JSE @ Your Service 4

Closing Price Methodology

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MEET THE **TEAM**

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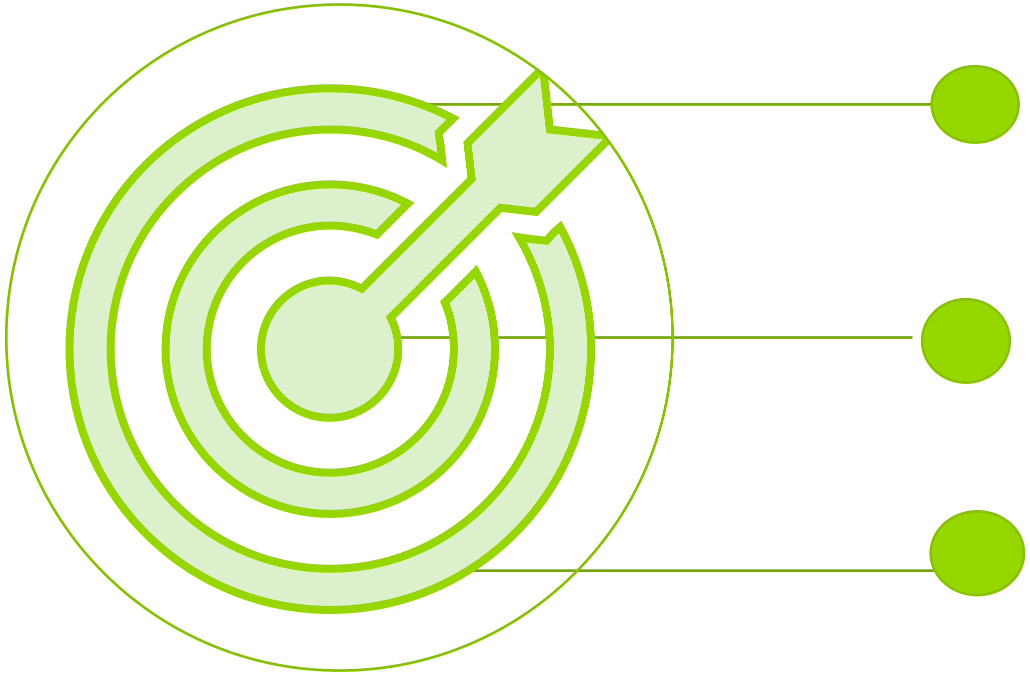
As Trading Operations, we are committed to making a meaningful impact in the financial markets by:

- Ensuring fairness, transparency and integrity across all markets
- Driving innovation and fostering growth through education and engagements

Our core responsibilities include:

- Managing day to day trading and market operations across all asset classes
- Overseeing new product releases from concept to production, including design, testing, delivery and handover for ongoing support
- Providing second level support to address client queries and issues
- **Client Service Centre (CSC)** serves as our **first-level support** and can be contacted on 011 520 7777 or customersupport@jse.co.za

Objectives



Create a collaborative space for all market participants.

Bridge the gap between traders, their frontends and functionality

Educate the market on standard JSE functionality

Address trader pain-points and align on basic market operations.

Enhance fairness and transparency across all members

Encourage co-creation, approachability and stronger relationships

Foster more frequent **face-to-face engagement** with each member

Vision for JSE @ Your Service

Empowering our clients through education, collaboration, and tailored support to unlock the full potential of JSE's trading ecosystem.

Educate & Empower

- Build foundational understanding of trading functionality and operational workflows
- Simplify complex concepts, address common queries, and demystify trading processes
- **Intended Audience:** Head of trading desks, traders and immediate teams, new members across EQM, EDM,& FXM, members of the trading desks and back office teams

Monthly Virtual session (60 minutes)

- **Themed educational walkthroughs** of trading functionalities
- Discuss evolving market practises
- Create a consistent learning rhythm and foster collaboration
- **Resources shared**: After each session, clients receive:
  - Recording for reference
  - The Presentation deck (PDF Format)
  - Quick links to relevant documentation
  - Summary of key takeaways

Tailored in-person visits (On request)

- Deep-dive into **client specific needs and workflows**
- Strengthen relationships and provide hands-on support
- Open discussions, brainstorming , knowledge sharing and problem solving.
- Flexible to present in meeting rooms or join traders at their desks for minimal impact to operations.
- Discuss updates on projects, new functionality and enhancements.

Building Together

- **Client input matters** : We want to hear what topics matters most to you
- Post-session surveys to assess usefulness, relevance and impact
- Use feedback to shape future sessions, formats and content
- A shared roadmap for continuous improvement and innovation
- Potential for a year-end in-person session based on engagement.

Recap from Previous Session

1 **Auction Fundamentals**

Auctions as liquidity events that pool buy and sell interest
Role in fair, transparent price formation
Overview of auction sessions across the trading day

2 **Volume Maximizing Auction Algorithm**

Principle: determine the price that maximizes executable volume
Treatment of imbalances and surplus orders
Step-by –step examples to illustrate price selected

3 **Futures Close Out (FCO) Auction Process – EDM (EQM)**

Transition of expiring futures into the dedicated FCO Auction Call
The **Volume Maximizing Algorithm** determines the official close-out price at uncrossing
The published FCO price is used for **futures settlement** and **option exercise**

4 **Currency Futures & FX Close-Out**

Currency Futures close out using an averaged spot FX rate at expiry
FX Close-Out Auctions are bank-only, market-order driven on expiry day

5 **Market Data Publication of Auction Sessions**

Auction phase starts, extensions, and end times communicated via MITCH and FIX/FAST status messages
Indicative price and executable volume published throughout auction calls

6 **Auction Triggers & Randomized Uncrossing**

Circuit breaker breaches trigger volatility auctions and private trader notifications (**Drop Copy NEWS**)
Auction uncrossing occurs at a random time window to prevent gaming and price manipulation
Randomisation applies to all auction types, including Opening, Closing, Volatility, Re-Opening and FCO

The recording and presentation from Session 3 can be access here, at the bottom of the page under “JSE @ Your Service Webinars”

2026 Monthly Training Plan

Month	Theme	Expected Outcomes
29 January 2026	The Daily Trading Lifecycle and JSE Trading model	Introduce the initiative, set expectations, and members gain understanding of the full day structure, including key sessions and how the JSE trading model supports price discovery and execution
26 February 2026	Type of Orders, Order Attributes & Order Management	Improve order handling accuracy, reduce rejections and optimize execution strategies using the correct order types and qualifiers
26 March 2026	Auction sessions, Matching Algorithm & Priority Rules	Understand auction logic, optimize participation and reduce execution risk, including FCO's
7 May 2026	**Closing Price Methodology**	**Members understand how closing prices are calculated , the role of the closing auction, and how it impacts valuations and settlement**
28 May 2026	Instruments, structured products and user created instruments	Members understand the instrument types available in all three markets and the creation of user created instruments, including bespoke structured products.
25 June 2026	Circuit breakers and Price bands , order rates, cancel on disconnect , IOC examples	Members understand safe trading practices and how circuit breakers and price bands protect market integrity active monitoring of volatility auctions, duration and manual intervention for market quality
30 July 2026	Trade types: Onbook and Reported including Trade Cancellations	Members understand single and dual trade reporting, trade cancellation and modification, including next day cancellations
27 August 2026	Exchange Traded Products & Market making	Improved trading strategies and product utilization
30 September 2026	Market data Dissemination and Technical gateways, including SENS and Indices	Members understand the structure and flow of JSE market data, how to access it, and how to use it effectively in trading decisions.
29 October 2026	Corporate actions	Detailed workflow of corporate actions, how they are captured in the trading engine and information made available via market data gateways.
26 November 2026	Year –End Wrap up & vision for the following year including Market Trends & Insights	Share key market developments, trading volumes, and behavioral insights. Celebrate progress and member contribution, build excitement for the next phase of engagement

Understanding Closing Prices

Definition

The Closing Price is the official end-of-day price published by the JSE, used for valuation, settlement, and reference purpose.

Market Significance

Portfolio valuation- Determines end-of –day portfolio values and
Margining & collateral- Used by clearing houses to calculate margin requirements
Index calculations – Forms the basis of index levels and fund tracking
Derivatives settlement – Drives futures and options settlement values

Key Principle

Fair, transparent price discovery achieved through the closing auction

Closing Price: Key Building Blocks

Different closing price methodologies use different combinations of these building blocks.

Volume Maximizing Auction Algorithm

The system uses a Volume Maximizing Algorithm to execute orders in an auction. Determination of the Auction Price is carried out as given below.

Order Book is Locked/Crossed: At Least One Limit Order (4 step process)

Step 1 – Volume Maximising Price

- The total quantity that is executable at each price point is computed.
- This is the lower of the total buy quantity and total sell quantity at each price point.
- Hidden quantities are included
- The auction price is the price where the largest quantity can be executed (i.e., volume maximizing price)

Step 2- Minimum Imbalance

If volume is maximized at multiple prices, then the auction price should be the price at which the imbalance is minimized. Imbalance is the difference between the following:

- The aggregate quantity of all market buy orders and limit buy orders with prices equal to or greater than the price being considered.
- The aggregate quantity of all the market sell orders and limit sell orders with prices equal to or less than the price being considered.

Step 3 – Market Pressure

If volume is maximized and the imbalance is minimized at multiple prices, the concept of market pressure is applied.

- If there are only multiple buy prices at which the imbalance is minimized, then the highest buy price is considered.
- If there are only multiple sell prices at which the imbalance is minimized, then the lowest sell price is considered.
- If there are multiple buy and sell prices at which the imbalance is minimized, then the highest buy and lowest sell are taken into step 4 of the algorithm.

Step 4- Dynamic Reference Price

If multiple prices are available from step 3, then the price will be determined with respect to the Dynamic Reference Price.

- The price which is closest to the Dynamic Reference Price is considered.
- If prices are equally close, the highest price is considered.
- If no Dynamic Reference Price is available, then the highest price is considered.

Closing Price Methodologies – Overview (EQM)

Primary price sources by segment and the closing price hierarchy

Segment	Primary Pricing Source	Secondary Pricing Source	Methodology
ZA01, ZA02,ZA03	Closing Auction	VWAP	Methodology 1
ZA04	Mid-point	None	Methodology 2
ZA06	Mid-point	Last AT/UT	Methodology 3
ZA11,ZA12	Closing Auction	VWAP	Methodology 1

Key interpretation points :

- Closing price follow a defined hierarchy: the primary source is always applied first; secondary sources are only used if primary criteria are not met.
- **Closing auctions** are preferred where sufficient liquidity exists, as they best reflect consensus market value at end of day.
- **VWAP** is used as a fallback to ensure a representative close when the auction conditions are met.
- **Mid-point** pricing applies to less liquid segments , reducing the impact of wide bid-offer spreads.
- Where applicable, the **last AT/UT** price is used to preserve price continuity when limited trading activity occurs.
- The selected methodology reflects a balance between price integrity, liquidity, and market fairness across segments.

METHODOLOGY 1 : Closing Auction Priority Method

How the closing price is determined in segments ZA01, ZA02 and ZA03

Closing Auction Price

- The closing price is first determined from the uncrossing trades at the end of the closing auction
- The price reflects maximum liquidity and price discovery at market close

VWAP Calculation

- If no uncrossing occurs, VWAP is calculated
- VWAP is derived from trades executed in the 10 minutes prior to the start of the closing auction

Last AT/UT

- Applied when no valid closing auction or VWAP is available
- Uses the last on-book trade of the day

Previous Close

- Used when no eligible trades occur during the trading day
- Ensures a closing price is still published

Special Case

- If no trades occur on the first day of listing, the closing price is set to zero

Methodology 2: Mid-Point Based

Applied to segments without a Closing Auction (ZA04)

Mid-Point of Lat BBO
- The closing price is first determined using the mid-point of the last Best Bid and Offer (BBO)
- The BBO is taken at the end of continuous trading, i.e. at the start of the Post –Close Session

Last AT/UT
- If only one side of the orderbook contains orders at the end of continuous trading
- The closing price is the last automated trade or uncrossing trade for the day

Best Bid or Best Offer
- If no trades occurred during the day, but one side of the order book contains orders
- The closing price is taken as the price of the best order on the participating side

Previous Close
- If the order book is empty
- The closing price references the previous close

Price source are evaluated sequentially until a valid closing price is determined.

Methodology 3: Mid-Point BBO Closing Price

Applied to segment ZA06 (no opening or closing auction)

No opening or Closing Auction

- Trading segment ZA06 does not support opening or closing auctions
- The closing price is therefore determined entirely from **continuous trading** activity

Mid-point of the Last Visible BBO

- The closing price is based on the mid-point of the last Best Bid and Offer (BBO)
- Derived from the visible order book during continuous trading
- This mid-point is the primary closing price determinant

Last AT/UT

- If there are insufficient orders to calculate a valid BBO mid-point
- The closing price is taken as the last automated trade or uncrossing trade for the day

Previous Close

- If there were no automated or uncrossing trades during the day
- The closing price references the previous close

Price source are evaluated sequentially until a valid closing price is determined.

Methodology 3: Mid-Point BBO Closing Price – importance of Market Makers

Role of Market Makers

- Provide **two-sided quotes (Bid & Offer)** → enables valid BBO
- Maintain **tight spreads** → improves mid-point accuracy
- Ensure **continuous liquidity throughout the trading day**
- Reduce reliance on **fallback pricing mechanisms**
- Support **stable and credible price formation**

JSE & Issuer Perspective

- Market makers Ensure order book depth and integrity
- Aligns with JSE objectives:
  - Fairness
  - Transparency
  - Market efficiency
- Provide investors with reliable, tradable reference prices

How Market Makers Enable Methodology 3

- Create a **balanced, active order book** → reliable mid-point pricing
- Continuously refresh quotes → prevents **empty or one-sided books**
- Absorb trading flow → reduces **volatility at close**
- Act as a **substitute for auction-based price discovery**

Key Takeaway

👉 *Methodology 3 works best with Market Maker participation*

👉 *Market Makers are the mechanism that makes the closing price credible*

Closing Price: Publication & Market Rules

Rules Applicable After Closing Price Determination

Publication & Transparency

The closing price is published to relevant market data gateways

The methodology applied (Methodology 1, 2, or 3) is published together with the closing price

Closing prices do not contain decimal values (If a reference price includes decimals, it is rounded up)

Suspensions, Halts & Close-Out Actions

If an instrument is suspended during the trading day, the closing price is published automatically at the time of suspension

If a **Halt and Close** action occurs, the closing price is published at that point

Additional closing prices are not generated once published

Carry –Forward Rules (Suspended Instruments)

If an instrument remains suspended on subsequent days,

- No new closing price is published
- The last published closing price is carried forward as the Previous Close

Related Market Reference Prices

Additional prices published alongside the Closing Price for market context.

- Highest and lowest on-book trade prices of the day.
- Volume
- VWAP
- Turnover
- Number of trades

Closing Price: Live Market Data Publication

Closing Prices will be published on the Live Market data feeds via the ***Statistics (w)*** *message on MITCH using the* Statistic Type, Open Close Indicator and Price fields….

Statistic Type	13	1	Alpha	**Value** **Meaning** O Opening Price C Closing Price
Price	14	8	Price	Opening or Closing price.
Open Close Indicator	22	1	Alpha	**Value** **Meaning** A UT B AT C Mid of BBO D Last AT E Last UT F Manual H VWAP I Previous Close J Zero L VWAP of n Volume U Best Bid V Best Offer Y Reference Price

These values will directly identify the step within the methodology that resulted in the closing price being determined.

Seq Tracking	44826897
SequenceNumber	44826897
InstrumentID	5985
Market Data Group	53
Message Count	1
MessageLength	24
MessageType	119
NanoSecond	813548000
Open Close Indicator	H
Packet Length	32
Price	9300
Statistic Type	C
SubBook	1

Closing Price: Live Market Data Publication

….and ***Market Data - Incremental Refresh (X)*** *message on FIX/FAST using the* MDEntryType (269) *field in conjunction with* MDEntryPx (270), Trade Condition (277) *and* OpenCloseIndicator (30002):

Seq Tracking	17509435
ApplSeqNum	17509435
AppID	JSELVL1P
MDEntryPx	1420
MDEntryType	5
MDSubBookType	1
MDUpdateAction	0
MessageType	X
NoMDEntries.NoMDEntries	1
OpenCloseIndicator	7
RptSeq	208
SecurityID	2094
SecurityIDSource	8
SendingTime	20260505-15:00:00.831238

Similarly, the Closing Price for this example was the "Last AT"

Value	Meaning
1	UT
2	AT
3	Mid of BBO after opening auction
4	Mid of BBO before closing auction call
6	VWAP
7	Last AT
8	Last UT
9	Previous Close
10	Manual
21	Zero
22	Best Bid
23	Best Offer

Closing Price Cross (CPX) Orders – REMINDER from Webinar 2

- Orders with this time qualifier are directed to the Closing Price Cross session (CPX)
- Can be entered during other sessions that accept orders and remain parked until the Closing Price Cross session starts
- Only valid for the current trading day will expire at the end of the CPX session
- CPX orders can only have be submitted with order types Limit and Market.

The CPX session at the end of the trading day once a closing price has been determined, allows market participants to trade **at the closing price for a further 8min** before instruments move into the Post Close Session.

IMPORTANT

- Systematically it becomes important to identify the closing price correctly (limited time to manually check this)
- "Last Trade Price" does not work for all the scenarios covered under the methodologies
- This results in missed opportunities to trade at the closing price
- Daily there are many rejections with "Invalid limit price (not equal to closing price)"

Reminder: Iceberg Orders in Auctions

Impact on Closing Price Formation

Auction Participation

Iceberg orders participate in all auctions with their full order quantity, including both visible and hidden portions

Price Formation & Execution

If the calculated auction price is at or within your limit, the full quantity will be eligible to execute in the uncrossing.

Order Handling During Auctions

You don't need to manually disclose more shares or submit a separate order.

The system automatically includes full quantity without order changes.

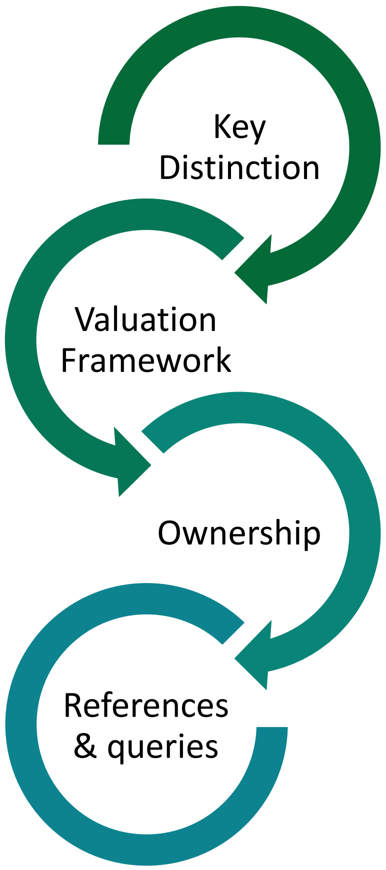
Post –Auction Behaviour

Any unexecuted quantity returns to the order book as an Iceberg order

Visible size is refreshed using **random replenishment methodology.**

EDM & FXM Closing Prices

High-level overview and ownership



Closing prices for Equity Derivatives (EDM) and Currency Derivatives (FXM) are model-based, not auction based. Equity closing price methodologies **do not apply**

Closing prices are produced using the Valuations Input System (VIS), developed as part of the ITAC project. VIS supports consistent and automated valuation across derivatives by standardizing calculation convention, rationalizing market and reference data inputs, and applying consistent curves, volatility surfaces, and currency fixings.

Valuations Methodologies are governed and maintained by the JSE Valuations Team
Valuation methodologies incorporate underlying instrument closing prices, interest rates and curves, dividends, carry and contract tenor.

Valuation-specific questions can be directed to the Valuations Team on: **Valuations@jse.co.za**

Thank you

Kindly scan the QR code to share your feedback, or use the survey link provided in the chat

let's connect