XDP DEPTH OF BOOK FEED CLIENT SPECIFICATION

NYSE ARCABOOK

Version	Date
1.10b	October 6, 2016

PREFACE

DOCUMENT HISTORY

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

VERSION	DATE	CHANGE DESCRIPTION
1.9a	03/17/2014	New message types: Add Order Attributed Messages (msg type '107') and Add Refresh Order Attributed Messages (msg type '108')
1.9b	04/14/2015	Removed OpenBook references
1.9c	12/18/2015	Removed references to NYSE & NYSE MKT exchanges Updated auction and imbalance information for Pillar architecture
1.10	04/08/2016	Updated execution messaging convention for Pillar
1.10a	07/28/2016	Clarified descriptions of fields in Imbalance message: ImbalanceQty, MarketImbalanceQty, AuctionType, ImbalanceSide
1.10b	10/6/2016	Corrected Imbalance message publication times in 1.2

REFERENCE MATERIAL

The following lists the associated documents, which either should be read in conjunction with this document or which provide other relevant information for the user:

- SFTI US Technical Specification
- SFTI US Customer Guide
- NYSE Symbology

CONTACT INFORMATION

Service Desk

- Telephone: +1 212 896 2830 (Option 4)
- Email: service.desk@nyse.com

FURTHER INFORMATION

For updated capacity figures, visit our capacity pages at: http://www.nyxdata.com/capacity

For details of IP addresses, visit our IP address pages at: https://www.nyse.com/publicdocs/nyse/data/IP_Addresses.xls

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1. XDP DEPTH OF BOOK FEED ORDER BOOK INFORMATION

1.1 OVERVIEW

The XDP Depth of Book feed provides real-time order by order view of the NYSE Arca's order book for all traded securities. The depth of book product includes the depth of book updates, the stock security status information, and Stock Imbalances. The data feed uses the push-based publishing model. This means that data will be published based on its availability. Once information is available, it will be published to clients.

1.2 ARCA PUBLICATION TIMES

All times are US Eastern Time

MSGTYPE	DESCRIPTION	NORMAL TRADING DAYS	EARLY CLOSING DAYS
100	Add Order Message	4:00am – 8:00pm	4:00am – 1:00pm
101	Modify Order Message	4:00am – 8:00pm	4:00am – 1:00pm
102	Delete Order Message	4:00am – 8:00pm	4:00am – 1:00pm
103	Execution Message	4:00am – 8:00pm	4:00am – 1:00pm
105	Imbalance Message	3:30am – 4:00pm	3:30am – 1:00pm
106	Order Book Add Order Refresh Message	4:00am – 8:00pm	4:00am – 1:00pm

1.3 CONTROL MESSAGE TYPES

MSGTYPE	DESCRIPTION
1	Sequence Number Reset
2	Time Reference Message
3	Symbol Index Mapping
10	Retransmission Request Message
11	Request Response Message
12	Heartbeat Response Message
13	Symbol Index Mapping Request Message
15	Refresh Request Message
31	Message Unavailable
32	Symbol Clear
33	Trading Session Change
34	Security Status Message
35	Refresh Header Message

1.4 REFRESH MESSAGE TYPES

MSGTYPE	DESCRIPTION

MSGTYPE	DESCRIPTION
35	Refresh Header Message
3	Symbol Index Mapping
105	Imbalance Message
34	Security Status Message
33	Trading Session Change
106	Order Book Add Order Refresh Message
108	Order Book Attributed Add Order Refresh Message

1.5 TRADING SESSIONS

SESSIONVALUE	DESCRIPTION	NYSE ARCA HOURS
1	Morning Hours	4:00am – 9:30am
2	National Hours	9:30am – 4:00pm 9:30am – 4:15pm (ETFs)
4	Late Hours	4:00pm – 8:00pm 4:15pm – 8:00pm (ETFs)

2. ORDER BOOK ADD ORDER MESSAGE – MSG TYPE '100'

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message: 31 Bytes
Msg Type	2	2	Binary	This field identifies the type of message '100' – Add Order Message
SourceTimeNS	4	4	Binary	This field represents the nanosecond offset from the time reference second in UTC time (EPOCH)
SymbolIndex	8	4	Binary	This field identifies the numerical representation of the symbol.
SymbolSeqNum	12	4	Binary	This field contains the symbol sequence number
OrderID	16	4	Binary	The Order ID identifies a unique order.
Price	20	4	Binary	This field contains the price point. Use the Price scale from the symbol-mapping index.
Volume	24	4	Binary	This field contains the order quantity in shares.
Side	28	1	ASCII	This field indicates the side of the order Buy/Sell. Valid values: ▪ 'B' – Buy ▪ 'S' – Sell
OrderIDGTCIndicator	29	1	Binary	This field specifies if Trade Order ID is a GTC order 0 – Day Order 1 – GTC Order
TradeSession	30	1	Binary	Valid values: ▪ 1 – Ok for morning hours ▪ 2 – Ok for national hours (core) ▪ 3 – OK for morning and core ▪ 4 – Ok for late hours ▪ 6 – OK for core and late ▪ 7 – OK for morning, core, and late

3. ORDER BOOK ATTRIBUTED ADD ORDER MESSAGE – MSG TYPE '107'

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message. 36 Bytes
Msg Type	2	2	Binary	This field identifies the type of message. 107 – Attributed Add Order Message
SourceTimeNS	4	4	Binary	This field represents the nanosecond offset from the time reference second in UTC time (EPOCH)
SymbolIndex	8	4	Binary	This field identifies the numerical representation of the symbol.
SymbolSeqNum	12	4	Binary	This field contains the symbol sequence number
OrderID	16	4	Binary	The Order ID identifies a unique order
Price	20	4	Binary	This field contains the price point. Use the Price scale from the symbol-mapping index.
Volume	24	4	Binary	This field contains the order quantity in shares
Side	28	1	ASCII	This field indicates the side of the order Buy/Sell. Valid values: ▪ 'B' – Buy ▪ 'S' – Sell
OrderIDGTCIndicator	29	1	Binary	This field specifies if Trade Order ID is a GTC order: ▪ 0 – Day Order ▪ 1- GTC Order
TradeSession	30	1	Binary	Valid values: ▪ 1 – Ok for morning hours ▪ 2 – Ok for national hours (core) ▪ 3 – OK for morning and core ▪ 4 – Ok for late hours ▪ 6 – OK for core and late ▪ 7 – OK for morning, core, and late
FirmID	31	5	Binary Integer	This field provides market participant's firm ID

4. ORDER BOOK MODIFY MESSAGE – MSG TYPE '101'

4.1 MESSAGE SENDING RULES

XDP Depth of Book feed sends this message when an order in the Order Book is modified. The Order ID refers to the original order sent in the add order message. The following events trigger a modify order message.

- The price of an order changes
- The size of an order changes
- An order is routed to an away market with some shares remaining in the Order Book

Note: If an away market declines a routed order, a Modify Order message is sent to "add" the declined shares back to Order Book.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message. 31 Bytes
Msg Type	2	2	Binary	This field identifies the type of message '101' – Modify Message
SourceTimeNS	4	4	Binary	This field represents the nanosecond offset from the time reference second in UTC time (EPOCH)
SymbolIndex	8	4	Binary	This field identifies the numerical representation of the symbol.
SymbolSeqNum	12	4	Binary	This field contains the symbol sequence number
OrderID	16	4	Binary	This identifies a unique order.
Price	20	4	Binary	This field contains the price point. Use the Price scale from the symbol mapping index.
Volume	24	4	Binary	This field contains the order quantity in shares
Side	28	1	ASCII	This field indicates the side of the order Buy/Sell. Valid values: 'B' – Buy 'S' – Sell
OrderIDGTCIndicator	29	1	Binary	This field specifies if Trade Order ID is a GTC order: ■ 0 – Day Order ■ 1 – GTC Order
ReasonCode	30	1	Binary	Modify Reason: ■ 5 – Change (lost position in book) ■ 6 – Routed (keep position in book) ■ 7 – Modify Fill keep position Note: This field may a future enhancement. The default value is currently 0, and should be disregarded.

5. ORDER BOOK DELETE MESSAGE – MSG TYPE '102'

5.1 MESSAGE SENDING RULES

XDP Depth of Book feed sends this message when an order is taken off of the order book. The following events will trigger the transmission of a delete order message.

- An order is cancelled
- An order expires
- An order is routed to an away market. Note: If the away market declines the matching engine preference, an Add Order message with the original Order ID will be sent to return the order to the Order Book

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message. 23 Bytes
Msg Type	2	2	Binary	This field identifies the type of message 102 – Delete Message
SourceTimeNS	4	4	Binary	This field represents the nanosecond offset from the time reference second in UTC time (EPOCH)
SymbolIndex	8	4	Binary	This field identifies the numerical representation of the symbol.
SymbolSeqNum	12	4	Binary	This field contains the symbol sequence number.
OrderID	16	4	Binary	The Order ID identifies a unique order.
Side	20	1	ASCII	This field indicates the side of the order Buy/sell. Valid values: 'B' – Buy 'S' – Sell
OrderIDGTCIndicator	21	1	Binary	This field specifies if Trade Order ID is a GTC order: 0 – Day Order 1 – GTC Order
ReasonCode	22	1	Binary	Delete Reason: ■ 1 – User Cancel ■ 2 – Modify (taken off book, Order ID may add again) ■ 3 – Delete Filled Note: This field may a future enhancement. The default value is currently 0, and should be disregarded.

6. ORDER BOOK EXECUTION MESSAGE – MSG TYPE '103'

6.1 MESSAGE SENDING RULES

If the reason codes are set to zero, signifying that this feature has not yet been implemented, the feed will disseminate the following:

1. In the event an order is partially filled, the data feed will first send an execution message followed by a modify message for the OrderID that has been partially executed. In the event an order receives multiple partial fills in the same transaction, the data feed will send one execution message for each partial fill and a single modify following the final partial fill, which aggregates all the partial fills.
2. In the event an order is fully executed, the data feed will first send an execution message followed by a delete for the OrderID that has been fully executed. In the event an order receives multiple partial fills followed by a full fill in the same transaction, the data feed will send one execution message for each partial fill and a delete following the final full execution.

If the reason codes are not to zero, then the data feed will only send the execution message with the appropriate reason code when a trade occurs.

3. In the event an order is partially filled, the execution message will show a reason code value of "7" requiring that the corresponding OrderID should have its volume reduced by the volume amount on the execution message.
4. In the event an order is fully executed, the data feed will send an execution message with a reason code value of "3". The corresponding OrderID should then be removed from the book since the volume has been fully executed.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message: 34 Bytes
Msg Type	2	2	Binary	This field identifies the type of message 103 – Execution Message
SourceTimeNS	4	4	Binary	This field represents the nanosecond offset from the time reference second in UTC time (EPOCH)
SymbolIndex	8	4	Binary	This field identifies the numerical representation of the symbol.
SymbolSeqNum	12	4	Binary	This field contains the symbol sequence number
OrderID	16	4	Binary	The Order ID identifies a unique order.
Price	20	4	Binary	This field contains the price the order execution price. Use the Price scale from the symbol mapping index.
Volume	24	4	Binary	This field contains the order quantity in shares
OrderIDGTCIndicator	28	1	Binary	This field specifies if executed Order is a GTC order. Valid values: 0 – Day Order 1 – GTC Order

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
ReasonCode	29	1	Binary	Execution Reason: ■ 0 – Default ■ 3 – Filled ■ 7 – Partial Fill (Did not lose position) Note: This field may a future enhancement. The default value is currently 0, and should be disregarded.
TradeID	30	4	Binary	The TradeID identifies a unique transaction in the matching engine and allows clients to correlate execution reports to the last sale.

7. ORDER BOOK ADD ORDER REFRESH MESSAGE – MSG TYPE ‘106’

7.1 MESSAGE SENDING RULES

NYSE Depth of Book feed sends this message only during a refresh or after a symbol clear which will result in a book refresh.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message. 35 Bytes
Msg Type	2	2	Binary	This field identifies the type of message 106 – Add Order Refresh Message
SourceTime	4	4	Binary	This field specifies the time when the msg was generated in the order book. The number represents the number of seconds in UTC time (EPOCH)
SourceTimeNS	8	4	Binary	This field represents the nanosecond offset from the time reference second in UTC time (EPOCH)
SymbolIndex	12	4	Binary	This field identifies the numerical representation of the symbol.
SymbolSeqNum	16	4	Binary	This field contains the symbol sequence number.
OrderID	20	4	Binary	The Order ID identifies a unique order.
Price	24	4	Binary	This field contains the price point. Use the Price scale from the symbol-mapping index.
Volume	28	4	Binary	This field contains the order quantity in shares.
Side	32	1	ASCII	This field indicates the side of the order buy/sell. Valid values: ‘B’ – Buy ‘S’ – Sell
OrderIDGTCIndicator	33	1	Binary	This field specifies if Trade Order ID is a GTC order: 0 – Day Order 1 – GTC Order
TradeSession	34	1	Binary	Valid values: ▪ 1 – Ok for morning hours ▪ 2 – Ok for national hours (core) ▪ 3 – OK for morning and core ▪ 4 – Ok for late hours ▪ 6 – OK for core and late ▪ 7 – OK for morning, core, and late

8. ORDER BOOK ATTRIBUTED ADD ORDER REFRESH MESSAGE – MSG TYPE '108'

7.1 MESSAGE SENDING RULES

NYSE Arca Depth of Book feed sends this message only during a refresh or after a symbol clear which will result in a book refresh.

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	Size of the message. 40 Bytes
Msg Type	2	2	Binary	This field identifies the type of message. 108 – Attributed Add Order Refresh Message
SourceTime	4	4	Binary	This field specifies the time when the msg was generated in the order book. The number represents the number of seconds in UTC time (EPOCH)
SourceTimeNS	8	4	Binary	This field represents the nanosecond offset from the time reference second in UTC time (EPOCH)
SymbolIndex	12	4	Binary	This field identifies the numerical representation of the symbol.
SymbolSeqNum	16	4	Binary	This field contains the symbol sequence number
OrderID	20	4	Binary	The Order ID identifies a unique order.
Price	24	4	Binary	This field contains the price point. Use the Price scale from the symbol-mapping index.
Volume	28	4	Binary	This field contains the order quantity in shares
Side	32	1	ASCII	This field indicates the side of the order Buy/sell. Valid values: ■ 'B' – Buy ■ 'S' – Sell
OrderIDGTCIndicator	33	1	Binary	This field specifies if Trade Order ID is a GTC order ■ 0 – Day Order ■ 1 – GTC Order
TradeSession	34	1	Binary	Valid values: ■ 1 – Ok for morning hours ■ 2 – Ok for national hours (core) ■ 3 – OK for morning and core ■ 4 – Ok for late hours ■ 6 – OK for core and late ■ 7 – OK for morning, core, and late
FirmID	35	5	Binary	This field provides market participant's firm ID

9. IMBALANCE MESSAGE– MSG TYPE ‘105’

FIELD NAME	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Msg Size	0	2	Binary	The size of the message: 52 Bytes
Msg Type	2	2	Binary	The type of message. 105 – Imbalance 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 Source Time
SymbolIndex	12	4	Binary	The ID of the symbol in the Symbol Index msg
SymbolSeqNum	16	4	Binary	The sequence number of this message in the set of all messages for this symbol
IndicativeMatchPrice	20	4	Binary	The best price at which the maximum volume of shares is executable in the applicable auction, subject to Auction Collars. It includes the non-displayed quantity of Reserve Orders. See Section 8.2 for further details.
PairedQty	24	4	Binary	The number of shares paired off at the Indicative Match Price
TotalImbalanceQty	28	4	Signed Binary	The total imbalance quantity at the Indicative Match Price. If the value is negative, the imbalance is on the Sell side, otherwise, the Buy side.
MarketImbalanceQty	32	4	Signed Binary	The total market order imbalance at the Indicative Match Price. If the value is negative, the imbalance is on the Sell side, otherwise, the Buy side.
AuctionTime	36	2	Binary	Projected Auction Time (hhmm)
AuctionType	38	1	ASCII	■ ‘O’ – Early Opening Auction ■ ‘M’ – Core Opening Auction ■ ‘H’ –Trading Halt Auction ■ ‘C’ – Closing Auction
ImbalanceSide	39	1	ASCII	This field indicates the side of the imbalance Buy/sell. Valid Values: ■ ‘B’ – Buy ■ ‘S’ – Sell Space – No imbalance Future enhancement. Currently defaulted to 0.
ContinuousBook ClearingPrice	40	4	Binary	Not supported, defaulted to 0.
ClosingOnly ClearingPrice	44	4	Binary	Not supported, defaulted to 0.
SSRFilingPrice	48	4	Binary	Not supported, defaulted to 0.

NYSE ARCA IMBALANCE CALCULATION

NYSE Arca conducts three single-price auctions during the day: the Early Opening Auction, the Core Opening Auction and the Closing Auction. As a part of the auction process, the indicative match price, matched volume, total imbalance, and market imbalance are disseminated every second if there is any change from the previous second.

NYSE Arca Auction-Eligible Securities

AUCTION TYPES	ELIGIBLE SECURITIES
Early Opening Auction Core Opening Auction Closing Auction	■ NYSE Arca-listed securities ■ UTP securities designated as eligible by the NYSE Group
Trading Halt Auctions	■ NYSE Arca-listed securities

MESSAGE TYPE	DESCRIPTION
Early Opening Auction	**Interest Included** 1. Limit Orders designated for the Early Trading Session. 2. During the last minute before the Early Opening Auction time, the non-displayed quantity of Reserve Orders designated for the Early Open Auction is included in the Matched Volume and Total Imbalance Volume. **Order Cancellation** Orders can be cancelled at any time up to the conclusion of the auction. **Calculation** ■ The Early Opening Auction occurs at the Indicative Match Price. ■ If two or more prices can maximize executable volume, the Early Opening Auction occurs at whichever price is closest to the previous Official Closing Price in an effort to maintain continuity. Unexecuted orders become eligible for the Opening Session immediately upon conclusion of the Early Opening Auction.
Core Opening Auction	**Interest Included** 1. Limit, Market, MOO, LOO and Primary Peg orders 2. During the last 5 seconds before the Core Opening Auction time, the non-displayed quantity of Reserve Orders is included in the Matched Volume and Total Imbalance Volume. **Order Cancellation**

<table>
<tr><th>MESSAGE TYPE</th><th>DESCRIPTION</th></tr>
<tr><td></td><td>Orders can be cancelled any time during the auction, except for MOO and LOO orders which can be cancelled only up to 1 minute before the conclusion of the auction.

Calculation

■ The match price is the price that maximizes the volume that can be executed.

If two or more prices can maximize executable volume, in an effort to maintain continuity the Core Opening Auction occurs at whichever price is closest to the the midpoint of the Auction NBBO. See Rule 7.35P for more detail.</td></tr>
<tr><td>Closing Auction</td><td>Interest Included

1. Limit, Market, MOC, LOC and Primary Peg orders
2. During the last minute before the Closing Auction time, the non-displayed quantity of Reserve Orders is included in the Matched Volume and Total Imbalance Volume.

Calculation

■ Orders will be executed in the Closing Auction at the Indicative Match Price

Further rules for NYSE Arca

■ If there are multiple prices at which the total imbalance can equally execute, the indicative price will be based on the price closest to the Consolidated Tape last sale.

If the price closest to the Consolidated Tape last sale would trade through the NYSE Arca Book, the indicative match price will be the best price available where no trade through occurs.</td></tr>
</table>

7.2 NYSE ARCA PUBLICATION TIMES

Imbalance updates are published in real time during the following time periods

AUCTION TYPE	NYSE ARCA
Early Opening Auction	3:30 a.m. ET - 4:00 a.m. ET
Core Opening Auction	8:00a.m. ET - 9:30 a.m. ET
Closing Auction	3:00 p.m. ET - 4:00 p.m. ET

9. PRODUCT ID

EXCHANGE	PRODUCT ID	DESCRIPTION
NYSE Arca	151	NYSE ArcaBook