

# NASDAQ TotalView-ITCH FPGA<sup>SM</sup>

## Version 4.1

### 1 Overview

Pending Securities and Exchange Commission (SEC) approval or immediately effective filing, The NASDAQ Stock Market, LLC plans to introduce a new delivery mechanism for the NASDAQ TotalView-ITCH<sup>SM</sup> product. Using field programmable gate array (FPGA) technology, the new TotalView-ITCH service is designed to deliver NASDAQ<sup>®</sup> direct data content in a reliable, low latency manner throughout the trading day, even during peak market conditions.

NASDAQ OMX<sup>®</sup> has traditionally used software-based data feed handlers to produce its TotalView-ITCH service. While NASDAQ OMX has optimized its code base, the software-based TotalView-ITCH service is subject to certain buffering and queuing effects during peak market conditions. While many firms rely on NASDAQ OMX to control and shape its outbound data rates during these periods, some firms would prefer that NASDAQ OMX employ a more deterministic approach to its data delivery.

By supporting both FPGA and software-based environments, NASDAQ OMX allows firms to select the delivery option that best fits their business needs. For those that choose the FPGA option, TotalView-ITCH FPGA will be disseminated in unshaped traffic pattern that reflects true market volumes at all points during the trading day.

From a messaging perspective, the TotalView-ITCH FPGA product will use the same ITCH 4.1 messaging standard as the software-based feed. The TotalView-ITCH FPGA will carry the following data elements (in binary number format) for all exchange-listed equities securities traded via the NASDAQ execution system:

- **Order level data with attribution:** For the NASDAQ execution system, NASDAQ will provide its full order depth using the standard ITCH format. TotalView-ITCH uses a series of messages of order messages to track the life of a customer order.<sup>1</sup> As an added feature, the TotalView-ITCH message formats will support NASDAQ market participant attribution. TotalView-ITCH carries order level data for NYSE-, NYSE Amex-, NYSE Arca- and BATS-listed securities as well as for NASDAQ-listed securities.
- **Trade messages:** To ensure that customers have complete information about NASDAQ order flow, TotalView-ITCH 4.1 supports a trade message to reflect a match of a non-displayable order in the NASDAQ system. TotalView-ITCH 4.1 also supports a separate trade message to reflect NASDAQ cross transactions.
- **Net Order Imbalance Data:** In the minutes leading up to the NASDAQ Opening and Closing Crosses<sup>®</sup> as well as the NASDAQ Crosses for IPO or halted/paused securities, NASDAQ disseminates the indicative clearing price and net order imbalance on NASDAQ. Because the calculation includes non-displayable as well as displayable order types, the Net Order Imbalance Indicator (NOII) is the best predictor of the NASDAQ opening and closing prices available to the public.
- **Administrative messages**, such trading actions and symbol directory messages:
  - Trading action messages are used to inform market participants when a security is halted/paused or released for trading.

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<sup>1</sup> TOTALVIEW-ITCH is an outbound market data feed only. The ITCH protocol does not support order entry. For information on NASDAQ order entry protocols, please refer to the [Trading Products section](#) of the NASDAQ OMX Trader<sup>®</sup> website.

- Symbol Directory messages provide basic security data such as the market tier and Financial Status Indicator.
- Market participant position message carries the Primary Market Maker status, Market Participant status and Market Maker mode fields used by some firms to comply with market regulations.
- **Event controls**, such as start of day, end of day and emergency market halt/resume.

## 2 Architecture

NASDAQ OMX will **broadcast** the TotalView-ITCH FPGA feed from the U.S. primary data center facility in Carteret, New Jersey in the [MoldUDP64](#) protocol option only. Given the unshaped network traffic, NASDAQ OMX is requiring firms to have 10 Gb or 40 Gb network connection into the Carteret, NJ data center to obtain the TotalView-ITCH FPGA feed.

As with the software version of the feed, the TotalView-ITCH FPGA feed will be comprised of a series of sequenced order messages. Outside of the fact that the FPGA data delivery is unthrottled or unshaped at the network level, the TotalView-ITCH payload will be the same for both versions of the TotalView-ITCH 4.1 data formats. TotalView-ITCH FPGA product is guaranteed to disseminate payload messages in the same exact order as the software-based version of the TotalView-ITCH feed.

With this messaging sequencing guarantee, TotalView-ITCH FPGA firms will be able to utilize the GLIMPSE 4.1 service to obtain current state of the book retransmissions. Firms may also use the software version of TotalView-ITCH 4.1 for fault tolerance or disaster recovery purposes.

## 3 Data Types

All integer fields are unsigned big-endian (network byte order) binary encoded numbers.

All alpha fields are left justified and padded on the right with spaces.

Prices are integer fields. When converted to a decimal format, prices are in fixed point format with 6 whole number places followed by four (4) decimal digits. The maximum price in TotalView-ITCH is 200,000.0000 (decimal, 77359400 hex).

## 4 Message Formats

**As noted above, the TotalView-ITCH FPGA product will use the 4.1 messaging standard. From this point forward, the TotalView-ITCH specification document will be the same for both the FPGA and software versions of the feed.**

### 4.1 Time Stamp – Seconds

For bandwidth efficiency reasons, NASDAQ will separate the TotalView-ITCH 4.1 timestamp into two pieces:

<b>Timestamp Portion</b>	<b>Message Type</b>	<b>Notes</b>
Seconds	Standalone message on TotalView-ITCH 4.1 feed	Reflects the number of seconds past midnight that the Timestamp message was generated.  Note: A Timestamp – Second message will be disseminated for every second for which there is at least one payload

		message.
Nanoseconds	Field within individual message formats on TotalView-ITCH 4.1 feed	Reflects the number of nanoseconds since the most recent Timestamp-Seconds message that the payload message was generated.

For the standalone Timestamp – Seconds message, the message format will be as follows:

TIMESTAMP - SECONDS MESSAGE				
Name	Offset	Length	Value	Notes
Message Type	0	1	"T"	Seconds Message.
Second	1	4	Integer	Number of seconds since midnight.

## 4.2 System Event Message

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

SYSTEM EVENT MESSAGE				
Name	Offset	Length	Value	Notes
Message Type	0	1	"S"	System Event Message.
Timestamp	1	4	Integer	Nanoseconds portion of the timestamp.
Event Code	5	1	Alpha	See System Event Codes below.

NASDAQ supports the following event codes on a daily basis on the TotalView-ITCH 4.1 data feed.

SYSTEM EVENT CODES – DAILY	
Code	Explanation
"O"	<i>Start of Messages.</i> Outside of time stamp messages, the start of day message is the first message sent in any trading day.
"S"	<i>Start of System hours.</i> This message indicates that NASDAQ is open and ready to start accepting orders.
"Q"	<i>Start of Market hours.</i> This message is intended to indicate that Market Hours orders are available for execution.
"M"	<i>End of Market hours.</i> This message is intended to indicate that Market Hours orders are no longer available for execution.
"E"	<i>End of System hours.</i> It indicates that NASDAQ is now closed and will not accept any new orders today. It is still possible to receive Broken Trade messages and Order Delete messages after the End of Day.
"C"	<i>End of Messages.</i> This is always the last message sent in any trading day.

In the event of an emergency market condition (EMC), NASDAQ will also support the following event codes on TotalView-ITCH 4.1.

SYSTEM EVENT CODES – AS NEEDED	
Code	Explanation
"A"	<i>Emergency Market Condition – Halt:</i> This message is sent to inform NASDAQ market participants that the EMC is in effect. No trading is allowed during the EMC.
"R"	<i>Emergency Market Condition – Quote Only Period:</i> This message is sent to inform NASDAQ market participants that the EMC quotation only

	period is in effect.
"B"	<i>Emergency Market Condition – Resumption</i> : This message is sent to inform NASDAQ market participants that EMC is no longer in effect.

## 4.3 Stock Related Messages

### 4.3.1 Stock Directory

At the start of each trading day, NASDAQ disseminates stock directory messages for all active symbols in the NASDAQ execution system.

Market data redistributors should process this message to populate the Financial Status Indicator (required display field) and the Market Category (recommended display field) for NASDAQ-listed issues.

STOCK DIRECTORY				
Name	Offset	Length	Value	Notes
Message Type	0	1	"R"	Stock Directory Message
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Stock	5	8	Alpha	Denotes the security symbol for the issue in the NASDAQ execution system. Refer to Appendix B for stock symbol convention information.
Market Category	13	1	Alpha	Indicates Listing market or listing market tier for the issue  "N" = New York Stock Exchange (NYSE) "A" = NYSE Amex "P" = NYSE Arca "Q" = NASDAQ Global Select Market <sup>SM</sup> "G" = NASDAQ Global Market <sup>SM</sup> "S" = NASDAQ Capital Market <sup>®</sup> "Z" = BATS BZX Exchange
Financial Status Indicator	14	1	Alpha	For NASDAQ-listed issues, this field indicates when a firm is not in compliance with NASDAQ continued listing requirements.  "D" = Deficient "E" = Delinquent "Q" = Bankrupt "S" = Suspended "G" = Deficient and Bankrupt "H" = Deficient and Delinquent "J" = Delinquent and Bankrupt "K" = Deficient, Delinquent and Bankrupt  Space = Company is in compliance, if NASDAQ-listed issue  For NYSE, NYSE Amex and NYSE Arca issues, this field will also be space-filled. Redistributors should refer to SIAC feeds for code if needed.
Round Lot Size	15	4	Integer	Indicates the number of shares that represent a round lot for the issue
Round Lots Only	19	1	Alpha	Indicates if NASDAQ system limits order entry for issue  "Y" = only round lots are accepted in this stock "N" = odd/mixed lots are allowed

### 4.3.2 Stock Trading Action

NASDAQ uses this administrative message to indicate the current trading status of a security to the trading community.

Prior to the start of system hours, NASDAQ will send out a Trading Action spin. In the spin, NASDAQ will send out a Stock Trading Action message with the "T" (Trading Resumption) for all NASDAQ- and other exchange-listed securities that are eligible for trading at the start of the system hours. If a security is absent from the pre-opening Trading Action spin, firms should assume that the security is being treated as halted in the NASDAQ platform at the start of the system hours. Please note that securities may be halted in the NASDAQ system for regulatory or operational reasons.

After the start of system hours, NASDAQ will use the Trading Action message to relay changes in trading status for an individual security. Messages will be sent when a stock is:

- Halted / paused
- Released for quotation
- Released for trading.

STOCK TRADING ACTION				
Name	Offset	Length	Value	Notes
Message Type	0	1	"H"	Stock Trading Action Message.
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Stock	5	8	Alpha	Stock symbol right padded with spaces.
Trading State	13	1	Alpha	Indicates the current trading state for the stock. Allowable values:  "H" = Halted or paused across all U.S. equity markets / SROs "V" = Halted or paused on NASDAQ only "Q" = Quotation only period for cross-SRO halt or pause "R" = Quotation only period for NASDAQ only halt or pause "T" = Trading on NASDAQ
Reserved	14	1	Alpha	Reserved.
Reason	15	4	Alpha	Trading Action reason.

### 4.3.3 Reg SHO Short Sale Price Test Restricted Indicator

In February 2011, the SEC will implement changes to Rule 201 of the Regulation SHO (Reg SHO). For details, please refer to [SEC Release Number 34-61595](#). In association with the Reg SHO rule change, NASDAQ will introduce the following Reg SHO Short Sale Price Test Restricted Indicator message format.

For NASDAQ-listed issues, NASDAQ will support a full pre-opening spin of Reg SHO Short Sale Price Test Restricted Indicator messages indicating the Rule 201 status for all active issues. NASDAQ will also send the Reg SHO Short Sale Price Test Restricted Indicator message in the event of an intraday status change.

REG SHO RESTRICTION				
Name	Offset	Length	Value	Notes
Message Type	0	1	"Y"	Reg SHO Short Sale Price Test Restricted Indicator

Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Stock	5	8	Alpha	Stock symbol right padded with spaces.
Reg SHO Action	13	1	Alpha	Denotes the Reg SHO Short Sale Price Test Restriction status for the issue at the time of the message dissemination. Allowable values are:  "0" = No price test in place  "1" = Reg SHO Short Sale Price Test Restriction in effect due to an intra-day price drop in security  "2" = Reg SHO Short Sale Price Test Restriction remains in effect

#### 4.3.4 Market Participant Position

At the start of each trading day, NASDAQ disseminates a spin of market participant position messages. The message provides the Primary Market Maker status, Market Maker mode and Market Participant state for each NASDAQ market participant firm registered in an issue. Market participant firms may use these fields to comply with certain marketplace rules.

Throughout the day, NASDAQ will send out this message only if NASDAQ Operations changes the status of a market participant firm in an issue.

MARKET PARTICIPANT POSITION				
Name	Offset	Length	Value	Notes
Message Type	0	1	"L"	Market Participant Position message
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
MPID	5	4	Alphabetic	Denotes the market participant identifier for which the position message is being generated
Stock	9	8	Alphanumeric	Denotes the security symbol for which the position is being generated
Primary Market Maker	17	1	Alphanumeric	Indicates if the market participant firm qualifies as a Primary Market Maker in accordance with NASDAQ marketplace rules  "Y" = primary market maker "N" = non-primary market maker
Market Maker Mode	18	1	Alphanumeric	Indicates the quoting participant's registration status in relation to SEC Rules 101 and 104 of Regulation M  "N" = normal "P" = passive "S" = syndicate "R" = pre-syndicate "L" = penalty
Market Participant State	19	1	Alphanumeric	Indicates the market participant's current registration status in the issue  "A" = Active "E" = Excused/Withdrawn "W" = Withdrawn

				"S" = Suspended "D" = Deleted
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#### 4.4 Add Order Message

An Add Order Message indicates that a new order has been accepted by the NASDAQ system and was added to the displayable book. The message includes a day-unique Order Reference Number used by NASDAQ to track the order.

NASDAQ will support two variations of the Add Order message format.

##### 4.4.1 Add Order – No MPID Attribution

This message will be generated for unattributed orders accepted by the NASDAQ system. (Note: If a firm wants to display a MPID for unattributed orders, NASDAQ recommends that it use the MPID of "NSDQ".)

ADD ORDER MESSAGE				
Name	Offset	Length	Value	Notes
Message Type	0	1	"A"	Add Order – No MPID Attribution Message.
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Order Reference Number	5	8	Integer	The unique reference number assigned to the new order at the time of receipt.
Buy/Sell Indicator	13	1	Alpha	The type of order being added.  "B" = buy order. "S" = sell order.
Shares	14	4	Integer	The total number of shares associated with the order being added to the book.
Stock	18	8	Alpha	The security symbol for which the order is being added.
Price	26	4	Integer	The display price of the new order. Refer to Data Types for field processing notes.

##### 4.4.2 Add Order with MPID Attribution

This message will be generated for attributed orders and quotations accepted by the NASDAQ system.

ADD ORDER – MPID ATTRIBUTION MESSAGE				
Name	Offset	Length	Value	Notes
Message Type	0	1	"F"	Add Order with MPID Attribution Message.
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Order Reference Number	5	8	Integer	The unique reference number assigned to the new order at the time of receipt.
Buy/Sell Indicator	13	1	Alpha	The type of order being added.  "B" = buy order. "S" = sell order.

Shares	14	4	Integer	The total number of shares associated with the order being added to the book.
Stock	18	8	Alpha	The security symbol for which the order is being added.
Price	26	4	Integer	The display price of the new order. Refer to Data Types for field processing notes.
Attribution	30	4	Alpha	NASDAQ market participant identifier associated with the entered order.

## 4.5 Modify Order Messages

Modify Order messages always include the Order Reference Number of the Add Order to which the update applies. To determine the current display shares for an order, ITCH 4.1 subscribers must deduct the number of shares stated in the Modify message from the original number of shares stated in the Add Order message with the same reference number. NASDAQ may send multiple Modify Order messages for the same order reference number and the effects are cumulative. When the number of display shares for an order reaches zero, the order is dead and should be removed from the book.

### 4.5.1 Order Executed Message

This message is sent whenever an order on the book is executed in whole or in part. It is possible to receive several Order Executed Messages for the same order reference number if that order is executed in several parts. The multiple Order Executed Messages on the same order are cumulative.

By combining the executions from both types of Order Executed Messages and the Trade Message, it is possible to build a complete view of all non-cross executions that happen on NASDAQ. Cross execution information is available in one bulk print per symbol via the Cross Trade Message.

ORDER EXECUTED MESSAGE				
Name	Offset	Length	Value	Notes
Message Type	0	1	"E"	Order Executed Message.
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Order Reference Number	5	8	Integer	The order reference number associated with the executed order.
Executed Shares	13	4	Integer	The number of shares executed.
Match Number	17	8	Integer	The NASDAQ generated day-unique Match Number of this execution. The match number is also referenced in the Trade Break Message.

### 4.5.2 Order Executed With Price Message

This message is sent whenever an order on the book is executed in whole or in part at a price different from the initial display price. Since the execution price is different than the display price of the original Add Order, NASDAQ includes a price field within this execution message.

It is possible to receive multiple Order Executed and Order Executed With Price messages for the same order if that order is executed in several parts. The multiple Order Executed messages on the same order are cumulative.



These executions may be marked as non-printable. If the execution is marked as non-printed, it means that the shares will be included into a later bulk print (e.g., in the case of cross executions). If a firm is looking to use the data in time-and-sales displays or volume calculations, NASDAQ recommends that firms ignore messages marked as non-printable to prevent double counting.

<b>ORDER EXECUTED WITH PRICE MESSAGE</b>				
<b>Name</b>	<b>Offset</b>	<b>Length</b>	<b>Value</b>	<b>Notes</b>
Message Type	0	1	"C"	Order Executed Message.
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Order Reference Number	5	8	Integer	The reference number of the order that was executed.
Executed Shares	13	4	Integer	The number of shares executed.
Match Number	17	8	Integer	The NASDAQ generated day-unique Match Number of this execution. The match number is also referenced in the Trade Break Message.
Printable	25	1	Alpha	Indicates if the execution should be reflected on time and sale displays and volume calculations. "N" = non-printable "Y" = printable
Execution Price	26	4	Integer	The price at which the order execution occurred. Refer to Data Types for field processing notes.

### 4.5.3 Order Cancel Message

This message is sent whenever an order on the book is modified as a result of a partial cancellation.

<b>ORDER CANCEL MESSAGE</b>				
<b>Name</b>	<b>Offset</b>	<b>Length</b>	<b>Value</b>	<b>Notes</b>
Message Type	0	1	"X"	Order Cancel Message.
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Order Reference Number	5	8	Integer	The reference number of the order being reduced.
Canceled Shares	13	4	Integer	The number of shares being removed from the display size of the order as the result of a cancellation.

### 4.5.4 Order Delete Message

This message is sent whenever an order on the book is being cancelled. All remaining shares are no longer accessible so the order must be removed from the book.

<b>ORDER DELETE MESSAGE</b>				
<b>Name</b>	<b>Offset</b>	<b>Length</b>	<b>Value</b>	<b>Notes</b>
Message Type	0	1	"D"	Order Delete Message.
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.

Order Reference Number	5	8	Integer	The reference number of the order being canceled.
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#### 4.5.5 Order Replace Message

This message is sent whenever an order on the book has been cancel-replaced. All remaining shares from the original order are no longer accessible, and must be removed. The new order details are provided for the replacement, along with a new order reference number which will be used henceforth. Since the side, stock symbol and attribution (if any) cannot be changed by an Order Replace event, these fields are not included in the message. Firms should retain the side, stock symbol and MPID from the original Add Order message.

ORDER REPLACE MESSAGE				
Name	Offset	Length	Value	Notes
Message Type	0	1	"U"	Order Replace Message
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Original Order Reference Number	5	8	Integer	The original reference number of the order being replaced.
New Order Reference Number	13	8	Integer	The new reference number for this order at time of replacement.  Please note that the NASDAQ system will use this new order reference number for all subsequent updates.
Shares	21	4	Integer	The new total displayed quantity.
Price	25	4	Integer	The new display price for the order. Refer to Data Types for field processing notes.

## 4.6 Trade Messages

### 4.6.1 Trade Message (Non-Cross)

The Trade Message is designed to provide execution details for normal match events involving non-displayable order types. (Note: There is a separate message for NASDAQ cross events.)

Since no Add Order Message is generated when a non-displayed order is initially received, NASDAQ cannot use the Order Executed messages for all matches. Therefore this message indicates when a match occurs between non-displayable order types. A Trade Message is transmitted each time a non-displayable order is executed in whole or in part. 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 NASDAQ time-and-sales displays as well as volume and other market statistics. Since Trade Messages do not affect the book, however, they may be ignored by firms just looking to build and track the NASDAQ execution system display.

TRADE MESSAGE (NON-CROSS)				
Name	Offset	Length	Value	Notes
Message Type	0	1	"P"	Trade Message

Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Order Reference Number	5	8	Integer	The unique reference number assigned to the order on the book being executed.  Effective December 6, 2010, NASDAQ OMX will populate the Order Reference Number field within the Trade (Non-Cross) message as zero. For the binary versions of the TotalView-ITCH data feeds, the field will be null-filled bytes (which encodes sequence of zero).
Buy/Sell Indicator	13	1	Alpha	The type of non-display order on the book being matched. "B" =buy order "S" =sell order
Shares	14	4	Integer	The number of shares being matched in this execution.
Stock	18	8	Alpha	The security symbol associated with the match execution.
Price	26	4	Integer	The match price of the order. Refer to Data Types for field processing notes.
Match Number	30	8	Integer	The NASDAQ generated session-unique Match Number for this trade. The Match Number is referenced in the Trade Break Message.

#### 4.6.2 Cross Trade Message

Cross Trade message indicates that NASDAQ has completed its cross process for a specific security. NASDAQ sends out a Cross Trade message for all active issues in the system following the Opening, Closing and EMC cross events. Firms may use the Cross Trade message to determine when the cross for each security has been completed. (Note: For the halted / paused securities, firms should use the Trading Action message to determine when an issue has been released for trading.)

For most issues, the Cross Trade message will indicate the bulk volume associated with the cross event. If the order interest is insufficient to conduct a cross in a particular issue, however, the Cross Trade message may show the shares as zero.

To avoid double counting of cross volume, firms should not include transactions marked as non-printable in time-and-sales displays or market statistic calculations.

<b>CROSS TRADE MESSAGE</b>				
<b>Name</b>	<b>Offset</b>	<b>Length</b>	<b>Value</b>	<b>Notes</b>
Message Type	0	1	"Q"	Cross Trade Message
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Shares	5	8	Integer	The number of shares matched in the NASDAQ Cross.
Stock	13	8	Alpha	The security symbol associated with the cross trade message.
Cross Price	21	4	Integer	The price at which the cross occurred. Refer to Data Types for field processing notes.
Match Number	25	8	Integer	The NASDAQ generated day-unique Match Number of this execution.
Cross Type	33	1	Alpha	The NASDAQ cross session for which the message is being generated.

				"O" = NASDAQ Opening Cross. "C" = NASDAQ Closing Cross. "H" = Cross for IPO and halted / paused securities. "I" = NASDAQ Cross Network: Intraday Cross and Post-Close Cross
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### 4.6.3 Broken Trade / Order Execution Message

The Broken Trade Message is sent whenever an execution on NASDAQ is broken. An execution may be broken if it is found to be "clearly erroneous" pursuant to [NASDAQ's Clearly Erroneous Policy](#). A trade break is final; once a trade is broken, it cannot be reinstated.

Firms that use the ITCH feed to create time-and-sales displays or calculate market statistics should be prepared to process the broken trade message. If a firm is only using the ITCH feed to build a book, however, it may ignore these messages as they have no impact on the current book.

BROKEN TRADE MESSAGE				
Name	Offset	Length	Value	Notes
Message Type	0	1	"B"	Broken Trade Message.
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Match Number	5	8	Integer	The NASDAQ Match Number of the execution that was broken. This refers to a Match Number from a previously transmitted Order Executed Message, Order Executed With Price Message, or Trade Message.

## 4.7 Net Order Imbalance Indicator (NOII) Message

NASDAQ disseminates NOII data at 5-second intervals in the minutes leading up to the NASDAQ Opening Cross and NASDAQ Closing Cross.

- For the NASDAQ Opening Cross, NOII messages will be disseminated during the two minutes leading up to the start of market hours.
- For the NASDAQ IPO, Halt and Imbalance Crosses, NOII messages will be disseminated during the quote only period. The first NOII message will be disseminated approximately five seconds after the Stock Trading Action message with the "Q" or "R" action value is disseminated.
- For the NASDAQ Closing Cross, NOII messages will be disseminated during the ten minutes leading up to the end of market hours.

NOII MESSAGE				
Name	Offset	Length	Value	Notes
Message Type	0	1	"I"	NOII Message
Timestamp - Nanoseconds	1	4	Integer	Nanoseconds portion of the timestamp.
Paired Shares	5	8	Integer	The total number of shares that are eligible to be matched at the Current Reference Price.
Imbalance	13	8	Integer	The number of shares not paired at the

Shares				Current Reference Price.
Imbalance Direction	21	1	Alpha	The market side of the order imbalance.  "B" = buy imbalance "S" = sell imbalance "N" = no imbalance "O" = Insufficient orders to calculate
Stock	22	8	Alpha	The security symbol for which the NOII message is being generated
Far Price	30	4	Integer	A hypothetical auction-clearing price for cross orders only. Refer to Data Types for field processing notes.
Near Price	34	4	Integer	A hypothetical auction-clearing price for cross orders as well as continuous orders. Refer to Data Types for field processing notes.
Current Reference Price	38	4	Integer	The price at which the NOII shares are being calculated. Refer to Data Types for field processing notes.
Cross Type	42	1	Alpha	The type of NASDAQ cross for which the NOII message is being generated  "O" = NASDAQ Opening Cross "C" = NASDAQ Closing Cross "H" = Cross for IPO and halted / paused securities
Price Variation Indicator	43	1	Alpha	This field indicates the absolute value of the percentage of deviation of the Near Indicative Clearing Price to the nearest Current Reference Price.  "L" = Less than 1% "1" = 1 to 1.99% "2" = 2 to 2.99% "3" = 3 to 3.99% "4" = 4 to 4.99% "5" = 5 to 5.99% "6" = 6 to 6.99% "7" = 7 to 7.99% "8" = 8 to 8.99% "9" = 9 to 9.99% "A" = 10 to 19.99% "B" = 20 to 29.99% "C" = 30% or greater Space = Cannot be calculated

## 5 Support

- For general product support for NASDAQ data feeds, please contact NASDAQ OMX Global Data Products at +1 301 978 5307 or [dataproductions@nasdaqomx.com](mailto:dataproductions@nasdaqomx.com).
- For technical support for NASDAQ data feeds, please contact NASDAQ OMX Global Software Development at [devsupport@nasdaqomx.com](mailto:devsupport@nasdaqomx.com).

## Appendix A

### Documentation Revision Control Log

**February 14, 2012: NASDAQ TotalView-ITCH Version 4.10**

NASDAQ OMX updated the introduction and architecture sections of the TotalView-ITCH 4.1 data feed specification for the FPGA delivery option.

**November 1, 2011: NASDAQ TotalView-ITCH Version 4.10**

NASDAQ OMX added a new Market Category code in Symbol Directory messages for the BATS BZX Exchange to distinguish BATS-listed issues. New market category code is "Z".

**April 6, 2011: NASDAQ TotalView-ITCH Version 4.10**

NASDAQ OMX added two new Trading Action – Reason codes to Appendix C for the NASDAQ Volatility Guard pilot program. New Reason codes were V1 and V2.

**November 4, 2010: NASDAQ TotalView-ITCH Version 4.10**

NASDAQ OMX updated the Reg SHO message description to reflect the new SEC implementation date.

**October 6, 2010: NASDAQ TotalView-ITCH Version 4.10**

NASDAQ OMX added a note to Trade (Non-Cross) message format stating that the Order Reference Number would be zero for all transactions as of December 6, 2010.

**July 14, 2010: NASDAQ TotalView-ITCH Version 4.10**

NASDAQ OMX added a new Regulation SHO Short Sale Price Test Restricted Indicator message format to be introduced in the fourth quarter of 2010.

**July 2, 2010: NASDAQ TotalView-ITCH Version 4.10**

NASDAQ OMX added new Action Trading code(s) to the Stock Trading Action message for the NASDAQ Volatility Guard trading pause.

**May 25, 2010: NASDAQ TotalView-ITCH Version 4.10**

NASDAQ added two new Trading Action Reason code values (T5 and T7) for single security trading pause situations.

**January 26, 2010: NASDAQ TotalView-ITCH Version 4.10**

Released a new version of the TotalView-ITCH documentation to support the following changes:

- Increased length of the symbol field from 6 characters to 8 characters in multiple message formats in support of the equity symbology initiative.
- Modified the values for the Market Category field in Symbol Directory messages to delineate among NYSE-, NYSE Amex- and NYSE Arca-listed issues.
- Added note to Appendix B to reflect that NASDAQ OMX is reviewing its stock symbol conventions to determine if changes are needed.

**February 3, 2009: NASDAQ TotalView-ITCH Version 4.00**

NASDAQ revised Order Reference Number field definition for the Add Order messages to remove the following statement: "The order reference number is increasing, but not necessarily sequential."

**October 21, 2008: NASDAQ TotalView-ITCH Version 4.00**

NASDAQ releases TotalView-ITCH 4.0 specifications to public. This document includes the following format modifications from earlier versions of the ITCH feed.

- Numeric fields modified to support binary integers
- Time stamp granularity changed to nanoseconds past midnight
- Added Order Replace message
- Updated protocol references to reflect new SoupBinTCP protocol associated with ITCH 4.0 feed.

**October 20, 2008: NASDAQ TotalView-ITCH Version 3.10**

NASDAQ releases TotalView-ITCH 3.1 specifications to the public. This document included the following format modifications from earlier versions of the ITCH feed.

- Expanded Order Reference Number and Match ID field size in all Order and Trade related messages to 12 bytes (from 9 bytes)
- Added Order Replace message
- Updated protocol references to reflect new network support documentation associated with ITCH 3.1

**September 16, 2008: NASDAQ TotalView-ITCH Version 3.00**

NASDAQ corrected a few corporate references in the TotalView-ITCH 3.0 specifications document. No material changes were made.

**June 10, 2008: NASDAQ TotalView-ITCH Version 3.00**

NASDAQ modified the TotalView-ITCH 3.0 specifications document to add new codes for emergency market condition (EMC) situations:

- Section 4.2 – System Event Message. Added the following three codes for EMC situations.
  - A = Emergency market condition – halt
  - R = Emergency market condition – quote only period
  - B = Emergency market condition – resumption
- Section 4.6.2 – Cross Trade message: Added cross type of “E” for EMC situations. Also added processing note to indicate that NASDAQ will begin to generate a cross trade message for all active issues in the system beginning in the third quarter of 2008.

**March 5, 2008: NASDAQ TotalView-ITCH Version 3.00**

NASDAQ modified the TotalView-ITCH 3.0 specifications document to reflect a change in the Message Type value for the new Market Participant Position message format to be added to data stream on or about April 21, 2008:

- Section 4.3.3 – Market Participant Position. The message type value for this message should be “L”.

**January 16, 2008: NASDAQ TotalView-ITCH Version 3.00**

NASDAQ modified the TotalView-ITCH 3.0 specifications document to reflect the following new message format to be added to data stream on or about April 21, 2008:

- Section 4.3.3 – Market Participant Position. This message is designed to provide Primary Market Maker status, Market Participant status and Market Maker mode fields used by some firms to comply with market regulations.

**April 30, 2007: NASDAQ TotalView-ITCH Version 3.00**

NASDAQ modified the TotalView-ITCH 3.0 specifications document to reflect the following changes:

- Section 4 – For clarity reasons, the Data Type field was updated for all formats to delineate between alphabetic and alphanumeric fields.
- Section 4.3.1 – Within the Issue Directory message format, NASDAQ updated the code list for the Market Category field to denote that space is an allowable value. The Market Category field may be space filled if the security symbol is associated with a test issue OR if NASDAQ Operations adds a production issue to its online systems intra-day.

**February 15, 2007: NASDAQ TotalView-ITCH Version 3.00**

NASDAQ modified the TotalView-ITCH 3.0 specifications document to reflect the following changes:

- 4.3.2 – Stock Trading Action. Updated document to reflect actual system processing rules for pre-opening trading action spin.
- Appendix B – Stock Symbol Convention. Updated document to reflect the most current URL links to NASDAQ symbology matrices.

**October 2, 2006: NASDAQ TotalView-ITCH Version 3.00**

NASDAQ modified the TotalView-ITCH 3.0 specifications document to reflect the following changes:

- Section 4.1 – Timestamp. Added sentence to address sequencing of second and millisecond timestamps.
- Corrected the numbering in remainder of section 4.

**August 22, 2006: NASDAQ TotalView-ITCH Version 3.00**

NASDAQ modified the TotalView-ITCH 3.0 specification document to reflect the following changes:

- Section 4.2 – System Events: Updated the explanations for the “O”, “Q”, “M” and “M” events to more accurately reflect the feed processing.
- Appendix B – Stock Symbol Conversion: Please contact NASDAQ Systems Engineering for up-to-date symbol suffix matrix.

**July 11, 2006: NASDAQ TotalView-ITCH Version 3.00**

NASDAQ releases TotalView-ITCH 3.0 specifications to the public. This document included the following format modifications from earlier versions of the ITCH feed.

- Moved the timestamp from the individual messages to separate seconds and milliseconds messages for bandwidth and processing efficiency reasons.
- Added the following new messages to be consistent with TotalView-Aggregated feed:
  - Stock Directory
  - Net Order Imbalance Indicator
- Replaced Halt/Resume message with Stock Trading Action message to be more consistent with other NASDAQ data feeds.
- Updated Add Order messages in the following ways:
  - Updated Add Order (A) message to remove the display field. Firms should process all orders for NASDAQ quotation displays.
  - Added new Add Order – MPID Attribution (F) message as NASDAQ execution system will support market participant attribution at the order level.
- Updated Modify Order messages in the following ways:
  - Updated Order Executed message to support Printable field. Printable field will be used to denote cross transactions.
  - Added new Order Executed With Price Message (C) for situations where the execution price is different from the display price of an order. This message is intended to reflect situations where there was price improvement with the NASDAQ system.
  - Added new Order Delete (D) message format to reflect when an order is cancelled in full. This change was done for bandwidth efficiency reasons.
- Added Cross Trade (Q) message to reflect bulk transactions such as the NASDAQ Crosses.



**February 24, 2006: NASDAQ TotalView-ITCH Version 2.0a**

- Replaced all references to INET to NASDAQ.
- Added attribution to "Add Order". This will be the first variable length message in ITCH. It was done to save bandwidth by not sending MMIDs for non-attributed orders.
- Added Halt/Resume message.

**March 17, 2004: ITCH Version 2.00**

- Replaced all references to Island (ISLD) with Inet ATS (INET).

**December 21, 2000: ITCH Version 2.00**

- Corrected the definition for price fields in the spec to match the actual behavior. Price fields are padded on the left with spaces, not zeros.

**November 5, 2001 – ITCH Version 2.00**

- Changed price field format to 6 whole number digits followed immediately by 4 decimal digits. The decimal point was no longer included in the field but implied by position. This reduced the bandwidth of the stream significantly and makes for much easier parsing and processing of price values.
- Changed timestamps to be stated as milliseconds past midnight rather than hundredths of seconds past midnight.
- Replaced the End of Session System event with the End of Day System Event. Although the messages looked identical, the semantics were different. The old End of Session System Event told subscribers that there would be no more messages during that session. The new End of Day System Event indicated that there are no more orders today, but there may still be more messages like Cancels on open orders and Breaks on previously executed orders.
- Removed language about any orders remaining on the book at the end of the session being dead. INET automatically cancels all open orders at the end of the day, so firms should not have any left-over orders on the book at the end of the session.
- Reduced the size of all shares fields from 9 digits to 6 digits.
- Removed Contra Broker Code from the Order Executed and Trade messages.

**January 19, 2000 – ITCH Version 1.00**

- Removed implementation ideas from document.
- Moved all session management to a higher-level protocol. ITCH now only specifies the actual messages concerning orders added and executed on the INET book.
- Added the Broken Trade Message to let you know when an execution is broken.
- Added the Print Message to enable people to build INET time-and-sales, INET last trade, and INET volume services.
- Removed the Timeout "why" for canceled orders.
- Removed the Text Message type.
- Increased the precision of timestamps to hundredths of seconds.
- Added Match Number to all executions.

**May 12, 1998 – ITCH Version 0.22**

- Added the Display field to the Add Order Message. This field denotes if the order is displayable in INET quote to the NASDAQ SIP under the SEC order handling rules.

**November 20, 1997 – ITCH Version 0.21**

- Changed documentation to show that the Fixed Rewind Request Message type is "W" . Earlier document should the type as "R" in error.
- Changed documentation for Login Request Message to note that a firm's connection would expire if it failed to log in within 30 seconds of initial login.
- Fixed the description of the Sequence Number field in the Heartbeat Message. The Sequence number should be the next expected sequence number, even during a rewind.

**October 1, 1997 – ITCH Version 0.20**

- Released initial product specification, in draft format, to a few developers for comment.

## Appendix B

### Stock Symbol Convention

NASDAQ OMX is in the process of revising its stock symbol suffix plan to accommodate root symbols of up to 5 characters across U.S. equity exchanges. Once the new plan is confirmed, NASDAQ OMX will post a Data Technical News item on the NASDAQ OMX Trader website with details.

Until further notice, NASDAQ OMX will follow its current practice.

For NYSE-, NYSE Amex- and NYSE Arca-listed securities with subordinate issue types, please refer to the [Ticker Symbol Conversion for CQS Securities page](#) on the NASDAQ OMX Trader website.

For NASDAQ-listed issues, NASDAQ OMX currently restricts its symbol length to a maximum of 5 characters. For common stock issuances, NASDAQ and BX will assign a symbol of 1 to 4 characters in length. For subordinate securities, NASDAQ and BX will assign a 5 character symbol for which the last character relays information about the issue class or issue type. For the current list of fifth character symbol suffixes, please refer to [Current List of Fifth Character Symbol Suffixes for NASDAQ-listed Issues](#) on the NASDAQ OMX Trader website.

## Appendix C

### Trading Action – Reason Codes

For NASDAQ-listed issues, NASDAQ acts as the primary market and has the authority to institute a trading halt or trading pause in an issue due to news dissemination or regulatory reasons.

For CQS issues, NASDAQ abides by any regulatory trading halts and trading pauses instituted by the primary or listing market as appropriate.

For both issue types, NASDAQ may also halt trading for operational reasons.

NASDAQ will send out a trading action message to inform its market participants when the trading status of an issue changes. For informational purposes, NASDAQ also attempts to provide the reason for each trading action update. For bandwidth efficiency reasons, NASDAQ uses a 4-byte code for the reason on its outbound data feeds.

REASON CODES FOR TRADING HALT ACTIONS	
Code	Value
T1	Halt News Pending
T2	Halt News Disseminated
T5	Single Security Trading Pause In Effect
T6	Regulatory Halt — Extraordinary Market Activity
T8	Halt ETF
T12	Trading Halted; For Information Requested by Listing Market
H4	Halt Non-Compliance
H9	Halt Filings Not Current
H10	Halt SEC Trading Suspension
H11	Halt Regulatory Concern
O1	Operations Halt; Contact Market Operations
IPO1	IPO Issue Not Yet Trading
M1	Corporate Action
M2	Quotation Not Available
V1	NASDAQ Volatility Guard Pause In Effect
Space	Reason Not Available

REASON CODES FOR QUOTATION/TRADING RESUMPTION ACTIONS	
Code	Value
T3	News and Resumption Times
T7	Single Security Trading Pause / Quotation Only Period
R4	Qualifications Issues Reviewed/Resolved; Quotations/Trading to Resume
R9	Filing Requirements Satisfied/Resolved; Quotations/Trading To Resume
C3	Issuer News Not Forthcoming; Quotations/Trading To Resume
C4	Qualifications Halt ended; Maintenance Requirements Met; Resume
C9	Qualifications Halt Concluded; Filings Met; Quotes/Trades To Resume
C11	Trade Halt Concluded By Other Regulatory Auth.; Quotes/Trades Resume
R1	New Issue Available
R2	Issue Available
IPOQ	IPO Security Released for Quotation (NASDAQ Securities Only)
IPOE	IPO Security — Positioning Window Extension (NASDAQ Securities Only)
V2	NASDAQ Volatility Guard Pause / Quotation Only Period
Space	Reason Not Available