Operating Omega ATS and Lynx ATS

ITCH 5.0 SPECFICATION v 1.04

(Market Data)

Revision History

Date	Revision	Description of Change
October 2, 2017	1.00	Created
October 5, 2017	1.01	Edits made to document.
October 18, 2017	1.02	Edits made to document.
October 30, 2017	1.03	General edits made for publishing.
January 10, 2018	1.04	Edits made to timestamp. The value is in nanoseconds but only microseconds precisions, 000 for nanosecond. Changed "Market" identifier to lower case in Stock Directory and Extended message type. Fixed typo for Cross Trade message type with Length of timestamp and offsets. Fixed typo for Trade Bust message type with Length of timestamp and offsets. Added Examples section to end of document.

Contents

1. Overview:

Omega ITCH 5.0 is the outbound protocol for our direct market data feed offered by OSI which applies to both Omega ATS' and Lynx ATS' multicast feeds. There are deviations from the standard ITCH format and OSI encourages users to go through the document to ensure their feed processors are set up correctly.

The protocol features the following data elements:

- Order level data: Omega 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.

- Execution messages: These reflect regular executions, executions of non-displayed orders, and intentional crosses.

- Administrative messages: Session level messages, symbol state changes and symbol directory messages are included:

  1.1. Symbol status messages are used to inform market participants when a security is halted or released for trading.
  1.2. Symbol Directory messages provide security data such as the mapping of the Symbol to the Instrument ID as well as information on each security.
  1.3. Session messages such as start of day, end of day and emergency market halt/resume.

2. Architecture

The ITCH 5.0 feed is made up of a series of sequenced messages that make up the ITCH 5.0 protocol. These are typically delivered using a higher level protocol that takes care of sequencing and delivery guarantees.

Omega utilizes the SoupTCP protocol or the QTP protocol as the higher level delivery protocol for ITCH 5.0. Please refer to the documents below for details. ITCH is an outbound market data feed only. The ITCH protocol does not support order entry.

- Omega SoupBinTCP Specification (SoupBinTCP Protocol)
- Omega QTP64 Multicast Specification (MoldUDP64 Protocol)

3. Data types

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

All alpha and alphanumeric fields are left justified and padded on the right with spaces. Prices are integer fields and are given in decimal format with 6 whole number places followed by 4 decimal digits.

Time fields are recorded based on *UTC time*.

3.1. Security Identification

Instruments are identified by 2-bytes Instrument ID assigned by Omega. The whole list of Instrument IDs, the mapping from Instrument ID to CUSIP and the mapping from Instrument ID to Security Symbols can be obtained from Omega's "Stock Directory" messages being sent at the start-of-day.

4. Message Formats

The ITCH feed is composed of a series of messages that describe orders added to, removed from, and executed on Omega as well as disseminates Stock trading action and Stock Directory information.

4.1. 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
Event Code	1	1	Alpha	See System Event Codes below
Reserved	2	2	Alpha	Reserved
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)

Omega supports the following event codes on a daily basis.

System event codes – daily

Code	Explanation
"O"	Start of Messages. Outside of time stamp messages, the start of day message is the first message sent out in a trading day
"S"	Start of System hours. This message indicates that Omega is open and ready to start accepting orders.
"Q"	Start of Market hours. This message is intended to indicate that Market Hours orders are available for execution.
"M"	End of Market hours. This message is intended to indicate that Market Hours orders are no longer available for execution.

"E"	End of System hours. It indicates that Omega is now closed and will not accept any new orders. It is still possible to receive Broken Trade messages and Order Delete messages after the End of System message.
"C"	End of Messages. This is always the last message sent in any trading day.

4.2. Stock Related Messages

At the start of each trading day, Omega disseminates stock directory messages for all supported securities.

4.2.1. Stock Directory

Name	Offset	Length	Value	Notes
Message Type	0	1	"R"	Stock Directory Message
Market	1	1	Alphanumeric	Indicates the listing market of security: 't' = TSX 'v' = Venture 'c' = CNSX 'q' = Nasdaq Canada 'o' = Omega 'z' = Aequitas
Stock	2	10	Alphanumeric & '.'	Denotes the security symbol on Omega ATS and Lynx ATS
Timestamp	12	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Board Lot Size	20	4	Integer	Indicates a board lot size
Instrument ID	24	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Shortable	26	1	Alpha	Indicates the short status of a security: 'E' = short exempt 'S' = shortable 'N' = not shortable
Dividend Indicator	27	1	Alpha	'A' = Annual 'S' = Semi Annual 'Q' = Quarterly 'M' = Monthly
CUSIP	28	9	Alphanumeric	9 character code for identifying North American securities for clearing and settlement
Currency	37	3	Alpha	Indicates currency for the symbol 'CAD' = Canadian Dollars 'USD' = US Dollars

Extended Stock Directory

Name	Offset	Length	Value	Notes
Message Type	0	1	"r"	Stock Directory Message
Market	1	1	Alphanumeric	Indicates the listing market of security: 't' = TSX 'v' = Venture 'c' = CNSX 'q' = Nasdaq Canada 'o' = Omega 'z' = Aequitas
Stock	2	10	Alphanumeric & '.'	Denotes the security symbol on Omega ATS and Lynx ATS
Timestamp	12	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Board Lot Size	20	4	Integer	Indicates a board lot size
Instrument ID	24	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Shortable	26	1	Alpha	Indicates the short status of a security: 'E' = short exempt 'S' = shortable 'N' = not shortable
Frequency	27	1	Alpha	'A' = Annual 'S' = Semi Annual 'Q' = Quarterly 'M' = Monthly
CUSIP	28	9	Alphanumeric	9 character code for identifying North American securities for clearing and settlement
Currency	37	3	Alpha	Indicates currency for the symbol 'CAD' = Canadian Dollars 'USD' = US Dollars
Security Type	40	1	Alpha	'b' = Bonds 'd' = Debemtures 'r' = Rights 'n' = Notes 'w' = Warrants
Expiry Date	41	8	Date	Date of expiry in the format YYYYMMDD
Description	49	20	Alphanumeric	Description of Security
Reserved	69	3	Alpha	Reserved

4.2.2. Stock Trading Action

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

Securities may be halted in the Omega system for both regulatory, business or operational reasons.

After the start of system hours, Omega 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 or released for trading.

Stock Trading Action

Name	Offset	Length	Value	Notes
Message Type	0	1	"H"	Stock Trading Action
Trading State	1	1	Alpha	'H' = Halted 'T' = Trading
Instrument ID	2	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Reason	12	4	Alphanumeric	'R' = Regulatory Halt 'B' = Business Halt Note: Field may be blank

4.3. Modify Order Messages

Modify Order messages always included the Order Reference Number of the Add Order to which the update applies. To determine the current display shares for an order, ITCH 5.0 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. Omega may send multiple Modify Order messages for the same Order Reference Number and the effect are cumulative. When the number of display shares for an order reaches zero, the order is dead and should be removed from the order book.

4.3.1. Add Order Message

An Add Order Message indicates that a new order has been accepted by Omega ATS or Lynx ATS and was added to the visible order book. The message includes a day unique Order Reference Number used by Omega to track the order.

Add Order Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"A"	Add Order Message
Buy/Sell Indicator	1	1	Alphabetic	Side of order: 'B' = Buy order

				'S' = Sell order
Instrument ID	2	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Order Reference Number	12	4	Integer	Unique reference number assigned to the new order. The order reference number is not necessarily sequential
Shares	16	4	Integer	Total number of shares associated with the order being added to the book
Price	20	4	Integer	The display price of the new order. Refer to Data Types for field processing notes.
Exec Broker ID	24	2	Integer	Firm number or '1' for anonymous orders
Reserved	26	2	Alpha	Reserved

4.3.2. 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 if that order is executed in several parts. The multiple Order Executed Messages on the same order are cumulative.

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

Order Executed Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"E"	Order Executed Message
Marker	1	1	Alphanumeric	Used to denote specialty markers
Instrument ID	2	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Order Reference Number	12	4	Integer	The Order Reference Number associated with the executed order
Executed Shares	16	4	Integer	The number of shares executed
Match Number	20	4	Integer	Day unique Match Number for this execution. This number will also be referenced in Trade Break Messages

Name	Offset	Length	Value	Notes
Contra Broker ID	24	2	Integer	Broker number for contra side or '1' for anonymous
Reserved	26	2	Alpha	Reserved

Order Executed with Price Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"C"	Order Executed Message
Marker	1	1	Alphanumeric	Used to denote specialty markers
Instrument ID	2	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Order Reference Number	12	4	Integer	The Order Reference Number associated with the executed order
Executed Shares	16	4	Integer	The number of shares executed
Execution Price	20	4	Integer	The display price of this execution if different from the original. Refer to Data Types for field processing notes.
Match Number	24	4	Integer	Day unique Match Number for this execution. This number will also be reference in any Trade Break Message
Contra Broker ID	28	2	Integer	Broker number for contra side or '1' for anonymous
Reserved	30	2	Alpha	Reserved

4.3.3. 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 should be removed from the book.

Order Delete Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"D"	Order Delete Message
Reserved	1	1	Alpha	Reserved
Instrument ID	2	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Order Reference Number	12	4	Integer	The Order Reference Number associated with the cancelled order

4.3.4. Order Replace Message

This message is sent whenever an order on the book has been cancelled and replaced. Order replaced means that either the order quantity increased or the price has changed and the order loses its time priority. All remaining shares from the original order are no longer valid. 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.

Order Replace Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"U"	Order Replace Message
Reserved	1	1	Alpha	Reserved
Instrument ID	2	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Original Order Reference Number	12	4	Integer	The original reference number of the order being replaced
New Order Reference Number	16	4	Integer	The new reference number for this order at time of replacement
Shares	20	4	Integer	The new total displayed quantity
Price	24	4	Integer	The new display price for the order

4.3.5. Order Cancel Message

This message is sent whenever an order on the book is modified as a result of a partial cancellation. Partial cancellation happens when the order quantity drops but the price stays the same and the order does not lose priority.

Order Cancel Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"X"	Order Cancel Message
Reserved	1	1	Alpha	Reserved
Instrument ID	2	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)

Order Reference Number	12	4	Integer	The reference number of the order being reduced. This references a previous Add Order message.
Cancelled Shares	16	4	Integer	The number of shares to be removed from the display size of the order as the result of a cancellation

4.3.6. Trade Message

The Trade Message is designed to provide execution details for normal match events involving non displayed order types.

Since no Add Order message is generated when a non displayed order is initially received, Omega cannot use the Order Executed message for all matches. Multiple Trade messages may be received 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 Omega's time and sales display as well as volume and other market statistics. Since Trade message does not affect the book however, they may be ignored by firms looking to build and track the displayed book of Omega ATS or Lynx ATS.

Trade Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"P"	Trade Message
Side	1	1	Alpha	Side of execution: 'B' = Buy 'S' = Sell Note: side will always be 'B'
Instrument ID	2	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Order Reference Number	12	4	Integer	The reference number of the order being executed
Shares	16	4	Integer	Number of shares executed
Price	20	4	Integer	Price of the execution
Match Number	24	4	Integer	Day unique match number for this execution. The Match Number is referenced in Trade Cancellation messages
Buy Broker ID	28	2	Integer	Buy broker number or '1' for anonymous

Name	Offset	Length	Value	Notes
Sell Broker ID	30	2	Integer	Sell broker number or '1' for anonymous

4.4. Cross Trade Message

Cross Trade Message

Name	Offset	Length	Value	Notes
Message Type	0	1	"Q"	Cross Trade Message
Cross Type	1	1	Alpha	'D' = Derivatives Cross 'I' = Internal Cross 'M' = Intentional Cross
Instrument ID	2	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Shares	12	4	Integer	Number of shares executed
Price	16	4	Integer	Price of execution
Match Number	20	4	Integer	Day unique Match Number for this trade
Buy Broker ID	24	2	Integer	Buy broker number or '1' for anonymous
Sell Broker ID	26	2	Integer	Sell broker number or '1' for anonymous
Bypass	28	1	Alpha	'Y' = Bypass 'N' = Non Bypass
Settlement Type	29	1	Integer	'0' = Regular Settlement '1' = Cash '2' = Next Day '3' = T+3 '4' = T+4
Reserved	30	2	Alpha	Reserved

4.5. Trade Bust Message

The Trade Bust message is sent whenever an execution on Omega ATS or Lynx ATS is cancelled. An execution may be cancelled due to an IIROC ruling or if both parties to a trade agree to a voluntary bust. Trade cancellations are final and will not be reinstated once cancelled.

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

Cancel Trade Message

Name	Offset	Length	Value	Notes

Message Type	0	1	"B"	Cancel Trade Message
Reserved	1	1	Alpha	Reserved
Instrument ID	2	2	Integer	Internal instrument identifier for Omega ATS and Lynx ATS
Timestamp	4	8	Integer	Nanoseconds since midnight. (000 for nanosecond value)
Match Number	12	4	Integer	Day unique Match Number of execution being cancelled.

5. Example Messages

Example: Stock Directory Message

ITCH5 hex Message:

[52 74 41 41 48 20 20 20 20 20 20 20 00 00 20 BD E7 C4 08 E0 00 00 00 64 00 02 53 51 30 30 32 39 32 32 32 30 31 43 41 44]

Hex to ASCII

52 = R

74 = t

41 41 48 20 20 20 20 20 20 20 = AAH

Hex to Decimal

00 00 20 BD E7 C4 08 E0 = 36000009292000

00 00 00 64 = 100

00 02 = 2

Hex to ASCII

53 = S

51 = Q

30 30 32 39 32 32 32 30 31 = 002922201

43 41 44 = CAD

Example: Stock Directory Message (extended)

ITCH5 hex message:

[72 74 41 54 50 2E 44 42 2E 55 20 20 00 00 20 BD E7 C4 08 E0 00 00 00 64 3D BD 53 53 30 34 38 37 38 51 41 51 36 55 53 44 64 32 30 31 33 30 31 31 37 41 54 4C 41 4E 54 49 43 20 50 4F 57 45 52 20 43 4F 52 50 4F 20 20 20]

Hex to ASCII

72 = r

74 = t

41 54 50 2E 44 42 2E 55 20 20 00 00 = ATP.DB.U

Hex to Decimal

20 BD E7 C4 08 E0 = 36000009292000

00 00 00 64 = 100

3D BD = 15805

Hex to ASCII

53 = S

53 = S

30 34 38 37 38 51 41 51 36 = 04878QAQ6

55 53 44 = USD

64 = d

32 30 31 33 30 31 31 37 = 20130117

41 54 4C 41 4E 54 49 43 20 50 4F 57 45 52 20 43 4F 52 50 4F = ATLANTIC POWER CORPO

20 20 20 = (blank)(blank)(blank)

Example: Stock Trading Action Message

[48 48 00 01 00 00 20 BD E7 FE 56 A8 42 20 20 20]

Hex to ASCII

48 = H

48 = H

Hex to Decimal

00 01 = 1

00 00 20 BD E7 FE 56 A8 = 36000013113000

Hex to ASCII

42 = B

20 20 20 = (blank)(blank)(blank)

Example: Add order message

FIX message: 1=Extra.2 21=1 55=AD 59=0 54=1 38=100 40=2 44=18.900 76=91 6751=TRADER01 6820=N 6888=OMGA 60=20171215-15:08:29.877 37=20171215-1 11=Order408 17=001A1 20=0 150=0 39=0 151=100 14=0 6=0.000 31=0.000 32=0 58=New Order ACK

ITCH5 hex message:

[41 42 00 15 00 00 31 93 91 F8 A8 D0 00 00 00 01 00 00 00 64 00 02 E2 48 00 01 20 20]

Hex to ASCII:

41 = **A**	(Msg type)
42 00 = **B**	(Buy/Sell indicator)

Hex to Decimal:

15 = **21**	(Instrument ID)
00 00 31 93 91 F8 A8 D0 = **54509878946000**	(Timestamp)
00 00 00 01 = **1**	(Order Reference Number)
00 00 00 64 = **100**	(Shares)
00 02 E2 48 = **189000**	(Price)
00 01 = **1**	(Exec Broker ID; 1 for annoymous)

Hex to ASCII:

20 20 = (blank)	(Reserved)

Example: Order execution message

Fix Message: 1=REPLACE.2 21=1 55=JE 59=0 54=1 38=1000 40=2 44=100.000 76=7 6751=TDITS01 6750=CL 7729=0 6820=N 6888=OMGA 60=20171218-17:14:54.574 37=20171218-6 11=Order415 17=021A1 20=0 150=2 39=2 151=0 14=1000 6=100.000 31=100.000 32=1000 30=OMGA 9730=R 12=-0.001400 13=1 6776=Y 58=Order Fill

ITCH5 hex Message:

[45 20 12 D5 00 00 38 79 85 0E 5B C8 00 00 00 03 00 00 03 E8 00 00 00 01 00 01 20 20]

Hex to ASCII

45 = E	Message Type

20 = (blank)		Marker

Hex to Decimal

12 D5 = 4821	Instrument ID
00 00 38 79 85 0E 5B C8 = 62094574509000	Timestamp
00 00 00 03 = 3	Order Reference Number
00 00 03 E8 = 1000	Executed Shares
00 00 00 01 = 1	Match Number

Hex to ASCII

00 01 = 1	Contra Broker
20 20 = (blank) (blank)	Reserved

Example: Order Delete Message

ITCH5 hex message

[44 20 12 D5 00 00 3D F5 EA 00 8E F8 00 00 00 05]

Hex to ASCII

44 = D

20 = (blank)

Hex to Decimal

12 D5 = 4821

00 00 3D F5 EA 00 8E F8 = 68126402187000

00 00 00 05 = 5

Example: Order Replace Message

ITCH5 hex message

[55 20 12 D5 00 00 3D F8 18 5B 8D C8 00 00 00 0A 00 00 00 0B 00 00 03 E8 00 0F 42 40]

Hex to ASCII

55 = U

20 = (blank)

Hex to Decimal

12 D5 = 4821

00 00 3D F8 18 5B 8D C8 = 68135769837000

00 00 00 0A = 10

00 00 00 0B = 11

00 00 03 E8 = 1000

00 0F 42 40 = 1000000

Example: Order Cancel Message

ITCH5 hex message

[58 20 12 D5 00 00 3F EC 91 0D 3E 60 00 00 00 12 00 00 03 E8]

Hex to ASCII

58 = X

20 = (blank)

Hex to Decimal

12 D5 = 4821

00 00 3F EC 91 0D 3E 60 = 70285278396000

00 00 00 12 = 18

00 00 03 E8 = 1000

Example: Trade Message (P)

FIX message: 1=REPLACE.1 21=1 18=M 55=JE 59=0 54=1 38=1000 40=P 44=100.000 76=7 6751=TDITS01 6750=CL 7729=0 6820=N 6888=OMGA 60=20171219-18:58:18.654 37=20171219-15 11=Order431 17=021A3 20=0 150=2 39=2 151=0 14=1000 6=5.705 31=5.705 32=1000 30=OMGA 9730=A 12=0.001900 13=1 198=15 6776=Y 58=Order Fill

ITCH5 hex message

[50 42 12 D5 00 00 3E 1E 05 09 00 68 00 00 00 0F 00 00 03 E8 00 00 DE DA 00 00 00 03 00 01 00 01]

Hex to ASCII

50 = P

42 = B

Hex to Decimal

12 D5 = 4821

00 00 3E 1E 05 09 00 68 = 68298654417000

00 00 00 0F = 15

00 00 03 E8 = 1000

00 00 DE DA = 57050

00 00 00 03 = 3

00 01 = 1

00 01 = 1

Example: Internal Cross Message

FIX Message: 21=1 55=EYE.A 59=0 54=8 38=1000 40=2 44=0.0025 76=91 6751=TRADER01 6831=TRD016 6836=2012 6832=OF 6837=CL 6833=IA 6838=SS 6839=079 6888=OMGA 6791=Y 6773=I 60=20171215-15:20:49.907 37=20171215-2 11=Order409 17=028A100000001 20=0 150=2 39=2 151=0 14=1000 6=0.0025 31=0.0025 32=1000 30=OMGA 12=0.000000 13=1 6776=Y 58=Order Fill

ITCH5 hex message:

[51 49 09 D7 00 00 32 3F DF 19 9C 30 00 00 03 E8 00 00 00 19 05 F5 E1 01 00 5B 00 5B 59 30 20 20]

Hex to ASCII:

51 = Q

49 09 = I

Hex to Decimal:

D7 = 215

00 00 32 3F DF 19 9C 30 = 55249907326000

00 00 03 E8 = 1000

00 00 00 19 = 25

05 F5 E1 01 = 100000001

00 5B = 91

00 5B = 91

Hex to ASCII:

59 = Y

30 = 0

20 20 = (blank)

Example: Trade Bust Message

ITCH 5 hex message

[42 20 12 D5 00 00 40 20 54 A5 3F 98 00 00 00 01]

Hex to ASCII

42 = B

20 = (blank)

12 D5 = 4821

00 00 40 20 54 A5 3F 98 = 70507603247000

00 00 00 01 = 1