



Cboe Futures Exchange Multicast Depth of Book (PITCH) Specification

Version 1.1.5

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Contents

1	Introduction	5
1.1	Overview	5
1.2	Feed Hours and System Restart	5
1.3	Feed Connectivity Requirements	5
1.4	Symbol Ranges, Units, and Sequence Numbers	7
1.5	Futures Specific Symbol Processing.....	7
1.6	Gap Request Proxy and Message Retransmission	8
1.7	Spin Servers.....	8
2	Protocol	10
2.1	Message Format	10
2.2	Data Types	11
2.2.1	Trade Date	11
2.3	Message Framing.....	11
2.4	CFE Sequenced Unit Header	12
2.5	Heartbeat Messages	12
2.6	Time	13
2.7	Unit Clear	14
2.8	Time Reference.....	14
2.9	Futures Instrument Definition	14
2.10	Price Limits	17
2.11	Add Order	17
2.12	Order Modification Messages.....	18
2.12.1	Order Executed	18
2.12.2	Reduce Size.....	19
2.12.3	Modify Order	19
2.12.4	Delete Order	20
2.13	Trade.....	21
2.14	Transaction Begin	22
2.15	Transaction End	22
2.16	Trade Break	23
2.17	Settlement.....	23
2.18	End of Day Summary	25
2.19	Trading Status	26
2.20	End of Session	27
3	Gap Request Proxy Messages.....	28
3.1	Login	28
3.2	Login Response	28
3.3	Gap Request	28

Cboe Futures Exchange
Multicast PITCH Specification (Version 1.1.5)

3.4	Gap Response	29
4	Spin Messages.....	30
4.1	Login	30
4.2	Login Response	30
4.3	Spin Image Available	30
4.4	Spin Request.....	30
4.5	Spin Response	31
4.6	Spin Finished	31
4.7	Spin Server Usage Example	32
5	Message Types	34
5.1	Gap Request Proxy Messages	34
5.2	Spin Server Messages	34
5.3	PITCH Messages.....	34
6	Example Messages.....	35
6.1	Login Message	35
6.2	Login Response Message	35
6.3	Gap Request Message	35
6.4	Gap Response Message	35
6.5	Spin Image Available Message	35
6.6	Spin Request Message.....	35
6.7	Spin Response Message	36
6.8	Spin Finished Message	36
6.9	Time	36
6.10	Unit Clear	36
6.11	Time Reference.....	36
6.12	Add Order – Long.....	37
6.13	Add Order – Short.....	37
6.14	Order Executed.....	37
6.15	Reduce Size – Long.....	37
6.16	Reduce Size – Short.....	37
6.17	Modify Order – Long	38
6.18	Modify Order – Short	38
6.19	Delete Order	38
6.20	Trade – Long.....	38
6.21	Trade – Short	39
6.22	Trade Break	39
6.23	End of Session	39
6.24	Transaction Begin	39
6.25	Transaction End	39

Cboe Futures Exchange
Multicast PITCH Specification (Version 1.1.5)

6.26	Futures Instrument Definition	40
6.27	Futures Instrument Definition w/ 2 Legs	40
6.28	Trading Status Message	41
6.29	Price Limits	41
6.30	End of Day Summary	41
6.31	Settlement.....	42
6.32	Sequenced Unit Header with 2 Messages	42
7	Multicast Configuration	43
7.1	Production Environment Configuration.....	43
7.1.1	Limitations/Configurations.....	43
7.1.2	Unit/Product Distribution	44
7.1.3	Multicast Routing Parameters	44
7.1.4	Address/Unit Distribution	44
7.2	US Futures Certification Environment Configuration.....	45
7.2.1	Unit/Product Distribution	45
7.2.2	Certification Multicast Routing Parameters.....	45
7.2.3	Address/Unit Distribution	45
8	Connectivity	46
8.1	Supported Extranet Carriers	46
8.2	Bandwidth Recommendation.....	46
9	Support	47
9.1	Canned Test Data	47

1 Introduction

1.1 Overview

Note that this specification will be the standard Multicast PITCH specification to be used for Cboe US Futures Exchange (“CFE”) platform. This protocol is essentially the same as the Multicast PITCH protocol used by the Cboe US Equities and Options exchanges, with the addition of CFE specific messages.

CFE participants may use CFE Multicast PITCH to receive real-time depth of book quotations and execution information direct from CFE. The Multicast PITCH protocol is more timely than the Multicast TOP protocol.

PITCH cannot be used to enter orders. For order entry, refer to the appropriate CFE FIX or BOE Specification.

All versions of the Multicast PITCH feed will be WAN-shaped (maximum 100 Mb/s) and will be available from one or both of CFE’s datacenters. Participants may choose to take one or more of the following Multicast PITCH feeds depending on their location and connectivity to CFE.

Multicast PITCH Feed Descriptions:

Exchange	Shaping	Served From Data Center (Primary/Secondary)	Multicast Feed ID
CFE	WAN	Primary	FC
CFE	WAN	Primary	FD
CFE	WAN	Secondary	FE

1.2 Feed Hours and System Restart

The PITCH feed will startup on Sunday at approximately 10:00 a.m. CT and shutdown on Friday at approximately 4:05 p.m. CT. A daily restart occurs between 4:05 and 4:45 p.m. CT each day at which time sequences will be reset. The daily restart is typically observed between 4:05 and 4:10 p.m. CT, but could occur later if needed for operational reasons. Feed startup and shutdown times may be adjusted without notice.

Under normal operations, it is expected that the order books will be cleared (Delete Order messages sent for any open orders, including GTC and GTD orders), prior to the daily restart and reset of sequences. Persisted GTC and GTD orders will be added back onto the order books immediately after restart.

1.3 Feed Connectivity Requirements

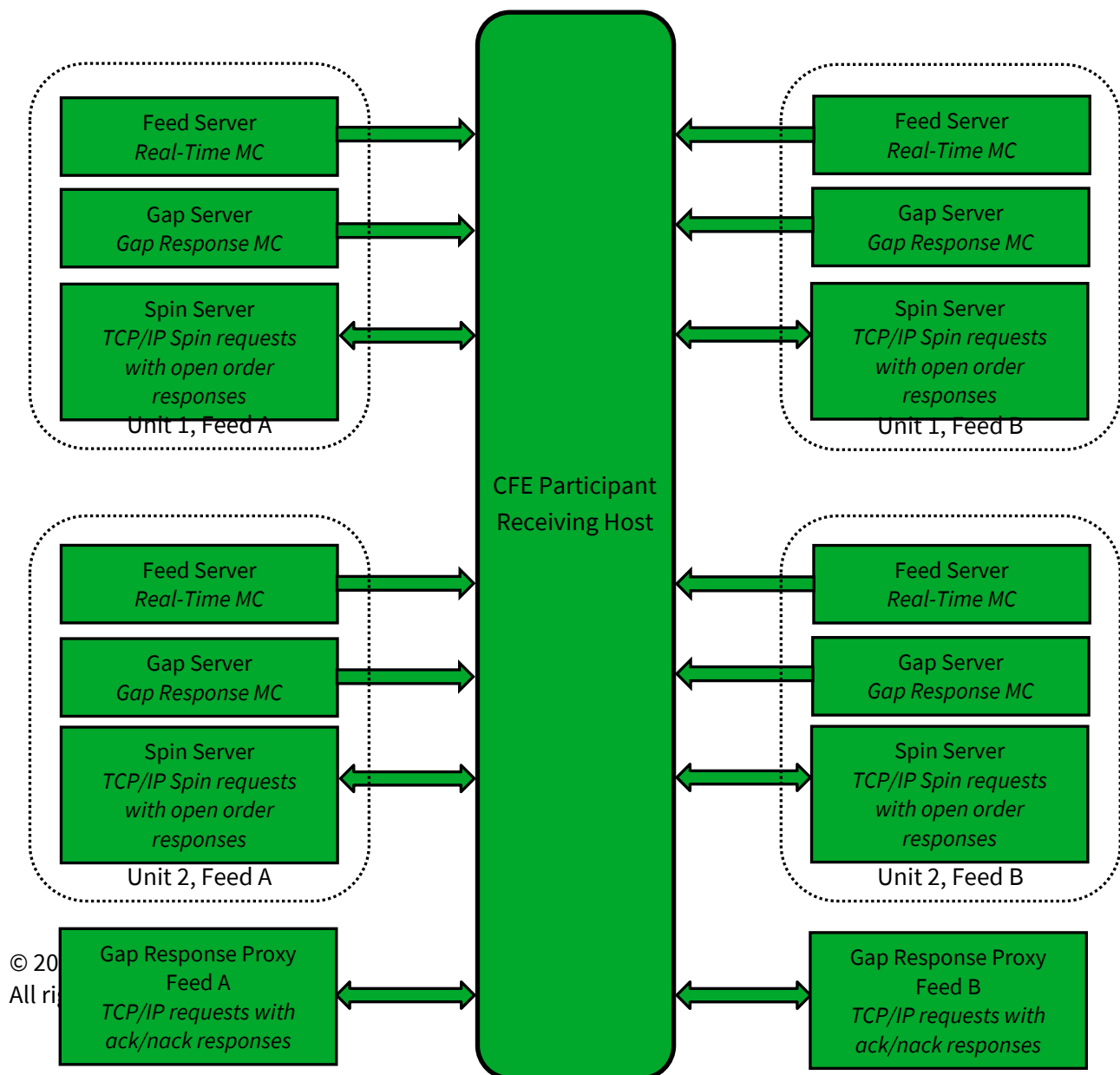
WAN-Shaped feeds are available to participants who meet the minimum bandwidth requirements to CFE via cross-connect, dedicated circuit, or a supported carrier.

Cboe Futures Exchange
Multicast PITCH Specification (Version 1.1.5)

Participants with sufficient connectivity may choose to take both the FA and FB feeds from the CFE's primary datacenter and arbitrate the feeds to recover lost data. Alternatively, participants may choose to arbitrate feeds from both datacenters. It should be noted that feeds from the secondary datacenter will have additional latency for those connected with CFE in the primary datacenter due to proximity and business continuity processing.

CFE Multicast PITCH real-time events are delivered using a published range of multicast addresses divided by symbol range units. Dropped messages can be requested using a TCP/IP connection to one of CFE's Gap Request Proxy ("GRP") servers with replayed messages being delivered on a separate set of multicast ranges reserved for packet retransmission. Intraday, a spin of all open orders may be requested from a Spin Server. This allows a client to become current without requesting a gap for all messages up to that point in the day.

The following diagram is a logical representation Multicast PITCH feed message flow between CFE and a participant feed handler that is listening to the "A" and "B" instances of two units:



1.4 Symbol Ranges, Units, and Sequence Numbers

Products will be separated into units by a [published distribution](#). Product distribution will not change intra-day. CFE does, however, **reserve the right to add multicast addresses or change the product distribution with 48 hours prior notice to participants**. Care should be taken to ensure that address changes, address additions, and product distribution changes can be supported easily.

Message sequence numbers are incremented by one for every sequenced message within a particular symbol unit. It is important to understand that one *or more* units will be delivered on a single multicast address. As with symbol ranges, unit distribution across multicast addresses will not change intra-day, but may change after notice has been given.

Symbol distribution across units as well as unit distribution across multicast addresses are identical for real-time and gap response multicast addresses.

1.5 Futures Specific Symbol Processing

CFE has implemented a symbol mapping mechanism (`Futures Instrument Definition` message) which maps each specific simple futures contract or spread instrument to a six character, ASCII *Symbol*. For example, the weekly VX11 contract expiring March 14, 2017 might be represented by the *Symbol* '0ab123'. This symbol mapping significantly reduces the size of the Multicast PITCH feed for futures and allows participants to use the same symbol handling mechanisms for the Cboe operated equity, options, and futures exchanges. This symbol mapping is the same as the Multicast TOP feed.

Mapping occurs on a continuous basis on each unit's multicast feed. `Futures Instrument Definition` messages can be both un-sequenced and sequenced. Un-sequenced messages are sent from pre-market through the end of trading in a continuous loop that will complete approximately once every minute. Once the same contract has been seen twice, the user can be certain the full loop has been observed. The rate is variable and will be adjusted as bandwidth allows.

Spread instruments may be occasionally created intra-day. In these cases, the `Futures Instrument Definition` message will be sent as a sequenced message on the real-time feed and from the Spin Server before any other messages that reference an instrument created intra-day are sent.

In addition to the symbol mapping events available on the Multicast TOP feed, a downloadable file with current mappings is available via the CFE website.

Production symbol files:

- ❖ [Simple](#)
- ❖ [Spread](#)

Certification symbol files:

- ❖ [Simple](#)
- ❖ [Spread](#)

1.6 Gap Request Proxy and Message Retransmission

Requesting delivery of missed sequenced data is achieved by establishing a TCP connection to a Multicast PITCH GRP port. This GRP port is specific to Multicast PITCH and is NOT shared with the Multicast TOP GRP port. Participants who do not wish to request missed messages do not need to connect to a GRP port for any reason or listen to the multicast addresses reserved for message retransmission. Participants choosing to request missed data will need to connect to their assigned GRP port, log in, and request gap ranges as necessary. All gap requests will be responded to with a Gap Response message. A Gap Response *Status* code of 'A'ccepted signals that the replayed messages will be delivered via the appropriate gap response multicast address. Any other Gap Response *Status* code will indicate the reason that the request cannot be serviced.

Gap requests are limited in message count, frequency, and age by the GRP. Gap requests will only be serviced if they are within a defined sequence range of the current multicast sequence number for the requested unit. Participants will receive a total daily allowance of gap requested messages. In addition, each participant is given renewable one second and one minute gap request limits.

If more than one gap request is received for a particular unit/sequence/count combination within a short timeframe, all requests will receive a successful Gap Response message from the GRP, but only a single replayed message will be sent on the gap response multicast address.

If overlapping gap requests are received within a short period of time, the gap server will only send the union of the sequence ranges across grouped gap requests. Participants will receive gap responses for their requested unit/sequence/count, but receivers should be prepared for the **gap responses to be delivered via multicast in non-contiguous blocks**.

Gap acknowledgements or rejects will be delivered to users for every gap request received by the GRP. Users should be prepared to see replayed multicast data before or after the receipt of the gap response acknowledgement from the GRP.

1.7 Spin Servers

A Spin Server is available for each unit. The server allows participants to connect via TCP and receive a spin of the inside book and symbols with limited trading conditions on that unit. By using the spin, a participant can get the current CFE book quickly in the middle of the trading session without worry of gap request limits. The Spin Server for each unit is assigned its own address and/or TCP port.

Upon successful login and periodically thereafter, a Spin Image Available message is sent which contains a sequence number indicating the most recent message applied to the book. Using a Spin Request message, a participant may request a spin for the orders up to a sequence number noted within one of the *last ten* Spin Image Available messages distributed. If the Spin Request submitted does not present a sequence number that matches one of the last ten Spin Image Available messages distributed, the spin will return orders up to the next closest sequence number

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

reported through a `Spin Image Available` message that is greater than the sequence number requested.

In the case a Participant sends a sequence number in a `Spin Request` that is higher than the sequence number reported by the most recent `Spin Image Available` message, the next spin image to be generated will be returned when it is available. If the requested sequence number is still higher at that time, an “O” (Out of Range) error will be generated.

A spin consists only of `Add Order` (expanded, long and/or short), `Futures Instrument Definition`, `Trading Status`, `Settlement`, `Price Limits`, `Time Reference` and `Time` messages. `Trading Status` messages will be sent in spins for all symbols that are not “S”uspended, which results in at least one message for every symbol that has not been “S”uspended since system startup. `Futures Instrument Definition` messages will be sent for all symbols on the unit, so a spin may be used to get the current list of all instrument definitions. Spins will not contain any message for an order which is no longer on the book. While receiving the spin, the participant must buffer multicast messages received. If the `Spin Image Available` message sequence number is the participant’s reference point, multicast messages with larger sequence numbers should be buffered. If a non-`Spin Image Available` sequence number is the participant’s reference point which they send in their `Spin Request`, they should buffer from that point on, but note that the spin they will receive sequence numbers beyond that point which they may disregard. When a `Spin Finished` message is received, the buffered messages must be applied to spun copy of the book to bring it current.

[Section 4.7](#) shows an example flow of messages between a participant and CFE’s Multicast PITCH feed and Spin Server.

2 Protocol

CFE users may use the PITCH protocol over multicast to receive real-time full depth of book quotations and execution information direct from CFE.

All orders and executions are reflected via the PITCH feed. All orders and executions are anonymous, and do not contain any participant identity.

2.1 Message Format

The messages that make up the PITCH protocol are delivered using CFE's *Sequenced Unit Header* which handles sequencing and delivery integrity. All messages delivered via multicast as well as to/from the Gap Request Proxy ("GRP") or Spin Server will use the *Sequenced Unit Header* for handling message integrity.

All UDP delivered events will be self-contained. Developers can assume that UDP delivered data will not cross frame boundaries and a single Ethernet frame will contain only one *Sequenced Unit Header* with associated data.

TCP/IP delivered events from the GRP may cross frames as the data will be delivered as a stream of data with the TCP/IP stack controlling Ethernet framing.

The PITCH data feed is comprised of a series of dynamic length sequenced messages. Each message begins with *Length* and *Message Type* fields. CFE reserves the right to add message types and grow the length of any message without notice. Participants should develop their decoders to deal with unknown message types and messages that grow beyond the expected length. Messages will only be grown to add additional data to the end of a message.

2.2 Data Types

The following field types are used within the `Sequenced Unit Header`, GRP messages, Spin Server messages, and PITCH.

- **Alphanumeric** fields are left justified ASCII fields and space padded on the right.
- **Binary** fields are unsigned and sized to “Length” bytes and ordered using Little Endian convention (least significant byte first).
- **Signed Binary** fields are signed and sized to “Length” bytes and ordered using Little Endian convention (least significant byte first).
- **Binary Price** fields are signed Little Endian encoded 8 byte binary fields with 4 implied decimal places (denominator = 10,000).
- **Binary Short Price** fields are signed Little Endian encoded 2 byte binary fields with 2 implied decimal places (denominator = 100).
- **Bit Field** fields are fixed width fields with each bit representing a Boolean flag (the 0 bit is the lowest significant bit; the 7 bit is the highest significant bit).
- **Printable ASCII** fields are left justified ASCII fields that are space padded on the right that may include ASCII values in the range of 0x20 – 0x7e.
- **Binary Date** fields are 4 byte unsigned Little Endian values where the base-10 representation is the YYYYMMDD representation of that date. For example, October 30, 2023 would be represented as 20,231,030 (20231030).
- **Time Offset** are 4 byte unsigned Little Endian values that represent the number of nanoseconds since the last `Time` message.

2.2.1 Trade Date

Throughout this document, the term “Trade Date” is synonymous with the term “Business Date”. The term Trade Date is used within this document to match identically named fields in the CFE FIX and BOE specs.

2.3 Message Framing

Depth of book update messages will be combined into single UDP frame where possible to decrease message overhead and total bandwidth. The count of messages in a UDP frame will be communicated using the CFE `Sequenced Unit Header`. Framing will be determined by the server for each unit and site. The content of the multicast across feeds (e.g. A/B) will be identical, but framing will not be consistent across feeds. Receiving processes that receive and arbitrate multiple feeds cannot use frame level arbitration to fill gaps.

2.4 CFE Sequenced Unit Header

The CFE Sequenced Unit Header is used for all CFE Multicast PITCH messages as well as messages to and from the Gap Request Proxy (“GRP”) and Spin Servers.

Sequenced and un-sequenced data may be delivered using the Sequenced Unit Header. Un-sequenced headers will have a 0 value for the *Hdr Sequence* field and potentially for the *Hdr Unit* field. All messages sent to and from the GRP and Spin Server are un-sequenced while multicast may contain both sequenced and un-sequenced messages.

Sequenced messages have implied sequences with the first message having the sequence number contained in the header. Each subsequent message will have an implied sequence one greater than the previous message up to a maximum of count messages. Multiple messages can follow a Sequenced Unit Header, but a combination of sequenced and un-sequenced messages cannot be sent within one header.

The sequence number for the first message in the next frame can be calculated by adding the *Hdr Count* field to the *Hdr Sequence*. This technique will work for sequenced messages and Heartbeats.

Sequenced Unit Header				
Field	Offset	Length	Value/Type	Description
<i>Hdr Length</i>	0	2	Binary	Length of entire block of messages. Includes this header and <i>Hdr Count</i> messages to follow.
<i>Hdr Count</i>	2	1	Binary	Number of messages to follow this header.
<i>Hdr Unit</i>	3	1	Binary	Unit that applies to messages included in this header.
<i>Hdr Sequence</i>	4	4	Binary	Sequence of first message to follow this header.
Total Length = 8 bytes				

2.5 Heartbeat Messages

The CFE Sequenced Unit Header with a count field set to “0” will be used for Heartbeat messages. During trading hours Heartbeat messages will be sent from the GRP, Spin Server, and all multicast addresses if no data has been delivered within 1 second. Heartbeat messages never increment the sequence number for a unit, but can be used to detect gaps on the real-time multicast channels during low update rate periods.

Heartbeats on the real-time multicast addresses during trading hours will have an *Hdr Sequence* value equal to the sequence of the next sequenced message to be sent for the unit. Heartbeats on gap multicast addresses will always have the *Hdr Sequence* field set to 0. All Heartbeat messages sent to and from the GRP and Spin Server are considered un-sequenced and should have sequence and unit fields set to 0.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

Outside of trading hours CFE sends `Heartbeat` messages on all real-time and gap channels with a sequence of "0" to help users validate multicast connectivity. `Heartbeat` messages might not be sent from 4:00 PM CST – 4:45 PM CST or during maintenance windows.

CFE expects `Heartbeat` messages to be sent to the GRP on live connections no less than every 5 seconds. Failure to receive two consecutive heartbeat messages will result in the GRP or Spin Server terminating the client connection. With the exception of `Time` messages, each PITCH message reflects the order addition, order deletion, order modification or execution of an order in the system.

2.6 Time

A `Time` message is sent whenever the source time for a unit passes over a second boundary. All subsequent time offset fields for the same unit will use the new `Time` value as the base until another `Time` message is received for the same unit. The `Time` field is the number of seconds relative to midnight Central Time, which is provided in the `Time Reference` message. The `Time` message also includes the `Epoch Time` field, which is the current time represented as the number of whole seconds since the Epoch (Midnight January 1, 1970).

Time				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x20	Time Message
<i>Time</i>	2	4	Binary	Number of whole seconds from midnight CentralTime.
<i>Epoch Time</i>	6	4	Binary	Number of whole seconds since the Epoch (Midnight January 1, 1970 UTC).
Total Length = 10 bytes				

2.7 Unit Clear

The `Unit Clear` message instructs feed recipients to clear all orders for the CFE book in the unit specified in the `Sequenced Unit Header`. It would be distributed in rare recovery events such as a data center fail-over. It may also be sent on system startup (after daily restart) when there are no persisted GTCs or GTDs.

Unit Clear				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x97	Unit Clear Message
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
Total Length = 6 bytes				

2.8 Time Reference

The `Time Reference` message is used to provide a midnight reference point for recipients of the feed. It is sent whenever the system starts up and when the system crosses a midnight boundary. All subsequent `Time` messages for the same unit will use the last *Midnight Reference* until another `Time Reference` message is received for that unit. The `Time Reference` message includes the *Trade Date*, so most other sequenced messages will not include that information.

`Time Reference` messages will be included in a spin response.

Time Reference				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xB1	Time Reference Message
<i>Midnight Reference</i>	2	4	Binary	Midnight Central Time reference time for subsequent <code>Time</code> messages, expressed as number of whole seconds since the Epoch (Midnight January 1, 1970 UTC).
<i>Time</i>	6	4	Binary	Number of whole seconds from midnight Central Time.
<i>Time Offset</i>	10	4	Binary	Nanosecond offset from last unit timestamp.
<i>Trade Date</i>	14	4	Binary Date	Current Trade Date
Total Length = 18 bytes				

2.9 Futures Instrument Definition

The `Futures Instrument Definition` message can be sent as a sequenced message or an un-sequenced message. It is sent as a sequenced message when the system starts up at the beginning of a trading session or if an instrument is created or modified during a trading day. A new sequenced message may be sent for a *Symbol* that does not visibly change any attribute. One un-sequenced

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

Futures Instrument Definition message for each *Symbol* is also sent in a continuous loop, which completes approximately once every minute.

If the instrument is a spread (*Leg Count* > 0) then the message contains one or more repeating groups of leg definitions beginning at the field indicated by *Leg Offset*. There is a limit of 4 leg definitions.

If the instrument is a variance future (*Variance* bit in *Futures Flags* = 1) then the message contains a block of Variance Future parameters beginning at the offset indicated by *Variance Offset*. A Futures Instrument Definition may have a Variance Futures block or Leg definitions, but not both. If the values for the Variance Future block are not available at the beginning of the trading day, "0" will be sent for those values until they are available. At that point, a sequenced Futures Instrument Definition message will be sent with the updated values.

The *Leg Offset* and *Variance Offset* fields are provided to support adding additional fields to this message between the offset fields and the Variance Future block and Leg definitions.

The *Report Symbol* field will contain either the weekly (e.g. VX01) or the monthly (e.g. VX) symbol for any simple futures contract. The *Report Symbol* will always contain the standard futures root symbol (e.g. VX) for all spread instruments.

Futures Instrument Definition messages are included in a spin response. Simple leg Futures Instrument Definition messages will be disseminated before complex leg Futures Instrument Definition messages sent in a spin response.

Futures Instrument Definition				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xBB	Futures Instrument Definition Message
<i>Time Offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp or <i>Unit Timestamp</i> in this message if it is non-zero.
<i>Symbol</i>	6	6	Printable ASCII	Six character, base 62 symbol.
<i>Unit Timestamp</i>	12	4	Binary	Unit timestamp expressed as number of whole seconds since the Epoch (Midnight, January 1, 1970 UTC).
<i>Report Symbol</i>	16	6	Alphanumeric	Symbol for product or underlying security.
<i>Futures Flags</i>	22	1	Bit Field	Bit 0 – Variance (1: Variance Future, 0: Standard Future)
<i>Expiration Date</i>	23	4	Binary Date	Expiration Date of Instrument.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

<i>Contract Size</i>	27	2	Binary	Contract size of Instrument.
<i>Listing State</i>	29	1	Alphanumeric	A = Active I = Inactive T = Test
<i>Price Increment</i>	30	8	Binary Price	Minimum Price Increment
<i>Leg Count</i>	38	1	Binary	Values greater than 0 indicate this is a spread instrument.
<i>Leg Offset</i>	39	1	Binary	Leg definitions, if any, begin at this offset from the beginning of the message. Possible values are 0 (no legs present) or 41 (spread instrument). Cboe reserves the right to change these values without prior notice.
<i>Variance Block Offset</i>	40	1	Binary	Variance Future parameter block begins at this offset from the beginning of the message. Possible values are 0 (no Variance Block) or 41 (Variance Block present). Cboe reserves the right to change these values without prior notice.
The following fields are only present if <i>Variance</i> bit in <i>Futures Flags</i> = 1.				
<i>Realized Variance</i>	41	8	Signed Binary	Realized Variance to date (signed 64-bit decimal with 8 implied decimal places)
<i>Num Expected Prices</i>	49	2	Binary	Number of expected S&P500 prices to be used for calculating returns during the life of the contract
<i>Num Elapsed Returns</i>	51	2	Binary	Number of returns elapsed as of the beginning of the trading day
<i>Previous Settlement</i>	53	8	Binary Price	Previous day Settlement Value
<i>Discount Factor</i>	61	8	Signed Binary	Discount Factor (signed 64-bit decimal with 16 implied decimal places)
<i>Initial Strike</i>	69	8	Binary Price	Initial strike
<i>Previous ARMVM</i>	77	8	Signed Binary	ARMVM that was used to adjust the previous day settlement price (signed 64-bit decimal value with 6 implied decimal places)
<i>Fed Funds Rate</i>	85	8	Signed Binary	Fed Funds rate of prior day (signed 64-bit number with 6 implied decimal places)

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

The following fields repeat <i>Leg Count</i> times (maximum of 4) for spread instruments.				
<i>Leg Ratio</i>	<i>Leg Offset +</i> (10 * Leg Index)	4	Signed Binary	Leg ratio (positive for bid-side, negative for ask-side)
<i>Leg Symbol</i>	<i>Leg Offset + 4 +</i> (10 * Leg Index)	6	Alphanumeric	Symbol of leg.
Variable Total Length = 41 (+ 52 if Variance Future) + (Leg Count * 10) bytes				

2.10 Price Limits

The *Price Limits* message is sent out at the start of a session for products subject to price limits per the contract specifications. The *Price Limits* message does not signal whether price limits are in effect for that symbol; it simply provides those values for when they are in effect. If multiple *Price Limits* messages are received for the same *Symbol*, the most recent values will override the previous values.

Price Limits messages are included in a spin response.

Price Limits				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xBE	<i>Price Limits</i> Message
<i>Time Offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Symbol</i>	6	6	Printable ASCII	Six character, base 62 symbol.
<i>Upper Price Limit</i>	12	8	Binary Price	Upper price limit
<i>Lower Price Limit</i>	20	8	Binary Price	Lower price limit
Total Length = 28 bytes				

2.11 Add Order

An *Add Order* message represents a newly accepted visible order on the CFE book. It includes a day-specific *Order Id* assigned by CFE to the order.

Add Order (long)				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x21	<i>Add Order</i> Message (long)
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Order Id</i>	6	8	Binary	Day-specific identifier assigned to this order
<i>Side Indicator</i>	14	1	Alphanumeric	B = Buy Order S = Sell Order
<i>Quantity</i>	15	4	Binary	Number of contracts being added to the book (may be less than the number entered).
<i>Symbol</i>	19	6	Printable ASCII	Six character, base 62 symbol.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

Price	25	8	Binary Price	The limit order price.
Total Length = 33 bytes				

Add Order (short)				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x22	Add Order Message (short)
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Order Id</i>	6	8	Binary	Day-specific identifier assigned to this order.
<i>Side Indicator</i>	14	1	Alphanumeric	B = Buy Order S = Sell Order
<i>Quantity</i>	15	2	Binary	Number of contracts being added to the book (may be less than the number entered).
<i>Symbol</i>	17	6	Printable ASCII	Six character, base 62 symbol.
<i>Price</i>	23	2	Binary Short Price	The limit order price.
Total Length = 25 bytes				

2.12 Order Modification Messages

Order Modification messages refer to an *Order Id* previously sent with an Add Order message. Multiple Order Modification messages may modify a single order and the effects are cumulative. Modify messages may update the size and/or the price of an order on the book. When the remaining size of an order reaches zero, the order is dead and should be removed from the book.

2.12.1 Order Executed

Order Executed messages are sent when an order on the CFE book is executed in whole or in part. The execution price equals the limit order price found in the original Add Order message or the limit order price in the latest Modify Order message referencing the *Order Id*.

Order Executed				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x23	Order Executed Message
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Order Id</i>	6	8	Binary	<i>Order Id</i> of a previously sent Add Order message that was executed.
<i>Executed Quantity</i>	14	4	Binary	Number of contracts executed.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

<i>Execution Id</i>	18	8	Binary	CFE generated day-unique execution identifier of this execution. <i>Execution Id</i> is also referenced in the <i>Trade Break</i> message.
<i>Trade Condition</i>	26	1	Alphanumeric	(Space) = Normal trade O = Opening trade ¹ S = Spread trade ¹ B = Block trade E = ECRP trade ¹ Sent for simple (non-spread) symbols only.
Total Length = 27 bytes				

2.12.2 Reduce Size

Reduce Size messages are sent when a visible order on the CFE book is partially reduced.

Reduce Size (long)				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x25	<i>Reduce Size</i> Message (long)
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Order Id</i>	6	8	Binary	<i>Order Id</i> of a previously sent <i>Add Order</i> message that has been reduced.
<i>Canceled Quantity</i>	14	4	Binary	Number of contracts canceled.
Total Length = 18 bytes				

Reduce Size (short)				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x26	<i>Reduce Size</i> Message (short)
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Order Id</i>	6	8	Binary	<i>Order Id</i> of a previously sent <i>Add Order</i> message that has been reduced.
<i>Canceled Quantity</i>	14	2	Binary	Number of contracts canceled.
Total Length = 16 bytes				

2.12.3 Modify Order

The *Modify Order* message is sent whenever an open order is visibly modified. The *Order Id* refers to the *Order Id* of the original *Add Order* message.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

Note that `Modify Order` messages that appear to be “no ops” (i.e. they do not appear to modify any relevant fields) will still lose priority.

Modify (long)				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x27	Modify Order Message (long)
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Order Id</i>	6	8	Binary	<i>Order Id</i> of a previously sent Add Order message that has been modified.
<i>Quantity</i>	14	4	Binary	Number of contracts associated with this order after this modify (may be less than the number entered).
<i>Price</i>	18	8	Binary Price	The limit order price after this modify.
Total Length = 26 bytes				

Modify (short)				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x28	Modify Order Message (short)
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Order Id</i>	6	8	Binary	<i>Order Id</i> of a previously sent Add Order message that has been modified.
<i>Quantity</i>	14	2	Binary	Number of contracts associated with this order after this modify (may be less than the number entered).
<i>Price</i>	16	2	Binary Short Price	The limit order price after this modify.
Total Length = 18 bytes				

2.12.4 Delete Order

The `Delete Order` message is sent whenever an open order is completely canceled. The *Order Id* refers to the *Order Id* of the original Add Order message.

Delete				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x29	Delete Order Message
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Order Id</i>	6	8	Binary	<i>Order Id</i> of a previously sent Add Order message that has been cancelled.
Total Length = 14 bytes				

2.13 Trade

The Trade message provides information about executions that occur off of the CFE book (such as ECRP/Block trades). Trade messages are necessary to calculate CFE execution data. Trade messages do not alter the book and can be ignored if messages are being used solely to build a book. The *Order Id* sent in a Trade message is obfuscated and will not tie back to any real *Order Id* sent back via a FIX or BOE order entry session.

Trade (long)				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x2A	Trade Message (long)
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Order Id</i>	6	8	Binary	Obfuscated <i>Order ID</i> or <i>Order Id</i> of the executed order.
<i>Side Indicator</i>	14	1	Alphanumeric	Always "B" = Buy Order regardless of resting side.
<i>Quantity</i>	15	4	Binary	Incremental number of contracts executed.
<i>Symbol</i>	19	6	Printable ASCII	Six character, base 62 symbol.
<i>Price</i>	25	8	Binary Price	The execution price of the order.
<i>Execution Id</i>	33	8	Binary	CFE generated day-unique execution identifier of this trade. <i>Execution Id</i> is also referenced in the Trade Break message.
<i>Trade Condition</i>	41	1	Alphanumeric	(Space) = Normal trade 0 = Opening trade ¹ S = Spread trade ¹ B = Block trade E = ECRP trade ¹ Sent for simple (non-spread) symbols only.
Total Length = 42 bytes				

Trade (short)				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x2B	Trade Message (short)
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Order Id</i>	6	8	Binary	Obfuscated <i>Order ID</i> or <i>Order Id</i> of the executed order.
<i>Side Indicator</i>	14	1	Alphanumeric	Always B = Buy Order regardless of resting side.
<i>Quantity</i>	15	2	Binary	Incremental Number of contracts executed.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

<i>Symbol</i>	17	6	Printable ASCII	Six character, base 62 symbol.
<i>Price</i>	23	2	Binary Short Price	The execution price of the order.
<i>Execution Id</i>	25	8	Binary	CFE generated day-unique execution identifier of this trade. <i>Execution Id</i> is also referenced in the <i>Trade Break</i> message.
<i>Trade Condition</i>	33	1	Alphanumeric	(Space) = Normal trade O = Opening trade ¹ S = Spread trade ¹ B = Block trade E = ECRP trade ¹ Sent for simple (non-spread) symbols only.
Total Length = 34 bytes				

2.14 Transaction Begin

The *Transaction Begin* message indicates any subsequent messages, up to the accompanying *Transaction End* message, are all part of the same transaction block. One example of where this might be used is when a single aggressive order executes against several resting orders. All PITCH messages corresponding to such an event would be included between a *Transaction Begin* and *Transaction End*. It is important to note that any PITCH *Message Type* may be included in a transaction block and there is no guarantee that the messages apply to the same price level or even the same *Symbol*. *Transaction Begin* messages do not alter the book and can be ignored if messages are being used solely to build a book.

Feed processors can use a transaction block as a trigger to postpone publishing a quote update until the end of the transaction block. In the prior example of a single aggressive order executing against multiple resting orders, a top of book feed would be able to publish a single trade message and quote update resulting from multiple *Order Executed* messages once it finished processing all of the messages within the transaction block.

Transaction Begin				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xBC	<i>Transaction Begin</i> Message
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
Total Length = 6 bytes				

2.15 Transaction End

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

The `Transaction End` message indicates that a transaction indicated by a previous `Transaction Begin` message has completed. `Transaction End` messages do not alter the book and can be ignored if messages are being used solely to build a book.

Transaction End				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xBD	<code>Transaction End</code> Message
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
Total Length = 6 bytes				

2.16 Trade Break

The `Trade Break` message is sent whenever an execution on CFE is broken. Trade breaks are rare and only affect applications that rely upon CFE execution-based data. A `Trade Break` followed immediately by a new `Trade` with the same *Execution Id* indicates that a trade correction has occurred. Applications that simply build a CFE book can ignore `Trade Break` messages.

Trade Break				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x2C	<code>Trade Break</code> Message
<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Execution Id</i>	6	8	Binary	CFE execution identifier of the execution that was broken. <i>Execution Id</i> refers to previously sent <code>Order Executed</code> or <code>Trade</code> message.
Total Length = 14 bytes				

2.17 Settlement

`Settlement` messages are normally sent once per day per instrument after settlement prices have been calculated for all applicable instruments on a given business date. If there is an error in the settlement it may be re-issued (see the *Issue* field).

Settlement				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xB9	<code>Settlement</code> Message
<i>Time Offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Symbol</i>	6	6	Printable ASCII	Six character, base 62 symbol.
<i>Trade Date</i>	12	4	Binary Date	Trade Date for the settlement.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

<i>Settlement Price</i>	16	8	Binary Price	Settlement Price
<i>Issue</i>	24	1	Alphanumeric	S = Initial Settlement R = Re-issued Settlement
Total Length = 25 bytes				

2.18 End of Day Summary

The *End of Day Summary* is sent out right after trading ends for a symbol. No more Market Update messages will follow an *End of Day Summary* for a particular symbol. A value of zero in the *Total Volume* field means that no volume traded on that symbol for the day. The *Total Volume* field reflects all contracts traded during the day. Block and ECRP trades are included in the *Total Volume* field, but they are also reported separately to provide more detail.

The *Summary Flags* field provides additional information on how to interpret the *High Price* and *Low Price* fields, especially in instruments that had no volume for the day and/or where 0 is a valid price (e.g. Trade At Settlement products). There are flags that indicate whether or not the *High Price* and *Low Price* fields are valid. If they are not valid, then there was no High (and/or Low) Price for the day. There are also flags that indicate whether the *High Price* was set by the highest bid and the *Low Price* was set by the lowest offer rather than a trade.

All *End of Day Summary* message values will span the full trading day, including all extended hours trading and all trading segments.

End of Day Summary				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xBA	End of Day Summary Message
<i>Time Offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Symbol</i>	6	6	Printable ASCII	Six character, base 62 symbol.
<i>Trade Date</i>	12	4	Binary Date	Trade Date for the message.
<i>Open Interest</i>	16	4	Binary	Prior Trade Date Open Interest for this symbol.
<i>High Price</i>	20	8	Binary Price	The higher of highest bid price and highest trade price for the day. Block and ECRP trades (<i>Trade Condition</i> = B or E) do not update <i>High Price</i> .
<i>Low Price</i>	28	8	Binary Price	The lower of lowest offer price and lowest trade price for the day. Block and ECRP trades (<i>Trade Condition</i> = B or E) do not update <i>Low Price</i> .
<i>Open Price</i>	36	8	Binary Price	The first trade on the day (in any session) will set the <i>Open Price</i> for the day (valid only if <i>Total Volume</i> > 0). Block and ECRP trades (<i>Trade Condition</i> = B or E) do not update <i>Open Price</i> .
<i>Close Price</i>	44	8	Binary Price	The last trade on the day (in any session) will set the <i>Close Price</i> for the day (valid only if <i>Total Volume</i> > 0). Block and ECRP trades (<i>Trade Condition</i> = B or E) do not update <i>Close Price</i> .

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

<i>Total Volume</i>	52	4	Binary	Total number of contracts traded for the day, including block and ECRP trades.
<i>Block Volume</i>	56	4	Binary	Total number of block contracts traded for the day.
<i>ECRP Volume</i>	60	4	Binary	Total number of contracts traded for the day.
<i>Summary Flags</i>	64	1	Bit Field	<p>Bit 0 = <i>High Price Valid</i> – Set if <i>High Price</i> is a valid value.</p> <p>Bit 1 = <i>High Price is bid</i>– Set if <i>High Price</i> was set by the highest bid (rather than a trade).</p> <p>Bit 2 = <i>Low Price Valid</i> – Set if <i>Low Price</i> is a valid value.</p> <p>Bit 3 = <i>Low Price is offer</i> – Set if <i>Low Price</i> was set by the lowest offer (rather than a trade).</p> <p>Bit 4 = <i>Open/Close Valid</i> – Set if both <i>Open Price</i> and <i>Close Price</i> fields contain valid values.</p> <p>Bit 5-7 = Reserved</p>
Total Length = 65 bytes				

2.19 Trading Status

The *Trading Status* message is used to indicate the current trading status of a Futures contract. A *Trading Status* message will be sent whenever a security's trading status changes. If a *Trading Status* has not been received for a symbol, then the *Trading Status* for the symbol should be assumed to be "S = Suspended". The following summarizes the *Trading Status* values in the CFE system:

- S = Suspended. A contract is in a suspended state when the associated product is closed and not accepting orders.
- Q = Accepting orders for queuing. Queuing state is used during the Pre-Open for all products and 3:15-3:30 pause in VX. It is also used for spread instruments that may not be tradeable due to Threshold Width.
- T = Trading. Used for both Extended and Regular Hours trading.
- H = Halt state. This state is used for Supervisory Halts initiated by the Trade Desk. Orders are not being accepted in this state.

Trading Status				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	Length of this message including this field.
<i>Message Type</i>	1	1	0x31	<i>Trading Status</i> message

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

<i>Time offset</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
<i>Symbol</i>	6	6	Printable ASCII	Six character, base 62 symbol.
<i>Reserved1</i>	12	2	Alpha	Reserved
<i>Trading Status</i>	14	1	Alpha	S = Suspended Q = Queuing T = Trading H = Halted
<i>Reserved2</i>	15	3	Alphanumeric	Reserved
Total Length = 18 bytes				

2.20 End of Session

The End of Session message is sent for each unit when the unit shuts down. No more sequenced messages will be delivered for this unit, but heartbeats from the unit may be received.

End of Session				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x2D	End of Session Message
<i>Timestamp</i>	2	4	Binary	Nanosecond offset from last unit timestamp.
Total Length = 6 bytes				

3 Gap Request Proxy Messages

The following messages are used for initializing a TCP/IP connection to the Gap Request Proxy (“GRP”) and to request message retransmissions. Participants only need to implement the following messages if gap requests will be made. The following messages will not be delivered using multicast.

3.1 Login

The `Login` message is the first message sent to the GRP by a user’s process after the connection to the GRP is established. Failure to login before sending any other message type will result in the connection being dropped by the GRP.

Login				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x01	Login Message
<i>SessionSubId</i>	2	4	Alphanumeric	<i>SessionSubId</i> supplied by CFE.
<i>Username</i>	6	4	Alphanumeric	<i>Username</i> supplied by CFE.
<i>Filler</i>	10	2	Alphanumeric	(space filled)
<i>Password</i>	12	10	Alphanumeric	<i>Password</i> supplied by CFE.
Total Length = 22 bytes				

3.2 Login Response

The `Login Response` message is sent by the GRP to a user’s process in response to a `Login` message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the connection will be dropped after the `Login Response` message is sent.

Login Response				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x02	Login Response Message
<i>Status</i>	2	1	Alphanumeric	Accepted or reason for reject.
Total Length = 3 bytes				

Login Response - Status Codes	
‘A’	Login Accepted
‘N’	Not authorized (Invalid Username/Password)
‘B’	Session in use
‘S’	Invalid Session

3.3 Gap Request

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

The `Gap Request` message is used by a user's process to request retransmission of a sequenced message (or messages) by one of CFE's gap servers.

Gap Request				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x03	Gap Request Message
<i>Unit</i>	2	1	Binary	<i>Unit</i> that the gap is requested for.
<i>Sequence</i>	3	4	Binary	<i>Sequence</i> of first message (lowest sequence in range).
<i>Count</i>	7	2	Binary	<i>Count</i> of messages requested.
Total Length = 9 bytes				

3.4 Gap Response

The `Gap Response` message is sent by the GRP in response to a `Gap Request` message. The *Unit* and *Sequence* fields will match the values supplied in the `Gap Request` message. A `Gap Response` message, with a Status of Accepted or reason for failure, will be sent for each `Gap Request` message received by the GRP.

Gap Response				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x04	Gap Response Message
<i>Unit</i>	2	1	Binary	<i>Unit</i> the gap was requested for.
<i>Sequence</i>	3	4	Binary	<i>Sequence</i> of first message in request.
<i>Count</i>	7	2	Binary	<i>Count</i> of messages requested.
<i>Status</i>	9	1	Alphanumeric	Accepted or reason for reject*.
Total Length = 10 bytes				
Gap Response - Status Codes				
'A'	Accepted			
'O'	Out of range (ahead of sequence or too far behind)			
'D'	Daily gap request allocation exhausted			
'M'	Minute gap request allocation exhausted			
'S'	Second gap request allocation exhausted			
'C'	Count request limit for one gap request exceeded			
'I'	Invalid Unit specified in request			
'U'	Unit is currently unavailable			

* - All non-'A' status codes should be interpreted as a reject.

4 Spin Messages

4.1 Login

The `Login` message is the first message sent to the Spin Server by a user's process after the connection to the Spin Server is established. Failure to login before sending any other message type will result in the connection being dropped by the Spin Server.

The format of the `Login` message for the Spin Server is identical to that of the GRP described previously in [Section 3.1](#).

4.2 Login Response

The `Login Response` message is sent by the Spin Server to a user's process in response to a `Login` message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the connection will be dropped after the `Login Response` message is sent.

The format of the `Login Response` message for the Spin Server is identical to that of the GRP described previously in [Section 3.2](#).

4.3 Spin Image Available

The `Spin Image Available` message is sent once per second and indicates through what sequence number a spin is available.

Spin Image Available				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x80	Spin Image Available Message
<i>Sequence</i>	2	4	Binary	Spin is available which is current through this sequence number.
Total Length = 6 bytes				

4.4 Spin Request

The `Spin Request` message is used by a user's process to request transmission of a spin of the unit's order book. Refer to [Section 1.6](#) for more complete details regarding *Sequence* specification as well as buffering requirements.

Spin Request				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x81	Spin Request Message

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

<i>Sequence</i>	2	4	Binary	Sequence number from a Spin Image Available message received by the participant.
Total Length = 6 bytes				

4.5 Spin Response

The Spin Response message is sent in response to a user's Spin Request message indicating whether a spin will be sent.

Spin Response				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x82	Spin Response Message
<i>Sequence</i>	2	4	Binary	Sequence number from a Spin Image Available message received by the participant.
<i>Order Count</i>	6	4	Binary	Number of Add Order messages which will be contained in this spin.
<i>Status</i>	10	1	Alphanumeric	Accepted or reason for reject*.
Total Length = 11 bytes				
Spin Response - Status Codes				
'A'	Accepted			
'O'	Out of Range (<i>Sequence</i> requested is greater than <i>Sequence</i> available by the next spin)			
'S'	Spin already in progress (only one spin can be running at a time)			

* - All non-'A' status codes should be interpreted as a reject.

4.6 Spin Finished

The Spin Finished message is sent to indicate that all messages for the spin requested have been sent. A Spin Finished message is only sent if a Spin Request was not rejected. Upon receipt of a Spin Finished message, any buffered multicast messages should be applied to the participant's copy of the book to make it current.

Spin Finished				
Field Name	Offset	Length	Type/(Value)	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x83	Spin Finished Message
<i>Sequence</i>	2	4	Binary	Sequence number from the Spin Request message.
Total Length = 6 bytes				

4.7 Spin Server Usage Example

The following diagram (see next page) shows the exchange of messages over time between a participant and CFE's Multicast PITCH feed and Spin Server. Note that while the example alone may seem to imply `Add Order` messages only would be sent on a spin, this is not the case. `Trading Status` message may be sent at the beginning of the spin.

At time 1, the participant has no state of the book and desires to become current. The participant caches the received Multicast PITCH messages (sequences 310172 and 310173) for later use. Since the participant has no book, they cannot yet be applied.

At time 5, the participant has successfully logged into the Spin Server and has cached another message, sequence 310174.

At time 7, the participant receives a `Spin Image Available` message which indicates that the spin server is capable of giving them a spin of all open orders as of sequence 310169. The participant does not have all messages cached after 310169 (they are missing 310170 and 310171), so this spin is not useful to the participant.

At time 10, the participant receives a `Spin Image Available` message which is useful since it would be a spin of all orders up to and including sequence 310175 and the participant has all messages after 310175 cached.

At time 11, the participant sends a `Spin Request` for all messages up to and including 310175 and continues to cache Multicast PITCH messages received.

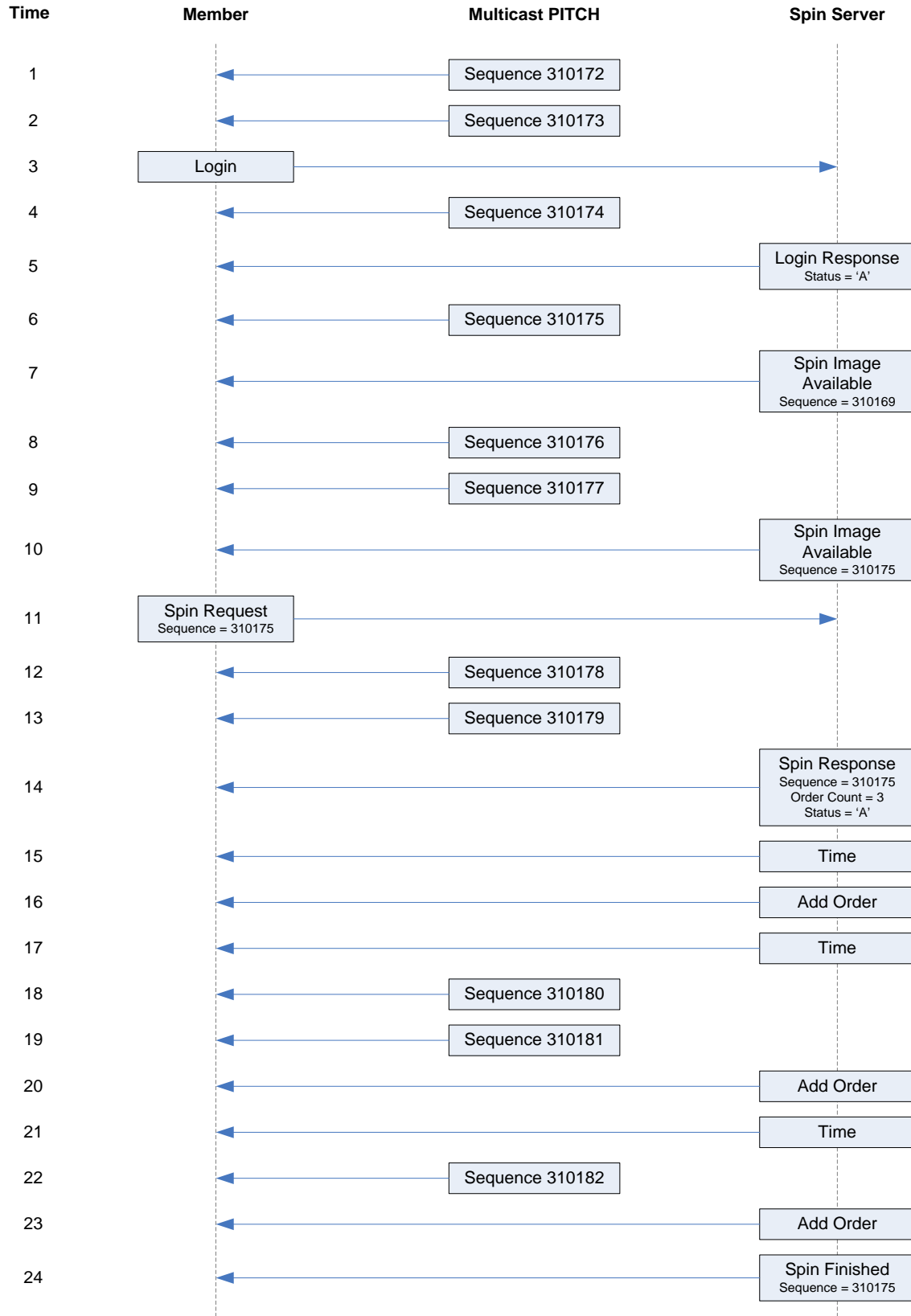
At time 14, the spin server acknowledges the spin request and indicates that three open orders will be sent.

At time 24, the spin server indicates that it has finished sending all open orders. The participant must then apply the cached messages from sequence number 310176 through current.

Notes:

- Spin Servers are available for each unit. Participants may need to employ multiple Spin Servers depending upon their architecture.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)



5 Message Types

5.1 Gap Request Proxy Messages

0x01	Login
0x02	Login Response
0x03	Gap Request
0x04	Gap Response

5.2 Spin Server Messages

0x01	Login
0x02	Login Response
0x80	Spin Image Available
0x81	Spin Request
0x82	Spin Response
0x83	Spin Finished

5.3 PITCH Messages

0x20	Time
0x21	Add Order - Long
0x22	Add Order – Short
0x23	Order Executed
0x25	Reduce Size – Long
0x26	Reduce Size – Short
0x27	Modify Order – Long
0x28	Modify Order – Short
0x29	Delete Order
0x2A	Trade – Long
0x2B	Trade – Short
0x2C	Trade Break
0x2D	End of Session
0x31	Trading Status
0x97	Unit Clear
0xB1	Time Reference
0xB9	Settlement
0xBA	End of Day Summary
0xBB	Futures Instrument Definition
0xBC	Transaction Begin
0xBD	Transaction End
0xBE	Price Limits

6 Example Messages

Each of the following message types must be wrapped by a sequenced or unsequenced unit header as described in [Section 2.4](#). Note that in the following examples, each byte is represented by two hexadecimal digits.

6.1 Login Message

Length	16	22 bytes
Type	01	Login
SessionSubId	30 30 30 31	"0001"
Username	46 49 52 4D	"FIRM"
Filler	20 20	" "
Password	41 42 43 44 30 30 20 20 20 20	"ABCD00 "

6.2 Login Response Message

Length	03	3 bytes
Type	02	Login Response
Status	41	Login accepted

6.3 Gap Request Message

Length	09	9 bytes
Type	03	Gap Request
Unit	01	Unit 1
Sequence	3B 10 00 00	First message: 4155
Count	32 00	50 messages

6.4 Gap Response Message

Length	08	8 bytes
Type	04	Gap Response
Unit	01	Unit 1
Sequence	3B 10 00 00	First message: 4155
Status	41	Accepted

6.5 Spin Image Available Message

Length	06	6 bytes
Type	80	Spin Image Available
Sequence	3B 10 00 00	Sequence: 4155

6.6 Spin Request Message

Length	06	6 bytes
Type	81	Spin Request
Sequence	3B 10 00 00	Sequence: 4155

6.7 Spin Response Message

Length	0B	11 bytes
Type	82	Spin Request
Sequence	3B 10 00 00	Sequence: 4155
Order Count	42 00 00 00	66 orders
Status	41	Accepted

6.8 Spin Finished Message

Length	06	6 bytes
Type	83	Spin Finished
Sequence	3B 10 00 00	Sequence: 4155

6.9 Time

Length	0A	10 bytes
Type	20	Time
Time	98 85 00 00	34,200 seconds = 09:30 AM Eastern
Epoch Time	F8 27 94 5A	1519659000 = February 26, 2018 9:30:00 AM Central

6.10 Unit Clear

Length	06	6 bytes
Type	97	Unit Clear
Time offset	18 D2 06 00	447,000 ns since last Time Message

6.11 Time Reference

Length	12	18 bytes
Type	B1	Time Reference
Midnight Reference	E0 50 92 5A	2018-02-25 00:00:00 Central (1519538400 seconds since the Epoch)
Time	00 E1 00 00	16:00:00
Time Offset	00 00 00 00	Exactly 16:00:00
Trade Date	02 ED 33 01	20180226 February 26, 2018

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

6.12 Add Order – Long

Length	21	33 bytes
Type	21	Add Order – Long
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order ID	96 95 94 93 92 91 00 00	
Side Indicator	42	Buy
Quantity	20 4E 00 00	20,000 contracts
Symbol	33 34 35 33 32 31	345321
Price	00 00 32 00 00 00 00 00	\$327.68

6.13 Add Order – Short

Length	19	25 bytes
Type	22	Add Order – Short
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order ID	98 97 96 D3 22 5A 0E 0E	
Side Indicator	42	Buy
Quantity	20 4E	20,000 contracts
Symbol	33 34 35 33 32 31	345321
Price	FF 7F	\$327.67

6.14 Order Executed

Length	1B	27 bytes
Type	23	Order Executed
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order Id	96 95 94 93 92 91 00 00	
Executed	2C 01 00 00	300 contracts
Quantity		
Execution ID	56 55 54 53 52 51 00 00	
Trade Condition	53	S – Spread Trade

6.15 Reduce Size – Long

Length	12	18 bytes
Type	25	Reduce Size – Long
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Canceled	00 00 01 00	65,536 contracts
Quantity		

6.16 Reduce Size – Short

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

Length	10	16 bytes
Type	26	Reduce Size - Short
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Canceled	64 00	100 contracts
Quantity		

6.17 Modify Order - Long

Length	1A	26 bytes
Type	27	Modify Order - Long
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Quantity	FF FF 00 00	65,535 contracts
Price	2C 33 32 00 00 00 00 00	\$328.99

6.18 Modify Order - Short

Length	12	18 bytes
Type	28	Modify Order - Short
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Quantity	FF FF	65,535 contracts
Price	0A 28	\$102.50

6.19 Delete Order

Length	0E	14 bytes
Type	29	Delete Order
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	

6.20 Trade - Long

Length	2A	42 bytes
Type	2A	Trade - Long
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Side	42	Buy
Quantity	F8 24 01 00	75,000 contracts
Symbol	33 34 35 33 32 31	345321

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

Price	E8 A3 0F 00 00 00 00 00	\$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Trade Condition	20	(space) Normal

6.21 Trade - Short

Length	22	34 bytes
Type	2B	Trade - Long
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	
Side	42	Buy
Quantity	64 00	100 contracts
Symbol	33 34 35 33 32 31	345321
Price	0A 28	\$102.50
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Trade Condition	53	S - Spread Trade

6.22 Trade Break

Length	0E	14 bytes
Type	2C	Trade Break
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC

6.23 End of Session

Length	06	6 bytes
Type	2D	End of Session
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message

6.24 Transaction Begin

Length	06	6 bytes
Type	BC	Transaction Begin
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message

6.25 Transaction End

Length	06	6 bytes
Type	BD	Transaction End
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

6.26 Futures Instrument Definition

Length	29	41 bytes
Type	BB	Futures Instrument Definition Message
Time Offset	78 E2 2F 1B	456,123,000 ns since Last Time Message
Symbol	30 30 31 31 32 32	001122
Unit Timestamp	E9 78 99 5A	2018-03-02 10:16:41 Central Time (1520007401 seconds since Epoch)
Report Symbol	56 58 20 20 20 20	VX
Futures Flags	00	0
Expiration Date	C4 ED 33 01	20180420 - Friday, April 20, 2018
Contract Size	64 00	100
Listing State	41	A - Active
Price Increment	64 00 00 00 00 00 00 00	\$0.01
Leg Count	00	0 legs
Leg Offset	00	0 - No Legs
Variance Block Offset	00	0 - No Variance Block

6.27 Futures Instrument Definition w/ 2 Legs

Length	3D	61 bytes
Type	BB	Futures Instrument Definition Message
Time Offset	78 E2 2F 1B	456,123,000 ns since Last Time Message
Symbol	39 39 38 38 37 37	998877
Unit Timestamp	E9 78 99 5A	2018-03-02 10:16:41 Central Time (1520007401 seconds since Epoch)
Report Symbol	56 58 20 20 20 20	VX
Futures Flags	00	0
Expiration Date	C4 ED 33 01	20180420 - Friday, April 20, 2018
Contract Size	64 00	100
Listing State	41	A - Active
Price Increment	64 00 00 00 00 00 00 00	\$0.01
Leg Count	02	2 legs
Leg Offset	29	Legs begin at byte 41
Variance Block	00	0 - No Variance Block

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

Offset		
Leg #1 Ratio	02 00 00 00	2 (2 Buy)
Leg #1 Symbol	38 37 36 35 34 33	876543
Leg #2 Ratio	FD FF FF FF	-3 (3 Sell)
Leg #2 Symbol	34 35 36 37 38 39	456789

6.28 Trading Status Message

Length	12	18 bytes
Type	31	Trading Status
Time offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	5A 56 5A 5A 54 20 20 20	ZVZZT
Trading Status	54	T = Trading
Reserved	30 20 20	

6.29 Price Limits

Length	1C	28 bytes
Type	BE	Price Limits
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	31 32 33 34 35 20	12345
Upper Price Limit	08 E2 01 00 00 00 00 00	\$12.34
Lower Price Limit	8C 81 01 00 00 00 00 00	\$9.87

6.30 End of Day Summary

Length	41	65 bytes
Type	BA	End of Day Summary
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	39 38 37 36 35 34	987654
Open Interest	B1 68 DE 3A	987,654,321 contracts
High Price	DC FB 09 00 00 00 00 00	\$65.43
Low Price	08 E2 01 00 00 00 00 00	\$12.34
Open Price	E0 49 08 00 00 00 00 00	\$54.32
Close Price	F8 A9 08 00 00 00 00 00	\$56.78
Total Volume	15 CD 5B 07	123,456,789 contracts
Block Volume	88 13 00 00	5,000 block contracts
ECRP Volume	E8 03 00 00	1,000 ECRP contracts
Summary Flags	15	High Price Valid 0x01 Low Price Valid 0x04 Has Open/Close 0x10

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

6.31 Settlement

Length	19	25 bytes
Type	B9	Settlement
Time Offset	60 84 8E 00	9,340,000 ns since last Time Message
Symbol	36 35 34 33 32 31	654321
Trade Date	03 ED 33 01	20180227
		February 27, 2018
Settlement Price	4C F8 06 00 00 00 00 00	\$45.67
Issue	53	S - Initial Settlement

6.32 Sequenced Unit Header with 2 Messages

Sequenced Unit Header:

Hdr Length	31 00	49 bytes, including header
Hdr Count	02	2 messages to follow
Hdr Unit	01	Unit 1
Hdr Sequence	01 00 00 00	First message has sequence number 1

Message 1: Add Order (Short)

Length	19	25 bytes
Type	22	Add Order - Short
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order ID	98 97 96 D3 22 5A 0E 0E	
Side Indicator	42	Buy
Quantity	20 4E	20,000 contracts
Symbol	33 34 35 33 32 31	345321
Price	FF 7F	\$327.67

Message 2: Reduce Size (Short)

Length	10	16 bytes
Type	26	Reduce Size - Short
Time Offset	08 5C 44 25	625,237,000 ns since Last Time Message
Order Id	98 97 96 D3 22 5A 0E 0E	
Canceled	64 00	100 contracts
Quantity		

7 Multicast Configuration

7.1 Production Environment Configuration

7.1.1 Limitations/Configurations

The following table defines the configuration for network and gap request limitations. These limitations are session based. CFE reserves the right to adjust the gap request limitations to improve the effectiveness of the gap request infrastructure.

Period/Type	Limit/Setting	Notes
MTU	1500	CFE will send UDP messages up to 1500 bytes. Participants should ensure that their infrastructure is configured accordingly.
WAN-Shaped Throttle	100 Mb/s	The real-time and gap multicast head ends are configured to shape their output to this level to minimize packet loss.
Gap Response Delay	2 ms	The Gap Server will delay resending sequenced messages via multicast for the specified limit in order to satisfy multiple GRP gap requests with one multicast response.
Count	100	Any single gap request may not be for more than this number of dropped messages.
1 Second	320 Requests	This is the maximum number of retransmission requests allowed per second for each session. This is renewed every clock second.
1 Minute	1,500 Requests	This is the maximum number of retransmission requests allowed per minute for each session. This is renewed every clock minute.
Day	100,000 Requests	This is the maximum number of retransmission requests allowed per day for each session.
Within Range	1,000,000 Messages	Users' retransmission requests must be within this many messages of the most recent sequence sent by the real-time feed per session.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

7.1.2 Unit/Product Distribution

The following table describes the CFE symbol distribution across units.

Symbol Range Start	Unit
VX	1
All Other Products	2

Note - CFE reserves the right to add units and/or change symbol distribution with 48 hours of notice and no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.

7.1.3 Multicast Routing Parameters

Data Center	Rendezvous Point
NY5 Primary Data Center A feed	74.115.128.164
NY5 Primary Data Center B feed	74.115.128.165
400SL Secondary Data Center E feed	170.137.16.128

7.1.4 Address/Unit Distribution

The following tables describe the unit distribution across the CFE Multicast PITCH feeds.

NY5 Primary Datacenter		WAN-Shaped [FC] 74.115.133.96/29		WAN-Shaped [FD] 74.115.133.104/29	
Unit	IP Port	Real-time MC	Gap Resp. MC	Real-time MC	Gap Resp. MC
1	30001	224.0.131.132	224.0.131.133	233.130.124.132	233.130.124.133
2	30002				

Note - CFE reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.

400SL Secondary Datacenter		WAN-Shaped [FE] 170.137.16.80/29	
Unit	IP Port	Real-time MC	Gap Resp. MC
1	31001	233.182.199.0	233.182.199.1
2	31002		

Note - CFE reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.

7.2 US Futures Certification Environment Configuration

7.2.1 Unit/Product Distribution

The following table describes the CFE symbol distribution across units.

Symbol Range Start	Unit
VX	1
All Other Products	2

Note - CFE reserves the right to add units and/or change symbol distribution with 48 hours of notice and no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.

7.2.2 Certification Multicast Routing Parameters

Data Center	Rendezvous Point
NY5 Primary Data Center	74.115.128.130

7.2.3 Address/Unit Distribution

The following tables describe the unit distribution across the certification CFE Multicast PITCH feeds.

NY5 Primary Datacenter		WAN-Shaped [Cert] 174.136.160.16/28	
Unit	IP Port	Real-time MC	Gap Resp. MC
1	32001	224.0.74.196	224.0.74.197
2	32002		

Note - CFE reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.

8 Connectivity

8.1 Supported Extranet Carriers

The WAN-Shaped feed will be made available to participants through extranet carriers that have completed their multicast implementation and registered with CFE for receipt of market data. CFE has certified a number of carriers defined in the [CFE Connectivity Manual](#) with respect to edistribution of CFE multicast data feeds. For more information on receiving Multicast PITCH through any of these providers, reach out to the vendor contact noted in the Extranet Providers section of the [CFE Connectivity Manual](#).

8.2 Bandwidth Recommendation

The WAN-shaped feeds require 100Mbps of bandwidth. CFE will use 90% of these respective bandwidths for Multicast PITCH to allow participants to use the same physical connection for order entry if desired.

9 Support

Please e-mail questions or comments regarding this specification to cfetradedesk@cboe.com.

9.1 Canned Test Data

Customers are strongly encouraged to capture their own test data from the Certification environment to ensure that their systems can correctly decode the PITCH feed and all available message types. To assist firms with their own testing a PITCH sample (taken from the Certification environment) is made available at the link below. Cboe does not guarantee that all message types will appear in test data and cautions that canned test data will be updated infrequently and may not fully reflect the current specification.

[CFE PITCH Test Data](#) (last updated 12/8/17)

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

Revision History

Document Version	Date	Description
1.0.0	05/01/17	Initial version.
1.0.1	06/28/17	Updated description for <i>Report Symbol</i> , <i>Leg Offset</i> and <i>Variance Block Offset</i> fields in <i>Futures Instrument Definition</i> message. Updated descriptions of <i>Variance Futures</i> fields in <i>Futures Instrument Definition</i> message. Updated list of messages included in spin responses. Added <i>Price Limits</i> message. Corrected inconsistencies of field and messages lengths for <i>Trade Long</i> and <i>Trade Short</i> messages.
1.0.2	07/11/17	Added <i>Rendezvous Points</i> , <i>Source IP addresses</i> , and <i>Multicast IP addresses</i> .
1.0.3	08/08/17	Replaced <i>Binary Long Price</i> with <i>Binary Price</i> . Updated <i>Data Types</i> to include definition of <i>Binary Price</i> .
1.0.4	09/21/17	Renamed <i>Trade Date</i> message to <i>Time Reference</i> . Added <i>Epoch Time</i> field to <i>Time</i> message. Fixed discrepancies between <i>Spec</i> and <i>Example Messages</i> .
1.0.5	09/26/17	Fixed discrepancies between available <i>PITCH</i> message types and those listed in section 5.3. Corrected feed label references in section 7.
1.0.6	10/17/17	Added clarification on <i>Trading Status</i> messages for <i>Complex Instruments</i> going in and out of <i>Queuing</i> because of <i>Threshold Width</i> Cboe branding/logo changes.
1.0.7	10/18/17	Fixed discrepancy with the <i>Secondary Data Center</i> listed as <i>CH4</i> instead of <i>400 S La Salle</i> .
1.0.8	11/24/17	Removed <i>LegOffset</i> = 93 value as this value is not possible to be sent. Added missing <i>Price</i> fields in example messages Added clarification to handling of <i>Order Executed at Price/Size</i> message <i>Futures Instrument Definition</i> messages are sent for all live symbols on a spin.
1.0.9	12/08/17	Price limits may apply during any trading hours subject to contract specifications.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

1.0.10	12/29/17	Trading Status messages for Complex instruments transitioning in and out of Queuing on account of Threshold Width no longer suppressed. Removed associated commentary from Trading Status message section. Added “I=Inactive” as possible <i>Listing State</i> . Updated <i>Realized Variance</i> , <i>Discount Factor</i> , <i>Previous ARMVM</i> , and <i>Fed Funds Rate</i> to Signed Binary data type. Corrected the offsets for <i>Leg Ratio</i> and <i>Leg Symbol</i> . Added Canned Test Data section.
1.0.11	01/17/18	Block and ECRP trades (<i>Trade Condition</i> = B or E) do not update <i>High Price</i> or <i>Low Price</i> . Corrected length of Transaction End from 48 to 6 bytes.
1.0.12	01/25/18	Updated field description of <i>Symbol</i> to remove “padding” language. The <i>Symbol</i> field is always six characters, base 62. <i>Price Limits</i> are included in a spin. Added Feed Hours and System Restart section. Clarified cases where the Unit Clear message would be sent. More specifics added to how End of Day Summary values are determined. If no Trading Status has been received for a <i>Symbol</i> , then the <i>Trading Status</i> is “S= Suspended”.
1.0.13	02/01/18	Added links to certification and production symbol mapping files.
1.0.14	02/21/18	Fixed remaining discrepancy with the Secondary Data Center listed as CH4 instead of 400 S La Salle. Updated <i>Trade Condition</i> field values to demonstrate that some values are only sent for simple instruments. Described how trade corrections are modeled in the feed. Additional clarifications added around daily restart based on customer feedback.
1.0.15	02/27/18	Fixed formatting of the Settlement message example.
1.1.0	03/01/18	Removed Executed at Price/Size message. This message is not used for CFE. Updated description of <i>High Price</i> and <i>Low Price</i> in End of Day Summary message.
1.1.1	03/22/18	The End of Day Summary message will be enhanced and expanded to 65 bytes . <ul style="list-style-type: none"> • <i>Total Volume</i> will be updated to include Block and ECRP volume. • <i>Block Volume</i> field will be added. • <i>ECRP Volume</i> field will be added. • <i>Bit Fields</i> field will be added. End of Day Summary example was updated.
1.1.2	03/23/18	Updated effective date of End of Day Summary message change from 1.1.1 to be effective 06/03/18.

Cboe Futures Exchange
Multicast Depth of Book (PITCH) Specification (Version 1.1.5)

1.1.3	05/10/18	Clarified the cases when sequenced Futures Instrument Definition messages are sent.
1.1.4	07/16/18	Removed <i>ModifyBitField1</i> from Modify Order - Short example in section 6.18; not applicable to futures.
1.1.5	11/08/18	Added note clarifying simple leg FID messages come before complex leg FID messages sent in Spin responses. Updated multicast feed ids in section 1.3 to follow standard naming convention.