



London
Stock Exchange

Turquoise Equities

TQ102- Connectivity Guide

Issue 2.2

31 October 2014



London
Stock Exchange Group

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1.0 Introduction

London Stock Exchange has completed acquisition of Turquoise paving the way for the creation of a new pan-European trading venture through a merger of the Turquoise and Baikal businesses.

The new venture, continuing to operate as Turquoise, aims to drive European trading volume growth and promote venue choice. Turquoise benefits from synergies with London Stock Exchange infrastructure through its migration to MillenniumIT trading technology as of November 2010.

1.1 Purpose

The purpose of this document is to provide participants with information on how to connect to the Turquoise MillenniumIT platform for both the Customer Development Service and the Production service.

1.2 Readership

This document is a supporting document to the interface technical specifications. When read in conjunction with the other technical specifications, these documents provide all of the details Turquoise participants require to migrate to the MillenniumIT trading platform.

This document is particularly relevant to project and technical staff within member firms and companies that provide Turquoise related services to member and non-member firms.

1.3 Document Series

This document is part of series of documents providing a holistic view of full trading and information services available from Turquoise.

For reference the full range of documents is outlined below:

- **TQ102 – Connectivity Guide (this document)**
- TQ103 – Trading Technical Parameters
- TQ201 - Trading Gateway (FIX 5.0) Specification
- TQ202 - Post Trade Gateway (FIX 5.0) Specification
- TQ203 – Drop Copy Gateway (FIX 5.0) Specification
- TQ301 – Trading Gateway (Native) Specification
- TQ401 – ITCH Level-2 Market Data Specification
- TQ501 – Guide to Reference Data Services
- TQ601 – Guide to Certification

1.4 Document History

Issue	Date	Description
R1 1.0	25 March 2010	First issue of this document published.
R2 1.0	24 May 2010	First issue of CDS release 2 document published.
R2.1 1.0	09 July 2010	First issue of CDS release 2.1 document published.
R2.1 1.1	23 July 2010	Second issue of CDS release 2.1 document published
R2.1 1.3	09 August 2010	Production addresses added
R2.1 1.4	01 September 2010	Disaster Recovery addresses defined
1.7	05 April 2011	Additional NATIVE and ITCH endpoints
1.8	07 November 2011	Amended availability of native trading gateways, ITCH multicast feed and Replay/Recovery services at secondary data site
1.9	12 January 2012	Sponsored Access SFTP site IP/port specification.
2.0	22 February 2012	Corrected availability of ITCH Replay/Recovery services at SDC
2.1	20 February 2013	Changed contact details
2.2	31 October 2014	Including the reference data IP's

1.5 Enquiries

Contact Technical Account Management at Turquoise for any functional queries regarding the services outlined in this document. Technical Account Management can be contacted Monday to Friday between 07:30UK and 18:00UK:

- Telephone: +44 (0)20 7797 3939
- Email: londontam@lseg.com

2.0 Connectivity Overview

2.1 Connectivity Protocol

Turquoise uses TCP/IP (Transmission Control Protocol/Internet Protocol) for network connectivity. All FIX and Native interface messages are transported using TCP. All data sent by the ITCH interface is broadcast via UDP (User Datagram Protocol) multicast. Turquoise only supports IPv4.

2.2 Services

Turquoise provides a gateway to enter orders into the trading system, receive market data, send trade reports, download own order and trade information.

Native Trading Gateway

The Native trading gateway provides a native low latency trading interface which allows participants to send and manage orders on the trading system. The interface enables clients to perform the following activities:

- (i) Submit an order
- (ii) Cancel an order
- (iii) Mass Cancel orders
- (iv) Cancel/Replace an order

The entry of quotes or trade reports is not supported by the Native trade gateway. The Native trading gateway uses a proprietary interface referred to as the Native interface.

FIX Trading Gateway

The FIX trading gateway allows participants to send and manage orders on the trading system. The interface enables clients to perform the activities outlined below.

- (i) Submit an order
- (ii) Cancel an order
- (iii) Mass Cancel orders
- (iv) Cancel/Replace an order

The entry of quotes or trade reports is not supported by the FIX trading gateway. The FIX trading gateway uses the FIX 5.0 SP2 protocol.

FIX Drop Copy Gateway

Turquoise provides a gateway to receive additional copies of Execution Reports generated by the trading system. This gateway may also be used by clients to download the current status of all their active orders in the event of a failure. The drop copy service cannot be used to submit orders or receive market data. The drop copy gateway uses the FIX 5.0 SP2 protocol.

FIX Post Trade Gateway

Turquoise provides a FIX post trade gateway that permits participants to perform the activities outlined below:

- (i) Receive real-time updates on executed trades
- (ii) Receive information on executed trades via a query-based service to facilitate a recovery after a failure.
- (iii) Submit an off-book trade for registration
- (iv) Request the cancellation of a confirmed off-book trade

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- (v) Request the cancellation of an on-book trade

The entry of quotes or orders is not supported by the post trade gateway. The post trade gateway uses the FIX 5.0 SP2 protocol.

Market Data Gateway

The Market Data gateway provides a stream of fixed width binary messages which provides the following real-time information:

- (i) Order depth for the entire order book for the Integrated order book.
- (ii) Price and volume for each executed on-book trade for both the Integrated order book and Dark Midpoint order book.
- (iii) Price, volume, date and time of each confirmed off-book trade if those trades require reporting under FSA regulations.
- (iv) Trading status of each instrument

The feed also includes a daily download of the instrument list of Turquoise. The Market Data gateway uses a proprietary interface based on the ITCH protocol.

2.3 Interfaces

The services provided by Turquoise are delivered by FIX, ITCH and Native interface protocols.

Native Interface

The Native interface consists of two channels. A Real-Time channel which provides the main order management functionality and a Recovery channel that allows clients to subscribe to missed messages due to disconnection from the Real-Time channel.

The Native interface uses fixed-length, non-encrypted messages in a binary format. Turquoise does not distribute API libraries for access to the Native interface. As messages will not be split across packets, the message header which prefixes all messages is used to determine the message type and how it should be parsed.

ITCH Interface

The ITCH interface consists of the Real-Time multicast channel, the Replay channel and the Recovery channel. The Real-Time multicast channel broadcasts a stream of fixed-width binary messages to provide real-time information delivered using UDP multicast. The TCP Replay channel permits recipients to request the retransmission of a limited number of messages already published on the Real-Time channel. This channel may be used by recipients to recover from a small data loss. The TCP Recovery channel permits recipients to request a snapshot of the order book for any active instrument in the market data group. This channel may be used by recipients to recover from a large-scale data loss.

FIX 5.0 SP2 Interface

The Financial Information Exchange (FIX) protocol enables access to Turquoise using a messaging standard developed for real-time electronic exchange of security transactions. FIX enables access to the trading services and security information within Turquoise. The interface is a point-to-point service based on the technology and industry standards TCP/IP, FIXT and FIX. The session and application event models and messages are based on versions 1.1 and 5.0 (Service Pack 2) of the FIXT and FIX protocols respectively.

2.4 Connection Options

Participants will be able to connect to Turquoise via their London Stock Exchange Extranet, hosting or VPN connectivity. Turquoise also supports 3rd party leased-line connectivity.

2.5 Architecture

Each participant connection will be enabled for access to the trading system via a Primary and Secondary gateway for each interactive interface; i.e. the FIX and Native interfaces.

One of the pair of gateways will be designated the Primary, and the other Secondary. In the event of failure of the Primary gateway, participants should connect/logon via the Secondary gateway. Any attempt to logon to the Secondary gateway outside of any failure event will be refused.

In case of unexpected disconnection from the Primary gateway participants should attempt to re-connect to the Primary gateway a total of three times, with three seconds between each attempt before attempting to connect the Secondary gateway.

Likewise, if there are further issues in connecting to the Secondary gateway a total of three connections, with three seconds between them, should be attempted.

After six failed connection attempts (three on each gateway) this may indicate a serious issue and the Exchange should be contacted for guidance.

Both Primary and Secondary gateways are duplicated at the Disaster Recovery Site.

2.6 Disaster Recovery

Turquoise will operate in cold standby mode. In the event of total loss of the Primary Site the Exchange will activate the Disaster Recovery Site. This procedure is expected to take in the order of 2 hours.

Once the Disaster Recovery Site is active then all order books will be cleared down and the trading system re-started. Following this, participants will be asked to connect to the Disaster Recovery Gateways. The Disaster Recovery Gateways will use the IP address and port of the Primary Gateway. Following recovery to the Disaster Recovery Site it is recommended that all participants should:

- Carry out an Own Trade Download to confirm which trades have been sent to clearing and settlement.
- Carry out an Own Order Book Download to confirm that no orders are currently active.

3.0 Extranex Connectivity

3.1 IP Addressing

3.1.1 Customer Development Service

Each Extranex participant is allocated a unique IP subnet address from the Exchange's private address range. Participants should connect to the Turquoise Customer Development Service (TQ-CDS) from the IP allocated for test services from this subnet.

Trading Services

Service	Channel	IP Address	Port
FIX Trading	Primary	194.169.9.131	51110
	Alternate	194.169.9.132	51111
FIX Post Trade	Primary	194.169.9.139	51120
	Alternate	194.169.9.140	51120
FIX Drop Copy	Primary	194.169.9.143	51130
	Alternate	194.169.9.144	51130
Native Trading	Primary	194.169.9.135	51140
	Alternate	194.169.9.136	51140
Native Recovery	Primary	194.169.9.135	51145
	Alternate	194.169.9.136	51145

Reference Data FTP & SFTP

Access via Internet	194.169.1.16	21 (FTP) 22 (SFTP)
Access via Extranex, Hosting, CMC	194.169.9.158	21 (FTP) 22 (SFTP)

Multicast Channels

Channel	Market Data Group	Multicast Destination Feed A	Multicast Source IP Feed A	Port Feed A
Level-2 ITCH	1	224.4.4.128	194.169.9.200	61100
	2	224.4.4.129		
	3	224.4.4.130		
	4	224.4.4.131		
	5	224.4.4.132		
	6	224.4.4.133		

Channel	Market Data Group	Multicast Destination Feed B	Multicast Source IP Feed B	Port Feed B
Level-2 ITCH	1	224.4.5.128	194.169.9.230	61100
	2	224.4.5.129		
	3	224.4.5.130		
	4	224.4.5.131		
	5	224.4.5.132		
	6	224.4.5.133		

Replay and Recovery(Snapshot) Services

Channel	Market Data Group	Port	Primary IP Address	Secondary IP Address*
Level-2 ITCH Replay	1	53101	194.169.9.210	194.169.9.240
	2	53102		
	3	53103		
	4	53104		
	5	53105		
	6	53106		
Level-2 ITCH Recovery(Snapshot)	1	54101	194.169.9.210	194.169.9.240
	2	54102		
	3	54103		
	4	54104		
	5	54105		
	6	54106		

*Note: The secondary Replay and Recovery services will only be available in the event of a failure of the primary Replay and Recovery services.

3.1.2 Production Environment

Trading Services

Service	Channel	Port	Primary IP Address	Secondary IP Address*
FIX Trading 01	Channel 1	59201	194.169.9.1	194.169.9.2
	Channel 2	59202		
FIX Trading 02	Channel 1	59221	194.169.9.3	194.169.9.4
	Channel 2	59222		
Post Trade 01	Channel 1	59401	194.169.9.24	194.169.9.25
	Channel 2	59402		
Drop Copy 01	Channel 1	59501	194.169.9.32	194.169.9.33
	Channel 2	59502		
Drop Copy 02	Channel 1	59521	194.169.9.34	194.169.9.35
	Channel 2	59522		
NATIVE Trading 01	Trading	59601	194.169.9.48	N/A
	Recovery	59801		
NATIVE Trading 02	Trading	59602	194.169.9.49	N/A
	Recovery	59802		
NATIVE Trading 03	Trading	59603	194.169.9.50	N/A
	Recovery	59803		
NATIVE Trading 04	Trading	59604	194.169.9.51	N/A
	Recovery	59804		
NATIVE Trading 05^	Trading	59605	194.169.9.52	N/A
	Recovery	59805		
NATIVE Trading 06^	Trading	59606	194.169.9.53	N/A
	Recovery	59806		

Participants required to use both Channel 1 and 2 for load-balancing FIX services.

* Note: The secondary gateways will only be available in the event of a failure of the primary gateways.

^ Note: These services are not available in the event of the invocation of the Secondary Data Centre.

Reference Data FTP & SFTP

Access via Internet	194.169.1.16	21 (FTP) 22 (SFTP)
Access via Extranex, Hosting, CMC	194.169.9.44	21 (FTP) 22 (SFTP)

Multicast Channels

Channel	Market Data Group	Multicast Destination Feed A ^	Multicast Source IP Feed A ^	Port Feed A ^
Level-2 ITCH	1	224.4.2.128	194.169.9.66	60100
	2	224.4.2.129		
	3	224.4.2.130		
	4	224.4.2.131		
	5	224.4.2.132		
	6	224.4.2.133		

Channel	Market Data Group	Multicast Destination Feed B	Multicast Source IP Feed B	Port Feed B
Level-2 ITCH	1	224.4.3.128	194.169.9.98	60100
	2	224.4.3.129		
	3	224.4.3.130		
	4	224.4.3.131		
	5	224.4.3.132		
	6	224.4.3.133		

Replay and Recovery(Snapshot) Services

Channel	Market Data Group	Port	Primary IP Address^	Secondary IP Address*
Level-2 ITCH Replay	1	63201	194.169.9.85	194.169.9.115
	2	63202		
	3	63203		
	4	63204		
	5	63205		
	6	63206		
Level-2 ITCH Recovery(Snapshot)	1	64201		
	2	64202		
	3	64203		
	4	64204		
	5	64205		
	6	64206		

* Note: The secondary Replay and Recovery services will only be available in the event of a failure of the primary Replay and Recovery services.

^ Note: These services are not available in the event of the invocation of the Secondary Data Centre.

3.2 Enablement Process

Requests to be connected to Turquoise should be directed to:

- connect@tradeturquoise.com

This should include the following information:

CDS (Customer Development Service)

- Company
- London Stock Exchange Extranex SAP
- Primary and secondary contact (name, email address, telephone number)
- Services required (ITCH, FIX Post Trade, FIX Drop Copy, FIX Trading, Native Trading)
- Participants will be enabled for all test IP addresses; x.x.x.24 to .31
- Date required

Production

- Company
- London Stock Exchange Extranex SAP
- Primary and secondary contact (name, email address, telephone number)
- Services required (ITCH multicast, FIX Post Trade, FIX Drop Copy, FIX Trading, Native Trading)
- IP address(es) to be enabled for Production
- Date required

3.3 Info for Network Administrators

Static routes for Turquoise Equities are as follows:

194.169.9.0/26	vlan950	Production Equities Trading Services
194.169.9.64/27	vlan952	Multicast Feed 'A' Source + Replay/Recovery
194.169.9.96/27	vlan953	Multicast Feed 'B' Source + Replay/Recovery
194.169.9.128/25	vlan951	CDS Equities Test Environment (all traffic)

Extranex connectivity documentation is located here:

<http://www.londonstockexchange.com/products-and-services/connectivity/extranex/extranex.htm>

Please contact Technical Account Management if any further info is required.

4.0 Sponsored Access

Sponsored Access Portal URLs

CDS

- <https://cds-sponsored-access.tradeturquoise.com>

Live Production

- <https://sponsored-access.tradeturquoise.com>

Restricted Instrument List SFTP Site

CDS and Production

- [194.169.1.16 : 22](https://194.169.1.16:22)

5.0 Hosting Connectivity

5.1 IP Addressing

IP addressing for connectivity to TQ-CDS and Production will follow Extranex connectivity.

5.2 Enablement Process

Requests to be connected to Turquoise should follow the procedure for Extranex.

6.0 Direct Connectivity

Please contact Technical Account Management to discuss 3rd party leased-line connectivity.

7.0 VPN Connectivity

VPN connectivity is available to TQ-CDS via the VPN Extranet Developer service.

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**Turquoise Services Limited / Turquoise
Trading Limited**

10 Paternoster Square

London EC4M 7LS

T: +44 (0) 20 7797 1000



London
Stock Exchange