Enhancement in the Pre-Trade Risk Management ("PTRM") System in Derivatives Markets:

HKATS Risk Functions Enhancement ("PTRM 2.0")

Sanly Ho
Managing Director, Co-Head of Trading Operations
Eddy Kwok
Vice President, Trading Operations

26th May 2021

HKEX
香 港 交 易 所

Disclaimer

Overview

Overview

- Established a set of light-touch, pre-trade and at-trade prescribed risk controls for General Clearing Participants (GCPs) and Clearing Participants (CPs) to manage respectively the pre-trade and at-trade risks of their Non-Clearing Participants (NCPs) and Exchange Participants (EPs) since 2016.

- Established at the same time a Kill Switch (stop and cancel) function for GCPs, CPs, NCPs and EPs.

- HKEX review regularly with all participants on the mandatory risk limits.

- Considered by the Derivatives Market users as an effective, back-stop pre-trade risk management system at the exchange level.

Agenda

- Target Audience

- Current PTRM System ("PTRM 1.0")

- Enhanced PTRM System ("PTRM 2.0")

- Technical Arrangements & Participant Readiness

Target Audience

- PTRM Authorized Person
- Responsible Officer
- Trading
- Risk Management
- Information Technology

To support both the preparation and implementation.

Current Information	Location
Information Paper (March 2021)	https://www.hkex.com.hk/-/media/HKEX-Market/Services/Trading/Derivatives/Trading-Mechanism/Pre-Trade-Risk-Management-(PTRM)-System-in-Derivatives-Markets/Information-Paper/PTRM2InfoPaper20210301.pdf?la=en
PTRM Web Corner	https://www.hkex.com.hk/Services/Trading/Derivatives/Overview/Trading-Mechanism/Pre-Trade-Risk-Management-(PTRM)-System-in-Derivatives-Markets?sc_lang=en

Current PTRM System ("PTRM 1.0")

PTRM 1.0 – Graphical User Interface ("GUI")

PTRM 1.0

EP	Customer Code	Pre-Trade Limit Group ("PTLG")	Prescribed Risk Controls		
			Automated Stop Functions Max Order Size Limits Max Order Rate Limits Max Intraday Exposure Limits	**Manual Stop Functions** Stop/ Unstop Unblock Kill Switch Mass Cancel	**Email Alerts** Notice Warn Breach Stop/ Kill Switch
ABC Limited	**ABC**	ABC1234 / ABC2345 — *User Picker List* HKCABC_HKABC_BASE	Prescribed Risk Limits Set 1	Manual Emergency Buttons for "BASE"	Email Alert Group 1
	ABCMM	ABCMM3456 — *User Picker List* HKCABC_HKABCMM_BASE	Prescribed Risk Limits Set 2	Manual Emergency Buttons for "BASE"	Email Alert Group 2
		HKCABC_HKABCMM_1 ABCMM4567	Prescribed Risk Limits Set 3	Manual Emergency Buttons for "1"	Email Alert Group 3

ABC1234 ABC2345 ABCMM3456 ABCMM4567 are OAPI Sessions / HKATS Online Sessions for Trading.

ABCMM4567 is assigned to PTLG **HKCABC_HKABCMM_1**. ABC1234 ABC2345 ABCMM3456 are unassigned.

PTRM 1.0 – CP / GCP Access Rights

The access right of a PTRM Graphical User Interface ("PTRM GUI") login session for a CP / GCP is full and these login sessions were defined in PTRM 1.0 as "Risk Limit Managers".

Risk Limit Manager Login Session (CABC)	Visible PTLG	Prescribed Risk Controls		
		Automated Stop Functions Max Order Size Limits Max Order Rate Limits Max Intraday Exposure Limits	**Manual Stop Functions** Stop/ Unstop Unblock Kill Switch Mass Cancel	**Email Alerts** Notice Warn Breach Stop/ Kill Switch
	HKCABC_HKABC_BASE	Can modify all risk limits	Can access all emergency buttons of the manual stop functions	Can modify
Login Session 1 (CABC)	HKCABC_HKABCMM_BASE	Can modify all risk limits	Can access all emergency buttons of the manual stop functions	Can modify
	HKCABC_HKABCMM_1	Can modify all risk limits	Can access all emergency buttons of the manual stop functions	Can modify

PTRM 1.0 – EP / NCP Access Rights

The access right of a PTRM Graphical User Interface ("PTRM GUI") login session for an EP / NCP is partial and these login sessions were defined in PTRM 1.0 as "Trading Units".

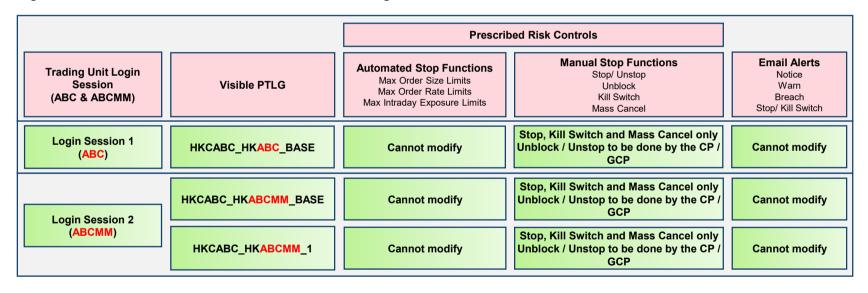| Trading Unit Login Session (ABC & ABCMM)	Visible PTLG	Prescribed Risk Controls		
		Automated Stop Functions Max Order Size Limits Max Order Rate Limits Max Intraday Exposure Limits	**Manual Stop Functions** Stop/ Unstop Unblock Kill Switch Mass Cancel	**Email Alerts** Notice Warn Breach Stop/ Kill Switch
Login Session 1 (ABC)	HKCABC_HKABC_BASE	Cannot modify	Stop, Kill Switch and Mass Cancel only Unblock / Unstop to be done by the CP / GCP	Cannot modify
Login Session 2 (ABCMM)	HKCABC_HKABCMM_BASE	Cannot modify	Stop, Kill Switch and Mass Cancel only Unblock / Unstop to be done by the CP / GCP	Cannot modify
	HKCABC_HKABCMM_1	Cannot modify	Stop, Kill Switch and Mass Cancel only Unblock / Unstop to be done by the CP / GCP	Cannot modify

PTRM 1.0 – Max. Intraday Exposure Limits

Maximum Intraday Exposure Check is at-trade – PTRM checking occurs after the order entering the order book.

Note:
- Count each order and trade exposure by aggregating the respective Unit Margin Rate ("UMR")
- Exposures will be aggregated for the whole business day (including T and T+1 Session) according to the prescribed formulas (Gross Futures Long / Short; Net Futures Long / Short; Gross Options Long / Short and Net Options Long / Short); Exposure counters will be re-set to 0 after the dayend
- Order exposure is adjustable from 0% to 100%; Order exposure will be released after order cancellation
- Blocking the PTLG upon any breach at 1 of the 4 limits; subsequent orders will be rejected
- OAPI order rejection message -850006

PTRM 1.0 – Max. Order Rate Limit

Maximum Order Rate Check is at-trade – PTRM checking occurs after the order entering the order book.
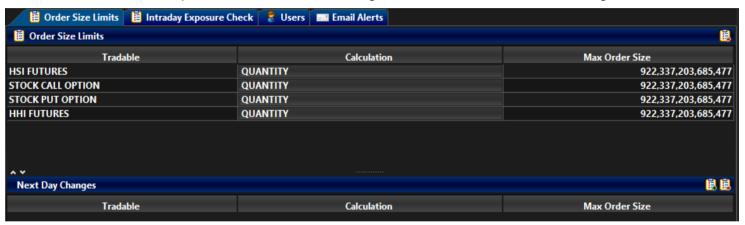

Note:

- Limit the number of orders within a user-defined period of time from 1 to 300 seconds
- Excluding Mass Quotes (MO96) and Block Trades; counting only Outright Orders (MO31) and Double-Sided Quotes (MO37)
- Blocking the PTLG upon a limit breach; subsequent orders will be rejected
- OAPI order rejection message -850004

PTRM 1.0 – Max. Order Size Limits

Maximum Order Size Check is pre-trade – PTRM checking occurs before the order entering the order book.

Order Size Limits	Intraday Exposure Check	Users	Email Alerts

Order Size Limits

Tradable	Calculation	Max Order Size
HSI FUTURES	QUANTITY	922,337,203,685,477
STOCK CALL OPTION	QUANTITY	922,337,203,685,477
STOCK PUT OPTION	QUANTITY	922,337,203,685,477
HHI FUTURES	QUANTITY	922,337,203,685,477

Next Day Changes

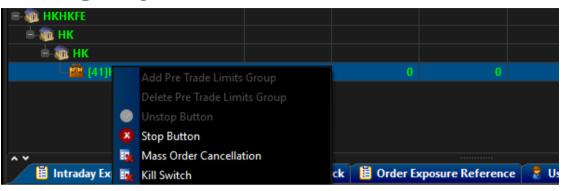| Tradable	Calculation	Max Order Size

Note:

- Control upon the creation of the specific product tradables by users
- Working at the same time with Central Order Size Limits
- Excluding Combinations and Block Trades
- Order rejection only; PTLG blocking not applicable
- OAPI order rejection message -850008

PTRM 1.0 – Emergency Buttons

Stop	• To stop a PTLG from order entering • Allow order cancellation
Unstop	• To allow again the order entering for a stopped PTLG
Unblock (Order Rate / Intraday Exposure)	• To unblock a PTLG after a limit breach and subsequently blocked
Mass Order Cancellation	• To cancel all outstanding orders of a PTLG
Kill Switch	• To cancel all outstanding orders of a PTLG and stop the PTLG from order entering

Enhanced PTRM System ("PTRM 2.0")

PTRM 2.0

All the following PTRM 1.0 settings, functions and risk limits will be retained / migrated:

1) All PTLGs defined by users and their assigned OAPI / HKATS Online Sessions
2) All Prescribed Risk Controls
3) All risk limits defined by users for all Prescribed Risk Controls
4) All product tradables defined by users per PTLG for Max. Order Size Check
5) All email addresses defined for receiving PTRM alerts
6) All PTRM reports (RX_UTIL & RX_AUDIT)
7) All PTRM GUI Login IDs, access rights (Risk Limit Managers & Trading Units) and passwords
8) PTRM GUI connectivity (PTRM GUI PC Hostname Tables, SDNET / HSN Circuits & PTRM Gateway Servers)

PTRM 2.0 - GUI

PTRM 2.0 – Functions Overview

Summary of PTRM 2.0 Prescribed Risk Controls

Prescribed Risk Controls	Remarks	Description
Execution Throttle Limits	*New functions!*	Initial limits will be set at 9,223,337,203,685,477
Intraday Position Limits		
Maximum Block Trade Size Limits		
Maximum Combo Size Limits		EPs have to add relevant Combo Tradables for the settings after the rollout
Order Exposure Reference Counter		New functions for EP's reference
Active User Reference Counter		
• Max. Intraday Exposure Limits • Max. Order Rate Limit • Max. Order Size Limits	Existing functions to be retained	EP's current limit settings will be migrated to the new version
Emergency Buttons	Existing functions to be retained	Stop, Unstop, Mass Cancellation & Kill Switch

PTRM 2.0 – Execution Throttle Limits

Formula for exposure accumulation:

Execution Throttle Limits	Formula for Long / Short Risk Exposure Counters
Gross Futures Long / Short Limit	**Long Counter** - Traded Futures Long Quantity x Long UMR
	Short Counter - Traded Futures Short Quantity x Short UMR
Gross Options Long / Short Limit	**Long Counter** - (Bought Calls Quantity x Long UMR) + (Sold Puts Quantity x Short UMR)
	Long Counter - (Sold Calls Quantity x Short UMR) + (Bought Puts Quantity x Long UMR)

Configurable time range T: 300 to 600 seconds

Counter Reset Frequency: The exposure accumulated in the last but 10th T/10 moving period will be deducted continuously (a 10-moving window basis)

Example:

If T = 300 seconds, then moving period = 30 seconds (T/10)

Length of each moving period = T/10

Timeline

Time t

		10th	9th			4th	3rd	2nd	1st	Current	UMR Exposure in each moving period
0	0	**500**	300	....		500	0	0	1000	50	

At *Time t*, the exposure will drop from 2300 to 1850 after deducting 500 from the last but 10th moving window

20

PTRM 2.0 – Execution Throttle Limits

Execution Throttle Exposure Versus Maximum Intraday Exposure

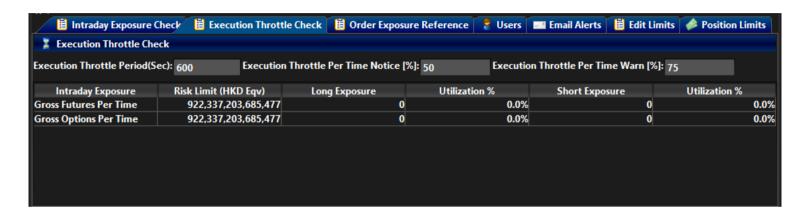| Item	Maximum Intraday Exposure	Execution Throttle Exposure
Formula	Open Futures Long Quantity x Long UMR + Traded Futures Long Quantity x Long UMR	Traded Futures Long Quantity x Long UMR
	Open Futures Short Quantity x Short UMR + Traded Futures Short Quantity x Short UMR	Traded Futures Short Quantity x Short UMR
	(Open Buy Calls Quantity x Long UMR) + (Open Sell Puts Quantity x Short UMR) + (Bought Calls Quantity x Long UMR) + (Sold Puts Quantity x Short UMR)	(Bought Calls Quantity x Long UMR) + (Sold Puts Quantity x Short UMR)
	(Open Sell Calls Quantity x Short UMR) + (Open Buy Puts Quantity x Long UMR) + (Sold Calls Quantity x Short UMR) + (Bought Puts Quantity x Long UMR)	(Sold Calls Quantity x Short UMR) + (Bought Puts Quantity x Long UMR)
Reset Frequency	1 Business Day	User-Configurable 300 to 600 seconds on a 10-moving-window basis

Execution Throttle Limits designed to provide the user a more effective at-trade Prescribed Risk Control regarding a rapid UMR exposure building up within a short period of time for trades only (All Block Trade Exposures excluded)
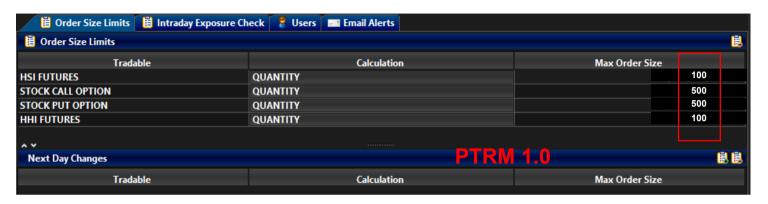
PTRM 2.0 – Execution Throttle Limits

Execution Throttle Period(Sec): 600	Execution Throttle Per Time Notice [%]: 50	Execution Throttle Per Time Warn [%]: 75

Intraday Exposure	Risk Limit (HKD Eqv)	Long Exposure	Utilization %	Short Exposure	Utilization %
Gross Futures Per Time	922,337,203,685,477	0	0.0%	0	0.0%
Gross Options Per Time	922,337,203,685,477	0	0.0%	0	0.0%

Remarks:

- The PTLG will be blocked upon a limit breach by any 1 of the 4 relevant Execution Throttle exposures
- Subsequent orders by the OAPI / HKATS Online Sessions assigned to the PTLG will be rejected
- New OAPI return code for the order rejection: (-850010) "User has exceeded Execution Throttle limit"
- To unblock, the user has to make an adjustment / wait until the relevant limit value > the relevant Execution Throttle exposure value as the condition for unblock
- New "Unblock execution throttle exposure" in the menu for Emergency Buttons will be undimmed once the condition for unblock is fulfilled

PTRM 2.0 – Intraday Position Limits
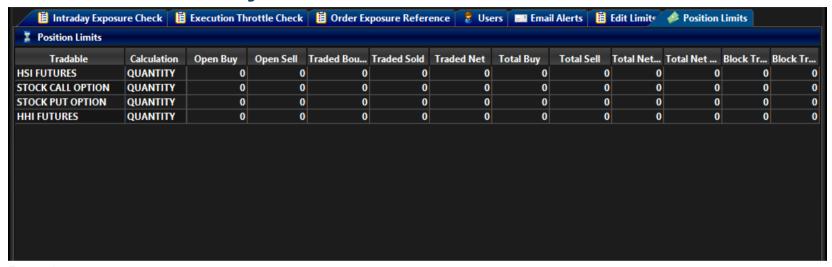
PTRM 2.0 – Intraday Position Limits

Intraday Position Limits is an at-trade risk check at the product tradable level with the following risk limits and exposure counters for each product tradable:

Intraday Position Limits Counters	Formula
Open Buy	The current number of open contracts on the buy side (Exclude Block Trade)
Open Sell	The current number of open contracts on the sell side (Exclude Block Trade)
Traded Bought	The current number of traded contracts on the buy side (Exclude Block Trade)
Traded Sold	The current number of traded contracts on the sell side (Exclude Block Trade)
Total Buy	Open Buy + Traded Bought (Exclude Block Trade)
Total Sell	Open Sell + Traded Sold (Exclude Block Trade)
Traded Net	Absolute value of (Traded Bought – Traded Sold)
Total Net Buy	Open Buy + Traded Bought – Traded Sold (Exclude Block Trade)
Total Net Sell	Open Sell + Traded Sold – Traded Bought (Exclude Block Trade)
Block Trade Bought	The current number of traded block trade contracts on the buy side
Block Trade Sold	The current number of traded block trade contracts on the sell side

Intraday Position Limits count the exposure in term of the accumulated number of contracts by product tradables while Maximum Intraday Exposure Limits count the exposure in term of the accumulated UMRs by a mix of all product tradables
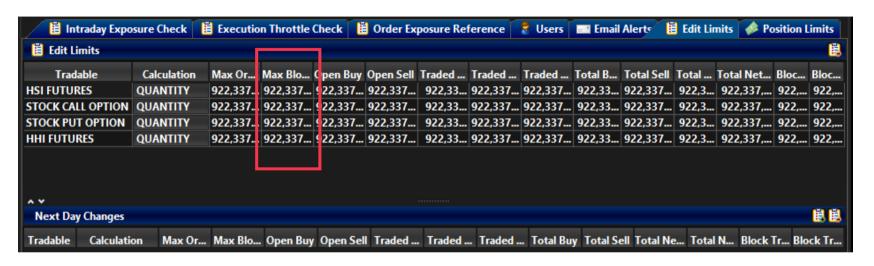
PTRM 2.0 – Intraday Position Limits

| Intraday Exposure Check | Execution Throttle Check | Order Exposure Reference | Users | Email Alerts | Edit Limits | Position Limits |

Position Limits

Tradable	Calculation	Open Buy	Open Sell	Traded Bou...	Traded Sold	Traded Net	Total Buy	Total Sell	Total Net...	Total Net ...	Block Tr...	Block Tr...
HSI FUTURES	QUANTITY	0	0	0	0	0	0	0	0	0	0	0
STOCK CALL OPTION	QUANTITY	0	0	0	0	0	0	0	0	0	0	0
STOCK PUT OPTION	QUANTITY	0	0	0	0	0	0	0	0	0	0	0
HHI FUTURES	QUANTITY	0	0	0	0	0	0	0	0	0	0	0

Remarks:

- The product tradable will be blocked upon a limit breach by any 1 of the 11 relevant Intraday Position Limits exposures
- Subsequent orders of that product tradable by the OAPI / HKATS Online Sessions assigned to the PTLG will be rejected
- New OAPI return code for the order rejection: (-850014) "User has exceeded Position limit"
- To unblock, the user has to make an adjustment / wait until the relevant limit value > the relevant Intraday Position Limits exposure value as the condition for unblock
- New "Unblock Position Limit" in the menu for Emergency Buttons will be undimmed once the condition for unblock is fulfilled
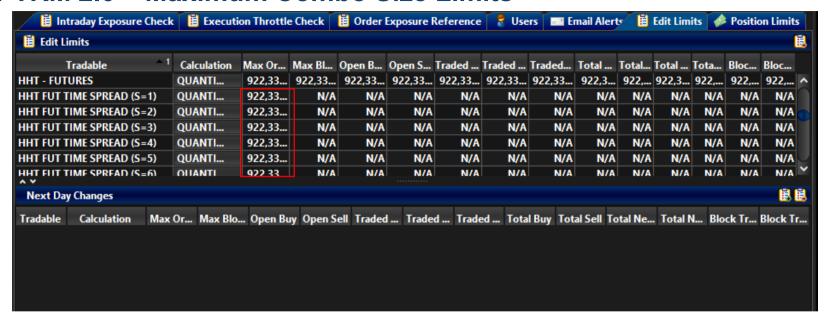- All Block Trade Exposures will be counted towards the BASE PTLG

PTRM 2.0 – Maximum Block Trade Size Limits

Remarks:

- Maximum Block Trade Size Limits control the block trade size per the corresponding product tradable setting. The sizes of block trade submitted by the OAPI / HKATS Online Sessions assigned to a PTLG are governed by the block trade size settings at that PTLG
- The check is pre-trade. Rejections for block trade size violations will occur before the reports being accepted
- New OAPI return code for the order rejection: (-850012) "User has exceeded Max. Block Trade Size limit"

PTRM 2.0 – Maximum Combo Size Limits
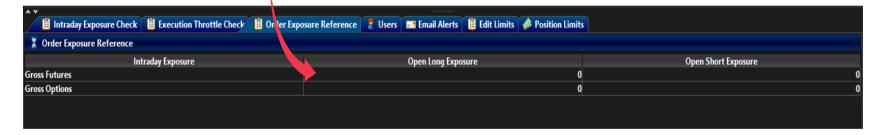

Remarks:
- Combos include Standard Combinations and Tailor-Made Combinations
- The user has to add the relevant combo tradables for combo order size restrictions
- The check is pre-trade. Rejections for combo size violations will occur before the orders being accepted
- Existing OAPI return code for the order rejection: (-850008) "User has exceeded Maximum Order Size Limit"

PTRM 2.0 – Order Exposure Reference Counter

Order Exposure Reference Counters	Formula
Gross Futures Long	Open Futures Long Quantity x Long UMR
Gross Futures Short	Open Futures Short Quantity x Short UMR
Gross Options Long	(Open Buy Calls Quantity x Long UMR) + (Open Sell Puts Quantity x Short UMR)
Gross Options Short	(Open Sell Calls Quantity x Short UMR) + (Open Buy Puts Quantity x Long UMR)

Remarks:

- The counters above count 100% order exposure irrespective of the current effective settings of Futures Order Coefficient (%) and Options Order Coefficient (%)

  The readings by Order Exposure Reference Counters are for reference only. EPs shall always refer back to their order books for outstanding order status confirmations

PTRM 2.0 – Active User Reference Counter

Remarks:

• Active User Reference Counter for a Base PTLG will be counting both the assigned and unassigned OAPI / HKATS Online Sessions

Technical Arrangements & Participant Readiness

Technical Arrangements & Participant Readiness

PTRM GUI Specifications (Recommended PC Requirement)

	Current Recommendation	Revised Recommendation
Processor	Intel Core i3-550 3.2GHz or Higher	Intel Core i3 6th Generation 3.2GHz or Higher
RAM	4 GB	
Extra Storage	10GB	
Network Adapter	100Mbps full-duplex	
OS	Microsoft Windows 10 (64 bit)	
Layered Software	JAVA 8 See Java System Requirements: http://java.com/en/download/help/sysreq.xml	
	Anti-virus software	
Supporting Browser	Windows Google Chrome (Version to be advised and notified by HKEX to EPs from time to time)	
Bandwidth Usage	Less than 1 Mbps of existing SDNET/2 or HKEX Service Network circuit per session	Approximately 1 Mbps of existing SDNET/2 or HKEX Service Network circuit per session Note: Higher bandwidth consumption per PTRM GUI connection is estimated when more tradables are addded (i.e., Instrument Tradables as per the current Maximum Order Size Limits)

Intraday Position Limits consume a higher amount of bandwidth for updating the relevant risk limits and counters if a large number of Instrument Tradables is created for more granular controls. It is **not** advised to leave the "Edit Limits" **or** the "Position Limits" tabs open to avoid unnecessary consumption in the bandwidth. The more the Instrument Tradables being added, the higher the PTRM GUI bandwidth consumption and display latency will be observed. It is estimated that an extra of 1Mbps of bandwidth per 40 Instrument Tradables defined per PTLG will be consumed when leaving the "Edit Limits" **or** the "Position Limits" tab open.

Technical Arrangements & Participant Readiness

OAPI Readiness

(-850010) <u>New!</u> User has exceeded Execution Throttle limit	• User has breached an Execution Throttle Limit and the transaction is rejected.
(-850012) <u>New!</u> User has exceeded Max. Block Trade Size limit	• User has breached a Max. Block Trade Size limit and the transaction is rejected.
(-850014) <u>New!</u> User has exceeded Position limit	• User has exceeded an Intraday Position limits and the transaction is rejected.
(-850002) <u>Existing</u> User is in a blocked Pre-trade Risk state	• Triggered by the "Stop Button" and the "Kill Switch". • User in a blocked Pre-Trade Risk State is not allowed to place any new order or order modification.
(-850004) <u>Existing</u> User has breached Maximum Order Rate Limit	• User has breached "Maximum Order Rate Limit" and the order is rejected.
(-850006) <u>Existing</u> User has breached Maximum Intraday Exposure Limit	• User has breached at least one "Maximum Intraday Exposure Limit" and the order is rejected.
(-850008) <u>Existing</u> User has exceeded Maximum Order Size Limit	• User has exceeded "Maximum Order Size Limit" and the order is rejected.

EPs/ Vendors are strongly recommended to assess or test their OAPI readiness for the new OAPI return codes by utilising HKATS End-To-End Test Environment prior to the Market Rehearsal event. Details of the testing arrangement and schedule will be announced in due course

Technical Arrangements & Participant Readiness

PTRM GUI Training Sessions

HKEX will provide training sessions on the new PTRM functions to all EP nominated Risk Limit Manager and Trading Unit users tentatively in Q2 of 2021. All PTRM Authorized Persons are required to join the training sessions

Production Preparations & Market Rehearsals

- HKEX plan to conduct production readiness tests for the market in Q3 of 2021
- As the final preparation before the production rollout, Market Rehearsal will be conducted in Q3 of 2021. PTRM Authorized Persons from EPs will be required to participate in the Market Rehearsal to confirm and EPs shall declare their readiness prior to the rollout
- The Market Rehearsal is estimated and recommended to be a participation by EP/CP's PTRM Authorized Persons, trading and IT support colleagues
- PTRM Authorized Persons are advised to familiarize themselves as soon as possible with the current PTRM 1.0 login procedures and functions as soon as possible and before the market event
  a) Login in with the designated **primary** URL, ports for PTRM 1.0 before the coming Market Rehearsal to ensure you know how to login to the HKEX PTRM system. Users are reminded to know also their designated **secondary** URLs and ports for the contingency login during a, e.g., site failover event. For details, please refer to Section 1.1.1 – Login Procedures of HKATS Risk Functions User's Guide
  b) Familiarize yourselves with the current PTRM 1.0 functions and controls
  c) Familiarize yourselves with the Java cache deletion procedure at your designated PTRM GUI PC

Technical Arrangements & Participant Readiness
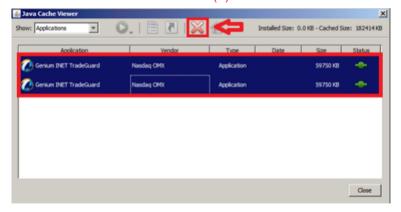
Java Cache Deletion

This is a necessary step to login the new PTRM 2.0 version during Market Rehearsal as well as logging in back to PTRM 1.0 after Market Rehearsal

Go to "Java" in "Control Panel"

Select all related cache(s) and delete them

Technical Arrangements & Participant Readiness

Q1 2021			Q2 2021			Q3 2021			Q4 2021		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Legend:
- 1 — Project Preparations
- 2 — Briefing Session on PTRM Enhancement
- 3 — Training Sessions
- 4 — End-to-End Test Environment for PTRM Enhancement
- 5 — Briefing Sessions for Market Rehearsal
- 6 — Market Rehearsal
- 7 — Production Rollout & Stabilization Period

Get Ready → Market Readiness → Rollout Activities

Thank You

HKATS Hotline: (+852) 2211 6360

Email: deriopt@hkex.com.hk