Market Data Solutions

Equities Feed

Specification

Version 1.2

4 September 2014

Template version 4.3

Document History

VERSION	DATE	SUMMARY OF CHANGES
1.0	2014-05-19	First draft
1.1	2014-08-05	Add Trading Schedule [s] message Add Orderbook Restrictions message [k] Change msg Ids: [E] to [e], [C] to [c], [Q] to [p], [F] to [f], [X] to [O] Consolidate Trade Indicator field on [q] message Remove Quote Level field from [O] message for top of book Change FirmId in [N] message to an Alpha field Rename ITCH BBO feed to ITCH Basic with Last Sale, and added Trade [p] message Reduced all individual quantity fields from 8 bytes to 4 Moved 'Halt' indication from [S] msg to [H] msg Consolidated fields in [Y] message
1.2	2014-09-04	Reinstate [C], [E], [P] messages for when Broker Anonymity is enforced Add Ownership Rule ID field to [f] message Add detail to [k] message fields Update reference data descriptions [H] msg now sent for all orderbooks at start of day Restore quantity fields to 8 bytes

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1 Context

1.1 Intended Audience

This document is intended for

- NASDAQ OMX technical staff
- Philippines Stock Exchange technical staff

1.2 Business Context

X-stream provides support for the standard INET protocols. The document will cover market data dissemination. ITCH is an efficient way of distributing market data in terms of bandwidth required.

1.3 Requirements

The INET ITCH protocol is widely used and considered an industry standard. This standard is ideal for a low latency messaging. X-stream should adhere, as closely as possible, to the latest published versions of both this fixed width message definitions.

The point-to-point transport layer for ITCH payloads will be SoupBinTCP. Details on this protocol can be found at the following link:

https://www.nasdaqtrader.com/content/technicalsupport/specifications/dataproducts/soupbintcp.pdf

SoupBinTCPv3.0 is required as it supports binary types in the payload. Binary types are employed in the latest ITCH and OUCH standards so required for X-stream.

The transport for one-to-many distribution of ITCH market data is MoldUDP64. The Mold protocol provides a sequenced and recoverable UDP multicast stream.

Note: For added security, X-stream enforces case sensitivity on all usernames and passwords used in the SoupBinTCP Login Request Packet ‘L’.

2 ITCH Data Types

Table 1 – ITCH Data Types

DATA TYPE	DESCRIPTION
Alpha	Left justified and right padded.
Null-Terminated Alpha	Left justified null terminated, i.e. variable length. Maximum length includes the null character.
Integer	Unsigned big-endian binary encoded.

2.1 Price Decimals

The number of Price Decimals in use for each orderbook is sent in the Orderbook Directory Message [R] push at the start of the day. When a price value is received as an Integer in messages for that orderbook, the following formula must then be used to determine the Price:

Price = Integer / 10$^{\text{PriceDecimals}}$

3 ITCH Messages

This section describes the messages used by the ITCH market data feeds generated by X-stream.

Table 2 – ITCH Time Stamp – Seconds Message [T]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	"T"	Time Stamp -Seconds Message Id.
Second	1	4	Integer	Number of seconds since midnight.

Table 3 – ITCH System Event Message [S]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	"S"	System Event Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Group	5	8	Alpha	Id for symbol grouping (Board level only). "N" = Normal "O" = Oddlot "I" = Index Left blank if the event is at System level or Orderbook level.
Event Code	13	1	Alpha	Event Code. Refer to System Event codes in table below.
Orderbook	14	4	Integer	Used to identify if the event applies to a single orderbook within the Group. Orderbook Code set to 0 if the event applies at a System level or Group level.

Table 4 – System Event Codes

SYSTEM EVENT CODE	EXPLANATION	ORDER ENTRY	ORDER AMEND & CANCEL	TRADING
'O'	Start of Messages. This is the first message sent.	N	N	N
'S'	Start of System Hours. The Pre-Open Session commences.	Y	Y	N
'R'	Pre-Open No Cancellation period.	Y	N	N
'Q'	Start of Market Hours. The Pre-Open uncross occurs, and continuous trading begins.	Y	Y	Y
'A'	The scheduled Break in trading begins.	N	N	N
'B'	The scheduled Break in trading ends.	Y	Y	Y
'L'	Pre-Close commences.	Y	Y	N
'J'	Pre-Close No Cancellation period.	Y	N	N
'P'	Trading At Last. The Closing Auction uncross occurs, and traders can then enter limit orders for execution at the determined closing price.	Y	N	Y*
'M'	End Of Market Hours.	N	N	N
'E'	End Of Trading. It indicates that the Exchange is closed.	N	N	N
'C'	End of System Messages. Last message sent.	N	N	N

Table 5 – ITCH Trading Schedule Message [s]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	"s"	Trading Schedule Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Group	5	8	Alpha	Id for symbol grouping (Board level only). "N" = Normal "O" = Oddlot "I" = Index Left blank if the event is at System level or Orderbook level.
Event Code	13	1	Alpha	Event Code. Refer to System Event codes in Table 4.
Orderbook	14	4	Integer	Used to identify if the event applies to a single orderbook within the Group. Orderbook Code set to 0 if the event applies at a System level or Group level.

NAME	OFFSET	LEN	VALUE	NOTES
Scheduled Time	18	4	Integer	Number of seconds past midnight that the event is scheduled.

Table 6 – ITCH Price Tick Size Message [L]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	"L"	Tick Size Table.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Tick Size Table Id	5	4	Integer	Indicates the Tick Size Table id.
Tick Size	9	4	Integer	Price Tick Size.
Price Start	13	4	Integer	Start of Price for this Tick Size.

Table 7 – ITCH Quantity Tick Size Message [M]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	"M"	Tick Size Table.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Tick Size Table Id	5	4	Integer	Indicates the Tick Size Table id.
Tick Size	9	8	Integer	Quantity Tick Size. If 0 then Quantity Start indicates the maximum allowed order quantity for the orderbook.
Quantity Start	17	8	Integer	Start of Quantity for this Tick Size.

Table 8 – ITCH Orderbook Directory Message [R]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	"R"	Orderbook Directory Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Orderbook	5	4	Integer	Unique orderbook identifier.
Price Type	9	1	Alpha	Indicates "U" ('per unit' price type) or "P" (price as percentage).
ISIN	10	12	Alpha	ISIN code
Sec Code	22	12	Alpha	Security code
Currency	34	3	Alpha	Trading currency
Group	37	8	Alpha	Id for symbol grouping (board only). "N" = Normal

NAME	OFFSET	LEN	VALUE	NOTES
				“O” = Oddlot “I” = Index
Lot Size	45	8	Integer	Lot size for the orderbook
Quantity Tick Size Table Id	53	4	Integer	Quantity Tick Size Table. Cross reference to Quantity Tick Size table.
Price Tick Size Table Id	57	4	Integer	Price Tick Size Table Id. Cross reference to Price Tick Size table.
Price Decimals	61	4	Integer	Decimals for price fields across all messages for this orderbook.
Delisting Date	65	4	Integer	YYYYMMDD 0 represents no delisting date.
Delisting Time	69	4	Integer	HHMMSS Ignore if delisting date is 0.
Instrument Type	73	1	Alpha	“C” = Common stock “P” = Preferred stock “W” = Warrant “E” = ETF “D” = PDR “I” = Index
Shares	74	8	Integer	The number of shares outstanding
Product Code	82	8	Alpha	The product code for the orderbook

Table 9 – ITCH Orderbook Restrictions Message [k]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“k”	Orderbook Restrictions Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Orderbook	5	4	Integer	Unique orderbook identifier.
Short Sell Eligible	9	1	Alpha	“Y”es “N”o
High Collar	10	4	Integer	Maximum allowed price via static limit. The price is 0x7FFFFFFF (hex) 2147483647 (dec) to indicate no limit.
Low Collar	14	4	Integer	Minimum allowed price via static limit. The price is 0x7FFFFFFF (hex) 2147483647 (dec) to indicate no limit.
CB Limit Up %	18	4	Integer	Circuit breaker maximum movement allowed up as a percentage from the

NAME	OFFSET	LEN	VALUE	NOTES
				Last Traded Price (dynamic limit). A value of 0 indicates no limit.
CB Limit Down %	22	4	Integer	Circuit breaker maximum movement allowed down as a percentage from the Last Traded Price (dynamic limit). A value of 0 indicates no limit.
CB Limit Decimals	26	4	Integer	Decimals to apply to the CB Limit Up % and CB Limit Down % values

Table 10 – ITCH Index Member Directory Message [Y]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“Y”	Index Member Directory Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Index Orderbook	5	4	Integer	Unique orderbook identifier for the Index.
Member Orderbook	9	4	Integer	The unique orderbook identifier for a component of the Index orderbook.
Index Member Weight	13	8	Integer	Weighting for the member component.

Table 11 – ITCH Index Value [Z]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“Z”	Index Value Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Index Orderbook	5	4	Integer	Unique orderbook identifier for the Index.
Value	9	8	Integer	Index Value.

Table 12 – ITCH Orderbook Trading Action Message [H]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“H”	Stock Trading Action Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Orderbook	5	4	Integer	Unique orderbook identifier.
Trading State	9	1	Alpha	Current trading state for orderbook. “T” = Trading “V” = Suspended This message is sent at the start of the

NAME	OFFSET	LEN	VALUE	NOTES
				day to indicate the initial state of each orderbook.Suspended intra-day with "V" + Reason "S", then unsuspended with "T" + Reason "N". Frozen intra-day with "V" + Reason "F", then thawed with "T" + Reason "N". Halted intra-day with "T" + Reason "H", then lifted with "T" + Reason "N".
Reason	10	1	Alpha	Refer to reason in table below.

Table 13 – Trading Action Reasons

TRADING ACTION REASON	EXPLANATION
'N'	Normal trading
'S'	Suspended by market control
'F'	Frozen due to circuit breaker (dynamic limit)
'H'	Halted (intraday auction)

Table 14 – ITCH Add Order Message [A]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	"A"	Add Order Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Order Number	5	8	Integer	The day unique reference number assigned to the new order. A value of zero indicates that this is a reference price update.
Order Verb	13	1	Alpha	"B"uy "S"ell Blank if reference price update.
Quantity	14	8	Integer	The total quantity of the order being added to the book. A value of zero indicates that this is a reference price update.
Orderbook	22	4	Integer	Unique orderbook identifier.
Price	26	4	Integer	The price of the new order, reference price update. The price is 0x7FFFFFFF (hex) 2147483647 (dec) to indicate a 'market' order or that a reference price is unavailable.

Table 15 – ITCH Order Executed Message [E]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“E”	Order Executed Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Order Number	5	8	Integer	The day unique order reference number of the passive order being executed.
Executed Quantity	13	8	Integer	The number of shares executed.
Match Number	21	8	Integer	The day unique match identifier.

Table 16 – ITCH Order Executed (with Broker ID) Message [e]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“e”	Order Executed (with Broker ID) Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Order Number	5	8	Integer	The day unique order reference number of the passive order being executed.
Executed Quantity	13	8	Integer	The number of shares executed.
Match Number	21	8	Integer	The day unique match identifier.
Passive Broker ID	29	4	Alpha	Broker identifier of the passive order. Blank if unset.
Active Broker ID	33	4	Alpha	Broker identifier of the active order. Blank if unset.

Table 17 – ITCH Order Executed With Price Message [C]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“C”	Order Executed with Price Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Order Number	5	8	Integer	The day unique executed order reference number.
Executed Quantity	13	8	Integer	The number of shares executed.
Match Number	21	8	Integer	The day unique match identifier.
Printable	29	1	Alpha	Indicates if the execution should be reflected in volume calculations. ‘N’ = Non Printable ‘Y’ = Printable

NAME	OFFSET	LEN	VALUE	NOTES
Execution Price	30	4	Integer	The price at which the execution occurred.

Table 18 – ITCH Order Executed With Price (and Broker ID) Message [c]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“c”	Order Executed with Price (and Broker ID) Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Order Number	5	8	Integer	The day unique executed order reference number.
Executed Quantity	13	8	Integer	The number of shares executed.
Match Number	21	8	Integer	The day unique match identifier.
Printable	29	1	Alpha	Indicates if the execution should be reflected in volume calculations. ‘N’ = Non Printable ‘Y’ = Printable
Execution Price	30	4	Integer	The price at which the execution occurred.
Passive Broker ID	34	4	Alpha	Broker identifier of the passive order. Blank if unset.
Active Broker ID	38	4	Alpha	Broker identifier of the active order. Blank if unset.

Table 19 – ITCH Broken Trade Message [B]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“B”	Broken Trade Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Match Number	5	8	Integer	The X-stream 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.
Reason	13	1	Alpha	The reason the trade was broken. See currently supported Broken Trade Reasons table below.

Table 20 – ITCH Broken Trade Reasons

REASON	EXPLANATION
‘S’	Supervisory – The trade was manually broken by the Exchange.

Table 21 – ITCH Order Delete Message [D]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“D”	Order Delete Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Order Number	5	8	Integer	The reference number of the order being cancelled.

Table 22 – ITCH Order Replace Message [U]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“U”	Order Replace Message Id
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Original Order Number	5	8	Integer	The original order number of the order being replaced.
New Order Number	13	8	Integer	The new reference number for the order at the time of replacement.
Quantity	21	8	Integer	The new total open quantity, i.e. the balance of the new order.
Price	29	4	Integer	The new price for the order. The price is 0x7FFFFFFF (hex) or 2147483647 (dec) for a ‘market’ order.

Table 23 – ITCH Indicative Price/Quantity Message [I]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“I”	Indicative Price/Quantity Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Theoretical Auction Quantity	5	8	Integer	The total quantity eligible to be matched at the current Theoretical Auction Price.
Orderbook	13	4	Integer	Unique orderbook identifier.
Best Bid	17	4	Integer	The current best buy price.
Best Offer	21	4	Integer	The current best sell price.

NAME	OFFSET	LEN	VALUE	NOTES
Theoretical Auction Price	25	4	Integer	The indicative auction price for this orderbook.
Auction Type	29	1	Alpha	Auction Type code. Refer to Auction Type codes in table below.

Table 24 – Auction Type Codes

AUCTION TYPE CODE	EXPLANATION
'O'	Opening Auction (Pre-open)
'I'	Intra-day Auction (Halt)
'C'	Closing Auction (Pre-close)

Table 25 – ITCH Trade Message [P]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	"P"	Trade Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Executed Quantity	5	8	Integer	The number of shares executed. 0 if the message is sent for Close Price.
Orderbook	13	4	Integer	Unique orderbook identifier.
Printable	17	1	Alpha	Indicates if the execution should be reflected in statistics calculations. 'N' = Non Printable 'Y' = Printable
Execution Price	18	4	Integer	The price at which the execution occurred.
Match Number	22	8	Integer	The day unique match identifier. 0 if the message is sent for the Close Price.
Trade Indicator	30	1	Alpha	Indicates the type of trade. ' ' = regular trade 'C' = intentional cross trade (the same user simultaneously entered both sides of the trade) 'B' = block sale 'M' = manual trade (market control)

Table 26 – ITCH Trade (with Broker ID) Message [p]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“p”	Trade (with Broker ID) Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Executed Quantity	5	8	Integer	The number of shares executed. 0 if the message is sent for Close Price.
Orderbook	13	4	Integer	Unique orderbook identifier.
Printable	17	1	Alpha	Indicates if the execution should be reflected in statistics calculations. ‘N’ = Non Printable ‘Y’ = Printable
Execution Price	18	4	Integer	The price at which the execution occurred.
Match Number	22	8	Integer	The day unique match identifier. 0 if the message is sent for the Close Price.
Trade Indicator	30	1	Alpha	Indicates the type of trade. ‘ ’ = regular trade ‘C’ = intentional cross trade (the same user simultaneously entered both sides of the trade) ‘B’ = block sale ‘M’ = manual trade (market control)
Buy Broker ID	31	4	Alpha	Broker identifier of the buy side of the trade. Blank if unset.
Sell Broker ID	35	4	Alpha	Broker identifier of the sell side of the trade. Blank if unset.

Table 27 – ITCH Foreign Shares Available Message [f]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	“f”	Foreign Shares Available Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Product Code	5	8	Alpha	The Product Code for which the foreign shares are available.
Ownership Rule ID	13	2	Alpha	Identifier of the foreign ownership rule for which this message applies.
Sign	15	1	Alpha	Whether the foreign shares available value is positive or negative.

NAME	OFFSET	LEN	VALUE	NOTES
				'+' = positive '–' = negative
Foreign Shares Available	16	8	Integer	The number of shares currently available for foreign ownership.

Table 28 – ITCH BBO Quotation Message [O]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	"O"	BBO Quotation Message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Orderbook	5	4	Integer	Unique orderbook identifier.
Best Bid Price	9	4	Integer	Best Bid price for the orderbook. A value of 0x7FFFFFFF (hex) 2147483647 (dec) indicates no bid depth.
Best Bid Size	13	8	Integer	Aggregated number of visible shares at the best bid price. A value of 0 indicates no bid.
Best Offer Price	21	4	Integer	Best Offer price for the orderbook. A value of 0x7FFFFFFF (hex) 2147483647 (dec) indicates no offer depth.
Best Offer Size	25	8	Integer	Aggregated number of visible shares at the best offer price. A value of 0 indicates no offer depth.

Table 29 – ITCH News Item Message [N]

NAME	OFFSET	LEN	VALUE	NOTES
Type	0	1	"N"	News Item message Id.
Timestamp	1	4	Integer	Nanoseconds since last Time Stamp seconds message.
Orderbook	5	4	Integer	Unique orderbook identifier.
NewsId	9	4	Integer	Unique news item identifier.
FirmId	13	30	Alpha	Reference Firm
Title	43	max(80+1)	Null-Terminated Alpha	News Title
Reference	varies	max(255+1)	Null-Terminated Alpha	Reference for news item associated object (e.g. a URL, file pathname)

NAME	OFFSET	LEN	VALUE	NOTES
NewsText	varies	Max(511+1)	Null-Terminated Alpha	News data.

4 ITCH Feeds

This section specifies the messages that are sent on each of the ITCH feeds. It indicates whether they are sent as a reference message either at the start of the day (SOD) or end of the day (EOD), and/or whether they are a dynamic message sent during the trading day.

4.1 ITCH Total View

The ITCH Total View market data feed consists of the ITCH messages in the table below.

Table 30 – ITCH Total View messages

TYPE	NAME	REFERENCE	DYNAMIC
T	Time Stamp		Yes
S	System Event		Yes
s	Trading Schedule	SOD	
L	Price Tick Size	SOD	
M	Quantity Tick Size	SOD	
R	Orderbook Directory	SOD	
k	Orderbook Restrictions	SOD	Yes
f	Foreign Shares Available	SOD	Yes
H	Orderbook Trading Action	SOD	Yes
A	Add Order	SOD†	Yes
E	Order Executed*		Yes
e	Order Executed (with Broker ID)**		Yes
C	Order Executed With Price*		Yes
c	Order Executed With Price (and Broker ID)**		Yes
B	Broken Trade		Yes
D	Order Delete		Yes
U	Order Replace		Yes
I	Indicative Price/Quantity		Yes
P	Trade*	EOD‡	Yes
p	Trade (with Broker ID)**		Yes

* Sent when the market has Broker Anonymity

** Sent when the market does not have Broker Anonymity

† Sent to indicate the reference price for an orderbook

‡ Sent to indicate the closing price for an orderbook

4.2 ITCH Basic with Last Sale

The ITCH Basic with Last Sale feed consists of the ITCH messages in the table below.

Table 31 – ITCH Basic with Last Sale messages

TYPE	NAME	REFERENCE	DYNAMIC
T	Time Stamp		Yes
S	System Event		Yes
s	Trading Schedule	SOD	
L	Price Tick Size	SOD	
M	Quantity Tick Size	SOD	
R	Orderbook Directory	SOD	
k	Orderbook Restrictions	SOD	Yes
H	Orderbook Trading Action	SOD	Yes
O	BBO Quotation		Yes
P	Trade*		Yes
p	Trade (with Broker ID)**		Yes

* Sent when the market has Broker Anonymity

** Sent when the market does not have Broker Anonymity

4.3 ITCH News

The ITCH News market data feed consists of the ITCH messages in the table below.

Table 32 – ITCH News messages

TYPE	NAME	REFERENCE	DYNAMIC
T	Time Stamp		Yes
S	System Event		Yes
s	Trading Schedule	SOD	
L	Price Tick Size	SOD	
M	Quantity Tick Size	SOD	
R	Orderbook Directory	SOD	
k	Orderbook Restrictions	SOD	Yes
H	Orderbook Trading Action	SOD	Yes
N	News Item		Yes

4.4 ITCH Index

The ITCH Index market data feed consists of the ITCH messages in the table below.

Table 33 – ITCH Index messages

TYPE	NAME	REFERENCE	DYNAMIC
T	Time Stamp		Yes
S	System Event		Yes
s	Trading Schedule	SOD	
L	Price Tick Size	SOD	
M	Quantity Tick Size	SOD	
R	Orderbook Directory	SOD	
k	Orderbook Restrictions	SOD	Yes
Y	Index Member Directory	SOD	
H	Orderbook Trading Action	SOD	Yes
Z	Index Value		Yes

5 ITCH Message Kinematics

5.1 Reference Data

At the beginning of the day, reference data messages will be sent on the ITCH feeds to provide information about the market. The Orderbook Directory Message [R] contains the unique integer orderbook identifier for use in fast security lookup. The Orderbook Restrictions Message [k] contains additional information about the orderbook, such as Collars and CB Limits, and this message can also be sent intra-day to notify about any changes.

Index instruments will be included in the Orderbook Directory on all data feeds. Index composition will be defined by subsequent Index Member Directory Messages [Y] on the ITCH Index feed only.

The Trading Schedule Message [s] will be sent with the Scheduled Time for all events.

The Foreign Shares Available Message [f] will be sent with the initial number of shares available to foreigners for a Product Code. Product Codes that do not allow foreign ownership will not send out an [f] message.

5.2 Orderbook Trading Action [H]

The Orderbook Trading Action will send the initial Trading State for all orderbooks. This indicates the end of the reference data at the start of the day.

When a group of orderbooks is suspended/unsuspended in X-stream INET then the Orderbook Trading Action [H] message will be sent for all orderbooks in the group to indicate a change in Trading State.

When an orderbook is halted, an Orderbook Trading Action [H] message will be sent with Trading State "T" (Trading) and Reason "H" (Halted). When the halt is lifted, an Orderbook Trading Action [H] message will be sent with Trading State "T" (Trading) and Reason "N" (Normal).

5.3 Broker Anonymity

Some ITCH messages will be sent based on whether the market is implementing Broker Anonymity or not, as announced by the exchange.

If Broker Anonymity is in force, ITCH will use:

- Order Executed [E]
- Order Executed with Price [C]
- Trade [P]

If Broker Anonymity is not in force, ITCH will use:

- Order Executed (with Broker ID) [e]
- Order Executed with Price (and Broker ID) [c]
- Trade (with Broker ID) [p]

5.4 Event Message Flow

The ITCH System Event Message [S] will be sent as a result of X-stream trade events being triggered at the system, group and orderbook level (e.g. Pre-Open, Open).

Auction Type codes for the ITCH Indicative Price/Quantity Message [I] will map the auction session in place (“O”pen auction, “I”ntraday Auction, “C”losing Auction).

The following table shows the possible values of System Event Codes and Auction Type values when a transition is triggered or during a particular trading session.

Table 34 – ITCH Event Message flow

X-STREAM TRANSITION	SYSTEM EVENT MESSAGE [S] SYSTEM EVENT CODE (System, Group or OrderBook Level)	ORDERBOOK TRADING ACTION MESSAGE [H] TRADING STATE / REASON (OrderBook Level)	INDICATIVE PRICE/ QUANTITY [I] AUCTION TYPE (OrderBook Level)
	‘O’ – “Start of Messages” First message sent.		
PREOPEN triggers	‘S’ – “Pre Open”		
During Pre-Open Auction		‘V’ – “Suspended” / ‘S’ – “Suspended” ‘T’ – “Trading” / ‘N’ – “Normal”	‘O’ – “Open Auction”
PREOPEN_NC triggers (no cancellation)	‘R’ – “Pre Open (No Cancellation)”		
OPEN triggers	‘Q’ – “Start Of Market Hours”		
During Trading		‘V’ – “Suspended” / ‘S’ – “Suspended” ‘V’ – “Suspended” / ‘F’ – “Frozen” ‘T’ – “Trading” / ‘N’ – “Normal”	
HALT triggers (unscheduled)		‘T’ – “Trading” / ‘H’ – “Halted”	
During HALT Auction			‘I’ – “Intra-day Auction”
LIFT triggers		‘T’ – “Trading” / ‘N’ – “Normal”	
BREAK triggers	‘A’ – “Start Break”		
End BREAK triggers	‘B’ – “End Break”		
PRECLOSE triggers	‘L’ – “Pre Close”		
During Pre-Close Auction		‘V’ – “Suspended” / ‘S’ – “Suspended” ‘T’ – “Trading” / ‘N’ – “Normal”	‘C’ – “Close Auction”
PRECLOSE_NC triggers (no cancellation)	‘J’ – “Pre Close (No Cancellation)”		

X-STREAM TRANSITION	SYSTEM EVENT MESSAGE [S] SYSTEM EVENT CODE (System, Group or OrderBook Level)	ORDERBOOK TRADING ACTION MESSAGE [H] TRADING STATE / REASON (OrderBook Level)	INDICATIVE PRICE/ QUANTITY [I] AUCTION TYPE (OrderBook Level)
POSTCLOSE triggers	'P' – "Trading At last"		
CLOSE triggers	'M' – "End Of Market Hours"		
END_OF_DAY	'E' – "End of System Hours"		
IPXS-EOM	'C' – "End of Messages" Last message sent.		
IPXS-ENDSESS			

5.5 Example Message Flow Pre-Open to Open

The ITCH System Event Message [S] will first be sent to indicate that the Exchange is open and ready to receive orders. The Event Code will be set to 'S' to indicate the start of the daily Pre-Open session.

Throughout the Pre-Open, ITCH messages will be sent as order actions change the state of the system – such as ITCH TV Add Order Message [A], ITCH TV Indicative Price/Quantity Message [I], ITCH Orderbook Trading Action Message [H] and ITCH TV Order Delete Message etc.

The auction opening will result in ITCH Order Executed With Price Messages [C] (or [c]) being sent if trades are generated. The Trade [P] (or [p]) message is not used here, so the client must keep track of these messages to maintain the order book.

The ITCH System Event Message [S] will then be sent to indicate the particular orderbook group (board) has transitioned to continuous trading. The Event Code will be set to 'Q' to indicate the transition to Open is complete.

5.6 Update of Reference Price

An Add Order [A] message with Order Number and Quantity both set to zero is used to indicate the reference price of an order book.

Add Order [A] messages are sent after the initial reference data messages to indicate the initial reference price.

A manual reference price update intra-day will generate an Add Order [A] message.

Reference price changes due to auctions will not generate an Add Order message.

5.7 Close Price

A Trade [P] (or [p]) message with Match Number and Executed Quantity both set to zero is used to indicate the close price of an order book.

Trade [P] (or [p]) messages are sent immediately after the 'Trading At Last' System Event Message [S] to indicate the close price.

5.8 Add Order [A] and Order Executed With Price [C] (or [c])

During normal trading, when an incoming order gets in and matches, an Order Executed [E] (or [e]) message is sent for the passive orders that match the incoming order (aggressor). An Order Add [A] message will then be sent for any outstanding balance of the incoming order that is booked; no Add Order [A] message will be sent if the incoming order is fully matched or expired.

At the opening of an auction, an Order Executed With Price [C] (or [c]) message is sent for each executed order. An Order Executed With Price message may also be sent for an order executed when thawing after a freeze.

5.9 Trade [P] (or [p])

For the ITCH Total View feed, the Trade [P] (or [p]) message is used to publish intentional cross, block and manually entered (market control) trades only. For auction executions or regular executions during continuous trading, the Order Executed With Price [C] (or [c]) and Order Executed [E] (or [e]) messages are sent, respectively.

For the ITCH Basic feed, the Trade [P] (or [p]) message is used to publish all trades. The Order Executed and Order Executed With Price messages are not used.

Appendix A - PSE WEP Differences

The following is a summary of the notable differences between the PSE WEP and ITCH market data messages. It is not an exhaustive list.

- WEP sends a 'Price Update' message to indicate a change to the reference price, while ITCH sends an 'Add Order' message with an order number of 0 and quantity of 0
- WEP sends a 'Price Update' message to indicate a change to the close price, while ITCH sends a 'Trade' message with match quantity of 0 and executed quantity of 0
- ITCH does not publish running market statistics (high, low, last). Subscribers to ITCH must track order executions and trades throughout the day in order to calculate these values.

Table 35 – WEP vs ITCH messages

WEP MESSAGE	ITCH EQUIVALENT
Real Time Index	Index Value
Index Summary	*No equivalent*
Index Composition	Index Member Directory
Stock State Change	System Event
Market Information	Orderbook Trading Action
Mail	News
Foreigner Shares Available	Foreign Shares Available
Indicative Matching Price	Indicative Price/Quantity
Collars	Orderbook Directory
Session Timetable	Trading Schedule
Display Bid or Ask	*Not used by PSE*
Start Referential	*No equivalent*
End Referential	*No equivalent*
Referential	Orderbook Directory, Price Tick Size, Quantity Tick Size
Order Update	Add Order, Order Replace, Delete Order, Order Executed, Order Executed with Price
Quote	BBO Quotation
Trade Creation	Order Executed with Price, Trade
Trade Cancel	Broken Trade
(Trade) Full Information	*No equivalent*
Price Update	Add Order, Trade
TCS Trade	Trade
Auction Summary	*No equivalent*

