Description

Equities, 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’ Full Order Book is an FPGA hardware accelerator with the entire feed processing module and Order Book implemented in logic. Algo-Logic Systems’ single-FPGA platform architecture achieves deterministic, ultra low latency without jitter regardless of the number of tracked symbols at data rates of up to 10 Gbps.

The L-3 Order Book provides traders the best opportunity to receive real-time information about the trading activity on their exchange by taking advantage of the exchange’s market data feeds that offer the highest level of transparency. The Order Book works on incremental L-3 update messages that come in as part of the market data feed over UDP/IP Multicast.

The Full Order Book performs all book building processing and reporting as logic inside a single FPGA. The low latency order book is designed using the on-chip memory for customer book sizes with many thousands of open orders, a dozen symbols, and reporting of ten L-2 levels. For use cases where millions of open orders and full market depth need to be tracked, the scalable order book is still implemented with a single FPGA but stores data in off-chip DDR3 memory.

Moreover, the Full Order Book can be seamlessly integrated with all existing components of Algo-Logic Systems’ low latency application library, including pre-built protocol parsing libraries, market data filtering, and TCP/IP endpoints to deploy complete tick-to-trade applications within a single FPGA platform.

Applications

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

Key Features and Use Cases

- Full Order Book with a L-2 default size of 10 price-levels per symbol, fully scalable to larger sizes
- Depth of L-2 price-level snapshots runtime configurable between 1 (BBO) and 30 deep, by the user via the application programming interface
- By default L-2 snapshots are generated for each symbol. The number of symbols in use and their respective snapshots are user configurable. L-2 snapshot generation frequency is also user configurable
- Full Order Book output logic seamlessly connects to customer’s proprietary algorithmic trading strategies

Full Order Book building process includes

I. Receiving parsed market data feed messages
II. Building and maintaining L-3 order level replica of the exchange’s displayable book
III. Building L-2 books for each symbol with the market depth and weight summary of all open orders
IV. Reporting locally generated copy of the top-of-book with configurable amount of market depth (L-2 snapshots) as well as the last trade information when orders execute
Full Order Book Metrics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>L-2 Snapshot Generation</td>
<td>On change of top levels of book, peak rate user configurable</td>
</tr>
<tr>
<td>L-2 Price Levels</td>
<td>Provided in snapshot from 1 to 30 levels, user configurable</td>
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<tr>
<td>Maximum L-3 Table Depth</td>
<td>3k (default) and up to 96k on-chip; 100k+ off-chip DDR3/QDRII memory</td>
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<tr>
<td>Order Book Update Message Rate</td>
<td>4 million add/delete incremental order book update messages per second</td>
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<tr>
<td>Number of symbols</td>
<td>12 (default) and up to 80 on-chip</td>
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<td>Platforms supported</td>
<td>Terasic DE5-Net, SolarFlare AOE, Nallatech P385, Bittware S5PH-Q, PLDA</td>
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<tr>
<td>Market Data Filtering Latency</td>
<td>180 nanoseconds</td>
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<tr>
<td>L-2 Book Processing Time</td>
<td>Under 120 nanoseconds</td>
</tr>
<tr>
<td>L-3 Book Processing Time</td>
<td>Under 230 nanoseconds</td>
</tr>
<tr>
<td>Complete Tick-to-Trade Latency</td>
<td>Under NDA</td>
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Full Order Book application with Level-II sample screenshot

The Algo-Logic Systems’ Order Book application Level-II sample screenshot is illustrated below. Symbols filtered by the Market Data Filter application are used as input to generate the L-3 and L-2 Order Book.

Ordering Codes

AL-OB – (Market) (# Symbols) (L3 depth) (Platform) → Example:
- Market (e.g.: NASDAQ ITCH 5.0)
- Number of symbols to monitor = 12, 24, 48, 80+
- Level 3 depth (# of Open Orders) = 3k or 48k on-chip; 100k+ off-chip
- Platform: Terasic DE5Net, SolarFlare AOE, Nallatech P385, Bittware S5PH-Q, PLDA