TotalView-ITCH

Version 2.0a

1 Overview

TotalView-ITCH 2.0a is a direct data feed product offered by The NASDAQ Stock Market, that features the following data elements:

- **Order level data with attribution:** For NASDAQ Single Book, NASDAQ will provide its full order depth using the standard ITCH format. ITCH uses a series of messages of order messages to track the life of a customer order.[1] As an added feature, the TotalView-ITCH 2.0a message formats support NASDAQ market participant attribution. TotalView-ITCH 2.0a carries order level data for NYSE- and Amex-listed securities as well as for NASDAQ-listed securities.

- **Trade messages:** To ensure that customers have complete information about NASDAQ order flow, TotalView-ITCH 2.0a supports a trade message to reflect a match of a non-displayable order in the NASDAQ system.

- Stock halt status information for the NASDAQ trading system.[2]

It should be noted that the ITCH 2.0a formats do <u>not</u> support full trading halt status information for NASDAQ listed issues or NASDAQ cross-related data.   If you are interested in such data elements, please refer to product specification for the TotalView-ITCH versions 3.0 and higher.

2 Architecture

The TotalView-ITCH 2.0a feed is made up of a series of sequenced messages. Each message is variable in length based on the message type and is composed of non-control ASCII bytes. The messages that make up the Totalview–ITCH 2.0a protocol are typically delivered using a higher level protocol that takes care of sequencing and delivery guarantees.

NASDAQ offers the TotalView–ITCH 2.0a data feed in three protocol options:

Protocol Option	Number of Outbound Channels
SoupTCP	Single outbound channel for all securities
Compressed via SoupTCP	Single outbound channel for all securities

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[1] 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 Services section of the NASDAQ Trader website.

[2] For regulatory halt information for NYSE and Amex listed issues, firms should process the condition field for the primary market center quotation messages on the SIAC Consolidated Quotation System (CQS) data feed. For regulatory halt information for NASDAQ listed issues, firms should process the Trading Action messages on the UTP Quotation Data Feed (UQDF) or UTP Trade Data Feed (UTDF) products.

Protocol Option	Number of Outbound Channels
MoldUDP	Single outbound channel for all securities

3 Data Types

All numeric fields are represented in ASCII digits and are right-justified. Padding spaces appear on the left as necessary.

Prices are given in decimal format with 6 whole number places followed by 4 decimal digits. The whole number portion is padded on the left with spaces; the decimal portion is padded on the right with zeros. The decimal point is implied by position; it does not appear inside the price field.

Timestamp reflects the NASDAQ system time at which the outbound message was generated. NASDAQ states time as the number of milliseconds past midnight. The time zone is U.S. Eastern Time.

All alpha fields are left-justified. Padding spaces appear on the right as necessary.

4 Message Formats

The TotalView-ITCH 2.0a feed is composed of a series of messages that describe orders added to, removed from, and executed on NASDAQ.

4.1 System Event Message

System Event Messages signal events that affect the entire NASDAQ system.

System Event Message				
Name	Offset	Len	Value	Notes
Time Stamp	0	8	Numeric	Time Stamp.
Message Type	8	1	"S"	System Event Message.
Event Code	9	1	Alpha	See System Event Codes below.

System Event Codes	
Code	Event Explanation
"S"	Start of Day. This is always the first message sent in any trading day. It indicates that NASDAQ is open and ready to start accepting orders.
"E"	End of Day. It indicates that NASDAQ is now closed and will not accept any new orders today. All orders that remain open in this session are now dead and can be purged from the book. It is still possible to receive Broken Trade Messages and Order Cancel Messages after the End od Day.

4.2 Add Order Message

An Add Order Message indicates that a new order has been accepted by the NASDAQ system and added onto the displayable book. It includes a day-unique Order Reference Number assigned by NASDAQ to the order. Please note that the Add Order message in the TotalView-ITCH 2.0a standard is a variable length message. The "MMID" field will be included in the data formats only if the "Display" field value equals "A" (attributed),

Add Order Message				
Name	**Offset**	**Len**	**Value**	**Notes**
Time Stamp	0	8	Numeric	Time Stamp.
Message Type	8	1	"A"	Add Order Message.
Order Reference Number	9	9	Numeric	The unique reference number assigned to this new order. Increasing, but not necessarily sequential.
Buy/Sell Indicator	18	1	Alpha	"B" = buy order. "S" = sell order.
Shares	19	6	Numeric	Total number of shares being added to the book (may be less than the number of shares entered).
Stock	25	6	Alpha	Stock symbol right padded with spaces.
Price	31	10	Price	The limit price of the order.
Display	41	1	Alpha	"Y" = displayed in the quote "A" = Attributable order Attributable orders will have an extra 4 bytes to be added to the end of this message, revealing the MMID of the firm that entered this order.
MMID (optional)	42	4	Alpha	The MMID of the firm entering the Attributable order. **NOTE:** This field will be present only if the Display field is set to "A". Subscribers should be prepared to handle an "Add Order Message" of either 42 or 46 bytes in length.

4.3 Modify Order Messages

A Modify Order Message always references an order previously transmitted with an Add Order Message via the Order Reference Number. Multiple Modify Order Messages can modify a single order and the effects are cumulative. A Modify Order Message always reduces the number of shares currently pending in the referenced open order by the number of shares indicated. When the number of currently pending shares for an order reaches zero, the order is dead and should be removed from the book.

4.3.1 Order Executed Message

This message is sent whenever an order on the book is executed in whole or in part. The execution price is always equal to the limit price of the order as indicated in the Add Order Message.

Order Execution Message				
Name	**Offset**	**Len**	**Value**	**Notes**
Time Stamp	0	8	Numeric	Time Stamp.
Message Type	8	1	"E"	Order Executed Message.
Order Reference Number	9	9	Numeric	The reference number of the order that was executed. References a previously sent Add Order Message.
Executed Shares	18	6	Numeric	The number of shares executed.
Match Number	24	9	Numeric	The NASDAQ generated day-unique Match Number of this execution. The match number is also referenced in the Trade Break Message.

4.3.2 Order Cancel Message

This message is sent whenever an order on the book is modified as a result of being canceled in whole or in part.

Order Cancel Message				
Name	**Offset**	**Len**	**Value**	**Notes**
Time Stamp	0	8	Numeric	Time Stamp.
Message Type	8	1	"X"	Order Cancel Message.
Order Reference Number	9	9	Numeric	The reference number of the order being canceled or reduced. References a previously sent Add Order Message.
Canceled Shares	18	6	Numeric	The number of shares canceled.

4.4 Trade Message

The Trade Message provides information about execution events that involve orders not visible on the NASDAQ book. Trade Messages do not affect the book, and can be ignored if you are just building a book.

Trade Messages are required to provide NASDAQ time-and-sales and other execution based data; they fill in the gaps left when an order that is not otherwise visible on ITCH is executed.

Since no Add Order Message is ever sent for non-displayed orders, it is not possible to send a Modify Order Message when a hidden order is executed. Instead, a Trade Message is transmitted each time a hidden order is executed in whole or in part. It is possible to receive several Trade Messages for the same order if that order is executed in several parts. The multiple Trade Messages on the same order are cumulative.

By combining the executions received separately via both Order Executed Messages and Trade Messages, it is possible to build a complete view of all executions that happen on NASDAQ.

Trade Message				
Name	*Offset*	*Len*	*Value*	*Notes*
Time Stamp	0	8	Numeric	Time Stamp.
Message Type	8	1	"P"	Trade Message Identifier
Order Reference Number	9	9	Numeric	The NASDAQ reference number of the executed order.
Buy/Sell Indicator	18	1	Alpha	"B" =buy order executed. "S" =sell order executed.
Shares	19	6	Numeric	Incremental number of shares executed.
Stock	25	6	Alpha	Stock symbol, right padded with spaces.
Price	31	10	Price	The match price of the order.
Match Number	41	9	Numeric	The NASDAQ generated session-unique Match Number for this trade. The Match Number is referenced in the Trade Break Message.

4.5 Broken Trade 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 Procedure. A trade break is final; once a trade is broken it cannot be reinstated.

Trade breaks happen only rarely on NASDAQ and will only affect applications that build a time-and-sales database or maintain cumulative NASDAQ volumes or high/low calculations. If you are only building a book, you can ignore these messages; they have no effect on the book.

Broken Trade Message				
Name	*Offset*	*Len*	*Value*	*Notes*
Time Stamp	0	8	Numeric	Time Stamp.
Message Type	8	1	"B"	Broken Trade Message.
Match Number	9	9	Numeric	The NASDAQ Match Number of the execution that was broken. This refers to a Match Number from a previously transmitted Order Modified - Execution Message or Trade Message.

4.6 Stock Halt Status Message

Prior to the start of system hours, NASDAQ will send out a Stock Halt Status spin. In the spin, NASDAQ will send out this message for those NASDAQ- and other exchange-listed securities will trade normally at the start of the system hours. If a security is absent from the pre-opening 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 this message to relay trading status changes for an individual security. Messages will be sent when a stock is halted or is released for trading.

Stock Halt Status Message				
Name	*Offset*	*Len*	*Value*	*Notes*
Time Stamp	0	8	Numeric	Time Stamp
Message Type	8	1	"H"	Stock Halt Status message

Stock	9	6	Alpha	Stock symbol, right padded with spaces.
Stock Halted	15	1	Alpha	Indicates if the stock symbol is halted on NASDAQ system. "T" = True, Stock is halted "F" = False, Stock is trading normally

5 Support

o For general product support for NASDAQ data feeds, please contact NASDAQ OMX Global Data Products at 301.978.5307 or dataproducts@nasdaqomx.com.

o For technical support for NASDAQ data feeds, please contact NASDAQ Systems Engineering at devsupport@nasdaqomx.com.

6 Revision History

6.1 Version 0.20 - 10/1/97

6.1.1 Draft spec released to a few developers

6.2 Version 0.21 - 11/20/97

6.2.1 Fixed Rewind Request Message type to be type "W" from "R". This was just a mistake. A rewind message has always been "W".

6.2.2 Added to the Login Request Message to denote the fact that if you don't log in within 30 seconds of connecting, your connection will be expired.

6.2.3 Fixed the description of the Sequence Number field in the Heartbeat Message. The Sequence number is the next expected sequence number, even during a rewind.

6.3 Version 0.22 - 5/12/98

6.3.1 Added the Display field to the Add Order Message.

6.4 Version 1.00 1/19/2000

6.4.1 Removed the implementation ideas from the document.

6.4.2 Moved all session management to a higher-level protocol. With the ITCH protocol versions 1.00 and higher, ITCH only specifies the actual messages concerning orders added and executed on the INET book.

6.4.3 Added the Broken Trade Message to let you know when an execution is broken incase you are keeping a time-and-sales database or cumulative volumes.

6.4.4 Added the Print Message to enable people to build INET time-and-sales, INET last trade, and INET volume services. Without this message, there was no way to see the trade data when hidden orders are executed.

6.4.5 Removed the Timeout "why" for canceled orders.

6.4.6 Removed the Text Message type. These messages will now be handled out of band using the various email lists.

6.4.7 Increased the precision of timestamps to hundredths of seconds.

6.4.8 Added Match Number to all executions.

6.5 Version 2.0 11/5/2001

6.5.1 All price fields are now 6 whole number digits followed immediately by 4 decimal digits. The decimal point is no longer included in the field and instead is now implied by position. This reduces the bandwidth of the stream significantly and makes for much easier parsing and processing of price values.

6.5.2 All timestamps are now given in milliseconds past midnight rather than hundredths of seconds past midnight.

6.5.3 Replaced the End of Session System event with the End of Day System Event. Although the messages look identical, the semantics are very different. The old End of Session System Event told you that there would be no more messages during that session. This was redundant, since you get that same piece of End of Session information from the higher-lever protocol's (SoupTCP or SoupFILE) End of Session marker. The new End of Day System Event tells you that there will be no more orders today, but there may still be more messages like Cancels on open orders and Breaks on previously executed orders.

6.5.4 Removed language about any orders remaining on the book at the end of the session being dead. INET will automatically cancel all open orders at the end of the day, so subscribers will never have any left-over orders on the book at the end of the session.

6.5.5 Reduced the size of all shares fields from 9 digits to 6 digits. Again, this makes the messages smaller and the values easier to process. This is possible because INET

restricted the maximum order size to 6 digits. This has no effect on market quality since anyone wanting to enter an order larger than 6 digits can simple enter more than one order.

6.5.6 Took out the Contra Broker Code from the Order Executed and Trade messages. So few of INET's executions involved SelectNet that it was really not worth sending this data anymore -- it was almost always blank.

6.6 Version 2.00 12/31/2001

6.6.1 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.

6.7 Version 2.00 3/17/04

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

6.8 Version 2.0A 2/24/06

6.8.1 Added attribution to "Add Order'. This will is the first variable length message in ITCH. It was done to save bandwidth by not sending MMIDs for non-attributed orders.

6.8.2 Added the Halt/Resume message.

6.9 Version 2.0A 7/28/06

6.9.1   Replaced all references to INET with NASDAQ.

6.9.2   Updated sections 1 to 3 to match the new TotalView-ITCH 3.0 and TotalView-Aggregated documentation style.

6.9.3   Added reference to TotalView-ITCH 3.0 product offering document in Overview section.

6.9.4   Updated contact reference in section 5 to include sales/administrative support as well as technical support contact information.

6.10 Version 2.0A 2/15/2007

6.9.5   Updated Stock Halt Status message description to clarify the pre-open spin process.