



# Cboe Options Exchange FLEX Feed Specification

Version 1.0.0

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## 1 Introduction

### 1.1 Overview

Note that this specification will be the standard specification to be used for market data for FLEX Options on the Cboe Options (“C1”) Exchange platform.

Cboe customers may use the FLEX feed to receive real-time auction updates and execution information.

Options FLEX feed cannot be used to enter orders. For order entry, refer to the US Options FIX Specification.

A WAN-Shaped version of the FLEX feed is available from both of Cboe’s datacenters. Customers may choose to take one or more of the following FLEX feed options depending on their location and connectivity to Cboe.

Exchange	Shaping (WAN)	Served From Data Center (Primary/Secondary)	Multicast Feed ID
C1 Options	WAN	Primary	CAF
C1 Options	WAN	Primary	CBF
C1 Options	WAN	Secondary	CEF

### 1.2 Feed Connectivity Requirements

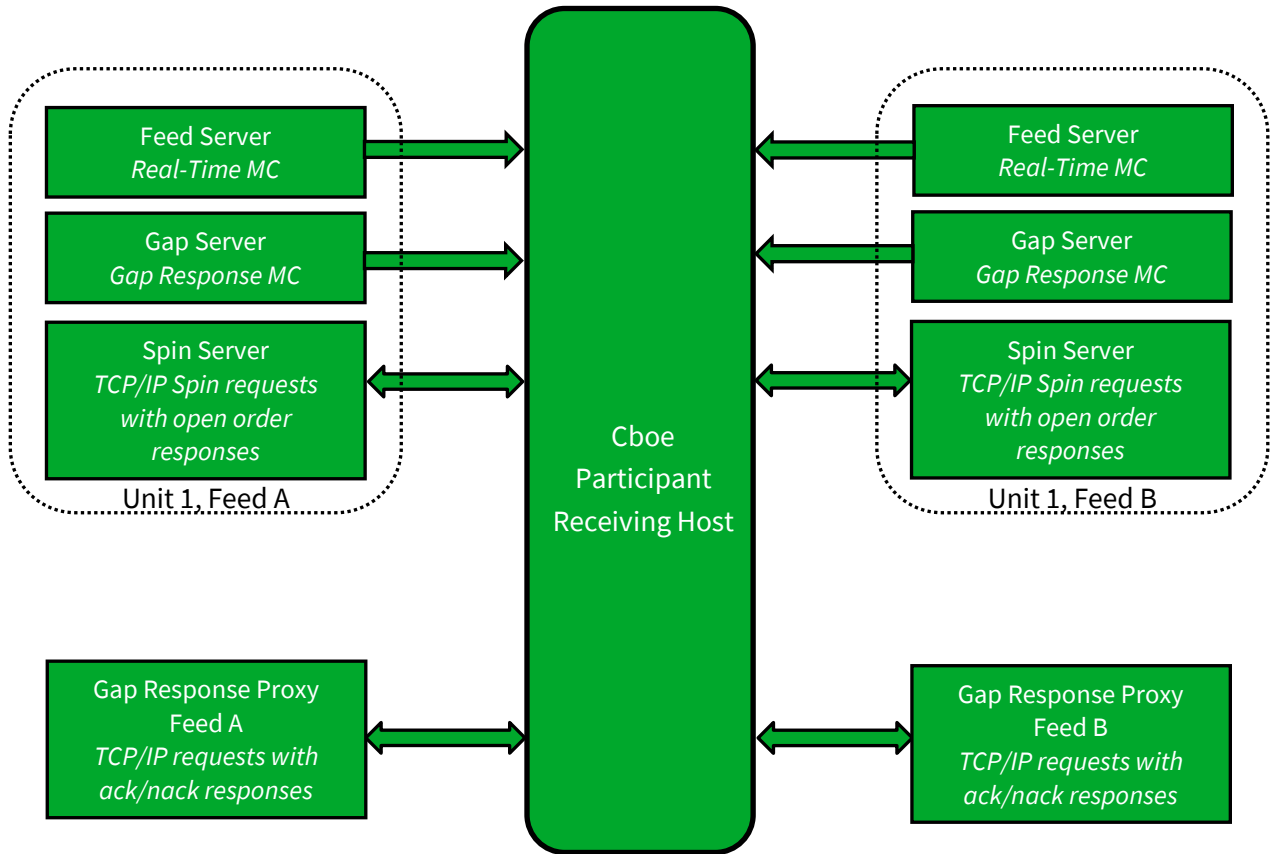
WAN-Shaped feeds are available to customers with a minimum of 100 Mb/s of connectivity to Cboe via cross connect or dedicated circuit.

Customers with sufficient connectivity may choose to take more than one WAN-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 Options FLEX feed real-time events are delivered using a single published multicast address for all symbol ranges.

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



### 1.3 FLEX Specific Symbol Processing

Cboe has implemented a symbol mapping mechanism for both simple and complex instruments on the FLEX feed. This symbol mapping significantly reduces the size of the FLEX feed and allows participants to use the same symbol handling mechanisms for the Cboe operated equity, options, and futures exchanges. Refer to the FLEX Instrument Definition and Complex FLEX Instrument Definition messages for more information.

The FLEX Instrument Definition or Complex FLEX Instrument Definition messages are sequenced messages that are sent when an instrument is created. If a user misses a mapping message, then that message can be recovered through either the GRP or SPIN Server.

### 1.4 Gap Request Proxy and Message Retransmission

Requesting delivery of missed sequenced data is achieved by establishing a TCP connection to a Gap Request Proxy (“GRP”) port. This GRP port is specific to FLEX feed and is NOT shared with any other Cboe Options market data feed. Participants who do not wish to request missed messages do not need to connect to a GRP port for any reason or listen to the multicast addresses reserved for message retransmission. Participants choosing to request missed data will need to connect to their assigned GRP port, 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 ‘A’ 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. Participants will receive a total daily allowance of gap requested messages. In addition, each participant is given renewable one second and one minute gap request limits.

If 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. Participants 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.

### 1.5 Spin Servers

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A Spin Server is available for each unit. The server allows participants to connect via TCP and receive a spin of all symbol definitions, including both FLEX Instrument Definition and Complex FLEX Instrument Definition messages, and Trading Status messages. By using the spin, a participant can get the current instrument definitions and trading status messages quickly in the middle of the trading session without worry of gap request limits. The Spin Server for each unit is assigned 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. Using a Spin Request message, a participant may request a spin for symbol definitions and trading status messages 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 participant 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.

Customers can also use the Spin Server to request a spin of all 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.



## 2 Protocol

### 2.1 Message Format

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

### 2.2 Data Types

The following field types are used within the feed.

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

### 2.3 Message Framing

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 site. The content of the multicast across feeds (e.g. A/B WAN-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 messages.

This feed will deliver sequenced and 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
<i>Hdr Length</i>	0	2	Binary	Length of entire block of messages. Includes this header and <i>Hdr Count</i> messages to follow.
<i>Hdr Count</i>	2	1	Binary	Number of messages to follow this header.
<i>Hdr Unit</i>	3	1	Binary	Unit that applies to messages included in this header.
<i>Hdr Sequence</i>	4	4	Binary	Sequence of first message to follow this header.
<b>Total Length = 8 bytes</b>				

## 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.

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 FLEX Feed Messages

#### 3.1 Time

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

Time				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field
<i>Message Type</i>	1	1	0x20	Time Message
<i>Time</i>	2	4	Binary	Number of whole seconds from midnight Eastern Time
<b>Total Length = 6 bytes</b>				

#### 3.2 FLEX Instrument Definition

A FLEX Instrument Definition message represents a complex instrument that is available to place orders. It is sent as a sequenced message.

Flex Instrument Definition				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x9C	Flex Instrument Definition Message
<i>Time Offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Feed Symbol</i>	6	6	Printable ASCII	<i>Symbol</i> right padded with spaces.
<i>OSI Root</i>	12	6	Printable ASCII	OSI Root right padded with spaces.
<i>Year</i>	18	2	Alphanumeric	Two digit year
<i>Month</i>	20	2	Alphanumeric	Two digit month
<i>Day</i>	22	2	Alphanumeric	Two digit day
<i>Call Put Indicator</i>	24	1	Alphanumeric	C = Call P = Put
<i>Dollar Strike</i>	25	5	Alphanumeric	Dollar strike (if not percentage) left padded with zero. If percentage, field is space padded.
<i>Decimal Strike</i>	30	3	Alphanumeric	Decimal strike (if not percentage) left padded with zero. If percentage, field is space padded.
<i>Symbol Condition</i>	33	1	Alphanumeric	N = Normal C = Closing Only
<i>Underlying</i>	34	8	Printable ASCII	Instrument Underlying right padded with spaces.

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<i>Exercise Style</i>	42	1	Alphanumeric	A = American E = European  Exercise style is always European for Asian and Cliquet.
<i>Settlement Type</i>	43	1	Alphanumeric	A = AM P = PM S = Asian Q = Cliquet
<i>Percentage</i>	44	4	Binary	Percentage when strike and price is percentage based (implied 4 decimal places). Otherwise zero.
<i>Observation Day</i>	48	2	Alphanumeric	Two digit observation day of month. Valid only for Asian and Cliquet options, otherwise space padded.
<i>Return Cap Percentage</i>	50	4	Binary	Return cap percentage (implied 2 decimal places). Valid only for Cliquet, otherwise zero.
<i>Creation Day</i>	54	2	Alphanumeric	Two digit creation day of the month. Valid only for Cliquet, otherwise space padded.
<i>Bit Fields</i>	56	1	Bit Field	Bit 0: If set, strike/price in percentage. Bit 1-7: Reserved
<b>Total Length = 57 bytes</b>				

### 3.3 Complex FLEX Instrument Definition

A Complex FLEX Instrument Definition message represents a complex instrument that is available to place orders. It is sent as a sequenced message.

The Complex FLEX Instrument Definition message will contain two or more repeating groups of leg definitions. There is a limit of 100 leg definitions. For complex instruments that contain over 17 legs, the complex instrument will be split across multiple messages as indicated by the Message Count.

Complex FLEX Instrument Definition				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x9B	Complex FLEX Instrument Definition Message
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Complex Instrument ID</i>	6	6	Printable ASCII	Complex Instrument ID right padded with spaces.
<i>Underlying</i>	12	8	Printable ASCII	Complex Instrument Underlying right padded with spaces.

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<i>Complex Instrument Type</i>	20	4	Alphanumeric	4 character field; each field describes a characteristic.  <b>Character 1: Complex Option Type</b> X = All legs are FLEX options  <b>Characters 2-4: Reserved</b>
<i>Leg Count</i>	24	1	Binary	The number of legs in the complex instrument. The maximum number of legs is 100.
<i>Message Count</i>	25	1	Binary	Number of messages required to define the complex instrument.
<i>Message Number</i>	26	1	Binary	Message number of the message count, e.g. 1 of 5.
<i>Message Leg Count</i>	27	1	Binary	The number of legs in this message.
The following fields repeat <i>Message Leg Count</i> times. The <i>Leg Index</i> is from 0 to <i>Message Leg Count</i> - 1.				
<i>Leg Symbol</i>	28 + 13 * Leg Index	8	Printable ASCII	FLEX Symbol, right padded with spaces.
<i>Leg Ratio</i>	36 + 13 * Leg Index	4	Signed Binary	Leg ratio (positive for buy-side, negative for sell-side).
<i>Leg Security Type</i>	40 + 13 * Leg Index	1	Alphanumeric	The instrument type of this leg.  X = FLEX option
<b>Total Length = 28 + (13 * Leg Count) bytes</b>				

### 3.4 Auction Notification

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

Auction Notification				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	Length of this message including this field
<i>Message Type</i>	1	1	0xAD	Auction Notification Message
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>FLEX Instrument ID</i>	6	6	Printable ASCII	FLEX Instrument ID right padded with spaces.
<i>Auction ID</i>	12	8	Binary	Day specific identifier assigned to this auction.
<i>Auction Type</i>	20	1	Alphanumeric	B = AIM F = FLEX Auction S = Solicitation Auction Mechanism

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<i>Side</i>	21	1	Alphanumeric	B = Buy S = Sell
<i>Price</i>	22	8	Binary Signed Long Price	Auction price. Will be blank when <i>Auction Type</i> = B or F
<i>Quantity</i>	30	4	Binary	Instrument quantity.
<i>Customer Indicator</i>	34	1	Alphanumeric	N = Non-Customer C = Customer
<i>ParticipantID</i>	35	4	Alphanumeric	Executing Broker (optional) of firm attributed to this auction.
<i>Auction End Offset</i>	39	4	Binary	Nanosecond offset from last timestamp.
<i>Client ID</i>	43	4	Alphanumeric	User defined identifier for quote attribution.
<b>Total Length = 47 bytes</b>				

### 3.5 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 auction, a user modification request to change the auction price or increase the original auction quantity or to cancel any remaining auction quantity from the original Auction Notification following an auction termination.

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

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

### 3.6 Auction Trade

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

Auction Trade				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	Length of this message including this field
<i>Message Type</i>	1	1	0xAF	Auction Trade Message

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<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp
<i>Auction ID</i>	6	8	Binary	Day specific identifier assigned to this auction
<i>Execution ID</i>	14	8	Binary	Day specific identifier assigned to this execution
<i>Price</i>	22	8	Binary Signed Long Price	Trade price. If instrument trades in percentage terms, then this represents the traded percentage with four implied decimals.
<i>Quantity</i>	30	4	Binary	Instrument quantity traded
<b>Total Length = 34 bytes</b>				

### 3.7 Trade

The Trade message provides information about executions of FLEX orders on the Cboe Options trading floor. Trade messages are necessary to calculate Cboe execution-based data.

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

Trade				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field
<i>Message Type</i>	1	1	0x2A	Trade Message
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp
<i>Order ID</i>	6	8	Binary	<i>Order ID</i> of the executed order.
<i>Side Indicator</i>	14	1	Alphanumeric	Always "B"
<i>Quantity</i>	15	4	Binary	Instrument quantity traded
<i>FLEX Instrument ID</i>	19	6	Printable ASCII	<i>FLEX Instrument ID</i> right padded with spaces.
<i>Price</i>	25	8	Binary Signed Long Price	Trade price. If instrument trades in percentage terms, then this represents the traded percentage with four implied decimals.
<i>Execution ID</i>	33	8	Binary	Cboe generated day-unique execution identifier of this trade. <i>Execution ID</i> is also referenced in the Trade Break message.
<i>Trade Condition</i>	41	1	Alphanumeric	(Space): Normal Trade L: Late Trade (C1 Only)
<b>Total Length = 42 bytes</b>				

### 3.8 Trade Break

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The `Trade Break` message is sent whenever a FLEX options execution on Cboe is broken. Trade breaks are rare and only affect applications that rely upon Cboe execution-based data.

Trade Break				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field
<i>Message Type</i>	1	1	0x2C	Trade Break Message
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp
<i>Execution ID</i>	6	8	Binary	Cboe execution identifier of the execution that was broken. <i>Execution ID</i> refers to previously sent Auction Trade or Trade message.
<b>Total Length = 14 bytes</b>				

### 3.9 Trading Status

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

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

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

A `Trading Status` message will also be sent:

- for a Regulatory Halt “Q”uoting Period in any series where the underlying has experienced a Regulatory Halt as well as the “T”rading resumption for the same series.
- in the event of an Exchange specific “S”uspension.
- for instruments that are in a “Q”uoting period for auctions.

The *Trading Status* field will be used to represent the status of the RTH Session (9:30 am ET – 4:15 pm ET) and the *GTH Trading Status* field will be used to represent the status of the GTH Session (3 am ET – 9:30 am ET).

Trading Status				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	Length of this message including this field
<i>Message Type</i>	1	1	0x31	Trading Status message



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<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp
<i>Symbol</i>	6	6	Printable ASCII	<i>Symbol</i> right padded with spaces.
<i>Reserved</i>	12	2	Reserved	Reserved
<i>Trading Status</i>	14	1	Alpha	H = Halted Q = Quote-Only S = Exchange Specific Suspension T = Trading
<i>Reserved</i>	15	1	Reserved	Reserved
<i>GTH Trading Status</i>	16	1	Alpha	H = Halted Q = Quote-Only S = Exchange Specific Suspension T = Trading
<i>Reserved</i>	17	1	Reserved	Reserved
<b>Total Length = 18 bytes</b>				

### 3.10 End of Session

The `End of Session` message is sent for each unit when the unit shuts down. No more 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
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field
<i>Message Type</i>	1	1	0x2D	<code>End of Session</code> Message
<i>Timestamp</i>	2	4	Binary	Nanosecond offset from last unit timestamp
<b>Total Length = 6 bytes</b>				

## 4 Gap Request Proxy Messages

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

### 4.1 Login

The `Login` message is the first message sent to the GRP by a user’s process after the connection to the GRP is established. Failure to login before sending any other message type will result in the connection being dropped by the GRP.

Login				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x01	Login Message
<i>SessionSubId</i>	2	4	Alphanumeric	<i>SessionSubId</i> supplied by Cboe.
<i>Username</i>	6	4	Alphanumeric	<i>Username</i> supplied by Cboe.
<i>Filler</i>	10	2	Alphanumeric	(space filled)
<i>Password</i>	12	10	Alphanumeric	<i>Password</i> supplied by Cboe.
<b>Total Length = 22 bytes</b>				

### 4.2 Login Response

The `Login Response` message is sent by the GRP to a user’s process in response to a `Login` message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the connection will be dropped after the `Login Response` message is sent.

Login Response				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x02	Login Response Message
<i>Status</i>	2	1	Alphanumeric	Accepted or reason for reject.
<b>Total Length = 3 bytes</b>				
Login Response - Status Codes				
‘A’	Login Accepted			
‘N’	Not authorized (Invalid Username/Password)			
‘B’	Session in use			
‘S’	Invalid Session			

### 4.3 Gap Request

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

Gap Request				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x03	Gap Request Message
<i>Unit</i>	2	1	Binary	<i>Unit</i> that the gap is requested for.
<i>Sequence</i>	3	4	Binary	<i>Sequence</i> of first message (lowest sequence in range).
<i>Count</i>	7	2	Binary	<i>Count</i> of messages requested.
<b>Total Length = 9 bytes</b>				

### 4.4 Gap Response

The `Gap Response` message is sent by the GRP in response to a `Gap Request` message. The *Unit* and *Sequence* fields will match the values supplied in the `Gap Request` message. A `Gap Response` message, with a Status of Accepted or reason for failure, will be sent for each `Gap Request` message received by the GRP.

Gap Response				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x04	Gap Response Message
<i>Unit</i>	2	1	Binary	<i>Unit</i> the gap was requested for.
<i>Sequence</i>	3	4	Binary	<i>Sequence</i> of first message in request.
<i>Count</i>	7	2	Binary	<i>Count</i> of messages requested.
<i>Status</i>	9	1	Alphanumeric	Accepted or reason for reject*.
<b>Total Length = 10 bytes</b>				
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.

## 5 Spin Messages

### 5.1 Login

The `Login` message is the first message sent to the Spin Server by a user's process after the connection to the Spin Server is established. Failure to login before sending any other message type will result in the connection being dropped by the Spin Server.

The format of the `Login` message for the Spin Server is identical to that of the GRP described previously in [Section 4.1](#).

### 5.2 Login Response

The `Login Response` message is sent by the Spin Server to a user's process in response to a `Login` message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the connection will be dropped after the `Login Response` message is sent.

The format of the `Login Response` message for the Spin Server is identical to that of the GRP described previously in [Section 4.2](#).

### 5.3 Spin Image Available

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

Spin Image Available				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x80	Spin Image Available Message
<i>Sequence</i>	2	4	Binary	Spin is available which is current through this sequence number.
<b>Total Length = 6 bytes</b>				

### 5.4 Spin Request

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

Spin Request				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x81	Spin Request Message
<i>Sequence</i>	2	4	Binary	Sequence number from a <code>Spin Image Available</code> message received by the customer.
<b>Total Length = 6 bytes</b>				

## 5.5 Spin Response

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

Spin Response				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x82	<code>Spin Response</code> Message
<i>Sequence</i>	2	4	Binary	Sequence number from a <code>Spin Image</code> Available message received by the customer.
<i>Order Count</i>	6	4	Binary	Always zero.
<i>Status</i>	10	1	Alphanumeric	Accepted or reason for reject*.
<b>Total Length = 11 bytes</b>				
Spin Response - Status Codes				
'A'	Accepted			
'O'	Out of Range ( <i>Sequence</i> requested is greater than <i>Sequence</i> available by the next spin)			
'S'	Spin already in progress (only one spin can be running at a time).			

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

## 5.6 Spin Finished

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

Spin Finished				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x83	<code>Spin Finished</code> Message
<i>Sequence</i>	2	4	Binary	Sequence number from the <code>Spin Request</code> message.
<b>Total Length = 6 bytes</b>				

## 5.7 Instrument Definition Request

The `Instrument Definition Request` message is used by a user's process to request transmission of this unit's Symbol Mappings. Refer to Section 1.5 for more complete details regarding *Sequence* specification as well as buffering requirements.

Instrument Definition Request				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field

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<i>Message Type</i>	1	1	0x84	Instrument Definition Request Message
<i>Sequence</i>	2	4	Binary	Must be 0. Only the current Symbol Mappings are available.
<b>Total Length = 6 bytes</b>				

### 5.8 Instrument Definition Response

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

Instrument Definition Response				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field
<i>Message Type</i>	1	1	0x85	Instrument Definition Response Message
<i>Sequence</i>	2	4	Binary	Will always be 0.
<i>Instrument Count</i>	6	4	Binary	Number of Symbol Mapping messages which will be contained in this spin.
<i>Status</i>	10	1	Alphanumeric	Accepted or reason for reject
<b>Total Length = 11 bytes</b>				
Instrument Definition Response - Status Codes				
'A'	Accepted			
'O'	Out of Range ( <i>Sequence</i> must be 0)			
'S'	Spin already in progress (only one spin can be running at a time)			

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

### 5.9 Instrument Definition Finished

The Instrument Definition Finished message is sent to indicate that all Symbol Mapping 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
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field
<i>Message Type</i>	1	1	0x86	Instrument Definition Finished Message
<b>Total Length = 2 bytes</b>				

## 6 Message Types

### 6.1 Gap Request Proxy Messages

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

### 6.2 Spin Server Messages

0x01	Login
0x02	Login Response
0x80	Spin Image Available
0x81	Spin Request
0x82	Spin Response
0x83	Spin Finished
0x84	Instrument Definition Request
0x85	Instrument Definition Response
0x86	Instrument Definition Finished

### 6.3 FLEX Feed Messages

0x20	Time
0x9C	FLEX Instrument Definition
0x9B	Complex FLEX Instrument Definition
0xAD	Auction Notification
0xAE	Auction Cancel
0xAF	Auction Trade
0x2A	Trade
0x2C	Trade Break
0x99	Trading Status
0x2D	End of Session

## 7 Example Messages

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

### 7.1 Login Message

Length	16	22 bytes
Type	01	Login
SessionSubId	30 30 30 31	"0001"
Username	46 49 52 4D	"FIRM"
Filler	20 20	" "
Password	41 42 43 44 30 30 20 20 20 20	"ABCD00"

### 7.2 Login Response Message

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

### 7.3 Gap Request Message

Length	09	9 bytes
Type	03	Gap Request
Unit	01	Unit 1
Sequence	3B 10 00 00	First message: 4155
Count	32 00	50 messages

### 7.4 Gap Response Message

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

### 7.5 Spin Image Available Message

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

### 7.6 Spin Request Message

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



### 7.7 Spin Response Message

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

### 7.8 Spin Finished Message

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

### 7.9 Instrument Definition Request

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

### 7.10 Instrument Definition Response

Length	0B	11 bytes
Type	85	Instrument Definition Response
Sequence	00 00 00 00	Sequence: 0
Instrument Count	B8 0B 00 00	3,000 Instruments
Status	41	Accepted

### 7.11 Instrument Definition Finished

Length	02	2 bytes
Type	86	Instrument Definition Finished

### 7.12 Time Message

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

### 7.13 FLEX Instrument Definition Message

Length	39	57 bytes
Type	9C	Flex Instrument Definition
Time offset	18 D2 06 00	447,000 ns since last Time Message
Feed Symbol	46 30 30 30 31 32	F00012
OSI Root	31 41 41 50 4C 20	1AAPL

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Year	31 38	18
Month	31 31	11
Day	32 32	22
Call/Put	43	C = Call
Dollar Strike	00 00 32 30 37	00207 = \$207
Decimal Strike	37 35 00	750 = \$0.750
Symbol Condition	4E	N = Normal
Underlying	41 41 50 4C 20 20	AAPL
Exercise Style	41	American
Settlement Type	50	PM
Percentage	00 00 00 00	Not percentage pricing
Observation Day	20 20	No Observation Day
Return Cap	00 00 00 00	250 = 2.5% Return cap
Creation Day	20 20	No Creation Day
Bit Fields	00	Not percentage pricing

### 7.14 Complex FLEX Instrument Definition Message

Length	43	67 bytes
Type	9B	FLEX Instrument Definition
Time offset	18 D2 06 00	447,000 ns since last Time Message
CID	43 30 30 30 31 32	C00012
Underlying	5A 56 5A 5A 54 20 20 20	ZVZZT
Complex Instrument Type	58 20 20 20	X = All Legs are Flex Options
Leg Count	03	3 legs
Message Count	01	Only one message needed to define instrument
Message Number	01	Message 1 of 1
Message Leg Count	03	3 legs
Leg Symbol	30 30 30 30 30 31 20 20	000001
Leg Ratio	FF FF FF FF	-1 = Sell 1
Leg Security Type	58	FLEX Option Leg
Leg Symbol	30 30 30 30 30 32 20 20	000002
Leg Ratio	FF FF FF FF	-1 = Sell 1
Leg Security Type	58	FLEX Option Leg
Leg Symbol	30 30 30 30 30 33 20 20	000003
Leg Ratio	02 00 00 00	2 = Buy 2
Leg Security Type	58	FLEX Option Leg

### 7.15 Auction Notification Message

Length	2F	47 bytes
--------	----	----------

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Type	AD	Auction Notification
Time offset	18 D2 06 00	447,000 ns since last Time Message
CID	30 30 6d 45 56 4f	00mEVO
Auction ID	05 40 5B 77 8F 56 1D 0B	631WC4000005
Auction Type	53	S = SAM
Side	42	B = Buy Side
Price	E8 A3 0F 00 00 00 00 00	\$102.50
Quantity	64 00 00 00	100
Customer	43	C = Customer
Indicator		
ParticipantID	45 46 49 44	EFID
Auct. End Offset	38 73 0E 00	947,000 ns since last Time Message
ClientID	41 42 43 44	ABCD

**7.16 Auction Cancel Message**

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	631WC4000005

**7.17 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	1.0250%
Quantity	64 00 00 00	100

**7.18 Trade Message**

Length	21	42 bytes
Type	2A	Trade
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Side	42	Buy
Quantity	F8 24 01 00	75,000 contracts
Symbol	33 34 35 33 32 31	345321
Price	E8 A3 0F 00 00 00 00 00	\$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Trade Condition	20	<Space> = Normal

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**7.19 Trade Break Message**

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

**7.20 Trading Status Message**

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	48	H = Halted
Hours Status		
Reserved	20	Reserved

**7.21 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 Multicast Configuration

### 8.1 Production Environment Configuration

#### 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.
WAN-Shaped Throttle	100 Mb/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 per session.

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**Unit/Symbol Distribution**

Unit	C1 Symbol Range
1	A – ADOZZ
2	ADP – ANETZ* <i>*except AMZN</i>
3	ANEU – BAAAZ
4	BAAB – BKNFZ
5	BKNG – BZZZZ
6	C – CLGXZ
7	CLGY – CSXAZ
8	CSXB – DISAZ
9	DISB – ETFBZ
10	ETFC – FIVDZ
11	FIVE – GLDAZ
12	GLDB – GOOGZ
13	GOOH – HSXZZ
14	HSY – IWLZZ
15	IWM – JNJAZ
16	JNJB – LMTAZ
17	LMTB – MLNXZ
18	MLNY – MUA AZ
19	MUAB – NTE SZ
20	NTET – OXYAZ
21	OXYB – QGENZ
22	QGEO – RHAAZ
23	RHAB – SMGZZ* <i>*except RUT, RUTW</i>
24	SMH – SYEZZ* <i>*except SPX, SPXW, SPY</i>
25	SYF – TSKZZ
26	TSL – UALAZ
27	UALB – VLOAZ* <i>*except VIX, VIXW</i>
28	VLOB – WDCAZ
29	WDCB – XLDZZ
30	XLE – ZZZZZ* <i>*except XSP</i>
31	AMZN
32	SPY
33	RUT, RUTW, XSP
34	SPX, SPXW
35	VIX, VIXW

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.

**Cboe Options FLEX Multicast Routing Parameters**

Data center	Rendezvous Point
Primary Data Center (NY5)	TBD
Secondary Data Center (CH4)	TBD

8.1.3

**Cboe Options FLEX Multicast Addresses**

The following tables describe the multicast address distribution across production multicast Cboe FLEX feeds.

8.1.4

NY5 Primary Datacenter		WAN-Shaped [CAF] TBD		WAN-Shaped [CBF] TBD	
Unit	IP Port	Real-time MC	Gap Resp. MC	Real-time MC	Gap Resp. MC
1	TBD				
2	TBD				
3	TBD				
4	TBD				
5	TBD				
6	TBD				
7	TBD				
8	TBD				
9	TBD				
10	TBD				
11	TBD				
12	TBD				
13	TBD				
14	TBD				
15	TBD				
16	TBD				
17	TBD	TBD	TBD	TBD	TBD
18	TBD				
19	TBD				
20	TBD				
21	TBD				
22	TBD				
23	TBD				
24	TBD				
25	TBD				
26	TBD				
27	TBD				
28	TBD				
29	TBD				
30	TBD				
31	TBD				
32	TBD				
33	TBD				

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

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CH4 Secondary Datacenter		WAN-Shaped [CEF] TBD	
Unit	IP Port	Real-time MC	Gap Resp. MC
1	TBD		
2	TBD		
3	TBD		
4	TBD		
5	TBD		
6	TBD		
7	TBD		
8	TBD		
9	TBD		
10	TBD		
11	TBD		
12	TBD		
13	TBD		
14	TBD		
15	TBD		
16	TBD		
17	TBD	TBD	TBD
18	TBD		
19	TBD		
20	TBD		
21	TBD		
22	TBD		
23	TBD		
24	TBD		
25	TBD		
26	TBD		
27	TBD		
28	TBD		
29	TBD		
30	TBD		
31	TBD		
32	TBD		
33	TBD		

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.



## 8.2 Certification Environment Configuration

### Unit/Symbol Distribution

Unit	C1 Symbol Range
1	A – ADOZZ
2	ADP – ANETZ* <i>*except AMZN</i>
3	ANEU – BAAAZ
4	BAAB – BKNFZ
5	BKNG – BZZZZ
6	C – CLGXZ
7	CLGY – CSXAZ
8	CSXB – DISAZ
9	DISB – ETFBZ
10	ETFC – FIVDZ
11	FIVE – GLDAZ
12	GLDB – GOOGZ
13	GOOH – HSXZZ
14	HSY – IWLZZ
15	IWM – JNJAZ
16	JNJB – LMTAZ
17	LMTB – MLNXZ
18	MLNY – MUAAZ
19	MUAB – NTESZ
20	NTET – OXYAZ
21	OXYB – QGENZ
22	QGEO – RHAAZ
23	RHAB – SMGZZ* <i>*except RUT, RUTW</i>
24	SMH – SYEZZ* <i>*except SPX, SPXW, SPY</i>
25	SYF – TSKZZ
26	TSL – UALAZ
27	UALB – VLOAZ* <i>*except VIX, VIXW</i>
28	VLOB – WDCAZ
29	WDCB – XLDZZ
30	XLE – ZZZZZ* <i>*except XSP</i>
31	AMZN
32	SPY
33	RUT, RUTW, XSP
34	SPX, SPXW
35	VIX, VIXW

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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.

**Cboe Options FLEX Certification Multicast Routing Parameters**

Data center	Rendezvous Point
Primary Data Center (NY5)	<b>TBD</b>

8.2.2

**Cboe Options FLEX Certification Multicast Addresses**

The following tables describe the multicast address distribution across production multicast Cboe FLEX feeds.

8.2.3

NY5 Primary Datacenter		WAN-Shaped TBD	
Unit	IP Port	Real-time MC	Gap Resp. MC
1	TBD	TBD	TBD
2	TBD		
3	TBD		
4	TBD		
5	TBD		
6	TBD		
7	TBD		
8	TBD		
9	TBD		
10	TBD		
11	TBD		
12	TBD		
13	TBD		
14	TBD		
15	TBD		
16	TBD		
17	TBD		
18	TBD		
19	TBD		
20	TBD		
21	TBD		
22	TBD		
23	TBD		
24	TBD		
25	TBD		
26	TBD		
27	TBD		
28	TBD		
29	TBD		
30	TBD		
31	TBD		
32	TBD		
33	TBD		

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 Connectivity**

### **9.1 Supported Extranet Carriers**

Cboe has certified a number of carriers defined in the [Cboe C1 Options Connectivity Manual](#) with respect to redistribution of Cboe Multicast data feeds. For more information on receiving the FLEX feed through any of these providers, reach out to the vendor contact noted in the Extranet Providers section of the Connectivity Manual.

### **9.2 Bandwidth Recommendation**

The WAN-shaped feeds require 100 Mbps of bandwidth. Cboe will use 90% of these respective bandwidths for the FLEX feed to allow customers to use the same physical connection for FIX order entry if desired.

## **10 References**

For more information on Cboe Symbology, please refer to the [Cboe Symbology Reference](#) document.

## **11 Support**

Please e-mail questions or comments regarding this specification to [tradedesk@cboe.com](mailto:tradedesk@cboe.com).

## Revision History

Document Version	Date	Description
1.0.0	11/16/18	Initial draft in support of FLEX Options on Cboe Options Exchange.