
Manipulating industrial robots — Graphical user interfaces for programming and operation of robots (GUI-R)

*Robots manipulateurs industriels — Interfaces graphiques utilisateur pour
la programmation et l'utilisation de robots (GUI-R)*



Reference number
ISO 15187:2000(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15187 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 2, *Robots for manufacturing environment*.

Annex A of this International Standard is for information only.

Introduction

ISO 15187 is part of a series of International Standards dealing with manipulating industrial robots. Other International Standards cover such topics as safety, general characteristics, co-ordinate systems, performance criteria and related test methods, terminology, and mechanical interfaces. It is noted that these standards are interrelated and are also related to other International Standards.

Annex A provides examples of possible platform with GUI for open architecture.

The purpose of this International Standard is to standardize the use of graphical user interfaces for robot programming and operation (called GUI-R). Important customer requirements for programming and operation of robots are

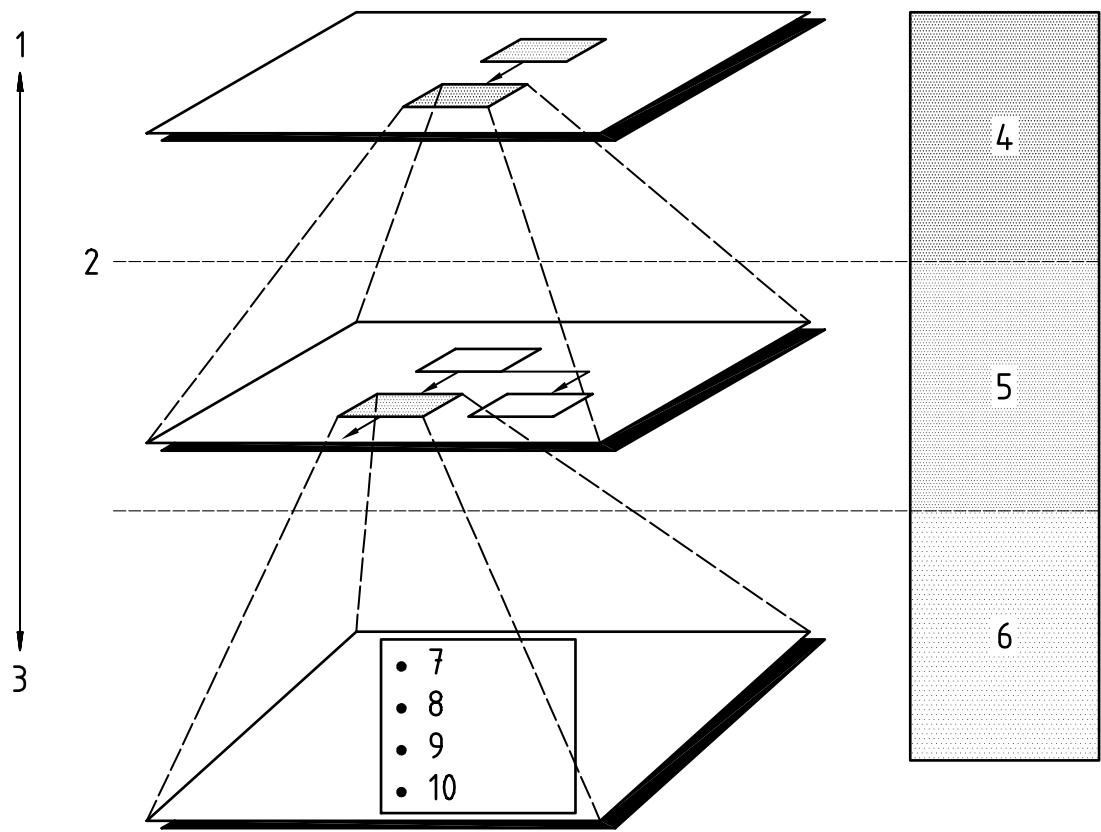
- simplification and
- standardized robot operation.

Programming and operation of industrial robots require a set of tools, e.g. editor, compiler, debugger, which help the user to specify a number of more or less complex functions to be performed by the robot control. There are many different functions for the robot control units in use world wide, and the GUI-R standard should simplify the programming with the help of graphics. In a first step GUI-R will give a style guide for the definition and use of graphical elements for the programming procedure of robots.

Therefore the GUI-R standard is nothing but the interface for the user to pick up elements for programming and operation by an easy manner. The function represented by these elements is defined in general, e.g. as a straight line robot move. The explicit, complete and detailed syntax and semantic meaning is not the purpose of GUI-R, e.g. all move parameters, the exact meaning of "straight line" by the linear interpolation including the behaviour of smoothing, and others. This is defined by the underlying robot system control and programming features: GUI-R is not a robot language expressed by graphical elements and icons. The user is obliged to read the robot system manuals and to learn about the special robot programming and control functions. GUI-R is a help to find the programming elements and to work with a graphic layout in the same manner for different robot systems. The program structure might be displayed on the screen by a program flow chart.

This International Standard only specifies the detailed specifications of GUI-R level and the concept of hierarchization, see Figure 1. The contents of the low-level hierarchy will not be specified intentionally, and consideration will be taken so that implementation will be easier.

Of course, a standard should be complete and precisely defined to cover the subject to be standardized. But there is a variety of robot programming languages and controls with different concepts, functions, syntax, and semantics. Because it is not possible to include all (partly contradictory) concepts and functions of existing (and future) robot languages for a representation by graphical elements, GUI-R covers only the main elements and functions for programming and operation. It doesn't specify all elements of one function level, e.g. icons for all possible statements of a robot language, and it doesn't specify all parameters or elements of a function or statement, e.g. the parameters of a move statement. This means GUI-R is concentrated on the main functions (defined horizontally) and on the main syntactical elements or parameters (defined vertically), see Figure 2.



Key

- | | | | |
|---|----------------|----|---------------------------------|
| 1 | High | 6 | Language Level (Implementation) |
| 2 | Abstract Level | 7 | C |
| 3 | Low | 8 | Visual Language |
| 4 | GUI Level | 9 | Flow Chart |
| 5 | Function Level | 10 | Others (Interpreter, etc.) |

Figure 1 — Image of hierarchies

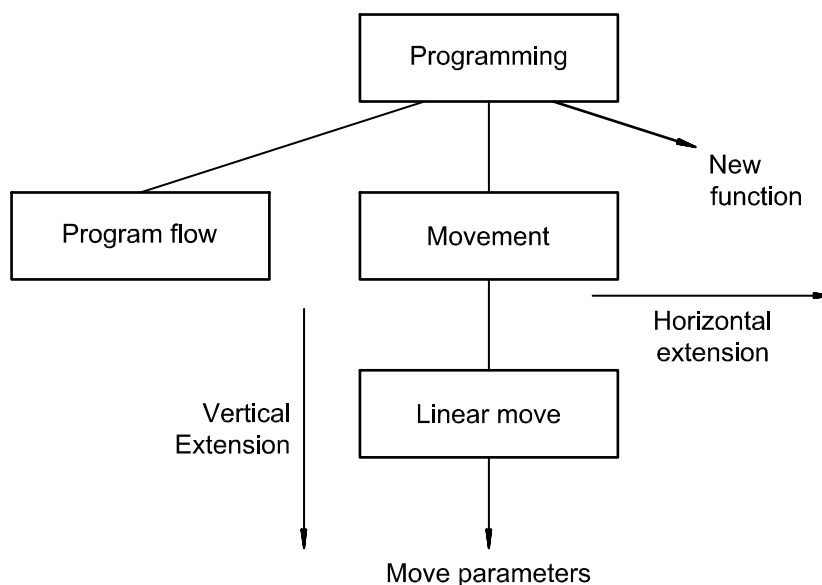


Figure 2 — Horizontal and vertical extensions

The GUI-R standard cannot cover all elements of a specific robot programming language, and it should be possible to use GUI-R also in the future for new functions. Therefore the definition of GUI-R allows the addition of new elements and rules as well as user or robot system vendor specific elements. The user or vendor can specify new elements on high functional level (horizontal extension), like for new statements or new functions, or new parameters can be added (vertical extension), e.g. for move control. Especially, it is not intended that GUI-R represents a complete functional or language definition.

Whenever it is possible, GUI-R contains reference (and perhaps a short explanation in addition, it depends on the background) to a standard or de-facto standard used for its definition base. The objective of the development of GUI-R is the use on robotic applications and not for general use in other fields like graphics. A decision was made to develop rules which are realistic and can find practical applications in industrial production. This resulted in sometimes developing vigorous GUI-R standard specifications and in other occasions provide references to other standards. The first case was used only if it was strongly needed.

GUI-R specifies how to position icons, how to structure the different areas on the screen for user programming and operation input and gives rules for the design of icons. But this could not be a "precise" definition: For example, it is not specified that the area for language statement icons is from screen co-ordinates (22,34) to (345,57) or that only blue is used for icon background. However, the scope of this International Standard has been defined in a pragmatic manner, e.g. the rules for a movement icon. There is a recommendation for GUI-R elements or screen layout, to help the user apply the standard, but not to restrict him too much. GUI-R was designed in such a manner that it is possible to convert the graphical elements into a robot language representation and vice versa.

Manipulating industrial robots — Graphical user interfaces for programming and operation of robots (GUI-R)

1 Scope

This International Standard specifies the structure and the elements of a graphical user interface for programming and operation of robots (GUI-R). Figure 3 shows the relation to the robot system, to the programming and simulation system, and to the program editor.

It is important that a graphic programming system can be used both off-line, working in a separate programming station, and on-line, working in direct connection with a robot system. The same kind of graphical user interface for off-line systems might then be used in combination with any existing robot and any existing textual language. The produced code might be stored on disk or other media for downloading to a robot system, or downloaded directly, e.g. via a serial link. An on-line system might be connected to a robot system via a high speed serial link or might be fully integrated into the robot control system.

The content of this International Standard is focussed on GUI-R for programming. The robot program itself, and its representation are thus beyond the scope of this International Standard.

GUI-R for operation will be covered in a future edition of this International Standard.

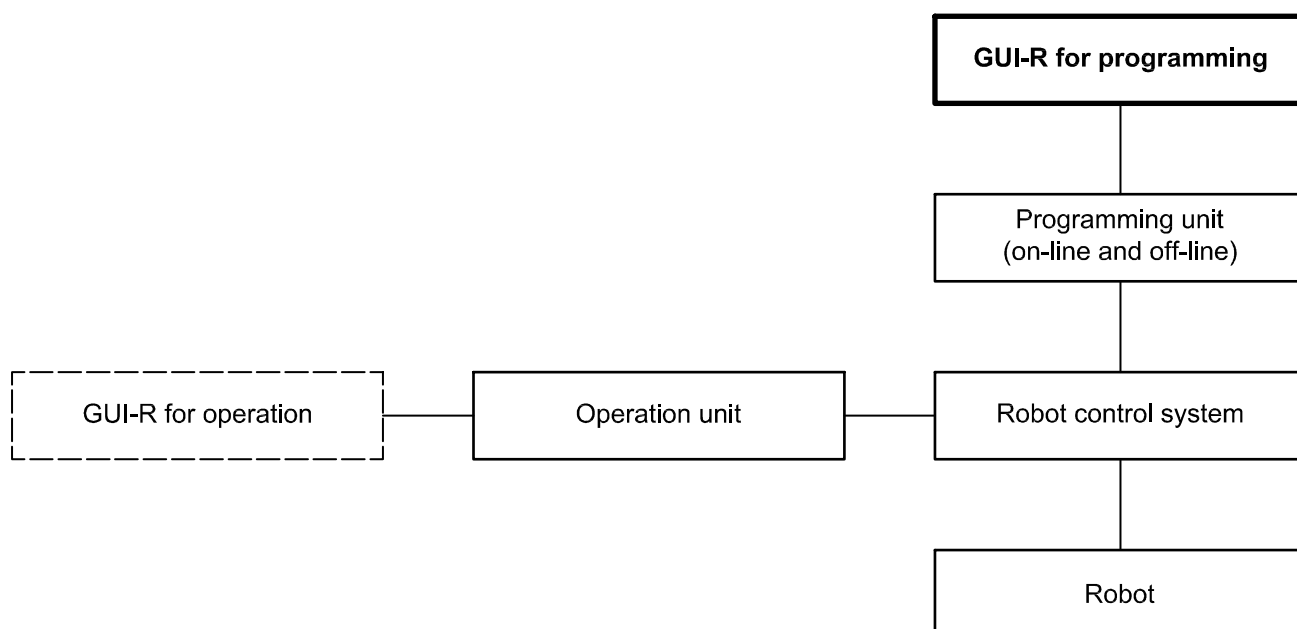


Figure 3 — Model of the context and environment for the robot programming and operation

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

IEC 60416, *General principles for the formulation of graphical symbols*.

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1 dialogue box

secondary window that gathers additional information from a user

3.2

icon

pictorial representation of an object

3.3

icon family

icon family consists of a set of icons which have a common basic icon combined with additional elements

3.4

menu

list of textual and/or graphical choices from which the user can choose

NOTE Different kinds of menus exist, such as pop-up (3.7) and pull-down (3.8) menus.

See Figure 10.

3.5

menu bar

horizontal bar at the top of a window that contains menus

3.6

object

entity or component identifiable by a user that can be distinguished by its properties, operations, and relationships

3.7

pop-up menu

menu that is displayed at the location of a selected object, containing commands that are contextually relevant to the selection

3.8

pull-down menu

menu that is displayed from a menu bar

3.9

status bar

area, typically placed at the bottom of a window, that allows the display of the current status of the information being viewed in the window and the progress of work

See Figure 7.