



A2X Binary Protocol (ATP) Specification

24th April 2019

Version 1.1.1



Version History

Version	Date	Comments
1.0	01 Aug 2017	Initial version.
1.1	24 Apr 2019	We have made some minor changes to the reject codes in the introduction and accepted protocol versions. We have also corrected the ordering of the standard header and trade bust fields.



1 Introduction

1.1 Introduction

This document describes the protocol and message formats for this trading interface. It is intended for those firms which are planning to develop against the protocol.

Please contact the A2X support team (support@a2x.co.za) for any questions related to this document.

1.2 Connectivity

A2X will provide trading Members that wish to use ATP to access the platform, with the necessary IP address and port information to establish a TCP/IP connection for their trading session.

In addition, a senderID and password for the session will be agreed.

One or more connections will be provided to the Member test environment and, on successful certification, connection details to the primary and backup production trading environments will be supplied. Connectivity options should be discussed with the A2X connectivity team.

1.3 Message Structure and Sequence Number Logic

The message structure principles for ATP are to provide efficient, fixed-length messages with binary field data directly aligned to the internal message structure used by the trading system.

To avoid unnecessary traffic on the internal trading system, session messages (login, logout, heartbeat) are not sequenced - only business messages relating to orders and trades are sequenced and recoverable. Sequenced messages belong to one of two streams - trading



Member to A2X or A2X to trading Member - each with their own numbering starting at 1 each trading day.

The sequence number of business messages to A2X must always increase. A message with a sequence number that is lower than, or the same as, one already seen will lead to the session being terminated with an appropriate error code. The sequence number of business messages sent from A2X to the trading Member will also increase, incremented by 1 on each message during the day.

1.4 Order Reference

In the ATP protocol it is not necessary for a separate client order identifier to be sent on an Order Add message.

The sequence number of the Order message is used by both sides as an 'order reference' to identify to that order in subsequent messages.

For example, if an Order Add message is sent in with msgSeqNo = 121, then any subsequent Order Modify messages for that order should carry orderRef = 121. Similarly an Order Cancel message should also carry the orderRef value. Responses and Trade messages from A2X will also carry orderRef = 121 to refer to the relevant order. Note that if an Order Modify or Order Cancel message had been sent in with, for example, msgSeqNo = 143 then the Order Modify Response or Order Cancel Response message would carry orderRef = 121 and msgRef = 143 to identify both the order and the request.

1.5 Clearing Configuration

Before trading is permitted in the cash equities market, the Trading Member must supply their CSDP details to the A2X Settlement Committee. This is verified and set up by A2X as part of the Member's trading configuration and settlement.



1.6 Cancel on Disconnect

Trading Members using ATP should note that "cancel on disconnect" behaviour is in place on ATP sessions by default. In other words, any open orders are cancelled as soon as a session disconnect is detected or if the user requests a session logout.

For example, if an Order Add message is sent in with msgSeqNo = 121, then any subsequent Order Modify messages for that order should carry orderRef = 121. Similarly an Order Cancel message should also carry the orderRef value. Responses and Trade messages from A2X will also carry orderRef = 121 to refer to the relevant order. Note that if an Order Modify or Order Cancel message had been sent in with, for example, msgSeqNo = 143 then the Order Modify Response or Order Cancel Response message would carry orderRef = 121 and msgRef = 143 to identify both the order and the request.

1.7 ATP Message Formats

This section provides details of the message formats used within the A2X Trading Protocol. This includes data types, message headers, message fields and descriptions.

In all messages, 1-byte packing is used and all integers are represented in little-endian format.

Data type	Size	Value
char(n)	n	Left justified ascii string, padded with zero (0x00) to length n
u8	1	unsigned integer 0-255
u16	2	unsigned integer 0-65,535



Data type	Size	Value
u32	4	unsigned integer 0-4,294,967,295
u64	8	unsigned integer 0-2 ⁶⁴ -1
Price	8	unsigned integer representing price with 5 decimal places implied i.e. value 1462500 represents a price of 14.625
Time	8	unsigned integer representing elapsed time in nanoseconds* since Unix epoch 00:00 UTC on 1st January 1970

1.8 Message Structure

All ATP messages carry a standard message header followed (for most message types) by a message body.

1.9 Order Status

This Order Status value is provided in the three most significant bits of the status byte field in the Order Add Response, Order Cancel Response and Order Modify Response messages.

Code	Order Status
1	Pending New (Internal use only)



Code	Order Status
2	Acknowledged
3	Cancelled
4	Rejected
5	Filled
6	Modified

For example Acknowledged for a day order is encoded as 0x40 (01000000), whereas Cancelled is encoded as 0x60 (01100000).

1.10 Reject Reasons

If an Order Add, or an Order Cancel or Order Modify request, is rejected then the Rejected order status is combined with a Reject Reason in the lower five bits of the status byte field.

The current set of reject reason codes are given below.

For example a reject because the given price does not conform to the tick table for the security would be encoded as 0x85 (10000101).

Code	Reject Reason
1	Not Authorised To Trade
2	Invalid Quantity
3	Invalid Price
4	Unknown Security
5	Price Does Not Conform To Tick



Code	Reject Reason
6	Invalid Order Type
7	Invalid Side
8	Invalid Order Capacity
9	Market Is Closed
10	Halted
11	Suspended
12	Invalid TimeInForce
13	Order Not Found / Not Open
14	No Clearing In Place
15	Failed Price Range Check
16	Invalid Clearing Account
17	Not Supported (e.g. stock not enabled for MaC)
18	Max Value Exceeded
19	MaC Ended (Cancelled or Locked)
20	Drop Feed Is Down
23	Stock Restricted
24	Minimum Consideration
27	Invalid



Code	Reject Reason
29	Bad Date
30	Duplicate
31	Reject Internal



2 ATP Message Components

2.1.1 Message Header

The header identifies the length and type of the message and, where appropriate, the sequence number of the message. The message body for a particular type of message is always a fixed length with all fields in a fixed order to support efficient creation and parsing of the binary ATP messages.

Field name	Type	Offset	Width	Comments
length	u16	0	2	Length of message including this header
msgType	u8	2	1	Message type
msgSeqNo	u32	3	4	Message sequence number from the user or A2X

2.2 Session Level Messages

2.2.1 Login Message

The Login message is the initial message used to establish a trading session. It is also used to re-establish a session after a break.

Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 1
protocolVersion	Protocol	7	2	A two byte field to represent the version of the ATP protocol that the user conforms to with major version number in the most significant byte and



				minor version number in the least significant byte. The current version v1.4 is LSB =4.represented by value 0x0104 i.e. MSB = 1
senderId	char(n)	9	16	Value as agreed with A2X to identify the Members ATP session
password	char(n)	25	16	Password as agreed with A2X to verify the user
inactivityTimeout	u16	41	2	Optional inactivity timeout in seconds. If there are no messages received for this period of time then A2X will close the session (triggering cancel on disconnect)
atpSeqNo	u32	43	4	The next sequence number from A2X that the trading Member is expecting. After a drop or break in the session this can be used by A2X to identify a gap and trigger any missed messages to be re-sent (see Login Response).

2.2.2 Login Response

The Login Response message is sent by A2X to acknowledge a Login request, and either accept or reject it.

Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 2
resultCode	u8	7	1	Result of logon attempt 0 = Successful login 1 = Already logged in 2 = Sequence number error



3 = Unsupported protocol

4 = Failed authentication (incorrect password)

clientSeqNo	u32	8	4	Next sequence number A2X expects to receive
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2.2.3 Heartbeat

A Heartbeat message is simply a message header with a heartbeat id as the message content. For a heartbeat, msgType is set to 0 and msgSeqNo is set to the sequence number that will be set on the next business message.

For example, pre-market, before any orders have been sent each Heartbeat message will carry msgSeqNo = 1. The value does not increment because the heartbeat is an unsequenced, session level message.

A2X will respond to a Heartbeat message with an outbound Heartbeat message to confirm receipt and the reliability of the connection.

Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 0

2.2.4 Logout Request Message

The Logout Request message is used by the trading Member to request the closure of a trading session. There is no message body required, simply a message header with msgSeqNo = 3.

Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 3



2.2.5 Logout Message

The Logout message is usually sent as a response to the Logout Request however it may also be sent by A2X in case of a low sequence number or other protocol violation, or for other reasons. The TCP/IP connection is closed immediately after this message has been sent.

Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 4
reasonCode	u8	7	1	Reason for logout 0 = User requested 1 = Admin (market operations) 2 = Disconnect 3 = End of Day 4 = Inactivity timeout 5 = Protocol error 6 = Sequence number error
reasonText	char(n)	8	32	Text describing reason for logout

2.3 Business Messages

2.3.1 Order Add Message

The Add Order message is sent by the trading Member to enter an order for a particular security.

Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 5



securityId	u16	7	2	Numeric security identifier
orderType	u8	9	1	1 = Limit Order 6 = Market at Close 8 = POCR 9 = Post-Only
timeInForce	u8	10	1	Time in force for this order 1 = Day order 2 = Fill or Kill (FOK) 3 = Immediate or Cancel (IOC)
side	u8	11	1	1 = Buy order 2 = Sell order
quantity	u32	12	4	Number of shares
price	Price	16	8	The price of the order
orderCapacity	u8	24	1	1 = Agency 2 = Principal
account	u8	25	1	Clearing account identifier 1 = House Account 2 = ID for agreed Client Account Code
userTag	u64	26	8	Free form tag assigned by trading Member

2.3.2 Order Cancel Message

The Order Cancel message is sent when a user wishes to cancel an open order.

Field name	Type	Offset	Width	Comments
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Message Header		0	7	msgType = 7
orderRef	u32	7	4	Order reference number
userTag	u64	11	8	Free form tag assigned by trading Member

2.3.3 Order Modify Message

The Order Modify message is sent when a user wishes to modify an open order. Order quantity and/or limit price may be modified. Both values must be included, even if one of them is unchanged.

Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 9
orderRef	u32	7	4	Order reference number
price	Price	11	8	The new price of the order
quantity	u32	19	4	The new order quantity
userTag	u64	23	8	Free form tag assigned by trading Member

2.3.4 Order Add Response

A2X sends an Add Order Response message to acknowledge the receipt of an Order Add message. The message is used to notify the trading Member whether or not their order was accepted and, if so, whether it executed (partially or fully) and whether any residual quantity has been added to the book or has been cancelled

Field name	Type	Offset	Width	Comments
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Message Header		0	7	msgType = 6	
orderRef	u32	7	4	Order reference number	
marketDataId	u32	11	4	The id of this order as seen in the A2X market data. This value will be zero if the order is cancelled (IOC) or fully traded on entry	
status	Status	15	1	Bits 0 to 5 - reason	reason code
					0 = None
					1 = Not Authorised To Trade
					2 = Invalid Quantity
					3 = Invalid Price
					4 = Unknown Security
					5 = Price Does Not Conform To Tick
					6 = Invalid Order Type
					7 = Invalid Side
					8 = Invalid Order Capacity
					9 = Market Is Closed
					10 = Halted
					11 = Suspended
					12 = Invalid TimeInForce
					13 = Order Not Found / Not Open
					14 = No Clearing In Place
					15 = Failed Price Range Check



16 = Invalid Clearing Account
17 = Not Supported (e.g. stock not enabled for MaC)
18 = Max Value Exceeded
19 = MaC Ended (Cancelled or Locked)
20 = Drop Feed Down
23 = Stock Restricted
24 = Minimum Consideration
27 = Invalid
29 = Bad Date
30 = Duplicate
31 = Reject Internal

Bits 5 to 8 - status

status code
1 = Pending New
2 = Acknowledged
3 = Cancelled
4 = Rejected
5 = Filled
6 = Modified

tradedQuantity	u32	16	4	Number of shares traded if any
timestamp	Time	20	8	Time that the order was accepted or rejected by the A2X system
userTag	u64	28	8	Free form tag as assigned by trading Member on the Order Add message



2.3.5 Order Cancel Response

A2X sends an Order Cancel Response to accept or reject an Order Cancel message. The message is also used if an order is cancelled by Market Operations or due to cancel on disconnect. For Market at Close orders, the message is used to cancel unmatched order quantity at lock time or if the match is cancelled for a particular security. Note that the cancel reason is particularly important for MaC orders, as discussed in the introduction.

Cancel Reason

The Cancel Reason is provided in the lower five bits of the status byte field in the Order Cancel Response message.

Code	Cancel Reason
1	Member request
2	A2X forced cancel
3	Market close
4	Expired
5	Reserved
6	Aborted
7	Self-trade prevention
8	Cancel on disconnect
9	Post-only

This is combined with the Cancelled order status, for example a cancel in response to a Trading Member's request is encoded as 01100001 (0x61) and a cancel of unmatched quantity at MaC lock time is encoded as 01100100 (0x64).



Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 8
orderRef	u32	7	4	Order reference number
requestRef	u32	11	4	Sequence number (msgSeqNo) of the trading Members cancel request message. Note that this field will be zero in the case of a forced cancel by A2X Market Operations.
statusClx	Status	15	1	<p>ReasonCode</p> <ul style="list-style-type: none"> 0 = None 1 = Member Request 2 = A2X forced cancel 3 = Market Close 4 = MaC Lock 5 = Reserved 6 = MaC Cancelled 7 = Self-Trade Prevention 8 = Cancel On Disconnect 9 = Post-Only Cancel 10 = Cancel Residual MaC Order Quantity 11 = Post-Only Cancel Resting <hr/> <p>Bits 0 to 5 - reason</p> <hr/> <p>Bits 5 to 8 - status</p> <ul style="list-style-type: none"> status code 1 = Pending New 2 = Acknowledged 3 = Cancelled 4 = Rejected



5 = Filled
6 = Modified

timestamp	Time	16	8	Time that the cancellation was accepted or rejected by the A2X system
userTag	u64	24	8	Free form tag as assigned by trading Member on the Order Cancel message

2.3.6 Order Modify Response

A2X sends an Order Modify Response to accept or reject an Order Modify message.

Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 10
orderRef	u32	7	4	Order reference number
requestRef	u32	11	4	Sequence number (msgSeqNo) of the trading Members modify request message.
statusMod	Status	15	1	reasonCode 0 = None 1 = Modification accepted
				Bits 0 to 5 - reason 2 = Order cancelled as a result of modification which updates the remaining quantity to zero
				Bits 5 to 8 - status status code



- 1 = Pending New
- 2 = Acknowledged
- 3 = Cancelled
- 4 = Rejected
- 5 = Filled
- 6 = Modified

timestamp	Time	16	8	Time that the modification was accepted or rejected by the A2X system
userTag	u64	24	8	Free form tag as assigned by trading Member on the Order Modify message

2.3.7 Trade Message

The Trade message is published when an order executes. The Trade message is also used to communicate indicative trade reports at lock time for Market at Close orders. Note that the price and tradeRef values will be zero for indicative trade reports published when MaC orders are matched at lock time.

Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 11
orderRef	u32	7	4	Order reference number
quantity	u32	11	4	Number of shares traded if any
price	Price	15	8	The price of the trade
side	u8	23	1	1 = Buy order 2 = Sell order



tradeRef	u32	24	4	Trade reference number
ccpCode	u8	28	1	Clearing CCP code 1 = Self clearing 2 = EMCFNL2A
liqIndicator	u8	29	1	1 = Added liquidity 2 = Removed liquidity 3 = Removed liquidity (hidden quantity)
securityId	u16	30	2	Numeric security identifier
timestamp	Time	32	8	Time that the trade occurred on the A2X system
userTag	u64	40	8	Free form tag as assigned by trading Member on the Order Add message or the most recent Order Modify message

2.3.8 Trade Bust Message

If a trade is invalidated, a Trade Bust message is sent to notify the trading Member.

Field name	Type	Offset	Width	Comments
Message Header		0	7	msgType = 12
orderRef	u32	7	4	Order reference number
quantity	u32	11	4	Number of shares on invalidated trade
price	Price	15	8	The price of the invalidated trade
side	u8	23	1	1 = Buy order 2 = Sell order



tradeRef	u32	24	4	Trade reference number for the invalidated trade
timestamp	Time	28	8	Time that the trade was busted by A2X Market Operations
