Lightspeed Book Engine

Protocol Specification

Version 1.04

October 25, 2016

All messages are text based in order to ensure human readability.

End Of Message (EOM) is a Line Feed (ASCII code 0x0a) or optionally a Carriage Return and Line Feed (ASCII codes 0x0d and 0x0a, respectively); both of these EOM indicators should be accounted for in client code.

Fields within a message are separated by "|" (ASCII code 0x7c)

Messages will be transmitted through standard TCP/IP sockets.

ECN's all use the same message formats, with differentiation occurring via the Participant ID field.

Participant ID is that ECN from which the client is receiving messages. If your implementation chooses to use the same procedure for multiple ECN messages, you may choose to switch your routine handling off the Participant ID field.

ECN	Participant ID
Arca	ARCA
Bats	BATS
Direct Edge	EDGA
Direct Edge	EDGX
Nasdaq	INET

Message Semantics:

ECN messages will follow the following semantics:

- Client applications subscribe to data for a particular symbol using the SS (symbol subscribe) message.
- Client applications unsubscribe to data for a particular symbol using the SQ (symbol quit) message.
- Additions to a book will only occur via EA (ecn addition) messages.
- Changes to existing orders on the book occur via ER (ecn revision) messages. Orders are not removed from the book by this message, even if Shares is zero.
- Orders revised by ER may or may not have their time priority on the book reset. If the priority is reset, the order must be moved to the bottom of its price level.
- EX (ecn cancellation) always removes entire orders from the book.
- Order executions occur via EE (ecn execution) messages. Partial executions are possible via the EE message, thus the Client Application must keep track of the shares on the book and remove the order when shares reaches zero. Upon removal in this case, a corresponding EX message is not transmitted.
- EC (ecn cleared) triggers a removal of all orders from the book. This message is used to reset the book and indicates intent to eventually transmit a replacement snapshot. A corresponding ES (ecn end snapshot) message will be transmitted after this snapshot.
- Hidden order executions are indicated by ET (ecn trade) messages.

Message Timestamps:

In addition, EA (ecn addition), EE (ecn execution), ER (ecn revision), ET (ecn trade notify), and EX (ecn cancellation) messages carry a timestamp. For EA messages, the timestamp indicates the time priority placement of the order. For all other messages, the timestamp is the time the particular event occurred.

Messages transmitted by Customer Application to Server:

[VI] Validate and Version Information

When connecting to any of the price servers the first message sent should be the VI message. All of the servers will now require this message and will not send any data without verifying the login information. Doing this allows the programming support team to assist you in debugging your problems. In response the client will receive a message if the login succeeded (“VA”) or failed (“VX”).

Customer Application to Server

Field	Description		Value
1	Message ID	Message type indicator	Text “VI”
2	User ID	Assigned User ID	Text
3	Password	Password for trader	Text
4	App Version	Application Version	Text

Heartbeats:

Customer Application to Server

Field	Description		Value
1	Message ID	Message type indicator	Text _h
2	Server Timestamp	Timestamp sent in heartbeat message by the server	Timestamp
3	Customer Timestamp	Local timestamp sent in response to server heartbeat request	Timestamp

[SS] Symbol Subscription

Subscribe to receive information on a given security.

Customer Application to Server

Field	Description		Value
1	Message ID	Message type indicator	Text “SS”
2	Stock Symbol	Security’s ticker symbol	Text
3	Participant ID	Participant ID of the ECN	Text

[SQ] Symbol Quit

Quit receiving ECN book messages. A successful quit results in no more EA (ecn addition), EX (ecn cancellation), ER (ecn revision), EE (ecn execution) or EC (ecn cleared) messages being sent to the Customer Application. There is no acknowledgement on sending an SQ (symbol quit) message.

Customer Application to Server

Field	Description		Value
1	Message ID	Message type indicator	Text “SQ”
2	Stock Symbol	Security’s ticker symbol	Text

3	Participant ID	Participant ID of the ECN	Text

[iS] Imbalance Subscription

Subscribe to receive information for all Imbalances (**ARCA** & **INET** only at this time)

Customer Application to Server

Field	Description		Value
1	Message ID	Message type indicator	Text "iS"
2	Participant ID	Participant ID of the ECN	Text

[iQ] Symbol Quit

Quit receiving Imbalance messages.

Customer Application to Server

Field	Description		Value
1	Message ID	Message type indicator	Text "iQ"
2	Participant ID	Participant ID of the ECN	Text

Messages transmitted by Server to Customer Application:

[VA] Validate Approved

Response to "VI" message Approved the identification will result in this message. After receiving this message, the client can send subscription messages.

Server to Customer Application

Field	Description		Value
1	Message ID	Message type indicator	Text "VA"
2	Venue	Venue connected to	Text
3	Text	Free form text	Text

[VX] Validate Rejected

Response to "VI" message. Rejected the identification will result in this message. After receiving this message any subscription message the client sends will return nothing.

Server to Customer Application

Field	Description		Value
1	Message ID	Message type indicator	Text "VX"
2	Venue	Venue connected to	Text
3	Text	Free form text	Text
4	Text	Free form text	Text

[&E] Error Message

Response to "SS" message. Any errors in syntax with communication to the server will result in this message.

Field	Description		Value
1	Message ID	Message type indicator	Text "&E"
2	Error	Free Form text	Text

Heartbeat Messages

Heartbeat messages have been introduced to maintain the health of a socket connection. Heartbeat messages are specific to the stream the client is reading, and are not system-wide. It is a requirement of the customer application to respond to all heartbeats sent by the server.

Server to Customer Application

Field	Description		Value
1	Message ID	Message type indicator	Text _H
2	Server Timestamp	Timestamp sent in heartbeat message by the server	Timestamp

[EA] ECN Addition

Addition of a specified quote in a given symbol to an ECN's book.

Field 8 (Timestamp) indicates the time priority of the order. This is either the time the order entered the book, or the time the order's priority was reset due to an ER (ecn revision) message. In either case, it indicates the time at which the order entered force at its current priority.

Field 9 (MMID) is an optional field that is only present if the vendor flagged the order as attributable.

Server to Customer Application

Field	Description		Value
1	Message ID	Message type indicator	Text "EA"
2	Participant ID	Participant ID	Text
3	Stock Symbol	Security's ticker symbol	Text
4	Buy/Sell	Side of the Book	Text
5	Order ID	Order ID of the quote	Text
6	Shares	Shares added to the book	Number
7	Price	Price at which quoted	Price
8	Timestamp	Time priority	Timestamp
9	MMID	Market Maker ID (Optional)	Text

[EC] ECN Book Cleared

The book has been cleared on the ECN side, all past orders for this security are now closed. This message is commonly sent when the server is cycled, a line to an ECN goes down, or when market data is sluggish. The security remains subscribed and a snapshot will be issued when data becomes reliable again.

Customer Application to Server

Field	Description		Value
1	Message ID	Message type indicator	Text "EC"
2	Participant ID	Participant ID of the ECN	Text
3	Stock Symbol	Security's ticker symbol	Text

[EE] ECN Execution

Report of a Full or Partial Fill of a specific order from an ECN's book.

If the remaining shares after execution is zero, the order is removed from the book and a corresponding EX (ecn cancellation) message will not be transmitted.

Server to Customer Application

Field	Description		Value
1	Message ID	Message type indicator	Text "EE"
2	Participant ID	Participant ID	Text
3	Stock Symbol	Security's ticker symbol	Text
4	Buy/Sell	Side of the Book	Text
5	Order ID	Order ID of the quote	Number
6	Shares Executed	Shares filled out of order ID	Number
7	Time Stamp	Execution Time	Timestamp

[ER] ECN Revision

Changes any or all characteristics of an order currently on an ECN's book.

If the revision changes price or increases the number of shares bid or offered, the order loses its priority and falls to the bottom of the price level. This behavior is explicitly indicated by the Priority Reset Flag to reduce ambiguity.

If the remaining shares after revision is zero, the order is not removed from the book.

Server to Customer Application

Field	Description		Value
1	Message ID	Message type indicator	Text "ER"
2	Participant ID	Participant ID	Text
3	Stock Symbol	Security's ticker symbol	Text
4	Buy/Sell	Side of the Book	Text
5	Order ID	Order ID of the quote	Number
6	Shares	Shares added to the book	Number
7	Price	Price at which quoted	Price

8	Priority Reset	Indicates if order lost priority due to revision	Text
9	Timestamp	Revision time	Timestamp

[ES] ECN End Snapshot

Indicates end of EA (ecn addition) messages for orders currently on the Server book. All following messages for the given stock will be real-time. The Server always transmits exactly one ES (ecn end snapshot) for each SS (symbol subscribe) message transmitted by the Customer Application, except in the case that the symbol doesn 't exisit at which time you will receive an error message "&E".

Customer Application to Server

Field	Description		Value
1	Message ID	Message type indicator	Text "ES"
2	Participant ID	Participant ID of the ECN	Text
3	Stock Symbol	Security's ticker symbol	Text

[ET] ECN Trade Notify

Report of an execution that occurred on an order not visible in an ECN's book.
For some trade notifications, the side of the trade may not be known. For these messages, 'X' will be transmitted for Field 4 (Buy/Sell). See Appendix B, BuySell Indicator table.

Server to Customer Application

Field	Description		Value
1	Message ID	Message type indicator	Text "ET"
2	Participant ID	Participant ID	Text
3	Stock Symbol	Security's ticker symbol	Text
4	Buy/Sell	Side of the Book	Text
5	Price	Price of Matched Order	Price
6	Shares Executed	Shares filled out of order ID	Number
7	Time Stamp	Execution Time	Timestamp

[EX] ECN Cancellation

Removal of a specific order from an ECN's book.

Server to Customer Application

Field	Description		Value
1	Message ID	Message type indicator	Text "EX"
2	Participant ID	Participant ID	Text
3	Stock Symbol	Security's ticker symbol	Text
4	Buy/Sell	Side of the Book	Text
5	Order ID	Order ID of the quote	Text
6	Shares	Shares being cancelled	Number

7	Time Stamp	Cancellation time	Timestamp

[AI] NYSE Arca Imbalance Message

NYSE Arca Imbalance.

Server to Customer Application

Field	Description		Value
1	Message ID	Message type indicator	Text "AI"
2	Stock Symbol	Security's ticker symbol	Text
3	ReferencePrice	The Reference Price is the Last Sale if the last sale is at or between the current best quote. Otherwise the Reference Price is the Bid Price if last sale is lower than Bid price, or the Offer price if last sale is higher than Offer price.	Price
4	PairedQty	This field contains the paired off quantity at the reference price point.	Number
5	TotalImbalanceQty	This field contains the total imbalance quantity at the reference price point.	Number
6	MarketImbalanceQty	This field indicates the total market order imbalance at the reference price Note: For NYSE Arca, positive or negative Imbalance Quantities denote a Buy or Sell imbalance, respectively.	Number
7	AuctionType	'O' – Open (4am) Arca Only 'M' – Market (9:30am) 'H' – Halt 'C' – Closing 'R' – Regulatory Imbalance	Text
8	ImbalanceSide	This field indicates the side of the imbalance Buy/sell. Valid Values: 'B' – Buy 'S' – Sell Space – No imbalance **Note:** This field is a future enhancement for NYSE Arca and will have a '0' value until such time. **Note:** This field is not yet implemented and is left as a future release. Clients will be notified upon availability.	Text
9	Time Stamp	Time when the msg was generated in the book.	Timestamp

[NI] INET Imbalance Message (NOII – Net Order Imbalance Indicator)

INET Imbalance.

Server to Customer Application

Field	Description		Value
1	Message ID	Message type indicator	Text “NI”
2	Stock Symbol	Security’s ticker symbol	Text
3	PairedShares	The total number of shares that are eligible to be matched at the Current Reference Price.	Number
4	ImbalanceShares	The number of shares not paired at the Current Reference Price.	Number
5	ImbalanceDirection	The market side of the order imbalance. “B” = buy imbalance “S” = sell imbalance “N” = no imbalance “O” = Insufficient orders to calculate	Text
6	FarPrice	A hypothetical auction-clearing price for cross orders only.	Price
7	NearPrice	A hypothetical auction-clearing price for cross orders as well as continuous orders.	Price
8	CurrentRefPrice	The price at which the NOII shares are being calculated.	Price
9	CrossType	The type of NASDAQ cross for which the NOII message is being generated “O” = NASDAQ Opening Cross “C” = NASDAQ Closing Cross “H” = Cross for IPO and halted / paused securities	Text
10	PriceVariationIndicator	This field indicates the absolute value of the percentage of deviation of the Near Indicative Clearing Price to the nearest Current Reference Price. “L” = Less than 1% “1” = 1 to 1.99% “2” = 2 to 2.99% “3” = 3 to 3.99% “4” = 4 to 4.99% “5” = 5 to 5.99% “6” = 6 to 6.99% “7” = 7 to 7.99% “8” = 8 to 8.99% “9” = 9 to 9.99% “A” = 10 to 19.99% “B” = 20 to 29.99% “C” = 30% or greater Space = Cannot be calculated	Test
11	Time Stamp	Time when the msg was generated in the book.	Timestamp

Appendix A - Data Types

Type	Description
Number	An unsigned integer. In some cases, the number may be prefixed by a letter used to distinguish fields visually
Text	Alphanumeric (space converted to underscore)
Price	An unsigned number, integer or decimal, no length or format requirements other than a decimal point should be proceeded by a number. In some cases, the price may be prefixed by a letter used to help distinguish the field when visually debugging the market data stream. Examples (all are valid prices): 4 15 3001.25 05.402 105.0
Timestamp	An unsigned integer representing the number of milliseconds past Midnight standard local time. This is Eastern Standard Time (UTC –0500) or Eastern Daylight Time (UTC –0400), according to local daylight savings time rules.
Imbalance	An unsigned integer with optional prefix. This field is prefixed by an 'S' to indicate sell-side imbalance or a 'B' to indicate buy-side imbalance. If there is no imbalance, this field has no prefix and value 0.

Appendix B - Field Definitions

Buy/Sell Indicator

Value	Description
B	Buy
S	Sell
X	Do not know (this indicator only occurs in ET [ECN Trade] messages)

Priority Reset Indicator

Value	Description
T	Order lost its priority.
F	Order kept its priority.
X	It is not known whether the order lost or kept its priority.

Revision History

1.00	8/24/2010	Initial version of this document
1.01	10/26/2010	Changed semantics in regards to EX message
1.02	08/03/2015	Added Arca Imbalance message "AI"
1.03	03/14/2016	Modified "VA" message to sync with source code
1.04	10/25/2016	Added INET (NOII) Imbalance message "NI"