



BATS Europe Connectivity Manual

Version 3.1c

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Introduction

The BATS Europe trading platform is housed in the Savvis datacentre in the Docklands, London.

BATS Europe supports the following network connectivity choices:

- **IPSec VPN** via the Internet for certification and test access only
- **Co-location Cross-Connect**
- **Extranet**
- **Directly Connected**

Participants are responsible for choosing their telecommunications provider, arranging for connections to the BATS Europe datacentre and paying for all communications charges, including cross-connects within the datacentre (cross-connect charges will appear with the monthly trading statement). Participants are encouraged to work with BATS Europe to ensure that connectivity is provisioned as smoothly as possible.

BATS Europe does not charge Participants for connectivity.

For all questions contact the BATS Europe NOC

Phone: +44 20 7012 8905
Email: noceurope@batstrading.com

IPSec VPN

Participants may connect to BATS Europe using IPSec over the Internet.

- Access to all TCP based feeds for certification and test only
- LAN-to-LAN IPSec VPNs only
- IP address of the host presented to BATS Europe must be registered

Co-location Cross-Connect

Participants may co-locate and cross connect to the BATS Europe to achieve the lowest latency connectivity. Participants interested in taking co-location space should contact the co-lo providers, Savvis or Fixnetix.

- The technical and commercial relationship is between the co-lo provider and the Participant, BATS Europe are not involved.
- A cross connection into BATS Europe is required.

Extranet

Participants may connect to BATS via an extranet.

- Extranet supplier provisions high speed up links to BATS Europe for multiple Participants
- Technical & commercial relationship is between the Extranet provider and the Participant
- Current Extranet providers are listed below

Directly Connected via Metro Ethernet

Participants may connect to BATS Europe via Metro Ethernet.

- No co-location space required
- Copper, single mode and multi-mode gigabit interfaces are supported
- Dark fibre into a gigabit interface is also supported
- Cross-connect from Telco demarcation point to BATS Europe network required

Directly Connected via Participant terminated routers

Participants may also terminate circuits on Participant-provided and owned communications equipment in the BATS Europe controlled space.

- Communications equipment is owned and maintained by the Participant
- Communications equipment only, servers cannot be supported
- Maximum of 400W in each of two separate cabinets
- All physical intervention is by Savvis warm hands service instructed by BATS Europe
- All equipment to be rack mounted and clearly labelled with the Participant and device name

BATS Europe may in the future pass through some or all of the associated costs of providing this option.

Bandwidth

Market Data feeds

BATS Europe offers three different market data feeds:

- Multicast PITCH
- TCP PITCH
- TCP *FAST* PITCH

Multicast PITCH

Launched in March 2009, Multicast PITCH has the following key features:

- Low latency, up to 400us faster than TCP based PITCH
- Two bandwidth versions
 - Gig shaped, requires gigabit cross connects
 - WAN shaped, requires minimum of 50M
- Gap Response Proxy to recover small data gaps
- Spin Server to efficiently recover from intra-day disconnects
- Efficient binary messaging and new modify order message
- Market selectivity: LSE, Paris, Xetra, Amsterdam each have their own multicast streams

The Multicast PITCH specification is published at:

http://www.batstrading.co.uk/resources/participant_resources/BATS_Europe_MC_PITCH_Specification.pdf

The peak 1mS, 10mS and 1 second bandwidths seen to date are:

Interval Seconds	Date of Peak	Time of Peak	Messages per Second	Bandwidth Mbps
0.001	23 Dec 2009	16:30:00	1,066,000	119
0.01	22 Dec 2009	16:30:00	615,400	69
1	11 Dec 2009	14:54:58	56,725	20

Note: For the Gig shaped feed the sub-second micro-bursts are not traffic shaped by BATS Europe whereas the WAN shaped feed will be.

The lowest latency option of BATS Europe market data is the Gig shaped Multicast PITCH feed.

TCP PITCH & TCP FAST PITCH

Both of these market data feeds (PITCH & FAST PITCH) use TCP. The peak bandwidths seen to date are:

Interval Seconds	Time of Peak	Messages per Second	TCP PITCH Bandwidth Mbps	TCP FAST PITCH Bandwidth Mbps	# times > 90 percent
1	14:54:58 11 Dec 2009	90,580	42	18	4
5	14.40.00 3 Aug 2009	60,744	29	10	1
10	14.40.00 3 Aug 2009	51,915	24	9	1

There will be sub-second microbursts that will exceed the one second peak rate. The extent to which the network connection to the Participant will cope with the microbursts exceeding the available bandwidth without packet loss will depend heavily on the buffers in the end to end path.

TCP FAST PITCH is the compressed version of the TCP PITCH market data feed, the full specification can be found at:

http://www.batstrading.co.uk/resources/participant_resources/BATS_Europe_FAST_PITCH_Specification.pdf

Participants should particularly read the performance statistics in the Latency and CPU Analysis section of the TCP FAST PITCH spec. This shows that for lower bandwidth circuits, the reduction in serialisation delays of using TCP FAST PITCH outweighs the overhead of encoding and decoding the FAST compression headers.

FIX Order Entry

The bandwidth for order entry via the FIX interface depends on the rate of message input, which will vary according to each Participants needs, details below:

FIX order entry bandwidth requirements

Bandwidth	256kbps	512kbps	1.5Mbps
FIX message rate	75/sec	150/sec	450/sec

Bandwidth Guidance

- BATS Europe is growing strongly and rapidly, the quality of the trading experience will depend on there being sufficient bandwidth. Hence Participants are strongly advised to provision enough spare bandwidth to cope with growth and exceptional market conditions.
- The current highest traffic peaks are detailed above, this will rise as the market develops. Sub-second micro-bursts will significantly exceed the one second peaks.
- BATS Europe recommends that Participants should order minimum 100M circuits. Participants are encouraged to take Multicast PITCH rather than multiple TCP PITCH feeds.
 - Gig shaped Multicast PITCH requires a one Gig cross-connect
 - WAN shaped Multicast PITCH currently requires 50M, of which 10M is for multicast re-transmits and FIX data
- The bandwidth a Participant chooses will be influenced by the trade off between cost of the bandwidth against the acceptability of delays caused by queuing during peaks.

IP Addressing

The details below apply to all connectivity methods other than VPN:

- BATS Europe preferred policy is that the source address of any TCP connection is from a 10.x.y.z address range allocated by BATS Europe.
- Each Participant is allocated an individual /25 subnet by default, of which the first five addresses are reserved. This subnet can be split to cope with routing to multiple destinations.
- BATS Europe hosts use registered addresses.
- BATS Europe supports static routing and dynamic routing via BGP.
- Each separate BATS Europe feed is allocated a unique TCP port, the port is determined by the BATS Europe Trade Desk during the provisioning process.
- BATS Europe also supports publicly registered Participant addresses.

Production Symbol Listing and Tick sizes

BATS Europe offers access to a CSV file of all production symbols including their tick sizes, this is accessed either via Participant connectivity or via www.batstrading.co.uk using wget.

NTP

BATS Europe offers multicast NTP synchronised to a stratum 1 GPS receiver.

Telecommunications Providers

Some telecommunications providers available within the Savvis datacentre are listed below. This list is a summary and is not indicative of BATS Europe preference or recommendation. For telco's not included on the list please contact BATS Europe NOC to discuss.

Company	Contact
AboveNet www.above.net	Michael Carter + 44 7747 847 664 michael.carter@above.net
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