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

Rexroth Bosch Group

Rexroth IndraMotion for Printing & Converting 09VRS Upgrade from SYNAX 200

R911324140
Edition 01

Application Description

Title
Rexroth IndraMotion for
Printing & Converting 09VRS
Upgrade from SYNAX 200

Type of Documentation
Application Description

Document Typecode
DOK-IM*PR*-UPGRADE*V09-AW01-EN-P

Internal File Reference
RS-5cf0312a20ba7bca0a6846a000546b86-1-en-US-10

Purpose of Documentation
This documentation should provide help for the first time you plan a project, perform engineering tasks and commission the system "IndraMotion for Printing" and upgrade from the "SYNAX 200" system to the new "IndraMotion for Printing" system easier.

Record of Revision

Edition	Release Date	Notes
120-3700-B302-01/EN	10.2008	First edition for 09VRS

Published by
Bosch Rexroth AG
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BRC/EAM3 (KlGo), BRC/EAY2 (BaWe(MePe)

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

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1 Introduction

1.1 This document ...

... has been prepared for SYNAX users who are working with "IndraMotion for Printing" for the first time. It should provide help for the first time you plan a project, perform engineering tasks and during commissioning and make transitioning to the new "IndraMotion for Printing" control system easier.

This document includes few function and application descriptions; instead it

- demonstrates the differences between SYNAX200 and IndraMotion for Printing (also called IndraMotion below)
- provides orientation for working in the new "IndraWorks" engineering environment and
- provides references to further manuals.

1.2 Reference Systems

All information in this manual refers to the controls specified below and the respective versions of firmware and software.

SYNAX200, Version 13

IndraMotion for Printing, Version 09

1.3 Further Documentation

Title	Ordering information	Content (in keywords)
Rexroth IndraMotion for Printing 09VRS System Overview	DOK-IM*PR*-SYSTEM**V09-FK01-EN-P R9113242138	Functional description for IndraMotion for print and converting machines
Rexroth IndraWorks Engineering 09VRS	DOK-IWORKS-ENGINEE*V09-AW01-EN-P R911325020	Elements of the IndraWorks user interface First Steps, Working with IndraWorks (projects and devices, project file, user and firmware management...)
Rexroth IndraWorks I-Remote Remote Control Software	DOK-IWORKS-IREMOTE*V01-AW01-EN-P R911310612	Application description Remote maintenance with IndraWorks
PLC Programming with Rexroth IndraLogic 2G	DOK-CONTRL-IL2GPRO*V09-AW01-EN-P R911325440	Application description PLC program development with IndraLogic second generation
Rexroth IndraWorks 09VRS CamBuilder	DOK-IWORKS-CAMBUIL*V09-FK01-EN-P R911324103	CamBuilder tool for creating and analyzing cam tables
Rexroth IndraWorks HMI 09VRS	DOK-IWORKS-HMI*V09****-AW01-EN-P R911325018	Application description HMI with IndraWorks
Rexroth WinStudio	DOK-CONTRL-WIS*PC**V06-KB01-EN-P R911307630	Brief description WinStudio tool for creating HMI dialogs

Introduction

Title	Ordering information	Content (in keywords)
Rexroth VCP-Operating Concept	DOK-SUPPL*-VIC*BED*02*-AW02-EN-P R911310666	Application description for small, type VCP control terminals
Rexroth IndraMotion MLC 09VRS	DOK-IM*ML-SYSTEM**V09-FK01-EN-P R911324961	System description for IndraMotion MLC
Rexroth IndraMotion MLC 09VRS FlexProfile	DOK-IM*MLC-FLEXPRO*V09-AW01-EN-P R911324963	IndraMotion MLC FlexProfile operating mode
Rexroth IndraMotion MLC 09VRS Parameters	DOK-IM*MLC-PARAM***V09-PA01-EN-P R911324949	IndraMotion MLC parameter description
Rexroth IndraMotion MLC 09VRS Diagnostics	DOK-IM*MLC-DIAG****V09-WA01-EN-P R911324952	IndraMotion MLC diagnostics description
Rexroth IndraMotion MLC 09VRS Error Code Tables	DOK-IM*MLC-ERRCOD**V09-WA01-EN-P R911325426	IndraMotion MLC table of error codes for PLC functions and function blocks
Rexroth IndraLogic 09VRS IndraLogic 2G Basic Libraries	DOK-IL*2G*-BASLIB**V09-FK01-EN-P R911324136	Basic libraries for the PLC system IndraLogic 2G
Rexroth IndraMotion MLC 09VRS PLC Sytem Libraries IndraLogic 2G	DOK-IM*MLC-SYSLIB**V09-FK01-EN-P R911325428	Basic library for the MotionLogic system MLC
Rexroth IndraMotion MLC/MLP 09VRS PLCopen Function Blocks and Data Types	DOK-IM*MLC-FUNLIB**V09-FK01-EN-P R911324959	Functional description for PLCopen function blocks and data types
Rexroth IndraMotion 09VRS Technology Basic Libraries	DOK-IM*ML*-TF*BASE*V09-FK01-EN-P R911324101	Technology basic libraries for the IndraMotion system: TechBase, TechInterface, TechTemplate, TechMotion, TechCam
Rexroth IndraMotion 09VRS General Technology Functions	DOK-IM*ML*-TF*GEN**V09-FK01-EN-P R911324127	General technology functions of the IndraMotion system: TechWinder, TechRegi, TechCrosscutCrossseal
Rexroth IndraMotion 09VRS Technology Function Sheet Fed	DOK-IM*ML*-TF*SHFD*V09-FK01-EN-P R911324134	Functional description technology function sheet feed

Title	Ordering information	Content (in keywords)
RECO Inline PROFIBUS DP; Application Manual	DOK-CONTRL-R-IL*PBSSYS-AW02-EN-P R911289597	Project planning documentation and functional descriptions for Rexroth inline components
RECO Inline Profibus DP Terminal and Module Supply, Functional Description	DOK-CONTRL-R-IL*PB*-BK-FK02-EN-P R911289587	
Rexroth RECO Inline Digital I/O Terminals, Functional Description	DOK-CONTRL-R-IL*DIO***-FK05-EN-P R911289589	
RECO Inline Analog I/O Terminals, Functional Description	DOK-CONTRL-R-IL*AIO***-FK02-EN-P R911289591	
RECO Inline Counter Terminals R-IB IL CNT, Application Description	DOK-CONTRL-R-IL-CNT***-AW02-EN-P R911289593	

1.4 Example Project AxisInterface

The example project is stored on the installation data carrier for IndraMotion MLC as a project archive with the name "AxisInterface_Example_MLC09VRS.zip".

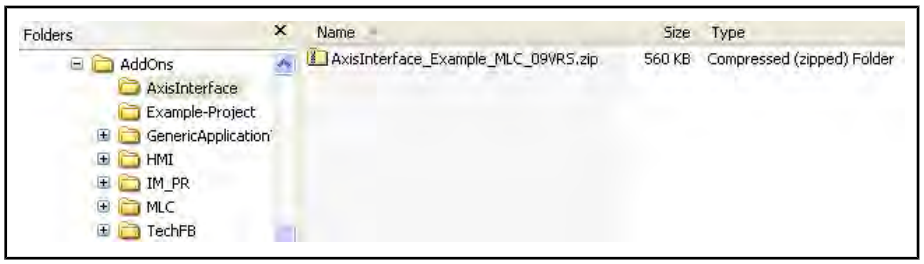


Fig. 1-1: Example project storage location

The example project shows how the drive's synchronous and secondary modes of operation at a virtual axis can be controlled using the axis interface.

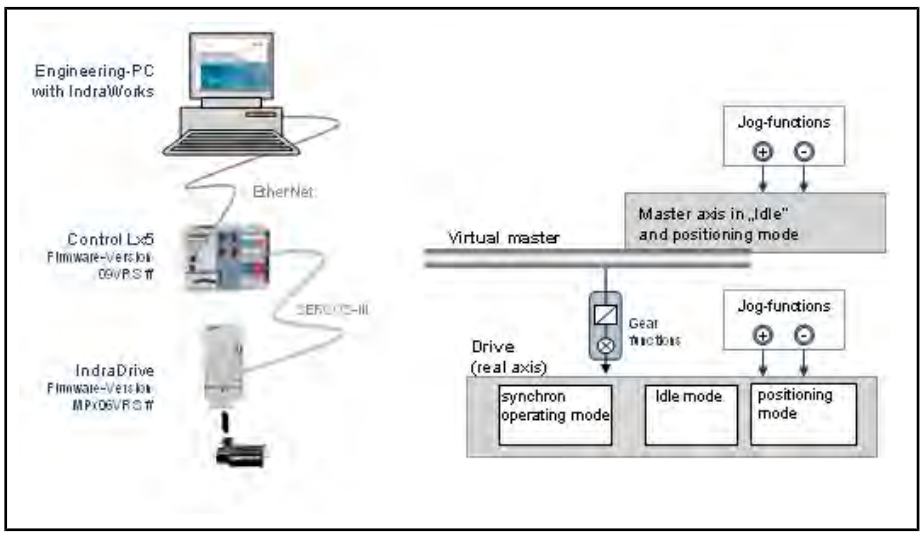


Fig. 1-2: Example project structure

For further information about the example project, see the "Rexroth IndraMotion 09VRS Technology Basic Libraries" documentation, "TechInterface" section.

2 Important Instructions on Use

2.1 Intended Use

2.1.1 Introduction

All Bosch Rexroth controls and drives are developed and tested in accordance with the state of the art technology.

It is not possible to track the continuous further improvement of all materials our controls and drives may come into contact with (e.g. lubricants at machine tools). Reactions with the materials used in the Bosch systems cannot generally be excluded.

Therefore, before using new lubricants, cleaning agents etc., must be checked for compatibility with the Bosch housing and device materials.

The products may only be used for the intended purpose. When they are not used as intended, situations may arise resulting in damage to person or material.

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

Before using Bosch Rexroth products, the following prerequisites must be fulfilled to ensure their proper use:

- Anyone using our products must read and understand the corresponding safety notes and intended use of the product.
- If the products are hardware, they must be kept in their original state, i.e. no constructional modifications should be made. Software products may not be decompiled; their source codes may not be modified.
- Damaged or defective products must not be installed or put into operation.
- It must be ensured that the products are installed according to the regulations specified in the documentation.

2.1.2 Scope of Use and Application

Bosch Rexroth drive controllers are intended to control electrical motors and monitor their operation.

To control and monitor the motor, it may be necessary to connect additional sensors and actuators.

☞ The drive controllers must only be used with the accessories and mounting parts listed in this documentation. Do not install or connect components not expressly specified in this documentation. This also applies to cables and lines.

☞ The unit may be operated only with the explicitly specified component configurations and combinations and only with the software and firmware specified in the appropriate functional description.

Before commissioning, every drive controller must be programmed to ensure that the motor executes the appropriate functions for the application.

The drive controllers have been developed for use in single and multi-axes drive and control tasks.

To allow for application-specific requirements in the drive controllers, our product range comprises various device types with different drive powers and interfaces.

The drive controller must only be operated under the mounting and installation conditions, the position, and the ambient conditions (temperature, type of protection, moisture, EMC, etc.) specified in this documentation.

2.2 Improper Use

The use of the drive controllers in applications other than those specified or described in the documentation and the technical data is considered as "improper".

Drive controllers must not be used if they …

- are subjected to operating conditions not corresponding to the specified ambient conditions. They must not be operated under water, under extreme temperature fluctuations, or within extreme maximum temperatures.
- Furthermore, the drive controllers can only be used in applications approved by Bosch Rexroth. Please note the specifications outlined in the general safety instructions!

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 Basic Differences

4.1 Parameters, Programs and Projects

SYNAX parameters

SYNAX200 is a parameterizable system. The SYNAX firmware includes prefabricated functions for operating modes for the master and slave axes and a variety of process controllers. The necessary functions are configured with parameters during commission. During operation on a machine, process data such as command values, phase offsets, etc. are written to parameters; current actual values are provided in parameters. Predefined control and status signals are provided for controlling the functions and evaluating feedback messages.

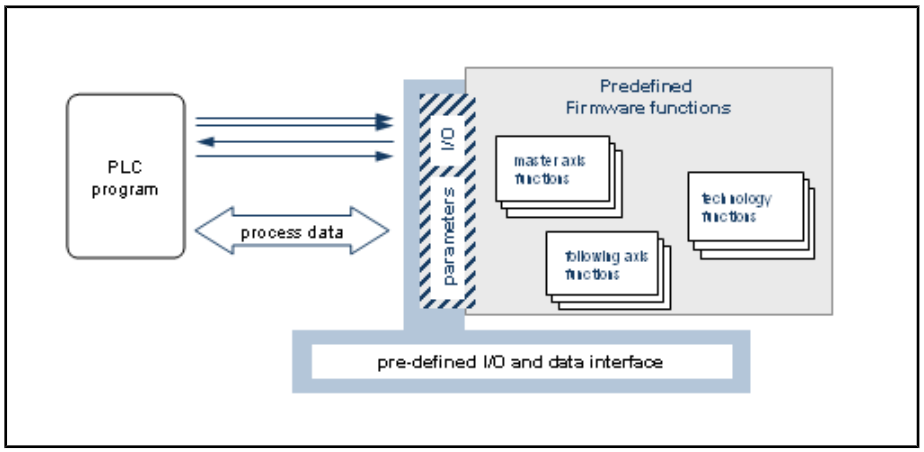


Fig.4-1: SYNAX200 - architecture

SYNAX programs

In the simplest case (SYNAX MotionOnly), except for creating the operations logic, SYNAX does not have to be used for programming.

Increasingly, the classic MotionOnly solution is being replaced by the MotionLogic version with integrated PLC "IndraLogic". The integrated PLC is now being used from applications in which the operations logic is simply replaced to automation platforms for machine modules or complete systems.

SYNAX project data

SYNAX200 offers a variety of self-acting tools for processing various subtasks. Each tool creates its own files:

SynTop:	Parameter file(s) in ASCII format
	Source text of the operations logic using a text editor (MotionOnly)
IndraLogic:	PLC program
CamBuilder:	Point tables as parameter file
VI composer:	HMI projects for VCP small control panels
WinStudio:	HMI projects for PC-based visualization

The project files must be managed manually. SYNAX200 does not have project management that automatically links project sections.

Basic Differences

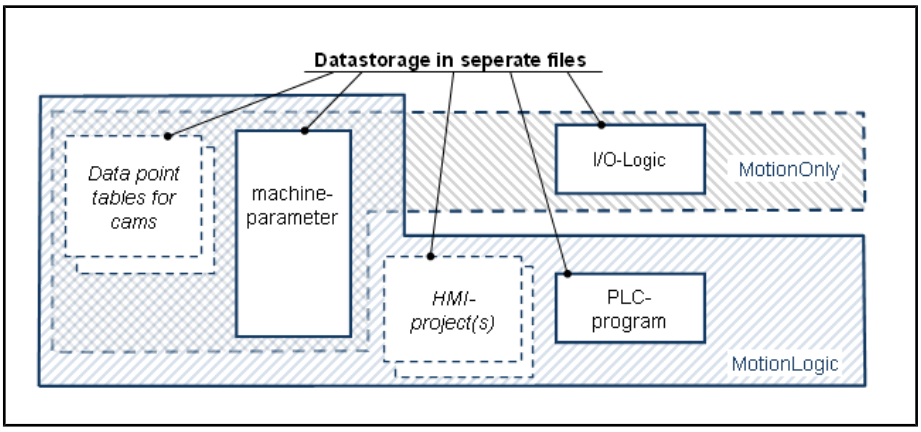


Fig.4-2: SYNAX200 - project data

IndraMotion parameters

IndraMotion recognizes parameters as well. As with SYNAX200, many basic settings are made using dialogs. For special drive functions and for setting the control look, dialogs similar to those in SynTop are provided.

Other parameter numbers and designations have been introduced with the new control. The most important differences are described in chapter 8 "Mapping the Binary Control Signals from SYNAX200 into IndraMotion for Printing" on page 45.

IndraMotion programs

From the very beginning, IndraMotion was designed as a MotionLogic system. That means that a PLC program always has to be written. In the basic version "IndraMotion MLC" the system provides standardized motion functions according to PLCopen. The application program is created using the function blocks in the PLCopen library. In contrast to SYNAX200, functions are not configured with parameters, but are instead activated by calling the appropriate PLCopen blocks in the PLC program. Binary I/O and process data are not predefined, but are instead declared as variables in the application program.

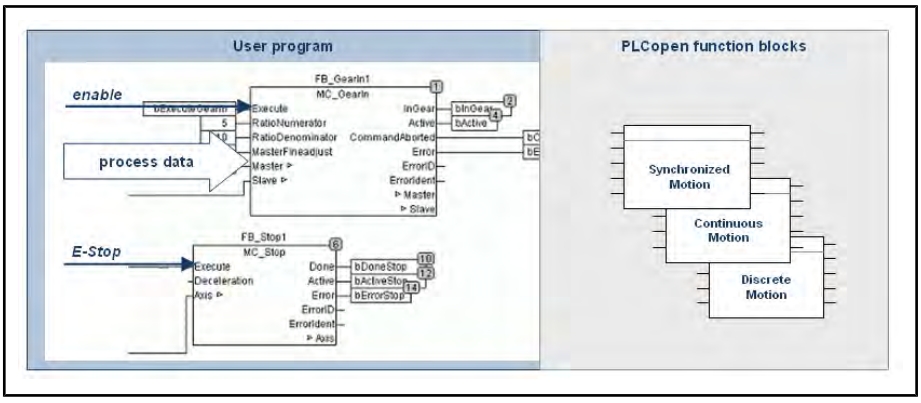


Fig.4-3: IndraMotion - architecture

As a platform designed specifically for the industry, "IndraMotion for Printing" includes preprogrammed blocks for print and converting machines. The following sections will provide more specific information.

In principle, PLC programming does not differ from SYNAX200: IndraMotion also uses IndraLogic with familiar editors based on IEC 61131.

IndraMotion projects

When using IndraMotion, individual tools are not used; instead, work takes places in the "IndraWorks" engineering environment. In "IndraWorks" all of the tools needed for project work are integrated.

Project planning, parameterization, programming	⇒	Control, drive, I/O and HMI components

Fig.4-4: IndraMotion - engineering

All of the tools used in SYNAX200 can also be found in IndraWorks - in their current version, of course.

IndraWorks creates projects. When starting a new project, a directory is created using the project name chosen by the user. The data for all project section are saved in this project directory.

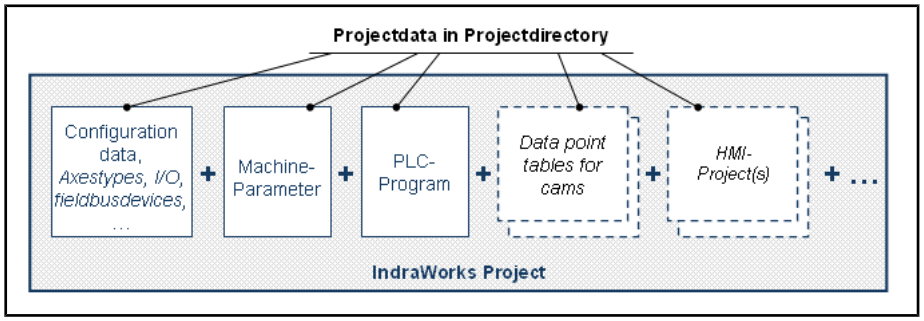


Fig.4-5: IndraMotion - project data

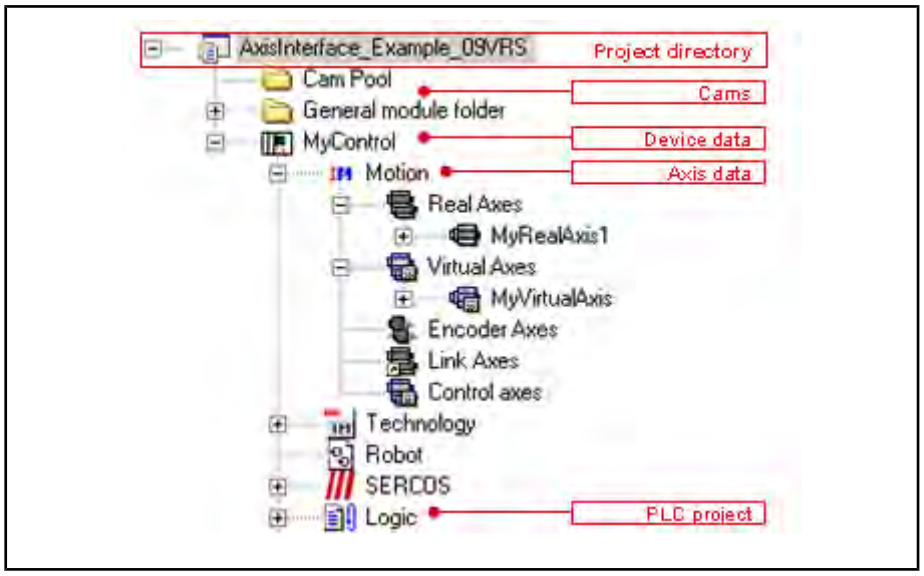


Fig.4-6: Fig.10 ProjektVerz.tif

4.2 User Interface

4.2.1 User Interfaces: SYNAX200

In SYNAX200, the interface for all functions is incorporated in the firmware. Predefined binary inputs/outputs and parameters are used to control the master and slave axes and the various technology functions.

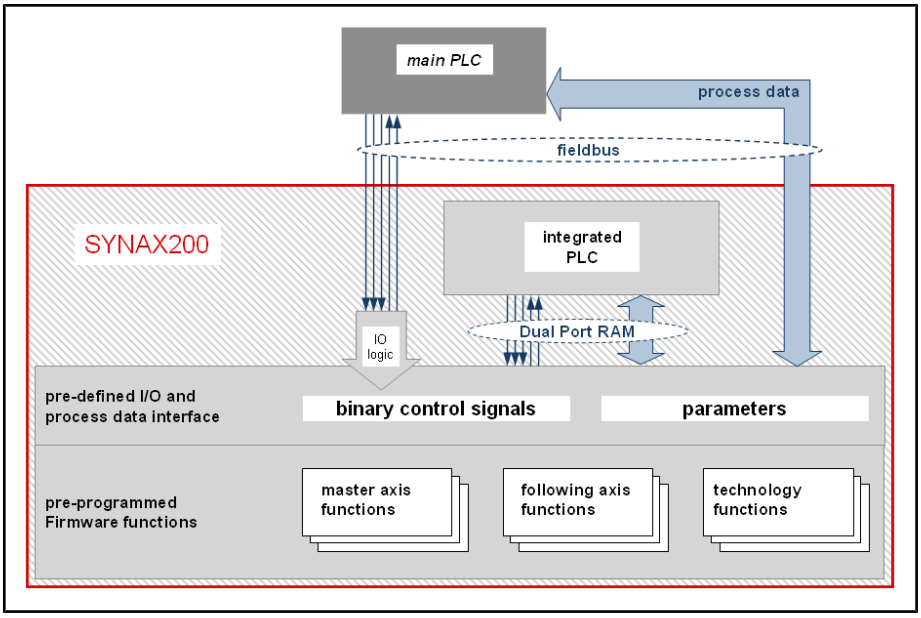


Fig.4-7: SYNAX200 - interfaces

4.2.2 User Interfaces: IndraMotion

For IndraMotion there are different interfaces depending on the entry level. Currently there are two:

- Level 1: PLCopen interface
- Level 2: Axis structures based on the "axis interface".

Both interfaces can be used in the application programs on the MLC control.

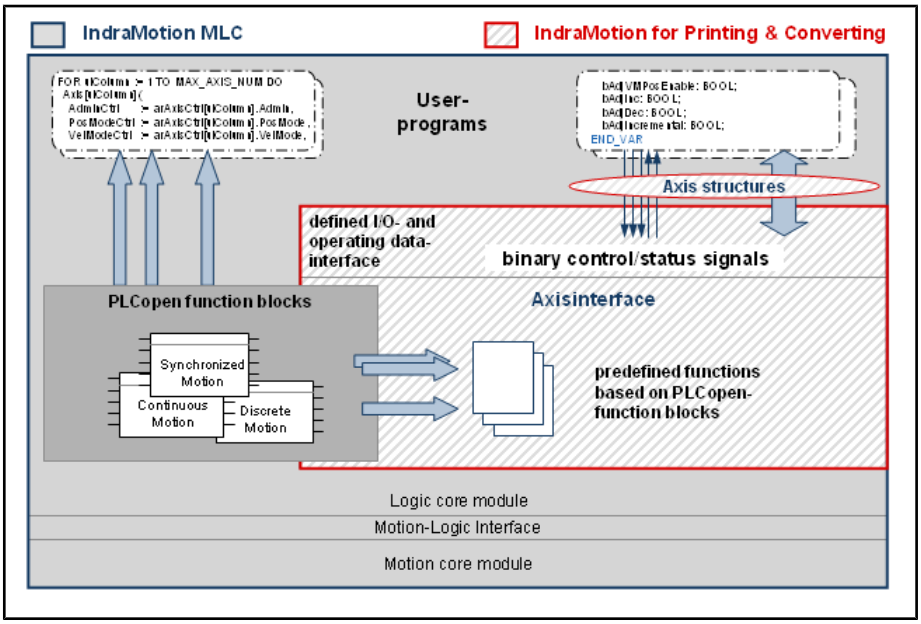


Fig.4-8: IndraMotion - interfaces

PLCopen interfaces

IndraMotion provides the programmer with a comprehensive library with standardized function blocks based on PLCopen. In principle, every axis function can be programmed with these blocks according to the rules of the PLCopen state machine. However, at this level there are no functions specific to certain machine types.

Programming based on PLCopen is not described in this document. The approach and all of the functions for PLCopen are described in detail in the "PLCopen Function Blocks and Data Types" manual.

Axis structures

Typical functions needed for print and converting machines have already been completely programmed in IndraMotion for Printing. The prefabricated functions mainly include the familiar SYNAX200 operating modes for master and slave axes. All control and status signals and the "parameters" that are typically needed for operating an axis are already defined. The control signals and the operating data are combined into so-called "axis structures". The functionality of this binary/operating data interface corresponds with those of the familiar SYNAX200 interfaces.

The prefabricated functions are delivered as the "ML_TechInterface" library. As a fixed component in the scope of delivery for IndraMotion for Printing, like all firmware they are tested before shipping and are subject to release maintenance.

4.3 Master and slave axes

4.3.1 Axis Designations

Master and slave axes are known from SYNAX200. Master axes can be operated as either virtual or real master axes. The concept "slave axis" designates a SERCOS drive.

For IndraMotion, new designations have been introduced:

	Designation in SYNAX200	Designation in IndraMotion
Master axes	Virtual master axis	Virtual axis
	Real master axis	Encoder axis
	---	Link axis
SERCOS drive	Slave axis	Real axis

Fig.4-9: Axis designations

The designation "link axis" is new. This axis type designates axes that reference their guide value via the cross communication in the control link or have a master position in the network.

4.3.2 Axis Project Planning

In SYNAX200, all master and slave axes are stored with their control signals and parameters in the control firmware. The actual, present axes are configured by entering their SERCOS addresses in a list. The address area includes addresses 1 to 40.

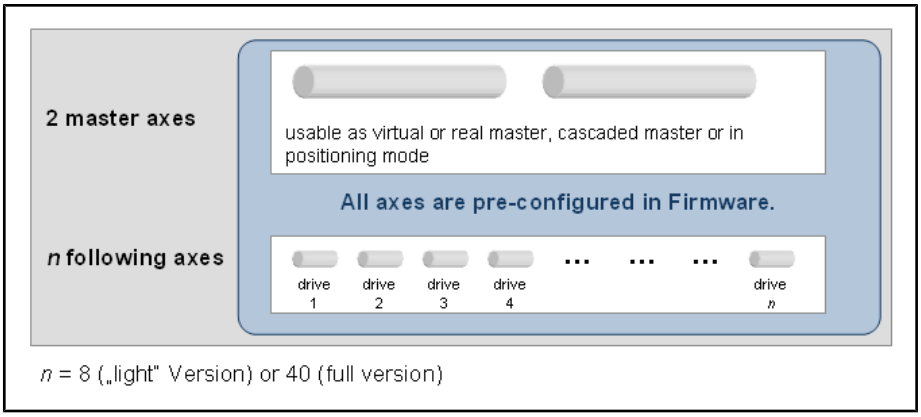


Fig.4-10: SYNAX200 - axes

In IndraMotion, the user determines how many axes of which types will be used in a project.

Master axes are planned as independent virtual axes, as encoder axes or as link axes, depending on function. SERCOS drives are created as real axes. As with SYNAX, each drive receives a SERCOS address. Here, the address area includes addresses 1 to 99.

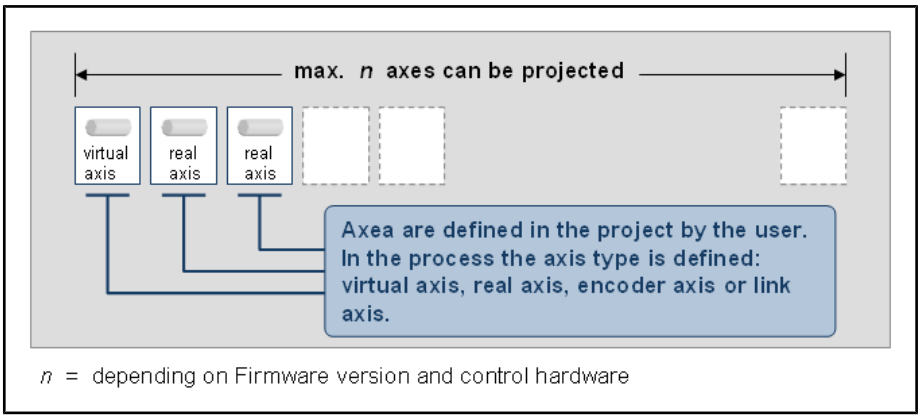


Fig.4-11: IndraMotion - axes

When the control is delivered, it is "empty". The planned axes are known in the control only after a project has been loaded.

☞ For IndraMotion the max. number of axes includes all axes. The master axes are counted as well. For this reason, the number of SERCOS drives that can be operated at one control depends on how many master axes are used.

4.4 Operating Modes of Master Axes and Drives

In SYNAX200 the operating mode must be specified for each axis to be used. Typical settings such as acceleration or synchronization behavior are also set in the dialogs for operating mode configuration.

For SERCOS drives there is a primary operating mode for synchronous operation, two secondary modes of operation and a special operating mode that can be freely configured.

For the master axes, the various, distinct operating modes are virtual master axis, real master axis, slave master axis and positioning mode.

There is no operating mode configuration for IndraMotion. No distinctions are made among primary, secondary and special operating modes. The desired

operating mode is simply selected in the PLC program. When the selection is made, typical operating data such as acceleration or synchronization data are transferred.

No distinction is made between drives and master axes in the PLC programming. Both axis types use the same blocks/functions.

With the SERCOS drive, any operating mode that is supported by the firmware can be used. In contrast to SYNAX200, no special presettings are required to change from one synchronous operating mode to another.

As in SYNAX200, the virtual master axis can be operated freely, in positioning mode or as a slave master axis. The real master axis is not specified as an operating mode of the master axis, but is instead its own axis type (see previous section).

5 The "IndraWorks" Engineering Environment

5.1 General information

This sections shows where the most important basic functions used for engineering in the new "IndraWorks" environment can be found. More detailed information for working with IndraWorks can be found in the "Rexroth IndraWorks Engineering; Operating and Programming Instructions" documentation or in the online help for IndraWorks.

5.2 General Operating Functions in the Icon Bar

5.2.1 General information

General operating functions are grouped together in an icon bar that can be configured. Basic functions such as phase switching, starting/stopping the PLC, deleting errors, etc. are in the default configuration.

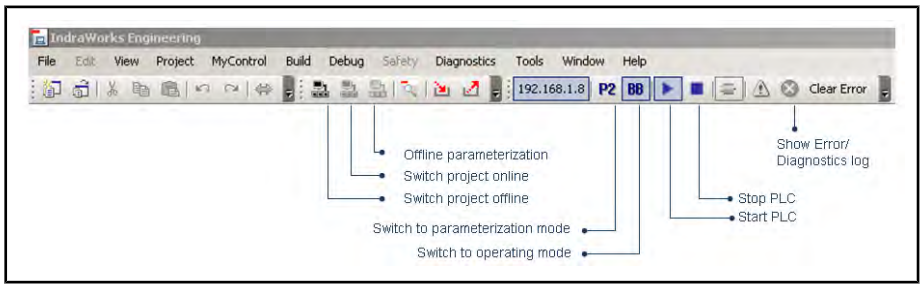


Fig.5-1: General operating functions in the icon bar

5.3 Device and axis specific operating functions in context menus

5.3.1 General information

All of the functions that are needed for engineering and during commission are grouped together in context menus. The context menus can be opened by clicking with the right mouse button on a device or an axis in the Project Explorer.

Context menu for the MLC control:

The "IndraWorks" Engineering Environment

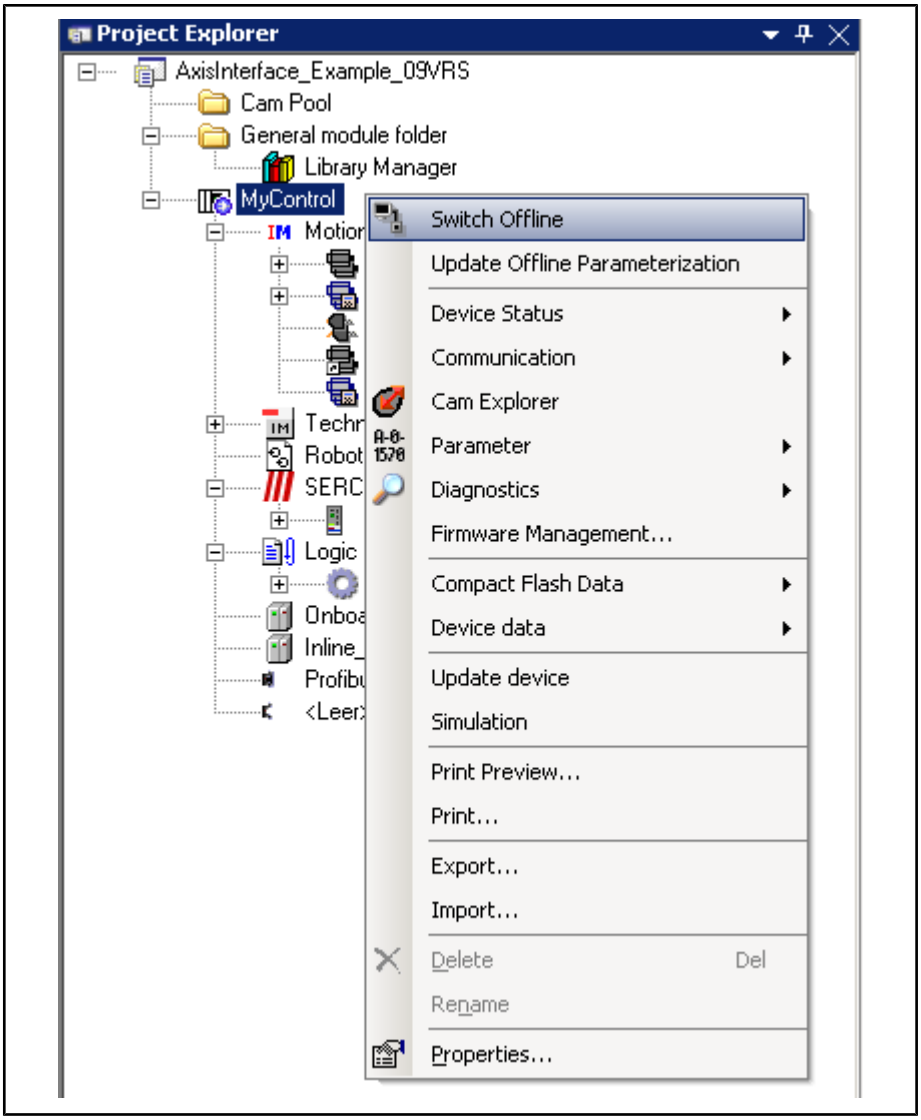


Fig.5-2: Context menu for the MLC control

Context menu for a virtual axis:

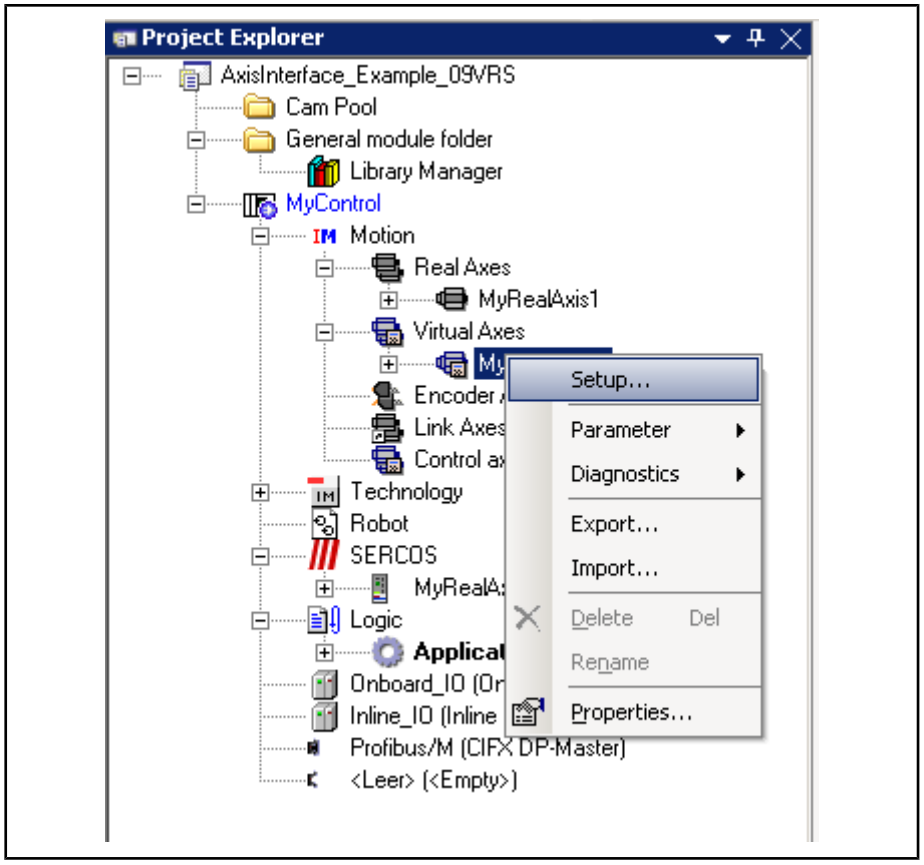


Fig.5-3: Context menu for the virtual master axis

Context menu for a real axis:

The "IndraWorks" Engineering Environment

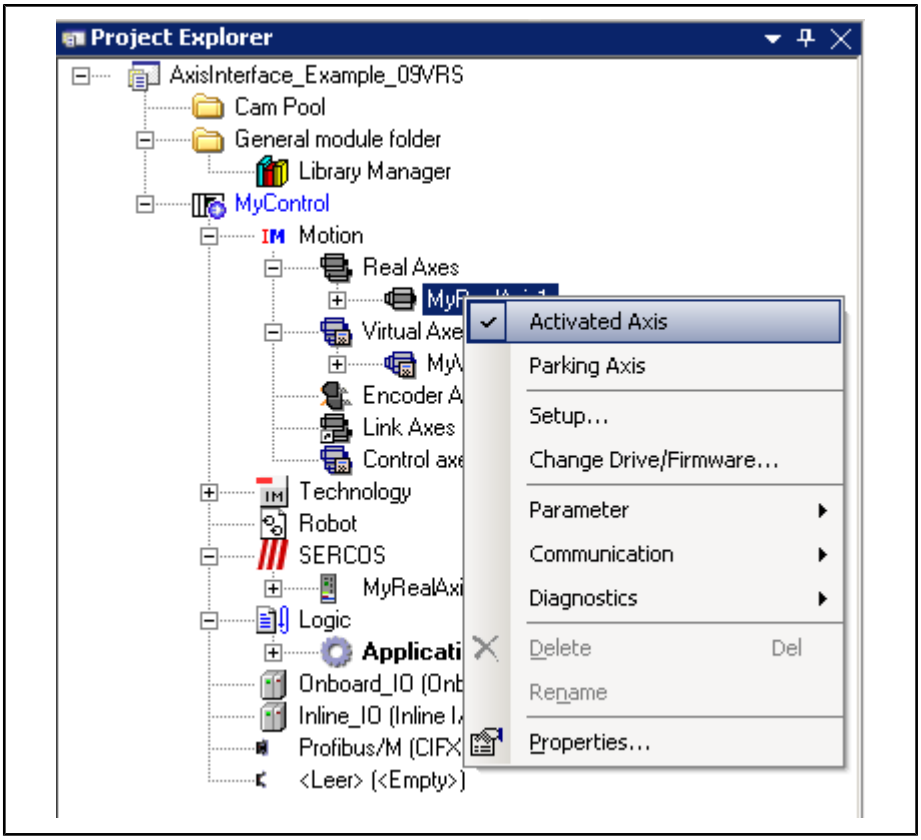


Fig.5-4: Context menu for the real axis

5.3.2 Displaying and Changing Individual Parameters

The dialog for displaying and changing individual parameters can be called with the parameter editor in the context menu (right-click on the control or axis).

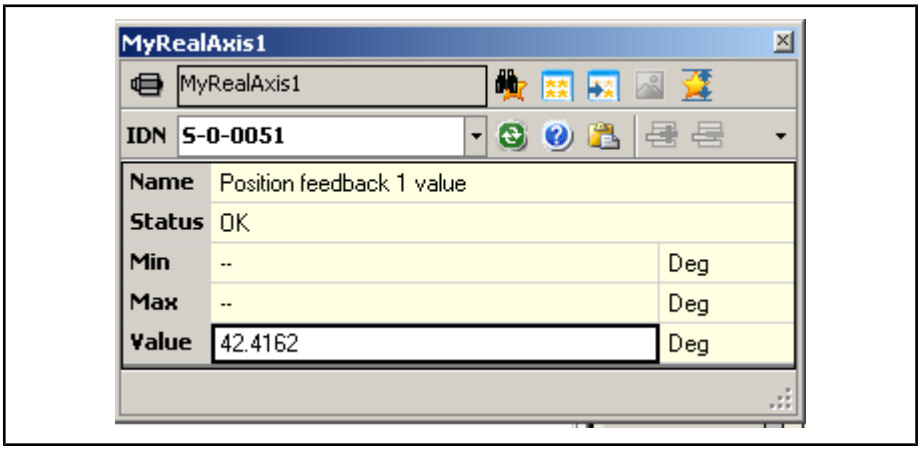


Fig.5-5: Displaying / changing individual parameters

5.3.3 Displaying a Parameter Group

In a parameter group, you can combine any parameters from various devices. The values displayed can be changed directly in the table - as long as they are writable.

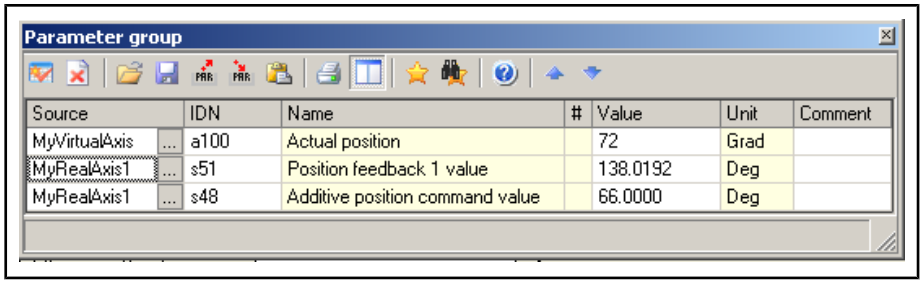


Fig.5-6: Displaying a parameter group

Several parameter groups and/or individual parameter boxes can be displayed simultaneously.

5.3.4 Saving and Loading Parameters

The functions for saving and loading parameters are hidden behind the terms "Export" and "Import". These functions are called from the context menus for the control.

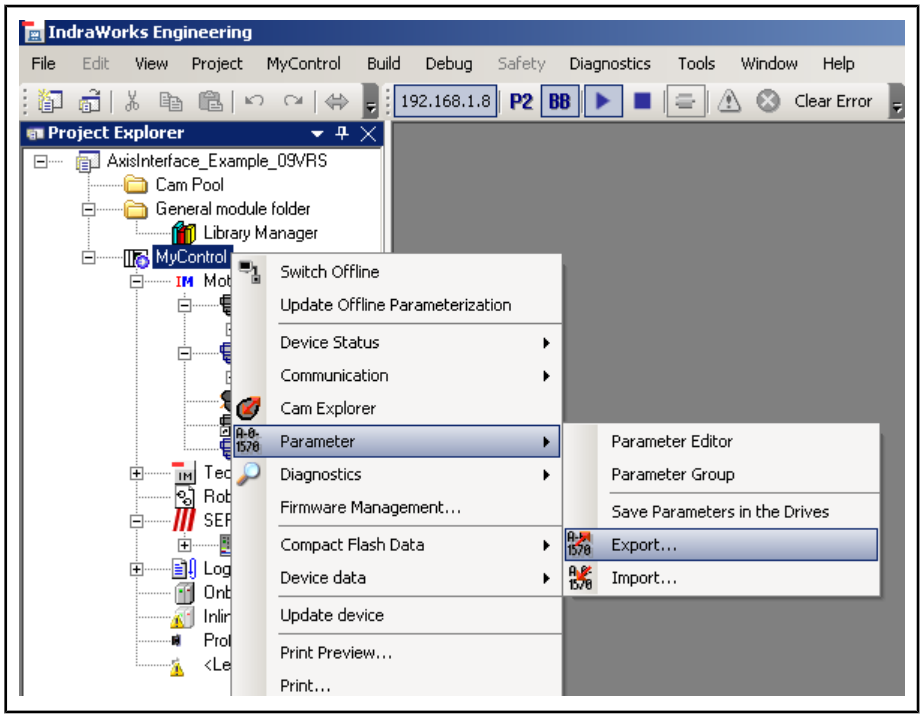


Fig.5-7: Saving and loading parameters

In the Export (Save) and Import (Load) dialogs for parameters, the familiar functions from SYNAX200 are offered.

☞ It is recommended that parameter backups be saved in the project directory. Saved parameters will then be automatically included when the project is archived.

5.3.5 Diagnostic

Individual diagnostic menus are provided for each device and axis. In addition, the error/diagnostic memory can be opened from the icon bar (see fig. 5-1 "General operating functions in the icon bar" on page 25).

The "IndraWorks" Engineering Environment

5.3.6 Loading Control Firmware

An update/upgrade of the control firmware is carried out in the firmware management area in the context menu for the control.

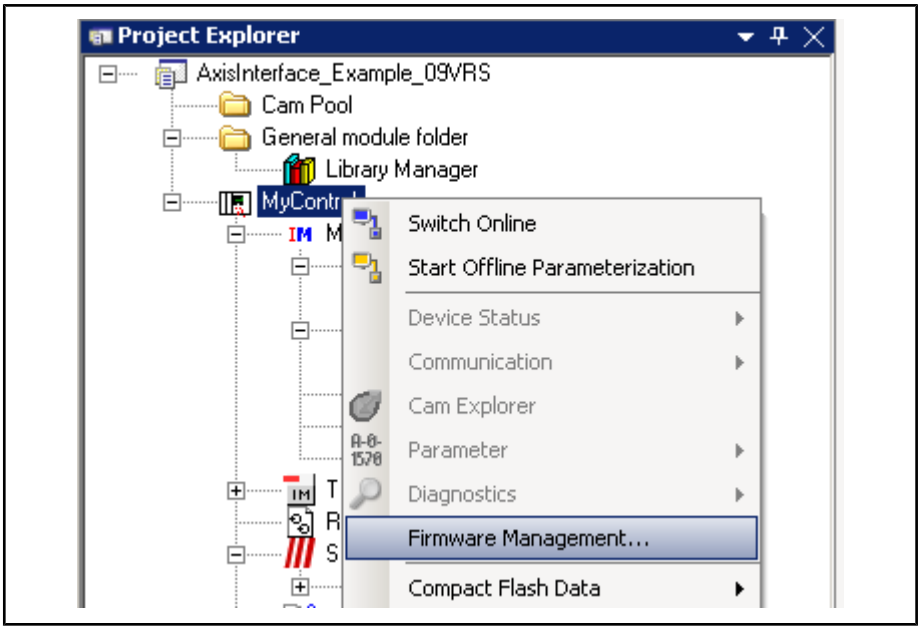


Fig.5-8: IndraMotion - firmware management

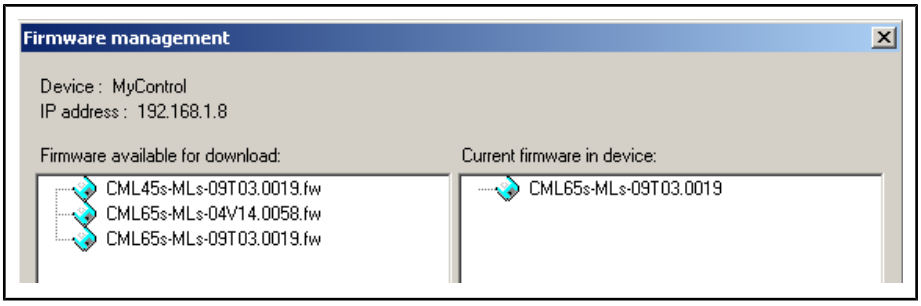


Fig.5-9: IndraMotion - firmware download

5.4 Changing a Drive Address

If an address of a SERCOS drive must be changed at a later time, proceed as follows:

1. In the context menu of the real axis, start the "Change Drive/Firmware..." function.

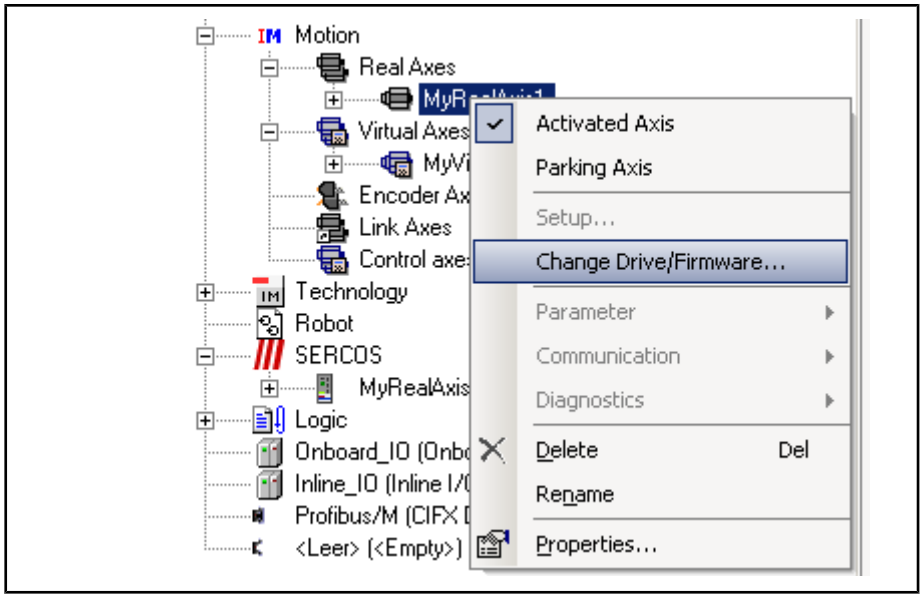


Fig.5-10: Changing an address - start

2. In the "Settings for Parameter Backup" dialog, select the option "Offline Data: save".

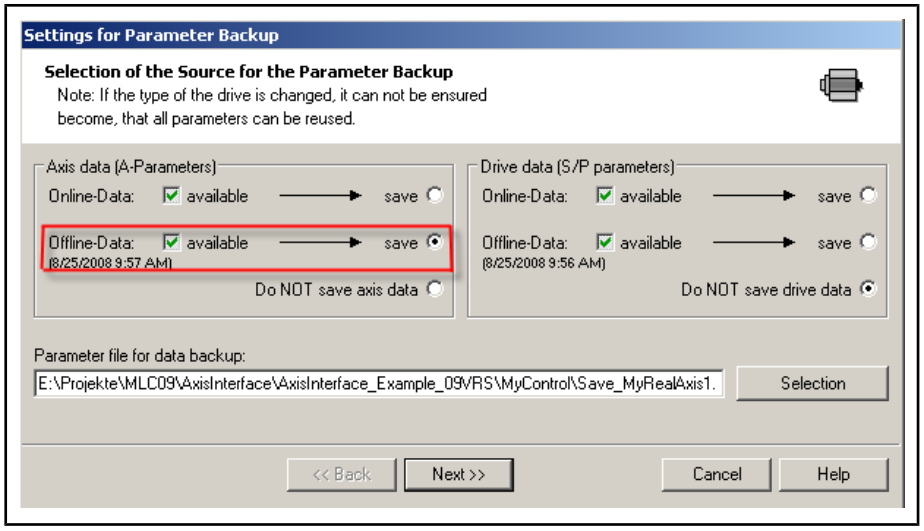


Fig.5-11: Changing an address - preparation

3. Confirm both of the following dialogs with "Next".
4. In the "Specify New Drive" dialog, select the new SERCOS address and confirm with "Next".

The "IndraWorks" Engineering Environment

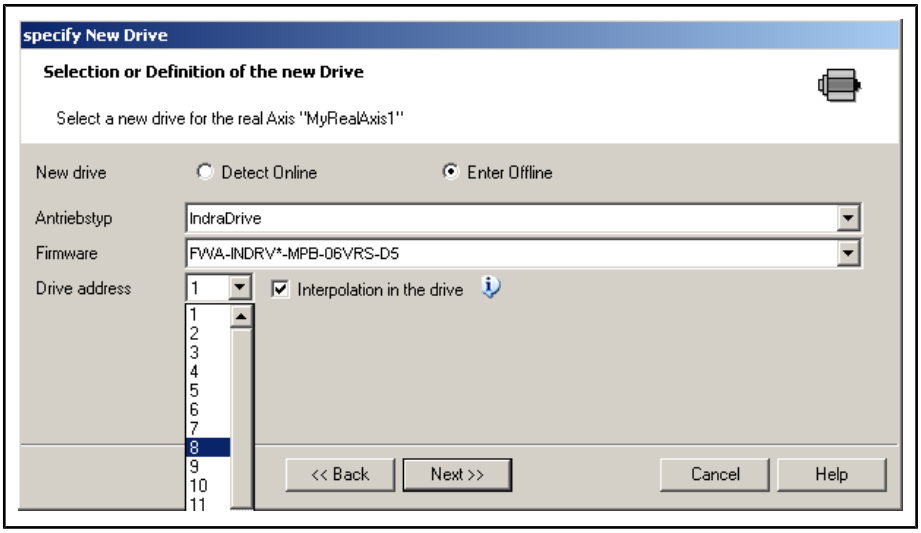


Fig.5-12: Changing a drive address

5. After completing the procedure, load the saved axis parameters (import).

6 The User Interface "AxisInterface"

6.1 The Library "ML_TechInterface"

IndraMotion for Printing provides prefabricated functions for print and converting machines. The simple interface makes it possible to quickly access all typical operating modes.

When IndraWorks is installed, special libraries for a variety of application areas are installed. The library for handling operating modes is called "ML_TechInterface". It contains function blocks with the designation ML_AxisInterface Typexx. The index "xx" identifies the block's scope of function. The following table shows the scope of function for the current block versions:

Block version	Supported operating modes
ML_AxisInterfaceType01	Synchronous operating modes, phase synchronization, speed synchronization, electronic cam, electronic motion profile Positioning mode for absolute and relative positioning Speed regulation

All blocks can be used in the same way for master axes and drives.

6.2 Data Interfaces

6.2.1 General information

The transfer of input and output data is carried out using predefined data interfaces. All relevant data are combined into axis structures. The axis interface uses one structure each for input and output data which area to be created in the user program as global arrays.

In this manual (as in the program examples included with delivery), the two structures are identified with "arAxisCtrl" and "arAxisStatus".

In addition to the two structure types for the axis interface there is one other "Axis Data" structure. This structure is standard and provides many basic status signals and actual values. In the output data structure for the axis interface the signals are bundled such that they exceed the standard required for printing and converting applications.

The User Interface "AxisInterface"

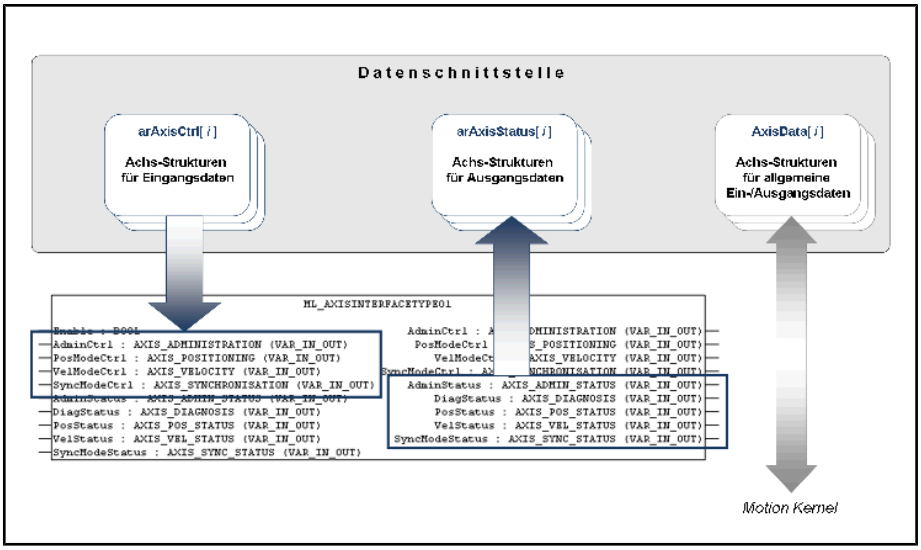


Fig.6-1: AxisInterface - overview

The two structure fields arAxisCtrl[] and arAxisStatus[] must be declared for the planned number of axes. The AxisData structure present includes the maximum possible number of axes by default.

The axis index i is the logical axis number (AXIS_REF.AxisNo).

6.2.2 Assigning Axis Interface Blocks

Axis interface blocks are assigned with substructures of the input or output data structures arAxisCtrl[] and arAxisStatus[]. Substructures are available for each operating mode.

Example:

Assignment for an axis with the axis designation "Axis1".

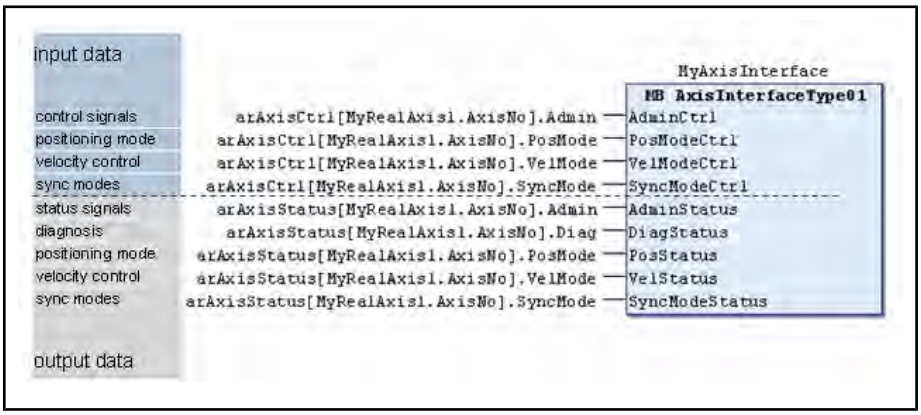


Fig.6-2: Axis interface block - assignment

6.3 Input Data Structures

6.3.1 General information

The arAxisCtrl[] structure contains the binary control signals and operating data that are required as input variables for the various operating modes. The structure is classified into several substructures for administration and the various operating modes:

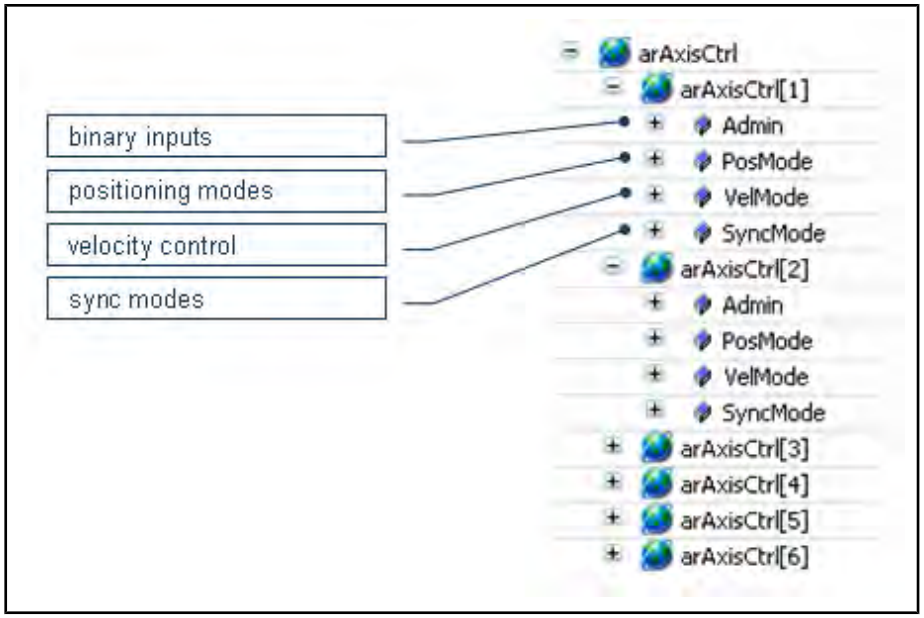


Fig.6-3: AxisInterface - input data structures

6.3.2 Control signals (Releases, Commands)

The Admin substructure contains control signals for controlling axes, e.g. releases, homing, clearing errors. The signals' functions correspond with the binary inputs known in SYNAX200. Details regarding the control signals can be found in chapter 8 "Mapping the Binary Control Signals from SYNAX200 into IndraMotion for Printing" on page 45.

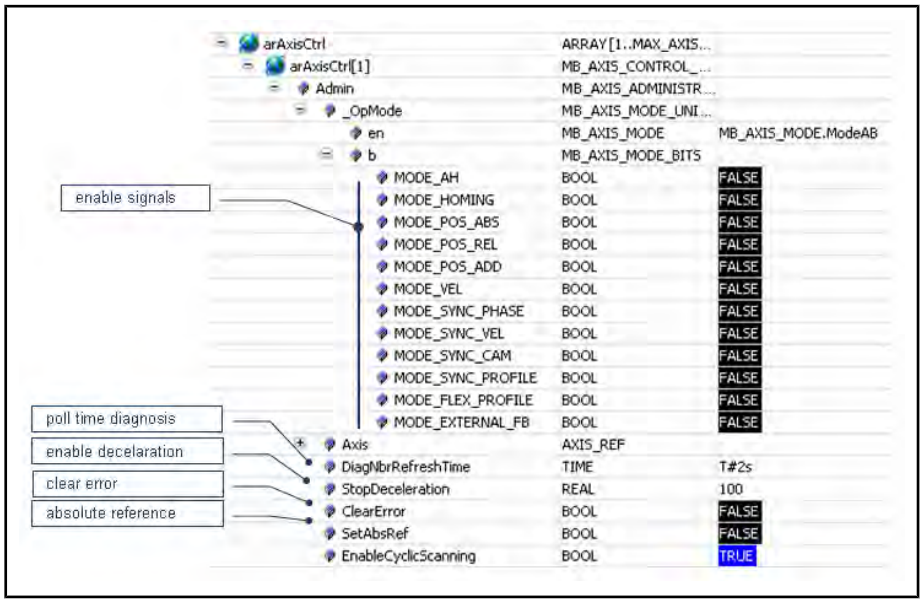


Fig.6-4: "Admin" input data structure

6.3.3 Synchronous Operating Modes: Operating Data and Jog Function

The SyncMode substructure contains the typical operating data for the synchronous operating modes. The data's functions correspond with the parameters known in SYNAX200.

The User Interface "AxisInterface"

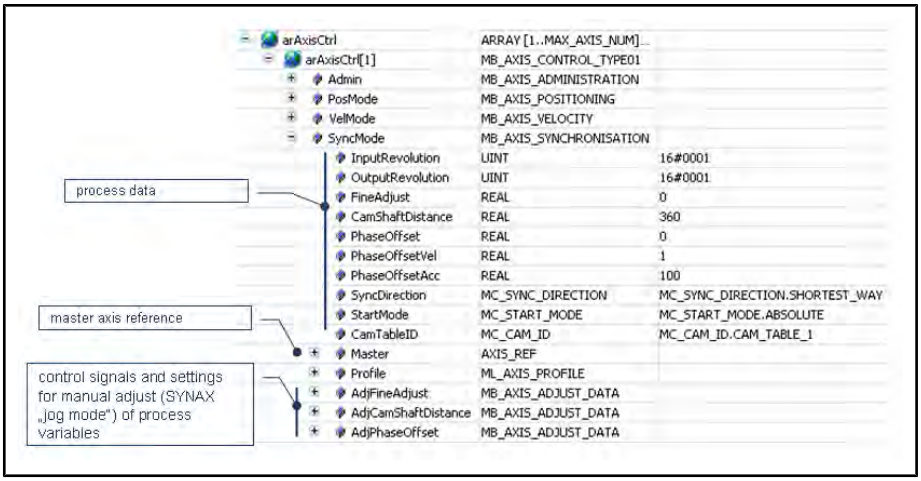


Fig.6-5: "SyncMode" input data structure

6.3.4 Velocity Regulation: Operating Data and Jog Function

The VelMode substructure contains the typical operation data for velocity regulation (drive) or idle (master axis). The data's functions correspond with the parameters known in SYNAX200.

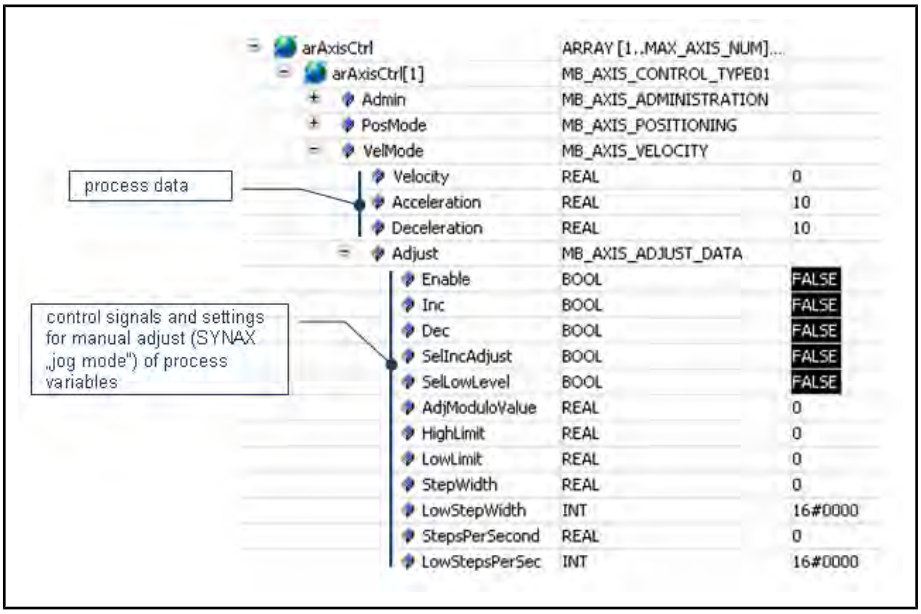


Fig.6-6: "VelMode" input data structure

6.3.5 Positioning Mode: Operating Data and Jog Function

The PosMode substructure contains the typical operating data for the positioning mode. The data's functions correspond with the parameters known in SYNAX200.

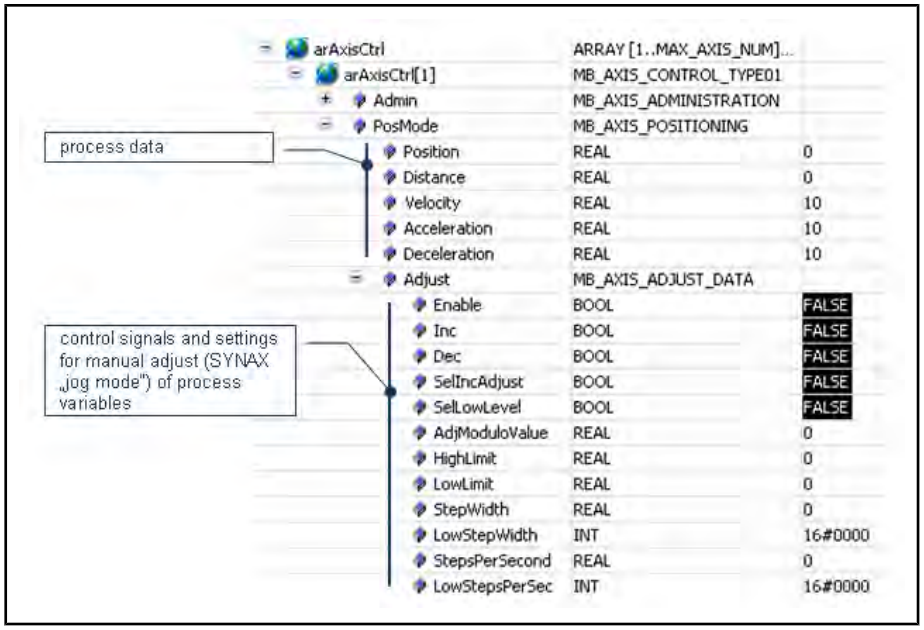


Fig.6-7: "PosMode" input data structure

6.4 Output Data Structures

6.4.1 General information

The arAxisStatus[] structure contains binary feedback messages and provided diagnosis data. The structure is classified into several substructures for administration, diagnosis and the various operating modes:

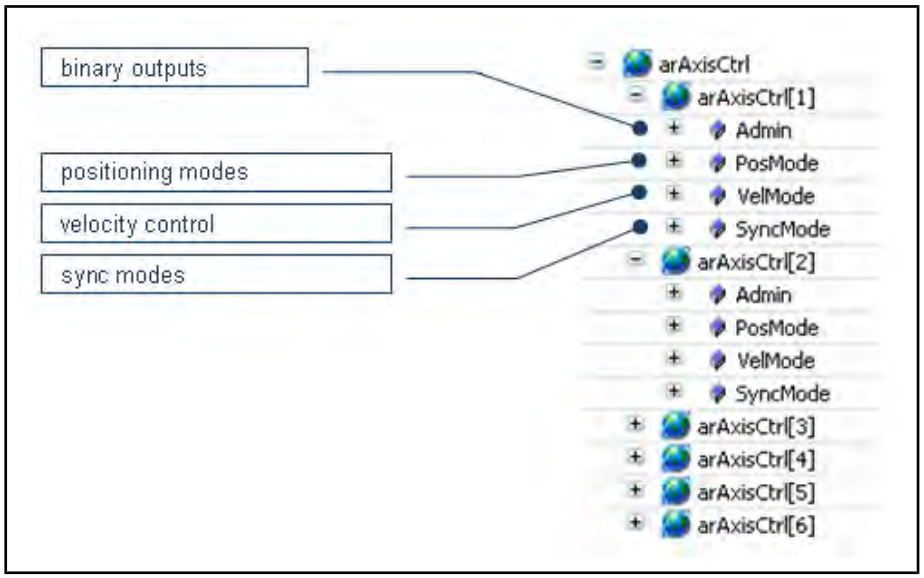
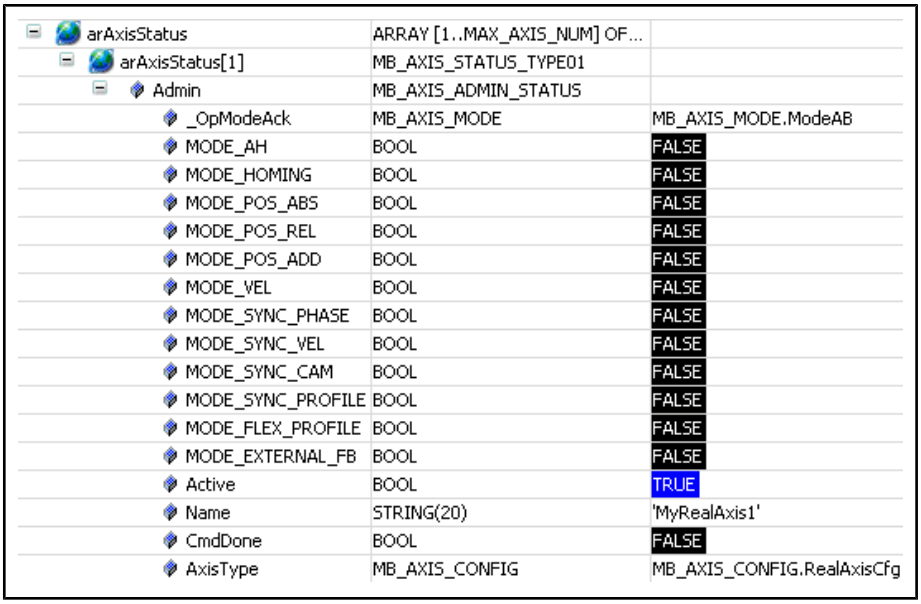


Fig.6-8: AxisInterface - output data structures

6.4.2 Status Signals (Release and Command Acknowledgements)

The Admin substructure contains the release acknowledgements for the various operating modes. The signals' functions correspond with the binary outputs known in SYNAX200. Details regarding the output signals can be found in chapter 8 "Mapping the Binary Control Signals from SYNAX200 into IndraMotion for Printing" on page 45.

The User Interface "AxisInterface"



arAxisStatus	ARRAY [1..MAX_AXIS_NUM] OF...	
arAxisStatus[1]	MB_AXIS_STATUS_TYPE01	
Admin	MB_AXIS_ADMIN_STATUS	
_OpModeAck	MB_AXIS_MODE	MB_AXIS_MODE.ModeAB
MODE_AH	BOOL	FALSE
MODE_HOMING	BOOL	FALSE
MODE_POS_ABS	BOOL	FALSE
MODE_POS_REL	BOOL	FALSE
MODE_POS_ADD	BOOL	FALSE
MODE_VEL	BOOL	FALSE
MODE_SYNC_PHASE	BOOL	FALSE
MODE_SYNC_VEL	BOOL	FALSE
MODE_SYNC_CAM	BOOL	FALSE
MODE_SYNC_PROFILE	BOOL	FALSE
MODE_FLEX_PROFILE	BOOL	FALSE
MODE_EXTERNAL_FB	BOOL	FALSE
Active	BOOL	TRUE
Name	STRING(20)	'MyRealAxis1'
CmdDone	BOOL	FALSE
AxisType	MB_AXIS_CONFIG	MB_AXIS_CONFIG.RealAxisCfg

Fig.6-9: Output data - acknowledgements

6.4.3 Diagnostics: Binary Signals and Error Information

The Diag substructure provides diagnosis data.

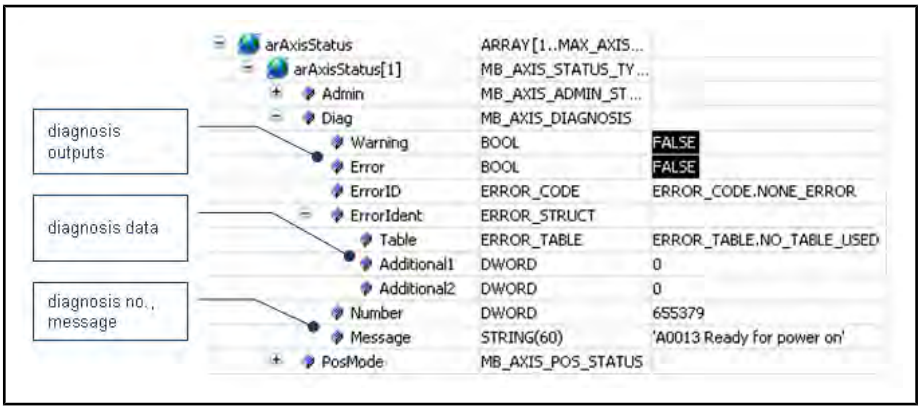


Fig.6-10: "Diag" output data structure

6.4.4 Synchronous Operating Modes: Acknowledgements

The SyncMode substructure contains the status and feedback messages for the synchronous operating modes. The outputs' functions correspond with the binary outputs for slave axes known in SYNAX200.

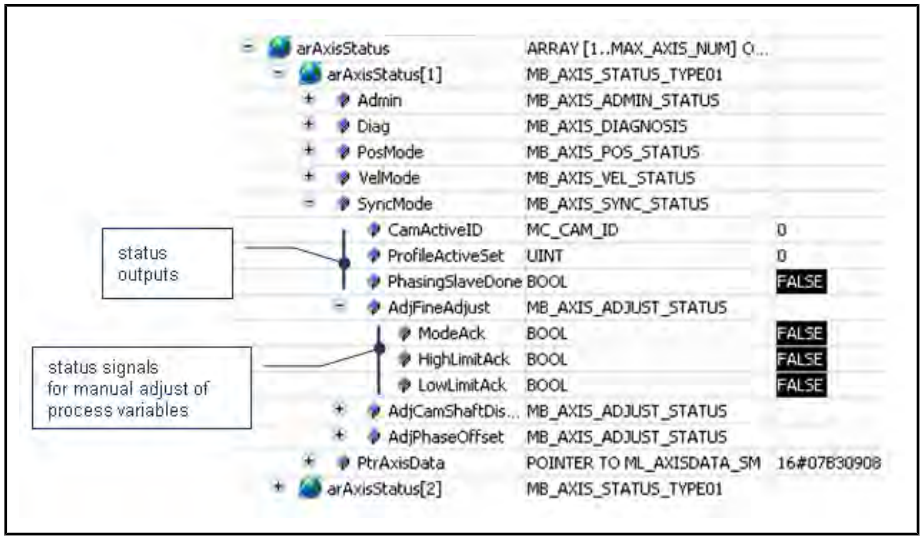


Fig.6-11: "SyncMode" output data structure

6.4.5 Positioning Mode and Velocity Regulation: Acknowledgements

The "PosMode" and "VelMode" substructures contain binary output signals for the positioning mode or idle (velocity regulation). The signals' functions correspond with the binary outputs known in SYNAX200.

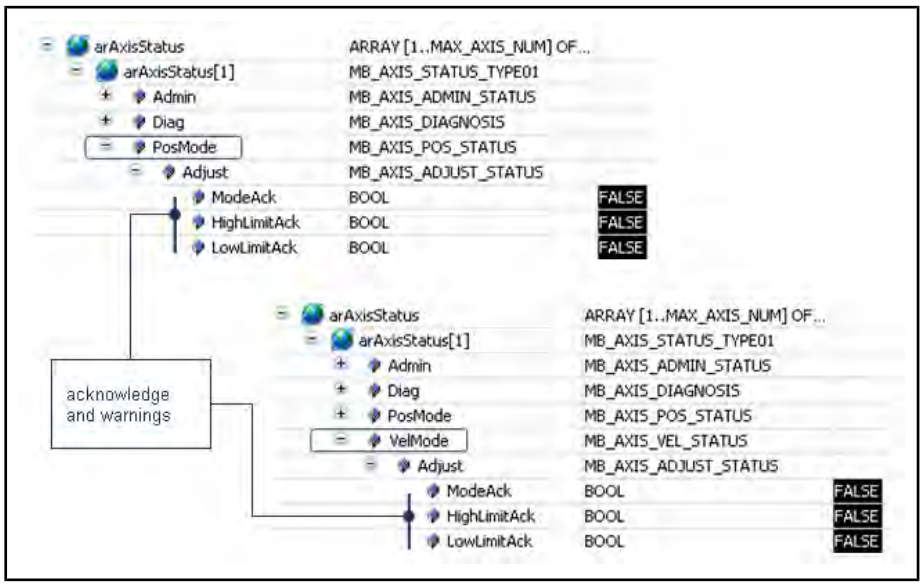


Fig.6-12: "VelMode" and "PosMode" output data structures

7 Operating Modes and Process Data

7.1 General Information, ML_AxisInterfaceTypexx Block

In the simplest case, the ML_AxisInterfaceTypexx block can executed in a loop over all planned drives and master axes. This program section is to be assigned as a cyclical task - **not as the SERCOS synchronous task !** (cf. "Rexroth IndraMotion 09VRS Technology Basic Libraries" documentation, "TechInterface" section).

7.2 Operating Mode Selection

7.2.1 General information

The operating mode for an axis is selected with the "Admin" structure element. Predefined ENUM values or BIT variables can be used to select the operating mode.

7.2.2 Operating Mode Selection with ENUM Values

The desired operating mode is written in the "Admin._OpMode.en" structure element.

The following operating modes are predefined:

ModeAB	No operating mode selected; Drive in AB
ModeAH	Drive hold
ModeHoming	Homing
ModePosAbs	Absolute positioning
ModePosRel	Relative positioning (Distance is added to the current **actual position value**)
ModePosAdd	Additive positioning (Distance is added to the current **actual command value**)
ModeVel	Idle (velocity regulation)
ModeSyncPhase	Phase synchronization
ModeSyncVel	Speed synchronization
ModeSyncCam	Electronic cam
ModeSyncProfile	Electronic motion profile
ModeExternalFB	External operating mode control (e.g. with technology FBs)

Example:

arAxisCtrl[MyAxis1.AxisNo] .Admin._OpMode.en: = ModeAB; (* deselect operating mode; no drive release *)

arAxisCtrl[MyAxis1.AxisNo]. Admin._OpMode.en: = ModeSyncPhase; (* Operating mode phase synchronization *)

7.2.3 Operating Mode Selection with BIT Variables

If you wish to work with binary signals - as with SYNAX200 - you can also use Boolean constants to select the operating mode:

MODE_AH	Drive hold
MODE_HOMING	Homing
MODE_POS_ABS	Absolute positioning
MODE_POS_REL	Relative positioning
MODE_POS_ADD	Additive positioning
MODE_VEL	Idle (velocity regulation)
MODE_SYNC_PHASE	Phase synchronization
MODE_SYNC_VEL	Speed synchronization
MODE_SYNC_CAM	Electronic cam
MODE_SYNC_PROFILE	Electronic motion profile (operating mode only for the control side)
MODE_EXTERNAL_FB	External operating mode control (e.g. with technology FBs)

Example:

arAxisCtrl[MyAxis1.AxisNo].Admin._OpMode.b.MODE_AH: = TRUE; (* drive hold *)

arAxisCtrl[MyAxis1.AxisNo].Admin. _OpMode.b.MODE_SYNC_PHASE: = TRUE; (* Operating mode phase synchronization *)

☞ Only one input can be set.

If several inputs are active at once, the block outputs an error message and puts the affected axis into "AB".

7.3 Handling Process Data

Individual input data is assigned to each operating mode. The current values are accepted when an operating mode is selected. As long as the operating mode is active, typical input values can be cyclically scanned and the changes accepted. To do so, the "EnableCyclicScanning" input must be set to TRUE.

The following table shows which input values can be processed cyclically on an ongoing basis:

Ongoing cyclical processing if EnableCyclicScanning = TRUE	Only for the values input when the operating mode is activated	Process variable
In general		
.Axis.StopDeceleration		Release deceleration
Positioning mode		
.PosMode.Position		Target position, absolute positioning
.PosMode.Distance		Travel, relative and additive positioning
.PosMode.Velocity		Positioning velocity
	.PosMode.Acceleration	Positioning acceleration
	.PosMode.Deceleration	Positioning deceleration
Velocity regulation (idle)		

Ongoing cyclical processing if EnableCyclicScanning = TRUE	Only for the values input when the operating mode is activated	Process variable
.VelMode.Velocity		Velocity command value, idle
.VelMode.Acceleration		Idle acceleration
.VelMode.Deceleration		Idle deceleration
Synchronous operating mode		
.SyncMode.InputRevolution		Electronic gear input revolutions
.SyncMode.OutputRevolution		Electronic gear output revolutions
.SyncMode.Fineadjust		Gear ratio fine adjustment
.SyncMode.CamShaftDistance		Cam shaft distance
.SyncMode.CamTableID		Point table selection
.SyncMode.PhaseOffset		Phase offset (additive position offset)
.SyncMode.Master		Master axis/Master allocation
	.SyncMode.PhaseOffsetVel	Synchronization velocity
	.SyncMode.PhaseOffsetAcc	Synchronization acceleration
	.SyncMode.SyncDirection	Synchronization direction
	.SyncMode.StartMode	Synchronization mode

☞ All input values are accepted once when an operating mode is activated. The "EnableCyclicScanning" does not have to be set in this case.

7.4 What is new in the synchronous operating modes?

In contrast to SYNAX200, IndraMotion offers the the following new functions and possibilities:

... Changing operating modes

With IndraMotion, changing operating modes is very simple: enter the new operating mode in the Admin._OpMode structure element. The block automatically ensures an uninterrupted transition without "torque gaps".

... Synchronous operating modes

Operation is no longer limited to one operating mode. The axis interface allows switching among any of a variety of synchronous operating modes with no preconfiguration required.

... Drive as master axis

In IndraMotion, a drive can also be a master. Therefore, not a virtual axis is entered in the ".SyncMode.Master" structure element, but instead, a real axis is entered as the master axis.

... More real time data in the SERCOS ring

More drive parameters are applies in the cyclical telegram section than in SYNAX200. This means that synchronization parameters and acceleration values can now be quickly changed as well.

8 Mapping the Binary Control Signals from SYNAX200 into IndraMotion for Printing

8.1 General information

This section describes the control and status signals made available by the axis interface and where these can be found.

8.2 Control Signals for SERCOS Drives

8.2.1 Drive Inputs: Overview of the Binary Inputs in SYNAX200

The following overview shows the current implementation status in comparison with SYNAX200:

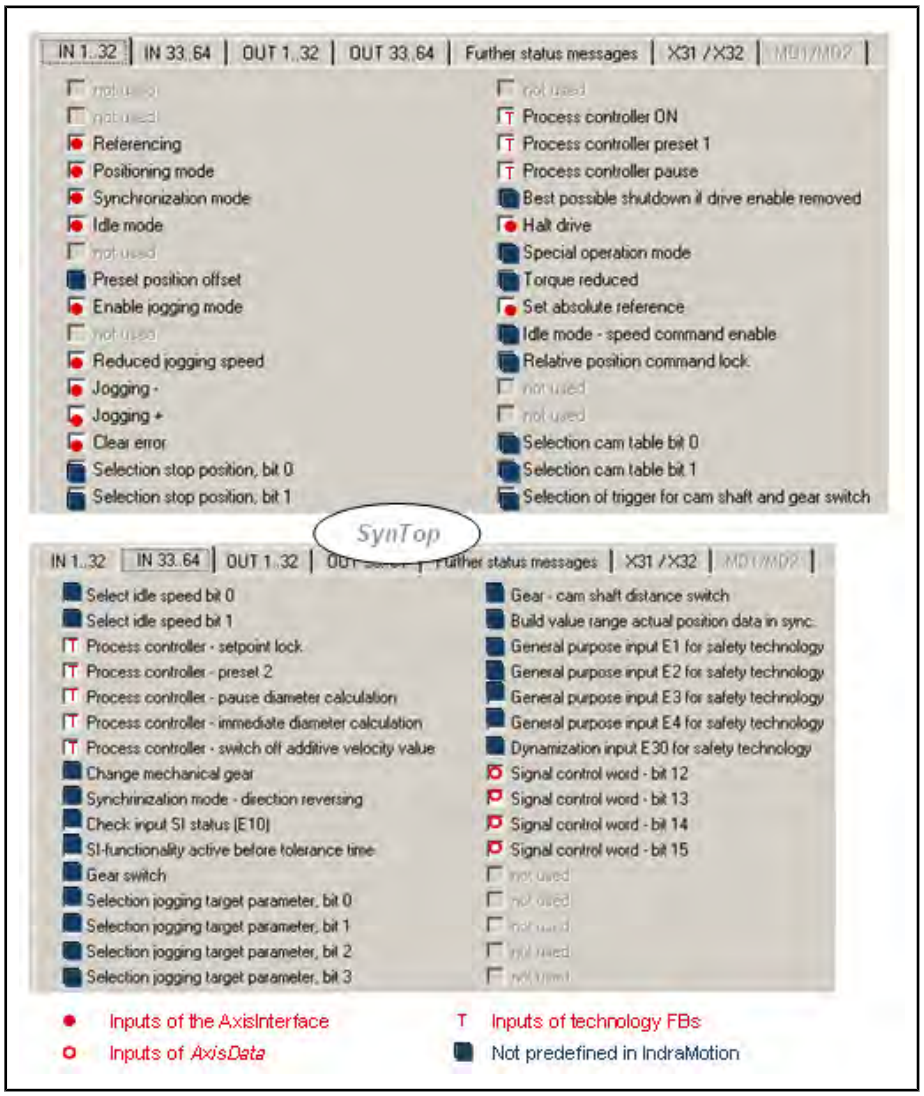


Fig.8-1: Binary inputs for real axes from SYNAX200

8.2.2 Which inputs are not part of the axis interface?

The axis interface contains all of the control signals that control the axis motions for synchronous and secondary operating modes or trigger commands. Signals

with special functions are implemented in the technology functions and other function blocks. These signals are listed below.

Control signals for process controllers

There are special technology function blocks for process controller functions such as register controllers, winders or tension controllers. These function blocks are grouped together in their own libraries. Control signals for process controller functions are provided by technology FBs.

Trigger selection for stroke and gear switching

"Trigger selection for stroke and gear switching" is only required for special technology functions such as the cross-cutter, so it is not included in the axis interface.

None of the currently implemented functions simulate this input.

Stroke or gear switching

"Stroke or gear switching" is only required for special technology functions such as the cross-cutter, so it is not included in the axis interface.

None of the currently implemented functions simulate this input.

Freely configurable input E1/E2/E3/E4 for safety technology

Signals for controlling safety technology within the drives are set with special functions.

Currently there is no standard solution.

Test input safe status (E10)

Signals for controlling safety technology within the drives are set with special functions.

Currently there is no standard solution.

Safe function active before tolerance time elapsed

Signals for controlling safety technology within the drives are set with special functions.

Currently there is no standard solution.

Dynamic sampling input E30 for safety technology

Signals for controlling safety technology within the drives are set with special functions.

Currently there is no standard solution.

Signal control word - bits 12-15

Four freely configurable control bits are included in AxisData:

Fig.8-2: AxisData -freely configurable control bits

8.2.3 Which inputs have been omitted?

Due to the close connection between motion (firmware) and logic (PLC), many inputs are no longer necessary. In SYNAX applications with a superordinate PLC, all of the data that changes per operation must be transferred over a field bus. To relieve the pressure on the field bus communication, this data is provided on the control.

Example: Lists with preset command values for target positions or idle speeds, preset values.

With IndraMotion, the PLC has direct access to the process data. For this reason, a selection or preset mechanism based on binary signals is not required.

Position offset preset

A preprogrammed preset function is not necessary in IndraMotion. Preset values can be provided in the PLC and can be written to the phase offset at any time.

Target position selection bit 0, bit 1

Position command values can be provided in the PLC program as an array, for example. The current target position can be written in the program at any time without any special bit handling.

Special case "Target position 0"

SYNAX200 has a special mechanism for activating the positioning mode with target position 0:

When the operating mode is activated, the current actual position value is read from the drive and accepted in target position 0. The axis remains in the current position in position control.

In IndraMotion, typical actual values are automatically read in the SERCOS cycle and are available in the PLC program. In this way, the function of "target position 0" can be easily mapped if necessary.

Optimum standstill when switching off AF

The function of this input is easy to realize in the PLC program:

- Use "Drive hold" to transfer the drive into standstill
- Wait for the standstill message
- Remove enable during standstill.

Special operating mode

In SYNAX200, the "special operating mode" is used if more than 3 operating modes are required, if the control firmware does not support the desired operating mode or if an operating mode without cyclical command value specification is used.

IndraMotion supports up to 8 different operating modes which can be selected in the PLC program without preconfiguration.

The special case "Enable without transferring cyclical data" is not implemented in IndraMotion.

Reduced torque

In SYNAX200, a binary input is used to switch between two preset torque limits.

With IndraMotion, a new torque limit can be transferred as an individual parameter to the drive in the PLC program.

Idle operation, enable command value

In SYNAX200, this input is used if a drive does not shut down immediately when the operating mode "Idle" is activated. The control holds the velocity command value at zero until enable command value is set. Only then is the current command value transferred to the drive.

With IndraMotion this mechanism is no longer necessary because the command value can be written to directly.

Accepting a relative command value

This input is omitted become the "Relative positioning" operating mode has been completely implemented in IndraMotion.

Cam preselection, bit 0, bit 1

IndraMotion supports more than 2 point tables for cams. With the drive firmware MPx04VRS, for example, 8 tables are available. The selection is not made with binary code, but instead with the number of the table.

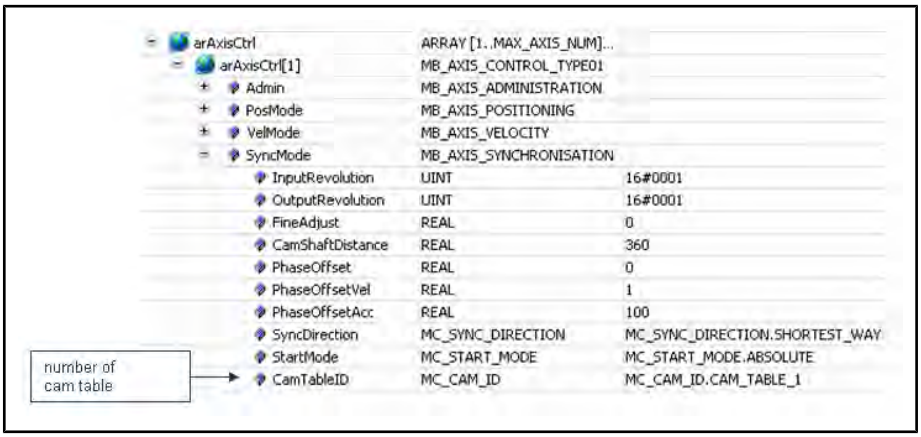


Fig.8-3: Point table selection

Idle speed selection bit 0, bit 1

Velocity command values can be provided in the PLC program as an array, for example. The current idle speed can be written in the program at any time without any special bit handling.

Changing a mechanical gear

Use a drive command

Synchronization operating mode - changing the direction of rotation

This input is omitted because, with IndraDrive, changing the direction of rotation in synchronous operation can be done in operating mode: parameter P-0-0108 "Master drive polarity" can be changed without switching into parameter mode.

Selecting jogging target parameters bit 0, bit 1, bit 2, bit 3

The axis interface provides separate jog inputs for various target parameters for each operating mode.

Selecting target parameters as in SYNAX200 is not required.

Calculating actual value range for position data for synchronization

Currently there is no standard solution. If necessary, the function can be mapped into the PLC program.

8.2.4 Drive Inputs: Reference Table

SYNAX200 inputs	IndraMotion inputs
General functions	
Drive hold	arAxisCtrl[i].Admin._OpMode.en: = ModeAH

SYNAX200 inputs	IndraMotion inputs
Homing	arAxisCtrl[i].Admin._OpMode.en: = ModeHoming
Setting the absolute measure	arAxisCtrl[i].Admin.Axis.SetAbsRef
Clear errors	arAxisCtrl[i].Admin.Axis.ClearError
Freely configurable signals	
Signal control word, bits 12-15	AxisData[i].wUserCmdDataBitA_q AxisData[i].wUserCmdDataBitB_q AxisData[i].wUserCmdDataBitC_q AxisData[i].wUserCmdDataBitD_q
Synchronous operating modes	
Synchronization operating mode	Separate inputs for each operating mode: arAxisCtrl[i].Admin._OpMode.en: = ModeSyncPhase arAxisCtrl[i].Admin._OpMode.en: = ModeSyncVel arAxisCtrl[i].Admin._OpMode.en: = ModeSyncCam
Positioning mode	
Positioning	Absolute positioning: arAxisCtrl[i].Admin._OpMode.en: = ModePosAbs
-- in SYNAX200: special operating mode	Relative positioning: arAxisCtrl[i].Admin._OpMode.en: = ModePosRel
Idle (velocity mode)	
Idle operating mode	arAxisCtrl[i].Admin._OpMode.en: = ModeVel
Jog functions (separate inputs for each operating mode and parameter) In IndraMotion for Printing, individual jog inputs are provided for each operating mode. The inputs have the same effect on preselected operating parameters as in SYNAX200. For the synchronous operating modes that have more than one jogging operation date, separate inputs are created for the various target parameters. The selection of target values in a parameter or with binary inputs as in SYNAX200 is not required.	
Enable jog mode	arAxisCtrl[i].**SyncMode.AdjFineAdjust**.Enable arAxisCtrl[i].**SyncMode.AdjCamShaftDist**.Enable arAxisCtrl[i].**SyncMode. AdjPhaseOffset**.Enable arAxisCtrl[i].**PosMode**.Adjust.Enable arAxisCtrl[i].**VelMode**.Adjust.Enable
Jog +	arAxisCtrl[i].**SyncMode.AdjFineAdjust**.Inc arAxisCtrl[i].**SyncMode.AdjCamShaftDist**.Inc arAxisCtrl[i].**SyncMode. AdjPhaseOffset**.Inc arAxisCtrl[i].**PosMode**.Adjust.Inc arAxisCtrl[i].**VelMode**.Adjust.Inc
Jog -	arAxisCtrl[i].**SyncMode.AdjFineAdjust**.Dec arAxisCtrl[i].**SyncMode.AdjCamShaftDist**.Dec arAxisCtrl[i].**SyncMode. AdjPhaseOffset**.Dec arAxisCtrl[i].**PosMode**.Adjust.Dec arAxisCtrl[i].**VelMode**.Adjust.Dec

Mapping the Binary Control Signals from SYNAX200 into IndraMotion for Printing

SYNAX200 inputs	IndraMotion inputs
Jogging velocity reduced	arAxisCtrl[i].**SyncMode.AdjFineAdjust**.SelLowLevel arAxisCtrl[i].**SyncMode.AdjCamShaftDist**.SelLowLevel arAxisCtrl[i].**SyncMode. AdjPhaseOffset**.SelLowLevel arAxisCtrl[i].**PosMode**.Adjust.SelLowLevel arAxisCtrl[i].**VelMode**.Adjust.SelLowLevel
Incremental jogging: adjustable using parameters in SYNAX200	arAxisCtrl[i].**SyncMode.AdjFineAdjust**.SelIncAdjust arAxisCtrl[i].**SyncMode.AdjCamShaftDist**.SelIncAdjust arAxisCtrl[i].**SyncMode. AdjPhaseOffset**.SelIncAdjust arAxisCtrl[i].**PosMode**.Adjust.SelIncAdjust arAxisCtrl[i].**VelMode**.Adjust.SelIncAdjust

8.2.5 Drive Outputs: Overview of the Binary Outputs in SYNAX200

The following overview shows the current implementation status in comparison with SYNAX200.

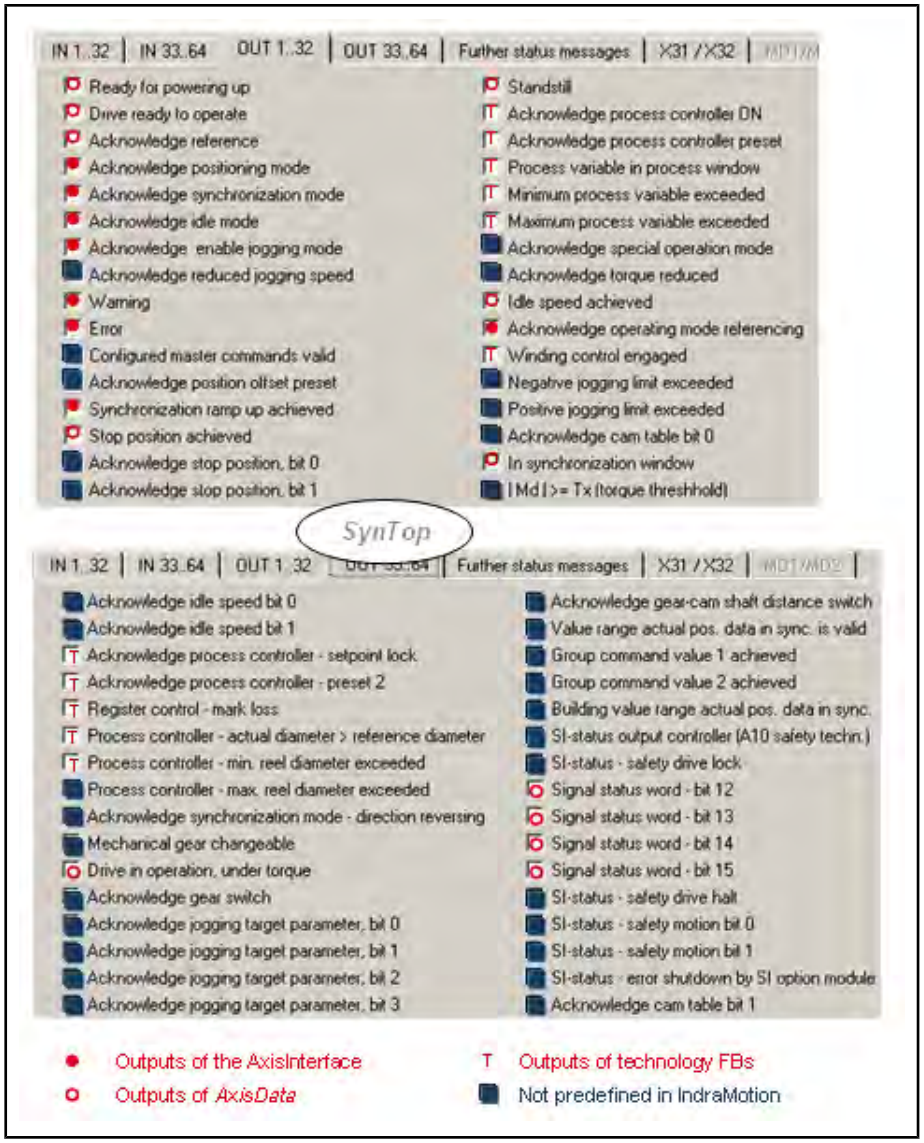


Fig.8-4: Binary outputs for real axes from SYNAX200

8.2.6 Drive Outputs: Reference Table

SYNAX200 outputs	IndraMotion outputs
General functions	
Ready for operation	AxisData[i].Axis_Inbb
Drive ready	AxisData[i].Axis_InAb
Drive in operation, under torque	AxisData[i].Axis_Power
Drive hold	arAxisStatus[i].Admin.MODE_AH
Acknowledge homing, absolute value present	AxisData[i].Axis_Homed
Standstill	AxisData[i].Axis_Standstill
Error warning	arAxisStatus[i].Diag.Warning
Error	arAxisStatus[i].Diag.Error
Freely configurable signals	

Mapping the Binary Control Signals from SYNAX200 into IndraMotion for Printing

SYNAX200 outputs	IndraMotion outputs
Signal status word, bits 12-15	AxisData[i].wUserActualDataBitA_i AxisData[i].wUserActualDataBitB_i AxisData[i].wUserActualDataBitC_i AxisData[i].wUserActualDataBitD_i
Synchronous operating modes	
Acknowledge synchronization operating mode	Separate outputs for each operating mode: arAxisStatus[i].Admin.**MODE_SYNC_PHASE** arAxisStatus[i].Admin.**MODE_SYNC_VEL** arAxisStatus[i].Admin.**MODE_SYNC_CAM**
Synchronization ended	arAxisStatus[i].SyncMode.PhasingSlaveDone
In the synchronization window	AxisData[i].Axis_InSynchron
Acknowledge cam bit 0, acknowledgement cam bit 0	Cam selection using table no. (CAM_TABLE_1, ..., CAM_TABLE_8): arAxisStatus[i].SyncMode. CamTableID
Positioning mode	
Acknowledge operating mode positioning	Absolute positioning: arAxisStatus[i].Admin.MODE_POS_ABS
- in SYNAX200: special operating mode	Relative positioning: arAxisStatus[i].Admin.MODE_POS_REL
Target position reached	AxisData[i].Axis_InPosition
Idle (velocity regulation)	
Acknowledge operating mode idle	arAxisStatus[i].Admin.MODE_VEL
Idle speed reached	AxisData[i].Axis_InVelocity
Jog functions	
Acknowledge enable jog mode	arAxisStatus[i].**SyncMode. AdjFineAdjust**.ModeAck arAxisStatus[i].**SyncMode. AdjCamShaftDist**.ModeAck arAxisStatus[i].**SyncMode. AdjPhaseOffset**.ModeAck arAxisStatus[i].**PosMode**.Adjust.ModeAck arAxisStatus[i].**VelMode**.Adjust.ModeAck
Negative jog limit reached	arAxisStatus[i].**SyncMode.AdjFineAdjust**.LowLimitAck arAxisStatus[i].**SyncMode.AdjCamShaftDist.**LowLimit Ack arAxisStatus[i].**SyncMode.AdjPhaseOffset**.LowLimit Ack arAxisStatus[i].**PosMode**.Adjust.LowLimit Ack arAxisStatus[i].**VelMode**.Adjust.LowLimit Ack
Positive jog limit reached	arAxisStatus[i].**SyncMode.AdjFineAdjust**.HighLimitAck arAxisStatus[i].**SyncMode.AdjCamShaftDist**.HighLimit Ack arAxisStatus[i].**SyncMode.AdjPhaseOffset**.HighLimit Ack arAxisStatus[i].**PosMode**.Adjust.HighLimit Ack arAxisStatus[i].**VelMode**.Adjust.HighLimit Ack

8.3 Control Signals for the Master Axis

8.3.1 Master Axis Inputs: Overview of the Binary Inputs in SYNAX200

The following overview shows the current implementation status in comparison with SYNAX200:

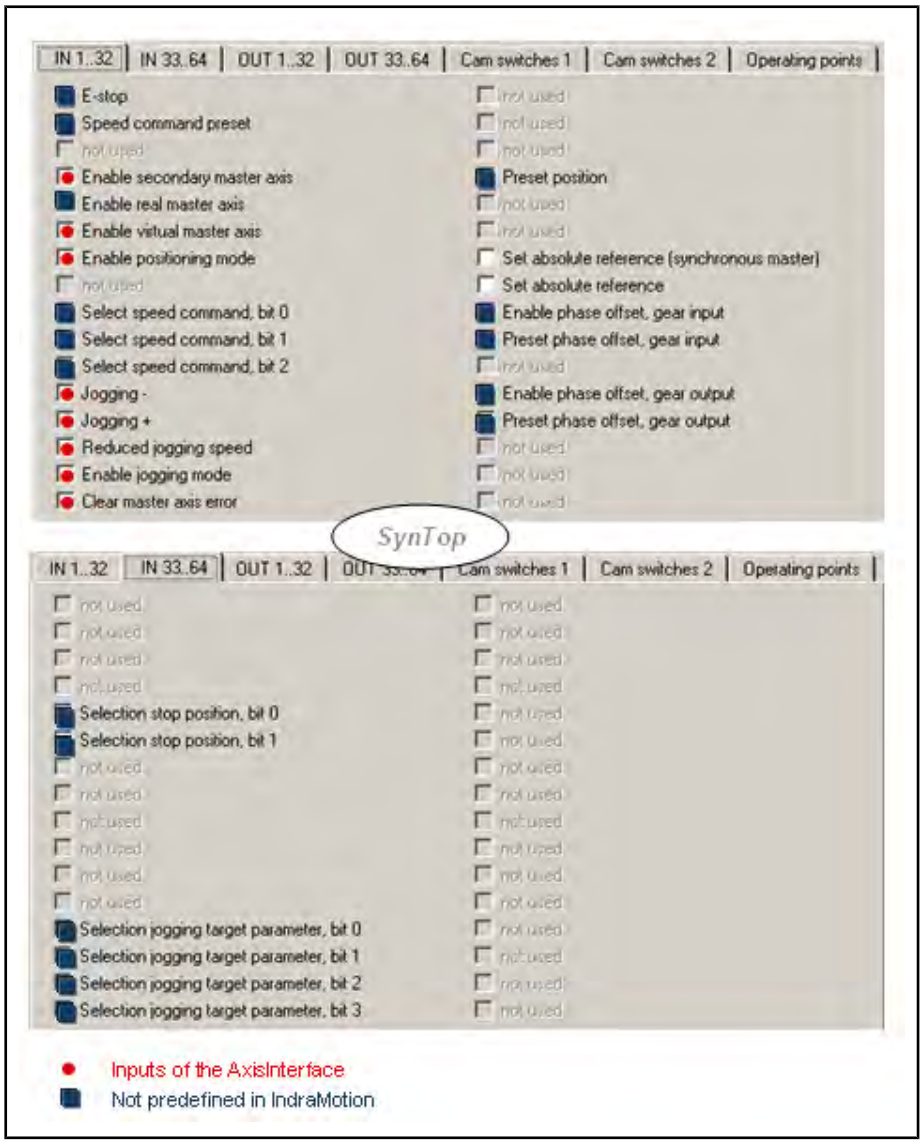


Fig.8-5: Binary inputs for master axes from SYNAX200

8.3.2 Which inputs have been omitted?

Preset velocity command value

A preprogrammed preset function is not available. The velocity command value can be changed directly in the PLC program.

Selecting the velocity command value bit 0, bit 1, bit 2

Velocity command values can be provided in the PLC program as an array, for example. The current command value can be specified in the program at any time without any special bit handling.

Preset position

A preprogrammed preset function is not available. A preset for the master axis position can be realized using master axis positioning.

Enable phase offset, gear input

Currently there is no standard solution. If necessary, the function can be mapped into the PLC program.

Preset phase offset, gear input

Currently there is no standard solution. If necessary, the function can be mapped into the PLC program.

Enable phase offset, gear output

Currently there is no standard solution. If necessary, the function can be mapped into the PLC program.

Preset phase offset, gear output

Currently there is no standard solution. If necessary, the function can be mapped into the PLC program.

Target position selection bit 0, bit 1

Position command values can be provided in the PLC program as an array, for example. The current target position can be written in the program at any time without any special bit handling.

Selecting jogging target parameters bit 0, bit 1, bit 2, bit 3

The axis interface provides separate jog inputs for various target parameters for each operating mode.

Selecting the target parameters is not required.

8.3.3 Master Axis Inputs: Overview Table

SYNAX200 inputs	IndraMotion inputs
General functions	
E-Stop	arAxisCtrl[i].Admin._OpMode.en := ModeAH
Clear master axis error	arAxisCtrl[i].Admin. ClearError
Positioning mode	
Enable positioning mode	arAxisCtrl[i].Admin._OpMode.en := ModePosAbs arAxisCtrl[i].Admin._OpMode.en := ModePosRel arAxisCtrl[i].Admin._OpMode.en := ModePosAdd
Velocity mode	
Enable virtual master axis	arAxisCtrl[i].Admin._OpMode.en := ModeVel
Jog functions	
Enable jog mode	**Separate inputs for each operating mode and parameter:** arAxisCtrl[i].**PosMode**.Adjust.Enable arAxisCtrl[i].**VelMode**.Adjust.Enable
Jog -	arAxisCtrl[i].**PosMode**.Adjust. Inc arAxisCtrl[i].**VelMode**.Adjust. Inc

SYNAX200 inputs	IndraMotion inputs
Jog +	arAxisCtrl[i].**PosMode**.Adjust. Dec arAxisCtrl[i].**VelMode**.Adjust. Dec
Incremental jogging: adjustable using parameters in SYNAX200	arAxisCtrl[i].**PosMode**.Adjust.SelIncAdjust arAxisCtrl[i].**VelMode**.Adjust.SelIncAdjust

8.3.4 Master Axis Outputs: Overview of the Binary Outputs in SYNAX200

The following overview shows the current implementation status in comparison with SYNAX200:

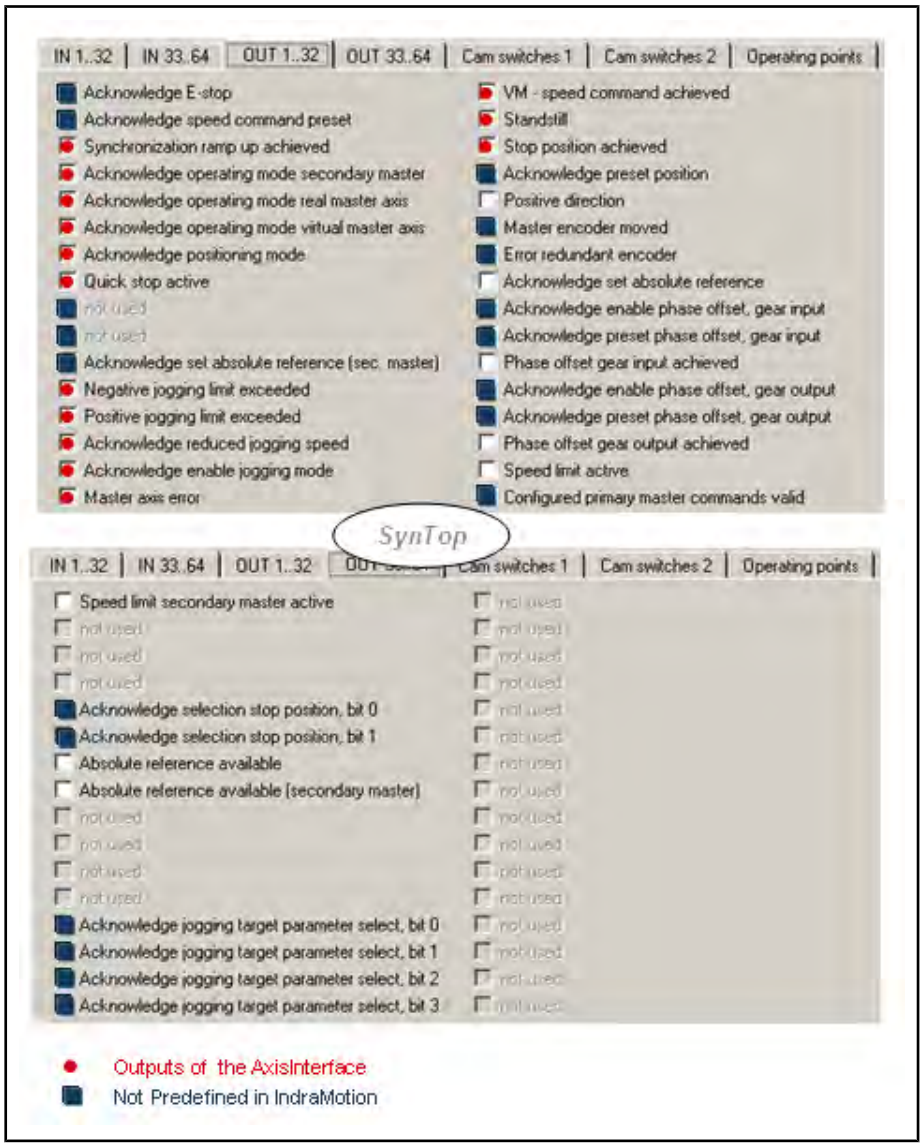


Fig.8-6: Binary outputs for master axes from SYNAX200

Mapping the Binary Control Signals from SYNAX200 into IndraMotion for Printing

8.3.5 Master Axis Outputs: Overview Table

SYNAX200 outputs	IndraMotion outputs
General functions	
Acknowledge homing, absolute value present	AxisData[i].Axis_Homed
Standstill	AxisData[i].Axis_Standstill
Error warning	arAxisStatus[i].Diag.Warning
Error	arAxisStatus[i].Diag.Error
Positioning mode	
Acknowledge operating mode positioning	Absolute positioning: arAxisStatus[i].Admin. MODE_POS_ABS
---	Relative positioning: arAxisStatus[i].Admin. MODE_POS_REL
Target position reached	AxisData[i].Axis_InPosition
idle	
Acknowledge operating mode idle	arAxisStatus[i].Admin. MODE_VEL
Idle speed reached	AxisData[i].Axis_InVelocity
Jog functions	
Acknowledge enable jog mode	**Separate acknowledgements for each operating mode and parameter:** arAxisStatus[i].**PosMode**.Adjust.ModeAck arAxisStatus[i].**VelMode**.Adjust.ModeAck
Negative jog limit reached	arAxisStatus[i].**PosMode**.Adjust.LowLimit Ack arAxisStatus[i].**VelMode**.Adjust.LowLimit Ack
Positive jog limit reached	arAxisStatus[i].**PosMode**.Adjust.HighLimit Ack arAxisStatus[i].**VelMode**.Adjust.HighLimit Ack

9 Mapping the Parameters from SYNAX200 into IndraMotion for Printing and Converting

9.1 Drive Parameters / Variables

9.1.1 Overview Table of Typical Input Values (Real Axis)

SYNAX200 - parameters	Variables / parameters in IndraMotion
A-0-0170 Electronic gear - input revolutions	arAxisCtrl[i]. SyncMode. InputRevolution
A-0-0126 Electronic gear - output revolutions	arAxisCtrl[i]. SyncMode. OutputRevolution
A-0-0004 Position command value additive	arAxisCtrl[i]. SyncMode. PhaseOffset
A-0-0060 Gear ratio fine adjustment	arAxisCtrl[i]. SyncMode. Fineadjust
A-0-0124 Cam stroke	arAxisCtrl[i]. SyncMode. CamShaftDistance
A-0-0096 Phase offset table begin	P-0-0061 Cyclical application (UserData)
A-0-0005 Position command value additive change rate	arAxisCtrl[i]. SyncMode. PhaseOffsetVel
- not available in SYNAX200 -	arAxisCtrl[i]. SyncMode. PhaseOffsetAcc
P-0-0154 Synchronization direction	arAxisCtrl[i]. SyncMode. SyncDirection
P-0-0154 Synchronization mode	arAxisCtrl[i]. SyncMode. StartMode
A-0-0011 Idle speed	arAxisCtrl[i]. VelMode. Velocity
A-0-0012 Idle acceleration	arAxisCtrl[i]. VelMode. Acceleration
- not available in SYNAX200 -	arAxisCtrl[i]. VelMode. Deceleration
S-0-0057 Positioning window	A-0-0203 Direction of travel
A-0-0056 Target position	arAxisCtrl[i]. PosMode. Position
A-0-0135 Relative travel	arAxisCtrl[i]. PosMode. Distance
A-0-0099 Positioning velocity	arAxisCtrl[i]. PosMode. Velocity
- not a control parameter in SYNAX200	arAxisCtrl[i]. PosMode. Acceleration
- not a control parameter in SYNAX200	arAxisCtrl[i]. PosMode. Deceleration

The command values in effect are shown as parameters (read only) and displayed in IndraWorks.

Mapping the Parameters from SYNAX200 into IndraMotion for Printing and Converting

Example:

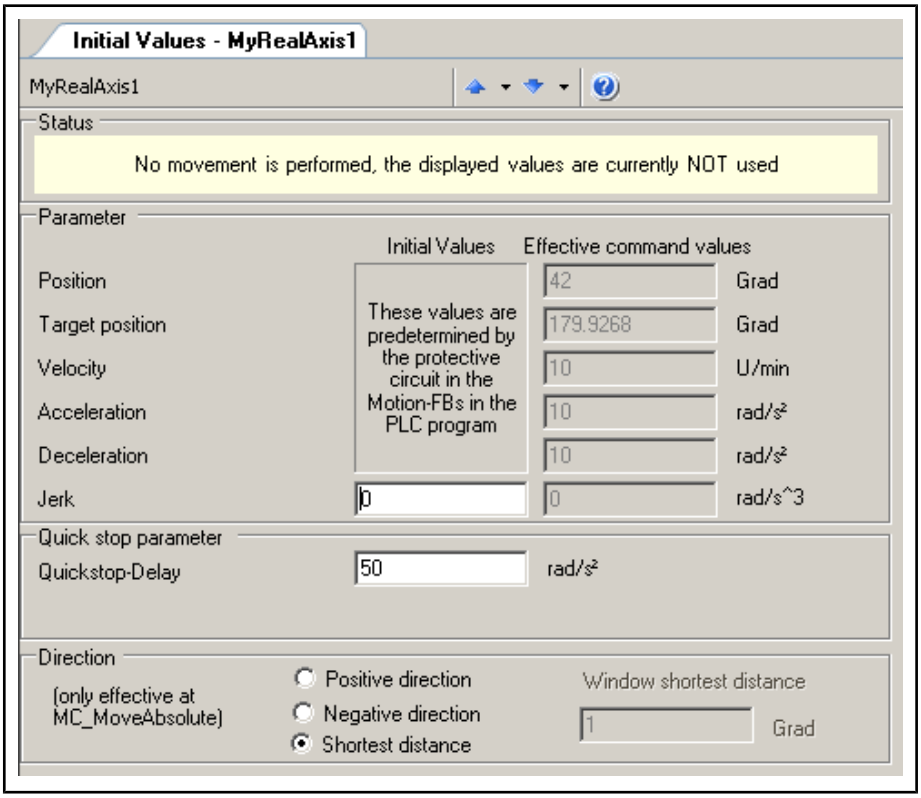


Fig.9-1: Display of the command values - real axis in effect

9.1.2 Overview Table of Typical Output Values (Drive)

SYNAX200 - parameters	Variables in IndraMotion
S-0-0051 / S-0-0052 Actual position value	AxisData[i]. rActualPosition_i
S-0-0036 Actual velocity	AxisData[i]. rActualVelocity_i
S-0-0084 Torque/force actual value	AxisData[i]. rActualTorqueForce_i

9.2 Master Axis Parameters / Variables

9.2.1 Overview Table of Typical Input Values (Master Axis)

SYNAX200 - parameters	Variables in IndraMotion
C-0-0006 VL - Additive velocity command value 1	arAxisCtrl[i]. VelMode. Velocity
C-0-0008 VL - Bipolar acceleration	arAxisCtrl[i]. VelMode. Acceleration
C-0-0009 Emergency halt deceleration	arAxisCtrl[i]. VelMode. Deceleration
C-0-0010 E-stop deceleration	arAxisCtrl[i]. Admin. Axis. StopDeceleration
C-0-0077 VL - Bipolar jerk limitation	A-0-0216 Jerk

The command values in effect are shown as parameters (read only) and displayed in IndraWorks:

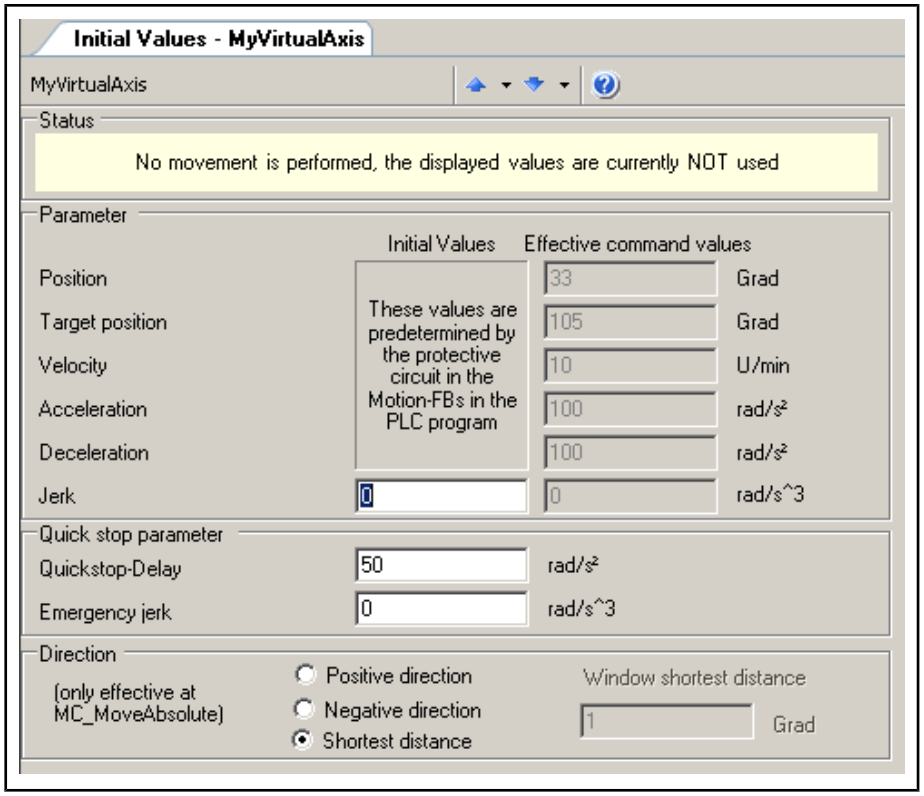


Fig.9-2: Display of the command values - virtual axis in effect

9.2.2 Overview Table of Typical Output Values (Master Axis)

SYNAX200 - parameters	Variables in IndraMotion
C-0-0066 Starting position	AxisData[i]. rActualPosition_i
C-0-0067 Output velocity	AxisData[i]. rActualVelocity_i

10 Service and Support

Our service helpdesk at out headquarters in Lohr, Germany, will assist you with all kinds of enquiries. Out of helpdesk hours please contact our German service department directly.

	Helpdesk	Service Hotline Germany	Service Hotline Worldwide
Time [1]	Mo-Fr 7:00 am - 6:00 pm CET	Mo-Fr 6:00 pm - 7:00 am CET Sa-Su 0:00 am - 12:00 pm CET	Outwith Germany please contact our sales/service office in your area first. For hotline numbers refer to the sales office addresses on the Internet.
Phone	+49 (0) 9352 40 50 60	+49 (0) 171 333 88 26 or +49 (0) 172 660 04 06	
Fax	+49 (0) 9352 40 49 41	–	
e-mail	service.svc@boschrexroth.de	–	
Internet	http://www.boschrexroth.com You will also find additional notes regarding service, maintenance (e.g. delivery addresses) and training.		

1) Central European Time (CET)

Preparing 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, fax numbers and e-mail address so we can contact you in case of questions.

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Notes

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R911324140

Printed in Germany
DOK-IM*PR*-UPGRADE*V09-AW01-EN-P