ASX 24 ITCH

Message Specification

Table of Contents

1 Introduction ... 4

1.1 ASX 24 ITCH ... 4
1.2 Blink and Glance Recovery Services ... 4

2 System Architecture ... 6

3 Message Protocol ... 7

3.1 Packet Header ... 7
3.1.1 Data Message Header ... 7
3.2 Data Types ... 7

4 Message Formats ... 9

4.1 Message Types and Sizes ... 9
4.2 Event Change Messages ... 10
4.2.1 Time Message ... 10
4.2.2 System Event ... 12

5 Application Data ... 13

5.1 Reference Data Messages ... 13
5.1.1 Future Symbol Directory ... 13
5.1.2 Spread Symbol Directory ... 14
5.1.3 Option Symbol Directory ... 14
5.1.4 Symbol Explanations ... 16
5.2 State Change Messages ... 18
5.2.1 Order Book State ... 18
5.2.2 Trading Status Explanation ... 18
5.3 Order Messages ... 19
5.3.1 Order Added ... 19
5.3.2 Order Modification Messages ... 19
5.3.3 Implied Order Messages ... 21
5.3.4 Custom Market Order Messages ... 23
5.4 Trade Messages ... 25
5.4.1 Order Executed ... 26
5.4.2 Order Executed with Price ... 26
5.4.3 Spread Executed ... 27
5.4.4 Trade (Spread Execution Chain) ... 28
5.4.5 Custom Market Executed ... 29
5.4.6 Custom Market Trade ... 30
5.4.7 Trade Cancellation ... 31
5.4.8 Trade Type Explanation ... 31
5.5 Market Updates ... 32
5.5.1 Equilibrium Price (Auction Info) ... 32
5.5.2 Open, High, Low, Last Trade Adjustment ... 32
5.5.3 Market Settlement ... 33
5.5.4 Text Message ... 33
5.5.5 Request for Quote ... 35
5.5.6 Anomalous Order Threshold Publish ... 35
5.5.7 Volume and Open Interest ... 36

6 Administration ... 37

6.1 Multicast Session and Sequence ... 37
6.1.1 Message Packet Recovery from Blink ... 37
6.1.2 Administrative Messages ... 39
6.2 How to build an order book view ... 44
6.2.2 A Note on Order Book Priority ... 44
6.2.3 Notes for Trade Message Execution ... 47

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6.2.4 Notes to Build a Market Image 51

7 Configuration and Infrastructure 57

7.1.1 Overview of Feeds 57
7.1.2 ASX 24 ITCH Connectivity Requirements 57
7.1.3 ASX 24 ITCH Configuration Requirements 59

8 Appendix 61

8.1 MoldUDP64 and SoupBin TCP 61
8.2 FAQ 62
8.3 Change History 68

9 Support Contact Details 69

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

1 Introduction

ASX 24 ITCH is the premium low latency protocol for accessing ASX 24 Market Information, delivered via a multicast connection directly from the ASX Trade24 platform. ASX 24 ITCH is based on the ITCH protocol and has been developed to maximise performance so as to meet the requirements of latency sensitive traders.

The ASX 24 ITCH protocol provides:

- Low latency market information access to all Products available in ASX Trade24 (significantly faster times than the current ASX Trade24 ITC and FIX feeds).
- Improved latency stability (reduced jitter).
- Control of the Socket.
- Time-stamping to the micro-second.
- Based on the internationally recognised and standardised 'ITCH' protocol.
- Real-time multicast message recovery – "Blink" and point to point data feed connection for snapshot market picture recovery – "Glance".

1.1 ASX 24 ITCH

ASX 24 ITCH features the following data elements (in binary number format) for products listed on the ASX Trade24 system:

- Full order book depth, trade volume and price details using a series of messages to track the life of an order and ensure a complete picture of order and trade flow, including a match of orders normally not reported, such as spread-to-spread trades.
- Event controls, such as market status of Contracts indicating Price Discovery, Open, Halt, Close, Activate, etc.
- Administrative messages, such as trading actions and symbol definition messages:
    - Informing market participants when the system is paused or resumed and Trade Date transitions.
    - Providing Contract definitions such as last trading date, decimal position, calculation parameters, etc.
- Value add Market data, such as Equilibrium or Levelling Price updates during Price Discovery periods, Daily Settlement Prices and Open Interest.
- Miscellaneous messages for Request for Quotes (RFQs) and other ASX Trade24 market information relayed using text.

1.2 Blink and Glance Recovery Services

A complement to ASX 24 ITCH real-time data feed the Blink and Glance recovery services provide direct data feed customers with a:

- Real-time mechanism to obtain missing multicast messages during the course of the multicast session for a Product grouping – Blink
- A point-to-point data feed connection providing a direct data feed delivering a snapshot of the current state of the order books for a Product grouping – Glance.

Glance and Blink uses the same message formats as the ASX 24 ITCH multicast.

Glance can be used to quickly synchronise with the ASX 24 ITCH feed. At the end of the Glance snapshot a sequence number is provided that can be used to connect and synchronise with the real-time ASX 24 ITCH feed.

Glance provides the following:

- Basic Reference Data for each order book including intra-day updates up until the time of login.
- Current trading state of each order book
- All active orders for each order book.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

- Traded Open, High, Low, Last, and settlement prices
- An End of Snapshot message providing the ASX 24 ITCH sequence number to use when connecting to the real-time ASX 24 ITCH feed.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

2 System Architecture

Access to the ASX Trade24 low-latency market feed will follow the ASX Trade ITCH data feed format closely in regards to access, protocol and services offered.

The ASX Trade24 system will have four dedicated servers at the primary site, Australian Liquidity Centre (ALC), where the first pair of servers will provide a primary ITCH service and the second pair providing redundancy. The DRS will have two dedicated servers providing an ITCH service at the Bondi site.

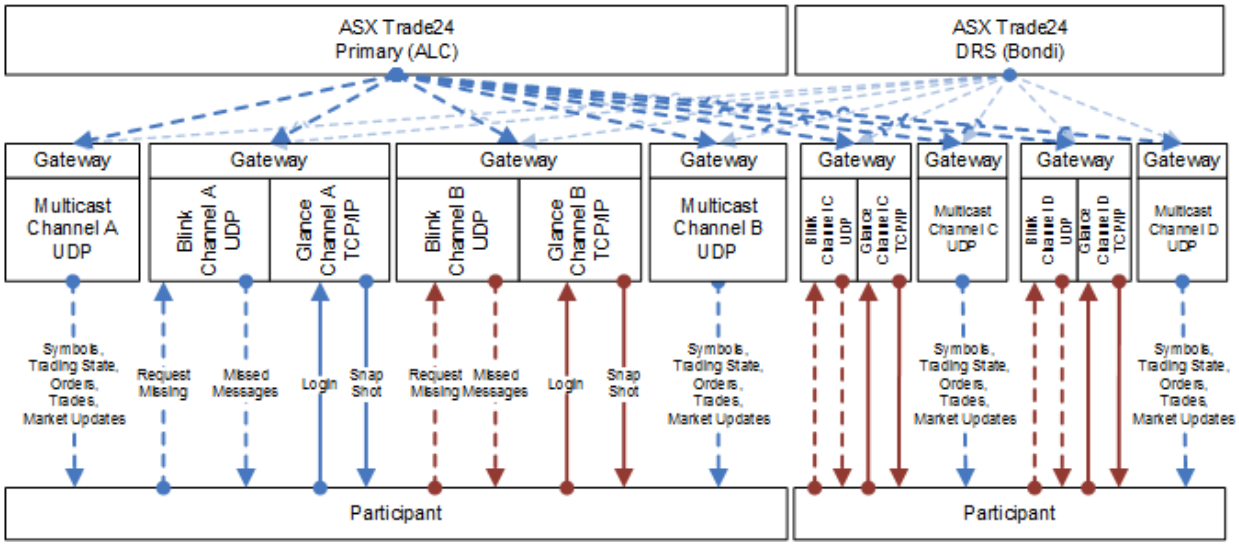
For each pair of servers, one server will multicast market data (ASX 24 ITCH) and the complement server will provide recovery services as follows:

- A real-time recovery of multicast message in the event of network loss (Blink), and
- A snap-shot recovery providing a current market image (Glance).

There will be several multicast transmissions where market data will be segregated into product groups based on the exchange identifier and instrument class (where instrument class is the grouping name of a product, e.g. DEBT, ENERGY, AG, INDEX, etc.). Each product group will be configured to multicast on a specific address/port and recover from a specific port of the complementary server. If a participant wishes to listen to the entire market, the participant must subscribe to all available multicasts.

The method of the data delivery and real-time recovery will use the MoldUDP64 protocol for multicast related data and the SoupBinTCP protocol for a snap-shot of the current market image. Refer Appendix 1: MoldUDP64 and SoupBin TCP for the protocol specifications.

As there is a primary and secondary multicast feed for each product group providing the same data, the participant has the option to listen to both multicast feeds for full participant redundancy, or simply one of the feeds and switch over in the event the multicast fails.



© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

3 Message Protocol

The data feed is made up of a series of sequenced messages. Each message is variable in length based on the message type. The messages are delivered using a protocol that takes care of sequencing, stay-alive, and delivery guarantees. All messages delivered via multicast or using either gap or full recovery will use a defined packet header structure.

The packet header is used to deliver all administrative and application messages to and from the server on all communication channels. A packet header may contain zero, one or more payload messages. While a packet header may contain multiple application messages, it will never contain more than one administrative message. A packet header will not contain both administrative and application messages.

3.1 Packet Header

All UDP delivered messages will be self-contained and can assume that UDP delivered data will not cross Ethernet packet boundary frames and a single Ethernet frame will contain only one packet header with associated data. Within each packet the data feed is comprised of a series of dynamically sized sequenced messages with each message defined using a message header indicating the length and type of each message.

Field Name	Offset	Length	Type	Notes
Session	0	10	Alpha	Identity of the multicast session the payload relates to. Format is T24YYWW999, where T24 identifies the ASX Trade24 Trading System, YY is the year, WW is the week of the year (week of 1st of January is week 1), and A Trading Service session number from 001-999.
Sequence	10	8	Numeric	Sequence Number of the first message to follow this header.
Count	18	2	Numeric	Number of messages to follow this header.
Payload	20	Variable		One or more payload data messages

3.1.1 Data Message Header

Each data message within the packet begins with Length and Message Type fields; therefore, Market Data decoders should be developed to deal with unknown message types and messages that grow beyond the expected length. Messages will only be grown to add additional data to the end of a message.

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Length of data message not including this field.
Message Type	2	1	Alpha	Code identifying this message type
Message Data	3	Variable		Message Content

3.1.1.1 Heartbeat

A Packet Header with a "Count" of zero will be used as a Heartbeat message. This message will never increment the sequence number and is the sequence number of the **next** expected Packet Header for subscribers to detect a missing multicast message. To ensure subscribers detect a data feed a Packet Header is transmitted at least once per second. If no market data has been multicast in the last second, a heartbeat will be multicast for subscribers to monitor multicast activity and detect message loss.

3.2 Data Types

All data elements used in packet headers, data message headers and payload messages will use a big-endian format for binary numeric data and left justified spaced padded ASCII for alphanumeric data. Numeric fields defined as bitwise flags will use a hexadecimal value indicating which bit flags are referenced. For instance, 0x04 will indicate the third least significant bit of the bit field.

There are two time fields defined: "Trade Date" and "Second".

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

- The "Trade Date" is defined as the number of days since 1970-01-01 and has range of 1970-01-01 to 2150-06-07 or 179 years. The "Trade Date" is used specifically to identify the trading period of each message. As ASX Trade24 is a continuous trading system Trade Dates tend to overlap during certain periods due to non-domestic or multi-session products. To ensure there is no ambiguity in a data message, the Trade Date is used to determine which trading period the message is referencing.
- The time field is the date and time using "Unix Time" and is defined as the number of seconds since 1970-01-01 00:00:00 UTC and has a range of 1970-01-01 00:00:00 to 2038-01-19 03:14:07. The time field is used for two purposes:
    - Stored in a Time message and used with the time stamp field to calculate the time of a data message, and
    - Indicates the last trading date and time for future contracts and option series. **Note**: the time is reported as local Sydney time. If the expiry date falls within the ADST period, the time will be reported as ADST. Generally, daylight saving begins at 2am on the first Sunday in October and ends at 3am on the first Sunday in April. See http://www.nsw.gov.au/daylight-saving for further information.

Type	Length	Notes
Alpha	Variable	These fields are composed of non-control ISO 8859 (Latin-1) encoded bytes. They are left justified and padded on the right with spaces.
Numeric	1	8 bit unsigned integer.
Numeric	2	Big-Endian encoded 16 bit unsigned integer.
Numeric	4	Big-Endian encoded 32 bit unsigned integer.
Numeric	8	Big-Endian encoded 64 bit unsigned integer.
Price	4	Big-Endian encoded 32 bit signed integer.

3.2.1.1 Timestamps

The server will, on each packet multicast, transmit a Time Message for every second for which at least one application data message is generated. The time specified in the Time Message serves as a reference for the times specified in all other messages following. The timestamps in all other messages are specified as a nanosecond offset from the most recent Time Message.

The Time Message is not transmitted during periods where no application data messages are generated for the multicast.

The recovery of missing packet messages will include the Time Message originally broadcast on the multicast (i.e. with the same timestamp).

The time field is the date and time using "Unix Time" and is defined as a Big-Endian "Numeric x 4" and is the number of seconds since 1970-01-01 00:00:00 UTC and has a range of 1970-01-01 00:00:00 to 2038-01-19 03:14:07.

3.2.1.2 Trade Date

As ASX Trade24 is a continuous trading system, 6 days x 24 hours, the Trade Date is an important element to determine the trading period for applying transactions. Trade Dates define discrete trading periods for each instrument product. As ASX Trade24 handles various domestic, international and multi-session products there tends to be an overlap of trading periods during certain times across several instrument products. To ensure there is no ambiguity in a data message, the Trade Date is used to determine which trading period the data message is referencing.

The Trade Date is always defined as a Big-Endian "Numeric x 2" and is the number of days since 1970-01-01 and has range of 1970-01-01 to 2150-06-07.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

4 Message Formats

The data feed is composed of a series of messages describing orders added, removed and executed on ASX Trade24 including trades, contract symbols and current status information. Most messages follow the same form as ASX ITCH data feed format, however as ASX Trade24 is a continuous trading system and the content is derivative data there will be differences in format from an equities data feed. For instance, an ASX ITCH Matching ID is 12 bytes, whereas the ASX 24 ITCH Match Number requires only 4 bytes.

4.1 Message Types and Sizes

Although it would be ideal to produce an ITCH feed identical to ASX Trade, data that is appropriate for equities trading is far too bulky for derivatives trading or provides participant identification in an anonymous market. With this in mind a reduction in a number of fields and the elimination of inappropriate elements has been undertaken to deliver efficient and leaner message types for ASX Trade24.

Name	Type	Notes
Time Message	"T"	Precedes any application message where the second changes. Used by subsequent messages for time stamping.
		State and Symbol Definition Messages
System Event	"S"	The system event message is used to signal a change in system or Trade Date status.
Future Symbol Directory	"f"	At system start-up and as each instrument moves to a new Trade Date, the list of available future contracts are disseminated. **Specific to ASX Trade24**
Spread Symbol Directory	"g"	At system start-up and as each instrument moves to a new Trade Date, the list of available spread contracts are disseminated. **Specific to ASX Trade24**
Option Symbol Directory	"h"	At system start-up and as each instrument moves to a new Trade Date, the list of available option contracts are disseminated. **Specific to ASX Trade24**
Order Book State	"O"	Indicates the market status of a contract.
Order Messages		**Order Book Messages**
Order Added	"A"	Indicates a new order is added to the order book.
Order Replaced	"U"	The price or volume of an order has been modified that affects the time priority.
Order Volume Cancelled	"X"	The volume of an order is adjusted down (no change to time priority)
Order Deleted	"D"	Order is removed from the order book
Implied Order Added	"j"	Indicates an implied order is added to the order book. **Specific to ASX Trade24**
Implied Order Replaced	"⊥"	The price or volume of an implied order has been modified. **Specific to ASX Trade24**
Implied Order Deleted	"k"	Remove implied order from the order book for a specific contract. **Specific to ASX Trade24**
Custom Market Order Added	"m"	Indicates a new custom market order is added to the custom order book. **Specific to ASX Trade24**
Custom Market Order Replaced	"n"	The volume of a custom market order has been modified. **Specific to ASX Trade24**
Custom Market Order Deleted	"r"	Custom market order is removed from the custom book. **Specific to ASX Trade24**
Trade Messages		**Trade Messages**
Order Executed	"E"	Indicates an order has fully or partially traded at the displayed price
Order Executed with Price	"C"	Indicates an order has fully or partially traded with another resting order at a different price due to levelling or the modification of another resting order to induce matching.
Spread Executed	"e"	Indicates a spread Order has fully or partially traded. **Specific to ASX Trade24**
Trade (Spread Execution Chain)	"P"	Indicates an order has fully or partially traded with a spread order type.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Name	Type	Notes
Custom Market Executed	"u"	Indicates a custom order has fully or partially traded. **Specific to ASX Trade24**
Custom Market Trade	"p"	Indicates a resting non-custom order has fully or partially traded with a resting custom order. **Specific to ASX Trade24**
Trade Cancellation	"B"	Indicates a previously published trade has been cancelled.
Market Updates		**Market Data Messages**
Equilibrium Price (Auction Info)	"Z"	Reports equilibrium price updates during a price discovery period.
Open, High, Low, Last Trade Adjustment	"t"	Reports market trade updates and adjustments. **Specific to ASX Trade24**
Market Settlement	"Y"	Reports market settlement updates and adjustments. **Specific to ASX Trade24**
Text Message	"x"	Reports text messages. **Specific to ASX Trade24**
Request for Quote	"q"	Reports RFQ messages. **Specific to ASX Trade24**
Snapshot Complete	"G"	Reports the end of a snapshot download.
Anomalous Order Threshold Publish	"W"	Reports the Extreme Trade Range price (ETR) and Anomalous Order Threshold price (AOT). **Specific to ASX Trade24**
Volume and Open Interest	"V"	Reports the VOI information at the end of each trade date. **Specific to ASX Trade24**

4.2 Event Change Messages

4.2.1 Time Message

For bandwidth efficiency reasons, ASX Trade24 will issue a 'seconds' time stamp every second and any message thereafter will be stamped with the number of nanoseconds past the last Time message received as a time reference point.

The server will, on each packet multicast, transmit this message for every second for which at least one application message is generated. The time specified in this message serves as a reference for the times specified in all other non-Time messages following. The timestamps in all other messages are specified as a nanosecond offset from the most recent Time message.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "T"
Second	1	4	Numeric	NOTE: A Timestamp – Second message will be disseminated for every second change where there is at least one payload message.
		5		

Additional Notes:

- The Time message is not transmitted during periods where no data messages are generated.
- The Time Message is the date and time (to the nearest second) to apply to any non-Time messages following it on a **specific market channel** only. Any non-Time messages following will use the last Time message received as the actual time the transaction was executed at the Matching Engine. Reading a Time message from one market channel and combining this Time message with the Time Stamp of messages for other market channels is not recommended. It is important that each market channel of data be handled separately to avoid time stamp inaccuracies.
- The Time Message on a market channel is sent ONLY if there are non-heartbeat transactions being transmitted. If a market channel has no activity for extended periods of time, the recipient will receive heartbeats, but there are NO Time messages sent with a heartbeat. If there is no activity on a market channel, the "Blink" or "Glance" servers will not provide a time either as it is based on the last transaction processed. To determine the trading system time during these extended periods of inactivity would be difficult although it could be guessed based on the counting of heartbeats of the market channel or using the Time message from another market channel to mark the current time.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

4.2.2 System Event

The system event message is used to signal a market or trading period event. The format is as follows:

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "S"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date of event as applicable, if Event Code is "P" or "R", applies to all active trade dates.
Event Code	7	1	Alpha	See System Event Code Explanation below
		8		

Code	System Event Code Explanation
"O"	New Trade Date is opening
"S"	Messages will start for this Trade Date
"C"	Trade Date has Ended
"P"	System is Paused, note applies to all trade dates
"R"	System is Resumed, note applies to all trade dates

The "Open" event code is an indicator that the next trade date has been defined. Generally this notification is also a signal for any new recipients that have been added to the trading system by the exchange will now be recognised.

The "Start" event code is an indicator there will be messages following indicating an existing product or a new product are moving to the new trade date. This message gives recipients an opportunity to perform any initialisation procedures for the new trade date.

The "Close" event code tells the recipient the indicated trade date has completed and there will be no messages transmitted pertaining to this trade date. Recipients can use this message to perform any "clean up" for a trade date.

The system "Pause" is a state ASX Trade24 Trading Service enters when a technical issue occurs. Technical issues consist of network failures, server failures or application failures. In most cases if a system "Pause" is received it will generally indicate the hot standby trading service is being promoted as the primary trading service. When a system "Resume" is received, it indicates the primary trading service is ready to commence active trading. During a "Pause" period, you will get at a minimum a heartbeat; however other messages can be received, such as text or order book state messages.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

5 Application Data

5.1 Reference Data Messages

5.1.1 Future Symbol Directory

As each product moves to the new Trade Date, ASX Trade24 will disseminate the future symbol messages defining the available futures, CFDs and Share Future contracts for each instrument.

Note:
The action of disseminating this message will automatically imply the contract is in a "Pending" session state.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "f"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Exchange	11	6	Alpha	Denotes the exchange identifier of the contract
Instrument	17	6	Alpha	Denotes the instrument identifier of the contract
Contract Type	23	1	Alpha	Indicates the type of contract. See Contract Type Explanation.
Expiry Year	24	2	Numeric	Year of expiry (YYYY) for Contract Type "F", zero otherwise
Expiry Month	26	1	Numeric	Month of expiry for Contract Types "F", zero otherwise 1 – Jan (F) 2 – Feb (G) 3 – Mar (H) 4 – Apr (J) 5 – May (K) 6 – Jun (M) 7 – Jul (N) 8 – Aug (Q) 9 – Sep (U) 10 – Oct (V) 11 – Nov (X) 12 – Dec (Z)
Price Decimal Position	27	1	Numeric	Position of the decimal point in the price
Price Fractional Denominator	28	4	Numeric	Denominator of the fractional part
Price Minimum Tick	32	2	Numeric	Minimum tick size
Last Trading Date	34	4	Numeric	Last Trading Date and Time. Applicable to Contract Types "F" only, zero otherwise. Note where the time is defined, it is local time AEST or ADST depending if the expiry date is during AEST or ADST.
Prior Day Settlement	38	4	Price	Prior Day Settlement price
Financial Type	42	1	Alpha	Indicates the how to valuate a contract. See Financial Type Explanation.
Currency	43	3	Alpha	Currency of contract
Lot Size or Face Value	46	4	Numeric	Size of each lot or face value of each lot
Maturity Value	50	1	Numeric	Number of days or years to maturity for bills or bonds, Financial Type is "X" or "B"
Coupon Rate	51	2	Numeric	Implied 2 decimal value indicating the coupon rate for bonds, e.g. 1234=12.34%, Financial Type is "X" only
Payments per Year	53	1	Numeric	Number payments per year for bonds, Financial Type is "X" only
		54		

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

5.1.2 Spread Symbol Directory

As each product moves to the new Trade Date, ASX Trade24 will disseminate the spread symbol messages defining the available calendar spread and inter-spread contracts.

Note:
The Future Symbols representing the "First Contract Number" and "Second Contract Number" defined will be transmitted at some time prior to this message.
The action of disseminating this message will automatically imply the contract is in a "Pending" session state.

For contracts that are inter-spreads, the underlying legs are in the same Trade Date.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "g"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Exchange	11	6	Alpha	Denotes the exchange identifier of the contract
Contract Type	17	1	Alpha	Indicates the type of contract. See Contract Type Explanation.
First Leg Contract Number	18	4	Numeric	Underlying Contract Number Identifier of the first contract leg.
Second Leg Contract Number	22	4	Numeric	Underlying Contract Number Identifier of the second contract leg.
Primary Ratio	26	1	Numeric	Ratio of the first contract leg
Secondary Ratio	27	1	Numeric	Ratio of the second contract leg
Price Decimal Position	28	1	Numeric	Position of the decimal point in the price
Price Fractional Denominator	29	4	Numeric	Denominator of the fractional part
Price Minimum Tick	33	2	Numeric	Minimum tick size
		35		

5.1.3 Option Symbol Directory

As each product moves to the new Trade Date, ASX Trade24 will disseminate the option symbol messages defining all the available options contracts.

Note:
The action of disseminating this message will automatically imply the contract is in a "Pending" session state.
For Single Session Options only, the exchange can activate or de-activate option symbols during the course of trading by issuing Order Book State messages for affected option contracts. If an option symbol is not active (Activated field is 'N') or is de-activated (Trading Status is "I"), reference to that option contract should be removed from the list of actively traded contracts. If an option symbol is active (Activated field is 'Y') or is activated (Trading Status is "A"), reference to that option contract should be added to the list of actively traded contracts.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "h"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Exchange	11	6	Alpha	Denotes the exchange identifier of the contract
Instrument	17	6	Alpha	Denotes the instrument identifier of the contract

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Field Name	Offset	Length	Type	Notes
Contract Type	23	1	Alpha	Indicates the type of contract. See Contract Type Explanation.
Expiry Year	24	2	Numeric	Year of expiry (YYYY)
Expiry Month	26	1	Numeric	Month of expiry, 1 – Jan (F) 2 – Feb (G) 3 – Mar (H) 4 – Apr (J) 5 – May (K) 6 – Jun (M) 7 – Jul (N) 8 – Aug (Q) 9 – Sep (U) 10 – Oct (V) 11 – Nov (X) 12 – Dec (Z)
Option Type	27	1	Alpha	Indicates the type of option "P" – Put Option or "C" – Call Option
Strike	28	4	Numeric	Strike price of contract
Underlying Contract Number	32	4	Numeric	Underlying Future Contract Number (zero if Contract Type "E")
Price Decimal Position	36	1	Numeric	Position of the decimal point in the price
Price Fractional Denominator	37	4	Numeric	Denominator of the fractional part
Price Minimum Tick	41	2	Numeric	Minimum tick size
Strike Price Decimal Position	43	1	Numeric	Position of the decimal point in the price
Strike Price Fractional Denominator	44	4	Numeric	Denominator of the fractional part
Strike Price Minimum Tick	48	2	Numeric	Minimum tick size for the Strike Price
Last Trading Date	50	4	Numeric	Last Trading Date and Time is local time AEST or ADST depending if the expiry date is during AEST or ADST.
Prior Day Settlement	54	4	Price	Prior Day Settlement price
Volatility	58	4	Numeric	Implied 3 decimal volatility for an option, i.e. 12345 is 12.345%
Financial Type	62	1	Alpha	Indicates the how to valuate a contract. See Financial Type Explanation.
Currency	63	3	Alpha	Currency of contract
Lot Size or Face Value	66	4	Numeric	Size of each lot or face value of each lot
Maturity Value	70	1	Numeric	Number of days or years to maturity for bills or bonds, Financial Type is "X" or "B"
Coupon Rate	71	2	Numeric	Implied 2 decimal value indicating the coupon rate for bonds, e.g. 1234=12.34%, Financial Type is "X" only
Payments per Year	73	1	Numeric	Number payments per year for bonds, Financial Type is "X" only
Activated	74	1	Alpha	For single session options only, "Y" indicates strike is active or is activated, "N" indicates strike is inactive or is deactivated.
		75		

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

5.1.4 Symbol Explanations

5.1.4.1 Contract Type Explanation

Code	Contract Type Explanation
"F"	Future or Forward contract (CFUT)
"O"	Regular Option contract (COPTA)
"E"	Equity Option contract (EOPTA)
"N"	Single Session Option (OOPT)
"S"	Calendar or Intra-Spread contract (CSPRD)
"A"	Arbitrage or Inter-Spread contract (SPRD)
"D"	Equity CFD or Share Future (SFUT)

5.1.4.2 Financial Type Explanation

Code	Contract Type Explanation
"C"	Commodity product
"D"	CFD product
"E"	Equity product
"X"	Government Bond product
"B"	Bank Bill product

5.1.4.2.1 Formulae of Valuation for Futures

There are currently 3 algorithms used for valuing futures. Each algorithm will use 1 or more of the following parameters "Lot Size or Face Value", "Maturity Value", "Coupon Rate" and/or "Payments per Year". To convert a price to a value, use the following table:

Financial Type	Formula
"C", "D" or "E"	*p = Adjust "Price" according to "Price Decimal Position" and "Price Fractional Denominator"* *Value = p x "Lot Size"*
"X"	*p = Adjust "Price" according to "Price Decimal Position" and "Price Fractional Denominator"* Yield = (100.0 – p) / 100.0 *IF Yield > 0.0* *a = 1.0 / (1.0 + (Yield / "Payments Per Year"))* *b = a ^ ("Maturity Value" x "Payments Per Year")* *c = "Coupon Rate" x (1.0 – b) / Yield* *Value = "Face Value" x (b + (c / 100.0))* **Note:** Rounding rules are applicable to 8 decimals for calculations for "a", "b" and "c". The "Coupon Rate" from definition is 2 decimal implied, divide by 100 prior to use in "c".
"B"	*p = Adjust "Price" according to "Price Decimal Position" and "Price Fractional Denominator"* *Yield = (100.0 – p) / 100.0* *IF Yield > 0.0* *Value = ("Face Value" x 365.0) / (365.0 + (Yield x "Maturity Value"))*

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

5.1.4.3 Price Display

As all price values are reported as a signed integer, each symbol definition contains fields identifying the manner of display and the smallest price increment the contract can move.

The “Price Decimal Position” is simply where to place the decimal in reported price. For instance, if the “Price Decimal Position” is 3, then a reported price of 12345 is 12.345. Valid range of values is 0-7.

The “Price Fractional Denominator” is how the fractional part of the price is reported. Generally, most products are decimal products, meaning the fractional part is a factor of 10 and generally follows the “Price Decimal Position”. For instance, if the “Price Decimal Position” is 3, the “Price Fractional Denominator” is usually 1000.

For non-decimal products (mainly American based), the “Price Fractional Denominator” is usually a factor of 2. For example, prices are quoted in ½’s, ¼’s, $^{1}/_{8}$‘s, … $^{1}/_{256}$‘s (note 16^{ths}, 32^{nds} and 64^{ths} are common as well). For these prices the display is slightly different. For example if the product has a price decimal of 3 and is quoted in ¼‘s then 12343 is really 12.34¾, if it was 64^{ths} then 12.3$^{43}/_{64}$.

The “Price Minimum Tick” is the smallest price the contract will move and is the numerator of the “Price Fractional Denominator".

Note that “Strike Price Decimal Position” and “Strike Price Fractional Denominator” follow the same rules and are applicable to the Strike Price for option contracts only. The “Strike Price Minimum Tick” is the number of ticks to the next strike price for a regular option series only.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

5.2 State Change Messages

5.2.1 Order Book State

ASX Trade24 uses this message to indicate the current session state of a contract to the market.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "O"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Trading Status	11	1	Alpha	Indicates the current session state for the contract. See Trading Status Explanation
		12		

5.2.2 Trading Status Explanation

Code	Trading Status Explanation	Code	Trading Status Explanation
"p"	Pending	"H"	Halted
"P"	Pre-Open (or first price discovery)	"C"	Closed
"l"	Levelling (lower case L)	"L"	Locked
"O"	Opened	"U"	End Lock or Unavailable
"d"	Pre-Price Discovery	"I"	Inactive or deactivated single session option
"D"	Price Discovery (a subsequent price discovery)	"A"	Activated or re-activated single session option
"R"	Regulatory Halt (an ad hoc price discovery)		

Note:
The action of disseminating this message will automatically imply the contract is in a "Pending" session state. The Pending session state "p" is always implied by the receipt of a Future Symbol Directory, Spread Symbol Directory, or an Option Symbol Directory and would normally never be sent, but is listed here for completeness only.

The Inactive status "I" and Activated status "A" applies to Single Session Options only (Option Symbol Directory with Contract Type field set to "N"). The exchange can activate or de-activate option symbols during the course of trading by issuing Order Book State messages for affected option contracts.

If an option symbol is not active (Option Symbol Directory "Activated" field is 'N') or is de-activated (Order Book State Trading Status field is "I"), reference to that option contract should be removed from the list of actively traded contracts.

If an option symbol is active (Option Symbol Directory "Activated" field is 'Y') or is activated (Order Book State Trading Status field is anything other than "I"), reference to that option contract should be added to the list of actively traded contracts.

The activation of single session options will use the Order Book State message. If the "Trading Status" field is set to "A", the option contract is now active and in a pending state. If the "Trading Status" field is a value other than "A" or "I", the option contract is activated and to be placed in the new session state. For instance, if the Trading Status field is "O", the exchange has activated the option contract while the product was opened and for the subscriber, the option contract is now active and opened.

Note:
Regarding the "Glance" server reporting Single Session Options, when a market image is recovered from "Glance", the "Activated" field of the option contract will be reflected in the Option Symbol Directory message downloaded as per the last processed Order Book State for the option contract.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

That is:

- If an option contract is de-activated during the course of trading, the "Activated" field of the Option Symbol Directory in the "Glance" server will be set to 'N', and its trading status will revert back to a 'Pending' session state.
- If an option contract is re-activated during the course of trading using an Order Book State with a "Trading Status" of "A", then the "Activated" field of the Option Symbol Directory in the "Glance" server will be set to 'Y' and its trading status will be set to a 'Pending' session state.
- If an option contract is re-activated during the course of trading using an Order Book State with a "Trading Status" other than "A", then the "Activated" field of the Option Symbol Directory in the "Glance" server will be set to 'Y' and its trading status will be set to the corresponding session state.

5.3 Order Messages

Order Number identifiers are unique in ASX Trade24 for the life of "real" orders. Modifying, cancelling or deleting orders should be arranged based on the buy/sell side and contract (or order book).

5.3.1 Order Added

An Order Added message indicates a new order has been accepted by the ASX Trade24 system and was added to the order book. All orders in ASX Trade24 are anonymous and one "Add" type is supported for "real" orders that are not custom market orders.

The message is referenced by an Order Number assigned by ASX Trade24 and is unique for the life of the order.

At the time of creation the order is assigned an Order Book Priority used by ASX Trade24 to track the order in regards to time priority. The priority number is sequential and therefore unique for the period ASX Trade24 is operating, i.e. start-up to shut down (normally Sunday night to Saturday morning). At every start of ASX Trade24, priorities are reset to 1 and reloaded orders will be re-assigned a new sequence based on the priority of the order prior to the last shutdown.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "A"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Side	11	1	Alpha	Type of order: "B" – Buy Order, "S" – Sell Order
Order Number	12	8	Numeric	Order number assigned by Matching Engine
Order Book Priority	20	4	Numeric	Time priority within the order book. See How to build an order book view.
Quantity	24	4	Numeric	Number of lots added to the book (all volume is visible)
Price	28	4	Price	Price of the order
		32		

5.3.2 Order Modification Messages

Order modification messages always include the Order Number of the Order Added message to which the update applies. To determine the current display volume for an order, subscribers must replace the original volume stated in the Order Added message with the volume stated in the Order Replaced or Order Volume Cancelled message of the same order number.

5.3.2.1 Order Replaced

This message is sent whenever an order in the book has been modified for price or volume where the priority changes. Even though the side and contract number cannot be changed, these fields are included in the message to provide fast look-up.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "U"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Side	11	1	Alpha	Type of order: "B" – Buy Order, "S" – Sell Order
Order Number	12	8	Numeric	The order number of the order being replaced.
Order Book Priority	20	4	Numeric	Time priority within the order book. See How to build an order book view.
Quantity	24	4	Numeric	Number of lots order is modified to (All volume is visible)
Price	28	4	Price	New price of the order
		32		

5.3.2.2 Order Volume Cancelled

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

The difference between this message and the Order Replaced is an Order Replaced will always show a change of order book priority in regards to the order's position in the queue.

Note:
An Order Volume Cancelled message is not sent when an order has partially traded. See Trade Messages to handle traded volumes.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "X"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Side	11	1	Alpha	Type of order: "B" – Buy Order, "S" – Sell Order
Order Number	12	8	Numeric	The order number of the order being reduced.
Quantity	20	4	Numeric	Number of lots order is modified to (All volume is visible)
		24		

5.3.2.3 Order Deleted

This message is sent whenever an order in the book is cancelled by the owner, expired, cancelled by the exchange, purged or volume cancelled. All remaining volume is no longer accessible so the order must be removed from the book.

Notes:
An Order Deleted message is not sent when an order has traded out. See Trade Messages to handle traded volumes.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "D"

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Field Name	Offset	Length	Type	Notes
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Side	11	1	Alpha	Type of order: "B" – Buy Order, "S" – Sell Order
Order Number	12	8	Numeric	The order number of the order being cancelled.
		20		

5.3.3 Implied Order Messages

As part of the ASX Trade24 trading system, reporting of implied prices derived from spreadable contracts is a special feature of market reporting and gives the market a clear picture of the available volume at the best price. To ensure a full market picture is reported ASX Trade24 will supply the implied prices as a special order type called an Implied Order. Implied orders can only be traded or modified indirectly.

The Implied Order Added message will refer to a single "implied" order and the Order Number assigned will always be unique for the life of the implied order. The priority assigned to an implied order will be based on a "real" order and although the same priority can be referenced in multiple contracts, it will always be unique within the same contract and side when compared to the priority of the "real" orders within the contract and side. However, the priority can be a duplicate with other implied orders in the same contract and side. If this is the case, the Order Number of the implied order will be the determining factor in regards to the position in the queue (see A Note on Order Book Priority).

There can be implied orders reported for a contract with no "real" orders and any "implied" orders are reported at the best price i.e. there will be no implied orders below the best price to create depth for a contract. For reporting purposes, ASX Trade24 denotes the price and volume of contract as being "implied" if the top of book order is an "implied" order.

Due to the nature of implied price reporting, it is possible to receive Implied Order Replaced messages for an existing implied order even though the price, priority or volume of the implied order does not change.

To remove implied orders, the Implied Order Deleted message is issued to remove only the implied orders for a specific Contract Number and side. Once an implied order is removed from the book, the order number referencing the removed implied order is available for reuse in a subsequent update to the implied pricing for that contract side.

5.3.3.1 Implied Order Added

This message is the same format as the Order Added message, except the nature of this order is it has an implied price, implied volume and a priority that is derived from two or more spreadable "real" orders.

If a subscriber can derive "implied" prices based on Order Added messages, this message can be ignored.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "j"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Side	11	1	Alpha	Type of implied order: "B" – Buy Order, "S" – Sell Order
Order Number	12	8	Numeric	Reference number of implied order
Order Book Priority	20	4	Numeric	Time priority within the order book. See How to build an order book view.
Quantity	24	4	Numeric	Number of implied lots added to the book (All volume is visible)
Price	28	4	Price	Implied price of order

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Field Name	Offset	Length	Type	Notes
		32		

5.3.3.2 Implied Order Replaced

This message is the same format as the Order Replaced message, except this replacement refers to an implied order and is sent whenever the implied pricing or volume has changed due to a price or volume movement of "real" orders for a side of a single contract number.

If a subscriber can derive "implied" prices based on Order Added messages, this message can be ignored.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "`l`"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Side	11	1	Alpha	Type of implied order: "B" – Buy Order, "S" – Sell Order
Order Number	12	8	Numeric	Reference number of implied order
Order Book Priority	20	4	Numeric	Time priority within the order book. See How to build an order book view.
Quantity	24	4	Numeric	Number of implied lots added to the book (All volume is visible)
Price	28	4	Price	Implied price of order
		32		

5.3.3.3 Implied Order Deleted

This message is the same format as the Order Deleted message, except this deletion refers to an implied order.

This message is sent whenever the implied pricing or volume has changed due to price or volume movement of "real" orders for a side of a single contract number. When received, any implied volume is no longer accessible so the "implied" order of the indicated side must be removed from the book.

If a subscriber can derive "implied" prices based on Order Added messages, this message can be ignored.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "k"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Side	11	1	Alpha	Type of implied order: "B" – Buy Order, "S" – Sell Order
Order Number	12	8	Numeric	Reference number of the implied order
		20		

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

5.3.4 Custom Market Order Messages

The Custom Market Order is a specialised message used for custom market orders. It represents a combination of two to six contracts from the Future Symbol Directory or Option Symbol Directory created by participants.

5.3.4.1 Custom Market Order Added

Any resting Custom Market Order that trades will be reported using the Custom Market Executed or Custom Market Trade message.

Note:
An Order Deleted message is not sent when an order has traded out. See Trade Messages to handle traded volumes.

Intra-day transmissions of this message will occur when a new custom market is added to the system.

The maximum number of legs is defined as 6.

Where a custom market order has less than 6 legs, the field values Contract Number, Ratio and Price will be zeroed and Side will be space filled for legs not defined.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to “m”
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Order Number	7	8	Numeric	Reference number of order
Order Book Priority	15	4	Numeric	Time priority within the custom order book.
Quantity	19	4	Numeric	Volume of Custom market
Legs	23	1	Numeric	Number of legs
Contract Number Leg 1	24	4	Numeric	Contract Number Identifier of this leg
Side Leg 1	28	1	Alpha	Side of this leg: “B” – Buy Order, “S” – Sell Order
Ratio Leg 1	29	2	Numeric	Volume Ratio of this leg
Price Leg 1	31	4	Price	Price of this Leg
Contract Number Leg 2	35	4	Numeric	Contract Number Identifier of this leg
Side Leg 2	39	1	Alpha	Side of this leg: “B” – Buy Order, “S” – Sell Order
Ratio Leg 2	40	2	Numeric	Volume Ratio of this leg
Price Leg 2	42	4	Price	Price of this Leg
Contract Number Leg 3	46	4	Numeric	Contract Number Identifier of this leg
Side Leg 3	50	1	Alpha	Side of this leg: “B” – Buy Order, “S” – Sell Order or <space> if leg is not defined
Ratio Leg 3	51	2	Numeric	Volume Ratio of this leg
Price Leg 3	53	4	Price	Price of this Leg
Contract Number Leg 4	57	4	Numeric	Contract Number Identifier of this leg
Side Leg 4	61	1	Alpha	Side of this leg: “B” – Buy Order, “S” – Sell Order or <space> if leg is not defined
Ratio Leg 4	62	2	Numeric	Volume Ratio of this leg
Price Leg 4	64	4	Price	Price of this Leg
Contract Number Leg 5	68	4	Numeric	Contract Number Identifier of this leg

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Field Name	Offset	Length	Type	Notes
Side Leg 5	72	1	Alpha	Side of this leg: “B” – Buy Order, “S” – Sell Order or <space> if leg is not defined
Ratio Leg 5	73	2	Numeric	Volume Ratio of this leg
Price Leg 5	75	4	Price	Price of this Leg
Contract Number Leg 6	79	4	Numeric	Contract Number Identifier of this leg
Side Leg 6	83	1	Alpha	Side of this leg: “B” – Buy Order, “S” – Sell Order or <space> if leg is not defined
Ratio Leg 6	84	2	Numeric	Volume Ratio of this leg
Price Leg 6	86	4	Price	Price of this Leg
		90		

5.3.4.2 Custom Market Order Replaced

This message is sent whenever an order in the custom market book has been modified for volume.

Custom market order modification messages always include the Order Number of the Custom Market Order Added to which the update applies. To determine the current display volume for an order, subscribers must replace the original volume stated in the Custom Market Order Added message with the quantity stated in the Custom Market Order Replaced message of the same order number.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to “n”
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Order Number	7	8	Numeric	Reference number of order
Order Book Priority	15	4	Numeric	Time priority within the custom market order book.
Quantity	19	4	Numeric	Number of lots order is modified to (All volume is visible)
		23		

5.3.4.3 Custom Market Order Deleted

This message is sent whenever an order in the custom market book is cancelled by the owner, expired, cancelled by the exchange or purged. All remaining volume is no longer accessible so the order must be removed from the book.

Note:
A Custom Market Order Deleted message is not sent when an order has traded out. See Trade Messages to handle traded volumes.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to “r”
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Order Number	7	8	Numeric	Reference number of order
		15		

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

5.4 Trade Messages

There are several types of reported trade messages:

- Order Executed – indicates a resting order of the same contract traded at the indicated order price.
- Order Executed with Price – indicates two non-spread resting orders of the same contract traded at a price different from one or both orders. These trades are generally levelling trades or orders modified to match.
- Spread Executed – indicates a resting spread order traded the underlying contract at the price reported.
- Trade (Spread Execution Chain) – indicates two resting orders of different contracts where the trade price is different from the order price for one or both sides. These trades are generally as a result of a spread order trading in a spread chain, or a spread trading with a non-spread.
- Custom Market Executed – indicates a resting custom market order was traded
- Custom Market Trade – indicates a resting custom market order was traded with another resting non-custom market order.
- Trade Cancellation – indicates a formerly executed trade has been cancelled.

Using the different trade execution message types, it is possible to build a complete view of all trade executions that happen on ASX Trade24.

Important Notes:

- The term "resting order" used in the context of the trade message refers to orders visible to the subscriber at the time of the trade. The order number (or order numbers) referenced in the trade will only refer to orders the subscriber has previously received. Trade messages that make reference to both sides are orders matched as a result of:
    - Levelling,
    - Orders party to a spread chain,
    - Modifying the price (or volume) of a resting order, and
    - Modifying the volume of a resting custom order.

- Where two resting orders are matched, ASX Trade24 sends only 1 trade message for each match with the information of the buyer and the seller. Having both sides referenced in the trade means the subscriber will receive and process only one trade message, instead of receiving and processing two individual trade messages.
- Unlike most other ITCH feeds, where the subscriber must calculate the remaining order volume, **an ASX Trade24 trade message provides the remaining quantity of the affected order** as a result of the trade. The subscriber replaces the quantity of the order party to the trade message with the remaining quantity indicated for that order. The purpose of this field will become apparent when working with trades involving spread orders as a spread order will always generate at least two trades and each trade will make reference to the volume of the same spread order.
- In addition to providing the remaining volume of each order, each trade will also have the trade price. This makes it much easier to process if a subscriber is interested in trade messages only.
- Orders must be removed from the book when remaining quantity is reported as zero.
- If the trade execution is marked as non-printable, and this will only occur if this is a spread-to-spread or custom-to-custom execution, the volume traded will be included in the contract's total traded volume, but the traded price will not affect the Open, High, Low or Last trade indicators for the contract. If the subscriber is looking to use the data in time-and-sales displays, it is recommended this trade message be ignored as an indicator of price.

- Where multiple transactions result from a single transaction, the transaction timestamp will be the same time as the timestamp of the transaction that initiated the trade sequence. This will assist subscribers to determine the start and end of a trade sequence. For instance, if a new order initiated 4 trade transactions with left over volume, the order added transaction and the 4 trade transactions will all have the same timestamp. Once the timestamp changes, this will indicate a new sequence of transactions.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

5.4.1 Order Executed

This message is sent whenever a resting order of the book is executed in whole or in part where the price and contract number of the order and trade are the same. It is possible to receive several Order Executed messages for the same order reference number if that order is executed in several parts.

Note:
The order reported in this message is always the passive order traded.

The trade side of the order is the same as the "Side", i.e. Buy Order is also the Buyer side of the trade.

The trade price is included in this message for completeness only even though the price of the order should be the same as the trade price.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "E"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
				This information identifies the location of the order
Contract Number	7	4	Numeric	Contract Number Identifier of Order Book Traded
Side	11	1	Alpha	Type of order: "B" – Buy Order, "S" – Sell Order
Order Number	12	8	Numeric	Reference number of order
Quantity Remaining	20	4	Numeric	Volume remaining on Order after matching, if 0, order has traded out and should be deleted
				This information identifies the trade characteristics
Trade Type	24	1	Alpha	See Trade Type Explanation
Match Number	25	4	Numeric	Deal Number
Executed Quantity	29	4	Numeric	Volume traded
Trade Price	33	4	Price	Price of Trade
		37		

See Examples of the Order Executed Message.

5.4.2 Order Executed with Price

This message is sent whenever two resting orders of the same contract are executed. This can occur in two circumstances:

- During levelling in whole or in part at a price that could be different from one or both resting order prices.
- If a resting order is modified for price and it matches in whole or in part at a price that could be different from the copy of the order held by the subscriber with another resting order.

It is possible to receive multiple "Order Executed with Price" messages for the same order if that order is executed in several parts during the course of matching. As each message is received the remaining volume will reflect the volume as a result of that trade.

Note:
Both buying and selling information is contained in this message indicating the subscriber must update for both orders.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "C"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
				This information identifies the location of the order
Contract Number	7	4	Numeric	Contract Number Identifier of Order Book Traded
Buying Order Number	11	8	Numeric	Buyer's Reference number of order
Buyer's Quantity Remaining	19	4	Numeric	Volume remaining on Order after matching, if 0 order has traded out and should be deleted
Selling Order Number	23	8	Numeric	Seller's Reference number of order
Seller's Quantity Remaining	31	4	Numeric	Volume remaining on Order after matching, if 0 order has traded out and should be deleted
				This information identifies the trade characteristics
Trade Type	35	1	Alpha	See Trade Type Explanation
Match Number	36	4	Numeric	Deal Number
Executed Quantity	40	4	Numeric	Volume traded
Trade Price	44	4	Price	Price of Trade
		48		

See Examples of the Order Executed with Price Message.

5.4.3 Spread Executed

This message is sent whenever the open leg of a resting spread order is traded in whole or in part where the price and the contract number will be different than the traded contract number. It is possible to receive several Spread Executed messages for the same order number if that order is executed in several parts.

For trades involving a spread order trading with a resting spread order, either inter or intra, where the reported trade price is based on the prior day settlement price of the underlying legs, the Spread Trade Price indicates the spread-to-spread trade price.

Note:
The order reported in this message is always the passive order traded.

The "Side" field is the buy side or sell side of the spread order and is not necessarily the same as the trade side. The field "Trade Side of Leg" indicates the side of the trade the order leg was matched to.

Where a spread order trades there will be 2 messages reported, one for the sell side and one for the buy side each with a different match number.

Where a spread order trades out, generally the near or primary leg will remove the order from the book and the far or secondary leg will report an Order Number of zero (however, the roles of near and far can be reversed). If an Order Number of zero is encountered, any action on the order book should be ignored.

See Examples of the Spread Executed Message.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "e"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
				This information identifies the location of the order
Contract Number	7	4	Numeric	Contract Number Identifier
Side	11	1	Alpha	Side of order: "B" – Buy Order, "S" – Sell Order
Order Number	12	8	Numeric	Reference number of order
Quantity Remaining	20	4	Numeric	Volume remaining on Order after matching, if 0, order has traded out and should be deleted
				This information identifies the trade characteristics
Trade Type	24	1	Alpha	See Trade Type Explanation
Match Number	25	4	Numeric	Deal Number
Executed Quantity	29	4	Numeric	Volume traded
Trade Price	33	4	Price	Price of Trade
Traded Contract Number	37	4	Numeric	Contract Number Identifier of the underlying Order Book Traded
Spread Trade Price	41	4	Price	If a spread-to-spread trade, this will be set to the spread price
Trade Side of Leg	45	1	Alpha	'B' – Order Leg is Buyer, 'S' – Order Leg is Seller
Printable	46	1	Alpha	Indicates if the execution should be reflected on time and sale displays: "N" = non-printable or "Y" = printable
		47		

5.4.4 Trade (Spread Execution Chain)

This message is sent whenever two resting orders of different contracts are executed in whole or in part at a price different from the initial display price(s) such as sweeping or spreading orders. Since the execution price is different than the display price of the original Add Order, a trade price field is included within the execution message.

Note:
Both buying and selling information is contained in this message indicating the subscriber must update for both orders.

For trades involving a spread order trading with a resting spread order, either inter or intra, where the reported trade price is not from an underlying order price, the Spread Trade Price indicates the spread-to-spread trade price.

See Examples of the Trade (Spread Execution Chain) Message.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "P"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
				This information identifies the location of the order

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Field Name	Offset	Length	Type	Notes
Buyer's Contract Number	7	4	Numeric	Buyer's Contract Number Identifier
Side of Buyer	11	1	Alpha	Side of order: "B" – Buy Order, "S" – Sell Order
Buyer's Order Number	12	8	Numeric	Buyer's Reference number of order
Buyer's Quantity Remaining	20	4	Numeric	Volume remaining on order after matching. If zero, order has traded out and should be deleted.
Seller's Contract Number	24	4	Numeric	Seller's Contract Number Identifier
Side of Seller	27	1	Alpha	Side of order: "B" – Buy Order, "S" – Sell Order
Selling Order Number	28	8	Numeric	Seller's Reference number of order
Seller Quantity Remaining	37	4	Numeric	Volume remaining on order after matching. If zero, order has traded out and should be deleted.
				This information identifies the trade characteristics
Trade Type	41	1	Alpha	See Trade Type Explanation
Match Number	42	4	Numeric	Deal Number
Executed Quantity	46	4	Numeric	Volume traded
Trade Price	50	4	Price	Price of Trade
Traded Contract Number	54	4	Numeric	Contract Number Identifier of the underlying Order Book Traded
Spread Trade Price	58	4	Price	If a spread-to-spread trade, this will be set to the spread price
Printable	62	1	Alpha	Indicates if the execution should be reflected on time and sale displays: "N" = non-printable or "Y" = printable
		63		

5.4.5 Custom Market Executed

This message is sent whenever the open leg of a resting custom market order is traded in whole or in part. The subscriber will receive several Custom Market Executed messages for the same order number as the order will be executed in several parts.

Note:
The custom market order reported in this message is always the passive order traded.

The field "Trade Side of Leg" indicates the side of the trade the custom leg was matched to.

Where a custom market order trades there will be at least 2 or more messages reported, one for each leg, each with a different match number.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Where a custom order trades out, the first leg will remove the order from the book and the subsequent legs will report an Order Number of zero. If an Order Number of zero is encountered, any action on the order book should be ignored.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "u"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
				This information identifies the location of the order
Order Number	7	8	Numeric	Reference number of custom order
Quantity Remaining	15	4	Numeric	Volume remaining on custom order after matching, if 0, order has traded out and should be deleted
				This information identifies the trade characteristics
Trade Type	19	1	Alpha	See Trade Type Explanation
Match Number	20	4	Numeric	Deal Number
Executed Quantity	24	4	Numeric	Volume traded
Trade Price	28	4	Price	Price of Trade
Traded Contract Number	32	4	Numeric	Contract Number Identifier of the underlying Order Book Traded
Trade Side of Leg	36	1	Alpha	'B' – Custom Leg is Buyer, 'S' – Custom Leg is Seller
Printable	37	1	Alpha	Indicates if the execution should be reflected on time and sale displays: "N" = non-printable or "Y" = printable
		38		

5.4.6 Custom Market Trade

This message is sent whenever a resting custom market order is matched with a resting non-custom market order executed in whole or in part at a price that could be different from the initial display price(s) such as spreading orders. Since the execution price could be different than the display price of the original Order Added, a trade price field is included within the execution message.

Notes:

Both buying and selling information is contained in this message indicating the subscriber must update for both orders.

The "Side" field is the buy side or sell side of the non-custom order and is not necessarily the same as the trade side, particularly where the order is a spread. The field "Trade Side of non-custom Order" indicates the side of the trade the order leg was matched to.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "p"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
				This information identifies the location of the non-custom market order
Contract Number	7	4	Numeric	Contract Number Identifier

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Field Name	Offset	Length	Type	Notes
Side	11	1	Alpha	Side of order: "B" – Buy Order, "S" – Sell Order
Order Number	12	8	Numeric	Reference number of order
Quantity Remaining	20	4	Numeric	Volume remaining on order after matching. If zero, order has traded out and should be deleted.
				This information identifies the custom market order
Custom Market Order Number	24	8	Numeric	Custom Market Order Reference number of order
Custom Market Quantity Remaining	32	4	Numeric	Volume remaining on custom market order after matching. If zero, custom market order has traded out and should be deleted.
				This information identifies the trade characteristics
Trade Type	36	1	Alpha	See Trade Type Explanation
Match Number	37	4	Numeric	Deal Number
Executed Quantity	41	4	Numeric	Volume traded
Trade Price	45	4	Price	Price of Trade
Traded Contract Number	49	4	Numeric	Contract Number Identifier of the underlying Order Book Traded
Trade Side of Non-Custom Order	53	1	Alpha	Side of non-custom order: "B" – is the Buyer, "S" – is the Seller
Printable	54	1	Alpha	Indicates if the execution should be reflected on time and sale displays: "N" = non-printable or "Y" = printable
		55		

5.4.7 Trade Cancellation

This message is sent whenever a trade is cancelled by exchange operations. This message does not affect any resting orders and is more for information purposes. Adjustments to the Open, High, Low, Last will be performed as separate action using the Open, High, Low, Last Trade Adjustment message.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "B"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Match Number	7	4	Numeric	Deal Number
		11		

5.4.8 Trade Type Explanation

Code	Code if Crossing	Trade Type Explanation
"T"	"t"	Normal Trade, trade price matches both order prices
"W"	"w"	Sweeping Trade, trade price matches resting order
"L"	"l"	Levelling Trade, trade price may be different than price of resting order(s)

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Code	Code if Crossing	Trade Type Explanation
"S"	"s"	Spread-to-Underlying trade (price is based on the order of the underlying future relating to intra, inter or custom matching with an outright order)
"R"	"r"	Intra-Spread-to-Intra-Spread trade (price is based on the near contract's prior day settlement)
"Q"	"q"	Inter-Spread-to-Inter-Spread trade (price is based on the secondary's contract's prior day settlement)
"U"	"u"	Custom-to-Custom trade

5.5 Market Updates

5.5.1 Equilibrium Price (Auction Info)

ASX Trade24 disseminates equilibrium prices during a price discovery period. As orders are added, modified, cancelled or deleted a message will be reported informing the market the potential opening price.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "Z"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Equilibrium Price	11	4	Price	Price at which matching will occur
Best Bid Price	15	4	Price	Best Bid Price
Best Ask Price	19	4	Price	Best Ask Price
Best Bid Quantity	23	4	Numeric	Best Bid Volume
Best Ask Quantity	27	4	Numeric	Best Ask Volume
		31		

5.5.2 Open, High, Low, Last Trade Adjustment

ASX Trade24 disseminates market trade price adjustments where the exchange operator modifies the open, high, low, last, last volume, total traded volume or total number of trades (usually due to a trade cancellation) or the product resets the open, high, low, last, last volume when it moves to the next session within the trade date. Each price is re-distributed with the Market Updates bitwise flags indicating which fields have been adjusted. This message is also issued during a snapshot download to enable the requestor to generate an up-to-date market image without having to regenerate from previous trades and market trade adjustment messages.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "t"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Opening Trade	11	4	Price	Opening Traded Price
Highest Trade	15	4	Price	Highest Traded Price
Lowest Trade	19	4	Price	Lowest Traded Price
Last Trade	23	4	Price	Last Traded Price
Last Volume	27	4	Numeric	Last Traded Volume
Total Traded Volume	31	4	Numeric	Total Traded Volume

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Field Name	Offset	Length	Type	Notes
Total Trades	35	4	Numeric	Total Number of Trades
Market Updates	39	1	Numeric	Bitwise flags define which fields changed as: 0x01 – Opening Trade Price 0x02 – Highest Traded Price 0x04 – Lowest Traded Price 0x08 – Total Traded Volume and Total Trades 0x10 – Last Traded Price 0x20 – Last Traded Volume 0x3F – All Fields
		40		

5.5.3 Market Settlement

ASX Trade24 disseminates settlement prices for all future and option contracts in two instalments, an interim and then a final. When the contract moves to the next trade date, the Future Symbol Directory or Option Symbol Directory message will reflect the final settlement price reported from the previous trade date in the prior day settlement field.

If operations perform a prior day settlement (the product has moved to the next trading date), an additional settlement message will be issued indicating the prior day settlement is being adjusted for the contract in the current trade date. It would be expected the subscriber will update the prior day settlement field with this value in Future Symbol Directory or Option Symbol Directory message.

For example if XTU2 is currently trading in trade date 2012-08-16 and the XTU2 was settled for the prior trading date 2012-08-15, the subscriber will receive:

Action	Trade Date	Contract	Price	Volatility	Type	Comment
Y	2012-08-**15**	XTU2	92.120	0.000	**I**	Interim settlement price for XTU2
Y	2012-08-**15**	XTU2	92.120	0.000	**F**	Final settlement price for XTU2
Y	2012-08-**16**	XTU2	92.120	0.000	**A**	Adjust prior day settlement price

In regards to the Volatility, this field is applicable for option contracts only and will be defined as an implied 3 decimal value, i.e. 12345 = 12.345%. The subscriber should update the "Volatility" field of the Option Symbol Directory regardless of the "Settlement Type" indicated.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "Y"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Settlement Price	11	4	Price	Settlement Price as indicated by Settlement Type
Volatility	15	4	Numeric	Volatility (implied 3 decimal), if non-option value is zero
Settlement Type	19	1	Alpha	Settlement Type qualifies the Settlement Price as one of: "I" – Settlement Price is the Interim settlement price "F" – Settlement Price is the Final settlement price "A" – Settlement Price is an adjustment for the Prior Day
		20		

5.5.4 Text Message

ASX Trade24 disseminates text messages to inform the market of ad hoc events. Events will include the following:

- General announcements (from operations)
- EFP trade information (from EFP server)
- Block trade information (from Block Trade server)
- Central strike option volatility (from DSP server)
- Single Session Option series underlying settlement price (from DSP server)
- Serial Option underlying settlement price (from ESP server)

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

- Custom RFQs (from participants)
- Volume and Open Interest (from SFEARS server).

Each message type is identified by the Source Id. For instance, EFP's will come from a Source Id called "EFP".

Note:
As a text message is not "exchange" specific, it will be multicast on all available ITCH feeds. If a subscriber is receiving 3 ITCH feeds, the text message will be received 3 times, one from each ITCH feed.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "x"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Source Id	7	6	Alpha	Indicates source of message
Text message	13	100	Alpha	Text message
		113		

5.5.4.1 Settlement Text Messages

For settlement information that is normally distributed on the last trading date to the market as a text message, these messages will be identified with a SourceId="ESPSVR" and be as follows:

- For non-Index product types:
```
Final Settlement Price [EEE CCMYY] [Price]
Provisional Settlement Price [EEE CCMYY] [Price]
```
- For Index product types:
```
First SOQ [EEE CCMYY] [Price] 99.99% Open
Second SOQ [EEE CCMYY] [Price] 99.99% Open
Third SOQ [EEE CCMYY] [Price] 99.99% Open
Fourth SOQ [EEE CCMYY] [Price] 99.99% Open
Final Settlement Price @ 99.99% Open [EEE CCMYY] [Price]
```

Where,

[EEE CCMYY] is the exchange, commodity, month and year.
[Price] is the price formatted with decimal adjustment.

For example:
```
Final Settlement Price NZFOE BBH14 97.080
First SOQ SFE APF14 5277.4 99.50% Open
Second SOQ SFE APF14 5277.4 99.50% Open
```

Note:
Settlement information will not be made available until April 2014.

5.5.4.2 Block Trades and EFPs Text Messages

For block trades, information that is normally distributed to the market as a text message, these messages will be identified with a SourceId="EFP" and be as follows:

EFPs:
```
EFP Regd @ [HH:MM] [Volume] [CCMY] @ [Price]
```

Normal Block Trades:
```
Block Trade Reg'd: [CCMY] [Volume] Lots @ [Price]
```

Block Trades for strips are 2 messages:
```
Block Trade Reg'd @ [HH:MM] [Volume]Lots - Legs to follow
Legs CCMY @[Price],…
```

Where,

[CCMY] is the commodity, month and year.
[Price] is the price formatted with decimal adjustment.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

[HH:MM] is the hour and minute of the trade.
[Volume] is the number of lots traded.

For example:

```
EFP Regd @ 08:30 1080 YTH4 @ 97.040
Block Trade Reg'd: YTH4 4903 Lots @ 97.000]
Block Trade Reg'd @ 10:12 25Lots - Legs to follow]
Legs GVU4 @1.86, GVZ4 @2.51, GVH5 @9.03, GVM5 @1.89,
```

5.5.4.3 Custom Market Request for Quote Text Messages

Custom market RFQs are distributed as a text message and are described in detail at http://www.asx.com.au/documents/trading_services/asx-trade24-developer-guide-fix-spec.pdf

5.5.4.4 Volume and Open Interest Text Messages

VOI messages will usually be distributed using the Volume and Open Interest message, however, where the contract has expired and the trade date has closed, a Text message may be used to report the information.

These messages will be identified with a SourceId="VOISVR" and are formatted as follows:

```
VOI for [EEE CCMYY[999999C[o]]] [YYYY-MM-DD] is CV=9999999, OI=9999999
```

Where:

[EEE CCMYY[999999C[o]]] is the future or option contract listed as exchange, commodity, month, year, option strike, put/call indicator and overnight option indicator
[YYYY-MM-DD] is the trade date the VOI information is applicable
CV is the cumulative volume
OI is the open interest

For example:

```
VOI for NZFOE BBH14 2014-01-15 is CV=413 OI=32147
VOI for SFE APH14050500P 2014-01-15 is CV=50 OI=2071
VOI for SFE XTH14097500Co 2014-01-15 is CV=10 OI=7900
```

Note:
The overnight option indicator "o", is used to distinguish single session overnight options (Contract Type "N") from regular options (Contract Type "O") for the XT-ONO and YT-ONO only. Where the text message relates to XD and YD single session daytime options the "o" indicator is not used. See Contract Type Explanation for more information.

5.5.5 Request for Quote

ASX Trade24 disseminates anonymous non-custom RFQs from the market.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "q"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Price	11	4	Price	Requested quote price
Quantity	15	4	Numeric	Requested quote volume
		19		

5.5.6 Anomalous Order Threshold Publish

ASX Trade24 reports this message to inform the market of setting, zeroing or adjusting the Extreme Trade Range price (ETR), the Anomalous Order Threshold price (AOT) and the associated ranges for a contract that requires Market Integrity Rules (MIR) enforcement.

The message will be reported in any one of the following circumstances:

- The ETR/AOT price is set to the levelling price upon opening,
- If there is no levelling price, the first trade after the opening,

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

- An update due to a change in the VWAP, or
- If the contract moves to a non-open session state (in this case the ETR price will be zero).

If the ETR Price is zero, then order price validation performed by the matching engine is no longer enforced.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "W"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
AOT Price	11	4	Price	Anomalous Order Threshold price (AOT)
AOT Upper Price	15	4	Price	Upper range of the AOT
AOT Lower Price	19	4	Price	Lower range of the AOT
ETR Price	23	4	Price	Extreme Trade Range price (ETR), if zero, then MIR is not enforced.
ETR Upper Price	27	4	Price	Upper range of the ETR
ETR Lower Price	31	4	Price	Lower range of the ETR
		35		

5.5.7 Volume and Open Interest

ASX Trade24 disseminates VOI information for each trade date. Due to the timing of the reporting of this information, it can be reported for the prior trade date where that trade date has been closed. To specify the VOI information pertains to the respective trade date, the field VOI Trade Date will indicate this. Note, in certain circumstances, e.g. for expired contracts, this information could be relayed as a Text Message.

Note:
VOI information will not be made available until the second half of 2014.

Field Name	Offset	Length	Type	Notes
Message Type	0	1	Alpha	Set to "V"
Timestamp	1	4	Numeric	Nanoseconds portion of the timestamp.
Trade Date	5	2	Numeric	Trade Date
Contract Number	7	4	Numeric	Contract Number Identifier
Cumulative Volume	11	4	Numeric	Volume traded or cleared for specified VOI trade date
Open Interest	15	4	Numeric	Number of open contracts at EOD for the specified VOI trade date
VOI Trade Date	19	2	Numeric	Trade Date VOI information is applicable
		21		

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6 Administration

ASX Trade24 market data is multicast across several product groupings. These product groupings are defined by the exchange and each product grouping consists of one or more products from an exchange or a particular type of product, such as agricultural, energy, debt, etc.

Administration consists of subscribers obtaining start-up and multicast recovery of market information for a product grouping. There will be one or more dedicated servers available for subscribers to obtain market data for start-up and multicast recovery for each product grouping. Each product grouping will have a specific set of pre-assigned addresses to service snapshot and multicast recovery functions.

6.1 Multicast Session and Sequence

For each product grouping every packet is multicast with a session, sequence number and a count of data messages. The session is an alphanumeric identifier indicating the market data is from a continuous multicast session when the back-end trading server began. If the session changes, the back-end trading server has been re-started as a result of a scheduled start-up or recovery from a failure.

If a subscriber receives a packet with a session that differs from the session of the last packet received, it is expected the subscriber will either purge the current market image or create a new market image identified by the new session.

For each new session, the sequence number will always start at 1. The sequence number is sequentially assigned and incremented for each packet multicast with a data message. If the packet is a heartbeat, the sequence number will not be incremented but will be the expected sequence number of the next packet.

The sequence number on each packet is the sequence number for the first data message and each data message within the packet has an implied sequence number one greater than the previous data message. The sequence number of the first data message of the next packet can be determined by adding the sequence number and message count of the prior packet.

As multicast is an unreliable protocol the subscriber is responsible for the detection of missing packets and the recovery. The detection of missing multicasts is simply inspecting the sequence number of the Packet Header and checking if it is greater than the **expected** sequence number based on the last Packet Header received.

Subscribers should be prepared to handle duplicate message packets, particularly before or after the receipt of recovered message packets has been made.

6.1.1 Message Packet Recovery from Blink

The “Blink” server is a recovery mechanism for subscribers to obtain missing multicasts during the course of the multicast session for a product grouping. The “Blink” server will keep a store of message packets specifically for multicast loss.

To recover missing message packets where a subscriber has detected a loss, a request can be made to the “Blink” server. To obtain the missing message packets a subscriber unicasts to a pre-assigned server address a Request Packet indicating the sequence number of the first message and the number of data messages to re-transmit.

The server will respond with the requested data messages with the originally broadcast Time Message of the multicast (i.e. with the same timestamp). A single packet will be unicast back to the requestor with a packet header containing as many data messages that can fit into a single UDP Ethernet frame.

Where a subscriber requests more data messages than can fit within one Ethernet frame, the subscriber must make another request starting from the next sequence number calculated based on the last received packet.

For instance, if a subscriber makes a request for sequence number 150 with a count of 40 messages (i.e. messages 150-189) the process is as follows:

1. Data messages 150 to 175 fit into one Ethernet frame, Blink unicasts this packet to the subscriber.
2. The subscriber makes another request for sequence number 176 with a count of 14 messages.
3. Blink creates a single packet of data messages 176 to 189 and unicasts this packet to the subscriber.

If a request for missing multicast is made where the request is outside the range of available messages, is an invalid request (incorrect session or corrupt) or the Blink server is recovering, the subscriber’s request will be ignored and no response will be issued.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6.1.1.1 Request Packet

To initiate a multicast recovery request the subscriber unicasts this message to a pre-assigned "Blink" server. The port used is specific to a product grouping of the multicast of the missing messages. The number of messages returned by the "Blink" server will be based on the number of messages fitting into a single UDP Ethernet frame, or approximately 1400 bytes. The subscriber will need to make additional requests if the initial response is not filled.

Field Name	Offset	Length	Type	Notes
Session	0	10	Alpha	Identity of the multicast session request relates to. See Packet Header.
Sequence Number	10	8	Numeric	Sequence number of the first message to re-transmit.
Requested Message Count	18	2	Numeric	Number of messages to be resent.
		20		

6.1.1.2 Snapshot Recovery from Glance

"Glance" is a point-to-point connection providing a direct data feed delivering a snapshot of the current state of the market for a specific product grouping for subscriber applications. Glance uses the same message format as the ASX 24 ITCH multicast and delivers data messages using the SoupBinTCP protocol.

For subscriber applications re-starting, a snapshot request can be made to obtain the current market data image of a specific product grouping.

For the snapshot, each product grouping will consist of the following data messages from each active Trade Date:

- System Event,
- For each contract of the trade date:
    - Reference Data Messages,
    - Order Book State,
    - Open, High, Low, Last Trade Adjustment,
    - Equilibrium Price (Auction Info),
    - Market Settlement,
    - Anomalous Order Threshold Publish
    - Order Added,
    - Implied Order Added
    - Volume and Open Interest (does not include any VOI disseminated as a text message)
- Custom Market Order Added.

As each message has a nanosecond offset field, a Time Message will preceded messages with a common time. As messages are sent in contract order, the subscriber may receive a Time Message for each message sent.

The time of the Open, High, Low, Last Trade Adjustment message is based on the time of the last trade affecting the message.

The Market Settlement will be either an 'I'nterim or 'F'inal message. Any market settlements indicating an adjustment will be reflected in the symbol directory message. For instance, if the prior day settlement price is adjusted during the course of trading, when the subscriber requests a snap-shot, the message adjusting the prior day settlement price is not sent, but the symbol directory message is sent with the new prior day settlement price.

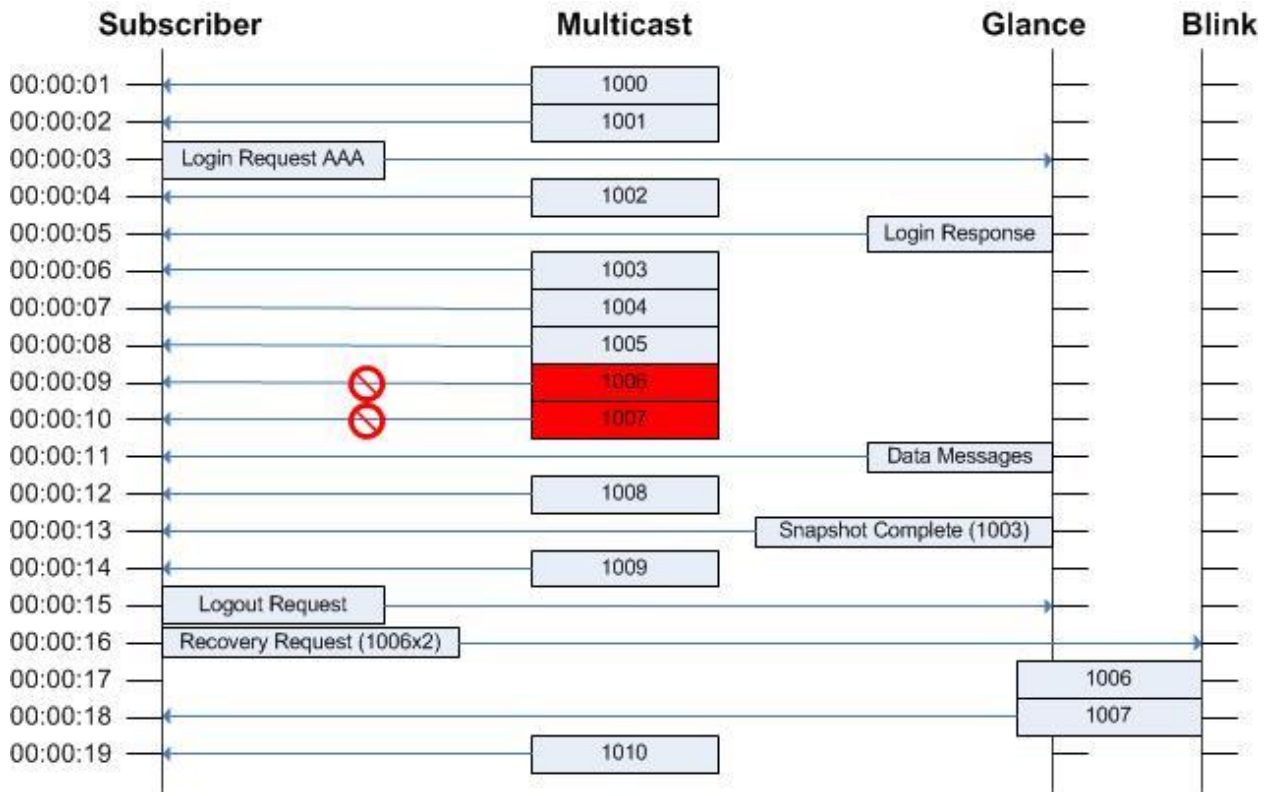
The time of the Order Added (including Implied Order Added and Custom Market Order Added), is based on the last update applied to the order. For instance, the time of the Order Replaced, Order Volume Cancelled, Implied Order Replaced or Custom Market Order Replaced message will be the time of the Order Added (implied or custom) sent to the subscriber.

The Glance server will deliver these messages sequentially in the order listed to enable a subscriber to re-create the current market data picture. **The snapshot recovery will not contain data messages of trades or of orders no longer in the book.**

While receiving a snapshot, the subscriber must continue to buffer any message packets received. Once the Snapshot Complete message has been received, the subscriber should use the sequence indicated in the Snapshot Complete message to process the buffered data messages greater than or equal to it and discard any buffered data message with a sequence number less than it.

As an example of making a snapshot request for start-up, the subscriber detects missing sequences during the recovery and recovers the missing message packets.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016



6.1.2 Administrative Messages

List of administrative messages:

Message Name	Type	Notes
Login Request Packet	"L"	Request to login sent by a subscriber.
Login Accepted Packet	"A"	Server response to valid login.
Login Reject Packet	"J"	Server response to an invalid login or a forced logoff.
Password Change Response	"P"	Server response to a password change request.
Subscriber Heartbeat Packets	"R"	Heartbeats to indicate subscribe is alive.
Server Heartbeat Packets	"H"	Heartbeats to indicate server is alive.
Sequenced Data Packet	"S"	Data messages sent to a subscriber
Snapshot Complete	"SG"	End of Snapshot message
Unsequenced Data Packet	"U"	Data or requests received from a subscriber.
Password Change Request	"U1"	Request to change the password sent by a subscriber.

To establish a session with the Glance server to obtain a snapshot, the subscriber should apply the following:

1. Connect using the assigned IP address and port to establish a TCP/IP session with the server.
2. Initiate a session by sending the Login Request Packet specifying the subscriber's assigned user name and password.
3. The server will validate the username, password and IP address of the subscriber.
4. Once the subscriber is authenticated, the server will respond with a Login Accepted Packet or Login Rejected Packet.
5. The subscriber must wait for the server's response before sending additional messages. Messages received from the subscriber before the exchange of logons will be ignored.
6. If a logon attempt fails because of an invalid user name, IP address or invalid password or if a message is sent prior to the login being established, the server will break the TCP/IP connection with the subscriber after sending a Login Rejected Packet.
7. If a logon attempt fails because of an invalid password, expired password, the user name is locked out or logins are not currently permitted, the server will send a Login Rejected Packet and break the TCP/IP connection.
8. If a username has exceeded the maximum number of logons per day during the current calendar day, the server will reject any new logon attempt with a Login Rejected Packet and break the TCP/IP connection.
9. If a Login Request Packet is not received within a configurable amount of time, say 5 seconds, of the establishment of a connection the server will break the TCP/IP connection.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

10. A second attempt to log in by an already logged in username made from a different connection will be rejected and the server will break the TCP/IP connection with the subscriber after sending a Login Rejected Packet.
11. If a second login request is made from the same connection, the server will ignore the request.

It is expected subscribers will maintain a connection with a Glance server for the duration of snapshot download. Subscribers not disconnecting after a snapshot download should expect a login reject packet from the server for cases where general maintenance is performed by the exchange, such as upgrades, server maintenance, etc.

6.1.2.1 Server Initiated Packets

6.1.2.1.1 Login Accepted Packet

The Glance server will always respond to a successful Login Request Packet with this message. Password Expiry will be reported if the logon has been accepted.

After this message has been received, the subscriber should expect a download of Sequenced Data Packet contains data messages to create a snapshot of the market image.

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Number of bytes after this field
Packet Type	2	1	Alpha	Set to "A"
Session	3	10	Alpha	Identity of the multicast session subscriber is logged into. See Packet Header.
Password Expiry	13	4	Alpha	Number of days until password expires. **This is an extension to the SoupBinTCP protocol.**
		17		

6.1.2.1.2 Login Reject Packet

The Glance server will always respond to a failed Login Request with this message or this message will be issued where the server requires a logoff due to other reasons. In each case the server will automatically force the disconnect after sending the response.

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Number of bytes after this field
Packet Type	2	1	Alpha	Set to "J"
Reject Reason Code	3	1	Alpha	Status of login request: "A" – Invalid username or password "S" – Requested Session or Market Data Group was either invalid or unavailable **These codes are an extension to the SoupBinTCP protocol:** "P" – Password expiry "C" – Logon Limit reached (use locked out) "F" – Forced logoff due to maintenance "H" – Heartbeat loss detected "I" – Improper Logon (duplicate, service not ready, etc.)
		4		

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6.1.2.1.3 Password Change Response

The server will respond to a change of password request as successful or failed. If successful the password expiry will be non-zero.

Note:
This is an extension to the SoupBinTCP protocol.

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Number of bytes after this field
Packet Type	2	1	Alpha	Set to "P"
Accepted	3	1	Alpha	Set to 'Y' if password change was successful, 'N' if the password is invalid.
Password Expiry	4	4	Alpha	If password change is accepted, set to the number of days until password expires, or zero if not accepted.
		8		

6.1.2.1.4 Server Heartbeat Packets

The server will send a heartbeat packet where more than 1 second passes when no data has been sent to the subscriber.

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Number of bytes after this field
Packet Type	2	1	Alpha	Set to "H"
		3		

6.1.2.1.5 Sequenced Data Packet

All data messages sent from Glance will use this message to transfer the data. The format of the message will be:

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Number of bytes after this field
Packet Type	2	1	Alpha	Set to "S"
Data	3	*		A single data message defined by the ASX 24 ITCH protocol

Glance will issue multiple messages using the following format:

Packet Length 2 bytes	"S"	Code	Data Elements *

Repeating the above sequence until the download is complete which is signalled with a Snapshot Complete.

Packet Length 2 bytes	"S"	"G"	Sequence 20 bytes

As an example, the following shows a Time Message (darker colour), System Event, Order Book State (3), Order Added and a Snapshot Complete (sizes are shown in decimal).

0006	S	T	seconds	0009	S	S	nanos	td	O	0006	S	T	seconds	0013	S	O	nanos	td	Contract Number 1	P	0013	S	O	nanos	td	Contract Number 2	P

0013	S	O	nanos	td	Contract Number 3	P	...	0006	S	T	seconds	0033	S	A	nanos	td	Contract Number 1	B/S, O#, Priority, Quantity, Price	0022	S	G	sequence

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6.1.2.1.5.1 Snapshot Complete

The transmission of this message signals the snapshot download is complete and the sequence indicates to the subscriber the next Packet Header to process to keep continuity with the market.

This message is a *Sequenced Data Packet* with an End of Snapshot payload message.

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Number of bytes after this field
Packet Type	2	1	Alpha	Set to "S"
Message Type	3	1	Alpha	Set to "G"
Sequence	4	20	Alpha	Sequence number of the next expected message to receive to synchronise with the market.
		24		

6.1.2.2 Subscriber Initiated Packets

6.1.2.2.1 Login Request Packet

Each subscriber must connect and log into a Glance server using a valid username and password.

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Number of bytes after this field
Packet Type	2	1	Alpha	Set to "L"
Username	3	6	Alpha	User identifier assigned to the subscriber by the ASX
Password	9	10	Alpha	Password assigned to the Username
Session	19	10	Alpha	Identity of the multicast session to logon into or all blanks to log into the active session. See Packet Header.
Requested Sequence Number	29	20	Alpha	Specifies the next sequence number in ASCII the subscriber wants to receive upon connection. Always set to "1" (any other value will be interpreted as "1").
		49		

6.1.2.2.2 Logout Request

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Number of bytes after this field
Packet Type	2	1	Alpha	Set to "O"
		3		

6.1.2.2.3 Subscriber Heartbeat Packets

The subscriber should send a heartbeat packet where more than 1 second passes when no data has been sent to the server. The server will send a Logout Response and disconnect if nothing is received for an extended period of time.

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Number of bytes after this field
Packet Type	2	1	Alpha	Set to "R"
		3		

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6.1.2.3 Unsequenced Data Packet

The Unsequenced Data Packet acts as an envelope to carry data messages from the subscriber to the Glance server. The format of the message will be:

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Number of bytes after this field
Packet Type	2	1	Alpha	Set to "U"
Data	3	*		A single data message as defined below

6.1.2.3.1 Password Change Request

The subscriber can make a request to modify the password of the username with this message. The password takes effect upon the next logon and applies to all servers the subscriber can log onto. The Glance server will respond with a Password Change Response message.

Field Name	Offset	Length	Type	Notes
Length	0	2	Numeric	Set to 11
Packet Type	2	1	Alpha	Set to "U"
Message Type	2	1	Alpha	Set to "1"
Password	3	10	Alpha	New Password assigned to the Username
		14		

The password policy of the ASX Trade24 will be enforced as follows:

- Maximum password age is 90 days.
- Must be a password length of 8-10 characters.
- Passwords must contain at least one character from each of the following four (4) classes:
  - English upper case letters, i.e. A, B, C, ... Z,
  - English lower case letters, i.e. a, b, c, ... z,
  - Westernised Arabic numerals i.e. 0, 1, 2, ... 9,
  - Non-alphanumeric ("special characters") that is "~!@#$%^()_-=+{}[]<>?".
- Password history setting of 8 passwords.
- Password history is kept for 365 days.
- When the password is modified it is assigned an expiry date and time of 23:59:59, if the expiry date has passed, the password is considered expired.
- The password can be modified at any time prior to 23:59:59 of the expiry date.
- The password comes into effect for the next logon.
- Only at the request of the recipient (for the initial logon or due to an expired password), will the ASX will issue a password with 0 days to expiry (i.e. the password will expire at midnight).
- Security is centralised, so all servers will have access to the same participant information.

Note:
At current time the password policy is not in effect until the new order entry servers are put in place.

The above password policy will NOT be enforced for the current ASX Trade24 FIX4.0 Gateways (AOEIs).

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6.2 How to build an order book view

The information needed to build an order book view from the ASX 24 ITCH message flow is contained in sections Order Messages and Trade Messages. The messages are:

- Order Added
- Order Replaced
- Order Volume Cancelled
- Order Deleted
- Implied Order Added
- Implied Order Replaced
- Implied Order Deleted
- Trade Messages
  - Order Executed
  - Order Executed with Price
  - Spread Executed
  - Trade (Spread Execution Chain)
  - Custom Market Trade.

6.2.1.1 Order Added

The Order Added and Implied Order Added will add an order to the book and will be appended or inserted into the order book positioned by:

- Contract Number
- Side
- Price
- Order Book Priority
- Order Number (applicable for implied orders as the Order Book Priority can be the same).

6.2.1.2 Order Replaced

The Order Replaced (or Implied Order Replaced) message signals the order has been modified in regards to price and/or volume and indicates a change of time priority. Where a change of priority occurs in regards to the "queue position" of an order, the current queue position in the order book may or may not be lost in the process. For the Order Replaced message, the order must be removed from its previous position and inserted at the new position based on the new price (if modified) and the Order Book Priority (regardless if the price is modified). An order inserted at an existing position shifts the order in that position down (and all orders below as well).

6.2.1.3 Order Volume Cancelled

The Order Volume Cancelled message signals the order has been modified in regards to volume only and will not change the queue position within the order book.

6.2.1.4 Order Delete

The Order Deleted message tells the subscriber to remove the referenced order.

The Implied Order Deleted message tells the subscriber to remove the referenced implied order.

6.2.1.5 Trades

When the subscriber receives a Trade Message indicating a partial trade, the buyer's order quantity must be replaced by the "Buyer's Quantity Remaining" and the seller's order quantity must be replaced by the "Seller's Quantity Remaining" of the message. Where the "remaining quantity" reported by the trade is zero, the buyer's order or seller's order (or both) is fully traded and must be removed from the order book.

In regards to the "queue position" of an order, a deleted or fully traded order causes existing orders below it to shift their position up one step to fill the "void".

6.2.2 A Note on Order Book Priority

The term "Order Book Priority" in ASX Trade24 is a "time" counter used to signify the placement in the collective order books. When an order is released or modified (and the price changes or volume is increased) ASX Trade24 will assign the next time

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

priority regardless of which order book it will be eventually assigned. To report the current position in the queue, the subscriber must perform this function based on the price and time priority ordering of each order within each contract side. The priority reported by ASX Trade24 is a pseudo time element to help the subscriber "place" the order, not the position of the order itself.

Important note, for implied prices, it is possible to have two implied orders with the same priority. In which case the Order Number associated with the implied orders will determine the position within the book, the implied order nearest to the top of the queue will be the lower order number.

For instance, the following transactions are received:

Type	Contract	Side	Price	Volume	Priority	Order Number
A	XTM1	B	94.000	10	1	200
A	XTM1	B	94.020	23	2	201
A	XTU1	B	95.000	45	3	202
A	XTM1	B	94.020	75	4	203
j	XTM1U1	B	-1.030	52	5	771
A	XTU1	S	95.050	52	5	204
A	XTM1	B	94.010	15	6	205
j	XTM1U1	S	-0.950	13	7	772
A	XTM1	S	94.050	13	7	206

Then the book will appear as:

Book	Order#	Priority	Vol	Bid	Ask	Vol	Priority	Order#
XTM1	201	2	23	94.020	94.050	13	7	206
	203	4	75	94.020				
	205	6	15	94.010				
	200	1	10	94.000				
XTU1	202	3	45	95.000	95.050	52	5	204
XTM1U1	*771*	*5*	*52**	*-1.030*	*-0.950*	*13**	*7*	*772*

If order #200 is modified to a new price of 94.020, then the book will appear as:

Type	Contract	Side	Price	Volume	Priority	Order Number
U	XTM1	B	94.020	10	8	200

Book	Order#	Priority	Vol	Bid	Ask	Vol	Priority	Order#
XTM1	201	2	23	94.020	94.050	13	7	206
	203	4	75	94.020				
	200	**8**	**10**	**94.020**				
	205	6	15	94.010				
XTU1	202	3	45	95.000	95.050	52	5	204
XTM1U1	*771*	*5*	*52**	*-1.030*	*-0.950*	*13**	*7*	*772*

Note that the Priority for #200 becomes the next priority 8 and the modified order removes the third depth level and adds volume to the best price.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Continuing on from the prior example, if a spread order is added, the book will appear as:

Type	Contract	Side	Price	Volume	Priority	Order Number
k	XTM1U1	S				772
j	XTU1	B	95.000	96	9	773
A	XTM1U1	S	-0.980	96	9	207

Book	Order#	Priority	Vol	Bid	Ask	Vol	Priority	Order#
XTM1	201	2	23	94.020	94.050	13	7	206
	203	4	75	94.020				
	200	8	10	94.020				
	205	6	15	94.010				
XTU1	202	3	45	95.000	95.050	52	5	204
	773	***9***	***96****	***95.000***				
XTM1U1	*771*	*5*	*52**	*-1.030*	**-0.980**	**96**	**9**	**207**

Note:

- A delete implied order for the XTM1U1 sell side is issued removing the existing implied price and volume.
- The spread order has added an implied order to the XTU1 bid.
- A new order improves the ask price for XTM1U1

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6.2.3 Notes for Trade Message Execution

6.2.3.1 A Note on Remaining Quantity

Each order that executes will have a remaining quantity as part of the trade message. The purpose of the field is to provide the subscriber enough information to update the current market image without having to perform a calculation of the new volume.

For most cases it would be a simple matter to deduct the traded volume from the current order volume. In the case of spread orders, particularly ratio spreads, this will be more complex as spread or custom orders will be party to more than one trade.

For example if we have in the book the following orders:

- Order XTM1 Bid 25@94000 #1001
- Order XTM1YTM1 Bid 35@10 #1002 (XT-YT ratio is 10:30)
- Order YTM1 Ask 25@94010 #1003.

In the above the XTM1 Bid and YTM1 Ask should trade with the XT-YT spread, however, because the volume of the YTM1 is insufficient to meet the ratio, the orders remain as resting orders.

An order enters the market such that it adds volume to the #1003 meeting the ratio requirements of the XT-YT spread creating a trade. Therefore the subscriber receives:

- Trade XTM1 10@94000, Buyer=1001, Seller=1002
- Trade YTM1 25@94010, Buyer=1002, Seller=1003
- Trade YTM1 5@94010, Buyer=1002, Seller=1004
- Order YTM1 Ask 15@94010 #1004.

Looking at the above trades that involve the XT-YT spread, what should the remaining volumes for each of the orders be? Without the remaining volume field for each order in the trade message, the subscriber will need to calculate the volume reduction for the inter-spread. To do so, sum the volumes traded for the XT and YT, retrieve the XT-YT ratio, divide the total volumes by the associated ratios to get the volume traded for the XT-YT and deduct that from the existing XT-YT order volume.

In answer to the above, the remaining volumes should be:

- #1001 is 15
- #1002 is 34
- #1003 is 0 (it traded out)
- #1004 is 15, but this is reported as an "Order Added" and was only listed as part of the last trade for illustration purposes only.

Using remaining volume removes any doubt about what the volume of any order should be at any time.

6.2.3.2 When a Spread or Custom Order Trades Out

The above example also illustrates an issue for multi-legged orders of when to apply the remaining volume where the order is traded out.

Where a spread (or custom) order trades there will be at least 2 messages reported, one for the sell side and one for the buy side (or in the case of custom orders, each leg will report a trade). As such if a spread order trades out, the remaining volume is reported as zero for the trades of both legs, if the subscriber acts on the first trade by removing the order, when the second trade is processed the spread order will already have been removed.

To ensure this does not happen, where a resting spread order trades out, ASX Trade24 reports the last leg (or legs 2, 3,... for custom orders) of the trade with an Order Number of zero ensuring the order isn't referenced when the first leg of the trade reports to remove the order from the book. If an Order Number of zero is encountered, no action is to be taken on the order book (this behaviour is typical of SpreadExecuted and CustomExecuted messages only).

6.2.3.3 Examples of the Order Executed Message

The following examples show the feed for subscribers to produce a market picture without choice market displays.

Example 1: An initiating order partially trades a resting order:

Action	Contract	Side	Price	Volume	Order#	Type	Remaining	Comment
A	XTM1	B	94000	10	1			Resting Order
E	XTM1	B	94000	3	1	T	7	Order #1 is adjusted to 7

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Example 2: An initiating order trades out a resting order and has remaining volume:

Action	Contract	Side	Price	Volume	Order#	Type	Remaining	Comment
A	XTM1	B	94000	7	1			Resting Order (from example 1)
E	XTM1	B	94000	7	1	T	0	Order #1 is removed from book
A	XTM1	S	94000	3	3			Order #3 is added (original volume 10)

Example 3: An initiating order trades out a resting order:

Action	Contract	Side	Price	Volume	Order#	Type	Remaining	Comment
A	XTM1	S	94000	3	3			Resting Order (from example 2)
E	XTM1	S	94000	3	3	T	0	Order #3 is removed (empty market)

Example 4: An initiating order sweeps through several resting orders and has remaining volume:

Action	Contract	Side	Price	Volume	Order#	Type	Remaining	Comment
A	XTM1	B	94020	10	14			Resting Order top of book
A	XTM1	B	94010	20	15			Resting Order first depth
A	XTM1	B	94000	30	16			Resting Order second depth
E	XTM1	B	94020	10	14	W	0	Order #14 is removed from book
E	XTM1	B	94010	20	15	W	0	Order #15 is removed from book
E	XTM1	B	94000	30	16	T	0	Order #16 is removed from book
A	XTM1	S	94000	5	17			Order #17 is added (original volume 65)

6.2.3.4 Examples of the Order Executed with Price Message

The following examples show the feed for subscribers to produce a market picture where there is a transition from a price-discovery state into levelling and then opening of a contract.

Example 5: A contract moves from a Pre-Open session state to an Open session state:

Action	Contract	Side	Price	Volume	Order#	Type	Remaining	Comment
A	XTM1	B	94230	10	1			Resting Order
A	XTM1	S	94210	15	2			Resting Order
Z	XTM1	T	94210	*	*			Equilibrium Update
A	XTM1	B	94210	20	3			Resting Order
A	XTM1	S	94245	8	4			Resting Order
A	XTM1	B	94255	13	5			Resting Order
Z	XTM1	T	94230	*	*			Equilibrium Update
A	XTM1	S	94240	6	6			Resting Order
A	XTM1	S	94230	8	7			Resting Order
C	XTM1	*	94230	13	B5 S2	L	B0 S2	Order #5 is removed from book
C	XTM1	*	94230	2	B1 S2	L	B8 S0	Order #2 is removed from book
C	XTM1	*	94230	8	B1 S7	L	B0 S0	Orders #1 and #7 removed from book

Example 6: A resting order is modified to trade out and partially trades with another resting order:

Action	Contract	Side	Price	Volume	Order#	Type	Remaining	Comment
A	YTM1	B	94000	10	8			Resting Bid Order
A	YTM1	S	94010	4	9			Resting Ask Order
C	YTM1	*	94000	4	B8 S9	T	B6 S0	Order #8 is adjusted, 9 is removed

Example 7: A resting order is modified and trades out another resting order and has remaining volume:

Action	Contract	Side	Price	Volume	Order#	Type	Remaining	Comment
A	YTM1	B	94010	12	8			Resting Bid Order
A	YTM1	S	94020	15	9			Resting Ask Order
C	YTM1	*	94010	12	B8 S9	T	B0 S3	Order #8 is removed, 9 is adjusted
U	YTM1	S	94010	3	9			Order #9 is adjusted for price/volume)

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6.2.3.5 Examples of the Spread Executed Message

The following examples show the feed for subscribers to produce a market picture without choice market displays. Note that in both examples, this is a case of an intra-spread matching with a resting intra-spread as noted by the Trade Type of "R".

Example 8: An initiating order partially trades a resting order:

Action	Contract	Side	Price	Volume	Order#	TCN	Type	Remaining	Comment
A	XTM1U1	S	+0	10	1				Add spread order to book
e	XTM1U1	S	94000	1	1	XTM1	R	9	Order is volume adjusted
e	XTM1U1	S	94000	1	1	XTU1	R	9	and again as the same

Example 9: An initiating order trades out a resting order and has remaining volume:

Action	Contract	Side	Price	Volume	Order#	TCN	Type	Remaining	Comment
A	XTM1U1	S	+0	10	1				Add spread order to book
e	XTM1U1	S	94000	10	1	XTM1	R	0	#1 is removed
e	XTM1U1	S	94000	10	0	XTU1	R	0	#1 is now #0
A	XTM1U1	B	+0	2	1				Add #2 (original vol. 12)

6.2.3.6 Examples of the Trade (Spread Execution Chain) Message

The following examples show the feed for subscribers to produce a market picture without choice market displays.

Example 10: An initiating order partially trades through a chain of resting orders:

Action	Contract	Side	Price	Volume	Order#	TCN	Type	Remaining	Comment
A	APM1	S	43770	15	1				Add order
j	APU1	S	43750	15	701				Implied APU1 Ask
A	APM1U1	B	+20	17	2				Add spread order to book
P	APM1		43770	3		APM1	S		Trade is APM1 3@43770
	APM1	***S***	***Seller***		***1***			***12***	***Seller is adjusted***
	APM1U1	***B***	***Buyer***		***2***			***14***	***Buyer is adjusted***
e	APM1U1	B	43750	3	2	APU1	S	14	Order#2 volume adjusted
l	APU1	S	43750	12	701				Update Implied APU1 Ask

Example 11: An initiating order trades out a resting order and has remaining volume:

Action	Contract	Side	Price	Volume	Order#	TCN	Type	Remaining	Comment
A	APM1	S	43770	12	12				Add order
j	APU1	S	43750	12	3072				Implied APU1 Ask
A	APM1U1	B	+20	14	13				Add spread order to book
j	APZ1	S	43780	8	4944				Implied APZ1 Ask
j	APM1Z1	B	-10	8	8945				Implied APM1Z1 Bid
A	APU1Z1	B	-30	8	14				Add spread order to book
P	APM1		43770	8		APM1	S		Trade is APM1 8@43770
	APM1	***S***	***Seller***		***12***			***4***	***Seller is adjusted***
	APM1U1	***B***	***Buyer***		***13***			***6***	***Buyer is adjusted***
P	APU1		43750	8		APU1	S		Trade is APU1 8@43750
	APM1U1	***S***	***Seller***		***13***			***6***	***Seller is adjusted***
	APU1Z1	***B***	***Buyer***		***14***			***0***	***Order#14 is deleted***
e	APU1Z1	S	43780	8	0	APZ1	S	0	Order#14 is now #0
l	APU1	S	43750	4	3072				Update Implied APU1 Ask
k	APZ1	S			4944				Deleted Implied APZ1
j	APU1Z1	S	-30	2	9760				New Implied APU1Z1 Ask
j	APM1Z1	S	-10	2	8944				New Implied APM1Z1 Ask
k	APM1Z1	B			8945				Del Implied APM1Z1 Bid
A	APZ1	B	43780	2	15				Add#15, original vol. 10

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Example 12: A resting order is modified and trades out another resting order and has remaining volume:

Action	Contract	Side	Price	Volume	Order#	TCN	Type	Remaining	Comment
A	APM3	S	43770	12	9				Add order
j	APN3	S	43750	12	4144				Implied APN3 Ask
A	APM3N3	B	+20	14	10				Add spread order to book
j	APQ3	S	43780	8	4960				Implied APQ3 Ask
j	APM3Q3	B	-10	8	7057				Implied APM3Q3 Bid
A	APN3Q3	B	-30	8	11				Add spread order to book
j	APM3	B	43740	8	8561				Implied bid
j	APN3	B	43720	8	4145				Implied bid
j	APM3N3	S	+50	8	3328				Implied spread ask
j	APM3Q3	S	+20	10	7056				Implied spread ask
j	APN3Q3	S	+0	10	4352				Implied spread ask
A	APQ3	B	43750	10	12				Add order (to be modified)
P	APM3		43770	8		APM3	S		Trade is APM3 8@43770
	APM3	***S***	***Seller***		***9***			***4***	***Seller is adjusted***
	APM3N3	***B***	***Buyer***		***10***			***6***	***Buyer is adjusted***
P	APN3		43750	8		APN3	S		Trade is APN3 8@43750
	APM3N3	***B***	***Seller***		***10***			***6***	***Seller is adjusted***
	APN3Q3	***B***	***Buyer***		***11***			***0***	***Order#11 is deleted***
E	APQ3	B	43780	8	12	APQ3	S	2	Order#12 is adjusted
k	APQ3	S			4960				Del Implied APQ3 Ask
k	APM3	B			8561				Del Implied APM3 Bid
k	APN3	B			4145				Del Implied APN3 Bid
k	APM3N3	S			3328				Del Implied APM3N3 Ask
k	APM3Q3	B			7057				Del Implied APM3Q3 Bid
I	APM3Q3	S	-10	2	7056				Implied is volume adjusted
I	APN3Q3	S	-30	2	4352				Implied is volume adjusted
U	APQ3	B	43780	2	12				Order is price adjusted

Example 13: A resting order is modified to trade out and partially trades with another resting order:

Action	Contract	Side	Price	Volume	Order#	TCN	Type	Remaining	Comment
A	APM3	S	43770	20	15				Add order
j	APN3	S	43830	16	4144				Implied APN3 Ask
A	APM3N3	B	-60	16	16				Add spread order to book
j	APQ3	S	43780	8	4960				Implied APQ3 Ask
j	APM3Q3	B	-10	8	7057				Implied APM3Q3 Bid
A	APN3Q3	B	-30	8	11				Add spread order to book
j	APM3	B	43750	4	8561				Implied bid
j	APM3N3	S	-40	4	3328				Implied spread ask
A	APN3	B	43810	4	17				Add order (to be modified)
P	APM3		43770	5		APM3	S		Trade is APM3 5@43770
	APM3	***S***	***Seller***		***15***			***15***	***Seller is adjusted***
	APM3N3	***B***	***Buyer***		***16***			***11***	***Buyer is adjusted***
P	APN3		43830	5		APN3	S		Trade is APN3 5@43830
	APM3N3	***B***	***Seller***		***16***			***11***	***Seller is adjusted***
	APN3	***B***	***Buyer***		***17***			***0***	***Order#17 is deleted***
k	APM3	B			8561				Del Implied APM3 Bid
k	APM3N3	S			3328				Del Implied APM3N3 Ask

Note: Order #17 was price adjusted to 43830 AND volume adjusted to five to trade.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Example 14: A special case where a deleting an order results in a trade:

Action	Contract	Side	Price	Volume	Order#	TCN	Type	Remaining	Comment
A	XTM3	S	96610	100	22				Add order
A	XTM3YTM3	S	+780	1	23				Add inter-spread order
A	YTM3	B	97400	1	24				Add order
A	YTM3	B	97390	100	25				Add order under best
D	YTM3	B			24				Best YTM3 is deleted
P	XTM3		96610	10		XTM3	S		Trade is XTM3 10@96610
	XTM3	***S***	***Seller***		***22***			***90***	***Seller is adjusted***
	XTM3YTM3	***S***	***Buyer***		***23***			***0***	***Order #23 is deleted***
E	YTM3	B	97390	30	25	YTM3	S	70	Trade is YTM3 30@97390
j	XTM3YTM3	B	+780	2	4289				New Implied inter-spread

Note: Order #24 was deleted but never trades, but the inter-spread volume requirement was satisfied with the remaining resting orders, so a trade is executed.
Inter-spread order is a 10:30 ratio.

6.2.4 Notes to Build a Market Image

The information needed to build a market image with the ASX 24 ITCH message flow is contained in sections Trade Messages and Market Updates. The messages are:

- Trade Messages
  - Order Executed
  - Order Executed with Price
  - Spread Executed
  - Trade (Spread Execution Chain)
  - Custom Market Executed
  - Custom Market Trade
- Market Updates
- Equilibrium Price (Auction Info)
- Open, High, Low, Last Trade Adjustment
- Market Settlement
- Anomalous Order Threshold Publish
- Volume and Open Interest

The market image consists of the following fields for each non-spreadable contract:

- Opening Trade Price is the first "Trade Price" for the trade date that is marked "Printable".
- Highest Trade Price is the maximum traded price for the trade date that is marked "Printable".
- Lowest Trade Price is the minimum traded price for the trade date that is marked "Printable".
- Last Traded Price is the traded price of the last trade where the trade is marked as "Printable".
- Last Traded Volume is the executed quantity of the last trade regardless of the "Printable" setting.
- Total Traded Volume is the total executed quantity of all trades for the trade date regardless of the "Printable" setting.
- Total Number of Trades is a count of the trades executed for the trade date.
- Equilibrium Price if the contract is in a price discovery trading state.
- Interim Settlement Price
- Final Settlement Price
- Volatility (from the option symbol directory only)
- Prior Day Settlement Price (from the future or option symbol directory)
- Extreme Trade Range information for contracts falling under the Market Integrity Rules
- Volume and Open Interest (if reported, note the Glance snapshot doesn't include VOI disseminated as text).

For spreadable contracts, i.e. intra-spread and inter-spread contracts, the above fields could be repeated, however, only the "Last Traded Price" would be relevant for the spread-to-spread trades that occur.

6.2.4.1 Trade Messages

To build the market image for the trade values, each of the trade messages must be processed to extract the:

- Traded Contract Number,
- Trade Price,
- Executed Quantity,
- Printable flag,

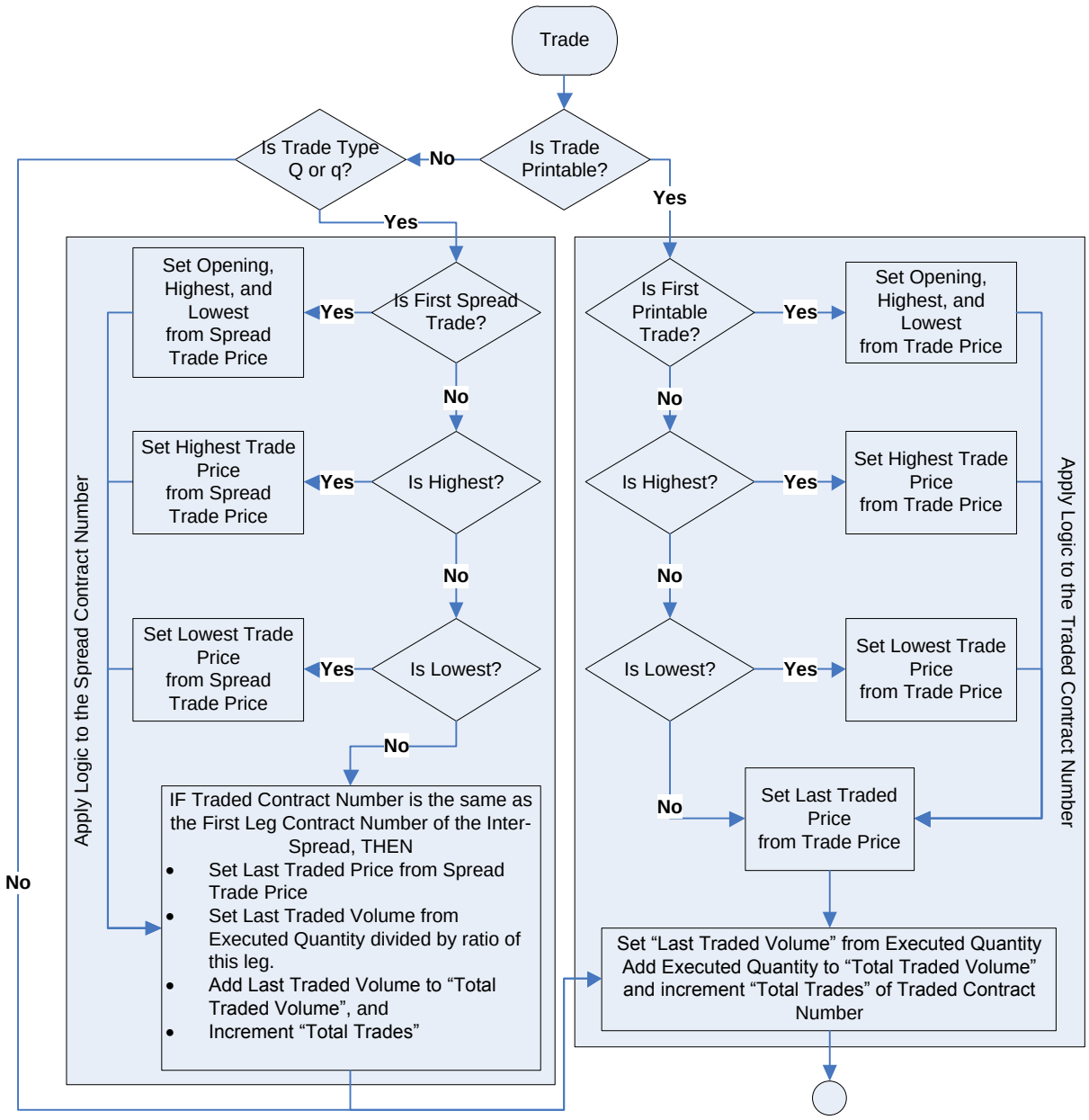
© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

- Spread Trade Price and
- Trade Type.

Following is a chart to extract each of the above values from the available fields within each type of trade message:

Field Names to Extract	**Order Executed**	**Order Executed with Price**	**Spread Executed, Trade (Spread Execution Chain)**	**Custom Market Executed, or Custom Market Trade**
Traded Contract Number	Contract Number	Contract Number	Traded Contract Number	Traded Contract Number
Trade Price	Trade Price	Trade Price	Trade Price	Trade Price
Executed Quantity	Executed Quantity	Executed Quantity	Executed Quantity	Executed Quantity
Printable	Always "Y"	Always "Y"	Printable	Printable
Spread Trade Price	N/A	N/A	Spread Trade Price	Spread Trade Price
Trade Type	Trade Type	Trade Type	Trade Type	Trade Type

The "Spread Trade Price" is available from the Spread Executed and Trade (Spread Execution Chain) messages and is defined if the "Printable" field is "N" AND the "Trade Type" is set to "R/r" or "Q/q". Otherwise the price will be set to zero (note that zero is a valid spread trade price). Where the spread trade price is defined, the value is only applicable to the spread contract defined by "Contract Number" for Spread Executed and "Buyer's Contract Number" or "Seller's Contract Number" for Trade (Spread Execution Chain).



© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

The calculation of the "Last Traded Volume" for a spread requires the leg ratio of the spread to calculate the number of spread lots traded from the executed quantity. The executed quantity is the number of underlying lots traded, so to get the number of spread lots traded, divide the executed quantity by the leg ratio. For instance, if XT-YT is a 10-31 ratio and the executed quantities are 60 XT lots for trade #1 and 186 YT lots for trade #2, then in both cases the number of spread lots traded is 6 lots (60/10 and 186/31). The ratio for the legs comes from the spread symbol definition message for the spread contract number.

Note: Each executed inter-spread trade will generate 2 Q or q messages, one for the first leg and a second for the second leg. For the "Total Traded Volume" and "Total Trades" calculation, this will double these numbers if both trades make the same calculation. To avoid this issue, only process the Q or q message where the first leg contract number is the same as the traded contract number to avoid the double calculation.

6.2.4.1.1 How to Determine the Spread Trade Price

A spread order (including custom orders) that is party to a trade is identified where the Trading Type is one of:
S, s, R, r, Q or q.

Where a trade has a Trade Type=R or r, this is an intra-spread trade where orders on both sides are spread orders. Where a spread-to-spread occurs, there will always be at least two different contracts listed amongst the trades. Where two contracts are listed the Spread Trade price will be the same value for both trades.

For instance,

```
A APX2Z2 B 5@30     O#=16 Priority=16
e APX2   R 1@44610 [T#=11 Buyer APX2Z2 B O#=16 V=4]
                    SpreadPrice=30 Printable=N
e APZ2   R 1@44580 [T#=12 Seller APX2Z2 B O#=16 V=4]
                    SpreadPrice=30 Printable=N
```

In the above a resting spread order is hit by another spread order for a volume of 1. In this case it is easy to see that a spread-to-spread trade (Trade Type=R or r) occurred for APX2Z2 at +30. This same logic will apply to inter-spreads as well (Trade Type=Q or q).

Continuing the above example, another spread order is added to make an implied price at APX2H3 B 4@70

```
j APX2H3 B 4@70     O#=1263205716328449 Priority=18
A APZ2H3 B 4@40     O#=18 Priority=18
e APX2   R 1@44610 [T#=13 Buyer APX2Z2 B O#=16 V=3]
                    SpreadPrice=70 Printable=N
P APZ2   R 1@44580 [T#=14 Buyer APZ2H3 B O#=18 V=3][Seller APX2Z2 B O#=16 V=3]
                    SpreadPrice=30 Printable=N
e APH3   R 1@44540 [T#=15 Seller APZ2H3 B O#=18 V=3]
                    SpreadPrice=40 Printable=N
l APX2H3 B 3@70     O#=1263205716328449 Priority=18
```

In the above case the spread trade prices are based on the sequence of the trade order. To determine the traded spread price for each spread contract the three trades need be processed as one. Starting with the farthest contract, in this case APH3, find the next contract APZ2. The spread trade price between these two contracts (APZ2H3) is +30. The next link will be from APZ2 to APX2 with a spread trade price between these two contracts (APX2Z2) is +70. The last link is from the nearest back to the farthest or APX2 to APH3 with a spread trade price between these two contracts (APX2H3) is +40. Note that in each case the second contract dictates the spread price.

So you would report the additional information:
APZ2H3 1@+30
APX2Z2 1@+70
APX2H3 1@+40

Where the Trade Type is S or s, this is an intra-spread, inter-spread or custom order that is party to the trade with an outright contract order. Where a spread-to-underlying occurs, there will always be at least two different contracts listed amongst the trades. In this case the spread trade price is not indicated because the outright order will anchor the trade price. To calculate the spread trade price is similar to the above, except the actual trade prices must be used.
For instance,

```
A APX2   B 6@44610  O#=27 Priority=27
j APX2Z2 B 6@-150   O#=1263218601230337 Priority=28
A APZ2   S 7@44760  O#=28 Priority=28
E APZ2   s 2@44760 [T#=21 Seller O#=28 V=5]
E APX2   s 2@44610 [T#=22 Buyer O#=27 V=4]
l APX2Z2 B 4@-150   O#=1263218601230337 Priority=28
```

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

In this case the two trades involve a spread (Trade Type='s'). Using similar logic above, starting with the farthest contract, in this case APZ2, find the next nearest contract APX2. The spread trade price between these two contracts (APX2Z2) is the difference between the trade prices 44610 – 44760 = -150 (note that if the near contract is the seller, reverse the sign of the spread price).

For the following sequence, there is a mix of underlying and spread orders involved. In this case we have two underlying contracts (APX2 and APZ2) implying an APX2Z2 and an additional spread order implying prices for APH3 and APX2H3. A spread order hits the APX2H3 causing a trade sequence.

```
A APZ2   S 7@44760  O#=33 Priority=33
j APX2Z2 B 7@-150   O#=1263218601230337 Priority=34
A APX2   B 11@44610 O#=34 Priority=34
j APH3   S 7@44670  O#=1185303599513600 Priority=35
j APX2H3 B 7@-60    O#=1263205716328449 Priority=35
A APZ2H3 B 16@90    O#=35 Priority=35
e APH3   s 1@44670 [T#=28 Seller APZ2H3 B O#=35 V=15]
P APZ2   s 1@44760 [T#=29 Buyer APZ2H3 B O#=35 V=15][Seller APZ2 S O#=33 V=6]
E APX2   s 1@44610 [T#=30 Buyer O#=34 V=10]
l APH3   S 6@44670  O#=1185303599513600 Priority=35
l APX2Z2 B 6@-150   O#=1263218601230337 Priority=34
l APX2H3 B 6@-60    O#=1263205716328449 Priority=35
```

In this case there are three trades linked with 2 spread orders and 2 underlying orders marked involving a spread (Trade Type='s'). Using similar logic above, starting with the farthest contract, in this case APH3, find the next nearest contract APZ2. The spread trade price between these two contracts (APZ2H3) is the difference between the trade prices 44760 – 44670 = +90. The next pair is APZ2 and APX2 giving APX2Z2 with a price of 44610 – 44760 = –150. Lastly APX2 back to the farthest contract APH3 (APX2H3) with a trade price of 44610 – 44670 = –60.

So you would report the additional information:
APZ2H3 1@+90
APX2Z2 1@–150
APX2H3 1@–60

Note that the Trade Type S or s will also report inter-spread and custom order matches as well.
For instance, here an inter-spread hits two resting XT and YT orders:

```
A XTH3         S 100@97065 O#=37 Priority=37
j XTH3YTH31032 B 3@585     O#=1279324728590337 Priority=38
A YTH3         B 100@97650 O#=38 Priority=38
E XTH3         s 10@97065 [T#=31 Seller O#=37 V=90]
E YTH3         s 32@97650 [T#=32 Buyer O#=38 V=68]
l XTH3YTH31032 B 2@585     O#=1279324728590337 Priority=38
```

This custom order covered call matches with the outright orders:

```
A XTH397000C B 8@360    O#=46 Priority=46
A XTH3       S 9@97065  O#=47 Priority=47
E XTH397000C s 1@360   [T#=35 Buyer O#=46 V=7]
E XTH3       s 1@97065 [T#=36 Seller O#=47 V=8]
```

As a last **note**, you can have a trade sequence where there are mixes of Trading Types or R or S, when calculating the spread prices ensure the trades used in the calculation are also the same Trade Type, i.e. don't mix Trade Type=R with Trading Type=S.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6.2.4.2 Market Updates

6.2.4.2.1 Adjustments

The trade fields for a future symbol or option symbol can be adjusted by the exchange using the Open, High, Low, Last Trade Adjustment message. This message contains the listed fields that can be adjusted as per the:

- Opening Trade Price,
- Highest Trade Price,
- Lowest Trade Price,
- Last Traded Price,
- Last Traded Volume,
- Total Traded Volume, and
- Total Number of Trades.

The message will contain all fields set as per the current market image contained within the back-end trading engine and the "Market Updates" bit-set will indicate which field was adjusted.

6.2.4.2.2 Auction Periods

During price discovery periods the Equilibrium Price (Auction Info) message will be distributed indicating the equilibrium trade price as a result of levelling the contract.

If the subscriber is using this message as part of a display, the display should be removed once an Order Book State with a "Levelling" trading status is received.

6.2.4.2.3 Settlement Prices

Settlement prices are applicable to future symbols and regular or serial option symbols. Single session option contracts do not have a settlement price as they expire daily and the underlying settlement price is distributed via a text message.

Settlement prices have two sources; the first is from the symbol field "Prior Day Settlement" and from the Market Settlement. The Market Settlement has three types of distributions:

1. Interim Settlement Price (and volatility if an option)
2. Final Settlement Price (and volatility if an option)
3. Prior Day Settlement Price Adjustment (and volatility if an option)

The interim settlement price is distributed prior to the final settlement price and is an indicator of what the final settlement price will be of a contract for a particular trade date. Before the final settlement price is distributed participants are given the opportunity to challenge the interim price. If there are no challenges to the interim price, the interim price is distributed as the final settlement price for the contract.

Note that the Trade Date field is relevant for settlements as the interim and final settlement prices pertain to the contracts within that trading date and the prior day settlement price is relevant to the next trade date.

If the Market Settlement is an adjustment for the Prior Day settlement, the distribution of this is a result of two actions performed by the exchange:

- The prior day settlement (and volatility if an option) is being manually adjusted
- The exchange is settling the contract for the prior trade date where the contract has moved and is trading in the next trade date.

Where the exchange is final settling for the prior trade date each contract will generate two Market Settlement messages:

- The final settlement price for the prior trade date, and
- An adjustment of the prior day settlement for the current trade date.

When a Market Settlement message to adjust the prior day settlement price is received, the "Prior Day Settlement" field of the Future Symbol Directory or Option Symbol Directory should be updated with this value.

In each case where the Market Settlement message refers to an option symbol, the volatility will be defined and should update the "Volatility" field of the Option Symbol Directory for the trade date indicated.

When a market image is recovered from "Glance", the settlement (and volatility) adjustment will be reflected in the Future Symbol Directory or Option Symbol Directory messages downloaded.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6.2.4.2.4 Extreme Trade Range Notifications

During matching periods there will be some products that have price limits put in place due the market integrity rules imposed by ASIC called the Anomalous Order Threshold Publish message.

For the subscriber this will be reported on a scheduled basis after the Extreme Trade Range (ETR) has been determined. The message will indicate the price range in which a participant can enter prices in without having the order being rejected.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

7 Configuration and Infrastructure

7.1.1 Overview of Feeds

The following provides an overview of the ASX 24 ITCH multicast feed components:

- Each ASX switched environment provides dual redundant ASX 24 ITCH data services.

- Each data service consists of:
  - A multicast base address and base port for real time data dissemination using MoldUDP64 protocol.
  - An IP address and base port for snapshot retrieval using SoupBinTCP protocol (Glance).
  - An IP address and base port for MoldUDP64 retransmit requests (Blink).

- Each base address or port is matched to a ASX Trade24 Exchange or subset of Exchanges

- Upon completion of the snapshot retrieval (Glance) an "end of snapshot" message will be received containing the ASX 24 ITCH sequence number with which to begin processing real time data.

- It is recommended to begin each multicast session with a Glance snapshot retrieval as these messages contain directory information in addition to the current order book snapshot.

- The MoldUDP64 messages sent by the Blink server as the result of a retransmit request will be received by the sending application on the port from which the request was sent.

7.1.2 ASX 24 ITCH Connectivity Requirements

ASX 24 ITCH utilises multicast through switched infrastructure. Participants of ASX 24 ITCH will be required to allow for the following infrastructure requirements:

1. **Physical Layer**
   - The service will be delivered on OM3 multimode duplex LC connector.
   - The Media standard is 10GBASE-SR 10 Gigabit Ethernet connection.
   - It is the participant's responsibility to provide SFP's/XFP's to terminate the fibres.

2. **Participant Addressing**
   - All addressing is IP Version 4.
   - The participant can use their own globally unique addressing.
   - The participant can be allocated a private /24 address range and two /30 address ranges by ASX to be used on the participant's infrastructure.

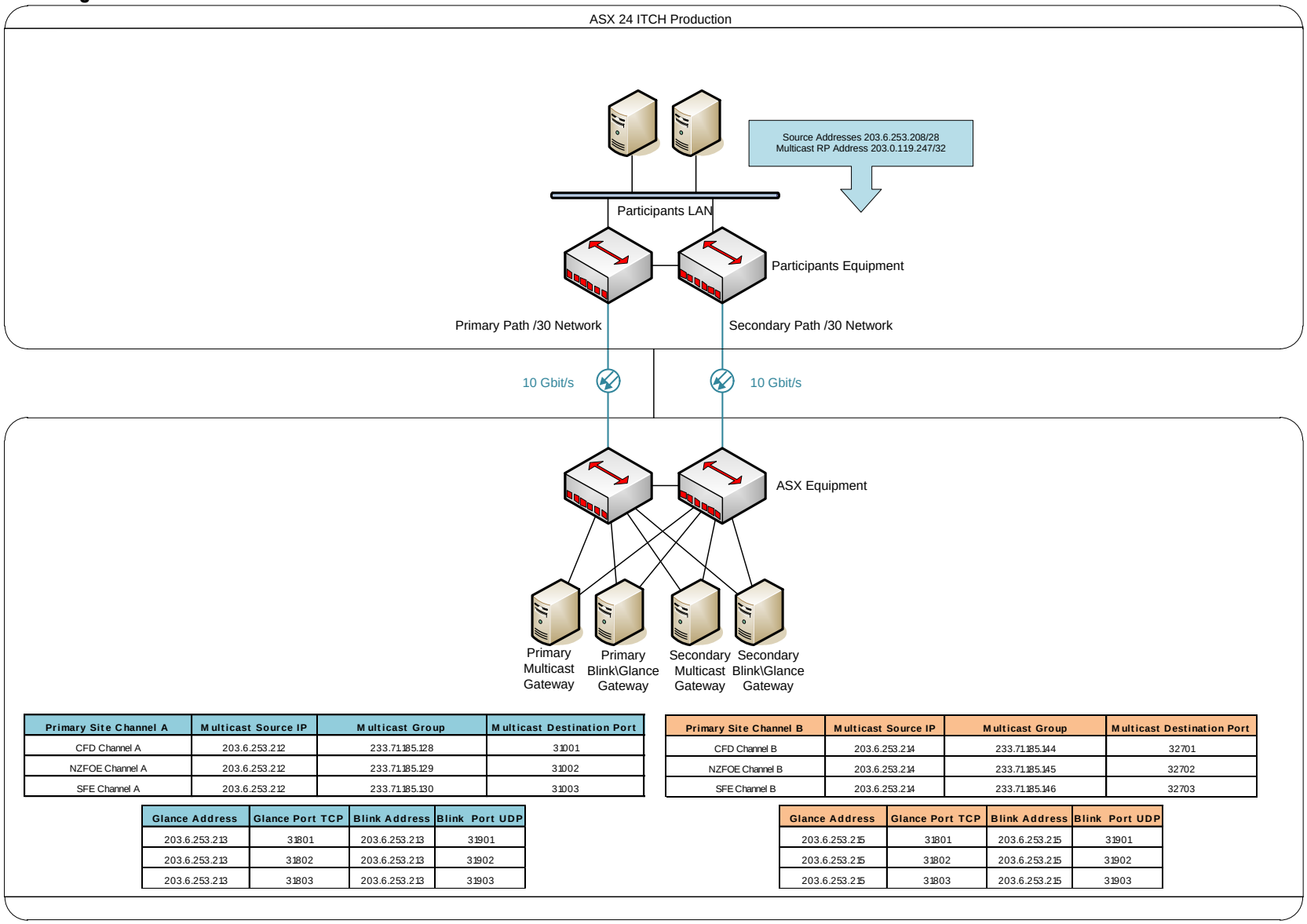
3. **ASX Addressing**
   - Multicast configuration (addressing, static RP, multicast groups) to be advised by ASX.
   - Unicast services addressing to be advised by the ASX.

4. **Participant's infrastructure.**
   - Participant's network infrastructure will require the multicast feature set.
   - Participant's infrastructure should be sized so it can buffer 10Gbit/sec bursts.
   - Participants can elect to have separate connections for ASX ITCH and ASX 24 ITCH but must terminate it on separate infrastructure.

5. **Customer test environment**
   - The customer test environment is provided on separate infrastructure thus a separate cross connect is required.
   - The physical layer specifications are the same as production.
   - The customer test environment only has one channel.

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

6. Production Diagram



Primary Site Channel A	Multicast Source IP	Multicast Group	Multicast Destination Port
CFD Channel A	203.6.253.212	233.71.185.128	31001
NZFOE Channel A	203.6.253.212	233.71.185.129	31002
SFE Channel A	203.6.253.212	233.71.185.130	31003

Glance Address	Glance Port TCP	Blink Address	Blink Port UDP
203.6.253.213	31801	203.6.253.213	31901
203.6.253.213	31802	203.6.253.213	31902
203.6.253.213	31803	203.6.253.213	31903

Primary Site Channel B	Multicast Source IP	Multicast Group	Multicast Destination Port
CFD Channel B	203.6.253.214	233.71.185.144	32701
NZFOE Channel B	203.6.253.214	233.71.185.145	32702
SFE Channel B	203.6.253.214	233.71.185.146	32703

Glance Address	Glance Port TCP	Blink Address	Blink Port UDP
203.6.253.215	31801	203.6.253.215	31901
203.6.253.215	31802	203.6.253.215	31902
203.6.253.215	31803	203.6.253.215	31903

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

7.1.3 ASX 24 ITCH Configuration Requirements

Users of ASX 24 ITCH will be required to configure for the below multicast solution. The following are the key elements for assessing the below requirements:

1. **Configuration**
   - The configuration is engineered so that all traffic goes via the primary path in an active-standby arrangement.
   - The following timers have been tuned to obtain optimum failover times in the event of a network failure within an ASX environment.

Timer	Setting
igmp query-interval	5 seconds
igmp query-max-response-time	4 seconds
pim query-interval	2 seconds

2. **Production Addressing**

   a. **Multicast**

Aggregate Address	203.6.253.208/28	233.71.185.128/28	
Primary Site Channel A	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**
NZFOE Channel A	203.6.253.212	233.71.185.129	31002
SFE Channel A	203.6.253.212	233.71.185.130	31003

Aggregate Address	203.6.253.208/28	233.71.185.144/28	
Primary Site Channel B	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**
NZFOE Channel B	203.6.253.214	233.71.185.145	32702
SFE Channel B	203.6.253.214	233.71.185.146	32703

Aggregate Address	203.6.253.192/28	233.71.185.224/28	
Primary Site Channel C	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**
NZFOE Channel C	203.6.253.196	233.71.185.225	31002
SFE Channel C	203.6.253.196	233.71.185.226	31003

Aggregate Address	203.6.253.192/28	233.71.185.240/28	
Primary Site Channel D	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**
NZFOE Channel D	203.6.253.198	233.71.185.241	31002
SFE Channel D	203.6.253.198	233.71.185.242	31003

   b. **Unicast**

Primary Site Channel A	Glance Address	Glance Port TCP	Blink Address	Blink Port UDP
NZFOE Channel A	203.6.253.213	31802	203.6.253.213	31902
SFE Channel A	203.6.253.213	31803	203.6.253.213	31903

Primary Site Channel B	Glance Address	Glance Port TCP	Blink Address	Blink Port UDP
NZFOE Channel B	203.6.253.215	31802	203.6.253.215	31902
SFE Channel B	203.6.253.215	31803	203.6.253.215	31903

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Primary Site Channel C	Glance Address	Glance Port TCP	Blink Address	Blink Port UDP
NZFOE Channel C	203.6.253.197	31802	203.6.253.197	31902
SFE Channel C	203.6.253.197	31803	203.6.253.197	31903

Primary Site Channel D	Glance Address	Glance Port TCP	Blink Address	Blink Port UDP
NZFOE Channel D	203.6.253.199	31802	203.6.253.199	31902
SFE Channel D	203.6.253.199	31803	203.6.253.199	31903

c. Multicast PIM Rendezvous Point

Multicast Rendezvous Point Address	
Primary Site Channel A	203.0.119.247
Primary Site Channel B	203.0.119.247
Primary Site Channel C	203.0.119.244
Primary Site Channel D	203.0.119.244

3. Customer Addressing (Test Environment)

a. Multicast (Test Environment)

Aggregate Address	203.6.253.224/28	233.71.185.160/28	
Primary Site Channel A	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**
NZFOE Channel A	203.6.253.229	233.71.185.161	31002
SFE Channel A	203.6.253.229	233.71.185.162	31003

b. Unicast (Test Environment)

Primary Site Channel A	Glance Address	Glance Port TCP	Blink Address	Blink Port UDP
NZFOE Channel A	203.6.253.230	31802	203.6.253.230	31902
SFE Channel A	203.6.253.230	31803	203.6.253.230	31903

c. Multicast PIM Rendezvous Point (Test Environment)

Multicast RP Address	203.0.119.242

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

8 Appendix

8.1 MoldUDP64 and SoupBin TCP

Communication between the ASX 24 ITCH, Blink, Glance servers and the participant is based on the following protocols:

- UDP multicast MoldUDP64 protocol between the ASX 24 ITCH server and participants,
- UDP unicast MoldUDP64 protocol between the Blink server and participants, and
- TCP/IP SoupBinTCP protocol between the Glance server and participants.

The following provides the MoldUPD64 and SoupBin TCP protocol specifications:

1. MoldUDP64 protocol specifications

moldudp64V1.pdf

2. SoupBin TCP protocol specifications

SoupBinTCP30.pdf

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

8.2 FAQ

1. Is there any way to determine from message content alone what source of a message is (SFE NZFOE, CFD)? We would like to use a single handler for all 3 but each source has its own Glance and Blink addresses so we need to be able to tell them apart to use the correct ones. If not available would you be open to adding such an indicator to the Packet Header or perhaps make it part of the Session field?

   No. The feeds provided are currently segregated based on the exchange and in future these could be further segregated based on product groups, such as SFE-Energy, SFE-Debt, etc. It would be expected for the recipient to keep track of the source of data and to take the necessary steps to perform the appropriate recovery for each multicast feed.

2. Knowing the market channel will help with recovery and where to recovery data for that channel, but will it also it will help with interpreting time?

   The time on a market channel is defined by the Time Message which is to the nearest second. The Time Message on a market channel is sent if there are non-heartbeat transactions being transmitted. If a market channel has no activity for extended periods of time, the recipient will receive heartbeats, but there are NO Time Messages sent with a heartbeat. If there is no activity on a market channel, using the “Blink” or “Glance” servers will not be able to provide a time either as it is based on the last transaction processed as well. To determine the time during these extended periods of no activity would be difficult although it could be guessed based on another market channel if that market channel had constant activity.

3. Time Message - will ASX Trade24 send a different initial time message for each of the 3 market channels? We anticipate we'll need to read each market channel time message and use this to then interpret all subsequent time updates.

   The Time Message is the date and time (to the nearest second) to apply to any non-Time messages following it on that market channel only. If you mix and match time messages between market channels there will potential confusion about which time to apply to which message. It is important that each market channel of data be handled separately to avoid these issues.

4. For the Options Volatility data in the ITC feed ASX provides the volatility figure for the Put Option only (unless there is a different volatility figure for the Call Option) will this be the same case in ASX 24 ITCH?

   No. Unlike ITC, put and call options are treated as individual entities under ITCH so the volatility will be provided for each put and call option contract.

5. Please confirm the definition and scenarios in which we would expect to receive the following Trading Status Explanations: "`l`" - Levelling & "`L`" – Locked

   These states operate in the same way the ASX Trade24 Gateway reports it via the FIX.

   The “Levelling” session state is the transition from a “Pre-Open” or “Price Discovery” session state to an “Opened” session state. The levelling period is usually a 30 second auction to match all open orders from the price discovery period and distribute trade and order updates before active trading commences.

   The “Locked” state is a session status that is generally reported 120 seconds prior to a product moving to the next trading date and when day orders are purged.

6. Please explain the meaning of a Levelling Trade? In what circumstances could a Levelling Trade be received?

   Levelling trades are “end-of-auction” trades or when all open orders active at the end of the pre-open or price discovery period are matched. You will receive levelling trades prior to any product opening, provided there is overlapping volume from the pre-open or price discovery period.

7. Does ASX Trade24 provide the Equilibrium Volume at all? Do not see a field for this in the Equilibrium Price (Msg Type Z) message.

   No. Only the price that the contract will level at is sent. As the recipient has access to every order price and volume, the equilibrium volume could be calculated knowing the equilibrium price.

8. Please help provide the definition of the Interim Settlement - at what time should we expect to receive this and what is the difference between the Interim and Final Settlement?

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Please review section "6.2.4.2.3 Settlement Prices" in this document. Generally, settlement prices can be received any time after the close of the contract until well into the next trade date. For instance, if the contract closes at 4:30pm and moves to the next trade date at 4:45pm, settlement prices can be expected for that contract from 4:30:01pm until 7pm.

9. From the ITC feed we take User Text Message content and use this information internally. In ASX 24 ITCH there is a specific "Request for Quote" message, however will other content from the current User Text Message provided in ASX 24 ITCH be available? E.g. EFP Registered trades, Block Trade registered etc.

   All text messages received by ASX Trade24 Trading Service destined for public display on ITC and FIX will be reported via the ITCH text message. This will include VOI information, Custom Market RFQs, EFPs, Block Trades, settlement information, etc. The text message will include a source identifier to assist a recipient to distinguish how to re-interpret a message if so desired. There will be announcements forth coming of the exact format and source identifiers of these text messages.

10. Will the ASX use Price Fractional Denominators that are not a power of 10? Section 5.1.4.3 of the spec mentions factors of e.g. 2 for American based non-decimal.

    Even though ASX Trade24 provides the ability to handle American products with fractions, such as US Treasury bills, the likelihood of listing an American product on ASX Trade24 is very slim.

11. In the Trade Cancellation Message, there is a Trade Date field; does this indicate that we could receive prior day trade cancellations? E.g. On 19th Feb receive a trade cancellation for a trade that was executed and sent to on 18th Feb? If 'yes' then how far back could the trade date be?

    Even though ASX Trade24 provides the ability to cancel trades, it is a function that has never been used. As for cancelling prior day trades, ASX Trade24 recognises only two Trade Dates as being active at any time. The prior trade date will generally end at 7pm each calendar day, so if 19th Feb is the "calendar day", then no, you will not get a trade cancellation message for the 18th Feb.

12. So to confirm, this means we will never get prior day trade cancellations? And will get current day trade cancels? I.e. is this 'feature never used to be used from Day One of ITCH?

    As the Trade Cancellation feature is currently not used in ASX Trade24, you will not get a Trade Cancellation message. However, if the policy of the ASX changes to report Trade Cancellations via the trading system, they can be reported for the current trade date or for the prior trade date. Trade Cancellations for the prior trade date will have a limited time period as the prior trade date ends at 7pm. For instance, if a trade occurs at 4:29pm on the 18th Feb then the time period to cancel that trade would be until 7pm of the 18th Feb, even though the Trade Date for the contract would have moved to the 19th Feb at 4:45pm.

13. Is there any indicator or way to interpret whether data received is for the Night or Day Session? We did not see any session indicators in the feed spec. In the current feed it's time based and this can cause complication and issues. Having session indicator/identification - to let us know when the market is moving from Day to Night and Night to Day would be of great help, could Trading Status Explanations be added for these? Pre-Open Day, Pre-Open Night, Open Day, Open Night etc.

    There is no concept of night and day session other than sessions being separated by a "d" order book status indicating a second (or third) session is starting within a trade date.

14. Does the ASX provide any Margin data in the feed? I did not see any but we have received queries from our Data team to see if we can maintain Margin info from the feed to help with the maintenance burden.

    Unfortunately no, although ASX Trade24 does send out a number of non-trading information items, margin data is not one of them.

15. In the Contract Type Explanation table in section 5.1.4.1 there is a code "E" for 'Equity Option contract (EOPTA). Can you help explain further the use of this code? As we are not aware of any Equity Options being traded on ASX Trade24.

    The Equity Option is an option product that covers NZ shares traded on NZX. The EOPTA contract type has not been used for a number of years, but is available in the event the ASX wishes to add options for ASX or NZX equity products.

16. Please help explain how GTC order types that should be carried from the Night-to-Day session are to be identified as such, and advise how we should know which orders should be carried over which shouldn't be carried over. Does ASX clear all orders at the end of the night session that need clearing? And is the state of the order book refreshed at the start of the day session - to capture any carry-over orders?

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

GTC orders are never purged during a trade date when moving from the night to the day session, no matter how many auction sessions. For GTC orders, when a product moves to "End Lock" and then moves to the new trade date, you will receive:

- A 'D' message for every GTC order within that product (for the Trade Date 1),
- An order book status of 'U' for Trade Date 1 (contract is now unavailable),
- A symbol definition for Trade Date 2 (contract is defined and pending), and
- An 'A' message for every GTC order for Trade Date 2.

In short, all order activity occurs within a Trade Date. During a period within the trade date, if an order delete is received, then delete the order, make no assumptions about when an order is deleted (or added). If a new Trade Date indicator is received, then assume there are no orders for the new trade date.

17. So this means the GTC orders between trading date 1 & 2 will be deleted at the end of Trade Date 1 (at the end of the day session) but will be re-instated at the start of Trade Date 2 (at the start of the night session)? Is this same process used for GTC orders within a Trading Date between when transitioning from the Night to Day Session?

    Yes and No. Yes, GTCs are deleted at the end of the trade date (or the end of the day session) and re-instated for the next trade date (start of the night session), however, when transitioning from night to day, GTC orders remain as active orders.

18. Implied Orders - The fact that there is 'build an order book view' in the feed spec, does this indicate that we should be combining Implied Orders in with ordinary orders in the order book we create, i.e. co-mingle them into the same book?

    This is a decision for the business model implemented. The implied orders are made to look like and act like orders, but they are not orders themselves. To ensure the recipient creates an accurate market picture as the Matching Engine sees the market image, the implied orders give the recipient the option to use the information and display it, OR the recipient can use the real orders and generate implied prices using a spreading algorithm to display information as seen fit. In addition, the recipient may want to be able to distinguish what is real and what is implied for a display and to give the ability to accurately determine how much volume is in front of one's order.

19. At the end of each trading day (or even for both night and day sessions?) should we be clearing out our implied or normal orders and allowing the books to rebuild at the start of the next day/session - or should we retain them?

    With respect to order traffic, and this pertains to the those transactions that are NOT 'j', 'k' or 'l', the Matching Engine will always ensure that the orders that are added sometime during the trade date will be deleted before each product moves to the next trading date. For GTC orders, these orders will then be re-added for the new trade date.

    As a note, if the Trading Service session number changes (see 3.1.1.1 Packet Header), then the above will not work and it is up to the recipient to "start-over" or clean-slate as the Matching Engine has been stopped and restarted (which happens every week). When this occurs, the recipient needs to take immediate action to re-start the market image.

    For implied order transactions 'j', 'k' and 'l', the current logic in the Matching Engine is that it will only send out implied order transactions when the product is not in a 'Closed' session state. This means that when the product closes, then no more implied orders will be calculated and thus no implied order deletes are reported. The side-effect of this problem is that when the "real" orders that generated these implied orders are deleted, the implied orders are not recalculated and thus there can be implied orders are left standing.

    As these "left-over" implied order transactions may be a problem for display purposes, when the trade date ends (i.e. System Event message with a code of 'C' is received), the recipient may wish to purge these implied orders.

    However, once the product moves to the new trading date, the recipient may find that implied orders from the prior trade date will have the same order number as those generated in the new trade date. This is a problem which can be resolved by treating each transaction with its corresponding trade date. So an implied order from Trade Date 1 is different from an implied order for Trade Date 2.

20. Please help explain how Spread trades will be sent to us? I'd like to better understand, if the Spread trade is sent to us via the Spread contract or the underlying contract.

    All trades must be a future or an option contract; although the document makes reference to spread-to-spread trades, you can't have a "spread trade". The term "Spread" trade is to inform the recipient that the trade was as a result of some form of match involving a spread order. If a spread order trades you will get at least two trades, one for each leg. If it is a chain spread then you will get n+1 trades where the n is the number of different spread contracts involved. The "Traded Contract Number" of a spread trade will be one of underlying legs of the spread (which is always a future or an option

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

contract), and the Contract Number will be the spread order that is party to the trade. Note that for a Spread Chain, the Buyer and Seller Contract Numbers can be a future contract and spread contract, or both are spread contracts.
The "Trade Type" will indicate what kind of trade this is as well. For instance, if the Trade Type is "R" or "Q", then this is a spread-to-spread trade and the trade price is based on the bid-ask price mid-point. Whereas if the Trade Type is "S", the trade price is based on a future order found in the spread chain. See section "5.4.8 Trade Type Explanation" for further information.

21. So this means that whenever we get trades resulting from Spread Orders or where a Spread Order interacts with Future Orders then the 'trade' information will be sent to us via the underlying leg level only? From the ASX Trade24 FIX Gateway we get trades for Inter-Spreads trades at the Spread Level but for Intra-Spreads (calendar) the trades are sent at the underlying level only. We were hoping in ASX Trade24 that we'd get Spread trades at the Spread level for both Inter- & Intra-Spreads - clients often ask why we don't show trades for Inter-Spreads on the Spread contract.

    In answer to the first question – Yes, the recipient will get the spread information via the underlying leg only. However, the information within the new trade message does give all the information required to formulate a spread trade. See section "6.2.3.1.1 How to Determine the Spread Trade Price".

22. Is there any way to accurately identify opening auction trades? Apart from receiving a whole bunch of trades at the same time for which the price matches the last indicative equilibrium price?

    The Trade Type "`L`" or '`l`" (see section 5.4.8) indicates an auction trade. The opening or first price discovery period is marked by the order book state 'P', subsequent auction periods will be marked by the order book state of 'D'. The recipient will need to keep track of the last price discovery period order book state to determine the nature of the resulting trades, for instance if they are day or night session trades.

23. For Custom Market trades provided, will we receive the trade for each leg individually (e.g. if there are 6 legs we'd receive 6 trade messages)? If so is the Custom Market Order the way in order to identify which trades are linked to which Custom Order?

    Correct, you will receive a trade for each leg, like spreads. For a custom that trades out completely when it hits the market you will never know, however, if another custom market hits a resting custom market, then you will receive a "u" or "p" message (see section 5.4.5 Custom Market Executed and 5.4.6 Custom Market Trade).

24. Please explain the Printable and non-Printable field. What Custom Trades will be printable? Which will not?

    The Printable and non-Printable fields refer to whether this trade will update the Open, High, Low, Last Trade prices. Where a spread-to-spread matches occurs the trade price generated is often skewed as it based on the bid-ask midpoint, or if there is no bid or ask, the settlement price of the nearest month. As such, the resulting trade price may not reflect a correct impression of the market and does not update the trade statistics. The same goes for custom-to-custom matches, although in this case the prices are fixed but to ensure the price doesn't give an incorrect impression of the market, the resulting trade prices don't update the Open, High, Low or Last.
    Where the Trade Type is R, r, Q, q, U or u, these will be reported as non-Printable.

25. For ASX Trade24 ITCH, we are wondering if when building an order book view, we would always get a correct book if we were to sort orders by Contract, Side, Price, Time, Order Number; i.e. actual Time instead of Order Book Priority? Since the Order Book Priority is a pseudo time element to help sort orders, we hope that sorting by Time would yield the same results as sorting by the provided Order Book Priority number. When an order is replaced (message types U/l/n), should the order time (as seen by our clients) remain as the original timestamp or should it change to the new timestamp from the update? And how does this affect the Order Book Priority - will it also get a new, higher number? Would we get identical results if we sorted by the new timestamp?

    The ASX recommends order book views are built as per the ASX 24 ITCH Message Specification using the sort order:
    - Contract Number
    - Side
    - Price
    - Order Book Priority
    - Order Number

    The timestamp indicates the time when a participant altered the order. The timestamp on a resting order will change based on certain actions that happened to that order. These actions are Order Replaced, Order Volume Cancel and Custom Replace (UXn). For each of these transactions, only Order Replaced and Custom Replaced will issue a new Order Book Priority. When a 'Glance' update is performed, the timestamps will be reflected with these actions. For

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

instance, if a recipient acts on the 'Replace' only actions (and does nothing with the Volume Cancel), then reconciliation of the recipient's book before and after the 'Glance' download will be different.

The ASX Trade24 Trading Engine uses the Order Book Priority as a means of determining order of execution, this includes implied orders as well. For the Order Volume Cancel the time of the order will change, but not it's priority in the queue. This means that if even though the order may have a newer timestamp, it will be executed in the same order as if no modification was made. Hence, the importance of the Order Book Priority.

Using "Time" sort for implied updates will certainly give a much different book. Implied prices are generated on any action that affects the price or volume of the implied pricing for that contract. This means an Implied Replace message will be received when a "real" order is added, replaced, volume reduced, cancelled or executed. In all of these actions it is possible for the order book priority to NOT change although the price or volume may change. If using "Time" sort of implied prices the integration of implied orders with the real orders will certainly be different.

In short the Timestamp is provided as the indication of when an action has occurred, the Order Book Priority is an indication of the execution order (queue position), and so sorting by timestamp will never give the same display or position in queue as compared to using the Order Book Priority.

26. Implied orders may have several orders with the same Order Book Priority and therefore their Order Numbers ultimately determine their sorting. Would such cases also get sorted correctly even if we use the Time instead of Order Book Priority?

    Definitely not. All implied orders will have the same timestamp and though the Order Numbers will be ascending giving the correct order for the implied prices, integrating with the real orders of the same contract will give a much different looking book. This re-ordering by "Time" sort will result in you seeing a much different order of execution than using Order Book Priority sort.

27. Will the Order Numbers start low (e.g. 1) and strictly increase throughout each session (and therefore also act as a kind of pseudo time indicator) or can there be more complex behaviours in the Order Numbers?

    Order numbers cycle through 1 to 99,999,999 and are not re-set. As a result, you could receive order number 99999998, 99999999 then 1, 2, 3 etc. In addition, an order is assigned an order number for the life of the order and GTC orders will use the same order number across different trade dates. It is possible for GTC orders to remain in the system for months resulting in the order numbers cycling over the GTC orders.

28. The code if crossing in Table 5.4.8 - Trade Type Explanation - by crossing, to confirm, ASX is referring to the same broker acting as both the buyer and seller.

    Correct. Although this is at a firm level. For instance, if firm ABC has two connections called AB1 and AB2, and if an order from AB1 matches with an order from AB2, because AB1 and AB2 are from the same firm, it is considered to be a "Cross-Trade".

29. Sweeping Trade type - please help provide the definition of a Sweeping trade?

    A sweeping trade is where an aggressive order price is above market matching opposite order prices. For instance, if a bid order of 10.00 hits the ask side, and the available ask orders are 9.90, 9.95 and 10.00, the matches at 9.90 and 9.95 will be reported as sweeping trades indicating that someone is "sweeping" the market.

30. Is there any change in behaviour regarding how Open Interest and Settlements are sent over: Multi-day holidays (e.g. Easter & Christmas) and Day Session Only holidays (e.g. Australia Day, Queen's B'day etc.)? Please confirm again how Open Interest and Settlement data should be sent over these different types of holidays?

    No, the behaviour of VOI sent will not change. The time at which VOI is sent over the ITC will be the same time an ITCH message will be sent.

31. Glance requires a password which can expire. To keep it simple, since we have a fully automated application, would it be possible to just make our password never expire?

    No. Direct access to ASX internal systems by our clients must be conducted using the security policy put in place by the ASX security officer.

32. If we do need to change the password regularly, when is a good time to do so? E.g. when LoginAccepted's PasswordExpiry is 0, or is that too late? Are holidays and weekends included in the expiry day count? Can we change it daily just to avoid potential expiry?

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

To cater for extra-long weekends, holidays, etc., if the Password Expiry is less than 7 days upon logon, then use that as a trigger to change the password.

33. Will a password change on the primary server automatically propagate to the backup server, or are they independent? Is there a race condition if we change the password on both servers at around the same time? Is it a problem if we change the password to different values on each side, at the same time?

    Security is centralised, so all Glance servers will have access to the same participant information.
    If a participant has multiple connections or servers logging onto the same or multiple Glance server(s), use a different username for each of the different connections to avoid any password issues.

    In regards to concerns about the password race conditions, here are the scenarios assuming the connections to server Glance A and Glance B are using the exact same username identifier:
    - If Glance A is connected with the old password '000' and Glance B is connected with old password '000', so far so good. If both servers change the password to 'AAA', no problems as the password will be updated with the same value twice.
    - If Glance A is connected with the old password 'AAA' and it is changed to 'BBB', then a connection is made to Glance B using the old password 'AAA', tough luck.
    - If Glance A is connected with the old password 'BBB' and Glance B is connected with old password 'BBB', so far so good. If the connection to Glance A changes the password to 'CCC', and the connection to Glance B changes the password to 'DDD', no problems. Writing to a central source will always enforce a lockout on another update, so there will never be two updates at the same time and it will either write 'CCC' first and then overwrite that with 'DDD' or vice versa. However, either connection to a Glance server must use the last updated password to successfully logon the next time.

34. How are the MIR price limits applied to spread orders?

    For inter-spread, intra-spread and custom market orders, if any leg is subject to the MIR price limits, and 1 or more legs fail the price limit check, then the entire order will be rejected, therefore no legging risk.

    Custom Market
    For Custom Market Orders, since the price is an outright price for each leg, if the AOT is set for a certain leg then the price of leg must be AOT-Lower >= price <= AOT-Upper for that leg. If any leg, where AOT is enforced, fails the price limit check, then the entire custom order will be rejected. For legs that aren't subject to the AOT price limits, then normal validation rules will apply.

    Spread Orders
    Intra- and Inter-spread orders will apply price limits in a similar manner as outright orders. However, given that spread orders are differentials, the price limits are based on the difference between the near and far AOT limits set for each leg (see chart below for more detail).

    The basic premise for spread price validation is to limit the ask or bid spread price such that it can't generate an implied outright price that exceeds the price limit rules. Since spreads are differential prices it is impossible to completely limit the ability to suppress all cases, so there is some levity allowed for spreading.

    For intra-spreads, if the AOT is not defined, then normal price validation rules will apply.

    For inter-spread orders, like custom market orders, there can be one leg subject to AOT price limits and the second not (and vice versa), in this case if the AOT price limit fails on one or both legs, then the entire order is rejected.

    Spread-to-Spread Trades
    For spread-to-spread trading, provided that the spread price is within the price limits for the aggressive spread order, the trade prices of the underlying contracts can be outside AOT price limits. The reason for this is to avoid adjustments to the trade price to force all legs to be within the AOT of the near and far, particularly in a rising or falling market where the calculated price would not reflect the movement of the market. In addition, if there is no ask or bid price to base a trade price upon, if the AOT is defined for either leg, then it will use that over the prior day settlement price.

    Following are the rules for the price limit checks for the spread order type, which will be applied after the pre-trade risk rules applied at the gateway AND after the normal validation rules done by the Matching Engine:

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

Condition IF AOT set AND	Reject Spread BID Order IF
No Near Ask AND No Far Bid	Spread Bid price > (Near AOT-UR) – (Far AOT-LR)
Near Ask is defined	Underlying Near Ask < Near AOT-Lower OR Underlying Near Ask – Spread bid price < Far AOT-Lower
Far Bid is defined	Underlying Far Bid > Far AOT-UR OR Underlying Far Bid + Spread bid price > Near AOT-Upper

Condition IF AOT set AND	Reject Spread ASK Order IF
No Near Bid AND No Far Ask	Spread Ask price < (Near AOT-Lower) – (Far AOT-Upper)
Near Bid is defined	Underlying Near Bid > Near AOT-Upper OR Underlying Near Bid – Spread Ask price > Far AOT-Upper
Far Ask is defined	Underlying Far Ask < Far AOT-Lower OR Underlying Far Ask + Spread Ask price < Near AOT-Lower

8.3 Change History

Date	Version	Author	Notes
2 Oct 2012	1.0	DH	Initial Version
29 Jul 2013	1.01	DH	Added actions of Glance in regards to single session options. Clarified use of Time and System Event messages Clarified distribution of Text messages. Clarified action of Login Request Packet. Clarified process for building trade information from inter-spread trades. Corrected and added examples. Added Test Environment addressing configuration requirements. Added FAQ to the Appendix. Clarified time regarding expiry dates Added Channel C addressing configuration requirements.
10 Jan 2014	1.1	DH	Added new messages VOI and ETR
17 Feb 2014	1.11	DH	Removed “Price” field from Order Volume Cancelled message
26 Jun 2014	1.12	DH	Fixed hyper-links for MoldUDP64 and SoupBin30 PDF documents Clarified VOI message download via Glance snapshot Added Spread MIR questions to FAQ
16 Jul 2014	1.13	DH	Updated VOI text message for single session options
14 Oct 2016	1.14	DH	Added Channel D IP addresses and updated diagram

© Copyright 2016 ASX Limited ABN 98 008 624 691. All rights reserved 2016

9 Support Contact Details

Contact the ASX Market Access support team either via email on MarketAccess@asx.com.au or phone 1800 663 053 (or on +612 9227 0372 from outside Australia).

After hours support for production problems is provided from 18:00 hours to 08:00 hours. Data content and test system problems are not supported during this period.

Contact: ASX Production Services – +61 2 9227 0821.

Disclaimer
This document provides general information only and may be subject to change at any time without notice. ASX Limited (ABN 98 008 624 691) and its related bodies corporate ("ASX") makes no representation or warranty with respect to the accuracy, reliability or completeness of this information. To the extent permitted by law, ASX and its employees, officers and contractors shall not be liable for any loss or damage arising in any way, including by way of negligence, from or in connection with any information provided or omitted, or from anyone acting or refraining to act in reliance on this information. The information in this document is not a substitute for any relevant operating rules, and in the event of any inconsistency between this document and the operating rules, the operating rules prevail to the extent of the inconsistency.

ASX Trademarks
The trademarks listed below are trademarks of ASX. Where a mark is indicated as registered it is registered in Australia and may also be registered in other countries. Nothing contained in this document should be construed as being any licence or right to use of any trademark contained within the document.
ASX®, ASX Trade 24®