US Options
Complex Auction
Multicast PITCH Specification

Version 2.1.15

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Contents

1 Introduction

1.1 Overview

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

Cboe customer may use Complex Auction Multicast PITCH to receive real-time auction update and execution information during complex options auctions.

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

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

Multicast PITCH Feed Descriptions:

Exchange	Shaping (Gig)	Served From Data Center (Primary/Secondary)	Multicast Feed ID
C1 Options	Gig	Primary	CAB
C1 Options	Gig	Primary	CBB
C1 Options	Gig	Secondary	CEB
C2 Options	Gig	Primary	WAB
C2 Options	Gig	Primary	WBB
C2 Options	Gig	Secondary	WEB
EDGX Options	Gig	Primary	EAB
EDGX Options	Gig	Primary	EBB
EDGX Options	Gig	Secondary	EEB

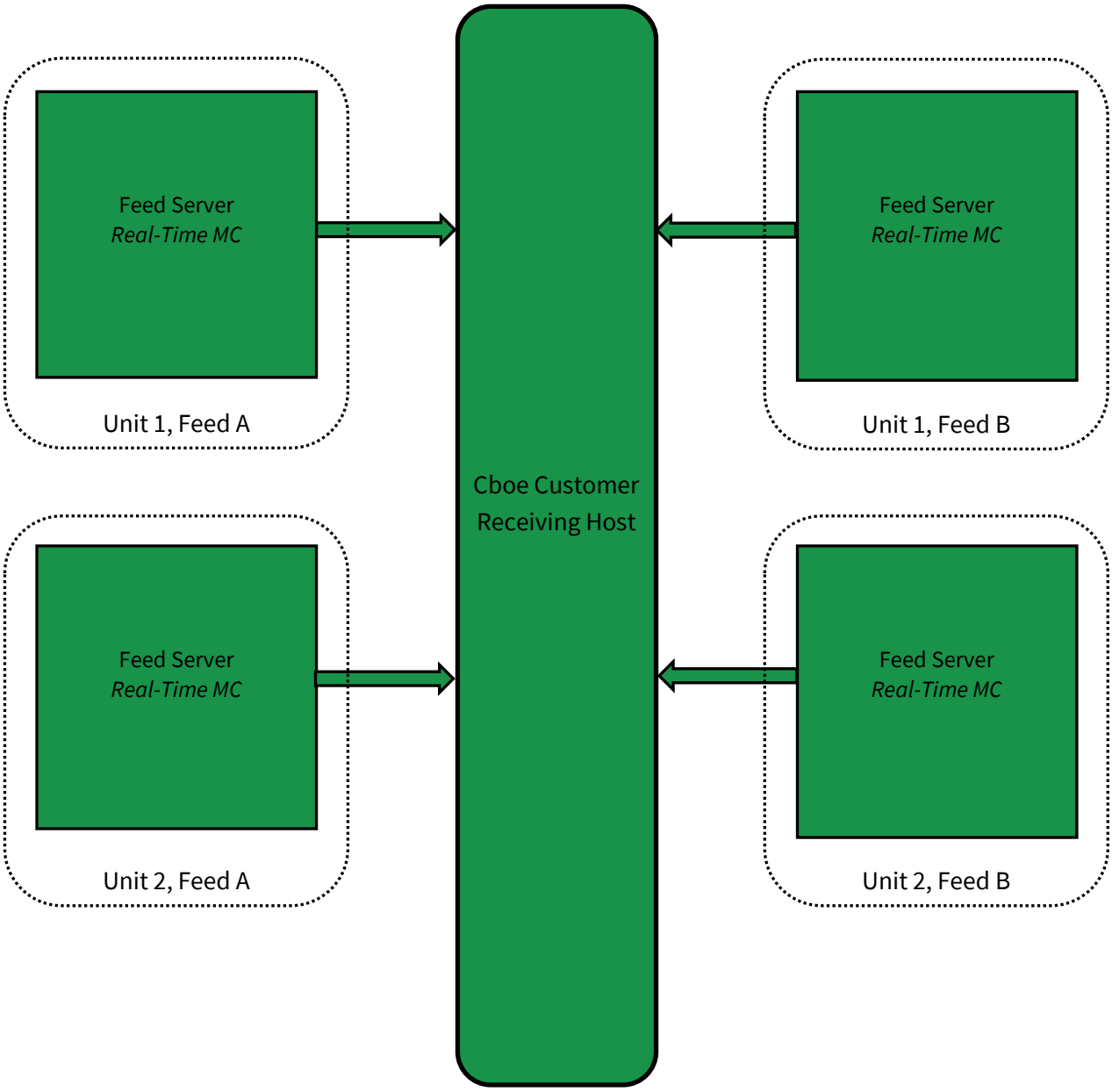
1.2 Feed Connectivity Requirements

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

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

Cboe Complex Auction Multicast PITCH real-time events are delivered using a published range of multicast addresses divided by symbol range units. It should be noted dropped messages cannot be recovered on this feed as this feed contains only unsequenced messages.

The following diagram is a logical representation of Complex Auction Multicast PITCH feed message flow between Cboe and a customer feed handler that is listening to the “A” and “B” instances of two units:



1.3 Symbol Ranges, Units, and Sequence Numbers

Symbols will be separated by Underlying into units and product distribution will not change intra-day. Cboe does, however, reserve the right to add multicast addresses or change the symbol distribution with prior notice to customers. Care should be taken to ensure that address changes, address additions, and symbol distribution changes can be supported easily.

It is important to understand that one *or more* units will be delivered on a single multicast address. As with symbol ranges, unit distribution across multicast addresses will not change intra-day, but may change after notice has been given.

It should be noted that this feed only contains unsequenced messages.

1.4 Complex Options Specific Symbol Processing

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

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

1.5 Gap Request Proxy and Message Retransmission

Recovery of missed data is not available on the Complex Auction Multicast PITCH feed. There are two main reasons. First this feed contains only unsequenced messages. Second the complex option auctions are short lived by nature making recovery of dropped messages impractical.

Prior to the start of any new auction, the corresponding `Complex Instrument Definition Expanded` message will be sent to ensure the customer has correct complex instrument information.

1.6 Spin Servers

A spin is not available on the Complex Auction Multicast PITCH feed as this feed is unsequenced.

2 Protocol

Cboe users may use the PITCH 2.X protocol over multicast to receive auction update and execution information direct from Cboe.

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

2.1 Message Format

The messages that make up the PITCH 2.X protocol are delivered using Cboe `Sequenced Unit Header` which handles sequencing and delivery integrity. All messages delivered via multicast as well 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.

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

2.2 Data Types

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

- **Alphanumeric** fields are left justified ASCII fields and space padded on the right.
- **Binary** fields are unsigned and sized to "Length" bytes and ordered using Little Endian convention (least significant byte first).
- **Signed Binary** fields are signed and sized to "Length" bytes and ordered using Little Endian convention (least significant byte first).
- **Binary Signed Short Price** fields are signed Little Endian encoded 2 byte binary fields with 2 implied decimal places (denominator = 100). The short price range is -327.68 to +327.67. Prices outside of this range will use the long price.
- **Binary Signed Long Price** fields are signed Little Endian encoded 8 byte binary fields with 4 implied decimal places (denominator = 10,000).
- **Bit Field** fields are fixed width fields with each bit representing a Boolean flag (the 0 bit is the lowest significant bit; the 7 bit is the highest significant bit).
- **Printable ASCII** fields are left justified ASCII fields that are space padded on the right that may include ASCII values in the range of 0x20 – 0x7e.
- **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) (**effective Q3 2021**).

2.3 Message Framing

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

2.4 Sequenced Unit Header

The `Sequenced Unit Header` is used for all Cboe Multicast PITCH messages.

This feed will deliver only unsequenced data using the `Sequenced Unit Header`. Unsequenced headers will have a 0 value for the sequence field and potentially for the unit field.

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	Always zero.
Total Length = 8 bytes				

2.5 Heartbeat Messages

The `Sequenced Unit Header` with a count field set to "0" will be used for heartbeat messages. During trading hours heartbeat messages will be sent from all multicast addresses if no data has been delivered within 1 second. Heartbeat messages never increment the sequence number for a unit.

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

3 PITCH 2.X Messages

3.1 Time Reference (Effective Q3 2021) (C1 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				

3.2 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. 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. The *Time* field is the number of seconds relative to midnight Eastern Time, which is provided in the `Time Reference` message. **Effective Q3 2021**, the `Time` message will also include the *Epoch Time* field, which is the current time represented as the number of whole seconds since the Epoch (midnight January 1, 1970).

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	Number of whole seconds since the Epoch (midnight January 1, 1970 UTC).

Effective Q3 2021				
Total Length = 6 bytes, 10 bytes effective Q3 2021				

3.3 Complex Instrument Definition Expanded

A `Complex Instrument Definition Expanded` message represents a complex instrument that is available to place orders. This message is unsequenced (sequence = 0) and is sent just prior to every `Auction Notification` message. `Complex Instrument Definition Expanded` messages will also be sent in a continuous loop through the day at variable rates as bandwidth allows. The *Time offeset* field should be ignored on `Complex Instrument Definition Expanded` messages.

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

Complex Instrument Definition Expanded				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x9A	`Complex Instrument Definition Expanded` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Complex Instrument Id	6	6	Printable ASCII	Complex Instrument Id right padded with spaces.
Complex Instrument Underlying	12	8	Printable ASCII	Complex Instrument Underlying right padded with spaces.
Complex Instrument Type	20	4	Alphanumeric	4 character field; each field describes a characteristic. **Character 1: Complex Option Type** O = All legs are options E = One leg is an equity leg **Characters 2-4: Reserved**
Leg Count	24	1	Binary	The number of legs in the complex instrument. The maximum number of legs is 12.
The following fields repeat *Leg Count* times for multi-leg strategies. *Leg Index i*s zero-based.				
Leg Symbol	25 + Leg Index * 13	8	Printable ASCII	Option or Equity Symbol of leg, right padded with spaces.

Leg Ratio	33 + Leg Index * 13	4	Signed Binary	Leg ratio (positive for buy-side, negative for sell-side). For options this is the number of contracts, for equities this is the number of shares.
Leg Security Type	37 + Leg Index * 13	1	Alphanumeric	O = Leg is an Option instrument E = Leg is an Equity instrument
Total Length = *25* + (*Leg Count * 13*) bytes				

3.4 Symbol Mapping

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

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

3.5 Auction Notification

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

Auction Notification				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xAD	`Auction Notification` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Complex Instrument Id	6	6	Printable ASCII	Complex Instrument Id right padded with spaces.
Auction ID	12	8	Binary	Day specific identifier assigned to this auction.
Auction Type	20	1	Alphanumeric	C = Complex Options (COA) S = Complex Solicitation Auction Mechanism B = Complex AIM O = COA All or None
Side	21	1	Alphanumeric	B = Buy S = Sell
Price	22	8	Binary Signed Long Price	Auction price The price field will be populated for all Auctions on EDGX Options, and for SAM Auctions on C1. This field will reflect the auction start price for SPX and SPXW AIM on C1. For all other AIM on C1 this field will be set to zero. This field will be set to zero for COA on C1 and C2 Options.
Quantity	30	4	Binary	Instrument quantity.
Customer Indicator	34	1	Alphanumeric	N = Non-Customer C = Customer
ParticipantID	35	4	Alphanumeric	Executing Broker (optional) of firm attributed to this quote.
Auction End Offset	39	4	Binary	Nanosecond offset from last timestamp.
Client ID	43	4	Alphanumeric	Optional user specified value attributed to this quote.
Total Length = 47 bytes				

3.6 Auction Cancel

`Auction Cancel` messages are used to disseminate the cancelation of an earlier `Auction Notification` message as a result of a user cancelation of the original complex auction, a user

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

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

Auction Cancel				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xAE	`Auction Cancel` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
Auction ID	6	8	Binary	Day specific identifier assigned to this auction
Total Length = 14 bytes				

3.7 Auction Trade

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

Auction Trade				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xAF	`Auction Trade` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
Auction ID	6	8	Binary	Day specific identifier assigned to this auction
Execution ID	14	8	Binary	Day specific identifier assigned to this execution
Price	22	8	Binary Signed Long Price	Trade price
Quantity	30	4	Binary	Instrument quantity traded
Total Length = 34 bytes				

3.8 Options Auction Update

`Options Auction Update` messages are used to disseminate price and size information during the Opening and Re-Opening (halt) process for complex instruments. The `Options Auction`

`Update` messages are sent every five seconds during an opening period. Refer to the Cboe Options Complex Book Process specification for more information.

Options Auction Update				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0xD1	`Options Auction Update` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Complex Instrument ID	6	8	Printable ASCII	*Complex Instrument* right padded with spaces.

Auction Type	14	1	Alphanumeric	`G = GTH Opening` (C1 Only) (**Effective Q3 2021 G value will be sent for Curb session opening**)
				`O = RTH Opening`
				`H = Halt Re-Opening`

Reference Price	15	8	Binary Long Price	*Not used for complex series. Will contain zero value.*
Buy Contracts	23	4	Binary	Cumulative Buy interest at the Indicative Price.
Sell Contracts	27	4	Binary	Cumulative Sell interest at the Indicative Price.
Indicative Price	31	8	Binary Signed Long Price	SNBBO Collared Volume Maximizing Imbalance Minimizing Price computed on combined Auction-Only and Continuous Book (if any).
Auction Only Price	39	8	Binary Signed Long Price	*Not used for complex series. Will contain zero value.*
Opening Condition	47	1	Alphanumeric	*Not used for Complex series. Will contain zero value.*
Composite Market Bid Price	48	8	Binary Signed Long Price	*Not used for Complex series. Will contain zero value.*
Composite Market Offer Price	56	8	Binary Signed Long Price	*Not used for complex series. Will contain zero value.*
Total Length = 64 bytes				

3.9 Auction Summary

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

The `Auction Summary` message has the following format:

Auction Summary				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x96	`Auction Summary` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Complex Instrument Id	6	8	Printable ASCII	*Complex Instrument Id* right padded with spaces.

Auction Type	14	1	Alphanumeric	`G = GTH Opening` (C1 Only) (**Effective Q3 2021 G value will be sent for Curb session opening**)
				`O = RTH Opening`
				`H = Halt Re-Opening`

Price	15	8	Binary Signed Long Price	Auction price
Quantity	23	4	Binary	Cumulative instrument quantity executed during the auction
Total Length = 27 bytes				

3.10 End of Session

The `End of Session` message is sent for each unit when the unit shuts down. No more auction 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 Message Types

4.1 PITCH 2.X Messages

0x20	Time
0xB1	Time Reference (**effective Q3 2021**)
0x9A	Complex Instrument Definition Expanded
0x2E	Symbol Mapping
0xAD	Auction Notification
0xAE	Auction Cancel
0xAF	Auction Trade
0xD1	Auction Update
0x96	Auction Summary
0x2D	End of Session

5 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.

5.1 Time Message

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

5.2 Time Message (Effective Q3 2021)

Length	10	10 bytes
Type	20	Time
Time	98 85 00 00	34,200 seconds = 09:30 AM Eastern
Epoch Time	68 11 35 60	1,614,090,600 seconds since the Epoch

5.3 Time Reference (Effective Q3 2021)

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

5.4 Complex Instrument Definition Expanded

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

Leg Ratio	FF FF FF FF	-1 = Sell 1
Leg Security Type	4F	Option Leg
Leg Symbol	30 30 30 30 30 32 20 20	000002
Leg Ratio	01 00 00 00	1 = Buy 1
Leg Security Type	4F	Option Leg

5.5 Symbol Mapping Message

Length	1E	30 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 30 39 32 30 43 30 30 31 35 30 30 30 30	MSFT 190920C00150000
Symbol Condition	43	‘C’ – Closing Only
Underlying	4D 53 46 54 20 20 20 20	MSFT

5.6 Auction Notification Message

Length	2F	47 bytes
Type	AD	Auction Notification
Time offset	18 D2 06 00	447,000 ns since last Time Message
CID	43 30 30 30 31 32	C00012
Auction ID	05 40 5B 77 8F 56 1D 0B	631WC4000005
Auction Type	4F	O = COA AON
Side	42	B = Buy Side
Price	00 00 00 00 00 00 00 00	Price not displayed
Quantity	64 00 00 00	100
Customer Indicator	43	C = Customer
ParticipantID	45 46 49 44	EFID
Auct. End Offset	38 73 0E 00	947,000 ns since last Time Message
Client ID	43 4C 49 44	CLID

5.7 Auction Cancel Message

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

5.8 Auction Trade Message

Length	22	34 bytes

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

5.9 Options Auction Update

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

5.10 Auction Summary

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

5.11 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

6 Multicast Configuration

6.1 Production Environment Configuration

6.1.1 Limitations/Configurations

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

Period/Type	Limit/Setting	Notes
MTU	1500	Cboe will send UDP messages up to 1500 bytes. Customers should ensure that their infrastructure is configured accordingly.
Gig-Shaped Throttle	1 Gb/s	The real-time and gap multicast head ends are configured to shape their output to this level to minimize packet loss.

6.1.2 Unit/Symbol 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
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), XSP (BZX 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	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.

6.1.3 C1 Options Multicast Routing Parameters

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

6.1.4 C2 Options Multicast Routing Parameters

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

6.1.5 EDGX Options Multicast Routing Parameters

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

6.1.6 C1 Options Address/Unit Distribution

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

Primary Datacenter		Gig-Shaped [CAB] 170.137.114.80/28	Gig-Shaped [CBB] 170.137.115.80/28
Unit	**IP Port**	**Real-time MC**	**Real-time MC**
1	30451	224.0.74.88	233.182.199.216
2	30452		
3	30453		
4	30454		
5	30455		
6	30456		
7	30457		
8	30458		
9	30459		
10	30460		
11	30461		
12	30462		
13	30463		
14	30464		
15	30465		
16	30466		
17	30467	224.0.74.89	233.182.199.217
18	30468		
19	30469		
20	30470		
21	30471		
22	30472		
23	30473		
24	30474		
25	30475		
26	30476		
27	30477		
28	30478		
29	30479		
30	30480		
31	30481		
32	30482		
33	30483		
34	30484		
35	30485		

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

Secondary Datacenter		Gig-Shaped [CEB] 170.137.124.224/28
Unit	**IP Port**	**Real-time MC**
1	31451	233.19.3.248
2	31452	
3	31453	
4	31454	
5	31455	
6	31456	
7	31457	
8	31458	
9	31459	
10	31460	
11	31461	
12	31462	
13	31463	
14	31464	
15	31465	
16	31466	
17	31467	233.19.3.249
18	31468	
19	31469	
20	31470	
21	31471	
22	31472	
23	31473	
24	31474	
25	31475	
26	31476	
27	31477	
28	31478	
29	31479	
30	31480	
31	31481	
32	31482	
33	31483	
34	31484	
35	31485	

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.

6.1.7 C2 Options Address/Unit Distribution

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

Primary Datacenter		Gig-Shaped [WAB] 174.136.164.64/28	Gig-Shaped [WBB] 174.136.164.80/28
Unit	**IP Port**	**Real-time MC**	**Real-time MC**
1	30401	224.0.131.162	233.130.124.162
2	30402		
3	30403		
4	30404		
5	30405		
6	30406		
7	30407		
8	30408		
9	30409		
10	30410		
11	30411		
12	30412		
13	30413		
14	30414		
15	30415		
16	30416		
17	30417	224.0.131.163	233.130.124.163
18	30418		
19	30419		
20	30420		
21	30421		
22	30422		
23	30423		
24	30424		
25	30425		
26	30426		
27	30427		
28	30428		
29	30429		
30	30430		
31	30431		
32	30432		
33	30433		

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

Secondary Datacenter		Gig-Shaped [WEB] 170.137.17.96/29
Unit	**IP Port**	**Real-time MC**
1	31401	233.182.199.112
2	31402	
3	31403	
4	31404	
5	31405	
6	31406	
7	31407	
8	31408	
9	31409	
10	31410	
11	31411	
12	31412	
13	31413	
14	31414	
15	31415	
16	31416	
17	31417	233.182.199.113
18	31418	
19	31419	
20	31420	
21	31421	
22	31422	
23	31423	
24	31424	
25	31425	
26	31426	
27	31427	
28	31428	
29	31429	
30	31430	
31	31431	
32	31432	
33	31433	

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.

6.1.8 EDGX Options Address/Unit Distribution

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

Primary Datacenter		Gig-Shaped [EAB] 174.136.164.32/28	Gig-Shaped [EBB] 174.136.164.48/28
Unit	**IP Port**	**Real-time MC**	**Real-time MC**
1	30651	224.0.131.160	233.130.124.160
2	30652		
3	30653		
4	30654		
5	30655		
6	30656		
7	30657		
8	30658		
9	30659		
10	30660		
11	30661		
12	30662		
13	30663		
14	30664		
15	30665		
16	30666		
17	30667	224.0.131.161	233.130.124.161
18	30668		
19	30669		
20	30670		
21	30671		
22	30672		
23	30673		
24	30674		
25	30675		
26	30676		
27	30677		
28	30678		
29	30679		
30	30680		
31	30681		
32	30682		
33	30683		

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

Secondary Datacenter		Gig-Shaped [EEB] 174.136.176.144/28
Unit	**IP Port**	**Real-time MC**
1	31651	233.19.3.144
2	31652	
3	31653	
4	31654	
5	31655	
6	31656	
7	31657	
8	31658	
9	31659	
10	31660	
11	31661	
12	31662	
13	31663	
14	31664	
15	31665	
16	31666	
17	31667	233.19.3.145
18	31668	
19	31669	
20	31670	
21	31671	
22	31672	
23	31673	
24	31674	
25	31675	
26	31676	
27	31677	
28	31678	
29	31679	
30	31680	
31	31681	
32	31682	
33	31683	

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.

6.2 Certification Environment Configuration

6.2.1 Unit/Symbol 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
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), XSP (BZX 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	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.

6.2.2 Multicast Routing Parameters

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

6.2.3 C1 Options Address/Unit Distribution

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

Primary Datacenter		Certification 170.137.126.16/28
Unit	IP Port	Real-time MC
1	32451	233.103.126.16
2	32452	
3	32453	
4	32454	
5	32455	
6	32456	
7	32457	
8	32458	
9	32459	
10	32460	
11	32461	
12	32462	
13	32463	
14	32464	
15	32465	
16	32466	
17	32467	233.103.126.17
18	32468	
19	32469	
20	32470	
21	32471	
22	32472	
23	32473	
24	32474	
25	32475	
26	32476	
27	32477	
28	32478	
29	32479	
30	32480	
31	32481	
32	32482	
33	32483	
34	32484	
35	32485	

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.

6.2.4 C2 Options Address/Unit Distribution

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

Primary Datacenter		Certification 174.136.160.80/28
Unit	**IP Port**	**Real-time MC**
1	32401	224.0.74.158
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	224.0.74.159
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	
33	32433	

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.

6.2.5 EDGX Options Address/Unit Distribution

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

Primary Datacenter		Certification 174.136.174.176/28
Unit	**IP Port**	**Real-time MC**
1	32651	224.0.74.188
2	32652	
3	32653	
4	32654	
5	32655	
6	32656	
7	32657	
8	32658	
9	32659	
10	32660	
11	32661	
12	32662	
13	32663	
14	32664	
15	32665	
16	32666	
17	32667	224.0.74.189
18	32668	
19	32669	
20	32670	
21	32671	
22	32672	
23	32673	
24	32674	
25	32675	
26	32676	
27	32677	
28	32678	
29	32679	
30	32680	
31	32681	
32	32682	
33	32683	

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.

7 Connectivity

7.1 Supported Extranet Carriers

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

7.2 Bandwidth Recommendation

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

7.3 Multicast Test Program

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

8 References

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

9 Support

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

Revision History

Document Version	Date	Description
2.0.0	05/11/17	Initial draft in support of Complex orders for EDGX Options Exchange. Based on Bats Multicast PITCH 2.X.
2.0.1	05/15/17	Removed `Trading Status` message.
2.0.2	05/18/17	Various minor updates and clarification added.
2.0.3	07/28/17	Added Multicast Ips/Ports for Certification environment.
2.0.4	08/08/17	Added Multicast Ips/Ports for Production environment.
2.0.5	09/01/17	Added C2 Options references.
2.0.6	10/17/17	Cboe branding/logo changes.
2.0.7	10/25/17	Incorrect Multicast Feed IDs were fixed in sections 1.1, 6.1.5, and 6.1.6
2.0.8	11/24/17	Auction Price is only valid for EDGX Options and will be set to zero for C2 Options. Added C2 Options Certification IP and Port information. Added RUT, RUTW options (C2 Options Only) to distinct unit (unit 33).
2.0.9	02/05/18	Update C2 Options IP and Port information.
2.0.10	03/08/18	Updated Unit Distribution ranges.
2.0.11	03/23/18	Unit Distribution ranges Effective Date updated to 4/14/18.
2.1.0	11/16/18	Added support for C1 Options.
2.1.1	12/04/18	Feature Pack 4 Updates.
2.1.2	02/14/19	Added certification IP port and unit distribution information.
2.1.3	03/05/19	Added matching engine unit 33 information in support of XSP trading on EDGX Options effective 04/08/19. Added C1 certification primary data center rendezvous point IP address and C1 Certification symbol ranges.
2.1.4	04/15/19	Added C1 production IPs and units. Added DJX to C2 ME 33 in Unit/Product Distribution tables (effective 05/08/19).
2.1.5	05/08/19	Corrected C1 Production Gig-Shaped [CAB] and [CBB] source network IP addresses.
2.1.6	05/14/19	Added *Composite Market Bid Price* and *Composite Market Offer Price* fields to the `Options Auction Update` message and updated associated example message. Added additional proprietary products to matching unit 31 in C1.
2.1.7	06/12/19	Corrected cert. and prod. C1 symbol range for units 9 and 20.

2.1.8	08/01/19	Added note indicating `Options Auction Update` message *Opening Condition* field value will always be zero. Updated example message. Corrected *Leg Count* field description in `Complex Instrument Definition Expanded` message to indicate a total of 12 legs are allowed.
2.1.9	09/18/19	Updated OSI Symbol example values in `Symbol Mapping` and `Constituent Symbol Mapping` message type examples.
2.1.10	08/27/20	Corrected QQQ and UKXM symbol exclusion entries in Unit Distribution table. Changed instances of `Complex Instrument Definition` to `Complex Instrument Definition Expanded`, as the former was deprecated 02/28/19. Clarified description of `Time` message. Added SPESG to Unit Distribution table for C1 unit 31 (effective 9/21/20).
2.1.11	10/06/20	Added SPESG to the Unit Symbol Distribution table Exclusion entries for C1.
2.1.12	10/20/20	Removed XSP from the Unit Symbol Distribution tables on EDGX (effective 11/2/20).
2.1.13	01/22/21	Updated *Price* field description on `Auction Notification` message to indicate that for SPX and SPXW AIM on C1, this field will reflect the auction start price (C1 Only) (effective 02/22/21).
2.1.14	02/01/21	Added MRUT to Unit/Symbol Distribution tables for C1 unit 31 (effective 03/01/21). Added new updated Unit/Symbol Distribution tables with harmonized symbol ranges (effective 03/22/21).
2.1.15	03/25/21	Updated the Unit Symbols Distribution Exceptions entries (effective 3/22/21). Added Binary Date field type to Section 2.2 - Data Types (**effective Q3 2021**). Added new `Time Reference` message (**effective Q3 2021**). Added *EpochTime* field to `Time` message (**effective Q3 2021**). Updated description of *Auction Type* field on `Options Auction Update` and `Auction Summary` messages (**effective Q3 2021**).