NYSE Euronext

ArcaTrade Specification for Options

For the NYSE Arca Options Exchange

January 23, 2009
Version 3.03

Table 1 Revision History

Date	Revision	Change Made by:	Synopsis of Change
01-06-2006	0.01	Fred Jones	Compilation of ArcaBook for Options and ArcaTrades for Equity and Bonds
02-17-2006	0.02	SMitchell	Reorganization and copy edits. Bandwidth changes. Access time changes. Message type changes to lowercase. Message sequencing not by series.
03-28-2006	0.03	Fred Jones	Indicate possible internal usage of underlying symbol field. Add 4 bytes padding to last sale message.
4-3-2006	1.00	Eric Stockland	Updated bandwidth recommendation
5-3-2006	1.05	Chris McCown	System Event(Halt/Unhalt) Tentative Multicast IP included.
4-14-08	1.06	Dzintars Dzilna	Cosmetic edits
10-17-08	3.0	Anil Nagasamudra	Added Sale Condition, Series Index Mapping, Removed OPRA symbology
11-14-2008	3.01	Chris McCown	Included Old IPs
01-14-09	3.01	David Le	Added source IP
01-21-09	3.02	David Le	Added Cert IP. Change Underlying message type to ‘n’
01-22-09	3.03	Anil Nagasamudra	Added additional details to index mapping request. Made underlying quantity reserved for future use.
01-31-2009	3.04	Anil Nagasamudra	Changed Ips for complex, Series, Imbalance, Last sale channels

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1 Introduction

ArcaTrade is a real-time data feed that disseminates bond and/or option last sale information to subscribers of Archipelago's equities and options trading platforms. ArcaTrade allows subscribers to produce and display the Archipelago® last sale ticker.

Archipelago provides two ArcaTrade interfaces to meet different customer requirements:

Interface	Bonds	Options	Description
ArcaTrade for Bonds	✓		A data feed for bond trades and trade modifications.
ArcaTrade for Options		✓	A data feed for option trades and trade modifications.

This specification is for developers that wish to write applications that interface with ArcaTrade for Options.

Trade data only reflects trades that take place within Archipelago trading platforms, rounded down to the nearest lot. Routed, mixed, and odd lot trades may be added to the feed at a later date.

ArcaTrade Interface

This interface is message-based, using fixed length messages over a UDP IP Multicast with binary number and fixed length ASCII fields. Binary values are in network Endian (Bid Endian) format.

The interface contains the following categories of messages:

- UDP (User Datagram Protocol) Multicast, to broadcast trade details
- TCP/IP Recovery, to recover packets dropped by the UDP multicast

Archipelago API Certification

Subscribers must certify their ArcaTrade subscription clients with Archipelago. Archipelago provides an IP address, port number, username, and password to use for testing. To schedule a test, please call the FIX hotline at 888-689-7739 (Option 1) or email connectivity@nyx.com

2 Communication

Access

ArcaTrade for Options subscribers connect to multicast addresses for the primary Last Sale data feeds and can also connect to a TCP/IP server for packet retransmissions.

ArcaTrade for Options disseminates last sale data from approximately 9:30a.m. to 4:00p.m. EST. ArcaTrade may be accessible for connectivity prior to 3:30a.m. EST depending on start-of-day processing.

Multicast Last Sale Data Feeds

Multicasts for ArcaTrade for Options uses UDP.

Each subscription address has two data feeds each with an IP address and port. For example:

Current IPs

Subscription	Type	Underlyings	NYSE Arca Primary Multicast IP	NYSE Arca Secondary Multicast IP	Primary Port	Secondary Port
255	Last Sales	A-Z	224.1.2.31	224.1.2.63	11255	12255

Future IPs

Subscription	Type	Underlyings	NYSE Arca Primary Multicast IP	NYSE Arca Secondary Multicast IP	AMEX Primary Multicast IP	AMEX Secondary Multicast IP	Primary Port	Secondary Port
127	Last Sales	A-Z	224.0.41.63	224.0.41.191	224.0.58.63	224.0.58.191	11063	12191

> **Note:** ArcaTrade for Options will disseminate all last sale data to a single multicast address. The number of subscriptions and their configuration is subject to change.

ArcaTrade for Options trade messages are sent in packets. Several messages can be transmitted in a single packet. Each packet has a header containing the packet size and a packet sequence number.

In the event a packet is lost on the primary feed for a subscription, clients can retrieve the lost packet from the secondary feed. Because UDP is unreliable and may drop packets from both feeds, Archipelago provides a TCP/IP Recovery Server from which clients can request dropped packets. See the Recovery section for more information.

TCP Source IP addresses

The table below outlines the TCP Source IP addresses, applicable to each Port.

TCP Source IP NYSE ARCA	TCP Source IP AMEX
63.211.72.xxx	208.92.194.xxx
8.9.19.xxx	8.9.33.xxx

Current OX CERT Breakout

Subscription	Type	Underlyings	Primary Multicast IP	Primary Port	Secondary Multicast IP	Secondary Port
255	Last Sales	A-ZZ	224.1.2.27	10050	224.1.2.47	20050

TCP Source IP CERT addresses

The table below outlines the TCP Source IP addresses, applicable to each Port.

TCP Source IP CERT NYSE ARCA
63.211.72.xxx

TCP/IP Recovery

Subscribers may connect to the TCP/IP Recovery Server to request dropped packets from the ArcaTrade for Options multicast feed. The Recovery Server accepts connections on predefined addresses and ports and requires a login before responding to requests. It accepts primary and backup connections to assist recovery on the subscriber's end.

Archipelago supplies subscribers with the following parameters:

- An IP address
- A port
- A username
- A password

Subscribers supply Archipelago with the IP address for their connection.

Bandwidth Requirements

The recommended minimum bandwidth for ArcaTrade for Options multicast is 1.5 Megabits per second, roughly a T1 connection.

Archipelago offers connectivity to both its Chicago and New Jersey data centers. ArcaTrade clients are strongly recommended to implement redundant connectivity to ensure they continue to receive last sale data in the event of issues with their primary connection.

3 Messages

Data Types

All numeric fields are in unsigned binary. Binary data is in network Endian (Big Endian) format. All alphanumeric fields are left justified and null padded.

Sequence Numbers

Sequence Numbers for packets and for messages are four byte integers. These numbers start the data feed session at one and increment by one for each new packet or message. See the Recovery section for more information on sequence numbers.

Prices

Prices are four byte integers in binary scaled to four decimal positions. To determine the decimal price, divide the whole integer price by 10,000.

- **Example 1**: Whole integer price is 135000. The decimal price is 135000 ÷ 10,000 = 13.50.
- **Example 2**: Whole integer price is 13500. The decimal price is 13500 ÷ 10,000 = 1.35.

Trade Reference ID

The Trade Reference ID will be a value of a 64 bit long. To convert it in a 32 bit processing environment the following example can be used.

Example 1: Big Endian Environment

Trade Reference ID	Offset	Len	Type	Notes and Values
ID	0	4	Binary	OrderID (1 – 4,294,967,294)
MarketID	4	2	Binary	Market ID (0-65,536)
SystemID	6	1	Binary	Matching engine number (0-256)
Pad	7	1		

- **Example 2**: Little Endian Environment

Trade Reference ID	Offset	Len	Type	Notes and Values
Pad	0	1		
SystemID	1	1	Binary	Matching engine number (0-256)
MarketID	2	2	Binary	Market ID (0-65,536)
ID	4	4	Binary	OrderID (1 – 4,294,967,294)

Timestamps

The timestamp field is a four byte integer that provides time in milliseconds starting from Midnight (00:00:00:000) of the trading day. ArcaTrade computes timestamps as:

```
Seconds x 1000 + milliseconds
```

For example, the timestamp for 10:00:00:376 is converted to:

```
(36000 x 1000) + 376 = 36000376.
```

Packets

All Packets are encapsulated in variable length Transmission Blocks, as shown below.

Packet Length	**Type**	**Subscription**	**Packet Sequence Number**	**Messages**
The full length of the packet as 2 byte Numeric Binary	A 1 byte Alpha/Numeric code: M = Message B = Heartbeat N = Not found (for TCP/IP packet replay only)	The subscription number for the packet as 1 byte Numeric Binary (0 -255)	A 4 Byte Numeric Binary. For heartbeat packets (Type=B), this is the last Packet Sequence Number sent.	Messages are not present in heartbeat or not found packets (Type B or N).

Messages within a packet may be for different option series.

Heartbeat packets do not contain messages and do not increment the Packet Sequence Number. Heartbeat packets are only sent during periods of inactivity to indicate the connection is still open.

Recovery

In the event a packet is lost on the primary ArcaTrade feed for a subscription, clients can check the secondary feed for the lost packet. If both feeds have dropped the packet, clients can request retransmission from the TCP/IP Recovery Server.

Clients use the subscription number and the packet sequence number to request missing packets in the Dropped Packet Request Message. Packet sequence numbers and message sequence numbers start from one each day for a specific multicast subscription number.

4 UDP Multicast Messages

All ArcaTrade for Options messages are sent over multicast. They all begin with the following header.

ArcaTrade for Options Message Header	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	0 – 65535 (value includes 8 byte header)
Message Type	2	1	Alpha/Numeric	A single character to identify the message
Possible Duplicate	3	1	Binary	0 = original message 1 = possible duplicate message
Time Stamp	4	4	Binary	Milliseconds since Midnight

Underlying Index Mapping

Underlying Index Messages will be the first messages sent down the multicast feeds. Each subscription will send the underlying mappings used on its subscription.

Underlying Index Mapping Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	32
Message Type	2	1	Alpha/Numeric	‘n’
Subscription	3	1	Binary	0-255 identifying the Subscription
Time Stamp	4	4	Binary	Milliseconds since Midnight
Message Body(24 Bytes)				
Underlying Index	8	4	Binary	Underlying Stock Mapping Index
Market ID	12	2	Binary	Identifies Market Origin: 0 - 65,535
System ID	14	1	Binary	Identifies Trading Engine: 0 - 255
Bit	15	1	Alpha	NULL
Reserved6	16	4	Binary	NULL
Price Scale	20	1	Binary	Decimal places on price
Price Resolution	21	1	Alpha	‘0’ = Penny ‘1’ = Penny/Nickel ‘5’ = Nickel/Dime
Exchange Code	22	1	Alpha	‘N’ = NYSE ‘Q’ = Nasdaq ‘P’ = Arca ‘A’ = AMEX
Security Type	23	1	Alpha	A = ADR C = Common

Underlying Index Mapping Message	Offset	Len	Type	Notes and Values
				E = ETF F = Foreign, I = Units M = Misc, P = Preferred R = Rights S = Shares of Ben Int T = Test U = Units W = Warrant
Symbol	24	6	Alpha	Stock Ticker Symbol, Left Justified - NULL Padded
Reserved3	30	1	Alpha	NULL
Reserved4	31	1	Alpha	NULL

Series Index Mapping

Series Index Messages will be immediately follow the underlying index messages. Each subscription will send the series mappings used on it's subscription.

Series Index Mapping Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	60
Message Type	2	1	Alpha/Numeric	'm'
Subscription	3	1	Binary	0-255 identifying the Subscription
Time Stamp	4	4	Binary	Milliseconds since Midnight
Message Body(52 Bytes)				
Series Index	8	4	Binary	Series Mapping Index
Market ID	12	2	Binary	Identifies Market Origin: 0 - 65,535
System ID	14	1	Binary	Identifies Trading Engine: 0 - 255
Bit	15	1	Alpha	NULL
Underlying Index	16	4	Binary	Underlying Stock Mapping Index
Reserved1	20	2	Binary	NULL
Reserved2	22	1	Binary	NULL
Reserved3	23	1	Alpha	NULL
Reserved6	24	4	Binary	NULL
Underlying Quantity	28	4	Binary	0. Reserved For Future Use.
Underlying Symbol	32	6	Alpha	Underlying Stock Ticker Symbol – (Left J space padded)
Expiry Year	38	2	Alpha	YY

Series Index Mapping Message	Offset	Len	Type	Notes and Values
Expiry Month	40	2	Alpha	MM
Expiry Day	42	2	Alpha	DD
Put or Call	44	1	Alpha	'P' = Put 'C' = Call
Strike Price Whole	45	5	Alpha	Right Justified, Zero Filled
Strike Price Decimal	50	3	Alpha	Left Justified, Zero Filled
Price Scale	53	1	Binary	Decimal places on price
Option Symbol	54	5	Alpha	The full OPRA symbol for this series. Left NULL padded.
Reserved4	59	1	Alpha	NULL

Last Sale Message

ArcaTrades sends this message for either of these trade events:

- An order partially trades
- An order completely trades

Last Sale Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	40
Message Type	2	1	Alpha/Numeric	'x'
Subscription	3	1	Binary	127 identifying the Subscription
Time Stamp	4	4	Binary	Milliseconds since Midnight
Message Body (32 bytes)				
Series Index	8	4	Binary	Series Mapping Index.
Market ID	12	2	Binary	NULL
System ID	14	1	Binary	NULL
Bit	15	1	Alpha	NULL
Sequence Number	16	4	Binary	Message sequence number. 1 – 4,294,967,294
Contracts	20	4	Binary	Number of contracts traded
Trade Reference Number	24	8	Binary	The unique reference number per trading platform (system code) assigned to this trade.
Price	32	4	Binary	Trade price
Possible Duplicate	36	1	Binary	0 = original message 1 = possible duplicate message
Complex	37	1	Alpha	"P" = Complex trade with equity leg "L" = Complex trade
Sale Condition	38	1	Alpha	"S" = ISO Sweep Trade "I" = Late Report
Padding	39	1	Alpha	Padding

Trade Bust or Correction Message

ArcaTrade sends this message for trade busts or trade corrections. The Event Code field identifies the triggering event.

Last Sale Message	Offset	Len	Type	Notes and Values

Last Sale Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	40
Message Type	2	1	Alpha/Numeric	'u'
Subscription	3	1	Binary	127 identifying the Subscription
Time Stamp	4	4	Binary	Milliseconds since Midnight.
Message Body (32 bytes)				
Series Index	8	4	Binary	Series Mapping Index.
Market ID	12	2	Binary	NULL
System ID	14	1	Binary	NULL
Bit	15	1	Alpha	NULL
Sequence Number	16	4	Binary	Message sequence number. 1 – 4,294,967,294
Contracts	20	4	Binary	Number of contracts traded
Trade Reference Number	24	8	Binary	The unique reference number per trading platform (system code) assigned to the trade that has been busted or corrected.
Price	32	4	Binary	Price of the trade that has been busted or corrected. For corrections, this represents the corrected price.
Possible Duplicate	36	1	Binary	0 = original message 1 = possible duplicate message
Complex	37	1	Alpha	"P" = Complex trade with equity leg "L" = Complex trade
Sale Condition	38	1	Alpha	"S" = ISO Sweep Trade "I" = Late Report
Event Code	39	1	Alpha	"B" = trade bust "C" = trade correction

System Event Message

System Event messages are used to Halt and Unhalt a Series.

System Event Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	24
Message Type	2	1	Alpha/Numeric	'v'
Subscription	3	1	Binary	0-255 identifying the Subscription
Time Stamp	4	4	Binary	Milliseconds since Midnight
Message Body(16 Bytes)				
Series Index	8	4	Binary	Series Mapping Index
Market ID	12	2	Binary	NULL

System Event Message	Offset	Len	Type	Notes and Values
System ID	14	1	Binary	NULL
Bit	15	1	Alpha	NULL
Message Sequence Number	16	4	Binary	Archipelago assigned sequence number. 1 – 4,294,967,294 within a series.
Reserved	20	2	Alpha	NULL
Event Code	22	1	Alpha	S = Suspend(Halt Series) U = Unhalt Series.
Reserved	23	1	Alpha	NULL

5 TCP/IP Recovery Messages

ArcaTrade for Options Recovery Server Messages

HeartBeat Request Message

The Recovery server sends this message every 60 seconds. This prevents some firewalls from timing out the TCP/IP connection. Clients must respond with a Heartbeat Response message. This message only has a message header.

HeartBeat Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	8 bytes
Message Type	2	1	Alpha/Numeric	'h'
Padding	3	1		
Time Stamp	4	4	Binary	Milliseconds since Midnight.

Test Response Message

The Recovery server sends this message in response to a Test Request message from a client.

Test Response Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	28 bytes
Message Type	2	1	Alpha/Numeric	't'
Padding	3	1		
Time Stamp	4	4	Binary	Milliseconds since Midnight.
Message Body(20 Bytes)				
Test Message	8	20	Alpha	The client text to echo from the Test Request message.

Login Accepted Message

The Recovery Server sends this message to indicate that a client's login request has been accepted.

Login Accepted Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	12 bytes
Message Type	2	1	Alpha/Numeric	'l'
Padding	3	1		
Time Stamp	4	4	Binary	Milliseconds since Midnight.
Message Body(4 Bytes)				
Padding	8	4	Alpha	

Login Rejected Message

The Recovery Server sends this message when a client request to log in is invalid. This message is also sent when the server has exceeded the maximum connection limit for this port or when a connection has timed out (client connects and does not log in within 30 seconds). The Reject Code field indicates the reason for the rejection. The Recovery Server closes the socket connection after sending this message.

Login Rejected Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	12 bytes
Message Type	2	1	Alpha/Numeric	'r'
Padding	3	1		
Time Stamp	4	4	Binary	Milliseconds since Midnight.
Message Body(4 Bytes)				
Reject Code	8	1	Alpha	"A" = Not Authorized "M" = Maximum Server Connections Reached "T" = Timeout
Padding	9	3	Alpha	

Packet Replay Message

The Recovery Server sends this message in response to client requests for missing packets.

Packet Replay Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Packet Length	0	2	Binary	Size of the packet including messages.
Message Type	2	1	Alpha	See the **Error! Reference source not found.** section for more information. M= Message N=Not found if the packet requested is unknown
Subscription	3	1	Binary	The subscription address. 0-255.
Packet Sequence Number	4	4	Binary	Sequence number of packet.
Message Body				
Messages	8	Variable	Variable	

Messages Sent by Subscribers

Login Request Message

Clients send this message to log into the ArcaTrade for Options Recovery Server. The server responds with a Login Accepted or Login Rejected message.

Logon Request Message	Offset	Len	Type	Notes and Values
Header (8bytes)				
Message Length	0	2	Binary	28 bytes
Message Type	2	1	Alpha/Numeric	'L'
Padding	3	1		
Time Stamp	4	4	Binary	Milliseconds since Midnight. (Not required)
Message Body(20 Bytes)				
Username	8	8	Alpha	Username
Password	16	12	Alpha	Password

Heartbeat Response Message

Clients send this message as a response to the Heartbeat Request message. If the server does not receive a Heartbeat Response within 60 seconds of sending the Heartbeat Request message, the server closes the connection. This message only contains a header.

HeartBeat Response Message	Offset	Len	Type	Notes and Values
Message Length	0	2	Binary	8 bytes
Message Type	2	1	Alpha/Numeric	'H'
Padding	3	1		
Time Stamp	4	4	Binary	Milliseconds since Midnight. (Not required)

Test Request Message

Clients send this message to request a response from the ArcaTrade for Options Recovery Server during periods of inactivity. The client can specify a text message for the server to echo backing its response.

Test Request Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	28 bytes
Message Type	2	1	Alpha/Numeric	'T'
Padding	3	1		
Time Stamp	4	4	Binary	Milliseconds since Midnight. (Not required)
Message Body(20 Bytes)				
Test Message	8	20	Alpha	Text to be echoed.

Index Mapping Request Message

Clients send this message to request a response from the ArcaBook for Options Recovery Server to get a full mapping of underlying stock and series details. The mapping messages are sent over the TCP socket uncompacted for all subscriptions.

Test Request Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	8 bytes
Message Type	2	1	Alpha/Numeric	'M'
Subscription	3	1	Binary	0 -255, the multicast subscription number
Time Stamp	4	4	Binary	Milliseconds since Midnight (not required)

Dropped Packet Request Message

Clients request missing packets with this message. This can be a single packet or a contiguous set of packets. Packets are identified by the Subscription number (multicast address) and the packet number.

Packet Request Message	Offset	Len	Type	Notes and Values
Header (8 bytes)				
Message Length	0	2	Binary	16 bytes
Message Type	2	1	Alpha/Numeric	'P'
Subscription	3	1	Binary	The multicast address for this missed packet. 0-255.
Time Stamp	4	4	Binary	Milliseconds since Midnight (not required)
Message Body(8 Bytes)				
Starting Packet Number	8	4	Binary	1 – 4,294,967,294
Ending Packet Number	12	4	Binary	1 – 4,294,967,294

