Automated Trading System

Dhaka Stock Exchange Limited
# Table of Contents

1 Preamble .......................................................................................................................... 3
2 Brief Historical Events Regarding Automated Trading System ........................................ 3
3 DSE Trading System ......................................................................................................... 4
   3.1 DSE Trading System, Hardware Infrastructure: ........................................................... 5
4 DSE Network Infrastructure .............................................................................................. 5
   4.1 Basic Block Diagram of DSE Network ........................................................................ 6
5 DSE Trading Software ..................................................................................................... 7
   5.1 Core System Software & Database .............................................................................. 7
   5.2 Trading Application, TESA ....................................................................................... 7
   5.3 TESA Solution Benefits .......................................................................................... 8
   5.4 Principal Functions of TESA ..................................................................................... 8
   5.5 DSE Trading System Communication Architecture .................................................... 9
   5.6 Terminals, MSA Plus Terminals are as follows ......................................................... 9
   5.7 Some Important features of MSA Plus Solution ......................................................... 10
   5.8 MSA Plus Deployment Diagram .............................................................................. 11
6 Markets ............................................................................................................................. 11
7 Trading sessions ............................................................................................................... 12
8 Market Control .................................................................................................................. 12
9 Market Information .......................................................................................................... 12
10 Broker Support ............................................................................................................... 13
12 Trade Data Dissemination .............................................................................................. 14
13 Automated Clearing and Settlement System Facilities .................................................. 15
14 e-Book Building Method for IPO Pricing Discovery ....................................................... 15
15 Other ICT Infrastructure: ............................................................................................... 16
1 Preamble

Globally the developments in Information and Communication Technology (ICT) have created a new instance in the securities market operation. Stock Exchanges all over the world have realized the potentiality of ICT and inclined to the electronic trading systems. DSE promises to develop its Trading System as state-of-the-art to ensure transparency, integrity in the trading of securities. DSE’s vision is to reach potential investors all over the world using advanced & sophisticated Information and Communication Technology.

To fulfill the dream of transforming DSE into modern world class exchange, DSE started its journey of automation on 10th August 1998 and is striving for continuous up-gradation of its trading platform. On the way of this we made a major up-gradation in DSE trading system and its infrastructure on 2005. At the end of 2010, DSE enhanced its ICT Infrastructure Capacity to 6 Lac trades per day.

Finally, to meet the potential growth of the trades and prospective investors, DSE has taken initiatives to upgrade its current Trading Application MSA to MSA-Plus (Upgraded TESA Client part), which was started on 10th June 2012.

2 Brief Historical Events Regarding Automated Trading System

- **April 28, 1954**: The stock exchange named Prime Stock Exchange of East Pakistan was incorporated. After Bangladesh came into being, it was renamed Dhaka Stock Exchange.
- **August 10, 1998**: Automated Trading System started, floor-less trading (end of open cry out system)
- **2001**: Implemented Broker Control Over Trader (BCOT) module in TESA
- **August 2002**: Implemented DSE Multiple Indices
- **December 2003**: Trade Data disseminated through DSE Website
- **August 2005**: Switch over to HP NonStop S7802 from TANDEM platform and upgraded system capacity was 50,000 trades per day
- **August 2005**: Established and implemented Broker Control Over Client (BCOC)
- **September 2005**: Expanding Network infrastructure of DSE to facilitated the trade over the country
- **December 2006**: Market Data Disseminated in DSE web site through MDS
- **April 2006**: Implemented Web based Automated Clearing & Settlement System
- **May 2007**: Provided Market Data through MDS to the different electronic and print media for disseminated the same.
- **2008**: Upgrade HP NonStop S7806, enhance the capacity of 1,50,000 trades per day by adding 4 CPUs
- **June 2009**: Reorganized the DSE Trading Network in structured and secured way
• **November 2009:** Implemented Internet based Market Data Server (MDS) and provided the facility for electronic & print media and others

• **January 2010:** Established Standard Data Center for DSE Trading Servers, Network and other infrastructure.

• **February 2010:** Implemented Book Building System for Exchanges

• **December 2010:** Upgrade HP NonStop S7810, enhance the capacity of 6,00,000 traders per day by adding 4 CPU, the number of CPU of the System is now ten.

• **April 2011 to May 2012:** To implement the upgraded Web Based Trading Software “MSA Plus”, User Acceptance Test (UAT), Brokerage House’s IT officer and Authorized Trader Training, Real time Mock Trading, Pre Go-Live tests and practice sessions were completed as part of MSA Plus project plan.

• **June 10, 2012:** Going live of Web Based Trading Software - MSA Plus and a formal inauguration is being made.

• **February 18, 2013:** Bengali version of DSE Official Web site has been inaugurated.

### 3 DSE Trading System

Presently DSE Automated Trading System is running on fault tolerant, highly available, scalable, hot swappable, upward compatible Mainframe Server of HP NonStop S7810 Server. HP NonStop S-Series Server is being used in the world including New York Stock Exchange, Bombay Stock Exchange, Bursa Malaysia Stock Exchange & London Stock Exchange. The Mainframe Server DSE is using only one of its in the Country. **Dhaka Stock Exchange successfully processed 3,89,310 of Trades on 05th December 2010 using this system.**

For smooth operation of trading connection secured, structured & distributed LAN & WAN setup has been established to connect DSE TREC Holder Companies Offices with the DSE Central Server.
Presently there are **229 Member House Servers** and **around 4000 TWS** are connected in the DSE Central Network through DSE LAN and expanded LAN and WAN setup from **1400 different locations**. **Almost 34 districts of Bangladesh** are under coverage of DSE-Network.

For successful completion of Clearing and Settlement activities DSE has developed Automated Clearing and Settlement System, which is a Web based integrated software, it preserves all the information for every TREC Holder Company of Dhaka Stock Exchange Broker can access required information.

**DSE Official website** [www.dsebd.org](http://www.dsebd.org) is designed to get the most comprehensive, up-to-date, easy to use necessary/useful DSE market related information. Web Based Market Data Server was designed for providing DSE Market Data to different Electronic and Print Media and Local/Foreign Financial Institutions. Additionally; investors can collect updated DSE market information through SMS service through their Mobile phone.

### 3.1 DSE Trading System, Hardware Infrastructure:

**HP NonStop S7810**

- DSE Automated Trading System is running on fault tolerant, highly available, scalable, hot swappable, upward compatible and online maintainable Mainframe Server of HP NonStop S7810 Server.
- HP NonStop S-Series Server is being used in almost all the leading Stock Exchanges in the world including NYSE, BSE & London Stock Exchange.

Considering market growth, the Automated Trading Server was upgraded time to time to enhance the trading capacity

<table>
<thead>
<tr>
<th>Implementation Period</th>
<th>Platform</th>
<th>Capacity sizing</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 1998</td>
<td>TANDEM NonStop K204</td>
<td>15,000 Trades/day</td>
</tr>
<tr>
<td>August 2005</td>
<td>HP NonStop S7802</td>
<td>50,000 Trades/day</td>
</tr>
<tr>
<td>March 2008</td>
<td>HP NonStop S7804</td>
<td>1,00,000 Trades/day</td>
</tr>
<tr>
<td>December 2008</td>
<td>HP NonStop S7806</td>
<td>1,50,000 Trades/day</td>
</tr>
<tr>
<td>December 2009</td>
<td>Fine tune Existing server</td>
<td>3,00,000 Trades/day</td>
</tr>
<tr>
<td>December 2010</td>
<td>HP NonStop S7810</td>
<td>5,00,000 Trades/day</td>
</tr>
</tbody>
</table>

### 4 DSE Network Infrastructure

- Secured, structured & distributed LAN & WAN setup has been established to connect DSE TREC Holder Company Offices with the Central Server.
- Fast Ethernet Backbone, Fiber Backbone, Radio link, DDN, Dialup connections are established utilizing intelligent Switches, Access-Servers, Cisco Routers including CISCO IPS & IDS security system.
- Presently there are **229 Member House Server (MSA)** (Primary connecting nodes) connected to the central Network.
• **Around 4000 TWS** are connected in the DSE Central Network through DSE LAN & expanded LAN and WAN setup.

• Presently DSE network POP at Dhanmondi is running smoothly to support Branches of the Brokerage houses.

• All network service providers’ (NSP) backbone connection and direct fiber connections from DSE to Brokerage House were taken to underground through NTTNs (Fiber at Home and Summit).

• To smooth support of Branch connectivity of Brokerage houses, DSE implemented hazard free single point solution for those connections through various vendors. Listed Network service providers are not required to lay cable up to the Brokerage house, they need to terminate the cable at DSE Setup for Branch support.

• More than 250 Workstations (including IP based devices like printer, scanner, photocopier etc) are supported by DSE official Network setup.

• CISCO Based Routing and Switching devices, along with Firewall (Check point and CISCO) are used for Network Infrastructure. Integrated Services Routers (CISCO 3900, 3800 and 2800 series router), Catalyst switches 2960 TCL & TTL, CISCO Firewall 5500, Checkpoint Firewall SafeOffice devices are used to develop Network Infrastructure for DSE ICT Support.

### 4.1 Basic Block Diagram of DSE Network

![Basic Block Diagram of DSE Network](image-url)
5 DSE Trading Software

5.1 Core System Software & Database

The system software is HP Proprietary Non-Stop Kernel and includes the database as part of the operating system thereby eliminating the layer typically found in most Database Management Systems (DBMS). The existing database NONSTOP SQL is a distributed relational database management system that uses the ANSI-standard Structured Query Language (SQL) to describe and manipulate data. The Database is simply a different operational session for the operating system. The proprietary nature of the system software arguably enhances system security.

HP system has its own Pathway built-in. HP Pathway with Non-Stop TS/MP software provides application server functionality that allows developing and deploying mission-critical online transaction processing (OLTP) applications on HP integrity Non-Stop servers. Using this software, developers can concentrate on implementing business logic without being concerned with Common application services such as load balancing, communications I/O, memory management, fault tolerance, and/or threading and scheduling. In this way, Pathway with Non-Stop TS/MP supplies a high performance highly available OLTP environment that is built-in rather than programmed it.

The system software treats all its hardware resources as objects and is thus entirely message driven. This allows application software to be deployed using client / server architecture providing shared data processing between the central server and the user workstation. The central trading system resides in the Stock Exchange premises, which is running 24 hrs in a day & 365 days in a year. The Application level security (operational level security) is already available in existing TESA. Beyond this, DSE is using Safe Guard to limit the access to files /objects of specific user enhancing security.

5.2 Trading Application, TESA

DSE has used TESA, “The Electronic Securities Architecture”, application software as Trading Application. TESA software is built for the global securities markets. It uses fault tolerant computers, intelligent workstations and client/server design techniques. This provides co-operative processing, high message integrity, continuous operation and fully automatic recovery. This co-operative mechanism enables very high speed processing which is essential for today's electronic markets.

TESA's Application Programmatic Interface (API) is the gateway to the TESA system from the outside world. All external devices connect through the API. The API provides the translation between external devices and internal processes. This means that a new process does not need to be written to support each new device, only the API needs to be modified.

TESA was developed considering distributed Database concept using MS-SQL Database in MSA Plus replicating with HP NonStop SQL of Trading Engine for intra-day information. MSA Plus is a Web Based Server Application running on the Member Server. Different Terminals use this client application, MSA Plus, using Web browser as a GUI (Graphical User Interface). Administrators,
Traders, iTTraders and Investors are performing trading activities using corresponding terminals. Basic software architecture of TESA is 'Thin Client', and it is Web based application. MSA is the "Gateway" between the traders and the Stock Exchange, which manages all the transactions and database operations between the traders and the Trading Engine.

5.3 **TESA Solution Benefits**

The TESA application suite derives significant advantages from being implemented on the HP NonStop platform. The HP NonStop customers have benefited from these advantages.

Fault Tolerance: One of the most important automation requirements for any stock exchange system is continuous system availability. With most systems Fault Tolerance is created at the application level. Fault Tolerance is a fundamental design feature of the HP NonStop architecture.

Data Integrity: Data integrity is an integral feature of HP architecture. TESA employs standard HP tools to achieve exceptional data integrity.

Scalability: The ability of an exchange to accommodate extraordinary increases in transaction volumes without loss of its Capital investment in automation is very important. The HP NonStop Server is massively scalable due to Parallel processors.

5.4 **Principal Functions of TESA**

- **Market Information**: Supplying all market information needed to formulate the buy and sell decisions.
- **Order Management**: Accept, validate and store orders and quotes from broker workstations and/or systems.
- **Order Execution**: Automatically executes orders when buy and sell prices match.
- **Trade Reporting**:Trade execution reports are provided to each trade participant, to the settlement system and/or the depository and to the market.
- **Index Calculation**: Calculates and publishes market indices (DSE General Index & Weighted Average Index).

Market Access: Provide exchange TREC Holder Companies with efficient affordable GUI-based tools for accessing the market.
5.5 **DSE Trading System Communication Architecture**

Various Terminals are used for Administration, Trading and Market View purpose.

1. **Broker Terminal**: Broker terminal is the gateway between the Users (Trader, Dealer, Investor and iTraider) and the Exchange. It needs to establish connection with Trading system so that the Users can logon to the trading engine.

2. **Admin Terminal**: Administrative functions within the Broker are carried out from the Admin Terminal like Client Registration, Trader Control, set buy Cash or sell Share Limit, investor registration, Logoff, Logon or Suspend etc. Broker can create ten Admin terminals to perform specified roles.

3. **Trader Terminal**: Traders are users who trade on behalf of client or investors. Traders connect to the MSA Plus and then Login remotely to the Trading Engine to perform Order submit, modify, withdraw, delete etc.

4. **Dealer Terminal**: All Dealer activities are performed here as like Trader Terminal.

5. **Investor Terminal**: Clients/Investors are allowed to place local orders through Internet (as per Client/Investor registration on Brokerage House). Investor can view Market information in Investor Terminal. A special purpose terminal, named iTraider, submits Investor’s Local order to the main Trade Engine.

6. **iTraider Terminal**: iTraider user manages Investor orders, it is special purpose terminal to handle only the Investors’ Orders that are submitted through Internet. iTraider cannot perform general trading on behalf of Clients.
7. **View Terminal (non trade terminal):** View Terminal users can locally login into MSA Plus application and access the information available locally. This Terminal can be used to view the Market (like Public Market), Market Depth, Market ticker, News, Index etc. Ten View Terminals can be created by an individual Broker.

5.7 **Some Important features of MSA Plus Solution**

- **MSA Plus** is a ‘Thin Client’ Web Based Application which does not require installation up to workstation level. Deployment and maintenance is easier and centralized. Users (traders or investors) have to type web address (URL) of corresponding Broker Web Server on the Internet Browser in their terminal.

- Investors can submit their buy and sell orders through Internet to the respective Broker Server using Investor Terminal. Broker’s iTader will submit those orders to the Trading Engine. Investors can also view the market through Internet using Investor Terminal.

- Broker will get facilities of Pre-validation of client’s buy (cash limit) and Pre-validation of client’s sell (share limit).

- Trader work stations are virtually unlimited (necessary hardware should be scaled as per volume requirement).

- Intraday Instrument graph for price movement of each instrument is available.

- Instrument’s buy/sell can be stopped temporarily either buy/sell or both for specific Trader.

- All workstations, (Trader, Dealer, View, iTader, Admin terminal etc.) will be connected to the TREC Holder Companies web server using suitable browser through network (LAN / Intranet / Internet).
- For secured Internet Connectivity Brokerage house can use SSL (Secured Socket Layer) connection (for example: VeriSign SSL Certificates) and establish physical security device like Firewall, Router etc.

- Client type can be categorized during client registration like Normal, foreign, dealer, corporate and other.

- For smooth trading operation Instrument category & sector parameters are incorporated for all market books.

- Client BOID and Company ISIN is incorporated. Export / Import facilities with a required new file format based on BO ID & ISIN will be available in MSA Plus to interact with broker’s back office System as well as CDBL.

### 5.8 MSA Plus Deployment Diagram

**[MSA Plus deployment diagram](#)**

### 6 Markets

Four types of market at DSE

1. **Public Market**: In this market instruments are traded in normal volume.

2. **Spot Market**: Instruments are traded in normal volumes under corporate action, if any.

3. **Odd lot Market**: Odd lots of all Instruments are trade in this market.

4. **Block Market**: Instruments are traded in bulk volume.
7 Trading sessions

TESA conducts trading in 5-phases.

- **Enquiry**: In this session Brokers can logon to the system. No order will be submitted in this session. No trade will be executed. Only previous orders can be withdrew in this session.

- **Opening**: The Opening is a pure, single-price auction. All buy and all sell orders are compared and calculate the open-adjust price. No trades will be executed in this session.

- **Continuous Trading**: During this phase, participants enter orders and immediate execution or for inclusion in the book. Automatic matching and execution takes place based on best price/first in, first out trading rules.

- **Closing**: Closing prices are calculated and disseminated to market participants.

- **Enquiry**: Market will be closed in this session & other facilities like the previous enquiry session.

8 Market Control

The Market Control Workstation allows the exchange administrative staff to control the operation of the market, e.g.

- **Session Control**: Opening and closing the market via interactive control or by preset timers.

- **Validation Parameters**: Setting and viewing parameters that control the trading engine validation e.g. tick size, Circuit Breaker, Circuit Filter, Market lot, Price protection Percentage.

- **Messaging**: Allows the dissemination of company announcement data and general market administrative massages.

9 Market Information

Market Information is a real-time market data system. It collects, manages, generates and stores information relating to trade instruments and issuing companies. Market Information is responsible for,

- **Collecting Real-Time Market Information**: Bids, offers, last sale (i.e. most recent trade price and volume), book and other data are gathered via the Trading engine. It supports TESA’s automated and manual trading modules and can process the trades of external and off-market systems.

- **Collecting company Information**: All information supplied by the listed companies is maintained in the TESA database.
• **Generating Market Statistics:** TESA generates market indices on a real time basis. It generates other statistical information such as Price.

10 Broker Support

**Research and Enquiry:** this module provides brokers access to the local Broker Support and TESA databases for enquiries and research purposes.

The multi-windows environment allows users to simultaneously view orders, market and trades. Broker Support offers Stock Exchange TREC Holder Companies two configurations; standalone and multi-user. Both configurations maintain a database consisting of information generated by the TESA Server and the local system.

Public Order Book

Trader Order Book


DSE Official website has designed as a directory and information source for investors, looking for information and tools to help them better their profits from the Stock Market. Our aim is simple - to be the most comprehensive, up to date, easy to use and get necessary/useful DSE market
related information from DSE website. From this website any investor can get information easily from home and abroad.

DSE website shows the following information for investor every day:

- Display DSE market information (price, indices, news etc.) continuously in the trading time.
- Display market data, historical data, graphs etc.
- Display Latest Share Price by different preferences.
- Display Day End Statistics, Top 10 Gainers, Top 10 Losers etc.
- Shows Instruments related and TREC Holder Company related Information
- Shows Investment Information in P/E: at a glance, AGM/EGM and Record Date Related Information, IPO Lottery Result, Recent SEC & DSE Circulars, Weekly Report
- Provide online tools like market portfolio, market price, Top 20 Shares, DSE 20 etc.
- Provide Investment Information in IPOs, Mutual Funds and Bonds.
- Check the trading history; Recent Market Information, Monthly Reviews & Graphs.

12 Trade Data Dissemination

Web based Market Data Server was designed for providing DSE Market Data to different media as follows:
- Mobile based service (like GPRS, SMS etc.)
- Web bases service.
- Electronic media (TV channels) & print media.
- Academic / Research Institution.
- Data Reseller etc.
- International Financial Institutions: Mubasher Trade, Bloomberg & Swiss-Pro Investment.

Investor can collect updated DSE market information through SMS service by sending message to "4636" and also view the GUI base information by installing BULL Software (It’s a GPRS Service) in their Mobile phone.

13 Automated Clearing and Settlement System Facilities

As there is no Clearing Corporation in Bangladesh, so we have to handle all clearing and settlement issues in this software using off-line connection with Banks and CDBL, where Clearing Corporation may able to handle these issues in online mode for better management and RMS.

User Facilities Provided By Automated Clearing & Settlement System

- A web based software for cash and share settlement in connection with designated Banks and Central Depository Bangladesh Limited (CDBL).
- This software preserves all settlement related information for DSE Finance/Operation Divisions and TREC Holder Companies of Dhaka Stock Exchange Ltd.
- The software enriched by incorporating different modules like; i) Settlement ii) TREC Holder Companies’ Margin iii) Fund management etc.
- It is centrally integrated; valid users can access and can get their information using their rights given. Information will be always updated to use without asking anyone.
- Process margin information, collection and financial adjustment
- Preserve Detail TREC Holder Companies Buy/Sell accounts statements
- Preserve Detail Account Statements including Tax and different types of Charges for DSE
- Preserve Valid/ Invalid/Deleted/Foreign Trade Detail
- Process Data for Central Depository System, Securities & Exchange Commission
- Preserve historical data for further use
- Auto Broker Debit System introduced to facilitate the payment system between DSE TREC Holder Companies and DSE by eliminating the use of cheques in the transaction process.
- The software provides necessary security, authentication and confidentiality as required.

14 e-Book Building Method for IPO Pricing Discovery

Book Building Method: The process by which an underwriter attempts to determine at what price to offer an IPO based on demand from institutional investors, introduced in Dhaka Stock Exchange in February 2010.

Functional Module for e-Book Building method:

- Registration Module
- Access Control Module
15 Other ICT Infrastructure:

Infrastructure for Testing Lab
DSE ICT has a testing Lab to test various issues related to Client end software, like MSA Plus, Clearing and Settlement system etc. Three mid-range Servers, CISCO Switches, Routers etc. are used to develop testing environment as per demand basis.

Power support
We have established a complete redundant Power setup in DSE; which consists:

- 1200 KVA Transformer
- 500 KVA Generator for peak load use
- Two 200 KVA Generator (dedicated for ICT)
- 100 KVA Generator, full time ICT support
- 15 KVA Voltage stabilizers behind the UPS
- One 12 KVA True on-line UPS providing minimum 3 hours Backup for Mainframe Server.
- Two 15 KVA True on-line UPS providing minimum 2 hour backup for peripheral setup

Physical Security
To ensure proper safety & security of ICT setup DSE has established the following system:

- Web-Based Security Access Control Solution (Honeywell)
- Fire (Smoke & Heat) detection System
- Fire Detection & Suppression System with BOC FS 125 (NAF S 125) GAS for DSE Data center