AS ISO 14649.11—2004
ISO 14649-11:2003

Australian Standard™

Industrial automation systems and integration—Physical device control—Data model for computerized numerical controllers

Part 11: Process data for milling

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Part 11: Process data for milling

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PREFACE

This Standard was prepared by the Standards Australia Committee IT-006, Information Technology for Industrial Automation and Integration.

This Standard is identical with, and has been reproduced from, ISO 14649-11:2003, *Industrial automation systems and integration—Physical device control—Data model for computerized numerical controllers,* Part 11*: Process data for milling*.

The objective of this Standard is to provide the technology-specific data elements needed as process data for milling. Together with the general process data described in AS ISO 14649.10, it describes the interface between a computerized numerical controller and the programming system for milling.

This Standard is Part 11 of AS ISO 14649—2004, *Industrial automation systems and integration—Physical device control—Data model for computerized numerical controllers*, which is published in parts as follows:

Part 1: Overview and fundamental principles
Part 10: General process data
Part 11: Process data for milling (this Standard)

The terms 'normative' and 'informative' are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

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(a) Its number appears on the cover and title page while the international standard number appears only on the cover.

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References to International Standards should be replaced by references to Australian or Australian/New Zealand Standards, as follows:

Reference to International Standard		*Australian Standard*	
ISO		AS ISO	
10303	Industrial automation systems and integration—Product data representation and exchange	10303	Industrial automation systems and integration—Product data representation and exchange
10303-11	Part 11: Description methods: The EXPRESS language reference manual	10303.11	Part 11: Description methods: The EXPRESS language reference manual
14649	Industrial automation systems and integration—Physical device control—Data model for computerized numerical controllers	14649	Industrial automation systems and integration—Physical device control—Data model for computerized numerical controllers
14649-10	Part 10: General process data	14649.10	Part 10: General process data

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INTRODUCTION

Modern manufacturing enterprises are built from facilities spread around the globe, which contain equipment from hundreds of different manufacturers. Immense volumes of product information must be transferred between the various facilities and machines. Today's digital communications standards have solved the problem of reliably transferring information across global networks. For mechanical parts, the description of product data has been standardized by ISO 10303. This leads to the possibility of using standard data throughout the entire process chain in the manufacturing enterprise. Impediments to realizing this principle are the data formats used at the machine level. Most computer numerical control (CNC) machines are programmed in the ISO 6983 "G and M code" language. Programs are typically generated by computer-aided manufacturing (CAM) systems that use computer-aided design (CAD) information. However, ISO 6983 limits program portability for three reasons. First, the language focuses on programming the tool center path with respect to machine axes, rather than the machining process with respect to the part. Second, the standard defines the syntax of program statements, but in most cases leaves the semantics ambiguous. Third, vendors usually supplement the language with extensions that are not covered in the limited scope of ISO 6983.

ISO 14649 is a new model of data transfer between CAD/CAM systems and CNC machines, which replaces ISO 6983. It remedies the shortcomings of ISO 6983 by specifying machining processes rather than machine tool motion, using the object-oriented concept of Workingsteps. Workingsteps correspond to high-level machining features and associated process parameters. CNCs are responsible for translating Workingsteps to axis motion and tool operation. A major benefit of ISO 14649 is its use of existing data models from ISO 10303. As ISO 14649 provides a comprehensive model of the manufacturing process, it can also be used as the basis for a bi- and multi-directional data exchange between all other information technology systems.

ISO 14649 represents an object oriented, information and context preserving approach for NC-programming, that supersedes data reduction to simple switching instructions or linear and circular movements. As it is object- and feature oriented and describes the machining operations executed on the workpiece, and not machine dependent axis motions, it will be running on different machine tools or controllers. This compatibility will spare all data adaptations by postprocessors, if the new data model is correctly implemented on the NC-controllers. If old NC programs in ISO 6983 are to be used on such controllers, the corresponding interpreters shall be able to process the different NC program types in parallel.

ISO TC184/SC1/WG7 envisions a gradual evolution from ISO 6983 programming to portable feature-based programming. Early adopters of ISO 14649 will certainly support data input of legacy "G and M codes" manually or through programs, just as modern controllers support both command-line interfaces and graphical user interfaces. This will likely be made easier as open-architecture controllers become more prevalent. Therefore, ISO 14649 does not include legacy program statements, which would otherwise dilute the effectiveness of the standard.

AUSTRALIAN STANDARD

Industrial automation systems and integration — Physical device control — Data model for computerized numerical controllers —

Part 11:
Process data for milling

1 Scope

This part of ISO 14649 specifies the technology-specific data elements needed as process data for milling. Together with the general process data described in ISO 14649-10, it describes the interface between a computerized numerical controller and the programming system (i.e. CAM system or shopfloor programming system) for milling. It can be used for milling operations on all types of machines, be they milling machines, machining centers, or lathes with motorized tools capable of milling. The scope of this part of ISO 14649 does not include any other technologies, like turning, grinding, or EDM. These technologies will be described in further parts of ISO 14649.

Subject of the milling_schema, which is described in this part of ISO 14649, is the definition of technology-specific data types representing the machining process for milling and drilling. This includes both milling of freeform surfaces as well as milling of prismatic workpieces (also known as 2½D-milling). Not included in this schema are geometric items, representations, manufacturing features, executable objects, and base classes which are common for all technologies. They are referenced from ISO 10303's generic resources and ISO 14649-10. The description of process data is done using the EXPRESS language as defined in ISO 10303-11. The encoding of the data is done using ISO 10303-21.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10303-11, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*

ISO 10303-21, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure*

ISO 14649-10, *Industrial automation systems and integration — Physical device control — Data model for computerized numerical controllers — Part 10: General process data*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14649-10 and the following apply.

3.1
finishing
milling operation used to cut a part

NOTE The finishing operation usually follows a roughing operation. The goal of finishing is to reach the surface quality required, cf. roughing.

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