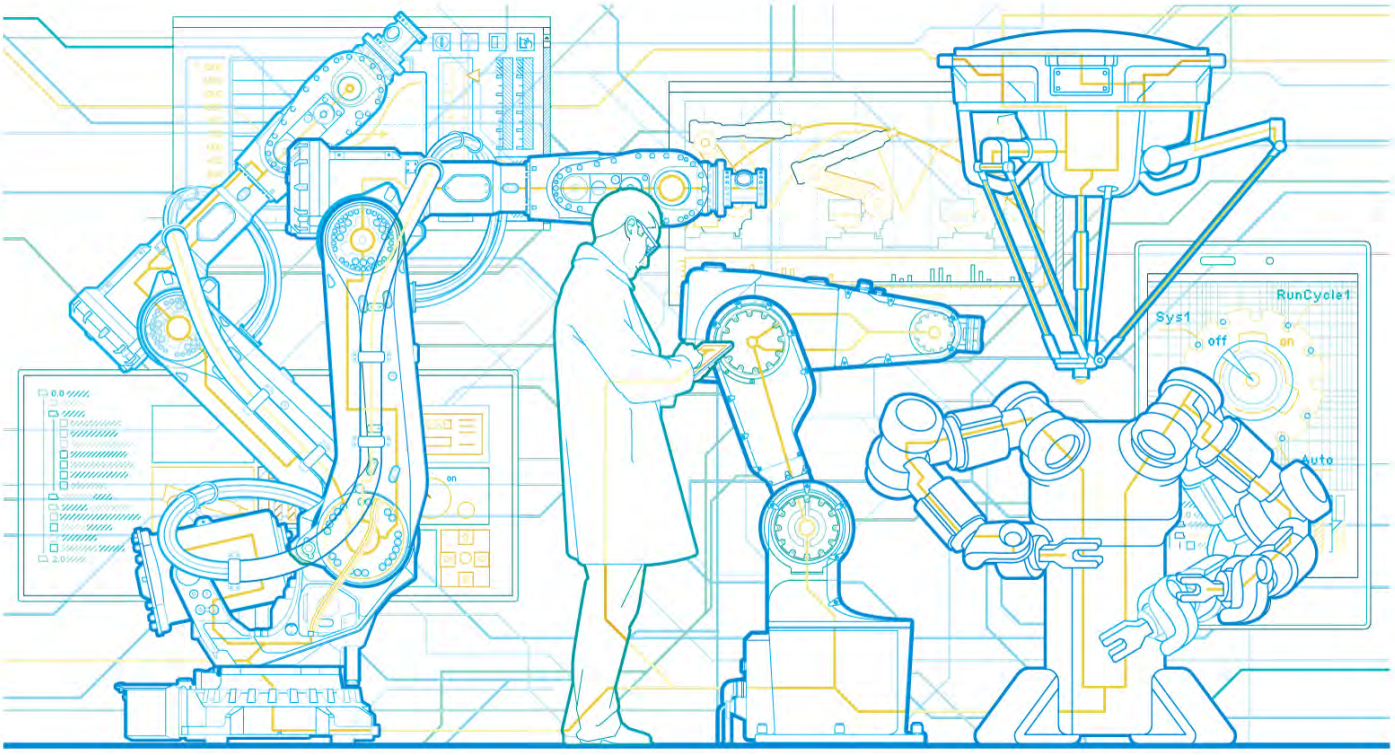

Operating manual
IRC5 with T10

Trace back information:
Workspace R17-1 version a4
Checked in 2017-03-20
Skribenta version 5.1.011

Operating manual

IRC5 with T10

RobotWare 6.05

Document ID: 3HAC050943-001

Revision: C

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Original instructions.

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Sweden

Table of contents

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Overview of this manual

About this manual

This manual contains instructions for daily operation of IRC5 based robot systems using a T10.

Usage

This manual should be used during operation.

Who should read this manual?

This manual is intended for:

- operators
- product technicians
- service technicians
- robot programmers

Prerequisites

The reader should:

- Be familiar with the concepts described in *Operating manual - Getting started, IRC5 and RobotStudio*.
- Be trained in robot operation.

References

Product manual - IRC5 IRC5 with main computer DSQC1000.	*3HAC047136-001*
Product manual - IRC5 Panel Mounted Controller IRC5 with main computer DSQC1000.	*3HAC047137-001*
Product manual - IRC5 Compact IRC5 with main computer DSQC1000.	*3HAC047138-001*
Operating manual - Getting started, IRC5 and RobotStudio	*3HAC027097-001*
Operating manual - RobotStudio	*3HAC032104-001*
Operating manual - IRC5 with FlexPendant	*3HAC050941-001*

Revisions

Revision	Description
-	Released with RobotWare 6.0.
A	Released with RobotWare 6.02. • Added pictures of IRC5 Compact and IRC5 Panel Mounted Controller to section *Location of the connector on page 21*. • Added explaining picture of base coordinate system in section *Setting the reference direction on page 23*. • Added picture and some more explanations to section *Programming the function keys on page 24*. • Added section *Additional axes and MultiMove on page 28*.

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Continued

Revision	Description
B	Released with RobotWare 6.03. • Added pictures of axis mode to *Axis mode on page 27* and *Additional axes and MultiMove on page 28*.
C	Released with RobotWare 6.05. • Updated descriptions of stops in section *Protective stop and emergency stop on page 16*. • Added section *Running in production on page 29*.

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Product documentation, IRC5

Categories for user documentation from ABB Robotics

The user documentation from ABB Robotics is divided into a number of categories. This listing is based on the type of information in the documents, regardless of whether the products are standard or optional.

All documents listed can be ordered from ABB on a DVD. The documents listed are valid for IRC5 robot systems.

Product manuals

Manipulators, controllers, DressPack/SpotPack, and most other hardware is delivered with a **Product manual** that generally contains:

- Safety information.
- Installation and commissioning (descriptions of mechanical installation or electrical connections).
- Maintenance (descriptions of all required preventive maintenance procedures including intervals and expected life time of parts).
- Repair (descriptions of all recommended repair procedures including spare parts).
- Calibration.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with exploded views (or references to separate spare parts lists).
- Circuit diagrams (or references to circuit diagrams).

Technical reference manuals

The technical reference manuals describe reference information for robotics products.

- *Technical reference manual - Lubrication in gearboxes*: Description of types and volumes of lubrication for the manipulator gearboxes.
- *Technical reference manual - RAPID overview*: An overview of the RAPID programming language.
- *Technical reference manual - RAPID Instructions, Functions and Data types*: Description and syntax for all RAPID instructions, functions, and data types.
- *Technical reference manual - RAPID kernel*: A formal description of the RAPID programming language.
- *Technical reference manual - System parameters*: Description of system parameters and configuration workflows.

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Application manuals

Specific applications (for example software or hardware options) are described in **Application manuals**. An application manual can describe one or several applications.

An application manual generally contains information about:

- The purpose of the application (what it does and when it is useful).
- What is included (for example cables, I/O boards, RAPID instructions, system parameters, DVD with PC software).
- How to install included or required hardware.
- How to use the application.
- Examples of how to use the application.

Operating manuals

The operating manuals describe hands-on handling of the products. The manuals are aimed at those having first-hand operational contact with the product, that is production cell operators, programmers, and trouble shooters.

The group of manuals includes (among others):

- *Operating manual - Emergency safety information*
- *Operating manual - General safety information*
- *Operating manual - Getting started, IRC5 and RobotStudio*
- *Operating manual - IRC5 Integrator's guide*
- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - RobotStudio*
- *Operating manual - Trouble shooting IRC5*

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1 Safety

1.1 About this chapter

Introduction to safety

This chapter describes safety principles and procedures to be used when a robot or robot system is operated.

It does not cover how to design for safety nor how to install safety related equipment. These topics are covered in the Product Manuals supplied with the robot system.

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1.2 Applicable standards

Note

The listed standards are valid at the time of the release of this document. Phased out or replaced standards are removed from the list when needed.

Standards, EN ISO

The product is designed in accordance with the requirements of:

Standard	Description
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1	Safety of machinery, safety related parts of control systems - Part 1: General principles for design
EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
EN ISO 10218-1	Robots for industrial environments - Safety requirements -Part 1 Robot
EN ISO 9787	Robots and robotic devices -- Coordinate systems and motion nomenclatures
EN ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN ISO 14644-1 [i]	Classification of air cleanliness
EN ISO 13732-1	Ergonomics of the thermal environment - Part 1
EN IEC 61000-6-4 (option 129-1)	EMC, Generic emission
EN IEC 61000-6-2	EMC, Generic immunity
EN IEC 60974-1 [ii]	Arc welding equipment - Part 1: Welding power sources
EN IEC 60974-10 [ii]	Arc welding equipment - Part 10: EMC requirements
EN IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1 General requirements
IEC 60529	Degrees of protection provided by enclosures (IP code)

[i] Only robots with protection Clean Room.
[ii] Only valid for arc welding robots. Replaces EN IEC 61000-6-4 for arc welding robots.

European standards

Standard	Description
EN 614-1	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
EN 574	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design

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Other standards

Standard	Description
ANSI/RIA R15.06	Safety requirements for industrial robots and robot systems
ANSI/UL 1740	Safety standard for robots and robotic equipment
CAN/CSA Z 434-14	Industrial robots and robot Systems - General safety requirements

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1.3 Safety signals in the manual

Introduction to safety signals

This section specifies all dangers that can arise when doing the work described in the user manuals. Each danger consists of:

- A caption specifying the danger level (DANGER, WARNING, or CAUTION) and the type of danger.
- A brief description of what will happen if the operator/service personnel **do not** eliminate the danger.
- Instruction about how to eliminate danger to simplify doing the work.

Danger levels

The table below defines the captions specifying the danger levels used throughout this manual.

Symbol	Designation	Significance
 xx0200000022	DANGER	Warns that an accident *will* occur if the instructions are not followed, resulting in a serious or fatal injury and/or severe damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, and so on.
 xx0100000002	WARNING	Warns that an accident *may* occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, etc.
 xx0200000024	ELECTRICAL SHOCK	Warns for electrical hazards which could result in severe personal injury or death.
 xx0100000003	CAUTION	Warns that an accident may occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment where there is a risk of damaging the product or causing a breakdown.
 xx0200000023	ELECTROSTATIC DISCHARGE (ESD)	Warns for electrostatic hazards which could result in severe damage to the product.

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Symbol	Designation	Significance
 xx0100000004	NOTE	Describes important facts and conditions.
 xx0100000098	TIP	Describes where to find additional information or how to do an operation in an easier way.

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1.4 Protective stop and emergency stop

Overview

The protective stops and emergency stops are described in the product manual for the controller.

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2 What is a T10?

Introduction

The T10 is a jogging device used to jog manipulators and mechanical units in an intuitive way by pointing the device in the direction of movement.

When using a FlexPendant for jogging, a predefined coordinate system is selected, such as world coordinates or tool coordinates, and the manipulator moves in the desired direction along the selected coordinate system.

Using the T10 for jogging is quite similar, but instead of selecting a coordinate system, the direction is shown in space with the device itself. For example when jogging vertically the T10 is held in vertical direction, when jogging horizontally the T10 is held in horizontal direction, etc. This is achieved thanks to the built in inertial measurement unit, consisting of accelerometers and gyroscopes, which measure the motion of the device in space.

The joystick is used for adjusting the jog speed and the positive or negative direction. The forward and backward movement of the joystick corresponds directly to the movement of the manipulator, which is the most intuitive way. The left and right movement of the joystick is used for reorientation.

Prerequisites

The RobotWare option *976-1 T10 Support* is necessary to run the T10 with the IRC5 robot controller.

Limitations

The base coordinate system is used for all jogging movements. See *Setting the reference direction on page 23*.

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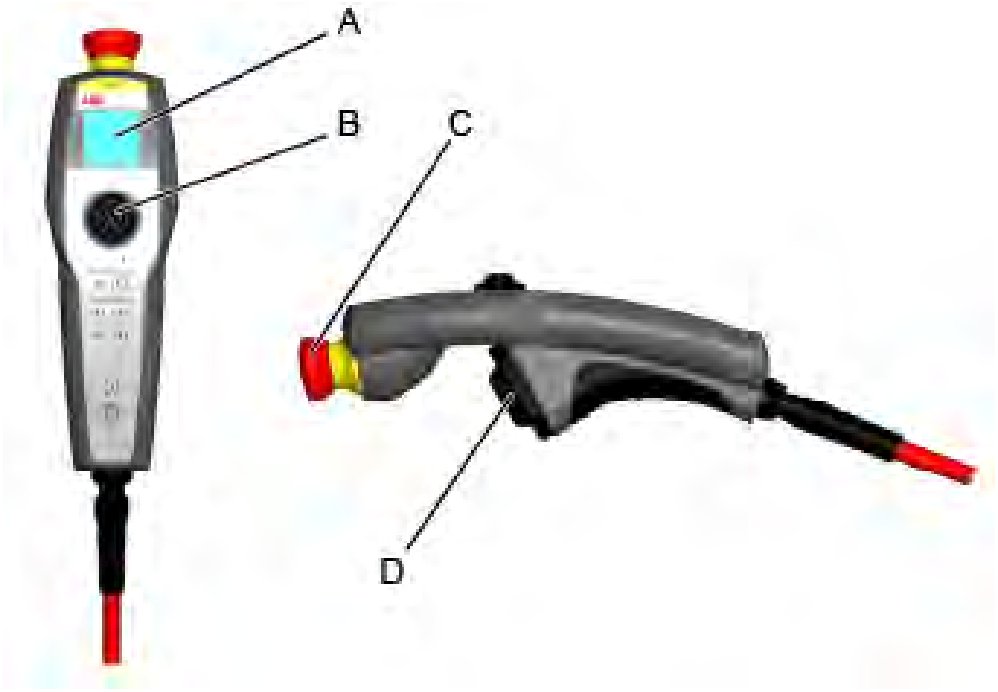
Overview



xx1400002068

	Description
A	Display
B	Joystick
C	Emergency stop button
D	Enabling device

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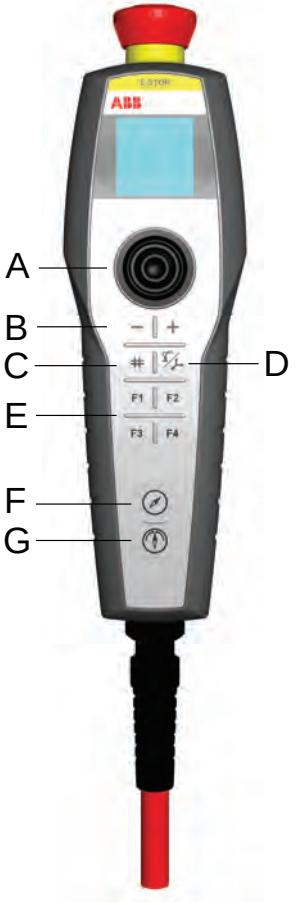
Keypad

		Description
 xx1400002070	A	Joystick button (press the joystick down). Not used.
	B	Minus - and plus + buttons. These buttons increment or decrement the joint number when axis mode jogging is selected. The active joint number of the selected mechanical unit is shown in the display. Press and hold a button to change mechanical unit (if there is more than one). In this case, a number is shown in the display to indicate which unit is selected. For a system with only one mechanical unit, no number is shown.
	C	Grid mode. Switches the grid mode on and off. This can be done only in cartesian jog mode. An indication is shown in the display, when cartesian mode is selected, if grid mode is active.
	D	Jog mode. Switches between axis mode and cartesian mode. Note that the mechanical unit must be calibrated in order to switch to cartesian mode.
	E	Programmable function keys, F1 to F4. For more information, see *Programming the function keys on page 24*.
	F	The compass button can be used at any time to verify the deviation from the reference direction. Press and hold the button to see the deviation.
	G	The reference button can be used at any time to set the reference direction of the device. Point the device parallel to the X-direction of the robot base coordinate system and press the button to set the reference direction. For more information, see *Setting the reference direction on page 23*.

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3 Connecting the T10

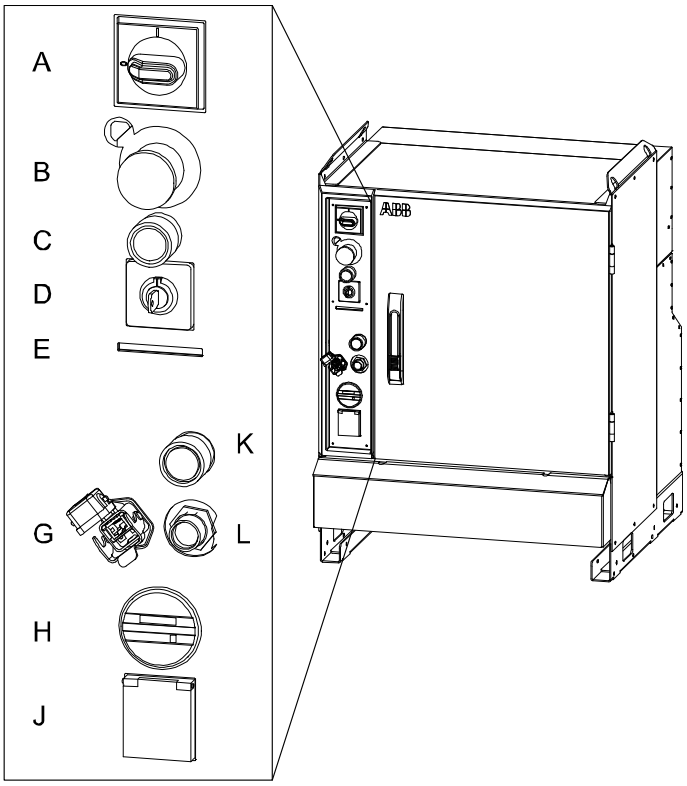
Location of the connector

The connector on the IRC5 controller is located on the operator's panel on the controller, or on an external operator's panel.

CAUTION

Always inspect the connector for dirt or damage before connecting it to the controller. Clean or replace any damaged parts.

IRC5



xx0600002782

L	Connector (A22.X1)

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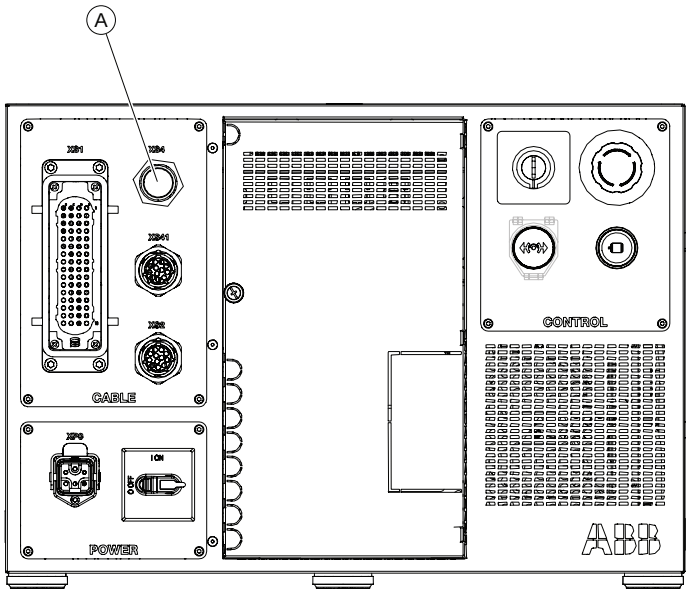
Continued

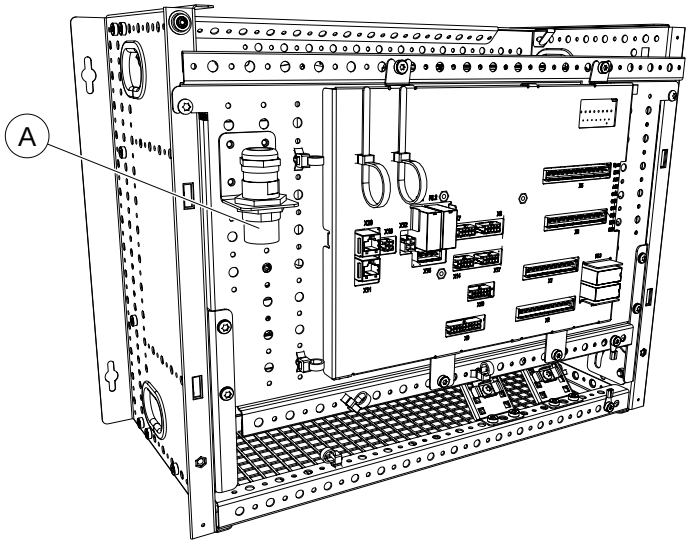
IRC5 Compact



xx1400001371

A	Connector

IRC5 Panel Mounted Controller



xx1300001947

A	Connector

Connecting a T10

Use the following procedure to connect the T10 jogging device.

	Action
1	If present, disconnect the FlexPendant.
2	Connect the T10 to the connector.

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4 Configuration

Startup

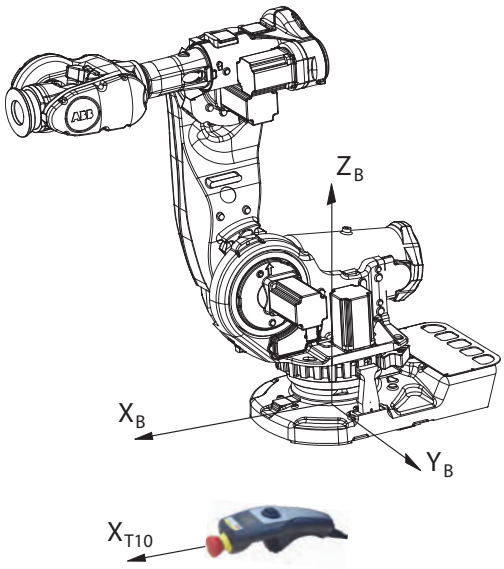
During startup (power-on) of the T10, it calibrates itself. During this period it must be left still, preferably on a flat surface. During the calibration process, which may take up to 30 seconds, a calibration symbol is shown on the display.

This symbol is shown during the calibration process. This is done during the startup (power-on) of the device.

xx1400002071

Setting the reference direction

The device uses sensors to calculate its current orientation and requires a reference (zero) direction in order to determine its own direction. Therefore, in order to use the device, it has to be referenced. This is a very simple and fast process. The reference button is used to set the reference direction of the device. Point the device parallel to the X-direction of the robot base coordinate system and press the button. This can be done at any time.



xx1500000866

X_B	X direction in the base coordinate system
X_{T10}	Direction of the T10 device

A symbol shows that the reference direction of the device must be set.

The reference direction determines how the X- and Y-directions of the device are aligned to the X- and Y-directions of the used coordinate system. The Z-direction is always vertical. Since the orientation of the device is calculated, an error will be accumulated over time. Sudden and fast movements of the device will increase the accumulation. However, the current reference direction can be verified at any

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Continued

time, by pressing and holding the compass button. A compass will be shown that indicates the direction.

The device is referenced.

xx1400002072

The device needs to be referenced.

xx1400002073

Note

Sensor errors lead to a growing deviation of the orientation in horizontal direction. To keep the quality of the orientation at a high level the T10 has to be referenced about every 10 minutes.

Programming the function keys

The function keys are four hardware buttons on the T10 that can be used for dedicated specific functions set by the user, see *Keypad on page 19*.

As default, the key F1 is configured as *AutoAck*. The other buttons are not configured with any function. Any button (including F1) can be configured with any of the following settings:

Action	Description
None	No action will be performed (default).
AutoAck	Acknowledges an auto change.
PPToMain	Moves the program pointer of all tasks to their respective main routine.
StartRapid	Starts execution of the currently selected tasks in the task panel.
StopRapid	Stops all tasks.

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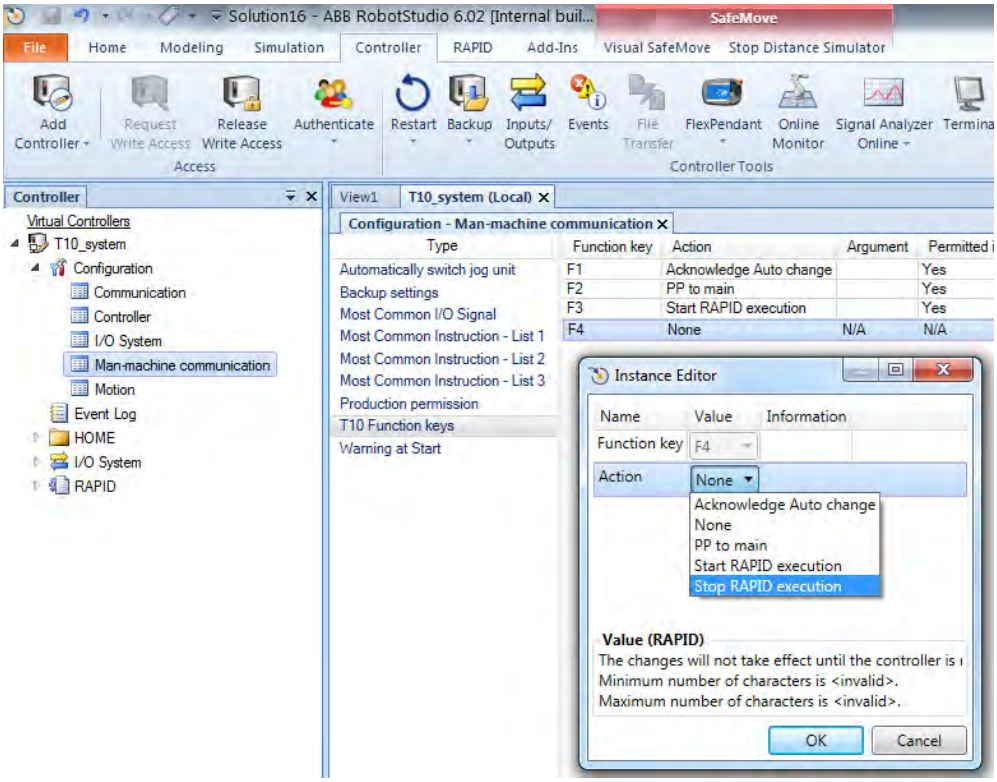
The function keys are programmed in the system parameters using RobotStudio.The parameter *Function key* belongs to the type *T10 Function keys*, in the topic *Man-machine Communication*.



xx1500001626

For more information, see *Technical reference manual - System parameters* and section **Configuration editor** in *Operating manual - RobotStudio*.

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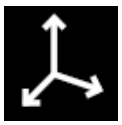
5 Jogging

Jog modes

The current jog mode is shown on the display.

Axis mode

xx1400002075



Cartesian mode

xx1400002076

Reorientation
This small symbol is only shown during reorientation.

xx1400002077

Axis mode

The joystick deflection forward/backward is used to jog one axis of the selected mechanical unit. The speed and direction is controlled by the joystick deflection. In this mode, the axis selection can be changed with the + and - buttons. The number of the active joint is shown on the right side of the display.

Axis mode for axis 5

xx1500001759

Cartesian mode

This mode is “point and jog”. Point the device in the desired direction and use the joystick to jog either forward or backward along the direction of the device.

Reorientation

Deflecting the joystick to the right or to the left starts a tool reorientation movement, if the mechanical unit supports the jog mode.

When reorienting in grid mode, the direction that is closest to the pointed direction of the device will be used.

Grid mode

Grid mode can only be used together with Cartesian mode.

In this mode, the robot will only move in one direction (X, Y or Z). The direction that is closest to the pointed direction of the device will be used. A rectangular symbol in the lower right corner of the display is shown if this mode is active.

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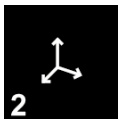
Continued

Additional axes and MultiMove

The T10 can be used for additional axes and MultiMove to jog one mechanical unit at a time. To switch between the mechanical units, press and hold the + or - button for more than one second. When the button is released, the number of the selected mechanical unit is shown in the bottom left of the display (only shown on systems with more than one mechanical unit).



xx1500001757

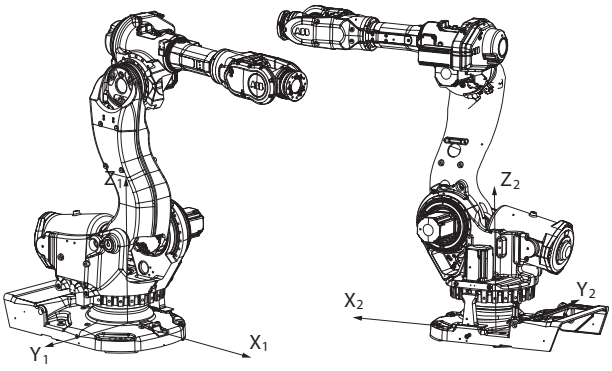
Cartesian mode for mechanical unit 2

xx1500001758

Axis mode for axis 5 on mechanical unit 2

Note

If the robots in a MultiMove system do not have parallel base coordinate systems, the reference direction must be set when changing robot. See *Setting the reference direction on page 23*.



xx1500001627

X_1, Y_1, Z_1	Base coordinat system for robot 1
X_2, Y_2, Z_2	Base coordinat system for robot 2

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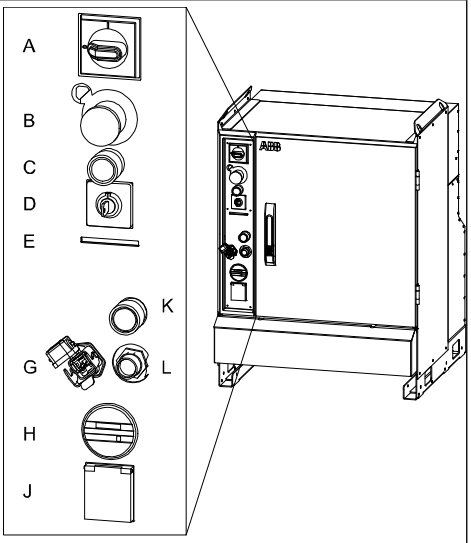
6 Running in production

6.1 Starting programs

Starting programs

Use this procedure to start a program for the first time or to continue running a program that has been stopped.

	Action	Information
1	Check that all necessary preparations are done to the robot and in the robot cell and that no obstacles exist within the robot work area.	**Note** If the robot was stopped by a safeguarding mechanism, this must be handled before restarting.
2	Make sure no personnel are inside the robot cell.	
3	Select operating mode on the controller with the mode switch.	 xx0600002782 C: Motors on button D: Mode switch
4	Press the Motors on button on the controller to activate the robot.	

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6.2 Stopping programs

Stopping programs

	Action
1	Check that the ongoing operation is in such a state that it can be interrupted.
2	Make sure it is safe to stop the program.
3	Press the **Stop** button on the hardware button set of the jogging device.

DANGER

Do not use the **Stop** button in an emergency. Use the emergency stop button.

Stopping a program with the **Stop** button does not mean that the robot will stop moving immediately.

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