

# ISO 23704-2:2022-06 (E)

## General requirements for cyber-physically controlled smart machine tool systems (CPSMT) - Part 2: Reference architecture of CPSMT for subtractive manufacturing

---

Contents	Page
Foreword .....	v
Introduction .....	vi
1 Scope .....	1
2 Normative references .....	1
3 Terms, definitions and abbreviated terms .....	1
3.1 Terms and definitions .....	2
3.2 Abbreviated terms .....	4
4 Conformance with the CPSMT reference architecture for subtractive manufacturing .....	4
5 Goals and objectives of the CPSMT reference architecture for subtractive manufacturing .....	4
6 Reference architecture of a CPSMT for subtractive manufacturing .....	6
7 Functional view of a CPCM for subtractive manufacturing .....	8
7.1 General .....	8
7.2 Machine tool unit (MTU) .....	8
7.2.1 Function of the MTU .....	8
7.2.2 Abnormalities of the MTU .....	9
7.3 Cyber-physical system (CPS) unit .....	9
7.3.1 General .....	9
7.3.2 Inner-loop element .....	9
7.3.3 Intra-loop element .....	10
7.3.4 Inter-loop element .....	11
8 Functional view of a CSSM for subtractive manufacturing .....	12
8.1 General .....	12
8.2 Data processing unit (DPU) .....	12
8.2.1 General .....	12
8.2.2 A CPCM interface element .....	13
8.2.3 UIS interface element .....	13
8.2.4 Data fusion element .....	13
8.2.5 Data storage element .....	13
8.2.6 Data transformer for external entities element .....	14
8.3 Digital twin unit .....	14
8.3.1 General .....	14
8.3.2 Machine tool unit context data model .....	14
8.3.3 Machine tool unit state data model .....	15
8.3.4 Machine tool unit state management element .....	17
8.3.5 Machine tool unit behaviour model .....	17
8.3.6 Machine tool unit behaviour model engine .....	17
8.4 MAPE unit .....	18
8.4.1 General .....	18
8.4.2 Monitoring element .....	18
8.4.3 Analysis element .....	18
8.4.4 Planning element .....	19

8.4.5	Execution element .....	19
8.5	External interface unit .....	20
8.5.1	General .....	20
8.5.2	Interface schema element .....	20
8.5.3	Interface manager element .....	20
9	Interface view of a CPSMT for subtractive manufacturing .....	21
9.1	General .....	21
9.2	Interfaces for the capability of autonomous handling of machine tool abnormalities .....	21
9.2.1	General .....	21
9.2.2	Data from a CPCM to a CSSM .....	21
9.2.3	Data from a CSSM to a CPCM .....	21
9.3	Interfaces for the capability of autonomous coordination with various shop floor devices .....	21
9.4	Interfaces for the capability of autonomous collaboration with the SFCS .....	22
9.4.1	General .....	22
9.4.2	Interface between a CSSM and an SFCS .....	22
9.4.3	The interface between an SFCS and a CPCM .....	22
9.5	Interfaces for the capability of exchange with the life cycle aspects, hierarchy level, and humans through a UIS .....	23
9.5.1	General .....	23
9.5.2	Interface between a CPCM and a UIS .....	23
9.5.3	Interface between a CSSM and a UIS .....	23
	<b>Annex A (informative) Concept model of shop floor system .....</b>	<b>25</b>
	<b>Annex B (informative) Concept of unified interfaces system (UIS) .....</b>	<b>28</b>
	<b>Annex C (informative) Example use cases of a CPSMT reference architecture for subtractive manufacturing .....</b>	<b>30</b>
	<b>Bibliography .....</b>	<b>37</b>