XDP OPTIONS CLIENT SPECIFICATION

NYSE ARCA OPTIONS
NYSE AMEX OPTIONS

Version
1.0k

Date
September 28, 2015

PREFACE

DOCUMENT HISTORY

The following table provides a description of all changes to this document.

VERSION	DATE	CHANGE DESCRIPTION
1.0	03/31/14	Initial publication of document
1.0a	04/23/14	Reworked explanations for streams, sequence numbers, line arbitration, refresh
1.0b	5/02/14	▪ TCP request/response formats modified for conformance with XDP Common Client Spec ▪ Client and server both use packet header on all request and response packets ▪ Heartbeats sent by server are packet headers as in multicast feeds (client HB responses continue to be HB Response msgs) ▪ Eliminate TCP Login Request msg (456) and TCP Login Request Response msg (457) ▪ Eliminate 2nd Request Response msg at end of download (Packet Header delivery flag indicates end of download) ▪ Corrections based on QA feedback: ▪ Removed Complex Correction message ▪ Added Stream IDs to msg type 437 and 439 ▪ Added SourceTime field to msg type 413 ▪ Corrected field order in 505 and 515 ▪ Corrected msg size for msg type 437 ▪ Corrected side format for msg type 415 and 429
1.0c	5/19/14	▪ Fixes to minor typos ▪ Backed out changes to TCP request/response formats incorrectly made in version 1.0b. Corrected content: ▪ Client and server do not use packet headers over TCP connections ▪ Over TCP connections, Heartbeats and heartbeat responses are message type 12 ▪ TCP Login Request msg (456) and TCP Login Request Response msg (457) are used – Source ID field corrected to 10 bytes long
1.0d	6/10/14	▪ Msg type 437: added Symbol, OptionSymbol and Group ID fields to ▪ Msg type 439: ▪ Removed SourceTime, SourceTimeNS and SeriesSeqNum ▪ Added ComplexSymbol field ▪ Msg types 403 and 405: Second level offset and Third level offset fields expanded from 1 byte binary to 2 bytes binary ▪ Msg type 456: corrected field offsets and MsgSize ▪ Max packet size corrected from 1500 to 1400 everywhere ▪ Clarified explanatory text in sections 1.3, 1.3.3, 1.3.4, 1.5.2, 1.5.3, 1.6, 2.2.2, 5.1
1.0e	6/19/14	1. Byte alignment changes for Msg type 437
1.0f	7/11/14	▪ Msg 403 and 405 (Depth): Added explanations of price levels ▪ Msg 439 (Complex Def): added 2-byte filler after NoOfLegs field ▪ MSg type 447: removed Reject code 7 as possible value ▪ Msg type 460: added new optional TCP Logout Request msg ▪ Msg 456: added 2-byte filler at the end of the message ▪ Msg type 503 and 505 (Depth Ref): Corrected length of price offsets ▪ Msg types 413, 427, 509, 515 (Imbalance): added O (Opening) as possible Auction Type value ▪ Packet header: removed 18, 19, 20 and 21 as possible Delivery flag values and any references to said throughout the document ▪ Indicated Series Seq Num in Refresh message would be different than that of original message

1.0g	11/14/14	Rebranded the document to ICE standard
1.0h	7/24/2015	Revisions for the 2015 launch ▪ Removed LZ4 compression ▪ Removed Complex Imbalance and Complex EOD Summary messages ▪ Removed Trade Correction Refresh message ▪ Removed Beginning of Auction indicator in Series Status message ▪ Changed levels 2 and 3 of Market Depth messages to be full prices ▪ Changed Volume of Trade, Correction, Trade Refresh msgs to 4 bytes ▪ Added delivery flag 3 ▪ Imbalance msg: removed AuctionTime, added Market Imbalance Side ▪ Complex Status message: revised list of values for SecurityStatus field ▪ Outright Summary msg: expanded total volume field to 4 bytes ▪ Renamed SeriesSeqNum to SymbolSeqNum ▪ Refresh msgs don't increment SymbolSeqNum, contain original timestamp ▪ Documented request server quotas section 1.7 ▪ Clarified, streamlined explanatory text is section 1 ▪ Grouped msg structures by feed
1.0i	8/5/2015	▪ Corrected msg sizes for msg types 407, 507, 411, 425, 513 ▪ Corrected Refresh Imbalance msg (509) to match Imbalance message (413)
1.0j	8/10/2015	▪ Added Quote Condition 4 to msg types 423, 501, 511 ▪ Minor clean-ups to descriptive text
0.1k	8/28/2015	▪ Corrected prices to be signed in all cases, added explanation of rationale ▪ Added notes that complex prices are used with the underlying price scale code.

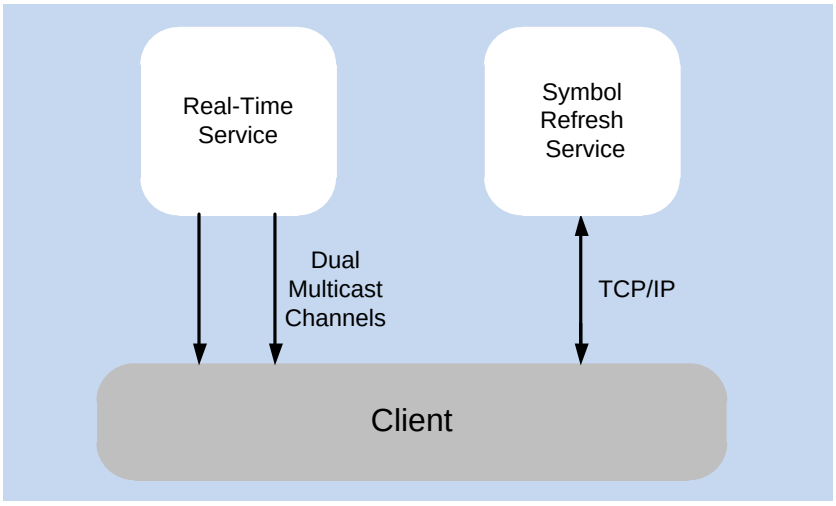
CONTENTS

1. XDP Options Fundamentals

NOTE: Due to the performance required to publish options data, some basic XDP Options features such as channelization and error-handling are different from the XDP feeds in other NYSE markets. For this reason, this document does not make reference to the XDP Common Client Specification. All information needed to develop options client applications is contained in this one specification.

1.1 ACCESS TO MARKET DATA

In XDP Options, clients subscribe to multicast addresses to receive real-time market data and refresh messages as well as start-of-day referential symbol data. If clients start late or experience a failure during the trading day, they may connect via TCP/IP to a Symbol Refresh Service to request referential symbol data. Since refresh messages are published in the normal multicast channels, there is no need for retransmissions or refreshes of real-time data.



XDP Options messages are packaged into three distinct Feeds.

XDP Options Top Feed	Top of book information for outright options symbols
XDP Options Deep Feed	Depth of Book information for outright options symbols
XDP Options Complex Feed	Top of book information for complex options symbols

1.1.1 Data Fundamentals

Real-time XDP Options data is message-based with fixed length fields (all fields are binary except a very small number of ASCII fields). In order to make efficient use of the network, the market data messages are bundled into larger application packets. The packets are published via multicast.

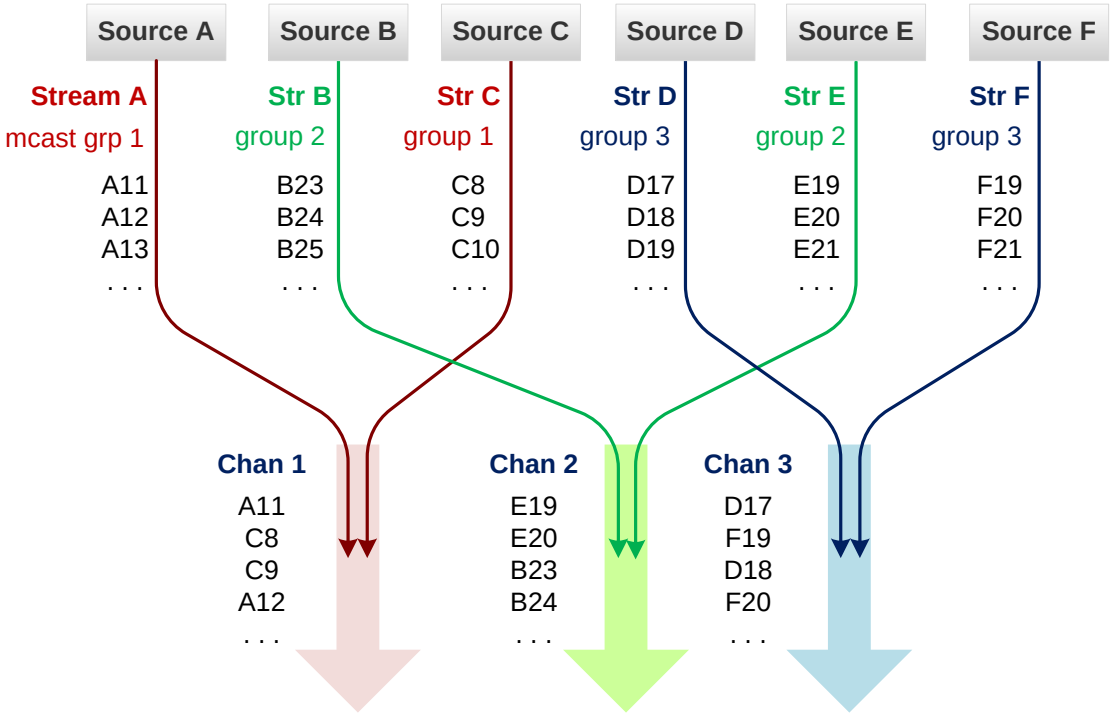
For capacity reasons, the market data packets are routed to clients via a number of predefined data sets called channels. Each channel is duplicated and published to two distinct multicast groups for redundancy. The two redundant multicast groups per channel (known as lines) are referred to as line A and line B.

1.1.1.1 Streams and Sequence Numbers

Due to the very high volume of data in the options markets, a given channel's data typically originates from several different Matching Engine servers. The subset of a channel's data that originates from a given server is referred to as a **stream**. Each packet in a channel is marked with a Stream ID identifying which stream the packet belongs to, and therefore which server the packet came from.

Unlike typical market data feeds in which each channel has a single sequence number series, in XDP Options feeds, each stream within a channel has its own sequence number series. And unlike typical feeds in which a sequence number uniquely identifies a message, in XDP Options feeds, a Stream ID and a sequence number taken together uniquely identify a message.

The benefit of this modest increase in complexity is that market data can be published to the client directly from the Matching Engine servers, with no extra tier of publishing applications in between. This results in significantly lower latency to the client.



1.2 REFRESH FUNCTIONALITY

If a client experiences a loss of data, either because his application fails and restarts intraday, or because he experiences a sequence number gap on one or more streams, he needs to receive a snapshot of the current state of the market for all affected symbols in order to be in sync with the market again. XDP Options provides this snapshot functionality by periodically publishing Refresh messages directly in the feed channels.

For any individual symbol, as soon as the first order or quote of the day is received, publication of Refresh messages begins.

On client restart or detection of a gap, the client recovers simply by continuing to listen to the feed channels and processing all messages received, including the Refresh messages. The client is guaranteed to be fully in sync with the market once again within at most two minutes.

This inline snapshot publication makes packet request functionality and a dedicated refresh feed unnecessary.

Refresh messages have different message types than their standard counterparts. Furthermore, a specific value displayed in the Delivery flag of the packet header indicates that the packet contains at least one Refresh message.

For the Top and Complex feeds, data points that automatically refresh per symbol are:

Refreshable data	Original message	Refresh message
Current quote	Quote	Refresh Quote
Last Trade	Trade, Correction, Cancel	Refresh Trade, Refresh Correction
Current imbalance, if any (Top only)	Imbalance	Refresh Imbalance

For the Deep feed, data points that automatically refresh per symbol are:

Refreshable data	Original message	Refresh message
Current 3 best price points with aggregated volumes (bid side and ask side)	Market Depth	Refresh Market Depth

Symbol-status and Crossing RFQ messages are time-sensitive, and therefore are only published as they occur.

1.2.1 Top and Complex feeds: refreshes of current Quote data

The Top feed and the Complex feed are fairly equivalent technically, so their refresh behaviors are the same.

Whenever a symbol publishes a new Quote a 2-minute quote refresh timer is set. If another new Quote is published within the next two minutes, the quote refresh timer is set again, so it starts over again.

As long as the symbol keeps publishing quotes within 2 minutes of each other, the quote refresh timer never expires, and no Refresh Quote message is ever sent. If 2 minutes pass and no new Quote has been published, the timer expires and the information published in the current Quote message is sent again as a Refresh Quote message. The timer is then set again, and if another 2 minutes passes with no new Quote, the same Refresh Quote is sent again. This continues until a new Quote is published.

If a symbol has no current quote because it is before start of day, no Refresh Quotes are sent. If the symbol is halted, Refresh Quote messages with defaulted values are sent every 2 minutes.

Note that although there are no Symbol Status Refresh messages, it is possible to determine that a symbol is halted based on the Quote Condition field in the Quote messages.

1.2.2 Top feed: refreshes of current Imbalance data

The Refresh Imbalance algorithm involves a dedicated Imbalance Refresh timer and is exactly the same as the Refresh Quote algorithm, except that when there is no current imbalance, no Refresh Imbalance messages are sent.

1.2.3 Top feed: refreshes of last Trade data

The Refresh Trade algorithm involves a dedicated Trade Refresh timer and is exactly the same as the Refresh Quote algorithm, except that there is added complexity when Corrections and Cancels to the last Trade come into the picture.

If a Correction to the last Trade is published, the Trade Refresh timer is set. If 2 minutes pass and no new Trade or Correction/Cancel to the last Trade is published, a Trade Refresh message is published with the corrections applied. This corrected Trade Refresh message is republished every 2 minutes as long as there is no new Trade or Correction/Cancel to the last Trade.

If a Cancel to the last Trade is published, the Trade Refresh timer is set. If 2 minutes pass and no new Trade or Correction/Cancel to the last Trade is published, the new last Trade (previously the second-to-last Trade) is republished as a Refresh Trade, since it is now the new last Trade. Note that any corrections that may have been made to the new last Trade are applied and reflected in the Refresh Trade. This continues every 2 minutes as long as there is no new Trade or Correction/Cancel to the last Trade.

1.2.4 Deep feed: refreshes of current book data

The Refresh Depth algorithm involves two dedicated Depth Refresh timers: one for the buy side and one for the sell side. The algorithm for each timer is exactly the same as the Refresh Quote algorithm.

Note that although there are no Symbol Status Refresh messages, it is possible to determine that a symbol is halted based on the non-significant price values in the Depth messages.

1.3 SYMBOL INDEX MAPPING

To promote compact messages and therefore high throughput and low latency, underlying symbols, series symbols and complex series symbols are not published as full names in market data messages, but as symbol index codes. Mappings between all symbol index codes and the corresponding full symbol names are provided by a set of symbol index mapping messages. These mapping messages also contain key referential data about each symbol.

Symbol Index Mapping messages come in three different message types corresponding to symbol type: Underlying, Outright, and Complex.

These messages are published over multicast channels as well as by request via the Request Server.

1.3.1 Symbol Mapping Via Multicast

At the start of the trading day, three sets of symbol index mapping messages (Underlying, Outright, and Complex Index Mapping messages) are published over the multicast channels. The Series feeds, Top and Deep, publish Underlying and Outright mapping messages. The Complex feed publishes Underlying and Outright mapping messages as well as Complex leg definition messages.

In the event a symbol is created during the trading day, individual Index mapping messages can also be published intraday. This is especially applicable to the Complex feed, whose symbols come and go as a matter of course.

1.3.2 Symbol Download via the Request Server

The Request Server can be used to request symbol mapping downloads intraday. Clients must connect to the Request Server via a TCP/IP connection first before sending and receiving the symbol download request and response messages (ack/nack).

To establish a connection, Clients must send a TCP Login Request message and wait for a response. As long as a TCP connection is established, the server generates a Heartbeat every minute to indicate that the session is active. Clients who wish to remain connected throughout the day must respond with a Heartbeat Response message within 5 seconds, or the server will close the connection. Clients can also send a Test message at any time to verify the state of their connections.

The Symbol download request contains a Source ID. The Source ID identifies the client application, and will be supplied by the exchange. It is important to note that only one Source ID can be used per application session. Requests are made by message type (Underlying, Outright, and Complex), and can be defined to request: all symbols of a given type, all symbols of a given type for a given channel, or a specific symbol of a given type.

The Request Server responds to each download request with a Refresh Response message. If the request is accepted, the symbol download is provided over the same TCP/IP connection. When the download is complete, the Request Server generates a second Request Response to indicated that the transmission is done.

The number of refreshes allowed per client per day is limited to a total of 100 requests.

The retransmission request may be rejected for any of the following reasons:

- Invalid Source ID (username)
- Invalid Channel ID
- Incorrectly formatted request packet
- Number of requests in the current day exceeds the predefined system limit

In case of a rejection, the Request Response message indicates the reason for failure.

If the reason for failure is exceeding a predefined system limit, all subsequent requests that continue to violate the limit will be rejected. If further requests are required, the client should contact NYSE.

1.4 PACKET, MESSAGE AND FIELD STRUCTURE

1.4.1 General Format Notes

The following processing notes apply to all messages:

- All fields are sent for every message
- Only field values appear in the published messages (no names or 'tags' appear in the messages)
- The field names that appear in the message format documents are for reference purposes only
- All the fields are contiguous, with reserved fields for alignment issues
- All field sizes are fixed
- Message sizes may vary due to optional trailing fields
- Binary fields are published in Little-Endian format
- ASCII fields are left-aligned and null padded
- Segmentation of messages across packets is not supported, so a message will never straddle a packet boundary.
- Reserved filler fields defined as ASCII are filled with a space, and those defined as Binary are populated with '0'.
- No compression is applied

1.4.2 Packet Structure

All packets of data sent on the multicast XDP feeds will have a common packet header followed by one or more messages (including the Heartbeat which consists of a packet header followed by a Stream ID message, type 455). For TCP connections to the Request Server, messages are not packetized either from the client or from the server.

The packet header format is the same for all packets, and contains packet length, number of messages within the packet, sequence number for the first message in the packet, and so on.

The format of each message in the packet depends on message type, but each message will start with a message size and a message type.

The maximum length of a decompressed packet is 1,400 bytes.

The message size will never exceed the maximum packet length (less the packet header size).

The packet header provides information including the total packet length, the sequence number of the first message in the packet, and the number of messages within the packet. The format is as follows:

FIELD	OFFSETS	SIZE (BYTES)	FORMAT	DESCRIPTION
PktSize	0	2	Binary	Size of the packet including this 16 -byte packet header in bytes
DeliveryFlag	2	1	Binary	A flag that indicates whether this is an original, retransmitted, or 'replayed' message. Valid values are: ▪ 1 – Heartbeat ▪ 2 – Contains original and Refresh msgs ▪ 3 – Contains only Refresh messages ▪ 10 – XDP Failover ▪ 11 – Contains only original messages ▪ 12 – Sequence Number Reset Message
NumberMsgs	3	1	Binary	The number of messages in this packet
SeqNum	4	4	Binary	The message sequence number of the first message in this packet. See Sequence Numbers.
SendTime	8	4	Binary	The time when the packet was published to the multicast channel, in seconds since Jan 1, 1970 00:00:00 UTC.
SendTimeNS	12	4	Binary	The nanosecond offset from the Send Time

The format of each message within a packet varies according to message type.

However, regardless of the message type, each message will start with a message header consisting of two fields: a two-byte message length, followed by a two-byte message type.

Table 1 Message Header Fields

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	-	2	Binary	Size of the message body in bytes including this field.
MsgType	-	2	Binary	Type of message.

1.4.3 Msg Size Field Processing

Customers should not hard code message sizes in feed handlers; instead the feed handler should use the Msg Size field to determine where the next message in the packet begins. This allows the XDP format to accommodate different market needs for data content and allow the format to be more agile.

The variable message size allows the feed handler to insulate client code from any future field additions that may not be desired.

For example, if an original format had the following 20-byte message:

FIELD	OFFSET	SIZE	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message. 20 bytes
Msg Type	2	2	Binary	Type of message Message '999' – Price message example
SourceTime	4	4		Seconds portion of the ME timestamp.
SourceTimeNS	8	4	Binary	NanoSeconds portion of the ME timestamp.
SymbolIndex	12	4	Binary	Numerical representation of the symbol.
Price	16	4	Binary	Price of the order see Price Formats. Use the Price Scale Code from the symbol index mapping message.

Look at the Msg Size field to know where the next record will be.

Now the new format adds a new four-byte volume field adjusting the Msg Size to 20 bytes.

The feed handler code automatically is prepared for the 24-byte format without any work, allowing for the receiving application to either continue to read on the first 20 bytes passed to it or develop to read the new field.

FIELD	OFFSET	SIZE	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message. 24 Bytes
Msg Type	2	2	Binary	Type of message Message '999' – Price message example
SourceTime	4	4		Seconds portion of the ME timestamp.
SourceTimeNS	8	4	Binary	NanoSeconds portion of the ME timestamp.
SymbolIndex	12	4	Binary	Numerical representation of

Look at the Msg Size field to know where the next record will be.

				the symbol.
Price	16	4	Binary	Price of the order, see Price Formats. Use the Price Scale Code from the symbol index mapping message.
Volume	20	4	Binary	Size of the order.

1.4.4 Stream ID Message

In all XDP Options multicast channels, each Packet Header is immediately followed by a Stream ID Message. This message's Stream ID field identifies which stream in the channel this packet belongs to.

By combining the Stream ID with the Sequence Number in the Packet Header, the client can uniquely identify each packet and can detect gaps (lost packets) within the stream.

See Streams and Sequence Numbers for more information.

Note that streams are not applicable to TCP connections to the Request Server, so Stream ID messages are not sent by either the client or by the Request Server.

1.4.5 Sequence Numbers

When reading the multicast channels, client applications should check the Stream ID and Sequence Number of every packet received.

Sequence numbers are unique for each stream, although they do not increase monotonically. Each new sequence number is incremented not by 1, but by the number of messages in the previous packet. So for example if a packet has Stream ID A, Sequence Number 60, and Num Msgs 5, then the next packet to arrive in Stream A will have Sequence Number 65.

Sequence numbers in the packet header are not packet sequence numbers, but message sequence numbers. For lower bandwidth, message sequence number fields are not explicitly expressed in each message, but once only in the packet header.

1.4.6 Symbol Sequence Numbers

In addition to the sequence number, many message types explicitly include a field called SymbolSeqNum, which identifies the message's position in the sequence of all messages published by the feed for an individual symbol.

The SymbolSeqNum increments every time a new non-refresh message for the same symbol is published. Refresh messages do not increment the SymbolSeqNum.

Clients who are tracking only a small number of symbols may opt to ignore message sequence numbers and track only Symbol Sequence Numbers for each symbol of interest.

If packets are dropped which do not contain updates to any of the symbols the client is tracking, he doesn't know about the gap and he doesn't need to know. If such a client experiences a Symbol Sequnce Number gap for a symbol he's tracking, he has to invalidate all current state for that symbol and listen to both current and refresh messages until the symbol's state is fully restored to current values.

1.4.7 Line Arbitration

Each channel is duplicated and published to two distinct multicast groups for redundancy. The redundant groups are referred to as line A and line B.

Client applications are advised to read both lines in real-time and process the packets that arrive first, regardless of whether they come from line A or line B. Packets that have lower-than-expected sequence numbers should be discarded.

Using this algorithm, if a packet has been dropped from line A, it can still be read from line B, and vice versa.

In the rare case where a packet is dropped from both lines, it is necessary to use the refresh mechanism to re-sync the market in the stream that gapped. (see Refresh Functionality)

1.4.8 Date and Time Conventions

Dates and times use UTC (Universal Time, Coordinated) EPOCH. For example Wednesday 12/1/09 22:05:17.000 UTC is indicated as 1259791537.

Time stamps are provided over two fields: one that identifies the whole number of seconds in UTC time, and another that contains the nanosecond offset.

NOTE: Refresh messages contain the same timestamp as the original message that the refresh representsis derived from.

1.4.9 Prices

All price fields are published as signed binary integers(prices of complex instruments can be negative). To interpret a price correctly, the client must use the published price value as a numerator along with the Price Scale Code in the symbol's Index Mapping Message as follows:

$$Price = \frac{Numerator}{10^{PriceScaleCode}}$$

For example, a price of $27.56 is represented as a published price field of 2756 and a PriceScaleCode of 2.

1.5 HEARTBEATS

1.5.1 Heartbeat Packets in Multicast Feeds

Heartbeat packets are sent over the multicast channels during the startup sequence and in periods of total inactivity (see System Behavior on Start and Restart for more information). Heartbeat packets are sent per stream, and therefore consist of a packet header followed by a Stream ID message.

Heartbeat packet header layout

FIELD	VALUE
PktSize	16 Bytes
DeliveryFlag	1 (Heartbeat Message Only)
NumberMsgs	1, due to the Stream ID msg (type 455) that follows
SeqNum	Next expected sequence number
SendTime	
SendTimeNS	

1.5.2 TCP Heartbeat Processing Notes

The following applies to TCP connections to the Request Server only.

Clients receive TCP Heartbeat messages (Msg Type 12) periodically (nominally every 60 seconds) whenever they have a TCP/IP connection with the Request Server.

Clients must respond to any heartbeat received by sending back a TCP Heartbeat message within 5 seconds. If no response is received by the Request Server within this timeframe, the server will close the TCP/IP connection.

The Request Server uses this mechanism to close improperly dropped connections, which can arise as a result of client or network hardware failures.

Request Server Heartbeats

1.6 OPERATIONAL INFORMATION

1.6.1 System Behavior on Start and Restart

At the start of the day, the following messages will be published over each stream:

- 10 Heartbeats for network multicast priming
- Sequence Number Reset message (Msg Type 1), sequence number is set to 1

This means that if channel X is composed of 3 streams, subscribers to channel X will see a total of 30 Heartbeats and 3 Sequence Number Reset messages.

1.6.2 Client System Failure

In case of client system failure, the client should restart, re-subscribe to the multicast channels, and rely on the inline Refresh messages to re-sync with the current state of the market.

For more information, see Refresh Functionality.

1.7 REQUEST SERVER PER-CLIENT QUOTAS

Requests made to the Request Server for refreshes of symbol information will not be accepted until the symbol index messages are published on the main data channels. This occurs at approximately 3:00 AM EST.

Requests are fulfilled in the order in which they were received.

The following limitations apply to all clients a given day.

1,000	Maximum number of requests allowed	Further requests will be rejected
50	Maximum connection attempts within 30 seconds	The client IP will be locked out
3	Maximum number of simultaneous login sessions	Further sessions will be closed
30 seconds	Maximum seconds between a TCP connection and a login request	Session will be closed

2. Top Feed Message Formats

In addition to the message types detailed here, the Top feed also publishes Underlying Index Mapping messages (435), Series Index Mapping messages (437), and various control messages. These are described in later sections.

2.1 OUTRIGHT QUOTE MESSAGE – MSG TYPE 401

The Outright Quote message provides the price and aggregated volume for the best bid and best offer. Volumes aggregate quote and order interest. The message also indicates aggregated Customer volumes within the overall volumes.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 40 Bytes
MsgType	2	2	Binary	Type of message: ▪ 401 – Outright Quote Message
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
SymbolSeqNum	16	4	Binary	Sequence number of messages for the outright options symbol.
AskPrice	20	4	Signed Binary	Best Ask price. To be used with the Price Scale Code from the Outright Index Mapping message.
BidPrice	24	4	Signed Binary	Best Bid price. To be used with the Price Scale Code from the Outright Index Mapping message.
AskShares	28	2	Binary	Total quantity available at the above Ask price.
BidShares	30	2	Binary	Total quantity available at the above Bid price.
AskCustomerShares	32	2	Binary	Total quantity of 'Customer' orders available at the Ask price.
Bid CustomerShares	34	2	Binary	Total quantity of 'Customer' orders available at the Bid price.
QuoteCondition	36	1	ASCII	▪ 1 (Regular Trading) ▪ 2 (Rotation) ▪ 3 (Trading Halted) ▪ 4 (Pre-open)
Reserved	37	1	Binary	Filler
Reserved	38	2	Binary	Filler

2.2 OUTRIGHT TRADE MESSAGE – MSG 407

The Outright Trade message is used to publish all Last Sales for outright symbols.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 36 bytes
MsgType	2	2	Binary	Type of message: ▪ 407 – Trade Message
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
TradeID	20	4	Binary	Unique Trade execution ID.
Price	24	4	Signed Binary	Price of the trade. Use the Price Scale Code from the symbol index mapping message.symbol index mapping message
Volume	28	4	Binary	Volume of the trade in number of contracts
TradeCond1	32	1	ASCII	▪ Blank = regular trade ▪ I = Late report ▪ R = Floor trade ▪ S = SO sweep trade
TradeCond2	33	1	ASCII	Complex indicator: ▪ P = Complex trade with equity trade ▪ L = Complex trade
Reserved	34	2	Binary	Filler

2.3 OUTRIGHT TRADE CANCEL MESSAGE – MSG TYPE 409

The Trade Cancel message is used to cancel or bust a trade.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 24 bytes
MsgType	2	2	Binary	Type of message: ▪ 409 – Outright Trade Cancel Message
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
OriginalTradeID	20	4	Binary	Original TradeID of the trade.

2.4 OUTRIGHT TRADE CORRECTION MESSAGE – MSG TYPE 411

The Trade Correction message is used to correct a trade.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message: ▪ 40 bytes
Msg Type	2	2	Binary	Type of message: ▪ 411 – Outright Trade Correction Message
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
OriginalTradeID	20	4	Binary	Original TradeID of the trade.
TradeID	24	4	Binary	New unique TradeID used to identify the corrected trade.
Price	28	4	Signed Binary	Price of the order. Use the Price Scale Code from the symbol index mapping message.
Volume	32	4	Binary	volume of the trade in number of contracts.
TradeCond1	36	1	ASCII	▪ Blank = regular trade ▪ I = Late report ▪ R = Floor trade ▪ S = SO sweep trade
TradeCond2	37	1	ASCII	Complex indicator: ▪ P = Complex trade with equity trade ▪ L = Complex trade
Reserved	38	2	Binary	Filler

2.5 OUTRIGHT IMBALANCE MESSAGE – MSG TYPE 413

The Outright Imbalance message is sent during the Pre-opening phase or a symbol Halt to provide indicative opening price and net imbalance of all orders at that price which are orders eligible for next Auction. It also indicates the type of Auction to follow. Imbalance values are calculated using both orders and quotes.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message: ▪ 36 bytes
Msg Type	2	2	Binary	Type of message. ▪ 413 – Outright Imbalance
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
ReferencePrice	20	4	Signed Binary	Indicative opening price.
PairedQty	24	2	Binary	Paired off quantity at the indicative opening price (Indicative matching quantity)
TotalImbalanceQty	26	2	Binary	Total imbalance quantity at the indicative opening price.
MarketImbalanceQty	28	2	Binary	Total market order imbalance at the indicative opening price.
AuctionType	30	1	ASCII	▪ O = Opening ▪ H = Halt
ImbalanceSide	31	1	ASCII	Side of the imbalance Buy/sell. Valid Values: ▪ B = Buy ▪ S = Sell ▪ Blank = No imbalance
MarketImbalanceSide	32	1	ASCII	Side of the market imbalance Buy/sell. Valid Values: ▪ B = Buy ▪ S = Sell ▪ Blank = No imbalance
Reserved	33	3	Binary	Filler

2.6 OUTRIGHT CROSSING RFQ MESSAGE – MSG 415

The Outright Crossing RFQ (Request for Quote) message is sent out in the event of an auction on an outright order.

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 28 bytes
MsgType	2	2	Binary	Type of message. ▪ 415 - Outright Crossing RFQ
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
Side	20	1	ASCII	Side of the RFQ ▪ B = Buy ▪ S = Sell
Reserved	21	1	Binary	Filler
Shares	22	2	Binary	Total quantity
Price	24	4	Signed Binary	Price of crossing transaction

2.7 OUTRIGHT SUMMARY MESSAGE – MSG 417

The Outright summary message provides trading highlights of the day. It is sent out once at the end of the trading day as soon as a symbol closes.

Note: If no trades occurred on a symbol for the whole trading day, no End of Day Summary is generated.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message: ▪ 40 bytes
Msg Type	2	2	Binary	Type of message. ▪ 417 – Outright Summary message
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
HighPrice	20	4	Signed Binary	Exchange high price of the symbol for the day. Use the Price Scale Code from the symbol index mapping message.
LowPrice	24	4	Signed Binary	Exchange Low price of the symbol for the day. Use the Price Scale Code from the symbol index mapping message.
Open	28	4	Signed Binary	Exchange Opening price of the symbol for the day. Use the Price Scale Code from the symbol index mapping message.
Close	32	4	Signed Binary	Exchange Closing price of the symbol for the day. Use the Price Scale Code from the symbol index mapping message.
TotalVolume	36	4	Binary	Exchange cumulative volume for the symbol throughout the day.

2.8 UNDERLYING STATUS MESSAGE – MSG 419

The Underlying Status message is used to inform the subscribers of changes in the status of an Underlying symbol.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Message size: ■ 24 bytes
MsgType	2	2	Binary	Type of message. ■ 419 – Underlying Status Message
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
UnderlyingIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
UnderlyingSeqNum	16	4	Binary	Sequence number of messages for the underlying symbol.
SecurityStatus	20	1	ASCII	▪ S Halt ▪ U Unhalt ▪ O Open indication ▪ X Close indication
Halt Condition	21	1	ASCII	Not applicable
Reserved	22	2	Binary	Filler

2.9 OUTRIGHT SERIES STATUS MESSAGE – MSG 421

The Series Status message is used to inform the subscribers of changes in symbol status of an outright symbol.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 24 bytes
MsgType	2	2	Binary	Type of message. ▪ 421 – Outright Series Status Message
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
SecurityStatus	20	1	ASCII	▪ L Light up a dark series ▪ N Open a dark series ▪ O Open ▪ X Close ▪ S Halt ▪ U Unhalt ▪ T Unhalt a dark series ▪ Q End of RFQ auction
HaltCondition	21	1	ASCII	Not applicable
Reserved	22	2	Binary	Filler

2.10 REFRESH OUTRIGHT QUOTE MESSAGE – MSG TYPE 501

The Refresh Quote message is sent in the event no quote messages are published for the symbol for 2 consecutive minutes. It has the same field content as the last published Outright Quote message, with the following exceptions:

- MsgType is 501
- SymbolSeqNum increments on every publication

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 40 bytes
MsgType	2	2	Binary	Type of message: ▪ 501 – Refresh Outright Quote message
SourceTime	4	4	Binary	The time when this data was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	Numerical representation of the outright options symbol.
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
AskPrice	20	4	Signed Binary	Best Ask price. Should be used with the Price Scale Code from the symbol index mapping message.
BidPrice	24	4	Signed Binary	Best Bid price. Should be used with the Price Scale Code from the symbol index mapping message
AskShares	28	2	Binary	total quantity available at the above Ask price.
BidShares	30	2	Binary	total quantity available at the above Bid price.
AskCustomerShares	32	2	Binary	total quantity of 'Customer' orders available at the above Ask price.
BidCustomerShares	34	2	Binary	total quantity of 'Customer' orders available at the above Bid price.
QuoteCondition	36	1	ASCII	▪ 1 (Regular Trading) ▪ 2 (Rotation) ▪ 3 (Trading Halted) ▪ 4 (Pre-open)
Reserved	37	1	Binary	Filler
Reserved	37	2	Binary	Filler

2.11 REFRESH OUTRIGHT TRADE MESSAGE – MSG 507

The Refresh Outright Trade message is sent in the event no Outright Trade messages are published for the symbol for 2 consecutive minutes. It has the same field content as the last published Outright Trade message (assuming no intervening corrections), with the following exceptions:

- MsgType is 507
- SymbolSeqNum increments on every publication

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 36 bytes
MsgType	2	2	Binary	Type of message: ▪ 507 – Refresh Outright Trade Message
SourceTime	4	4	Binary	The time when this data was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	Numerical representation of the outright options symbol.
SymbolSeqNum	16	4	Binary	Sequence number of messages for the outright options symbol.
TradeID	20	4	Binary	The TradeID identifies a unique Trade execution.
Price	24	4	Signed Binary	Price of the trade.
Volume	28	4	Binary	Volume of the trade in number of contracts
TradeCond1	32	1	ASCII	Blank (regular trade) ▪ I (Late report) ▪ R (Floor trade) ▪ S (ISO sweep trade)
TradeCond2	33	1	ASCII	Complex indicator: ▪ P (Complex trade with equity trade) ▪ L (Complex trade)
Reserved	34	2	Binary	Filler

2.12 REFRESH OUTRIGHT IMBALANCE MESSAGE – MSG TYPE 509

The Refresh Outright Imbalance message is sent in the event no Outright Imbalance messages are published for the symbol for 2 consecutive minutes during Pre-opening or a symbol Halt. It has the same field content as the last published Outright Imbalance message, with the following exceptions:

- MsgType is 509
- SymbolSeqNum increments on every publication

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message: ▪ 36 bytes
Msg Type	2	2	Binary	Type of message. ▪ 509 – Refresh Trade message
SourceTime	4	4	Binary	The time when this data was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	Numerical representation of the symbol.
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
ReferencePrice	20	4	Signed Binary	Indicative matching price
PairedQty	24	2	Binary	Paired off quantity at the indicative matching price (Indicative matching quantity)
TotalImbalanceQty	26	2	Binary	Total imbalance quantity at the indicative matching price.
MarketImbalanceQty	28	2	Binary	Total market order imbalance at the indicative matching price
AuctionType	30	1	ASCII	▪ O (Opening) ▪ H (Halt)
ImbalanceSide	33	1	ASCII	Side of the imbalance Buy/sell. Valid Values: ▪ 'B' – Buy ▪ 'S' – Sell ▪ Space – No imbalance
MarketImbalanceSide	32	1	ASCII	Side of the market imbalance Buy/sell. Valid Values: ▪ B = Buy ▪ S = Sell ▪ Blank = No imbalance
Reserved	33	3	Binary	Filler

3. Deep Feed Message Types

In addition to the message types detailed here, the Deep feed also publishes Underlying Index Mapping messages (435), Series Index Mapping messages (437), and various control messages. These are described in later sections.

3.1 OUTRIGHT MARKET DEPTH MESSAGE, BUY – MSG TYPE 403

The Buy Market Depth message provides prices and aggregated volumes for each of the best three Buy levels. Volumes include orders and quotes.

There is a separate message for the best three Sell levels. No add/delete messages are used.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 40 bytes
MsgType	2	2	Binary	Type of message: ▪ 403 – Buy Market Depth
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
First Level Price	20	4	Signed Binary	Price of first buy level
Second Level Price	24	4	Signed Binary	Price of second buy level
Third Level Price	28	4	Signed Binary	Price of third buy level
First Level Volume	32	2	Binary	Total volume at first price level
Second Level Volume	34	2	Binary	Total volume at second price level
Third Level Volume	36	2	Binary	Total volume at third price level
Reserved	38	2	Binary	Filler

3.2 OUTRIGHT MARKET DEPTH MESSAGE, SELL – MSG TYPE 405

The Sell Market Depth message provides prices and aggregated volumes for each of the best three Sell levels. Aggregated volumes include orders and quotes.

There is a separate message for the best three Buy levels. No add/delete messages are used.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 40 bytes
MsgType	2	2	Binary	Type of message: ▪ 405 – Sell Market Depth
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	The unique ID of the symbol in the Series Index message
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
First Level Price	20	4	Signed Binary	Price of First Sell level
Second Level Price	24	4	Signed Binary	Price of Second Sell level
Third Level Price	28	4	Signed Binary	Price of Third Sell level
First Volume	32	2	Binary	Total volume at First price level
Second Volume	34	2	Binary	Total volume at Second price level
Third Volume	36	2	Binary	Total volume at Third price level
Reserved	38	2	Binary	Filler

3.3 REFRESH OUTRIGHT MARKET DEPTH MESSAGE, BUY – MSG TYPE 503

The Refresh Market Depth Buy message is sent in the event no Buy Market Depth messages are published for the symbol for 2 consecutive minutes. It has the same field content as the last published Outright Quote message, with the following exceptions:

- MsgType is 503
- SymbolSeqNum increments on every publication

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 40 bytes
MsgType	2	2	Binary	Type of message: ▪ 503 – Refresh Buy Market Depth
SourceTime	4	4	Binary	The time when this data was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	Numerical representation of the outright options symbol.
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
First Level Price	20	4	Signed Binary	Price of first buy level
Second Level Price	24	4	Signed Binary	Price of second buy level
Third Level Price	28	4	Signed Binary	Price of third buy level
First Volume	32	2	Binary	Total volume at first price level
Second Volume	34	2	Binary	Total volume at second price level
Third Volume	36	2	Binary	Total volume at third price level
Reserved	38	2	Binary	Filler

3.4 REFRESH OUTRIGHT MARKET DEPTH MESSAGE, SELL – MSG TYPE 505

The Refresh Market Depth Sell message is sent in the event no Sell Market Depth messages are published for the symbol for 2 consecutive minutes. It has the same field content as the last published Sell Market Depth message, with the following exceptions:

- MsgType is 505
- SymbolSeqNum increments on every publication

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 40 bytes
MsgType	2	2	Binary	Type of message: ▪ 505 – Refresh Sell Market Depth
SourceTime	4	4	Binary	The time when this data was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
SeriesIndex	12	4	Binary	Numerical representation of the outright options symbol.
SymbolSeqNum	16	4	Binary	Sequence number of messages for the outright options symbol.
First Level Price	20	4	Signed Binary	Price of first sell level
Second Level Price	24	4	Signed Binary	Price of second sell level
Third Level Price	28	4	Signed Binary	Price of third sell level
First Volume	32	2	Binary	Total volume at first price level
Second Volume	34	2	Binary	Total volume at second price level
Third Volume	36	2	Binary	Total volume at third price level
Reserved	38	2	Binary	Filler

4. Complex Feed Message Formats

In addition to the message types detailed here, the Complex feed also publishes Complex Symbol Definition messages (439) and various control messages. These are described in later sections.

4.1 COMPLEX QUOTE MESSAGE – MSG TYPE 423

The Complex Quote message is a two-sided message providing best bid and offer limits of orders on complex symbols with aggregated volumes at each limit. The message also indicates aggregated Customer volumes within the overall volumes.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 40 Bytes
MsgType	2	2	Binary	Type of message: ▪ 423 – Complex Quote
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
ComplexIndex	12	4	Binary	The unique ID of the symbol in the Complex Index msg
SymbolSeqNum	16	4	Binary	Sequence number of messages for the complex symbol.
AskPrice	20	4	Signed Binary	Best Ask price. Should be used with the Price Scale Code from the Underlying Index Mapping message.
BidPrice	24	4	Signed Binary	Best Bid price. Should be used with the Price Scale Code from the Underlying Index Mapping message.
AskShares	28	2	Binary	total quantity available at the above Ask price.
BidShares	30	2	Binary	total quantity available at the above Bid price.
AskCustomerShares	32	2	Binary	total quantity of 'Customer' orders available at the above Ask price.
BidCustomerShares	34	2	Binary	total quantity of 'Customer' orders available at the above Bid price.
QuoteCondition	36	1	ASCII	▪ 1 (Regular Trading) ▪ 2 (Rotation) ▪ 3 (Trading Halted) ▪ 4 (Pre-open)
Reserved1	37	1	Binary	Filler
Reserved2	38	2	Binary	Filler

4.2 COMPLEX TRADE MESSAGE – MSG 425

The Complex Trade message is used to publish all complex Last Sales.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 36 bytes
MsgType	2	2	Binary	Type of message: ▪ 425 – Trade Message
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
ComplexIndex	12	4	Binary	The unique ID of the symbol in the Complex Index msg
SymbolSeqNum	16	4	Binary	Sequence number of messages for the complex symbol.
TradeID	20	4	Binary	(blank) n/a for complex symbols
Price	24	4	Signed Binary	Price of the trade. Use the Price Scale Code from the Underlying Index Mapping message.
Volume	28	4	Binary	Volume of the trade in actual number of contracts
TradeCond1	32	1	ASCII	▪ Blank (regular trade) ▪ I (Late report) ▪ R (Floor trade) ▪ S (ISO sweep trade)
TradeCond2	33	1	ASCII	(blank) n/a for complex symbols
Reserved	34	2	Binary	Filler

4.1 COMPLEX CROSSING RFQ MESSAGE– MSG 429

The Complex Crossing RFQ (Request for Quote) message is sent out in the event of an auction on a complex order.

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message body in bytes. ▪ 28 bytes
MsgType	2	2	Binary	Type of message. ▪ 429 – Complex Crossing
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceNS	8	4	Binary	The nanosecond offset from the SourceTime.
ComplexIndex	12	4	Binary	The unique ID of the symbol in the Complex Index msg
SymbolSeqNum	16	4	Binary	Sequence number of messages for the complex symbol.
Side	20	1	ASCII	Side of the RFQ ▪ B (Buy) ▪ S (Sell)
Reserved	21	1	Binary	Filler
Shares	22	2	Binary	Total quantity
Price	24	4	Signed Binary	Price of crossing transaction. Use the Price Scale Code from the Underlying Index Mapping message.

4.2 COMPLEX STATUS MESSAGE – MSG 433

The Complex Status message is used to inform the subscribers of changes in symbol status of a complex symbol.

FIELD NAME	OFFSET	SIZE	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Message size: ▪ 24 bytes
MsgType	2	2	Binary	Type of message. ▪ 433 – Complex Status Message
SourceTime	4	4	Binary	Second portion of the ME timestamp.
SourceTimeNS	8	4	Binary	Nanosecond portion of the ME timestamp.
ComplexIndex	12	4	Binary	Numerical representation of the complex symbol.
SymbolSeqNum	16	4	Binary	Sequence number of messages for the complex symbol.
SecurityStatus	20	1	ASCII	▪ O Open ▪ X Close ▪ S Halt ▪ Q End of RFQ auction
Halt Condition	21	1	ASCII	Not applicable
Reserved	22	2	Binary	Filler

4.3 REFRESH COMPLEX QUOTE MESSAGE – MSG TYPE 511

The Refresh Complex Quote message is sent in the event no quote messages are published for the symbol for 2 consecutive minutes. It has the same field content as the last published Complex Quote message, with the following exceptions:

- MsgType is 511
- SymbolSeqNum increments on every publication

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 40 Bytes
MsgType	2	2	Binary	Type of message: ▪ 511 – Refresh Complex Quote Message
SourceTime	4	4	Binary	The time when this data was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
ComplexIndex	12	4	Binary	Numerical representation of the complex symbol.
SymbolSeqNum	16	4	Binary	Sequence number of messages for the complex symbol.
AskPrice	20	4	Signed Binary	Best Ask price. Use the Price Scale Code from the Underlying Index Mapping message.
BidPrice	24	4	Signed Binary	Best Bid price. Use the Price Scale Code from the Underlying Index Mapping message.
AskShares	28	2	Binary	Total quantity available at the Ask price.
BidShares	30	2	Binary	Total quantity available at the Bid price.
AskCustomerShares	32	2	Binary	Total quantity of 'Customer' orders available at the above Ask price.
BidCustomerShares	34	2	Binary	Total quantity of 'Customer' orders available at the above Bid price.
QuoteCondition	36	1	ASCII	▪ 1 (Regular Trading) ▪ 2 (Rotation) ▪ 3 (Trading Halted) ▪ 4 (Pre-open)
Reserved1	37	1	Binary	Filler
Reserved2	38	2	Binary	Filler

4.5 REFRESH COMPLEX TRADE MESSAGE– MSG 513

The Refresh Complex Trade message is sent in the event no Complex Trade messages are published for the symbol for 2 consecutive minutes. It has the same field content as the last published Complex Trade message, with the following exceptions:

- MsgType is 513
- SymbolSeqNum increments on every publication

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 36 bytes
MsgType	2	2	Binary	Type of message: ▪ 513 – Refresh Complex Trade Message
SourceTime	4	4	Binary	The time when this data was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
ComplexIndex	12	4	Binary	Numerical representation of the symbol.
SymbolSeqNum	16	4	Binary	Sequence number of messages for the Outright options symbol.
TradeID	20	4	Binary	(blank) n/a for complex symbols
Price	24	4	Signed Binary	Price of the trade. Use the Price Scale Code from the Underlying Index Mapping message.
Volume	28	4	Binary	Volume of the trade in actual number of contracts
TradeCond1	32	1	ASCII	▪ Blank (regular trade) ▪ I (Late report) ▪ R (Floor trade) ▪ S (ISO sweep trade)
TradeCond2	33	1	ASCII	n/a
Reserved	34	2	Binary	Filler

5. Index Mapping Message Formats

5.1 UNDERLYING INDEX MAPPING MESSAGE – MSG 435

On system startup, each multicast channel sends all the symbols on its channel. Underlying Index Mapping messages are published first, followed by all Series Index Mapping messages, and for the Complex feed, Complex Symbol Definitions last of all.

If individual series for the same underlying symbol appear in multiple streams, the Underlying Index Mapping message is sent down all relevant channels.

This message is published in Top, Deep and Complex feeds. It is also available via a symbol refresh request.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message: 28 bytes
Msg Type	2	2	Binary	Type of message 435 – Underlying Index Mapping
UnderlyingIndex	4	4	Binary	The unique ID of this underlying symbol in this market. This ID cannot be used to cross reference a security between markets.
UnderlyingSymbol	8	11	ASCII	Full symbol in NYSE Symbology.
ChannelID	19	1	Binary	Multicast channel ID of the symbols being provided.
Market ID	20	2	Binary	Identifies originating market: ▪ 1 (NYSE Cash) ▪ 2 (Europe Cash) ▪ 3 (NYSE Arca Cash) ▪ 4 (NYSE/Arca Options) ▪ 5 (NYSE/Arca Bonds) ▪ 6 (ArcaEdge) ▪ 7 (LIFFE) ▪ 8 (NYSE Amex Options) ▪ 9 (NYSE MKT Cash)
System ID	22	1	Binary	ID of the Originating System
Exchange Code	23	1	ASCII	Exchanges where it is listed: ▪ N (NYSE) ▪ P (NYSE Arca) ▪ Q (NASDAQ) ▪ A (NYSE MKT)
PriceScaleCode	24	1	Binary	Price Scale Code for price conversion of the symbol. See Price Formats.
SecurityType	25	1	ASCII	Type of Security: ▪ A (ADR) ▪ C (COMMON STOCK) ▪ D (DEBENTURES) ▪ E (ETF)

				▪ F (FOREIGN) ▪ I (UNITS) ▪ M (MISC/LIQUID TRUST) ▪ P (PREFERRED STOCK) ▪ R (RIGHTS) ▪ S (SHARES OF BENEFICIARY INTEREST) ▪ T (TEST) ▪ U (UNITS) ▪ W (WARRANT)
Price Resolution	26	1	Binary	▪ 0 (All Penny) ▪ 1 (Penny/Nickel) ▪ 5 (Nickel/Dime)
Reserved	27	1	Binary	Filler

5.2 SERIES INDEX MAPPING MESSAGE– MSG 437

Series symbols are used to identify options instruments. They are unique to a given stream, but not across the entire market. The Series ID must therefore be concatenated with Market ID and system ID to uniquely identify a given instrument.

On system startup, each multicast channel sends all the symbols on its channel. Underlying Index Mapping messages are published first, followed by all Series Index Mapping messages, and for the Complex feed, Complex Symbol Definitions last of all.

A Series Index message is also sent intraday whenever a new outright symbol is created (or was erroneously omitted from the initial spin), and is available via the symbol refresh request.

This message is published in Top, Deep and Complex feeds. It is also available via a symbol refresh request.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Message size: ▪ 60 bytes
MsgType	2	2	Binary	Type of message. ▪ 437 - Series Index Mapping
SeriesIndex	4	4	Binary	The unique ID of this series in this market. This ID cannot be used to cross reference a security between markets.
ChannelID	8	1	Binary	Multicast channel ID of the symbols being provided.
Reserved	9	1	Binary	Filler
MarketID	10	2	Binary	Identifies originating market: ▪ 1 (NYSE Cash) ▪ 2 (Europe Cash) ▪ 3 (NYSE Arca Cash) ▪ 4 (NYSE/Arca Options) ▪ 5 (NYSE/Arca Bonds) ▪ 6 (Global OTC) ▪ 7 (LIFFE) ▪ 8 (NYSE Amex Options) ▪ 9 (NYSE MKT Cash)
SystemID	12	1	Binary	Identifies Trading unit (TU)
Reserved	13	1	Binary	Filler
StreamID	14	2	Binary	Identifies Stream on which this symbol will be updated
UnderlyingIndex	16	4	Binary	Underlying Stock Mapping Index
ContractMultiplier	20	2	Binary	Contract quantity
MaturityDate	22	6	ASCII	YY MM DD
PutOrCall	28	1	Binary	▪ 0 (Put) ▪ 1 (Call)
StrikePrice	29	10	ASCII	Strike price. ASCII 0-9 with optional decimal point. EG: 51.75, 123
PriceScaleCode	39	1	Binary	Decimal places on price

UnderlyingSymbol	40	11	ASCII	Full underlying symbol in NYSE Symbology
OptionSymbolRoot	51	5	ASCII	OCC root of option symbol
GroupID	56	4	Binary	Used by Market Makers. Predefined group of series within a given underlying symbol.

5.3 COMPLEX SYMBOL DEFINITION MESSAGE – MSG 439

The Complex Symbol Definition message provides a description of the legs in a Complex symbol, and specifies its unique Complex symbol ID. A leg can be an option or an equity; the leg type is indicated in the LegSecurityType field. The number of leg definitions is provided in the message. The order of legs is deterministic. The length of the message is variable depending on the number of legs in the complex symbol.

On system startup, each Complex feed multicast channel sends all the symbols on its channel. Underlying Index Mapping messages are published first, followed by all Series Index Mapping messages, and lastly Complex feed, Complex Symbol Definition messages.

This message is also sent intraday whenever a new complex symbol is created.

It is published in the Complex feed and is also available via a symbol refresh request.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ Variable, 80 bytes maximum
MsgType	2	2	Binary	Type of message. ■ 439 – Complex Symbol Definition
ComplexIndex	4	4	Binary	The unique ID of this symbol for all feeds in this market. This ID cannot be used to cross reference a security between markets.
ComplexSymbol	8	21	ASCII	Complex Symbol. This is an alpha numeric symbol which can be used for a unique strategy until one of the legs expire.
ChannelID	29	1	Binary	multicast channel ID of the symbols being provided.
MarketID	30	2	Binary	Identifies originating market: ▪ 1 (NYSE Cash) ▪ 2 (Europe Cash) ▪ 3 (NYSE Arca Cash) ▪ 4 (NYSE/Arca Options) ▪ 5 (NYSE/Arca Bonds) ▪ 6 (ArcaEdge) ▪ 7 (LIFFE) ▪ 8 (NYSE Amex Options) ▪ 9 (NYSE MKT Cash)
SystemID	32	1	Binary	Identifies Trading unit (TU)
Reserved	33	1	Binary	Filler
StreamID	34	2	Binary	Identifies Stream on which this symbol will be updated
NoOfLegs	36	2	Binary	Number of legs in complex symbol 1 – 5
Reserved	38	2	Binary	Filler
Leg definition – max of 5				
SymbolIndex	40	4	Binary	Series index if Security type is Option

				Underlying index if Security type is Equity
LegRatioQty	44	2	Binary	Leg ratio
Side	46	1	ASCII	Leg side ▪ B (Buy) ▪ S (Sell)
SecurityType	47	1	ASCII	Leg Security Type ▪ O (Options Series leg) ▪ E (Equity stock leg)

6. Control Message Formats

6.1 STREAM ID MESSAGE – MSG 455

In all multicast channels, a Stream ID Message is sent immediately after each packet header to uniquely identify the source or Stream ID of the data in the packet. Stream ID Messages are not applicable in TCP request/response connections, and so are not used by either the client or the Request Server.

This message is published in the Top, Deep and Complex feeds.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 8 Bytes
MsgType	2	2	Binary	Type of message: ▪ 455 – Stream ID Header Message
StreamID	4	2	Binary	Represents the Stream ID for this packet update. The Stream ID represents a unique source (specific thread within a publisher task).
Reserved	6	2	Binary	Filler

6.2 TCP LOGIN REQUEST MESSAGE – MSG 456

This message is sent by clients to log into the Request Server. The server responds with a Login Request Response message, msg type 457.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 28 Bytes
MsgType	2	2	Binary	Type of message: ▪ 456 – Login Request Message
SourceID	4	10	ASCII	Name of the source requesting login. This field is up to 9 characters, null terminated.
Password	14	12	ASCII	Password of the requestor
Reserved	26	2	Binary	Filler

6.3 TCP LOGIN REQUEST RESPONSE MESSAGE – MSG 457

This message is sent in response to a client request to log into the Symbol Refresh Server. It indicates whether or not the login request has been accepted. In the event the request is rejected, the message indicates the reason for the rejection. A request may be rejected for the following reasons:

- The requestor is not authorized or has an invalid password
- The server has exceeded the maximum connection limit for this port
- The connection has timed out (client connects and does not log in within 30 seconds).

In the event the request is rejected, the Symbol Refresh Server closes the socket connection after sending this message.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 8 Bytes
MsgType	2	2	Binary	Type of message: ▪ 457 – Login Request Response Message
ResponseCode	4	1	ASCII	▪ A (Accepted) ▪ B (Rejected)
RejectCode	5	1	ASCII	▪ blank (Accepted) ▪ A (Not authorized) ▪ M (Maximum server connections reached) ▪ T (Timeout)
Reserved	6	2	Binary	Filler

6.4 TCP HEARTBEAT MESSAGE - MSG 12

This message is sent by the Request Server to the client as soon as a TCP connection is established, and is republished approximately every 60 seconds to indicate the session is active.

A responding TCP Heartbeat message from the client system must be received by the server within 5 seconds of sending the heartbeat, or else the session will be terminated.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 16 Bytes
MsgType	2	2	Binary	Type of message: ▪ 12 – Heartbeat
SourceID	4	10	ASCII	Name of the connected client. This field is up to 9 characters, null terminated.
Reserved	14	2	Binary	

6.5 TEST REQUEST MESSAGE – MSG 458

This message can be sent by clients to request a response from the Request Server during periods of inactivity. The client can specify a text message for the server to echo back its response.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 12 Bytes
MsgType	2	2	Binary	Type of message: ▪ 458 – Test Request Message
TestMessage	4	8	ASCII	Text to be echoed back

6.6 TEST REQUEST RESPONSE MESSAGE – MSG 459

This message is sent back from the Request Server to a client in response to a Test Request message.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 12 Bytes
MsgType	2	2	Binary	Type of message: ▪ 459 – Test Request Response Message
TestMessage	4	8	ASCII	Client text to echo from the Test Request message

6.7 UNDERLYING INDEX MAPPING REQUEST MESSAGE - MSG TYPE 441

This message is sent by Subscribers via TCP/IP to request Underlying index mapping messages.

If the UnderlyingIndex field in the message is populated with a specific value, the response will contain the Underlying index requested. In this case, any value in the ChannelID field is ignored.

If the UnderlyingIndex field in the message is populated with the value '0', the response will contain all the Underlying indices on the channel defined in the ChannelID field.

If the ChannelID field is populated with the value '0', the request will contain all the Underlying symbols on the Exchange. In this case, any value in the UnderlyingIndex field is ignored.

The Request Server responds to this message with a Request Response Message, to indicate the outcome of the request. If the request is accepted, the Request Response Message is followed by the index mapping messages requested. When the download is complete, a second Request Response Message is sent to indicate that the transmission is finished.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 20 Bytes
MsgType	2	2	Binary	Type of message: ▪ 441 – Underlying Index Mapping Request Message
UnderlyingIndex	4	4	Binary	The ID from the Underlying Index message of the requested symbol. To request a refresh for all symbols in the channel, set this field to 0.
SourceID	8	10	ASCII	Name of the requestor.
ChannelID	18	1	Binary	Multicast channel ID of the symbol(s) being requested. To request all underlying symbols in all channels, set this field to 0.
Reserved	19	1	Binary	Filler

6.8 SERIES INDEX MAPPING REQUEST MESSAGE - MSG TYPE 443

This message is sent by Subscribers via TCP/IP to request Series index mapping messages.

If the SeriesIndex field in the message is populated with a specific value, the response will contain the Series index requested. In this case, any value in the ChannelID field is ignored.

If the SeriesIndex field in the message is populated with the value '0', the response will contain all the Series indices on the channel defined in the ChannelID field.

If the ChannelID field is populated with the value '0', the request will contain all the Outright options symbol on the Exchange. In this case, any value in the SeriesIndex field is ignored.

The Request Server responds to this message with a Request Response Message, to indicate the outcome of the request. If the request is accepted, the Request Response Message is followed by the index mapping messages requested. When the download is complete, a second Request Response Message is sent to indicate that the transmission is finished.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 20 bytes
MsgType	2	2	Binary	Type of message. ▪ 443 – Series Index Mapping Request Message
SeriesIndex	4	4	Binary	The ID from the Series Index msg of the requested symbol. To request a refresh for all symbols in the channel, set this field to 0.
SourceID	8	10	ASCII	Name of the requestor.
ChannelID	18	1	Binary	Multicast channel ID of the symbol(s) being requested. To request all series symbols in all channels, set this field to 0.
Reserved	19	1	Binary	Filler

6.9 COMPLEX SYMBOL DEFINITION REQUEST MESSAGE - MSG TYPE 445

This message is sent by Subscribers via TCP/IP to request Complex symbol definition messages.

If the ComplexSymbolIndex field in the message is populated with a specific value, the response will contain the Complex symbol definition index requested. In this case, any value in the ChannelID field is ignored.

If the ComplexSymbolIndex field in the message is populated with the value '0', the response will contain all the Series indices on the channel defined in the ChannelID field.

If the ChannelID field is populated with the value '0', the request will contain all the Complex Symbols on the Exchange. In this case, any value in the ComplexSymbolIndex field is ignored.

The Request Server responds to this message with a Request Response Message, to indicate the outcome of the request. If the request is accepted, the Request Response Message is followed by the index mapping messages requested. When the download is complete, a second Request Response Message is sent to indicate that the transmission is finished.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 20 Bytes
MsgType	2	2	Binary	Type of message. ▪ 445 – Complex Index Mapping Request Message
ComplexSymbolIndex	4	4	Binary	The ID from the Complex Index msg of the requested symbol. To request a refresh for all symbols in the channel, set this field to 0.
SourceID	8	10	ASCII	Name of the requestor.
ChannelID	18	1	Binary	Multicast channel ID of the symbol(s) being requested. To request all complex symbols in all channels, set this field to 0.
Reserved	19	1	Binary	Filler

6.10 REQUEST RESPONSE MESSAGE - MSG TYPE 447

This message will be sent via TCP/IP in response to the client's request for symbol mapping messages.

If the request is accepted and the mapping messages provided, this message is sent again immediately at the end of the transmission to indicate that the download is complete.

If the request is rejected, the reason for the rejection is indicated in this message.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Message size: ▪ 16 bytes
MsgType	2	2	Binary	Type of message. ▪ 447 –Request Response Message
SourceID	4	10	ASCII	Name of the source requesting retransmission.
ChannelID	14	1	Binary	Multicast channel ID
Status	15	1	Binary	Outcome of the request. Valid values: ▪ 0 – Request was accepted ▪ 1 – Rejected due to an Invalid Source ID ▪ 4 – Rejected due to maximum number of refresh requests in a day ▪ 6 – Rejected due to an Invalid Channel ID ▪ 8 – Underlying download complete ▪ 9 – Series download complete ▪ 10 – Complex download complete

6.11 TCP LOGOUT REQUEST MESSAGE – MSG TYPE 460

The TCP Logout Request message can be sent by the client to the Request Server as an optional means of disconnecting. The Request Server responds by disconnecting the client.

The other alternative is for the client to simply disconnect when all needed information is received.

Note that if the client fails to respond to any TCP Heartbeat message within five seconds, the server will close the socket.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 4 bytes
MsgType	2	2	Binary	Type of message. ▪ 460 – Logout Request

6.12 SEQUENCE NUMBER RESET - MSG TYPE 1

This message is sent to 'reset' the Sequence Number at start of day or following to a failover. Note that this message will contain a valid sequence number.

The table below describes the body fields of a Sequence Number Reset message, Msg Type 1.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary	Size of the message: ▪ 16 Bytes
MsgType	2	2	Binary	Type of message. ▪ 1 – Sequence Number Reset
SourceTime	4	4	Binary	The time when this msg was generated in the order book, in seconds since Jan 1, 1970 00:00:00 UTC.
SourceTimeNS	8	4	Binary	The nanosecond offset from the SourceTime.
ProductID	12	1	Binary	The product ID used in the XDP header to identify the feed.
ChannelID	13	1	Binary	Multicast channel ID over which the packet was sent.
Reserved	14	2	Binary	Filler