

Description

Futures and options exchanges; market makers; hedge funds; and traders require real-time knowledge of the best bid and ask prices for the instruments that they trade. Algo-Logic Systems' Futures & Options (F&O) Order Book is an FPGA hardware accelerator with the entire feed processing module and Order Book implemented in logic.

Algo-Logic's single-FPGA platform architecture achieves deterministic, ultra low latency without jitter regardless of the number of tracked instruments at data rates of up to 10 Gbps.

Algo-Logic's Futures & Options Order Book supports:

1. Book building for instruments that have actual orders
 - I. CME multiple depth (i.e. real) book up to 10 levels deep
2. Book building for instruments that have implied orders
 - I. CME implied book up to 2 levels deep
 - II. CME consolidated book up to 10 levels deep
3. Processing of CME MDP 3.0 messages
 - I. Market Data Incremental Refresh (35=X) MDP 3.0 message type, used for:
 - Updating real and implied books in normal operation throughout the trading day
 - Start-of-day book initialization
 - Late joiner book initialization
 - CME Natural Refresh recovery mechanism
4. Reporting L2 snapshots with the best bid/ask information up to 10 levels deep
 - I. L2 snapshots are generated when each repeating group with a market data update is processed
 - II. L2 snapshots contain corresponding Security ID field, along with sided Price and Size fields
 - III. Real book snapshot is generated for instruments that have no implied orders
 - IV. Consolidated book snapshot is generated for instruments that have implied orders

Applications

- High frequency market makers
- Algorithmic trading systems requiring both complexity and speed
- Highest performance tick-to-trade systems
- Low latency feed distributions needing to minimize bandwidth utilization
- Arbitrage opportunity discovery in the nanosecond timescale

Order Book Building Process

Full Order Book building process includes:

- I. Processing of Market Data Incremental Refresh (35=X) MDP 3.0 messages for start-of-day book initialization as well as updating real and implied books in normal operation throughout the trading day
- II. Merging real and implied books into one consolidated book for instruments that have implied orders
- III. Performing recovery using CME Natural Refresh mechanism in the event of packet loss
- IV. Reporting the L2 snapshots for consolidated books with the best bid/ask information

CME Feed Handler

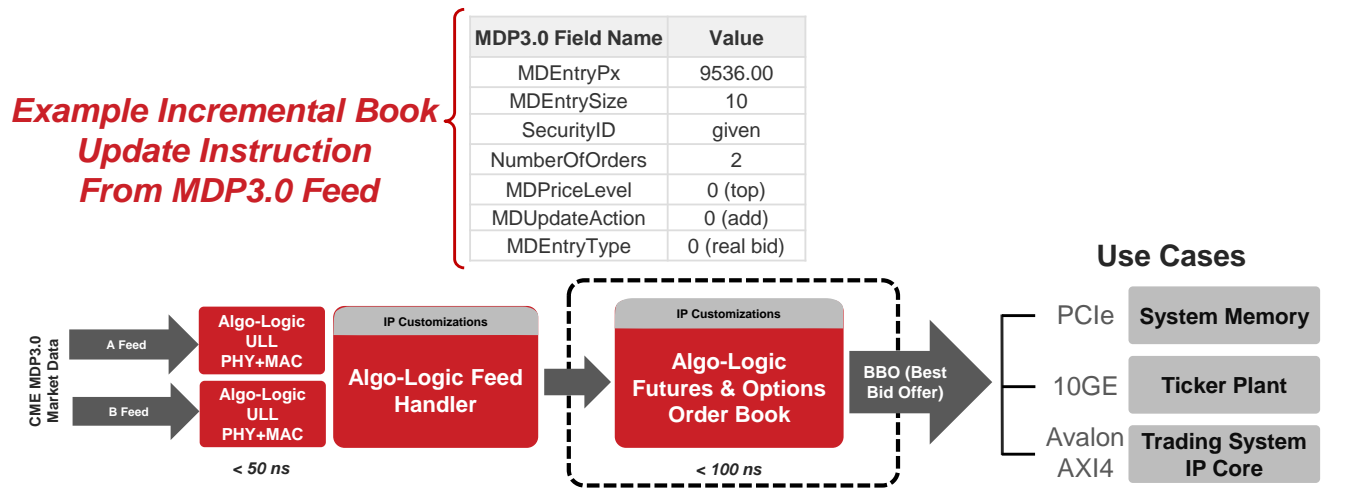
The CME Futures & Options Order Book integrates with the Algo-Logic Feed Handler to provide additional functions:

- A/B Feed Arbitration
- Multicast Channel Filter
- UDP Parser
- MDP 3.0 Parser

Futures & Options Order Book Metrics

L2 Snapshot Generation	On processing of each repeating group with an incremental book update
L2 Price Levels	Provided in snapshot from 1 to 10 levels
Incremental Book Update Rate	39 million incremental order book update instructions per second
Number of Instruments for 1 Level	Up to 64 with L2 snapshots containing top of book price
Number of Instruments for 10 Levels	Up to 20 with L2 snapshots containing 10 price levels
FPGA Devices Supported	Altera Stratix V A7 and larger Stratix V family devices
Order Book Processing Time	Under 100 nanoseconds from time parsed repeating group fields are available

Futures & Options Order Book Application with Example Input and Output



Real Book						Implied Book				Consolidated Book			
Order Count	Bid		Ask		Order Count	Bid		Ask		Bid		Ask	
	Quantity	Price	Price	Quantity		Quantity	Price	Price	Quantity	Quantity	Price	Price	Quantity
12	510	9536.00	9537.00	65	4	120	9536.50	9537.00	30	120	9536.50	9537.00	95
38	850	9535.50	9537.50	650	30	180	9536.00	9539.00	150	690	9536.00	9537.50	650
15	300	9535.00	9538.00	750	50					850	9535.50	9538.00	750
12	200	9534.50	9538.50	400	18					300	9535.00	9538.50	400
10	180	9534.00	9539.50	250	15					200	9534.50	9539.00	150

Example Output BBO

Ordering Codes

AL-OB – (Market) (# Instruments) (# Price Levels) (L2 Snapshot Interface) → Example:

- Market: CME MDP 3.0
- Number of instruments to monitor: 1-64
- Number of price levels to generate in L2 snapshot: 1-10
- L2 snapshot interface: Avalon, AXI4, PCIe, 10GE