



Thematic assessment on pre-trade controls implemented by investment service providers engaging in algorithmic trading

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Authors

Jyrki Manninen/jyrki.manninen@finanssivalvonta.fi

Elina Pesonen/elina.pesonen@finanssivalvonta.fi

Pasi Åkerfeldt/pasi.akerfeldt@finanssivalvonta.fi

1 Background, objectives and summary of the thematic assessment

1.1 Background, objectives and method of implementing the thematic assessment

In January 2024, the European Securities and Markets Authority (ESMA) launched a Common Supervisory Action (CSA) together with national supervisors regarding investment service providers engaged in algorithmic trading. The supervisory action applied to pre-trade controls, hereinafter also referred to as 'PTCs', which investment service providers must have in place in order to prevent erroneous orders. The Financial Supervisory Authority carried out a supervisory action as a thematic assessment on the pre-trade controls of Finnish investment service providers that engage in algorithmic trading.

ESMA's supervisory action, which was carried out in coordination with national supervisors, is a continuation of the survey carried out by ESMA in 2022 on the same subject area. The objective of the supervisory action was to collect more detailed information on how investment service providers in



different Member States have implemented PTCs for algorithmic trading as required by MiFID II¹ and the complementary Commission Delegated Regulation (EU) 2017/589 (RTS 6).²

In algorithmic trading, PTCs form part of the risk management required of investment service providers by regulation. PTCs are controls taking place before a trade in which the aim is to manage the risks presented to the investment service provider and the trading system with mechanisms in the investment service provider's trading systems that either completely prevent (hard blocks) or alert of (soft blocks) erroneous orders.

The Financial Supervisory Authority carried out the thematic assessment by sending written questions based on the ESMA survey templates by email to the investment service providers selected for the thematic assessment (hereinafter also referred to as 'respondents', 'respondent' or 'company') and that engage in algorithmic trading defined in the Act on Investment Services. On the basis of the written replies submitted by each respondent, a request for additional information containing more specific questions was also sent.

1.2 Background information on regulation

1.2.1 Definition of algorithmic trading

In accordance with the Act on Investment Services, in the regulation, algorithmic trading refers to trading in financial instruments³ where a computer algorithm automatically determines the individual parameters of orders⁴. The parameters of an order include whether an order is initiated, the timing, price and quantity of the order, and how the order is managed after its submission. However, algorithmic trading does not include systems that are used only for:

- routing orders to one or several trading venues (automatic order routers, AORs);
- order processing that does not include setting trading parameters;
- confirming orders;
- post-trade processing of executed transactions.

ESMA has clarified that computer algorithms which only draw the attention of the trader to a trading opportunity do not constitute algorithmic trading. The reason given by ESMA is that the definition of algorithmic trading requires that algorithms are used also in the execution of the transaction.⁵ Therefore, robo-advisors, for example, which are nowadays used to provide investment advisory services to retail customers, are also excluded from the definition. ESMA has also separately clarified that the regulatory requirements are not applicable to algorithmic trading that takes place outside trading venues, i.e. over the counter (OTC), for example, with an algorithm generating quotes that are sent to certain clients who have requested quotes⁶.

¹ Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU (recast).

² Commission Delegated Regulation (EU) 2017/589 of 19 July 2016 supplementing Directive 2014/65/EU of the European Parliament and of the Council with regard to regulatory technical standards specifying the organisational requirements of investment firms engaged in algorithmic trading.

³ In addition to shares, bonds and derivative instruments, financial instruments include money market instruments, units in UCITS and emissions rights.

⁴ Act on Investment Services (14.12.2012/747), chapter 1, section 25.

⁵ ESMA Q&A 7, 3 Direct Electronic Access (DEA) and algorithmic trading.

⁶ ESMA Q&A 8, Direct Electronic Access (DEA) and algorithmic trading.



1.2.2 Regulation related to the thematic assessment

Algorithmic trading is governed in chapter 7a of the Act on Investment Services, in which the requirements of Article 17 of MiFID II have been implemented. More detailed regulations on pre-trade controls are contained in Article 15 of RTS 6 as follows:

- Article 15(1) of RTS 6: pre-trade controls;
- Article 15(3) of RTS 6: execution throttles;
- Article 15(4) of RTS 6: market and credit risk limits;
- Article 15(5) of RTS 6: automatic order cancellation.

Article 17(1) of MiFID II contains the requirements set for algorithmic trading with which the directive aims to regulate the risks that significant developments relating to trading technology and its broader use are deemed to be caused to the sound functioning of the market.⁷ The paragraph requires that a firm engaging in algorithmic trading has in place effective systems and risk controls suitable to the business it operates to ensure that:

- its trading systems are resilient and have sufficient capacity;
- its trading systems are subject to appropriate trading thresholds and limits;
- its trading systems prevent the sending of erroneous orders or the systems otherwise functioning in a way that may create or contribute to a disorderly market.

The more detailed requirements for pre-trade controls are defined in Article 15(1) of RTS 6. The delegated regulation requires that investment firms have in place the following controls before order entry:

- price collars which automatically block or cancel orders that do not meet set price parameters for a financial instrument;
- maximum order value, which prevents orders with an uncommonly large order value from entering the order book of a trading venue;
- maximum order volume, which prevents orders with an uncommonly large order size from entering the order book of a trading venue;
- maximum messages limit, which prevents sending an excessive number of messages pertaining to the submission, modification or cancellation of an order to a trading venue's order book.

Article 15(3) of RTS 6 requires that an investment firm also has in place automated execution throttles which control the number of times its algorithmic trading strategy has been applied.

According to Article 15(4) of RTS 6, an investment firm must set market and credit risk limits on its algorithmic trading in accordance with the criteria laid down in the article.

Article 15(5) of RTS 6 requires that an investment firm must automatically block or cancel orders from a trader if it becomes aware that that trader does not have permission to trade a particular financial instrument. An investment firm must automatically block or cancel orders where those orders risk compromising the investment firm's own risk thresholds.

⁷ MiFID II recital 62



1.3 Background information on survey respondents

The Finnish investment service providers which, in accordance with the regulation, have notified the Financial Supervisory Authority that they engage in algorithmic trading were selected as the target of the thematic assessment. The same investment service providers also participated in the survey carried out by ESMA in 2022. The companies are of very different sizes and they engage in algorithmic trading for different purposes (order execution, dealing on own account and asset management) and at different scales. However, before the final selection of targets, using information gathered through its supervisory duties, the Financial Supervisory Authority assessed potential other investment service providers that could have been included in the thematic assessment.

Foreign investment service providers also engage in algorithmic trading in Nasdaq OMX Helsinki. Since the Financial Supervisory Authority is not the competent authority of these investment service providers, these remote brokers were left outside this thematic assessment. At least some of them will likely be assessed in the corresponding assessment by their own competent authorities.

1.4 Summary of the thematic assessment

On the basis of the answers to the thematic assessment, respondents had generally implemented the pre-trade controls for algorithmic trading required by regulation. However, significant variations in the implementation of the controls and the related procedures, including integration with market and credit risk limits, were observed, which appeared to be caused by the size of the respondents' organisation and the nature and scope of the algorithmic trading carried out by them. Some respondents also referred to the pre-trade controls of their DMA⁸ service providers and trading venues instead of their own controls, but the responses did not indicate to what extent their adequateness had been assessed in relation to trading errors, for example.

Significant differences between the respondents were also observed in the governance and monitoring of pre-trade controls. The responses indicated that, for some respondents, the role of the second line of defence⁹ was insufficient in the governance and monitoring of pre-trade controls. For some of the respondents, the compliance function did not appear to have any role in the pre-trade controls, and in one case, even risk management did not participate in any way in the governance of the pre-trade controls. In these cases, the processing of the controls and the alerts produced by them were entirely the responsibility of the operational level.

The definition of more specific universal good practices on the basis of the thematic assessment is challenging because the number of respondents was small, and their algorithmic trading practices were very heterogeneous.

⁸ Direct electronic market access.

⁹ The three lines of defence risk management model, in which the first line consists of employees engaging in operational activities and the management, the second line is composed of the risk management professionals, including compliance, and the third line comprises the respondent's internal audit.



2 Pre-trade controls

2.1 Implementation and calibration of pre-trade controls

The ESMA Common Supervisory Action had to do especially with the requirements of Article 15(1) of the RTS 6, which can in practice often be implemented with preventative (hard block) or alerting (soft block) pre-trade controls. Preventative hard block controls refer to mechanisms that prevent order entry when a predefined limit is reached or another condition is met. The trader cannot independently bypass or adjust the condition. Alerting soft block controls refer to mechanisms which, when pre-determined conditions are met, either only alert the trader entering the order about the transaction, or they can be independently bypassed by the trader without any contribution from another party.

All the respondents to the thematic assessment had implemented the pre-trade controls required by regulation. Two respondents indicated that, in addition to their own pre-trade controls, they use a pre-trade risk management service provided by the trading venue to its members for part of their trading. However, on the basis of the answers received, it is difficult to assess whether the pre-trade controls were implemented and calibrated appropriately. On the basis of the answers, at least the respondents that engage in algorithmic trading more extensively have adapted their pre-trade controls to suit their different functions. Controls have been implemented and adapted according to the financial instrument type and depending on whether own or external algorithms have been used to execute transactions, whether dealing on own account or on behalf of a client, how orders are received from the client, and in which trading venue the orders are executed.

Some of the respondents had all four controls required by regulation (price collar, maximum order value, maximum order volume and maximum number of messages related to an order). All respondents were using the controls for maximum order value and maximum number of messages related to orders. Some of the respondents were lacking own controls related to price. The respondents argued that the price control for orders takes place through the respondents' broker providing DMA service or through the trading venue's own controls. On the basis of the responses received, it remained unclear whether the respondents have fully taken into account the possibility of human errors, for example, when entering parameters related to price limit to trading algorithms, or how the algorithms behave in disrupted markets, and whether the controls carried out by the DMA service providers used by them are sufficient in these respects.

The control limiting the maximum number of orders referred to in Article 15(3) of RTS 6 was used by some of the respondents. The responses also pointed out that the requirement is especially relevant in HFT¹⁰, in which none of the respondents participate.

All of the respondents confirmed that they use pre-trade controls for all the financial instruments with which they engage in algorithmic trading.

The respondents said that they set limits related to maximum value and volume in different ways. For example, respondents had order- and financial instrument-specific limits based on the risk mandates of each business unit, and cumulative value adjustments. One respondent to the survey who practices portfolio management said that they derive the maximum values and volumes of orders from the financial instrument-specific limits set by their clients. Another respondent said that they set the limits

¹⁰ High-frequency algorithmic trading



regarding maximum value as low as possible based on experience, in a way, however, that ensures that the limits do not unnecessarily restrict the respondent's daily trading activities.

With respect to controls limiting the number of messages related to an order, one of the respondents said that they set the limits on the basis of the trading strategy employed, while another sets the limit on the basis of their understanding of a number of such messages that indicates software errors or market disruptions. One respondent uses controls in which the respondent sets a limit for the number of messages, after which the algorithms automatically slow down.

Most of the respondents indicated that they use preventative controls (hard blocks). However, the answers provided by the investment service providers do not provide a more detailed justification for this, with the exception of one respondent according to whom the controls that block the maximum values and volumes are based on clients' risk limits, and thus they would have no reason to execute orders that would exceed clients' risk limits. All the respondents confirmed that their traders cannot bypass the preventative controls alone, as this requires the participation of another representative of the respondent.

One respondent who has both alerting and preventative controls described how the triggering of the controls can be caused by an unusual number of messages, software errors or market disruptions, and that the levels can be set in different ways to different trading applications. Another respondent who has both types of controls regarding the maximum value of an order said that alerting controls are included in its trading algorithms, while preventative controls are set through the pre-trade risk management service provided by the trading venue, and are applied generally.

All the respondents said that they assess and test the functioning of the pre-trade controls regularly or at least in conjunction with changes to trading algorithms. One of the respondents explained that they had not verified the processes and parameters underlying the controls and had not tested them since they were implemented. However, they did say that the functioning of each alerting control is tested in conjunction with the implementation of a trading algorithm or when changes are made to it.

None of the respondents said that they communicated with the trading venue about the pre-trade controls in their use. However, on the basis of the answers two respondents used a pre-trade risk management service provided by a trading venue in at least part of the algorithmic trading orders. Therefore, we can assume that the trading venue is also aware of the pre-trade controls used by the investment service providers in question.

If pre-trade controls can also be purchased as pre-trade risk management services provided by a trading venue to its members, the services can be used to implement the pre-trade controls regarding algorithmic trading required by regulation in the trading venues in question. On the basis of the responses to the thematic assessment, at least two respondents use such service, and in the Financial Supervisory Authority's view it is a good way to implement the controls, for example, when the company's own resources would be too limited in view of building the controls or the company otherwise does not deem it to be cost-effective to build the controls fully independently.

2.2 Pre-trade controls and market and credit risk limits

In the ESMA Common Supervisory Action, with regard to Article 15(4) of RTS 6, a point of particular interest was whether the pre-trade controls for algorithmic trading are possibly integrated into the



market and credit risk limits required by regulation. The purpose of the market and credit risk limits is to ensure that investment service providers do not take excessive risks that could endanger capital adequacy or profitability.

One of the respondents explained that the market and credit risk limits in its operations are set generally to all the respondent's risk-taking functions, including algorithmic trading. This is why the risk limits have not been separately integrated into the planning and calibration of pre-trade controls applied in algorithmic trading.

Another respondent who engages in asset management answered that the maximum order value and maximum volume controls built into its trading algorithms are designed to take account of the market exposure desired by the client and prevent the position from exceeding the client's highest theoretical position limit or risk limit in any financial instrument belonging in the client's investment strategy.

The third respondent, who trades on their own account, said that, in addition to the maximum value of orders, they had set limits for the value of their positions, the gain/loss of their positions, and the number of sold shares. The respondent also said that the maximum order values are set specifically from the perspective of their risk appetite and are fixed at the lowest possible level on the basis of previous experiences, however in a way that does not unduly limit the respondent's daily trading activities.

2.3 Procedures, training and monitoring regarding pre-trade controls

The Financial Supervisory Authority also collected information on the procedures, training and monitoring pertaining to pre-trade controls. On the basis of the responses received, the methods of recording the standard operating procedures varied substantially between the respondents. The respondent that engages in algorithmic trading the most extensively has prepared written documentation on how the respondent has implemented the pre-trade controls required by regulation in different trading functions and has also prepared internal operating guidelines on algorithmic trading. The other respondents had little to no guidelines at all regarding pre-trade controls.

All the respondents said that they monitor PTC alerts in real time. Respondents who use alerting controls had a procedure in place in which at least two people participate in the processing of individual alerts, in accordance with the four eyes principle. The respondent who engages in algorithmic trading the most extensively has an independent unit, which is separated from the trading function, for monitoring alerts in real time in addition to the trading function. In the second company that replied to the questionnaire, alerts are automatically reported to the risk management function. In the third company, alerts are processed in the trading function in cooperation with the managing director.

The answers regarding the roles of the first and second line of defence in PTC alert processing varied with the size of the respondents' organisations. In the organisation of the respondent with the largest organisation, the first line of defence is responsible for real-time monitoring and carries out the more minor measures caused by alerts. More serious events such as system and process errors are reported to the compliance function, which is part of the second line of defence, and cases that require the launch of a formal process are reported to the operational risk function. According to the response of the second company, the alerts are reported also to the risk management function, which is part of the second line of defence. According to the third response, the company's second line of defence does not play any role because only the portfolio managers and the managing director are responsible for monitoring the alerts.

As part of the thematic assessment, the respondents were requested to provide information on the persons authorised to decide on the implementation of pre-trade controls, changes to these, and procedures related to changes. This question also prompted a wide variety in the responses depending on the size of the organisation. The respondent with the largest organisation has a separate committee consisting of managerial staff which decides, among other things, on pre-trade control, its implementation and changes to it. The representatives of the compliance and operational risk functions also participate in the meetings of the committee on a case-by-case basis.

In the second company, according to the answer, the risk management function determines the framework according to which the pre-trade controls are determined, and portfolio management is responsible for their technical implementation. Risk management is also authorised to challenge the set pre-trade control parameters and changes to these. According to the third response, the company's managing director makes all the decisions related to pre-trade controls. However, the company's portfolio managers can change the algorithm-specific alerting controls. The parameters of the pre-trade risk management service purchased by the company from the trading venue can only be changed by the managing director or their deputy.

Two respondents said that, in addition to pre-trade controls, they had several other controls related to the detection and prevention of employees' human errors. All the respondents to the survey said that they train their employees regularly to minimise and process human errors.

In the ESMA Common Supervisory Action, a separate point of interest was the extent to which the trading algorithms of external service providers are used in algorithmic trading, and how pre-trade controls are governed in such cases. One of the respondents to the thematic assessment said that they also use trading algorithms developed and maintained by external service providers in parts of their trading. However, according to the respondent, they themselves are responsible for all the preliminary checks of the orders they send to external service providers, but after this, the application of pre-trade controls depends on by whom and how the child orders generated by the service provider's algorithms are implemented.