

Rexroth OptiFeed-FM CLM1.4 2 (4) Axis Positioning Control with Option Profibus LAP-05VRS

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Functional Description



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with Option Profibus LAP-05VRS

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- for description of all functional features

Record of Revisions

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1 System Setup

1.1 The CLM at a Glance

The CLM is a compact, modular, 4-axis CNC control that can be combined with maintenance-free dynamic Rexroth AC Servo drives to create an efficient and economical control and drive system.

Typical applications are:

- Feed-to-Length Systems
- Packaging Machinery
- Thermoforming Machinery
- Linear Portals
- Robot Devices
- Bending Machinery
- Wood-processing Machinery

The efficient user program enables the CLM to execute complicated processes.

Combined with maintenance-free, dynamic Rexroth AC Servo drives, the CLM achieves:

- a noticeable increase in productivity because of improved system availability and higher feed-to-length capacity.
- markedly increased quality through incremental control of position, velocity and acceleration.
- eliminating the need for an additional PLC control through many additional functions.
- ON-LINE programmability
- programming in the appropriate language, either directly from the front panel or from a PC via a serial interface.
- tailoring of drive and machine data using simple parameter input. no specialized unit is required for parameter input.
- segmentation of complex machine processes due to a user program with 3000 instructions. immediate availability of all status information about initial startup, monitoring and service support via the system display or the serial interface.
- increased system security because of continuous drive and measuring wheel encoder monitoring.
- a compact control and drive package, in combination with Rexroth drives.

1.2 Technical Data

- Operating Modes:**
- Parameter Input
 - Manual
 - Automatic
- Control Characteristics:**
- 4 axes
 - units can be defined in mm, inches and degrees
 - dimensions can be programmed as incremental or absolute
 - preselection of velocity in ‰ of Vmax
 - maximum system and manual (jog) velocity programmable via parameters
 - feed velocity programmable via the user program
- Program Data:**
- 3000 instructions
 - any number of subprograms, with nesting hierarchy up to 127
 - system variables
 - 400 available variables
 - 224 marker flags
- Logic Task:**
- 1000 assignments
 - Processing speed: 1000 assignments/sec
 - Cycle time 4ms
 - System Marker Flags
 - 320 marker flags
- Interfaces:**
- parallel interface
24 permanent system inputs and 18 permanent system outputs
88 inputs and 51 outputs available (freely-programmable) in the user program
- Control Interface:**
- 4 analog inputs +/- 10 V (12-bit resolution)
 - 4 analog outputs +/- 10 V (14-bit resolution) – for controlling 4 servo drives
- Data Interface:**
- serial, RS232C or RS485
 - freely-selectable baud rate and transmission format
- Fieldbus Interface:**
- Profibus
- Measuring System Interface:**
- linear and rotary incremental encoders with a maximum sampling frequency of 1 MHz
 - synchronous absolute encoders / SSI synchronous transmission, gray-coded
- Voltage Supply:**
- Voltage: + 24 V DC; + 20 %; determined by the drive electronics, e.g. TVM, KDV, TVD

- Current Requirements:**
- approx. 450mA – for the CLM without encoder or accessories
 - approx. 50 mA – per incremental encoder
 - approx. 125 mA – per absolute encoder
 - approx. 50 mA – for the decade switch unit (IDS01)
 - approx. 100 mA – for the expansion of inputs and outputs (Option E)
- Dimensions:**
- The dimensions of the CLM control correspond to the modularly built Rexroth AC controllers, e.g. TVM and TDM.
Depth x Width x Height = 330 x 105 x 390 mm
- Weight:**
- The CLM control weighs approximately 13.3 lbs. (6 kg).

1.3 Saving Data

The user program is saved in buffered RAM memory on a module card (MOK19) inside the CLM.

Note: This data can be lost in the event of an error. Therefore, it is critically important to back up this data in another place outside the control. (e.g.: external computer that contains the MotionManager PC program, or as a hard copy)

Buffering occurs with the help of a battery back-up, which is continuously charged during operation and which provides power to the RAM memory when the power supply is turned off. At the factory, the battery is not charged to 100% capacity. Total charging time is approx. 40 hours and data security using a fully charged battery is 0.5 years.

During each new start-up of the control and every four hours during operation, a battery test is performed. If the battery charge not sufficient, the error `Battery is low` is displayed after turning on the power supply, and the `Error` output is not set. This error can be cleared using the Clear key. Every 10 minutes, the message `Battery is low` is displayed.

1.4 System Overview

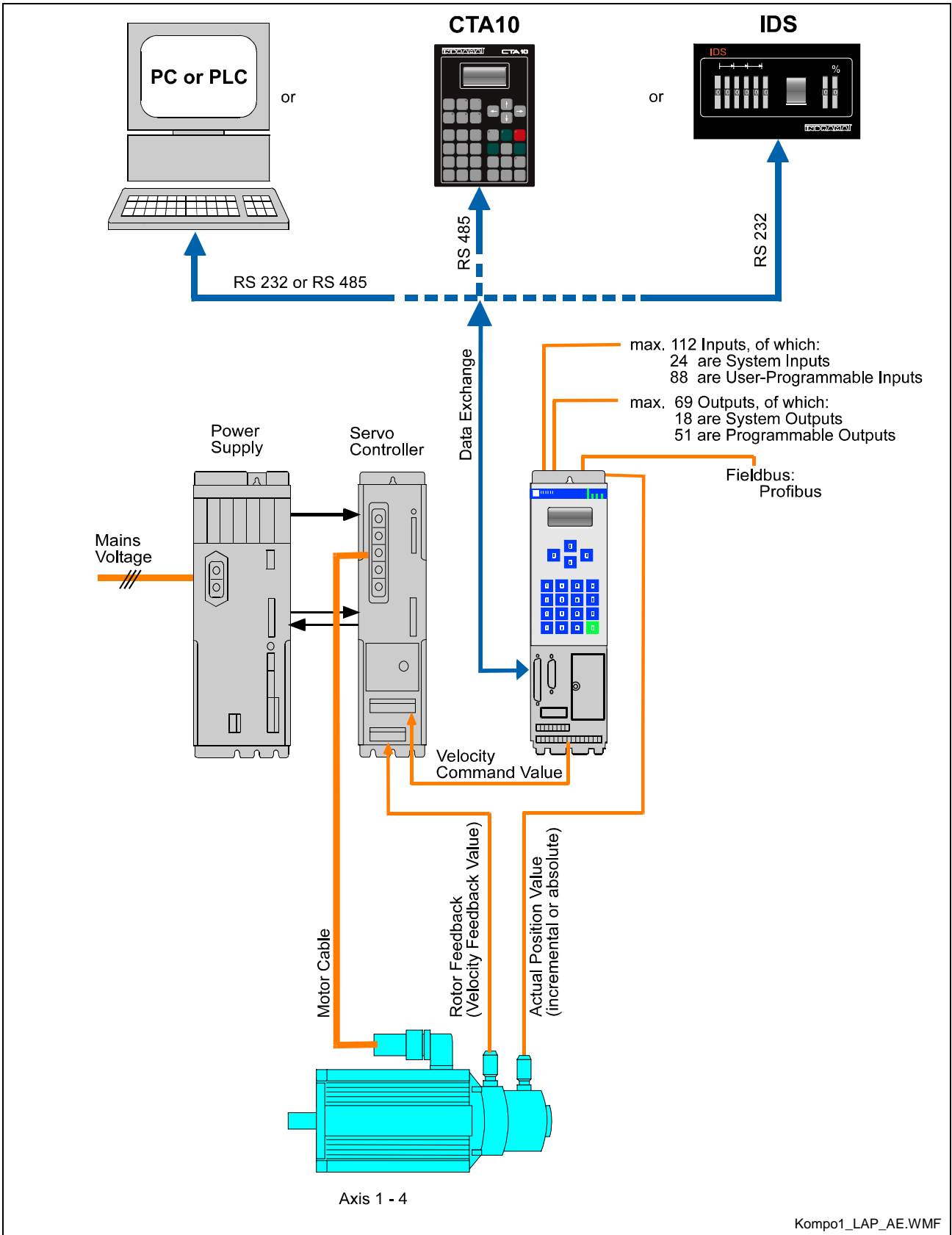


Fig. 1-1: System Overview

Kompo1_LAP_AE.WMF

2 Important directions for use

2.1 Appropriate use

Introduction

All Rexroth controls and drives are developed and tested according to the state-of-the-art of technology.

As it is impossible to follow the continuing development of all materials (e.g. lubricants in machine tools) which may interact with our controls and drives, it cannot be completely ruled out that any reactions with the materials used by Bosch Rexroth might occur.

For this reason, before using the respective material a compatibility test has to be carried out for new lubricants, cleaning agents etc. and our housings/our housing materials.

The products may only be used in the manner that is defined as appropriate. If they are used in an inappropriate manner, then situations can develop that may lead to property damage or injury to personnel.

Note: Rexroth, as manufacturer, is not liable for any damages resulting from inappropriate use. In such cases, the guarantee and the right to payment of damages resulting from inappropriate use are forfeited. The user alone carries all responsibility of the risks.

Before using Rexroth products, make sure that all the pre-requisites for appropriate use of the products are satisfied:

- Personnel that in any way, shape or form uses our products must first read and understand the relevant safety instructions and be familiar with appropriate use.
- If the product takes the form of hardware, then they must remain in their original state, in other words, no structural changes are permitted. It is not permitted to decompile software products or alter source codes.
- Do not mount damaged or faulty products or use them in operation.
- Make sure that the products have been installed in the manner described in the relevant documentation.

Areas of use and application

Rexroth CLM1.4-LAP defines appropriate use as for precision motion control of to four axes.

Control and monitoring of (the) CLM1.4-LAP may require additional sensors and actors.

Note: CLM1.4-LAP may only be used with the accessories and parts specified in this document. If a component has not been specifically named, then it may not be either mounted or connected. The same applies to cables and lines.

Operation is only permitted in the specified configurations and combinations of components using the software and firmware as specified in the relevant function descriptions.

The CLM1.4-LAP and every drive controller has to be programmed before starting it up, making it possible for the motor to execute the specific functions of an application.

The CLM1.4-LAP has been developed for use in single or multiple-axis drives and control tasks.

Typical applications of CLM1.4-LAP are:

- Handling and assembly systems,
- Roll feeds
- Automatic bending machines and
- Woodworking machines

The CLM1.4-LAP may only be operated under the assembly, installation and ambient conditions as described here (temperature, system of protection, humidity, EMC requirements, etc.) and in the position specified.

2.2 Inappropriate use

Using the CLM1.4-LAP 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".

CLM1.4-LAP may not be used if

- they are subject to operating conditions that do not meet the above specified ambient conditions. This includes, for example, operation under water, in the case of extreme temperature fluctuations or extremely high maximum temperatures or if
- Rexroth has not specifically released them for that intended purpose. Please note the specifications outlined in the general Safety Guidelines!

3 Safety Instructions for Electric Drives and Controls

3.1 Introduction

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

Do not attempt to install or start up this equipment without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment, contact your local Bosch Rexroth representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the equipment is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the equipment.



WARNING

Improper use of this equipment, 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!

3.2 Explanations

The safety instructions describe the following degrees of hazard seriousness in compliance with ANSI Z535. The degree of hazard seriousness informs about the consequences resulting from non-compliance with the safety instructions.

Warning symbol with signal word	Degree of hazard seriousness according to ANSI
 DANGER	Death or severe bodily harm will occur.
 WARNING	Death or severe bodily harm may occur.
 CAUTION	Bodily harm or material damage may occur.

Fig. 3-1: Hazard classification (according to ANSI Z535)

3.3 Hazards by Improper Use



DANGER

**High voltage and high discharge current!
Danger to life or severe bodily harm by electric shock!**



DANGER

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



WARNING

High electrical voltage due to wrong connections! Danger to life or bodily harm by electric shock!



WARNING

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



CAUTION

Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!



CAUTION

Risk of injury due to improper handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock or incorrect handling of pressurized systems!



CAUTION

Risk of injury due to incorrect handling of batteries!

3.4 General Information

- 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 starting up 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 equipment.
- Only persons who are trained and qualified for the use and operation of the equipment may work on this equipment or within its proximity.
 - The persons are qualified if they have sufficient knowledge of the assembly, installation and operation of the equipment 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 equipment 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 equipment is designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Use only safety features and applications that are clearly and explicitly approved in the Project Planning Manual.

For example, the following areas of use are not permitted: construction cranes, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, transport of hazardous goods, nuclear applications, applications sensitive to high frequency, mining, food processing, control of protection equipment (also in a machine).
- 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.
- Startup 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 documentation "EMC in Drive and Control Systems".
The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national regulations.
- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

3.5 Protection Against Contact with Electrical Parts

Note: This section refers to equipment and drive components with voltages above 50 Volts.

Touching live parts with voltages of 50 Volts and more with bare hands or conductive tools or touching ungrounded housings can be dangerous and cause electric shock. In order to operate electrical equipment, certain parts must unavoidably have dangerous voltages applied to them.



DANGER

High electrical voltage! Danger to life, severe bodily harm by electric shock!

- ⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.
 - ⇒ Follow general construction and safety regulations when working on high voltage installations.
 - ⇒ Before switching on power the ground wire must be permanently connected to all electrical units according to the connection diagram.
 - ⇒ Do not operate electrical equipment at any time, even for brief measurements or tests, if the ground wire is not permanently connected to the points of the components provided for this purpose.
 - ⇒ Before working with electrical parts with voltage higher than 50 V, the equipment must be disconnected from the mains voltage or power supply. Make sure the equipment cannot be switched on again unintended.
 - ⇒ The following should be observed with electrical drive and filter components:
 - ⇒ Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning to work. Measure the 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.
 - ⇒ Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.
 - ⇒ A residual-current-operated protective device (RCD) must not be used on electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.
 - ⇒ Electrical components with exposed live parts and uncovered high voltage terminals must be installed in a protective housing, for example, in a control cabinet.
-

To be observed with electrical drive and filter components:



DANGER

**High electrical voltage on the housing!
High leakage current! Danger to life, danger of
injury by electric shock!**

- ⇒ Connect the electrical equipment, the housings of all electrical units and motors permanently with the safety conductor at the ground points before power is switched on. Look at the connection diagram. This is even necessary for brief tests.
- ⇒ Connect the safety conductor of the electrical equipment always permanently and firmly to the supply mains. Leakage current exceeds 3.5 mA in normal operation.
- ⇒ Use a copper conductor with at least 10 mm² cross section over its entire course for this safety conductor connection!
- ⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. Otherwise, high voltages can occur on the housing that lead to electric shock.

3.6 Protection Against Electric Shock by Protective Low Voltage (PELV)

All connections and terminals with voltages between 0 and 50 Volts on Rexroth products are protective low voltages designed in accordance with international standards on electrical safety.



WARNING

**High electrical voltage due to wrong
connections! Danger to life, bodily harm by
electric shock!**

- ⇒ Only connect equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) to all terminals and clamps with voltages of 0 to 50 Volts.
- ⇒ Only electrical circuits may be connected which are safely isolated against high voltage circuits. Safe isolation is achieved, for example, with an isolating transformer, an opto-electronic coupler or when battery-operated.

3.7 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of the 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.

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 injury 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. Unintended machine motion is possible if monitoring devices are disabled, bypassed or not activated.
 - ⇒ Pay attention to unintended machine motion or other malfunction in any mode of operation.

 - ⇒ 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, especially if there is a possibility of loose parts flying off.
 - ⇒ Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.
 - ⇒ Isolate the drive power connection by means of an emergency stop circuit or use a starting lockout to prevent unintentional start.
 - ⇒ Make sure that the drives are brought to a safe standstill before accessing or entering the danger zone. Safe standstill can be achieved by switching off the power supply contactor or by safe mechanical locking of moving parts.
 - ⇒ 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
 - 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 equipment 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.
-

3.8 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated near current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons 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, hearing aids and metal implants are not permitted to enter the following areas:
 - Areas in which electrical equipment and parts are mounted, being operated or started up.
 - Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.
 - ⇒ If it is necessary for a person with a heart pacemaker to enter such an area, then a doctor must be consulted prior to doing so. Heart pacemakers that are already implanted or will be implanted in the future, have a considerable variation in their electrical noise immunity. Therefore there are no rules with general validity.
 - ⇒ Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise, health hazards will occur.
-

3.9 Protection Against Contact with Hot Parts



CAUTION

Housing surfaces could be extremely hot! Danger of injury! Danger of burns!

- ⇒ Do not touch housing surfaces near sources of heat! Danger of burns!
- ⇒ After switching the equipment off, wait at least ten (10) minutes to allow it to cool down before touching it.
- ⇒ Do not touch hot parts of the equipment, such as housings with integrated heat sinks and resistors. Danger of burns!

3.10 Protection During Handling and Mounting

Under certain conditions, incorrect handling and mounting of parts and components may cause injuries.



CAUTION

Risk of injury by incorrect handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock!

- ⇒ Observe general installation and safety instructions with regard to handling and mounting.
- ⇒ Use appropriate mounting and transport equipment.
- ⇒ Take precautions to avoid pinching and crushing.
- ⇒ Use only appropriate tools. If specified by the product documentation, special tools must be used.
- ⇒ Use lifting devices and tools correctly and safely.
- ⇒ For safe protection wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
- ⇒ Never stand under suspended loads.
- ⇒ Clean up liquids from the floor immediately to prevent slipping.

3.11 Battery Safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or material damage.



CAUTION

Risk of injury by incorrect handling!

- ⇒ Do not attempt to reactivate discharged batteries by heating or other methods (danger of explosion and cauterization).
- ⇒ Never charge non-chargeable batteries (danger of leakage and explosion).
- ⇒ Never throw batteries into a fire.
- ⇒ Do not dismantle batteries.
- ⇒ Do not damage electrical components installed in the equipment.

Note: Be aware of environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose batteries separately from other waste. Observe the legal requirements in the country of installation.

3.12 Protection Against Pressurized Systems

Certain motors and drive controllers, corresponding to the information in the respective Project Planning Manual, must be provided with pressurized media, such as compressed air, hydraulic oil, cooling fluid and cooling lubricant supplied by external systems. Incorrect handling of the supply and connections of pressurized systems can lead to injuries or accidents. In these cases, improper handling of external supply systems, supply lines or connections can cause injuries or material damage.



CAUTION

Danger of injury by incorrect handling of pressurized systems !

- ⇒ Do not attempt to disassemble, to open or to cut a pressurized system (danger of explosion).
- ⇒ Observe the operation instructions of the respective manufacturer.
- ⇒ Before disassembling pressurized systems, release pressure and drain off the fluid or gas.
- ⇒ Use suitable protective clothing (for example safety glasses, safety shoes and safety gloves)
- ⇒ Remove any fluid that has leaked out onto the floor immediately.

Note: Environmental protection and disposal! The media used in the operation of the pressurized system equipment may not be environmentally compatible. Media that are damaging the environment must be disposed separately from normal waste. Observe the legal requirements in the country of installation.

Notes

4 Display and Operating Devices

4.1 General Information about the CTA

The CTA, which has a liquid-crystal display (LCD), is located on the front panel of the CLM.

The display consists of 4 lines of 16 characters each. Below the display is a keypad with pressure-sensitive keys for data entry and manipulation of the display options.

A cursor blinks at the location where an input is to be made. The cursor automatically moves to the next position after a data key is pressed.

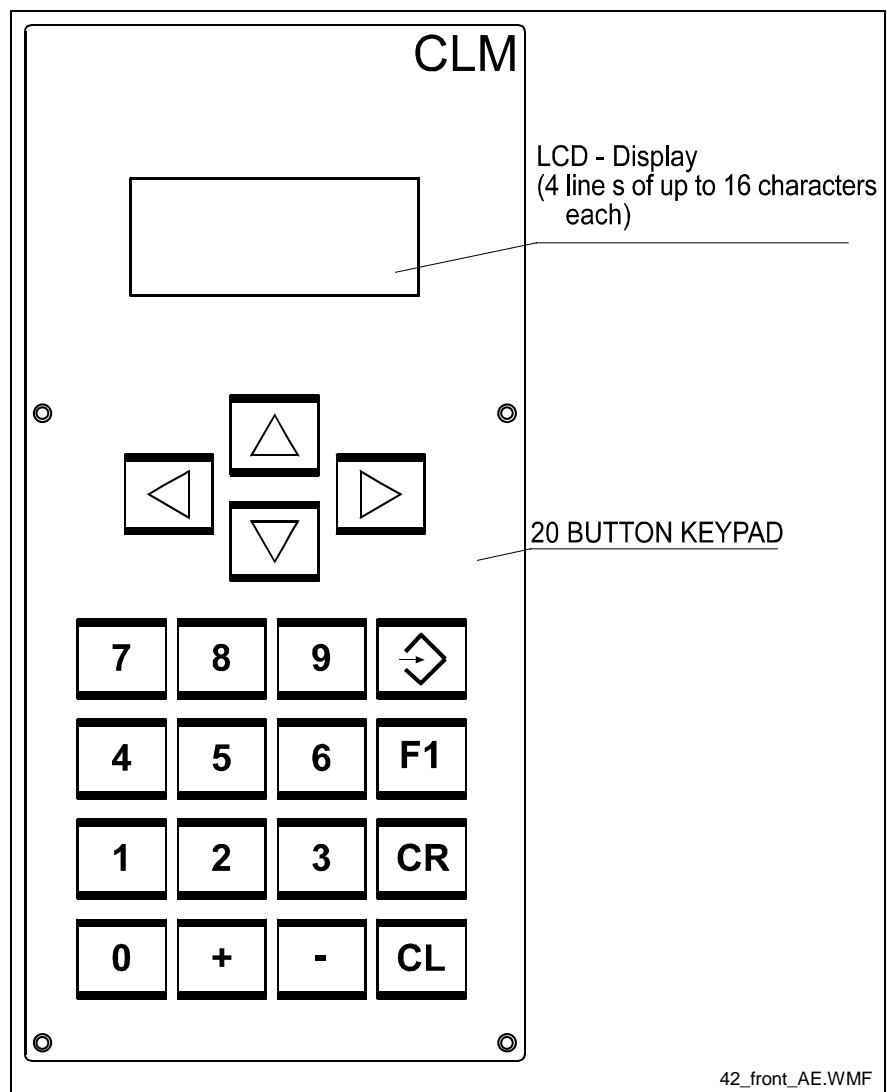


Fig. 4-1: Front Panel

CLM Display

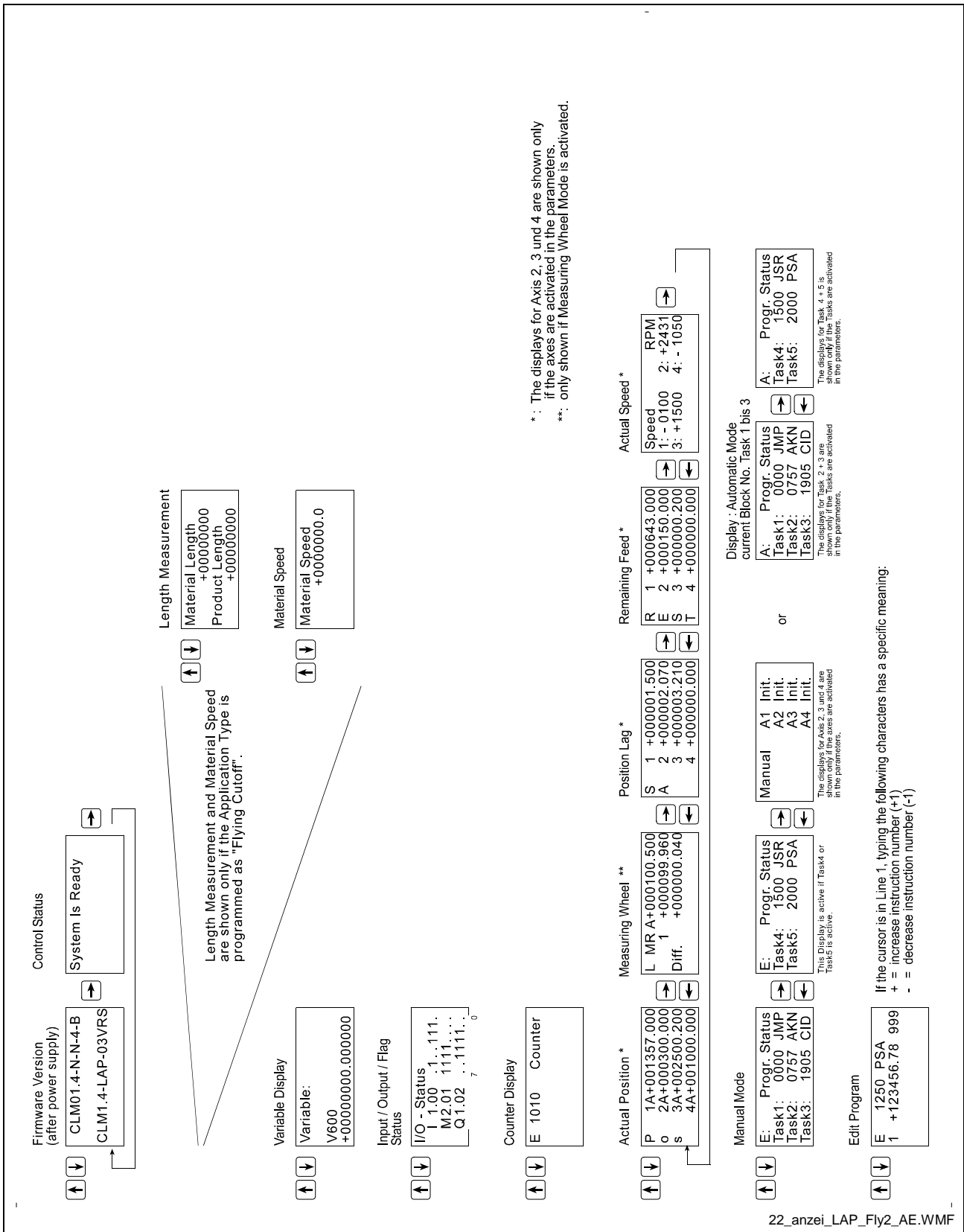


Fig. 4-2: Map of Display Screens

4.2 Description of the Input Keys

Data Entry Keys



to



These keys allow for the input of program, Logic Task or parameter data and their functionality, depending on the type of data required.



or



These keys allow for input of the operational sign (e.g. feed direction) during program input (cursor in 2nd display line), and are displayed accordingly. In addition, the program instruction number (cursor in 1st display line), the Logic Task instruction number, the counter number, the variable number or the parameter number can be quickly edited by ± 1 .

Control Keys



Faults can be cleared using the 'Clear' key.



Using this key, the cursor can be moved to defined positions for data input.

Program Load: Pressing the CR key twice moves the cursor from the second display line to the first line directly following the program command, and on the first digit of the program instruction number.

Parameter Input: Pressing the CR key twice moves the cursor from any position in the data field to the first position of the data field and then to the second digit of the parameter number.



or



These keys move the cursor by one space to the right or left. During data input, the cursor is moved within the data field depending on the internal input mask, which means that the cursor can only be moved to fields which require an input.



or



1. With these keys, switching between different display options is possible.

2. Display Mode 'Program Load':

If the cursor is positioned after the command, the user can use these keys to scroll through the user commands.

If the cursor is placed at a position that can contain M, Q, I or O, the user can scroll through these characters.

If the cursor is positioned at a position that can contain a V (variable), the user can toggle between variable and constant input types.

3. Display Mode 'Parameter Input':

If the cursor is positioned on the parameter number, the user can scroll through the parameter types (B0, A1, A2, A3, A4, C0).

If the cursor is placed at a position that can contain M, Q, I or O, the user can scroll through these characters.

2. Display Mode 'Logic Task Input':

If the cursor is positioned in the command, the user can use these keys to scroll through the Logic Task commands.

If the cursor is placed at a position that can contain M, Q or I, the user can scroll through these characters.



Program Load: After pressing this key, the data shown on the display is transferred to the program memory. After the data is transferred, the next program instruction (current instruction number +1) is displayed and the cursor is placed after the command.

Parameter Input: After pressing this key, the data shown on the display is transferred to the parameter memory. After the data is transferred, the next parameter (current number + 1) is displayed.

For Logic Task Input: After pressing this key, the data shown on the display is transferred to the Logic Task memory. After the data is transferred, the next Logic Task instruction (current instruction number +1) is displayed and the cursor is placed in the command.



1. Display Mode 'Program Load':

If the cursor is positioned after the command, an 'NOP' is displayed when pressing this key. This way, 'NOP' can more quickly be written into program lines.

2. Display Mode 'Firmware Version':

Pressing this key displays the release status in the 4th display line.

3. Display Mode 'Parameter Input' or 'Logic Task Input':

Pressing this key toggles between 'Parameter Input' and 'Logic Task Input' Modes.

4. Display Mode 'Diagnostic Status Message'

If the CLM displays an error message, pressing this key displays the NC instruction, Logic Task instruction or variable where the error occurred.

4.3 Description of the Display Modes

Because of the varied information that must be displayed, the display is multi-functional. The operating mode determines the available quantity and types of display modes.

The following operating modes exist:

- Parameter
- Manual
- Automatic

Depending on the operating mode, the following displays are possible:

Operating Mode: Parameter



1. Parameter Input
2. Logic Task Input

Operating Mode: Manual

1. CLM Firmware Version / Diagnostics
2. (Length Counter)
3. (Material Velocity)
4. Variable Display
5. Status of the inputs, outputs and markers
6. Counter
7. Position Display / (Measuring Wheel) / Position Lag / Remaining Distance / Velocity
8. Task Display
9. Program Input

Operating Mode: Automatic

1. CLM Firmware Version / Diagnostics
2. (Length Counter)
3. (Material Velocity)
4. Variable Display
5. Status of the inputs, outputs and markers
6. Counter
7. Position Display / (Measuring Wheel) / Position Lag / Remaining Distance / Velocity
8. Task Display
9. Program Input

After turning on the control or after clearing a fault, the CLM either displays the firmware version or 'Parameter Input' mode is active (see Operating Mode). The  and  keys allow scrolling between the displays.

Variable Display

```

Variable :
V 6 0 0
+ 0 0 0 0 0 0 0 0 . 0 0 0 0 0 0
    
```

In this display, the variable contents are shown. The contents of the user-programmable variables (V600 to V999) can be edited directly .

Display: Inputs / Outputs / Marker Flags

I / O	-	Status
I 1	. 0 0	. . . 1 1 . . 1
Q 1	. 0 1	1 1 1 . . 1 1 1
M 2	. 0 2	. . . 1 1 1 . .

Bit 7 0

The cursor can be positioned here using the **CR** key. Using the **▲** and **▼** keys, the user can invoke a different display.

In this display, the current status of the inputs, outputs or marker flags is shown. The bits of the selected byte are displayed on each line.

The byte address can be changed by pressing **+** or **-** . Using the **◀** or **▶** keys, you can move between lines.

Counter Display

```



E : 1 2 3 4 Counter
Act . :
Total :
    
```

In this display mode, the current status of any programmed counter can be viewed. The desired program instruction number must be entered in the first line.

To achieve this, the cursor can be moved to the program instruction number by pressing **◀** or **▶** and then entering the desired number using the keys **0** to **9**. The entered program instruction number is maintained in all operating conditions, until a new number is input. If no counter is programmed in the displayed program instruction, nothing is displayed on the second, third and fourth lines.

The program instruction number can be increased or decreased by one by pressing **+** or **-**.


Position Display

In this display mode, the user can display the current position by pressing  or .

Display Mode 'Length'

P	1 A + 0 0 1 3 7 5 . 3 4 5
o	2 + 0 0 0 2 5 0 . 0 0 0
s	3 + 0 0 0 0 1 0 . 5 0 0
	4 A + 0 0 0 5 5 5 . 1 1 0

Actual position value in IU (input units)
 Space = Not Homed
 A = Homed (absolute)
 Axis Number

'Not homed' is displayed if the drive is not set to absolute while detecting a position using an incremental encoder. The actual position display can be reset to zero by pressing , so that a new relative zero point can be entered. Zeroing occurs for all axes.


'Homed' is displayed for the drive, while detecting a position using an incremental encoder after homing, or generally when using an absolute encoder.

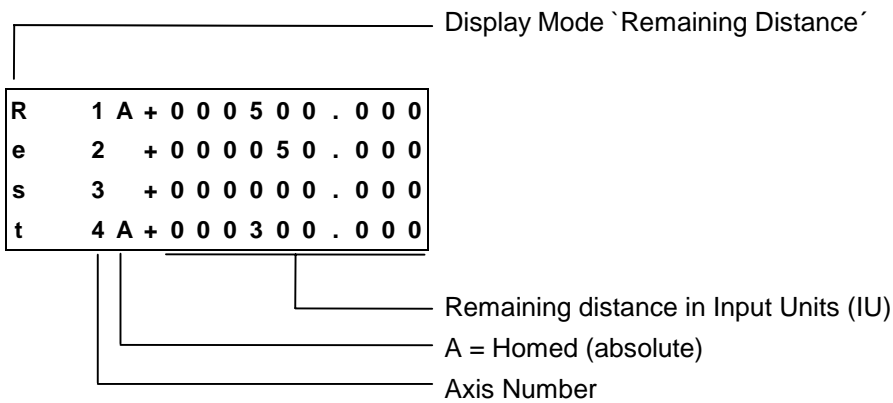
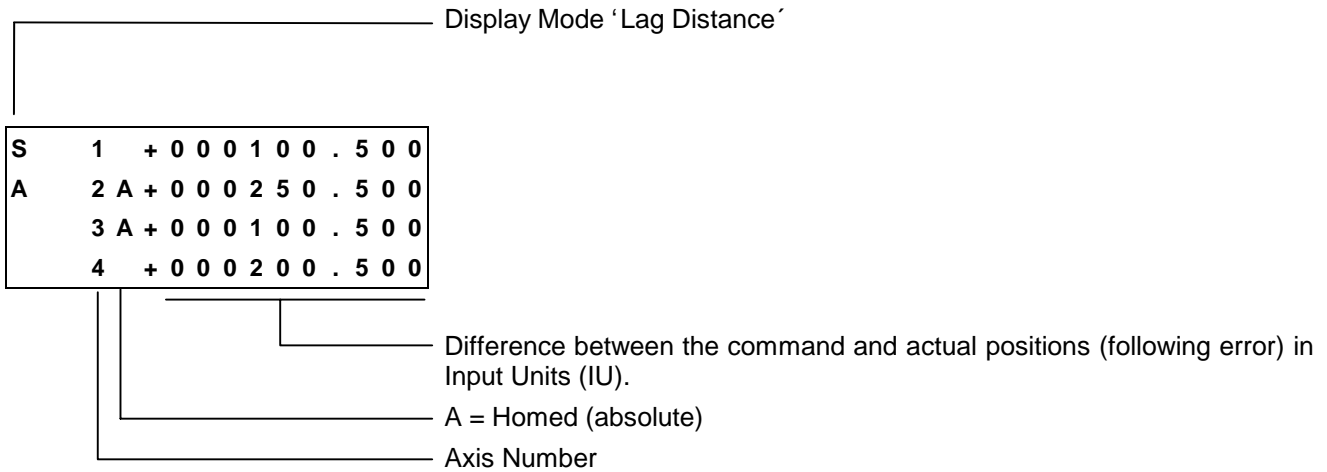
Display Mode 'Length'

Display Measuring Wheel Mode, Axis 1 or Axis 2

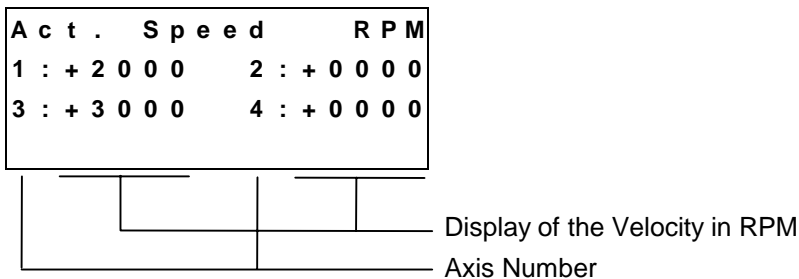
L MR	A + 0 0 1 0 0 . 0 0 0	= Actual Position, Measuring Wheel
1	+ 0 0 0 9 9 . 9 6 0	= Actual Position of Drive, Axis 1 or Axis 2
D i f f .	+ 0 0 0 0 0 . 0 4 0	= Difference between Measuring Wheel and Drive

This display is valid only when Axis 1 or Axis 2 is operated in the 'Measuring Wheel Mode' (Parameter A100 or A200) application type.

If the axis is not homed, the displayed position can be set to zero by pressing .



For Interrupting, Immediate Stop and Positioning Monitoring, the remaining travel distance is shown. For axes that are not programmed, no information is shown on the display.





The displayed velocity is an average of the last 32 cycles, in order to keep the contents of the display consistent. Velocity values are rounded to the nearest whole number. For axes that are not programmed, no information is shown on the display.

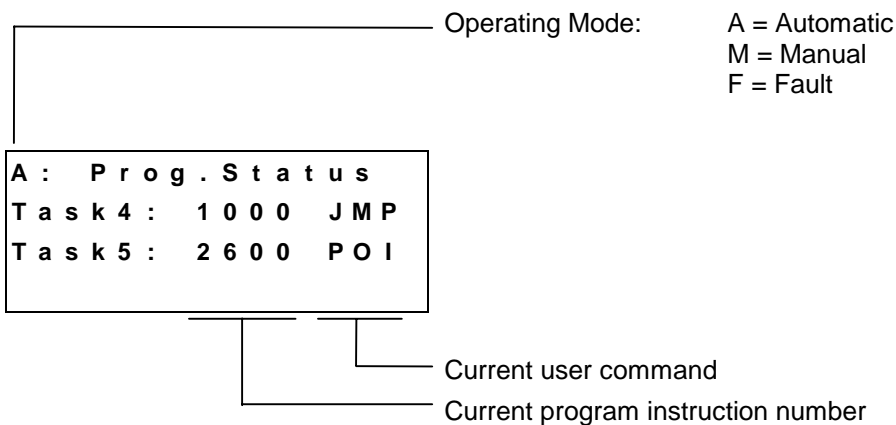
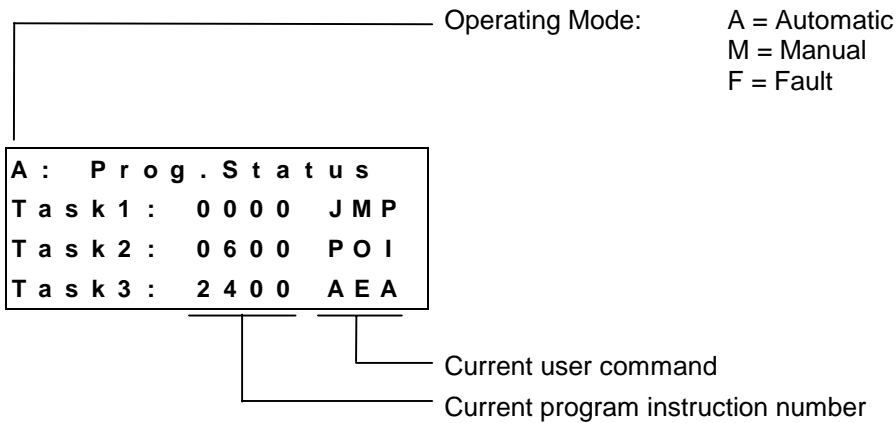
Operation Data

Automatic

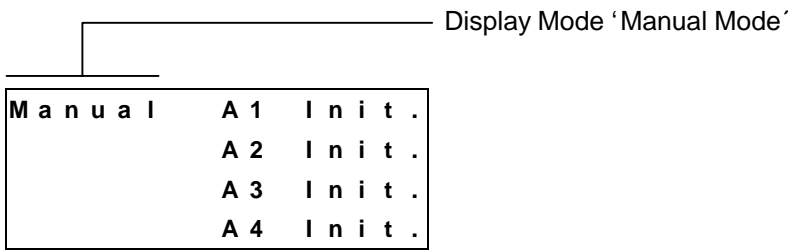
In this display mode, the program instruction that is currently being processed is displayed.

The first 3 tasks (if programmed) are displayed simultaneously. If Tasks 4 and 5 are also programmed, these can be displayed by pressing  or .

The display in Automatic Mode is also valid for Manual Mode.



Manual



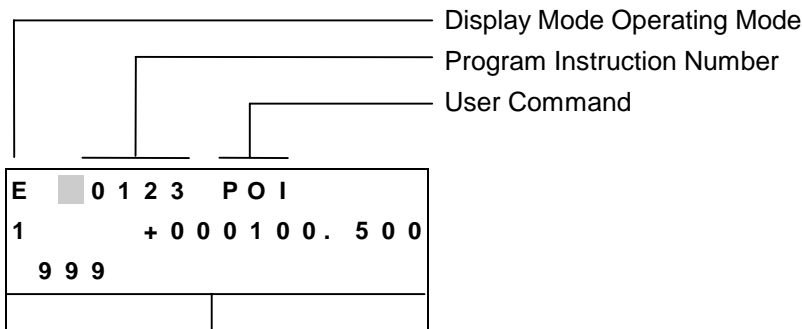
`Init.` = Homed

This information is shown when the applicable drive has been homed as an absolute axis. For absolute encoders, the display is shown immediately; for incremental encoders it is shown after a homing operation.

`A1` to `A4` = Drive 1 to Drive 4

Individual drives are only shown if they are enabled. To accomplish this, the corresponding input `Enable` (Connector 3/Pin 6 or 7, or Connector 22/Pin 1 or 4) must be set to +24V.

Program Input

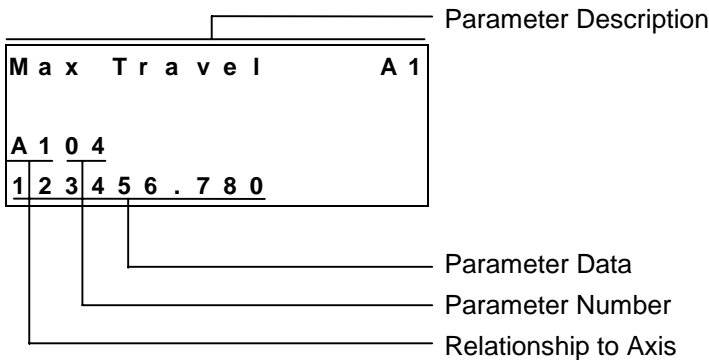


Data that belongs to the displayed user command

In this display mode, the user program can be changed via manual inputs on the keypad. By overwriting the instruction number, each program instruction between 0000 and 2999 can be retrieved and edited.

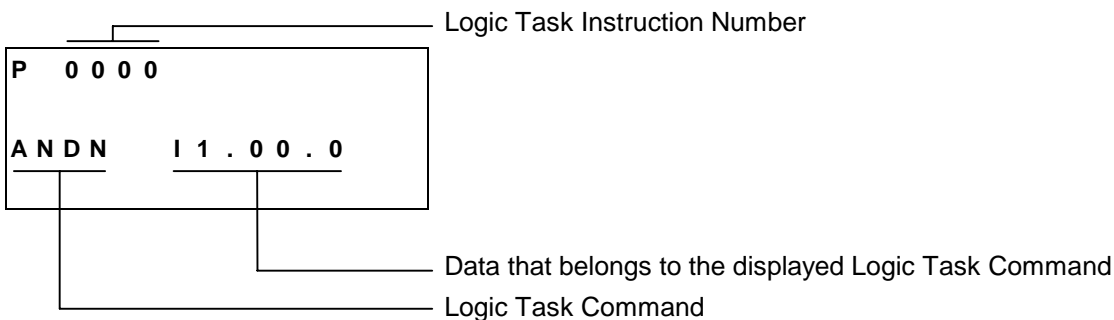
The ability to enter program data via the keypad can be disabled in Parameter B001.

Parameter Input



This display mode is available only in the operating mode 'Parameter'. Here, all rating data of a system is input in parameters. The input of parameters is described in the 'Parameters' chapter. Pressing the **F1** key opens the 'Logic Task Input' display mode.

Logic Task Input



This display mode is available only in the operating mode 'Parameter'. In this display mode, the Logic Task program can be changed via manual inputs on the keypad. By overwriting the instruction number, each program instruction between 0000 and 0999 can be retrieved and edited. Inputting the Logic Task Program is described in the 'Logic Task' chapter. Pressing the **F1** key opens the 'Parameter Input' display mode.

Notes

5 Writing the User Program

5.1 Overview of All User Commands

	Command Code and its Meaning	Page Number
A	ACC - Acceleration Change	5-11
	AEA - Bit Set / Clear	5-12
	AEO - Acceleration Override	5-12
	AKN - Acknowledge Bit	5-13
	AKP - Acknowledge Byte	5-14
	APE - Byte Set / Clear	5-15
B	BAC - Branch Conditional on Count	5-16
	BCE - Branch Conditional on Bit	5-17
	BIC - Branch Conditional on Bit Field Value	5-17
	BIO - Branch Conditional on Byte Compare	5-19
	BPA - Branch Conditional on Byte	5-20
C	CID - Change Variable Value	5-20
	CIO - Copy Bit Field	5-21
	CLC - Clear Counter	5-21
	CON - Continuous Operation	5-22
	COU - Count	5-22
	CPJ - Compare and Jump	5-24
	CPL - Clear Position Lag	5-25
	CPS - Compare and Set a Bit	5-25
	CST - Change Subroutine Stack	5-26
	CVT - Convert Variable <--> Marker	5-27
	E	EOS - End of Synchronization
F	FAK - Length Scaling Factor	5-29
	FOL - Follow Master	5-30
	FUN - Functions	5-31
H	HOM - Home Axis	5-32
J	JMP - Jump Unconditional	5-33
	JSR - Jump to Subroutine	5-33
	JST - Jump and Stop	5-34
	JTK - Jump in Task	5-34

L	LMK - Part Length with Length Correction	5-35
	LML - Part Length	5-36
	LMR - Part Length with Registration	5-37
M	MAT - Mathematics	5-39
	MLO - Material Length Output	5-40
	MLT - Material Length Test	5-41
N	NOP - No Operation	5-41
P	PBK - Stop Motion	5-42
	POA - Positioning, Absolute	5-43
	POI - Positioning, Incremental	5-44
	PSA - Positioning, Absolute with In-Position	5-45
	PSI - Positioning, Incremental with In-Position	5-46
R	REP - Registration Position Limit	5-47
	RMI - Registration Mark Interrupt	5-48
	RSV - Restart Vector	5-50
	RTM - Rotary Table Mode	5-51
	RTS - Return from Subroutine	5-52
S	SAC - Set Absolute Position Counter	5-53
	SET - Set Variable Value	5-57
	SRM - Search for Registration Mark	5-58
	SRP - Print Mark Registration	5-60
T	TXT - Text Row	5-63
V	VCC - Velocity Change	5-64
	VEO - Velocity Override	5-66
W	WAI - Wait (Time Delay)	5-69

5.2 General Information

The basic programming is pre-set, and the user has no external access to it.

The programming language for the user program is a code similar to the BASIC programming language and was developed especially for use with this program.

The user program can have a maximum size of 3000 instructions or lines. Only one command is stored within each program instruction.

In programming, any four-digit program number between `0000` and `2999` is allowed.

The user program can be input via the keypad or loaded via the serial port.

In both cases, program loading can occur in any operating mode. A running program should not be interrupted.

The processing time for an instruction depends on the selected cycle time and is a duration of 2 - 4 ms.

After that, the instruction with the next higher sequence number is processed (unless a jump instruction is given). In the descriptions that follow, this action is called `proceed immediately to next instruction`.

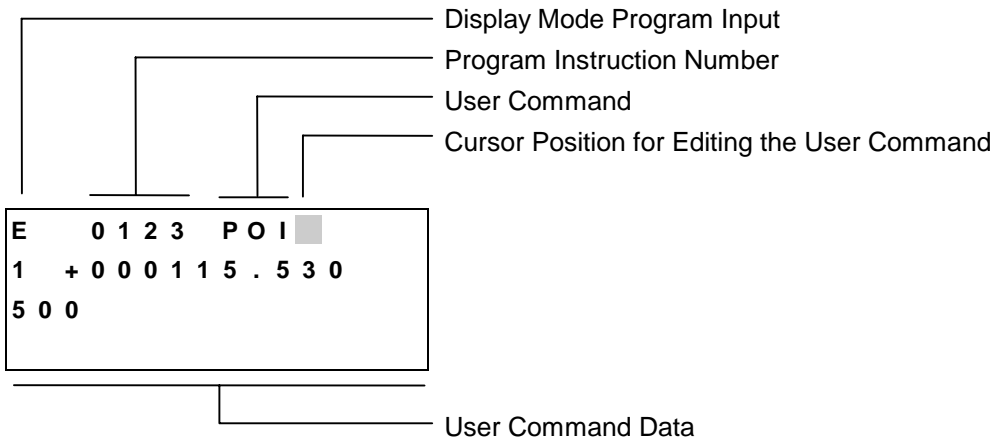
In the case of commands involving wait states for receipt of an outcome, the process time is always extended by the cycle time required for the outcome to arrive.

In most commands, both constants and variables can be used. For clearer understanding, command examples are shown once with variables and once with constants. If both example lines contain a variable or a constant in the same location, only this type of value is allowed.

5.3 Program Input

Input via the Keypad

For programming via the keypad, the CLM must be in the display mode 'Program Input'.



In line 1 of the input menu, the number of the program instruction to be displayed or programmed is input.

To accomplish this, move the cursor to the first position in the program instruction number by pressing and input the desired number using the data keys.

The cursor moves one space to the right after each input. Back up by pressing .

While inputting the instruction number, the command assigned to the number is displayed. After inputting the last digit of the program instruction number, the cursor moves to the first place after the user command.

In this position, it is possible to scroll through all commands in alphabetical order by pressing and .

This chapter contains an overview of all commands.

After locating the desired command, move the cursor to the data field in the 2nd (and 3rd) row using or . Here, the data for the command is input or edited using the data keys.

The new data is visible on the display, but it has not yet replaced the old data. This (replacing the old data) occurs only after saving.

To save the edited data, press the Save key.

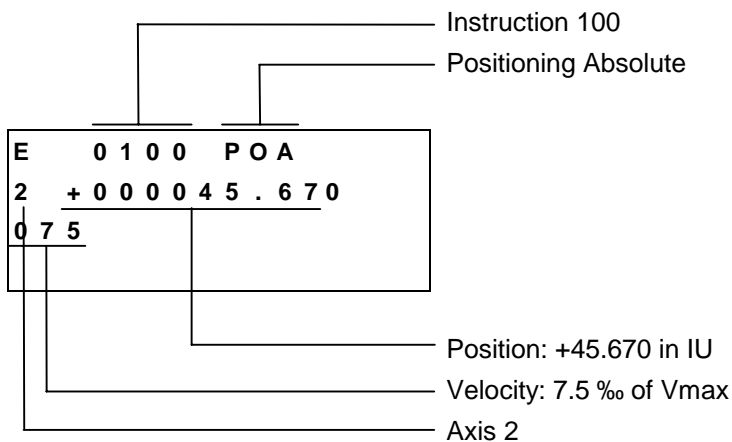
After pressing the Save key , the information is saved. Then, the next program instruction (+1) is displayed and the cursor is placed after the command.

Cursor Movement If the cursor is placed after a command, it is moved to the first position in the instruction number by pressing . If the cursor is in line 2 or 3, it is moved to the position after the command by pressing . From all other positions, the cursor is moved to the first position in the instruction number by pressing .

Advancing to the Next Instruction As long as the cursor is in the first row, the instruction number can be changed by pressing and .

Editing data can be aborted at any time. By pressing , the cursor returns to the first position of the instruction number and the previously saved contents of the program instruction are redisplayed.

Example:



For each command, a predefined input mask is completed with data.

For each incorrectly programmed character, a `?' is displayed. A command is correctly programmed when no `?' characters appear in the instruction after pressing . If you attempt to save an instruction that contains `?', the input is not accepted.

Using the and keys, the user can change to a different display. To accomplish this, the cursor must be in the input field for the program instruction number.

Loading via the Serial Port

The program can be loaded via the serial port of any computer that has an RS232C or RS485 interface.

Parameters B002 and B003 or B004 and B005 control the activation and setting of the serial port.

The transmission format used by the CLM is described in the chapter entitled 'Interfaces'.

5.4 Starting the User Program

The user program can be started only in 'Automatic' Mode. One exception is the 'Manual Vector'.

The program start address for Task 1 is reset to '0000' after each change of operating mode or CLM power up. The start addresses for Task 2 to Task 5 are set in Parameters B011 and B012.

The Task 3 program runs as a higher-level program in every operating mode (except Parameter Mode) and is not affected by the 'Start' or 'Immediate Stop' input.

The program start command is received via the 'Start' input (refer to chapter entitled 'Interfaces').

Note: If the application type 'Flying Cutoff' is programmed, processing of the Task 1 program begins immediately after switching from 'Manual' to 'Automatic' Mode, using the previous length instruction minus 1. Tasks 2, 4 and 5 begin in the programmed start instruction (Parameter B011 or B012). The 'Start' input has no function.

5.5 Stopping the User Program

The running program can be stopped at any time. There are two ways to accomplish this:

- 1) Stop the program externally using the 'Immediate Stop' input (refer to the chapter entitled 'Interfaces').
- 2) Stop the program using the 'JST' user command.

If the operating mode was not changed after such a stop, the program continues from the point of interruption once the start command is received.

There are also two ways to interrupt the user program. Unlike a program stop, no start command is required once the cause of the interrupt is removed, i.e., the program immediately continues from the point of the interrupt.

- 1) Program interrupt caused by signal at the 'Interrupt' input.
- 2) Program interrupt caused by signal at the 'Feed Angle Monitoring' input.

See chapter entitled 'Inputs / Outputs / Marker Flags'.

Note: If the application type 'Flying Cutoff' is programmed, processing of the program can only be stopped by switching from 'Automatic' to 'Manual' Mode. The 'JST' command may not be programmed and the 'Feed Angle Monitoring' and 'Interrupt' functions must be deactivated (see chapter entitled 'Flying Cutoff').

In the event of an error message in the CLM, the user program is always stopped in Tasks 1, 2, 4 and 5. Continuation of the program following correction of the problem is possible only at instruction '0000' for Task 1 and for Tasks 2, 4 and 5 for the instruction defined in Parameters B011 and B012.

Exception: refer to 'Restart' ('Restart' chapter).

Note: If the application type 'Flying Cutoff' is programmed, after clearing the error, processing of the Task 1 program begins immediately after switching from 'Manual' to 'Automatic' Mode, using the previous length instruction minus 1. Tasks 2, 4 and 5 begin in the programmed start instruction (Parameter B011 or B012). The 'Restart' function must be deactivated.

5.6 Variables

The commands contain data which are subsets of the instruction.

These constants can also be changed on-line via the serial interface, but not from the user program.

Using variables is an alternative for using constants. They can be programmed in place of the constants, so that this data can also be edited from the user program.

The variables are retained and all have the same format:

+12345678.123456

If a variable is used in a command, only the size of the constant that has been placed here is used. If the content of the variable is greater or less than the size of the data, an error message is generated.

Note: The variable's operational sign is always taken into account!

Examples:

For a travel command POI, several inputs are shown.

With Constants:

POI 1 +123456.123 111

Velocity in ‰
Feed Length in IU
Axis 1

For feed length, the following data size is assigned min.: -999999.999
max: +999999.999

For velocity, the following data size is assigned min: 000
max: 999

V600 = +00123456.123456

V601 = +999.9999

V602 = +01234567.123456

V603 = -999.99999

V604 = -1234.123456

POI 1 +V600 V601

The value +123456.123 is picked up from the variable V600.

The value 999 is picked up from the variable V601.

POI 1 +V602 V603

The value of variable V602 is too large. An error message is generated.

The value of variable V603 is negative. An error message is generated.

POI 1 -V604 V601

The content of variable V604 is negative. With the operational sign from the command, the feed length becomes positive.

User-Programmable Variables

The following variables can be used for programming in the NC user programs:

V600 to V999

General System Variables

The general system variables can only be read.

No.	Definition	Description
V000	Cycle Counter 1	The counter is incremented by 1 for each NC cycle
V001	Cycle Counter 2	When the NC program has been started in Automatic Mode, the counter is incremented by 1 for each NC cycle
V002	Actual instruction Task 1	The current status of the program instruction counter for Task 1
V003	Actual instruction Task 2	The current status of the program instruction counter for Task 2
V004	Actual instruction Task 3	The current status of the program instruction counter for Task 3
V005	Actual instruction Task 4	The current status of the program instruction counter for Task 4
V006	Actual instruction Task 5	The current status of the program instruction counter for Task 5
V007	Analog Input 1	Input Voltage at Analog Input 1 standardized to +/- 1
V008	Analog Input 2	Input Voltage at Analog Input 2 standardized to +/- 1
V009	Analog Input 3	Input Voltage at Analog Input 3 standardized to +/- 1
V010	Analog Input 4	Input Voltage at Analog Input 4 standardized to +/- 1
V011	Velocity of Master Encoder 1	Actual Velocity of Master Encoder 1 in IU / s
V015	Length of IDS01 (5 places before decimal, 1 place after decimal)	The loaded length of decade switch IDS01 with 5 places before the decimal and 1 place after the decimal.
V016	Length of IDS01 (4 places before decimal, 2 places after decimal)	The loaded length of decade switch IDS01 with 4 places before the decimal and 2 place after the decimal.
V017	Length of IDS01 (3 places before decimal, 3 places after decimal)	The loaded length of decade switch IDS01 with 3 places before the decimal and 3 place after the decimal.
V018	Velocity of IDS01	Loaded velocity of decade switch IDS01 multiplied by a factor of 10. The variable can be directly applied in a move command.
V019	Time Counter	Running time of the CLM control in hours
V025	Processed Material Length	The material length that was processed through the tool, which was measured using the FUN command.
V026	Currently Processed Material Length	Material length that has been currently processed through the tool, in IU. Measurement must be activated using the FUN command.
V040	Current Feed Length, Master Encoder 1	Current feed length for Master Encoder 1 in IU. Measurement must be activated using the FUN command
V041	Buffered Feed Length, Master Encoder 1	Feed length that was measured using the FUN command for Master Encoder 1 in IU
V042	Current Feed Length, Master Encoder 2	Current feed length for Master Encoder 2, in IU. Measurement must be activated using the FUN command
V043	Buffered Feed Length, Master Encoder 2	Feed length that was measured using the FUN command for Master Encoder2, in IU
V045	Fieldbus Baud Rate	Baud rate set by the fieldbus master, in Kbaud
V046	Fieldbus Timeout	Timeout set by the fieldbus master, in ms

V047	Actual Position of motor encoder Axis 1	Actual Position of motor encoder Axis 1 for measuring wheel mode in IU
V048	Actual Position of motor encoder Axis 2	Actual Position of motor encoder Axis 2 for measuring wheel mode in IU

Fig. 5-1: General System Variables

Axis-Related System Variables

The axis-related system variables can only be read.

They exist for each axis and are assigned to variables V1xx - V4xx.

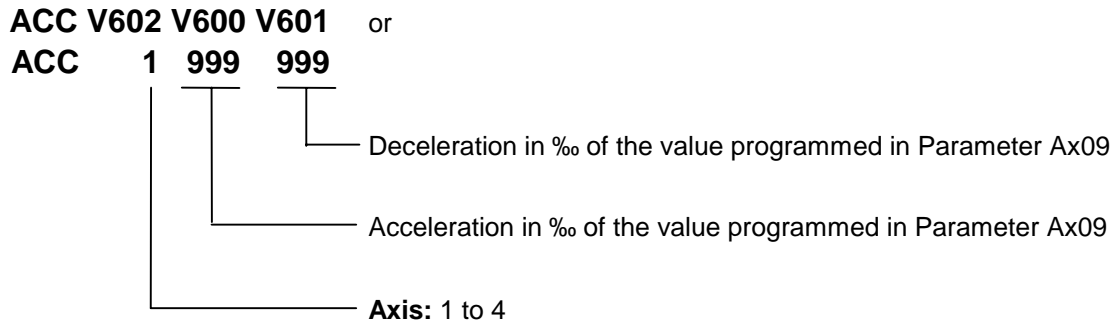
No.	Definition	Description
Vx00	Actual Position, Axis x	Axis x Current Actual Position in IU
Vx03	Position Lag, Axis x	Axis x Current Position Lag in IU
Vx04	Velocity, Axis x	Axis x Current Actual Velocity in IU/s
Vx10	Remaining Distance, Axis x	Axis x Current Remaining Distance in IU
Vx11	Current Feed Length, Axis x	Axis x Current Feed Length in IU. Measurement must be activated using the FUN command.
Vx12	Buffered Feed Length, Axis x	Axis x Buffered Feed Length in IU. Measurement must be activated using the FUN command.

Legend: x = Axis Number

Fig. 5-2: Axis-Related System Variables

5.7 Description of Commands

ACC - Acceleration Change



Acceptance of the new acceleration and deceleration value is immediate.

The new acceleration and deceleration value is retained until changed by a new `ACC` command.

After switching from Automatic to Manual Mode, following an error or power up, the valid acceleration and deceleration value is always the value programmed in Parameter Ax09.

Example of how to change the acceleration value:

0000	ACC	1 999 999	- Set acceleration to 100%
0001	POI	1 +000200.000 999	- Position, then proceed immediately to next instruction
0002	AKN	M2.00.0	- Wait until position is reached Programmed in Parameter Ax27
0003	ACC	1 500 999	- Reduce acceleration to 50%
0004	WAI	00.100	- Wait until drive unit is stabilized
0005	PSI	1 +000300.000 999	- Positioning at 50% acceleration without proceeding to next instruction
0006	WAI	02.000	- Wait 2 seconds
0007	JST	0000	- Program end in instruction 0000

Fig. 5-3: Example of Programming an Acceleration Change

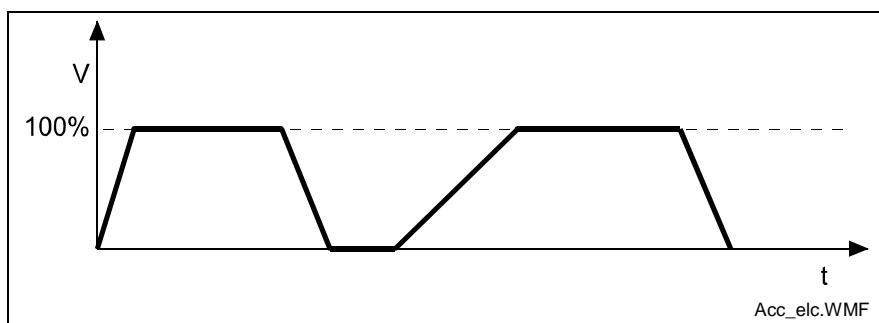
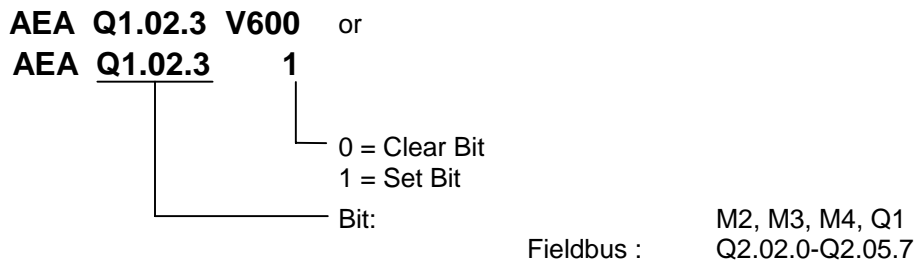


Fig. 5-4: : Example Showing Acceleration Change

The program proceeds to the next instruction following the time period of one cycle.

AEA - Bit Set/Clear

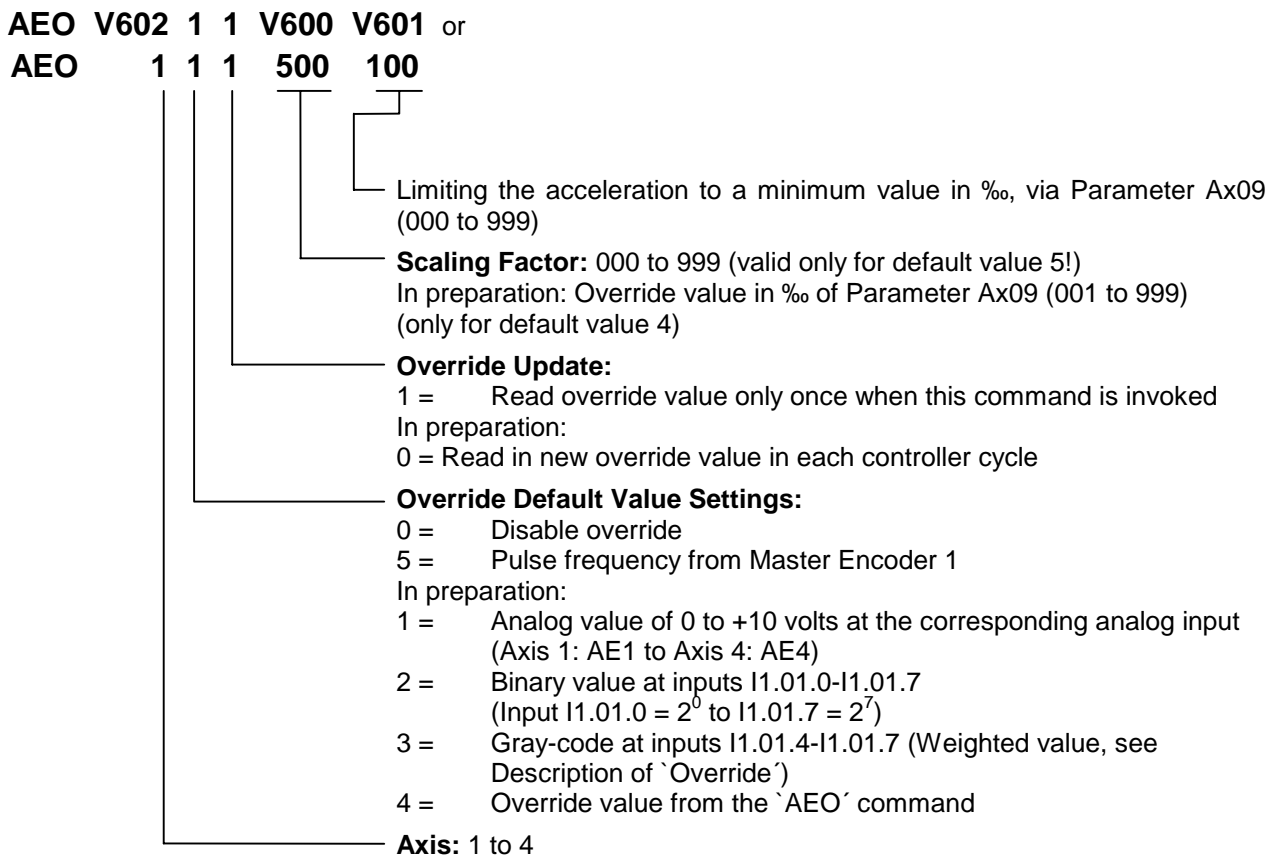


This command affects the status of the programmed bit.

Hardware outputs are set at the beginning of the following cycle. Commands in the current instruction of a task with a higher task number directly affect the changing of this bit.

The program proceeds to the next instruction following the time period of one cycle.

AEO - Acceleration Override



The program proceeds to the next instruction following the time period of one cycle.

Description of Override Default value from Master Encoder 1:

This function can only be activated using the `AEO` command if the axis in Parameter Ax00 is set to mode 0 (normal feed axis). Additionally, Master Encoder 1 (Parameter C000 to C003) must be set up correctly in the parameters. Otherwise, the program proceeds to the following instruction immediately.

The acceleration is changed depending on the measuring wheel pulse frequency, so that the acceleration path remains constant from 0 to V (drive) = measuring wheel velocity.

The override acceleration is transferred, as for the `ACC` command, as soon as any positioning move in process has been completed.

The new acceleration via the override is calculated as follows:

Acceleration [IU/s²] =

$$\text{Parameter Ax09} \times \frac{(\text{Velocity of Meas.Wh.Encoder [IU / s]})^2}{(\text{Parameter Ax06})^2} \times \frac{\text{Scaling Factor}}{1000}$$

L: IU = Input Units

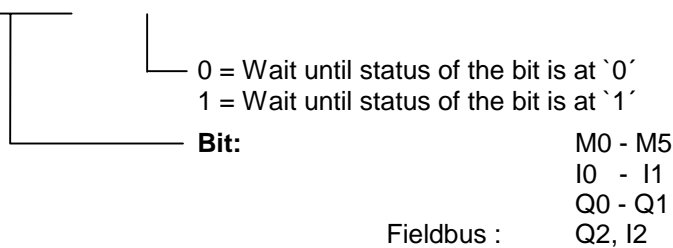
Fig. 5-5: Acceleration Override

This relationship is only valid for command velocity = 999.

The value for acceleration via override may not be lower than the minimum acceleration set with the `AEO` command.

AKN - Acknowledge Bit

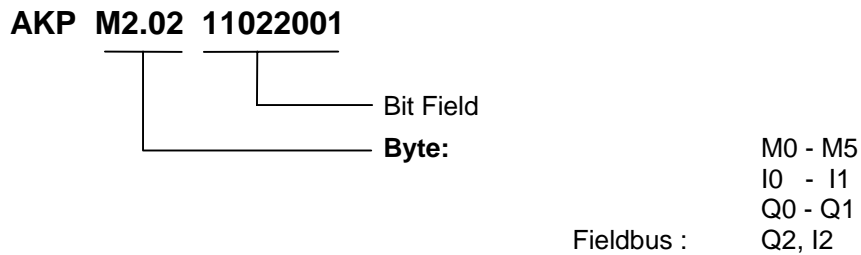
AKN M2.02.2 V600 or
 AKN M2.02.2 1



This is where the status of the programmed bit is verified. The program proceeds to the next instruction as soon as the bit assumes the desired status.

For inputs not present in the hardware, the signal level is always set to `0`.

AKP - Acknowledge Byte



This command represents an extension of the `AKN` command. It can be used to verify that conditions have been met for a particular byte. The program proceeds to the next instruction if all bits have met their conditions. If not, the program waits at this instruction until all conditions for proceeding on to the next instruction have been met.

Three different conditions are possible:

- 0 = The bit is checked to see if it is set to `0`.
- 1 = The bit is checked to see if it is set to `1`.
- 2 = The bit is not checked.

Example:

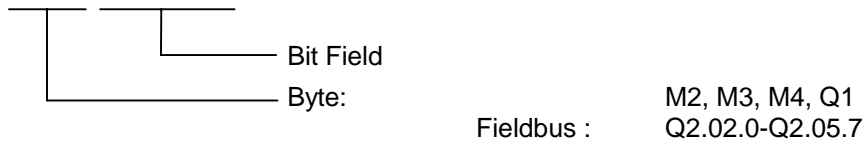
0008_AKP_M_0_._0_2_ _2	1	0	0	1	2	2	0
	7	6	5	4	3	2	1

Bits 0, 4 and 5 are checked to see if they are set to `0`.
 Bits 3 and 6 are checked to see if they are set to `1`.
 Bits 1, 2 and 7 are not checked.

The program proceeds to the next instruction once all bits are in the correct state.

APE - Byte Set / Clear

APE M2.02 21022001



This command represents an extension of the `AEA` command. It can be used to switch the bits in a byte. At the same time, each of the bits can be controlled independently.

Three different conditions are possible:

- 0 = The bit is set to `0`.
- 1 = The bit is set to `1`.
- 2 = The status of the bit remains unchanged.

Example: a)

0008_APE_M2.02	_2	1	0	0	2	2	1	0	
		7	6	5	4	3	2	1	0

Bits 0, 4 and 5 are set to `0`.
 Bits 1 and 6 are set to `1`.
 Bits 2, 3 and 7 are not changed.

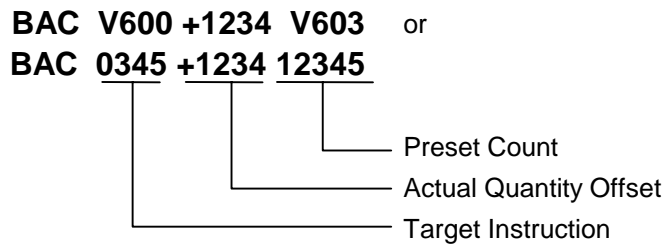
Example: b)

0008_APE_M2.02	_2	1	1	1	0	0	0	2	
		7	6	5	4	3	2	1	0

Bits 1, 2 and 3 are set to `0`.
 Bits 4, 5 and 6 are set to `1`.
 Bits 0 and 7 are not changed.

The program proceeds to the next instruction following the time period of one cycle.

BAC - Branch Conditional on Count



Like the `COU` command, this command allows the program to count events, process cycles, quantities, etc.

First the quantity is incremented. Then, the actual quantity is compared with the desired target quantity. If the programmed target quantity is not reached, the program jumps to the target location. If the target quantity is reached, the actual quantity is reset to zero and the program proceeds to the next instruction.

Example: a) Count following the event

0000	WAI	01.000
0001	PSI	1 +000050.000 250
0002	BAC	0000 +0000 00010
0003	JST	0000

Positioning is executed 10 times, and then the program waits for a new start signal.

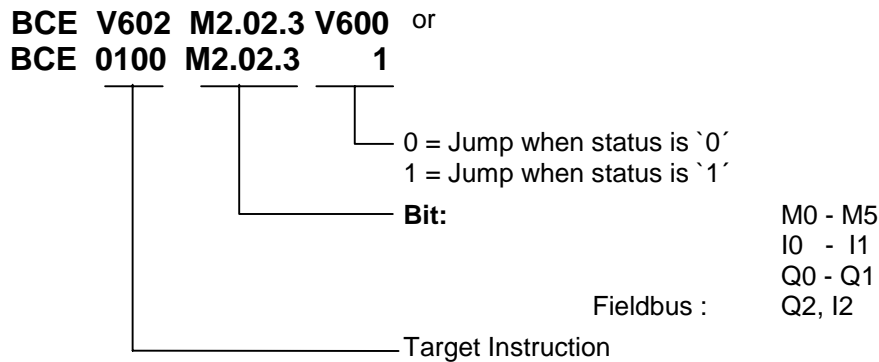
Example: b) Count prior to the event

0000	BAC	0002 +0000 00010
0001	JST	0000
0002	PSI	1 +000050.000 250
0003	WAI	01.000
0004	JMP	0000

Positioning is executed 9 times, and then the program waits for a new start signal.

For additional information on this command, see the explanation below under the `COU` command.

BCE - Branch Conditional on Bit

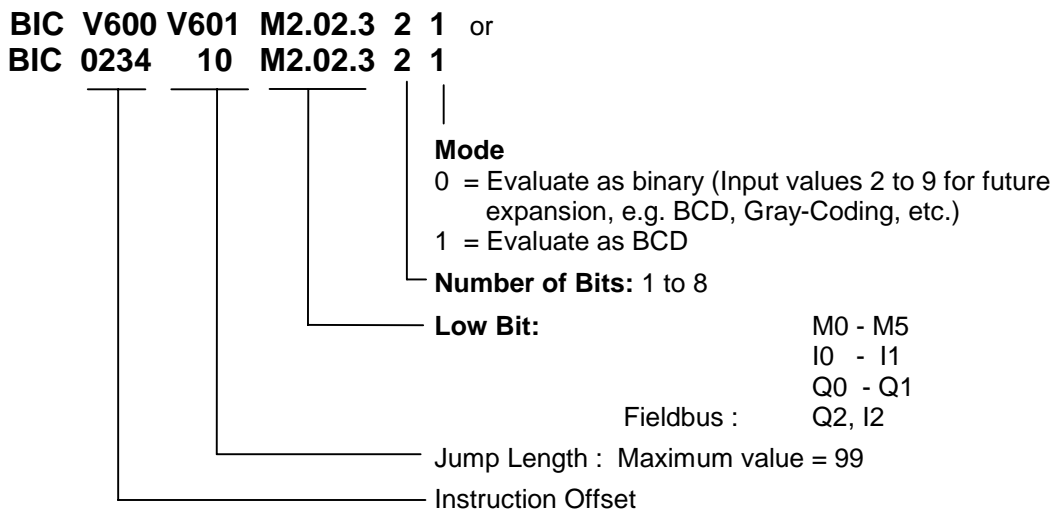


The jump to the target instruction is executed if the programmed bit has met the preselected condition.

If the condition is not met, the program continues at the instruction with the next higher number.

The program continues after the time period of one cycle.

BIC - Branch Conditional on Bit Field Value



This command executes a jump to a calculated target location. The destination depends on the state of the programmed bits. Up to 8 bits are considered. If a target location of >2999 is produced, the error message `Invalid Block #` is generated.

If digits >9 result from the BCD evaluation, the error message `BCD Input Error` is issued.

The target instruction is calculated as follows:

$$Target\ Instruction = Instruction\ Offset + (Total\ Scaling \times Jump\ Interval)$$

Fig. 5-6: Calculation of Target Instruction with Binary Input Logic

BCD Evaluation Examples:	M2.03					M2.02					
	Start Bit	7	6	5	4	3	2	1	0		
Current Status	: 0	1	1	0	1	1	0	1	0	1	1

1) Input : BIC 0500 11 M2.02.4 5 0
 Selected Bits : 1 0 1 1 0
 Binary Scaling : 2^4 2^3 2^2 2^1 2^0
 Equiv. Decimal Value : 16 8 4 2 1
 Target Instruction : $(16 + 0 + 4 + 2 + 0) = 22$
 $22 * 11 + 500 = 0742$

2) Input : BIC 0300 02 M2.02.2 8 0
 Selected Bits : 1 1 0 1 1 0 1 0
 Binary Scaling : 2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0
 Equiv. Decimal Value : 128 64 32 16 8 4 2 1
 Target Instruction : $(128 + 64 + 0 + 16 + 8 + 0 + 2 + 0) = 218$
 $218 * 02 + 300 = 0736$

BCD Evaluation Examples:	M2.03					M2.02					
	Start Bit	7	6	5	4	3	2	1	0		
Current Status	: 1	0	1	0	1	1	0	0	1	1	1

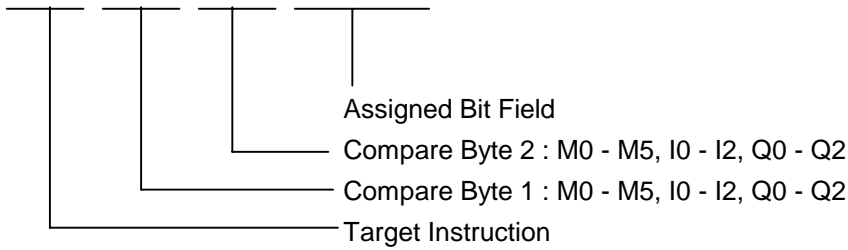
1) Input : BIC 0500 11 M2.02.4 5 1
 Selected Bits : 1 0 1 1 0
 Decimal Scaling : 10 8 4 2 1
 Total Scaling : $10 + 0 + 4 + 2 + 0 = 16$
 Target Instruction : $16 * 11 + 500 = 0676$

2) Input : BIC 0300 02 M2.02.2 8 1
 Selected Bits : 0 1 0 1 1 0 0 1
 Decimal Scaling : 80 40 20 10 8 4 2 1
 Total Scaling : $0 + 40 + 0 + 10 + 8 + 0 + 0 + 1 = 59$
 Target Instruction : $59 * 02 + 300 = 0418$

The program proceeds to the target location following the time period of one cycle.

BIO - Branch Conditional on Byte Compare

BIO V600 M2.02 Q1.06 01201201 or
 BIO 0123 M2.02 Q1.06 01201201



The assigned bit field is to designate which bits of the two compare bytes are to be checked for which states.

- 0 = The bit is checked to see if it is set to `0`.
- 1 = The bit is checked to see if it is set to `1`.
- 2 = The bit is not checked

The condition is met when the state of all selected bits in both compare bytes matches the state of the assigned bit field.

The jump is executed when all conditions are met.

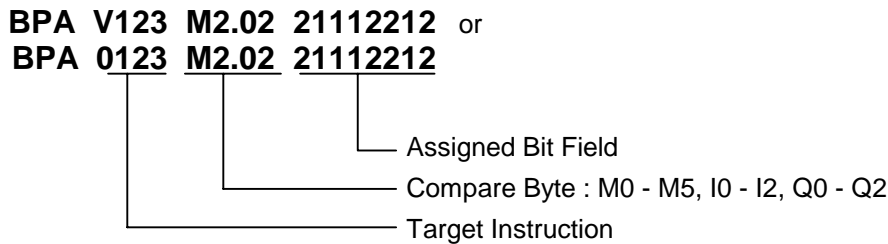
Example:

0032_BIO_0123_M2.02_Q1.00	1	1	1	1	0	0	0	0
Compare Byte 1	1	1	1	0	0	0	1	0
Compare Byte 2	1	1	0	0	0	0	1	0
Result	1	1	X	X	0	0	X	0
	7	6	5	4	3	2	1	0

For results places with a content of 0 or 1, the condition is met. For results places with a content of X, the conditions are not met, and therefore the overall condition is not met.

The program continues after the time period of one cycle.

BPA - Branch Conditional on Byte



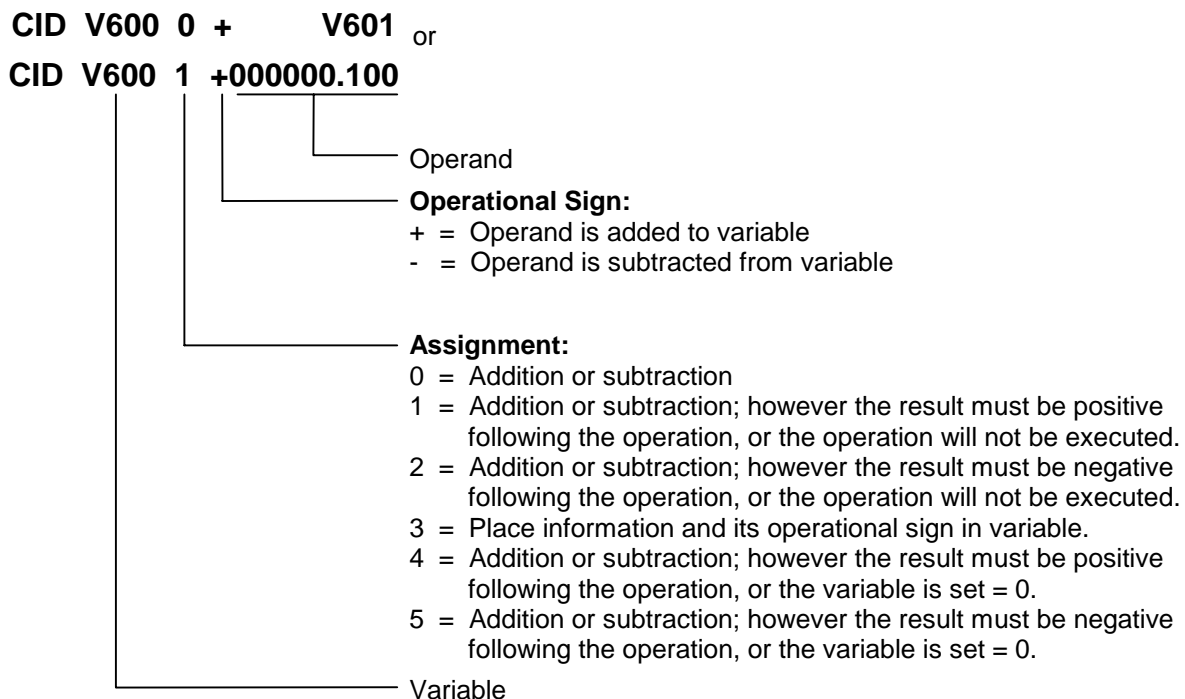
Here, the byte is checked for a met condition. At the same time, the condition can be stipulated separately for each bit. The jump to the target location is executed only if all programmed conditions are met. Otherwise, the program proceeds to the next instruction.

Three different conditions are possible:

- 0 = The condition is true if the bit is set to `0`.
- 1 = The condition is true if the bit is set to `1`.
- 2 = The bit is not checked.

The program continues after the time period of one cycle.

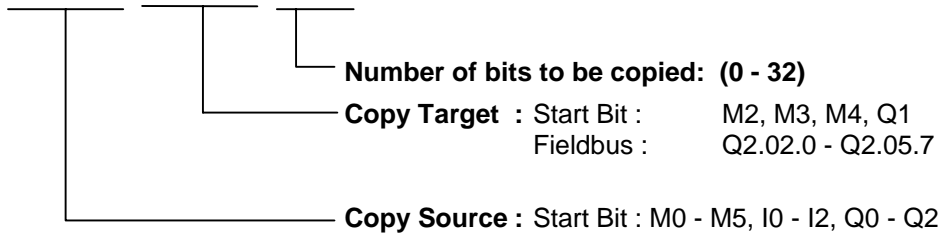
CID - Change Variable Value



This command changes the data in a variable.

CIO - Copy Bit Field

CIO M2.02.3 Q1.01.3 V123 or
 CIO M2.02.3 Q1.01.3 07



This command can be used to copy bit states. This command is particularly important for security programs. Regularly saving the data ensures that it may be possible to continue the program with the proper state settings following a fault.

Example:

```
0456 CIO I1.01.0 M2.02.0 5
```

The status of inputs I1.01.0 to I1.01.4 is copied to markers M2.02.0 to M2.02.4.

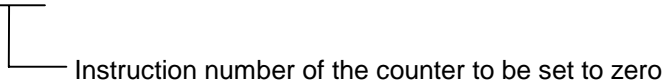
Status of the Input Bits	1	0	1	0	1	0	1	1
	7	6	5	4	3	2	1	0

Status of the Marker Bits								
before	=	0	0	0	0	0	0	0
after	=	0	0	0	0	1	0	1
		7	6	5	4	3	2	1

The program proceeds to the next instruction following the time period of one cycle.

CLC - Clear Counter

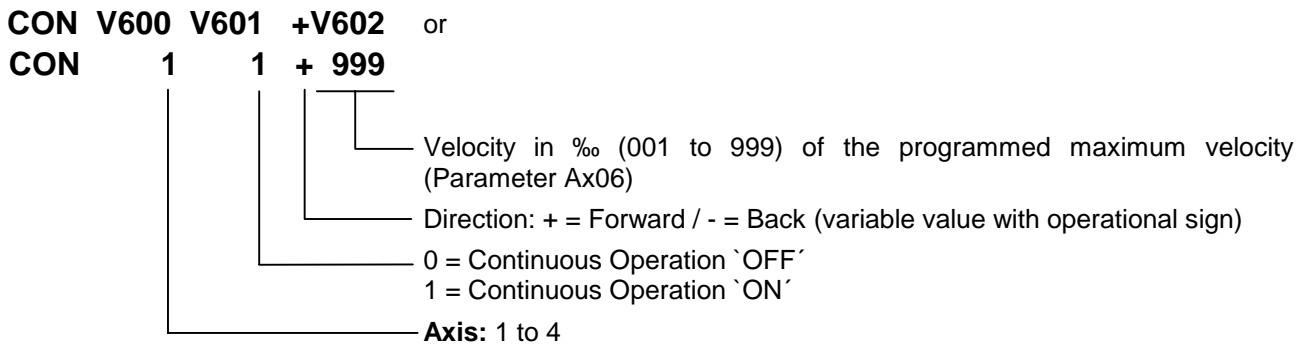
CLC V661 or
 CLC 0123



At the specified instruction number, this command resets the current value of a counter to zero. If the specified instruction contains no 'BAC' or 'COU' count command, this instruction is skipped.

The program proceeds to the next instruction following the time period of one cycle.

CON - Continuous Operation



The CON command can also be used in the `Homed` state. In that case, however, the position limit values (**Parameters Ax03 and Ax04**) must be noted.

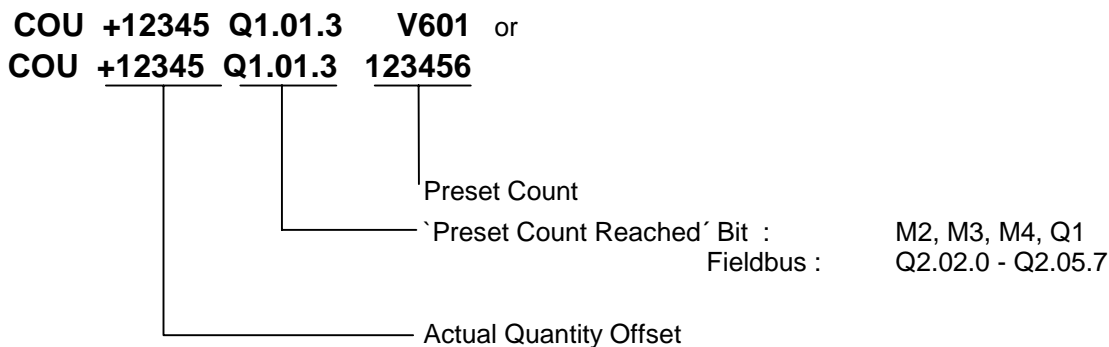
Within the program, continuous operation can be switched off only using the commands `CON`, `JST` or `PBK`.

A change in the operating mode (e.g., from Automatic to Manual) switches continuous operation off.

Acceleration and deceleration are always executed using the current values.

The program proceeds to the next instruction following the time period of one cycle.

COU - Counter



In the same way as the `BAC` command, this command allows the program to count events, process cycles, quantities, etc.

The quantity is incremented each time the instruction is processed. Then, the actual quantity is compared with the desired target quantity. Once the target quantity is reached, the programmed bit is activated and the actual quantity is set to zero.

The programmed bit is only enabled here. If it is necessary for this bit to be disabled, this action must take place at another location within the user program.

Counters can be set at any position as often as desired within the user program.

Example:

```
0000 CLC 0002
0001 AEA Q1.00.4 0
0002 COU +00000 Q1.00.4 000010
0003 PSI 1 +000050.000 999
0004 WAI 01.000
0005 BCE 0001 Q1.00.4 0
0006 JST 0001
```

Positioning is executed ten times. Then, output Q1.00.4 is set and the system waits for a new start signal.

Note on actual count offset for `COU` (Count) and `BAC` (Branch Conditional on Count):

The counter shown on the display or Status 4 via the serial interface can be used to check the counter status. The actual quantity is not apparent within the command itself. Once a `COU` command (`BAC` command) has been read in, the actual quantity can be manipulated. To accomplish this, the actual quantity offset must be entered. With the `BAC` command, the offset has one less digit.

Actual Quantity Offset	Effect
+00000 or -00000	No effect on the actual quantity
+02345 or -02345	The actual quantity offset, with its operational sign, is added to the actual quantity
000000	When the operational sign is a `0`, the actual quantity is set to zero

The actual quantity offset is significant only if the `COU` command (`BAC` command) has been read in (even when storing occurs via the RS interface). When the program is running, the offset has no meaning. In the user program, the actual quantity can be reset to zero using the **CLC` command.**

During a production cycle, it may be necessary to change the desired target quantity. This can be accomplished by overwriting the quantity within the command and then resaving.

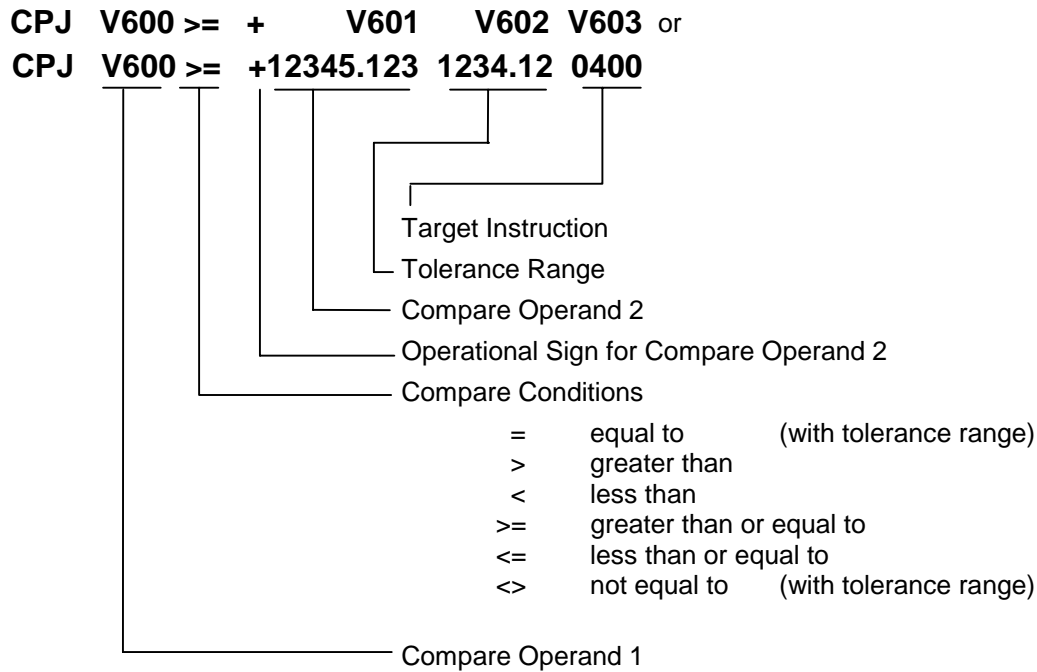
In order to prevent unintentional repetition of a one-time correction every time the program is read in, the offset within the command itself is reset to `+00000` once the actual quantity offset has been accepted. This prevents unintentional changes from being made to the actual quantity.

Notes: The current actual quantity of every counter is retained even in the event of a fault, emergency stop, change of operating mode or shutdown.

If the target piece count is programmed through a variable for the `COU` and `BAC` commands, the current piece count is automatically assigned to the variable with the number higher by 1.

The program proceeds to the next instruction following the time period of one cycle.

CPJ - Compare and Jump



The jump to the target location is executed when the comparison has been made.

If the condition is not met, the program continues at the instruction with the next higher number.

For the compare conditions `equal to` and `not equal to`, the condition is met when the difference between the two operands lies within the tolerance range.

The program continues after the time period of one cycle.

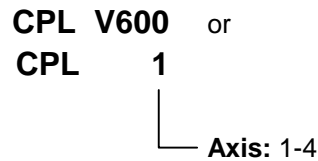
Example: CPJ V600 >= +V601 0000.00 0400

V600 = 100.000

V601 = 090.000

The command branches to instruction 400.

CPL - Clear Position Lag



The position lag of the axis is set to zero on a one-time basis. Normally, this action is useful only for special tasks such as moving to a positive stop. When this task is performed, buildup of a substantial position lag is possible because the monitoring systems are deactivated and the performance of the drive has been affected.

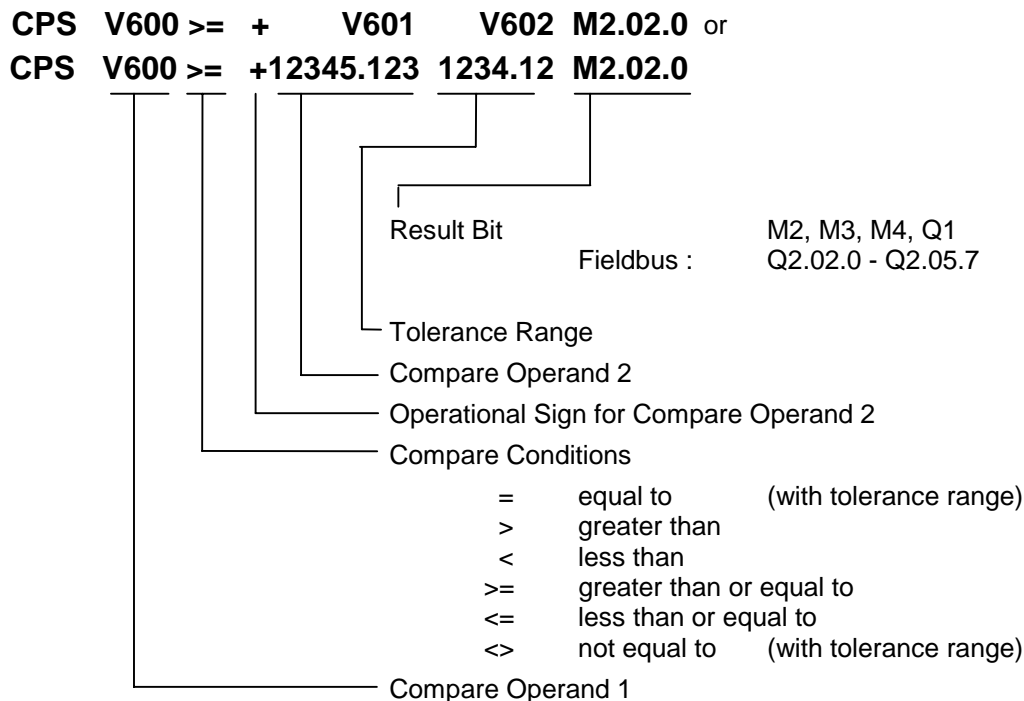
The program proceeds to the next instruction following the time period of one cycle.



CAUTION

This command directly accesses the position control circuit. It is therefore possible for unauthorized changes to be made in the values for length, position and acceleration.

CPS - Compare and Set a Bit



The result bit is set when the comparison has been made. Otherwise, the result bit is deleted.

For the compare conditions `equal to` and `not equal to`, the condition is met when the difference between the two operands lies within the tolerance range.

The program continues after the time period of one cycle.

CST - Clear Subroutine Stack

CST 1 1

- 0 = Clear the subroutine stack
- 1 = Correct the subroutine stack by 1 level
- 2 = Correct the subroutine stack by 2 levels and so on until
- 9 = Correct the subroutine stack by 9 levels
- 0 = Task 1 and Task 2
- 1 = Task 1
- 2 = Task 2
- 3 = Task 1, 2, 4 and 5
- 4 = Task 4
- 5 = Task 5

This command can be used to correct the subroutine stack.

If several subroutines are accessed within one program cycle, a direct return across several levels is not possible with the RTS command. If the subroutine stack has been corrected using the `CST` command, a subsequent `RTS` command will execute a direct return across several levels.

Note: If all subroutine stacks have been cleared, issuing an `RTS` command after the `CST X 0` command will result in an `RTS nesting` error.

Example:

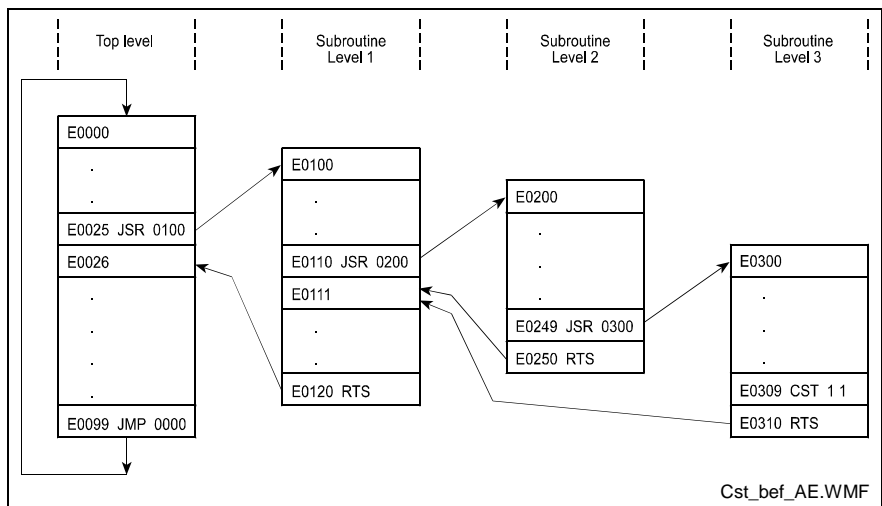
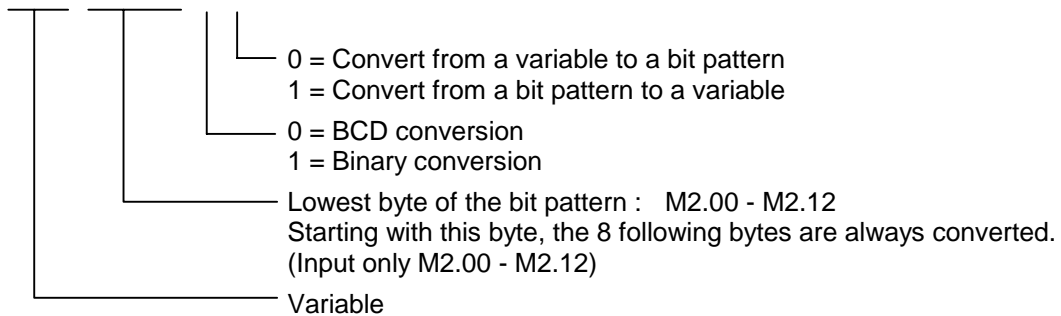


Fig. 5-7: Example Overview of Subroutine Stack Levels

CVT - Convert Variable <-> Marker

CVT V601 M2.02 1 1



This command converts a binary or BCD bit pattern to a variable or converts a variable to a binary or BCD bit pattern.

Binary : 1 x operational sign bit (1 = negative 0 = positive)
highest bit in the highest byte before the decimal point
4 x bytes before the decimal point
4 x bytes after the decimal point

BCD : 1 x byte before the decimal point (1-FF = negative, 0 = positive)
4 x bytes before the decimal point (8 decimal places)
3 x bytes after the decimal point (6 decimal places)

The program proceeds to the next instruction following the time period of one cycle.

Example:

Convert the content of a variable to a BCD bit pattern

V600 = -87654321.654321

CVT V600 M2.00 0 0

Marker Flags	Bit Number 7654 3210	Value	Comment
M2.00	0010 0001	2 1	After decimal point
M2.01	0100 0011	4 3	After decimal point
M2.02	0110 0101	6 5	After decimal point
M2.03	0010 0001	2 1	Before decimal point M2.03.0 indicates if value is even or odd.
M2.04	0100 0011	4 3	Before decimal point
M2.05	0110 0101	6 5	Before decimal point
M2.06	1000 0111	8 7	Before decimal point
M2.07	1111 1111		Operational sign

Fig. 5-8: Marker Use According to CVT Command

Example: Loading the Decade Switch

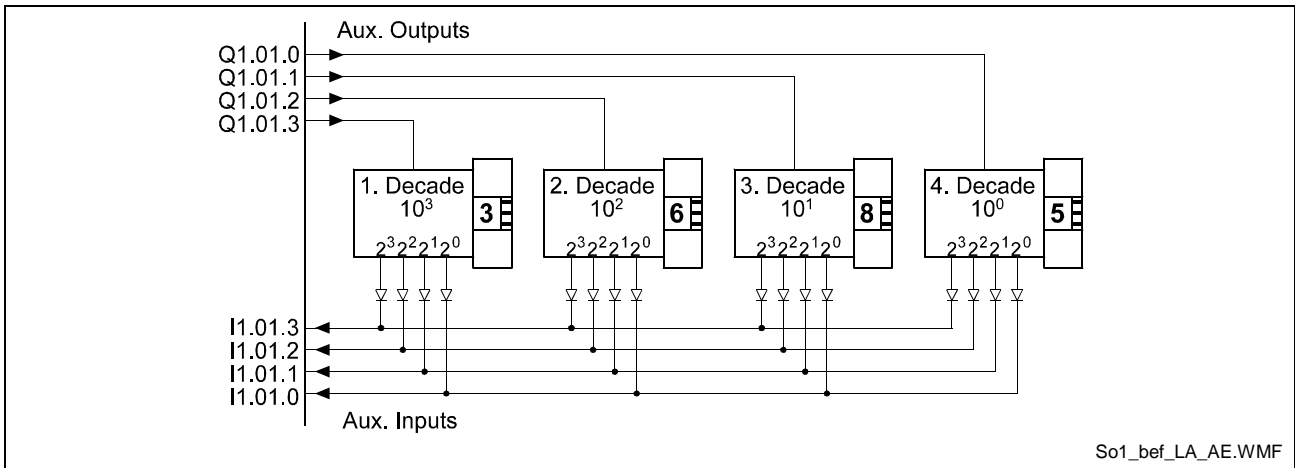


Fig. 5-9: Loading the Decade Switch

Commands	Comment
APE Q1.01 22220001	Select Decade 4 10^0
WAI 00.02	Wait Until Level is Stable
CIO I1.01.0 M2.03.0 04	Load Value of the Decade Switch
APE Q1.01 22220010	Select Decade 3 10^1
WAI 00.02	Wait Until Level is Stable
CIO I1.01.0 M2.03.4 04	Load Value of the Decade Switch
APE Q1.01 22220100	Select Decade 2 10^2
WAI 00.02	Wait Until Level is Stable
CIO I1.01.0 M2.04.0 04	Load Value of the Decade Switch
APE Q1.01 22221000	Select Decade 1 10^3
WAI 00.02	Wait Until Level is Stable
CIO I1.01.0 M2.04.4 04	Load Value of the Decade Switch
CVT V600 M2.00 0 1	Write Decade Switch Value after V600

Fig. 5-10: Programming Example: Loading the Decade Switch

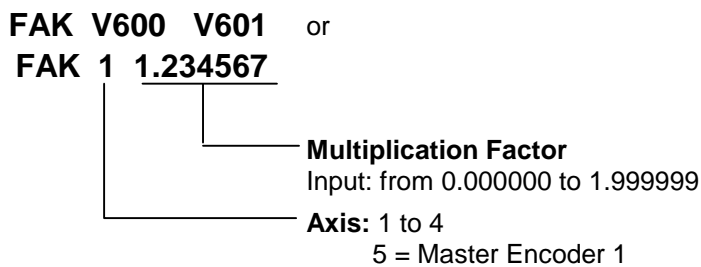
EOS - End of Synchronization

EOS

A processing program must always end with this command.

Note: The `EOS` command is valid only for Axis 1 and for Mode 5 `Flying Cutoff`.

FAK - Length Scaling Factor



Positioning travel of the `POA`, `POI`, `PSI` and `PSA` commands is **always** the result of a preselected linear value or position and a multiplication factor.

The formula below applies for incremental positioning:

$$\textit{Positioning Travel} = \textit{Preselected Length} \times \textit{Multiplication Factor}$$

Fig. 5-11: Calculation of Incremental Positioning

The formula below applies for absolute positioning:

$$\textit{Target Position} = \textit{Preselected Absolute Position} \times \textit{Multiplication Factor}$$

Fig. 5-12: Calculation of Absolute Positioning

Each change in the factor applies to all subsequent positioning motions. A positioning motion already in progress is no longer affected by changes in this factor.

To make a change in the operating mode (Manual/Automatic), the multiplication factor is preset to a value of 1.000000.

If a value of 5 is programmed for the axis, the feed rate constant of Master Encoder 1 (measuring wheel) is multiplied by the multiplication factor. The value in the parameter (Parameter C002) remains unchanged. After each power up, clearing of an error and after exiting Parameter Mode, the factor is internally set to a value of 1.000000.

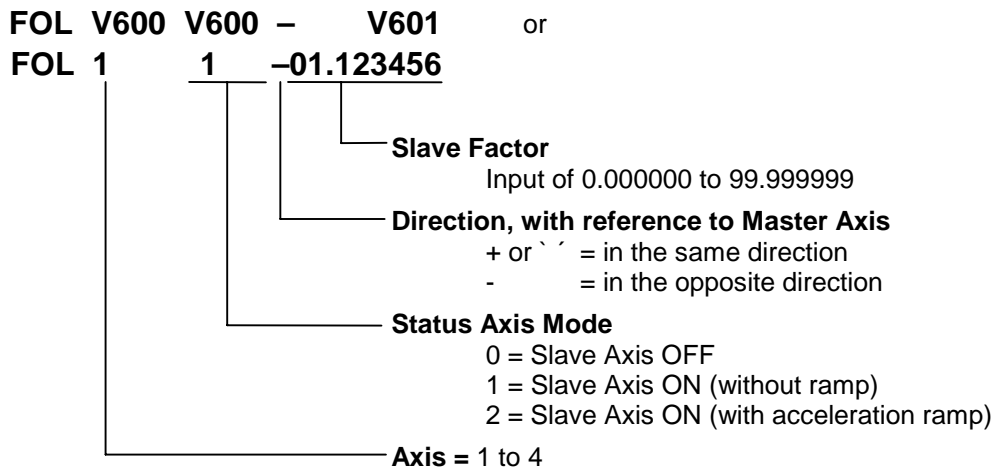
Note: The function `Measuring Wheel Correction` is valid only for Axis 1 and for Mode 5 `Flying Cutoff`.

0000	PSI	1 +000100.000 999	- Positioning = 100
0001	JSR	0100	
0002	FAK	1 1.234500	
0003	PSI	1 +000100.000 999	- Positioning = 123.45
0004	JSR	0100	
0005	FAK	1 1.000300	
0006	PSI	1 +000100.000 999	- Positioning = 100.03

Fig. 5-13: Example of Multiplication Factor for Positioning Motions

The program proceeds to the next instruction following the time period of one cycle.

FOL - Follow Master



This command is valid for assigning the parameter for the axis to be used as a slave axis or synchronous axis (Parameter Ax00).

The 'FOL' command can be used to enable or disable the slave axis function. The behavior of the slave axis can also be changed by using a slave factor.

The positioning travel of the slave axis in IU is calculated as follows:

$$\text{Positioning Travel Master Axis in IU} \times \text{Slave Factor}$$

L: IU = input units

Fig. 5-14: Positioning Travel of Slave Axis

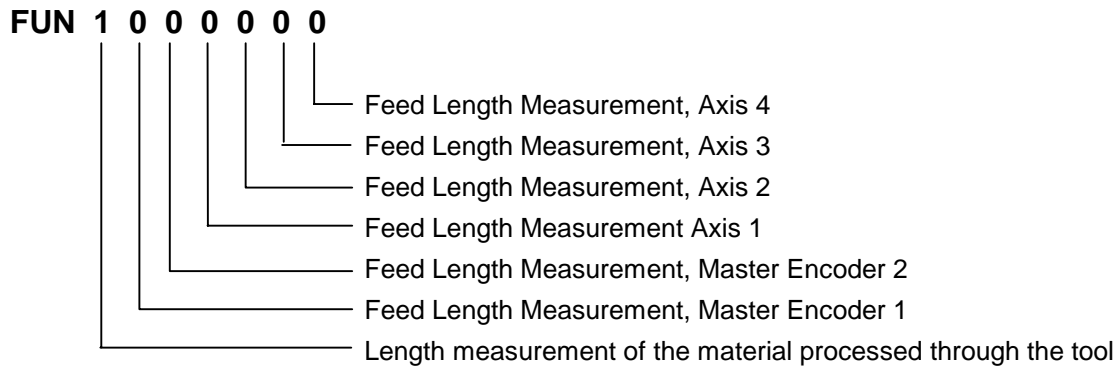
In calculating the positioning travel in IU for the slave and master axes, the IU shall be considered in terms of the feed constant for the relevant axis (slave or master). Any differences in the values calculated for the input units shall also be taken into account.

Other programmed positioning motions of the slave axis (e.g., using POI or PSI) are additive in terms of velocity!

After exiting 'Parameter' mode or after clearing an error, the slave axis is defaulted to Mode 1 (without ramp) with a slave factor of 1.000000. For an operating mode change from 'Manual' to 'Automatic,' or vice versa, the condition (on or off) remains, along with the previous slave factor value.

- Slave Axis Mode 1** If the slave axis is turned on or off, or if the slave factor is changed, the slave axis follows the master axis with no ramp.
- Slave Axis Mode 2** If the slave axis is turned on or off, the slave axis accelerates or decelerates using an acceleration ramp. The acceleration and deceleration values are set in Parameters Ax08 and Ax09 or in the ACC command.
- When changing the slave factor, re-synchronization occurs by using the acceleration ramp.
- For 'Immediate Stop,' the slave axis stops using the acceleration ramp. The activation state remains.
- For 'Start' after a previous 'Immediate Stop,' re-synchronization occurs when the previous activation state was 'ON.'
- For 'Interrupt,' stopping and re-synchronization occurs using the acceleration ramp.
- The program proceeds to the next instruction following the time period of one cycle.

FUN - Functions



- 0 = Buffer the measured value, then clear counter and re-start measurement.
- 1 = Clear counter and re-start measurement. The buffered measured value is retained.
- 2 = No change

Feed Length Measurement Using the `FUN` command, already executed feed lengths can be measured. The current measurement values are available in System Variables V040, V042, V111, V211, V311 and V411. The buffered measurement values can be read from System Variables V041, V043, V112, V212, V312 and V412.

Measuring the Fed Material Using the `FUN` command, the material length that has been processed through the tool can be measured. The movements of the carriage and the material movements are detected. The currently fed material length is available in System Variable V026. Using System Variable V025, the buffered measurement value can be read out.

Note: The material length fed through the tool is valid only for Axis 1 and for Mode 5 `Flying Cutoff`.

The program proceeds to the next instruction following the time period of one cycle.

HOM - Home Axis

HOM V600 or
 HOM 1
 └───┬───┘
 Axes 1 to 4

This command produces an absolute measurement reference. What occurs basically corresponds to homing in Manual Mode. To accomplish this, **Parameters Ax23 through Ax25** must be programmed accordingly.

This command is not needed when the position is detected using absolute encoders, since they already generate an absolute measurement reference.

Otherwise, the error message `HOM - Command` is generated.

During homing, make sure that no command is processed which executes a drive motion.

A query within the program to determine whether homing has been successfully completed is accomplished by polling the `Homed` output in **Parameter Ax24**.

Note: In general, completion of the homing routine following each `HOM` command should be verified using an `AKN` command.

Example:

Input in Parameter Ax24 = M2.02.0 +100 0

0011	HOM	1	- Home Axis 1
0012	AKN	M2.02.0 1	- Wait until homing is completed
0013	POA	1 +000010.000 999	- Positioning, Absolute

A detailed description of the homing function is provided in the chapter entitled `Homing`.

The program proceeds to the next instruction following the time period of one cycle.

JMP - Jump Unconditional

JMP V601 or
JMP 0123

Target Instruction

When it reaches this user command, the program jumps to the specified target location.

This allows the programmer to jump directly to another part of the program. This enables the main program to be divided up into fixed program blocks, which can be of great help when making changes or additions.

An unconditional jump from the end of the program to the beginning produces an endless loop. Such a program continues to run without interruption.

A valid command must be present in the target location, otherwise the error message `Invalid Prg Cmd` will be generated.

The program proceeds to the target location following the time period of one cycle.

JSR - Jump to Subroutine

JSR V601 or
JSR 0123

Start instruction of the subroutine

In programs containing several identical functions, the programming can be simplified by entering repeat functions into a subroutine.

A program structure is thus clearer and shorter.

The return from a subroutine is always automatically to the instruction with the next sequential number following the instruction which initiated the jump to the subroutine.


A maximum of 127 subroutine levels are possible. At more than 127 levels, the error message `JSR nesting` is generated.

Note: The last instruction in each subroutine must be an `RTS` (Return From Subroutine) command. If this command is invoked without first jumping to a subroutine, the error message `RTS nesting` is generated.

The program proceeds to the start instruction following the time period of one cycle.

JST - Jump and Stop

JST V611 or
JST 0123



Target Instruction

With this command, the program jumps to the specified target location. However, program execution stops there. The program continues only when the voltage changes from `0` to `1` at the system input `Start`. With the new start signal, the program continues at the target location.

This command is used frequently to end a machining cycle.

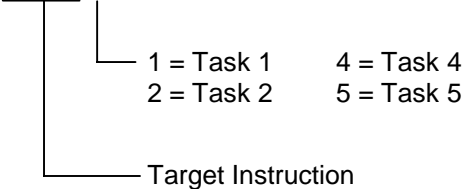
If the drive is in motion, it is brought to a standstill by the programmed acceleration/deceleration values. The remaining travel distance is stored and executed after the next start. There is no loss of dimensions. Continuous operation using the `CON` command is disabled!

The output states are not changed by a `JST` command. In multitasking, a `JST` command results in a programmed stop in all running tasks. Task 3 is not affected.

This corresponds to the system input `Immediate Stop`.

JTK - Jump in Task

JTK V611 1 or
JTK 0123 1



1 = Task 1 4 = Task 4
 2 = Task 2 5 = Task 5

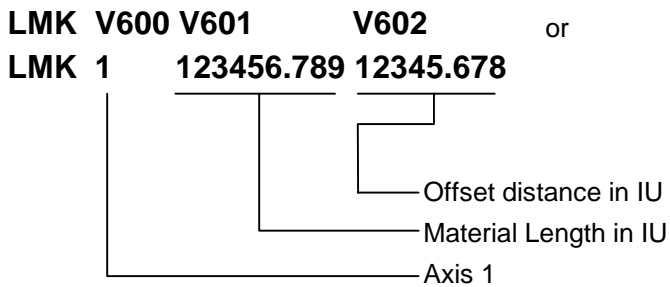
Target Instruction

This command can be used to influence program execution in one of the other tasks. Program execution within the programmed task is aborted and the task jumps to the specified target location.

- The command `JTK_0100_2` in Task 1 causes execution of the Task 2 program to continue at instruction 100.
- The `JTK` command can also be programmed in Task 3.
- The command `JTK_0100_1` in Task 1 has the same meaning as the `JMP_0100` command

The program proceeds to the next instruction following the time period of one cycle.

LMK - Part Length with Length Correction



With this command, the CLM processes a pre-set material length, as with the `LML` command. However, this length can be corrected using the `Raster 1` input (Connector X3/Pin 16). If a raster is detected (+24V signal), the input offset distance is set and processed as a new distance. The raster signal is recognized by the CLM from the time a de-synchronization is initiated until the next synchronization occurs. The correction is only made once for each instruction processed. If the raster pulse is detected shortly before synchronization and a large offset distance is set, it is possible that the carriage may decelerate before accelerating back to synchronize again.

If the raster signal is only triggered when the carriage is in the home position, the offset length \pm the light barrier offset must be greater than the acceleration path.

If the raster signal occurs when the carriage is returning to its original position, the offset length \pm the light barrier offset must be greater than 4x the acceleration path.

Notes: The `LMK` command is intended for use with incremental encoders.

The `LMK` command is valid only for Axis 1 and for Mode 5 `Flying Cutoff`.

This command may not be stored in Program Instruction 0000.

LML - Part Length

LML V601 V600 or
LML 1 123456.789

Material Length in IU

Axis 1

When the desired material length has been processed, the carriage (Axis 1) is accelerated to the material speed. If the carriage is in synchronous motion with the material, the program proceeds to the next instruction. If a cut width of the cutting tool is programmed in Parameter A141, the entered material length is increased by the width of the cutting tool.

Notes: The 'LML' command is valid only for Axis 1 and in Mode 5 'Flying Cutoff'.
 This command may not be stored in Program Instruction 0000.

In the following examples, the following lengths are known:

- Light Barrier Offset = 100 mm
- Distance between Marks = 1000 mm
- Offset = 300 mm

Example 1:

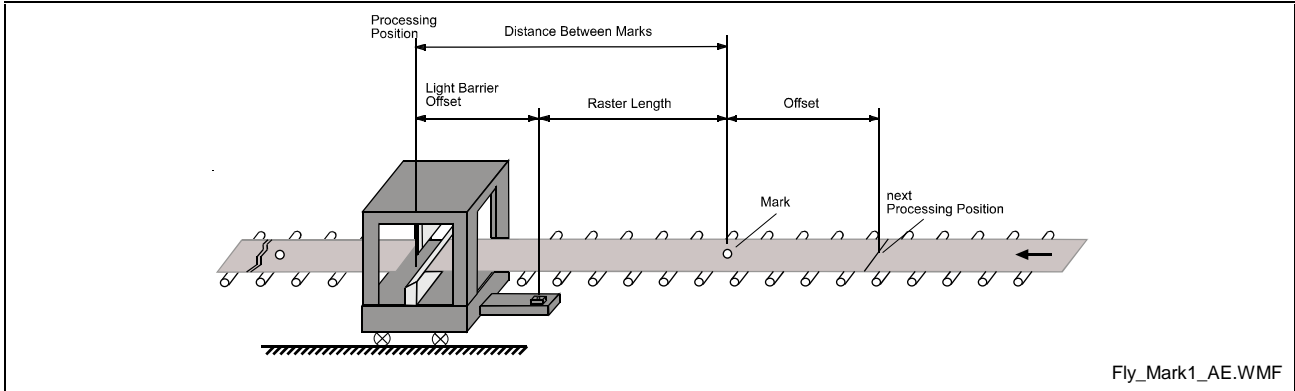


Fig. 5-15: `LMR` Command Example 1

The processing tool is located above the processing location and the light barrier is mounted **before** the material entry point on the carriage.

The following values result:

$$\text{Raster Distance} = \text{Distance between marks} - \text{Light Barrier Offset}$$

$$1000 \text{ mm} - 100 \text{ mm} = 900 \text{ mm}$$

$$\text{Offset Distance} = \text{Offset} + \text{Light Barrier Offset}$$

$$300 \text{ mm} + 100 \text{ mm} = 400 \text{ mm}$$

Example 2:

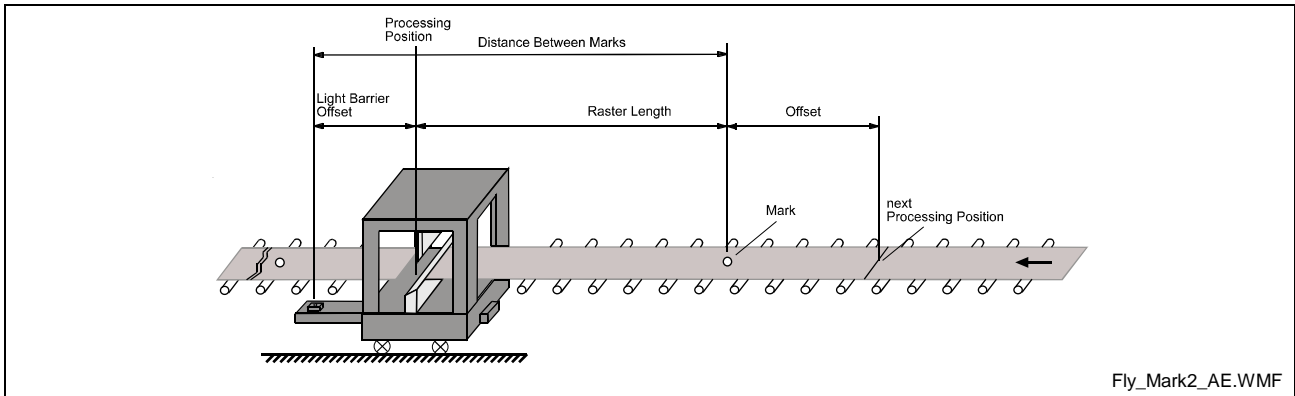


Fig. 5-16: `LMR` Command Example 2

The processing tool is located above the processing location and the light barrier is mounted **after** the material entry point on the carriage.

The following values result:

$$\text{Raster Distance} = \text{Distance between marks} + \text{Light Barrier Offset}$$

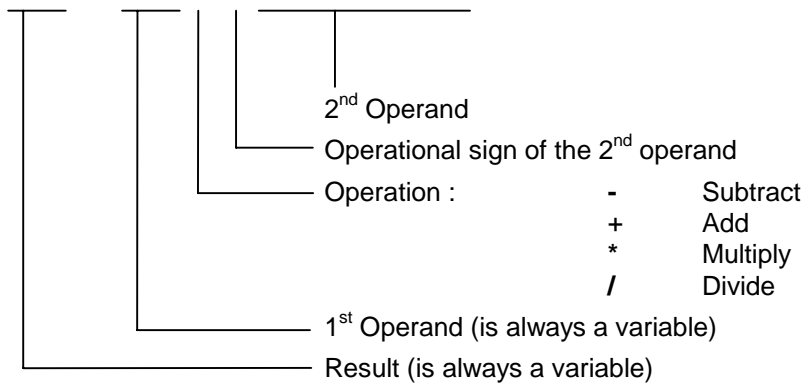
$$1000 \text{ mm} + 100 \text{ mm} = 1100 \text{ mm}$$

$$\text{Offset Distance} = \text{Offset} - \text{Light Barrier Offset}$$

$$300 \text{ mm} - 100 \text{ mm} = 200 \text{ mm}$$

MAT - Mathematics

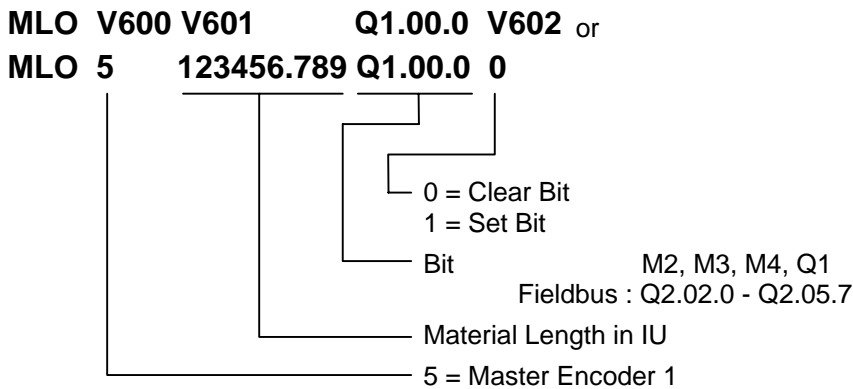
MAT V600 = V601 - + V602 or
MAT V600 = V601 - +123456.987654



The calculation is transferred to a calculating unit. This unit functions independently from the cycle time. Furthermore, this calculating unit can be used by the other tasks. Therefore, this command can endure over the time period of multiple cycles.

The program proceeds to the next instruction when the calculation is completed.

MLO - Material Length Output

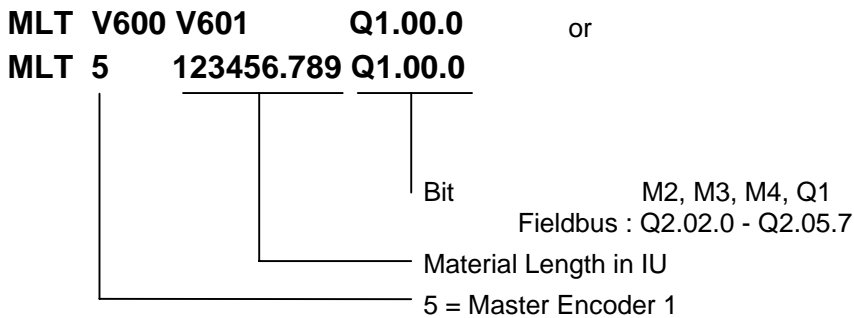


Using the `MLO` command, a bit can be set or cleared in Automatic Mode, depending upon the length of the material that has been fed.

When this command is read for the first time, length measurement is enabled. If the length of the material that has been processed is longer than the programmed value, the output is enabled or disabled. The length measurement is reset, which means that, again, if the length of the material that has been processed is longer than the programmed value, the output is enabled or disabled again. If the value 0 is programmed for the material length, or if Automatic Mode becomes inactive, measurement is disabled.

Note: If the already fed length of material is greater than the programmed value when the command is loaded, the bit is set or cleared and the length measurement restarts.

MLT - Material Length Test



Using the `MLT` command, the material length that has been processed through the tool can be tested.

At the programmed bit, after the command is skipped, the system indicates whether the processed material length is greater or smaller than the material length programmed in the command. The programmed bit takes on a status of `1` when the processed material length is greater than the programmed value. If the processed material length is smaller than the programmed value, the bit is cleared.

Notes: In order to use the `MLT` command, the `FUN` command must be programmed in the processing program or the manual cut program.

The `MLT` command is valid only for Axis 1 and for Mode 5 `Flying Cutoff`.

NOP - No Operation

NOP

This command has no function and operates like a blank block. While executing the program in Automatic Mode, this command is processed like any other command.

The program proceeds to the next instruction following the time period of one cycle.

PBK - Stop Motion

PBK V600 or
PBK 1
 └─ Axes 1 to 4

This command can be used to interrupt positioning motions in progress. The relevant axis is brought to a standstill using the current deceleration value. Following deceleration, any remaining positioning travel is ignored. If continuous operation has been enabled using `CON`, it is disabled.

After the `PBK` command has been skipped, other positioning commands can follow immediately.

Example:

0000	CON	1 1 +999
0001	WAI	02.000
0002	PBK	1
0003	POI	1 +000050.000 100

After the `PBK` command has been read in, the axis still moves over the deceleration distance from $V = 99.9\%$ to $V = 0$ plus 50 IU. There is, however, a continuous transition from $V = 99.9\%$ to $V = 10\%$.

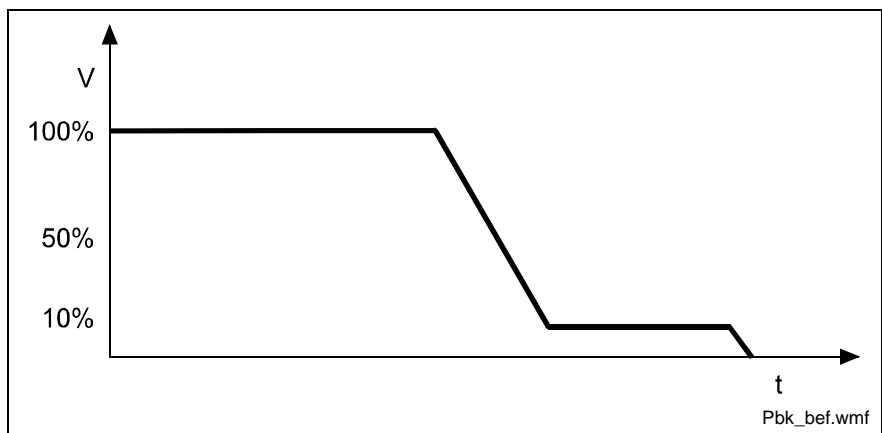
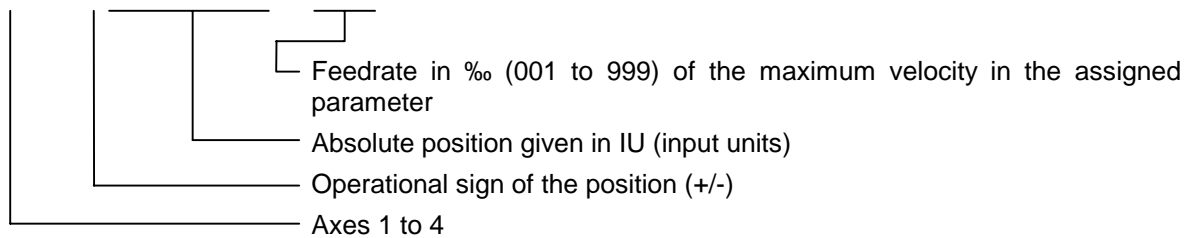


Fig. 5-17: Example of Positioning Break

The program proceeds to the next instruction following the time period of one cycle.

POA - Positioning, Absolute

POA V600 + V601 V602 or
 POA 1 +123456.789 999



From its current position, the drive is moved to the programmed absolute position referenced to the zero point.

Example: 1) Current Position = -100.000

```
0000 POA 1 +000200.000 999
```

The drive unit is moved 300 mm forward to the +200 position.

Example: 2) Current Position = +400.000

```
0011 POA 1 +000200.000 999
```

The drive unit is moved 200 mm backward to the +200 position.

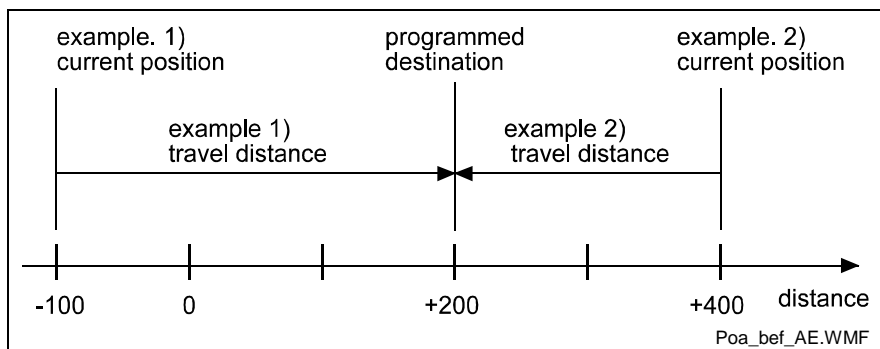


Fig. 5-18: Example of Positioning, Absolute

This command may be used only if an absolute measurement reference is present. This is the case when an absolute encoder is used for position detection or for position detection following a return to zero (homing) movement (see also `Homing`). Otherwise the error message `Not homed` is issued.

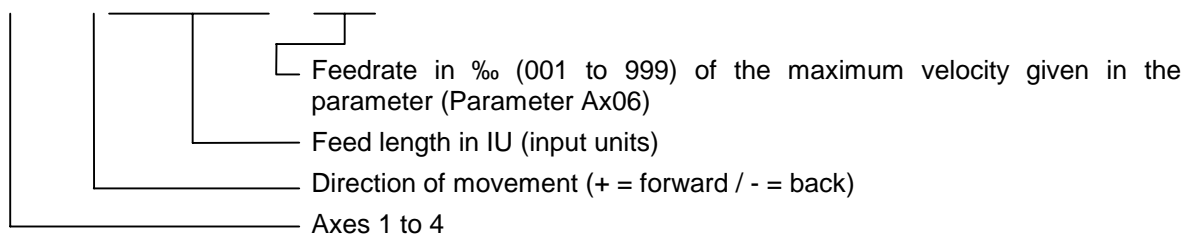
Example:

```
0000 POA 1 +00010.005 999
0001 JSR 0100
0002 POA 1 +000020.003 999
0003 JSR 0100
0004 POA 1 +000030.000 500
0005 JSR 0100
```

The program proceeds to the next instruction following the time period of one cycle.

POI - Positioning, Incremental

POI V600 + V601 V602 or
 POI 1 +123456.789 999



The position setpoint is incremented or decremented by the amount of the programmed value.

This feed length is adjusted to account for any remaining travel distance.

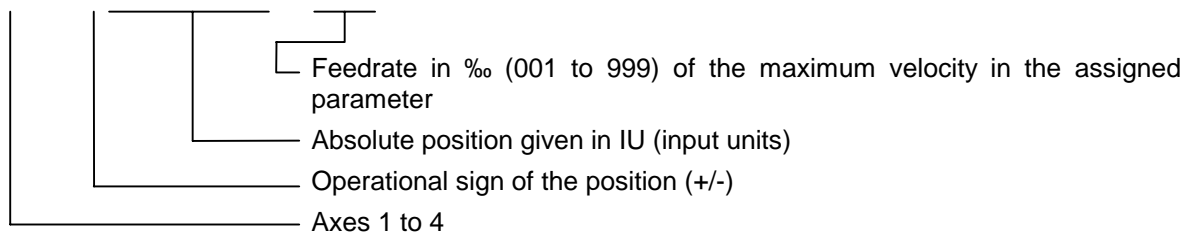
Example: The drive unit traverses the distance: -100 +200 = +100

0000	POI	1 -000100.000 999
0001	PSI	1 +000200.000 999
0002	JSR	0555
0003	JMP	0000

The program proceeds to the next instruction following the time period of one cycle.

PSA - Positioning, Absolute with In-Position

PSA V600 + V601 V602 or
PSA 1 +123456.789 999



This command corresponds to the 'POA' command. However, the program proceeds to the next instruction only if the programmed absolute position has been reached.

The drive unit is considered to have reached the correct position as soon as it reaches the 'Position Window' (see Parameter Ax27 'Switching Threshold') for the programmed position.

Example:

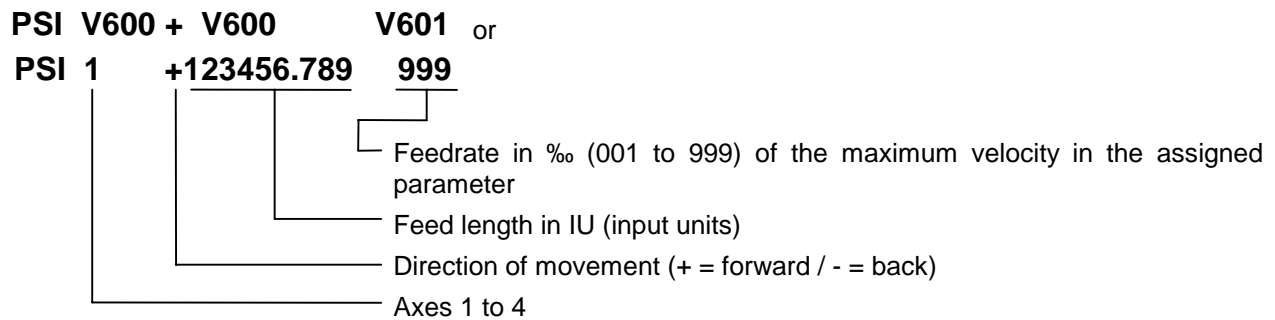
+ 100.00 = Current Position
0.20 = Switching Threshold, Parameter Ax27
± 0.20 = Position Window

0000	PSA	1	+000200.000	999
------	-----	---	-------------	-----

The program proceeds to the next instruction when the drive unit has reached position +199.80 to +200.20.

Note: Adjustment for the highest accuracy naturally takes place even after the program has gone on to the next instruction. The adjustment accuracy is therefore not dependent on the size of the position window.

PSI - Positioning, Incremental with In-Position



This command corresponds to the `POI` command. However, the program proceeds to the next instruction only after the positioning procedure has been completed (position acknowledgement). This procedure is completed as soon as the drive unit has traversed the programmed feed length within the `Position Window` (Ax27). Adjustment for the highest accuracy takes place even after the program has gone on to the next instruction.

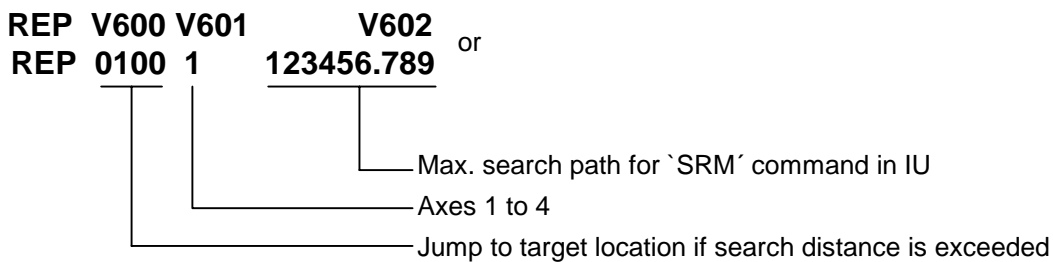
The size of the `Position Window` is stipulated in Parameter Ax27 (Switching Threshold).

Example:

0000	PSI	1 +000100.000 999
0001	WAI	00.500
0002	AEA	Q1.00.6 1
0003	JSR	0666
0004	JMP	0000

First, Axis 1 is started up. Once the final position has been reached and an additional waiting time of 0.5 seconds has elapsed, output Q1.00.6 is activated.

REP - Registration Position Limit



This command is a supplement to the `SRM` command. It permits limits to be placed on the search distance needed to find a reference marker.

If the maximum search distance entered here is exceeded without finding a reference marker, the program executes a jump to the specified target location. At the same time, the drive unit decelerates to a complete stop.

The `REP` command must not be executed immediately after the `SRM` command. A search distance that was defined in an `REP` command remains until another `REP` command is called.

After a change in operating mode, after a fault or after power up, the search distance is cleared.

The following command combinations are permissible:

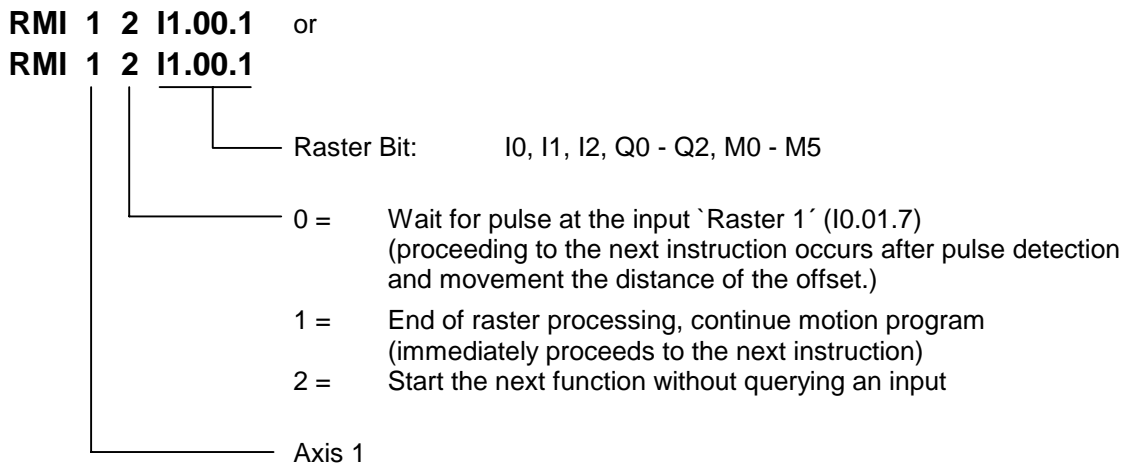
- 1) Moving to a reference point without search distance limitation.

0020	SRM	1 +000000.000 +050 I1.01.0
------	-----	----------------------------

- 2) Moving to the reference point is programmed in the `SRM` command.
A limit of max. 500 IU is programmed in the `REP` command.

0030	SRM	1 +000000.000 +050 I1.01.0
0031	REP	0900 1 000500.000

RMI - Registration Mark Interrupt



Using this command, an additional processing function can be executed, independently of the motion program for Axis 1.

The additional raster processing is initiated after detection of an input signal and movement of any offset distance for Axis 1. The rising edge of the pulse is evaluated. The motion program for this raster processing function is interrupted and continued later.

An offset distance can be programmed as an incremental movement (POI, PSI). This command must immediately follow the `RMI_1_0_xx.xx.x`.

The velocity that can be altered using the offset feed is reset to its previous value when the feed program continues.

If the velocity indication is = 000% in the offset feed, the previous command velocity remains valid.

The functions `Interrupt`, `Feed Angle Monitoring`, and `Override` are permitted.

Constraints using the `RMI` command:

- The raster program **must** be programmed in Task 2.
- The `RMI` command is not executed when a restart occurs.
- The `RMI` command only functions correctly for feed and offset feed operations in the direction of the positioning move (e.g. `PSI_1_+...`).
- In Task 2 (`RMI` program), no feed operation besides the offset may be programmed.
- After the `RMI` command (`RMI_1_0_xx.xx.x`) has been invoked, it is no longer possible to mask a hole.
- Detecting an additional raster before the command `RMI_1_1_xx.xx.x` is not possible.
- The offset feed must be longer than the braking distance, or the axis will reverse.

Note: This command is only available for Axis 1.

Example:

Holed sheet metal is to be sorted according to hole type. At the punching table, holes are punched in the sheet metal. Material feed is performed by the pass rolling mill. A hole is a reference signal for raster detection. Since an unknown change in length occurs during profiling, separation of the sheet metal cannot be performed using the same feed program, because it is possible that the hole pattern may drift toward the edge of the material. For this reason, separation is performed according to the reference hole. The reference hole can be detected using a light barrier, approach switch, or similar mechanism.

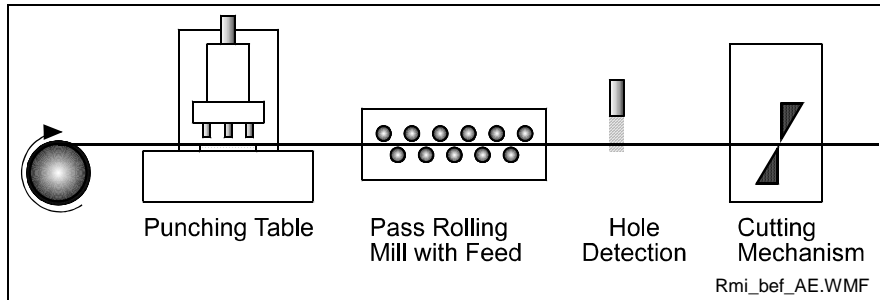


Fig. 5-19: RMI Command Example

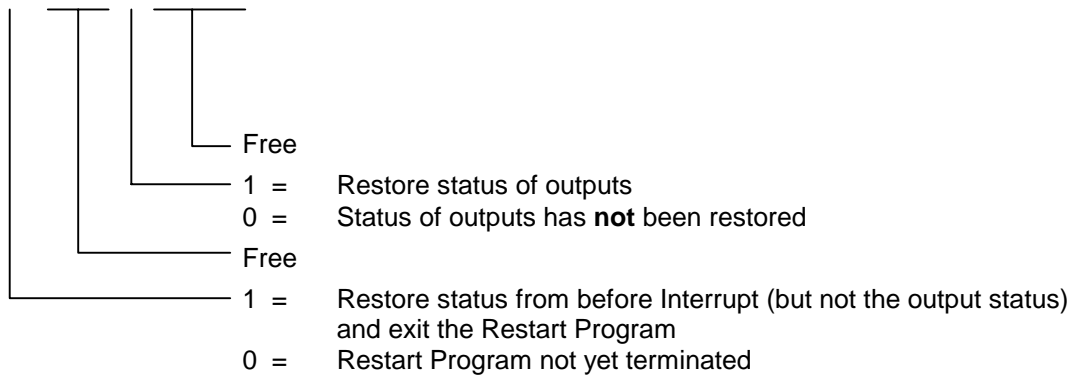
Programming Example:

Task 1			
0000	PSI	1 +000050.000 999	- Main Program
0001	JSR	0005	- Punching Unit 1
0002	PSI	1 +000025.000 999	
0003	JSR	0009	- Punching Unit 2
0004	JMP	0000	- New Cycle
Punching Unit 1			
0005	AEA	Q1.00.0 1	- Punching Unit 1 ON
0006	WAI	00.200	- Wait (Time Delay)
0007	AEA	Q1.00.0 0	- Punching Unit 1 OFF
0008	RTS		- Back to Main Program
Punching Unit 2			
0009	AEA	Q1.00.1 1	- Punching Unit 2 ON
0010	WAI	00.200	- Wait (Time Delay)
0011	AEA	Q1.00.1 0	- Punching Unit 2 OFF
0012	RTS		
Task 2			
0200	RMI	1 0 I1.01.7	- Wait for raster signal and movement of the offset
0201	PSI	1 +000015.500 500	- distance from the raster position
0202	JSR	0210	- Tool Program
0203	RMI	1 1 I1.01.7	- Perform feed operation in the Main Program
0204	JMP	0200	- New Cycle
Tool Program			
0210	AEA	Q1.00.2 1	- Cutting Mechanism ON
0211	WAI	00.250	- Wait (Time Delay)
0212	AEA	Q1.00.2 0	- Cutting Mechanism OFF
0213	WAI	00.250	- Wait (Time Delay)
0214	RTS		

Fig. 5-20: RMI Command Programming Example

RSV - Restart Vector

RSV 1 V600 1 0 0 1 1 or
 RSV 1 0000 1 0 0 1 1



This command affects the execution of the Restart Program. It selectively restores the status of the interrupted program and then terminates the Restart Program.

Example: B016 = 2000

Program 1:

2000	RSV	1 0000 10000	- Terminate Restart Program and completely restore status
------	-----	--------------	---

Program 2:

2000	AKN	I1.00.4 1	- Wait for input
2001	WAI	01.000	- 1-second wait time
2002	RSV	1 0000 10000	- Terminate Restart Program and completely restore status

Program 3:

2000	RSV	0 0000 10000	- Restore status of outputs
2001	AKN	I1.00.4 1	- Wait for input
2002	WAI	01.000	- 1-second wait time
2003	RSV	1 0000 00000	- Terminate Restart Program and completely restore status, except for outputs

See also Section `Restart`.

The program proceeds to the next instruction (or the instruction in the interrupted program) following the time period of one cycle.

RTM - Rotary Table Mode

RTM V601 V600 or
RTM 1 0

Rotary Table Mode:

- 0 = mode accepted from **Parameter Ax05**
- 1 = shortest distance
- 2 = programmed direction
- >2 = no change in mode

Axes 1 to 4

Rotary table must be preselected under the type of motion in **Parameter Ax00** and the axis must be homed.

The **parameter setting Ax05** is active after each power up or error acknowledgement, or after termination of Parameter Mode. Changing between Manual and Automatic Mode does not change the current Rotary Table Mode.

The program proceeds to the next instruction following the time period of one cycle.

RTS - Return from Subroutine

RTS

As described for the `JSR` command, a subroutine must be concluded with an `RTS` return command.

If several subroutine levels have been accessed in one program cycle, a return from a higher subroutine level leads first to the next lower subroutine level rather than directly back to the main program.

Example:

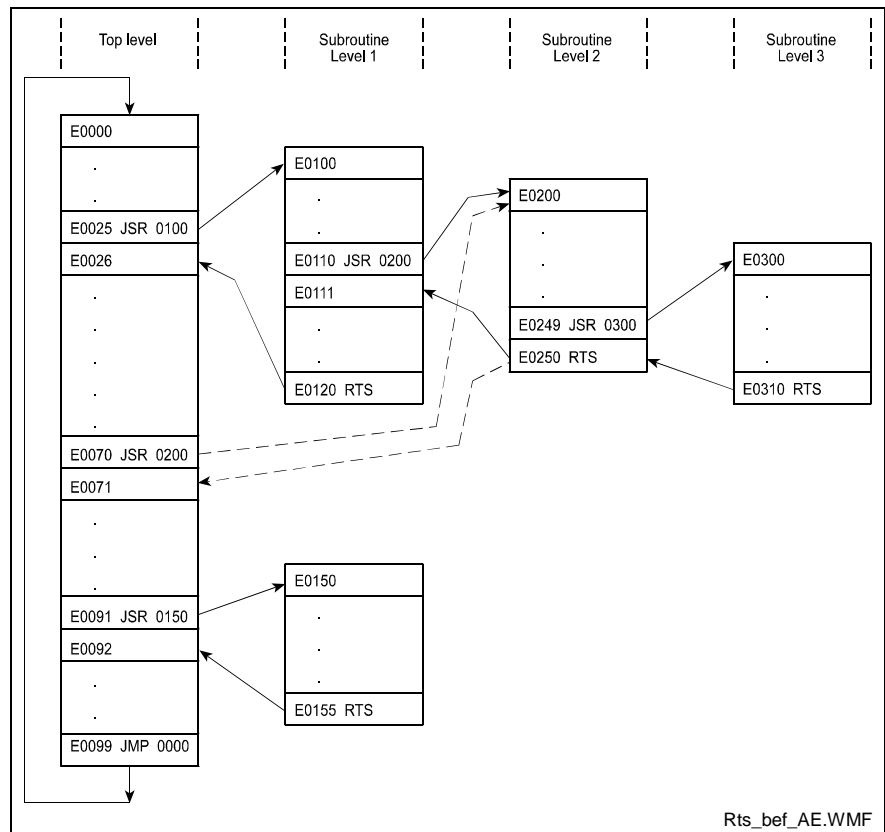


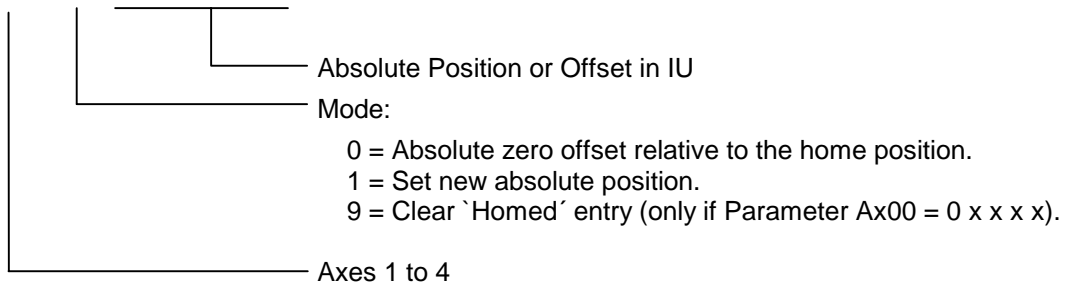
Fig. 5-21: Example of Return from Subroutine Levels

The program proceeds to the next instruction following the time period of one cycle.

SAC - Set Absolute Position Counter

SAC V601 0 +V600 or

SAC 1 0 +123456.789



Using this command, the coordinate system is offset or set to a particular value.

The changes made using the `SAC` command are temporarily valid. After a power up, switch to Parameter Mode or clearing an error, the initial coordinate system becomes valid again.

The command is executed correctly only when the axis signals `Position reached` (Parameter Ax27).

The program proceeds to the next instruction following the time period of one cycle.

Motion type = 0 (Rotary) The parameters "Ax03, Min. Travel Limit" and "Ax04, Max. Travel Limit" are not valid.

Axis Not Homed:

- Modes 0 and 1:
The actual position is set to the value found in the `SAC` command. This way, the axis is homed.
- Mode 9 :
No function. The program proceeds to the next instruction.

Axis Homed:

- Mode 0 :
The target position is offset by the value in the `SAC` command. (referenced to the initial coordinate system)
- Mode 1 :
The target position is set to the value found in the `SAC` command.
- Mode 9 :
The absolute position reference is canceled and the actual position is set to the value 0. The axis is no longer homed.

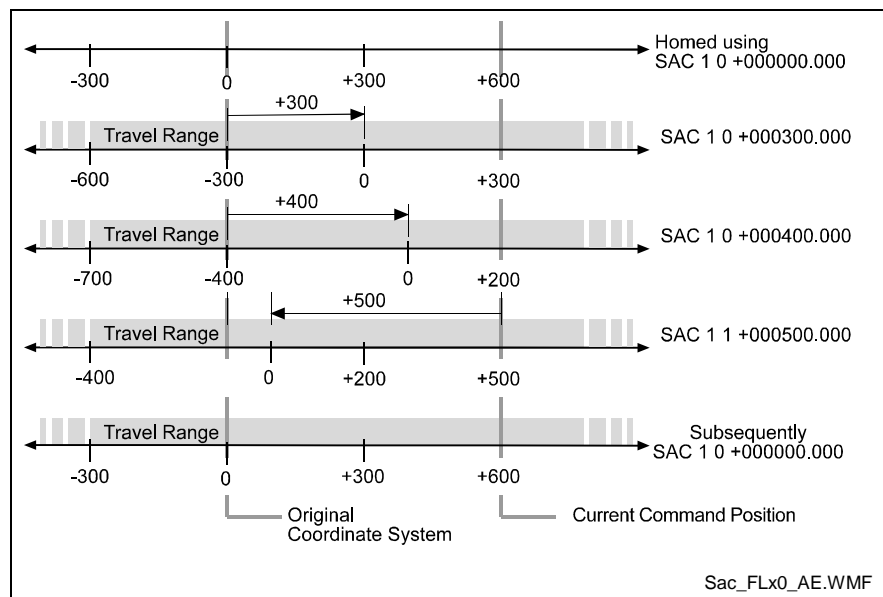


Fig. 5-22: How the `SAC` Command Works (Rotary)

Motion Type = 1 (Linear)

Axis Not Homed:

- Modes 0 and 1:
The axis cannot be homed using the `SAC` command. The error message "**Axis not homed**" is issued.
- Mode 9 :
No function. The program proceeds to the next instruction.

Axis Homed:

The parameters "**Ax03, Min. Travel Limit**" and "**Ax04, Max. Travel Limit**" are valid. They remain in the initial coordinate system.

- Mode 0 :
The target position is offset by the value in the `SAC` command. (referenced to the initial coordinate system)
- Mode 1 :
The target position is set to the value found in the `SAC` command.
- Mode 9 :
No function. The program proceeds to the next instruction.

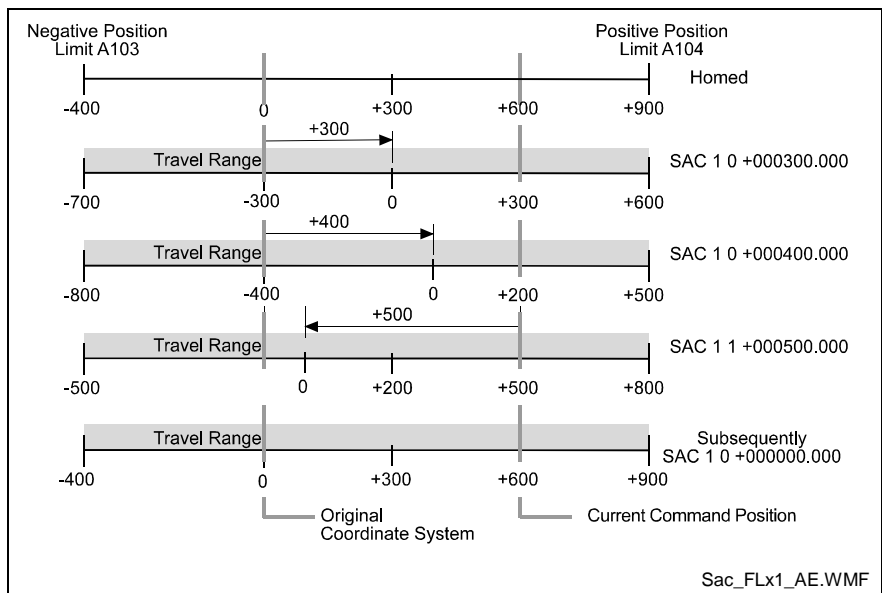


Fig. 5-23: How the `SAC` Command Works (Linear)

**Motion Type = 2
(Rotary Table)**

The parameters "Ax03, Min. Travel Limit" and "Ax04, Max. Travel Limit" are not valid.

Axis Not Homed:

- Modes 0 and 1:
The axis cannot be homed using the `SAC` command. The error message "Axis not homed" is issued.
- Mode 9 :
No function. The program proceeds to the next instruction.

Axis Homed:

- Mode 0 :
The target position is offset by the value in the `SAC` command. (referenced to the initial coordinate system)
- Mode 1 :
The target position is set to the value found in the `SAC` command.
- Mode 9 :
No function. The program proceeds to the next instruction.

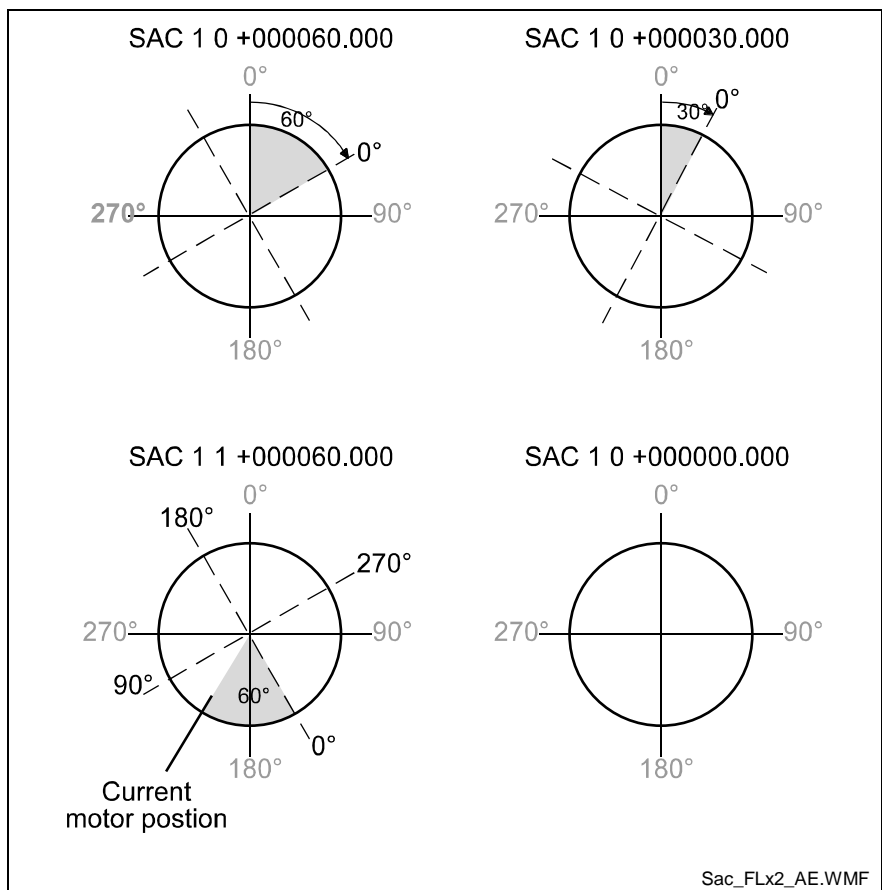
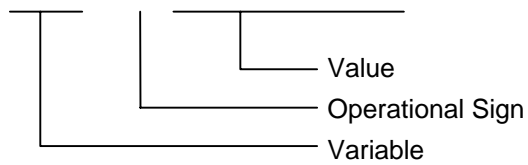


Fig. 5-24: How the `SAC` Command Works (Rotary Table)

SET - Set Variable Value

SET V600 = + V601 or
SET V600 = +12345678.123456

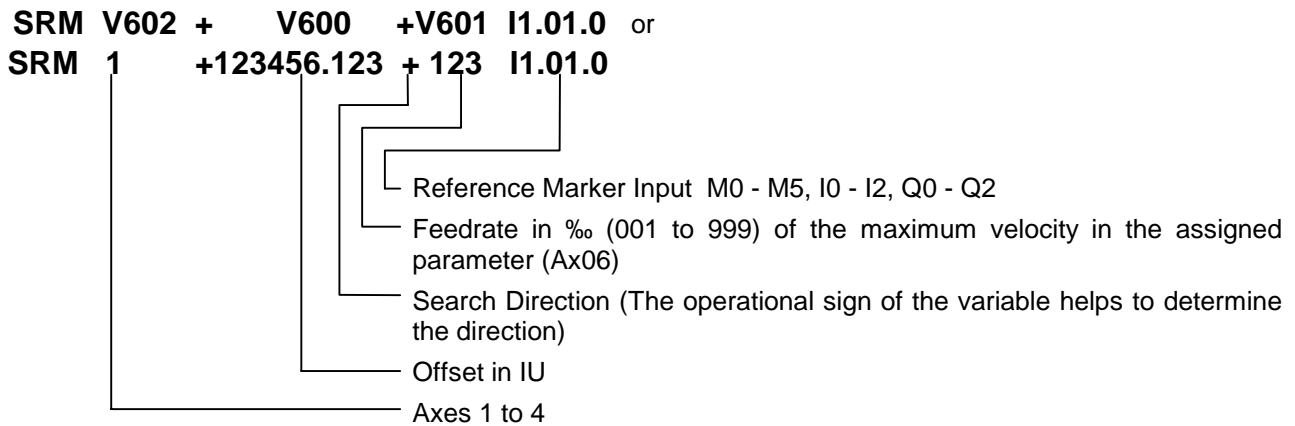


Using this command, the user-programmable variables V600 to V999 can be set from the program or copied from another variable.

If Axis X is not homed, the system variables V047, V048 and Vx00 can be set with the `SET` command.

The program proceeds to the next instruction following the time period of one cycle.

SRM - Search for Registration Mark



This command can be used to search for a reference marker at any time. The axes, the search direction, the search velocity and the reference signal input can be selected by the user. Once the command is invoked, the search for the reference marker proceeds at the preselected velocity. The reference marker is detected by means of the rising edge of a pulse (from 0V to +24V) at the programmed input.

As soon as the reference mark is detected, the program proceeds to the next instruction.

If a value of I0.01.7 (Raster 1) or I0.01.4 (Raster 2) is programmed for the reference marker input, a 'Raster' input is selected as the reference marker input. This input has no hardware debouncing. This input can also initiate an interrupt. This input is therefore able to detect the reference marker substantially more accurately (within a time frame of approx. 100 microseconds).

Offset Dimension:

The move to an offset dimension (referenced to the reference point) is accomplished immediately after detection of the reference point.

It is also possible to limit and monitor the search travel until the reference marker is found (see also the 'REP' command).

Detection of the reference point occurs within a time frame of 2 to 4 ms (controller cycle time). If a highly accurate reference point is required, the search velocity must be reduced. The achievable accuracy is determined as follows:

$$\text{SearchVelocity in IU / s} * 2 * \text{CycleTime [s]}$$

L: IU = Input Units
 s = seconds

Fig. 5-25: Calculation of the Search Velocity

Note: No new absolute measurement reference (zero point) is created using the 'SRM' command. This is possible only through the homing function.

The input 'Raster 1' (I0.01.7) can only be used by Axis 1 and the input 'Raster 2' (I0.01.4) can only be used by Axis 2 as a reference marker input.

Example: The maximum velocity is 200 IU/s. The cycle time is 2 ms. A normal input with a debouncing time of the time period of one cycle is selected.

```
0000 SRM 1 +000000.000 +500 I1.01.0
```

The search velocity is $200 \text{ IU/s} * 500 \text{ ‰} = 100 \text{ IU/s}$. The accuracy is $> 0.4 \text{ mm}$.

With the system input `Raster 1` (I0.01.7) or `Raster 2` (I0.01.4), there is no debouncing time and the detection time is approx. 0.1 ms. The accuracy is $> 0.01 \text{ IU}$.

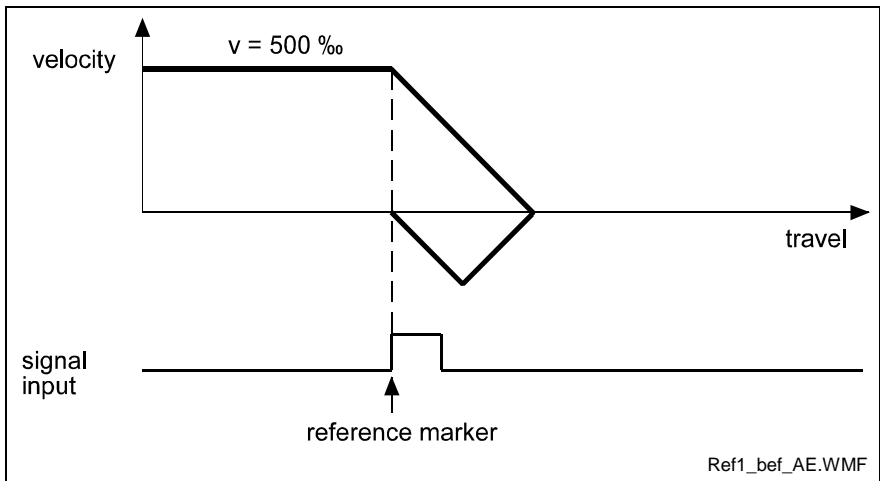


Fig. 5-26: Example of Movement to a Reference Mark

Example of moving to a reference mark with offset programming:

```
0000 SRM 1 +000200.000 +500 I1.01.0
```

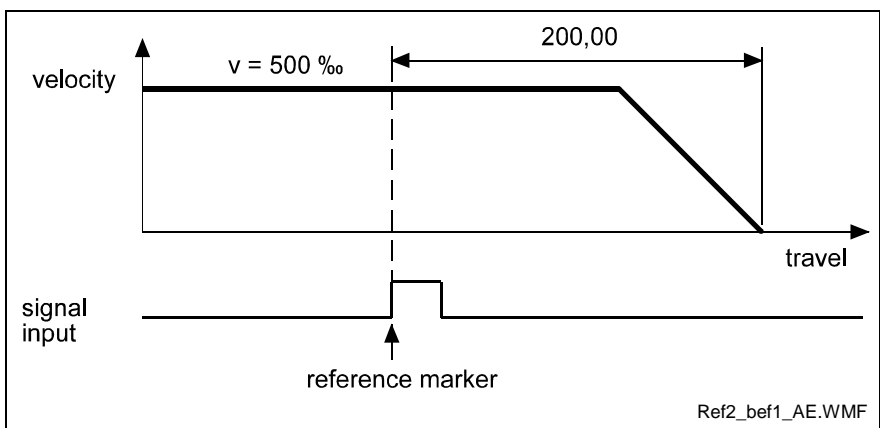
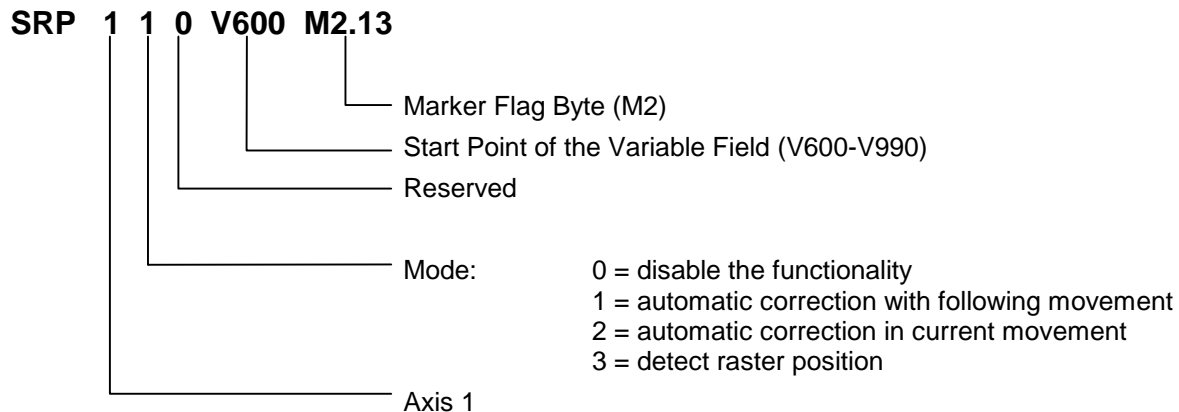


Fig. 5-27: Example of Moving to a Reference Mark with Offset Programming

SRP - Print Mark Registration



Raster detection is accomplished using the SRP command. The command is invoked at the beginning of the automatic program and it thus enables the functionality. The beginning of the measurement occurs with the following feed command PSI. Depending on the assignment, the result can be processed immediately or in the next positioning operation. For Assignment 1, no correction is made in the first PSI command after the SRP.

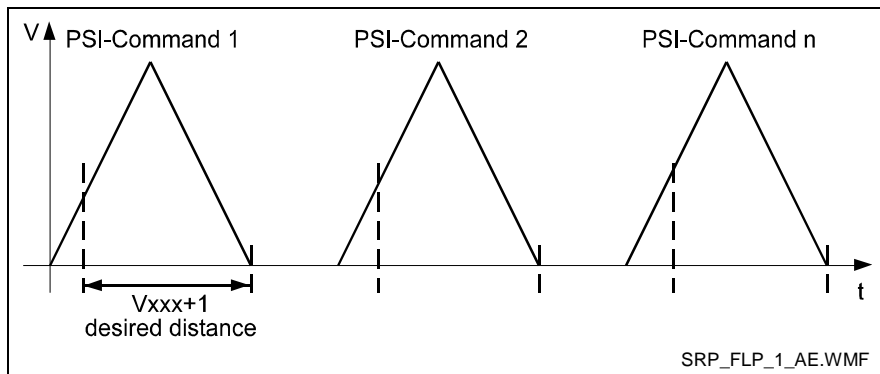


Fig. 5-28: Registration Marks

Marker Flag Byte:

M2.xx.4 Raster detected (read only)

Raster Input:

X3 Pin 16 This is a fast input (Raster 1).

Variable Field:

Different data is required for the various assignments. This data is input into a common variable field, where each assignment does not use every variable. The lowest address of the variable field is determined in the command.

Vxxx+0 = **measured distance** to the end position of the positioning operation in IUs (read only).

Vxxx+1 = **desired distance** to the end position of the positioning operation in IUs (read only).

Vxxx+2 = **maximum correction value** in IUs. (positive values only)
The difference between Vxxx+0 and Vxxx+1 can be limited to a maximum measurement with these variable.

- Vxxx+3 = **Beginning of search** in IUs
(measured from the start position of the command)
- Vxxx+4 = **End of search** in IUs
(measured from the start position of the command)
Vxxx+4 = 000 (no monitoring of search distance)
- Vxxx+5 = **target instruction**, when end of search is exceeded
- Vxxx+6 (Reserved)

Mode:

0 = disabling the functionality "Raster detection"

1 = automatic correction with following movement

The difference between the desired and the measured distance is output. The feed length of the next feed command is corrected by this value. To avoid a large correction, and therefore a movement which is too small, a maximum correction value can be set in the variable Vxxx+2.

The beginning and end of the search can be set in variables Vxxx+3 and Vxxx+4. If there is no raster signal in this area, the program branches to the instruction number set in variable Vxxx+5. The positioning operation is completed. If search monitoring is not enabled and no raster signal is detected, the next positioning movement is executed without correction.

2 = automatic correction in the current positioning operation

This function corresponds to Assignment 1. The correction is performed immediately after detection of the raster signal.

3 = Raster position detection

This function corresponds to Assignment 1. However, no correction is made. The information is entered in variable Vxxx+0 and marker flag M2.xx.4. This data is cleared only when the next positioning command is started.

Note: This command is only available for Axis 1.

Examples:

	SET	V601 = 20	Distance to End Position
	SET	V602 = 10	Maximum Correction
	SET	V604 = 0	No Search Monitoring
	SRP	1 1 0 V600 M2.02	
	WAI	0.1	
Start	PSI	1 +100 999	Feed Command
	JSR	Processing	
	JMP	Start	

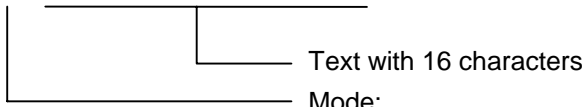
Fig. 5-29: Example for Mode = 1

	SET	V601 = 20	Distance to End Position
	SET	V602 = 10	Maximum Correction
	SET	V604 = 0	No Search Monitoring
	SET	V700 = +100	Desired Positioning
	SET	V701 = +V700	Calculated Positioning
	SET	V702 = 0	Interim Value
	SRP	1 3 0 V600 M2.02	
	WAI	0.1	
Start	PSI	1 +V701 999	Feed Command
	BCE	Corr M2.02.4 1	
	SET	V701 = V700	
	JMP	Prog	
Corr	MAT	V702 = V601 – V600	
	MAT	V701 = V700 + V702	
Prog	JSR	Processing	
	JMP	Start	

Fig. 5-30: Example for Mode = 3

TXT - Text Row

TXT 0 ABCDEFGHIJKLMNOP



Mode:

- 0 = Text can be requested via Status 63.
- 1 = Text can be requested via Status 53.
- 2 = Text is no longer output as Status 53.

Using the TXT command, text that can be read via Status Messages 53 or 63 across the serial interface can be prepared as defined in a program. The character set includes ASCII characters from ASCII code 32 to 95 (from the space character, numbers and capital letters to the underscore character).

Note: ASCII characters from ASCII code 32 to 95
except \$ and \.

Output via Status 63:

Up to 64 characters can be used for the description in this status. This is achieved by using 4 TXT commands that must be written successively in the program. These are executed in the time period of one cycle (see parameter B010). If less than 4 TXT commands are used, the Status 63 output has a length of $n * 16$ characters.

Example:

```
0000 TXT 0 WAIT _ F O R _ _ _ _ _
0001 TXT 0 FEED _ A N G L E _ _ _ _ _
```

Status 63

```
Xs63_WAIT_FOR_ _ _ _ _ _ FEED_ANGLE_ _ _ _ _ $ h h CR LF
```

Output via Status 53:

Using Status 53, the current error code can be requested. If there is no fault and a TXT command with Mode 1 is executed, the one-line text from the TXT command is output when reading Status 53. Error messages are dominant and are output in place of the text.

The program text in Status 53 is enabled only in Manual and Automatic modes, and it is deleted when switching from Automatic to Manual or Manual to Parameter.

Example:

Program is in Automatic Mode

```
0000 TXT 1 STOP _ P R E S E N T _ _ _ _
0001 TXT 0 WAIT _ F O R _ _ _ _ _
0002 TXT 0 FEED _ A N G L E _ _ _ _ _
0003 AEA Q1.00.6 1
```

Status 53

```
? s X _ 5 3 _ CR LF
```

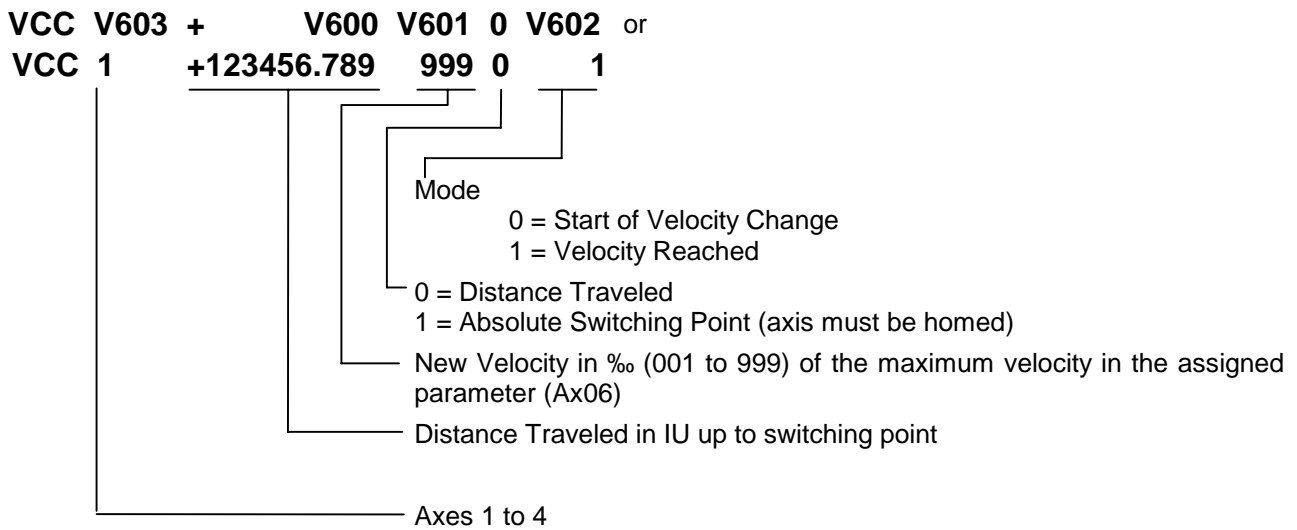
```
Xs53_00_STOP_PRESENT_ _ _ _ _ $hh CR LF
```

Status 63

```
? s X _ 6 3 _ 1 2 _ CR LF
```

```
Xs63_WAIT_FOR_ _ _ _ _ _ FEED_ANGLE_ _ _ _ _ $ h h CR LF
```

VCC - Velocity Change



Mode 0 : Start of velocity change

Velocity changes are always referenced to the most recently initiated positioning function.

The program proceeds to the next instruction immediately after the distance programmed in the VCC command, referenced to the start position of the most recent positioning function, has been traversed.

A change in velocity can take place only when the positioning functions do not include position acknowledgement (POI, POA).

The position portion in the last VCC value must be smaller than the previously started positioning function, otherwise that VCC command is not executed and the program proceeds to the next instruction.

Example:

The actual start position is 0 mm.

0000	POI	1 +000100.000 999	- Move 100 IU, then proceed to next instruction
0001	VCC	1 +000050.000 250 0 0	- after 50 IU, change to 25% velocity
0002	VCC	1 +000075.000 500 0 0	- after 75 IU, change to 50% velocity
0003	VCC	1 +000090.000 100 0 0	- after 90 IU, change to 10% velocity
0004	AKN	M2.00.0 1	- Wait until target position is reached
0005	WAI	01.000	- End of cycle, wait 1 second
0006	JMP	0000	- Repeat program

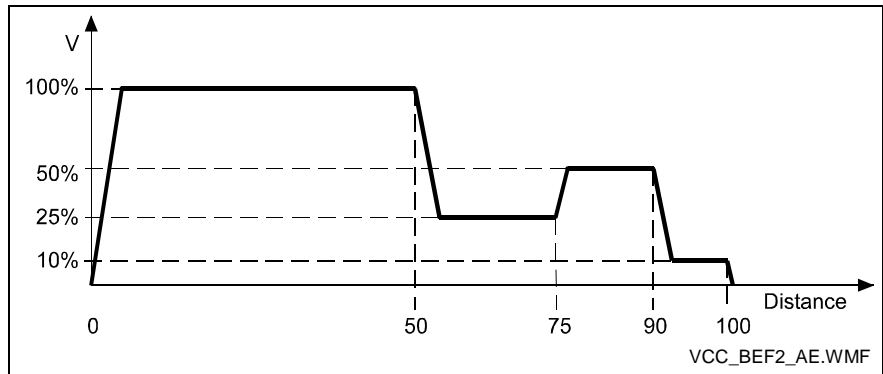


Fig. 5-31: Change Velocity (Distance Traveled)

Mode 1 : Velocity reached

This command changes the velocity of a positioning move in progress such that the desired velocity is reached at the specified absolute position.

The program proceeds to the next instruction immediately after the drive unit begins changing its velocity. This point depends on the acceleration, the difference in velocity and the position lag.

If this point has already been reached or exceeded when the VCC command arrives, the program proceeds immediately to the next instruction, accepting the new velocity.

The axis must be homed to zero.

Example:

The actual start position is 100 mm.

0000	POA	1 +000300.000	999	- Move to absolute position +300 IU
0001	VCC	1 +000200.000	500 1 1	- At position +200 IU, V = 50%
0002	VCC	1 +000280.000	100 1 1	- At position +280 IU, V = 10%
0003	AKN	M2.00.1	1	- Wait until target position is reached
0004	WAI	01.000		- End of cycle, wait 1 second
0005		

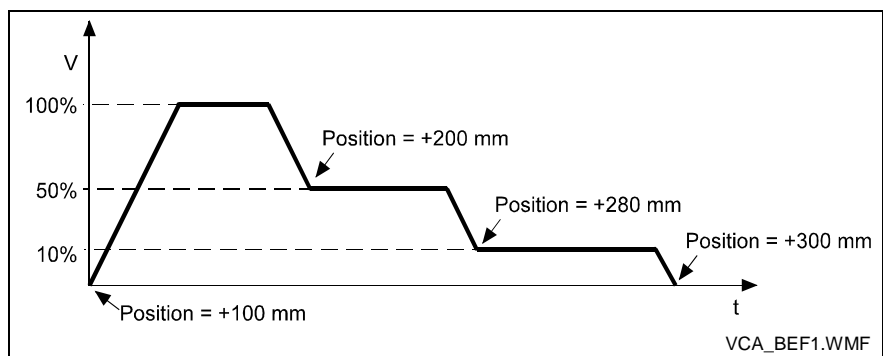
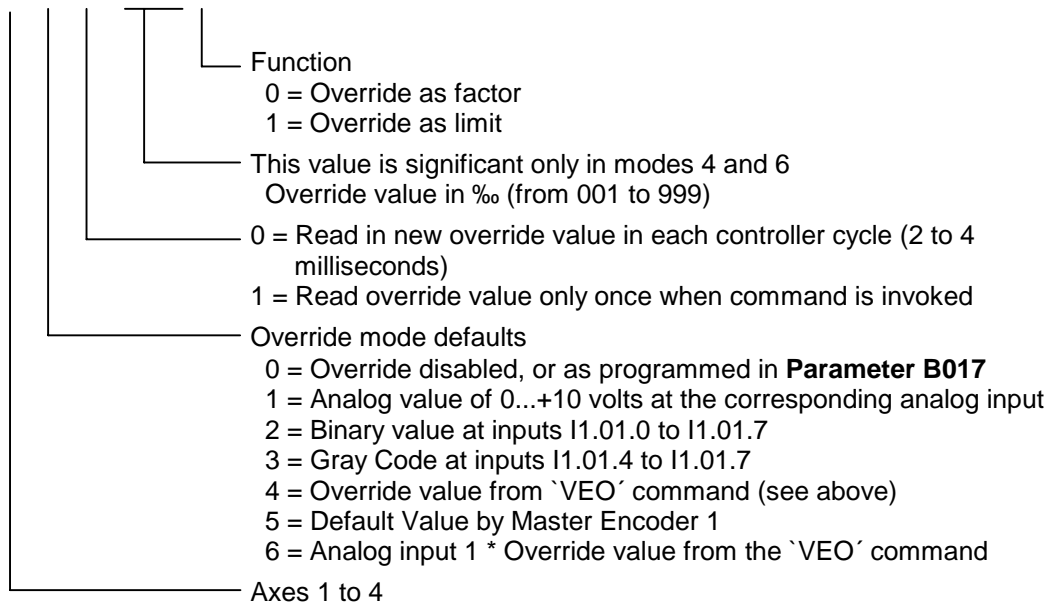


Fig. 5-32: Change Velocity (Absolute Position)

VEO - Velocity Override

VEO V601 1 0 V600 1 or
 VEO 1 1 0 500 1



This command produces a reduction in the velocity of all of the programmed traversing commands.

With the `Override as factor` function, the override value is multiplied by the programmed velocity from the commands.

With the `Override as limit` function, the override value is multiplied by the programmed velocity from the parameter Vmax (**Param. Ax06**), and therefore limits the velocity. Activation of an override function using the VEO command has priority over activation of any function within **Parameter B017**.

Once a `VEO` command has been invoked, it applies to all subsequent motions until it is canceled. See also the examples on the following pages.

Any change in operating mode between `Automatic` and `Manual` cancels the override function invoked by the `VEO` command. The values can be changed again in Task 3.

The program proceeds to the next instruction following the time period of one cycle.

Override Mode 5

This function can only be activated using the `VEO` command if the axis is designated as a `Normal Axis` in Parameter Ax00. Additionally, the parameters for Master Encoder 1 must be correctly set (Parameters C000 to C003). Otherwise, the program proceeds to the following instruction immediately.

The following relationship applies:

$$Override\ Value = \frac{Master\ Enc.\ Vel. [IU_Master\ Enc. / s]}{Maximum\ Velocity [IU_Motor / s]} \times Multiplier$$

L: IU - Input Units

Fig. 5-33: Formula for Default Values via Master Encoder 1

The maximum velocity is taken from **Parameter Ax06**.

After each power up or error acknowledgement, or after termination of Parameter Mode, the multiplier is always equal to 1 (preset). The multiplier can be edited using the `FOL` command.

If the axis reaches a velocity of more than 1.25 times Vmax (**Parameter Ax06**), because of a programming error or excessive velocity of the master encoder, the error message `max. Override Ax` is issued.

However, the velocity of the drive is limited to Vmax in any case, for master encoder speeds > Vmax.

Flying Cutoff Using the 'VEO' command, the reverse velocity can be reduced in 'Flying Cutoff' mode. The reverse velocity results from multiplying the override value by the maximum velocity from Parameter A106. If the default override value is off, the maximum velocity from Parameter A106 is used as the reverse velocity.

Notes: To reduce the reverse velocity in 'Flying Cutoff' mode, only Mode 0 and Mode 4 (override from VEO command) are permitted for determining the default override value. Only the information about the override value and the default override value is relevant.

The reduction of the reverse velocity is possible only in Automatic Mode.

After a re-start, error or use of 'Parameter' Mode, the reverse velocity is the maximum velocity from Parameter A106.

Examples: `VEO` - Velocity Override

0000	BPA	0004 M2.02 21022222	- Program Selection; Jump to Progr. A
0001	BPA	0006 M2.02 20122222	- Program Selection; Jump to Progr. B
0002	BPA	0008 M2.02 21122222	- Program Selection; Jump to Progr. C
0003	JMP	0000	- Wait Loop
0004	VEO	1 4 1 999 1	- Program A; velocity unchanged
0005	JMP	0009	- Execute positioning function
0006	VEO	1 4 1 700 1	- Program B; velocity limited
0007	JMP	0009	- Execute positioning function
0008	VEO	1 4 1 500 0	- Program C; reduce velocity
			- Execute positioning function
0009	POI	1 +000100.000 999	- Move 100 mm and proceed to next instruction
0010	VCC	1 +000035.000 800 0 0	- after 35mm, change to 80% velocity
0011	VCC	1 +000050.000 600 0 0	- after 50mm, change to 60% velocity
0012	VCC	1 +000065.000 400 0 0	- after 65mm, change to 40% velocity
0013	VCC	1 +000080.000 200 0 0	- after 80 mm, change to 20% velocity
0014	AKN	M2.02.4 1	- Wait until switching threshold is reached
0015	WAI	01.000	- At end of cycle, wait 1 second
0016	JMP	0000	- Jump to program selection

The above example from the program generates the following velocity profiles:

1) Program A – unaffected velocity profile

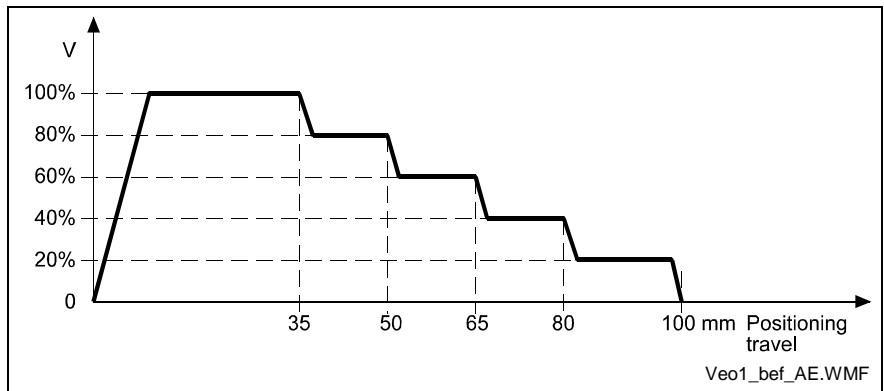


Fig. 5-34: VEO Command - Change Velocity

2) Program B – velocity limited to 70% by instruction number 0006

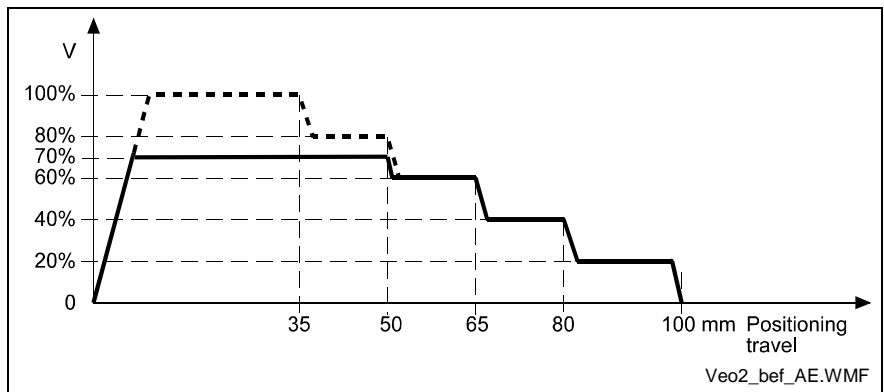


Fig. 5-35: VEO Command - Limit Velocity to 70%

3) Program C - Multiplication by factor of `500` from instruction number 0008

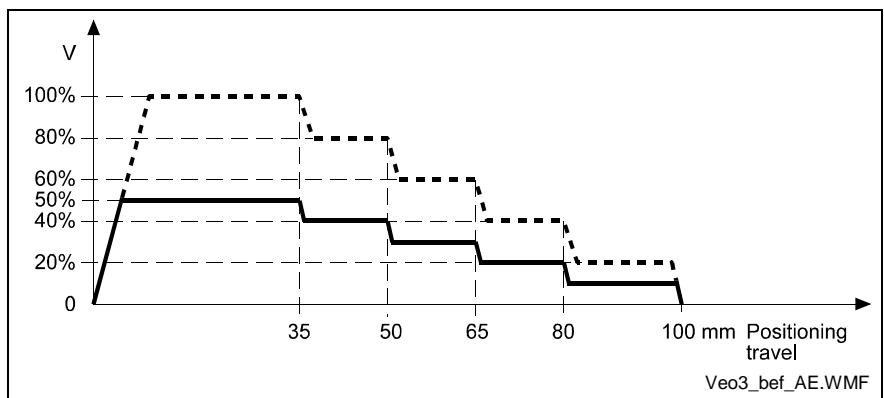


Fig. 5-36: VEO Command - Multiplication by a Factor

WAI - Wait (Time Delay)

WAI V600 or
WAI 00.500

└── Wait time in seconds

Execution of the next instruction is delayed until the programmed time has elapsed, i.e., the program proceeds to the next instruction after the waiting time has elapsed.

Notes

6 Logic Task

6.1 General Information

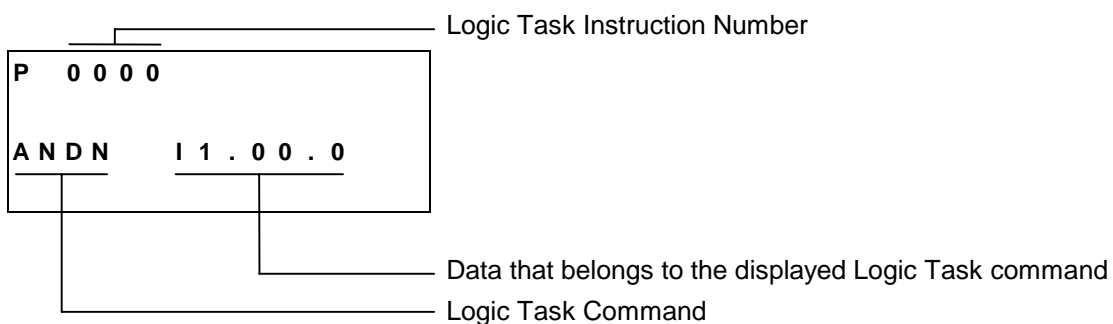
The Logic Task program is written into a line-by-line memory that contains 1000 lines. It is saved in a buffered area and it can be edited via the keypad or the serial interface. After turning the CLM on, the program is interpreted by the built-in compiler and processed without a start signal. For programming and for stopping the Logic Task, the system must be switched to Parameter Mode. When leaving Parameter Mode, the program is recompiled and it is started immediately (only if no errors are present). If an error is present, the error message 'Logic Prg. Error' is issued.

An average processing speed of 1000 assignments/sec is reached, where there is a minimum cycle time of 4 ms.

6.2 Program Input

Input via the Keypad

For programming via the keypad, the CLM must be in the display mode 'Logic Task Input'. To enter this display mode, one must press **F1** in 'Parameter' Mode.







In line 1 of the input menu, the number of the Logic Task instruction to be displayed or programmed is input.

To accomplish this, move the cursor to the first position in the program instruction number by pressing **←** and input the desired number using the data keys.


The cursor moves one space to the right after each input. Back up by pressing **←**.


While inputting the instruction number, the command assigned to the number is displayed. After entering the last digit of the program instruction number, the cursor jumps directly to the first character of the Logic Task command.


In this position, it is possible to scroll through all commands in alphabetical order by pressing  and .

After locating the desired command, move the cursor to the data field using  or . Here, the data for the command is input or edited using the data keys.


The new data is visible on the display, but it has not yet replaced the old data. This (replacing the old data) occurs only after saving.

To save the edited data, press the Save  key.

After pressing the Save key , the information is saved. Then, the next program instruction (+1) is displayed and the cursor is placed on the first character of the Logic Task command.

Editing data can be aborted at any time. By pressing , the cursor returns to the first character of the Logic Task command and the previously saved contents of the program instruction are redisplayed.

For each command, a predefined input mask is completed with data.

For each incorrectly programmed character, a `?' is displayed. A command is correctly programmed when no `?' characters appear in the instruction after pressing . If you attempt to save an instruction that contains `?', the input is not accepted.

End of the Logic Task Program The Logic Task program must end with the `END` command.

Deactivating the Logic Task To deactivate the Logic Task, an `END` command must be programmed into program instruction 0000.

Loading via the Serial Port

The program can be loaded via the serial port of any computer that has an RS232C or RS485 interface.

Parameters B002 and B003 or B004 and B005 control the activation and setting of the serial port.

The transmission format used by the CLM is described in the chapter `Interfaces`.

The MoMaNT programming interface provides a simple input and editing option.

6.3 Overview of All Logic Task Commands

Load, Save, Set and Reset Assignments		Logical Assignments	
LD	ST	AND	AND(
LDN	STN	ANDN	ANDN(
SET	RES	OR	OR(
SETC	RESC	ORN	ORN(
SETCN	RESCN	XOR	XOR(
		XORN	XORN(

Other Assignments			
END	NOP		
)			

Fig. 6-1: Logic Task Commands

For the load assignments and logical assignments, M0, M1, M4 - M6, Q0 - Q2 and I0 - I2 are allowed as operands.

For the Save, Set and Reset Assignments, M5, M6, Q1 and Q2.02 - Q2.05 are allowed as operands.

6.4 Load, Save, Set and Reset Assignments

Commands for Loading and Saving

LD	Loads the value of the operand
LDN	Loads the negated value of the operand
ST	Assigns the current value to the operand
STN	Assigns the bit-by-bit negated value to the operand

Set and Reset Commands

SET	Setting the bit operand, unconditional
SETC	Setting the bit operand, if the previous result is TRUE; otherwise no change
SETCN	Setting the bit operand, if the previous result is FALSE; otherwise no change
RES	Resetting the bit operand, unconditional
RESC	Resetting the bit operand, if the previous result is TRUE; otherwise no change
RESCN	Resetting the bit operand, if the previous result is FALSE; otherwise no change

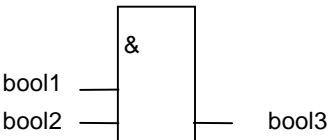
6.5 Logical Assignments

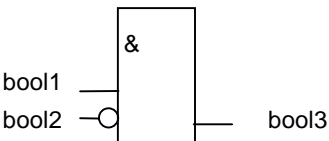
AND Logic

The 'AND Logic' functions bit-by-bit.

- AND** AND logic of the current value with the value of the operand
- ANDN** AND logic of the current value with the bit-by-bit negated value of the operand
- AND(** AND logic of the current value with the logical value of the following term
- ANDN(** AND logic of the current value with the negated logical value of the following term

Examples: AND Logic

FBS	AWL	Type
	<pre>LD bool1 AND bool2 ST bool3</pre>	<pre>bool1: BOOL bool2: BOOL bool1: BOOL</pre>
bool1	1 0 1 0	
bool2	1 1 0 0	
bool3	1 0 0 0	

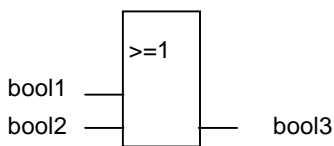
FBS	AWL	Type
	<pre>LD bool1 ANDN bool2 ST bool3</pre>	<pre>bool1: BOOL bool2: BOOL bool1: BOOL</pre>
bool1	1 0 1 0	
bool2	1 1 0 0	
bool3	0 0 1 0	

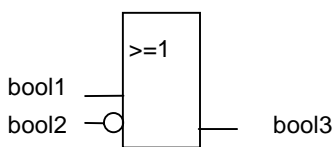
OR Logic

The 'OR Logic' functions bit-by-bit.

- OR** OR logic of the current value with the value of the operand
- ORN** OR logic of the current value with the bit-by-bit negated value of the operand
- OR(** OR logic of the current value with the logical value of the following term
- ORN(** OR logic of the current value with the negated logical value of the following term

Examples: OR Logic

	FBS	AWL	Type															
	<pre>LD bool1 OR bool2 ST bool3</pre>	<pre>bool1: BOOL bool2: BOOL bool1: BOOL</pre>																
<table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px;">bool1</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">0</td> </tr> <tr> <td style="padding: 2px;">bool2</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">0</td> </tr> <tr> <td style="padding: 2px;">bool3</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">0</td> </tr> </table>	bool1	1	0	1	0	bool2	1	1	0	0	bool3	1	1	1	0			
bool1	1	0	1	0														
bool2	1	1	0	0														
bool3	1	1	1	0														

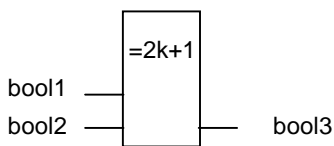
	FBS	AWL	Type															
	<pre>LD bool1 ORN bool2 ST bool3</pre>	<pre>bool1: BOOL bool2: BOOL bool1: BOOL</pre>																
<table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px;">bool1</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">0</td> </tr> <tr> <td style="padding: 2px;">bool2</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">0</td> </tr> <tr> <td style="padding: 2px;">bool3</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1</td> </tr> </table>	bool1	1	0	1	0	bool2	1	1	0	0	bool3	1	0	1	1			
bool1	1	0	1	0														
bool2	1	1	0	0														
bool3	1	0	1	1														

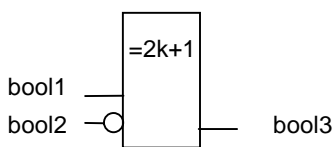
XOR Logic

The 'XOR Logic' functions bit-by-bit.

- XOR** Exclusive OR logic of the current value with the value of the operand
- XORN** Exclusive OR logic of the current value with the bit-by-bit negated value of the operand
- XOR(** Exclusive OR logic of the current value with the logical value of the following term
- XORN(** Exclusive OR logic of the current value with the negated logical value of the following term

Examples: XOR Logic

	FBS	AWL	Type															
	LD bool1 XOR bool2 ST bool3	bool1: BOOL bool2: BOOL bool1: BOOL																
<table border="1" style="border-collapse: collapse;"> <tr> <td style="width: 10%;">bool1</td> <td style="width: 10%;">1</td> <td style="width: 10%;">0</td> <td style="width: 10%;">1</td> <td style="width: 10%;">0</td> </tr> <tr> <td>bool2</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>bool3</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> </tr> </table>	bool1	1	0	1	0	bool2	1	1	0	0	bool3	0	1	1	0			
bool1	1	0	1	0														
bool2	1	1	0	0														
bool3	0	1	1	0														

	FBS	AWL	Type															
	LD bool1 XORN bool2 ST bool3	bool1: BOOL bool2: BOOL bool1: BOOL																
<table border="1" style="border-collapse: collapse;"> <tr> <td style="width: 10%;">bool1</td> <td style="width: 10%;">1</td> <td style="width: 10%;">0</td> <td style="width: 10%;">1</td> <td style="width: 10%;">0</td> </tr> <tr> <td>bool2</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>bool3</td> <td>1</td> <td>0</td> <td>0</td> <td>1</td> </tr> </table>	bool1	1	0	1	0	bool2	1	1	0	0	bool3	1	0	0	1			
bool1	1	0	1	0														
bool2	1	1	0	0														
bool3	1	0	0	1														

6.6 Other Assignments

NOP	No Command (can be used as a placeholder)
END	End of the assignment list
)	End of a term

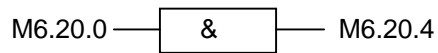
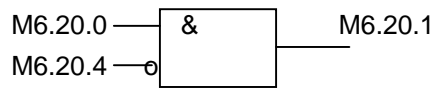
Examples:

Spurious Pulse Positive Starting Edge

M6.20.0 = Input

M6.20.1 = Result

M6.20.4 = Intermediate flag



```

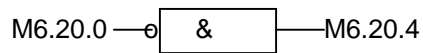
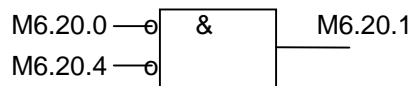
LD   M6.20.0
ANDN M6.20.4
ST   M6.20.1
LD   M6.20.0
ST   M6.20.4
  
```

Spurious Pulse Negative Starting Edge

M6.20.0 = Input

M6.20.1 = Result

M6.20.4 = Intermediate flag



```

LDN  M6.20.0
ANDN M6.20.4
ST   M6.20.1
LDN  M6.20.0
ST   M6.20.4
  
```


7 Functions

7.1 Operating Modes

Parameter Mode

Programming the parameters and the logic task is possible only in this operating mode. When this mode is exited, the interactions between the parameters are reviewed and the Logic Task program is tested.

All Tasks are stopped in Parameter Mode. The outputs and non-retained marker flags are cleared.

Manual Mode

The unit is in Manual Mode when no errors are present, and it is not in Parameter or Automatic Mode. It is used primarily to move the axis with the Jog forward or Jog reverse functions.

The two tasks

- NC Task 3
- Logic Task

are functioning. The following functions can also be called up.

- Homing
- Manual Vector
- Interrupt
- Feed Angle Monitoring

Automatic Mode

In Automatic Mode, NC tasks 1, 2, 4 and 5 can be activated using the start command.

All functions are possible except for the jog and manual vector functions.

7.2 Measuring Wheel Mode

Feed-to-length drives are used to feed material that is processed downstream (for example, sheet-metal cutting). The motor encoder cannot be used to measure the material length if there is slip between the material and the drive. In such cases, an optional encoder (the measuring wheel encoder) can be used. Ideally, there is no slip between this encoder and material, and the individual lengths can be measured accurately.



CAUTION

If the measuring wheel encoder has no contact with the material:

The position control circuit is open via the encoder. This means that the motion of the drive is uncontrolled.

⇒ Start the measuring wheel mode command (automatic or manual input) only if the measuring wheel is in contact with the material.

Pertinent Parameters

- **A100, A200: Mode**
- **A131, A231: Measuring Wheel Mode**
- **A116, A216 :Encoder Difference Monitoring**
- **C000, C004: Master Encoder, Data**
- **C001, C005: Master Encoder, Type**
- **C002, C006: Master Encoder, Feed Constant**
- **C003, C007: Master Encoder, Offset**

Functioning

Repositioning is always controlled by the servo drive in Manual Mode. In Automatic Mode, repositioning is controlled by the measuring wheel encoder. If an input is defined (see Parameter A131 or A231), the user can switch between measuring wheel encoder and motor encoder at any time in Automatic Mode.

Repositioning by measuring wheel can be activated only if the following three conditions are met:

- The material is in feed rollers and under the measuring wheel.
- The feed rollers are closed.
- The measuring wheel encoder is pressed against the material.

If one of the previous conditions is not met, the drive can temporarily run on until it is stopped by error detection within the control. The following two error messages can be shown:

- Measuring Wheel / Encoder 1 or Measuring Wheel / Encoder 2
- Drive Runaway

If position loop reset is required in conjunction with 'measuring wheel mode', the 'measuring wheel mode' signal must be removed via the signal input while resetting the position loop. Care must be taken not to exceed switching times.

For length measurements with a measuring wheel, the following two options are available:

- Option 1) The position loop is closed via the measuring wheel encoder when measuring wheel operating mode is active. The motor encoder is only used for monitoring. Disadvantage: When mechanical construction is unstable, this system is susceptible to variances.
- Option 2) The position loop is closed via the motor encoder. The position difference between the motor encoder and the measuring wheel encoder is added to the current movement as a correction. When construction is unstable, only the correction value varies. The correction is disabled as soon as the motor reaches the switching threshold defined in Parameter A127 or A227. The position differences that occur after disabling the correction are compiled and added to the next movement. Activation occurs via Parameter A100 or A200.

Note: Option 2 is not appropriate for exact positioning (depending on Parameter A127 or A227, Switching Threshold), because of premature disabling of the correction function.

7.3 Velocity Override

The override function permits an infinitely variable reduction in the currently programmed velocity in Manual and Automatic Modes (exception: homing using the HOM command).

Override via Analog Input

The override is controlled via the connection of voltage to

AE1 (X5/11 and X5/12)

AE2 (X5/14 and X5/15)

AE3 (X7/4 and X7/5)

AE4 (X7/7 and X7/8)

The graph below shows the relationship between the applied voltage and the override factor.

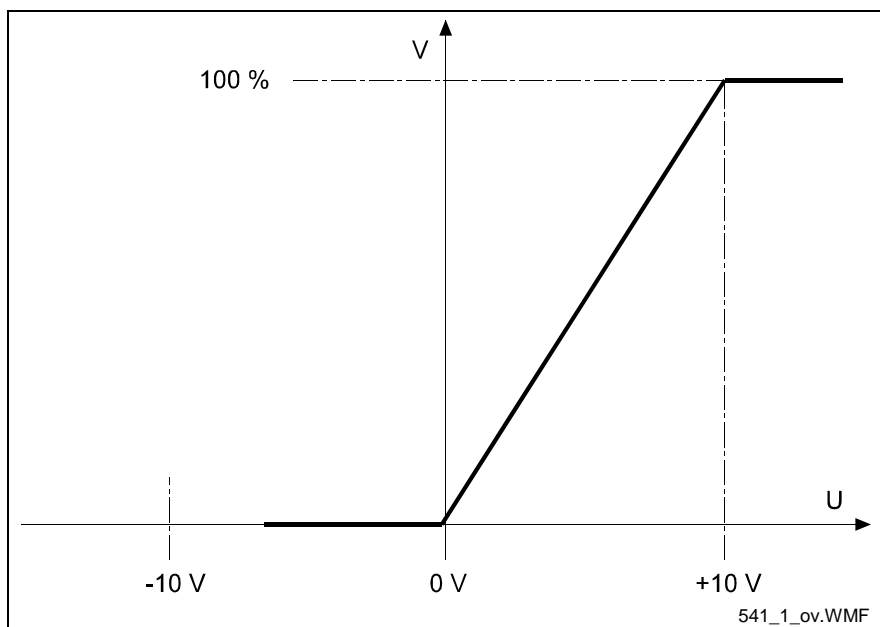


Fig. 7-1: Analog Override

The velocity 'Vo' is produced by multiplying the programmed traversing velocity 'Vp' by the override factor 'F' (F = 0 - 1 corresponds to 0V - 10V):

$$V_o = V_p \times F$$

L:	Vo	=	Velocity
	Vp	=	Traversing Velocity
	F	=	override factor

Fig. 7-2: Velocity Calculation with Override

This function can be activated in Parameter B017 or using the 'VEO' command.

A possible protective circuit is illustrated in the following connection diagram.

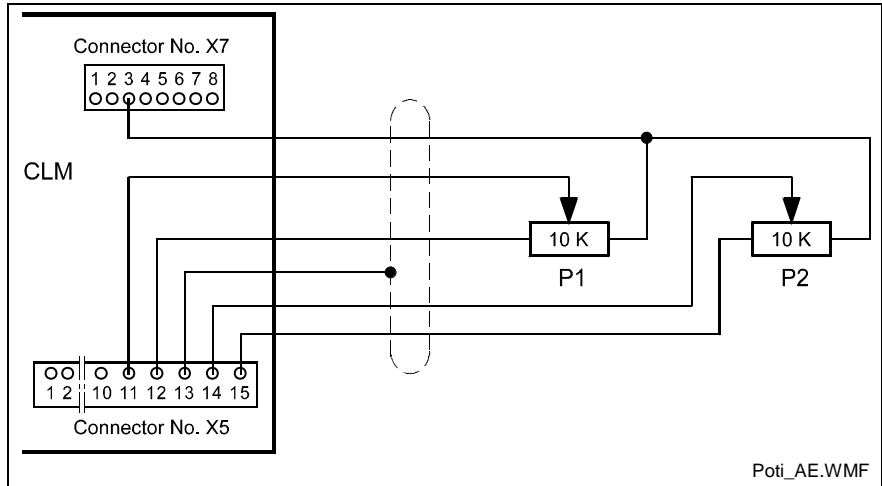


Fig. 7-3: Example for Analog Override

For the 'Override' function, +10V are present at Connector X7/Pin3. The resistance value of the potentiometers used should be 10 kΩ.

The resistance value limits are: min. 4.7 kΩ and max. 100 kΩ

Override via Gray-Code Inputs

The override velocity can also be set using a step switch programmed with Gray code. This switch must be connected to inputs I1.01.4 to I1.01.7. This function is activated in Parameter B017 or using the 'VEO' command.

The set velocity always references the currently programmed velocity.

Input No.	I1.01.4	I1.01.5	I1.01.6	I1.01.7	Velocity
Weighted Value	2 ⁰	2 ¹	2 ²	2 ³	In %
	0	0	0	0	0
	1	0	0	0	1
	1	1	0	0	2
	0	1	0	0	4
	0	1	1	0	6
	1	1	1	0	8
	1	0	1	0	10
	0	0	1	0	20
	0	0	1	1	30
	1	0	1	1	40
	1	1	1	1	50
	0	1	1	1	60
	0	1	0	1	70
	1	1	0	1	80
	1	0	0	1	90
	0	0	0	1	100

Example:

The max. velocity is entered in Parameter A106 .

A106	000500.000
------	------------

The following program instruction is processed.

0000	PSI	1	+001000.000	500
------	-----	---	-------------	-----

Input I1.01.4 = weighted value of 1

Input I1.01.5 = weighted value of 1

Input I1.01.6 = weighted value of 0

Input I1.01.7 = weighted value of 0

The max. velocity is 500 mm/sec.

In the sample instruction, the velocity is reduced to 50%. The result is 250 mm/sec.

If the override has also been activated in Parameter B017, the velocity is $0.02 \times 250 = 5$ mm/sec.

Override via Binary-Code Inputs

The evaluation is handled via inputs I1.01.0 through I1.01.7. This function is activated individually for each axis in parameter B017 or using the 'VEO' command.

Input Number	:	I1.01.7							I1.01.0
Binary Value	:	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Decimal Value	:	128	64	32	16	8	4	2	1

The decimal values of all of the above inputs set to '1' are added together.

The resulting velocity is obtained as follows:

$$V_o = V_p \times \frac{\text{Sum of all Decimal Values}}{255}$$

L: V_o = Velocity
 V_p = Traversing Velocity

Fig. 7-4: Velocity Calculation

7.4 Vector Programming

Interrupt Vector

With the interrupt vector, a program running in Automatic Mode in Task 1 can be interrupted externally at any time. The program sequence then continues at the interrupt program address (Parameter B015). There is no return to the interrupted main program.

The interrupt vector can be invoked only in Automatic Mode. Therefore, the 'Start' or 'Stop' actions remain in effect. The subroutine stack (JSR, RTS) is cleared each time the interrupt vector is invoked.

Invoking the interrupt vector during a subroutine can wait until the subroutine has ended (Parameter B015).

Note: The interrupt vector is available only in Task 1.

Manual Vector

This makes it possible to run a user program in Manual Mode. The vector program must be concluded with an 'RTS' command (the stack is not changed).

Note: In the manual vector program, no feeds can be programmed.

When the operating mode is changed from 'Manual' to 'Parameter', the manual vector program is terminated. While the manual vector program is running, any attempt to change the operating mode to 'Automatic' is suppressed until the program has concluded.

The manual vector program is started by detection of the rising edge of a signal pulse at the programmed input (Parameter B014). If '00.00.0 1 xxxx' is programmed in this parameter, the manual vector program is to be started only via a change in operating mode. The start instruction for the manual vector program must not be within the main program.

During jogging or homing in Manual Mode, no manual vector is accepted. No jogging or homing is possible while the manual vector program is running. Any such command is ignored.

Example: Input in Parameter B014

B014	I1.01.0 0 0400
------	----------------

Input in the programming instruction

0400	AEA	Q1.00.0 0
0401	AEA	Q1.00.1 0
0402	RTS	

Outputs Q1.00.0 and Q1.00.1 are cleared when the manual vector is invoked.

7.5 Multitasking

The control can process 5 cycles simultaneously (Task). The user can enter a program in each of these 5 tasks. In each task, one instruction (command) is processed within the NC cycle time (Parameter B010).

When programming Tasks 1 through 5, take note of the following:

- The same subroutine may not be called up by more than one task at the same time!
- Movements of a given axis may not be initiated by more than one task at the same time!
- Prior to activation of Task 3, make sure that a program is present at its start instruction!

Task 1 Task 1 runs only in Automatic Mode. Program execution begins after a 'Start' and ends with a 'Stop' command. After re-entering Automatic Mode, the program counter resets to '0000' with each start command. If the start command follows execution of a prior immediate stop, the program continues from the point of interruption.

Normally, only Task 1 is in operation.

Example:

0000	AKN	M2.00.0	1
0001	PSI	1 +000100.000	999
0002	AEA	Q1.01.0	1
0003	WAI	00.250	
0004	AEA	Q1.01.0	0
0005	COU	+00000 Q1.00.0	000100
0006	JMP	0000	

Task 2 Task 2 is activated only if it has been enabled in Parameter B011. That is also where the start instruction that begins the program in Task 2 is entered for each start following re-entry into Automatic Mode.

Example: Input in Parameter B011

B011	0200 0000 0
------	-------------

Input in the programming instruction

0200	AKN	I1.00.0	1
0201	AEA	Q1.00.0	0
0202	PSI	1 +000500.000	999
0203	APE	Q1.01.0	22001112
0204	WAI	00.500	
0205	APE	Q1.01.0	22221112
0206	WAI	00.800	
0207	APE	Q1.01.0	22000002
0208	WAI	02.000	
0209	COU	+00000 Q1.00.7	000010
0210	JMP	0200	

Task 3 Task 3 is also enabled in Parameter B011. In addition, the start instruction is defined. Program execution of Task 3 begins automatically immediately after power-up (even in Manual Mode).

Task 3 is deactivated only in Parameter Mode. Task 3 continues to run, even in the event of a fault or emergency stop.

Lockouts can therefore also be monitored via this cycle.

Note: Axis movements may not be processed in Task 3.

Example: Input in Parameter B011

B011	0000 0800 0
------	-------------

Input in the programming instruction

0800	AKN	I1.00.0	1
0801	APE	Q1.01.0	00000000
0802	WAI	02.000	
0803	AEA	Q1.01.0	1
0804	AKN	I1.00.00	1
0805	AEA	Q1.01.0	0
0806	AEA	Q1.01.1	1
0807	WAI	00.100	
0808	AEA	Q1.01.1	0
0809	JMP	0802	

Tasks 4 and 5 Tasks 4 and 5 are equivalent to Tasks 1 and 2. They can be enabled in Parameter B012.

Note: Tasks 1, 2, 3, 4 and 5 are equivalent. Within the NC cycle, the tasks are completed in the order 1, 2, 3, 4, 5. An output set in Task 1 is processed in Task 4 as a set output.

7.6 Slave Axis / Synchronous Axis

If Slave Axis / Synchronous Axis Mode is enabled, the slave axis executes all movements synchronously with the master axis.

The slave axis is enabled separately for each axis in Parameter Ax00. There, the master axis is also selected.

The available operating modes are described in Parameter Ax00.

In Slave Operating Mode 'Axis x follows Master Encoder', Parameters C000 to C003 must also be programmed.

If a movement is programmed for the slave axis in a later part of the program, only the slave axis is moved.

The 'FOL' command sets the ratio at which the slave axis will follow the master axis. The 'FOL' command is only effective if Slave Axis / Synchronous Axis Mode is enabled.

To keep the resulting errors to a minimum, a following error compensation value (feedforward) can be set in Parameter Ax11.

The following conditions should be met:

- 1) If an interrupt or feed angle monitoring is planned, it must be programmed for both axes. Additionally, the same input must be used for both axes.
- 2) For jogging, the jog buttons must only be used for the master axis. If the slave jog buttons are pressed, only the slave axis moves.
- 3) Possible positioning commands are POI, PSI, POA, PSA and CON.

The CLM takes into account the obvious differences between the two axes, such as encoder graduation mark, feed constants and drive sensitivity. Measuring Wheel Mode is possible for Axis 1.

The slave factor for the slave axis can be changed using the 'FOL' command.

7.7 Rotary Table

The CLM can also be used to control a rotary table.
Both absolute and incremental encoders can be used.

Note: Rotary tables have an absolute reference point. Therefore, when using an incremental encoder, 'Homing' is required!

Rotary table control is activated in Parameter Ax00. When using an incremental encoder, Parameter Ax02 also must be programmed.

Rotary Table with Absolute Encoder

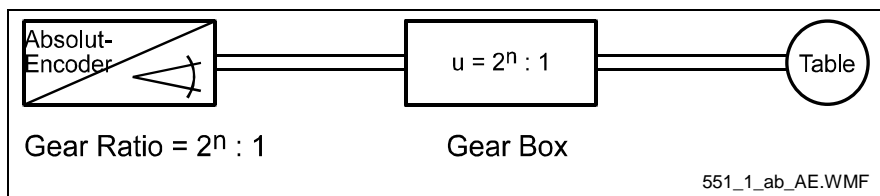


Fig. 7-5: Absolute Rotary Table

with $n = 1, 2, 3 \dots$

The mechanical characteristic is input in Parameter Ax19.

Note: The gear ratio between the encoder and the table must be exactly a power of 2.

The number of encoder revolutions must be greater than or equal to the gear ratio. In Parameter Ax19, the ratio must be entered in place of the number of encoder revolutions!

Example (for Axis 1):

Number of Encoder Revolutions=	256
Encoder Resolution	= 1024
Feed Rate Constant	= 10

Gear Ratio 256 : 1 / Input in Parameter A119:

A119	01024	0256
------	-------	------

Gear Ratio 128 : 1 / Input in Parameter A119:

A119	01024	0128
------	-------	------

Gear Ratio 512 : 1

This ratio is not allowed, unless an encoder with 512 or more revolutions is used.

With these requirements, the results per table revolution are:

$$\frac{IU}{\text{Table Revolutions}} = \text{Feed Rate Constant} \times \text{Ratio} = IUT$$

L: IU = Input Units
IUT = Input Units per Table Revolution

Fig. 7-6: Formula for Rotary Table with Absolute Encoder

Note: The zero point offset that is input in Parameter Ax25 may not exceed the value `IUT`, otherwise the error message `is invalid` is issued.

Example:

The input unit is degrees. This means that the `IUT` input represents 360 degrees. If `+ 00010.000` is input in Parameter Ax25, the zero point is defined at 10 degrees.

Note: The travel limit (Parameters Ax03 and Ax04) have no meaning.

Rotary Table with Incremental Encoder

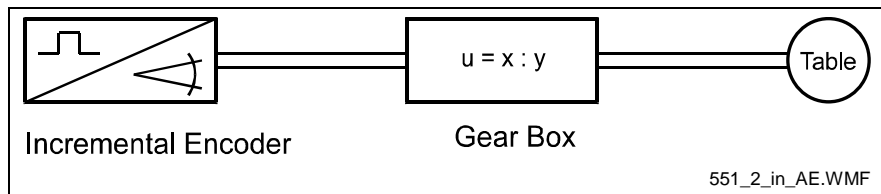


Fig. 7-7: Incremental Rotary Table

with X = 1 ... 9999
 with Y = 1 ... 9999
 and X > = Y

The mechanical characteristics are entered in Parameter Ax02.

Parameter Ax01 has a different definition when 'Rotary Table with Incremental Encoder' is selected:

$$\text{Parameter Ax01} = \frac{IU}{\text{Table Revolution}} = IU \text{ per Table Revolution}$$

L: IU = Input Units

Fig. 7-8: Formula for Rotary Table with Incremental Encoder

The feed rate constant is calculated internally as follows:

$$\text{Feed Rate Constant} = \frac{\text{Parameter Ax01}}{\text{Gear Ratio (Parameter Ax02)}}$$

Fig. 7-9: Formula for Calculating the Feed Rate Constant

Example:

360 IU / Table Revolution, $u = 590 : 1$

$$\text{Feed Rate Constant} = \frac{360}{590} = 0.610169491$$

Fig. 7-10: Example Calculation for Feed Rate Constant

The zero offset in Parameter Ax25 may not exceed the value 'Input Units per Table Revolution', otherwise the error message 'Invalid Input' is issued.

Before the first positioning move, an absolute position reference must be established. This is accomplished by 'Homing'.

Otherwise, the same process as for 'Rotary Table with Absolute Encoder' must be followed.

Positioning

Positioning for the rotary table can be absolute (the path references the zero position) or incremental (referenced to the last position).

For absolute positioning with a rotary table, the programmed position is approached by the shortest path or in the direction indicated in the positioning command, depending on the programming in Parameter Ax05. The programmed distance may only be a number between `0` and `IU/table revolution`. Negative values are not permitted.

For incremental operation, the rotary table is moved in the selected direction by the selected distance. The distance is not limited by the value `IU/table revolution`.

Rotary Table, Calculation Example for Axis 1

Example Data for Axis 1:

- The absolute encoder has 1024 lines/revolution and revolves a total of 256 times
- Gear Ratio 256 : 1 to the Rotary Table
- Motor with Gear Ratio 80 : 1 to the Rotary Table
- Motor Velocity for Command Value of 10 V = 1500 RPM
- One table revolution represents 360 degrees, or 3600 IU when the selected IU is 0.1 degrees
- Desired Angular Acceleration = 17.5 Rad/s²

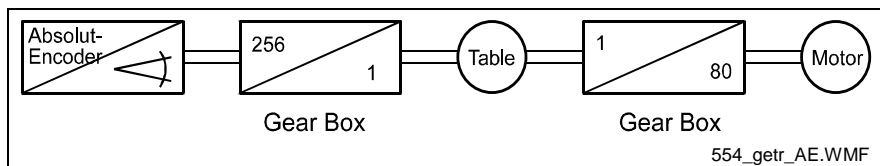


Fig. 7-11: Rotary Table with Gearboxes

- 1.) The Feed Rate Constant in Parameter A101 designates the path, which results from the drive relationships during one revolution of the encoder (or of the drive motor, if the encoder is on the motor axis):

$$Parameter A101 = \frac{3600 IU}{256} = 14.0625 IU$$

L: IU = Input Units
256 = Gear Ratio

Fig. 7-12: Example Calculation for Rotary Table with Gear

- 2.) Because the encoder is not located directly on the motor shaft, the maximum velocity for the encoder must be calculated as follows:

$$n_{\max} = 1500 \text{ RPM} \times \frac{256}{80} = 4800 \text{ RPM}$$

L: 256 = Gear Ratio
80 = Motor with Gear Ratio

Fig. 7-13: Example Calculation for Rotary Table with Gear

The result must be input into Parameter A112.

- 3.) The formula for calculating the maximum velocity is 'Encoder Velocity x Encoder Feed Rate Constant'. The result is input in Parameter A106:

$$\frac{4800}{60} \text{ 1/s} \times 14.0625 \text{ IU} = 1125 \text{ IU/s} \approx 112.5^\circ/\text{s}$$

L: IU = Input Units

Fig. 7-14: Example Calculation for Maximum Velocity

This is the maximum input value for Parameter A106.

- 4.) The maximum acceleration is calculated as follows and input into Parameter A108:

$$17.5 \frac{\text{Rad}}{\text{s}^2} \times \frac{360^\circ}{2 \times \pi} = 1002.7^\circ/\text{s}^2 \text{ or } 10027 \text{ IU/s}^2$$

L: IU = Input Units

Fig. 7-15: Example Calculation for Maximum Acceleration

7.8 Decade Switch `IDS01`

The decade switch `IDS01` is designed for installation in a front panel. This decade switch can be used to input lengths in input units `IU` and velocity values in percent into the CLM. Data transfer and power supply of the decade switch occur via a cable connection between the CLM and Connector 6 (serial interface).



CAUTION

Malfunction in the control of motors and moving elements

Risk of electric shock by touching.

⇒ Safe software and hardware design. This connector may not be plugged in while the unit is powered.

When using an RS232C interface, the distance between the IDS01 and the CLM may not exceed 15 meters. Use of an external power supply allows for much larger distances.

Enabling querying of the decade switch in Parameter B002 causes continuous monitoring of the decade switch transmission in Automatic Mode. If the transmission contains errors or there is no transmission, the error message `IDS-Break-Error` is issued.

In the program structure, the IDS01 information can be processed with variables V015 to V018.

Example:

0000	PSI	1 +V016	V018
0001	AEA	Q1.00.0	1
0002	WAI	00.500	
0003	AEA	Q1.00.0	0
0004	JMP	0000	

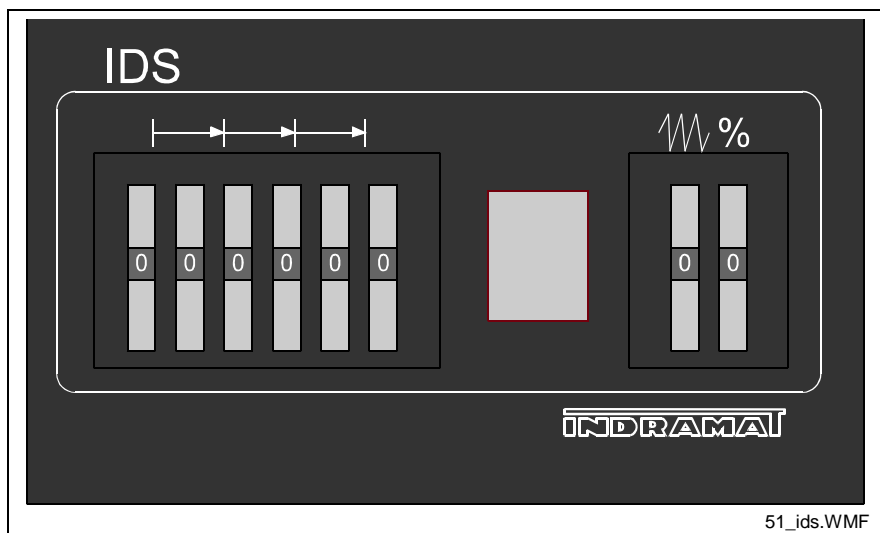


Fig. 7-16: IDS01 - Front View

The following models are available: IDS01.1-2 for programming with 2 decimal places and IDS01.1-3 for 3 decimal places.

For dimensions, see the chapter entitled Dimensions.

7.9 Homing

For absolute positioning of the motor with an incremental encoder, it is necessary to establish an accurate reference point using a positioning routine (homing).

General Information

For the normal feed axis, the following homing options are available:

- Option 1: Homing to home switch and marker pulse (Parameter Ax24)
- Option 2: Homing to marker pulse (without home switch) (Parameter Ax24)
- Option 3: Homing to home switch (Parameter Ax24)
- Option 4: Homing to home switch (Parameter Ax24)

For 'Flying Cutoff,' the following homing options are available:

- Option 1: Homing to home switch and marker pulse (Parameter Ax24)
- Option 4: Homing to home switch (Parameter Ax24)
- Option 5: Passive homing (Parameter Ax24)

The resulting 'Homing' is signaled by turning on the output programmed in Parameter Ax24.

The output is turned off by:

- re-homing
- 'Position Lag' / 'Drive Runaway' Fault
- Switching to Parameter Mode

The output can be turned off via the program; the axis remains homed.

For operation in an absolute system with an incremental encoder, all axes homed by absolute means remain homed during faults and E-Stop conditions. Detected position(s) remain, so that movements during the fault can be considered. Re-starting the CLM or exiting and re-entering Parameter Mode clears the 'homed' condition.

Note: The 'Drive Runaway' and 'Position Lag' Faults always clear the 'homed' condition.

Option 1: Homing to Home Switch and Marker Pulse

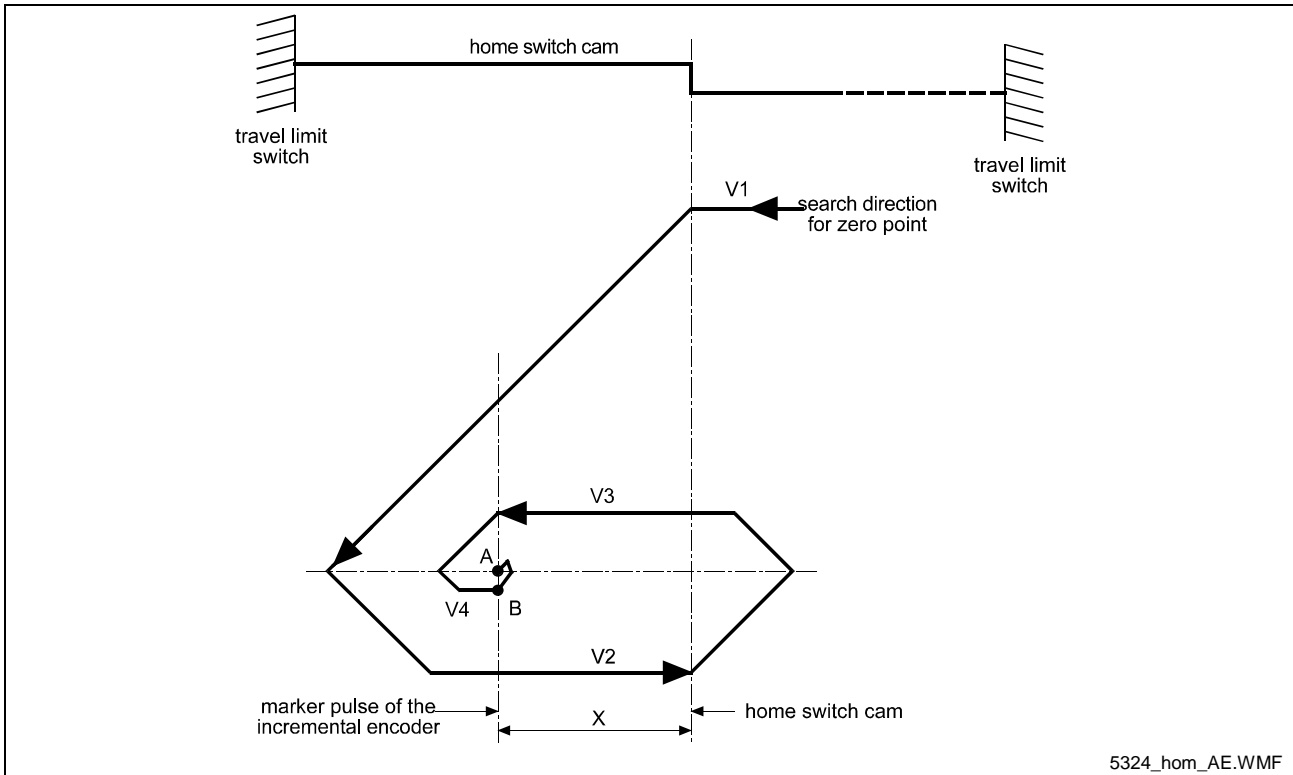


Fig. 7-17: Homing to Home Switch and Marker Pulse

Legend

- A = Stop Position/Marker Pulse
- B = Acceptance of New Position (Norming of the Absolute Position)
- V1 = Parameter - Homing Velocity
- V2 = 25 % of the Parameter - Homing Velocity
- V3 = max. 10 increments/controller cycle (system velocity)
- V4 = max. 1 increment/controller cycle (system velocity)
- X = $> 1/16$ and $< 15/16$ Feed Constant

- 1.): If the carriage is not positioned on the home switch cam, it is moved to the home switch cam using the homing velocity designated in Parameter Ax24.
- 2.): As soon as the cam switch is activated, the carriage reverses and moves off the cam at $\frac{1}{4}$ of the value in the Homing Velocity parameter. After leaving the cam, the carriage is reversed again and moved back to the cam at 10 increments per controller cycle (see Parameter B010), until the first marker pulse has been evaluated by the incremental encoder. Now, the carriage direction is reversed again, and the carriage is moved to the exact position of the marker pulse (± 1 increment) at 1 increment per controller cycle.
- 3.): If the carriage is positioned on the cam when the homing routine is initialized, it is moved off the cam at $\frac{1}{4}$ the velocity designated in the parameter. Then, the same process as described in 2.) is followed.

Placement of the Home Switch

As described above, the zero position of the AC servo drive is determined by contact with the home switch cam. The zero position can also be set in increments of one motor revolution each through the activation position of the switch.

The CLM diagnostics ensure that the home switch and the marker pulse cannot be too close together, by monitoring their switching points. This eliminates instability in the evaluation of the motor revolution because of switching tolerances.

If the switching point of the home switch is closer than 1/16 motor revolution to the marker pulse, the control does not complete the homing routine but enters fault mode with the error message 'Mrkr Pulse Pos'.

The home switch must be shifted by 1/3 of the feed constant.

Activation of the Home Switch

Activating the home switch must occur so that the switch is completely closed by reverse motion (movement away from the workpiece).

The cam for activating the home switch must be long enough to ensure that the activation will not be cancelled while completing the reverse motion to the travel limit switch of the unit. This is necessary to indicate to the control the direction the carriage must travel to approach the zero position.

Because the relationship between the turning direction of the servo motor and the movement from and to the workpiece is dependent upon machine construction, the homing direction must be set in a parameter. If no marker pulse is detected from the encoder within one encoder revolution, the CLM enters fault mode with the error message 'No Marker Pulse'.

Termination of the Homing Routine

If a stop, interrupt, feed monitoring or mode change command is received in Manual Mode, the cycle is terminated and must be reinvoked.

In Automatic Mode, the homing routine restarts immediately after the interrupt or stop is cleared and the start button is pressed.

Following an error or a change in operating mode during the homing routine, the homing routine must be reinvoked.

Option 2: Homing without Home Switch

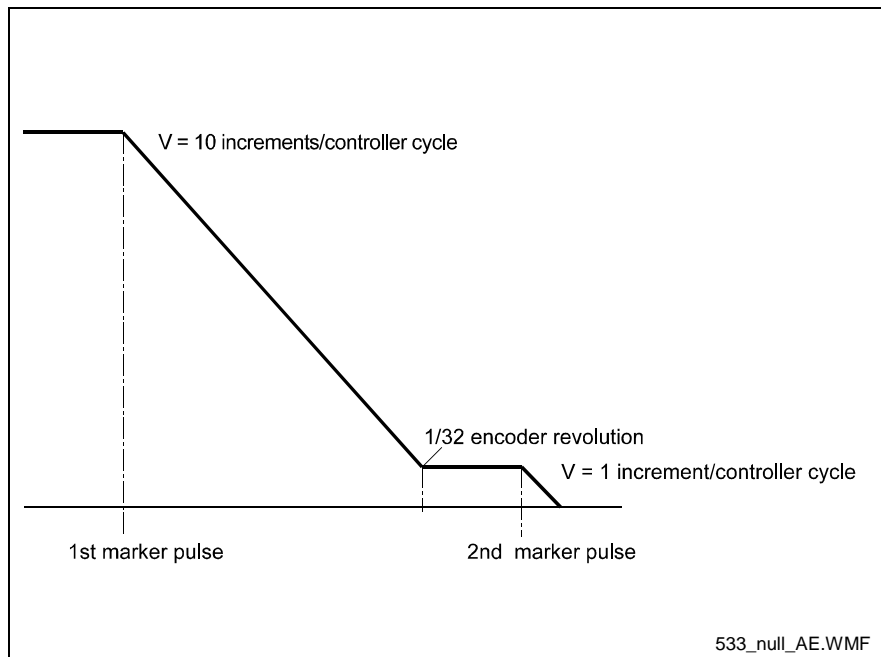


Fig. 7-18: Homing without Home Switch

The first marker pulse is searched for at 10 increments/controller cycle. If it is found, a positioning move in the same direction occurs, to a position 1/32 revolution before the second marker pulse. After reaching this position, the second marker pulse is searched for at 1 increment/controller cycle.

The search direction is defined in Parameter Ax24.

A possible application is a spindle drive with a pre-designated turning direction.

Note: The homing type, Option 2 is not permitted for the application type 'Flying Cutoff.'

Option 3: Homing to Home Switch

Homing is started using an input signal at the 'Homing' input. Homing takes place at the velocity and in the direction programmed in Parameter Ax24, whether or not the axis is located at the home switch. The axis is homed when a rising edge is detected at the 'Home Switch' input.

Note: The homing type, Option 3 is not permitted for the application type 'Flying Cutoff.'

Option 4: Homing to Home Switch

Homing is started using an input signal at the 'Homing' input. When initializing the homing routine, if the axis is located at the home switch, it is first moved off the home switch. Then, homing takes place at the velocity and in the direction programmed in Parameter Ax24. The axis is homed when a rising edge is detected at the 'Home Switch' input.

Option 5: Passive Homing

If Axis 1 is located at the home switch and the 'Jog Forward, Drive 1' is pressed in 'Manual' Mode, the axis is homed as soon as it is moved off of the home switch.

If Axis 1 is not located at the home switch and the 'Jog Reverse, Drive 1' is pressed in 'Manual' Mode, the axis is homed as soon as it is moved onto the home switch.

If the axis is positioned on the home switch, switching from 'Manual' to 'Automatic' is permitted. As soon as the carriage is synchronized and is moved off of the home switch, the axis is homed.

Note: The homing type, Option 5 is permitted only for the application type 'Flying Cutoff.'

7.10 Open Feed Roll (Electrical Release)

The function 'Open Feed Roll' is activated by programming an input in Parameter Ax30. If it contains `00.00.0`, this function is not programmed.

By placing +24V at the input 'Open Feed Roll', the function is activated.

In addition, an output must be programmed. This output is powered when the drive is in position. At the same time, a command value of `0` is issued. Then, it is possible that the drive may drift.

The function 'Open Feed Roll' is available for Axes 1 to 4, independently.

See also description for Parameter Ax30.

While the feed rolls are open, when a feed instruction is encountered, motion and proceeding to the next instruction are delayed until the input becomes `0`.

7.11 Restart

The 'Restart' function continues a program interrupted by a loss of power, an error message or a switch from Automatic to Manual Mode.

Restart is only possible following one of the situations mentioned above.

The condition is that a program was running in Automatic Mode.

For each of these situations, the current status of Task 1, 2, 4 and 5 (feedrate, absolute target position, status of the outputs, etc.) is saved temporarily.

A Restart is initiated by a rising signal edge (jump from 0V to +24V) at the system input 'Re-Start' (CLM connector X3 / pin 15) in Automatic Mode.

If no Restart is possible at the time, this input has the same functionality as the system input 'Start'.

The functionality of this input can be determined by considering the status of the output described below.

Restart is not possible for example:

- a) when Power loss, error or E-Stop occurred during a program stop or in Manual Mode.
- b) when the error message 'Position Lag' or 'Drive Runaway' occurred during evaluation of a position using an incremental encoder.
- c) in Mode 5 'Flying Cutoff'.

The system output 'Restart possible' (CLM connector X4 / pin 9) indicates whether or not a Restart can be executed.

Output set to:	0 Volts	=	no Restart possible
	+24 Volts	=	Restart possible

With a Restart program, the Restart process can be controlled.

It can be activated by inputting a Start instruction for the Restart program in Parameter B016.

When the parameters are set, this program is called by a rising edge at the 'Re-Start' input. The actual Restart process is not initiated until the end of the program.

The 'RSV' command affects the execution of the Restart program. It allows selective restoration of the interrupted program's status.

The Restart program ends with another 'RSV' command.

See also descriptions of the 'RSV' command and Parameter B016.

7.12 Flying Cutoff Functionality

Functional Description

A flying cutoff machine must synchronize and move a tool carriage to a material and to process this material or cut it to a given length on the fly. The moving material is scanned using a stationary measuring wheel with an incremental encoder. This incremental encoder transmits impulses to the CLM in proportion to the material length feeding through it. From these impulses that the measuring wheel transmits, the material speed is calculated.

The drive that moves the tool carriage also drives an incremental or an absolute encoder. With this encoder, the stroke of the tool carriage is detected from the CLM. The CLM calculates the position difference between the desired processing location on the material and the actual tool location.

When the desired material length has been fed through, the CLM accelerates the carriage to synchronize with the material speed. Any fine adjustment of the position to the exact processing location is not linked to the material speed. When synchronization is attained, the CLM initializes the processing of the material. After the material processing is completed, the tool carriage moves to its original position at maximum speed.

Programming Example

A program for flying cutoff must be programmed in Task 1. For normal flying cutoff operations, a 5-instruction routine can be used. See the following example:

Instruction number	Program Command	Comment
0000	NOP	
0001	LML 1 001000.000	Production length
0002	JSR 1000	Cutoff program
0003	BAC 0000 +0000 00100	Piece count
0004	NOP	
0005	NOP	
0006	LML 1 002000.000	Production length
0007	JSR 1000	Cutoff program
0008	BAC 0005 +0000 00200	Piece count
0009	NOP	
etc.		

Fig. 7-19: Programming Example for Flying Cutoff

The `NOP` in the first instruction of the 5-instruction group 0000 (0005, 0010 etc.) is a placeholder. Here, the subroutine can be entered with different start requirements.

In the 2nd instruction of the 5-instruction group 0001 (0006, 0011 etc.), the `LML` command determines the production length.

Then, the cutoff program follows in the 3rd instruction of the 5-instruction group 0002 (0007, 0012 etc.).

Detection of the piece count is in the 4th instruction of the 5-instruction group 0003 (0008, 0013 etc.).

The `NOP` in the 5th instruction of the 5-instruction group 0004 (0009, 0014 etc.) has the same function as in the 1st instruction of the 5-instruction group 0000 (0005, 0010 etc.). A subroutine with queries for certain requirements can be inserted here.

The following program is an example for a typical flying cutoff sequence:

Instruction Number	Program Command	Comment
		Product 1
0000	NOP	
0001	LML 1 001000.000	Production length 1
0002	JSR 1000	Cutoff program
0003	BAC 0000 +0000 00100	Piece count
0004	NOP	
		Product 2
0005	NOP	
0006	LML 1 002000.000	Production length 2
0007	JSR 1000	Cutoff program
0008	BAC 0005 +0000 00200	Piece count
0009	NOP	
0010	JMP 0000	
		Cutoff program
1000	CPJ V100 < +01000.000 0000.00 1000	Minimum cutoff stroke
1001	AEA Q1.00.0 1	Punch down
1002	AKN I1.00.0 1	Wait until punch down
1003	AEA Q1.00.0 0	Punch up
1004	AKN I1.00.0 1	Wait until punch up
1005	CPJ V100 < +02000.000 0000.00 1005	Minimum carriage stroke
1006	EOS	End of processing program
1007	RTS	Jump back

Fig. 7-20: Programming Example for Typical Flying Cutoff

Notes

In 'Flying Cutoff' operation, the following points are to be considered/followed:

- The flying cutoff program must be programmed in Task 1.
- Input I0.00.4 'Immediate Stop' (Connector X3, Pin 5) or input I2.00.4 (for system control via the fieldbus) has no function.
- Input I0.00.3 'Start' (Connector X3, Pin 4) or input I2.00.3 (for system control via the fieldbus) has no function. The program sequence in Task 1 begins immediately after switching from 'Manual' to 'Automatic' Mode in the old length instruction minus 1, or in program instruction 0000 (depending on the programming of Parameter A138). Tasks 2, 4 and 5 begin in their corresponding programmed start instruction (Parameter B011 or B012).
- The function 'Feedforward' is always activated, independently of the programming in Parameter A111.
- The acceleration or deceleration may not be reduced (Parameter A109 = 000 000).
- The following functions must be deactivated:
 - Jerk Limiting (Parameter A110)
 - Feed Angle Monitoring, Interrupt (Parameter A115)
 - Open Feed Roll (Parameter A130)
 - Deceleration active, Command Velocity reached (Parameter A132)
 - Interrupt Vector (Parameter B015)
 - Restart Vector (Parameter B016)
 - Override Axis 1 (Parameter B017)
- The following commands may not be programmed for Axis 1:

ACC	AEO	CON	CPL	FOL
HOM	JST	PBK	POA	PSA
REP	RMI	RSV	RTM	SAC
SRM	SRP	VCC		

- If the commands 'POI' and 'PSI' are used for Axis 1, the maximum velocity (Parameter A106) is always used as the feedrate (regardless of the velocity programmed in the command).
- Interface commands 'Program Start' and 'Program Stop' are not allowed via the interface.

Immediate Cut

If the CLM is in 'Automatic' Mode and a signal is present at the 'Immediate Cut' (Parameter A134) input, the axis immediately accelerates to the material speed, regardless of the pre-set length, and the processing program for the length instruction is started. However, the signal at the input is only accepted if the axis is at the start position (Position 0). The signal must be a pulse.

Manual Cut Vector

If the CLM is in 'Manual' Mode and a signal is present at the 'Immediate Cut' input (Parameter A134), a processing program is in progress. The start instruction is set in Parameter A134. The program must end with a 'RTS' command. Subroutines with the 'JSR' and 'RTS' commands can be integrated into the processing program. While the processing program is running, the 'Jog forward' and 'Jog reverse' inputs are disabled.

Cut Inhibit

If the CLM is in 'Automatic' Mode and the Axis is not yet in the flying motion, synchronization is suppressed when a signal is present at the 'Cut Inhibit' input (Parameter A133). The signal must be a pulse. Only when a signal is present at the 'Immediate Cut' input (Parameter A134) is the process continued by immediately cutting the material.

Note: When switching from 'Automatic' to 'Manual', the 'Cut Inhibit' function is canceled.

Test Mode

The CLM is able to simulate automatic processing. In order to do this, Test Mode must be activated in Parameter A100. In 'Automatic' Mode, the material feed is simulated by an internal clock generator. In the 'Material Speed' display mode, the material speed can be increased or decreased in 32 steps between zero and the maximum velocity (Parameter A106) by pressing \square or \square . By pressing \square , the material speed is immediately set to zero.

Note: When switching from 'Automatic' to 'Manual' Mode, the material speed is set to zero.

Indexing

Indexing is necessary to start without wasting material, during normal processing. After manual processing with a manual cut, the CLM monitors every movement of the carriage and the material. The resulting length is subtracted from the length set in the length command when a switch from 'Manual' to 'Automatic' occurs. The remaining length is the distance to be traveled before the next processing step.

If more material than the currently set length in the length instruction has been fed through the processing tool since the last manual cut, the CLM issues an 'Index Length' error.

Example:


A manual cut is executed in 'Manual' Mode, with a carriage position of +1000mm. Afterward, the carriage is moved back to its initial position. After switching to 'Automatic' Mode, a production length of 5000mm is to be processed (length in 'LML' command = 005000.000).

If indexing is activated, the 1000mm are included in the calculation, which means that the first cut piece has a length of 5000mm.


If indexing is not activated, the first piece has a length of 6000mm, because the 1000mm are not part of the calculation.

Note: For indexing, the 'FUN' command must be programmed into the processing program or the manual cut program, with the length measurement of the material processed through the tool.

Product Length Counter

For the product length counter all measuring wheel movements (Master Encoder 1) in Automatic Mode are counted. If the 'Cut Inhibit' function is active, the fed material length is not counted. The product length counter is displayed by the CLM with the material length counter in 'Product Length/Material Length' display mode. Alternatively, the product length counter and the material length counter can be queried via the serial interface (Status 54). If the product length counter is to be cleared, this is possible with the '!_CLL2' interface command. Pressing  in 'Product Length / Material Length' display mode clears the product length and the material length counters.

Material Length Counter

For the material length counter all measuring wheel movements (Master Encoder 1) in Manual Mode and Automatic Mode are counted. The material length counter is displayed by the CLM with the product length counter in 'Product Length/Material Length' display mode. Alternatively, the material length counter and the product length counter can be queried via the serial interface (Status 54). If the material length counter is to be cleared, this is possible with the '!_CLL1' interface command. Pressing  in 'Product Length / Material Length' display mode clears the material length and the product length counters.

Reverse Inhibit

When processing is finished ('EOS' command in the tool program) the CLM waits for a signal at the 'Reverse Inhibit' input. If no signal is present, the carriage decelerates and stops. The reverse motion to the home position is suppressed until a signal is present at the input. If a signal is applied before the 'EOS' command is processed, it is not evaluated by the CLM.

Rapid Stop

The function 'Rapid Stop' is used for rapid movement of the tool away from the material and for stopping the carriage.

If the material is being processed while synchronization is taking place, and if a signal is applied at the 'Rapid Stop' input, the processing program is immediately interrupted and the tool is rapidly moved away from the material using another program. The start instruction for the rapid stop program is set in the parameter. The rapid stop program must end with an 'EOS' command. As long as this program is being processed, synchronization is maintained. Afterward, the command values are set to 0V and the 'Rapid Stop' error is issued.

If no synchronization is present, and if a signal is applied at the 'Rapid Stop' input, the rapid stop program is not executed. Afterward, the command values are set to 0V and the 'Rapid Stop' error is issued.

Maximum Stroke

The function 'Maximum Stroke' is used for rapid movement of the tool away from the material and for stopping the carriage.

If the material is being processed during synchronized movement, and if a stroke length is programmed in the parameter, the program is immediately interrupted and the tool is moved away from the material using another program, if the difference between the carriage and the maximum travel limit is smaller than the programmed stroke (see example). The start instruction for the program is set in the parameter. The processing program must end with an 'EOS' command. As long as this program is being processed, synchronization is maintained. Afterward, the command values are set to 0V and the 'Maximum Stroke' error is issued.

Crop Cut

If the CLM is in 'Automatic' Mode and a signal is present at the 'Crop Cut' input (Parameter A142), the crop cut length entered in parameter A142 is set as the length. However, the signal at the input is only accepted if the axis is at the start position (Position 0). The signal must be a pulse.

Tool Width

While the material is cut to length, it is assumed that no waste is produced during the separation. For sawing and punching, however, the cut length is shortened by the width of the cut width. In order to arrive at the correct cut length, the width of the cutting tool is added to the cut length for the 'LML' command.

Reverse Optimization

Reverse Optimization can be used to protect the mechanics in the 'Flying Cutoff' application. It is designed for applications with processing sequences that are changing or differently timed. Acceleration and deceleration for forward motion continues to take place using the value set in Parameter A108. Acceleration for reverse motion is calculated. If optimization is possible, the flying unit moves back to the original position at a reduced acceleration and accelerates back into synchronization without standing still or with a shorter standstill time. If optimization of the reverse motion is not possible, the flying unit moves back to the original position at the acceleration programmed in Parameter A108.

Note: If the function 'Reverse Inhibit' is active, no reverse optimization occurs.

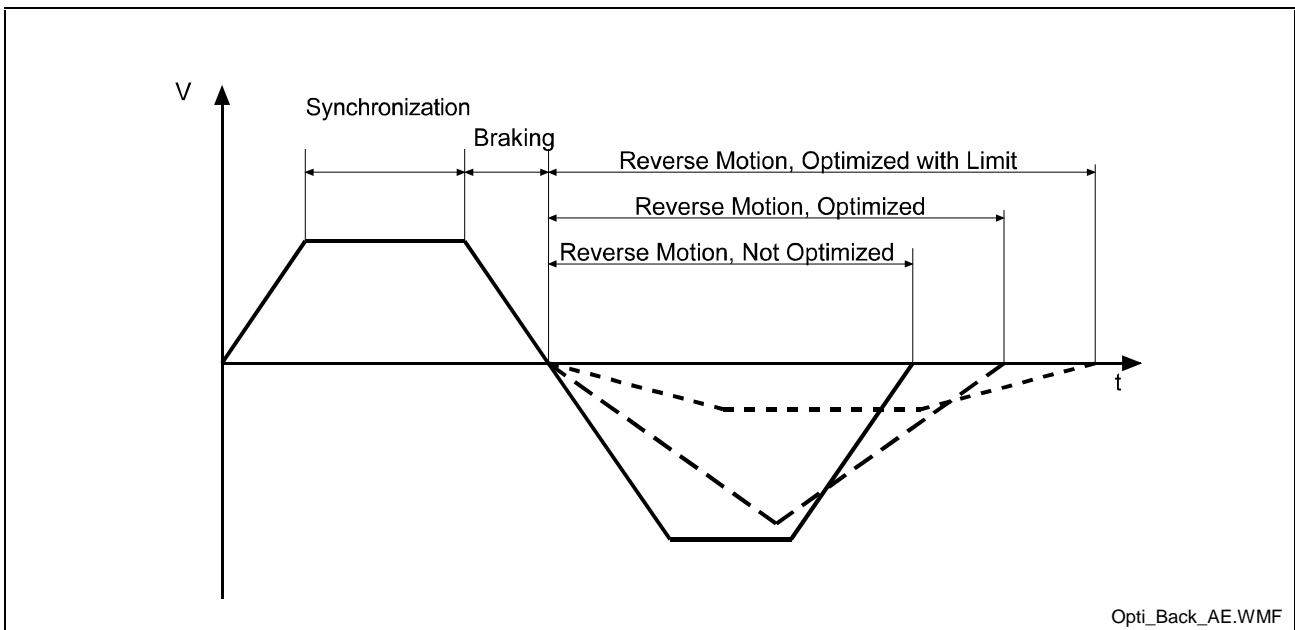


Fig. 7-21: Reverse Optimization

7.13 Time Counter

With the time counter the running time of the CLM control can be determined. The number of elapsed hours can be controlled via System Variable V019. The time counter can be cleared using the `!_CLLVAR0019` interface command.

8 Parameters

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8.1 General Information

The parameters and the user program are stored on a module card. This card has the description `MOK19`.

Note: This data can be lost in the event of an error. Therefore, it is critically important to back up this data in another place outside the control (e.g.: external computer or as a hard copy).


All system rating data and mechanical details are input into the CLM as parameters.

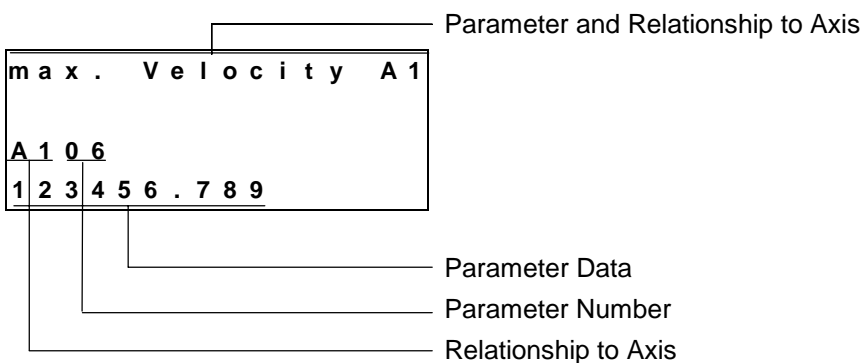
Parameters are input in Parameter Mode. For most parameter numbers, only one piece of information can be stored.

The parameters and the user program are protected from power loss.

After power up, pressing the `Clear` key for faults, or loading parameters, the parameters are checked. For erroneous or missing parameters, an corresponding error message (Invalid Input) is issued.

When parameters are changed, a recalculation of all parameter-dependent program instructions is performed when exiting Parameter Input mode. During this time, the message `Please Wait` appears on the display.

Note: The parameter data is transferred to the memory using the Save key .



In the first display line, the parameter description with the corresponding relationship to the axis is always displayed.

In the third display line, the relationship to the axis and the parameter number is displayed.

In the fourth display line, the parameter data is displayed.

The unit designation `IU` that is used in the parameter descriptions means that an input in `input units` is required.

Parameter Mode The parameters are organized in 6 groups. The first group is the general parameters. The next four groups are assigned to Axes 1 to 4. The data structure is identical for all four axes. In the last group, the parameters are for the additional encoders, e.g. measuring wheel.

The parameter identification is comprised of a block identifier and the actual (two-digit) parameter number.


Parameter Identification	Group Designation	Parameter Number
General Parameters	B0	00 to 19
Axis 1 Parameters	A1	00 to 42
Axis 2 Parameters	A2	00 to 42
Axis 3 Parameters	A3	00 to 42
Axis 4 Parameters	A4	00 to 42
Encoder Parameters	C0	00 to 08





The CLM functions at least with Axis 1, which means that parameter sets B0xx, C0xx and A1xx must be programmed in any case.



Parameter Input To store a parameter, the Store key  must be pressed.



A validity check of the parameters is performed after leaving Parameter Mode. Erroneous parameters are displayed and must be corrected.

When entering Parameter Mode, Parameter A100 is displayed. The cursor is placed on the tens digit of the parameter number.

Repeatedly pressing  places the cursor to the left on the first digit of the parameter data or on the tens digit of the parameter number.

Repeatedly pressing  or  places the cursor on the tens digit of the parameter number. Each press of  or  switches to the next parameter block (from B000 to A100, A200, A300, A400 and C000). The blocks for the axes that do not have set parameters (see B000) are skipped and not shown.

The individual parameters can be selected in Parameter Mode by directly inputting the parameter number or scrolling using  and .

Using  and , the cursor can be placed on the parameters. There, the new parameter number can be input directly using the numbered keys.

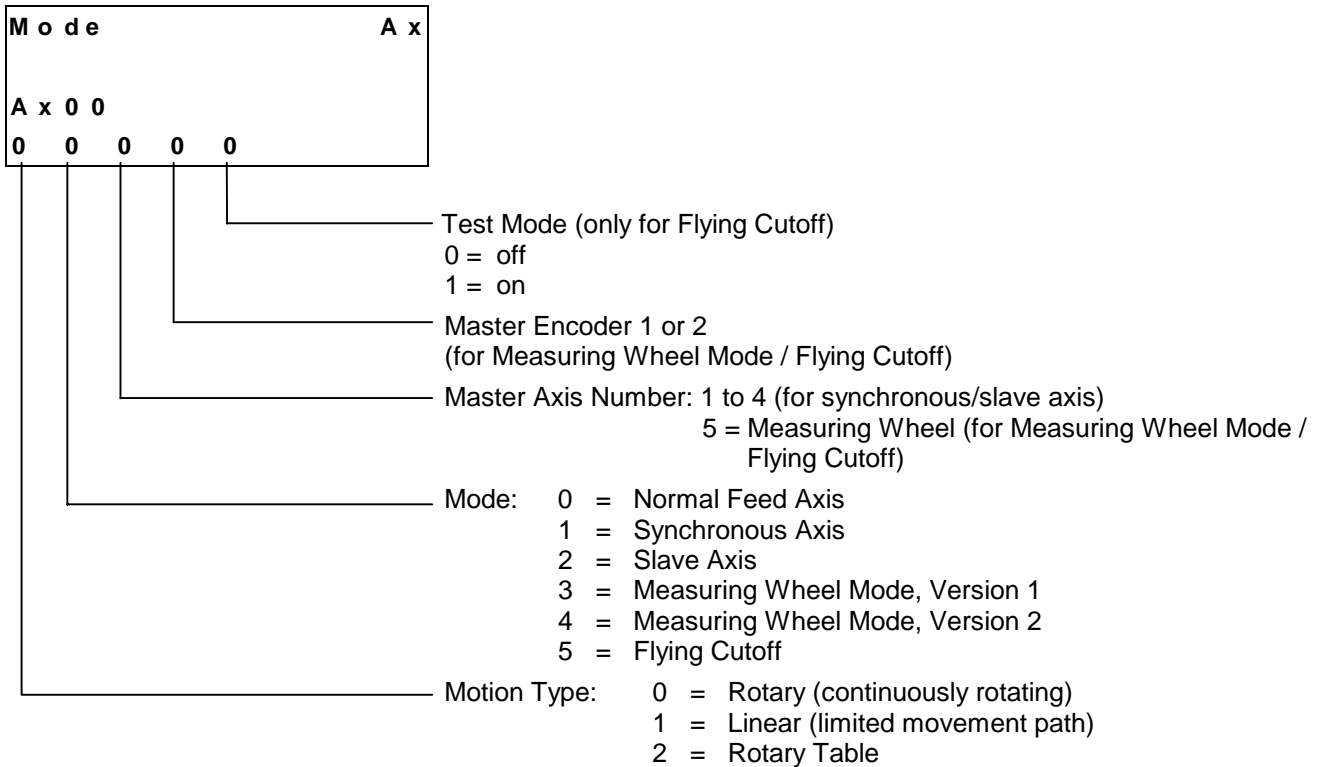
After storing a parameter, the next parameter is shown.

Notes: The inputs and outputs listed in the parameter description, as well as all input values shown are only examples.

Double assignment of inputs and outputs results in malfunctions and must be avoided.

8.2 System Parameters

Ax00 Mode



Type of Motion:

With **rotary** motion, the drive unit normally turns continuously in one direction. The feed rolls transport the product to its relative position and it is then processed. Feed-to-length mechanisms are typically used. There are no travel limit switches.

With **linear** motion, the drive unit moves a mechanical system only a specified distance. Normally, absolute positioning is performed and travel limit switches monitor the distance traversed.

The **rotary table** normally turns continuously. Positioning is absolute within one revolution (modulo value). There are no travel limit switches.

- Mode:**
- 0** = Normal Feed Axis
 - 1** = Synchronous Axis. This axis executes the same movements as the master axis, without phase adjustment. An evaluation of the actual impulses for the master axis is possible using the FOL command.
 - 2** = Slave Axis. This axis follows the actual position of the master axis. An evaluation of the actual impulses for the master axis is possible using the FOL command.
 - 3** = Measuring Wheel Mode, Version 1. Using this function, at times an external encoder detects the position. It is possible to switch back and forth between the motor encoder and the measuring wheel encoder. Only relative distances are traversed.
 - 4** = Measuring Wheel Mode, Version 2. The actual values of the motor encoder and the measuring wheel encoder are compared and the travel distance is corrected by the difference.
 - 5** = Flying Cutoff

The following operating modes are possible:

- Axis 1 = Normal Feed Axis
- Slave Axis : Axis 1 follows Master Encoder 1
 - Measuring Wheel Mode : Version 1 / Version 2
 - Flying Cutoff
- Axis 2 = Normal Feed Axis
- Synchronous Axis : Axis 2 Synchronous to Axis 1
 - Slave Axis : Axis 2 follows Axis 1
 - : Axis 2 follows Master Encoder 1
 - Measuring Wheel Mode : Version 1 / Version 2
- Axis 3 = Normal Feed Axis
- Synchronous Axis : Axis 3 Synchronous to Axis 1
 - : Axis 3 Synchronous to Axis 2
 - Slave Axis : Axis 3 follows Axis 1
 - : Axis 3 follows Axis 2
 - : Axis 3 follows Master Encoder 1
- Axis 4 = Normal Feed Axis
- Synchronous Axis : Axis 4 Synchronous to Axis 1
 - : Axis 4 Synchronous to Axis 2
 - : Axis 4 Synchronous to Axis 3
 - Slave Axis : Axis 4 follows Axis 1
 - : Axis 4 follows Axis 2
 - : Axis 4 follows Axis 3
 - : Axis 4 follows Master Encoder 1

Note: Master Encoder 1 is intended for use with axis 1 and Master Encoder 2 is intended for use with axis 2 for the application type 'Measuring Wheel Mode'.

Ax01 Axis x Feed Constant

F	e	e		C	o	n	s	t	a	n	t		A	x
A	x	0	1											
0	0	5	0	.	0	0	0	0	0	0				

Feed Constant in IU

Note: This is where the IU is defined

IU = Input Unit

This parameter describes the conversion from rotary to linear motion. It is defined as the linear displacement of the load during one revolution of the gear output shaft.

Input can be in any desired dimension (e.g. mm, cm, m, inch, degrees, etc.) and is referred to below as the input unit (IU).

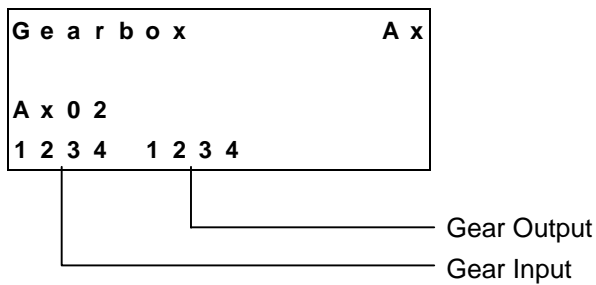
It is important that all other measurements entered be referenced to this same unit.

The input has five decimal places.

Input range: from 0.01000 to 5000.00000 in IU

Note: For rotary table programming using an incremental encoder, the unit per table revolution is set in Parameter Ax01, e.g.: Ax01 = 0360.00000 corresponds to 360° per table revolution. The gear ratio is defined in Parameter Ax02.

Ax02 Gear



A mechanical gear is often employed between the motor and the load. For applications using rotary table and incremental encoders, this parameter determines the relationship between the motor and the load.

The **gear ratio** is defined as:

$$i = \frac{\text{Input Revolutions of Load Gear}}{\text{Output Revolutions of Load Gear}}$$

Fig. 8-1: Gear Ratio

See also functional description for 'Rotary Table'.

Example:

Five turns of the motor shaft equal two turns of the output shaft.

⇒ Input Revolutions : 5
 Output Revolutions : 2

Input min.: 1
 Input max.: 9999

Note: This parameter is only valid for rotary table mode with incremental encoders.

Ax03 Axis x Minimum Travel Limit Value

```

Min Travel Ax
Ax03
-000100.000
    
```

Min. Travel Limit in IU

Here, the minimum allowable travel limit value is input. The limit is available only in Absolute Mode.

In Manual Mode, the corresponding jog key becomes inactive when this position is reached. In Automatic Mode, if the actual position becomes smaller than this limit value, the error 'Min. Travel Lmt' is output.

The travel range value is measured from the home position and is not calculated using the offset dimension Ax25.

If a target position beyond the negative position limit is pre-set for the drive, the error message 'Target Pos < Lim' is output.

Example, when using an incremental encoder:

When using an incremental encoder, depending upon programming, the home position shifts forward or backward from the home switch. The minimum value is always input as a negative value.

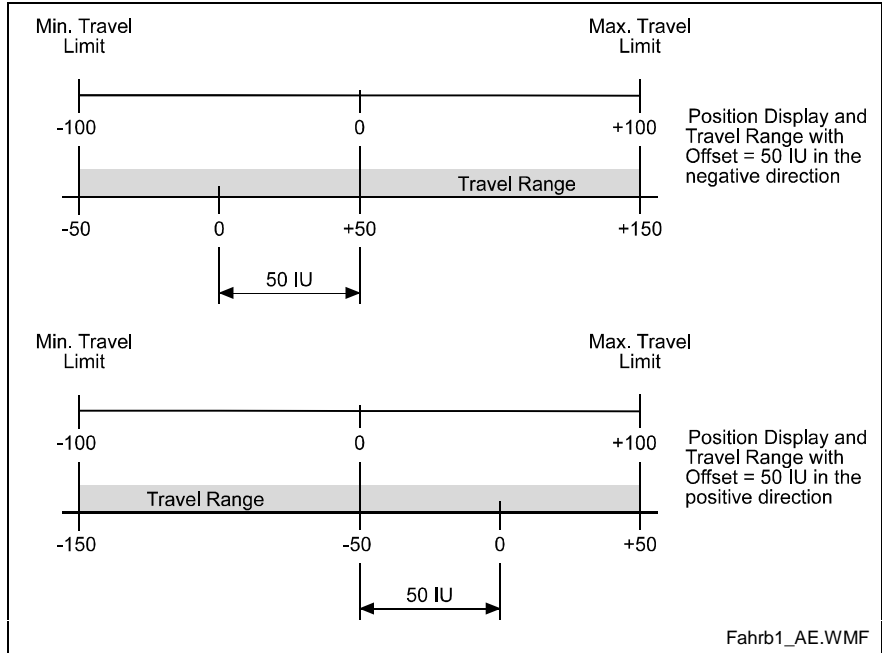


Fig. 8-2: Travel Range with Incremental Encoder

Example, when using an absolute encoder:

For absolute encoders, the home position always shifts in the positive direction from the encoder home position. The minimum value is always input as a positive value.

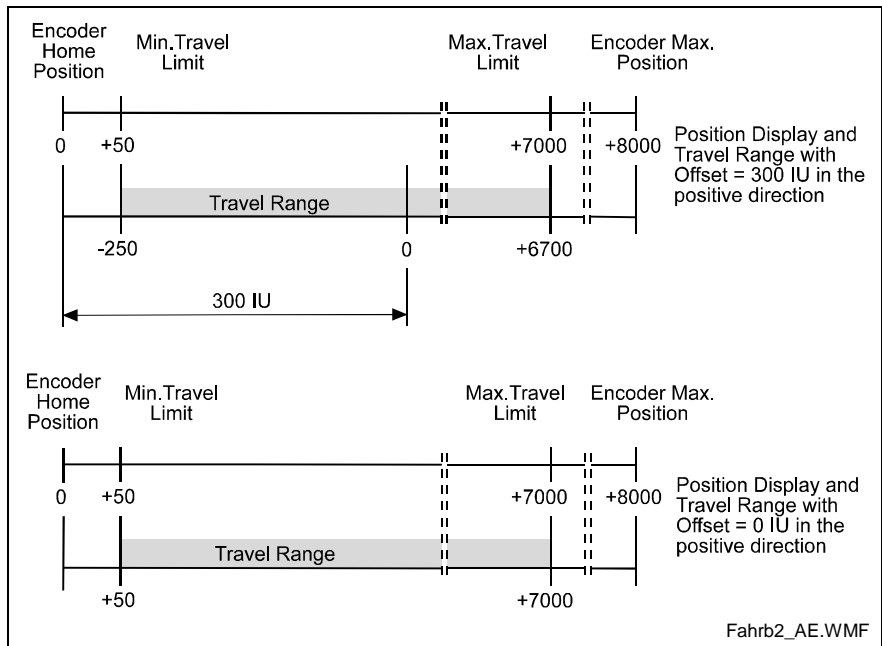


Fig. 8-3: Travel Range with Absolute Encoder

Ax04 Axis x Maximum Travel Limit Value

```

Max Travel Ax
Ax 04
+ 0 1 2 3 4 5 . 7 8 9
    
```

Max. Travel Limit in IU

Here, the maximum allowable travel limit value is input.

The limit is available only in Absolute Mode.

In Manual Mode, the corresponding jog key becomes inactive when this position is reached.

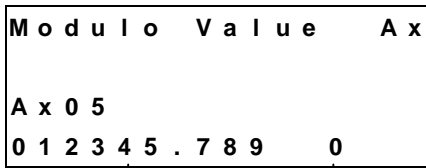
In Automatic Mode, if the actual position becomes larger than this limit value, the error 'Max. Travel Lmt' is output.

The travel range value is measured from the home position and is not calculated using the offset dimension Ax25.

If a target position beyond the positive position limit is pre-set for the drive, the error message 'Target Pos > Lim' is output.

The maximum value is always input as a positive value.

Ax05 Axis x Modulo Value



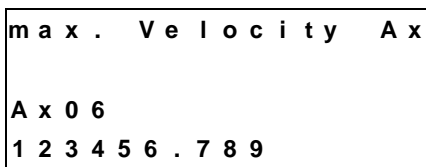
0 = Programmed Direction (for Rotary Table)
 1 = Shortest Path
 Modulo Value (in preparation)

When the modulo format is set, the modulo value determines the numeric value at which the position data overflow to 0.

This parameter is used only with motion type 2 (Rotary Table, **Parameter Ax00**) and normally indicates the circumference of the table.

Input min.: 0.000 IU
 Input max.: 200000.000 IU

Ax06 Axis x Maximum Velocity



Maximum Velocity in IU/s

The maximum velocity input here is the highest velocity to be used for travel.

The maximum velocity may not be larger than the maximum possible velocity, which is calculated as follows:

$$Possible V_{max} = \frac{RPM (P. Ax12)}{60} \times Feed Constant$$

L: Vmax = Maximum Velocity
 RPM = Revolutions per Minute

Fig. 8-4: Axis x Maximum Velocity

If the velocity is larger than 'Vmax possible', the error message 'is Invalid' is shown on the display.

Input Range: from 0.100 to 50000.000 in IU/s

Ax07 Axis x Jog Velocity

man . Velocity Ax
Ax07
000166.666

Velocity in Manual Mode in IU/s

With the velocity entered here, the drive is moved using `Jog forward` or `Jog reverse`.

Input Range: from 0.100 to 50000.000 in IU/s

also: Ax07 <= Ax06

Ax08 Axis x Acceleration Rate

Accel Rate Ax
Ax08
000100

Acceleration in IU/s²

The drive accelerates with the value set here. A different deceleration value can be programmed in Parameter Ax09.

Input Range: from 1 to 999999 in IU/s²

Ax09 Acceleration / Deceleration Rate

Accel / Decel Ax
Ax09
123 123

Deceleration in ‰ of Ax08

Acceleration in ‰ of Ax08

If the value 000 is input, the value in Parameter Ax08 is valid.

Ax10 Jerk Constant

```

J e r k   C o n s t a n t   A x
A x 1 0
0 . 2 3 4
    
```

Time Constant for Acceleration Change (s)
 Input Range: 0.000 to 1.024
 0 = Jerk limiting inactive, constant acceleration

The 'Time Constant for Acceleration' sets the time during which the CLM accelerates. Internally, the CLM rounds the time constant up.

$$\frac{\text{Jerk Constant (s)} \times 1000}{\text{Position Loop Cycle Time (ms)}} = 2^n$$

Fig. 8-5: Calculation of the Time Constant

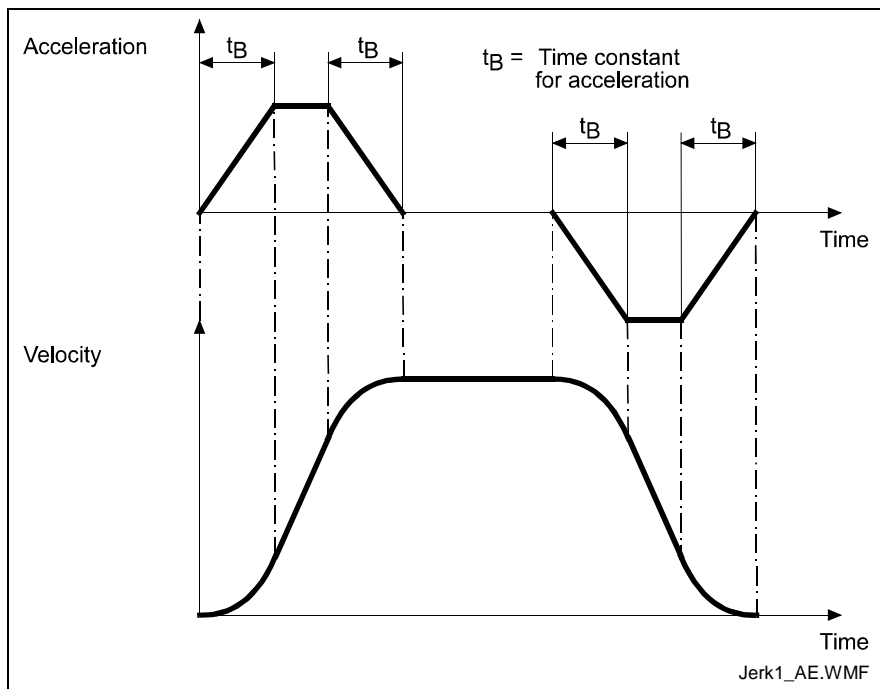


Fig. 8-6: Jerk Limiting

Ax11 Axis x Kv Factor

K v	F a c t o r	A x
A x 1 1		
0 1 . 2 3 0		

Feedforward :	0 = off
	1 = on
	>1 = on + with interim values for command pulses
	2 = Average of 2 values
	3 = Average of 4 values
	4 = Average of 8 values
	5 = Average of 16 values
	6 = Average of 32 values
	7 = Average of 64 values
	8 = Average of 128 values
	9 = Average of 256 values

Kv Factor

Feedforward can only be turned on for `Flying Cutoff` or `Slave Axis`.

With the Kv Factor, the position gain is defined. The Kv Factor determines the position lag that would be calculated at maximum velocity.

Kv = 1 produces a position lag of 1 mm at a velocity of 1 m/min.

Input Range: from 0.01 to 20.00

The Kv factor must be matched to the given mechanical conditions.

A Kv Factor that is too small reduces drive dynamics.

A Kv Factor that is too large causes the drive to become unstable.

To determine the optimal value, begin with Kv = 1.00.

Ax12 Axis x Drive Sensitivity



Command Value in volts at max. velocity with 1 decimal place (00.5 to 10.0)
 Max. Encoder Velocity in RPM (0001 to 9999)

The maximum velocity Ax06 is calculated as follows:

$$V_{max} = \frac{RPM}{60} \times Feed\ Constant$$

Fig. 8-7: Maximum Velocity

Note: For drive amplifiers with analog inputs ≤ 10 V that limit the velocity command value, the drive amplifier and the CLM should be calibrated at 9 V to ensure sufficient system resources at maximum velocity.

Ax13 Reserved (Free)



Ax14 Axis x Position Monitoring Window

```

Monitor Wind. Ax
Ax14
0 1 2 3 Q 1 . 0 0 . 0

```

Output 'Position error > Max. allowable deviation'

This output is set when the position deviation is greater than the allowed deviation. An input of 00.00.0 means no output programmed. The output programmed here is set only when the error message is deactivated. The error message can be deactivated by inputting 1 as the first character in Parameter Ax14.

Maximum allowable position deviation in percent of the maximum position deviation (position lag). Normally, a value of 10-20 % is to be entered here.

Input Range: from 001 to 100

0 = Error Messages 'Drive Runaway' and 'Position Lag' active

1 = Error Messages disabled

2 = Error Message 'Drive Runaway' on, 'Position Lag' off

3 = Error Message 'Drive Runaway' off, 'Position Lag' on

The CLM constantly monitors the position of Axis x. The CLM uses a mathematical model of the system to calculate the expected position error.

'Drive Runaway' is present when the current position of the encoder exceeds the command position of the motor.

'Position Lag' is present when the current position of the encoder is less than the expected position of the motor.

'Drive Runaway' and 'Position Lag' lead to a corresponding error message.

The maximum allowable deviation between the actual position and the position calculated in the motor is set in Parameter Ax14 in %.

The maximum position deviation is calculated as follows:

$$\text{Position Deviation in IU} = \frac{\text{max. Velocity in IU/s}}{K_v} \times \frac{60}{1000}$$

$$\pm \text{Position Deviation in IU} = \frac{\text{Velocity (as in Ax12)} \times \text{VK (as in Ax01)}}{K_v - \text{Factor (as in Ax11)} \times 1000}$$

L: IU = Input Units

K_v = Factor Value / Parameter Ax11

VK = Feed Constant / Parameter Ax01

Fig. 8-8: Position Monitoring

Example:

IU	=	mm
Maximum Velocity (Ax12)	=	2000 RPM
VK (Ax01)	=	100 mm
Kv (Ax11)	=	1

$$\pm \text{Max. Pos. Deviation in IU} = \frac{2000 \text{ RPM} \times 100 \text{ mm}}{1 \times 1000} = 200 \text{ mm}$$

Fig. 8-9: Example of Position Monitoring

With a change to the parameters 'Kv Factor' and 'Maximum Velocity', because the input is in percent, the monitoring window does not need to be reprogrammed.

So that the correct error message is always issued, Parameter Ax27 (Switching Threshold) should be smaller than:

$$\frac{\text{Parameter Ax14 in \%}}{100} = \text{max. Position Deviation}$$

Fig. 8-10: Calculation of the Switching Threshold

If Parameter Ax14 is programmed as too small a value, even a normal movement generates a 'Drive Runaway' or 'Position Lag' fault.

Examples for 'Drive Runaway':

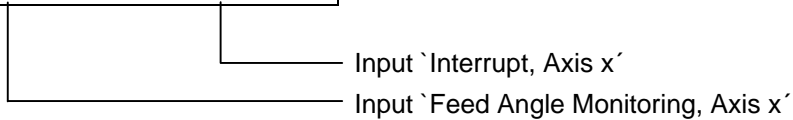
- 1) Parameter Ax21 'Direction' conflicts with the encoder wiring or the command value.
- 2) The axis moves without the output of a command position.
- 3) The input value in Parameter Ax19 does not correspond with the encoder data (too small).
- 4) The maximum velocity in Parameter Ax12 is smaller than the indication on the amplifier module.

Examples for 'Position Lag':

- 1) The programmed positioning command is not executed (no movement) because:
 - a) the encoder cable is not connected.
 - b) the encoder cable is defective
- 2) The input value in Parameter Ax19 does not correspond with encoder data (too large).
- 3) The maximum velocity in Parameter Ax12 is larger than the indication on the amplifier module.
- 4) The acceleration is too large.
- 5) The signal 'Controller Enable' from the CLM does not reach the drive.
- 6) The value selected in Parameter Ax14 is too small.

Ax15 Feed Angle Monitoring / Interrupt

F e e d A n g l e M o n A x	
A x 1 5	
I 1 . 0 0 . 0	I 1 . 0 0 . 1



1) Feed angle monitoring

Whether or not the feed is to be monitored is entered here.

With an input of `00.00.0`, the axis is not monitored.

If no signal is present at the specified input, no feed takes place. The CLM processes all instructions that do not contain a feed length. As soon as the program encounters an instruction containing a feed distance, the CLM stops at this instruction until a signal is applied at the input. If the signal drops out during feed, an error message is issued.

This function is enabled in Manual and Automatic Mode.

2) Interrupt

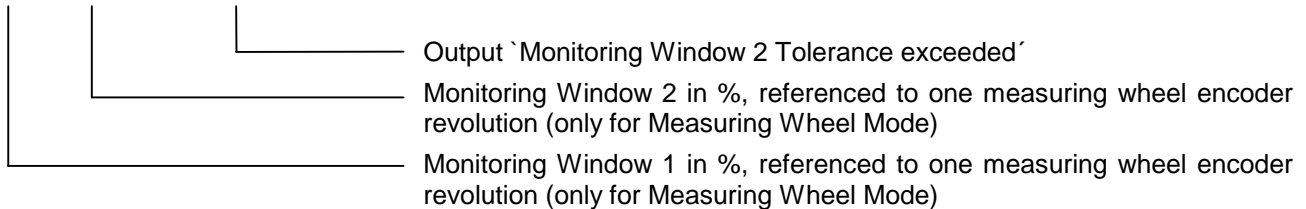
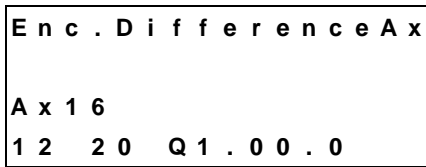
Whether or not it is possible to interrupt the current feed is entered here.

With an input of `00.00.0`, no interrupt monitoring occurs. If the signal at the specified input is lost, any initiated positioning functions are not executed, or those already in progress are stopped. All instructions containing no feed distances continue to be processed as usual. As soon as the program encounters an instruction containing a feed distance, the CLM stops at this instruction until a signal is applied at the input.

If any other operating condition is retained, execution or continuation of the positioning function takes place as soon as the signal is present or when it reoccurs.

This function is enabled in Manual and Automatic Mode.

Ax16 Axis x Encoder Difference



For Measuring Wheel Encoder Monitoring, the values from measuring wheel encoder and drive encoder are shown and compared to a tolerance field within one measuring wheel encoder revolution.

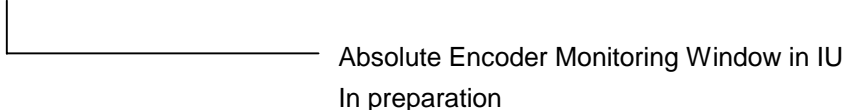
If the difference between the measuring wheel encoder and the drive encoder becomes larger than the programmed monitoring window 1 within one measuring wheel encoder revolution, the error message `Encoder Fault Ax` is issued.

If the difference between the measuring wheel encoder and the drive encoder becomes larger than the programmed monitoring window 2 within one measuring wheel encoder revolution, the output `Monitoring Window 2 Tolerance exceeded` is turned on.

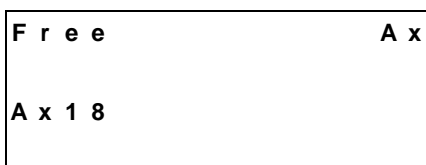
After one measuring wheel encoder revolution the measuring counter is reset for a new measurement.

When the Monitoring Window is set to `00`, monitoring is not activated.

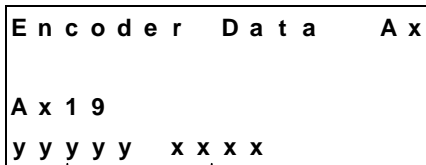
Ax17 Axis x Absolute Encoder Monitoring Window



Ax18 Reserved (Free)



Ax19 Axis x Encoder Data



Revolutions

For Incremental Encoders: undefined
 For Multi-Turn Absolute Encoders: 24-Bit Encoder: 0001 ... 4096
 23-Bit Encoder: 0001 ... 2048
 22-Bit Encoder: 0001 ... 1024
 21-Bit Encoder: 0001 ... 0512
 For Single-Turn Absolute Encoders: 0000 ... 0014 (input in bits)
 Revolutions = 2^{xxxx}
 Default Value xxxx = 0000

Pulses per revolution of the encoder

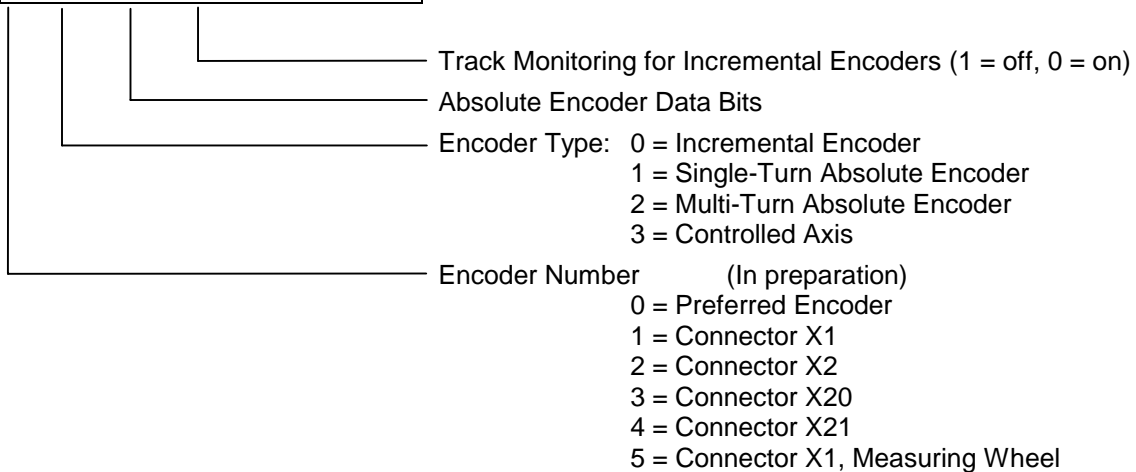
For Incremental Encoders: 00100 ... 10000 direct input
 For Multi-Turn Absolute Encoders: 00016 ... 04096 direct input
 For Single-Turn Absolute Encoders: 00007 ... 00021 (input in bits)
 Resolution = 2^{yyyy} Revolutions

Here, the incremental encoder data or absolute encoder data are input.
 If an incremental encoder is used, the input of revolutions is meaningless.
 The following absolute encoders can be used:
 Single-turn absolute encoder with 12 to 21 data bits and
 Multi-turn absolute encoder with 21 to 24 data bits (tree format).

Note: When using single-turn absolute encoders, the sum of the bits for revolutions and resolution may not be larger than the number of absolute encoder data bits programmed in Parameter Ax20 ($xxxx + yyyy < 12 - 21$) !

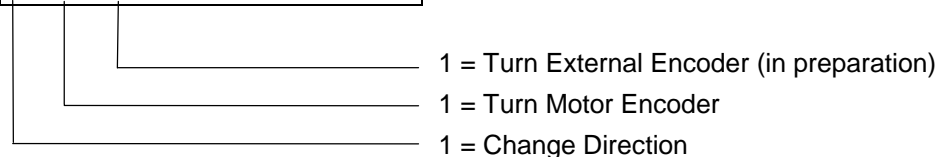
Ax20 Axis x Encoder Type

E n c o d e r T y p e A x
A x 2 0
0 1 0 0 0



Ax21 Axis x Drive Direction

D i r e c t i o n A x
A x 2 1
0 0 0

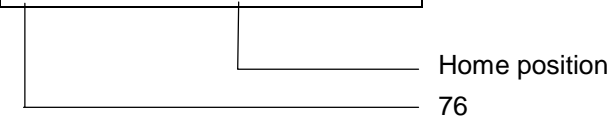


Designated directions can be combined.

Ax22 Axis x Absolute Encoder Home Position

In preparation

A b s . E n c . H o m P o s A x
A x 2 2
0 0 + 1 2 3 4 5 6 . 7 8 9



Ax23 Axis x Homing I/O

H o m i n g I / O		A x
A x 2 3		
I 1 . 0 0 . 0	I 1 . 0 0 . 1	

Input: Home Switch

Input: Homing

When `00.00.0` is entered, homing is only possible using the `HOM` command.

With a rising signal edge at the `Homing` input, the homing cycle is started. The home position can be targeted in Manual Mode via the command input or in Automatic Mode via the `HOM` command.

When using Homing Type 1 (only with marker pulse), no home switch needs to be programmed.

For further information, see the chapter entitled `Homing`.

Ax24 Axis x Homing Search Distance

H o m i n g S e a r c h		A x
A x 2 4		
Q 1 . 0 0 . 0	+ 1 2 3	0

Homing Type: 0 = With Home Switch and Marker Pulse (Option 1)

1 = Only with Marker Pulse (Option 2)

2 = Only with Home Switch (Option 3)

3 = Only with Home Switch (Option 4)

4 = Passive Homing (Option 5)

Search Velocity in ‰ of the maximum velocity

Search Direction +/-

Output `Homed`

Homing Type, Option 1

Homing is started using an input signal at the 'Homing' input. When initializing the homing routine, if the axis is not located at the home switch, the velocity and direction programmed in Parameter Ax24 is used to move to the home switch. As soon as the home switch has been activated, the axis reverses and moves away from the home switch at ¼ the homing velocity programmed in the parameter. After leaving the home switch, the movement is reversed again and moved to the home switch at 10 increments per controller cycle (see Parameter B010), until the first marker pulse has been evaluated by the incremental encoder. Now the axis direction is reversed again, and moved to the exact position of the marker pulse (± 1 increment) at 1 increment per controller cycle.

- Homing Type, Option 2** Homing is started using an input signal at the 'Homing' input. A search for the first marker pulse occurs at a velocity of 10 increments per controller cycle in the direction programmed in Parameter Ax24. If it is found, a positioning move in the same direction occurs, to a position 1/32 revolution before the second marker pulse. After reaching this position, the second marker pulse is searched for at 1 increment/controller cycle.
- Homing Type, Option 3** Homing is started using an input signal at the 'Homing' input. Homing takes place at the velocity and in the direction programmed in Parameter Ax24, whether or not the axis is located at the home switch. The axis is homed when a rising edge is detected at the 'Home Switch' input.
- Homing Type, Option 4** Homing is started using an input signal at the 'Homing' input. When initializing the homing routine, if the axis is located at the home switch, it is first moved off the home switch. Then, homing takes place at the velocity and in the direction programmed in Parameter Ax24. The axis is homed when a rising edge is detected at the 'Home Switch' input.
- Homing Type, Option 5** If Axis 1 is located at the home switch and the 'Jog Forward, Drive 1' is pressed, the axis is homed as soon as it is moved off of the home switch.
If Axis 1 is located at the home switch and the 'Jog Reverse, Drive 1' is pressed, the axis is homed as soon as it is moved onto the home switch.
If the axis is positioned on the home switch, switching from 'Manual' to 'Automatic' is permitted. As soon as the carriage is synchronized and is moved off of the home switch, the axis is homed.

Notes: The homing types, Option 2 and 3 are not permitted for the application type 'Flying Cutoff.'

The homing type, Option 5 is permitted only for the application type 'Flying Cutoff.'

Ax25 Axis x Homing Offset

H o m i n g O f f s e t A x									
A x 2 5									
+	1	2	3	4	5	.	6	7	8

Offset Dimension

The zero point located during homing shifts itself in a positive or negative direction by the offset dimension, depending on the operational sign.

Notes: For absolute encoders, the home position always shifts in the positive direction from the encoder home position, independently of the programmed operational sign.
For `Flying Cutoff`, only a negative offset dimension may be programmed.

Ax26 Reserved (Free)

F r e e										A x
A x 2 6										

Ax27 Axis x Switching Threshold

S w i t c h i n g T h r s h A x														
A x 2 7														
Q	1	.	0	0	.	0	1	2	3	4	.	5	6	7

Switching Threshold in IU

Output `Position reached`
00.00.0 = no output

The drive cannot reach the exact command position under all circumstances (e.g. because of friction, drive rigidity, etc.).

How close the approach must be to the target position for the CLM to generate the `Position reached` message is entered here.

Ax28 Position Window

In preparation

P o s i t i o n W i n . A x															
A x 2 8															
Q	1	.	0	0	.	0		1	2	3	4	.	5	6	7

Position Window

Output: Axis is in the last programmed position

Ax29 Axis x Presignaling

P o s P r e s i g n a l A x															
A x 2 9															
Q	1	.	0	0	.	0		1	.	2		1	2	3	4

Distance from the target position in IU

Time in 0.1 s (pulse)

0.0 = Output as Constant Signal

Presignaling Output

00.00.0 = Presignaling not activated

The presignaling function programmed in this parameter applies for every positioning command (POI, PSI, POA, PSA).

As soon as the distance still to be traversed becomes less than the programmed presignaling distance, the output is enabled.

The output remains enabled continuously or for the programmed time period. The output is disabled each time a new feed instruction is received.

Ax30 Axis x Open Feed Roll

O p e n F e e d R o l l A x														
A x 3 0														
I	1	.	0	0	.	0		Q	1	.	0	0	.	0

Output: Open Feed Roll Enabled

Input: Open Feed Roll

For more information, see the chapter entitled 'Open Feed Roll'.

Ax31 Axis x Measuring Wheel Mode

M . Wheel Mode Ax
A x 3 1
I 1 . 0 0 . 0

Input: `Measuring Wheel Active` (only for `Measuring Wheel Mode`)
 `00.00.0` = Measuring Wheel always active

For measuring wheel mode, the repositioning comes from the servo drive in Manual Mode and from the measuring wheel encoder in Automatic Mode. Using the `Measuring Wheel Active` input, switching between the measuring wheel encoder and the motor encoder is possible.

Ax32 Axis x Various Functions

Functions Ax
A x 3 2
Q 1 . 0 0 . 0 Q 1 . 0 0 . 0

Output: Deceleration Active
 Output: Target Velocity Reached

Ax33 Axis x Cut Inhibit

Cut Inhibit Ax
A x 3 3
I 1 . 0 0 . 0 Q 1 . 0 0 . 0

Output: Cut Inhibit
 Input: Cut Inhibit

If the CLM is in `Automatic` Mode and the Axis is not yet in the flying motion, synchronization is suppressed when a signal is present at the `Cut Inhibit` input. The signal must be a pulse. Only when a signal is present at the `Immediate Cut` input (Parameter A134) is the process continued by immediately cutting the material.

Notes: When switching from `Automatic` to `Manual`, the `Cut Inhibit` function is canceled.

The function Cut Inhibit is valid only for Mode 5 `Flying Cutoff` and for Axis 1.

Ax34 Axis x Cut Vector

Cut Vector	Ax
Ax 34	
1 1 . 0 0 . 0 0 7 0 0 0	

Indexing

0 = No Indexing

1 = Indexing Activated

Start Instruction Manual Cut Vector Program

Input: `Immediate Cut`

00.00.0 = Function Off

If the CLM is in `Automatic` Mode and a signal is present at the `Immediate Cut` input, the axis immediately accelerates to the material velocity, regardless of the pre-set length, and the processing program for the length instruction is started. However, the signal at the input is only accepted if the axis is at the start position (Position 0). The signal must be a pulse.

If the CLM is in `Manual` Mode and a signal is present at the `Immediate Cut` input, a processing program is in progress. The start instruction is set in the parameter. The program must end with an `RTS` command. Subroutines with the `JSR` and `RTS` commands can be integrated into the processing program. While the processing program is running, the `Jog forward` and `Jog reverse` inputs are disabled.

Indexing is necessary to start up without wasting material, during normal processing. After manual processing with a manual cut, the CLM monitors every movement of the carriage and the material. The resulting length is subtracted from the length set in the length command when a switch from `Manual` to `Automatic` occurs. The remaining length is the distance to be traveled before the next processing step.

If more material than the currently set length in the length instruction has been fed through the processing tool since the last manual cut, the CLM issues an `Index Length` error

Notes: For indexing, the `FUN` command must be programmed into the processing program or the manual cut program, with the length of the material that has been fed through the tool.

The function `Indexing` is valid only in Mode 5 `Flying Cutoff` and for Axis 1.

Example:

A manual cut is executed in `Manual` Mode, with a carriage position of +1000mm. Afterward, the carriage is moved back to its initial position. After switching to `Automatic` Mode, a production length of 5000mm is to be processed (length in `LML` command = 5000.000).

If indexing is activated, the 1000mm are included in the calculation, which means that the first cut piece has a length of 5000mm.

If indexing is not activated, the first piece has a length of 6000mm, because the 1000mm are not part of the calculation.

Ax35 Axis x Reverse Inhibit

R	e	v	e	r	s	e	I	n	h	i	b	i	t	A	x
A	x	3	5												
I	1	.	0	0	.	0	0	0	0	0	0	0	0	0	0

Reserved

Input: `Reverse Inhibit`
00.00.0 = Function off

When processing is finished (`EOS` command in the tool program) the CLM waits for a signal at the `Reverse Inhibit` input. If no signal is present, the carriage decelerates and stops. The reverse motion to the home position is suppressed until a signal is present at the input. If a signal is applied before the `EOS` command is processed, it is not evaluated by the CLM.

Note: The function `Reverse Inhibit` is valid only for Axis 1 and in Mode 5 `Flying Cutoff`.

Ax36 Axis x Rapid Stop

R	a	p	i	d	S	t	o	p	A	x
A	x	3	6							
I	1	.	0	0	.	0	0	0	0	0

Start Instruction Rapid Stop Program

Input: `Rapid Stop`
00.00.0 = Function off

The function `Rapid Stop` is used for rapid movement of the tool away from the material and for stopping the carriage.

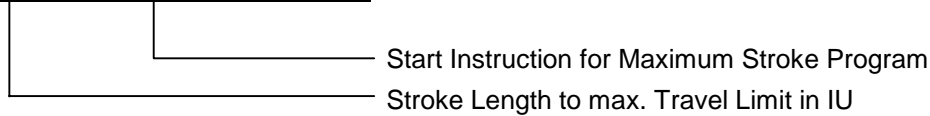
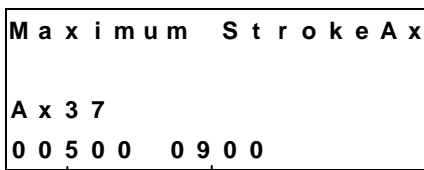
If the material is being processed while synchronization is taking place, and if a signal is applied at the `Rapid Stop` input, the processing program is immediately interrupted and the tool is rapidly moved away from the material using another program. The start instruction for the rapid stop program is set in the parameter. The rapid stop program must end with an `EOS` command. As long as this program is being processed, synchronization is maintained. Afterward, the command values are set to 0V and the `Rapid Stop` error is issued.

If no synchronization is present, and if a signal is applied at the `Rapid Stop` input, the rapid stop program is not executed. Afterward, the command values are set to 0V and the `Rapid Stop` error is issued.

If no program is required to move the tool away from the material, the start instruction of the rapid stop program must be 0000.

Note: The function `Rapid Stop` is valid only for Axis 1 and in Mode 5 `Flying Cutoff`.

Ax37 Axis x Maximum Stroke



If the material is being processed during synchronized movement, and if a stroke length is programmed in the parameter, the program is immediately interrupted and the tool is moved away from the material using another program, if the difference between the carriage and the maximum travel limit is smaller than the programmed stroke (see example). The start instruction for the program is set in the parameter. The processing program must end with an `EOS` command. As long as this program is being processed, synchronization is maintained. Afterward, the command values are set to 0V and the `Maximum Stroke` error is issued.

If no program is required to move the tool away from the material, the start instruction of the maximum stroke program must be 0000.

Example:

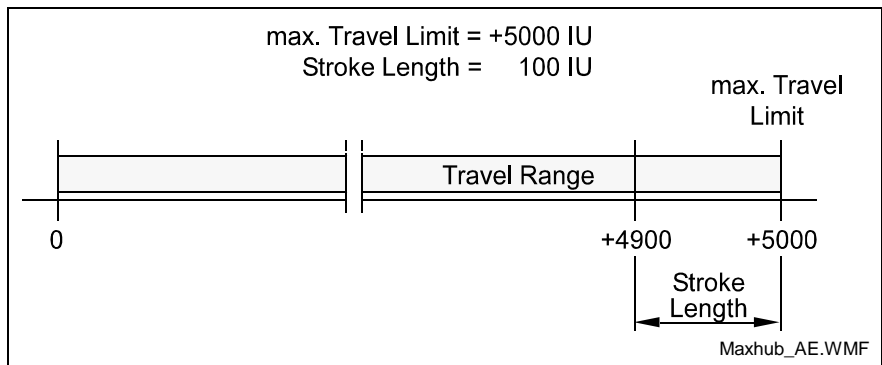


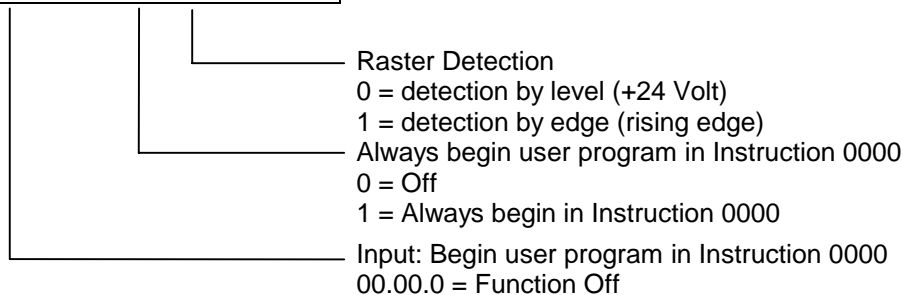
Fig. 8-11: Maximum Stroke

Notes: If the maximum travel limit is reached before the processing program for moving the tool away from the material is finished, the command values are set to 0V and the `Max. Travel Lmt` error is issued.

The function `Rapid Stop` is valid only for Axis 1 and in Mode 5 `Flying Cutoff`.

Ax38 Axis x Functions 2

F u n c t i o n s 2 A x
A x 3 8
I 1 . 0 0 . 0 0 0



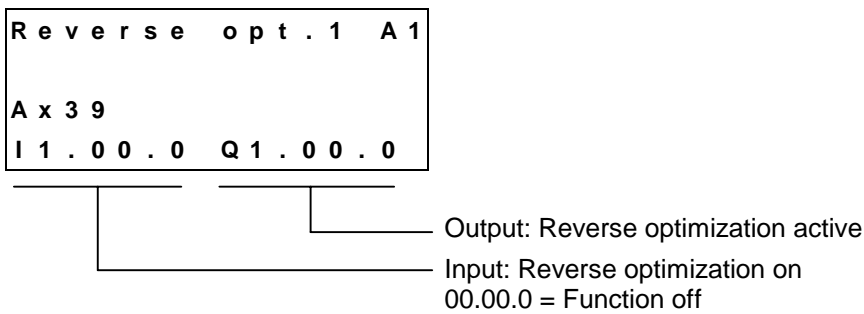
Raster Detection Raster detection (`LMR` command or `LMK` command) can be by level or by edge.

Start Instruction of the User Program Program execution of Task 1 begins after switching from `Manual` to `Automatic` Mode, using the previous length instruction minus 1. If the CLM is to begin with Instruction 0000, this can occur as follows:

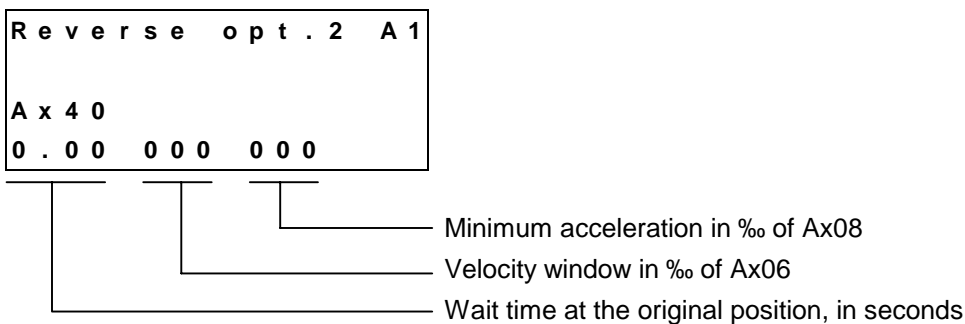
- In the parameter, the function `Always begin user program in Instruction 0000` is programmed.
- In the parameter, an input is programmed. If a signal is applied to the programmed input in `Manual` Mode, the CLM begins with Instruction 0000 when a switch from `Manual` to `Automatic` occurs.
- If the and keys are pressed simultaneously in `Manual` Mode, the CLM begins with Instruction 0000 when a switch from `Manual` to `Automatic` occurs.
- If the interface command `!_CLO` is sent via the serial interface in `Manual` Mode, the CLM begins with Instruction 0000 when a switch from `Manual` to `Automatic` occurs.

Note: The functions `Raster Detection` and `Start Instruction of the User Program` are valid only for Axis 1 and in Mode 5 `Flying Cutoff`.

Ax39 Axis x Reverse Optimization 1



Ax40 Axis x Reverse Optimization 2



Minimum Acceleration For large production lengths, the reverse acceleration can become very small. Using the value in Parameter A140, a minimum reverse acceleration can be set.

Velocity Window If, during reverse motion, the material velocity is increased by more than the velocity window programmed in Parameter A140, a switch is made to the acceleration set in Parameter A108.

Wait Time For very large fluctuations in the material velocity, it is possible that the flying unit may no longer reach the original position at the reverse acceleration during reverse motion, because acceleration to the next processing location must occur. To avoid this, a 'wait time in the original position' can be programmed.

Ax41 Axis x Tool Width

Tool Width	Axis
Ax 4 1	
0 5 . 0 0	

Width of cutting tool in IU

While the material is cut to length, it is assumed that no waste is produced during the separation. For sawing and punching, however, the cut length is shortened by the width of the cut width. In order to arrive at the correct cut length, the width of the cutting tool is added to the cut length for the `LML` command.

Note: The function `Tool Width` is valid only for Axis 1 and in Mode 5 `Flying Cutoff`.

Ax42 Axis x Crop Cut

Crop Cut	Axis
Ax 4 2	
0 5 0 0 . 0 0 0 0 . 0 0 0 . 0	

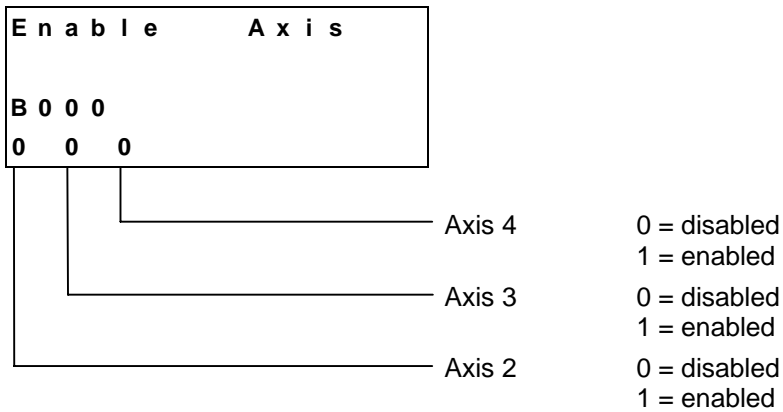
`Crop Cut` input
 00.00.0 = Function off
 Length of Crop Cut in IU

If the carriage is in the home position, a crop cut is triggered by a rising edge at the programmed input. The crop cut length entered in the parameter is set as the length.

Note: The function `Crop Cut` is valid only for Axis 1 and in Mode 5 `Flying Cutoff`.

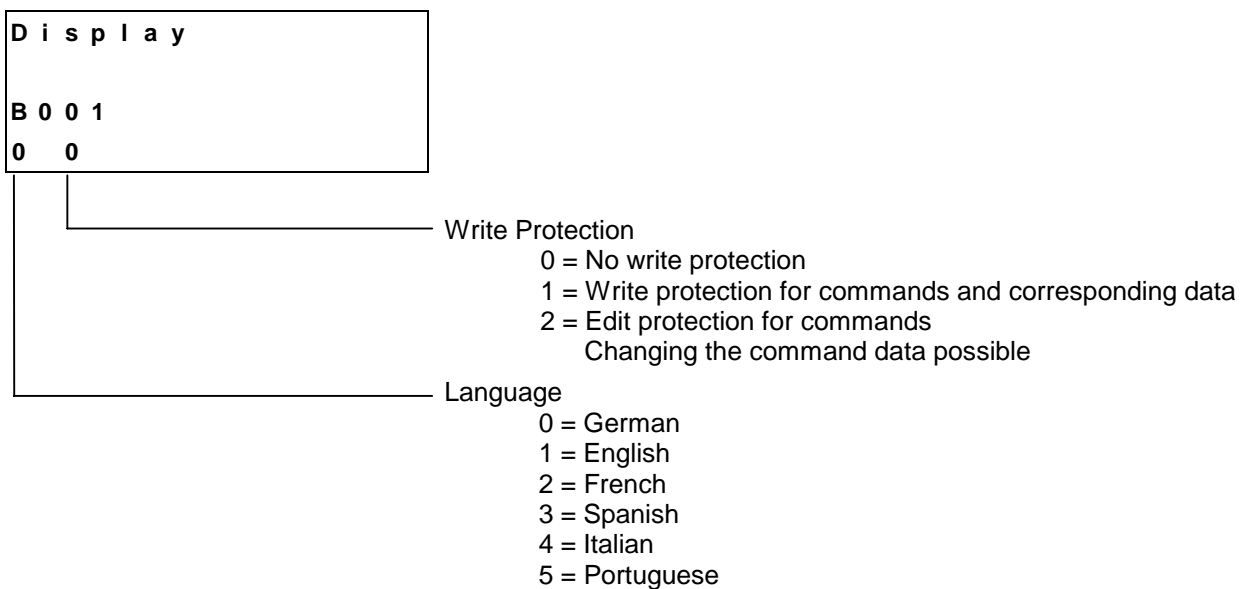
8.3 General Parameters

B000 Enable Axis



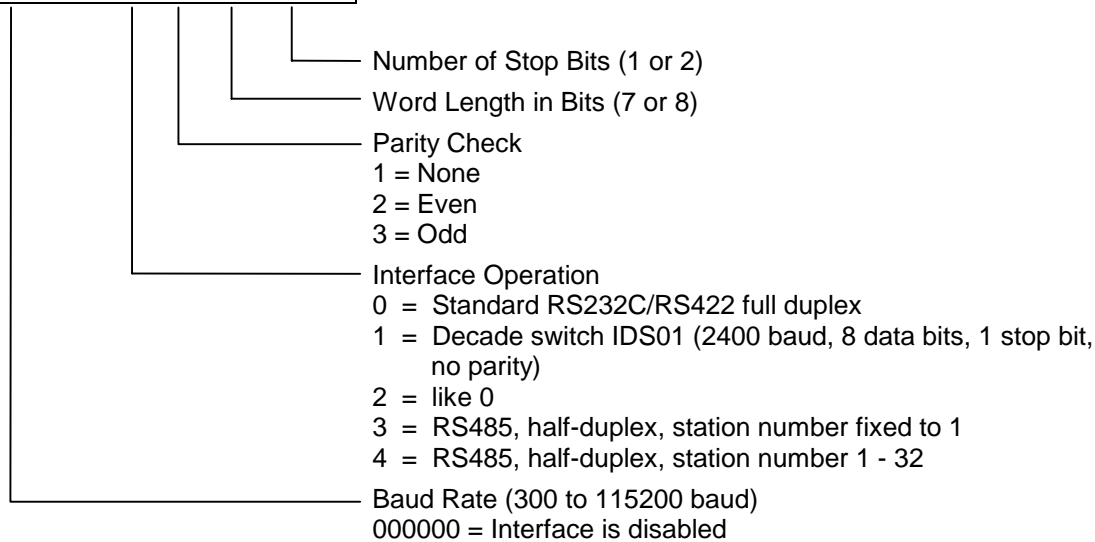
For an enabled axis, the corresponding parameter set Axxx must be programmed.

B001 Display



B002 RS Interface Format X6

RS Format X6									
B002									
0	0	9	6	0	0	0	1	8	1



The CLM's serial interface X6 can exchange data with the system in different ways. The selected transmission format is defined in Parameter B002. For further details, see `Serial Interface`.

If the decade switch input is preselected via an IDS01 unit, the other values need not be input.

Notes: If the two parameters B002 and B003 are correctly saved, the X6 serial interface is immediately ready for operation and the X8 serial interface (Parameter B004 and B005) is turned off. Invalid inputs in the parameters disable the X6 serial interface. Only one serial interface at once (X6 or X8) can be activated. Operating the RS422 interface is not possible using hardware handshake RTS / CTS (Parameter B003).

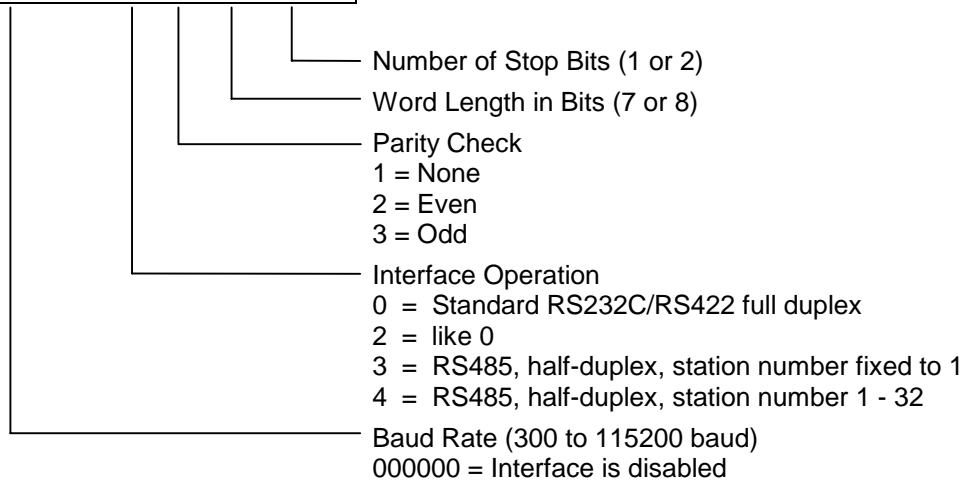
Example for decade switch querying:

For the decade switch, the transmission parameters for the interface are stipulated as follows:

2400	Baud
8	Bit
1	Start Bit
1	Stop Bit
	No parity check

B004 RS Interface Format X8

R	S	F	o	r	m	a	t	X	8
B	0	0	4						
0	0	9	6	0	0	0	1	8	1



The CLM's serial interface X8 can exchange data with the system in different ways. The selected transmission format is defined in Parameter B004. For further details, see `Serial Interface`.

Notes: If the two parameters B004 and B005 are correctly saved, the X6 serial interface (Parameters B002 and B003) is turned off and the X8 serial interface is immediately ready for operation. Invalid inputs in the parameters disable the X8 serial interface. Only one serial interface at once (X6 or X8) can be activated. Operating the RS422 interface is not possible using hardware handshake RTS / CTS (Parameter B005).

B006 Reserved (Free)

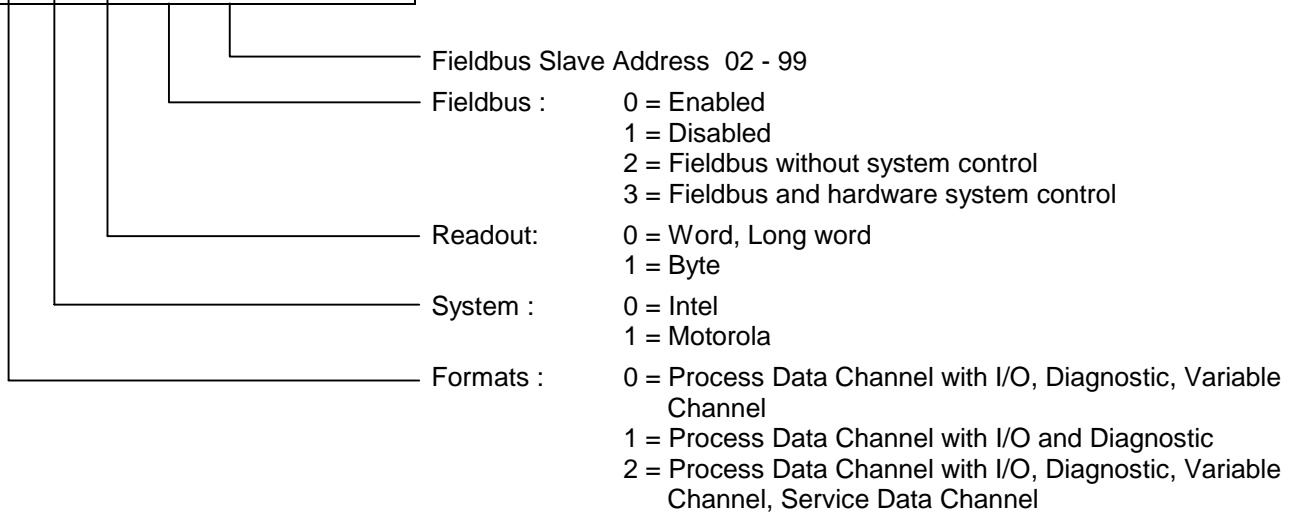
F r e e B 0 0 6

B007 Reserved (Free)

F r e e B 0 0 7

B008 Fieldbus Formats

F i e l d b u s F o r m a t s B 0 0 8 1 1 0 1 0 5

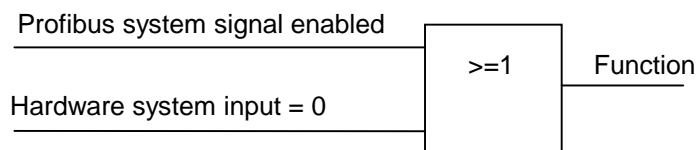


In fieldbus operating Mode 3, the CLM hardware system inputs are linked with a logical OR to the compatible system inputs of the Profibus in the CLM.

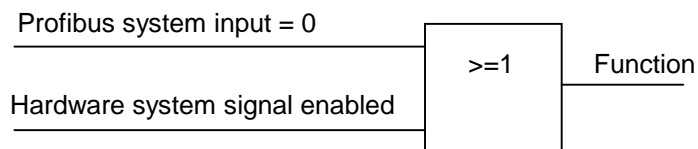
System outputs are always assigned to hardware outputs and Profibus outputs.

Caution: Activating a function via the CLM system hardware inputs (X3, X22) and the Profibus inputs can result in a conflict of signals. For all system inputs, the logical '1' signal is dominant.

Profibus System Signal Enabled



CLM Hardware System Signal Enabled



For further information, see chapter entitled 'Command Communications'.

B009 Reserved (Free)

Free

B 0 0 9

B010 Cycle Time

C y c l e T i m e
B 0 1 0
2 . 0

_____ Cycle Time in ms

1.0 = 1.0	ms
1.1 = 1.1	ms
1.2 = 1.2	ms
1.3 = 1.3	ms
1.4 = 1.4	ms
1.5 = 1.5	ms
1.6 = 1.6	ms
1.7 = 1.7	ms
1.8 = 1.8	ms
1.9 = 1.9	ms
2.0 = 2.0	ms
2.5 = 2.5	ms
3.0 = 3.0	ms
3.5 = 3.5	ms
4.0 = 4.0	ms

For the value 0.0, the CLM automatically sets the cycle time to the following default values:

1 or 2 axes programmed:	2 ms
3 axes programmed:	3 ms
4 axes programmed:	4 ms

The default setting for Parameter B010 is 0.0 for the automatic default setting.

While operating the CLM, if the message

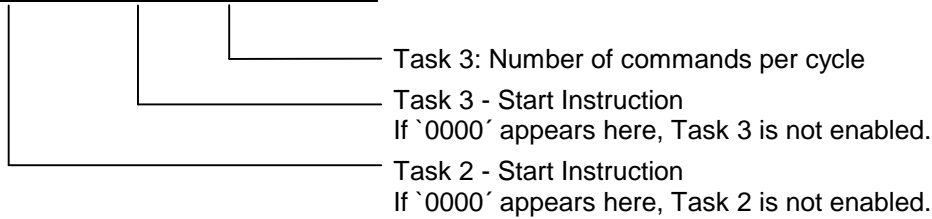
System Failure !
Code #IRQOVL

appears, the cycle time is too short.

The value selected in Parameter B010 must be increased. At a minimum, the default values should be programmed.

B011 Start Task 2 & 3

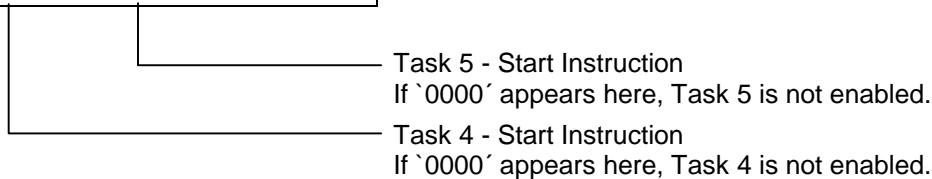
S t a r t T a s k 2 & 3									
B 0 1 1									
0	2	2	2	0	3	3	3	1	



For further details, see the chapter entitled `Multitasking`.

B012 Start Task 4 & 5

S t a r t T a s k 4 & 5									
B 0 1 2									
0	0	0	0	0	0	0	0	0	



Tasks 4 and 5 show the same behavior as Task 2.

For further details, see the chapter entitled `Multitasking`.

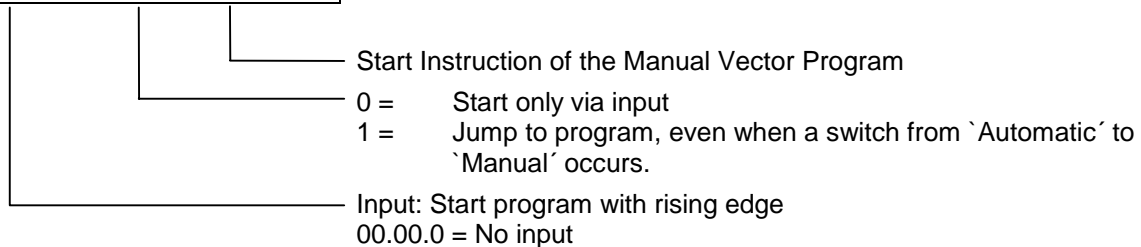
B013 Logic Task

In preparation

L o g i c T a s k									
B 0 1 3									

B014 Manual Vector

M a n u a l V e c t o r
B 0 1 4
I 1 . 0 0 . 0 1 0 1 0 0



Using `Manual Vector`, execution of a user program in Manual Mode is possible. Subroutines with the `JSR` and `RTS` commands are possible. The vector program ends with an `RTS` command if no further subroutine is called (the stack is empty).

When the operating mode is changed from `Manual` to `Parameter`, a running manual vector program is terminated. While the manual vector program is running, any attempt to change the operating mode to `Automatic` is suppressed until the program has concluded.

The manual vector program is started by detection of the rising edge of a signal pulse at the programmed input. If `00.00.0 1 xxxx` is programmed in this parameter, the manual vector program is to be started only via a change in operating mode. The start instruction for the manual vector program must not be within the main program.

During jogging or homing in Manual Mode, no manual vector is accepted. No jogging or homing is possible while the manual vector program is running. Any such command is ignored.

Note: In the manual vector program, no feeds can be programmed.

B015 Interrupt Vector

Only Task 1-

I n t e r r u p t V e c t o r
B 0 1 5
1 . 0 0 . 0 1 0 0 9 0 0

Interrupt program address

0 = A positioning function in progress is not interrupted
 1 = A positioning function in progress is interrupted (the drives are decelerated to a complete stop)

0 = The vector is inhibited during a subroutine (JSR). (rising edge)

1 = the vector is always enabled (rising edge)

2 = The vector is inhibited during a subroutine (JSR). (falling edge)

3 = The vector is always enabled (falling edge)

If `00.00.0` is entered here, the vector is deactivated.

Note: The interrupt vector is available only in Task 1.

For further information, see chapter entitled `Vector Programming`.

B016 Restart Vector

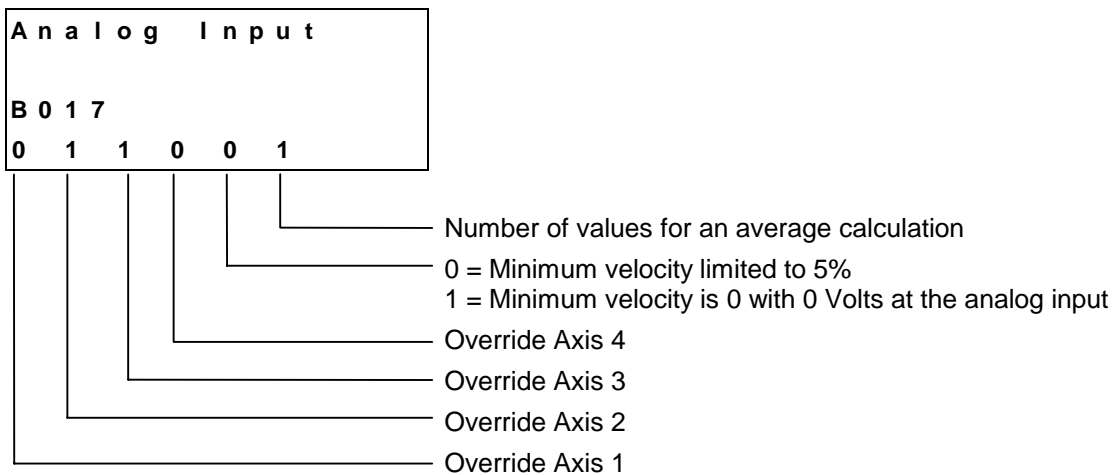
R e - S t a r t V e c t o r
B 0 1 6
0 0 0 0

Start instruction for the re-start program

When `0000` is input, no re-start program is present. The status is immediately restored.

For further information, see the chapter entitled `Restart`.

B017 Analog Input / Override



1) Averaging for the analog input:

0 = No averaging	8 values for analog input
1 = Averaging of	16 values for analog input
2 = Averaging of	32 values for analog input
3 = Averaging of	64 values for analog input
4 = Averaging of	128 values for analog input
5 = Averaging of	256 values for analog input
6 = Averaging of	512 values for analog input
7 = Averaging of	1024 values for analog input
8 = Averaging of	2048 values for analog input
9 = Averaging of	

The values that have been read in can be queried via Status 45 or 49 (see `Serial Interface` chapter).

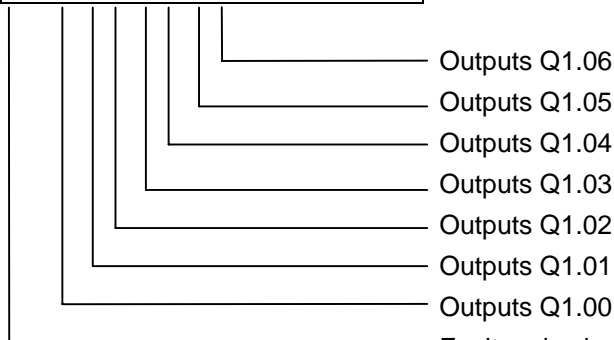
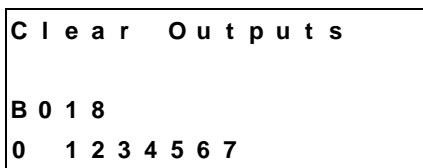
2) Override

The following inputs are possible for override:

- 0 = Override is off
- 1 = Override via Analog Input 1
- 2 = Override via Analog Input 2
- 3 = Override via Analog Input 3
- 4 = Override via Analog Input 4
- 5 = Binary encoded override via Inputs I1.01.0 to I1.01.7
- 6 = Gray-coded override via Inputs I1.01.4 to I1.01.7

Any analog input can be assigned to an axis.

B018 Clear Outputs



Outputs Q1.06

Outputs Q1.05

Outputs Q1.04

Outputs Q1.03

Outputs Q1.02

Outputs Q1.01

Outputs Q1.00

Fault code via outputs (Outputs Q1.00 - Q1.05)

0 = Function not enabled

1 = Fault code via outputs Q1.00

2 = Fault code via outputs Q1.01

3 = Fault code via outputs Q1.02

4 = Fault code via outputs Q1.03

5 = Fault code via outputs Q1.04

6 = Fault code via outputs Q1.05

Clear Outputs

This function allows the user to influence the clearing of outputs when faults occur.

For each group of 8 outputs, the following inputs are possible:

0 = Clear outputs when a fault or E-STOP occurs.

1 = Do not clear outputs when a fault or E-STOP occurs. The outputs are only cleared after the fault has been cleared.

2 = Do not clear outputs when error or E-STOP occurs or is cleared ('Clear' key, external 'Clear').

Note: If the BB relay drops out, all outputs present in the hardware are shut off internally.

Error Code via Outputs:

00 to 3F - General fault

40 to 6F - Fault, Axis 1

70 to 9F - Fault, Axis 2

A0 to CF - Fault, Axis 3

D0 to FF - Fault, Axis 4

Code Describing the Fault

00	No fault, Manual or Automatic Mode
01	No fault; Parameter Mode
02	Invalid input in Parameter XX
03	E-Stop
04	Battery is low
05	Parameter lost
06	Program lost
07	Division by zero
08	Wrong operating mode
0A	Invalid program command
0B	JSR nesting
0C	RTS nesting
0D	Input not in BCD Format
0E	Invalid block number
10	System error `Exception`
11	System errors `Stack overflow`, `EPROM data lost` `Position Loop - IRQ too long`
12	IDS - Connection interrupted
13	IDS - Checksum error
14	IDS - Format error
15	IDS - Data string too long
16	Wrong axis number
17	Hardware for Axis 3/4 missing
18	Wrong CLM hardware
19	Voltage monitoring $\pm 15V$
1A	REP - command not possible
1B	SAC - command not possible
1D	Input / Output Number wrong in command
1E	Error in VCC command
1F	Variable number illegal
2C	Track Monitoring, Incremental Encoder 1
2D	Track Monitoring, Incremental Encoder 2
2E	Track Monitoring, Incremental Encoder 3
2F	Track Monitoring, Incremental Encoder 4
30	Track Monitoring, Incremental Measuring Wheel Encoder
31	Attempt to write to a system variable
32	Incorrect value of a variable during read access
33	Fieldbus card error
34	Fieldbus card initializing error
35	EOS command missing (Flying Cutoff)
36	Axis 1 not in home position (Flying Cutoff)
37	Fieldbus Timeout
38	Logic Task Program Error
39	Logic Task Program Lost
3A	Index Length (Flying Cutoff)
3B	Rapid Stop (Flying Cutoff)

Code Describing the Fault

3C	Maximum Stroke (Flying Cutoff)
3D	I/O-No. Illegal
40	Drive 1 not ready
41	Feed angle monitoring, Axis 1
42	Drive runaway, Axis 1
43	Position lag (following error), Axis 1, too large
44	Absolute encoder 1 not connected
45	Absolute encoder data error, Axis 1
46	Minimum travel limit, Axis 1
47	Maximum travel limit, Axis 1
48	Not homed, Axis 1
49	Homing: Cam too short, Axis 1
4A	Homing: No marker pulse, Axis 1
4B	Homing: Marker pulse position, Axis 1
4C	Encoder error, measuring wheel
4D	Max. override, Axis 1
4E	Axis 1 is disabled
4F	Continuous marker pulse 1
50	Target position < Minimum travel limit, Axis 1
51	Target position > Maximum travel limit, Axis 1
52	HOM - Command not possible, Axis 1
70	Drive 2 not ready
71	Feed angle monitoring, Axis 2
72	Drive runaway, Axis 2
73	Position lag (following error), Axis 2, too large
74	Absolute encoder 2 not connected
75	Absolute encoder data error, Axis 2
76	Minimum travel limit, Axis 2
77	Maximum travel limit, Axis 2
78	Not homed, Axis 2
79	Homing: Cam too short, Axis 2
7A	Homing: No marker pulse, Axis 2
7B	Homing: Marker pulse position, Axis 2
7D	Max. override, Axis 2
7E	Axis 2 is disabled
7F	Continuous marker pulse 2
80	Target position < Minimum travel limit, Axis 2
81	Target position > Maximum travel limit, Axis 2
82	HOM - Command not possible, Axis 2

Code Describing the Fault

A0	Drive 3 not ready
A1	Feed angle monitoring, Axis 3
A2	Drive runaway, Axis 3
A3	Position lag (following error), Axis 3, too large
A4	Absolute encoder 3 not connected
A5	Absolute encoder data error, Axis 3
A6	Minimum travel limit, Axis 3
A7	Maximum travel limit, Axis 3
A8	Not homed, Axis 3
A9	Homing: Cam too short, Axis 3
AA	Homing: No marker pulse, Axis 3
AB	Homing: Marker pulse position, Axis 3
AD	Max. override, Axis 3
AE	Axis 3 is disabled
AF	Continuous marker pulse 3
B0	Target position < Minimum travel limit, Axis 3
B1	Target position > Maximum travel limit, Axis 3
B2	HOM - Command not possible, Axis 3
D0	Drive 4 not ready
D1	Feed angle monitoring, Axis 4
D2	Drive runaway, Axis 4
D3	Position lag (following error), Axis 4, too large
D4	Absolute encoder 4 not connected
D5	Absolute encoder data error, Axis 4
D6	Minimum travel limit, Axis 4
D7	Maximum travel limit, Axis 4
D8	Not homed, Axis 4
D9	Homing: Cam too short, Axis 4
DA	Homing: No marker pulse, Axis 4
DB	Homing: Marker pulse position, Axis 4
DD	Max. override, Axis 4
DE	Axis 4 is disabled
DF	Continuous marker pulse 4
E0	Target position < Minimum travel limit, Axis 4
E1	Target position > Maximum travel limit, Axis 4
E2	HOM - Command not possible, Axis 4

Example:

Parameter B018 = 3 xxxxxx ; `Position lag (following error), Axis 2`

Status of the outputs: Q1.02.x

Weighted value: $2^3 \ 2^2 \ 2^1 \ 2^0 \ 2^3 \ 2^2 \ 2^1 \ 2^0$

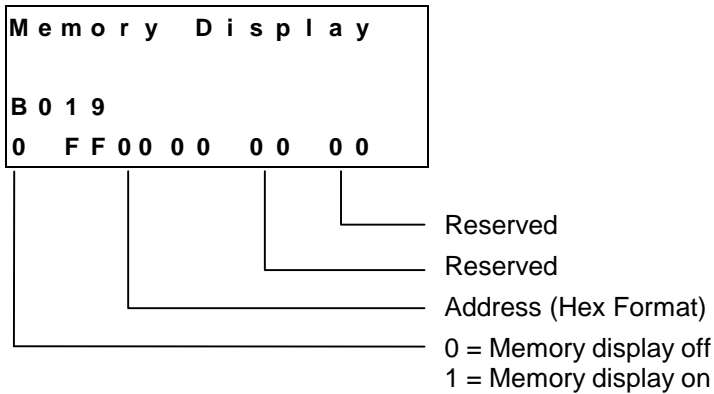
0 1 1 1 0 0 1 1

7

3

→ Hex Code 73

B019 Memory Display









If the memory display is turned on, the contents of the entire RAM memory can be shown on the display. The memory address in Parameter B019 is a default address that is shown on the display after turning on the CLM or after a fault.

However, the address may be changed during operation by directly overwriting it.

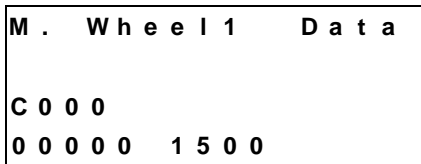
With the `plus` and `minus` keys, the memory address can be changed byte-by-byte.

The letters `A` to `F` are composed by simultaneously pressing the key combination `Save` and `Number`. The following key combinations compose each letter:

- Save key  and 1 = A
- Save key  and 2 = B
- Save key  and 3 = C
- Save key  and 4 = D
- Save key  and 5 = E
- Save key  and 6 = F

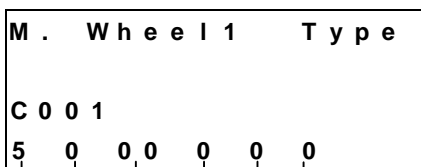
8.4 Master Encoder Parameters

C000 Master Encoder 1, Data



Revolutions (absolute encoder) in preparation
Encoder graduation mark 100 - 10000 (pulses per encoder revolution)

C001 Master Encoder 1, Type



Averaging of the master pulses (only for `Flying Cutoff`)
0 = Off
1 = Averaging of 2 values
2 = Averaging of 4 values
3 = Averaging of 8 values
4 = Averaging of 16 values
5 = Averaging of 32 values
6 = Averaging of 64 values
7 = Averaging of 128 values

Encoder direction:
0 = do not turn
1 = turn

Track Monitoring: 0 = Enabled
1 = Disabled

Number of absolute encoder data bits (in preparation)

Encoder type: 0 = Incremental Encoder
1 = Single-turn absolute encoder (in preparation)
2 = Multi-turn absolute encoder (in preparation)

Encoder number of master encoder 1:
5 = Master encoder 1 is incremental encoder 5 (connector X1)

Master encoder 1 can be used for the functions `Slave Axis`, `Measuring Wheel Mode Axis 1`, `Flying Cutoff` or to measure feed length with the FUN command. These functions are enabled in Parameter Ax00.

For further information, see the chapters entitled `Measuring Wheel Mode` and `Slave Axis / Synchronous Axis`.

C002 Master Encoder 1, Feed Constant

M . W h . 1 F e e d C o n s t
C 0 0 2
0 5 0 0 . 0 0 0 0 0

Feed constant of master encoder 1 in IU

Input Range: from 0.01000 to 5000.00000 in IU

C003 Master Encoder 1, Offset

M . W h e e l 1 O f f s e t
C 0 0 3
+ 1 2 3 4 5 . 6 7 8

This parameter currently has no function.

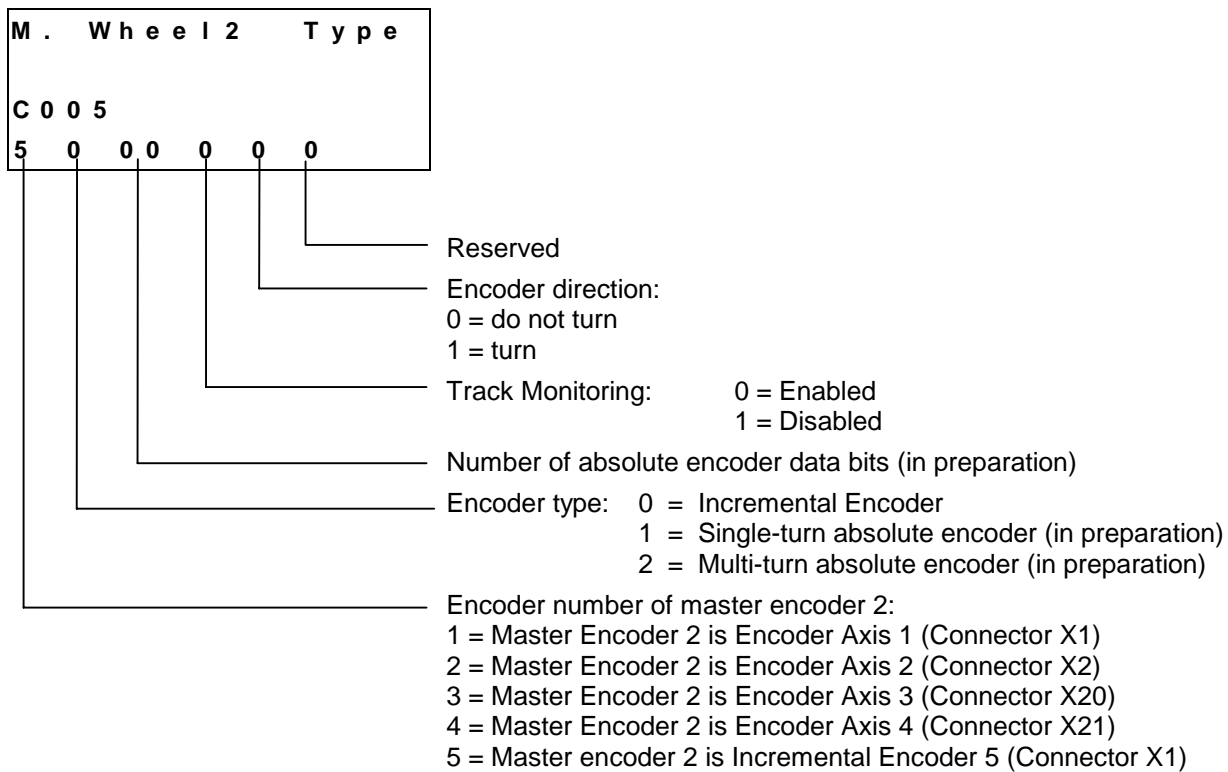
C004 Master Encoder 2, Data

M . W h e e l 2 D a t a
C 0 0 4
0 0 0 0 0 1 5 0 0

Revolutions (absolute encoder) in preparation

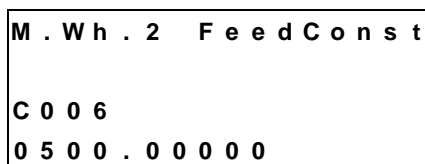
Encoder graduation mark 100 - 10000 (pulses per encoder revolution)

C005 Master Encoder 2, Type



Master Encoder 2 can be used for the function 'Measuring Wheel Mode Axis 2' or to measure feed length with the FUN command.

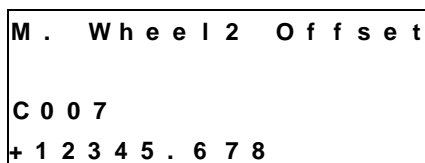
C006 Master Encoder 2, Feed Constant



Feed constant of master encoder 2 in IU

Input Range: from 0.01000 to 5000.00000 in IU

C007 Master Encoder 2, Offset



This parameter currently has no function.

C008 Master Encoder 1, Internal

M . W h e e l 1 i n t e r n
C 0 0 8
I 1 . 0 0 . 0 6 1 0

Variable, with which the material speed is transmitted in IU/s

`No Material' input
00.00.0 = Function off

With this function, the end of the material is processed.

If a signal is applied at the `No Material' input, the material velocity is no longer controlled by the master encoder; it is picked up from the programmed variable and maintained until the signal drops off again. Then, the material velocity for Master Encoder 1 is used again.

Notes: The velocity is switched immediately (without acceleration or deceleration).

The velocity in the variable may not be larger than the maximum velocity (Parameter A106).

This function is valid only for Axis 1 and in Mode 5 `Flying Cutoff'.

8.5 List of CLM Parameters

Software : _____ Com. No. : _____
 Date : _____ Client/End user: _____
 Prep. by : _____ Serial No. : _____

Designation	Parameter	Data
Axis Enable	B0 00	
Display	B0 01	
RS Format X6	B0 02	
RS Functions X6	B0 03	
RS Format X8	B0 04	
RS Functions X8	B0 05	
Reserved	B0 06	
Reserved	B0 07	
Fieldbus Formats	B0 08	
Reserved	B0 09	
Cycle Time	B0 10	
Tasks 2 & 3	B0 11	
Tasks 4 & 5	B0 12	
Logic Task	B0 13	
Manual Vector	B0 14	
Interrupt Vector	B0 15	
Restart Vector	B0 16	
Analog Input / Override	B0 17	
Clear Outputs	B0 18	
Memory Display	B0 19	

Fig. 8-12: Parameter List B0 xx

Note: The parameters designated with ``*`` may only be altered with permission of the machine builder or drive manufacturer!

Designation	No.	Axis 1	Axis 2	Axis 3	Axis 4
Mode	Ax 00*				
Feed Constant	Ax 01*				
Gear	Ax 02*				
Min. Travel Limit Value	Ax 03				
Max. Travel Limit Value	Ax 04				
Modulo Value	Ax 05				
Maximum Velocity	Ax 06				
Jog Velocity	Ax 07				
Acceleration Rate	Ax 08*				
Acceleration / Deceleration	Ax 09*				
Jerk Constant	Ax 10				
Kv Factor	Ax 11*				
Drive Sensitivity	Ax 12*				
Reserved	Ax 13				
Position Monitoring Window	Ax 14				
Feed Angle Monitoring / Interrupt	Ax 15				
Encoder Difference	Ax 16				
Absolute Encoder Monitoring Window	Ax 17				
Reserved	Ax 18				
Encoder Data	Ax 19				
Encoder Type	Ax 20				
Drive Direction	Ax 21				
Absolute Encoder Home Position	Ax 22				
Homing I/O	Ax 23				
Homing Search Distance	Ax 24				
Homing Offset	Ax 25				
Reserved	Ax 26				
Switching Threshold	Ax 27				
Position Window	Ax 28				
Presignaling	Ax 29				
Open Feed Roll	Ax 30				
Measuring Wheel Mode	Ax 31				
Various Functions	Ax 32				
Cut Inhibit	Ax 33		---	---	---
Cut Vector	Ax 34		---	---	---
Reverse Inhibit	Ax 35		---	---	---
Rapid Stop	Ax 36		---	---	---
Maximum Stroke	Ax 37		---	---	---
Functions 2	Ax 38		---	---	---
Reverse Optimization 1	Ax 39		---	---	---
Reverse Optimization 2	Ax 40		---	---	---
Tool Width	Ax 41		---	---	---
Crop Cut	Ax 42		---	---	---

Fig. 8-13: Parameter List Ax xx

Note: The parameters designated with `*` may only be altered with permission of the machine builder or drive manufacturer!

Designation	Parameter	Data
Master Encoder 1, Data	C0 00	
Master Encoder 1, Type	C0 01	
Master Encoder 1 Feed Constant	C0 02	
Master Encoder 1, Offset	C0 03	
Master Encoder 2, Data	C0 04	
Master Encoder 2, Type	C0 05	
Master Encoder 2, Feed Constant	C0 06	
Master Encoder 2, Offset	C0 07	
Master Encoder 1, Internal	C0 08	

Fig. 8-14: Parameter List C0 xx

8.6 Minimum and Maximum Values for Parameter Input

Parameter	Designation		Min. Data	Max. Data
Ax 01	Feed Constant	IU	0.0100	5000.00000
Ax 05	Modulo Value	IU		
Ax 06	Maximum Velocity	IU/s	0.100	50000.000
Ax 07	Jog Velocity	IU/s	0.100	50000.000
Ax 08	Acceleration	IU/sec ²	1	999999
Ax 10	Jerk Constant		0.000	1.024
Ax 11	KV Factor		0.01	20.00
Ax 12	Drive Sensitivity	Volts	0.5	10.0
Ax 19	Encoder Data		100	10000
C000	Master Encoder 1, Data		100	10000
C002	Master Encoder 1, Feed Constant	IU	0.0100	5000.00000
C004	Master Encoder 2, Data		100	10000
C006	Master Encoder 2, Feed Constant	IU	0.0100	5000.00000

Fig. 8-15: Parameter Input Range

9 Interfaces

9.1 Inputs, Outputs and Marker Flags

Designation

The designation of the inputs, outputs and marker flags.

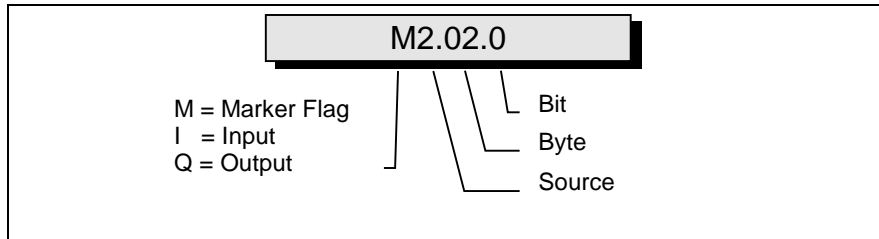


Fig. 9-1: Structure of the Inputs / Outputs / Marker Flags

e.g. I1.00.6

I Input

I1 Input, Connector X3

I1.00 Input, Connector X3, Group 0 (Byte)

I1.00.6 Input, Connector X3, Group 0, Bit 6

Inputs

The inputs are designated with 'I'. They can be programmed and processed in the parameters, commands, and in the Logic Task. They are read at the beginning of each cycle or at the start of the Logic Task.

Outputs

The outputs are designated with 'Q'. They can be programmed and processed in the parameters, commands, and in the Logic Task. They are processed at the beginning of each cycle or at the start of the Logic Task. If an output is designated in the Logic Task, this output can no longer be processed in one of the NC Tasks or via the functions enabled in the parameters.

Marker Flags

The marker flags are designated with 'M'. They can be programmed and processed in the parameters, commands, and in the Logic Task. They are processed at the beginning of each cycle or at the start of the Logic Task. To avoid confusion, the NC Task and the Logic Task have different marker flags. Transfer marker flags handle the exchange of information between the NC Task and the Logic Task.

Source

Origin or category

Bytes

8 inputs, outputs or marker flags are grouped together (to form bytes).

BIT

The bit designates the input, output or marker flag. Numbering is from 0 to 7.

Inputs

The CLM has 112 inputs .

All CLM input signals are galvanically isolated from the control using an opto-electronic coupler.

The signal voltage of the inputs is +24 V \pm 10%. Under no circumstances may the CLM's 24 V supply voltage be used to supply power to the inputs.

The current consumption of each input is approximately 8 mA at +24 V external voltage.

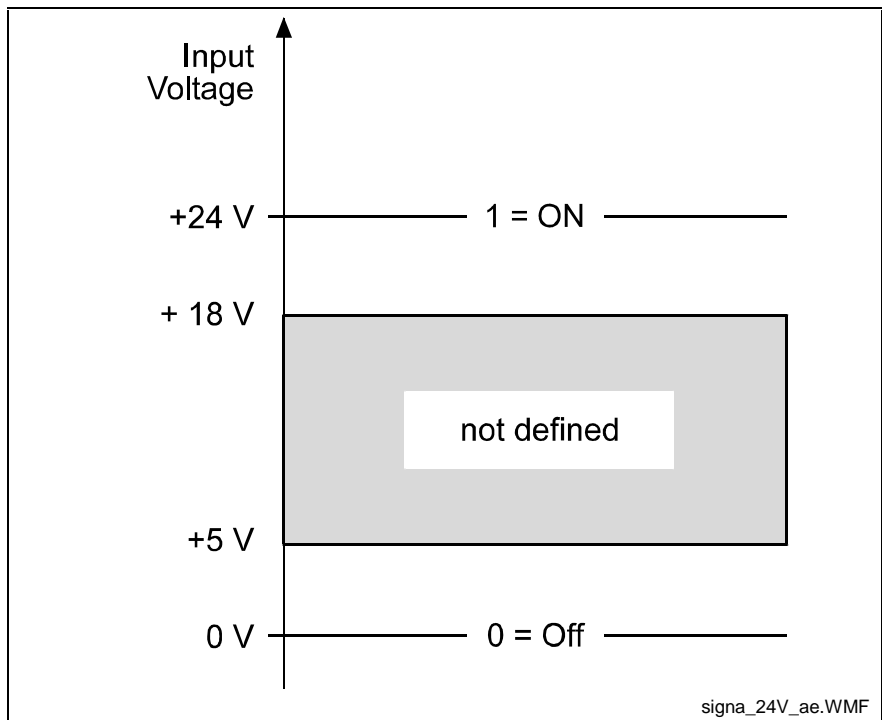


Fig. 9-2: Signal Level of the Inputs

The terms `1`, `On` or `Activated` can all be defined by a signal level of +24V.

The terms `0`, `Off` or `Deactivated` can all be defined by a signal level of 0V.

Depending upon the function to be initiated, the CLM differentiates between two signal types:

Static Signal Type

This function is shown as long as the corresponding signal level is constantly (statically) present. Most functions are `active high`, which means they are active at signal level `1`. A few functions are `active low`, which means they are active at signal level `0`. To differentiate, the `active low` functions have a "NOT" line over their descriptions.

Dynamic Signal Type

This function is not dependent on a constantly present signal level. This function is activated by a rising signal edge (signal level increases from `0` to `1`) or a falling signal edge (signal level decreases from `1` to `0`).

The input signals can be categorized into five groups, depending upon their definitions:

	Input Signal	Pre-Programmed	User-Programmable
1.	Safety Inputs	E-Stop	Interrupt Feed Angle Monitoring
2.	Start-up Information	Enable Axis x	
3.	Operating Modes	Parameter Automatic / Manual	
4.	Commands	Start Immediate Stop External Clear Jog Forward Axis x Jog Reverse Axis x Restart Raster	Measuring Wheel Mode Homing Manual Vector Interrupt Vector Open Feed Roll Cut Inhibit Immediate Cut Reverse Inhibit Rapid Stop Start Instr. of Program Reverse Optimization Crop Cut
5.	Auxiliary Inputs		I1.xx.x

Fig. 9-3: Input Signals

All pre-programmed inputs are designated as 'system inputs' in the rest of the manual.

All user-programmable inputs are designated as 'auxiliary inputs'.

Type	CLM
System Inputs	24
Auxiliary Inputs	88

Fig. 9-4: Inputs

Pre-Programmed Inputs

Safety Inputs

E-Stop	Connector No.: 3 / Pin No.: 3	I0.00.2
	Fieldbus :	I2.00.2 (only Fieldbus Operating Mode 3)

In the operating state, +24V external must be present at this input. If this signal is missing, the refresh contact 'Bb' (Connector 5, Pins 3 & 4) in the CLM opens and the command values are set without a transition to 0V.

All outputs, including the output 'Error Message', are turned off. The drive is stopped by cutting the motor supply power (Refresh Bb Contact), using Command Value = 0V, by clearing drive enable and using the activated mechanical brake.

For accident prevention, however, one cannot depend solely on this functionality of the CLM.

Attention: For fieldbus operating mode 3, the logical '1' signal is dominant (see Chapter entitled 'Command Communications').'



CAUTION

Error During Handling and Installation

Equipment damage can occur.

⇒ Danger of injury to personnel because of erroneous drive movements must be eliminated at the facility in which the drives are used! A 100% effective measure for stopping the drive is only possible by disconnecting the motor power supply (E-Stop Sequence).

See also Parameter Ax15, Inputs 'Interrupt' and 'Feed Angle Monitoring'.

Start-Up Information

Enable Axis 1		
Connector No.: 3 / Pin No.: 6		I0.00.5
Fieldbus :		I2.01.7 (only Fieldbus Operating Mode 3)
Enable Axis 2		
Connector No.: 3 / Pin No.: 7		I0.00.6
Fieldbus :		I2.01.7 (only Fieldbus Operating Mode 3)
Enable Axis 3		
Connector No.: 22 / Pin No.: 1		I0.02.0
Fieldbus :		I2.01.7 (only Fieldbus Operating Mode 3)
Enable Axis 4		
Connector No.: 22 / Pin No.: 4		I0.02.3
Fieldbus :		I2.01.7 (only Fieldbus Operating Mode 3)

The axis enable inputs are used to enable each axis individually. If an enable signal is not present, the control enable output and the brake output of the axis in question are off.

When switching to Automatic Mode, the axis enable signals must be present; otherwise the error message 'Drive not ready' follows.

When the signal 'Enable Axis X' is cleared, an axis that has been homed using an incremental encoder remains homed in Manual Mode. The absolute reference point is not lost.

Note: Within the 'Enable' message, the message 'Motor ready for operation', which means that power is on, must be maintained.

Note: For an absent enable signal, parameter input is possible in Parameter Mode, and program input is possible in Manual Mode!

Operating Modes

Parameter Mode	Connector No.: 3 / Pin No.: 1	10.00.0
	Fieldbus :	12.00.0

In this mode, users can program the parameters. The Parameter Mode input is also dominant for 'System Inputs via the Fieldbus'. Therefore, Parameter Mode can be forced independently from the fieldbus.

Automatic / <u>Manual</u>	Connector No.: 3 / Pin No.: 2	10.00.1
	Fieldbus :	12.00.1

The CLM has 3 possible operating modes:

- Parameter Input
- Automatic
- Manual

Each particular operating mode is invoked via two hardware inputs. If neither 'Parameter Input' nor 'Automatic' is present as the operating mode, the CLM is in the 'Manual' operating mode.

If both 'Parameter Input' and 'Automatic' inputs are on, the error message 'Operating Mode' is issued.

Switching Example:

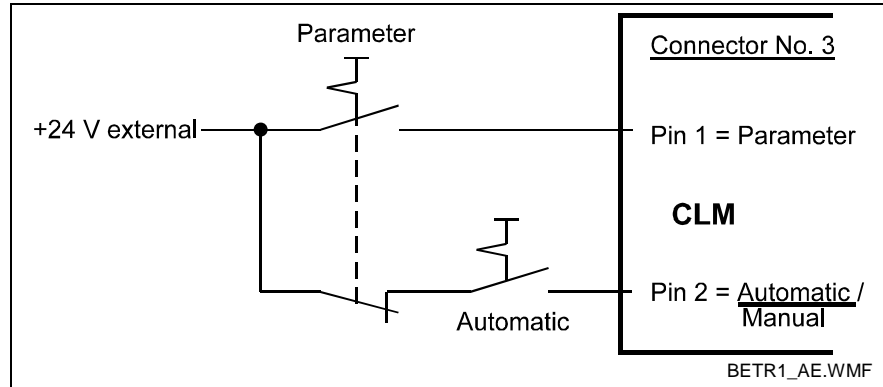


Fig. 9-5: Example of Operating Mode Switch

Command Inputs

Start Connector No.:3 / Pin No.: 4 10.00.3
Fieldbus : 12.00.3

If a rising edge is present at the 'Start' input, the program is started when Automatic is preselected.

Note: For the application type 'Flying Cutoff', the 'Start' input has no meaning.

Immediate Stop Connector No.:3 / Pin No.: 5 10.00.4
Fieldbus : 12.00.4

If the signal at the 'Immediate Stop' input is lost, the program flow is stopped immediately. If the feed drive is in motion, it immediately decelerates to a standstill via the programmed deceleration. The remaining travel distance is stored and is the first to be executed after the next start. There is no loss of dimensions.

Note: For the application type 'Flying Cutoff', the 'Immediate Stop' input has no meaning.

External clear Connector No.:3 / Pin No.: 8: 10.00.7
Fieldbus : 12.00.7

When a positive edge is present at the input 'External Clear', any displayed fault is cleared. This input is only queried from the software for 'E-Stop' and 'Fault'. When the program or parameters are lost, the clear function is only available using the 'CL' key.

Jogging	Jog Forward Axis 1	
	Connector No.:3 / Pin No.: 9	I0.01.0
	Fieldbus :	I2.01.0
	Jog Forward Axis 2	
	Connector No.:3 / Pin No.: 11	I0.01.2
	Fieldbus :	I2.01.2
	Jog Forward Axis 3	
	Connector No.:22 / Pin No.: 2	I0.02.1
	Fieldbus :	I2.00.5 (only Fieldbus Operating Mode 3)
	Jog Forward Axis 4	
	Connector No.:22 / Pin No.: 5	I0.02.4
	Fieldbus :	I2.01.4 (only Fieldbus Operating Mode 3)

If a signal is present at the `Jog Forward Axis x` input, the drive moves forward (positive direction) at the velocity entered in Parameter Ax07 when in Manual Mode.

	Jog Reverse Axis 1	
	Connector No.:3 / Pin No.: 10	I0.01.1
	Fieldbus :	I2.01.1
	Jog Reverse Axis 2	
	Connector No.:3 / Pin No.: 12	I0.01.3
	Fieldbus :	I2.01.3
	Jog Reverse Axis 3	
	Connector No.:22 / Pin No.: 3	I0.02.2
	Fieldbus :	I2.00.6 (only Fieldbus Operating Mode 3)
	Jog Reverse Axis 4	
	Connector No.:22 / Pin No.: 6	I0.02.5
	Fieldbus :	I2.01.5 (only Fieldbus Operating Mode 3)

If a signal is present at the `Jog Reverse Axis x` input, the drive moves in reverse (negative direction) at the velocity entered in Parameter Ax07 when in Manual Mode.

There is no movement if no signal, or an `Immediate Stop`, `Interrupt` or `Feed Monitoring` signal is present!

Restart	Connector No.: 3 / Pin No.: 15	I0.01.6
	Fieldbus :	I2.01.6

If the output `Restart Possible` is active, the program can be continued from the place where it was stopped with a low-to-high input signal at this input.

This input is available only in Automatic Mode.

For further information, see the chapter entitled `Restart`.

Raster	Raster 1	
	Connector No.:3 / Pin No.: 16	I0.01.7
	Fieldbus :	-----
	Raster 2	
	Connector No.:3 / Pin No.: 13	I0.01.4
	Fieldbus :	-----

These are a fast signal inputs (detection in max. of 100 μ s). The input `Raster 1` can only be used for axis 1 and for program commands `SRM`, `RMI`, `LMR` and `LMK`. The input `Raster 2` can only be used for axis 2 and for program command `SRM`.

User-Programmable Inputs

Inputs I1.00.0-I1.01.7 Connector No.: 3 / Pin No.: 17 to 32

Inputs I1.02.0-I1.05.7 Connector No.: 11 / Pin No.: 1 to 32

Inputs I1.06.0-I1.09.7 Connector No.: 12 / Pin No.: 1 to 32

Inputs I1.10.0-I1.10.7 Connector No.: 22 / Pin No.: 9 to 16

All user-programmable outputs can be cleared via the user-programmable inputs.

The inputs, if programmed accordingly, can also be used for the following functions:

Interrupt	- Parameter Ax15
Feed Angle Monitoring	- Parameter Ax15
Measuring Wheel Mode	- Parameter Ax31
Homing	- Parameter Ax23
Manual Vector	- Parameter B014
Interrupt vector	- Parameter B015
Open feed roll	- Parameter Ax30
Cut Inhibit	- Parameter A133
Immediate Cut	- Parameter A134
Reverse Inhibit -	- Parameter A135
Rapid Stop	- Parameter A136
Start Instruction Of Program	- Parameter A138
Reverse Optimization	- Parameter A139
Crop Cut	- Parameter A142

There are a total of 88 available inputs.

Outputs

The CLM has 69 outputs .

To attain a high resistance to faults, the output signals from the internal bus system are galvanically isolated and operated by external voltage.

The maximum selectable current is 80 mA at a maximum of 30V.

The output signals can be categorized into four groups, depending upon their definitions:

	Output Signal	Pre-Programmed	User-Programmable
1.	Security Outputs	Error Message	Position Lag > Limit
2.	Start-up Information	Drive Enable Axis x Brake Axis x Restart Possible Run Task Inhibit Operation	Position Reached Presignaling Axis Homed Open Feed Roll Active Velocity Reached Deceleration Active Cut Inhibit Reverse Optimization Tolerance 2 Exceeded
3.	Operating Modes	Parameter Automatic Manual	
4.	Auxiliary Outputs		Q1.xx.x

Fig. 9-6: Output Signals

All pre-programmed outputs are designated as 'system outputs' in the rest of the manual.

All user-programmable outputs are designated as 'auxiliary outputs'.

Type	CLM
System Outputs	18
Auxiliary Outputs	51


Fig. 9-7: Outputs

Pre-Programmed Outputs

Security Outputs

<u>Error message</u>	Connector No.:4 / Pin No.: 6	Q0.00.5
	Fieldbus :	Q2.00.5

In the event of a fault, the output is immediately deactivated.

A fault can only be cleared via the input 'External Clear', the  key, or via the serial interface.

Start-Up Information

Drive Enable	Drive Enable Axis 1		
	Connector No.:4 / Pin No.: 4	Q0.00.3	or
	Connector No.: 7 / Pin No.: 1 (max. 3 mA)		
	Fieldbus :	Q2.00.3	
	Drive Enable Axis 2		
	Connector No.: 4 / Pin No.: 7	Q0.00.6	or
	Connector No.: 7 / Pin No.: 2 (max. 3 mA)		
	Fieldbus :	Q2.00.6	
	Drive Enable Axis 3		
	Connector No.: 4 / Pin No.: 15	Q0.01.6	or
	Connector No.: 19 / Pin No.: 6 (max. 3 mA)		
	Fieldbus :	Q2.01.6	
	Drive Enable Axis 4		
	Connector No.: 4 / Pin No.: 16	Q0.01.7	or
	Connector No.: 19 / Pin No.: 7 (max. 3 mA)		
	Fieldbus :	Q2.01.7	

Drive Enable occurs in Automatic or Manual Mode, when +24 V is present at the following inputs:

- $\overline{\text{E-Stop}}$
- Enable Axis 1
- Enable Axis 2
- Enable Axis 3
- Enable Axis 4

In case of a fault or after clearing the Enable signal for the axes, Drive Enable is immediately disabled. For a direct connection to the TDM or KDS, Drive Enable is also available on the terminal strips X7 and X19 (load capacity approx. 3 mA).

The Drive Enable function is to be connected directly with the drive amplifier via a relay (not via a PLC!).

Note: In Automatic Mode, Drive Enable must be present for activated axes (at all times for Axis 1). The axes are activated using Parameter B000. Otherwise, the error message 'Drive not ready' is generated.

Brake Output	Brake Axis 1		
	Connector No.: 4 / Pin No.: 5	Q0.00.4	
	Fieldbus :	Q2.00.4	
	Brake Axis 2		
	Connector No.: 4 / Pin No.: 8	Q0.00.7	
	Fieldbus :	Q2.00.7	
	Brake Axis 3		
	Connector No.: 22 / Pin No.: 17	Q0.02.0	
	Fieldbus :	Q2.01.3(only Fieldbus Operating Mode 3)	
	Brake Axis 4		
	Connector No.: 22 / Pin No.: 18	Q0.02.1	
	Fieldbus :	Q2.01.4(only Fieldbus Operating Mode 3)	

When switching the power supply to the CLM on, a check of the set parameters is completed, as well as a calculation of the resulting values.

During this time, the drives must be disabled. Therefore, the brakes are only enabled when 'Manual' or 'Automatic' Modes are allowed, and Drive Enable is on.

After Drive Enable is switched on, the brake is enabled with a 200 ms delay.

In case of a fault or after clearing the Enable signal for the axes, the brake is immediately disabled.

If the output signal is switched again via external logic, the CLM receives this information when the axis enable signal is cleared.

In addition, the user-definable outputs can be used for the following start-up information:

Restart Restart possible
Connector No.: 4 / Pin No.: 9 Q0.01.0
Fieldbus : -----

This output is set after a shutdown situation. A shutdown situation is present if a power loss or power surge occurs to the 24 V power supply. In the event of a shutdown situation, an error message is issued by the CLM or the control goes into E-Stop.

A set output shows that the continuation of the last active program is possible at the point of interruption.

The output can also be set in Manual Mode. However, a restart is possible only in Automatic Mode.

Run Task Run Task
Connector No.: 4 / Pin No.: 10 Q0.01.1
Fieldbus : Q2.01.1

This output shows that a program in Task 1, 2, 4 and 5 (when enabled) is being processed. It is set when the CLM is in Automatic Mode, a start signal was issued, and no Immediate Stop is present.

If the program was stopped (e.g. via the signal 'Immediate Stop', the 'JST' command or switching to 'Manual' Mode), the output is cleared.

A manual vector program does not cause the output to be set!

Inhibit Operation Connector No.: 4 / Pin No.: 14 Q0.01.5
Fieldbus : Q2.01.5

This output is set if a move command cannot be executed, because, for example, an interrupt or feed angle monitoring signal is present or an axis enable signal is not present in Jog Mode.

Operating Modes

Parameter Mode Connector No.: 4 / Pin No.: 3 Q0.00.2
Fieldbus : Q2.00.2

If the operating mode 'Parameter Input' is accepted by the CLM, this output is powered.

Automatic Mode Connector No.: 4 / Pin No.: 2 Q0.00.1
Fieldbus : Q2.00.1

If the operating mode 'Automatic' is accepted by the CLM, this output is powered.

Manual Mode Connector No.: 4 / Pin No.: 1 Q0.00.0
Fieldbus : Q2.00.0

If the operating mode 'Manual' is accepted by the CLM, this output is powered.

User-Programmable Outputs

User-Programmable Outputs

Outputs	Q1.00.0 - Q1.01.7	Connector No.: 4 / Pin No.: 17 to 32
Outputs	Q1.02.0 - Q1.05.7	Connector No.: 13 / Pin No.: 1 to 32
Outputs	Q1.06.0 - Q1.06.2	Connector No.:22 / Pin No.: 19 to 21

All outputs are user-programmable in the user program.

Moreover, these user-programmable outputs can be used for the following functions:

Position lag greater than limit	- Parameter Ax14
Position Reached	- Parameter Ax27
Pre-signaling	- Parameter Ax29
Axis homed	- Parameter Ax24
Open feed roll active	- Parameter Ax30
Velocity reached	- Parameter Ax32
Deceleration active	- Parameter Ax32
Cut Inhibit	- Parameter A133
Reverse Optimization	- Parameter A139
Tolerance 2 exceeded	- Parameter Ax16

Monitoring Inputs and Outputs

Ready for Operation (Bb) Ready for Operation (Bb) Connector No.:5 / Pin No.: 3 and 4

This output is a potential-free relay contact. The allowable contact load is 250 mA / 24 V.

The internal hardware and software conditions are monitored. The contact does not close until the internal conditions have been checked and the security inputs are present.

This contact is opened when an E-Stop occurs. The status of this relay is shown using the LED `H1` above connector X7 on the front of the CLM. If the LED is off, the relay contact is opened.

Note: The contact `Ready for Operation (Bb)` must be included in the E-Stop chain!

Marker Flags

The marker flags can be distinguished as follows:

Source	Bytes	Function
0	00...49	System Marker Flags (Inputs)
1	00...49	System Marker Flags (Outputs)
2	00...19	NC Marker Flags
3	00...07	Saved NC Marker Flags
4	00...09	Transfer Marker Flags NC → Logic Task
5	00...09	Transfer Marker Flags Logic Task → NC
6	00...19	Saved Logic Task Marker Flags
6	20...39	Logic Task Marker Flags

Fig. 9-8: Marker Flag Categories

System Marker Flags (Inputs)

In preparation

Here, the requirements are mirrored.

These marker flags can only be read by the programs.

System Marker Flags (Outputs) M1.00 - M1.49

Here, the CLM conditions are mirrored.

These marker flags are read-only using the Logic Task and the NC Task.

System Marker Flag M1.10.0 "Axis 1 synchronous":

If Axis 1 is set up in the parameters as a slave axis, and if Axis 1 follows the master using the set factor, the system marker flag M1.10.0 is set to '1.' If Axis 1 is not synchronous to the master, the system marker flag M1.10.0 is set to '0.'

System Marker Flag M1.20.0 "Axis 2 synchronous":

If Axis 2 is set up in the parameters as a slave axis, and if Axis 2 follows the master using the set factor, the system marker flag M1.20.0 is set to '1.' If Axis 2 is not synchronous to the master, the system marker flag M1.20.0 is set to '0.'

System Marker Flag M1.30.0 "Axis 3 synchronous":

If Axis 3 is set up in the parameters as a slave axis, and if Axis 3 follows the master using the set factor, the system marker flag M1.30.0 is set to '1.' If Axis 3 is not synchronous to the master, the system marker flag M1.30.0 is set to '0.'

System Marker Flag M1.40.0 "Axis 4 synchronous":

If Axis 4 is set up in the parameters as a slave axis, and if Axis 4 follows the master using the set factor, the system marker flag M1.40.0 is set to '1.' If Axis 4 is not synchronous to the master, the system marker flag M1.40.0 is set to '0.'

NC Marker Flags M2.00 - M2.19

These marker flags can be read and written via NC commands. These marker flags are cleared when exiting Automatic Mode, losing power or when a fault occurs.

Saved NC Marker Flags M3.00 - M3.07

These marker flags can be read and written via NC commands. They are not cleared, even when power is lost.

Transfer Marker Flags M4.00 - M4.09

NC → Logic Task

These marker flags are only for signal transfers between the NC Tasks and the Logic Task. They can be read and written by the NC Tasks. The Logic Task can only read these marker flags. These marker flags are cleared when power is lost.

Transfer Marker Flags Logic Task → NC	M5.00 - M5.09 These marker flags are only for signal transfers between the Logic Task and the NC Tasks. They can be read and written by the Logic Task. The NC Tasks can only read these marker flags. These marker flags are cleared when exiting Parameter Mode, when a fault occurs in the Logic Task, or when power is lost.
Saved Logic Task Marker Flags	M6.00 - M6.19 These marker flags can be read and written by the Logic Task. They are not cleared, even when power is lost.
Logic Task Marker Flags	M6.20 - M6.39 These marker flags can be read and written by the Logic Task. These marker flags are cleared when exiting Parameter Mode, when a fault occurs in the Logic Task, or when power is lost.

9.2 Serial Interface

General Information

The CLM's integrated serial RS232C or RS485 interface supports programming of the control via personal computer (PC) in any operating mode.

In addition, status signals, the currently executing program and the parameters can be requested.

Parameters can only be transferred to the control in 'Parameter' Mode.

The interface is standardized according to DIN 66020 (CCITT V.24) or EIA-RS232C and equipped for full duplex operation.

The data flow between the CLM and the PC is controllable via the 'X-ON / X-OFF'-Protocol (software handshake) or the RTS-CTS Handshake.

Data transfer is executed in 'ASCII' format.

Interface Connection

RS232C - V.24 Interface:

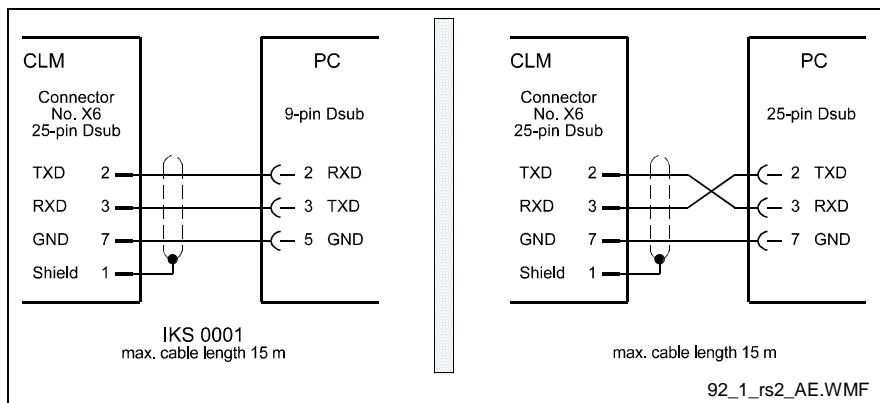


Fig. 9-9: Serial Interface Connection

Definition of the signal leads, according to DIN 66020:

Connection 2 = RxD (Received Data) Data Lead

Data is received via this channel.

The 'Off' condition has the logical value 'One'.

Connection 3 = TxD (Transmitted Data) Data Lead

Data are sent via this channel.

The 'Off' condition has the logical value 'One'.

Connection 5 = GND (Signal Ground) Ground Lead

This line is the common return for all signal leads.

Signal Level: To operate the interface, the following signal levels are required:

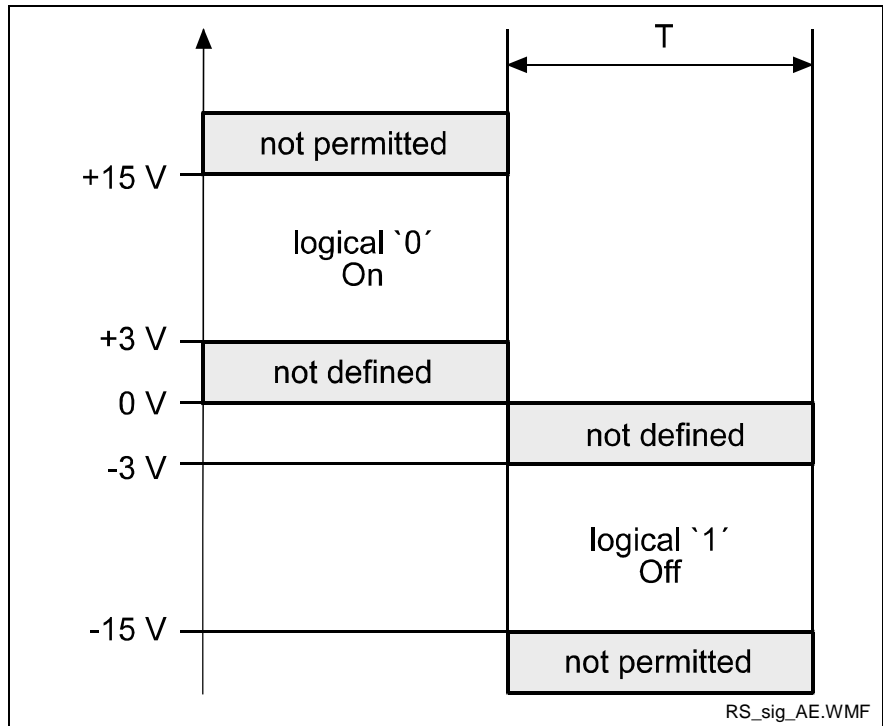


Fig. 9-10: Signal Levels for Interface

Data Format: A character is comprised of the following:

- 1) 1 start bit
- 2) 7 or 8 data bits (word length)
- 3) 1 parity bit (not present when no parity check is programmed)
- 4) 1 or 2 stop bits, depending on word length

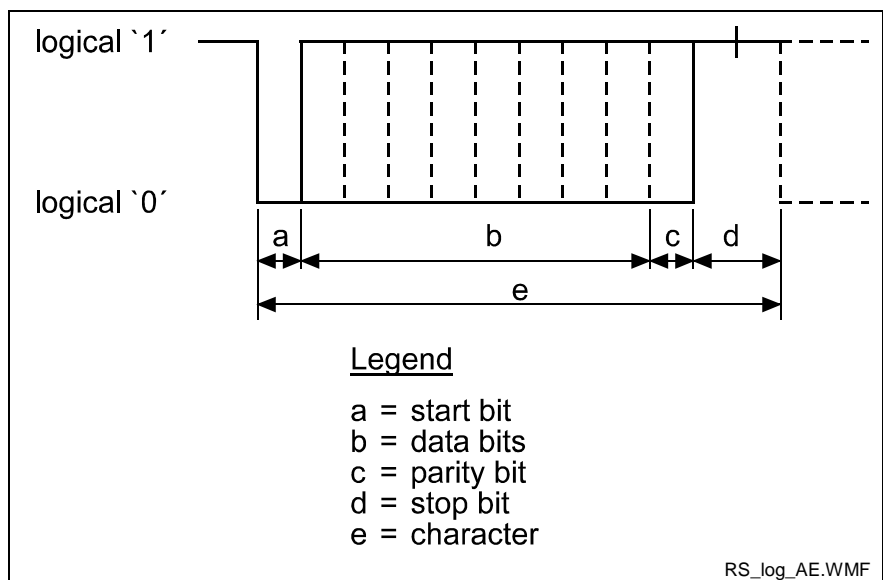


Fig. 9-11: Data Format

RS 485 Serial Data Interface: The RS485 bus system can be used to connect up to 32 CLM controls to a PC with the appropriate interface.

In this case, the PC is defined as the master device and the connected CLM controls as slave devices.

The station number of each CLM is input into the CLM via parameters.

For all data transmissions, the station number is also transmitted.

Data Transmission: For the transmission of or request for information, the station number is input after the first control character instead of the space character. For the station number, values between 1 and 32 are allowed.

For station numbers 10 to 32, a letter is input, according to the following list:

Station No.	Transmit Value
1	1
2..9	2..9
10	A
11	B
12	C
13	D
14	E
15	F
etc., through	
32	W

Example for Station No. 10 (Hex = A):

Request to the CLM:

```
?AN0000CR LF
```

Response from the CLM:

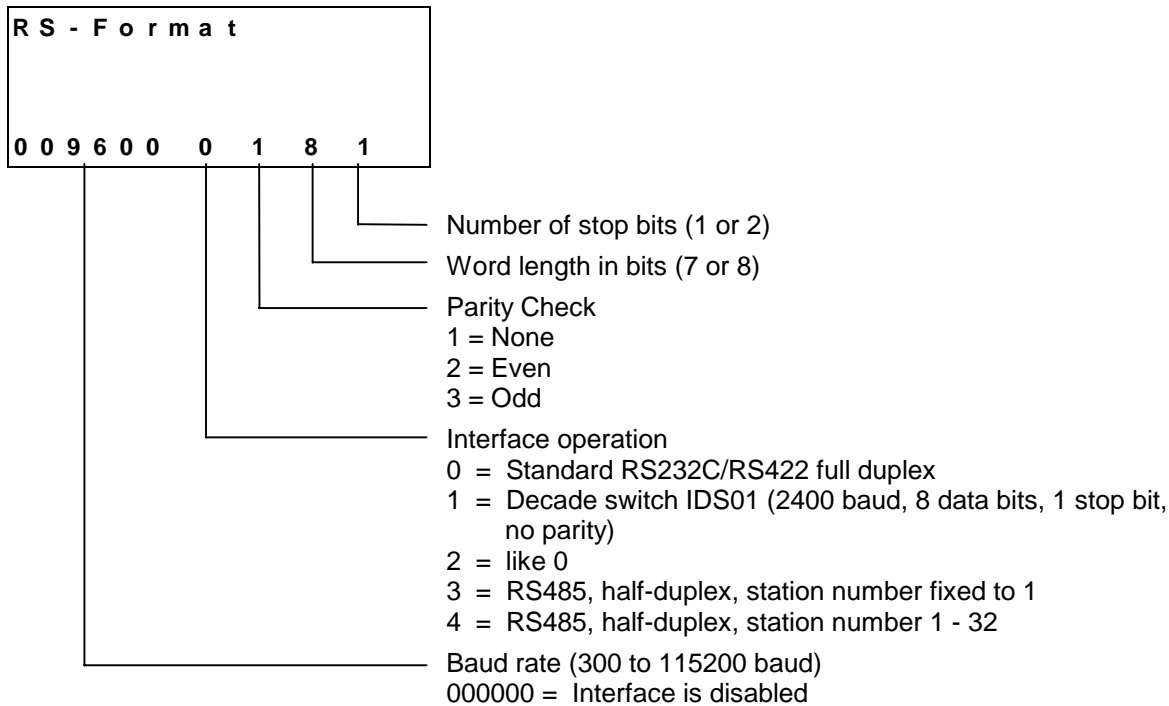
```
#AN0000_Instruction Contents CR LF
```

The data transmission format for the serial interface is set in Parameters B002 and B003 or B004 and B005. Here, it is also determined whether the interface operates as a data interface or as an interface to the decade switch unit `IDS01`.

For further information, see description for Parameters B002 and B003 or B004 and B005.

Interface Parameters

Interface Format X6 / X8



The CLM's serial interface can exchange data with the system in different ways. The selected transmission format is defined in Parameter B002 or B004. If the decade switch input is preselected via an IDS01 unit, the other values need not be input.

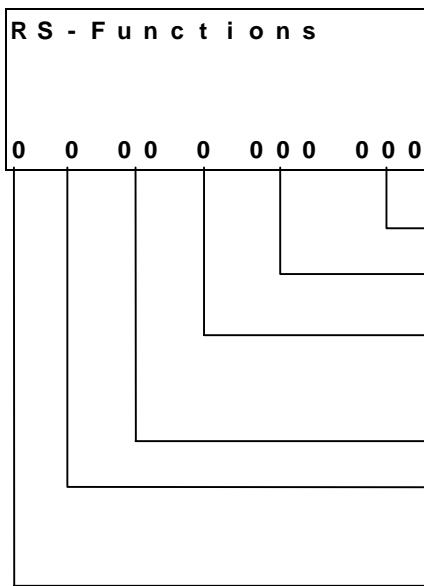
Baud Rate: The desired baud rate can be selected from the following list of values:

Baud Rate
300
600
1200
2400
4800
9600
19200
38400
57600
115200

An input of `000000` means that the interface is off.

Note: Only one serial interface at once (X6 or X8) can be activated.

Interface Functions X6 / X8



Reserved

Response delay in ms in RS485 Mode
000 = no delay

1 = in the event of a fault, an error message is sent automatically via the interface (only for RS232).
0 = function disabled

Station number 01 - 32

Interface confirmation (Y CR LF)
0 = off
1 = on

Handshake / Checksum:
0 = Checksum validation on - Hardware handshake RTS/CTS off
1 = Checksum validation off - Hardware handshake RTS/CTS off
2 = Checksum validation on - Hardware handshake RTS/CTS on
3 = Checksum validation off - Hardware handshake RTS/CTS on

If the checksum validation is off, transmission of the checksum can be skipped. In this case, `CR LF` is sufficient instead of `\$hh CR LF`.

Interface Confirmation 0 = Confirmation disabled
1 = Confirmation enabled

Data input of program and parameter sets via the serial interface is monitored. If erroneous data are present, an error message is sent via the serial interface.

If interface confirmation is selected and if the CLM has completely and correctly received and performed calculations for a program or parameter set, `Y CR LF` is sent via the serial interface as a confirmation.

Description of All Characters Used in the Data String

First Control Character in the Data String:

The first control character indicates the beginning of a data transmission:

- 1) **?** Hexadecimal 3F / Character for data query

If the control receives a `?`, the requested information (program instruction, parameter, status message, variable, logic task) is output.

- 2) **#** Hexadecimal 23 / Characters for program transmission

If the CLM receives a '#', the following characters are saved to the CLM (program instruction, parameters, variables, Logic Task).

- 3) **!** Hexadecimal 21

If the control receives a `!`, the following characters are picked up as the control command.

- 4) **:** Hexadecimal 3A

Colon for polling query.

Second Control Character in the Data String:

S This character identifies the station number. The `s` is replaced by an appropriate character, depending on the operating mode.

- 1) In RS232C operating mode, the `s` is replaced by a blank space. No other character is accepted.

- 2) In RS485 mode, the `s` is replaced by the respective station number (1 - 9; A - W). If this number does not correspond to the number in the parameter (see Parameter B003 or B005), there is no response to the received data.

If `s` is a blank space, this information is relevant for all users on the bus.

Third Control Character:

The third character identifies the information type:

- 1) **N** Hexadecimal 4E / Character for instruction number

The information following the `N` is interpreted as a program instruction.

- 2) **K** Hexadecimal 4B / Character for parameter

The information following the `K` is interpreted as a parameter.

- 3) **X** Hexadecimal 58 / Character for status

- 4) **P** Hexadecimal 50 / Character for Logic Task

The information following the `P` is interpreted as a Logic Task instruction.

- 5) **V** Hexadecimal 56 / Character for variable

The information following the `V` is interpreted as a variable.

Other Control Characters:

1) **\$** Hexadecimal 24 / Character for checksum

2) **hh** Hexadecimal value / Checksum

These two characters represent the result of the checksum for a piece of information. The checksum is sent by the CLM along with each type of information. When data is received, the checksum can be disregarded.

3) **CR** Hexadecimal 0D / Character for carriage return
(Carriage Return)

LF Hexadecimal 0A / Character for line-feed

The characters `CR` and `LF`, together, form the end of each transmission.

Information Characters: All information characters are coded hexadecimally. The following characters are used to exchange information:

1) **0** through **9** Hexadecimal 30 through 39

A through **Z** Hexadecimal 41 through 5A

The numerals `0` through `9` and the letters `A` through `Z` are available for command and data input.

2) **—** Hexadecimal 20 / Space (space bar)

To produce the desired format, the space is used at various points within the data string.

3) **+** Hexadecimal 2B / Operational sign for data

- Hexadecimal 2D / Operational sign for data

4) **.** Hexadecimal 2E

, Hexadecimal 2C

When numeric values are received, the CLM accepts both a period and a comma. Both are accepted as the decimal point. For numeric values, a decimal point is always sent by the CLM.

Software Handshake:	X-ON	Hexadecimal 11
	X-OFF	Hexadecimal 13

The data flow is controlled with a software handshake.

When the CLM sends data via the 'TxD' channel and receives an 'X-OFF' signal (hexadecimal 13) via the 'RxD' channel, the CLM interrupts the transmission until another 'X-ON' signal (hexadecimal 11) is received via the 'RxD' channel.

If the CLM receives data via the 'RxD' channel and an interruption of the data transmission is necessary, the CLM sends an 'X-OFF' signal via the 'TxD' channel.

If the transmission can be continued, the CLM sends an 'X-ON' signal via the 'TxD' channel.

Generating the Checksum

- Examples: 1. #_N0000_POI_1_ _ _ _ 123456.789_123_ \$
 2. #5N0123_NOP_ _ _ \$

Character	Hex	Σ Hex	Character	Hex	Σ Hex
#	23	23	#	23	23
_	20	43	5	35	58
N	4E	91	N	4E	A6
0	30	C1	0	30	D6
0	30	F1	1	31	107
0	30	121	2	32	139
0	30	151	3	33	16C
_	20	171	_	20	18C
P	50	1C1	N	4E	1DA
O	4F	210	O	4F	229
I	49	259	P	50	279
_	20	279	_	20	299
1	31	2AA	_	20	2B9
_	20	2CA			
_	20	2EA			
_	20	30A			
_	20	32A			
+	2B	355			
1	31	386			
2	32	3B8			
3	33	3EB			
4	34	41F			
5	35	454			
6	36	48A			
.	2E	4B8			
7	37	4EF			
8	38	527			
9	39	560			
_	20	580			
1	31	5B1			
2	32	5E3			
3	33	616			
_	20	636			

Fig. 9-12: Generating the Checksum

- The sum of all `ASCII` characters is calculated, from the first control character to the last character before the `\$`.
- Then, the `High Byte` is added to the `Low Byte`. A transmission occurring during this time is ignored.
- The Two's Complement of the `Low Byte` of this sum results in the checksum

Example 1: #_N0000_1_ _ _ _ 123456.789_123_ **\$C4**

Sum: 636 → 06 + 36 = 3C. The Two's Complement of 3C is **C4**.

Example 2: #5N0123_NOP_ _ _ **\$45**

Sum: 2B9 → 02 + B9 = BB. The Two's Complement of BB is **45**.

Data Transmission

Program Transmission

Transmit Program Instructions to the CLM:

A new instruction is read in as shown in the example below.
 The character sequence `# s N` always comes first.
 An entry must always be concluded with `CR LF`.

Format:

```
#sNbbbb_ccc_ddddddddddddddddddd_$hh CR LF
```

Meaning of the characters used:

- s = Blank space for RS232C or station number for RS485
- b = Instruction Number
- c = Command code
- d = Instruction information (data field with up to 32 characters)

Examples of data transmissions to the CLM:

```
#_N0100_POI_1_+12345.786_123_$hh CR LF
#_N0101_AEA_Q1.00.3_1_$C0 CR LF
#_N0102_BPA_0123_M2.02_____21112212_$32 CR LF
```

The data formats are stipulated for each command and must be complied with!

Cmd	Data	Data
ACC	ACC_1____234_567_	ACC_V602_V600_V601_
AEA	AEA_Q1.01.1_1_	AEA_Q1.01.0_V600_
AEO	AEO_1____1_1_500____100_	AEO_V600_1_1_V601_V602_
AKN	AKN_M2.02.3_1_	AKN_M2.02.3_V600_
AKP	AKP_M2.02_01201201_	AKP_M2.02_01201201_
APE	APE_Q1.01_01201201_	APE_Q1.01_01201201_
BAC	BAC_1234_-5678_98765_	BAC_V600_-5678_V601_
BCE	BCE_0234_I1.00.3____1_	BCE_V601_I1.01.3____V600_
BIC	BIC_0234_56_____M0.12.3_0_1_	BIC_V601_V600_____M0.12.3_0_1_
BIO	BIO_0234_M2.03_Q0.00_01201201_	BIO_V600_M2.03_Q0.01_01201201_
BPA	BPA_0234_M2.02_____01201201_	BPA_V600_M2.02_____01201201_
CID	CID_V600_1_____+12345.678_	CID_V600_1_____+V601_
CIO	CIO_M2.02.3_Q1.01.1_08_	CIO_M2.02.3_Q1.01.1_V600_
CLC	CLC_0234_	CLC_V600_
CON	CON_1____1____+234_	CON_V602_V600_+V601_
COU	COU_+12345_Q1.01.1_654321_	COU_+12345_Q1.01.1_V600_
CPJ	CPJ_V600>=+12345.678_1234.56_1234_	CPJ_V604_>=+V600_____V601____V603_
CPL	CPL_1_	CPL_V600_
CPS	CPS_V602<=+12345.678_1234.56_Q1.01.1_	CPS_V602_<+V600_____V601____Q1.01.1_

Transmit Parameters to the CLM: To store parameters, the CLM must be in 'Parameter' Mode!
 Format:

```
#sK_xxyy_dddddddddddddddd_$hh CR LF
```

Meaning of the characters used:
 x = Parameter identifier
 y = Parameter Number
 d = Parameter data (data field with up to 16 characters)

If no checksum validation function has been programmed prior to entering Parameter Mode, this function remains disabled, even though Parameter B003 or B005 has been overwritten, until Parameter Mode is exited.

Note: For compatibility to older firmware versions, the control character '!' can also be used instead of the control character '#.'

Parameter	Data
B000	# _K_B000_0_0_0_0\$8E
B001	# _K_B001_0_0_0_0\$DD
B002	# _K_B002_019200_0_1_8_1\$E4
B003	# _K_B003_0_1_00_0_000_000\$A8
B004	# _K_B004_000000_0_0_0_0_0\$F8
B005	# _K_B005_0_0_00_0_000_000\$A7
B006	# _K_B006_\$59
B007	# _K_B007_\$58
B008	# _K_B008_0_0_0_0_0_02\$B3
B009	# _K_B009_\$56
B010	# _K_B010_0.0\$CF
B011	# _K_B011_0000_0000_0\$6B
B012	# _K_B012_1000_2000\$B7
B013	# _K_B013_\$5B
B014	# _K_B014_00.00.0_0_0000\$DB
B015	# _K_B015_00.00.0_0_0_0000\$8A
B016	# _K_B016_0000\$97
B017	# _K_B017_0_0_0_0_0_0_0\$95
B018	# _K_B018_0_0001000\$B3
B019	# _K_B019_2_FF0000_00_00\$B4

Fig. 9-14: Transmission Formats of the B0xx Parameters

Parameter	Data
Ax00	# _K_A100_1_0_0_0_0\$EC
Ax01	# _K_A101_0010.00000\$7D
Ax02	# _K_A102_0000_0000\$BB
Ax03	# _K_A103_-111111.111\$46
Ax04	# _K_A104_+100000.000\$4F
Ax05	# _K_A105_000000.000_0\$2A
Ax06	# _K_A106_000100.000\$78
Ax07	# _K_A107_000100.000\$77
Ax08	# _K_A108_000010\$35
Ax09	# _K_A109_000_000\$15
Ax10	# _K_A110_0.000\$6F
Ax11	# _K_A111_01.00_0\$1D
Ax12	# _K_A112_03000_10.0\$88
Ax13	# _K_A113_\$5B
Ax14	# _K_A114_0_010_00.00.0\$0B
Ax15	# _K_A115_00.00.0_00.00.0\$9E
Ax16	# _K_A116_00_00_00.00.0\$0A
Ax17	# _K_A117_0000.000\$D7
Ax18	# _K_A118_\$56
Ax19	# _K_A119_01024_1024\$75
Ax20	# _K_A120_0_0_00_1\$0B
Ax21	# _K_A121_0_0_0\$8B
Ax22	# _K_A122_00_+000000.000\$CF
Ax23	# _K_A123_ 1.00.0_ 1.00.1\$6A
Ax24	# _K_A124_Q1.00.0_-100_0\$BA
Ax25	# _K_A125_-00000.000\$7B
Ax26	# _K_A126_\$57
Ax27	# _K_A127_Q1.00.2_0010.000\$44
Ax28	# _K_A128_00.00.0_0000.000\$68
Ax29	# _K_A129_00.00.0_1.0_0000\$76
Ax30	# _K_A130_00.00.0_00.00.0\$A1
Ax31	# _K_A131_00.00.0\$0E
Ax32	# _K_A132_00.00.0_00.00.0\$9F
Ax33	# _K_A133_00.00.0_00.00.0\$9E
Ax34	# _K_A134_00.00.0_0100_0\$D8
Ax35	# _K_A135_00.00.0_00000\$F8
Ax36	# _K_A136_00.00.0_0000\$28
Ax37	# _K_A137_00000_0000\$83
Ax38	# _K_A138_00.00.0_0_0\$66
Ax39	# _K_A139_00.00.0_00.00.0\$98
Ax40	# _K_A140_0.00_000_000\$3B
Ax41	# _K_A141_00.00\$6B
Ax42	# _K_A142_0000.00_00.00.0\$9C

Fig. 9-15: Transmission Formats of the Axxx Parameters

Parameter	Data
C000	# _K_C000_01250_0000\$84
C001	# _K_C001_0_0_00_0_0_0\$6B
C002	# _K_C002_0020.00000\$7A
C003	# _K_C003_+00000.000\$80
C004	# _K_C004_01250_0000\$80
C005	# _K_C005_0_0_00_0_0_0\$67
C006	# _K_C006_0000.00000\$78
C007	# _K_C007_+00000.000\$7C
C008	# _K_C008_00.00.0_000\$58

Fig. 9-16: Transmission Formats of the C0xx Parameters

Variables **Readout of a Variable**

Variables can be read out in any operating mode.

Format:

```
?sVxxx CR LF
```

In response to this query, the contents stored in the queried variable 'xxx' are sent.

```
Vsxxx_+12345678.123456_$hh CR LF
```

Meaning of the characters used:

- x = Variable Number
- h = Checksum

Writing to a Variable

```
#sVxxx_+ddddddd.ddddddd_$hh CR LF
```

Meaning of the characters used:

- x = Variable Number
- h = Checksum
- d = Variable information

Logic Task: Logic Task instructions can be read out in any operating mode.

Format:

```
?sP_xxxx CR LF
```

In response to this query, the contents stored in the queried Logic Task instruction 'xxxx' are sent.

```
Psxxxx_dddddddd_$hh CR LF
```

Meaning of the characters used:

- x = Logic Task instruction number
- d = Instruction information (data field with up to 16 characters)

Writing a Logic Task assignment

```
#sPx xx_x_d d d d d d d d_$h h C R L F
```

Meaning of the characters used:

- x = Logic Task instruction number
- d = Instruction information (data field with up to 16 characters)

Readout of Status Information

The following status messages can be queried for each status request via the serial data interface:

Status `00`	=	Actual position of Axes 1 and 2 in IU
Status `01`	=	Transmission error, interface
Status `02`	=	Current program instruction number, Task 1
Status `03`	=	Actual position of Axes 1 and 2 in increments (Hexadecimal)
Status `04`	=	Piece Counter
Status `05`	=	Firmware Version
Status `08`	=	Current instructions and return instruction numbers of tasks 1 through 3
Status `09`	=	Measuring Wheel Mode: Actual position of Axis 1 and position of motor encoder
Status `10`	=	Position lag of Axes 1 and 2 in IU
Status `19`	=	Hardware and firmware version
Status `39`	=	Current instructions and return instruction numbers for Tasks 4 and 5
Status `40`	=	Actual position of Axes 3 and 4 in increments
Status `41`	=	Actual position of Axis 1 by reference marker
Status `42`	=	Actual velocity of Axes 3 and 4 in 1/min
Status `43`	=	Position lag of Axes 3 and 4 in IU
Status `44`	=	Actual position of Axes 3 and 4 in IU
Status `45`	=	Voltage at Analog Inputs 3 and 4
Status `47`	=	Actual velocity of the measuring wheel encoder 1
Status `48`	=	Actual velocity of Axes 1 and 2 in 1/min
Status `49`	=	Voltage at Analog Inputs 1 and 2
Status `53`	=	Error message
Status `54`	=	Material length counter and product length counter
Status `60`	=	Incorrect number (parameter, NC instruction, Logic Task instruction, variable)
Status `61`	=	Output of a Byte M/I/Q
Status `63`	=	Text output (TXT command)

Status `00` Actual position of Axes 1 and 2 in IU

The status query:

```
?sX__00_ CR LF
```

produces the message:

```
Xs00_evmmmmm.mmm_evnnnnnn.nnn_$hh CR LF
```

Meaning of the characters used:

- e = ` ` stands for relative position (not homed)
- `A` stands for absolute position (axis homed)
- v = Operational sign of the actual position
- m = Actual position of Axis 1 in IU
- n = Actual position of Axis 2 in IU

Status `01` Transmission error, interface

The CLM sends this status information automatically if an error occurs in the transmission. Status 01 can *not* be queried.

In the event of a transmission error, the CLM delivers the following message:

```
Xs01_ff_tttttttttttttttttt_$hh CR LF
```

Meaning of the characters used:

- f = Fault (error) number
- t = Fault (error) text (always 20 characters)

Below is a list of the fault (error) numbers and their meanings:

Error No.	Fault Text	Description
01	RS Block # Wrong	Incorrect characters in the instruction number. The transmitted instruction number is not a decimal value.
02	RS Format Error	The format of the transmitted data is incorrect
03	RS Block Data Error	The transmitted instruction data are incorrect.
04	RS Checksum Error	The transmitted checksum is incorrect.
05	Invalid Mode	An attempt was made to transmit parameter data to the CLM. The control was not in 'Parameter' operating mode at the time.
06	Wrong RS Param #	The transmitted parameter number is not a decimal number.
07	Param. # too large	The transmitted parameter number is too large.
08	Wrong RS Status #	The number given in a status request is not a decimal number.
09	Status # illegal	An attempt was made to query status information that was not present in the CLM.
10	M-Wheel Param Error	The measuring wheel parameters have not been set (e.g. for Status Number 47).
11	Invalid Param Block	Incorrect parameter identifier.
12	Block # too large	The transmitted instruction number is greater than 2999.
13	Invalid Prg Command	An invalid command was transmitted to the CLM.
16	Value too large	
18	Not accepted	Incorrect variable data, incorrect source type in Status 61
23	Wrong Variable #	An attempt was made to store a system variable
25	Invalid Operand	Invalid operand in the Logic Task command

Status `02` Current program instruction number (valid only for Task 1)

The status query:

```
?sX__02_ CR LF
```

produces the message:

```
Xs02_nnnn_uuuu_$hh CR LF
```

Meaning of the characters used:

- n = Current instruction number with four decimal places
- u = instruction number after the first `JSR` command in the main program

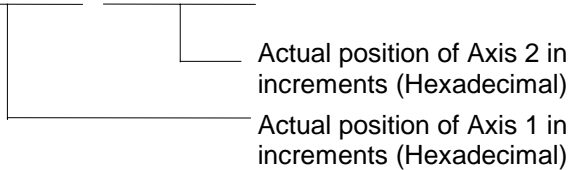
Status `03` Actual position of Axes 1 and 2 in increments

The status query:

```
?sX__03_ CR LF
```

produces the message:

```
Xs03_000C14FA_000A39CD_$$$$$$ $hh CR LF
```



The actual position in IU is calculated as follows:

1) Example for incremental encoders:

- Parameter A119 = 01500_0000
- Parameter A101 = 0010.00000

From these, the actual position in increments, hexadecimally represented as `000C14FA`, is calculated. This corresponds to a decimal value of `791802`.

$$Actual\ position\ in\ IU = \frac{Actual\ Position\ in\ Increments \times Parameter\ A101}{Parameter\ A119 \times 4}$$

$$Actual\ position = \frac{791802 \times 10.0000}{1500 \times 4} = 1319,67\ IU$$

L: IU = input units

Fig. 9-17: Calculation of the Actual Position with an Incremental Encoder

2) Example for absolute encoders:

Parameter A119 = 04096_0512
 Parameter A101 = 0020.00000

From these, the actual position in increments, hexadecimally represented as `000A39CD`, is calculated. This corresponds to a decimal value of `670157`.

$$Actual\ Position\ in\ IU = \frac{Actual\ Position\ in\ Increments \times Parameter\ A101}{Resolution\ from\ Parameter\ A119}$$

$$Actual\ Position = \frac{670157 \times 20.0000}{4096} = 3272.25IU$$

L: IU = input units

Fig. 9-18: Calculation of the Actual Position with an Absolute Encoder

Status `04` Piece Counter

The status query:

`?sX__04_nnnn_CR LF`

produces the message:

`Xs04_nnnn_iiii_zzzzzz_____ $hh CR LF`

Meaning of the characters used:

- n = Counter instruction number
- i = Actual quantity
- z = Preset count

If the requested instruction contains no counter, blank spaces `_` are output for `i` and `z`.

Status `05` Firmware Version

The status query:

`?sX__05_CR LF`

produces the message:

`Xs05__vvvvvvvvvvvvvvvvvvvv_ $hh CR LF`

Meaning of the characters used:

- v = Firmware version (also appears on the CTA display)

Status `08` Current instruction number and return instruction number to the main program of tasks 1 through 3

The status query:

```
?sX__08_CR LF
```

produces the message:

```
Xs08_aaaa_bbbb_cccc_dddd_eeee_fff_$hh CR LF
```

Meaning of the characters used:

- a = Task 1 - Current instruction number
- b = Task 1 - Instruction number of the main program
- c = Task 2 - Current instruction number
- d = Task 2 - Instruction number of the main program
- e = Task 3 - Current instruction number
- f = Task 3 - Instruction number of the main program

In the case of tasks that have not been enabled, an appropriate number of blank spaces is output.

If a task is not located in a subroutine, only the current instruction number is output.

Status `09` Measuring Wheel Mode: Actual position of Axis 1 and position of motor encoder

The status query:

```
?sX__09_CR LF
```

produces the message:

```
Xs09__evmmmmm.mmm_vnnnnnn.nnn_$hh CR LF
```

Meaning of the characters used:

- e = ` ` stands for relative position (not homed)
- `A` stands for absolute position (axis homed)
- v = Operational sign of the actual position
- m = Actual position of Axis 1 in IU. The sums of all measuring wheel encoder movements are added
- n = Actual position of the motor encoder in IU (incremental encoder 1)

If Axis 1 is not homed, the displayed absolute position can be set to zero at any time by pressing `CR` on the CTA.

Status `10` Position lag of Axes 1 and 2 in IU

The status query:

```
?sX__10_CR LF
```

produces the message:

```
Xs10_vmmmmm.mmm_vnnnnnn.nnn_$hh CR LF
```

Meaning of the characters used:

- v = Operational sign for position lag (following error)
- m = Position lag (following error) of Axis 1 in IU
- n = Position lag (following error) of Axis 2 in IU

Status `19` Hardware and firmware version

The status query:

```
?sX__19_CR LF
```

produces the following message, e.g.,:

```
Xs19_CLM01.4-P-E-4-BCLM1.4-LAP-01V08$hh CR LF
```

Firmware Version
max. 16 characters

Hardware version
max. 16 characters

Status 19 provides the same information that is shown for the firmware version on the CLM display.

Status 19 provides the same information 'hardware/firmware version' for all CLM firmware versions. This way, the RS485 bus master can detect the firmware type of all connected controls.

Status `39` Current instructions and return instruction numbers for Tasks 4 and 5

The status query:

```
?sX__39_CR LF
```

produces the message:

```
Xs39_aaaa_bbbb_cccc_dddd_$hh CR LF
```

Meaning of the characters used:

- a = Task 4 - Current instruction number
- b = Task 4 - Instruction number of the main program
- c = Task 5 - Current instruction number
- d = Task 5 - Instruction number of the main program

In the case of tasks that have not been activated, an appropriate number of blank spaces ` ` is output.

If a task is not located in a subroutine, only the current instruction number is output.

Status `40` Actual position of Axes 3 and 4 in increments

The status query:

```
?sX__40_ CR LF
```

produces the message:

```
Xs40_000C14FA_000A39CD_$$$$$hh CR LF
```

Actual position of Axis 4 in increments
(Hexadecimal)

Actual position of Axis 3 in increments
(Hexadecimal)

The actual position in IU, when using an incremental or absolute encoder, is calculated as described in the examples for Status `03`.

Status `41` Actual position of Axis 1 by reference marker

The status query:

```
?sX__41_ CR LF
```

produces the message:

```
Xs41_evmmmmm.mmm_$$$$$hh CR LF
```

Meaning of the characters used:

- e = ` ` stands for relative position (not homed)
- `A` stands for absolute position (axis homed)
- v = Operational sign of the actual position
- m = Actual position of Axis 1 in IU

The following message issues the actual position of Axis 1 for the last raster.

The absolute actual position of Axis 1 is buffered to the raster input with a leading edge, using the `SRM` command.

The last saved position can be read out at any time using Status 41.

The attainable accuracy is dependent on the delay between the signal at the raster input and the position detection by the CLM.

The delay is approximately 0 to 150 µs.

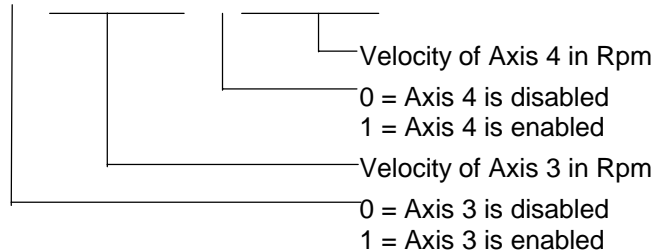
Status `42` Actual velocity of Axis 3 and 4 in 1/min

The status query:

```
?sX__42_CR LF
```

produces the message:

```
Xs42_1_+1234.56_1_+1234.56_$hh CR LF
```



The velocity values that are output are average values (calculated over 32 control cycles).

Status `43` Position lag of Axes 3 and 4 in IU

The status query:

```
?sX__43_CR LF
```

produces the message:

```
Xs43_vmmmmm.mmm_vnnnnnn.nnn_$hh CR LF
```

Meaning of the characters used:

- v = Operational sign for position lag (following error)
- m = Position lag (following error) of Axis 3 in IU
- n = Position lag (following error) of Axis 4 in IU

Status `44` Actual position of Axes 3 and 4 in IU

The status query:

```
?sX__44_CR LF
```

produces the message:

```
Xs44_evmmmmm.mmm_evnnnnnn.nnn_$hh CR LF
```

Meaning of the characters used:

- e = ` ` stands for relative position (not homed)
`A` stands for absolute position (axis homed)
- v = Operational sign of the actual position
- m = Actual position of Axis 3 in IU
- n = Actual position of Axis 4 in IU

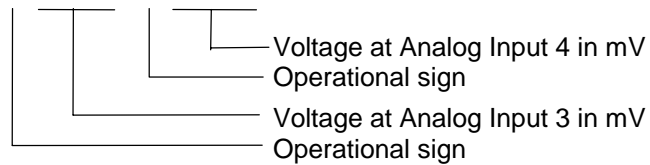
Status `45` Voltage at analog inputs 3 and 4

The status query:

```
?sX__45_CR LF
```

produces the message:

```
Xs45_+12345_+12345_$hh CR LF
```



The analog inputs 1 and 2 can be requested via Status `49`.

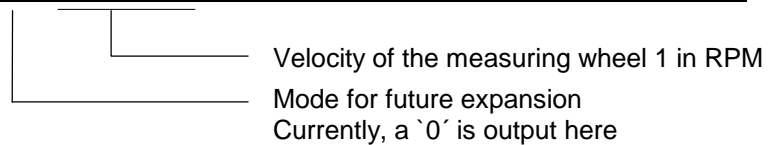
Status `47` Actual velocity of the measuring wheel encoder 1

The status query:

```
?sX__47_CR LF
```

produces the message:

```
Xs47_0_+1234.56_$hh CR LF
```



The velocity values that are output are average values (calculated over 32 control cycles).

When no measuring wheel encoder resolution is programmed in Parameter C000, Status 01 (Error Message 10: M-Wheel Param Error) is output in place of Status 47.

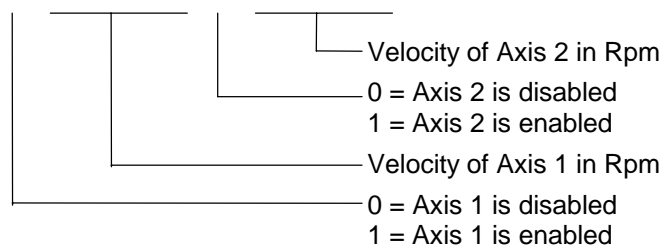
Status `48` Actual velocity of Axis 1 and 2 in 1/min

The status query:

```
?sX__48_CR LF
```

produces the message:

```
Xs48_1_+1234.56_1_+1234.56_$hh CR LF
```



The velocity values that are output are average values (calculated over 32 control cycles).

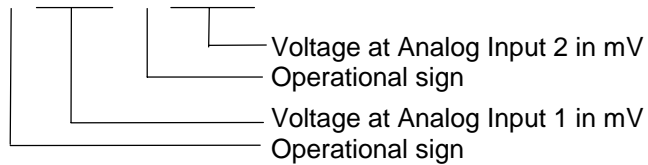
Status `49` Voltage at Analog Inputs 1 and 2

The status query:

```
?sX__49_CR LF
```

produces the message:

```
Xs49_+12345_+12345_$hh CR LF
```



Analog inputs 3 and 4 can be requested via Status `45`.

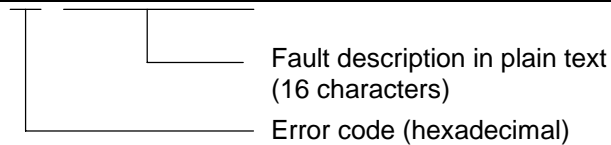
Status `53` Error Message

The status query:

```
?sX__53_CR LF
```

produces the message:

```
Xs53_nn_tttttttttttttt_$hh CR LF
```



If the TXT command was called with mode 1, the text from this TXT command is output with status 53.

For error texts and codes, see Parameter B018 and the chapter entitled `Diagnostic Messages`.

Status `54` Material length counter and product length counter

The status query:

```
?sX__54_ CR LF
```

produces the message:

```
Xs54_vmmmmmmmm_vpppppppp_$hh CR LF
```

Meaning of the characters used:

- v = Operational sign of the material length or product length
- m = Material Length in IU
- p = Product Length in IU

The material length and product length counters are only supported for the application type `Flying Cutoff`.

Status 60 Output of the erroneous parameter number, NC instruction number, Logic Task instruction number, variable number

The status query:

```
?sX__60_a_ CR LF
```

produces the message:

```
Xs60_a_nnnn_$hh CR LF
```

Instruction number, parameter number or variable number

0 = Parameter
1 = NC
2 = Logic Task
3 = Variable

Note: If no error is present, space characters ' ' are output for the number 'n.'

Status `61` Output of a Byte M/I/Q

The status query:

```
?sX__61_mt.nn_ CR LF
```

produces the message:

```
Xs61_mt.nn_bbbbbbbb_$hh CR LF
```

Bit 7 0

m = Source Type I / Q / M
t = Source Number
n = Byte Number
b = Bits

Status `63` Text output

The status query:

```
?sX__63_vb_ CR LF
```

produces the message:

```
Xs63_tttttttt. . . tttttttt_$hh CR LF
```

Meaning of the characters used:

v = 1-4: from line
b = 1-4: to line
t = 16, 32, 48 or 64 characters of the TXT command with mode 0

Interface Commands

For all commands, it is necessary for the checksum transmission to be independent of the programming in Parameter B003 or B005!

Program Start

```
!sSTART_$$hh CR LF
```

Starts the program in Automatic Mode.

Program Stop

```
!sSTOP_$$hh CR LF
```

Immediately stops a running Automatic program. A program that has been stopped in this way cannot be re-started via the 'Start' input (Connector X3/Pin 4), but only via a START interface command.

Clear Fault

```
!sCLEAR_$$hh CR LF
```

Clears a fault message

Clear Time Counter

```
!sCCLVAR0019$$hh CR LF
```

With this command, the time counter can be cleared. This is only permitted in 'Parameter' Mode. If the CLM is not in 'Parameter' Mode and if the above control command is sent, the CLM sends the error message 'Invalid mode'

Start Instruction of the User Program

```
!sCL0_$$hh CR LF
```

If the CLM is in operating mode 5 'Flying cutoff', the execution of the program starts when switching from 'Manual' to 'Automatic', using the old part length minus 1. If start of the program is to occur in instruction 0000, the above control command must be transmitted via the serial interface. If the CLM is not in 'Manual' Mode and if the above control command is sent, the CLM sends the error message 'Invalid mode' via the serial interface.

Clear Material Length Counter

```
!sCLL1_$$hh CR LF
```

With this command, the material length counter can be cleared.

Clear Product Length Counter

```
!sCLL2_$$hh CR LF
```

With this command, the product length counter can be cleared.

For the following commands, these points are valid:

- The axis is activated after re-starting (following power loss) and after an E-Stop!
- The current status of an axis (enabled/disabled) remains constant for:

all error messages
any change of operating mode AUTO/MANUAL/PARA.

Enable Axis x `!sMxON_$hh CR LF`

If the precondition is met, drive enable and the brake each have 24V.

Disable Axis x `!sMxOFF_$hh CR LF`

- Drive enable and Brake = 0V
- Axis-specific fault messages disabled

Meaning of the characters used:

x = Axis 1-4

Axes 1 to 4 are enabled or disabled via the serial interface with identical commands.

If the enable signal for a disabled axis is lost, no error message is issued.

Set Default Values Write all parameters with default values.

`!sCSETPA_$hh CR LF`

Note: This command is only accepted in Parameter Mode.

Write NOP to NC Instructions NOP commands are written to all NC program instructions.

`!sCNOPNC$hh CR LF`

Write NOP commands to NC program instructions.

`!sCNOPNCvvvvbbbb_$hh CR LF`

vvvv = beginning with NC instruction number (0000 - 2999)

bbbb = up to and including NC instruction number (0000 - 2999)

Note: These commands are only accepted in Parameter Mode.

Write NOP to Logic Task Instructions

Write NOP commands to all Logic Task program instructions.

```
!sCNOPLT$hh CR LF
```

Note: 'END' is written to instruction 0000 !

Write NOP commands to Logic Task program instructions.

```
!sCNOPLTvvvvbbbb_$hh CR LF
```

vvv = beginning with Logic Task instruction number (0000 - 0999)

bbbb = up to and including Logic Task instruction number (0000 - 0999)

Note: If instruction 0000 is the first instruction, 'END' is written to it. These commands are only accepted in Parameter Mode.

Clear NC Variables

Clear all user-programmable variables V600 to V999.

```
!sCCLVAR$hh CR LF
```

Clear a variable range.

```
!sCCLVARvvvvbbbb_$hh CR LF
```

vvv = beginning with variable number (0600...0999)

bbbb = up to and including variable number (0600...0999)

Note: These commands are only accepted in Parameter Mode.

Polling Query

A query, in the shortest possible format, which cyclically polls all of the CLM controls connected to the RS485 bus.

The query:

```
:s CR LF
```

produces the message:

```
:snn CR LF
```

Meaning of the characters used:

s	=	Station Number (1 - W)
nn	=	Fault code (hexadecimal)

For a list of errors, see the 'Parameter' chapter, Parameter B018.

Notes

10 Command Communications

10.1 Profibus

Rexroth provides advanced drive technology with a user-friendly interface. This is how, for example, homing and jogging were defined as individual operating modes in the DriveCom product. Rexroth has provided this functionality (as also defined in the ProfiDrive) as bits in the control word, and thus can now offer an interface that is easier to use.

Setting the Slave Address The slave address is set in Parameter B008.

Status at Delivery:

The CLM1.4 address is set to 00 at delivery.

Settable Addresses: Slave addresses 1-99 (decimal) are supported.

Depending on the fieldbus type, however, the following limitations exist:

Profibus DP address: **2 ... 89 permitted**

Note: Slave address 0 does not exist and cannot be used in applications.

Slave Address The address is read from Parameter Mode to the operating mode when starting up the CLM, and it is used to set the parameters for the fieldbus. To set the slave address, parameter input X3/1 is used. This input is dominant and is used for the initial startup of the control.

Unit Source File For each Profibus DP unit, a unit source file (*.GSD), in which the data for the operation on the bus are stored, must be present. This file is required for each unit when configuring the bus master.

The unit source file for the CLM with LAP firmware is an ASCII file named: **IN2_04eb.gsd**

This unit source file also contains the following information, issued for this configuration by the PNO:

Ident Number = 04eb hex

In addition, there are different selection options for setting the transmission length. This is dependent on the data to be transmitted. See Fig. 10-4.

Data Channel The maximum data channel size is 32 bytes.

Service Data Channel	Process Data Channel
6 Words	8 (7) Words

Fig. 10-1: Transmission

The length of the process data channel is dependent on the format set in Parameter B008.

Fieldbus Parameters

A parameter must be programmed for the fieldbus. The parameter is part of the group B0xx.

B008 Fieldbus Format

Process Data Channel

O Channel (CLM Output)	Diagnostic Channel	Variable Channel
3 Words	1 Word	4 Words

Fig. 10-2: Receive Channel CLM → Master

I Channel (CLM Input)	Variable Channel
3 Words	4 Words

Fig. 10-3: Transmission Channel Master → CLM

Parameter B008	Process Data Channel	
	Receive Length Profibus Master	Send Length Profibus Master
Format 0	8 Words	7 Words
Format 1	4 Words	3 Words
Format 2	8 Words	7 Words

Fig. 10-4: Transmission Length, Process Data Channel

I/O Channel The I/O Channel consists of 3 words. Depending on the selected fieldbus operating mode, the status word and control word are (0 or 3) defined differently. The other two words are not defined. Their function is assigned via the user program or the parameters.

For a fieldbus operating mode of 0 (see Parameter B008), the status word and the control word are defined as follows:

I/O Status Word (CLM Output)

Bit	Definition	Designation
0	Manual Mode	Q2.00.0
1	Automatic Mode	Q2.00.1
2	Parameter	Q2.00.2
3	Drive Enable 1	Q2.00.3
4	Brake 1	Q2.00.4
5	Fault	Q2.00.5
6	Drive Enable 2	Q2.00.6
7	Brake 2	Q2.00.7
8	Reserved	Q2.01.0
9	Run	Q2.01.1
10	Reserved	Q2.01.2
11	Brake 3	Q2.01.3
12	Brake 4	Q2.01.4
13	Inhibit Operation	Q2.01.5
14	Drive Enable 3	Q2.01.6
15	Drive Enable 4	Q2.01.7

Fig. 10-5: Status Word CLM → Master

I/O Control Word (CLM Input)

Bit	Definition	Designation
0	Parameter Mode	I2.00.0
1	Manual / Automatic	I2.00.1
2	Reserved	I2.00.2
3	Start	I2.00.3
4	Immediate Stop	I2.00.4
5	Jog Forward 3	I2.00.5
6	Jog Reverse 3	I2.00.6
7	Clear Errors	I2.00.7
8	Jog Forward 1	I2.01.0
9	Jog Reverse 1	I2.01.1
10	Jog Forward 2	I2.01.2
11	Jog Reverse 2	I2.01.3
12	Jog Forward 4	I2.01.4
13	Jog Reverse 4	I2.01.5
14	Restart	I2.01.6
15	Reserved	I2.01.7

Fig. 10-6: Control Word Master → CLM

For a fieldbus operating mode of 3 (see Parameter B008), the status word and the control word are defined as follows:

I/O Status Word (CLM Output)

Bit	Definition	Designation
0	Manual Mode	Q2.00.0
1	Automatic Mode	Q2.00.1
2	Parameter	Q2.00.2
3	Drive Enable 1	Q2.00.3
4	Brake 1	Q2.00.4
5	Fault	Q2.00.5
6	Drive Enable 2	Q2.00.6
7	Brake 2	Q2.00.7
8	Reserved	Q2.01.0
9	Run	Q2.01.1
10	Reserved	Q2.01.2
11	Brake 3	Q2.01.3
12	Brake 4	Q2.01.4
13	Inhibit Operation	Q2.01.5
14	Drive Enable 3	Q2.01.6
15	Drive Enable 4	Q2.01.7

Fig. 10-7: Status Word CLM → Master

I/O Control Word (CLM Input)

Bit	Definition	Designation
0	Parameter Mode	I2.00.0
1	Manual / Automatic	I2.00.1
2	EMERGENCY_STOP	I2.00.2
3	Start	I2.00.3
4	Immediate Stop	I2.00.4
5	Jog Forward 3	I2.00.5
6	Jog Reverse 3	I2.00.6
7	Clear Errors	I2.00.7
8	Jog Forward 1	I2.01.0
9	Jog Reverse 1	I2.01.1
10	Jog Forward 2	I2.01.2
11	Jog Reverse 2	I2.01.3
12	Jog Forward 4	I2.01.4
13	Jog Reverse 4	I2.01.5
14	Restart	I2.01.6
15	Enable (all axes)	I2.01.7

Fig. 10-8: Control Word Master → CLM

User-configurable I/O

CLM Input

I2.02 }
I2.03 } in one word when received

I2.04 }
I2.05 } in one word when received

are the addresses of the available words

CLM Output

Q2.02 }
Q2.03 } in one word when sent

Q2.04 }
Q2.05 } in one word when sent

are the addresses of the available words

Diagnostic Channel The diagnostic (Status, Warning, Error Message) is made available in a word as a hexadecimal number. The content represents the diagnostic numbers assigned in the description.

Variable Channel The length is 4 words, and all variables can be transmitted in 4 different formats.

From Master to CLM

Read Control Word	Write Control Word	Variable Data
1 Word	1 Word	1 Long Word

Fig. 10-9: Variable Channel Master → CLM

1 Word: Read Control Word

1 Word: Write Control Word

1 Long: Variable Data

From CLM to Master

Read Status Word	Write Status Word	Variable Data
1 Word	1 Word	1 Long Word

Fig. 10-10: Variable Channel CLM → Master

1 Word: Read Status Word

1 Word: Write Status Word

1 Long: Variable Data

Write Status Word / Read Status Word

Bits	Function
0..9	Variable Number
10..13	Format / Error Number
14	Error Bit
15	Handshake Bit toggles to the Status Word

Fig. 10-11: Status Word for Variable

Write Control Word / Read Control Word

Bits	Function
0..9	Variable Number
10..13	Format
14	Reserved (always 0)/ Version Number: 0
15	Handshake Bit toggles to the Status Word

Fig. 10-12: Control Word for Variable

Handshake Process

When restarting the CLM, the handshake bits are the same.

When the master makes a read or write request, the respective handshake bit must be toggled in the control word. After the CLM has processed the request, it toggles the respective handshake bit in the status word.

Handshake Bit Control Word	Handshake Bit Status Word	Status
0	0	No function
1	0	Request from the Master
1	1	Request processed by the Slave (CLM)
1	1	No function
0	1	Request from the Master
0	0	Request processed by the Slave (CLM)
0	0	No function

Fig. 10-13: Handshake Process

The CLM variables have a fixed format:

+99999999.999999

While transmitting the variables via the Profibus interface, a 32-bit number (1 Long) with an operational sign, that is interpreted according to its format selection, is transmitted. The data capacity of the variable is reduced. For the two types of fixed point formats, the places after the decimal are always rounded. For the integer format, only the places before the decimal are used. The transmission formats must correspond to the application of the variable in the NC program.

Format The following data formats are defined

Format 0 (0000) = Integer, rounded	(+/-99999999)
Format 1 (0001) = Fixed point (3)	(+/-99999.999)
Format 2 (0010) = Fixed point (6)	(+/- 99.999999)
Format 3 (0011) = IEEE Floating point	(in preparation)
Format 4 (0100) = Integer, not rounded	(+/-99999999)

Error number When the error bit (Bit 14) is set in the status word, error numbers are assigned to the format bits (Bits 10-13). The following error numbers are assigned:

Error 0 (0000) = Variable number too large
Error 1 (0001) = Variable number illegal
Error 2 (0010) = Unknown format
Error 3 (0011) = Data too large
Error 4 (0100) = Data too small
Error 5 (0101) = Data not displayable (IEEE)
Error 6 (0110) = Variable not writable
Error 7 (0111) = Bit 14 in the control word is '1'

Variable number The system variables (V000 to V599) can only be read. The user-programmable variables (V600 to V999) can be both read and written.

Service Data Channel

All the programs, parameters, variables and status information can be sent to the slave or read out via this channel.

The data exchange occurs after the ASCII Data Protocol of the 'Serial Interface.' Only the checksum, station number and 'CR LF' at the end of the protocol are disregarded.

Reading a Datum	1. Read request (e.g. ? N0000)	→ Write
	2. Readout of the requested datum	→ Read
Writing a Datum	1. Write request	→ Write
	2. Readout of the response telegram	→ Read

Handling the Service Data Channel

Structure of the Control Word in the Service Data Channel

The control word is sent in the direction of master to slave. It is 16 bits wide and the individual bits are defined as follows:

Control Word

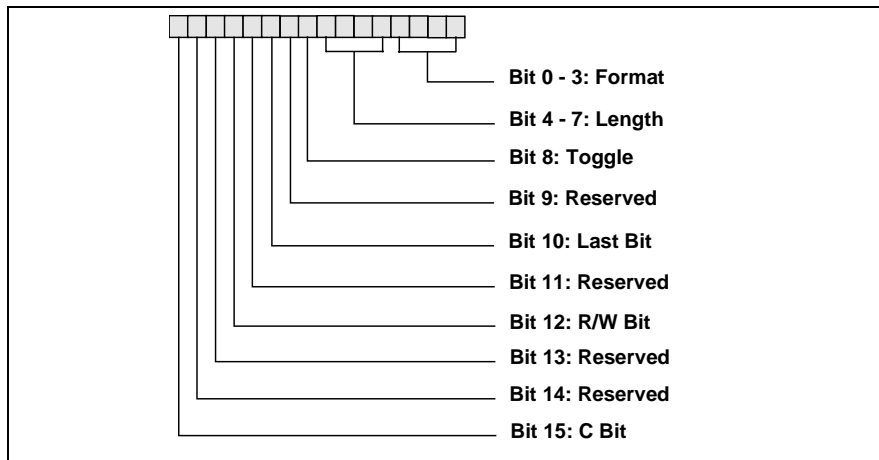


Fig. 10-14: Structure of the Control Word in the Service Data Channel

The individual bits are defined as follows:

- Format:** These bits indicate the meaning of the transmitted data. Currently, only one format (B) exists.
- Length:** These four bits indicate the length of the valid data byte in the Service Data Channel, not including the control word. The content of the invalid data is not defined.
- Toggle:** This bit changes its status for each new cycle. It is used for a software handshake between master and slave. The master may only send this bit if the toggle bit in the status word has the same status as in the control word that was just sent.
- Last:** Last Bit: This bit is set when the last fragment of a data set is sent. This way, the slave can recognize that it can assemble and edit the previously collected fragments.
- R/W:** Read/Write; Read = 1, The master sets this bit when it would like to read data.
- C:** Reserved. (Always 0)

Note: Reserved Bits are to be set to '0.'

Status Word The status word is sent in the direction of slave to master. It is 16 bits wide and the individual bits are defined as follows:

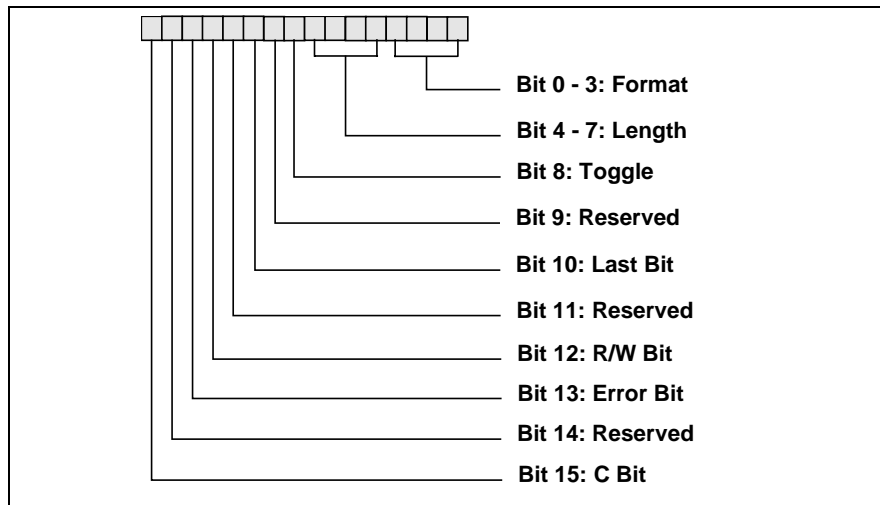


Fig. 10-15: Structure of the Status Word in the Service Data Channel

The individual bits are defined as follows:

- Format:** These bits indicate the meaning of the transmitted data. Currently, only one format (B) exists.
- Length:** These four bits indicate the length of the valid data byte in the Service Data Channel, not including the control word. The content of the invalid data is not defined.
- Toggle:** This bit changes its status for each new cycle. It is used for a software handshake between master and slave. The slave recognizes new data when the received toggle bit (control word) is not equal to the sent toggle bit.
- Last:** Last Bit: This bit is set when the last fragment of a data set is sent. This way, the slave can display to the master that it is sending the last fragment.
- R/W:** Read/Write; Read = 1, The slave sets this bit. (Copy of the master bit)
- Error Bit:** This bit indicates an error that has occurred in the slave. The following data indicate the reason for the error.
- C:** Reserved.

Note: Reserved Bits are to be set to '0.'

Communication Between Master and Slave

A general description of the communication relationships is illustrated in the following graphic. The following two services are shown from the perspective of the master:

- Read Request (Readout of the requested data)
(Readout of the response telegram)
- Write Request (Read request)
(Write request)

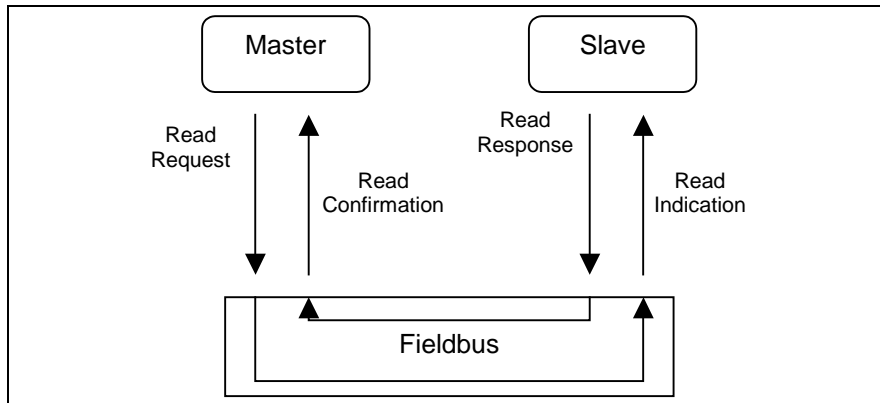


Fig. 10-16: Master Reads Datum

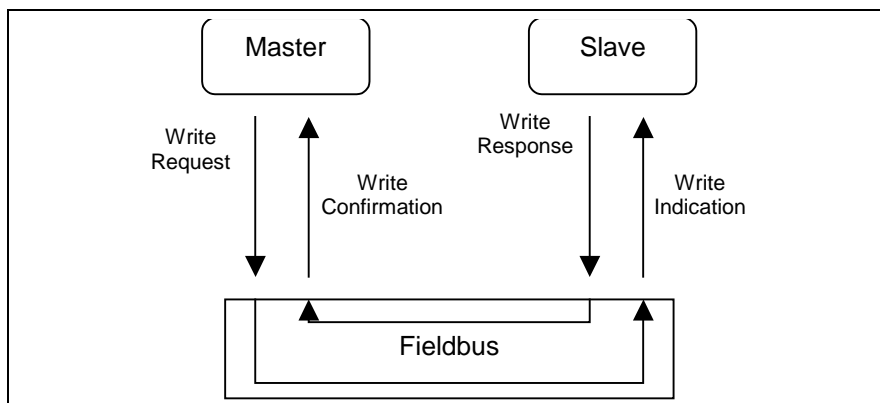


Fig. 10-17: Master Writes Read or Write Request

The 'Request' and 'Indication' services contain the same data; the difference is in the perspective ('Request' from the master's perspective, 'Indication' from the slave's perspective).

If the master sends a service to the slave, the first word is the control word. If, however, an answer is sent from the slave to the master, the first word is the status word. Both words control the sequence of the Service Data Channel.

If the data to be transmitted are longer than the length of the Service Data Channel, they must be fragmented. The required information is also contained in the control/status word. The total length that may be transmitted via the Service Data Channel is 128 bytes.

Reading a Value

The master clears the R-Bit to signal a request. In this example, an NC instruction is read out. The length of the control word is set to 8, which indicates the valid length of the data in bytes, not counting the control word. The toggle bit is set to '1,' assuming it was set to '0' before. The L-Bit is also set, because all the data is sent in one block and therefore, the last fragment is transmitted.

Control Word														Service Data													
	C	E	R		L		T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data				
M	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	1	1	3F	20	4E	30	30	30	30	20	x	x
																	?	_	N	0	0	0	0	_			

Fig. 10-18: The Master Sends a 'Write Request'

The slave responds with a 'Write Response' that contains no data.

Status Word														Service Data													
	C	E	R		L		T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data	Data			
S	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	1	x	x	x	x	x	x	x	x	x	x

Fig. 10-19: The Slave Sends a 'Write Response'

The master now wants to read out the requested datum with a 'Read Request.'

Control Word														Service Data													
	C	E	R		L		T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data	Data			
M	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1	1	x	x	x	x	x	x	x	x	x	x

Fig. 10-20: The Master Sends a 'Read Request'

The slave responds with a 'Read Response,' which contains the requested data (total length = 14 bytes). The length indication was set to 10 and the toggle bit was also set to '1.' The L-Bit is not set, because the data is fragmented and cannot all be transmitted at once. An additional fragment is required to receive the rest of the data.

Status Word														Service Data												
C	E	R	L	T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data	Data					
S	0	0	0	1	0	0	0	0	1	0	1	0	1	0	1	1	23	20	4E	30	30	30	30	20	4E	4F
														#	_	N	0	0	0	0	_	N	O			

Fig. 10-21: 'Read Response' From the Slave (First Fragment)

Now, the master must switch the toggle bit to show the slave that it is ready to receive new data. The R/W-Bit, the L-Bit, the length and the data are not of interest, and are therefore not considered by the slave. However, the master should set the bits as shown below.

Control Word														Service Data												
C	E	R	L	T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data						
M	0	0	0	1	0	1	0	1	0	0	0	0	1	0	1	1	x	x	x	x	x	x	x	x	x	x

Fig. 10-22: The Master Sends a 'Read Request' for the Second Fragment

The slave responds with the second fragment, which contains the remaining 4 bytes. The L-Bit is set, because the system is processing the last fragment. In addition, the length is set accordingly.

Status Word														Service Data												
C	E	R	L	T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data						
S	0	0	0	1	0	1	0	1	0	1	0	0	1	0	1	1	50	20	20	20	x	x	x	x	x	x
														P	_	_	_									

Fig. 10-23: 'Read Response' From the Slave (Last Fragment)

Writing a Value

In this example, an NC instruction is written:

- # N0000 NOP

The master clears the R-Bit to signal a write operation. In this example, the length of the operating datum is 12 bytes. Because only 5 data words are available in the Service Data Channel, the request cannot be sent all at once, but must be fragmented. Therefore, the L-Bit is not set; the toggle bit was switched opposite of the previous state.

Control Word														Service Data												
C	E	R	L	T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data						
M	0	0	0	0	0	0	0	1	1	0	1	0	1	0	1	1	23	20	4E	30	30	30	30	20	4E	4F
														#	_	N	0	0	0	0	_	N	O			

Fig. 10-24: 'Write Request' From the Master (First Fragment)

The slave responds with a 'Read Response' that contains no data. This response indicates to the master that the slave is again ready to receive additional data. Each time, the status word is a copy of the control word, for which the length was set to 0 and the L-Bit was set.

Status Word													Service Data															
C	E	R	L	T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data								
S	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	1	x	x	x	x	x	x	x	x	x	x	x	x

Fig. 10-25: 'Write Response' From the Slave

Now, the master can send the rest of the data in the next 'Write Request.' The master must change the status of the toggle bit again and the length must be indicated accordingly. The L-Bit is set, because the system is processing the last fragment.

Control Word													Service Data														
C	E	R	L	T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data							
M	0	0	0	0	0	1	0	0	0	0	1	0	1	1	1	50	20	x	x	x	x	x	x	x	x	x	x
													P	-													

Fig. 10-26: 'Write Request' From the Master (Second Fragment)

The slave now has all the information to process the master's request. To confirm successful execution of the service to the master, the slave sends a 'Write Response,' which consists of the status word, to the master.

Status Word													Service Data														
C	E	R	L	T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data							
S	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	x	x	x	x	x	x	x	x	x	x	x

Fig. 10-27: 'Write Response' From the Slave

If the error bit is not active, the transmission is completed successfully. However, as for the 'Serial Interface,' it is still possible to request a transmission confirmation.

Status/Control Word													Service Data														
C	E	R	L	T	Length				Format				Data	Data	Data	Data	Data	Data	Data	Data							
M	0	0	0	1	0	1	0	1	0	0	0	0	1	0	1	1	x	x	x	x	x	x	x	x	x	x	x
S	0	0	0	1	0	1	0	1	0	0	1	0	1	0	1	1	59	20									
													Y	-													

Fig. 10-28: Transmission Confirmation

Error Messages

If the slave detects an erroneous message, it generates an error message. This message contains an error code as a 16-bit value that indicates the source of the error. The error message has the following structure:

Status Word											Service Data																					
C	E	R	L	T	Length			Format			Data	Data	Data	Data	Data	Data	Data	Data	Data													
S	0	0	1	d	0	1	0	d	0	0	1	0	1	0	1	1	y	y	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Fig. 10-29: Structure of the Slave's Error Message

The error bit is set and the R and toggle bits have the same value as the bit set in the master. The error code indicates an internal error code. The definition of the error code for internal errors is described as follows.

Error Code yy (Hex)	Description
0x0085	The sum of the data in all of the collected fragments is too large.
0x0088	An internal error occurred during communication between the fieldbus card and the drive controller.
0x008A	The index sent by the master is not present.
0x008B	The format is unknown.
0x008C	The length of the valid data indicated in the status word is longer than the parameter channel length.
0x008D	Communication is not possible because the parameter channel was configured with only 1 word.
0x0090	The format changed during collection of individual fragments.
0x0095	Additional data besides the index and subindex is present in a read request.
0x0096	The internal SIS communication returned an error.
0x009A	This functionality has not been implemented.
0x009B	Switching between the 'old' and 'new' parameter channel is occurring for sending / receiving data.
0x009C	The indicated subindex does not exist.
0x009D	The subindex is write-protected.
0x00F0	A timeout occurred during communication between the fieldbus card and the drive controller.
0x01nn	nn = Error code for the 'serial interface'
0x01FF	The length indicated by the slave for the data to be transmitted is incorrect. (>128)

Fig. 10-30: Error Codes

If a 0x01nn error is present, this error can be read out again as 'plain text.'

		Status/Control Word										Service Data																
		C	E	R	L	T	Length				Format		Data	Data	Data	Data	Data	Data	Data	Data	Data	Data						
M		0	0	0	0	0	1	0	0	0	1	0	1	1	3F	20	4E	33	30	30	30	20	x	x				
															?	_	N	3	0	0	0	_						
S		0	0	1	0	0	1	0	1	0	0	0	1	0	01	0C												
																12												
M		0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1	1	x	x	x	x	x	x	x	x	x	x
S		0	0	0	1	0	1	0	0	0	1	0	1	0	58	20	30	31	20	31	32	20	42	6C				
															X	_	0	1	_	1	2	_	B	I				
M		0	0	0	1	0	1	0	0	1	1	0	0	0	1	0	1	1	x	x	x	x	x	x	x	x	x	x
S		0	0	0	1	0	0	0	0	1	1	0	1	0	6F	63	6B	20	2C	20	74	6F	6F	20				
															o	c	k	_	#	_	t	o	o	_				
M		0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	1	1	x	x	x	x	x	x	x	x	x	x
S		0	0	0	1	0	1	0	0	0	1	0	0	0	6C	61	72	67	65									
															l	a	r	g	e									

Fig. 10-31: Error Output With Plain Text

Termination of the Data Exchange

In some cases, it can make sense to terminate the data exchange (the slave sends no more data). The master can indicate the termination of the data exchange to the slave by using the format 0xF in the control word and setting the length, the L-Bit and the R-Bit to zero. The toggle bit must be switched according to the previous state. The slave then terminates the data exchange and waits for a new service.

		Control Word										Service Data																
		C	E	R	L	T	Length				Format		Data	Data	Data	Data	Data	Data	Data	Data	Data	Data						
M		0	0	0	0	0	0	1	0	d	0	0	0	0	1	1	1	1	x	x	x	x	x	x	x	x	x	x
S		0	0	0	0	0	0	1	0	d	0	0	0	0	1	1	1	1	x	x	x	x	x	x	x	x	x	x

Fig. 10-32: Termination of the Data Exchange During Fragmenting

Parallel Interface

If the system is controlled via the fieldbus, (Fieldbus Operating Mode 0), the following hardware inputs must be assigned:

- Parameter Connector No.:3 / Pin No.:1
- $\overline{\text{E-Stop}}$ Connector No.:3 / Pin No.:3
- Enable 1 Connector No.:3 / Pin No.:6
- Enable 2 Connector No.:3 / Pin No.:7 (only when Axis 2 present)
- Enable 3 Connector No.:22 / Pin No.:1 (only when Axis 3 present)
- Enable 4 Connector No.:22 / Pin No.:4 (only when Axis 4 present)

Assignment of Profibus Connector X30

Signal Assignment for X30 Profibus Connector

Pin	DIR	Signal	Function
1		--	n.c.
2		--	n.c.
3	I/O	RS485+	Receive/transmit data plus
4	O	CNTR-P	Repeater control signal
5		0V	0V
6	O	+5V	Repeater supply
7		--	n.c.
8	I/O	RS485-	Receive/transmit data minus
9		0V	0V

Fig. 10-33: Signal Assignment of Connector X30

Interface compatibility As per DIN EN 50 170

Signal Specification

Signal	Specification
+5V Repeater supply	+5V ($\pm 10V$) max. 75 mA
Repeater control signal	TTL compatible 1: transmit 0: receive Output resistance: 350R $V_{OL} \leq 0,8 V$ at $I_{OL} \leq 2 mA$ $V_{OH} \geq 3,5 V$ at $I_{OH} \leq 1 mA$
Receive/send data	EIA-RS485 standard

Fig. 10-34: Signal Specification



CAUTION

**Danger of destroying output
"+5V Repeater supply" with overload!**

- ⇒ do not short
- ⇒ do not exceed maximum current

Profibus LED Diagnostics

For diagnosing the Profibus interface, four LEDs are available on the front of the fieldbus card. These LEDs signal the status of the synchronization between the fieldbus interface and the control, as well as the bus activity for the cyclic data exchange.

LED Designation	LED Status	Definition
H30	ON	Cyclic Process Data channel is active
H31	- -	- -
H32/33	alternately blinking	synchronization between the fieldbus card and the CLM established
H32/33	blinking simultaneously	synchronization between the fieldbus card and the CLM not established
all LEDs	blinking simultaneously	serious error in the fieldbus card. Turn unit off / on

Fig. 10-35: Diagnostic LEDs for Profibus X30

11 Diagnostic Messages

11.1 General Information about Error Identification

If the CLM detects an error, it shows the reason for the error on the display.

After clearing the error, the CLM must be restarted. This can be accomplished by pressing **CL** on the display or by using an external 'Clear' command.

11.2 Error Diagnostic

Error	
NC Instr :	0 1 1 0
LT Instr :	
Variable :	0 6 2 0

If the CLM diagnoses an error, an error message is shown on the display. If the **F1** key is pressed, an additional display shows in which NC instruction, Logic Task instruction or variable the error occurred. Pressing the **F1** key returns to the error display.

11.3 Error Code Numbers

Every error message has a hexadecimal code number. The customer can read this number via the RS interface or via outputs.

Following is an overview of code numbers and their assignment to error messages:

Code Number	Assignment
00 to 3F	General Error
40 to 6F	Axis 1 Error
70 to 9F	Axis 2 Error
A0 to CF	Axis 3 Error
D0 to FF	Axis 4 Error

Fig. 11-1: Assignment of Error Codes

Following is a list of code numbers and their meanings when an error occurs:

Code #	Error Message	Page
00	No error message; Manual or Automatic Mode	11-5
01	No error message; Parameter Mode	11-5
02	Parameter XXXX is invalid	11-5
03	EMERGENCY STOP	11-5
04	Battery is low	11-5
05	Parameters lost	11-6
06	Program lost	11-6
07	Division by zero	11-6
08	Invalid mode	11-6
0A	Invalid prg cmd	11-6
0B	JSR nesting	11-7
0C	RTS nesting	11-7
0D	BCD Input error	11-7
0E	Invalid Block #	11-7
10	System failure Code #EXCPXX ('Exception')	11-8
11	System failure Code #STKOVF ('Stack overflow')	11-8
11	System failure Code #IRQOVL ('IRQ too long')	11-8
11	System failure Code #EPROM ('EPROM data lost')	11-8
12	IDS01 - Break error	11-9
13	IDS01 - Checksum error	11-9
14	IDS01 - Char format	11-9
16	Axis no. false	11-9
17	Hardw. Axes 3 & 4	11-9
19	CLM \pm 15 Volts	11-10
1A	REP command (not possible)	11-10
1B	SAC command (not possible)	11-10
1D	Command I/O	11-10
1E	VCC command (not possible)	11-10
1F	Var. No. illegal	11-11
2C	Inc. Enc. 1 faulty	11-11
2D	Inc. Enc. 2 faulty	11-11
2E	Inc. Enc. 3 faulty	11-11
2F	Inc. Enc. 4 faulty	11-11
30	Inc. Enc. 5 faulty	11-11
31	Write Sys. Var.	11-11
32	Variable value	11-11
33	Fieldbus	11-12
34	Fieldbus init	11-12
35	Missing EOS cmd (Flying Cutoff)	11-12
36	Not Homeposition (Flying Cutoff)	11-12
37	Fieldbus timeout	11-12
38	Logic prg. error	11-13

Code #	Error Description	Page
39	Logic prg. lost	11-13
3A	Index Length (Flying Cutoff)	11-13
3B	Rapid Stop (Flying Cutoff)	11-13
3C	Maximum Stroke (Flying Cutoff)	11-13
3D	I/O-No. Illegal	11-14
40	Drive 1 not ready	11-15
41	Feed angle loss, Axis 1	11-15
42	Drive runaway, Axis 1	11-15
43	Excess Pos lag (following error), Axis 1	11-16
44	Abs. enc. error, Axis 1	11-16
45	Abs. range error, Axis 1	11-16
46	Min travel lmt, Axis 1	11-17
47	Max travel lmt, Axis 1	11-17
48	Not homed, Axis 1	11-17
49	Homing: Cam too short, Axis 1	11-17
4A	Homing: No marker pulse, Axis 1	11-18
4B	Homing: Marker pulse pos., Axis 1	11-18
4C	Encoder fault, Axis 1	11-18
4D	Max. override, Axis 1	11-18
4E	Axis 1 not enabled	11-19
4F	Marker high, Axis 1	11-19
50	Target pos < lim, Axis 1	11-19
51	Target pos > lim, Axis 1	11-19
52	HOM - Command (not possible), Axis 1	11-20
70	Drive 2 not ready	11-15
71	Feed angle loss, Axis 2	11-15
72	Drive runaway, Axis 2	11-15
73	Excess Pos lag (following error), Axis 2	11-16
74	Abs. enc. error, Axis 2	11-16
75	Abs range error, Axis 2	11-16
76	Min travel lmt, Axis 2	11-17
77	Max travel lmt, Axis 2	11-17
78	Not homed, Axis 2	11-17
79	Homing: Cam too short, Axis 2	11-17
7A	Homing: No marker pulse, Axis 2	11-18
7B	Homing: Marker pulse pos., Axis 2	11-18
7D	Max. override, Axis 2	11-18
7E	Axis 2 not enabled	11-19
7F	Marker high, Axis 2	11-19
80	Target pos < lim, Axis 2	11-19
81	Target pos > lim, Axis 2	11-19
82	HOM - Command (not possible), Axis 2	11-20

Code #	Error Description	Page
A0	Drive 3 not ready	11-15
A1	Feed angle loss, Axis 3	11-15
A2	Drive runaway, Axis 3	11-15
A3	Excess Pos lag (following error), Axis 3	11-16
A4	Abs. enc. error, Axis 3	11-16
A5	Abs. range error, Axis 3	11-16
A6	Min travel lmt, Axis 3	11-17
A7	Max travel lmt, Axis 3	11-17
A8	Not homed, Axis 3	11-17
A9	Homing: Cam too short, Axis 3	11-17
AA	Homing: No marker pulse, Axis 3	11-18
AB	Homing: Marker pulse pos., Axis 3	11-18
AD	Max. override, Axis 3	11-18
AE	Axis 3 not enabled	11-19
AF	Marker high, Axis 3	11-19
B0	Target pos < lim, Axis 3	11-19
B1	Target pos > lim, Axis 3	11-19
B2	HOM - Command (not possible), Axis 3	11-20
D0	Drive 4 not ready	11-15
D1	Feed angle loss, Axis 4	11-15
D2	Drive runaway, Axis 4	11-15
D3	Excess Pos lag (following error), Axis 4	11-16
D4	Abs. enc. error ,Axis 4	11-16
D5	Abs. range error, Axis 4	11-16
D6	Min travel lmt, Axis 4	11-17
D7	Max travel lmt, Axis 4	11-17
D8	Not homed, Axis 4	11-17
D9	Homing: Cam too short, Axis 4	11-17
DA	Homing: No marker pulse, Axis 4	11-18
DB	Homing: Marker pulse pos., Axis 4	11-18
DD	Max. override, Axis 4	11-18
DE	Axis 4 not enabled	11-19
DF	Marker high, Axis 4	11-19
E0	Target pos < lim, Axis 4	11-19
E1	Target pos > lim, Axis 4	11-19
E2	HOM - Command (not possible), Axis 4	11-20

Fig. 11-2: Coded Error Messages

11.4 Error Descriptions

The following sections describe the error messages that appear on the CLM display.

General Error Messages

Code Number **00** = No Error Message
The CLM is in Manual or Automatic Mode.

Code Number **01** = No Error Message
The CLM is in Parameter Mode.

<p style="text-align: center;">I s I N V A L I D P a r a m e t e r A 1 0 0 M o d e A 1</p>
--

Code Number **02**

The specified parameter contains incorrect data.

- ⇒ The parameter value is too large.
- ⇒ The parameter value is too small.
- ⇒ The parameter value contains no decimal numbers or only partial decimal numbers.
- ⇒ The wrong firmware version was loaded to the CLM. If this firmware contains other or additional parameters, the correct values must be written to them. If the function of the parameter is unknown, or if the function is not required, generally the value `0` must be entered.

<p style="text-align: center;">E M E R G E N C Y S T O P E M E R G E N C Y S T O P</p>
--

Code Number **03**

- ⇒ The `EMERGENCY STOP` signal at Connector X3/Pin 3 is missing or was briefly interrupted.

<p style="text-align: center;">E r r o r B a t t e r y i s l o w !</p>
--

Code Number **04**

- ⇒ The battery is low and must be recharged. For this reason, the battery should be charged for at least 40 hours.

E r r o r
P a r a m e t e r s l o s t

Code Number **05**

The contents of one or more parameters have been altered without new data input by the user.

⇒ The contents of all parameters must be checked.

Note: This error can be cleared automatically by exiting Parameter Mode.

E r r o r
P r o g r a m l o s t

Code Number **06**

The contents of one or more program instructions have been altered without new data input by the user.

The contents of all program instructions used must be checked.

E r r o r
D i v i s i o n b y z e r o

Code Number **07**

- Contact Rexroth Customer Service!

⇒ Division by zero in the MAT command.

⇒ In the conversion of the parameter data, a division by zero occurred. The validity of all parameters must be checked.

E r r o r
I n v a l i d M o d e !

Code Number **08**

Parameter Mode and Automatic Mode were preselected at the same time.

E r r o r
I n v a l i d P r g C m d

Code Number **0A**

While executing the user program, the CLM has reached an instruction that contains erroneous data.

⇒ The data instruction contains an invalid command or invalid data.

E r r o r
J S R N e s t i n g

Code Number **0B**

The nesting for subroutine programming exceeds 127 levels.

⇒ Check the program.

⇒ It is possible that a `JSR` command was programmed without an `RTS`.

E r r o r
R T S N e s t i n g

Code Number **0C**

The nesting for subroutine programming is less than 0 levels.

⇒ Check the program.

⇒ It is possible that a `RTS` command was programmed without an `JSR`.

E r r o r
B C D I n p u t e r r o r

Code Number **0D**

Erroneous `BIC` command

⇒ The bit pattern of the programmed bits in the BIC command does not have the BCD format.

E r r o r
I n v a l i d B l o c k #

Code Number **0E**

The program instruction number is greater than 2999.

⇒ A program task in progress arrived at instruction number 3000.


⇒ The instruction number of a calculated program jump in the `BIC` command was too large.




⇒ In a program instruction that indicates the target instruction, the target instruction contains invalid characters.

S y s t e m F a i l u r e ! C o d e # E X C P X X
--

Code Number **10** - Contact Rexroth Customer Service!

A significant error occurred.
 ⇒ The external wiring must be checked.

Note: If this error has not yet been cleared using the  key, more details can be specified for troubleshooting by Customer Service. To do this, proceed as follows:

- 1) Press  on the CLM keypad.
 - 2) Take note of the code `XX`.
 - 3) Write down all information that appears by pressing the  or  keys.
 - 4) Clear the error.
 - 5) Take note of the firmware version that appears on the CLM display.
-

S y s t e m F a i l u r e ! C o d e # S T K O V F
--

Code Number **11** - Contact Rexroth Customer Service!

Serious internal error. Stack overflow, pseudo exception.
 ⇒ A firmware error may be present.

S y s t e m F a i l u r e ! C o d e # I R Q O V L
--

Code Number **11**

Serious internal error. Interrupt overlap, pseudo exception.
 ⇒ The internal timing of the CLM has been exceeded. The cycle time in Parameter B010 may need to be incremented by one level.

S y s t e m F a i l u r e ! C o d e # E P R O M
--

Code Number **11** - Contact Rexroth Customer Service!

Serious internal error. Loss of EPROM data, pseudo exception.
 ⇒ The data in the EPROM have changed. Operation is no longer possible. The EPROM must be replaced.

E r r o r
I D S B r e a k - E r r o r

Code Number 12

The reception from the `IDS01` decade switch has been interrupted.

- ⇒ The cable connections must be checked.
- ⇒ The maximum cable length is 15 m.

E r r o r
I D S C h e c k s u m E r r

Code Number 13

The reception from the `IDS01` decade switch has been disrupted. An erroneous checksum was received.

- ⇒ The cable connections must be checked.
- ⇒ The maximum cable length is 15 m.

E r r o r
I D S C h a r F o r m a t

Code Number 14

The reception from the `IDS01` decade switch has been disrupted. The format of the received data is incorrect.

- ⇒ The cable connections must be checked.
- ⇒ The maximum cable length is 15 m.

E r r o r
A x i s N o . f a l s e

Code Number 16

A command was called in the program, which contained an axis number not equal to 1-4.

- ⇒ Check the program.

E r r o r
H a r d w . A x i s 3 & 4

Code Number 17

Axis 3 or 4 is enabled in Parameter B000 and the corresponding parameter instructions for Axis 3 or 4 are programmed, but the 4-axis expansion is not present.

```

      E r r o r
C L M  + / -  1 5  V o l t s

```

Code Number **19**

- Contact Rexroth Customer
Service!

There is a serious internal error. The internal ± 15 Volt monitoring has been initiated. Operation is no longer possible.

```

      E r r o r
R E P   C o m m a n d

```

Code Number **1A**

A `REP` command was placed directly after an `SRM` command, but a different axis number was programmed in the `REP` command than in the `SRM` command.

```

      E r r o r
S A C   C o m m a n d

```

Code Number **1B**

An `SAC` command was called.

- ⇒ `Controlled Axis` is selected as the encoder type in Parameter Ax20.
- ⇒ An invalid mode is programmed in the `SAC` command.

```

      E r r o r
C o m m a n d   I / O

```

Code Number **1D**

A command with an invalid input, output or marker number was called.

- ⇒ Check the programmed input, output and marker numbers.

```

      E r r o r
V C C   C o m m a n d

```

Code Number **1E**

A `VCC` command was called.

- ⇒ The axis is being operated in `Rotary Table` Mode and the programmed switching point in the `VCC` command is negative.

E r r o r V a r . N o . i l l e g a l
--

Code Number **1F**

An `SRP` command was called.

⇒ The start point of the variable field is less than 600 or greater than 990.

E r r o r I n c . E n c . X f a u l t y
--

Code Number **2C**

Incremental Encoder 1 - Axis 1

Code Number **2D**

Incremental Encoder 2 - Axis 2

Code Number **2E**

Incremental Encoder 3 - Axis 3

Code Number **2F**

Incremental Encoder 4 - Axis 4

Code Number **30**Incremental Encoder 5 -
Measuring Wheel

The output signals of the incremental encoders are monitored by the CLM's electronic evaluation feature (Track Monitoring). If one or more of these signals are missing, this error message is issued.

⇒ Check the encoder.

⇒ Check the encoder cable.

⇒ Check the encoder cable wiring for any kinks.

Note: Monitoring is only performed for encoders that have an assigned function.

E r r o r W r i t e S y s . - V a r .
--

Code Number **31** Write attempt of an NC command to a
Variable < 600

E r r o r V a r i a b l e V a l u e
--

Code Number **32** Erroneous variable value during execution
of the command

During the execution of a command, the content of a variable is accessed. The content is checked against correctly functioning values in the command:

- too large
- operational sign
- integer value

E r r o r
F i e l d b u s
x x

Code Number **33**

Fieldbus Hardware

xx:

- 0 = No Error
- 1 = Flash Erase Error
- 2 = Verify Error
- 3 = Programming Error
- 4 = Wrong Hardware
- 5 = Card Missing
- FF = Timeout

E r r o r
F i e l d b u s I n i t
x x

Code Number **34**

Fieldbus Initialization

xx:

- 0 = No Error
- F0 = Timeout, Initialization command could not be transmitted.
- F1 = Timeout, Initialization command was not cleared
- F2 = Fieldbus Parameter Error
- F3 = No valid fieldbus data
- F4 = Initialization command was not issued.

E r r o r
M i s s i n g E O S C m d

Code Number **35**

`EOS` command missing during `Flying Cutoff`

The processing program did not end with the `EOS` command.

E r r o r
N o t H o m e p o s i t i o n

Code Number **36**

Error message during `Flying Cutoff`
When switching from Manual to Automatic Mode, the axis was not in its original position.

E r r o r
F i e l d b u s T i m e o u t

Code Number **37**

Cyclic transmission of the process data via the fieldbus is monitored. The CLM has not received a new telegram during the maximum cycle time (Variable V046).

E r r o r L o g i c P r g . E r r o r
--

Code Number **38**

Logic Task Program Error

- ⇒ An invalid command is programmed in the Logic Task.
 - ⇒ An invalid input, output or marker number is programmed in the Logic Task.
 - ⇒ No `END` command is programmed in the Logic Task.
- The positioning of the parentheses is wrong in the Logic Task.

E r r o r L o g i c P r g . L o s t
--

Code Number **39**

= Logic Task Program Lost

The contents of one or more Logic Task program instructions have been altered without new data input by the user.

- ⇒ The contents of all Logic Task program instructions used must be checked.

E r r o r I n d e x L e n g t h
--

Codenummer **3A**

During 'Flying Cutoff,' after the last manual cut, more material was fed through the processing location than the currently pre-set part length in the instruction.

E r r o r R a p i d S t o p
--

Codenummer **3B**

During 'Flying Cutoff,' a signal was applied at the input 'Rapid Stop' (Parameter A136) in Automatic Mode.

E r r o r M a x S t r o k e L i m i t
--

Codenummer **3C**

During 'Flying Cutoff,' the maximum stroke (Parameter A137) is targeted in Automatic Mode.

E r r o r
I / O - N o . i l l e g a l

Codenummer **3D**

The number of bits to be copied in the 'CIO' command is greater than 32.

Error Messages for Axes 1 to 4

The designation 'X' stands for the affected axis 1 through 4.

E r r o r D r i v e X n o t r e a d y
--

Code Number for	Axis 1 = 40
	Axis 2 = 70
	Axis 3 = A0
	Axis 4 = D0

Automatic Mode is selected (Connector X3/Pin 2) and the input signal 'Enable Axis X' is missing.

E r r o r F e e d A n g l e L o s s X
--

Code Number for	Axis 1 = 41
	Axis 2 = 71
	Axis 3 = A1
	Axis 4 = D1

The signal at the input 'Feed Angle Monitoring' (Parameter Ax15) dropped off during a move on Axis X.

E r r o r D r i v e R u n a w a y A X
--

Code Number for	Axis 1 = 42
	Axis 2 = 72
	Axis 3 = A2
	Axis 4 = D2

The position control loop signals a positive feedback (see Parameter Ax14).

- ⇒ The designated direction for position detection (encoder) and/or for the analog output are opposite of the cable connection. Check cable connection and/or change designated direction in Parameter Ax21.
- ⇒ External forces have pushed the axis too far beyond its target position.
- ⇒ The cable connection of the analog output has been interrupted and the axis drifts from its command position.
- ⇒ The encoder resolution input in the control (Parameter Ax19) is smaller than the actual encoder resolution.
- ⇒ The relationship of maximum velocity/voltage (Parameter Ax12) does not correspond to the values of the drive controller.
- ⇒ The selected position monitoring window is too small for the application. The standard value is 10%.
- ⇒ The drive cannot reach the velocity command value and overshoots when the movement direction is changed.

E r r o r
E x c e s s P o s L a g X

Code Number for	Axis 1 = 43
	Axis 2 = 73
	Axis 3 = A3
	Axis 4 = D3

The position control loop signals an excessive position lag (see Parameter Ax14).

- ⇒ The axis does not execute a started positioning command, because:
 - 1) the encoder cable is not connected
 - 2) the encoder cable is defective or the wrong cable
 - 3) the encoder is defective.
- ⇒ The cable connection of the analog output is interrupted.
- ⇒ The encoder resolution programmed in the control (see Parameter Ax19) is larger than the actual encoder resolution.
- ⇒ The relationship of maximum velocity/voltage (Parameter Ax12) does not correspond to the values of the drive controller.
- ⇒ The selected position monitoring window is too small for the application. The standard value is 10%.
- ⇒ The drive cannot reach the velocity command value, because:
 - 1) the motor has too little power
 - 2) the input for acceleration (see Parameter Ax008/Ax09) was set too high.
- ⇒ The signal `Drive Enable Axis X` does not reach the drive.

E r r o r
A b s . E n c . E r r o r X

Code Number for	Axis 1 = 44
	Axis 2 = 74
	Axis 3 = A4
	Axis 4 = D4

No absolute encoder is connected, or data transmission from the encoder to the CLM is interrupted.

- ⇒ The cable connections must be checked.

E r r o r
A b s . R a n g e E r r o r X

Code Number for	Axis 1 = 45
	Axis 2 = 75
	Axis 3 = A5
	Axis 4 = D5

Values are outside the measuring range of the absolute encoder for Axis X. The value is less than the encoder value `0` or greater than the maximum number of encoder revolutions (see Parameter Ax19/Ax20).

- ⇒ Check the set encoder type (single-turn or multi-turn encoder).
- ⇒ Check the input value for `Absolute Encoder Data Bits` in Parameter Ax20.
- Caution: There are two different types of Stegmann encoders, type AG100MSSI!
 - 1) AG100MSSI 4096***512** - **21** data bits must be entered in Parameter Ax20.
 - 2) AG100MSSI 4096***4096** - **24** data bits must be entered in Parameter Ax20.
- ⇒ The maximum number of encoder revolutions is less than the number set in Parameter Ax19.

E r r o r				
M i n	T r a v e l	L m t	X	

Code Number for

- Axis 1 = **46**
- Axis 2 = **76**
- Axis 3 = **A6**
- Axis 4 = **D6**

In Automatic Mode, the value is less than the minimum travel limit (see Parameter Ax03).

⇒ Check program. The target position for a positioning command may be outside the travel limit range.

Note: For operation with an absolute encoder, the axis can be moved back within the travel range in Manual Mode, after an error is cleared using the `Jog forward` input.

E r r o r				
M a x	T r a v e l	L m t	X	

Code Number for

- Axis 1 = **47**
- Axis 2 = **77**
- Axis 3 = **A7**
- Axis 4 = **D7**

In Automatic Mode, the value exceeds the maximum travel limit (see Parameter Ax04).

⇒ Check program. The target position for a positioning command may be outside the travel limit range.

Note: For operation with an absolute encoder, the axis can be moved back within the travel range in Manual Mode, using the `Jog reverse` input after an error is cleared.

E r r o r				
A x i s	X	n o t	H o m e d	

Code Number for

- Axis 1 = **48**
- Axis 2 = **78**
- Axis 3 = **A8**
- Axis 4 = **D8**

In the program, a command was called that requires an axis with an absolute reference point.

⇒ The following commands are affected: POA, PSA, VCC.

⇒ Before calling these commands, the axis must be designated as absolute (see `Homing` and Parameters Ax23 to Ax25).

E r r o r				
C a m	t o o	s h o r t	X	

Code Number for

- Axis 1 = **49**
- Axis 2 = **79**
- Axis 3 = **A9**
- Axis 4 = **D9**

No marker pulse was found for the encoder in the homing routine.

⇒ The home switch cam is too short. The cam must reach one end of the travel distance (see `Homing`).

E r r o r
No m a r k e r p u l s e X

Code Number for

Axis 1 = **4A**

Axis 2 = **7A**

Axis 3 = **AA**

Axis 4 = **DA**

No marker pulse was detected within one revolution of the encoder during the homing routine. (see `Homing`).

- ⇒ Check the cable connection, to verify whether the marker pulse signals might be inverted or the marker pulse is not connected.
- ⇒ The encoder does not issue a marker pulse.

E r r o r
M r k r P u l s e P o s A X

Code Number for

Axis 1 = **4B**

Axis 2 = **7B**

Axis 3 = **AB**

Axis 4 = **DB**

In the homing routine, it has been determined that the distance between the marker pulse for the incremental encoder and the edge of the homing switch cam is less than 1/16 revolution or greater than 15/16 revolution.

E r r o r
E n c o d e r F a u l t A X

Code Number for

Axis 1 = **4C**

Axis 2 = **7C**

`Measuring Wheel Operating Mode` is active, but no repositioning by the measuring wheel occurred.

- ⇒ Check if the measuring wheel fails to turn while the drive encoder turns.
- ⇒ If pulses are missing, check the cable connections to the measuring wheel encoder.
- ⇒ Eliminate any slip between material and measuring wheel.
- ⇒ Check the designated direction of the measuring wheel encoder.
- ⇒ Check the parameter settings for the measuring wheel encoder and/or the motor encoder.
- ⇒ Check feed constants.

E r r o r
M a x . O v e r r i d e A X

Code Number for

Axis 1 = **4D**

Axis 2 = **7D**

Axis 3 = **AD**

Axis 4 = **DD**

An override was programmed using the `VEO` command. The default is set by the master encoder 1. The override velocity is significantly larger than the maximum possible velocity of the axis.

- ⇒ Check programming of the `VEO` command and, possibly, the `FOL` command.
- ⇒ Check the master encoder 1 parameters (C000 to C003).

E r r o r A X n o t e n a b l e d
--

Code Number for

- Axis 1 = **4E**
- Axis 2 = **7E**
- Axis 3 = **AE**
- Axis 4 = **DE**

In the program, a command was called for an axis that was not enabled.

- ⇒ The axis is not enabled in Parameter B000.
- ⇒ The axis has been disabled using the `!sMxOFF_\$hhCrLf` interface command.

E r r o r M a r k e r h i g h A X
--

Code Number for

- Axis 1 = **4F**
- Axis 2 = **7F**
- Axis 3 = **AF**
- Axis 4 = **DF**

Error message during a homing routine.

- ⇒ The encoder marker pulse is continuously active, which makes homing impossible.
- ⇒ Check the cable connection, to verify whether the marker pulse signals might be inverted or the marker pulse is not connected.
- ⇒ The encoder does not issue a marker pulse.

E r r o r T a r g e t P o s < L i m X

Code Number for

- Axis 1 = **50**
- Axis 2 = **80**
- Axis 3 = **B0**
- Axis 4 = **E0**

In the program, a positioning command was invoked for which the absolute position value is less than the minimum travel limit value.

- ⇒ The following commands are affected: POA and PSA
- ⇒ Check the program and the travel limits (Parameters Ax03 and Ax04).

E r r o r T a r g e t P o s > L i m X

Code Number for

- Axis 1 = **51**
- Axis 2 = **81**
- Axis 3 = **B1**
- Axis 4 = **E1**

In the program, a positioning command was invoked for which the absolute position value is greater than the maximum travel limit value.

- ⇒ The following commands are affected: POA and PSA
- ⇒ Check the program and the travel limits (Parameters Ax03 and Ax04).

	E r r o r	
H O M	C o m m a n d	A X

Code Number for

Axis 1 = **52**Axis 2 = **82**Axis 3 = **B2**Axis 4 = **E2**

A homing routine was invoked using the `HOM` command. Homing is not possible.

⇒ Check Parameters Ax23 to Ax25.

⇒ Homing using position detection via the absolute encoder is not possible.

12 Dimensions, Accessories and Typecodes

12.1 CLM 1.4 Dimensions and Connector Layout

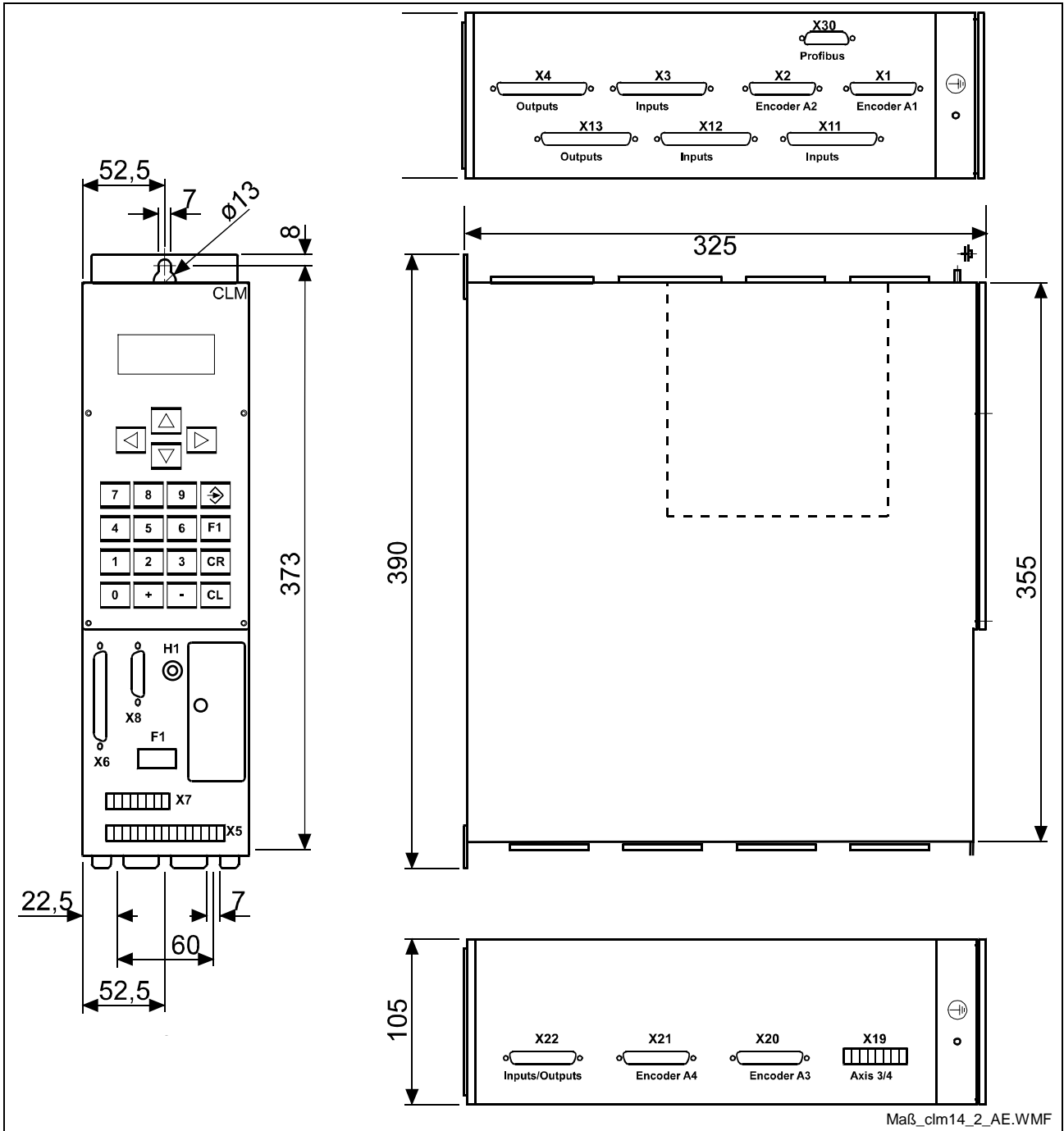


Fig. 12-1: CLM 1.4 Dimensions and Connector Layout

12.2 Separately mounted Keypad (CTA)

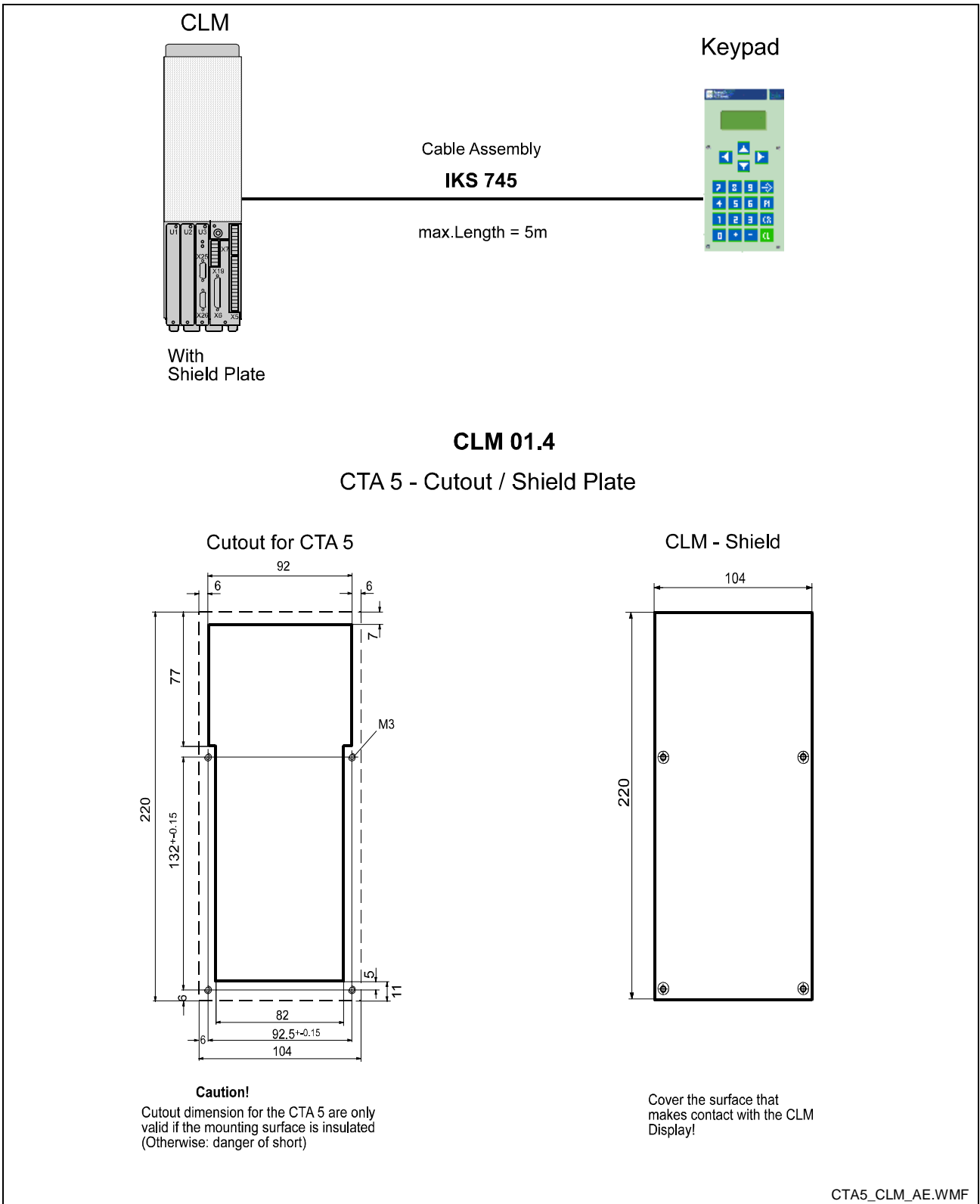


Fig. 12-2: Separately mounted Keypad

12.3 IDS01 Decade Switch Dimensions

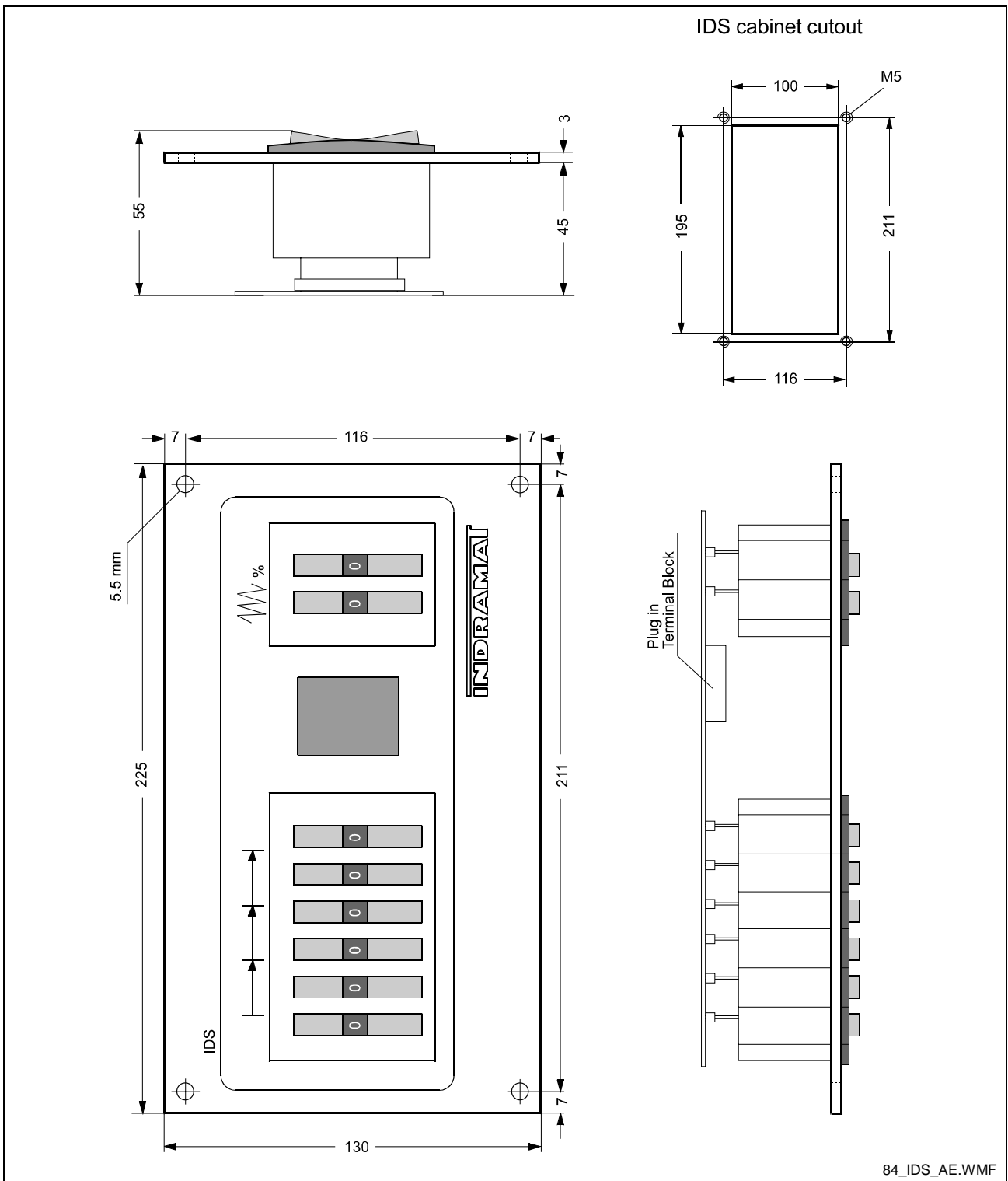


Fig. 12-3: IDS01 Decade Switch Dimensions

12.4 CLM 1.4 Accessories

CLM 1.4 Basic Equipment (2-Axis)

Type of Connected Accessories	Contents of Connected Accessories, Connector No.:
E 1 - CLM	1 3 4 5 6 7
E 2 - CLM	1* 3 4 5 6 7
E 3 - CLM	2 5 6 7
E 4 - CLM	5 6 7
E 5 - CLM	5 7
E 6 - CLM	1 2 3 4 5 6 7
E 7 - CLM	1* 2 3 4 5 6 7

Fig. 12-4: CLM 1.4 Accessories

CLM 1.4 with I/O Expansion (2-Axis)

Type of Connected Accessories	Contents of Connected Accessories, Connector No.:
E 8 - CLM	1 3 4 5 6 7 11 12 13
E 9 - CLM	1 2 3 4 5 6 7 11 12 13
E 10 - CLM	1* 3 4 5 6 7 11 12 13
E 11 - CLM	1* 2 3 4 5 6 7 11 12 13

L: Connector No. 11 to 13: for Expansion of Inputs/Outputs

Fig. 12-5: CLM 1.4 Accessories

CLM 1.4 (4-Axis) with/without I/O Expansion

Type of Connected Accessories	Contents of Connected Accessories, Connector No.:
E 12 - CLM	1 2 3 4 5 6 7 19 20 21 22
E 13 - CLM	1 2 3 4 5 6 7 11 12 13 19 20 21 22
E 14 - CLM	5 6 7 19
E 15 - CLM	5 7 19
E 16 - CLM	1* 2 3 4 5 6 7 19 20 21 22
E 17 - CLM	1* 2 3 4 5 6 7 11 12 13 19 20 21 22

L: Connector No. 19 to 22: for Axes 3 & 4

Fig. 12-6: CLM 1.4 Accessories

Connectors designated with an `*` have two outgoing feeder cables.

12.5 CLM 1.4 Typecodes

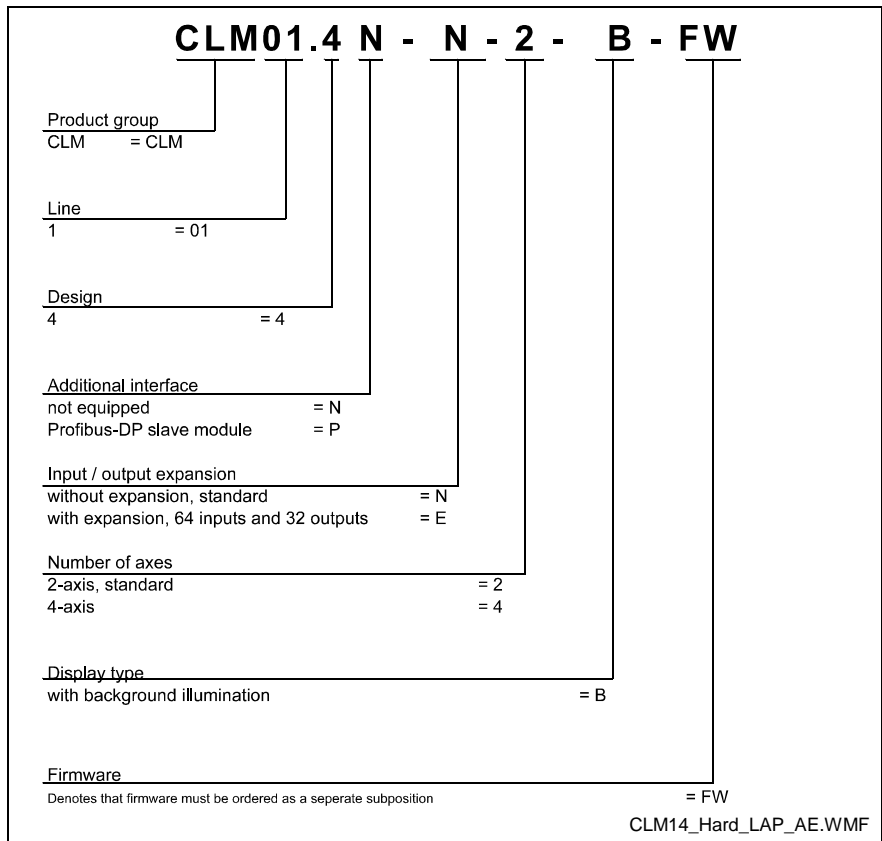


Fig. 12-7: CLM1.4 Hardware Typecodes

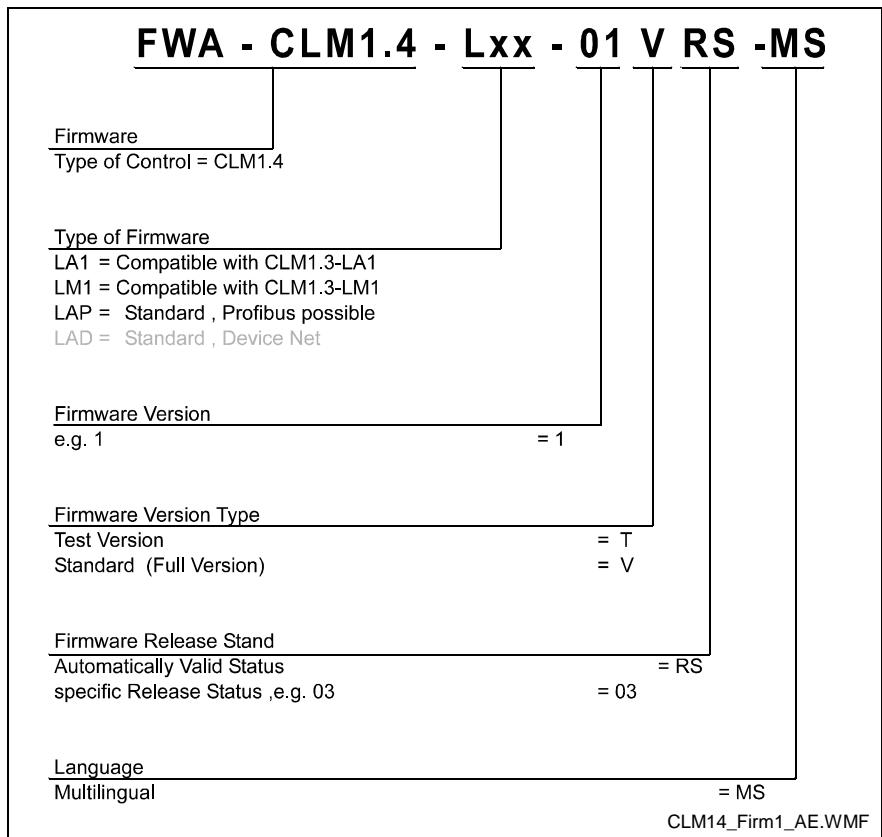


Fig. 12-8: CLM1.4 Firmware Typecodes

12.6 IDS01 Decade Switch Typecodes

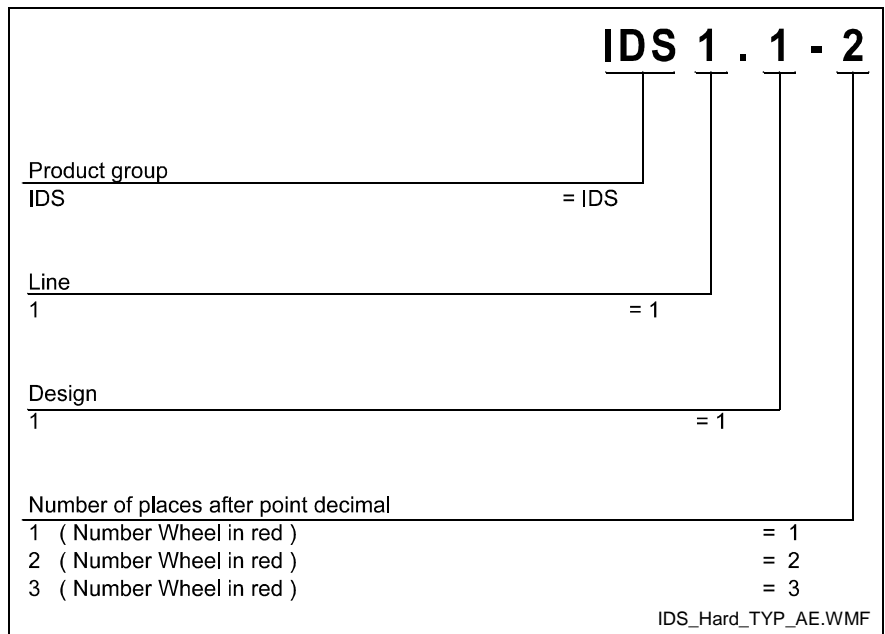


Fig. 12-9: IDS01 Decade Switch Typecodes

13 Terminal Connection Diagrams

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13.2 Power Supply and System Signals for Axes 1 and 2

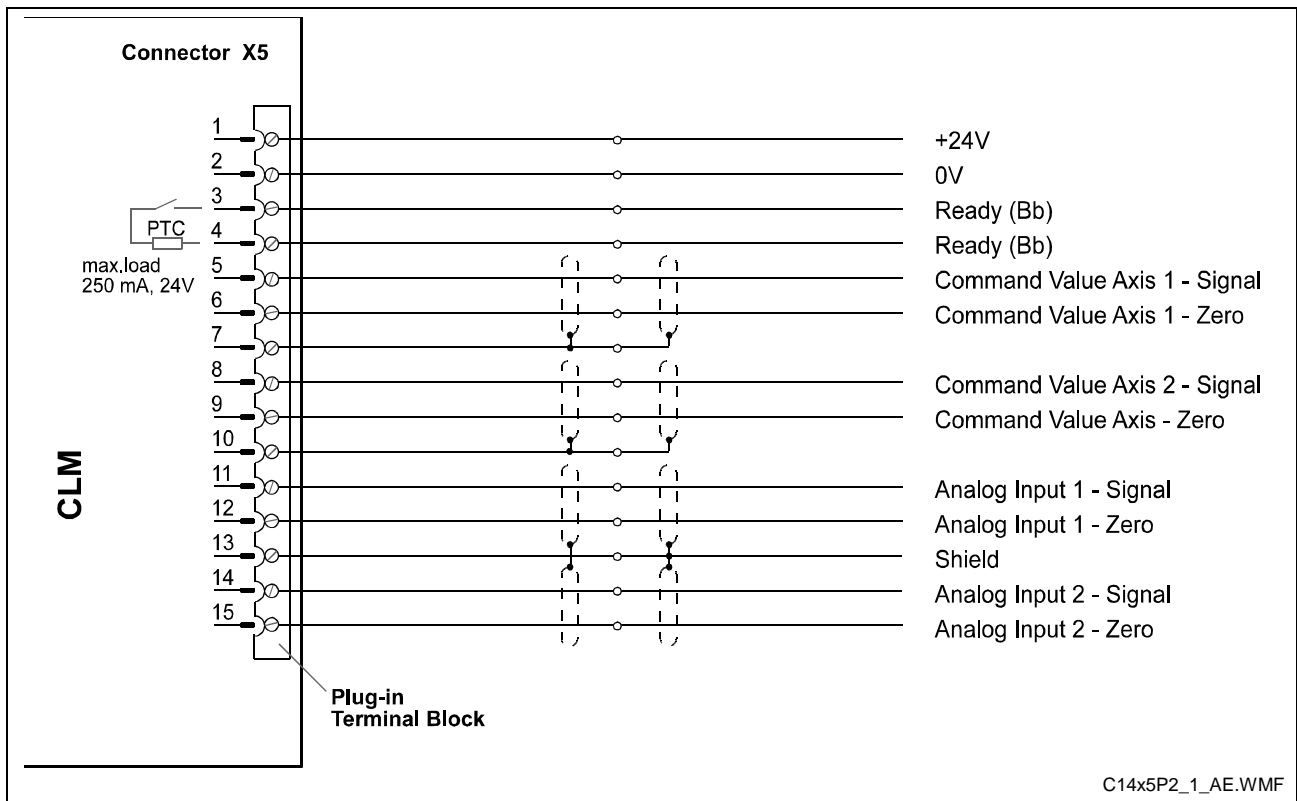


Fig. 13-1: Connector X5 - Power Supply and System Signals, A1 & 2

13.3 System Signals for Axes 3 and 4

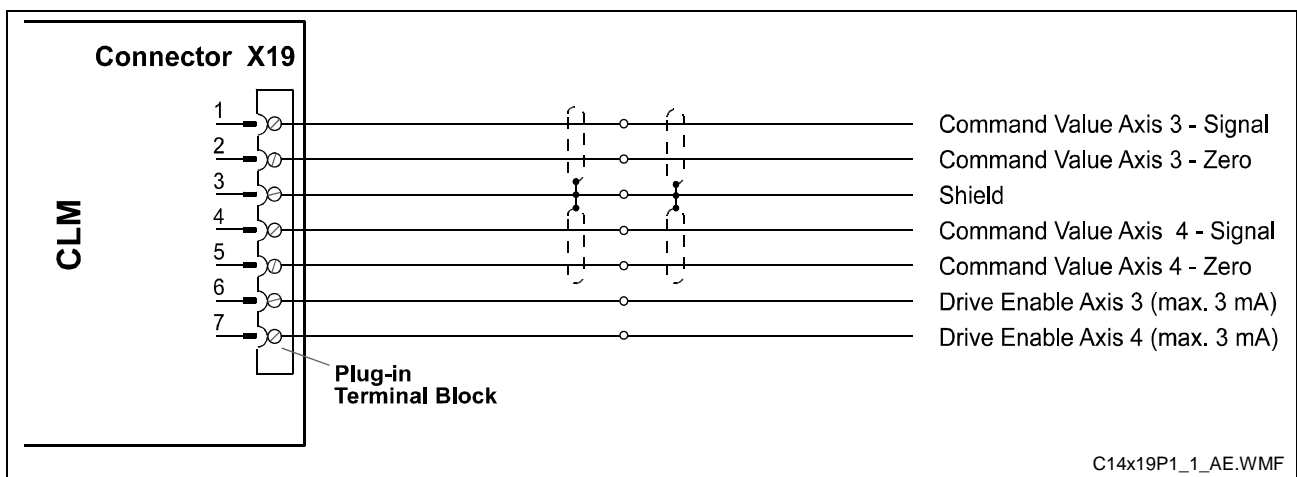


Fig. 13-2: Connector X19 - System Signals, A3 & 4

13.4 System Signals for Axes 1 to 4

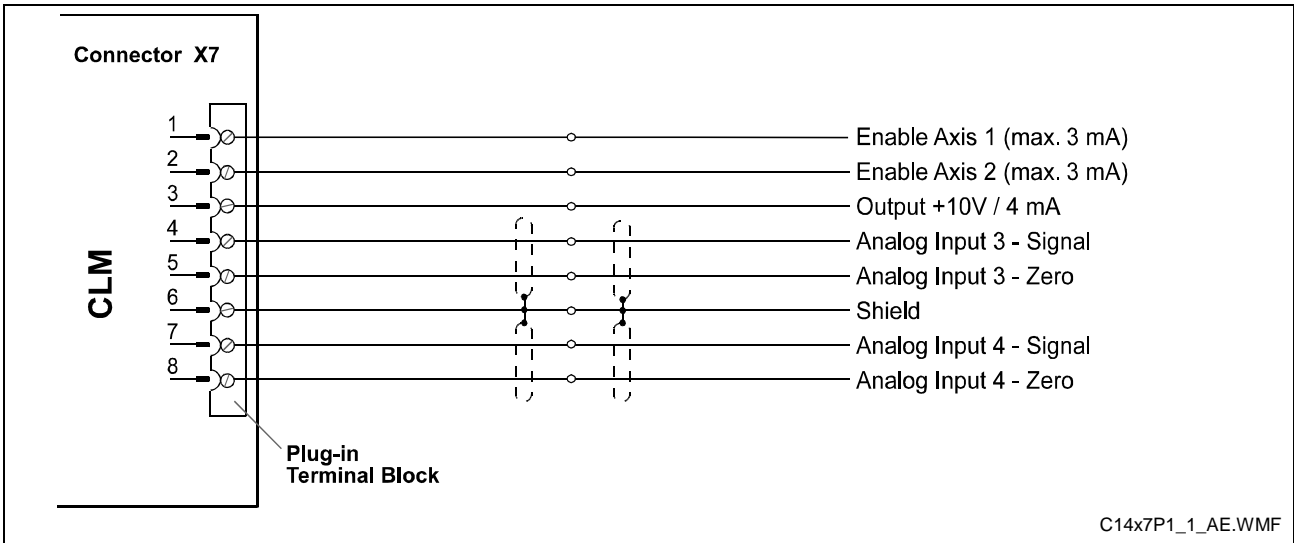


Fig. 13-3: Connector X7 - System Signals A1 to A4

13.5 Data Interface - Serial Channel A

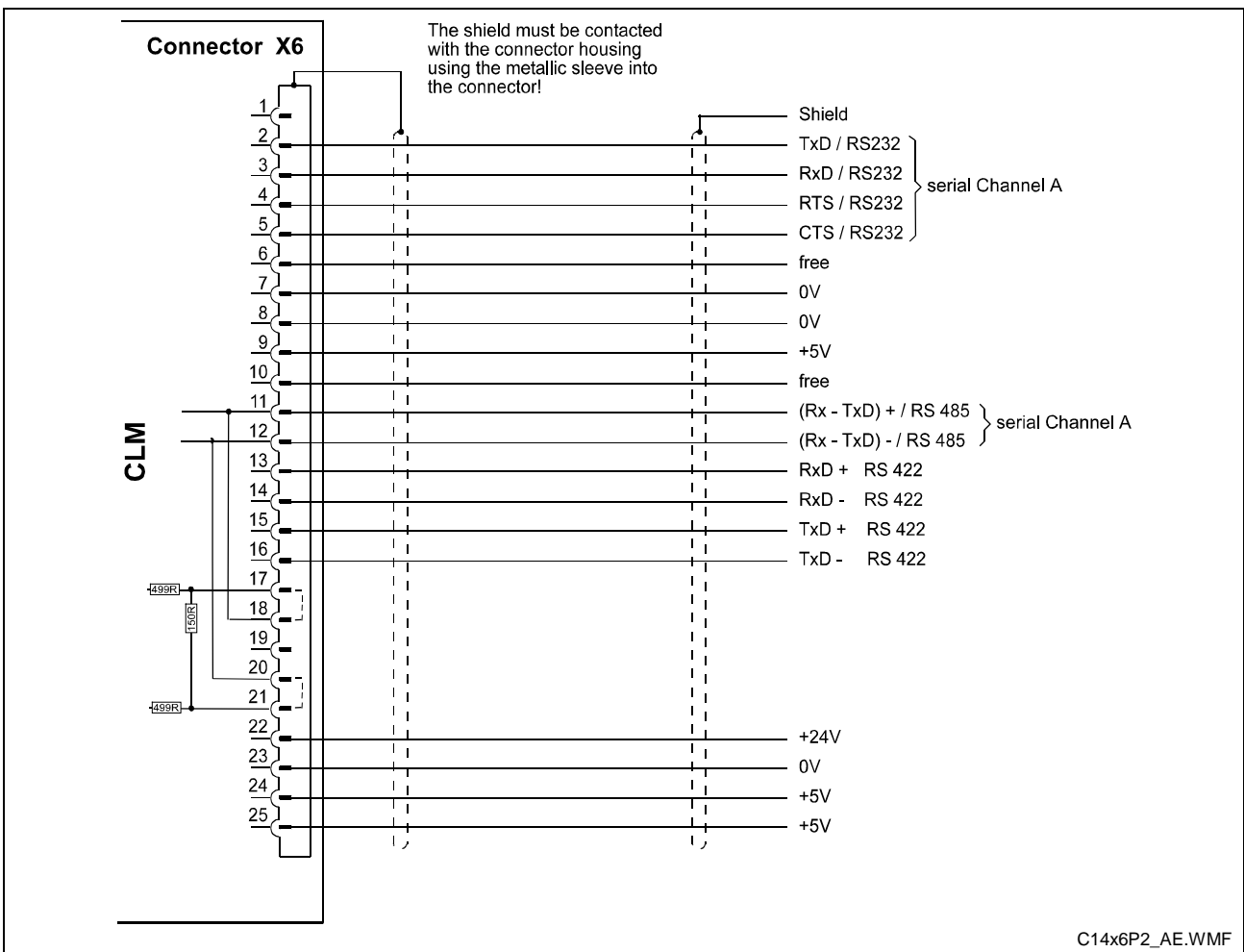


Fig. 13-4: Connector X6 - Data Interfaces, General Overview

13.6 RS232C/RS485 Data Interface - Serial Channel A

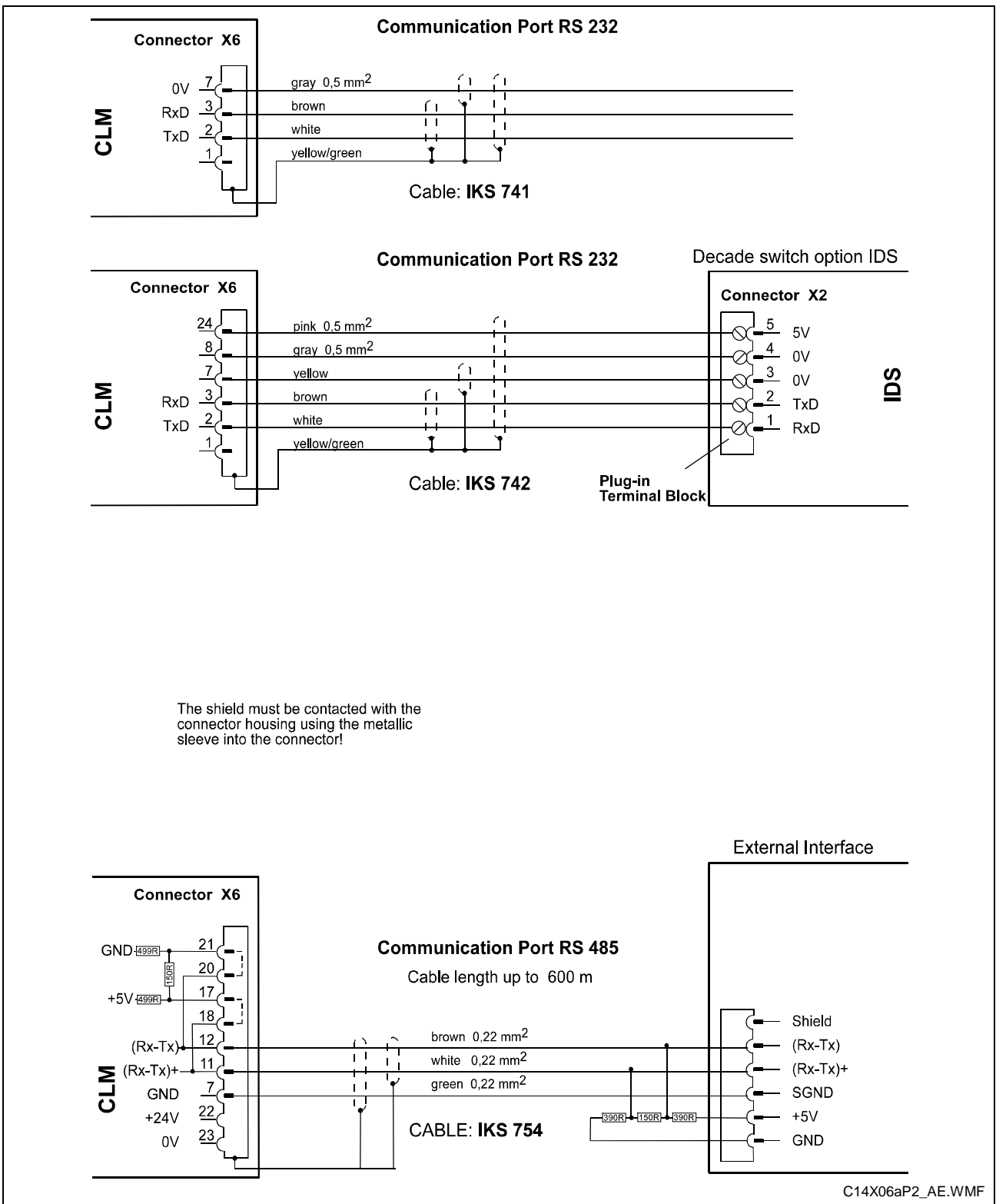


Fig. 13-5: Connector X6 - RS232C/RS485 Data Interface – Serial Channel A

13.7 RS485 Data Interface - Serial Channel A

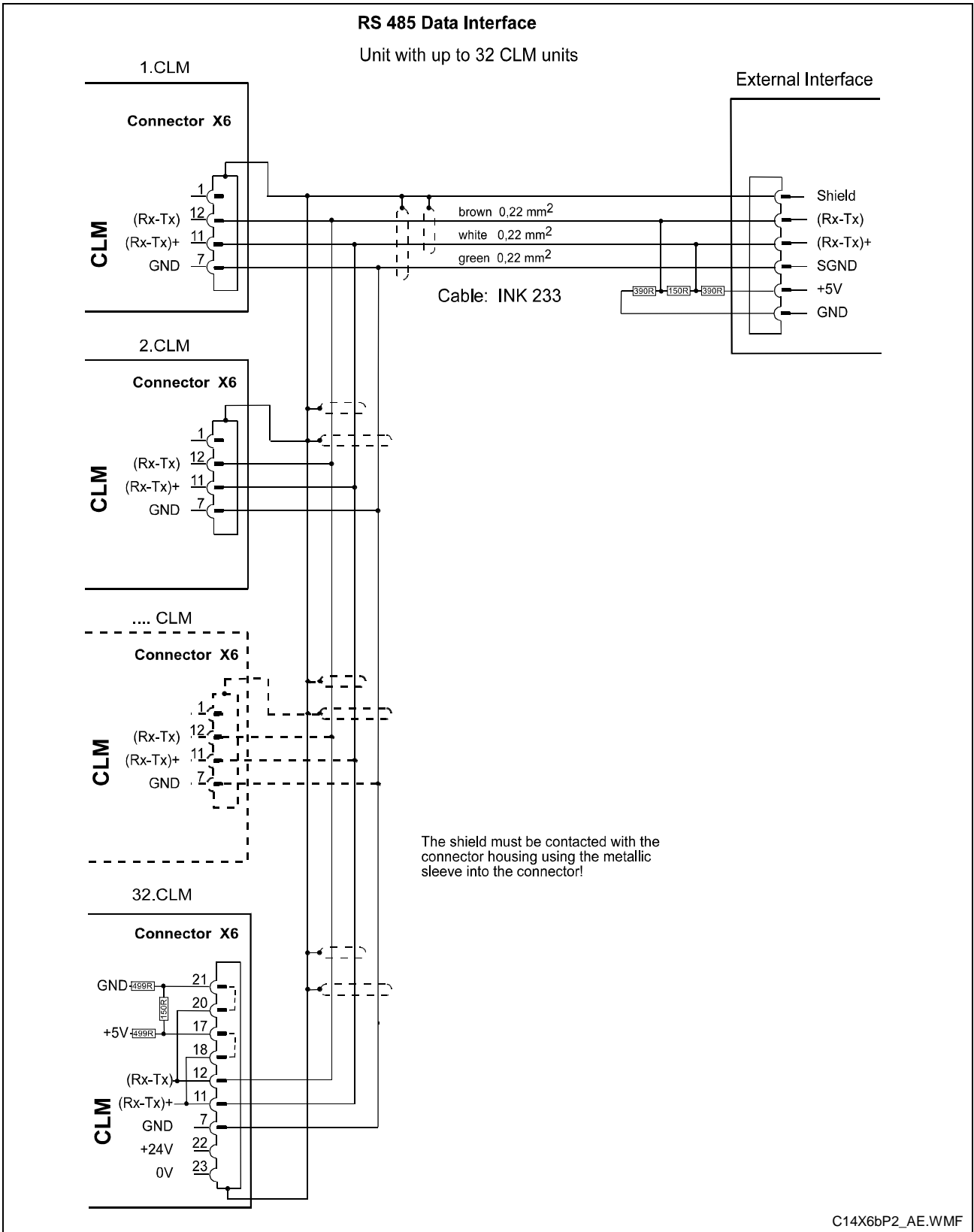


Fig. 13-6: Connector X6 - RS485 Data Interface - Serial Channel A

13.8 RS232C/RS485 Data Interface - Serial Channel B

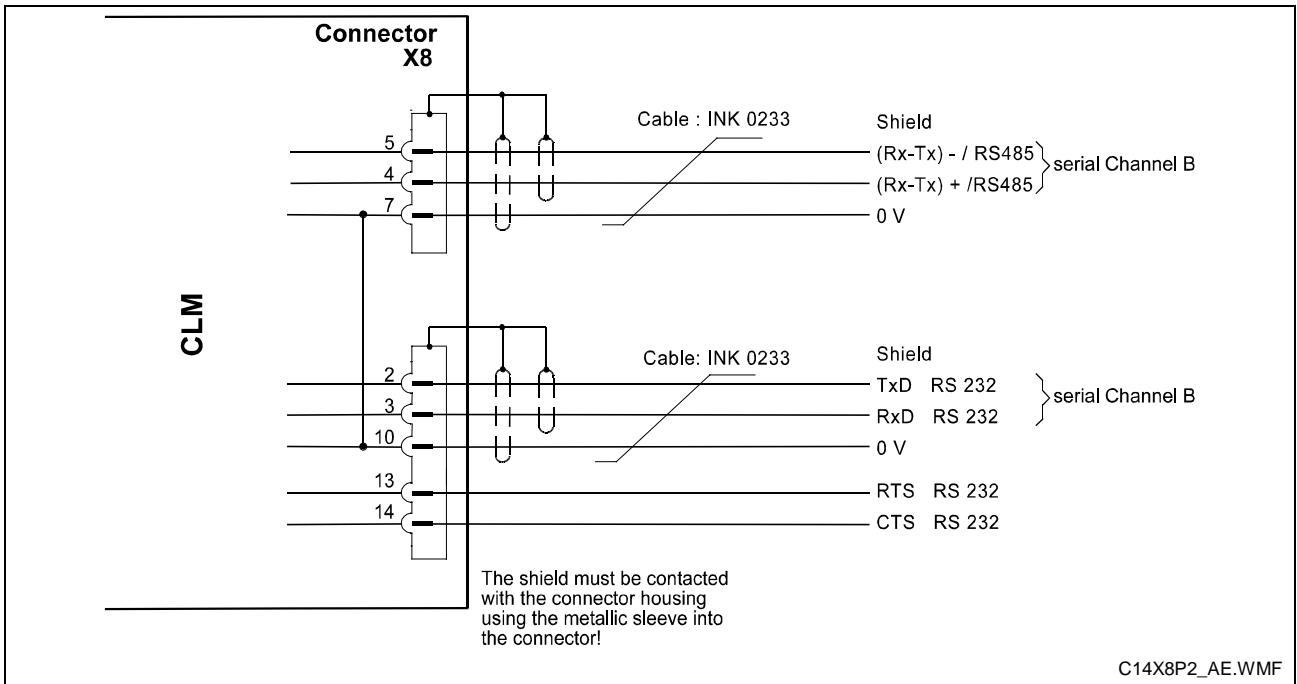


Fig. 13-7: Connector X8 - RS232C/RS485 Data Interface – Serial Channel B

13.9 Axis 1 Encoder Inputs

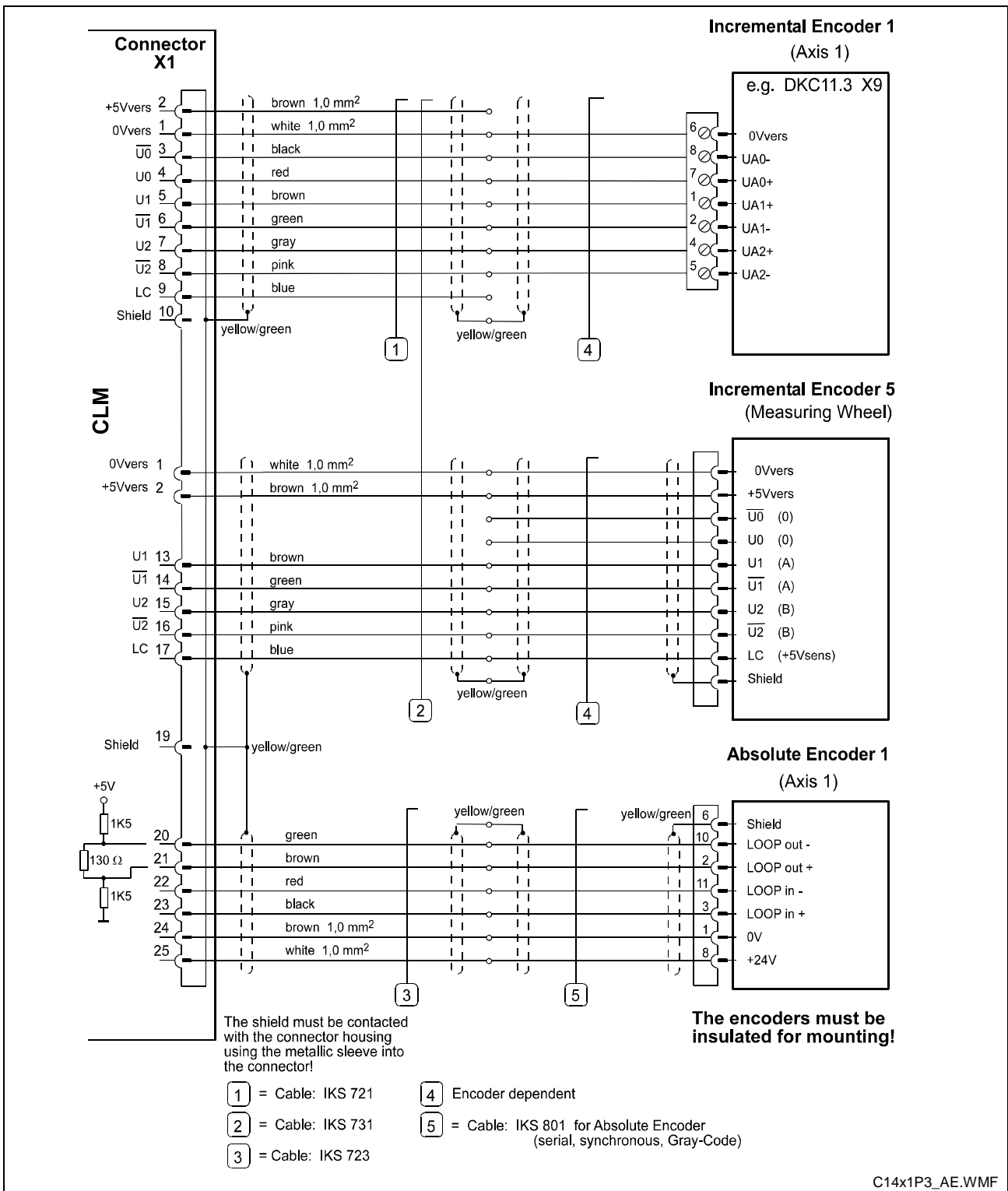


Fig. 13-8: Connector X1 - Axis 1 Encoder Inputs

13.10 Axis 2 Encoder Inputs

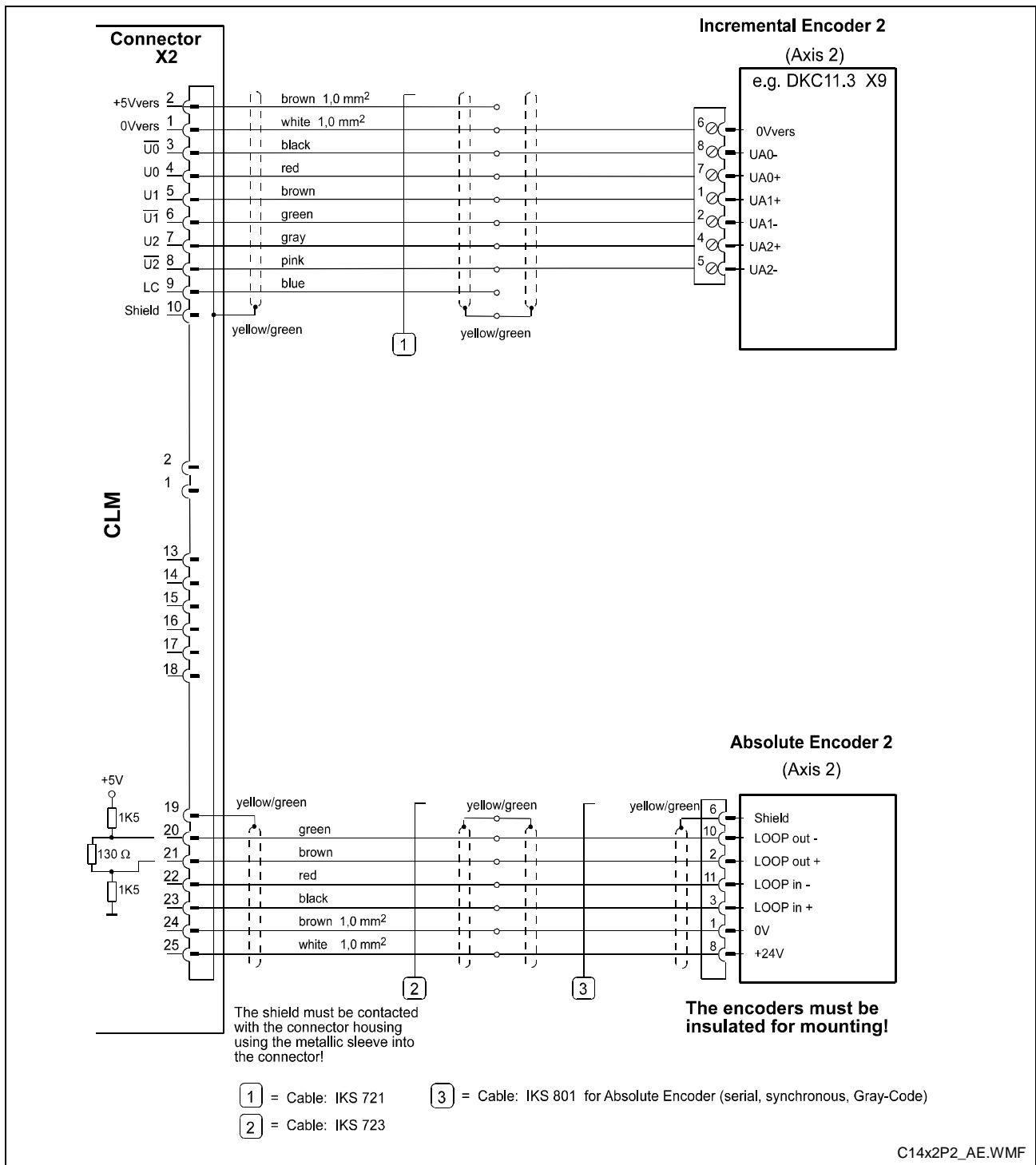


Fig. 13-9: Connector X2 - Axis 2 Encoder Inputs

13.11 Axis 3 Encoder Inputs

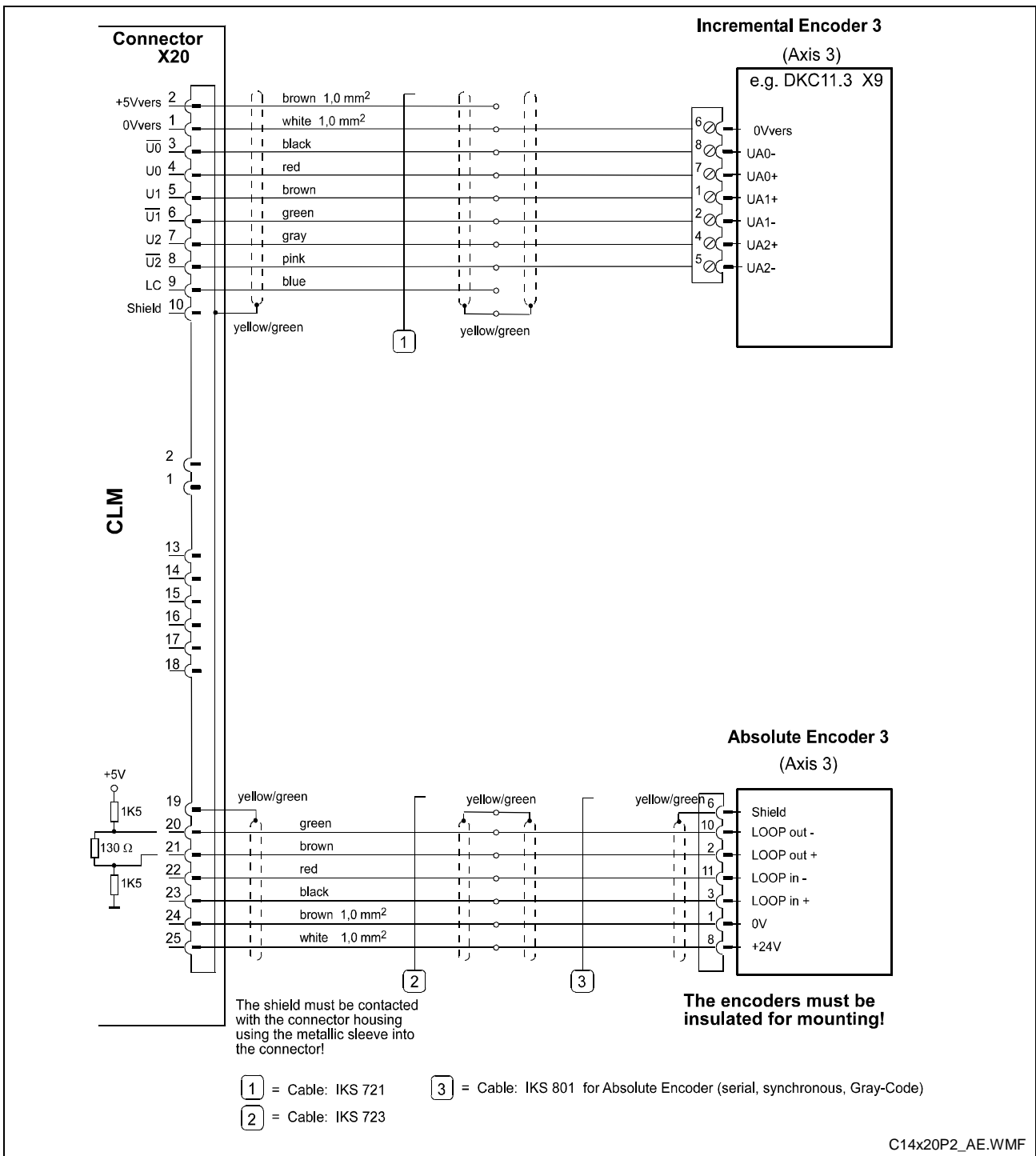


Fig. 13-10: Connector X20 - Axis 3 Encoder Inputs

13.12 Axis 4 Encoder Inputs

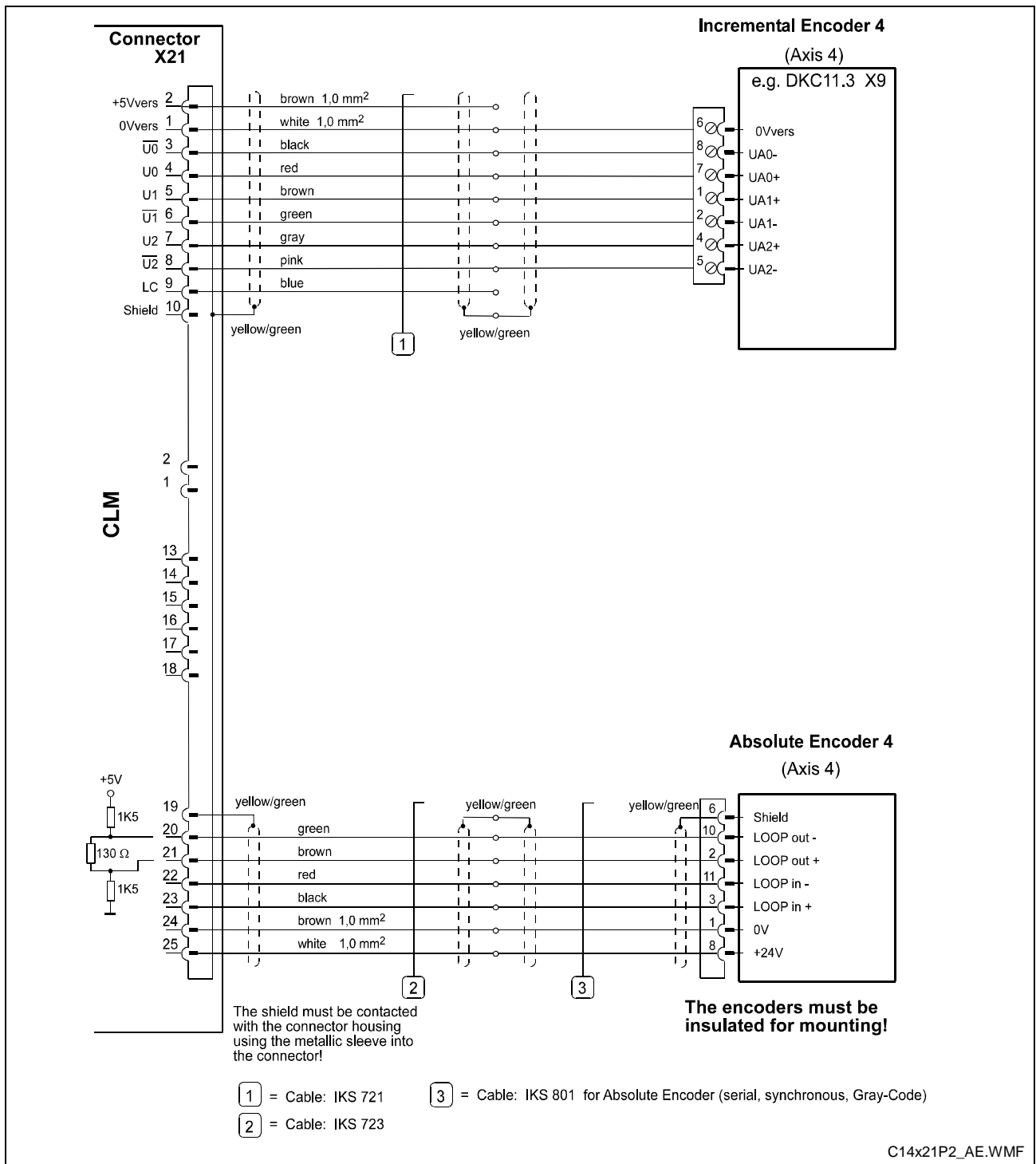


Fig. 13-11: Connector X21 - Axis 4 Encoder Inputs

13.13 Inputs - Part 1

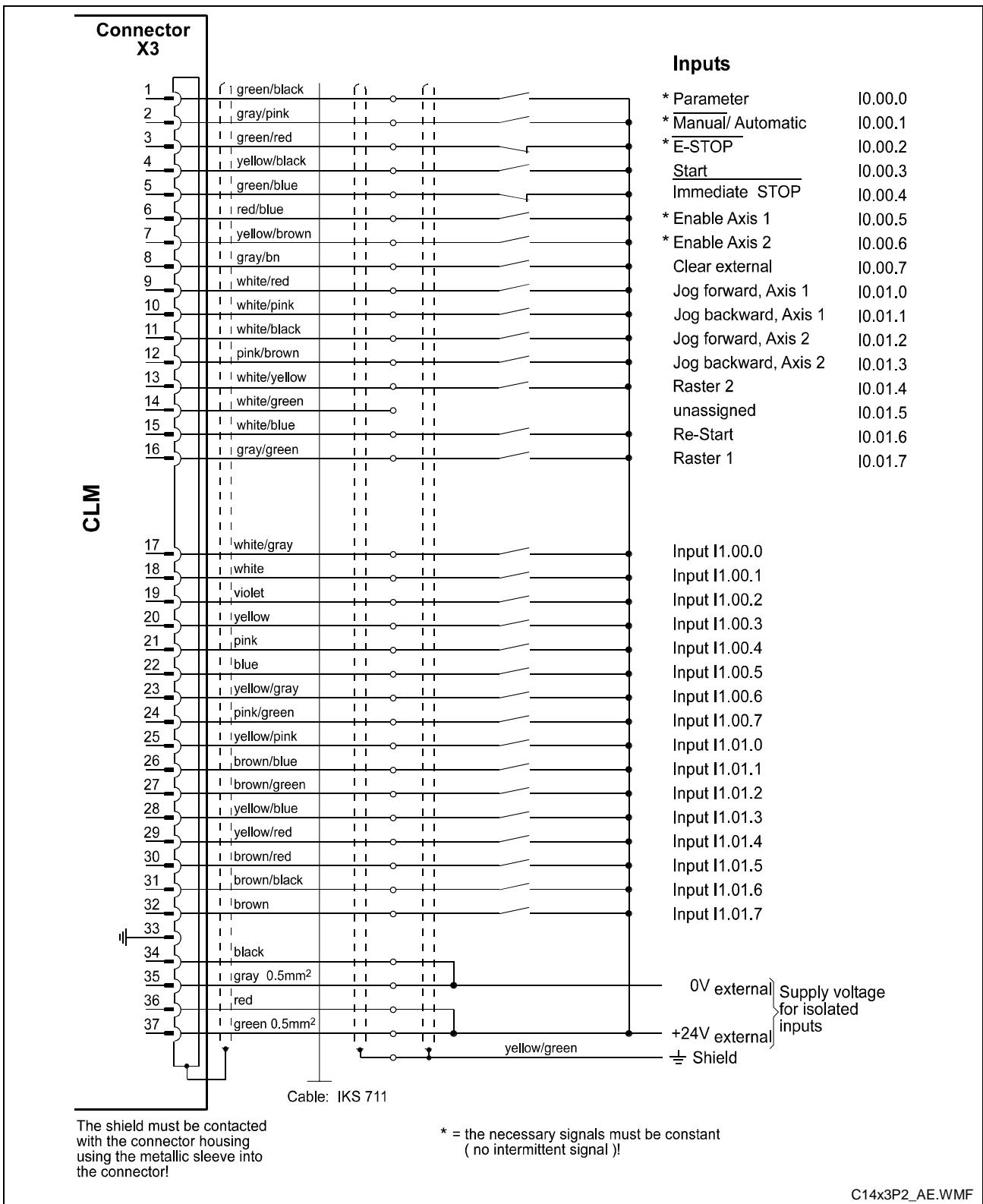


Fig. 13-12: Connector X3 - Inputs - Part 1

13.14 Inputs - Part 2

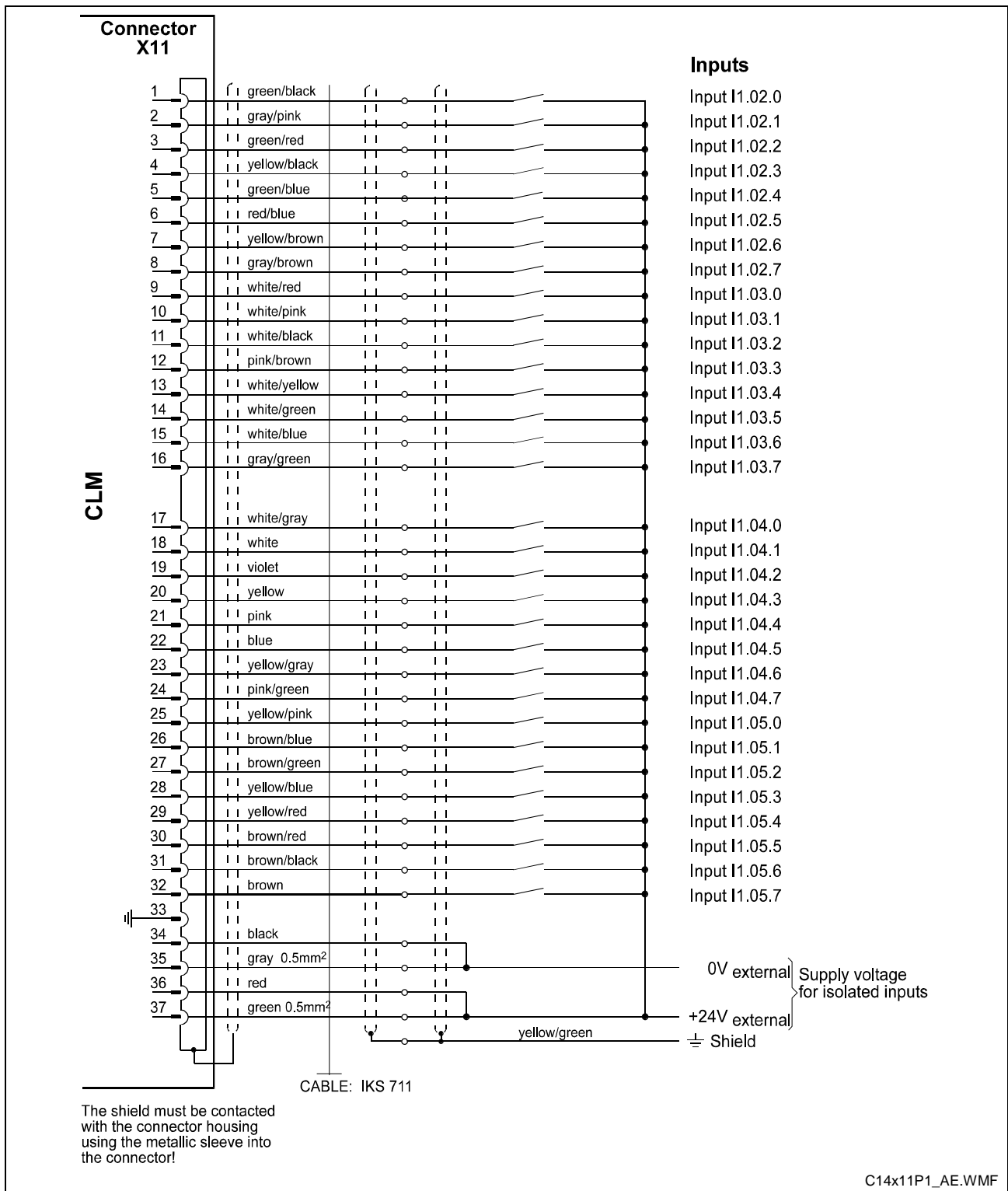


Fig. 13-13: Connector X11 - Inputs - Part 2

13.15 Inputs - Part 3

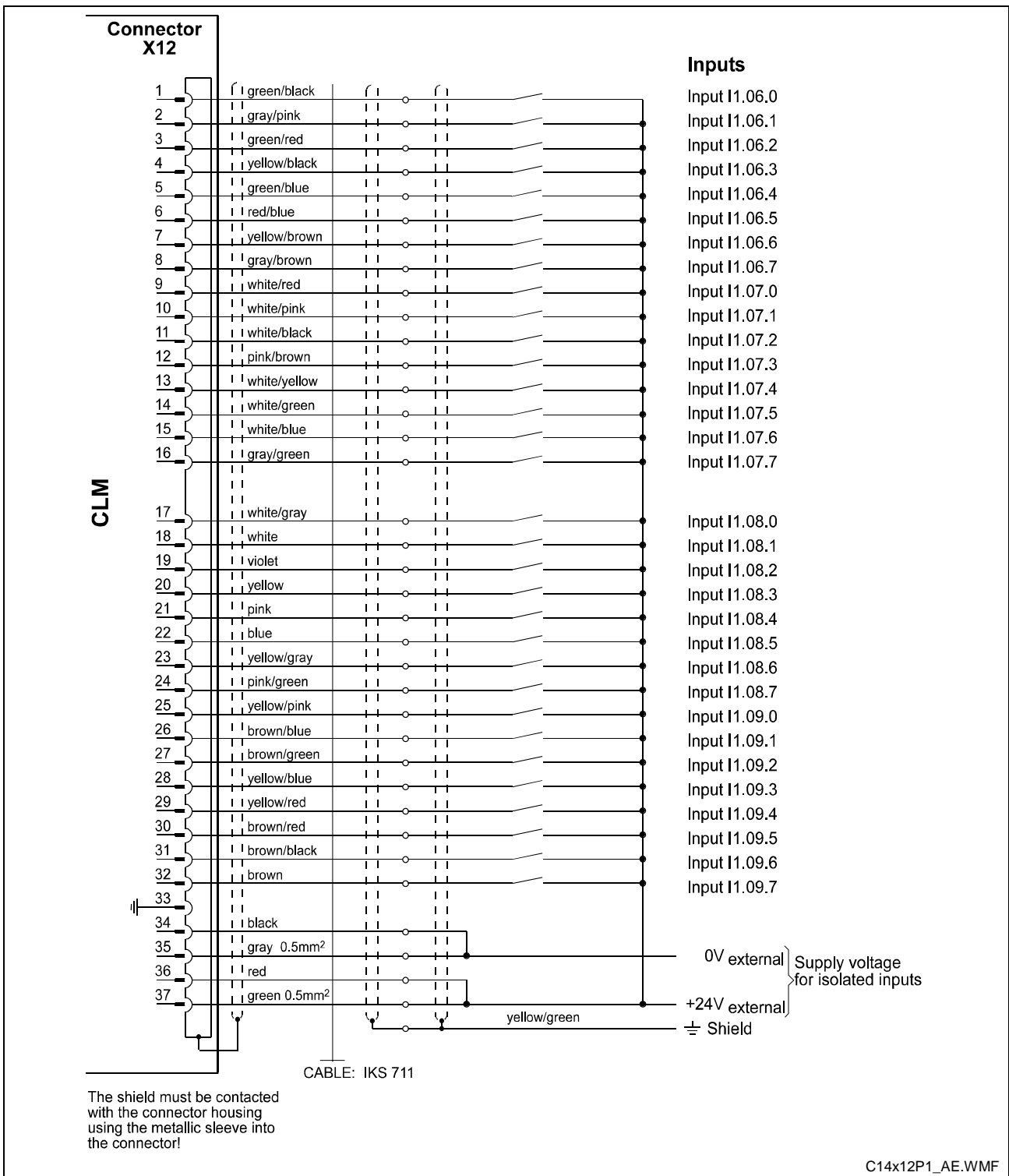


Fig. 13-14: Connector X12 - Inputs - Part 3

13.16 Outputs - Part 1

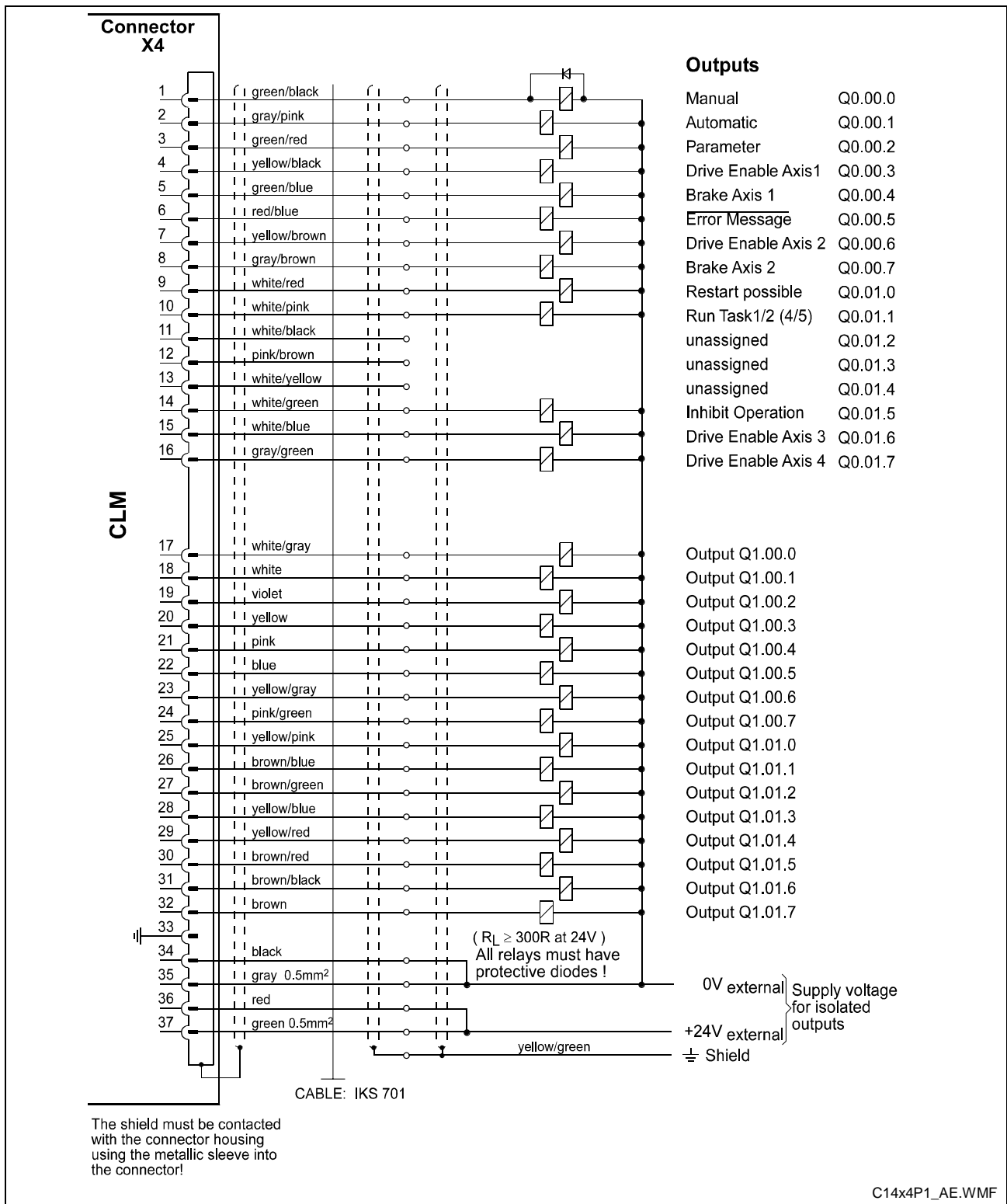


Fig. 13-15: Connector X4 - Outputs - Part 1

13.17 Outputs - Part 2

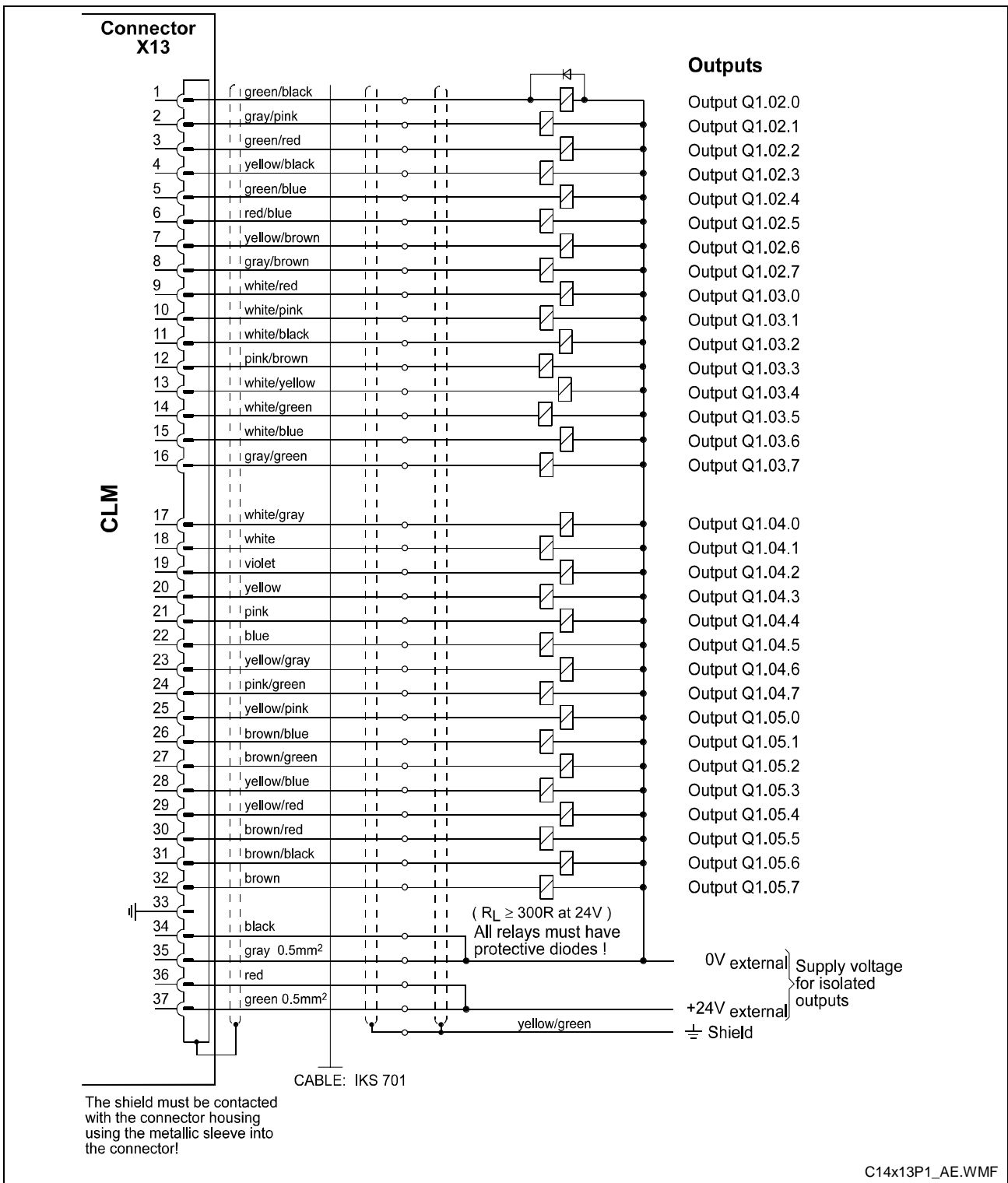


Fig. 13-16: Connector X13 - Outputs - Part 2

13.18 Inputs and Outputs

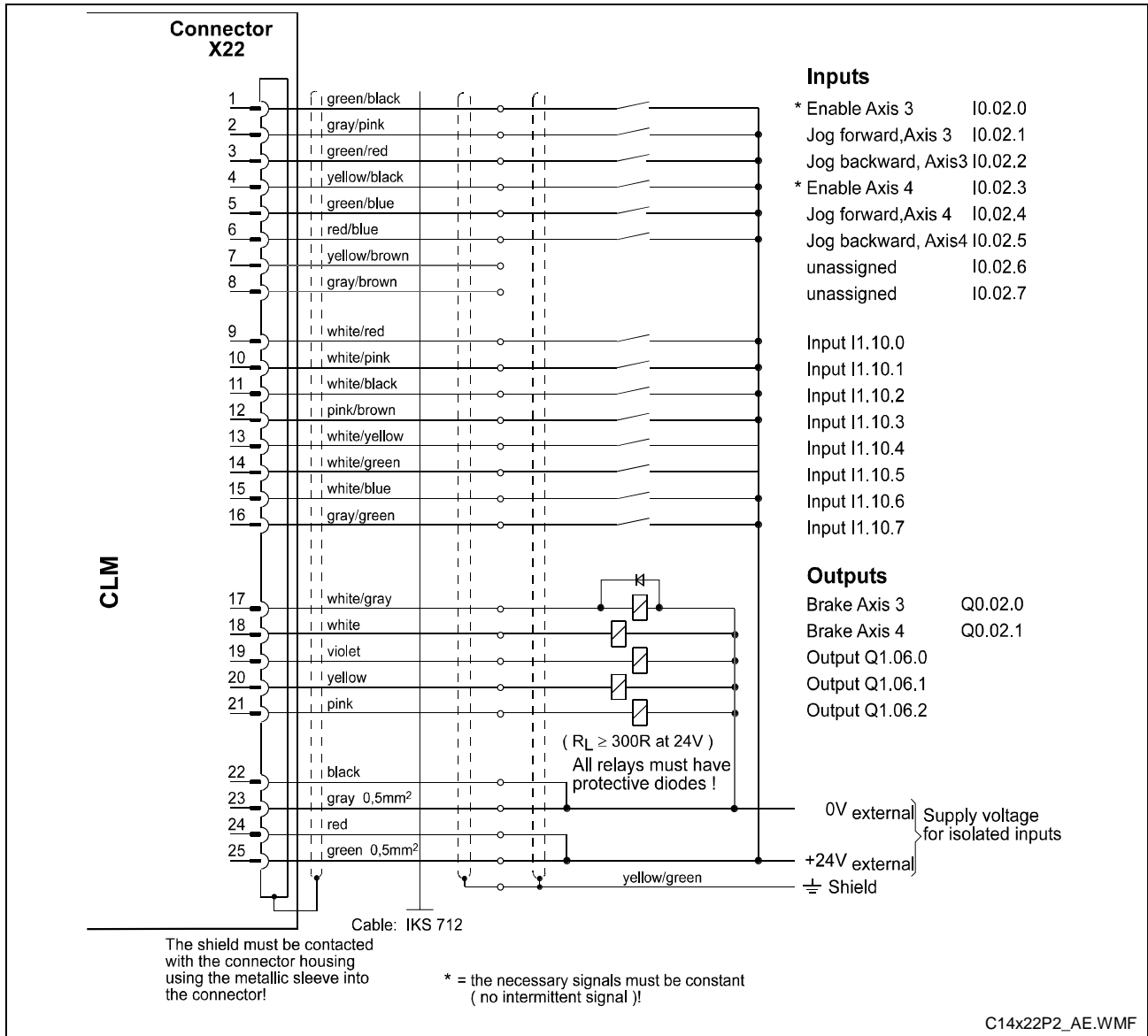


Fig. 13-17: Connector X22 - Inputs and Outputs

13.19 Profibus (optional)

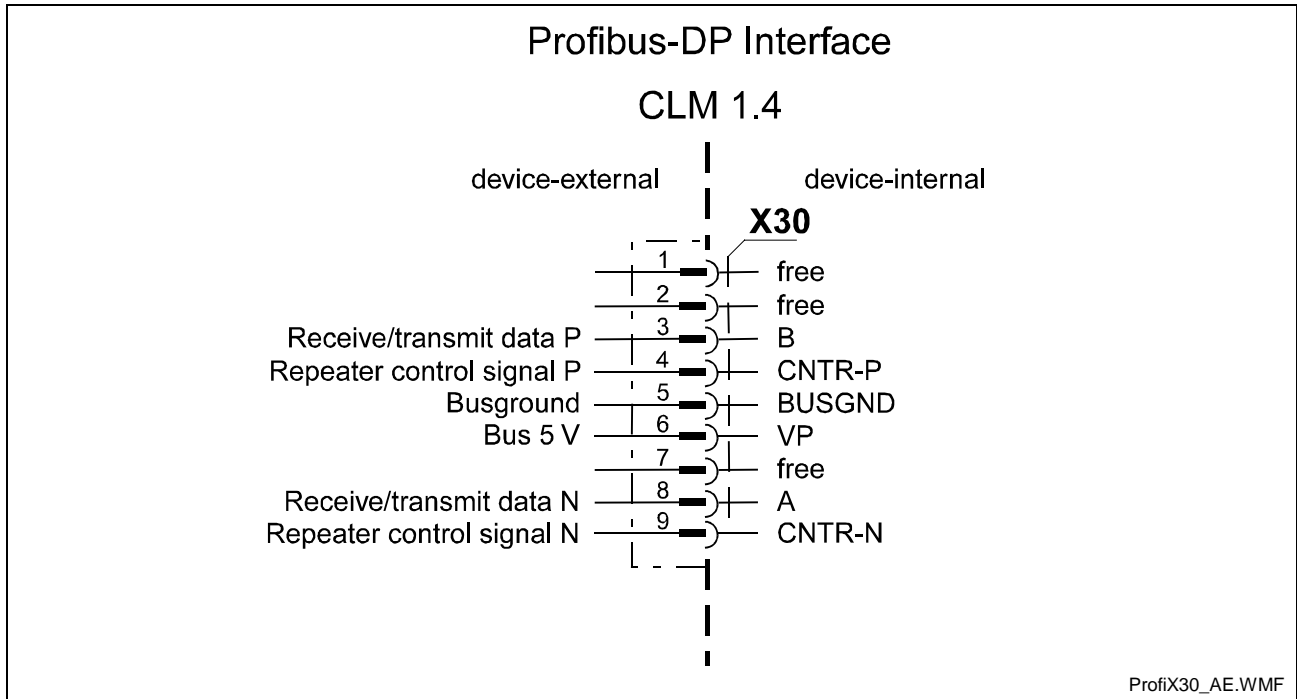


Fig. 13-18: Connector X30 - Profibus (optional)

13.20 CLM - DKC

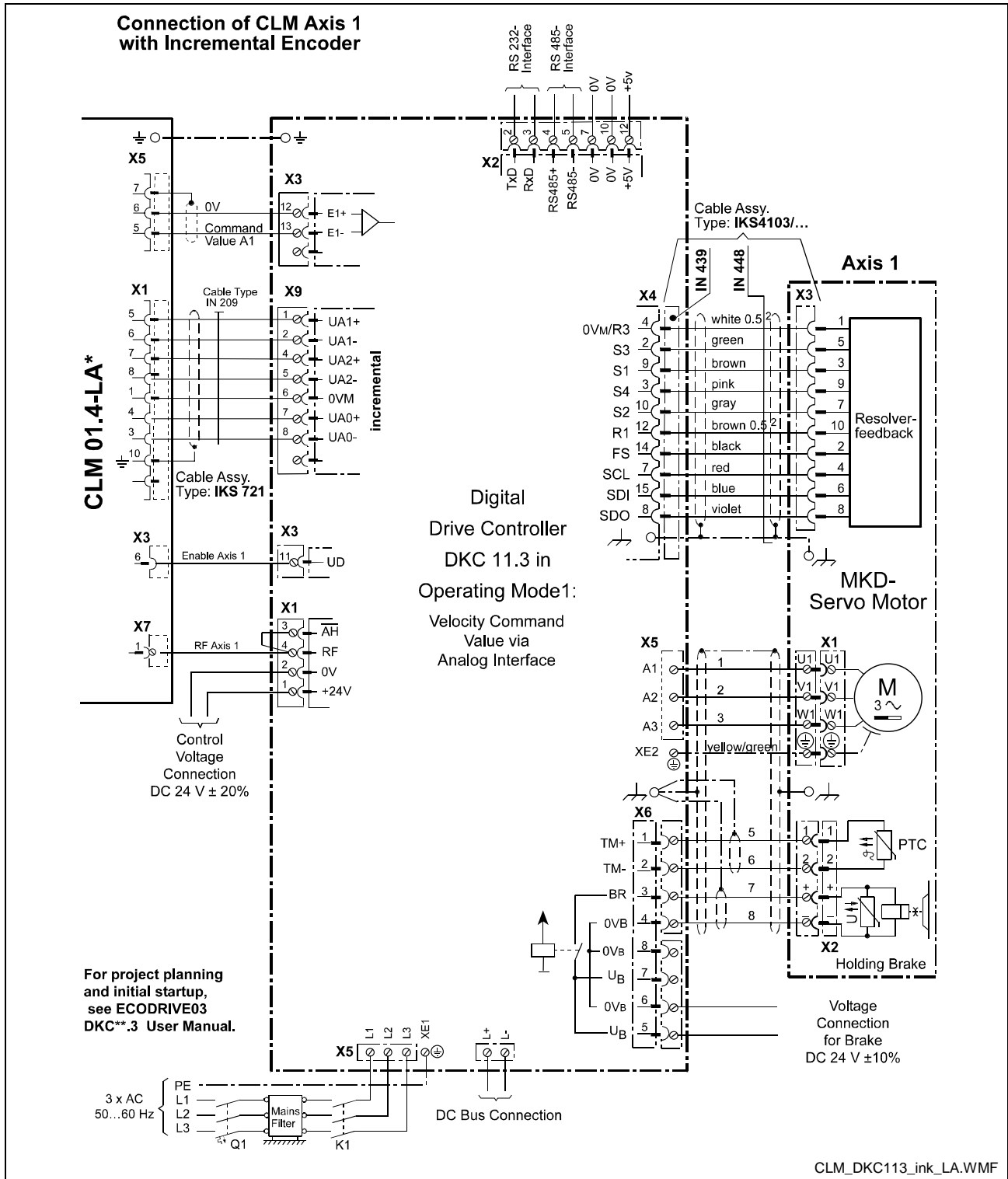


Fig. 13-19: CLM - DKC, Incremental

14 Installation Notes

14.1 General Information

These controls are designed as modular units to be built into a control cabinet. The controls are electrically connected via connectors on the top side of the unit.

Protection System:

Front Panel = IP 20

Electronics and Connectors = IP 20

The installation should offer a type of protection appropriate for the environmental conditions, for protection of the unit especially against deposits of metal dust, oil, moisture and strong electromagnetic interference, as well as for maintaining the allowable ambient temperature.

Max. allowable ambient temperature:

with natural air flow = 45° Celsius

with forced ventilation
at 3 m/s air speed = 55° Celsius

Min. allowable ambient temperature: = 5° Celsius

Local power loss = 45 W max.

Reliability These controls are exemplary in their resistance to network and switching problems. However, the following rules must be followed during installation, to eliminate excessive problem situations.

Interference Suppression With electronic controls, no inductive loads should be moved without appropriate interference suppression.

For operation with DC voltage, appropriate interference suppression is achieved by the arrangement of free-wheeling diodes, and for operation with AC voltage, it is achieved by the arrangement of type-specific, standard RC interference suppression elements directly at the inductance.

Only the interference suppression element that is arranged directly at the inductance fulfills the intended purpose!

If this is not the case [installation directly at the inductance], more interference actually results because of surges in the interference suppression circuitry.

This general rule should be followed as closely as possible. It is far easier to prevent interference than to eliminate the results of existing interference.

Under no circumstances can contacts that control the movement of inductive loads, inductances without interference protection, or connections between such elements, be used in the same area as the control.

This means that the control must be separated from such sources of interference by a Faraday's cage (its own section in the control cabinet).

Wiring of the Controller Cables

The controller cables must meet the minimum requirements for diameter, shielding and grounding listed in the Terminal Connection Diagrams. The illustrated branching conditions must also be met. It does not suffice to establish the galvanic connections; the connection points must be adhered to.

If, for example, two parallel leads that branch from one point are shown, it is unacceptable to connect only one lead and to branch it at a later point.

Induction looping (error transmitters and antennas) and potential shifting that causes interference can occur.

Switching Signal Inputs and Outputs

The switching signal inputs and outputs are galvanically isolated using an opto-electronic coupler and can be wired without much concern. However, these cables are subject to interference and must therefore be kept well away from all other controller cables for every part of the installation.

This means that these cables must be wired to the controller from a different direction or, when wired in parallel, they must be run through separate steel tubing.

Of course, the same is true for the cables for the respective power supply.

Controller and Power Supply Cables

The cables between the controller and the drive electronics should be as short as possible.

With the exception of the switching signal inputs and outputs described above, the controller cables are subject to the following rules.

No unshielded wiring in areas without interference protection (cabinet and canal). See also Section 14.1, 'Interference Suppression'.

No parallel wiring of controller, network and power cables without special protection measures for the controller cables.

No parallel wiring of controller cables with other system cables without special protection measures for the controller cables.

This means: Controller cables and controller power cables, when wired parallel to other system components, must be run through steel or other metal tubing. This is also valid, even if these cables are already shielded and also in relation to the power cables for the electric servo drives.

- Power Cables** The power cables for the electric servo drives, meaning the primary and secondary cables for the power transformer and the motor connections, are relatively resistant to interference.
- Because of the emissions from these cables, all controller cables, e.g. tachometer, command value and incremental encoder cables, must be separated.
- The wiring of the power cables for the servo drives within the part of the control cabinet that houses the control must be as short as possible and as far away from the controller and the controller cables as possible.
- Power Transformer and Smoothing Throttle** The power transformer and the smoothing throttle of electrical servo drives may not be arranged in the same area (of the control cabinet) as the controller, because of the generated heat and emissions.
- Connection to Power Supply** For electric servo drives, the power connection for the drive electronics is to be branched from the power supply connection, separately from the controller cabling.
- When these cables are run parallel to other system cables, the power supply cabling must be run inside grounded steel or metal tubing.
- Grounding** Correct grounding is one of the critical prerequisites for fault-free operation. For grounding, the branching conditions in the terminal connection diagrams must be strictly followed.
- If branching from the defined central point does not follow the illustration, fault (induction) loops will result.
- Grounding bars of any strength have no effect with improper branching.
- Control Power Transformer** A transformer with protection winding is to be used as the control power transformer. The protection winding must be run to the central grounding point.

14.2 Instructions for Using Cooling Units in Control Cabinets

To maintain ambient conditions in control cabinets, it may be necessary to cool the air inside the control cabinet with a cooling unit.

Improperly used cooling units can cause damage to the installed controllers because of condensation and condensate!

Damage by Condensation Warm, damp air enters the control cabinet and condensation collects on the control units during cooling!

Damage by Condensate If cooling units are poorly arranged, the condensate that is continually produced by the cooling units can drip into control units or be sprayed inside them by the cool air stream.

Correct Use of Cooling Units

Avoiding Condensation Use cooling units only with well-insulated control cabinets, to avoid condensation due to warm, damp outside air!

If the control cabinets are being used with open doors (initial startup, service, etc.), ensure that the control units can never be cooler than the air in the control cabinet after the doors are closed, otherwise condensation can occur. The cooling unit must continue to be operated even when the system is turned off, until the temperature of the air in the control cabinet and the installed equipment remains at the same level.

Set cooling units with a fixed temperature setting to not lower than 40°C!

Set cooling units with adjustable temperature setting so that the inside air temperature of the control cabinet is not below that of the outside temperature. Set temperature limit to 40°C!

Avoiding Drips and Sprays Arrange cooling units so that any condensate cannot drip into or on the installed control units.

Cooling units on the top of the control cabinet require a specialized control cabinet construction (see Fig. 14-1)!

The control cabinet should be constructed so that the fan for the cooling unit cannot spray the condensate that collects after the unit has been turned off for a period of time on the control units (see Fig. 14-2).

Note: No water must be allowed to drip on the installed control units! Furthermore, the correct temperature of the cooling units must be observed!

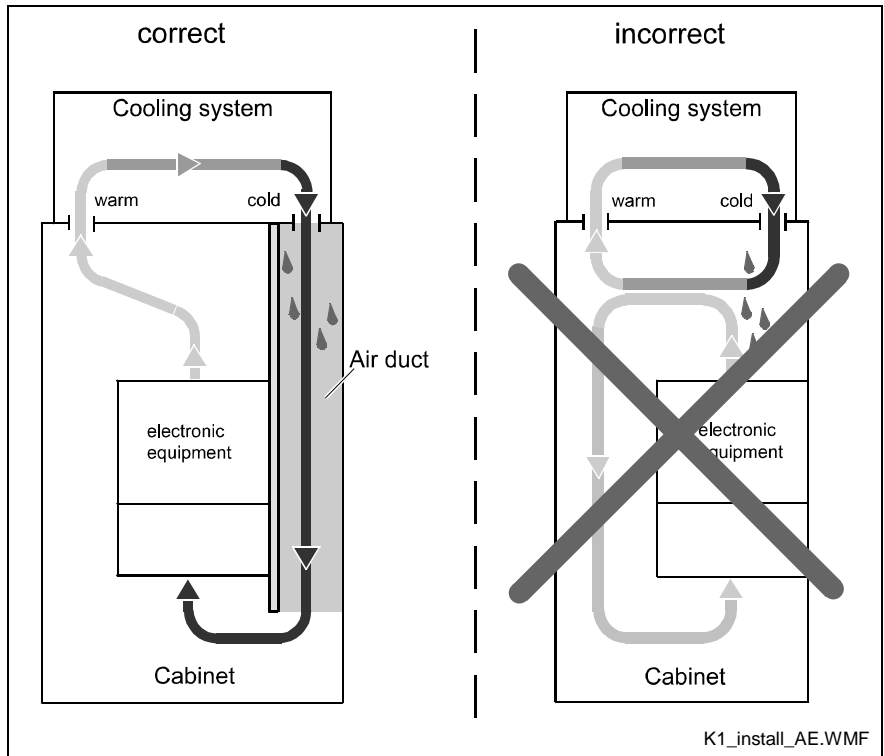


Fig. 14-1: Arrangement of the Cooling Unit on the Top of the Control Cabinet

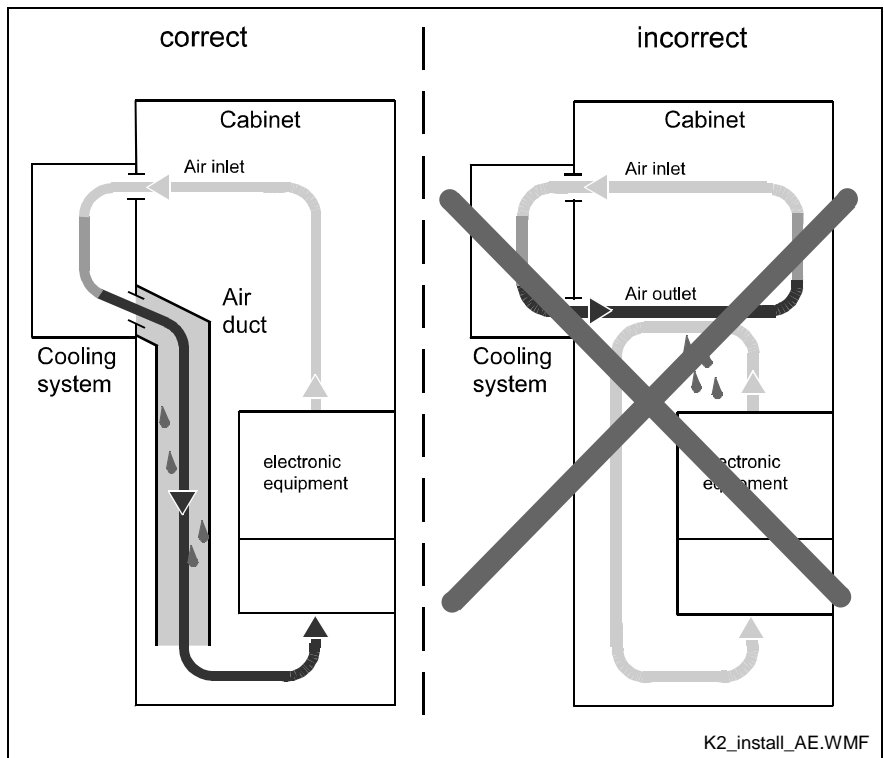


Fig. 14-2: Arrangement of the Cooling Unit on the Front of the Control Cabinet

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16 Service & Support

16.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- telefonisch - by phone:
über Service Call Entry Center
- via Service Call Entry Center
- per Fax - by fax:
- per e-Mail - by e-mail: service.svc@boschrexroth.de

49 (0) 9352 40 50 60

Mo-Fr 07:00-18:00
Mo-Fr 7:00 am - 6:00 pm

+49 (0) 9352 40 49 41

16.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

After helpdesk hours, contact our service department directly at

+49 (0) 171 333 88 26

oder - or

+49 (0) 172 660 04 06

16.3 Internet

Unter www.boschrexroth.com finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen *) unserer auf den folgenden Seiten aufgeführten Vertriebs- und Servicebüros.

At www.boschrexroth.com you may find additional notes about service, repairs and training in the Internet, as well as the **actual** addresses *) of our sales- and service facilities figuring on the following pages.



Verkaufsniederlassungen



Niederlassungen mit Kundendienst



sales agencies



offices providing service

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

Please contact our sales / service office in your area first.

*) Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

*) Data in the present documentation may have become obsolete since printing.

16.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

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

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel./Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

1. Detailed description of the failure and circumstances.
2. Information on the type plate of the affected products, especially type codes and serial numbers.
3. Your phone/fax numbers and e-mail address, so we can contact you in case of questions.

16.5 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

vom Ausland:

(0) nach Landeskennziffer weglassen!

from abroad:

don't dial (0) after country code!

Vertriebsgebiet Mitte Germany Centre Rexroth Indramat GmbH Bgm.-Dr.-Nebel-Str. 2 / Postf. 1357 97816 Lohr am Main / 97803 Lohr Kompetenz-Zentrum Europa Tel.: +49 (0)9352 40-0 Fax: +49 (0)9352 40-4885	SERVICE CALL ENTRY CENTER MO – FR von 07:00 - 18:00 Uhr from 7 am – 6 pm Tel. +49 (0) 9352 40 50 60 service.svc@boschrexroth.de	SERVICE HOTLINE MO – FR von 17:00 - 07:00 Uhr from 5 pm - 7 am + SA / SO Tel.: +49 (0)172 660 04 06 oder / or Tel.: +49 (0)171 333 88 26	SERVICE ERSATZTEILE / SPARES verlängerte Ansprechzeit - extended office time - ♦ nur an Werktagen - only on working days - ♦ von 07:00 - 18:00 Uhr - from 7 am - 6 pm - Tel. +49 (0) 9352 40 42 22
Vertriebsgebiet Süd Germany South Bosch Rexroth AG Landshuter Allee 8-10 80637 München Tel.: +49 (0)89 127 14-0 Fax: +49 (0)89 127 14-490	Vertriebsgebiet West Germany West Bosch Rexroth AG Regionalzentrum West Borsigstrasse 15 40880 Ratingen Tel.: +49 (0)2102 409-0 Fax: +49 (0)2102 409-406 +49 (0)2102 409-430	Gebiet Südwest Germany South-West Bosch Rexroth AG Service-Regionalzentrum Süd-West Siemensstr.1 70736 Fellbach Tel.: +49 (0)711 51046-0 Fax: +49 (0)711 51046-248	
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Great Britain – Großbritannien Bosch Rexroth Ltd. Electric Drives & Controls Broadway Lane, South Cerney Cirencester, Glos GL7 5UH Tel.: +44 (0)1285 863000 Fax: +44 (0)1285 863030 sales@boschrexroth.co.uk service@boschrexroth.co.uk	Finland - Finnland Bosch Rexroth Oy Electric Drives & Controls Ansatie 6 017 40 Vantaa Tel.: +358 (0)9 84 91-11 Fax: +358 (0)9 84 91-13 60	France - Frankreich Bosch Rexroth SAS Electric Drives & Controls Avenue de la Trentaine (BP. 74) 77503 Chelles Cedex Tel.: +33 (0)164 72-70 00 Fax: +33 (0)164 72-63 00 Hotline: +33 (0)608 33 43 28	France - Frankreich Bosch Rexroth SAS Electric Drives & Controls ZI de Thibaud, 20 bd. Thibaud (BP. 1751) 31084 Toulouse Tel.: +33 (0)5 61 43 61 87 Fax: +33 (0)5 61 43 94 12
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