

ISE & GEMX Depth of Market Feed Specification

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1. Overview

Depth of Market (Depth) Feed is a direct data feed product in the product in the Nasdaq ISE (ISE) and Nasdaq GEMX (GEMX) systems offered by Nasdaq that features the following:

- Notifies participants of imbalances on opening and reopening (resumption from halt) periodically before the events.
- **Top five price levels of the order book:** This feed displays the bids and offers at the top five price levels of the book. All displayable quote and order interest is aggregated into the total quantity. The aggregated quantity of Customer and Professional Customer orders are also displayed at each of the top five price levels of both sides.
- **Ticker Messages:** Displays last trade information along with opening price, cumulative volume, high and low prices for the day.
- **Administrative and market event messages including:**
 - Options Directory messages to be disseminated to relay basic option symbol and contract information for those securities traded on the options market.
 - Security Open Message to be disseminated for each security as soon as the opening auction process is completed to inform recipients that the option symbol denoted in the message is available for auto execution within the options market system.
 - Trading action messages to inform market participants when a specific security is halted or released for trading on the options market.
- A separate connection for obtaining snapshots, called Glimpse, enabling the user to reconnect intra day and be current with the live stream. Connecting to Glimpse intra day obtains a snapshot of all System Events, Option definitions, Option States, and the top five bid and offer price levels for all options configured for this stream. The snapshot of the stream is taken at the point in time when the user connects and logs in to Glimpse. The snapshot is tagged with a sequence number, the point at which one can listen to the live stream.

2. Architecture

The feed will be made up of a series of sequenced messages. Each message is variable in length based on the message type and is composed of binary and alphanumeric data. The messages that make up this protocol are typically delivered using a higher level protocol that takes care of sequencing and delivery guarantees.

The options system offers the data feed in two protocol options:

Protocol Option	Number of Outbound Channels
SoupBinTCPv3.00	Multiple output channels, each channel supporting a subset of securities, the range defined by first letter of underlying
MoldUDP64v1.00	Multiple output channels, each channel supporting a subset of securities, the range defined by first letter of underlying

The feed is composed of a Multicast and Soup channel.

Please note that Nasdaq provides local redundancy in the NY Metro Area (local “A” and “B” feeds), as well as the remote Chicago Region (“C” and “D” feeds). The secondary “C” and “D” feeds are available for general use; however please note that performance characteristics will be reduced due to the remote location of these feeds.

Both the local primary (“A feed”) and local secondary (“B feed”) will be hosted by servers co-located with the local trading system and will have identical performance characteristics. The remote primary (“C feed”) and remote secondary (“D feed”) will be hosted by servers co-located with the remote trading system and will have identical (but reduced) performance characteristics. The messages in each of the “A”, “B”, “C” and “D” feeds are identical: Mold or Soup messages will have the same Mold or Soup sequence numbers across all of the streams.

The Glimpse snapshot is available in Soup connections only. Just like in the real-time stream, there are two local “A” and “B” connections as well as two remote “C” and “D” connections.

In the event of disaster recovery, the “C” and “D” feeds should be used as primary feeds when order entry is switched from the NY Metro Area to the Chicago Region.

3. Data Types

All Alpha or Alphanumeric fields are left justified and padded on the right with spaces.

All Integer fields are unsigned big-endian (network byte order) binary encoded numbers unless otherwise specified. Integers may be 1, 2, 4 or 6 bytes long.

Prices are 2, 4 or 8 byte Integer fields. 2 byte Price fields are unsigned positive numbers. 4 and 8 byte Price fields are signed numbers. When an 8 byte price is converted to a decimal format, prices are in fixed point format with 12 whole number places followed by 8 decimal digits. When a 4 byte price is converted to a decimal format, prices are

in fixed point format with 6 whole number places followed by 4 decimal digits. When a 2 byte price is converted to a decimal format, prices are in fixed point format with 3 whole number places followed by 2 decimal digits.

Time is expressed as a 6 byte Integer, representing the number of nanoseconds past midnight of the current day.

4. Message Formats

This feed supports five basic types of messages:

- System Events
- Administrative Data and Market Events
- Imbalances before opening and reopening
- Best bid and offer price level updates
- Ticker information

Within the system event and administrative types, the options system may support multiple message formats as outlined below.

4.1. System Event Message

The system event message type is used to signal a market or data feed handler event. The format is as follows:

System Event Message

Name	Offset	Length	Value	Notes
Message Type	0	1	Alpha	“S” = System Event Message
Timestamp	1	6	Integer	The time, expressed as the number of nanoseconds after midnight.
Event Code	7	1	Alpha	Refer to System Event Codes below
Current Year	8	2	Integer	The current calendar year (example: 2016).
Current Month	10	1	Integer	The current calendar month, with values 1 to 12 inclusive, January=1, etc.
Current Day	11	1	Integer	The current calendar day, with values 1 to 31 inclusive.
Version	12	1	Integer	Version of this interface. Currently set to 1.
Sub-version	13	1	Integer	Sub-version of this interface. Currently set to 0.

System Event Codes

Code	Explanation	When (typically)
"O"	Start of Messages. This is always the first message sent in any trading day.	After ~12:00am
"S"	Start of System Hours. This message indicates that the options system is open and ready to start accepting orders.	After Start of Messages and before Start of Currency Opening Process
"Q"	Start of Opening Process. This message is intended to indicate that the options system has started its opening auction process.	9:30:00am
"N"	Start of Normal Hours Closing Process. This message is intended to indicate that the options system will no longer generate new executions for options that trade during normal hours.	4:00:00pm
"L"	Start of Late Hours Closing Process. This message is intended to indicate that the options system will no longer generate new executions for options that trade during extended hours.	4:15:00pm
"E"	End of System Hours. This message indicates that the options system is now closed.	~5:15pm
"C"	End of Messages. This is always the last message sent in any trading day.	~5:20pm
"W"	End of WCO Early closing. This message is intended to indicate that the exchange will no longer accept any new orders or changes to existing Orders on last trading date of WCO options	12:00 Noon

4.2. Option Directory Message

At the start of each trading day, the options system disseminates directory messages for all symbols eligible for trading in the options system.

Options Directory Message

Name	Offset	Length	Value	Notes
Message Type	0	1	Alpha	"D" = Directory Message
Timestamp	1	1	Integer	The time, expressed as the number of nanoseconds after midnight.
Option ID7	7	4	Integer	Option ID for this option, assigned daily, valid for trading day.
Security Symbol	11	6	Alphanumeric	Denotes the option root symbol (security symbol)
Expiration Year	17	1	Integer	Last two digits of the year of the option expiration
Expiration Month	18	1	Integer	Expiration Month of the option (1-12)
Strike Price	20	8	Integer	Explicit strike price in fixed point format with 12 whole number places followed by 8 decimal digits.
Option Type	28	1	Alpha	Explicit strike price in fixed point format with 12 whole number places followed by 8 decimal digits.
Option Type	28	1	Alpha	"C" = Call option "P" = Put option
Source	30	13	Integer	Identifies the source of the option, valid for the trading day.
Underlying Symbol	30	13	Alpha	Denotes the unique symbol assigned to the underlying security within the Exchange System.
Trading Type	43	1	Alpha	Indicates what kind of option this is: "E" = Equity "I" = Index "F" = ETF "C" = Currency
Contract Size	44	2	Integer	Underlying deliverable size

Options Directory Message

Name	Offset	Length	Value	Notes
Option Closing Type	46	1	Alpha	Denotes which System Event is used to determine when trading ceases in this symbol. "N" = Normal Hours "L" = Late Hours
Tradable	47	1	Alpha	Denotes whether or not this option is tradable at the exchange: "Y" = Option is tradable "N" = Option is not tradable
Closing Only	49	1	Alpha	Closing position of the option: "Y" = Option is Closing Position Only. Only Market Maker origin orders can have open position "N" = Option is not Closing Position Only

Options Directory Notes:

1. The options directory messages are sent once per symbol, typically before the "Start of System Hours" System Event. Should it be necessary, intra-day updates to this message will be sent as they occur. In the case of an intra-day update, for a given Option Id, the canonical information for the option is invariant (will not change). The canonical information consists of Security Symbol, Expiration Year Month and Day, Strike Price and Option Type. Other attributes for the Option may change.
2. Firm should note that they will only receive Option Directory messages for the symbol range associated with the matching engine serving that connection.
3. The Underlying Symbol is in most cases the same as the industry standard ticker underlying. In rare cases, such as a special settlement symbol, the exchange assigns unique underlying symbols.
4. This is a sequenced message and therefore can be replayed upon re-connection.
5. If an Option is removed from the system intra-day, a new options directory message will be sent with "Tradable" field set to "N".
6. The Minimum Price Variation (MPV) has the following values:
 - a. "E" – All prices are in penny increments
 - b. "S" – Prices below \$3.00 are in increments of \$0.05, prices above \$3.00 are in increments of \$0.10
 - c. "P" – Prices below \$3.00 are in increments of \$0.01, prices above \$3.00 are in increments of \$0.05

4.3. Trading Action Message

The options system uses this administrative message to indicate the current trading status of an index or equity option within the options market.

Prior to the start of system hours, the options system will send out a Trading Action message. The options system will send out a Trading Action message with the "T" (Trading Resumption) for all options contracts that are eligible for trading at the start of the options market system hours. If a security is absent from the pre-opening Trading Action spin, firms should assume that the security is being treated as halted in the options platform at the start of the system hours. Securities may be halted in the options system for regulatory or operational reasons.

After the start of system hours, the options system will use the Trading Action message to relay changes in trading status for an individual security. Messages will be sent when an option is halted or is released for trading

Trading Action Message

Name	Offset	Length	Value	Notes
Message Type	0	1	Alpha	"H" = Trading Action
Timestamp	1	6	Integer	The time, expressed as the number of nanoseconds after midnight.
Option ID	7	4	Integer	Integer ID of the option, as defined in the Options Directory Message. Reflects the current trading state for the options security in the options market. The allowable values
Current Trading State	11	1	Alpha	are: "H" = Halt in effect "T" = Trading on the options system

4.4. Security Open/Closed Message

The options system uses this administrative message to indicate when an option has completed the opening process and is now available for auto execution or when the option has closed and is no longer available for auto execution.

The system disseminates the Security Open/Closed Message for each option as soon as the opening is completed. Upon receipt of the message with "Open State" = "Y", the recipient is advised that the option denoted in the message is now available for auto execution within the options system. Upon receipt of the message with "Open State" = "N", the recipient is advised that the option is no longer eligible for auto-execution within the options system.

Security Open/Closed Message

Name	Offset	Length	Value	Notes
Message Type	0	1	Alpha	"O" = Security Open/Closed
Timestamp	1	6	Integer	The time, expressed as the number of nanoseconds after midnight.
Option ID	7	4	Integer	Integer ID of the option, as defined in the Options Directory Message.
Open State	11	1	Alpha	Reflects the current eligibility for auto execution of the options security in the options market. The allowable values are: Y = Open for auto execution N = Closed for auto execution

Note: Recipients should continue to process the Trading Action message in order to determine if a contract is in a Halt state for the day. A security open message should not override the Trading action message indicating if an index or equity option is halted.

Recipients should use both messages in tandem to indicate if the issue is halted and/or or open for auto execution.

4.5. Opening Imbalance Message

Nasdaq disseminates Opening Imbalance information at regular intervals in the time leading up to the Nasdaq Opening Auction events. For the Nasdaq Opening Auction, Nasdaq will begin the dissemination of Opening Imbalance messages for a put or call option prior to the start of the opening process event and also prior to the halt resumption (reopening) process event.

Opening Imbalance Message

Name	Offset	Length	Value	Notes
Message Type	0	1	Alpha	"N" = Opening Imbalance
Timestamp	1	6	Integer	The time, expressed as the number of nanoseconds after midnight.
Option ID	7	4	Integer	Integer ID of the option, as defined in the Options Directory Message.
Paired Contracts	11	4	Integer	The total number of contracts that are eligible to be matched at the Current Reference Price.
Imbalance Direction	15	1	Alpha	Indicates the market side of the imbalance: "B" = buy imbalance "S" = sell imbalance
Imbalance Price	16	4	Integer	The imbalance price in fixed point format with 6 whole number places followed by 4 decimal digits.
Imbalance Volume	20	4	Integer	The imbalance volume.

4.6. Depth Incremental – Short Form Message

For bandwidth efficiency reasons, this message is offered in two versions, the Short Form and Long Form. The Short Form has 2 byte Price and Size fields. Note that 2 byte Prices are in pennies and does not imply a loss of precision in the price. The Long Form has 4 byte Price and Size fields. If any field does not fit in the abbreviated 2 byte length, the Long Form of the message is used.

This message is used to send information regarding any of the top five price levels of an option's order book. The message may contain multiple repeating items, each of which updates one side of one price level. All repeating items within the message relate to the same option. This feed will show the top 5 price levels of the book pre-opening.

NOTE: Quotes are displayed on this feed prior to the open and may be displayed crossed before the market for Option is open. Additionally, market order quantity that can rest pre-open will be included in the Bid and Ask Size fields.

Usage

Update Action – New Price Level

When a new price level is created in the order book, a Depth Incremental message is sent with "Update Action" set to "N" (New). This indicates:

- That the new price level is to be inserted at the specified price level.
- All existing rows in the order book at this level or lower are to be pushed down. If there were already five price levels then the last price level should be deleted.
- There is no explicit instruction to delete the bottom price level when inserting a new price level. The field "Price Level" is used to identify which price level is to be inserted. If it is set to one:
- It is to be inserted at the top, regardless of the prices.
- The subscriber's application should check that there are no prices better than this price level and if they do exist then they should be deleted. This should not happen in normal operation.

Update Action – Change Price Level

If a Depth Incremental message is sent with “Update Action” set to “C” (Change), this would indicate:

- A change at the given price level.
- All fields on the specified side at the price level should be updated.

Update Action – Delete Price Level

If a Depth Incremental message is sent with “Update Action” set to “D” (Delete), this would indicate:

- The indicated price level is to be deleted.
- All lower (worse) price levels move up.

Update Action – Delete From Price Level

When a Depth Incremental message is sent with “Update Action” set to “F” (Delete From), this would indicate:

- All price levels starting at the indicated price level are to be deleted.
- This message can be used to clear the book on one side (Price Level = 1).

Examples of how this message is to be processed is described in “Appendix A – Depth Incremental Message Examples” in this specification.

Depth Incremental – Short Form Message

Name	Offset	Length	Value	Notes
Message Type	0	1	Alpha	“I” = Depth Incremental – Short Form
Timestamp	1	6	Integer	The time, expressed as the number of nanoseconds after midnight.
Option ID	7	4	Integer	Integer ID of the option, as defined in the Options Directory Message.
Quote Condition	11	1	Alpha	Quoting condition of the book: “X” = not autox eligible <space> = regular quote/autox eligible
Bid Market Order Size	12	2	Integer	Number of market order contracts on the bid side.
Ask Market Order Size	14	2	Integer	Number of market order contracts on the ask side.
Number of Depth Incrementals	16	1	Integer	The number of times the following 7 or 3 fields repeat. See NOTE below.
Repeated Number of Depth Incrementals times	Update Action	1	Alpha	‘N’ = New ‘C’ = Change ‘D’ = Delete ‘F’ = Delete From
	Side	1	Alpha	‘B’ = Bid ‘A’ = Offer (Ask)
	Level	1	Integer	The numeric order of the price level, where “1” is the (best) price level. With is feed, this field has a value from 1 to 5 inclusive.
	Price	2 or 0	Integer (if present)	Price level’s price. When converted to a decimal format, this price is in fixed point format with 3 whole number places followed by 2 decimal digits (no loss of precision implied). See NOTE below.
	Size	2 or 0	Integer (if present)	Number of aggregated contracts in price level. See NOTE below.
	Cust Size	2 or 0	Integer (if present)	Aggregated Customer quantity in the price level. See NOTE below.
	ProCust Size	2 or 0	Integer (if present)	Aggregated Customer Professional quantity in the price level. See NOTE below.

NOTE: The Price, Size, Cust Size and ProCust Size fields are present for “New” and “Change” Update Actions only. If Update Action is “Delete” or “Delete From”, these fields are absent. Therefore, each repeating Update section of the message will be 11 (Add, Change) or 3 (Delete, Delete From) bytes long.

4.7. Depth Incremental – Long Form Message

This message is the same as the Depth Incremental Message – Short Form described above except that Prices and Sizes are 4 byte Integers, the price having 4 implied decimal places.

Rules for this message are the same as described in the Short Form of this message.

Examples of how this message is to be processed is described in “Appendix A – Depth Incremental Message Examples” in this specification.

Depth Incremental – Long Form Message

Name	Offset	Length	Value	Notes
Message Type	0	1	Alpha	“I” = Depth Incremental – Long Form
Timestamp	1	6	Integer	The time, expressed as the number of nanoseconds after midnight.
Option ID	7	4	Integer	Integer ID of the option, as defined in the Options Directory Message.
Quote Condition	11	1	Alpha	Quoting condition of the book: “X” = not autox eligible <space> = regular quote/autox eligible
Bid Market Order Size	12	4	Integer	Number of market order contracts on the bid side.
Ask Market Order Size	16	4	Integer	Number of market order contracts on the ask side.
Number of Depth Incrementals	20	1	Integer	The number of times the following 7 or 3 fields repeat. See NOTE below.
Repeated Number of Depth Incrementals	Update Action	1	Alpha	‘N’ = New ‘C’ = Change ‘D’ = Delete ‘F’ = Delete From
	Side	1	Alpha	‘B’ = Bid ‘A’ = Offer (Ask)
	Level	1	Integer	The numeric order of the price level, where “1” is the (best) price level. With is feed, this field has a value from 1 to 5 inclusive.
	Size	4 or 0	Integer (if present)	Number of aggregated contracts in price level. See NOTE below.
	Cust Size	4 or 0	Integer (if present)	Aggregated Customer quantity in the price level. See NOTE below.
	ProCust Size	4 or 0	Integer (if present)	Aggregated Customer Professional quantity in the price level. See NOTE below.

NOTE: The Price, Size, Cust Size and ProCust Size fields are present for “New” and “Change” Update Actions only. If Update Action is “Delete” or “Delete From”, these fields are absent. Therefore, each repeating Update section of the message will be 19 (Add, Change) or 3 (Delete, Delete From) bytes long.

4.8. Ticker Message

The ticker message is used to send real time trade information. The format is as follows:

Ticker Message

Name	Offset	Length	Value	Notes
Message Type	0	1	Alpha	"T" = Ticker
Timestamp	1	6	Integer	The time, expressed as the number of nanoseconds after midnight.
Option ID	7	4	Integer	Integer ID of the option, as defined in the Options Directory Message.
Last Price	11	4	Integer	Most recent price.
Size	15	4	Integer	Last traded quantity.
Volume	19	4	Integer	Total traded quantity.
High	23	4	Integer	High price for the day.
Low	27	4	Integer	Low price for the day.
First	31	4	Integer	Opening price for the day.
Trade Condition	35	1	Alpha	Same value as the Trade Condition sent to OPRA for this trade. To obtain a list of Trade Conditions, refer to the NOTE below.

NOTE: The Trade Condition is the same as defined in the OPRA specification: http://www.opradata.com/specs/opra_input_binary_part_spec.pdf. The OPRA Trade Condition is enumerated in the "Message Type" field of the "Equity and Index Last Sale" message (Category "a") in the specification document. The specification has a table of the possible Message Types (Trade Condition) along with a detailed description of each type. Always refer to the www.opradata.com website to ensure the possible Trade Conditions sent out by this feed, which are consistent with the Trade Conditions defined by OPRA

5. Glimpse for Depth of Market Feed

Depth of MarketFeed has a mechanism for out-of-band recovery: Glimpse for Depth of Market Feed. Connecting to Glimpse intra day obtains a snapshot of System Events, Option definitions, Option states, Tickers, and the top five price levels in all order books streamed by this feed connection. The snapshot of the live stream is taken at the point in time when the user connects and logs in to Glimpse. The snapshot is tagged with a sequence number, the point which one can listen to the live stream.

The Glimpse connection is available in the SoupBinTCPv3.00 protocol.

In addition to all the previously described messages, the Glimpse connection uses an additional message; the Snapshot Message. This message serves two purposes:

- To denote the end of the snapshot;
- To tag the snapshot to a sequence number of the live stream. The sequence number in the message reflects the Depth of Market Feed sequence number at the time the Glimpse spin was requested (logged in to the Soup connection).

Snapshot Message

Name	Offset	Length	Value	Notes
Message Type	0	1	Alpha	"M" = End of Snapshot Message
Sequence Number	1	20	Numeric	Depth of Market Feed sequence number when the Glimpse snapshot was taken. To keep the stream current, process the Depth of Market Feed messages beginning with the message sequence number in this snapshot message.

Note: While Depth of Market Feed is a binary data feed, the SoupBINTCP protocol uses ASCII characters for the sequence number in the logon request message format.

Note: Imbalance messages are not included in the Glimpse snapshot

6. Support

- For general product support for Nasdaq data feeds, please contact Nasdaq Market Data at clientsuccess@nasdaq.com
- For technical support for Nasdaq data feeds, please contact NASDAQ Systems Engineering at devsupport@nasdaq.com.

Appendix A – Depth Incremental Message Examples

Depth Incremental Messages are used to send changes to any of the top five price levels. The Depth Incremental message contains multiple repeating items, each of which updates inside of one price level. All repeating items in one message relate to the same option.

Refer to “Depth Incremental – Short Form Message” and “Depth Incremental – Long Form Message” sections in this document for the format of this message.

The following examples explain how the update action field is used to maintain the view of the book.

A.1 – Update Action = New Price Level

When a new price level is created in the order book, a Depth Incremental message is sent with “Update Action” set to “N” (New). This indicates:

- That the new price level is to be inserted at the specified price level.
- All existing rows in the order book at this level or lower are to be pushed down. If there were already five price levels then the last price level should be deleted.
- There is no explicit instruction to delete the bottom price level when inserting a new price level. The field “Price Level” is used to identify which price level is to be inserted. If it is set to one:
 - It is to be inserted at the top, regardless of the prices.
 - The subscriber’s application should check that there are no prices better than this price level and if they do exist then they should be deleted. This should not happen in normal operation.

Example 1: An order creates a new Best Bid.

Book State 1: Initial state of the book

Option Id= 123, Quote Condition = “<space>”

Bid (0 Market Orders)					Ask (0 Market Orders)			
Level	Price	Size	Cust	ProCust	Price	Size	Cust	ProCust
1	0.97	30	15	0	1.00	50	0	0
2	0.94	80	0	10				
3	0.92	60	0	0				
4	0.90	50	0	0				
5	0.88	10	0	0				

A new Professional Customer Buy Order 0.98 (70000) is added to the book. Note that the long form of the Depth Incremental Message is used because the Size and ProCust Size fields require 4 bytes to store the information.

Depth Incremental – Long Form Message

Name	Offset	Value	Hex Value
Message Type	0	“I”	49
Timestamp	1	9:45:12.123456789	1F EF 2D A5 5D 15
Option Id	7	123	00 00 00 7B
Quote Condition	11	“<space>”	20
Bid Market Order Size	12	0	00 00 00 00
Ask Market Order Size	16	0	00 00 00 00
Number of Depth Incrementals	20	1	01
Update Action	21	“N” (New)	4E

Depth Incremental – Long Form Message

Name	Offset	Value	Hex Value
Name	Offset	Value	Hex Value
Side	22	"B" (Bid)	42
Level	23	1	01
Price	24	0.98	00 00 26 48
Size	28	70000	00 01 11 70
Cust Size	32	0	00 00 00 00
ProCust Size	36	70000	00 01 11 70

Network byte stream of Depth Incremental message (in hex):

- 49 1F EF 2D A5 5D 15 00 00 00 7B 20 00 00 00 00 00 00 00 01 4E 42 01 00
00 26 48 00 01 11 70 00 00 00 00 00 01 11 70

The new row is inserted as price level 1 and all subsequent rows are pushed down. The old row 5 is deleted.

Book State 2: State of the book after the order is entered

Option Id= 123, Quote Condition = "<space>"

Bid (0 Market Orders)					Ask (0 Market Orders)			
Level	Price	Size	Cust	ProCust	Price	Size	Cust	ProCust
1	0.98	70000	0	70000	1.00	50	0	0
2	0.97	30	15	0				
3	0.94	80	0	10				
4	0.92	60	0	0				
5	0.90	50	0	0				

A.2 – Update Action = Change Price Level

If a Depth Incremental message is sent with "Update Action" set to "C" (Change), this would indicate:

- A change at the given price level.
- All fields on the specified side at the price level should be updated.

Example 2: An order at the top price level is partially executed. For this example the book's initial state is "Book State 2" above. The partial execution reduces the contracts from 70000 to 10.

Partial execution of 69990 contracts in top price level (10 contracts remaining).

Depth Incremental – Short Form Message

Name	Offset	Value	Hex Value
Message Type	0	"i"	69
Timestamp	1	9:45:13.234567891	1F EF 6F DF 92 D3
Option Id	7	123	00 00 00 7B
Quote Condition	11	"<space>"	20
Bid Market Order Size	12	0	00 00
Ask Market Order Size	14	0	00 00
Number of Depth Incrementals	16	1	01
Update Action	17	"C" (Change)	43

Depth Incremental – Short Form Message

Name	Offset	Value	Hex Value
Message Type	0	"i"	69
Side	18	"B" (Bid)	42
Name	Offset	Value	Hex Value
Level	19	1	01
Price	20	0.98	00 62
Size	22	10 (new size)	00 0A
Cust Size	24	0	00 00
ProCust Size	26	10 (new size)	00 0A

Network byte stream of Depth Incremental message (in hex):

- 69 1F EF 6F DF 92 D3 00 00 00 7B 20 00 00 00 00 01 43 42 01 00 62 00 0A 00 00 00 0A

Book State 3: State of the book after the order is executed

Option Id= 123, Quote Condition = "<space>"

Bid (0 Market Orders)					Ask (0 Market Orders)			
Level	Price	Size	Cust	ProCust	Price	Size	Cust	ProCust
1	0.98	10	0	10	1.00	50	0	0
2	0.97	30	15	0				
3	0.94	80	0	10				
4	0.92	60	0	0				
5	0.90	50	0	0				

A.3 – Update Action = Delete Price Level

If a Depth Incremental message is sent with "Update Action" set to "D" (Delete), this would indicate:

- The indicated price level is to be deleted.
- All lower (worse) price levels move up.

If a Depth Incremental message is sent with "Update Action" set to "C" (Change), this would indicate:

- A change at the given price level.
- All fields on the specified side at the price level should be updated.

Example 3: The remaining quantity at the top price level of the bid side is deleted. For this example the book's initial state is "Book State 3" above.

Deletion of the top price level on the bid side (note that there no prices or sizes associated with the Delete action).

Depth Incremental – Short Form Message

Name	Offset	Value	Hex Value
Message Type	0	"i"	69
Timestamp	1	10:07:25.345678912	21 25 97 E2 06 40
Option Id	7	123	00 00 00 7B
Quote Condition	11	"<space>"	20
Bid Market Order Size	12	0	00 00

Depth Incremental – Short Form Message

Name	Offset	Value	Hex Value
Ask Market Order Size	14	0	00 00
Number of Depth Incrementals	16	1	01
Update Action	17	"D" (Delete)	44
Side	18	"B" (Bid)	42
Level	19	1	01

Network byte stream of Depth Incremental message (in hex):

- 69 21 25 97 E2 06 40 00 00 00 7B 20 00 00 00 01 44 42 01

Book State 4: State of the book after the top bid price level is deleted

Option Id= 123, Quote Condition = "<space>"

Bid (0 Market Orders)					Ask (0 Market Orders)			
Level	Price	Size	Cust	ProCust	Price	Size	Cust	ProCust
1	0.97	30	15	0	1.00	50	0	0
2	0.94	80	0	10				
3	0.92	60	0	0				
4	0.90	50	0	0				

A.4 – Update Action = Delete From Price Level

When a Depth Incremental message is sent with "Update Action" set to "F" (Delete From), this would indicate:

- All price levels starting at the indicated price level are to be deleted.
- This message can be used to clear the book on one side (Price Level = 1).

Example 4: Clear the book. For this example the book's initial state is "Book State 4" above.

A Depth Incremental message is sent to clear the book (note that there no prices or sizes associated with the Delete From action).

Depth Incremental – Short Form Message

Name	Offset	Value	Hex Value
Message Type	0	"i"	69
Timestamp	1	10:15:58.456789123	21 9D 0F B0 38 83
Option Id	7	123	00 00 00 7B
Quote Condition	11	"<space>"	20
Bid Market Order Size	12	0	00 00
Ask Market Order Size	14	0	00 00
Number of Depth Incrementals	16	2	02
Update Action	17	"F" (Delete From)	46
Side	18	"B" (Bid)	42
Level	19	1 (bid side_	01
Update Action	20	"F" (Delete From)	46
Side	21	"A" (Offer, Ask)	41
Level	22	1 (ask side)	01

Network byte stream of Depth Incremental message (in hex):

- 69 21 9D 0F B0 38 83 00 00 00 7B 20 00 00 00 02 46 42 01 46 41 01

The book is now cleared.

A.5 – Multiple Updates in one Depth Incremental Message

There can be multiple updates in one message. The bid is updated first, and in a rising market, the bid can overlap the offer before the offer is moved out of the way. The recipient must apply all items in the message before evaluating the resulting book.

NOTE: The price level changes as each update is applied within a message. For example, with two update actions: delete price level 3 followed by change price level 3:

- the first update to delete price level 3 results in row 4 being moved up to row 3
- the second update to change price level 3 results in a change to the new row 3 (old row 4)

Example 5: Multiple updates:

- the top level quotes are changed from: 0.97(15) x 1.00(50) to 1.00(50) x 1.02(50)
- a new bid price level 2 is added
- bid quotes on other levels are added

Book State 5: State of the book before the multiple updates in one message

Option Id= 123, Quote Condition = "<space>"

Bid (0 Market Orders)					Ask (0 Market Orders)			
Level	Price	Size	Cust	ProCust	Price	Size	Cust	ProCust
1	0.97	15	0	0	1.00	50	0	0
2	0.94	80	0	10				
3	0.92	60	0	0				
4	0.90	50	0	0				

A Depth Incremental message is sent to Delete the current quotes, insert new quotes and update existing quotes. (Lightly shaded rows indicate repeating Update Actions).

Depth Incremental – Short Form Message

Name	Offset	Value	Hex Value
Message Type	0	"I"	69
Timestamp	1	13:07:03.567891234	2A F3 17 FD 3B 22
Option Id	7	123	00 00 00 7B
Quote Condition	11	"<space>"	20
Bid Market Order Size	12	0	00 00
Ask Market Order Size	14	0	00 00
Number of Depth Incrementals	16	7	01
Update Action	17	"D" (Delete)	44
Side	18	"B" (Bid)	42
Level	19	1	01
Update Action	20	"N" (New)	4E
Side	21	"B" (Bid)	42
Level	22	1	01

Depth Incremental – Short Form Message

Name	Offset	Value	Hex Value
Price	23	1.00	00 64
Size	25	50	00 32
ProCust Size	27	0	00 00
Cust Size	29	0	00 00
Update Action	31	"D" (Delete)	44
Side	32	"A" (Ask, Offer)	41
Level	33	1	01
Update Action	34	"N" (New)	4E
Side	35	"A" (Ask, Offer)	41
Level	36	1	01
Price	37	1.02	00 66
Size	39	50	00 32
ProCust Size	41	0	00 00
Cust Size	43	0	00 00
Update Action	45	"N" (New)	4E
Side	46	"B" (Bid)	42
Level	47	2	02
Price	48	0.98	00 62
Size	50	30	00 1E
ProCust Size	52	0	00 00
Cust Size	54	0	00 00
Update Action	56	"C" (Change)	43
Side	57	"B" (Bid)	42
Level	58	3	03
Price	59	0.94	00 5E
Size	61	60	00 3C
ProCust Size	63	0	00 00
Cust Size	65	10	00 0A
Update Action	67	"C" (Change)	43
Side	68	"B" (Bid)	42
Level	69	5	05
Price	70	0.90	00 5A
Size	72	60	00 3C
ProCust Size	74	0	00 00
Cust Size	76	10	00 0A

Network byte stream of Depth Incremental message (in hex):

- 69 2A F3 17 FD 3B 22 00 00 00 7B 20 00 00 00 01 44 42 01 4E 42 01 00 64
00 32 00 00 00 00 44 41 01 4E 41 01 00 66 00 32 00 00 00 00 4E 42 02 00 62
00 1E 00 00 00 00 43 42 03 00 5E 00 3C 00 00 00 0A 43 42 05 00 5A 00 3C 00
00 00 0A

Book State 6: State of the book after the multiple updates on one message

Option Id= 123, Quote Condition = "<space>"

Bid (0 Market Orders)					Ask (0 Market Orders)			
Level	Price	Size	Cust	ProCust	Price	Size	Cust	ProCust
1	1.00	50	0	0	1.02	50	0	0
2	0.98	30	0	0				
3	0.94	80	0	10				
4	0.92	60	0	0				
5	0.90	60	10	0				

Appendix B – Sample Messages

Each message defined in this protocol has an example to clarify how the message is parsed. Some points to consider:

- The encapsulating protocol defines the message length, in bytes. This can be used as an aid to parsing the messages;
- The first byte of the message is always message type. Once the type of the message is known, the rest of the message can be parsed from the definitions of the messages.

Example 1 – System Event Message

At 9:30:00.123456789 am, the system sends a System Event message which announces a Start of Opening Process event for date April 23, 2017. The version of this interface is 1.0.

System Event Message

Name	Offset	Value	Hex Value
Message Type	0	"S"	53
Timestamp	1	9:30:00.123456789	1F 1A D6 35 BD 15
Event Code	7	"Q"	51
Current Year	8	2017	07 E1
Current Month	10	4	04
Current Day	11	23	17
Version	12	1	01
Sub-Version	13	0	00

Network byte stream (in hex):

- 53 1F 1A D6 35 BD 15 51 07 E1 04 17 01 00

Example 2 – Options Directory Message

At 6:30:00.234567891 am, the system sends an Options Directory message describing a tradable option having ID 85393 with the following properties: security symbol "OIH1", equity option, expiration date 1/20/2017, strike price \$29.10000000, type call option, underlying symbol "OIH", contract size 100, Option is Closing Position Only, normal closing hours, "Scaled" MPV, trading on the exchange on source 2.

Options Directory Message

Name	Offset	Value	Hex Value
Message Type	0	"D"	44
Timestamp	1	6:30:00.234567891	15 48 4A AB 48 D3

Options Directory Message

Name	Offset	Value	Hex Value
Option Id	7	85393	00 01 4D 91
Security Symbol	11	"OIH1"	4F 49 48 31 20 20
Expiration Year	17	2017	11
Expiration Month	18	1	01
Expiration Day	19	20	14
Strike Price	20	29.10000000	00 00 00 00 AD 73 13 80
Option Type	28	Call	43
Source	29	2	02
Underlying Symbol	30	"OIH"	4F 49 48 20 20 20 20 20 20 20 20 20 20
Trading Type	43	"E"	45
Contract Size	44	100	00 64
Option Closing Type	46	"N"	4E
Tradable	47	"Y"	59
MPV	48	"S"	53
Closing Only	49	"Y"	59

Network byte stream (in hex):

- 44 15 48 4A AB 48 D3 00 01 4D 91 4F 49 48 31 20 20 11 01 14 00 00 00 00 AD
73 13 80 43 02 4F 49 48 20 20 20 20 20 20 20 20 20 45 00 64 4E 59 53 59

Example 3 – Trading Action Message

At 1:51:45.234567891 pm, the system sends a Trading Action message indicating that option with id 85393 has been halted.

Trading Action Message

Name	Offset	Value	Hex Value
Message Type	0	"H"	48
Timestamp	1	13:51:45.234567891	2D 63 77 C7 62 D3
Option Id	7	85393	00 01 4D 91
Current Trading State	11	"H"	48

Network byte stream (in hex):

- 48 2D 63 77 C7 62 D3 00 01 4D 91 48

Example 4 – Security Open/Closed Message

At 9:30:00.345678912 am, the system sends a Security Open/Closed message indicating that option with id 85393 is open for auto execution.

Security Open/Closed Message

Name	Offset	Value	Hex Value
Message Type	0	""	4F
Timestamp	1	9:30:00.345678912	1F 1A E3 74 94 40
Option Id	7	85393	00 01 4D 91
Open State	11	"Y"	59

Network byte stream (in hex):

- 4F 1F 1A E3 74 94 40 00 01 4D 91 59

Example 5 –Opening Imbalance Message

At 9:28:35.987654321 am, the system sends an Opening Imbalance message indicating that option with id 85393 has 35 paired contracts with imbalance on the buy side with imbalance price of \$1.0000 and imbalance volume of 10 contracts.

Opening Imbalance Message

Name	Offset	Value	Hex Value
Message Type	0	"N"	4E
Timestamp	1	9:28:35.987654321	1F 07 3F 53 46 B1
Option Id	7	85393	00 01 4D 91
Paired Contracts	11	35	00 00 00 23
ImbalanceDirection	15	"B"	42
Imbalance Price	16	1.0000	00 00 27 10
Imbalance Volume	20	10	00 00 00 0A

Network byte stream (in hex):

- 4E 1F 07 3F 53 46 B1 00 01 4D 91 00 00 00 23 42 00 00 27 10 00 00 00 0A

Example 6 – Depth Incremental – Short Form

Sample messages are described in "Appendix A – Depth Incremental Message Examples" section.

Example 7 – Depth Incremental – Long Form

A sample message is described in "Appendix A – Depth Incremental Message Examples" section.

Example 9 – Ticker Message

At 3:58:44.891234567 pm, the system sends a Ticker message for option id 85393, last price \$1.1000, size 16, volume 127535, high \$1.8000, low \$0.9200, first \$1.0000.

Ticker Message

Name	Offset	Value	Hex Value
Message Type	0	"T"	54
Timestamp	1	15:58:44.891234567	34 51 0E B5 31 07
Option Id	7	85393	00 01 4D 91
Last Price	11	1.1000	00 00 2A F8
Size	15	16	00 00 00 10
Volume	19	127535	00 01 F2 2F
High	23	1.8000	00 00 46 50

Ticker Message

Name	Offset	Value	Hex Value
Low	27	0.9200	00 00 23 F0
First	31	1.0000	00 00 27 10
Trade Condition	35	"<blank>"	20

Network byte stream (in hex):

- 54 34 51 0E B5 31 07 00 01 4D 91 00 00 2A F8 00 00 00 10 00 01 F2 2F 00 00
46 50 00 00 23 F0 00 00 27 10 20

Example 10 – Snapshot Message

The last message of the Glimpse snapshot is a Snapshot message to complete the snapshot. In this example the final message of the snapshot indicates that the snapshot is complete and the recipient should process data on the live stream starting at Sequence Number 123456789 (i.e. the snapshot is a picture of the live stream from sequence 1 to 123456788 inclusive).

Snapshot Message

Name	Offset	Value	Hex Value
Message Type	0	"M"	4D
Sequence Number	1	00000000000123456789 (zero-padded ASCII number)	30 30 30 30 30 30 30 30 30 30 30 31 32 33 34 35 36 37 38 39

Network byte stream (in hex):

- 4D 30 30 30 30 30 30 30 30 30 30 30 30 30 31 32 33 34 35 36 37 38 39

Appendix C – Document Revision Control Log

September 13, 2016: Nasdaq Gemini/ISE/Mercury Depth of Market Feed - Version 1.00

- Initial specification..

October 12, 2016: Nasdaq ISE/Gemini/Mercury Depth of Market Feed - Version 1.01

- Fixed Trading Type enumeration in Option Directory Message.
- Glimpse includes ticker messages as part of the snapshot.

January 13, 2017: Nasdaq ISE/Gemini/Mercury Depth of Market Feed - Version 1.01

- Adjusted Start of Currency Opening Process enumeration from “W” to “F”.
- Clarifying intra-day removal of option impact on option directory message

April 19, 2017: Nasdaq ISE/GEMX/MRX Depth of Market Feed - Version 1.01

- Removing FX Opening System Event Enumeration as FX products will open at 9:30 with other options

May 30, 2017: Nasdaq ISE/GEMX/MRX Depth of Market Feed - Version 1.01

- Adding system event enumeration “W” for early close on expiration day of WCO (FX) options

June 13, 2017: Nasdaq ISE/GEMX/MRX Depth of Market Feed - Version 1.01

- Adjusting system start enumeration “O” Start of Messages to 12:30 AM

December 17, 2019: Nasdaq ISE/GEMX/MRX Depth of Market Feed - Version 1.02

- Updated the Start of Messages (System Event Code “O”) time to ~2:00 am.

November 3, 2022: Nasdaq ISE/GEMX Depth of Market Feed - Version 1.02

- Removed any reference to Nasdaq MRX (MRX)

January 9, 2023: Nasdaq ISE/Nasdaq GEMX Trade Feed – Version 1.0.3

- Version updated to 1.0.3
- Clarifying the Data Types: Added “2 byte Price fields are unsigned positive numbers. 4 and 8 byte Price fields are signed numbers.

June 2, 2023: Nasdaq ISE/GEMX Depth of Market Feed - Version 1.03

- Start of Messages(“O”) event start time changed from “After ~2am” to “After ~12am”