MOON ATS – Overnight Multicast Data Feeds

Technical Specification

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1. Introduction

1.1 Overview

This document provides technical specifications for the MOON ATS (“MOON”) market data feeds.

The MOON ATS publishes a complete Order by Order (Depth) plus aggregated Top of Book (TOB) feed.

2. Binary Channels

2.1 Binary Message Distribution

Each UDP multicast packet will contain a packet header. In the case where this header indicates it is a Heartbeat or Sequence Number Reset, the packet will contain no other messages. The SeqNum field will always contain the next expected sequence number not the current. For most packets, the PacketFlag field will be unset (zero), which indicates normal message traffic. In this case, the Messages field of the packet header will contain the number of messages contained in that packet.

Each message contained in the packet will contain a message header, which specifies the message type and message size. The message type and size fields should be used for decoding individual messages. It is important to note that future versions may append additional data fields to a message, thus proper use of the message size will be critical to ensuring backward compatibility.

Messages will be formatted in big endian, with each field having a fixed length and a fixed position.

2.1.1 Packet Header

Field	Offset	Size	Format	Description
PacketSize	0	2	Binary Short Integer	Size of packet + header size in bytes
SeqNum	2	4	Binary Integer	Sequence number of packet (channel specific). If heartbeat or if sequence number is being reset, will contain next expected sequence number.
PacketFlag	6	1	Binary Byte	see Packet flag definition
Messages	7	1	Binary Byte	Number of messages in packet
PacketMilli	8	4	Binary Integer	Milliseconds since local time midnight (EST/EDT)

2.1.2 Packet Flag

Bit	Name	Set	Clear
0	Heartbeat[1]	Heartbeat Message	Normal Message Content
1	Reserved		
2	Reserved		
3	Reserved		
4	Reserved		

Bit	Name	Set	Clear
5	Reserved		
6	Reserved		
7	Reserved		

[1] A Heartbeat is sent if no business level message has been published for more than a second. The heartbeats will continue to be sent in 1 second intervals until the next business level message is published.

2.1.3 Message Header

Field	Offset	Size	Format	Description
MessageSize	0	2	Binary Short Integer	Size of message + header size in bytes
MessageType	2	1	Binary Byte	See Message Type Below
Message Payload	3	-		

Message	Security	Start of Spin	End of Spin	Trading Session	Order Add	Order Update	Order Delete	Order Execution	Order Execution with Price	Trade	Top Of Book	Imbalance	Login Request	Login Response	Retransmission Request	Retransmission Response	Spin Request	Spin Response	Heartbeat	System Recovery Event
Value	9	11	12	20	21	22	23	24	25	26	27	28	l	a	r	b	s	c	h	J

Table 1: Message Type Values

2.2 Message Definitions

2.2.1 Start of Spin

After a Spin Response Message, with status ‘S’, this message appears on all channels and indicates the beginning of a spin message cycle.

Field	Offset	Size	Format	Description
SpinType	0	1	Binary Byte	1 – Reference
SpinStartTimeMilli	1	8	Binary Long	Milliseconds since UTC epoch
SpinLastSeqNum	9	4	Binary Integer	Ignore, not used
Message Size		13		

2.2.2 End of Spin

This message appears on all channels and indicates the end of a spin message cycle. It will be followed by a Spin Response Message, with status ‘E’

Field	Offset	Size	Format	Description
SpinType	0	1	Binary Byte	1 – Reference
SpinMsgCt	1	4	Binary Integer	Total messages in spin
SpinEndTimeMilli	5	8	Binary Long	Milliseconds since UTC epoch
SpinLastSeqNum	13	4	Binary Integer	Number of messages in spin.
Message Size		17		

2.2.3 Trading Session

This message appears on all channels and is sent out at the start of each MOON trading session:

- Order Acceptance: MOON will accept orders starting at 7:30 PM.
- Market Open: Orders are accepted for publication and trading at 8:00 PM
- Market Close: Orders expire at 4 AM.

The message can also be sent mid-day if a technical outage caused a temporary closure of a market.

Field	Offset	Size	Format	Description
Time	0	8	Binary Long	Milliseconds since UTC epoch
TradingSession	8	1	Binary Byte	1 – Order Acceptance (7:30 PM) 6 – Overnight (8 PM) 5 – Market Close (4 AM)
Message Size		9		

2.2.4 Security

The Security Message appears on all channels and provides basic security attribute information for all OTC equity securities.

Field	Offset	Size	Format	Description
Symbol	0	14	Printable ASCII	Ticker symbol
LastUpdateMilli	14	8	Binary Long	Milliseconds from UTC epoch
SecurityAction	22	1	Binary Integer	0x1 = Update 0x2 = Add 0x3= Delete 0x4= Spin
AssetClass	23	1	Binary Byte	0x1 = Equity 0x2 = Fixed Income
SecurityID	24	4	Binary Integer	Unique security ID issued by OTC Markets
SecurityFlags	28	2	Bit Field	See SecurityFlag definition

Field	Offset	Size	Format	Description
Tier	30	1	Binary Byte	The market tier assigned by OTC Markets Group. Valid values: 0 – No Tier
ReportingStatus	31	1	Printable ASCII	A – Alternative Reporting Standard B – Bank/Thrift F – SEC Reporting G – International Reporting I – Insurance Company N – No Reporting O – Other Reporting Standard R – FINRA Reporting V – SEC Reporting - Investment Company W – SEC Reporting – Reg A
SecurityStatus	32	1	Printable ASCII	A – Active Q – Quote Only S – Suspended H – Halted I – Internal Halt R – Revoked D – Deleted X – Removed from IDQS
Message Size		33		

2.2.5 Security Flag

This flag notes security level attributes and is only included in the Security Message.

Bit	Name	Set	Clear
0	PiggybackFlag 15c2-11 “PiggyBack” exempt security status flag	Yes	No
1	CaveatFlag Indicates whether a Caveat Emptor warning has been applied to the security.	Yes	No
2	144A QIB Only Indicates that the security may only be purchased or sold by Qualified Institutional Buyers (QIBs) or agents acting on behalf of QIBs.	Yes	No
3	UnsolicitedOnlyFlag Indicates if a security may only be quoted Unsolicited.	Yes	No
4	Closing Cross Auction Indicates if security participates in the OTC Link Closing Cross Auction	Yes	No
5 - 15	Reserved		

2.2.6 Order Add

This message appears on the DOB channel.

Field	Offset	Size	Format	Description
Time	0	4	Binary Integer	Milliseconds from midnight
Order Id	4	14	Printable ASCII	Day-specific identifier assigned to this order. See Note below.
Side Indicator	18	1	Printable ASCII	"B" = Buy Order "S" = Sell Order
Quantity	19	4	Binary Integer	Number of shares being added to the book
Symbol	23	14	Printable ASCII	Symbol right padded with spaces.
Price	37	8	Binary Long Price	The limit order price. The long value represents the price scaled by 1,000,000 (6 decimal places).
Firm Id	45	4	Printable ASCII	Firm’s MPID
Unsolicited	49	1	Printable ASCII	"Y" = Unsolicited "N" = Not Unsolicited
Order Flags	50	2	Binary Short Integer	TBD
Message Size		52		

Note: The Order ID consists of 14 alphanumeric characters. Use the first 12 characters of the string and convert them from base-36 to a 64-bit integer. Ignore the last two characters. Example: Order ID: 7A400CY528L9SN. Use 7A400CY528L9 → convert from base-36 to a 64-bit integer. Ignore the last two characters SN.

2.2.7 Order Update

This message appears on the DOB channel.

Field	Offset	Size	Format	Description
Time	0	4	Binary Integer	Milliseconds from midnight
Order Id	4	14	Printable ASCII	Order Id of a previously sent Add Order message that has been modified
Quantity	18	4	Binary Integer	Number of shares associated with this order after this modify (may be less than the number entered)
Price	22	8	Binary Long Price	The limit order price after this modify. The long value represents the price scaled by 1,000,000 (6 decimal places).
Order Flags	30	2	Binary short Integer	TBD
Message Size		32		

2.2.8 Order Delete

This message appears on the DOB channel.

Field	Offset	Size	Format	Description
Time	0	4	Binary Integer	Milliseconds from midnight
Order Id	4	14	Printable ASCII	Order Id of a previously sent Add Order message that has been deleted.
Message Size		18		

2.2.9 Order Flag

This flag is part of two messages: Order Add and Order Update

Bit	*Name*	Set	Clear
0 - 15	Reserved		

2.2.10 Order Execution

This message appears on the DOB channel. An Order Executed message will be published when all or some of the displayed quantity of a previously published order executes at the published price.

Field	Offset	Size	Format	Description
Time	0	4	Binary Integer	Milliseconds from midnight
Order Id	4	14	Printable ASCII	Order Id of a previously sent Add Order message that was executed
Executed Quantity	18	4	Binary Integer	Number of shares executed
Remaining Quantity	22	4	Binary Integer	Number of shares remaining after the execution. Will be zero if fully filled.
Execution Id	26	8	Binary Long	System generated day- unique execution identifier of this execution.
Message Size		34		

2.2.11 Order Execution with Price

This message appears on the DOB channel. An Order Executed with Price message will be published when all or some of the displayed quantity of a previously published order executes at a price different than the published price.

Field	Offset	Size	Format	Description
Time	0	4	Binary Integer	Milliseconds from midnight
Order Id	4	14	Printable ASCII	Order Id of a previously sent Add Order message that was executed
Executed Quantity	18	4	Binary Integer	Number of shares executed
Remaining Quantity	22	4	Binary Integer	Number of shares remaining after the execution. Will be zero if fully filled.
Execution Id	26	8	Binary Long	System generated day- unique execution identifier of this execution.
Price	34	8	Binary Long Price	The execution price of the order. The long value represents the price scaled by 1,000,000 (6 decimal places).
Message Size		42		

2.2.12 Trade (Non-Displayed Liquidity)

This message appears on the DOB channel. A Trade message will be published when non-displayed quantity of a previously published reserve order executes or when an order executes that is < Min Quote Size and does not currently have an active Order Add message.

Field	Offset	Size	Format	Description
Time	0	4	Binary Integer	Milliseconds from midnight
Side Indicator	4	1	Printable ASCII	Always "B" = Buy Order regardless of resting side
Quantity	5	4	Binary Integer	Incremental number of shares executed
Symbol	9	14	Printable ASCII	Symbol right padded with spaces.
Price	23	8	Binary Long Price	The execution price of the order. The long value represents the price scaled by 1,000,000 (6 decimal places).
Execution Id	31	8	Binary Long	System generated day- unique execution identifier of this trade
Reserved	39	8		Reserved
Message Size		47		

2.2.13 Top Of Book

This message appears on the TOB channel.

Field	Offset	Size	Format	Description
Time	0	4	Binary Integer	Milliseconds from midnight
Symbol	4	14	Printable ASCII	Symbol right padded with spaces.
Ask Price	18	8	Binary Long Price	Best Ask Price. The long value represents the price scaled by 1,000,000 (6 decimal places).
Ask Volume	26	4	Binary Integer	Aggregate size at Ask Price
Bid Price	30	8	Binary Long Price	Best Bid Price. The long value represents the price scaled by 1,000,000 (6 decimal places).
Bid Volume	38	4	Binary Integer	Aggregate size at Bid Price
Unsolicited	42	1	Printable ASCII	"Y" = Unsolicited "N" = Not Unsolicited
Message Size		43		

2.2.14 Imbalance

This message appears on all channels. This message is not available in the Overnight TradingSession.

Field	Offset	Size	Format	Description
Time	0	4	Binary Integer	Milliseconds from midnight
Symbol	4	14	Printable ASCII	Symbol right padded with spaces.
Current Inside Paired Shares	18	4	Binary Integer	Number of OC and IO shares that would be matched at the Current Inside Closing Price.
Current Inside Closing Price	22	8	Binary Long Price	The calculated closing price without Day / extended Day orders, bounded by the inside. The long value represents the price scaled by 1,000,000 (6 decimal places).
Current Inside Imbalance Quantity	30	4	Binary Integer	Number of marketable OC and IO shares that would be left unmatched at the Current Inside Closing Price.
Current Inside Imbalance Side	34	1	Printable ASCII	Buy or sell side of the Current Inside Imbalance Quantity: B – imbalance is on buy side S – imbalance is on sell side N – no imbalance O – no marketable orders
Full Closing Price	35	8	Binary Long Price	The calculated closing price. The long value represents the price scaled by 1,000,000 (6 decimal places).
OC/IO Only Closing Price	43	8	Binary Long Price	The calculated closing price without Day / extended Day orders. The long value represents the price scaled by 1,000,000 (6 decimal places).
MOC shares unmatched	51	1	Printable ASCII	Indicates if any MOC shares are left unmatched: B – Buy MOC shares not matched S – Sell MOC shares not matched O – no MOC shares not matched
Message Size		52		

3. Message Recovery

Since by its nature multicast distribution is unreliable, messages may be lost or delivered out of order. Therefore, the subscriber must implement message recovery processing. To aid in this processing two recovery mechanisms are provided:

1. Gap Fills: A TCP socket based message recovery service is provided for any messages that are missed on the feed channel.
2. On-Demand Snapshots: Snapshots may be requested via TCP for all channels. Data will be delivered via the TCP connection.

Note: A test/certification environment is available. Please refer to our 'Multicast Group' document at https://www.otcmarkets.com/content/doc//otcm-ecn-multi-cast-groups.pdf for the correct IPs/ports.

3.1 Retransmission

3.1.1 Login

Logon message is the first message required to send to the server once a connection is established. At minimum, the firm and user id in the logon request should be provided.

The Login Response Message is sent to a client's response to a TCP/IP Login Message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the TCP/IP connection will be dropped.

Additionally, a few parameters can be set in Logon data.

- HeartbeatInterval, in seconds, set this field if you want server to send you heartbeat
- After login successful, FI will send a client a heartbeat once every 60 seconds. If there is no heartbeat from client for more than 5 minutes, system will disconnect.

3.1.2 Login Request Message ("l") (lowercase L)

Field	Offset	Size	Format	Description
UserId	0	16	Printable ASCII	User id assigned by system
Password	16	16	Printable ASCII	Password assigned by system
Message Size		32		

3.1.3 Login Response Message ("a")

Field	Offset	Size	Format	Description
UserId	0	16	Printable ASCII	User id assigned by system

Field	Offset	Size	Format	Description
Status	16	1	Binary Byte	Status Always “Y”. If it is an invalid userid, system will close socket after 5 seconds without sending back a login response
Message Size		17		

3.1.4 Retransmission Request Message (“r”)

Field	Offset	Size	Format	Description
Start Sequence	0	4	Binary Integer	Start sequence number
Number Of Messages	4	4	Binary Integer	Number of messages requested -1 to indicate all messages up to date
Retran via TCP	8	1	Binary Byte	Y –Sent back on the same TCP channel
Message Size		9		

3.1.5 Retransmission Response Message (“b”)

Field	Offset	Size	Format	Description
Start Sequence	0	4	Binary Integer	Start sequence number
Number Of Messages	4	4	Binary Integer	Number of messages requested
Status	8	1	Binary Byte	Status Y – retransmission will follow as requested N – request ignored
Message Size		9		

Note: The replay server sends a heartbeat message every second. If the server replay response to a request takes too much time, then it’s up to the client to either wait for a few heartbeats, or arbitrary time, then disconnect and send another replay request.

3.1.6 Spin Request Message (“s”)

Field	Offset	Size	Format	Description
Client Identifier	0	4	Binary Integer	Optional client identifier

Field	Offset	Size	Format	Description
Message Size		4		

3.1.7 Spin Response Message (“c”)

Field	Offset	Size	Format	Description
Client Identifier	0	4	Binary Integer	Echo back from spin request
Status	4	1	Binary Byte	Status The server will send a Spin Response (‘c’) with status Start of Spin (‘S’). It will then transmit Trading Session, Security, Orders or TOB, etc., followed by another Spin Response (‘c’) with status End of Spin (‘E’). Ignore any Heartbeat messages. Note: spin messages are always returned to the same TCP socket where they originate
Message Size		5		

3.1.8 Heartbeat Message (“h”)

Field	Offset	Size	Format	Description
Client Identifier	0	4	Binary Integer	Optional identifier
Message Size		4		

4. System Recovery

4.1 System Recovery Event (“J”)

In case there is a catastrophic issue at exchange, and the system needs to reset and restart, it will send out system recovery event.

First, it will send a System Recovery Event with Recovery with type ‘S’, This event will tell clients to start preparation. If Next Sequence Number field is set (non-zero value), client should expect the next sequence number to be that value. Once client receives this message, client should remove all caches for Top of book and Depth of book entries. Also, client should expect individual book order id will reset and restart from 1. So, it is very important that client clean all its cache data.

Once the first System Recovery Event ‘S’ message is sent out, only heartbeat messages will be sent out until the second System Recovery Event message is sent out.

At the scheduled time indicated in first system recovery message, system will send out a second system recovery event with type ‘B’. This is to indicate recovery begin.

After this, system will do a spin for all symbols and open orders. It will send out top of book and depth of book in the respective feeds.

Field	Offset	Size	Format	Description
Deprecated	0	4		
Recovery Type	4	1	Binary Byte	‘S’ scheduling of start of recovery event ‘B’ Recovery begins
Next Sequence Number	5	4	Binary Integer	Sequence Number that you should use when recovery starts. If set to 0, sequence number will not reset Only set when Recovery Type is ‘S’
Recovery Start time	9	8	Binary Long	Expected time recovery spin will start
Message Size		17		

Document Revision History

Version	Description of Version	Date Completed
1.2	• Clarified description in ‘Order ID’ field of Order Add message. • Clarified description in ‘Status’ field of Spin Response Message (“c”) message.	11/2025
1.1	Clarified description in all price fields Deprecated ‘TimeStamp’ field of System Recovery Event (“J”) message.	10/2025
1.0.1	Corrected TradingSession description ‘Market Open’ to ‘Overnight’.	03/2025
1.0	Initial Version	11/2024