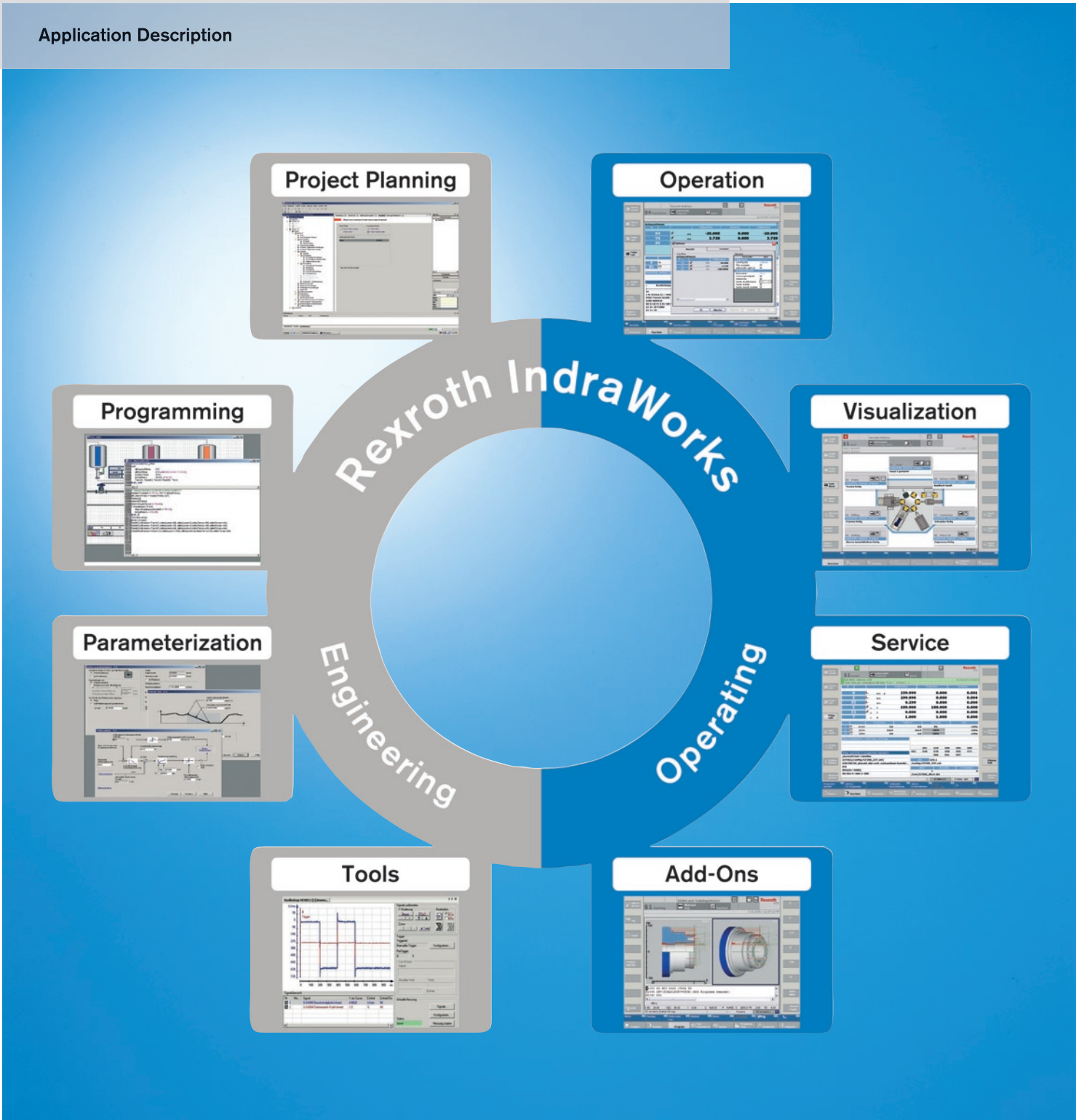
Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth Bosch Group

Rexroth IndraWorks Simulation

R911320258
Edition 01

Application Description



Title Rexroth IndraWorks
Simulation

Type of Documentation Application Description

Document Typecode DOK-IWORKS-SIMU****V07-AW01-EN-P

Internal File Reference RS-748816b0390f57aa0a6846a0002a1fc0-1-en-US-2

Purpose of Documentation This documentation describes the functions of simulation component View3D, virtual control panel, virtual control and its operation in IndraWorks.

Record of Revision

Edition	Release Date	Notes
120-2700-B309-01/EN	04.2007	First edition for V07

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Published by Bosch Rexroth AG

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Note This document has been printed on chlorine-free bleached paper.

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1 General

1.1 Why Simulation?

Due to the ever-increasing competitive pressure among the manufacturers of machines, we are always looking for new ways of minimizing the costs for a machine project. This includes every phase of the machine life cycle (construction, commissioning, production). Due to more and more powerful computer systems, simulation is becoming more and more important: in the future, there may even be virtual factories in which all the processes of a production plant can be reproduced virtually. One component of this virtual factory is the virtual machine, which can be used, with the help of suitable simulation tools, to support the individual phases of the machine life cycle.

1.2 What is Simulated?

There are suitable simulation techniques for every phase of the machine life cycle. These simulation techniques are clearly delimited from one another, but also have shared points of intersection, such as the transfer of construction data for the machine from the CAD system to the 3D visualization system.

In the construction phase of a machine, for example, the FEM (**F**inite **E**lement **M**ethod) analysis or the MBS (**M**ultiple**B**ody**S**imulation) analysis is used, while behavioral simulation is used more in the commissioning phase. For production, on the other hand, process optimization (e.g. cycle time optimization) is in the foreground.

If we examine now the simulation techniques during the commissioning phase, we can make a further distinction. On the one hand, there is the so-called hardware-in-the-loop simulation; on the other, there is software-in-the-loop simulation.

Hardware-in-the-loop

In this simulation technique, a real control is a component of the simulation setup. All other components are simulated on one or more computers. Communication between the real control and the simulation components is implemented using, for example, Profibus slave cards.

Software-in-the-loop

In this simulation technique, all the components are simulated on one or more computers.

1.3 Goals of Simulation in IndraWorks

The emphasis for applying simulation techniques at Bosch Rexroth in the area of system development for Motion Control lies on optimizing the commissioning of controls and machine tools. This involves mainly behavioral simulation, such as tests of the PLC program or of the NC program.

Components such as a virtual control (NC and PLC), a virtual control panel, virtual drives, a 3D viewer and a peripherals simulation (I/O simulation) are required to attain this goal. Only the interplay of all these components permits effective behavioral simulation.

In addition to the shortening of commissioning times, however, there are other areas of application for simulation that result in cost and time savings for the user.

- Demonstrator for sales at the customer location
- Testing program procedures (both CNC and PLC)

General

- Setting the parameters of the control and the drives
- Application for training purposes
- Reproduction of problems (trouble-shooting)
- Validation of error solutions

2 Important Instructions on Use

2.1 Intended Use

2.1.1 Introduction

The Bosch Rexroth products are developed and manufactured according to the latest state of the art. Before delivery, they are checked for operational safety.

The products may only be used in the proper manner. When they are not used as intended, situations may arise which result in damage to person or material.

☞ Bosch Rexroth, as the manufacturer of the products, will not assume any warranty, liability or payment of damages in case of damage resulting from a non-intended use of the products. If he fails to use the products as intended, the user will be solely responsible for any resulting risks.

Before using the Bosch Rexroth products, the following prerequisites must be fulfilled to ensure that they are used as intended:

- Everyone who in any way deals with one of our products must read and understand the corresponding notes regarding safety and regarding proper use.
- If the products are hardware, they must be kept in their original state, i.e. no constructional modifications may be made. Software products may not be decompiled; their source codes may not be modified.
- Damaged or improperly working products must not be installed or put into operation.
- It must be ensured that the products are installed according to the regulations mentioned in the documentation.

2.1.2 Area of Use and Application

In IndraWorks, simulation tools are used to

- Shorten the response times
- verify the application programs
- visualize the machine cinematics

☞ The simulation consists of several components which must be compatible to each other.

The virtual control panel is used in connection with the control emulation. During utilizing the virtual control panel of the real control it has to be considered that the signals can not arrive between virtual control panel and control because of communication errors. Therefore a PLC program and a producing machine can no longer be stopped via control.

2.2 Improper Use

Using the devices outside of the above-referenced areas of application or under operating conditions other than described in the document and the technical data specified is defined as "inappropriate use".

The Rexroth simulation tools may not be used if

Important Instructions on Use

- Bosch Rexroth has not specifically released them for that intended purpose. In this connection, observance of the statements in the General Safety Notes is imperative!

3 Safety Instructions for Electric Drives and Controls

3.1 Safety Instructions - General Information

3.1.1 Using the Safety Instructions and Passing them on to Others

Do not attempt to install or commission this device without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with the device. If you do not have the user documentation for the device, contact your responsible Bosch Rexroth sales representative. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the device.

If the device is resold, rented and/or passed on to others in any other form, these safety instructions must be delivered with the device in the official language of the user's country.

WARNING

Improper use of these devices, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in material damage, bodily harm, electric shock or even death!

Observe the safety instructions!

3.1.2 How to Employ the Safety Instructions

Read these instructions before initial commissioning of the equipment in order to eliminate the risk of bodily harm and/or material damage. Follow these safety instructions at all times.

- Bosch Rexroth AG is not liable for damages resulting from failure to observe the warnings provided in this documentation.
- Read the operating, maintenance and safety instructions in your language before commissioning the machine. If you find that you cannot completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation, as well as care in operation and maintenance, are prerequisites for optimal and safe operation of this device.
- Only assign trained and qualified persons to work with electrical installations:
  - Only persons who are trained and qualified for the use and operation of the device may work on this device or within its proximity. The persons are qualified if they have sufficient knowledge of the assembly, installation and operation of the product, as well as an understanding of all warnings and precautionary measures noted in these instructions.
  - Furthermore, they must be trained, instructed and qualified to switch electrical circuits and devices on and off in accordance with technical safety regulations, to ground them and to mark them according to the requirements of safe work practices. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.

- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The devices have been designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Only use safety-relevant applications that are clearly and explicitly approved in the Project Planning Manual. If this is not the case, they are excluded. Safety-relevant are all such applications which can cause danger to persons and material damage.
- The information given in the documentation of the product with regard to the use of the delivered components contains only examples of applications and suggestions.

  The machine and installation manufacturer must

  – make sure that the delivered components are suited for his individual application and check the information given in this documentation with regard to the use of the components,
  – make sure that his application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Commissioning of the delivered components is only permitted once it is sure that the machine or installation in which they are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only permitted if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the section on EMC in the respective documentation (Project Planning Manuals of components and system).

  The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national regulations.
- Technical data, connection and installation conditions are specified in the product documentation and must be followed at all times.

National regulations which the user must take into account

- European countries: according to European EN standards
- United States of America (USA):
  – National Electrical Code (NEC)
  – National Electrical Manufacturers Association (NEMA), as well as local engineering regulations
  – regulations of the National Fire Protection Association (NFPA)
- Canada: Canadian Standards Association (CSA)
- Other countries:
  – International Organization for Standardization (ISO)
  – International Electrotechnical Commission (IEC)

3.1.3 Explanation of Warning Symbols and Degrees of Hazard Seriousness

The safety instructions describe the following degrees of hazard seriousness. The degree of hazard seriousness informs about the consequences resulting from non-compliance with the safety instructions:

Warning symbol	Signal word	Degree of hazard seriousness acc. to ANSI Z 535.4-2002
	Danger	Death or severe bodily harm will occur.
	Warning	Death or severe bodily harm may occur.
	Caution	Minor or moderate bodily harm or material damage may occur.

Fig.3-1: Hazard classification (according to ANSI Z 535)

3.1.4 Hazards by Improper Use

DANGER

High electric voltage and high working current! Risk of death or severe bodily injury by electric shock!

Observe the safety instructions!

DANGER

Dangerous movements! Danger to life, severe bodily harm or material damage by unintentional motor movements!

Observe the safety instructions!

WARNING

High electric voltage because of incorrect connection! Risk of death or bodily injury by electric shock!

Observe the safety instructions!

WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

Observe the safety instructions!

CAUTION

Hot surfaces on device housing! Danger of injury! Danger of burns!

Observe the safety instructions!

CAUTION

Risk of injury by improper handling! Risk of bodily injury by bruising, shearing, cutting, hitting or improper handling of pressurized lines!

Observe the safety instructions!

CAUTION

Risk of injury by improper handling of batteries!

Observe the safety instructions!

3.2 Instructions with Regard to Specific Dangers

3.2.1 Protection Against Contact with Electrical Parts and Housings

☞ This section concerns devices and drive components with voltages of **more than 50 Volt**.

Contact with parts conducting voltages above 50 Volts can cause personal danger and electric shock. When operating electrical equipment, it is unavoidable that some parts of the devices conduct dangerous voltage.

DANGER

High electrical voltage! Danger to life, electric shock and severe bodily injury!

- Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain and repair this equipment.
- Follow general construction and safety regulations when working on power installations.
- Before switching on the device, the equipment grounding conductor must have been non-detachably connected to all electrical equipment in accordance with the connection diagram.
- Do not operate electrical equipment at any time, even for brief measurements or tests, if the equipment grounding conductor is not permanently connected to the mounting points of the components provided for this purpose.
- Before working with electrical parts with voltage potentials higher than 50 V, the device must be disconnected from the mains voltage or power supply unit. Provide a safeguard to prevent reconnection.
- With electrical drive and filter components, observe the following:

  Wait **30 minutes** after switching off power to allow capacitors to discharge before beginning to work. Measure the electric voltage on the capacitors before beginning to work to make sure that the equipment is safe to touch.
- Never touch the electrical connection points of a component while power is turned on. Do not remove or plug in connectors when the component has been powered.
- Install the covers and guards provided with the equipment properly before switching the device on. Before switching the equipment on, cover and safeguard live parts safely to prevent contact with those parts.
- A residual-current-operated circuit-breaker or r.c.d. cannot be used for electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device according to the relevant standards.
- Secure built-in devices from direct touching of electrical parts by providing an external housing, for example a control cabinet.

For electrical drive and filter components with voltages of **more than 50 volts**, observe the following additional safety instructions.

DANGER

High housing voltage and high leakage current! Risk of death or bodily injury by electric shock!

- Before switching on, the housings of all electrical equipment and motors must be connected or grounded with the equipment grounding conductor to the grounding points. This is also applicable before short tests.
- The equipment grounding conductor of the electrical equipment and the devices must be non-detachably and permanently connected to the power supply unit at all times. The leakage current is greater than 3.5 mA.
- Over the total length, use copper wire of a cross section of a minimum of 10 mm^2 for this equipment grounding connection!
- Before commissioning, also in trial runs, always attach the equipment grounding conductor or connect to the ground wire. Otherwise, high voltages may occur at the housing causing electric shock.

3.2.2 Protection Against Electric Shock by Protective Extra-Low Voltage

Protective extra-low voltage is used to allow connecting devices with basic insulation to extra-low voltage circuits.

All connections and terminals with voltages between 5 and 50 volts at Rexroth products are PELV systems. [1] It is therefore allowed to connect devices equipped with basic insulation (such as programming devices, PCs, notebooks, display units) to these connections and terminals.

WARNING

High electric voltage by incorrect connection! Risk of death or bodily injury by electric shock!

If extra-low voltage circuits of devices containing voltages and circuits of more than 50 volts (e.g. the mains connection) are connected to Rexroth products, the connected extra-low voltage circuits must comply with the requirements for PELV. [2]

3.2.3 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of connected motors. Some common examples are:

- improper or wrong wiring of cable connections
- incorrect operation of the equipment components
- wrong input of parameters before operation
- malfunction of sensors, encoders and monitoring devices
- defective components
- software or firmware errors

Dangerous movements can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

1) *"Protective Extra-Low Voltage"*

2) *"Protective Extra-Low Voltage"*

The monitoring in the drive components will normally be sufficient to avoid faulty operation in the connected drives. Regarding personal safety, especially the danger of bodily harm and material damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.

DANGER

Dangerous movements! Danger to life, risk of injury, severe bodily harm or material damage!

- Ensure personal safety by means of qualified and tested higher-level monitoring devices or measures integrated in the installation.

  These measures have to be provided for by the user according to the specific conditions within the installation and a hazard and fault analysis. The safety regulations applicable for the installation have to be taken into consideration. Unintended machine motion or other malfunction is possible if safety devices are disabled, bypassed or not activated.

To avoid accidents, bodily harm and/or material damage:

- Keep free and clear of the machine's range of motion and moving parts. Possible measures to prevent people from accidentally entering the machine's range of motion:
  - use safety fences
  - use safety guards
  - use protective coverings
  - install light curtains or light barriers
- Fences and coverings must be strong enough to resist maximum possible momentum.
- Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the device if the emergency stop is not working.
- Isolate the drive power connection by means of an emergency stop circuit or use a safety related starting lockout to prevent unintentional start.
- Make sure that the drives are brought to a safe standstill before accessing or entering the danger zone.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example:
  - mechanically securing the vertical axes,
  - adding an external braking/ arrester/ clamping mechanism or
  - ensuring sufficient equilibration of the vertical axes.
- The standard equipment motor brake or an external brake controlled directly by the drive controller are **not sufficient to guarantee personal safety**!
- Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for:
  - maintenance and repair work
  - cleaning of equipment
  - long periods of discontinued equipment use
- Prevent the operation of high-frequency, remote control and radio equipment near electronics circuits and supply leads. If the use of such devices cannot be avoided, verify the system and the installation for possible malfunctions in all possible positions of normal use before initial startup. If necessary, perform a special electromagnetic compatibility (EMC) test on the installation.

3.2.4 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated by current-carrying conductors and permanent magnets in motors represent a serious personal danger to those with heart pacemakers, metal implants and hearing aids.

WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

- Persons with heart pacemakers and metal implants are not permitted to enter following areas:
  - Areas in which electrical equipment and parts are mounted, being operated or commissioned.
  - Areas in which parts of motors with permanent magnets are being stored, repaired or mounted.
- If it is necessary for somebody with a pacemaker to enter such an area, a doctor must be consulted prior to doing so. The noise immunity of present or future implanted heart pacemakers differs greatly so that no general rules can be given.
- Those with metal implants or metal pieces, as well as with hearing aids, must consult a doctor before they enter the areas described above. Otherwise health hazards may occur.

3.2.5 Protection Against Contact with Hot Parts

CAUTION

Hot surfaces at motor housings, on drive controllers or chokes! Danger of injury! Danger of burns!

- Do not touch surfaces of device housings and chokes in the proximity of heat sources! Danger of burns!
- Do not touch housing surfaces of motors! Danger of burns!
- According to the operating conditions, temperatures can be **higher than 60 °C**, 140°F during or after operation.
- Before accessing motors after having switched them off, let them cool down for a sufficiently long time. Cooling down can require **up to 140 minutes**! Roughly estimated, the time required for cooling down is five times the thermal time constant specified in the Technical Data.
- After switching drive controllers or chokes off, wait 15 minutes to allow them to cool down before touching them.
- Wear safety gloves or do not work at hot surfaces.
- For certain applications, the manufacturer of the end product, machine or installation, according to the respective safety regulations, has to take measures to avoid injuries caused by burns in the end application. These measures can be, for example: warnings, guards (shielding or barrier), technical documentation.

3.2.6 Protection During Handling and Mounting

In unfavorable conditions, handling and mounting certain parts and components in an improper way can cause injuries.

CAUTION

Risk of injury by improper handling! Bodily injury by bruising, shearing, cutting, hitting!

- Observe the general construction and safety regulations on handling and mounting.
- Use suitable devices for mounting and transport.
- Avoid jamming and bruising by appropriate measures.
- Always use suitable tools. Use special tools if specified.
- Use lifting equipment and tools in the correct manner.
- If necessary, use suitable protective equipment (for example safety goggles, safety shoes, safety gloves).
- Do not stand under hanging loads.
- Immediately clean up any spilled liquids because of the danger of skidding.

3.2.7 Battery Safety

Batteries consist of active chemicals enclosed in a solid housing. Therefore, improper handling can cause injury or material damage.

CAUTION

Risk of injury by improper handling!

- Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- Do not recharge the batteries as this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not dismantle batteries.
- When replacing the battery/batteries do not damage electrical parts installed in the devices.
- Only use the battery types specified by the manufacturer.

☞ Environmental protection and disposal! The batteries contained in the product are considered dangerous goods during land, air, and sea transport (risk of explosion) in the sense of the legal regulations. Dispose of used batteries separate from other waste. Observe the local regulations in the country of assembly.

3.2.8 Protection Against Pressurized Systems

According to the information given in the Project Planning Manuals, motors cooled with liquid and compressed air, as well as drive controllers, can be partially supplied with externally fed, pressurized media, such as compressed air, hydraulics oil, cooling liquids and cooling lubricating agents. Improper handling of the connected supply systems, supply lines or connections can cause injuries or material damage.

CAUTION

Risk of injury by improper handling of pressurized lines!

- Do not attempt to disconnect, open or cut pressurized lines (risk of explosion).
- Observe the respective manufacturer's operating instructions.
- Before dismounting lines, relieve pressure and empty medium.
- Use suitable protective equipment (for example safety goggles, safety shoes, safety gloves).
- Immediately clean up any spilled liquids from the floor.

☞ Environmental protection and disposal! The agents used to operate the product might not be economically friendly. Dispose of ecologically harmful agents separately from other waste. Observe the local regulations in the country of assembly.

4 Quick Start

In the following, the execution sequence that makes it possible to sensibly operate the various simulation components of IndraWorks is described for an IndraMotion MTX project. It is not suitable for a user who has no prior knowledge of the simulation components. The inexperienced user must first read the entire documentation to become familiar with the subject matter.

Execute the following steps to be able to simulate an IndraMotion MTX project on a PC:

1. Start IndraWorks using the link on the desktop
2. Load the desired IndraMotion MTX project into IndraWorks
3. Start the IndraMotion MTX emulation (also see chapter 6.4.6 "Starting and Exiting the MTX Emulation " on page 69)
4. Set the communication settings for the IndraMotion MTX and the PLC to “localhost”
5. The PLC must be stopped.
6. The NC kernel data must be restored (also see chapter 6.4.4 "Designing the NC Core " on page 63).
7. The PLC program must be loaded and started (also see chapter 6.4.5 "Designing the PLC " on page 67)
8. Activate the IndraWorks project for Operation Desktop (also see chapter 6.4.3 "Designing the HMI " on page 60)
9. Create the VAM simulator (e.g. VAM 40) in IndraWorks Engineering (also see chapter 6.2.1 "Configuration in IndraWorks" on page 33) and configure it (also see chapter 6.2 "Using the Virtual Control Panel " on page 33)
10. Start the Windows program “IndraWorks VAM simulator” (also see chapter 6.2.2 "Connection to Virtual Control " on page 44)

You can find detailed information about IndraMotion MTX emulation in the “Virtual Commissioning of the MTX” chapter of the documentation “IndraMotion MTX Commissioning”.

If a machine model exists, it can be loaded into the 3D viewer and controlled using data from the emulation using process variables. To do this, proceed as follows:

1. Add a new model to the project (also see chapter 6.3 "Using 3D Visualization " on page 47).
2. Link the process variables to the objects of the model (also see chapter 6.3.2 "Process Connection " on page 54).
3. Start the simulation of the model in IndraWorks.

5 Components of the Simulation

5.1 Project Explorer

The simulation components can be found in the IndraWorks Project Explorer in the node **Simulation** -> **3D Visualization**.

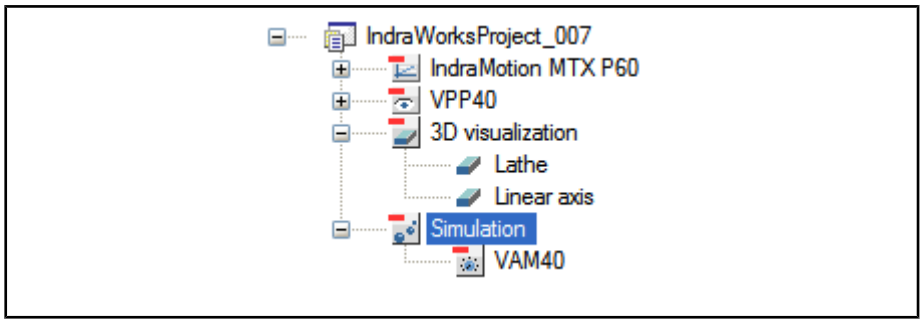

Fig.5-1: Project Explorer

Project node Simulation

Below the node **Simulation** there is the **VAM40** or **VAM41** entry with which the configuration pages can be opened.

☞ If the node **Simulation** and/or the entry of a **VAM** does not exist, this can be added as follows using the project node:

- Call menu item **Add ...** in the contextual menu of the project node.
- In the dialog box **Add new element**, open the template **VAM40** or **VAM41** from the category **Simulation** ▸ **Virtual control panels**.

  The entry of the selected **Virtual Control Panel** is added to the project tree within the node **Simulation**.

Alternatively, component **VAM40** or **VAM41** can be moved by drag-and-drop from the IndraWorks library into the project.

Project node 3D visualization

Node **3D Visualization** can be used to access 3D models of the View3D application. Available 3D models are displayed under the node.

New 3D models can be added to the IndraWorks project by dragging and dropping them from the library or using contextual menu **Add ...** on node **3D Visualization**.

Refer also to: chapter 6.3.1 "3D Models in IndraWorks" on page 47.

☞ If project node **3D Visualization** does not yet exist, it is generated automatically when a new 3D model is added to the project.

You can also find the functions **Import ...** and **Delete** in the contextual menu of node **3D Visualization**. The Import function can be used to import View3D models that have been exported from an IndraWorks project into the current IndraWorks project (see chapter 6.3.1 "3D Models in IndraWorks" on page 47). Function **Delete** is used to delete node **3D Visualization** and **all View3D models** from the IndraWorks project.

The contextual menu of a 3D model contains the following menu items:

- **Subroutine**

  Opens a 3D model in View3D
- **Export...**

Exports a 3D model from the IndraWorks project

- **Delete**

  Deletes the 3D model from the IndraWorks project

- **Rename**

  Renaming a 3D model

See also chapter 6.3.1 "3D Models in IndraWorks" on page 47.

5.2 3D Visualization

5.2.1 General Description

The View3D visualization system is used to represent a machine model as a three-dimensional volume model (3D scene).

Individual objects in the 3D scene can be combined with process values of the IndraMotion MTX within View3D. If the NC program of the machine is executed using the virtual control (also see chapter 5.4 "Virtual Control " on page 28), the axis movements of the machine can be traced in the three-dimensional machine model.

Additional functions in View3D include among others:

- Rotating a 3D scene
- Zoom function
- Wireframe representation
- Saving of camera positions (viewpoints)

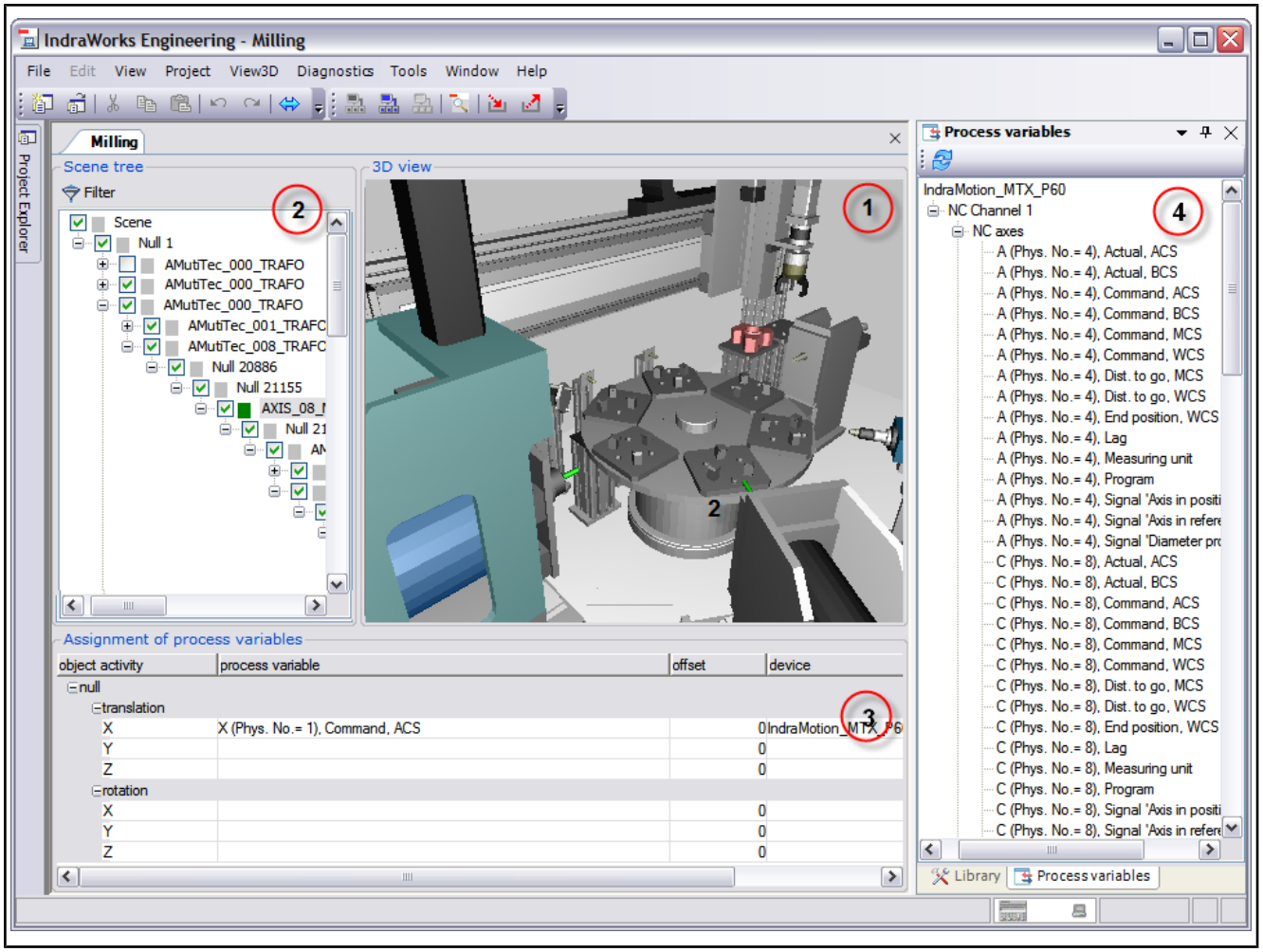

Fig.5-2: View3D in IndraWorks

The View3D application consists of the following 4 areas:

1. 3D view

   The 3D view is used to display the 3D scene (see chapter 5.2.2 "Model Visualization " on page 20).

2. Scene tree

   The scene tree represents the logical and kinematic structure of the scene. Individual objects of the model can be marked for further processing in the scene tree (for example, they can be hidden in the 3D view).

   See chapter 5.2.3 "Scene Tree " on page 22.

3. List for allocating process variables

   The assignments between the 3D model and the process values of the control are shown in the assignment list (see chapter 5.2 "3D Visualization " on page 18).

4. Process variables

   The available process variables of the assigned control are shown in this tree view (see chapter 5.5 "Process Connection " on page 28).

5.2.2 Model Visualization

Basic functions

Selecting 3D objects

An object can be marked by clicking the left mouse button; this is indicated by a yellow frame. A marked object is also highlighted in the scene tree. Conversely, clicking the left mouse button on a part of the scene tree highlights the corresponding part in the model with a yellow frame.

The marking can be removed by clicking the left mouse button on a blank space outside of the model.

Rotating a 3D scene

To allow the 3D model to be viewed from every perspective, the 3D scene can be rotated using the mouse or the keyboard.

- Mouse operation

  If the mouse is moved within the 3D view with the left mouse button held down, the model rotates according to the mouse movements. If the mouse is moved to the left or right, the model rotates around the Y-axis. If the mouse is moved up or down, the model rotates around the X-axis.

- Keyboard input

  The model can be rotated around the Y-axis using keys <Ins> and <Del>.

Moving a 3D scene

To position the 3D model, the 3D scene can be moved in View3D.

If the mouse is moved within the 3D view with the center mouse button held down, the 3D scene is positioned according to the mouse movement.

Zooming a 3D scene

To be able to better see the details in the 3D model, you can zoom into the 3D scene.

- Mouse operation

  If the mouse is moved within the 3D view with the right mouse button held down, the view “zooms” into the 3D scene. Moving the mouse upwards zooms out of the model. Moving the mouse downwards zooms into the model.

- Keyboard input

  You can zoom within the 3D view using the <PgUp> and <PgDn> keys. Pressing the <PgUp> key zooms into the model; pressing the <PgDn> key zooms out of the model.

Coordinate Systems

The following coordinate systems exist in View3D:

- **Global coordinate system**

  The global coordinate system indicates the global coordinate axes of the 3D model.

  See also chapter "Basic 3D visualization functions " on page 55.

- **Local coordinate system**

  The local coordinate system indicates the local orientation of individual objects.

  The alignments of the local coordinate system are also decisive for the direction of movement of the 3D object with a process connection.

  See also chapter "Basic 3D visualization functions " on page 55.

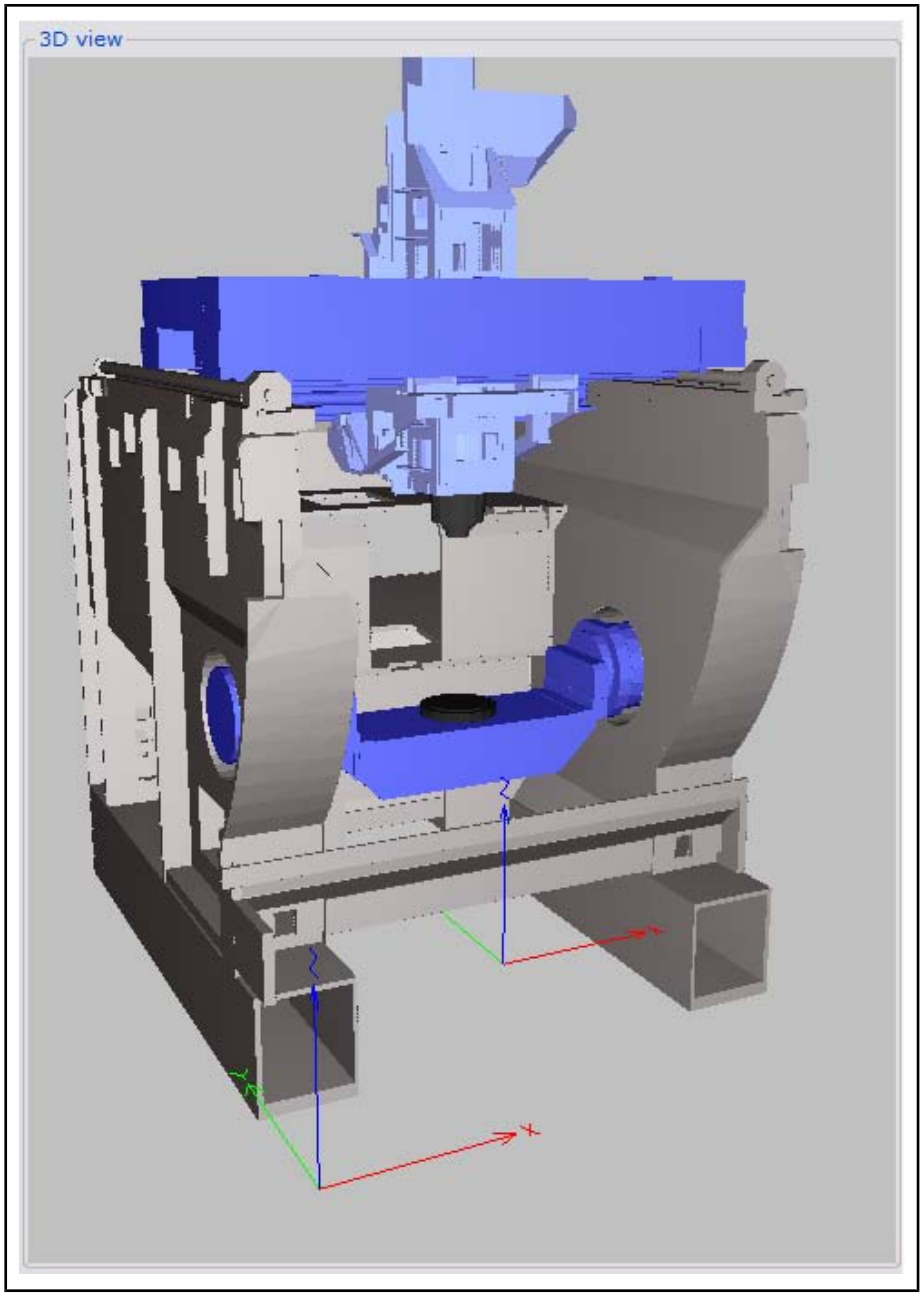

Fig.5-3: Coordinate Systems

Scaling the 3D model

The Scaling function can be used to adapt the scaling of a 3D model to the scaling of the assigned process variables.

The Scaling function is activated in the main menu using menu item **View3D ▸ Scale model...** (see chapter 6.3.1 "3D Models in IndraWorks" on page 47).

Functions for manipulating 3D objects

Control reset

Pressing key <Pos 1> moves the 3D scene into a predefined camera position. This is an internal basic setting that cannot be changed.

Moving/rotating objects

To move an object, it must be marked beforehand. Then press one of the keys <X>, <Y> or <Z> to select the desired axis direction for the move. In addition, you must now move the mouse (with the left mouse button held down) to the left or right in order to move the object.

If you press and hold the right mouse button instead of the left one, the object is rotated around the selected axis.

Saving camera positions

Keys <0> to <9> can be used to save and call 10 different camera positions. To do this - see the explanation in chapter "Basic functions" on page 20 - the camera position is changed and then saved using key combination <Ctrl+number>.

A camera position (viewpoint) can be called again by pressing one of the keys <0> to <9>.

Explosion/implosion

Pressing the <End> key brings manipulated objects back to the basic position (implosion).

If you then press the <E> key, the objects move back to the manipulated position (explosion).

5.2.3 Scene Tree

General

The object structure (kinematic relationship of the objects) of the 3D scene is shown in the Scene tree.

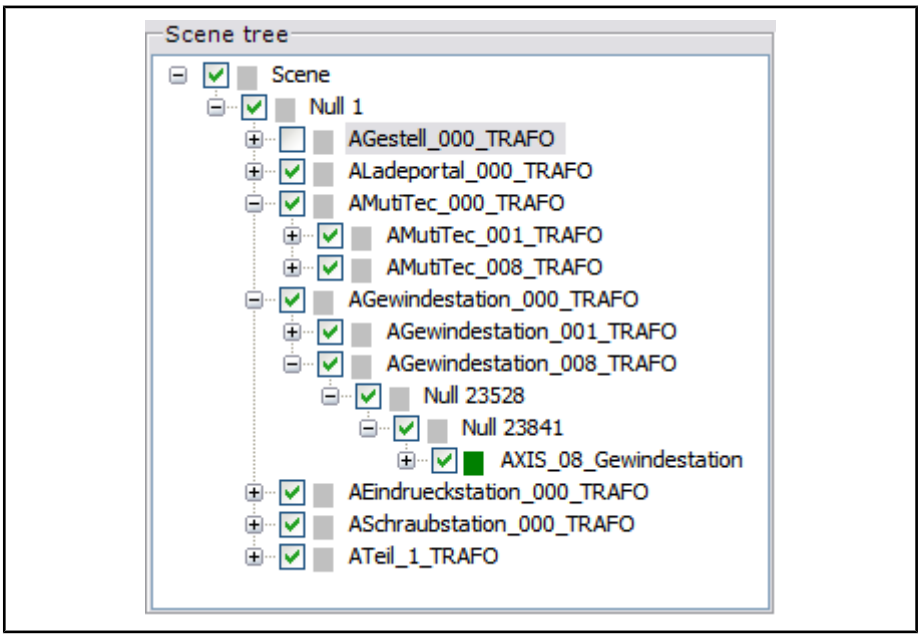

Fig.5-4: Scene tree

Objects preceded by a checkmark are visible in the 3D view. Objects can be shown/hidden in the 3D view by clicking the mouse on the checkmark.

Contextual menu

The contextual menu of the object node can be used to access the following object-related functions:

- Rename

  The selected 3D object can be renamed here.

- Properties...

  This menu item can be used to open dialog box **Properties of object** in order to edit the properties (e.g. material) of the selected 3D object.

Process Connection

Each individual kinematics object has 6 degrees of freedom (X-Y-Z translation and X-Y-Z rotation) to which a process variable can be assigned.

A process variable can be assigned to a degree of freedom by dragging a process variable out of the Process variables window and dropping it onto an

object in the Scene tree (see chapter 6.3 "Using 3D Visualization " on page 47).

Objects that have been assigned a process variable can be recognized by a green square.

The assignment of process variables to the degrees of freedom of the selected object can be seen in the assignment list.

Filter function

Press the <Filter> button to filter the Scene tree according to assigned objects. To do this, at least one object with a process connection must exist.

Object properties

The properties of a 3D object can be changed using the **Object properties** dialog box.

The dialog box can be opened by clicking contextual menu **Properties** on an object node in the scene tree.

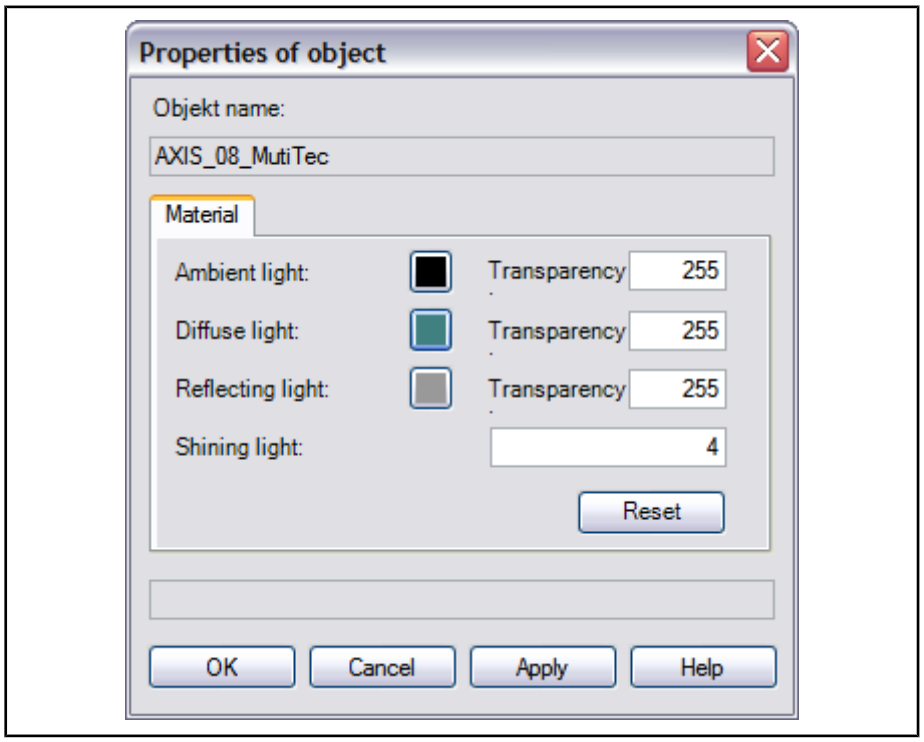

Fig.5-5: Properties of object: "Material"

The color and transparency of the selected object can be changed here.

See also chapter 6.3.3 "Operating 3D Visualization " on page 55.

The point of rotation and the angle of a kinematics object can be modified in the **Object properties** dialog box.

5.2.4 Assignment list for process variables

General

The Assignment list shows the assignment of a device's process variable to a degree of freedom of a kinematics object in the 3D scene.

Components of the Simulation

Assignment of process variables

object activity	process variable	offset	device
AXIS_08_MutiTec			
rotation			
X		0	
Y		0	
Z		0	
translation			
X		0	
Y		0	
Z	Z (Phys. No.= 3), Command, ACS	0	IndraMotion MTX P60

Fig.5-6: Assignment list for process variables

The following columns exist in the Assignment list:

- Object activity

  This column contains the name of the selected kinematics object. Below the name are degrees of freedom X, Y and Z for rotation and translation.

- Process variable

  If a process variable is assigned to the selected object, the name of the process variable is shown here.

- Offset

  An offset can also be specified for each process value.

- Control

  If process variables have been assigned, the name of the control that supplies the process values is shown here.

Assignment

A process variable can be assigned to a degree of freedom of the selected kinematics object in the Assignment list by dragging and dropping a variable out of the Process variables window (also see chapter 6.3.2 "Process Connection " on page 54).

An assignment can be removed by selecting the corresponding line and pressing the <Del>key.

5.2.5 Properties of the View3D Model

Dialog box **Model properties** can be used to adjust the settings of the View3D model. A distinction is made between **General** and **Light settings**.

See also chapter 6.3.3 "Operating 3D Visualization " on page 55.

General Settings

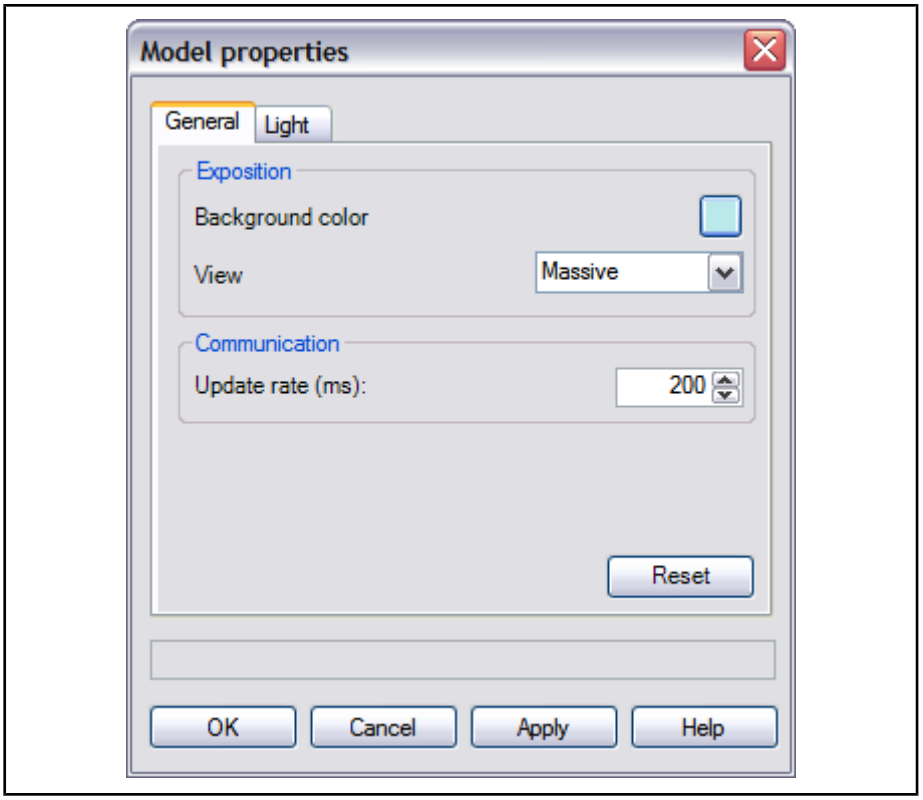

Fig.5-7: Model properties: "General"

- Display
  - Background color

    A color picker can be used here to change the background color of the 3D scene.
  - View

    A selection box can be used here to switch between a **Massive** and a **Wireframe** display.
- Communication

  The update rate set here specifies the time (in milliseconds) in which process values are updated by the communication server.

Light settings

Sliders in the Light settings can be used to change the lighting intensity according to ambient light, diffuse light and reflecting light.

Components of the Simulation

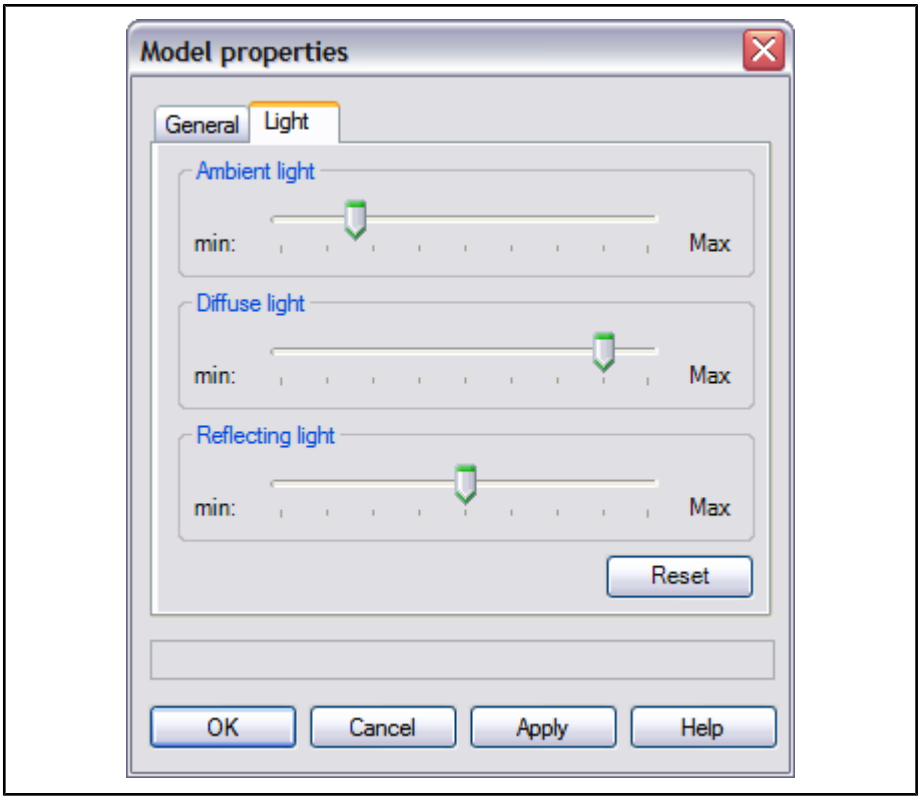

Fig.5-8: Model properties: "Light"

5.3 VAM simulator

5.3.1 General Description

The VAM simulator is used as replacement for the real VAM 40 and VAM 41 if it is worked with the MTX simulator. The appearance and functions replicate the real VAMs. In the current version, the texts are available in English and German.

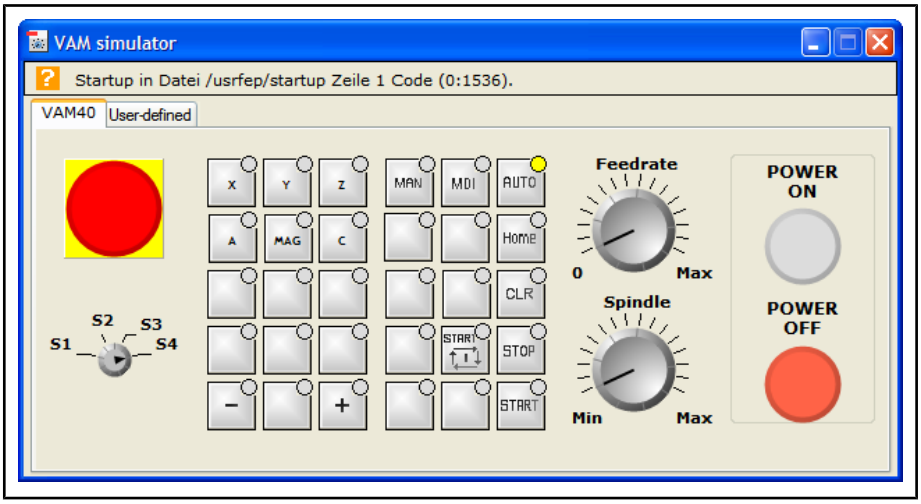

Fig.5-9: VAM simulator VAM 40

5.3.2 Configurator

The VAM simulator is configured in IndraWorks Engineering.

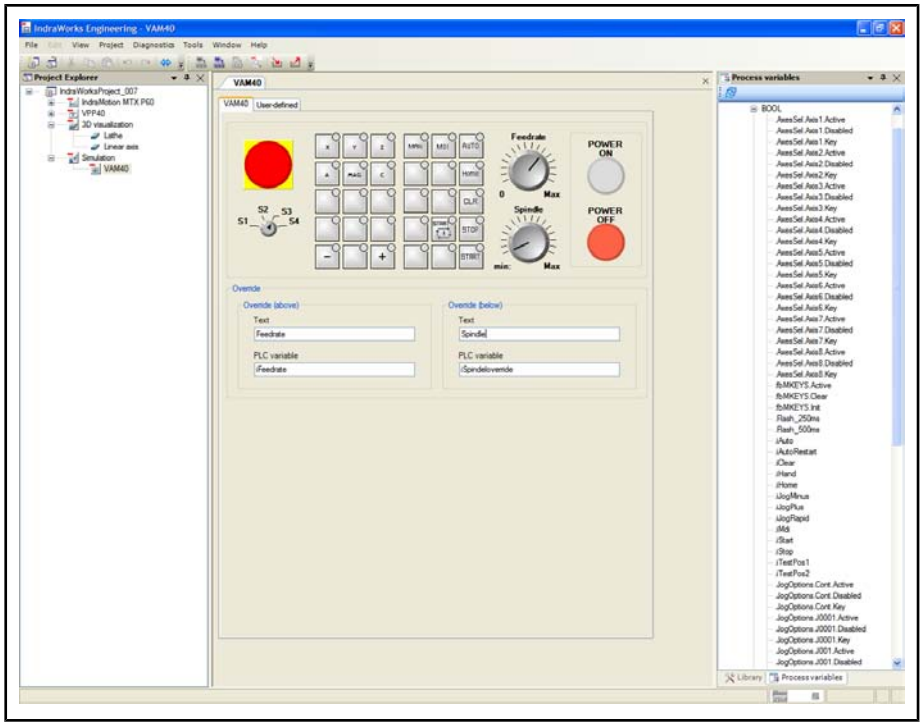

Fig.5-10: Configuration in IndraWorks

The project node simulation with subnode VAM40 or VAM41

Via double click on the project node of a virtual control panel, the pages for the configuration will be called. On the upper half of the page, the image of the virtual control panel is displayed, in the lower half there is the configuration page of the element selected in the image displayed.

The configuration page of the emergency stop

Only the PLC variable for later communication can be generated on the emergency stop page.

The configuration page of the key-operated switch

The individual switch settings are labeled and the PLC variables are assigned on the configuration page of the key-operated switch.

The configuration page of the override

The configuration page of the override is used to label and assign the PLC variables.

The configuration page of the keypads

This page is used to assign the PLC variables and to label the keypads with texts or prepared images. Each individual key can be allocated by entering a text or by dragging and dropping an image from the symbol list.

Depending from the selected type (VAM 40 or VAM 41) there are the following different functions available.

The configuration page of the quick-stop module

The configuration page of the quick-stop module can be used to make various settings for the two keys:

- Labeling the key
- Function

  Since the keys on the real VAM 40 are hardware-wired and the switches are equipped with make and break contacts, these settings can also be selected here.
- Assigning PLC variables

The configuration page for the free configurable elements

In the configuration page of eight free configurable elements, the following can be selected:

- LED

- Button with LED
- Button without LED
- Switch with 2 positions
- Switch with 3 positions

  Position in the middle has no function.

This elements can be labelled and assigned with PLC variables.

☞ Since the keys on the real VAM 41 are hardware-wired and the switches are equipped with make and break contacts, these settings can also be selected here.

5.3.3 The Application

The application is separate; it is used to control the PLC program in IndraMotion MTX emulation. This can be started independently of IndraWorks Engineering or IndraWorks Operation. When the VAM simulator is started, the configuration is read out from the currently active project.

☞ The VAM simulator communicates directly with the emulation. IndraWorks Operation or IndraWorks Engineering do not need to be started.

5.4 Virtual Control

5.4.1 General Description

A virtual control is the most important simulation component because it regulates the entire process - just like the real control. It contains the same functions as the real control and is identically parameterized, programmed and operated. Therefore, the method of operation does not change for the user if he switches between a virtual control and a real one; only the communication parameters of the Engineering interface must be reset. However, since the virtual control runs under Windows, its only limitation is that it is not real-time-capable.

With the emulation of the IndraMotion MTX machine tool control, Bosch Rexroth has such a virtual control.

For further information regarding IndraMotion MTX emulation, see chapter 6.4 "Using the Virtual Control" on page 59.

5.5 Process Connection

Window **Process variables** is used to access the process data of a device.

☞ Only NC or PLC process variables of device family IndraMotion MTX are currently supported.

The process data of the device are displayed in a tree structure.

In the root node of the tree there is a name of the device. If there is no communication connection to the device, this is marked with the following note: “There is no communication to device available!”

Depending on the application and the device, various process variables appear under the device node; these are in turn divided into various categories (e.g. data type).

With the button “Reload process variable” the displayed variables can be updated. This is necessary if e.g. global variables are modified in the PLC program.

If an error occurs, the device node is shown in red. If you position the mouse cursor over the device node, additional information about the error appears in an info box.

Process variable window in IndraWorks Engineering

The process variable window is displayed in the IndraWorks Engineering as dockable window.

A process variable is assigned to an element of the corresponding application using drag-and-drop.

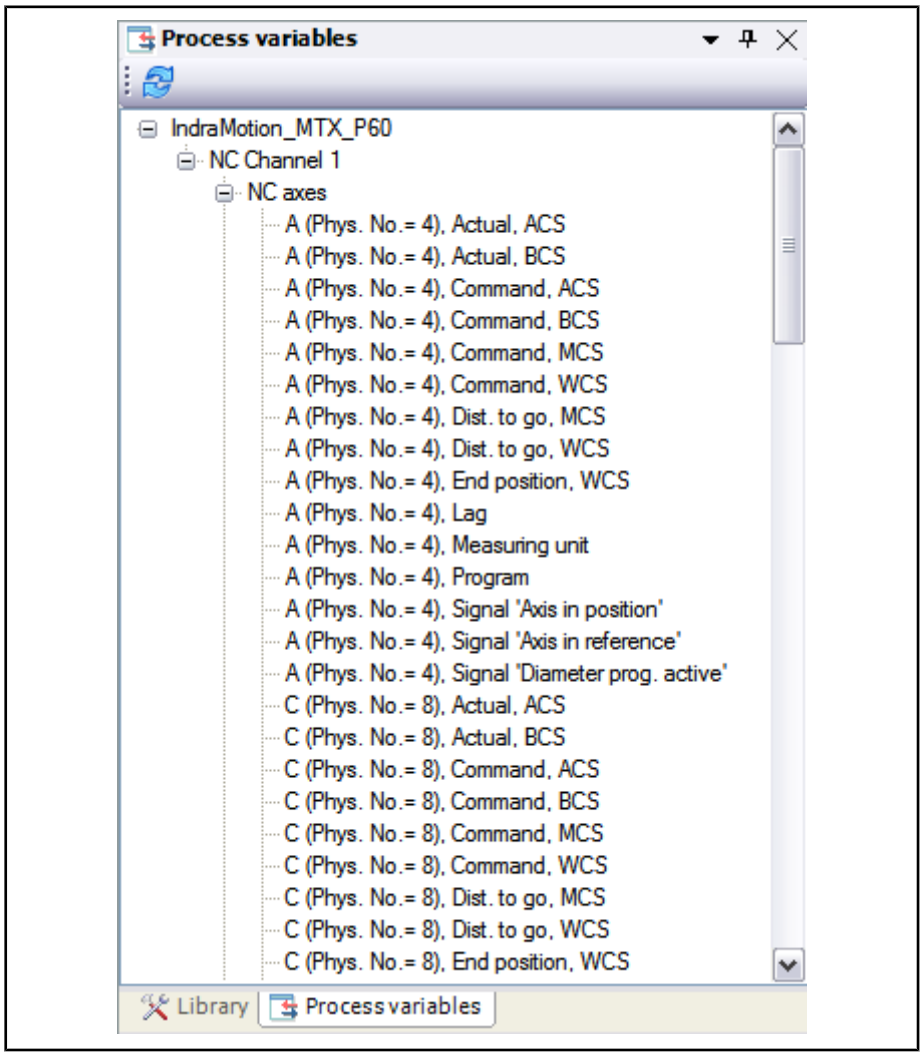

Fig.5-11: Process variables of NC in the IndraWorks Engineering

Process variable dialog in VAM simulator

Beside the configuration, the process variable window is now also in use during executing the VAM simulator to influence the PLC variables temporarily. The process variable window is displayed as dialog there.

A selected process variable can be applied into the virtual control panel with the <Ok> key.

Components of the Simulation

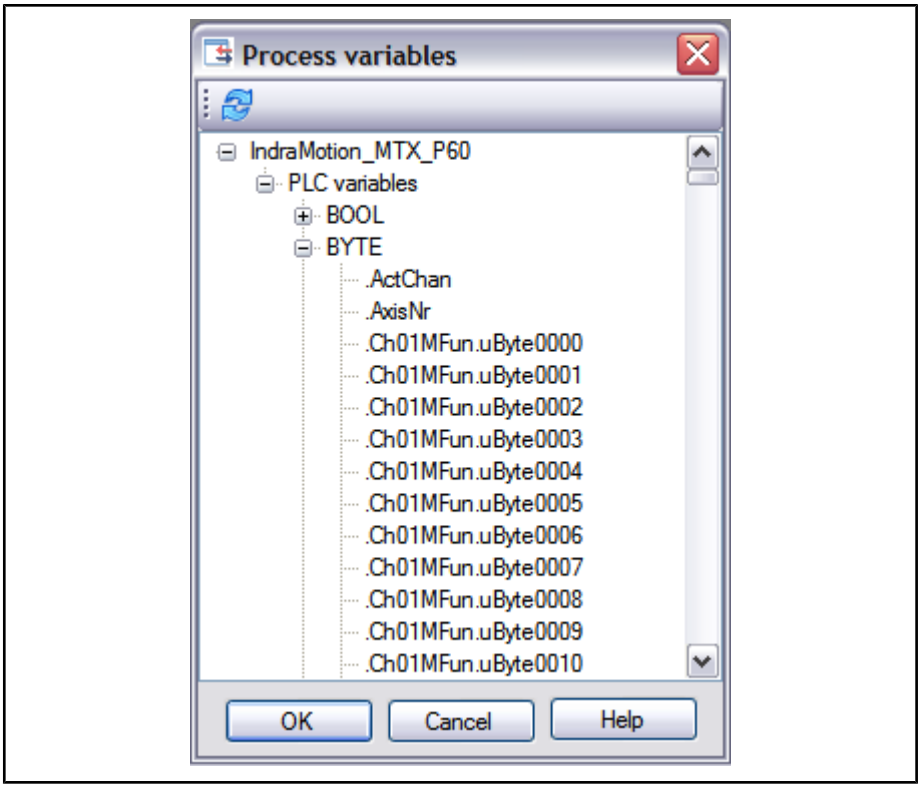

Fig.5-12: Process variable dialog in VAM simulator

5.6 Library

5.6.1 Simulation Components

All components of the simulation can be found in the IndraWorks library under the heading **Simulation**.

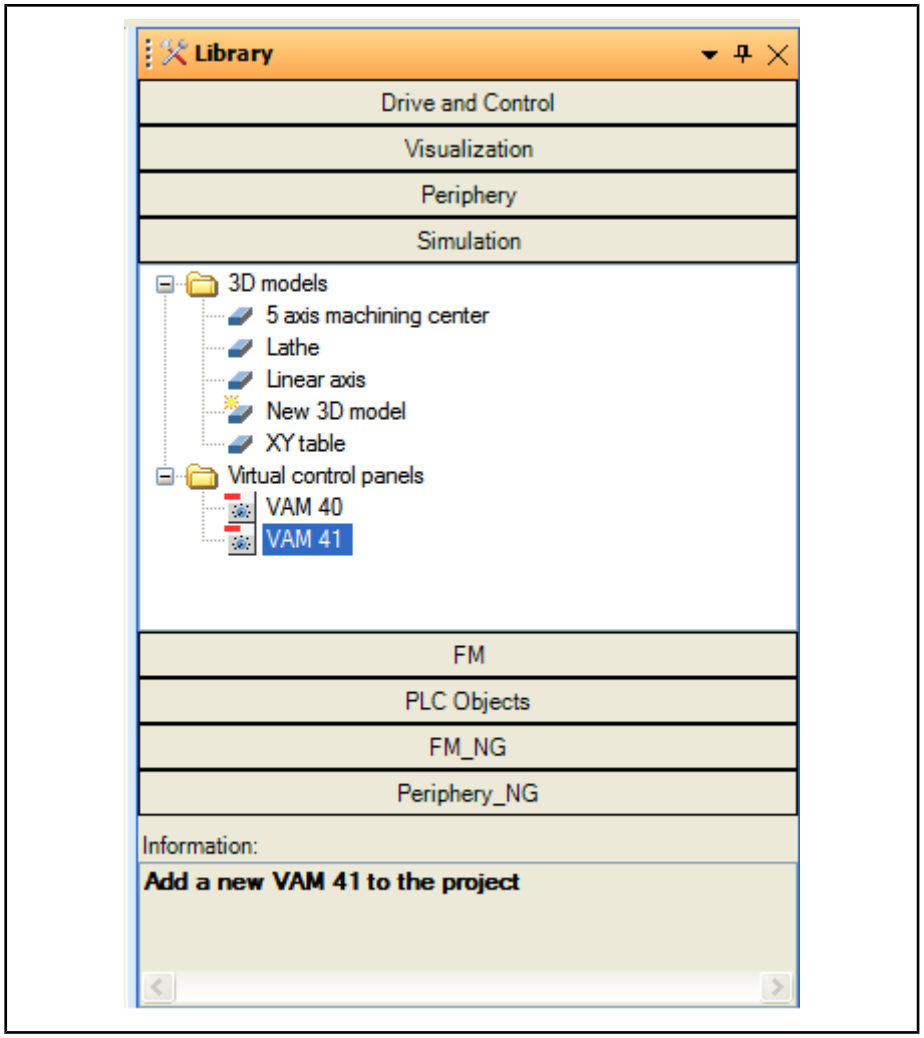

Fig.5-13: IndraWorks library

As is the case for other library components, simulation components can be inserted into an IndraWorks project using drag-and-drop.

The following categories exist in the library:

- 3D models
- Virtual control panels

5.6.2 3D Models

Under the heading **Simulation** in the IndraWorks library, you can find a directory named **3D models** containing the following components:

- 5-axis machining center

  Default model of a 5-axis machining center
- Lathe

  Default model of a lathe
- Compound table

  Default model of a compound table
- Linear axis

  Default model of a linear axis
- New 3D model

This component can be used to create a new 3D model.

5.6.3 Virtual control panels

Under the heading **Simulation** in the IndraWorks library, you can find a directory named **Virtual Control Panels** containing the following components:

- VAM 40

  A virtual control panel based on the real VAM 40.
- VAM 41

  A virtual control panel based on the real VAM 41.

6 Operation in IndraWorks

6.1 Creating a Model

6.1.1 General

The import format for 3D scenes into View3D is VRML (Virtual Reality Modeling Language). Files in the format VRML 2.0 (or VRML97) are supported.

VRML files are recognized by the file extension ".wrl" (world).

Most 3D modeling tools can export 3D scenes in VRML format.

☞ The import of compressed VRML files (the file extension is also ".wrl") is not supported by View3D.

6.1.2 Creating a Simple 3D Model

As a rule, any 3D modeling tool with VRML export can be used to create 3D models. However, not all modeling tools can be used to create kinematic relationships between individual 3D objects.

Kinematic relationships have a fundamental significance for machine models. In a compound table, for example, the X-axis also moves when the Y-axis is moved.

The following rules must be considered during creating a 3D model in VRML 2.0 format:

- There is just one root node in the tree structure of model allowed, all further nodes on this level will be ignored.
- No VRML primitives are allowed in the model (the export must be executed with the option "Indexed Phase Set")
- Translation / rotation to the object is not allowed on the end node in the tree structure. Either this is moved to a group of a higher level or a mesh algorithm is executed on the object.
- Sensors (animation) are not supported.
- Textures that are content of a model will be displayed in View3D.

6.1.3 Importing eM-RealNC Models

View3D can also import VRML models that have been created using the NC simulation software "Tecnomatix eM-RealNC" from Unigraphics Solutions GmbH (http://www.tecnomatix.de). Tecnomatix eM-RealNC has provided a VRML export interface for this purpose.

6.2 Using the Virtual Control Panel

6.2.1 Configuration in IndraWorks

Configuring the Virtual Control Panel

Creating a Virtual Control Panel

In order to be able to configure a Virtual Control Panel, a project must have been created in IndraWorks.

A virtual control panel is created in an existing IndraWorks project via **Project node ▸ right mouse button ▸ Add new element ▸ Virtual control panel** or using the library via tab **Simulation ▸ Virtual control panels**; then the panel is dragged to the project node and dropped there.

Operation in IndraWorks

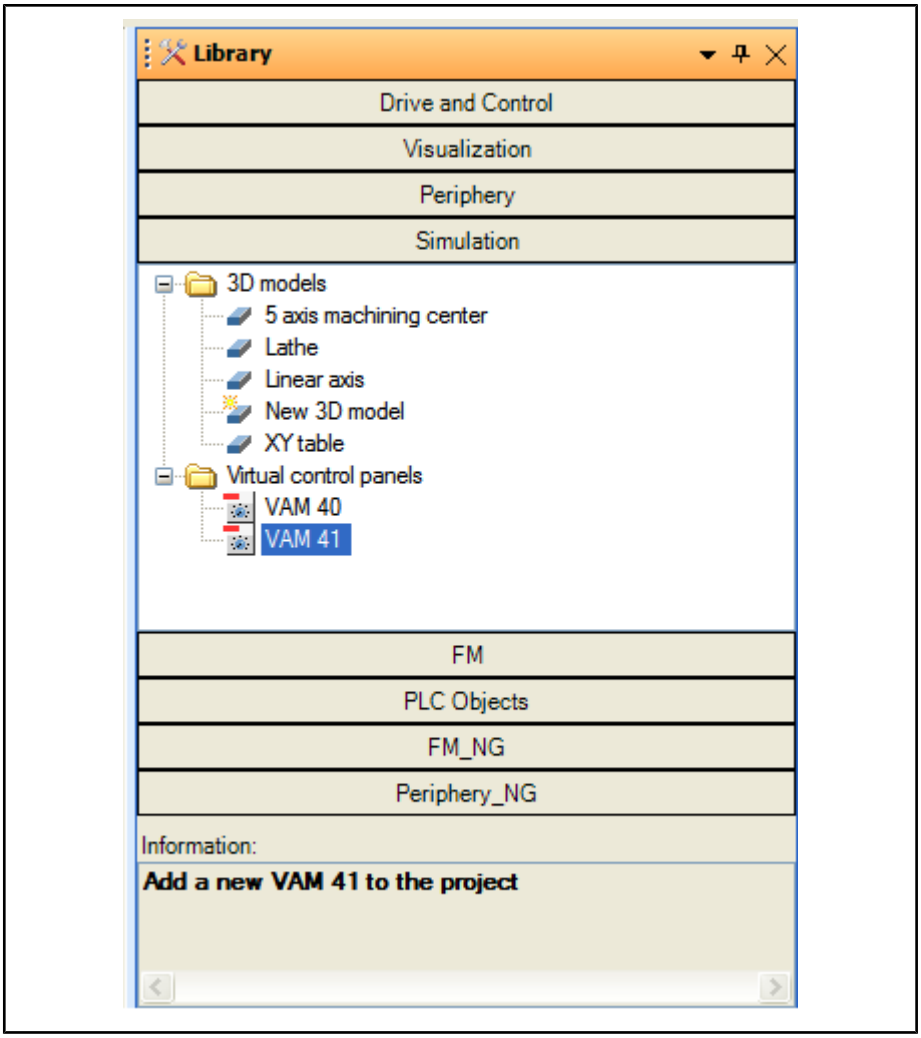

Fig.6-1: Simulation library

Then dialog box “Create VAM4x” appears, in which the following settings are possible:

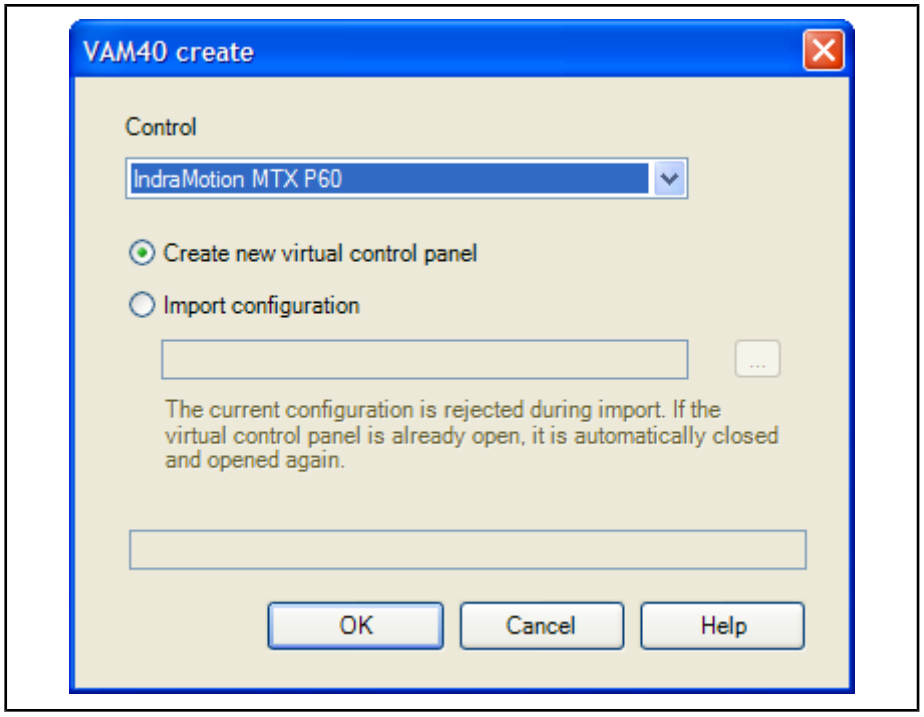

Fig.6-2: Create dialog new VAM simulator

- Selection of the control with which the selected VAM should communicate.
- Creating a new virtual control panel.

  A new VAM simulator created by selecting **Create new control panel ▸ OK**.
- Creating a preconfigured control panel.

  Select function “Import configuration” and then select a configured configuration file in the browser using the <...> button. Then confirm the selection and exit dialog box “Create new VAM4x” by pressing <OK>.

“VAM” then appears as a subnode in the simulation node.

The configuration pages open by <double-clicking> the node of the VAM (or clicking the **right mouse button on ▸ Open**).

Assigning process variables

Process variables are assigned by dragging and dropping them onto to the corresponding element in the VAM 40 or VAM 41 display. MTX simulator must have been started in order for this list to be visible.

Operation in IndraWorks

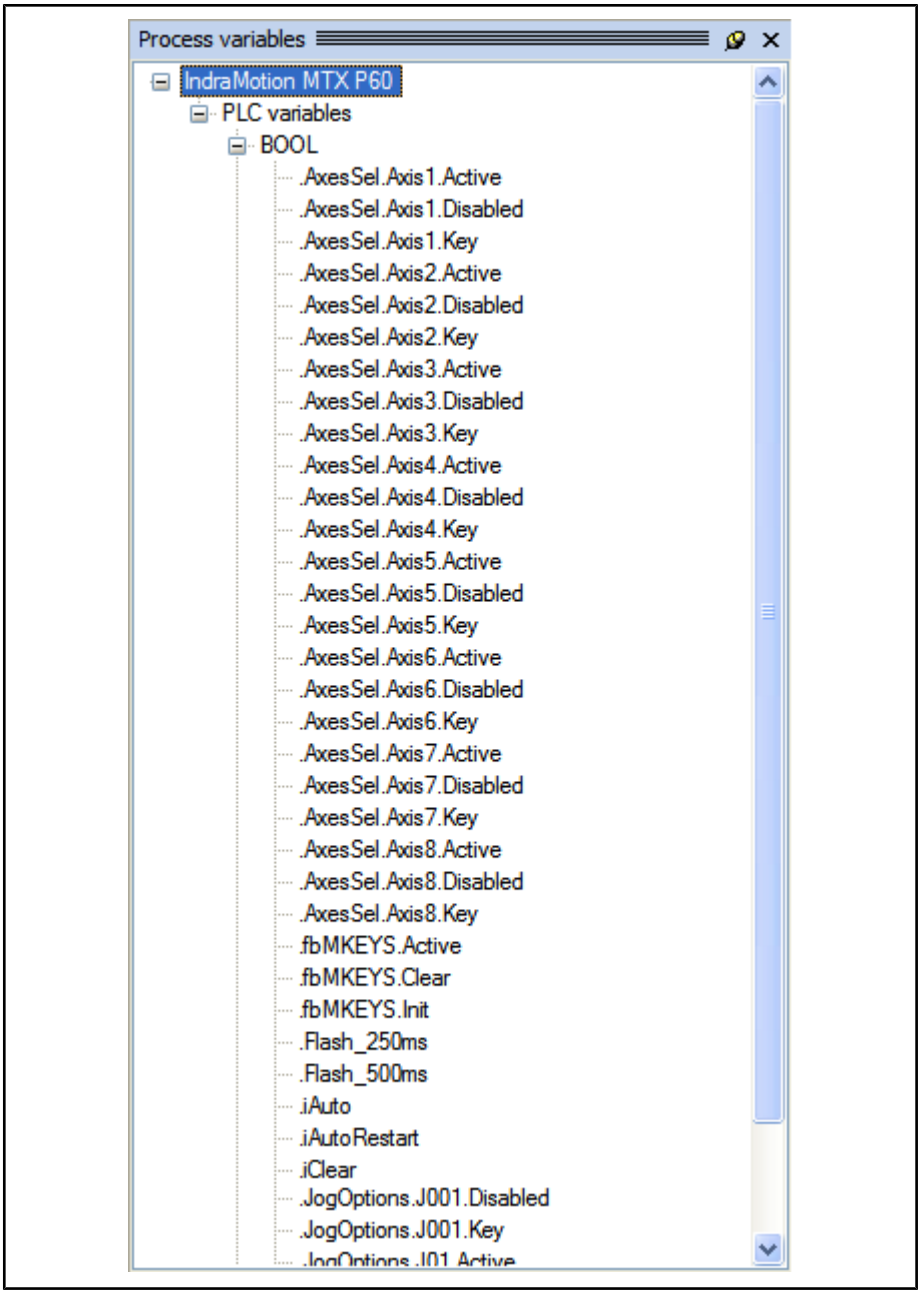

Fig.6-3: View of process variables

Configuring the emergency stop

There are two ways to assign a PLC variable to the emergency stop.

1. In the Process variables window, select a BOOL variable and drag and drop it onto the display of the emergency stop in the VAM. After you release the mouse button, the configuration page of the emergency stop - with the PLC variable entered in the text field - opens automatically if it is not yet open.
2. Activate the configuration page by placing the focus on the emergency stop in the display of the virtual VAM. Then enter the variable with which the emergency stop is to communicate in the text field.

The emergency stop can communicate only with BOOL variables!

Configuration of the key-operated switch

Labeling the key-operated switch

By highlighting the key-operated switch in the display of the virtual VAM, its configuration page opens. The switch positions are labeled in the individual text fields. The number of characters for the texts is unlimited; the new label appears immediately in the display of the VAM.

Assigning PLC variables

PLC variables can be assigned in two ways:

1. Select the PLC variable from the Process variables tree and drag and drop it onto the display of the key-operated switch. Then a contextual menu opens in which selections can be made to specify which switch setting should later communicate with the variable. The assignment of positions 1 - 4 goes from left to right.
2. Enter the PLC variable in the appropriate text field. The configuration page of the key-operated switch is activated by highlighting the key-operated switch in the display of the virtual VAM.

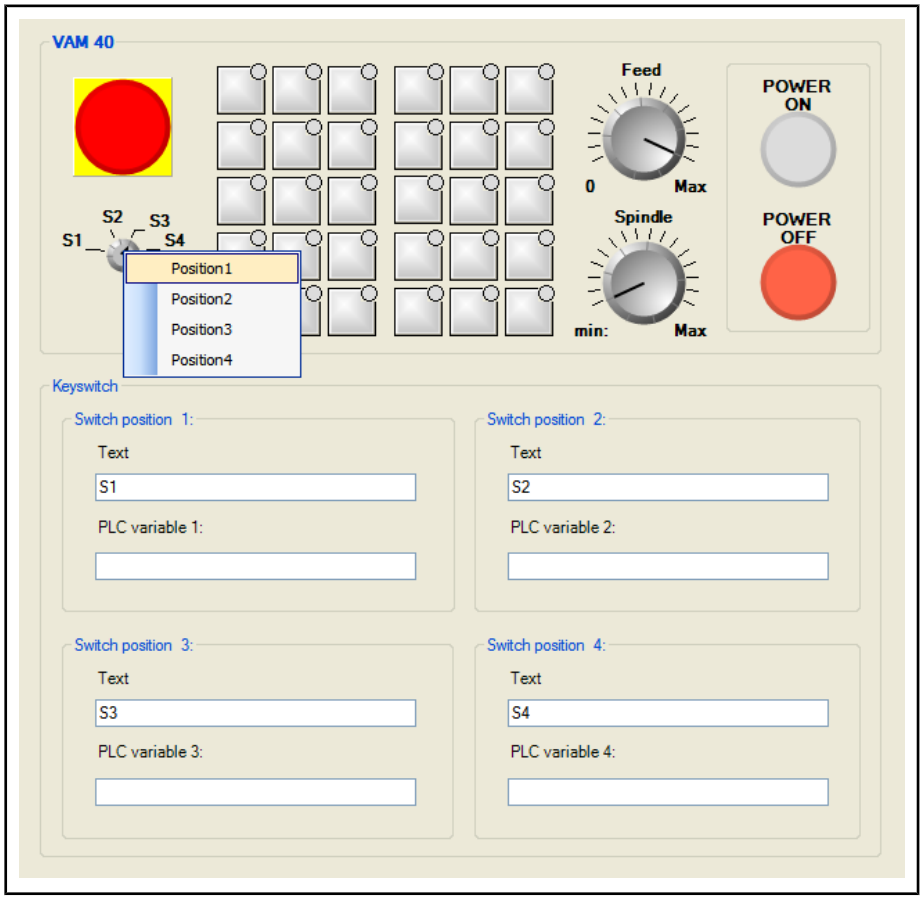

Fig.6-4: Configuration page of the key-operated switch

Only BOOL variables can be assigned to the key-operated switch.

Configuring the overrides

Labeling the overrides

Highlighting one of the overrides in the display of the virtual VAM opens its configuration page. The overrides are labeled in the individual text fields. The number of characters for the texts is unlimited; the new label appears immediately in the display of the VAM.

Assigning PLC variables

As is the case for the other elements, PLC variables are assigned in two different ways:

1. Select the PLC variable from the Process variables tree and drag and drop it onto the display of the override with which the variable is to be activated. The name of the variable can then be seen in the appropriate text field on the configuration page.
2. When you “go” to the display of an override, the configuration page of the override opens. The PLC variable can now be written in one of the text fields.

☞ The overrides are activated using BYTE variables.

Configuring the keypads

The configuration page of the keypads is opened by highlighting a key on the keypad.

Assigning text to the keys

When labeling an individual key, first highlight the desired key on the keypad. Then switch to the text field of “Labeling the key” and enter the text.

Assigning images to the keys

The previously generated pictures from the default page can be utilized or own pictures can be added via the user-defined page via import. This are available for every new virtual control panel.

Import the user-defined pictures via pressing the <Import> key. Afterwards, a dialog is opened in which the picture with the ending “*.bmp” can be searched. Afterwards the picture is displayed on the tab and can be stored on the keys of virtual control panel.

The key assignment can occur on two different ways: per drag & drop or if the keys are not in the visible area of Windows Desktop: per context menu.

- Per Drag & Drop

  First select any image in the “Symbols” category. Then press the left mouse button and drag the cursor to the desired key.

- Per context menu

  First, the key on which the screen should be visible later should be selected in the image of VAM. Afterwards, the screen is selected in the “Symbols” category and the right mouse button is pressed. the context menu opens with the text “Assign bitmap of key X3Y3”. After executing the context menu item, the picture is displayed on the requested key of virtual control panel.

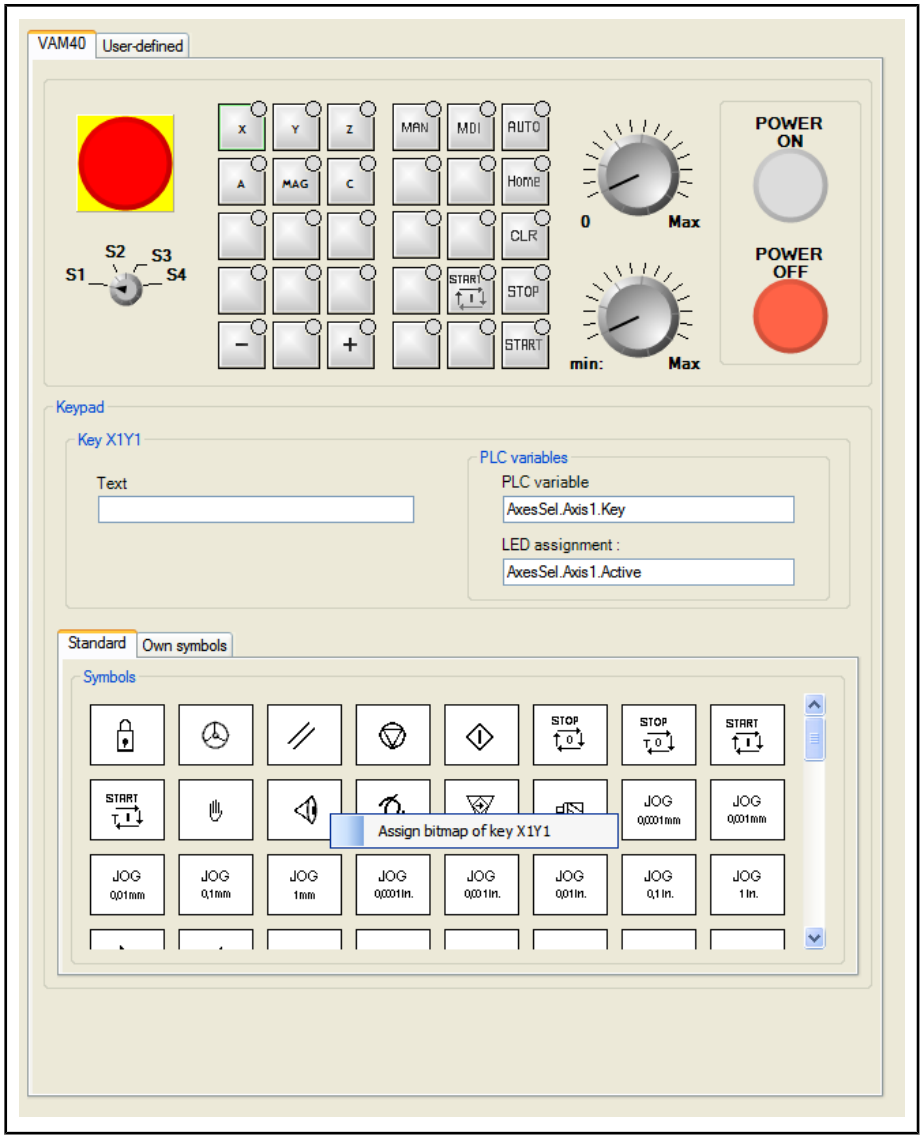

Fig.6-5: Assigning the screens via context menu

Assigning PLC variables to the keys

As is the case for the emergency stop and the key-operated switch, PLC variables can be added in two different ways.

1. In the Process variables window, select a PLC variable and drag and drop it onto the desired key. After you release the button, you must specify on what the variable should have an effect. The key and the associated LED can be selected to do this. The name of the variable can then be seen in the appropriate text field on the configuration page.
2. In the VAM display, highlight the button with which the PLC variable is to be addressed later. Then enter the PLC variable in the text field of the LED or key.

Operation in IndraWorks

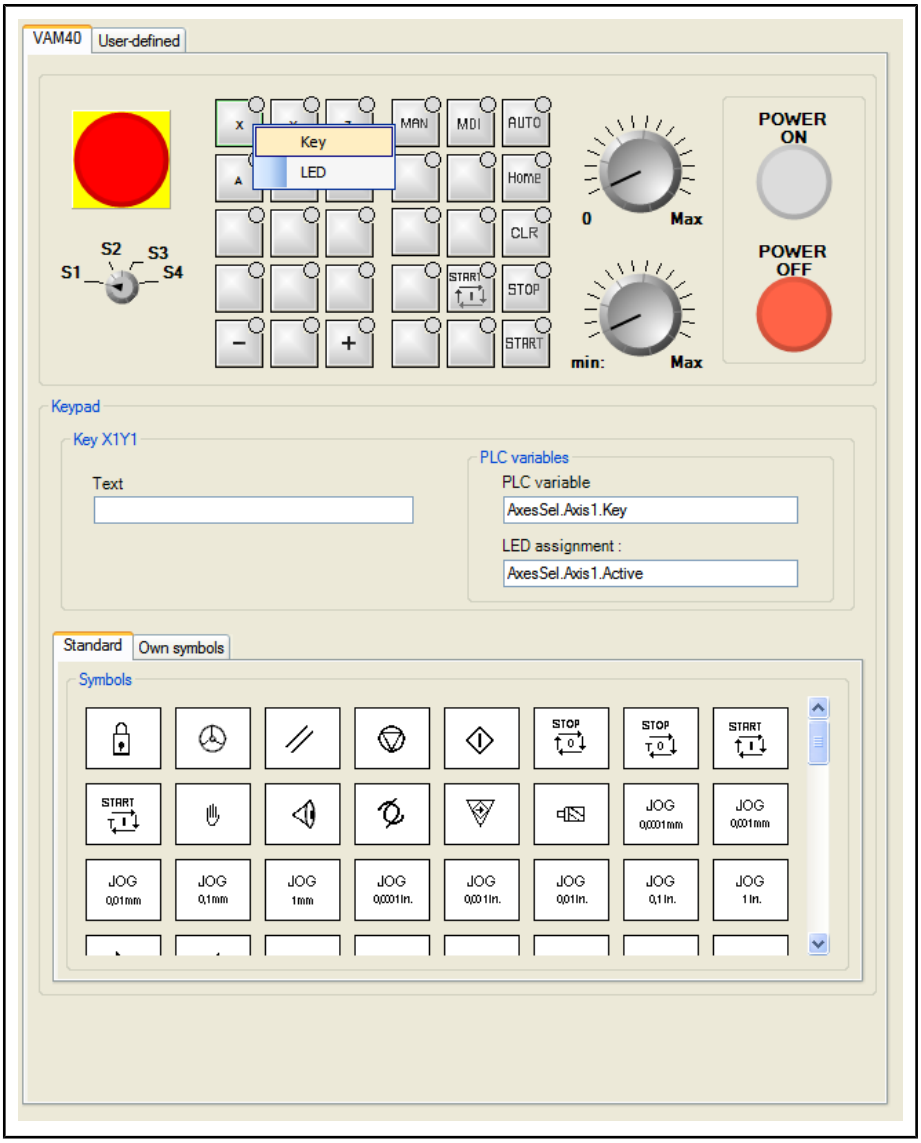

Fig.6-6: Configuration page of the keypads

Only BOOL variables can be assigned to the LEDs and keys.

VAM 40-specific configuration pages

Configuration of the quick-stop module

The configuration page of the quick-stop module is opened by selecting the quick-stop module in the display of the virtual VAM 40.

Labeling the keys

The new labels can be entered in the text fields of the “(Top) key” and “(Bottom) key”. Line breaks and line lengths are not taken into account. The label is immediately shown in the VAM 40 display.

Functions of the keys

Since the keys on the real VAM 40 are hardware-wired and the switches are equipped with make and break contacts, these settings must be selected here. This is accomplished by setting function “Break-contact” or “Make-contact”.

Assigning PLC variables

There are also two different ways to assign the PLC variables to the keys and LED in the quick-stop module.

1. In the Process variables window, select a PLC variable and drag and drop it onto the desired key. If the upper button is selected, a contextual menu appears in which the association of the PLC variable still remains to be clarified. The key and the associated LED can be selected to do this. There is no dialog box for the lower button because only the button can be assigned. The name of the variable can then be seen in the appropriate text field on the configuration page.
2. Highlight the quick-stop module in the display of the VAM 40. Then enter the PLC variable for the desired element in the text field of the configuration page.

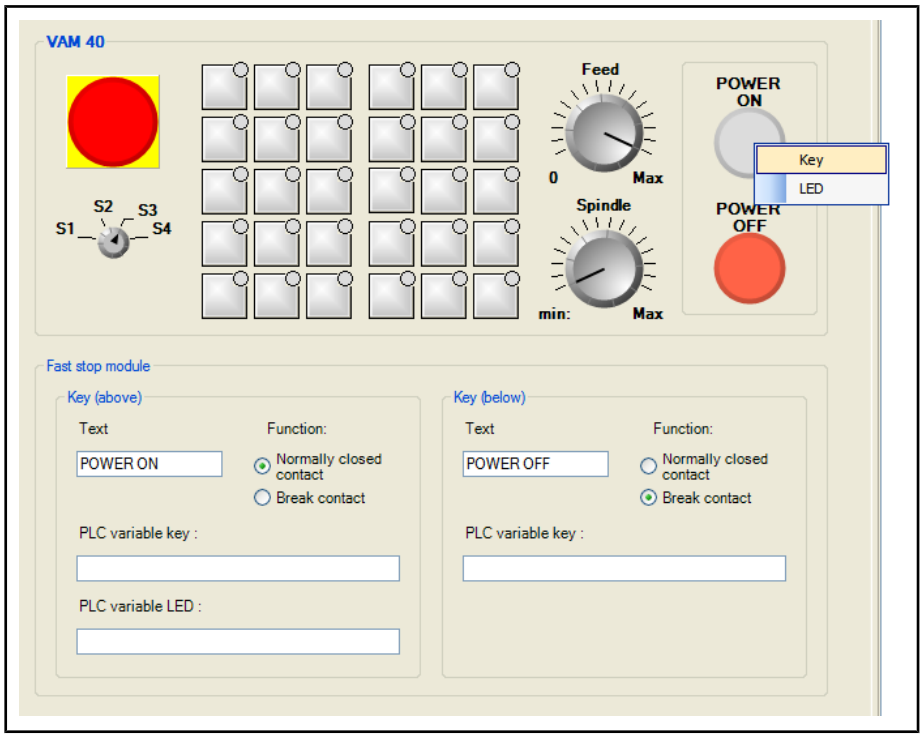

Fig.6-7: Configuration page of the quick-stop module

Only BOOL variables can be assigned to the LED and keys.

VAM 41-specific configuration pages

Configuration of eight free configurable elements

The configuration page of the eight free configurable elements is displayed by selection of the rectangular checkbox or the already selected elements in the image of VAM 41.

Within “Function of the element” it can be selected between several elements.

- LED
- Button with LED
- Button without LED
- Switch with 2 positions
- Switch with 3 positions

  No PLC variable can be assigned to the mid-position.

This elements can be labelled and assigned with PLC variables.

Operation in IndraWorks

Since the keys on the real VAM 41 are hardware-wired and the switches are equipped with make and break contacts, these settings can also be selected here.

Labelling the elements

Labelling of individual elements is executed via the “Text” field on the configuration page. The line breakage and character length are also not considered here, the labelling is immediately displayed in the image of VAM 41.

Function of the keys with and without LED

Since the keys on the real VAM 41 are hardware-wired and the switches are equipped with make and break contacts, these settings must also be selected here. This is accomplished by setting function “Break-contact” or “Make-contact”.

Function of the switch

The PLC variable is always set to logic one for the switch with 2 switch positions. The PLC variable on which the position is assigned to, is set to logic zero.

The function of the switch with 3 positions is identical to the switch with 2 positions; in the middle position both PLC variables are set to logic zero.

Assigning PLC variables

There are two possibilities to assign the PLC variables to the elements like for other configuration pages.

1. In the Process variables window, select a PLC variable and drag and drop it onto the desired element. If the element is a button with LED or a switch, a context menu is opened in which the classification of PLC variable must be cleared. For the “button with LED” there is the selection between LED and button and for “switches” between the right and left side.
2. Focussing the elements in the image of the VAM 41. Then enter the PLC variable for the desired element in the text field of the configuration page.

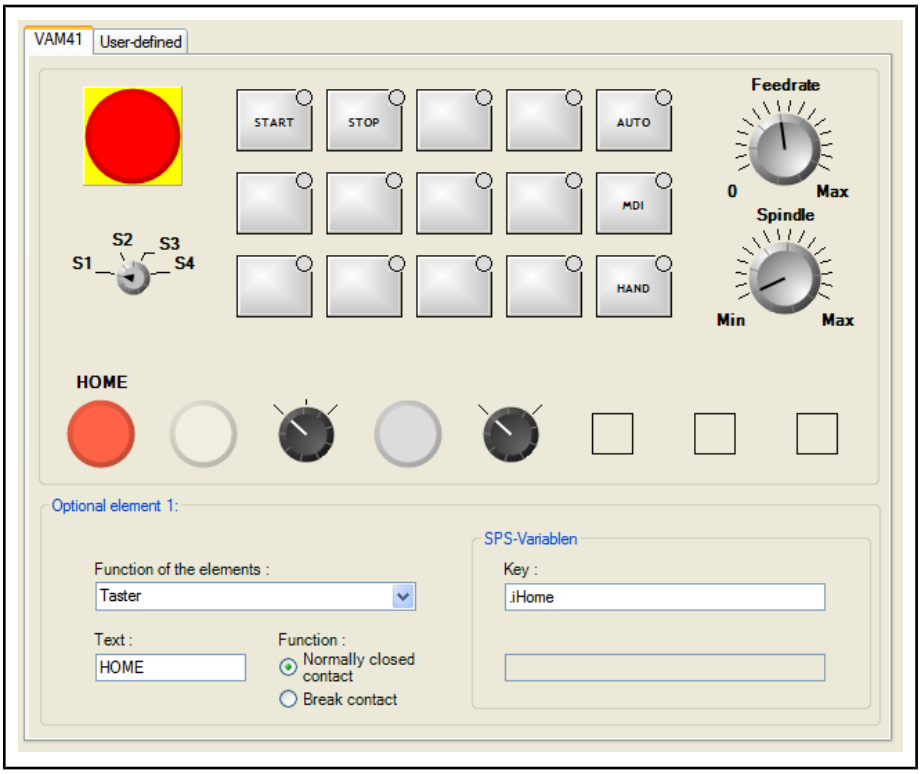

Fig.6-8: Free configurable elements VAM 41

Only BOOL variables can be assigned to the LED like the buttons and the switches.

Configuring the tab

On the tab parallel to VAM 40 or VAM 41, PLC variables can be free assigned to because of insufficient space or if they have another type than “BOOL” and “BYTE”. If a variable is successfully assigned to a field, the data type-depending value field is displayed.

But the current value of variable is only visible in the application and can only be influenced there!

As is the case for the other configuration pages, PLC variables are assigned in two different ways:

1. In the Process variables window, select a PLC variable and drag and drop it onto the desired field. The name of variable is displayed in the text field and the suitable value field is visible.
2. Focussing one of the 14 field and enter the PLC variable.

   When the file is exited, it is checked if the entered PLC variable exists. If this is not the case, it is colored in red. The color will disappear not until it is corrected and the field is exited again.

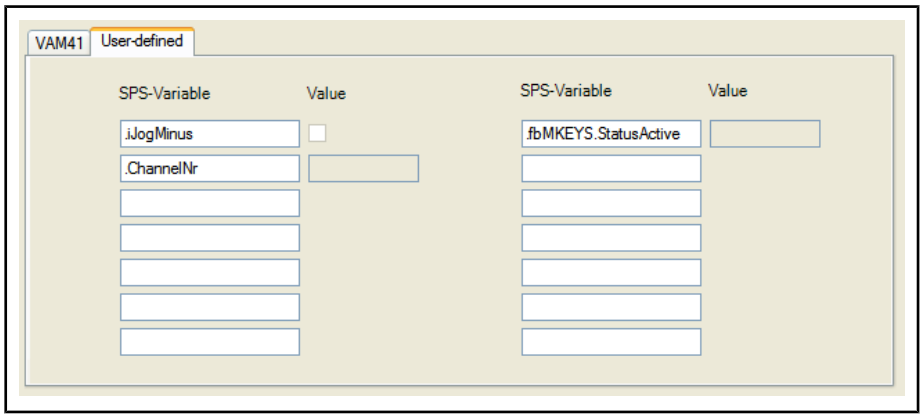

Fig.6-9: Configuring the tab in IndraWorks

Contextual menu of the virtual control panel in the Project Explorer

The contextual menu is called via **Project Explorer ▸ VAM4x ▸ right mouse button**.

The following functions can also be carried out:

Open The virtual control panels are opened using this function.

Import... During an import, the same dialog box opens as for the creation of a new control panel, but the function “Create new control panel” is dimmed. The control with which communication is to occur later can be changed, if necessary.

Then select the configuration to be imported using the <...> button in the browser and confirm it.

The name of configuration file must have the ending “*.vcp” or “VirtualControlPanel_VAM40.xml” (from version IW-Simulation-01VRS) !

Then confirm dialog box “Create new VAM4x” by pressing <OK>. If a VAM is open at this time, it is closed automatically; the previous configuration is discarded and the panel is opened again with the imported configuration.

it is checked if the configuration to import corresponds to the type of new virtual control panel. If this is not the case, the import is cancelled.

Export... If menu item “Export” is selected, dialog box “Export” opens; the storage location can be specified here. After confirming, a current copy of the configured control panel is in the destination directory and has the ending “*.vcp”.

Assign control... Contextual menu item “Assign control...” is used to subsequently assign or change a control. When a selection has been made and the dialog box is confirmed by pressing <OK>, the virtual control panel closes when it is supposed to be open. Then it is automatically reopened.

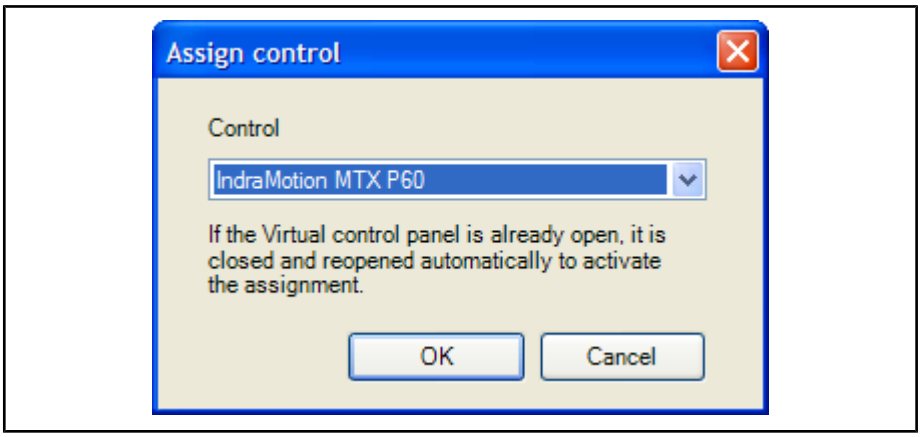

Fig.6-10: Assign control

Delete If function “Delete” is selected, the virtual control panel is removed from the project. However, the simulation node is retained.

6.2.2 Connection to Virtual Control

Before the VAM simulator can be started successfully, the following must be carried out to be able to establish a connection to the virtual control:

Preparations in IndraWorks Engineering

1. Set the project in which the Virtual Control Panel was configured to Active. This is accomplished by selecting the menu item **Project ▸ Activate for IndraWorks Operation**.
2. Start MTX Emulation.

Preparations in IndraLogic .

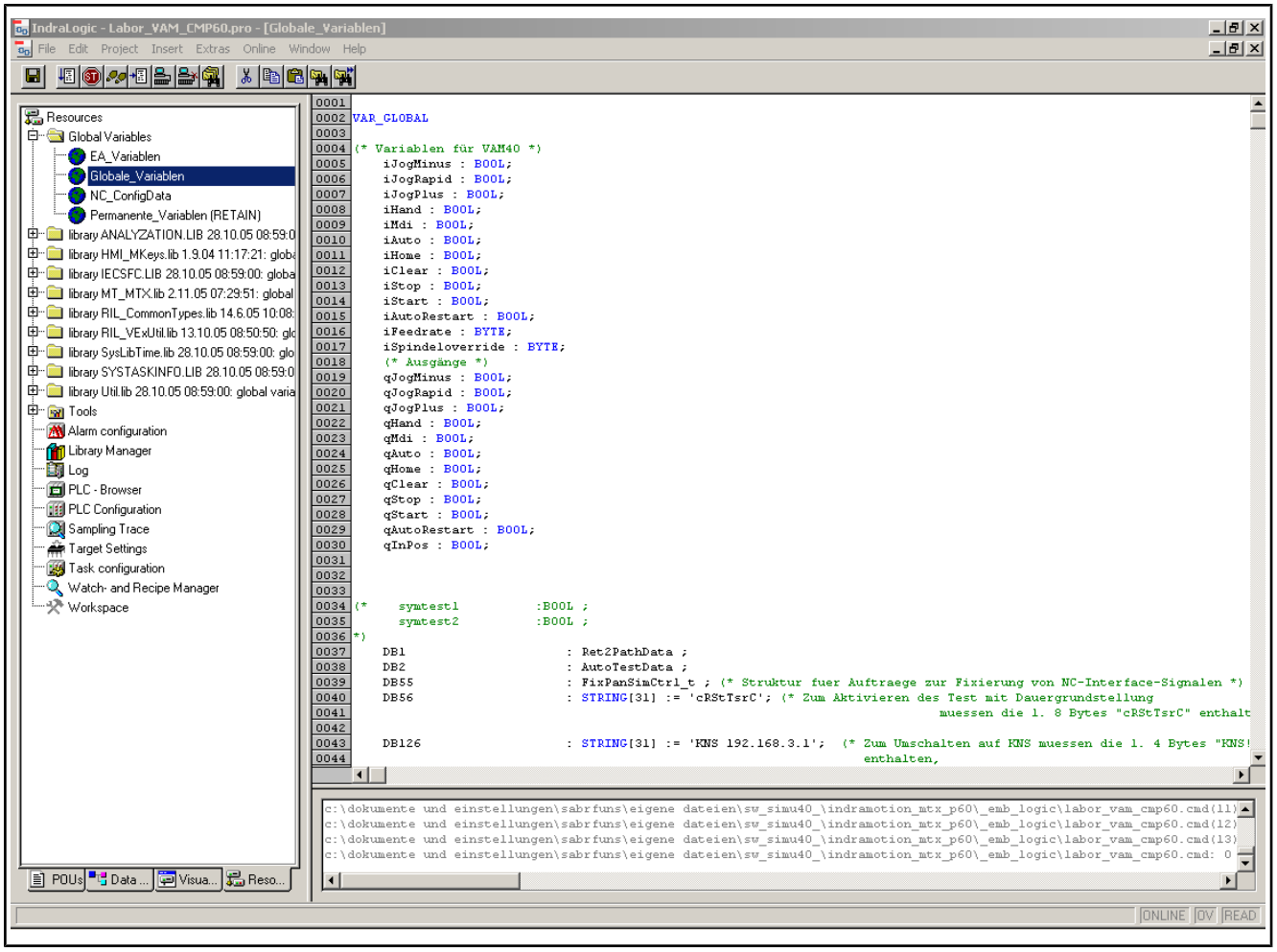

Fig.6-11: Preparations in IndraLogic

- In the PLC program, create all the variables that are to receive a connection with the VAM simulator as “Global variables”. These variables are used to activate the individual switch settings, buttons, lamps and overrides.

  These are created as follows: Variable name: BOOL, e.g. **iStart : BOOL;**

Do not assign an address; remove it if necessary!

- Reset the PLC program, log in and start.

6.2.3 Start and operate

Start

The VAM simulator is started via **Start ▸ Program Files ▸ IndraWorks ▸ Virtual Control Panel** or using the “IndraWorks Virtual Control Panel” icon on the desktop.

Utilizing the user-defined tab

All PLC variables which are added in the configuration, can nor be deleted nor modified. Only the value of this variables can be influenced. Variables which are added during runtime, are deleted after closing the VAM simulator and must be entered again during restart.

As in the configuration, PLC variables can be added in two different ways.

1. Confirming the key <...> beside the desired PLC variable field. Afterwards, the process variable browser is opened in which the desired PLC variable can be selected. By pressing the <OK> key, it is entered in the field and

the data-dependent value field with the current value is displayed from the PLC.

2. Focussing one of the not assigned PLC variable fields and entering the PLC variables into the field.

   When the file is exited, it is checked if the PLC variable exists in the PLC. If this is not the case, it is colored in red.

Modifying the variable values is applied so that the desired value is entered in the value field. With the <Enter> key or exiting the value field, the value is sent to the PLC.

☞ If the value range is exceeded during modifying the PLC variable value and this is send to the PLC, an error message is displayed and a new input is necessary!

6.2.4 Context menu in VAM simulator

If the VAM simulator has been started, three functions can be activated/deactivated using the **right mouse button**. To set the functions not again during every start, they are saved.

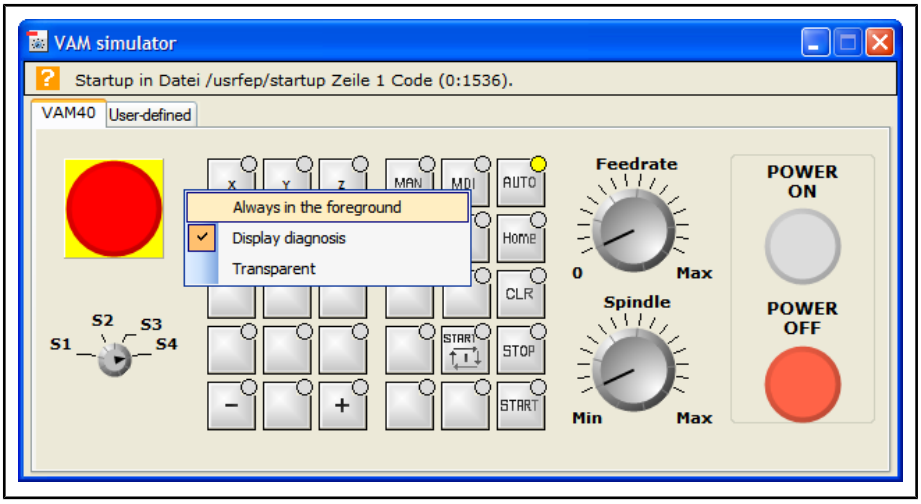

Fig.6-12: Contextual menu display in the virtual control panel

Function “Always in the foreground”

Function “Always in the foreground” is used to always keep the VAM simulator in the foreground so that it does not disappear behind Operation Desktop when this is being used. It can be activated/deactivated at any time by selecting **right mouse button ▸ Always in the foreground**.

Function “Display diagnosis”

The diagnosis display is used to show error, warning and info texts even if Operation Desktop is closed. It can be activated/deactivated at any time by selecting **right mouse button ▸ Display diagnosis**. The location for the display is always adapted automatically.

☞ only the message currently in the control is displayed!

“Transparent” Function

With this function, the VAM can be switched transparent to see the application in the background. It can be activated/deactivated at any time by selecting **right mouse button ▸ Transparent**.

6.2.5 Error Messages and Remedies

Error box “No active project exists!”

Remedy: Open IndraWorks Engineering and set the project in which the Virtual Control Panel was configured to Active. This is accomplished by selecting menu item **Project ▸ Activate for IndraWorks Operation**.

Then restart the “IndraWorks Virtual Control Panel”.

Error box “No virtual control panel configured!”

Remedy: Open IndraWorks Engineering and open the project in which the Virtual control Panel was configured. Create a virtual control panel via **Project node** ▸ **right mouse button** ▸ **Add new element** ▸ **Virtual control panel** or via selecting **Library** ▸ **Simulation** on **Virtual control panel** ▸ **VAM4x** and drag & drop on the project node. Then proceed according to chapter "VAM 40-specific configuration pages " on page 40.

Error box “Communication can not be established!”

Remedy: Start emulation via**Start** ▸ **Program Files** ▸ **Rexroth** ▸ **IndraWorks** ▸ **MTX Emulation**

Error box “Error writing PLC variables”

This error message can have various causes; therefore various remedies are available:

1. Check whether the PLC variables were stored under “Global variables” and are of type BOOL. Exception: Override activation uses BYTE variables.
2. Check the communication to the PLC and reestablish the connection if necessary.

Error box “No control assigned!”

Remedy: Open IndraWorks Engineering and the project in which the virtual control panel was configured. Execute the following afterwards: **VAM** ▸ **right mouse button** ▸ **Assign control** and select the control which should be communicated. Restart the VAM simulator.

6.3 Using 3D Visualization

6.3.1 3D Models in IndraWorks

Adding 3D Models

General

In order to be able to use a 3D model in the View3D visualization system, it must first be added to the IndraWorks project.

The following formats are supported:

- *.wrl (3D models in VRML97 format)
- *.d3d (internal View3D format)
- *.v3d (View3D export format)

Handling instruction: Adding a 3D model using Project Explorer

Adding a 3D model into the IndraWorks project using Project Explorer is described here.

IW Engineering / Simulation: Adding a 3D model using Project Explorer

- In the Project Explorer on node **3D visualization** (or on the **project node** if node **3D visualization** does not yet exist), select the contextual menu **Add** ▸ **Add new element...**.
- Select template **New 3D model** in dialog box **Add New Element** under category **Simulation** ▸ **3D models** and press the <Open> button.

Operation in IndraWorks

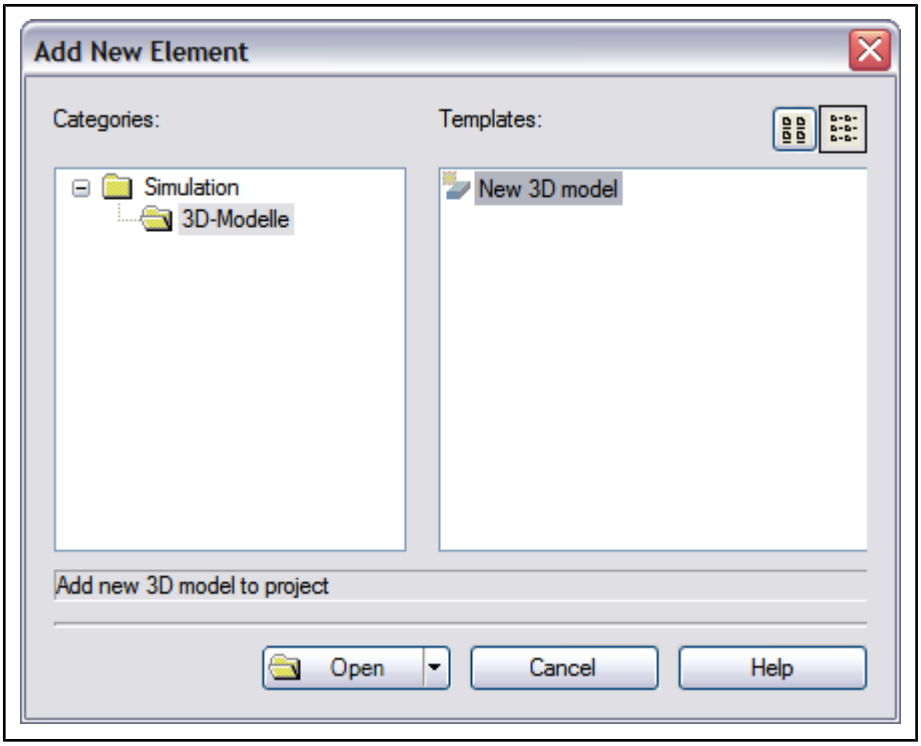

Fig.6-13: Adding a new element

- In the following dialog box, enter the name for the View3D model and select an import file for the 3D scene.

  Press the <...> button to open a file selection dialog box in which the 3D model can be selected.

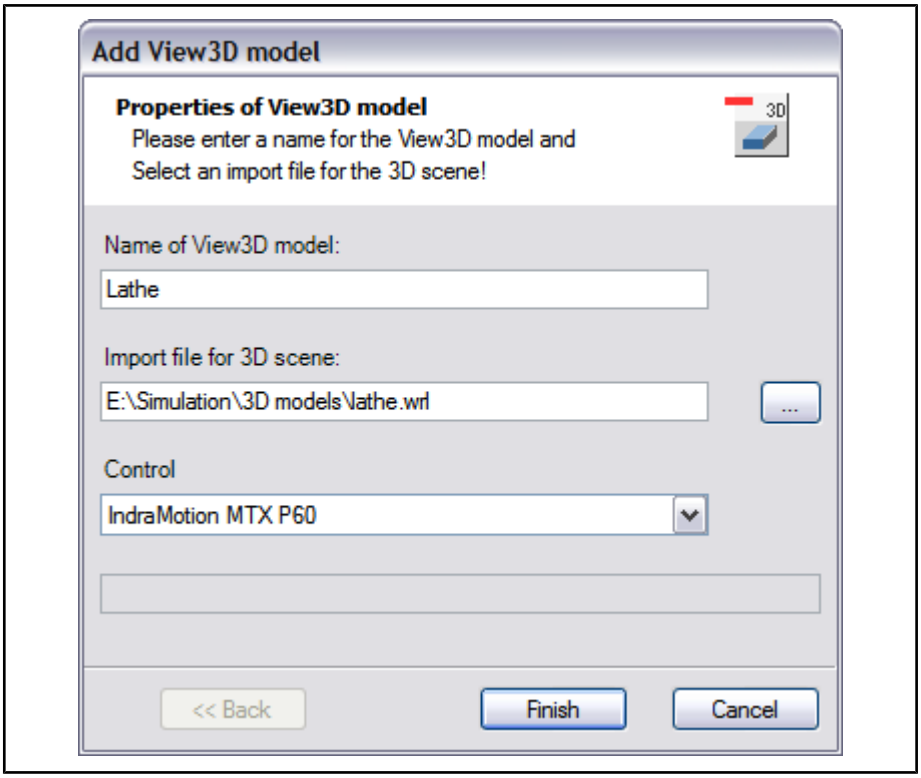

Fig.6-14: Adding a View3D model

- If there is a control in the IndraWorks project, you can select it here for the process connection of View3D.
- Press the <Finish> key. The View3D model is added to node **3D visualization** in the project tree.

Handling instruction: Adding a 3D model using the library

Adding a 3D model into the IndraWorks project using the library is described here.

IW Engineering / Simulation: Adding a 3D model using the IndraWorks library

- In the IndraWorks library, open category **3D models** under **Simulation** and drag the object “New 3D model” (press and hold the right mouse button) to Project Explorer and drop it onto node **3D visualization** (or onto the project node; also see chapter 5.6 "Library " on page 30).
- In the following dialog box, enter the name for the View3D model and select an import file for the 3D scene.

  Press the <...> button to open a file selection dialog box in which the 3D model can be selected.

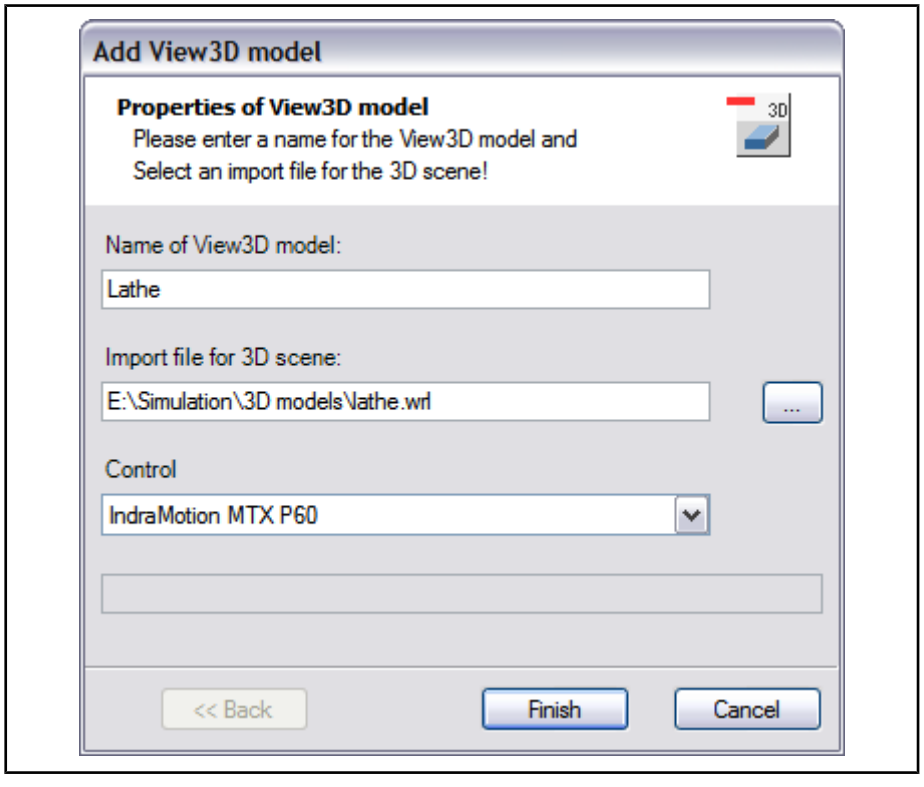

Fig.6-15: Adding a View3D model

- If there is a control in the IndraWorks project, you can select it here for the process connection of View3D.
- Press the <Finish> key.

  The View3D model is added to node **3D visualization** in the project tree.

Handling instruction: Adding a default 3D model

Adding a default 3D model to the IndraWorks project using the library is described here.

IW Engineering / Simulation: Adding a default 3D model

- In the IndraWorks library, open category **3D models** under **Simulation**.

Drag a default 3D model to Project Explorer and drop it onto node **3D visualization** (or onto the project node; also see chapter 5.6 "Library " on page 30).

- In the following dialog box, select a control for the process connection (if necessary) and press the <Finish> button.

  The default model is added to node **3D visualization** in the project tree.

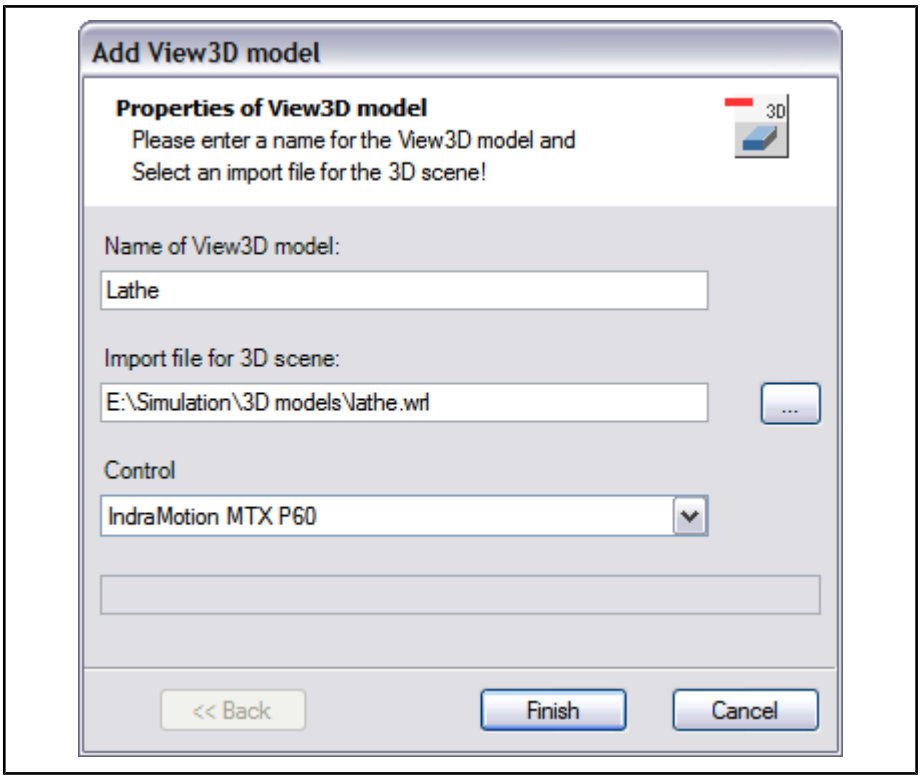

Fig.6-16: Adding a default model

Opening, renaming and deleting 3D models

Opening a 3D model in View3D

Highlight the desired View3D model within node **3D visualization** using the mouse or the cursor keys and open it using contextual menu **Open** or by double-clicking.

☞ If a View3D model has been created in an MTX05VRS project and if this project was then opened in an MTX 06VRS environment, the View3D model can no longer be opened because an incompatibility has resulted due to the required extensions. To solve this problem, please delete the View3D model and reinsert the original VRML model. Then scale the model and assign the process variables.

Renaming a 3D model

The name of the View3D model can be changed in the Project Explorer. To do this, select contextual menu **Rename** on the View3D model in the Project Explorer or press key <F2>. Then the name can be changed and entered by pressing the <Enter> key.

Deleting a 3D model

A View3D model can be deleted from the IndraWorks project in the Project Explorer using contextual menu **Delete** or with key <Del>.

Export/Import

General

The Export and Import functions can be used to export View3D models - including the configured process connection - from an IndraWorks project or to import them into an IndraWorks project.

The file extension for exported View3D models is ***.v3d**.

Handling instruction: Exporting a View3D model from an IndraWorks project

Exporting a View3D model from an IndraWorks project is described here.

IW Engineering / Simulation: Exporting a View3D model

- In Project Explorer, select menu item **Export...** from the contextual menu of the 3D model.

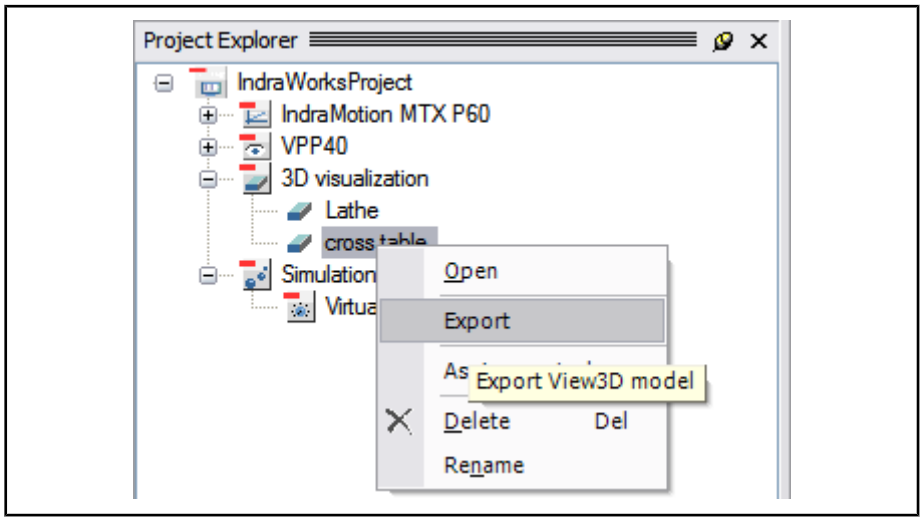

Fig.6-17: Exporting a View3D model

- The name and target path for the export file can be entered in a file selection box.

Handling instruction: Importing a View3D model into an IndraWorks project

Importing a View3D model into an IndraWorks project is described here.

IW Engineering / Simulation: Importing a View3D model

- In Project Explorer, select menu item **Import...** from the contextual menu of node **3D visualization**.

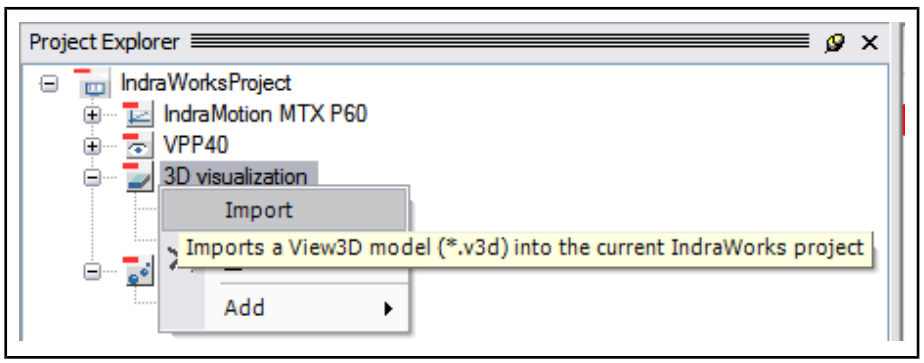

Fig.6-18: Importing a View3D model

- In the Import dialog box, enter the name for the View3D model and enter a View3D import file, or open the file selection dialog box using the <...> button and select an import file.

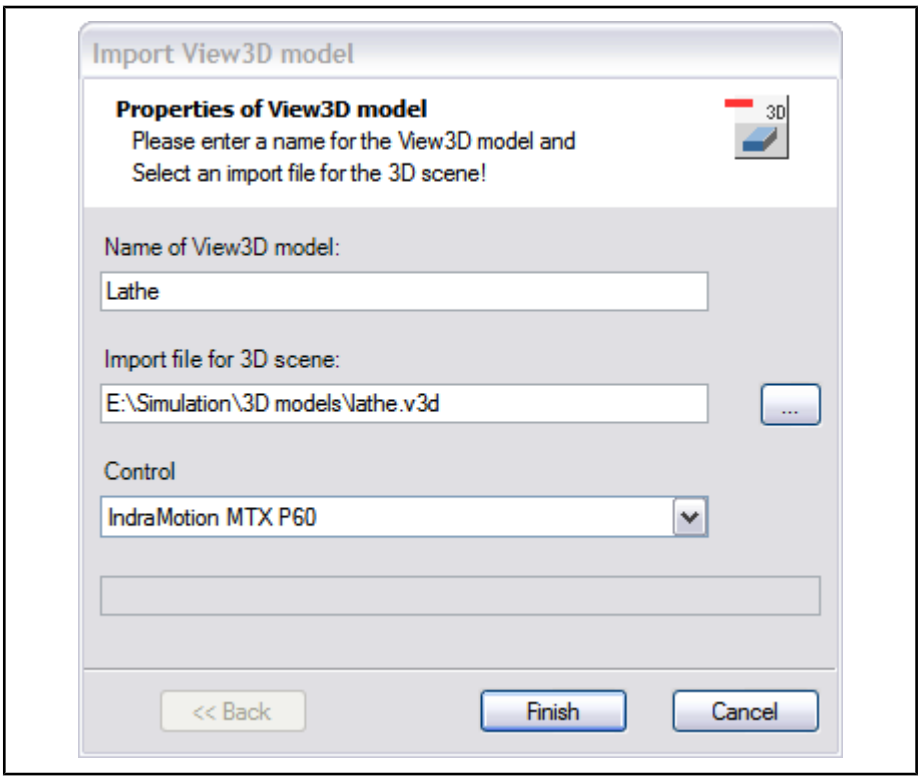

Fig.6-19: Selecting a View3D import file

- If necessary, select a control for the process connection and complete the import by pressing the <Finish> button.

Scaling a 3D model

Handling instruction: Scaling a 3D model

Adapting the scaling of a 3D model to the scaling of the process values is described here.

- Activate the measuring function using menu item **Scaling model...** in the main **View3D** menu.

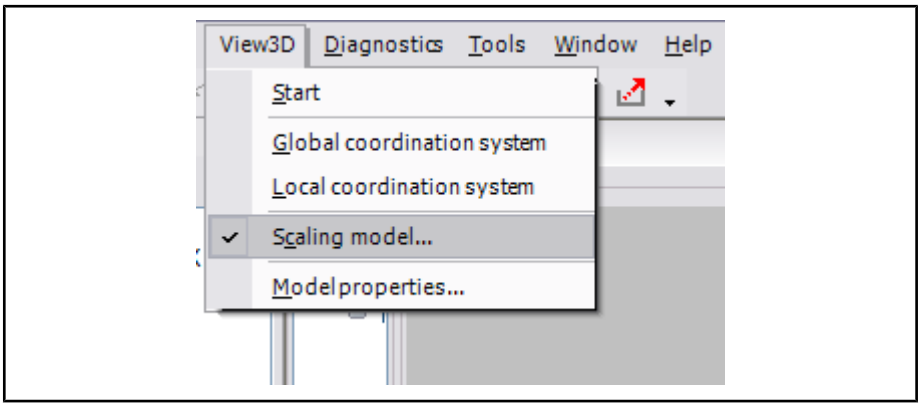

Fig.6-20: Calling function "Scaling model"

- Select the desired object in the 3D view using the left mouse button.

The selected object receives a yellow frame with accentuated corner points.

- Select a path by selecting 2 corner points.

  A dialog box opens in which the length of the desired path can be entered. The selected path is now shown in green.

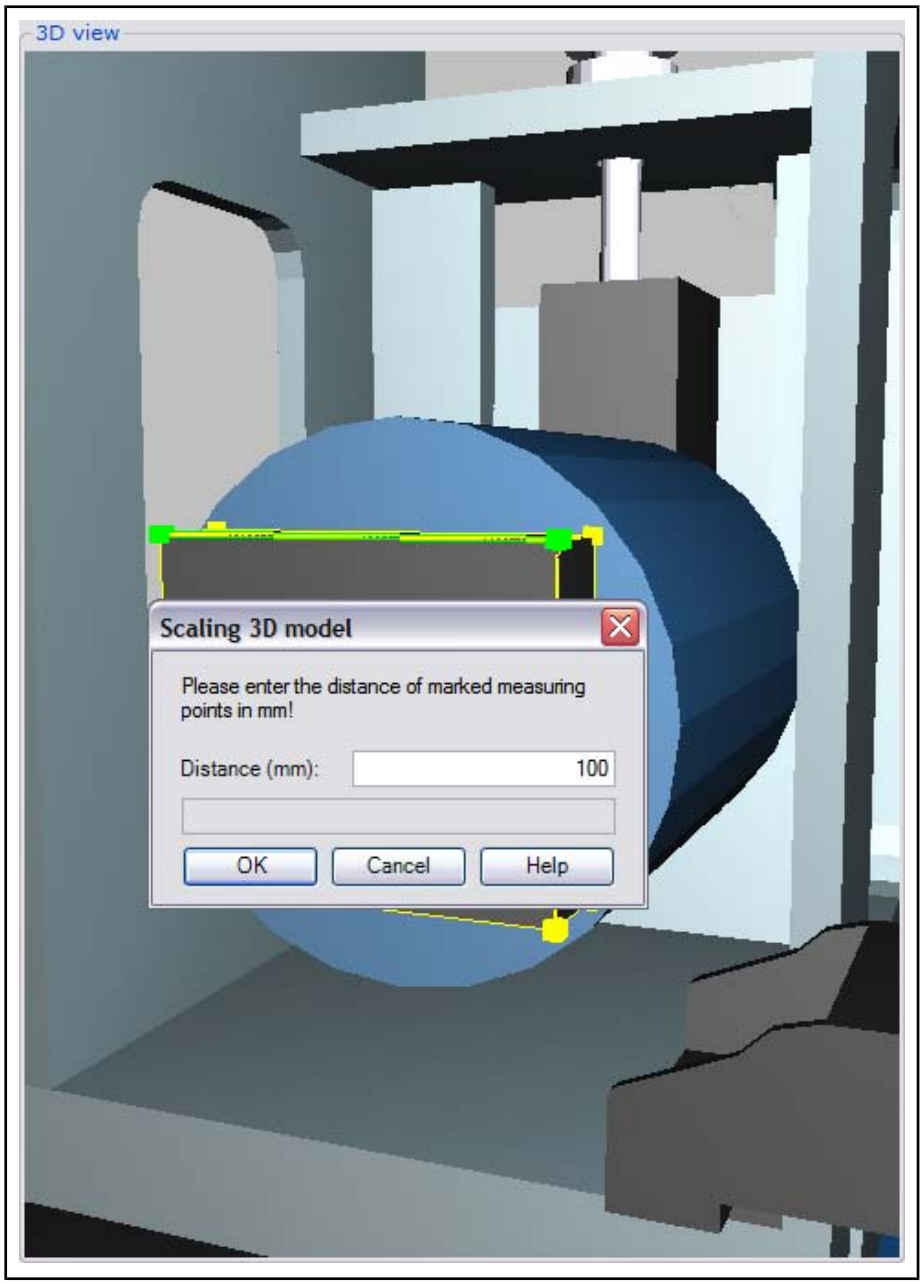

Fig.6-21: Scaling a 3D model

- After the length is entered, the measuring function is exited by pressing the <Ok> button and the 3D model is scaled accordingly.

☞ The scaling function can also be called while a process connection is active. In this way, the 3D model can be used to immediately check the changes.

- If the value for the length is set too low, the 3D objects move beyond the end position (they may even be moved out of the visible area of the 3D Viewer).
- If the distance is too high, it may be impossible to detect the movement of the 3D objects.

6.3.2 Process Connection

Connecting 3D objects with IndraMotion MTX axis values

Handling instruction: Assigning a process value to a 3D object

This handling instruction describes how a 3D object can be linked to a process variable.

IW Engineering / Simulation: Assigning a process value to a 3D object

A 3D object can be connected to a process variable in 2 ways:

1. Process assignment using the Assignment list
   - Select a 3D object in the scene tree or the 3D view.

     The entries **Offset (X,Y,Z)** and **Rotation (X,Y,Z)** for the selected object appear in the Assignment list.
   - Select a process variable in window **Process variables** and - with the right mouse button held down - drag it to the Assignment list, then drop it over the desired entry (e.g. offset in X axis direction).
2. Assigning process variables using the scene tree
   - In window **Process variables**, drag a variable - with the right mouse button held down - to the scene tree and drop it over the desired 3D object.

     A contextual menu on the 3D object opens with the available actions **Offset (X,Y,Z)** / **Rotation (X,Y,Z)**.
   - Select the desired action from the contextual menu of the object.

     The 3D object receives a green highlight and is transferred to the Assignment list.

☞ If window **Process variables** cannot be seen, it can be shown using menu item **View ▸ Process variables** in the main menu.

Configuring the process connection

Handling instruction: Changing the offset for process values

An offset can be added to every process value.

The entry of offset values is described in this handling instruction.

IW Engineering / Simulation: Adding an offset to the process value of a View3D object

- Select a 3D object with a configured process connection from the scene tree (can be recognized by the green marking).
- Change the offset value of the process variables in the Assignment list.

Establishing a connection to the control

Handling instruction: Starting a View3D process connection

This handling instruction describes how to activate the View3D process connection in order to control 3D objects using process values.

IW Engineering / Simulation: Establishing a View3D process connection for control

In the main menu, select menu item **View3D ▸ Start**.

The following actions are now carried out:

- Window **Assignment for process variables** disappears.
- The process connection is started and the 3D objects are supplied with the process values of the control.

Handling instruction: Stopping a View3D process connection

An active process connection in View3D can be stopped using this handling instruction.

Boundary condition The process connection must be active (this can be recognized by the checkmark on menu item **Start** in the main **View3D** menu).

IW Engineering / Simulation: Terminating a View3D process connection for control

In the main menu, select menu item **View3D ▸ Start**.

The following actions are now carried out:

- The process connection is stopped.
- Window **Assignment for process variables** appears.

6.3.3 Operating 3D Visualization

Basic 3D visualization functions

Coordinate systems

Global coordinate system The global coordinate system of the 3D scene can be shown/hidden in the main menu using menu item **View3D ▸ Global coordinate system** (also see chapter 5 "Components of the Simulation " on page 17).

Local coordinate system The local coordinate system indicates the local orientation of individual objects. To do this, the local coordinate system must be activated using the main menu **View3D ▸ Locale coordinate system** and an object must be selected (also see chapter "Basic functions" on page 20).

Manipulating 3D objects

Handling instruction: Moving a View3D object

This handling instruction describes how a single View3D object in the 3D model can be moved.

IW Engineering / Simulation: Moving a View3D object

- Select the 3D object using the left mouse button.
- Press the <X>, <Y> or <Z> key while simultaneously pressing the left mouse button. The object can now be moved in the X, Y or Z coordinate direction by moving the mouse to the left or right.

Handling instruction: Rotating a View3D object

The procedure for rotating a View3D object in the 3D scene is described here.

IW Engineering / Simulation: Rotating a View3D object

- Select the 3D object using the left mouse button.
- Press the <X>, <Y> or <Z> key while simultaneously pressing the right mouse button. The object can now be rotated around the X, Y or Z coordinate axis by moving the mouse to the left or right.

Changing settings of the View3D model

"Model properties" dialog box

Settings of the View3D model are changed in the **Properties of the View3D model**dialog box (also see chapter 5.2 "3D Visualization " on page 18).

The dialog box is called in the main menu using menu item **View3D ▸ Model properties...**.

The dialog box is divided into **General** and **Light settings**.

General Settings

Change background color.

The background color of the 3D model can be changed as follows:

After the <Background color> button is pressed, a color picker appears in which the new background color can be selected.

☞ The setting of the background color is shown immediately in the 3D model.

Changing the model view

Selection box **View** can be used to switch the model view between **Massive** and **Wireframe**.

☞ The setting of the view is shown immediately in the 3D model.

Changing the process communication update rate

The update time (in milliseconds) for the process communication can be entered in entry field **Update rate**.

☞ The update rate can be changed only if the process connection is inactive.

The settings can be transferred by pressing the <Ok> or <Apply> button.

Pressing the <Cancel> button closes the dialog box and leaves the settings unchanged.

Light settings

The lighting of the 3D scene can be set using the 3 following sliders:

- Ambient light
- Diffuse light
- Reflecting light

The settings are immediately shown in the 3D scene.

If the light setting is as desired, it can be retained by pressing <Ok> or <Apply>.

Pressing the <Cancel> button closes the dialog box and leaves the lighting settings unchanged.

Changing object properties

Dialog box **Properties of object** can be used to change object-based properties (such as the material).

The dialog box **Object Properties**can be opened by opening contextual menu **Properties...** on the desired 3D object in the scene tree.

The material of a 3D object can be manipulated using the following settings:

- Ambient light

  The color setting and transparency for the ambient light can be set here.
- Diffuse light

  Color and transparency settings for diffuse light.
- Reflecting light

  Color and transparency settings for reflecting light.
- Shining light

  This value affects the intensity of the reflecting light.

All material properties depend on the lighting settings of the 3D model (see chapter "Changing settings of the View3D model " on page 56).

All changes to the material properties are immediately shown in the 3D scene. Press the <Reset> button to return to the last setting.

The current material properties can be transferred by pressing the <Ok> or <Apply> button.

6.3.4 Licensing of IndraWorks components

General

Licensing IndraWorks software components is administrated via the option dialog. Please open the option dialog via **Tools - Options** and select the page “Software license” in “General”.

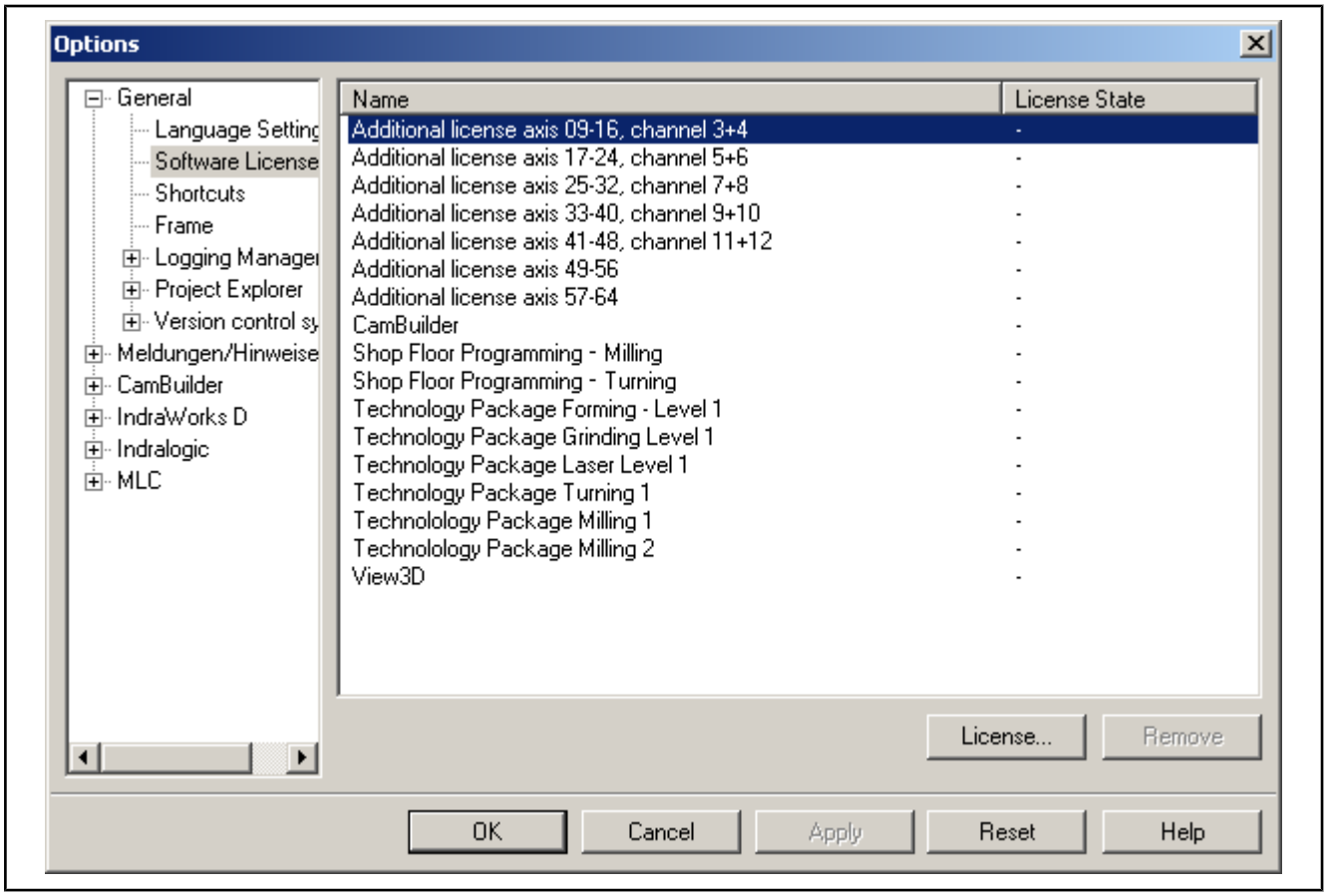

Fig.6-22: Option dialog, licensing

The side shows all available software components that requires a license with its license status. The scope of entries depends from the installed system.

License status	Meaning
-	There was no license installed on the computer. The component cannot be used.
licensed	A full user license was installed on the computer. The component cannot be used unlimited.
Demo license 30 days	A temporarily limited complete license was installed on the computer. The component can still be used within the indicated number of days (maximum 30 days) for evaluation.

Fig.6-23: License status

A license description is displayed if the mouse pointer is over the corresponding list entry.

Installing a license

To license a software component, please select it from the list and press “License...” afterwards.

☞ “ License...” is deactivated if already a full user license is installed.

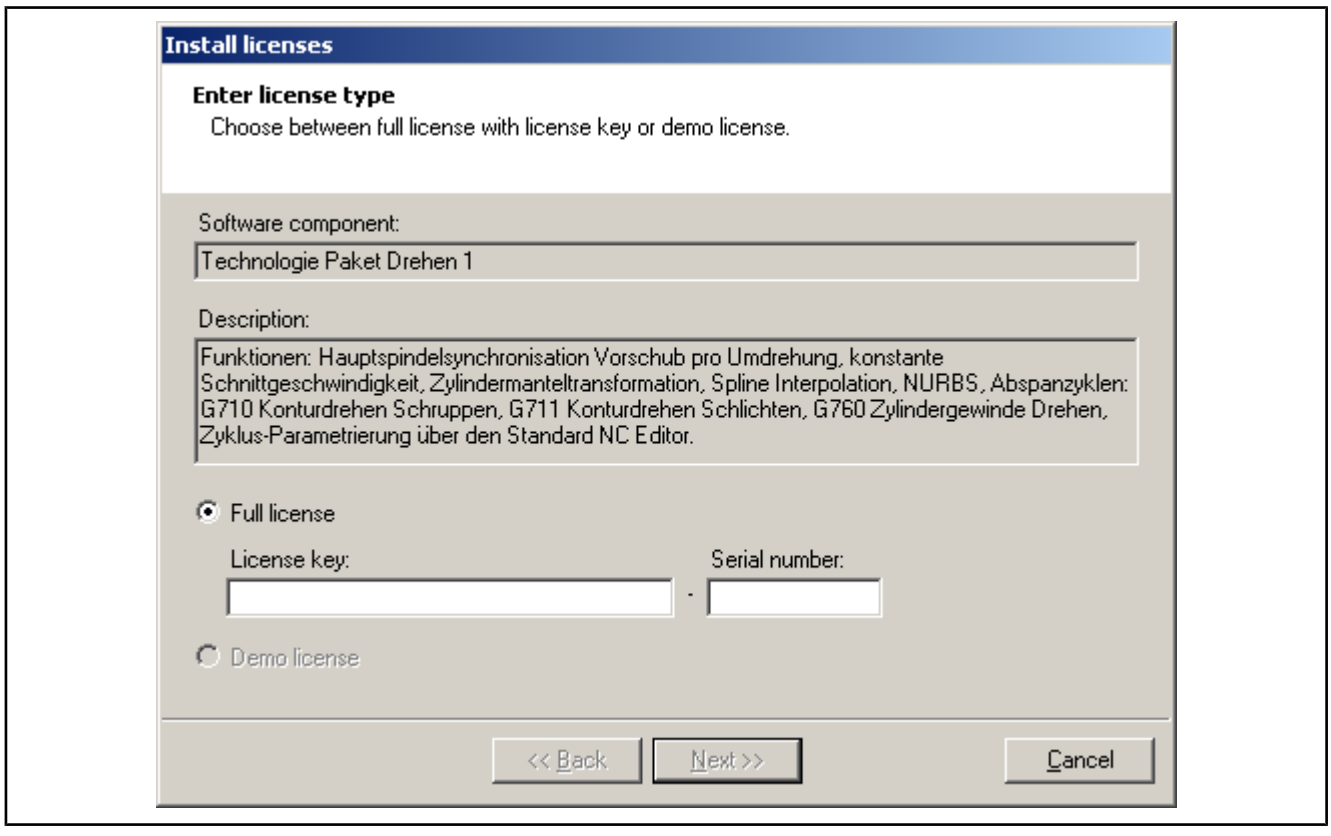

Fig.6-24: Install license dialog, determine license type

Decide whether you would like to install an unlimited full user license or a demo license. With a demo license, the selected software component can be tested 30 days long.

☞ If “demo license” is deactivated, either a demo license is installed or the selected component does not support a demo license.

Please enter the license key for installation of a full user license and the serial number if necessary. The required data are received with the purchase of the license.

Press “Next >>”.

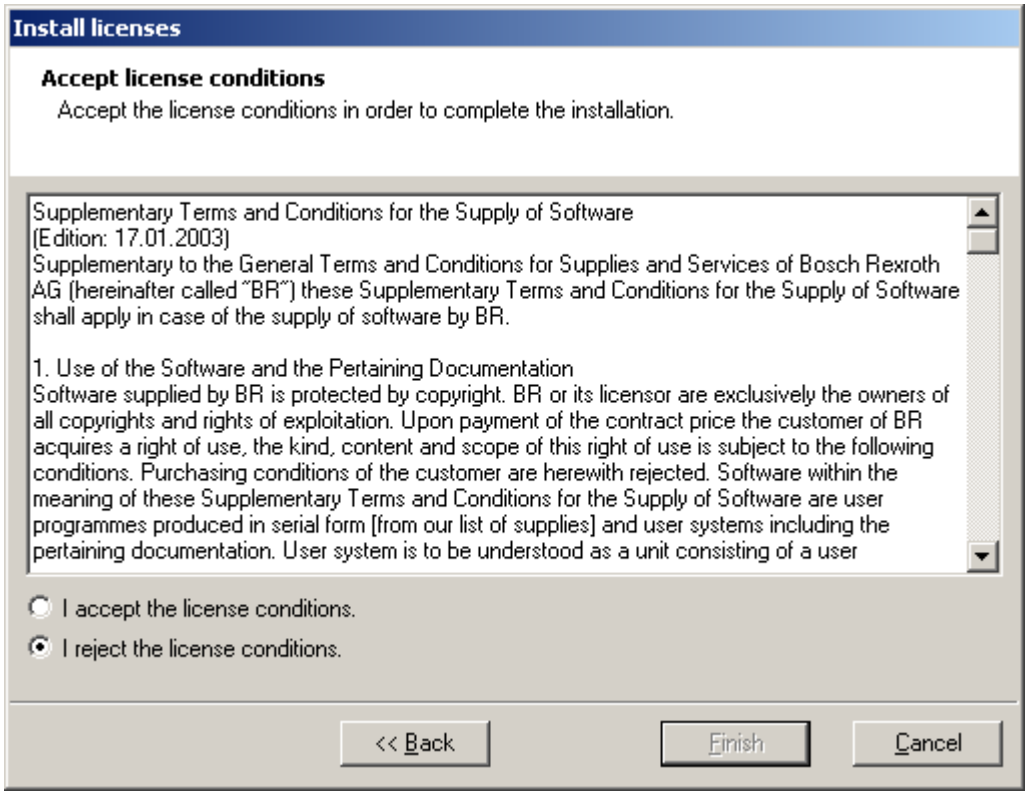

Fig.6-25: Install license, license conditions

Please read the license conditions completely.

Accept the license conditions, select “I accept the license conditions” and press “Complete”.

If you do not accept the license conditions, please press “Cancel”. No license is installed.

6.4 Using the Virtual Control

6.4.1 Installation of the MTX Emulation

General

Description

Brief Description The MTX Emulation is installed from the installation CD by following the relevant dialog boxes of the installation program. It is recommended to accept the default values.

Boundary conditions If the default memory size of 0.5 MB is not sufficient, the RAM file system memory of the emulation must be increased to 3 MB.

Handling Instruction: Extend the RAM File System Memory of the Emulation

If more memory space is necessary for the application, it can be extended as follows:

Windows / Windows Explorer: Change file designations

- In the folder “D:\Program Files\Rexroth\IndraWorks\mtx\emu”
  - rename the file “t3usrfep.pxf” to “t3usrfep.pxf.1MB” and
  - rename the file “t3usrfep.pxf.3MB” to “t3usrfep.pxf”.

Figure	Flowchart	Example	Instruction	Documentation
Documentation:	IndraWorks Commissioning Instructions		MTX Emulation	

Fig.6-26: Link

6.4.2 Designing the Emulation

Restoring an existing project

General

Brief Description With IndraWorks Engineering, existing projects can be restored which have been created earlier or on a different computer for real systems or the MTX Emulation.

Description In the following, you will find a description of how to transfer (=restore) an IndraWorks project from a real control to the emulation. Among other things, the IndraWorks project storage contains the control parameters, the Profibus configuration, the PLC program, the definition files for the M- and F-keys, the logbooks and the user-defined screens.

Restoring of the project is carried out by using the function “restore” in the menu “project”.

Handling Instruction: Restoration of an existing Project for the MTX Emulation

In the following, you will find a description of how to transfer (=restore) an IndraWorks project from a real control to the emulation.

IW Engineering / Motion: Restore control data

Figure	Flowchart	Example	Instruction	Documentation
Instruction:			Restore data	
Documentation:	IndraWorks Commissioning Instructions		Data backup	

Fig.6-27: Link

6.4.3 Designing the HMI

General

Description

Brief Description The designed HMI data can only have an effect on the user interface if downloaded to the runtime folder of the user interface.

Boundary conditions The runtime folder can only be set if the installation path of the target control (emulation) is different to the installation path of the source control on which the project has been created.

Handling Instruction: Designing the HMI for the MTX Emulation

The handling instruction contains instructions for settings for the HMI specific to MTX Emulation.

IW Engineering / HMI BTV 40: Opening of and setting parameters in the properties dialog box

- With the right mouse key click on the node of the HMI device in the project navigator.

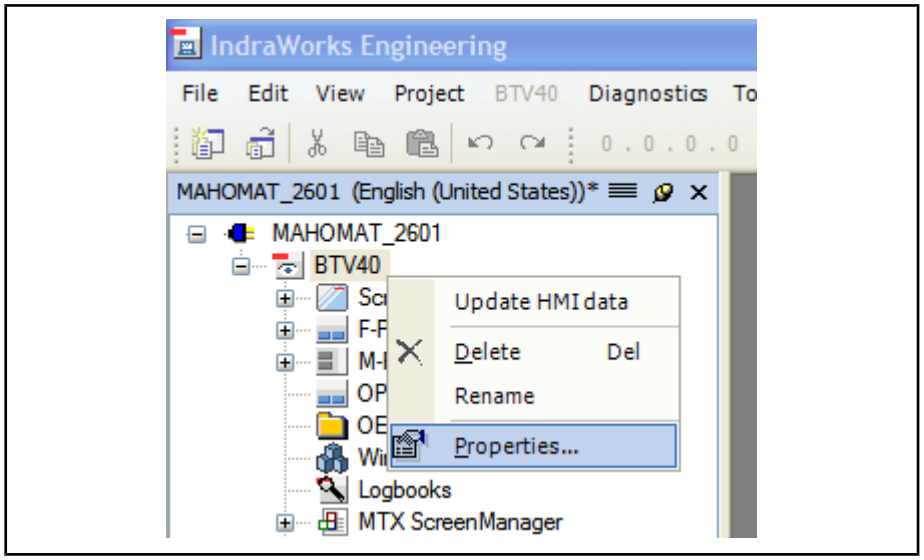

Fig.6-28: IndraWorks project - Properties

- Select the properties dialog box by clicking on the entry “Properties” using the left mouse key. The dialog box for setting the properties of the HMI project will now open.

Operation in IndraWorks

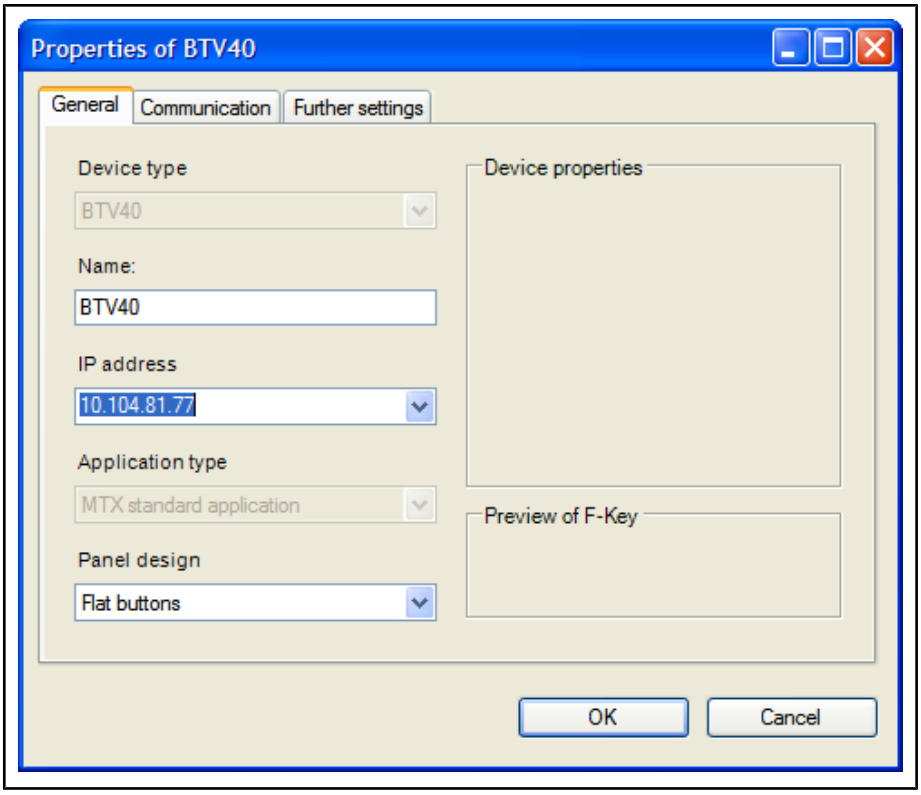

Fig.6-29: IndraWorks project - "Properties" dialog box

- Enter the path for runtime installation of the MTX (normally, it is identical to the installation path of the MTX).
- Exit the properties dialog box by pressing "OK".

IW Engineering / Project: Activate the IndraWorks project

- The IndraWorks project is activated in the main menu under "Project / Activate for Operation".

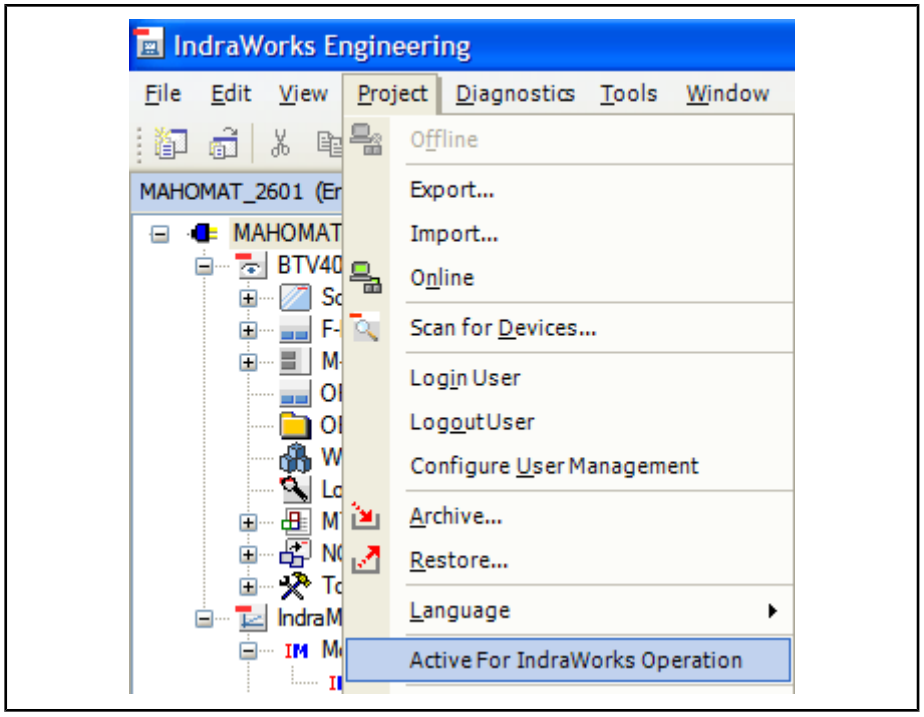

Fig.6-30: Activate the IndraWorks project

- Download the HMI project to the runtime folder by pressing the command for activation.
- The IndraWorks project will be displayed with the next start-up of the MTX user interface.

6.4.4 Designing the NC Core

General

Description

Brief Description

Among other things, the NC core data contain the usrfep and the root files, the machine data as well as the database tables for the system and tool data. The data of the NC core is located in the IndraWorks project tree below the device node “IndraMotion MTX P60”.

To restore the NC core data of a project, which has been created on a real control, one first has to adapt the “Properties of the IndraMotion MTX P60” and then activate the NC core data in two steps.

Handling Instruction: Designing the NC Core

The handling instruction contains instructions for adaptations for the NC core specific to the use of the MTX Emulation. These instructions refer to existing data which is to be activated by restoring them.

IW Engineering / IndraMotion MTX P60: Adapt the properties of the device “IndraMotion MTX P60”

- With the right mouse key, click on the device node “IndraMotion MTX P60”. The properties dialog box of the “IndraMotion MTX P60” will open.

Operation in IndraWorks

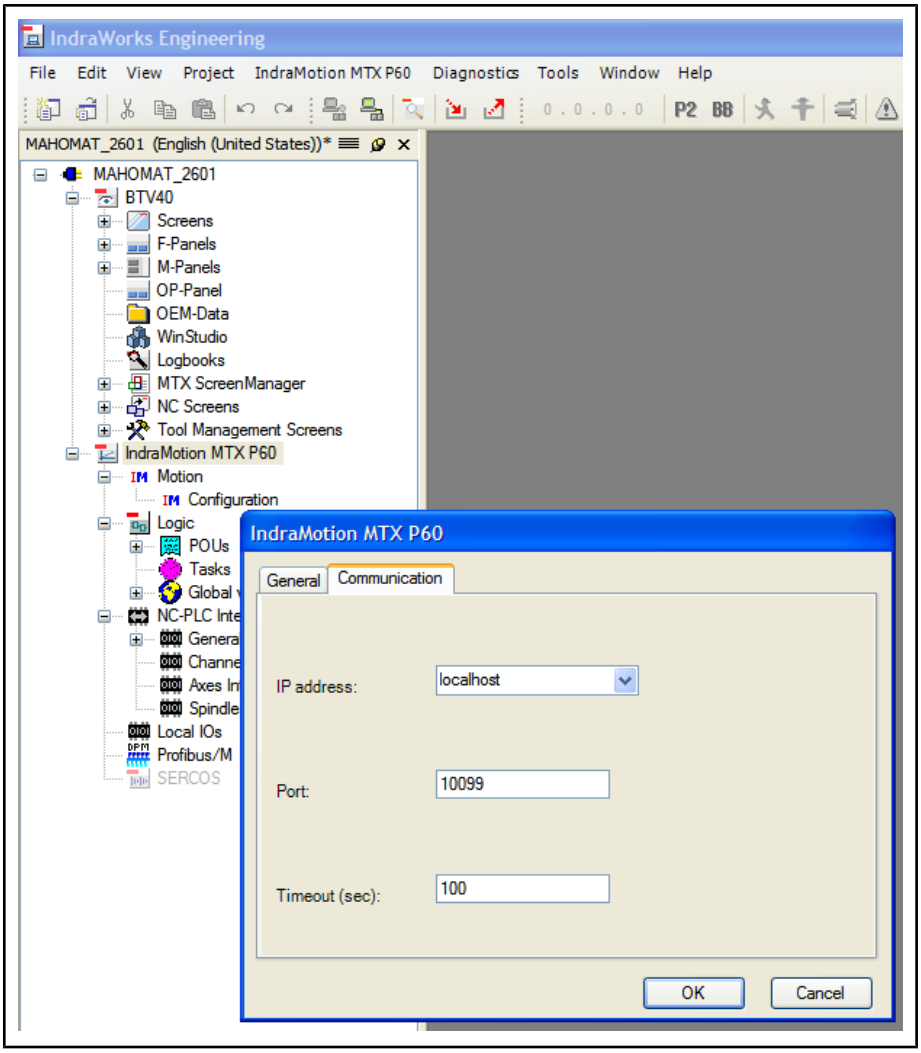

Fig.6-31: IndraMotion - "Properties" dialog box

- Select the tab "Communication" using the left mouse key.
- In the input field "IP address", select the entry "localhost" and exit the dialog box by pressing OK.

IW Engineering / IndraMotion MTX P60: Restore NC core data

- Start the IndraMotion MTX Emulation by executing the file "emu.bat". The file "emu.bat" is located in the following directory:

  "...\Program Files\Rexroth\IndraWorks\mtx\emu\" (see also handling instruction "Start-up of the Emulation").
- Stopping of the IndraLogic in the Program "IndraLogic" by pressing "F5".
- In IndraWorks, highlight the node "IndraMotion MTX P60\Motion" and call the function "Restore" with the right mouse key.
- In the following dialog boxes, select the desired archive and, for the time being, load only the data of the "User FEPROM".

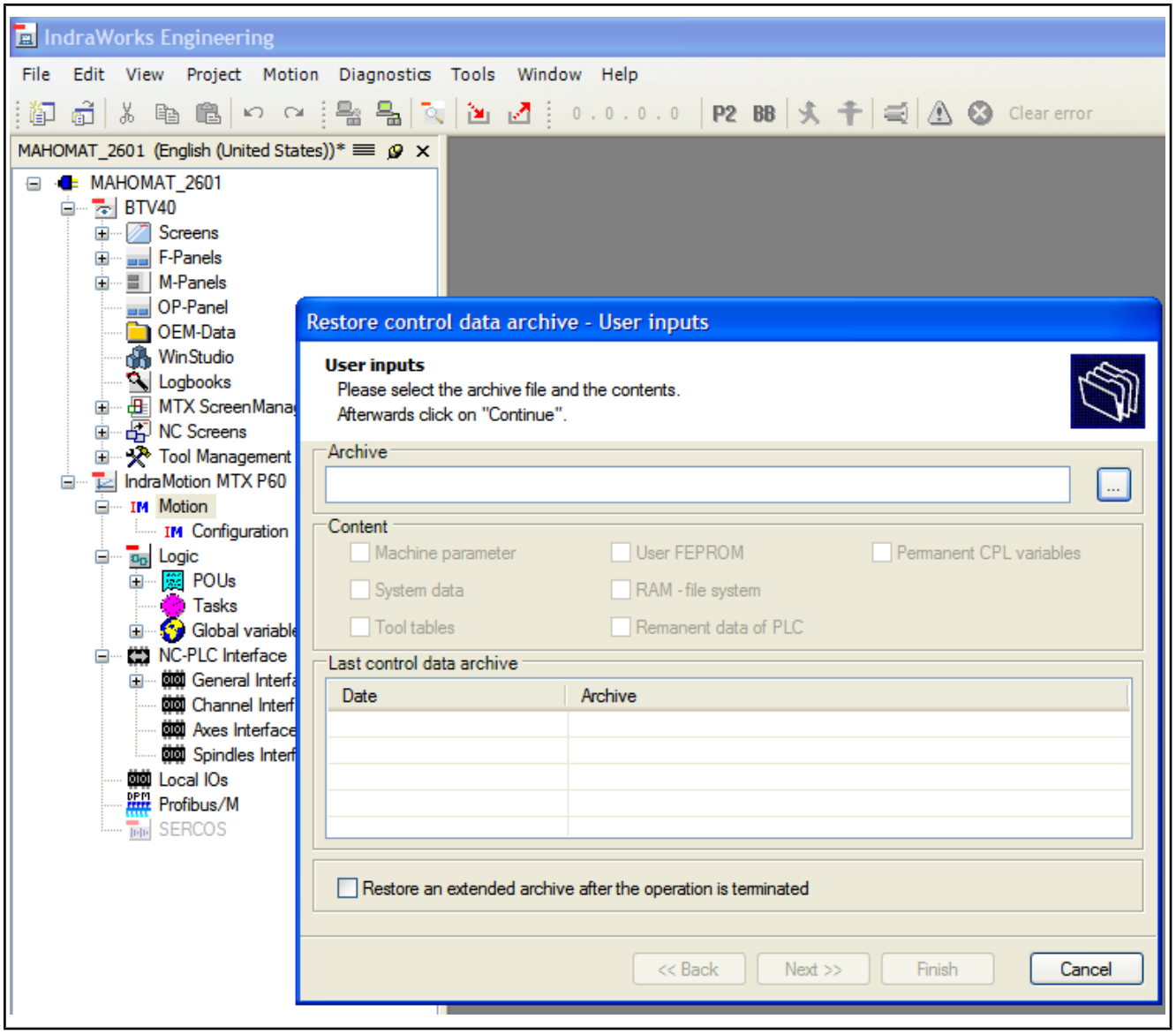

Fig.6-32: Restoring NC core data

- Afterwards exit IndraWorks Engineering and emulation.
- The emulation is closed by entering “14” in the DOS window.

Operation in IndraWorks

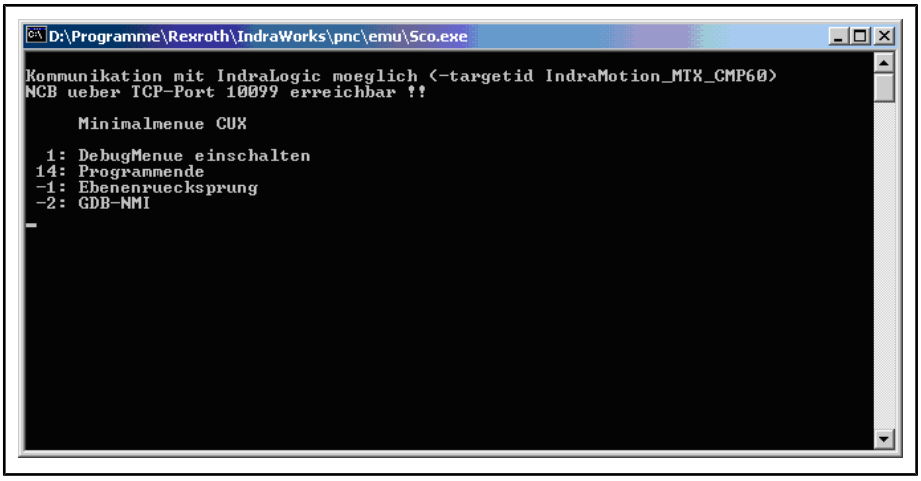

Fig.6-33: DOS prompt for emulation

- Start the emulation and IndraWorks Engineering again (see handling instruction “Start-up of Emulation”).
- Stopping of the PLC via IndraLogic.
- Now, select and reload all NC core data, except for the already loaded data of the user FEPROM.
- Close the emulation and IndraWorks Engineering again and restart them. The emulation is now working with the loaded NC core data.

☞ Any changed data (e.g. configuration parameter, tool data) go into effect only if the emulation is exited by entering “14” in the DOS window.

Special features when working with the MTX Emulation

The MTX emulation does not have a “CMP60 Control” with which the startup modus is set, the startup phase is observed and different commands to save parameters, load Firmware, start/stop PLC,... can be executed. The following sequence describes how this functions can be executed in the MTX emulation.

Emulation system restart (startup mode 0)

It is necessary to restart the system to, for example, apply modifications for machine parameters (MACODA).

1. Exits IndraWorks.
2. Exit the emulation in the DOS window by entering “14”. The changed parameters are saved on the computer by writing the files “typ3ram.pxf” and “t3usrfep.pxf” on the PC and the changes become effective upon the next startup of the emulation.
3. Restart emulation.
4. Restart IndraWorks.

Bootstrapping (startup mode 6)

Via bootstrapping, which can be compared to starting up the real MTX with startup mode 6, the RAM file system of the control is created again.

☞ A new root file system is created by bootstrapping. As a result, all the data of the old file system are lost. If an intact user FEPROM file system exists, the PLC boot project and configuration data are loaded from there.

Bootstrapping is necessary to, for example, apply the modifications to the tool database size as well as the structure of tool data records.

1. Copy modifications on tool data record into usrfep.
2. Exits IndraWorks.
3. Exit the emulation in the DOS window by entering “14”.
4. Delete the RamFileSystem, i.e. delete the file “...\Program Files\Rexroth \IndraWorks\mtx\emu\typ3ram.pxf”.
5. Restart emulation.
6. Restart IndraWorks.

Creating the user FEPROM file system (startup mode 7)

Creating a user FEPROM file system, which can be compared to execution of startup mode 7 of the real MTX, is necessary if all project-specific data can be deleted on a control or if the user FEPROM file system is damaged.

The user FEPROM is recreated by creating the user FEPROM file system. As a result, all the data of the old file system are lost. The root file system remains. The permanent CPL variables will be deleted.

1. Exits IndraWorks.
2. Exit the emulation in the DOS window by entering “14”.
3. Delete the user FEPROM file system, i.e. delete the file “...\Program Files \Rexroth\IndraWorks\mtx\emu\typ3ram.pxf”.
4. Restart emulation.
5. Restart IndraWorks.

6.4.5 Designing the PLC

General

Description

Brief Description

First, the communication settings of the PLC project have to be changed if the IndraWorks PLC project comes from a real control or if the IndraWorks had been installed previously in a directory other than the directory of active version. After that, the PLC project can be activated.

Handling Instruction: Restoring the PLC project

This handling instruction described the steps for starting up the PLC project which had already been running on a real control.

IW Engineering / Logic: Restoring the PLC project

- Highlight the node “IndraMotion MTX P90\Logic” and start the “Properties” dialog box by means of the right mouse key.
- In the “Properties” dialog box, select the tab “Communication Settings”.

Operation in IndraWorks

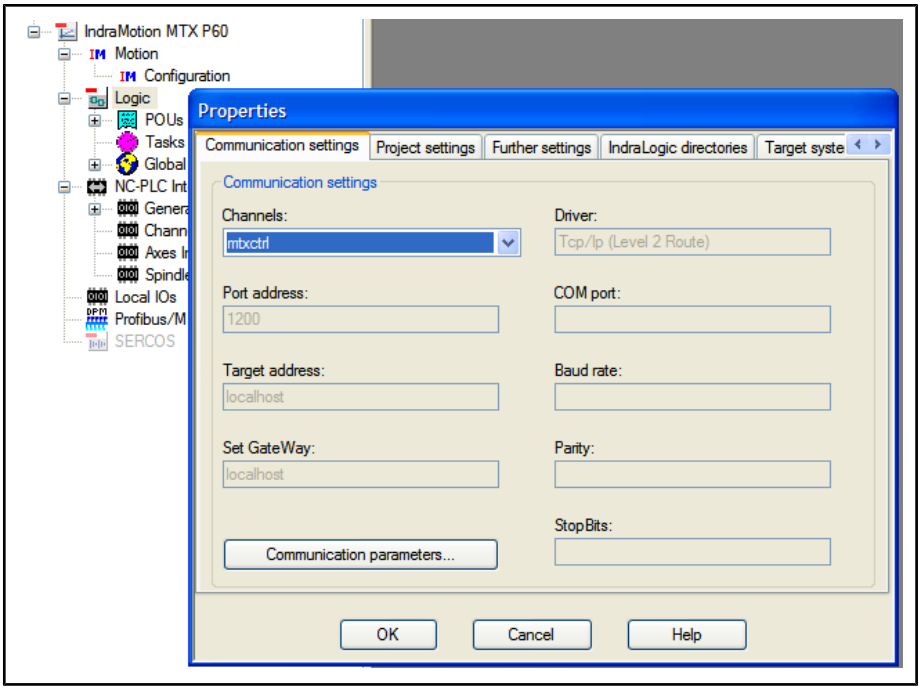

Fig.6-34: Communication parameters of the PLC

- Click on the “Communication Parameters” button. The “Communication Parameter” dialog box will open.
- In dialog box “Communication Parameters”, make the settings shown in the next figure and confirm them by pressing “OK”. If applicable, the existing settings have to be deleted first.

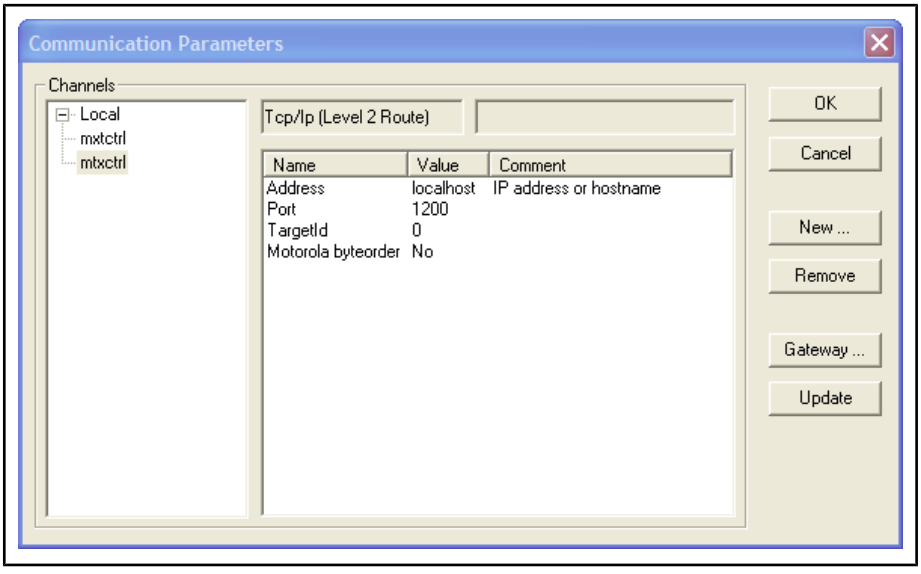

Fig.6-35: Settings in the dialog box “Communication Parameters”

- In the dialog box “Properties” (see above), open the tab “IndraLogic Directories” and, if applicable, adapt the path information to the installation paths of the emulation. Only one path information may be maintained.

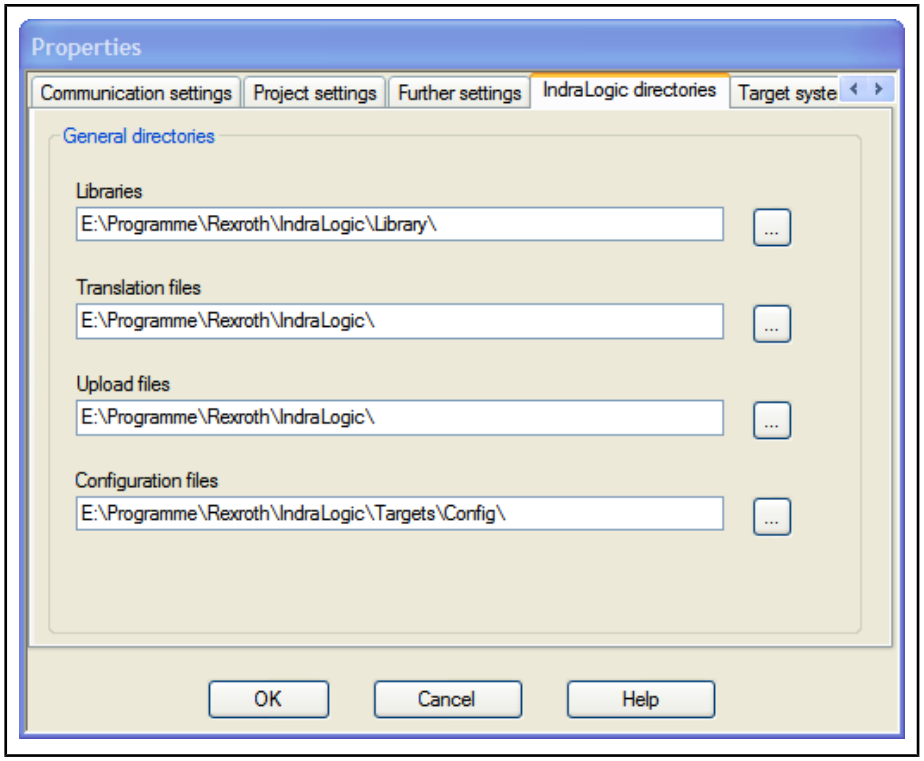

Fig.6-36: Settings in the dialog box "Properties / Directories"

- Exit the properties dialog box by pressing "OK".
- In IndraWorks, click on the node "Logic" using the right mouse key and trigger the command "Update". The IndraLogic project has now been adapted to the "Emulation" and can be started.
- Start IndraLogic by double-clicking on the node "Logic" and transmit and download the PLC project.

Figure	Flowchart	Example	Instruction	Documentation
Documentation:	IndraLogic System Description		Working with Projects	

Fig.6-37: Link

6.4.6 Starting and Exiting the MTX Emulation

General

Description

Brief Description

The emulation comprises both the NC core and the PLC which are started and stopped together. For this purpose, the Windows application "Sco.exe" is available; its functions during runtime can be checked via a DOS window.

To accept e.g. Macoda changes or tool data configuration changes, it is necessary to restart the system.

Boundary conditions

The emulation must always be started prior to working with IndraWorks Engineering (designing interface) and the IndraMotion MTX user interface.

Handling Instruction: Starting the Emulation

The handling instruction contains a description of how to start the emulation (CNC and PLC).

Windows: Starting the Emulation

- The emulation is started with the batch file "...\Program Files\Rexroth \IndraWorks\mtx\emu\emu.bat" gestartet.

- Trouble-free start-up of the emulation can be recognized by means of the feedback (see the below figure).

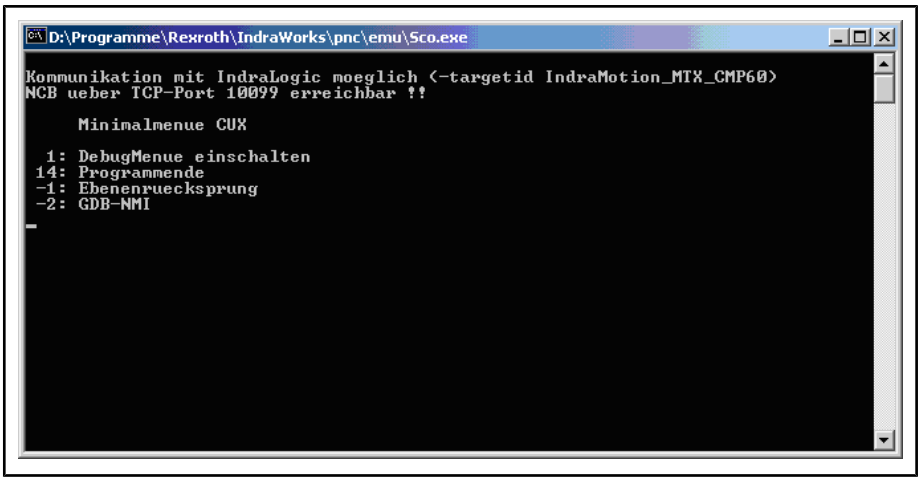

Fig.6-38: Start the emulation

The emulation must always be started prior to working with IndraWorks Engineering and the IndraMotion MTX. It is recommended to create a link on the Windows desktop for starting the batch file.

Figure	Flowchart	Example	Instruction	Documentation
Documentation:	IndraWorks Commissioning		Start the emulation	

Fig.6-39: Link

Handling instruction: Stopping emulation

The handling instruction contains a description of how to stop the emulation (CNC and PLC).

Windows: Starting the Emulation

- The emulation is closed by entering “14” in the DOS window.

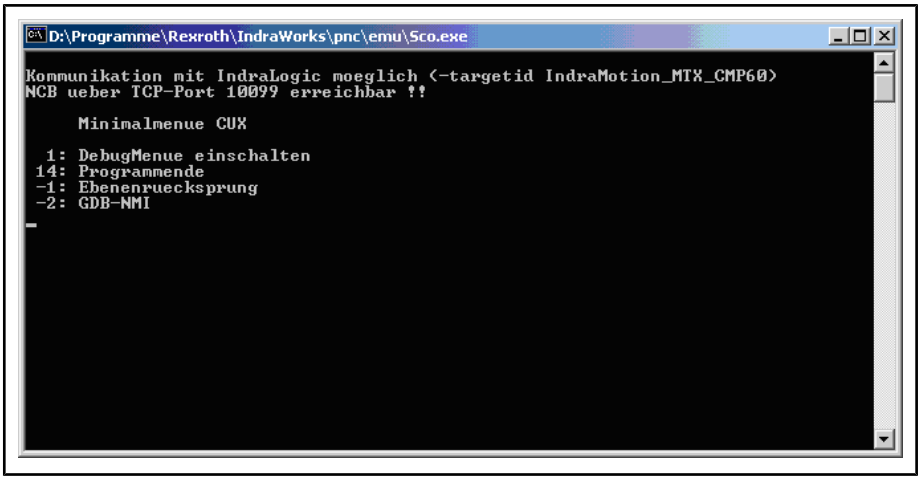

Fig.6-40: Stopping the emulation

Any changed data (e.g. machine parameters, tool data) will only be saved if the emulation is ended by entering “14” in the DOS window.

Figure	Flowchart	Example	Instruction	Documentation
Documentation:	IndraWorks Commissioning		Stopping the emulation	

Fig.6-41: Link

Handling Instruction: System restart of the emulation

The handling instruction contains a description of how to restart the emulation (CNC and PLC). A system restart of the emulation is necessary e.g. to make changed machine data effective.

Windows: Restarting the Emulation

- Exit IndraWorks Engineering Desktop and/or Operation Desktop.
- Exit the emulation in the DOS window by entering “14”. The changed parameters are saved on the computer by writing the files of file system “typ3ram.pxf” and user feprom “t3usrfep.pxf”; the changes become effective upon the next startup of the emulation.
- Restart emulation.
- Restart IndraWorks Engineering Desktop and/or Operation Desktop.

☞ Any changed data (e.g. MACODA, tool data) will only be effective if the emulation is ended by entering “14” in the DOS window! For the MTX Emulation it is not necessary to set different start-up modes.

Figure	Flowchart	Example	Instruction	Documentation
Documentation:	IndraWorks Commissioning		Emulation System Restart	

Fig.6-42: Link

6.4.7 Starting Operation Desktop

Brief Description The MTX user interface is started in the same manner as the user interface of a real application. For this purpose, a link is created in the desktop (“IndraWorks HMI”) when installing the MTX Emulation.

7 Communication - SCP

SCP (**S**calable **C**ommunication **P**latform) is the standardized IndraWorks communication platform. All communication between Bosch Rexroth products, such as the VAM simulator and the PLC, is carried out using SCP.

Data are exchanged between VAM simulator and the PLC using SCP items, which consist of the names of PLC variables, starting with PLC.Pvl,.**PLC variable name**.

You can find additional information in the SCP documentation.

8 Service and Support

8.1 Helpdesk

Our service helpdesk at our headquarters in Lohr, Germany, will assist you with all kinds of inquiries.

Contact us:

- By phone through the Service Call Entry Center,
  Monday to Friday 7:00 am - 6:00 pm CET
  +49 (0) 9352 40 50 60
- By fax
  +49 (0) 9352 40 49 41
- By e-mail: service.svc@boschrexroth.de

8.2 Service Hotline

Out of helpdesk hours please contact our German service department directly:

+49 (0) 171 333 88 26

or

+49 (0) 172 660 04 06

Hotline numbers for other countries can be found in the addresses of each region (see below).

8.3 Internet

Additional notes regarding service, maintenance and training, as well as the current addresses of our sales and service offices can be found on

http://www.boschrexroth.com

Outwith Germany please contact our sales/service office in your area first.

8.4 Helpful Information

For quick and efficient help please have the following information ready:

- Detailed description of the fault and the circumstances
- Information on the type plate of the affected products, especially type codes and serial numbers
- Your phone and fax numbers as well as your e-mail address so we can contact you in case of questions

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Notes

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R911320258

Printed in Germany
DOK-IWORKS-SIMU****V07-AW01-EN-P