



# ITCH Protocol Specification

BIST

Version: 2103

## HİZMETE ÖZEL

Document ID:	ITCH_ProtSpec_80
Documentation Release:	GENIUM_Product_a2103
Release Date:	2022-12-19
Publication Date:	2022-12-19

All content in this document is owned, or licensed, by Nasdaq, Inc. or its affiliates ('Nasdaq'). Unauthorized use is prohibited without written permission of Nasdaq. While reasonable efforts have been made to ensure that the contents of this document are accurate, the document is provided strictly "as is", and no warranties of accuracy are given concerning the contents of the information contained in this document, including any warranty that the document will be kept up to date. Nasdaq reserves the right to change details in this document without notice. To the extent permitted by law no liability (including liability to any person by reason of negligence) will be accepted by Nasdaq or its employees for any direct or indirect loss or damage caused by omissions from or inaccuracies in this document.

Copyright © 2017 Nasdaq, Inc. All rights reserved.

---

# Table of Contents

<b>1</b>	<b>SUMMARY OF CHANGES.....</b>	<b>4</b>
<b>2</b>	<b>ABOUT THE MANUAL.....</b>	<b>5</b>
<b>3</b>	<b>ITCH OVERVIEW .....</b>	<b>6</b>
3.1	Architecture.....	6
3.2	Data Types .....	7
<b>4</b>	<b>MESSAGE FORMATS .....</b>	<b>11</b>
4.1	Time Messages .....	11
4.2	Reference Data Messages.....	11
4.3	Event and State Change Messages .....	15
4.4	Market by Order Messages .....	15
4.5	Trade Messages .....	22
<b>A</b>	<b>APPENDIX A, HOW TO BUILD AN ORDER BOOK VIEW .....</b>	<b>24</b>
<b>B</b>	<b>APPENDIX B, HOW TO BUILD A TRADE TICKER .....</b>	<b>25</b>
<b>C</b>	<b>APPENDIX C, TRADES IN COMBINATION ORDER BOOKS .....</b>	<b>26</b>
<b>D</b>	<b>APPENDIX D, RESERVE ORDER MATCHING .....</b>	<b>27</b>
<b>E</b>	<b>APPENDIX E, PROTOCOL FLOW.....</b>	<b>28</b>

# 1 Summary of Changes

Changes between this version and version a1983 (4.0.1024).

No	Date	Changes	Comment
1		The order book directory message Market ID removed from chapter <a href="#">Order Book Directory</a> on page 11.	
2		The "Order Book ID" field offset corrected in the "4.5.1 Trade Message".	Version 2102 20190520
3	19 December 2022	"Appendix E, Protocol Flow" section has been added.	Version 2103 20221219

## **2 About the Manual**

The purpose of this document is to describe the ITCH protocol.

## 3 ITCH Overview

Genium INET ITCH is a direct data feed product. The ITCH feed displays all public orders and trades that occur on the auto-matched market(s).

ITCH is an outbound market data feed only, the protocol does not support order entry. ITCH features, among others, the following data elements:

- **Order level data (MBO) with attribution**

The system will provide its full order depth using the standard ITCH format. ITCH uses a series of order messages to track the life of a customer order, including order executions. The ITCH message formats support market participant attribution, if used by the marketplace.

- **Trade messages**

ITCH supports a trade message to reflect a match of a non-displayable order in the system.

- **Reference Data**

- Order book Directory messages provide basic security data such as the ISIN code and Financial Product.
- Tick Size Table Entry messages to convey Tick Sizes for order books.

- **Event controls**

- Order book State message to inform receivers of state changes.

**Note:**

ITCH provides an order-book view and auto-matched trades.

- Do not assume that the mechanisms of the matching logic can be derived from observing the ITCH feed.
- ITCH cannot be used to manage private orders.
- ITCH does not provide privately negotiated trades reported to the marketplace.

**Note:**

For multicurrency contracts the trade volumes are not multiplying with exchange rates since there is no support in ITCH for currency conversions. Please note that the actual volumes in the market for the contracts traded, other than TRL, may differ from the ITCH logs for that reason.

### 3.1 Architecture

The ITCH feed is made up of a series of sequenced messages. Each message is variable in length based on the message type. The messages will be binary encoded using MoldUDP64. The messages that make up the ITCH protocol are typically delivered using a higher level protocol that takes care of sequencing and delivery guarantees.

MoldUDP64 is a light-weight networking protocol built on top of UDP that provides a mechanism for listeners to detect and re-request missed packets. Each message is explicitly sequence numbered. If a packet loss is detected by the client, it can re-request that packet from the MoldUDP64 gateway, and it will be resent as a UDP unicast to that client.

## 3.2 Data Types

Type	Size	Notes
Numeric	1, 2, 4, or 8 bytes	Unsigned big-endian binary encoded numbers.  <b>Note:</b> The transport layer, MoldUDP64, uses big-endian for its numeric values.
Alpha	variable	Left justified and padded on the right with spaces. Composed of non-control ISO 8859-1 (Latin-1) encoded bytes.
Price	4 bytes	Prices are signed integer fields. Number of decimals is specified in the Order book Directory message.  <b>Note:</b> A Price field with bit 31 set (the highest bit, MIN_INT) while all other bits are zero (decimal -2147483648) means that no price was available. This value also represents a market order in the Add Order messages.  The Tick Size Table Entry message contains an 8 Byte Price field.





## 4 Message Formats

The ITCH feed is composed of a series of messages that describe orders added to, removed from, and executed on the Genium INET Trading system. It also contains messages for basic reference data of the order books as well as state changes and halts.

### 4.1 Time Messages

For bandwidth efficiency reasons, timestamps are separated into two pieces:

Timestamp portion	Message Type	Notes
Seconds	Standalone message	Unix time (number of seconds since 1970-01-01 00:00:00 UTC)  A Timestamp – Second message will be disseminated for every second for which there is at least one payload message.
Nanoseconds	Field within individual messages	Reflects the number of nanoseconds since the most recent Timestamp-Seconds message that the payload message was generated.

#### 4.1.1 Seconds Message

This message is sent every second for which at least one ITCH message is being generated. The message contains the number of seconds since the start of 1970-01-01 00:00:00 UTC, also called Unix Time.

Table 1: Timestamp - Seconds Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"T"	T - Seconds Message
Second	1	4	Numeric	Unix time (number of seconds since 1970-01-01 00:00:00 UTC)

## 4.2 Reference Data Messages

### 4.2.1 Order Book Directory

At the start of each trading day, Order book directory messages are disseminated for all active securities, including halted securities, in the Genium INET Trading system.

**Note:**

Intra-day transmissions of this message may occur when new order books are added to the system. Updates to existing order books may also be represented by intra-day Order book Directory messages.

Table 2: Order book Directory

Name	Offset	Length	Value	Notes
Message Type	0	1	"R"	Order book Directory Message
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Order book ID	5	4	Numeric	Denotes the primary identifier of an order book.  <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Note:</b> Expired Order book IDs may be reused for new instruments.</p> </div>
Symbol	9	32	Alpha	Security short name.
Long Name	41	32	Alpha	Human-readable long name of security.
ISIN	73	12	Alpha	ISIN code identifying security.
Financial Product	85	1	Numeric	Values: 1 = Option 2 = Forward 3 = Future 4 = FRA 5 = Cash 6 = Payment 7 = Exchange Rate 8 = Interest Rate Swap 9 = REPO 10 = Synthetic Box Leg/Reference 11 = Standard Combination 12 = Guarantee 13 = OTC General 14 = Equity Warrant 15 = Security Lending 18 = Certificate
Trading Currency	86	3	Alpha	Trading currency.
Number of decimals in Price	89	2	Numeric	Number of decimals used in price for this order book.  <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Note:</b> A value of 256 means that the instrument is traded in fractions (each fraction is 1/256).</p> </div>
Number of decimals in Nominal Value	91	2	Numeric	Number of decimals in Nominal Value.
Odd Lot Size	93	4	Numeric	Indicates the number of securities that represents an odd lot for the order book.

Name	Offset	Length	Value	Notes
				<div style="border: 1px solid blue; padding: 5px;"> <p><b>Note:</b> A value of 0 indicates that this lot type is undefined for the order book.</p> </div>
Round Lot Size	97	4	Numeric	Indicates the quantity that represents a round lot for the issue
Block Lot Size	101	4	Numeric	Indicates the number of securities that represents an odd lot for the order book. <div style="border: 1px solid blue; padding: 5px;"> <p><b>Note:</b> A value of 0 indicates that this lot type is undefined for the order book.</p> </div>
Nominal Value	105	8	Numeric	Nominal value.
Number of Legs	113	1	Numeric	Number of legs. Only applicable for combination instruments.
Underlying Order book ID	114	4	Numeric	Order book ID of underlying instrument. Only applicable for derivative instruments except for combinations
Strike Price	118	4	Price	Only applicable for derivative instruments.
Expiration Date	122	4	Date	Date of expiration. Only applicable for derivative instruments.
Number of decimals in Strike Price	126	2	Numeric	Number of decimals used in Strike Price for this order book. Only applicable for derivative instruments.
Put or Call	128	1	Numeric	Option type. Values: 1 = Call 2 = Put A value of 0 indicates that Put or Call is undefined for the order book.

## 4.2.2 Combination Order Book Leg

This message provides a mapping between a combination order book and one of the combination leg order books.

A Combination instrument (standard or Tailor-Made) is a synthetic instrument consisting of two or more real instruments. In Genium INET, combination instruments are set up as regular order books in which orders can be placed.

The Combination instrument and each of the leg instruments are represented by Order book Directory messages in ITCH. The Combination Order book Leg message represents a mapping between a combination order book and one of its leg order books. For each combination order book, one Combination Order book Leg message will be generated per leg that the combination consists of.

Intra-day transmissions of this message may occur when new combination order books are added to the system. This is typically the case for tailor-made combinations. Updates to existing combination order books may also be represented by intra-day Order book Directory messages.

Table 3: Combination Order book Leg

Name	Offset	Length	Value	Notes
Message Type	0	1	"M"	Combination Order book Leg Message
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Combination Order book ID	5	4	Numeric	Denotes the primary identifier of an order book. NOTE: Expired Order book IDs may be reused for new instruments.
Leg Order book ID	9	4	Numeric	Order book ID of Leg instrument
Leg Side	13	1	Alpha	Values: B = As Defined C = Opposite
Leg Ratio	14	4	Numeric	

### 4.2.3 Tick Size Table Entry

This message contains information on a tick size for a price range. Together, all Tick Size messages with the same order book ID form a complete Tick Size Table. Each order book has a set of Tick Size Table Entries to define its tick size table.

**Note:**  
The number of decimals in prices are given by the Order Book Directory message for this order book.

Table 4: Tick Size Table Entry

Name	Offset	Length	Value	Notes
Message Type	0	1	"L"	Tick Size Message.
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Order book ID	5	4	Numeric	The order book to which this entry belongs.
Tick Size	9	8	Price	Tick Size for the given price range.
Price From	17	4	Price	Start of price range for this entry.
Price To	21	4	Price	End of price range for this entry. Zero (0) means infinity.

## 4.3 Event and State Change Messages

### 4.3.1 System Event Message

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

Table 5: System Event Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"S"	S – System Event Message.
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Event Code	5	1	Alpha	The system supports the following event codes on a daily basis: "O" = Start of Messages. Outside of time stamp messages, the start of day message is the first message sent in any trading day. "C" = End of Messages. This is always the last message sent in any trading day.

### 4.3.2 Order Book State Message

The Order book state message relays information on state changes.

Table 6: Order Book State Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"O"	Order Book State Message.
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Order Book ID	5	4	Numeric	Order book identifier.
State Name	9	20	Alpha	Name of Order Book State

## 4.4 Market by Order Messages

**Note:**

Order IDs are only unique per order book and side. When modifying or deleting orders, be careful to only update the order with the correct side and order book, since the same Order ID may be present in multiple order books and/or sides.

### 4.4.1 Add Order Messages

An Add Order Message indicates that a new order has been accepted by the Genium INET Trading system and was added to the displayable book. The message includes an Order ID that is *unique per order book and side* used by the Genium INET Trading to track the order.

**Note:**  
For a description of how market orders are represented, see subchapter “Data Types” on page [10](#).

Two variations of the Add Order message format are supported:

- Add Order—No MPID Attribution  
Generated for unattributed orders in the Genium INET Trading system.
- Add Order—With MPID Attribution  
Generated for attributed orders and quotations entered into the Genium INET Trading system.

Table 7: Add Order—No MPID Attribution

Name	Offset	Length	Value	Notes
Message Type	0	1	"A"	Add Order Message.
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Order ID	5	8	Numeric	The identifier assigned to the new order. <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"><b>Note:</b> The number is only unique per Order book and side.</div>
Order Book ID	13	4	Numeric	Order book identifier.
Side	17	1	Alpha	“B” = buy order. “S” = sell order.
Order Book Position	18	4	Numeric	Rank within order book. For details, see “Appendix A, How to Build an Order Book View” on page <a href="#">25</a> .
Quantity	22	8	Numeric	The visible quantity of the order. <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"><b>Note:</b> Orders with an undisclosed quantity will have this field set to 0.</div>
Price	30	4	Price	The display price of the new order. For details about field processing notes, see subchapter “Data Types” on page <a href="#">10</a> .
Order Attributes	34	2	Numeric	Additional order attributes. Values: 0 = Not applicable

Name	Offset	Length	Value	Notes
				8192 = Bait/implied order  <b>Note:</b> Applicable types may be defined by the marketplace.  <b>Note:</b> This field is a bit map. Multiple values may be set simultaneously.
Lot Type	36	1	Numeric	Lot Type. Values: 2 = Round Lot

Table 8: Add Order—With MPID Attribution

Name	Offset	Length	Value	Notes
Message Type	0	1	"F"	Add Order Message.
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Order ID	5	8	Numeric	The identifier assigned to the new order.  <b>Note:</b> The number is only unique per Order book and side.
Order book ID	13	4	Numeric	Order book identifier.
Side	17	1	Alpha	"B" = buy order. "S" = sell order.
Order book Position	18	4	Numeric	Rank within order book. For details, see "Appendix A, How to Build an Order Book View" on page <a href="#">25</a> .
Quantity	22	8	Numeric	The visible quantity of the order.  <b>Note:</b> Orders with an undisclosed quantity will have this field set to 0.
Price	30	4	Price	The display price of the new order. For details about field processing notes, see subchapter "Data Types" on page <a href="#">10</a> .
Order Attributes	34	2	Numeric	Additional order attributes. Values: 0 = Not applicable 8192 = Bait/implied order

Name	Offset	Length	Value	Notes
				<div style="border: 1px solid black; padding: 5px;"> <p><b>Note:</b> Applicable types may be defined by the marketplace.</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p><b>Note:</b> This field is a bit map. Multiple values may be set simultaneously.</p> </div>
Lot Type	36	1	Numeric	Lot Type. Values: 2 = Round Lot
Participant ID	37	7	Alpha	Market participant identifier associated with the entered order.

## 4.4.2 Modify Order Messages

Modify Order messages always include the Order ID, Order book ID and Side of the Add Order to which the update applies.

To determine the currently displayed quantity for an order, ITCH subscribers must deduct the quantity stated in the Modify message from the original quantity stated in the Add Order message with the same Order ID. Genium INET Trading may send multiple Modify Order messages for the same order and the effects are cumulative. When the displayed quantity for an order reaches zero, the order is dead and should be removed from the book.

### 4.4.2.1 Order Executed Message

This message is sent whenever an order on the book is executed in whole or in part.

If the incoming order causing the match cannot be fully filled, the remainder will be placed in the book after the match has occurred.

It is possible to receive several Order Executed Messages for the same order if that order is executed in several parts. Multiple Order Executed Messages on the same order are cumulative.

Table 9: Order Executed Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"E"	Order Executed Message.
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Order ID	5	8	Numeric	The order ID associated with the executed order.
Order book ID	13	4	Numeric	Order book identifier.
Side	17	1	Alpha	"B" = buy order. "S" = sell order.
Executed Quantity	18	8	Numeric	The quantity being executed.



Name	Offset	Length	Value	Notes
Match ID	26	8	Numeric	Assigned by the system to each match executed.
Combo Group ID	34	4	Numeric	Used to group combination order book executions and the trades in the constituent order books together. See Appendix C for details.
Reserved	38	7		
Reserved	45	7		

### 4.4.2.2 Order Executed with Price Message

This message is sent in the relatively rare event that an order on the book is executed in whole or in part with a price different than the initial display price.

If the incoming order causing the match cannot be fully filled, the remainder will be placed in the book after the match has occurred.

It is possible to receive several Order Executed messages for the same order if that order is executed in several parts. Multiple Order Executed messages on the same order are cumulative.

The executions may be marked as non-printable. If a participant is looking to use the ITCH data in trade tickers or volume calculations, it is recommended that participants ignore messages marked as non-printable to prevent double counting.

**Note:**

- Combination orders on the book that execute will always be represented by this message.
- Combination orders that execute will have the Printable flag set to "N". The trades that occur in the legs of the combination will be printable. This avoids double counting of the combination order and its leg trades. Leg trades will be published with the Trade message.

Table 10: Order Executed with Price Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"C"	Order Executed Message.
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Order ID	5	8	Numeric	The order ID associated with the executed order.
Order book ID	13	4	Numeric	Order book identifier.
Side	17	1	Alpha	"B" = buy order. "S" = sell order.
Executed Quantity	18	8	Numeric	The quantity being executed.
Match ID	26	8	Numeric	Assigned by the system to each match executed.
Combo Group ID	34	4	Numeric	Used to group combination order book executions and the trades in the constituent order books together. See Appendix C for details.
Reserved	38	7		

Name	Offset	Length	Value	Notes
Reserved	45	7		
Trade Price	52	4	Price	
Occurred at Cross	56	1	Alpha	Values: "Y" = Yes, trade occurred at the cross "N" = No, trade occurred at continuous market
Printable	57	1	Alpha	Indicates if the trade should be included in trade tickers and volume calculations. Values: "N" = non-printable "Y" = printable

### 4.4.2.3 Order Replace Message

**Note:**  
The Order Replace Message is not used, it remains in the ITCH specification for future reference.

A replace of an existing order will be represented by an Order Delete Message followed by an Order Add Message but the original order ID will remain.

This message is sent whenever an order on the book has been cancel-replaced. The remaining quantity from the original order is no longer accessible and must be removed.

The Side and Order book ID, remain the same as the original order.

Table 11: Order Replace Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"U"	Order Replace Message.
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Order ID	5	8	Numeric	The original order identifier of the order being replaced. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>The Order ID is only unique per order book and side.</li> <li>The Order ID does not change when the order is replaced.</li> </ul> </div>
Order book ID	13	4	Numeric	Order book identifier.
Side	17	1	Alpha	"B" = buy order. "S" = sell order.
New Order book Position	18	4	Numeric	New Rank within order book. For details, see "Appendix A, How to Build an Order Book View" on page <a href="#">25</a> .
Quantity	22	8	Numeric	New visible quantity of the order.

Name	Offset	Length	Value	Notes
Price	30	4	Price	New Price of the order.
Order Attributes	34	2	Numeric	Additional order attributes. Values: 0 = Not applicable 8192 = Bait/implied order  <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"><b>Note:</b> Applicable types may be defined by the marketplace.</div> <div style="border: 1px solid black; padding: 5px;"><b>Note:</b> This field is a bit map. Multiple values may be set simultaneously.</div>

#### 4.4.2.4 Order Delete Message

This message is sent whenever an order on the book is being deleted. There will be no remaining quantity, so the order should be removed from the book.

Normally, no Order Delete message is sent when an order is completely filled. The receiver needs to keep track of the remaining quantity on all orders by recalculating the remaining quantity on each Order Executed message received. Orders must be removed from the book when the remaining quantity reaches 0.

Order Deletes are sent out when orders are suspended due to connection loss.

Table 12: Order Delete Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"D"	Order Delete Message
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Order ID	5	8	Numeric	The original order identifier of the order being deleted.  <div style="border: 1px solid black; padding: 5px;"><b>Note:</b> The Order ID is only unique per order book and side.</div>
Order book ID	13	4	Numeric	Order book identifier.
Side	17	1	Alpha	"B" = buy order. "S" = sell order.

## 4.5 Trade Messages

### 4.5.1 Trade Message

The Trade Message is designed to provide execution details for normal match events involving non-displayable order types. This message is also used to publish individual cross trades.

Since no Add Order Message is generated when a non-displayed order is initially received, the Order Executed message cannot be used for all matches. The Trade Message is used to report a match for a non-displayable order in the book.

It is possible to receive multiple Trade Messages for the same order if that order is executed in several parts. Trade Messages for the same order are cumulative.

Trade Messages should be included in trade tickers as well as volume and other market statistics. Since Trade Messages do not affect the displayed book, however, they may be ignored by participants just looking to build and track the order book view.

Table 13: Trade Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"P"	Trade Message
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Match ID	5	8	Numeric	Assigned by the system to each match executed.
Combo Group ID	13	4	Numeric	Used to group combination order book executions and the trades in the constituent order books together. See Appendix C for details.
Side	17	1	Alpha	Type of non-display order on the book being matched. "B" =buy order "S" =sell order Will be set to blank (space) for anonymous markets.
Quantity	18	8	Numeric	Quantity being matched in this execution.
Order book ID	26	4	Numeric	Order book identifier.
Trade Price	30	4	Price	
Reserved	34	7		
Reserved	41	7		
Printable	48	1	Alpha	Indicates if the trade should be included in trade tickers and volume calculations. Values: "N" = non-printable "Y" = printable
Occurred at Cross	49	1	Alpha	Values: "Y" = Yes, trade occurred at the cross "N" = No, trade occurred at continuous market

## 4.5.2 Auction Messages

Markets by order dissemination may be disabled during auctions by configuration. In such cases, every existing order will be removed from the book by an Order Delete message immediately prior

**Note:**

Owners of these orders must not interpret this as order cancellations. Use the private order flow to determine the state of your orders.

to the auction.

### 4.5.2.1 Equilibrium Price Update

This message is used when auctions occur. The message provides the changes in equilibrium price.

If any Price field has bit 31 set (the highest bit, MIN\_INT) while all other bits are zero (decimal - 2147483648), this means that no price is available.

Table 14: Equilibrium Price Update

Name	Offset	Length	Value	Notes
Message Type	0	1	"Z"	Equilibrium Price Update Message
Timestamp – Nanoseconds	1	4	Numeric	Nanoseconds portion of the timestamp.
Order book ID	5	4	Numeric	Order book ID.
Available Bid Quantity at Equilibrium Price	9	8	Numeric	Quantity at equilibrium price on the bid side.
Available Ask Quantity at Equilibrium Price	17	8	Numeric	Quantity at equilibrium price on the ask side.
Equilibrium Price	25	4	Price	Equilibrium Price.
Best Bid Price	29	4	Price	Best Bid Price.
Best Ask Price	33	4	Price	Best Ask Price.
Best Bid Quantity	37	8	Numeric	Best Bid Quantity.
Best Ask Quantity	45	8	Numeric	Best Ask Quantity.

# A Appendix A, How to Build an Order Book View

The information needed to build an order book view from the ITCH message flow is contained in the Add Order Messages and the Modify Order Messages. The messages are:

- Add Order – No MPID Attribution
- Add Order – MPID Attribution
- Order Executed
- Order Executed with Price
- Order Replace
- Order Delete.

The purpose of the two flavors of the Add Order messages is to add an order to the book.

Orders are ranked by Order book Position. 1 denotes the highest ranked order. For an Order Replace, the order must be removed from its previous position and inserted at New Order Book Position. An order inserted at an existing position shifts the order on that position down (and all orders below as well. A deleted or fully filled order causes existing orders below it to shift their position up one step to fill the “void.”

- The Order Executed (with Price) message signals a partial or full fill. The order quantity must be reduced by the quantity of the Order Executed message.
- The Order Replace message signals that the order has been modified. The current ranking may or may not be lost in the process. Order Book Position will show the new ranking within the book.
- The Order Delete message tells the recipient to remove the order referenced.

# B Appendix B, How to Build a Trade Ticker

The Trade Ticker is based on the following messages:

- Order Executed
- Order Executed with Price
- Trade.

**Note:**

- Trades and Order Executed with Price messages marked as non-printable are excluded to avoid double booking of trades.
- Reported trades are not included in ITCH.

# C Appendix C, Trades in Combination Order Books

When a Combination order is executed, trades also occur in all legs of the combination. To learn about the Combination instrument and its constituents, query the Combination Order book Directory message.

- Communication of Combo vs. Combo Executions
  - Order Executed with Price message for the Combination Order Book, with the Printable flag set to N (to avoid double counting)
  - Trade messages in the constituent order books.
- Communication of Combo vs. Outright Executions
  - Order Executed, and/or Order Executed with Price messages for the constituent order books
  - Trade message in the Combination Order book, with the Printable flag set to N (to avoid double counting).
- The Combination Order Book execution and the constituent Order book executions have different Match ID, but the same Combo Group ID. Use the Combo Group ID field to group the Order Executed and the Trade messages for a combination execution together. Note: The Combo Group ID field should not be assumed to be unique over time.



# D Appendix D, Reserve Order Matching

When a reserve order is matched, one or several times, the messages for the following scenarios are:

Scenario	Message
Reserve order fully filled - matching against the visible and the hidden quantity	E - with the quantity matched against the reserve orders visible quantity
	P - with the quantity matched against the reserve orders hidden quantity
Reserve order not fully filled - matching against the hidden quantity only	D - removing the visible quantity of the reserve order from the order book
	P - with the total matched quantity
	<b>Note:</b> Seen as the matching has only occurred against the hidden quantity
	A - re-adding the visible quantity to the order book.

**Note:**  
Reserve order is also known as Iceberg order.

# E Appendix E, Protocol Flow

The daily ITCH data flow is summarized below;

After joining the multicast group by using the ITCH IP/port(s) (on primary & secondary data flows), clients can start listening the ITCH data stream like order level data, trade messages, reference data and event messages. ITCH feed is made up of a series of sequenced messages. Each message is explicitly sequence numbered and variable in length, based on the message type. The messages will be binary encoded using MoldUDP64.

GLIMPSE (binary encoded using SoupBinTCP) and REWINDER (binary encoded using MoldUDP64) services are part of ITCH data feed to perform a late join or recovering from a data gap. For more information about SoupBinTCP and MoldUDP64, please refer to the additional specifications.

Before REWINDER or GLIMPSE services are used, clients must be running and continuously listening ITCH real-time data feed as the first step of recovery and/or late join issues in ITCH.

If a packet (a particular message or group of messages) loss is detected and can not be supplied from secondary data flow, client can re-request that packet from the REWINDER server, and the messages will be resent as a UDP unicast to that client.

GLIMPSE provides a snapshot of the current state of the order books. GLIMPSE can be used to quickly sync up with the real-time ITCH feed. At the end of the GLIMPSE snapshot, clients must continue listening real-time ITCH feed from the sequence number specified in GLIMPSE snapshot.

GLIMPSE and REWINDER services use the same message formats as ITCH protocol.

