spin, this is not the case. `Trading Status` message may be sent at the beginning of the spin session and `Auction Update` messages may be found mixed between `Add Order` messages according to their timestamps.

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

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

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

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

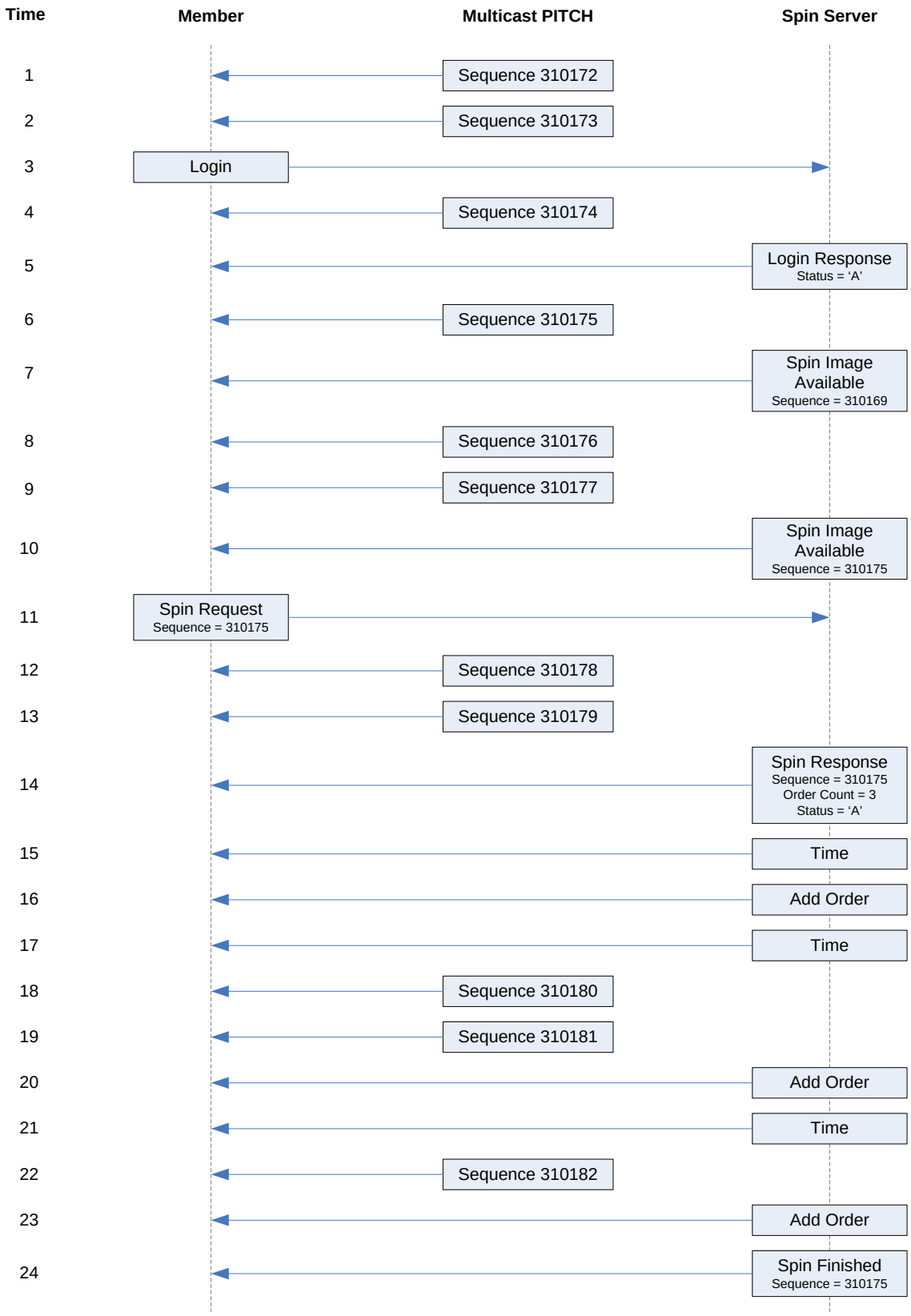
At time 11, the member sends a `Spin Request` for all messages up to and including 310175 and continues to cache Multicast PITCH messages received.

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 member must then apply the cached messages from sequence number 310176 through current.

Notes:

- Spin Servers are available for each unit. Members may need to employ multiple Spin Servers depending upon their architecture.
- As a rule of thumb, in its equities markets Cboe typically has ~400,000 open orders across all units, or an average of about 12,500 orders per unit. In options, Cboe typically has greater the 3.2 million open orders across all units, or an average of about 100,000 orders per unit. The actual number per unit varies depending upon activity in individual symbols. Expect this number to increase and plan accordingly.



6.11 Spin Server Rollover Usage Example

The following diagram (see next page) shows the exchange of messages over time between a member and Cboe's Multicast PITCH feed and spin server during rollover.

At time 1, the member has no state of the book and desires to become current. The member caches the received Multicast PITCH messages (sequences 4,294,967,294 and 4,294,967,295) for later use. Since the member has no book, they cannot yet be applied.

At time 5, the member has successfully logged into the Spin Server and has cached another message, sequence 1 (the sequence number has rolled over).

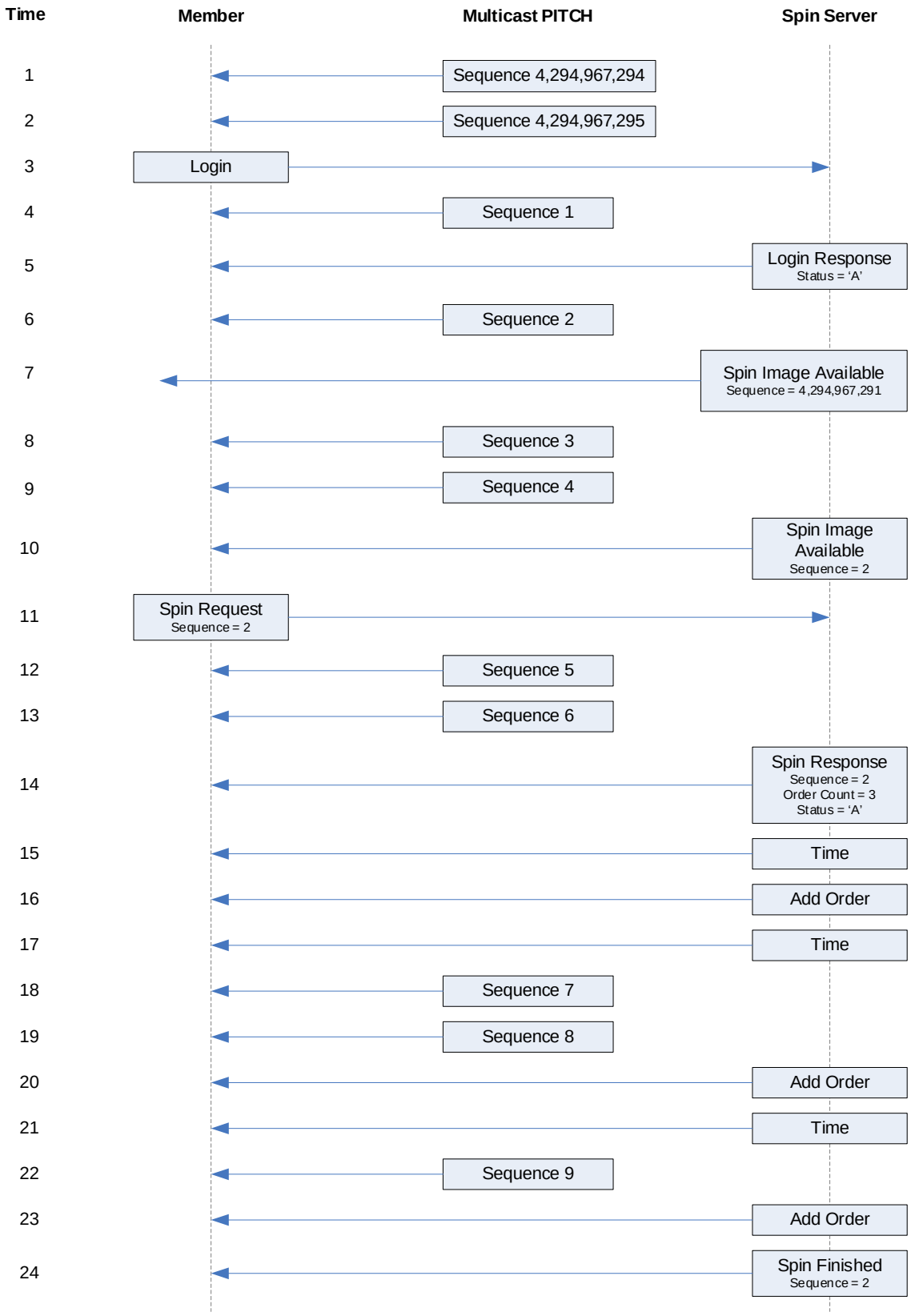
At time 7, the member receives Spin Image Available message which indicates that the spin server is capable of giving them a spin of all open orders as of sequence 4,294,967,291. The member does not have all messages cached after 4,294,967,291 (they are missing 4,294,967,292 and 4,294,967,293), so this spin is not useful to the member.

At time 10, the sequence number has rolled over and the member receives a Spin Image Available message with sequence number 2. This is useful since it would be a spin of all orders up to and including rolled over sequence 2, and the member has all messages starting at 4,294,967,294 cached.

At time 11, the member sends a Spin Request for all messages up to and including 2 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 member must then apply the cached messages from sequence number 3 through current.



7 Message Types

7.1 Gap Request Proxy Messages

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

7.2 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

7.3 PITCH 2.X Messages

0xB1	Time Reference (C1 Options Only)
0x20	Time
0x97	Unit Clear
0xBC	Transaction Begin
0xBD	Transaction End
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
0x30	Trade – Expanded
0x2C	Trade Break

0x2D	End of Session
0x2E	Symbol Mapping
0x31	Trading Status
0xD2	Width Update
0x95	Auction Update
0xD1	Options Auction Update
0x96	Auction Summary
0xAD	Auction Notification
0xAE	Auction Cancel
0xAF	Auction Trade
0x98	Retail Price Improvement
0x9D	SOQ Strike Range Update
0x9E	Constituent Symbol Mapping

8 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.

8.1 Sequenced Unit Header with 2 Messages

Sequenced Unit Header:

Hdr Length	31 00	50 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 shares
Symbol	5A 56 5A 5A 54 20	ZVZZT
Price	01 00	0.01
Flags	01	Display

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 shares

8.2 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”

8.3 Login Response Message

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

8.4 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

8.5 Gap Response Message

Length	0A	10 bytes
Type	04	Gap Response
Unit	01	Unit 1
Sequence	3B 10 00 00	First message:4155
Count	32 00	50 messages
Status	41	Accepted

8.6 Spin Image Available Message

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

8.7 Spin Request Message

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

8.8 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

8.9 Spin Finished Message

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

8.10 Instrument Definition Request

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

8.11 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	3,000 Instruments
Status	41	Accepted

8.12 Instrument Definition Finished

Length	02	2 bytes
Type	86	Instrument Definiton Finished

8.13 Time Reference (C1 Options Only)

Length	12	18 bytes
Type	B1	Time Reference
Midnight Reference	D0 8B 34 60	2021-02-23 00:00:00 Eastern (1614056400 seconds since the Epoch)
Time	00 E1 00 00	16:00:00
Time Offset	00 00 00 00	Exactly 16:00:00
Trade Date	2F 62 34 01	2021-02-23 February 23, 2021

8.14 Time Message

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

8.15 Time Message (Options Only)

Length	0A	10 bytes
Type	20	Time
Time	98 85 00 00	34,200 seconds = 09:30 AM Eastern
Epoch Time (C1 Only)	68 11 35 60	1,614,090,600 seconds Since the Epoch

8.16 Unit Clear

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

8.17 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	20 4E 00 00	20,000 shares
Symbol	5A 56 5A 5A 54 20	ZVZZT
Price	5A 23 00 00 00 00 00 00	$0.9050
AddBitField1	01	Displayed

8.18 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	20 4E	20,000 shares
Symbol	5A 56 5A 5A 54 20	ZVZZT
Price	E8 A3 0F 00 00 00 00 00	$102.50
AddBitField1	01	Displayed

8.19 Add Order – Expanded

Length	29	41 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	20 4E 00 00	20,000 shares
Symbol	5A 56 5A 5A 54 20 20 20	ZVZZT
Price	5A 23 00 00 00 00 00 00	$0.9050
AddBitField1	01	Displayed
MPID	4D 50 49 44	MPID
Customer Indicator	4E	Non-Customer

8.20 Order Executed (*Options*)

Length	1B	27 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 Quantity	64 00 00 00	100 shares
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Trade Condition	53	S = Spread

8.21 Order Executed (*Equities*)

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 Quantity	64 00 00 00	100 shares
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC

8.22 Order Executed at Price/Size (*Options*)

Length	27	39 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 shares
Remaining	BC 4D 00 00	19,900 shares
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Price	E8 A3 0F 00 00 00 00 00	$102.50
Trade Condition	20	(space) = Normal

8.23 Order Executed at Price/Size (*Equities*)

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 shares
Remaining	BC 4D 00 00	19,900 shares
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Price	E8 A3 0F 00 00 00 00 00	$102.50

8.24 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	F8 24 01 00	75,000 shares

8.25 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 shares

8.26 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	F8 24 01 00	75,000 shares
Price	E8 A3 0F 00 00 00 00 00	$102.50
ModifyBitField1	03	Displayed & Maintains Priority

8.27 Modify Order – Short

Length	13	19 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	631WC4000005
Quantity	64 00	100 shares
Price	0A 28	$102.50
ModifyBitField1	03	Displayed & Maintains Priority

8.28 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	631WC4000005

8.29 Trade – Long (*Options*)

Length	2A	42 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	F8 24 01 00	75,000 shares
Symbol	5A 56 5A 5A 54 20	ZVZZT
Price	E8 A3 0F 00 00 00 00 00	$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Trade Condition	53	S = Spread

8.30 Trade – Long (*Equities*)

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	F8 24 01 00	75,000 shares
Symbol	5A 56 5A 5A 54 20	ZVZZT
Price	E8 A3 0F 00 00 00 00 00	$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC

8.31 Trade – Short (*Options*)

Length	22	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 shares
Symbol	5A 56 5A 5A 54 20	ZVZZT
Price	0A 28	$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Trade Condition	20	(space) = Normal

8.32 Trade – Short (*Equities*)

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 shares
Symbol	5A 56 5A 5A 54 20	ZVZZT

Price	0A 28	$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC

8.33 Trade – Expanded (*Options*)

Length	2B	43 bytes
Type	30	Trade – 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	42	Buy
Quantity	F8 24 01 00	75,000 shares
Symbol	5A 56 5A 5A 54 20 20 20	ZVZZT
Price	E8 A3 0F 00 00 00 00 00	$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Trade Condition	53	S = Spread

8.34 Trade – Expanded (*Equities*)

Length	2B	43 bytes
Type	30	Trade – 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	42	Buy
Quantity	F8 24 01 00	75,000 shares
Symbol	5A 56 5A 5A 54 20 20 20	ZVZZT
Price	E8 A3 0F 00 00 00 00 00	$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC

8.35 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	34 2B 46 E0 BB 00 00 00	0AAP09VEC

8.36 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

8.37 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	4E	'N' – Normal
Condition		
Underlying	4D 53 46 54 20 20 20 20	MSFT

8.38 Trading Status Message (*Equities*)

Length	12	18 bytes
Type	31	Trading Status
Time offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	5A 56 5A 5A 54 20 20 20	ZVZZT
Halt Status	54	T = Trading
Reg SHO Action	30	0 = No price test
Reserved1	20	
Reserved2	20	

8.39 Trading Status Message (*Options*)

Length	12	18 bytes
Type	31	Trading Status
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	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

8.40 Width Update Message (C1, C2, and EDGX Options Only)

Length	13	19 bytes
Type	D2	Width Update
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Underlying	5A 56 5A 5A 54 20 20 20	ZVZZT
Width Type	52	R = Regular
Multiplier	0F 00 00 00	Multiplier of 1.5

8.41 Auction Notification Message (C1 and EDGX Options Only)

Length	2F	47 bytes
Type	AD	Auction Notification
Time offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	30 30 6D 45 56 4F	00mEVO
Auction ID	05 40 5B 77 8F 56 1D 0B	631WC4000005
Auction Type	54	T = SUM

Side	42	B = Buy Side
Prc	E8 A3 0F 00 00 00 00 00	$102.50
Contracts	64 00 00 00	100 contracts
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

8.42 Auction Cancel Message (C1 and EDGX Options Only)

Length	0E	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	

8.43 Auction Trade Message (C1 and EDGX Options Only)

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	
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Prc	E8 A3 0F 00 00 00 00 00	$102.50
Contracts	64 00 00 00	100 contracts

8.44 Auction Update Message (BZX)

Length	2F	47 bytes
Type	95	Auction Update
Time offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	5A 56 5A 5A 54 20 20 20	ZVZZT
Auction Type	49	I = IPO
Reference Prc	E8 A3 0F 00 00 00 00 00	$102.50
Buy Side Shrs	F8 24 01 00	75,000 shares
Sell Side Shrs	20 4E 00 00	20,000 shares
Indicative Prc	E8 A3 0F 00 00 00 00 00	$102.50
Auct. Only Prc	E8 A3 0F 00 00 00 00 00	$102.50

8.45 Auction Update Message (BYX)

Length	2F	47 bytes
Type	95	Auction Update
Time offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	5A 56 5A 5A 54 20 20 20	ZVZZT

Auction Type	50	P = Periodic Auction
Reference Prc	A4 0D 03 00 00 00 00 00	n/a, set to zero
Buy Side Shrs	F4 01 00 00	500 shares paired
Sell Side Shrs	F4 01 00 00	500 shares paired
Indicative Prc	00 00 00 00 00 00 00 00	n/a, set to zero
Auct. Only Prc	00 00 00 00 00 00 00 00	n/a, set to zero

8.46 Options Auction Update Message (Options Only)

Length	40	64 bytes
Type	D1	Options Auction Update
Time offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	30 30 6D 45 56 4F 20 20	00mEVO
Auction Type	56	Volatilty Auction
Reference Price	E8 A3 0F 00 00 00 00 00	$102.50
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	E8 A3 0F 00 00 00 00 00	$102.50
Opening Condition	4F	O = Would Open
Composite Market Bid Price	50 69 0F 00 00 00 00 00	$101.00
Composite Market Offer Price	70 B7 0F 00 00 00 00 00	$103.00

8.47 Auction Summary Message (BYX Equities, BZX Equities, and Options Only)

Length	1B	27 bytes
Type	96	Auction Summary
Time offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	30 30 6D 45 56 5F 20 20	00mEVO
Auction Type	4F	RTH Opening
Price	E8 A3 0F 00 00 00 00 00	$102.50
Quantity	4B 00 00 00	75

8.48 Retail Price Improvement Message (BYX Exchange Only)

Length	0F	15 bytes
Type	98	Retail Price Improvement
Time offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	5A 56 5A 5A 54 20 20 20	ZVZZT
RPI	41	Buy & Sell RPI

8.49 SOQ Strike Range Update (C1 Only)

Length	2A	42 bytes
Type	9D	SOQ Strike Range Update
Time offset	18 D2 06 00	447,000 ns since last Time Message
SOQ Identifier	56 58 53 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20	VXS
Lower Strike Price	40 66 03 01 00 00 00 00	$1,700
Upper Strike Price	00 48 E8 01 00 00 00 00	$3,200

8.50 Constituent Symbol Mapping (C1 Only)

Length	3A	58 bytes
Type	9E	Constituent Symbol Mapping Message
Feed Symbol	30 30 6D 45 56 4F	00mEVO
OSI Symbol	53 50 58 57 20 20 31 39 30 39 32 37 43 30 32 33 39 30 30 30 30	SPXW 190927C02390000
Symbol Condition	4E	‘N’ – Normal
Underlying SOQ Identifier	53 50 58 20 20 20 20 20 56 58 53 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20	SPX VXS

9 Multicast Configuration

9.1 US Equities Production Environment Configuration

9.1.1 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. Members 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.
WAN-Shaped Throttle	100 Mb/s	
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 per session.

9.1.2 BYX/EDGA/EDGX Unit/Symbol Distribution

The following table describes the Cboe symbol distribution across units.

Unit	Symbol Range Start
1	A
2	AIV
3	AT
4	BIE
5	CAU
6	CNP
7	CXX
8	DRJ
9	ELT
10	EX
11	FNW
12	GLE
13	HEI
14	IEM
15	IWF
16	JPN
17	LNC
18	MIN
19	NE
20	OGT
21	PGB
22	QLE
23	RSX
24	SHQ
25	SPZ
26	TDC
27	TSR
28	URJ
29	VLO
30	WEB
31	XLF
32	*All Cboe Listed Securities*

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.

9.1.3 BZX Unit/Symbol Distribution

The following table describes the Cboe symbol distribution across units for BZX Exchange. Note that the unit distribution differs from other Cboe US Equity Exchanges as a result of additional Matching Units that have been allocated specifically to the BZX Exchange platform in support of Cboe Listed Securities.

Unit	Symbol Range	Unit	Symbol Range
1	A-AIUZZ	19	NE-OGSZZ
2	AIV-ASZZZ	20	OGT-PGAZZ
3	AT-BIDZZ	21	PGB-QLDZZ
4	BIE-CATZZ	22	QLE-RSWZZ
5	CAU-CNOZZ	23	RSX-SHPZZ
6	CNP-CXWZZ	24	SHQ-SPYZZ
7	CXX-DRIZZ	25	SPZ-TDBZZ
8	DRJ-ELSZZ	26	TDC-TSQZZ
9	ELT-EWZZZ	27	TSR-URIZZ
10	EX-FNVZZ	28	URJ-VLNZZ
11	FNW-GLDZZ	29	VLO-WEAZZ
12	GLE-HEHZZ	30	WEB-XLEZZ
13	HEI-IELZZ	31	XLF-ZZZZZ
14	IEM-IWEZZ	32*	*Cboe Listed ETP unit assignments may be obtained from a CSV file, which is generated each morning at 2 a.m. ET.*
15	IWF-JPMZZ	33*	
16	JPN-LNBZZ	34*	
17	LNC-MIMZZ	35*	*CBOE, ZBZX,ZTEST*
18	MIN-NDZZZ		

*Unit ONLY supports Cboe Listed Securities.

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.

9.1.4 BZX Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.140
Primary Data Center C feed	74.115.128.141
Primary Data Center B feed	74.115.128.142
Primary Data Center D feed	74.115.128.143
Secondary Data Center E feed	174.136.181.191

9.1.5 BYX Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.144
Primary Data Center C feed	74.115.128.145
Primary Data Center B feed	74.115.128.146
Primary Data Center D feed	74.115.128.147
Secondary Data Center E feed	174.136.181.255

9.1.6 EDGA Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.132
Primary Data Center C feed	74.115.128.133
Primary Data Center B feed	74.115.128.134
Primary Data Center D feed	74.115.128.135
Secondary Data Center E feed	174.136.181.253

9.1.7 EDGX Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.136
Primary Data Center C feed	74.115.128.137
Primary Data Center B feed	74.115.128.138
Primary Data Center D feed	74.115.128.139
Secondary Data Center E feed	174.136.181.254

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

9.1.8 BZX Address/Unit Distribution

The following tables describe the unit distribution across the BZX Exchange Multicast PITCH feeds.

Primary Datacenter		Gig-Shaped [ZA] 174.136.161.160/28		WAN-Shaped [ZC] 174.136.161.176/28		Gig-Shaped [ZB] 174.136.161.192/28		WAN-Shaped [ZD] 174.136.161.208/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30001	224.0.130.128	224.0.130.144	224.0.130.160	224.0.130.176	233.209.92.128	233.209.92.144	233.209.92.160	233.209.92.176
2	30002								
3	30003								
4	30004								
5	30005	224.0.130.129	224.0.130.145	224.0.130.161	224.0.130.177	233.209.92.129	233.209.92.145	233.209.92.161	233.209.92.177
6	30006								
7	30007								
8	30008								
9	30009	224.0.130.130	224.0.130.146	224.0.130.162	224.0.130.178	233.209.92.130	233.209.92.146	233.209.92.162	233.209.92.178
10	30010								
11	30011								
12	30012								
13	30013	224.0.130.131	224.0.130.147	224.0.130.163	224.0.130.179	233.209.92.131	233.209.92.147	233.209.92.163	233.209.92.179
14	30014								
15	30015								
16	30016								
17	30017	224.0.130.132	224.0.130.148	224.0.130.164	224.0.130.180	233.209.92.132	233.209.92.148	233.209.92.164	233.209.92.180
18	30018								
19	30019								
20	30020								
21	30021	224.0.130.133	224.0.130.149	224.0.130.165	224.0.130.181	233.209.92.133	233.209.92.149	233.209.92.165	233.209.92.181
22	30022								
23	30023								
24	30024								
25	30025	224.0.130.134	224.0.130.150	224.0.130.166	224.0.130.182	233.209.92.134	233.209.92.150	233.209.92.166	233.209.92.182
26	30026								
27	30027								
28	30028								
29	30029	224.0.130.135	224.0.130.151	224.0.130.167	224.0.130.183	233.209.92.135	233.209.92.151	233.209.92.167	233.209.92.183
30	30030								
31	30031								
32	30032	224.0.130.136	224.0.130.152	224.0.130.168	224.0.130.184	233.209.92.136	233.209.92.152	233.209.92.168	233.209.92.184
33	30033								
34	30034								
35	30035								

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.

Secondary Datacenter		WAN-Shaped [ZE] 174.136.181.160/28	
Unit	**IP Port**	**Real-time MC**	**Gap Response MC**
1	31001	233.19.3.80	233.19.3.81
2	31002		
3	31003		
4	31004		
5	31005	233.19.3.82	233.19.3.83
6	31006		
7	31007		
8	31008		
9	31009	233.19.3.84	233.19.3.85
10	31010		
11	31011		
12	31012		
13	31013	233.19.3.86	233.19.3.87
14	31014		
15	31015		
16	31016		
17	31017	233.19.3.88	233.19.3.89
18	31018		
19	31019		
20	31020		
21	31021	233.19.3.90	233.19.3.91
22	31022		
23	31023		
24	31024		
25	31025	233.19.3.92	233.19.3.93
26	31026		
27	31027		
28	31028		
29	31029	233.19.3.94	233.19.3.95
30	31030		
31	31031		
32	31032		
33	31033		
34	31034		
35	31035		

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.

9.1.10 BYX Address/Unit Distribution

The following tables describe the unit distribution across the BYX Exchange Multicast PITCH feeds.

Primary Datacenter		Gig-Shaped [YA] 174.136.162.160/28		WAN-Shaped [YC] 174.136.162.176/28		Gig-Shaped [YB] 174.136.162.192/28		WAN-Shaped [YD] 174.136.162.208/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30201	224.0.130.192	224.0.130.208	224.0.130.224	224.0.130.240	233.209.92.192	233.209.92.208	233.209.92.224	233.209.92.240
2	30202								
3	30203								
4	30204								
5	30205	224.0.130.193	224.0.130.209	224.0.130.225	224.0.130.241	233.209.92.193	233.209.92.209	233.209.92.225	233.209.92.241
6	30206								
7	30207								
8	30208								
9	30209	224.0.130.194	224.0.130.210	224.0.130.226	224.0.130.242	233.209.92.194	233.209.92.210	233.209.92.226	233.209.92.242
10	30210								
11	30211								
12	30212								
13	30213	224.0.130.195	224.0.130.211	224.0.130.227	224.0.130.243	233.209.92.195	233.209.92.211	233.209.92.227	233.209.92.243
14	30214								
15	30215								
16	30216								
17	30217	224.0.130.196	224.0.130.212	224.0.130.228	224.0.130.244	233.209.92.196	233.209.92.212	233.209.92.228	233.209.92.244
18	30218								
19	30219								
20	30220								
21	30221	224.0.130.197	224.0.130.213	224.0.130.229	224.0.130.245	233.209.92.197	233.209.92.213	233.209.92.229	233.209.92.245
22	30222								
23	30223								
24	30224								
25	30225	224.0.130.198	224.0.130.214	224.0.130.230	224.0.130.246	233.209.92.198	233.209.92.214	233.209.92.230	233.209.92.246
26	30226								
27	30227								
28	30228								
29	30229	224.0.130.199	224.0.130.215	224.0.130.231	224.0.130.247	233.209.92.199	233.209.92.215	233.209.92.231	233.209.92.247
30	30230								
31	30231								
32	30232								

Secondary Datacenter		WAN-Shaped (YE) 174.136.181.224/28	
Unit	**IP Port**	**Real-time MC**	**Gap Response MC**
1	31701	233.19.3.112	233.19.3.113
2	31702		
3	31703		
4	31704		
5	31705	233.19.3.114	233.19.3.115
6	31706		
7	31707		
8	31708		
9	31709	233.19.3.116	233.19.3.117
10	31710		
11	31711		
12	31712		
13	31713	233.19.3.118	233.19.3.119
14	31714		
15	31715		
16	31716		
17	31717	233.19.3.120	233.19.3.121
18	31718		
19	31719		
20	31720		
21	31721	233.19.3.122	233.19.3.123
22	31722		
23	31723		
24	31724		
25	31725	233.19.3.124	233.19.3.125
26	31726		
27	31727		
28	31728		
29	31729	233.19.3.126	233.19.3.127
30	31730		
31	31731		
32	31732		

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.

9.1.11 EDGA Address/Unit Distribution

The following tables describe the unit distribution across production EDGA Exchange Multicast PITCH feeds.

Primary Datacenter		Gig-Shaped [AA] 174.136.170.160/28		WAN-Shaped [AC] 174.136.170.176/28		Gig-Shaped [AB] 174.136.170.192/28		WAN-Shaped [AD] 174.136.170.208/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30301	224.0.130.0	224.0.130.16	224.0.130.32	224.0.130.48	233.209.92.0	233.209.92.16	233.209.92.32	233.209.92.48
2	30302								
3	30303								
4	30304								
5	30305	224.0.130.1	224.0.130.17	224.0.130.33	224.0.130.49	233.209.92.1	233.209.92.17	233.209.92.33	233.209.92.49
6	30306								
7	30307								
8	30308								
9	30309	224.0.130.2	224.0.130.18	224.0.130.34	224.0.130.50	233.209.92.2	233.209.92.18	233.209.92.34	233.209.92.50
10	30310								
11	30311								
12	30312								
13	30313	224.0.130.3	224.0.130.19	224.0.130.35	224.0.130.51	233.209.92.3	233.209.92.19	233.209.92.35	233.209.92.51
14	30314								
15	30315								
16	30316								
17	30317	224.0.130.4	224.0.130.20	224.0.130.36	224.0.130.52	233.209.92.4	233.209.92.20	233.209.92.36	233.209.92.52
18	30318								
19	30319								
20	30320								
21	30321	224.0.130.5	224.0.130.21	224.0.130.37	224.0.130.53	233.209.92.5	233.209.92.21	233.209.92.37	233.209.92.53
22	30322								
23	30323								
24	30324								
25	30325	224.0.130.6	224.0.130.22	224.0.130.38	224.0.130.54	233.209.92.6	233.209.92.22	233.209.92.38	233.209.92.54
26	30326								
27	30327								
28	30328								
29	30329	224.0.130.7	224.0.130.23	224.0.130.39	224.0.130.55	233.209.92.7	233.209.92.23	233.209.92.39	233.209.92.55
30	30330								
31	30331								
32	30332								

Secondary Datacenter		WAN-Shaped (AE) 174.136.182.112/28	
Unit	**IP Port**	**Real-time MC**	**Gap Response MC**
1	31301	233.19.3.48	233.19.3.49
2	31302		
3	31303		
4	31304		
5	31305	233.19.3.50	233.19.3.51
6	31306		
7	31307		
8	31308		
9	31309	233.19.3.52	233.19.3.53
10	31310		
11	31311		
12	31312		
13	31313	233.19.3.54	233.19.3.55
14	31314		
15	31315		
16	31316		
17	31317	233.19.3.56	233.19.3.57
18	31318		
19	31319		
20	31320		
21	31321	233.19.3.58	233.19.3.59
22	31322		
23	31323		
24	31324		
25	31325	233.19.3.60	233.19.3.61
26	31326		
27	31327		
28	31328		
29	31329	233.19.3.62	233.19.3.63
30	31330		
31	31331		
32	31332		

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.

9.1.12 EDGX Address/Unit Distribution

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

Primary Datacenter		Gig-Shaped [XA] 174.136.172.160/28		WAN-Shaped [XC] 174.136.172.176/28		Gig-Shaped [XB] 174.136.172.192/28		WAN-Shaped [XD] 174.136.172.208/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30401	224.0.130.64	224.0.130.80	224.0.130.96	224.0.130.112	233.209.92.64	233.209.92.80	233.209.92.96	233.209.92.112
2	30402								
3	30403								
4	30404								
5	30405	224.0.130.65	224.0.130.81	224.0.130.97	224.0.130.113	233.209.92.65	233.209.92.81	233.209.92.97	233.209.92.113
6	30406								
7	30407								
8	30408								
9	30409	224.0.130.66	224.0.130.82	224.0.130.98	224.0.130.114	233.209.92.66	233.209.92.82	233.209.92.98	233.209.92.114
10	30410								
11	30411								
12	30412								
13	30413	224.0.130.67	224.0.130.83	224.0.130.99	224.0.130.115	233.209.92.67	233.209.92.83	233.209.92.99	233.209.92.115
14	30414								
15	30415								
16	30416								
17	30417	224.0.130.68	224.0.130.84	224.0.130.100	224.0.130.116	233.209.92.68	233.209.92.84	233.209.92.100	233.209.92.116
18	30418								
19	30419								
20	30420								
21	30421	224.0.130.69	224.0.130.85	224.0.130.101	224.0.130.117	233.209.92.69	233.209.92.85	233.209.92.101	233.209.92.117
22	30422								
23	30423								
24	30424								
25	30425	224.0.130.70	224.0.130.86	224.0.130.102	224.0.130.118	233.209.92.70	233.209.92.86	233.209.92.102	233.209.92.118
26	30426								
27	30427								
28	30428								
29	30429	224.0.130.71	224.0.130.87	224.0.130.103	224.0.130.119	233.209.92.71	233.209.92.87	233.209.92.103	233.209.92.119
30	30430								
31	30431								
32	30432								

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.

Secondary Datacenter		WAN-Shaped (XE) 174.136.182.240/28	
Unit	**IP Port**	**Real-time MC**	**Gap Response MC**
1	31401	233.19.3.64	233.19.3.65
2	31402		
3	31403		
4	31404		
5	31405	233.19.3.66	233.19.3.67
6	31406		
7	31407		
8	31408		
9	31409	233.19.3.68	233.19.3.69
10	31410		
11	31411		
12	31412		
13	31413	233.19.3.70	233.19.3.71
14	31414		
15	31415		
16	31416		
17	31417	233.19.3.72	233.19.3.73
18	31418		
19	31419		
20	31420		
21	31421	233.19.3.74	233.19.3.75
22	31422		
23	31423		
24	31424		
25	31425	233.19.3.76	233.19.3.77
26	31426		
27	31427		
28	31428		
29	31429	233.19.3.78	233.19.3.79
30	31430		
31	31431		
32	31432		

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.

9.2 US Options Production Environment Configuration

9.2.1 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. Members should ensure that their infrastructure is configured accordingly.
8 Gig-Shaped Throttle (C1 only)	8 Gb/s	The real-time and gap multicast head ends are configured to shape their output to this level to minimize packet loss.
5 Gig-Shaped Throttle	5 Gb/s	The real-time and gap multicast head ends are configured to shape their output to this level to minimize packet loss.
1 Gig-Shaped Throttle (BZX, C2, and EDGX only)	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.

9.2.2 Unit Distribution

Units 1-30

Unit	BZX/C1/C2/EDGX Symbol Range	Exceptions
1	A – ADBD~	
2	ADBE – ASMK~	Excludes AMZN
3	ASML – BBX~~	
4	BBY – BYND~	
5	BYNE – COUO~	
6	COUP – DH~~~	
7	DI – ENPG~	Excludes DJX
8	ENPH – FCXA~	
9	FCXB – GLDA~	
10	GLDB –INCX~	Excludes GOOG, GOOGL
11	INCY – IWMA~	
12	IWMB – LMS~~	
13	LMT – MELI~	
14	MELJ – NED~~	Excludes MRUT, MXEA, MXEF, NANOS
15	NEE – NSCA~	
16	NSCB – OKS~~	Excludes OEX
17	OKT – PTOM~	
18	PTON –ROKU~	Excludes QQQ, RLG, RLV
19	ROKV – SHOP~	Excludes RUI, RUT, RUTW
20	SHOQ – SQAA~	Excludes SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPESG, SPX/SPXW, SPY
21	SQAB – TQQP~	
22	TQQQ – ULTA~	Excludes TSLA, UKXM
23	ULTB – WAAA~	Excludes VIX, VIXW
24	WAAB – XLT~~	Excludes XEO
25	XLU – Z~~~~	Excludes XSP
26	GOOG, GOOGL	
27	TSLA	
28	QQQ	
29	AMZN	
30	SPY	

Units 31-35

Unit	BZX/C2 Symbol Range	C1 Symbol Range
31	DJX (C2 Only), RUT, RUTW (C2 Only)	DJX, MRUT, MXEA, MXEF, OEX, RLG, RLV, RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPESG, XEO, UKXM, XSP
32	N/A	NANOS, VIX, VIXW
33	N/A	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.

9.2.3 BZX Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.148
Primary Data Center C feed	74.115.128.149
Primary Data Center B feed	74.115.128.150
Primary Data Center D feed	74.115.128.151
Secondary Data Center E feed	174.136.181.223

9.2.4 C1 Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.187
Primary Data Center C feed	74.115.128.183
Primary Data Center B feed	74.115.128.188
Primary Data Center D feed	74.115.128.184
Secondary Data Center E feed	174.136.181.249

9.2.5 C2 Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.170
Primary Data Center C feed	74.115.128.171
Primary Data Center B feed	74.115.128.172
Primary Data Center D feed	74.115.128.173
Secondary Data Center E feed	170.137.16.132

9.2.6 EDGX Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.152
Primary Data Center C feed	74.115.128.153
Primary Data Center B feed	74.115.128.154
Primary Data Center D feed	74.115.128.155
Secondary Data Center E feed	174.136.181.251

9.2.7 BZX Options Address/Unit Distribution

The following tables describe the unit distribution across the BZX Options Multicast PITCH feeds.

Primary Datacenter		Gig-Shaped [OA] 174.136.163.160/28		5G-Shaped [OC] 174.136.163.176/28		Gig-Shaped [OB] 174.136.163.192/28		5G-Shaped [OD] 174.136.163.208/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30101	224.0.131.0	224.0.131.16	224.0.131.32	224.0.131.48	233.130.124.0	233.130.124.16	233.130.124.32	233.130.124.48
2	30102								
3	30103								
4	30104								
5	30105	224.0.131.1	224.0.131.17	224.0.131.33	224.0.131.49	233.130.124.1	233.130.124.17	233.130.124.33	233.130.124.49
6	30106								
7	30107								
8	30108								
9	30109	224.0.131.2	224.0.131.18	224.0.131.34	224.0.131.50	233.130.124.2	233.130.124.18	233.130.124.34	233.130.124.50
10	30110								
11	30111								
12	30112								
13	30113	224.0.131.3	224.0.131.19	224.0.131.35	224.0.131.51	233.130.124.3	233.130.124.19	233.130.124.35	233.130.124.51
14	30114								
15	30115								
16	30116								
17	30117	224.0.131.4	224.0.131.20	224.0.131.36	224.0.131.52	233.130.124.4	233.130.124.20	233.130.124.36	233.130.124.52
18	30118								
19	30119								
20	30120								
21	30121	224.0.131.5	224.0.131.21	224.0.131.37	224.0.131.53	233.130.124.5	233.130.124.21	233.130.124.37	233.130.124.53
22	30122								
23	30123								
24	30124								
25	30125	224.0.131.6	224.0.131.22	224.0.131.38	224.0.131.54	233.130.124.6	233.130.124.22	233.130.124.38	233.130.124.54
26	30126								
27	30127								
28	30128								
29	30129	224.0.131.7	224.0.131.23	224.0.131.39	224.0.131.55	233.130.124.7	233.130.124.23	233.130.124.39	233.130.124.55
30	30130								
31	30131								
32	30132								
33	30133	224.0.131.8	224.0.131.24	224.0.131.40	224.0.131.56	233.130.124.8	233.130.124.24	233.130.124.40	233.130.124.56

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. Members should not configure their networks or systems for these addresses.

Secondary Datacenter		BZX Options Gig-Shaped [OE] 174.136.181.192/28	
Unit	**IP Port**	**Real-time MC**	**Gap Response MC**
1	31801	233.19.3.96	233.19.3.97
2	31802		
3	31803		
4	31804		
5	31805	233.19.3.98	233.19.3.99
6	31806		
7	31807		
8	31808		
9	31809	233.19.3.100	233.19.3.101
10	31810		
11	31811		
12	31812		
13	31813	233.19.3.102	233.19.3.103
14	31814		
15	31815		
16	31816		
17	31817	233.19.3.104	233.19.3.105
18	31818		
19	31819		
20	31820		
21	31821	233.19.3.106	233.19.3.107
22	31822		
23	31823		
24	31824		
25	31825	233.19.3.108	233.19.3.109
26	31826		
27	31827		
28	31828		
29	31829	233.19.3.110	233.19.3.111
30	31830		
31	31831		
32	31832		
33	31833		

9.2.8 C1 Options Address/Unit Distribution

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

Primary Datacenter		5G-Shaped [CA] 170.137.114.32 /27		8G-Shaped Feed [CC] 170.137.114.0 /27		5G-Shaped Feed [CB] 170.137.115.32 /27		8G-Shaped Feed [CD] 170.137.115.0 /27	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30301	224.0.74.46	224.0.74.55	224.0.74.0	224.0.74.37	233.182.199.174	233.182.199.183	233.182.199.128	233.182.199.165
2	30302			224.0.74.1				233.182.199.129	
3	30303			224.0.74.2				233.182.199.130	
4	30304			224.0.74.3				233.182.199.131	
5	30305	224.0.74.47	224.0.74.56	224.0.74.4	224.0.74.38	233.182.199.175	233.182.199.184	233.182.199.132	233.182.199.166
6	30306			224.0.74.5				233.182.199.133	
7	30307			224.0.74.6				233.182.199.134	
8	30308			224.0.74.7				233.182.199.135	
9	30309	224.0.74.48	224.0.74.57	224.0.74.8	224.0.74.39	233.182.199.176	233.182.199.185	233.182.199.136	233.182.199.167
10	30310			224.0.74.9				233.182.199.137	
11	30311			224.0.74.10				233.182.199.138	
12	30312			224.0.74.11				233.182.199.139	
13	30313	224.0.74.49	224.0.74.58	224.0.74.12	224.0.74.40	233.182.199.177	233.182.199.186	233.182.199.140	233.182.199.168
14	30314			224.0.74.13				233.182.199.141	
15	30315			224.0.74.14				233.182.199.142	
16	30316			224.0.74.15				233.182.199.143	
17	30317	224.0.74.50	224.0.74.59	224.0.74.16	224.0.74.41	233.182.199.178	233.182.199.187	233.182.199.144	233.182.199.169
18	30318			224.0.74.17				233.182.199.145	
19	30319			224.0.74.18				233.182.199.146	
20	30320			224.0.74.19				233.182.199.147	
21	30321	224.0.74.51	224.0.74.60	224.0.74.20	224.0.74.42	233.182.199.179	233.182.199.188	233.182.199.148	233.182.199.170
22	30322			224.0.74.21				233.182.199.149	
23	30323			224.0.74.22				233.182.199.150	
24	30324			224.0.74.23				233.182.199.151	
25	30325	224.0.74.52	224.0.74.61	224.0.74.24	224.0.74.43	233.182.199.180	233.182.199.189	233.182.199.152	233.182.199.171
26	30326			224.0.74.25				233.182.199.153	
27	30327			224.0.74.26				233.182.199.154	
28	30328			224.0.74.27				233.182.199.155	
29	30329	224.0.74.53	224.0.74.62	224.0.74.28	224.0.74.44	233.182.199.181	233.182.199.190	233.182.199.156	233.182.199.172
30	30330			224.0.74.29				233.182.199.157	
31	30331			224.0.74.30				233.182.199.158	
32	30332			224.0.74.31				233.182.199.159	
33	30333	224.0.74.54	224.0.74.63	224.0.74.32	224.0.74.45	233.182.199.182	233.182.199.191	233.182.199.160	233.182.199.173
34	30334			224.0.74.33				233.182.199.161	
35	30335			224.0.74.34				233.182.199.162	

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. Members should not configure their networks or systems for these addresses.

Secondary Datacenter		5G-Shaped Feed [CE] 170.137.124.192/28	
Unit	**IP Port**	**Real-time MC**	**Gap Response MC**
1	31301	233.19.3.192	233.19.3.208
2	31302		
3	31303		
4	31304		
5	31305	233.19.3.193	233.19.3.209
6	31306		
7	31307		
8	31308		
9	31309	233.19.3.194	233.19.3.210
10	31310		
11	31311		
12	31312		
13	31313	233.19.3.195	233.19.3.211
14	31314		
15	31315		
16	31316		
17	31317	233.19.3.196	233.19.3.212
18	31318		
19	31319		
20	31320		
F21	31321	233.19.3.197	233.19.3.213
22	31322		
23	31323		
24	31324		
25	31325	233.19.3.198	233.19.3.214
26	31326		
27	31327		
28	31328		
29	31329	233.19.3.199	233.19.3.215
30	31330		
31	31331		
32	31332		
33	31333	233.19.3.200	233.19.3.216
34	31334		
35	31335		

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.

9.2.9 C2 Options Address/Unit Distribution

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

Primary Datacenter		Gig-Shaped [WA] 174.136.168.160/28		5G-Shaped [WC] 174.136.168.176/28		Gig-Shaped [WB] 174.136.168.192/28		5G-Shaped [WD] 174.136.168.208/28	
Unit	IP Port	Real-time MC	Gap Resp. MC	Real-time MC	Gap Resp. MC	Real-time MC	Gap Resp. MC	Real-time MC	Gap Resp. MC
1	30201	224.0.131.176	224.0.131.192	224.0.131.208	224.0.131.224	233.130.124.176	233.130.124.192	233.130.124.208	233.130.124.224
2	30202								
3	30203								
4	30204								
5	30205	224.0.131.177	224.0.131.193	224.0.131.209	224.0.131.225	233.130.124.177	233.130.124.193	233.130.124.209	233.130.124.225
6	30206								
7	30207								
8	30208								
9	30209	224.0.131.178	224.0.131.194	224.0.131.210	224.0.131.226	233.130.124.178	233.130.124.194	233.130.124.210	233.130.124.226
10	30210								
11	30211								
12	30212								
13	30213	224.0.131.179	224.0.131.195	224.0.131.211	224.0.131.227	233.130.124.179	233.130.124.195	233.130.124.211	233.130.124.227
14	30214								
15	30215								
16	30216								
17	30217	224.0.131.180	224.0.131.196	224.0.131.212	224.0.131.228	233.130.124.180	233.130.124.196	233.130.124.212	233.130.124.228
18	30218								
19	30219								
20	30220								
21	30221	224.0.131.181	224.0.131.197	224.0.131.213	224.0.131.229	233.130.124.181	233.130.124.197	233.130.124.213	233.130.124.229
22	30222								
23	30223								
24	30224								
25	30225	224.0.131.182	224.0.131.198	224.0.131.214	224.0.131.230	233.130.124.182	233.130.124.198	233.130.124.214	233.130.124.230
26	30226								
27	30227								
28	30228								
29	30229	224.0.131.183	224.0.131.199	224.0.131.215	224.0.131.231	233.130.124.183	233.130.124.199	233.130.124.215	233.130.124.231
30	30230								
31	30231								
32	30232								
33	30233	224.0.131.184	224.0.131.200	224.0.131.216	224.0.131.232	233.130.124.184	233.130.124.200	233.130.124.216	233.130.124.232

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. Members should not configure their networks or systems for these addresses.

Secondary Datacenter		C2 Options Gig-Shaped [WE] 170.137.17.80/29	
Unit	**IP Port**	**Real-time MC**	**Gap Response MC**
1	31201	233.182.199.64	233.182.199.80
2	31202		
3	31203		
4	31204		
5	31205	233.182.199.65	233.182.199.81
6	31206		
7	31207		
8	31208		
9	31209	233.182.199.66	233.182.199.82
10	31210		
11	31211		
12	31212		
13	31213	233.182.199.67	233.182.199.83
14	31214		
15	31215		
16	31216		
17	31217	233.182.199.68	233.182.199.84
18	31218		
19	31219		
20	31220		
21	31221	233.182.199.69	233.182.199.85
22	31222		
23	31223		
24	31224		
25	31225	233.182.199.70	233.182.199.86
26	31226		
27	31227		
28	31228		
29	31229	233.182.199.71	233.182.199.87
30	31230		
31	31231		
32	31232		
33	31233	233.182.199.72	233.182.199.88

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.

9.2.10 EDGX Options Address/Unit Distribution

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

Primary Datacenter		Gig-Shaped [EA] 174.136.171.160/28		5G-Shaped [EC] 174.136.171.176/28		Gig-Shaped [EB] 174.136.171.192/28		5G-Shaped [ED] 174.136.171.208/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30501	224.0.131.64	224.0.131.80	224.0.131.96	224.0.131.112	233.130.124.64	233.130.124.80	233.130.124.96	233.130.124.112
2	30502								
3	30503								
4	30504								
5	30505	224.0.131.65	224.0.131.81	224.0.131.97	224.0.131.113	233.130.124.65	233.130.124.81	233.130.124.97	233.130.124.113
6	30506								
7	30507								
8	30508								
9	30509	224.0.131.66	224.0.131.82	224.0.131.98	224.0.131.114	233.130.124.66	233.130.124.82	233.130.124.98	233.130.124.114
10	30510								
11	30511								
12	30512								
13	30513	224.0.131.67	224.0.131.83	224.0.131.99	224.0.131.115	233.130.124.67	233.130.124.83	233.130.124.99	233.130.124.115
14	30514								
15	30515								
16	30516								
17	30517	224.0.131.68	224.0.131.84	224.0.131.100	224.0.131.116	233.130.124.68	233.130.124.84	233.130.124.100	233.130.124.116
18	30518								
19	30519								
20	30520								
21	30521	224.0.131.69	224.0.131.85	224.0.131.101	224.0.131.117	233.130.124.69	233.130.124.85	233.130.124.101	233.130.124.117
22	30522								
23	30523								
24	30524								
25	30525	224.0.131.70	224.0.131.86	224.0.131.102	224.0.131.118	233.130.124.70	233.130.124.86	233.130.124.102	233.130.124.118
26	30526								
27	30527								
28	30528								
29	30529	224.0.131.71	224.0.131.87	224.0.131.103	224.0.131.119	233.130.124. 71	233.130.124.87	233.130.124.103	233.130.124.119
30	30530								
31	30531								
32	30532								
33	30533	224.0.131.72	224.0.131.88	224.0.131.104	224.0.131.120	233.130.124.72	233.130.124.88	233.130.124.104	233.130.124.120

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. Members should not configure their networks or systems for these addresses.

Secondary Datacenter		EDGX Options Gig-Shaped [EE] 174.136.176.112/28	
Unit	**IP Port**	**Real-time MC**	**Gap Response MC**
1	31901	233.19.3.16	233.19.3.17
2	31902		
3	31903		
4	31904		
5	31905	233.19.3.18	233.19.3.19
6	31906		
7	31907		
8	31908		
9	31909	233.19.3.20	233.19.3.21
10	31910		
11	31911		
12	31912		
13	31913	233.19.3.22	233.19.3.23
14	31914		
15	31915		
16	31916		
17	31917	233.19.3.24	233.19.3.25
18	31918		
19	31919		
20	31920		
21	31921	233.19.3.26	233.19.3.27
22	31922		
23	31923		
24	31924		
25	31925	233.19.3.28	233.19.3.29
26	31926		
27	31927		
28	31928		
29	31929	233.19.3.30	233.19.3.31
30	31930		
31	31931		
32	31932		
33	31933		

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.

9.3 US Equities Certification Environment Configuration

9.3.1 BYX/EDGA/EDGX Unit/Symbol Distribution

The following table describes the Cboe symbol distribution across units.

Unit	Symbol Range Start
1	A
2	AIV
3	AT
4	BIE
5	CAU
6	CNP
7	CXX
8	DRJ
9	ELT
10	EX
11	FNW
12	GLE
13	HEI
14	IEM
15	IWF
16	JPN
17	LNC
18	MIN
19	NE
20	OGT
21	PGB
22	QLE
23	RSX
24	SHQ
25	SPZ
26	TDC
27	TSR
28	URJ
29	VLO
30	WEB
31	XLF
32	*All Cboe Listed Securities*

9.3.2 BZX Unit/Symbol Distribution

The following table describes the Cboe symbol distribution across units for BZX Exchange. Note that the unit distribution differs from other Cboe US Equity Exchanges as a result of additional Matching Units that have been allocated specifically to the BZX Exchange platform in support of Cboe Listed Securities.

Unit	Symbol Range	Unit	Symbol Range
1	A-AIUZZ	19	NE-OGSZZ
2	AIV-ASZZZ	20	OGT-PGAZZ
3	AT-BIDZZ	21	PGB-QLDZZ
4	BIE-CATZZ	22	QLE-RSWZZ
5	CAU-CNOZZ	23	RSX-SHPZZ
6	CNP-CXWZZ	24	SHQ-SPYZZ
7	CXX-DRIZZ	25	SPZ-TDBZZ
8	DRJ-ELSZZ	26	TDC-TSQZZ
9	ELT-EWZZZ	27	TSR-URIZZ
10	EX-FNVZZ	28	URJ-VLNZZ
11	FNW-GLDZZ	29	VLO-WEAZZ
12	GLE-HEHZZ	30	WEB-XLEZZ
13	HEI-IELZZ	31	XLF-ZZZZZ
14	IEM-IWEZZ	32*	*Cboe Listed ETP unit assignments may be obtained from a CSV file, which is generated each morning at 2 a.m. ET.*
15	IWF-JPMZZ	33	
16	JPN-LNBZZ	34*	
17	LNC-MIMZZ	35*	*ZTEST*
18	MIN-NDZZZ		

*Unit ONLY supports Cboe Listed Securities.

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.

9.3.3 Equities Certification Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Certification Data Center	74.115.128.129

9.3.4 BZX Address/Unit Distribution

The following tables describe the unit distribution across certification BZX Exchange Multicast PITCH feeds out of the Primary datacenter.

Primary Datacenter		Certification 174.136.174.80/28	
Unit	IP Port	Real-time MC	Gap Resp. MC
1	32001	224.0.74.236	224.0.74.237
2	32002		
3	32003		
4	32004		
5	32005		
6	32006		
7	32007		
8	32008		
9	32009		
10	32010		
11	32011		
12	32012		
13	32013		
14	32014		
15	32015		
16	32016		
17	32017	224.0.74.238	224.0.74.239
18	32018		
19	32019		
20	32020		
21	32021		
22	32022		
23	32023		
24	32024		
25	32025		
26	32026		
27	32027		
28	32028		
29	32029		
30	32030		
31	32031		
32	32032		
33	32033		
34	32034		
35	32035		

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.

9.3.5 BZX Simulated DR Address/Unit Distribution

The following tables describe the unit distribution across certification BZX Exchange Multicast PITCH feeds out of the Primary datacenter.

Simulated DR Data Center		DR Certification 174.136.174.232/29	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32001	224.0.74.212	224.0.74.213
2	32002		
3	32003		
4	32004		
5	32005		
6	32006		
7	32007		
8	32008		
9	32009		
10	32010		
11	32011		
12	32012		
13	32013		
14	32014		
15	32015		
16	32016		
17	32017	224.0.74.214	224.0.74.215
18	32018		
19	32019		
20	32020		
21	32021		
22	32022		
23	32023		
24	32024		
25	32025		
26	32026		
27	32027		
28	32028		
29	32029		
30	32030		
31	32031		
32	32032		
33	32033		
34	32034		
35	32035		

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.

9.3.6 BYX Address/Unit Distribution

The following tables describe the unit distribution across certification BYX Exchange Multicast PITCH feeds out of the Primary datacenter.

Primary Datacenter		Certification 174.136.174.144/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32201	224.0.74.232	224.0.74.233
2	32202		
3	32203		
4	32204		
5	32205		
6	32206		
7	32207		
8	32208		
9	32209		
0	32210		
11	32211		
12	32212		
13	32213		
14	32214		
15	32215		
16	32216		
17	32217	224.0.74.234	224.0.74.235
18	32218		
19	32219		
20	32220		
21	32221		
22	32222		
23	32223		
24	32224		
25	32225		
26	32226		
27	32227		
28	32228		
29	32229		
30	32230		
31	32231		
32	32232		

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.

9.3.7 EDGA Address/Unit Distribution

The following tables describe the unit distribution across certification EDGA Exchange Multicast PITCH feeds out of the Primary datacenter.

Primary Datacenter		Certification 174.136.174.16/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32401	224.0.74.224	224.0.74.225
2	32402		
3	32403		
4	32404		
5	32405		
6	32406		
7	32407		
8	32408		
9	32409		
10	32410		
11	32411		
12	32412		
13	32413		
14	32414		
15	32415		
16	32416		
17	32417	224.0.74.226	224.0.74.227
18	32418		
19	32419		
20	32420		
21	32421		
22	32422		
23	32423		
24	32424		
25	32425		
26	32426		
27	32427		
28	32428		
29	32429		
30	32430		
31	32431		
32	32432		

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.

9.3.8 EDGX Address/Unit Distribution

The following tables describe the unit distribution across certification EDGX Exchange Multicast PITCH feeds out of the Primary datacenter.

Primary Datacenter		Certification 174.136.174.48/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32301	224.0.74.228	224.0.74.229
2	32302		
3	32303		
4	32304		
5	32305		
6	32306		
7	32307		
8	32308		
9	32309		
10	32310		
11	32311		
12	32312		
13	32313		
14	32314		
15	32315		
16	32316		
17	32317	224.0.74.230	224.0.74.231
18	32318		
19	32319		
20	32320		
21	32321		
22	32322		
23	32323		
24	32324		
25	32325		
26	32326		
27	32327		
28	32328		
29	32329		
30	32330		
31	32331		
32	32332		

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.

9.4 US Options Certification Environment Configuration

9.4.1 Unit Distribution

Units 1-30

Unit	BZX/C1/C2/EDGX Symbol Range	Exceptions
1	A – ADBD~	
2	ADBE – ASMK~	Excludes AMZN
3	ASML – BBX~~	
4	BBY – BYND~	
5	BYNE – COUO~	
6	COUP – DH~~~	
7	DI – ENPG~	Excludes DJX
8	ENPH – FCXA~	
9	FCXB – GLDA~	
10	GLDB –INCX~	Excludes GOOG, GOOGL
11	INCY – IWMA~	
12	IWMB – LMS~~	
13	LMT – MELI~	
14	MELJ – NED~~	Excludes MRUT, MXEA, MXEF, NANOS
15	NEE – NSCA~	
16	NSCB – OKS~~	Excludes OEX
17	OKT – PTOM~	
18	PTON –ROKU~	Excludes QQQ, RLG, RLV
19	ROKV – SHOP~	Excludes RUI, RUT, RUTW
20	SHOQ – SQAA~	Excludes SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPESG, SPX/SPXW, SPY
21	SQAB – TQQP~	
22	TQQQ – ULTA~	Excludes TSLA, UKXM
23	ULTB – WAAA~	Excludes VIX, VIXW
24	WAAB – XLT~~	Excludes XEO
25	XLU – Z~~~~	Excludes XSP
26	GOOG, GOOGL	
27	TSLA	
28	QQQ	
29	AMZN	
30	SPY	

Units 31-35

Unit	BZX/C2 Symbol Range	C1 Symbol Range
31	DJX (C2 Only), RUT, RUTW (C2 Only)	DJX, MRUT, MXEA, MXEF, OEX, RLG, RLV, RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPESG, XEO, UKXM, XSP
32	N/A	NANOS, VIX, VIXW
33	N/A	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.

9.4.2 Options Certification Multicast Routing Parameters

Primary Certification Data Center	Rendezvous Point
BZX, C2, EDGX	74.115.128.129
C1	74.115.128.131

9.4.3 BZX Options Address/Unit Distribution

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

Primary Datacenter		Certification 174.136.174.112/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32101	224.0.74.240	224.0.74.241
2	32102		
3	32103		
4	32104		
5	32105		
6	32106		
7	32107		
8	32108		
9	32109		
10	32110		
11	32111		
12	32112		
13	32113		
14	32114		
15	32115		
16	32116		
17	32117	224.0.74.242	224.0.74.243
18	32118		
19	32119		
20	32120		
21	32121		
22	32122		
23	32123		
24	32124		
25	32125		
26	32126		
27	32127		
28	32128		
29	32129		
30	32130		
31	32131		
32	32132		
33	32133		

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.

9.4.4 C1 Options Address/Unit Distribution

The following table describes the unit distribution across certification C1 Options 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	32301	233.103.126.0	233.103.126.2
2	32302		
3	32303		
4	32304		
5	32305		
6	32306		
7	32307		
8	32308		
9	32309		
10	32310		
11	32311		
12	32312		
13	32313		
14	32314		
15	32315		
16	32316		
17	32317	233.103.126.1	233.103.126.3
18	32318		
19	32319		
20	32320		
21	32321		
22	32322		
23	32323		
24	32324		
25	32325		
26	32326		
27	32327		
28	32328		
29	32329		
30	32330		
31	32331		
32	32332		
33	32333		
34	32334		
35	32335		

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.

9.4.5 C2 Options Address/Unit Distribution

The following table describes the unit distribution across certification C2 Options 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	32201	224.0.74.164	224.0.74.166
2	32202		
3	32203		
4	32204		
5	32205		
6	32206		
7	32207		
8	32208		
9	32209		
10	32210		
11	32211		
12	32212		
13	32213		
14	32214		
15	32215		
16	32216		
17	32217	224.0.74.165	224.0.74.167
18	32218		
19	32219		
20	32220		
21	32221		
22	32222		
23	32223		
24	32224		
25	32225		
26	32226		
27	32227		
28	32228		
29	32229		
30	32230		
31	32231		
32	32232		
33	32233		

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.

9.4.6 EDGX Options Address/Unit Distribution

The following table describes the unit distribution across certification EDGX Options 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	32501	224.0.74.244	224.0.74.245
2	32502		
3	32503		
4	32504		
5	32505		
6	32506		
7	32507		
8	32508		
9	32509		
10	32510		
11	32511		
12	32512		
13	32513		
14	32514		
15	32515		
16	32516		
17	32517	224.0.74.246	224.0.74.247
18	32518		
19	32519		
20	32520		
21	32521		
22	32522		
23	32523		
24	32524		
25	32525		
26	32526		
27	32527		
28	32528		
29	32529		
30	32530		
31	32531		
32	32532		
33	32533		

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.

10 Options Trade Condition Codes

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

Type	Field Value
a	Single Leg Auction Non ISO Cboe auction types include AIM, SAM
b	Single Leg Auction ISO Cboe auction types are AIM ISO, SAM ISO
c	Single Leg Cross Non ISO Cboe auction types include Cust to Cust AIM, QCC
d	Single Leg Cross ISO Cboe order type is Cust to Cust AIM ISO
e	Single Leg Floor Trade
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
m	Complex Floor Trade Against Single Leg(s) All complex floor executions are reported as condition ‘m’.
n	Complex with Stock Electronic Trade Includes COA auctions done electronically
o	Complex with Stock Cross Cboe auction types include C-QCC w/ Stock
p	Complex with Stock Floor Trade
t	Complex Floor Trade of Proprietary Products Marked as “Combo Order”
u	Multilateral Compression Trade of Proprietary Products
v	Extended Hours Trade. Transaction represents a trade executed during the Curb session.
I	Electronic Trade

K*	Cabinet Order
O*	Opening Trade
S	ISO

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

11 Connectivity

11.1 Supported Extranet Carriers

The WAN-Shaped feed will be made available to customers through extranet carriers that have completed their multicast implementation and certified with Cboe on a per-market basis. 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.

11.2 Bandwidth Recommendation

The Gig-shaped feeds require 1Gbps of bandwidth while the WAN-shaped feeds require 100Mbps of bandwidth. 5-Gig feeds require at least one 10 Gbps connection that is provisioned for 5-Gig options feeds. Cboe will use 90% of these respective bandwidths for Multicast PITCH to allow members to use the same physical connection for FIX order entry if desired.

11.3 Multicast Test Program

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

12 References

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

13 Support

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

Revision History

Document Version	Date	Description
2.0.0	12/19/08	Initial version 1.0.0.
2.0.1	12/26/08	Correction to Hdr Sequence example.
2.0.2	01/06/09	Symbol distribution update, IP information added.
2.0.3	01/08/09	Symbol distribution update.
2.0.4	01/12/09	Added Source IP and RP information.
2.0.5	01/16/09	Reference added for Multicast PITCH test program.
2.0.6	01/21/09	Length on Trade – Short example created.
2.1.0	01/29/09	Added information on Spin Servers & WAN Source Ips.
2.2.0	05/27/09	Added FLAG fields to the Add and Modify messages.
2.2.1	06/03/09	Added certification environment details.
2.3.0	08/11/09	Removed BOLT references.
2.4.0	10/05/09	Added extensions for options symbol mapping.
2.5.0	11/13/09	Updated to new technical specification template. Modified Side Indicator to always be “B” regardless of resting side. Added list of Extranets supporting Multicast PITCH redistribution for WAN-shaped feeds.
2.5.1	12/01/09	Missing Price row added to Order Executed at Price/Size message. Multicast PITCH settings for Options Certification added.
2.5.2	12/14/09	Added logic for decoding internal matched vs. routed trades via Execution ID.
2.6.0	01/12/10	Expanded Form created for Add Order and Trade messages. Added Symbol Distribution for US Options Production. Updated Supported Carriers.
2.6.1	02/10/10	Added Multicast IP Ports for US Options Production.
2.6.2	02/11/10	Corrected “length” in example 11.25.
2.6.3	02/19/10	Modified source Multicast addresses for US Options Production in Section 7.4.
2.6.4	02/26/10	Updated Supported Carriers in Section 13.1 to highlight Equities vs. Options market differences.
2.6.5	04/06/10	Expanded Form implemented for Add Order and Trade messages for 8-character symbol support.

2.7.0	04/16/10	Added references for BYX Equity Exchange. BYX Multicast address tables added in Sections 6.5, 6.6 and 8.4. Converted Feed IDs to 2 character format.
2.7.1	06/02/10	Completed updates to table in Section 6.6 for BYX detailing production address/unit distribution.
2.7.2	06/09/10	Obfuscate `Trade` message Order IDs by default
2.7.3	07/20/10	SAVVIS COIN B certified to redistribute Multicast PITCH for Bats Options.
2.8.0	08/16/10	Added "Order Representation" section. Described OrderID obfuscation logic for reserve and hidden orders. Updated feed symbol distribution for Bats Options. Reordered various sections.
2.9.0	09/03/10	Added `Trading Status` message definition. Added ability to receive `Trading Status` messages during a spin.
2.9.1	09/16/10	Updated Rendezvous Point addresses for BYX.
2.9.2	09/21/10	Corrected minor typo in `Trading Status` message type description.
2.9.3	10/05/10	Corrected typo in BYX WAN Shaped Gap response IP address.
2.9.4	11/09/10	Clarified `Modify Order` messages were a category of messages and not a specific message type.
2.9.5	01/07/11	`Order Executed at Price/Size` message clarification.
2.9.6	02/02/11	Clarified that `Trading Status` messages are presently applicable to Equities only.
2.9.7	04/14/11	Corrected BYX Certification Gap response IP address.
2.10.0	05/09/11	Added `Auction Update` message. Effective Date 10/7/11.
2.10.1	05/25/11	Corrected Options Production symbol distribution table. Distribution has been in effect since 05/02/11.
2.10.2	06/06/11	Various changes based on feedback and internal discussions.
2.10.3	06/27/11	Minor formatting update.
2.10.4	07/22/11	Minor corrections to Auction Update messages applied. Spin Session Example updated to include references to Trading Status and Auction Update messages. Updated Options Production symbol distribution table. Distribution to be effective 07/27/11.

2.10.5	08/01/11	Added Quote-Only Halt Status in preparation for support of future Bats Listings. Minor formatting updates.
2.11.0	09/09/11	Added Auction Update message. Effective date 10/7/11. The first character of Execution IDs will use “C” for Auction Fills. Effective date 10/7/11.
2.11.1	10/21/11	Updated Example Messages with an Execution ID that meets the criteria defined in Section 2.5.
2.12.0	11/16/11	Published plans to convert from 24 units to 32 units in Bats Options effective 12/12/11 in production and from 2 to 8 matching units in certification on 11/28/11.
2.12.1	12/10/11	Removed references to previous unit distributions.
2.13.0	01/31/12	Published plans to convert from 12 units to 32 units in Bats BYX Exchange production environment effective 02/25/12.
2.13.1	02/01/12	Minor clarification added to Modify Order description.
2.13.2	02/14/12	Changed Symbol Range Start on unit 23 for BYX Exchange from ‘SA’ to ‘S’.
2.14.0	02/29/12	Published plans to convert from 12 units to 32 units in Bats BZX Exchange production environment effective 04/14/12 (postponed to 05/12/12).
2.15.0	03/07/12	Added 4 byte MPID to the Add Order (expanded) message. Effective 5/7/12.
2.15.1	04/02/12	Updated effective date of 12 unit to 32 unit conversion for Bats BZX Exchange to be 05/12/12.
2.15.2	05/04/12	Cleaned up some errata in the section 8 Example Messages.
2.15.3	05/17/12	Removed references to previous unit distributions for BZX Exchange.
2.16.0	06/01/12	Added multicast IP addresses for Chicago, IL (CIL) secondary data center.
2.16.1	06/06/12	Updated multicast port ranges for CIL market data feeds.
2.17.1	08/07/12	Removed multicast IP addresses for Nutley, NJ (NNJ) secondary data center.
2.17.2	08/13/12	Updated Feed Descriptions with correct information following secondary datacenter migration.
2.18.0	09/14/12	Added Unit Clear message. Effective date 02/15/13. Added Retail Price Improvement message support for the BYX Exchange. Effective date 11/05/12 (test symbols) and 01/11/13 (other defined symbols).

2.19.0	11/15/12	Added multicast IP addresses for Weehawken, NJ redundant primary feeds (ZB, ZD, YB, YD, OB, OD). Availability date of the new feeds to be determined.
2.19.1	11/29/12	Fixed typo on multicast address tables for BYX and Options.
2.19.2	03/28/13	Revised OA and YA feed emitter source IP addresses. Effective date 04/15/13 and 04/22/13 respectively.
2.19.3	04/24/13	Added YB/YD release date – effective May 3, 2013. Added OB/OD release date – effective May 7, 2013. Added ZB/ZD release date – effective May 9, 2013. Removed old OA and YA feed emitter source IP addresses.
2.19.4	05/01/13	Fixed source IP address typo on BZX ZB feed.
2.19.5	05/15/13	Removed redundant feed (B/D) effective dates.
2.19.6	05/28/13	Added field to Symbol Mapping Message type for Symbol Condition – effective July 18, 2013.
2.19.7	06/06/13	Added Unit Auction Summary (0x96), Unit Clear (0x97) and Retail Price Improvement (0x98) to list of message types.
2.20.0	08/19/13	Updated symbol distributions for BYX and BZX Exchange certification and production environments to accommodate a unit dedicated Bats Listed securities. Added 3rd Unit to BYX and BYX Exchange certification environments.
2.20.1	08/28/13	Updated BZX and BYX Equities GRP second request limits to 320/second.
2.20.2	09/11/13	Updated BZX Options GRP second request limit to 320/second.
2.20.3	10/05/13	GRP Retransmission limits updated to session based limits. Effective 10/10/13 for Options and 10/11/13 for Equities.
2.20.4	01/29/14	Updated Trading Status message definition to include Options market. Effective 03/06/14.
2.30.0	04/04/14	Version of Multicast PITCH Specification for the NY5 data center supporting EDGA, EDGX, BYX, BZX and Bats Options Exchange. Requirement of Spin Request to match Spin Image Available sequence numbers has been relaxed. Effective on BYX, BZX and Options on 10/03/14. Spin Response Status of 'O' no longer supported. Trading Status of 'H' will be implied at system startup and 'T' will be sent as securities are available for trading. Effective on BYX, BZX and Options on 10/03/14. Add Order Expanded ParticipantID may indicate "RTL" for retail specified orders in equities.
2.30.1	04/30/14	Changed `Add Order Expanded` *ParticipantID* from being able to indicate "RTL" to "RETL" for retail specified orders in equities.

2.30.2	06/05/14	Changed `Add Order Expanded` *ParticipantID* from being able to indicate "RETL" to "RTAL" for retail specified orders in equities. Effective on BYX and BZX on 10/03/14.
2.30.3	08/01/14	`Trading Status` of 'A' will be distributed when Bats equity markets are accepting orders for queuing in preparation for the market open. Effective on BYX, BZX on 11/14/14. `Trading Status` of 'Q' will be distributed when Bats equity markets are accepting orders for queuing in preparation for the market open. Effective on Bats Options on 10/03/14. `Trading Status` of 'S' will be used to indicate an Exchange specific suspension in trading. Effective on BYX, BZX and Options on 10/03/14. `Trading Status` of 'H' will be implied at system startup. Spins will include a Trading Status message for every symbol that has not been Halted ('H') since system startup. Effective on BYX, BZX and Options on 10/03/14. Updated Multicast configuration addresses defined throughout Chapter 9 for NY5.
2.30.4	08/05/14	Added references back into this specification for NJ2 multicast addressing for BYX and BZX Exchange (production).
2.30.5	08/07/14	`Spin Response` *Status* of 'O' will continue to be supported. Effective 10/03/14 it will only be sent when the *Sequence* requested is greater than *Sequence* available by the next spin.
2.30.6	09/12/14	Added clarification to symbol distributions to include EDGA and EDGX markets.
2.31.0	10/07/14	Removed references to changes effective 10/3/14. Add clarification to `Spin Response` to allow for zero order count where only messages available are `Trading Status` or `Time` messages.
2.31.1	10/27/14	`Trading Status` of 'S' will be implied at system startup. Effective 11/10/14 on Bats Options and 11/14/14 on BYX/BZX Exchange. `Trading Status` messages will be sent in spins for all symbols that are not "S"uspended. Effective 11/10/14 in Bats Options and effective 11/14/14 in BYX/BZX.
2.32.0	01/21/15	Specification title change.
2.32.1	01/22/15	Updated multicast addressing tables for BYX, BZX and Bats Options production environments in NY5 to highlight availability dates.
2.32.2	05/05/15	Update name change for Bats Options Exchange to BZX Options Exchange.
2.32.3	05/18/15	Removed all references to NJ2 datacenter.

2.32.4	07/01/15	Updated *ParticipantID* field of the `Add Order Expanded` message to include "CUST" for customer orders on EDGX Options. Added EDGX Options multicast address tables. Addresses to be defined at a later date
2.32.5	07/16/15	Updated multicast addressing tables for EDGX Options production and certification environments in NY5.
2.32.6	07/24/15	Updated multicast addressing tables for EDGX Options Secondary in Chicago. Updated multicast port numbers for all EDGX Options feeds.
2.32.7	08/10/15	Updated rendezvous points for certification and the EDGX Options Exchange.
2.33.0	09/09/15	BZX Exchange address, unit distribution and symbol distribution updates effective 09/15/15 for certification and 10/19/15 for production. Changes in support of 3 new matching engines added for Bats Listed Securities. Only Gig-Shaped Feeds will be supported initially for EDGX Options. Eliminated WAN-Shaped Feed references.
2.33.1	09/21/15	Correction to BZX Exchange CH4 multicast IP assignment for new units 33-35, effective 10/19/15.
2.33.2	09/24/15	Eliminating WAN-Shaped Feeds for BZX Options effective 12/04/15.
2.34.0	12/08/15	Adding 5G-Shaped Feeds to NY5 data center for BZX Options and EDGX Options effective 01/22/16.
2.35.0	12/15/15	Symbol distribution updates effective 01/30/16 in production for EDGX Options and effective 02/06/16 in production for BZX Options. Effective for both options certification environments 01/08/16.
2.35.1	01/06/16	Updated symbol distribution for BZX/EDGX Options effective 01/08/16 in certification.
2.35.2	01/14/16	New source addresses for BZX/EDGX Options effective 01/22/16 updated.
2.36.0	01/22/16	Added *Customer Indicator* field to `Add Order Expanded` and removed the usage of 'CUST' in the *ParticipantID* field for EDGX Options. Changes will be effective for all equities and options certifications environments effective 02/02/16 and production environments ~~effective 03/01/16~~.
2.37.0	02/19/16	Updated symbol distribution for BZX/EDGX Options to remove reference to retired distribution Bats branding/logo changes.
2.37.1	02/24/16	*Customer Indicator* and *ParticipantID* field changes referenced in 2.36.0 postponed to be delivered effective 03/29/16.

2.37.2	04/07/16	Updated Example 8.13 to have the *Customer Indicator* and *ParticipantID* fields Added symbol "BATS" to BZX unit 35
2.37.3	05/17/16	Updated `Trading Status` to support Options Quoting Period change to 7:30 am ET. Modified Multicast PITCH Feeds Description to include 5-Gig Options feeds. Added support to "EDGX Options SUM Auctions" for: `Auction Notification, Auction Cancel and Auction Trade` message types effective 07/11/16
2.37.4	06/28/16	Removal of NBBO Price from Auction Notification Message and set message length to 43 bytes.
2.37.5	08/01/16	Added support for BAM Auctions.
2.37.6	09/06/16	Updated BZX Certification Unit/Symbol Distribution Added Simulated DR Multicast Address/Unit Distribution
2.37.7	01/06/17	Updated BZX Certification Unit/Symbol Distribution Updated description of `Auction Trade` message type.
2.37.8	04/11/17	Updated Unit/Symbol Distributions for BYX/EDGA/EDGX/BZX Production. Effective 5/22/2017 Updated Unit/Symbol Distributions for BYX/EDGA/EDGX/BZX Certification. Effective 5/8/2017
2.37.9	09/01/17	Added C2 Options references.
2.37.10	10/17/17	Cboe branding logo changes.
2.38.0	11/27/17	Added C2 Options Certification IP and Port information. Added RUT, RUTW options (C2 Options Only) to distinct unit (unit 33). Added clarification to handling of `Order Executed at Price/Size` message. Added *Trade Condition* to trade related messages for options only. Effective 1/16/2018.
2.38.1	02/05/18	Corrected the dissemination times listed for `Auction Update` messages in BZX Equities. *Trading Status* of "A" is valid for equities only. Added C2 Options Production IP and Port information. Improved distribution of Symbol Mapping Messages Effective 3/2/2018.
2.38.2	03/08/18	Updated Options Unit Distribution ranges. Updated BZX Equities Unit Distribution ranges for units 32-34 (effective in certification on 3/19/18 and production on 4/12/18).

2.38.3	03/21/18	Added 400SL Secondary Data Center E feed Rendezvous Point for C2. Added links to Equities Unit Distribution CSV file for both certification and production.
2.38.4	03/23/18	Updated Options Unit Distribution ranges effective date to 4/14/18.
2.39.0	07/03/18	Added support for Cboe Market Close (CMC) in `Auction Update` and `Auction Summary` messages effective TBD.
2.39.1	07/10/18	Execution IDs that start with 'M' are Cboe Market Close trades.
2.39.2	08/02/18	Updated symbol distribution list for BZX unit 35.
2.39.3	08/15/18	Updated BZX Options Unit Distribution ranges to support RUT on new unit 33.
2.39.4	08/21/18	Removal of Customer Indicator for C2 Options effective 08/31/18.
2.40.0	11/16/18	Added support for Cboe Options Exchange (C1).
2.40.1	11/21/18	Updated options feed configurations to note that 8 Gb/s and 5 Gb/s feed versions will be offered for C1.
2.40.2	12/06/18	Added notes identifying C1 Feature Pack 4 updates.
2.40.3	12/21/18	Removed Late Trade and Floor Trade values from *Trade Condition* field, as these were added in error. Added note indicating a `Top Trade` message can also be sent when an auction executes against a non-displayed order, such as a contra response (Effective in EDGX with Feature Pack 4).
2.40.4	02/05/19	Removed Bit 4 – Cabinet Order information from pertinent `Add Order` and `Order Executed` messages, as C1 will not have an electronic book for Cabinet orders.
2.40.5	02/14/19	Added certification IP addresses and unit distribution information for Cboe Options.
2.40.6	03/05/19	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. Added new table describing what messages are available in a spin for each asset class. `Options Auction Update` messages are sent at 5 or 60 second intervals depending on whether there has been a change.
2.40.7	03/26/19	Corrected total length for `Symbol Mapping` message to 38 bytes.
2.40.8	04/05/19	Correction to EDGX Options Real-time and Gap Response EE Feeds for Unit 33

2.40.9	04/08/19	Additional correction to EDGX Options Real-time and Gap Response EE Feeds for Unit 33.
2.40.10	04/15/19	Added Production IP addresses for C1 Options. `Transaction Begin` and `Transaction End` messages are currently restricted to C1 only. *ClientID* in `Add Order (expanded)` is only sent in Options and is not sent in Equities. Added DJX to C2 ME 33 in Unit/Product Distribution tables (effective 05/08/19).
2.40.11	04/30/19	Added new 'R' value to the *Customer Indicator* field in `Add Order (expanded)` message to indicate a Retail Order on EDGX Equities (effective 07/01/19).
2.40.12	05/01/19	Added notes indicating `Auction Summary, Options Auction Update,Transaction Begin, Transaction End, and Width Update` messages will be disseminated for C2 and EDGX options (effective with C1 Feature Pack 7).
2.40.13	05/08/19	Removed *Trading Status* field value 'S' = Exchange Specific Suspension from `Trading Status` message for Options, as this was added in error. Corrected C1 Production 5G-Shaped [CA], [CB} and 8G-Shaped [CC], [CD] network IP addresses. Corrected description of `Width Update` message to indicate that message is only sent in the event that baseline MCW and OCW values are modified from their original state.
2.40.14	05/14/19	Updated `Options Auction Update` message with *Opening Condition* = C (Crossed Composite Market), and added *Composite Market Bid Price* and *Composite Market Offer Price* fields. Added new `SOQ Strike Range Update` message. Updated example for `Options Auction Update` and added example for `SOQ Strike Range Update` messages. Added additional proprietary products to matching unit 31 in C1.
2.40.15	05/20/19	Added `Constituent Symbol Mapping` message with example.
2.40.16	06/12/19	Corrected certification and production C1 symbol range for units 9 and 20.
2.40.17	08/15/19	Added notes indicating `Options Auction Update` message *Opening Condition* field values 'B' and 'S' are C1 Only.
2.40.18	08/16/19	Updated C1 Options Multicast Routing Parameters for Primary Data Center A and B feeds.

2.40.19	09/17/19	Clarified references to 8 Gig-shaped, 5 Gig-shaped, and 1 Gig-shaped throttles noted in section 9.2.1 to indicate that Cboe Options does not support a 1 Gig-shaped feed. Corrected Sequenced Unit Header with 2 Messages example to indicate total of 50 bytes.
2.40.20	10/11/19	Corrected UKXM symbol exclusion entry in Unit Distribution table. Clarified description of `Time` message. Updated effective date for `Customer Idicator` value "R = Retail order". Effective on EDGX Equities only 11/1/19.
2.40.21	10/31/19	Added Options Trade Condition Codes section (effective 01/13/20).
2.40.22	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).
2.40.23	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).
2.40.24	01/3/20	Updated description for Options Trade Condition Code 't' to Complex Floor Trade of Proprietary Products Marked as "Combo Order".
2.40.25	01/7/20	Added note to Equities Trading Status Message indicating when 'A' and 'T' values will be disseminated in support of Managed Portfolio Shares. Effective on BZX Equities, TBD.
2.40.26	01/08/20	Removed "l = Complex Auction Against Single Legs(s)" from Options Trade Condition Codes table.
2.40.27	01/15/20	Added note indicating *Options Auction Update* and *Auction Summary* will be supported on BZX in support of new opening process (effective 01/30/20).
2.40.28	01/21/20	Added note to Options Trade Condition Code table indicating the value "i = Complex Floor Trade" will be deprecated effective 1/27/20. Upon the effective date all complex floor executions will be reported as condition 'm'.
2.40.29	01/30/20	Corrected Unit Symbol Distribution tables to indicate QQQ is an exception for C1 Unit 20 as it has a dedicated location on Unit 28. Added effective date for Cboe Market Close on BZX Equities, 3/6/20.

2.41.0	02/28/20	Language describing new sequence rollover behavior in case a given unit exceeds the maximum sequence (effective 3/16/20). Added Spin Server Rollover Usage Example. Added Gap Server Rollover Usage Example.
2.41.1	03/02/20	Added effective date for new sequence rollover behavior in case a given unit exceeds the maximum sequence.
2.41.2	08/27/20	Added SPESG to the Unit Symbol Distrbiution tables for C1 unti 31 (effective 9/21/20).
2.41.3	10/05/20	Added SPESG to the Unit Symbols Distribution C1 Exceptions.
2.41.4	10/20/20	Added XSP to the Unit Symbol Distribution tables for BZX and removed it from EDGX (effective 11/2/20).
2.41.5	10/27/20	Corrected description of `GTH Trading Status` to include value of 'R' as this value is currently being disseminated.
2.41.6	11/10/20	Added note to Equities `Trading Status` message to indicate new Early Order Acceptance and Early Trading Session times for EDGX Only (~~effective 12/7/20~~).
2.41.7	12/04/20	Removed note to Equities `Trading Status` message for Managed Portfolio Shares indicating times when 'A' and 'T' values will be disseminated specifically for Managed Portfolio Shares. Updated effective date of new Early Order Acceptance and Early Trading Session times on Equities `Trading Status` to TBD (EDGX Only).
2.41.8	01/22/21	Updated Price field description on `Auction Notification` message to indicate that for SPX and SPXW AIM, this field will reflect the auction start price (C1 Only) (effective 02/22/21).
2.41.9	02/01/21	Added MRUT to the Unit/Product Distribution tables for C1 unit 31 (effective 3/01/21). Added new updated Unit/Product Distribution tables with harmonized symbol ranges (effective 3/22/21).
2.41.10	02/08/21	Updated effective date of new Early Order Acceptance and Early Trading Session times on Equities `Trading Status` to 03/08/21 (EDGX Only).
2.41.11	03/03/21	Updated the `Delete Order` message description.
2.41.12	03/11/21	Updated the Unit Symbols Distribution Exceptions entries (effective 3/22/21).

2.41.13	03/25/21	Added Binary Date field type to Section 2.2 - Data Types (effective 10/10/21 ~~TBD~~ ~~09/27/21~~ ~~Q3 2021~~). Added new `Time Reference` message (effective 10/10/21 ~~TBD~~ ~~09/27/21~~ ~~Q3 2021~~). Added *EpochTime* field to `Time` message (effective 10/10/21 ~~TBD~~ ~~09/27/21~~ ~~Q3 2021~~). ~~Updated description of *Auction Type* field on `Options Auction Update` and `Auction Summary` messages (effective TBD 09/27/21 Q3 2021).~~ Updated description of *GTH Trading Status* field on `Trading Status` message (effective 11/21/21 ~~TBD 09/27/21~~ ~~Q3 2021~~). Cleaned up exchange-specific references on auction-related message types.
2.41.14	04/27/21	Added Periodic Auctions to `Auction Update` and `Auction Summary` messages (BYX Only) (**Effective 04/14/22** ~~Effective Q3 2021~~ ~~TBD~~).
2.41.15	05/06/21	Added clarification to the description of heartbeat messages indicating that when the system fails to receive two consecutive heartbeat messages within the specified interval the client connection is terminated. Added 'u = Multilateral Compression Trade of Proprietary Products' to Options Trade Condition Codes (Effective TBD ~~07/06/21~~)
2.41.16	05/13/21	Updated Curb session effective date to ~~02/07/22~~ ~~TBD~~ ~~09/27/21~~. Added 'v = Extended Hours Trade' Trade Condition code (effective 01/24/22 ~~TBD~~ ~~09/27/21~~). Updated link to Multicast test program.
2.41.17	06/15/21	Updated effective date for extended GTH session to 11/21/21.
2.41.18	06/18/21	Updated Cboe Compression Service Multilateral Compression effective date to ~~TBD~~ 08/12/21.
2.41.19	07/19/21	Updated Periodic Auctions effective date to (**Effective 04/14/22** ~~TBD~~).
2.41.20	07/28/21	Updated Cboe Compression Service Multilateral Compression effective date to 08/12/21.
2.41.21	08/26/21	Updated Sections 4.4 and 4.5 headings to indicate Options Only. Updated EDGX Order Acceptance starting time to 2:30 a.m. (effective 09/07/21). Updated Curb session effective date to ~~02/07/22~~ ~~TBD~~.

2.41.22	09/09/21	Added *Trading Status* field value 'L = Curb Trading (C1 Only)' for `Trading Status` messages (effective 01/24/22 ~~TBD~~). *GTH Trading Status* field will not be used for Curb session. ~~Updated description of *Auction Type* field on `Options Auction Update` and `Auction Summary` messages (*effective* TBD)~~.
2.41.23	09/30/21	Updated technical specification hyperlinks. Updated values for Execution IDs to indicate IDs that start with '1' or '2' are for Cboe Internal Match trades. Updated effective date for new `Time Reference` message (C1 Options Only), *EpochTime* field to `Time` message (C1 Options Only), and Binary Date field type to Section 2.2 - Data Types to 10/10/21. Added new section 1.3 - '24x5 Feed Hours and System Restart (C1 Options Only)' (effective 10/10/21).
2.41.24	11/04/21	Corrected example `Time` message values. Updated Curb session effective date to ~~02/07/22~~. Updated effective date for 'v = Extended Hours Trade' Trade Condition code to 01/24/22. Updated effective date for *Trading Status* field value 'L = Curb Trading' to 01/24/22. Removed note indicating *AuctionType* value 'O' on the Options `Auction Update` and `Auction Summary` messages will be sent prior to Curb session. This value will only be sent for the RTH Opening.
2.41.25	01/03/22	Updated `Delete Order` message description.
2.41.26	02/02/22	Added NANOS to the C1 unit 32 Unit/Product Distribution tables (effective 03/14/22).
2.41.27	03/01/22	Removed XSP from the BZX unit 31 Unit/Product Distribution tables.
2.41.28	03/25/22	Updated Periodic Auctions effective date to 04/14/22 (BYX Only).
2.41.29	04/20/22	Added 'P = Periodic Auction Trade' to Execution IDs (BYX Only).