



# whitepaper

## Woodworking machines

In this document we are analyzing a specific type of woodworking machines, such as lathes, calendula burs, etc., typically using automatic or manual change of machining tools.

Standards EN ISO 19085-1 and EN ISO 19085-3 specify that in this type of machines the following requirements must be met:

1. A selector device (identifying the tool in use). Performance Level (PL) not required
2. A maximum speed control, on the spindle, to verify that the spindle does not exceed 10% the maximum speed allowed by the identified tool. Performance Level c (PL c) required

From an analysis of the different manufacturers of woodworking machines we determined that tools can operate typically in a range of 5 speeds (9.000, 12.000, 18.000, 24.000 and 30.000 revolutions per minute) and, in some particular cases, at 10.000, 15.000 and 20.000 revolutions per minute.

Safety controllers are therefore required to control up to 8 different speeds.

## STANDARDS

The standards providing safety requirements for this type of machinery are:

### UNI EN ISO 19085-1:2017

#### Woodworking machines - Safety - Part 1: Common requirements (ISO 19085-1:2017)

ISO 19085-1:2017 gives the safety requirements and measures to reduce risks related to woodworking machines arising during operation, adjustment, maintenance, transport, assembly, dismantling, disabling and scrapping and which are common to machines used in the woodworking industry. It is applicable to woodworking, stationary and displaceable machines when they are used as intended and under the conditions foreseen by the manufacturer.

#### 5.7.3. Infinitely variable speed by frequency inverter

Machine equipped with an infinitely variable speed control (i.e. frequency inverter) for the tool drive shall have speed monitoring<sup>1</sup>. The selected speed shall be indicated the selector device. Where the speed is automatically selected by the control system, the selected speed need not to be indicated.

The control for speed monitoring shall ensure that, as soon as the real speed exceeds the selected speed by more than 10% the drive shall be stopped automatically in stop category 0 according to IEC 60204-1:2005. 9,22.

Note: A deviation of the selected speed may be caused by, e.g. an error in the selected value converting system, the controlling system or the rotary pulse generator of the infinite variable speed control.

The SPR/CS for speed monitoring shall achieve  $PLr = c$ .

### UNI EN ISO 19085-3:2018

#### Working machines - Safety requirements - Part 3: Numerically controlled (NC) boring and routing machines

This document gives the safety requirements and measures for numerically controlled (NC) boring machines, NC routing machines and NC combined boring/routing machines (as defined in 3.1), hereinafter referred to as "machines".

#### 5.7.3 Infinitely variable speed by frequency inverter

As an exception to speed monitoring with the selected speed as limit value, the monitoring may use the maximum rotational speed of the tool.

Unless the tool characteristics are automatically read from the tool, at least the maximum rotational speed of the tool needs to be set by the operator after loading of the tool changing system or after manual insertion of the tool.

The stored data shall be displayed, and confirmed by the operator. Alternatively, tool ID can be confirmed if already associated with tool maximum rotational speed. When tool ID is edited, tool maximum rotational speed shall be confirmed.

It shall not be possible to select a speed value higher than the maximum rotational speed of the tool stored in the memory of the control system (no PLr).

NOTE: During the next revision of this document, it is intended that it deals with requirement on tool identification.

For spindles with speed pre-set at fixed value and for spindles which are only capable of being used with boring tools, no speed monitoring are required.

1 For speed monitoring of PSD(SR) (power drive system, safety-related), IEC 61800-5-2:2007, 4.2.3.4 Safety-limited speed (SLS) applies



## APPLICATIONS

Woodworking machines with automatic tool selector (typically CNC machines) where operations are controlled by an integrated PLC. The most popular applications are the following:

- Drilling machines
- Lathes, calendula burs
- Milling machines

These machines operate with different tools controlled and selected by an Automatic Tool Changer (ATC). It is therefore possible to operate the machines with or without operator intervention.

The main elements of an ATC are:

- The tool magazine
- The exchange group

For this type of machines, as specified by the standards, the control of the safety speed of each tool during operations is mandatory.





## THE MOSAIC SOLUTION

The Reer Safety Controller system Mosaic offers a wide range of speed monitoring expansion cards (MV series), allowing safety speed monitoring for a maximum of 8 different speeds on different axis (depending on Mosaic configuration).

The Speed Control function block of the Mosaic Safety Designer (MSD) software monitors the speed of a device generating an output 0 (FALSE) when the measured speed exceeds a predetermined threshold. If the speed is below the predetermined threshold the output will be 1 (TRUE).



### MV - Speed monitoring units

Safety speed monitoring (up to PL e) for: Zero speed control, Maximum speed control, Speed range control, Direction

#### MV0

Input for 2 proximity switches

#### MV1

Input for 1 incremental encoder (TTL, HTL or SIN/COS) and 2 proximity switches

#### MV2

Input for 2 incremental encoders (TTL, HTL or SIN/COS) and 2 proximity switches

## SELECTING THE NUMBER OF THRESHOLDS

The parameter "Threshold number" [A] in the Speed Control functional block Property window, allows you to enter the number of maximum-speed thresholds.

Changing this value will increase/decrease the number of thresholds that can be entered from a minimum of 1 to a maximum of 8.

When the number of thresholds selected is greater than 1, the input pin [B] for the selection of the specific threshold will appear in the lower part of the functional block.

2 threshold settings

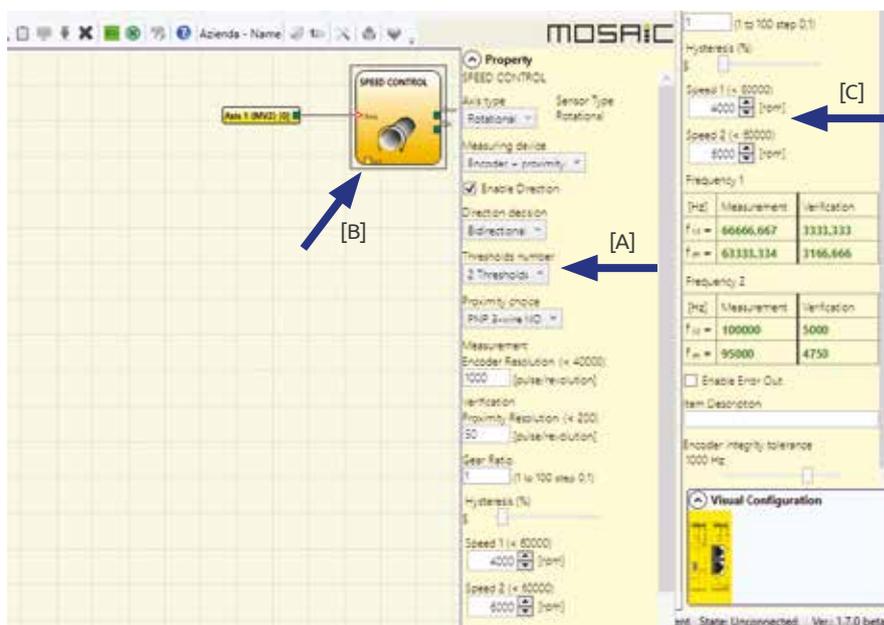
In1	Threshold no
0	Speed 1
1	Speed 2

Up to 4 threshold settings

In2	In1	Threshold no.
0	0	Speed 1
0	1	Speed 2
1	0	Speed 3
1	1	Speed 4

Up to 8 threshold settings

In3	In2	In1	Threshold no.
0	0	0	Speed 1
0	0	1	Speed 2
0	1	0	Speed 3
0	1	1	Speed 4
1	0	0	Speed 5
1	0	1	Speed 6
1	1	0	Speed 7
1	1	1	Speed 8



Speed 1...8 parameters selection [C]. These fields are used to enter the value of maximum speed above the one the function block output (OVER) will be 0 (FALSE). If the measured speed is less than the set value, the function block output (OVER) will be 1 (TRUE).

Starting from the firmware versions listed in the following table, the number of thresholds related to the maximum speed value has been doubled from 4 to 8 in order to comply with the indicated standards.

Module	Fw.	Max. number of thresholds
M1	> 4.0	8
MVx	>2.0	
M1S	>5	8
MVx	> 2.0	



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Code	NA 13
Product	Mosaic Safety Controller - MV Modules
Date	26-03-2020
Application	Woodworking machines using automatic or manual change of machining tools
Object	Functional requirements of this type of machine (lathes, cutters, calenders) the MV modules for safe speed control double the number of thresholds (from 4 to 8)