Cboe Titanium Cboe Canada Multicast PITCH Specification

Version 1.0.14

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Contents

Introduction

Overview

This specification is the standard Cboe Titanium Multicast PITCH specification for the Cboe Canada Inc. ("Cboe Canada") platforms, which are as follows:

- the NEO-L, NEO-N, and NEO-D Trading Books, plus the Special Settlement Term order book (the SST) and the Crossing Facility (collectively, "Cboe Canada NEO"); and
- the MATCHNow Trading Book ("MATCHNow").

Note that NEO-L and SST are represented as a full depth order book and NEO-N as a market by price book. NEO-D, the Crossing Facility, and MATCHNow do not disseminate order events, only trades.

Members may use the Multicast PITCH protocol to receive real-time trading information directly from Cboe Canada. The Multicast PITCH protocol provides symbol information, real-time depth of book quotations, and execution information direct from Cboe Canada. Members can connect to the Multicast PITCH feed from 05:00 to 18:45 ET.

Cboe Canada Multicast PITCH cannot be used to enter orders. For order entry, refer to the Cboe Canada FIX or BOE Specification.

All versions of the Cboe Canada Multicast PITCH feed are Gig-shaped and are available from one or both Cboe Canada data centers. Members may choose to take one or more of the following Cboe Canada Multicast PITCH feeds depending on their location and connectivity to Cboe Canada.

There are two distinct sets of Cboe Canada NEO Multicast PITCH feeds: one for NEO-L, SST, and the Crossing Facility, and another for NEO-N and NEO-D. There is one set of MATCHNow Multicast PITCH feeds. The Cboe Canada Multicast PITCH Feed Descriptions are below:

Table 1. Cboe Canada Multicast PITCH Feeds

MARKET	SHAPING	SERVED FROM DATA CENTER (PRIMARY/ SECONDARY)	MULTICAST FEED ID
MATCHNow	Gig	Primary	MAM - Feed A
MATCHNow	Gig	Primary	MBM - Feed B
MATCHNow	Gig	Secondary	MEM - Feed E
NEO-L, SST, Crossing Facility	Gig	Primary	NLAM - Feed A
NEO-L, SST, Crossing Facility	Gig	Primary	NLBM - Feed B
NEO-L, SST, Crossing Facility	Gig	Secondary	NLEM - Feed E
NEO-N, NEO-D	Gig	Primary	NDAM - Feed A
NEO-N, NEO-D	Gig	Primary	NDAM - Feed B
NEO-N, NEO-D	Gig	Secondary	NDAM - Feed E

Feed Connectivity

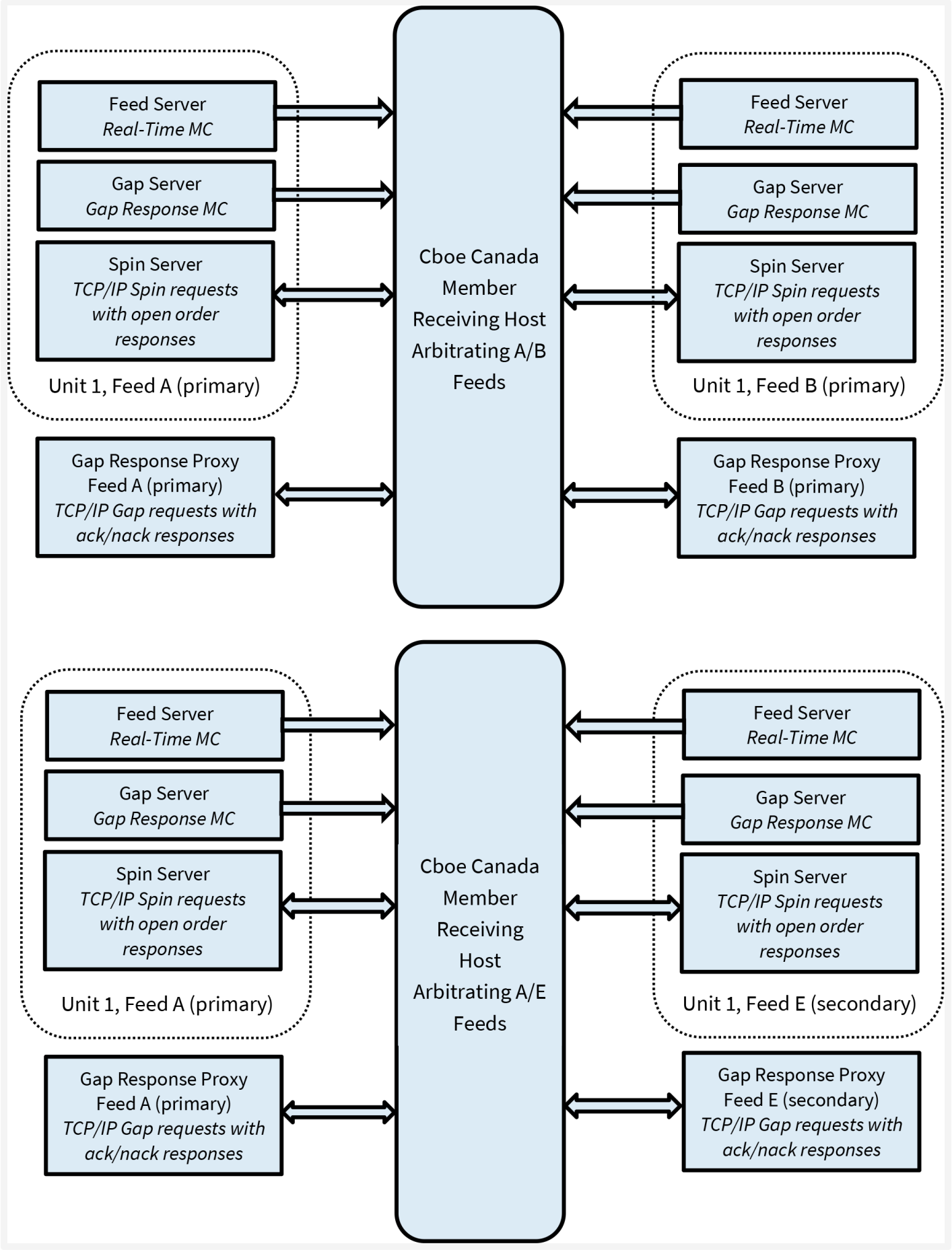
PITCH feeds are available to Members connecting to Cboe Canada via cross-connect, dedicated circuit, or a supported carrier.

Members with sufficient connectivity may choose to take both the A and B feeds from Cboe Canada's primary data center and arbitrate the feeds to recover lost data. Alternatively, Members may choose to arbitrate feeds from both data centers. Note that feeds from the secondary data center will have additional latency compared to those connected to Cboe Canada in the primary data center due to proximity and business continuity processing.

When arbitrating, Members can utilize the fact that the redundant feeds have sequenced messages and process the next expected sequence from whichever feed it is received from first. The A and B feeds are created utilizing distinct infrastructure, and the architecture is such that neither the A nor B feed should be expected to be advantaged relative to the other (i.e., performance should be generally equal). Any duplicate message sequence can be dropped. Arbitration reduces the chances of losing a message due to packet loss.

Multicast PITCH real-time events are delivered using a published range of multicast addresses divided into units, each with a unique symbol range. A TCP/IP connection to one of Cboe Canada's Gap Request Proxy (GRP) servers can be used to request dropped messages. Replayed messages are delivered on a separate set of multicast ranges reserved for packet retransmission. Intraday, for Cboe Canada NEO only, a spin of all open orders may be requested from a Spin Server. This allows Members 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 Canada and a Member feed handler listening to the A, B, and E instances of a unit. Note the Spin Server only applies to Cboe Canada NEO and is not available for MATCHNow.



Symbol Ranges, Units, and Sequence Numbers

Symbols are separated into units, and the Unit/Symbol Distribution on page 93 will not change intraday. Cboe Canada does, however, **reserve the right to add multicast addresses or change the symbol distribution. Members will be notified and provided sufficient time to conform with the changes. Care should be taken to ensure that address changes, address additions, and symbol distribution changes can be supported easily**.

Message sequence numbers are incremented by one for every sequenced message within a particular symbol unit. It is important to understand that one or more units will be delivered on a single multicast address. As with symbol ranges, unit distribution across multicast addresses will not change intraday but may change after notice has been given.

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

Gap Request Proxy and Message Retransmission

Requesting delivery of missed sequenced data is achieved by establishing a TCP connection to a Cboe Canada GRP port and then receiving requested messages on designated gap recovery multicast addresses. Members not wishing 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. Members 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`** message *Status* code of A (accepted) signals that the replayed messages will be delivered via the appropriate gap response multicast address. Any other **`Gap Response`** message *Status* code indicates the reason that the request cannot be serviced.

The GRP limits gap requests by message count, frequency, and age. Gap requests are only 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 the gap allowances are exceeded, the gap request will be rejected as defined Gap Response Message Fields on page 46. The Member can then wait until the time-based gap request limits reset or perform a spin as defined Spin Request Message Fields on page 53. If the daily allowance of gap requests is exceeded, the Member must perform a spin.

If overlapping gap requests are received within a short period of time, all requests will receive a successful **`Gap Response`** message from the GRP, but the gap server will 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 acknowledgments or rejects will be delivered to Members for every gap request received by the GRP. Members should be prepared to see replayed multicast data before or after the receipt of the gap response acknowledgment from the GRP.

Gap Server Usage Example on page 47 shows an example flow of messages between a Member and Cboe Canada's Multicast PITCH feed, Gap Server, and Gap Request Proxy.

Spin Servers

A Spin Server is available for each unit in Cboe Canada NEO only. The server allows Members to connect via TCP and receive a spin of the current books, instruments, or trades on that unit. By using the spin, Members can get the current books 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 applied to the book. Using a **Spin Request** message, Members 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** message submitted does not present a sequence number matching 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** message higher than the sequence number reported by the most recent **Spin Image Available** message, the next spin image 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.

There are three types of spins; an order book spin, an instrument spin, and a trade spin. An order book spin consists of **Trading Status, Add Order**, and **Single Side Update** messages. **Trading Status** messages are sent in spins for all symbols even if they are suspended (S) since system start-up. Spin requests made after system start-up but before order acceptance will contain a **Trading Status** message for every symbol. Order book spins do not contain any message for orders no longer on the book. An instrument spin consists of **Instrument Directory** messages. A trade spin consists of **Trade**, **Trade Break**, **and Trade Correction** messages. Note for the trade spin, **Order Executed** messages are converted to **Trade** messages.

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** message sequence number is the Member's reference point which they send in their **Spin Request** message, they should buffer from that point on. However, the Member should then disregard all messages from the feed server that are not greater than the sequence number in the **Spin Response** message. When a **Spin Finished** message is received, the buffered messages must be applied to the spun copy of the book to bring it current.

Instrument Definition Request Message Fields on page 56 shows an example message flow between a Member and Cboe Canada NEO Multicast PITCH feed and Spin Server.

Members are required to send Heartbeat messages to Cboe Canada NEO no less than every 5 seconds, even while a spin response is in progress. Failure to do so is the most common cause of Member difficulties while processing spin responses, especially during periods of high market activity. Cboe Canada recommends Members send a heartbeat every second to stay well within this heartbeat requirement.

Protocol

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

Message Format

The messages that make up the PITCH protocol are delivered using the **`Sequenced Unit Header`** message header which handles sequencing and delivery integrity. All messages delivered via multicast as well as to/from the Gap Request Proxy (GRP) use the **`Sequenced Unit Header`** message 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`** message 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 feed is comprised of a series of dynamic length sequenced messages. Each message begins with *Length* and *Message Type* fields. Cboe Canada 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.

Data Types

The following field types are used within the **`Sequenced Unit Header`** message header, GRP messages, Spin Server messages, and PITCH.

- **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 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 Time** fields are 8-byte unsigned Little Endian values representing the number of nanoseconds since the epoch (00:00:00 UTC on 1 January 1970).
- **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).

Message Framing

PITCH messages will be combined into a single UDP frame where possible to decrease message overhead and total bandwidth. The count of messages in a UDP frame will be communicated using the **`Sequenced Unit Header`** message header. Framing will be determined by the server for each unit and site. The content of the multicast across feeds (e.g., A/B) 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.

Sequenced Unit Header Message Fields

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

Both sequenced and unsequenced data may be delivered using the **`Sequenced Unit Header`** message header. Un-sequenced headers will have a 0 value for the *Hdr Sequence* field and potentially for the *Hdr Unit* field. All messages sent to and from the GRP and Spin Servers are unsequenced while multicast may contain both sequenced and unsequenced 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`** message header, but a combination of sequenced and unsequenced messages cannot be sent within one header.

The sequence number for the first message in the next frame can be calculated by adding the *Hdr Count* field to the *Hdr Sequence*. This technique will work for sequenced messages and **`Heartbeat`** message.

Table 2. Sequenced Unit Header

FIELD	OFFSET	LENGTH	VALUE/TYPE	DESCRIPTION
Hdr Length	0	2	Binary	Length of entire block of messages. Includes this header and messages following *Hdr Count.*
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				

Heartbeat Messages

The **`Sequenced Unit Header`** message header with a *Hdr Count* field set to 0 will be used for heartbeat messages. During trading hours heartbeats will be sent from the GRP, Spin Server, and all multicast addresses if no data has been delivered within one 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 and Spin Server are unsequenced and should have *Hdr Sequence* and *Hdr Unit* fields set to 0.

Outside of trading hours Cboe Canada sends heartbeats on all real-time and gap channels with a sequence of 0 to help Members validate multicast connectivity. Heartbeats might not be sent outside of normal trading hours during scheduled maintenance.

Cboe Canada expects heartbeats to be sent to the GRP and Spin Servers on live connections no less than every 5 seconds. Failure to receive two consecutive heartbeats will result in the GRP or Spin Server terminating the Member connection. **This also applies when the Member is receiving a spin from the Spin Server, the heartbeats must continue to be sent from the Member to the Spin Server.**

Execution IDs and Order IDs

Execution IDs and Order IDs that are reported in PITCH may be converted to base 36 and then matched to Execution IDs and Order IDs that are received over FIX or BOE acknowledgments. Conversion rules and examples are provided to allow for Members to match these ID types.

Execution IDs

Convert to nine-character, base 36, zero-padded on the left. Binary values represented in Little Endian format.

Table 3. Execution IDs

BINARY VALUE (HEX)	DECIMAL (BASE 10)	CBOE BASE36 VALUE
24 45 20 30 15 00 00 00	91001734436	015T02ZOK
8B 0F FF 6E 27 00 00 00	169365933963	025T03ROR

The first 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 trades as follows:

- 0 (zero) = Cboe Internal Match

Order IDs

Convert to 12-character, base 36. No padding should be required. Binary values represented in Little Endian format.

Table 4. Order IDs

BINARY VALUE (HEX)	DECIMAL (BASE 10)	CBOE BASE36 VALUE
00 60 A3 58 6C 5E 29 40	288958144494319104	27174309PSLC
09 AC 22 D4 83 8A EF 22	157336438470486729	17174206VA2X

PITCH Messages

PITCH messages reflect the state of Cboe Canada including the order addition, order deletion, order modification, or execution of an order in the system.

Unit Clear Message Fields

The **`Unit Clear`** message instructs feed recipients to clear all orders for the Cboe Canada order book in the unit specified in the **`Sequenced Unit Header`** message header. It is distributed in rare recovery events such as a data center fail-over.

Table 5. 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
Reserved	2	4	Binary	Reserved (undefined)
Total Length=6 bytes				

Instrument Directory Message Fields (Cboe Canada NEO Only)

The **`Instrument Directory`** message disseminates information for each symbol. A separate **`Trading Status`** message indicates the status of each symbol. If no **`Trading Status`** message is received for a symbol, it is assumed to be Suspended.

Table 6. Instrument Directory

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x60	**`Instrument Directory`** message
Timestamp	2	8	Binary Time	Time the message was generated.
Allowed Book Types	10	1	Bit Field	Defines the order book types allowed for the symbol. Each designated bit represents a book type. 0 means not allowed and 1 means allowed. **Bit 0-2**: Reserved **Bit 3**: NEO-L **Bit 4**: NEO-N **Bit 5**: NEO-D **Bit 6**: Crossing Facility **Bit 7**: SST
Symbol	11	14	Alphanumeric	Symbol (right padded with spaces).
Segment	25	6	Alphanumeric	Segment the symbol is assigned to (right padded with spaces). CBOECA= Cboe Canada Securities TSX= TSX Securities TSXV= TSXV Securities CSE= CSE Securities NEOC= NEO Connect Securities FOTS= Foreign Other Traded Securities
Currency	31	3	Alphanumeric	The possible values will be the ISO 4217 codes for currency.
Lot Size	34	4	Binary	Indicates the minimum quantity/nominal value tradable on the market for a security.
Full Name	38	120	Alphanumeric	The unique long name assigned to the symbol.
Active Market Maker	158	2	Binary	The active market maker broker id who will be carrying our market maker obligations for the instrument.
Security Type	160	1	Binary	The security type of the instrument. 1 = Equity 2 = Debt 3 = Closed End Fund 4 = Depositary Receipt 5 = Exchange Traded Fund 6 = Foreign Listed Security 7 = Structured Product 8 = Unit 9 = Warrant 52= Unlisted Security
Instrument Flags	161	1	Bit Field	**Bit 0**: Odd Lot Allowed flag 0 = Not Allowed

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
				1 = Allowed **Bit 1**: Closing Eligible flag 0 = Not eligible 1 = Eligible **Bit 2-7**: Reserved
Previous Close	162	8	Binary Price	The previous day's closing price.
Total Length=170 bytes				

Trading Status Message

The **`Trading Status`** message indicates the current trading status of a security. A **`Trading Status`** message is sent whenever trading status changes for a security.

Trading Status Message (Cboe Canada NEO Only)

Sequenced **`Trading Status`** messages are sent upon system start up for all active securities with *Trading Status* = S(suspended). **`Trading Status`** messages will continue to be published upon symbol state changes, such as at the beginning of order acceptance.

The following summarizes the *Trading Status* values in the Cboe Canada NEO system:

Table 7. NEO-L Trading Status Summary

TRADING STATUS	SUB-STATUS	DESCRIPTION
A=Accepting	<space> (none)	Accepting orders for the Opening Call.
	D=Delayed	Issued at the scheduled opening time if the opening process invokes the 10-minute delayed open period.
	O=Halt Lift Scheduled	Halt lift scheduled for at or before the Opening Call. Accepting orders for Opening Call.
F=Halted (Full)	<space> (none)	Orders (and order modifications) are not accepted. Cancels are accepted.
	R=Halt Lift Scheduled	Halt lift scheduled for after the Opening Call, reopening call initiated to uncross Cboe Canada listed securities in NEO-L. Accepting orders for reopening call.
H=Halted	<space> (none)	New orders, modifications, and cancels will be accepted but queued until the symbol re-opens.
	R=Halt Lift Scheduled	Re-opening auction initiated to uncross Cboe Canada listed securities. Accepting orders for reopening call.
M=Delayed Closing	<space> (none)	Closing Call delayed.
P=Post Close	<space> (none)	Continuous Trading Session has ended. New orders cannot be entered, and existing orders cannot be modified. GTC/GTD orders can be cancelled.
S=Suspended	<space> (none)	Trading Suspended. Sent at system startup and at the end of the trading day, or in the event trading is suspended for operational reasons. Orders (and order modifications) are not accepted. Cancels are accepted prior to done for day message.
T=Trading	<space> (none)	Open for continuous trading.
	I=Imbalance	Closing Call
	C=Closing Offset	Closing Offset
X=Extended	<space> (none)	Extended Trading Session.

Table 8. All Other Books Trading Status Summary

TRADING STATUS	SUB-STATUS	DESCRIPTION
A=Accepting	<space> (none)	Accepting orders for queuing in preparation for the market open. Applies only to NEO-D.
F=Halted (Full)	<space> (none)	Orders (and order modifications) are not accepted. Cancels are accepted.
H=Halted	<space> (none)	New orders, modifications, and cancels will be accepted but queued until the symbol re-opens.

TRADING STATUS	SUB-STATUS	DESCRIPTION
O=Pre-Close	<space> (none)	All orders are locked and cannot be modified or cancelled. Applies only to NEO Connect.
P=Post Close	<space> (none)	Continuous Trading Session has ended. New orders cannot be entered, and existing orders cannot be modified. GTC/GTD orders can be cancelled. Applies only to SST.
S=Suspended	<space> (none)	Trading Suspended. Sent at system startup and at the end of the trading day, or in the event trading is suspended for operational reasons. Orders (and order modifications) are not accepted. Cancels are accepted during continuous trading.
T=Trading	<space> (none)	Open for continuous trading.
X=Extended	<space> (none)	Extended Trading Session.

The *Trading Status* and *Trading Sub-Status* fields represent the status of the Cboe Canada NEO trading session.

Table 9. Trading Status Message Fields (Cboe Canada NEO Only)

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x61	**`Trading Status`** message
Timestamp	2	8	Binary Time	Time the message was generated. Only the latest *Trading Status* for each symbol/order book type pair will be sent during a **`Spin Request`**. When this message is received as part of a **`Spin Request`**, the *Timestamp* value will be set to 1 and should be ignored.
Order Book Type	10	1	Binary	0=All Books 3=NEO-L 4=NEO-N 5=NEO-D 6=Crossing Facility 7=SST
Symbol	11	14	Alphanumeric	Symbol (right padded with spaces).
Trading Status	25	1	Alphanumeric	A=Accepting F=Halted (Full) H=Halted M=Delayed Closing O=Pre-close P=Post Close S=Trading Suspended T=Trading X=Extended Trading
Trading Sub-Status	26	1	Alphanumeric	space=None (0x20) C=Closing Offset D=Delayed I=Imbalance O=Halt Lift Schedule for Opening R=Halt Lift Schedule for Re-Opening
Halt Reason	27	1	Alphanumeric	space=None (0x20)

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
				B=Business C=Cease Trading Order I=IPO R=Regulatory S=Suspension
Total Length=28 bytes				

Trading Status Message Fields (MATCHNow Only)

The following summarizes the *Trading Status* in the MATCHNow system:

- H=Halt state. New orders, modifications, and cancels are accepted but queued until the symbol re-opens.
- A=Accepting. Sent starting at 7:00 a.m. ET once orders can be accepted for queuing in preparation for the market open.
- T=Trading. Sent when symbol is open for trading, sometime after 9:30 a.m. ET.
- S=Trading suspended. Sent at the end of the trading day or if trading is suspended for operational reasons. Trading Suspended is implied at system startup.

Trading Status represents the status of the MATCHNow trading session (9:30 a.m. - 4:00 p.m. ET).

Sequenced **`Trading Status`** messages are sent upon system start up for all active securities with Trading Status = S (suspended). **`Trading Status`** messages will continue to be published upon symbol state changes, such as at the beginning of order acceptance.

Table 10. Trading Status

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x43	**`Trading Status`** message
Timestamp	2	8	Binary Time	Time the message was generated.
Symbol	10	14	Alphanumeric	Symbol (right padded with spaces).
Listing Exchange	24	4	Alphanumeric	Exchange codes of the listing exchange: 'TSX' 'TSXV' 'CSE' 'NEOL'
Trading Status	28	1	Alphanumeric	A = Accepting H = Halted S = Trading Suspended T = Trading
Reserved	29	3	Binary	Reserved (undefined)
Total Length=32 bytes				

Add Order Message Fields (Cboe Canada NEO Only)

The **`Add Order`** message represents a newly accepted order on Cboe Canada NEO. It includes a unique *Order Id* assigned by Cboe Canada NEO to the order.

Table 11. Add Order

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x62	**`Add Order`** message
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	3 = NEO-L 7 = SST
Order Id	11	8	Binary	Unique identifier assigned to this order.
Side Indicator	19	1	Alphanumeric	B = Buy Order S = Sell Order
Quantity	20	4	Binary	Number of shares being added to the order book.
Symbol	24	14	Alphanumeric	Symbol (right padded with spaces).
Price	38	8	Binary Price	The display price of the order.
Broker Id	46	2	Binary	Identity of trading Member that submitted the order (or 1 for anonymous).
Settlement Type	48	1	Binary	Settlement terms of the order. 0 = No special settlement terms specified 1 = Cash 6 = Future 11= Non-net
Settlement Date	49	4	Binary Date	The date the order would settle.
Reserved	53	1	Binary	Reserved (undefined)
Total Length=54 bytes				

Order Modification Messages (Cboe Canada NEO Only)

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 reaches zero, the order is dead and should be removed from the order book.

Reduce Size Message Fields

The **`Reduce Size`** message is sent when a visible order on Cboe Canada NEO is partially reduced. Orders that are reduced in size do not lose priority.

Table 12. Reduce Size

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x63	**`Reduce Size`** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	3 = NEO-L 7 = SST
Order Id	11	8	Binary	Order Id of a previously sent **`Add Order`** message that has been reduced.
Cancelled Quantity	19	4	Binary	Number of shares cancelled.
Total Length=23 bytes				

Delete Order Message Fields

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. Therefore, a **`Delete Order`** message does not indicate that a given *Order Id* will not be sent again on a subsequent **`Add Order`** message. Members should be prepared to handle this scenario.

Table 13. Delete Order

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x64	**`Delete Order`** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	3 = NEO-L 7 = SST
Order Id	11	8	Binary	Order Id of a previously sent **`Add Order`** message that has been removed from order book.
Total Length=19 bytes				

Modify Order Message Fields

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 appearing to be "no ops" (i.e., they do not appear to modify any relevant fields) will still lose priority.

Table 14. Modify Order

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x65	**`Modify Order`** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	3 = NEO-L 7 = SST
Order Id	11	8	Binary	*Order Id* of a previously sent **`Add Order`** message that has been modified.
Quantity	19	4	Binary	Number of shares associated with this order after this modify (may be less than the number entered).
Price	23	8	Binary Price	The order price after this modify.
Reserved	31	1	Binary	Reserved (undefined)
Total Length=32 bytes				

Order Executed Message Fields

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

Table 15. Order Executed

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x66	**`Order Executed`** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	3 = NEO-L 7 = SST
Order Id	11	8	Binary	Order Id of a previously sent **`Add Order`** message that was executed.
Executed Quantity	19	4	Binary	Number of shares executed.
Execution Id	23	8	Binary	Cboe Canada NEO generated day-unique execution identifier of this execution.
Buy Broker Id	31	2	Binary	Trading participant identity of the buyer of the trade (or 1 for anonymous).
Sell Broker Id	33	2	Binary	Trading participant identity of the seller of the trade (or 1 for anonymous).
Execution Flags	35	1	Bit Field	Bit 0: Reserved Bit 1: Auction flag 0 = Not an Auction Trade 1 = Auction Trade Bit 2-7: Reserved
Total Length=36 bytes				

Trade Message

The **Trade** message provides information about executions of orders not displayed on any Cboe Canada trading book. **Trade** messages may also provide information about displayed orders that are traded at a price other than their displayed price, in which case the trade will be followed by **Delete Order** and **Modify Order** messages to commensurately update the book. **Trade** messages are necessary to calculate Cboe Canada execution-based data. **Trade** messages do not alter the book and can be ignored if messages are being used solely to build a book.

Trade Message Fields (Cboe Canada NEO Only)

The **Trade** message sends the trade price, trade quantity, execution id, and trade condition of a trade.

Table 16. Trade Message (Cboe Canada NEO Only)

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x67	**Trade** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	3 = NEO-L 4 = NEO-N 5 = NEO-D 6 = Crossing Facility 7 = SST
Symbol	11	14	Alphanumeric	Symbol (right padded with spaces).
Quantity	25	4	Binary	Incremental number of shares executed or reported.
Price	29	8	Binary Price	The price of the trade.
Execution Id	37	8	Binary	Cboe Canada NEO generated day-unique execution identifier of this execution. *Execution Id* is also referenced in the **Trade Break** and **Trade Correction** messages.
Buy Broker Id	45	2	Binary	Trading participant identity of the buyer of the trade (or 1 for anonymous).
Sell Broker Id	47	2	Binary	Trading participant identity of the seller of the trade (or 1 for anonymous).
Cross Type	49	1	Binary	The type of the Cross order. 0 = None 5 = Internal Cross 11= Basis Cross 12= Contingent Cross 14= VWAP Cross 15= Regular Cross 18= Derivative Cross 19= Closing Price Publication 20= Net Asset Value (NAV) Note: When the Cross Type = 19 (Closing Price Publication), Quantity will be set to 0 (zero) and both Buy

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
				and Sell Broker IDs will be set to 301 (NEO Exchange's Broker ID).
Trade Flags	50	1	Bit Field	**Bit 0**: Bypass flag (always 0 if *Cross Type* is 0) 0 = No Bypass 1 = Bypass **Bit 1**: Auction flag 0 = Not an Auction Trade 1 = Auction Trade **Bit 2-7**: Reserved
Settlement Type	51	1	Binary	Settlement terms of the order. 0 = No special settlement terms specified 1 = Cash 6 = Future 11= Non-net
Settlement Date	52	4	Binary Date	The date the order would settle.
Reserved	56	1	Binary	Reserved (undefined)
Total Length=57 bytes				

Trade Message Fields (MATCHNow Only)

The **`Trade`** message sends the trade price, trade quantity, execution id, and trade condition of a trade as well as the cumulative volume for the trading session. A **`Trade`** message will be sent for each execution, but not every **`Trade`** message indicates a trade. *Trade Condition* = X (Trade Break) is sent whenever an execution is broken. Trade breaks will contain the *Symbol*, *Quantity*, *Price*, and *Execution Id* of the original trade. The *Total Volume* field will be reduced by the number of shares reported in the *Quantity* field.

Table 17. Trade Message (MATCHNow Only)

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x42	**`Trade`** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Symbol	10	14	Alphanumeric	Symbol (right padded with spaces).
Quantity	24	4	Binary	Incremental number of shares executed or reported (see *Trade Condition*).
Price	28	8	Binary Price	The price of the trade.
Execution Id	36	8	Binary	MATCHNow generated day-unique execution identifier of this execution. *Execution Id* is also referenced in the **`Trade Break`** message (Trade Condition 'X').
Buy Broker Number	44	2	Binary	Broker number of the buyer of the trade (or 1 for anonymous).
Sell Broker Number	46	2	Binary	Broker number of the seller of the trade (or 1 for anonymous).
Total Volume	48	4	Binary	Total number of shares traded in this symbol during the current trading session (may decrease if the *Trade Condition* field indicates a trade break).
Trade Condition	52	1	Alphanumeric	' ' = Regular Trade X = Trade Break
Trade Flags	53	1	Bit Field	**Bit 0**: Conditional 0 = Regular Trade 1 = Conditional Trade **Bit 1**: Odd Lot 0 = Regular Trade 1 = Odd Lot Trade **Bits 2-7**: Reserved
Reserved	54	2	Binary	Reserved (undefined)
Total Length=56 bytes				

Trade Break Message Fields (Cboe Canada NEO Only)

The **`Trade Break`** message is sent whenever an execution on Cboe Canada NEO is cancelled. Applications that simply build a Cboe Canada NEO book can ignore **`Trade Break`** messages.

Table 18. Trade Break

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x68	**`Trade Break`** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	3 = NEO-L 4 = NEO-N 5 = NEO-D 6 = Crossing Facility 7 = NEO SST
Symbol	11	14	Alphanumeric	Symbol (right padded with spaces).
Original Quantity	25	4	Binary	Original number of shares executed or reported.
Original Price	29	8	Binary Price	Original price of the execution.
Execution Id	37	8	Binary	Cboe Canada NEO generated day-unique identifier of the execution that was broken. *Execution Id* refers to previously sent **`Order Executed`** or **`Trade`** message.
Total Length=45 bytes				

Trade Correction Message Fields (Cboe Canada NEO Only)

The **`Trade Correction`** message is sent whenever an execution on Cboe Canada NEO is corrected. Applications that simply build a Cboe Canada NEO book can ignore **`Trade Correction`** messages.

Table 19. Trade Correction

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x69	**`Trade Correction`** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	3 = NEO-L 4 = NEO-N 5 = NEO-D 6 = Crossing Facility 7 = NEO SST
Symbol	11	14	Alphanumeric	Symbol (right padded with spaces).
Original Quantity	25	4	Binary	Original number of shares executed or reported.
Original Price	29	8	Binary Price	Original price of the execution.
Original Settlement Type	37	1	Binary	Original settlement terms of the order.
Original Settlement Date	38	4	Binary Date	Original date the order would settle.
Corrected Quantity	42	4	Binary	Corrected number of shares executed or reported.
Corrected Price	46	8	Binary Price	Corrected price of the execution.
Corrected Settlement Type	54	1	Binary	Corrected settlement terms of the order.
Corrected Settlement Date	55	4	Binary Date	Corrected date the order would settle.
Execution Id	59	8	Binary	Cboe Canada NEO generated day-unique identifier of the execution that was corrected. *Execution Id* refers to previously sent **`Order Executed`** or **`Trade`** message.
Total Length=67 bytes				

Market By Price Update Messages (Cboe Canada NEO Only)

Market by price update messages modify the symbol's displayed quantity for the specified price level. When the quantity is zero there are no more displayable orders on the book for the specified price level.

Single Side Update Message Fields

`Single Side Update` messages provide an updated displayed price and size for a single side of a Symbol.

Table 20. Single Side Update

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x6A	**`Single Side Update`** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	4=NEO-N
Symbol	11	14	Alphanumeric	Symbol (right padded with spaces).
Side Indicator	25	1	Alphanumeric	B = Buy Order S = Sell Order
Quantity	26	4	Binary	Total number of shares at this price level. A zero indicates there are no shares displayed for this side at the price level.
Price	30	8	Binary Price	The price level.
Reserved	38	1	Binary	Reserved (undefined)
Total Length=39 bytes				

Auction Messages (Cboe Canada NEO Only)

`Auction Update` and **`Auction Summary`** messages provide information for the Opening Call, Closing Call, and reopening call (halt).

Auction Update Message Fields

`Auction Update` messages disseminate price and size information and Composite Market bid and offer prices during Opening Call, Closing Call, and reopening call (halt). **`Auction Update`** messages are sent during an auction period, unless in a delayed closing as described below.

If a symbol on NEO-L enters a delayed closing at the time of the Closing Call, a **`Trading Status`** message having *Trading Status* = M (delayed closing) will be issued, immediately followed by a single **`Auction Update`** message having the most recent NLSP as the reference price. No further **`Auction Update`** messages will be issued during the delayed closing.

Table 21. Auction Update

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x6B	**`Auction Update`** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	3=NEO-L
Symbol	11	14	Alphanumeric	Symbol (right padded with spaces).
Auction Type	25	1	Alphanumeric	O = Opening Call C = Closing Call H = Halt Auction (Reopening call)
Reference Price	26	8	Binary Price	Midpoint of the BBO, or NLSP if entering a delayed closing (trading status 'M'). Not used ($0.00) for Opening Call and reopening call.
Imbalance Quantity	34	4	Binary	The size of the auction unmatched shares at the *Reference Price* (for the Closing Call). The size of the auction unmatched shares at the *Indicative Price* (for the Opening Call and reopening call).
Imbalance Side Indicator	38	1	Alphanumeric	The side of the auction imbalance at the *Reference Price* (for the Closing Call). The side of the auction imbalance at the *Indicative Price* (for the Opening Call and reopening call). B = Buy Side S = Sell Side N = No Imbalance
Matched Shares	39	4	Binary	The matched shares at the *Reference Price* (for the Closing Call). The matched shares at the *Indicative Price* (for the Opening Call and reopening).
Indicative Price	43	8	Binary Price	Price at which the auction book and the continuous book would match.
Auction Only Price	51	8	Binary Price	For the Closing Call: Price at which the Closing Call Book would match using only eligible auction orders. Not used for the Opening Call and reopening call.

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Reserved	59	1	Binary	Reserved (undefined)
Total Length=60 bytes				

Auction Summary Message Fields (Cboe Canada NEO Only)

`Auction Summary` messages disseminate the results of an Opening Call, Closing Call, or reopening call (Halt) on Cboe Canada NEO. An **`Auction Summary`** message for each Cboe Canada Listed Security is sent at the conclusion of its Opening Call and represents the Cboe official Opening Price. A Closing **`Auction Summary`** message for each Cboe Canada Listed Security is sent at the conclusion of its Closing Call and represents the Cboe official Closing Price.

Table 22. Auction Summary

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x6C	**`Auction Summary`** message.
Timestamp	2	8	Binary Time	Time the message was generated.
Order Book Type	10	1	Binary	3=NEO-L
Symbol	11	14	Alphanumeric	Symbol (right padded with spaces).
Auction Type	25	1	Alphanumeric	O = Opening Call C = Closing Call H = Halt Auction (Reopening call)
Price	26	8	Binary Price	Auction price.
Shares	34	4	Binary	Cumulative number of shares executed during the auction.
Reserved	38	1	Binary	Reserved (undefined)
Total Length=39 bytes				

End of Session Message Fields

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

Table 23. 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.
Reserved	2	4	Binary	Reserved (undefined)
Total Length=6 bytes				

Gap Request Proxy Messages

The following messages are used to initialize 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 **`Sequenced Unit Header`** message header as described Sequenced Unit Header Message Fields on page 16. The following messages will not be delivered using multicast.

Members are advised to log into the GRP service at start of day in readiness to request the recovery of gaps as they occur. Please note that the recoverable window of messages advances throughout the day.

Login Message Fields

The **`Login`** message is the first message the Member process sends to the GRP after 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.

Table 24. 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 Canada.
Username	6	4	Alphanumeric	*Username* supplied by Cboe Canada.
Filler	10	2	Alphanumeric	(space filled)
Password	12	10	Alphanumeric	*Password* supplied by Cboe Canada.
Total Length=22 bytes				

Login Response Message Fields

The **`Login Response`** message is sent by the GRP to the Member process in response to a **`Login`** message. The *Status* field reflects 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.

Table 25. 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				

Table 26. Login Response - Status Codes

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

Heartbeat

Heartbeat messages must be sent once every five seconds to keep the Member's connection to the GRP server alive. Heartbeat messages are sent using the **`Sequenced Unit Header`** message header as described Sequenced Unit Header Message Fields on page 16.

Gap Request Message Fields

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

Table 27. 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				

Gap Response Message Fields

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.

Table 28. 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				

Table 29. 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.

Gap Server Usage Example

The following diagram shows the message exchange over time between a Member and Cboe Canada's Multicast PITCH feed, Gap Request Proxy, and Gap Server.

At time 0, assume the Member state of the book is current through sequence 310170, and the next expected sequence is 310171.

At time 1, the Member sends a **`Login`** message to the Gap Request Proxy (GRP) server, and at time 2 receives a **`Login Response`** message indicating the login has been accepted. The Member is now successfully logged into the GRP and able to request gaps. Note this is only for example purposes, and in practice the Member is encouraged to log into the GRP at the start of the trading day.

At time 3 and 4, the Member receives sequences 310171 and 310172. These messages are in sequence and the Member applies these messages to their book. The state of the book is current through sequence 310172 and the next expected sequence is 310173.

At time 5 and 6, the Member receives sequences 310176 and 310177 and determines sequences 310173 through 310175 are missing (i.e., a gap was detected). Sequences 310176 and 310177 are then cached for later use.

At time 7, a **`Gap Request`** message is sent to the GRP to request the missing messages, starting at sequence 310173 for a total of 3 messages.

At time 8, the Member receives sequence 310178. Since there are still missing sequences, it cannot apply this message to the book and sequence 310178 is cached for later use.

At time 9, the Member receives a **`Gap Response`** message from the GRP indicating the gap request was successful and it can expect the requested messages to be sent from the Gap Server.

At time 10, the Member receives sequence 310179. Since there are still missing sequences, it cannot apply this message to the book and sequence 310179 is cached for later use.

At time 11, the Member receives sequence 310173 from the Gap Server. Since the last sequence applied was 310172, the Member can apply this message to the book. The state of the book is current through sequence 310173 and the next expected sequence is 310174.

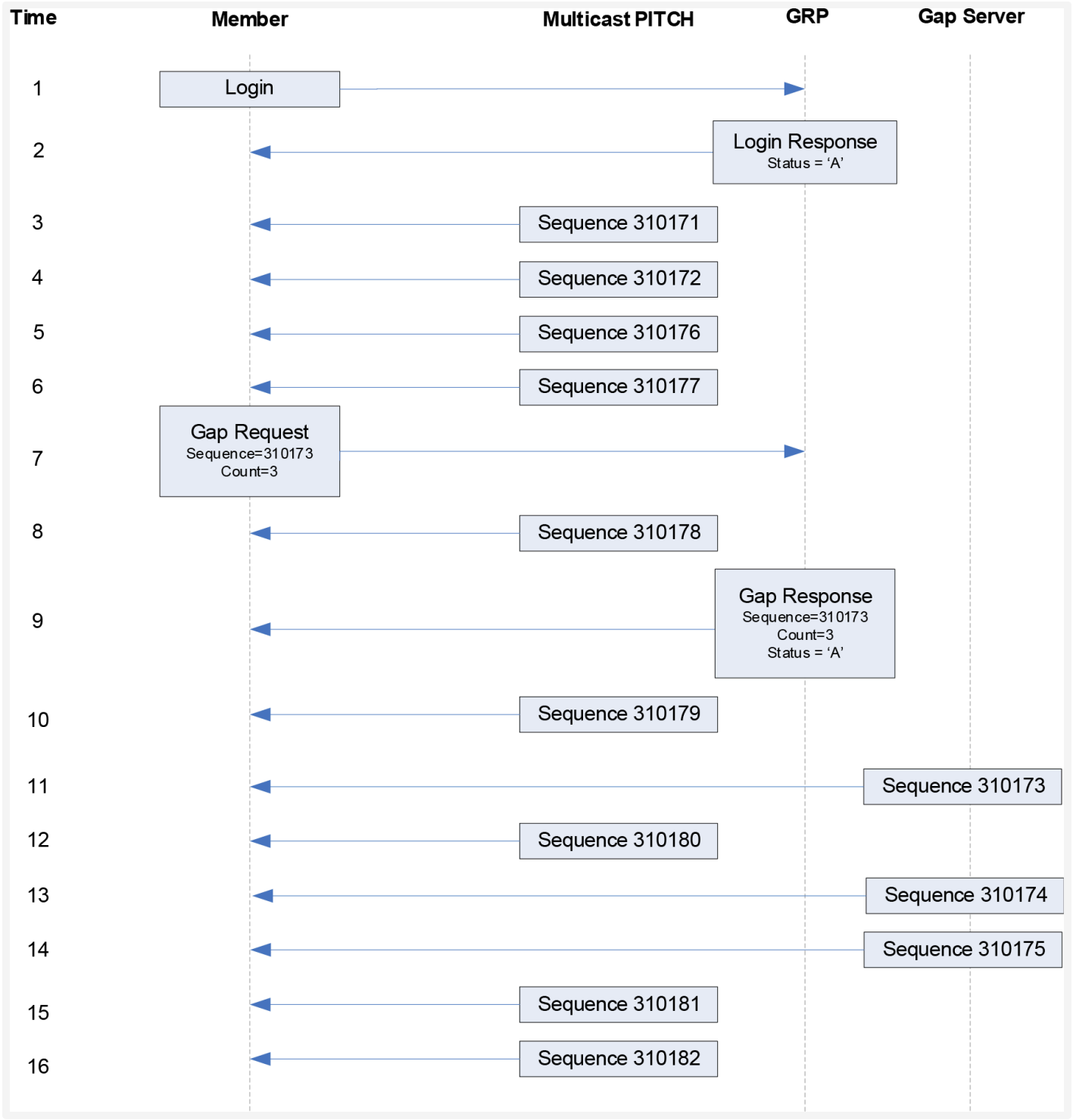
At time 12, the Member receives sequence 310180. Since there are still missing sequences, it cannot apply this message to the book and sequence 310180 is cached for later use.

At time 13 and 14, the Member receives sequences 310174 and 310175 from the Gap Server. Since the last sequence applied was 310173, the Member can apply these messages to the book.

Now that all the missing sequences have been received from the Gap Server, the Member can apply the cached sequence messages 310176 through 310180. At this point the book should be current with the PITCH feed. The state of the book is current through sequence 310180 and the next expected sequence is 310181.

At times 15 and 16, sequences 310181 and 310182 are received. Since there are no missing sequences, and these messages are in sequence, the Member applies these messages to their book. The state of the book is current through sequence 310182 and the next expected sequence is 310183.

It should be noted that other Members may also request gaps, and the Members should be prepared to ignore any message from the Gap Server it is not expecting or does not need.



Spin Messages (Cboe Canada NEO Only)

Login

The **`Login`** message is the first message the Member's process sends to the Spin Server after 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 as described previously Login Message Fields on page 42.

Login Response

The **`Login Response`** message is sent by the Spin Server to a Member's process in response to a **`Login`** message. The *Status* field reflects 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 Login Response Message Fields on page 43.

Heartbeat

Heartbeat messages must be sent once every five seconds to keep the Member's connection to the spin server alive. Heartbeat messages are sent using the **`Sequenced Unit Header`** message header as described Sequenced Unit Header Message Fields on page 16 and Heartbeat Messages on page 17.

Spin Image Available Message Fields

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

Table 30. 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				

Spin Request Message Fields

The **`Spin Request`** message is used by a Member's process to request transmission of a spin of the unit's order book. Refer here on page 12 for more complete details regarding *Sequence* specification and buffering requirements.

Table 31. 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				

Spin Response Message Fields

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

Table 32. 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.
Order Count	6	4	Binary	Number of **`Add Order`** and **`Single Side Update`** messages which will be contained in this spin.
Status	10	1	Alphanumeric	Accepted or reason for reject*.
Total Length=11 bytes				

Table 33. 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.

Spin Finished Message Fields

The **`Spin Finished`** message indicates 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.

Table 34. 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 Response`** message.
Total Length=6 bytes				

Instrument Definition Request Message Fields

The **`Instrument Definition Request`** message is used by a Member's process to request transmission of this unit's **`Instrument Directory`** messages. See Spin Servers on page 11 for more complete details regarding *Sequence* specification and buffering requirements.

Table 35. 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 instruments are available.
Total Length=6 bytes				

Instrument Definition Response Message Fields

The **`Instrument Definition Response`** message indicates whether a spin will be sent in response to a Member's **`Instrument Definition Request`** message.

Table 36. 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 **`Instrument Directory`** messages which will be contained in this spin.
Status	10	1	Alphanumeric	Accepted or reason for reject*.
Total Length=11 bytes				

Table 37. Instrument Definition Response - Status Codes

'A'	Accepted
'O'	Out of Range (*Sequence* must be zero)
'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.

Instrument Definition Finished Message Fields

The **`Instrument Definition Finished`** message indicates that all messages for the spin requested have been sent. An **`Instrument Definition Finished`** message is only sent if an **`Instrument Definition Request`** was not rejected.

Table 38. 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				

Trade Replay Request Message Fields

The **`Trade Replay Request`** message is used by a Member's process to request transmission of this unit's **`Trade`**, **`Trade Break`**, and **`Trade Correction`** messages. Note **`Order Executed`** messages will be converted to **`Trade`** messages. See Spin Servers on page 11 for more complete details regarding *Sequence* specification and buffering requirements.

Table 39. Trade Replay Request

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x87	**`Trade Replay Request`** message.
Sequence	2	4	Binary	Must be 0. Only the current trades are available.
Total Length=6 bytes				

Trade Replay Response Message Fields

The **`Trade Replay Response`** message indicates whether a spin will be sent in response to a Member's **`Trade Replay Request`** message.

Table 40. Trade Replay Response

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x88	**`Trade Replay Response`** message.
Sequence	2	4	Binary	Will always be 0.
Trade Count	6	8	Binary	Number of **`Trade`**, **`Trade Break`**, and **`Trade Correction`** messages which will be contained in this spin.
Status	14	1	Alphanumeric	Accepted or reason for reject*.
Total Length=15 bytes				

Table 41. Trade Replay Response - Status Codes

'A'	Accepted
'O'	Out of Range (*Sequence* must be zero)
'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.

Trade Replay Finished Message Fields

The **`Trade Replay Finished`** message indicates that all messages for the spin requested have been sent. A **`Trade Replay Finished`** message is only sent if a **`Trade Replay Request`** message was not rejected.

Table 42. Trade Replay Finished

FIELD NAME	OFFSET	LENGTH	TYPE/(VALUE)	DESCRIPTION
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x89	**`Trade Replay Finished`** message.
Total Length=2 bytes				

Spin Server Usage Example

The following diagram (see next page) shows the message exchange over time between a Member and Cboe Canada NEO's Multicast PITCH feed and Spin Server. The order book spin consists of **`Trading Status`**, **`Add Order`**, and **`Single Side Update`** messages.

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 can give 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.

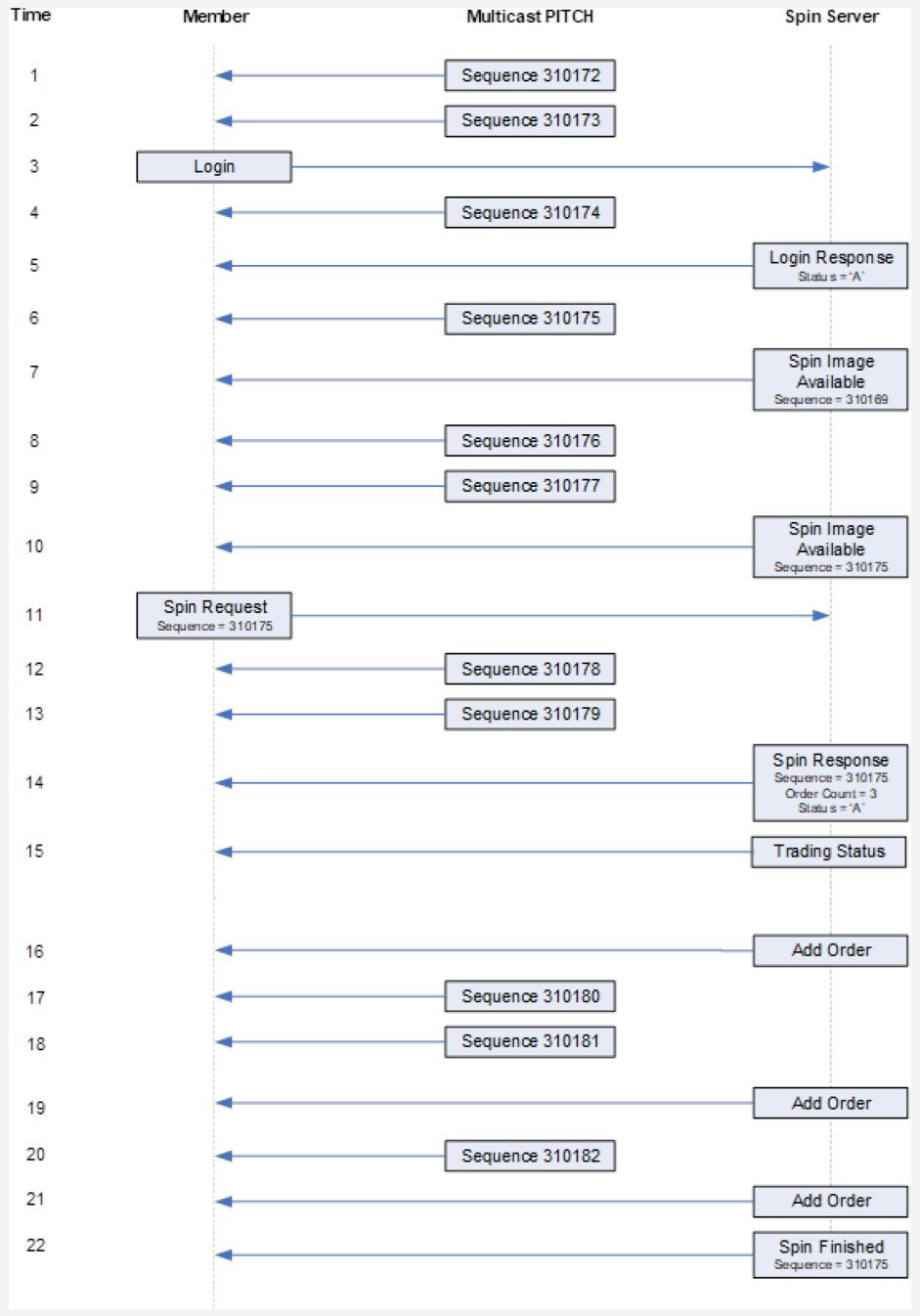
At time 11, the Member sends a **`Spin Request`** message for all messages up to and including 310175 and continues to cache Multicast PITCH messages received.

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.



Message Types

Gap Request Proxy Messages

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

Spin Server Messages

```
0x01        Login
0x02        Login Response
0x80        Spin Image Available
0x81        Spin Request
0x82        Spin Response
0x83        Spin Finished
0x84        Instrument Definition Request
0x85        Instrument Definition Response
0x86        Instrument Definition Finished
0x87        Trade Replay Request
0x88        Trade Replay Response
0x89        Trade Replay Finished
```

PITCH Messages

```
0x97        Unit Clear
0x60        Instrument Directory
0x61        Trading Status (NEO)
0x43        Trading Status (MATCHNow)
0x62        Add Order
0x63        Reduce Size
0x64        Delete Order
0x65        Modify Order
0x66        Order Executed
0x67        Trade (NEO)
0x42        Trade (MATCHNow)
0x68        Trade Break
0x69        Trade Correction
0x6A        Single Side Update
0x6B        Auction Update
0x6C        Auction Summary
0x2D        End of Session
```

Example Messages

Each of the following message types must be wrapped by a sequenced or unsequenced`Sequenced Unit Header` message header as described in Sequenced Unit Header Message Fields on page 16. In the following examples, each byte is represented by two hexadecimal digits.

Login Message

Table 43. Login Message

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

Login Response Message

Table 44. Login Response Message

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

Gap Request Message

Table 45. Gap Request Message

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

Gap Response Message

Table 46. Gap Response Message

Length	10	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

Unit Clear

Table 47. Unit Clear

Length	06	6 bytes
Type	97	Unit Clear
Reserved	20 20 20 20	(Reserved)

Instrument Directory

Table 48. Instrument Directory

Length	AA	170 bytes
Message Type	60	Instrument Directory
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Allowed Book Types	38	NEO-L
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20 20	ABC
Segment	4E 45 4F 20 20 20	CBOECA
Currency	43 41 44	CAD
Lot Size	64 00 00 00	100 shares
Full Name	5A 5A 5A … 5A 5A 5A 5A	120 Zs
Active Marker Maker	7B 00	123
Security Type	01	1 = Equity
Instrument Flags	03	Bit 0: Odd Lot Allowed; Bit 1: Closing Eligible
Previous Close	87 D6 12 00 00 00 00 00	123.4567

Trading Status (Cboe Canada NEO)

Table 49. Trading Status (Cboe Canada NEO)

Length	1C	28 bytes
Message Type	61	Trading Status
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	05	NEO-D
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20 20	ABC
Trading Status	54	T = Trading
Trading Sub Status	20	space = None
Halt Reason	20	space = None

Trading Status (MATCHNow)

Table 50. Trading Status (MATCHNow)

Length	20	32 bytes
Message Type	43	Trading Status
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20	CANADA
Listing Exchange	4E 45 4F 4C	NEOL
Trading Status	41	A = Accepting
Reserved	00 00 00	(Reserved)

Add Order

Table 51. Add Order

Length	36	54 bytes
Message Type	62	Add Order
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	03	NEO-L
Order Id	05 40 5B 77 8F 56 1D 0B	631WC4000005 (base36)
Side Indicator	42	B = Buy
Quantity	96 00 00 00	150 shares
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20 20	ABC
Price	A8 5E BC 00 00 00 00 00	1234.5000
Broker Id	7B 00	123
Settlement Type	00	No special terms
Settlement Date	00 00 00 00	00000000
Reserved	00	(Reserved)

Reduce Size

Table 52. Reduce Size

Length	17	23 bytes
Message Type	63	Reduce Size
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	07	SST
Order Id	05 40 5B 77 8F 56 1D 0B	631WC4000005 (base36)
Cancelled Quantity	F4 01 00 00	500 shares

Delete Order

Table 53. Delete Order

Length	13	19 bytes
Message Type	64	Delete Order
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	03	NEO-L
Order Id	05 40 5B 77 8F 56 1D 0B	631WC4000005 (base36)

Modify Order

Table 54. Modify Order

Length	20	32 bytes
Message Type	65	Modify Order
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	07	SST
Order Id	05 40 5B 77 8F 56 1D 0B	631WC4000005 (base36)
Quantity	C8 00 00 00	200 shares
Price	44 D6 12 00 00 00 00 00	123.4500
Reserved	00	(Reserved)

Order Executed

Table 55. Order Executed

Length	26	38 bytes
Message Type	66	Order Executed
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	03	NEO-L
Order Id	05 40 5B 77 8F 56 1D 0B	631WC4000005 (base36)
Executed Quantity	BC 02 00 00	700 shares
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC (base36)
Buy Broker Id	C8 01	456
Sell Broker Id	01 00	1 = Anonymous
Execution Flags	02	Auction Trade

Trade (Cboe Canada NEO)

Table 56. Trade (Cboe Canada NEO)

Length	24	36 bytes
Message Type	67	Trade
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	03	NEO-L
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20	CANADA
Quantity	C2 01 00 00	450 shares
Price	44 D6 12 00 00 00 00 00	123.4500
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC (base36)
Buy Broker Id	C8 01	456
Sell Broker Id	01 00	1 = Anonymous
Cross Type	00	
Trade Flags	02	Auction Trade
Settlement Type	00	
Settlement Date	00 00 00 00	
Reserved	00	(Reserved)

Trade (MATCHNow)

Table 57. Trade (MATCHNow)

Length	38	56 bytes
Message Type	42	Trade
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20	CANADA
Quantity	C2 01 00 00	450 shares
Price	44 D6 12 00 00 00 00 00	123.4500
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC (base36)
Buy Broker Number	7B 00	123
Sell Broker Number	01 00	1 = Anonymous
Total Volume	A0 86 01 00	100,000
Trade Condition	20	space = Regular Trade
Trade Flags	01	Conditional Trade
Reserved	00 00	(Reserved)

Trade Break

Table 58. Trade Break

Length	2D	45 bytes
Message Type	68	Trade Break
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	06	Crossing Facility
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20	ABC
Original Quantity	C2 01 00 00	450 shares
Original Price	44 D6 12 00 00 00 00 00	123.4500
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC (base36)

Trade Correction

Table 59. Trade Correction

Length	43	67 bytes
Message Type	69	Trade Correction
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	03	SST
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20	ABC
Original Quantity	C2 01 00 00	450 shares
Original Price	44 D6 12 00 00 00 00 00	123.4500
Original Settlement Type	06	6 = Future
Original Settlement Date	50 D7 34 01	20240208
Corrected Quantity	5E 01 00 00	350 shares
Corrected Price	F8 B2 45 00 00 00 00 00	456.7800
Corrected Settlement Type	06	1 = Cash
Corrected Settlement Date	52 D7 34 01	20240210
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC (base36)

Single Side Update

Table 60. Single Side Update

Length	27	39 bytes
Message Type	6A	Single Side Update
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	04	NEO-N
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20 20	CANADA
Side Indicator	53	S = Sell
Quantity	2C 01 00 00	300 shares
Price	44 D6 12 00 00 00 00 00	123.4500
Reserved	00	(Reserved)

Auction Update

Table 61. Auction Update

Length	3C	60 bytes
Message Type	6B	Auction Update
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	03	NEO-L
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20 20	CANADA
Auction Type	43	C = Closing Call
Reference Price	44 D6 12 00 00 00 00 00	123.4500
Imbalance Quantity	2C 01 00 00	300 shares
Imbalance Side Indicator	42	B = Buy Side
Matched Shares	5C 30 00 00	12,380
Indicative Price	FC E1 12 00 00 00 00 00	123.7500
Auction Only	74 CE 12 00 00 00 00 00	123.2500
Reserved	00	(Reserved)

Auction Summary

Table 62. Auction Summary

Length	39	27 bytes
Message Type	6C	Auction Summary
Timestamp	00 AC 5A 93 40 D9 B1 17	1707384605123456000 ns since epoch
Order Book Type	03	NEO-L
Symbol	43 41 4E 41 44 41 20 20 20 20 20 20 20 20 20	CANADA
Auction Type	4F	O = Opening Call
Price	44 D6 12 00 00 00 00 00	123.4500
Shares	5C 30 00 00	12,380
Reserved	00	(Reserved)

End of Session

Table 63. End of Session

Length	06	6 bytes
Type	2D	End of Session
Reserved	00 00 00 00	(Reserved)

Order Entry Response Examples

The following examples demonstrate the Cboe Canada Multicast PITCH messages sent in response to various orders entered in Cboe Canada.

Reduce Size Example

ACTION	MESSAGE DESCRIPTION
A visible order to buy 1000 shares of "ABC" at 10.00 is entered. The order is assigned Id 100000000001 and rests on the book. An **`Add Order`** message with price of 10.00 and quantity of 1000 is sent.	Type: 62 (Add Order) Timestamp: 1612968348641622000 (nanos) Order Book Type: 3 (NEO-L) Order Id (base36): 100000000001 Side: B (Buy) Quantity: 1000 Symbol: "ABC" Price: 10.00 Broker Id: 123 Settlement Type: 0 (no special terms) Settlement Date: 0 Reserved: 0 (Reserved)
The Member modifies the size of the order from 1000 to 900. A **`Reduce Size`** message is sent with quantity that was reduced.	Type: 63 (Reduce Size) Timestamp: 1612968348641623000 (nanos) Order Book Type: 3 (NEO-L) Order Id (base36): 100000000001 Cancelled Quantity: 100

Modify Order Example

ACTION	MESSAGE DESCRIPTION
A visible order to buy 1000 shares of "ABC" at 10.00 is entered. The order is assigned Id 100000000001 and rests on the book. An **`Add Order`** message with price of 10.00 and quantity of 1000 is sent.	Type: 62 (Add Order) Timestamp: 1612968348641622000 (nanos) Order Book Type: 3 (NEO-L) Order Id (base36): 100000000001 Side: B (Buy) Quantity: 1000 Symbol: "ABC" Price: 10.00 Broker Id: 123 Settlement Type: 0 (no special terms) Settlement Date: 0 Reserved: 0 (Reserved)
The Member modifies the price of the order from 10.00 to 11.00. A **`Modify Order`** message is sent with the new price of 11.00.	Type: 65 (Modify Order) Timestamp: 1612968348641623000 (nanos) Order Book Type: 3 (NEO-L) Order Id (base36): 100000000001 Quantity: 1000 Price: 11.00 Reserved: 0 (Reserved)

NEO-N Example

ACTION	MESSAGE DESCRIPTION
An order to buy 1000 shares of "ABC" at 10.00 is entered for the NEO-N book. There are no previous orders at this price level. A **`Single Side Update`** message is sent with the new price level and quantity of 1000.	Type: 6A (Single Side Update) Timestamp: 1612968348641620000 (nanos) Order Book Type: 4 (NEO-N) Symbol: "ABC" Side: B (Buy) Quantity: 1000 Price: 10.00 Reserved: 0 (Reserved)
Another order to buy 500 shares of "ABC" at 10.00 is entered for the NEO-N book. A **`Single Side Update`** message is sent for the price level with updated quantity of 1500.	Type: 6A (Single Side Update) Timestamp: 1612968348641621000 (nanos) Order Book Type: 4 (NEO-N) Symbol: "ABC" Side: B (Buy) Quantity: 1500 Price: 10.00 Reserved: 0 (Reserved)
Another order to sell 1000 shares of "ABC" at 10.00 is entered for the NEO-N book. The order executes against the resting buy order and a **`Trade`** message is sent.	Type: 68 (Trade) Timestamp: 1612968348641622000 (nanos) Order Book Type: 4 (NEO-N) Symbol: "ABC" Quantity: 1000 Price: 10.00 Execution Id (base36): 01000000A Buy Broker Id: 1 (Anonymous) Sell Broker Id: 1 (Anonymous) Cross Type: 0 (None) Trade Flags: 0 (No bypass, No Auction) Settlement Type: 0 (No special terms) Settlement Date: 0 (No date) Reserved: 0 (Reserved)
Since the quantity at the price level of 10.00 was modified, a **`Single Side Update`** message is sent for the price level with updated quantity of 500.	Type: 6A (Single Side Update) Timestamp: 1612968348641623000 (nanos) Order Book Type: 4 (NEO-N) Symbol: "ABC" Side: B (Buy) Quantity: 500 Price: 10.00 Reserved: 0 (Reserved)
Another order to sell 500 shares of "ABC" at 10.00 is entered for the NEO-N book. The order executes against the resting buy order and a **`Trade`** message is sent.	Type: 68 (Trade) Timestamp: 1612968348641624000 (nanos) Order Book Type: 4 (NEO-N) Symbol: "ABC" Quantity: 500 Price: 10.00 Execution Id (base36): 01000000B Buy Broker Id: 1 (Anonymous) Sell Broker Id: 1 (Anonymous) Cross Type: 0 (None)

ACTION	MESSAGE DESCRIPTION
	Trade Flags: 0 (No bypass, No Auction) Settlement Type: 0 (No special terms) Settlement Date: 0 (No date) Reserved: 0 (Reserved)
Since the quantity at the price level of 10.00 was modified, a **`Single Side Update`** message is sent for the price level with updated quantity of 0, meaning there is no more buy size available at this price level.	Type: 6A (Single Side Update) Timestamp: 1612968348641624000 (nanos) Order Book Type: 4 (NEO-N) Symbol: "ABC" Side: B (Buy) Quantity: 0 Price: 10.00 Reserved: 0 (Reserved)

Multicast Configuration

Production Environment Configuration

Limitations/Configurations

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

Table 64. Network and Gap Request Limitations

PERIOD/TYPE	LIMIT/SETTING	NOTES
MTU	1500	Cboe Canada sends UDP messages up to 1500 bytes. Members should ensure their infrastructure is configured accordingly.
Gap Response Delay	2 ms	The Gap Server delays resending sequenced messages via multicast for the specified limit 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	Maximum number of retransmission requests allowed per second for each session, renewed every clock second.
1 Minute	1,500 Requests	Maximum number of retransmission requests allowed per minute for each session, renewed every clock minute.
Day	100,000 Requests	Maximum number of retransmission requests allowed per day for each session.
Within Range	1,000,000 Messages	Members' retransmission requests must be within this many messages of the most recent sequence sent by the real-time feed per session.

Unit/Symbol Distribution

The following sections describe the Cboe Canada symbol distribution across units.

Table 65. Cboe Canada Symbol Range

UNIT	CBOE CANADA NEO AND MATCHNOW SYMBOL RANGE
1	A - FZZZZ
2	G - MZZZZ
3	N - SZZZZ
4	T - ZZZZZ

Note - Cboe Canada 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.

Multicast Routing Parameters

Table 66. Cboe Canada Multicast Routing Parameters

DATA CENTER	RENDEZVOUS POINT
NEO-L, SST, Crossing Facility Primary Data Center A feed	74.115.128.24
NEO-L, SST, Crossing Facility Primary Data Center B feed	74.115.128.25
NEO-L, SST, Crossing Facility DR Data Center E feed	174.136.181.242
NEO-N, NEO-D Primary Data Center A feed	74.115.128.26
NEO-N, NEO-D Primary Data Center B feed	74.115.128.27
NEO-N, NEO-D DR Data Center E feed	174.136.181.243
MATCHNow Primary Data Center A feed	74.115.128.1
MATCHNow Primary Data Center B feed	74.115.128.2
MATCHNow DR Data Center E feed	174.136.181.241

For additional information about physical connectivity, see the Cboe Canada Connectivity Manual.

NEO-L, SST, and Crossing Facility Address/Unit Distribution

The following tables describe the unit distribution across the Cboe Canada NEO PITCH feeds for NEO-L, SST, and the Crossing Facility.

Table 67. Primary Data Center - NEO-L, SST, and Crossing Facility Address/Unit Distribution

PRIMARY DATA CENTER		GIG-SHAPED A FEED [NLAM] 170.137.220.32/28		GIG-SHAPED B FEED [NLBM] 170.137.220.48/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC	REAL-TIME MC	GAP RESP. MC
1	33801	233.100.203.32	233.100.203.33	233.100.203.40	233.100.203.41
2	33802				
3	33803				
4	33804				

Note - Cboe Canada 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.

Table 68. Secondary Data Center - NEO-L, SST, and Crossing Facility Address/Unit Distribution

SECONDARY DATA CENTER		GIG-SHAPED E FEED [NLEM] 170.137.38.144/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC
1	33601	233.100.203.48	233.100.203.49
2	33602		
3	33603		
4	33604		

Note - Cboe Canada 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.

NEO-N and NEO-D Address/Unit Distribution

The following tables describe the unit distribution across the Cboe Canada NEO PITCH feeds for NEO-N and NEO-D.

Table 69. Primary Data Center - NEO-N and NEO-D Address/Unit Distribution

PRIMARY DATA CENTER		GIG-SHAPED A FEED [NDAM] 170.137.220.32/28		GIG-SHAPED B FEED [NDBM] 170.137.220.48/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC	REAL-TIME MC	GAP RESP. MC
1	33901	233.100.203.36	233.100.203.37	233.100.203.44	233.100.203.45
2	33902				
3	33903				
4	33904				

Note - Cboe Canada 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.

Table 70. Secondary Data Center - NEO-N and NEO-D Address/Unit Distribution

SECONDARY DATA CENTER		GIG-SHAPED E FEED [NDEM] 170.137.38.144/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC
1	33701	233.100.203.52	233.100.203.53
2	33702		
3	33703		
4	33704		

Note - Cboe Canada 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.

MATCHNow Address/Unit Distribution

The following tables describe the unit distribution across the MATCHNow PITCH feeds.

Table 71. Primary Data Center - MATCHNow Address/Unit Distribution

PRIMARY DATA CENTER		GIG-SHAPED A FEED [MAM] 170.137.221.64/28		GIG-SHAPED B FEED [MBM] 170.137.221.80/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC	REAL-TIME MC	GAP RESP. MC
1	30801	233.103.126.32	233.103.126.33	233.103.126.36	233.103.126.37
2	30802				
3	30803				
4	30804				

Note - Cboe Canada 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.

Table 72. Secondary Data Center - MATCHNow Address/Unit Distribution

SECONDARY DATA CENTER		GIG-SHAPED E FEED [MEM] 170.137.38.16/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC
1	31601	233.103.126.40	233.103.126.41
2	31602		
3	31603		
4	31604		

Note - Cboe Canada 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.

Certification Environment Configuration

Unit/Symbol Distribution

The following table describes the Cboe Canada symbol distribution across units.

Table 73. Cboe Canada Unit/Symbol Distribution

UNIT	CBOE CANADA NEO AND MATCHNOW SYMBOL RANGE
1	A - FZZZZ
2	G - MZZZZ
3	N - SZZZZ
4	T - ZZZZZ

Note - Cboe Canada 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.

Multicast Routing Parameters

Table 74. Cboe Canada Certification Multicast Routing Parameters

PRIMARY CERTIFICATION DATA CENTER	RENDEZVOUS POINT
NEO-L, SST, Crossing Facility	74.115.128.29
NEO-N, NEO-D	74.115.128.30
MATCHNow	74.115.128.3

Table 75. Cboe Canada Simulated DR Certification Multicast Routing Parameters

SIMULATED DR CERTIFICATION DATA CENTER	RENDEZVOUS POINT
NEO-L, SST, Crossing Facility	74.115.128.28
NEO-N, NEO-D	74.115.128.31

NEO-L, SST, and Crossing Facility Address/Unit Distribution

The following tables describe the unit distribution across the certification Cboe Canada NEO PITCH feeds for NEO-L, SST, and Crossing Facility.

Table 76. Certification - NEO-L, SST, and Crossing Facility Address/Unit Distribution

PRIMARY DATA CENTER		CERTFEED [CERT] 170.137.220.80/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC
1	34801	233.100.203.56	233.100.203.57
2	34802		
3	34803		
4	34804		

Note - Cboe Canada 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.

NEO-L, SST, and Crossing Facility Simulated DR Address/Unit Distribution

The following table describes the unit distribution across the certification Cboe Canada NEO PITCH feeds for NEO-L, SST, and Crossing Facility.

Table 77. Simulated DR - NEO-L, SST, and Crossing Facility Address/Unit Distribution

SIMULATED DR DATA CENTER		CERTFEED [CERT] 170.137.220.112/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC
1	34801	233.100.203.0	233.100.203.1
2	34802		
3	34803		
4	34804		

Note - Cboe Canada 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.

NEO-N and NEO-D Address/Unit Distribution

The following tables describe the unit distribution across the certification Cboe Canada NEO PITCH feeds for NEO-N and NEO-D.

Table 78. Certification - NEO-N and NEO-D Address/Unit Distribution

PRIMARY DATA CENTER		CERTFEED [CERT] 170.137.220.80/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC
1	34901	233.100.203.60	233.100.203.61
2	34902		
3	34903		
4	34904		

Note - Cboe Canada 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.

NEO-N and NEO-D Simulated DR Address/Unit Distribution

The following table describes the unit distribution across the certification Cboe Canada NEO PITCH feeds for NEO-N and NEO-D.

Table 79. Simulated DR - NEO-N and NEO-D Address/Unit Distribution

SIMULATED DR DATA CENTER		CERTFEED [CERT] 170.137.220.112/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC
1	34901	233.100.203.4	233.100.203.5
2	34902		
3	34903		
4	34904		

Note - Cboe Canada 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.

MATCHNow Address/Unit Distribution

The following tables describe the unit distribution across the certification MATCHNow PITCH feeds.

Table 80. Certification - MATCHNow Address/Unit Distribution

PRIMARY DATA CENTER		CERTFEED [CERT] 170.137.221.16/28	
UNIT	IP PORT	REAL-TIME MC	GAP RESP. MC
1	32801	233.103.126.44	233.103.126.45
2	32802		
3	32803		
4	32804		

Note - Cboe Canada 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.

Connectivity

Supported Extranet Carriers

Cboe Canada may certify a number of carriers to redistribute Multicast data feeds, as defined in the Cboe Canada Connectivity Manual. For more information on receiving Cboe Canada Multicast PITCH through any of these providers, please contact the vendor noted in the Extranet Providers section of the Connectivity Manual.

Bandwidth Recommendation

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

Support

Please direct questions or comments regarding this specification to TradeDeskCA@cboe.com.

Revision History

DOCUMENT VERSION	DATE	DESCRIPTION
1.0.0	03/21/24	Initial combined version for all Cboe Canada books.
1.0.1	06/20/24	Updated description of Trading Status 'M' in section 3.3.1.Added configuration information to section 8.1 and 8.2.
1.0.2	07/25/24	Added Trading Status =F and Sub-Status=O and R to Trading Status message (Cboe Canada NEO Only). Added configuration information to section 8.1 and 8.2.
1.0.3	08/16/24	Updated Segment value NEO to CBOECA. Updated Opening/Closing Auction references to Opening/Closing Call. Updated Closing Auction Extension references to Delayed Closing. Updated price movement extension references to Delayed Closing.
1.0.4	09/06/24	Spin requests made after system start-up will contain a **`Trading Status`** message for every symbol. Effective 11/13/24, **`Trading Status`** messages will be sent upon system start up rather than at the start of order acceptance.
1.0.5	10/09/24	Effective 11/13/24, clarified initial **`Trading Status`** messages will be sent upon system start up in addition to sending at the start of order acceptance. Updated Segment field to "CBOECA" in Instrument Directory example. Updated **`Trade Replay Response`** message length to 15 bytes.
1.0.6	11/07/24	Members can connect to the Multicast PITCH feed from 05:00 to 18:45 ET. Added new IP address tables and rendezvous points for NEO-L, SST, and Crossing Facility Simulated DR and NEO-N and NEO-D Simulated DR. Updated names of NEO-L A, B, and E feeds to NLAM, NLBM, and NLEM, respectively. Updated names of NEO-N/D A, B, and E feeds to NDAM, NDBM, and NDEM, respectively.
1.0.7	01/15/25	Updated with Cboe Titanium branding.
1.0.8	02/07/25	Updated *Reserved* field to *Halt Reason* in Trading Status Message (Cboe Canada NEO Only) on page 23. Updated example message: Trading Status (Cboe Canada NEO) on page 73. Noted in Trade Message on page 32: **`Trade`** messages also provide information about displayed orders. Noted in Auction Update Message Fields on page 38: **`Auction Update`** messages are sent during an auction period, unless in a delayed closing.
1.0.9	02/13/25	Updated price movement extension reference to Delayed Closing.
1.0.10	03/12/25	Replaced *Reserved* field with *Execution Flags* in Order Executed Message Fields on page 31.
1.0.11	04/17/25	Updated *Timestamp* description in Trading Status Message Fields on page 24.
1.0.12	10/23/25	Added *Cross Type*=20 (Net Asset Value (NAV)) to Trade Message Fields on page 32 (Cboe Canada NEO only) (effective 01/13/26).
1.0.13	10/27/25	Updated starting send time of A=Accepting from 8:00 a.m. ET to 7:00 a.m. ET in Trading Status Message Fields (MATCHNow Only) on page 26. Minor clarity and formatting updates.
1.0.14	02/09/26	Clarified in Delete Order Message Fields on page 29: an order that is deleted from the book may return to the book later.