

ICS 25.040.30

CCS L66



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 44589-2024

Technical requirements for adaptive capability of robots

机器人自适应能力技术要求

Issued on: September 29, 2024

Implemented on: April 1, 2025

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

Table of Contents

1	Scope
2	Normative references
3	Terms and definitions
4	Abbreviations
5.1	Overview
5.2	Posture Deviation Compensation
5.3	Anti-interference
5.4	Task Generalization
6.1	General requirements
6.2	Perception Component Requirements
6.3	Requirements for force-position coordination control components
7	Requirements for robot adaptive capabilities
7.1	General requirements
7.2	Posture Deviation Compensation Capability
7.3	Anti-interference capability

Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1. Structure and drafting rules for standardization documents" Drafting is required. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document was proposed by the China Machinery Industry Federation. This document is under the jurisdiction of the National Technical Committee on Robotics Standardization (SAC/TC 591). This document was drafted by: Beijing Institute of Automation of the Mechanical Industry Co., Ltd., Shanghai Feixi Robotics Technology Co., Ltd., iFlytek Co., Ltd., Guangdong Midea Electric Co., Ltd., Shenzhen Han's Robotics Co., Ltd., Zhejiang University, Chongqing Kairui Robotics Technology Co., Ltd., Shandong Provincial Institute of Standardization, Shanghai Fourier Intelligent Technology Co., Ltd., Shenzhen Institute of Artificial Intelligence and Robotics, Shanghai Artificial Intelligence Technology Association, Bronte Robotics Co., Ltd., Shanghai Xiangong Intelligent Technology Co., Ltd., Shanghai Jieka Robotics Technology Co., Ltd., Guangzhou Blue Ocean Robotics Systems Co., Ltd., Wuhu Ruka Robotics Technology Co., Ltd., Wuxi Riemann Robotics Technology Co., Ltd.

Co., Ltd., Guangzhou Ligong Industrial Co., Ltd., Hangzhou Lingxi Robot Intelligent Technology Co., Ltd., Suzhou Linghou Robot Co., Ltd., Jiangxi Provincial Communication Terminal Industry Technology Research Institute Co., Ltd., Jiangsu Luobei Electric Vehicle Co., Ltd., Shenzhen Sucheng Precision Technology Co., Ltd., Beijing Huili Intelligent Technology Co., Ltd., Shenzhen Youai Zhihe Robot Technology Co., Ltd., Jiangsu Feida Baokai Electric Co., Ltd., Suzhou Tower Mi Robot Co., Ltd. and Zhichang Technology Group Co., Ltd. The main drafters of this document are: Wang Shiquan, Hu Xiaoping, Zhang Liqiang, Yang Qiuying, Xu Zhennan, Tang Wenbo, She Fengzhu, Ji Chao, Liang Qiaoling, Tao Yumei, Chen Wenjie, Wang Guangneng, Jiang Kuishu, Deng Xiangwu, Wu Xuan, Zhao Zhao, Xue Jingwan, Xiong Rong, Wang Yue, Li Benwang, Gong Xuyin, Zeng Xiang, Fu Zhanghua, Zhu Qianqiao, Guo Jinlong, Huang Qiangsheng, Xu Xiong, Xu Wenbin, Yang Yucai, Zhang Gang, Li Weichong, Ding Ding, Cao Jun, Wu Chengzhong, Xu Huajian, Guo Yanling, Yang Tao, Bian Xu, Xia Jun, Zhu Yue, Gan Zhongxue, and He Yanhao. Technical requirements for robot adaptive capabilities

1 Scope

GB/T 44589-2024 sets the technical requirements for the adaptive capability of robots - the ability to complete a task when the world is not exactly where the program assumed it was. It is the property that separates an industrial arm working from a fixture from a robot that can pick a part presented at a slightly wrong angle, insert it against an unexpected contact force, or carry out a task it was shown rather than one it was taught point by point. The standard names three capability items: pose deviation compensation, disturbance rejection, and task generalisation. It sets the general requirements on the components that make them possible, in particular the perception components and the force-position coordinated control components, then the requirements on the robot's adaptive capability itself for each item, and the corresponding test methods, with an annex grading the level of adaptability against technical indicators and giving the comprehensive rating method. It takes effect on 1 April 2025.

This document specifies the adaptive capability items, components and capability technical requirements of the robot's adaptive capability at the force control level. This document is applicable to the technical development, testing and evaluation of robot adaptive capabilities at the force control level. Other types of adaptive capabilities can be referenced use.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document. For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This

document.

GB/T 38559-2020 Technical specification for force control of industrial robots

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 Robot system It consists of (multiple) robots, (multiple) end effectors and any machinery, equipment, devices or sensors required for the robots to complete their tasks. The system is formed. [Source: GB/T 12643-2013, 2.14]

3.2 adaptive capability of robot The robot's ability to complete work tasks in unstructured working conditions by using force-position coordinated control. Identify and analyze the environment and tasks, and perform adaptive regulatory control to complete complex tasks.

3.3 force sensing The robot's ability to sense and measure external forces through algorithmic estimation or force sensors.

3.4 force position collaborative control A composite control strategy that combines force control (torque control) and position control (positioning control). [Source: GB/T 38559-2020, 3.15]

3.5 force control The control mode takes force or torque as the control target, and the accuracy, precision and force control response speed of force or torque sensing are adaptive. Should be able to meet the requirements.

3.6 Unstructured operating conditions The elements in the working conditions are uncertain, irregular, and subject to external interference. The working conditions include operating objects, environments, and tasks.