

# V4 dYdX Orderbook

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Tested on: Ubuntu Server 20.04.6 LTS

Let's start off by looking at the end result first. This is the order book for ETH-USD. There are 5 areas to talk about, a to e.

```
vmware@v4dydxorderbooks: /mnt/ramdisk6
2023-09-02 04:22:37 Last trade: 2023-09-02T04:22:29.386Z N/A 1634.5 BUY (0.014) a
Bid
1634.4 (13.695) 7212 2023-09-02 04:21:59
1634.0 (0.001) 7302 2023-09-02 04:22:22
1633.3 (0.016) 7304 2023-09-02 04:22:23
1633.1 (0.014) 7332 2023-09-02 04:22:29
1632.7 (0.014) 7333 2023-09-02 04:22:30
1632.5 (0.016) 7317 2023-09-02 04:22:27
1632.4 (0.016) 7267 2023-09-02 04:22:14
1631.7 (0.016) 7303 2023-09-02 04:22:23
1631.6 (0.015) 7289 2023-09-02 04:22:19
1631.4 (0.015) 7275 2023-09-02 04:22:18
maxbid : 1634.4
minask : 1634.5 (+0.1000) 0.0061%
bidvolume: 13.818
askvolume: 0.14200000000000002
minoffset: 7212
maxoffset: 7350 (+138)
nextFundingRate: 0.000035943181818182 2023-09-02 04:21:39
openInterest : 576.368 2023-09-02 04:22:29
trades24H : 17806 2023-09-02 04:22:29
volume24H : 9189892.1145 2023-09-02 04:22:29
Runtime : 0:00:00.017141
Ask
1634.5 (0.003) 7326 2023-09-02 04:22:29
1634.6 (0.015) 7241 2023-09-02 04:22:06
1634.8 (0.015) 7350 2023-09-02 04:22:36
1635.2 (0.015) 7290 2023-09-02 04:22:19
1635.8 (0.016) 7319 2023-09-02 04:22:27
1636.1 (0.017) 7312 2023-09-02 04:22:26
1636.3 (0.015) 7298 2023-09-02 04:22:20
1636.5 (0.015) 7288 2023-09-02 04:22:19
1636.8 (0.015) 7250 2023-09-02 04:22:08
1637.3 (0.016) 7266 2023-09-02 04:22:14
```

a. This is the last trade from the v4\_trades websocket channel.

```
vmware@v4dydxorderbooks: /mnt/ramdisk6
2023-09-02 04:22:37 Last trade: 2023-09-02T04:22:29.386Z N/A 1634.5 BUY (0.014) a
Bid
1634.4 (13.695) 7212 2023-09-02 04:21:59
1634.0 (0.001) 7302 2023-09-02 04:22:22
1633.3 (0.016) 7304 2023-09-02 04:22:23
1633.1 (0.014) 7332 2023-09-02 04:22:29
1632.7 (0.014) 7333 2023-09-02 04:22:30
1632.5 (0.016) 7317 2023-09-02 04:22:27
1632.4 (0.016) 7267 2023-09-02 04:22:14
1631.7 (0.016) 7303 2023-09-02 04:22:23
1631.6 (0.015) 7289 2023-09-02 04:22:19
1631.4 (0.015) 7275 2023-09-02 04:22:18
maxbid : 1634.4
minask : 1634.5 (+0.1000) 0.0061%
bidvolume: 13.818
askvolume: 0.14200000000000002
minoffset: 7212
maxoffset: 7350 (+138)
nextFundingRate: 0.000035943181818182 2023-09-02 04:21:39
openInterest : 576.368 2023-09-02 04:22:29
trades24H : 17806 2023-09-02 04:22:29
volume24H : 9189892.1145 2023-09-02 04:22:29
Runtime : 0:00:00.017141
Ask
1634.5 (0.003) 7326 2023-09-02 04:22:29
1634.6 (0.015) 7241 2023-09-02 04:22:06
1634.8 (0.015) 7350 2023-09-02 04:22:36
1635.2 (0.015) 7290 2023-09-02 04:22:19
1635.8 (0.016) 7319 2023-09-02 04:22:27
1636.1 (0.017) 7312 2023-09-02 04:22:26
1636.3 (0.015) 7298 2023-09-02 04:22:20
1636.5 (0.015) 7288 2023-09-02 04:22:19
1636.8 (0.015) 7250 2023-09-02 04:22:08
1637.3 (0.016) 7266 2023-09-02 04:22:14
```

From left to right, we got: 1) local server date and time, then 2) the trade's date and time, 3) It's either 'N/A' here or the *tradecreatedatheight* value if it is a long-term trade, 4) the price, 5) side, and 6) size.

b. This is the list of bids from high price to low price.

2023-09-02 04:22:37 Last trade: 2023-09-02T04:22:29.386Z

b

Bid					
1634.4	(13.695)	7212	2023-09-02	04:21:59	
1634.0	(0.001)	7302	2023-09-02	04:22:22	
1633.3	(0.016)	7304	2023-09-02	04:22:23	
1633.1	(0.014)	7332	2023-09-02	04:22:29	
1632.7	(0.014)	7333	2023-09-02	04:22:30	
1632.5	(0.016)	7317	2023-09-02	04:22:27	
1632.4	(0.016)	7267	2023-09-02	04:22:14	
1631.7	(0.016)	7303	2023-09-02	04:22:23	
1631.6	(0.015)	7289	2023-09-02	04:22:19	
1631.4	(0.015)	7275	2023-09-02	04:22:18	

maxbid : 1634.4

From left to right, we got: 1) price, 2) size, 3) the 'offset' (we'll talk about this below), and 4) the local server date and time when the price was received on websocket.

c. Same thing as above except these are asks.

36Z N/A 1634.5 BUY (0.014)

c

Ask					
1634.5	(0.003)	7326	2023-09-02	04:22:29	
1634.6	(0.015)	7241	2023-09-02	04:22:06	
1634.8	(0.015)	7350	2023-09-02	04:22:36	
1635.2	(0.015)	7290	2023-09-02	04:22:19	
1635.8	(0.016)	7319	2023-09-02	04:22:27	
1636.1	(0.017)	7312	2023-09-02	04:22:26	
1636.3	(0.015)	7298	2023-09-02	04:22:20	
1636.5	(0.015)	7288	2023-09-02	04:22:19	
1636.8	(0.015)	7250	2023-09-02	04:22:08	
1637.3	(0.016)	7266	2023-09-02	04:22:14	

d. This is some stats from the bids/asks above.

d

```

1631.4 (0.015) 7275 2023-09-02
maxbid : 1634.4
minask : 1634.5 (+0.1000) 0.0061%
bidvolume: 13.818
askvolume: 0.14200000000000002
minoffset: 7212
maxoffset: 7350 (+138)
nextFundingRate: 0.00003594318181818182 202

```

In particular, we see: 1) the highest bid, 2) the lowest ask along with a delta both in amount and percent, 3) the total bid volume, 4) the ask volume, 5) the minimum offset, and 6) the maximum offset along with a delta. Note that these numbers will change if you choose a different depth level. In this example, we set depth = 10 so we see 10 bids and 10 asks (this will display

completely, assuming that many levels are available; if not, we'll see the maximum of what is on the book).

- e. Some market parameters from the v4\_markets websocket.

```
maxoffset: 7350 (+138)
nextFundingRate: 0.000035943181818182 2023-09-02 04:21:39
openInterest : 576.368 2023-09-02 04:22:29
trades24H : 17806 2023-09-02 04:22:29
volume24H : 9189892.1145 2023-09-02 04:22:29
Runtime : 0:00:00.017141
```

What you see here depends on what comes through the websocket. In addition to the next funding rate, open interest, and 24 hour trades and USD volume, you will eventually see: priceChange24H, effectiveAt, effectiveAtHeight, marketId, and price (from Oracle). Finally, the last time tells you how long it took to render this data, in this case just 17ms.

## Notes

1. Please see the V3 orderbook.pdf first at <https://github.com/chiwalfm/dydxexamples>
2. The following are the V4 files with their V3 equivalents. They work exactly the same except on V4 dYdX-Testnet-2

V4 program	V3 program
v4dydxob.py	dydxob.py
v4dydxtrades.py	dydxtrades.py
v4dydxv4markets.py	dydxv3markets.py
v4dydxob2.py	dydxob2.py

3. In addition, the program `v4dydxmarkets.py` can be used to list every market and their status (equivalent to `dydxmarkets.py` for V3). There's currently 33 total.

```
vmware@v4dydxorderbooks:~/extra$ python3 v4dydxmarkets.py
BTC-USD ACTIVE
ETH-USD ACTIVE
LINK-USD ACTIVE
MATIC-USD ACTIVE
CRV-USD ACTIVE
SOL-USD ACTIVE
ADA-USD ACTIVE
AVAX-USD ACTIVE
FIL-USD ACTIVE
AAVE-USD ACTIVE
LTC-USD ACTIVE
DOGE-USD ACTIVE
ICP-USD ACTIVE
ATOM-USD ACTIVE
DOT-USD ACTIVE
XTZ-USD ACTIVE
UNI-USD ACTIVE
BCH-USD ACTIVE
EOS-USD ACTIVE
TRX-USD ACTIVE
ALGO-USD ACTIVE
NEAR-USD ACTIVE
SNX-USD ACTIVE
MKR-USD ACTIVE
SUSHI-USD ACTIVE
XLM-USD ACTIVE
XMR-USD ACTIVE
ETC-USD ACTIVE
LINCH-USD ACTIVE
COMP-USD ACTIVE
ZEC-USD ACTIVE
ZRX-USD ACTIVE
YFI-USD ACTIVE
vmware@v4dydxorderbooks:~/extra$
```

4. Because V4 does not have a centralized order book, there is no longer a global 'offset' parameter (like we had in V3) for order book price updates. At any given time, the 'correct' order book is sitting in the mempool of the current block proposer. The block proposer changes every block, so that means a new canonical mempool and therefore a new canonical order book. Therefore you may see crossed prices from the indexer's websocket. The way we deal with that is we assign every order book price, our own local offset (using the websocket's *message\_id*) and we assume that later prices have higher precedence. If you do not want to remove crossed prices, you can change `v4dydxob2.py`'s *remove\_crossed\_prices* to False

```
import os
import signal
import sys
import time
from datetime import datetime
remove_crossed_prices = True

widthmarketstats = 24
widthprice = 10
widthsize = 10
widthoffset = 11
```

5. Let's take a look at an order book with crossed prices (by setting the parameter above).

```
vmware@v4dydxorderbooks: ~/extra
2023-09-02 04:39:52 Last trade: 2023-09-02T04:39:47.661Z N/A 1634.3 BUY (0.016)
Bid | Ask
1633.3 (0.001) 11176 2023-09-02 04:39:07 | 1629.0 (0.001) 9973 2023-09-02 04:34:33
1633.1 (0.001) 11225 2023-09-02 04:39:17 | 1633.1 (0.001) 10010 2023-09-02 04:37:19
1632.9 (0.015) 11295 2023-09-02 04:39:34 | 1633.7 (0.001) 11347 2023-09-02 04:39:51
1632.6 (0.017) 11272 2023-09-02 04:39:27 | 1633.9 (0.002) 11105 2023-09-02 04:38:53
1631.2 (0.015) 11350 2023-09-02 04:39:51 | 1634.1 (0.002) 11229 2023-09-02 04:39:19
1630.5 (0.016) 11336 2023-09-02 04:39:48 | 1634.2 (0.001) 11292 2023-09-02 04:39:33
1630.2 (0.014) 11281 2023-09-02 04:39:32 | 1634.3 (0.001) 11329 2023-09-02 04:39:47
1630.1 (0.016) 11333 2023-09-02 04:39:47 | 1634.4 (0.001) 11018 2023-09-02 04:38:36
1629.8 (0.017) 11310 2023-09-02 04:39:39 | 1635.4 (0.016) 11337 2023-09-02 04:39:48
1629.7 (0.015) 11264 2023-09-02 04:39:26 | 1635.8 (0.015) 11262 2023-09-02 04:39:26
maxbid : 1633.3
minask : 1629.0 (+-4.3000) -0.2633%
bidvolume: 0.127
askvolume: 0.041
minoffset: 9973
maxoffset: 11350 (+1377)
nextFundingRate: 0.00003585625 2023-09-02 04:39:41
openInterest : 576.185 2023-09-02 04:39:51
trades24H : 17838 2023-09-02 04:39:51
volume24H : 9197916.6136 2023-09-02 04:39:51
Runtime : 0:00:00.017098
```

Here you can see the highest bid is 1633.3 which is higher than the lowest ask of 1629, but you can also see the offset of the bid is 11176 while the offset of the ask is much lower at 9973. Therefore, our logic is to assume the higher offset takes precedent which allows us to remove 1629 from the list of asks. The **dydxob2.py** program does that automatically by default, as you can see below. No crossed prices!

```
vmware@v4dydxorderbooks: ~/extra
2023-09-02 04:41:47 Last trade: 2023-09-02T04:41:42.659Z N/A 1633.9 BUY (0.013)
Bid | Ask
1633.4 (13.794) 11514 2023-09-02 04:40:36 | 1633.9 (0.018) 11740 2023-09-02 04:41:43
1633.0 (0.001) 11714 2023-09-02 04:41:37 | 1634.1 (0.014) 11741 2023-09-02 04:41:43
1632.9 (0.03) 11718 2023-09-02 04:41:40 | 1634.2 (0.001) 11292 2023-09-02 04:39:33
1632.7 (0.015) 11748 2023-09-02 04:41:43 | 1634.3 (0.001) 11631 2023-09-02 04:41:18
1632.5 (0.028) 11747 2023-09-02 04:41:43 | 1634.5 (0.016) 11719 2023-09-02 04:41:40
1632.2 (0.031) 11762 2023-09-02 04:41:44 | 1635.0 (0.016) 11701 2023-09-02 04:41:33
1631.8 (0.016) 11650 2023-09-02 04:41:20 | 1635.5 (0.031) 11760 2023-09-02 04:41:44
1631.3 (0.014) 11623 2023-09-02 04:41:17 | 1636.6 (0.015) 11659 2023-09-02 04:41:29
1631.2 (0.016) 11720 2023-09-02 04:41:40 | 1637.1 (0.032) 11729 2023-09-02 04:41:40
1631.1 (0.015) 11758 2023-09-02 04:41:43 | 1637.5 (0.015) 11636 2023-09-02 04:41:18
maxbid : 1633.4
minask : 1633.9 (+0.5000) 0.0306%
bidvolume: 13.96
askvolume: 0.15900000000000003
minoffset: 11292
maxoffset: 11762 (+470)
nextFundingRate: 0.00003658035714285714 2023-09-02 04:41:41
openInterest : 576.165 2023-09-02 04:41:41
trades24H : 17837 2023-09-02 04:41:41
volume24H : 9178030.4686 2023-09-02 04:41:41
Runtime : 0:00:00.019345
```

6. One last thing is that by default, the order book display a price in color if it matches the last trade.

```
vmware@v4dydxorderbooks: ~/extra
2023-09-02 04:42:21 Last trade: 2023-09-02T04:41:54.903Z N/A 1633.
Bid | Ask
1633.4 (13.794) 11514 2023-09-02 04:40:36 | 1633.7
1633.3 (0.015) 11847 2023-09-02 04:42:15 | 1633.9
```

In this example, the asks is the same price as the last trade.