US Equities
TOP Specification

Version 1.3.1

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Contents

1 Introduction

1.1 Overview

Cboe members may use the TOP protocol to receive real-time top of book quotations direct from Cboe. Market data received through TOP is more timely than obtaining the same data via the consolidated feed. The TOP protocol offers approximately 66% reduction in the number of events and 84% reduction in the number of bytes of application data sent, compared to the Cboe TCP PITCH protocol.

The quotations received via TOP provide an aggregated size and do not indicate the size or number of individual orders at the best bid or ask. Hidden orders (FIX 9479=I) are not represented in TOP. The TOP protocol also provides last trade price and size and cumulative volume data.

Note that this specification will be the standard TOP specification to be used for Cboe BYX Exchange, BZX Exchange, EDGA Exchange and EDGX Exchange platforms within the NY5 data center.

Complete depth of book market data can be received via the Cboe PITCH protocol.

TOP cannot be used to enter orders. For order entry, refer to the appropriate Cboe FIX Specification.

1.2 Typography

Example messages are shown in a `constant width` typeface. Some invisible ASCII characters are shown using special characters:

- Space (0x20); shown as an underscore: "_"
- New line (0x0A); shown as "«"

1.3   Data Types

The data types used are similar to the data types used in Cboe PITCH.

- **Numeric** fields are a string of ASCII digits, right justified and zero filled on the left. For example, for a six place numeric field, `000123` represents 123.
- **Alpha** and **Alphanumeric** fields are left justified and space padded on the right. For example, for a six place alpha field for symbol ZVZZT is represented as `ZVZZT_`.
- **Prices** are decimal with either long form (6 whole number digits followed by 4 decimal digits) or short form (3 whole number digits followed by 2 decimal digits). The whole number portion is zero filled on the left; the decimal portion is zero filled on the right. The decimal point is implied by position and does not explicitly appear in the field. For a long form price, `0000123400` represents 12.34. For a short form price, `01234` represents 12.34.
- **Boolean** fields contain either "`Y`" or "`N`".
- **Timestamp** fields are 8 whole number milliseconds past midnight, Eastern Time, right justified and zero filled on the left, with no decimal point. For example, `32483556` represents 9:01:23.556 am.

2 Protocol

2.1 Message Format

The TOP data feed is comprised of a series of fixed-length, line-oriented, unsequenced messages. The length of each message is dependent upon the message type. Each message consists of non-control ASCII bytes.

3   Sessions

The client connects to an assigned host and port using a TCP/IP socket.

3.1   Connectivity

IP Address	Address to connect to.	Supplied by Cboe.
TCP Port	Port to connect to.	Supplied by Cboe.
Password	Sent upon initial successful connection.	Supplied by Cboe.

For information on connectivity options to Cboe, refer to the Cboe US Equity/Options Connectivity Manual.

3.2   Logon

Upon connection, the member must send a **Logon** message. The message indicates whether the member would like a spin of the current top of book for all symbols. The server will respond with either a **Logon Accepted** or **Logon Rejected** message. If a spin was requested, a **Spin** message is sent for each symbol, followed by a **Spin Done** message. If updates occur *during* the spin, you will receive **Seconds**, **Milliseconds**, **Long/Short Bid Update**, **Long/Short Ask Update**, **Long/Short Two-Sided Update**, and **Long/Short Trade** messages *before* receiving the **Spin Done** message. Seconds and Milliseconds messages are used to interleave timestamp information between messages, preventing duplicate timestamp information from being embedded in multiple messages.

3.3   Heartbeat

The client must send **Client Heartbeat** messages once per second. If a client heartbeat isn't received for five seconds, the connection is terminated. The server will send **Server Heartbeat** messages once per second if no other messages have been sent in the last second.

4 Logon Related Messages

4.1 Logon Message (Client)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"L"	Logon message
Username	1	6	Alphanumeric	Username, assigned by Cboe
Password	7	10	Alphanumeric	Password, assigned by Cboe
Spin Flag	17	1	Boolean	If "Y", spin current top of book
\n	18	1	\n	End of message

4.2 Logon Accepted (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"C"	Logon Accepted message
\n	1	1	\n	End of message

4.3 Logon Rejected (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"J"	Logon Rejected message
Reject Reason	1	1	Alpha	"A" = Authentication or authorization problem (currently the only reason sent)
\n	2	1	\n	End of message

4.4 Example

Successful login:

```
L A B C _ _ _ p a s s _ _ _ _ _ _ Y «
C «
```

Rejected login:

```
L A B C _ _ _ p a s s _ _ _ _ _ _ Y «
J A «
```

5 Spin Related Messages

5.1 Spin Message (Server)

If a spin was requested in the **Logon** message, spin messages will be sent for any symbol which has had a visible order placed for it that day. If the connection is established prior to market open, no orders will have been placed and zero spin messages will be sent. If a symbol has had orders that day but currently has no orders, a spin message will be sent with zero price and quantity for each side. If a symbol has a one sided quote, zero price and quantity will be sent for the side which has no orders.

The timestamp reflected in the Spin message is the time at which the update to the top of book occurred, *not* the time when the Spin message was sent to the member.

5.1.1 Expanded Spin Message (Server)

The following **expanded** version of the Spin Message (server) has been made available to accommodate larger symbol sizes possible through the ISRA plan.

Field Name	Offset	Length	Value	Description
Message Type	0	1	"s"	Spin message
Timestamp	1	8	Timestamp	Time of top of book update; milliseconds since midnight, Eastern time
Symbol	9	8	Alpha	Symbol
Bid Price	17	10	Price	Bid price; 0 if no bids
Bid Quantity	27	6	Numeric	Bid quantity; 0 if no bids
Ask Price	33	10	Price	Ask price; 0 if no offers
Ask Quantity	43	6	Numeric	Ask quantity; 0 if no offers
Last Trade Time	49	8	Timestamp	Time of last trade; milliseconds since midnight, Eastern time
Last Trade Price	57	10	Price	Last trade price; 0 if no trades
Last Trade Size	67	6	Numeric	Last trade size; 0 if no trades
Cumulative Volume	73	9	Numeric	Cumulative volume executed today; 0 if no trades
Halt Status	82	1	Alpha	"H" = Halted "T" = Trading
Reg SHO Action	83	1	Alpha	"0" = No price test in effect "1" = Reg SHO price test restriction in effect
Reserved1	84	1	Alpha	Reserved
Reserved2	85	1	Alpha	Reserved

| \n | 86 | 1 | \n | End of message |

5.2   Spin Done Message (Server)

Once all Spin messages have been sent, a **Spin Done** message is sent. A Spin Done message is not sent if a spin wasn't requested during logon.

Field Name	Offset	Length	Value	Description
Message Type	0	1	"D"	Spin Done message
\n	1	1	\n	End of message

5.3   Example

Spin of TESTA (two sided quote), TESTB (one sided quote, offer only), and ZVZZT (no current quote):

```
        s34348112TESTA___000012340000020000001235000010003434700000000
1234000001000001201 00T0__«
        s34399808TESTB___000000000000000000000971200000900343461100000
97110000020000003 0300T0__«
        s34250522ZVZZT___000000000000000000000000000000000000000000000
0000000000000000000000T0__«
        D«
```

6   Heartbeat Messages

6.1   Server Heartbeat Message (Server)

A Server Heartbeat message is sent once per second if no update messages have been sent.

Field Name	Offset	Length	Value	Description
Message Type	0	1	"H"	Server Heartbeat message
\n	1	1	\n	End of message

6.2   Client Heartbeat Message (Client)

A Client Heartbeat message should be sent once per second by the client. If a Client Heartbeat is not received for five seconds, the connection will be terminated.

Field Name	Offset	Length	Value	Description
Message Type	0	1	"R"	Server Heartbeat message
\n	1	1	\n	End of message

7   Time Update Messages

7.1   Seconds Message (Server)

Sent for every second for which at least one message is being generated.

Field Name	Offset	Length	Value	Description
Message Type	-	1	"T"	Seconds message
Seconds	1	5	Numeric	Number of seconds since midnight; e.g,. 32400 = 9:00am
\n	6	1	\n	End of message

7.2   Milliseconds Message (Server)

Sent for every millisecond for which at least one message is being generated.

Field Name	Offset	Length	Value	Description
Message Type	-	1	"M"	Milliseconds message
Milliseconds	1	3	Numeric	Number of milliseconds since last Second message
\n	4	1	\n	End of message

8   Top of Book Update Messages

There are expanded, long and short forms of bid and ask updates. Short form messages are sent if the symbol is less than five characters, the price is less than or equal to 999.99, and the size can be expressed in five characters. Expanded form messages are sent if the symbol is greater than six characters and have been made available to accommodate larger symbol sizes possible through the ISRA plan.

8.1   Bid/Ask Update Messages

Replace the previous Top of Book bid/offer for a symbol.

8.1.1   Expanded Bid Update Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"E"	Long Bid Update message
Symbol	1	8	Alpha	Symbol
Bid Price	9	10	Price	Bid price; 0 if no bids
Bid Quantity	19	6	Numeric	Bid size; 0 if no bids
\n	25	1	\n	End of message

8.1.2   Long Bid Update Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"B"	Long Bid Update message
Symbol	1	6	Alpha	Symbol
Bid Price	7	10	Price	Bid price; 0 if no bids
Bid Quantity	17	6	Numeric	Bid size; 0 if no bids
\n	23	1	\n	End of message

8.1.3   Short Bid Update Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"b"	Short Bid Update message
Symbol	1	4	Alpha	Symbol
Bid Price	5	5	Price	Bid price; 0 if no bids
Bid Quantity	10	5	Numeric	Bid size; 0 if no bids
\n	15	1	\n	End of message

8.1.4 Expanded Ask Update Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"e"	Long Ask Update message
Symbol	1	8	Alpha	Symbol
Ask Price	9	10	Price	Ask price; 0 if no offers
Ask Quantity	19	6	Numeric	Ask size; 0 if no offers
\n	25	1	\n	End of message

8.1.5 Long Ask Update Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"A"	Long Ask Update message
Symbol	1	6	Alpha	Symbol
Ask Price	7	10	Price	Ask price; 0 if no offers
Ask Quantity	17	6	Numeric	Ask size; 0 if no offers
\n	23	1	\n	End of message

8.1.6 Short Ask Update Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"a"	Short Ask Update message
Symbol	1	4	Alpha	Symbol
Ask Price	5	5	Price	Ask price; 0 if no offers
Ask Quantity	10	5	Numeric	Ask size; 0 if no offers
\n	15	1	\n	End of message

8.2 Two-Sided Update Messages

Replaces both the previous bid and offer for a symbol.

8.2.1 Expanded Two-Sided Update Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"F"	Long Two-Sided Update message
Symbol	1	8	Alpha	Symbol
Bid Price	9	10	Price	Bid price; 0 if no bids
Bid Quantity	19	6	Numeric	Bid size; 0 if no bids
Ask Price	25	10	Price	Ask price; 0 if no offers
Ask Quantity	35	6	Numeric	Ask size; 0 if no offers
\n	41	1	\n	End of message

8.2.2 Long Two-Sided Update Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"U"	Long Two-Sided Update message
Symbol	1	6	Alpha	Symbol
Bid Price	7	10	Price	Bid price; 0 if no bids
Bid Quantity	17	6	Numeric	Bid size; 0 if no bids
Ask Price	23	10	Price	Ask price; 0 if no offers
Ask Quantity	33	6	Numeric	Ask size; 0 if no offers
\n	39	1	\n	End of message

8.2.3 Short Two-Sided Update Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"u"	Short Two-Sided Update message
Symbol	1	4	Alpha	Symbol
Bid Price	5	5	Price	Bid price; 0 if no bids
Bid Quantity	10	5	Numeric	Bid size; 0 if no bids
Ask Price	15	5	Price	Ask price; 0 if no offers
Ask Quantity	20	5	Numeric	Ask size; 0 if no offers
\n	25	1	\n	End of message

8.3 Example

Long/Short Bid Update and Long/Short Ask Update messages interleaved with Seconds and Milliseconds messages (Client Heartbeat messages are not shown):

```
T34348«
M110«
aQID_0394500200«
bRIMM1312200100«
bRIMM1312200400«
M118«
BZVZZT_0000123400001100«
M801«
BZVZZT_0000123500000100«
UQQQQ__00004870002402000000487100000200«
T34349«
M009«
aSPY_1417005500«
bIWM_0727700500«
BQQQQ__0000487000240000«
uQID_039441200000394500300«
```

9   Trade Messages

When an execution occurs, a message is sent which includes the cumulative volume and last price and size. Multiple executions which occur concurrently will be compressed into a single update for bandwidth savings. TOP does not send a trade message for every individual fill. See the example messages below.

As with book updates, short, long and expanded form execution messages will be sent. An **expanded** version of the Trade Message has been made available to accommodate larger symbol sizes possible through the ISRA plan.

In the event of a trade break or correction, it is possible that the cumulative volume will *decrease* from the previous update.

9.1   Expanded Trade Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"f"	Long Trade message
Symbol	1	8	Alpha	Symbol
Last Price	9	10	Price	Last trade price
Last Quantity	19	6	Numeric	Last trade quantity
Cumulative Volume	25	9	Numeric	Cumulative number of shares traded today
\n	34	1	\n	End of message

9.2   Long Trade Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"V"	Long Trade message
Symbol	1	6	Alpha	Symbol
Last Price	7	10	Price	Last trade price
Last Quantity	17	6	Numeric	Last trade quantity
Cumulative Volume	23	9	Numeric	Cumulative number of shares traded today
\n	32	1	\n	End of message

9.3   Short Trade Message (Server)

Field Name	Offset	Length	Value	Description
Message Type	0	1	"v"	Short trade message
Symbol	1	4	Alpha	Symbol
Last Price	5	5	Price	Last trade price
Last Quantity	10	5	Numeric	Last trade quantity
Cumulative Volume	15	7	Numeric	Cumulative number of shares traded today
\n	22	1	\n	End of message

9.4   Example

Trade messages interleaved with quote updates:

```
T34348«
M110«
bRIMM1312200400«
bRIMM1312200100«
vRIMM13122003001200400«
M801«
VSPY___000137980000010002425060I«
```

10 Administrative Messages

10.1 Trading Status Message

The Trading Status Message is used to indicate the current trading status of a security. A Trading Status Message will be sent whenever a security's trading status changes.

Trading Status of 'S' will be implied at system startup. 'T' will be sent as securities are available for trading. 'A' will be distributed when orders can be accepted for queuing in preparation for the market open.

Field Name	Offset	Length	Value	Description
Message Type	0	1	"t"	Trading Status Message
Symbol	1	8	Alpha	Symbol
Halt Status	9	1	Alpha	"A" = Accepting Order for Queuing "H" = Halted "Q" = Quote-Only (Cboe Listings) "S" = Exchange Specific Suspension "T" = Trading
Reg SHO Action	10	1	Alphanumeric	"0" = No price test in effect "1" = Reg SHO price test restriction in effect
Reserved1	11	1	Alpha	Reserved
Reserved2	12	1	Alpha	Reserved
\n	13	1	\n	End of message

11 References

For more information on Cboe Symbology, please refer to the [Cboe Symbology Reference](#) document.

12 Support

Please e-mail questions or comments regarding this specification to tradedesk@bats.com.

Revision History

Document Version	Date	Description
1.0	06/16/08	Initial Version 1.0.
1.0.1	06/26/08	Corrected Typos in symbology table.
1.0.2	10/06/08	Revised wording to reflect transition to Bats Exchange.
1.0.3	12/03/08	Moved Symbology reference to a separate document.
1.0.4	08/26/09	Removed SRO quote reference.
1.1.0	01/12/10	Expanded form messages created to support larger symbol size.
1.1.1	04/06/10	Converted specification to new document format. Implemented support for 8 character symbols.
1.1.2	04/15/10	Updated FIX reference for BYX.
1.2.0	10/23/10	Added Trading Status message definition (Message Type = "t"). Added Trading Status fields to Expanded Spin Message (Message Type = "s"). Deprecated Short Spin Message (Message Type = "S").
1.2.1	04/16/14	Reference added for availability of the TOP protocol to EDGA and EDGX platforms that will be implemented in the NY5 datacenter.
1.2.2	02/18/15	Update to Time Update Message (Milliseconds) to indicate messages are sent from Server and not by Client.
1.2.3	02/27/15	Updated Trading Status message with new *Halt Status* definitions.
1.3.0	02/19/16	Bats branding/logo changes.
1.3.1	10/17/17	Cboe branding/logo changes.